The One N and Three Cs of Infrastructure Rehabilitation:
Non-invasive Condition Assessment, Cooperative Agreements, Cured-in-Place Trunk Water Main Pipe Lining, and Competitive Bidding

Annual Meeting of the City Engineers Association of Minnesota
January 30, 2013

What Will We Cover Today?

- Non-invasive Condition Assessment
  - Gathering Additional Pipe Integrity/Condition Data
    - City of Red Wing
  - Why did Golden Valley Choose CIPP?
- CIPP Cooperative Agreements

- CIPP for Distribution Water Main Pipe
  - Product
  - Basic Project Steps
  - Lessons Learned
- CIPP Competitive Bidding

Planning: Objective

Level of Service
Customer Expectation

Cost of Service
Life Cycle Cost & Annual Capital Cost

PJP3-2

PJP3-3
How Have We Tested Pipe Integrity/Condition?

**Direct**
- Visual inspection (CCTV or manned entry)
- Sampling
- Nondestructive testing
- Age and material

**Indirect**
- Failure history
- Leakage level
- Flow testing
- Soil resistivity

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**Acoustic-Based Integrity/Condition Testing**

Wave propagation velocity \( v = \frac{D}{\Delta T} \), where \( \Delta T \) is the time delay between signals 1 and 2.

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**Acoustic-Based Integrity/Condition Testing Pipe Wall Condition Assessment**

Raised areas cannot carry load. Dotted lines represent minimum band of continuous metal.
Benefits of Acoustic-Based Integrity/Condition Testing

- Non-intrusive
- Non-disruptive
- Works on all pipes except plastic
- Can include survey level locations of valves, hydrants, etc.

Simultaneous leak detection completed

Why Benefits Are Important?

- No water service interruptions
- Assess in any weather
- Assess on block-by-block, or shorter, basis
- Reduce cost to create water
- Reduce electricity to distribute water and convey sewerage
- Reduce cost to excavate/restore area around leak......catch it in earliest stages
- Better understand how much of pipe network to rehabilitate
- Better coordinate rehabilitation with improvement plans for other infrastructure

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Why Did Golden Value Choose CIPP?

- Conflicts
  - Railroads
  - Private utility
  - Commercial traffic
  - Privately owned boulevard landscaping
- Premature pavement damage
- Political Capital
- 25% less cost than dig and replace method
- 80% less carbon footprint than dig and replace method

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Why Did SEH Suggest a Cooperative Agreement?

- Relationship with vendors says 3 cities interested
- Involvement in APWA and AWWA told us 3 cities knew each other
- Awareness, as leader applying trenchless rehabilitation, of CIPP cost
- Familiar with Cooperative Agreements
CA Hurdles…

- Management, Council, Attorney at three cities must agree to one CA document
- Opt-out clause
- Up-front payment of 95 percent of the amount of engineers estimate of construction
- Timing among three city calendars

CA Contracting Authority
City of Golden Valley MN

Why?
- Experience with CA
- Extensive experience with CA for CIPP lining sanitary sewer
- Staff available to manage project, contracts, and payments

How did the CA Perform?
2010 - 2011 Bidders

<table>
<thead>
<tr>
<th>Installer</th>
<th>Location</th>
<th>Product</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fer-pal Construction</td>
<td>Taylor, Michigan</td>
<td>Aqua-pipe</td>
</tr>
<tr>
<td>SAK Construction</td>
<td>O’Fallon, Missouri</td>
<td>Aqua-pipe</td>
</tr>
<tr>
<td>Insituform</td>
<td>St. Louis, Missouri</td>
<td>Insitu-main</td>
</tr>
<tr>
<td>Aquarehab</td>
<td>Laval, Quebec</td>
<td>Nordpipe</td>
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Sanexen’s Aqua-Pipe CIPP Liner
- Stand-alone, structurally sound liner taking place of disintegrated host pipe
- Rehabilitate 6", 8", 10" 12" and 16" cast/ductile pipes
- 2 concentric, tubular, plain weave polyester jackets (fire hose)
- Inner jacket bonded with polyurethane elastomer

NSF International
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Water Main Rehabilitation \textit{Basic Project Steps}

1. Locate the pipe
2. Install temporary by-pass
3. Excavate access pits
4. Clean the pipe
5. CCTV Inspection, Plugging, Laser Profiling, and Corp Stop Coordinates
6. Install and Cure the Liner
7. Hydrostatic pressure test
8. Reinstate service connections
9. Reconnection
10. Disinfect the pipe
11. Site restoration

Water Main Rehabilitation \textit{Basic Project Steps}

\textbf{Install Temporary Bypass:}
Water Main Rehabilitation  *Basic Project Steps*

**Excavate Access Pits:**

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**Clean the Pipe:**

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**CCTV Inspection, Plugging, Laser Profiling, and Corp Stop**

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Water Main Rehabilitation  Basic Project Steps
CCTV Inspection, Plugging, Laser Profiling, and Corp
Stop Coordinates
Water Main Rehabilitation *Basic Project Steps*

Install and Cure the Liner
Water Main Rehabilitation *Basic Project Steps*

**Install and Cure the Liner**

- Initial cold water circulation for 15 minutes
- Circulate hot water at 147°F (64°C) for 1-1/2 hrs up to 2 hrs under 25 psi pressure
- Lock down under static operating pressure for 24 hrs
Water Main Rehabilitation Basic Project Steps

Hydrostatic Pressure Test

- Carried out before reinstatement of service connections

  As per ASTM F1743 section 8.3

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Water Main Rehabilitation Basic Project Steps

Reinstate Service Connections

- Service reinstated with robotic drill guided by CCTV
- CIPP bonds to host pipe to maintain proper seal around service connection.

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Water Main Rehabilitation Basic Project Steps

Reconnection:

Disinfect the Pipe:

Site Restoration:
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Lessons Learned

- Bid early = better prices
- Use liquidated damages
- Good time to replace meters
- Service reinstatement more difficult on smaller diameter pipes
- Resin can migrate past caps
- Large diameter services
- At endpoint valves ahead of project
  - install new stick of pipe
  - replace inoperative valves

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## Case Studies – Project Cost per City

<table>
<thead>
<tr>
<th></th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Golden Valley</td>
<td>Hutchinson</td>
</tr>
<tr>
<td>Boone Avenue</td>
<td>Legend Drive</td>
<td>TH 15</td>
</tr>
<tr>
<td><strong>Pipe Data</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diameter - Inches</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Length - Feet</td>
<td>1,750</td>
<td>960</td>
</tr>
<tr>
<td>No. of Services</td>
<td>2</td>
<td>16</td>
</tr>
<tr>
<td><strong>Bid Lining Only</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost - per LF (1)</td>
<td>$124</td>
<td>$126</td>
</tr>
<tr>
<td>Low</td>
<td>$107</td>
<td></td>
</tr>
<tr>
<td><strong>Bid Construction</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost - per LF (2)</td>
<td>$374</td>
<td>$285</td>
</tr>
<tr>
<td>Low</td>
<td>$352</td>
<td>$221</td>
</tr>
<tr>
<td><strong>Bid Traffic Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost - per LF (3)</td>
<td>$16</td>
<td>$4</td>
</tr>
<tr>
<td>Low</td>
<td>$11</td>
<td>$3</td>
</tr>
</tbody>
</table>

- **(1)** Cost to furnish and install the liner and reestablish service connections
- **(2)** Excludes cost of traffic control
- **(3)** All costs rounded to the nearest $1

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### Questions?

**Thank You!**

- Steve Thoms, City of Red Wing Operations Foreman - 651.385.3680 or steve.thoms@ci.red-wing.mn.us
- Mitchell R Hoeft, City of Golden Valley Project Engineer – 763.593.3961 or mhoeft@goldenvalleymn.gov
- Paul Pasko, SEH Project Manager – 952.912.2811 or ppasko@sehinc.com