Effective Asset Management Planning through a Lifecycle Lens

Presented By: Jim Engfer and Andrew Foley
PWX Conference: Monday, August 29th, 2016

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Agenda

1 Introductions
2 Overview of Asset Management
3 Asset Inventory and Inspection
4 Asset Management Life Cycle Analysis
5 Case Studies
6 Questions and Answers
Overview of Asset Management

Seven Asset Management Questions

1. What do you own?
2. What is it worth?
3. What condition is it in?
4. What do we need to do to #?
5. When do we need to do it?
6. How much money do we need?
7. How will we pay for it?

- Determine system inventory
- Determine system value
- Determine Asset Condition
- Develop work requests (O&M/Capital)
- Prioritize and determine work schedule
- Develop and analyze life cycle cost profile
- Develop sustainable funding model
Asset Management Tactics

1. Define Network
2. Collect Data
3. Assess Present Status
4. Needs Analysis
5. Economic Analysis
6. Priority Programming

Asset Inventory and Inspections
Identification of Assets

**Major Assets**
- Sewers (Storm and Sanitary)
- Electric
- Water
- Streets

**Right of Way Assets**
- Sign inventory
- Pavement
- Traffic signals
- Guardrail
- Hydrants and valves
- Curb stops/services
- Sidewalks/ADA features

**Other Assets**
- Trees
- Trails
- Buildings
- Play areas
- Equipment

Document Assets

**Spatial Data**
- Paper maps
- Digital maps (CAD)
- Geographic Information Systems (GIS)

**Attribute Information**
- Static information
- Pipe size, material, etc.
- Dynamic information
- Inspections, maintenance, etc.
Collection of Asset Data

Methods
- Field data collection
  - Pen and paper
  - Survey equipment
  - Laptops/tablets
  - Smart devices
  - Cameras
- Scanned maps “rectified” to aerial imagery
- CAD drawings
- LIDAR (mobile and stationary)
- CCTV (inspections)
- Data submittal requirements

Inspection of Assets

Field Inspections
- Sanitary sewer
- Storm sewer
- Potable water systems
- Pavement, trails, sidewalks

Flow Monitoring

Sanitary Sewer Evaluation
- Smoke testing
- Dye tracing
- Basement evaluations

NPDES MS4 Outfalls

Facility Inspections

Bridge Inspections
System Condition Assessment

NASSCO Standards for Assessments
- Pipeline Assessment Certification Program (PACP)
- Manhole Assessment Certification Program (MACP)
- Lateral Assessment Certification Program (LACP)
- Standardized codes for deficiencies

Acceptable → Minimal Collapse Risk → Collapse Unlikely → Collapse Likely → Collapse Imminent

Zoom Camera
Mobile Imagery
- LiDAR
- Video (CCTV)

Document Work Performed
- Work orders
- Maintenance performed

Data Management Needs

Data Types
- Asset Inventory
- Asset Condition
- Planned Maintenance
- Capital Repairs
- Maintenance History
- Financials
  - Maintenance
  - Repairs
  - Replacement
  - Life Cycle costs
Where do the Data Types reside?

GIS – Spatial databases
Paper - Maps, reports, inspection forms
Spreadsheets – Inspections data, maintenance records
CMMS - Computerized Maintenance Management system
ERP – Enterprise Resource Planning
DMS – Document Management System
Business Intelligence

Asset Management Lifecycle Analysis
Life Cycle Analysis

Condition Assessment
- What is the condition of the asset?
- Micro-monitoring, CCTV
  - Condition codes
- Installation date
- Typical useful life
- Remaining service life

Know your Window of Opportunity...

<table>
<thead>
<tr>
<th>Condition</th>
<th>Life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor Maintenance</td>
<td></td>
</tr>
<tr>
<td>Major Maintenance</td>
<td></td>
</tr>
<tr>
<td>Rehabilitation</td>
<td></td>
</tr>
<tr>
<td>Replace</td>
<td></td>
</tr>
</tbody>
</table>
Timely Intervention is Key

Cost

Life

Minor

Major

Rehab

Replace

Typical Condition/Performance Assessment Parameters

I. Structural Condition
   • Visual Rating (CCTV)
   • Manholes
   • Age
   • Material properties

II. Hydraulic Properties
   • Capacity
   • Velocity

III. Environmental Impact
   • Environmental impact
   • Pollution
   • Health problems
   • Property damage
   • Extraneous flows

IV. Conformance to Standards
   • Manhole spacing
   • Minimum pipe size
   • Cover opening size

V. Strategic Importance
   • Sewer criticality
   • Neighborhood disruption

VI. Maintenance
   • Frequency
   • Cost
Dynamic Infrastructure Bubbles
Typical Distribution of Infrastructure by Age

- 0–25% of asset life
  - Minor Maintenance: 26% in 2013, 23% in 2038, 14% in 2063

- 25–50% of asset life
  - Major Maintenance: 37% in 2013, 26% in 2038, 23% in 2063

- 50–75% of asset life
  - Rehabilitation: 14% in 2013, 37% in 2038, 26% in 2063

- 75–100% of asset life
  - Replacement: 23% in 2013, 14% in 2038, 37% in 2063

Financial Analysis

**Total Capital Requirements = $ Lifecycle**

- ✓ Growth: 0.5% per annum up to 2031
- ✗ Engineering Cost: Included in TCAA Replacement Values
- ✗ Contingency: Included in TCAA Replacement Values
- ✗ Overhead & Admin
- ✗ Borrowing Costs

**Total O & M Requirements = $ Lifecycle**

- ✓ Growth: 0.5% per annum up to 2031
- ✗ Overhead & Admin

**Total O & M & Capital Requirements / Life Cycle = $**

[Annual Sustainable Funding Level]
Pavement Management Program
Napoleon, OH

Pavement Condition Survey

Images
- Continuous high-resolution digital images collected on the entire network (80 miles)

Surface Distress Data
- Various distress types were measured based on their severity ("how bad") and extent ("how much")
- Overall Surface Distress Index (SDI) was calculated
  - SDI of 100 (defect-free surface)
  - SDI of 0 (pavement with significant distresses)

Roughness Data
- Measured through the International Roughness Index (IRI)
- Results were summarized into a Riding Comfort Index (RCI)
  - 80-100 (smooth road)
  - 0-20 (very rough road)
Distress Data (SDI)

- Approximately 30%: poor condition
- Approximately 38%: fair condition
- Approximately 32%: good condition

Roughness Data (RCI)

- Approximately 12%: poor ride comfort
- Approximately 65%: marginal ride comfort
- Approximately 26%: good ride comfort

Note: Roughness does not play a significant role in the perceived condition of the road network on lower volume or lower speed roads. Roughness is usually “felt” on higher speed roads, like collectors and arterials.
Overall Condition

- Local Avg PQI = 50
- Collector Avg PQI = 60

Typically, higher volume/higher use roads have a higher level of service.

Excellant PQI 100
Appian Av (E Maumee Av – Short St)

Good PQI 80
Lemans Dr (Cape Dr – Duquesne Dr)

Fair PQI 60
Wayne Park Dr (W Riverview Ave – Co Rd M 1)

Poor PQI 10
Grenada Av (Glenswood Av – Darkeville Av)
### Need Year Results

Backlog is all roads that are currently below the PQI. Would cost $9M to clear the backlog.

<table>
<thead>
<tr>
<th>Year</th>
<th>Length (miles)</th>
<th>% Length</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>21.8</td>
<td>33.8</td>
</tr>
<tr>
<td>2016</td>
<td>1.7</td>
<td>3.0</td>
</tr>
<tr>
<td>2017</td>
<td>2.2</td>
<td>3.9</td>
</tr>
<tr>
<td>2018</td>
<td>2.5</td>
<td>4.4</td>
</tr>
<tr>
<td>2019</td>
<td>3.4</td>
<td>6.0</td>
</tr>
<tr>
<td>2020</td>
<td>2.8</td>
<td>5.0</td>
</tr>
<tr>
<td>2021</td>
<td>2.5</td>
<td>4.4</td>
</tr>
<tr>
<td>2022</td>
<td>1.9</td>
<td>3.4</td>
</tr>
<tr>
<td>2023</td>
<td>2.5</td>
<td>4.4</td>
</tr>
<tr>
<td>2024</td>
<td>2.0</td>
<td>3.6</td>
</tr>
<tr>
<td>2025</td>
<td>1.6</td>
<td>2.8</td>
</tr>
<tr>
<td>2026+</td>
<td>11.3</td>
<td>20.1</td>
</tr>
</tbody>
</table>

Backlog will continue to increase by $350,000 to $900,000 annually over the next 10 years if these roads are not fixed.

### Rehabilitation - Decision Trees

**Asphalt**

- Overband Crack Seal
- Fog Seal
- Mastic Surface Treatment
- Chip Seal
- SAMI
- Microsurfacing
- FiberMat
- 1" Standard HMA Overlay
- 1.5" Standard HMA Overlay
- Joint Repair
- Reconstruction

**Concrete**

- 0 - Do Nothing
- 1" Joint Repair

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Unit Cost ($/sq ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overband Crack Seal</td>
<td>$0.07</td>
</tr>
<tr>
<td>Fog Seal</td>
<td>$0.08</td>
</tr>
<tr>
<td>Mastic Surface Treatment</td>
<td>$0.17</td>
</tr>
<tr>
<td>Chip Seal</td>
<td>$0.28</td>
</tr>
<tr>
<td>SAMI</td>
<td>$0.33</td>
</tr>
<tr>
<td>Microsurfacing</td>
<td>$0.36</td>
</tr>
<tr>
<td>FiberMat</td>
<td>$0.46</td>
</tr>
<tr>
<td>1&quot; Standard HMA Overlay</td>
<td>$1.20</td>
</tr>
<tr>
<td>1.5&quot; Standard HMA Overlay</td>
<td>$1.70</td>
</tr>
<tr>
<td>1.5&quot; Mill &amp; Overlay</td>
<td>$2.00</td>
</tr>
<tr>
<td>Joint Repair</td>
<td>$0.50</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>$7.50</td>
</tr>
</tbody>
</table>
Economic Analysis

User definable decision trees and rehabilitation alternatives identifies most cost effective strategy

- Presents the benefit (jump/increase) of applying a specific treatment compared to the “No Action” scenario.

Economic Analysis Results

<table>
<thead>
<tr>
<th>Annual Budget</th>
<th>10-Year Total Cost</th>
<th>2016 Avg PQI</th>
<th>2025 Avg PQI</th>
<th>2016 %Backlog</th>
<th>2025 %Backlog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Annual Budget (~$300,000 Resurfacing + ~$400,000 Reconstruction)</td>
<td>$6.9 M</td>
<td>55</td>
<td>54</td>
<td>38%</td>
<td>50%</td>
</tr>
<tr>
<td>Maintain PQI 55 (~$425,000 Resurfacing + ~$75,000 Reconstruction)</td>
<td>$5.0 M</td>
<td>55</td>
<td>55</td>
<td>38%</td>
<td>47%</td>
</tr>
<tr>
<td>Increased Budget (~$400,000 Resurfacing + $400,000 Reconstruction)</td>
<td>$7.9 M</td>
<td>55</td>
<td>58</td>
<td>37%</td>
<td>44%</td>
</tr>
<tr>
<td>Unlimited Funding (~$810,000 Resurfacing + ~$500,000 Reconstruction)</td>
<td>$13.9 M</td>
<td>77</td>
<td>83</td>
<td>14%</td>
<td>3%</td>
</tr>
</tbody>
</table>
Economic Analysis Results by Functional Class

<table>
<thead>
<tr>
<th>Budget</th>
<th>10-Year Total Cost</th>
<th>2016 Avg PQI</th>
<th>2025 Avg PQI</th>
<th>2016 Backlog</th>
<th>2025 Backlog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Achieve Local 45</td>
<td>$1.6 M</td>
<td>49</td>
<td>45</td>
<td>43%</td>
<td>61%</td>
</tr>
<tr>
<td>Maintain Local 50</td>
<td>$2.0 M</td>
<td>50</td>
<td>50</td>
<td>42%</td>
<td>53%</td>
</tr>
<tr>
<td>Achieve Local 55</td>
<td>$2.6 M</td>
<td>50</td>
<td>55</td>
<td>42%</td>
<td>44%</td>
</tr>
<tr>
<td>Achieve Collector 55</td>
<td>$1.6 M</td>
<td>60</td>
<td>55</td>
<td>34%</td>
<td>48%</td>
</tr>
<tr>
<td>Maintain Collector 60</td>
<td>$2.2 M</td>
<td>60</td>
<td>60</td>
<td>43%</td>
<td>40%</td>
</tr>
<tr>
<td>Achieve Collector 65</td>
<td>$2.7 M</td>
<td>60</td>
<td>65</td>
<td>34%</td>
<td>32%</td>
</tr>
</tbody>
</table>

Treatment Recommendations
$400,000 Resurfacing + $400,000 Reconstruction

Note: It costs less to keep good roads in good condition.
Integrated into GIS

- Use to visualize the results/current condition of the street
- Use to develop thematic maps for PQL, Year of Need, Year Planned, etc.
- Ability to update and maintain the attribute data to allow for continued management and update

Asset Management Program

Mt. Pleasant, South Carolina
### Asset Portfolio – Stormwater

<table>
<thead>
<tr>
<th>Asset Component</th>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipes</td>
<td>806,052 ft.</td>
</tr>
<tr>
<td>Junction boxes</td>
<td>7,844</td>
</tr>
<tr>
<td>SWM ponds</td>
<td>20</td>
</tr>
<tr>
<td>Roadside ditches</td>
<td>55,507 ft.</td>
</tr>
<tr>
<td>Driveway culverts</td>
<td>20</td>
</tr>
<tr>
<td>Under drains</td>
<td>878,000 ft.</td>
</tr>
<tr>
<td>Catchbasins</td>
<td></td>
</tr>
<tr>
<td>Curb Inlet</td>
<td>6,365</td>
</tr>
<tr>
<td>Open channels/canal</td>
<td>25 miles</td>
</tr>
<tr>
<td>Yard inlets</td>
<td></td>
</tr>
<tr>
<td>Outfalls and control</td>
<td>20</td>
</tr>
<tr>
<td>structured</td>
<td></td>
</tr>
<tr>
<td>Isolation structures</td>
<td>20</td>
</tr>
<tr>
<td>Pumping station</td>
<td>1</td>
</tr>
<tr>
<td>structures and equipment</td>
<td></td>
</tr>
</tbody>
</table>

### Asset Portfolio – Roadways

<table>
<thead>
<tr>
<th>Asset Component</th>
<th>Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pavement Sections</td>
<td>35,913.52 ft²</td>
</tr>
<tr>
<td>Sidewalk</td>
<td>456,635 ft²</td>
</tr>
<tr>
<td>Curb</td>
<td>877,849 ft</td>
</tr>
<tr>
<td>Signs</td>
<td>8,800</td>
</tr>
<tr>
<td>Multi-use paths</td>
<td>10,560</td>
</tr>
<tr>
<td>Sound Walls</td>
<td>1</td>
</tr>
<tr>
<td>Signals</td>
<td>55</td>
</tr>
<tr>
<td>Pavement Markings</td>
<td>300,000 ft</td>
</tr>
<tr>
<td>Bridges (includes Culverts)</td>
<td>10</td>
</tr>
<tr>
<td>ADA Ramps &amp; Curbs</td>
<td>1,700</td>
</tr>
</tbody>
</table>
Storm Drainage

Total Asset Value - $375 million
$12,200 per household

Road System:
- Inventory
- Road Area: 29.7M ft²
- Bridges: 10
- Replacement: $180M
- Per served property: $6,200

The Visible Infrastructure

The Invisible Infrastructure

Water System:
- Not owned by Town

Storm System:
- Inventory
- Pipe Length: 606,000 ft
- Ditches: 315,000 ft
- Replacement: $153M
- Per served property: $6,000

Sanitary System:
- Not owned by Town
### Town of Mount Pleasant Infrastructure Report Card

<table>
<thead>
<tr>
<th>Asset Group</th>
<th>Rating 2011</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stormwater System</td>
<td>C+</td>
<td>In light of the fact that the Town of Mount Pleasant has experienced significant growth since the 1980’s it would be anticipated that the condition of these assets would be fairly good and in general it is felt that this is the case. It is recommended that investment is made in a comprehensive asset inventory and condition assessment program to confirm that this is the case. The significant future challenge facing the Town is ensuring that sufficient revenues are generated in the coming years to ensure that the necessary asset renewal projects can be adequately funded. The current funding levels represent approximately 15% of sustainable funding levels. Upcoming EPA regulations related to the National Pollutant Discharge Elimination System or NPDES will also place significant pressures on these budgets as they are implemented.</td>
</tr>
<tr>
<td>Road Network</td>
<td>C-</td>
<td>The road network is currently in good/ fair condition. However, the existing revenues available for the ongoing maintenance and operation of the network represent approximately 21% of the sustainable funding required to sustain the infrastructure. There is also a significant liability within the bridge inventory that needs to be addressed by providing funding for the necessary inspection and repair work that is required to ensure that these assets continue to provide an adequate level of service.</td>
</tr>
</tbody>
</table>

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**Cost-Effective Asset Management Means Wise Investments**

- **Doing the right thing**
- **To the right asset**
- **At the right time**
Without proper planning...
questions and answers

Jim Engfer
Jim.Engfer@stantec.com
(651) 604-4819

Andrew Faley
Andrew.Faley@stantec.com
(614) 486-4383