INDOT Research

TECHNICAL *Summary*

Technology Transfer and Project Implementation Information

TRB Subject Code: 54-9 Traffic Performance Measures *June 2004*
Publication No.: FHWA/IN/JTRP-2004/26, SPR-2661 *Draft Final Report*

Reconciling Speed Limits with Design Speeds

Introduction

The INDOT Design Manual recommends that a design speed is selected based on the functional classification, urban vs. rural environment, terrain, traffic volumes and project scope of work. The design speed should be equal or greater than the legal or anticipated speed limit. According to AASHTO, a design speed should be consistent with the speed a driver is likely to expect on the highway.

By using design speeds, highways are designed in a conservative manner to facilitate the safe motion of vehicles even in adverse but reasonable conditions. Consequently, the 85th percentile of actual free-flow speeds may exceed the design speed. This situation does not have to cause excessive hazard because the majority of drivers adequately perceive the risk.

Some Indiana road sections designed and built in the past do not meet the current design standards. INDOT makes a continuous effort to modernize these sections. Due to prohibitive costs, reduced design speeds and design exceptions are considered. Guidance is needed to help reduce the discrepancy between the economically justifiable design solutions and the design standards expected by the motorists. Predicting the 85th percentile speed on modernized sections would help designers in finding solutions that meet both the motorists' expectations and the current design standards to the possible extent. The objective of the research was the development of a tool for predicting the actual speeds on modernized two- and four-lane roads in Indiana.

Findings

The mean free-flow speed and its variability across drivers are considered important safety factors. The existing speed-predicting models combine the mean speed impacts with the speed dispersion impacts, which make identification of the speed factors and interpretation of the results difficult. Furthermore, the existing models are specialized to selected percentiles and are not able to estimate the entire range of the speed variability at a site. This report presents an advanced method of modeling free-flow speeds that overcomes the limitations of the existing models. This has been accomplished by representing the percentile speed as a linear combination of the mean and the standard deviation.

Free-flow speeds and highway geometry characteristics collected on two-lane rural highways and four-lane suburban and rural highways were used to develop the models. The crash experience on the studied highways was considered to eliminate segments where a high number of crashes indicated that the driver perception of the risk might be incorrect. The models demonstrated their efficiency in identifying relationships between speed and diverse road geometry characteristics, e.g. cross-section dimensions, horizontal curve elements, intersection and driveway densities and median type.

Implementation

The developed speed models were included in a prototype software tool to help highway designers implement the models. The tool generates a profile of the mean speed and any specified percentile speed for the entire project length based on the preliminary highway design values. The tool can be used to evaluate if the predicted speeds meet the desired speeds for the design project, to identify locations in the project with design inconsistencies and to evaluate possible modifications in the design values at any location of the highway project.

Contacts

For more information:

Prof. Andrew Tarko
Principal Investigator
School of Civil Engineering
Purdue University
West Lafayette IN 47907
Phone: (765) 494-5027
Fax: (765) 496-7996
E-mail: tarko@ecn.purdue.edu

Indiana Department of Transportation
Division of Research
1205 Montgomery Street
P.O. Box 2279
West Lafayette, IN 47906
Phone: (765) 463-1521
Fax: (765) 497-1665

Purdue University
Joint Transportation Research Program
School of Civil Engineering
West Lafayette, IN 47907-1284
Phone: (765) 494-9310
Fax: (765) 496-7996
E-mail: jtrp@ecn.purdue.edu
http://www.purdue.edu/jtrp