

SPECIFICATIONS

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**Project Plan Sheet Listing
Friendship Drive Storm Water Improvements**

<u>SHEET NAME</u>	<u>SHEET NUMBER</u>
COVER	1
GENERAL NOTES	2
LEGEND	3
TYPICAL SECTIONS	4
STANDARD DETAILS	5
REMOVAL PLAN	6
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EPSC PLAN	10

Janette Drive Storm Water Improvements

<u>SHEET NAME</u>	<u>SHEET NUMBER</u>
COVER	1
GENERAL NOTES	2
LEGEND	3
TYPICAL SECTIONS	4
STANDARD DETAILS	5
REMOVAL PLAN	6
CONSTRUCTION PLAN	7-9
EPSC PLAN	10

SECTION 01000 - SPECIAL PROVISIONS

- 1.1 Notice of Starting Work - The Contractor shall notify the Engineer in writing SEVENTY-TWO (72) hours before starting work at the project site. In case of a temporary suspension of work, the Contractor shall give reasonable notice before resuming work.
- 1.2 Archeological Finds - In the event any archaeological artifacts within the project limits are discovered during the course of the work, the property owner shall have and retain all right, title, and interest to such artifacts. Should archeological materials be observed, the contractor shall immediately stop work in the area and notify the Engineer prior to proceeding with work in the area. In the event an archeological examination delays the Contractor's work, he shall be entitled to an extension of time to complete the work that is equal to the number of days he is delayed. No additional compensation will be paid.
- 1.3 Blasting or any use of explosives will not be permitted for trench excavation.
- 1.4 Working Hours - The Contractor shall coordinate working hours with the Department of Public Works for local roadways. Working hours are subject to change at any time due to construction related complaints from the public, special events in the area, school traffic, or other issues.
- 1.5 RESTORATION – Private drives are to be restored to pre-construction condition. Provide photo or video evidence of before and after conditions if required by the City.
- 1.6 CATCH BASIN REMOVAL – Remove existing catch basins as shown in the drawings or as directed by the Engineer. Payment shall be made at the Unit price bid per each structure removed.
- 1.7 PIPE REMOVAL – Remove existing storm sewer pipe as shown in the drawings or as directed by the Engineer. Payment shall be made at the unit price bid per linear foot of pipe removed.
- 1.8 EXPLORATORY EXCAVATION - The location of exploratory test holes shall be as shown on the plans or as directed by the Engineer. This work shall include, but not be limited to, excavation and removal off-site of all exhumed materials, sheeting shoring, and placing and compacting approved backfill materials. The Contractor shall provide adequate time to allow the Engineer to properly, and completely, locate all existing utilities.

The completed work as measured for "Exploratory Excavation" will be paid for at the contract unit price, per each.

Exploratory Excavation shall be paid for per test hole dug, excluding those within ten feet of separate test hole. The contract unit price shall be payment in full for all labor, materials, and equipment necessary to dig test holes and shall include the following (except such items for which separate prices are received on the Bid Form): excavating; disposal of unsuitable or excess excavated materials; temporary sheeting, bracing and shoring of excavations; support of existing pipe lines/utilities; furnishing, placing and compacting granular backfill; cleanup; surface restoration, and all work necessary to verify the location, elevation and material type of the utility being evaluated. The Contractor shall coordinate with the Engineer regarding test hole locations in advance of construction in order to allow for possible design changes due to conflicts

Exploratory Excavation shall be paid only if authorized by the Engineer. Any test hole dug without consent of the Engineer will be done at the Contractor's expense.

- 1.9 Contractor to provide pit pump water filtration if dewatering is utilized during construction. No payment will be approved for any dewatering and/or well pointing operations. Obtain permits with appropriate agencies on all dewatering activities and appropriately filter and displace groundwater in accordance with permits and regulatory agencies requirements.
- 1.10 TRAFFIC CONTROL BASELINE REQUIREMENT:

The traffic control baseline requirement for the duration of this project has been

established as follows:

THE BASELINE TRAFFIC CONTROL REQUIREMENTS OUTLINED HEREINAFTER SHALL BE CONSIDERED INCIDENTAL TO THE WORK AND SHALL BE MERGED INTO THE OTHER BID ITEMS LISTED IN THE BID SCHEDULE. NO SEPARATE PAYMENT FOR TRAFFIC CONTROL OF ANY TYPE SHALL BE MADE.

The Contractor shall be solely responsible for all traffic control/ flagging required to create a safe work zone and maintain vehicular and pedestrian traffic complaint with all local, State, and Federal requirements and regulations.

The Contractor shall develop a Traffic Control Plan for approval by Public Works for local roadways in advance of the Work.

All roadways shall be fully accessible to traffic during non-work hours and accessible to local traffic during work hours. Additionally, the Contractor shall coordinate with MPW for local roadways in advance of any roadway or lane closure.

END OF SECTION

SECTION 01010 - SUMMARY OF WORK

- 1.1 Location and Description of Work – Gateway Storm Water Improvements – The projects are located in the City of Goodlettsville, within the northeastern portion of Davidson County.

Contract A: Janette Ave.

The work generally consists of the installation of approximately 1,570 linear feet of RCP storm sewer along with catch basins and HMA paving for a complete project.

Contract B: Friendship Dr.

The work generally consists of the installation of approximately 850 linear feet of RCP storm sewer along with catch basins and HMA paving for a complete project.

- 1.2 Items regulating the Execution of the Work

- A. **ATTENTION TO WORK** - The Contractor shall give his personal attention to and shall supervise the work to the end that it shall be prosecuted faithfully; and, when he is not personally present on the work, he shall at all times be represented by a competent superintendent or foreman who shall be present at the work and who shall receive and obey all instructions or orders given under this Contract, and who shall have full authority to execute the same, and to supply materials, tools and labor without delay, and who shall be the legal representative of the Contractor. The Contractor shall be liable for the faithful observance of any instructions delivered to him or to his authorized representatives.
- B. **ACCESS TO WORK** - The Contractor shall at all times provide proper facilities for access and inspection of the work by representatives of the Owner and of such official Governmental agencies as may be designated by the Owner as having jurisdictional rights to inspect the work.
- C. **WORK IN STREETS AND ALLEYS** - Throughout the performance of the work or in connection with this Contract, the Contractor shall construct and adequately maintain suitable and safe crossing over all trenches and any detours as are necessary to care for public and private traffic. The material excavated from trenches shall be compactly deposited along the sides of the trench or elsewhere in such a manner as shall give as little inconvenience as possible to the traveling public, to adjoining property owners, to other contractors or to the Owner.
- D. **WORK IN VICINITY OF EXISTING SEWERS** - Where the work on this project is in the vicinity of existing public or private sewers, the Contractor shall schedule his operations in such a manner that all existing sewer service will be adequately maintained. Where existing sewers are to be removed from service permanently or temporarily, the Contractor shall convey, in a manner acceptable to the Engineer, and without bypassing to the environment, all sewage and drainage which may be received by those sewers until the existing sewers are returned to service or replaced. The Contractor shall not use any existing sanitary sewer to divert or dispose of storm or surface water. After a connection has been made to any existing sanitary sewers, the Contractor shall plug the nearest opening to said connection and make such provisions that are necessary for pumping, bypassing, and conducting storm or surface water, to insure the above until the acceptance of the project.
- E. **WORK ON STATE HIGHWAY RIGHT OF WAY** - Where the work on this project encroaches upon the right-of-way of any State or Interstate Highway, the Owner will execute a contract with proper authorities for the installation of the proposed sewers. The Contractor shall notify the proper authorities prior to entering upon such right-of- way and shall be responsible for all damage and satisfying the requirements of these authorities.

F. WORK ON PRIVATE PROPERTY

1. The Contractor will be responsible for complying with all easement conditions as shown on any recorded easement.
2. The Contractor shall be responsible for obtaining any additional area, which he may deem necessary for the construction of this project. The Contractor shall obtain a written agreement with the Landowner and forward it to the Engineer before use of the property.
3. The Contractor shall be responsible for the preservation of and shall use every precaution to prevent damage to all trees, shrubbery, fences, culverts, bridges, pavements, driveways, sidewalks, houses or buildings and all water, sewer, gas, telephone and electric lines thereto and all other private and public property along or adjacent to the work.
4. Any damage that occurs will be restored to a like condition as existed prior to construction, in the Contract Documents, unless otherwise indicated or specified.
5. Forty-eight (48) hours prior to construction in any easement or streets the Contractor shall notify in writing the affected property owners in the area. This notification shall include the Contractor's name and the name and phone number of the contact person.

- G. BI-WEEKLY JOB SITE MEETINGS - Once every two (2) weeks, on a date mutually agreed upon by the Contractor and the Engineer, a job site meeting shall be held for review of the Project, including, but not limited to: the construction schedule, progress, traffic control, pending submittals, and any other issues that may arise. This meeting shall be used to review the contractor's monthly applications for payment.

END OF SECTION

SECTION 01039 – COORDINATION AND MEETINGS

1.1 GENERAL

A. SECTION INCLUDES

1. Preconstruction conference
2. Progress meetings
3. Pre-installation conferences

B. PRECONSTRUCTION CONFERENCE

1. Engineer will schedule a conference prior to Notice to Proceed.
2. Attendance Required: Owner, Engineer, Contractor and others deemed necessary by Owner.

C. PROGRESS MEETINGS

1. Engineer shall schedule and administer meetings throughout progress of the work.
2. Engineer shall make arrangements for bi-weekly meetings, prepare agenda with copies for participants, preside at meetings; record minutes; and distribute copies to Contractor, and participants.
3. Attendance Required: Contractor, major subcontractors, Owner, and Engineer, as appropriate to agenda topics for each meeting.

D. PRE-INSTALLATION CONFERENCES

1. When required in individual specification section or as deemed necessary by the Engineer, Contractor shall convene a pre-installation conference at work site prior to commencing work of the Section.
2. Require attendance of parties directly affecting, or affected by, work of the specific Section.
3. Notify Engineer seven (7) days in advance of meeting date.
4. Prepare agenda, preside at conference, record minutes, and distribute copies within two (2) days after conference to participants.

END OF SECTION

SECTION 01310 – PROGRESS SCHEDULES

1.1 GENERAL

A. Section Includes

1. Requirements
2. Content
3. Revisions to Schedules
4. Submittals

B. Requirements

1. The Work under this Contract will be planned, scheduled, executed, and reported by the Contractor using a CPM (Critical Path Method) schedule within a Work Breakdown Structure.
2. Seasonal weather conditions shall be considered and included in the planning and scheduling of all work influenced by high or low ambient temperatures and/or precipitation to ensure completion of all Work within the Contract Time.

C. Content

1. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
2. Identify work of separate stages and other logically grouped activities, such as:
 - a. Asphalt removal
 - b. Excavation
 - c. Catch basin Installation
 - d. Storm sewer Construction
 - e. Restoration
3. Provide sub-schedules to define critical portions of the entire schedule.
4. Show accumulated percentage of completion of each item.
5. Provide separate schedule of submittal dates for shop drawings, product data, and samples and indicate date reviewed submittals will be required back from the Engineer. Indicate decision data for selection of finishes.
6. Use of Float - Total float is the number of days by which a part of the Work in the Progress Schedule may be delayed from its early dates without necessarily extending the Contract Time. Contract float is the number of days between the Contractor's anticipated date for early completion of the Work, or specified part, and the corresponding Contract Time. Total float and contract float belong to the project and are not for the exclusive benefit of any party. They shall be available to the Owner and the Contractor, to accommodate changes in the Work, or to mitigate the effect of events that may delay performance or completion. The Contractor will monitor and optimize the use of float for the benefit of the project.
7. Early Completion - An early completion schedule is one which anticipates completion of all or specified parts of the Work ahead of the corresponding Contract Time. Since contract float belongs to the project, the Contractor shall not be entitled to any extension in Contract Time, or recovery for any delay incurred because of extensions in an early completion date, until all contract float is used or consumed and performance or completion of the Work extends beyond the corresponding Contract Time.

8. Float Suppression - The Contractor shall remove any float suppression techniques, e.g., preferential sequencing (crew movements, equipment use, for reuse, etc.), extended durations, imposed dates, scheduling of non-critical work, artificial logic, and others, as a prerequisite to a request for an increase in contract price or Contract Time. Use of any type of schedule constraints must be identified to the Engineer.
- D. Revisions to Schedule
1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
 2. Identify activities modified since previous submittal, major changes in scope, and other identifiable changes.
 3. Provide a narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or recommendation and its effect.
- E. Submittals
1. Submit initial schedules within 10 days after date of Notice to Proceed. After review by Engineer submit revised electronic schedules, modified to suit recommended changes within 7 days.
 2. Submit revised electronic Progress Schedules with every Application for Payment. The Contractor's Progress Schedule will be reviewed to assure the schedule is coordinated with all activities.
 3. Submit a copy of the electronic format of the Schedule Plus one (1) hard copy in accordance with Section 01340, Shop Drawings, Product Data and Samples.

END OF SECTION

SECTION 01340 – SHOP DRAWINGS AND PRODUCTS

1.1 GENERAL

A. SECTION INCLUDES

1. Submittal Procedures
2. Proposed Products List
3. Shop Drawings
4. Product Data
5. Manufacturer's Instructions
6. Manufacturers Certificates

B. SUBMITTAL PROCEDURES

1. Make submittals promptly, in accordance with the approved progress schedules. Submit 3 copies plus the number of copies the Contractor wishes returned.
2. Sequentially number the transmittal forms. Re-submittals shall have the original number with a suffix.
3. Identify project, Contractor, Subcontractor or Supplier, and Specification section number.
4. Apply Contractor's stamp, signed and dated, certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
5. Identify variations from Contract Documents and products or systems.
6. Provide space for Contractor and Engineer's review stamp.
7. Revise and resubmit, identifying all changes made from previous submittal.
8. Distribute copies of reviewed submittals to job site file, record documents file and other parties. Instruct parties to promptly report any inability to comply with the provisions.

C. PROPOSED PRODUCTS LIST

1. Within 10 days after date of Notice to Proceed submit complete list of Major Products proposed for use with name of manufacturer, trade name, and model number of each product.
2. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and referenced standards.

D. SHOP DRAWINGS

1. Submit 3 copies plus the number of copies the Contractor wishes returned.
2. After review, reproduce and distribute in accordance with article on procedures above and for record documents described in Section 01720 Project Record Documents.

E. PRODUCT DATA

1. Submit 3 copies plus the number of copies the Contractor wishes returned.
2. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturer's standard data to provide information unique to this project.

3. After review, distribute in accordance with article on procedures above and provide copies for record documents.

F. MANUFACTURER'S INSTRUCTIONS

1. When specified in individual Specification Sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting and finishing in quantities specified in the Product Data Paragraph.
2. Identify conflicts between manufacturer's instructions and the Contract Documents.

G. MANUFACTURERS CERTIFICATES

1. When specified in individual Specification Sections, submit manufacturer's certificate to the Engineer for review and in quantities specified in the Product Data Paragraph.
2. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.
3. Certificates may be recent or previous test results on material or product, but must be acceptable to Engineer.

END OF SECTION

SECTION 013523 – SAFETY AND HEALTH

1.1 SECTION INCLUDES

- A. Contractor's Responsibility.
- B. Potential Exposures during Execution Work.
- C. Safety and Health Regulations.
- D. Safe Access to the Work.
- E. Construction Safety Program.
- F. Emergency Response Plan.
- G. Safety Equipment.
- H. Accidents.

1.2 RELATED SECTIONS

1.3 Contractor's Responsibility

- A. The Contractor shall conduct its operations and perform all work safely and implement all work necessary to ensure the safety for its personnel and others. The Contractor shall be solely and completely responsible for jobsite conditions including the safety for all persons and public and private property during the Contract period. This protection shall be provided for all persons including, but not limited to, his employees, employees from other contractors or subcontractors, members of the general public, Metro's employees, Engineer's employees, Construction Manager's employees and regulatory agencies' personnel who may be on or about the Work. Protecting public and private property includes, but is not limited to, utilities, pipes, equipment, motor vehicles and structures. These requirements shall apply continuously and not be limited to normal working hours.

1.4 Potential Exposures WHILE EXECUTING Work

- A. Portions of the Work involve gravity and pressure sewer pipes, manholes and appurtenances which provide potential exposure to raw sewage and disease-producing organisms normally found in wastewater. The working environment is known to be associated with detrimental gases, oxygen deficiencies, flowing water velocity, excavation soils instability and confined space issues. The Contractor shall be experienced and qualified to anticipate and meet this project's safety and health requirements.
- B. Workmen involved in removing, renovating or installing sewage equipment and sewer collection system piping components may be exposed to disease-producing organisms in wastewater. The Contractor shall require his personnel to use personal protective equipment (PPE) and observe proper hygienic precautions.
- C. Solvents, gasoline and other hazardous materials and gases may enter the pumping stations, equalization tanks and treatment plant with incoming sewage. Therefore, certain areas are hazardous to open flame, sparks or unventilated occupancy. The Contractor shall take measures to assure his personnel observe proper safety precautions when working in these areas.
- D. Contractor shall provide plain language in its Safety Program indicating they know about the project's safety and health dangers, and are experienced and qualified to perform the Work indicated.

1.5 Safety and Health Regulations

- A. Safety provisions shall conform to the Federal and State Departments of Labor Occupational Safety and Health Act (OSHA), and all other applicable federal, state,

county and local laws, ordinances, codes, the requirements set forth herein and any regulations possibly specified elsewhere in these Contract Documents. Where any provision conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations or relieve him of the penalties set forth therein.

- B. The Contractor shall comply with Safety and Health Regulations for Construction.

PRODUCTS

2.1 NOT USED

EXECUTION

3.1 SAFE ACCESS TO THE WORK

- A. The Contractor shall at all times provide proper facilities for safe access to the work by Metro, the Construction Manager, the Engineer and their authorized representatives including all testing personnel and all authorized government officials.

3.2 CONSTRUCTION SAFETY PROGRAM

- A. The Contractor shall develop and implement a safety program and submit a plan for the program to the Construction Manager within 30 days of the Notice to Proceed for Metro's review and approval. The Contractor's plan shall include but not be limited to the following.
 1. Safety organization and representatives.
 2. Employee training and orientation.
 3. Blood-borne pathogen exposure prevention.
 4. PPE requirements.
 5. Procedure for mandatory initial and refresher confined space training for all Contractor and subcontractor onsite personnel.
 6. Procedures for electrical and mechanical Lock-Out/Tag-Out.
 7. Procedures for Hot Works in hazardous areas.
 8. General site safety regulations.
 9. Record keeping and reporting requirements.
 10. Safety promotion programs or incentive goals.
 11. Documentation incorporated into the Contractor's safety manual whereby its personnel have been informed about and know what health precautions should be taken when working in a wastewater treatment plant and in the wastewater collection system.
 12. Contractor's plan shall include a list with emergency phone numbers shall for 24-hour/7 days a week response.

3.3 SAFETY EQUIPMENT

- A. The Contractor shall implement a hard hat and PPE system for all employees and subcontractors. Company logos must also be provided on all hard hats. All hard hats and PPE used on the project must comply with OSHA requirements and applicable standards and be in good working condition at all times.

3.4 EMERGENCY RESPONSE PLAN

- A. The Contractor shall develop and implement an Emergency Response Plan. The plan

shall be submitted within 60 days from the Notice to Proceed for review and acceptance. The Contractor's plan shall include but not be limited to the following.

1. Emergency evacuation procedures.
 2. Emergency notification plan.
 3. Emergency supplies.
 4. Disaster supply kit.
- B. The Contractor shall develop and maintain a program for confined space entry before, during and after the construction work has been executed.

3.5 ACCIDENTS

- A. Contractor shall promptly report all accidents which cause death, personal injury or property damage. The report shall be submitted to the Construction Manager in writing, and provide full details and witness statements. This procedure shall be followed for all accidents resulting from or in conjunction with performing the Work, whether on or adjacent to the site.
- B. If the accident causes death, serious injuries or serious damages, the accident shall be reported immediately by telephone or messenger to the Construction Manager.
- C. If anyone makes any claim against Contractor or a subcontractor due to an accident, Contractor shall promptly report the facts in writing to the Construction Manager giving full details about the claim.

END OF SECTION

SECTION 01560 - TEMPORARY CONTROLS

1.1 GENERAL

- A. Section Includes
 - 1. Water Control
 - 2. Dust Control
 - 3. Noise Control
 - 4. Pollution Control
 - 5. Site Utilities, Temporary Water Service, and Sanitary Facilities
 - 6. Barriers
 - 7. Protection
 - 8. Progress Cleanup
- B. Related Sections
 - 1. Section 01568 – Erosion Control
 - 2. Section 01710 – Cleanup and Restoration

1.2 WATER CONTROL

- A. The Contractor shall grade the site to drain, maintain excavations free of water and provide, operate, and maintain pumping equipment.
- B. Slope Protection and Erosion Control – The Contractor shall protect the site from ponding or running water. The Contractor shall use temporary control measures as directed by the Engineer during the life of the Contract to control erosion and water pollution, through the use of berms, dikes, dams, sediment basins, fiber mats, netting, mulches, grasses, slope drains, temporary silt fences, and other control devices. The temporary pollution control provisions contained in this section shall be coordinated with the permanent erosion control features to assure economical, effective, and continuous erosion control throughout the construction of post-construction period.
 - 1. Execution
 - a. Construction Requirements - The Contractor shall be required to incorporate all permanent erosion control features into the project at the earliest practicable time as outlined in his accepted schedule. Temporary pollution control measures shall be used to correct conditions that develop during construction that were not foreseen during the design stage; that are needed prior to installation of permanent pollution control features; or that are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the project.
 - b. Maintenance - The temporary erosion control features installed by the Contractor shall be acceptably maintained by the Contractor until no longer needed or permanent erosion control methods are installed. Any materials removed shall become the property of the Contractor. In the event that temporary erosion and pollution control measures are required due to the Contractor's negligence, carelessness, or failure to install permanent controls as a part of work as scheduled, and are ordered by the Engineer, such work shall be performed by the Contractor at his own expense. Where the work to be performed is not attributed to the Contractor's negligence, carelessness, or failure to install permanent controls and

falls within the specification for a work item that has a contract price, the units of work shall be paid for at the proper contract prices.

- c. Erosion Control Outside Project Area - Temporary pollution control shall include construction work outside the project area where such work is necessary as a result of construction such as borrow pit operations, haul roads and equipment storage sites. Bid price in such cases shall include all necessary clearing and grubbing, construction incidentals, maintenance, and site restoration when no longer needed.

1.3 Dust Control

- A. The Contractor shall execute the work by methods to minimizing raising dust from construction activities. All available precautions shall be taken to control dust. When the Engineer judges dust to be a problem, the Contractor shall control dust by sprinkling, by applying calcium chloride, or by other means as directed.
- B. If track drills are used for drilling rock, water must be provided with the drill to eliminate the dust.
- C. No separate payment of dust control will be made for the various items used, and contract unit and/or lump sum prices will be full compensation for furnishing all material, equipment, tools, labor, and incidentals required to control dust. No additional compensation will be allowed for any costs incurred due to delays caused by necessary dust control operations.

1.4 Noise Control – The Contractor's vehicle, equipment and activities should minimize noise; conform to latest TOSHA standards; and abide by local codes.

1.5 Pollution Control

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. The Contractor shall insure that no wastewater bypassing will occur due to construction activities unless a schedule is approved by the Tennessee Department Environment and Conservation and by EPA if required by the terms of the NPDES permit.
- C. The Contractor's attention is directed to the Tennessee Water Pollution Control Act of 1977 as modified by the 1987 amendments. Special attention is called of the following sections, which read in part:
 - 1. "TCA 69-3-113 Causing Pollution...
 - 2. (a) It shall be unlawful for any person to discharge any substance into the waters of the state or place or cause to be placed in any location where such substances either by themselves or in combination with others, cause and of the damages as defined in 69-3-013(22), unless such discharge shall be due to an unavoidable accident or unless such action has been properly authorized.
 - 3. (b) In addition it shall be unlawful for any person to act in a manner or degree which violates any provisions of this part or of any rule, regulation, or standard of water quality promulgated by the Board or of any permits or issued pursuant to the provisions of this part...
 - 4. 69-3-103(22) Pollution means such alteration of the physical, chemical, biological, bacteriological or radiological properties of waters of this state including but not limited to changes in temperature, taste, color, turbidity, or

odor of the waters:

5. (A) As will result or will likely result in harm, potential harm or detriment of the public health, safety, or welfare;
6. (B) As will result or will likely render the water substantially less useful or domestic, municipal, industrial, agricultural, recreational, or other reasonable uses; or
7. (C) As will leave or will likely leave the waters in such conditions as to violate any standards of water quality established by the board;
8. (32) "Waters" means any and all water, public or private, on or beneath the surface of the ground, which are contained within flow through, or border upon Tennessee or any portion thereof except those bodies of water confined to and retained within the limits of private property in single ownership which do not combine or effect a junction with natural surface or underground waters [Acts 1971, Ch. 164, 3; 1977, Ch. 366, 1; T.C.A., 70-326; Acts 1984, Ch. 804, 1; 1987, Ch. 111, 1.]".
9. It shall be the Contractor's responsibility to furnish and install any items; including but not limited to, siltation fences, rip-rap and any special construction techniques, necessary to comply with the Tennessee Water Quality Control Act of 1977 as modified by the 1987 amendments.

1.6 Site Utilities, Temporary Water Service, and Sanitary Facilities

- A. The Contractor shall not open, turn on, or make any connections to any hydrant unless prior written permission is obtained.
- B. Where the Contractor desires a water supply in connection with any construction work, he shall make complete and satisfactory arrangements with any Utility District which may own the water main from which water is to be obtained. Payment for such water will be made by the Contractor in accordance with the Utility District's official rates.
- C. The Contractor, for and in behalf of his work under this contract, shall provide and maintain all necessary facilities, such as water supply, fences, sanitary facilities, suitable storage places, electrical power, telephone, etc., except as may be otherwise specifically stipulated in the Special Provisions. Sanitary facilities shall be suitable for those employed on this Contract and of a type that will not create a public nuisance. The Contractor shall provide and maintain an adequate potable water supply for use of employees at the work site. Sanitary facilities and potable water supply shall be subject to approval of local and State Departments of Health.

1.7 Barriers

- A. The Contractor shall provide barriers to prevent unauthorized entry to construction areas and to protect existing facilities and adjacent properties from damage from construction operations.
- B. The Contractor shall provide barriers required by governing authorities for public right-of-way.
- C. The Contractor shall provide protection for plant life designated to remain. If the Contractor fails to adequately protect designated plant life, he will be responsible for replacement at his own cost.

1.8 Protection

- A. Protection of Persons and Property
 1. The Contractor shall furnish such watchmen, guards, fences, warning signs, lights, walkways, and shall take all other precautions as shall be necessary,

to prevent damage to persons or property. All structures and improvements in the vicinity of the work shall be protected by the Contractor; and, if such property is damaged, injured or destroyed by the Contractor, his employees, subcontractors, or agents, it shall be restored to a condition as good as when he entered upon the work.

2. The safety provisions of applicable laws, including but not limited to building and construction codes, shall be observed. Machinery, equipment, and all hazards shall be guarded (or hazards eliminated) in accordance with the safety provisions of the Manual of Accident Prevention in Construction published by the Associated General Contractors of America, to the extent that such provisions are not in contravention of applicable law.

B. Protection of Contractor's Work and Property

1. The Contractor shall protect his work, supplies, and materials from damage due to the nature of the work, the action of the elements, trespassers or any cause whatsoever, until the completion and acceptance of the work.
2. Neither the Owner nor any of its officers, employees or agents assumes any responsibility for collecting indemnity from any person or person causing damage to the work of the Contractor.

C. Protection of Existing Structures - Unless otherwise indicated on the Contract Drawings, or unless otherwise addressed by the owner thereof, all utilities and all structures of any nature, whether below or above ground, that may be affected by the work, shall be protected and maintained by the Contractor and shall not be disturbed or damaged by him during the progress of the work. Provided that, should the Contractor disturb, disconnect, or damage any utility or any structure, all expenses of whatever nature arising from such disturbance or the replacement or repair thereof shall be borne by the Contractor.

D. Safety Inspection and Accident Reports - The Contractor shall routinely conduct safety inspections of the work in progress and keep a logbook in relation to the inspections. In the case of a personal injury accident, the Contractor bears the responsibility of initiating an investigation immediately and filing a complete report with the Owner within 20 days of the accident. Property damage incidents will be treated in a similar manner.

E. The Contractor shall comply with the "Safety and Health Regulations for Construction" and subsequent amendments, promulgated by the Department Labor under the Occupational and Health Act of 1970 (P.L.91-596) and under Section 107 of the Contract Work hours and safety standards Act (P.L. 92-54). All chemicals used during construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions. Contractor shall comply with all provisions of the State of Tennessee "Right to Know" law.

F. Should the Contractor elect to use explosives in the prosecution of the work, the Contractor shall employ only workmen familiar and skilled in the use of explosives, carefully cover the explosion with suitable timber, matting and/or excavation, and exercise the utmost care so as not to endanger life or property. The Contractor shall obtain all necessary permits and/or licenses and carry on such work in compliance with all State of Tennessee laws. Whenever explosives are stored or kept, they shall be stored in a safe and secure manner, and all storage places shall be plainly marked "DANGEROUS - EXPLOSIVES".

1.9 Progress Cleanup

A. The Contractor shall not allow the site of the work to become littered with trash and

waste materials, but shall maintain the same in a neat and orderly condition throughout the construction period. The Engineer shall have the right to determine what is or is not waste material or rubbish and the place and manner of disposal. An adequate number of trash receptacles shall be provided and emptied daily if necessary.

- B. On or before completion of the Work, the Contractor shall comply with Section 01710 Cleanup and Restoration.

END OF SECTION

SECTION 01568 – EROSION CONTROL

1.1 GENERAL - This work shall consist of erosion control on all cut and fill operations, excavation, backfill, or other construction activities within the limits of the construction site, within any temporary or permanent easements, and within any borrow site used during the period of construction. The protection of these sites shall continue throughout the construction period. During flood seasons, protect the sites by sandbagging, the pumping of water, and any other means appropriate to restrain flooding of plant and equipment. During dry weather, sprinkle the sites with water or use other means as necessary to provide dust control. In case of abnormally cold weather, any construction such as excavation work may be delayed until warmer weather or covered to prevent freezing.

1.2 MEASUREMENT AND PAYMENT

Erosion Prevention and Sediment Control (EPSC) activities will be paid for at the unit prices bid in the proposal. The Contractor shall be obligated to adhere to the requirements as shown on the project plans and any state or local regulations. The Engineer shall have full authority to temporarily suspend work if conditions indicate that additional EPSC measures are warranted, in the opinion of the Engineer.

1.3 PRODUCTS

- A. Grass seed - Temporarily stabilize areas from which topsoil has been removed and topsoil stockpiles by seeding fast growing annuals such as cereal, rye, annual ryegrass, sudan grass, and millet that provide quick protection. These annual grasses are to be seed certified by the State Department of Agriculture and can be worked into the soil when the site is prepared for final seeding of more permanent species. Use commercial lime and fertilizer on exposed areas subject to severe erosion.
- B. Silt fence, sediment tube and any other erosion control BMPs used shall meet the requirements of Section 209 of TDOT Standard Specifications for Road and Bridge Construction.
- C. Erosion control blanket Type III shall meet the requirements of Section 805 of TDOT Standard Specifications for Road and Bridge Construction.

1.4 EXECUTION

A. CONSTRUCTION AND EXCAVATION

- 1. Conduct construction so as to provide the site with maximum protection from erosion at all times.
- 2. Conduct excavation activities to provide erosion and sediment control as follows:
 - a. Do not start clearing and excavation until a firm construction schedule is submitted to and approved by the Engineer. Continuously coordinate the schedule with the clearing and excavation activity.
 - b. In streets and other paved areas, remove excavated material from the site as construction progresses to prevent any erosion of this material.
 - c. In other areas, place the excavated material so as not to block any drainage area. Replace this excavated material in the trench immediately after repairs have been completed and are approved by the Owner.
 - d. Retain natural vegetation whenever feasible.
 - e. Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches or

other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified.

- f. Take particular care along streams and drainage ditches so that fallen trees, debris, and excavated material will not adversely affect the stream flow. Exercise care to minimize the destruction of stream banks. Wherever the stream banks are affected by construction, reduce the slope of the stream banks to provide a suitable condition for vegetative protection. Minimize land exposure in terms of area and time.
- g. Cover exposed excavated areas with mulch or vegetation.
- h. Mechanically retard the rate of runoff water.
- i. Trap the sediment contained in the runoff water.
- j. Divert water from erosive areas.
- k. Take care during the pouring of concrete, hauling of materials, etc., to keep vehicles from creating a severe erosion problem. Proper scheduling of operations and prompt repair of ruts created during this operation is necessary from this source.
- l. Control dust by sprinkling or other means as necessary to keep it to a minimum.
- m. Pave or otherwise stabilize roadways and driveways as soon as feasible.
- n. Re-grade and reseed surfaces eroded or otherwise damaged during any and all construction operations as necessary.

END OF SECTION

SECTION 01710 - CLEANUP AND RESTORATION

1.1 GENERAL

A. Section Includes

1. This item shall include the requirements for cleaning and restoring areas and facilities disturbed by construction operations.
2. This item identifies work that may be required on temporary surfacing, or permanent pavement replacement of any public street or roadway disturbed during construction operations. This work will be performed and payment made in accordance with other sections of these Specifications.

B. Related Sections

1. Section 01000 – Special Provisions
2. Section 02222 - Excavation.
3. Section 02223 - Backfilling.

C. Requirements

1. The Contractor shall not allow the site(s) of the Work to become littered with trash and waste material, but shall maintain the same in a neat and orderly condition throughout the construction period. The Engineer shall determine what is or is not waste material and the time, place and manner of the disposal of the same.
2. The Contractor's method for disposal of trash and waste shall not cause damage or create a nuisance to other public or private property.
3. The Contractor shall keep the construction site(s) clean and remove surplus and discard materials, temporary structures, stumps, and portions of trees and debris of any kind. He shall leave the site of the Work in a neat and orderly condition, similar or equal to that prior to construction.
4. Cleanup and Restoration operation shall be conducted concurrent with construction operations and shall be completed before final acceptance by the Owner. The Contractor shall replace with like and kind any trees, shrubbery, fences, culverts, bridges, houses, or buildings and all water, sewer, gas, telephone and electrical lines thereto, and all other private and public property along or adjacent to the Work.
5. The Contractor shall topsoil, rake, fertilize, seed and straw all lawns and grass areas disturbed by construction operations.
6. All private and public property along or adjacent to the Work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.
7. Before final acceptance by the Owner, the Contractor shall replace and/or restore any water, sewer, drain, and gas lines and appurtenances, electrical, telephone, telegraph conduits and wire, both underground and above ground, and appurtenances; traffic signals, fire and police alarm systems and appurtenances; sidewalks, curb & gutters, drainage ditches and pavements and all other public utility facilities and appurtenances along or adjacent to the Work that may have been disturbed by construction operations.
8. All public utility facilities and appurtenances along or adjacent to the Work disturbed by construction operations shall be restored to a condition similar or equal to that existing prior to construction.
9. Temporary pavement of public streets and roads shall be installed, and

payment shall be made as specified in Section 02575 - Pavement Repairs.

10. Permanent pavement replacement of public streets and roads shall be installed and payment shall be made as specified in Section 02575 - Pavement Repairs and as specified in Section 01000 - Special Provisions.
11. Gravel, Bituminous and/or concrete driveway and/or parking, parking areas and concrete sidewalks and/or ramp replacement shall be installed; and payment shall be made as specified in Section 02575 Pavement Repair and as specified in Section 01000 - Special Provisions.
12. Contractor's attention is called to the fact that no additional payment will be allowed under this contract for maintaining the gravel shoulder with crushed stone once the trench has been completely gravel refilled and prior to the shoulder being shot and chipped. Also, no additional payments will be allowed for that portion of the shoulder beyond the trench limits disturbed by construction.
13. Restoration of areas and facilities disturbed by construction operations shall be properly and regularly maintained in a condition similar or equal to that prior to construction during a period of two (2) years after the final acceptance of the Work by the Owner. Any repairs required because of unsatisfactory backfill or defective materials, and workmanship shall be at the expense of the Contractor. Maintenance measures made necessary by ordinary wear and tear shall not be at the expense of the Contractor.
14. Cleanup and restoration of areas and facilities disturbed by construction operations shall be considered and integral part of the excavation or construction work and no separate payment will be allowed except as specified.

1.2 PRODUCTS – Not Used

1.3 EXECUTION – Not Used

END OF SECTION

SECTION 01720 – PROJECT RECORD DOCUMENTS

1.1 GENERAL

A. SECTION INCLUDES

1. Items Required.
2. Maintenance.
3. Submittals.

B. Related Sections

1. Section 01340 – Shop Drawings, Product Data and Samples

C. Items Required

1. The Contractor shall maintain a record copy of the following items at the site for the Engineer's review:
 - a. Drawings (modified to suit As-Built Condition).
 - b. Specifications and schedules (with modifications noted).
 - c. Addenda.
 - d. Change orders and other documents which modify the original documents.
 - e. Approved shop drawing, product data and samples including documentation of all submittal transmittals.
 - f. Records of all changes made during construction.
 - g. Field Test Records.
 - h. Manufactures Certificates.
 - i. Equipment Manuals.
 - j. Inspection Certificates.

D. Maintenance

1. Store record documents and samples in the field office, apart from the documents used for construction.
 - a. Provide files, racks and secure storage for record documents and samples.
2. Label and file record documents in sequence with section number listings in Table of Contents of the Project Manual.
 - a. Label each document "Project Record" in the lower right hand corner.
3. Maintain Record Documents in a clean, dry, legible condition.
 - a. Do not use Record Documents for Construction purposes.
4. Keep Record Documents and Samples available for inspection by Engineer.
5. Document Changes
 - a. Record information concurrently with construction progress. Do not conceal work until information has been recorded.
 - b. Contract Drawings and Shop Drawings: legibly mark each item to record actual construction including the following:
 - i. Actual elevations of footings, slabs, and tops of walls.
 - ii. Actual horizontal location of building corners and openings.
 - iii. Actual horizontal and vertical location of piping and utilities corners, values, etc. above and below ground. Reference to building exterior lines or other permanent objects. Show

- direction of flow in pipe and elevation.
- iv. Field change of dimensions and details.
- v. Changes made by contract modification.
- vi. Added details not on the original contract.
- c. Project Manual: Legibly mark to record actual construction, including the following:
 - i. On appropriate pages, record changes made by addenda, change orders and other modifications.
 - ii. On appropriate pages, enter trade name, manufacturer, catalog number, and name of supplier of each product and item actually installed, if different from that specified.
 - iii. Other items installed but not originally specified.
- E. Submittals
 - 1. At Contract closeout, deliver Record Documents and Samples, including Record "As Built" drawings, to Engineer.
 - 2. Submit Record Documents under cover of a transmittal letter containing:
 - a. Date.
 - b. Project Title and number
 - c. Contractor's and Subcontractor's name and addresses.
 - d. Title and number of each Record Document.
 - e. Certification that each document submitted is complete and accurate.
 - f. Signature of Contractor or his authorized Representative.
- 1.2 Products
 - A. Not used
- 1.3 Execution
 - A. Not Used

END OF SECTION

SECTION 02150 – SHORING AND BRACING

1.1 GENERAL

A. SECTION INCLUDES

1. Sheet piling, shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.
2. Maintenance of bracing, as required.
3. Building excavation is specified in another section.

B. QUALITY ASSURANCE

1. Supervision: Assign supervision of shoring and bracing work to a qualified foundation consultant.
2. Regulations: Comply with local codes and ordinances of governing authorities having jurisdiction.

C. SUBMITTALS - Design Drawings: Provide design drawings for shoring and bracing system and other data prepared and sealed by a registered Professional Engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

D. JOB CONDITIONS

1. Before starting work, check and verify governing dimensions and elevations. In company with Engineer, jointly survey condition of adjoining properties. Take photographs, as directed by Engineer, recording any prior settlement or cracking of structures, pavements, and other improvements. Prepare a list of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and Engineer and others conducting the investigation.
2. Survey adjacent structures and improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. Locate datum level used to establish benchmark elevations sufficiently distant so as not to be affected by movement resulting from excavation operations.
3. During excavation, resurvey benchmarks weekly, employing a licensed Land Surveyor or registered Professional Engineer. Maintain accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags or other damage is evident.

E. EXISTING UTILITIES

1. Protect existing active sewer, water, gas, electricity and other utility services and structures.
2. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal and discontinuing of services, as affected by this work.

1.2 PRODUCTS - MATERIALS - General: Provide suitable shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

1.3 EXECUTION

A. SHORING

1. Protect the site from caving and unacceptable soil movement. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures. Contractor shall be responsible for tying sheet piling back to bulkhead.
2. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work. If wood is part of the shoring system near existing structures, use pressure preservative treated materials or remove before placement of backfill.

B. BRACING

1. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.
2. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.
3. Install internal bracing, if required, to prevent spreading or distortion to braced frames.
4. Maintain bracing until structural elements are secured by other bracing or until permanent floor construction is able to withstand lateral earth and hydrostatic pressures.
5. Remove sheeting, shoring and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.
6. Repair or replace, as directed by Engineer, adjacent work damaged or displaced through the installation or removal of shoring and bracing work.

END OF SECTION

SECTION 02222 - EXCAVATION

1.1 GENERAL

A. SUMMARY

1. The work to be performed under this section shall include the preparation of the site of work; the loosening, loading, removing and disposing of all materials, wet or dry, which are necessary to be removed to construct all water mains, sanitary sewers and appurtenances included under this Contract; furnishing, placing and maintaining all sheeting, shoring, bracing and timbering necessary for the proper protection and safety of the work, the workmen, the public and adjacent property and improvements; the dewatering of the excavation; and all other work necessary and incidental to perform the excavation required to construct the water mains, sanitary sewers and appurtenances under this Contract.
2. Sufficient barriers, lights, and flares shall be provided and maintained at all trenches and excavations to insure the safety of the workmen and public.
3. Excavation will be unclassified and the cost shall be merged into the unit prices bid for other items of work under this Contract. No distinction shall be made between rock and dirt excavation, and no separate payment will be allowed.

B. RELATED SECTIONS

1. Section 02225: EARTHWORK FOR STRUCTURES AND PIPELINES

1.2 PRODUCTS - Not Used

1.3 EXECUTION

A. PREPARATION OF THE SITE

1. The Contractor shall notify any private property owner, company, or individual and/or proper utility facility owner or supervising official not less than twenty-four (24) hours in advance of any work which might damage or interfere with the operation or use of their property and/or public utility facilities.
2. Where the area to be excavated is occupied by trees, brush or other vegetable growth, such growth shall be cleared from the area and disposed of in a satisfactory manner except trees, cultivated shrubs, flowers, etc., situated within public right-of-way and /or easements through private property, but not located directly within excavation limits, shall remain undisturbed. "Small ornamental trees, cultivated shrubs, flowers, etc., located directly within excavation limits shall be transplanted so they may be replaced during property restoration operations." No tree larger than six (6) inches in diameter shall be removed or disturbed unless specifically indicated on the plans or without the permission of the Engineer. The Contractor shall exercise special precautions for the protection and preservation of such objects throughout all stages of construction and will be held liable for any damage, which may result to said objects from excavation or construction operations. Tree removal for trees 6 inches to 18 inches in diameter shall be paid for at the unit price bid per each.
3. The Contractor shall remove from the site of work debris, objectionable matter and such small buildings and structures as are specifically noted on the Contract Drawings to be removed. All other structures or objects such as buildings, walks, curbs, walls, fences, etc., located within excavation limits shall be removed in such a manner that they may be replaced during property

restoration operations. All such objects not located within excavation limits shall not be disturbed or removed without the permission of the Engineer, and the Contractor shall exercise special precautions for the protection and preservation of such objects throughout all stages of construction and will be held liable for any damage which may result to objects from excavation or construction operations.

4. Where excavation is to be done in paved areas, the pavement shall be neatly cut or sawed to the required width; the Contractor shall exercise special precautions that all pavements located outside the limits of excavation are not disturbed or damaged and will be held liable for any damage which may result to said pavements from excavation or construction operations.
5. Prior to excavation operations, the Contractor shall accurately locate all public utility facilities and all private water and sewer service lines, septic tanks and drain fields or connections thereto that may be affected by the proposed construction. During excavation operation, the Contractor shall take special precautions that all such facilities and appurtenances thereto are not damaged or disturbed and will be held liable for any damage which may result to said facilities from excavation or construction operations.
6. Measurement for Payment – Pavement removal performed in accordance with Article 1.3A. of this section will be measured and paid for by the unit price bid per square yard, unless noted otherwise. No separate measurement for payment will be made for other excavation work. It will be considered a subsidiary obligation to the Contractor under other bid items to which it relates. Preparation of the site shall be considered an integral part of the excavation work, and no separate payment will be allowed.

B. TRENCH EXCAVATION

1. Trench Width
 - a. The ground shall be excavated in open trenches, of sufficient width and depth to provide ample room within the limits of excavation or the line of sheeting and bracing, for the proper construction of water mains, storm drainage systems, and/or sanitary sewers and their appurtenances as shown on the Contract Drawings and for removing any material which the Engineer may deem unsuitable for foundation.
 - b. In trench excavations where the storm sewer pipes are laid, the width of the trench at the top of the pipe shall be as specified in Section 02720 – Storm Sewers and Drain Systems, provided a greater width may be permitted by the Engineer where it is necessary to sheet or brace the trench. There shall be a minimum of six (6) inches clear space on each side of the pipe to permit placing of backfill around the pipe.
2. Trench Construction
 - a. The bottom of the trench shall be excavated to a minimum depth of six (6) inches below the bottom of the pipe. Pipe bedding materials shall be as specified in Section 02223 - Backfilling. Dirt shall be interpreted to mean all soils other than rock, sand, or gravel. Any excavation carried below these depths shall also be refilled with crushed stone, and refill with tamped dirt or large rocks will not be allowed. Prior to placing the required refill, loose dirt or rocks shall be removed from the bottom of the trench.
 - b. In dirt excavation the required trench bottom shall not be at or near the

existing rock line. A minimum distance of six inches of dirt between the required trench bottom and the existing rock must be maintained. Should the rock line be encountered, the trench bottom shall be reconstructed with compacted dirt (95% density) or crushed stone.

- c. No refill shall be placed until the Engineer has determined that the foundation is sufficient to support the proposed construction. Any additional excavation necessary to obtain a satisfactory foundation shall be specified in Paragraph 4.c of this Article.
 - d. In areas not subject to vehicular traffic excavation of the trench shall not advance more than two hundred (200) feet ahead of pipe laying, or further than, in the opinion of the Engineer, the Contractor can lay pipe by the end of the day's work.
 - e. In all excavation, except in paved areas, where rock is encountered, the excavated dirt and rock materials shall be separated in such a manner that during backfilling operations the top one (1) foot of trench backfill shall be dirt as specified hereinafter.
 - f. Excavation, backfilling, cleanup and temporary pavement on any individual road or street in which sewers are installed shall be prosecuted concurrently with the sewer installation to the point that satisfactory ingress and egress to public streets and private property can be maintained.
 - g. Excavation and waste material stored about the work shall be so placed and work so conducted as to cause no obstruction to the traveling public.
 - h. At any time when, in the judgment of the Engineer, the Contractor has obstructed or closed or is conducting operations on a greater portion of the streets, or public ways than is necessary for the proper execution of the work, the Engineer may require the Contractor to finish the sections on which work is in progress before work is started on any additional section.
 - i. The Contractor shall make provisions by bridges or otherwise, at cross streets, highways, sidewalks, and private driveways for free passage of vehicles and pedestrians. Where bridging is impractical or unnecessary, the Contractor may make arrangements satisfactory to the Engineer for the diversion of traffic.
 - j. The Contractor shall secure the approval and obtain operation procedures from the Department of Public Works before closing or starting construction operations within the right-of-way of any street or alley.
3. Catch Basin Excavation - Excavation for catch basins and other structures shall not exceed that required to allow clear space between the outer surface of the structure and the banks of the excavations or the sheeting used to protect the excavation, as required for obtaining the required compaction of the backfill material. The bottom of the excavation shall be true to shape and elevation as shown on the Contract Drawings. Any excavation carried below the required elevation shall be refilled with crushed stone (#67 or 57) or concrete specified for use in the base of the structure at the Contractor's expense.
4. Ground Conditions
- a. General

- i. The Contractor shall assume the risk of subsurface conditions and/or obstructions encountered during the execution of the work except as specified elsewhere in other sections. The contract unit price shall include the cost of removal of quicksand, hardpan, clay, rock, boulders, rubbish, unforeseen obstacles, underground conduits, gas pipes, water pipes, drain tile, trees, roots, timber or masonry structures, railroad tracks, pavements, and sidewalk and the delay and/or damage occasioned by the same, whether or not shown on the Contract Drawings.
 - ii. No claim for an additional compensation beyond the Contract price of the work will be allowed on account of the character of the ground in which the trenches or other excavation is made.
- b. Rock
 - i. Should rock be encountered in the excavation, it shall be removed by blasting or other methods. Where blasts are made, the excavation shall be covered with sufficient excavation and/or timber or steel matting to prevent danger to life or property. The Contractor shall secure all permits required by law for blasting operation and additional hazard insurance required at his own expense and shall observe all applicable laws and ordinances pertaining to blasting operations.
 - ii. If track drills are used for drilling rock, water must be used during drilling to reduce dust.
- c. Unstable Material - When unstable soil is encountered at the trench bottom, is shall be removed to a depth required to assure support of the pipeline and refilled to the proper grade with crushed stone as specified in Section 02223 - Backfilling of these specifications. Pay item for materials placed will be under additional crushed stone refill.
- d. Underground Utilities
 - i. The location of existing piping and underground utilities such as sewer lines, gas lines, electrical conduits, telephone conduits, and etc., as shown on the Contract Drawings, have been determined from the best available information by actual surveys, or furnished and taken from the records and drawings of the existing utilities. However, the Owner does not assume responsibility for the possibility that, during construction, utilities other than those shown may be encountered, or that actual location of those shown may be different from the locations designated on the Contract Drawings.
 - ii. The Contractor shall, furnish all labor and tools to either verify and substantiate or definitely establish the position of underground utilities. Payment for this work will be in accordance with Section 01000 - Special Provisions.
- e. Variations in Alignment and/or Grade
 - i. The Owner reserves the right to make minor variations in the alignment and grade of the proposed construction to meet any changed conditions discovered during construction. The

required excavation shall be done at the Contract unit price bid, and no other payment will be allowed the Contractor for such shifts.

C. SHEETING, SHORING AND BRACING

1. The Contractor is responsible for furnishing and installing all temporary sheeting, shoring and bracing required to maintain the excavation in a safe working condition and to permit the safe and efficient installation of all items of Contract work.
2. Sheeting, shoring and bracing shall be used in wet, saturated or flowing ground, ground subject to slides, cave-ins, settlement or movement and/or locations shown on the Contract Drawings.
3. Where excavations are made adjacent to existing buildings or other structures or in paved streets or alleys, the Contractor shall take particular care to sheet, shore and brace the sides of the excavation adequately so as to prevent any undermining or settlement beneath such structures or pavement. Underpinning of adjacent structures shall be done when necessary and reviewed by the Engineer.
4. All sheeting, shoring and bracing shall have sufficient strength and rigidity to withstand the pressure exerted and to maintain the wall of the excavation in place.
5. Lumber used may be any species, which will satisfactorily withstand driving. It shall be sawed with square corners, and shall be free from worm holes, loose knots, wind shakes, decay and unsound portion which might impair its strength or tightness. Minimum thickness shall be two-inch (2") nominal. Lumber shall be No. 2 common yard lumber in less than six-inch (6") sizes and common structural grade on timber six (6) inches and over. Steel sheet piling of an approved design and type may be used.
6. Sheeting, shoring and bracing shall not be left in place unless shown on the Contract Drawings or necessary for the safety and protection of new or existing work.
7. The sheeting, shoring and bracing shall be removed as the work progresses in such a manner as to prevent caving in of the sides of the excavation, or damage to the new or existing work. While sheeting, shoring and bracing are being removed; all voids left shall be filled and compacted. The Contractor may elect to use a portable steel box in lieu of the above, if approved by the Engineer.
8. All sheeting, shoring and bracing shall be considered an integral part of the excavation work, and no separate payment will be allowed.

D. DEWATERING EXCAVATION

1. The Contractor shall provide all ditching, pumping, well pointing and bailing, build all drains, and provide all work necessary to keep the excavation clear of ground water, sewage or storm water during the process of the work and until the finished work is deemed satisfactory by the Engineer.
2. No pipe shall be laid in water, and water shall not be allowed to run over masonry until concrete or mortar has set at least forty-eight (48) hours.
3. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer without damage to adjacent property or to other work under construction. The Contractor shall not dispose of storm or surface water through new or existing sanitary sewerage facilities. After a

connection has been made to any existing sanitary sewer, the Contractor shall plug the nearest opening to said connection and make provisions that are necessary for pumping, by-passing and conveying storm or surface water to insure the above.

4. Necessary precautions shall be taken to protect all construction against flooding and/or floatation from hydrostatic uplift.
5. The dewatering of the excavation shall be considered an integral part of the excavation work, and no separate payment will be allowed.

E. FOUNDATION STRENGTHENING

1. After the excavation is opened and the grade established, it shall be examined by the Engineer who will determine whether or not it is a satisfactory foundation for pipes and/or appurtenances, or if it is necessary to stabilize the base.
2. When ordered by the Engineer or designated on the Contract Drawings, the base shall be stabilized by installing concrete cradle or encasement, or by removing unsatisfactory material and refilling with gravel as directed by the Engineer during construction.

END OF SECTION

SECTION 02225 - EARTHWORK FOR STRUCTURES AND PIPELINES

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Structure excavation and foundation preparation shall consist of necessary excavating, removal, and satisfactory disposal of all material within the limits hereinafter stipulated and preparing the foundation for the installation or construction of culverts, underdrains, and other structures not otherwise provided for by TDOT Standard Specifications all in accordance with TDOT Standard Specifications and this Section and in reasonably close conformity with the lines, grades, and typical cross sections shown in the plans or established by the Engineer.
- B. This Work shall also include the construction and subsequent removal of all bracing, shoring, cribbing, etc.; all pumping and bailing; all backfilling; and the disposal of excess or unsuitable material.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01560 – Temporary Controls
Section 02222 - Excavation
Section 02720 - Storm Sewers and Drain Systems

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"Underground Utility Damage Prevention Act of the State of Tennessee", Latest Revision

"Stormwater Management Manual" (SMM), Latest Revision, Metropolitan Government of Nashville and Davidson County

"Occupational Safety and Health Act" (OSHA), Latest Revision, State and Federal Governments

"American Society of Testing and Materials" (ASTM), Latest Revision

1.5 CLASSIFICATION

Structure excavation and foundation preparation will be classified and paid for under the following designations:

- A. Culvert Excavation (unclassified).

Structure excavation and foundation preparation performed within the limits stipulated in TDOT Standard Specifications Subsections 204.08 and 204.10 and paragraphs 4.1 and 4.3 for all box pipe culverts, sewers, conduits, all other culverts, and all minor structures of any type and description will not be measured and paid for directly but the cost will be incidental in other items unless otherwise noted in the plans.

- B. Bedding Material for Support for Pipe Culverts.
Class A - portland cement concrete Class A.
Class B - specially selected granular soil.

PART 2 - MATERIALS

2.1 FOUNDATION FILL MATERIAL

Material for foundation fill material shall consist of suitably graded sand, gravel, slag, or stone as approved by the Engineer.

2.2 BEDDING MATERIAL

- A. Material for Class B bedding for pipe culverts shall consist of sand or a natural sandy soil all of which passes a three-eighths (3/8) inch sieve and not more than ten (10) percent passes a no. 200 sieve, or stone, gravel, chert, or slag meeting the grading requirements for either grading C, D, or E in TDOT Standard Specifications Subsection 903.05.
- B. In rock cuts or other areas designated by the Engineer where a free drainage bedding or backfill material is required the material shall be crushed stone, crushed slag, or washed gravel meeting the requirements in TDOT Standard Specifications Subsection 903.17 and Section 02720 - Storm Sewers and Drain Systems.

2.3 CONCRETE

Concrete shall conform to the requirements in TDOT Standard Specifications Section 604 and Section 03300 - Cast-In-Place Concrete. Unless otherwise shown in the plans or in the special provisions Class A concrete shall be used for foundation seals and shall meet the requirements in TDOT Standard Specifications Subsection 604.19 and Section 03300 - Cast-In-Place Concrete. Concrete for culvert pipe cradles shall be Class A.

2.4 BACKFILL MATERIAL

- A. Material for backfill shall be fine compactable soil selected from structure excavation if approved by the Engineer as being suitable. Additional material needed shall be obtained from roadway or borrow excavation as described in TDOT Standard Specifications Section 203
- B. Granular backfill material for structures shall be Class A aggregate, grading D meeting the requirements in TDOT Standard Specifications Subsection 903.05

2.5 FLOWABLE FILL

When required by the plans backfill material (flowable fill) will be placed at locations shown in the plans or as directed by the Engineer. Flowable fill shall be of such consistency and strength as to not settle and of such consistency and strength that it can be removed without the use of heavy equipment after final set.

- A. Materials used in the placement of flowable fill shall meet the following requirements:

<u>Material</u>	<u>TDOT Subsection</u>	<u>Public Works Section</u>
portland cement, type I	901.01	03300
fine aggregate*	903.01	03300
fly ash (Class C or Class F)	AASHTO M 295	03300
water	918.01	03300
air entraining admixtures**	918.09	03300

* Any clean fine aggregate with one hundred (100) percent passing a three-eighths (3/8) inch mesh sieve and not more than fifteen (15) percent passing a no. 200 sieve may be used.

** High air generators or forming agents may be used in lieu of conventional air entraining admixtures and may be added at jobsite and mixed in accordance with manufacturers recommendation.

- B. Flowable fill is a mixture of portland cement, fly ash, fine aggregate, air entraining admixture, and water and contains a low cementitious content for reduced strength development. Submit mix designs to the Engineer for approval. The following are suggested mix guides for excavatable and non-excavatable flowable fill:

<u>Material</u>	<u>Excavatable Per Cubic Yard</u>	<u>Non-Excavatable Per Cubic Yard</u>
portland cement, type I	75 lbs. - 100 lbs.	75 lbs. - 150 lbs.
fly ash (Class C or Class F)	none	150 lbs. - 600 lbs.
water	*	*
air**	5% - 35%	5% - 15%
28 day compressive strength**	100 psi max.	125 psi min.
unit weight (wet)**	90 lbs - 110 lbs.	100 lbs. - 125 lbs.

* Mix designs shall produce a consistency that will result in a flowable self leveling product at time of placement.

** The requirements for percent air, compressive strength, and unit weight are for laboratory designs only and are not intended for jobsite acceptance requirements.

Fine aggregate shall be proportioned to yield one cubic yard (1 yd³).

- C. The above proportions may be adjusted by the Engineer to obtain the consistency required for satisfactory flow. Consistency shall be determined as follows: place an open ended cylinder (pipe) three (3) inches in diameter by six (6) inches in height in an upright position on a smooth level surface. Fill the cylinder with a representative sample of the flowable fill proposed for use. Remove the cylinder by lifting it straight up thus allowing sample to diffuse on the smooth level surface. The flowable fill should diffuse into a circular shape having an approximate diameter of not less than eight (8) inches.
- D. Each consistency test shall represent up to one hundred (100) cubic yards of flowable fill at each installation.
- E. Use flowable fill manufactured at plants that qualify as approved sources in accordance with the "Standard Operating Procedure for Ready-Mix Concrete". Revolution counter requirements are waived.

- F. Deliver flowable fill using concrete construction equipment. Place flowable fill by chute, pumping, or other methods approved by the Engineer. Tremie flowable fill through water.
- G. Use straps, soil anchors, or other approved means of restraint to ensure correct alignment when flowable fill is used as backfill for pipe or where floatation or misalignment may occur.
 - 1. Protect flowable fill from freezing for a period of thirty-six (36) hours after placement.
 - 2. Place flowable fill to the designated fill line without vibration or other means of compaction. Do not place flowable fill during inclement weather, e.g. rain or ambient temperature below forty (40) degrees Fahrenheit.
 - 3. Take all necessary precautions to prevent any damages caused by the hydraulic pressure of the fill during placement prior to hardening. Provide the means to confine the material within the designated space.
- H. Acceptance of flowable fill will be based on a minimum temperature of flowable fill at the point of delivery of fifty (50) degrees Fahrenheit.
- I. The Contractor shall furnish certification that all flowable fill delivered to the project contains the relative proportions of solid materials specified above.

PART 3 - EQUIPMENT

All equipment necessary for the satisfactory performance of this Work shall be on the project and approved before the Work will be permitted to begin.

PART 4 - EXECUTION

4.1 EXCAVATION

C. Pipe Culverts.

In addition to any of the foregoing provisions that are applicable the following procedures will be required:

- 1. In excavating for pipe culverts the width of the pipe trench shall be sufficient to permit satisfactory jointing of the pipe and thorough tamping of the bedding material under and around the pipe.
- 2. When rock, hardpan, or other unyielding material is encountered in the pipe trench it shall be removed below the foundation grade for a depth of six (6) inches or as directed by the Engineer.

B. Utilization of Excavated Materials.

All suitable excavated material shall be utilized as backfill or embankment. Excess or unsuitable material shall be disposed of in such a manner as not to obstruct the stream or otherwise impair the efficiency or appearance of the structure. No excavated material shall be deposited at any time in such a manner as to endanger a partly finished structure.

- 1. The Contractor shall handle and deposit excavated materials in such a manner as to furnish proper protection to materials which will be incorporated in the structure.

2. In streams the disposal of material will be subject to the laws of the U.S. Government and requirements set out in the standard permit form of the applicable government agency approving the location and plans and authorizing the construction of the structure.

4.2 FOUNDATION PREPARATION

A. Pipe Culverts.

Bedding for pipe culverts shall conform to the requirements given below for Class A, B, or C bedding whichever is shown in the plans or in the special provisions. If the class of bedding is not shown Class C bedding shall be placed.

1. Class A bedding for pipe culverts shall consist of a continuous concrete cradle constructed in conformity with the details shown in the plans and the applicable requirements in TDOT Standard Specifications Section 604 and Section 03300 - Cast-In-Place Concrete.
2. Class B bedding shall be constructed by bedding the culvert pipe in a trench cut in natural ground or compacted embankment to a depth as shown in the plans. The pipe shall be bedded on a six (6) inch thickness of Class B material and sufficient additional Class B material accurately shaped by a template to fit the lower part of the pipe exterior for at least ten (10) percent of its overall height. Class B material shall then be rammed and tamped in layers not over six (6) inches in loose thickness around the pipe to a minimum depth of that shown in the plans. The remaining depth of trench shall then be backfilled and compacted as outlined in TDOT Standard Specifications Subsection 204.11 (b) and paragraph 4.4 below. When bell and spigot pipe is to be placed recesses shall be dug in the bedding material of sufficient width and depth to accommodate the bell without its resting on the bottom of the recess. The width of the recess shall not exceed the width of the bell by more than two (2) inches.
3. Class C bedding shall be constructed by bedding the culvert pipe in a shallow trench cut in natural ground or compacted embankment to a depth of not less than ten (10) percent of the outside vertical pipe diameter and shall be shaped to fit the lower pipe exterior for the specified embedment. When bell and spigot pipe is to be placed recesses shall be dug in the earth foundation of sufficient width and depth to accommodate the bell without its resting on the bottom of the recess. The width of the recess shall not exceed the width of the bell by more than two (2) inches.

4.4 BACKFILLING

All backfill that becomes a part of the roadway prisms or their foundations shall be placed in layers and compacted to ninety-five (95) percent density in accordance with the provisions in TDOT Standard Specifications Section 205 and Section 02210 - Embankments.

A. Pipe Culverts.

After the bedding has been prepared and the pipe installed the trench shall be backfilled with bedding material and/or fine compactable soil selected from excavation or borrow in accordance with the plans. Prior to backfilling concrete pipe the joints shall be cured in accordance with the provisions in TDOT Standard Specifications Subsection 607.07 and Section 02720 - Storm Sewers and Drain Systems. The material shall be placed along each side of the pipe in layers not over six (6) inches in loose depth. Each layer shall be moistened or dried if necessary to near optimum moisture content and thoroughly compacted with mechanical tampers. Special care shall be taken to compact thoroughly the material under

the haunches of the pipe and to insure that the backfill material is in intimate contact with the side of the pipe. The backfill shall be brought up evenly on both sides of the pipe and for the full required length. Except as may be required where the imperfect trench method is prescribed the backfill material shall be placed for the full depth of the trench.

1. When the top of the pipe is above the top of the trench embankment material shall be placed and compacted in layers not more than six (6) inches in loose depth for a width on each side of the pipe equal to at least twice the horizontal inside diameter of the pipe or twelve (12) feet whichever is less. The embankment on each side of the pipe for a distance equal to the horizontal inside diameter of the pipe shall be of the same material and compacted in the same manner as required for backfill in the foregoing paragraph. The remainder of the fill material shall be soil which can be readily compacted and shall contain no frozen lumps, chunks or plastic clay, stones that would be retained on a three (3) inch sieve, or other objectionable material. It shall be compacted as required for backfill or by rolling in accordance with the applicable requirements in TDOT Standard Specifications Section 204 and this Section. The embankment shall be placed evenly on both sides of the pipe for the full width of the roadbed up to an elevation a minimum of one (1) foot above the top of the pipe. Above this elevation and also above the top of a backfilled trench that is one (1) foot or more above the top of the pipe embankment shall be placed in accordance with the applicable requirements in TDOT Standard Specifications Section 205 and Section 02210 - Embankments except those requirements where the imperfect trench method is prescribed.
2. When the imperfect trench method is required by the plans the pipe shall be bedded, the trench backfilled, and the embankment placed as prescribed above to a height above the top of the pipe equal to the vertical outside diameter of the pipe plus one (1) foot. A trench equal in width to the outside horizontal diameter of the pipe shall then be excavated in the newly placed backfill or embankment directly over the pipe keeping the trench walls as nearly vertical as possible and down to an elevation one (1) foot above the top of pipe. The lower one-fourth (1/4) of the trench shall be backfilled with straw or other highly compressible material and the remainder of the trench backfilled with the excavated trench material deposited in the loosest possible manner. After the trench backfill has been completed the remainder of the embankment shall be constructed by normal methods to the finished grade line.
3. When the material specified in TDOT Standard Specifications Subsection 903.17 and Section 02720 - Storm Sewers and Drain Systems is used for Class B bedding the compaction and density requirements will be waived. The height of the lift may be increased up to a maximum of three (3) feet after the material has been thoroughly forced under the haunches of the pipe.

C. Backfill Material (flowable fill).

1. Flowable fill shall be placed at locations shown in the plans or as directed by the Engineer. The flowable fill shall be covered or otherwise protected while in the plastic state. No embankment or base shall be placed on the flowable fill prior to final set or hardening as determined by the Engineer.
2. Prior to placement of the flowable fill pipe and bedding shall be installed in accordance with the TDOT Standard Specifications and this Section and with details shown in the plans. All sections of pipe shall be securely braced or anchored both horizontally and vertically if necessary to prevent movement of the pipe during placement of the flowable fill. Pipe sections shall be joined so as to prevent the influx of flowable fill around the joints. The Contractor shall replace at his expense any pipe or sections of pipe which do not conform to the above requirements.

PART 5 - MEASUREMENT AND PAYMENT

5.1 METHOD OF MEASUREMENT

- A. Water and its removal will not be measured as it is a necessary part of the Work.
- B. Excavation below foundation elevation as indicated or directed made at the direction of the Engineer will be measured and computed for payment provided the cause which made this extra excavation necessary is not attributable to the Contractor.
- C. No allowance will be made for excavation necessary in connection with the construction of box bridges, box culverts, retaining walls, or minor structures including pipe culverts and sewers unless otherwise indicated in the plans except that undercutting for these structures made at the direction of the Engineer to remove unsuitable foundation material will be classified and paid under item 203-05 undercutting as provided in TDOT Standard Specifications Section 203 and Section 02200 - Earthwork.
- D. Materials excavated prior to the necessary measurements having been obtained by the Engineer cannot be measured in their original position and therefore will not be computed for payment.
- E. Slides, cave-ins, and excavation extending outside of the workable limits will not be computed for payment.
- F. Material in a foundation which has bulged due to the driving of piles and which must be removed will not be measured or computed for payment.
- G. No excavation above the normal ground surface will be measured for payment unless otherwise shown in the plans.
- H. The normal ground surface as used in TDOT Standard Specifications Section 204 and this Section is defined as the bottom of channel excavations when channel excavation is indicated in the Contract Documents, the template section of the roadway in cuts, or the natural ground surface whichever is at the lower elevation. When it is required that the structure excavation be made in new embankment the normal ground surface shall be the planes of the new embankment at the elevation specified or directed for construction in advance of performing the required structure excavation but in no case shall the normal ground surface be above the planes of the new embankment.
- I. When the plans indicate that direct payment will be made for excavation for box bridges, box culverts, retaining walls, or minor structures including pipe culverts and sewers the volume of culvert excavation (unclassified) will be determined by measuring the actual quantity excavated between the normal ground surface and the foundation elevation as approved provided the limits of the excavation do not extend beyond the vertical planes located eighteen (18) inches horizontally outside the neat lines of the section of the structure at foundation elevation as indicated or directed. For box bridges and box culverts without bottom slabs the foundation elevation is considered to be the bottom of footings and the flow line elevation between footings. No allowance will be made for overlapping areas.
- J. No increase or decrease in payment will be allowed for changes in amount of excavation due to the shifting of locations of structures from that shown in the plans or for the additions of structures to those shown in the plans when the plans do not indicate that direct payment will be made for this excavation. Further if this area of excavation namely eighteen (18) inches horizontally outside of the neat line of the structure at foundation elevation overlaps an area in which the excavation is computed on a separate Contract Unit Bid Price the excavation in the overlapping area will not be allowed.
- K. Rock required to be removed and the space backfilled in order to prepare a satisfactory bed for pipe culverts will be computed only for a depth of six (6) inches below the bed of the pipe as approved. No allowance shall be made for the material used in backfilling except bedding

material when specified.

- L. No allowance will be made for shaping necessary to accommodate the bells of the pipe.
- M. The volume of Class A bedding shall be based on the theoretical quantity in cubic yards per foot of pipe as shown on the standard drawings.
- N. The volume of Class B bedding shall be based on the theoretical quantity in cubic yards per foot of pipe as shown on the standard drawings.
- O. Backfill material (flowable fill) shall be measured by the cubic yard complete in place. Measurement shall be made along the centerline of the pipe for the width of trench shown in the plans. Depth for payment shall be based on field measurements of the actual trench depth prior to placement. The volume of any portion of the pipe enclosed by the flowable fill shall be deducted.

5.2 BASIS OF PAYMENT

- A. Unless otherwise indicated in the plans no direct payment will be made for foundation preparation and backfill and the costs involved shall be included in the Contract Unit Bid Price for other items of construction.
- B. Material moved prior to securing the necessary measurement; material specified to be moved under TDOT Standard Specifications Section 203; slides or cave-ins occurring outside of the working limits stipulated TDOT Standard Specifications Subsections 204.08 and 204.10 and paragraphs 4.1 and 4.3 above; material excavated outside of said working limits; material excavated even though within the said working limits below foundation elevation as indicated or directed and made necessary on account of the construction methods of the Contractor or failure on his part to provide sufficient or proper protection; presplitting of rock; material excavated below foundation when shooting; bulged material caused by driving piles in a foundation; water and its removal; and in general material moved which it would have been unnecessary to move in order to complete the structure in accordance with the plans, TDOT Standard Specifications and this Section, or the directions of the Engineer will not be paid for.
- C. Backfill Material (flowable fill).

Accepted quantities of backfill material (flowable fill) shall be paid for at the Contract Unit Bid Price per cubic yard which shall be full compensation for all materials, mixing, transporting, placing, and finishing of the flowable fill as well as all labor, tools, equipment, and other incidentals necessary for the satisfactory completion of the Work. No measurement and payment will be made for material placed outside the neat line limits or outside the adjusted limits or for unused or wasted material.

END OF SECTION - 02225

SECTION 02500 – PAVING AND RESURFACING

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Work shall consist of furnishing and placing one (1) or more courses of aggregates and additives if required on a prepared subgrade in accordance with TDOT Standard Specifications Section 303 and this Section and in reasonably close conformity with the lines, grades, thickness, and typical cross sections shown in the plans or established by the Engineer. Mineral aggregates base shall be type A or type B whichever is shown in the plans and called for in the bid schedule.
- B. This Work shall consist of a foundation composed of a hot mixture of aggregate and asphalt prepared in a hot bituminous mixing plant. It shall be constructed in one (1) or more layers on a prepared subgrade, granular subbase, or base in accordance with TDOT Standard Specifications Section 307 and this Section and in reasonably close conformity with the lines, grades, thicknesses, and typical cross sections shown in the plans or as directed by the Engineer.
- C. This Work shall consist of an application of bituminous material and cover material if required on a designated base in accordance with the requirements in TDOT Standard Specifications Section 402 and this Section and in reasonably close conformity with the lines shown in the plans or established by the Engineer.
- D. This Work shall consist of furnishing and applying bituminous material to a previously prepared base or surface to provide a bond for a superimposed course in accordance with the requirements in TDOT Standard Specifications Section 403 and this Section.
- E. This Work shall consist of a bituminous mat composed of mineral aggregate bonded with bituminous material. It shall be constructed on a designated surface in accordance with TDOT Standard Specifications Section 404 and this Section and in reasonably close conformity with the lines, grades, and cross sections indicated in the plans or established by the Engineer.
- F. This Work shall consist of an application of bituminous material followed by an application of cover material in accordance with TDOT Standard Specifications Section 405 and this Section and in reasonably close conformity with the lines, grades, and cross section shown in the plans or established by the Engineer.
- G. TDOT Standard Specifications Section 407 and this Section include general requirements that are applicable to all types of bituminous pavements of the plant mix type irrespective of gradation of aggregate, kind and amount of bituminous material, or pavement used. Deviations from these general requirements will be indicated in the specific requirements for each type.
- H. This Work shall consist of one (1) or more courses of bituminous mixture constructed on the prepared foundation in accordance with TDOT Standard Specifications Section 407 and this Section and the specific requirements of the type under CONTRACT and in reasonably close conformity with the lines, grades,

typical cross sections, and rate of application or thickness shown in the plans or established by the Engineer.

- I. This Work shall consist of an asphaltic concrete pavement composed of a mixture of coarse aggregate, fine aggregate, mineral filler if specified or required, and asphalt cement constructed on a prepared roadbed in accordance with TDOT Standard Specifications Section 411 and this Section and in reasonably close conformity with the lines, grades, typical cross section, and rate of application shown in the plans or established by the Engineer. The provisions in TDOT Standard Specifications Section 407 and this Section shall apply to this construction unless otherwise stipulated.
- J. This Work shall consist of cold planning an existing bituminous plant mix pavement in accordance with the requirements in TDOT Standards Specifications Section 415 and this Section and in reasonably close conformity with the lines and grades shown in the plans or established by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01340 - Shop Drawings and Products
Section 02200 - Earthwork
Section 02225 - Earthwork for Structures and Pipelines
Section 02520-Cement Concrete Curb, Gutter, and Combined Curb and Gutter Section
Section 02522 - Cement Concrete Sidewalks, Driveways, and Median Pavement Section
Section 03300 - Cast-In-Place Concrete

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"American Society for Testing and Materials" (ASTM), Latest Revision PART 2

- MATERIALS

2.1 MINERAL AGGREGATE BASE

- A. The mineral aggregate shall meet the requirements in TDOT Standard Specifications Subsection 903.05 for Class A or Class B aggregates depending upon whether type A or type B base is required in the construction. Type A base will require the use of Class A aggregate grading D. Either Class A or Class B aggregate may be used for type B base.
 - 1. When the stationary plant method for mixing is used the aggregate will be accepted for gradation immediately following mixing or immediately prior to mixing based on periodic samples taken from the pugmill output or from the belt feeding the pugmill.
 - 2. When two (2) or more materials are blended on the road by means of mechanical mixers the aggregate will be accepted for gradation after mixing and

before compaction based on samples taken from each layer of base material. Aggregate that does not require blending will be accepted for gradation at the aggregate production plant based on samples taken from stockpiles of plant production immediately prior to delivery to the road.

- B. Calcium chloride shall meet the requirements in TDOT Standard Specifications Subsection 918.02 for type 1, type 2, or calcium chloride liquor.
- C. Sodium chloride shall meet the requirements in TDOT Standard Specifications Subsection 918.03.

2.2 BITUMINOUS PLANT MIX BASE (HOT MIX)

- A. The materials used in this construction shall conform to the requirements in TDOT Standard Specifications Subsections 903.06, 918.09 (B), and 904.01.
- B. The specific grading of aggregate to be used will be specified in the CONTRACT or shown in the plans. Mineral aggregate, bituminous material, and the plant mix will be accepted as provided for in TDOT Standard Specifications Subsection 407.02.

2.3 PRIME COAT

- A. Materials shall meet the requirements in TDOT Standard Specifications Subsections 903.13, 904.02, and 904.03.
- B. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 402.02.

2.4 TACK COAT

Bituminous materials shall conform to the requirements in TDOT Standard Specifications Subsections 904.01 through 904.03 and 918.09 (B).

- A. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 403.02.
- B. When emulsified asphalt is used, water as approved by the Engineer may be added to the asphaltic emulsion and thoroughly mixed therewith in such proportion not to exceed thirty (30) percent by volume of added water that the resulting mixture will give the desired cover of residual bitumen. The exact quantity of added water will be established by the Engineer.

2.5 DOUBLE BITUMINOUS SURFACE TREATMENT

- A. Materials used in this construction shall meet the requirements in TDOT Standard Specifications Subsections 903.14, 904.02, and 904.03.
- B. The ranges of application temperatures in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 404.02.

2.6 BITUMINOUS SEAL COAT

- A. Materials used in this construction shall meet the requirements in TDOT Standard

Specifications Subsections 903.13 and 904.01 through 904.03.

- B. Application temperatures for bituminous materials in degrees Fahrenheit shall be as shown in TDOT Standard Specifications Subsection 405.02.

2.7 BITUMINOUS PLANT MIX PAVEMENTS (GENERAL)

The individual materials shall meet the applicable requirements in TDOT Standard Specifications.

- A. Aggregates shall meet the applicable requirements in TDOT Standard Specifications Section 903.
- B. Mineral filler shall meet the requirements in TDOT Standard Specifications Subsection 903.16.
- C. Bituminous materials shall meet the applicable requirements in TDOT Standard Specifications Section 904.
- D. Chemical additive shall meet the requirements in TDOT Standard Specifications Subsection 918.09 (B).
- E. Aggregate shall be separated into coarse and fine aggregate stockpiles. When coarse aggregate is stockpiled by means causing segregation it shall be separated into coarse and medium coarse stockpiles.
- F. Each size and type of aggregate shall be stocked in a separate pile, bin, or stall. The storage yard shall be maintained in an orderly condition with a walkway between stockpiles that are not separated by partitions. The stockpiles shall be readily accessible for sampling.
- G. The mineral aggregate will be conditionally accepted for quality in the stockpile at the producer's site. The bituminous material may be conditionally accepted at the asphalt terminal. Acceptance of the aggregate gradation and asphalt cement content shall be determined from hot bin samples or sample(s) taken from the completed mix at the asphalt plant after it has been loaded onto the trucks for transport to the project as specified herein.
- H. Where anti-stripping additive other than hydrated lime as described in TDOT Standard Specifications Subsection 918.09 (B) and this Section is required it shall be added by approved on line blending equipment at the Contractor's mixing plant.

The dispenser shall be capable of adding heat stable anti-stripping additive within a tolerance of ten (10) percent of the specified rate.

2.8 ASPHALTIC CONCRETE SURFACE (HOT MIX)

- A. Materials used in this construction shall meet the requirements in TDOT Standard Specifications Subsections 903.11, 903.16, 904.01, and 918.09 (B).
- B. The mineral aggregate, bituminous material, and plant mix will be accepted as provided for in TDOT Standard Specifications Subsection 407.02.

PART 3 - EQUIPMENT

All equipment necessary for the satisfactory performance of this construction shall be on the project and approved before Work will be permitted to begin. The equipment used for this construction shall meet the requirements specified in TDOT Standard Specifications Subsections 303.05, 307.04, 402.03, 403.03, 404.03, 405.03, 407.04 through 407.08, 411.04, and 415.02.

PART 4 - EXECUTION

4.1 MINERAL AGGREGATE BASE

Mineral aggregate base shall conform in general construction requirements, mixing, spreading, shaping and compaction, maintenance, thickness requirements, and surface requirements to the requirements in TDOT Standard Specifications Subsections 303.06 through 303.12.

4.2 BITUMINOUS PLANT MIX BASE (HOT MIX)

Bituminous plant mix base (hot mix) shall conform in composition of mixtures, general construction requirements, preparation of subgrade, subbase, or surface, and thickness and surface requirement to the requirements in TDOT Standard Specifications Subsections 307.03 and 307.05 through 307.07.

4.3 PRIME COAT

Prime coat shall conform in limitations, preparation of surface, application of prime, application of cover material, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 402.04 through 402.08.

4.4 TACK COAT

Tack coat shall conform in preparation of surface and application of bituminous material to the requirements in TDOT Standard Specifications Subsections 403.04 and 403.05.

4.5 DOUBLE BITUMINOUS SURFACE TREATMENT

Double bituminous surface treatment shall conform in limitations, preparing designated surface, applications of bituminous material and mineral aggregate, rolling and curing, shoulders, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 404.04 through 404.09.

4.6 BITUMINOUS SEAL COAT

Bituminous seal coat shall conform in limitations, preparing the designated surface, application of bituminous material, spreading and rolling aggregate, shoulders, and maintenance and protection to the requirements in TDOT Standard Specifications Subsections 405.04 through 405.09.

4.7 BITUMINOUS PLANT MIX PAVEMENT (GENERAL)

Bituminous plant mix base (hot mix) shall conform in composition of mixtures (includes Contractor's quality control system), weather limitations, conditioning of existing surface, preparation of bituminous material, preparation of aggregates, mixing, spreading and finishing, compaction (includes density requirements and test strips), joints, pavement samples, and surface requirements to the requirements in TDOT Standard Specifications Subsections 407.03 and 407.09 through 407.18.

4.8 ASPHALTIC CONCRETE SURFACE (HOT MIX)

Asphaltic concrete surface (hot mix) shall conform in composition of mixtures, general construction requirements, preparing the designated surface, mixing, and surface requirements to the requirements in TDOT Standard Specifications Subsections 411.03 and 411.05 through 411.08.

4.9 COLD PLANING OF BITUMINOUS PLANT MIX PAVEMENTS

Cold planing of bituminous plant mix pavements shall conform in general requirements and surface requirements to the requirements in TDOT Standard Specifications Subsections 415.03 and 415.04.

4.10 PAVEMENT REPAIR

Where trenches have been opened in any roadway or street that is a part of the State highway system surfaces shall be restored in accordance with the requirements of the Tennessee Department of Transportation. All other restoration shall be done in accordance with this Section and Public Works details.

- A. Excavation in the pavement area shall require that pavement surfaces be cut and brought to a neat line by use of an air hammer, saw, or other suitable equipment.
- B. Upon completion of installation of utility backfill fill the trench with mineral aggregate type A, grading D (crusher run stone) and temporary asphalt patch with two (2) inches of cold mix or hot bituminous seal coat until such time that the permanent pavement patch is constructed.
- C. Complete the pavement restoration for the various types of roadway typical sections in conformance with Public Works details and this Section.
- D. Concrete curb or combined curb and gutter, driveways, median pavement, and sidewalks shall be restored as required to match existing construction. Replace damaged sections with complete new sections or squares. Patching of damaged sections will not be permitted.
- E. Maintain restored sections and surfaces as part of this CONTRACT for a period of one (1) year following the date of final acceptance.
- F. The minimum width to be trimmed on each side of the trench line as seen in the section may be waived or amended upon approval of the Inspector however a minimum width of replacement shall be four (4) feet to allow for a roller.
- G. All excavations made within public right-of-way will require excavation and street closure permits from the Department of Public Works prior to commencing Work.
- H. Flowable fill shall meet the requirements in TDOT Standard Specifications Section 204 except as modified in Pubic Works Technical Specifications Section 02225 latest revision.
- I. When a manhole top or other utility casting requires adjustment to an elevation one (1) inch or more above the existing pavement grade and is exposed to traffic before final paving is completed a temporary ramp shall be constructed by feathering bituminous concrete for three hundred sixty (360) degrees around the manhole or utility casting. A taper slope of not less than two (2) feet per one (1) inch shall be used. During the paving operation but prior to the placement of the topping course the bituminous

concrete taper shall be removed from around the manhole to a minimum depth of one (1) inch below the top of manhole.

4.11 CASTING ADJUSTMENTS

Manholes, catch basins, inlets, valve boxes and all other utility structures shall be constructed in accordance with Section 611.10 of the TDOT "Standard Specifications for Road and Bridge Construction". All castings and fittings shall be placed in the positions indicated on the Plans or as directed by the Engineer, and shall be set true to line and grade.

- A. Backfill of the new adjusted casting shall be accomplished using an asphalt binder as defined in Section 307 of the TDOT "Standard Specifications for Road and Bridge Construction" and shall be placed in accordance with Section 407.09, 407.11, and 407.15 with regard to Weather Limitations, Material Temperature, and Compaction requirements. Binder shall be placed in no more than 3 inch lifts and compacted using a compaction process to achieve required density.

PART 5 - MEASUREMENT AND PAYMENT

5.1 METHOD OF MEASUREMENT

- A. Mineral Aggregate Base

Mineral aggregate for mineral aggregate base, type A or type B will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109.

1. When mixing is performed in a stationary plant the weight of all surface moisture on the aggregate at the time of weighing in excess of eight (8) percent will be deducted. No direct payment for water will be made.
2. When mixing is performed on the road the weight of surface moisture on the aggregate at the time of weighing in excess of eight (8) percent will be deducted. Water added to the materials on the road at the direction of the Engineer will be measured for payment.
3. Water measured for payment as provided in TDOT Standard Specifications Subsection 303.13 and above will be measured by the M.G. (1000 gallons) by means of calibrated tanks or distributors or by means of accurate water meters.
4. Sodium chloride will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109.
5. Calcium chloride will be measured by the ton.
6. Calcium chloride received in liquid form will be weighed as provided for in TDOT Standard Specifications Section 109. The weight of liquid calcium chloride will be converted to tons by using the following formulae:

32% solution: $((\text{total tons of 32\% solution}) \times 0.32) = \text{tons (0.94)}$

38% solution: $((\text{total tons of 38\% solution}) \times 0.38) = \text{tons (0.94)}$

7. When calcium chloride liquor in a solution of 32% or more but less than 38% is used it will be paid for as a 32% solution. A solution of 38% or greater will be

paid for as a 38% solution.

B. Bituminous Plant Mix Base (hot mix).

Aggregate and asphalt cement for bituminous plant mix base (hot mix) will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Subsection 407.19 and subparagraph 5.1 G below. Materials for prime or tack coat if specified will be measured as prescribed in TDOT Standard Specifications Sections 402 or 403 and subparagraphs 5.1 C and D below.

1. If recycled mix is used the completed mix including new mineral aggregate, planings, asphalt cement, and additive shall be measured by the ton in accordance with TDOT Standard Specifications Section 109. For bidding purposes the asphalt cement content of the specified mixes shall be as shown in the Contract Documents. In the event that the Engineer sets an asphalt content other than that stated in the Contract Documents a price adjustment will be made based on the asphalt content set by the Engineer and the invoice price of the asphalt cement F.O.B. the asphalt plant. The price adjustment will be calculated according to the formula in the Contract Documents.
2. The liquid anti-strip additive will be measured by the gallon and paid as outlined in TDOT Standard Specifications Subsection 307.09 and subparagraph 5.2 B below. Hydrated lime will be measured by the ton and paid as outlined in TDOT Standard Specifications Subsection 307.09 and subparagraph 5.2 B below.
3. No direct payment will be made for polymer or latex additives and cost thereof shall be included in the Contract Unit Bid Price for the modified asphalt cement or modified mixture.

C. Bituminous Plant Mix Pavements (general).

Chemical additives or modifiers when required will not be measured for payment but will be considered as part of the asphalt cement.

1. Mineral filler will not be measured separately for payment but will be included in mineral aggregates.
2. Asphalt cement and mineral aggregate including mineral filler when required will be measured by the ton.
3. Where the mix is loaded from a storage or surge bin the quantities will be determined by weighing the completed mix on truck scales meeting the requirements in TDOT Standard Specifications Section 109 and calculating the weight of asphalt cement and mineral aggregate based on percentages measured into the mix by the appropriate scales or meters described in TDOT Standard Specifications Subsection 407.04.
4. Where the mix is loaded directly into the hauling equipment from a batch plant asphalt cement and mineral aggregate will be measured in batch quantities by scales or scales and meters as described in TDOT Standard Specifications Subsection 407.04 (b).
5. Where a continuous mix plant is used bituminous material for bituminous plant mix pavement will be measured by the ton in accordance with the provisions in TDOT Standard Specifications Section 109. The mineral aggregate including

mineral filler when required will be determined by weighing the bituminous pavement mixture on truck scales meeting the requirements in TDOT Standard Specifications Section 109 and deducting the weight of the bituminous material from the weight of total mixture accepted.

6. When the Work described under TDOT Standard Specifications Subsection 407.10 is required the removal and disposal of existing surface (concrete) will be measured by the square yard in accordance with the provisions in TDOT Standard Specifications Section 109. Such measurement shall include the removal of bituminous overlay.
7. The removal and disposal of existing surface (bituminous) will be measured by the cubic yard in accordance with the provisions in TDOT Standard Specifications Section 109. Such measurement shall include the removal of base material except concrete as directed by the Engineer.
8. Removal of unsatisfactory subgrade material where existing pavement has been removed will be measured by the cubic yard in accordance with the provisions in TDOT Standard Specifications Subsection 203.09 and Section 02200 - Earthwork. Material used to replace such undercutting will be measured and paid for in accordance with the specification for the type of material used.
9. Bituminous mixtures used to fill openings left by pavement removal will be measured for payment in accordance with the provisions in TDOT Standard Specifications Subsection 407.19 and subparagraph 5.2 G. Base materials used to fill openings left by base removal will be measured as provided for in the respective TDOT Standard Specifications sections for each type specified.
10. Adjustment of catch basin grates and frames, water valve boxes, gas valve boxes, and manhole covers and frames shall be measured per each when required.

D. Cold Planing of Bituminous Plant Mix Pavements.

Cold planing of bituminous pavement will be measured by the ton of material removed, by the cubic yard of material removed, or by the square yard of planed pavement. The method of measurement will depend upon the pay item designated in the proposal.

1. Where payment is by the ton the material removed from areas acceptably planed will be measured by the ton in accordance with TDOT Standard Specifications Section 109.
2. Where payment is by the cubic yard the material removed from areas acceptably planed will be measured by the cubic yard in accordance with TDOT Standard Specifications Section 109.
3. Where payment is by the square yard the pavement acceptably planed will be measured by the square yard in accordance with TDOT Standard Specifications Section 109.
4. Unless otherwise specified water used to control dust will not be measured for separate payment but will be considered incidental to the planing operation.
5. Salvage value of cold planings will be measured in the same units and by the

same method as cold planing of bituminous pavement.

5.2 BASIS OF PAYMENT

A. Mineral Aggregate Base.

1. The accepted quantities of mineral aggregate base of the type specified will be paid for at the Contract Unit Bid Price per ton for mineral aggregate, per ton for calcium chloride, per ton for sodium chloride and per M.G. (1000 gallons) for water complete in place.
2. The Work required for preparation of subgrade as provided for under TDOT Standard Specifications Subsection 303.06 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.

B. Bituminous Plant Mix Base (hot mix).

The accepted quantities of bituminous plant mix base (hot mix) complete in place will be paid for at the Contract Unit Bid Price per ton for the aggregate and/or the asphalt cement. Prime coat or tack coat will be considered incidental to the placement of bituminous plant mix base (hot mix).

In cases where the combined specific gravity of the mineral aggregate exceeds two and eighty-hundredths (2.80) the tonnage of mineral aggregate will be adjusted for payment by multiplying the tonnage of mineral aggregate used by a specific gravity of two and eighty-hundredths (2.80) and dividing by the higher specific gravity.

1. The Work required for preparation of subgrade, subbase, base, or surface as provided for under TDOT Standard Specifications Subsection 307.06 and this Section will be measured and paid for in accordance with the provisions in the applicable TDOT Standard Specifications Sections or Subsections and Public Works Technical Specifications Section under which the Work is performed.
2. If recycled mix is used the accepted quantities of bituminous plant mix base (hot mix) complete in place will be paid for at the Contract Unit Bid Price per ton of the total mix which will include mineral aggregate, planings, asphalt cement, and additive. Payment will be made to the Contractor for additional asphalt cement as provided for in TDOT Standard Specifications Section 307 and this Section at the purchase price F.O.B. the asphalt mixing plant as verified by invoice and no compensation will be allowed for further handling or processing. The Department of Public Works will be reimbursed from monies due the Contractor for a decrease in asphalt cement content in the amount equal to the purchase price F.O.B. the asphalt plant.
3. The liquid anti-strip additive will be paid for based on certified invoices of material cost not to exceed fifteen (15) dollars per gallon. Hydrated lime anti-strip additive will be paid for based on certified invoices of material cost not to exceed ninety (90) dollars per ton. This payment shall be full compensation for all labor, materials, equipment, and other incidentals incurred in utilizing the anti-strip additive.

C. Bituminous Plant Mix Pavements (general).

All Work performed and measured as prescribed in TDOT Standard Specifications Section 407 and this Section will be paid for as provided in the respective TDOT Standard Specifications sections for each type specified. Acceptance of the mixture, defective materials, acceptance procedures, additional tests, and acceptance for mix density on the roadway will be paid for as described in TDOT Standard Specifications Subsection 407.20.

D. Cold Planing of Bituminous Plant Mix Pavements.

1. The accepted quantity of cold planed bituminous pavement will be paid for at the Contract Unit Bid Price which payment shall be full compensation for all labor, materials, equipment, hauling, and incidentals necessary to plane the pavement, control dust, and dispose of the cuttings.
2. The Contract Unit Bid Price for salvage value of cold planing will be deducted from monies due the Contractor to compensate the Department of Public Works for the removed material.

END OF SECTION - 02500

**SECTION 02520 -CEMENT CONCRETE CURB, GUTTER,
AND COMBINED CURB AND GUTTER**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This Work shall consist of curb, gutter, or combined curb and gutter constructed of portland cement concrete in accordance with TDOT Standard Specifications Section 702 and this Section at the locations and in reasonably close conformity with the lines, grades, and dimensions shown on the plans or established by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01710 - Cleanup and Restoration
Section 02200 - Earthwork
Section 02500 - Paving and Surfacing
Section 02522 - Cement Concrete Sidewalks, Driveways, and Median Pavement
Section 03300 - Cast-In-Place Concrete

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"American Society for Testing and Materials" (ASTM), Latest Revision

"American Concrete Institute" (ACI), Latest Revision

"Americans with Disabilities Act" (ADA), Latest Revision

"Americans with Disabilities Act Accessibility Guidelines" (ADAAG), Latest Revision

"Architectural Barriers Act" (ABA), Latest Revision

PART 2 - MATERIALS

2.1 GENERAL REQUIREMENTS

Materials shall meet the applicable requirements in TDOT Standard Specifications Sections 604 and 913 and in Section 03300 - Cast-In-Place Concrete together with the conditions and requirements set forth in this Section.

2.2 PREFORMED JOINT FILLER

Prefomed joint filler shall conform to the requirements in TDOT Standard Specifications Subsection 905.01 and in Section 03300 - Cast-In-Place Concrete unless otherwise specified in the plans.

2.3 DRAIN PIPE

This pipe shall conform to AASHTO M 178 or AASHTO M 179 for the specified material and diameters. Unless otherwise specified the pipe shall be of standard quality class. When specified the

pipe spigot shall have integral spacer lugs to provide for an annular opening and self centering feature.

2.4 CONCRETE

Concrete for curb, gutter, and combined curb and gutter shall be Class A concrete meeting all the requirements prescribed in TDOT Standard Specifications Section 604 and in Section 03300 - Cast-In-Place Concrete with the following modifications:

A. When the use of a curb machine is authorized the Contractor may request a concrete design based on the following:

<u>Water</u>	<u>Cement</u>	<u>Combined Coarse and Fine Aggregate</u>
4 gallons (maximum) coarse aggregate fine aggregate	94 lbs.	505 lbs. size nos. 7, 57, 67, or 78 45% to 60%

B. Entrained air will not be required in curb concrete made with the above combination.

C. The water and percentages of fine and coarse aggregate may be adjusted within the above limits to permit satisfactory placement.

D. Compressive test specimens may be made by the vibratory method in accordance with AASHTO T 23 or other approved methods.

PART 3 - EQUIPMENT

A. Forms except the templates between ten (10) foot sections may be either wood or metal meeting the requirements prescribed in TDOT Standard Specifications Subsection 701.03. The templates shall be one-eighth (1/8) inch thick metal of the same width as that of the curb, gutter, or combination curb and gutter and not less than one-quarter (1/4) inch more in depth than the respective depth of the type curb and gutter being constructed. The templates shall have lugs or other devices to hold them in position during placing of the concrete and shall be of such design as to permit removal without causing damage to the concrete. For gutters a strike off template of the form and shape of the gutter shall be used to shape the top surface of the gutter.

B. Compaction of subgrade shall be accomplished by any type of tamping or rolling equipment that will produce the desired results.

C. Mixers shall meet the requirements in TDOT Standard Specifications Subsection 604.12 and in Section 03300 - Cast-In-Place Concrete. A curb machine that will place the concrete in a satisfactory manner may be used when approved by the Engineer. Finishing equipment shall include satisfactory floats, edgers, spades, and tamps.

PART 4 - EXECUTION

4.1 GENERAL

Curb, gutter, or combined curb and gutter shall meet all the applicable requirements of the ADA, ADAAG, and ABA.

4.2 PRELIMINARY WORK

Clearing and grubbing, removal of structures and obstructions, excavation and undercutting, and

embankment construction shall be performed in accordance with the provisions in TDOT Standard Specifications Sections 201, 202, 203, and 205 and in Section 02100 - Site Preparation, Section 02200 - Earthwork, Section 02210 - Embankments, and Section 02225 - Earthwork for Structures and Pipes respectively.

4.3 SUBGRADE PREPARATION

Subgrade preparation for curb, gutter, and combined curb and gutter shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The subgrade shall be shaped and compacted to a firm even surface in reasonably close conformity with the grade and section shown in the plans. All soft and yielding material shall be removed and replaced with acceptable material which shall then be compacted as directed.

4.4 EXPANSION JOINTS

Expansion joints shall be formed at the intervals and locations shown in the plans using preformed filler three-quarters (3/4) inch thick unless otherwise specified. They shall be placed in line with corresponding expansion joints in adjoining pavement or other construction. Joint filler shall be cut to the full cross section of the curb, gutter, or curb and gutter.

4.5 LIMITATIONS OF MIXING

Limitations on the mixing of concrete shall be as prescribed in TDOT Standard Specifications Subsection 501.11 and in Section 03300 - Cast-In-Place Concrete.

4.6 MIXING, PLACING, AND FINISHING CONCRETE

Concrete shall be mixed in accordance with the requirements in TDOT Standard Specifications Subsection 604.14 and in Section 03300 - Cast-In-Place Concrete.

A. Immediately before placing the concrete the subgrade shall be thoroughly wetted and the forms given a coating of light oil. The forms shall be thoroughly cleaned and oiled each time before using. Placing concrete shall be performed as provided for in TDOT Standard Specifications Subsection 501.12 except that the mechanical spreader will not be required.

B. The concrete shall be placed immediately after mixing. The edges, sides, or faces shall be thoroughly spaded and vibrated sufficiently to consolidate the concrete thoroughly and bring the mortar to the surface after which the surface shall be finished smooth and even by means of a wooden float.

C. Concrete curb, gutter, and combined curb and gutter shall be constructed reasonably true to line, grade, and cross section and unless otherwise specified in the plans in sections having uniform lengths of ten (10) feet. The length of these sections may be reduced where necessary for closures but no section less than six (6) feet will be permitted. The templates shall be set carefully before the placing of the concrete and allowed to remain in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place. The forms on the face of all curbs shall be removed as soon as the concrete will hold its shape and the surface then floated with a wooden float to a smooth and even finish. No plastering will be permitted. Unless otherwise specified the top edges of the curb and the edge of the gutter shall be rounded to the radius as shown on the standard drawings and the edges on each side of templates and expansion joint material shall be finished with an edging tool with a radius of not over one-quarter (1/4) inch and then all lines or marks shall be removed with a wet brush. The back of curbs shall be finished not less than three (3) inches below the top of backfill against the curb. Any exposed surface or surfaces against which some rigid type of construction is to be made shall be left smooth and uniform so as to permit free movement of the curb, gutter, or combined curb and gutter.

D. All tool marks shall be removed with a wetted brush or wooden float and the finished surface shall present a uniform and pleasing appearance.

E. When the use of curb machines is permitted finishing shall be performed as specified above except that contraction joints may be sawed a minimum depth of one-quarter (1/4) the thickness of the section at intervals not less than six (6) feet nor more than ten (10) feet in lieu of constructing the curbs in sections.

F. Weep holes or drainage openings shall be placed through curbs as indicated in the plans or as directed by the Engineer and coarse aggregate shall be placed behind each opening as needed.

4.7 PROTECTION AND CURING

A. Immediately after finishing the concrete protection and curing shall be performed in accordance with the provisions in TDOT Standard Specifications Subsection 501.18.

B. The Contractor shall protect the curb, gutter, and combined curb and gutter until finally accepted. Any concrete that is damaged during that period shall be repaired by removing and reconstructing each ten (10) foot section that has been damaged. This reconstruction shall be at the Contractor's expense.

4.8 BACKFILLING

Immediately after the concrete has set sufficiently and the forms have been removed the space back of the curb or combined curb and gutter shall be filled with suitable material. This material shall be placed in layers not exceeding four (4) inches in loose thickness and compacted until firm and stable.

4.9 FINAL CLEANUP

Final cleanup shall be performed in accordance with the requirements in TDOT Standard Specifications Subsection 104.11 and in Section 01710 - Cleanup and Restoration.

PART 5 - MEASUREMENT AND PAYMENT

5.1 METHOD OF MEASUREMENT

A. Concrete curb, concrete gutter, and concrete combined curb and gutter will be measured for payment by the cubic yard complete in place. The volume per linear foot of length shall be obtained from the dimensions shown in the plans. Linear measurements will be surface measurements taken along the center of gravity of the section.

B. No measurement will be made for preparing the subgrade, for backfill, for expansion joint materials, or drain pipe unless otherwise indicated in the plans.

C. No measurement for payment will be made for curb integral with concrete pavement or concrete base unless otherwise specified in the plans or in this CONTRACT.

5.2 BASIS OF PAYMENT

The accepted quantities of concrete curb, concrete gutter, or concrete combined curb and gutter will be paid for at the Contract Unit Bid Price per cubic yard for the respective items.

END OF SECTION - 02520

**SECTION 02522 - CEMENT CONCRETE SIDEWALKS,
DRIVEWAYS, AND MEDIAN PAVEMENT**

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

This Work shall consist of constructing, driveways excluding driveways that are integrally part of structures of portland cement concrete on a prepared subgrade in accordance with TDOT Standard Specifications Section 701 and this Section and in reasonably close conformity with the lines, grades, and typical cross sections shown in the plans or established by the Engineer.

1.2 RELATED WORK SPECIFIED ELSEWHERE

Section 01710 - Cleanup and Restoration
Section 02500 - Paving and Surfacing
Section 02520 - Cement Concrete Curb, Gutter, and Combined Curb and Gutter
Section 03300 - Cast-In-Place Concrete

1.3 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

1.4 APPLICABLE REFERENCES

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"American Society for Testing and Materials" (ASTM), Latest Revision

"American Concrete Institute" (ACI), Latest Revision

"Americans with Disabilities Act" (ADA), Latest Revision

"Americans with Disabilities Act Accessibility Guidelines" (ADAAG), Latest Revision

"Architectural Barriers Act" (ABA), Latest Revision

PART 2 - MATERIALS

2.1 GENERAL REQUIREMENTS

Materials shall meet the requirements in TDOT Standard Specifications Sections 604 and 913 and in Section 03300 - Cast-In-Place Concrete together with the conditions and requirements set forth in this Section.

2.2 PREFORMED JOINT FILLER

Preformed joint filler shall conform to the requirements in TDOT Standard Specifications Subsection 905.01 and in Section 03300 - Cast-In-Place Concrete. Sand shall conform to ASTM C 144.

2.3 DRAIN PIPE

Drain pipe shall conform to the requirements in TDOT Standard Specifications Subsection 914.04 and in Section 02520 - Cement Concrete Curb, Gutter, and Combined Curb and Gutter unless

otherwise specified in the plans.

2.4 CONCRETE

Concrete for driveways shall be Class A concrete meeting all the requirements prescribed in TDOT Standard Specifications Section 604 and in Section 03300 - Cast-In-Place Concrete.

2.5 MORTAR

Cement and sand used for preparation of mortar shall conform to the requirements in TDOT Standard Specifications Section 607 and in Section 02720 - Storm Sewers and Drain Systems.

PART 3 - EQUIPMENT

A. Forms shall be of wood, metal, or other suitable material and shall extend for the full depth of the concrete. All forms shall be true to line, free from warp, and of sufficient strength to resist the pressure of the concrete without springing. Curved forms of proper radius shall be used on all radial sections and shall be of a design acceptable to the Engineer. Bracing and staking of forms shall be such that the forms remain in both horizontal and vertical alignment until their removal.

B. Mixers shall meet the requirements in TDOT Standard Specifications Subsection 604.12 and in Section 03300 - Cast-In-Place Concrete.

C. Satisfactory floats, templates, straightedges, edgers, spades, and tamps shall be furnished. Compaction of subgrade shall be accomplished by any type of tamping or rolling equipment that will produce the desired results.

D. A slip form paver which is capable of producing the required results may be used in lieu of forms.

PART 4 - EXECUTION

4.1 PRELIMINARY WORK

Clearing and grubbing, removal of structures and obstructions, excavation and undercutting, and embankment construction shall be performed in accordance with the provisions in TDOT Standard Specifications Sections 201, 202, 203, and 205, and Section 02225 - Earthwork for Structures and Pipelines respectively.

4.2 SUBGRADE PREPARATION

Subgrade preparation for driveways shall be made to the required depth and to a width that will permit the installation and bracing of the forms. The subgrade shall be shaped and compacted to a firm even surface in reasonably close conformity with the grade and cross section shown in the plans. All soft and yielding material shall be removed and replaced with acceptable material which shall then be compacted as directed.

4.3 EXPANSION JOINTS

A. Unless otherwise indicated in the plans or directed by the Engineer premolded expansion joint filler one-half (1/2) inch in thickness shall be placed at locations and in line with expansion joints in the adjoining pavement, gutter, or curb. All premolded expansion joint filler shall be cut to full width or length of the proposed construction and shall extend to within one-half (1/2) inch of the top or finished surface. All longitudinal expansion joints shall be placed as indicated in the plans or as directed by the Engineer. All expansion joints shall

be true, even, and present a satisfactory appearance.

B. Construction joints shall be formed around all appurtenances such as manholes, utility poles, etc., extending into and through the sidewalk or median area. Premolded expansion joint filler one-half (1/2) inch thick shall be installed in these joints. Expansion joint filler of the thickness indicated shall be installed between concrete sidewalks and any fixed structure such as a building or bridge. One-half (1/2) inch thick expansion joint filler shall be installed between concrete curb and median pavement and unless otherwise specified between concrete curb and sidewalk. This expansion joint material shall extend for the full depth of the walk or median pavement.

4.4 LIMITATIONS OF MIXING

Limitations on the mixing of concrete shall be as prescribed in TDOT Standard Specifications Subsection 501.11 and in Section 03300 - Cast-In-Place Concrete.

4.5 MIXING AND PLACING CONCRETE

A. Concrete shall be mixed in accordance with the provisions in TDOT Standard Specifications Subsection 604.14 and in Section 03300 - Cast-In-Place Concrete. Placing concrete shall be performed as provided for in TDOT Standard Specifications Subsection 501.12 except that mechanical spreaders will not be required. Immediately before placing the concrete the subgrade shall be thoroughly wetted and the forms given a coating of light oil. The forms shall be thoroughly cleaned and oiled each time before using.

B. Concrete driveways shall be constructed to the dimensions and finished elevations as specified in the plans.

D. Joints shall be constructed at intervals of twenty-five (25) feet to thirty (30) feet except for closures but no interval less than six (6) feet will be permitted.

E. A four (4) feet wide grass area furnishing zone adjacent to curb shall be provided for placement of light standards, poles, fire hydrants, mailboxes, etc.

H. Place premolded expansion joints, longitudinal expansion joints, and construction joints in accordance with the requirements in paragraph 4.3 above.

I. Ramps (curb and driveway) shall be constructed to the dimensions and finished elevations as specified in the plans or Contract Documents and shall also conform to the requirements of the ADA, ADAAG, and ABA. Surface of ramp shall be stable, firm, and slip resistant. Surface texture of ramp shall be that obtained by a coarse brooming transverse to the slope of the ramp. Ramps shall not be constructed using brick or an exposed aggregate concrete finish and shall not contain longitudinal or transverse expansion joints or groves.

4.6 FINISHING

The concrete shall be struck off with a transverse template resting upon the side forms. After the concrete has been struck off to the required cross section it shall be finished with floats and straightedges until the required surface requirements have been obtained.

A. When the surface of the concrete is free from water and just before the concrete obtains its initial set it shall be finished and swept lightly with a broom in order to produce a sandy texture. The longitudinal surface variations shall be not more than one-quarter (1/4) inch under a twelve (12) foot straightedge nor more than one-eighth (1/8) inch on a five (5) foot transverse section. The surface of the concrete shall be so finished as to drain completely at all times.

B. The edges of the driveways shall be carefully finished and rounded with an edging tool having a radius of one-half (1/2) inch.

C. Unless otherwise indicated in the plans marks or grooves may be placed at right angles to the center line of driveways and approximately eight (8) inches apart. These markings shall be between one-eighth (1/8) inch to one-quarter (1/4) inch in depth and shall be made with a suitable marking tool. A grooving tool six (6) inches to eight (8) inches in width with multiple grooves for grooving alternate strips eight (8) inches apart may be used. Any irregularities caused by the edges of the marking tool shall be removed by the use of a wetter brush or wooden float. All marking edges shall be rounded satisfactorily.

D. Grooves shall not be placed in the surface of driveways reinforced for beam action where the full thickness of concrete is required for strength.

E. The edges of the concrete at expansion joints shall be rounded with an edging tool having a radius of one-quarter (1/4) inch. All marks caused by edging shall be removed with a wetted brush or wooden float. The top and ends of expansion joint material shall be cleaned of all concrete and the expansion joint material shall be so trimmed as to be slightly below the surface of the concrete.

4.7 PROTECTION AND CURING

Forms may be removed at any time that removal will not damage the concrete. No pressure shall be exerted upon the concrete in removing forms.

A. Curing and protection during cold weather shall be performed as provided for in TDOT Standard Specifications Subsection 501.18.

B. Pedestrians will not be allowed upon concrete driveways until twelve (12) hours after finishing concrete and no vehicles or loads shall be permitted on any driveway until the Engineer has determined that the concrete has attained sufficient strength for such loads. An accessible alternative route(s) meeting the requirements of the ADA and approval of the Engineer shall be provided by the Contractor.

C. The Contractor shall construct and place such barricades and protection devices as are necessary to keep pedestrians and other traffic off the sidewalk, driveway, or median. An accessible alternative route(s) meeting the requirements of the ADA and approval of the Engineer shall be provided by the Contractor.

D. Any driveway damaged prior to final acceptance of the project shall be repaired at the Contractor's expense by removing concrete within groove limits and replacing it with concrete of the type and finish in the original construction.

4.8 BACKFILLING

Immediately after removing the side forms the spaces along the edges of driveways shall be filled with suitable material. This material shall be placed in layers not exceeding four (4) inches in loose thickness and compacted until firm and stable.

4.11 FINAL CLEANUP

Final cleanup shall be performed in accordance with the requirements in TDOT Standard Specifications Subsection 104.11 and in Section 01710 - Cleanup and Restoration.

PART 5 - MEASUREMENT AND PAYMENT

5.1 METHOD OF MEASUREMENT

A. Driveways will be measured by the square foot complete in place. The area shall be obtained by surface measurements. Where standard widths are constructed the measurements shall not exceed the standard widths shown in the plans unless on written direction of the Engineer.

B. No measurement for payment will be made for preparing the subgrade, for backfill, expansion joint materials, or drain pipe unless otherwise indicated in the plans as these are necessary parts of the construction.

5.2 BASIS OF PAYMENT

The accepted quantities of driveways will be paid for at the Contract Unit Bid Price per square foot for the respective items complete in place.

END OF SECTION - 02522

SECTION 02720 - STORM SEWERS AND DRAIN SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. This Work shall consist of the construction of pipe culverts, side drains, slope drains, and storm sewers of the kinds and dimensions shown in the plans and/or Contract Documents or stipulated in the proposal. The construction shall be accomplished in accordance with this Section and in reasonably close conformity with the lines, grades, and cross sections shown in the plans and/or Contract Documents or established by the Engineer. The Work shall include such labor, materials, and equipment as shall be necessary to make connections with other drainage structures as shown in the plans and/or Contract Documents or as directed by the Engineer.
- B. This Work shall consist of removing and relaying pipe culverts and storm sewers as shown in the plans and/or Contract Documents, stipulated in the proposal, or directed by the Engineer. Removal and relaying shall be accomplished in accordance with this Section and in reasonably close conformity with the lines, grades, and cross sections shown in the plans and/or established by the Engineer. The Work shall include such labor and materials as shall be necessary to make connections with other drainage structures as shown in the plans and/or Contract Documents or as directed by the Engineer. This item shall not include pipes which are to be removed but not to be incorporated in the Work.
- C. This Work shall consist of constructing curb inlets, combination inlets, and headwalls (pipe end walls) at the locations shown in the plans and/or Contract Documents and in reasonably close conformity to the lines, grades, and design dimensions shown in the plans and/or Contract Documents or as directed by the Engineer and in accordance with the provisions in this Section. The Work shall include the furnishing and installation of such incidental appurtenances and connections to pipe and other structures as shall be required to complete the construction as shown in the plans and/or Contract Documents or as directed by the Engineer.

1.2 APPLICABLE SPECIFICATIONS

"STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, Tennessee Department of Transportation (TDOT)

1.3 APPLICABLE REFERENCES

"Stormwater Management Manual" (SMM), Latest Revision, Metropolitan Government of Nashville and Davidson County

"American Society for Testing and Materials" (ASTM), Latest Revision

"American Association of State Highway and Transportation Officials" (AASHTO), Latest Revision

"American Concrete Institute" (ACI), Latest Revision

"Standard Building Code Requirements for Reinforced Masonry", Latest Revision,

American National Standards Institute (ANSI)

"Standard for Cast Iron Pit Cast Pipe", Latest Revision, American National Standards Institute (ANSI)

1.4 QUALITY ASSURANCE

All precast concrete items shall be products of one (1) or more manufacturer having demonstrated competence in the design and production of precast concrete specialties of the types specified herein for a minimum of three (3) years.

PART 2 - MATERIALS

2.1 GENERAL REQUIREMENTS

Materials used in this construction shall meet the requirements in TDOT Standard Specifications Sections 607, 609, 610, 611, 703, and 710 in addition to the general requirements in this Section.

- A. Where pipe culverts (side drains) are specified they shall be in accordance with the following:
 - 1. Pipe culverts (side drains) fifteen (15) inches through thirty-six (36) inches shall be Class III concrete pipe meeting the requirements in either paragraph 2.2 below or AASHTO M86.
 - 2. Pipe culverts (side drains) larger than thirty-six (36) inches shall be Class III concrete pipe meeting the requirements in paragraph 2.2.
- B. Materials for special end connections to other pipes or structures required to complete the Work as indicated in the plans and/or Contract Documents or directed by the Engineer shall conform to the requirements in this Section and the applicable subsections in TDOT standard specifications unless otherwise specified.
- C. Reinforced concrete pipe shall be flat base, round, or oval as shown in the plans and/or Contract Documents.
- D. The sizes of pipe shall be identified by the nominal inside diameter. The pipe shall be of the sizes stipulated in this CONTRACT, shown in the plans and/or Contract Documents, or established by the Engineer.
- E. Steel and aluminum pipe are considered as optional for corrugated metal pipe, pipe arches, and underdrains. The Contractor may use either he prefers however in no case shall different metals or corrugations be mixed in a single line of pipe.
- F. Concrete shall be Class "A" and manufactured, placed, and cured in accordance with the applicable requirements in Section 03300 - Cast-In-Place Concrete.
- G. All bolts, anchors, frames, hangers, etc., for castings and plates shall be as approved by the Engineer.
- H. The Contractor may use either the curb inlet and combination inlet section detailed in the

plans and/or Contract Documents or substitute comparable sections of cast in place concrete, precast reinforced concrete, or brick masonry as shall be applicable. When a substitution is proposed for a curb inlet or combination inlet section detailed in the plans and/or Contract Documents the Contractor shall construct the substitute section in accordance with the applicable standard drawing as approved by the Engineer. In the event the Department of Public Works and/or TDOT has no standard drawing of the substitute section the Contractor shall submit shop drawings of the revised section to the Engineer for approval prior to construction. After securing the necessary approval the Contractor shall furnish the Engineer a permanent four (4) mil mylar reproducible of the design.

- I. All materials and devices used in making connections shall be approved by the Engineer before being used.
- J. Underdrains shall be of the kinds specified. Unless otherwise specified circular pipe for underdrains shall have a diameter of four (4) inches. Semi-circular pipe for underdrains shall have a diameter of four and five-eighths (4 5/8) inches. In the case of pipe the size shall be understood to mean the nominal inside diameter.
- K. Pipe shall have a minimum cover of eighteen (18) inches above the top of the pipe.

2.2 REINFORCED CONCRETE PIPE

Reinforced concrete storm sewer pipe shall be Class III unless otherwise specified in the plans and/or Contract Documents and shall conform to ASTM C 76 for the specified diameters. Horizontal and vertical elliptical pipe shall conform to ASTM C 507 and arch pipe shall conform to ASTM C 506.

- A. Precast reinforced concrete end sections shall conform to the cited specifications to the extent to which they apply.
- B. Pipe shall have ends sealed inside and outside of pipe with mortar or bituminous type joints and shall be accepted on the basis of plant load bearing tests, material tests, and inspection of pipe for visual defects and imperfections.
- C. Joints shall be made with portland cement mortar, rubber gaskets, or other types of joints recommended by the pipe manufacturer and approved by the Engineer.

2.3 JOINT MORTAR

Pipe joint mortar shall consist of one (1) part portland cement and two (2) parts sand with water necessary to obtain the required consistency. Portland cement shall conform to the requirements in Section 03300 - Cast-In-Place Concrete, type I. The sand shall conform to the requirements in TDOT Standard Specifications Subsection 903.02. The water shall be approved for quality by the Engineer. Mortar shall be used within thirty (30) minutes after its preparation.

2.4 RUBBER GASKETS

Rubber gaskets shall conform to the requirements of ASTM C443.

2.5 HEMP OR OAKUM GASKETS

Gaskets of hemp or oakum packing for joint filler shall be closely twisted and shall be of the size and type required for the pipe under construction. Gaskets shall be in one (1) piece of sufficient length to pass around the pipe andlap.

2.6 NON-REINFORCED CONCRETE PIPE

Non-reinforced concrete storm sewer pipe shall be Class III unless otherwise specified in the plans and/or Contract Documents and shall conform to ASTM C 14 for the specified diameters.

2.7 STRUCTURAL STEEL

All rolled plates, shapes, and bars for structural use shall conform to ASTM A 36 unless otherwise specified.

2.8 BUILDING BRICK

Brick when made from clay or shale shall conform to AASHTO M 114. When made of concrete they shall conform to ASTM C 55. The kind and grade shall be as specified.

2.9 SEWER BRICK

Brick shall conform to AASHTO M 191 and unless otherwise specified or indicated shall be grade SM size eight inch by three and five-eighths inch by two and one-quarter inch (8" x 3 5/8" x 2 1/4").

2.10 MASONRY MORTAR

Mortar shall be composed of one (1) part portland cement and two (2) parts sand. Hydrated lime in an amount not to exceed ten (10) percent may be added to portland cement. Water shall be added to the mixture in such quantity as to form a stiff paste.

- A. The mortar shall be hand mixed or machine mixed. In the preparation of hand mixed mortar the sand, cement, and hydrated lime shall be thoroughly mixed together in a clean tight mortar box until the mixture is of uniform color after which water shall be added. Machine mixed mortar shall be prepared in an approved mixer and shall be mixed not less than one and one-half (1 1/2) minutes.
- B. Mortar shall be used within thirty (30) minutes after mixing. Retempering of mortar shall not be permitted.
- C. Cement and water used for mortar shall conform to the applicable requirements in Section 03300 - Cast-In-Place Concrete. Sand shall conform to the applicable requirements in TDOT Standard Specifications Subsection 903.02. Hydrated lime shall conform to the applicable requirements of ASTM C206.

2.11 STEEL BAR REINFORCEMENT

Steel bar reinforcement shall conform to the applicable requirements in Section 03300 - Cast-In-Place Concrete.

2.12 GRAY IRON CASTINGS

All castings shall be of the type specified and shall be within reasonably close conformity with the dimensions shown in the plans and/or Contract Documents. The castings shall conform to ASTM A 48 with the additional requirements herein and unless otherwise specified all castings shall be Class 30.

- A. At the option of the Engineer castings may be tested for strength by the transverse method in accordance with ASTM A 438 and in conformance with the requirements in TDOT Standard Specifications Subsection 908.07.
- B. When the transverse test method is used and the test bar fails to meet the load requirements as prescribed in TDOT Standard Specifications Subsection 908.07 the broken end of the bar may be machined by the manufacturer and tested for tensile strength. If this tension specimen conforms to the requirements of the specified class it shall be considered as having met irrespective of the transverse breaking load.
- C. Test bars for both transverse and tension testing shall be cast in accordance with ASTM A 48, table II, test bar B.
- D. All castings shall be cleaned of sand and scale by sand blasting or other effective methods so as to present a smooth, clean, and uniform surface and treated with two (2) coats of bituminous sealpaint.
- E. Gray iron castings shall have the date of manufacture cast into each unit.
- F. Curb inlet and combination inlet castings shall have the lid and lid seat of the rim machined to form a true bearing. Frames and covers shall have ground bearing surfaces to prevent rocking and rattling under traffic as shown in the plans and/or Contract Documents.
- G. All castings shall weigh at least ninety-five (95) percent of the theoretical weight shown in the plans and/or Contract Documents.

2.13 MANHOLES AND METER AND VALVE BOXES

- A. Manholes and meter and valve boxes set in paved areas (street or sidewalks) within the right-of-way shall be gray iron casting or concrete. The castings shall conform to ASTM A 48 with the additional requirements herein and unless otherwise specified all castings shall be Class 30.
- B. All lids and frames shall be gray iron casting or concrete with gray iron casting lid and gray iron casting frame and shall conform to ASTM A 48 with the additional requirements herein and unless otherwise specified all castings shall be Class 30.

2.14 COMBINATION INLET STEPS

Combination inlet steps shall be a composite of a no. 4 grade 60 deformed steel bar encased in copolymer polypropylene plastic of the "press fit" design rubber or aluminum. The steps shall conform with the requirements in the "SUBDIVISION SPECIFICATIONS FOR STREETS AND ROADS", Latest Revision, and the plans and/or Contract Documents.

2.15 PRECAST CURB INLETS AND COMBINATION INLETS

Precast curb inlets and combination inlets shall conform to ASTM C 478.

2.16 PERFORATED CONCRETE PIPE

Perforated concrete pipe shall conform to AASHTO M 175 or to ASTM C 444 for the specified diameters and unless otherwise specified it shall be standard strength.

2.17 AGGREGATE FOR UNDERDRAINS

Aggregate for underdrains shall be crushed stone, crushed slag, or washed gravel meeting the quality requirements of ASTM D 692 and the grading requirements for size 6, 7, 8, 57, or 78 in TDOT Standard Specifications Subsection 903.22.

2.18 FILTER CLOTH

Filter cloth material shall meet the requirements in Section 02270 - Rip-Rap.

2.19 CONCRETE HEADWALLS

Cast in place headwalls shall be reinforced concrete and shall be in conformance with the requirements in the "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, and the plans and/or Contract Documents. Concrete shall be Class "A" as specified in Section 03300 - Cast-In-Place Concrete.

2.20 PRECAST CONCRETE

Precast concrete structures produced by the dri-cast method shall be in conformance with ASTM C 478. Precast concrete bases, riser sections, cones, and headwalls shall conform to the requirements in the "SUBDIVISION SPECIFICATIONS FOR STREETS AND ROADS", Latest Revision, and the plans and/or Contract Documents. The applicable provisions in Section 03300 - Cast-In-Place Concrete shall apply to the production of curb inlets, combination inlets, and headwalls except that the design mix (f'_c) shall be four thousand (4000) pounds per square inch. Reinforcing steel for precast boxes, curb inlets, and combination inlets shall conform to the requirements in Section 03300 - Cast-In-Place Concrete.

2.21 CONCRETE CAPPING

Concrete for concrete capping shall be Class "A" in conformance with Section 03300 - Cast-In-Place Concrete.

2.22 CEMENT CONCRETE DITCH PAVING

Concrete for cement concrete ditch paving shall be Class "A" concrete meeting all the requirements prescribed in Section 03300 - Cast-In-Place Concrete.

PART 3 - EQUIPMENT

All equipment necessary for the satisfactory performance of this Work shall be on hand and approved by the Engineer prior to construction. The equipment provided by the Contractor shall include hoisting

equipment capable of handling and placing the pipe in final position without damage to the pipe. Mechanical tamps shall also be included.

- A. Forms shall be either wood or metal meeting the requirements in Section 02522 - Concrete Walks, Driveways, and Ramps. A strike off template of the form and shape of the ditch section shall be used to shape the top surface of the paved ditch.
- B. Compaction of subgrade shall be accomplished by any type of tamping or rolling equipment that shall produce the required results.
- C. Mixers shall meet the requirements in Section 03300 - Cast-In-Place Concrete. Mechanical ditch paving machines shall be used when approved by the Engineer.
- D. Finishing equipment shall include satisfactory floats, edgers, spades, and tamps.

PART 4 - EXECUTION

4.1 GENERAL

- A. Clearing and grubbing, removal of structures and obstructions, excavation and undercutting, and embankment construction shall be performed in accordance with the provisions in Section 02200 - Earthwork.
- B. Temporarily support, protect, and maintain all underground and surface structures and utilities encountered in the process of the Work. Where the grade or alignment of the pipe is obstructed by existing utilities such as conduit, pipe, or other obstruction the Contractor shall immediately notify the Engineer and utility company concerning conflict.
- C. Bedding and backfill material for pipe culverts, curb inlets, combination inlets, headwalls, and any other storm and/or drainage structures shall conform to the requirements in Section 02225 - Earthwork for Structures and Pipelines. When no bedding is specified the requirements for Class "C" bedding shall apply
- D. When excavation is made across private property the topsoil and/or sod disturbed by the excavation operations shall be salvaged, maintained and/or stored, and replaced in its original position in conformance to Section 01568 - Erosion Control, Section 01710 - Cleanup and Restoration, Section 02200 - Earthwork, and Section 02935 - Seeding and Sodding unless otherwise specified.
- E. Install piping in such a manner as to obtain sufficient flexibility and to prevent excessive stresses in materials and excessive bending movements at joints. Conduct Work in strict conformance with the procedures established by the manufacturers of the various types of pipe.
- F. In no case shall the type of pipe change between drainage structures.

4.2 STRUCTURE EXCAVATION & FOUNDATION PREPARATION FOR PIPE CULVERTS

This Work shall be performed in accordance with the provisions in Section 02225 - Earthwork for Structures and Pipelines.

- A. The bedding for pipe culverts shall conform to the requirements in Section 02225 - Earthwork for Structures and Pipelines for Class "A", Class "B", or Class "C". When no

bedding class is specified, the requirements for Class "C" bedding shall apply. Bedding for pipe culverts and storm sewer cross drains shall have a longitudinal camber of the magnitude specified by the Engineer.

- B. When excavation is made for installing storm sewers across private property the topsoil and sod disturbed by the excavation operations shall be salvaged and replaced in its original position unless otherwise specified. All costs of restoring the area to its original conditions shall conform to the requirements in Section 01710 - Cleanup and Restoration.

4.3 LAYING PIPE CULVERTS AND STORM SEWERS

Lay pipe to a true uniform line and grade from elevations indicated in the plans and/or Contract Documents with continuous bearing of barrel on cradle or bedding material.

- A. Pipe culverts and storm sewers shall be laid beginning at the downstream end of the pipe line. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length. Bell or groove ends of rigid pipe and outside circumferential laps of flexible pipe shall be placed facing upstream and the spigot ends of rigid pipe shall be placed facing downstream. Flexible pipe shall be placed with longitudinal laps or seams at the sides. Lay each section of pipe in such a manner as to form a close concentric joint with the adjoining section and to prevent any sudden offsets in the flowline.
- B. Insure that pipe is well bedded on a solid foundation. Correct any defects due to settlement. Excavate bell holes sufficiently large to insure proper jointing and pipe support. Exercise precautions to include the furnishing and placing of bedding to prevent any pipe from resting directly on rock.
- C. Plug or regrout lift holes left in the pipe prior to backfilling operations.
- D. As the Work progresses clear the interior of the pipe of all dirt and superfluous materials of every description.
- E. Keep trenches and excavations free of water during construction and until final inspection. Do not lay pipe in water or in a frozen bedding condition. Prevent flotation and relay pipe that has floated.

4.4 JOINING PIPE

Rigid pipe shall be of bell and spigot or tongue and groove design unless one (1) type is specified. The method of joining pipe sections shall be such that the ends are fully entered and the inner surfaces are reasonably flush and even.

- A. Joints for rigid pipe shall be made with portland cement mortar, rubber gaskets, or other types of joints recommended by the pipe manufacturer and approved by the Engineer shall be permitted.
- B. For mortar joints the pipe ends shall be thoroughly cleaned and wetted with water before the joint is made. Stiff mortar shall then be placed in the lower half of the bell or groove of the pipe section already laid and on the upper half of the spigot or tongue of the section to be laid. The two (2) pipe sections shall then be tightly joined with their inner surfaces flush and even. The inside of the joint shall then be finished smooth and any surplus material removed from the pipe. The completed mortar joints shall be protected against rapid drying by suitable covering material.

- C. Rubber ring gaskets shall then be installed so as to form a flexible watertight seal. When other type joints are permitted they shall be installed or constructed in accordance with the recommendations of the manufacturer.
- D. Pipe shall be inspected before any backfill is placed. Any pipe found to be out of alignment, unduly settled, or damaged shall be taken up and relaid or replaced.
- E. Flexible pipe shall be firmly joined by approved coupling bands. For flexible pipe joints the connecting band shall be of the same material and thickness as the main pipeline. The band shall be installed as to the manufacturer's specifications. The band when installed shall prevent the infiltration of water or backfill material.

4.5 BACKFILL

After the pipe is installed the trench shall be backfilled in accordance with the provisions in Section 02225 - Earthwork for Structures and Pipelines.

4.6 DISPOSAL OF EXCESS OR UNSUITABLE MATERIAL

Excess or unsuitable material shall be disposed of according to the requirements in Section 02200 - Earthwork or as directed by the Engineer. Excavated material shall be utilized as prescribed in Section 02225 - Earthwork for Structures and Pipelines.

4.7 REMOVAL OF PIPE

The pipe shall be carefully removed and so handled as not to damage or cause the pipe to be unfit for relaying. The Contractor shall be required to replace at his own expense pipe of the kind and quality damaged by his negligence or inefficient handling.

4.8 PREPARATION OF PIPE FOR RELAYING

The pipe shall be thoroughly cleaned inside and outside of dirt, debris, mortar, and other foreign matter.

- A. The Contractor shall perform any necessary cutting of salvaged pipe in order to obtain required lengths and shall furnish coupling bands, gaskets, and other jointing materials necessary to make all connections.
- B. All pipe to be relaid shall be sound and in good condition. Any broken or deteriorated section of pipe or connection shall be rejected for use.

4.9 RELAYING OR PLACING PIPE AND BACKFILL FOR PIPE REMOVED AND RELAID

The requirements for relaying or placing pipe of the various types specified shall be as prescribed in paragraphs 4.3 through 4.5 above. Backfilling shall be performed in accordance with the provisions in Section 02225 - Earthwork for Structures and Pipelines.

4.10 STRUCTURE EXCAVATION, FOUNDATION PREPARATION, AND BEDDING FOR PIPE DRAINS

Structure excavation and foundation preparation shall be performed in accordance with the

provisions in Section 02225 - Earthwork for Structures and Pipelines. Bedding for pipe drains unless otherwise stipulated shall be Class "C" bedding as prescribed in Section 02225 - Earthwork for Structures and Pipelines. Backfilling of trenches shall be performed according to the requirements in Section 02225 - Earthwork for Structures and Pipelines.

4.11 PLACING AND JOINTING PIPE DRAINS

- A. Pipe for drains shall be placed in conformity with all applicable requirements in paragraph 4.3 above. Jointing of concrete, clay, and corrugated metal drain pipe shall be performed in accordance with the provisions in paragraph 4.4 above.
- B. Jointing of cast iron pipe shall be performed in accordance with the recommendations of the manufacturer using the fittings and methods recommended by the manufacturer.

4.12 CURB INLET AND COMBINATION INLET CONSTRUCTION

All concrete construction shall be accomplished in accordance with the requirements in Section 03300 - Cast-In-Place Concrete. All brick construction shall be performed in accordance with the provisions in TDOT Standard Specifications Section 613.

- A. Construct curb inlets and combination inlets in accordance with this Section and the plans and/or Contract Documents. Unless modifications to the existing system are being performed provide monolithic base of precast construction.
- B. Construct appropriate flow channels in the bottom of curb inlets and combination inlets conforming to the requirements in "STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION", Latest Revision, and as shown in the plans and/or Contract Documents. Flow channel construction shall provide a smooth transition between adjacent sections.
- C. Cast in place concrete for curb inlets and combination inlets shall be placed monolithically. Concrete shall be allowed to drop freely up to five (5) feet in height. Where greater drops are required a tremie or other device shall be used.
- D. Joints for brickwork shall be completely filled and shall be smooth and free from surplus mortar on the inside of the structure. Brick shall be laid radially with every sixth (6th) course laid as a stretcher course. Brick curb inlets and combination inlets shall be pargeted over the entire inside surface of the walls.
- E. Inlet and outlet pipe shall extend through the walls of curb inlets and combination inlets for a sufficient distance beyond the outside surface to allow for connections but shall be cut off flush with the wall on the inside surface unless otherwise directed. Tightly mortar in pipe with quick setting non-shrink grout.
- F. The concrete or brick mortar shall be so constructed around the pipes as to prevent leakage and form a neat connection.
- G. Firmly anchor steps where required to wall according to manufacturer's recommendations. Steps shall project not less than five (5) inches from the inner surface of the wall. Steps set in vertical alignment shall be not less than twelve (12) inches wide.
- H. Bedding and backfill material shall be placed in conformance to the provisions in Section

02225 - Earthwork for Structures and Pipelines.

- I. No backfill or traffic shall be allowed on precast sections until seven (7) calendar days have elapsed since the representative test specimens have attained the required compressive strength.

4.13 INVERTS

Inverts shall be of Class "A" concrete and shall conform to the shapes indicated in the plans and/or Contract Documents. The inverts shall be so constructed as to cause the least possible resistance to flow. The shape of the inverts shall conform uniformly to inlet and outlet pipes. A smooth and uniform finish shall be required.

4.14 CASTINGS AND FITTINGS

Castings and fittings shall be handled in a manner that shall prevent damage.

All damaged castings and fittings shall be rejected.

- A. All Castings and fittings shall be placed in the positions indicated in the plans and/or Contract Documents or as directed by the Engineer and shall be set true to line and grade.
- B. If castings are to be set in concrete or cement mortar all anchors or bolts shall be in place and position before the concrete or mortar is placed. The casting shall not be disturbed until the mortar or concrete has set.
- C. When castings are to be placed upon previously constructed masonry the bearing surface of masonry shall be brought true to line and grade and present an even bearing surface in order that the entire face or back of the casting shall come in contact with the masonry. Castings shall be set in mortar beds or anchored to the masonry as indicated in the plans and/or Contract Documents or as directed by the Engineer.
- D. All castings shall be set firm and snug and shall not rattle. Adjust the frame and castings to finished grade by brick or concrete adjusting ring construction. Unless otherwise specified gray iron castings shall be cleaned and treated with two (2) coats of bituminous paint.

4.15 MANHOLES AND METER AND VALVE BOXES

All manhole and meter and valve box lids and frames shall be set firm and snug and shall not rattle. Adjust the frame and castings to finished grade by brick or concrete adjusting ring construction. Unless otherwise specified gray iron casting lids and frames shall be cleaned and treated with two (2) coats of bituminous paint.

4.16 CAPPING EXISTING DRAINAGE STRUCTURES AND/OR PIPE

At all locations shown in the plans and/or Contract Documents or where directed by the Engineer the Contractor shall cap existing drainage structures and/or cut and cap existing pipe. This item shall include excavation, cutting existing pipe, furnishing and installing an approved cap and necessary concrete blocking, backfill, and all labor and materials required for a complete installation.

4.17 ADJUSTING AND/OR REWORKING EXISTING DRAINAGE STRUCTURES

At all locations shown in the plans and/or Contract Documents or where directed by the Engineer the Contractor shall adjust and/or rework existing drainage structures. This item shall include excavation; adjusting and/or cutting existing pipe; adjusting existing frame, grate, and/or covering; adjusting and/or reworking drainage structure depth, width, and elevation as shown in the plans and/or Contract Documents; backfill; and all labor and materials required for a complete installation.

4.18 FINAL CLEANUP

Final cleanup shall be performed as prescribed in Section 01710 - Cleanup and Restoration.

- A. All excess or unsuitable material shall be disposed of as directed by the Engineer.
- B. All material becoming the property of the City of Goodlettsville shall be stored as directed by the Engineer.

PART 5 - MEASUREMENT AND PAYMENT

5.1 MEASUREMENT

- A. Pipe culverts and storm sewers of the different types classes, shapes, and sizes specified shall be measured for payment at a Contract Unit Bid Price per linear foot along the centerline of the installed pipe for each type, class, shape, and size constructed complete in place which shall be full compensation for excavation (unless otherwise specified), bedding and backfill material, labor and materials used in making joints and connections to other structures, strutting when required, and completing all incidentals necessary to complete the item. When the plans and/or Contract Documents provide for direct payment for structure excavation measurement and payment shall be in accordance with Section 02225 - Earthwork for Structures and Pipelines for culvert excavation(unclassified).
- B. Pipe culverts (side drains) and slope drains shall be measured for payment at a Contract Unit Bid Price per linear foot along the centerline of installed pipe for each size constructed complete in place which shall be full compensation for labor and material for making joints, excavation, bedding and backfill material, and all incidentals necessary to complete the Work. No measurements for payment shall be made in excess of the ordered length of the pipe. Pipe culverts (side drains) shall be ordered in increments of two (2) feet.
- C. Curb inlets and combination inlets shall be measured for payment at a Contract Unit Bid Price per each for the various types, diameters, and ranges of depth complete in place as indicated in the plans and/or Contract Documents which shall be full compensation for performing all operations incidental thereto such as excavation, bedding, and backfill and for furnishing all materials, equipment, tools, labor, and incidentals necessary to complete the item. Steps, type of structure (brick or precast), casting and frames, mortar, and any other incidental items necessary for complete installation shall not be paid for directly but the cost thereof shall be included in the Contract Unit Bid Price of the curb inlet or combination inlet. Measurement for payment shall be based upon vertical depth from invert of curb inlet or combination inlet to top of structure. Standard depth of structure shall be from zero (0) feet to six (6) feet. Additional depth shall be paid for on a one (1) foot vertical increment. When the plans provide for direct payment for structure excavation measurement and payment shall be in accordance with Section 02225 - Earthwork for Structures and Pipelines for structure excavation.

- D. If precast headwalls are approved by the Engineer payment shall be at a Contract Unit Bid Price per each complete in place which shall be full compensation for excavation, bedding and backfill material, steel reinforcement, and all Work and incidental items necessary for complete installation.
- E. Cutting and capping existing drainage structure and/or pipe shall be measured for payment at a Contract Unit Bid Price per each which shall be full compensation for the actual number of existing drainage structures capped or existing pipe cut and/or capped complete in place including frames, grates, concrete, excavation, backfill, and all Work and incidental items necessary for complete installation. No separate payment shall be made for excavation, backfill, and rodding or blocking.
- F. Adjusting and/or reworking existing drainage structures or existing drainage structure covers, grates, and frames shall be measured for payment at a Contract Unit Bid Price per each which shall be full compensation for the actual number of existing drainage structures adjusted and/or reworked or the actual number of existing drainage structure covers, grates, and frames adjusted complete in place including concrete, excavation, and backfill. No separate payment shall be made for excavation, backfill, labor, or materials.
- G. Concrete pipe culverts and concrete storm sewers of the different classes, shapes, and sizes specified shall be measured by the linear foot of pipe installed and accepted. The quantity of pipe cut off not to exceed two (2) feet shall be paid for at the Contract Unit Bid Price for pipe in place.
- H. Unless otherwise indicated in the plans and/or Contract Documents no measurement of structure excavation shall be made and the cost involved shall be included in the Contract Unit Bid Price for other items of construction. When the plans and/or Contract Documents provide for direct payment of structure excavation measurement and payment shall be made in accordance with Section 02225 - Earthwork for Structures and Pipelines.
- I. No payment shall be made for labor and materials used in making branch connections. The length of pipe in the branch connection shall be measured and included in the quantity of pipe installed in the branch line.

END OF SECTION - 02720

SECTION 02935 - TOPSOIL, SEEDING, AND SODDING

1.1 GENERAL

- A. SUMMARY - Provide all labor, materials, tools and equipment as required to have topsoil, fertilizer, lime, mulch, and seed applied on all areas disturbed by construction. This work will be performed and payment made in accordance with other sections of these Specifications.
- B. RELATED SECTIONS
 - 1. Section 01568: Erosion Control
 - 2. Section 01710: Cleanup and Restoration
 - 3. Section 02223: Backfilling

1.2 PRODUCTS

A. MATERIALS

- 1. Topsoil
- 2. Seed - Grass seed shall consist of and be sown at the rate of forty (40) pounds of Kentucky Bluegrass, ten (10) pounds of red top, ten (10) pounds of white clover and ten (10) pounds of farm rye per acre. Oats shall be substituted for rye if seed is sown in the spring.
- 3. Straw
- 4. Sod
 - a. Sod shall consist of live, dense, well rooted growth of permanent grasses, free from Johnson grass, Nut grass, and other obnoxious grasses, of suitable character for the purpose intended and for the soil in which it is to be planted. It shall be uninjured at the time of planting. Sod must be free of weeds, bind weeds, or other matter, which has a tendency to kill the grass.
 - b. Sod for area sodding shall be at least 8" wide and 12" long and shall have a reasonably uniform thickness of at least 3".
- 5. Fertilizer - Fertilizer shall comply with the requirements of Subsection 918.15 of the Tennessee Department of Transportation Standard Specifications for Road and Bridge Construction (1981) and shall be Grade 10-10-10, unless otherwise indicated. Agricultural limestone shall conform to the requirements of Subsection 918.17 of the above Standard Specifications.

1.3 EXECUTION

A. INSTALLATION

- 1. Topsoiling and Seeding
 - a. This shall include the separation and re-depositing of topsoil, final grading, raking, fertilizing, seeding and placing of straw of trenches and areas disturbed by construction operations across public and/or private property.
 - b. Where directed in writing by the Engineer after completion of cleanup and backfill operations, the Contractor shall topsoil, grade, rake, fertilize, seed and straw all trench lawns and grass areas disturbed by construction operations.
 - c. Topsoil may be the top soil originally excavated from the area and

separated from the common excavation for re-depositing under this item if suitable soils are encountered or topsoil obtained off the site of work from other sources by the Contractor and satisfactory to the Engineer. All arrangements and expenses for securing, loading, hauling and spreading topsoil shall be by the Contractor.

- d. The topsoil shall be deposited and spread to a minimum finished depth of at least four (4) inches.
- e. When the topsoil has been placed to the required depth, the area shall be final graded to blend in and to the contour of the original ground surface. The surface shall then be fine raked to remove all vegetable matter, stones, or other objectionable material and leveled and smoothed ready for fertilizing.
- f. At least forty-eight (48) hours before sowing any seed, commercial fertilizer shall be uniformly spread over the topsoil at the rate of eight hundred (800) pounds per acre by a mechanical spreader and mixed into the soil for a depth to two (2) inches. The area shall then be lightly raked and/or harrowed until the surface of the finished grade is smooth, loose and pulverized.
- g. Grass seed shall then be sown by a mechanical spreader operating in two directions and lightly raked. The Contractor shall use care in raking not to destroy the finished grade or disturb the distribution of seed. The seeded area shall be thoroughly watered with a fine spray in such a manner as not to wash out the seed. Sowing of seed shall be done only within the seasons extending from March 1 to June 1 and August 1 to November 30.
- h. All areas seeded shall be covered with a light covering of straw approximately one-fourth inch (1/4") in depth.

2. Topsoiling and Sodding

- a. The sodding operations shall be limited to March 1st through October 1st, unless weather and soil conditions are considered favorable and permission is granted by the Engineer.
- b. All sod shall be planted only when the soil is moist and otherwise favorable to growth.
- c. The surface shall contain not less than one foot of topsoil and be loosened to a depth of not less than 3" and raked to remove any lumpy materials.
- d. As necessary, the soil shall be sprinkled until saturated at least 1" in depth and kept moist until the sod is placed thereon. Immediately before placing sod, fertilizer and lime shall be applied uniformly to the prepared surface of the ground. Fertilizer shall be applied at the rate of 12 pounds of Grade 10-10-10, or equivalent, per 1,000 square feet. Agricultural limestone shall be applied at the rate of 100 pounds per 1,000 square feet.
- e. Sod shall be placed on the prepared surface with the edges in close contact and, so far as possible, in a position to break joints. Each piece of sod laid shall be fitted in the space and shall be rolled or hand tamped to the satisfaction of the Engineer.
- f. The sod shall be maintained moist from the time of removal from the point of origin until placed, and shall be placed as soon as practicable after removal from the place where it was growing.

- g. On steep slopes, or where necessary, pinning or pegging will be required to hold the sod in place.

B. MAINTENANCE

1. The seeded areas shall be watered, maintained and patched as necessary until the Contractor's work is completed and he leaves the site and/or a suitable stand of grass is obtained.
2. The sod shall be watered for a minimum period of two weeks after setting. The Contractor shall not allow any equipment or material on any planted area and shall erect barricades and guards, if necessary, to prevent his equipment, labor, or the public from traveling on or over any planted area.
3. It shall be the obligation of the Contractor to mow and maintain the grassed areas and to secure an acceptable growth of grass before final acceptance of the Project.

END OF SECTION

SECTION 03300 - CAST-IN-PLACE CONCRETE

1.1 GENERAL

A. SECTION INCLUDES

1. Cast-in-place concrete footings, foundations, walls.
2. Slabs on grade.
3. Thrust blocks.
4. Concrete finishing and curing.

B. REFERENCE STANDARDS

1. ACI 301 - Specifications for Structural Concrete for Buildings.
2. ACI 302 - Guide for Concrete Floor and Slab Construction.
3. ACI 304 - Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
4. ACI 305 - Hot Weather Concreting.
5. ACI 306 - Cold Weather Concreting.
6. ACI 318 - Building Code Requirements for Reinforced Concrete.
7. ASTM C31 - Standard Method of Making and Curing Concrete Compressive and Flexural Strength Test Specimens in the Field.
8. ASTM C33 - Standard Specification for Concrete Aggregates.
9. ASTM C39 - Standard Method of Test for Compressive Strength of Molded Concrete Cylinders.
10. ASTM C42 - Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
11. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
12. ASTM C143 - Standard Method of Test for Slump of Portland cement Concrete.
13. ASTM C150 - Standard Specifications for Portland cement.
14. ASTM C171 - Specifications for Sheet Materials for Curing Concrete.
15. ASTM C172 - Standard Method of Sampling Fresh Concrete.
16. ASTM C173 - Standard Method of Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
17. ASTM C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
18. ASTM C260 - Standard Specifications for Air-Entraining Admixtures for Concrete.
19. ASTM C309 - Specifications for Liquid Membrane-Forming Compounds for Curing Concrete.
20. ASTM C330 - Standard Specifications for Lightweight Aggregates for Structural Concrete.
21. ASTM C494 - Standard Specifications for Chemical Admixtures for Concrete.
22. ASTM C618 - Standard Specifications for Fly Ash and Raw or Calcined Natural Pozzolans for Use in Portland cement.

C. QUALITY ASSURANCE

1. Perform work in accordance with ACI 301.
2. Obtain materials from same source throughout work.
3. Field Reference Manual: Contractor shall have a copy of the latest edition of "ACI Manual SP-15" available in field office.

D. TESTING

1. Concrete Testing Service: Employ, at Contractor's expense a testing laboratory acceptable to Engineer to perform material evaluation tests and to

design concrete mixes.

2. Materials and installed work may require testing and retesting, as directed by Engineer, at any time during progress of work. Allow free access to material stockpiles and facilities. Tests, not specifically indicated to be done at Owner's expense, including retesting of rejected materials and installed work, shall be done at Contractor's expense.
3. Testing firm will take cylinders and perform slump unit weight and air entrainment tests in accordance with ACI 301.
4. Five concrete test cylinders will be taken for every 50 cubic yards or less of each class of concrete placed each day.
5. One additional test cylinder will be taken during cold weather and cured on site under same conditions as concrete it represents.
6. One slump test will be taken for each set of test cylinders taken.

E. SUBMITTALS

1. Submit the following in accordance with Section 01340.
 2. Product Data: Submit manufacturer's product data with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Engineer.
 3. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.
 4. Manufacturer's letter of certification that curing compound will not adversely affect the adhesion of subsequent materials to be applied to concrete.
 5. Material Certificates: Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.
- F. NOTICE - Notify Engineer not less than 24 hours prior to placing concrete. Omitted and misplaced reinforcement and embedded items and work not complying to codes, as specified herein or indicated by the plans are the Contractor's responsibility. The Contractor is not relieved of responsibility by the Engineer's observation.

1.2 PRODUCTS

A. CONCRETE MATERIALS

1. Portland cement: ASTM C150, Type II, unless otherwise acceptable to Engineer.
2. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
3. Normal Weight Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.
4. Local aggregates not complying with ASTM C33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to the Engineer.
5. Lightweight Aggregates: ASTM C330.
6. Water: Potable.

7. Air-Entraining Admixture: ASTM C260; Micro-Air manufactured by Master Builders.
8. Water-Reducing Admixture: Hydroxylated polymer type; Pozzolith 300 Series; ASTM C494; manufactured by Master Builders.
9. Chemical Admixtures:
 - a. Type A - water reducing.
 - b. Type B - retarding.
 - c. Type C - accelerating.
 - d. Type D - water reducing and retarding.
 - e. Type E - water reducing and accelerating.
 - f. Type F - water reducing, high range admixtures.
 - g. Type G - water reducing; high range; and retarding admixtures.
10. Chemical admixtures shall not be used without the approval of the concrete mix designer.
11. Chemical admixtures shall comply with ASTM C494.
12. For corrosion protection, maximum water soluble chloride ion concentration in hardened concrete at 28 days from water, aggregates, cementitious materials and admixtures shall not exceed limits below:

a. Reinforced concrete exposed to chloride	0.15%
b. Reinforced concrete that will be protected	1.00%
c. Other reinforced concrete construction	0.30%
13. Pozzolans: Fly ash and raw or calcined natural pozzolans for use in Portland cement concrete shall conform to ASTM C618.

B. RELATED MATERIALS

1. Non-Shrink Grout: Master Builder's premixed material conforming to CRD-C621, capable of being placed at a fluid, 25 second flow (CRD-C 611), without segregation or bleeding (CRD-C9) for up to two hours after placement, and within the temperature range of 45° to 100°, and remain in the flowable state up to one and one-half hours at temperatures up to 100°. Rebar and Dowel Grouting: Embeco 885 or Masterflow 928 at fluid consistency for vertical bars.
2. Bonding Agent:
 - a. Non-Structural Surface Repairs: Acrylic latex emulsion. Sonneborn Sonocrete.
 - b. Structural Bonding and Horizontal Rebar and Dowels: 100% solids, two component, moisture-insensitive epoxy resin system. Master Builders Concrecive Liquid (LPL) for bonding, Concrecive Paste (LPL) for dowels.
3. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M182, Class 2.
4. Moisture-Retaining Cover: One of the following, complying with ASTM C171.

- a. Waterproof paper.
 - b. Polyethylene film.
 - c. Polyethylene-coated burlap.
5. Curing Compound: Liquid membrane-forming material conforming to ASTM C-309 unless otherwise noted. Master Builders Masterkure. Do not use curing compound in area to receive materials that would not bond.
 6. Epoxy Adhesive: 100% solids, two component material suitable for use on dry or damp surfaces.
 7. Headed Concrete Anchors: Shall be Nelson H4L or S3L Series manufactured by The T.R.W. Nelson Division or an approved equal.
 8. Substitutions: Products of the following manufacturers are acceptable subject to quality standards established by specified products. Products of other manufacturers may be submitted in accordance with Section 01630.
 - a. Burke
 - b. Euclid

C. PROPORTIONING AND DESIGN OF MIXES

1. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301. If trial batch method used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer. The concrete mix design shall be at Contractor's expense.
2. Submit written reports to Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.
3. Design mixes to provide normal weight concrete with the following properties, as indicated on drawings and schedules: 4000 psi 28-day compressive strength; 560 lbs. cement per cu. yd. minimum; W/C ratio, 0.44 maximum.
4. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.
5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as follows:
 - a. Ramps and Sloping Surfaces: Not more than 3".
 - b. Concrete containing HRWR Admixture (Super Plasticizer): Not more than 8". The concrete shall arrive at the job site at a slump of 2" to 3", be verified, then the HRWR admixture added to increase the slump to the approved level.
 - c. Other Concrete: Not less than 2" and not more than 4".
6. Fresh Unit Weight: Provide normal weight concrete with a fresh unit weight of 145 to 152 pcf.

D. ADMIXTURES

1. Use accelerating admixtures in cold weather only when approved by Engineer. Use of admixtures will not relax cold weather placement requirements.
2. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
3. Add air entraining agent to concrete mix for concrete work subject to freeze-thaw cycling and exposed to exterior.
4. Use air-entraining admixture in exterior exposed concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content within following limits:
 - a. Concrete structures and slabs exposed to freezing and thawing or subjected to hydraulic pressure:
 - i. 4% to 6% for maximum 1-1/2" aggregate.
 - ii. 5% to 7% for maximum 1" aggregate.
 - iii. 6% to 8% for maximum 3/4" aggregate.
 - b. Other Concrete: 2% to 4% air.

E. CONCRETE MIXING - Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction.

1. Job site mixing shall be allowed for minor applications only.
2. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
3. Maximum of 2 gallons of water per cubic yard may be added to the batch for material of insufficient slump.
4. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required. When air temperature is between 85 degrees F (30 degrees C) and 90 degrees F (32 degrees C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 degrees F (32 degrees C), reduce mixing and delivery time to 60 minutes.

1.3 EXECUTION

A. OBSERVATION

1. Observe formwork installation. 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.
2. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work.

B. PREPARATION

1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent. Apply bonding agent in accordance with manufacturer's

instructions.

2. At locations where new concrete is dowelled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
3. Coordinate installation of joint materials and vapor barrier with placing of forms and reinforcing steel.
4. Moisten wood forms immediately before placement when form coatings are not used.

C. PLACING CONCRETE

1. General: Comply with ACI 304, and as herein specified.
2. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
3. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
4. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI recommended practices.
5. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix. Lower frequency vibrators may be used with "flowing" concrete (concrete containing superplasticizer).
6. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
7. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
8. Bring slab surfaces to correct level with straightedge and strike-off. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
9. Maintain reinforcing in proper position during concrete placement operations.
10. Cold Weather Placing: ACI 306.
11. Hot Weather Placing: ACI 305.

D. JOINTS

1. Construction Joints: Locate and install construction joints, which are not shown on drawings, so as not to impair strength and appearance of the structure, as acceptable to Engineer.
2. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs and

between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.

3. Place construction joints perpendicular to the main reinforcement. Continue reinforcement across construction joints.
4. Form contraction joints by inserting pre-molded hardboard or fiberboard strip into fresh concrete until top surface of strip is flush with slab surface. After concrete has been leveled, remove inserts and continue the finishing operation.
5. Joint filler for exposed control joints in slabs-on-ground shall be a semi-flexible, 100% solids epoxy designed for non-moving control joints, with a minimum Shore D hardness of 50. Master Builders Masterfill CJ.

E. FINISHING

1. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and finished and other projections exceeding 1/4" in height rubbed down or chipped off.
2. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied to concrete, or a covering material applied directly to concrete, such as waterproofing, damp-proofing, painting or other similar system. This is as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed.
3. Related Unformed Surfaces: At tops of walls, horizontal offset surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.
4. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, and as otherwise indicated.
5. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to a tolerance not exceeding 5/16" in 10' when tested with a 10' straight edge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, re-float surface to a uniform, smooth, granular texture.
6. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, paint or other thin film finish coating system.
 - a. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not

exceeding 3/16" in 10' when tested with a 10' straightedge. Grind smooth surface defects, which would telegraph through applied floor covering system.

- b. Slab areas recessed to receive equipment such as flush mounted floor mats, shall receive a trowel finish as detailed above.

F. CONCRETE CURING AND PROTECTION

1. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting; keep continuously moist for not less than 7 days.
3. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least 7 days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
4. Provide moist curing by following methods:
 - a. Keep concrete surface continuously wet by covering with water.
 - b. Continuous water-fog spray.
 - c. Covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
5. Provide moisture-cover curing as follows: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
6. Provide curing compound to slabs as follows:
 - a. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours). Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within 3 hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - b. Do not use membrane curing compounds on surfaces which are to be covered with coating material applied directly to concrete, waterproofing, damp-proofing, membrane roofing, painting, and other coatings and finish materials, unless otherwise acceptable to Engineer. Use moisture-cover curing for these surfaces.
7. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces exposed to heating by the sun or to wind by keeping forms wet in place for the full curing period or until forms can be safely removed. If forms are removed, continue curing by methods specified above, as applicable till the end of the full curing period.
8. Curing Unformed Surfaces: Cure unformed flat surfaces by application of the specified curing compound or moisture-cover curing or by covering the surface completely with water.

G. MISCELLANEOUS CONCRETE ITEMS

1. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
2. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
3. Non-Shrink Grout: All column base plates, equipment bases, and other locations noted on the structural drawings, shall be grouted with the specified non-shrink grout.

H. CONCRETE SURFACE REPAIRS

1. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
2. Cut out honeycomb, rock pockets, voids over 1/4" in any dimension, and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than 1". Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with the specified bonding compound. Place patching mortar after bonding compound has dried.
3. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color surrounding. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
4. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of architect. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discoloration's that cannot be removed by cleaning. Flush out form tie holes; fill with dry pack mortar, or pre cast cement cone plugs secured in place with bonding agent.
5. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
6. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having required slope.
7. Repair finished unformed surfaces that contain defects, which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
8. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
9. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent

concrete. Proprietary patching compounds may be used when acceptable to Engineer.

10. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete, apply bonding compound and allow bonding compound to dry. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.
11. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.
12. Use epoxy-based adhesive and/or mortar for structural repairs, where directed by Engineer.
13. Repair methods not specified above may be used, subject to acceptance of Engineer.

I. QUALITY CONTROL TESTING DURING CONSTRUCTION

1. Materials and operations shall be tested and inspected as work progresses. Failure to detect defective work shall not prevent rejection when defect is discovered, nor shall it obligate MWS for final acceptance.
2. Testing agencies shall meet the requirements of "Standard Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction", ASTM E329.
3. The following testing services shall be performed by the designated agency and shall be paid by the Contractor:
 - a. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 - b. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one test for each set of compressive strength test specimens.
 - c. Air Content: ASTM C 173, volumetric method for lightweight concrete; ASTM C 231 pressure for normal weight concrete; one for each set of compressive strength test specimens.
 - d. Concrete Temperature: Test hourly when air temperature is 40 degrees F (4 degrees C) and below, and when 80 degrees F (27 degrees C) and above; and each time a set of compression test specimens made.
 - e. Compression Test Specimen: ASTM C 31; one set of 5 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.

- f. Compressive Strength Tests: ASTM C 39; one set for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or for each 5,000 square feet of surface area placed; 2 specimens tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.
 - g. When frequency of testing will provide less than 4 strength tests for a given class of concrete, conduct testing from at least 4 randomly selected batches or from each batch if fewer than 4 are used.
 - h. When total quantity of a given class of concrete is less than 50 cubic yards, strength test may be waived by Engineer if, in his judgment, adequate evidence of satisfactory strength is provided.
 - i. When strength of field-cured cylinders is less than 85% of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
 - j. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
4. To facilitate testing and inspection, Contractor shall:
 - a. Furnish labor to assist testing agency in obtaining and handling samples at the job site.
 - b. Advise testing agency in advance of operations to allow for the assignment of testing personnel.
 - c. Provide and maintain, for the use of the testing agency, adequate facilities for proper curing of concrete test specimens on the project site in accordance with ASTM C31.
 5. Test results will be reported in writing to Engineer and Contractor on same day that tests are made. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at 28 days, concrete mix proportions and materials; compressive breaking strength and type of break for both 7-day tests and 28-day tests.
 6. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.
 7. If, after additional testing, evidence of low-strength concrete still exists, load tests in accordance with Chapter 20 of ACI 318-83 may be ordered by MWS. In the event the concrete is determined to be inadequate by the MWS, the Contractor will remove it from the Project and replace it with concrete conforming to these Specifications, subject to all testing requirements herein. All such remedial work shall be at the Contractor's expense.
 8. The Contractor shall be fully responsible for seeing that all concrete and concrete placements meet the project requirements. Failure of Owner or

Owner's Representative or Testing Laboratory to detect defective work, workmanship, or materials shall in no way prevent rejection and the Contractor taking approved corrective action when such defects are discovered. MWS or the Testing Laboratory shall not, thereby, be obligated to make a final acceptance.

9. The Contractor may request additional tests of fresh concrete, additional test specimens and additional compressive strength tests at his own expense.

END OF SECTION

