



0-6704: Reduction of Motorists' Delay and Crash Potential Upstream of Highway Work Zones

Background

Work zone lane closures on highways create difficulty in providing efficient traffic operations and safe conditions for drivers and workers. Lane closures due to highway work zones reduce available capacity, which increases congestion potential and poses several issues in maintaining unobstructed traffic operations. Merging at these closures increases weaving, may cause queue jumping, and presents the risk of rear-end collisions. Drivers subjected to these stressful conditions may exhibit unsafe behavior that stems from road rage. According to a driver survey, around half of drivers see merging as the single most stressful situation facing drivers. This stress is primarily due to drivers using the closed lane to pass the slower moving traffic in the open lane in order to force their way in downstream, otherwise known as queue jumping. The purpose of this project is to assess delay and safety issues related to various work zone conditions and provide recommendations to ensure efficient operations and safe conditions for both users and workers.

What the Researchers Did

The researchers used a combination of field observations, micro-simulation, and dynamic traffic assignment (DTA) tools to develop a procedural guide for freeway work zone traffic control planning. Key elements of the procedure include determination of hours and days in which traffic demand is less than, equal to, or greater than the proposed work zone capacity. It includes consideration of traffic diversion to paths other than those passing through the work zone. It suggests conditions for optimal use of early merge or late merge and provides guidelines for use of signal controlled merge operations.

A schematic version of the procedure is shown in Figure 1.

What They Found

Significant findings include the following:

- If the timing of work zone activity can be set so that traffic demand does not exceed work zone capacity, an early merge scheme will provide maximum safety and minimum user delay. Under low volume conditions, early merge can present little or no delay for travelers through the work zone.
- Early merge concepts become highly problematic when traffic demand approaches or exceeds work zone capacity. Under these conditions, incidents of queue jumping, excessive lane changing, and crashes tend to escalate.
- If hours and days of work zone activity must include times in which traffic demand exceeds capacity, late merge concepts are the best option.
- Late merge schemes generally are designed to use all available lane space prior to the work zone for queue storage; therefore, they provide the best available procedure if traffic demand approaches or exceeds work zone capacity.

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- For times in which demand exceeds capacity of the work zone, use of the signal-controlled merge offers promise to reduce queue jumping, lane changing and associated crashes. Suggestions for signal timing for signal-controlled merge processes are provided.
- Estimation of the work zone traffic demand should be desirably based on counts or at least estimates of traffic volumes prior to work zone installation. Although every work zone is unique, generally the traffic demand after work zone installation will be less than demand before work zone activation; that is, diversion of traffic from the work zone is almost always non-zero.
- Estimation of work zone traffic diversion can best be done through before-after application of a DTA model. The DTA process generally requires a detailed network description and never predicts link volumes that exceed capacity. The DTA process can be expected to yield link traffic volumes, as opposed to the link demands produced by a static traffic assignment (STA) process.
- If DTA is not yet available for the work zone location, before-after application of a traditional STA model offers a reasonable second choice. STA has serious limitations as far as realistically representing the process that leads to congestion and increased travel time, but in a before-after comparison of the work zone area, it does provide value. STA assignment models are currently available in all urban and suburban Metropolitan Planning Organization shops.
- If neither DTA nor STA assignment capabilities are available, a 15 percent reduction of before-work-zone-traffic volume may be applied to estimate traffic demand during work zone activity.

- A queue length prediction tool was developed for those situations in which traffic demands exceeding work zone capacity are a reality. The tool can be used to estimate where variable message signs or other uniquely critical control devices should be placed.

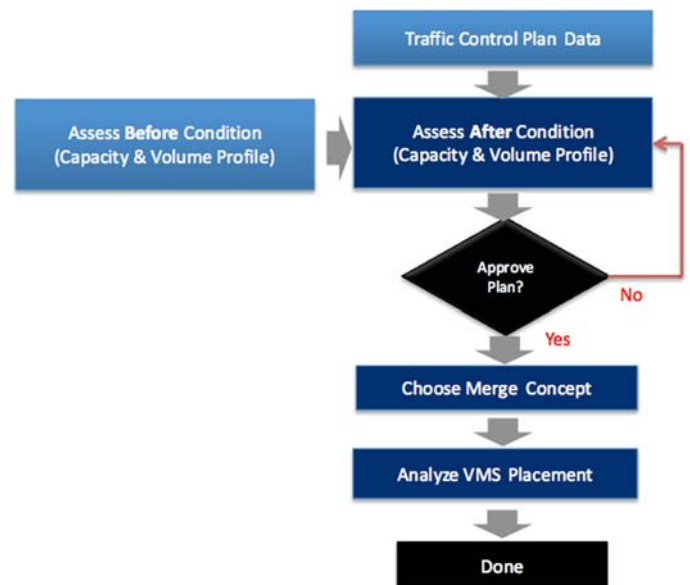


Figure 1. Conceptual Guide for Work Zone Traffic Control Planning

What They Found

The procedural guide developed through this study provides a rational approach to work zone traffic control. Application of the guide to urban and suburban projects will provide a basis for reducing user costs and improving both user and worker safety. A workshop with visual aids was developed to present these concepts in an efficient, painless fashion. The workshop materials can be provided as a self-study tool or through a face-to-face training session.

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