Chapter 6.0 Conclusions And Recommendations

In recent years accidents, injuries, and fatalities have shown an increasing trend at highway work zones. These trends render work zones as hazardous and potential accident locations along highways and freeways. A study on the I-81 Corridor in Virginia showed traffic safety, work zone safety, trucking issues, and intercity traveler needs to be important issues for the Corridor. Examination and analysis of work zone-related accidents demonstrates the need for dynamic/real-time systems to enhance work zone safety and traffic control. Based on the need for dynamic systems to help resolve work zone problems and the magnitude of construction activities planned for the I-81 Corridor in the next twenty years, it is desirable that a real-time advanced warning and traffic control system be investigated to help enhance work zone safety and facilitate traffic control.

The major focus of this research effort was to develop system and functional requirements for the real-time advanced warning and traffic control system. Evaluation criteria, MOEs, and issues related to the evaluation of the system were identified and examined. The functional requirements developed include four major functions, namely advanced warning, surveillance, advisory, and control. Each of these functions consist of sub-functions. Table 10 shows the four main functions and their respective sub-functions.

Table 10. System Functions and Sub-functions in Order of Importance

REAL-TIME WORK ZONE SYSTEM FUNCTIONS AND SUB-FUNCTIONS			
Advanced Warning	**Surveillance**	**Advisory**	**Control**
Congestion	Incident Detection	Delay Advisory	Change Lanes
Queuing	Queue Detection	Speed Advisory	Speed Limit
Speed Variation	Congestion Monitoring	Alternate Route Advisory	
Work Zone Characteristics	Measurement of Traffic Flow Variables		

The real-time advanced warning and traffic control system is envisioned for extensive use on all types of work zones. Thus, it is important that the system conform to certain requirements to ensure its applicability to work zones. The system requirements developed for the real-time advanced warning and traffic control system include real-time operation, credible signage, portability, ease of installation, adaptability, conformation with the Virginia Work Area Protection Manual standards and guidelines, NTCIP compliance, open architecture, use of suitable information dissemination tools, cost effectiveness, reliability, and all-weather day/night operation.

The evaluation criteria identified measure the system's capabilities in fulfilling the necessary functional and system requirements. These criteria include functionality, system reliability, performance criteria (measurement accuracy and algorithmic accuracy), installation ease, operation and maintenance ease, technology maturity, adaptability, and cost. As part of the system evaluation, potential measures of effectiveness (MOEs) for the real-time advanced warning and traffic control system were identified. The MOEs were categorized according to the following two subdivisions: (a) MOEs for the entire system, and (b) MOEs for evaluation of system performance. Table 11 shows the potential MOEs identified for each of the two categories.

Table 11. Potential Measures of Effectiveness for System Evaluation

POTENTIAL MEASURES OF EFFECTIVENESS FOR	
Entire System	**Evaluation of System Performance**
Reduction in the number of occurrences of congestion and queues	Accuracy in measurement of traffic flow variables
Reduction in speeds	Incident detection rate
Reduction in mean queue length	Mean detection time
Reduction in delays	False Alarm Rate
Reduction in the number of accidents/severity of accidents	
Speed and advisory compliance	

This research also identified and examined issues related to the actual evaluation of the system, such as time duration for evaluation and data collection techniques.

Based on the work carried out in identifying the need for real-time work zone systems, developing functional and system requirements, identifying evaluation criteria and MOEs, and identifying and examining the issues for system evaluation, the following conclusions and recommendations are made:

- There is a need to obtain traffic exposure data to accurately assess the current problem of work zone safety. Variables such as length of work zone, time duration, and number of vehicles exposed to the work zone (or AADT for the work zone section) must be recorded to obtain traffic exposure data.
- A uniform work zone accident reporting system should be devised for all states. It should include important information such as accident type, location of accident within work zone, and probable cause.
- Based on information available, a need may be identified for the implementation of real-time/dynamic work zone systems to enhance work zone safety and facilitate traffic control.
- The functional requirements of the real-time work zone system should be modified by omitting less important functions and focusing on certain functions that tackle a specific problem, such as queuing or providing delay information.
- The identified evaluation criteria and measures of effectiveness (MOEs) may be used as guidelines or potential criteria and MOEs for the evaluation of the real-time advanced warning and traffic control system. However, several related issues must be addressed before performing the evaluation.
- Traffic exposure data is the key information in the computation of reduction in the number of accidents due to deployment of the system.
- This study is an initial attempt to explore the requirements desirable for a real-time advanced warning and traffic control system for work zones, and issues related to its evaluation. Further study is warranted before implementing the study findings. A real-

world application will shed further light on the benefits of these real-time advanced warning and traffic control system.