

Phase 2 Technical Memorandum (Task #2)

**CHATHAM COUNTY ADVANCED TRAFFIC
MANAGEMENT SYSTEM AND TRAFFIC
MANAGEMENT CENTER STRATEGIC PLAN
TRAFFIC MANAGEMENT CENTER
IMPROVEMENT OPTIONS**

Prepared for:



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In Association with:



February 2016

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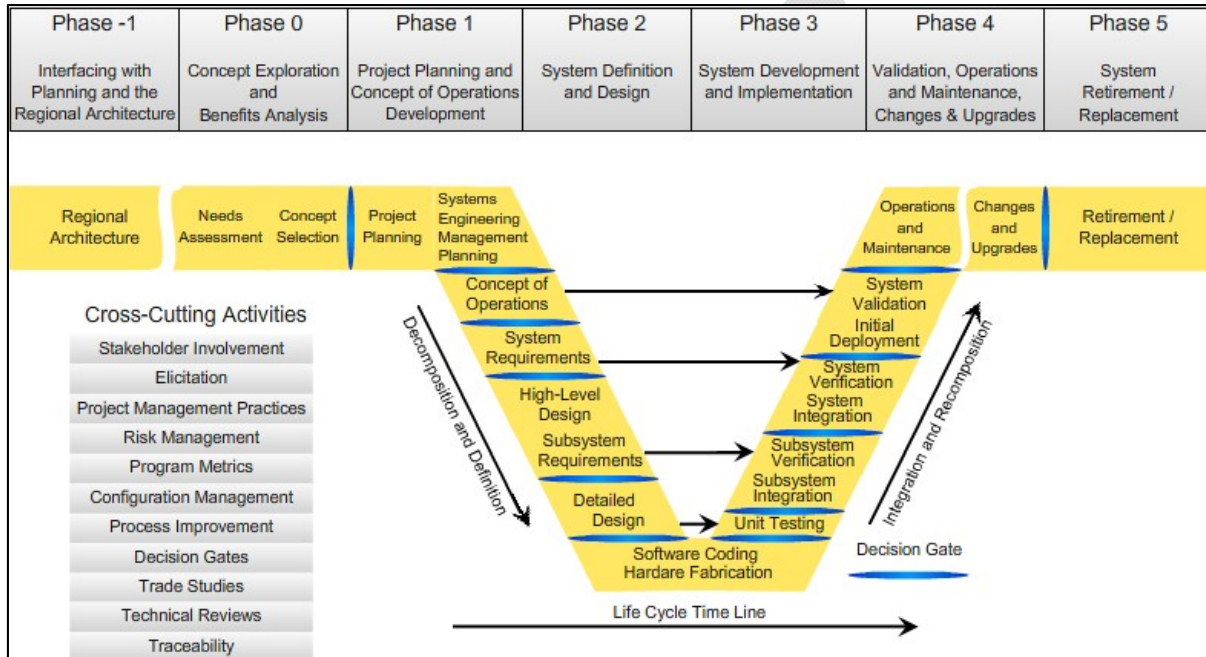
1 Introduction

The Traffic Management Improvement Options Technical Memorandum summarizes the both field and central system recommendations in the development of the Chatham County Intelligent Transportation System (ITS) and Traffic Management Center (TMC) Strategic Plan, referred to henceforth in this document as the *ATMS Strategic Plan*. The Plan is being developed under a task order of GDOT funding contract 00010027. The recommendations in this document are based on the recommended goals and objectives identified in the Task 1 Technical Memorandum, and referenced as is appropriate throughout this document. Building upon these goals and objectives, this Technical Memo describes the Traffic Management Improvement Options that have been identified to be of the highest value to the Coastal Region. Furthermore, these options will then be further defined in such a way to support the need(s) identified for a consolidated Regional Traffic Management Center and System. The findings here will be used to create the necessary documentation that will serve as both an education and marketing resource to the MPO in building and garnering support from amongst the various regional stakeholders. It will also be a basis for project definitions for the purposes of obtaining funding and for further system design and development activities. The program benefits from the Regional Traffic Management Center deployments will be covered in the Task 3 Technical Memorandum.

2 Purpose

The report follows the US Department of Transportation-defined Systems Engineering process as is mandated in all federally funded ITS projects. The *ATMS Strategic Plan* will be developed consistent with the principles of the Systems Engineering Process for Intelligent Transportation System (ITS) project planning, design, implementation, and operations. Note that activities performed in Phases 1 and 2 of this study fall within “Phase 0” of the Systems Engineering Process as shown in **Figure 2-1**.

Figure 2-1: System Engineering Process



In this document, an alternatives evaluation will be conducted that will identify potential improvement options that should be considered to address short-, medium- and long-term traffic management needs, and are consistent with the Goals and Objectives previously defined and approved by the CORE MPO. Based on the approved goals and objectives, the alternatives evaluation focuses on those improvement options that can be implemented over the short, medium and long terms. The evaluation will consider the Traffic Management Center, system components, including traffic signal controllers and cabinets, communications, other traffic management hardware and software, and identification of regional traffic hot spots that impact congestion and mobility.

The following main sections are provided in this document:

- Introduction
- Purpose (this section)
- Traffic Signal Systems
- Communications Options
- Other ITS Devices
- System Integration Options

3 Traffic Signal Systems

3.1 Inventory and Findings

Inventory information has been gathered for traffic signals in the City of Savannah, the City of Pooler, and other signals located in Chatham County, as well as adjacent signals in Bryan and Effingham counties. The focus in **Table 3-1** is on Savannah, Pooler, Chatham County and GDOT.

Table 3-1: Signalization Inventory Summary

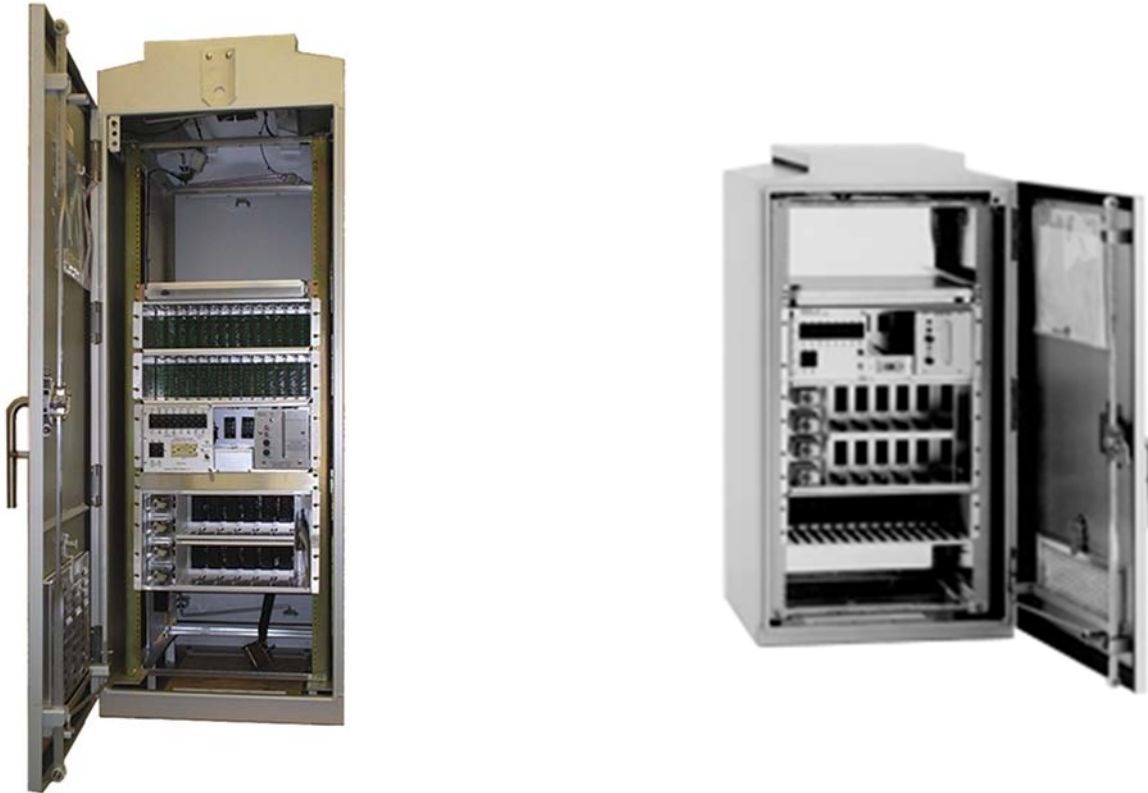
Agency	No. of Signals	% 2070 Controllers	% Fiber Comms	% Wireless Comms	# of Locations with Video Detection
Savannah	263	90%	50%	5%	14
GDOT	94	98%	40%	25%	9
Chatham County	50	92%	0%	60%*	2
Pooler	8	100%	88%	0	0

**All 30 GDOT-maintained signals in Chatham County will have wireless communications by this fall. GDOT has offered to assist the County with communications as well, but that will be longer term.*

In short, nearly all of the signals in the region utilize Model 2070 controllers and associated microprocessor rack-based cabinets, consisting of either Model 332 ground-mount cabinets (See **Figure 3-1**) or smaller Model 336 cabinets (See **Figure 3-1**) suitable for pole, pedestal or elevated pad mounting, all of which are useful in more congested urban environments. It was determined that the various stakeholders are content with this field hardware, and any signalized locations in the region not yet using these standards would benefit from this configuration, allowing for standardization of traffic signal hardware across the region along with the potential for greater interoperability of traffic control systems across the region, a key tenet of regional ITS activities.

As a result, there is no immediate need to upgrade/swap out most of the existing cabinets and/or controllers within the region, except where intersection or operational reconfiguration requires changes to the signal displays, phasing, or coordination strategies. Instead, efforts would be more appropriately focused on the deployment of enhanced functionality and improved operational procedures, as discussed further below. Some of that enhanced functionality does depend on the existing controllers and cabinets.

Figure 3-1: Model 332 Enclosure (left), Model 336 Enclosure (right)



Standardization will ultimately lead to a simpler and more repeatable traffic signal management solution for the region. In addition, this would allow for more convenient integration of systems allowing for interoperability, sharing of control, improved remote access by signal technicians, and in the future, potential deployment of a single, centralized control system.

A centralized solution would ideally include provisions for both signal control system elements, as well as traditional freeway type devices, such as CCTV, DMS, vehicle detection, etc.

4 Operational Enhancements

The following activities have been identified as important for improved regional operations in and around the region.

4.1 Regional Corridor Integration and Coordination

One of the most promising new concepts for regional system operations is Integrated Corridor Management (ICM). ICM incorporates many different traffic signal and ITS elements into a coordinated and consolidated congestion response strategy. ICM is predicated on inter-agency coordination and communication along with addressing both traffic and transit services within a corridor. This could range from background tools such as real-time data sharing and analysis of current and recent flow trends, to on-street strategies such as transit signal priority and preferential signal timings for particular routes and traffic flows. Ultimately, ICM strategies are intended to improve regional transportation performance measures, including travel time reliability, reduction in transit travel time, and ideally, improved person-throughput across corridors and between jurisdictions (as a result of improved transit services as well as more efficient traffic flow). Corridor considerations may include the following major roads or streets with parallel routes:

- A. "Southern Corridor" – I-95/US 17 from US 84 to I-16/Central Savannah
- B. "Northern Corridor" – I-95/US 17 from SR 21 north of I-16/Central Savannah
- C. "Western Corridor" – I-16/US 80/Victory Drive
- D. "I-516/DeRenne Corridor" – I-516, from DeRenne Avenue to I-16
- E. "Truman Corridor" – oriented north/south along Truman Parkway and Abercorn Street, and;
- F. "Eastern Corridor" – Victory Drive/President Street/East Bay Street

Deployment of ICM would require the following technologies be implemented in the various corridors:

- Traffic detection to determine volumes and travel speeds
- Travel time measurement on key routes to determine overall performance
- Tracking of transit vehicles to monitor on-time performance, delays, and passenger loadings
- Implementation of real-time signal timing adjustments, including:
 - Adaptive control (anticipation of increased traffic flow based on upstream traffic monitoring and historical data),
 - Bus signal priority (early green or green extension to accommodate buses with passengers that are on or behind schedule).
- Real-time congestion, travel time and alternate route / parking information using both roadside signage (e.g., dynamic message signs) and traveler information systems (511 voice, web, mobile apps)

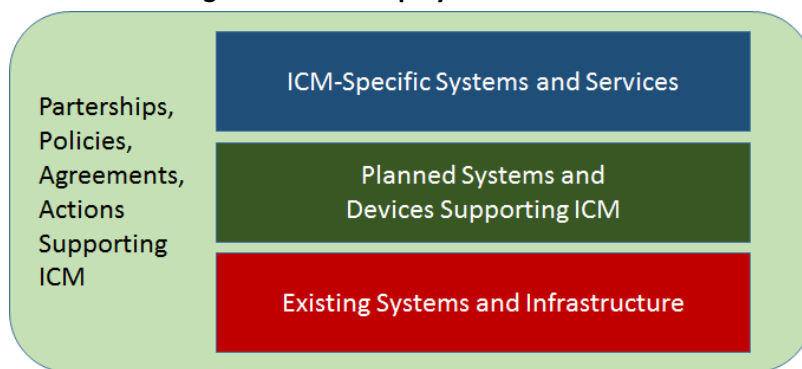
The ICM concept in larger cities includes, as a fundamental element, automated decision-support systems which permit the assembling of multiple strategies (parking restrictions in central areas, bus transit priority, signal timing, etc.) to address a specific condition, for example, a special event, major accident, or road closure. On a smaller scale, it may not be necessary to provide such an automated decision-support system without the quantity of facilities and congestion levels, so long as the ability to monitor and manage the transportation network in real-time is there.

To address the combination of legacy and new devices needed to support ICM, as well as new functions and central system components, investment needs for ICM may be separated into four distinct components of a deployment framework as summarized in **Figure 4-1**.

- ICM policies, procedures, agreements and partnerships between local, regional and state agencies underpin the deployment layers
- Existing field devices and control systems already in place are shown at the base layer
- The second layer shows new field devices and control systems that address “gaps” needed to meet the regional multi-modal traveler needs
- The top layer represents an “ICM System (ICMS)” that would provide corridor-wide decision support and coordinated strategies, and would be contained within the top layer.

It is expected that any regional corridor management strategies in the CORE region would focus on partnering activities, leverage existing ITS, traffic and transit management, and adding strategic traffic, transit and traveler information elements that would support real-time information and addressing different travel alternatives. In the longer term, the top-layer decision support might be feasible based on future population and traffic growth as well as expansion of transit services.

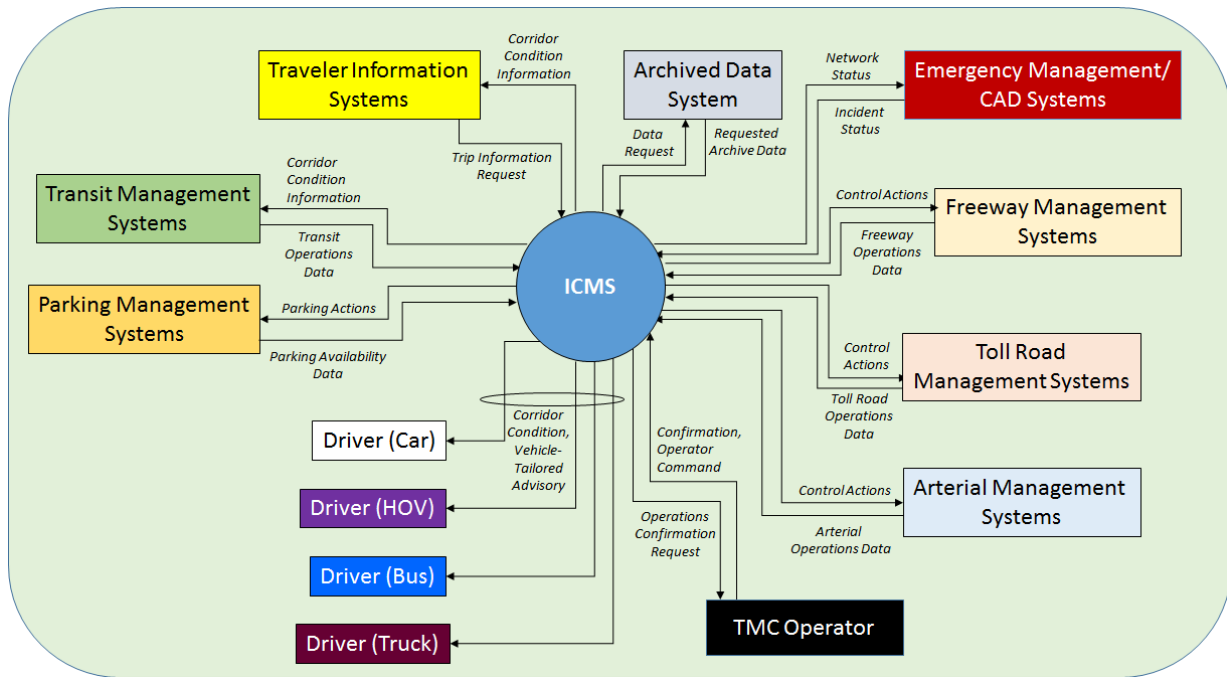
Figure 4-1: ICM Deployment Framework



Source: FHWA Freeway Management and Operations Handbook, 2016 Revision

Figure 4-2 provides a context diagram from the FHWA Freeway Management and Operations Handbook (2016 update) illustrating the interfaces needed for an ICMS in order to integrate different components of the transportation system, including freeway and arterial management (including traffic signals), transit, parking, emergency management, and traveler information systems. Toll roads are shown in the example and may be relevant should such facilities be implemented in the region in the future. In addition to legacy systems and agency partners, new functionality may be provided that is related to transit signal priority, transit information, parking management, and active traffic management (e.g., variable speed limits).

Figure 4-2: ICMS Context Diagram



Source: FHWA Freeway Management and Operations Handbook, 2016 Revision

4.2 Improving Existing Signal Efficiency

Traffic is by nature dynamic and evolving. Any traffic system should be subject to recurring analysis to see where changes would be beneficial. While this is largely seen as a short-term solution, it should be considered part of the long term ongoing operations. The area will benefit by continuing to focus on improving the efficiency of the existing system(s). Additionally, while isolated improvements may have significant impact, regional coordination of signals provides an opportunity for another level of efficiency unmatched by individual signals or even systems. There are various strategies that could be employed to meet this objective. These are presented below.

4.2.1 Signal Timing

Signal timing is typically the most cost-effective means of making an immediate improvement in the efficiency of a signal system. Signal timing strategies are designed to minimize travel times and air pollution, maximize fuel savings, and optimize traffic flow and progression throughout a signal network. Under most systems, signal timing is established by predetermined traffic movements. However, optimized signal timing is a complex endeavor. It is based on collected traffic data, and thus based on current usage of the system. Obviously, that means a system will perform better in the near-term, as it is fine-tuned to current usage trends.

But as conditions and the system itself changes in configuration (e.g., new intersections, road widenings) and/or usage, the timings need to be revisited on a regular basis to maintain those efficiencies. Retiming of signals is typically included and scheduled along with capital improvement projects, providing one type of funding mechanism. Ideally, operations budgets should include regular intervals for review and revision of signal timing, so as to not be dependent on capital improvements

which in turn may be dependent on successfully obtaining local, state or even Federal funding. One way of facilitating regular signal timing activities is through regional centralized control systems, which facilitate monitoring and managing operations as well as archiving appropriate traffic data. Having such a system also leverages the use of local operations staffs efficiently, permitting the targeting of key corridors on an as-needed basis and thus more targeted use of staff resources.

4.2.2 Detection

Signal systems, specifically actuated systems, depend on a healthy and accurate detection infrastructure. Regardless of other technologies, it's extremely difficult to have an efficient signal system without a properly configured and well maintained network of detectors. By every indication, there are no systemic issues with detection in the regional area. However, there are always ways of expanding and improving detection. Obvious enhancements afforded by expanded detection are signal strategies such as adaptive and traffic responsive. There are many detection technologies available today, from inductive loops to span wire video. The data made available from a more extensive and robust detection network affords the flexibility to enhance both the signal system as well as elements of a comprehensive Advanced Traffic Management System (ATMS). One key consideration is maintenance – the detector network should be readily maintainable using available agency resources. This also means the technology should be proven and cost-effective. Maintaining a healthy network of detectors is just as important as installing that network in the first place.

4.3 Regional Coordination for Signal Operations

The Coastal Region has a number of jurisdictions responsible for signal operations, including the City of Savannah, Georgia DOT, Chatham County, and other local agencies, as per the inventory in Appendix A. The importance of freight transportation in the region (given the Port of Savannah location northwest of the central city), the vulnerability of the region in the event of hurricanes, and the large amount of tourist traffic point to the importance of coordinated operations and real-time information and coordination. Likewise, the main Interstate route into Savannah, I-16, terminates in Savannah and its main spur route, I-516, terminates both in the northwest and south of the central area. A centralized regional operations center could coordinate signals under one jurisdiction as well as address the impacts of freight, tourist, and evacuation traffic in a regional sense. This is further discussed below.

5 Communications Options

5.1 Overview

Communications improvement options take into consideration not only traffic signal systems, but coordination of other transportation management activities involving ITS technologies such as CCTV, dynamic message signing, and freeway management-related activities including system detection, incident management, and the emerging area of active traffic management (involving tools such as variable speed limits, dynamic lane and shoulder operations, etc.)

As presented elsewhere, the ATMS Strategic Plan is based on the three goals of reducing congestion, enhancing travel safety, and improving regional operations. The latter consideration is of great importance with respect to telecommunications, as it allows for potential efficiencies in designing and maintaining wireline infrastructure to support a variety of freeway and local applications, as well as identifying where wireless technologies could provide satisfactory and cost-effective services. In the future, with the advent of connected and autonomous vehicles in the coming decades, the leveraging of both wireline infrastructure and wireless vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications should be considered in any investment decisions made by CORE MPO and regional agencies.

5.2 Current Infrastructure and Findings

As explained in the TMC Needs Assessment Report, communications to support a regional Traffic Management System are lacking. There are many improvements that are recommended to better support a centralized system operating from a regional TMC. While the Regional TMC Report to be developed under Task 3 will address this further, there are some improvements that have already been identified as necessary.

5.2.1 City of Savannah

Generally the region has limited fiber communications coverage. The City of Savannah currently has less than 50% of their signals connected via fiber. Additionally, the existing fiber is multi-mode, which allows for limited distance between communications nodes (1 km maximum for a 1 GB/second transmission speed, less for higher speeds) and limited bandwidth capacity, which is quickly running out. Multi-mode fiber today is generally best-suited for premises-based (i.e., indoor) applications. The City could benefit greatly by adding additional single mode fiber to its infrastructure. Not only would the additional fiber provide greatly needed bandwidth, single-mode would allow for greater communications speeds over longer distances, plus greater reliability and availability through the use of self-healing ring networks that provide full communications coverage even if one segment of the network is cut or malfunctions.

5.2.2 Georgia DOT

From a regional perspective, other communications infrastructure upgrades are also recommended. Given there is not currently a regional TMC, GDOT has had little need to invest in additional connections to their signals in the area. Whether it is to increase system cooperation and integration,

or to enhance the usefulness of the regional TMC, extending communications options and allowing for connections to those GDOT signals in the region/district is critical. This extended infrastructure would allow TMC operations to have a wider area of real time coverage, and wider array of options at their disposal while managing both every day and emergent situations throughout the region.

Additionally, a connection with the GDOT network in general would be highly advantageous. This additional connection would allow for 2-way communications with other regional TMC's or with statewide operations, thus allowing for a more complete data sharing network for larger events, and in particular, emergencies such as hurricane evacuations.

Another advantage of data-sharing between a future Savannah regional TMC and the rest of GDOT would include the ability to transfer control of certain devices across regional boundaries will afford the region's system to fit seamlessly into the statewide GDOT system, creating a more homogeneous system throughout. This will provide robustness, flexibility, and future options to the region. The exact advantages and realized benefits throughout the region demands additional consideration and research. Ultimately sharing of data, just for the sake of sharing data, is not the panacea of an efficient system. Rather, the efficient and purposeful sharing of data is what holds value. However, that value needs to be identified before investments are made.

5.2.3 Chatham County and Other Municipalities

Lastly, additional communications upgrades are necessary if the system is to include other city and county systems within the region, consistent with the regional corridor management concepts presented earlier. The Chatham County signal systems are largely without existing communications, so there are many opportunities for improvement there. The City of Pooler has fiber running to many of its intersections, but not directly connected to its signal controllers. Connections to allow monitoring and/or control of those intersections would be advised. Obviously, evaluation of each of the corridors, with respect to geographical and operational readiness, is required to best understand the level of investment required.

5.3 Recommended Communications Improvements

As part of upcoming tasks in development of the detailed ATMS Strategic Plan, specific communications upgrades will be evaluated and prioritized based upon the importance and overall value toward meeting the system goals and objectives. In addition to the new connections that will be identified, the existing communications infrastructure will be re-evaluated to determine if any necessary upgrades are needed. Special consideration will be given to evaluating the age of existing equipment, the pool of stakeholders with an interest in participating, and the potential compatibility with a new and upgraded system.

One last important piece of the communications infrastructure will be to identify the communications needs to support the physical regional TMC, discussed further in the Justification for Regional Approach below. Obviously selection of a site for the TMC will be paramount to determining what communications will be necessary. Considerations for communications, and ease of installation, are important factors when selecting a physical location for a TMC, and will need to be evaluated thoroughly.

5.4 Justification for Regional Approach

5.4.1 Addressing Regional Needs

The first step in addressing recurring congestion is to identify the overall transportation objectives of the region. It should be noted that while data collection and analysis is extremely valuable, it is not a congestion management objective in and of itself. When identifying the regional objectives, it's important to look at all desired modes of traffic, not simply private vehicles, but also transit and freight traffic.

The goals and objectives were identified in the Phase II, Task 1 document and are shown in **Table 5-1** below.

Regional operations objectives were developed to be diverse enough to cover both recurring and non-recurring congestion. Furthermore, they serve as a guide to identifying the desired results. Those desired results, in turn, allow the local jurisdictions to measure their performance and their effectiveness in achieving their desired goals. The objectives do not provide the measures, but rather guidance in their development of those measures.

Congestion issues need to be addressed both at the freeway and arterial level. This involves a combination of statewide, regional and local resources. Statewide, GDOT manages incident and emergencies through its NaviGATOR program (although not all regions currently have TMC facilities at this time), and provides information through its 511 program via phone, web and mobile apps. Regionally, Chatham County EMA has developed a Category-5 resilient Emergency Management Center near the Savannah Airport. Locally, City of Savannah monitors its traffic operations centrally.

5.4.2 Recurring Conditions

Managing recurring congestion is critical to the vitality and ultimately the sustainability of a regional transportation program. It's important to remember that congestion can never be completely eliminated. However, by properly managing congestion, the region can realize great benefit: improved mobility, reduced GhG emissions, and generally a better quality of life for those in the region.

There are three primary elements of congestion management. The first is real time management of the signals in the region. Through an ATMS, with dedicated staff, and leadership commitment, great improvements are possible. The second is through an ICM strategy for one or more corridors, as described earlier. Coordinating between parallel freeways and transit in the region allows the operators to achieve peak throughput. Finally, the last key element is the sharing of accurate traveler information. Sharing of accurate traveler information between agencies and with the public can aid with carpooling, transit, time of day trip decision making, parking management, and even congestion pricing. In the outskirts, where alternatives are less available, traveler information on congestion can have even greater value.

Table 5-1: Regional Goals and Objectives

Goals	Objectives
Reduce Congestion	1 Minimize wait time at signals
	2 Maximize throughput at signals
	3 Minimize the number of non-recurring incidents
	4 Minimize duration of incidents
	5 Minimize roadway impacts due to weather
	6 Provide information to travelers on congestion/incidents
	7 Reduce congestion where geometric changes are not feasible
Enhance Travel Safety on the Road Network	8 Reduce the number of crashes in the region
	9 Reduce the severity of crashes in the region
	10 Provide advance warning for queues
	11 Clear hazards quickly
	12 Safe travel in work zones
Improve regional transportation system operations	13 Collect and share current travel conditions data with other agencies
	14 Coordinate with other agencies on incidents
	15 Increase availability of and access to data for planning, operations, and programming purposes
	16 Position the region to be able to take advantage of new tools and technologies as they become available

Peak-hour and off-peak operations can be impacted greatly by traffic signal timing settings. Conversely, freeway management for recurring conditions, and in some cases (notably I-516), the freeway merges into directly into the arterial network. The prevailing national and statewide approach for providing management and information on freeways is to provide traffic flow monitoring and travel time data collection so that real-time travel times may be posted on dynamic message signs, with CCTV cameras providing monitoring of congestion conditions.

On freeways with peak volumes of 1800 vehicles per lane or greater combined with heavy entrance ramp volumes (say, 800 or more per lane per hour), a common approach to managing congestion is the deployment of ramp metering (which entails one-vehicle-per-lane-per-green-signal indication, providing one or more seconds separation between vehicles entering a freeway, which reduces

mainline delays due to merging traffic at entrance ramps). At this time, ramp metering is assumed to be, at best, a future component of the network.

5.4.3 Improved Incident Management

When incidents occur, traffic impacts, including but not limited to lane closures and congestion, reduce roadway capacity. Incidents can be vehicle crashes, disabled and abandoned vehicles, debris in the roadway, work zones, adverse weather, and other events that impact the transportation system.

Incident management includes all efforts that go into the detection, response, and after-response associated with removing an incident, or unplanned traffic disruption of the transportation network. It consists of a process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Effective incident management not only reduces the duration and impacts of traffic incidents; it improves the safety of motorists, crash victims and emergency responders. The primary tools of incident management include developing procedures to improve how traffic incidents are responded to and managed, while also developing a reliable communication network among incident responders.

It is important for all stakeholders (encompassing TMC operators and “first responders” such as police and fire departments) to be prepared for any type of incident management situation. Preparation for incident management situations can be achieved through planning, training exercises, personnel qualification and certification.

TMC responsibilities in incident management consist of:

- Assisting in incident detection and confirmation/verification
- Providing accurate and reliable diversion routes during emergent situations
- Posting accurate and timely messaging to appropriate DMS devices
- Providing accurate and near real-time traveler information to the public and media through all required channels
- Broadcasting incident information continually on Highway Advisory Radio (HAR) when possible
- Coordinating Safety Service Patrol (SSP) response for the benefit of verification and/or management of incidents

By disseminating information about the incident to the public, motorists can make alternative travel plans and delays can be reduced. Effective detection, verification, response and clearance of these incidents can significantly reduce travel time delays. Clearing incidents rapidly is also crucial in minimizing congestion and reducing secondary crashes. Proper incident management yields significant benefits through reduced vehicle delays and enhanced safety to motorists through the reduction of incident frequency and improved response and clearance times.

Ongoing incident management procedures utilize the following proven strategies for remaining at maximum efficiency:

- Annual re-certification for all incident management team members

- Regular regional workshops to promote maximum communication and education of updated industry standard practices
- Annual or Quarterly incident management Performance Reports to stakeholders to provide full transparency into operational performance
- Continued financial programming necessary to maintain the program and all of its moving pieces

Incident management will occur even if it is only with the first responders on the scene. But the use of a TMC provides many opportunities to maximize the efficiency of incident management. This includes quicker response to conditions using ITS tools, and remote assistance to those at the scene through monitoring on CCTV and diversion of traffic heading into the incident zone.

5.4.4 Improved System Integration and Data Sharing

The most advanced traffic signal systems are made to process large amounts of data in real-time, and provide the programmed response to potentially rapidly changing conditions. By integrating the various systems and providing a reliable mechanism for sharing that real-time data, the region can realize great benefit. In addition to the improved situational awareness amongst the systems, the ability to analyze and/or process that data in multiple ways allows stakeholders to publish useful and meaningful data to the general public.

Real-time arterial detection collects different types of data depending on location. One type of detection may be found at mid-block locations or well in advance of a signal. These are often called advance or system detectors, which address not only presence but volumes, speeds and flow density, through a physical measure known as “detector occupancy”. The other type is at the actual intersections/controllers, typically referred to as presence or stopline detection. These detect the presence of vehicles in particular lanes and are used both to actuate a signal phase (especially for left turn lanes or side street movements) and to extend the green display when there is a continuous flow of vehicles over the detectors.

Additionally, the controllers can use both the system and stopline detector data as part of a traffic responsive strategy (which selects a timing plan based on particular traffic flow criteria) or a more fluid adaptive control system (which dynamically adjusts signal timing parameters based on advance detector data, anticipating the volume and travel speed for platoons of vehicles, in order to reduce stopped delay). Arterial real-time data can be shared with other systems/jurisdictions, allowing them to trigger other responses, such as traffic signal timing adjustments in adjacent jurisdictions. This shared data can also be fused in a manner to make it readily available or publishable to the general public to allow for better and more informed travel decisions. Such data typically includes travel time measurements, but may also include travel speed information. Data can also be combined with other multi-modal data to allow for even more flexibility in how it might be used by the consumer. Journey planner applications in conjunction with real-time traveler information systems can provide comparisons of freeway and parallel arterial travel times along with transit services between particular customer origins and destinations.

Historical or archived data also holds tremendous value to public agencies. There are various systems available for processing and analyzing this archived data. The archived data could grow quite large

with time, leading to the use of the terminology of “big data.” Data analytics and data visualization offer many possibilities for the public agency, including optimized incident management and signal timing strategies based on comparing current conditions with normal conditions, seasonal changes, or long-time travel patterns. In addition to helping identify areas that need closer attention to enhance travel throughput or efficiency, analysis of the data can help defend the need for improvements throughout the region. Investing in data analytics is money well spent.

Analytics investments transform processes by automating the business processes associated with turning data into information. Time that staff once spent on low-level data acquisition (including manual traffic counting activities), quality control, and processing can now be spent on higher-level business processes: analysis, decision-making, and communication. This makes agencies more efficient and saves money by automating tasks that previously took expensive and time-consuming outside consulting efforts.

As agencies begin to understand the impacts of their investments through analytics, they can improve their overall agency performance and save their customers time and money. Because understanding system performance is the key requirement to improving system quantitatively, the returns to agency customers are substantial. Analytics software and services leverage existing investments in operations data systems. Analytics approaches often entail a modest investment in software, a minimal investment in staff, and no additional investments in hardware. Thus, the investment is relatively modest. Because it fundamentally transforms the way that agencies do business, the payoff is large, leading to high returns.

As agency staff incorporates analytics into their daily routines, they begin increasing opportunities to automate data business processes and gain deeper understanding of their system’s performance. The cumulative impact of these agency resources, saved through automation, continuously adds to the overall return on an analytics investment. In addition, as agencies better understand their system performance, they find new ways to improve it and serve their customers.

5.4.5 Regional TMC and ATMS Considerations

Based on the above, it becomes apparent that the region would benefit from having a Regional TMC, a coordinated/common centralized advanced traffic management system (ATMS) solution, and a coordinated set of objectives for multiple jurisdictions within the region. GDOT support will be critical, as will the various MPO and other jurisdictional entities. In Task 3, the Study Team will explore a select few of the case study targets in more depth, including lessons learned, along with the various strategies the agencies employed to build their respective TMCs and/or system upgrades. Also, the Team will evaluate the needs/desires of the various stakeholders throughout the region, in order to identify the elements that make the most sense to implement.

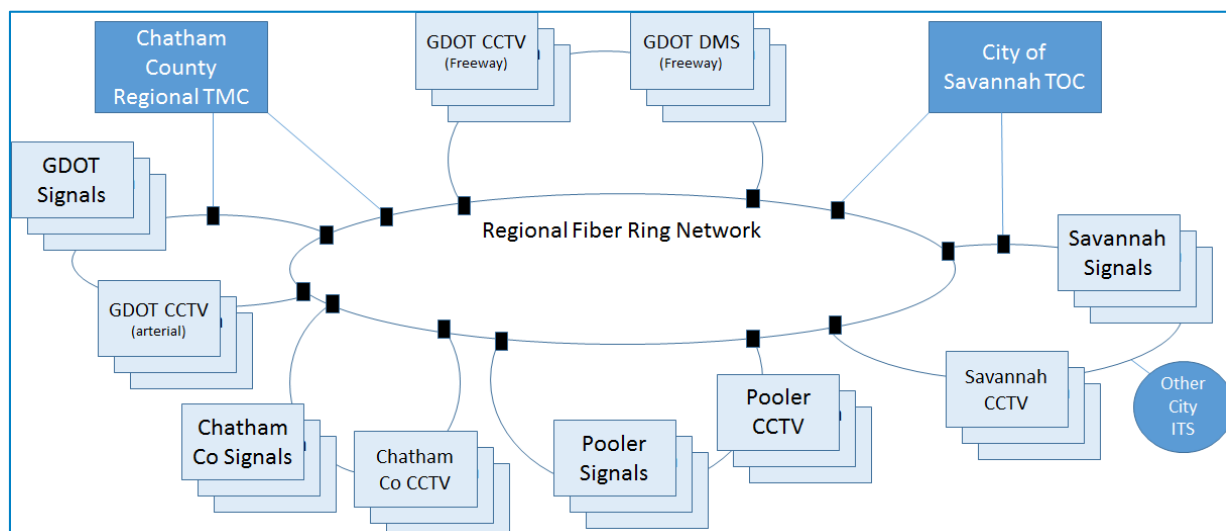
Other important benefits of a regional ATMS include coordination and data sharing throughout the entire region and state. By deploying a robust ATMS, the area could get great benefit with sharing transportation data and coordinating various management strategies with GDOT. By coordinating transportation management activities, the region could provide a more coordinated approach to managing transportation, creating a more reliable, seamless, and predictable, travelling experience by the general public.

5.4.6 Localization and Redundancy Considerations

Given the efforts to date by agencies such as City of Savannah in special event and day-to-day operations management, it is important to build upon those activities. Although the previous sections have identified the potential benefits of regional activities, many day-to-day activities require enhancing the local systems as well. Another consideration, particularly in light of hurricanes and other weather-related concerns, is providing a safe and secure system to support evacuations and emergency route planning and temporary closures. This involves the use of redundant communications design techniques (typically in the form of fiber ring networks as well as redundant wireless links to communication hubs along the fiber network), along with redundancy of operation (e.g., providing a back-up operations capability in the event of a power failure or other emergency at a primary facility).

Task 3 activities should consider both communications redundancy and TMC redundancy alternatives. One example would be implementing a regional GDOT / county TMC within the Chatham County EMA facility (Category 5-resilient) while the City of Savannah maintains a local Traffic Operations Center for its signal system, but with GDOT freeway management and other data management backups at the local TOC. Conversely, a redundant access and hosting of the City's signal system should be located at the Regional TMC, with access to real-time signal and traffic information from GDOT, county and local signal systems accessible on a common network. By connecting the fiber ring networks to both Centers', redundant control, communications and management capabilities should be available in the event of emergencies. **Figure 5-1** shows a redundant framework where a regional ring is connected to multiple local rings of communications, with operations centers having connectivity to both the regional ring and one local ring network in order to assure high availability through proper redundancy and communications access.

Figure 5-1: Regional ITS Network Concept



6 Other ITS Devices

As previously detailed, there are numerous enhancements needed for the communications infrastructure(s) to support regional traffic signal and operations management activities. However, in order to make a truly useful traffic management program and system, there would need to be an expansion in coverage. The region currently has a limited number of ITS devices such as cameras, detection and dynamic message signs. The Phase I report identified several operational and functional concerns across the region, many of which ITS directly addresses. Locations and numbers of devices must be developed in a more detailed study, but it is reasonable to assume that the amount of ITS equipment is expected to increase in the coming years as the region addresses the known operational issues.

6.1 City of Savannah

The City of Savannah Traffic Department has limited numbers of ITS devices. Although there has been installation of fiber communications to roughly half the signalized intersections and roughly 5% more intersections with wireless communications, their additional ITS systems are limited to 6 locations with video detection systems. In order to effectively utilize a centralized system to help manage incidents and special events, the City will certainly need to expand the CCTV coverage area. CCTV would provide the City with more information on daily congestion and incidents and combined with the police department will enhance the ability to manage special events. Strategically placing CCTV around the region at various known “hot” spots and bottlenecks would greatly enhance the ability of a TMC to effectively move traffic and goods throughout the region. CCTV also provides enhanced security applications in the region.

Dynamic Message Signs (DMS) should also be acquired and utilized. As mentioned in the TMC Needs Assessment document, the region could benefit from the addition of portable message signs. DMS are beneficial to the region by allowing for a more rapid means of disseminating important information to the traveling public in real-time. Permanent DMS structures and controllers can require a considerable financial commitment. As such, additional research needs to be performed to identify the most ideal location(s) and configurations. With the historical significance of the area, and the associated aesthetic desires, additional considerations need to be made for the actual design and form factor of any structures considered in the region.

The City will also benefit by expanding their existing traffic detection strategy. Enhancing their existing detection with a network of system detection would afford the opportunity to move toward an Adaptive Control System. Additional detection devices would also provide for even more data collection, archiving, analytics and dissemination. Like most other considerations here, detection needs to be designed and placed with purpose. Again, efficient analytics will provide identification of areas/corridors that might benefit the most from additional detection coverage.

6.2 GDOT and Outlying Areas

GDOT has a limited number of ITS devices locally. The DMS and CCTV that exist are mainly located along the Interstate network. Additional CCTV coverage at key interchanges and along key arterial

corridors would be valuable in addressing recurring congestion, incidents at ramps, and operations on alternate routes in the event of a freeway closure or during evacuations. The region would likely benefit from having a similar suite of device types added to local systems such as City of Savannah, Chatham County and the City of Pooler, in conjunction with regional TMC operations activities which would enable the monitoring of both freeway and arterial corridors.

Specific ITS device locations and enhancements should be considered based on specific location and operations criteria which indicate that benefits are likely through deployment. Criteria may include but not be limited to the following:

- Accident rates on specific route segments
- Traffic volumes on specific route segments
- Travel time reliability during peak or special event traffic, along with travel time index (travel times during peak / special event periods compared to free flow travel time)
- Proximity to special event venues and ingress/egress routes
- Arterial route runs parallel to, and/or connects with, a parallel Interstate corridor
- Route is designated specifically for major evacuations

High incident and high congestion segments of a road network may justify “full CCTV coverage” (i.e., close spacing of cameras, between $\frac{1}{2}$ and $\frac{3}{4}$ mile, to enable viewing the entire route), while interchanges with other Interstate routes or parallel / alternate routes may warrant implementation of DMS in advance of these interchanges, if not already in place.

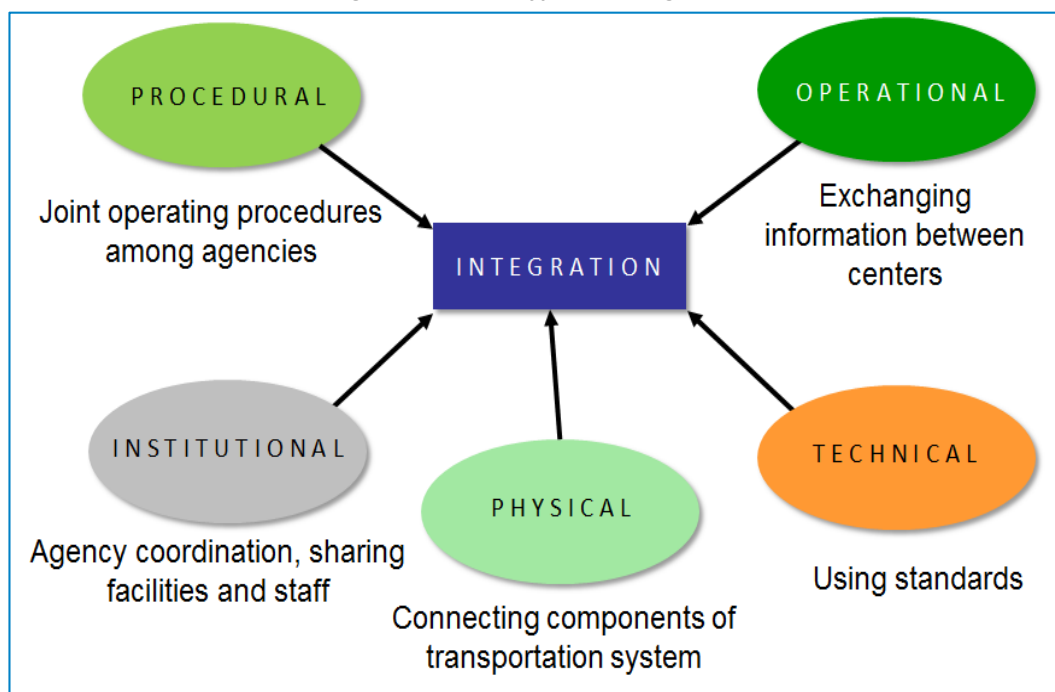
7 System Integration Options

It is assumed that the existing operational status quo is not satisfactory in the region; that in order to address congestion, emergency management, incident management, and special event management, new tools and functional abilities are needed. Much has been accomplished in recent years with a large emphasis on field staff. But as the region grows and both congestion and mobility is increasingly seen as a regional, multi-agency concern, the integration of various activities and decision processes becomes increasingly important.

To achieve the vision of a "seamless" transportation network, the involved agencies and practitioners must recognize and address the many inter-facility, inter-jurisdictional, and inter-modal dependencies through the following types of integration (summarized in **Figure 7-1**):

- "Technical integration" of transportation operations on a regional level, specifically including network topologies, database considerations, related elements of the National ITS Architecture, standards for message sets and protocols, etc. that enable different management centers (e.g., transportation, emergency services, information providers) to readily (and automatically) exchange, store, and access information from one another – a process known as "center-to-center" communications.
- "Institutional integration", including identification of agency roles, interagency collaboration and coordination requirements, information sharing requirements and standards
- "Procedural integration", including coordinated planning and programming processes that address the entire surface transportation network as a whole
- "Operational integration", related to the use of the shared information for managing the transportation system (e.g., coordinated incident management, regional traveler information, adjusted signal timing and ramp metering rates)
- "Physical integration", including those systems, interfaces and infrastructure which enable cooperative and collaborative operations involving multiple agencies, facilities and modes

Figure 7-1: Five Types of Integration



Source: FHWA Freeway Management and Operations Handbook, 2016 Revision

Each transportation agency has a different level of deployment of control and management of their roadways and infrastructure. Much of it is minimal in terms of electronic and real time management. The industry has decades of history of how each individual system can be improved to provide increased management capabilities – typically through increased number of field devices and more up to date management systems (controllers, computers, and communications). This report has identified multiple enhancements to the various systems throughout the region: communications, devices, operations, etc. While these enhancements have a strong track record for improving the operations of TMS, it is typically for the individual systems – not the region. The traveler does not see jurisdictions; they see a region. In order to address the regional TMS needs, some level of integration must occur between the various systems. Individual systems will need to be upgraded, but if they are not integrated as they are upgraded, bottlenecks and choke points will continue to exist, incident management will not improve, and the overall movement of goods and people will decline.

The enhancements identified above are based upon the expectation the area will be successful in building a necessary Regional TMC. The system utilized within that TMC would greatly benefit from any or all of the aforementioned enhancements. Making the Regional TMC an operational and organizational reality is imperative for successful management of the region's roadways. A physical TMC should be considered necessary; the deployment of a centralized solution which incorporates the support and resources from all the various stakeholders with an interest in participation is also critical for achieving the most success.

The technical aspects of regional integration must not be viewed in isolation from other considerations. Information sharing is a collaborative effort, geared towards identifying problems,

coordinating activities, and planning for future investment needs. Technical integration can therefore not occur without institutional integration (e.g., the various agencies agreeing on the need to share information, their respective roles, the information to be shared, standards). Accordingly, the institutional issues associated with regional integration are also discussed herein.

Beyond technical and institutional integration, successful regional operations also depend on procedural integration (e.g., coordinated planning and programming processes that address the entire surface transportation network as a whole). Moreover, after the information has been exchanged between TMCs, something useful needs be done with it (e.g., coordinated incident management, regional traveler information, adjusted signal timing and ramp metering rates) – that is, there must be operational integration and the implementation of physical interfaces or components (physical integration) to enable it.

An important first step is an organization must be created to address regional coordination. Many regions start with a simple MPO committee, but real success is achieved when the operational staff of each agency is working together on a daily basis. Second, communications is critical – both with field devices and between systems. If there is one regional system, communications is simplified. But systems could be located in different locations but be seamlessly integrated with each other over a robust and secure communications network. Third, each system will need to expand the data collection capabilities. This includes both sensor data and video.

There are 5 alternatives that have been initially identified:

- Do nothing – maintain existing infrastructure
- Agency-specific TMC's (one for GDOT, City of Savannah, Chatham County and Pooler)
- Single regional TMC
- Hybrid of Regional TMC (including GDOT and other regional entities) and City of Savannah TOC with redundant functionality (concept developed above)
- GDOT miniTOPS (part of statewide deployment contract)

Multiple enhancements have been identified to the various systems throughout the region: communications, devices, operations, etc. Those enhancements are based upon the expectation the area will be successful in building a necessary Regional TMC. The system utilized within that TMC would greatly benefit from any or all of the aforementioned enhancements. Again, making the Regional TMC a reality is imperative for successful management of the region's roadways. Not only is a physical TMC necessary; the deployment of a centralized solution which incorporates the support and resources from all the various stakeholders with an interest in participation is critical. Furthermore, integration with both the GDOT system and the GDOT Operating Procedures/Strategies will be paramount. In fact, the most advantageous scenario for the Chatham County Regional TMC is to become a part of the existing GDOT MiniTOPs program, as an independent ITS deployment hat would fall under a statewide service and maintenance contract.

The above System Integration Options will need to be addressed when developing the Regional Traffic Management plan

8 Next Steps

Additional evaluation (e.g., Signal Systems, Regional Communications, ITS systems, etc.) is needed to identify and further develop the various alternatives presented above. Those alternatives would be reviewed and further developed in coordination with the other local stakeholders. The alternatives also need to be evaluated more thoroughly to determine the most appropriate use of funds when building out the resulting TMC. Ideally we can identify other agencies that can utilize the convenience of the resulting TMC. Those other agencies would likely include provisions for maximized coordination amongst the co-located entities. The consultant team has direct experience with working in other regions to build such a coordinate inter-agency deployment.

Additionally, the CORE MPO is planning a local Workshop / Planning session to present ideas and stimulate discussion amongst area stakeholders in February 2016. All stakeholders and/or interested parties are encouraged to attend, and hear from those within the region and throughout the Industry talk about the future of the Chatham County Transportation Management initiatives.