Performance Evaluation of Late Merge Work Zone Control

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Introduction

Work zones are areas of roadway blocked for construction or maintenance work. This affects users of the roadways by reducing traffic flow, thus increasing travel time through work zones.

A 2009 FHWA report stated that the possibility of a driver facing an active work zone is one out of every hundred miles driven on the highway. In addition, approximately 24% of non-recurring delays and 10% of total delays on freeways are caused by work zones.

Literature review suggested that the majority of State DOTs rely on their earlier experience without consideration of operational impact of any temporary traffic control (TTC). Earlier studies showed that late merge control performs better than other TTC strategies for short-term work zones using a 3-to-2 lane drop.

However, **the performance of late merge TTC for long-term work zones using various lane-drops needs to be further investigated.**

Study Objective

Explore the **operational impacts of late merge traffic control** for work zones for 3-to-2 and 3-to-1 lane drop, under varying traffic demand during the 24-hr period of the day.

Late merge

Late merge is a temporary traffic control strategies that influences drivers to drive in their lanes up to the starting point of tapered portion of work zone. This way the road space can be used up to the merge point of work zone.

Methodology

A 14-mile segment of I-65 in Birmingham, AL was modeled in PTV VISSIM, an industry-standard microscopic simulation software. The baseline model and work zone scenarios with late merge control under various conditions were tested.

Figure 1: Late merge technique

Data and Tools

Directional traffic demand was obtained from the ALDOT for Sept. 2017, and ArcGIS was used to identify the traffic counters within the study segment. A random weekday volume was coded in the baseline model.

Figure 2: Study Segment

Validation and Calibration

The baseline model was successfully validated using average speeds available from the National Performance Management Research Data Set (NPMRDS).

Simulation Experimental Design

Using the I-65 testbed, various work zone configurations were simulated to assess their operational impacts. The simulation experimental design under **static late merge** considered the **type of lane drop** (3-to-2 and 3-to-1); and **work-space length** (1000 – 5000 ft, with increments of 1000 ft.).
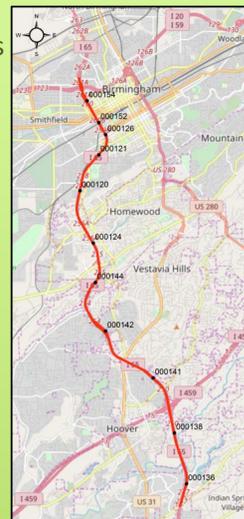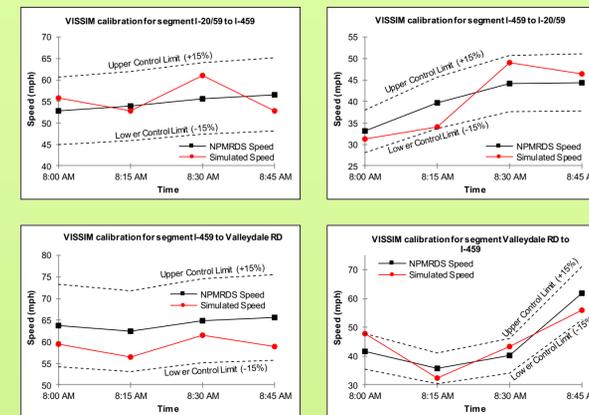
Calibration and Validation

Figure 3: Calibration of baseline model with NPMRDS speed

Simulation

Figure 4: Vehicle maneuvers during late merge control strategy

Vehicles used the rightmost lane with work zone up to merge point of work zone and formed queue in the rightmost lane. After few seconds, vehicles moved to the left lanes available.
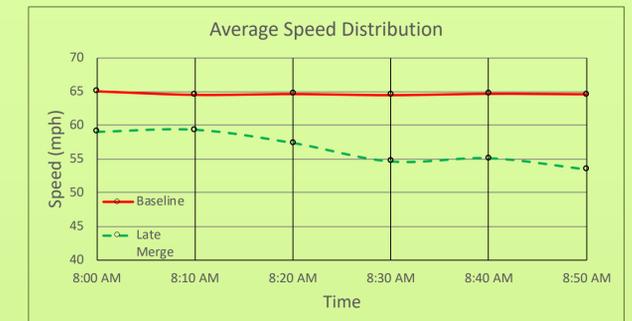
Sample Results

Figure 5: Avg. Speed with and without 3-2 lane closure (8-9:00 AM)

This is a snapshot of Average Speeds at the work zone segment with and without a lane closure during the peak hour. The analysis is ongoing and will provide results showing **Average Speed distribution over space (along the corridor) and time (over 24hrs)**. Similar analysis is performed for other Performance Measures including **Delays, Volumes, Densities,** and **Emissions.**

Conclusions

Study results will provide an insight about the impact of late merge control on traffic operations of work zones. A full factorial experiment will be conducted to understand the performance of late merge control under different work-zone lengths and lane closures.

Transportation agencies can use the findings of the study to plan future work zones, particularly those involving partial closures on freeways.

Acknowledgements

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