

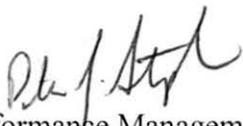


U.S. Department
of Transportation
Federal Highway
Administration

Memorandum

Subject: **INFORMATION:** Supplement to the 1998 Technical
Bulletin on Life Cycle Cost Analysis
(FHWA-SA-98-79)

Date: March 4, 2015

From: Peter J. Stephanos, Director 
Office of Transportation Performance Management

In Reply
Refer to: HIPM-1

To: Directors of Field Services
Federal Lands Highway Division Engineers
Director, Office of Technical Services
Division Administrators

This memorandum transmits a supplement to the Life-Cycle Cost Analysis in Pavement Design - Interim Technical Bulletin published in September, 1998. This supplement was developed in response to findings from the GAO audit report, "Federal-Aid Highways: Improved Guidance Could Enhance States' Use of Life-Cycle Cost Analysis in Pavement Selection" (GAO-13-544).

The Interim Technical Bulletin recommends procedures for conducting life-cycle cost analysis (LCCA) at the project level. The Interim Technical Bulletin was originally developed for pavement applications, but it has become the Agency's guidance for LCCA of pavements, structures, value engineering or any other situation with an economic analysis of alternatives is conducted. Specifically, LCCA is required when:

- conducting value engineering of large projects (23 CFR 627) and
- using alternate bidding for pavement type selection (TA5040.39).

LCCA is recommended practice when comparing alternate designs for both pavements and bridges.

The supplement provides clarified guidance on estimating agency costs, additional guidance about when to re-evaluate LCCA results in a dynamic environment, and additional guidance on how to present the results to management.

The supplement should be used in conjunction with the Technical Bulletin to provide a complete picture of the current guidance. Ultimately, we intend to issue an update to the Technical Bulletin which will incorporate the material in the supplement and other updates.

Please communicate this information to relevant stakeholders.

Further information on Life Cycle Cost Analysis including the Technical Bulletin is located at <http://www.fhwa.dot.gov/infrastructure/asstmgmt/lcca.cfm>. If you have any questions please contact Mark Swanlund at 202-366-1323 (mark.swanlund@dot.gov).

Attachment

LCCA in Pavement Design, Technical Bulletin

Page 12: Replace

ESTIMATE AGENCY COSTS

To ensure confidence in the LCCA results, it is important that the cost estimates and other data used in the analysis are credible, reasonable, objective and unbiased. The results of the LCCA are sensitive to the quality of data for costs and performance life of specific treatment strategies. As such, special attention should be paid to collecting and using valid and relevant historical data when available. Historical data sources include state bid price databases and asset management systems. When relevant historical data is not available, estimated values can be used, but the rationale for developing the estimated values should be clearly documented.

To further enhance the credibility of the estimate and the analysis, it is recommended to use independent cost estimates or independent quality reviews where major costs drivers are subject to analyst judgment for input values. For large complex projects, it may be justified to have an independent review of cost estimates and other data by another agency unit or external reviewers. For other projects, it may be justified to have another agency unit conduct periodic compliance review of the cost estimates and other data used in LCCA, for all or selected number of projects.

To maintain transparency and continuity, the data sources used in developing the estimates and assumptions as well as any intermediate calculations conducted outside of LCCA tool to arrive at the cost estimates and other data must be documented and included as part of the LCCA documentation. This includes State DOTs having a documented process for the preparation and management of cost estimates used in LCCA. For further guidance and best practices in developing reliable cost estimates, the reader is encouraged to refer the *Cost Estimating and Assessment Guide* (GAO-09-3SP) published by the General Accounting Office or the *Practical Guide to Cost Estimating* published by the by the American Association of State Highway and Transportation Officials.

LCCA comparisons are always made between mutually exclusive competing alternatives. LCCA need only consider differential costs between alternatives. Costs common to all alternatives cancel out, these cost factors are generally noted and excluded from LCCA calculations.

Agency costs include all costs incurred directly by the agency over the life of the project. They typically include initial preliminary engineering, contract administration, construction supervision and construction costs, as well as future routine and preventive maintenance, resurfacing and rehabilitation cost, and the associated administrative cost. Routine reactive-type maintenance cost data are normally not available except on a very general, area-wide cost per lane mile. Fortunately, routine reactive-type maintenance costs generally are not very high, primarily because of the relatively high performance levels maintained on major highway facilities. Further, SHAs that do report routine reactive-type maintenance costs note little difference between most alternative pavement strategies. When discounted to the present, small

reactive maintenance cost differences have negligible effect on NPV and can generally be ignored.

Agency costs also include maintenance of traffic cost and can include operating cost such as pump station energy costs, tunnel lighting, and ventilation. At times, the salvage value, the remaining value of the investment at the end of the analysis period, is included as a negative cost.

Salvage Value represents value of an investment alternative at the end of the analysis period. The two fundamental components associated with salvage value are residual value and serviceable life.

Residual Value refers to the net value from recycling the pavement. The differential residual value between pavement design strategies is generally not very large, and, when discounted over 35 years, tends to have little effect on LCCA results.

Serviceable Life represents the more significant salvage value component and is the remaining life in a pavement alternative at the end of the analysis period. It is primarily used to account for differences in remaining pavement life between alternative pavement design strategies at the end of the analysis period. For example, over a 35-year analysis, Alternative A reaches terminal serviceability at year 35, while Alternative B requires a 10-year design rehabilitation at year 30. In this case, the serviceable life of Alternative A at year 35 would be 0, as it has reached its terminal serviceability. Conversely, Alternative B receives a 10-year design rehabilitation at year 30 and will have 5 years of serviceable life at year 35, the year the analysis terminates. The value of the serviceable life of Alternative B at year 35 could be calculated as a percent of design life remaining at the end of the analysis period (5 of 10 years or 50 percent) multiplied by the cost of Alternative B's rehabilitation at year 30.

Sunk Costs represent a special category of costs that are irrelevant to the decision at hand. Analysts should be careful not to include them in LCCA. An example may serve best in understanding the concept.

An individual places a \$10 nonrefundable deposit on a \$100 camera at Store A. Before picking up the camera, the individual finds an identical camera on sale at Store B for \$80. From an economic efficiency perspective, from which store should the individual purchase the camera? What bearing does the \$10 deposit have on the decision?

The \$10 deposit is a sunk cost and is irrelevant to the decision. The decision comes down to paying Store A the \$90 balance for the camera, or paying Store B \$80 for an identical camera. Not all cases of sunk cost are this clear and, again, analysts need to take care to guard against including them in LCCA. An example more specific to pavement design might involve the reluctance of a designer to select an alternative with a much lower life-cycle cost because it would mean *wasting* the money previously spent on developing final plans for a clearly inferior alternative.

RE-EVALUATE LCCA INPUTS

In cases where the LCCA is performed early in the project development process, it is recommended to reevaluate inputs and assumptions and revise the analysis as needed to ensure that the most accurate information is available to the decision makers. The Cost Estimating and Assessment Guide (GAO-09-3SP) published by the General Accounting Office recommends updating the estimate to reflect changes to technical and program assumptions or to keep the estimate current as the project passes through key development milestones.

Cost data is available at varying levels of detail throughout the project delivery process. However, the purpose of the LCCA should define the detail that is required for the cost inputs. Most often, for pavement type selection, this information should be available in the design stage when project plans and specifications have progressed to the point where a type selection decision is required.

Under certain situations, it may be advisable to update the project estimates, redo the LCCA and revise the pavement design recommendation, if warranted. Factors that would justify updating the analysis prior to advertising for bids include:

- Material cost volatility of more than 10% based on bid price history
- Real discount rate volatility of more than 2%
- Project size and scope changes that influence unit prices and quantities
- Traffic volume estimate changes that would have an impact on pavement design
- Traffic management strategy changes that would have an impact on construction sequencing
- Cost estimate is more than 2-3 years old

PRESENTATION OF RESULTS TO MANAGEMENT

In many instances the results of the analysis are presented to management for review and approval or industry stakeholders for use in alternate bidding for pavement type selection. It is important that this presentation of the results clearly describe not only the results but the assumptions, limitations, and risk factors included in the analysis. It is recommended that the analyst prepare a briefing with enough detail to easily defend the analysis and conclusions.

The LCCA briefing should clearly illustrate the following key points:

- Estimate/analysis ground rules and assumptions
- Sensitivity or probabilistic analysis results presented in a concise and easy to understand manner
- Discussion of risk and uncertainty analysis such as cost drivers, historical performance data, historical cost data, and discount rates.
- Conclusions and recommendations