SYSTEMS ENGINEERING ANALYSIS

Baton Rouge to Lafayette ITS-TIM Phase 2

S.P. No. 737-99-0604

F.A.P. No. NH-9903(524)

December 2008

Presented to:

Louisiana Department of Transportation
And Development

ABMB ENGINEERS, INC.

Wilbur Smith Associates
ENGINEERS PLANNERS ECONOMISTS

STATE PROJECT NUMBER: 737-99-0604
FEDERAL AID PROJECT NUMBER: NH-9903(524)
BATON ROUGE TO LAFAYETTE
INTELLIGENT TRANSPORTATION SYSTEMS (ITS)–
TRAFFIC INCIDENT MANAGEMENT (TIM) PHASE 2
ROUTES: I-10, I-49, US 90, & US 190
ACADIANA, IBERVILLE, LAFAYETTE, POINTE COUPEE, ST. MARTIN, ST. LANDRY, AND WEST BATON ROUGE PARISHES

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1 Introduction

To assure interoperability of systems and a coherent traffic management program, the implementation of an Intelligent Transportation System (ITS) project requires consideration as to how the project will fit into the National, State and Regional ITS Architectures (specifically the Acadiana ITS Deployment Plan, 2002). The Federal Highway Administration (FHWA) has developed and mandated that a "Systems Engineering" process be used whenever ITS technologies are to be deployed. This process will give the implementing agency confidence that resources are being used optimally, returning the maximum value for transportation dollars spent.

Louisiana Department of Transportation and Development (DOTD), supported by the FHWA, has requested the implementation of the Baton Rouge to Lafayette ITS-TIM Phase 2 Project. There are four major highway facilities included in the study area which are the focus of the project.

The first highway facility in this study area is Interstate 10 (I-10) extending from LA 95 Austria Rd. (Exit 92), to LA77 Bayou Rd. (Exit 139), a distance of approximately 47 miles. I-10 is the primary travel corridor for the study area with traffic incident management focused between Baton Rouge and Lafayette.

The second highway facility is I-49 extending from I-10 (Exit 103B) to LA 167 (Exit 23), a distance of approximately 23 miles.

The third highway facility is US 190 extending from Andrepont Rd. to LA 413 Poydras Bayou Dr., a distance of approximately 46.6 miles. US 190 will be used as the primary detour route in the event that traffic should need to be redirected from I-10 due to a prolonged traffic incident. I-49 connects I-10 and US 190.

The fourth highway facility is US 90 extending from I-10 to E. Verot School Rd., a distance of approximately 5.7 miles.

Note that the project limits also include a 3.5 mile approach to the boundaries defined above for power deployments, traffic control, etc.

Also within the project limits are the DOTD ITS Statewide Traffic Management Center (TMC) located at 1212 East Highway Drive, Baton Rouge, LA, and the Louisiana State Police Troop I office located at 121 E Pont des Mouton Rd., Lafayette, LA. **Figure 1** shows the limits of the project and study area.

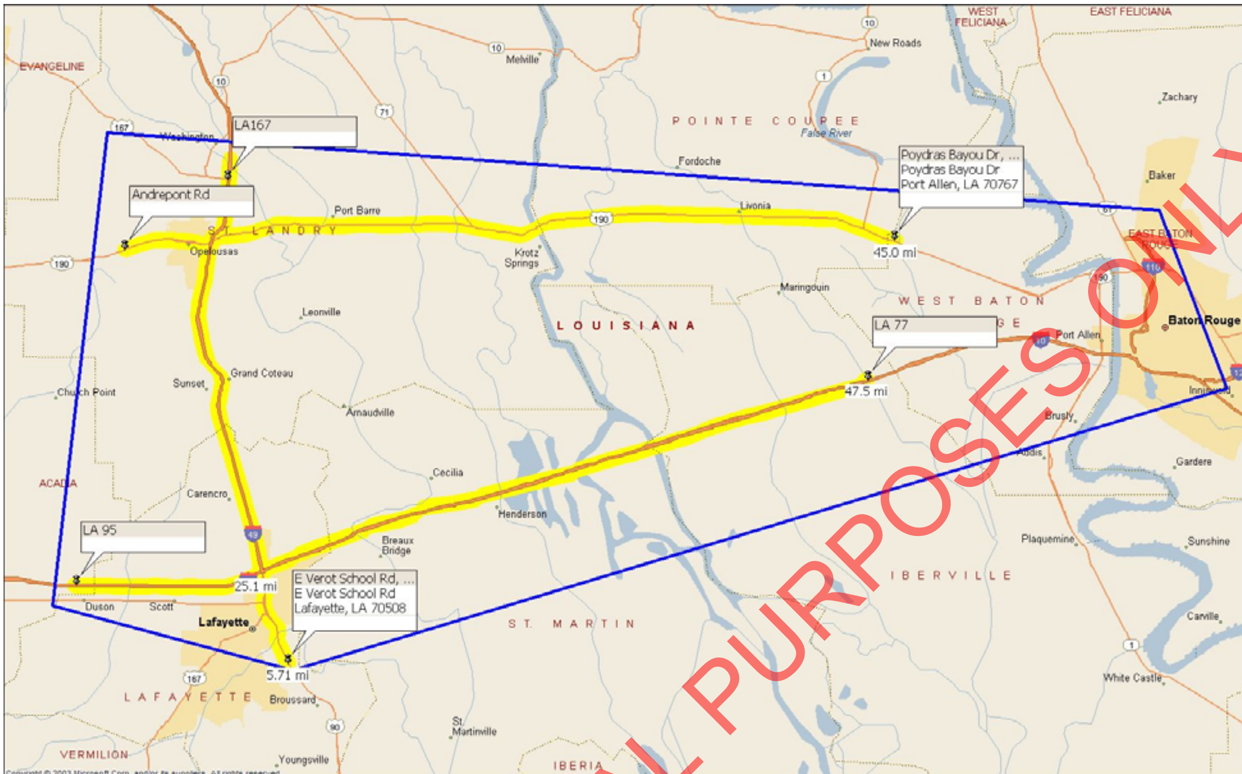

Figure 1: Project Area and Physical Limits

The principle roadway in the study area is I-10. This freeway facility is typically a four-lane (two lanes per east and west directions) divided facility with 12- foot travel lanes and 10- foot inside and outside shoulders. I-10 is the principle interstate system for east-west movement in the southern U.S. In the major urban areas of Lafayette and Baton Rouge, the freeway facility increases to four and five travel lanes, depending on capacity demand and interchange weaving requirements. There are 10 interchanges located on the facility from Baton Rouge to Lafayette. The speed limit is posted at 70 mile per hour for the majority of the facility. Daily traffic volume between Lafayette and Baton Rouge urban area ranges from 41,000 to 44,000. Daily traffic volume for the Lafayette urban area ranges from 47,000 to 57,000. Daily traffic volume for I-49 between Lafayette and Opelousas averages around 33,000. US 190 between Opelousas and Baton Rouge has a daily traffic count that ranges from 9,000 to 14,000.

Unique to the I-10 facility is an 18-mile bridge over the Atchafalaya Basin. The bridge is situated approximately half way between Baton Rouge and Lafayette. The bridge typically has 10-foot outside shoulders and 6-foot inside shoulders. At two locations (near Exits 121 and 127) the shoulders are 2-feet wide. Due to the large commercial truck volume and accident history, the 18-mile bridge has a differential speed limit. The posted speed limit is 60-mph. However, commercial truck traffic is restricted to the right hand lane and has a posted truck speed limit of 55-mph. The bridge has three emergency crossovers used for bridge maintenance and emergency access. These crossovers are not used for detouring vehicles due to geometric limitations and safety concerns. This bridge presents an operational challenge whenever an incident occurs because of the lack of detour options.

The goal of the project is to expand the existing ITS system that will provide DOTD, Lafayette Consolidated Government Department of Traffic and Transportation (LCG), and the Louisiana State Police (LSP) Troop I with traffic surveillance and management tools to more effectively facilitate traffic and incident management activities across the Lafayette area. Additional ITS field equipment will improve the ability of DOTD, LCG, and LSP to detect, verify, advise affected motorists, respond, manage traffic, and clear traffic incidents within the project limits. The project goal is improve mobility and safety for all motorists.

The Design-Build (DB) contracting method will be used by DOTD to implement a fully operational ITS project. DOTD has prepared a Scope of Services Package (SOSP) that will be used by the Design-Builder to design and construct the system. There are a number of advantages for DOTD when using this contracting technique. First, it allows the design-builder the flexibility of implementing an ITS system with the most recently tested and effective technologies. Second, the overall risk for designing, constructing, testing and implementing the ITS system falls to the Design-Builder. Third, this process should reduce project implementation time.

It is intended that DOTD ITS Statewide TMC in Baton Rouge and DOTD District 03 Traffic Engineering Department will operate the ITS field equipment to be deployed by this project. LSP Troop I and LCG will only have monitoring capability.

2 Acronyms and Abbreviations

Wherever the following abbreviations or acronyms are used in this SE document, they are interpreted as follows:

AASHTO	American Association of State Highway and Transportation Officials
ADC	Analog-to-Digital Conversion
ADSL	Asymmetric Digital Subscriber
ARN	Area Radio Network
ATIS	Advanced Traveler Information Systems
C2C	Center-to-center
C2F	Center-to-field
CDMA	Code Division Multiple Access
CDPD	Cellular Digital Packet Data
CONOPS	Concept of Operations
CMS	Changeable Message Sign
DARC	Data Radio Channel System
DATEX-ASN	Data Exchange ASN.1
DB	Design Build
DCM	Data Collection and Monitoring
DMS	Dynamic Message Sign
E9-1-1	Enhanced 9-1-1
EDGE	Enhanced Data for Global Evolution
EM	Emergency Management
EOC	Emergency Operations Center
FCC	Federal Communications Commission
FHWA	Federal Highway Administration
FR	Functional Requirement
GHz	Gigahertz
GSM	Global System for Mobile Communication
IEEE	Institute of Electrical and Electronic Engineers
IM	Incident Management
ISO	International Standards Organization
ITE	Institute of Transportation Engineers
ITS	Intelligent Transportation Systems
Kbps	Kilobits per Second
DOTD	Department of Transportation and Development
LCS	Lane Control Signals
LSP	Louisiana State Police
MHz	Megahertz
MOU	Memorandum of Understanding
NEC	National Electric Code
NEMA	National Electrical Manufactures Association
NTCIP	National Communications for ITS Protocol
NS	Network Surveillance
O&M	Operations and Maintenance
OER	Octet Encoding Rules
OFDM	Orthogonal Frequency Division Multiplexing
PAR	Peak-to-Average Ratio
PCS	Personal Communications Services

POTS	Plain Old Telephone Service
PR	Performance Requirement
RVD	Radar Vehicle Detector
SCP	Signal Control and Prioritization
SDO	Standard Development Organizations
SE	Systems Engineering
SNMP	Simple Network Management Protocol
STIC	Sub carrier Traffic Information Channel System
STMF	Simple Transportation Management Framework
STMP	Simple Transportation Management Protocol
SOSP	Scope of Services Package
SSC	Surface Street Control
TCP/IP	Transmission Control Protocol/Internet Protocol
TD	Traffic Detector
TIS	Traveler Information System
TIM	Traffic Incident Management
TMC	Traffic Management Center
TMP	Transportation Management Protocols
TOC	Traffic Operations Center
TSS	Transportation Sensor Systems
UDP/IP	User Datagram Protocol/Internet Protocol
US	United States
USDOT	United States Department of Transportation
WAN	Wide Area Network
WLAN	Wireless Local Area Network

3 Systems Engineering Approach

The Systems Engineering approach offers a structured method to achieve project goals and objectives. This approach combines skills associated with engineering, project management, and soft sciences (economic, social, and legal). It helps to address all project issues and provide completeness to the system. Systems Engineering also provides for "traceability," which provides the basis for construction testing and acceptance by the Project Engineer, as well as the link between completion of individual pay items and implementation of the basic purpose and scope of the project. Traceability is the capacity to track every requirement in the system to the system component that satisfies it. Also, traceability is important when considering future changes to the system design, operation, verification and testing. Through the Systems Engineering approach, a traceability matrix is developed.

Figure 2, the "V" Diagram or Model[1], is a visual illustration of the Systems Engineering process used for ITS, with each step involved as the project progresses through development.

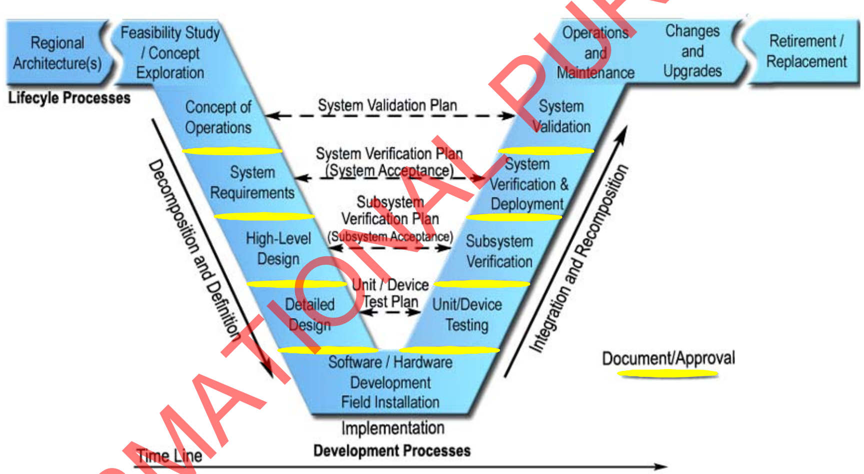

Figure 2: "V" Diagram Illustrating Systems Engineering Process

The left side of the "V" Diagram provides a 'top-down' approach for system planning and design development while the right side provides 'bottom-up' implementation approach for systems testing and verification. The left side of the "V" must take into account the corresponding processes across on the right side of the "V". The "V" diagram is a composition of three different perspectives, namely user's perspective, engineer's perspective, and contractor's perspective.

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[1] Source: *Systems Engineering ITS Guide*, FHWA, 2005
http://ops.fhwa.dot.gov/publications/seitsguide/images/image021.jpg

The Stakeholder's (user's) perspective helps to create the list of requirements. These requirements provide detailed definitions needed to support system design. The perspective of a systems engineer is focused on detailed subsystem components design to achieve stated requirements. The perspective of a contractor is focused on the actual deployment of the system components, which ensures compliance with the design specifications.

4 Project Physical Architecture

It is essential that a project physical architecture be developed to illustrate the important ITS interfaces and the major system elements. The project physical architecture assigns processes from the logical architecture to subsystems and it groups data flows from the logical architecture into architecture flows. These flows and corresponding communication requirements define the interfaces which are a main focus of the project ITS standards. The elements identified for this project are listed below. **Figure 3** illustrates the project physical architecture under consideration. It graphically depicts the overall understanding of the physical architecture components and architecture flows associated with the project.

- DOTD ITS Statewide TMC
- DOTD ITS Section
- DOTD District 03 Traffic Operations Center
- DOTD District 03 CCTVs
- DOTD District 03 DMSs
- DOTD District 03 VDs
- DOTD District 03 HAR
- DOTD District 03 Traffic Signals
- DOTD District 61 Traffic Operations Center
- DOTD District 61 CCTVs
- DOTD District 61 VDs
- DOTD District 61 Traffic Signals
- LSP Troop I Dispatch Operator[2]
- LCG Dept. of Traffic and Transportation[3]

[2] Note communications will be placed within the LSP Troop I office. The physical connection and integration of the communications between the LSP network and ITS network are to be provided by others outside of the design-build project.
[3] Note the connection of the DOTD District 03 CCTVs is to be provided by others outside of this design-build project.

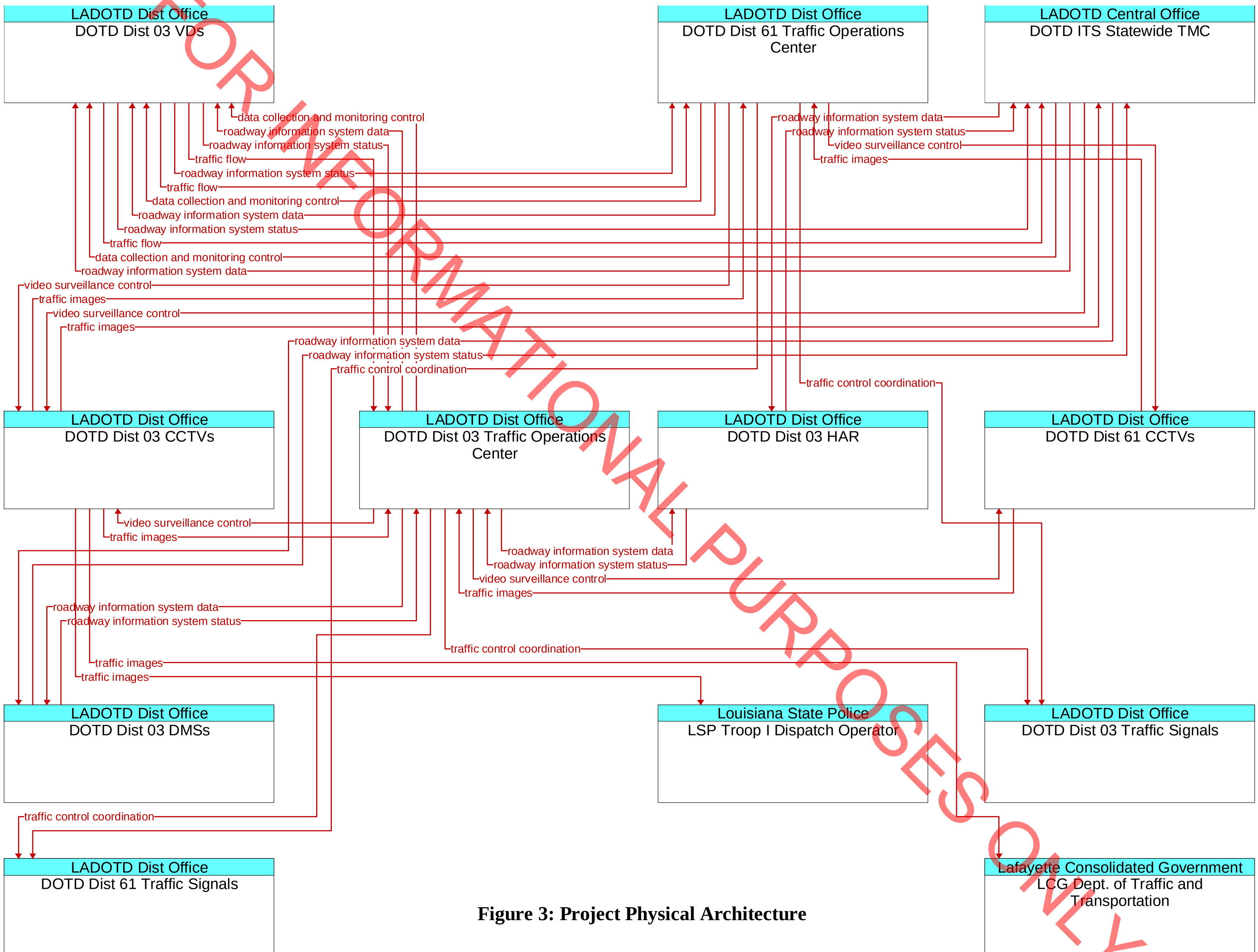


Figure 3: Project Physical Architecture

5 Concept of Operations

Concept of Operations (ConOps) describes how the proposed system will function, the environment in which it will operate, and the people who will use and support the system. ConOps identifies the stakeholders involved in the project and their responsibilities. It also describes the roles and responsibilities for operations and maintenance of the various system users.

The ConOps is a non-technical discussion of the ITS system that should be understood by all project stakeholders. The ConOps presents a view of the operational system once the project is completed, the intended benefits of the system, and the impact on the region in which it is deployed. This ConOps is a general description of how the Baton Rouge to Lafayette ITS-TIM Phase 2 Project will function and the operational responsibilities of each agency involved. The system, which cannot be used to transfer liability related to operating specific facilities, identifies operational roles to each agency.

5.1 Needs

The purpose of the Baton Rouge to Lafayette ITS-TIM Phase 2 Project is to reduce the negative impacts of traffic congestion and incidents within the Lafayette area. Also, this project will enhance traffic operations and multi-agency coordination for normal and abnormal traffic conditions, evacuation operations, and further enhance the response to and command of incidents for EM and TIM purposes.

The project needs have been identified as:

- To detect, verify, and assess traffic congestion and incidents
- To distribute information to motorists in a timely manner
- To provide system monitoring and coordinated operations between the DOTD ITS Statewide TMC, DOTD District 03, DOTD District 61, LCG Dept. of Traffic and Transportation, and the LSP Troop I office

5.2 Scope

The Baton Rouge to Lafayette ITS-TIM Phase 2 Project provides for the interaction of fourteen elements as previously identified in the Project Physical Architecture. The scope of this project includes the deployment of the ITS equipment components, communications, and integration.

5.3 Justification for the ITS Project

I-10 is the major east-west controlled access freeway facility connecting major population centers across southern Louisiana. It is a major transportation route[4] that enhances commerce and economic development within the state of Louisiana, other states along the Gulf Coast, and the nation.

As previously discussed, the section of I-10 within the project limits has only one alternative route, US 190. Access to the alternate route is I-49 in Lafayette and LA 415, LA 1 & I-110 in Baton Rouge. The distance along I-10 between the Baton Rouge and Lafayette access points to US 190 is approximately 48 miles. Over the 48 miles there are several 2– lane rural roads which are not suited for interstate traffic. Due to the single alternate route and limited access, immediate detection, response, site management, and motorist notification of incidents is critical to travel.

The significance of this project was recently called to the motoring public's attention when a oil well fire on the Atchafalaya Basin lead to a closure of the I-10 18-mile bridge from November 15, 2007 to November 25, 2007. Traffic between Lafayette and Baton Rouge was redirected along US 190.

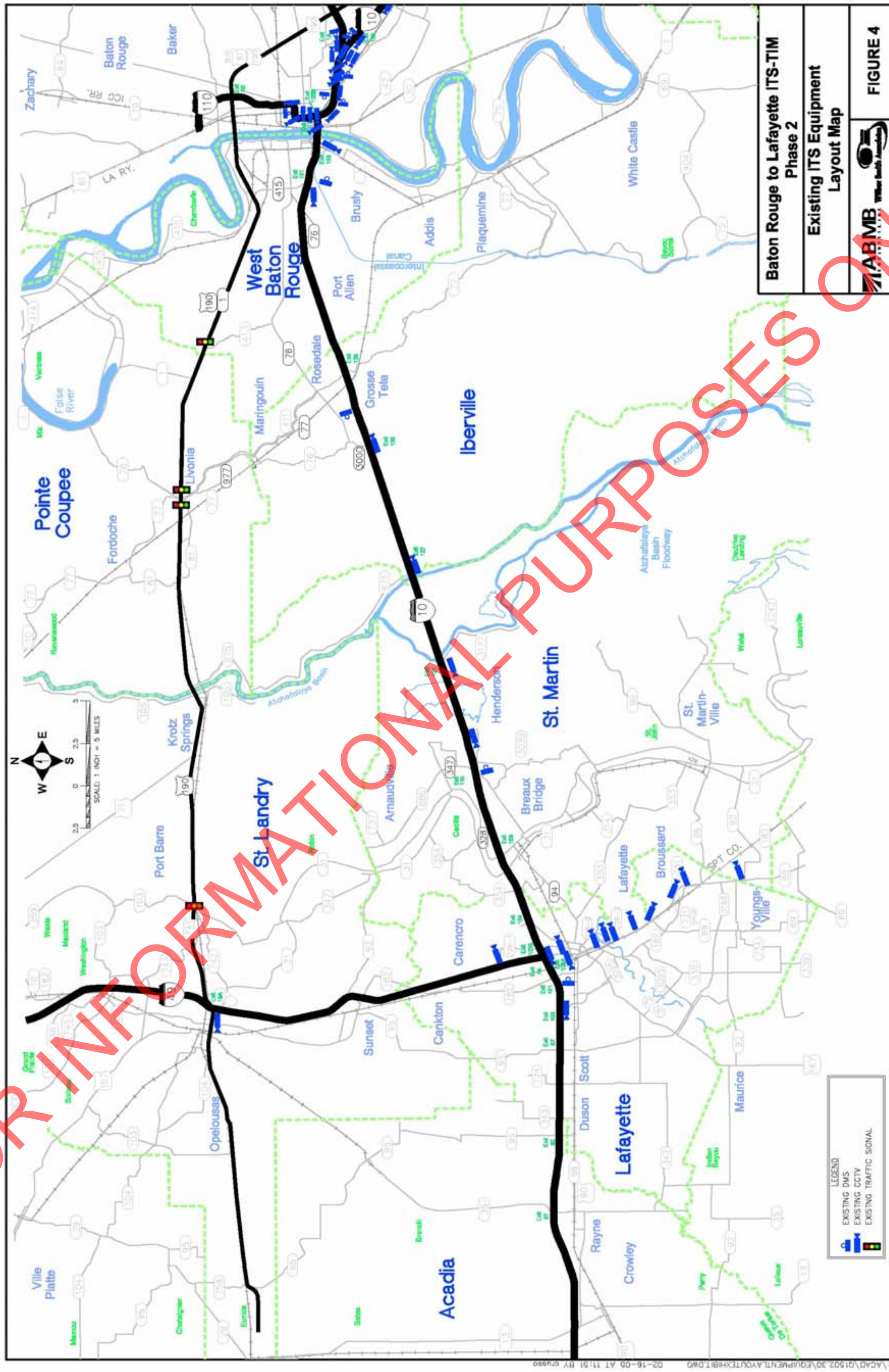
5.4 Existing Operations

Within the project limits, DOTD ITS Statewide TMC actively monitors the existing CCTVs along I-10 and I-49. There are currently eight CCTVs in operation along I-10 in the project limits. Also, the DOTD ITS Statewide TMC operates three fixed-portable CMS within District 61 in the project limits. In District 03, four permanent DMS and eight fixed-portable CMS within the project limits are operated by District 03 Traffic Engineering Office (i.e., traffic operations center as indicated in the physical architecture) with oversight provided by the DOTD ITS Statewide TMC. The US 190 traffic signal in Port Barre is operated by the District 03 Traffic Engineering Office. The other three US 190 traffic signals (2-Livonia, 1-Erwinville) are operated by the District 61 Traffic Engineering Office. Note the District 61 and District 03 boundary is the East Atchafalaya River crossing (near exit 127).

LCG Dept. of Traffic and Transportation passively monitor eleven CCTVs along US 90 and I-49 within the project limits.

Figure 4 shows the locations of the previously mentioned ITS field devices existing within the project limits.

[4] The importance of this project has significantly increased with the recent events of Hurricanes Katrina and Gustav in 2005 and 2008 respectively. These hurricanes inundated parts of the greater New Orleans and the southern Louisiana area causing massive flooding, destroying thousands of homes and business, and severely impacting the State's economy. The hurricanes caused massive evacuations and relocation of Louisiana citizens working in the southern Louisiana region. With the destruction of so much residential housing, the affected population relocated to other areas in the state, specifically the river parishes along the I-10 corridor identified herein. The relocation of these people has caused an increase travel demand into and out of the numerous communities on a daily basis.


Baton Rouge to Lafayette ITS-TIM
Phase 2
Existing ITS Equipment
Layout Map
FIGURE 4
LEGEND
EXISTING DMS
EXISTING CCTV
EXISTING TRAFFIC SIGNAL
Pointe Coupee
West Baton Rouge
Iberville
St Landry
St. Martin
Lafayette
Acadia
FOR INFORMATIONAL PURPOSES ONLY

5.4.1 Traffic/Roadway Management

DOTD District 61 and DOTD District 03 are responsible for the overall traffic management of I-10 within the study area.

DOTD District 03 Traffic Engineering Office and District 61 Traffic Engineering Office currently operate and maintain four traffic signalized intersections (1 and 3, respectfully) in the project limits along US 190. None of the existing traffic signals have remote communications with either district office. All timing changes are performed by the respective district personnel in the field.

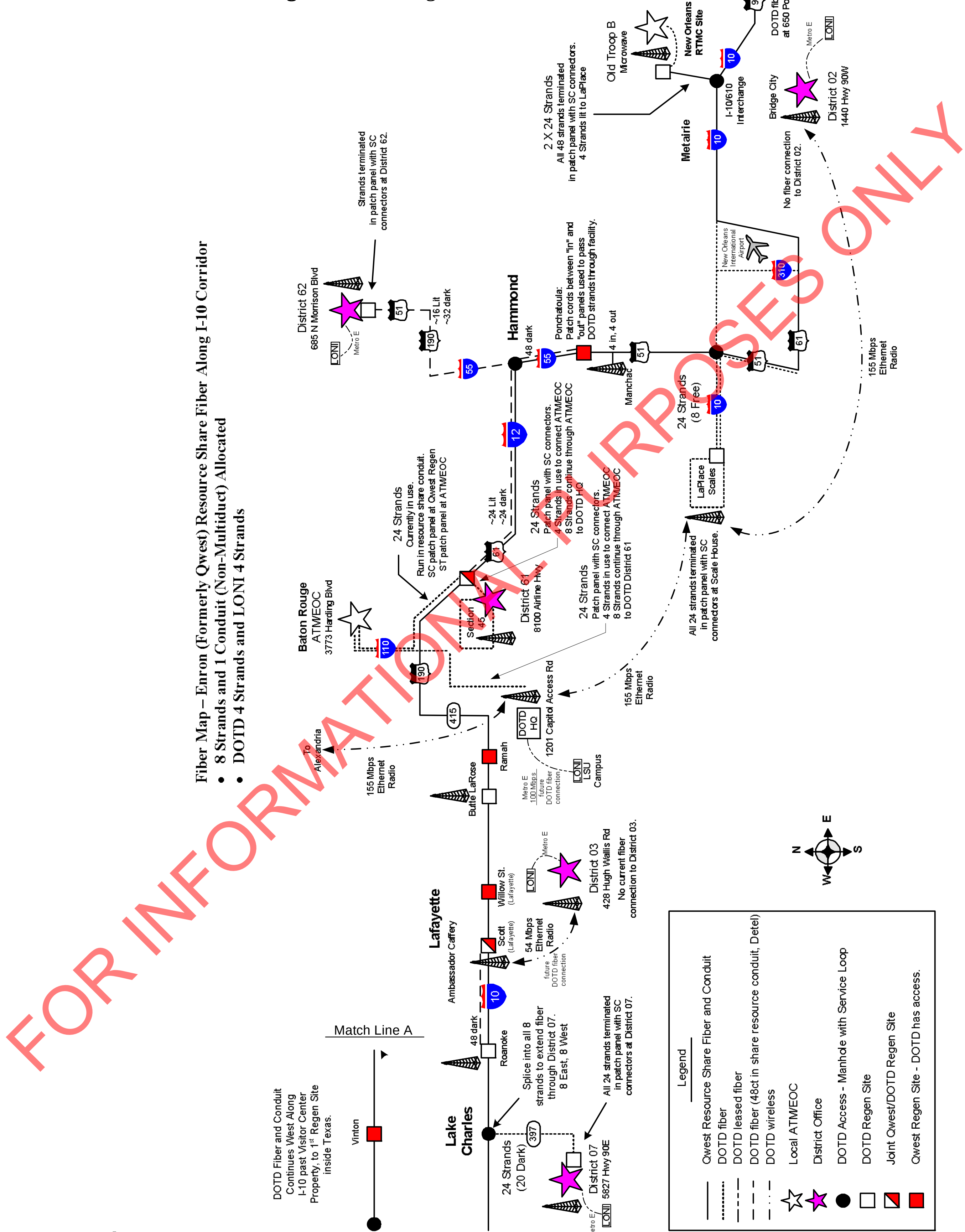
The four permanent DMS boards within the project limits use fiber optic hybrid flip disk technology to display a message. This technology is no longer being manufactured and is limited in support. DOTD personnel can communicate with the DMS boards via POTS lines using dial-up modems.

DOTD's current communication infrastructure uses fiber optic cable and microwave technology. Within the project limits, DOTD currently has eight long haul fibers within a permitted duct bank along DOTD's right-of-way. The eight fibers are within a public-private shared cable and all eight fibers have been allocated or lit. Also, within the duct bank, DOTD owns one vacant 1¼" conduit.

DOTD maintains four microwave towers in the project limits. One is located in Scott at I-10 Exit 100, Scott tower. The other microwave towers are located at the I-49/US 190 interchange, adjacent to the I-10 Atchafalaya Basin Welcome Center (Exit 121, Butte La Rose tower) and off the shoulder of I-10 westbound near the city of Grosse Tete. The Scott and Butte La Rose tower sites serve as regeneration sites for the eight long haul fibers. Fiber Ethernet connections are available at these sites. **Figure 5** shows the existing communication infrastructure.

DOTD has ITS Operators monitoring traffic operations at the ITS Statewide TMC. The staff consists of one Statewide Operation Supervisor and two full-time ITS Operators. The DOTD ITS Statewide TMC center is staffed 24 hours a day, 7 days a week. DOTD District 03 currently has various personnel who passively monitor existing cameras 24 hours a day, 7 days a week.

Figure 5: Existing Communication Infrastructure



5.4.2 Incident Management

Primarily, the motorists traveling the corridor will detect incidents and call 911 from their cell phones. Police and emergency patrol vehicles as well as DOTD personnel in the field also provide a means of detection. Where camera surveillance is available in the region, DOTD ITS Statewide TMC operators actively monitor the cameras and provide incident detection and verification. When cameras are not available in an area where an incident has been reported, it must be verified by responding field personnel. Based on the incident location, the responding enforcement agency field officer(s), local police and/or LSP Troop I, manages the traffic scene. The local dispatch officer, from the enforcement agency managing the traffic scene, requests and coordinates the resources of police and fire departments, as well as DOTD personnel necessary to clear the traffic incident and restore the freeway facility to normal operations. Information regarding the roadway operations and safety conditions is provided to the public via DMS, Internet, email alerts, and local radio stations.

On the 18-mile bridge there are three "crossover" locations with barrier gates for access control. The crossovers are 50-feet wide by 130-feet long areas of refuge that can be accessed by means of electronic card readers on both right hand shoulders across from each crossover. The crossovers are used by emergency managers as helipads, storage for inoperable vehicles, emergency vehicle marshalling, and access to the opposite direction of travel. Currently the gates are powered by a solar power system. Access to the crossovers requires emergency vehicles to negotiate across high volume, high speed lanes of traffic to utilize the cross-over.

5.4.3 Emergency Management

DOTD ITS Statewide TMC, DOTD District 03, DOTD District 61, LCG, LSP Troop I, and other local enforcement agencies are responsible for coordinating the emergency management operations for events such as hurricanes, fuel and chemical spills from trucks and tankers, chemical discharges from plants, and radiological discharges from the nearby nuclear power plant. There are several independent emergency operation centers tasked with responding to the above mentioned emergency situations. It should be noted that in large emergencies, such as hurricane evacuation, the DOTD ITS Statewide TMC becomes the DOTD Statewide Emergency Operations Center (EOC). The ITS equipment available for traffic/roadway management and incident management is used for emergency management as needed.

5.5 System Overview

The Baton Rouge to Lafayette ITS-TIM Phase 2 proposed project architecture is based on a distributive system design with a centralized TMC computer server located at the DOTD ITS Statewide TMC in Baton Rouge. The system shall bring all data and video communication together on one backbone network making all data and video available to any system that has access to the same backbone network.

As part of this project LSP Troop I will be provided with a connection to DOTD's backbone for monitoring surveillance cameras. However, physical connection of the deployed cameras and communications will not be connected or integrated into the existing LSP network as part of this design-build project; connection and integration will be provided by others. Note that LCG will be connected to the backbone by others as part of a separate project.

It should be noted that this project will not readily provide streaming video to LSP or LCG as they will be connected by others. However, these agencies have been included in this document to indicate their relationship with the project being implemented.

DOTD District 03 and DOTD District 61 traffic engineering offices are currently connected to the DOTD communication backbone. Upgrade to existing communications and integration of the ITS field equipment deployed by the project with the two districts will be provided by others outside of the design-build project.

A distributed traffic incident and emergency management system requires a highly reliable and robust communications network. As previously stated, DOTD's existing fiber backbone as shown in Figure 5 is available to supplement the communication needs for the project limits. **Table 1** shows agency accessibility to the communications network:

Table 1: Agency Accessibility

Agency	ITS Access
DOTD ITS Statewide TMC	NS, TIS, DC
DOTD District 03	NS, TIS, DC
DOTD District 61	NS, DC
LCG	NS
Louisiana State Police, Troop I	NS

NS-Network Surveillance, TIS-Traveler Information System, and DC-Data Collection

It is anticipated that stakeholders will continue to provide oversight and direction for this project as it is designed and implemented. For further information regarding stakeholders please refer to section 5.6. The following section outlines the proposed operations of the agencies with regard to the deployment of this project. Operations and maintenance outside of this section are anticipated to remain as currently performed.

5.5.1 ITS Equipment Operations

Current operations of the ITS field equipment in Lafayette is provided through vendor software. With some exceptions, the DOTD ITS Statewide TMC and other regional TMCs operates the majority of the ITS field equipment statewide through a traffic management software manufactured by 360 Surveillance called Cameleon ITS. The Baton Rouge ITS field equipment is operated via a system called Management Information System for Transportation (MIST).

The ITS field equipment deployed by this project will initially be operated by vendor software. DOTD will integrate the deployed ITS field equipment outside of the design-build project with Cameleon ITS. The deployed equipment will be operated using Cameleon ITS until the statewide integrated system software has been developed. The DOTD ITS Statewide TMC Operators will continue to actively monitor the cameras in the Lafayette area until DOTD District 03 obtains full time ITS operations staff to actively monitor the cameras. DOTD District 03 will continue to passively monitor cameras and actively post messages to the DMS and HAR sites. Hours of operations between District 03 ITS operators and DOTD ITS Statewide TMC will remain 24/7.

5.6 Stakeholders

As can be seen from **Table 1**, the envisioned project may involve the interaction of numerous individual agencies located within the region. It is anticipated that project deployment will provide the tools that will allow these stakeholders to facilitate their traffic and transportation management roles.

A Memorandum of Understanding (MOU) has been developed on the interaction of the previously named agencies along with numerous unnamed agencies all involved in Traffic Management, Incident Management, and Emergency Management for this section of I-10 and its alternate route, US 190. A copy of the MOU has been attached in Appendix A for reference. Although all these agencies listed in the MOU are involved in Traffic Management, Incident Management, and Emergency Management, only DOTD, LSP, and LCG have been identified due to their operations of the ITS field equipment resulting from the deployment of the Baton Rouge to Lafayette ITS-TIM Phase 2 Project.

5.7 Operational Environment

The operational environment for the Baton Rouge to Lafayette ITS-TIM Phase 2 Project includes a description of operational procedures, skills and experience of personnel, security issues and processes, communications, data management, and ownership. Since this project is adding ITS field devices to an existing system, the operational environment will not change.

Currently, DOTD ITS Operators are operating each TMC based on the Standard Operator's Procedures (SOP) for the Baton Rouge ATM-EOC. The Statewide TMC Supervisor is in the process of developing an SOP for each TMC. Each SOP will standardize operations across the state, yet cater to the local needs of the region. For additional information or a copy of the SOP, please contact the DOTD ITS Section.

5.8 Operational Scenarios

The Operational Scenarios describes a sequence of events and activities that are carried out by the user, system, and environment. Operational Scenarios identify what event or action initiates the sequence, who or what performs each step, and when communications occur (to/from whom or what). For this project, each function consists of a process used to respond to traffic incidents and access ITS field equipment.

5.8.1 Traffic Incident Management Operations (TIM)

Since DOTD ITS Statewide TMC, DOTD District 03, and DOTD District 61 are connected to the communications backbone, benefits of the system will be gained. In the occurrence of an incident, if the given location is near a CCTV camera, the ITS operator will have the ability to detect and verify the incident without having to visit the field. LSP and LCG operators can monitor CCTV cameras in the system through its connection into DOTD's network. The LSP and LCG connections into the DOTD network are limited to CCTV camera monitoring access only. CCTV cameras that are located along I-10 are used for incident detection and vehicle detection. This also applies for the alternate route, I-49 and US 190. However, cameras at alternate routes are located at major intersections or interchanges.

The ITS operators at DOTD ITS Statewide TMC and DOTD District 03 will have the ability to post messages on DMS boards and HAR sites which shall be located at decision points, defined as points where motorists can make a decision whether or not to take an alternate route or remain on the bridge. Alternate routing will be provided in the occurrence of an incident and/or emergency. Note DMS and HAR deployed by the project are only within DOTD District 03 region.

The ITS operators at DOTD ITS Statewide TMC, DOTD District 03, and DOTD District 61, will have the ability to use vehicle detectors (VDs) for their operations. Vehicle detectors will be located along I-10, I-49, and US 190. These detectors, along with other existing detectors outside of the project, will be used to determine travel times, gather traffic data, and detect traffic incidents. DOTD ITS Statewide TMC, DOTD District 03, and DOTD District 61 shall have the ability to view data from the VDs via compiled reports and the graphical user interface that is part of the traffic management software. Data gathered from the VDs shall be collected at the DOTD ITS Statewide TMC and accessed by DOTD District 03 and DOTD District 61. LSP and LCG will be provided with the data collected from the VDs via email request to the DOTD ITS Statewide TMC.

When interstate traffic is redirected via the alternate route, US 190, the DOTD District 03 and DOTD District 61 traffic engineering offices adjust traffic signal timing plans as needed to accommodate the additional traffic demand based on the conditions observed from the CCTV cameras and vehicle detectors along the alternate route. It is understood between DOTD districts that DOTD District 03 may adjust traffic signal timing on all 4 traffic signals along US 190 in the event of a detour. DOTD District 03 will notify DOTD District 61 of such adjustments. Likewise, the adverse may occur.

5.8.2 Emergency Management Operations

During emergency situations, the ITS Operator will post emergency specific messages on DMSs and HARs. For emergencies within the region, DOTD District 03 will operate the system from the District 03 office. For multi-region or statewide emergencies (i.e., hurricane evacuation), the DOTD ITS Statewide TMC will assume control and operate the CCTVs, VDs, HARs, and DMSs. Traffic signals will still remain under the respective DOTD district traffic engineering office.

5.9 Summary of Impacts

Table 2 shows the project impacts of deployment resulting from this study document for each agency below. This table includes the local agency connections, regional to statewide connections, and the connections that will be established as a part of this project. It should be noted that additional operations and maintenance will vary for each agency based on the level of use chosen. As connections are made to the local and statewide backbone, the regional ITS architecture will need to be updated to show the connections.

Table 2: Summary of Impacts

Center	Impact					
Connected Centers	Access to other centers on local and statewide backbone	Network surveillance (Monitor CCTV cameras)	Network surveillance (Control CCTV cameras)	Post messages to DMS	Post messages to HAR	Monitor Traffic Detectors
DOTD ITS Statewide TMC	•	•	•	•	•	•
DOTD District 03	•	•	•	•	•	•
DOTD District 61	•	•	•			•
LCG		•				
Louisiana State Police, Troop I		•				

6 Requirements

Requirements provide a foundation of information needed to move from the conceptual view presented in the ConOps to the concrete view which defines what must be done and included in the project design. These requirements form the basis for design, implementation, testing and operations.

DOTD ITS Statewide TMC, DOTD District 03 Traffic Engineering Office, DOTD District 61 Traffic Engineering Office, LSP Troop I, and LCG serve as traffic management centers that benefit from the ITS field equipment. To facilitate efficient flow of information, all requirements have been identified as being functional (FR).

6.1 ITS Field Equipment Functional Requirements

FR1 DMS shall be used to disseminate information to in-route travelers

FR1.1 DMS shall display, at a minimum, 3 lines of 18 characters of text.

FR1.1.1 DMSs shall display upper case alphabetic letters “A” thru “Z”

FR1.1.2 DMSs shall display numeric digits “0” thru “9”

FR1.1.3 DMSs shall display a blank

FR1.1.4 DMSs shall display punctuation marks

FR1.1.5 DMSs shall display special characters: . , / ? ; ‘ : “ < > @ # & * - ← → ↑ ↓

FR1.2 DMS display shall use Light Emitting Diodes (LED)

FR1.3 DMS display shall be amber

FR1.4 DMS display shall be full matrix

FR1.5 DMS shall be able to display messages in reverse video (black characters on amber background)

FR1.6 DMS shall display flashing messages

FR1.7 DMS shall display scrolling messages

FR1.8 DMS shall utilize a message library

FR1.9 DMS shall automatically adjust display intensity with ambient conditions.

FR1.10 DMS shall provide one phrase messages

FR1.11 DMS shall provide two phrase messages

FR1.12 DMS shall be installed upstream of major decision points

FR1.13 DMS controller shall provide the status information at a minimum to the center

FR1.13.1 DMS controller shall provide the unique DMS ID

FR1.13.2 DMS controller shall provide the DMS location

FR1.13.3 DMS controller shall provide the time and date of the displayed message

FR1.14 DMS controller shall provide fault information to the center

FR1.14.1 DMS controller shall provide power failure

FR1.14.2 DMS controller shall provide unrecognized commands

FR1.14.3 DMS controller shall provide IO board errors

FR1.14.4 DMS controller shall provide communication failure

FR1.14.5 DMS controller shall provide pixel/panel failure

FR1.15 DMS sub-system (display panel and controller) shall conform to the standards

FR1.15.1 DMS sub-system (display panel and controller) shall conform to NEMA Standards Publication TS 4-2005 (Hardware Standards for Dynamic Message Signs (DMS) With NTCIP Requirements)

FR1.15.2 DMS sub-system (display panel and controller) shall conform to NTCIP 1203-DYNAMIC MESSAGE SIGN STANDARDS

FR1.16 DMS site shall have an IP addressable battery backup

FR1.16.1 IP addressable battery backup shall allow proper shut down of the DMS sign and controller

FR2 CCTV cameras shall be used to monitor in-route travelers

FR2.1 CCTV cameras shall be a solid state color camera

FR2.1.1 CCTV cameras shall meet or exceed the National Television Standards Committee (NTSC) standards

FR2.1.2 Image sensor shall have ¼" interline transfer progressive scan

FR2.1.3 CCTV cameras shall have a minimum horizontal resolution of 525 television lines

FR2.1.4 CCTV cameras shall have a minimum sensitivity of 3.0 lux @ 1/60 second (color day)

FR2.1.5 CCTV cameras shall have a minimum sensitivity of 0.2 lux @ 1/4 second (color day)

FR2.1.6 CCTV cameras shall have a minimum sensitivity of 0.3 lux @ 1/60 second (mono night)

FR2.1.7 CCTV cameras shall have a minimum sensitivity of 0.02 lux @ 1/4 second (mono night)

FR2.1.8 CCTV camera shall have day/night switchover

FR2.1.8.1 Day/night switchover shall be programmable

FR2.1.8.1.1 Day/night switchover shall be programmable for day/night auto

FR2.1.8.1.2 Day/night switchover shall be programmable for day/night manual

FR2.1.9 CCTV camera shall have an onscreen ID

FR2.1.9.1 CCTV camera shall have a title programmable of 8 lines, 12 characters minimum

FR2.2 CCTV cameras shall have a zoom lens

FR2.2.1 CCTV cameras lens shall have a minimum optical zoom of 23x

FR2.2.2 CCTV cameras lens shall have a minimum digital zoom of 1x through 10x

FR2.2.3 CCTV cameras lens shall have selectable auto focus

FR2.3 CCTV cameras shall be in a pressurized enclosure

FR2.3.1 CCTV cameras shall be pressurized with dry nitrogen (IP Rating IP67)

FR2.3.2 CCTV cameras shall be pressurized to 3 psi

FR2.4 CCTV cameras shall pan, tilt, and zoom upon command

FR2.4.1 CCTV cameras shall have 360 degrees of continuous pan

FR2.4.2 CCTV cameras shall have a minimum 0 to 90 degrees of tilt down with auto flip at 90 degrees

FR2.4.3 CCTV cameras shall have 64 presets minimum

FR2.4.4 CCTV cameras shall have greater than 250 degrees/second preset speed at 0.1% accuracy

FR2.4.5 CCTV cameras shall have 16 sectors minimum

FR2.4.6 CCTV cameras shall have a minimum of 8 programmable zones set for blanking

FR2.4.7 CCTV cameras shall have digital position feedback

FR2.5 CCTV camera sites shall have an IP addressable battery backup

FR2.5.1 IP addressable battery backup shall allow operations for 1 hour minimum

FR2.6 CCTV camera site shall allow for remote power reset

FR2.7 CCTV camera site shall allow for remote camera unit reset

FR2.8 CCTV camera unit shall be accessible via a lowering device

FR3 Vehicle Detectors (VD) shall be used to monitor in-route travelers

FR3.1 Vehicle Detectors shall provide data

FR3.1.1 Vehicle Detectors shall provide volume per lane

FR3.1.2 Vehicle Detectors shall provide presence per lane

FR3.1.3 Vehicle Detectors shall provide type (classification) per lane, 6 minimum

FR3.1.3.1 Classifications shall be user defined

FR3.1.4 Vehicle Detectors shall provide speed per lane (configurable)

FR3.1.5 Vehicle Detectors shall provide time, duration, and date the data was acquired

FR3.2 Vehicle detection controller shall provide status information to the center

FR3.2.1 Vehicle detection controller shall provide device ID

FR3.2.2 Vehicle detection controller shall provide device location

FR3.2.3 Vehicle detection controller shall provide current device fault

FR3.2.4 Vehicle detection controller shall provide selectable frequency of the data polling interval (15, 30, 45, and 60 seconds)

FR3.2.5 Vehicle detection controller shall provide selectable data collection period (5, 15, 30, and 60 minutes)

FR3.3 Vehicle detection controller shall provide fault information to the center

FR3.3.1 Vehicle detection controller shall provide power failure

FR3.3.2 The vehicle detection controller shall provide unrecognized command

FR3.3.3 The vehicle detection controller shall provide IO board errors

FR3.3.4 The vehicle detection controller shall provide communication failure

FR3.4 Vehicle Detections system shall conform to industry standards

FR3.5 Vehicle Detector site shall have an IP addressable battery backup

FR3.5.1 IP addressable battery backup shall allow operations for 1 hour minimum

FR3.6 Vehicle Detection unit shall be accessible via a lowering device

FR4 Highway Advisory Radio (HAR) shall be used to disseminate information to in-route travelers

FR4.1 HAR shall provide in-route messages to travelers via AM radio broadcast.

FR4.1.1 HAR shall be broadcasted on a predefined AM radio station

FR4.2 HAR messages shall provide transportation related information

FR4.2.1 HAR messages shall warn motorists of possible hazards, road delays or detours ie: forest fire, weather advisories, chemical spill, survey/testing crews, and/or construction or maintenance

FR4.2.2 HAR messages shall warn motorists of road closure or delay due to a incident or emergency situation

FR4.2.3 HAR messages shall advise motorists of future activities that may result traffic disruptions such as construction and/or maintenance activities

FR4.2.4 HAR messages shall advise motorists of speed limit changes which may be temporary

FR4.2.5 HAR messages shall provide safety initiatives such as ie: Buckle Up, Drive Safely

FR4.3 HAR messages shall be FCC licensed AM band broadcast

FR4.3.1 HAR to be broadcast on a licensed frequency between 530 kHz and 1710 kHz

FR4.4 HAR shall be broadcasted using a minimum of 10-watt transmitters

FR4.4.1 Broadcast radius shall be a minimum of 3 miles depending on topography, atmospheric conditions, and the time of day

FR4.5 HAR shall be point broadcasted

FR4.5.1 A single transmitter shall be used to broadcast over a given area

FR4.6 HAR shall be programmable

FR4.6.1 HAR controller shall be programmed using a central control software on a desktop computer

FR4.6.1.1 Central control software shall allow digital audio messages to be entered into the system

FR4.6.2 HAR controller shall be programmed using telephone (cell phone or landline)

FR4.7 HAR shall provide live broadcast

FR4.8 HAR shall store a minimum of 250 pre-recorded messages

FR4.9 HAR shall have minimum of 80 minutes of recording time allowed

FR4.10 HAR shall have minimum 2 day message backup

FR4.11 HAR controller shall provide fault information to the center

FR4.11.1 HAR controller shall provide transmitter power failure

FR4.11.2 HAR controller shall provide advisory sign failure

FR4.11.3 HAR controller shall provide unrecognized commands

FR4.11.4 HAR controller shall provide IO board errors

FR4.11.5 HAR controller shall provide communication failure

FR4.12 HAR controller shall provide the status information at a minimum to the center

FR4.12.1 HAR controller shall provide a unique HAR ID

FR4.12.2 HAR controller shall provide the HAR location

FR4.12.3 HAR controller shall provide the time and date of the broadcasted message

FR4.13 HAR shall manage a minimum of 5 roadside advisory signs per transmitter

FR4.13.1 User shall be able to activate the flashing beacons on the roadside sign

FR4.13.2 HAR roadside advisory signs shall be able to activated/deactivated independently

FR4.14 HAR transmitter site shall have an IP addressable battery backup

FR4.14.1 IP addressable battery backup shall allow for the broadcast of programmed messages for 3 days minimum

6.2 TMC Communications and Control Functional Requirements

FR5 DOTD District 03 shall be communicate with traffic signal controllers (by others)

FR5.1 Traffic signal control software shall provide control of traffic signal controllers in the field

FR6 DOTD District 61 shall communicate with traffic signal controllers (by others)

FR6.1 Traffic signal control software shall provide control of traffic signal controllers in the field

FR7 DOTD District 03 shall have primary control of all ITS field devices (by others)

FR8 DOTD ITS Statewide TMC shall have secondary control of all ITS field devices

FR9 DOTD District 61 shall have tertiary control of all ITS field devices (by others)

FR10 DOTD ITS Statewide TMC shall communicate with DMS sites

FR10.1 DOTD ITS Statewide TMC shall receive current display status

FR10.2 DOTD ITS Statewide TMC shall receive internal temperature warnings

FR10.3 DOTD ITS Statewide TMC shall receive current operating status

FR10.4 DOTD ITS Statewide TMC shall receive malfunction warnings

FR10.5 DOTD ITS Statewide TMC shall receive confirmation of a message posted

FR11 DOTD ITS Statewide TMC shall control DMS

FR11.1 DOTD ITS Statewide TMC shall post message to the DMS

FR11.2 DOTD ITS Statewide TMC shall load messages into the DMS library

FR11.3 DOTD ITS Statewide TMC shall change display of messages

FR11.3.1 DOTD ITS Statewide TMC shall change brightness

FR11.3.2 DOTD ITS Statewide TMC shall change font size

FR11.3.3 DOTD ITS Statewide TMC shall configure length of phase

FR11.4 DOTD ITS Statewide TMC shall activate/deactivate DMS flashing beacon

FR12 DOTD District 03 shall communicate with DMS sites (by others)

FR12.1 DOTD District 03 shall receive current display status

FR12.2 DOTD District 03 shall receive internal temperature warnings

FR12.3 DOTD District 03 shall receive current operating status

FR12.4 DOTD District 03 shall receive malfunction warnings

FR12.5 DOTD District 03 shall receive confirmation of a message posted

FR13 DOTD District 03 shall control DMS (by others)

FR13.1 DOTD District 03 shall post message to the DMS

FR13.2 DOTD District 03 shall load messages into DMS library

FR13.3 DOTD District 03 shall change display of messages

FR13.3.1 DOTD District 03 shall change brightness

FR13.3.2 DOTD District 03 shall change font size

FR13.3.3 DOTD District 03 shall configure length of phase

FR13.4 DOTD District 03 shall activate/deactivate DMS flashing beacon

FR14 DOTD ITS Statewide TMC shall communicate with CCTV camera sites

FR14.1 DOTD ITS Statewide TMC shall receive streaming video of traffic supplied by CCTV cameras

FR14.1.1 Streaming video shall be 15 frames per second, minimum

FR14.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from the CCTV cameras

FR14.3 DOTD ITS Statewide TMC shall receive current operating status of the CCTV cameras

FR14.4 DOTD ITS Statewide TMC shall receive malfunction warnings from the CCTV cameras

FR15 DOTD ITS Statewide TMC shall control CCTV cameras

FR15.1 DOTD ITS Statewide TMC shall pan CCTV cameras

FR15.2 DOTD ITS Statewide TMC shall tilt CCTV cameras

FR15.3 DOTD ITS Statewide TMC shall zoom CCTV cameras

FR15.4 DOTD ITS Statewide TMC shall adjust focus

FR15.5 DOTD ITS Statewide TMC shall designate/program blacked-out areas

FR15.6 DOTD ITS Statewide TMC shall set the time displayed on the video from the CCTV cameras

FR15.7 DOTD ITS Statewide TMC shall set the date displayed on the video from the CCTV cameras

FR15.8 DOTD ITS Statewide TMC shall set preset views for the CCTV cameras

FR15.9 DOTD ITS Statewide TMC shall remotely reset the CCTV cameras

FR16 DOTD District 03 shall communicate with CCTV camera sites (by others)

FR16.1 DOTD District 03 shall receive streaming video of traffic supplied by CCTV cameras

FR16.1.1 Streaming video shall be 15 frames per second, minimum

FR16.2 DOTD District 03 shall receive internal temperature warnings from the CCTV cameras

FR16.3 DOTD District 03 shall receive current operating status of the CCTV cameras

FR16.4 DOTD District 03 shall receive malfunction warnings from the CCTV cameras

FR17 DOTD District 03 shall control CCTV cameras (by others)

FR17.1 DOTD District 03 shall pan CCTV cameras

FR17.2 DOTD District 03 shall tilt CCTV cameras

FR17.3 DOTD District 03 shall zoom CCTV cameras

FR17.4 DOTD District 03 shall adjust focus

FR17.5 DOTD District 03 shall designate/program blacked-out areas

FR17.6 DOTD District 03 shall set the time displayed on the video from the CCTV cameras

FR17.7 DOTD District 03 shall set the date displayed on the video from the CCTV cameras

FR17.8 DOTD District 03 shall set preset views for the CCTV cameras

FR17.9 DOTD District 03 shall be able to remotely reset the CCTV cameras

FR18 DOTD District 61 shall communicate with CCTV camera sites (by others)

FR18.1 DOTD District 61 shall receive streaming video of traffic supplied by CCTV cameras

FR18.1.1 Streaming video shall be 15 frames per second, minimum

FR18.2 DOTD District 61 shall receive internal temperature warnings from the CCTV cameras

FR18.3 DOTD District 61 shall receive current operating status of the CCTV cameras

FR18.4 DOTD District 61 shall receive malfunction warnings from the CCTV cameras

FR19 DOTD District 61 shall control CCTV cameras (by others)

FR19.1 DOTD District 61 shall pan CCTV cameras

FR19.2 DOTD District 61 shall tilt CCTV cameras

FR19.3 DOTD District 61 shall zoom CCTV cameras

FR19.4 DOTD District 61 shall adjust focus

FR19.5 DOTD District 61 shall designate/program blacked-out areas

FR19.6 DOTD District 61 shall set the time displayed on the video from the CCTV cameras

FR19.7 DOTD District 61 shall set the date displayed on the video from the CCTV cameras

FR19.8 DOTD District 61 shall set preset views for the CCTV cameras

FR19.9 DOTD District 61 shall remotely reset the CCTV cameras

FR20 LSP Troop I shall communicate with CCTV camera sites (by others)

FR20.1 LSP Troop I shall receive streaming video of traffic supplied by CCTV cameras

FR20.1.1 Streaming video shall be 15 frames per second, minimum

FR21 LCG shall communicate with CCTV camera sites (by others)

FR21.1 LCG shall receive streaming video of traffic supplied by CCTV cameras

FR21.1.1 Streaming video shall be 15 frames per second, minimum

FR22 DOTD ITS Statewide TMC shall communicate with VD sites

- FR22.1 DOTD ITS Statewide TMC shall receive polled traffic data from the VD
  - FR22.1.1 Traffic data shall consist of volume per lane
  - FR22.1.2 Traffic data shall consist of vehicle classification per lane
  - FR22.1.3 Traffic data shall consist of speed per lane
  - FR22.1.4 Traffic data shall consist of occupancy per lane
- FR22.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from VD
- FR22.3 DOTD ITS Statewide TMC shall receive current operating status of VD
- FR22.4 DOTD ITS Statewide TMC shall receive malfunction warnings from the VD

FR23 DOTD ITS Statewide TMC shall control VD sites

- FR23.1 DOTD ITS Statewide TMC shall create detection zone for the VD
- FR23.2 DOTD ITS Statewide TMC shall adjust existing detection zones
- FR23.3 DOTD ITS Statewide TMC shall set classification thresholds
- FR23.4 DOTD ITS Statewide TMC shall set current time
- FR23.5 DOTD ITS Statewide TMC shall set current date
- FR23.6 DOTD ITS Statewide TMC shall remotely reset VD

FR24 DOTD District 03 shall communicate with VD sites (by others)

- FR24.1 DOTD District 03 shall receive polled traffic data from the VD
  - FR24.1.1 Traffic data shall consist of volume per lane
  - FR24.1.2 Traffic data shall consist of vehicle classification per lane
  - FR24.1.3 Traffic data shall consist of speed per lane
  - FR24.1.4 Traffic data shall consist of occupancy per lane
- FR24.2 DOTD District 03 shall receive internal temperature warnings from VD
- FR24.3 DOTD District 03 shall receive current operating status of VD
- FR24.4 DOTD District 03 shall receive malfunction warnings from the VD

FR25 DOTD District 03 shall control VD sites (by others)

- FR25.1 DOTD District 03 shall create detection zone for the VD
- FR25.2 DOTD District 03 shall adjust existing detection zones
- FR25.3 DOTD District 03 shall set classification thresholds
- FR25.4 DOTD District 03 shall set current time
- FR25.5 DOTD District 03 shall set current date
- FR25.6 DOTD District 03 shall remotely reset VD

FR26 DOTD District 61 shall communicate with VD sites (by others)

- FR26.1 DOTD District 61 shall receive polled traffic data from the VD

FR26.1.1 Traffic data shall consist of volume per lane

FR26.1.2 Traffic data shall consist of vehicle classification per lane

FR26.1.3 Traffic data shall consist of speed per lane

FR26.1.4 Traffic data shall consist of occupancy per lane

FR26.2 DOTD District 61 shall receive internal temperature warnings from VD

FR26.3 DOTD District 61 shall receive current operating status of VD

FR26.4 DOTD District 61 shall receive malfunction warnings from the VD

FR27 DOTD District 61 shall control VD sites (by others)

FR27.1 DOTD District 61 shall create detection zone for the VD

FR27.2 DOTD District 61 shall adjust existing detection zones

FR27.3 DOTD District 61 shall set classification thresholds

FR27.4 DOTD District 61 shall set current time

FR27.5 DOTD District 61 shall set current date

FR27.6 DOTD District 61 shall remotely reset VD

FR28 DOTD ITS Statewide TMC shall communicate with HAR sites

FR28.1 DOTD ITS Statewide TMC shall receive message broadcast confirmation from the HAR

FR28.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from HAR transmitter

FR28.3 DOTD ITS Statewide TMC shall receive current operating status of HAR transmitter

FR28.4 DOTD ITS Statewide TMC shall receive power status of HAR transmitter

FR28.5 DOTD ITS Statewide TMC shall receive current operating status of HAR advisory sign

FR28.6 DOTD ITS Statewide TMC shall receive malfunction warnings from the HAR

FR28.7 DOTD ITS Statewide TMC shall activate HAR advisory sign beacons

FR29 DOTD ITS Statewide TMC shall control HAR sites

FR29.1 DOTD ITS Statewide TMC shall create new messages

FR29.2 DOTD ITS Statewide TMC shall load existing message

FR29.3 DOTD ITS Statewide TMC shall set duration of message broadcast

FR29.4 DOTD ITS Statewide TMC shall set current time

FR29.5 DOTD ITS Statewide TMC shall set current date

FR29.6 DOTD ITS Statewide TMC shall remotely reset HAR

FR30 DOTD District 03 shall communicate with HAR sites (by others)

FR30.1 DOTD District 03 shall receive message broadcast confirmation from the HAR

FR30.2 DOTD District 03 shall receive internal temperature warnings from HAR transmitter

FR30.3 DOTD District 03 shall receive current operating status of HAR transmitter

FR30.4 DOTD District 03 shall receive power status of HAR transmitter

FR30.5 DOTD District 03 shall receive current operating status of HAR advisory sign

FR30.6 DOTD District 03 shall receive malfunction warnings from the HAR

FR30.7 DOTD District 03 shall activate HAR advisory sign beacons

FR31 DOTD District 03 shall control HAR sites (by others)

FR31.1 DOTD District 03 shall create new messages

FR31.2 DOTD District 03 shall load existing message

FR31.3 DOTD District 03 shall set duration of message broadcast

FR31.4 DOTD District 03 shall set current time

FR31.5 DOTD District 03 shall set current date

FR31.6 DOTD District 03 shall remotely reset HAR

6.3 Communications Plant and Power Functional Requirements

FR32 Traffic signal cabinets shall have Ethernet communications

FR32.1 Traffic signal controllers communicate via Ethernet communications (by others)

FR33 Fiber optic communications backbone cable shall be provided

FR33.1 A minimum of 3 – 2" diameter HDPE conduits shall be constructed within interstate right-of-way from the Scott tower site to LSP Troop I office building

FR33.2 Single mode fiber optic cable, 96 count minimum, shall be provided from the DOTD communications tower in Scott (I-10 Exit 100) to LSP Troop I office building

FR33.2.1 Fiber optic communications cable may be installed within the existing DOTD vacant 1¼" conduit, part of Qwest Communications duct bank, within I-10 right-of-way as an alternative to new conduit installation

FR33.2.1.1 Use of the vacant 1¼" conduit shall require meeting Qwest Communications requirements

FR33.2.2 LSP Troop I business network to be connected to the Ethernet communications (by others)

FR33.3 A minimum of 2 – 3" diameter conduits, or equivalent innerduct, shall be constructed on the I-10 – 18 mile Atchafalaya Basin Bridge

FR33.3.1 Conduit shall be installed on the bridge structure from the western bridge abutment to the mid basin crossover (between I-10 exits 121 and 127)

FR33.3.2 Conduit shall be installed on the bridge structure from the eastern basin crossover to the eastern bridge abutment

FR33.4 Single mode fiber optic cable, 96 count minimum, shall be provided on the I-10 18-mile Atchafalaya Basin Bridge in required conduit

FR34 Commercial power shall be provide to all ITS field device

FR35 Power distribution shall be provided across the I-10 18-mile Atchafalaya Basin Bridge for power

FR35.1 A minimum of 1 – 2” diameter conduits shall be constructed along the I-10 18-mile Atchafalaya Basin Bridge for power

FR35.1.1 Conduit shall be installed on the bridge structure from the western bridge abutment to the mid basin crossover (between I-10 exits 121 and 127)

FR35.1.2 Conduit shall be installed on the bridge structure from the eastern basin crossover to the eastern bridge abutment

FR35.2 Power shall be provided for ITS field devices on the Atchafalaya Basin Bridge

FR35.3 Power shall be provided for electric crossover gate mechanism

THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES FIBER COMMUNICATION IN NEW CONDUIT

FR35.4 Fiber optic communications backbone cable shall be provided

FR35.4.1 A minimum of 3 – 2” diameter HDPE conduits shall be constructed within interstate right-of-way

FR35.4.2 Fiber optic communications backbone shall be installed to provided Ethernet connectivity

FR35.4.2.1 Minimum fiber count for communication runs over 500 feet shall be 48 fibers

FR35.4.2.2 Minimum fiber count for communication runs under 500 feet shall be 12 fibers

THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES FIBER COMMUNICATION IN EXISTING DOTD VACANT CONDUIT

FR35.5 Fiber optic communications backbone cable shall be provided

FR35.5.1 Fiber optic communications cable shall be installed within the existing DOTD vacant 1¼” conduit, part of Qwest Communications duct bank, within I-10 right-of-way

FR35.5.1.1 Use of the vacant 1¼” conduit shall require meeting Qwest Communications requirements

FR35.5.2 Fiber optic communications backbone shall provided Ethernet connectivity

FR35.5.2.1 Minimum fiber count for communication runs over 500 feet shall be 48 fibers

FR35.5.2.2 Minimum fiber count for communication runs under 500 feet shall be 12 fibers

THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES WIRELESS COMMUNICATION

FR35.6 Wireless communications backbone shall be provided

FR35.6.1 Wireless communications backbone shall be installed to provide Ethernet connectivity where fiber optic communications backbone is not mandated

6.4 Requirements Traceability Matrix

The purpose of the requirements traceability matrix is to identify the section of the Concept of Operations document from which the requirement is derived, as well as the high level and associated detailed requirements. Once design and implementation are completed, the matrix will contain the linking information to the design specifications and implementation information that addresses requirements. The Traceability Matrix provides a check list for construction testing and acceptance by the Project Engineer, as well as the link between completion of individual pay items and implementation of the basic purpose and scope of the project. The Requirements Traceability Matrix is provided in **Appendix B, Table B-1**. Note the requirements that are not required as part of the design-build project have been shaded.

7 System Design

As part of a Systems Engineering process, a system design is required for an ITS project. The system design process defines how a system will be built. The design activities supported in a DOTD ITS project result in a design document that contains both high-level and detailed design specifications as well as any supporting information needed to implement and integrate ITS facilities.

A system design is developed from the system requirements. For the Baton Rouge to Lafayette ITS-TIM Phase 2 Project, these requirements have been previously defined (please refer to Section 6). Since the previous requirements section has defined what the system will do, the requirements will be translated into a hardware and software design that can be deployed.

The system design process has two phases. The first phase is high-level design where high level requirements are translated into decisions about how the system will be built, how subsystems are organized, and how verification should be handled at a high level. In the high-level design process, design concepts are developed. During the second phase of design, plan sets and top-level specifications are defined in detail and at a level where implementation is supported. As part of this project, design concepts are satisfied and detailed design specifications are developed.

Since the Baton Rouge to Lafayette ITS-TIM Phase 2 Project uses the design-build method, the high-level design is provided as part of the SOSP document. The detail design will be required to meet the technical specifications section of the SOSP.

7.1 High-Level Design

The high-level design process gives way to the development of an overall system design prior to working out the details of an individual system. The Concept of Operations and System Requirements of the project have been identified based on the purpose and the need for the ITS project (sections 5 and 6, respectively). Please refer to these sections for clarifications on the purpose of the system, system development, operation and maintenance, identification of stakeholders, and the current and planned operating sites.

7.1.1 Project Organization

This section will describe how the project is divided into subsystems. Each subsystem has its purpose, functionality, and interface with other sub-systems and component parts. As previously stated, subsystem organization can be seen in the Project Physical Architecture.

The Baton Rouge to Lafayette ITS-TIM Phase 2 Project will provide communication connection and data flow between the project elements. From the Project Physical Architecture, the following have been defined as elements:

1. DOTD ITS Statewide TMC
2. DOTD ITS Section

3. DOTD District 03 Traffic Operations Center
4. DOTD District 03 CCTVs
5. DOTD District 03 DMSs
6. DOTD District 03 VDs
7. DOTD District 03 HAR
8. DOTD District 03 Traffic Signals
9. DOTD District 61 Traffic Operations Center
10. DOTD District 61 CCTVs
11. DOTD District 61 VDs
12. DOTD District 61 Traffic Signals
13. LSP Troop I Dispatch Operator
14. LCG Dept. of Traffic and Transportation

All of these subsystems communicate through the communications backbone. The information, data, video images, control, etc. that these centers send and receive has been previously defined in the Concept of Operations and Requirements section of this document. Please refer to these sections and the Project Physical Architecture for further information.

7.1.1.1 Hardware and Software Components

The hardware and software component of each subsystem is directly connected to the communication backbone. These components have been defined in the Functional Specification section of the Scope of Services Package (i.e., the request for proposal).

A communications alternative section has been developed as part of this System Engineering analysis. Please refer to Alternative Communications Configurations section for information regarding connections between subsystems, hardware components, and software implementation. Please note that different types of communication connectivity were explored.

7.2 Detailed Design

As previously stated, the detailed design provides the detailed plans and configuration needed for system implementation. For the Baton Rouge to Lafayette ITS-TIM Phase 2 Project, please refer to section 8 for the Alternative Communications Configurations section, Functional Specifications, and to the resulting detail design plans.

8 Alternative Communication Configurations

An important component of the SE Analysis for the Baton Rouge to Lafayette ITS-TIM Phase 2 Project is the communication and alternative analysis. This analysis evaluates a number of communication technologies to determine their application to this project. Satisfaction of the project communication needs requires the identification of a transmission media that accommodates the current information demand and provides capacity to meet future system demand. The selected transmission media must be capable of handling system communication needs at a high operational performance level.

8.1 Communication Technologies

There are a number of different types of communication technologies available for ITS network applications. Some of the technologies cited below are not applicable for this project. However, it is important that DOTD be aware of the variety of technologies currently being used throughout the communication industry. They are:

- Fiber optic cable (Single Mode)
- Cellular Digital Packet Data (CDPD)
- Global System for Mobile Communication (GSM/EDGE) Enhanced Data for Global Evolution
- Radio Frequency (Spread Spectrum)
- Terrestrial Microwave Links
- Area Radio Network (ARN)
- Telephone Lease Lines
- Code-Division Multiple Access (CDMA)
- Orthogonal Frequency Division Multiplexing (OFDM)

The critical factors in the selection of a preferred alternative are the following:

- High reliability and availability
- Low capital and operating (i.e., maintenance) costs
- Provisions for high bandwidth capacity and transmission speed with flexibility to accommodate future expansion
- Protection of the interconnected server, workstations and controllers from unauthorized access and malicious intent

General advantages of direct wire connection versus a wireless connection:

- Bandwidth is limited only by the edge devices
- Life span of 15+ years
- Connection can only be interrupted by invasive measures (e.g. break in the fiber)
- Maintenance is generally less than that of wireless

General disadvantages of direct wire connection versus a wireless connection:

- Susceptible to being broken during construction
- Requires costly conduit/duct (e.g. structure mounted bullet resistant conduit)

- Installation cost is higher than that of wireless

8.1.1 Fiber Optic Cable (Single Mode)

The advantages of single mode fiber optic cable are the following:

- Allowable distance between transmission equipment, transmission rate, and bandwidth capacity is significantly greater than any other communication method, thereby providing nearly unlimited future System expansion
- Lightning protection devices are not required
- Ratio of cable diameter to bandwidth capacity is very small
- Provides highest level of security when properly monitored
- Not susceptible to electro-magnetic and radio frequency interference
- Not susceptible to corrosion
- Provides high transmission reliability if quality materials are specified and testing is performed to verify compliance
- Preterminated fiber available for quick installation and no splicing required

The disadvantages of single mode fiber optic cable are the following:

- Splicing and connector termination requires specialized equipment and skilled technicians
- Technician training required for repairing, replacing, and testing fiber cable
- Test equipment is more complex and expensive relative to copper test equipment
- Susceptible to breaking if the fiber bends are smaller than the recommended bending radius or excessive load is applied
- Requires devices to convert from optical to electrical end user equipment
- Substantial capital cost of installation
- Preterminated fiber requires additional planning because fiber that is dropped off the backbone is no longer continuous beyond that drop point

8.1.2 Cellular Digital Packet Data (CDPD)

CDPD is a packet-switched, full duplex data communication system that cellular carriers use specifically for data transmission and as a means of filling unused voice channel capacity. The advantages of CDPD are the following:

- Eliminates need for incurring underground cable installation costs
- Not susceptible to electro-magnetic interference and limited susceptibility to radio frequency interference
- Maximum flexibility in locating and moving the required modem (assuming adequate cell coverage)

The disadvantages of CDPD are the following:

- Requires payment of a recurring service fee (payment is only for data sent and received in packets, not minutes)
- Major carriers plan to discontinue CDPD service with the migration to 3G technologies
- Transmission Speed limited to 28.8 Kbps
- Dependent on cellular coverage provided by existing infrastructure. Connection likely to be lost if signal strength falls below –105 dBm
- Requires separate modem for each controller
- Unencrypted data is susceptible to eavesdropping

8.1.3 Global System for Mobile Communication (GSM)

CDMA is the dominant technology for cellular and/or PCS networks in North America (see section 8.1.8 for CDMA). GSM is the dominant technology for cellular and/or PCS networks in Europe. Cellular and PCS differ primarily in their respective operational frequency bands: 800 MHz for cellular and 1900 MHz for PCS. The advantages of GSM are the following:

- Lower cost of data rate plans for wireless WANs. Prices for these plans have fallen significantly, creating a more compelling reason to switch to wireless data networks for remote device communications
- New technology gives wireless gateways the ability to maintain an "always on" connection without being charged for total airtime, so users pay only for the data they actually send over the wireless connection
- Maximum flexibility in locating and moving the required gateway (assuming adequate cell coverage)
- Transmission speeds of 3.0 Mbps can be achieved with EDGE technology where service is available

The disadvantages of GSM are the following:

- Airtime cost excessive for continuous communication service
- Only two providers in one area
- Actual data throughput reduced due to protocol overhead
- Remote areas may not have service

8.1.4 Radio Frequency (Spread Spectrum)

Spread spectrum uses wideband modulation to impart noise-like characteristics to an RF signal. The bandwidth is spread by means of a code which is independent of the data. The independence of the code distinguishes this from standard modulation schemes in which the data modulation will always spread the spectrum. The receiver synchronizes to the transmitter code to recover the data. The use of an independent code and synchronous reception allows multiple users to access the same frequency band at the same time without interference. Frequency hopping and direct sequence systems are the most widely used implementations of this technology and the associated equipment is commercially available. The advantages of radio frequency transmission are the following:

- Eliminates need for incurring underground cable installation costs
- Not susceptible to electro-magnetic interference
- Provides a low probability of intercept and includes anti-jam features
- Radio frequency interference with narrowband communications is minimized by use of lower spectral power density and for a frequency hopping implementation, an ability to reconstruct the data when some frequencies are blocked
- Does not require a FCC license to operate

The disadvantages of radio frequency transmission are the following:

- Requires overhead locations to mount antennas that maintain line of sight
- Requires routing cable and conduit from antenna to modem installed in cabinet
- Requires separate modem for each controller
- Limited susceptibility to radio frequency interference
- Requires the highest equipment expenditure that includes sufficient spares (Also expected to have the highest total cost consisting of initial capital cost and net present value of operating/maintenance cost)
- Antenna is susceptible to vandalism
- Requires special skills and equipment to maintain
- Requires the most training to maintain

8.1.5 Terrestrial Microwave Links

Terrestrial microwave is a line-of-sight technology that cannot extend beyond the earth's horizon. Long distance terrestrial transmission of data is accomplished using relay points known as "hops). Typically, each hop consists of a tower with one antenna for receiving and another for transmitting. Terrestrial microwave systems operate in the low-gigahertz range, typically at 4-6 GHz, 11 GHz, 18 GHz, and 21- 23 GHz.

The advantages of terrestrial microwave links are as follows:

- Useful as a point-to-point trunk
- Can transmit data and a limited number of full motion video channels
- Can control groups of traffic control devices
- Can use both analog and digital transmission
- Offers the highest data throughput rates of any wireless technology

The disadvantages of terrestrial microwave links are as follows:

- Line-of-sight may be required based on the frequency
- In most cases, requires FCC license
- Channel availability limited
- May have little choice in operating frequency
- Possible interference due to rain, snow, and atmospheric effects
- May require antenna tower

- Available bandwidth usually limited
- Typically most expensive wireless technology to implement

8.1.6 Area Radio Network (ARN)

Area Radio Network (ARN) is representative of a radio network usually operating in the UHF/VHF frequency bands. These networks are normally used for in-house communications of equipment devices and maintenance staff and personnel.

The advantages of ARN are as follows:

- Can operate traffic controllers or other devices
- Can provide voice communications to highway maintenance vehicles
- Can support 9600 baud data rate
- Can prove cost effective depending on application

The disadvantages of ARN are as follows:

- Terrain may be limited
- Limited channel availability in urban area
- Requires antenna at each site
- Turnaround time excessive for some applications
- Service reliability may limit use for some applications (Example, CTV video)

8.1.7 Telephone Lease Lines Line

The advantages of telephone line are as follows:

- Can operate traffic controllers or other devices
- Can provide video transmission at low fps
- Asymmetric Digital Subscriber (ADSL) can support full motion video

The disadvantages of telephone are as follows:

- ADSL leasing cost
- Limited video availability

8.1.8 Code-Division Multiple Access (CDMA)

CDMA (Code-Division Multiple Access) refers to any of several protocols used in so-called second-generation (2G) and third-generation (3G) wireless communications. As the term implies, CDMA is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimizing the use of available bandwidth. The technology is used in ultra-high-frequency (UHF) cellular telephone systems in the 800-MHz and 1.9-GHz bands. CDMA employs analog-to-digital conversion (ADC) in combination with spread spectrum technology. Audio input is first digitized into binary elements. The frequency of the transmitted signal is then made to vary according to a defined pattern (code) so that it can be intercepted only by a receiver whose frequency response is programmed with the same code and so it follows along with the exact transmitter frequency. There are trillions of possible frequency-sequencing codes which enhance privacy and make cloning difficult.

The CDMA channel is nominally 1.23 MHz wide. CDMA networks use a scheme called soft handoff which minimizes signal breakup as a handset passes from one cell to another. The combination of digital and spread-spectrum modes supports several times as many signals per unit bandwidth as analog modes. CDMA is compatible with other cellular technologieswhich allows for nationwide roaming.

The original CDMA standard, also known as CDMA One and still common in cellular telephones in the U.S., only offers a transmission speed of up to 14.4 Kbps in its single channel form and up to 115 Kbps in an eight-channel form. CDMA2000 and wideband CDMA deliver data many times faster.

The advantages of CDMA are as follows:

- Frequency diversity
- Multi-path resistance
- Privacy/security
- Graceful degradation

The disadvantages of CDMA are as follows:

- Self- jamming[5]
- Near-far problem
- Soft hand-off
- Not suitable for very high bit rate (like in WLAN)
- Monthly service subscription

8.1.9 Orthogonal Frequency Division Multiplexing (OFDM)

OFDM is a modulation technique for transmitting large amounts of digital data over a radio wave. OFDM works by splitting the radio signal into multiple smaller sub-signals that are then transmitted simultaneously at different frequencies to the receiver. This spacing provides the "orthogonality" technique which prevents the demodulators from seeing frequencies other than their own. OFDM reduces the amount of crosstalk in signal transmissions. 802.11a WLAN, 802.16 and WiMAX technologies use OFDM. OFDM is best used in high dense area where multipath effect is severe such asin a building or in a city where multipath is severe. OFDM

[5] Self-jamming is a phenomena that arises because the sequence in which multiple user signals received are not exactly orthogonal. It results in an elevated noise floor and a higher bit error rate in regards to the receiving end, otherwise known as the up-link.

should not be implemented in areas where multipath is not an issue, such as open space rural areas/LOS.

The advantages of OFDM are as follows:

- High bandwidth efficiency
- Robust in multipath environments (typically urban)
- Suitable for very high bit rate systems (like WLAN)
- Offers flexibility in modulation and multiple accesses

The disadvantages of OFDM are as follows:

- Sensitive to carrier frequency offset causing incorrect carrier frequency
- Large Peak-to-Average ratio (PAR) which causes amplifier non-linearity
- Sensitive to channel fade (flat fade)

8.2 Project Communications

Implementation of the Baton Rouge to Lafayette ITS-TIM Phase 2 project directly connects ITS field equipment to DOTD ITS Statewide TMC and connects the LSP Troop I office to the DOTD communications backbone.

The connection of the centers and ITS field equipment is in compliance with the requirements for the DOTD Statewide ITS Plan which promotes maximizing interoperability for the statewide ITS network. For this project, DOTD is using a design-build contracting process. The DB contracting process provides a proposing firm with a functional specification of the project. The proposing firm develops a specific design approach to the project along with a cost estimate.

This project's SE Analysis offers three viable communications technologies for consideration which are: fiber optics, radio frequency wireless, and microwave. Each one (or a combination) can provide the data transmission capacity, reliability, and scalability to address the communications needs per the different applications identified for the project. The primary element of differentiation for these technologies is the cost and reliability associated with their implementation.

The existing fiber backbone described in **Figure 5** of this document was provided to DOTD as part of a permit filed by Enron Communications, Inc. in 1999. DOTD received 1 – 1 ¼" vacant conduit and 8 allocated strands of long haul fiber in the Enron duct. DOTD envisions the use of the vacant conduit as a feasible means of expanding its communication infrastructure to ITS field equipment. Existing pull boxes (access points) to the conduit are limited. The use of this conduit requires installation of additional access points and coordination with Qwest Communications International, Inc. (the current owner of the Enron duct). Also, DOTD and LSP currently own towers within the project limits that may allow for wireless expansion to cover communications to field devices as well. These communication options are presented in the Scope of Services Package (i.e., request for proposal) for the plan design and construction of the project.

Life cycle cost analyses have been provided for this project. See section 13.1 of this document for information pertaining to the life cycle cost analysis.

9 Power Configuration

Electrical power for the Baton Rouge to Lafayette ITS-TIM Phase 2 Project is a significant component in its implementation. The criteria for power design is primarily determined by the power needs of the ITS field equipment (DMS, CCTV, HAR, VD, and crossover gates) and the ease of accessing commercial power. This project is unique in that the I-10 roadway spans the Atchafalaya river basin, a distance of approximately 18-miles. Consequently the cost of supplying commercial power to ITS field equipment components is substantial. DOTD has deemed, in order to obtain the reliability required to operate the ITS field equipment and accommodate the crossovers, commercial power is required along the 18-mile bridge.

10 Software Alternative Configurations

An important component of the Baton Rouge to Lafayette ITS-TIM Phase 2 Project is the system software necessary to manage and communicate with the different ITS field components associated with the project. DOTD's first deployment of integrated system software for TMCs was a software package titled MIST. This software allowed operators to manage and monitor ITS field equipment located within the Baton Rouge metropolitan area.

More recently, DOTD has implemented a traffic management software product by 360 Surveillance titled Cameleon ITS at the DOTD ITS Statewide TMC, Houma Subdistrict 02, and District 04 TMC - Shreveport. Cameleon ITS is a system software package that allows operators to monitor and manage ITS field equipment from a central TMC (or multiple TMCs). DOTD envisions Cameleon as an interim solution until they better define their statewide ITS software integration needs.

It is a requirement of this project that the system to be deployed be tested using vendor software. Outside the design-build project, DOTD will integrate the ITS field equipment with the Cameleon traffic management software operating at the DOTD ITS Statewide TMC. This would also require the installation of this software at the LSP Troop I and District 03 TMC locations.

11 ITS Standards

Standards are specifications that define how the different ITS sub-components interconnect and interact within the established parameters of the National ITS Architecture. Specifically, they stipulate how the different technologies interoperate to automatically share information. DOTD benefits from ITS standards for this project in several ways including:

- Reducing the risk of equipment obsolescence
- Reducing the risk of a single point of supply and proprietary products
- Lowering prices for equipment
- Minimizing design and implementation confusion
- Assuring quality

Additionally, federal regulations require that ITS projects must conform to the National ITS Architecture and its standards if they are financed using funds from the Highway Trust Fund. The architecture currently identifies 13 key standards areas that can be found in the ITS Standards Requirements Document (SRD).

ITS projects that are currently deployed by DOTD incorporate standards developed by a number of standards developing bodies. The American Association of State Highway and Transportation Officials (AASHTO), Institute of Transportation Engineers (ITE), and National Electrical Manufactures Association (NEMA) have taken the lead in developing standards for traffic management devices and their interoperability. These devices include DMS, traffic signals, traffic sensors, etc. The Institute of Electrical and Electronic Engineers (IEEE) and the International Standards Organization (ISO) primarily provide the standards for communication infrastructure. This includes communication cables, switches, nodes, etc. Finally, the National Electric Code (NEC) provides standards to all related electrical and power requirements associated with ITS projects. It should be noted that the development of standards is an ongoing and evolving process; therefore, standards will need to be continually reviewed as DOTD implements future projects.

The purpose of this chapter is to identify the standards that will be used in developing design concepts, detail design, and operational procedures associated with this project.

11.1 Project Standards

The most significant set of standards for ITS projects is the National Transportation Communications for ITS Protocol (NTCIP). This family of standards will establish the parameters for the development, design, and implementation of the ITS component of the project. AASHTO, ITE, and NEMA have taken the lead in developing NTCIP standards. NTCIP is a family of communication protocols (protocol is a system of rules and procedures governing communications between two devices) and data definition standards that serve and address the diverse needs of the various subsystems and user services presented in the national, state, and regional ITS architectures. NTCIP consists of a whole family of protocols covering the spectrum from point-to-point command/response to sophisticated object oriented techniques. NTCIP provides standards for two different ITS applications: center-to-field (C2F) and center-to-center (C2C), both of which are applicable to this project.

11.1.1 Center-to-Field Standards

There are two existing application protocols (and one protocol under development) for C2F communications: the Internet's Simple Network Management Protocol (SNMP) and the Simple Transportation Management Protocol (STMP). These protocols use the get-/set-messaging model. Each protocol has its advantages: SNMP is the simplest to implement while STMP is the most flexible and band width efficient. **Table 3** presents the comparison of the two protocols.

Table 3: SNMP and STMP Comparisons

Characteristic	SNMP	STMP
Can send any base date element	Yes	Yes
Bandwidth Efficiency	Worse	Better (uses dynamic objects)
Supports routing and dial-up	Options	Options
Message Set	Supported	Limited to 13
Ease of Implementation	Easy	Hard

Devices with either of the two protocols can use the same communication lines with other devices using the same protocols. The manufacturer or type of device (traffic signals, DMS, etc.) is not important. Each device is assigned an address that is unique on that line or channel which allows the management system to communicate with that device.

The communication link for C2F can be any type of medium (i.e. fiber optics, cable, spread spectrum, radio, etc.). It does not matter whether the communications medium is owned or leased by DOTD. The only requirement assumes that communication is a half-duplex poll and response and that the time for transmission and the response time for the end device are within the tolerances the devices need to communicate.

Although STMP is designed to use communication channels with slow transmission rates, it is not as bandwidth efficient as proprietary protocols used in the past.

11.2 Standards Applicable to the Project

A number of technical standards must be considered in the development of this project. There are over 80 ITS standards now being developed by different standards development organizations (SDOs). ITS designers are encouraged by United States Department of Transportation (U.S. DOT) to use SDO approved standards when developing ITS projects.

Mapping the applicable ITS standards to the project architecture provides a clearer understanding as to how each standard should be considered in design of the project. There are three architectural components to which the standards must be applied for this project: Center to Field, Center-to-Center and Center-to-Vehicle/Traveler. Adhering to these standards will assure interoperability and interchangeability of the project's components and its overall integration with current ITS operations. **Table 4** presents the relevant standards for each architectural component that may be used in the implementation of this project.

Table 4: ITS Standards Applicable to Project

Standard Number	Standard Name	C2F	C2C	Center to Veh/Traveler
NTCIP 1101	Simple Transportation Management Framework (STMF)	•		
NTCIP 1102	Octet Encoding Rules (OER)	•	•	
NTCIP 1103	Transportation Management Protocols (TMP)	•	•	
NTCIP 1104	Center-to-Center Having Convention Specification		•	
NTCIP 1201	Global Object Definitions	•		
NTCIP 1202	Object Definitions for Actuated Traffic Signal Controller	•		
NTCIP 1203	Object Definitions for Dynamic Message Signs	•		
NTCIP 1205	Object Definitions for CCTV Camera Control	•		
NTCIP 1206	Object Definitions for Data Collection and Monitoring (DCM) Devices	•		
NTCIP 1208	Object Definitions for CCTV Switching	•		
NTCIP 1209	Object Definitions for Transportation Sensor Systems (TSS)	•		
NTCIP 1210	Field Management Stations - Part 1: Object Definitions for Signal System Masters	•		
NTCIP 1211	Object Definitions for Signal Control and Prioritization (SCP)	•		
NTCIP 1400	TCIP Framework Standard	•	•	
NTCIP 1402	TCIP Incident Management Objects	•	•	
NTCIP 2101	Point-to-Point Using RS-232 Subnetwork Profile		•	
NTCIP 2102	Point-to-Multi-Point Protocol Using FSK Modem Subnetwork Profile		•	
NTCIP 2103	Subnet Profile for Point-to-Point Over RS-232		•	
NTCIP 2104	Ethernet Subnetwork Profile		•	
NTCIP 2202	Internet (TCP/IP and UDP/IP) Transport Profile	•	•	
NTCIP 2301	Application Profile for Simple Transportation Management Framework (STMF)	•		
NTCIP 2302	Application Profile for Trivial File Transfer Protocol	•		
NTCIP 2303	Application Profile for File Transfer Protocol	•	•	

Standard Number	Standard Name	C2F	C2C	Center to Veh/Traveler
NTCIP 2304	Application Profile for Data Exchange ASN.1 (DATEX-ASN)	●		
NTCIP 8003	Profile Frame Work	●	●	
NTCIP 9001	NTCIP Guide	●	●	●
EIA-794	Data Radio Channel (DARC) System			●
EIA-795	Sub carrier Traffic Information Channel (STIC) System			●
IEEE Std 1404		●	●	
IEEE Std 1488, 2000	Trail-Use Standard for Message Set Template for ITS	●	●	●
IEEE Std 1489, 1999	Data Dictionaries for ITS	●	●	●
IEEE Std 1512, 2000	Common Incident Management Sets for Use by Emergency Management Centers	●		●
IEEE SH 94633-94638	Analysis of Existing Standards and Those Under Development Applicable to the needs of ITS Short Range and Wide Area Wireless Communications	●	●	●
ITE-AASHTO TM 1.03	Traffic Management Data Dictionary	●	●	
ITE-AASHTO TM 2.01	Message Sets for External Traffic Management Center Communications	●	●	
SAE J1763	General Reference Model	●	●	●
SAE J2353	Advanced Traveler Information Systems (ATIS) Data Dictionary	●		●
SAE J2354	Advanced Traveler Information Systems (ATIS) Message Sets	●		●
SAE J2369	ATIS Message Sets Delivered Over Bandwidth Restricted Media			●

12 Testing

Testing fulfills the system engineering requirements of verification and validation. Verification can be simple described as “was the system built correctly?” While validation may be described as “was the correct system built?” Testing through the project development until the completion of the project provides for a successful project. The use of traceability matrices allows for the stakeholders to ensure that the envision system described in the ConOps is the actual functional system deployed. During the construction of the project, equipment must be tested at various stages to ensure its operability, function, and performance. These tests are detailed in the specification document developed to accompany the detail design plans. Also, once the system is constructed, tests on integrating the equipment into the existing system shall be required. These tests are also as defined and required by the specifications.

During the detail design of this project, the design-builder will be required to trace the conception of the project through the testing phase using the advanced traceability matrix provided as part of the SOSP. Ultimately, this matrix will allow for DOTD personnel to check off the project deployment requirement and to ensure a successful final system.

13 Maintenance

DOTD shall be the agency responsible for maintaining the equipment deployed as part of this project. Currently, DOTD uses contract and agency personnel to provide maintenance on ITS equipment through DOTD's ITS Division. The DOTD Maintenance Supervisor has been tasked with approximately 30 staff members to ensure the continued function of the various ITS systems statewide. DOTD currently has an anticipated annual budget of $2.5 million dollars for maintenance of the state. It is expected that the maintenance budget will be divided to facilitate each region. If any region doesn't use its total amount allocated, the money may be shifted to another region for maintenance.

Also, for each project deployment, an extended maintenance agreement accompanies the construction contract documents. This extended maintenance agreement (contract) requires 1 year of warranty and maintenance service on the system. Thereafter, for 1 year, DOTD has the option to extend the warranty through the contractor for an additional 3 years. This project is anticipated to include the extended maintenance requirement agreement.

13.1 Life Cycle Funding

Life cycle funding from the systems engineering prospective is a total project process. In other words, the total costs (i.e. need for funding in constant of inflated dollars) associated with the successful development, implementation, operation, and maintenance for the "life" of an ITS project must be determined. A life cycle cost analysis provides DOTD with a realistic perspective of funding needs for their ITS projects and programs. This information is used to develop future funding requests and in developing benefit/cost analyses for their ITS program and individual projects.

A life cycle funding analysis for this is comprised of three components: equipment installation, operations, and maintenance.

Equipment installation refers to the actual procurement and installation of ITS equipments. For example, the purchase and installation for a pedestal mounted DMS is approximately $200,000 per sign. Additionally, estimating the life-cycle funding for ITS equipment must take into account the useful life expectancy of each component. For example, the useful life-expectancy of a DMS is 8 to 10 years. The useful life of fiber optic cable is 20 years, and the life expectancy for conduit and structures is 20 years plus. One way to estimate equipment cost is to use the component that has the longest life expectancy as a base line. Then, estimate the replacement cycle of other components with shorter life expectancies. An example would be if the conduit system lasts 20 years and the DMS only last 5 years, then the DMS replacement costs will occur 4 times during the project life cycle.

Estimating cost of operations is straight forward. If the project is estimated to last 20 years (before replacement or decommissioning), then DOTD will need to determine how many staff persons (or contracted maintenance) will be required over that period of time. Presented in **Appendix C** are life cycle cost analyses for this project. It should be noted that the quantity of equipment and locations in the life cycle cost analyses are approximated based on conceptual designs. The exact quantity and locations of ITS field equipment devices will be further defined in the SOSP and by the Design-Builders actual design.

Three life cycle cost analyses have been provided in **Appendix C**. The life cycle cost analyses presents the deployed system in 3 scenarios: **Table C-1**: Fiber Reasonable (i.e., fiber continuously along I-10 through project limits), **Table C-2**: Wireless (where fiber is not required), and **Table C-3**: Leased (where fiber is not required). Also, each scenario uses operations and maintenance (O&M) cost based on the data obtained from the USDOT ITS Unit Cost Database when available. The costs are in terms of 2005 dollars. The price per unit is based on current DOTD project estimates. The cells are highlighted in yellow where USDOT numbers are used. Although some equipment presented has a longer life cycle then 10 years, only the first 10 years have been presented. It should be noted that any replacement cost for equipment that has a life cycle less than 10 years is covered under the cost of O&M. Also, it is assumed that there is no salvage value at the end of the equipment's life.

Maintenance funding for an ITS project is determined by the complexity (i.e. the type and quantity of devices) and the operational life of the project. The longer the system operates, the greater the maintenance costs. Additionally, maintenance costs will be skewed as the equipment ages. The older the equipment, the more maintenance (staff time and replacement parts) will be required to keep it functioning with in specified limits. For planning purposes, a general rule-of-thumb for estimating overall annual maintenance costs for an ITS system is 5 percent of the total capital costs. Also, the 10 year total life cycle cost has been provided in 2 ways. First is linear where the annual O&M is continuous for the 10 year period. In the second, O&M is inflated at an exponential rate of 3% per year.

APPENDIX A

MEMORANDUM OF UNDERSTANDING

REFERRED TO

DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT

INTRADEPARTMENTAL CORRESPONDENCE

_____ REFERRED FOR ACTION
_____ ANSWER FOR MY SIGNATURE
_____ FOR FILE
_____ FOR YOUR INFORMATION
_____ FOR SIGNATURE
_____ RETURN TO ME
_____ PLEASE SEE ME
_____ PLEASE TELEPHONE ME
_____ FOR APPROVAL
_____ PLEASE ADVISE ME

BY _____ DATE _____
BY _____ DATE _____
BY _____ DATE _____

IN REPLY REFER TO
FILE NO.

TO: MR. GORDON NELSON, P.E.
ASSISTANT SECRETARY OF OPERATIONS

FROM: STEPHEN GLASCOCK, P.E., PTOE
ITS DIRECTOR

SUBJECT: INTELLIGENT TRANSPORTATION SYSTEMS (ITS)
TRAFFIC-INCIDENT MANAGEMENT (TIM) PROGRAM
I-10 (LAFAYETTE TO BATON ROUGE)
MEMORANDUM OF UNDERSTANDING (MOU)
LOUSIANA STATE POLICE, DOTD & LOCAL TIM AGENCIES

DATE: JANUARY 3, 2006

Attached herewith is a proposed MOU (2 originals) drafted between representatives of LSP, DOTD, and various local public safety agencies that documents command and control responsibilities for performing Traffic-Incident Management activities on the I-10 from Lafayette to Baton Rouge. This agreement is a product of work performed by the Department's ITS Consultant (ABMB Engineers) in developing an ITS project for this I-10 segment. Under the terms of this arrangement, LSP, DOTD, and the local agencies agree to manage traffic-related incidents in accordance with the established guidelines and procedures included herein.

This MOU has been developed and reviewed by all parties and is hereby recommended for your approval and signature.

w/attachments

copy: Mr. William Fontenot
Mr. Roy Schmidt
ITS Section

RECOMMENDED FOR APPROVAL DATE

RECOMMENDED FOR APPROVAL DATE

RECOMMENDED FOR APPROVAL DATE

APPROVED DATE

MEMORANDUM OF UNDERSTANDING
between the
LOUISIANA STATE POLICE
LOUISIANA DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT
ST. MARTIN PARISH SHERIFF'S OFFICE
THE BREAUX BRIDGE POLICE DEPARTMENT
HENDERSON POLICE DEPARTMENT
IBERVILLE PARISH SHERIFF'S OFFICE
BAYOU BLUE VOLUNTEER FIRE DEPARTMENT
GROSSE TETE/ROSEDALE VOLUNTEER FIRE DEPARTMENT
LAFAYETTE PARISH SHERIFF'S OFFICE
LAFAYETTE POLICE DEPARTMENT
CARENCRO POLICE DEPARTMENT
SUNSET POLICE DEPARTMENT
GRAND COTEAU POLICE DEPARTMENT
OPELOUSAS POLICE DEPARTMENT
ST. LANDRY PARISH SHERIFF'S OFFICE
PORT BARRE POLICE DEPARTMENT
KROTZ SPRINGS POLICE DEPARTMENT
POINTE COUPEE PARISH SHERIFF'S OFFICE
LIVONIA POLICE DEPARTMENT
WEST BATON ROUGE PARISH SHERIFF'S OFFICE
BATON ROUGE POLICE DEPARTMENT
VILLAGE OF GROSSE TETE POLICE DEPARTMENT
ST. MARTIN PARISH FIRE DISTRICT
and
ST. MARIN PARISH FIRE DISTRICT
on behalf of the
BREAUX BRIDGE VOLUNTEER FIRE DEPARTMENT
HENDERSON VOLUNTEER FIRE DEPARTMENT
CECILA VOLUNTEER FIRE DEPARTMENT
BUTTE LAROSE VOLUNTEER FIRE DEPARTMENT

Command and Control for Traffic Incident Management on Interstate 10 (I-10) between Baton Rouge and Lafayette, Louisiana.

This Memorandum of Understanding (MOU), by and between the above captioned Parties, establishes guidelines and procedures for the management of vehicular crashes and breakdowns, spilled cargo and any other event that impedes the normal flow of traffic (traffic incident) on Interstate 10 between Baton Rouge and Lafayette, Louisiana ("I-10 Corridor") .

WHEREAS, communication and clearly defined roles for command and control of traffic incidents on the I-10 Corridor directly impacts public safety and traffic operations particularly on the Atchafalaya Basin Crossing where the ingress and egress of vehicular traffic is particularly on the Atchafalaya Basin Crossing where the ingress and egress of vehicular traffic is limited.

WHEREAS, each Party to this MOU has responsibilities and available resources to address various contingencies associated with these traffic incidents.

WHEREAS, the coordination of activities between the parties when responding to traffic incidents will enhance public safety, protect the safety of emergency responders and the public, and will safely and efficiently restore the roadway to free flowing traffic.

NOW THEREFORE, the Parties hereto agree as follows:

1.0 APPLICABILITY AND PURPOSE

The procedures contained in this MOU apply to all Parties to this MOU when responding to traffic incidents on the I-10 Corridor. "**Traffic incident**" means a vehicular accident, vehicular breakdown, spilled cargo or any other event that impedes the normal flow of traffic on the I-10 Corridor.

The management of traffic incidents will sometimes require several different responders (e.g. fire fighters and police) and generally, more than one law enforcement department has jurisdiction over an area in which a traffic incident occurs. Local law enforcement departments are primarily responsible for the investigation and management of traffic incidents, however, may require assistance from other agencies in the management of a traffic incident. The purpose of this MOU is to coordinate the activities of the multiple state and local responders when responding to traffic incidents and to clearly define command and control and to establish guidelines pertaining to the management and re-routing of traffic.

2.0 CLASSIFICATION OF TRAFFIC INCIDENTS

Traffic incidents will be classified as either Major, Intermediate or Minor based on the amount of time expected to restore the I-10 Corridor to normal flow of traffic. These classifications are defined by the following time-frames:

1. **Minor** - under 30 minutes.
2. **Intermediate** - 30 minutes to 2 hours
3. **Major** - 2 or more hours

3.0 INCIDENT COMMANDER

An "**Incident Commander**" is that individual having sole authority, command and control over the management of a traffic incident. All responders and affected agency personnel involved in the management of a traffic incident shall serve under the direction of the Incident Commander.

The role of Incident Commander will be assumed by either law enforcement personnel, firefighting personnel or Louisiana State Police Hazardous Material (LSP HAZMAT) personnel or any combination thereof depending on the circumstances.

3.1 Law Enforcement Incident Command:

LSP has concurrent jurisdiction with each of the following local law enforcement departments on various portions of the I-10 Corridor Atchafalaya Basin Crossing:

St. Martin Sheriff's Office (SMSO): Jurisdiction
For traffic incidents occurring on the I-10 Corridor within St. Martin Parish between mile markers 106 and 127.

Breaux Bridge Police Department (BBPD): Jurisdiction
For traffic incidents occurring on the I-10 Corridor that fall between mile markers 109 and 111.

Henderson Police Department (HPD): Jurisdiction
For traffic incidents occurring on the I-10 Corridor that fall between mile markers 115 and 117.

Iberville Parish Sheriff's Office (IPSO): Jurisdiction
For traffic incidents occurring on the I-10 Corridor that fall within Iberville Parish between mile markers 127 and 141.

Local law enforcement has authority to assume the role of Incident Commander related to traffic incidents within their respective jurisdictions, however, will defer that authority to LSP if circumstances warrant and as provided in this MOU.

If local law enforcement or fire department is the first to arrive at the scene, an officer employed by that law enforcement entity or fire department, as the case may be, will serve as the Incident Commander unless or until relieved by LSP. A local law enforcement officer who is relieved of his/her Incident Command by LSP will be referred to as the "**Interim Incident Commander**". LSP will always assume the role of Incident Commander in Iberville Parish for IPSO.

If relieved by LSP, the Interim Incident Commander will remain on the scene to assist with the investigation and traffic control as directed by the LSP Incident Commander.

3.2 Major and Intermediate Traffic Incidents:

For Major and Intermediate Traffic Incidents, the LSP Shift Supervisor or his/her designee will almost always assume the role of Incident Commander upon arrival at the scene of the traffic incident. In rare instances, local law enforcement will remain as Incident Commander.

3.3 **Minor Traffic Incidents**:

For Minor traffic incidents, local law enforcement will normally remain as the Incident Commander for the duration of the Traffic Incident.

3.4 **Responsibilities of Law Enforcement Incident Commander**:

When law enforcement personnel, state or local, are serving as Incident Commander they shall be responsible for the following duties:

A. Take necessary measures to protect the life and safety of accident victims, emergency responders and the public.

B. Once life measures are taken, the Incident Commander will attempt to relay the following information to the LSP dispatcher:

1. the number and type of vehicles involved,
2. extent of roadway obstructions,
3. personnel and equipment needed from other parties to clear the roadway,
4. whether involved vehicles display a Hazardous Materials (HAZMAT) placard,
5. whether LSP HAZMAT services are required,
6. recommendations related the need to detour traffic and establish detour routes,
7. the classification of the traffic incident (Major, Minor, Intermediate), and
8. whether to post the relevant LADOTD pre-approved advisory messages the applicable dynamic message signs associated with the Atchafalaya Basin crossing.

The Incident Commander's designee will contact LADOTD as soon as possible to report the classification of the traffic incident for purposes of revising advisory messages on the dynamic message signs.[1]

C. The Incident Commander is authorized to order responders at the scene to withdraw and await the arrival of LSP HAZMAT.

D. The Incident Commander will coordinate and request resources whether, equipment, personnel or information, from other Parties.

1. If an LSP Trooper assumes Incident Command from the Interim Incident Commander, the LSP Trooper will verify that the Interim Incident Commander has relayed required information through LSP Dispatch and to LADOTD.

E. The Incident Commander will determine when the traffic incident is "Cleared" and normal traffic flow has been established and will notify LADOTD of same.

F. After the traffic incident is cleared, the Incident Commander will contact and direct those Parties with equipment at the scene to have it removed. Also, the Incident Commander will direct the LSP dispatcher to return the dynamic message signs to their pre-traffic incident condition.

3.5 Traffic Incidents Involving a Fire Scene:

"Fire Scene" means the zone of danger, as determined by the ranking fire protection or fire prevention officer and the chief law enforcement officer at a location where a situation has developed requiring the services of and is responded to by members of a fire department. (LSA-R.S. 33:1971)

When the traffic incident involves a fire scene, the ranking fire protection or fire prevention office at a fire scene ("firefighter") shall have the sole authority, command and control of all fire safety personnel and all persons within the zone of danger ("Fire Ground Authority").

Fire Ground Authority does not extend to fire vehicles that are not actively engaged in control of the fire scene. Once the Incident Commander and the Fire Ground Authority have determined the zone of danger, all unnecessary vehicles shall be removed from the scene as soon as possible.

The Fire Ground Authority will provide command and control within the zone of danger while the Incident Commander will provide command and control for the overall Traffic Incident scene. The Fire Ground Authority shall not in any manner restrict the authority of law enforcement officers in the performance of their duties at any scene.

Fire Districts shall defer traffic management responsibilities to law enforcement personnel and will manage traffic only in their absence, and when deemed necessary for the protection of the firefighters at the scene.

If first to arrive, the ranking fire protection or fire prevention office shall act as Incident Commander only until law enforcement arrives and assumes that role. Once a fire scene has been declared "under control" by the Fire Ground Authority, control will be turned over to the Incident Commander.

When dispatched by 911 or the Emergency Management Center, the following fire departments will provide services in their respective jurisdictions:

<u>St. Martin Fire District (SMFD)</u> Responsibilities/Jurisdiction:

The St. Martin Fire District (SMFD) is comprised of the Breaux Bridge Volunteer Fire Department, Henderson Volunteer Fire Department, Cecilia Volunteer Fire Department, and the Butte LaRose Volunteer Fire Department. SMFD will train, enforce and coordinate the roles and responsibilities of each when responding to traffic incidents on the I-10 Corridor within St. Martin Parish.

<u>Bayou Blue Volunteer Fire Department (BBVFD)</u> Jurisdiction/Responsibilities:

I-10 from Ramah (mile marker 135) west to the Iberville Parish line (mile marker 127).

If BBVFD is unable to respond or requires assistance or rescue equipment, GTRVFD will respond for incidents requiring fire department services on I-10 from Ramah (mile marker 135) west to the Iberville Parish line (mile marker 127).

BBVFD shall be responsible for providing rescue services, including equipment and personnel, necessary to rescue anyone who falls into the Atchafalaya Basin or is ejected off the Atchafalaya Basin bridge from mile markers 135 to 127.

<u>Grosse Tete/Rosedale Volunteer Fire Department (GTRVFD)</u> Jurisdiction/Responsibilities:

I-10 from mile marker 141 west to Ramah (mile marker 135).

If GTRVFD is unable to respond or requires assistance, BBVFD will respond for incidents requiring fire department services on I-10 from mile marker 141 west to Ramah (mile marker 135).

3.6 <u>Hazardous Material Incident Command</u>:

If the traffic incident involves the management of hazardous materials and the services of LSP HAZMAT, then both fire department personnel and law enforcement personnel shall defer to LSP HAZMAT, who shall assume the authority of Incident Commander.

4.0 COMMUNICATION BETWEEN PARTIES

4.1 LSP Dispatch:

A. The LSP Desk Sergeant and/or the LSP Dispatch or his/her designee ("LSP Dispatcher") will be responsible for the following:

1. dispatching and coordinating resources requested by the Incident Commander,
2. notify and coordinate with LADOTD information relative to potential road closures and detour routes and provide LADOTD with information that may be beneficial to the motoring public and public at large in averting the Traffic Incident,
3. informing the Incident Commander of changes in the status of the incident,
4. relaying detour route(s) to the appropriate parties when roadways in their respective jurisdictions serve as detour routes,
5. dispatching personnel to key locations for traffic control as required by the Incident Commander,
6. notifying affected agencies of the incident,
7. ensuring additional personnel are positioned for crash prevention,
8. notifying the appropriate LSP Troop Commander(s) of the incident.
9. posting LADOTD pre-approved advisory messages on the dynamic message signs or requesting LADOTD to do the same, and
10. returning the dynamic message sign to is pre-traffic incident condition once notified the traffic incident is cleared or requesting LADOTD to do the same.

B. If LSP HAZMAT is required, the LSP Dispatcher shall notify the HAZMAT hotline. LSP Dispatcher shall refer to the response guidelines found in the HAZMAT Manual to relay the necessary safety precautions to the Incident Commander.

C. The Incident Commander will serve as liaison between LSP Dispatch and other entities responding to the traffic incident.

5.0 ROAD CONDITIONS, ALTERNATE ROUTES and ROAD CLOSURES

LSP Incident Commander in conjunction with **LADOTD** will make all decisions related to road closures on I-10 or on any other major roads when required as part of Traffic Incident Management.

Designated alternate routes have been established based on the location of the Traffic Incident. **LSP** Incident Commander will determine if traffic is to be detoured around the traffic incident and will be responsible for requesting resources from available agencies as needed to mitigate traffic congestion and to improve traffic operations associated with the traffic incident.

LSP Incident Commander shall actively consider the recommendations of LADOTD in making decisions concerning detour routes and shall seek verification from LADOTD that the designated alternate routes are operational. The designated alternate routes will be used unless LADOTD determines that they are not operational (e.g. under construction, lane closures, etc.).

LSP will post **ONLY** LADOTD pre-approved advisory messages to the applicable dynamic message signs required for traffic incident management between Baton Rouge and Lafayette. **LADOTD** will provide LSP the appropriate, software, control and training required to operate the dynamic message signs. **LADOTD** holds the right to alter any advisory messages posted on the dynamic message sign during the duration of the traffic incident.

LSP may request **LADOTD** to post advisory messages to the applicable dynamic message signs in lieu of **LSP** posting messages

LADOTD will assist in the establishment of temporary detours and will provide information regarding existing roadway conditions and construction and maintenance activities on proposed detour routes as requested.

LADOTD may verify and recommend temporary detour routes if designated alternate traffic routes are not operational for that purpose.

LADOTD will provide equipment and personnel to assist with the removal of debris from the roadway when requested and if resources are available.

LADOTD will deploy and strategically place available traffic control devices (barricades, barrels, detour signs, etc) for re-routing traffic off of the I-10 Corridor and along alternate routes when requested and if resources are available.

LADOTD will notify affected parties prior to construction or maintenance activities on the I-10 corridor if such activities are likely to have a significant impact on traffic flow.

Local Law Enforcement /Traffic Control on Alternate Routes:

The following local law enforcement departments will provide assistance as requested by the Incident Commander relative to traffic management on alternate routes within their respective jurisdictions:

Lafayette Parish Sheriff's Office (LPSO)
Lafayette Police Department (LPD),
Carencro Police Department (CPD),
Sunset Police Department (SPD),
Grand Coteau Police Department (GCPD),
Opelousas Police Department (OPD),

St. Landry Parish Sheriff's Office (SLPSO),
Port Barre Police Department (PBPD),
Krotz Springs Police Department (KSPD),
Pointe Coupee Parish Sheriff's Office (PCPSO),
Livonia Police Department (LivPD),
West Baton Rouge Parish Sheriff's Office (WBRPSO),
Baton Rouge Police Department (BRPD), and
Village of Grosse Tete Police Department (VGTPD)
St. Martin Sheriff's Office (SMSO)
Breaux Bridge Police Department (BBPD)
Henderson Police Department (HPD)
Iberville Parish Sheriff's Office (IPSO)

They will be responsible for providing the following services:

a. Traffic enforcement and control services on roadways in their respective jurisdictions when these roadways are used as alternate routes for I-10 Corridor traffic.

b. Personnel for the operation of intersections/interchanges used to reroute traffic within their jurisdiction when requested by LSP.

If any Law Enforcement Department is unable to provide the assistance requested, they shall immediately notify the Incident Commander via the LSP dispatcher.

6.0 GENERAL PROVISIONS

A. Each Party will develop and implement policies and procedures for communicating change in command among each respective agency if such policies and procedures are not already in existence.

B. Equipment shall be positioned to minimize the impact on traffic and to protect the safety of those individuals responding to the incident, accident victims and the motoring public.

C. All parties shall follow Incident Management best practices and procedures as specified in LSP manual, regional traffic incident management programs, etc.

D. All barrels, barricades, and signing shall be positioned in accordance to LADOTD policy and the Manual on Uniform Traffic Control Devices (MUTCD).

E. Equipment used for traffic control and incident management shall be returned to the appropriate owning agency after the incident has been cleared and the site has been restored to its pre-incident condition.

F. At no time shall one agency prevent or prohibit another from performing their lawful duties unless a life threatening situation exists.

6.1 AFTER ACTION REVIEW

The Incident Commander shall call for an After Action Review (AAR) will the agencies participating in a **major incident** within two weeks of the incident, if possible. The AAR shall serve as a training mechanism to improve practices. A written summary of the AAR and its recommendations shall be submitted to the Regional Traffic Incident Management Coordinator and the chief official of each agency involved in the incident.

An AAR may be called for an intermediate or minor incident when deemed necessary by the incident commander.

AGREED AND EXECUTED BY:

Print (Name, Agency): Gordon E Nelson DOTD

Signature: [signature] Date: 1/6/06

Print (Name, Agency): Michael B. Cazes WBR SO

Signature: [signature] Date: 1/11/06

Print (Name, Agency): BRENT AllAIN IBERVILLE SO

Signature: Sheriff Brent Allain Date: 3-15-06

Print (Name, Agency): Michael Hughes

Signature: Michael Hugh Date: 3-15-06

Print (Name, Agency): RONAld J. THERIOT

Signature: Ronald J Theriot Date: 3/15/06

Print (Name, Agency): Carlos Stout, Carencro Police Dept.

Signature: [signature] Date: 3/15/06

Print (Name, Agency): Michael W. Neustrom, Lafayette Sheriff's Office

Signature: [signature] Date: 3/15/06

Print (Name, Agency): LAFAYETTE POLICE DEPT

Signature: [signature] Date: 3/17/06

Print (Name, Agency): Henderson Police Dept.

Signature: [signature] Date: 3-15-06

Print (Name, Agency): Chief Susie Lacassin, Krotz Springs Police Dept

Signature: Susie Lacassin Date: 3-16-2006

Print (Name, Agency): DAVID G. RICHARD PortBarre P.D.

Signature: [signature] Date: 3-16-06

Print (Name, Agency): Chief Alex T. Peck Opelousas PD

Signature: Alex T Peck Date: 3-16-06

Print (Name, Agency): Howard Zerangue, Sheriff. St. Landry S.O.

Signature: Howard Zerangue Date: 3.16.06

Print (Name, Agency): JONTY N. COCO - GRAND COTEAU POLICE DEPT.

Signature: [signature] Coco Date: 3-16-06

Print (Name, Agency): ALEXCIE GUILLORY SUNSET P.D

Signature: Alfcie Guillory Date: 3.16.06

Print (Name, Agency): Brad Joffrion - Livonia Police Dept.

Signature: Brad Joffrion Date: 3-16-06

Print (Name, Agency): Paul R. Smith Pointe Coupee S.O.

Signature: [signature] Date: 3-16-06

AGREED AND EXECUTED BY:

Print (Name, Agency): Guy M. Bowin St. Martin Fire Dist.

Signature: [signature] Date: 3/21/06

Print (Name, Agency): Charles Thibodeaux - Breaux Bridge Police Dept.

Signature: Charles Thibodeaux Date: 3-22-06

Print (Name, Agency): Tommy Dardenne - Grosse Tete Police Dept.

Signature: Tommy Dardenne Date: 03-22-06

Print (Name, Agency): C.J. LeDuff Baton Rouge Police Dept.

Signature: [signature] Date: 3/27-2006

Print (Name, Agency): Walter J. Bagot Bayou Blue Vol. Fire Dept.

Signature: Walter Bagot Date: 31 March 2006

Print (Name, Agency): Col Henry Whitehorn

Signature: Col Henry Whitehorn Date: 4/17/06

Print (Name, Agency): ______________________

Signature: ______________________ Date: ________

Print (Name, Agency): ______________________

Signature: ______________________ Date: ________

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Signature:_______________________________________ Date: ___________

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Signature:_______________________________________ Date: ___________

APPENDIX B

TRACEABILITY MATRIX

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
• To detect, verify, and assess traffic congestion and incidents • To distribute information to motorists in a timely manner							
	FR1 DMS shall be used to disseminate information to in-route travelers						
		FR1.1 DMS shall display, at a minimum, 3 lines of 18 characters of text.					
			FR1.1.1 DMSs shall display upper case alphabetic letters "A" thru "Z"				
			FR1.1.2 DMSs shall display numeric digits "0" thru "9"				
			FR1.1.3 DMSs shall display a blank				
			FR1.1.4 DMSs shall display punctuation marks				
			FR1.1.5 DMSs shall display special characters: . , / ? ; ' : " < > @ # & * - ← → ↑ ↓				
		FR1.2 DMS display shall use Light Emitting Diodes (LED)					
		FR1.3 DMS display shall be amber					
		FR1.4 DMS display shall be full matrix					
		FR1.5 DMS shall be able to display messages in reverse video (black characters on amber background)					
		FR1.6 DMS shall display flashing messages					
		FR1.7 DMS shall display scrolling messages					
		FR1.8 DMS shall utilize a message library					
		FR1.9 DMS shall automatically adjust display intensity with ambient conditions.					
		FR1.10 DMS shall provide one phrase messages					
		FR1.11 DMS shall provide two phrase messages					
		FR1.12 DMS shall be installed upstream of major decision points					
		FR1.13 DMS controller shall provide the status information at a minimum to the center					
			FR1.13.1 DMS controller shall provide the unique DMS ID				
			FR1.13.2 DMS controller shall provide the DMS location				
			FR1.13.3 DMS controller shall provide the time and date of the displayed message				
		FR1.14 DMS controller shall provide fault information to the center					
			FR1.14.1 DMS controller shall provide power failure				

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
			FR1.14.2 DMS controller shall provide unrecognized commands				
			FR1.14.3 DMS controller shall provide IO board errors				
			FR1.14.4 DMS controller shall provide communication failure				
			FR1.14.5 DMS controller shall provide pixel/panel failure				
		FR1.15 DMS sub-system (display panel and controller) shall conform to the standards					
			FR1.15.1 DMS sub-system (display panel and controller) shall conform to NEMA Standards Publication TS 4-2005 (Hardware Standards for Dynamic Message Signs (DMS) With NTCIP Requirements)				
			FR1.15.2 DMS sub-system (display panel and controller) shall conform to NTCIP 1203-DYNAMIC MESSAGE SIGN STANDARDS				
		FR1.16 DMS site shall have an IP addressable battery backup					
			FR1.16.1 IP addressable battery backup shall allow proper shut down of the DMS sign and controller				
	FR2 CCTV cameras shall be used to monitor in-route travelers						
		FR2.1 CCTV cameras shall be a solid state color camera					
			FR2.1.1 CCTV cameras shall meet or exceed the National Television Standards Committee (NTSC) standards				
			FR2.1.2 Image sensor shall have ¼" interline transfer progressive scan				
			FR2.1.3 CCTV cameras shall have a minimum horizontal resolution of 525 television lines				
			FR2.1.4 CCTV cameras shall have a minimum sensitivity of 3.0 lux @ 1/60 second (color day)				
			FR2.1.5 CCTV cameras shall have a minimum sensitivity of 0.2 lux @ 1/4 second (color day)				
			FR2.1.6 CCTV cameras shall have a minimum sensitivity of 0.3 lux @ 1/60 second (mono night)				
			FR2.1.7 CCTV cameras shall have a minimum sensitivity of 0.02 lux @ 1/4 second (mono night)				
			FR2.1.8 CCTV camera shall have day/night switchover				
				FR2.1.8.1 Day/night switchover shall be programmable			
					FR2.1.8.1.1 Day/night switchover shall be programmable for day/night auto		
					FR2.1.8.1.2 Day/night switchover shall be programmable for day/night manual		
			FR2.1.9 CCTV camera shall have an onscreen ID				
				FR2.1.9.1 CCTV camera shall have a title programmable of 8 lines, 12 characters minimum			

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR2.2 CCTV cameras shall have a zoom lens					
			FR2.2.1 CCTV cameras lens shall have a minimum optical zoom of 23x				
			FR2.2.2 CCTV cameras lens shall have a minimum digital zoom of 1x through 10x				
			FR2.2.3 CCTV cameras lens shall have selectable auto focus				
		FR2.3 CCTV cameras shall be in a pressurized enclosure					
			FR2.3.1 CCTV cameras shall be pressurized with dry nitrogen (IP Rating IP67)				
			FR2.3.2 CCTV cameras shall be pressurized to 3 psi				
		FR2.4 CCTV cameras shall pan, tilt, and zoom upon command					
			FR2.4.1 CCTV cameras shall have 360 degrees of continuous pan				
			FR2.4.2 CCTV cameras shall have a minimum 0 to 90 degrees of tilt down with auto flip at 90 degrees				
			FR2.4.3 CCTV cameras shall have 64 presets minimum				
			FR2.4.4 CCTV cameras shall have greater than 250 degrees/second preset speed at 0.1% accuracy				
			FR2.4.5 CCTV cameras shall have 16 sectors minimum				
			FR2.4.6 CCTV cameras shall have a minimum of 8 programmable zones set for blanking				
			FR2.4.7 CCTV cameras shall have digital position feedback				
		FR2.5 CCTV camera sites shall have an IP addressable battery backup					
		FR2.5.1 IP addressable battery backup shall allow operations for 1 hour minimum					
		FR2.6 CCTV camera site shall allow for remote power reset					
		FR2.7 CCTV camera site shall allow for remote camera unit reset					
		FR2.8 CCTV camera unit shall be accessible via a lowering device					
	FR3 Vehicle Detectors (VD) shall be used to monitor in-route travelers						
		FR3.1 Vehicle Detectors shall provide data					
			FR3.1.1 Vehicle Detectors shall provide volume per lane				
			FR3.1.2 Vehicle Detectors shall provide presence per lane				
			FR3.1.3 Vehicle Detectors shall provide type (classification) per lane, 6 minimum				
				FR3.1.3.1 Classifications shall be user defined			
			FR3.1.4 Vehicle Detectors shall provide speed per lane (configurable)				
			FR3.1.5 Vehicle Detectors shall provide time, duration, and date the data was acquired				

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR3.2 Vehicle detection controller shall provide status information to the center					
			FR3.2.1 Vehicle detection controller shall provide device ID				
			FR3.2.2 Vehicle detection controller shall provide device location				
			FR3.2.3 Vehicle detection controller shall provide current device fault				
			FR3.2.4 Vehicle detection controller shall provide selectable frequency of the data polling interval (15, 30, 45, and 60 seconds)				
			FR3.2.5 Vehicle detection controller shall provide selectable data collection period (5, 15, 30, and 60 minutes)				
		FR3.3 Vehicle detection controller shall provide fault information to the center					
			FR3.3.1 Vehicle detection controller shall provide power failure				
			FR3.3.2 The vehicle detection controller shall provide unrecognized command				
			FR3.3.3 The vehicle detection controller shall provide IO board errors				
			FR3.3.4 The vehicle detection controller shall provide communication failure				
		FR3.4 Vehicle Detections system shall conform to industry standards					
		FR3.5 Vehicle Detector site shall have an IP addressable battery backup					
			FR3.5.1 IP addressable battery backup shall allow operations for 1 hour minimum				
		FR3.6 Vehicle Detection unit shall be accessible via a lowering device					
	FR4 Highway Advisory Radio (HAR) shall be used to disseminate information to in-route travelers						
		FR4.1 HAR shall provide in-route messages to travelers via AM radio broadcast.					
			FR4.1.1 HAR shall be broadcasted on a predefined AM radio station				
		FR4.2 HAR messages shall provide transportation related information					
			FR4.2.1 HAR messages shall warn motorists of possible hazards, road delays or detours ie: forest fire, weather advisories, chemical spill, survey/testing crews, and/or construction or maintenance				
			FR4.2.2 HAR messages shall warn motorists of road closure or delay due to a incident or emergency situation				
			FR4.2.3 HAR messages shall advise motorists of future activities that may result traffic disruptions such as construction and/or maintenance activities				

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
			FR4.2.4 HAR messages shall advise motorists of speed limit changes which may be temporary				
			FR4.2.5 HAR messages shall provide safety initiatives such as ie: Buckle Up, Drive Safely				
		FR4.3 HAR messages shall be FCC licensed AM band broadcast					
			FR4.3.1 HAR to be broadcast on a licensed frequency between 530 kHz and 1710 kHz				
		FR4.4 HAR shall be broadcasted using a minimum of 10-watt transmitters					
			FR4.4.1 Broadcast radius shall be a minimum of 3 miles depending on topography, atmospheric conditions, and the time of day				
		FR4.5 HAR shall be point broadcasted					
			FR4.5.1 A single transmitter shall be used to broadcast over a given area				
		FR4.6 HAR shall be programmable					
			FR4.6.1 HAR controller shall be programmed using a central control software on a desktop computer				
				FR4.6.1.1 Central control software shall allow digital audio messages to be entered into the system			
			FR4.6.2 HAR controller shall be programmed using telephone (cell phone or landline)				
		FR4.7 HAR shall provide live broadcast					
		FR4.8 HAR shall store a minimum of 250 pre-recorded messages					
		FR4.9 HAR shall have minimum of 80 minutes of recording time allowed					
		FR4.10 HAR shall have minimum 2 day message backup					
		FR4.11 HAR controller shall provide fault information to the center					
			FR4.11.1 HAR controller shall provide transmitter power failure				
			FR4.11.2 HAR controller shall provide advisory sign failure				
			FR4.11.3 HAR controller shall provide unrecognized commands				
			FR4.11.4 HAR controller shall provide IO board errors				
			FR4.11.5 HAR controller shall provide communication failure				
		FR4.12 HAR controller shall provide the status information at a minimum to the center					
			FR4.12.1 HAR controller shall provide a unique HAR ID				
			FR4.12.2 HAR controller shall provide the HAR location				
			FR4.12.3 HAR controller shall provide the time and date of the broadcasted message				
		FR4.13 HAR shall manage a minimum of 5 roadside advisory signs per transmitter					

Note shaded requirements are not required as part of the Baton Rouge to Lafayette ITS-TIM Ph 2 Project.

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
			FR4.13.1 User shall be able to activate the flashing beacons on the roadside sign				
			FR4.13.2 HAR roadside advisory signs shall be able to activated/deactivated independently				
		FR4.14 HAR transmitter site shall have an IP addressable battery backup					
			FR4.14.1 IP addressable battery backup shall allow for the broadcast of programmed messages for 3 days minimum				
	FR5 DOTD District 03 shall be communicate with traffic signal controllers (by others)						
		FR5.1 Traffic signal control software shall provide control of traffic signal controllers in the field					
	FR6 DOTD District 61 shall communicate with traffic signal controllers (by others)						
		FR6.1 Traffic signal control software shall provide control of traffic signal controllers in the field					
	FR7 DOTD District 03 shall have primary control of all ITS field devices (by others)						
	FR8 DOTD ITS Statewide TMC shall have secondary control of all ITS field devices						
	FR9 DOTD District 61 shall have tertiary control of all ITS field devices (by others)						
	FR10 DOTD ITS Statewide TMC shall communicate with DMS sites						
		FR10.1 DOTD ITS Statewide TMC shall receive current display status					
		FR10.2 DOTD ITS Statewide TMC shall receive internal temperature warnings					
		FR10.3 DOTD ITS Statewide TMC shall receive current operating status					
		FR10.4 DOTD ITS Statewide TMC shall receive malfunction warnings					
		FR10.5 DOTD ITS Statewide TMC shall receive confirmation of a message posted					
	FR11 DOTD ITS Statewide TMC shall control DMS						
		FR11.1 DOTD ITS Statewide TMC shall post message to the DMS					
		FR11.2 DOTD ITS Statewide TMC shall load messages into the DMS library					
		FR11.3 DOTD ITS Statewide TMC shall change display of messages					
			FR11.3.1 DOTD ITS Statewide TMC shall change brightness				
			FR11.3.2 DOTD ITS Statewide TMC shall change font size				
			FR11.3.3 DOTD ITS Statewide TMC shall configure length of phase				
		FR11.4 DOTD ITS Statewide TMC shall activate/deactivate DMS flashing beacon					

Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
	FR12 DOTD District 03 shall communicate with DMS sites (by others)						
		FR12.1 DOTD District 03 shall receive current display status					
		FR12.2 DOTD District 03 shall receive internal temperature warnings					
		FR12.3 DOTD District 03 shall receive current operating status					
		FR12.4 DOTD District 03 shall receive malfunction warnings					
		FR12.5 DOTD District 03 shall receive confirmation of a message posted					
	FR13 DOTD District 03 shall control DMS (by others)						
		FR13.1 DOTD District 03 shall post message to the DMS					
		FR13.2 DOTD District 03 shall load messages into DMS library					
		FR13.3 DOTD District 03 shall change display of messages					
			FR13.3.1 DOTD District 03 shall change brightness				
			FR13.3.2 DOTD District 03 shall change font size				
			FR13.3.3 DOTD District 03 shall configure length of phase				
			FR13.4 DOTD District 03 shall activate/deactivate DMS flashing beacon				
	FR14 DOTD ITS Statewide TMC shall communicate with CCTV camera sites						
		FR14.1 DOTD ITS Statewide TMC shall receive streaming video of traffic supplied by CCTV cameras					
			FR14.1.1 Streaming video shall be 15 frames per second, minimum				
		FR14.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from the CCTV cameras					
		FR14.3 DOTD ITS Statewide TMC shall receive current operating status of the CCTV cameras					
		FR14.4 DOTD ITS Statewide TMC shall receive malfunction warnings from the CCTV cameras					
	FR15 DOTD ITS Statewide TMC shall control CCTV cameras						
		FR15.1 DOTD ITS Statewide TMC shall pan CCTV cameras					
		FR15.2 DOTD ITS Statewide TMC shall tilt CCTV cameras					
		FR15.3 DOTD ITS Statewide TMC shall zoom CCTV cameras					
		FR15.4 DOTD ITS Statewide TMC shall adjust focus					
		FR15.5 DOTD ITS Statewide TMC shall designate/program blacked-out areas					
		FR15.6 DOTD ITS Statewide TMC shall set the time displayed on the video from the CCTV cameras					

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR15.7 DOTD ITS Statewide TMC shall set the date displayed on the video from the CCTV cameras					
		FR15.8 DOTD ITS Statewide TMC shall set preset views for the CCTV cameras					
		FR15.9 DOTD ITS Statewide TMC shall remotely reset the CCTV cameras					
	FR16 DOTD District 03 shall communicate with CCTV camera sites (by others)						
		FR16.1 DOTD District 03 shall receive streaming video of traffic supplied by CCTV cameras					
			FR16.1.1 Streaming video shall be 15 frames per second, minimum				
		FR16.2 DOTD District 03 shall receive internal temperature warnings from the CCTV cameras					
		FR16.3 DOTD District 03 shall receive current operating status of the CCTV cameras					
		FR16.4 DOTD District 03 shall receive malfunction warnings from the CCTV cameras					
	FR17 DOTD District 03 shall control CCTV cameras (by others)						
		FR17.1 DOTD District 03 shall pan CCTV cameras					
		FR17.2 DOTD District 03 shall tilt CCTV cameras					
		FR17.3 DOTD District 03 shall zoom CCTV cameras					
		FR17.4 DOTD District 03 shall adjust focus					
		FR17.5 DOTD District 03 shall designate/program blacked-out areas					
		FR17.6 DOTD District 03 shall set the time displayed on the video from the CCTV cameras					
		FR17.7 DOTD District 03 shall set the date displayed on the video from the CCTV cameras					
		FR17.8 DOTD District 03 shall set preset views for the CCTV cameras					
		FR17.9 DOTD District 03 shall be able to remotely reset the CCTV cameras					
	FR18 DOTD District 61 shall communicate with CCTV camera sites (by others)						
		FR18.1 DOTD District 61 shall receive streaming video of traffic supplied by CCTV cameras					
		FR18.1.1 Streaming video shall be 15 frames per second, minimum					
		FR18.2 DOTD District 61 shall receive internal temperature warnings from the CCTV cameras					
		FR18.3 DOTD District 61 shall receive current operating status of the CCTV cameras					
		FR18.4 DOTD District 61 shall receive malfunction warnings from the CCTV cameras					

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
	FR19 DOTD District 61 shall control CCTV cameras (by others)						
		FR19.1 DOTD District 61 shall pan CCTV cameras					
		FR19.2 DOTD District 61 shall tilt CCTV cameras					
		FR19.3 DOTD District 61 shall zoom CCTV cameras					
		FR19.4 DOTD District 61 shall adjust focus					
		FR19.5 DOTD District 61 shall designate/program blacked-out areas					
		FR19.6 DOTD District 61 shall set the time displayed on the video from the CCTV cameras					
		FR19.7 DOTD District 61 shall set the date displayed on the video from the CCTV cameras					
		FR19.8 DOTD District 61 shall set preset views for the CCTV cameras					
		FR19.9 DOTD District 61 shall remotely reset the CCTV cameras					
	FR20 LSP Troop I shall communicate with CCTV camera sites (by others)						
		FR20.1 LSP Troop I shall receive streaming video of traffic supplied by CCTV cameras					
			FR20.1.1 Streaming video shall be 15 frames per second, minimum				
	FR21 LCG shall communicate with CCTV camera sites (by others)						
		FR21.1 LCG shall receive streaming video of traffic supplied by CCTV cameras					
			FR21.1.1 Streaming video shall be 15 frames per second, minimum				
	FR22 DOTD ITS Statewide TMC shall communicate with VD sites						
		FR22.1 DOTD ITS Statewide TMC shall receive polled traffic data from the VD					
			FR22.1.1 Traffic data shall consist of volume per lane				
			FR22.1.2 Traffic data shall consist of vehicle classification per lane				
			FR22.1.3 Traffic data shall consist of speed per lane				
			FR22.1.4 Traffic data shall consist of occupancy per lane				
		FR22.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from VD					
		FR22.3 DOTD ITS Statewide TMC shall receive current operating status of VD					
		FR22.4 DOTD ITS Statewide TMC shall receive malfunction warnings from the VD					
	FR23 DOTD ITS Statewide TMC shall control VD sites						
		FR23.1 DOTD ITS Statewide TMC shall create detection zone for the VD					
		FR23.2 DOTD ITS Statewide TMC shall adjust existing detection zones					

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR23.3 DOTD ITS Statewide TMC shall set classification thresholds					
		FR23.4 DOTD ITS Statewide TMC shall set current time					
		FR23.5 DOTD ITS Statewide TMC shall set current date					
		FR23.6 DOTD ITS Statewide TMC shall remotely reset VD					
	FR24 DOTD District 03 shall communicate with VD sites (by others)						
		FR24.1 DOTD District 03 shall receive polled traffic data from the VD					
			FR24.1.1 Traffic data shall consist of volume per lane				
			FR24.1.2 Traffic data shall consist of vehicle classification per lane				
			FR24.1.3 Traffic data shall consist of speed per lane				
			FR24.1.4 Traffic data shall consist of occupancy per lane				
		FR24.2 DOTD District 03 shall receive internal temperature warnings from VD					
		FR24.3 DOTD District 03 shall receive current operating status of VD					
		FR24.4 DOTD District 03 shall receive malfunction warnings from the VD					
	FR25 DOTD District 03 shall control VD sites (by others)						
		FR25.1 DOTD District 03 shall create detection zone for the VD					
		FR25.2 DOTD District 03 shall adjust existing detection zones					
		FR25.3 DOTD District 03 shall set classification thresholds					
		FR25.4 DOTD District 03 shall set current time					
		FR25.5 DOTD District 03 shall set current date					
		FR25.6 DOTD District 03 shall remotely reset VD					
	FR26 DOTD District 61 shall communicate with VD sites (by others)						
		FR26.1 DOTD District 61 shall receive polled traffic data from the VD					
			FR26.1.1 Traffic data shall consist of volume per lane				
			FR26.1.2 Traffic data shall consist of vehicle classification per lane				
			FR26.1.3 Traffic data shall consist of speed per lane				
			FR26.1.4 Traffic data shall consist of occupancy per lane				
		FR26.2 DOTD District 61 shall receive internal temperature warnings from VD					
		FR26.3 DOTD District 61 shall receive current operating status of VD					
		FR26.4 DOTD District 61 shall receive malfunction warnings from the VD					
	FR27 DOTD District 61 shall control VD sites (by others)						
		FR27.1 DOTD District 61 shall create detection zone for the VD					

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR27.2 DOTD District 61 shall adjust existing detection zones					
		FR27.3 DOTD District 61 shall set classification thresholds					
		FR27.4 DOTD District 61 shall set current time					
		FR27.5 DOTD District 61 shall set current date					
		FR27.6 DOTD District 61 shall remotely reset VD					
	FR28 DOTD ITS Statewide TMC shall communicate with HAR sites						
		FR28.1 DOTD ITS Statewide TMC shall receive message broadcast confirmation from the HAR					
		FR28.2 DOTD ITS Statewide TMC shall receive internal temperature warnings from HAR transmitter					
		FR28.3 DOTD ITS Statewide TMC shall receive current operating status of HAR transmitter					
		FR28.4 DOTD ITS Statewide TMC shall receive power status of HAR transmitter					
		FR28.5 DOTD ITS Statewide TMC shall receive current operating status of HAR advisory sign					
		FR28.6 DOTD ITS Statewide TMC shall receive malfunction warnings from the HAR					
		FR28.7 DOTD ITS Statewide TMC shall activate HAR advisory sign beacons					
	FR29 DOTD ITS Statewide TMC shall control HAR sites						
		FR29.1 DOTD ITS Statewide TMC shall create new messages					
		FR29.2 DOTD ITS Statewide TMC shall load existing message					
		FR29.3 DOTD ITS Statewide TMC shall set duration of message broadcast					
		FR29.4 DOTD ITS Statewide TMC shall set current time					
		FR29.5 DOTD ITS Statewide TMC shall set current date					
		FR29.6 DOTD ITS Statewide TMC shall remotely reset HAR					
	FR30 DOTD District 03 shall communicate with HAR sites (by others)						
		FR30.1 DOTD District 03 shall receive message broadcast confirmation from the HAR					
		FR30.2 DOTD District 03 shall receive internal temperature warnings from HAR transmitter					
		FR30.3 DOTD District 03 shall receive current operating status of HAR transmitter					
		FR30.4 DOTD District 03 shall receive power status of HAR transmitter					
		FR30.5 DOTD District 03 shall receive current operating status of HAR advisory sign					
		FR30.6 DOTD District 03 shall receive malfunction warnings from the HAR					

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR30.7 DOTD District 03 shall activate HAR advisory sign beacons					
	FR31 DOTD District 03 shall control HAR sites (by others)						
		FR31.1 DOTD District 03 shall create new messages					
		FR31.2 DOTD District 03 shall load existing message					
		FR31.3 DOTD District 03 shall set duration of message broadcast					
		FR31.4 DOTD District 03 shall set current time					
		FR31.5 DOTD District 03 shall set current date					
		FR31.6 DOTD District 03 shall remotely reset HAR					
	FR32 Traffic signal cabinets shall have Ethernet communications						
		FR32.1 Traffic signal controllers communicate via Ethernet communications (by others)					
	FR33 Fiber optic communications backbone cable shall be provided						
		FR33.1 A minimum of 3 – 2" diameter HDPE conduits shall be constructed within interstate right-of-way from the Scott tower site to LSP Troop I office building					
		FR33.2 Single mode fiber optic cable, 96 count minimum, shall be provided from the DOTD communications tower in Scott (I-10 Exit 100) to LSP Troop I office building					
			FR33.2.1 Fiber optic communications cable may be installed within the existing DOTD vacant 1¼" conduit, part of Qwest Communications duct bank, within I-10 right-of-way as an alternative to new conduit installation				
				FR33.2.1.1 Use of the vacant 1¼" conduit shall require meeting Qwest Communications requirements			
			FR33.2.2 LSP Troop I business network to be connected to the Ethernet communications (by others)				
		FR33.3 A minimum of 2 – 3" diameter conduits, or equivalent innerduct, shall be constructed on the I-10 – 18 mile Atchafalaya Basin Bridge					
			FR33.3.1 Conduit shall be installed on the bridge structure from the western bridge abutment to the mid basin crossover (between I-10 exits 121 and 127)				
			FR33.3.2 Conduit shall be installed on the bridge structure from the eastern basin crossover to the eastern bridge abutment				
		FR33.4 Single mode fiber optic cable, 96 count minimum, shall be provided on the I-10 18-mile Atchafalaya Basin Bridge in required conduit					
	FR34 Commercial power shall be provide to all ITS field device						

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
	FR35 Power distribution shall be provided across the I-10 18-mile Atchafalaya Basin Bridge for power						
		FR35.1 A minimum of 1 – 2" diameter conduits shall be constructed along the I-10 18-mile Atchafalaya Basin Bridge for power					
			FR35.1.1 Conduit shall be installed on the bridge structure from the western bridge abutment to the mid basin crossover (between I-10 exits 121 and 127)				
			FR35.1.2 Conduit shall be installed on the bridge structure from the eastern basin crossover to the eastern bridge abutment				
		FR35.2 Power shall be provided for ITS field devices on the Atchafalaya Basin Bridge					
		FR35.3 Power shall be provided for electric crossover gate mechanism					
	THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES FIBER COMMUNICATION IN NEW CONDUIT						
		FR35.4 Fiber optic communications backbone cable shall be provided					
			FR35.4.1 A minimum of 3 – 2" diameter HDPE conduits shall be constructed within interstate right-of-way				
			FR35.4.2 Fiber optic communications backbone shall be installed to provided Ethernet connectivity				
				FR35.4.2.1 Minimum fiber count for communication runs over 500 feet shall be 48 fibers			
				FR35.4.2.2 Minimum fiber count for communication runs under 500 feet shall be 12 fibers			
	THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES FIBER COMMUNICATION IN EXISTING DOTD VACANT CONDUIT						
		FR35.5 Fiber optic communications backbone cable shall be provided					
			FR35.5.1 Fiber optic communications cable shall be installed within the existing DOTD vacant 1¼" conduit, part of Qwest Communications duct bank, within I-10 right-of-way				
				FR35.5.1.1 Use of the vacant 1¼" conduit shall require meeting Qwest Communications requirements			
			FR35.5.2 Fiber optic communications backbone shall provided Ethernet connectivity				
				FR35.5.2.1 Minimum fiber count for communication runs over 500 feet shall be 48 fibers			
				FR35.5.2.2 Minimum fiber count for communication runs under 500 feet shall be 12 fibers			
	IF THE FOLLOWING REQUIREMENTS SHALL BE MET IF THE PROPOSAL INCLUDES WIRELESS COMMUNICATION						

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Need	Requirement (Tier 1)	Requirement (Tier 2)	Requirement (Tier 3)	Requirement (Tier 4)	Requirement (Tier 5)	Component/ Subsystem/Device	PE Sign Off
		FR35.6 Wireless communications backbone shall be provided					
			FR35.6.1 Wireless communications backbone shall be installed to provide Ethernet connectivity where fiber optic communications backbone is not mandated				