24" PCCP TRANSMISSION MAIN INSPECTION AND TARGETED REPLACEMENT

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Presentation Outline

• Background and Breaks
• Replacement and Inspection Plan
• Replacement and Installation of Access Points
• Overview of Technology PipeDiver
• Construction of the Access Points
• PipeDiver Inspection
• Follow-up Surgical Replacement
• Lessons Learned
24" PCCP - ENGLEWOOD - TENAFLY - CRESSKILL

Approx. 12,200 LF of 24" PCCP Installed in 1977/1978

Approx. 6,700 LF of 24" PCCP Installed in 1974/1975
Break No. 1 – 12/14/18 (1974 Section)

[Images of damaged and inspected pipes]

9/2/2021 | 24” PCCP Transmission Main - Inspection and Targeted Replacement
Break No. 2 – 2/6/19 (1977 Section)
Break Nos. 3 & 4—10/20/19 & 11/21/19 (1977 Section)
Break Locations

24" PCCP - ENGLEWOOD - TENAFLY - CRESSKILL

Breaks #3 & #4
Break #2
Break #1
Replacement and Inspection Plan

- Phase I:
  - Replace 2,000 LF in Tenafly just beyond area of breaks
    - At ends of replacement, install valves and access points for PipeDiver
    - Install new isolation valves beyond replacement area
      - Install additional valves and access points
  - Phase II:
    - Perform inspection
  - Phase III:
    - Replace pipe sections identified from electromagnetic inspection
Replacement and Inspection Plan

24" PCCP - ENGLEWOOD - TENAFLY - CRESSKILL

- Install Access Points and Isolation Valves (for insertion)
- Install Access Points and Isolation Valves (for extraction)
- Replacement of 2,000 LF
Replacement and Installation of Access Points
Replacement and Installation of Access Points
Overview of Technology PipeDiver

Anna Santino, P.E.,
Sr. Condition Assessment Engineer,
Assessment Services, Xylem
PipeDiver Electromagnetic Inspection Tool

- An inline, free-swimming pipeline condition assessment tool
- Targets pipe wall distress
- Ideal for inspecting critical mains that cannot be removed from service
Electromagnetic Data Analysis – PCCP

DISTANCE

PHASE

AMPLITUDE

PIPE NO.
## PipeDiver Electromagnetic Results

### Electromagnetic Inspection Results

Pipe Sections that Exhibit Electromagnetic Anomalies Consistent with Broken Wire Wraps

<table>
<thead>
<tr>
<th>Pure Reference Number</th>
<th>Job Number</th>
<th>Upstream Station</th>
<th>Pipe Length (feet)</th>
<th>Downstream Station</th>
<th>Break Region Location (feet from Upstream Station)</th>
<th>Number of Broken Wire Wraps by Region</th>
<th>Total Number of Broken Wire Wraps</th>
<th>Comments</th>
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<td>28+57</td>
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Electromagnetic Data Calibration
Forensics Evaluation

Concrete Mortar
- Unsound sand particles and porous
- Susceptible to receive moisture

Steel Prestressing Wire
- Very poor torsional ductility
- Severe hydrogen embrittlement

Steel Cylinder
- Weld exhibited poor weldability with reduced yield and tensile strength
Finite Element Analysis Performance Curve

Strength Limit
at Design Operating + Surge Pressure

Figure 5.7. FEA Performance Curve for Contract HU-74-12 LCP-PCCP with 10 feet of Earth Cover
Field Locates
Construction of the Access Points, PipeDiver Inspection, & Follow-up Surgical Replacement

Michael Johnson, P.E., C.P.E., Associate, Buck, Seifert & Jost, Inc.
Construction of Access Points

- Insertion points
  - 16in opening for the tool to be inserted
  - 24in valves on either side
    - A gate valve used on the side the tool would pass and a butterfly valve on the other side to keep the tool from passing a butterfly valve. Pure was concerned that the tool would get stuck on the BFV (which it did in front of the hospital)
  - 8 feet from the centerline of the insertion tee to the face of the downstream gate valve
    - This was so that the entire diver could fit inside the space between valves
    - This made the North insertion difficult
Construction of Access Points

• Extraction Points
  • 24in opening for the retrieval net to be installed and the pipe diver to be removed
  • 24in valves on either side
  • 12 feet from the centerline of the extraction tee to the upstream gate valve
    • This made the South extraction difficult
Construction of Access Points

24" PCCP Transmission Main - Inspection and Targeted Replacement
PipeDiver Inspection

- No Des Truck and Setup

- Avoid hydrant to waste
- Maintain velocity 1 to 1.5fps
PipeDiver Inspection

24" PCCP - ENGLEWOOD - TENAFLY - CRESSKILL

- Install Access Points and Isolation Valves (for insertion)
- Install Access Points and Isolation Valves (for extraction)
- 20 Locations identified with wire breaks
- Install Access Points and Isolation Valves (for insertion)
- Install Access Points and Isolation Valves (for extraction)
Follow-up Surgical Replacement

Some Pipe segments with 30+BWW, Options to Replace?

20 Locations consolidated to 16, Three (3) Shutdowns

Order Materials
- 24”Ø- 2.5’ Long – Spigot x MJ Sleeve Adapter (Left)
- 24”Ø- 2.5’ Long – Bell x MJ Sleeve Adapter (Right)
- 24”Ø Ductile Iron Pipe (DIP)
- 24” MJ Sleeves and Retainer Glands
Follow-up Surgical Replacement

- Road marked out with “between” locations for pipe section, based on GPS
- Perform isolated shutdowns. No Test pits until then.
  - Dig a Small Test Hole
  - Locate Joint
Follow-up Surgical Replacement

- Expose full pipe length, +3 ft US and DS Joint
- Externally sound pipe, compare electromagnetic waves using pipewalker
- GPS location
Follow-up Surgical Replacement

- Cracks visible in outer core and as tried to remove....
Follow-up Surgical Replacement
Follow-up Surgical Replacement

- 24”Ø- Bell x MJ Sleeve Adapter (Left)
- 24”Ø- Spigot x MJ Sleeve Adapter (Right)
- 24”Ø- 18’ DIP
Follow-up Surgical Replacement

- Installed Valve Box for Leak Detection Monitoring to restore service
- < a week per segment replacement
Lessons Learned
Lessons Learned

- Teamwork, planning, and communications
- Relying on new valves
- Expect the unexpected
  - COVID impact
  - Valve impact
    - Broken valve
    - Proximity of butterfly valve
  - Other utility impacts
- Use of NO-DES technology for flow control