CONNECTING Ouachita 2045

TECHNICAL REPORT #6

Transportation Systems Management and Operations

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1.0 Introduction

This report documents some of the existing Transportation System Management Operations (TSMO) strategies currently in place in the Monroe Metropolitan Planning Area (MPA). It also displays potential TSMO strategies that could be implemented.

The main goal of deploying TSMO strategies is to manage existing roadway infrastructure more efficiently using existing resources. The following strategies can be implemented as part of a TSMO strategic plan to reduce congestion and increase the safety and efficiency of the transportation system.

- Intelligent Transportation Systems (ITS) Architecture
- Existing TSMO Strategies
- Work Zone Management
- Traffic Incident Management
- Connected and Automated Vehicle Deployment
- Management of Mobility, Reliability, and Efficiency
- Multimodal Coordination

2.0 Background Plans and Studies

Associated studies and procedures have influenced and shaped the development of this plan in a number of ways. They are summarized below:

- Intra-department agreements – These agreements identify stakeholders in ITS architecture development. Effective ITS involves the integration of multiple stakeholders and their transportation systems.
- Standard operating procedures – these procedures define the roles and responsibilities of the participating stakeholders in the region and the willingness of agencies to accept their roles and responsibilities. The roles and responsibilities include (but are not limited to) areas such as:
    - Arterial Management
    - Emergency Management
    - Incident Management
    - Transit Management
    - Traveler Information
    - Maintenance and Construction
- ITS Deployment Study – these studies include proposed ITS projects identified as part of the regional ITS architecture along with their service and geographic scope and total cost. For instance, the current Monroe Regional ITS Architecture has listed a Regional Traffic Management Center (RTMC) dedicated for Monroe as a planned ITS project. The RTMC will be responsible for local traffic management activities that are currently handled at the Statewide TMC.
- Transportation Improvement Program (TIP) – reviewing the most recent Monroe Regional ITS Architecture, no dedicated funding source for ITS projects was identified in the TIP for the Monroe region.
- Traffic Incident Management Plan – these plans provide a roadmap for providing incident detection capabilities to help manage both planned and unexpected events and help mitigate the impact to the transportation network.

3.0 ITS Architecture

A major component of any successful TSMO strategy is the incorporation of existing and future ITS. The use of ITS provides advanced information and communication technology that improves transportation safety and mobility and enhances productivity. It also encompasses a broad range of wireless and wire line communications-based information and electronics technologies. When integrated into the transportation system's infrastructure, and vehicles, these technologies relieve congestion, improve safety, and enhance productivity. Since TSMO is an approach to relieve congestion, improve safety, and enhance mobility, it is important to review the ITS plan first. These systems will provide the technology needed to achieve these goals. The *Monroe Regional ITS Architecture* provides a blueprint for managing the transportation network holistically and to optimize existing and future infrastructure. The plan states that:

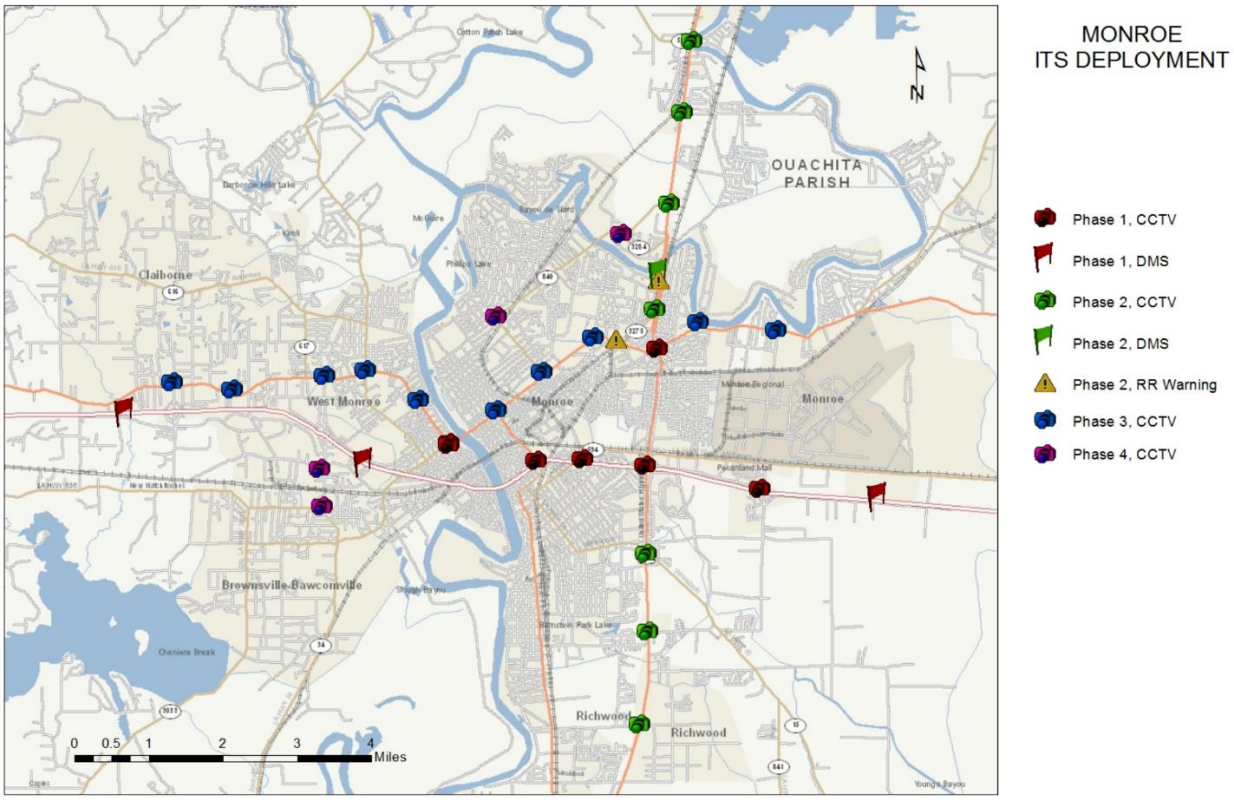
> "The Monroe Regional ITS Architecture is a roadmap for transportation systems integration. The architecture was developed through a cooperative effort by the region's transportation agencies, covering all modes and all roads in the region. It represents a shared vision of how each agency's systems will work together in the future, sharing information and resources to provide a safer, more efficient, and more effective transportation system for travelers in the region." [1]

The chief agency leading ITS efforts in the State of Louisiana is the Louisiana Department of Transportation and Development (LADOTD). The LADOTD has a number of intra-department agreements with other (local) stakeholder organizations where there is a frequent need to exchange information. This exchange is mainly based on the needs coming from one department or the other.

Figure 1 illustrates the current ITS deployment plans in the region. At this time, only Phase 1 has been implemented.

[1] Stantec. 2014. Monroe Regional ITS Architecture. State Project Number 4400000633. Task Order 701-65-1403. Federal Aid Project Number ITS-9908(541). ITS Architecture (New and Updates). May. Available online at: http://wwwsp.dotd.la.gov/Inside_LaDOTD/Divisions/Operations/ITS/Louisiana%20ITS%20Deployment%20Plan/Monroe%20Regional%20ITS%20Architecture%202014.pdf.

Figure 1: Monroe Region ITS Deployment



4.0 Existing TSMO Strategies

One of the main objectives of deploying TSMO strategies is to use the current capacity of the roadway network as efficiently as possible. However, congestion often prevents the current system from operating efficiently during peak periods. To use the full capacity of the existing network, it is important to mitigate bottlenecks and reduce congestion. Congestion is generally categorized into recurring and non-recurring congestion. Recurring congestion typically is attributed to bottlenecks or poor traffic signal operations, while non-recurring congestion is typically associated with work zones, crashes, adverse weather, or special events.

A review of existing strategies in place in the Monroe MPA was conducted and summarized below.

- Incident Management: Incidents are currently identified and managed by local authorities. However, messages can be displayed on Dynamic Message Signs (DMS) in the region if the Statewide TMC is notified of any incidents or major construction activity. The Monroe region plans to have a more robust traffic incident management system, which will detect an incident through roadside surveillance devices (e.g., closed-cicuit television [CCTV]) coordinated through a regional TMC.

5.0 TSMO Strategy Recommendations

TSMO strategies have been used for several years but have mostly been associated and applied under other programs. Examples of existing traffic incident programs include:

- Local Emergency Operation Centers
- Ouachita Parish Sheriff's Office (Dispatch Center)
- Louisiana 511 Website
- LADOTD Statewide TMC
- City of West Monroe Police Department (Dispatch Center)
- City of Monroe Police Department (Dispatch Center)

Currently, LADOTD is exploring ideas that will implement TSMO procedures and produce a benefit for the Monroe region. For instance, LADOTD plans to establish an RTMC in Monroe to improve traffic and better communicate with other agencies. Also, as a response to the potential connected and automated vehicle (CAV) implementations across the major metropolitan areas, LADOTD is developing a "Statewide Data Management System" to optimize the benefits of CAV technologies and improve safety and mobility.

The following sections describe some of the strategies that could be implemented as part of the TSMO strategic plan to reduce congestion and increase the safety and efficiency of the transportation system.

Work Zone Management

Work zone management (WZM) involves organizing and operating areas impacted by road construction to minimize traffic delays and maintain safety for workers and travelers. Traffic conditions are generally monitored using CCTV, cameras controlled using DMS, Highway Advisory Radio (HAR), gates, and barriers. Through the implementation of TSMO, the Iowa Department of Transportation evaluated ITS in work zones (so-called "smart" work zones), which included speed sensors, travel time sensors, queue detection trailers, and DMS. Between congestion and crash reductions, the smart work zones resulted in a benefit-cost ratio of 2.1:1 when new equipment was purchased and 6.9:1 without equipment costs.

The following are opportunities in which TSMO can help enhance WZM:

- Completing Federal Highway Administration (FHWA) Capability Maturity Model (CMM) framework for WZM.
- Inclusion of work zone ITS technology for dynamic management (dynamic queuing, variable speed limits, dynamic lane merge, entering/exiting construction vehicle notification) and work zone traffic signal adjustments can help manage traffic to improve worker and motorist safety and minimize traffic delays.
- Use connected vehicle (CV) applications, such as Work Zone Traveler Information, to monitor and aggregate work zone data. Additionally, Incident Scene Work Zone Alerts for Drivers and Workers (INC-ZONE) is a CV application that warns on-scene workers of vehicles with trajectories or speeds that pose a high risk to their safety. It also warns drivers passing an incident zone if they need to slow down, stop, or change lanes. These applications can help organize and operate work zone areas.
- Work Zone Traveler Information and INC-ZONE connect vehicles to infrastructure. Therefore, it is important to prepare regional infrastructure to communicate with vehicles.
- Coordinate work zone information with other groups such as traffic management and maintenance and construction centers. For example, keeping communications open among local public works construction activity, LADOTD District activities, and the LADOTD ITS Section (responsible for traffic management) can achieve this goal.
- Provide work zone speeds and delays status to the motorist before they reach the work zones.
- Prioritize smart work zone needs by prioritizing them in areas with ITS gaps.
- Provision of funding for work zone ITS on projects should be discussed and allocated early in the project development process.

Traffic Incident Management

The main goal of Traffic Incident Management (TIM) is to detect, verify, respond to, and clear traffic incidents in a manner that provides the road user with least disruption possible. Detection can either be manual (typically via CCTV) or automated. Once an incident is detected, it is managed by either construction or emergency responders. These activities are typically coordinated at a regional TMC. This centralizes the response and helps traffic operations personnel respond appropriately to confirmed decisions. These responses include modifications in traffic control strategy and resource coordination among center subsystems.

Through the implementation of TSMO, The Pennsylvania DOT implemented Incident Response Management, which reduced incident response times by 8.7 minutes, incident clearance times by 8.3 minutes, and hours of delay by 547,000 hours per year. This resulted in a total monetary savings of $6.5 million per year. Many organizations have also appointed a local incident commander who ensures the reliability of TIM measures being implemented and takes charge of incident scenes.

The following are opportunities in which TSMO can help enhance TIM:

- Complete FHWA CMM framework for the TIM.
- Have a central information hub — for example, the planned regional TMC for Monroe — will improve detection and response to traffic incidents in real time.
- This faster response will also help disseminate incident information to other travelers to reduce travel delays.
- The planned TMC can also coordinate with other subsystems such as: Monroe Police Department, tow trucks, or other field services, as part of the emergency plan.
- Use CV application, such as Incident Scene Pre-Arrival Staging Guidance for Emergency Responders (RESP-STG), which provides input to responders on vehicle routing, staging, and secondary dispatch decisions, which can assist with the clearing of traffic incidents.
- Establish a multi-disciplinary incident review committee with various first responders (e.g., police, fire, medical) to grade operations on incidents and train their staff accordingly.
- Use data logged at the regional TMC (e.g., number of incidents per year, average incident clearance times) to inform data-driven decisions.
- Extend the Motorist Assistance Patrol (MAP), which assists motorists by providing various services and restoring the interstate to peak traffic capacity, to the Monroe metropolitan area.
- Have a TIM coordinator and allowing them to collaborate with Monroe TMC, city and state police departments, and MAP to share best practices.

Connected and Automated Vehicles Deployment

The main goal of the CAV TSMO plan is to deploy CAV infrastructure progressively. That is, deploy it in stages proportional to the self-driving technology introduced by car manufacturers. Advancing the Monroe region's TSMO capabilities will rely on the deployment of emerging transportation technologies such as CAV. Additionally, a strong TSMO program will help this region best leverage these technologies to the benefit of the road users. Currently, CAV infrastructure does not exist in the Monroe region.

Many states have taken initiative in developing a CAV strategic plan based on their respective needs, and few have considered CAV as a TSMO Business Area. For example, the Michigan Department of Transportation (MDOT) has developed a CAV Strategic Program and established CAV contacts/ambassadors in each of the MDOT regions. Through this program, the groundwork has been laid to integrate ITS, signals, and CAV for operability, and MDOT's CAV group also coordinates with the TSMO Data Working Group to determine relevant systems and data elements and the opportunity for CAV data inclusion and use.

Some of the opportunities where TSMO can help enhance CAV technology are described below:

- Data exchange and storage will be a key feature of efficient CAV technology. Developing a plan that will determine the data collection and storage plan is important to region's development.
- Integrate CAV systems with signals and other ITS technology in the Monroe region (for instance, add new CV2X devices at future ITS device locations).
- Obtain direction from LADOTD management to have each work area work independently with the CAV group to share data, information, and interoperability.
- Coordinate with the TSMO Data Working Group to identify relevant systems and data elements and the opportunity for CAV data inclusion and use.

Management of Mobility, Reliability, and Efficiency

While TSMO strategies are typically focused on reducing the frequency of congestion on freeways and arterials, other ways of finding efficiency involve reducing delays associated with various functional activities. The LADOTD has developed statewide programs and initiatives to address these challenges in recent years, but implementation of a TSMO program alongside these existing efforts can enhance and integrate these activities, improving safety and mobility in the region.

Some of the opportunities where TSMO can help manage mobility, reliability, and efficiency are described below:

- Complete FHWA CMM framework for road weather, planned special event, traffic signal, work zone, and traffic incident management.
- Use connected vehicle application such as Dynamic Speed Harmonization, which aims to recommend harmonious speeds in response to congestion, incidents, and road conditions to maximize throughput, reduce crashes, and improve system reliability.
- Implement Queue Warning — an application that warns drivers of existing or potential queues ahead in real time — helps to reduce delays and improve mobility.
- Implement Weather Response Traffic Information — an application that uses real-time data and communications systems to warn motorists during severe weather events, thereby enhancing operations as part of road weather management.
- In a special event, applications such as Emergency Communications and Evacuation are useful in addressing the needs of evacuees with and without special needs or their own transportation.
- Review adverse weather planning documents with stakeholders to make updates as necessary.
- Deploy environmental sensors on and around the roadway to collect weather conditions.
    - The Monroe metropolitan area can also use sensor systems located on maintenance and construction vehicles to collect these data. These data can be used to process the information and inform decisions on operations. A regional TMC can work on integrating this road weather sensor technology into existing systems and technologies to share information quickly with stakeholders and improve traffic management during weather events.
- Future ITS deployments in LADOTD District 05 (the Monroe region) may help address extreme weather-related issues and leverage the strength of the systems to enhance operation during hurricane evacuation.
- Quantify resiliency metrics associated with weather events to understand scope and potential countermeasures.

- Develop a budget of resources and a business case for safety and reliability during adverse weather.
- A regional TMC can track a wide range of events, which is useful in understanding how the system is behaving during special events.
    - Through TSMO collaboration, a working group can be developed that will coordinate with responders and event planners to prepare for system unreliability.
- Integrate a Traffic Information System Dashboard into existing LADOTD District 05 systems and technology.
- Collaborate with the public and event planners to encourage active transportation and transit to and from events.
- Identify locations without communication and cross-reference with projects nearby to prioritize locations for adding communications.
- Deploy Automated Traffic Signal Performance Metrics (ATSPMs) and integrate findings from the database with maintenance ticketing processes.
- Provide training and collaboration opportunities between LADOTD District 05 Traffic Operations and the City of Monroe (and other locals as applicable) to extend benefits of dynamic signal timing improvements.

Multi-Modal Coordination

Communication among transit and traffic agencies is important in improving multi-modal service coordination. Traveler convenience at transit transfer points and clusters (a collection of stops, stations, or terminals where transfers can be made conveniently) can be increased with multi-modal coordination among transit agencies, which improves operating efficiency.

Some of the opportunities where TSMO can help manage mobility, reliability, and efficiency are described below:

- Freight and transit are important modes of transportation; therefore, their interaction and integration are important as a part of TSMO strategy.
- Using a CV application (such as Freight-Specific Dynamic Travel Planning and Performance) enhances traveler information systems, which address specific needs (such as wait times at ports, road closures, work zones, and route restrictions) can play an important role in multi-modal coordination.
    - Coordination among public transportation providers and travelers can be enabled with the Connection Protection application, which improves the probability of successful transit transfers.
- There is a need to share a transit transfer service information between multi-modal transportation service providers and transit agencies.
    - LADOTD District 05 traffic operations and local entities can coordinate to work on this.
- Establish a group that will identify potential operations-related multi-modal performance measures.
- Identify crash locations and/or corridors that require high reliability (e.g., transit or freight corridors) to better coordinate multiple modes.

6.0 Conclusion

This document has explored some existing and potential TSMO strategies for the Monroe metropolitan area. The main goal of deploying TSMO is to manage existing roadway infrastructure more efficiently using existing resources. TSMO strategies have been used for several years but have mostly been associated and applied under other roadway and technology-focused programs.

A review of existing strategies in place in the Monroe region was conducted, and it was found that incident management is currently a strategy practiced in the Monroe region. Some other potential strategies that could be implemented in the future include Work Zone Management, Traffic Incident Management, Connected and Automated Vehicle Deployment, Mobility Management, and Multi-Modal Coordination. Utilization of these strategies may lead to more efficient transportation operations overall and a well-managed transportation system.