Research Project: SP508B4D
Date: December 2006

RESEARCH SUMMARY

DEVELOPMENT AND FIELD EVALUATION OF A REAL-TIME TRAVEL TIME PREDICTION SYSTEM

Problem

Due to the increasing congestion in most urban networks, providing reliable trip times to commuters has emerged as one of the most critical challenges for all existing advanced traveler information systems (ATIS). However, predicting travel time is a very complex and difficult task, as the resulting accuracy varies with many variables of time-varying nature, including the day-to-day traffic demands, responses of individual drivers to daily commuting congestion, conditions of the road facility, weather, incidents, and reliability of available detectors. To contend with these issues, transportation professionals have proposed and implemented a variety of systems for providing travel times in the past two decades. However, most real world systems provide travel times based on only the current traffic conditions, not the predicted travel time for en-route trips or for pre-trip planning.

Objectives

This study has the following principal objectives:

- Develop a travel time estimation module to provide reliable estimates of completed trips under all types of recurrent traffic patterns with sparsely distributed traffic detectors.
- Construct a travel time prediction module for freeway segments with a large detector spacing, and take full advantage of historical travel times and traffic patterns.
- Integrate a missing data estimation module to deal with various missing data patterns that often occur in a real-world system.
- Calibrate an incident detection module to switch the travel time prediction system to a different mode (i.e., display delay warnings instead of predicted travel times) when an incident has been detected.

Description

This study has developed a real-time travel time prediction system for a highway segment with sparsely-distributed detectors. The entire system consists of the following principal modules: detector location optimization model, travel time estimation models, missing data imputation model, accident detection models, and travel time prediction models. A field demonstration of the developed system was implemented on the I-70 freeway segment connected to I695 in the Baltimore metropolitan area.

Results

The effectiveness of the developed system was evaluated by an independent consulting firm through a field demonstration on the I-70 segment connected to the Baltimore I-695 over a period of one month, using only 10 detectors for the length of 25 miles. The results indicated that more than 90 percent of the predicted travel times during the demonstration period actually fell within the preset threshold of $\pm$ 2 minutes.

Report Information

This document is available from the research Division of Maryland State Highway

Maryland State Highway Administration Research Division, 707 N. Calvert Street, C-412, Baltimore MD 21202
Tel: 410-545-2921 or 1-888-204-0157