Big I (I-40/I-25) Reconstruction and ITS Infrastructure

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I. Background

The New Mexico Department of Transportation (NMDOT) rebuilt the Big I interchange in Albuquerque to make it safer and more efficient and to provide better access. The Big I is where the Coronado Interstate (I-40) and the Pan American Freeway (I-25) intersect in Albuquerque, New Mexico. The original Big I was designed to support an average daily traffic (ADT) of 40,000 vehicles and was severely over capacity, experiencing an average of 1.7 crashes per day that were estimated to cost about $12 million annually (data from 1999). ADT in the interchange was approximately 300,000 vehicles prior to its redesign; the redesigned Big I has a design capacity of 400,000 ADT. The two-year project began on June 30, 2000 and involved 111 lane-miles of construction and 45 new and 10 rehabilitated bridges.

For the Big I project, NMDOT employed ITS in the form of a mobile traffic monitoring and management system to help move the large number of vehicles through the extensive construction area. Mobile traffic monitoring and management systems use electronics and communications equipment to monitor traffic flow and provide delay and routing information to drivers and agency personnel. The ITS application deployed at the Big I in 2000 was used for the duration of the work zone (two years). The ITS components were deployed just prior to construction, with plans to incorporate portions of the system as part of a permanent ITS application for freeway management once construction was completed.

NMDOT used ITS for this major construction project for several reasons, including: changes in traffic patterns, nighttime closures, and pre-determined alternate routes required that travelers be provided with high quality real-time information on travel route availability. The high volume of traffic moving through the Big I created great potential for congestion. NMDOT estimated that normal traffic volume had to be reduced by at least 20 percent to keep traffic moving through the Big I area. Incidents would create further congestion and require rapid response to avoid additional delays. A system was needed to provide accurate information, support quick identification of incidents, and help manage traffic through the area.

The main goals of the ITS portion of the Big-I reconstruction were:

- To provide traffic management capabilities and traffic information on traffic routing, detours, and significant incidents;
- To minimize capacity restrictions due to incidents by more quickly identifying incidents and determining an appropriate and effective response to clear the roadway; and

- To enhance traffic safety.

The total cost of the Big I ITS infrastructure project was $1.5 million. NMDOT assumed ownership of all the ITS components at the end of the construction project.

II. System Description

The Big-I project had two ITS related sides: the work zone ITS, and the long term infrastructure ITS. The system included eight fixed closed-circuit television (CCTV) cameras, eight modular dynamic message signs (DMSs), four arrow dynamic signs, four light-emitting diode (LED) portable DMS trailers, four ADDCO, Inc. Smart Zone® portable traffic management systems, which integrate CCTV cameras and dynamic message signs on one fully portable traffic management system, and four highway advisory (HAR) units. The cameras and the DMSs were linked electronically to temporary Big I traffic management center (TMC) using an Internet platform with both wireline and wireless communications. In addition to the DMSs and HAR, information on traffic conditions was distributed via websites, media outlets, and a fax/e-mail distribution list.

III. System Operations

System cameras were electronically linked via wireless communications to a central base station server in the traffic management center. The base station server processed and displayed the images collected by system cameras. A NMDOT staff person monitored the camera images continuously from 5:00 am to 8:00 pm. Problems such as incidents were identified manually by the staff person based on observation of these images. When a camera image showed an incident in the roadway, the NMDOT staff radioed a Highway Emergency Lender Program (HELP) safety service patrol vehicle to go to the location to offer assistance. Information from both the camera images and the HELP vehicle staff observations assisted emergency response teams in gauging what vehicles they needed to send for the incident, eliminating excessive responses that could unnecessarily tie up roadway capacity and increase costs. To assist in handling incidents, NMDOT staff maintained close coordination with emergency service providers. The ITS application also assisted in tracking incidents. Whenever an incident was within view of one of the cameras, a picture of the incident was recorded and stored in an incident database along with the incident report.

The central base station server software held a set of scenarios for the DMSs. These scenarios were not set to activate automatically, although they could be. The scenarios enabled the staff to activate a pre-defined message scenario for all the DMSs with "one click" access. Because the core of the Big I was entirely closed most nights, a whole series of detour messages needed to be displayed each night. The pre-defined scenarios made this task a simple one. During incidents, NMDOT could also manually activate DMS messages indicating the accident location, lanes affected, and whether delays were occurring. The extent of delay and length of queue were not displayed

The concept of operations is summarized in the figure 1 below.

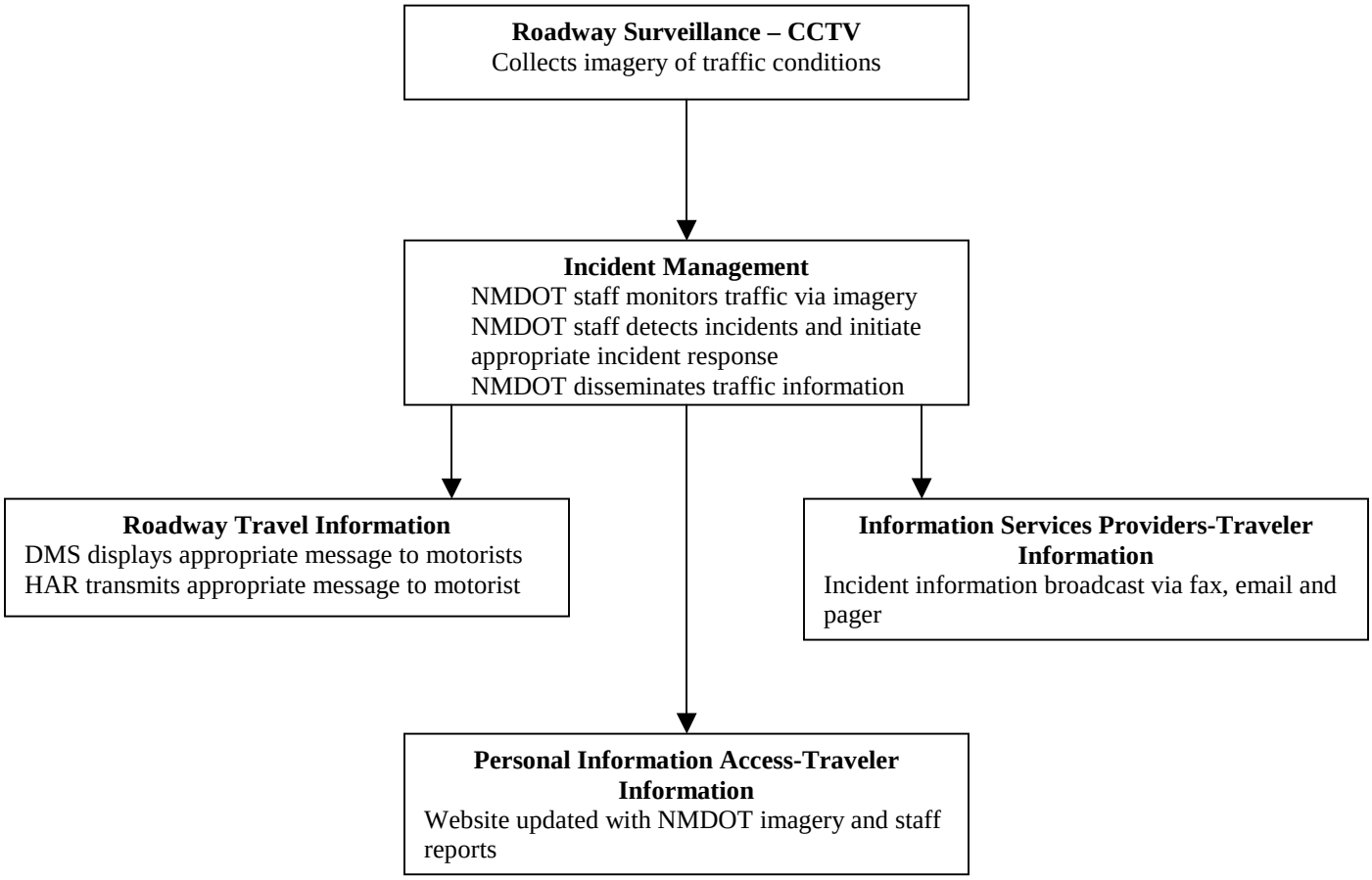

Figure 1: Big I ITS Concept of Operations

In addition to any messages displayed on the DMSs, current information on conditions in the Big I was available via the Big I website, highway advisory radio, facsimile and e-mail updates, and pager. The camera images were typically available to the public in real-time on the Big I website (http://www.thebigi.com). The camera images on the website were updated automatically every three minutes or less, and much of the website's

contents were refreshed manually on a weekly basis. Weekly reports and other bulletins were made available online at http://members.aol.com/nmroads immediately upon distribution of notices, and this information was used to regularly update the Big I website.

The Big I website typically received 2,000 to 3,000 hits per day. NMDOT staff knew that travelers frequently used the website because they received complaints if there was a problem with even one camera. Website data also were transmitted to a commercial paging service that reformatted the information and made it available to approximately 30,000 subscribers. The four HAR broadcast messages were updated manually at least daily, and more frequently as needed. "Interstate Ernie" traffic reports that include traffic updates on the Big I project were sent via facsimile and/or e-mail to more than 1,600 recipients. Faxes were sent out weekly, or more frequently as needed, to inform the media and affected agencies about road closures, detours, schedule changes, and major incidents that constrained the roadway for more than three to six hours. In an interview survey of 1000 travelers conducted between April and June, 2001, 60.2 percent of respondents believed that NMSHTD had provided them with accurate and timely information on the Big I project.

NMDOT purchased the system and intended to leave many of the ITS components in place to become part of a permanent freeway management system. NMDOT operated the system after receiving training from the vendor.

IV. Lessons Learned

Planning and System Development:

- NMDOT needs to "sell" ITS to the incident management community and let them dictate how to use the system to coordinate with incident response.
- Portability of the ITS units is key in the core of the work zone because the configuration changes frequently and requires that the units be moved.
- For wireless communication, it is important to ensure that the system Internet address has enough priority so that information gets through the network.
- It is important to use a proactive approach to build public awareness of the project and the information that the ITS application will provide. Successful techniques include holding press conferences, issuing news releases, and keeping local media up to date.
- It is necessary to allow for access to sensors stations because they may need to be reset manually when there is a power interruption, such as a lightning storm.

System Operations:

- When changes in the work zone roadway geometry are made, it is important to allow time for drivers to learn the new traffic pattern before reporting problem areas to the contractor based on observations from the system's cameras.

V. Conclusion

The use of ITS for the Big I reconstruction project proved to be very successful in mitigating the effects of construction on traffic mobility and safety. The NMDOT plan called for the use of ITS during construction, and also allowed some of the system components to be made as a permanent part of the freeway management system for the Big I. ITS infrastructure on the Big I is one of many examples of how ITS is being implemented across the nation to help agencies better manage traffic while performing necessary infrastructure improvements.