Caltrans 2013 Life-Cycle Cost Analysis

Webinar

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HQ Pavement Program
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California Department of Transportation
August 22, 2013
Bromford Housing Group
UK’s highest accolade to those employers who have “led the way” and set an example of good practice in enabling disabled people to realise their potential through work.

Not only do they give the recognition to those employers who have demonstrated a high standard of equal opportunities, but they also provide an incentive to other employers by showing that employing disabled people makes a difference at work.

Updated 2013 LCCA Procedures Manual and RealCost v2.5 CA software
Purpose of the Webinar

Overview of 2013 LCCA:

- Changes in Policy
- Changes in Procedure
- Changes in RealCost v2.5CA
- Available resources
# Agenda

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<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
<th>Affiliation</th>
<th>Time (Min.)</th>
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<tbody>
<tr>
<td>1. Policy and Procedures</td>
<td>Amy Fong</td>
<td>Caltrans HQ Pavement Program</td>
<td>20</td>
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<td>2. RealCost v2.5CA</td>
<td>Dr. Changmo Kim</td>
<td>University of California Pavement Research Center (UCPRC)</td>
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<td>3. Resources</td>
<td>Dr. Ding Cheng</td>
<td>CSU Chico California Pavment Preservation Center</td>
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<td>4. Questions &amp; Answers</td>
<td>All Caltrans Participants</td>
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<td>30</td>
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“The California Department of Transportation ensures investments in California’s transportation system are cost effective and efficient from the initial capital expenditure to the later maintenance and operations expenditures.

The Department uses Life-Cycle Cost Analysis (LCCA) to ensure that the costs over the life of a facility are considered when making project decisions.”
Principles

Get the most out of what you build

– Balance between initial and future costs (LCC)
– Minimize user delay
– Maximize worker safety
– Optimize materials
LCCA = Long Term Cost Savings
Typical Analysis Period for Pavement Project

- Initial Activity
- HM-1 Maintenance
- HM-1 Maintenance
- CAPM
- Rehabilitation

Pavement Condition:
- Excellent
- Good
- Fair
- Poor

- Pavement Design Life
- Activity Service Life
- Analysis Period
- Terminal Serviceability

Years

Remaining Service Life Value (RSV)
LCCA Exception (2007)

1) Major Maintenance
2) Minor A and Minor B
3) Projects using PEER
4) Maintenance pullout
5) Landscape paving
Additional Exception (2013)

LCCA CAPM has little to no impact on results
  – Limited options
  – Low costs & savings
  – Answers the same
  – State Law gives preference to rubber

2013 LCCA Update

Dropping requirement for CAPM in 2013 update
# Pavement Alt Selection (2007)

## Table 1. Typical Alternatives for Various Types of Projects with Pavement

<table>
<thead>
<tr>
<th>New/Reconstruction</th>
<th>Document</th>
<th>Conditions</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3</th>
<th>Other Alternatives that could be considered</th>
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<tr>
<td>PID</td>
<td>20-yr Traffic Index (Tl&lt;sub&gt;20&lt;/sub&gt;)</td>
<td>Tl&lt;sub&gt;20&lt;/sub&gt; &gt; 15</td>
<td>20-yr Rigid (ICP)</td>
<td>40-yr Rigid (ICP)</td>
<td>40-yr Rigid (CRCP)</td>
<td>20-yr Flex&lt;sup&gt;(c)&lt;/sup&gt;</td>
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<td></td>
<td>10 &lt; Tl&lt;sub&gt;20&lt;/sub&gt; ≤ 15</td>
<td>20-yr Flex&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>40-yr Rigid (ICP)</td>
<td>40-yr Flex&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>40-yr Rigid (CRCP)</td>
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<tr>
<td></td>
<td></td>
<td>Tl&lt;sub&gt;20&lt;/sub&gt; ≤ 10</td>
<td>20-yr Flex&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>40-yr Rigid (ICP)</td>
<td>40-yr Flex&lt;sup&gt;(c)&lt;/sup&gt;</td>
<td>20-yr Composite&lt;sup&gt;(b)&lt;/sup&gt;</td>
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<td>PR (PA&amp;ED)</td>
<td>PID Preferred Pavement Type &amp; Design Life</td>
<td>Flexible (20-yr design)</td>
<td>Flex (HMA)</td>
<td>Flex (RHM)</td>
<td>Rigid (ICP)</td>
<td>Flex (HMA w/ OGFC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexible (40-yr design)</td>
<td>Flex (HMA w/ OGFC)</td>
<td>Flex (RHM-G w/ RHM)</td>
<td>Rigid (ICP)</td>
<td>Flex (HMA w/ RHM)</td>
</tr>
<tr>
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<td></td>
<td>Rigid (20-yr design)</td>
<td>Rigid (ICP)</td>
<td>Flex (RHM)</td>
<td>Flex (HMA)</td>
<td>Rigid (ICP)</td>
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<td>Rigid (40-yr design)</td>
<td>Rigid (ICP)</td>
<td>Rigid (CRCP)</td>
<td>Flex (RHM-G w/ RHM)</td>
<td>Composite&lt;sup&gt;(g)&lt;/sup&gt;</td>
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<td>Composite (HMA)</td>
<td>Composite (RHM)</td>
<td>Flex (HMA)</td>
<td>Flex (RHM)</td>
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<td>Composite (40-yr design)</td>
<td>Composite (HMA)</td>
<td>Composite (RHM)</td>
<td>Rigid (ICP)</td>
<td>Rigid (CRCP)</td>
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</table>
Pavement Alt Selection (2013)

Pavement type selection is too complicated (from Users Group feedback)

- Multiple rules to comply
- Too many choices
- Don’t know which choices are viable pavement alt

Pavement Type Selection Flowcharts

1. New Construction/Reconstruction
2. Rehabilitation
3. Widening

2013 LCCA Update
Flowcharts must be used to determine pavement alternatives.
Pavement Flowchart
Rehabilitation

1. **Does the project trigger CAPM or Rehab?**
   - **Choose CAPM strategy. LCCA not required.**
   - **Compare:**
     1. CAPM (slab replacement)
     2. 40-yr Rehab (replace outer 2 lanes)

2. **Is the existing surface Rigid or Flexible?**
   - **Rigid**
   - **Flexible**

3. **Is stage 3 cracking between 10% and 20% in lane?**
   - **Yes**
   - **No**

4. **Is stage 3 cracking between 10% and 20% in lane?**
   - **Yes**
   - **No**

5. **Is AADT ≥ 15,000?**
   - **Yes**
   - **No**

6. **Is Alligator B cracking 30%-50% and avg rutting ≤ ½?**
   - **Yes**
   - **No**

7. **Can # of lanes be temp reduced or detoured to allow stage construction?**
   - **Yes**
   - **No**

8. **Is 20-yr TI ≥ 11.5?**
   - **Yes**
   - **No**
Clarified Ramp LCCA Instructions

Figure A3-1 Layout showing AADT for I-5 and for off-ramp (pre-construction)
Production Rate Tables

- Reviewed production rates
- New ramp production rate tables

Table 3-4 Productivity Estimates of Typical Future Rehabilitation Strategies for Flexible Pavements

<table>
<thead>
<tr>
<th>Final Surface Type</th>
<th>Future M&amp;R Alternative</th>
<th>Pavement Design Life (years)</th>
<th>Maintenance Service Level</th>
<th>Average Lane-mile Completed Per Closure</th>
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<tr>
<td></td>
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<td></td>
<td>Daily Closure (Weekday)</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5 to 7-Hour Closure</td>
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<tr>
<td>CAPM</td>
<td></td>
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<td></td>
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<tr>
<td>HMA</td>
<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.84</td>
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<tr>
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<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.36</td>
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<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.55</td>
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<tr>
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<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.30</td>
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<tr>
<td>HMA w/RHMA</td>
<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.55</td>
</tr>
<tr>
<td></td>
<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.30</td>
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<tr>
<td>RHMA-G</td>
<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>1.12</td>
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<td>5+</td>
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<td>0.48</td>
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<td>Overlay</td>
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<tr>
<td></td>
<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.34</td>
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</table>
2013 LCCA Procedure Manual

• Expand purpose and need
• Expand what to do
• Update RealCost chapter
• Expand interpreting results
Continuous Improvements

- Identify improvements
- Monitor & learn
Challenges that RealCost v2.5CA Addressed
RealCost v2.5CA Enhancements

1. Up to 4 pavement alternatives
   – Makes it easier to analyze multiple alternatives at the same time

2. Up to 24 future M&R activities
   – Capability to include future preventive maintenance projects as M&R activities \( \rightarrow \) more accurate
   – Ability to expand M&R sequences
3. Up to 4 Traffic Pattern to choose from
   – More accurate user costs

4. M&R Sequence Automation
   – Less time consuming
   – Less likelihood of errors

5. M&R Cost Estimate Calculators
   – More accurate project specific costs
Caltrans LCCA Resources

By
Dr. DingXin Cheng, Director
California Pavement Preservation Center
California State University, Chico
August 22, 2013
Presentation Outline

- FHWA LCCA Website
- Caltrans LCCA Website
- New RealCost version 2.5CA and LCCA Procedures Manual
- Caltrans LCCA Online Training
- Caltrans LCCA Examples
Life-Cycle Cost Analysis in Pavement Design

- In Search of Better Investment Decisions -

Pavement Division Interim Technical Bulletin
September 1998

FHWA LCCA Website

- Technical Guidance
- Recommendation
- Good/Best Practices
1. Which pavement alternative results in the lowest total cost to the agency over the life of the project?

2. To what level of detail have the alternatives been investigated?

3. What are the user-cost impacts of alternative pavement design strategies?
New Caltrans LCCA Website

Tool Box

- RealCost Version 2.5CA
- Pavement Climate Regions Map
- Appendix O-O
- Frequently Asked Questions (FAQs)
- 2012 Consumer Price Index (CPI) Value
- 2012 Value of User Time
Caltrans LCCA Procedures Manual


- Updated 2013 LCCA Procedures Manual
- For RealCost version 2.5CA
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<td>Title Page, Disclaimer &amp; Acknowledgement</td>
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<td>Preface</td>
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<td>Table of Contents, List of Figures, &amp; List of Tables</td>
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<tr>
<td>Chapter 1: Introduction</td>
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<td>Chapter 2: LCCA Approaches</td>
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<td>Appendix 2: List of RealCost Limitations and Bugs</td>
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<td>Appendix 4: Typical Pavement M&amp;R Schedules for California</td>
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<td>Appendix 5: Traffic Inputs Estimation</td>
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<td>Appendix 6: Alternate Procedure for Calculating Construction Year AADT</td>
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<td>Appendix 7: List of Tables</td>
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<td>Appendix 8: LCCA Pavement Type Selection Flow Charts</td>
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Caltrans LCCA Online Training

Introduction
- Life-Cycle Cost Analysis Introduction, (in development, check back in September, 2013)

Interactive Training
- Life-Cycle Cost Analysis Interactive Training, (Dec 2009 – To be updated for RealCost v 2.5CA in October 2013)

Conclusion and Summary
- Life-Cycle Cost Analysis Conclusion, (in development, check back in September, 2013)
Caltrans LCCA Examples

- LCCA Example Roadway Rehabilitation
- LCCA Example Ramp (in development)
- LCCA Example Widening (in development)
- Project Document LCCA Description Example
- LCCA Exception Request Example
- LCCA Report Example
- Appendix O-O Example
- District 7 LCCA Policy DP-96
- District 8 Materials Design LCCA Checklist for v2.2 (contact info: Bruce Kean)
- District 8 Materials Design LCCA Report Guide for v2.2 (contact info: Bruce Kean)
Caltrans LCCA Related Resources

- Deputy Directive: Use of LCCA in Project Decision Making (June 30, 2010)
- Highway Design Manual - Chapter 610: Pavement Engineering Considerations (see Topics 612 and 619)
- Project Development Procedures Manual: Chapter 8 - Overview of Project Development
- Traffic Data Branch (Division of Traffic Operations Vehicle Systems Unit)
Transmittal of LCCA Information

Submit your LCCA to HQ
Attn: HQ Life-Cycle Cost Analysis Coordinator
HQ Division of Maintenance, Pavement Program
Transportation Laboratory, MS5

5900 Folsom Boulevard, Quad 1
Sacramento, CA 95819-4612

Or

e-mail PDF files to
LCCA@dot.ca.gov
Other Resources

- HQ LCCA Coordinator Contact information
  - Amy Fong, amy.fong@dot.ca.gov, (916) 227-5838
- Frequent RealCost v2.5CA Error Messages
  - RealCost v2.2CA
- Division of Transportation Planning manuals and technical supplements
- CA4PRS Home Page
- FHWA LCCA Website
Wake Up!
Turn on the light!
Act amazed.
Thank you.
THANK YOU!!!

Questions or Comments Regarding to RealCost

Please contact Caltrans
HQ LCCA Coordinator:
Amy Fong
amy.fong@dot.ca.gov
Tel.: (916) 227-5838