Asset Management and Industry Solutions - A Municipal Perspective

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Highlights

• Municipal Infrastructure in Canada
• Scope of Asset Management and State-of-Art Review
• Asset Management Initiatives
  – International
  – Canadian
• Industry Standards and Practices
• Asset Management Implementation
  – Asset Management Operational Effectiveness
  – Prioritization
  – Asset Specific Performance and Service Levels
• Conclusion
Municipal Assets in Canada

- Approx. 3500 Municipalities in Canada
  - 444 in Ontario
- Municipal infrastructure assets
  - Worth $1.1 trillion, approx. 20% of total built asset of $5.5 trillion (NRC)
  - Spending $15B /year
- Infrastructure report card (2012)
  - 123 municipalities data
  - Four categories: roads, drinking water, sanitary and storm water
  - Five-level rating system
  - Ranks between “fair” and “very poor”
  - Total replacement cost $171.8B
Dealing in Everyday

- Congestion
- Watermain breaks
  - Water loss, Inflow/Infiltration
- Pothole repair
- Sewer overflow
- Basement flooding
- Natural disasters
- Funding shortfall
Is Asset Management Functioning?

- Asset Management Plan Implementation
- Capital Projects and Forecasts
  - Budget
  - Materials
  - Labour
  - Levels of Service
  - Performance
  - Risk
- Policy and Strategy
  - Tools and Techniques
- Investment Decision
  - Prioritization
  - Optimization
- Condition Evaluation
  - Evaluation/Analysis
  - Options Review
  - Engineering
- Work Administration
  - Data Collection
- Work Order Management
  - WBS
  - Schedule
  - Preventive and Corrective Work
  - Service Life
  - Life Cycle Cost
- Finance
- Operation and maintenance
- Condition Inspection
- Resource Allocation
- PSAB Reporting
  - PSAB Reporting
- Problem Identification
- Growing Pains
  - GROWING PAINS
  - GROWING PAINS
  - GROWING PAINS
Where Do I Start?
How Do I Start?
Asset Management Initiatives

• Australia and New Zealand:
  – Institute of Public Works Engineering Australia (IPWEA)
  – Asset Management Quarterly International (AMQI)
  – Commonwealth Scientific and Industrial Research Organization (CSIRO)
  – Asset Management Council (AMC)
    – Asset Management Body of Knowledge (AMBOK)
Asset Management Initiatives

• US initiatives:
  – American Public Works Association (APWA)
  – AMSA – Managing for Public Infrastructure Assets
  – AWWA – Publications and reports
  – Federal Facilities Council (FFC) - Investments in Federal Facilities
  – AASHTO, TRB and FHWA (Federal Highway Administration)
    • Asset Management Office: Primer on Asset Management, LCCA, GASB and Case Studies
    • Transportation Asset Management Manual
    • Software: LCCA, BMS and PMS etc.
  – National Association of College and University Business Officers (NACUBO)
  – Others: WIN, NASSCO (PACP and MACP), WERF and EPA
Canadian Initiatives

- **Canadian initiatives:**
  - FCM (Federation of Canadian Municipalities)
    - Green Municipal Funding (GMF)
    - LAMP (Leadership in Asset Management Program)
  - National Guide (IC, FCM, NRC)
    - Canada wide network of $25.7 million budget
    - Over 56 best practices in 7 target areas
  - Infrastructure Canada
    - Knowledge - Building, Outreach and Awareness (KOA) program
    - Infrastructure Canada Program
    - Canada Strategic Infrastructure Fund
    - Building Canada Fund
  - **Infrastructure Ontario**
  - **NRC - Municipal Infrastructure Investment Planning (MIIP)**
    - 10 municipalities consortium
    - Evaluates tools and techniques for investment planning
    - 15 best practices report
Canadian Initiatives

– Transportation Association of Canada (TAC)
  • Primer on Highway Asset Management (1999)

– Canadian Institute of Charted Accountants (CICA)
  • Accounting and Reporting for Physical Assets by Governments (1990)
  • Accounting for Infrastructure in the Public Sector (2003)

– Canada Mortgage and Housing Corporation (CMHC)
  • Study reports on financial planning, alternative financing and municipal infrastructure

– Public Sector Accounting Board (PSAB)
  • Tangible capital asset
  • Reporting 2009

– Canadian Standards Association (CSA)
– Municipal Infrastructure Data Standards (MIDS)
– Municipal Performance Measurement Program (MPMP)
Canadian Initiatives

– Ontario Municipal CAO’s Benchmarking Initiative (OMBI)
– National Water and Wastewater Benchmarking Initiative (NWWBI)
– Municipal Infrastructure Management Systems (MIMS)
– Acts and Legislation (Federal, Provincial and Territorial)
– Asset Management BC
– Institute of Asset Management (IAM) – Canada
– CNAM (Canadian Network of Asset Managers)
Asset Management Initiatives

• UK and Europe
  – BSI (British Standards Institute)
    • PAS (Publicly Available Specification) 55: 2008

• Institute of Asset Management (IAM)
  – Asset Management – An Anatomy
  – Competences Framework
  – Certification and Diploma Program

• Global Forum on Maintenance and Asset Management (GFMAM)
  – Asset Management Landscape
Industry Standards?

- BSI PAS 55:2008
  - Standard for optimal management of physical assets
  - International benchmark
  - 28-point checklist in lifecycle planning and cost/risk/performance optimization
  - Developed with more than 6 years, by over 50 public and private organization
  - Applicable to all sectors and all asset types
Industry Standards

- IAM conceptual model:
  - Six (6) facets
    - 39 subjects
Industry Standards

- IAM conceptual model:
  - Six (6) facets
    - Strategy and Planning
    - Asset Management Decision Making
    - Lifecycle Delivery
    - Asset Information
    - Organization & People
    - Risk & Review
  - 39 subjects
How Aligned Is Your Organization?

PAS 55 Specifications (BSI Standards) and ISO 55000 Standards:
- ISO 55000 - Overview, Principles and Terminology
- ISO 55001 - Asset Management, Management Systems Requirements
- ISO 55002 – Management Systems, Guidelines for Application of 55001

• Integrating Asset Management within organizational culture
  – Communicate change
  – Gain commitment
  – Develop policy and procedures
  – Assign roles and responsibilities
  – Monitoring progress

[Source: ISO 55000 – 2014]
AM Plan – A Communication Tool

Step 1 to 3 – Data oriented
Step 4 to 5 – Methodology and policy issues
Step 6 – Decision-making

- Basic Inventory
  - What do you own?
  - Where is it located?
  - What is it worth?

- Condition Assessment
  - What is its condition?
  - What is the remaining service life?

- Infrastructure Deficit
  - What is the deferred investment backlog?

- Current and Future Needs
  - Service-level requirements
  - Investment requirements
  - Funding strategies

- Decision Tools
  - Options considered/What if analysis
  - Lifetime-cycle costing
  - Performance measures

- Asset Management Plan

- Priority Setting
  - What will you fix?
  - What will you replace?
  - What will you dispose of?

- Decision making

- Calculations
- Models
- Protocols

Asset knowledge
AM Implementation Strategy

NRC – MIIP (Municipal Infrastructure Investment Planning) Project

How ?
- Optimize Investment
- Recommend Resources
- Integrate Needs
- Forecast Needs
- Rate Asset
- Inspect Assets
- Itemize Assets
- Select Protocols

Why ?
- Alternatives
- Criticality
- Life Cycle Cost
- Service Life
- Performance
- Inventory

122 tasks verified for Six facets
Asset Management Maturity

PAS 55 Maturity Scale

Self assessment protocol
Five level maturity matrix in each service criteria

<table>
<thead>
<tr>
<th>Service Category</th>
<th>Service Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Organizational Adoption of Asset Management</td>
<td>Asset Management Commitment</td>
</tr>
<tr>
<td>Buy-in and commitment for Asset Management at all levels in the organization through leadership, change management and communication.</td>
<td>1.1 Overall Strategic Planning</td>
</tr>
<tr>
<td></td>
<td>1.2 Performance Measurement &amp; Reporting</td>
</tr>
<tr>
<td></td>
<td>1.3 Resources and Roles &amp; Responsibility in place and understood</td>
</tr>
<tr>
<td></td>
<td>1.4 Learning And Development</td>
</tr>
<tr>
<td></td>
<td>1.5 Change Management and Communications</td>
</tr>
<tr>
<td></td>
<td>Asset Management/Policy</td>
</tr>
<tr>
<td></td>
<td>1.6 Asset Management Policy and Strategy- aligned or integrated with sustainability efforts</td>
</tr>
<tr>
<td></td>
<td>Asset Management Governance</td>
</tr>
<tr>
<td></td>
<td>1.7 Asset Management Governance</td>
</tr>
<tr>
<td>2 Linking assets to services and outcomes</td>
<td>Level of Service Framework</td>
</tr>
<tr>
<td>Cost of Service Delivery</td>
<td>2.1 Level of Service framework including sustainability considerations</td>
</tr>
<tr>
<td>Service Engagement/Goal Setting</td>
<td>2.2 Cost of Service Delivery</td>
</tr>
<tr>
<td></td>
<td>2.3 LOS Forecasting</td>
</tr>
<tr>
<td></td>
<td>2.4 Service Engagement/Goal Setting</td>
</tr>
<tr>
<td>3 Robust Risk Assessment and Prioritization of</td>
<td>Risk &amp; Vulnerability</td>
</tr>
<tr>
<td>Prioritization of Investments</td>
<td>3.1 Risk Framework - Strategic Level And Asset Level</td>
</tr>
<tr>
<td></td>
<td>3.3 Robust Capital Investment Planning</td>
</tr>
<tr>
<td>4 Life Cycle Management</td>
<td>Optimized Asset Interventions</td>
</tr>
<tr>
<td>Asset Management Planning</td>
<td>4.1 Optimized Asset Interventions</td>
</tr>
<tr>
<td></td>
<td>4.2 Asset Management Plans (AMP)</td>
</tr>
</tbody>
</table>
AM Operational Effectiveness

• Three levels
  – Corporate
  – Customer
  – Asset

• Approaches

  Traditional Approach
  • Asset oriented
  • Operations and maintenance (O&M) based on age and condition
  • Limited optimization for service delivery and improvements

  Serviceability Approach
  • Customer oriented
  • O&M based on Levels of Service (LOS) and risk
  • Considers system capability
  • Optimized with costs, risks and service delivery level (performance)
Asset Condition and Performance

Assessment Methods

• Subjective grading
  – Most common, based on visual inspection, in-situ measurements, or expert opinion
  – A score that is consistent with the level of distress
  – Rating systems 0 to 5, 1 to 3, 1 to 7, 1 to 10 and 1 to 100 etc.
  – Accuracy depends on inspector’s experience

• Distress based evaluation
  – Distress diagnosis is primarily done by observations
  – A predefined protocol
  – Identify the most severe conditions affecting the performance
  – Weighted factors or deduct values

• Automated systems
Sewer Asset Condition Evaluation

[Logic Based Data Collection
WERF's SCRAPS]
Service Life of Assets

- **Factor method (ISO 15686-1:2000)**
  - Six contributing factors:
    - A - Quality of components in construction
    - B - Design level
    - C - Construction quality
    - D - Maintenance level
    - E - Environmental conditions (internal and external)
    - F - In-use conditions
  - Remaining service life (RSL) = Asset design life × A × B × C × D × E × F

- **Probabilistic method (Markov)**
Resources and Options

- Infrastructure economics
- The “Triple-Two” Rule (CWF 2006)
  - Pay-as-you-Go or Debt financing
  - Taxation or User pay
  - Public sector or Private sector
- AFP – Value for Money
- Infrastructure Bank
Asset Prioritization

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCI</td>
<td>50</td>
</tr>
<tr>
<td>AADT</td>
<td>10</td>
</tr>
<tr>
<td>CRV</td>
<td>15</td>
</tr>
<tr>
<td>Performance deficiency</td>
<td>5</td>
</tr>
<tr>
<td>Maintenance needs</td>
<td>5</td>
</tr>
<tr>
<td>Total Repair/rehab cost</td>
<td>5</td>
</tr>
<tr>
<td>Detour length</td>
<td>10</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

**Structure Priority Number Factors and Weightings**

- **BCI**: 50
- **AADT**: 10
- **CRV**: 15
- **Performance Deficiencies**: 5
- **Maintenance**: 5
- **Total Repair/rehab cost**: 5
- **Detour length**: 10

**Total**: 100
Asset Prioritization

Asset Replacement Cost (ARC):

\[ARC = (CRV + 23\% \text{ of CRV}) \times \text{Urban Cost Factor}\]
Performance in the Life Cycle

- Key Performance Indicators (KPI)
  - Asset information
  - Stakeholders
  - Condition and risk
  - Service quality
  - Financial
  - Regulatory

<table>
<thead>
<tr>
<th>Measured Indicators (Wastewater)</th>
<th>Target Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{peak \ day}/I_{average \ day}$</td>
<td>&lt;5</td>
</tr>
<tr>
<td>Hydraulic capacity</td>
<td>&gt;0.3 m</td>
</tr>
<tr>
<td>Basement flooding</td>
<td>&lt;20/year</td>
</tr>
<tr>
<td>Surcharge</td>
<td>20/year</td>
</tr>
<tr>
<td>Number of blockages</td>
<td>50/year</td>
</tr>
<tr>
<td>Service interruptions 100km/year</td>
<td>&lt;40</td>
</tr>
<tr>
<td>Number of complaints (pollution, odour, contamination etc.)</td>
<td>&lt;10/year</td>
</tr>
<tr>
<td>Response time</td>
<td>&lt;3 hrs</td>
</tr>
<tr>
<td>Repair cost/year (last 5 years)</td>
<td>$$</td>
</tr>
</tbody>
</table>

Distribution of Life Cycle Costs

- Concept/Ideas: 3
- Design/Planning: 12
- Installation/Construction: 35
- Operations and Maintenance: 45
- Demolition: 5

Life Cycle Phases
# Performance Measures for Services

## Services

<table>
<thead>
<tr>
<th>Services</th>
<th>Service Goals (Road Network)</th>
<th>LOS Targets - Technical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessible</td>
<td>Affordable</td>
<td>Cost of maintaining, repair and rehabilitating the road network</td>
</tr>
<tr>
<td></td>
<td>Meets the needs of all users</td>
<td>Community believes that the road system is sufficient to meet their needs without restrictions</td>
</tr>
<tr>
<td>Safety</td>
<td>The road network is safe to use</td>
<td>Signs, traffic signals and road markings comply with standards (MTO, MUTCD etc.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of accidents (pedestrian, cycle and vehicles/lane –km)</td>
</tr>
<tr>
<td>Reliability</td>
<td>The road network is reliable and predictable</td>
<td>Average travel speed for various road classifications (x km/hr)</td>
</tr>
<tr>
<td>Cost</td>
<td>Reduce operational and maintenance costs</td>
<td>Average maintenance cost per lane-km</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average costs for safety enhancements/km</td>
</tr>
<tr>
<td>Regulatory</td>
<td>Comply with MMS</td>
<td>Road patrols, pothole repair, winter maintenance etc.</td>
</tr>
<tr>
<td>Customer Service</td>
<td>Responsiveness</td>
<td>Customer satisfaction (number of complains and response time)</td>
</tr>
</tbody>
</table>
Concluding Remarks

• In Reality...
  – Significant gap in knowledge, support, funding and policy
  – Variable asset life, adaptability and resiliency
  – Infrastructure condition deteriorates with time
  – Asset network is expensive and interconnected
  – Inconsistencies in tools and techniques
  – Organizational structure need to support Asset Management business
  – Lack of investments and decisions based on short-term business interests not long-term risks
  – Standards, codes and practice policies adopt changes in slow process

• Benefits of adopting ISO 55000 Standards
  – Consistent approaches
  – Mitigate risks
  – Maintain State-of-Good Repair (SOGR)
Thank You

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