Sliplining and Other Culvert Repair Options
Ken Moulds, Subsurface, Inc.
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TOPICS
• Slip Lining
• RCP Joint Repair
• CIPP (Cured In Place Pipe)
• UV Cure vs. Steam, Hot Water
• Soil Stabilization / Void Filling

SLIP LINERS
• High Density Polyethylene (HDPE)
• Polyvinyl Chloride (PVC)
• Screw or Snap connections between pipe sections, depending on manufacturer
• Corrosion and Chemical resistant
• Easy Installation
• Smooth interior usually yields lower Manning’s number than host pipe
• High Flow characteristics
• Cost Effective
Where Do Our Roads Go?

- What is the most common problem with RCP?
  - Broken joints
  - Separated joints
- What have we always done?
  - Dig it up, reset it or replace it.

RCP JOINT SEALING AND REPAIR
• *A Separated joint* is a RCP structure that has pulled apart as a result of freeze-thaw cycles, vibration, piping, weakened bedding, poor installation, and decomposing filter cloths.

**Completely Separated Joint**

**Broken Joint**
**RCP JOINT SEALING AND REPAIR**

- New technologies have created more options at less cost using a three step process.
  - Seal the joint from the inside with a combination of oakum rope and a highly adhesive, flexible polyurethane resin.
  - Then seal the outside of the joint from the inside of the pipe with another flexible, adhesive, long lasting polyurethane resin.
  - Replace lost soils and fill voids with yet another polyurethane product that is light weight, load bearing, highly expansive.
  - All of which have a life expectancy of over 100 years.
- This process can be done on structures 36” and above.
- What about box culverts that have sheared?

**Specification for RCP Joint Sealing**

- The spec must be understood by the engineer, the inspector, and the contractor.
- Each step must be performed in order.
- Polyurethane resins have unique characteristics and are designed to function accordingly.

**Old Habits Die Hard**

- Recognize that you have options other than open cutting.
- You are not the first. Trenchless No-Dig technology in surface transportation has come a long way.
- Time has shown us that most drainage structures that have been fully treated have a renewed life expectancy.
- Avoid Detours.

**Misaligned Joint**
Rebuilding Joint

Drilling Holes

Injection and Observation Ports
**Oakum Before Trimming**

**Drilling the Backside of Joint**

**Injection**

**Expanding Grout**
If cost does matter, then the temperature of the grout or resin matters! Controlling the temperature is important from storage to the point of injection. Heated storage, Heated drums, Heated hoses.


**EVERY DAY COUNTS!**

- Winter is a good time to work in wetlands and hard to get at sites.
**CURED-IN-PLACE PIPE (CIPP)**

CIPP is a trenchless rehabilitation method used to repair existing pipelines. CIPP is a jointless, seamless, pipe-within-a-pipe. It has the capability to rehabilitate pipes ranging in diameter from very small to very large (4”-110”).

- Each CIPP liner is specifically designed for each individual host pipe and location.
- Starts out as raw felt or fiberglass depending on cure type.
- Made to the thickness and diameter required by ASTM standards.

**CURED-IN-PLACE PIPE (CIPP)**

- Sent to a wet-out facility where it is impregnated with the resins needed for curing.
- The liner is either refrigerated if steam cured, or crated if UV cured to prevent premature curing.
- Shipped to site in appropriate trailer/reefer.
- Installed and cured on site.
- Does not bond to host pipe.
- Designed to be a load bearing pipe if the host pipe completely degrades.
- Life expectancy of over 50 years.
LINING
Questions to be answered in deciding on a solution:

• What is the “host?” RCP or CMP?
• Is the current pipe properly sized for the drainage area?
• How will this decision affect the hydraulics of the culvert?
• What is the depth to the invert?
• What is the length and grade?
• What kind of surface is above?
• What is the traffic count?
• How will the public be affected by the replace vs. rehabilitate decision?
• How much will a detour cost?
• How much right of way is there on each side?
• Does cost matter?

WHY CONSIDER CIPP?

• Good option when hydraulics are important in the decision.
• In a RCP host you can maintain 100% of the existing flow rate, and in most cases gain a few points.
• Good for small diameter culverts.
• Farming and Ranching community like it because of flow characteristics.

Steam Cured CIPP

• Liner must be kept refrigerated to prevent premature curing.
• Shelf life is approximately 30 days if wet-out liner has been kept at the proper temperature.
• Insert liner into pipe and pressurize to obtain snug fit with host pipe.
• Cured by blowing steam into liner
Bladder Bag

CONTROL STRUCTURE
Liner must be kept out of the light, natural or artificial, to prevent premature curing.
• Can be stored at room temperature for up to 12 months.
• Wall thickness can be standardized.
• Cured by pulling a “light train” with special UV light bulbs through pressurized liner.
• Temperature can be monitored and controlled throughout entire curing process.
• Extra material on the ends cut off with diamond tipped blade.
**Pipe Preparation**

- Host pipe needs to be cleaned, CCTV’d, and glide foil installed.

**Installation**

- Liner is then pulled through the host pipe.

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**UV Truck**

- Carbon footprint is approx. 90% less compared to steam cured.
**UV Truck Curing Unit**

**UV Light Train**

**Installation**

- Liner inflated and UV Light Train inserted.

**UV Curing**
Cured UV Liner

Finished UV Liner

Ken Moulds
Kenny@subsurface-inc.com
119 4th St. S
P.O. Box 37, Moorhead, MN 56561
Office: 218-227-5963
Cell: 605-838-8384

Partners

Transportation Learning Network
Contact Information

Program Director
Tim Horner, P.E.
Office: (701) 328-9859
Cell: (701) 391-9787
timothy.horner@ndsu.edu

Technical Training Specialist
Chris Padilla
Office: (701) 328-9867
Cell: (701) 202-5730
chris.padilla@ndsu.edu

NDSU
UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
TRANSPORTATION LEARNING NETWORK
NORTH DAKOTA LOCAL TECHNICAL ASSISTANCE PROGRAM