Concrete Pavement’s Role in Asset Management

North Carolina Concrete Pavement Conference
Durham – November 17-18, 2016
Talking Points

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Moving Ahead for Progress in the 21st Century Act

MAP - 21

DIVISION A – FEDERAL-AID HIGHWAY AND HIGHWAY SAFETY CONSTRUCTION PROGRAMS

TITLE I – FEDERAL-AID HIGHWAY

SEC. 1103. DEFINITIONS

(a) Definitions

(3) “(2) ASSET MANAGEMENT.—The term ‘asset management’ means a strategic and systematic process of operating, maintaining, and improving physical assets, with a focus on both engineering and economic analysis based upon quality information, to identify a structured sequence of maintenance, preservation, repair, rehabilitation, and replacement actions that will achieve and sustain a desired state of good repair over the lifecycle of the assets at minimum practicable cost.”

Does “minimum practicable cost” include ability to pay for future action?
(4) PLAN CONTENTS.—A State asset management plan shall, at a minimum, be in a form that the Secretary determines to be appropriate and include—

- "(A) a summary listing of the pavement and bridge assets on the National Highway System in the State, including a description of the condition of those assets;
- "(B) asset management objectives and measures;
- "(C) performance gap identification;
- "(D) lifecycle cost and risk management analysis;
- "(E) a financial plan; and
- "(F) investment strategies.
GAO reviewed FHWA’s guidance on Life Cycle Cost Analysis and assessed the extent to which FHWA’s guidance conforms to the GAO’s Cost Guide

Recommendation

MAP-21

“(E) REPORT.—Not later than 1 year …
the Comptroller General shall submit …
a report on the results of the study which
shall include -
“(i) a summary of the latest research on
lifecycle cost analysis; and
“(ii) recommendations on the appropriate—
“(I) period of analysis;
“(II) design period;
“(III) discount rates; and
“(IV) use of actual material life and
maintenance

GAO Report

The Secretary of Transportation should
direct the FHWA Administrator to issue
updated LCCA guidance to fully
incorporate the cost-estimating best
practices in GAO’s Cost Guide, including
guidance regarding the following:
• input data quality and reliability,
• use of independent cost estimates,
• documentation of the analysis,
• how to present the analysis for management
approval, and
• describing when the estimate should be
updated
GAO’s Cost Guide Regarding Inflation


Inflation listed 46 times

Inflation index listed 11 times

Discount rate only listed in regard to referencing OMB’s 1992 Circular No. A-94 and DOD’s 1995 Instruction No. 7041.3

• Only mention of inflation in GAO-13-544 is in a footnote about OMB A-94 on p 6
• Only significant mention of discount rate in GAO-13-544 was on p 14 “Specific areas in need of clarification cited by state officials included technical clarification about discount rate and user costs, among others.”
6) b) **Discount rate** – Discount rates have a significant impact on the determination of the NPV of alternate pavement designs. The Life-Cycle Cost Analysis (LCCA) in Pavement Design – Interim Technical Bulletin, September 1998, provides guidance on the process of LCCA. The Technical Bulletin recommends that NPV is the economic efficiency indicator of choice. Future cost streams should be estimated in constant dollars and discounted to present using a real discount rate. **Discount rates used should reflect historical trends over long periods of time.** Real discount rates should be consistent with OMB circular A-94, Appendix C.

“Discount rates used should reflect historical trends over long periods of time” - however, long term construction inflation is ignored.
Discount Rate

Nominal Discount Rate (30-Year Treasury Note) Compared to Real Discount Rate
Life-Cycle Cost Analysis

LCCA uses discounting to convert anticipated future costs to present dollar values so that the lifetime costs of different alternatives can be directly compared. Discounting is an economic method of accounting for the time value of an investment.

“anticipated future costs” – how many states estimate future costs?
Constant Dollars

“Constant dollars, often called real dollars, reflect dollars with the same or constant purchasing power over time. In such cases, the cost of performing an activity would not change as a function of the future year in which it would be accomplished.

For example, if hot-mix asphalt concrete (HMAC) costs $20/ton today, then $20/ton would be used for future year HMAC cost estimates.”

Life-Cycle Cost Analysis in Pavement Design FHWA-SA-98-079

The average price for hot-mix asphalt in North Carolina was approximately $31.50 in 1998
How Do We Define Constant Dollars

Price of Oil Compared to Minimum Wage

- Income: $1.15 - $7.25  factor of 6.3
- Oil: $2.85 - $45  factor of 15.8
Only significant increase in real dollars was 1961 to 1971 and 1994 to 1999. Decreased from 1973 to 1982. Essentially flat from 2001 to today.
Economic or Financial Analysis

"How do we evaluate future costs in asset management"

‘Economic analysis helps answer the questions "Why do it at all?" "Why do it this way?" "Why do it now?"
Financial analysis helps answer the questions "Can it be financed?" "Who will bear the burden?“’ p. 21

3.5 Conclusions Regarding Anticipated Future Funding

The assumed reduction in Federal support is projected to contribute to a 13% decline in 2013 NCDOT revenues. **Given the combination of reduced Federal funds, static tax rates and the effects of increasing fuel efficiency, total revenues are projected to experience 2.9% average annual decline in real terms over the 2040 plan period.** As a result, the purchasing power of baseline funding is severely diminished over time….
North Carolina DOT Revenue Projection

Financial Plan and Investment Strategies, 2040 Plan, Aug 2012, p.10

Exhibit 8
NCDOT Baseline Revenue Projections
$ in Billions

- 2011
- 2013
- 2015
- 2017
- 2019
- 2021
- 2023
- 2025
- 2027
- 2029
- 2031
- 2033
- 2035
- 2037
- 2039

- Highway Fund
- Highway Trust Fund
- Federal Funds
Is North Carolina gaining in purchasing power?

NC Transportation 2015 annual report PERFORMANCE

Constant dollars… real dollars, reflect dollars with the same or constant purchasing power over time.
Should Life Cycle Cost consider fiscal constraints?

FHWA, Financial Planning for Transportation Asset Management: An Overview, February 2015, p.70

**Figure 17.** The impact of inflation (shown in orange) eroding purchasing power

SOURCE: WSDOT
Indexes

“The indiscriminate use of indexes of price changes to situations where they do not apply can cause serious distortions in the decision-making process.

Nationwide composite cost indexes should not be used when state or local indexes are available.

Neither should composite indexes be used if component indexes are available.” p. 34


The “real discount rate” is essentially an implied index – lumping all commodity price changes to the GDP deflator.
Pavement Indexes Are Not Constant

From 1993 to 2015 PCCP index is 3% and AC surface course is 4.8%
Nominal Discount Rate

*Allows for individual commodity inflation and discounts by anticipated level of funding*

“The essential time to consider inflation is when the project budget is being prepared, after economic analysis has shown the project to be economically viable.

Future year or multiyear project budgets are appropriated in future year dollars rather than base year dollars.

**Failure to account for inflation in project budgets will almost always result in too few future year dollars being set aside to complete the projects…**

Economic Analysis Primer, FHWA IF-03-032

Is there any correlation between LCC and the department’s Financial Plan and Investment Strategies?
Where to begin?

A report by FHWA found that an over-reliance on short-term pavement repairs will fail to provide the long-term structural integrity needed in a roadway surface to guarantee the future performance of a paved road or highway. The 2010 report, “Beyond the Short Term: Transportation Asset Management for Long-Term Sustainability, Accountability and Performance,” warned that transportation agencies that focus only on current pavement surface conditions will eventually face a highway network with an overwhelming backlog of pavement rehabilitation and replacement needs.
Remaining Service Interval

Figure 1. RSI. *Implementation of Remaining Service Interval Concept*, FHWA-HRT-16-066
Must Have Some Long Term RSI Pavements

Moscow Road 1914
Muscatine County

Eddyville Cemetery 1909
Mahaska County

Kurt Smith, APTech, 2014
Kevin Merryman, Iowa DOT, 2016
Concrete Overlays

# of miles in Iowa
- 1204 on asphalt
- 734 on concrete

Oldest road
- On asphalt - 1977
- On concrete - 1980

Average age – half of projects constructed since 2005
- 12 on asphalt (25.1 prior to 2005)
- 13.5 on concrete (20.1 prior to 2005)

Range in thickness 2” - 12”
Range in panel size 3’ - 40’

IA 13 in Delaware County
Original Construction 1931 – 18 ft pavement
Widened in 1964 w/2” overlay & w/3” in 1984
Milled ¼” prior to overlay
Concrete – 3.5” & 4.5” thick - jt spacing 4.5’ X 4.5’, 6’ X 6’, 9’ X 9’; 28’ wide
Tie Steel at Lane Lines Only – No Dowels
Joints 1/8” Not Sealed
Over 1 Million ESAL’s since construction
What does it really cost?

“The present situation in funding of highway maintenance and improvements, described earlier in this paper, involves rising costs and reduced revenues. Both are reflections of inflationary pressures. If this scenario is indicative of future trends, then these factors should be taken into account in engineering economic evaluations of alternative maintenance, rehabilitation, and replacement strategies for highway facilities. The real cost of providing essential future services in terms of the value of expendable future income is” p. 633

\[ F' = F \left[ \frac{1+f}{1+q} \right]^n \]

\( F' \) = present worth of future services  
\( F \) = present cost of services (products)  
\( q \) = rate of increase in funding  
\( f \) = rate of inflation for service  
\( n \) = time of expenditure in years

US 999, County, NC 100,000 sq yds

12” HMA 10” PCCP

When looking at a 40 year analysis and the North Carolina DOT’s funding stream and construction inflation, the present day dollars equate to a $2,464,900 better value for 10” PCCP. The -2.9% real discount rate documented in the “2040 Plan” equates to PDV of $4,980,400 for the PCCP section.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Today’s Cost (at year of action)</th>
<th>Inflated Cost</th>
<th>Real Discount Rate (per OMB)</th>
<th>Nominal Discount Rate Based on projected receipts in the Financial Update presented at the Nov 2nd Board meeting</th>
<th>Real Discount Rate per Financial Plan and Investment Strategies, 2040 Plan</th>
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<tr>
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<tr>
<td>12” Hot Mix -Initial 3 Rehab – mill &amp; fill Total</td>
<td>$4,083,900</td>
<td>$4,083,900</td>
<td>$4,083,900</td>
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<tr>
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<td>$3,610,800</td>
<td>$8,036,200</td>
<td>$2,446,400</td>
<td>$5,066,100</td>
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<td>$7,694,700</td>
<td>$12,120,100</td>
<td>$6,530,300</td>
<td>$9,150,000</td>
<td>$12,440,200</td>
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<tr>
<td>10” PCCP - Initial 2 Rehab – saw, seal, patch, grind Total</td>
<td>$5,382,000</td>
<td>$5,382,000</td>
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<td>$945,000</td>
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<td>$6,327,000</td>
<td>$7,385,700</td>
<td>$6,030,300</td>
<td>$6,685,100</td>
<td>$7,459,400</td>
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<tr>
<td>Difference/Adjustment in rehab costs</td>
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<td>$4,734,400</td>
<td>$500,000</td>
<td>$2,464,900</td>
<td>$4,980,400</td>
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$52.86/ton for HMA estimate and $46/sq yd for PCCP estimate

Inflated costs are 2012 basis CAGR from the NC DOT data 1998 - 2016
Conclusions

…Ideally, a long-term asset management plan should have a long-term financial plan that addresses the funding needs of the asset from the time it is constructed to the end of life when it is retired from services…

FHWA, Financial Planning for Transportation Asset Management: An Overview, February 2015, p.76

In business, a financial plan can refer to the three primary financial statements (balance sheet, income statement, and cash flow statement) created within a business plan. Financial forecast or financial plan can also refer to an annual projection of income and expenses for a company, division or department. A financial plan can also be an estimation of cash needs and a decision on how to raise the cash, such as through borrowing or issuing additional shares in a company.

From Wikipedia, the free encyclopedia
Conclusions

*Concrete pavements play a major role in asset management*

- Inventory is only one part
- Performance curves from pavement management should be reviewed periodically
- Cost estimates have to be updated to account for price volatility
- Finances have a significant role in asset management
- Commodity prices - indexes - are not constant in North Carolina
- Investments should be looking at future - not today’s - costs in terms of expendable future income
- Highway funding levels are not keeping pace with construction inflation in North Carolina

Maintenance budgets are increasing at the expense of construction budgets.
Thank you for your time