Examples of Asset Management Using BMS Analysis Tools

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Reed M. Ellis, Ph.D., P.Eng.,
Vice President, Stantec
Outline

1 Introduction
2 Stantec BMS - Overview
3 Two Case Studies
4 Summary
5 Questions
Introduction

Agencies are applying bridge management principles using new generation advanced BMS
Introduction

Stantec BMS

• Developed following tradition of OBMS (c. 2000*) and MTQ BMS (2008*)

• BMS 2010 was 3rd BMS (2010*), and developed as a COTS platform (* published, refer to literature)

• Now Stantec BMS

• Provincial DOT, Major Cities, Municipalities, Regional Municipalities, Energy/Power
Introduction

**Stantec BMS**
- Used by agencies to manage inventory and inspections, perform prioritization, risk analysis, budgeting and work program development
- Inspections are performed by Agencies themselves and/or by consultants.
- Bridge management analysis performed by agencies or by Stantec on behalf of agencies
- Some smaller agencies implement the BMS and retain support to do inventory and inspection and analysis to provide full BM services externally.
Introduction

Asset Management Plans and BMS

• Large and small agencies are preparing asset management plans using the BMS
• Asset management plans take different forms
  • Provincial DOT, major cities, municipalities, regional municipalities, energy/power
  • Goals are similar
  • BMS should be flexible to handle the different demands
• Not common to see results from BMS and how BMS are used.
• Share a few case studies
Developed from OBMS and MTQ BMS, the latest BMS is Stantec’s 3rd BMS.
Overview

Stantec BMS

• Complete bridge management solution
• Inventory
• Inspection - Element level, severity and extent, condition state
• Financial framework is based on LCCA and B/C
Overview

**Stantec BMS**

- 3 levels of analysis
  - Element (treatment and timing selection),
  - Project (combines elements and timings into projects with costs, benefits, B/C)
  - Network (unlimited budget scenarios and resulting prioritized work program with B/C)
Overview

**Stantec BMS**
- Condition index (BCI similar to BHI in USA)
- Full capabilities for inspection and historical multimedia files, documents, etc.
- Built-in GIS mapping
Overview

**Stantec BMS**

- Treatments – unlimited for each element
  - Different types of repair, rehabilitation methods
  - DN and Replacement
- Functional improvement models
  - Strengthening, widening, height restrictions
  - Based on traffic growth, truck distribution models
- Deteriorations models – forecast repair quantities, structure condition, and network condition
Overview

Stantec BMS

- Analyses that are available
  - Budget scenarios and prioritized work program
  - Target condition (BCI) and prioritized work program
  - Funding allocation to districts/regions
  - Risk analysis (condition)
3 Two Case Studies

How different agencies use BMS to meet asset management goals
1. Provincial DOT

Prince Edward Island DOT

- Using Stantec BMS since 2008
- Complete management of bridge management program for 1574 structures
- Currently inspections are by consultants who use check out database via web version of BMS
- Provide inspection data and recommendations
- Department uses BMS to determine BCI and Risk Profile
- Asset valuation is performed by the BMS automatically (RC, Written Down RC, and Depreciation)
1. Provincial DOT

Prince Edward Island DOT
• Annual Report to Minister
Department of Transportation And Infrastructure Renewal

Key Performance Indicator Report

BCI Distribution
Subset: All inspected structures, # of Structures: 288, Avg BCI: 70.3

Subset: All inspected structures, # of Structures: 288
Department of Transportation And Infrastructure Renewal

Key Performance Indicator Report

BCI Break Down
Subset: All inspected structures, # of Structures: 288, Avg BCI: 70.3

- < 60: 27.0%
- >= 60, < 70: 26.0%
- >= 70: 47.0%

Subset: All inspected structures, # of Structures: 288
Justification of Bridge Management Program

- Improvement in average BCI, Good
- Reduction of Poor
- Demonstrates effectiveness
## Network BCI Trend (%)

<table>
<thead>
<tr>
<th></th>
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</tr>
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<tbody>
<tr>
<td>Good (70 &lt; BCI)</td>
<td>35%</td>
<td>32%</td>
<td>37%</td>
<td>40%</td>
<td>43%</td>
<td>47%</td>
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<tr>
<td>Fair (60 &lt; BCI &lt; 70)</td>
<td>29%</td>
<td>28%</td>
<td>26%</td>
<td>31%</td>
<td>29%</td>
<td>27%</td>
</tr>
<tr>
<td>Poor (BCI &lt; 60)</td>
<td>37%</td>
<td>40%</td>
<td>37%</td>
<td>29%</td>
<td>28%</td>
<td>26%</td>
</tr>
<tr>
<td>Average BCI</td>
<td>62.8</td>
<td>61.9</td>
<td>66.6</td>
<td>69</td>
<td>69.3</td>
<td>70.3</td>
</tr>
</tbody>
</table>
• Justification of Budgets

• Forecasted results 5 yrs
• Specified Budget plus:
• DN
• Unlimited Funds
• What does 70.3 become in 5 yrs?
• % Poor 26% becomes?

Network BCI Trend (%)

<table>
<thead>
<tr>
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<td>69.3</td>
<td>70.3</td>
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</table>
### Network Risk Profile

#### Number of Structures in Each Risk Category

<table>
<thead>
<tr>
<th>Probability of Service Interruption</th>
<th>10K</th>
<th>100K</th>
<th>1M</th>
<th>10M</th>
<th>100M</th>
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<tr>
<td>High</td>
<td>3</td>
<td>13</td>
<td>36</td>
<td>17</td>
<td>0</td>
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<tr>
<td>Medium-High</td>
<td>1</td>
<td>4</td>
<td>21</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Medium</td>
<td>1</td>
<td>9</td>
<td>19</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>Low</td>
<td>23</td>
<td>24</td>
<td>19</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

#### Network Risk Distribution

<table>
<thead>
<tr>
<th>Risk Level</th>
<th># of Structures</th>
<th>%</th>
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<tbody>
<tr>
<td>High</td>
<td>67</td>
<td>23.26%</td>
</tr>
<tr>
<td>Medium-High</td>
<td>76</td>
<td>26.39%</td>
</tr>
<tr>
<td>Medium</td>
<td>68</td>
<td>23.61%</td>
</tr>
<tr>
<td>Low</td>
<td>77</td>
<td>26.74%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>288</strong></td>
<td><strong>100.00%</strong></td>
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### Network Risk Trend

<table>
<thead>
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<tbody>
<tr>
<td>Risk Level</td>
<td># of Struct</td>
<td>%</td>
<td># of Struct</td>
<td>%</td>
<td># of Struct</td>
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<tr>
<td>High</td>
<td>79</td>
<td>29.5</td>
<td>74</td>
<td>28.9</td>
<td>68</td>
</tr>
<tr>
<td>Medium-High</td>
<td>66</td>
<td>24.6</td>
<td>68</td>
<td>26.6</td>
<td>74</td>
</tr>
<tr>
<td>Medium</td>
<td>65</td>
<td>24.3</td>
<td>61</td>
<td>23.8</td>
<td>62</td>
</tr>
<tr>
<td>Low</td>
<td>58</td>
<td>21.6</td>
<td>53</td>
<td>20.7</td>
<td>62</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>268</strong></td>
<td><strong>100</strong></td>
<td><strong>256</strong></td>
<td><strong>100</strong></td>
<td><strong>266</strong></td>
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</table>
2. Medium Sized Municipality

City of Hamilton

• For structures, using Stantec BMS since 2005 (Lite Version)
• Complete management of bridge management program for about 400 City structures
• Currently inspections are by consultants who use check out database on field notebooks
• Provide inspection data and recommendations
• Department uses BMS to determine BCI and Risk Profile
• Retains Stantec to perform analysis for decision making, and reporting into the City’s State of the Infrastructure Report
2010 State of the Infrastructure Report
• Structures (Bridges and Culverts)

Table 6.2: Road Network and Traffic System Condition Assessment

<table>
<thead>
<tr>
<th>Asset</th>
<th>Individual Ratings</th>
<th>Overall Rating</th>
<th>Trend</th>
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<tbody>
<tr>
<td></td>
<td>2009</td>
<td>2010</td>
<td>2009</td>
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<tr>
<td>Road Network</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition &amp; Performance</td>
<td>D+</td>
<td>D-</td>
<td>D+</td>
</tr>
<tr>
<td>Capacity vs. Need</td>
<td>C+</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Funding vs. Need</td>
<td>D-</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>Structures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition &amp; Performance</td>
<td>C-</td>
<td>B-</td>
<td>C-</td>
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<tr>
<td>Capacity vs. Need</td>
<td>B</td>
<td>B</td>
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</tr>
<tr>
<td>Funding vs. Need</td>
<td>D-</td>
<td>A+</td>
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<tr>
<td>Traffic System</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition &amp; Performance</td>
<td>D+</td>
<td>D+</td>
<td>D+</td>
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<td>Capacity vs. Need</td>
<td>C+</td>
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</tr>
<tr>
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<td>F</td>
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<td></td>
</tr>
</tbody>
</table>

- Condition & Performance
  - Ave. BCI vs Target
- Capacity vs Need
  - Load capacity % posted
  - Traffic capacity (used roadway)
- Funding vs. Need
  - Approximate in 2010, lacking data
2016 State of the Infrastructure

- Structures (Bridges and Culverts)
- Condition & Performance
  - Ave. BCI vs Target
- Capacity vs Need
  - Load capacity % posted
  - Traffic capacity (used roadway)
- Funding vs Need
  - BMS budget and prioritization analysis
Inventory

Age Distribution
Subset: All CoH Owned Structures, # of Structures: 352, Avg Age: 43

<table>
<thead>
<tr>
<th>Bridge Age</th>
<th>% Network</th>
</tr>
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<tbody>
<tr>
<td>0-10</td>
<td>10</td>
</tr>
<tr>
<td>11-20</td>
<td>3</td>
</tr>
<tr>
<td>21-30</td>
<td>14</td>
</tr>
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<td>31-40</td>
<td>11</td>
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<td>41-50</td>
<td>19</td>
</tr>
<tr>
<td>51-60</td>
<td>16</td>
</tr>
<tr>
<td>61-70</td>
<td>13</td>
</tr>
<tr>
<td>71-80</td>
<td>3</td>
</tr>
<tr>
<td>81-90</td>
<td>3</td>
</tr>
<tr>
<td>&gt; 90</td>
<td>3</td>
</tr>
<tr>
<td>N/A</td>
<td>1</td>
</tr>
</tbody>
</table>
Inventory

Age Distribution
Subset: All CoH Owned Bridges, # of Structures: 161, Avg Age: 39

Age Distribution
Subset: All CoH Owned Culverts, # of Structures: 191, Avg Age: 46
<table>
<thead>
<tr>
<th></th>
<th># Structures</th>
<th>Ave BCI</th>
<th>Ave. Weighted BCI</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010 SoTI Report</td>
<td>360</td>
<td>73.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bridges</td>
<td>234</td>
<td>74.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Culverts</td>
<td>126</td>
<td>73.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016 BMS Update</td>
<td>352</td>
<td>70.8</td>
<td>77.0</td>
<td>More complete data</td>
</tr>
<tr>
<td>Bridges</td>
<td>161</td>
<td>73.7</td>
<td>77.7</td>
<td></td>
</tr>
<tr>
<td>Culverts</td>
<td>191</td>
<td>68.3</td>
<td>70.5</td>
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</table>

**Average Condition Index**
## Condition

<table>
<thead>
<tr>
<th></th>
<th># Structures</th>
<th>Ave BCI</th>
<th>G (%)</th>
<th>F (%)</th>
<th>P (%)</th>
</tr>
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<td>36</td>
<td>14</td>
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</table>

BCI Breakdown G/F/P
Condition

BCI Breakdown G/F/P
Condition – Forecasting

All City Structures (352)
Do Nothing $0 5Y and 10 Y
Ave BCI and BCI Breakdown G/F/P

Current BCI Distribution
Needs Analysis

Scenarios
1. Do Nothing (Baseline #1)
2. Unconstrained (Baseline #2)
3. $8M per yr, larger projects
4. Other? 50% budget for reference
2016 State of the Infrastructure

• Structures (Bridges and Culverts) - used BMS to provide all inputs

• Condition & Performance


• Capacity vs Need

  - Load capacity % posted – BMS reports load posting and load rating data
  - Traffic capacity (used roadway)

• Funding vs Need

  - BMS analysis – Budgets are keeping deterioration under control especially bridges, less so culverts. Funding is available to meet needs. Good report card score, slight improvement.
4 Summary
Summary

Overview of Stantec BMS

- Complete bridge management solution
- Capabilities useful for creating asset management plans, Annual Reports, Report Cards etc.
- BMS is not overly complex, easy to use, results easy to understand.
Summary

Two Case Studies
• BMS was used to provide the information for asset management plans
  - condition reports, performance measure reports
  - Asset Valuation
  - Risk Analysis
  - Needs Analysis, Budget Scenarios, and Prioritized work programs
  - Needs vs Funding
  - Asset Report Card
Questions?
Thank you!