Project Summary

Texas Department of Transportation

0-5865: Arterial Intelligent Transportation Systems - Infrastructure Elements and Traveler Information Requirements

Background

Applying Intelligent Transportation Systems (ITS) to arterial systems allows TxDOT to significantly enhance transportation system operation efficiency and improve traffic mobility. However, no guidelines are available to assist TxDOT staff in selecting the most beneficial arterial ITS elements and desirable ITS technologies. To address these gaps, this study was initiated by TxDOT to investigate the arterial ITS elements, technologies, arterial performance measures, and information dissemination technologies for arterial ITS deployments. Evaluation of various ITS strategies and available technologies to meet TxDOT needs is the essence of this research project. The research addresses two TxDOT goals: making the current transportation system more efficient through innovative arterial ITS deployments, and maximizing the benefits of existing ITS infrastructure and new arterial ITS deployments. Three main emphasis areas were addressed:

- identify the elements of arterial management systems that would benefit most from ITS technologies and related real-time information,
- identify the available ITS technologies that would have the most immediate impact on arterial management systems, and
- identify performance measures and traveler information dissemination modes that provide the most clear arterial performance information to the traveling public.

What the Researchers Did

To accomplish the project objectives, the research team completed the following tasks in a two-year schedule:

- synthesize national and international experience in Arterial Intelligent Transportation Systems,
- identify critical arterial performance measures and innovative strategies and technologies to improve arterial performance measurement,
- identify the most beneficial ITS elements for arterial management,
- identify desirable ITS technologies and solutions for arterial management,
- evaluate traveler information dissemination modes for arterial management,
- develop a guideline to identify and prioritize arterials suitable for ITS implementation, and
- conduct a case study to demonstrate how to develop arterial ITS applications.

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What They Found

Arterial ITS applications have the potential to reduce travel time, increase travel time reliability, increase vehicle throughput in the transportation network, and reduce fuel and environmental costs. With the rapid development of technologies, arterial ITS components are becoming more affordable and widely available. As a result, the ability of TxDOT to monitor and manage its arterial systems is technically feasible.

The different agencies such as MPOs, TxDOT districts, and RMAs in Texas had different arterial performance measures. The top arterial performance measures were evaluated. Six effective arterial performance measures, used mostly to characterize arterial roadways, include Arterial Vehicle Miles Traveled, Level of Service, Speed/ Travel Rate, Travel Time, Volume/Capacity Ratio, and Volume.

Traffic Control, which includes the subcategories of Transit Signal Priority, Emergency Vehicle Preemption, Adaptive Signal Control, Advanced Signal Systems, and Variable Speed Limits all have shown significant benefits to the arterial systems and are in line with TxDOT's strategic planning goals.

Information dissemination, primarily in the form of Dynamic Message Signs (DMS) provides drivers with information regarding traffic conditions and is effective when drivers are unfamiliar with the area. Highway Advisory Radio is beneficial when drivers are familiar with the network, but is underutilized.

What This Means

Detection technologies are a key component to successful deployment of any arterial ITS technology system. Researchers recommend using various means of data collection technologies such as detectors, video detection, GPS detection, cell phone detection, toll tag detection, and so on to improve arterial data collection.

Coordinated signal control plays an important role in responding to recurrent or non-recurrent congestion. Signal optimization is the most effective way to improve arterial traffic operations. The software and hardware are already mature and widely available. Therefore, TxDOT should consider coordinated signal control implementation through cooperation with local transportation agencies to enhance arterial system performance.

Information dissemination technologies are essential for arterial management enhancement. Desirable characteristics of arterial traveler information systems include (a) provide route and decision guidance (b) be timely, accurate, available, and cost effective, and (c) be easy to access and safe to use. It is recommended that TxDOT staff should fully consider these characteristics to maximize the benefits when implementing the information dissemination technologies.

The ideal message design should reduce the driver's uncertainty regarding traffic conditions instead of overwhelming him or her with unneeded data. An auditory method is adequate and effective when drivers are familiar with the network. If DMS systems are going to be deployed on the arterial network, particularly during peak hours, the DMS should be located so that traffic can be easily redirected to an alternative route that under normal operating conditions has some available capacity to accommodate additional traffic volumes. These findings should be carefully considered for future information dissemination applications.

For More Information:

0-5865 Arterial Intelligent Transportation Systems—Infrastructure Elements and Traveler Information Requirements

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