



# Choosing the Right Culvert Repair Solution



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Choosing the right approach to solve your specific repair situation is not always a simple task. The appropriate solution depends on the type of culvert deterioration, the root cause of the problem, and the extent to which the structure of the failing culvert allows you to rehabilitate rather than replace. The full solution to rehabilitating a deteriorated culvert may also depend on correcting failed conditions on the outside of the culvert at the inlet and outlet.

In the mid-1980s, the Federal Highway Administration (FHWA) developed a 10 point scale (9 to 0) that is useful as a guideline for assessing the condition of the culvert. In this scale, 9 represents a culvert in new condition, and 0 represents one that has totally failed.

GeoTree Solutions offers a number of solutions to repair or rehabilitate a variety of problems seen in corrugated metal (CMP) and concrete pipe culverts. Our solutions may be used individually to solve a specific issue, or together to fully rehabilitate a culvert with a range of problems. Some examples are:

Problem	Culvert Type	Solution
Scour/Pitting or Invert paving	CMP/Concrete	GeoTree Invert Repair Mortar
Shape deformations	CMP	GeoSpray® Mortar
Joint failures or misalignments	CMP	GeoSpray® Mortar
	Concrete	RenewWrap® FRP
Cracks	Concrete	GeoFuse Crack Repair
Deterioration (rebar corrosion)	Concrete	GeoSpray® Mortar
		RenewWrap® FRP
Infiltration	CMP/Concrete	GeoPlug

Generally speaking, GeoTree Invert Repair Mortar material functions as a new wear surface for culvert inverts and as an erosion control measure for culvert surrounds, and is not a structural repair. Our GeoSpray products can provide structural repair options for more severe culvert failure conditions. GeoPlug is useful as a temporary water stop for infiltration.



**Rating 8: Very Good**



**Rating 6: Satisfactory**



**Rating 5: Fair**



**Rating 4: Poor**



**Rating 3: Very Poor**

# CMP Culvert Rating and Decision Guide

## CULVERT REPAIR

Condition Rating	Condition Description	GeoTree Solutions	
		GT Invert Repair	GeoSpray
9	New Condition		
8	<b>Shape:</b> good, smooth curvature in barrel <b>Horizontal:</b> within 10 percent of design <b>Seams and Joints:</b> tight, no openings <b>Aluminum:</b> superficial corrosion, slight pitting <b>Steel:</b> superficial rust, no pitting		
7	<b>Shape:</b> generally good, top half of pipe smooth but minor flattening of bottom <b>Horizontal diameter:</b> within 10 percent of design <b>Seams or Joints:</b> minor cracking at a few bolt holes, minor joint or seam openings, potential for backfill infiltration <b>Aluminum:</b> moderate corrosion, no attack of core alloy <b>Steel:</b> moderate rust, slight pitting		
6	<b>Shape:</b> fair, top half has smooth curvature but bottom half has flattened significantly <b>Horizontal diameter:</b> within 10 percent of design <b>Seams or Joints:</b> minor cracking at bolts is prevalent in one seam in lower half of pipe. Evidence of backfill infiltration through seams or joints <b>Aluminum:</b> significant corrosion, minor attack of core alloy <b>Steel:</b> fairly heavy rust, moderate pitting		
5	<b>Shape:</b> generally fair, significant distortion at isolated locations in top half and extreme flattening of invert <b>Horizontal diameter:</b> 10 percent to 15 percent greater than design <b>Seams or Joints:</b> moderate cracking at bolt holes along one seam near bottom of pipe, deflection of pipe caused by backfill infiltration through seams or joints <b>Aluminum:</b> significant corrosion, moderate attack of core alloy <b>Steel:</b> scattered heavy rust, deep pitting		
4	<b>Shape:</b> marginal significant distortion throughout length of pipe, lower third may be kinked <b>Horizontal diameter:</b> 10 percent to 15 percent greater than design <b>Seams or Joints:</b> caused by loss of backfill through open joints <b>Aluminum:</b> extensive corrosion, significant attack of core alloy <b>Steel:</b> extensive heavy rust, deep pitting		
3	<b>Shape:</b> poor with extreme deflection at isolated locations, flattening of crown, crown radius 20 to 30 feet <b>Horizontal diameter:</b> in excess of 15 percent greater than design <b>Seams or Joints:</b> 3 in. long cracks at bolt holes on one seam <b>Aluminum:</b> extensive corrosion, attack of core alloy, scattered perforations <b>Steel:</b> extensive heavy rust, deep pitting, scattered perforations, invert X % section loss		
2	<b>Shape:</b> critical, extreme distortion and deflection throughout pipe, flattening of crown, crown radius over 30 feet horizontal diameter: more than 20 percent greater than design <b>Seams:</b> plate cracked from bolt to bolt on one seam <b>Aluminum:</b> extensive perforations due to corrosion <b>Steel:</b> extensive perforations due to rust		
1	<b>Shape:</b> partially collapsed with crown in reverse curve <b>Seams:</b> failed <b>Road:</b> closed to traffic		
0	<b>Pipe:</b> totally failed <b>Road:</b> closed to traffic		

Color block = Recommended

# Concrete Culvert Rating and Decision Guide

## CULVERT REPAIR

Condition Rating	Condition Description	GeoTree Solutions	
		GeoSpray	RenewWrap
9	New Condition		
8	<b>Alignment:</b> good, no settlement or misalignment <b>Joints:</b> tight with no defects apparent <b>Concrete:</b> no cracking, spalling, or scaling present; surface in good condition		
7	<b>Alignment:</b> generally good; minor misalignment at joints; no settlement <b>Joints:</b> minor openings, possible infiltration/exfiltration <b>Concrete:</b> minor hairline cracking at isolated locations; slight spalling or scaling present on invert		
6	<b>Alignment:</b> fair, minor misalignment and settlement at isolated locations <b>Joints:</b> minor backfill infiltration due to slight opening at joints; minor cracking or spalling at joints allowing exfiltration <b>Concrete:</b> extensive hairline cracks, some with minor delaminations or spalling; invert scaling less than 0.25 in. deep or small spalls present		
5	<b>Alignment:</b> generally fair; minor misalignment or settlement throughout pipe; possible piping <b>Joints:</b> open and allowing backfill to infiltrate; significant cracking or joint spalling <b>Concrete:</b> cracking open greater than 0.12 in. with moderate delamination and moderate spalling exposing reinforcing steel at isolated locations; large areas of invert with surface scaling or spalls greater than 0.25 in. deep		
4	<b>Alignment:</b> marginal; significant settlement and misalignment of pipe; evidence of piping; end sections dislocated, about to drop off <b>Joints:</b> differential movement and separation of joints; significant infiltration or exfiltration at joints <b>Concrete:</b> cracks open more than 0.12 in. with efflorescence and spalling at numerous locations; spalls have exposed rebars which are heavily corroded; extensive surface scaling on invert greater than 0.5 in		
3	<b>Alignment:</b> poor with significant ponding of water due to sagging or misalignment pipes; end section drop off has occurred <b>Joints:</b> significant openings, dislocated joints in several locations exposing fill materials; infiltration or exfiltration causing misalignment of pipe and settlement or depressions in roadway <b>Concrete:</b> extensive cracking, spalling, and minor slabbing; invert scaling has exposed reinforcing steel		
2	<b>Alignment:</b> critical; culvert not functioning due to alignment problems throughout <b>Concrete:</b> severe slabbing has occurred in culvert wall, invert concrete completely deteriorated in isolated locations		
1	<b>Culvert:</b> partially collapsed <b>Road:</b> closed to traffic		
0			

Color block = Recommended

## GeoSpray Geopolymer



## RenewWrap FRP



## GeoPlug



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