

## CHAPTER 1 INTRODUCTION

### 1.1 Purpose of This Manual

This manual describes uniform policies and procedures of Life-Cycle Cost Analysis (LCCA), for projects with pavement on the State Highway System, regardless of funding source. This manual provides step-by-step instructions for using *RealCost Version 2.5CA*, a program developed by the Federal Highway Administration (FHWA) and modified by Caltrans to better meet the needs of California.

This manual provides guidance and data for performing LCCA for pavement. It will help assure that pavement alternatives are analyzed objectively and consistently statewide, regardless of who engineers, builds, or funds the project. The *RealCost Version 2.5CA* program, this procedure manual, and additional information including LCCA examples can be accessed from the Caltrans LCCA Website at:

<https://dot.ca.gov/programs/maintenance/pavement/concrete-pavement-and-pavement-foundations/life-cycle-cost-analysis>.

### 1.2 MAP-21 & Asset Management

On July 6, 2012, President Barack Obama signed into law P.L. 112-141, the Moving Ahead for Progress in the 21<sup>st</sup> Century Act (MAP-21). MAP-21 provides transportation funds and transforms the framework for investments to guide the growth and development of the country's vital transportation infrastructure. It ensures that investments of federal-aid funds are directed to support progress toward achieving performance targets established in an asset management plan.

“Asset Management is a strategic approach to managing transportation infrastructure. The goal of Asset Management is to get the best results and performance from the preservation, improvement, and operation of infrastructure assets with the resources available. LCCA provides decision makers with the ability to determine the least-cost solution for a transportation investment requirement and is therefore a natural fit within the Asset Management framework.”<sup>1</sup>

### 1.3 Purpose of LCCA

With increasing public scrutiny, government agencies are under great obligation to demonstrate their stewardship of public funds. MAP-21 encourages the use of LCCA for the evaluation of all major investment decisions in order to increase the effectiveness of those

---

<sup>1</sup>“Life-Cycle Cost Analysis Primer”, U.S. Department of Transportation, Federal Highway Administration, Office of Asset Management, August 2002.

decisions. The goal is to achieve and sustain a desired state of good repair over the life-cycle of the assets at minimum practicable cost. (23 U.S.C. 101(a)(2), MAP-21 § 1103). Managing and preserving pavements is an increasingly important goal of highway agencies around the country.

LCCA identifies the most cost-effective pavement alternatives for the long-term (initial costs plus long term maintenance and repair costs.). As transportation funds are tighter, Caltrans holds the responsibility towards taxpayers that California's transportation systems are cost effective and efficient. This responsibility begins at the initial capital expenditure and extends to the later maintenance and operations expenditures, throughout the entire life-cycle of the pavement.

### 1.4 Caltrans' Policy

**The pavement alternative with the lowest life-cycle is viewed as having the lowest impact to Caltrans even if it has a higher initial cost.<sup>1</sup>**

HDM Topics 612 and 619 identify situations where a LCCA must be performed to assist in determining the most appropriate alternative for a project by comparing the life-cycle costs of different pavement types and design strategies including:

- 1) Pavement types (flexible, rigid, or composite);
- 2) Rehabilitation strategies;
- 3) Pavement design lives comparisons (e.g., 20 vs. 40 years); and
- 4) Implementation strategies (combining, widening and rehabilitation projects vs. constructing them separately).

LCCA must be performed and documented, using the procedures and data in this manual, for all projects which include pavement work on the State Highway System except for the following types of projects:

- Major maintenance (HM-1)
- Minor A and Minor B
- Permit Engineering Evaluation Reports (PEER)
- Maintenance pullouts
- Landscape paving
- CAPM

For the exempted projects, the Project Engineers and the project development team may determine on a case-by-case basis to perform a life-cycle cost analysis and how it should be documented for each project development phase.

---

<sup>1</sup> See Deputy Directive #107 "Use of Life Cycle Cost Analysis in Project Decision Making", by Malcolm Dougherty, Chief Deputy Director dated June 30, 2010.

Pavement work consists of all the work associated with constructing a pavement structure, including subgrade, subbase, base, surfacing, earthwork, pavement drainage, traffic handling to construct the pavement, removal of existing pavement or earthwork, and other costs necessary to build the pavement. It should also include associated support costs for planning, engineering, and construction oversight. It can consist of constructing, widening, rehabilitating, or overlaying lanes, shoulders, gore areas, intersections, parking lots, or other similar activities.

#### ***1.4.1 LCCA Exception Request***

**Exemptions from LCCA require the written approval of the Chief Office of Concrete Pavement and Pavement Foundations in the HQ Pavement Program, and must be documented in the project initiation and approval documents.** It is policy not to grant exemptions due to shortages in resources, funding sources, or not having sufficient time. Exemptions should involve a unique or unusual situation not addressed in this manual. Exemption requests must be submitted to the HQ LCCA Coordinator and must include project description, layout, typical cross sections, and reason for exemption.

#### ***1.4.2 When to Perform LCCA***

LCCA should be completed as early as possible in the project development process. Perform a LCCA during the Project Initiation Document (PID) phase and again during the Project Approval & Environmental Document (PA&ED) phase.

With the exception of rehabilitation (program code 120, 122, and 125), performing a LCCA can be deferred from the PID phase to the PA&ED phase at the discretion of the district if any of the following apply:

- 1) Construction costs will not be programmed from the PID, such as the Project Study Report-Project Development Support (PSR-PDS).
- 2) Project is programmed for construction using the pavement and traffic control costs for the pavement alternative with the higher initial costs.

Any deferral of LCCA should be documented in the PID and include the necessary resources to complete the analysis during the PA&ED phase.<sup>1</sup> **LCCA must be completed prior to the PA&ED date.**

**If a change in pavement design alters the pavement design life or other performance objectives during the design of the project, update the LCCA to include the new pavement alternative.**

---

<sup>1</sup> Pavement Policy Bulletin PPB 10-04, approved on April 12, 2010.

### 1.4.3 Where to Document LCCA

To document life-cycle costs in project documents follow the procedures in Appendix O-0 of the Project Development Procedures Manual (PDPM). **When the pavement alternative with the lowest life-cycle cost is not selected, the reasons must also be documented.**

### 1.4.4 LCCA in Value Analysis

This manual is intended to provide the procedures required to implement the current LCCA policies. LCCA must conform to the procedures and data in this manual. **Life-cycle cost analysis performed as part of a Value Analysis study can only be used to meet the requirements for LCCA in HDM 619 and Project Development Procedures Manual, Chapter 8 if the analysis is done in accordance with the requirements found in this Life-Cycle Cost Analysis Procedures Manual for pavements.**

### 1.4.5 LCCA in Other References

Additional information can be found in Chapter 8 of the PDPM. This manual shall supersede any conflicting LCCA procedures found in the PDPM. This manual does not supersede HDM design procedures.

## 1.5 Roles and Responsibilities

The roles and responsibilities for LCCA within Caltrans are defined below.

- *HQ Pavement Program* is responsible for the development of Caltrans' policies, programs, guidelines, manuals, procedures, and standards that are used statewide for project pavement design.
- *HQ LCCA Coordinator* provides technical LCCA expertise and assistance to district staff.
- *District Directors*:
  - Ensures that their district follows Caltrans policies, procedures, and guidelines;
  - Implement quality control and quality assurance practices for each project development component; and
  - Implement independent quality assurance (commonly referred to as oversight) for each project development component.

It is up to the individual districts to determine how to execute LCCA. Most Districts bear the responsibility to Design, while others to Materials or Cost Estimating Unit.

- *District Project Engineer* in Planning and Design are "responsible in charge" of the project development documents:
  - Establishes design parameters;
  - Verifies alternatives meet needs;
  - Development of LCCA;
  - Determines best pavement structure for the project; and
  - Documents decisions made.

- *District Materials* recommends pavement alternatives for new construction, widening, and rehabilitation. Provides expert advice. A preliminary Materials Report should be issued for LCCA (PID and PA&ED).
- *District Traffic* provides traffic data to the Project Engineer such as traffic forecasting, traffic volumes, traffic index, and transportation management plan.
- *District Maintenance* provides existing pavement conditions and may provide pavement alternatives for Maintenance and CAPM projects.
- *Project Managers, Functional Managers, and Supervisors* empower employees with appropriate tools, resources, time, and training to deliver project components. Ensure project compliance with policies, standards, procedures, and best practices.
- *Outside Entities (i.e. Local Agencies and Consultants)* are to use LCCA when performing on projects on the State Highway System. Districts are Caltrans' contacts with outside entities and are responsible for coordinating processes with the outside entity to ensure compliance with Caltrans' project development procedures.