ADAPTIVE ASSET MANAGEMENT BASED ON DATA AVAILABILITY

NCTCOG Public Works Roundup – September 17th, 2020

Mike Garza, P.E. Assistant Director of Public Works, Coppell
Dexter May, P.E. Project Manager at Plummer Associates, Inc.
AGENDA

• Asset Management Basics

• The Spectrum of Electronic Data Availability

• Three Case Studies

• Coppell’s Current Database and Inspection Plan
“Asset management is the practice of managing infrastructure capital assets to minimize the total cost of owning and operating them, while delivering the service level customers desire.” - USEPA

\[
\text{Likelihood of Failure (LOF)} \times \text{Consequence of Failure (COF)} = \text{Risk}
\]
<table>
<thead>
<tr>
<th>Year</th>
<th>Inspect Segment Numbers</th>
<th>Total Distance (Linear Feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>1 to 134</td>
<td>45,553</td>
</tr>
<tr>
<td>2021</td>
<td>135 to 303</td>
<td>45,308</td>
</tr>
<tr>
<td>2022</td>
<td>304 to 447</td>
<td>45,591</td>
</tr>
<tr>
<td>2023</td>
<td>448 to 614</td>
<td>45,541</td>
</tr>
<tr>
<td>2024</td>
<td>615 to 791</td>
<td>45,530</td>
</tr>
<tr>
<td>2025</td>
<td>792 to 1,000</td>
<td>45,352</td>
</tr>
<tr>
<td>2026</td>
<td>1,001 to 1,193</td>
<td>45,518</td>
</tr>
<tr>
<td>2027</td>
<td>1,194 to 1,383</td>
<td>45,526</td>
</tr>
<tr>
<td>2028</td>
<td>1,384 to 1,593</td>
<td>45,521</td>
</tr>
<tr>
<td>2029</td>
<td>1,594 to 1,782</td>
<td>45,563</td>
</tr>
</tbody>
</table>
ASSET MANAGEMENT BASICS – COLLECTION SYSTEM

Likelihood of Failure (LOF)
- Age
- Material
- Condition

Consequence of Failure (COF)
- Proximity to:
  - Major roads
  - Water bodies
  - Size/Flow Capacity

Risk

Dependent upon Electronic Data
• Electronic representation of a collection system can vary significantly
### RANGE OF DATA AVAILABILITY

![Data Availability Chart](image)

<table>
<thead>
<tr>
<th>Tier</th>
<th>Georeferenced Location</th>
<th>Attributes(^1)</th>
<th>Condition Scores</th>
</tr>
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<tbody>
<tr>
<td>I</td>
<td>Maybe</td>
<td>&lt;50%</td>
<td>No</td>
</tr>
<tr>
<td>II</td>
<td>Yes</td>
<td>&gt;50%</td>
<td>No</td>
</tr>
<tr>
<td>III</td>
<td>Yes</td>
<td>&gt;90%</td>
<td>Yes</td>
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</tbody>
</table>

\(^1\) Includes diameter, age, and material
However, even a risk prioritization for a City in Tier I provides value.
CASE STUDY #1

**Location:** West Texas  
**Population:** >100,000  
**Collection System:** 700 miles  
**Data Availability:** Tier I

<table>
<thead>
<tr>
<th>Data</th>
<th>Available?</th>
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</thead>
<tbody>
<tr>
<td>Georeferenced Location</td>
<td>Some</td>
</tr>
<tr>
<td>Pipeline Diameter</td>
<td>90%</td>
</tr>
<tr>
<td>Pipeline Material</td>
<td>90%</td>
</tr>
<tr>
<td><strong>Pipeline Age</strong></td>
<td>0%</td>
</tr>
<tr>
<td>Condition Scores</td>
<td>No</td>
</tr>
</tbody>
</table>
• **Age** – Initially assigned based on development date of closest land parcel. Refined to match timeframe in which pipe material was typically installed.
  - Example: Asbestos Concrete Pipe installed between 1940 and 1970.

• **Condition** – Staff knowledge capture workshop scoring by grid
CASE STUDY #2 – COPPELL

Location: Coppell
Population: <50,000
Collection System: 220 miles
Data Availability: Tier II

Like Case Study #1, the condition of pipes in Coppell was estimated from a staff knowledge workshop.
CASE STUDY #3

Location: DFW Metroplex
Population: >100,000
Collection System: 500 miles
Data Availability: Tier III

<table>
<thead>
<tr>
<th>Data</th>
<th>Available?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georeferenced Location</td>
<td>Yes</td>
</tr>
<tr>
<td>Pipeline Diameter</td>
<td>100%</td>
</tr>
<tr>
<td>Pipeline Material</td>
<td>100%</td>
</tr>
<tr>
<td>Pipeline Age</td>
<td>100%</td>
</tr>
<tr>
<td>Condition Scores</td>
<td>30%</td>
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</table>

For cities in Tier III, more sophisticated models (machine learning) can be used to predict the condition of pipes that have not been inspected.
NOT ALL CITIES IN TIER III ARE EQUAL

Case Study #3

City of Tampa

Model Accuracy
64%

Model Accuracy
84%
COPPELL’S JOURNEY FROM TIER II TO TIER III
COPPELL’S GIS DASHBOARD

• Using the asset management data developed by Plummer, Coppell created a GIS dashboard to view water lines, wastewater lines, and roads in real time.

• The Dashboard is used to view and prioritize pipeline and road replacement.

• As field repairs and replacements are made, the GIS data is updated.
All data, specifically including the geographic and tabular data herein are provided “as is” without warranty of any kind, either expressed, implied, or statutory, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.
COPPELL’S INSPECTION PLAN

• The City teamed up with UT Arlington and RedZone Robotics

• Inspected a total of 300,000 linear feet of sanitary sewer pipe (26% of system)
  • 150,000 linear feet of 8 to 12-inch PVC
  • All non-PVC pipes greater than or equal to 15-inches
• Information collected from the inspections will be used in artificial intelligence models to predict the remaining life of the City’s pipelines that are 21” or larger.

• Inspections started in late April 2020. Report is expected in October 2020.

• Results will be used to develop CIP projects.
• Each City is at a different place along the spectrum of available electronic data.

• Surrogate data can be used for missing information.

• The sophistication and accuracy of an asset management plan increases in direct proportion to the amount of available electronic data.

• The accuracy of statistical models is dependent on a large, balanced dataset.

• Proactive planning leads to informed decision making and efficient resource allocation.
THANK YOU

Mike Garza, P.E. Assistant Director of Public Works, Coppell, mgarza@coppelltx.gov

Dexter May, P.E. Project Manager at Plummer Associates, Inc. dmay@plummer.com