Comprehensive Manhole Assessment & Rehabilitation Program – Fond du Lac Case Study

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Sanitary Manholes are Often “Out of Site and Out of Mind…”

…But They Shouldn’t Be!

Same Manhole, After Rehabilitation

Presentation Overview

- Background
- Manhole Assessment and Rehabilitation Project Drivers
- Summary of Assessment Process
- Rehabilitation Products and Processes
- Manhole Condition Summary
- Project Costs
- I/I Removal and Cost-Effectiveness
- Lessons Learned

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City of Fond du Lac

- Population: ~43,000
- ~4,100 Manholes
- Several Connections from Outside Sewer Group (OSG) Communities
- Relatively High Groundwater

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Background

- SSES Completed in 2005.
- Manholes Likely Contributing Significant I/I
- Need for Comprehensive Manhole Assessment and Rehab

Manhole Assessment and Rehabilitation Drivers

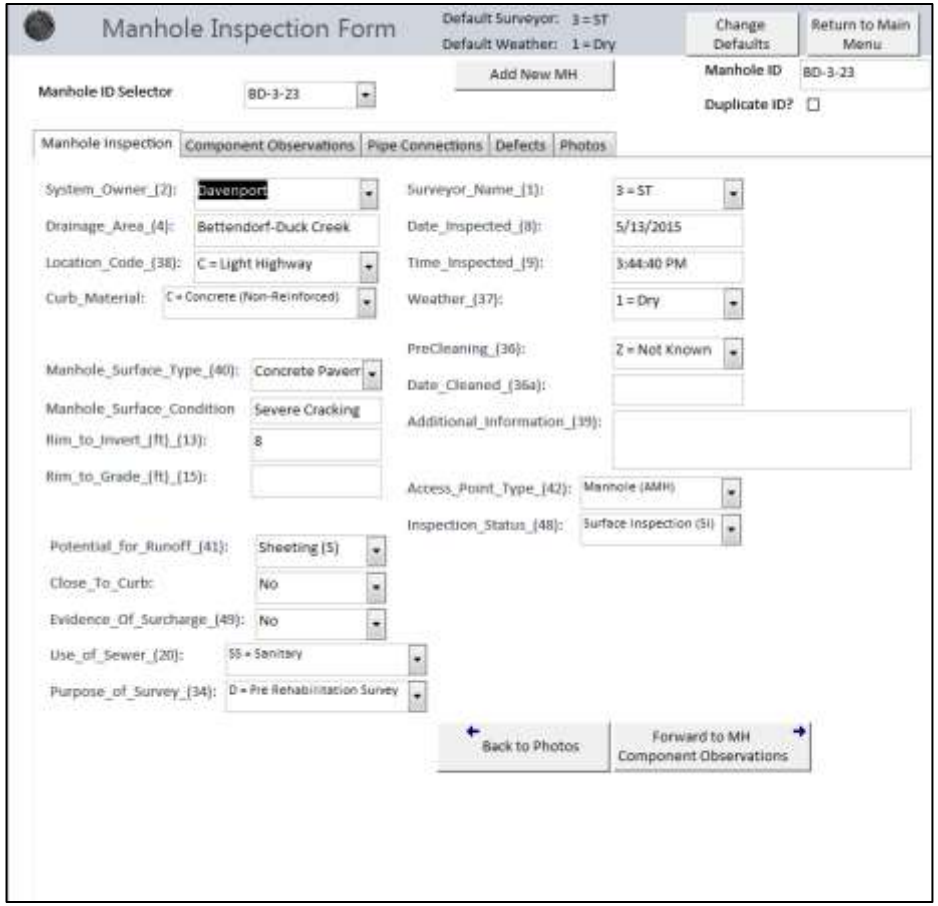
- Structural Deterioration – High Priority in Initial Years.
- I/I
- Corrosion

Manhole Assessment Program Development

- MACP
- Standardized process which results in uniformity of observations
- What information do we need to set up a rehab program?
- What additional information do we want to capture?
- Efficient assessments
- Assessment procedures were modified as program progressed

Assessment Process

- Standardized forms
- Microsoft Access Database
- Tablet Computer
- 1 Person (where possible)
- Overall rating for quick prioritization
- Rehab Recommendations from Field



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Manhole Rehabilitation – No One Size Fits All Solution

- Structural vs. I/I vs. corrosion?
- Life of rehabilitation product
- Cost $$
- Established process/product?
- Existing materials
- Location
- Majority of manholes can be rehabilitated.

Cover and Gasket Replacement

- Differing types
- Cover cannot be too worn
- Prep important!
- Marginally successful

Top Replacement

- Brick vs precast cone?
- Compaction – consider flowable fill
- New chimney rings

Cured-In-Place Chimney Liner

- Geometry of chimney

Hand Applied Chimney Liner

- Accommodates changes in chimney geometry
- Prep work, application methods
- Timing of application depends on manhole construction

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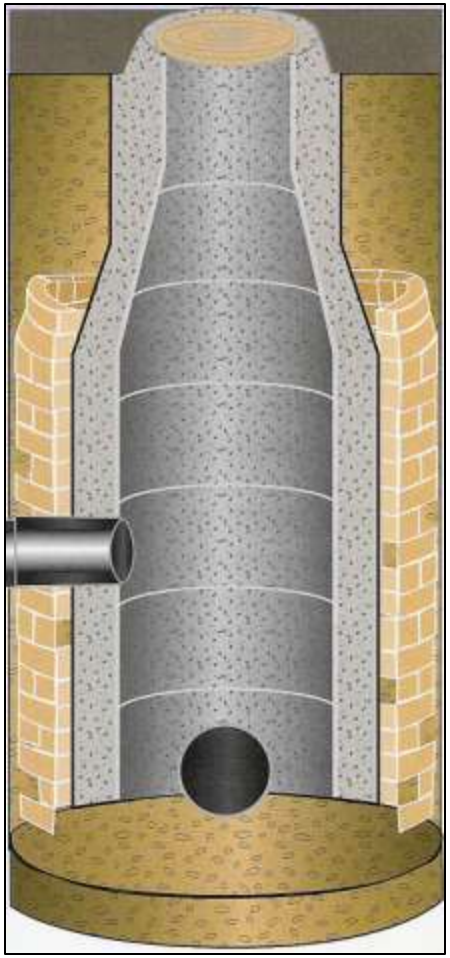
Cementitious Liners

Credit: Kim Construction Company, Inc.

- Differing materials
- Application methods

Cast-In-Place Manhole



Credit: Hydro-Klean

- Existing manhole serves as exterior form
- Minor excavation required

Bench/Channel Reconstruction

Chemical Grouting

Credit: Great Lakes TV Seal, Inc.

- Differing grout materials
- Differing techniques

Credit: Great Lakes TV Seal, Inc.

Replacement vs. Rehabilitation

- Rehab cost > replacement?
- Consider non-monetary factors
  - Location
  - Duration of construction
  - Compaction
  - Expected life of manhole
- Depth

Depth	Approximate Replacement Cost
<4 feet	$6,000
4 to 6 feet	$7,000
6 to 8 feet	$8,500
>8 feet	$10,000+

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Construction Observation/Testing

- Verify prep work – Very important for coatings
- Thickness
- Continuity of coatings – holiday testing
- Compressive strength
- Adhesion testing
- Manufacturer's directions!

Manhole Condition Summary

Overall Condition Rating	1 – Very Bad	2 – Poor	3 – Average	4 – Good	5 – Excellent	Mean
Pre-Rehab	47	279	1,079	1,237	1,423	3.9

- All 1's, and 2's rehabilitated
- 476 3's rehabilitated

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Project Costs

Year	2010	2011	2012	2013	2014	2015	2016	Total
Total MH's	92	123	175	203	177	111	84	**802**
Total Cost ($)	255,249	429,238	454,921	321,435	263,038	144,833	172,640	**2,041,354**

- Overall Average Cost per MH = $2,545

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I/I Removal Estimates

	Low End	High End
Total I/I Removed (2010-2014)	929 gpm	3,116 gpm
Total MH Rehab Cost (2010-2014) ($)	1,723,881	
Actual Unit Cost of I/I Removal (2010-2014)	1,855 $/gpm	553 $/gpm
SSES Cost-Effective I/I Removal Threshold (adjusted)	860 $/gpm	

- Significant portion of rehab was required, regardless of I/I

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Lessons Learned - Assessments

- Manholes differ in each community
- Overall ratings and rehabilitation recommendations are most valuable
- Efficiency!
- Photos!
- Take notes of anything out of ordinary

Lessons Learned - Rehabilitation

- Robust specification
  - Contractor/product experience
  - Prep work requirements
  - Testing
- Diligent record keeping is a must!
- Consider extended warranty

Questions?

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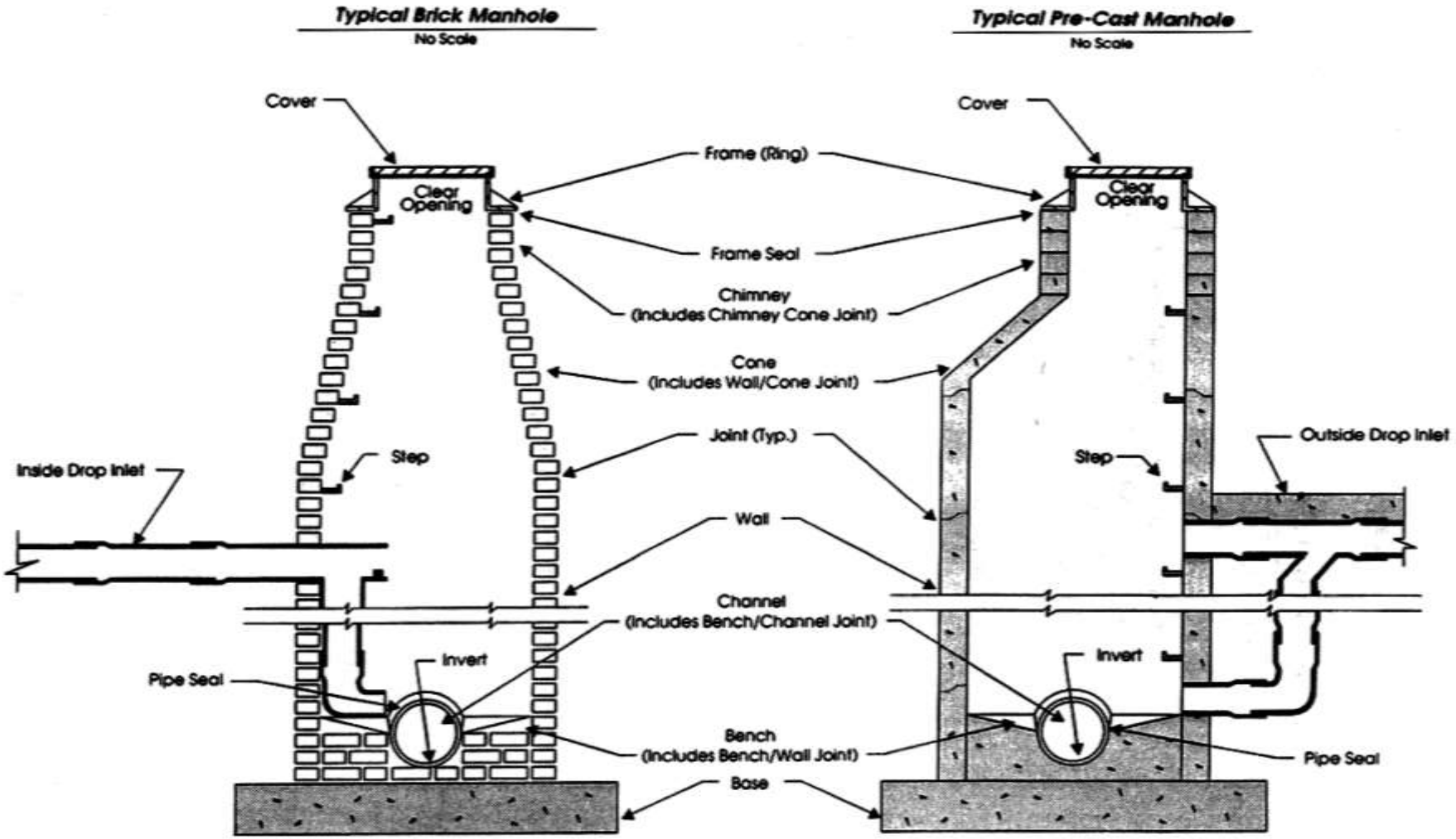
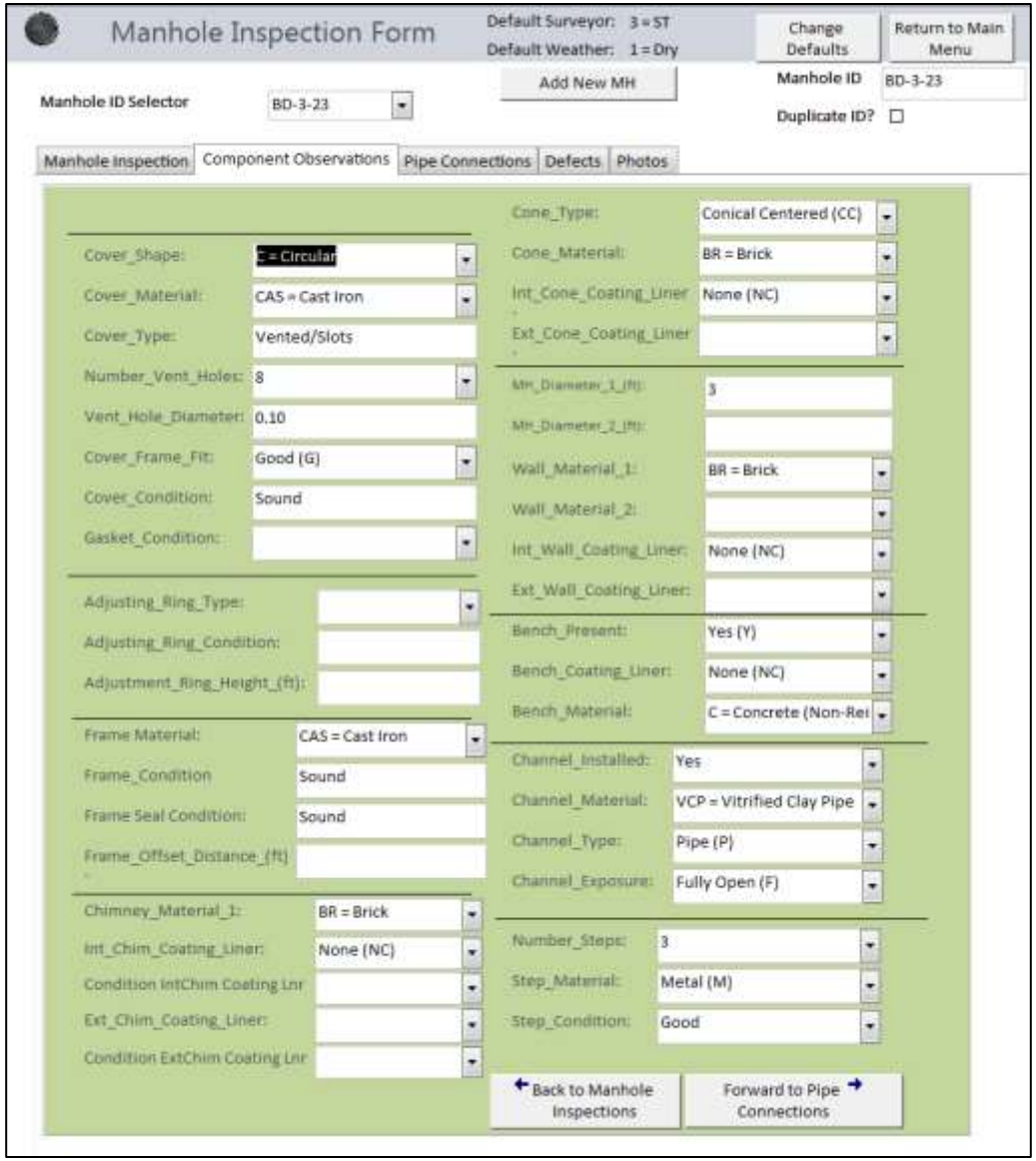
Manhole Diagram



Manhole Component Form



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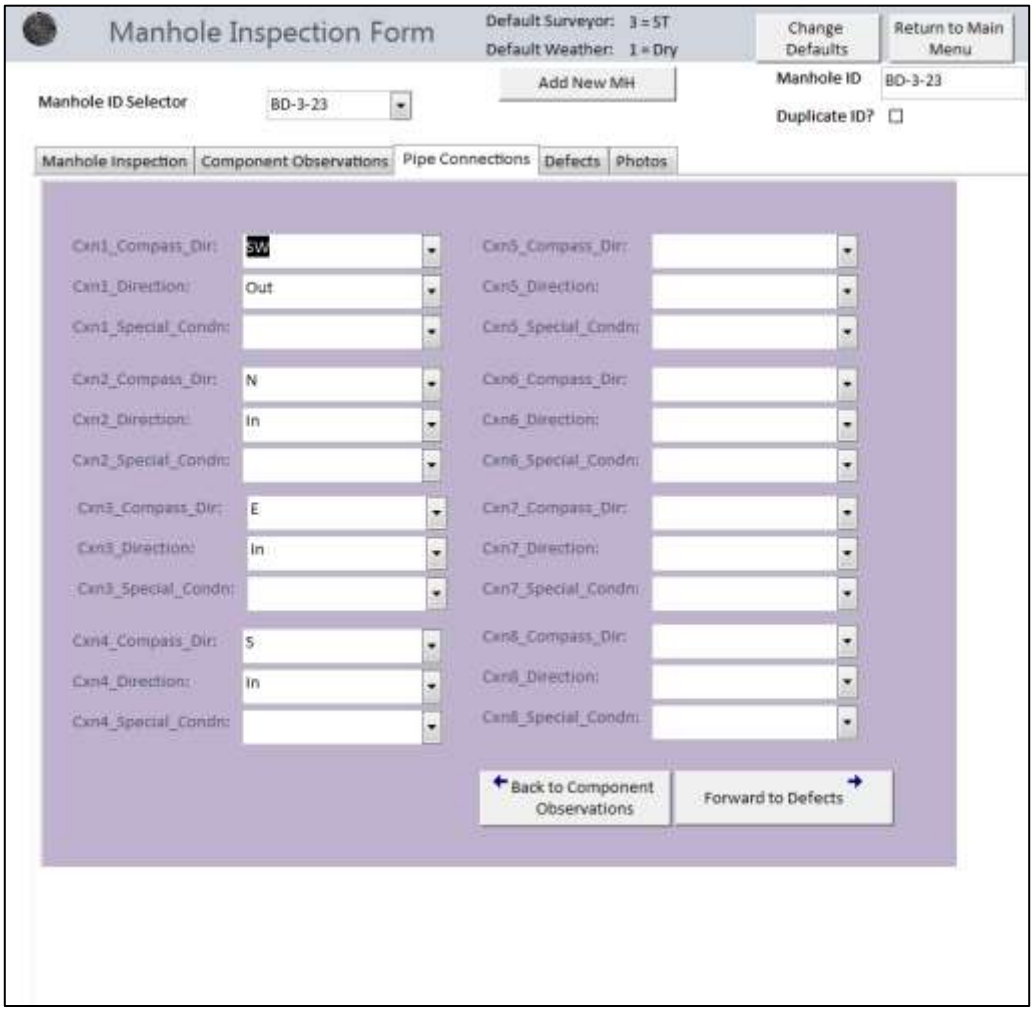
Pipe Connections Form



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Defects Form

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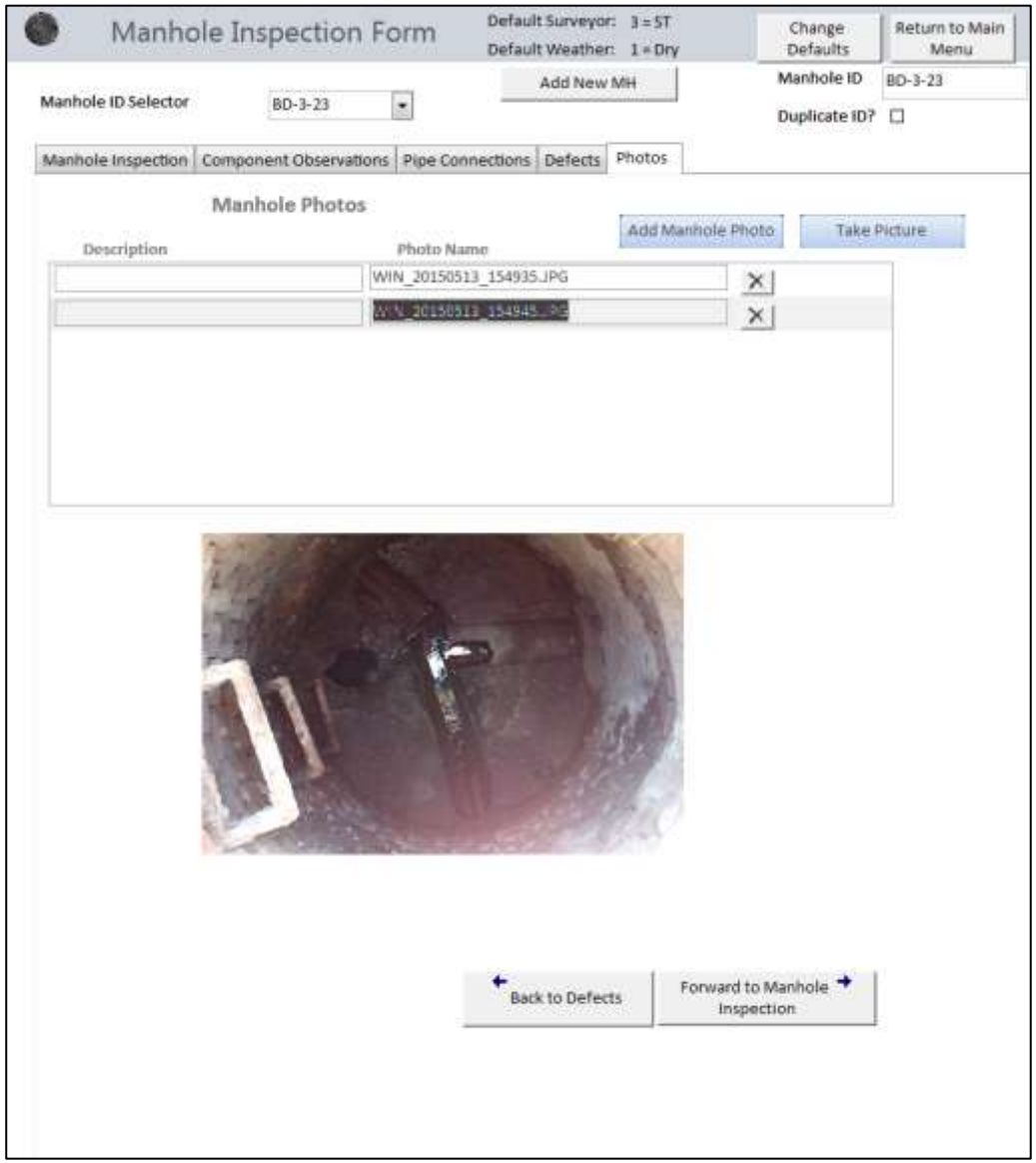
Photos Form


Manhole Inspection Form
Default Surveyor: 3 = ST
Default Weather: 1 = Dry
Change Defaults
Return to Main Menu
Add New MH
Manhole ID
BD-3-23
Manhole ID Selector
BD-3-23
Duplicate ID?
Manhole Inspection
Component Observations
Pipe Connections
Defects
Photos
Manhole Photos
Add Manhole Photo
Take Picture
Description
Photo Name
WIN_20150513_154935.JPG
Back to Defects
Forward to Manhole Inspection

Other Cover Rehabilitation

- Plug pick holes
- Frame gasket
- Inflow dish
- Replace!

Credit: The Man Pan

Credit: Cretex Specialty Products

Internal Mechanical Chimney Seal

Credit: Cretex Specialty Products

- Chimney geometry
- Easily verifiable during construction

Credit: Sealing Systems, Inc.

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External Chimney Seal

Credit: Cretex Specialty Products

- Chimney geometry
- Mechanical vs. heat shrink vs. adhesive

Credit: Sealing Systems, Inc.

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Epoxy Coatings

Credit: Kim Construction Company, Inc.

- Several different types
- Corrosion protection
- Prep work!!!

Modified Polymer Skin Panel

Credit: Spectrashield

- Several different types
- Corrosion protection and I/I
- Prep work!!!

Structural Polyurethanes

- Several different types
- Corrosion protection, I/I, structural

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PVC and HDPE Liners

Credit: Predl Systems

- Rehabilitation or new construction
- Custom fit

Full Depth CIP Lining

Credit: LMK Technologies

- Custom fit liner
- Corrosion protection
- Structural

Credit: LMK Technologies

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Channel Lining Systems

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