The Ohio Department of Transportation Office of Research & Development Executive Summary Report

Innovative Methods for Calculation of Freeway Travel Time Using Limited Data

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Problem

ODOT's policy for Dynamic Message Sign utilization requires travel time(s) to be displayed as a default message. The current method of calculating travel time involves a workstation operator estimating the travel time based upon observation of high-density vehicle detectors.

Dynamic Message Sign on Freeway I-75 in Cincinnati, Ohio

With the proliferation of cell phone usage and the advent of computer-aided dispatch links from 911 call centers, incident detection no longer requires a high density of vehicle detectors along the highway. Therefore, ODOT's future freeway management system deployments (Cleveland, Akron-Canton, Dayton-Springfield, and Toledo) will only have a limited set of vehicle detectors for data sampling.

ODOT currently utilizes two different algorithms to estimate travel time in its Freeway Management Systems for display on Dynamic Message Signs. These methods may no longer be accurate with limited vehicle detector data. Therefore, innovative methods for accurately calculating travel times are needed to maintain the message sign policy.

Objectives

The objective of this research is to determine the accuracy of ODOT's travel time estimation methods utilizing vehicle detectors as a lesser interval than have been previously utilized, and to investigate if improvements can be made in the estimation. The focus of this study is the area covered by the ARTIMIS program in Cincinnati.

Description

Travel time estimations created by processing of simulated freeway loop detector data using proposed method have been compared with travel times reported from VISSIM model. An improved methodology was proposed to estimate freeway corridor travel time under congested traffic. Field data were also collected using the floating car method and comparison of the estimated with the field measured travel times was made.

Conclusions & Recommendations

We found that the existing midpoint algorithm is not effective in reducing the estimation error in congestion conditions; the estimation error can be over 30% in case of a traffic incident. The improved method is able to generate reasonably accurate results in different traffic and geometric conditions, and its performance is supported by consistency in statistical testing. By using this method to estimate travel time, the errors in high volume situations are reduced to 5%~10% corresponding to detector spacing from 1/3~4/3 miles.

Implementation Potential

The improved method can be relatively easily implemented with the help of surveillance cameras monitoring the congested areas at major ramps and interchanges. The error correction term can be processed on a spreadsheet program to calculate the extra times due to congestion. Although this research is only a methodology study, once proven successful by field testing and evaluation, fewer detector stations will be needed and the long-term savings in system operation and maintenance costs will be immense.