STRIDE | Southeastern Transportation Research, Innovation, Development and Education Center

Technology Transfer Final Report

STRIDE Project J

Improving Work Zone Mobility through Planning, Design and Operations

Rod E. Turochy, Ph.D.

Auburn University

December 2021

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the information presented herein. This document is disseminated in the interest of information exchange. The report is funded, partially or entirely, by a grant from the U.S. Department of Transportation's University Transportation Centers Program. However, the U.S. Government assumes no liability for the contents or use thereof.

ACKNOWLEDGEMENT OF SPONSORSHIP AND STAKEHOLDERS

This work was sponsored by a contract from the Southeastern Transportation Research, Innovation, Development and Education Center (STRIDE), a Regional University Transportation Center sponsored by a grant from the U.S. Department of Transportation's University Transportation Centers Program.

1. Project Overview

The purpose of this research project was to produce information that transportation agencies could use to better manage traffic operations in their work zones, particularly those involving lane closures on freeways. This research project examined several aspects of modeling traffic flow through freeway work zones so that agencies can develop more realistic traffic simulation models and be armed with information on the effectiveness of various temporary traffic control strategies. There were four parts to this project.

1) First, a traffic simulation model of a rural freeway lane closure was developed and calibrated. This part of the research also addressed the validity of default parameters in VISSIM for time headway and truck acceleration capabilities. Additionally, a stochastic approach to evaluating freeway work zone capacity was proposed and a test case developed.
2) The second part of this study evaluated the effects of early merge and late merge scenarios across a range of freeway lane closure and traffic volume cases.
3) The third part used video camera images to identify driver behavior and merging patterns at freeway work zones across a range of traffic conditions and roadway geometric configurations.
4) The fourth part of the project employed mesoscopic traffic modeling of freeway work zones and how the results affected work zone operations to mitigate congestion.

2. Research Goals

The goals and objectives of this research project were intended to help transportation agencies improve their traffic simulation modeling of freeway work zones, resulting in more effective traffic control planning and operations. The development and calibration of a traffic simulation model of a rural freeway work zone involving a 2-to-1 lane closure yielded an opportunity to modify several default parameters in the traffic simulation program VISSIM to better reflect driver behavior and capabilities of the vehicle fleet present on rural freeways in the United States, particularly the southeastern region. Exploration of capacity of freeway work zones as a dynamic, or probabilistic phenomenon, rather than the traditional approach of capacity as a static or fixed value, was explored. Another objective of this study was to investigate the operational impacts of two TTC strategies for work zones, namely static late- and early merge control, under varying traffic demand with 3-to-1 lane closure configurations. Finally, demonstration of the processing of video camera images to characterize driver behavior, particularly associated with merging maneuvers in advance of two different 3-to-2 lane closures, was accomplished.

3. Findings

The traffic data collected for this study in a 2-to-1 lane closure provided an opportunity to examine the appropriateness of the use of default values for several parameters in VISSIM. Specifically, truck performance characteristics and time headway distributions developed from the field data are presented in the research report and are recommended for use in the U.S, instead of the default values in VISSIM. Driver behavior parameters of standstill distance and lane-change distance developed from the field data are substantially larger than those provided in VISSIM and therefore are recommended for use in the modeling of freeway work zones in the U.S. In a separate simulation effort to model 3-to-1 lane closures, it was found that late-merge scenarios generally outperform early merge behavior scenarios and the length of the lane closure was found not to have any substantial impact on traffic

operations. At another location where observations of driver behavior were made through the processing of video camera images, it was found that in advance of a 3-to-2 lane closure, merging tends to happen further in advance of a lane closure on a straight section of freeway than in a horizontal curve, and that heavy truck drivers tend to merge further in advance than do passenger car drivers.

4. Performance Metrics

Metric	# Completed
OUTPUTS	
Product(s): Number of new or improved tools, technologies, products, methods, practices, and processes created or improved	1
Technical Report: Number of client-based technical reports published	STRIDE Final Report
OUTCOMES	
Body of Knowledge: Number of trainings for transportation professionals	1
Professionals Trained: Number of professionals participating in trainings	48
IMPACTS	
Stakeholders: Number of stakeholders you met with to encourage adoption or implementation of product(s)	1 – Alabama DOT
Adoption/Implementation: Number of incidences outputs of research have been implemented or adopted	0

5. Product

Improvements to Traffic Simulation Models of Freeway Work Zones

Improvements to traffic simulation models of freeway work zones were developed in this research project. The recommended values, in lieu of the default settings in VISSIM, for properties including truck acceleration characteristics, standstill distance, and time headway distribution, more accurately replicate field conditions. These values should be suitable for modeling freeway work zones in rural settings in the region, and the truck acceleration characteristics representative of the U.S. trucking fleet should be generalizable to typical freeway conditions across the nation.

6. Who benefits/will benefit from your product(s)?

- Transportation agencies planning and designing work zones on freeways
- Traffic simulation modelers

7. Body of Knowledge & Professionals Trained

1) **STRIDE webinar**: A webinar "Traffic Simulation Parameters, Merge Configurations, and Capacity Modeling for Freeway Work Zones" was held on 04/21/2021 for this project. Presenters were Rod Turochy (Auburn) and Virginia Sisiopiku (UAB). 48 professionals attended the webinar and the YouTube recording has had 49 views.

8. Stakeholder Engagement

MEETING DETAILS		NARRATIVE DESCRIPTION
STRIDE Rep.	Rod Turochy	Held a videoconference progress meeting on an ALDOT research project. Discussed STRIDE Projects
Date of Activity	03/27/2020	

Type of Activity	phone meeting	J and P2 and how those complement/relate to the ALDOT project on the effects of queue warning systems in work zones. Requested attendees' future input on P2 and support to implement results of J and P2.
Location	Via videoconference	
Stakeholder(s)	Alabama DOT: Jeff Benefield, Kerry NeSmith	

9. Adoption/Implementation

Regarding adoption, the products (research results) are publicized through STRIDE in the form of the research brief, final report, and archived webinar. Two papers published through the Transportation Research Board's Journal of the TRB provide another avenue for potential users of the work to find the results.

10. Broader Impacts

The impact of broad implementation of the research results include more accurate modeling of traffic conditions in work zones on freeways, and to some extent, beyond work zones. This type of modeling is used to inform transportation agencies of the impacts of work zones on road users and can support decision making regarding traffic volumes that may result in queues at freeway work zones. These models also support decision making regarding acceptable impacts to traffic and therefore when to allow lane closures on freeways.