



CITY OF GREENVILLE

“Danish Festival City”

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CITY OF GREENVILLE **STANDARD SPECIFICATIONS** **FOR CONSTRUCTION**

JULY 2009

PREPARED BY:

CITY OF GREENVILLE
ENGINEERING DEPARTMENT
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The mission of the City of Greenville, as a part of the Coalition of Greater Greenville, is to serve through leadership and action, to assure all citizens a collaborative, planned and visionary community.

SECTION 1.30 - SPECIAL CONTROLS

- 1.30.10 SCOPE - The work covered by this section of the specifications pertains to SPECIAL CONTROLS for the performance of the work.
- 1.30.11 REFERENCE SPECIFICATIONS - Any standards or specifications by any technical society, association, governmental agency or other source that are referenced in these specifications shall be binding as they were fully repeated and are considered to be a part of these specifications.
- 1.30.12 GENERAL PROVISIONS - The Contractor shall perform all work in a manner to comply with all applicable laws of the State of Michigan with regard to air, water, and noise pollution.
- A. AIR POLLUTION - The Contractor shall maintain all traveled areas in a safe, dust-free condition at all times. All tracked mud, dirt, or other material shall be removed daily from all adjacent paved roads. During dry periods the Contractor shall prevent dust from becoming airborne by applying a minimum of 33% solution of Calcium Chloride as a dust palliative. Payment will be made based on load tickets and inspector daily logs.
 - B. WATER POLLUTION - The Contractor will be required to perform all operations in a manner that will conform to the requirements of Act 346, Inland Lakes and Streams Act and Act 347, Soil Erosion and Sedimentation Control Act. Those requirements are indicated in Section 1.45 and are referenced on the plans and in the required permits which are included in Appendix B. A copy of the permits shall be located on the site at all times.
 - C. NOISE POLLUTION - The Contractor shall exercise judgement in the conduct of operations which by nature result in excessive noise especially adjacent to residential areas. All such operations shall take place during reasonable daylight periods, which are defined as 7:00 a.m. through 6:00 p.m. unless otherwise authorized by the Engineer.
 - D. SOLID WASTE - The project site shall be kept in a neat and orderly condition and all debris and waste materials shall be collected and placed in a designated container daily until it can be removed from the project site. The collected material shall regularly be removed and properly disposed of at the Contractor's expense. The Waste Management Transfer Station is located nearby and would be one acceptable method of disposal.
 - E. SANITARY WASTE - The Contractor shall provide and maintain appropriate sanitary facilities for his employees and subcontractors. The Act 98 sanitary sewer permit is included in Appendix B.
 - F. WATER MAIN PERMIT - The Michigan Department of Public Health permit for construction of the water main is included in Appendix B.

1.30.13 VEHICULAR AND PEDESTRIAN TRAFFIC CONTROL - Lane closures that are necessary shall be in accordance with the details on the plans. Traffic shall be maintained at all times to allow normal operations for the existing commercial and industrial properties.

END OF SECTION

SECTION 1.40 - SOIL COMPACTION AND TESTING

PART 1 GENERAL

1.40.10 SCOPE - This section of the specifications sets forth the compaction requirements for various aspects of the Project. The Contractor shall supply all labor, equipment and material necessary to meet these minimum standards as a measure of acceptability.

1.40.20 RELATED WORK SPECIFIED ELSEWHERE - This work relates to the following sections of the specifications:

Section 2.25 - BEDDING AND BACKFILL FOR UTILITIES

1.40.30 DEFINITIONS -

- A. GRANULAR MATERIALS - Soils having a loss by washing of 15% or less.
- B. NON-GRANULAR MATERIALS - Soils having a loss by washing of more than 15%.
- C. LOSS BY WASHING - Materials finer than a No. 200 sieve as determined by ASTM C117.
- D. MAXIMUM UNIT WEIGHT - The maximum dry pounds per cubic foot at the optimum moisture content as determined by the following procedures:
 - 1. Modified Proctor - AASHTO 180, Method C, shall be used for granular and non-granular materials.
 - 2. Michigan Cone - The standard method of field testing may used for field determination but shall be confirmed by a Modified Proctor.
- E. OPTIMUM MOISTURE CONTENT - The percent of moisture in the soil at which the maximum unit weight can be achieved as determined by the Modified Proctor Test.
- F. LIFT - The vertical measure of a layer of soil when measured in it's uncompacted state.

PART 2 MATERIALS

1.40.20 SOURCE OF MATERIALS - The materials used will vary based on the construction operation as specified herein or noted on the plans. The Contractor shall notify the Engineer of the source of the materials at the preconstruction meeting. See Section 1.10.11A.

PART 3 EXECUTION

1.40.30 COMPACTION AND TESTING - The Contractor shall compact all bedding, backfill, subgrades (both cut and fill), subbase, base, and bituminous materials to the percentage of maximum unit weight specified herein. All compaction operations shall be performed using suitable methods and equipment specifically designed for earth compaction. Rollers shall be of standard design and can be vibratory, rubber tire or smooth steel drum type for granular materials. Kneading type rollers will be allowed for non-granular materials. All operations shall be performed such that they do not damage or displace any pipes, utilities or structures. Any damage will be corrected at the Contractor's expense.

A. TOLERANCE IN MOISTURE CONTENT - The allowable range for the moisture content for testing are:

1. Granular soils: 3% below to 2% above the optimum

2. Non-granular soils: 1% below to 3% above the optimum

If the moisture content falls below the allowable percentage, water may be added. If the moisture content is higher than the allowable percentage, the material shall be allowed to dry. Drying may be enhanced by discing or harrowing.

B. TESTING - Moisture and insitu density tests will be made on the compacted areas in locations and at times as selected by the Engineer. Costs of all testing will be borne by the Owner. However, failing tests of on-site materials for compliance with the specifications which were requested by the Contractor, will be paid for by the Contractor.

C. TABLE OF COMPACTION OPERATIONS AND REQUIREMENTS - This table, included in this section lists requirements for minimum in-place densities and maximum lifts for various compaction operations, material classifications, and locations. The lift thickness, moisture content, type of equipment, number of passes, and weight and speed of equipment shall be adjusted to produce the required compaction density with consistent results.

D. SUBSIDENCE AND SETTLEMENT - The Contractor shall be responsible to conduct all compaction operations in such a manner to avoid significant soil settlement. Any damage caused from excessive settlement during the time of the contract, shall be repaired at the Contractor's expense, regardless of passing tests.

TABLE OF COMPACTION OPERATIONS AND REQUIREMENTS

<u>OPERATION</u>	<u>MATERIAL CLASSIFICATION</u>	<u>MAXIMUM LIFT</u>	<u>MINIMUM DENSITY</u>
A. UTILITY BACKFILL			
1. Bedding undercut (to 4" below pipe)	Granular	6"	95%
	Crushed Stone	12"	N/A
2. Pipe bedding (4" below to 12" above pipe)	Granular	9"	95%
3. Trench A back-fill (12" above pipe to top of trench)	Trench Material (other than unstable clay)	12"	90%
4. Trench B back-fill (12" above pipe to top of trench)	Granular	12"	95%
5. Backfill under existing utilities.	Granular	6"	95%
6. Backfill around structures.	Granular	12"	95%
B. EMBANKMENTS			
1. General	Granular	12"	95%
	Approved Non-Granular	9"	95%

C. STREETS

1.	Subgrade	Existing Material	N/A	95%
2.	Sand Subbase	Granular	12"	95%
3.	Gravel Base	As specified	4"	98%
4.	Bituminous Pavement	As specified	2"	97%

END OF SECTION

SECTION 2.20 - EXCAVATION FOR UTILITIES

PART 1 GENERAL

2.20.10 SCOPE - This section of the specifications describes the procedures necessary to carry out the trench excavation for the installation of the sanitary sewer, storm sewer, and water main. The Contractor shall provide all labor, equipment and materials necessary to carry out this operation.

2.20.11 RELATED WORK SPECIFIED ELSEWHERE - This work relates to the following sections of the specifications:

Section 1.30 - SPECIAL CONTROLS
Section 1.40 - SOIL COMPACTION AND TESTING
Section 2.25 - BEDDING AND BACKFILL FOR
UTILITIES
Section 2.30 - SANITARY SEWERS
Section 2.35 - STORM SEWERS
Section 2.40 - WATER MAINS
Section 2.90 - RESTORATION

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION

2.20.30 TRENCH EXCAVATION

- A. REQUIREMENTS - Excavation shall proceed in a neat and orderly manner. Bedding and backfill material shall be readily available during operations, and excess material shall be removed promptly. Backfilling shall proceed along with the trenching operation. Proper compaction shall be attained as specified in Section 1.40.
- B. CAUTION IN EXCAVATION - The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities and structures may be determined. The Contractor will be held responsible for damage to utilities and structures that are known to exist in the area of excavation. This kind of damage will be repaired at the Contractor's expense. The Contractor will not be responsible for the cost of damage to utilities or structures, which could not be known to exist nearby.
- C. EXCAVATION TO GRADE - The trench shall be excavated to the depth required to provide proper bedding and backfill for the pipe. The trench bottom should be uniform and continuous to provide consistent bearing and support for the pipe.
- D. EXCAVATION BELOW GRADE - When the trench is excavated below the grade necessary to provide proper bedding as shown on the plans, the trench shall be brought up to bedding grade using compacted granular material or smooth pea stone. If the overexcavation is due to unsuitable material in the trench bottom, and was directed by the

Engineer or his representative, the Contractor may be due additional compensation in accordance with Section 2.10.41 of these specifications. The Contractor has an obligation to promptly notify the Engineer of unsuitable trench conditions. However, overexcavation not directed by the Engineer or his representative shall be at the Contractor's expense.

- E. WIDTH OF TRENCH - The trench shall be of sufficient width to allow proper installation and joining of pipes, and to allow compaction equipment room to maneuver and accomplish proper density. The width of the trench shall also be determined to maintain a safe working environment for the Contractor's employees at all times. The trench width shall meet all requirements of the State of Michigan Safety Inspector, the Department of Labor, and MI-OSHA.
- F. END OF DAY REQUIREMENTS - There shall not be more than one pipe without backfill to the top of the trench at the end of the work day unless specific permission is given by the Engineer. The end of that pipe shall be completely covered with something rigid such as plywood and braced with the bucket of the excavator to prevent entry into the pipe. Manholes shall also be covered. The top of the trench shall be shaped to prevent, to the best of the Contractor's ability, rainwater from entering the trench. Orange safety fence shall surround the perimeter of the open trench at the end of each day's operation.
- G. REMOVAL AND DISPOSAL OF WATER - If groundwater or rainwater should enter the trench, the Contractor shall provide pumping, bailing or other drainage facilities to remove water from the trench. Any dirt or debris shall also be removed from the inside of the pipe.
- H. OBSTRUCTIONS - If obstructions not shown on the plans are encountered. The Contractor shall promptly notify the Engineer of such obstructions. The Engineer will direct the Contractor within 24 hours on how to proceed. If the obstruction causes additional work, or causes the Contractor to cease operations, the Contractor will be entitled to additional compensation by Change Order.
- I. SUBSURFACE EXPLORATIONS - The Contractor shall expose existing utilities at crossings in advance of the crossing to determine the location of the utility. If a conflict is apparent, the Engineer shall be notified to determine how to proceed. The exploration shall be incidental to the contract. If the Contractor has exercised due care in the exploration, and a conflict requires additional work, then 2.20.30H shall apply.

END OF SECTION

SECTION 2.25 - BEDDING AND BACKFILL FOR UTILITIES

PART 1 GENERAL

2.25.10 SCOPE - This section describes the procedures used to properly install pipe bedding and backfill of utility trenches. The Contractor shall provide all labor, equipment, and material to conform to this specification.

2.25.11 RELATED WORK SPECIFIED ELSEWHERE - This work relates to the following sections of the specifications:

Section 1.30 - SPECIAL CONTROLS
Section 1.40 - SOIL COMPACTION AND TESTING
Section 2.20 - EXCAVATION FOR UTILITIES
Section 2.30 - SANITARY SEWERS
Section 2.35 - STORM SEWERS
Section 2.36 - MANHOLES
Section 2.40 - WATER MAINS
Section 2.50 - CONCRETE

2.25.12 DEFINITIONS

- A. **BEDDING** - The bedding is the portion of the trench from 4" below the bottom of pipe to 12" above the top of pipe.
- B. **BACKFILL** - The backfill is the portion of the trench from 12" above the top of pipe to the top of the trench.
- C. **TOP OF TRENCH** - The top of trench outside of pavement areas will be 3" below the final grade. The top of trench under pavement sections will be at the top of subgrade.

PART 2 MATERIALS

2.25.20 BEDDING

- A. **GRANULAR** - This material shall conform to MDOT Class 2 material as determined by sieve analysis (ASTM C-136) which is defined as 100% passing 1" and 3" sieves, 0-30% passing a No. 100 sieve and maximum loss by wash of 7%.
- B. **STONE** - This material shall be uniformly graded, rounded, washed pea stone of such a size as to be retained on a 3/16" sieve.
- C. **CONCRETE** - Concrete bedding, where required shall be Class B wet mix concrete conforming to Section 2.50 of these specifications.

2.25.21 BACKFILL

- A. TRENCH "A" BACKFILL - This is appropriate in areas outside of the roadway and shall consist of native soil excavated from the trench, except where excavated soil is unsuitable to be compacted to the proper density. Unsuitable material will be topsoil, vegetation, refuse, debris, boulders or any other material deemed unsuitable by the Engineer.
- B. TRENCH "B" BACKFILL - This is required under pavement areas and shall be the same material as specified for granular bedding in Section 2.25.20A.

PART 3 EXECUTION

2.25.30 BEDDING - Bedding shall be placed under the pipe by hand and shaped in a uniform and consistent manner. The bedding shall be uniform for the entire width and length of the trench. Special care shall be taken to assure that there are no voids under the pipe haunches and that the pipe line and grade are not disturbed. The bedding material shall be placed and compacted according to Section 1.40 of these specifications.

2.25.31 SPECIAL CARE FOR FLEXIBLE PIPE BEDDING - Bedding for the flexible pipe storm sewer will require special care to ensure proper sidewall support. Care should be taken to prevent mixing of the bedding material with dissimilar material, and compaction should be carried out to eliminate any voids. If the bedding or undercut material is stone, a geotextile separator shall be used to separate the stone from native or granular soil. The geotextile will be incidental to the utility work.

2.25.32 BACKFILL - Backfill shall be carefully placed and compacted in lifts as specified in Section 1.40 of these specifications. Care should be taken to avoid damage to the pipe during backfill operations. The Contractor will be responsible to repair any damage to pipes due to improper backfill, at his own expense.

2.25.33 BACKFILL AT STRUCTURES - Backfill around structures shall conform with Trench "B" material in all cases. Structures which are not within 5 feet or under the roadway may use Trench "A" backfill material beyond 3 feet of the structure.

2.25.34 BEDDING AND BACKFILLING IN FREEZING WEATHER - No bedding or backfilling shall proceed in freezing weather, except by written permission from the Engineer. Frozen material shall never be used as bedding or backfill.

END OF SECTION

CITY OF GREENVILLE - SECTION 2.30 - SANITARY SEWERS

PART 1 GENERAL

2.30.10 SCOPE - This section describes the items of work related to the installation of sanitary sewer.

PART 2 PRODUCTS

2.30.20 REQUIREMENTS - All materials shall be new. Reuse of previously installed pipe will not be allowed. Storage, handling and installation of the materials shall conform to manufacturer recommendations.

2.30.21 MATERIAL LISTS - The Developer shall supply a list of all materials furnished under this specification to the Engineer for his approval. The list shall include the name and address of the manufacturer of the pipe, fittings and specials, and the type of material to be used.

2.30.22 PIPE - Pipe for industrial applications shall be extra-strength vitrified clay pipe meeting ASTM C-700 except as upgraded by the National Clay Pipe Institute specifications for extra-strength pipe. Commercial and residential applications may be either vitrified clay pipe as described above; PVC Truss pipe, meeting the requirements of ASTM D 2680; or PVC solid wall pipe (SDR 35 for depths 10 feet or less or SDR 26 for depths over 10 feet), meeting the requirements of ASTM D 3034.

2.30.23 PIPE BELL (Vitrified Clay)- Pipe bells shall be integral to the pipe, but may be of different materials. Bells may be vitrified clay, fiberglass (FIBURLOC) as manufactured by UNICON, PVC meeting ASTM D-1784, Class 12454-B (NO BELL) as manufactured by CLOW, or approved equal. All joints shall conform to ASTM C-425.

2.30.24 PIPE BELL (PVC) - Pipe bells shall be integral to the pipe and shall be of the same material.

2.30.25 FITTINGS - Service lateral connections to the main line sewer, shall be accomplished by using standard manufactured wyes compatible with the sewer main materials. Changes in line or grade on services may be made using other standard fittings meeting the industry accepted standards for the material. Plugs shall be plastic and suitable for air testing. For repairs or new taps on existing sewers, a sewer saddle shall be used to make the connection. Protruding pipes into the interior of the main line sewer will not be allowed.

2.30.26 MANHOLES - Precast concrete bases, sections, and reducing cones shall be constructed in accordance with ASTM C 478. The base shall be cast integrally with the lower riser. Pipe openings shall be cast into the appropriate locations as shown on the plans. Manhole openings shall be furnished with an integral seal system,

consisting of a rubber boot, which fastens to the pipe with a stainless steel band. The boot should fit snugly onto the pipe. Joints between manhole sections shall be made using rubber "O-rings" with the proper lubrication. A minimum of 0.1 foot drop shall be incorporated between the incoming and outgoing pipe inverts.

2.30.27 CASTINGS - The City of Greenville standard for sanitary sewer frame and lid shall be EJIW #1045 with type 1040A SAN SWR CPH2 solid cover.

2.30.28 MANHOLE ADJUSTING RINGS - Rings shall be used to adjust the casting to the proper elevation, if adjustment is necessary. The rings shall be standard precast concrete with a minimum height of 2-inches and a maximum height of 6-inches.

PART 3 EXECUTION

2.30.30 GENERAL - The handling of the pipe during installation and the making of joints shall follow the recommendations of the manufacturer. Materials that are affected by ultraviolet radiation and/or temperature shall be duly protected from exposure.

2.30.31 INSPECTION OF MATERIALS - All materials shall be certified by the manufacturer and may be inspected by the City Engineer or his representative for defects. Any damaged materials will be marked and shall be removed from the project site. Materials damaged during installation shall be immediately removed.

2.30.32 INSTALLATION

- A. LINE AND GRADE - The sewer shall be laid using laser beams to maintain line and grade. The elevations of inverts shall be within 1/2-inch of grades marked on the hubs.
- B. PIPE CUTTING - Full sections of pipe shall be used whenever possible. If cutting is necessary, it shall be done using appropriate tools that will produce a clean, perpendicular cut. Cutting shall not cause damage to the pipe or coatings and all burrs shall be removed.
- C. LAYING PIPE - All mud, frozen material, or other objectionable material shall be removed from the pipe before it enters the trench. Pipe shall be laid so that the bell is on the upgrade end. The installation shall proceed from the downstream end to the upstream end. The pipes shall be consistently true to the laser beam and each pipe shall be checked accordingly. In no case shall grade adjustments be made using any material other than granular bedding material conforming to MDOT Class III.
- D. PIPE BACKFILL - Pipes shall be backfilled with granular material, conforming to MDOT Class III, and compacted to 95% of maximum unit weight as determined by Modified Proctor, or Michigan Cone tests. Written approval from the City Engineer shall be the only exception to these requirements.

- E. JOINTS - Joints shall be made using the manufacturer's recommended procedure and lubricants. Wood blocks or other approved materials shall be used to protect the pipe and fitting ends from pry bars, chains, or other means of pushing the pipe into the premium joint. Joints shall remain tightly closed after the pipe is completely in place. If the pipe will not remain in the joint tightly, it shall be removed.
- F. INSTALLATION OF MANHOLES - The trench shall be excavated to a sufficient size to accept the structure and leave room for workers to safely maneuver. The precast manhole bottom section shall be set plumb and level on a compacted, granular bedding 8" thick. Native granular soil, having a loss by washing of less than 15% and approved by the City Engineer, may be used instead. When groundwater is found in the trench the bedding shall be 12" of peastone material; defined as uniformly graded, washed stone which is retained on a 3/16" sieve. Risers and cones shall be added as necessary to conform to the plan grades. "O-rings" shall be properly placed and lubricated for sanitary sewer, before the addition of the next section. Steps shall be aligned to form a continuous ladder.
- G. MANHOLE TAPS - When necessary to tap a line into an existing sanitary sewer, the tap shall be made by cutting a hole in the wall using a saw and sledge hammers or other acceptable means of creating a hole without causing damage to other parts of the manhole structure. Precautions shall be taken to conform to all confined space entry requirements as specified by MI-OSHA. When the hole is open, a pipe shall be placed into the manhole, and non-shrink grout shall be used to surround the pipe at the opening, inside and outside until there are no gaps.
- H. SERVICE LATERALS - The wye fitting shall be placed so that it tips up at a 45° angle. A standard 45° bend shall be installed next and the service pipe shall be laid at a minimum of 1/8-inch per foot (1% slope). A greater slope may be used if the depth of the sewer at the end will be greater than 8-feet. Service laterals shall not be backfilled until the City Engineer or his representative has inspected the connection.
- I. NEW CASTINGS - The castings, including both frame and lid, shall be installed flush with pavement, curb and gutter or finished grade as applicable. All sanitary manholes shall have a Type "A" Cover, unless otherwise allowed by the City Engineer. The cover shall be adjusted to the proper elevation by precast concrete adjusting rings and secured by placing a continuous and uniform coat of mortar around the edges of the frame and adjusting ring.
- J. ADJUSTMENTS TO EXISTING CASTINGS - Castings that are shown to be adjusted shall be carefully removed and adjusted by either removing or adding adjusting rings as necessary, replacing the frame and lid, and securing the installation with a continuous and uniform coat of mortar around the edges of the frame and adjusting ring.

20.30.33 TESTING - An air pressure test will be required to confirm the soundness of the new joints against infiltration and exfiltration. The test shall be performed in the

presence of the City Engineer or his representative. If groundwater is present an infiltration test may also be required. The following is the procedures to be used for such testing.

A. AIR TESTING

1. Equipment - The following is a list of equipment necessary to perform the air test:
 - Portable air compressor
 - Standard air hose and connections
 - 50-foot (min) single & triple air hose
 - 1 each of single and triple connection pneumatic sewer plug
 - Hand air pump
 - Stopwatch
 - Air gauge, 0-30 psig range, graduated in tenths

2. Preliminary Requirements- After all sewers, laterals, and manholes have been installed and backfilled, the sewer shall be cleaned. The testing equipment shall also be checked.
 - a. Cleaning - The new sewer shall be cleaned using either a hydraulic jet system or a "pig" system. The jet forces a nozzle upstream from a manhole with water pressure and pushes debris downstream to the entering manhole. There shall be sufficient hose length to reach between manholes. The pig method requires a ball or apparatus which tightly fits into the pipe and is forced downstream by water pressure. Debris is forced downstream ahead of the pig. Either method will require a means to remove any debris brought to the manhole.

 - b. Preliminary Testing - The pneumatic plugs shall be qualified by sealing both ends of a single pipe and pumping air into the pipe until the pressure reaches 15 psig. The plugs shall be able to hold this pressure without bracing and without movement.

3. Test Procedures - Each length of sewer shall be tested from manhole to manhole by sealing the sewer with the pneumatic plugs at both ends. Air shall then be pumped into the sealed section until the pressure reaches 4.0 psig greater than the average back pressure due to groundwater. The pressure shall be allowed to stabilize for 2 minutes. After this, the time, in minutes, for the pressure to decrease from 3.5 to 2.5 psig greater than the average back pressure due to groundwater, shall not exceed the following according to ASTM C 828:

0.7 min/100' for 6-inch pipe

1.2 min/100' for 8-inch pipe

If the section to be tested includes both sizes of pipe, calculate the test time for each size and add the test times to arrive at the total test time for the section.

- B. TV INSPECTION – For City-sponsored projects, the City Engineer shall have the option of performing a TV inspection of any section of sewer for signs of structural damage, joint leaks, or infiltration. The costs of the inspection shall be paid by the City of Greenville unless the inspection reveals faulty construction or materials. In such case the inspection cost will be the responsibility of the Contractor. For developer-sponsored projects, televising with a mandrel and related reports are required to ensure that pipe is round and joints are straight and true.
- C. CORRECTION OF DEFECTIVE WORK - Whenever any of the above tests indicate defective material or installation, the Developer shall repair and retest the section to the satisfaction of the City Engineer, at no additional cost.

END OF SECTION

CITY OF GREENVILLE
SPECIAL PROVISION
FOR
UTILITY BORE AND JACK

LOCAL:DES:DWH

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8-30-04

1. Description. This section describes the boring and jacking of a casing pipe beneath major Greenville Streets and MDOT roads to act as a carrier pipe for water main or sanitary sewer pipes. The Contractor will be required to bore and jack the casing pipe, install the utility pipes to plan grade and fill the void between the casing pipe and the pipe. The Contractor is to provide all materials, equipment, labor and other items required to complete the work, whether specifically described or implied.

2. Materials. The Contractor shall furnish all materials specified and shall provide material certification from the pipe supplier for the casing pipe along with source and load tickets for the filler material.

- A. CASING- Jacked in place steel pipe shall meet the requirements of either ASTM A 53, Type E or S, Grade B, ASTM A139 Grade B, or ASTM A-106 Grade B or C; API-SL, Grade B; or AP+5L Grades X42 through X56. The ends of the steel pipe to be jacked shall be prepared for field welding at the joints. The nominal outside diameter of the steel pipe and wall thickness shall be as shown in the following table.

Nominal Size	Nominal Outside Diameter	Wall Thickness
2	2.375	0.154
4	4.500	0.188
6	6.626	0.188
8	8.625	0.188
10	10.750	0.188
12	12.750	0.188
14	14.000	0.250
16	16.000	0.250
18	18.000	0.250
20	20.000	0.250
24	24.000	0.250
30	30.000	0.312
36	36.000	0.312
42	42.000	0.438
48	48.000	0.500
54	54.000	0.563

- B. UTILITY PIPE- Water main and sanitary sewer pipes shall conform to current City of Greenville specifications.

- C. CASING FILLER- Casing filler material shall meet the requirements of commercial grade peastone, granular material Class II or cementitious grout as follows:

- a) Peastone-commercial grade meeting the following gradation requirements.

Sieve Size:	5/8"	3/8"	No. 4	Loss By Wash
%Passing:	100%	0-85%	0-8%	0-3%

- b) Granular material Class II shall meet the requirements of 2003 MDOT standard specification.
- c) Approved alternate.

3. Construction methods. Access pits shall be at a location that will not unduly interfere with traffic or with the use of adjacent property. It shall be large enough to accommodate at least one section of pipe and guide rails or sills shall be provided to support the pipe at the established line and grade during jacking operations. Such guides shall be kept coated with suitable lubricant.

Suitable bracing and protection for the access pits shall be provided as required by the work and OSHA.

All access pits and open excavation within the right-of-way shall be protected with suitable fencing and type II barricades to prohibit access to the work site. Equipment will not be used in lieu of fencing to protect access pits.

The pipe shall be constructed to the alignment and grades specified on the plans. Alignment deviations will not be permitted unless specifically authorized by the Engineer.

Jacks of sufficient capacity shall be provided and used in jacking the pipe. A backstop or cribbing, or other approved means, shall be provided that is substantial enough to withstand the thrust, which will be developed during jacking. A jacking head consisting of bearing blocks shall be used to transfer the pressure uniformly from the jacks to the perimeter of the pipe.

Jacking forces shall be distributed in a manner that average compressive stresses developed will not exceed design compressive strength of the pipe used.

Prior to jacking the pipe out of the shaft, the outside surface may be coated with bentonite or other suitable lubricant. Bentonite or other suitable lubricant may be applied at the front face of the lead pipe simultaneously with the jacking operation. A steel cutting ring may be installed on the leading edge of the first pipe. A lubricant sill plank may be required in the heading to maintain vertical alignment.

Sufficient quantities of auger lengths and casing lengths shall be provided to allow for adjustment in the position of the auger head. Upon initial placement, the leading edge of the casing shall precede the auger by a length equal to or greater than 1/2 the diameter of the casing. Adjustment in the position of the auger head shall not be made unless authorized by the Engineer.

A bore and jack record sheet or log shall be kept by the contractor and will be his responsibility to maintain and update whenever additions or alterations are made to the length of the casing or auger.

Delays between jacking operations may result in soil settling around the jacked pipe, thus making it difficult, and sometimes impossible, to resume movement. Should conditions arise making it

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impossible to further jack the pipes without damage, the balance of the pipe shall be constructed by methods approved by the City Engineer.

All voids around the outside of the jacked pipe shall be filled by means of pressure grouting with approved material as specified in the 2003 MDOT standard specification. Grouting shall be completed within 48 hours of completing the bore or as directed by the City Engineer. Should soil squeezing occur causing failure or damage to the earth supports, immediate steps shall be taken to stop the flow of earth and to strengthen the bracing. If loss of heading occurs, the problem area shall be stabilized as soon as possible and all voids filled by such methods and materials as approved by the Engineer.

Should soil conditions, equipment failure, material failure or obstructions prevent completion of the jacking operations, the partially completed jacked-in-place pipe shall be abandoned in place, and backfilled in accordance with the placement of casing filler.

The utility pipe shall be placed inside the casing, to the specified grade using means acceptable to the City Engineer.

Filler material is to be placed by an approved method, which will provide a uniform and thorough filling of the void. The casing shall be filled to within 1 inch of the top, $\pm \frac{1}{2}$ inch. Upon completion of the filling operation, the ends of the casing shall be sealed with a 1-foot thick bulkhead of commercial grade concrete or approved alternate.

END OF SECTION

CITY OF GREENVILLE - SECTION 2.35 - STORM SEWERS

PART 1 GENERAL

2.35.10 SCOPE - This section describes the items of work related to the installation of storm sewers.

PART 2 PRODUCTS

2.35.20 PIPE

- A. CONCRETE - Concrete pipe shall be manufactured in accordance with ASTM C-76 Reinforced Concrete Pipe. The thickness class shall be appropriate for the depth.
- B. POLYETHYLENE - Polyethylene pipe shall be manufactured with high-density polyethylene with a corrugated exterior and a smooth interior and shall conform to AASHTO M294. An additional requirement for 48-inch pipe will include a minimum pipe stiffness of 17 psi at 5% deflection. The material shall conform to ASTM D 1248 Type III, Category 4, Grade P33, Class C. Acceptable materials are Hancor, HI-Q pipe or ADS, N-12 pipe.
- C. POLYETHYLENE COUPLINGS - Couplings for the polyethylene pipe shall be factory installed whenever possible and shall cover at least one full corrugation on the connecting pipe. They shall be manufactured using the same materials as the pipe. Acceptable materials are Hancor, HI-Q Sure-Lok or ADS, N-12 Pro Link 5.0. Split couplings and ties shall be used for sizes that the integral coupling is not available.
- D. UNDERDRAIN - Pipe used for underdrain shall be 4", perforated, corrugated, polyethylene tubing with a geotextile sock covering the entire length. Split couplings shall be used to make connections.

2.35.21 MANHOLES

- A. PRECAST CONCRETE - Precast concrete bases, sections, and reducing cones shall be constructed in accordance with ASTM C 478. The base shall be cast integrally with the lower riser. Storm sewer manholes larger than 48" may have a separate base and lower riser. Pipe openings shall be cast or cored into the appropriate locations as shown on the plans. Precast manholes shall have Co-Polymer Polypropylene coated steel steps cast into the wall so that the steps line up for manhole sections. Broken or damaged sections will not be accepted. Where the plans call for provision for future pipes, a styrofoam blank shall be cast into the manhole of the size opening and direction required.
- B. MANHOLE BLOCK - Storm sewer manholes, catch basins and inlets may be constructed using concrete radial block conforming to ASTM C 139. The block shall

be sufficient for the diameter manhole being constructed. Mortar shall conform to the requirements of ASTM C 270, Type M. The foundation for such structures shall be either a precast base or cast-in-place slab using grade 35S concrete.

- C. PIPE CONNECTIONS - Pipe connections shall be sealed with non-shrink grout, to be mixed and placed according to manufacturer recommendations. A sufficient amount of grout shall be used to completely eliminate any gaps between the pipe and manhole inside and outside of the manhole. Joints between the manhole sections shall be sealed using mastic.

2.35.22 CASTINGS

- A. TYPE "A" COVER - The City of Greenville standard for storm sewer frame and lid shall be EJIW #1120 with type A solid cover.
- B. TYPE "D" COVER - The City of Greenville standard for storm sewer gutter type frame and lid shall be EJIW #5105 with a Type M1 grate.
- C. TYPE "G" COVER - The City of Greenville standard for storm sewer swale type grates shall be EJIW #6517.
- D. TYPE "K" COVER - The City of Greenville standard for storm sewer curb type frame and lid shall be EJIW #7045 with Type M1 grate.

2.35.23 MANHOLE ADJUSTING RINGS - Rings shall be used to adjust the casting to the proper elevation, if adjustment is necessary. The rings shall be standard precast concrete with a minimum height of 2-inches and a maximum height of 6-inches.

2.35.24 GEOTEXTILES

- A. PIPE JOINT WRAP - The geotextile for pipe wrap shall have the following minimum characteristics:
- Weight = 3.0 oz/sy
 - Apparent opening size = 20 to 100
 - Burst strength (ASTM D 3786) = 100 psi
 - Flow Rate = 60 gal/min/ft²
- B. LINER FOR HEAVY RIP-RAP - The geotextile liner for the rip-rap area shall contain a small amount of non-toxic lampblack as an ultraviolet inhibitor and have the following minimum characteristics:
- Weight = 4.5 oz/sy
 - Apparent opening size = 70 to 120
 - Burst strength (ASTM D 3786) = 250 psi
 - Tensile strength = 200 lbs
 - Flow Rate = 60 gal/min/ft²

2.35.25 END SECTIONS

- A. CONCRETE - If concrete pipe is used, the end section shall also be precast concrete conforming to ASTM C 76, Class II as shown on the plans. Concrete for the end sections made by the wet-cast method shall contain an entrained air content of $6.0 \pm 2.0\%$. Concrete for end sections made by the dry-pack process shall contain a minimum of 658 pounds of cement per cubic yard and a liquid air entraining agent used at 4 times the dosage as needed for conventional slump concrete. Connections to pipe shall be by means of tongue and groove joints.
- B. METAL - Metal end sections, of appropriate size shall be used for polyethylene pipe and shall be fabricated as shown on the plans and shall be furnished complete with coupling bands and hardware as shown. The metallic coating on the end section shall be zinc coated steel.

2.35.26 RIP-RAP - Rip-rap shall consist of individual stones, precast concrete blocks, or broken concrete where approved by the City Engineer. It shall consist of 8-inch minimum depth stone. Smaller pieces may be used to fill in gaps.

2.35.27 CERTIFICATIONS - The Developer shall submit a certification from the manufacturers of products in this specification to the City Engineer. The certification shall indicate conformance with the referenced ASTM and AASHTO specifications.

PART 3 EXECUTION

2.35.30 GENERAL - The handling of the pipe during installation and the making of joints shall follow the recommendations of the manufacturer. Materials that are affected by ultraviolet radiation and/or temperature shall be duly protected from exposure.

2.35.31 INSPECTION OF MATERIALS - All materials shall be certified by the manufacturer and may be inspected by the City Engineer or his representative for defects. Any damaged materials will be marked and shall be removed from the project site. Materials damaged during installation shall be immediately removed.

2.35.32 INSTALLATION OF PIPE

- A. LINE AND GRADE - The sewer shall be laid using laser beams to maintain line and grade. The elevations of inverts shall be within 1/2-inch of grades marked on the hubs.
- B. PIPE CUTTING - Full sections of pipe shall be used whenever possible. If cutting is necessary, it shall be done using appropriate tools that will produce a clean, perpendicular cut. Cutting shall not cause damage to the pipe or coatings and all burrs shall be removed.

- C. LAYING PIPE - All mud, frozen material, or other objectionable material shall be removed from the pipe before it enters the trench. Pipe shall be laid so that the bell is on the upgrade end. The installation shall proceed from the downstream end to the upstream end. The pipes shall be consistently true to the laser beam and each pipe shall be checked accordingly. In no case shall grade adjustments be made using any material other than granular bedding material, conforming to MDOT Class III.
- D. PIPE BACKFILL - Pipes shall be backfilled with granular material, conforming to MDOT Class III, and compacted to 95% of maximum unit weight as determined by Modified Proctor, or Michigan Cone tests. Written approval from the City Engineer shall be the only exception to these requirements.
- E. JOINTS - Joints shall be made using the manufacturer's recommended procedure and lubricants. The pipe shall be protected from damage by pushing the pipe into the joint. Joints shall remain tightly closed after the pipe is completely in place. However, the joint does not need to be a premium joint. In non-premium joints silt shall be prevented from entering the system by use of a 3-foot wide band of geotextile wrapped around the joint centered on the visible point of connection. The geotextile shall be of sufficient length to completely surround the pipe with a minimum of 2-feet of overlap. The geotextile shall be firmly held in place during bedding and backfill operations.

2.35.33 INSTALLATION OF END SECTION - End sections shall be used at all storm sewer outlets. The end section shall be placed at the end of the pipe and secured by the manufacturer's recommended procedure. A geotextile liner shall be placed under the end section and shall be the width of the end section plus 2-feet on either side and shall extend from the point of connection with the pipe to a sufficient distance to support the required rip-rap. If the liner needs to be overlapped, there shall be a minimum of 1-foot of overlap. The seam shall run perpendicular to the direction of flow. Rip-rap shall be carefully placed to prevent the shifting and movement of individual stones. There shall be an average of 8-inches of depth of rip-rap material.

2.35.34 INSTALLATION OF UNDERDRAIN - Where underdrain is required, it shall be installed following the manufacturer's recommendation. The slope shall be consistent and care should be taken to avoid low spots. The bedding material shall be pea stone, defined as uniformly graded, washed stone which is retained on a 3/16" sieve.

END OF SECTION

CITY OF GREENVILLE - SECTION 2.40 - WATER MAINS & APPURTENANCES

PART 1 GENERAL

2.40.10 SCOPE - This section describes the items of work related to the installation of water mains, valves, valve boxes, hydrants and related items.

PART 2 PRODUCTS

2.40.20 DUCTILE IRON (D.I.) PIPE - Pipe shall be new and of the type as specified herein and as noted on the plans. It shall conform to ANSI/AWWA C151/A21.51 and the following:

- A. Class and Size - Unless otherwise noted on the plans, pipe wall thickness shall be Class 53 and meet a pressure rating 350 psi. Ductile iron shall be used for three inch (3") and larger diameter pipe.
- B. Exterior Coating - Bituminous, 1 mil thick.
- C. Lining - Standard thickness cement-mortar conforming to ANSI/AWWA C104/A21.4.
- D. Pipe Markings - All pipe delivered to the job site shall bear the marks required by the ANSI/AWWA specification.
- E. Pipe Joints - All joints for the mainline water main shall be push-on type including Tyton or Bell-Tite with appropriate gaskets conforming to ANSI A21.1.

2.40.21 VALVES

- A. BUTTERFLY VALVES - All valves on 12" or larger water main shall be mechanical joint butterfly valves conforming to AWWA C504-74. All valves shall open left.
- B. GATE VALVES - All valves on 10" or smaller water mains and hydrant leads shall be mechanical joint, resilient seat gate valves conforming to AWWA C509-80. All valves shall open left.

2.40.22 VALVE BOXES - Valve boxes shall be cast iron, screw type, three (3) piece; cover shall be furnished marked "Water." EJIW series 6860.

2.40.23 FIRE HYDRANTS - Shall conform to ANSI/AWWA C502 and the following:

- A. Type and Size - Breakaway traffic flange; 5-1/4 inch main valve seat.
- B. Connections - Two (2) - 2-1/2 inch hose nozzles and one pumper connection; national standard threads.
- C. Direction of Opening - Open left.
- D. Manufacturer - EJIW Model 5-BR, or equal.
- E. Operating nut - Pentagon shaped.

2.40.24 FITTINGS - Bends, tees, and reducers of sizes noted on the plans shall be mechanical joint cast or ductile iron conforming to ANSI/AWWA C153/A21.53.

2.40.25 BEDDING AND BACKFILL MATERIAL - Bedding and backfill for water mains and appurtenances shall be compacted granular material conforming to MDOT Class II.

PART 3 EXECUTION

2.40.30 WATER MAIN INSTALLATION

- A. GENERAL - Installation shall be in accordance with ANSI/AWWA C600 for ductile iron pipe.
- B. LAYING PIPE - Pipe shall be laid with the bell ends facing the direction of laying, unless otherwise directed or allowed by the City Engineer.
- C. REQUIRED SEPARATION - The minimum requirement is to maintain at least a ten foot separation horizontally and 18-inches vertically from any sewer.
- D. GRADE AND ALIGNMENT - The minimum cover for water main shall be five feet, unless otherwise allowed by the City Engineer.
- E. PIPE BACKFILL - Pipes shall be backfilled with granular material, conforming to MDOT Class II, and compacted to 95% of maximum unit weight as determined by Modified Proctor, or Michigan Cone tests. Written approval from the City Engineer shall be the only exception to these requirements.
- F. WET TRENCH LAYING - When the trench contains water, open ends of the pipe shall be closed by a watertight plug. This provision shall apply during the noon hour as well as overnight.
- G. PIPE ENCASEMENT - Ductile iron pipe, bedded in an area of aggressive soil, such as peat, shall be encased in a polyethylene encasement.

- H. ELECTRICAL CONTINUITY - Electrical continuity shall be provided for ductile iron pipe, using metal wedges driven into the pipe joints.
- I. THRUST BLOCKS - Shall be made of Class B, poured-in-place concrete. Thrust blocks shall be placed at all bends, dead ends, tees, reducers, hydrants and valves, as required.
1. Thrust Table - Shall be used for sizes noted. For larger sizes, the details will be shown on the plans. Area in square feet of concrete thrusting against undisturbed earth shall be computed by dividing the total thrust, in pounds from the table, by the safe bearing load of the soil.

WATER MAIN SIZE	TEE OR PLUG	90° BEND	45° BEND	22½° BEND	11¼° BEND
4"	2,840	4,000	2,100	1,100	600
6"	5,800	8,200	4,300	2,300	1,100
8"	8,900	14,000	7,400	3,900	2,000
10"	14,800	21,000	11,000	5,800	2,900
12"	20,900	30,000	15,500	8,200	4,100
14"	28,000	40,000	21,000	11,000	5,500

2. Safe Bearing Loads for Soils (Horizontal Thrust)

<u>Soil</u>	<u>Safe Bearing Load Lbs. Per Sq. Ft.</u>
Muck, Peat, etc.	0
Soft Clay	1,000
Sand	2,000
Sand	3,000
Sand and Gravel Cemented w/Clay	4,000
Hard Compacted Clay	5,000

3. THRUST BLOCKS IN UNSTABLE SOIL CONDITIONS Thrust shall be resisted by piling driven to solid foundations or by removal of unstable soil material and replacement with ballast of sufficient stability to resist thrust. Thrust block size and method of thrust resistance shall be approved by the Engineer before construction.
4. SPECIAL THRUST CONTAINMENT - Use of joint ties and joint restraint systems such as Megalugs, or equal, may be used in lieu of thrust blocks and shall be placed according to manufacturers recommended distances from fittings subject to water forces.

- J. PIPE INSULATION - Where less than the minimum depth of bury is allowed by the City Engineer for extenuating circumstances, and depth of bury is less than 4 feet, a two-inch thick sheet of polystyrene shall be placed 2-feet wide over the water main. It shall be placed horizontally, 6-inches above the top of pipe and centered on the pipe centerline.

- 2.40.31 VALVE INSTALLATION - Valves shall be installed as recommended by the manufacturer.

- 2.40.32 FIRE HYDRANT INSTALLATION
 - A. HYDRANT BASE - Hydrants shall be placed upon a poured-in-place or precast concrete base (Class B, 4 inches thick) of at least two square feet, on a 4-inch crushed stone base, or as otherwise allowed by the City Engineer. Suitable solid stone or salvaged slabs may be used for the concrete base as approved by the City Engineer. A pocket of crushed stone shall be placed around the bottom eighteen (18) inches of the hydrant barrel depth.
 - B. DEPTH OF BURY - Hydrant leads shall have a 5-foot minimum cover, including crossings through ditch sections.
 - C. HYDRANT DRAIN PORTS - Shall remain unplugged unless otherwise indicated on the plans.
 - D. HYDRANT THRUST RESTRAINT - Shall conform to paragraph 2.40.30I of this specification.
 - E. HYDRANT BACKFILL - Hydrants shall be backfilled with granular material, conforming to MDOT Class III, and compacted to 95% of maximum unit weight as determined by Modified Proctor, or Michigan Cone tests. Written approval from the City Engineer shall be the only exception to these requirements.

- 2.40.33 HYDROSTATIC TESTING
 - A. GENERAL - Upon completion of installation of the water main and appurtenances, the Developer shall be required to perform pressure tests in accordance with ANSI/AWWA C600, Section 4 - Hydrostatic Testing, and the following:
 - B. PRE-TEST PROCEDURES - All valves, including hydrant auxiliary valves, shall be opened to allow complete filling the pipe with water. The filling shall be done in such a way to remove all air from the pipe, valves and hydrants. Additional corporation stops may be necessary at high points to allow the air to be expelled.

- C. FINAL PRESSURE AND LEAKAGE TEST - Shall conform to ANSI/AWWA C600 - Hydrostatic Testing, in the presence of the City Engineer, who shall receive 24 hours notice prior to testing. If it is necessary for the Engineer to observe more than one test on any section of mainline, the Developer shall pay for the additional cost involved for observation of subsequent tests.
- E. LEAK REPAIR - The Developer shall provide all labor and materials, etc., as required to repair any leaks, or otherwise required to meet these tests; all leaks shall be repaired, regardless of the amount of leakage. Water damage resulting from flushing or testing procedures shall be the responsibility of the Developer.

2.40.34 DISINFECTION

- A. GENERAL - The Developer shall be responsible to properly disinfect the constructed water system and pay all costs for testing. Procedures shall conform to ANSI/AWWA C651, and the following:
- B. PRELIMINARY FLUSHING - After the pressure test and before disinfection, the new pipe shall be flushed until the water runs clear. Each valved section of the newly laid pipe shall be flushed separately with potable water from the public supply.
- C. DISINFECTION - The new mains shall be disinfected in increments designated by the City Engineer. Samples shall be taken from corporation stops only. If mains dead end at hydrants, with no adjacent valve, an additional corporation stop shall be installed for sampling.
- D. BACTERIOLOGICAL WATER SAMPLES - Shall be collected by an authorized representative of the Developer, in the presence of the City Engineer in conformance with ANSI/AWWA C651. Two successive safe tests taken 24 hours apart are required; analysis shall be made by a State approved laboratory.
- E. FAILING TESTS - In the event of an unsafe test, the test shall be repeated as described above. The Developer shall be responsible for the costs of all tests.

END OF SECTION

SECTION 2.50 - CONCRETE

PART 1 GENERAL

2.50.10 SCOPE - This section describes the concrete mix requirements for curb and gutter applications and general use on the Project site.

2.50.11 RELATED WORK SPECIFIED ELSEWHERE - This work relates to the following sections of the specifications:

Section 2.30 - SANITARY SEWERS

Section 2.35 - STORM SEWERS

Section 2.40 - WATER MAINS

Section 2.55 - CONCRETE CURB AND GUTTER

2.50.12 REFERENCE SPECIFICATIONS - Concrete used for this project shall conform to Grade 35S concrete as specified in of the "2003 Standard Specifications for Construction" for the Michigan Department of Transportation.

Mortar and grout shall be non-shrink Type H-2 as specified in the "2003 Standard Specifications for Construction" for the Michigan Department of Transportation.

PART 2 PRODUCTS

2.50.20 All materials used in the preparation of the concrete mix shall be in accordance with the reference specification.

PART 3 EXECUTION

2.50.30 The Contractor shall submit a mix design specific to the source materials to the Engineer for review one week prior to pouring. The Contractor may begin pouring upon receiving acceptance for the mix design.

END OF SECTION

SECTION 2.55 - CONCRETE CURB AND GUTTER

PART 1 GENERAL

2.55.10 SCOPE - This section describes the procedures to be used to construct the concrete curb and gutter. The Contractor shall supply all labor, equipment, and materials necessary to construct the concrete curb and gutter.

2.55.11 RELATED WORK SPECIFIED ELSEWHERE - This work relates to the following sections of the specifications:

Section 1.40 - SOIL COMPACTION AND TESTING

Section 2.50 - CONCRETE

Section 2.70 - GRAVEL BASE

PART 2 PRODUCTS

2.55.20 CONCRETE - Concrete shall conform to the specifications as outlined in Section 2.50, which is equal to MDOT grade 35S concrete as specified in Section 7.01 of the "1990 Standard Specifications for Construction".

2.55.21 STEEL REINFORCEMENT - The reinforcing steel for the curb and gutter shall meet the requirements of ASTM A 706 for Grade 60 deformed steel bars. The steel reinforcement shall consist of #4 bars.

2.55.22 JOINT FILLERS - The joint filler shall consist of fiber material conforming to ASTM D 1751. It shall be unbroken or deformed and shall be of the same shape as the cross-section of MDOT F-4 curb as shown on the plans.

2.55.23 WHITE MEMBRANE CURING COMPOUND - The curing compound shall conform to the requirements of ASTM C 309, Type 2, Class B Vehicle.

PART 3 EXECUTION

2.55.30 BASE PREPARATION - The base shall be smoothed, graded and compacted to the required line, grade, and cross-section as shown on the plans and staked in the field. The base shall be prepared ahead of the pouring of concrete so that it can be checked and corrected if necessary. The base will be unacceptable for receiving concrete if it is soft, muddy, or frozen. A moist, but firm condition will be acceptable.

2.55.31 PLACING FORMS - Where forms are used, they shall be steel, free from hardened concrete, mud or loose dirt. They shall be set directly on the prepared base, and neatly and firmly locked together at joints. They shall be supported with a minimum of 3 stakes per form. Vertical and horizontal movement shall be held to 1/8- inch in either direction. Flexible forms shall be used at driveway openings, intersections and other curved areas. The flexible forms shall have adequate back bracing to prevent shifting of the forms during pouring operations.

2.55.32 PREPARATION FOR SLIPFORM METHODS - Where curb and gutter is placed by slipform methods, the stringline shall be set ahead of the pouring to give time for corrections to the line or base as necessary upon checking by the Engineer.

2.55.33 PLACING STEEL REINFORCEMENT - Steel reinforcement shall be placed at the required spacing and location as shown on the plans. The method of supporting the steel and holding it in place shall meet the approval of the Engineer. The bars shall be lapped 10-inches and shall end 2-inches from expansion joints.

2.55.34 PLACING CONCRETE - Concrete of sufficient quality to meet the requirements of these specifications, shall be placed uniformly into the forms and consolidated by shovel or vibrator. Slipform methods shall deposit concrete in a uniform and consistent manner directly on the approved base. The template form shall create the cross-section as shown on the plans without major deviations. The slipform machinery shall consolidate the concrete to eliminate voids in the concrete.

2.55.35 JOINTS - Expansion joints shall be placed at 100-foot intervals, by placing bitumen coated joint filler material at the joint location. The filler shall extend the full depth of the curb and gutter cross-section and shall be recessed between 1/4 and 1/2 inch below the finished surface. Transverse joints shall be placed every 10-feet.

2.55.36 FINISHING - Finishing shall take place immediately following the placement of the concrete and shall be complete prior to the initial set of the concrete. The concrete surface shall be finished smooth by using a moistened wood float to the cross-section shown on the plans. The surface shall then be slightly roughened using a broom or burlap. Joints shall be finished using an approved tool having a radius of 1/4-inch. The gutter and top of curb shall not vary more than 3/16 of an inch when checked with a 10-foot straight edge. This shall be checked prior to completing finishing. Additional concrete needed to fill low spots shall be taken from the job mixture.

2.55.37 CURING - White membrane curing compound shall be applied in a uniform manner to the curb and gutter upon initial set of the concrete and within 24 hours of finishing. It shall be thoroughly mixed prior to use. It shall be applied at a rate of one gallon per 80 lineal feet of curb.

2.55.38 WEATHER AND TEMPERATURE LIMITATIONS - The Contractor will be responsible for protecting the concrete from damage from poor weather conditions. Damaged areas, as determined by the Engineer, will be replaced at the Contractor's expense. Concrete shall not be placed if the ambient air temperature is at or below 25°F, or if the concrete temperature is above 90°F.

END OF SECTION