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

AN INTELLIGENT DECISION SUPPORT SYSTEM FOR WORK ZONE TRAFFIC MANAGEMENT AND PLANNING

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Problem

Periodic resurfacing, rehabilitation, restoration, and reconstruction work is needed on the aging highway system in the state of Ohio to maintain a desired level of service for the traveling public. However, temporary work zones on highways disrupt the normal flow of traffic and reduce the level of service. Freeway work zones have become a major source of traffic congestion and travelers' delays which result in reduced freeway capacity, increased driver frustration, increased traffic accident, increased road user delay cost, and increased fuel consumption and vehicle emissions. Thus, highway agencies are facing with the challenging problem of effectively planning and managing the work zone to ameliorate its effects on the vehicular traffic. The increasing demand in maintaining an efficient highway system provides the impetus to develop rational and rigorous computer models for reliable estimation of the work zone capacity and traffic queue delay and length to help work zone engineers create effective work zone traffic plans.

Objectives

The objectives of the proposed research are to develop new computational models for estimating the work zone capacity and traffic queue delay and length as a function of a large number of factors impacting the work zone and implement them into a user-friendly interactive object-oriented software system for effective work zone traffic management and planning. The use of several recent computing and information technologies are explored: a) case-based reasoning (CBR), b) neural networks, c) fuzzy logic, and d) object-orient programming.

Description

A CBR model is created for freeway work zone traffic management considering work zone layout, traffic demand, work characteristics, traffic control measures, and mobility impacts. A freeway work zone traffic delay and cost optimization model is presented in terms of the length of the work zone segment and the starting time of the work zone using average hourly traffic data. An adaptive computational model is created for estimating the work zone capacity and queue length and delay. A neuro-fuzzy logic model is developed for estimation of the freeway work zone capacity taking into account seventeen different factors impacting the work zone capacity. An object-oriented model is developed for freeway work zone capacity and queue delay and length estimation. The model is implemented into an interactive software system, called *IntelliZone*. *IntelliZone*'s capacity estimation engine is based on pattern recognition and neural network models incorporating a large number of factors impacting the work zone capacity.

Conclusions & Recommendations

Scientific models have been created for estimation of the work zone capacity for the first time. This research provides the foundation for a new generation of advanced decision support systems for effective management of traffic at work zones. The validation results indicate that the work zone capacity can be estimated by clustering-neural network models in general with an error of less than 10%, even with limited data available to train the models. The extensive parametric study of main factors impacting the work zone capacity provides quantitative and objective results of value to work zone engineers and highway agencies when creating traffic management plans for work zones.

Implementation Potential

IntelliZone is a user-friendly software system that can be used as an intelligent assistant for work zone traffic management and planning. It allows work zone engineers to perform scenario analysis and create traffic management plans consistently, reliably, and efficiently.