Montana Department of Transportation
Research Programs

EXPEIRMENTAL PROJECTS PROGRAM

HIGHWAYS FOR LIFE (HFL) CULVERT REHABILITATION PROJECT – FINAL REPORT

Project Name:	NH-HFL 8-1(30)23 MacDonald Pass Guardrail/Erosion
FHWA Project Number:	MT 00-17
Project Location:	MacDonald Pass; Powell and Lewis & Clark Counties – The eleven mile project is located approximately 15 miles west of Helena on US 12 (N-8) between RP 23.2 and RP 34.2: The section of the project which contains the experimental portion is located approximately between RP 26.0 and RP 27.0 on the west side of MacDonald Pass
Description:	The relining of 10 (ten) 24" (610 mm) corrugated steel pipe (CSP) culverts with two type of lining applications; Cure In-place Pipe (CIPP) and seam welded High-density Polyethylene Pipe (18"/46cm HDPE). The ten culverts were split evenly for each treatment.
Date of Installation:	September 2008
Evaluation Date:	October 2009-April 2013
Principal Investigator:	Craig Abernathy - Experimental Projects Manager (ExPM)

Objective

This project was nominated by the Montana Department of Transportation (MDT) through the Federal Highway Administration (FHWA) Highways for LIFE (HfL) pilot program to promote the adoption of innovations and new technologies, thereby improving safety and highway quality while reducing congestion caused by construction.

The qualification for the HfL requirement was the use of CIPP and HDPE application to reline the existing CSP which required no excavation or lane closures during those procedures. This in turn eliminated congestion, traffic delay, and potential safety issues which would normally occur during a conventional culvert replacement project.

Documentation

The purpose of the experimental project is to document the processes involved in the installation of the two stated procedures. Information collected will include visual representation of the installations to denote the specific application, applicable anecdotal support, and any construction issues that may affect performance of the treatments during the ongoing analysis and determination of performance. This report is for the needs of the experimental evaluation and not meant to replace any other project related documentation. Images contained in this report represent the practice per application and examples of procedure may be taken from different locations on the project.

Climatic conditions during installations ranged from snow and cold to warm and sunny.

CIPP and HDPE site locations are physically marked on the eastbound outside lane (approximately RP 26-27) as follows:

Field Mark	**Stationing**
1-HDPE	184+18
2-HDPE	189+47
3-CIPP	194+99
4-CIPP	199+97
*5-CIPP	206+44
6-HDPE	209+71
7-CIPP	213+29
8-HDPE	216+98
9-CIPP	221+61
10-HDPE	230+58

*This site of the CSP culvert had a broken cleaner head within the line located approximately 30' from the culvert inlet on the northbound side. The contractor initially attempted to remove the head. Eventually, the contractor was forced to excavate the roadway to the CSP and had to cut the CSP to remove the broken cleaner head. The CSP was replaced, back fill restored, and the area paved in preparation for the CIPP installation.

Performance Summary to Date

Due to weather constraints, the 2010 project inspection did not take place. All installations were inspected at the inlet and outlets. The majority CIPP and HDPE culverts were free of obstructions and visually intact. One exception was the inlet of unit 4 (CIPP at STA 199+97). During the 2009-2012 inspections it was found to be completely clogged with what was assumed winter sanding material deposited by hard rains. Due to the application of plant mix (asphalt cement) at the shoulder to direct water to the containment ponds down slope, it inadvertently washed the particulates into the inlet blocking it. During the April 2013 inspection this inlet was again found to be obstructed with sanding material. Inspection of the other nine (9) inlets showed them to be relatively unobstructed.

During installation the inlet/outlets were grouted for both types of culverts. The majority of the grouted ends are beginning to fracture and small chunks have fallen off, most likely due to freeze-thaw and expansion/contraction of the dissimilar materials. This issue is solely associated with the HDPE culvert inserts since they required a bulkhead for the grouting phase. At this time it is not an indicator of performance since the bulkheads were considered sacrificial. Visually all treatments are performing well. The following are representative images taken during the annual inspection. The April 2013 reporting begins on page 20.

All current information available regarding this project can be found at:

http://www.mdt.mt.gov/research/projects/macpass_culvert.shtml

October 2009

🡅 1-HDPE Outlet (Sta. 184+18)

🡅 2-HDPE Outlet (Sta. 189+47): Note the deteriorating grouted bulkhead. Large sections are beginning to breakoff (red arrow). The piece of grout on top of the CSP came from the bottom of the outlet. The purpose of the grout was to create a bulkhead at the outlet to create a dam to contain the grout used to fill the void between the exiting CSP and the HDPE liner during installation. The fracturing of the bulkhead is not considered a detriment to performance.

3-CIPP Outlet (Sta. 194+99): The red line depicts where the CSP is in relationship with the CIPP.

4-CIPP Outlet (Sta. 199+97)

🡅 4-CIPP Inlet: Completely filled with sanding material

🡅 5-CIPP Outlet (Sta. 206+44)

🡅 6-HDPE Outlet (Sta. 209+71)

🡅 6-HDPE Inlet: Although difficult to see in this image, the grouted collar has almost completely delaminated from the CSP and HDPE liner. Also it appears to be partially blocked (up to an estimated 70%) by sanding material or other particulates.

🡅 7-CIPP (Sta. 213+29)

🡅 8-HDPE (Sta. 216+98)

🡅 9-CIPP (Sta. 221+61)

🡅 10-HDPE (Sta. 230+58)

July 2011

↑ 1-HDPE Outlet (Sta. 184+18)

↑ 2-HDPE Outlet (Sta. 189+47)

🡅 3-CIPP Outlet (Sta. 194+99)

🡅 4-CIPP Outlet (Sta. 199+97)

4-CIPP Inlet: Completely filled with sanding material (July 2011)

5-CIPP Outlet (Sta. 206+44)

🡅 6-HDPE Outlet (Sta. 209+71)

🡅 7-CIPP (Sta. 213+29)

↑ 8-HDPE (Sta. 216+98)

↑ 9-CIPP (Sta. 221+61)

🡅 10-HDPE (Sta. 230+58)

May 2012

🡅 1-HDPE Outlet (Sta. 184+18)

🡅 2-HDPE Outlet (Sta. 189+47): Note the continuing deterioration of the grouted bulkhead.

🡅 3-CIPP Outlet (Sta. 194+99)

🡅 4-CIPP Outlet (Sta. 199+97)

🡅 5-CIPP Outlet (Sta. 206+44)

🡅 6-HDPE Outlet (Sta. 209+71)

🡅 7-CIPP (Sta. 213+29)

🡅 8-HDPE (Sta. 216+98)

🡅 9-CIPP (Sta. 221+61)

🡅 10-HDPE (Sta. 230+58)

May 2103

🡅 Representative image of average outlet condition of the Cure-in-Place Pipe (CIPP) liner.

🡇 Representative image of average outlet condition of the High-density Polyethylene Pipe (HDPE) liner.

🡸 Image of inlet 4 (CIPP at STA 199+97), view west. Containment pond is located around the corner.

🡸Close-up of inlet 4. This inlet has been clogged since installation.

🡸 Although difficult to see in this image. The majority on the inlets were free of obstruction. Several inlets may have had several inches of sanding material at the base.