Life Cycle Planning

California Transportation Asset Management Plan

Dawn D. Foster, PE
Senior Transportation Engineer
Caltrans, Director’s Office of Asset Management
Background

• Transportation Asset Management Plans include Life Cycle Planning to inform performance targets as required by California law and federal regulations.

• Life Cycle Planning is a strategy for managing an asset over its life to achieve target level performance while minimizing life cycle costs.
Federal requirements for the TAMP state that LCP include the following:

- Identification of deterioration models
- Potential work types, including treatment options and unit costs
- A strategy for minimizing life cycle costs and achieving performance targets
- Asset performance targets
Life Cycle Planning for Bridges
Life Cycle Planning

Asset Management saves money
- Performing preventive maintenance keeps assets in better condition – at a lower cost over the long term

Deferring maintenance costs more
- Higher-cost reconstruction or replacement is needed when assets are not maintained in a state of good repair
Caltrans owns and manages over 13,160 bridges.

On average, most of the bridges in California are over 45 years old and have increasing maintenance needs.

A three-pronged approach to asset (bridge) management has been a successful strategy for many years but there is still work to be done.
Strategy to maintain “Good” and some “Fair” condition Bridges

- **Preventive Maintenance Program** - *Minor work* such as immediate repairs, joint and spall repairs, painting needs, and other maintenance type work
  
  1) Caltrans bridge crews
  
  2) Maintenance contractors

Strategy for “Poor” and some “Fair” condition Bridges

- **Caltrans SHOPP Program** - *Major work* including rehabilitation or replacement work
  
  3) Major construction projects
Best Management Practices

Caltrans has a number of Best Management Practices that preserve the life of our bridges

• Experienced Bridge Inspectors that analyze and identify bridge needs
  ➢ On-going training for both state and local inspectors
• Centralized statewide management of bridges
• Bridge strategy meetings that provide a uniform approach to recommended maintenance activities
• Bridge scour and seismic vulnerability screenings to ensure that the most critical needs are addressed
• Detailed project specifications for construction methods
• Strict oversight of bridge construction
Caltrans also employs additional strategies for improving the life of bridges:

• Utilizing new materials that last longer and are easier to apply

• Implementing new policies to ensure that new projects are built with cost effective and easily maintained elements

• Applying accelerated bridge construction techniques
## Typical Bridge Treatment

### Typical Concrete Bridge Treatment Costs

<table>
<thead>
<tr>
<th>Activity</th>
<th>Unit</th>
<th>Unit Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methacrylate Deck</td>
<td>Square Feet</td>
<td>$4</td>
</tr>
<tr>
<td>Replace Joints</td>
<td>Linear Feet</td>
<td>$200</td>
</tr>
<tr>
<td>Polyester Concrete Overlay</td>
<td>Square Feet</td>
<td>$25</td>
</tr>
<tr>
<td>Deck on Deck</td>
<td>Square Feet</td>
<td>$125</td>
</tr>
<tr>
<td>Rail Replacement</td>
<td>Linear Feet</td>
<td>$250</td>
</tr>
<tr>
<td>Replace Bridge</td>
<td>Square Feet</td>
<td>$635</td>
</tr>
</tbody>
</table>
## Unit Costs for State Hwy System Bridges

<table>
<thead>
<tr>
<th>Costs Per Square Foot</th>
<th>Fix Fair to Good</th>
<th>Fix Poor to Good</th>
<th>Add New</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHS Bridge</td>
<td>$344</td>
<td>$483</td>
<td>$635</td>
</tr>
</tbody>
</table>
Caltrans current strategy to perform bridge work is according to the work recommendation generated by inspections.

- Identify preventive maintenance (preservation)
- Identify rehabilitation or replacement (non-preservation)

Caltrans future strategy to perform bridge work is to move towards a more systematic approach that would routinely apply preservation strategies prior to identification of defects.

- More work is needed to achieve this strategy, but is being considered as we mature in the area of LCP
# LCP Strategies

## Condition-Based LCP Strategy for an Example Concrete Bridge

### Costs Per Square Foot

<table>
<thead>
<tr>
<th>Activity</th>
<th>Year</th>
<th>Cost</th>
<th>Present Value (PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Construction</td>
<td>0</td>
<td>$7,620,000</td>
<td>$7,620,000</td>
</tr>
<tr>
<td>Methacrylate Deck Replace Joints</td>
<td>15</td>
<td>$64,000</td>
<td>$35,537</td>
</tr>
<tr>
<td>Polyester Concrete Overlay Replace Joints</td>
<td>30</td>
<td>$316,000</td>
<td>$97,429</td>
</tr>
<tr>
<td>Replace Bridge</td>
<td>75</td>
<td>$7,620,000</td>
<td>$402,211</td>
</tr>
<tr>
<td><strong>Net Present Value</strong></td>
<td></td>
<td></td>
<td><strong>$8,155,177</strong></td>
</tr>
</tbody>
</table>
## Alternative Systematic-Based LCP Strategy for a Concrete Bridge

### Costs Per Square Foot

<table>
<thead>
<tr>
<th>Activity</th>
<th>Year</th>
<th>Cost</th>
<th>Present Value (PV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New Construction</td>
<td>0</td>
<td>$7,620,000</td>
<td>$7,620,000</td>
</tr>
<tr>
<td>Methacrylate Deck Replace Joints</td>
<td>10</td>
<td>$64,000</td>
<td>$43,236</td>
</tr>
<tr>
<td>Polyester Concrete Overlay</td>
<td>20</td>
<td>$316,000</td>
<td>$144,218</td>
</tr>
<tr>
<td>Deck on Deck Rail Replacement</td>
<td>40</td>
<td>$1,655,000</td>
<td>$344,718</td>
</tr>
<tr>
<td>Methacrylate Deck on Deck</td>
<td>50</td>
<td>$64,000</td>
<td>$9,006</td>
</tr>
<tr>
<td>Polyester Concrete Overlay</td>
<td>70</td>
<td>$316,000</td>
<td>$20,293</td>
</tr>
<tr>
<td>Replace Bridge</td>
<td>90</td>
<td>$7,620,000</td>
<td>$223,334</td>
</tr>
<tr>
<td><strong>Net Present Value</strong></td>
<td></td>
<td></td>
<td><strong>$8,404,805</strong></td>
</tr>
</tbody>
</table>
Background Information

- Followed FHWA Guidelines for Benefit-Cost Analysis of Federal Programs and US DOT Economic Analysis Primer
- February 2017 California Life Cycle Benefit/Cost Analysis was used for Present Value calculation
- Caltrans Program (Asset) Managers were consulted on treatment schedules and unit costs
The standard criterion for deciding whether a government program can be justified on economic principles is net present value.

Net present value is computed by…

- Assigning monetary values to benefits and costs
- Discounting future benefits and costs using an appropriate discount rate; and
- Subtracting the sum total of discounted costs from the sum total of discounted benefits
What about the Locals?

- California conducts a statewide local streets and roads needs assessment every two years.
  - Documents LCP practices across local agencies (600+ in California)
- Caltrans inspectors provide routine inspections typically performed biannually for state and most locally owned bridges
- All data collected during inspection process are documented and maintained in the SMART (Structure Maintenance Automated Report Transmittal) bridge management system
- A Local Bridge Advisory Committee made up of city and county organizations, FHWA, and the California Transportation Commission provide a forum to confer with cities and counties on local bridge funding for improving local bridges
LCP Maturity

- **Level 1**: Single Asset Based Needs
- **Level 2**: Project Level LCCA
- **Level 3**: Corridor LCP
- **Level 4**: Network Level LCP
Contact Information:
Dawn Foster
Phone # (916) 323-7747
e-mail: dawn.foster@dot.ca.gov