

TECHNICAL SUMMARY

Analysis of User Waiting Costs for Construction Projects
On Louisiana's Interstate Highway System

Summary of Report Number 372

P.I. (s) Fereydon Aghazadeh, Gerald
Knapp, Thomas Ray
Louisiana State University

LTRC Contacts:
Mark Morvant, P.E.
(225) 767-9124
Masood Rasoulian, P.E.
(225) 767-9112

INTRODUCTION

Life cycle cost analysis (LCCA) is an analysis technique for economically evaluating the complete lifetime costs of competing project alternatives. It considers not only initial construction costs, but also ongoing maintenance costs over the lifetime of the project and other user costs such as lost productivity due to traffic delays. Projects are then chosen not just on lowest initial costs, but also on their ability to minimize user costs over the entire project lifetime.

The Federal Highway Administration (FHWA) has published guidelines for conducting LCCA in its *Life-Cycle Cost Analysis in Pavement Design* technical bulletin, hereafter referred to as the FHWA LCCA manual. The Louisiana Department of Transportation and Development (LADOTD) currently use these LCCA models on selected projects.

The FHWA LCCA guidelines provide a methodology and model for calculation of both agency costs (construction, maintenance, and management costs) and user costs. User costs are the costs borne by cars and trucks using the roadway. For maintenance, construction, and rehabilitation projects, user costs are primarily due to capacity reductions in the form of lane reductions, such as two lanes on an interstate having to merge into to one lane. From a driver's point of view, the impact of congestion is longer travel times with associated lost productivity, higher fuel costs, increased pollution, increased accident rates, and less easily quantified costs such as user dissatisfaction and frustration.

LADOTD is interested in evaluating the use of the FHWA LCCA user cost model. This model predicts estimated user costs due to congestion resulting from a planned construction, maintenance, or rehabilitation project. The estimate is then used as part of an overall cost-benefits analysis of the project's feasibility that also considers direct construction costs (labor, materials, and equipment) and future maintenance cost changes.

The FHWA LCCA user cost model is based on results from several national studies. This study investigates the model's validity as applied to two major construction projects within the state. The study also investigates the model's sensitivity to errors in its input parameters, many of which must be estimated.

OBJECTIVES & SCOPE

The objective of this study was to evaluate the accuracy of the FHWA LCCA user delay cost model in estimating user delay costs for roadwork projects in Louisiana. This research addressed only the user delay cost component of the FHWA LCCA model. Evaluation of the FHWA LCCA model was limited to two state roadwork projects in progress at the time of this study, I-10 in LaPlace and I-10 in Lake Charles. The evaluation consisted of 1) analysis of the accuracy of model inputs, 2) analysis of the model outputs as compared to actual delay times observed, and 3) sensitivity analysis of the model's user delay cost estimates to errors in model inputs.

RESEARCH APPROACH

Delay times were observed and analyzed at two different construction zones — I-10 at LaPlace and I-10 at Lake Charles. The LaPlace construction occurred between mileposts 194 and 209 on I-10 between Sorrento and LaPlace. The construction zone was approximately 4.3 miles long in each direction, although it varied slightly in length on different days. The primary alternate route was US-61 between the Sorrento and LaPlace interchanges. Trip time data was collected on six days during the construction period for this location.

The Lake Charles construction occurred in both directions between mileposts 44 and 64 on I-10 between Iowa and Jennings. The construction zone was approximately 6.5 miles in length in the westbound direction, and it also varied slightly on different days. The eastbound construction zone was initially about 1.25 miles when observations were collected in November, but was about 6.5 miles in length when observations were later collected in December 2001. Trip time data was collected on seven days during construction at this location.

On each of these days, researchers made several trips in each direction, using a car equipped with Global Positioning System (GPS). The speed of the car, travel distance, and travel time were measured every minute from the GPS device and recorded continuously. Trip times and distances were recorded either from the start of queuing, or from the start of the work zone, whichever began first. Distance and time were recorded through the end of the work zone. Additionally, vehicle count data were collected by the LADOTD at test sites during and after construction using a pneumatic traffic-counting tube, and provided to researchers.

CONCLUSIONS AND RECOMMENDATIONS

For the LaPlace construction project, an in-depth analysis of the LADOTD's LCCA model performance was conducted. The actual traffic of the work zone during construction at the LaPlace site appeared to be substantially lower than that projected by the FHWA LCCA manual and used in the LADOTD model. The model overestimated delay time by 10 percent (with a confidence interval of between 3 percent and 17 percent) due largely to reduction in queue-related delays resulting from diversion around the work zone. This was the dominant source of error in the LaPlace model. Lack of traffic count data collected during the construction period limited the ability of the researchers to draw significant conclusions about the model from the Lake Charles project.

Based on the analysis, the following items are recommended:

Care needs to be taken in model input parameters for work zone vehicle speeds, work zone lengths, Average Daily Traffic (ADT), hourly traffic distribution, and cost rates.

Traffic distributions should be based on more than one day's worth of traffic count data collected prior to construction. The traffic counts should also be used to confirm the validity of the assumed ADT, if the ADT is not known to be current.

The model should be modified to account for the effect of diversion on queue-related delays.

The model should be modified to account for reduced speeds through the work zone during peak traffic hours (regardless of queuing).

Cost rates derived in earlier years should be extrapolated to the present using CPI factors.

Weekends should be modeled separately from weekdays, as traffic demand and distribution changed substantially.

If there are known construction work phases that will change in length during each phase, the phases should be modeled separately.

Further investigation should be made to develop a reliable predictor of road capacity during construction for Louisiana roadways.

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