

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: ALLOWABLE PIPE CRITERIA FOR CULVERTS AND STORM SEWERS	NUMBER: IIM-LD-121.15
SPECIFIC SUBJECT: ALLOWABLE PIPE CRITERIA	DATE: AUGUST 26, 2005
	SUPERSEDES: IIM-LD-121.14
DIVISION ADMINISTRATOR APPROVAL: Mohammad Mirshahi, P.E. State L & D Engineer Approved: August 26, 2005	

Shading is omitted.

---

### EFFECTIVE DATE

---

- This memorandum is effective upon receipt for all projects that have not completed a Pre-Construction Bidability Review.
- 

### ALLOWABLE PIPE TYPE TABLES

---

- The Allowable Pipe Type Tables have been relocated to Standard PC-1 in the Road and Bridge Standards.
- Revisions has been made to the Allowable Pipe Types in order to provide a 75 year service life for pipes under the roadways that are constructed, funded or will ultimately be maintained by the department.
- The fill height limitation of 20' that was previously applied to certain materials has been eliminated.
- Road and Bridge Standard PC-1 has been revised and insertable sheets are available for applicable projects.

## SOIL AND WATER DATA

---

- The pH and resistivity of the soil and water as well as the velocity of flow, where an abrasive bed load is present or anticipated, are major factors in determining service life of metal pipe. An evaluation of the pH, resistivity and abrasive bed load potential must be conducted at each location where metal pipe is an allowable option and where **any** of the following conditions exist:
  - Diameter or span of 36 inches (900 mm) or greater. For multiple pipe installations, the span is measured between the interiors of the outside walls of the outer most pipes and is measured along a line perpendicular to the barrel of the pipe.
  - Culvert is to be installed in a live stream environment (perennial or intermittent).
  - Culvert is to be installed in an area of documented premature pipe failure.
- The pH and resistivity analysis of the soil and water are to be requested from the Materials Division for each culvert location meeting the noted criteria. In areas of documented premature pipe failure, the pH and resistivity analysis is to be requested for any type of proposed pipe material.
- The locations where pH and resistivity information is needed should be noted on the plans that are used to request culvert foundation information from the Materials Division.
- It should be recognized that the pH values of the soil and water could experience seasonal changes during the course of the year. Should the Materials Division feel that the results of their initial pH test are not a true representation of the conditions that the culvert will be exposed to, they should perform additional test and provide their best recommendation for the values to be used in determining the allowable pipe materials.

## ALLOWABLE PIPE TYPE SUMMARY

An Allowable Pipe Type Summary is to be shown at the end of the Drainage Summary.

The types of allowable pipe will vary with classification of roadway and geographic location within the State. Numerous combinations of pipe types may be used on a particular project.

It will be necessary to formulate a tabulation to specifically fit each project based upon the various roadway classifications involved and location of the project.

An example for a Rte. 64 project in York County is shown below.

The base for the following table can be found in the CADD Cell Library.

### EXAMPLE

ALLOWABLE PIPE TYPES (UNLESS OTHERWISE SHOWN ON PLANS) (SEE STANDARD DRAWING PC-1 FOR HEIGHT OF COVER LIMITATIONS FOR EACH TYPE)											
PIPE LOCATION	CONCRETE	POLYMER COATED (10/10) CORRUGATED SPIRAL RIB	UNCOATED GALVANIZED CORRUGATED STEEL	CORRUGATED ALUMINUM ALLOY	POLYETHYLENE CORRUGATED TYPE C	POLYETHYLENE DOUBLE- WALL TYPE S AND TYPE D	ALUMINUM COATED TYPE 2 CORRUGATED STEEL	POLYMER COATED (10/10) CORRUGATED STEEL DOUBLE WALL (SMOOTH INTERIOR)	POLYVINYLCHLORIDE (PVC) CORRUGATED STORM DRAIN PIPE (SMOOTH INTERIOR)	ALUMINUM SPIRAL RIB PIPE	POLYMER COATED (10/10) CORRUGATED STEEL
Rte. 64 & Ramps	X			X	X	X			X		X
Route 635 (Rural Local Road)	X			X	X	X			X		X
Storm Drain Systems Main Roadway & Ramps	X										
Storm Drain Systems Route 635	X	X				X		X	X	X	
Entrances	X		X	X		X	X		X		X
Shoulder Slot Inlet			X	X	X		X		X		X

## ACCEPTABLE MANNING ROUGHNESS COEFFICIENT (n)

---

The roughness coefficient for each pipe material represents the value for newly installed pipe and has been determined by laboratory tests with an adjustment factor to compensate for the additional losses experienced in actual field installations. Values may be higher for existing pipe installations that have experienced some deterioration.

<u>MATERIAL</u>	<u>ROUGHNESS COEFFICIENT (n)</u>
Concrete Pipe	0.013
PVC (Polyvinylchloride) Storm Drain Pipe (Smooth Interior)	0.011
Polyethylene Double Wall (Type S and Type D) (Smooth Interior)	0.012
Steel or Aluminum Spiral Rib Pipe	0.014
Polymer Coated Corrugated Steel Double Wall (Smooth Interior)	0.013
Corrugated Steel Pipe Fully Concrete Lined	0.013
Corrugated Pipe – Steel, Aluminum or Polyethylene	0.024*
Structural Plate Pipe – Steel or Aluminum	0.035*

\* Represents general value. May vary with size and shape of corrugations.

---

## STORM SEWER PIPE – SITE PLANS AND SUBDIVISIONS

---

- Plans and computations submitted to the Department for review must specify the type of pipe to be used in the storm drain system and the storm drain system must be designed using the acceptable “n” value for that type. After plans are approved, no substitution or change in the type of pipe material will be allowed until the designer or contractor submits revised plans to the Department for review. The revised design cannot be implemented until approved by the Department.

---

## STORMWATER MANAGEMENT BASINS

---

- Culverts under or thru the dam of a Stormwater Management Basin are to be reinforced concrete pipe with rubber gaskets. Pipe Specifications: 232 (AASHTO M170), Gasket Specifications: 212 (ASTM C443).
  - A concrete cradle is to be used under the pipe to prevent seepage thru the dam. The concrete cradle is to extend the full length of the pipe.
- 

## MINIMUM CULVERT SIZE UNDER HIGH FILLS

---

- In order to facilitate inspection and future rehabilitation (if needed) of culverts in fills (not cover) of 20 feet (6 m) or greater, the minimum culvert size allowed/specified should be a 60 inch (1500 mm) diameter. On Lower Functional Classification (LFC) roadways, as defined in the Allowable Pipe Type Tables in the Road and Bridge Standard PC-1, the District Construction or Maintenance Engineer and/or the Resident Manager/Engineer may waive the minimum 60 inch (1500 mm) diameter size requirement provided that:
  - 1) At locations where the hydraulic capacity would require a pipe diameter of less than 60 inches (1500 mm), the minimum pipe diameter shall be that necessary for adequate hydraulic conveyance plus 12 inches (300 mm) with a 36 inch (900 mm) minimum diameter and a 60 inch (1500 mm) maximum diameter. The table below shows the minimum pipe diameter to use based on that required for hydraulic capacity.

<b>PIPE DIAMETER REQUIRED FOR USE IN HIGH FILLS</b>		
<b>IF THE MINIMUM PIPE DIAMETER REQUIRED TO MEET HYDRAULIC CAPACITY IS:</b>	<b>THEN USE THIS PIPE DIAMETER IN FILLS <math>\geq</math> 20':</b>	
	<b>DESIRABLE</b>	<b>MINIMUM</b>
12" – 24"	60"	36"
30"		42"
36"		48"
42"		54"
48"		-
54"	-	60"

- 2) It is recognized that it will be potentially more difficult for the inspection, maintenance and future rehabilitation (if necessary) of culverts in high fill areas if a size smaller than a 60 inch (1500 mm) diameter is utilized.