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
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

<table>
<thead>
<tr>
<th>Topic</th>
<th>Presenter</th>
<th>Affiliation</th>
<th>Time (Min.)</th>
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<tr>
<td>1. Policy and Procedures</td>
<td>Amy Fong</td>
<td>Caltrans HQ Pavement Program</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 Pavmt Preservation Center</td>
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<td>4. Questions &amp; Answers</td>
<td>All Caltrans Participants</td>
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Deputy Directive (DD) #107
June 30, 2010

“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
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>Project Type</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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<tbody>
<tr>
<td>PR (PA&amp;ED)</td>
<td>PID</td>
<td>20-yr Traffic Index ($T_{160}$)</td>
<td>Flex (HMA)</td>
<td>Flex (HMA)</td>
<td>Flex (HMA)</td>
<td>Flex (HMA w/ CRCP)</td>
</tr>
<tr>
<td></td>
<td>PID Preferred Pavement Type &amp; Design Life</td>
<td>$T_{160} &gt; 15$</td>
<td>Flex (RHMA)</td>
<td>Rigid (IPCF)</td>
<td>Flex (RHMA)</td>
<td>Flex (HMA w/ CRCP)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 &lt; $T_{160} \leq 15$</td>
<td>Rigid (IPCF)</td>
<td>Rigid (IPCF)</td>
<td>Rigid (IPCF)</td>
<td>Rigid (CRCP)</td>
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<tr>
<td></td>
<td></td>
<td>$T_{160} \leq 10$</td>
<td>Rigid (IPCF)</td>
<td>Rigid (IPCF)</td>
<td>Rigid (IPCF)</td>
<td>Rigid (CRCP)</td>
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1. (1)
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

2013 LCCA Update

Pavement Type Selection Flowcharts

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

Flowcharts must be used to determine pavement alternatives.
Pavement Flowchart

New Construction/Reconstruction
Pavement Flowchart
Rehabilitation

1. Does the project trigger CAPM or Rehab?

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

3. Is AADT ≥ 15,000?
   - No
   - Yes

4. Is Alligator cracking 30%-50% and avg rutting ≤ ½”?
   - No
   - Yes

5. Is 20-yr TI ≥ 11.5?
   - No
   - Yes

6. Is the # of lanes in one direction > 3?
   - Yes
   - No

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

8. Compare:
   1. CAPM (slab replacement)
   2. 40-yr Rehab (replace outer 2 lanes)

9. Choose CAPM strategy.
   LCCA not required.
Pavement Flowchart
Widening

Choose design base on exist shoulder surface type or worker safety. See HDM for guidance. LCCA not required.

Will road at either end be widened within next 20 yr?

Intersection Only

BEGIN HERE: Type of Widening

Follow procedures for Lane Widening

Choose 40-yr design of same surface type as exist

Can pavement be overlaid by at least 0.20' in future?

Choose design with lowest LCC alternative

Compare:
1. 20-yr Flexible
2. 40-yr JPCP

Is exist pavement more than 20 years old?

Will exist lane be rehabilitated at same time?

Perform LCCA on Rehabilitation work. See Rehabilitation Selection Flowchart to determine strategy to analyze. Omit CAPM alternatives.

Consider:
Options to combine Rehabilitation & Widening

Will auxiliary lanes be added?

Is auxiliary lane more than 1,500' in length?

Ramp

Follow procedures for Lane widening

Yes

No

Yes

No

Yes

No

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>
<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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<tbody>
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<td></td>
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<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>
<td></td>
<td></td>
<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>
</tr>
<tr>
<td></td>
<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.36</td>
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<tr>
<td>HMA w/OGFC</td>
<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>0.55</td>
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<td>Mill &amp; Overlay</td>
<td>5+</td>
<td>1,2,3</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>
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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>RHMA-G</td>
<td>Overlay</td>
<td>5+</td>
<td>1,2,3</td>
<td>1.12</td>
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<td>1,2,3</td>
<td>0.48</td>
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<td>RHMA-G w/RHMA-O</td>
<td>Overlay</td>
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<td>0.84</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
RealCost v2.5CA Enhancements (Cont.)

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
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?
Life-Cycle Cost Analysis

Aerial Photo of Interchange
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
Updated 2013 LCCA Procedures Manual
- For RealCost version 2.5CA
<table>
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<th>Description</th>
<th>Last Updated</th>
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<tr>
<td>Title Page, Disclaimer &amp; Acknowledgement</td>
<td>August 1, 2013</td>
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<tr>
<td>Preface</td>
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<tr>
<td>Table of Contents, List of Figures, &amp; List of Tables</td>
<td>August 1, 2013</td>
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<tr>
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<td>Chapter 2: LCCA Approaches</td>
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<td>Chapter 3: RealCost Version 2.5CA</td>
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<td>Chapter 4: Summary and Conclusions</td>
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<td>References</td>
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<td>Appendix 1: Glossary and List of Acronyms</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
Website: LCCA District PEER Exchange

- 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)

"Something's just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty."
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

- Life-Cycle Cost Analysis Procedures Manual
  (PDF, 3.4MB), (Modified Aug, 2010)
  - 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:
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