EXTENDING THE USEFUL LIFE OF SEWER ACCESS SHAFTS THROUGH CONDITION ASSESSMENT AND REHABILITATION

Five Cities 2017 Conference

Department of Public Utilities Division of Sewerage and Drainage Sewer System Engineering Section
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INTRODUCTION

- Need for structure management
  - Aging infrastructure
  - Risk management
    - Planned vs. Emergency outages
  - Financial implications
STRUCTURE DETERIORATION Symptoms

- Visual signs of structural cracking
- Lining deterioration / falling off
- Sinkholes
- Rust spots
- Water leakage
- Material build up
- Odor issues
02 PROJECT BACKGROUND
**BACKGROUND**

- Upper Scioto West Interceptor Sewer (USWIS)
  - 30,000 linear feet tunnel
  - 4’ – 7’ diameter
  - 14 access shafts, between 14’ -90’ deep
  - 2 bio-filters – odor control
  - 2 flow monitors
  - Large service area
    - City of Columbus
    - City of Dublin
    - City of Hilliard
  - Asset Management
    - Construction completed in 1999
    - Annual shaft inspections
      » Requires special cage for manned entry
      » Access challenges
    - Bio-filter rehabilitation
PROBLEM SYMPTOMS

- Broken concrete at the base of the shafts
- Lining falling off
- Material build-up
- Water leaks evident along the shaft walls
- Cracks on the shaft walls
03 CONDITION ASSESSMENT AND INSPECTION
INSPECTION SAFTEY

- Confined Space Entry
  - Documentation
  - Three man crew + City cage operator

- Safety Plan
  - Inspection Procedure
  - Contact Information
  - Emergency Plan
  - Nearest Hospital

- Personal Safety Equipment
CITY OF COLUMBUS
UPPER SCIOTO WEST INTERCEPTOR SEWER
INSPECTIONS PERFORMED

- Visual site inspection
- Visual shaft inspection
  - City assisted with use of their inspection cage
- Sounding
- Schmidt Hammer testing
- Isopleth testing
- Concrete cores removed and petrographic analysis
Inspections Performed

Isopleth Testing

Concrete Cores Removed for Testing

Schmidt Hammer Testing

Visual Inspection
Petrographic Analysis

- Concrete cores removed from 6 shafts
- Surface analysis performed
  - Signs of chemical attack
    - Sulfuric Acid
    - Sulfate
  - Reduction in surface material
  - Calcite and gypsum deposits present
    - Water intrusion
- Cement paste tests
  - Cement beyond the surface in good shape
- Compressive strength tests
  - Results varied between 6,630 and 10,400 psi
Inspection results

- Shafts placed in four categories based the inspection results
  - Minor Damage
    - Shaft door corrosion
    - Minimal loss of protective lining
  - Moderate Damage
    - More severe corrosion/cracking/lining/localized damage than Minor Category
    - Some water intrusion
  - Significant Damage
    - More severe corrosion/cracking/lining/localized damage than Moderate Category
    - Multiple areas of water intrusion
    - Some structural damage
  - Major Damage
    - More severe corrosion/cracking/localized damage than Significant Category
    - Structural damage that could cause failure

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<th>Shaft Number</th>
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Site Inspection results

- Each shaft site was inspected for access ease.
- To gain access to the shafts a heavy trailer carrying the inspection cage must be backed up to the shaft access hatches.
- Many of the access hatches are in grass or low lying areas that cannot be accessed during wet conditions.
04 DESIGN CONSIDERATIONS
Site Recommendations

- Provide access pads to 10 shafts to allow for access in any condition
  - Costs range between $20,000 - $80,000 per site
- Fix all access hatches
- Coordinate site improvements with appropriate agency
  - City of Columbus
  - Franklin County
  - City of Hilliard
  - City of Dublin
Site Access Pad Considerations

- Structural
- Ascetics
- Cost
- Installation
- Durability
Shaft Recommendations

- Recommendations were given depending on the damage category the shaft inspection dictated
- Annual inspections were recommended for all shafts
  - Minor – 1 Shaft - $10,000 per shaft
    - Hatch repair and painting
  - Moderate- 2 Shafts - $40,000 – per shaft
    - Same as Minor
    - Spot crack/concrete repair
    - Lining installed around all joints/cracks/pipe penetrations
  - Significant – 10 Shafts - $100,000 – per shaft
    - Same as Moderate
    - Spot crack, concrete and structural repairs
    - New lining in the entire shaft
  - Major – 1 Shaft - $200,000 per shaft
    - Same as Significant
    - Extensive concrete structural repairs
Lining Considerations

- Corrosion resistance
- Shaft humidity
- Water intrusion
- Structural requirements
- Past performance within the City
- Lining Manufacturers
  - SprayWall by SprayRoq
  - PolySpray FS-250 by HydraTech
  - SewerGard No. 210S by Sauereisen
Project Details

- New lining of 13 shafts
- Access to 10 sites improved with new concrete pavers
- Hardware replacement and new painting of all access hatches
- Shaft 11 concrete base rehabilitation
- Concrete repair to all cracks, hollow areas, exposed rebar
- Chemical grout injection for water intrusion
05 CONCLUSION - TAKEAWAYS
CONSTRUCTION

- Construction to begin in 2017
- Project Cost $1,961,000
- Contractor
  - Sunesis Construction Company
CONCLUSION - TAKEAWAYS

- There are many benefits to managing underground structures
  - Risk Management
    - Avoid costly emergency by-pass pumping and repairs
    - Prevents sink holes – pedestrian safety issues
    - Prevents debris from getting into the system
  - Scheduling Inspection
    - Easier access for inspections of the shafts and the tunnel
    - Easier access for future tunnel rehabilitation projects
  - Financial Planning
  - Extend the useful life of your assets
    - Cost savings from delayed new construction
    - More bang for your buck
ACKNOWLEDGEMENTS

CITY OF COLUMBUS
- MATT PANKO, PE
- JEREMY CAWLEY, PE
- GEORGE MEYERS, PE

HDR
- JENNIFER FROMMER, PE
- GREG MIECZKOWSKI
- RICHARD POUSARD, PE
- GREG FROST, PE
- STEVE FOX, PE
- MIKE PAINE, PE
- ANDREW HUNTER, PE
- AARON PUMMELL

CHESTER ENGINEERS
- ROGER HARRIS, PE
- MATT KIEFER, PE
- JOSHUA BROOKS, PE

CRT – CONCRETE RESEARCH & TESTING
- NICK SCAGLIONE
THANK YOU

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QUESTIONS?