Welcome to PACP Version 7.0
The New Standard to Pipe Asset Management

Presented by:
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NASSCO
Wright-Pierce
Engineering a Better Environment

NASTT-NE
November 17, 2016
Overview

- Background
- PACP Updates
- MACP/LACP Updates
- Risk Management
- Program Benefits
- V7 Software Certification
- Q/A
Background

- Industry Standard
  - Pipes, structures, laterals
  - Original Release 2002
  - Minor/Major Updates
- Increased User Base
- New User Base
  - USCE and DOTs
- Revisions by Committee
  - Over 100 CS Professionals
- Version 7.0 May 2015
**Mission**

Improve the success rate of everyone involved in the pipeline rehabilitation industry through education, technical resources, and industry advocacy.

**Goals**

Set industry standards for the assessment and rehabilitation of underground pipelines by providing standardization and consistency in evaluating pipes, manholes and laterals.
Statistics

- 500+ Member Organizations
- Over 20,000 users
- US, Canada, South America
  - Manual available in English, French, Spanish
PACP Updates

- Educational Improvements
- Robust/Informative Header Form
- Deterioration Mechanisms
- Supplemental Technologies
- Inspection Status
- Consequence of Failure
- Additional edits/improvements
  - 7.0.1 and 7.0.2
Educational Improvements

- Training material follows manual
- Clarification language for FAQs
- Significant illustrations added: diagrams, schematics, photographs, examples
- Pipe Material, Linings, & Coatings
- Moved Buckling into Deformed Code
- Color Coded Chart Enhancements
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**20** Sewer Use **2-8**
- SS = Sanitary
- SW = Stormwater
- PR = Processes
- CB = Combined
- FM = Force Main
- XX = Not Known
- ZZ = Other

**21** Direction **2-9**
- U = Upstream
- D = Downstream

**22** Flow Control **2-9**
- P = Plugged
- L = Lift Station
- B = Bypassed
- N = Not Controlled
- D = Dewatered Using Jetter

**25** Shape **2-10**
- A = Arched
- B = Barrel
- C = Circular
- E = Egg-shaped
- H = Horseshoe
- O = Oval (elliptical)

**26** Material **2-10**
- AC = Asbestos Cement
- ABS = Acrylonitrile Butadiene Styrene
- BR = Brick
- CAS = Cast Iron
- CMP = Corrugated Metal Pipe
- CP = Concrete Pipe

**26** Material **2-10**
- CSB = Conc. Segments Bolted
- CSU = Conc. Segments Unbotted
- CT = Clay Tile
- DIP = Ductile Iron Pipe
- FRP = Fiberglass Reinforced Pipe

**26** Material **2-10**
- OB = Orangeburg/Pitch Fiber
- PCCP = Pre-Stressed Concrete Cylinder Pipe
- PCP = Polymer Concrete Pipe
- PE = Polyethylene
- PP = Polypropylene

**26** Material **2-10**
- PSC = Plastic/Steel Composite
- PVC = Polyvinyl Chloride
- RCP = Reinforced Concrete Pipe
- RMP = Reinforced Plastic Pipe
- SP = Steel Pipe
- SB = Segmented Block

**26** Material **2-10**
- VCP = Vitrified Clay Pipe
- WD = Wood
- XXX = Not Known
- ZZZ = Other

**27** Lining Method **2-11**
- CP = Cured-In-Place Pipe
- FF = Fold and Form
- GRC = Glass Reinforced Cement
- SW = Spiral-Wound
- SC = Continuous Rein Slip Liner
- SE = Sectional Slip Liner
- SN = Segmented Panel

**27a** Coating Method **2-12**
- EP = Epoxy
- PO = Polyurethane
- PU = Polyurea
- CT = Coal Tar
- CM = Cement Mortar
- XX = Not Known
- ZZ = Other

**34** Purpose **2-14**
- A = Maintenance
- B = Infiltration/Inflow Invest.
- C = Post-Rehabilitation
- D = Pre-Rehabilitation
- E = Pre-Acceptance
- F = Routine Assessment

**34** Purpose **2-14**
- G = Capital Improvement Program Assessment
- H = Resurvey
- R = Pre-Existing Video
- X = Not Known

**36** Pre-Cleaning **2-15**
- J = Jetting
- H = Heavy Cleaning
- N = No Pre-Cleaning
- X = Not Known
Header Form Updates

- Reviewed by & Certificate #
- Inspection Status
- Vertical Datum (Z elev)
- Inspection Technology Used
- Coating or Lining Method
- Infiltration (I) code modifiers (B, L, C, J)
- Tap (T) code modifiers prioritized (D, I, C, A, B)
## Deterioration Mechanisms

<table>
<thead>
<tr>
<th>Structural</th>
<th>O&amp;M</th>
<th>Construction/Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil quality</td>
<td>Cleaning Methods</td>
<td>Surcharging</td>
</tr>
<tr>
<td>Position of GW Table</td>
<td>Roots</td>
<td>Quality of Construction</td>
</tr>
<tr>
<td>Loads</td>
<td>FOG</td>
<td>Lateral Connection Methods</td>
</tr>
<tr>
<td>Alignment/Sags</td>
<td>$\text{H}_2\text{S}$</td>
<td></td>
</tr>
<tr>
<td>Pipe Strength</td>
<td>Blockages</td>
<td></td>
</tr>
<tr>
<td>Mortar Loss</td>
<td>Improper Pipe Repairs</td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td>Illustration</td>
<td></td>
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<tr>
<td>-------</td>
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</tr>
<tr>
<td><strong>Stage 1</strong> – Dissolved oxygen concentrations can be depleted in force mains and large slow moving gravity pipes, where the sewage stagnates. Sulfate reducing bacteria, present within the wastewater and in the slime layer on the pipe, convert the sulfates into dissolved hydrogen sulfide and hydrogen sulfide ions. The top image shows this slime layer as it occurs on the pipe walls of a force main or siphon. The bottom image shows the slime layer occurring on the bottom of a low slope pipe where there is no turbulence to introduce dissolved oxygen into the sewage.</td>
<td><img src="image1" alt="Force Main" /> <img src="image2" alt="Gravity Pipe" /></td>
<td></td>
</tr>
</tbody>
</table>

| Stage 2 - The sulfide is then released as hydrogen sulfide gas at points of wastewater turbulence (drops, discharges, velocity changes). Hydrogen sulfide gas is then oxidized to create sulfuric acid ($\text{H}_2\text{SO}_4$) by bacteria living on sewer walls and structures above the wastewater. The acid reacts with the concrete to produce low-strength by-products and corrode the pipe material. This image illustrates the usual deterioration above the water level, which is created by the release of hydrogen sulfide gas. | ![Image3] |

*Figure 1: Surface Deterioration from H$_2$S Attack*
Inspection Technologies

- Laser profiling
- Laser diode measurement tools
- Sonar
- Sidewall scanning
- Zoom camera
- Pipe penetrating radar
Inspection Status

- New field
- Taken from MACP
- Complete (CI) vs. Incomplete Inspections
  - BM = Buried and Marked
  - NA = No Access
  - NE = Does not Exist
  - NF = Not Found
  - NI = Traffic
  - NO = Not Opened
  - SD = Surcharged/Debris or too much debris
- Ability to easily report production
MACP/LACP Updates

- Manhole Diagram
- Manhole Ratings
- Simplified Level 1 Inspections
- New Codes:
  - Backflow Preventers
  - Roof Vents
Risk Management

- **Condition** = Likelihood of Failure (LoF)
  - PACP condition ratings
- **Criticality** = Consequence of Failure (CoF)

<table>
<thead>
<tr>
<th>Environmental Contamination</th>
<th>Social Impacts</th>
<th>Economical Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil Contamination</td>
<td>Hospitals</td>
<td>Repairs</td>
</tr>
<tr>
<td>Groundwater</td>
<td>Schools</td>
<td>Legal Fees</td>
</tr>
<tr>
<td>Waterways</td>
<td>Critical Services</td>
<td>Fines</td>
</tr>
</tbody>
</table>
Risk Management

- CoF provided by customer
- Manual provides method to establish CoF

\[
\text{RISK} = \text{LoF} \times \text{CoF}
\]
## Program Benefits

<table>
<thead>
<tr>
<th>Data Collection</th>
<th>Engineering/Management</th>
<th>Regulatory</th>
</tr>
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<tbody>
<tr>
<td>Simplifies inventory process</td>
<td>Improved data quality, reliable data</td>
<td>CMOM Consent Orders</td>
</tr>
<tr>
<td>Increases consistency</td>
<td>Better understand pipeline condition</td>
<td>AM Plans &amp; Approval</td>
</tr>
<tr>
<td>Improves objectivity</td>
<td>Deterioration modeling &amp; benchmarking</td>
<td>Annual Reporting</td>
</tr>
<tr>
<td>Standard codes for condition</td>
<td>Project &amp; Funding Approval</td>
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</tr>
<tr>
<td>Ease in benchmarking</td>
<td>CIP &amp; AM Planning</td>
<td>Recognized &amp; Suggested by EPA</td>
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</tbody>
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Condition Assessment of Underground Pipes

April 2015

4. Data Management

A successful condition assessment program requires that the data collected are organized, analyzed, and maintained in a database system. This important step not only allows a utility to manage, sort, evaluate and store the data, it helps to develop an understanding of trends. There are three general approaches to database management that have varying degrees of cost and complexity but all of which use commercially available software:

1. Software specifically designed for condition assessment and asset management.
2. Database software that is not specifically designed for condition assessment.
3. Spreadsheet software.

Condition Assessment/Asset Management Software

There are numerous commercially available data management programs for condition assessment with a range in level of complexity and cost. The primary component is a storage location for data and defect coding on pipe segments, both spatially and over time. Start commercially available systems also

Another type of commercially available software is designed to summarize the results of a CCTV pipe inspections and its defects data. This has become standard practice in the industry. NASSCO certifies CCTV operators and licenses software programs to be consistent using the Pipeline Assessment Certification Program (PACP), Manhole Assessment Certification Program (MACP), and Lateral Assessment Certification Program (LACP) rating systems (discussed below).
V 7.0.2 Software Release Update

- NASSCO certifies data collection/AM software
- Data conforms to all standards
- Input/output is seamless between programs and versions; all use MS Access database
- Certification process underway
Summary

- Significant Improvements – “user friendly and organized”
- Technical, Educational, Organizational
- New Risk Management Appendix describes Asset Management Using PACP
- Provides benefits on multiple levels!
  - Operations, Engineering, Management, Regulatory
PACP/MACP/LACP Recertification

- PACP Online Recertification – 11/23
- 1 year grace period from expiration
- MACP/LACP – online recertification in development
For more information…

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-or-
www.nassco.org
Questions / Discussions

Thank you!