1. Project Description

a) What is the purpose of the project?

The Mississippi Gulf Coast is a tapestry of unique communities, each with their own natural and man-made charms. US Highway 90 is the thread that weaves them all together. Running from Louisiana in the West to Alabama in the east, US 90 skirts the Gulf of Mexico as it winds through cities and towns and past wetlands, casinos, and antebellum homes.

US 90 has played a vital role in the health and growth of coastal Mississippi for decades. But as traffic demands grew through the 1990's and 2000's, US 90 became locked within its current right-of-way. Widening the corridor beyond its existing four to six lanes was impractical or simply impossible because of adjacent ecological and historic impacts.

By 2005, motorists were experiencing growing congestion, increased travel times and crashes. Daily traffic volumes had reached over 48,000 in some sections, exceeding capacity and creating gridlock conditions. Something needed to be done to address these problems.

Then, on August 29, 2005, the hurricane hit.

After Katrina's storm surge retreated, there was little left on the Gulf Coast. The crushing force of the water toppled the bridges at Biloxi and Bay St. Louis and washed away entire sections of the roadway. In most locations, the traffic signals were not just damaged; they were gone. Gulf Coast Mississippi's main artery was severed.

As Mississippians began clearing the wreckage and rebuilding their communities, the Mississippi DOT immediately began planning to rebuild US 90. For MDOT, the emphasis was not just on replacing what had been, but taking the opportunity to build back better than before. For a constrained US 90 corridor that could not be widened, this meant engaging local jurisdictions in a collaborative partnership to build a "smarter" US 90 with ITS elements to maximize the corridor's capacity.

The MDOT design team developed ambitious goals for a US 90 ITS project that would bring state-of-the-art traffic management capabilities along the 43-mile corridor with 54 signalized intersections spanning six cities and two counties. Project goals included:

1. bringing all corridor signals all into a single, coordinated, advanced traffic management system to providing optimal traffic operations for vehicles, pedestrians, bicyclists and transit;
2. establishing a robust and "storm resistant" communications network to support the ATMS initially, while allowing for future planned ITS applications along the corridor and in the region; and
3. supporting reconstruction of the corridor and re-establishment of the local economy.

An aggressive project design and implementation schedule of two years was established which required extremely close coordination between the ITS and roadway improvement efforts.

b) What needs and challenges does it address? Whom does it serve?

Attempting a fast-track ITS project of this magnitude along a devastated corridor and across devastated communities presented significant and unique challenges. With traffic volumes returning to pre-Katrina levels in some sections, the need to bring the system online as quickly as possible was added incentive.

MDOT and its partners formed a multi-agency design team and began the project with a fast-track review of available ITS technologies. It was at this point that several private sector companies also partnered with MDOT to provide critical input into technology assessment and alternatives evaluation.

Qualified contractors of any type were difficult to find with the massive rebuilding needed in Mississippi, Louisiana and Alabama. As a result, MDOT decided to break the 43-mile project into five smaller projects which could be handled by a broader range of contractors and suppliers that would work concurrently. ITS system components were included in each of the five contracts.

Implementing the ITS project in phases presented obvious challenges to installing an integrated, contiguous ITS system along the corridor. This technical challenge was compounded by the logistics of forging partnerships and agreements with local agencies along the route. These challenges were minimized through the development of a standard resource sharing document used with all jurisdictions.

Another critical challenge involved designing a communications network that not only met immediate ATMS system needs, but would also support planned future ITS applications in the region. And, since the system would be vulnerable to damage from future storms and hurricanes, it needed redundancy to cope with the potential for multiple breaks in the system.

The final fast-track ITS project was designed to (1) provide immediate and optimal traffic management capability along the corridor, and for all adjacent jurisdictions, (2) provide capacity to meet the future local MDOT ITS needs, (3) provide critical real-time information to travelers in the corridor via MDOT's traffic information web-site (MSTraffic.com), and (4) support corridor reconstruction efforts.

c) Was it designed as a short-term or long-term effort?

The US 90 project was designed to provide both short- and long-term benefits. It needed to be designed to be deployed and operational in the short term to provide immediate traffic management capabilities and support corridor reconstruction, yet flexible and scalable enough to meet long-term ITS needs for the corridor and region.

A key factor in the long term vision of the ITS design was the ability to use the selected wireless communications system as the foundation for additional ITS systems in the future, such as I-10 freight mobility applications and the planned Gulf Region Incident Management System (GRIMS). Several local ITS systems (such as city/county ATMS, weather monitoring, AVL) are also planned to utilize the communications network provided with this project.

d) How does it further the development and/or deployment of ITS? How does it help the organization achieve its goals?

MDOT's goal for this project was not just to replace what was destroyed, but make use of the latest and most appropriate ITS technologies to meet existing and future transportation needs for US 90 and the region. As challenging a set of circumstances as Katrina handed the project, the storm also provided the opportunity to develop a totally new ITS system that would reconnect the coastal communities' main thoroughfare and provide a more efficient and safer roadway than ever before.

The US 90 traffic management system utilizes the regional ACTRA system server and new Ethernet controllers. Detection devices had to be operationally reliable and flexible enough to support varying pavement and construction conditions while still providing traffic counts and movement detection. The MDOT design team determined that a combination of in-ground inductance loops and video detection units best met the needs of the project. Factors involved in this decision included: historic oak trees in the US 90 median that restricted video coverage; locations with unstable pavement conditions that could not support in-pavement loops; and the goal to provide real-time traffic data and video images to agencies and

the public. As a result, video detection sensors, or VDS, were selected for intersection turn lanes and side streets, and in-ground loops were used for advanced detection on the main lanes.

The VDS is used to collect both traffic data and imagery from the intersections that are then made available on the MStraffic.com web site. This website provides users live streaming video from the detection cameras as well as an interface for displaying current and historical traffic data in varying formats that can be completely personalized to the user. The US 90 VDS application, with its integrated collection and reporting tools, is the first of its kind in the United States. State and local agencies are able to view, via a standard Internet web browser, intersection traffic counts, real-time traffic conditions, generate a variety of historical data reports, and design custom views tailored to their specific needs. This data access supports many purposes such as improving signal operations, confirming incidents and planning for emergency traffic operations.

Fresh in the designers' minds was the need for the Mississippi Emergency Management Agency and MDOT to better manage evacuations in the case of another natural disaster. This VDS and the data it provides gives MDOT planning and traffic staff a new toolset to plan coastal evacuations in the event of another storm. Motorists themselves can also monitor travel conditions and estimate travel times by viewing the output of the system's CCTV cameras and VDS on MDOT's MSTraffic.com website. They can also register on the site to receive automated traffic alerts on their portable communication devices.

The US 90 traffic management system requires a reliable and robust communications system for effective operation. MDOT decided, in partnership with local agencies and communications suppliers, that a redundant broadband wireless network would not only be the fastest to deploy, but also be more cost effective, scalable and dynamic than other technologies. The designed network is a carrier-class solution that can support the throughput demands of live video and real-time traffic data not just for the 54 intersections and 18 CCTV deployed in this project, but also to support future ITS devices and systems at hundreds of other locations in the region (such as the regional corridors of I-10, I-110 and US 49).

The **MSTraffic.com** US 90 communication system is designed much like a cellular network. The backbone portion of the network is 100 Mb, full-duplex, utilizing license-restricted, point-to-point, 6 GHz and 11GHz frequencies. Ten "distribution stations" form a self-healing, redundant wireless network and provide for three-to-five-mile, 360-degree coverage areas. To simplify the design and reduce cost, distribution stations did not require dedicated towers; they were located on existing elevated structures including tall buildings and water storage towers. Local agencies worked with MDOT to facilitate access

to many of the needed distribution station sites. All ten distribution sites are connected to a centralized location, the MDOT Gulfport Project Office.

A unique feature of the communications network design is that distribution stations provide 1.5 Mb (T1 equivalent) point to multi-point last mile connections utilizing both 900 MHz (non-line of sight) and 4.9 GHz public safety (near line of sight) frequencies. The distribution stations in turn link to local intersection radios which interface to a local Ethernet switch. Real-time video and traffic data are routed back to the Regional Traffic Operations Center (RTOC) in Gulfport and then to MDOT's Statewide Traffic Management Center (TMC) in Jackson. From there information is disseminated to incident and emergency services personnel at both the State and local levels.

A key element of the wireless communication system's design is its' redundant rings of communication. In the event of a failure at one of the nodes, data on the system can take a variety of alternate paths to its destination. Base stations can also revert to the 900Mhz to communicate to one another in the event of a failure on the 4.9Ghz frequency. The system is fully operational across a 60-mile swath US 90 and SR 603, and the possibilities for expansion of regional ITS applications are limitless.

2. Project Results

a) Prior to the start of the project, what were the conditions, results, or situations that serve as "the baseline" against which you compare the project's outcomes?

Due to Katrina's impacts, this nomination is not based on traditional quantitative "before and after" analysis. Rather, it is about how State and local governments, in partnership with private ITS suppliers, seized the opportunity to work together to deploy advanced ITS technologies to address immediate transportation needs, while building the foundation for greatly expanded regional ITS technology applications in the future.

The traffic conditions that existed immediately prior to Katrina included daily traffic volumes over 48,000 with levels of service E and F. The baseline condition for US 90 immediately after Katrina was hugely different. Today, the corridor serves roughly half of those volumes with spot congestion near the reopened casinos. It will be many years before the US 90 corridor reaches pre-Katrina traffic levels, but as it does this ITS project will provide greatly improved travel conditions, traveler information, incident management and emergency response.

b) What are the results of the project?

Every element of this ITS project was developed with the lessons learned from Katrina in mind, to build back a better US 90 that is immediately safer and more efficient for travelers, while at the same time being better able to withstand future storm events.

Currently, over 3,000 users visit MSTraffic.com daily with about 2,000 of those subscribed to traffic alerts. Travel times along the corridor improve with each completed phase. At the same time, emergency response times are improved as operators at the Statewide Traffic Management Center have been able to spot incidents in real-time and inform responders as well as posting incident alerts on MSTraffic.com, allowing travelers to avoid trouble spots.

In addition, due to the availability of accurate traffic data collected via the VDS and provided in an easily workable format via the MSstraffic.com site, MDOT engineers have been able to implement and evaluate new signal timings for the corridor resulting in improved traffic operations.

c) What is "the new dimension of performance?" How are the results in 2b superior to those in 2a?

As traffic levels return to and eventually surpass their 2005 levels, the permanent use of this system will allow for maximum efficiency and safety along the US 90 corridor. Using the newly available data, engineers can continually optimize signal timing while local agencies can monitor intersection operations and clear incidents more efficiently, keeping travelers safer and further improving service levels on the corridor. Most importantly, data collected by the ITS and live video imagery can be used by emergency planners, MEMA and MDOT in future storm events. In addition, the US 90 ITS allows remote operational changes to be implemented quickly to lessen the impact of unexpected traffic problems that arise.

d) Did the project produce any unanticipated results?

There have been positive unanticipated results in the areas of building relationships and partnerships that will be beneficial in facilitating future ITS and transportation improvement projects. The project has also helped to create a regional focus and attitude in stakeholder agencies concerning traffic management and emergency response, including better coordination with neighbors Louisiana and Alabama.

3. Project Impact

More efficient traffic movement and faster incident detection and response on US 90 is increasing the quality of life and safety for all the residents and businesses of the Mississippi Gulf Coast. This project makes real-time traffic information and imagery accessible to travelers, so they can plan their travel in advance.

The US 90 ITS project has the potential to save lives and reduce injury through rapid detection of crashes and other dangers, cutting incident response time considerably. In the event of another natural disaster, pre-determined emergency timing plans will help residents evacuate more quickly, potentially saving lives.

4. Potential as a Model

Even though the conditions precipitating the US 90 ITS project were extraordinary, the resulting system can serve as a guide for rapid implementation of scalable ITS applications for a variety of different locations and situations.

From a project management standpoint, this project is a model for inter-agency partnerships, crossing jurisdictional boundaries and resource sharing. Key to streamlining the arrangements with the multiple agencies was the use of a standardized resource sharing agreement that combined shared ITS resources (communications, CCTV, DMS, etc.) between MDOT and local agencies into one document. It also alleviated the need to generate new agreements for each individual agency on future projects, thereby saving significant time and facilitating future partnership projects.

Since the US 90 wireless system is a redundant, self-healing communications network, minor service outages need not derail the entire system. This makes the system especially well-suited to withstand all but the most severe forces of nature. The compact footprint of the cameras, video detectors and wireless repeaters would also be ideal in other applications where there are right-of-way limitations, the construction of communication towers is problematic, and wired communications prove too costly.

5. Additional Background

The US 90 ITS project was started and is wholly operated by MDOT. It has relied on the partnership and participation of government agency partners from the Federal level down to the individual municipalities, and in cooperation with private sector ITS suppliers. The project was funded primarily from the Federal Emergency Response fund, Transportation Enhancement funds, and MDOT.

This project required the support of many local partners to coordinate locations and approvals needed to install the various ITS components. These local agencies included the Cities of Biloxi, Gulfport, Long Beach, Pass Christian, Waveland and Bay St. Louis, as well as Hancock County Port and Harbor Commission, Dedeaux Water Association and the Gulf Regional Planning Commission. There were also numerous private sector partners including construction firms, equipment suppliers, and design consultants. The use of radio spectrum had to be licensed through the FCC and approved by Mississippi's Wireless Communications Commission, and elevated installations had to be cleared with the FAA.

To improve awareness of this project and its benefits to the project stakeholders and the public at-large, special outreach tools were developed by MDOT:

- a project brochure, *Reconnecting the Gulf Coast-US 90 Rebuilds After Hurricane Katrina,*
- a project video, and
- a dedicated project web-site (mdothwyus90.com).

6. Statement by the Project's Leadership

The US 90 ITS project shows that innovatively meeting transportation needs and improving the lives of the residents of coastal Mississippi doesn't require just newer and more sophisticated equipment. It requires creative problem solving and long-lasting partnerships with a diverse range of stakeholders committed to success.

For this project, innovation came in finding creative solutions, working in partnership with multiple agencies toward a common goal, and applying the most effective and cost-efficient technologies to meet the transportation needs of the area. Innovation was demonstrated by providing a secure, scalable, high-capacity wireless communications system that serves current and future needs of the corridor and agencies in the region. Innovation also delivered a highly-functional and cost-effective combination of 18 closed-circuit traffic cameras and detection devices for 54 signalized intersections built in five separate construction projects across a 43-mile corridor. This innovation also provides a stream of readily available traffic data and video to traffic engineers, planners, emergency responders and the public through web-based interfaces that provide a level of traveler information never before available along the coast.