Phase 2 Technical Memorandum (Task #1)

CHATHAM COUNTY ADVANCED TRAFFIC MANAGEMENT SYSTEM AND TRAFFIC MANAGEMENT CENTER STRATEGIC PLAN

GOALS AND OBJECTIVES

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Table of Contents

List of Tables

1 Introduction

The Goals and Objectives Technical Memorandum summarizes the recommended goals and objectives in the development of the Chatham County Intelligent Transportation System (ITS) and Traffic Management Center (TMC) Strategic Plan. The Plan is being developed under a task order of GDOT funding contract 00010027. The Goals and Objectives in this Technical Memorandum are for a wide variety of ITS and operational needs identified in Phase I and the Phase II stakeholder meeting. As the focus of this study is related to traffic management, these goals and objectives are almost all exclusively related to a regional Traffic Management Center.

The goals of the Chatham County Intelligent Transportation System (ITS) and Traffic Management Center (TMC) Strategic Plan Phase II are similar to many other regional efforts – reduce congestion, enhance travel safety, and improve regional transportation system operations. The recommended objectives matching these goals are identified below and include:

- Reduce Congestion
  - Minimize the wait time at signals
  - Maximize throughput at signals
  - Minimize the number of nonrecurring incidents
  - Minimize the duration of incidents
  - Minimize roadway impacts due to weather
  - Provide information to travelers on congestion/incidents prior to reaching decision points
  - Reduce congestion where major geometric changes are not currently programmed
- Enhance Travel safety
  - Reduce the number of crashes
  - Reduce the severity of crashes
  - Provide advance warning for queues
  - Clear hazards quickly
  - Provide safe travel in work zones
- Improve Regional Transportation System Operations
  - Collect and share current travel conditions data with other agencies
  - Coordinate with other agencies on incidents
  - Increase availability of and access to data for planning, operations, and programming purposes

The goals and objectives will be presented in detail in the Goals and Objectives Section of this Technical Memorandum.

2 Purpose

The Federal Highway Administration (FHWA) has required the use of Systems Engineering in all federally funded ITS projects. Systems engineering reduces the risk of schedule and cost overruns and increases the likelihood that the implementation will meet the user's needs, this is especially true in the case of implementing complex technical systems. Other benefits include:

- Improved stakeholder participation;
- More adaptable, resilient systems;
- Verified functionality and fewer defects;
- Higher level of reuse from one project to the next; and,
- Better documentation.

Whether in detailed design or the early planning stages, the systems engineering process lays out an approach that helps the developers and stakeholders ensure that the system they are building will actually perform the tasks that they need.

Identifying a vision is a key element of the systems engineering process. Vision statements are typically very high level with goals and objectives that describe how the vision will be achieved. It is important that any component, subsystem, or project identified in the overall analysis be matched back to one of these objectives. The reverse is also true – if you have an objective, you should have some component, subsystem, or project identified to achieve that objective.

3 Vision

In the CORE MPO ATMS Strategic Plan – Traffic Control Center Needs Assessment Phase I, a number of previous studies and plans were listed that all identified the need for improved traffic operations and management in the Savannah region, including:

- Tricentennial Plan – Comprehensive Plan
  - Goal E. Objective f. – Optimize the operations of transportation systems
- CORE MPO 2030 Long-Range Transportation Plan
  - Goal 5 Objectives – Maximize efficiency of signalized intersections and expand use of ITS
- Congestion Management Plan
  - Updated signal timing would improve 15-23% of congested roadways and improve constrained corridors

Building from these goals and the recommendations from previous studies, the following statement identifies the vision and purpose of this plan.

VISION STATEMENT: Enhance mobility for the greater Savannah region through efficient management and optimized operations of the roadway transportation system.

The Vision Statement is in concurrence with those from the larger previous studies, while focusing on the needs of this study. This includes being specific enough to focus on roadway issues such as daily congestion while allowing for integration of transit, special event, and emergency management needs. This is consistent with current FHWA support for Traffic System Management and Operations. The goals identified above directly relate and flow from this vision.

As determined by the CORE MPO ATMS Strategic Plan – Traffic Control Center Needs Assessment, the Phase II study will focus on the feasibility and needs of a regional TMC. The vision, goals, and objectives developed in this document address the larger operational concerns of the region, with or without a TMC. However, how each objective addresses how it relates to a TMC.

4 Needs

In Phase I, several operational needs were identified which focus on how the traffic system currently operates, and how the region would like to operate in the future. These needs were developed based solely on operational concerns – not with the specific goal of a regional TMC. However, the ideal path for meeting many of these needs is through the development of a TMC. The needs identified in Phase I were summarized in the following categories:

- Traffic management
- Public Transit
- Traveler Information
- Commercial Vehicle Operations
- Emergency Management
- Archived Data
- Truck Routes
- Maintenance and Construction
- Hurricane Evacuation

Phase I also discussed at length the benefits of integrating the various systems to provide the means to manage all of these needs. These needs were discussed with the stakeholders at two separate meetings. While there were no objections to the list, the stakeholders generally had a more narrow view of the primary needs with the focus on a smaller subset of needs that were more directly related to their primary concerns such as signal integration, congestion reduction, and special event management – whether these are planned events, minor incidents, or major evacuations. The results of the discussions are incorporated into the goals identified below.

5 Goals and Objectives

The Phase I document identifies needs – the building blocks of goals and objectives. Draft goals and objectives were presented to the stakeholders at the March 2015 stakeholders meeting. Table 1 is a simple listing of the goals and objectives.

Table 1: CORE MPO ATMS Strategic Plan Goals and Objectives

Goals	Objectives
Reduce Congestion	1. Minimize the wait time at signals 2. Maximize throughput at signals 3. Minimize the number of nonrecurring incidents 4. Minimize the duration of incidents 5. Minimize roadway impacts due to weather 6. Provide information to travelers on congestion/incidents prior to reaching decision points 7. Reduce congestion where major geometric changes are not currently programmed
Enhance Travel safety	8. Reduce the number of crashes 9. Reduce the severity of crashes 10. Provide advance warning for queues 11. Clear hazards quickly 12. Provide 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

Each of the objectives is addressed individually below. This includes a discussion of the issues relative to each objective and how each objective relates specifically to a regional TMC. Metrics and detailed objectives are identified in **Appendix A**.

5.1 Goal - Reduce Congestion

Objective - Minimize wait time at signals

Metric – Reduce delay at identified signals by 20%

Measure – Before/after travel times along corridor

Objective - Maximize throughput at signals

Metric – Increase peak hour volumes at identified signals by 10%

Measure – Peak hour counts at selected intersections before and after

Metric – Increase transit usage in selected corridors by 20%

Measure – Passenger counts on selected bus routes before and after

By far, delays at signals were noted as the primary issue for the region. These two objectives allow for several approaches to help with this problem. Signal optimization is the primary tool although increased transit usage could also help by reducing the number of vehicles on the roads. There are many ways signals can be optimized; in incremental steps, across a corridor, or throughout a region.

The ultimate in signal optimization is fully integrated regional control. Traffic signal vendors generally have proprietary systems that offer such capabilities such as closed loop systems or adaptive signal control. As there are several agencies and more than one signal system vendor in the region, this is generally not feasible. Regional control is not something that is "set and forget", it needs to be maintained and optimized on a regular basis. The system needs to be monitored for unusual events and to ensure the system is working as designated. While each individual agency could implement improvements across their system or along specific corridors, true regional optimization will likely only occur with regional coordination and potentially regional control. This can be accomplished through Center to Center (C2C) coordination, or through developing a single regional facility and system.

Objective - Minimize the number of non-recurring incidents

Metric – Reduce crashes in the corridor by 20%

Measure – Number of crashes before and after

Metric – Reduce signal pre-emption time at select signals by 10%

Measure – Amount of time signal is in pre-emption mode before and after

Crashes and other incidents can have a significant impact on the signal system. Crashes can obstruct the roadway and minimize the capacity on a segment. Crashes also impact the signal systems which impacts emergency responders' utilization of signal pre-emption. Many of the crashes in the urban area are congestion related. This objective then becomes secondary to the previous objective – reduce congestion, reduce crashes caused by congestion (secondary crashes).

Crashes that occur in the rural areas of the region, the issue becomes less about delay and more about detours as the road network and alternatives are limited. In the rural areas, this objective is tied with incident response and traveler information as will be shown later.

A well-informed central TMC can provide quicker incident response to crashes and improved traveler information for the traveling public.

Objective - Minimize the duration of incidents

Metric – Improve response time by 10%

Measure – Use information from regional dispatch system to measure time before and after

Metric – Improve total incident time by 10%

Measure – Use information from regional dispatch system to measure time before and after

Studies have shown that on freeways every minute of delay from an incident results in anywhere from 4-9 minutes of delay in congestion[1]. Arterials offer different challenges and opportunities with more access and alternatives, but the principle is the same – reduce the incident time, reduce the impact by a larger amount. Improved incident response time and management is the key to reducing the duration of an incident. A lot of this comes from increased responder training and potentially new tools. A big portion of the duration of most incidents is in the early stages – detection, verification, and notification. For the vast majority of incidents today, one or more of the parties involved has a mobile phone and calls 911. This is by far the fastest possible way to detect an incident. On freeways, incidents are typically verified using cameras owned and operated by GDOT. The regional 911 center has minimal camera coverage. The GDOT will likely possess the majority of the cameras in the region. Camera images should be shared among the agencies. Camera sharing is typically best accomplished through a single TMC.

Objective - Minimize roadway impacts due to weather

Metric – Provide advance weather information

Measure – The amount of social media items (e.g., emails, tweets, etc.) provided to the public

The primary weather concerns for the Savannah area are hurricanes, tropical storms and severe thunderstorms, although ice storms occasionally occur. Specific to traffic management, one of the most effective tools for managing traffic in poor weather is traveler information. Traveler information can come through traditional media, social media, and mobile device applications. Dynamic message signs on the road are another means of providing travelers with information if available.

Traveler information is best served through a coordinated single source such a TMC. The media and other third party sources can obtain the information from the TMC and distribute the information such as on the news, radio, website, texts, mobile applications and social media outlets.

While a building is not required, a centralized TMC organization serves this purpose well. While the county EMA may handle this also, this would only be while active and as one option is to co-locate, the two can work in coordination. Additionally, as with many emergency responders, often EMAs prefer others to deal with the media so they can deal with the actual emergency.

Aside from traveler information it is also possible to tweak the signal system to help traffic move from affected areas. This is extremely complex and requires active staff involvement.

Objective - Provide information to travelers on congestion and incidents

Metric – Use social media to provide information on incidents

Measure – The amount of social media items (e.g., emails, tweets, etc.) provided to the public

[1] NTIMC: Benefits of Traffic Incident Management, available online: http://www.transportation.org/sites/ntimc/docs/Benefits11-07-06.pdf

Metric – Use the internet and mobile apps to provide information on congestion

Measure – The number of subscribers and amount of data downloaded

Metric – Share information on incidents between agencies

Measure – The number of incidents where transportation agencies shared real time information

Congestion information comes primarily through two types of sources – human observations or sensor measurement. Transportation agencies use on road traffic sensor devices such as loop detectors and cameras to collect traffic information. There are also private resources for traffic information that use smart phone devices, commercial vehicle fleets and in car systems to acquire anonymous probe data which can be compiled to created travel time information similarly to what a DOT can do with traffic sensor data. Incident data is typically received at 911 centers, unless it is special event related.

As with the previous objective, a single source of information is best. FHWA has promoted shared centers and integration of incident information between emergency responders and DOTs. Again, as one option is to co-locate, the two can work in coordination. There are private sources of data, especially congestion information. Waze, Inrix and others have established a market and are providing valuable services to many in the public. The third metric has to be public agency supported. The first two could be provided by the private sector if no "core level of service" is expected from the transportation operating agencies in the region.

Objective - Reduce congestion where geometric changes are not feasible

Metric – Agencies identify and implement three projects each year

Measure – The number projects implemented

This objective supports the use of Transportation System Management and Operations activities. The key is to have the region identify bottlenecks or other issues across the system and determine if operational changes can help address the problem. This requires cooperation among the agencies.

Depending on what solutions are proposed, a TMC may or may not have value.

5.2 Goal - Enhance Travel Safety

Objective - Reduce the number of crashes in the region

Metric – Reduce crashes in the corridor by 20%

Measure – Number of crashes before and after

Objective - Reduce the severity of crashes in the region (Or say reduce the number of fatalities and serious injuries)

Metric – Reduce severity crashes in the corridor by 20%

Measure – Measure average severity of crashes before and after

This is very similar to the objective above of reducing the number of non-recurring incidents above. In 2013, 23% of all traffic crash fatalities in the United States occurred at intersections[2]. Many of the problems are related to signal operations. This objective will require analysis to determine appropriate solutions for each unique intersection.

Depending on what solutions are proposed, a TMC may or may not have value.

Objective - Provide advance warning for queues

Metric – Reduce crashes at selected sites with recurring queues by 10%

Measure – Number of crashes before and after

Metric – No crashes related to queues from special events

Measure – Number of crashes before and after

Queue warnings are very helpful at reducing crashes at locations of recurring congestion. Field devices are too expensive to be deployed at every potential queue location making this an appropriate tool for corridors with existing problems. Whether the queue occurs on a freeway or arterial, if it is a recurring problem there should be a traffic incident management plan in place to help address this problem. That plan will not only include queue warning systems where appropriate, but other mitigation strategies such as field personnel assisting traffic directly. Theoretically, for an arterial system if the signal system is optimized there should be minimal queues. This objective is closely related to traffic management plans for special events.

Some basic queue warning devices are controlled through field devices – specifically the local controller triggering advance signing. While this does not necessarily need to be actively managed by a TMC, someone still needs to monitor the device and the frequency and timing of it's activation.

Objective - Clear hazards quickly

Metric – Improve response time by 10%

Measure – Use information from regional dispatch system to measure time before and after

Metric – Improve total incident time by 10%

Measure – Use information from regional dispatch system to measure time before and after

Hazards include crashes with lanes blocked, or debris such as fallen trees or spilled truckloads. As with any incident, a quicker response time is critical to reducing the overall incident time. This objective is essentially the same as "minimize duration of incidents".

[2] National Highway Traffic Safety Administration, Fatality Analysis Reporting System (FARS) Encyclopedia. http://www-fars.nhtsa.dot.gov/Main/index.aspx

A TMC would aid greatly in reducing response time as noted above with increased visual awareness and improved information sharing with emergency responders.

Objective - Safe travel in work zones

Metric – Reduce crashes in work zones by 10%

Measure – Number of crashes before and after

The focus here is on work zones outside of large construction projects. Large projects typically have their own traffic management plan. While there are many things that should be done in the field to make the work zone as safe as possible, there are still activities that the region should address. The greatest potential is with timely collection and sharing of information. A single source of data, in an electronic format will allow for quicker data sharing Traveler information data can provide a warning to people so they can adjust their travel plans and route. Safe travel can be measured strictly by number of work zone crashes each year.

A TMC would provide a single source data collection and sharing of information. Whether the data goes to the media, social media, local apps, etc., having the data in a single electronic format is critical. While this can be accomplished on computers in various departments, a TMC is a natural organizational asset suited for this purpose.

5.3 Goal - Improve Regional Transportation System Operations

Objective - Collect and share current travel conditions data with other agencies

Metric – Establish direct connections to another agency

Measure – Count the number of direct connections

Metric – Share data with a regional TMC

Measure – Count the number of data connections or GB of data shared

A key concept for the region is that a single TMC does not have to start as a single system. Looking at arterials over a large geographic area, it is difficult to in one action unite all signals into a single TMC system. For the interim, various agencies will operate their systems directly. Coordination between agencies (C2C) is absolutely critical to addressing congestion issues and data sharing is one of the first steps to achieving this. It can be measured by the number of direct connections that are established.

A TMC is critical for this objective. Sharing data from one signal system to another is of limited use for real time signal timing, but important for long term coordination. In the long term, a single system could be developed that manages the region collectively. In the interim, a regional TMC allows professionals to interact with each other so that each can manage their systems for optimal performance.

Objective - Coordinate with other agencies on incidents

Metric – Increase face to face coordination with other agencies

Measure – Keep track of the number of incidents that had face to face coordination before and after

Incident coordination is important especially on arterial networks where a medium size incident can quickly affect several jurisdictions. Emergency responders typically already have mutual aid agreements and coordination procedures. DOT's need to monitor these incidents to see if any signal timing needs to change, traveler information needs to be provided, or assistance provided to the emergency responders (e.g., an arrow board for longer term incidents). This is a difficult objective to measure. The best way to track is by number of incidents and type of coordination. The goal being to move to more automated or immediate face to face communications.

When the impact is isolated to a single stretch of road, the owning agency is typically able to coordinate alone. When in a more urban environment, or when longer detour routing is required, a TMC provides the framework for that coordination. More data is available in a single location and typically staff from the various agencies are co-located and able to quickly and directly interface.

Objective - Increase availability of and access to data for planning, operations, and programming purposes

Metric – Provide data to MPO

Measure – GB of data shared

Metric – Provide data to other agencies

Measure – GB of data shared

A combined TMC is data intensive. When data on multiple routes is available in the same electronic format, many other agencies find it important to use this information. For example, planning signal upgrades for the region it may be important to see what the change in traffic is not just on a single route but on the alternative routes also. Operations often depend on quick access to data during management of an incident or event including latest counts from other jurisdictions. Many agencies have always desired the data, but until it is located in an easy to access format, are unable to use this resource. This data sharing can easily be measured in terms of volume of data accessed by outside agencies.

A TMC with all the data in a single database often make data sharing feasible for the first time.

Objective – Position the region to be able to take advantage of new tools and technologies as they become available

Metric – Agency staff stay informed of trends and new traffic and incident management tools

Measure – Staff hours in training, number of webinars attended, or number of committees staff participate in.

Metric – Build out of regional communications infrastructure

Measure – Strand/miles of fiber, number of communication nodes

Metric – Improve regional operations coordination

Measure – Create and support regional operations committees

The private sector has expanded the concept of "smart cars" considerably in the last few years. The Google Car is the most visible component, but in addition, FHWA has invested heavily in connected vehicle research and deployment. From a public agency viewpoint, the good news is that the automobile industry is driving much of this research and the vast majority of cost will be upon the consumer. The bad news is there is still an infrastructure that will need to be created by the public agencies. For the short term, the best course of action for the region is to stay involved and informed about new technologies and applications. It is not important for the Savannah region to be an early adopter of these technologies, but it is important for the region to make good decisions about long term infrastructure investments to be able to take advantage of the new technologies when the situation arises. This may mean building in extra communications and space in cabinets for new equipment. This does not have to be limited to smart cars. Other new technologies will likely appear in the next five or ten years.

A single TMC with all the data in a single database is important for many of these new vehicle technologies. Just as important is the establishing of regional groups that address operations. If the local operations are not conducive to the flexibility of new systems as well as the data demands, the new technology will have limited success.

- More transit ITS – mention some in throughput; any other suggestions
- Any possible candidates for adaptive signal control etc. – mentioned in first section, but I believe Iteris will cover this subject in much greater depth in their deliverables.

6 Next Steps

This technical memorandum uses the systems engineering process to lay the foundation for a TMC. Goals and objectives have been identified with the intent to find a balance between addressing operational needs of the region with a focus on TMCs. There are other operational issues that are not addressed in these goals and objectives – that is as intended. These goals and objectives should be used as a starting point for consideration of the feasibility of a regional TMC.

7 Appendix A – Sample TMC Goals and Objectives

Goals	Primary Objectives	Secondary Objectives	Metric
Reduce Congestion			
1	**Minimize wait time at signals**		
		Reduce signal delay 20%	Before/after travel times
		At select intersections, along a corridor, etc.	
2	**Maximize throughput at signals**		
		Increase peak hour volumes 10%	Peak hour traffic counts
		Increase transit usage 20%	Boarding counts
3	**Minimize the number of non-recurring incidents**		
		Reduce crashes 20%	Number of crashes
		Reduce signal pre-emption time 10%	Time signals are in emergency pre-emption
4	**Minimize duration of incidents**		
		Improve response time 10%	CAD reports
		Improve total incident time 10%	CAD reports
5	**Minimize roadway impacts due to weather**		
		Provide advance weather information	Measure public outreach per event
6	**Provide information to travelers on congestion/incidents**		
		Use web social media for incidents	Web site hits, tweets, emails, etc.
		Share information on incidents between agencies	Number of incidents shared
7	**Reduce congestion where geometric changes are not feasible**		
		Regional committee identify 3 projects a year; each with an appropriate metric	Successful completion of operational projects
Enhance Travel Safety on the Road Network			
8	**Reduce the number of crashes in the region**		
		Reduce crashes 20%	Number of crashes

9	**Reduce the severity of crashes in the region**		
		Reduce severity of crashes 20%	Severity index for crashes
10	**Provide advance warning for queues**		
		Reduce crashes at site 10%	Number of crashes
			Need to monitor system performance
		No crashes related to special event queues	Number of crashes
11	**Clear hazards quickly**		
		Improve response time 10%	CAD reports
		Improve total incident time 10%	CAD reports
12	**Safe travel in work zones**		
		Reduce crashes in WZ by 10%	Number of crashes
Improve regional transportation system operations			
13	**Collect and share current travel conditions data with other agencies**		
		Establish direct connections to another agency	Number of direct connections
		Share data with a regional TMC	Number of sources of data at regional TMC
14	**Coordinate with other agencies on incidents**		
		Increase face to face coordination versus phone exchange	Percent of incidents coordinated by face to face versus phone
15	**Increase availability of and access to data for planning, operations, and programming purposes**		
		Provide X GB of data to MPO	GB of data shared
		Provide Y GB of data to other agencies	GB of data shared
16	**Position the region to be able to take advantage of new tools and technologies as they become available**		
		Agency staff stay informed of trends and new traffic and incident management tools	Staff hours in training, number of webinars attended, or number of committees with participation
		Build out of regional communications infrastructure	Strand/miles of fiber, number of communication nodes
		Improve regional operations coordination	Create and support regional operations committees