Optimisation of Funding for Bridge Assets

Experiences of Asset Management Strategies

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Topics

- Finnish Transport Infrastructure Agency
- Motivation
- Railways and Railway Bridges
- Strategic Level Bridge Management
- Lessons Learnt
Railways in Finland

2,500 level crossings (main and secondary tracks) and 45 tunnels on the main lines.

350 traffic operating points for passenger and freight transport.

85.7 million journeys made in railway passenger transport and 38.4 million tonnes carried in freight transport.

6,000 kilometres, of which 90% on single track.

Length of the electrified line 3,284 Track kilometres.

High-speed railway network, over 160 km/h on 1,059 Track kilometres.

85.7 million journeys made in railway passenger transport and 38.4 million tonnes carried in freight transport.
Motivation

1. Inadequate funding
2. Ageing infrastructure
3. Application of ISO55000-series
4. Requirement of the MOF
5. Road bridge management more mature
6. Decision making to be transparent and systematic
Motivation #1: Inadequate funding

Sustainable funding
# Railway Bridges

## Bridge type

<table>
<thead>
<tr>
<th>Bridge type</th>
<th>#</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete, high traffic</td>
<td>1143</td>
<td>48%</td>
</tr>
<tr>
<td>Concrete, low traffic</td>
<td>752</td>
<td>32%</td>
</tr>
<tr>
<td>Steel, high traffic</td>
<td>69</td>
<td>3%</td>
</tr>
<tr>
<td>Steel, low traffic</td>
<td>233</td>
<td>10%</td>
</tr>
<tr>
<td>Other bridges (stone)</td>
<td>168</td>
<td>7%</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>2365</td>
<td>100%</td>
</tr>
</tbody>
</table>

High traffic: > 5 Mb/yr
General five-class condition classification

Concrete bridges are in better condition – usually younger than steel bridges

Over 50% of concrete bridges in “satisfactory” condition – soon in need of repair
Model Structure

▲ Modeling based on KL’s and median time spent in each KL(n) (+ distribution)
▲ By time deterioration moves bridges to lower condition classes

<table>
<thead>
<tr>
<th>Time in class by bridge type</th>
<th>KL5</th>
<th>KL4</th>
<th>KL3</th>
<th>KL2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete, high traffic</td>
<td>4</td>
<td>25</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Concrete, low traffic</td>
<td>4</td>
<td>25</td>
<td>35</td>
<td>10</td>
</tr>
<tr>
<td>Steel, high traffic</td>
<td>4</td>
<td>25</td>
<td>25</td>
<td>5</td>
</tr>
<tr>
<td>Steel, low traffic</td>
<td>4</td>
<td>25</td>
<td>35</td>
<td>10</td>
</tr>
</tbody>
</table>
Preventive maintenance and rehabilitation are executed at certain condition classes.

Optimisation:
- Object function: sustain percentage\((KL_1+KL_2)\) by bridge type => rehabilitation needs/year
- Simulation of individual bridges over a long period (30-100 years)
First 20 years are bearable, then expenses will increase

Why: concrete bridges currently in KL4 (good) will be in rehabilitation stage
Lessons Learnt

1. Inadequate funding – the model tells we are 20-30 % below the needed funding level
2. Ageing infrastructure – problems will come later than expected
3. Application of ISO55000-series – one more asset strategy prepared
4. Requirement of the MOF – better understanding of funding needs
5. The chosen approach is simple, but robust enough for strategic level decision making
6. Decision making now more transparent - and compatible with road bridge management
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