

Tech Brief

Guidelines for Life Cycle Cost Analysis

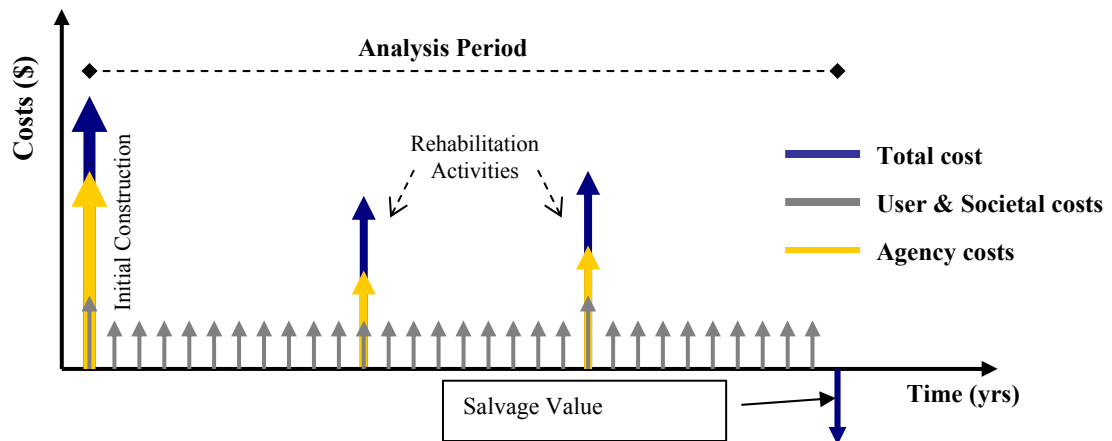
Need a solution?
Think Jersey DOT

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HERE'S THE PROBLEM...

Life Cycle Cost Analysis (LCCA) is an indispensable technique that employs well-established principles of economic analyses to evaluate long-term performance of competing investment options. The process is performed by summing up the discounted monetary equivalency of all benefits and costs that are expected to be incurred in each option. Most of the LCCA input parameters are inherently uncertain, such as the discount rate, the analysis period, and the type and timing of future rehabilitation activities that will take place in each of the life cycle options. In order to conduct LCCA in a reliable and trustworthy manner, a thorough understanding of the theoretical engineering and economics background must be acquired



AND, HERE IS THE SOLUTION...

Develop standard guidelines for conducting Life Cycle Cost Analysis, so that it may be used by units with the New Jersey Department of Transportation.

BUT, HOW CAN IT BE DONE?

Conducting a literature search a set of guidelines that can be used as a tool, in order to conduct Life Cycle Cost Analysis that is dependable and trustworthy.

THESE ARE OBJECTIVES OF THE STUDY...

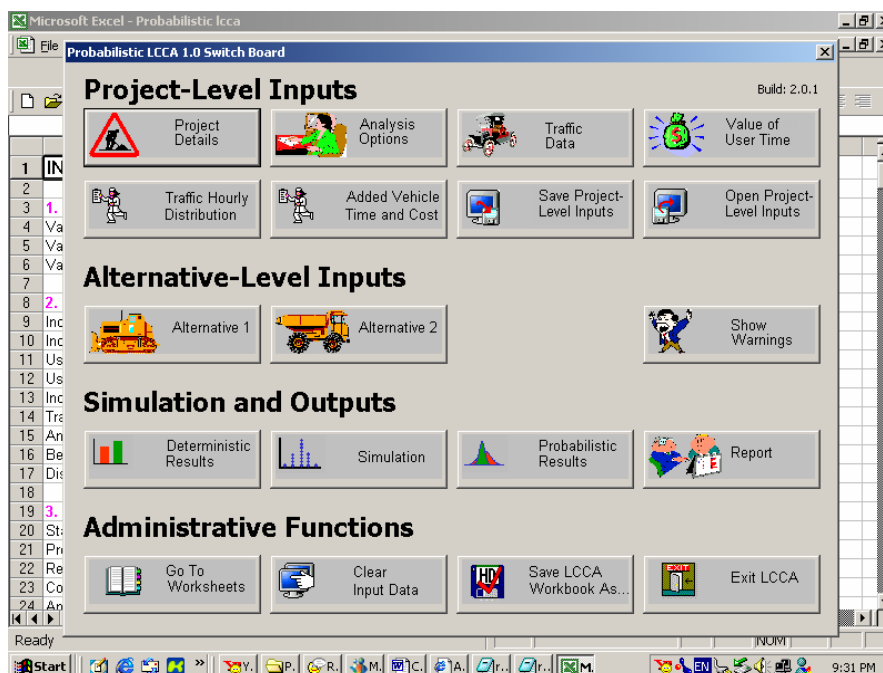
- To develop a systematic and generic approach to conducting Life Cycle Cost Analysis.
- To attribute these guidelines in monitoring contractors' pay schedules, as applicable to the New Jersey Department of Transportation.

AND, HERE IS WHAT WE DID...

The analytical framework of LCCA serves as a support system for making informed and conversant choices in infrastructure management. The process is performed by summing up the monetary equivalency of all benefits and costs at their respective time of occurrence throughout the analysis period. They are then converted into a common time dimension so that different alternatives may be compared properly.

This research resulted in guidelines that focus essentially on the practical side of LCCA, presenting an in-depth qualitative discussion of the LCCA and its various components. The weaknesses and strengths of each component of LCCA and their influence on the outcome were illustrated using numerical examples. This discussion aims at providing the analyst with a complete insight into the LCCA process.

Most of the available literature or guidelines about LCCA serve as an "instruction manual" without fully discussing the theoretical basis behind the steps followed. Our guidelines, alternatively, are a short manuscript that allow the reader to acquire a full grasp of the theoretical and practical basis of the process that is much needed to make reasonable judgment about the proper course of action to follow in project evaluation.



Five questions were developed to use as economic indicators:

1. Are benefits included in the analysis?
2. What is the level of decision-making and/or analysis involved?
3. What methods suit the requirements of the particular agency involved?
4. How important is the initial capital investment in comparison to future expenditure?
5. What method of analysis is the most understandable to the decision maker?

The next step was outlining a firm set of procedures for the actual Life Cycle Cost Analysis Procedure. The LCCA structured approach can be outlined in the following steps:

- 1) Define project's alternatives.
- 2) Decide on the approach: Probabilistic vs. Deterministic.
- 3) Choose general economic parameters: Discount Rate, Analysis Period.
- 4) Establish expenditure stream for each alternative:
 - a) Design rehabilitation strategies and their timings.
 - b) Estimate differential agency costs.
 - c) Estimate differential user costs.
 - d) Estimate differential societal costs.
- 5) Compute Net Present Value for each alternative.
- 6) Compare and interpret results/ Sensitivity Analysis.
- 7) Re-evaluate design strategies if needed.

In concluding the research process, a sample Life Cycle Cost Analysis was conducted to put practical application to the guidelines developed. The sample activity utilized data for a user cost analysis during a work zone construction project.

CONCLUSION...

The continuing challenge for the State agencies is to establish acceptance quality levels (AQL) of constructed pavements for full payment, and rejectable quality levels (RQL) at and below which they will be rejected.

This research successfully yielded guidelines for conducting a Life Cycle Cost Analysis which provide a framework for performing LCCA, estimating its input parameters, and interpreting its results. In addition, a distinct example application of LCCA in monitoring contractors' pay schedules is possible using these guidelines.

The analytical framework of LCCA further serves as a support system for making informed and conversant choices in infrastructure management.

WHAT IS THE NEXT STEP?

A much more difficult prospect is determination of the difference in expected life and the life-cycle costs of initial construction and successive maintenance, rehabilitation, and reconstruction, between the as-built and as-designed (specified) pavement. Conceptually, what would be required here is the ability to predict performance – rutting, cracking and roughness— of both the as-built and specified pavements under the same load assumptions, compute the present values (PV), and use the difference in PVs as the basis for a pay adjustment.

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A final report is available online at <http://www.state.nj.us/transportation/research/research.html>

If you would like a copy of the full report, please FAX the NJDOT, Bureau of Research, Technology Transfer Group at (609) 530-3722 or send an e-mail to Research.Bureau@dot.state.nj.us and ask for:

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