Simple and Cost Effective Methods of Manhole Rehabilitation

Sacha Tetzlaff
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Presentation Overview

- Why worry about MH I/I and deterioration?
- Types of Problems Commonly Found
  - Basic or Minor Problems
    - Simple, cheap and easy fixes
  - Complex or Major Problems
    - Relatively simple to complex, but more expensive fixes
Budgetary and Capacity Concerns

- Cost to transport and treat
- Need bigger more expensive pump stations and WWTPs
- Power costs
- More chemical use due to dilution
- More equipment wear and tear
- Silt, sediment, and grit issues
- Erosion leads to manhole failures
WWTP Process Concerns

- Hydraulic overloading and short-circuiting
- High flows may require process changes including having more treatment tanks in service
- Reduces water temperature
- Sediment reduces tank capacity
- Less effective BPR
Sources and Causes of ManholeLeaks and Deterioration

- Cover and seal
- Under frame/casting
- Joints, cracks & holes
- Pipe seals
- Root penetrations
- Hydrogen sulfide corrosion
- Groundwater level
- Traffic loading/impact
- Freeze/thaw cycles
## Manhole Cover Inflow Estimations

<table>
<thead>
<tr>
<th>Water Head Over Cover</th>
<th>Bearing Surface Only - concealed pickholes; no gasket (gpm)</th>
<th>Inflow (gpd)</th>
<th>One 1.5-inch Open Pick Hole (gpm)</th>
<th>Inflow (gpd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/16 inch</td>
<td>10</td>
<td>14,400</td>
<td>10</td>
<td>14,400</td>
</tr>
<tr>
<td>1/4 inch</td>
<td>12</td>
<td>17,280</td>
<td>15</td>
<td>21,600</td>
</tr>
<tr>
<td>1/2 inch</td>
<td>14</td>
<td>20,160</td>
<td>19</td>
<td>27,360</td>
</tr>
<tr>
<td>1 inch</td>
<td>17</td>
<td>24,480</td>
<td>26</td>
<td>37,440</td>
</tr>
<tr>
<td>4 inch</td>
<td>23</td>
<td>33,120</td>
<td>40</td>
<td>57,600</td>
</tr>
</tbody>
</table>

*Data taken from 1976 Neenah Foundry Company’s “A Report on Inflow of Surface Water Through Manhole Covers”

20 manholes with 1.5 inch open pick hole and 1/4 inch of water over them

= 432,000 gpd
# Infiltration Estimations

<table>
<thead>
<tr>
<th>Type of Leak</th>
<th>GPM</th>
<th>GPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slow Drip</td>
<td>0.015</td>
<td>20</td>
</tr>
<tr>
<td>Fast Drip</td>
<td>0.03</td>
<td>45</td>
</tr>
<tr>
<td>Steady Dribble</td>
<td>0.062</td>
<td>90</td>
</tr>
<tr>
<td>1/16 Inch Stream</td>
<td>0.28</td>
<td>400</td>
</tr>
<tr>
<td>1/8 Inch Stream</td>
<td>0.56</td>
<td>800</td>
</tr>
<tr>
<td>Drinking Fountain Stream</td>
<td>0.5</td>
<td>720</td>
</tr>
<tr>
<td>½ Inch Garden Hose</td>
<td>5</td>
<td>7,200</td>
</tr>
</tbody>
</table>

*Compiled from collections of data by National Power Rodding, Inc. and Strand Associates, Inc.*

50 manholes with 1/16 inch stream leaks = 20,000 gpd
Important Factors to Consider

- General location and elevation of the area surrounding manhole
  - Low-lying area
  - Recessed manhole
  - Drainage pathways
  - Proximity to curb
  - Cracked pavement
  - Wetland, lake, waterway
  - Surrounding surface material
  - Nearby trees and roots
Common Manhole Problems

- Many very simple problems
  - Covers
  - Pick holes
  - Gaskets/sealing

- Deterioration
  - Cracks/gaps
  - Mortar eroded
  - Beginnings of structural failure

- Commonly in upper portion of manholes
- Relatively easy and inexpensive to fix

Manhole location and elevation
Covers and Gaskets

- Plug open pick holes or replace covers
- Use gasketed covers (replace gaskets)
- Provide for good sealing
Are Your Covers Effectively Sealed?
Common Manhole Problems (cont.)

- Many simple problems
  - Location/elevation
  - Offsets
  - Deterioration in chimney
  - Few minor infiltration leaks
Some Simple Solutions

- Chimney seals
- Barrel joint seals
- Concrete patching
- Grouting
- Rebuild upper portion of manhole
- Raise to, or above, grade
Chimney and Barrel Seals
Concrete Patching and Plugging
Grouting
Rebuilding the Chimney
Common Manhole Problems (cont.)

- More significant or complex problems
  - Significant infiltration
  - Structural deterioration
  - Hydrogen sulfide corrosion
Some More Involved Solutions

- Concrete patching
- Manhole liners
- Corrosion protection
- Build a manhole within a manhole

Note: Multiple methods may need to be used to achieve goal successfully
Manhole Lining

Cementitious manhole liner over brick substrate
Epoxy Lining
Cured In Place Liner
Manhole Within A Manhole

Concrete

FRP

Cover

Frame Seal

In-Place Portland Cement Concrete

Cast In-Place Protective Plastic Lining (if required)

Diameter 36" Min. (48" Normal)

Reconstructed Bench and Trough

Existing Brick or Pre-Cast Manhole

Concrete
A spokeswoman for the public works department said the sinkhole was caused when a manhole gave way as rainwater gushed through Milwaukee’s drainage system.

July 22, 2010 – Milwaukee

It will take the city at least 6 weeks to fix the sink hole. Traffic will continue to be rerouted during that time, Barrett said.
Summary

- Manholes can be significant I/I source
- Many leaks and structural problems can be relatively inexpensive to fix
- Lots of repair/rehabilitation methods available
- Appropriate rehabilitation method and material selection is crucial
Conclusion

- Successfully reduce I/I
- Prevent structural failures, backups and overflows
- Save money and headaches
- Increase system capacity
- Improve WWTP process operations
Questions?

Sacha Tetzlaff
Strand Associates, Inc.
www.strand.com