

**Delaware Department of Transportation
Division of Transportation Solutions
Design Guidance Memorandum**

Memorandum Number 1-20 Revised

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|-----------------------|----------------------------|----------------------------------|
| 1. Road Design Manual | 2. Bridge Design Manual | 3. Utilities Design Manual |
| 4. Real Estate Manual | 5. Standard Specifications | 6. Standard Construction Details |

Title: Pipe Materials Effective date: May 1, 2020

Sections to Implement:

- | | | |
|------------------------------|--------------------------------------|-------------------------|
| <u>X</u> Project Development | <u>X</u> Planning | <u>X</u> DTC |
| <u>X</u> Bridge | <u>X</u> Quality | <u>X</u> Traffic |
| <u>X</u> Team Support | <u>X</u> Maintenance &
Operations | <u> </u> Other _____ |
| <u>X</u> Utilities | | |

I. Purpose

To provide guidance on DelDOT’s policy for the selection of pipe materials. This guidance defines the locations where various pipe products are considered to be equally acceptable for all projects. This information shall be used to determine which pipe products will be bid for projects. The project manager and/or designer shall determine which pipe product shall be specified from the materials considered adequate for the installation. The decision shall be made based on economics, available cover and any other factors that may affect the performance of the pipe (e.g., soil pH, type of water exposure, susceptibility to abrasion, fire, etc.).

II. Design Guidance

For any type of pipe, many factors contribute to its successful performance, including:

- Hydraulic Characteristics and Capacity
- Structural Capacity
 - Cover
 - Loads
- Environmental Conditions
 - pH of the soil and water conveyed by the pipe
 - Soil resistivity
 - Abrasion due to sand and/or gravel
 - Standing water

Regardless of the pipe material, all pipes require proper installation, including:

- Pipe material in good condition from delivery until final installation
- Compaction
- Backfill material
- Proper installation procedures
- Inspection during installation
- Post-installation inspection per DelDOT’s *Storm Sewer CCTV Manual for Storm Sewer Assessment and Acceptance* and specifications

The minimum cover for pipes shall conform to the values in Figure 1. See Figure 2 for a clarification of the limits of the cover measurement under rigid and flexible pavements.

Figure 1
Minimum Cover

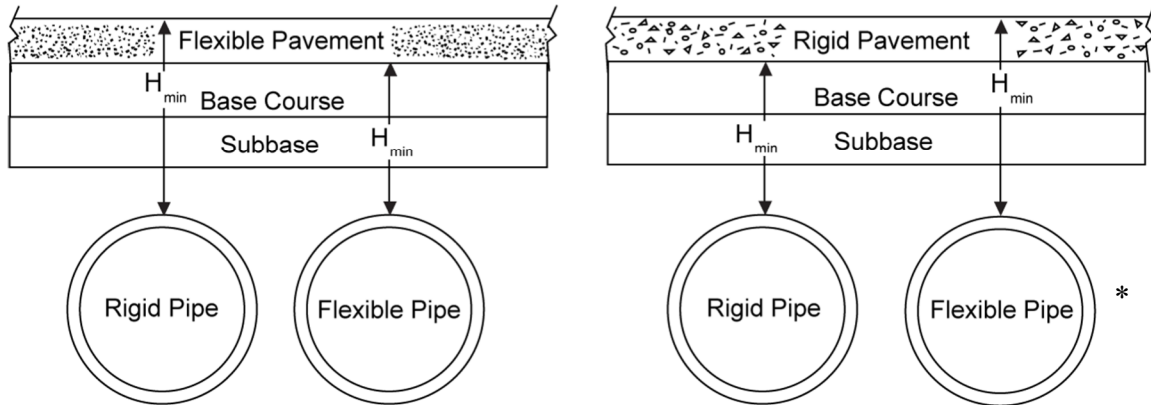
Type	Condition	Minimum Cover, H_{min}^*
Flexible Pipe		
Corrugated Metal Pipe		$S/8 \geq 12.0$ in.
Spiral Rib Metal Pipe	Steel Conduit	$S/4 \geq 12.0$ in.
	Aluminum Conduit where $S \leq 48.0$	$S/2 \geq 12.0$ in.
	Aluminum Conduit where $S > 48.0$	$S/2.75 \geq 24.0$ in.
Structural Plate Pipe Structures		$S/8 \geq 12.0$ in.
Steel Reinforced Thermoplastic Pipe		$S/5 \geq 12.0$ in.
Thermoplastic Pipe	Under unpaved areas	$S/8 \geq 12.0$ in.
	Under paved areas	$S/2 \geq 24.0$ in.
Rigid Pipe		
Reinforced Concrete Pipe**	Under unpaved areas or flexible pavement	$S/8 \geq 12.0$ in. (measured from top of flexible pavement or top of ground)
	Under rigid pavement	9.0 in. (measured from bottom of rigid pavement)

* See Figure 2 for the orientation for minimum cover for rigid and flexible pipe. Note that if manufacturer recommends a larger cover, manufacturer recommendations shall govern.

** Class IV or V reinforced concrete pipe may be used in accordance with AASHTO design standards where the cover is shallower than the minimum cover for class III.

Where: S = Largest interior pipe dimension (in.)

Figure 2
Minimum Cover Orientation



H_{min} = minimum allowable cover dimension

Note: The minimum cover dimension is not to be confused with the fill height used for calculation purposes, which shall be from the top of the pipe to the top of the surface, regardless of the pipe type or pavement type.

*Minimum 6" below bottom of rigid pavement

For DelDOT projects, there are four service levels of pipe installations defined as follows. The pipe materials listed under each service level are considered equally acceptable for that level. Note that metal pipes are not considered a standard material and require approval by the appropriate Maintenance District Engineer before using.

- **Service Level I Pipe Installations** require an expected service life of 75 years or more. All pipe which is to be installed under roadways with a classification of expressway, arterial or collector shall be service level I. This includes pipe running transversely across the road and longitudinally under the pavement and/or curb. Additionally, pipe outside of the roadway for expressways, arterials and collectors shall be a service level I installation unless future roadway widening over the pipe is not anticipated.
 - Reinforced Concrete Pipe (RCP) is considered to have a service life of 75 years or more. The class of RCP shall be specified in the plans. RCP shall be manufactured and installed in accordance with Section 601 of the Standard Specifications.
 - Thermoplastic Pipe – Thermoplastic pipe is considered to have an expected service life of 75 years. The maximum allowable diameter for use on DelDOT projects is 60 inches. Thermoplastic pipes shall be manufactured and installed in accordance with Section 601 of the Standard Specifications.
 - Steel-Reinforced Thermoplastic Pipe – Steel-reinforced thermoplastic pipe is considered to have an expected service life of 75 years. Steel-reinforced thermoplastic pipes shall be manufactured and installed in accordance with the contract Special Provisions.

Service Level II Pipe Installations require an expected service life of 50 years or more. All pipes that are to be installed under local roadways and high-volume commercial entrances (such as shopping centers) shall be service level II or better. This includes pipe running transversely across the road and pipe running longitudinally under the pavement and/or curb. Additionally, pipe outside of the roadway for local roads shall be service level II installations. Pipe installations on expressways, arterials and collectors that are outside of the roadway and in locations where future roadway widening over the pipe is not anticipated may also be service level II installations. The following products are considered to have a service life of 50 years or more and are equally acceptable. Service level I pipes may also be used for these installations.

- Corrugated Aluminum Pipe and Spiral Rib Aluminum Pipe – Aluminum pipe is considered to have a service life of 50 years. The type of aluminum pipe shall be specified in the plans. Aluminum pipes shall be manufactured and installed in accordance with the contract Special Provisions. Metal pipe shall not be used where there may be standing water in the pipe for longer than 12 hours.

- **Service Level III Pipe Installations** require an expected service life of 25 years or more for commercial entrances and multi-family residential entrances. High-volume entrances, such as those for large shopping malls, shall be a minimum of service level II. The following products are considered to have a service life of 25 years or more and are equally acceptable. Service level I and II pipes may also be used for these installations.
 - Polymer-Coated Corrugated Steel Pipe – Polymer-coated corrugated steel pipe is considered to have a service life of 35 years. Polymer-coated corrugated steel pipes shall be manufactured in accordance with AASHTO M245 and installed in accordance with the contract Special Provisions. Installation sites shall be limited to those where the soil and water have a pH from 3 to 12 and a soil resistivity above 200 ohm-cm. Metal pipe shall not be used where there may be standing water in the pipe for longer than 12 hours.
 - Aluminum-Coated (Type 2) Corrugated Steel Pipe – Aluminum-coated (Type 2) corrugated steel pipe is considered to have a service life of 25 years. Aluminum-coated (Type 2) corrugated steel pipes shall be manufactured and installed in accordance with the contract Special Provisions. Installation sites shall be limited to those where the soil and water have a pH from 5 to 9 and a soil resistivity above 1,500 ohm-cm. Metal pipe shall not be used where there may be standing water in the pipe for longer than 12 hours.

- **Service Level IV Pipe Installations** require an expected service life of 15 years or more for residential driveway entrances. Service level I, II and III pipes may also be used for these installations.
 - Galvanized Corrugated Steel Pipe – Galvanized corrugated steel pipe is considered to have a service life of 15 years. Galvanized corrugated steel pipes shall be manufactured and installed in accordance with the contract Special Provisions. Installation sites shall be limited to those where the soil and water have a pH from 6 to 10 and a soil resistivity of 2,000 to 8,000 ohm-cm. Metal pipe shall not be used where there may be standing water in the pipe for longer than 12 hours.

Other pipe materials may be considered for installation with approval from the Deputy Director of Design. The choice of a pipe material for a particular project shall be documented in the project's drainage report or quantity calculations.

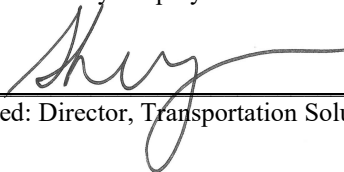
III. Justification

To select the appropriate pipe material for use in proposed work.

Revised Date: April 1, 2020


04/07/2020

Recommended by: Deputy Director -Design


04/07/2020

Approved: Director, Transportation Solutions / Chief Engineer

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