

## Designer Guidelines for Trenchless Culvert Repair and Rehabilitation

In general, culverts used for highway drainage can be placed into two categories; Rigid and Flexible. The following is a list of common problems associated with each type and potential remediation products, techniques and associated ODOT specifications that can be used without the need for open cut excavation. At locations where fill heights are less than 5 feet, replacement may offer an overall lower cost and should be considered.

It is assumed that by the design stage any culvert deficiencies in need of repair have been determined, therefore no detailed descriptions of cause or condition are provided. FHWA Culvert Repair Practices Manual Volume 1 & 2 (Publication FHWA-RD-95-089) is an excellent resource for more in depth explanations of many of the culvert problems and repair techniques listed herein.

If voids are present in the backfill, conduit repair includes pressure grouting, epoxy injection or approved equal to restore the backfill structural capacity.

### **RIGID PIPE**

#### **Reinforced Concrete Pipe (RCP)**

The following table assumes the pipe has reached equilibrium and is structurally capable of supporting the loads it is subjected to. If not, stabilization must first be achieved.

PROBLEM	REMEDIATION
Longitudinal Cracking < 0.1"	No repair if pH is above values listed for appropriate conduit in L&D, Volume 2, Figure 1002-4
Longitudinal Cracking > 0.1" - < 0.2"	Repair crack with portland cement mortar or epoxy materials
Slabbing & Spalling	Patch with portland cement mortar or epoxy materials
Infiltration / Exfiltration Joint Separation	Chemical grouting, stainless steel or PVC sleeves, rubber gasket with stainless steel banding, SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Chemical Erosion	Apply chemical resistant spray-on coating after patching or cement mortar lining CMS 611.11 with SS834 Conduit Renewal Using Resin Based Liner, cured-in-place-pipe (CIPP), SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Deteriorated Invert	Invert paving with portland cement concrete CMS 611.11, SS833 Conduit Renewal Using Spray Applied Structural Liner, SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe

#### Non-structurally sound RCP

PROBLEM	REMEDIATION
Structurally Deficient Requiring Total Conduit Rehabilitation / Replacement	SS833 Conduit Renewal Using Spray Applied Structural Liner, SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Partially Structurally Deficient Requiring Only Sectional Conduit Rehabilitation / Replacement	Segmental lining, stainless steel or PVC sleeves, SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe

## FLEXIBLE PIPE

### Steel & Aluminum Pipe

Generally structurally sound pipe.

PROBLEM	REMEDIATION
Corrosion – Light No Invert Perforations	Invert paving with portland cement concrete CMS 611.11, SS834 Conduit Renewal Using Resin Based Liner
Corrosion – Heavy Perforations to the Pipe and/or Invert	Invert paving with portland cement concrete CMS 611.11 with SS834 Conduit Renewal Using Resin Based Liner, SS833 Conduit Renewal Using Spray Applied Structural Liner, cured-in-place-pipe (CIPP), SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe
Infiltration / Exfiltration	Portland cement grout, chemical grouting, cured-in-place-pipe (CIPP), SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe

Non-structurally sound pipe

PROBLEM	REMEDIATION
Structurally Deficient Requiring Total Conduit Rehabilitation / Replacement	SS833 Conduit Renewal Using Spray Applied Structural Liner, SS837 Liner Pipe, SS841 Conduit Renewal Using Spiral Wound Liner, SS938 Steel Reinforced Thermoplastic Ribbed Pipe, structural steel pipe liner, tunnel liner plate, pipe jacking, pipe bursting

### Plastic Pipe

PROBLEM	REMEDIATION
Cracks	Welding, welding with sheet reinforcing, chemical grouting, stainless steel or PVC sleeves, cured-in-place-pipe (CIPP) UV cure only
Infiltration / Exfiltration Joint Separation	Chemical grouting, stainless steel or PVC sleeves, rubber gasket with stainless steel banding, cured-in-place-pipe (CIPP) UV cure only