Life-Cycle Cost Analysis

Tashia J. Clemons
Federal Highway Administration
Office of Asset Management
Objective

FHWA Updates & LCCA

1. FHWA Updates
2. LCCA program status
3. State Example
Keeping Good Roads Good
2010-2011
Corridor assessment

- I-95 corridor
- What data are states using to manage “conditions” of I-95
- Common performance indicators
- Good, Fair or Poor
- MD-DE-VA
- “Evaluation of Highway Performance Measures for a Multi-Study Corridor - A Pilot Study”
  http://www.fhwa.dot.gov/asset/hif10015/
Keeping Good Roads Good

Infrastructure Health Project

- 2 objectives

1. Identify performance indicators
   - Good, fair & poor
   - Condition Data needed
   - Reported

2. Identify pavement health indicators
   - What do we need to measure
• Four-week training, blended learning

• Target audience: state and local maintenance supervisors

• Strong emphasis on preservation and performance improvement
Maintenance Leadership Academy

Six Modules

✓ Maintenance Management
✓ System Preservation
✓ Roadsides and Drainage
✓ Weather-related Operations
✓ Safety and Workzones
Life-Cycle Cost Analysis
LCCA Program Status

Distance Learning Course

Onsite RealCost LCCA Workshop

RealCost User Manual

Technical Bulletin

Bridge LCCA
Life-Cycle Cost Analysis Definition

- Life-Cycle Cost Analysis is a **process** for evaluating the total economic worth of a usable project segment by analyzing initial costs and discounted future costs, such as maintenance, user, reconstruction, rehabilitation, restoring, and resurfacing costs, over the life of the project segment.

*Source: Transportation Equity Act for the 21st Century*
Pavement Preservation vs. Reconstruction

State Examples

Arizona State DOT

Washington State DOT
Pavement Preservation vs. Reconstruction

Arizona Department of Transportation

- Continuous weakening of substructure material
- Cost & performance

- Sponsored a Study - Cost-Benefit Analysis of Continuous Pavement Preservation Design Strategies Versus Reconstruction Final Report 491

*Prepared by:* K.L. Smith, L. Titus-Glover, M.I. Darter, H.L. Von Quintus, R.N. Stubstad, and J.P. Hallin
- Break-even
- Continuous preservation
- Rehabilitation treatments
Life-Cycle cost Analysis (LCCA)

- Probabilistic approach
- FHWA’s LCCA spreadsheet program
Input Analysis

- Pavement performance
- Service life estimates
- Best estimates of unit costs
- Work zone-related user cost
- Discount rates
- Analysis period
Alternative Strategies

- Life Cycle Cost
  - 4 strategies
  - 15 commonly occurring pavement scenarios
## Traffic Info Used in LCCA

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<th>AADT, veh/day (^a)</th>
<th>Cars as Percentage of AADT, %</th>
<th>Percent Single Trucks (^b)</th>
<th>Percent Combo Unit Trucks (^b)</th>
<th>Annual Growth of Traffic, %</th>
<th>Speed Limit, mi/hr</th>
<th>Lanes Open (^c)</th>
<th>Free Flow Capacity, vphpl</th>
<th>Rural or Urban? (^d)</th>
<th>Queue Dissipation Capacity, vphpl</th>
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## Value of Time

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Final results

- Reduction in total LCC
- Increase (from 0 to 2) in the number of rehabs between original construction and the first reconstruction events
- 9 of the 15 scenarios
- Break-even point
  - Occurs after 2 to 3 cycles of rehab
Washington State DOT

- 1993 Revised Code WA
  - Required project selection be based on the lowest life cycle cost concept
  - Optimal timing (opportunity window) 2 to 3 yrs
Life-Cycle Cost Analysis

Washington State DOT

Rehabilitation Cycle (years)

Annual Cost

4 5 6 7 8 9 10 11 12 13 14 15 16 17

0 10 20 30 40 50 60
Network level Economic Analysis

- Design life yielded the most benefits

- Pavement Management System (PMS)
  - Pavements
  - Anticipated deterioration curves
  - Rehabilitation activity cycles
  - Anticipated costs in the year the activity would occur
• “worst first” to “a needs based approach”.

• 3 performance measures of pavement distress.

  1. Pavement Structural Condition (PSC)
  2. International Roughness Index (IRI)
  3. Rutting
Minimum Rating

- 50 for PSC
- 220 inches/mile for IRI
- 10 mm (.4 in) for rutting

- The LCCA validation process was conducted again in 2000
Pavement Structural Condition (Statewide - All Pavements)

Life-Cycle Cost Analysis

Washington State DOT
• Lowest LCC by conducting preservation activities
  – Early stages of deterioration to prolong their life
  – Need for major rehabilitation
Success is measured by network condition of their pavements

- In 1971
  - 50% poor conditions

- Today
  - Less 10% are in poor condition
Resource Documentation

- Arizona report
  
  *Cost-Benefit Analysis of Continuous Pavement Preservation Design Strategies Versus Reconstruction*
  

- FHWA Case Study
  
  *Pavement Management Systems The Washington State Experience*
  
Resources

Training

Fundamentals of Life Cycle Cost Analysis Live Instructor Led Distance Learning Course

Onsite RealCost Life-Cycle Cost Analysis (LCCA) Software Workshop

http://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.cfm
Life-Cycle Cost Analysis

Resources

LCCA Primer
FHWA-IF-02-047

Technical Bulletin
FHWA-SA-98-079

Transportation Asset Management Case Studies

LCCA Software
RealCost 2.5
and
User Manual

http://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.cfm
Thank you

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Washington, DC 20590
202-366-1569

http://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.htm