

Culvert Slip-Lining & Trenchless Rehabilitation

LPESA 2021 Fall Conference

November 4, 2021



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Outline

- 1. Drainage Structures & their Role in Modern Infrastructure**
- 2. Common Factors that effect culvert performance**
- 3. Temporary Culvert Repair Practices**
- 4. Trenchless Rehabilitation Methods**
- 5. Important Considerations**
- 6. Case Study Review**
- 7. Closing Comments**

Drainage Structures & Their Role in Modern Roadway Infrastructure

Curbs, Curb Inlets, Gutters, Catch Basins, & Drop Inlets

Drainage structures used on streets and highways collect water, transferring it away from the road. Their purpose is to keep roadways free of water, draining into ditches and underground structures, transferring to creeks and rivers.

Culverts

Culverts allow water to continue its flow uninterrupted. Road and railway embankments cannot be allowed to obstruct the water flow. Culverts prevent flooding and erosion, making their job extremely important.



What factors effect Culvert Performance?



Common Defects of Culvert Barrels

1. **Crack:** Improper handling during installation, or movement/settlement of pipe sections.
2. **Joint Misalignment:** Misalignments are due to joint separations or differential settlements of the culvert sections.
3. **Corrosion of Invert:** Degradation of metal culvert material due to chemical reactions.
4. **Joint In/Exfiltration:** Joint separation leading to infiltration of external water and/or exfiltration of culvert flow.
5. **Shape Deformation:** The culvert is deflected, settled, or distorted due to insufficient support from backfill.
6. **Bedding Voids:** Bedding voids formed by erosion of the soil that supports the culvert from the bottom.

SCOUR OR EROSION AT INLET END

CAUSE

No headwall.

Ditch surrounding the culvert is steeply graded.

Poor culvert alignment or location.

Culvert Barrel is clogged.

SOLUTION

Install headwall.

Line inlet with stone/ballast.

Realign culvert pipe to meet flow direction.

Clean culvert and flush debris.

CAUSE

■ Pipe is sloped too much.

■ No head walls or aprons

■ Water volume exceeds discharge capacity.

SOLUTION

■ Build an outfall splash pad/apron that will catch discharge.

■ Install endwalls or apron.

■ Check culvert size and replace if needed.



**SCOUR OR EROSION AT
OUTLET END**

CAUSE

Vehicles, equipment, or debris striking culvert end.

SOLUTION

Reinforce ends of culvert barrel with headwall wingwall.



**DENTED OR CRUSHED
CULVERT ENDS**

Temporary Culvert Repair Methods

Poured Concrete Invert

Spot Patch & Repair

**Repair/Modification to Culvert
End Treatment**

Internal Joint Bands

Shotcrete or Gunnite Lining



Trenchless Rehabilitation



Cured In Place Liner (CIPP)

Spray Applied Liner

Vinyl Wrap Liner

Rigid Slip Liner

What is the Installation Process?

3 Step Process

- 1. Clean & Dewater host structure**
- 2. Installation of Slip-Liner, to include welding or joining of joints.**
- 3. Grouting of Annular Space**



FACTORS TO CONSIDER FOR CULVERT REPAIR



Flow Capacity: What is the supportable flow rate of the culvert under a specific set of weather and site conditions?



Design Life: What is the period for which the alternative solution is estimated to maintain structural integrity and function as designed?



Increased Structural Integrity: What is the ability of the rehabilitation method to improve the overall structural integrity or strength of the culvert?



Adaptability: What is the solution's ability to be expanded upon or altered in the future.



Total Estimated Cost: What are the total estimated costs, including contingencies and design fees as well as materials and construction costs?

Environmental Impact: impact does the solution have on the surrounding environment and stream?



Community/Traffic Disruption: How will the rehabilitation method impact traffic flow, business operations, and the community's daily life?



Estimated Construction Time: How long will it take to complete?



Permitting Difficulty: The amount of difficulty and labor related to obtaining proper permits for the solution's construction.



Contractor Availability: The overall availability of relatively local contractors to install the solution?





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