SARBS – Collections Training Seminar  Jan. 26, 2012

CCTV – Sewer Imaging Technology Update

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Telespection by Halliburton – 1966-67
**United States Pipe Market**

- Large Diameter Pipelines: 40,000 Miles
- Mid-Diameter Pipelines: 80,000 Miles
- Small Diameter Pipelines: 600,000 Miles

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Length</th>
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<tr>
<td>&gt; 36”</td>
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<tr>
<td>15” – 33”</td>
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<tr>
<td>6” – 12”</td>
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**What are you trying to accomplish?**

- How many of you are involved with collecting sewer inspection images?
- Why are you CCTVing sewers?
- What technologies / cameras do you use?
- How did you select the technology?
- How do you determine if you are successful?
- Have you established key performance indicators (KPIs)?
Today’s “Conventional” CCTV System

- Color, seldom use black & white
- Pan, Tilt, Rotate, seldom use fixed fisheye lens
- Zooming capabilities (optical and/or digital)
- 1,000-1,500 lf of cable, typical
- Non-steerable or steerable, options
- Greatest percentage of systems are setup to inspect pipelines from 6” to 24” (maybe 30”) diameter
- Systems available for inspection of large diameter pipelines say, d>30”-36” diameter, but they require additional equipment such as hoists, pneumatic wheels, scissor lifts, floats, increased lighting, etc.

WEFTEC 2011 - Exhibitor Search

- Pipe and Collection Systems > Pipe/Sewer Inspection Equipment

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<tr>
<th>Company</th>
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<tr>
<td>Ottawa Underground</td>
<td>1628, Hall C</td>
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<tr>
<td>Cues Inc</td>
<td>1127, Hall B</td>
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<tr>
<td>Inland Pipe Rehabilitation</td>
<td>3255, Hall E</td>
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<td>2440, Hall D</td>
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<td>2231, Hall D</td>
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<td>SPS</td>
<td>4351, Hall F</td>
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<tr>
<td>Superior Signal Company LLC</td>
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Pole Mounted Zooming Camera Pole Mounted Zooming Camera Pole Mounted Zooming Camera Pole Mounted Zooming Camera
Pipeline Pipeline Pipeline Pipeline
Manhole Inspection Alternative Manhole Inspection Alternative Manhole Inspection Alternative Manhole Inspection Alternative

- Manufacturers claim inspection distances anywhere between 50 to 400 feet from access structure
- The brighter the lighting, the better the lens, the better the images
- Possible to eliminate pipelines from further full access inspection

Video Inspection of Manholes and Pipelines

- asphalt
- missing bricks
- offset second section
- crack
- broken rungs
- infiltration
- roots
- infiltration at joint
- collapsed pipe
- circle crack
- longitudinal crack
- joint with roots
- open joint
- offset joint
- A
- A'
- 360°
Pipeline Inspection with Pole Mounted Zooming Cameras

MH Inspection Camera - Digital CCTV

IBAK’s Panaromo MH Camera
• Digital 3D Optoscaner
• All-round manhole scanning
• Pan and rotate direction of view
• Inspection speed of ~ 1 ft/sec
• Data analysis in vehicle or office
• For manholes of any depth
If the Pipes Are Large Enough, Entry is an Option for Inspection

What Do We See With Zoom Cameras?
If the Pipes Aren’t Large Enough for Entry, What are the Options for Inspection?

CCTV is the most widely available and used sewer pipeline inspection option today.

Newer Types of Tracked Transporters
Newer Types of Wheeled Transporters

Newer Floating Platform Transporter Options
Used in Pipes Too Full to Drive Through
New Long-Range Transporters

Inspection Distances of 5,000 to 7,000 feet are now an option for pipes as small as 12” diameter.

Mainline and Lateral Inspection Options

LAMP II
Lateral & Mainline Probe II
Laser Diodes & Video Caliper Measurement

Laser Diodes combine the latest laser beam technology with an advanced digital video caliper for measuring pipe joints, cracks, defects, debris and other abnormalities within the pipeline.

360° Digital Video Optical Scanning

Optical Visual Scanning
- Inspection above water surface in pipe
- Record of 100% of pipe surface
- Advantages
  - Enhanced defect classification
  - Defects are Measurable
  - Enables future defect classification comparison and trend analysis
  - Manufacturers claim faster than CCTV

360 degree scanned image
Cylindrical scan to flat image
User Selects View of Pipe from Visual Scan Data

Observations highlighted on Side and Front View seen in thumbnail view

2D Plan View of Pipeline

User Selects View of Pipe from Visual Scan Data

[Image of visual scan data with highlighted observations]
Autonomous Digital Scanning
CCTV Robot Suitable for 6”-12” Pipes

Laser Scanning – A Simple Concept

- Performed in conjunction with CCTV, with lights turned low or off
- Ring of laser light is projected onto the internal pipe surface for inspection above the flow surface
- Laser image is in the field of view of the CCTV camera while it moves thru the pipe
- Analysis is performed on the laser light ring to build a digital profile via dimensional measurements
- For use in real-time or with historic video records (VHS, CD, DVD)
- Measurement vs. Visual Inspection
Ring Laser (2D) Scanner – CCTV Add-on

Ring Laser (2D) Scanner – Stand Alone System

Cues, Pearpoint, Aries, Envisiosight, IBAK Panoramo, IPEK,
Laser Scanning in difficult CCTV Lighting

Laser Scanning Measures Pipe Dimensions

Determine Pipe Shape/Geometry
Laser Scanning Provides Measurements to Augment Visual CCTV Data

Laser Scan provides measurement of pipe material loss

CCTV with Laser Scan – Partially Full Pipe

CCTV and Laser Scanning work well in dry pipes for pipeline inspection above the water surface
Now's a great time to use Sonar Inspection Tools to inspect the pipeline below the water surface.

Data Presentation – Scan to Profile View
### Scan Data used for Corrosion Profile

<table>
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<tr>
<th>CITY - FILE NO. 4J</th>
<th>TOTAL FOOTAGE: 118.6</th>
<th>TOTAL STATIONS: 97</th>
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<tr>
<td>5.2 TO 106.0 FEET</td>
<td>CURRENT FOOTAGE: 106.0</td>
<td>CURRENT STATIONS: 93</td>
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<tr>
<td></td>
<td>DIAMETER = 66</td>
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**CROWN = 67.75**

**CORROSION LOSS IN INCHES:**
- < 0.1
- 0.1 - 0.4
- 0.4 - 0.8
- 0.8 - 1.2
- 1.2 - 1.6
- 1.6 - 2.0
- 2.0 - 2.4
- 2.4 - 2.8
- 2.8 - 3.2
- 3.2 - 3.6
- > 3.6

### Sonar Profiling below the Water Surface

- Sediment by Footage measurement
- Total Cumulative Sediment
- Capacity Loss due to Sediment
- Pipe Blockage Identification
- Pipe Shape

**SONAR sensor rotates 360 degrees**

**Distance measurement via time of flight**

**Pipe Sediment**

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**Sediment Avtmt**

**Sediment Avtmt**

**Sediment Avtmt**

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**Sediment Avtmt**

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**Ideal Shape**

**Deflected Shape**

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**Pipe Sediment**
Incline and Meander Units are Improving

- Blue indicates *Uncalculated* Incline (raw data includes bumps at joints, debris, cracks, etc.)
- Red indicates *Calculated* Incline, of Vertical Alignment
- Can be a difficult proposition in small lines

Multi-Sensor Inspection Options Available
Questions, Comments?

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