Alternate Route Advisories in Work Zones

Summary of Uses and Benefits

About

The ENTERPRISE Pooled Fund Program initiated a project to document the resources available as well as uses and benefits regarding alternate route advisories in work zones. A detailed literature search was conducted to summarize work zone materials available related to alternate route advisory technologies. In addition, intelligent work zone (IWZ) representatives from transportation agencies were contacted to provide details on recent related deployments and provide input to the project.

The purpose of the project was to understand the current status of work on IWZ activities by combining the resources gathered through a literature search with the information collected from the transportation agencies on recent deployments. Also included is a summary of alternate route advisories in work zones including examples of successes, any guidance possible when technologies are most effective, and the configurations that demonstrated the best results.

While this summary is focused on alternate route advisories in work zones, it is important to note that similar summaries were also developed by ENTERPRISE for dynamic merge systems, variable speed limits; and queue warning systems within work zones. These summaries are available on the ENTERPRISE Project Webpage.

Definition

Alternate route advisories in work zones consist of sensors and Portable Changeable Message Signs (PCMS) located in and around the work zone. As congestion begins to form, the PCMS are activated by the sensors and display a message to provide drivers with an alternate route (e.g. TRAVEL TIME VIA X/ 20 MIN, TRAVEL TIME VIA Y/ 45 MIN).

Minnesota Alternate Route Sign

Resources

The following table includes resources that were reviewed related to alternate route advisories. Information was gathered from available online resources (e.g. published reports, agency web pages, news articles) or through coordination with transportation agencies that have deployed queue warning systems. For those projects that an online hyperlink was not available, a brief summary of the information gathered for the project is provided at the end of this document.

Alternate Route Advisories Related Resources

State/Resource	Document/Intelligent Work Zone Deployment
American Traffic Safety Services Association (ATSSA)	• Online Resource: ITS Safety and Mobility Solutions – Improving Travel Through America's Work Zones[1] (2008) - ITS resource manual from ATSSA on multiple areas related to improving safety and efficiency of traffic in work zones.
Illinois	• Deployment Summary: I-70 & I-57 – Effingham (2016) • Deployment Summary: I-57 – Marion (2010)
Federal Highway Administration (FHWA)	• Online Resource: Full Road Closure For Work Zone Operations: A Cross-Cutting Study[2] (2003) - Variety of U.S. case studies on road closures and alternate routes.
Maryland	• Online Resource: Work Zone Lengths for a Four-Lane Road with an Alternate Route[3] (2003) - Evaluation of several alternatives defined by number of closed lanes, fractions of traffic diverted to alternative routes and crossover of diverted traffic to opposite lanes.
Minnesota	• Online Resource: Evaluation of Rural Travel Times During Construction[4] (2013) - Project report focuses on evaluation methods and overall procurement process of the project vs. functionality of Real-time Travel Time Display System.
Nebraska	• Online Resource: Evaluation of Work Zone Speed Advisory System (WZSAS)[5] (2001) - Evaluation study to assess the effectiveness of WZSAS in encouraging traffic diversion when there is congestion in the work zone and its applicability as a traffic management tool.
New Jersey	• Online Resource: Optimization of Work Zone Schedule Considering Time-Varying Traffic Diversion[6] (2009) - Study on using a work zone schedule optimization model and alternate routes.
North Carolina	• Online Resource: Response of North Carolina Motorists to a Smart Work Zone System[7] (2003) - Survey conducted of local residents to determine their perceptions and acceptability of the Smart Work Zone.
Street Smart Rental	• Online Resource: Alternative Routes Deployment Criteria Considerations[8] - Short webpage on deployment criteria and anticipated system effects of alternate routes in work zones.

Texas	• Online Resource: I-35 Hillsboro, Texas[9] (2006) - Case study about alternate route conditions and lessons learned.
USDOT Federal Highway Administration	• Online Resource: Work Zone Intelligent Transportation Systems Implementation Guide[10] (2014) - Document to provide guidance on implementing ITS in work zones to assist public agencies, firms, developers, etc.

Benefits

There are a number of benefits from deployment of alternate route systems in work zones. Messages that include the location of the expected delay, anticipated delay time, and or possible alternate routes benefits drivers because it provides real-time information so road users can make informed decisions to alter their routes and travel times. Alternate routes in work zones also advise drivers to seek other routes in order to reduce work zone traffic congestion, which decreases fuel consumption and emissions. It also reroutes traffic to reduce traffic demands on roadway sections and allows for more efficient material delivery, which expedites work progress. In addition a resource manual developed by ATSSA, ITS Safety and Mobility Solutions – Improving Travel Through America's Work Zones[1]1 found that alternate routes can reduce the potential for work zone crashes and helps relieve driver anxiety by providing increased knowledge of the work zone situation and conditions.

Public Outreach

Good communication through internet websites, 511 traveler information systems, public media announcements, highway advisory radio, and permanent ITS systems about work zone conditions can help drivers make informed decisions about their travel plans.

The Minnesota DOT surveyed the public after implementing an alternate route and real-time travel time display system on a rural highway work zone project on I-35 in 2013, Evaluation of Rural Travel Times During Construction[4], and generally received positive feedback. Responses indicated an appreciation of the work zone congestion information to allow for route planning, expectation setting, and less overall stress.

An on-line survey conducted by Nebraska in 2001 Evaluation of Work Zone Speed Advisory System[5], found that 71% of respondents indicated that they would get off of the freeway and take an alternate route if they encountered major congestion on the freeway and 83% of respondents indicated that they would take another route if they found out about major traffic congestions on their normal route before leaving.

When to Use Alternate Routes

Alternate route advisory systems are used for a variety of reasons such as for full road closures or partial closures that result in major traffic delays. A resource manual developed by ATSSA, ATIS Safety and Mobility Solutions – Improving Travel Through America's Work Zones[1], suggests considering alternate routes when another roadway option is available and can accommodate long-distance, regional travelers. This is because most travelers would prefer an alternate route that provides the lowest travel time to the next major populated area or major roadway interchange. Also, when a viable alternate route exists it can help absorb travel demand through the work zone. However, it is important to note that even if an alternate route is an option, if that route is at capacity the alternate route should not be considered.

Alternate routes are often used in conjunction with other ITS technologies, such as advanced messaging signs conveying delay times through the work zone. If the delay becomes excessive (more than the alternate route) then the signs suggest that motorists take the alternate route to increase mobility and reduce overall area wide delays.

Sign Messages and Thresholds

Alternate route advisory information typically is displayed on a changeable message sign by providing the delay time and an alternate route (e.g. 20 MINUTE DELAY, USE XX AS AN ALTERNATE ROUTE) or by providing a comparison of the travel time through the work zone and the alternate route. The sign may also include static portions with changeable panels to indicate delay or travel time.

In addition, PCMS may be strategically placed in advance of an exit and provide only delay time. This information may encourage drivers to consider exiting and finding an alternate route. For example, an evaluation study from Nebraska, Evaluation of Work Zone Speed Advisory System[5], placed PCMS in advance of the work zone at key exits to provide alternate route options to drivers. The system encouraged traffic diversion when there was congestion in the work zone without instructing the drivers to the alternate route.

Transportation agencies may set their own threshold of delayed travel time before considering using an alternate route, but typically a system should be considered if a 10 to 15 minute delay is expected through the work zone.

One example of alternate route sign messages and thresholds used on a project is on I-35 Hillsboro in Texas[9]. Texas used route guidance and PCMS advisory signs that displayed messages based on pre-determined speed and occupancy thresholds, as shown in Table 1 to provide motorists with real-time information on downstream traffic conditions.

Table 1: Example Queue Thresholds on I-35 Hillsboro in Texas

Traffic Flow/Threshold	**PCMS Sign 1** (furthest from work zone)	**PCMS Sign 2**
Normal Traffic, Flow through Work Zone > 55MPH	WORKZONE AHEAD 2 MILES	NO DELAYS -x:xxPM-
Speed Average 40<x>55MPH @ 5 min Lane Occ>20%	WORKZONE AHEAD 2 MILES	MODERATE DELAYS -x:xxPM-
Speed Average 25<x>40MPH @5min Lane Occ>30%	WORKZONE AHEAD 2 MILES	EXPECT DELAYS -x:xxPM-

Contracting

In the US DOT FHWA Work Zone ITS Implementation Guide[10], an overview of procurement approaches (direct or indirect) are provided as well as information to consider when determining the procurement award mechanism, issuing a request for proposals and selecting the preferred vendors, consultant or contractor.

Minnesota's I-35 project, Evaluation of Rural Travel Times During Construction[4], on a 70-mile stretch of rural freeway is a successful example of contracting for alternate routes and real-time travel time display system. MnDOT procured a stand-alone contract using Design-Bid-Build and Best Value Procurement. The stand-alone contract was considered effective by both the Minnesota DOT and the Contractor in procuring a qualified Contractor. For this project, MnDOT required the Contractor to propose a system in which the means and methods were previously successful in order to ensure the Contractor had experience with the proposed system.

Alternate Route Advisories Deployment Examples

Following are alternate route advisories deployment example project summaries.

Alternate Route Deployment Summary: I-70 and I-57 – Effingham, Illinois

Effingham, IL is located at the crossroads of two major freeways (I-70 & I-57) which accommodate very high heavy truck volumes (over 50%). The Illinois Governor directed DOT staff to utilize smart work zones and specifically queue warning systems after the state experienced two major fatalities on heavy truck routes in work zones the previous year. This project's primary goal was to greatly increase safety and eliminate serious and fatal crashes related to vehicles crashing into the rear end of a queue of vehicles that often forms just before a lane reduction work zone taper. 25 Portable Changeable Message Signs, 35 Traffic Sensors, and 20 Camera Trailers were utilized. Advanced signs conveyed delay times through the work zone and if delays became excessive (more than the alternate route) then they suggested that motorist take the adjacent alternate routes to increase overall area mobility and reduce overall area wide delays. The sign Messages when the thresholds triggered were:

- Free Flow: NO DELAY NEXT XX MILES
- Moderate Delay: XX MIN DELAY NEXT XX MILES
- High Delay: CONSIDER ALT RTE EXIT XXX
- Max Delay: EXPECT MAJOR DELAYS FOLLOW DETOUR EXIT XXX

Alternate Route Deployment Summary: I-57 – Marion, Illinois

A project on I-80 just southwest of Chicago, Illinois in the Summer of 2010 was conducted. The system did very well notifying the traveling public of stopped or slowed traffic ahead with accurate distances. We worked with the manufacturer to expand its use and develop algorithms to provide "real time" delays and promote the use of detour routes. Various systems have been utilized on a number of interstate projects since then and our PD staff continues to modify the special provision to reflect the most current technologies and promote competitive bidding by the various manufacturers.

Works Cited

[1] American TrafficSafety Services Association. (2008). *ITS Safety and Mobility Solutions- Improving Travel Through America's Work Zones*. http://www.atssa.com/galleries/default-file/2008July21_ITS_Safety_and_Mobility.pdf

[2] Federal Highway Administration. (2003). *Full Road Closure for Work Zone Operations: A Cross-Cutting Study.* http://ops.fhwa.dot.gov/wz/resources/publications/FullClosure/CrossCutting/its.htm

[3] Chen, C. Schnofeld, P. (2003). *Work Zone Lengths for a Four-Lane Road with an Alternate Route.* College Park, Maryland: Transportation Research Board. http://www.ltrc.lsu.edu/TRB_82/TRB2003-000944.pdf

[4] Athey Creek Consultants. (2013). *Evaluation of Rural Travel Times During Construction.* Minnesota Department of Transportation. http://www.dot.state.mn.us/guidestar/2013/evaluation-of-mndot-rural-travel-times/pdf/i35evalreport.pdf

[5] Pesti, Geza, et al. (2001). *Evaluation of Work Zone Speed Advisory System.* Intelligent Transportation Systems: U.S. Department of Transportation. http://ntl.bts.gov/lib/jpodocs/repts_te/14057.htm

[6] Tang, Y., Chien, S. (2009) *Optimization of Work Zone Schedule Considering Time-Varying Traffic Diversion.* Newark, New Jersey: Transportation Research Board. http://www.workzonesafety.org/files/documents/database_documents/TRB2010paper_Tang.pdf

[7] Bushman, R., Berthelot, C. (2003). *Response of North Carolina Motorists to a Smart Work Zone System.* http://stsmo.transportation.org/Documents/05-0968.pdf

[8] Street Smart Rental. *Dynamic Late Merge Deployment Criteria Considerations.* http://www.streetsmartrental.com/products/alternative-routes.html

[9] U.S. Department of Transportation and Federal Highway Administration. (2006). *I-35 Hillsboro, Texas.* Hillsboro, Texas. http://ops.fhwa.dot.gov/wz/its/wz_comp_analysis/hillsboro_tx.htm

[10] U.S. Department of Transportation. (2014). *Work Zone Intelligent Transportation Systems Implementation Guide*. Washington D.C.: Federal Highway Administration. http://ops.fhwa.dot.gov/publications/fhwahop14008/fhwahop14008.pdf