Life-Cycle Cost Analysis

Tashia J. Clemons
Federal Highway Administration
Office of Asset Management
1. Pavement Preservation
2. FHWA Updates
3. LCCA Program Status
4. State Example
Keeping Good Roads Good
Without Pavement, We Would Be Stuck In The Mud!

Washington-Richmond road, 1919
NMAH, Archives Center, API Collection
Less Than 100 Years Ago...
We’ve Come a Long Way ...
Society Depends on Infrastructure

**INFRASTRUCTURE**

4 Million Miles of Roads & 600,000 Bridges
Statistics We Should Know:

- Federal = 3%
- State = 20%
- Local = 77%

2/3 are Paved (1/3 Unpaved)
94% of Paved have an Asphalt Surface
Partnerships Are Required

- FHWA
- Academia
- State DOTs
- Local Governments
- Private Sector
Three FHWA Asset Management Teams:
- Systems Management and Monitoring
- Engineering and Economic Investment
- Construction and System Preservation
Doing the *right* thing...

...to the *right* pavement.

...at the *right* time...

TO KEEP THE “GOOD” ROADS GOOD!
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
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 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
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

- Break-even
- Continuous preservation
- Rehabilitation treatments
Life-Cycle cost Analysis (LCCA)

- Probabilistic approach
- FHWA’s LCCA spreadsheet program
✓ 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>Rural or Urban?&lt;sup&gt;d&lt;/sup&gt;</th>
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## Life-Cycle Cost Analysis

### Agency Construction Cost

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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

Annual Cost

Rehabilitation Cycle (years)

Annual Cost

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

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

33
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)

- Very Good
- Good
- Poor
- Very Poor

WSDOT Goal:
- 75%
- 25%
• 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
Life-Cycle Cost Analysis

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
Training

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

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

Resources

LCCA Primer
FHWA-IF-02-047

Technical Bulletin
FHWA-SA-98-079

RealCost 2.5
and
User Manual
Summary and Closing Remarks

- Pavement Preservation
- Keeping Good Roads Good
- LCCA/RealCost
- State Examples

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

Thank you

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