Innovative Solutions through Engineered Products

OTECA 2015 – Conduit Renewal
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Conduit Renewal - Resin Based Lining

What is it?

The process of rehabilitating a culvert system by repairing the inside of the culvert

- stabilizing the pipe
- creating a lining to direct water through the storm culvert
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What is involved with a ODOT Culvert Rehabilitation Project?

• Determine if your lining requires strength, based on a partially deteriorated or a fully deteriorated pipe
• Follow the ODOT supplemental specification
• Control traffic
• Bypass pumping
• Cleanout debris (sand, silt, stone, boulders)
• Containment to help to control dust, overspray and weather
• Prepare surface by sand blasting or hydro-blasting
• Spray application of resin base system
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What is a resin based liner?
A resin based liner is a spray applied system that has a quick cure time and can provide a desired thickness level.
Equipment/Footprint

PolySpray
Spray Equipment PolySpray
Application

PolySpray
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What Specifications are used?

• **Supplemental Specification 833**
  - Conduit renewal using spray applied structural lining
    - Fully deteriorated pipe
    - Cost are $60-70 square foot turn key

• **Supplemental Specification 834**
  - Conduit renewal using resin based lining
    - Partially deteriorated pipe
    - Cost are $35-45 square foot turn-key
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Specification 834
Partially deteriorated culverts
Eliminate corrosion and provide ground stability, specifically the inverts
ODOT District 6

Route 33 Marysville, OH
Deteriorated Invert
Applied at 300 mils
36” – 620 Feet
48” – 258 Feet
54” – 626 Feet
78” – 530 Feet
Blanchester, Ohio
Steel Arch Culvert 12.5 Ft x 7.5 Ft 92 feet
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**Specification 833**

- Utilize ASTM F 1216-09 to calculate liner thickness
  - Fully Deteriorated
- Provide proper flow bypass
- Provide a pre-Installation inspection
- Installation
- Post installation inspection and video
- Verify minimal thickness
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ODOT 12 Project 130617 - PID 95137
Fully deteriorated condition
72” RCP pipe
Structural
Resin based lining
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Project layout
Interstate 480 Mile Marker 20
Access manhole on west bound lane of highway
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Initial inspection
Deterioration of the concrete (spalling)
Minor water infiltration
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Supplemental Specification 833

<table>
<thead>
<tr>
<th>Property</th>
<th>Test Method</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent Elongation</td>
<td>ASTM D 638</td>
<td>Max. 15%</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D 638</td>
<td>Min. 6,000 psi</td>
</tr>
<tr>
<td>Flexural Modulus</td>
<td>ASTM D 790</td>
<td>Min. 250,000 psi</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>Ground Water Height</td>
<td>At the top of the pipe unless site conditions indicate higher</td>
<td>ft</td>
</tr>
<tr>
<td>Soil Density</td>
<td>120 minimum</td>
<td>lb/cf</td>
</tr>
<tr>
<td>Soil Modulus of Reaction</td>
<td>2,000 maximum</td>
<td>psi</td>
</tr>
<tr>
<td>Long Term Material Modulus</td>
<td>50% of short term material modulus</td>
<td>psi</td>
</tr>
<tr>
<td>Factor of Safety</td>
<td>2.0 minimum</td>
<td>n/a</td>
</tr>
<tr>
<td>Ovality</td>
<td>5 minimum</td>
<td>percent</td>
</tr>
<tr>
<td>Live Loading</td>
<td>HL-93 Vehicle</td>
<td>psi</td>
</tr>
<tr>
<td>Thickness</td>
<td>Largest value of the following: 0.5, thickness per equation X 1.3, or thickness calculated by equation X1.4; increase calculated value to nearest 0.5 intervals</td>
<td>inches</td>
</tr>
</tbody>
</table>
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ASTM F-1216-09 Appendix X.1

Equation X1.3

\[ q_r = \frac{1}{N} \left[ 32 R_w B' E' s. C \left( \frac{E_l I}{D^3} \right) \right]^{1/2} \]

OR

Equation X1.4

\[ \frac{EI}{D^3} \geq 0.093 \]
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ODOT 12 Project 130617 - PID 95137

- Bypass water
- Clean surface
- Patch deteriorated areas
- Eliminate water infiltration
- Provide environmental controls
- Apply primer system
- Apply resin system to specified thickness
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Application of the resin based lining
Remote operation
Rotating guns applied the resin process
Applied at 75-100 mils per pass. (Total of 750 mils)
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Post Inspection of the resin based lining
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Lining system is designed to withstand the basic live and static loads, while maintaining ground stability.
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Summary

• Economical solution for invert and flow line repair
• Very small footprint and low disruption of traffic
• Environmentally friendly
• Little to no restriction to inlet flow and hydraulic flow
• Long term repair