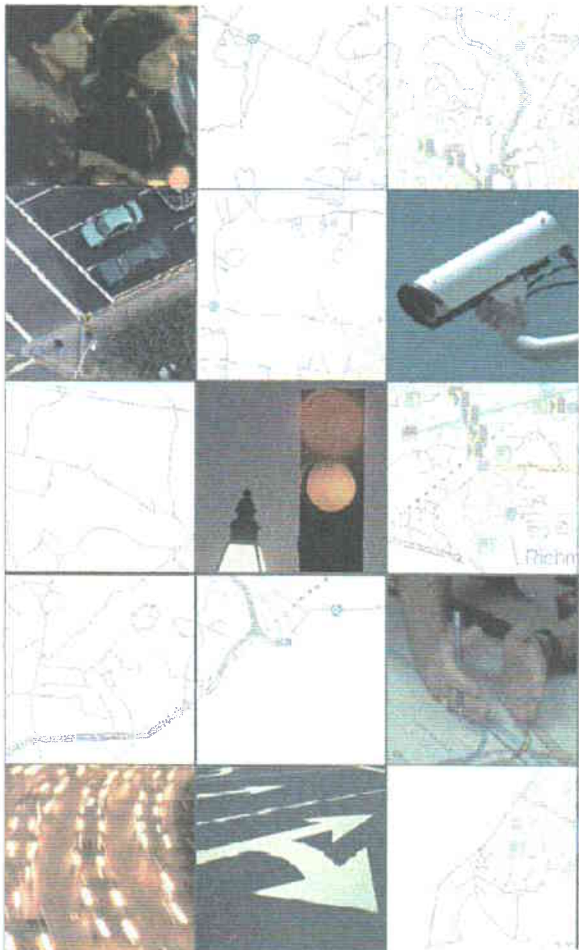
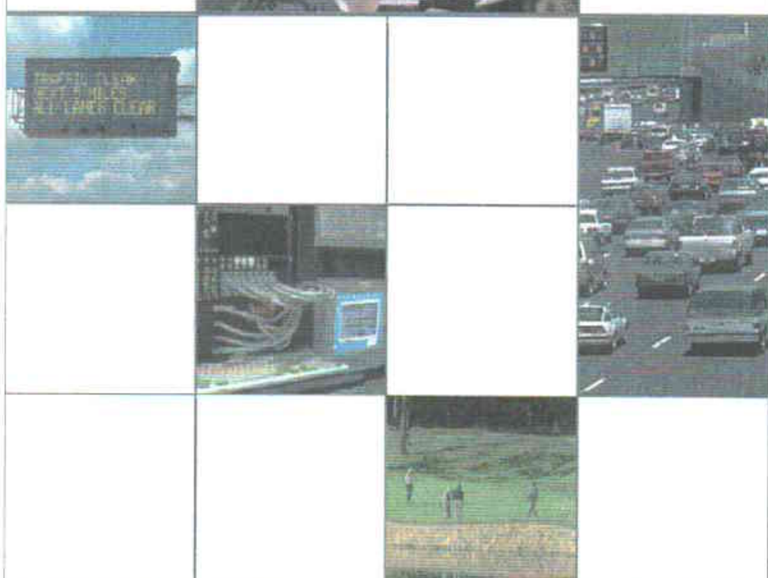


Augusta Regional ATMS Master Plan

FINAL REPORT



Prepared by:
PB Farradyne
Gresham Smith and Partners
Manual Padron and Associates

February 2002

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APPENDICES

1.0 Introduction

The Augusta Regional Transportation Study (ARTS) encompasses a three county region in the Augusta metropolitan area including Richmond and Columbia Counties in Georgia and Aiken County in South Carolina.

This report documents the efforts undertaken by the Advanced Transportation Management System (ATMS) Master Plan project team. This team included representatives from the three county region as well as consultants from PB Farradyne, Gresham, Smith and Partners and Manuel Padron & Associates.

The PB team was tasked with the development of a regional master plan for deployment of an Intelligent Transportation System (ITS) in the ARTS area. This report, along with other previous deliverables, documents the results of the study and includes the following elements:

- Section 2.0: Inventory of Existing Systems and Plans
- Section 3.0: Concept of Operations (Including Regional Architecture)
- Section 4.0: Proposed Staffing for Augusta Regional Transportation Control Center
- Section 5.0: Location Analysis of the Augusta Regional Transportation Control Center
- Section 6.0: Preliminary Design and Layout of the Augusta Regional Transportation Control Center
- Section 7.0: Communications Plan
- Section 8.0: Recommended Plan and Project Priorities
- Section 9.0: General Equipment Specifications

2.0 Inventory Of Existing ITS and Traffic Conditions

The first step in developing this plan for the Augusta region was to conduct an inventory of existing conditions on the freeways and major arterials. This inventory included available data on existing traffic control devices, locations of recurring congestion, and any current plans for ITS projects including GDOT's Statewide ITS Strategic Deployment Plan. The existing communications infrastructure for traffic control was also inventoried. Graphical files using ArcView GIS software were developed to illustrate the existing conditions. Figures 1 and 2 show the existing ITS inventory for the Augusta region.

2.1 Existing Traffic Control Devices

Information was collected regarding the traffic control signals within the study area. Data was obtained on as many elements as available. At a minimum, the team attempted to obtain the location, type and communications for each signal. The tables shown in Appendix A summarize the inventory results for the signals in each of the three counties.

2.2 Locations Of Recurring Congestion

Based on the inventory of existing conditions and discussions with various personnel, it was determined that the following locations appear to exhibit a significant amount of recurring congestion:

- I-520 corridor (during the holiday season)
- Gordon Highway corridor
- Wrightsboro Road (PM peak), near Augusta Mall
- Washington Road
- River Watch Parkway @ I-20
- Walton Way, Wheeler Road at I-520

Recurrent congestion is one input in the decision process for locating ITS field devices. Because congestion is key issue in the region, the ITS deployment plan will include a focused on these areas.

2.3 Current Planned ITS Projects

The major ITS projects currently planned for the study area include GDOT Freeway ITS deployment on both I-520 and I-20. This deployment will include the installation of surveillance cameras, vehicle detection devices, and dynamic message signs. Figure 3 and Table 1 show the approximate planned locations for the surveillance cameras and dynamic message signs. This coverage area includes three dynamic message signs and ten cameras. Initial communications will be dial-up, producing slow-scan video images from the cameras.

In addition to the ITS field devices, the GDOT HERO incident response coverage will also be expanded to cover the Georgia portions of I-520 and I-20 in this area. The future ITS infrastructure is further described in section 9.

Based on the information obtained to date, there are not any other major ITS projects planned at this time by the City and County agencies within the study area.

Augusta Transportation Management System

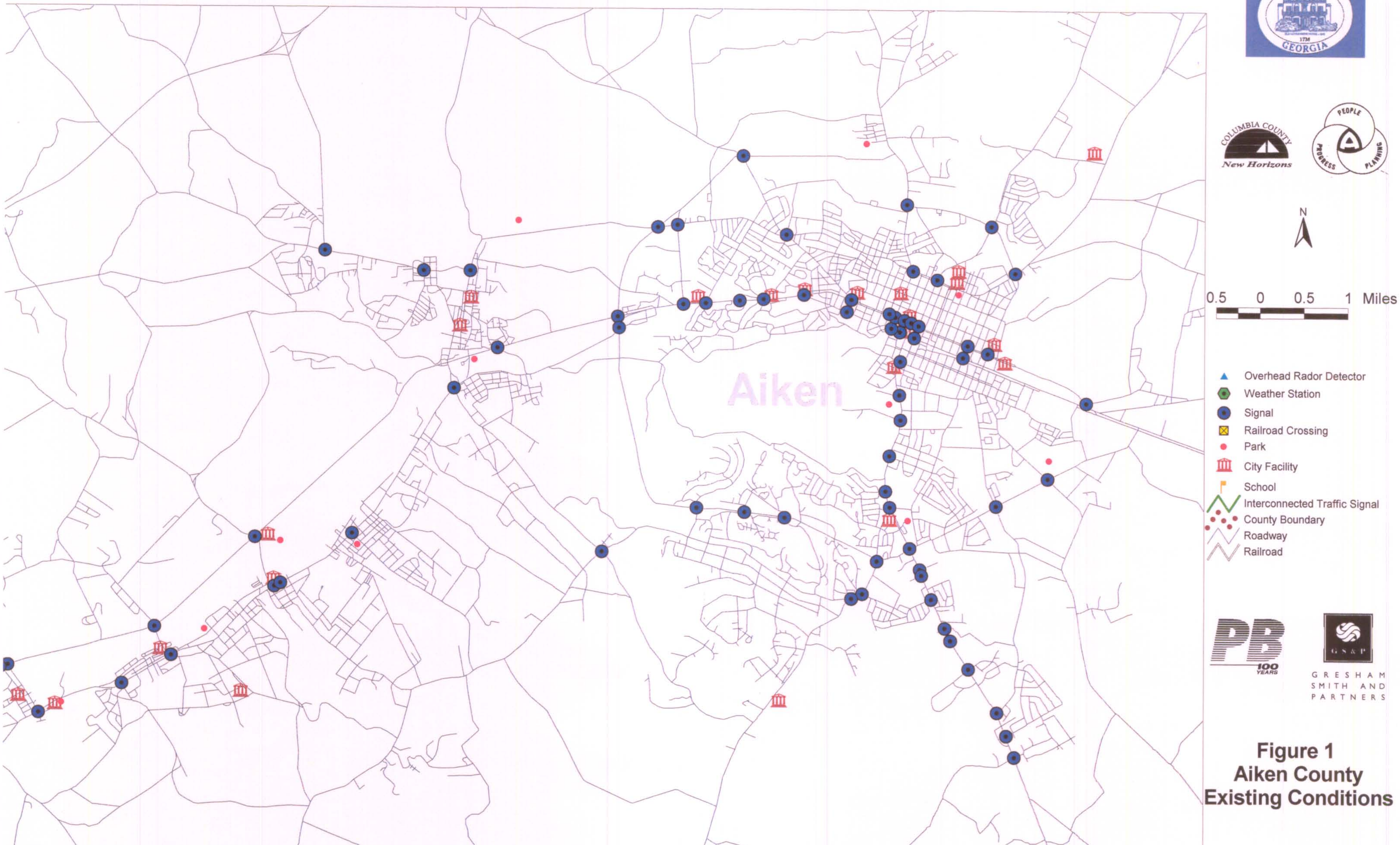


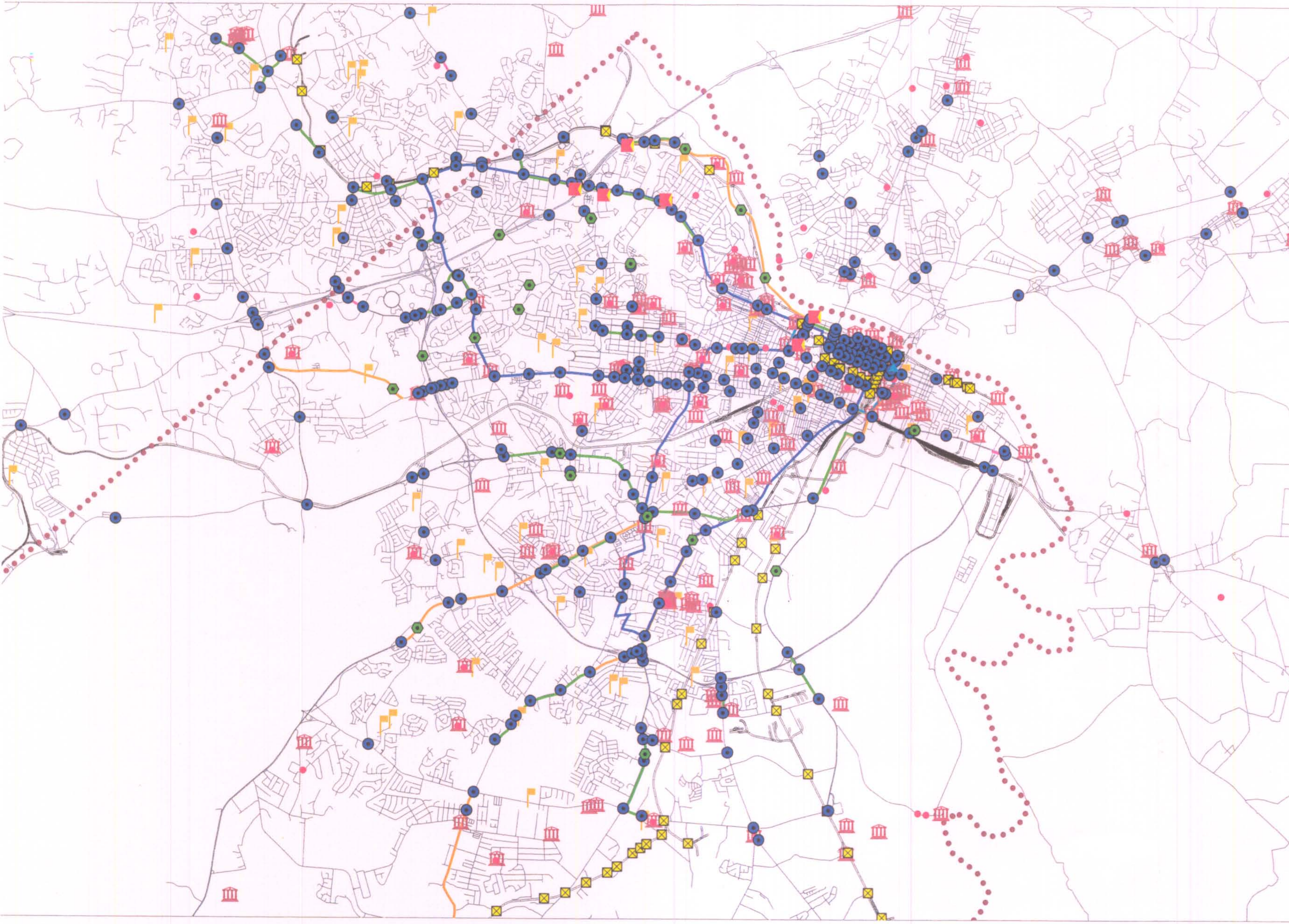
Figure 1
Aiken County
Existing Conditions

Augusta Transportation Management System

AUGUSTA GEORGIA

COLUMBIA COUNTY New Horizons

PEOPLE PROGRESS PLANNING



N

0.8 0 0.8 1.6 Miles

- Existing Video Camera
- Overhead Radar Detector
- Weather Station
- Signal
- Railroad Crossing
- Park
- City Facility
- School
- Interconnected Traffic Signal
- Existing Richmond Shared Fiber
- Proposed Richmond Extension
- Existing Richmond Fiber
- Programmed Richmond Fiber
- County Boundary
- Roadway
- Railroad

PB 100 YEARS

GRESHAM SMITH AND PARTNERS

Figure 2
Richmond and Columbia Counties Existing Condition

Figure 3: Planned locations for the surveillance cameras and dynamic message signs for GDOT's ITS Deployment Plan

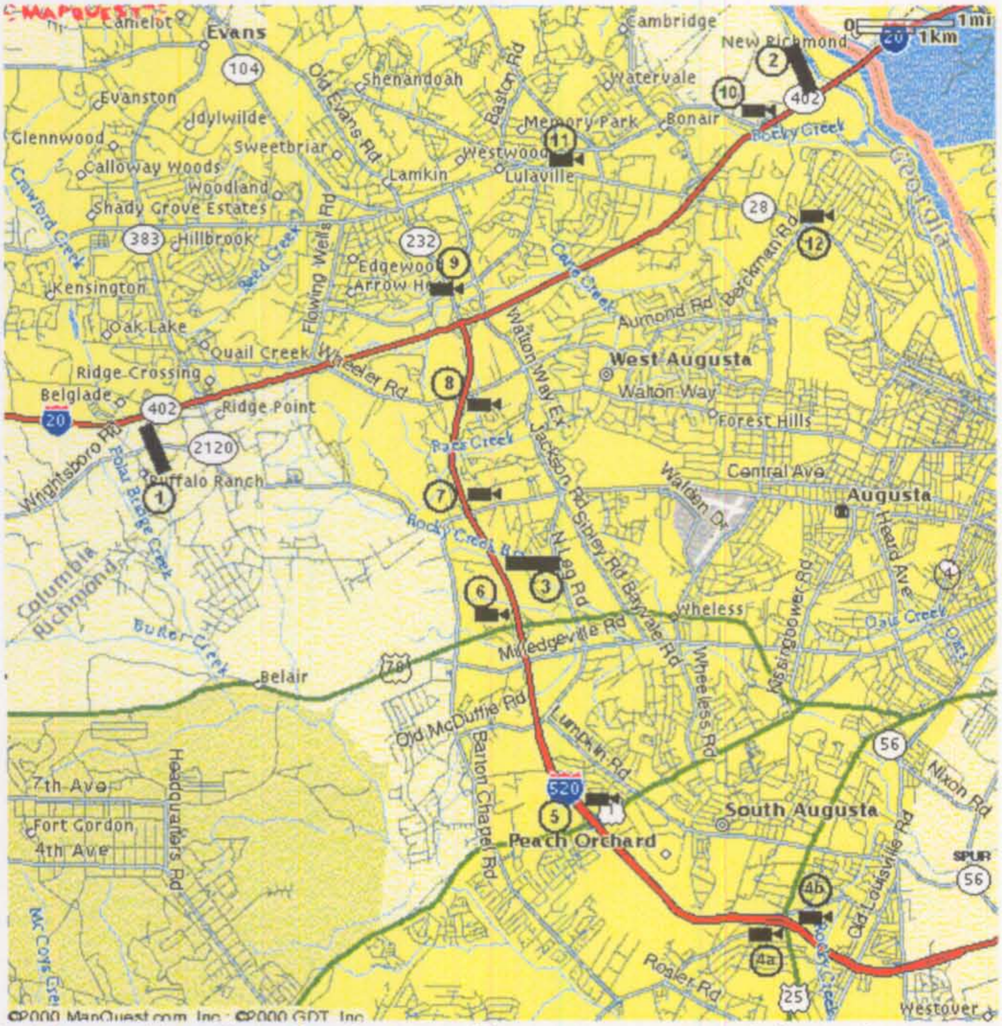


Table 1: Planned locations for the surveillance cameras and dynamic message signs for GDOT's ITS Deployment Plan

Device	Main Road	Cross Street	Location
DMS 1	I-20 EB	1 mi west of exit 194	over eastbound lanes
DMS 2	I-20 WB	1/2 mi east of rest area	over westbound lanes
DMS 3	I-520 NB	just south of Glenn Hill Drive	over northbound lanes
CCTV 4a	I-520 EB	Exit 7 (SR 121/Windsor Springs Rd)	southeast quadrant of Interchange
CCTV 4b	I-520 WB	Exit 7 (US 25/Peach Orchard Rd)	northeast quadrant of interchange
CCTV 5	I-520 NB	Exit 5 (US 1/SR 4/Deans Bridge Rd)	northeast quadrant of interchange
CCTV 6	I-520 SB	Exit 3 (SR 10/US 78/US 278/Gordon Hwy)	northwest quadrant of interchange
CCTV 7	I-520 NB	Exit 2 (CR 1501/Wrightsboro Rd)	northeast quadrant of interchange
CCTV 8	I-520 NB	Exit 1 (CR 601/Wheeler Rd)	southeast quadrant of interchange
CCTV 9	I-520 Ext/SR 232	Pleasant Home Rd	undetermined
CCTV 10	I-20 WB	Exit 200 (SR 104/Riverwatch Pkwy)	northeast quadrant of interchange
CCTV 11	SR 104 (Washington Rd)	Pleasant Home Rd	undetermined
CCTV 12	SR 28 (Washington Rd)	Berckmans Rd	undetermined

2.4 Miscellaneous Inventory Items

During the inventory process, several miscellaneous issues were discussed that are important to consider during the development of the ITS system.

Existing ITS Elements

Parking guidance signs exist on Broad Street, but are no longer operational. These signs should be evaluated to determine if they should be upgraded or removed completely.

Existing Communications

Several city and county agencies are currently using leased communications for communications with traffic control devices. If fiber is installed as part of future ITS projects, consideration should be given to eliminating these leases wherever possible. There are several existing construction projects along I-20 and I-520 where conduit is being installed for future use by the ITS system. Augusta-Richmond County has a shared resource agreement where they receive 4 to 6 fibers from each cable company as they place fiber optic cable around the city. This fiber should be used wherever possible when deploying ITS devices.

2.5 Existing Conditions - GIS Database

The current GIS inventory for the Augusta Regional Area includes the following items:

- railroad crossings
- parks
- city facilities
- schools
- interconnected traffic signals
- county boundaries
- roadways
- railroads
- video cameras

The GIS Database was modified to include additional items in another task of this project. Additional items recently included in the GIS inventory include:

- video cameras: proposed, and currently under design by GDOT
- proposed dynamic message signs and DMS under design by GDOT
- proposed overhead radar detectors
- proposed weather stations
- existing and future signals
- proposed SONET ring and extension
- proposed GDOT fiber
- programmed Richmond County fiber
- proposed ITS fiber
- communication network boundary

3.0 Concept Of Operations

The Concept of Operations (COO) identifies the who, what, where and how of integrated ITS deployment. It outlines which agencies will be involved in the deployment of ITS, what their roles and responsibilities in deploying and operating ITS are planned to be, and how the agencies will work together in an integrated manner to improve regional transportation operations.

3.1 Stakeholder Involvement

The concept of operations for the ATMS Master Plan is based on stakeholder input received during extensive stakeholder involvement process. Initial stakeholder meetings were held in September 2000. At these meetings, the capabilities of ITS technologies were presented and stakeholder input was received. Each workshop included an educational presentation on ITS, uses and benefits of ITS, and a visioning session to obtain the future direction for ITS in the Augusta region. A survey was developed that asked stakeholders to document the following:

- Existing traffic problems in their area
- Existing traffic control and control systems
- Planned traffic control systems
- Current communications networks
- Transportation roles and responsibilities
- Current roles and responsibilities in incident control and emergency response
- Future ITS needs

This survey was mailed along with an introductory cover letter to a representative(s) of each agency identified as a stakeholder by the steering committee. The list of stakeholders included the following agencies:

Georgia
- Augusta-Richmond County Planning Commission
- City of Augusta Traffic Engineering
- Georgia DOT
- Georgia Highway Patrol
- Augusta-Richmond County (Public Works, Police, Fire, EMS, 911)
- Augusta Public Transit
- Columbia County (Planning, Public Works, Police, Fire, EMS, 911)
- Fort Gordon
- North Augusta

South Carolina
- South Carolina DOT
- South Carolina Highway Patrol
- Aiken County (Planning & Development, Engineering, Sheriff, EMS, 911)
- City of Aiken

A second round of stakeholder activity was held in October 2000. Workshops were held to receive additional input, and to develop a regional vision for ITS. A preliminary description of the Augusta regional concept of operations was presented. This document was distributed to the participants and comments were obtained for incorporation into the final concept of operations, presented in this report.

A third stakeholder meeting was held in January 2001, and included a presentation of the final draft Concept of Operations, with an opportunity for stakeholder feedback.

3.2 Augusta Regional ITS Concept of Operations

The core ITS operating concept for the Augusta region is partnership. The three counties (Richmond, Columbia and Aiken) will partner with Georgia DOT and South Carolina DOT, and other local and state agencies, in an integrated, regional ITS deployment. This partnership is based on institutional cooperation, funding commitments, and the operation of two regional transportation control centers (TCC) with communications infrastructure for real time traffic information processing, dissemination and display. One center will be located in Aiken County, and another in either Richmond or Columbia Counties (most likely in Richmond County). Each center will be integrated with their respective statewide systems. The Georgia statewide center, based in Atlanta, is part of a statewide ITS network called Georgia Navigator. Local operations centers are connected together to create the statewide system via the statewide center. The Navigator system will continue to manage the Georgia portion of the regional freeway system, including the Interstate system freeways in Richmond and Columbia County. South Carolina DOT has not yet developed a statewide center, however, this concept assumes that any ITS deployment in Aiken can be linked directly to future ITS in other regions of the state. To complete the integrated connection, the two local centers will be directly connected. Another key concept is that the Augusta regional transportation management center, most likely in Richmond County, will be linked directly through real time communications to the Aiken regional traffic management center in Aiken County.

The vision of Richmond and Columbia Counties is to develop a transportation management center based on the operational concepts of the Georgia DOT Navigator system, creating an integrated ITS throughout the counties that links any participating traffic operations agency, emergency response agency and transit agency by real time communications and provides travelers with real time travel information. This link will enable real-time data sharing among operating partners and enable the development of a regional view of multimodal traffic conditions.

The Concept of Operations envisions an Augusta-Richmond County Traffic Operations Center (TOC) that manages the street network and enhances incident management within the county. This facility may share space with a center to be managed by Georgia DOT (GDOT) that operates the freeway system in both Richmond and Columbia Counties.

Aiken County envisions a similar system that is compatible with ITS deployments in South Carolina and linked to the Richmond County TCC. The Aiken County TCC may be shared with South Carolina DOT.

Both TCCs will share real time data and video with any emergency operations, local traffic operations center or transit center that is operated by local city agencies or other county government departments that so desires to participate. All participating agencies will share and disseminate appropriate data and video to the public through a variety of media. Figure 4 on the next page illustrates the proposed future regional ITS connections.

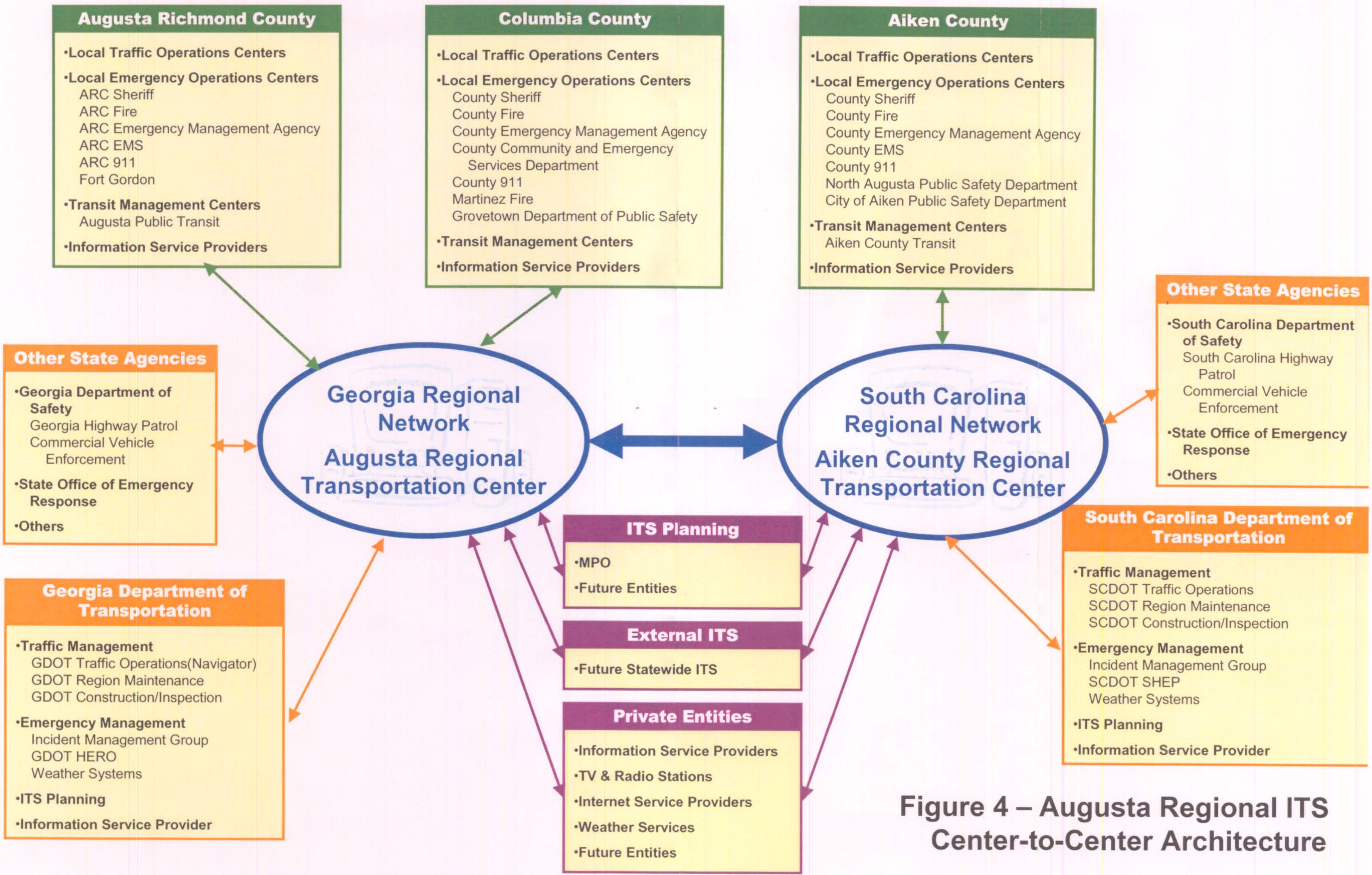


Figure 4 – Augusta Regional ITS Center-to-Center Architecture

The following sections include more detailed descriptions of each concept element.

Freeway Management Center

GDOT will operate and maintain the Augusta regional freeway management center through the Navigator program for freeways in Richmond and Columbia County. The responsibilities of GDOT include operating and maintaining the center, the central Navigator software and the freeway field devices.

Functions of the Navigator program currently include:

- Detection on freeways
- Surveillance on freeways
- Development and implementation of freeway control strategies
- Incident management
- Traffic data archive and data management/warehousing capabilities
- Traffic, incident and construction information dissemination capability, including VMS, HAR, Internet web site
- Real time communications to local TOCs and transit centers
- Real time communications to information service providers and media
- Real time communications to interactive traveler information network (kiosks and web site)
- Real time regional data sharing capability
- Dispatch for HERO vehicles
- Incident log for HERO operators
- Vehicle tracking for HERO vehicles
- Middleware that enables integration among all participating agencies (under development)
- ITS maintenance management and information tools
- Ramp metering

These functions will be part of the Augusta Regional Concept, except for ramp metering. Ramp metering is unlikely to be implemented in the Augusta region in the near future.

South Carolina DOT may implement a center with similar functionality in order to manage operations on I-20 in Aiken County and to coordinate with the dispatch for SHEP vehicles (freeway service patrol). Operations in the Georgia and South Carolina freeway management centers must coordinate operating plans and share information in real time.

Local Traffic Operations Centers

Augusta-Richmond County will operate a local traffic control center (TCC). The Augusta-Richmond County TCC will operate and maintain surface street signal control throughout the county and the cities within Richmond County. Coordination with the Augusta freeway management center and other TCCs will be conducted by real time surveillance and detection, data sharing, and sharing information on operating plans. The Augusta-Richmond County TCC may have all the management functions available in the freeway management center except for freeway control. The Augusta-Richmond County TCC will use GDOT specified hardware/software for communications with Navigator at the freeway management center. The Augusta-Richmond County TCC may choose to implement only a few of the functions listed below or they may delay the implementation of some functions until later phases. The Augusta-

Richmond County TCC and the GDOT freeway management center may be co-located and could be operated jointly through an operating agreement.

It is likely in the initial phase of ITS in the Augusta region that the Augusta-Richmond County TCC will also operate the traffic signal system and ITS field devices in Columbia County. The existing signals in Columbia County can be connected to Augusta-Richmond County through extensions along Washington Road, Furys Ferry Road, Davis Road and Bobby Jones Expressway. Columbia County may decide to develop a local TCC in the future or the county may want to explore co-locating a TCC with Augusta-Richmond County, which would be jointly operated through an operating agreement.

The City of Aiken will operate a TCC to control the traffic signal system and ITS field devices in Aiken. Aiken County and the City of North Augusta may also operate TCCs or they may share space and joint operations with the City of Aiken. The Aiken TCC and the SCDOT freeway management center may be co-located and could be operated jointly based on protocols established in an interagency operating agreement.

Operating agreements between GDOT, SCDOT and local agencies are required to specifically define agency roles. An operating agreement should include negotiations on capital and operating costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information. The Augusta-Richmond County TCC may be co-located with emergency operations centers (EOCs) or other centers in the future. Additional agreements between Augusta-Richmond County and other agencies within the County may also be needed.

Functions of the local TCCs may include:

- Traffic signal control
- Signal preemption for emergency vehicles
- Signal preemption for buses
- Automated enforcement of red light running
- Highway/rail intersection controls
- Real time communications to the TMC, other local TCCs, EOCs and transit centers
- Real time regional data sharing capability
- Incident management
- Road weather detection
- Parking management
- Traffic data archive capability
- Real time video display
- Real time video control (based on control hierarchy)
- Traffic, incident and construction information dissemination capability, including VMS, HAR, Internet web site
- Real time communications to information service providers, media and public facilities
- Operations of signals, signs and cameras under emergency evacuation procedures

Local Emergency Operations Centers

Local emergency operations centers (EOCs) will be operated and maintained by police, sheriffs, fire, 911, and Emergency Medical Services (EMS) departments in cities and the three counties. Real time communications and video are to be sent from the TCCs to the dispatch center for each participating agency and incident information is to be sent from the EOCs back to the TCCs. Local agencies will use compatible hardware/software for communications with TCCs and freeway management centers. Some EOCs may choose to implement only select functions listed below or they may delay the implementation of some functions until later phases.

Operating agreements are required to specifically define the role of each state and local agency. The operating agreement will include negotiations on capital and operating costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information. Some local jurisdictions may choose to co-locate the operations centers of several local agencies (i.e. police, fire and 911 dispatch). Some jurisdictions may also elect to co-locate a TCC and EOC. That jurisdiction will determine the participating agencies in any jurisdiction's center.

Agencies that have been identified as potential EOCs are

Georgia

- Georgia Highway Patrol
- Augusta-Richmond County Sheriff's Department
- Augusta-Richmond County Fire Department
- Augusta-Richmond County Emergency Management Agency
- Augusta-Richmond County EMS
- Augusta-Richmond County 911 (in Sheriff's Department)
- Columbia County Sheriff's Department
- Columbia County Fire Departments
  - Martinez Fire Department
- Columbia County Community and Emergency Services Department
  - Columbia County Emergency Management Agency
- Columbia County 911 (in Sheriff's Department)
- Grovetown Department of Public Safety (police and fire)
- Fort Gordon

South Carolina

- South Carolina Highway Patrol
- Aiken County Sheriff's Department
- Aiken County Emergency Management Agency
- Aiken County EMS
- Aiken County 911
- City of North Augusta Public Safety Department (police, fire, 911)
- City of Aiken Public Safety Department (police, fire, 911)

Functions of EOCs may include:

- Real time communications to the TMC, local TCC, other EOCs and transit centers
- Real time video display
- Real time video camera control (based on control hierarchy)
- Incident management
- Vehicle tracking for emergency vehicles
- Signal preemption for emergency vehicles

- Dispatch for emergency vehicles
- Dispatch for towing providers
- Coordination with other centers under emergency evacuation procedures

Transit Management Centers

Augusta Public Transit will operate and maintain the local transit management center in Richmond County. Aiken County Transit will operate and maintain the local transit management center in Aiken County. Transit agencies will use compatible hardware/software for communications with the freeway management centers and TCCs. Transit operating agreements are required to specifically define the role of the freeway management centers, the TCCs and the transit managers. The transit agencies may choose to implement only a few of the functions listed below or they may delay the implementation of some functions until later phases.

Operating agreements are required to specifically define the role of GDOT, SCDOT local TCCs and each local transit agency. The operating agreement will include negotiations on capital and operating costs, a commitment to provide sufficient staff and maintenance resources, hierarchy of system control and use of traffic and video data and information.

Functions may include:

- Transit vehicle tracking
- Fixed route operation and management
- Demand responsive operation and management
- Real time video display
- Real time video camera control (based on control hierarchy)
- Highway/rail intersection controls
- Automated transit passenger counting
- Transit fare management, including "smart cards"
- Transit maintenance and fleet management
- Transit security
- Traveler information dissemination
- Real time communications to the TMC, local TCCs and EOCs

Information Service Providers

An information service provider (ISP) is an entity that receives data and information from the traffic management, transit management and emergency management centers and distributes it to the traveling public. The information can be disseminated by wide area broadcast (radio or television) or through interactive services (telephone, pager, personal computer or kiosk). The service provider can be a public agency such as GDOT, Richmond County or a city. Private (for profit) companies can also acquire public data, add value and resell it to the public through subscriptions or by broadcast with advertising. The services to be provided include broadcast and interactive traveler services.

In Georgia (primarily the Atlanta area), GDOT, via the TMC in Atlanta, supplies basic traveler information to the GeorgiaNet web site, local agencies, the public, the media and private vendors through various communications media, such as VMS, HAR, kiosks and linked data communications. Local agencies, by agreement with GDOT, may also provide traffic and traveler information to the TMC for dissemination, directly to the public or to private vendors.

SCDOT has a statewide traveler information web site which displays traffic conditions in all of their counties except for Aiken County.

Private vendors may receive and add value to traveler information received from the freeway management, traffic management and transit centers. Information dissemination may be by a variety of means such as radio and television broadcast, telephone/cellular service, Internet and pager. Private vendors will use compatible hardware/software for communications with the TMC. The Counties may contract directly with a private ISP, by agreement with GDOT or SCDOT, in order to disseminate locally specific traveler information to the traveling public.

Jurisdictional Responsibilities

The major responsibilities for the implementation of the ITS program including design, construction, management, operations and maintenance will be shared among various participating agencies namely GDOT, SCDOT, the counties, cities within those counties and local transit agencies. Design, construction, operations, management, and maintenance on the Interstate highway system will be the prime responsibilities of GDOT, whereas operations, management, and maintenance (OM&M) on surface streets will be the prime responsibilities of the cities and counties. The transit agencies, including Augusta Public Transit and Aiken County Transit, will be responsible for design, construction, operations, management, and maintenance of transit facilities.

An Operations and Maintenance (O&M) Plan should be prepared by each operating agency. It will further delineate the responsibilities of each city and the counties for the expansion of the Augusta Regional ITS program. In general, each city and the county will maintain the devices, traffic signal control equipment, and communication components located on city and non-interstate right-of-way. GDOT or SCDOT will maintain the infrastructure that supports the electrical equipment and communications within the interstate right-of-way.

3.3 ITS Architecture

A regional ITS architecture was developed that illustrates the regional, integrated ITS in systems engineering terms. This ITS architecture satisfies consistency guidelines outlined in federal regulations for conformance with the ITS National Architecture. The Augusta Regional ITS Architecture is documented in Technical Memorandum 2 prepared for this project. The process began with stakeholder involvement that included all agencies responsible for traffic operations, transit operations and incident response in the region. The information collected included current roles and responsibilities, data collected, data desired but not available, data sharing capabilities and an ITS vision for each agency. The inventory of existing operations and systems was compiled and summarized for use in development of the ITS planning efforts.

Based on the information collected by the surveys, the inventory, the workshops and interviews, a regional concept of operations was developed and reviewed by the participating agencies. The concept of operations defined the elements and operating responsibilities of the regional ITS architecture. Both the vision and the concept of operations were presented to all stakeholders for review and comment before the document was submitted to ARTS.

The ITS Architecture report also details the method developed to ensure the inclusion of ITS in the regional transportation planning process and conformance with the proposed federal rules pertaining to ITS Architecture (further described in section 4 of this report).

3.4 ITS Architecture Consistency Rule

On January 8, 2001, the FWHA rule and FTA policy on ITS Architecture and Standards were published to implement section 5206(e) of the Transportation Equity Act for the 21st Century (TEA-21). The FTA and FHWA have different processes and procedures for project development. Therefore, the FHWA has issued a Regulation, and FTA has issued a Policy. The policy language in each document is consistent and will be carried out in a coordinated fashion, as applicable under FTA and FHWA project management and oversight procedures. This final rule/policy requires that ITS projects funded by the Highway Trust Fund and the Mass Transit Account conform to the National ITS Architecture, as well as to USDOT adopted ITS Standards.

The final rule/policy requires that:

- Regions currently implementing ITS projects must have a regional ITS architecture in place in four years. Regions not currently implementing ITS projects must develop a regional ITS architecture within four years from the date their first ITS project advances to final design.
- ITS projects funded by the Highway Trust Fund and the Mass Transit Account must conform to a regional ITS architecture.
- Major ITS projects should move forward based on a project level architecture that clearly reflects consistency with the National ITS architecture. A major ITS Project is any ITS project that impacts regional integration or national interoperability. In other words they are those ITS projects in a region which are critical to future integration and therefore must be developed within the framework of an architecture.
- Projects must use USDOT adopted ITS standards as appropriate. To date, the USDOT has not adopted any ITS standards, and a formal rulemaking process will precede any USDOT ITS standard adoption. The proposed rule does not require replacement of existing systems or equipment. Applicable ITS standards would be used as new features and system upgrades are planned with the use of the National ITS Architecture.
- Standards are mandated only when they become officially adopted by the USDOT; at this point the USDOT has not adopted any ITS standards. The USDOT encourages the use of applicable ITS standards prior to their official adoption, however, as appropriate.
- Compliance with the regional ITS architecture will be in accordance with USDOT oversight and Federal-aid procedures, similar to non-ITS projects.

The rule includes requirements for both the ITS planning stage, and the project implementation stage. This report focuses on the planning stage. Per the rule, the regional ITS plan and architecture shall include, at a minimum, the following:

1. A description of the region;
2. Identification of participating agencies and other stakeholders;
3. An operational concept that identifies the roles and responsibilities of participating agencies and stakeholders in the operation and implementation of the systems included in the regional ITS architecture;
4. Any agreements (existing or new) required for operations, including at a minimum those affecting ITS project interoperability, utilization of ITS related standards, and the operation of the projects identified in the regional ITS architecture;
5. System functional requirements;
6. Interface requirements and information exchanges with planned and existing systems and subsystems (for example, subsystems and architecture flows as defined in the National ITS Architecture);
7. Identification of ITS standards supporting regional and national interoperability;
8. The sequence of projects required for implementation; and,
9. The agencies and other stakeholders participating in the development of the regional ITS architecture shall develop and implement procedures and responsibilities for maintaining it, as needs evolve within the region.

This plan is consistent with the requirements of the ITS Architecture rule.

4.0 Integrating ITS Within The Transportation Planning Process

This section documents the processes and methods that the Augusta Regional Transportation Study (ARTS) can incorporate into their ongoing transportation planning process to ensure that ITS strategies and projects are considered as an integral part of the overall regional transportation plan, transportation improvement program, and operations activities.

4.1 Modifications to Planning Process

From an organizational standpoint, ARTS is comprised of three committees: the Policy Committee, the Technical Coordinating Committee, and the Citizens Advisory Committee. The current adopted responsibilities, composition, and operating framework of the ARTS three committee structure are included in Appendix B. The Policy Committee is comprised of local, state and federal appointed and elected officials, and is responsible for prioritizing projects and making final decisions on transportation planning and programming issues. The South Carolina Subcommittee serves in an advisory capacity to the Policy Committee, and is responsible for insuring that the South Carolina portion of ARTS is kept up-to-date. The South Carolina Subcommittee is comprised of local elected officials (voting members), and federal, state and local appointed personnel (non-voting members). The Technical Coordinating Committee reviews projects and activities from a technical standpoint. Transportation planners and engineers from federal, state and local levels comprise the Technical Coordinating Committee. The Citizens Advisory Committee reviews projects and activities from the perspective of the general public. All parts of the ARTS area are represented on the Citizens Advisory Committee.

Task forces, stakeholder groups, and subcommittees to the Technical Coordinating Committee provide additional planning support for specific transportation related issues. A group's membership, mission, and duration of existence is determined by the particular need it is fulfilling. These groups have provided planning support in areas such as bicycle and pedestrian planning, congestion management system planning, long-range plan development, and most recently this effort to develop an ITS Master Plan. Specifically, the support groups have been:

- Bikeway Plan Task Force – In 1993, ARTS established this task force as a subcommittee of the Technical Coordinating Committee that was comprised of planners and engineers from area local governments and several private citizens, including representatives from local bicycle advocacy groups. The group was involved in an inventory of existing road conditions, needs identification, an attitudinal survey, and bikeway planning. In 1994, after the Bikeway Plan was adopted, the task force was disbanded, but several citizen members then served on the Citizens Advisory Committee.

- Test Network Subcommittee – ARTS established this subcommittee to facilitate the model calibration and identification of transportation needs to support the development of the 2015 Long Range Transportation Plan (and later extensions to 2020 and 2025). The membership is comprised of representatives from Augusta-Richmond County, North Augusta, Aiken, Columbia County, Aiken County, Augusta Public Transit, Aiken County Transit, GADOT, SCDOT, and the Chairman of the Citizens Advisory Committee. The group provided guidance in developing and calibrating the base network, identifying roadway and access deficiencies, and recommending plan improvements for test networks.

- Congestion Management System Subcommittee – The Test Network Subcommittee also acts as the Congestion Management System (CMS) Subcommittee. The group's responsibilities included assistance in preparing and carrying out the CMS Work Plan. Acting in its dual capacity during the long-range plan development, the group also provided guidance in developing and recommending congestion management strategies for seriously congested corridors.

- ITS Stakeholder Group – A stakeholder involvement process was conducted in September and October 2000 that included surveys, briefings, and workshops to determine existing conditions, traffic control and management systems, and communications networks, as well as transportation roles and responsibilities, current plans and future needs regarding ITS. Potential stakeholders included City and County departments and agencies within the three Counties. The stakeholder involvement process was used to develop the Augusta Regional ITS Concept of Operations.

4.1.1 Rationale for an ARTS ITS Subcommittee

The ARTS has established an important precedent in forming groups to support the three primary transportation planning committees. These groups have made positive contributions to the process and its planning products. ITS presents a set of challenges not found in most other types of transportation improvement strategies. ITS has a heavy emphasis on operations, communications, and evolving technologies that many transportation planning agencies are not used to dealing with. In crossing modal, institutional and geographic boundaries, ITS presents significant coordination challenges. These are usually substantially more difficult than the technology issues. The coordination of individual ITS elements into a cohesive system and the integration of ITS into other transportation projects makes the total concept of ITS more complex. We recommend that ARTS establish a standing Intelligent Transportation Systems (ITS) Subcommittee to serve as the forum for ITS coordination and integration issues in the Augusta Region, as well as discussions on incorporation of ITS projects into the planning process. The responsibilities and organization of the subcommittee would be as follows:

- ✓ The Intelligent Transportation Systems (ITS) Subcommittee is the group responsible for identifying, defining, and coordinating potential ITS strategies and projects for evaluation and consideration by the Transportation Coordinating Committee.

- ✓ The ITS Subcommittee is comprised of ITS stakeholders from the ARTS area's local agencies and pertinent private entities, as well as representatives from Georgia and South Carolina Departments of Safety, Transportation, and Emergency Response.

- ✓ The ITS Subcommittee will elect a Chair who will be responsible for bringing ITS issues and proposals to the ARTS Transportation Coordinating Committee for consideration. Consideration of plan and Transportation Improvement Program (TIP) modifications will follow adopted ARTS procedures as described in Appendix B – ARTS Organization and Management.

- ✓ The ITS Subcommittee will at least meet quarterly; it is anticipated during updates of the long-range plan and annual updates of the TIP that the ITS Subcommittee may need to meet more often, and this schedule will be established in advance by the ARTS. The Subcommittee meetings will follow the requirements of the adopted ARTS Public Involvement Policy.

✓ The Augusta-Richmond County Planning Commission (ARCPC) in its role as the Metropolitan Planning Organization for ARTS will provide staff support to Subcommittee meetings. The Executive Director of the ARCPC serves as the ARTS Project Director. The technical staff support to the Subcommittee in terms of ITS project development, evaluation, and submission to the planning process will be carried out by the transportation operating agencies from the three counties (Richmond, Columbia, and Aiken) under the lead of the Augusta-Richmond County Traffic Engineer, and coordinated with the ARTS Project Director.

✓ At its discretion, the ITS Subcommittee may form subgroups to focus on specific issues. Potential subgroups could be formed such as:

- Transportation Management Operators
- Incident Management Operators
- Information Service Providers/Customers

✓ Maintain the regional ITS architecture, and check if ITS projects that are proposed are consistent with the regional ITS architecture.

5.0 Proposed TCC Staffing

The staffing needs for the TCC will depend on the number of hours the center will be staffed, and the functions that will be performed. The determination of the functions and hours is based on a management level commitment to operating the transportation network. That is, a commitment to ensuring the transportation network is performing optimally.

5.1 The Rationale for Operations and Management of the Transportation System

This section provides the rationale for a local/state government to provide staff and resources to actively operate and manage the transportation system in their jurisdiction. This justification for conducting operations assists decision-makers in allocating the funds necessary to support the additional staff described in the next section.

Operations and management of the transportation system implies that the operating agencies will utilize the existing facilities to the greatest extent. These operating agencies will be responsive to customer needs. They will also respond to incidents, events, and weather conditions in real time.

Performance Goals and Objectives

The foundation of every successful operations organization is a combination of many items, the most fundamental being the commitment and support that is established by senior management. It is senior management that sets the direction and goals for all of the ITS programs that an organization undertakes. During the course of developing an operations program, it is essential that management purposefully include ideas and concerns that may be important to the operations staff. As a result, the goals and objectives that are established are done so as a team effort. The commitment from senior management must extend beyond this process however, by providing operations staff with the tools and training that will allow them to accomplish the common goals.

Once the course has been set, it is key that the ITS program objectives be documented and made available to all staff. A convenient way to accomplish this is to include the operational objectives as part of the Mission Statement for the ITS unit. In that way, the entire organization can be focused on the same mission, goals and objectives without confusion. The ITS program goals should be revisited annually to ensure that the any changes in the operational program are reflected. In addition, qualitative or quantitative measures should be implemented to assess the program's degree of success. Some examples of this would be:

- Measurement criteria for Quality of Service (e.g., reductions is delay at signals, customer satisfaction, etc.)
- Measurement criteria for Incident Response times (e.g., time to confirm, time to response, time to clear, reductions in delay due to DMS messages, etc.)

As a result of setting the goals and objectives for the ITS operations organization, an organizational structure needs to be put in place to carry out the mission. In that regard, those agencies, or their consultant, must analyze their staff to determine if the appropriate skill sets available to achieve the agency's objectives. Also, the structure of the unit must be formally documented for the overall agency so as to communicate the structure to all personnel. If the appropriate number of staff is not available, the unit can establish mentoring programs to cultivate personnel with interest in the program or provide third party training to accelerate development. Outsourcing some of the responsibilities of the unit can also mitigate shortfalls in staff availability. For example, the mere number of devices and miles of operating systems can often overwhelm a small but knowledgeable field maintenance staff. When this situation occurs, many agencies across the country combat this problem by outsourcing field device maintenance. Existing knowledgeable maintenance staff can play an invaluable role, if this option is chosen, by providing their expertise in the development of the maintenance contract specifications, and by actively administering the contract. The knowledge and abilities accrued by this small but experienced staff will enhance the overall maintenance function of the unit when supplemented by contract personnel.

Planning and Evaluation

The ITS operations unit must plan for operations, and plan for measuring those operations.

For example, a basic principle for an operations unit is that it is can successfully respond to unplanned incidents (crashes, weather events and the like). This however, does not happen by chance. For the developing unit, it is imperative that a systematic approach to planning for operations be established. The planning approach can be based on scenario evaluation and exercises, functional evaluation or other form of systematical planning for the condition-response criteria. Once the appropriate methodology is in place, the process should be reviewed on an annual basis to fine-tune the approach as well as to adapt to changing external circumstances. The criteria for evaluating performance must also be planned. An often-overlooked part of the planning process of a unit is the need to plan for evaluating success. To do this, criteria need to be established that reflect changes in operational performance and efficiencies. Data to support the criteria can be collected by integrating the data collection into response activities. A measurement system should be established for each of the various responsibilities of the operations unit, so as to provide a means to evaluate the unit's success. A simple method to accomplish this would be to keep accurate and continuous records and logs to support the measurement process. This task can be made easier by employing computerization to automatically provide supportive documentation. With the data collection process in place, the operations unit can objectively evaluate the established processes on a regular basis, and further refine the measurement process as part of an annual re-evaluation.

Customer Focus

An important part of the operations and maintenance unit's operational impact depends a great deal on the extent to which the unit is perceived as a valuable asset to the agency. To support the agency, the operations unit needs to have a strong customer orientation. For the operations unit, the term "customer" relates to several distinct interactions; intra-agency, inter-agency and the general public.

At the intra-agency level it is important for the operations unit to be involved in many, if not all, of the agency's projects from the planning stage of project development. In this regard, requested operational requirements often inhibit efficiencies in construction scheduling and provide positive benefits to motorists by lessening the impact to the public. As an example, an operations unit request for surveillance devices to be included in construction projects often result in the agency being able to recognize and resolve problems quickly during various stages of construction. Other benefits may include the operations unit providing insight into known problem areas or unique traffic patterns within a project area. Overall, the inclusion of operational considerations early in the planning process of a project should be considered as an asset to the agency and not be overlooked.

A second type of customer orientation that the operations unit must be actively involved with is interaction with other operating agencies. Promoting a cooperative relationship with other regional agencies is needed so as to provide a unified regional approach to traffic management issues and concerns, and to maximize the benefit to the public. The level of effort to establish this relationship and to provide the needed resources when required may be substantial but also results in significant benefits to the unit as well as the region. Specific areas of integration and coordination are addressed in the following sections.

Interaction with the public is another area in which an operations unit needs to focus their resources. A positive public perception of an agency is supported when an operations unit is actively involved in public concerns related to the agency. Some examples of interacting with the public would be to:

- Provide customer focus groups and public meetings
- Conduct public surveys to solicit community concerns
- Evaluate project alternatives in terms of community impact
- Perform cost-benefit analysis in evaluating project alternatives

Regional Coordination and Integration

Once the operations unit has been established within the agency one of its most important functions will be to interact with operations units from other agencies as well as law enforcement agencies within the region. Because of the commonality of regional concerns as well as operational activities in general, regional coordination is fundamental and should be accomplished on a regularly scheduled basis. Some of the issues for discussion and coordination can include:

- Operational issues of common interest (i.e. staffing, maintenance, etc.)
- Sharing of personnel among agencies to experience various agency operational perspectives
- Asset and equipment sharing (communications facilities, equipment required for emergencies, etc.) to enhance regional operational efficiency
- Developing, scheduling and practicing coordinated interagency operations under controlled conditions
- Post-mortems, or review of coordinated operations following major events or incidents

One of the most important areas to be decided in the regional forum will be the determination of roles and responsibilities during incidents that affect multiple agencies or jurisdictions under various type of incident and non-incident conditions. To ensure completeness, the concept of operations should describe in sufficient detail any interaction that may occur between the agencies and organizations. Once these have been defined it is important that these roles and responsibilities are documented and shared by all the participating agencies so as to eliminate any confusion by staff. Furthermore, each agency should agree to execute a Regional Memorandum of Understanding that sanctions the decisions and affirms senior management's acceptance and support of the concept.

There are also other areas for discussion and coordination that the agency operations unit can resolve in the regional forum that can benefit both the agencies' themselves and the general public. Specifically, routine maintenance activities, and issues involving jurisdictional boundaries can be advanced in discussion groups or working sub-units to address issues such as:

- Fostering inter-agency reporting of equipment failures (e.g. signal failures, need for bulb replacement, sign damage, etc.) by personnel
- Coordinating signal system operations across jurisdictional boundaries including employing common signal cycle lengths for closely spaced intersections
- Providing consistency in guide signing installed across jurisdictional boundaries
- Coordinating speed limits across jurisdictional boundaries whenever possible
- Providing for both periodic and real-time information sharing with the other agencies (including traffic data, incident information, planning information, utility information, deployment of field unites, etc.)
- Providing direct telephone lines between agencies and relevant dispatch centers and traffic management centers of other agencies
- Participating in an integrated Internet display of regional traffic information
- Defining methods for sharing of critical information

Just as it is important for an agency to involve its operations unit early in the design or planning process of projects, so too is it important to share that knowledge base and possible opportunities with the other agencies in the region. Early identification of conflicting construction projects and eliminating duplicity of efforts and deployments of ITS within the region will better serve the region as well as indicate to the public that regional activities are coordinated and consistent with a regional plan. As such, it becomes increasingly important that the region operate within the adopted regional architecture by employing relevant information and technology standards.

Information, Knowledge and Data Collection and Storage Considerations

As the operations unit matures and a multiplicity of ITS devices are deployed there will be an increase in the amount of valuable data that the operations (and maintenance) unit and systems collect. The time to plan for the types of data to be collected and the means by which the data will be stored and retrieved should be addressed during the early stages of the operations unit development. It is beneficial to determine the types of data that will be collected, as well as the frequency of collection as soon as possible so that valuable data is not lost. As a guide, the data collection process should support the evaluation criteria for the operations program. For example, data could be collected to show traffic demand, travel time, queue lengths, accidents, incident response times and total time to clear incidents. Each data item will demand different frequencies of collection and need to be analyzed individually to determine an applicable time frame either by season, day of week, time of day, etc. It is recommended that the data be archived for at least five years so that the data can be analyzed to identify trends and to show improvement to traffic as a result of traffic operations changes.

Another important component of the data collection process is to collect data to support the maintenance functions of the unit. As an example, an agency could collect maintenance related data that substantiates device failure response times, repair times, inventories, device failure information, and the effectiveness of preventative maintenance efforts as a minimum. If at all possible, it is recommended that a computerized maintenance management/asset management system be put in place early in the development of the maintenance unit. This will ensure that valuable data is not lost and will assist the maintenance unit by alleviating some of the burden of the data collection process. The computerized system should be capable of recording data and substantiate the actions of the maintenance unit as follows:

- Collect data related to maintenance response times, maintenance frequencies and repair times
- Maintain an equipment inventory system
- Ensure that the system records the date of purchase, make, model and serial number of all equipment and software
- Ensure that the system records all failures, including the date and time of failure, any conditions potentially relating to the failure, date and time of repair, and the technician making the repair
- Ensure that the system provide information on mean time between failures for each type of equipment
- Perform causal analysis of failures when failure rates appear inappropriate
- Analyze maintenance practices to determine if changing maintenance practices can reduce failure rates
- Optionally, ensure that the system provide information on the mean time to repair for emergency calls
- Collect data to evaluate the effectiveness of preventive maintenance
- Optionally, ensure that the system can be used for dispatching service personnel, recording equipment reliability, and analyzing maintenance effectiveness

As part of the development of the data collection process, the operations and maintenance unit must specify a degree of detail of the data so as to be able to provide end users with information that will enhance their decision making process. Typically, the end users will be both management and line staff..

Although the data collection and analysis tasks appear to be onerous, their value cannot be overstated. The management of the operations and maintenance unit should promote performance analysis. The data can be used as a tool for evaluation, decision-making and justification for a number of functions as follows:

- Use the information to evaluate the goals of the strategic plan
- Use the information to support activities related to achievement of the strategic plan
- Use travel time information to support signal-timing activities
- Use the incident data for scheduling service patrols and/or to justify the need for additional patrols
- Use the maintenance data to develop preventative maintenance schedules

5.2 Operational Areas

After the significant amount of effort to develop the operations and maintenance program comes the benefit of actually addressing the issues and problems at hand. Depending on the amount of staff available, operations management may need to prioritize some of the activities that are core to the functional responsibilities of the operations and maintenance unit. In some of the areas, the newly developed unit may have sufficient operating expertise so that day-to-day issues can be dealt with expeditiously, while other areas will require extensive coordination, research and implementation. In either case, the following sections are presented as a guide of functional areas that the typical operations unit should assess relative to their mission.

Emergency Evacuation

Perhaps the most critical area for an operations unit to carry out is the analysis and recommendations to support emergency evacuation plans. Typically, this is a regional concern where the agency operations unit can provide assistance in developing the plans, analyzing roadway capacities and providing enhancements through the implementation of ITS devices. As a result of the evacuation plan, the operations unit should develop their own coordinated response plan to implement the functions that have been assumed by the agency. Interagency coordination is essential in this area and distinct agency operational plans will provide interagency staff with the guidance needed during emergency conditions. The following list is some of the areas where the agency operations unit can provide a positive impact on both the plan development and implementation:

- Participate in the development of written and accepted plans for managing roadways during evacuations
- Analyze the possibility of one-way operation for high capacity arterial and freeways
- Provide expertise in the evaluation of evacuation routes
- Provide inter-agency coordination support
- Develop signal timing plans along arterial roadways and at key intersections to enhance evacuation routes
- Evaluate the use of other traffic control devices for evacuation purposes
- For military bases in the vicinity (Fort Gordon and the Savannah River Plant), develop a plan for managing the roadway system to ensure the rapid movement of military resources from the base to the air/land/water terminals
- Provide for the rapid deployment of other ITS elements such as portable DMS or HAR stations
- Evaluate utilizing video feeds into the emergency management center

The South Carolina Emergency Management Agency has developed detailed plans for evacuation of the state's coastal areas. These plans include major evacuation routes through Aiken County and into Georgia.

Traffic Signal Operations

Traffic signal operational considerations and signal timing plans are one of the most noticeable operations elements to the motorist and thus are generally in the forefront of every operations unit. Keeping ahead of changing traffic patterns and new traffic generators should be a priority to an operations unit. Measures need to be put in place so as to mitigate traffic signal timing deficiencies and to keep up with the variations of traffic flow. In addition, particular attention should be focused on opportunities to implement signal systems along busy arterials as well as keeping high capacity individual intersection timings tuned for the best operation. Depending on the number of intersections within the operations unit scope, it may be advisable to have a signal/intersection survey team on staff to address the issue of signal operation and intersection design. This team can also address citizen complaints, provide follow-up calls to the citizens and provide an evaluation of improvements after they have been put into operation. The primary focus for operations regarding traffic signal operations will be to:

- Re-time intersections and signal systems every three years
- Use signal optimization software, simulation and field evaluation
- Coordinate signal timings across jurisdictional lines
- Develop a cross jurisdictional agreement (formally or informally) with neighboring areas regarding signal timing or responsibility
- Evaluate the re-timings after they are installed
- If adaptive control is used, review the parameters every three years
- Use traffic signal pre-emption or priority to accommodate the flow of transit vehicles
- Use traffic signal pre-emption or priority to accommodate the flow of emergency vehicles
- Coordinate signal timing with railroad crossings
- Consider the need for photo enforcement

Construction Management

Traffic impacts as a result of construction activity invariably require the input and recommendations from the agency operations unit. The operations staff must assess the construction activity relative to the location, hours of construction, length of time, number of work zones, area businesses or public facilities and even the time of year to fully determine the effects to the motorist. After the assessment is complete, construction traffic mitigation plans must be developed (depending on the nature of the construction activities) and implemented. Maintenance and protection of traffic plans will vary considerably depending on the type of roadway and should be considered integral to the agency construction permitting process. Some traffic mitigation techniques that can be employed are:

- Adjusting the hours of construction to avoid unacceptable vehicle delays
- Provide signal re-timing to compensate for operational changes resulting from construction
- Adjusting transit routes to minimize impacts of construction
- Planning detours for each construction activity, implement as planned, and provide follow-up monitoring
- Informing the public on how and when this will impact their travel
- Using incident management techniques to decrease the cumulative effect of an incident on traffic patterns already disrupted due to the work zone
- Partnering with law enforcement agencies to enforce the traffic control devices, including speed limits, in work zones

Incident Management

Day-to-day incident management will be a significant function of the operations unit and as such will require procedure development, intuitive judgment and in some cases the implementation of new policies to establish incident response plans. Incident management consists of three distinct "phases"; incident detection, incident verification and incident response. Operational procedures need to be developed based on the type and severity of the incident so that appropriate actions can be taken and resources can be dispatched to clear the incident and restore normal conditions. Partnerships must be developed the responding agencies; police, fire/rescue, EMS and 911 dispatch centers. The traffic management operations staff can also assist itself by developing signal timing plans for system intersections that would alleviate main street congestion during increases in traffic as a result of diverting traffic onto the arterial during an incident. Other measures to be considered are to develop "clear-the-road" policies during incidents, the use of service patrols during incidents and a defined policy and plan to use area tow truck services. Service patrols can play an important role in the identification and response to both recurring and non-recurring incidents. They can also be used routinely as reporters of congestion, and can even collect travel time data on both freeways and arterials.

Incident Response

An integral function of any traffic management center and operations unit is to ensure that appropriate responses to incidents (both planned and unplanned) are carried out effectively and efficiently. To accomplish this, the operations unit must develop and implement a 24-hour inter-agency incident response plan that adequately addresses a full range of possible types and severities of incidents. It is vital to the success of the organization that all staff embers are trained in their appropriate roles for each scenario and can carry out their function as planned. The unit must ensure that adequate wireless voice communications exists with all emergency service providers in the area as well as with neighboring jurisdictional authorities. If possible, operational systems should provide automated notification to emergency response personnel as well as senior management in the event that the incident has wide ranging ramifications that should be addressed by them. Once the in-house and emergency response personnel are notified of the incident, it is imperative that the public be notified by any and all means appropriate. All appropriate notification techniques such as HAR, public radio, web sites and employing DMS at strategic locations should be dispatched.

It is essential that the incident response plans be developed in conjunction and in partnership with regional "sister" agencies to achieve a coordinated plan. Thus, interagency coordination will become an all-important facet of developing and executing and incident response plan. As such, concerned agencies should develop interagency agreements for incident management. The groups should meet regularly to discuss regional traffic issues, develop integrated response plans and to review response plans soon after they are used. In addition, diversion routing should be coordinated on a regional basis depending on the magnitude of the incident. For example, evacuation plans that are the result of the planning for a disaster are regional in nature and must be coordinated and dealt with by a regional response plan.

As part of incident response, operations units must address the issue of clearing the incident and returning to normal operating conditions. The definition of the plan to clear incidents of various severities must define all of the responsibilities of each agency (in the case of an incident having regional impacts) and of the staff involved. In some cases, operations units may need to enlist heavy equipment and operators from within the agency to clear an incident. To accomplish this, the operations unit (or agency) should maintain a database of the location and availability of the equipment and emergency telephone numbers of the personnel expected to operate the equipment. As a measure of effectiveness, an operations unit can establish acceptable clearance times to establish a goal for the team as well as provide a means by which alterations in the plan can be evaluated.

Maintenance

The operations unit depends upon the information provided by the ITS systems deployed and as such must develop a plan to maintain the systems. There are two components to the systems: the field hardware and communications infrastructure and the equipment in the Traffic Management Center. In some cases it may be to the operations unit advantage to provide the maintenance for both however, depending on the complexity and sheer numbers of field devices, contract maintenance may be needed to fill the gaps in manpower or available skills. The management of the traffic operations unit must evaluate both to develop a maintenance plan that will adequate service the needs of the unit and provide the levels of service that it requires to function as mandated by the agency. The following paragraphs address some of the issues that should be included as part of that evaluation and other suggestions intended to provide a direction for the development of a maintenance plan.

Perhaps one of the most critical areas that need to be addressed in the development and execution of an operations maintenance plan is the need to obtain and maintain documentation. Without proper documentation, efficient maintenance cannot be achieved and in the worse case cannot be accomplished at all or at a significantly increased cost. An inventory of devices should include references to supporting documentation and specifics such as firmware revision numbers and any peculiarities that may be known. This database of information must be in itself meticulously maintained so as to assure accuracy. The operations unit should consider creating a library of such documentation consisting of user manuals, maintenance manuals, communications network documentation including leased circuit identification information, software revisions and original installation media and documentation associated with configuration management objectives.

As a daily activity, operational procedures should include a "health-check" of all major ITS elements such as DMS, CCTV. HAR, communications channel verification, etc. This process serves a dual purpose in that the operations staff will know which equipment is available for their use as well as a first step in notifying maintenance staff that there is a potential problem. This is not meant to mean that each vehicle detector should be manually checked. In that case, failure reports that are automatically generated by central software should be reviewed by appropriate personnel and action initiated to resolve the problem. The failure report documentation will further serve to identify failure prone pieces of equipment and form a basis for the development of a preventative maintenance plan.

Realizing that no device or system installation will operate indefinitely, operations management needs to budget and provide a funding source for the purchase of spare equipment. Failure reports can be used as justification of the amounts of equipments needed and replacement costs can be budgeted. Care must be exercised in developing these budgets so as not to extend the useful life of the equipment beyond a reasonable amount of service life.

Beyond the traditional areas of maintenance of devices and field equipment there now are issues relative to the operation of the systems and devices from the traffic management center. Failures related to these systems tend to be more catastrophic in that if a central server fails, the entire system or a large part of the overall system is rendered inoperative. To combat this problem, several steps should be taken to minimize the overall impact of computer failures:

- Develop a disaster recovery plan to mitigate hardware and software failures
- Ensure that system hardware components, especially the hard disks, are hot swappable
- Create disk images of critical hard disks, especially servers
- Keep unrelated software packages off workstations.
- Maintain a log on each computer as to any software revisions installed, remake an image if necessary
- Record all IP addresses in a secure location
- Record or maintain configuration files for all routers and switches
- Record any setup strings for critical modems
- Keep a paper log of telephone numbers for dial-up devices
- Provide uninterruptible power supplies for all key servers and workstations

- Provide generator power for as many systems (preferably the entire operations center) as possible with automated cut-over
- Keep multiple copies of protocol data for devices and/or software in the operations center as well as an off-site location

If the agency's IT department is overwhelmed with other priorities, it may also be helpful to have an on-call computer service contract with an outside vendor.

In general, most system software used in ITS systems will be provided with installation disks and system start-up documentation. It is important that these documents and materials, as well as all other important documentation, be kept in a safe place with another copy kept offsite. The importance of documentation cannot be overemphasized and maintaining that documentation with upgrades and revisions will greatly assist the operations unit in the event of a disaster and provide for a smooth transition path to future upgrades.

In consideration of all of the above, it may be advantageous to the operations unit to assign all of the system related responsibilities to a System Administrator. This role would assume other scheduled system maintenance functions such as archiving data, ensuring that computer log files don't grow to unacceptable sizes, interfacing with maintenance vendors or other on-call service providers etc. The creation of this position depends to a great extent, on the number of systems deployed and related field devices to be maintained.

5.3 Proposed Staffing

The number of persons required to perform the day-to-day functions of the operations unit will depend on the number of hours of operation that the agency decides to provide operational services. It also depends on the number of devices, miles of roadways to be monitored, the existence and number of service patrols, etc. In the operations center itself, as a minimum, there should be at least two operators and one shift supervisor. This number will need to grow depending on the full extent of the operations unit's responsibility and if the number of hours that the operations center is manned increases. If in-house maintenance is provided there should be at least one full time technician available. This requirement also depends on the number of devices, age of the systems, geographic locations etc. In relatively small or limited systems, the technician can also assume the role of System Administrator.

Whatever size the operations unit grows to, it is vitally important that the staff is initially assigned their duties in accordance with their skills. This is especially true when considering the person who will be assigned to the role of System Administrator and Shift Supervisor. These key positions will be on the front line of each day's activities and will be making spontaneous critical decisions that can impact many motorists. It is also very important to provide training to these key personnel and to their subordinates to nurture their development. Much of the activities associated with operating the systems can be achieved by on the job training. However, maintenance and system administration will require specific skill sets that are not readily available together in the marketplace. Traditionally, the skills needed to maintain most networked software can be filled by the IT department of the agency. ITS software and systems are unique however, and requires knowledge of protocols as well as real time communications. Although experienced electrical contractors and systems developers/integrators have these types of individuals on staff, it is unlikely that a public agency would be able to hire them in today's competitive job market. Therefore, in-house development of potential candidates for these positions should seriously be considered and appropriate training be offered where skills may be lacking.

The Augusta Regional Transportation Management Center (RTMC) will provide coordination among agencies and control technologies to better manage the transportation system in the Augusta region. Potential partners or possible joint facilities include:

- Augusta-Richmond County Public Works (Traffic Engineering Division)
- Augusta-Richmond County 911 dispatch, coordinating with police, fire, EMS
- Columbia County Public Works
- Columbia County 911 dispatch
- Georgia DOT
- City of North Augusta

Other possible partners or communication links may include the following agencies in South Carolina:

- Aiken County Public Works
- Aiken County 911 dispatch
- City of Aiken Public Works
- South Carolina DOT

The TCC for the Augusta region will be constructed over a 20-year period with the first phase to be operational in 3-years. The TCC will require 5,000 to 10,000 square feet of space, depending on the number of agencies housed in the center. Additional space is required if other staff and activities are housed in the same building.

System Operations

Initial operating hours are expected to be 6:00 am to 7:00 pm on business days (normally 5 days per week). The TCC should operate in two shifts, 6:00 am – 3:00 pm and 10:00 am – 7:00 pm. The operating hours and number of devices (for the 20-year build out) indicate the following operations staff is needed:

- One TCC Manager – responsible for staff management, liaison with other agencies, shift manager during prime operating hours, system administration for computer system.

- One Shift Supervisor – responsible for staff management during hours when the TCC manager is off duty.

- Two full time operators, one per shift

- Two part time operators, available to fill in for full time operators when sick or on vacation and when the operators are busy. Part time operators may be City technicians already on staff or part time students/off-duty firemen, etc. It is assumed that part time operators work 50% of the time.

The total staff needed for the TCC includes four full time and two part time employees. Additional operations staff will be needed when the operating hours are extended in the future.

System Maintenance

The number of devices for the 20-year build out indicates the following maintenance staff will be needed:.

- One Maintenance Supervisor – responsible for maintenance staff management
- Three Field Maintenance Staff

The initial phase may require only one field maintenance staff person. The other positions may be filled as devices are added to the system. The total staff needed for system maintenance includes four full time employees.

Anticipated Costs

Table 2 shows the anticipated costs of operating and maintaining the TCC on an annual basis. Initial costs will be somewhat less for maintenance depending on the number of devices in the field. Staff benefits costs are assumed to be 25% of salary costs.

Table 2: Estimated Annual Operations and Maintenance Costs for the Augusta TCC

Position	Salary	Benefits	Total Cost
Operations			
TCC Manager (1)	$45,000	$11,250	$56,250
Shift Supervisor (1)	$35,000	$8,750	$43,750
Operators – full time (2)	$20,000 each	$5,000 each	$50,000
Operators – part time (2)	$10,000 each	$2,500 each	$25,000
Total Operations Staff			**$175,000**
Maintenance			
Maintenance Supervisor (1)	$30,000	$7,500	$37,500
Field maintenance (3)	$22,000 each	$5,500 each	$82,500
Total Maintenance Staff			$120,000
Total Operations and Maintenance Staff			**$295,000**
Additional Costs			
Fiber optic cable maintenance contract			$60,000
Spare parts inventory			$60,000
Building utility and maintenance			
Total Operations and Maintenance			**$415,000**

6.0 TCC Location Analysis

The location and design of the Regional Transportation Control Center (TCC) is very important, since the center serves as the focal point for the ITS program and may serve other regional functions as well. The center will serve as a data collection point where all transportation data from the ITS system is collected and processed. The operators of the control center will use the information collected at the center to monitor the real-time operations of the roadway and initiate the control strategies necessary to improve the operations and safety of the transportation system. The center can also serve as the site where all involved agencies (within and outside the department) can coordinate their responses to various traffic situations and incidents. The dissemination of traffic flow information to the media and motoring public will also typically originate from this center.

A transportation control center ultimately serves a critical role in the successful operation of an ITS system and in providing coordination with other transportation control agencies. It is essential that the center be designed such that it provides an optimum environment for the operators to control and manage the functional elements of the system. It is also essential that the center be physically located so that it provides for the most effective and efficient overall operations coordination for the specific region in which it's located.

6.1 Location Criteria And Analysis

There are a number of major factors and issues that are necessary to consider in the planning and design of a transportation control center, including:

- Setting clearly identifiable goals for what systems and functions will be managed from the center (both short and long range)
- Identifying the other agencies that may have additional functions located in the center, defining functional needs and data flow requirements for center operations
- Identifying the likely operating characteristics of the center (number of personnel, hours of operation, etc.)
- Sizing the facility to meet equipment, personnel and other function needs
- Determining the center's optimal location based on economics, access, interaction with other agencies, and availability to the public and media (if desired)

Determining the best location for a transportation control center requires a preliminary analysis or understanding of all of these factors.

6.2 Purpose and Role of the Augusta Regional TCC

The functions of a TCC can vary depending upon the goals and philosophies for the ITS system. This task incorporates the goals and expectations of the operating agency into the major roles/functions of the proposed transportation control center.

Applicable questions/issues that were considered during this task included:

- Will the center be a complete regional transportation center, or just a regional "arterial" traffic center?
- What functions does the operating agency want to be carried out in the center (e.g., traffic control, incident control, dispatching, etc.)?
- Will the center serve as a public relations tool?
- Will the center be operated for Special Events? Inclement Weather?

Based on the information available at this time, the Augusta Regional Transportation Control Center will focus primarily on the operation and control of the arterial system within the Augusta region. GDOT will likely also have personnel in the building who will manage the freeway system. The overall purpose of the TCC will be to provide coordination among agencies and control technologies to better manage the transportation system in the Augusta region.

It is anticipated that the TCC will serve the following roles:

- Location for coordinating and implementing traffic management and incident management strategies and control.
- Location for distributing traffic and travel information to travelers, the public and the media.
- Location for coordinating the maintenance and repair of malfunctioning or damaged ITS field equipment, and for testing of ITS field devices.
- Location for coordinating the response to minor transportation incidents and providing support to emergency response agencies on major incidents impacting the street system.
- Location for providing support to special events coordination.
- Location to coordinate scheduling of all roadway work.
- Location for monitoring and coordinating with other traffic control centers, emergency management centers, and transit operation centers.
- Location for providing media and the general public access to view the operations of the ITS system.

It is important to note that the center will *not* function as the regional command post or dispatching center for coordinating the response to major emergencies or special events. The Georgia Emergency Management Agency (GEMA) currently conducts the role of a regional emergency management command post; this role will continue for GEMA. The TCC will provide support to GEMA during major emergencies and special events while continuing to manage traffic throughout the Augusta region.

6.3 Agency Involvement in the Augusta TCC

Once the roles for the center have been established, the next question that must be addressed in the initial planning stages is who needs to be located in the control center, either full-time or temporarily. One major factor affecting these decisions is whether the center will be operated by a single agency or by several agencies through a joint operation.

The following agencies were considered as *potential* partners for a possible joint use facility:

- Augusta-Richmond County Public Works Department, Traffic Engineering Division (ARCPW)
- Augusta-Richmond County 911 Dispatch
- Columbia County Public Works
- Columbia County 911 Dispatch
- Georgia Department of Transportation (GDOT)

After various discussions, it was determined that the TCC would be operated and maintained by ARCPW, with additional staffing provided by GDOT. Additional space will be provided for GDOT and shared-used space will be provided for other agencies that may wish to use the system on a temporary basis.

6.4 Goals and Objectives of the Augusta TCC

The design of the TCC and freeway management systems and software should accomplish the following goals:

- **Maximize Roadway Capacity -** This will be accomplished by distributing the traffic load over time and space to control congestion and other delays.
- **Minimize Impact of Roadway Incidents** - This ITS system will accomplish this in two ways:
  1. Reducing incident probability (accidents, stalls, debris) by providing the public with traffic conditions, weather, and road surface reports.
  2. Reducing the travel delay associated with incidents that do occur.
- **Assist in Providing Emergency Services -** The TCC will assist in providing emergency services by incident detection and verification, incident notification, coordination of multiple responses, and modification of other elements of the ITS system to improve emergency response. This may include emergencies near the roadway (e.g. structural fires) as well as on the roadway.
- **Contribute to the Regulation of Demand** - Maintenance activities and major incidents may temporarily reduce the capacity of roadway segments. Special events may generate traffic levels that greatly exceed normal roadway capacity. The TCC may reduce the resulting congestion and travel delay by influencing demand. Using the

numerous available information channels, the TCC can encourage drivers to re-route trips, reschedule trips, or use alternate modes of transportation.

- **Provide Real-Time Travel Information to the Public** – This may be accomplished through the use of Dynamic Message Signs, the Internet, Highway Advisory Radio, and other information service providers.

- **Create and Maintain Public Confidence** - Underlying all of these objectives is the unavoidable need to maintain public confidence in the transportation control system and to establish a high level of credibility in terms of the information provided. The TCC must be viewed by the public as a source of accurate and usable information. System errors that produce incorrect or untimely information lead to a lack of credibility.

6.5 Functional Requirements of the Augusta RTCC

After establishing the goals and objectives, the functional requirements of the center were defined. Functions are identified and constructed as broad statements of work to be performed by the system as a whole in order to meet its mission objective(s). The function list should include the operations and activities required to meet these objectives. The following were identified in the Augusta Regional Concept of Operations as the desired functions for the Augusta RTCC.

- Traffic signal control
- Signal preemption for emergency vehicles
- Signal preemption for buses
- Automated enforcement of red light running
- Highway/rail intersection monitoring
- Real time communications to the Transportation Management Center in Atlanta (TMC), other TCCs, GEMA and transit centers
- Real time regional data sharing capability
- Incident management
- Road weather detection
- Parking management
- Traffic data archive capability
- Real time video display
- Real time video control (based on control hierarchy)
- Traffic, incident and construction information dissemination capability, including DMS, HAR, Internet web site
- Real time communications to information service providers, media and public facilities
- Operations of signals, signs and cameras under emergency evacuation procedures

It is assumed that the Augusta-Richmond County IT Department and GDOT will assist in fiber optic cable maintenance and computer/software maintenance. Based on the functions to be performed and the estimated staffing requirements, Table 3 shows a breakdown of the minimum recommended space requirements for the Augusta TCC.

Table 3: Augusta TCC Minimum Functional Space Requirements

Room	Space Requirements (s.f.)	Comments
Operations		
Video Display	60	4 large screen monitors
TCC Operator Stations	180	3 operator stations
GDOT Operator Stations	180	3 operator stations
Shared-use Station	60	1 operator station
HERO Dispatch Stations	120	2 operator stations
Files	100	Flat/vertical files, bookshelves
Miscellaneous	100	
Circulation	500	Hallways, viewing space, etc.
Subtotal	**1300**	
Equipment/Communications		
Communication Racks	450	Assume 10 racks
Other	150	UPS, misc. equip., circulation
Subtotal	**600**	
Offices		
TCC Operations Staff	504	3 offices @ 12' x 14' each
System Maintenance Staff	336	2 offices @ 12' x 14' each
Expansion Offices	336	2 offices @ 12' x 14' each
Subtotal	**1176**	
Other Areas		
Dual-use Conference/Media Room	800	20' x 40' with sliding wall, use as large meeting/ presentation room or as 2 separate conference rooms
Maintenance Room	475	Workbenches, shelving, etc.
Production Area	180	Copier, printer, fax, table, etc.
Reception Area	500	Receptionist desk, waiting area, chairs
Breakroom	180	Kitchen w/4-6 chairs
Restrooms	400	Handicap accessible
Storage/Closets	250	
Hallways/Circulation/Misc.	500	
Electrical/HVAC	120	
TOTAL FUNCTIONAL SPACE:	**6500**	

These space requirements are minimum desirable requirements based on the anticipated roles, functions and agency involvement described previously. The actual size of the future building will likely vary based on available funding, changes to the expected functions for the building or possible co-location within another building. For the purpose of the remainder of this report, it is assumed that this will be a stand-alone building. These size requirements will be used to evaluate potential sites for the building, develop a conceptual layout, and to estimate the preliminary costs.

6.6 Candidate Locations for the Augusta TCC

The search for the most appropriate location for the Augusta TCC began with general discussions regarding the various possible locations. The options discussed included using either an existing building or constructing a new building on city or county owned property.

The available city or county owned property for constructing a new TCC was evaluated and discussed. Initially, these discussions revealed that the prime location was land located on the north side of Wrightsboro Road north of Daniel Field. Later discussions indicated that the TCC would likely be included in a new Public Works Department campus to be developed in an abandoned city park (Bayvale Park) on Milledgeville Road adjacent to Bobby Jones Expressway (I-520). This location was a beneficial and cost-effective location based on the following:

- Property ownership and development costs (already owned by Augusta-Richmond County)
- Centralized location within the County
- Proximity to proposed communications network
- Access to regional roadway network
- Sufficient space to accommodate needs

The remainder of this report will assume the new TCC building will be constructed at this site; however, if future decisions are made to locate the building elsewhere, the same criteria and recommendations will still apply.

7.0 Preliminary Design Of TCC

This section details the recommendation of a facility layout for the future Augusta Regional Transportation Control Center. It is assumed that a new building will be erected to house this new facility. The proposed layout is exhibited and descriptions of each necessary room and/or area are provided.

It should be noted that the recommendations made hereafter are based on today's state-of-the-art and state-of-the-practice. Technological and other advancements that may occur in the next two years, the timeframe of the building construction, should be considered within the final design of the TCC facility. This is especially true for workstation/computer and video wall equipment, which should be purchased as late in the implementation as possible.

7.1 Recommended Layout Of TCC

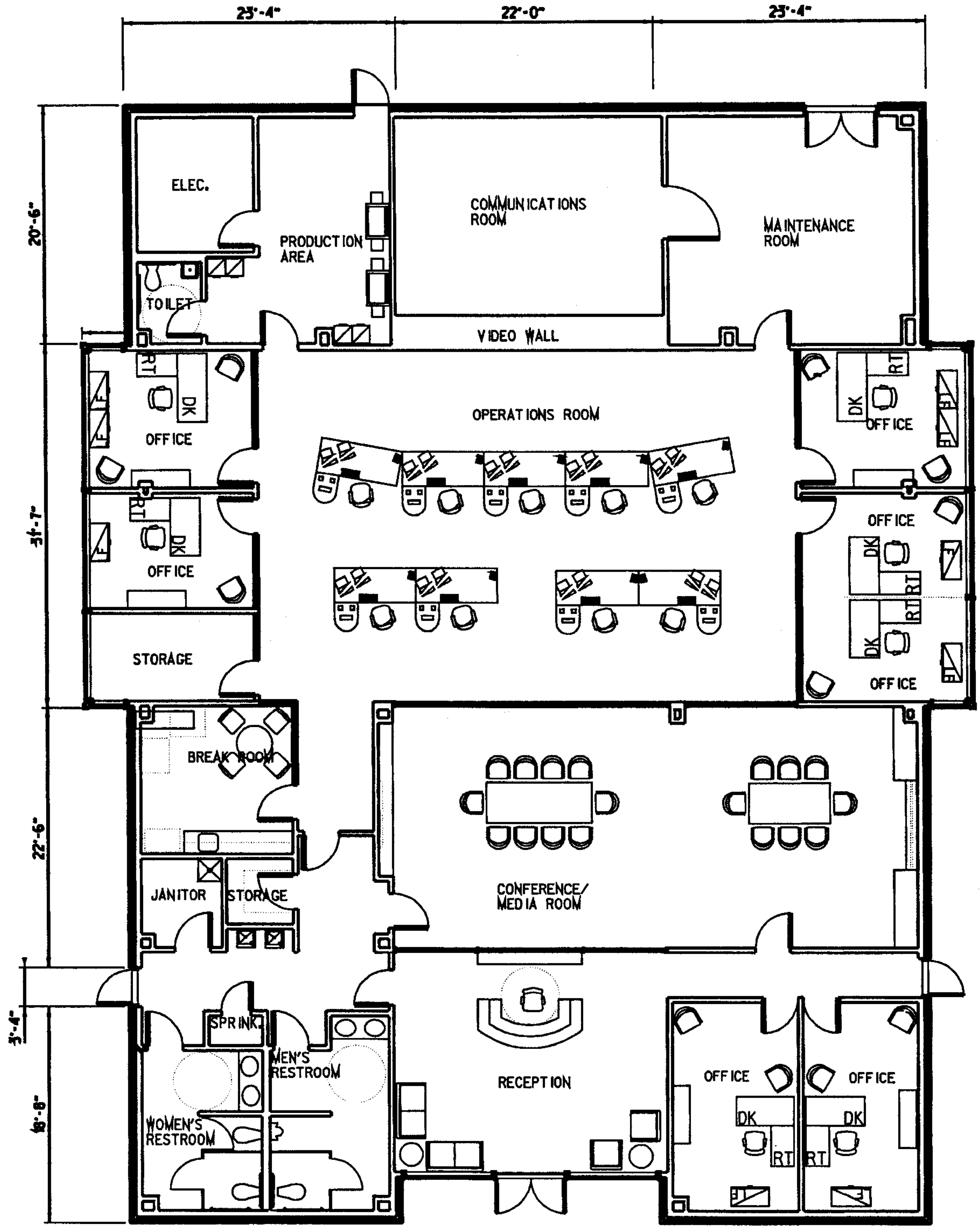
Each Transportation Control Center (TCC) has certain unique requirements, but also many items that are common among TCCs. Space planning and physical requirements common to most TCCs include the actual Operations Room, a video wall, a Communications Room, and some type of visitor's viewing area.

The overall process began with data collection and interviews. This collection effort resulted in the functional requirements and space requirements as outlined in the previous section. Several possible layouts were considered based on these requirements. After considering the possible alternatives, the resulting recommended layout is presented in this section. This layout is exhibited in Figure 5.

The following major areas/offices are included in the layout.

- Operations Room
- Video Wall
- Communications Room
- Maintenance Room
- Conference Room
- Media Area
- Reception Room/Entry Area
- Offices
- Other facilities (kitchen, restrooms, etc.)

Each of the proposed areas is explained in further detail in the following paragraphs.



AUGUSTA REGIONAL TRANSPORTATION CONTROL CENTER - SCHEMATIC LAYOUT

0 5' 10' 15'

APPROXIMATELY 6,500 SQUARE FEET

Figure 5: Proposed Layout of the Augusta Regional TCC

7.2 Operations Room

The operations room will be the focal point of the facility. The main departments operating in the RTCC are Traffic Operations and HERO Dispatching. Initially (13 hours for 5 days), a minimum of two operators, one shift supervisor and one HERO dispatcher will be staffing the operations room during each shift. However, the room is sized to allow expansion up to nine operators, including two workstations being dedicated to "shared operations", two HERO dispatch workstations and five operator workstations. Shared operations means that depending on the situation, different agencies/departments such as emergency/fire/police or local agencies could use a workstation.

7.3 Video Wall

This subsection describes the location, requirements, and considerations associated with the video wall.

Video Wall Position

From a functional standpoint, the ideal location of the video wall would be where everyone in the TCC can see it. The next best possible solution would be for the video wall to be readily seen by the operators, dispatchers, the conference room, the media area and the other offices on both of the floors. Finally, another, but less desirable solution would be for the video wall to be seen by the operators, dispatchers and the supervisor only.

Furthermore, from a public relations standpoint, the best solution would be for the video wall to be readily seen by anyone who enters the Conference Room and/or the Media Area. Those rooms and areas would need to provide sufficient room for the media to be located in front of the video wall.

The proposed layout will accommodate the ideal solutions with the exception of certain offices on the first and second floor as well as the equipment and maintenance rooms, the latter ones could be considered not having a need to view the video wall.

Projection Technologies

The development of detailed requirements for the video wall should be done when the RFP for the TCC is being developed. Currently, the technologies for flat screen displays are advancing rapidly, but the associated prices are still quite high. However, the prices are expected to decrease dramatically in the next couple of years. Other technologies that are currently used in TCCs include rear and front projection screens, vertically positioned projection screens that project images via mirrors, and "projection cubes".

At the time of RFP development, the available technologies and the associated prices should be revisited and a final recommendation should be prepared.

Current technology favors projection cubes with a diameter of 50-60 inches and a resolution of at least 800 x 600 pixels (depending on the projection technology). The approximate cost per cube is about $25,000 for a 50" cube. Additional necessary equipment are the video wall controller including software and any cards fulfilling special desired functions. The wall controller can be quite expensive at about $40,000. Figure 6 shows an example of a projection cube[1]. The most expensive maintenance item is the replacement of the projection lamp ($500 to $800); the minimum life cycle of these lamps is between 6,000 to 8,000 hours.

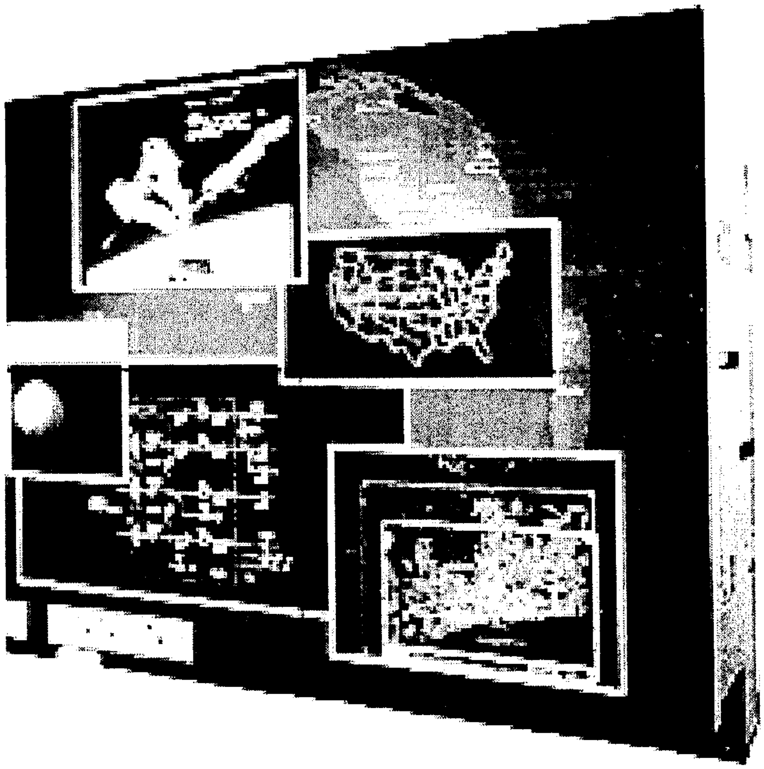


Figure 6: Example of a Projection Cube

Projection screen technology is cheaper (about $50,000 for a display area similar to 4 cubes), but its resolution is much lower, and it cannot accommodate as many video inputs as the 'cube' technology. This technology is still being procured for TCCs, but it is not considered state-of-the-art.

The construction of the video wall should meet all applicable local building codes. The wall will need to have two different types of constructions:

- One for the projection cubes, which should be purchased from a vendor specialized in video wall display solutions. The vendor provides this construction to ensure that all equipment can easily adjusted and replaced. The projection cubes should be installed at a height of 3-4 feet above the raised floor.
- One for the 'video monitor' area where the wall construction may follow the 'normal' stud and frame sheet rock design with the following considerations. The lowest row of video monitors should be installed at a minimum height of 3-4 feet above the raised floor. However, monitors located at 4 ft will only be viewable optimally by the operators in the first row. The monitors are to be installed on pull-out shelves facing the equipment room. This will make it easy to remove and/or replace the monitors. The face of the

1 Electrohome Netmaster EQ 4025 shown

video monitors as well as the video recorders shall be flush with the front of the video wall. Any openings or gaps between monitor and wall should be covered.

A minimum of one power outlet per device must be provided on the rear of the video wall. The video wall has to include 2 inch x 2 inch air vents to allow air flow. The surface of the wall should be painted in a flat base paint of industrial quality in a color appropriate with the décor of the RTCC.

Video Monitors

The video wall could include a number of video monitors (in place of additional cubes) that display sequences of CCTV images received from Augusta-owned CCTV or from the other agencies' CCTV, if available in the future. The video monitors should be identical to reduce technician requirements and to increase negotiation power (the more monitors purchased at one time, the cheaper each one will be).

All necessary mounting brackets, other mounting hardware, cabling, and connectors should be provided as part of the procurement. Note that the mounting brackets must allow for adjustment of the vertical and horizontal angle of the monitors to achieve an optimum viewing position.

Video Wall Setup

The video wall should include the projection cubes in the center position with monitor banks (or additional cubes) on both sides. Each monitor should be serviceable from the rear as well as the front without the use of any tools by placing each monitor on fully extendable pull-out shelves.

The number of CCTV cameras in the field should be divided by the number of monitors in a row, which would provide the sequence used to "scroll" through the images. For example, if there are 8 monitors and 32 CCTVs in the field, each monitor will scroll thru 4 CCTV images (if divided equally).

The bottom section of the video wall should be recessed to accommodate additional filing and storage cabinets. Any video recorders can also be placed here. The cabinets and bookcases should be flush with the front of the video wall to avoid obstruction of the operator's view. The cabinets and bookcases should be in tone with the décor of the TCC. The middle part of the wall will however not be available, since the projection cubes require unobstructed access.

7.4 Communications Room

The room behind the video wall will house the equipment necessary for day-to-day operations of the TCC. The equipment for these different functions include the video wall transmission and distribution equipment, the field communications equipment, and the dispatching equipment (i.e. radio) as well as equipment necessary to terminate general building / department equipment (LAN and other general purpose equipment).

Cabling will be needed to connect the equipment in the Communications Room with the workstations in the operations room for video, voice, and data communications.

The equipment room should also house the proposed TCC-specific un-interrupted power supply (UPS) to provide service during power outages.

Equipment Racks

A number of 19" equipment racks are proposed for the field equipment interface. These racks will contain the video switcher, the video wall operations equipment, the radio/dispatch equipment, the modems to interface with field equipment, the weather station interface equipment, etc. Additionally, separate servers for the operations-specific data will be placed in these racks. Five equipment racks should be sufficient for the planned TCC equipment, but this number will depend on the total and type of equipment specified for the TCC and field device build-out.

Doors

Due to the nature of the equipment that will be located in the room, one lockable, vented door is proposed for security reasons. This door will provide access to the Maintenance Room, where field equipment and other ITS equipment will be tested and repaired.

Other Equipment

Other equipment necessary for installation in the Communications Room includes the communications hardware and the internal telephone system (commonly referred to as "PBX system").

The size of the Communications Room should provide for future expansion space since the number of field devices, and therefore the number of corresponding central system equipment, will increase. Many TCCs experience expansion problems due to communications rooms that were planned too small and without any expansion capabilities.

7.5 Maintenance Room

ITS equipment needs to be tested prior installation in the field. In order for smooth installations of new equipment and repair of older equipment, a fairly large room should be provided with its own door to the outside/loading dock/parking lot as well as to the TCC Communications and TCC Operations Room.

The equipment of the Maintenance Room should include:

- at least four communications outlet boxes,
- at least ten power outlets located throughout the room,
- a workstation containing the same software used in the Operations Room,
- one workbench,
- at least two equipment racks and two heavy-duty shelving systems, and
- storage cabinets for manuals, tools and equipment spares.

The room should also have an access door into the adjacent TCC Communications Room so that failed equipment can be easily removed/replaced.

7.6 Conference/Media Room

This combination of conference room and media room creates a multipurpose room. It can serve as the visitor room during special public relations activities, which is indicated through its location and proximity to the Reception Area. It can also serve as the media room so that camera crews can view and use the video wall as backdrop for announcements. The room should include a folding wall (sound-baffling material) that can separate the room in two smaller rooms serving as 'conference room' on one side and as 'media room' on the other. Both parts of this room should have a podium, a portable projection system, and a sound system. A glass window/wall will provide visibility into the operation center. Placement of this area on the first floor allows easy access, supervised activities and proximity to restrooms.

The conference room window(s) should include curtains to allow the conference room to be isolated from the operations area if desired. Each side of this combination room should include the following equipment:

- workstation that can perform same operations as Traffic Operations consoles,
- portable video display including projection screen,
- video conferencing equipment,
- ten communications outlet boxes (either integrated into conference tables or floor mounted),
- fifteen power outlets located throughout the room (either integrated into conference tables or floor mounted and some wall-mounted),
- two white boards, and
- appropriately sized conference table with chairs.

Additionally, Augusta may want to consider installing coax cable hook-ups in the "media room" part of this combination room. The cabling could then either run up to the roof or to a particular hub in the parking lot, where the TV stations could park and connect to their transmission vans. If the parking lot hub solution is not desirable, Augusta could also decide to give interested TV stations access to the roof to install TV transmitters. Considering and including coax cabling during the building phase of this facility is certainly the most cost effective way.

7.7 TCC Offices

Several offices will be provided throughout the facility for use by TCC operations management staff, maintenance staff and future expansion.

7.8 Reception Area

The reception area is for receiving guests, controlling access to the facility, and staff may also be used for general support activities. The area should be aligned with the entrance to the conference room for ease of directing tour and press groups without disrupting the overall operations of the facility. Restrooms should be located off this area to avoid visitors roaming the facility.

7.9 Other Facilities

The following list includes items and rooms that are shown in the layout but that are self-explanatory. Any particulars about these items are indicated:

- Kitchen/Break Room – at least one kitchen/break room should be provided in the TCC. The room should be located as close as possible to the Operations Room so staff can visit the break room and either see into the operations room or quickly access the Operations Room. If the location of the kitchen prohibits a direct view into the Operations Room, a monitor showing rotating CCTV images should be installed in the kitchen.
- Restrooms – men's and women's restrooms should be accessible from the reception area. An additional unisex restroom is included adjacent to the production area for operator's use; this location will allow quick access back to the Operations Room.
- Facility Storage Room / Cleaning Storage Room – this room is different from the Maintenance Room. Space within the building needs to be provided where the cleaning crews can store their equipment.

7.10 Regulatory Considerations

Certain regulations must be adhered to while designing the design and layout of the TCC. Such considerations include the following:

7.11 ADA Requirements

As required by law, the TCC must comply with the guidelines of the Americans with Disabilities Act (ADA). The ADA requirements (Titles III and IV) state that certain accessibility need to be provided within new and renovated buildings. These requirements have been clarified in the United States Architectural and Transportation Barriers Compliance Board's ("The Access Board's") "Accessibility Guidelines for Buildings and Facilities".

The entire area must be readily accessible and have a minimum aisle width of 36 inches; however, from a human factor perspective, TCCs should not exhibit the impression of being overly cluttered and cramped. Therefore, aisles between workstations as well as entrance areas with a minimum width of 3.5 feet should be provided. According to ADA requirements and interpretation guidelines, the minimum width of doorways must be at least 32 inches; the layout shows that all doorways have a width of <u>at least</u> 36 inches to allow wheelchair and also equipment access.

In addition, ADA would require access ramps onto the raised flooring, which is state-of-the-practice in any TCC.

While ADA requirements pertinent to the TCC facilities have been incorporated in the layout shown below, the building architect will need to review the final plan to ensure that any special ADA requirements (i.e., State-specific) as well as local and state fire codes have been fulfilled. ADA requirements for elevators, hallways, restrooms, drinking fountains, and other facilities found throughout the facility need to be considered.

ADA requirements regarding telecommunications such as TDD TELEPHONE facilities will also need to be considered.

7.12 Employee Space Allocations

Another aspect that plays into the space planning design is County regulations. These regulations provide guidelines with respect to the office space allocations for particular employee levels. These guidelines have not been incorporated into the layout design in favor of a more generic approach. Office sizes may need to be altered during the final architectural design of the building.

7.13 Recommendations for TCC Expansion Capabilities

The scope and number of field devices and software end-applications that are to be controlled and/or monitored by the TCC will affect the physical layout of the TCC Operations Room and the Communications Room. These increases need to be anticipated and accounted for when determining the final space requirements for the TCC. The proposed TCC layout presented in this report does account for these possible expansion needs. Included in the layout are spare capacities to accommodate additional workstations as well as offices. These spaces may not be filled at the operational start-up of the TCC, but they will be needed in the future (for either temporary or permanent activities). These extra spaces need to be included within the initial layout design, because a physical expansion after the building has been erected will prove to be costly.

Items that will expedite and ease the problems associated with physical expansion are:

- Modular setup of workstations – the workstations should be designed so that moving or expanding them will be very easy including 'snap' connections that do not require use of tools.
- Modular setup of offices – the offices should include noise-reducing walls that are also modular in design. Again, a 'snap' approach for wall connections would be preferable, but some tooling will be required to provide for a sturdy wall connection.
- Modular wiring – wiring trays will be located under the floor including multi-function outlet boxes. The flooring layout should be flexible enough to allow easy repositioning of these outlet boxes.
- Video Wall – as the number of operators in the TCC and the number of CCTVs will increase so may the desire to increase the number of video monitors in the TCC. The layout of the wall surface housing the projection units is large enough to accommodate more monitors.

7.14 TCC Security Considerations

Two forms of security should be considered for the development of the TCC: operations room access and computer access.

Physical Access / Security

Providing a secure and undisturbed environment is essential to the operators responsible for executing functions within the operations room, and it needs to be considered that the media and other non-essential staff will have access to the facility. Experiences with similar facilities have shown that there will be a large number of visitors and frequent tours of the TCC. While there should always be a staff person accompanying visitors, it is not always feasible to track every visitor within a larger group. Thus, it is not just important to provide an overall building security, but a separate level of security for the actual operations room.

In order to facilitate this, an overall building security system that allows assignment of different security levels is specified. One level would be to allow personnel access to the building (after hours, since the building will include a receptionist during normal hours of operation), while another, more restricted level would allow certain personnel access to the operations room.

Fire Suppression

The TCC needs to consider installation of a fire suppression system. Traditionally, office buildings included a water-based sprinkler system to address this issue. With the appearance of computer and networking equipment (and the associated investments), many office buildings and complexes started to install fire suppression systems that were non-water based to protect the investment.

In the past, fire suppression systems based on HALON were implemented. However, this material that has been proven to be damaging to the environment (Ozone layer) and is therefore not used in new installations. Instead, a variety of alternatives such as Inergen, FM-200, and FE-13 Carbon Dioxide are being used in non-water based fire suppression systems.

The main reasons to use these non-water based systems in critical facilities such as data processing rooms, telecommunications switching facilities, process control rooms, and others, are that it:

- Is electrically nonconductive,
- Is safe for use in human occupied facilities,
- Would not damage sensitive electronic equipment,
- Has zero ozone depletion, zero global warming, and zero atmospheric lifetime.

The main disadvantage of these non-water based fire suppression systems is the associated cost. These type of systems cost between 10 to 40 times as much as a water-based system not including the recharging of the system, which should occur on a yearly basis.

Another alternative to this costly system would involve purchasing appropriate computer equipment insurance that would cover the replacement costs of the computer hardware. However, daily or weekly backups of the data would need to be made to avoid losing all the data, which may be more costly to replace than the hardware. Offsite storage of backup data is recommended and adds another level of security.

Software / Communications Security

Security must also be considered in the area of software and communications. While it is anticipated that personnel in the facility is connected to a local area network (LAN), separate servers should be considered that contain operations-sensitive data in order to avoid unauthorized access.

Another requirement of the TCC-specific LAN will be to incorporate a secure dedicated network. While most of the TCC functions will operate on a private secure network, some functions require the use of the Internet and public networks. Access to the outside world will require a certain level of security for how the information is accessed and used. When they are interfaced to public networks, like the Internet, a safer and more intelligent route requires the use of different security methods that may be used wherever the Internet and private networks intersect such as routers, firewalls, intrusion detection systems (IDS's), and vulnerability assessment tools (scanners, etc.). Which one or which combination of these methods should be used needs to be determined in conjunction with the software and LAN.

7.15 TCC Environmental Considerations

The following subsection describes various types of environmental issues such as HVAC, lighting, location of the facility and other environmental items such as columns that may obstruct the view.

Physical Constraints

The main focal point within the operations rooms (and of the facility at large) will be the oversized video wall. Thus, the use of columns or posts blocking the views is not recommended. Architecturally, the support beams should be integrated into programmed walls to create a facility without any columns within the Operations Room.

Lighting Considerations

It is common practice to install different types of lighting within a command and control facility such as the TCC. The different types include task lighting, zone lighting and room lighting.

Task lighting is lighting that is needed by individuals performing particular tasks. This type of lighting will be controlled by the particular individual and is usually installed at the workstation or desk. Either halogen or incandescent lighting is used for this purpose. The lighting may or may not be equipped with a dimming function.

The Operations Room should be broken into zones, i.e., the area right in front of the video wall being one area, each row of workstations being another, and the perimeter around the workstations alongside the offices yet another. Each of these zones should have a separate dimmable light control. The dimmers are needed to control the amount of glare on the video monitors and computer screens.

Finally, the ability to turn room lights on and off should also be provided within the Operations Room. Again, these lights should also include dimmable controls. This type of lighting should be provided for cleaning and equipment installation purposes. Depending on the needs of the TCC, room lighting may not necessarily be needed, since zone lighting can provide for this functionality.

HVAC Considerations

Heat, ventilation, and air conditioning are very important items in any office building. However, installing separate controls for facilities that generate a lot of heat is essential. This is due to the increased heat dissipation of all computerized equipment as well as the close proximity of humans in a room for extended periods.

The Communications Room will contain a lot of computer equipment. Therefore, it is recommended to provide a separate HVAC control and chiller for this area, separate from all other areas. Additionally, the Operations Room where personnel are seated should also have separate controls for the HVAC system.

7.16 TCC Preliminary Cost Estimate

Based on the proposed building layout and equipment needs, the estimated preliminary cost for the new Augusta Regional Transportation Control Center is broken down below:

Building Construction:	$	812,500	(6500 sf. @ $125/sf)
Site & Utilities:	$	100,000	
Designer Fee:	$	73,000	(8% of Construction Cost)
Sub-Total:	**$**	**985,500**	

The cost shown above are for building construction only and do no include the cost of the software, computer equipment, communications equipment etc. These costs will vary significantly based on initial level of deployment. While Navigator software will be furnished by GDOT, customization of Navigator for the Augusta region will be required. Depending on whether GDOT will provide the customization programming or ARCPW will be responsible this cost will vary considerably. The following costs are estimated software/equipment costs for the ultimate system.

Computer/Equipment Costs:	$800,000	
*Software Costs:	$	200,000
Sub-Total:	**$**	**1,000,000**

* Software costs could vary significantly based on type of software chosen and amount of customization.

8.0 Communications Plan

This section presents a proposed approach for implementing the telecommunications to interconnect the regional stakeholders, and to install the field devices proposed in this ITS plan.

8.1 Needs Assessment

The deployment of a regional ITS system will require the installation of a fiber optic network that services multiple state and is capable of transmitting both low speed data, voice, and full-motion, color, video.

One task in the development of the Advanced Transportation Management System for the Augusta Regional Transportation System (ARTS) is a telecommunications plan. The purpose of the telecommunications plan is to define the communication requirements to support ITS deployment and examine if other municipal activities can be supported by this deployment. The central question addressed in this task was "Can other agencies use the communications capacity that will be constructed for ITS?"

In order to conduct this assessment, the consulting team met with representatives of several agencies in all three counties in the Augusta region to determine their current communications activities and future needs. During these meetings, it was determined that it may not be feasible to extend an ITS communication network throughout each county, therefore we should concentrate on the most populated areas of the region.

The answer to the central question is: Yes, different government agencies can benefit by sharing information across a high-speed communications network from City Hall to remote locations and between agencies. We determined that each community participating in the ARTS project has different needs and budgets, as well as different topology requirements (network routing, size of the serving area, etc.) for a communication network.

Another important question is funding alternatives: "How do communities pay for these types of networks?" One way might be to include spare, un-dedicated fiber optics inside cables that will be installed for ITS purposes. The construction cost associated with installing fiber optic cables is the most expensive cost associated with building a communication network. As cables are being installed for ITS purposes, each local government could pay the incremental cost difference for purchasing a larger fiber cable size (typically a small expense) and over time, these communities would have enough fiber deployed to cost effectively establish a multi-agency communication network.

This report has addressed each community's needs in our overall plan and developed a recommended network configuration for each community. These network configurations are discussed in detail in the network summary section and the proposed network layout is shown on the attached maps.

It was determined that three reasonable scenarios could be developed for the Augusta region:

1. A dedicated fiber optic network (STAR configuration) that connects the ITS field devices back to a county owned Transportation Control Center (TCC).

2. A hybrid fiber optic network (STAR configuration) that would support ITS and other agency network requirements.

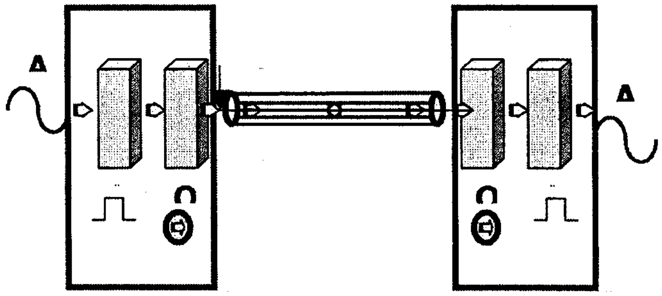
3. A high capacity fiber optic SONET ring network in Richmond County and another in Aiken County, with a home run fiber optic connection between the two TCCs located in each state.

It is our conclusion that scenario #2 would be the best overall approach for this region. Details of the communications system analysis are included in Appendix C.

8.2 Network Definitions

Fiber Optics - single-mode optical fiber offers large bandwidth capacity, is immune to noise, provides longer distance transmission characteristic, is small and lightweight and supports both low speed and broadband video transmission.

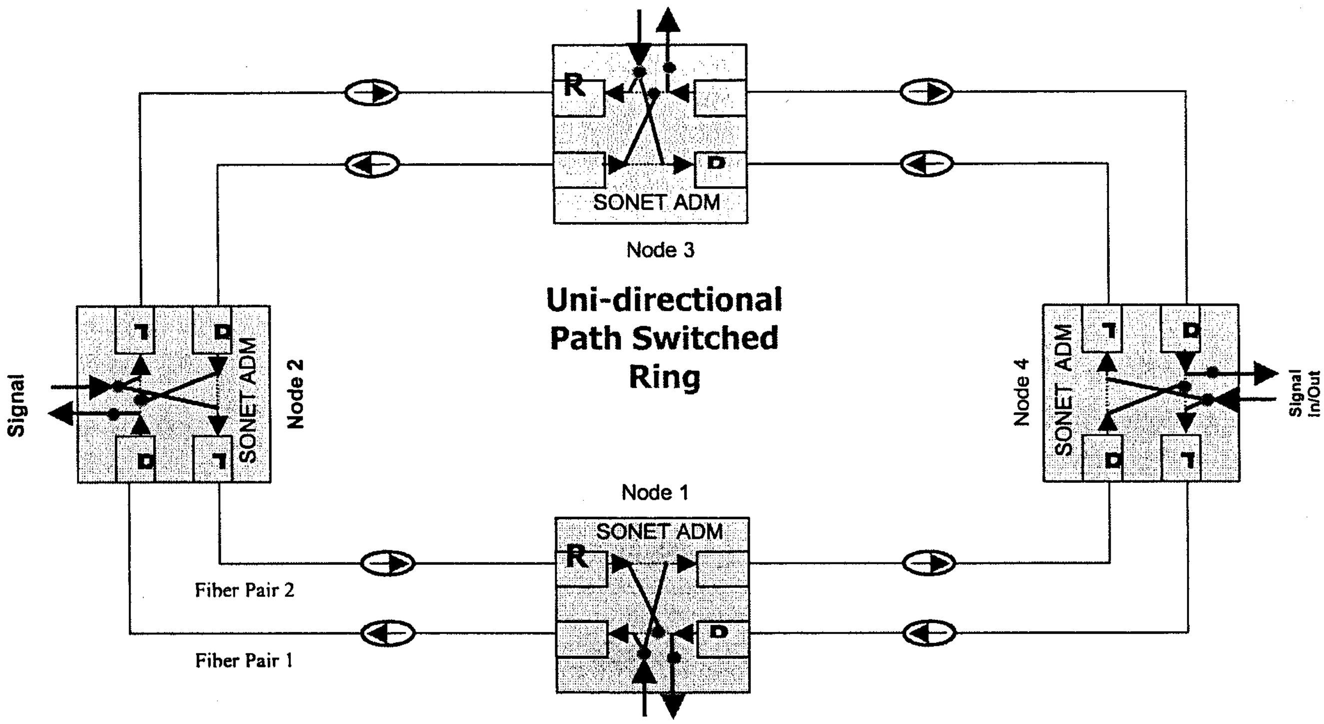
Network Hubs - must be an environmentally controlled environment to house the cable terminations and electronic equipment. Hubs act as points where many circuits are gathered and then multiplexed (or combined) into more efficient wideband circuits for transmission back to the TCC.



Typical Fiber

Star Configuration - is a point-to-point architecture. This means, a single origination point (TCC or HUB) and a single destination point (ITS Field Device). Point-to-multipoint configurations are not feasible due to the unavailability of low-loss taps to connect field devices.

SONET Ring - provides the transport ONLY mechanism between node locations (i.e. City hall, TCC, HUB, etc.) and does NOT include the interface connections (channel banks) to the users end equipment. It provides the "light and intelligence" to the fiber plant and when deployed in a true ring architecture, it provides overall network protection from cable cuts or node failures



Channel Banks - low speed channel equipment must be installed to provide the interface connection to put network traffic onto the SONET transport system thereby connecting the end users to the communications network.

8.3 Network Capacity Standards

This report recommends a network architecture that is consistent with the Georgia Department of Transportation's (GDOT) current ATMS architecture in Atlanta and other regions of Georgia, including standard fiber cable sizes, fiber allocations, and networking protocol and is therefore NaviGAtor Compliant. The following standards were used in preparing the conceptual design

- Only singe-mode fiber cable will be used;
- Minimum fiber optic cable size for ITS trunk/distribution lines will be 24 count;
- Closed Circuit Television (CCTV) camera video signals and pan, tilt, zoom (PTZ) transmit/receive controls are combined on (1) dedicated single mode fiber;
- The following ITS field devices require with low bandwidth and will be "daisy-chained" on the same fibers:

Device	Max. Per Fiber Pair
CCTV control	None
Traffic Signal Controllers	Eight (8)
Dynamic Message Signs	Two (2)
Radar Detectors	Eight (8)
Weather Stations	Eight (8)

- Different type of ITS field devices may NOT share the same fiber pairs.

8.4 Summary of Recommended Network

This summary defines the conclusions and deployment recommendations for each County participating in ARTS.

The lengths of each cable segment were measured from the maps using the GIS capabilities of the mapping system. Cost estimates for each scenario were developed from recent fiber optic installations in Georgia.

Augusta/Richmond County – currently has rights to use optical fibers installed by Adelphia Business Solutions in the metro Augusta area. Our study determined these fibers are not beneficial to a hybrid network for the following reasons:

1) The Adelphia fibers do not extend to the outer reaches of the County;
2) The fiber optic transmission requirements do not exceed the maximum distance for serving ITS field devices directly from the TCC;
3) Additional fiber optic distribution cables would still be required to connect ITS field devices located adjacent to the Adelphia fiber because only four fibers are available to be used by the city.

The Adelphia fibers would be very useful if Augusta deployed a multi-agency SONET communication network for sharing data between City Hall and remote sites or between multiple agencies. The deployment of this type of network may reduce the city's' cost by eliminating leased communications lines currently being used for connections and would allow the TCC to share information such as voice, data and video with other departments connected to the network

Although the cost of a SONET network is very reasonable, this type of network more expensive than a STAR configuration and a SONET network is not required for the deployment of Augusta's ITS system. To establish a SONET backbone network the city would need to complete the following:

- Connect 4 underground fibers furnished by Adelphia Business Solutions to city buildings.
- Extend the Adelphia fibers to other city and county buildings that are not located along the Adelphia fiber route.
- Build a diverse underground cable route from the proposed TCC to the Adelphia fibers.
- Install SONET electronics at each city building requiring a connection.

Network Recommendation

The use of a SONET backbone for deploying the ATMS system in Augusta/Richmond County does not provide any direct advantages for the ITS program; therefore we recommend the installation of aerial fiber optic distribution cables be installed on existing utility poles from the proposed TCC to the proposed ITS field devices. The fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimate is included in the Cost Data section of this report found in Appendix D.

Augusta / Richmond County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
ITS Fiber Optic Network					
New Fiber Optic ITS Distribution Cable	53.1	Mile	$87,248	$4,632,886	
				Total ITS Fiber Optic Backbone	$4,632,886

Columbia County - a SONET ring configuration was found to be impractical since only the southern edge of the county is projected to have enough density of equipment to require that level of capacity. The proposed architecture would service this area as an extension of the Augusta system with a direct fiber optic connection between the Augusta-Richmond TCC and to the new Columbia County Government Center.

Network Recommendation

We recommend the installation of aerial fiber optic distribution cables be installed on existing utility poles for the Columbia/Richmond County line to the proposed ITS field devices. The fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimates is included in the Cost Data section of this report found in Appendix D.

Columbia County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
ITS Fiber Optic Network					
New Building Entrance	1	Each	$46,636	$46,636	
New Fiber Optic ITS Distribution Cable	15.4	Mile	$87,248	$1,343,624	
				Total ITS Fiber Optic Backbone	$1,390,261

Aiken County - the installation of a SONET network in this county proved to be a cost effective approach for ITS deployment based on the following reasons:

1) The maximum fiber optic transmission distance to connect ITS field devices in the North Augusta area are exceeded if the TCC is located in Aiken. Therefore, fiber optic equipment (HUB) must be installed in North Augusta to collect and amplify the optical signal necessary to reach the TCC in Aiken.
2) Four fibers are required for a SONET network and can be cost effectively included in the fiber optic cables required to connect ITS field devices to the TCC.

Network Recommendation

We recommend the installation of aerial fiber optic cables be installed on existing utility poles from proposed Aiken TCC to a network HUB located in North Augusta and to the proposed ITS field devices. The cables between the TCC and North Augusta will be constructed along diverse routes providing maximum protection against outages caused by cable failures (i.e. storm damage, cable cut, etc.). The cable along these routes will provide both the SONET backbone and distribution to the ITS field devices. The cable fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimates is included in the Cost Data section of this report found in Appendix D.

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
ITS Fiber Optic Network					
New Fiber Optic ITS Distribution Cable	35.8	Mile	$87,248	$3,123,490	
				Total ITS Fiber Optic Backbone	$3,123,490
Multi Agency SONET Backbone					
New Aerial Fiber Optic SONET Backbone	47.2	Mile	$87,248	$4,118,106	
New Building Entrance Link to Sonet Backbone (Diverse)	2	Each	$46,636	$93,273	
				Total Sonet Backbone	$4,211,379
				Total Cost	$7,334,868

9.0 Recommended Plan And Project Priorities

This section presents the suggested ITS plan including prioritization and short, mid and long-term implementation recommendations.

9.1 Components of the Plan

The specific transportation control and incident management components to be implemented in the Augusta Richmond County ATMS program are included in the concept of operations presented in Section 5.2.

In addition to these specific strategies that will be operated and maintained through the Augusta TCC, additional functions from the GDOT Navigator ITS program will also be used in the Augusta region. These include:

- Georgia DOT Navigator central control software for freeway and incident control
- Bi-Tran traffic signal control software to communicate with 2070 traffic controllers
- Implementation of HERO service on the Georgia freeways
- Communications network, including fiber optic cable and wireless applications
- Detection devices on freeways and major arterials, including video image detectors, in-pavement loops and radar
- Surveillance devices, including CCTV cameras
- Conversion of existing slow-scan camera to real-time video
- Traveler information services for traffic and transit, such as dynamic message signs, highway advisory radio, kiosks, and an Internet web site
- Weather detection equipment for wet pavement, fog warning, flood level and ice.
- Implementation of Advanced Vehicle Location (AVL) system on transit vehicles.
- Implementation of automatic passenger counters (APC) on transit vehicles.

9.2 Phased Implementation Plan

As with any major transportation initiative, ITS deployment should be implemented incrementally, both to maximize system effectiveness and to recognize limitations on available funding. With this in mind, the recommended implementation schedule is divided into three phases:

- Phase 1 (1-5 years)
- Phase 2 (6-10 years)
- Phase 3 (11-20 years)

The timeframe for each phase is approximate and may vary based on available funding. Cost estimates listed in the tables below assume constant costs for field equipment. Projects should be assigned to each phase based on a desire to address the most critical traffic and safety needs first.

Candidate locations for ITS Deployment included key arterials with high traffic demand and congestion. The projects shown in the following implementation plan do not include freeway-related projects that will be fully installed and funded by GDOT.

The deployment scenarios for the arterials are shown as two different levels of "surface street control". The Low-level ITS equipment package is limited to the collection of information by individual intersection detectors and/or advanced signal timing. The high-level surface street control would also include placement of traffic speed detectors and surveillance cameras along the arterial. This system detection data would be transmitted back to the transportation control center on a real-time basis.

The following implementation plan is also presented graphically in the Augusta Regional ATMS Deployment Map.

Phase 1 Deployment (1-5 Years)

Project	*Unit Cost*		*Total Cost*	
	Capital	*O & M*	*Capital*	*O & M*
Construct & Operate TCC Building & Equipment	$2,625,500	$500,000	$2,625,500	$500,000
Traffic Signal Controller Upgrades	$7,000	$1,000	$539,000	$77,000
CCTV Cameras	$20,000	$1,000	$900,000	$45,000
Radar Speed/Volume Detectors	$8,000	$500	$264,000	$16,500
Dynamic Message Signs	$150,000	$3,000	$1,650,000	$33,000
Railroad-Highway Grade Crossings Advanced Grade Crossing (gates and sensors)	$47,000	$1,000	$329,000	$7,000
Roadside Weather Information System	$50,000	$2,000	$250,000	$10,000
Install fiber optic cable	$87,248		$2,988,244	
TOTAL FOR PHASE 1 DEPLOYMENT			$9,545,744	$688,500

Phase 2 Deployment (5-10 Years)

Project	*Unit Cost*		*Total Cost*	
	Capital	*O & M*	*Capital*	*O & M*
Construct & Operate TCC Building & Equipment		$500,000		$500,000
Traffic Signal Controller Upgrades	$7,000	$1,000	$581,000	$83,000
CCTV Cameras	$20,000	$1,000	$760,000	$38,000
Radar Speed/Volume Detectors	$8,000	$500	$248,000	$15,500
Dynamic Message Signs	$150,000	$3,000	$900,000	$18,000
Railroad-Highway Grade Crossings Advanced Grade Crossing (gates and sensors)	$47,000	$1,000	$329,000	$7,000
Roadside Weather Information System	$50,000	$2,000	$250,000	$10,000
Install fiber optic cable	$87,248		$2,647,977	
TOTAL FOR PHASE 2 DEPLOYMENT			$5,715,977	$671,500

Phase 3 Deployment (10-20 Years)

Project	*Unit Cost*		*Total Cost*	
	Capitol	*O & M*	*Capitol*	*O & M*
Construct & Operate TCC Building & Equipment		$500,000		$500,000
Traffic Signal Controller Upgrades	$7,000	$1,000	$441,000	$34,250
CCTV Cameras	$20,000	$1,000	$260,000	$13,000
Radar Speed/Volume Detectors	$8,000	$500	$64,000	$4,000
Dynamic Message Signs	$100,000	$3,000	$400,000	$12,000
Railroad-Highway Grade Crossings Advanced Grade Crossing (gates and sensors)	$47,000	$1,000	$329,000	$7,000
Roadside Weather Information System	$50,000	$2,000	$250,000	$10,000
Install fiber optic cable	$87,248		$3,529,862	
TOTAL FOR PHASE 3 DEPLOYMENT			$5,273,862	$580,250

The following tables outline the arterials that will be equipped during each phase of implementation.

Phase 1 Arterials

Arterial Name	*From*	*To*	*Approx. Mileage*
Gordon Highway	Barton Chapel Rd.	Reynolds St.	9.25 mi.
Highland Ave.	Gordon Highway	Wrightsboro Rd.	1.75 mi.
Wrightsboro Rd.	Barton Chapel Rd.	Monte Sano Ave.	3.50 mi.
Monte Sano Ave.	Wrightsboro Rd.	Walton Way	0.75 mi.
Jackson Rd.	Wheeler Rd.	Wrightsboro Rd.	1.25 mi.
Wheeler Rd.	West Wheeler Pkwy.	Walton Way Ext.	1.50 mi.
Walton Way	Bransford Rd.	15th St.	3.00 mi.
15th St.	Walton Way	Broad St.	0.50 mi.
John C. Calhoun Expy.	Washington Rd.	15th St.	2.00 mi.
Washington Rd.	Flowing Wells Rd.	15th St.	8.00 mi.
Furys Ferry Rd.	Richmond Co. Line	Washington Rd.	0.50 mi.
Riverwatch Pkwy.	Furys Ferry Rd.	Alexander Dr.	2.25 mi.
TOTAL MILEAGE FOR PHASE 1			**34.25 mi.**

Phase 2 Arterials

Arterial Name	*From*	*To*	*Approx. Mileage*
Tobacco Rd.	Gracewood Rd.	Peach Orchard Rd.	0.25 mi.
Peach Orchard Rd.	Tobacco Rd.	Tubman Home Rd.	4.50 mi.
Windsor Spring Rd.	Tobacco Rd.	Peach Orchard Rd.	3.50 mi.
Deans Bridge Rd.	Morgan Rd.	Gordon Highway	4.25 mi.
Tubman Home Rd.	Peach Orchard Rd.	Gordon Highway	0.35 mi.
Wrightsboro Rd.	Monte Sano Ave.	15th St.	2.00 mi.

15th St.	Wrightsboro Rd.	Laney-Walker Blvd.	0.25 mi.
Laney-Walker Blvd.	15th St.	Gordon Highway	1.50 mi.
Walton Way	15th St.	Gordon Highway	1.50 mi.
Telfair St.	13th St.	Gordon Highway	1.25 mi.
Greene St.	13th St.	Gordon Highway	1.25 mi.
Broad St.	13th St.	Gordon Highway	1.25 mi.
13th St.	Broad St.	Walton Way	0.50 mi.
Reynolds St.	10th St.	Gordon Highway	0.75 mi.
Davis Rd.	Washington Rd.	Wheeler Rd.	2.00 mi.
Pleasant Home Rd.	I-520	Davis Rd.	0.25 mi.
Bobby Jones Expy.	Washington Rd.	Pleasant Home Rd.	1.00 mi.
Washington Rd.	Fieldstone Way	Flowing Wells Rd.	3.00 mi.
Belair Rd.	Wrightsboro Rd.	Wheeler Rd.	1.00 mi.
TOTAL MILEAGE FOR PHASE 2			**30.35 mi.**

Phase 3 Arterials

Arterial Name	*From*	*To*	*Approx. Mileage*
Tobacco Rd.	U.S. 1/Deans Bridge Rd.	Windsor Spring Rd.	2.75 mi.
Mike Padgett Highway	Old Waynesboro Rd.	Lumpkin Rd.	3.50 mi.
Doug Barnard Pkwy.	Tobacco Rd.	Lumpkin Rd.	3.00 mi.
Lumpkin Rd.	Wells Dr.	Doug Barnard Pkwy.	3.00 mi.
Barton Chapel Rd.	Deans Bridge Rd.	Gordon Highway	2.25 mi.
Milledgeville Rd.	Deans Bridge Rd.	15th St.	0.75 mi.
15th St.	Milledgeville Rd.	Wrightsboro Rd.	1.25 mi.
Tutt Ave.	15th St.	Steed St.	0.25 mi.
Steed St.	Tutt Ave.	Milledgeville Rd.	0.50 mi.
Martin Luther King Jr. Blvd.	Steed St.	12th St.	0.50 mi.
Wrightsboro Rd.	15th St.	Mill St.	0.50 mi.
Central Ave.	Troupe St.	15th St.	1.25 mi.
Druid Park Ave.	Laney-Walker Blvd.	Central Ave.	0.25 mi.
Hickman Rd.	Walton Way	Kings Way	0.35 mi.
Troupe St.	Wrightsboro Rd.	Central Ave.	0.25 mi.
Laney-Walker Blvd	Gordon Highway	I-520	2.25 mi.
Broad St.	Gordon Highway	13th Street	0.50 mi.
Bransford Rd.	Wheeler Rd.	Walton Way	0.35 mi.
Berckmans Rd.	Ingleside Dr.	Walton Way	1.00 mi.
Ingleside Dr.	Boy Scout Rd.	Berckmans Rd.	0.50 mi.
Boy Scout Rd.	Washington Rd.	Ingleside Dr.	1.50 mi.
Baston Rd.	Furys Ferry Rd.	Washington Rd.	0.75 mi.
Furys Ferry Rd.	Evans to Locks Rd.	Baston Rd.	1.75 mi.
Cox Rd.	Hereford Farm Rd.	Belair Rd.	0.75 mi.
Flowing Wells Rd.	W. Old Trail Rd.	Washington Rd.	0.75 mi.
Belair Rd.	Wheeler Rd.	Washington Rd.	3.75 mi.
Aiken County, SC			
Jefferson Davis Highway	Old Aiken Rd.	Richmond Co. Line	2.50 mi.
Martintown Rd.	I-20	Knox Ave.	3.75 mi.
TOTAL MILEAGE FOR PHASE 3			**40.45 mi.**

Figures 7 and 8 show the proposed ITS in the Augusta region.

Augusta Transportation Management System

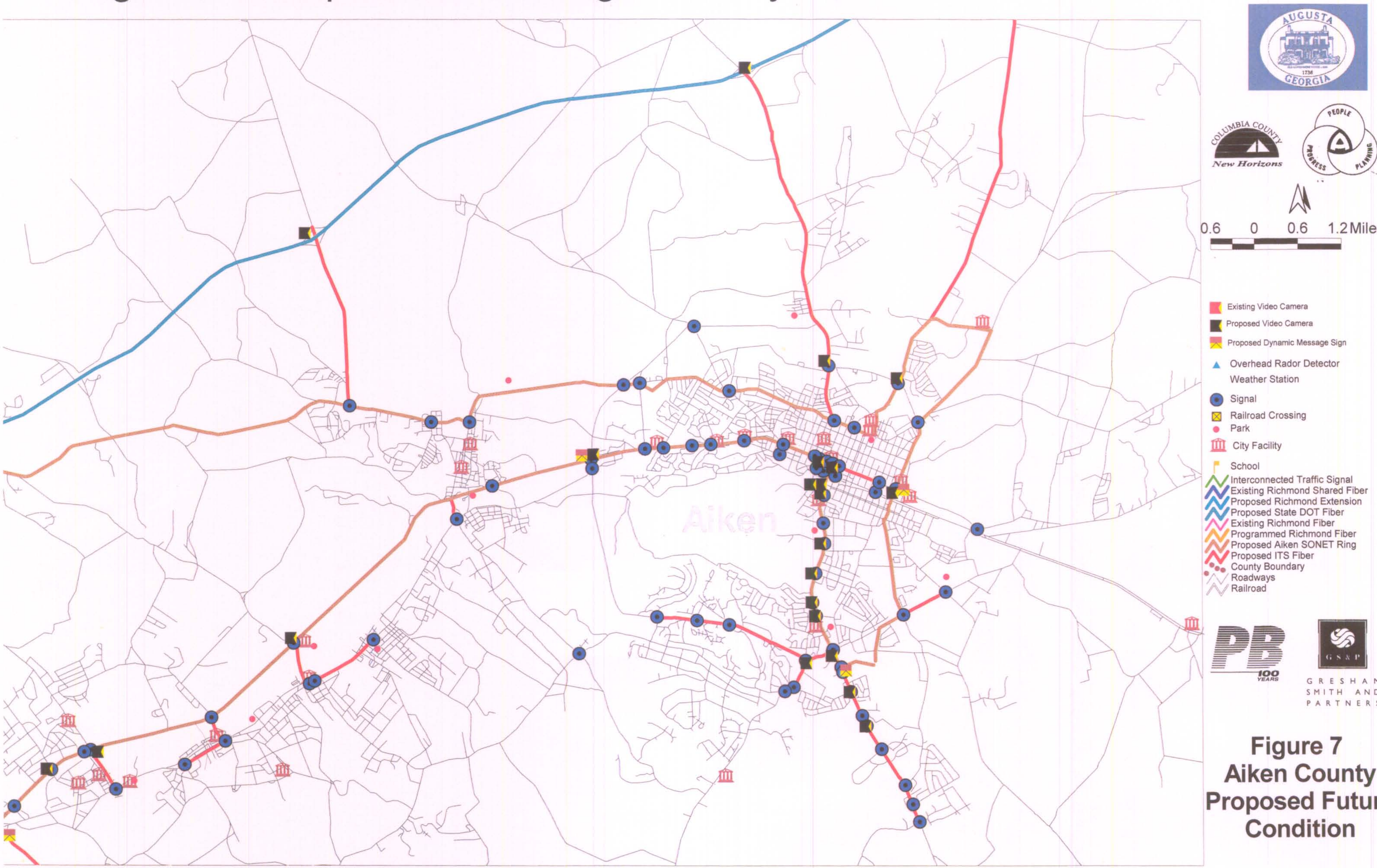
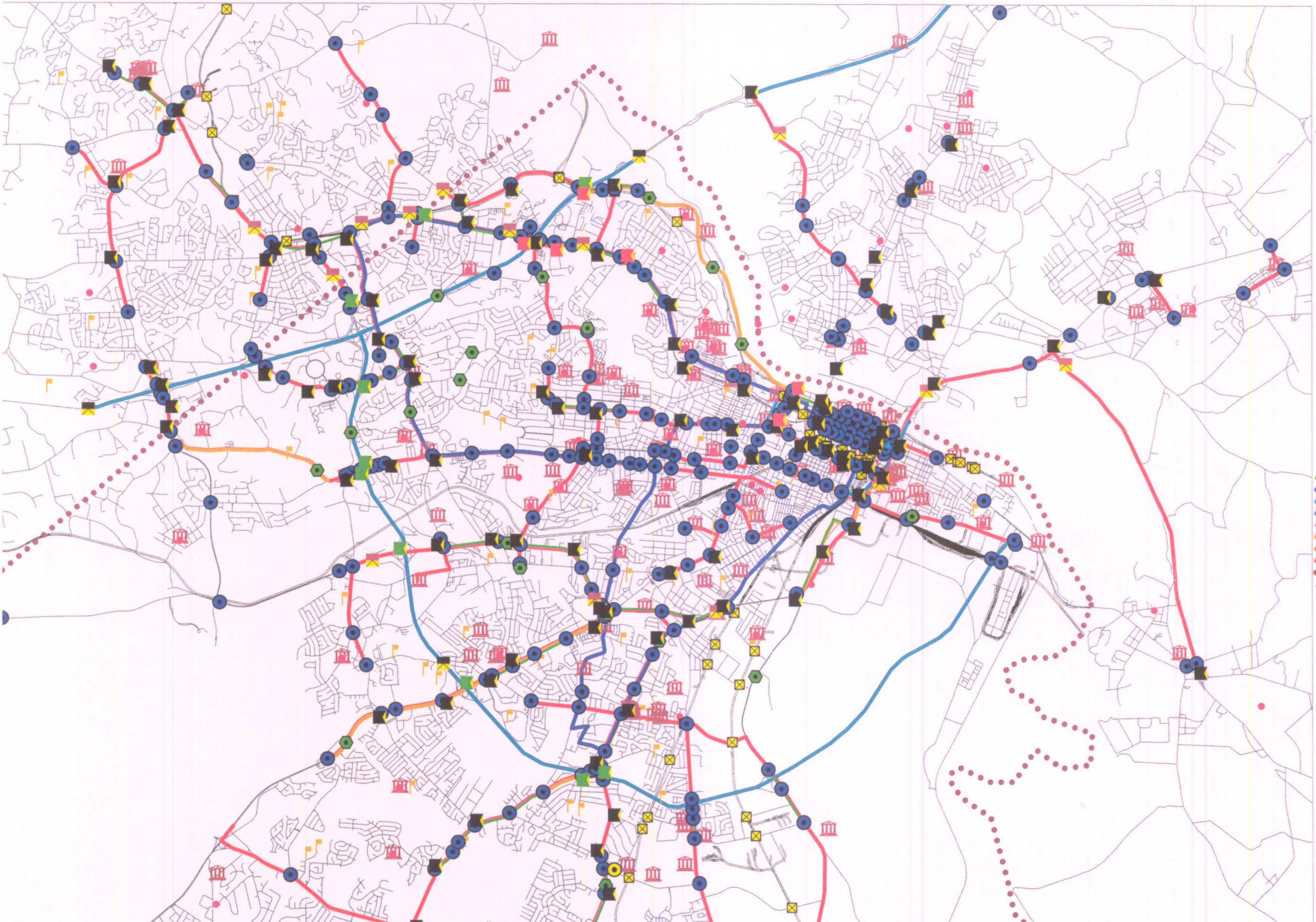


Figure 7
Aiken County
Proposed Future Condition

Augusta Transportation Management System



AUGUSTA GEORGIA 1736

COLUMBIA COUNTY New Horizons

PEOPLE PROGRESS PLANNING

N

0.8 0 0.8 Miles

- Existing Video Camera
- Video Camera Under Design By GDOT
- Proposed Video Camera
- DMS Under Design by GDOT
- Proposed Dynamic Message Sign
- Overhead Rador Detector
- Weather Station
- Signal
- Railroad Crossing
- Park
- City Facility
- School
- Interconnected Traffic Signal
- Existing Richmond Shared Fiber
- Proposed Richmond Extension
- Proposed State DOT Fiber
- Existing Richmond Fiber
- Programmed Richmond Fiber
- Proposed Aiken SONET Ring
- Proposed ITS Fiber
- County Boundary
- Railroad
- Roadway

PB 100 YEARS

GRESHAM SMITH AND PARTNERS

Figure 8
Richmond and Columbia Counties Proposed Future Condition

9.3 Funding Alternatives

Funding is a vital element of any transportation program. The purpose of this section is to provide the information necessary to consider the funding alternatives (and their requirements) that are available for the ITS projects. Innovative funding sources are included.

Federal Perspective

Federal funding is divided into categories, each with it's own characteristics. The following categories of federal highway funding exists today:

- National Highway System (NHS)
- Surface Transportation Program (STP)
- Congestion Mitigation and Air Quality Improvement Program (CMAQ)
- Bridge
- Interstate Maintenance
- Safety
- Specific Programs

The enabling Federal legislation allocating these funds is Title 23 of US Code as most recently modified by the Transportation Equity Act for the 21st Century (TEA-21).

Under TEA-21, several changes were made to mainstream the ITS program into the well-funded traditional federal-aid highway categories. As a result, ITS projects are explicitly eligible for NHS, STP, CMAQ funding. Further, ITS "capital and operating costs for traffic monitoring, management, and control facilities and programs" are eligible. The definition of operating costs is defined as: labor costs, administrative costs, costs of utilities and rent, and other costs associated with the continuous operation of traffic control, such as integrated traffic control systems, incident management programs and traveler information and traffic control centers. Use of CMAQ funds for operations is limited to a three-year period. The other traditional funds do not have a time limit.

TEA-21's ITS program funding allocates monies primarily for ITS Integration, ITS Standards, Operational Tests, Research, and ITS Deployment Incentives.

Traditional Funding

A consideration in funding eligibility is the role of the Metropolitan Planning Organization (MPO). In Transportation Management Areas (TMAs), NHS and Interstate Maintenance projects are selected by the State, in consultation with the MPOs, and consistent with the Transportation Improvement Program (TIP). With all other federally funded projects, the MPOs select the projects in consultation with the State, consistent with the TIP. In reality, GDOT and the MPOs strive for consensus on all of the projects in the TIP, whether or not federally funded.

National Highway System (NHS)

ITS projects are eligible for NHS funds. GDOT allocates 70% of the total NHS funds by Congressional District. The remaining 30% is assigned to discretionary projects on a statewide basis.

Surface Transportation Program (STP)

ITS projects are also eligible for use of Surface Transportation Program funds. STP funds can be used in most places in the state including the Interstate system. There are however, certain subcategories of STP funds that are restricted to certain kinds of projects. Relevant to ITS, these are summarized below.

STP funded projects are selected by the MPOs within the Transportation Management Areas. When in areas with populations below 200,000, the State selects, again with MPO consultation and concurrence. Any Federal Aid ITS projects in an urbanized area, including interstate projects, must appear in the MPO's TIP.

Interstate Maintenance (IM)

Interstate maintenance funds are designated for resurfacing, restoring, rehabilitating and reconstruction (4R), including adding travel lanes, on most existing Interstate System routes. This category can be used for ITS projects on the interstate system in GDOT. IM candidate projects are submitted to the FHWA Division office. By State policy, IM funds are used only for the interstate system.

Innovative Funding

Innovative funding has been advocated for ITS for some time. This perhaps is due to the unique, relatively new nature of ITS projects. At the same time, mainstreaming of ITS projects is advocated using the traditional funding sources. For the ITS program to be fulfilled, it is appropriate to consider all possible funding sources, as agency and political support for the ITS program is gathered. Each of the funding sources below can be used for ITS.

<u>ITS Deployment (Demonstration) Program</u>

Under this program, eligible projects must demonstrate integration of multi-modal ITS components in metropolitan areas, rural areas, statewide, for multi-state city settings to improve mobility, promote safety, increase traffic flow, etc. including building on existing ITS projects. The Federal share is 50%. The FHWA lead contact person is Toni Wilbur, HOTM-1, Telephone, (202) 366-2199. Proposals are submitted to FHWA Washington Headquarters. Traditionally, however, Congress has earmarked these funds. This fact requires sponsors of projects to gain local congressional support for candidate projects.

<u>Soft Match</u>

Soft Match involves credit for the non-Federal share of funding on a project. Toll revenue expenditures are used as a credit toward the non-Federal matching share of all programs authorized, with certain exceptions. A different form of soft match involves use of the value of in-kind services for the soft match, under certain rules.

Public/Private Partnerships

These partnerships can take several forms, but can simply be thought of as a barter arrangement between the public and private sector. Funding, via these partnerships, takes many forms including special taxing districts, land or cash donations, impact fees and other arrangements.

State Infrastructure Bank (SIB)

The SIB is an investment fund that offers loans, credit enhancements and other forms of financial assistance to surface transportation projects that meet federal standards and are eligible for assistance under Title 23 and capital projects defined by Title 49. The loans are capitalized with Federal funds.

Advanced Construction (AC)

This approach involves using state funds for a project eligible for eventual reimbursement with Federal funds. Advanced construction funds can be used in IM, NH, CM programs. This approach is characterized as an excellent tool to ensure that no available Federal funds are lost in a Federal fiscal year.

APPENDIX A

Existing Traffic Signal Devices

AUGUSTA-RICHMOND COUNTY
TRAFFIC SIGNALS
INVENTORY

Type	Communication	Cabinet Type
A- Actuated	C- On central computer	B- Base Mounted
S- Semi-actuated	T- Coordinated, but no cabe to master controller (T.B.C.)	P- Pole Mounted
F- Fixed time		mc- Maste/Local Combination
M-Mechanical	R- Radio system(incomplete)	m- Separate Maste Cabinet
P- With railroad preemption	I- Isolated (Free)	

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
1	5th St.	@	Broad St.	F	T	Transyt	1880E	1107	Feb-87	1200	8392	4Ø-B	34613
2	5th St.	@	Telfair St.	F	T	Transyt	1880E	8714	Nov-92	12EL	4697	4Ø-P	2921
3	13th St.	@	Broad St.	F	C	Transyt	1880E	2610	Feb-87	1200	8243	4Ø-B	34613
4	13th St.	@	Greene St.	F	T	Transyt	1880EL	14774	Mar-96	1200	6188	4Ø-B	34300
5	13th St.	@	Jones St.	F	C	Transyt	1880E	7319	Sep-88	1200	8468	4Ø-P	34615
6	13th St.	@	Reynolds St.	F	C	Transyt	1880E	3231	Oct-90	1200	11452	4Ø-P	34615
7	13th St.	@	Telfair St.	S	T	Transyt	1880EL	20116	Sep-98	600	2881	4Ø-B	24700
8	15th St.	@	Broad St.	A	C	Transyt	1880E	6274	Jun-88	1200	11352	8Ø-Bmc	901
9	15th St.	@	Calhoun Exp.	A	C	Transyt	1880E	10775	Oct-93	12EL	1315	4Ø-P	1753
10	15th St.	@	Castleberry's	S	I	Transyt	1880E	6144	Jun-88	1200	8460	4Ø-P	34542
11	15th St.	@	Essie McIntyre Blvd.(Sunset)	A	I	Transyt	1880	6635	Mar-84	600	2060	4Ø-B	24654
12	15th St.	@	Government Rd./Carver Dr.	S	I	Transyt	1880E	3385	Nov-90	12EL	7533	4Ø-P	2293
13	15th St.	@	Greene St.	A,P	C	Transyt	1880E	4516	Apr-91	12EL	1456	4Ø-P	2192
14	15th St.	@	Harper St./Pope Ave.	A	I	Transyt	1880	3337	Dec-82	1200	838	4Ø-B	34064
15	15th St.	@	Jones St./River Watch Pkwy.	A	C	Transyt	1880E	6854	Aug-88	12EL	964	8Ø-B	973
16	15th St.	@	Laney-Walker Blvd.	A	I	Transyt	1880E	4428	Apr-91	1200	4538	8Ø-B	28030
17	15th St.	@	Reynolds St./River Watch	A	C	Transyt	1880E	3356	Nov-90	12EL	806	4Ø-B	1956
18	15th St.	@	Walton Way	A	I	Transyt	1880E	7034	Apr-92	1200	7154	8Ø-B	2057
19	Barton Chapel Rd.	@	Glenn Hills Dr.	A	I	D.T.S.	170E	8408	98	210E	204286	8Ø-B	20533 (336)
20	Barton Chapel Rd.	@	Old McDuffie Rd.	S	I	Transyt	1880E	1617	Mar-87	1200	4529	4Ø-P	22414
21	Berckman Rd.	@	Ingleside Dr./Willowridge Dr.	S	I	Transyt	1880E	3334	Nov-90	1200	1413	4Ø-P	1037
22	Bobby Jones Exp.	@	Old Trail Rd.	A	C	Transyt	1880E	7159	Sep-88	1200	11198	8Ø-B	2670
23	Bobby Jones Exp.	@	Scott Nixon Memorial Dr.	A	C	Transyt	1880E	7163	Sep-88	12EL	717	8Ø-Bm	2159
24	Boy Scout Rd.	@	Ingleside Dr./Aumond Rd.	A	I	Transyt	1880E	12330	Aug-94	12EL	3354	8Ø-B	973
25	Boy Scout Rd.	@	Skinner Mill Rd.	A	I	Transyt	1880E	7163	Apr-92	12EL	3454	4Ø-B	2293
26	Broad St.	@	6th St.	F,P	R	Transyt	1880EL	2181	Aug-92	6ELR	4252	2Ø-B	22975

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
27	Broad St.	@	7th St.	F	R	Transyt	1880EL	1952	92	6ELR	3586	2Ø-B	22961
28	Broad St.	@	8th St.	F	R	Transyt	1880EL	1946	92	6ELR	3587	2Ø-B	22961
29	Broad St.	@	9th St.(James Brown Blvd.)	F	R	Transyt	1880EL	1860	92	6ELR	3617	2Ø-B	22961
30	Broad St.	@	10th St.	F	R	Transyt	1880EL	1909	92	6ELR	3550	2Ø-B	22961
31	Broad St.	@	11th St.	F	R	Transyt	1880EL	1911	92	6ELR	3619	2Ø-B	22961
32	Broad St.	@	12th St.	F	R	Transyt	1880EL	1921	92	6ELR	3618	2Ø-B	22961
33	Broad St.	@	Crawford Ave./Pearl Ave.	F	I	Transyt	1880E	3790	Jan-88	1200	9971	4Ø-P	1102
34	Broad St.	@	East Boundary St.	S	I	Transyt	1880	11968	Apr-86	160	683	4Ø-B	24189
35	Broad St.	@	Eve St.	F	I	Transyt	1880S	11659	Apr-86	1200	5136	2Ø-P	22581
36	Broad St.	@	Milledge Rd.	A	I	Transyt	1880	2007	Jun-82	1200	10138	8Ø-B	28123
37	Central Ave.	@	Baker Ave.	F	T	Transyt	1880E	3212	Oct-90	12EL	872	4Ø-P	1101
38	Central Ave.	@	Druid Park Ave.	S	I	Transyt	1880	791	Dec-81	12EL	4677	4Ø-B	2293
39	Central Ave.	@	Heard Ave.	F	T	Transyt	1880E	3333	Nov-90	12EL	959	4Ø-P	1101
40	Central Ave.	@	Hickman Rd.	F	C	Transyt	1880E	3414	Nov-90	12EL	1038	4Ø-Bmc	2007
41	Central Ave.	@	Highland Ave.	A	I	Transyt	1880E	3346	May-91	1200	10389	8Ø-Bmc	410
42	Central Ave.	@	Monte Sano Ave.	F	I	Transyt	1880S	11601	Apr-86	1200	6782	2Ø-P	22581
43	Central Ave.	@	Troupe St.	F	T	Transyt	1880E	3316	Nov-90	12EL	884	4Ø-P	1101
44	Deans Bridge Rd.	@	Milledgeville Rd.	A	I	Transyt	1880	6250	Jun-84	1200	6680	8Ø-B	115-299-347-162
45	Doug Barnard Pkwy.	@	Bobby Jones Exp.(EB ramp)	A	C	Transyt	1880E	7812	Aug-89	12EL	2121	4Ø-B	2952
46	Doug Barnard Pkwy.	@	Bobby Jones Exp.(WB ramp)	A	C	Transyt	1880E	4962	Jul-91	1200	13960	4Ø-B	2293
47	Doug Barnard Pkwy.	@	Marvin Griffin Rd.	A	C	Transyt	1880E	5865	Dec-85	1200	4105	8Ø-Bm	1587
48	Doug Barnard Pkwy.	@	Tobacco Rd./Bush Field	A-P	I	D.T.S.	170E	11813	99	210E	209225	8Ø-B	1252 (336)
49	Druid Park Ave.	@	Laney-Walker/Mulhern St.	S	I	Transyt	1880	6741	May-84	1200	4638	4Ø-B	1037
50	Gordon Hwy	@	Barton Chapel Rd.	A	C	Transyt	1880E	5886	Nov-91	12EL	3066	8Ø-Bm	973
51	Gordon Hwy	@	Dan Bowles Rd./Old Sav.Rd.	A	C	Transyt	1880E	3377	90	12EL	559	8Ø-B	1953
52	Gordon Hwy	@	Gate 1 / Jimmiie Dyess	A	I	D.T.S.	170E	5201	99	210E	202657	8Ø-B	1498 (336)
53	Gordon Hwy	@	Gate 2 / Robinson Ave.	A	I	D.T.S.	170E	494878	00	210E	206447	8Ø-B	1533 (336)
54	Gordon Hwy	@	Hwy 1(Deans Bridge Rd.)	A	C	Transyt	1880E	3214	Oct-90	1200	13894	8Ø-Bm	1954
55	Gordon Hwy	@	Kissingbower Rd.	A	C	Transyt	1880E	4477	88	1200	10032	8Ø-B	353
56	Gordon Hwy	@	Milledgeville Rd. (East)	A	C	Transyt	1880E	4514	91	1200	5377	8Ø-B	1587
57	Gordon Hwy	@	Milledgeville Rd. (West)	A	C	Transyt	1880E	7718	Jul-92	1200	13981	8Ø-B	1587
58	Gordon Hwy	@	Molly Pond Rd./D. Barnard	A	C	Transyt	1880E	4028	88	1200	13757	8Ø-Bm	1587
59	Gordon Hwy	@	North Leg	A	C	Transyt	1880E	4027	88	1200	9983	8Ø-B	1587
60	Gordon Hwy	@	Olive Rd./Old Savannah Rd.	A	C	Transyt	1880E	4374	Oct-90	1200	9948	8Ø-B	525
61	Gordon Hwy	@	Sibley Rd.	A	C	Transyt	1880E	3986	Feb-88	1200	10009	8Ø-B	353

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
62	Gordon Hwy	@	Skyview Dr.	A	C	Transyt	1880E	4984	91	12EL	954	8Ø-B	1954
63	Gordon Hwy	@	Thomas Lane/Regency Blvd.	A	C	Transyt	1880E	4022	88	1200	10139	8Ø-B	353
64	Gordon Hwy	@	Tubman Home Rd.	A	C	Transyt	1880E	4483	88	1200	10059	8Ø-B	353
65	Gordon Hwy	@	Walton Way	A	C	Transyt	1880E	9922	May-93	12EL	5873	8Ø-B	3171
66	Gordon Hwy	@	Wheeless Rd./Highland Ave.	A	C	Transyt	1880E	4034	88	1200	9949	8Ø-B	353
67	Greene St.	@	4th St.	S	C	Transyt	1880E	1231	87	1200	8454	4Ø-B	34613
68	Greene St.	@	5th St.	S	C	Transyt	1880E	10770	93	1200	8403	8Ø-B	2925
69	Greene St.	@	6th St.	S,P	C	Transyt	1880E	1256	87	1200	8469	4Ø-B	34612
70	Greene St.	@	7th St.	S	C	Transyt	1880E	2619	87	1200	8459	4Ø-B	34613
71	Greene St.	@	8th St.	S	C	Transyt	1880E	1261	87	1200	8474	8Ø-Bm	34613
72	Greene St.	@	9th St.(James Brown Blvd.)	S	C	Transyt	1880E	1260	87	1200	8434	4Ø-B	34613
73	Greene St.	@	10th St.	S	C	Transyt	1880E	1263	87	1200	3741	4Ø-B	34613
74	Greene St.	@	11th St.	S	C	Transyt	1880E	1255	87	1200	8405	4Ø-B	1037
75	Greene St.	@	12th St.	S	C	Transyt	1880E	7571	88	1200	9754	8Ø-B	900
76	Highland Ave.	@	Damascus Rd./Walden Dr.	S	I	Transyt	1880	8822	Jun-85	1200	8689	4Ø-P	34661
77	Highland Ave.	@	Henry St.	S	C	Transyt	1880E	3354	Nov-90	12EL	946	4Ø-P	1101
78	Highland/Berckman	@	Wheeler Rd.	A	I	Transyt	1880E	442	Sep-89	1200	12860	4Ø-P	1037
79	Hwy 1	@	Georgetown Dr./Wal-Mart	A	I	Transyt	1880	756	Oct-81	1200	5535	4Ø-P	38121
80	Hwy 1	@	Glenn Hills Dr./Augusta Tech	A	C	Transyt	1880E	10184	Jul-93	12EL	6046	8Ø-B	1938
81	Hwy 1	@	Golden Camp Rd./Dover St.	A	C	Transyt	1880E	8848	Nov-92	12EL	6172	8Ø-B	3219
82	Hwy 1	@	Lumpkin Rd.	A	C	Transyt	1880E	1000	88	12EL	6117	8Ø-Bm	3218
83	Hwy 1	@	Meadowbrook Dr./B. Chapel	A	I	Transyt	1880E	10773	Oct-93	1200	14136	8Ø-B	38048
84	Hwy 1	@	Morgan Rd.	A	I	Transyt	1880E	9034	Dec-92	12EL	4689	8Ø-B	973
85	Hwy 1	@	Richmond Hill Rd. West	A	C	Transyt	1880E	10170	Jul-93	12EL	6194	8Ø-B	3221
86	Hwy 1	@	Richmond Hill Rd./Regency	A	C	Transyt	1880E	4469	Feb-88	1200	9985	8Ø-B	353
	Hwy 1	@	Spring Grove Dr.	**Future**									
87	Hwy 1	@	Wheeless Rd.	A	C	Transyt	1880E	10168	Jul-93	12EL	6196	8Ø-B	3220
88	Hwy 25	@	Bobby Jones Exp.(EB ramp)	A	C	Transyt	1880E	7018	Mar-92	1200	10027	4Ø-B	700
89	Hwy 25	@	Bobby Jones Exp.(WB ramp)	A	C	Transyt	1880E	8197	Dec-88	1200	11878	4Ø-B	700
90	Hwy 25	@	Bungalow Rd.	S	I	Transyt	1880	6271	Jun-84	1200	2253	8Ø-B	90-220-237-98-12
91	Hwy 25	@	Harold Rd.	S	I	Transyt	1880	596	Dec-81	1200	13980	8Ø-B	973
92	Hwy 25	@	Hwy 88	A	I	D.T.S.	170E	7626	97	210E	970305275	8Ø-B	1492 (336)
93	Hwy 25	@	Lumpkin Rd.	S	I	Transyt	1880E	4972	Jul-91	1200	6235	8Ø-B	2664
94	Hwy 25	@	Pepperidge Dr.	A	C	Transyt	1880E	10774	Oct-93	12EL	4914	8Ø-B	6608
95	Hwy 25	@	Phinizy Rd.	A	C	Transyt	1880E	3992	Feb-88	1200	10012	4Ø-B	344

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
96	Hwy 25	@	Reedale Ave.	A	C	Transyt	1880E	10190	Jul-93	12EL	4852	8Ø-B	2159
97	Hwy 25	@	Rosier Rd.	A	C	Transyt	1880E	3388	Nov-90	1200	10219	8Ø-Bmc	1082
98	Hwy 25	@	Tobacco Rd.	A	C	Transyt	1880E	9004	Dec-92	1200	13914	8Ø-B	973
99	Hwy 25	@	Tubman Home Rd.	S	I	Transyt	1880	5003	Nov-83	1200	4300	8Ø-B	38240
100	Hwy 25	@	Windsor Spring Rd.	A	C	Transyt	1880E	8262	Dec-88	1200	12000	8Ø-B	589
101	Hwy 56	@	Apple Valley Dr.	A	C	Transyt	1880E	6879	Aug-88	1200	11179	8Ø-B	1150
102	Hwy 56	@	Bobby Jones Exp.(EB ramp)	A	C	Transyt	1880E	7349	Sep-88	1200	11209	8Ø-B	589
103	Hwy 56	@	Bobby Jones Exp.(WB ramp)	A	C	Transyt	1880E	6876	Aug-88	1200	10900	8Ø-B	2980
	Hwy 56	@	Goshen Rd.	**Future**									
104	Hwy 56	@	Lumpkin Rd.	A	I	D.T.S.	170E	11228	99	210E	209225	8Ø-B	1253 (336)
105	Hwy 56	@	Marvin Griffin Rd.	A	C	Transyt	1880E	6779	Aug-88	1200	11529	8Ø-Bm	589
106	Hwy 56	@	Old Waynesboro	A	C	Safetran	170E	487887	00	210E	208306	8Ø-Bm	29022 (332)
107	Hwy 56	@	Phinizy Rd.	A	I	D.T.S.	170E	10161	98	210E	201713	8Ø-B	10075
108	Hwy 56	@	Tobacco Rd.	A	C	Safetran	170E	487874	00	210E	208306	8Ø-B	28774 (336)
109	Hwy 88	@	Windsor Spring Rd.	A	I	D.T.S.	170E	7633	97	210E	970404124	8Ø-B	1496 (336)
110	Jimmie Dyess Pkwy.	@	Belair Rd.	A	I	S.C.C.	170E	3525	99	210E	203472	8Ø-B	23337 (336)
111	Jimmie Dyess Pkwy.	@	Powell Rd.	A	I	Safetran	170E	451829	98	210E	201873	8Ø-Bmc	20063 (332)
112	Jimmie Dyess Pkwy.	@	Wrightsboro Rd.	A	I	S.C.C.	170	9829	98	210E	202899	8Ø-B	1537
113	Laney-Walker Blvd.	@	5th St./Arthern Rd.	S	I	Transyt	1880	2432	Aug-82	600	1789	4Ø-B	24654
114	Laney-Walker Blvd.	@	9th St.(James Brown Blvd.)	F	I	Transyt	1880	6423		1200	814	4Ø-P	1037
115	Laney-Walker Blvd.	@	11th St.	F	I	Transyt	1880S	11574	Apr-86	1200	6900	2Ø-P	22581
116	Laney-Walker Blvd.	@	12th St.	F	I	Transyt	1880E	7103	Nov-93	300	3923	2Ø-P	3303
117	Laney-Walker Blvd.	@	Bobby Jones Exp. (NB ramp)	A	I	Safetran	170E	445791	98	210E	204412	8Ø-B	19968 (336)
118	Laney-Walker Blvd.	@	Bobby Jones Exp. (SB ramp)	A	I	Safetran	170E	451835	98	210E	204412	8Ø-Bmc	20024 (332)
119	Laney-Walker Blvd.	@	Columbia Nitrogen Rd.	S	I	Transyt	1880	2146	May-90	1200	13391	4Ø-P	1037
120	Laney-Walker Blvd.	@	East Boundary St.	A	I	Safetran	170E	420753	96	210E	9605313	8Ø-B	16096 (336)
121	Laney-Walker Blvd.	@	Ervin Towers (cross walk)	A	I	Transyt	1880	5997	Jun-84	160	161	2Ø-B	22067
122	Laney-Walker Blvd.	@	Hornsby School (cross walk)	A	I	Transyt	1880	5239	Sep-83	1200	8644	4Ø-P	34619
123	Laney-Walker Blvd.	@	M.C.G.	S	I	Transyt	1880	6814	May-84	300	1091	2Ø-P	22392
124	Laney-Walker Blvd.	@	Twiggs St.	F	I	Transyt	1880E	4981	Jul-91	160	103	2Ø-P	22413
125	Lumpkin Rd.	@	Richmond Hill Rd.	A	I	D.T.S.	170E	11225	99	210E	209225	8Ø-B	1255 (336)
126	Lumpkin Rd.	@	Wells Dr./Augusta Tech Dr.	A	I	Transyt	1880E	10771	Oct-93	1200	1951	8Ø-B	2925
127	Milledgeville / MLK	@	Olive Rd.	A	I	Transyt	1880	6271	Jun-84	1200	4328	8Ø-B	90-284-346-188
128	Milledgeville Rd.	@	Kissingbower Rd.	A	I	Transyt	1880	7045	May-88	1200	8408	4Ø-P	716
129	Milledgeville Rd.	@	Tubman Home Rd.	A	I	Transyt	1880	6333	Jun-84	1200	12926	4Ø-B	2293

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
130	Milledgeville Rd.	@	Wheeless Rd.	A	I	Safetran	170E	489431	99	210E	208169	8Ø-B	29654 (336)
131	MLK Blvd.	@	12th St.	F	I	Transyt	1880	10542	Dec-85	1200	10048	2Ø-P	22581
132	MLK Blvd.	@	15th St.	A	I	Transyt	1880	2046	Jul-82	600	2842	4Ø-B	24291
133	MLK Blvd.	@	Turpin St./Steed St.	F	I	Transyt	1880	10633	Dec-85	600	2095	4Ø-P	24516
134	Monte Sano Ave.	@	McDowell St.	A	I	Transyt	1880E	4427	Apr-91	12EL	8862	4Ø-P	3174
135	North Leg	@	Wylds Rd.	A	C	Transyt	1880E	1219	Feb-87	12EL	4693	8Ø-B	2925
136	Olive Rd.	@	Eagles Way	A	I	Transyt	1880E	8980	Dec-92	1200	14152	4Ø-B	353
137	Pleasant Home Rd.	@	Crane Ferry Rd.	A	I	Safetran	170E	420752	97	210E	9605314	8Ø-B	16095 (336)
138	Pleasant Home Rd.	@	Davis Rd./Scott Nixon Dr.	A	C	Transyt	1880E	7538	Jun-92	12EL	1205	8Ø-B	973
139	R. A. Dent Blvd.	@	Laney-Walker Blvd.	F,P	I	Transyt	1880	2315	Sep-82	600	2836	2Ø-P	24658
140	R. A. Dent Blvd.	@	University Hospital	S	I	Transyt	1800	326	Feb-79	160	1389	4Ø-B	24189
141	Reynolds St.	@	5th St.	F	T	Transyt	1880E	1098	Feb-87	1200	8467	4Ø-P	34613
142	Reynolds St.	@	7th St.	F	R	Transyt	1880EL	2317	Nov-92	6ELR	3500	2Ø-B	22961
143	Reynolds St.	@	8th St.	F	R	Transyt	1880EL	1857	Mar-92	6ELR	3546	2Ø-B	22961
144	Reynolds St.	@	9th St.(James Brown Blvd.)	F	R	Transyt	1880EL	1947	Apr-92	6ELR	3593	2Ø-B	22961
145	Reynolds St.	@	10th St.	F	R	Transyt	1880EL	1915	Apr-92	6ELR	3516	2Ø-B	22961
146	River Watch Pkwy.	@	Alexander Dr.	A,P	C	Transyt	1880EL	12939	Mar-95	12EL	7942	8Ø-B	3894
147	River Watch Pkwy.	@	Claussen Rd.	A,P	C	Transyt	1880E	3363	Nov-90	12EL	812	8Ø-Bmc	1941
148	River Watch Pkwy.	@	Fury's Ferry Rd.	A	C	Transyt	1880E	3696	Jan-92	12EL	953	8Ø-B	973
	River Watch Pkwy.	@	Pleasant Home**(Columbia Co.)**	A,P	C	S.C.C.	170	14211	93	210E		8Ø-Bmc	8299 (332)
150	River Watch Pkwy.	@	River Shoals Pkwy.	A	C	Transyt	1880E	9906	May-93	1200	6874	8Ø-B	3173
151	River Watch Pkwy.	@	Riverwest Dr.	A	C	Transyt	1880EL	13803	Aug-95	12EL	3071	8Ø-B	973
152	River Watch Pkwy.	@	Stevens Creek Rd.	A,P	C	Transyt	1880EL	4952	Jul-91	12EL	3870	8Ø-B	2642
153	Robert Daniel Pkwy.	@	Agerton Ln.	A	C	Transyt	1880EL	16498	Aug-97	12EL	10478	8Ø-B	1150
154	Sand Bar Ferry Rd.	@	Bobby Jones (NB off ramp)	A	I	Safetran	170E	445790	98	210E	204412	8Ø-B	19967 (336)
155	Sand Bar Ferry Rd.	@	Courtland Dr. (cross walk)	A	I	Transyt	1880	4131	Sep-83	300	780	2Ø-P	22321
	Skinner Mill Rd.	@	Warren Rd.	**Future**									
	Stevens Creek Rd.	@	Claussen Rd.	**Future**									
156	Telfair St.	@	7th St.	F	R	Transyt	1880EL	2294	Nov-92	300	3730	2Ø-P	22988
157	Telfair St.	@	8th St.	F	R	Transyt	1880EL	1914	Apr-92	300	3749	2Ø-B	22988
158	Telfair St.	@	9th St.(James Brown Blvd.)	F	R	Transyt	1880EL	2310	Nov-92	300	3731	2Ø-P	22988
159	Telfair St.	@	10th St.	F	R	Transyt	1880EL	2306	Nov-92	300	3729	2Ø-P	22988
160	Telfair St.	@	11th St.	F	R	Transyt	1880EL	2309	Nov-92	300	3747	2Ø-P	22988
161	Telfair St.	@	12th St.	F	R	Transyt	1880EL	8622	Nov-92	12EL	4678	4Ø-P	2922
162	Tobacco Rd.	@	Gracewood Rd.	A	C	Transyt	1880E	7329	Sep-88	1200	13982	4Ø-B	2293

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
163	Tobacco Rd.	@	Morgan Rd.	A	I	D.T.S.	170E	5896		210E	201873	8Ø-B	1386 (336)
164	Tobacco Rd.	@	Windsor Spring Rd.	A	I	D.T.S.	170E	11214	Apr-00	210E	209225	8Ø-B	10320 (332)
165	Walton Way	@	5th St.	S	C	Transyt	1880E	9908	May-93	12EL	5889	8Ø-Bmc	3170
166	Walton Way	@	7th St.	F	R	Transyt	1880EL	2316	Nov-92	300	3728	2Ø-P	22988
167	Walton Way	@	8th St.	F	R	Transyt	1880EL	2289	Nov-92	300	3736	2Ø-P	22988
168	Walton Way	@	9th St.(James Brown Blvd.)	F	R	Transyt	1880EL	2318	Nov-92	300	3750	2Ø-P	22988
169	Walton Way	@	11th St.	F	R	Transyt	1880EL	2314	Nov-92	300	3751	2Ø-P	22988
170	Walton Way	@	12th St.	F	R	Transyt	1880EL	8711	Nov-92	12EL	4674	4Ø-P	2924
171	Walton Way	@	13th St.	A	I	Transyt	1880EL	8721	Nov-92	12EL	1151	8Ø-B	1029
172	Walton Way	@	Baker Ave.	A	T	D.T.S.	170E	9022	98	210E	205796	8Ø-B	10031 (336)
173	Walton Way	@	Bransford Rd.	A	C	Transyt	1880E	8794	Nov-92	12EL	4676	4Ø-B	2921
174	Walton Way	@	Crawford Ave.	A	T	D.T.S.	170E	9478	98	210E	205061	8Ø-B	10030 (336)
175	Walton Way	@	Druid Park Ave.	A	T	D.T.S.	170E	9480	98	210E	205053	8Ø-B	10029 (332)
176	Walton Way	@	Fleming Ave.	S	C	Transyt	1880E	3248	Oct-90	12EL	930	4Ø-P	1101
177	Walton Way	@	Heard Ave.	A	T	D.T.S.	170E	9475	98	210E	205018	8Ø-B	10032 (336)
178	Walton Way	@	Highland Ave.	S	C	Transyt	1880E	3311	Nov-90	12EL	887	4Ø-P	1101
179	Walton Way	@	Johns Rd.	S	T	Transyt	1880E	8076	Dec-88	1200	6915	4Ø-P	2745
180	Walton Way	@	Lake Forest Dr.	A	C	Transyt	1880E	4607	Mar-88	1200	10096	8Ø-Bmc	1330
181	Walton Way	@	Milledge Rd.	S	T	Transyt	1880E	2585	Feb-87	12EL	949	4Ø-P	1101
182	Walton Way	@	Monte Sano Ave.	S	C	Transyt	1880E	3353	Nov-90	12EL	952	4Ø-P	1101
183	Walton Way	@	St. Sebasian Way	S	R	Transyt	1880EL	8591	Nov-92	12ELR	4670	4Ø-B	2926
184	Walton Way Ext.	@	Jackson Rd./Walton Way	A	C	Transyt	1880E	7543	Jun-92	12EL	2960	8Ø-B	973
185	Walton Way Ext.	@	Robert C. Daniel, Jr. Pkwy.	A	C	Transyt	1880EL	16662	Jul-97	12EL	10471	8Ø-B	1150
186	Walton Way Ext.	@	Skinner Mill Rd.	A	C	Transyt	1880E	7522	Jun-92	12EL	3726	4Ø-B	2293
187	Walton Way Ext.	@	Wheeler Rd.	A	C	Transyt	1880E	737	Oct-89	1200	13179	8Ø-B	353
188	Washington Rd.	@	Alexander Dr./Stanley Dr.	A	C	Transyt	1880E	7162	Apr-92	12EL	3462	8Ø-B	2664
189	Washington Rd.	@	Azalea Dr.	A	C	Transyt	1880E	7084	Apr-92	12EL	3504	4Ø-B	2665
190	Washington Rd.	@	Berckmans Rd.	A	C	Transyt	1880E	7013	Mar-92	12EL	3425	8Ø-Bm	2671
191	Washington Rd.	@	Bertram Rd.	A	C	Transyt	1880E	6993	Mar-92	12EL	3443	8Ø-B	2664
192	Washington Rd.	@	Boy Scout Rd./Center West	A	C	Transyt	1880E	7035	Apr-92	1200	12995	8Ø-B	1029
193	Washington Rd.	@	Eisenhower Dr.	A	C	Transyt	1880E	7161	Apr-92	12EL	3474	4Ø-B	2665
194	Washington Rd.	@	Fury's Ferry Rd./Kings Chapel	A	C	Transyt	1880E	7008	Mar-92	1200	6970	8Ø-B	1252
195	Washington Rd.	@	I-20 (EB ramp)	A	C	Transyt	1880E	7164	Apr-92	12EL	3518	4Ø-B	2667
196	Washington Rd.	@	I-20 (WB ramp)	A	C	Transyt	1880E	7166	Apr-92	12EL	3460	4Ø-B	2667
197	Washington Rd.	@	Patriots Way	A	C	Transyt	1880E	7043	Apr-92	12EL	3468	8Ø-B	2663

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
198	Washington Rd.	@	Pleasant Home Rd.	A,P	C	S.C.C.	D170	15577	Oct-90	210E	9205129	8Ø-B	4539 (336)
199	Washington Rd.	@	Stevens Creek Rd.	A	C	Transyt	1880E	7044	Apr-92	12EL	3457	4Ø-B	2665
	Washington Rd.	@	Warren Rd.	**Future**									
200	Washington Rd.	@	Woodbine Rd./East Vineland	A	C	Transyt	1880E	6840	Mar-92	12EL	3510	8Ø-B	2925
201	Wheeler Rd.	@	Agerton Ln.	A	C	Transyt	1880EL	16555	Jul-97	12EL	10634	8Ø-B	1150
202	Wheeler Rd.	@	Augusta West/Medical Center	A	C	Transyt	1880EL	16644	Aug-97	12ELRA	1442	8Ø-B	1252
203	Wheeler Rd.	@	Bobby Jones Exp.(NB ramp)	A	C	Transyt	1880E	802	89	1200	13183	8Ø-Bm	973
204	Wheeler Rd.	@	Bobby Jones Exp.(SB ramp)	A	C	Transyt	1880E	792	89	1200	13211	8Ø-B	973
205	Wheeler Rd.	@	Bransford Rd./Joy Rd.	A	I	Transyt	1880E	9896	May-93	12EL	3965	8Ø-B	973
206	Wheeler Rd.	@	Frontage Rd./Interstate Pkwy.	A	I	D.T.S.	170E	6526	99	210E	9608157	8Ø-B	1502
207	Wheeler Rd.	@	I-20 (EB ramp)	A	I	D.T.S.	170E	7660	99	210E	201999	8Ø-B	1426
208	Wheeler Rd.	@	Marks Church/Robert Daniel	A	C	Transyt	1880EL	14702	Dec-95	12EL	10083	8Ø-B	1029
209	Wheeler Rd.	@	Perimeter Pkwy./G.C.Wilson	A	C	Transyt	1880E	4012	88	1200	10017	8Ø-B	353
210	Windsor Spring Rd.	@	Bobby Jones Exp.(EB ramp)	A	C	Transyt	1880E	8221	Dec-88	1200	11948	4Ø-B	700
211	Windsor Spring Rd.	@	Bobby Jones Exp.(WB ramp)	A	C	Transyt	1880E	7347	Sep-88	1200	11265	4Ø-B	700
212	Windsor Spring Rd.	@	Cross Creek Rd.	A	I	D.T.S.	170E	12999	00	210E	210802	8Ø-B	10443 (332)
213	Windsor Spring Rd.	@	Lincolnton Pkwy.	A	I	D.T.S.	170E	11818	99	210E	209225	8Ø-B	1256 (336)
214	Windsor Spring Rd.	@	Meadowbrook Dr.	A	I	D.T.S.	170E	11820	99	210E	209225	8Ø-B	10323 (332)
215	Windsor Spring Rd.	@	Richmond Hill Rd.	A	I	D.T.S.	170E	12015	99	210E	203472	8Ø-B	1251 (336)
216	Windsor Spring Rd.	@	Rosier Rd.	A	I	D.T.S.	170E	12014	99	210E	209225	8Ø-B	1258 (336)
217	Windsor Spring Rd.	@	Sconyers Way	A	C	Transyt	1880E	7806	Nov-88	1200	11651	8Ø-Bm	589
218	Windsor Spring Rd.	@	Willis Foreman Rd.	A	I	Transyt	1880	5395	Jan-85	12EL	5880	4Ø-P	3172
219	Windsor Spring Rd.	@	Windsor Spring Elem. School	A	I	D.T.S.	170E	11202	99	210E	209225	8Ø-B	1249 (336)
220	Windsor Spring Rd.	@	Woodlake Rd.	A	I	D.T.S.	170E	11798	99	210E	209225	8Ø-B	1252 (336)
221	Wrightsboro Rd.	@	Augusta Mall (East)	A	C	Transyt	1880E	8178	Jan-89	1200	10473	8Ø-Bm	1461
222	Wrightsboro Rd.	@	Augusta Mall (West)	A	C	Transyt	1880E	8147	Jan-89	1200	10506	8Ø-B	353
223	Wrightsboro Rd.	@	Augusta West Pkwy.	A	C	Transyt	1880E	8174	Jan-89	1200	10449	8Ø-B	1461

	Main street		Side street	Type	Com.	Manuf.	Controller Model #	Controller Serial #	Year	Monitor Model #	Monitor Serial #	Cabinet Type	Cabinet #
224	Wrightsboro Rd.	@	Barton Chapel Rd.	A	C	Transyt	1880E	749	Nov-89	12EL	7990	4Ø-B	700
225	Wrightsboro Rd.	@	Bobby Jones Exp.(NB ramp)	A	C	Transyt	1880E	5833	Jun-88	1200	10437	4Ø-B	179
226	Wrightsboro Rd.	@	Bobby Jones Exp.(SB ramp)	A	C	Transyt	1880E	1232	Mar-87	1200	13207	4Ø-B	179
227	Wrightsboro Rd.	@	Damascus Rd.	A	I	Transyt	1880E	1204	Feb-87	160	158	2Ø-B	22067
228	Wrightsboro Rd.	@	Daniel Village	S	I	Transyt	1880E	7767	92	1200	11883	4Ø-B	2952
229	Wrightsboro Rd.	@	Heard Ave.	A	I	Transyt	1880E	9921	May-93	1200	11104	4Ø-P	413
230	Wrightsboro Rd.	@	Highland Ave.	A	I	Transyt	1880E	4965	91	12EL	2287	8Ø-B	589
231	Wrightsboro Rd.	@	Johns Rd.	F	I	Transyt	1880	10641	Dec-85	1200	821	4Ø-P	338
232	Wrightsboro Rd.	@	Jordan Rd./Wilson St.	S	I	Transyt	1800	1026	80	160	185	4Ø-B	24189
233	Wrightsboro Rd.	@	Marks Church Rd.	A	C	Transyt	1880E	1214	Oct-90	12EL	3428	8Ø-B	1029
234	Wrightsboro Rd.	@	Mill St.	F	I	Transyt	1880	2336	Sep-82	1200	4653	2Ø-P	22581
235	Wrightsboro Rd.	@	Monte Sano Ave.	F	I	Transyt	1880E	2864	Sep-90	1200	6885	4Ø-P	2293
236	Wrightsboro Rd.	@	North Leg/Jackson Rd.	A	I	Transyt	1880E	4590	Apr-91	1200	8291	8Ø-B	38048
237	Wrightsboro Rd.	@	Pine Needle Rd.	S	I	Transyt	1880E	8720	Nov-92	1200	4312	4Ø-B	700
238	Wrightsboro Rd.	@	Schley St./Freedom Way	A	I	Transyt	1880E	3342	Nov-90	1200	11204	4Ø-P	413
239	Wrightsboro Rd.	@	Troupe St.	A	I	Transyt	1880	1965	82	1200	4696	4Ø-P	368
240	Wrightsboro Rd.	@	Valley Park E.	A	I	Transyt	1880	4431	83	1200	10244	8Ø-B	38614
241	Wrightsboro Rd.	@	Winter St.	F	I	Transyt	1880	4429	Aug-83	1200	4098	4Ø-B	21-03-001-003

APPENDIX B

Augusta Regional Transportation Study

Organization and Management

ORGANIZATION AND MANAGEMENT

The Augusta Regional Transportation Study operates under a three committee structure: a Policy Committee responsible for overall direction and conclusions of the Study; a Citizens Advisory Committee designed to provide the Study process with a general citizen input; and a Technical Coordinating Committee made up of individuals possessing the technical capabilities of carrying out the in-depth analysis necessary in the preparation of such a Study.

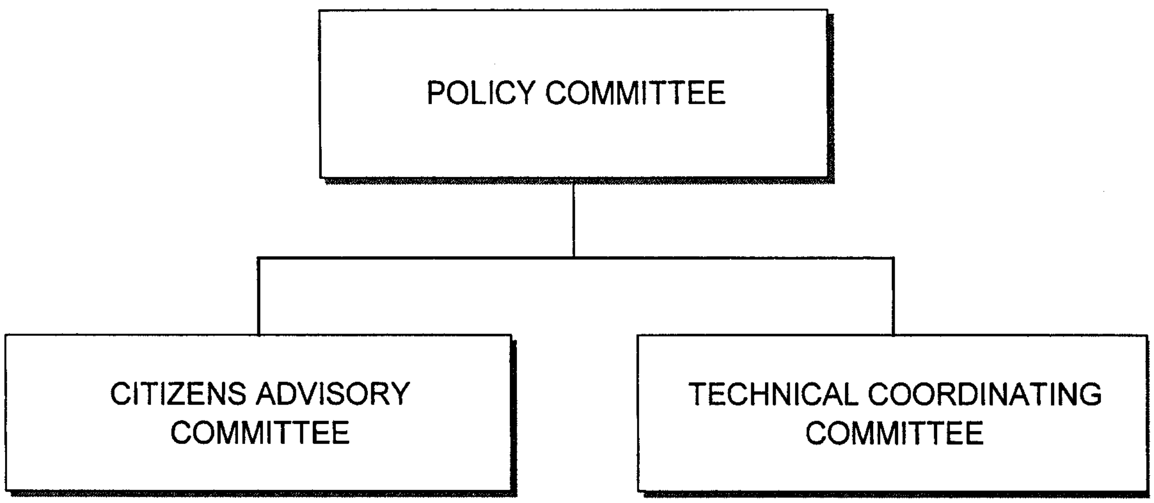


FIGURE 1 - AUGUSTA REGIONAL TRANSPORTATION STUDY FRAMEWORK

As illustrated above, the Policy Committee is responsible for the establishment of policy and overall guidance of the Study. In carrying out its responsibilities it receives recommendations and in turn makes the decisions that actually set transportation priorities. The local governments within the Study Area are all represented in this group. The Georgia Department of Transportation, the South Carolina Department of Transportation, the Federal Highway Administration, and the Federal Transit Administration also have representatives. Fort Gordon's Commanding General is also a member of the Committee in order to furnish information on the impact of a military installation on the transportation system.

The Citizens Advisory Committee (CAC) is an integral part of the public involvement process for the ARTS and is comprised of ten (10) citizens from throughout the urbanized area. The CAC meets monthly to receive updates on transportation projects, to review ARTS related planning activities, and to discuss problems and concerns of the membership. The CAC meets the same day of the month as the Technical Coordinating Committee, and sometimes the two committees hold joint meetings. This fosters the direct exchange of ideas and concerns between the two groups.

The CAC provides direct input on the work of the Technical Coordinating Committee (TCC) and also conveys problems and concerns to the Policy Committee. The chair of the CAC is a voting member of the TCC and a nonvoting member of the Policy Committee. Among other things, CAC members are responsible for familiarizing themselves with transportation issues and projects in the urbanized area, informing the TCC and Policy Committee about transportation problems, and encouraging others to become involved in the transportation planning process. The Citizens Advisory Committee Handbook provides additional information about the membership and responsibilities of the CAC.

It is the goal of the Augusta Regional transportation Study to have a proactive public involvement process in order to evaluate alternative transportation improvements in relation to other values. These evaluations, constituting expressions of public attitudes, can provide practical guidance to those who are empowered to make the decisions. Public involvement is not viewed as a substitute for decision-making by the Policy Committee, but as an essential contribution to such decision-making. Thus, the purpose of involvement should be the development of better plans and is not simply meant as a means of clearing the way for implementation.

The Technical Coordinating Committee is the group that conducts the detailed studies relating to the transportation system in the Augusta area. Recommendations for changes in the plan are made to this group so that they might determine the appropriateness of the recommendation. If a change is deemed appropriate, it is forwarded to the Policy Committee for proper consideration.

The detailed procedure for changing the plan is as follows:

1. All proposed modifications to the Augusta Regional Transportation Study shall be presented to the Technical Coordinating Committee for consideration from one of the following sources:

    a. Policy Committee

    b. Technical Coordinating Committee Subcommittee

    c. Citizens Advisory Committee

    d. Georgia Department of Transportation

    e. South Carolina Department of Transportation

2. Requests for changes in the plan can be made by private citizens, special interest groups or representatives of local, regional, state or federal agencies. Such requests should be made to the Technical Coordinating Committee for study.

3. A request for plan modification which is presented to the Technical Coordinating Committee shall include:

    a. Location and description of the proposed modification.

    b. The nature of the modification requested (i.e., capacity, location and classification).

c. Statement of reason for requested modification.

d. Statement showing availability of funding.

4. The Technical Coordinating Committee will make a preliminary review of each request received to determine the overall effect a possible modification would have on the total plan, priorities, and funding sources. No network testing is required in this initial review.

5. If the review under Step 4 indicates that this modification could not result in a satisfactory plan, then the Technical Coordinating Committee will, by vote of the committee, reject the requested change and no further action will be required if the request originated within the Technical Coordinating Committee. If the request originated outside the Technical Coordinating Committee, then the request Technical Coordinating Committee will recommend to the Policy Committee that the request be denied and no further action will be required if concurred with by the Policy Committee. The Policy Committee can request that the network be tested before reaching a decision.

6. If it appears from the initial review by the Technical Coordinating Committee that a valid plan could result, then the modified network will be tested. If a satisfactory network results from the testing, then a submission will be made to the Policy Committee by the Technical Coordinating Committee after review by the Citizens Advisory Committee. This submission will point out the advantages and disadvantages of making the change and will contain the recommendations of the Technical Coordinating Committee and the Citizens Advisory Committee. If the change is denied by vote of the Policy Committee, then no further action will be required. If approved by vote of the Policy Committee, then the modified plan will be submitted to the appropriate local officials for adoption as the official transportation plan for the urbanized area.

7. If a satisfactory coordinating network does not result from the testing, then by vote of the Technical Coordinating Committee the request will be rejected and no further action will be required where the request originated within the Technical Coordinating Committee. If the request originated outside the Technical Coordinating Committee, then the Technical Coordinating Committee will recommend to the Policy committee that the request be denied and no further action will be required if concurred by the Policy Committee.

8. The Policy Committee could, in unusual circumstances, approve a change not providing for a satisfactory network. Appropriate policy decisions would be necessary, however, by the Policy Committee to assure that a reasonable level of service would be provided. (This would include such decisions as increasing the transit service provided, restricting parking in downtown area, raising of parking fees, etc.)

9. The Technical Coordinating Committee shall be responsible for notifying all persons, groups, and/or agencies involved in a particular request, of the final decision reached and final action taken.

Staff services for what is known as the original portion of the Augusta Regional Transportation Study area are provided by the Aiken County Planning and Development Department, the Georgia Department of Transportation, the South Carolina Department of Transportation, and the Augusta-Richmond County Planning Commission. In the areas of the Study added after the

1980 Census, known as the expanded study area, staff is provided by the South Carolina Department of Transportation and the Aiken County Planning and Development Department. The local staff workload is the responsibility of the Project Director who is the Executive Director of the Augusta-Richmond County Planning Commission. The workload is developed, supervised and reviewed by the Project Director in conformance with the Study process. The local staff also includes professionals trained and experienced in transportation planning who have as their primary charge the technical work necessary to keep the Study relevant.

The local transportation planners work directly with the responsible planners on the staff of the Georgia Department of Transportation and the South Carolina Department of Transportation. The Georgia Department of Transportation and the South Carolina Department of Transportation have professional planners who coordinate state aspects of any studies, assist in the preparation of analytical analysis techniques, and play a major role in the development and utilization of the computer models for the Study. The relationship of the Staff of these two agencies is yet another reflection of the cooperative nature of the Study.

APPENDIX C

Communications Systems Analysis

NEEDS ASSESSMENT

The deployment of a regional ITS system will require the installation of a fiber optic network that services multiple state and is capable of transmitting both low speed data, voice, and full-motion, color, video.

One task in the development of the Advanced Transportation Management System for the Augusta Regional Transportation System (ARTS) is a telecommunications plan. The purpose of the telecommunications plan is to define the communication requirements to support ITS deployment and examine if other municipal activities can be supported by this deployment. The central question addressed in this task was "Can other agencies use the communications capacity that will be constructed for ITS?"

In order to conduct this assessment, the consulting team met with representatives of several agencies in all three counties in the Augusta region to determine their current communications activities and future needs. During these meetings, it was determined that it may not be feasible to extend an ITS communication network throughout each county, therefore we should concentrate on the most populated areas of the region.

The answer to the central question is: Yes, different government agencies can benefit by sharing information across a high-speed communications network from City Hall to remote locations and between agencies. We determined that each community participating in the ARTS project has different needs and budgets, as well as different topology requirements (network routing, size of the serving area, etc.) for a communication network.

Evaluated funding alternatives: "How do communities pay for these types of network"? One way might be to include spare, un-dedicated fiber optics inside cables that will be installed for ITS purposes. The construction cost associated with installing fiber optic cables is the most expensive cost associated with building a communication network. As cables are being installed for ITS purposes, each local government could pay the incremental cost difference for purchasing a larger fiber cable size (typically a small expense) and over time, these communities would have enough fiber deployed to cost effectively establish a multi agency communication network.

This report has addressed each community's needs in our overall plan and developed a recommended network configuration for each community. These network configurations are discussed in detail in the network summary section and the proposed network layout is shown on the attached maps.

It was determined that three reasonable scenarios could be developed for the Augusta region:

1. A dedicated fiber optic network (STAR configuration) that connects the ITS field devices back to a county owned Traffic Management Center (TMC).

2. A hybrid fiber optic network (STAR configuration) that would support ITS and other agency network requirements.

3. A high capacity fiber optic SONET ring network in Richmond County and another in Aiken County, with a home run fiber optic connection between the two Traffic Management Center's (TMC) located in each state.

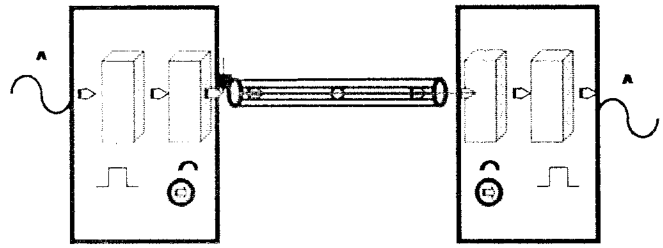
It is our conclusion that scenario #2 would be the best overall approach for this region. Details of the communications system analysis are included in the appendix.

NETWORK DEFINITIONS

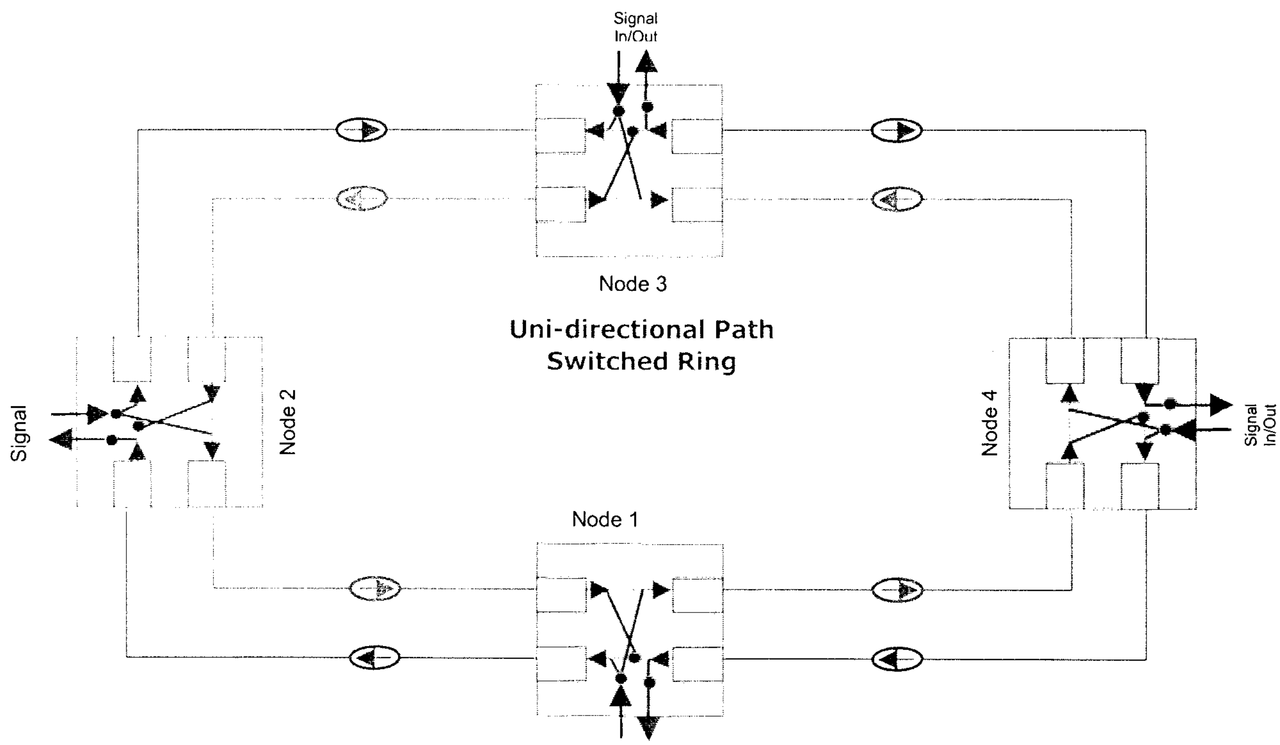
Fiber Optics - single-mode optical fiber offers large bandwidth capacity, is immune to noise, provides longer distance transmission characteristic, is small and lightweight and supports both low speed and broadband video transmission.

Network Hubs - must be an environmentally controlled environment to house the cable terminations and electronic equipment. Hubs act as points where many circuits are gathered and then multiplexed (or combined) into more efficient wideband circuits for transmission back to the TMC.

Star Configuration - is a point-to-point architecture. This means, a single origination point (TMC or HUB) and a single destination point (ITS Field Device). Point-to-multipoint configurations are not feasible due to the unavailability of low-loss taps to connect field devices.



SONET Ring - provides the transport ONLY mechanism between node locations (i.e. City hall, TMC, HUB, etc.) and does NOT include the interface connections (channel banks) to the users end equipment. It provides the "light and intelligence" to the fiber plant and when deployed in a true ring architecture, it provides overall network protection from cable cuts or node failures



Channel Banks - low speed channel equipment must be installed to provide the interface connection to put network traffic onto the SONET transport system thereby connecting the end users to the communications network.

NETWORK COMPLIANCE

This report recommends a network architecture that is consistent with the Georgia Department of Transportation's (GDOT) current ATMS architecture in Atlanta and other regions of Georgia, including standard fiber cable sizes, fiber allocations, and networking protocol and is therefore NaviGAtor Compliant. The following standards were used in preparing the conceptual design

- Only singe-mode fiber cable will be utilized;
- Minimum fiber optic cable size for ITS trunk/distribution lines will be 24 count;
- Closed Circuit Television (CCTV) camera video signals and pan, tilt, zoom (PTZ) transmit/receive controls are combined on (1) dedicated single mode fiber;
- The following ITS field devices require with low bandwidth and will be "daisy-chained" on the same fibers:

Device	Max. Per Fiber Pair
CCTV	None
Traffic Signal Controllers	Eight (8)
Dynamic Message Signs	Two (2)
Radar Detectors	Eight (8)
Weather Stations	Eight (8)

- Different type of ITS field devices may NOT share the same fiber pairs.

NETWORK SUMMARY

This summary defines our conclusions and deployment recommendations for each County participating in the Augusta Regional Transportation System.

The lengths of each cable segment were measured from the maps using the GIS capabilities of the mapping system. Cost estimates for each scenario were developed from recent fiber optic installations in Georgia.

Augusta/Richmond County – currently has rights to use optical fibers installed by Adelphia Business Solutions in the metro Augusta area. Our study determined these fibers are not beneficial to an ITS only network for the following reasons:

1) The Adelphia fibers do not extend to the outer reaches of the county;
2) The fiber optic transmission requirements do not exceed the maximum distance for serving ITS field devices directly from the TMC;
3) Additional fiber optic distribution cables would still be required to connect ITS field devices located adjacent to the Adelphia fiber because only four fibers are available to be used by the city.

The Adelphia fibers would be very useful if Augusta deployed a multi agency SONET communication network for sharing data between City Hall and remote sites or between multiple agencies. The deployment of this type of network may reduce the city's' cost by eliminating leased communications lines currently being used for connections and would allow the TMC to share information such as voice, data and video with other departments connected to the network

Although the cost of a SONET network is very reasonable, this type of network more expensive than a STAR configuration and a SONET network is not required for the deployment of Augusta's ITS system. To establish a SONET backbone network the city would need to complete the following:

- Connect 4 underground fibers furnished by Adelphia Business Solutions to city buildings.
- Extend the Adelphia fibers to other city and county buildings that are not located along the Adelphia fiber route.
- Build a diverse underground cable route from the proposed TMC to the Adelphia fibers.
- Install SONET electronics at each city building requiring a connection.

Network Recommendation

The use of a SONET backbone for deploying the ATMS system in Augusta/Richmond County does not provide any direct advantages for the ITS program; therefore we recommend the installation of aerial fiber optic distribution cables be installed on existing utility poles from the proposed TMC to the proposed ITS field devices. The fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimates is include in the Cost Data section of this report.

Augusta / Richmond County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
ITS Fiber Optic Network					
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	53.1	Mile	$87,248	$4,632,886	
				Total ITS Fiber Optic Backbone	$4,632,886
ITS Field Devices					
Speed / Volume Detection	0	Each	$25,000	$0	
Video Surveillance	0	Each	$30,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Web Site Development	0	Each	$50,000	$0	
				Total ITS Field Devices	**$0**
				Total ITS Deployment Cost	**$4,632,886**

Columbia County - a SONET ring configuration was found to be impractical since only the southern edge of the county is projected to have enough density of equipment to require that level of capacity. The proposed architecture would service this area as an extension of the Augusta system with a direct fiber optic connection between the Augusta-Richmond TMC and to the new Columbia County Government Center.

Network Recommendation

We recommend the installation of aerial fiber optic distribution cables be installed on existing utility poles for the Columbia/Richmond County line to the proposed ITS field devices. The fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimates is include in the Cost Data section of this report.

Columbia County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
ITS Fiber Optic Network					
New Building Entrance	1	Each	$46,636	$46,636	
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	15.4	Mile	$87,248	$1,343,624	
			Total ITS Fiber Optic Backbone		$1,390,261
ITS Field Devices					
Speed / Volume Detection	0	Each	$25,000	$0	
Video Surveillance	0	Each	$35,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Web Site Development	0	Each	$50,000	$0	
			Total ITS Field Devices		**$0**
			Total ITS Deployment Cost		**$1,390,261**

Aiken County - the installation of a SONET network in this county proved to be a cost effective approach for ITS deployment based on the following reasons:

1) The maximum fiber optic transmission distance to connect ITS field devices in the North Augusta area are exceeded if the TCC is located in Aiken. Therefore, fiber optic equipment (HUB) must be installed in North Augusta to collect and amplify the optical signal necessary to reach the TCC in Aiken.
2) Four fibers are required for a SONET network and can be cost effectively included in the fiber optic cables required to connect ITS field devices to the TCC.

Network Recommendation

We recommend the installation of aerial fiber optic cables be installed on existing utility poles from proposed Aiken TMC to a network HUB located in North Augusta and to the proposed ITS field devices. The cables between the TMC and North Augusta will be constructed along diverse routes providing maximum protection against outages caused by cable failures (i.e. storm damage, cable cut, etc.). The cable along these routes will provide both the SONET backbone and distribution to the ITS field devices. The cable fiber optic cable routes, cable sizes and ITS field devices are depicted on the attached maps.

Network Cost Estimate

The details used in developing this cost estimates is include in the Cost Data section of this report.

Aiken County, South Carolina

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
New Building Entrance Link to Sonet Backbone (Diverse)	2	Each	$46,636	$93,273	
				Total Sonet Backbone	$93,273
ITS Fiber Optic Network					
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	35.8	Mile	$87,248	$3,123,490	
				Total ITS Fiber Optic Backbone	$3,123,490
ITS Field Devices					
Speed / Volume Detection	0	Each	$25,000	$0	
Video Surveillance	0	Each	$35,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Web Site Development	0	Each	$50,000	$0	
				Total ITS Field Devices	**$0**
				Total ITS Deployment Cost	**$3,123,490**

COST DATA

New Fiber Optic ITS Distribution Cable (Mile)

	Description	Quantity		Rate	Total
Engineering					
Labor	Building Entrance Link (BEL) Design	5,280	ft	2.00	$10,560
Labor	Permits	5	ea	500.00	$2,500
				Engineering Subtotal	*$13,060*
Outside Plant Underground Contstruction					
Labor	Trench / Bore (Rock) includes restoration	128	ft	90.00	$11,520
Labor	Trench - Machine (3) 1.25" HDPE	200	ft	22.00	$4,400
Labor	Directional Bore - (3) 1.25" HDPE	200	ft	28.00	$5,600
Material	(3) 1.25" HDPE	528	ft	1.05	$554
Labor	Place Handhole (36" X 60" X 36")	1	ea	600.00	$600
Material	Place Handhole (36" X 60" X 36")	2	ea	790.00	$1,580
Labor	Place Warning Signs	2	ea	25.00	$50
Material	Place Warning Signs	2	ea	10.00	$20
Labor	Core Bore Manhole	1	ea	350.00	$350
Material	Duct Plugs, Tags, Etc.	32	ea	3.31	$106
Material	Warning Tape (Standard)	1	roll	60.00	$60
				OSP Construction Subtotal	*$24,840*
Outside Plant Aerial Contstruction					
Labor	Place 10M Suspension Strand	4,752	ft	2.75	$13,068
Material	Place 10M Suspension Strand	4,752	ft	*0.25*	$1,188
Labor	Place 10M Down Guy & 12M Anchor	6	ft	100.00	$600
Material	Place 10M Down Guy & 12M Anchor	6	ft	50.00	$300
Labor	Utility Make-Ready	4	ft	2,500.00	$10,000
Labor	Splice Fiber Drop to Cable	4	ft	400.00	$1,600
Material	Splice Fiber Drop to Cable	4	ft	500.00	$2,000
				OSP Construction Subtotal	*$28,756*
Fiber Optic Cable					
Labor	Lash Cable to Suspension Strand	5,280	ft	1.40	$7,392
Material	48 Single Mode Fiber Optic Cable	5,280	ft	2.50	$13,200
				Cable Subtotal	$20,592
				Total Fiber Optic Sonet Backbone	**$87,248**

Building Entrance Link (Diverse)

	Description	Quantity		Rate	Total
Engineering					
Labor	Building Entrance Link (BEL) Design	1	ea	3,000.00	$3,000
Labor	Permits	2	ea	500.00	$1,000
				Engineering Subtotal	*$4,000*
Outside Plant Contstruction					
Labor	Trench / Bore (Rock) includes restoration	50	ft	90.00	$4,500
Labor	Trench - Machine (3) 1.25" HDPE	400	ft	22.00	$8,800
Labor	Directional Bore - (3) 1.25" HDPE	150	ft	28.00	$4,200
Material	(3) 1.25" HDPE	600	ft	1.05	$630
Labor	Place Handhole (36" X 60" X 36")	2	ea	600.00	$1,200
Material	Place Handhole (36" X 60" X 36")	2	ea	790.00	$1,580
Labor	Place Warning Signs	2	ea	25.00	$50
Material	Place Warning Signs	2	ea	10.00	$20
Labor	Core Bore Manhole	6	ea	350.00	$2,100
Material	Duct Plugs, Tags, Etc.	8	ea	3.31	$26
Material	Warning Tape (Standard)	1	roll	60.00	$60
				OSP Construction Subtotal	*$23,166*
Inside Plant Construction					
Labor	Place 4" GIP Riser Duct	150	ft	35.00	$5,250
Material	Place 4" GIP Riser Duct	150	ft	68.00	$10,200
Labor	Core Bore Concrete Floor	2	ea	450.00	$900
				ISP Construction Subtotal	$16,350
Fiber Optic Cable					
Labor	Pull Fiber in - Existing Conduit	800	ft	1.40	$1,120
Material	48 Single Mode Fiber Optic Cable	800	ft	2.50	$2,000
				Cable Subtotal	$3,120
				Total Building Entrance Link	**$46,636**

APPENDIX D

Telecommunication Network Deployment Cost Data

ARTS Communication Network Deployment Estimate

PB Telecommunications, Inc.

Augusta / Richmond County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
Multi Agency Sonet Backbone					
Existing Underground Fiber Optic Sonet Backbone	28.4	Mile	$0	$0	
Adelphia Fiber Optic not used for backbone	1.8	Mile	$1	$2	
New Underground Fiber Optic Sonet Backbone	2.6	Mile	$200,652	$521,695	
New Aerial Fiber Optic Sonet Backbone	0	Mile	$87,248	$0	
New Building Entrance Link to Sonet Backbone (Diverse)	10	Each	$46,636	$466,365	
Sonet Electronics	10	Each	$33,650	$336,500	
				Total Sonet Backbone	$1,324,562
ITS Fiber Optic Network					
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	53.1	Feet	$87,248	$4,632,886	
				Total ITS Fiber Optic Backbone	$4,632,886
ITS Field Devices					
Speed / Volume Detection	0	Each	$43,000	$0	
Video Surveillance	0	Each	$43,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Traveler Information System	0	Each	$78,000	$0	
				Total ITS Field Devices	**$0**
				Total ITS Deployment Cost	**$4,632,886**
				Total ITS and Sonet Backbone Deployement Cost	**$5,957,447**

ARTS Communication Network Deployment Estimate

PB Telecommunications, Inc.

Columbia County, Georgia

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
Multi Agency Sonet Backbone					
Existing Underground Fiber Optic Sonet Backbone	0	Mile	$0	$0	
Fiber Optic from others not used for backbone	0	Mile	$0	$0	
New Underground Fiber Optic Sonet Backbone	0	Mile	$200,652	$0	
New Aerial Fiber Optic Sonet Backbone	0	Mile	$87,248	$0	
New Building Entrance Link to Sonet Backbone (Diverse)	1	Each	$46,636	$46,636	
Sonet Electronics	1	Each	$33,650	$33,650	
				Total Sonet Backbone	$80,286
ITS Fiber Optic Network					
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	15.4	Feet	$87,248	$1,343,624	
				Total ITS Fiber Optic Backbone	$1,343,624
ITS Field Devices					
Speed / Volume Detection	0	Each	$43,000	$0	
Video Surveillance	0	Each	$43,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Traveler Information System	0	Each	$78,000	$0	
				Total ITS Field Devices	**$0**
				Total ITS Deployment Cost	**$1,343,624**
				Total ITS and Sonet Backbone Deployement Cost	**$1,423,911**

PB 100 YEARS ®

ARTS Communication Network Deployment Estimate

PB Telecommunications, Inc.

Aikens County, South Carolina

Description	Quantity	UOM	Estimate Cost	Subtotal	Total
Multi Agency Sonet Backbone					
Existing Underground Fiber Optic Sonet Backbone	0	Mile	$0	$0	
Fiber Optic from others not used for backbone	0	Mile	$0	$0	
New Underground Fiber Optic Sonet Backbone	0	Mile	$200,652	$0	
New Aerial Fiber Optic Sonet Backbone	47.2	Mile	$87,248	$4,118,121	
New Building Entrance Link to Sonet Backbone (Diverse)	13	Each	$46,636	$606,274	
Sonet Electronics	13	Each	$33,650	$437,450	
				Total Sonet Backbone	$5,161,845
ITS Fiber Optic Network					
Existing Fiber Optic Distribution Cable	0	Feet	$5,000	$0	
New Fiber Optic ITS Distribution Cable	35.8	Feet	$87,248	$3,123,490	
				Total ITS Fiber Optic Backbone	$3,123,490
ITS Field Devices					
Speed / Volume Detection	0	Each	$43,000	$0	
Video Surveillance	0	Each	$43,000	$0	
Variable Message Sign	0	Each	$143,000	$0	
Weather Monitoring Station	0	Each	$35,000	$0	
Highway Advisor Radio	0	Each	$40,000	$0	
Traveler Information System	0	Each	$78,000	$0	
				Total ITS Field Devices	**$0**
				Total ITS Deployment Cost	**$3,123,490**
				Total ITS and Sonet Backbone Deployement Cost	**$8,285,335**

New Fiber Optic Sonet Backbone (Mile)

	Description	Quantity		Rate	Total
Engineering					
Labor	OSP Sonet Backbone Design	5,280	ft	3.50	$18,480
Labor	Permits	5	ea	500.00	$2,500
				Engineering Subtotal	*$20,980*
Outside Plant Underground Contstruction					
Labor	Trench / Bore (Rock) includes restoration	500	ft	90.00	$45,000
Labor	Trench - Machine (3) 1.25" HDPE	2,780	ft	22.00	$61,160
Labor	Directional Bore - (3) 1.25" HDPE	2,000	ft	28.00	$56,000
Material	(3) 1.25" HDPE	5,280	ft	1.05	$5,544
Labor	Place Handhole (36" X 60" X 36")	8	ea	600.00	$4,800
Material	Place Handhole (36" X 60" X 36")	8	ea	790.00	$6,320
Labor	Place Warning Signs	12	ea	25.00	$300
Material	Place Warning Signs	12	ea	10.00	$120
Labor	Core Bore Manhole	1	ea	350.00	$350
Material	Duct Plugs, Tags, Etc.	32	ea	3.31	$106
Material	Warning Tape (Standard)	6	roll	60.00	$360
				OSP Construction Subtotal	*$180,060*
Fiber Optic Cable					
Labor	Pull Fiber in - Existing Conduit	5,280	ft	1.40	$7,392
Material	48 Single Mode Fiber Optic Cable	5,280	ft	2.50	$13,200
				Cable Subtotal	$20,592
				Total Fiber Optic Sonet Backbone	**$200,652**

Building Entrance Link (Diverse)

Description		Quantity		Rate	Total
Engineering					
Labor	Building Entrance Link (BEL) Design	1	ea	3,000.00	$3,000
Labor	Permits	2	ea	500.00	$1,000
				Engineering Subtotal	*$4,000*
Outside Plant Contstruction					
Labor	Trench / Bore (Rock) includes restoration	50	ft	90.00	$4,500
Labor	Trench - Machine (3) 1.25" HDPE	400	ft	22.00	$8,800
Labor	Directional Bore - (3) 1.25" HDPE	150	ft	28.00	$4,200
Material	(3) 1.25" HDPE	600	ft	1.05	$630
Labor	Place Handhole (36" X 60" X 36")	2	ea	600.00	$1,200
Material	Place Handhole (36" X 60" X 36")	2	ea	790.00	$1,580
Labor	Place Warning Signs	2	ea	25.00	$50
Material	Place Warning Signs	2	ea	10.00	$20
Labor	Core Bore Manhole	6	ea	350.00	$2,100
Material	Duct Plugs, Tags, Etc.	8	ea	3.31	$26
Material	Warning Tape (Standard)	1	roll	60.00	$60
				OSP Construction Subtotal	*$23,166*
Inside Plant Construction					
Labor	Place 4" GIP Riser Duct	150	ft	35.00	$5,250
Material	Place 4" GIP Riser Duct	150	ft	68.00	$10,200
Labor	Core Bore Concrete Floor	2	ea	450.00	$900
				ISP Construction Subtotal	$16,350
Fiber Optic Cable					
Labor	Pull Fiber in - Existing Conduit	800	ft	1.40	$1,120
Material	48 Single Mode Fiber Optic Cable	800	ft	2.50	$2,000
				Cable Subtotal	$3,120
				Total Building Entrance Link	**$46,636**

Sonet Equipment (Each Site)

Description	Quantity		Rate	Total
Shelf Configuration				
Chassis DDM-2000	1	ea		$0
User Panel	1	ea		$0
Sys Ctl	1	ea		$0
OH Ctl	1	ea		$0
DS1	16	ea		$0
DS3	2	ea		$0
MXRVO	4	ea		$0
OLIU	2	ea		$0
TGS 1&2	2	ea		$0
Misc Connection Accessories	1	ea		$0
	Sonet Equipment Subtotal			*$25,000*
Marconi Power Distribution & Backup				
Chassis VMS 60 (19")	1	ea		$0
Monitor Ctrl Panel	1	ea		$0
Rectifier	3	ea		$0
Distribution Module	1	ea		$0
Breaker	2	ea		$0
Battery Backup (2Hrs)	1	ea		$0
Misc Connection Accessories	1	ea		$0
Equipment Rack, 23"x7'	1	ea		$0
	OSP Construction Subtotal			*$8,650*
	Total Building Entrance Link			**$33,650**

New Fiber Optic ITS Distribution Cable (Mile)

	Description	Quantity		Rate	Total
Engineering					
Labor	Building Entrance Link (BEL) Design	5,280	ft	2.00	$10,560
Labor	Permits	5	ea	500.00	$2,500
				Engineering Subtotal	*$13,060*
Outside Plant Underground Contstruction					
Labor	Trench / Bore (Rock) includes restoration	128	ft	90.00	$11,520
Labor	Trench - Machine (3) 1.25" HDPE	200	ft	22.00	$4,400
Labor	Directional Bore - (3) 1.25" HDPE	200	ft	28.00	$5,600
Material	(3) 1.25" HDPE	528	ft	1.05	$554
Labor	Place Handhole (36" X 60" X 36")	1	ea	600.00	$600
Material	Place Handhole (36" X 60" X 36")	2	ea	790.00	$1,580
Labor	Place Warning Signs	2	ea	25.00	$50
Material	Place Warning Signs	2	ea	10.00	$20
Labor	Core Bore Manhole	1	ea	350.00	$350
Material	Duct Plugs, Tags, Etc.	32	ea	3.31	$106
Material	Warning Tape (Standard)	1	roll	60.00	$60
				OSP Construction Subtotal	*$24,840*
Outside Plant Aerial Contstruction					
Labor	Place 10M Suspension Strand	4,752	ft	2.75	$13,068
Material	Place 10M Suspension Strand	4,752	ft	*0.25*	$1,188
Labor	Place 10M Down Guy & 12M Anchor	6	ft	100.00	$600
Material	Place 10M Down Guy & 12M Anchor	6	ft	50.00	$300
Labor	Utility Make-Ready	4	ft	2,500.00	$10,000
Labor	Splice Fiber Drop to Cable	4	ft	400.00	$1,600
Material	Splice Fiber Drop to Cable	4	ft	500.00	$2,000
				OSP Construction Subtotal	*$28,756*
Fiber Optic Cable					
Labor	Lash Cable to Suspension Strand	5,280	ft	1.40	$7,392
Material	48 Single Mode Fiber Optic Cable	5,280	ft	2.50	$13,200
				Cable Subtotal	$20,592
				Total Fiber Optic Sonet Backbone	**$87,248**