Integrate CCTV data to enterprise GIS work flows

Otay Water District
Introduction

• Background of Otay Water District
• GIS at Otay
• CCTV for Sewer Collection System
• Integrate CCTV and Inspection data with GIS
• NASSCO standard (PACP, MACP and LACP) rating in GIS and for Asset Management
• Inter-department workflows
Otay Water District

South San Diego County, California
125.5 square miles,
52,000 customers
- Potable
- Recycle
- Sewer

Second largest in San Diego County.
Only District with lands for future development
GIS at Otay

- Data collection – Survey grade
- ArcGIS suite as the platform
- Enterprise GIS architecture design
- Data models
- Applications
- System integration
- Workflows
SCADA Integration

GIS Development Timeline

- 2001: Conversion from Paper/CAD
- 2005: User Needs Analysis, Data Model Design, Cluster Server ArcSDE Storage
- 2007: Business Analysis for Mobile GIS, New Facilities Update and Redline
- 2009: Business Analysis for Data Update
- 2011: Permit Integration, Permit Integration
- 2013: SCADA Integration, CMMS Integration Cityworks, AVL GPS Insight, Dig-Alert Dig Smart

Data:
- Conversion From Paper/CAD
- Atlas Book
- Mobile GIS
- As-built Viewer
- E-facility book
- Dashboard Viewer
- Asset Management Data

Process:
- User Needs Analysis
- System Architecture Design
- Business Analysis for Mobile GIS
- Asset Management Interview

CAD, Shapefile, Personal Geodatabase, Enterprise Geodatabase
CCTV (Closed-Circuit Television)

Inspection and Condition Assessment - Before

- Multiple Contractors for different time periods.
  - Different rating systems
  - Different reporting systems
- Lack of access for District staff - video files were stored at district server
- Lack of QAQC
CCTV Inspection and Condition Assessment - Current
GIS data as the foundation

• District CCTV van with computer equipment and CCTV camera

• Unique ID was assigned to each pipe segment in GIS

• ArcReader application and CCTV interface/data management software (POSM) were installed in the van’s computer

• GIS data was exported as the foundation to inspect the pipes
Operation to collect the inspection data

- Locate the pipe through ArcReader
- Prepopulate pipe information from GIS automatically
- Enter the inspection info into POSM
- POSM controls the CCTV camera
- Observations are entered
- PACP and MACP codes are automatically populated
### POSM - Custom

**Project:** NORTH DOUGLAS VILLAGE 4

**Asset ID:**

**Manhole:** 330227M23 to 330227M11

**Direction:** Forward

**Location:** THORNBERG

**Time:** 9/13/2006 12:54:00 PM

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**Resume Selected**

**Start New Session**

**Hansen / Neztek Manager**

**Print Reports for Selected**

**Database Template Editor**

**Observation and Code Editor**

**Delete Selected Session**

**Import CSV GIS Data**

**Export GIS and HTML Data**

**Modify Session Information**

**Import POSM Data**

**Import Nassco Pacp Data**

**Database Connection Manager**

**ReSync Database**

**Edit Preferences**

**Session Management**

**Exit Posm**
Synch field data to GIS server

• Schedule the CCTV van to connect to network
• Synchronize the newly collected records into server database
• Maintain the database in the van periodically.
POSM server based database

- SQL server based
- Use FacilityID as the unique key
- Create a unique URL for inspection report for each segment
- Adopt the NASSCO rating standard
NASSCO standard for sewer system

- **NASSCO** - National Association of Sewer Service Companies
- Adopt the NAASSO Standard across the board
  - Operation
  - Engineering
  - Asset Management program
- Promote Training and Certification Program in the District
  - Pipeline Assessment and Certification Program (PACP)
  - Manhole Assessment and Certification Program (MACP)
  - Lateral Assessment and Certification Program (LACP)
### Section 4—Continuous Defect Coding

**"TRULY" 4-1**
- Truly continuous defects run along the sewer without any interruption for more than three feet (1 meter).
- Examples:
  - Longitudinal Fractures
  - Longitudinal Cracks

**"REPEATED" 4-1**
- Repeated continuous defects occur at regular intervals along the sewer.
- These occur at pipe joints and include:
  - Encrustation
  - Open Joints
  - Circumferential Fractures

### Code Changes in Version 6.0.1
- Added: Buckling Wall (KW), Buckling Dimpling (KD), and Buckling Inverse Curvature (KI)

### Section 5—Structural Defect Coding (Module 6A)

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Module 5.31</th>
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<tbody>
<tr>
<td>C</td>
<td>Crack</td>
<td>5-1</td>
</tr>
<tr>
<td>CL</td>
<td>Longitudinal</td>
<td>5-2</td>
</tr>
<tr>
<td>CC</td>
<td>Circumferential</td>
<td>5-2</td>
</tr>
<tr>
<td>CM</td>
<td>Multiple</td>
<td>5-2</td>
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<tr>
<td>CS</td>
<td>Spiral</td>
<td>5-2</td>
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<tr>
<td>CH</td>
<td>Hinge</td>
<td>5-2</td>
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<tr>
<td>S</td>
<td>Surface Damage</td>
<td></td>
</tr>
<tr>
<td>SRC</td>
<td>Reinforcement</td>
<td></td>
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<tr>
<td>SAV</td>
<td>Aggregate</td>
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<tr>
<td>SAV</td>
<td>Visible</td>
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<tr>
<td>SAV</td>
<td>Aggregate</td>
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</tr>
<tr>
<td>SAV</td>
<td>Visible</td>
<td></td>
</tr>
<tr>
<td>SMW</td>
<td>Missing Wall</td>
<td>5-32</td>
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<tr>
<td>LZ</td>
<td>Liner</td>
<td></td>
</tr>
<tr>
<td>WF</td>
<td>Welding Failure</td>
<td></td>
</tr>
<tr>
<td>RP</td>
<td>Point Repair</td>
<td></td>
</tr>
<tr>
<td>BF</td>
<td>Brickwork</td>
<td></td>
</tr>
</tbody>
</table>

**Updated November 2010**
NASSCO Rating / Scoring System

- Structural Scoring
- Operational and Maintenance Scoring
- Number of Defects
- Pipe Rating
- Ratings Index

<table>
<thead>
<tr>
<th>Grade</th>
<th>Structural</th>
<th>O&amp;M</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>12</td>
<td>12</td>
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<tr>
<td>3</td>
<td>6</td>
<td>0</td>
<td>6</td>
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<td>2</td>
<td>418</td>
<td>58</td>
<td>476</td>
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<tr>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Overall</td>
<td>425</td>
<td>70</td>
<td>495</td>
</tr>
</tbody>
</table>

Number of Defects | 212 | 32 | 244
Pipe Rating       | 322Z| 432E| 4332
Pipe Ratings Index| 2   | 2  | 2
Operation preventive maintenance

- Schedule the cleanup using the condition score
- Target more on the known area for high frequent maintenance
- Notify the property owner for lateral cleanup
- Develop a rehabilitation and replacement plan based on the inspection data
- Budget the replacement based on the condition score
Engineering Capital Improvement Plan

- Access the CCTV data through GIS viewers
- Access the observation report through GIS viewers
- Produce critical pipe segment report
- Asset Management Program
<table>
<thead>
<tr>
<th>Distance</th>
<th>Fault Observation</th>
<th>Time</th>
<th>Picture</th>
</tr>
</thead>
</table>
| 87.1     | Water Mark  
Severity: None  
Percent: 20 | 4:10 | ![Image](image1.jpg) |
| 134.4    | Alignment Left  
Severity: None  
Percent: 10  
Remarks: Slight bend to left  
Maint Weight: 1 | 06:12 | ![Image](image2.jpg) |
| 143.4    | Camera Underwater  
Severity: None  
Cont Defect: S02  
Maint Weight: 4 | 06:52 | ![Image](image3.jpg) |
| 160.9    | Camera Underwater  
Severity: None  
Cont Defect: F02  
Maint Weight: 4 | 08:03 | ![Image](image4.jpg) |
Project Name:

Date: 5/23/2013 1:34:00 PM
Street: 1112 Cadogann dr.
Length Surveyed: 212.1
Pacp Quick Overall Rating: 4C11
Height (Diameter): 8
Street: 1112 Cadogann dr.

Facility ID: MH-377-001, MH-377-003
Upstream MH: MH-377-001
Downstream MH: MH-377-003
Direction of Survey: Downstream
Material: Polyvinyl Chloride

ID Number: MH-377-001

(0.0) AMH - Manhole Remark: CCTV Downstream
(0.0) MWL - Water Level

(87.1) MWL - Water Level Sag - Cont Def: S01 Remark: Start of sag
(87.1) MWM - Water Mark

(134.4) LL - Alignment Left Remark: Slight bend to left
(143.4) MCU - Camera Underwater - Cont Def: S02

(160.9) MCU - Camera Underwater - Cont Def: F02
(163.8) MWLS - Water Level Sag - Cont Def: F01 Remark: Start of sag

(210.3) MGO - General Observation Remark: Connection to manhole looks good
(212.1) MGO - General Observation Remark: Base of Manhole looks good
(212.1) MGO - General Observation Remark: Looking up to Manhole cover looks good
(212.1) AMH - Manhole Remark: End of inspection

Total Distance: 212.1

ID Number: MH-377-003
<table>
<thead>
<tr>
<th>Saved Reports for the Current Session</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title Page</td>
</tr>
<tr>
<td>Observation (Fault) Page</td>
</tr>
<tr>
<td>Plot of the Pipe</td>
</tr>
<tr>
<td>List of the Captured Video</td>
</tr>
<tr>
<td>Defect Header and Codes</td>
</tr>
<tr>
<td>Additional Reports</td>
</tr>
<tr>
<td>Folder</td>
</tr>
<tr>
<td>--------</td>
</tr>
</tbody>
</table>
Conclusion and Future plan

- Leverage GIS and other new technology to manage the traditional utility maintenance program
- Integrate with Field Mobile GIS application (InfraMap)
- Integrate with Sewer Master Plan
- Integrate with CMMS
- Asset Management
Thank You!

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