

# ITD Pipe Materials Selection & Specification Procedures



*July 2011*



## **INTRODUCTION:**

This technical memorandum is written as a guide to the selection of compliant pipe materials and the elimination of non-compliant pipe materials for projects which are subject to the Idaho Transportation Department's Roadway Design Manual (RDM) and the Idaho Transportation Department's Standard Specifications for Highway Construction, 2004 (SSHC). As a note to the reader, the SSHC is updated on a regular basis and pipe materials selection may require reference to the current Supplemental Specifications. Material specifications that are not included in the ITD reference list may be used in specific cases. Compliance with proper material specification is subject to these requirements based on location within right of way, ownership, and federal funding. Additional material references include AASHTO's Standard Specifications Manual (AASHTO) and the American Society for Testing and Materials Annual Book of Standards (ASTM).

Pipe materials **SELECTION** and **SPECIFICATION** procedures are included in this technical memorandum. Pipe materials **SELECTION** procedures include the identification of ownership and criteria used to select compliant pipe materials in the project design process. The pipe materials **SPECIFICATION** procedures describe the methods that materials are identified to contractors for bidding and construction. Projects with architectural structures included will also have site specifications included with the consulting architectural specifications. This technical memorandum is to be used in the specification of pipe materials with written Special Provisions and identification of pipe alternatives on the ITD standardized Pipe Summary Sheets.

This technical memorandum is formatted to cover pipe materials grouped by use. Those uses include culverts, storm sewer, irrigation, water and sewer. Table 1 is provided in the appendix as a design tool to track decision processes associated with pipe material selection. The ITD pipe specification policy is intended to identify all compliant pipe materials, trench bedding, manholes, and headwalls and inlet options. Only materials deemed non-compliant for each case are to be eliminated from consideration. The scope of this technical memorandum does not include engineering calculations used to size and/or select appropriate conveyance facilities.

This technical memorandum is provided under the authority of the State Hydraulics Engineer. For further questions regarding clarification regarding this technical memorandum, please contact:

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Pipe material selection associated with storm runoff and river conveyance requires the designer to identify which category of pipe and inlets they are designing. The distinction between culverts and storm sewers are identified in the Roadway Design Manual Sections 640.00 and 645.00 respectively. The following is a summary of those distinctions:

### CULVERTS:

- Convey surface runoff generated upstream of the roadway through the right of way
- Discharge to locations downstream of the roadway
- Culverts likely do not treat water quality or detain water quantity in a permanent storm water BMP.

### STORM SEWERS:

- Storm sewers convey runoff generated within the roadway or project site
- Deliver to either a retention / detention facility, to a culvert, or offsite in an approved area
- Storm sewers will typically deliver to a permanent storm water quality BMP and sometimes to a retention/detention facility.

## **CULVERT PIPE MATERIAL SELECTION PROCEDURES**

### Relevant Reference List:

ITD Roadway Design Manual (RDM) Subsections 640.00, 670.00 – Figure 6-2, 672.00, and 675.00 (Complete Tables)

ITD Standard Specifications for Highway Construction 2004 (SSHC) Subsections 602.02, 706.01 – 706.17. Current SSHC Supplemental Specifications.

ITD Standard Drawings D7 – D10, D12 (bedding), E-6 – E-9

Project Specific Phase II Materials Report

AASHTO Standard Specifications

ASTM

For the elimination of non-compliant culvert materials, the designer shall begin with the RDM Subsection 640.04 Culvert Life. Culvert required design life is based on roadway classification and fill height. See Subsection 640.06 in the RDM for guidance to the elimination of non-conforming pipe materials. Use information from the Phase II Materials report regarding pH and Resistivity to eliminate non-compliant aluminum and steel pipe with Figure 6-2 in Section 670.00 and the graph in Section 672.00 (RDM). Review the coverage, trench depth and traffic loads associated with the crossing in question. Use tables in Section 675.00 (RDM) to confirm that minimum fill cover depth (the traffic load consideration), and the maximum total trench depth are met. If these minimum and maximum criteria are not met for the given pipe diameter, eliminate material from consideration. It is important to note that a gage rating number is smaller for thicker pipe walls. Larger gage numbers indicate a thinner pipe wall. Concrete pipe classification follows criteria listed in the AASHTO Standard Specification 1A for reinforcement requirements and for concrete wall thickness.

The ITD SSHC Subsection 602.02 includes a list of materials allowed under ITD Specifications for Culverts. Pipe materials not on this list can be eliminated from consideration. Performance measures associated with these materials are included in the ITD SSHC under Subsections 706.01 – 706.17.

Structures for culverts include headwalls, manholes and inlets are identified in the ITD Standard Drawings E-6 – E-9. This information is to be included on the pipe summary sheet with pipe material descriptions as indicated below. Concrete pipe classifications may require the specification of a specific bedding class. See the specification procedures section below for methods of specification, measurement and payment associated with bedding class.

### **CULVERT PIPE MATERIAL SPECIFICATION PROCEDURES**

These pipe materials specification procedures describe the methods that materials are identified to contractors for bidding and construction. This technical memorandum is to be used in the specification of pipe materials with written Special Provisions and identification of pipe alternatives on the ITD standardized Culvert and Irrigation Pipe Summary Sheet as well as the Pipe Siphon Summary Sheet. Culvert material specifications which are in compliance with the SSHC Sections 602 and 706 are specified in plan sets only and do not require an additional special provision to be written in the project specifications. The appropriate bid item numbers are to be indicated on the Roadway Summary Sheet and the appropriate Culvert and Irrigation Pipe Summary Sheet as well as the Pipe Siphon Summary Sheet.

For culvert and irrigation pipe design, the Culvert and Irrigation Pipe Summary Sheet as well as the Pipe Siphon Summary Sheet shall be included in the construction plans set. Culvert and irrigation crossings typically occur perpendicularly to roadways and a single station can be used to identify location. Indicate the station of the crossing on the left, indicate the pipe sizes and lengths, and mark the allowed pipe material and gasket connection with an “X”. Add quantities for structures within the same row as the station location identifier. For concrete pipes, reinforcement class and corresponding bedding type are indicated. If more than one combination of reinforcement class and bedding type are compliant, additional rows can be used to indicate compliant combinations. Refer to ITD Standard Detail D-12 for a distinction between Types 1, 2, and 3 bedding. Steel pipes require a gage rating to be identified and aluminum pipes require a thickness to be identified. Payment and measurement for bedding is covered in SSHC Section 210.00. It is recommended that detail sheet D-12 be included if specific bedding requirements are part of the plan set. It is important that the pipe summary sheet indicate all materials, bedding, structures and lengths allowed for contractors to select the lowest cost. Sheet totals and project totals are indicated at the bottom of the summary sheet, and are to include information in columns which include quantities such as the pipe size / length group of columns and the structures group of columns.

### **STORM SEWER PIPE MATERIAL SELECTION PROCEDURES**

Relevant Reference List:

ITD Roadway Design Manual (RDM) Subsections 640.00, 645.00, 670.00 – Figure 6-2, 672.00, and 675.00 (Complete Tables)

## ITD Pipe Materials Selection and Pipe Materials Specification Procedures

ITD Standard Specifications for Highway Construction (SSHC) Subsections 605.02, 706.01 – 706.17.

ITD Standard Drawings E-6 – E-9, D-12 (bedding)

Project Specific Phase II Materials Report

AASHTO Standard Specifications

ASTM

For the elimination of non-compliant storm sewer materials, the designer shall reference the RDM Subsection 645.00 where it is stated that “Project life for the purpose of selecting storm sewer material will be 100 years.” Refer to Subsection 640.06 in the RDM. This section gives guidance to the elimination of non-conforming pipe materials based on Phase II Materials Reports, earth and traffic loads and hydraulic parameters. Use information from the Phase II Materials report regarding pH to eliminate non-conforming materials in Figure 6-2 in Section 670.00. Eliminate non-compliant pipe materials with the criteria listed in RDM Subsection 640.07. Note that last paragraph, indicates that storm sewer pipe materials shall be concrete, PVC or corrugated PE pipe. The graph in Section 672.00 (RDM) is not valid for storm sewer pipe selection as steel and aluminum are non-conforming materials. Review the coverage, trench depth and traffic loads associated with the project in question. Use tables in Section 675.00 (RDM) to confirm that minimum fill cover depth (the traffic load consideration), and the maximum total trench depth are met. If these minimum and maximum criteria are not met for the given pipe diameter, eliminate material from consideration. It is important to note that concrete classification relates to reinforcement and wall thickness and follows criteria identified in the AASHTO Standard Specification 1A. Concrete pipe classifications may require the specification of a specific bedding class. See the specification procedures section below for methods of specification, measurement and payment associated with bedding class. There are different trench bedding requirements for different concrete pipe classifications.

The ITD SSHC Subsection 605.02 includes a list of materials allowed by ITD for sewers. Note that CMP is a non-conforming material for storm sewers due to limitations imposed by the RDM. Pipe materials not on this list can be eliminated from consideration. Performance measure associated with these materials are included in the ITD SSHC under Subsections 706.01 – 706.17.

Structures for storm sewers include headwalls, manholes and inlets are identified in the ITD Standard Drawings E-6 – E-9. This information is to be included on the pipe summary sheet with pipe material descriptions as indicated below. Concrete pipe classifications may require the specification of a specific bedding class. See the specification procedures section below for methods of specification, measurement and payment associated with bedding class.

### **STORM SEWER PIPE MATERIAL SPECIFICATION PROCEDURES**

These storm sewer pipe materials specification procedures describe the methods that materials are identified to contractors for bidding and construction. This technical memorandum is to be used in the specification of pipe materials with written Special Provisions and identification of pipe alternatives on the ITD standardized Sanitary/Storm Sewer Pipe Summary Sheets. Storm Sewer material specifications which are in compliance with the SSHC Manual Sections 605 and 706 are

specified in plan sets only. If the design intent is to specify storm sewer pipe which is approved and is not consistent with SSHC, an additional Special Provision is required in the specifications. The appropriate bid item numbers are to be indicated on the Roadway Summary Sheet and the appropriate Sanitary/Storm Sewer Pipe Summary Sheet.

For storm sewer pipe design, the Sanitary/Storm Sewer Pipe Summary Sheet shall be included in the construction plan set. Because storm sewer pipe may run perpendicular to or with roadway stationing a range of stations is used to identify locations on the pipe summary sheet. Indicate the range of stations on the left and add the pipe diameter with the design lengths in the appropriate columns. Mark the allowed pipe materials with an "X" in the rows associated with the station range. Identify the quantities of the structures in the appropriate columns. For concrete pipes, reinforcement class and corresponding bedding type are indicated. If more than one combination of reinforcement class and bedding type are compliant, additional rows can be used to indicate compliant combinations. For sanitary sewer pipe steel and aluminum materials are allowed. Mark the corrugation lengths and depths associated with the RDM Section 675.00 as well as the gage (for steel) and thickness (for aluminum). If pipe materials require specific bedding, an additional row of information for the same range of stations may need to be added. Refer to ITD Standard Detail D-12 for a distinction between Types 1, 2, and 3 bedding. Payment and measurement for bedding is covered in SSHC Section 210. It is recommended that detail sheet D-12 be included if specific bedding requirements are part of the plan set. It is important that the pipe summary sheet indicate all materials, bedding, structures and lengths allowed for contractors to select the lowest cost. Sheet totals and project totals are indicated at the bottom of the summary sheet, and are to include information in columns which include quantities such as the pipe size / length group of columns and the structures group of columns.

### **IRRIGATION PIPE MATERIAL SELECTION PROCEDURES**

#### Relevant Reference List:

- ITD Roadway Design Manual (RDM) Subsections 640.00, 670.00 – Figure 6-2, 672.00, and 675.00 (Complete Tables)
- ITD Standard Specifications for Highway Construction (SSHC) Subsections 603.02 (Siphons), 604.02, 706.03 – 706.15.
- ITD Standard Drawings D7-D13
- Project Specific Phase II Materials Report
- AASHTO Standard Specifications
- ASTM

Irrigation delivery pipe requires appropriate CMP and concrete gaskets with regard to RDM Subsection 640.01. For the elimination of non-compliant irrigation materials, the designer shall reference the RDM Subsection 640.04 Culvert Life. Irrigation Pipe design life is based on roadway classification and fill height. Refer to Subsection 640.06 in the RDM. This section gives guidance to the elimination of non-conforming pipe materials. Use information from the Phase II Materials report regarding pH and Resistivity to eliminate non-compliant corrugated metal pipe with Figure 6-2 in Section 670.00 and the graph in Section 672.00 (RDM). Review the coverage, trench depth and

traffic loads associated with the project in question. Use tables in Section 675.00 (RDM) to confirm that minimum fill cover depth (the traffic load consideration), and the maximum total trench depth are met. If these minimum and maximum criteria are not met for the given pipe diameter, eliminate material from consideration. It is important to note that a gage rating number is smaller for thicker pipe walls. Larger gage numbers indicate a thinner pipe wall. Irrigation delivery companies and districts may have additional material criteria. Identify the owner and confirm that pipe material selection is compliant with the appropriate additional specifications.

Inverted pipe siphons can be used for irrigation crossings that experience coverage limits or obstacles. Refer to ITD SSHC Section 603 for material specifications. Pipe and gasket materials not on this list can be eliminated from consideration. Performance measure associated with these materials are included in ITD SSHC under Subsections 706.04 – 706.15.

The ITD SSHC Subsection 604.02 includes a list of materials allowed under ITD Specifications for Irrigation Pipe. Pipe materials not on this list can be eliminated from consideration. Performance measure associated with these materials are included in the ITD SSHC under Subsections 706.03 – 706.15.

Structures for irrigation delivery include headwalls and are identified in the ITD Standard Drawings D7 – D13. This information is to be included on the pipe summary sheet with pipe material descriptions as indicated below. Concrete pipe classifications may require the specification of a specific bedding class. See the specification procedures section below for methods of specification, measurement and payment associated with bedding class.

### **IRRIGATION PIPE MATERIAL SPECIFICATION PROCEDURES**

These irrigation pipe material specification procedures describe the methods that materials are identified to contractors for bidding and construction. Specification includes information identified in specifications and on the Roadway Summary Sheet and the Pipe Culvert/Irrigation/Pipe Siphon Summary Sheets. Irrigation pipe material specifications which are in compliance with the SSHC Sections 602 and 706 are specified in plan sets only, and do not require a Special Provision to be added to the project specifications. The appropriate bid item numbers are to be indicated on the Roadway Summary sheet and the appropriate Pipe Culvert/Irrigation/Pipe Siphon Summary Sheet.

For irrigation pipe design, the Culvert and Irrigation Pipe Summary Sheet and/or the Pipe Siphon Summary Sheet shall be included in the construction plan set. Irrigation crossings typically occur perpendicularly to roadways and a single station can be used to identify location on the summary sheet. Indicate the station of the crossing on the left and list the pipe diameter with appropriate length in the columns under the Pipe Size column group. Mark the allowed pipe material in the rows adjacent to the station identifier for compliant pipe materials with an “X”. Quantities shall be listed in the rows to identify minor structures, inlets and catch basins, etc. For metal pipes including steel and aluminum, appropriate gage ratings (for steel) and thickness (for aluminum) are to be identified. Also, corrugation lengths and depths are to be indicated within the columns under the Metal Pipe group. For concrete pipes, reinforcement class and corresponding bedding type need to be indicated.

If more than one combination of reinforcement class and bedding type are compliant, additional rows can be used to indicate compliant combinations within the same station location. Refer to ITD Standard Detail D-12 for a distinction between Types 1, 2, and 3 bedding. Payment and measurement for bedding is covered in SSHC Section 210.00. It is recommended that detail sheet D-12 be included if specific bedding requirements are part of the plan set. It is important that the pipe summary sheet indicate all materials, bedding, structures and lengths allowed for contractors to select the lowest cost. Sheet totals and project totals are indicated at the bottom of the summary sheet. Sheet totals and project totals are indicated at the bottom of the summary sheet, and are to include information in columns which include quantities such as the pipe size / length group of columns and the structures group of columns.

### **SANITARY SEWER PIPE MATERIAL SELECTION PROCEDURES**

#### Relevant Reference List:

- ITD Roadway Design Manual (RDM) Subsection 675.00 (Complete Tables)
- ITD Standard Specifications for Highway Construction (SSHC) Subsections 605.02, 706.01 – 706.17.
- ITD Standard Drawings E-7 – E-9, D-12 (bedding)
- ISPWC
- Uniform Plumbing Code
- AASHTO Standard Specifications
- ASTM
- Local Jurisdictional Sizing and Material Specifications

It is important for the designer to identify the ownership and maintenance responsibilities for sanitary sewer. Nearly all sanitary sewer pipe located within road right of way is owned and operated by groups other than ITD. This case is also true of sanitary sewer manholes. Sewer laterals designed to serve ITD facilities such as POE's and rest areas are most likely owned and operated by ITD. For sanitary sewer material selection, the designer must meet both the owner's specifications and ITD's specifications.

Information regarding compliant sanitary sewer pipe and manhole materials is not presented in the RDM. The appropriate references for verification of compliant materials are the ITD SSHC and the local design standards. Local design standards typically include local modifications to the Idaho Standards for Public Works Construction (ISPWC). Because construction plans and specifications require compliance with each criteria, it is recommended that these additional design standards are obtained for reference. This document will only refer to specifications included in the ITD SSHC.

For the elimination of non-compliant sanitary sewer materials within the right of way, the designer shall begin with the ITD SSHC Subsection 605.02. Materials that are not listed in this section are non-compliant and cannot be specified within ITD ROW. Further specification information is listed in ITD SSHC Subsection 706.01 through 706.17. This section gives guidance to the elimination of non-conforming pipe materials. Sanitary sewer pipe requires smooth interior walls. Eliminate non-



compliant materials with interior wall corrugations. Concrete pipe shall include appropriate trench bedding class and pipe reinforcement classification as illustrated in RDM Subsection 675.00.

Structures for sanitary sewers include manholes and are identified in the ITD Standard Drawings E-7 – E-9. This information is to be included on the pipe summary sheet with pipe material descriptions as indicated below.

### **SANITARY SEWER PIPE MATERIAL SPECIFICATION PROCEDURES**

These sanitary sewer pipe materials specification procedures describe the methods that materials are identified to contractors for bidding and construction. Specification includes information identified in specifications, Roadway Summary Sheet and the Sanitary/Storm Sewer Pipe Summary Sheet. Sanitary sewer material specifications which are in compliance with the ITD SSHC Sections 605 and 706 are specified in Roadway Summary Sheet and the Sanitary/Storm Sewer Pipe Summary Sheet only, and do not need a Special Provision to be included in the project specifications. For Sanitary/Storm Sewer Pipe Summary Sheets, indicate the station range on the left and list the pipe diameter with appropriate length in the columns under the Pipe Size column group. Mark the allowed pipe material in the rows adjacent to the station identifier for compliant pipe materials with an “X”. Quantities shall be listed in the rows to identify manholes, catch basins and inlets. Corrugated metal pipes are not allowed for sanitary sewer applications. For concrete pipes, reinforcement class and corresponding bedding type need to be indicated. If more than one combination of reinforcement class and bedding type are compliant, additional rows can be used to indicate compliant combinations within the same station location. Refer to ITD Standard Detail D-12 for a distinction between Types 1, 2, and 3 bedding. Payment and measurement for bedding is covered in SSHC Section 210.00. It is recommended that detail sheet D-12 be included if specific bedding requirements are part of the plan set. It is important that the pipe summary sheet indicate all materials, bedding, structures and lengths allowed for contractors to select the lowest cost. Sheet totals and project totals are indicated at the bottom of the summary sheet. Sheet totals and project totals are indicated at the bottom of the summary sheet, and are to include information in columns which include quantities such as the pipe size / length group of columns and the structures group of columns.

If a sanitary sewer pipe associated with an ITD project is to be owned and operated by a different group, it is possible that compliance with their specification will require a Special Provision with the PS&E package.

### **WATER MAIN PIPE MATERIAL SPECIFICATION**

Relevant Reference Material:

ISPWC

Local Agency Updates to ISPWC

Uniform Plumbing Code

The design of a publically owned and operated water main shall be done by the agency’s consultant. Plans shall follow the appropriate agency design requirements and specification requirements. Water

## ITD Pipe Materials Selection and Pipe Materials Specification Procedures

main plan sheets are to be included in the PS&E packages and shall stand alone. Water main information is not to be included on the Roadway Summary Sheet nor on any Pipe Summary Sheets.

The design of ITD owned water laterals shall be compliant with the Uniform Plumbing Code. These facilities will deliver domestic water from either individual water systems (wells), or from a water purveyor (city or metro district, in a main). Also included in this list are fixtures, (hydrants, bends, meters..etc.) and irrigation connections.

Specifying water laterals will be done as an SP in the PS&E package and will be itemized on the Roadway Summary sheet only. The roadway summary sheet shall include sizing lists consistent with the proposal in the PS&E package.

### **Appendix:**

Figure 6-2 RDM: Compliant materials based on soils pH

RDM Section 672.00: Estimated life based on soils and materials

Table 1: Non-compliant materials elimination checklist

ITD Pipe Materials Selection and Pipe Materials Specification Procedures

<b>PIPE SELECTION TABLE</b>			
Route	Key Number		Title/Location
<b>Pipe Classification / Use</b>	Pipe Ownership		Within ITD ROW?
Design Life	Phase II Materials		Station Range / Milepost Range
	pH ____	Resistivity ____	
Interstate ROW?			
<b>Complete Pipe List</b>	Compliance Status		Comment
	Yes	No	
Concrete (non reinforced)			
Concrete Class II			
Concrete Class III			
Concrete Class IV			
Concrete Class V			
Corrugated Steel			
Corrugated Aluminum			
Corrugated Polyethylene			
Ribbed Polyethylene			
Acrylonitrile-Butadiene-Styrene (ABS)			
Polyvinyl Chloride-nonribbed (PVC)			
High-Density Polyethylene (HDPE)			

**670.00 – CULVERT MATERIALS SELECTION TABLE**

Figure 6-2 should be used when selecting culvert materials.

Figure 6-2

**CULVERT MATERIALS SELECTION TABLE**

PIPE	pH Value									
	3	4	5	6	7	8	9	10	11	12
Galvanized Steel				X	X	X				
Bituminous-Coated Galvanized Steel*			X	X		X	X	X		
Aluminized Steel			X	X	X	X				
Bituminous-Coated Aluminized Steel*			X	X	X	X	X	X		
Polymer-Coated Steel (AASHTO M245/M246)		X	X	X	X	X	X	X		
Aluminum			X	X	X	X				
Bituminous-Coated Aluminum*		X	X	X	X	X	X	X		
Reinforced & Non-Reinforced Concrete			X	X	X	X	X	X	X	X
Plastic		X	X	X	X	X	X	X	X	X

\*Use bituminous-coated ONLY when required (increasing metal thickness by one gauge increment is an acceptable substitute for bituminous coating whenever pipe life is 20 years or more).

**NOTES:**

1. The chart covers structural plate, culvert, siphon, irrigation, sewer, embankment protector, and underdrain pipe where applicable.

Non-metallic pipe, bituminous-coated aluminum pipe or bituminous-coated aluminized steel pipe shall be used when the soil resistivity is less than 1000 ohm-cm and the pH is above 5.

If bed-load velocities of abrasive materials exceed 5 ft/sec, specify 3" x 1" corrugations for steel pipe. Pipes less than 36" exposed to these conditions will have special evaluation.

If the bed load velocities of abrasive materials exceed 5 ft/sec aluminum or aluminized steel pipe 60" and larger should not be used. Steel pipe can be used, but its invert should be paved with concrete.

Aluminum or aluminized steel CMP must be asphalt-coated where in direct contact with fresh concrete. Special notes in the pipe summary for field coating the concrete-aluminum contact surface may be used in lieu of coating the entire length of pipe.

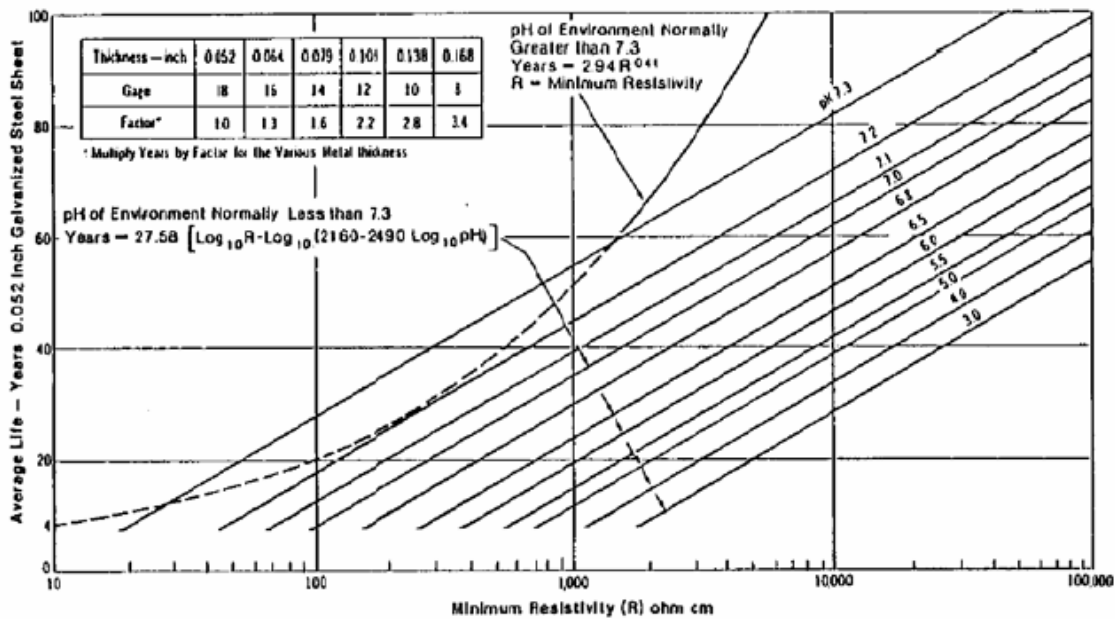
Metallic pipe of unlike materials shall not be joined together. Galvanized steel hook bolts may be used to tie aluminum plate pipe to concrete headwalls.

Aluminum pipe shall not be bedded in or backfilled with soils classified as CH or CL. Granular bedding backfill material should be imported.

Metal pipe shall not be used in sewer under high type pavement if there are underground utilities that have cathodic protection or if such protection is planned to be installed in the future. For the purpose of this limitation, a high type pavement is defined as Portland cement concrete or plantmix with a 5" plastic pipe (PVC or Polyethelene) is limited in size and fill height, requires protection for culvert ends.

All PVC and Polyethelene pipe will be protected from ultraviolet radiation by either being covered or coated.

### 672.00 – ESTIMATED LIFE OF STEEL OR ALUMINUM CULVERTS



Source: "Handbook of Steel Drainage & Highway Construction Products," American Iron and Steel Institute (1994), page 339. To purchase online [www.steel.org](http://www.steel.org), select Shop, Search for Steel Drainage.