Asset Management and Risk-Based Condition Assessment of Critical Linear Infrastructure

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CLIENT DIRECTOR

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## TODAY’S AGENDA

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>Why Asset Management?</td>
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<td>Asset Management Tools</td>
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<td>Condition Assessment</td>
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<td>Open Discussion</td>
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WHY ASSET MANAGEMENT?
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- Over the last several years, failures of various pipe lines have made the local and national news.
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WHY ASSET MANAGEMENT?

Road Closure, Boil Water Order, Infrastructure Damage
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Restriction for water-related activities on a
River and Intracoastal Waterway
Water activities in three cities affected
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WHY ASSET MANAGEMENT?
20 million gallons of raw sewage was discharged reaching surface waters

WHY ASSET MANAGEMENT?

- Many of the nation's linear infrastructure is approaching or have past their original design life expectancy
- Over the last several years, failures of various pipe lines have made the local and national news.
- Many of these failures became catastrophes of significant scale with grave social, economic, and environmental impacts
20 million gallons of raw sewage was discharged reaching surface waters
WHY ASSET MANAGEMENT?

How bad is my aging infrastructure?

Where’s the funding?

What do I do with all this data?

Is Capital or O&M my biggest issue?

Help!

Performance

Cost

Risk

How do I meet organizational goals?

Asset Management covers a W I D E area. So let’s organize this into something meaningful!
STRATEGIC DIRECTIONS IN THE US WATER INDUSTRY

- Survey 454 Water Utilities
- Major concerns and direction for each utility
- Questions track industry trends and evolve with the changing needs
- 70% expect “good practice” asset management in 3 years
INTEGRATED ASSET MANAGEMENT

1. Current State of Assets
2. Required Level of Service
3. Asset Criticality / Risk
4. Capital and O&M Budgets
5. Funding Strategy

- Performance
- Risk
- Cost
ISO 55001 – ASSET MANAGEMENT STANDARD

• International asset management standard published in January 2014
• Guidelines for good practice asset management
• Requirements for developing an asset management system (framework)
• Key principle that assets provide value to the organization and its stakeholders

ISO 55001 provides a framework for asset management
OPTIMIZING ASSET MANAGEMENT

- **Purpose**
  - Objectives
- **Value**
- **Assets**

- **Asset Management:**
  “The coordinated activities of an organization to realize value from assets”

- Realization of value requires optimization of performance, cost, and risk
ELEMENTS OF ISO 55001

4 Context of the Organization

5 Leadership

6 Planning

7 Support

8 Operation

9 Performance Evaluation

10 Improvement

ISO 55001:2014
Management
• System
• Structure

Plan → Do → Check → Act

• ISO 55001:2014
• Management
• System
• Structure
BENEFITS OF ASSET MANAGEMENT

• Improve Financial Performance
• Informed Asset Investment Decisions
• Manage Risk
• Improved Services and Outputs
• Demonstrate Compliance
• Enhanced Reputation
• Improved Organisational Sustainability
• Improved Efficiency and Effectiveness
ASSET MANAGEMENT TOOLS
CMMS EXPERTISE FOR WATER & WASTEWATER UTILITIES

- Accela
- Antero
- AssetPoint
- Cartegraph
- Cityworks
- Datastream MP2
- Infor EAM (formerly Datastream 7i)
- Infor Public Sector (formerly Hansen)
- Lucity
- Maximo
- MicroWest AMMS
- Oracle eAM (formerly Synergen)
- SAP
DYNAMIC PLANNING TOOLS - COST VS. FUNCTIONALITY

COST ($)

USER INTERFACE & FUNCTIONALITY

iCIP
InfoMaster
CapPlan
Riva
# CMMS Expertise

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<th>CMMS Software</th>
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**CMMS guidance based on owner-specific needs**
GUIDANCE SHOULD FOCUS ON THE KEY DIFFERENCES

• All reputable systems can do the basics
  • Asset registry, relate work orders to assets, track work order costs (labor, materials, equipment, contractors), manage PM schedules, etc.

• 5 Key Points
  - Configurability
  - Business Functionality
  - System & Integration Architecture
  - GIS Integration
  - Mobile Capabilities
WHY DOES OUR APPROACH WORK?

Purposely vendor neutral

- Client focused – not vendor focused
- Establish and maintain implementation partner relationships to develop and maintain technical capabilities
- No financial incentives for Black & Veatch to recommend one solution over another

Allows us to identify and recommend the right solution for your system
CONDITION ASSESSMENT
INSPECTION TECHNOLOGIES &
RISK ANALYSIS
**MASTER PLANNING**

- **Old Traditional Master Planning & CIP**
  - Not risk-based
  - Static CIP Report
  - Time and situation constrained
  - Not adaptable

- **New Dynamic & Adaptive CIP**
  - Elevate awareness
  - Leverage risk-based prioritization
  - Interactive and dynamic
  - Enhanced scenario management
  - Geographic interface
  - Graphic displays
INFORMATION SYSTEMS ARE TOOLS TO SUPPORT ASSET MANAGEMENT

- Assets
- Mapping
- Asset Inventory
- Trends
- Photos
- Work Orders
- Inspections
- SSO Documentation
- O&M Manuals
ASSET MANAGEMENT AND MASTER PLANNING

Hydraulic Analysis and Growth

Risk-Consequence Prioritized Improvements

Combined Recommended System Improvements

Probability of Failure

Consequence of Failure
Risk = Probability (Likelihood) of Failure (PoF) \times \text{Consequence of Failure (CoF)}
PoF SCORING, WEIGHTING & ANALYSIS

- Asset History & Operations
  - Break / Backup History
  - Work Order History
  - Operating Condition

- Environmental Characteristics
  - Soil Conditions
  - Major Roadways
  - Stream Crossings

- Physical Characteristics
  - Age
  - Life Expectancy
  - Diameter
  - Material
  - Depth of Burial
CoF SCORING, WEIGHTING & ANALYSIS

- Environmental Consequences
  - Parks and Recreational Areas
  - Water Way and Wetland Proximity
- Health and Safety Consequences
  - Land Use
  - Proximity to Major Transportation
  - Proximity to Other Utilities
  - Proximity to Water Supply
  - Sensitive Locations (Hospitals, Schools, etc.)
- Magnitude of Failure
  - Difficulty of Repair
  - Redundancy
  - Critical Customers
- Hydraulic Model Results
- Pipe Size
## RISK ANALYSIS & RESULTS

### Risk-Based Approach to Linear Assets

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### Probability of Failure

- **Run to Failure**
- **Condition Monitoring Strategy**
- **Predictive Monitoring Strategy**
- **Economic-Based Replacement Strategy**
- **Replace / Redesign Strategy**

*Increasing Risk*
UNDERSTANDING FAILURE LEADS TO BETTER INSPECTIONS

External Loads
- Soil
- Traffic
- Overburden

Soil Characteristics
- External Corrosion

Internal Corrosion
- Water Quality $H_2S$

Internal Pressures

Bedding Condition and Material

Design and Construction Practices

Temperature

Movement

Leakage
TECHNOLOGY SELECTION

Investigate “appropriate” methods to gather data to make informed judgment of condition.

- No Silver Bullet
  - Don’t believe the hype

- Tried and True
  - Track record of successful use (not all created equal)

- Complementary Data Sets
  - Prudent to use multiple techniques

Overlapping data sets increases confidence
PROVIDE THE RIGHT SOLUTION FOR EACH CLIENT AND EACH PROJECT.

- Not tied to any condition assessment toll
- We are familiar with all the tolls in the toolbox.
- We continuously track the state of the industry regarding development of new condition assessment tools, and changes in existing technologies
APPROPRIATE TECHNOLOGIES MATCHED TO SPECIFIC CONDITIONS

Low Risk
- Corrosion and Soil Survey
- Hydraulic Capacity and Pressure Survey
- External Leak Detection
- Inline Leak Detection
- Acoustic Pipe Wall Screening
- Magnetic Pipe Wall Screening
- In-Service CCTV Inspection
- Basic Structural Design Analysis
- Failure Probability Curves
- Guided Wave Testing
- Robotic Inspections – CCTV, Laser Profile, Scanning SONAR
- Manned Internal Inspection
- Test Pitting with Direct Pipe Wall Measurements
- RFTC for Metallic Pipe
- Electromagnetics for PCCP
- High Resolution Structural Analysis
- Long Term Condition Monitoring

Medium Risk

High Risk
Building a world of difference.

Together

BLACK & VEATCH