LCC-Efficient Procurement of Bridge Infrastructures

Lahja Rydberg-Forssbeck
Swedish Transport Administration

On Behalf of:

Mohammed Safi
FOLKBRO & ÅF Infrastructure AB

Peter Simonsson
Georege Racutanu
Swedish Transport Administration
Introduction

- **Bridge Life-Cycle Cost (LCC)**

- The time value of money, discount rate

- Life-Cycle Costing/Life-Cycle Cost Analysis (LCCA)

- The concept of the lowest proposal & the concept of least LCC proposal
Important Principals in Procurement within Public Agencies

“The Swedish Transport Administration is an authority and by law must endeavor to procure goods, services and contracts in competition”

To ensure credibility and transparency
Bridge Investment & Management from a LCCA Perspective

- The main difference lies in the procurement method/contract type
- Fixed target strategy in management but not usually fixed in investment, particularly under D-B
- The lowest bid and no consistent LCC guidelines
- Trafikverkret’s goal is: 50% D-B by 2018
- A new award criterion under D-B: lowest LCC bid
Unified LCC-Efficient Benchmarks

- There are several improper ways to employ the concept of the lowest LCC bid as the contract award criterion under D-B

- The optimal way is for procurers to establish consistent LCC-efficient benchmarks and guidelines then clearly present them as core specification in the tender documents.
Comprehensive Approach:

1. A preliminary LCCA
2. Monetary LCC-efficient benchmarks
3. Bid evaluation criteria: lowest LCC bid
The Swedish Bridge and Tunnel Management System "BaTMan"

https://batman.vv.se/batman/
BaTMan’s Navigation Tool (WebHybris)
# Case Study

The Karlsnäs Bridge  
2013

<table>
<thead>
<tr>
<th>Proposal No.</th>
<th>Description</th>
<th>Cross-Section Details</th>
<th>Outlines &amp; Remarks</th>
</tr>
</thead>
</table>
| 1            | One bridge, two steel boxes (Trafikverket’s conceptual design) | ![Cross-Section Image](image1.png) | 5 Spans  
4x60m + 2x40m  
Superstructure depth: 2.3m |
| 2            | Two bridges, two steel I beams per bridge | ![Cross-Section Image](image2.png) | 5 Spans  
4x60m + 2x40m  
Superstructure depth:  
Haunch beam  
Max. 3.2m  
Min. 1.8m |
| 3            | Two bridges, one pre-stressed concrete box per bridge | ![Cross-Section Image](image3.png) | 7 Spans  
5x50m + 2x35m  
Superstructure depth:  
Haunch beam  
Max. 2.8m  
Min. 1.6m |
| 4            | One bridge, two pre-stressed concrete boxes. | ![Cross-Section Image](image4.png) | 7 Spans  
5x50m + 2x35m  
Superstructure depth:  
Haunch beam  
Max. 2.8m  
Min. 1.6m |
| 5            | One bridge, one integral-cantilever concrete box | ![Cross-Section Image](image5.png) | 4 Spans  
2x100m + 2x60m  
Superstructure depth:  
Haunch beam  
Max. 6.5m  
Min. 2.3m |
LCCA Results

![Bar chart showing LCCA results for different proposals. The chart compares LCM cost NPV, r=2% and LCM cost NPV, r=4% with INV cost.]
Impact of varying the discount rate on the proposals’ LCC
LCC added-values computed at indicated discount rates (SEK)

<table>
<thead>
<tr>
<th>Proposal</th>
<th>0%</th>
<th>2%</th>
<th>4%</th>
<th>6%</th>
<th>8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>14.65</td>
<td>5.48</td>
<td>2.27</td>
<td>-1.54</td>
<td>-0.74</td>
</tr>
<tr>
<td>(2)</td>
<td>38.44</td>
<td>14.16</td>
<td>5.75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>(3)</td>
<td>8.77</td>
<td>3.06</td>
<td>1.21</td>
<td>-2.02</td>
<td>-0.97</td>
</tr>
<tr>
<td>(4)</td>
<td>0.00</td>
<td>-0.01</td>
<td>0.02</td>
<td>-2.54</td>
<td>-1.23</td>
</tr>
<tr>
<td>(5)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>-2.57</td>
<td>-1.26</td>
</tr>
</tbody>
</table>
Structural-members’ LCC added-values at a discount rate of 4%

To maintain contractors’ freedom in D-B tendering processes and allow consideration of innovative/different designs.

<table>
<thead>
<tr>
<th>Bridge structural-member</th>
<th>Unit</th>
<th>LCC sub added-value</th>
<th>Unit LCM cost (K SEK/Unit)</th>
<th>Fixed Cost (K SEK)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearings number</td>
<td>set</td>
<td></td>
<td>7.0</td>
<td>54.4</td>
</tr>
<tr>
<td>Expansion joint length</td>
<td>m</td>
<td></td>
<td>5.8</td>
<td>156.4</td>
</tr>
<tr>
<td>Edge beam length</td>
<td>m</td>
<td></td>
<td>1.6</td>
<td>108.3</td>
</tr>
<tr>
<td>Painted area</td>
<td>m²</td>
<td></td>
<td>0.4</td>
<td>85.3</td>
</tr>
<tr>
<td>Parapets’ length</td>
<td>m</td>
<td></td>
<td>1.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Paved area</td>
<td>m²</td>
<td></td>
<td>0.5</td>
<td>462.0</td>
</tr>
<tr>
<td>Drainage system points</td>
<td>set</td>
<td></td>
<td>32.7</td>
<td>0.0</td>
</tr>
<tr>
<td>Slopes and cones area</td>
<td>m²</td>
<td></td>
<td>0.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Superstructure area</td>
<td>m²</td>
<td></td>
<td>0.2</td>
<td>0.0</td>
</tr>
<tr>
<td>Total bridge area</td>
<td>m²</td>
<td></td>
<td>0.6</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Procurement of the Karlsnäs Bridge

- The LCC added-values and BSM’s LCC added-values had been stated in the tender documents.

- 5 Contractors had participated, all of them are Proposal 3

- The contract was awarded to the lowest LCC bid, with an INV cost of 115 million SEK.

- **Trafikverket has saved 57 million SEK**
Thank You

Questions?