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**DIVISION III  
MATERIALS STANDARDS**

**1. GENERAL**

All materials shall conform to the Michigan Department of Transportation **1990 Standard Specifications for Construction**, including amendments and supplements thereto, except as herein modified.

**1A. Cement and Lime**

Portland cement shall be Type I, IA, or II, conforming to MDOT Sec. 8.01.

Hydrated lime shall conform to MDOT Sec. 8.01.

**1B. Aggregates & Soil Materials**

Coarse concrete aggregates shall be 6A or 6AA limestone conforming to MDOT Sec. 8.02.

Fine concrete aggregates shall be 2NS conforming to MDOT Sec. 8.02

Dense-graded aggregates shall be MDOT Series 21, 22, or 23, as specified, conforming to MDOT Sec. 8.02, except that aggregate base courses for road construction shall be either natural aggregate or crushed limestone, and the maximum limit for loss by washing shall be 8.0%.

Dense-graded aggregate for utility bedding and backfill shall be MDOT 6A crushed limestone, conforming to MDOT Sec. 8.02.

Granular material shall be well-graded soil conforming to MDOT Sec. 8.02, Class I, II, or 2NS as specified, except that Class II shall be modified such that 100 percent passes a 2 in. square sieve and the uniformity coefficient shall be 6 or greater.

Excavated material, if used as fill material, shall consist of loam, clay, sand, gravel, or other similar material, provided all material is free of cinders, ashes, refuse, vegetable or organic matter, boulders, rocks, stones, broken concrete or other matter which, in the Engineer's judgment, is unsuitable as fill material.

Stone for riprap shall conform to the Standard Specifications for Road and Bridge Construction of MDOT. Material shall have a maximum weight per piece of 150 lbs and with not more than 5% weighing less than 3 lbs per piece. The material shall be evenly graded with 30% to 50% of material weighing not less than 75 lbs per piece.

**1C. Steel Reinforcement**

Reinforcing steel shall be Grade 60 conforming to MDOT Sec. 8.05.

Welded steel wire fabric shall conform to MDOT Sec. 8.05.

**1D. Structural Steel**

Structural steel shall be ASTM A 36 conforming to MDOT Sec. 8.06.  
Bolts, nuts, and washers for joining structural steel shall conform to MDOT Sec. 8.06.

**1E. Miscellaneous Metal Products**

Anchor bolts and fasteners shall conform to MDOT Sec. 8.07. Hook bolts shall conform to MDOT Sec. 8.16.

**1F. Portland Cement Concrete**

The slump for concrete to be used for curb and gutter construction shall be 0-3 inches. For flatwork (e.g., sidewalks, drive approaches) the slump shall be 2-4 inches.

Class A concrete shall consist of portland cement, coarse aggregate (6AA limestone), fine aggregate, and water, proportioned with 564 lbs. cement (6 sacks) per cubic yard to produce a minimum 28 day compressive strength of 3500 psi, conforming to MDOT Sec. 7.01, Grade 35P. When used above ground, the air content shall be 5-7%. Occasional samples falling between 4.5% and 7.5% will be permitted. The water-cement ratio, by weight, may not exceed 0.45 for air entrained concrete, or 0.50 for non-air entrained concrete.

Class A High Early Strength concrete shall be the same as Class A concrete except cement content shall be 846 lbs. (9 sacks) per cubic yard conforming to MDOT Section 7.03, Concrete Repair Mixture Type P-MS. Chloride shall be added only as directed by the City.

Class B concrete shall consist of Portland cement, coarse and fine aggregates, and water, proportioned with 517 lbs. cement (5.5 sacks) per cubic yard to produce a minimum 28 day compressive strength of 3000 psi, conforming to MDOT Sec. 7.01, Grade 30P. When used above ground, the air content shall be 5-7%. Occasional samples falling between 4.5% and 7.5% will be permitted. The water-cement ratio, by weight, may not exceed 0.45 for air entrained concrete or 0.50 for non-air entrained concrete.

Class C concrete shall consist of portland cement, coarse and fine aggregates, and water, proportioned with 470 lbs. cement (5 sacks) per cubic yard to produce a minimum 28 day compressive strength of 2500 psi. The air content shall be 5-7%. Occasional samples falling between 4.5% and 7.5% will be permitted. The water-cement ratio, by weight, may not exceed 0.45.

Class X concrete shall consist of Portland cement, coarse and fine aggregates, and water, proportioned with 282 lbs. cement (3 sacks) per cubic yard to produce a minimum 28 day compressive strength of 1000 psi.

Cement Mortar shall consist of one part Type II Portland cement, two parts fine aggregate, and sufficient water to produce a workable mix.

**1G. Flowable Fill**

Flowable fill shall consist of one of the following mixes:

- a. Portland cement, fly ash, and water.
- b. Portland cement, granular material, fly ash, and water.
- c. Fly ash, granular material and water.

All flowable fill after setting is intended to be removable by conventional mechanical excavation methods.

All materials to be used in flowable fill shall meet the following requirements:

			<u>Specific Gravities ***</u>
Portland Cement	MDOT Std. Spec's. 8.01		3.15
Fly ash	ASTM C 618(1)*		2.40
Granular material Class II	MDOT Std. Spec's. 8.02**	2.60	
Water	MDOT Std. Spec's. 8.11		1.00

\*Except there is no limit on the loss of ignition.

\*\*Except that 100% shall pass 3/4-inch sieve.

\*\*\*Specific gravity values used for mix proportions given. If material used differs from these values appropriate adjustments should be made.

Acceptable mixtures for flowable fill are as follows:

1. FF Mix Number One  
Cement Stabilized Fly Ash Mixture (Class F Fly Ash)
 

Portland Cement		100 lbs./cu.yd.
Fly ash	(Class F)	2000 lbs./cu.yd.
Water		Sufficient water to produce the desired flowability (approx. 80 gal./cu.yd.)
  
2. FF Mix Number Two  
Controlled Density Fill Mixture (Class F Fly Ash)
 

Portland Cement		50 lbs./cu.yd.
Fly ash	(Class F)	500 lbs./cu.yd.
Granular material		2600 lbs./cu. yd.
Water		Sufficient water to produce the desired flowability (approx. 50 gallons /cu. yd.)
  
3. FF Mix Number Three  
Controlled Density Fill Mixture (Class C Fly Ash)
 

Fly ash	(Class C)	300 lbs./cu.yd.
Granular material		2600 lbs./cu.yd.
Water		Sufficient water to produce the desired flowability (approx. 50 gallons)

**1H. Other Materials**

Water shall be clean and free from oil, salt, acid, alkali, sugar or vegetable matter.

Air-Entraining admixtures for concrete shall conform to the requirements of ASTM C 260 and MDOT Sec. 8.24.

Water reducing admixtures for concrete shall conform to the requirements of ASTM C 494, Type A, and MDOT Sec. 8.24.

Curing compounds for concrete shall conform to the requirements of ASTM C 309 and MDOT Sec. 8.24, and shall be white in color.

Timber and lumber shall conform to MDOT Sec. 8.12.

Joint and waterproofing materials shall conform to MDOT Sec. 8.16.

Traffic sign (both temporary and permanent) materials shall conform to MDOT Sec. 8.26.

## **2. UTILITIES**

### **2A. Concrete Pipe and Fittings**

Reinforced concrete pipe shall conform to the requirements for reinforced concrete pipe of ASTM Designation C 76, Class IV, unless otherwise designated on the Plans. For diameters larger than listed in ASTM Specifications, wall thickness and reinforcing steel shall be as shown in detail on the Plans.

Reinforced elliptical concrete pipe shall conform to the requirements for reinforced concrete elliptical pipe of ASTM Designation C 507, Class as designated on the Plans. For diameters larger than listed in ASTM Specifications, wall thickness and reinforced steel shall be as shown in detail on the Plans.

Non-reinforced concrete pipe shall conform to the requirements for concrete pipe of ASTM Designation C 14, Class as designated on the Plans.

Concrete water main pipe shall be Prestressed Concrete Cylinder Pipe, Lined Cylinder Type, or, where concrete river crossing pipe is specified, it shall be Prestressed Concrete Cylinder Pipe, Lined Cylinder Type with Subaqueous Lugs. All concrete water main pipe shall meet the requirements of AWWA C301, and shall be designed for sustained internal working water pressure of 150 psi unless specified otherwise on the Plans or Detailed Specifications. The design calculations and a tabulated pipe laying schedule shall be submitted to the Public Services Director for review. The laying schedule shall show, as a minimum, the centerline and invert elevations, as well as the station, of each end of each pipe. Identification marks will be required for fittings and special length pieces. Cement shall conform to standard specifications for Portland Cement ASTM C 150, Types I or II. Steel cylinders for pipes, fittings, and specials shall be tested for tightness. Concrete water main fittings shall be standard fittings conforming to the requirements of Section 4 of AWWA C 301.

### ***Joints***

Joints for reinforced concrete pipe shall meet ASTM C 443 and shall be rubber gasket for tongue and groove, full bell and spigot rubber O-ring gasket, or modified grooved tongue with rubber gasket. Joints for sewers over 36 inches in diameter shall have inside joints cement mortar pointed to their full depth and shall have the outside joints provided with a cement mortar collar.

Joints for non-reinforced concrete pipe shall be rubber gasket for tongue and groove, or modified grooved tongue with rubber gasket.

Joints for prestressed concrete cylinder pipe used for water mains shall be bell and spigot with O-ring gasket meeting Sections 2.9, 2.11, 3.3, and 3.4 of AWWA C-301 specifications.

Joints for reinforced concrete water mains 30 inches in diameter and larger shall have inside joints cement mortar pointed to their full depth. All reinforced concrete water mains shall have the outside joints provided with a cement mortar collar.

Joints for reinforced concrete elliptical pipe shall be mastic compound with inside cement mortar pointing to full depth and outside cement mortar collar.

Lubricants used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

### ***Pipe Marking***

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., C 76, Class IV).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) The date of manufacture.
- e) Testing lot number or testing lab stamp.
- f) Reinforced concrete pipe with elliptical reinforcement shall be clearly marked on the inside and the outside opposite walls along the minor axes of the elliptical reinforcing.
- g) Water main pipe and fittings shall have special marks of identification to show proper location in the line by reference to layout drawings.
- h) Beveled pipe shall be marked with the amount of bevel and the point of maximum length shall be marked on the beveled end.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

All reinforced concrete water main pipe shall be stacked on pallets off of the existing grade.

Concreted pipe of any type shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications.
- b) Fractures or cracks passing through the wall.
- c) Defects that indicate imperfect proportioning, mixing, or molding.
- d) Surface defects indicating honeycombed or open texture.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- f) Insecure attachment of branches or spurs.
- g) Damaged ends, where in the judgment of the Public Services Director such damage would prevent making a satisfactory joint.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

## **2B. High Density Polyethylene Smooth Interior Pipe**

High density polyethylene (HDP) pipe shall be ADS N-12 pipe or Hancor Titeline pipe meeting the requirements of AASHTO M294 or ASTM F892. The pipe shall be corrugated with an integrally formed smooth interior.



### ***Joints***

Joints for HDP pipe from 12" to 18" diameter shall be gasketed watertight joints using watertight sleeves conforming to the requirements of ASTM D3212. The sleeves shall have an indentation in the center to ensure proper positioning of the pipe. Sleeves shall be factory installed on one end of the pipe, with a factory installed gasket on the opposite end of the pipe. The gaskets shall be a solid cross-section ring meeting the requirements of ASTM F477. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Joints for 21" and 24" HDP pipe shall be either gasketed watertight joints as described above, or silt tight joints using split coupling bands and geotextile fabric. The coupling band shall engage a minimum of four corrugations, two on each side of the pipe joint. The joints shall be coupled in accordance with the manufacturer's requirements. A continuous geotextile filter fabric sock shall be placed over the coupling band, extending a minimum of one foot past each end of the coupling band. The ends of this filter fabric sock shall be secured with coupling band tie straps placed in the bottom of the corrugations.

### ***Pipe Marking***

The following information shall be clearly marked on each length of pipe:

- a) Specification designation (e.g. AASHTO M294).
- b) The name or trademark of the manufacturer.
- c) Nominal size.
- d) The plant designation code.
- e) The date of manufacturer.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

HDP pipe shall be subject to rejection on account of any of the following:

- a) Cracked pipe.
- b) Creased pipe.
- c) Unpigmented or non-uniformly pigmented pipe.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

## **2C. Vitrified Clay Pipe and Fittings**

Vitrified clay sewer pipe shall be the bell and spigot type, glazed or non-glazed, and shall be of full internal diameter from 4 through 18 inches inclusive. Clay pipe shall conform to the material and testing requirements

of ASTM C 700, extra strength.

### ***Joints***

Joints for vitrified clay sewer pipe shall be compression type joints conforming to the material and testing requirements of ASTM C 425. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

### ***Pipe Marking***

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., C 700, ES).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) Testing lot number or testing lab stamp.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Vitrified clay pipe shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket.
- c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- f) Insecure attachment of branches or spurs.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

## **2D. Polyvinyl Chloride Pipe and Fittings**

Polyvinyl chloride (PVC) pipe shall have an integral wall bell and spigot. PVC pipe shall conform to the material and testing requirements of ASTM D 3034-83. Minimum wall thickness shall be SDR 35.

### ***Joints***

Joints for PVC pipe shall be elastomeric gasketed push-on joints conforming to the requirements of ASTM D

3212-81. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

***Pipe Marking***

The following information shall be clearly marked on each length of pipe at intervals of five feet or less:

- a) Manufacturer's name or trademark and code.
- b) Nominal pipe size.
- c) The PVC cell classification (e.g. "12454-B").
- d) The legend "Type PSM SDR-35 PVC Sewer Pipe".
- e) The designation "Specification D 3034".

The following information shall be clearly marked on each fitting:

- a) Manufacturer's name or trademark.
- b) Nominal size.
- c) The material designation "PVC".
- d) "PSM"
- e) The designation "Specificalton D 3034".

***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Pipe shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket.

- c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

## **2E. Sewer Service Leads, Risers and Fittings**

Sewer service leads, risers and fittings shall meet the requirements of the current City of Ann Arbor Building Code (Chapter 98 of the City Code). Allowable pipe materials are; SDR 35 polyvinyl chloride (PVC) plastic conforming to the material and testing requirements of ASTM D3034; vitrified clay pipe conforming to the material and testing requirements of ASTM C700; and cast iron pipe conforming to the material and testing requirements of ASTM A74.

Whenever adapters are required to properly connect the pipe with pipe of other material or manufacturer, the nominal I.D. of adapters shall be manufactured for that specific purpose and shall be the same size as the nominal diameter of pipe connected thereto. Adapters shall also be furnished and used as required by the manufacturer. The adaptor shall be a style "CB" gasketed sewer saddle manufactured by Romac Industries, Inc. or approved equal, or a flexible neoprene rubber boot.

### ***Joints***

Joints for SDR 35 PVC pipe shall be bell and spigot rubber o-ring gasket joints conforming to the requirements of ASTM D-3212. Lubricant supplied by the pipe manufacturer shall be used, and the joints shall be coupled in accordance with the manufacturer's requirements.

Joints for vitrified clay pipe shall be compression type joints conforming to the material and testing requirements of ASTM C425. Lubricant used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

Joints for cast iron pipe shall be mechanical compression joints conforming to the material and testing requirements of ASTM C564.

### ***Pipe Marking***

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., SDR 35, ASTM D3034).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.
- d) Testing lot number.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Pipe for sewer service leads and risers shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications. Pipe in all cases shall be full diameter.
- b) Fractures or cracks passing through the barrel or socket.
- c) Chips or fractures on the interior of the pipe exceeding two inches in length, one inch in width, or depth more than 1/4 of the thickness of the wall.
- d) Blisters that are either broken, exceed three inches in diameter, or project more than 1/8 inch above the surrounding surface of the pipe.
- e) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

### **2F. Cast Ductile Iron Pipe & Fittings**

Cast ductile iron pipe shall be Iron Grade 60-42-10 and meet the requirements of ANSI/AWWA C151/A21.51 in all respects; with standard thickness cement mortar lining and asphaltic seal coat in accordance with ANSI/AWWA C104/A21.4; and coated outside with an asphaltic coating in accordance with ANSI/AWWA C151/A21.51. 100% of the ferrous metals used in the manufacture of cast ductile iron pipe shall be recycled from scrap and other sources. All pipe shall be Pressure Class 350 (Table 50.5 ANSI/AWWA C150/A21.50), or Thickness Class 50 (Table 50.15, ANSI/AWWA C150/A21.50). Ductile iron pipe crossing under a railroad shall be thickness Class 56.

Cast ductile iron river crossing pipe shall be Clow Corp. "F-141 River Crossing Pipe", U.S. Pipe "USIFLEX Boltless Flexible Joint Pipe" or equal approved by the Public Services Director, and shall be thicknesses Class 56 minimum. It shall have a boltless flexible joint of the ball and socket type, and be designed for, and rated at, a minimum interior working water pressure of 250 psi.

Restrained joint pipe, where called out on the Plans, shall be factory manufactured by the installation of retainer weldment and ductile iron locking segments or rings. Restrained joint pipe shall be TR-Flex restrained joint pipe manufactured by U.S. Pipe, Lok-Ring joint pipe manufactured by American Ductile Iron Pipe, or equal as approved by the Public Services Director.

Cast or ductile iron fittings shall be push-on joint, unless otherwise specified (with the exception of solid sleeves and fire hydrants which shall be mechanical joint), meeting the requirements of ANSI/AWWA C110/A21.10 for short body cast iron fittings. Fittings shall have a cement mortar lining and asphaltic seal coat in accordance with ANSI/AWWA C104/A21.4 and ANSI/AWWA C110/A21.10. The outside of all fittings shall have an asphaltic coating in accordance with ANSI/AWWA C110/A21.10.

Solid sleeves shall be long sleeves.

### ***Pipe Wrapping***

All Cast Ductile Iron Pipe & Fittings (except river, railroad and highway crossing pipe) shall be polyethylene

wrapped per ANSI/AWWA C105/A21.5.

### ***Joints***

Push-on joints shall be single gasket joint meeting the requirements of ANSI/AWWA C111/A21.11.

Mechanical joints for fire hydrants and solid sleeves shall be in accordance with ANSI/AWWA C111/A21.11 and shall include the Mega lug joint restraint system manufactured by EBAA Iron Sales, Inc. Bolts for mechanical joints shall be high strength, low alloy steel bolts only, meeting the requirements of ANSI/AWWA C111/A21.11.

Cast ductile iron river crossing pipe joints shall be a push-on type ball and socket joint utilizing a first grade rubber gasket. The joint shall be capable of 15-degree full turning deflection without separation, leakage, or restriction of the pipe waterway. Joint restraint shall be provided by a boltless means which is locked against accidental disengagement of the restraining component. Pipe shall be furnished with the necessary gaskets, lubricant, and retainer locking accessories.

Joints for restrained joint pipe shall be in accordance with ANSI/AWWA C111/A21.11. Bolts and nuts for the retainer assembly shall be stainless steel.

Restrained, push-on joint pipe shall be American Pipe's "Fast-Grip" gasket system or U.S. Pipe's "Field-Lok" gasket system.

The use of retainer glands and set screws shall not be acceptable.

Lubricants used in making up joints shall be supplied by the pipe manufacturer and the joints shall be coupled in accordance with the manufacturer's requirements.

### ***Pipe Marking***

The following information shall be clearly marked and/or cast on each length of pipe:

- a) The pipe designation and class (e.g., D.I., Class 50).
- b) The name or trademark of the manufacturer.
- c) Country where cast.
- d) The year in which the pipe was produced.

The following shall be distinctly cast on each fitting:

- a) The pressure rating of the fitting.
- b) Nominal diameters of openings.
- c) The name or trademark of the manufacturer.
- d) Country where cast.
- e) The number of degrees or fraction of the circle on all bends.
- f) Ductile iron fittings shall have the letters "DI" or "Ductile" cast on them.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

All materials that will potentially be in contact with the City water supply must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system. These materials shall include pipe coatings, pipe metals, cement linings, and joint lubricants and gaskets.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the Public Services Director sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection. The Contractor shall also notify the Public Services Director when the material has arrived at the site.

All ductile iron water main pipe shall be stacked on pallets off of the existing grade, with each end plugged or bagged so as to keep the pipe interior clean until final installation.

Cast ductile iron pipe and fittings shall be subject to rejection on account of any of the following:

- a) Variation in any dimension exceeding the permissible variations given in the material specifications.
- b) Any crack or defect in the cement mortar lining which, in the opinion of the Public Services Director, is non-repairable, including but not limited to loose or "hollow" lining.
- c) Any signs of physical damage or poor manufacturing which might render the material unsuitable for its intended use.
- d) Variation of more than 1/16 inch per lineal foot in alignment of pipe intended to be straight.
- e) Damaged ends, where in the judgment of the Public Services Director such damage would prevent making a satisfactory joint.
- f) Improper handling during delivery, unloading or installation.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

### **2G. Valves**

Gate valves shall be Waterous Series 300 and T300 NRS Double Disc Gate Valve, Mueller A-2380 Series, East Jordan Series A, or Kennedy AWWA 571X, NRS with two inch square operating nut, opening right. Joints shall be push-on joint meeting the requirements of ANSI/AWWA C111/A21.11. Sixteen inch and larger gate valves shall be furnished with a three inch valved by-pass, opening right. Twenty inch and larger gate valves shall be List 14 AWWA Gate Valves: Eddy - Iowa Division, James B. Clow & Sons, Inc., and shall be furnished with bronze rollers, tracks and scrapers, having enclosed bevel gearing, and shall be installed horizontally. Gearing shall consist of cut tooth cast steel gears with rolled bronze pinion shafts having a minimum mechanical advantage ratio of 2 to 1.

Butterfly valves and operators for sizes twelve inch and larger shall meet AWWA Specifications C504-74. Butterfly valves shall be Henry Pratt "Groundhog" or Mueller "Linesal III" with operator for buried service with two inch square operating nut, opening right. Joints as specified on the Plans or elsewhere herein shall be mechanical joint ANSI/AWWA C111/A21.11 or flanged joint ANSI B16.1 with 125# or 250# drilling and bolting.

Valve boxes shall be Buffalo type, Size D, screw type, 3-piece, 5-1/4 inch shaft with a #6 base for valves 8 inches or less, and a #8 base for valves of 10 or 12 inches. The word "Water" shall be cast in raised letters on the cover. Boxes shall be Tyler 6860 or equal approved in writing by the Public Services Director.

Curb boxes shall be Buffalo type, Size 95E, screw type, 2-piece, 2-1/2 inch shaft, extendable from 4-1/2 ft. to 6 ft. Boxes shall be Mueller Type H-10350, Tyler 6500, or Bibby Ste. Croix B-2000.

All valves must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

**2H. Fire Hydrants**

Fire hydrants shall be either the East Jordan Iron Works Model 6-BR with traffic flange, or the Waterous Model TVC-5 with traffic flange. Only the East Jordan hydrant shall be used in areas of high density zoning (see **Division II, Section 5D.** of these Standards).

All fire hydrants shall have the following features: a 6 inch mechanical joint pipe connection, ANSI/AWWA C111/A21.11; two 2-1/2 inch National Standard hose connections; one 3-1/2 inch Ann Arbor Standard pumper connection, with 7-1/2 threads per inch and 4.05 in. O.D.; 1-3/8 inch pentagon operating and cap nuts (1-3/8 in. point-to-flat at top; 1-7/16 in. point-to-flat at base); open left; breakable flange construction; no barrel drain; and a painted red finish, unless separated from the distribution system by a check valve. Depth of bury (bottom of pipe to ground surface) is generally 6 feet but may vary depending on specific site conditions. The pumper nozzle must be 21 in. ± 3 in. above finished grade, and the breakable traffic flange must be between finished grade and 8 in. above finished grade.

Fire hydrant extensions for Waterous hydrants shall be Waterous Part #F1-K562-6. Extensions for East Jordan Iron Works hydrants shall be hydrant model 6-BR extension kit.

All fire hydrants must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

**2I. Tapping Sleeves and Valves**

Tapping sleeves and valves shall be manufactured of cast iron and designed for water service with a minimum working pressure of 150 psi. The sleeve shall be a full-bodied split sleeve design manufactured by Clow number F-5205; Muller Co. number H-615; Waterous Series 800 or East Jordan.

Tapping Sleeves for Prestressed Concrete Steel Cylinder Pipe shall be in accordance with AWWA M-9. The sleeves shall have a separate gland which permits installation of the sleeve prior to cutting of the prestress wires. The gland shall have a fusion epoxy coated (per AWWA C-213) waterway, and a broad gasket set in a retaining groove of a pressure plate gusseted to eliminate flexing. The gland shall be equipped with load bearing set screws to protect the cylinder. Grout under saddle is needed whether saddle is epoxy coated or not. Sleeves shall be furnished with grouting seals and grout horns to facilitate filling the space between the sleeve and the pipe. Tapping sleeves shall be a Price Brothers Company Tapping Sleeve for Prestressed Concrete Steel Cylinder Pipe or approved equal.

Tapping valves shall be double-disk type of the same manufacture as the sleeve, NRS with two inch square operating nut-opening right, with a mechanical joint outlet.

All tapping sleeves and valves must be certified by Underwriters Laboratory (UL) or the National Sanitation Foundation (NSF) for use in a potable water system.

**2J. Casing Pipe**

Steel casing pipe used for construction at railroad or State highway crossings shall comply with the following minimum requirements unless more stringent requirements are established by the railroad or State. Casing pipes at other locations shall comply with the following minimum requirements unless otherwise indicated on the Plans or in the Specifications.

Nominal Diameter of Casing Pipe <u>(Inches)</u>	Minimum Wall Thickness <u>(Inches)</u>
---	--



Under 14	0.250
14,16, and 18	0.312
20 and 22	0.375
24,26,28, and 30	0.500
32 and 34	0.563
36,38,40,42, and 48	0.625

Steel pipe shall be non-spiral pipe and have a minimum yield strength of 35,000 psi. All joints shall be made leakproof using full penetration, continuous welds. Welds shall be ground smooth outside and inside (except inside 22 in. diameter and less) to prevent conflict with the soil or pipe placement. Steel pipe shall meet the requirements of ASTM A 53, Type E or S, Grade B.

***Pipe Marking***

The following information shall be clearly marked on each length of pipe:

- a) The pipe designation and class (e.g., A 53, Type S, Grade B).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.

***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe that, independent of physical tests specified under the standard specifications designated herein, fails to conform to the requirements of these Specifications.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

**2K. Corrugated Metal Pipe**

Corrugated metal pipe shall be galvanized steel pipe conforming to the requirements for Type I and Type II pipe of AASHTO M36 and the requirements of MDOT Standard Specification Sec. 8.08 Class D pipe.

The pipe shall have a bituminous coating conforming to the requirements of AASHTO M 190 and the requirements of MDOT Standard Specifications Sec. 8.08.

### ***Joints***

Joints for corrugated metal pipe shall be made with coupling bands which conform to the material and testing requirements of AASHTO M36, and MDOT Standard Specifications Sec. 8.08.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe or fittings that, independent of physical tests specified under the standard specifications designated herein, fail to conform to the requirements of these Specifications.

The Contractor shall notify the City Engineer sufficiently in advance so that an Inspector may be on the job during the unloading of materials. A minimum notice of 24 hours is required for such unloading and inspection.

Corrugated metal pipe shall be subject to rejection on account of loosening or separation of the bituminous coating from the galvanizing, or blistering of the galvanizing. Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of work by the Contractor without cost to the City.

## **2L. Pipe For Edge, Bank, and Foundation Drains**

### ***Smooth Plastic Pipe***

Smooth plastic pipe shall be perforated with circular or slotted holes in accordance with the requirements of AASHTO M 175. Smooth plastic pipe shall be made of polyvinylchloride or acrylonitrile-butadiene-styrene plastic conforming to the material and testing requirements of ASTM D3033 or D3034, except that the pipe stiffness for 6 inch nominal diameter pipe shall not be less than 30 psi at 5% deflection, and the requirements for joint tightness shall not apply.

### ***Corrugated Plastic Tubing***

Corrugated plastic tubing shall be perforated in accordance with the requirements for the perforations of AASHTO M 36 or the tubing may be slotted. If slotted, the length of the individual slots shall not exceed 10 percent of the nominal inside circumference of the tubing and the width of the slots shall not exceed 1/8 inch. The slots shall be located in the valley of the corrugations and shall provide a minimum inlet area per unit length of pipe equal to 0.75 percent of a cylindrical surface having the same diameter as the nominal inside diameter of the tubing. The slots shall be cleanly cut so as not to restrict the inflow of water and uniformly spaced along the length of the pipe in rows. The perforation rows shall be evenly spaced around the circumference of the tubing.

Corrugated plastic tubing shall be made of polyethylene (PE) or polyvinylchloride (PVC) plastic and shall conform to the requirements for Heavy-Duty Tubing of ASTM F 405 except that the basic material for use in fabricating PVC tubing shall be a PVC plastic meeting the requirements as specified in ASTM D 3033.

### ***Pipe Wrapping***

All pipe for edge, bank, and foundation drains shall be wrapped with geotextile filter fabric. Geotextile filter fabric shall be of nylon, polypropylene, fiberglass, or polyester and shall be either woven, heat bonded, knitted, or of continuous fibers. The geotextile filter fabric shall completely cover and be secured to the pipe. In an unstretched condition, knitted polyester fabrics shall weigh at least 3.0 ounces per square yard and all other geotextiles shall weigh at least 3.5 ounces per square yard. The fabric shall be strong and tough and have a porosity such that the fabric will retain soil particles larger than 0.106 mm (no. 140 sieve) and shall pass aggregate particles finer than 0.025 mm. Geotextiles shall be stored and handled carefully and in accordance with the manufacturer's recommendations and shall not be exposed to heat or direct sunlight to such extent as to significantly affect their strength or toughness. Torn or punctured geotextiles may not be used.

### ***Pipe Tagging***

The following information shall be clearly tagged on each length of pipe.

- a) The pipe designation and class (e.g., ASTM D 3033).
- b) The name or trademark of the manufacturer.
- c) Identification of the manufacturing plant.

### ***Manufacturer's Certification***

All pipe furnished shall be accompanied by the manufacturer's certificate of test showing conformity with the Specifications. Each certificate shall identify a specific lot number, quantity of pipe, and show actual test results for the lot furnished. These certificates shall be submitted to the Inspector at the time of unloading.

### ***Inspection***

All pipe furnished shall be subject to inspection on arrival at the job site by the Public Services Director. The purpose of the inspection shall be to cull and reject pipe that, independent of physical tests specified under the standard specifications designated herein, fails to conform to the requirements of these Specifications.

Rejected pipe shall be plainly marked by the Inspector and immediately removed from the site of the work by the Contractor, without cost to the City.

## **2M. Manholes and Drainage Structures**

Storm sewer drainage structures shall be constructed of precast or cast in place reinforced concrete sections, or concrete masonry units. All sanitary sewer manholes and gate wells (water main valve manholes) shall be constructed of precast reinforced concrete sections.

Precast reinforced concrete bases, bottom sections, manhole risers, grade adjustment rings, concentric cones, eccentric cones, and flat slab tops shall conform to the requirements of ASTM C 478. Joints on precast manholes used on all sanitary sewers shall meet ASTM C 443, rubber O-ring gasket.

Precast manhole tees and radius pipe sections shall conform to requirements for reinforced concrete pipe, ASTM C 76, Class IV. Joints shall conform to adjacent pipe. Tees and radius pipe shall conform to details indicated on drawings offered by the Concrete Pipe Association of Michigan, Inc., or Engineer approved equal.

Concrete masonry units shall conform to the requirements for concrete masonry units for catchbasins and manholes, ASTM C 139.

Concrete brick shall conform to the requirements for concrete building brick, ASTM C 55, Grade N-I.

Cast iron frames and covers for manholes and drainage structures shall conform to the requirements for grey iron castings, ASTM A 48, Class No. 30. Specific, approved castings are listed in the Casting Schedule in the

Standard Details.

Plastic coated manhole steps shall be injection molded of copolymer, polypropylene, encapsulating a 1/2 inch grade 60 steel reinforcing bar. Plastic-coated manhole steps shall meet the performance test described in ASTM C-478, Paragraph II, and shall have an impact resistance of 300 ft.-lbs., with only minor deflection and no cracking or breaking.

The steps shall resist pull out forces of 1500 lbs.

### ***Manhole Connections***

Sewer pipe to precast manhole connections shall be through: 1) a flexible neoprene rubber boot which shall be securely clamped into a core-drilled pipe port. Pipe ports shall be core-drilled at the point of manhole manufacture and shall be accurately located within 1/2-inch of proposed sewer centerline; or, 2) a self-adjusting mechanical pipe to manhole seal which provides a resilient flexible and infiltration-proof joint (Res-seal); or, 3) a flexible rubber wedge firmly rammed into a rubber gasket which is cast into the manhole (Press Wedge II), or equal approved in writing by the Public Services Director.

Neoprene rubber for manhole boots shall meet the requirements of ASTM C443 and shall have a minimum thickness of 3/8-inch. Pipe clamp bands shall be of corrosion-resistant steel.

## **2N. Cured-In-Place Pipe (CIPP)**

The tube material shall meet the requirements of ASTM F1216. The dry tube shall consist of one or more layers of flexible needled felt, or an equivalent nonwoven material, which is compatible with the resin system used, and capable of carrying the resin, withstanding installation pressures and curing temperatures. The outside layer of the tube shall be plastic coated with a material that is compatible with the resin system used.

The tube shall be fabricated to a size that, when installed, will tightly fit the internal circumference of the sewer to be lined. The tube shall extend for the full sewer run, from manhole to manhole.

A general purpose, unsaturated, styrene-based, thermoset resin and catalyst system, or an epoxy resin and hardener which is compatible with the inversion process, shall be used. The resin must be able to cure in the presence of water, and the initiation temperature for cure shall be less than 180°F.

The CIPP shall have a minimum flexural strength of 4,500 psi, and a modulus of elasticity of 500,000 psi.

The Contractor shall furnish to the Public Services Director written certification that the CIPP conforms to the requirements of these Standards.

## **3. BITUMINOUS MIXTURES**

### **3A. General**

Bituminous pavement mixtures shall be mixed in accordance with the requirements specified in MDOT Section 7.10

### **3B. Aggregate**

The aggregate used in the bituminous mixture shall be in accordance with Table A. The aggregates shall meet the gradation and physical requirements specified in MDOT Section 8.02 with the exceptions and additions specified herein.

Dense Grade Aggregate 20AAA shall be used in the production of Bituminous Mixtures No. 1300, No. 1500, and No. 1800 and shall meet the gradation and physical requirements specified for Dense Graded Aggregate 20AA with the additional requirements that the total percent of aggregate passing the No. 4 sieve shall be 55-75 percent and the minimum crushed particle content shall be 60 percent.

Aggregate containing limestone, crushed concrete, or steel furnace slag may not be used in the production of wearing course mixtures.

The Contractor may elect to blend aggregates. When the Contractor so elects, the requirements for the aggregate, the composition, and the use of hot bins shall be as specified under **3C. Blending Aggregates**.

### **3C. Blending Aggregates**

The Contractor shall submit to the Public Services Director for review and approval, a mix design which has been prepared by an approved testing laboratory. The bituminous mixture shall meet the requirements specified herein under **3E. Composition of Bituminous Mixture**.

The Contractor shall provide uniformity in the gradations of the aggregates placed in the cold feed bins so that the combination of aggregates produced for the mixture by blending the aggregates from two or more cold feed bins will be uniformly fed by means of adjustable feeders onto a belt supplying the asphalt plant. The feeders shall be equipped with cutoffs which will automatically stop the operations of the asphalt plant at any time the flow of any aggregate fraction is changed so as to affect the uniformity of the finished product.

The Contractor has the option of using hot bins for proportioning the aggregates to meet the specified tolerances.

Aggregate gradation tests will be made on aggregate extracted from samples of bituminous mixture taken from the trucks. At the start of production and at other times when tests indicate that the aggregate gradation is fluctuating, truck samples will be taken at a frequency of one sample per 250 tons of mixture, but not more than 4 samples per day. During other periods, where tests indicate the aggregate gradation is stable, truck samples will be taken at a frequency of one sample per 500 tons of mixture, but not more than 2 samples per day.

The Public Services Director may require the Contractor to furnish graded aggregate from approved stockpiles, if in the opinion of the Public Services Director, the blended aggregate as incorporated in the bituminous mixture does not meet the requirements specified herein.

### **3D. Bituminous Material**

Asphalt cement shall meet the requirements as specified in MDOT Section 8.04 for the penetration (viscosity) grade as approved by the Public Services Director in the mix design.

Asphalt Penetration values shall be 120-150 for local streets, 85-100 for major streets, and 200-250 for bike paths/walkways unless otherwise directed by the Public Services Director.

### **3E. Composition of Bituminous Mixture**

The specified aggregates, mineral filler (if required), and asphalt cement shall be combined as necessary to produce a mixture proportioned within the master gradation range limits shown in Table A and within the

uniformity tolerance limits shown in Table C. Bituminous mixtures shall also meet the mix design criteria specified in Table B.

**TABLE A: MASTER GRADATION RANGE FOR BITUMINOUS MIXTURES**

Total Percent Passing Designated Sieve for  
Applicable Bituminous Mixture\*

Sieve Sizes	No. 1800 No. 1500 No. 1300 20 (AAA)	No. 1300 (36 A)	No. 1300 (36A) Modified	No. 1100 (20AA)	No. 1100 (20A)	No. 900 (20A)	No. 900 (20B)	No. 700 No. 500 (20C)
1 1/2" 1" 3/4" 1/2" 3/8" No. 4 No. 8 No. 30 No. 200	----- ----- 100 90-100 65-95 55-75 45-70 20-45 3-10	----- ----- ----- 100 92-100 65-90 55-75 25-50 4-10	----- ----- ----- 100 65-90 45-70 20-45 4-9	----- ----- 100 90-100 65-95 ----- 45-70 20-45 3-10	----- ----- 100 60-90 ----- 40-65 20-40 3-10	----- ----- 100 60- 90 ----- 40- 65 20- 40 3-10	----- ----- 100 60-95 ----- 40-70 20-45 3-10	100 80- 100 ----- ----- 55-90 ----- 30-55 15-40 3-10
% Bitumen in Mixture	5-7**	5-9**	5-9**	5-7**	5-7**	5- 8**	5-8**	3-6**
% Crushed Particle Content (Min.)	60	60	60	40	25	25	---	25

\*Composition limits are shown in percent by weight, based on the total aggregate, including mineral filler, in the mixture.

\*\* For mixtures No. 900, 1100, 1300, 1500, and 1800 placed in two courses, the bitumen content of the leveling course will be designed to have up to 0.5 percent less bitumen than the optimum specified for the top course. Mixtures No. 500 and 700 will be designed to have 4.5 percent bitumen content unless indicated otherwise on the Plans or in the Detailed Specifications. Exceptions will be made when highly absorbent aggregates are used or when a base course or leveling mixture is to be left open to carry traffic over the winter.

When tested at optimum asphalt content in accordance with ASTM D 1559, the bituminous mixture shall meet the requirements for stability, flow, and voids in mineral aggregate (VMA) as specified in Table B.

Table B: MIX DESIGN CRITERIA FOR DENSE-GRADED AGGREGATES

Mixture Number	Aggregate Required	Stability (pounds) minimum	Flow, (hundredths of an inch)	VMA (percent) minimum	Air Voids (percent) target
500	20C	500	7 - 16	13.0	4.0
700	20C	700	8 - 16	13.0	4.0
900	20B/20A	900	8 - 16	13.5	2.5
1100	20A/20AA	1100	8 - 16	13.5	3.0
1300	20AAA/36A	1300	8 - 16	14.0	3.0
1500	20AAA	1500	8 - 16	14.0	3.0
1800	20AAA	1800	9 - 16	14.0	3.0

Mixtures failing to meet the requirements specified in Table B will be rejected and the Contractor will be required to submit additional samples of aggregates until a material is found which will produce a mixture meeting the Table B requirements.

If there is a change in the source or type of any material, the Contractor shall submit a new mix design to the Public Services Director for approval.

After the mix design formula is established, the aggregate gradation and the bitumen content of the bituminous mixture furnished for the work shall be maintained within the uniformity tolerance limits permitted for the mix design as specified in Table C and within the master gradation range as specified in Table A. Paving shall not continue after two consecutive aggregate gradations on one sieve, or bitumen contents as determined by the field extractions, are not within the uniformity tolerance limits. (Work days will be charged during the down time). Before resuming any production, the Contractor shall make all necessary alterations to the materials or plant so that the mix design can be maintained within the tolerances shown in Table C and within the master gradation range shown in Table A.

TABLE C: UNIFORMITY TOLERANCE LIMITS FOR BITUMINOUS MIXTURE

Mixture Number	Range	Percentage Passing Designated Sieves				Bitumen Content	Marshall Stability LBS-(Min.)
		3/8 in.	No. 8	No. 30	No. 200		
900,1100 1300, 1500 1800	1*	±5.0	±5.0	±4.0	±1.0	±0.4	Less than 1275 for 1300 mixture
	2**	±5.1-8.0	±5.1-8.0	±4.1-7.0	±1.1-3.0	±0.41-0.6	Less than 1250 for 1300 mixture
500, 700	1*	±7.0	±7.0	±6.0	±2.0	±0.4	
	2**	±7.1-10.0	±7.1-10.0	±6.1-9.0	±2.1-4.0	±0.41-0.6***	

\*Range 1: Maximum Allowable Deviations Permitted from Mix Design Within the Master Gradation Range.

\*\*Range 2: Suspend Mix Production and Make Necessary Changes.

\*\*\*The Bitumen content may exceed 0.6 percent above the 4.5 percent design content but shall not exceed 0.6 percent above the optimum bitumen content.



**4. STREETLIGHTS**

**4A. General**

All material and equipment furnished under this Section shall fully comply with the latest IEEE, NEMA and ANSI Standards, for that class of equipment and these Specifications.

**4B. Raceway System**

Conduit shall bear the Underwriters' Laboratories, Inc. label and shall show the manufacturer's name and trademark.

Conduit sizes shall be as shown on the construction drawings.

Should the City determine that a spare conduit shall be provided, a nylon pulling line shall be pulled through the conduit for future use.

***Rigid Galvanized Steel Conduit***

Rigid galvanized steel conduit shall comply with the latest revision of Article 346 of the National Electric Code (NEC) and shall be hot-dip galvanized inside and out. The zinc coating shall be continuous and thorough and shall not scale or blister or be removable by any reasonable process of handling or erection.

All connections to rigid galvanized steel shall be threaded.

Conduit for service pole risers shall be rigid galvanized steel of the size required by the NEC.

***Plastic Conduit***

Plastic conduit shall comply with the latest revision of Article 347 of the NEC and shall be heavy wall, rigid, Schedule 40 PVC for conduit runs. Schedule 80 PVC shall be installed under roadways or commercial driveways.

All conduit connections shall be watertight.

**4C. Wire and Cable**

All poles must have a three wire system, including dead ends. Cable in poles must be marked to indicate connection to power source (typical red/blue).

Cable and wire shall be manufactured by:

Alcan	Collyer	Hatfield	Reynolds
Alcoa	Esses	Kaiser	Rome
Anaconda	General Cable	Okonite	Southwire
Cerro	General Electric	Phelps Dodge	Triangle

Cable shall be sized as indicated on the Plans and shall meet the following: underground cable shall be 600V, XLPE, U.L. listed USE, 3 single cord paralleled, or triplexed, copper, #2 AWG cable for direct bury. #4 copper cable may be used as neutral. The insulation shall be XLPE and U.L. listed USE. Color code phase identification shall be repeated at all connections. The conductor coding shall adhere to covering and not be readily removed by rubbing.

**4D. Cable Connectors**

The connection of conductors from size #12AWG and larger to terminal parts or other conductors shall be made with heavy-duty cast alloy solderless connectors of the pressure double indent type.

Tap connectors at lighting standards shall be multiple aluminum connector with four positions for #2 AWG Copper and a 5th position for #12 AWG or larger fixture wire. Connectors shall be Utilco Cat. No. SLC-4-0-1-L with cover for tap block.

Wire brush and approved corrosion inhibiting compound shall be applied to all connections.

All splices shall be accessible through the handhole and shall extend 4-6 inches outside the handhole. No splices will be allowed which are inaccessible inside the pole.

**4E. Tape**

Where Utilco connections are not used, all joints in outlet or junction boxes shall be taped in such manner that the insulating value of the joint or splice will be at least equal to the insulating value of the conductor to which it is applied.

**4F. Disconnect Cabinet**

The lighting system shall have a disconnect mounted in a cabinet adjacent to the Detroit Edison power supply, not to exceed a distance of 10 feet. The disconnect cabinet and pad may be purchased from the Transportation Division or shall conform to the specifications of Hennessy Products #210049. Cable entering the breaker shall be #8 or larger. The service disconnect shall be a Square D or GE single pole circuit breaker at a rating of no less than 3 amps per lamp with a minimum of 30 amps.

**4G. Lighting Fixtures**

Lighting fixtures shall include all lamps or tubes, transformers, ballasts, starters, supports, hangers, brackets, canopies, globes and all other parts and devices necessary for complete operation and installation. All threaded fittings shall be lubricated with a non-corrosive grease.

***Luminaire Specifications***

Enclosure - Standard horizontal luminaire with two-bolt slip-fitted and rigid retractor door.

Reflector - Borosilicate Glass.

Reflector - Semifixed top mounted reflector/heat shield.

		<u>250 W HPS</u>	<u>100 W HPS</u>
Manufacturers:	General Electric Cat. No. -	M4RR25S7A1GMN3	M2RR10S1M2GMS2
	American Electric Cat. No. -	S250295 or 126-H133	113-56212-6

#### **4H. Poles and Foundations**

Streetlight post and foundation shall be as follows:

Detroit Edison code 06 post with XIM Primer and SUB-OX Black Surface Treatment, Factory-applied  
Detroit Edison Specification 452 shims

##### **Concrete Base**

Detroit Edison code 05 Bearing plate with 11" bolt circle  
Detroit Edison code 05 foundation  
Detroit Edison code 21 foundation rod

##### **Screw-in Base**

Detroit Edison Specification C11242NG4VP as provided by Chance, Inc.

##### **Poles**

Approved supplier and poles are as follows:

Single Davit:

Shakespeare (Cat. #AS 30-16N1BB01) Standard Duty light pole with OPAR-6 arm and OPHW1 hardware.

Double Davit:

Shakespeare (Cat. #AH 30-26N1BB01) Heavy Duty light pole with 2 OPAR-6 arms and OPHW1 hardware.

Supplier: Madison Electric Company  
P.O. Box 1367  
Ann Arbor, Michigan 48106  
(313) 665-6131

##### **Anchor Bolts**

(4 pcs) 7/8" x 66" and (4 pcs) tie rods 1/2" x 102" complete with nuts, washers and hardboard templates shall be furnished and installed by the Contractor. Anchor bolts will be provided with templates by the manufacturer. Option: (4 pcs) 1" x 40" with 4" els and double nuts as provided by the manufacturer may also be accepted.

##### **Wiring**

Pole and luminaire factory shall be prewired and tested. Wires shall be 12 gauge stranded Black, White and Green, 105 degrees C. AWM. Grounding screws shall be provided in pole base and luminaire.

##### **Photoelectric Controls**

Each light fixture is to have a Tork 2005 photoelectric control.

##### **Lamp Ballasts**

Ballasts shall be of regulation design, high power factor (95% or better), constant wattage type (+ or -), 5%

wattage variation for (+ or -), 10% voltage variation, individually fused, 120 volt.

The ballasts shall be rated for -20 degree Fahrenheit operation, and shall be mildew resistant in a weatherproof housing, as manufactured by Jefferson Electric, Advance Transformer, General Electric, or approved equal.

**Ballast Fuses**

Fuses shall be furnished, mounted within post compartment, with suitable voltage ratings as follows:

250 Watt Ballast, 120 V	Five (5) Amperes
100 Watt Ballast, 120 V	Five (5) Amperes
50 Watt Ballast, 120 V	Five (5) Amperes

One fuse shall be furnished per ballast. The fuses shall be BUSS "limitron" Type KTK, or equal. Fuses shall not be located within the luminaire fixture.

The fuse-holder shall be rated at 600 volts and shall be BUSS "Tron", Type HEB, in line fuse-holder protected from weather. The fuse holder may use crimp type tubular terminals or set screw type connectors. Insulating boots shall be used with the fuse holder to cover connections. Taping will not be permitted.

**4I. Handholes**

**Located in earth**

The 12-inch x 18-inch rectangular handhole and cover shall be manufactured by Brooks Products, Inc. of Cucamonga, CA. No. 1419. The 13-inch x 24-inch rectangular handhole shall be manufactured by Brooks Products, Inc., No. HDPE 1324-18. The covers for both sizes of handholes shall be the bolt-down type.

**Located in concrete**

Handholes which are located in concrete are to be manufactured by Quazite and shall conform to the following:

<u>Boxes</u>	<u>Covers</u>	<u>Cover Logo</u>	<u>Size</u>
12"x12"	Quazite PC1212BA12	PC1212HA00	17 Electric
11"x18"	Quazite PC1118BA12	PC1118HA00	17 Electric

The covers for both sizes of handholes shall be the locking type.

**4J. DDA Streetlight**

These provisions apply only to streetlight located within the DDA district as defined by the "Master Plan for Pedestrian Improvements" as produced by the Downtown Development Authority District for Ann Arbor, Michigan. Copies of this plan are available from the Planning Department.

**Lamping:**

100 W HPS, 70 W HPS, or 50 W HPS

**Light Pole:**

Single Lamp Union Metal OTE-100 H-N80Y1-120-100 HPS  
Double Lamp Union Metal OTE-70 H-N80Y4-120-70 HPS  
5 Globe Lamp Union Metal OTE-1-70/4-50H-N80Y3-120

Local Supplier: The Dynamic Group, Inc.  
29940 Orchard Lake Road  
P.O. Box 2965  
Farmington Hills, Michigan 48018

**Paint**

Each streetlight pole must be painted in accordance with Detroit Edison specifications using XIM Primer and SUB-OX Black.

All other details shall conform to **Division III, Section 4** of these Standards.

**Alternate DDA Streetlight Specifications**

Alternate streetlight specifications for projects within the DDA district may be substituted for the light pole standard, the lamping requirement, the lighting level, and paint specifications upon receiving approval from the Public Services Director.

**5. SOIL EROSION & SEDIMENTATION CONTROL**

**5A. Temporary Seeding**

Dates, kinds and rates of temporary seed:	April 1 - April 15
	Spring Oats or Barley (2 lbs/1000 s.f.) or Domestic Rye Grass (.5 lbs/1000 s.f.)
	June 1 - July 31
	Sudan grass (1 lb./1000 s.f.)
August 1 - October 15	
Rye (3 lbs/1000 s.f.) or Perennial Rye grass (.5 lbs./1000 s.f.)	
September 20 - October 15	
Wheat (3 lbs./1000 s.f.)	

**5B. Soil Erosion Control Silt Fence**

**Posts**

Posts shall be a minimum of four feet long and constructed of either hardwood or plastic. Posts shall be 1-1/2" x 1-1/2" with a minus tolerance of 1/8" providing the cross sectional area is a minimum of 2.25 square inches.

**Geotextile Fabric**

Fabric shall be composed of strong rot-proof synthetic fibers formed into a fabric of either the woven or nonwoven type. The fabric shall contain stabilizer and/or inhibitors to make the filaments resistant to deterioration from exposure to sunlight or heat.

The edges of the fabric shall be finished to prevent the outer yarn from pulling away from the fabric. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties. The fabric shall have a minimum width of 36". Sheets of fabric may be sewn or bonded together. No deviation from any physical requirements will be permitted due to the presence of seams.

The fabric shall be manufactured with pockets for posts, hems with cord, or with posts preattached using staples or button head nails.

During all periods of shipment and storage, the fabric shall be wrapped in a heavy-duty protected covering which will protect the cloth from sunlight, mud, dust, dirt, and debris. The fabric shall not be exposed to temperatures greater than 140 degrees F.

The fabric shall meet the physical requirements given below:

<u>Property</u>	<u>Test Method</u>	<u>Standard Fence Requirements*</u>
Tensile Strength, lbs.	ASTM D 4632	90
Elongation, %**	ASTM D 4632	40 max.
Permittivity, gal/min/ft. <sup>2</sup>	ASTM D 4491	15
Apparent Opening Size, Maximum (US Sieve No.)	ASTM D 4751	20
Ultraviolet Degradation, 4%	ASTM D 4355	70

\*Minimum - Use value in weaker principal direction. All numerical values represent minimum average roll value (i.e., test results from any sampled roll in a lot shall meet or exceed the minimum values in the table) - Stated values are for non-critical, non-severe conditions. Lot sampled according to ASTM D 4354.

\*\*Percent of minimum tensile strength (ASTM D 4632) retained after weathering per ASTM 4355 for 500 hours.

Acceptance of geotextile material to be determined according to ASTM D 4759.

The City will require a letter from the manufacturer certifying that its geotextile meets specification requirements.

### *Fasteners for Wooden Posts*

Wire staples shall be No. 17 gage (minimum), and shall have a crown at least 3/4 inch wide and legs at least 1/2 inch long. Staples shall be evenly spaced with at least five per post.

Nails shall be 14 gage (minimum), 1 inch long with 3/4 inch button heads. Nails shall be evenly spaced with at least 4 per post.

## **6. LANDSCAPING & RESTORATION**

### **6A. Plant Material**

Plant materials shall conform to the species and sizes shown on the Plans and in the Detailed Specifications and shall be sound; healthy; vigorous; free from plant diseases and insect pests or their eggs; have normal, healthy root systems; be of the specified measurements such as spread, ball size, number of canes, caliper, height, quality designations, etc.; all in accordance with the latest edition of the American Association of Nurserymen (AAN) American Standard for Nursery Stock. Trees shall be calipered six inches above the ground. Trees planted in rows shall be uniform in size and shape unless otherwise directed by the Public Services Director or shown on the Plans.

#### *Plant Material Quality Assurance*

- a) All trees required for the Project shall be tagged by the Contractor at the source, for inspection and approval by the Public Services Director, prior to digging and shipment. The Contractor shall notify the Public Services Director in writing at least two weeks prior to each desired inspection.
- b) All plant material shall be subject to final approval by the Public Services Director at the project site before installation.
- c) The Contractor shall provide certificates or other documentation that the materials supplied fully comply with these Specifications.
- d) When requested, the Contractor shall provide material samples for approval by the Public Services Director before the materials are delivered to the site. Any materials supplied that do not conform to the approved sample may be rejected by the Public Services Director.

Plant material sources must be located in the same or higher hardiness zone as determined by the latest edition of the "Plant Hardiness Zone Map", prepared by the Agricultural Research Service, U.S. Department of Agriculture.

Substitutions may be permitted with the authorization of the Public Services Director, upon submission of documentation that specified plants are not obtainable. Substitutions shall consist of the nearest equivalent size and variety of plants as approved by the Public Services Director. All requests for pay adjustments due to substitutions shall be submitted in writing to the Public Services Director for approval along with the request for approval of substitutions.

Plant material designated "BB" in the plant list shall be balled and burlapped. They shall be dug with firm, natural balls of earth of sufficient diameter and depth (at least 10 times larger than the caliper size) to encompass the fibrous and feeding root systems necessary for full recovery of the plant. Root balls shall be securely wrapped with burlap and bound with cord. No balled and burlapped plant shall be planted if the ball is cracked or broken.

Plant material designated "Cont." in the plant list shall be container grown. They shall be plants that have been transplanted into a container and grown long enough for the new fibrous root system to retain its shape when removed from the container. The container shall be rigid enough to hold the ball shape during shipping.

All plant material shall be delivered to the site in vehicles which are properly covered to provide protection from drying winds. No plant shall be bound with rope or wire in a manner that would damage the bark or break the branches.

**6B. Planting and Backfill Soil Material**

The soil mixture to be used for preparing the planting beds, and for tamping around the roots/root balls during the process of planting and transplanting shall be prepared on-site and shall be four parts topsoil to one part peat, with the addition of five pounds of superphosphate to each cubic yard of the mixture, unless otherwise shown on the Plans.

- a) Peat shall be granulated raw Canadian peat or baled Canadian peat, containing not more than 9% mineral on a dry basis.
- b) Superphosphate shall contain 40% of phosphoric acid.
- c) Topsoil shall be fertile, friable, sandy loam without admixture of sub-soil, and shall be free of stones, roots, sticks, and other extraneous material 2 inches in diameter or larger. A certified analysis of the topsoil from each source shall be submitted to the Public Services Director for approval before delivery to the site. If deficiencies in the topsoil are found as a result of this analysis, they shall be corrected at no expense to the City.

**6C. Staking (Support) and Wrapping Material**

Stakes for supporting plant materials shall be sound, 2"x2"x30" long stakes. Posts for staking shall be minimum 2-1/2" diameter, 9 feet long wood or metal posts.

Staking cable shall be No. 12 gauge galvanized steel wire twisted. As an alternative, P-60 polyester cord strapping may be used.

Hose for covering cable or cord shall be new or used, black, green or red, two-ply fiber reinforced garden hose, not less than 1/2" inside diameter. "Seconds" rejected by factory are acceptable.

Tree Wrap shall be 4-inch wide treated "Kraft" wrapping or approved equal.

**6D. Miscellaneous Landscaping Materials**

Mulch shall be shredded hardwood bark, free of leaves, twigs, or other extraneous material, and shall be treated with a pre-emergent weed killer, such as Banlon, per manufacturer's directions. The Contractor shall submit a sample to the Public Services Director for approval prior to delivery to the site.

Where called for on the Plans and as directed by the Public Services Director, steel edging shall be Ryerson steel edging, 3/16" thick by 4" high, with 18" stakes, or approved equal. All uncoated steel shall be painted with two coats flat black or dark green Rustoleum or approved equal.

Anti-desiccant wax for all evergreen trees and shrubs shall be Wilt Pruf or Dow Wax spray.



Slurry of peat moss and bonemeal for Transplanting Operations:

- a) Peat moss shall be granulated raw Canadian peat or baled Canadian peat moss, containing not more than 9% mineral on a dry basis.
- b) Bonemeal shall be delivered to the site in original unopened containers which shall bear the manufacturer's guaranteed statement of analysis. Bonemeal shall be stored in weatherproof locations such that it will be kept completely dry and such that its effectiveness is not impaired.

**6E. Seeding, Sodding and Restoration Materials**

Topsoil shall be good quality loamy topsoil, free from lumps, sod, stones, and other debris of any kind, and approved by the Public Services Director.

Fertilizer shall be a complete commercial fertilizer of at least 25% organic base containing 10% nitrogen, 20% phosphorous, and 10% potash.

Permanent seed mixture shall meet the requirements of MDOT Sec. 8.21 for Class A seeding.

Sod shall consist of a vigorous growing, dense, perennial grass turf sufficiently tough so that when a square, 12"x12" is cut to the required thickness and suspended by one corner, it will not tear apart. The sod shall be approved by the Public Services Director in its original location before cutting operations are started. The sod shall be of densely rooted approved varieties of Kentucky bluegrass, excluding merion blue. The sod shall be cut to a uniform thickness of not less than 1 inch, and an area of not less than 1/2 square yard.

Mulch shall be clean, grain-free straw meeting the requirements of MDOT Sec. 8.21.

**6F. Chain Link Fence**

The fence framework, fabric, and related accessories shall be a complete system as specified herein. Acceptable fence system manufacturers are; Allied Tub & Conduit Corporation; Anchor Fence, Inc.; Cyclone Fence/United States Steel Corporation; and, Semmerling Fence and Supply, Inc. The use of systems of other manufacturers equal to those specified may be used if prior approval is granted by the Public Services Director.

The Contractor may be required to submit shop drawings, manufacturer's catalog cuts with printed specifications, and framework and fabric samples to the Public Services Director for review and approval, a minimum of seven days prior to the proposed delivery of materials. The shop drawing submittal shall include complete details of fence construction, fence height, post spacing, dimensions and unit weights of framework, and concrete footing details. The framework sample shall include one 12" long piece of each size. The fabric sample shall be one 12" square piece of fabric.

***Fabric***

Vinyl-coated fence fabric shall be 11 GA galvanized (0.30 oz/sf) steel core, or aluminized (0.40 oz/sf) steel core, and 10 GA minimum OD including vinyl coating. The fence fabric shall have a black fused/bonded vinyl coating in accordance with ASTM F934. The coating shall be applied prior to the weaving of the fabric, so as not to encapsulate joints. The fabric shall meet or exceed 850 pounds breaking strength.

Galvanized steel core chain link fence fabric shall be 9 GA steel, hot-dipped galvanized (1.2 oz of zinc/sf of fabric). The coating shall be applied prior to the weaving of the fabric, so as not to encapsulate joints. The fabric shall meet or exceed 1,200 pounds breaking strength.

The fabric shall be woven in a 2" diamond mesh. The top and bottom selvages shall be knuckled, unless otherwise specified. The loops of the knuckled selvages shall be closed or nearly closed with a space not exceeding the diameter of the wire.

Fence fabric heights up to 12' shall be one-piece, with no horizontal joint.

**Posts and Rails**

Posts and rails shall be Schedule 40 steel pipe meeting the requirements of ASTM F 1083, except as modified herein, hot-dipped galvanized (1.8 oz/sf of zinc) in accordance with ASTM A 120. All posts and rails shall have a black fused/bonded vinyl coating, 10-15 mils in thickness, unless otherwise specified.

All posts and rails shall be straight, true to section, and conform to the following weights:

Nominal Pipe Size	Approximate Pipe O.D.	Weight before galvanizing (lbs/lf)
1"	1-5/16"	1.68
1-1/4"	1-5/8"	2.27
1-1/2"	1-7/8"	2.72
2"	2-3/8"	3.65
2-1/2"	2-7/8"	5.79
3"	3-1/2"	7.58
3-1/2"	4"	9.11
4"	4-1/2"	10.79
6"	6-5/8"	18.97

**Fittings and Fasteners**

All fittings and fasteners shall be pressed steel or malleable iron (unless otherwise specified herein), hot-dipped galvanized (1.2 oz/sf of zinc), conforming to ASTM F 626. For vinyl-coated fence installations, all fittings and fasteners shall be black vinyl-coated with a continuous coating coverage of 5-7 mils in thickness.

Caps shall fit snugly over posts to exclude moisture. The inside diameter of caps shall accommodate the vinyl coating of the posts and caps. Cone-type caps shall be used for terminal, turning, and gate posts; loop-type caps shall be used for line posts.

All rail ends shall be capped.

Top rail sleeves shall be tubular steel, 0.051 thickness x 6" long (minimum), expansion type, with internal spring when required.

Tension bars (stretcher bars) shall be 3/4" wide x 3/16" steel strips.

Tension bands and brace bands shall be 12 GA x 3/4" wide pressed steel, with beveled edges.

Truss rods shall be 3/8" diameter merchant quality steel rod with turnbuckle or other adjustment means.

Tension wire shall be marcelled 7 GA steel wire, with zinc coating (0.80 oz/sf minimum) conforming to ASTM A 824.

Tie wires shall be aluminum, 9 GA, alloy 1100-H4 or equal.

Hog rings shall be 11 GA steel wire, with zinc coating (0.80 oz/sf minimum).

Clamps shall be 12 GA pressed steel, secured with 5/16" diameter carriage bolts.

Bolts, nuts, and miscellaneous hardware shall be ASTM A307, Grade A, thermally color-coated or hot-dipped galvanized to match the fence fabric.

### ***Gates***

Gate frame assemblies shall meet the fence specifications, except as modified herein. Gate posts shall be equal to terminal post sizing, and gate framework shall be equal to rail sizing.

For vinyl-coated installations, gate panels up to 4' in width by 10' in height shall receive a continuous vinyl color-coating to match the fence fabric, or shall be assembled in such a manner that welding is not required. For larger panels, all welded surfaces shall be sanded smooth and painted with an epoxy paint (if fabric is vinyl-coated) or a galvanized finish to match the fabric.

The Contractor shall provide one pair of 180° industrial offset hinges per leaf, and one fork latch for single swing gates or one industrial latch for double swing gates. The latches shall have a padlock eye, which shall be operable from either side of the gate. The Contractor shall also provide one drop rod per leaf and sleeves set in Class "B" concrete to hold the rods in both the closed and 90° open positions.