Condition Assessment and Rehabilitation of Large Sewers: Chambers Creek Interceptor Tunnel
Ohio Water Environment Association

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Agenda

• Project Background
• Condition Assessment
• Rehabilitation Options
• Project Design
• Construction Challenges
• Conclusions
• Q&A
PROJECT BACKGROUND
Pierce County, WA
Background

- Constructed in 1983
- Approximately 16,000 LF total Condition Assessment (rehabilitation project 5,500 LF)
- 72-inch diameter RCP with a 24-inch diameter cunette
- Depth ranges from several feet of cover to over 100 ft of cover
- Located in the vicinity of Chambers Creek Road, 64th Street Court, the Charles Wright Ravine
Project Location
Existing Tunnel Cross Section
ELEVATIONS AND DEPTHS ARE VARIABLE IN THIS REGION. THOSE NOTED HERE ARE AN AVERAGED REPRESENTATION TO CHARACTERIZE THE STRATA.
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Background (Cont.)

- Precast RCP laid within 96-inch ID timber-lagging tunnel and grouted in place
- Experienced H₂S corrosion
- Four existing access portals near the alignment being rehabilitated (including three portals and a drop structure)
- Alignment also includes large radius horizontal curves (1,200 ft and 450-ft)
- Previous rehabilitation methods included Linabond for pipe and Raven Coating at the drop structure
Information Collected

- **Sonar**
  - Condition under flow
  - Debris Quantity
- **Laser**
  - Ovality
  - Eccentricity
  - Average ID
- **Gas**
  - $H_2S$
- **CCTV**
  - NASSCO PACP
Sample Defects Found
Tunnel Condition Assessment Summary Graph

Area detected by Laser Profiling as greatest deviation from original diameter

- Lina Bond Repair 06+31 to 33+00
- Level 5 PACP Defects
- Level 4 Defects
- Level 3 to 1 Defects

Distance (Feet)

Inches

Dissip. MH 12367 19+50 Drop Structure 37+00 MH 12275 47+50 MH 6203 93+00

Level 4 Breakdown
- 4L3X: 65-69 Level 4 defects, 125-129 level 3 defects
- 4S3Q: 100-104 Level 4 defects, 90-94 level 3 defects
- 433A: 3 Level 4 defects, 10-14 level 3 defects

Average ID Change (Laser Profile)
## Accumulated Debris

<table>
<thead>
<tr>
<th>Upstream MH</th>
<th>Downstream MH</th>
<th>Diam.</th>
<th>Inspection Distance (ft)</th>
<th>Cumulative Sediment Volume (cu. Ft)</th>
<th>Average Sediment Depth (inches)</th>
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<tr>
<td>06203</td>
<td>12275</td>
<td>72</td>
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<td>Totals</td>
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<td></td>
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<td>5,691</td>
<td>324.8</td>
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REHABILITATION OPTIONS
Rehabilitation Options

- Bondstrand® RPMP
- Channeline
- Hobas
- Insituform
- RibLoc
- Sabas
- Sekisui
- Trolining
- Linabond
Rehabilitation Technologies Allowed

- Bondstrand RPMP
  - Ameron International Water Transmission Group
- Channeline
  - Channeline International
- Sabas
  - SABAS Pipeline Systems LLC

<table>
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<tr>
<th>Criteria</th>
<th>Average Weighted Ranking</th>
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<tr>
<td>Capacity</td>
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<tr>
<td>Implementation Cost</td>
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<td>Availability of Materials and Contractors</td>
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<td>Longevity</td>
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<td>Risk of Cost Increase</td>
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<tr>
<td>Impact on Community</td>
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<td>Safety</td>
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<tr>
<td>Construction Duration</td>
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<td>Maximum Use of Existing Assets</td>
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<td>Bypass Requirements</td>
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<tr>
<td>Ability to Oversee Current Construction</td>
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<tr>
<td>Flexibility</td>
<td>26.8</td>
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<tr>
<td>Ease of Construction/Scheduling</td>
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</table>

<table>
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<tr>
<th>Technology</th>
<th>Design Life (50 years+)</th>
<th>Cost</th>
<th>Availability (Location)</th>
<th>Capacity (MGD)</th>
<th>Risk (L-M-H)</th>
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<td>Bondstrand</td>
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<td>Japan</td>
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PROJECT DESIGN
Minimum Criteria/Requirements

• Maintain existing capacity

• 50+ years life expectancy

• Existing capacity 73.3 MGD
  – n=0.013 (new pipe)
  – S=0.0010 (minimum)
  – 33 MGD observed after last significant storm in 2008
Flow Conditions

Monthly Average Instantaneous Flows in the Chambers Creek Interceptor Tunnel @ MH 6203

Monthly Average Instantaneous Flows @ MH #6202
Other Criteria

- 2,500(±) LF minimum rehabilitation of existing tunnel
  - 90-100 feet below grade
- Option to rehabilitate up to 5,500 LF under single contract
- Temporary installation/access shafts abandoned in place
  - Upper 15-ft must be removed
- Surface bypassing of the main tunnel flow not permitted
- Interface new rehabilitation with existing Linabond used for previous rehabilitation
Proposed Tunnel Cross Section after Rehabilitation
Major Scope Items

- Cleaning of existing tunnel
- Pre- and post-rehabilitation CCTV
- Permits
- Construction of new access portals for installation
- Bypass of Tacoma flows only (at drop structure)
- Modifications to drop structure
- Procurement and installation of rehabilitation product
- Grouting of annular space and cunette
- Traffic control
- Temporary erosion and sediment control
- Restoration of existing access portals
- Surface restoration
Bidding Alternatives

2,500 LF (±) Base Bid

3,500 LF (Alternative Bid #1)

4,500 LF (Alternative Bid #2)

5,500 LF (Alternative Bid #3)
Installation Shafts

- **Basis**
  - Designed by the contractor
  - Depends on installation equipment and method
  - 24-ft maximum dimension (based on installation equipment)
  - Maximum jacking force NTE 25% of initial axial pipe capacity
Portal #3
Tacoma Flows at Drop Structure

- Existing 30-inch pipe
- Between 2 and 8 MGD
- Connect to drop structure
- Construction Surface Bypass
- Reconnect after rehab
Station 37+00 – Existing Drop Structure
Restoration of Installation Shafts

- New shafts constructed for rehab installation
  - Abandon after installation
    - Filled to full depth
    - Capped
  - No additional permanent portals (manholes) required
- Restoration paid as part of price for each installation shafts
Surface Restoration

- Paving
- Striping
- Landscaping
  - Restored to original conditions
  - Keep accurate photo records
- No additional requirements beyond existing conditions
CONSTRUCTION
Goals for Project Procurement

- Fair
- Manage objectives
- Have mechanism to rehabilitate more than 2,500 ft
- Select qualified contractor
Bidding Alternatives

2,500 LF (±) Base Bid
3,500 LF (Alternative Bid #1)
4,500 LF (Alternative Bid #2)
5,500 LF (Alternative Bid #3)
Eligibility Requirements

• Corporation Experience
  – Tunneling
  – Rehabilitation of large diameter pipelines (≥ 48-inch)
    • Minimum 5,000 feet of sliplining in last five years
    • 20-ft deep or greater
    • No flow bypass
  – Financial Solvency
  – Insurance

• Superintendent Experience – meet at least three
  – Rehabilitation of large diameter pipelines
  – Minimum 5,000 feet of sliplining or SPR in last five years
  – Installation in flow conditions
  – Deep installations (>20 feet)
Sabas

- Injection-molded Reinforced (Fiberglass) Polymer Mortar Pipe
- Rehabilitation Technology
  - Segmental Sliplining
- Service Life
  - 50-100 years
- Proposed 1.34” thick pipe w/ 2.5” grout
Installation Shafts
Installation Shafts
Unforeseen Conditions

• Verification of field clearance inside tunnel
  – Offset joints
  – Lips
• Unsuccessful internal bypass
• Areas with less severe corrosion and smaller annulus
Mitigation Steps during Construction

- Removed FRP skids
- Installed external bypass
- Perform additional remedial work to remove concrete on sloped benches
- Slipline in the dry by hand-carrying FRP liner
- Joint FRP sections with Sikaflex 221
Construction of New Permanent Access

- Added a saddle manhole
  - 120-inch precast
  - Cast-in-place LW hatch over the interceptor
Challenges of Modifications to the Drop Structure

- Confined space with limited access
- NFPA classified space
- Measurement, fabrication and fit up of HDPE x FRP fitting
- Specialty fiberglass work to match fitting to liner
- Restraining HDPE pipe at bottom of drop structure
Finished Product
CONCLUSIONS
Conclusions

• Original contract for 3,500 ft was $9.37M
• Change Orders $4.5M
• Grand Total paid $14.3 M (w/taxes)
• Rehabilitation of tunnel was successful
• Fata flaws are negotiable
  – Bypass pumping
• Complexity of project could benefit by using GC/CM contracting procedure