U.S. Department of Transportation
Federal Highway Administration

Georgia Division

61 Forsyth Street S.W.
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June 30, 2015

In Reply Refer To:
HPE-GA

Russell R. McMurry, P.E., Commissioner
Georgia Department of Transportation
One Georgia Center
600 West Peachtree Street, NW
Atlanta, GA 30308

Dear Commissioner McMurry:

We have reviewed your request to use a proprietary adaptive traffic control system along SR9/Roswell Road from Atlanta City Limits to CS 7000/Abernathy Road Project, PI# 0012629, located in the City of Sandy Springs, Fulton County.

After addressing our comments from our previous letter dated September 16, 2014, we concur that the revised SE report demonstrates that the SCOOT Adaptive Traffic Control System is the best reasonable alternative required for synchronization with the existing system and that it is in the public interest.

Therefore, FHWA finds that it is acceptable to use the SCOOT for the purpose of synchronization with existing facilities. This approval is only applicable for use on PI # 0012629, Fulton County. The City of Sandy Springs is responsible for ensuring that these items comply with the Buy America Act.

If you have any questions, please contact Julio A. Nuñez at (404) 562-3638.

Sincerely,

for Rodney N. Barry, P.E.
Division Administrator

Cc: Brent Story, State Design Policy Engineer
Dave Peters, Conceptual Design Group Manager

Russell McMurry, P.E., Commissioner

GEORGIA DEPARTMENT OF TRANSPORTATION

One Georgia Center, 600 West Peachtree Street, NW
Atlanta, Georgia 30308
Telephone: (404) 631-1000

June 8, 2015

Mr. Rodney Barry – Division Administration
Federal Highway Administration
61 Forsyth Street, Suite 17T100
Atlanta, GA 30277
Attention: Melinda Roberson

Subject: Request for Proprietary Items Usage
PI # 0012629
SR 9 From Atlanta City Limits to CS 7000/Abernathy Rd – ITS
City of Sandy Springs, Fulton County

Mr. Barry:

Please review the attached request from the City of Sandy Springs for the use of a proprietary adaptive traffic control system along US 19/SR 9/Roswell Road from the Atlanta City Limits to CS 7000/Abernathy Rd, P.I. Number 0012629.

The attached *Systems Engineering Report for the SR 9 Adaptive Traffic Signal System* produced for PI Number 0012629 concludes that the SCOOT system is the only system studied that meets all of the key requirements for synchronizing with the city's existing traffic signal systems while allowing for future expansion of the multi-jurisdictional adaptive traffic signal system. The SCOOT system would synchronize with the existing system installed under PI Number 0006727 with the intent to improve operations along US 19/SR 9.

The Department considers that it is in the public interest to utilize the requested proposed proprietary items and that the requested items are compliance with 23 CFR 635.411.

Should you have any questions or concerns, please contact Dave Peters at 404-631-1738 or Xavier James at 404-631-1583.

Sincerely,

Brent Story, P.E.
State Design Policy Engineer

BAS:drp

SANDY SPRINGS
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May 28, 2015

Mr. Rodney Barry
Division Administrator
Federal Highway Administration
U.S. Department of Transportation
61 Forsyth Street, S.W.
Suite 17T100
Atlanta, Georgia 30303

Subject: Product Certification for GDOT PI No. 0012629

Dear Mr. Barry:

The City of Sandy Springs, with the support of the Georgia Department of Transportation, is requesting approval to specify the SCOOT product for use on this project for the purpose of expanding a multi-jurisdictional adaptive traffic signal system that synchronizes with the City's existing traffic signal system.

The requirements of 23 CFR 635.411 stipulate that justification is required for products in Federal-Aid contracts which are patented/proprietary in nature. The requirement for this particular product is listed under 635.411 Material or product selection (a)(2), which states "The State transportation department certifies either that such patented or proprietary item is essential for synchronization with existing highway facilities, or that no equally suitable alternate exists."

I, Brad Edwards, Director of Transportation, of the City of Sandy Springs, do hereby certify that in accordance with the requirements of 23 CFR 635.411(a)(2), that this proprietary item is essential for synchronization with existing highway facilities.

Background

The City of Sandy Springs desires to implement a citywide adaptive traffic signal system. To date the City has the following projects to install SCOOT to meet this goal.

- Existing Intersections under SCOOT operation (16 intersections)
    - SR 9/Roswell Rd at Dunwoody Pl
    - SR 9/Roswell Rd at Hightower Trl
    - SR 9/Roswell Rd at Northridge Rd
    - SR 9/Roswell Rd at Pitts Rd
    - SR 9/Roswell Rd at Morgan Falls Rd
    - SR 9/Roswell Rd at Trowbridge Rd
    - SR 9/Roswell Rd at Dalrymple Rd

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- SR 9/Roswell Rd at Abernathy Rd
- Abernathy Rd at Wright Rd
- Johnson Ferry Rd at Riverside Dr
- Johnson Ferry Rd at River Valley Rd
- Johnson Ferry Rd at Abernathy Rd
- Riverside Dr at River Valley Rd
- Riverside Dr at Heards Ferry Rd
- Riverside Dr at I-285 westbound ramp
- Riverside Dr at I-285 eastbound ramp

- Intersections in design for SCOOT operations –GDOT PI 0012629 (27 intersections; 4 in City of Atlanta)
  - SR 9/Roswell Rd at Vernon Woods Dr
  - SR 9/Roswell Rd at Sandy Springs Cir
  - SR 9/Roswell Rd at Johnson Ferry Rd
  - SR 9/Roswell Rd at Mt. Vernon Hwy
  - SR 9/Roswell Rd at Hilderbrand Dr
  - Johnson Ferry Rd at Sandy Springs Cir
  - Mt. Vernon Hwy at Sandy Springs Cir
  - Mt. Vernon Hwy at Boylston Dr
  - Mt. Vernon Hwy at Johnsons Ferry Rd
  - SR 9/Roswell Rd at Sandy Springs Pl
  - SR 9/Roswell Rd at Hammond Dr
  - Hammond Dr at Sandy Springs Cir
  - Hammond Dr at City Walk/The Exchange at Hammond
  - Hammond Dr at Boylston Dr
  - SR 9/Roswell Rd at Cliftwood Dr/Carpenter Dr
  - SR 9/Roswell Rd at I-285 westbound ramp
  - SR 9/Roswell Rd at I-285 eastbound ramp
  - SR 9/Roswell Rd at Lake Placid Dr
  - SR 9/Roswell Rd at The Prado Shopping Center
  - SR 9/Roswell Rd at Glenridge Dr
  - SR 9/Roswell Rd at Mt. Paran Rd/Beachland Dr
  - SR 9/Roswell Rd at Belle Isle Rd
  - SR 9/Roswell Rd at Windsor Pkwy
  - SR 9/Roswell Rd at W Wieuca Rd
  - SR 9/Roswell Rd at Chastain Square Shopping Center
  - SR 9/Roswell Rd at Chastain Dr

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- Intersections in design for SCOOT operations –GDOT PI 0013141 (28 intersections)
    - Glenridge Dr at Hammond Dr
    - Glenridge Dr at Glenridge Townhomes
    - Glenridge Dr at Glenforest Rd
    - Glenridge Dr at I-285 westbound ramp
    - Glenridge Dr at I-285 eastbound ramp
    - Glenridge Dr at Johnson Ferry Rd
    - Glenridge Dr at High Point Rd
    - Glenridge Conn at Johnson Ferry Rd
    - Glenridge Conn at GA 400 southbound ramp
    - Glenridge Conn at GA 400 northbound ramp
    - Glenridge Conn at Meridian Mark Dr
    - Hammond Dr at Barfield Rd
    - Hammond Dr at GA 400 southbound ramp
    - Hammond Dr at GA 400 northbound ramp / Concourse Pkwy
    - Hammond Dr at Concourse East
    - Hammond Dr at Citizen Perimeter Apartments
    - Johnson Ferry Rd at Glenridge Point Pkwy
    - Johnson Ferry Rd at Hollis Cobb Dr
    - Meridian Mark Rd at Northside Professional Center
    - Peachtree-Dunwoody Rd at Hammond Dr
    - Peachtree-Dunwoody Rd at Concourse Pkwy
    - Peachtree-Dunwoody Rd at I-285 westbound ramp
    - Peachtree-Dunwoody Rd at I-285 eastbound ramp
    - Peachtree-Dunwoody Rd at Lake Hearn Dr
    - Peachtree-Dunwoody Rd at Hollis Cobb Dr
    - Peachtree-Dunwoody Rd at Northside / St. Joseph's Hospital
    - Peachtree-Dunwoody Rd at Johnson Ferry Rd
    - Peachtree-Dunwoody Rd at Glenridge Conn
- Intersections under construction for SCOOT operations (10 intersections)
    - Interstate North Pkwy at Riveredge Pkwy (future signalized intersection)
    - Northside Dr at Interstate North Pkwy / New Northside Dr
    - Northside Dr at I-285 westbound ramp
    - Northside Dr at I-285 eastbound ramp
    - Northside Dr at Powers Ferry Rd
    - New Northside Dr at I-285 westbound ramp

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- New Northside Dr at I-285 eastbound ramp
- New Northside Dr at Powers Ferry Rd
- Spalding Dr / Dalrymple Rd at Trowbridge Rd / Spalding Dr
- Spalding Dr at Peachtree-Dunwoody Rd

- Future intersections for SCOOT implementation – COSS FY 2016 (16 intersections)
  - Abernathy Rd at Glenridge Dr
  - Abernathy Rd at Barfield Rd
  - Abernathy Rd at GA 400 SB Ramps
  - Abernathy Rd at GA 400 NB Ramps
  - Abernathy Rd at Peachtree Dunwoody Rd
  - Abernathy Rd at Mt. Vernon Hwy
  - Perimeter Center W at Sandy Springs Marta Station
  - Perimeter Center W at REI Driveway
  - Mt. Vernon Hwy at Peachtree Dunwoody Rd
  - Mt. Vernon Hwy at Barfield Rd
  - Mt. Vernon Hwy at Glenridge Dr
  - Mt. Vernon Hwy at Northpark Pl
  - Peachtree Dunwoody Rd at Northpark Pl
  - Peachtree Dunwoody Rd at Costco/Home Depot Driveway
  - Peachtree Dunwoody Rd at Crestline Pkwy/Central Pkwy
  - Peachtree Dunwoody Rd at Summer Dr/Central Pkwy

This certification is specifically for GDOT PI 0012629 which will install SCOOT along SR 9 from Chastain Drive, within the City of Atlanta, to Vernon Woods Drive in Sandy Springs which is an expansion to the existing system installed under GDOT PI 0006727. Adjacent signals on Hammond Drive, Johnson Ferry Road, and Mt. Vernon Highway are also included. The goal of the project is to provide for optimized signal operations along SR 9/Roswell Road to minimize daily vehicular delay and congestion.

The City of Sandy Springs is the sponsor, leading and coordinating the design effort, with support from GDOT, and will let the construction contract. The project includes:

1. **Adaptive traffic signal system** to maximize the efficiency of the traffic signals on SR 9 throughout the city. The system will tie to the existing system that enables implementation of diversion/emergency timing plans across jurisdictional boundaries.
2. **New detection** at all intersections that will be optimally located for an adaptive system. Detection data will be archived and retrievable for planning purposes.

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All of the elements installed on this project will enable the City to improve the operational efficiency of SR 9, with the adaptive system providing the greatest benefit with its ability to continually provide efficient real-time signal timing.

SCOOT Adaptive System Synchronization Request

The attached *Systems Engineering Report for the SR 9 Adaptive Traffic Signal System #2* (SE Report) is provided for additional information. The SE Report defines the City's adaptive signal system goals and objectives, existing/desired signal timing processes, existing signal system constraints, and high-level requirements. The report concludes that of the five systems evaluated, the SCOOT system meets the most high-level requirements, and is the only system that meets all of the key requirements related to external constraints, such as compatibility with the existing SEPAC firmware and TACTICS software already purchased and deployed by GDOT. The SCOOT system is the only system that can run in parallel to the existing GDOT statewide signal system, TACTICS, and the SCOOT adaptive mode can be activated by time of day which allows dual coordination to be achieved when desired with major crossing arterials.

The City of Sandy Springs, with the support of the Georgia Department of Transportation, is therefore requesting approval to specify the SCOOT product for use on this project for the purpose of expanding the existing multi-jurisdictional adaptive traffic signal system that synchronizes with the City's existing traffic signal systems.

Please contact Brad Edwards at (770) 206-2534 if you have questions or need additional information.

Sincerely,

A. Brad Edwards, P.E.
City of Sandy Springs
Director of Transportation

Attachment: *Systems Engineering Report for SR 9 Adaptive Traffic Signal System #2, Version 1.0*

cc: General Files

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SR 9 ATMS Project #2

Systems Engineering Report for SR 9 Adaptive Traffic Signal System #2

Version 1.0

Prepared for:

Federal Highway Administration
Cities of Sandy Springs and Atlanta, GA
Georgia Department of Transportation

Prepared by:

City of Sandy Springs, GA

September 30, 2014

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List of Acronyms and Terms

ACSLite – Adaptive Control Software Lite (Adaptive Signal System)
ACTRA – Assembly Contingency Transmitter Receiver/Amplifier (GDOT's Statewide Signal System)
ATCS – Adaptive Traffic Control System (Adaptive Signal System)
ATMS – Advanced Transportation Management Systems
CCTV – Closed Circuit Television
CMS – Central Management Software
FHWA – Federal Highway Administration
GDOT– Georgia Department of Transportation
InSync – In Synchronization (Adaptive Signal System)
ITS – Intelligent Transportation System
NCHRP – National Cooperative Highway Research Program
OPAC – Optimization Policies for Adaptive Control
RTOP – Regional Traffic Operations Program
SCATS – Sydney Coordinated Adaptive Traffic System (Adaptive Signal System)
SCOOT – Split Cycle Offset Optimization Technique (Adaptive Signal System)
SE – Systems Engineering
SOP – Standard Operating Procedure
SR – State Route
TACTICS – GDOT's New Statewide Signal System (Next generation upgrade to ACTRA)
TBC – Time Base Coordination
TCC – Traffic Control Center
TMC – Traffic Management Center
VPN – Virtual Private Network

1 Introduction

The SR 9 Advanced Transportation Management System (ATMS) #2 project covers 5 miles of SR 9 from Vernon Woods Drive in Sandy Springs to Chastain Drive in Atlanta (15 signals in Sandy Springs, 4 signals in Atlanta). Currently, the 19 signals are controlled under GDOT's RTOP program. Six adjacent signals on Hammond Drive, Johnson Ferry Road, Sandy Springs Circle, Boylston Drive, and Mt. Vernon Highway in Sandy Springs are also included in this project. The intent of SR 9 ATMS #2 (GDOT PI #0012629) is to expand the existing system installed under ATMS #1 (GDOT PI #0006727) to south of Abernathy Road. It also includes continuation of safety improvement, traffic flow enhancement, and congestion reduction efforts beyond the first SR 9 ATMS project.

This *Systems Engineering Report*, which specifically addresses the SR 9 Traffic Signal System #2, is a supplement to the *SR 9 Systems Engineering Report for SR 9 Adaptive Traffic Signal System* document released in March, 2011. The content of this report was developed in coordination with the Federal Highway Administration (FHWA), Georgia Department of Transportation (GDOT), and the Cities of Sandy Springs and Atlanta, GA.

1.1 Purpose

The purpose of the *Systems Engineering Report (SE Report)* is to provide the following:

- Signal Timing System Goals and Objectives
- Signal Timing System Processes
- Signal Timing System Needs
- High Level Signal Timing System Requirements
- Signal Timing System Strategies Identification and Evaluation
- System Recommendations and Conclusions

1.2 Description of Existing Traffic Signal and Communications System

The Cities of Sandy Springs and Atlanta have the following existing systems and general responsibilities along the SR 9 corridor from Vernon Woods Drive to Chastain Drive.

1.	Central Signal System:	Sandy Springs: Siemens TACTICS version 2.1.3 Siemens UTC SCOOT version 32.7-2 Atlanta: Siemens TACTICS version 2.1.3
2.	Controller Type:	2070L controllers with 1B, 2A and 7A modules
3.	Cabinet:	332 cabinets
4.	Controller Firmware:	Siemens SEPAC version 3.32g in ECOM EPAC configuration
5.	Signal Communications:	Sandy Springs: Ethernet network using fiber cabling Atlanta: Fiber cable connection exists and is communicating to server
6.	TMC Operations:	Sandy Springs and Atlanta: Existing Traffic Management Center (TMC) with timing engineer remotely monitoring signals during multiple peak periods each week
7.	Maintenance:	Through a permit from GDOT, the Cities' maintenance crews are responsible for preventive and unscheduled maintenance of signal equipment.
8.	Training:	Utilize GDOT-provided training on signal timing and maintenance
9.	Standards:	Follow GDOT standards for signal equipment

1.3 Audience

The audience for the *SE Report* includes:

- FHWA
- GDOT Office of Traffic Safety and Design personnel responsible for the design of the SR 9 ATMS project
- GDOT Office of Traffic Operations personnel responsible for management and administration of the Regional Traffic Operations Program (RTOP)
- The Cities of Sandy Springs and Atlanta which operate the SR 9 traffic signals under permit to the Department

1.4 Reference Materials

The *SE Report* for the SR 9 Traffic Signal System is based upon other documents including but not limited to:

- *SR 9 ATMS Concept of Operations*, September 2008
- *SR 9 Systems Engineering Report for SR 9 Adaptive Traffic Signal System,* March 2011
- *Atlanta Regional ITS Architecture*, July 2004
- *NaviGAtor Concept of Operations*, August 2007
- *NCHRP SYNTHESIS 307, Systems Engineering Processes for Developing Traffic Signal Systems*, 2003
- *NCHRP SYNTHESIS 403, Adaptive Traffic Control Systems: Domestic and Foreign State of Practice*, 2010

2 Signal Timing System Goals and Objectives

The specific goals and objectives for the adaptive portion of the traffic signal system on the SR 9 corridor include:

1. Minimize congestion and promote smooth flow on SR 9 and provide reasonable service to the cross street traffic
2. Quickly respond and adjust to traffic fluctuations including special events, incidents, seasonal variations (schools out, holidays, etc.), and long-term trends
3. Recognize when oversaturated conditions exist, and then utilize pre-defined user preferences
4. Provide seamless signal timing/synchronization across jurisdictional boundaries
5. Provide equitable land use access
6. Monitor and record system-measured traffic conditions and automated responses
7. Enable continuous multi-jurisdictional coordinated response to incidents and special events along corridor
8. Provide the next most effective control mode in the case of failure

3 Signal Timing System Processes and Constraints

Subsections 3.1 through 3.4 describe typical signal timing processes employed by the two cities. The current constraints experienced by the cities are described in Section 3.5.

3.1 Peak (AM/Lunch/PM) Signal Timing Process

The majority of the SR 9 corridor traverses through retail/commercial centers with shopping and restaurants and many driveway connections that cause friction on the corridor. During a typical weekday peak period, the traffic flow on SR 9 is congested approaching major cross streets where the intersections are oversaturated. The directional traffic flow slightly favors the southbound direction in the AM peak and the northbound in the PM peak, and is balanced during the lunch peak. The traffic volumes in the lunch peak sometimes exceed the AM and PM peaks in the commercial areas with many restaurants, such as near Abernathy Road, Hammond Drive, and the Prado Shopping Center entrance. Traffic conditions, notably the demand for the various movements at congested intersections, change unpredictably outside of AM and PM peak hour periods, such as during lunch peak conditions.

The local agencies typically retime the SR 9 signals every two to three years, and then they do their best to maintain the timings at the highest level possible with their current systems. Most interim timing updates are made when staff become aware of issues that are impacting the corridor. Signal maintenance is also conducted when staff become aware of issues. Each local agency has a strong maintenance staff that can make signal repairs, communications repairs, and install new loops.

Error! Reference source not found. illustrates the timing process the cities follow for the AM, Lunch, and PM peak periods. Each of the cities desires to monitor their SR 9 signals during all peak periods; however, at the present time, they typically do not have enough signal timing staff available to monitor all peak periods each day. With 19 intersections along the 5-mile SR 9 corridor, 6 intersections adjacent to SR 9, and many more within their respective cities, there are simply too many intersections to monitor closely each peak period. If a problem is found, it would currently be difficult to quickly implement an effective alternative timing plan.

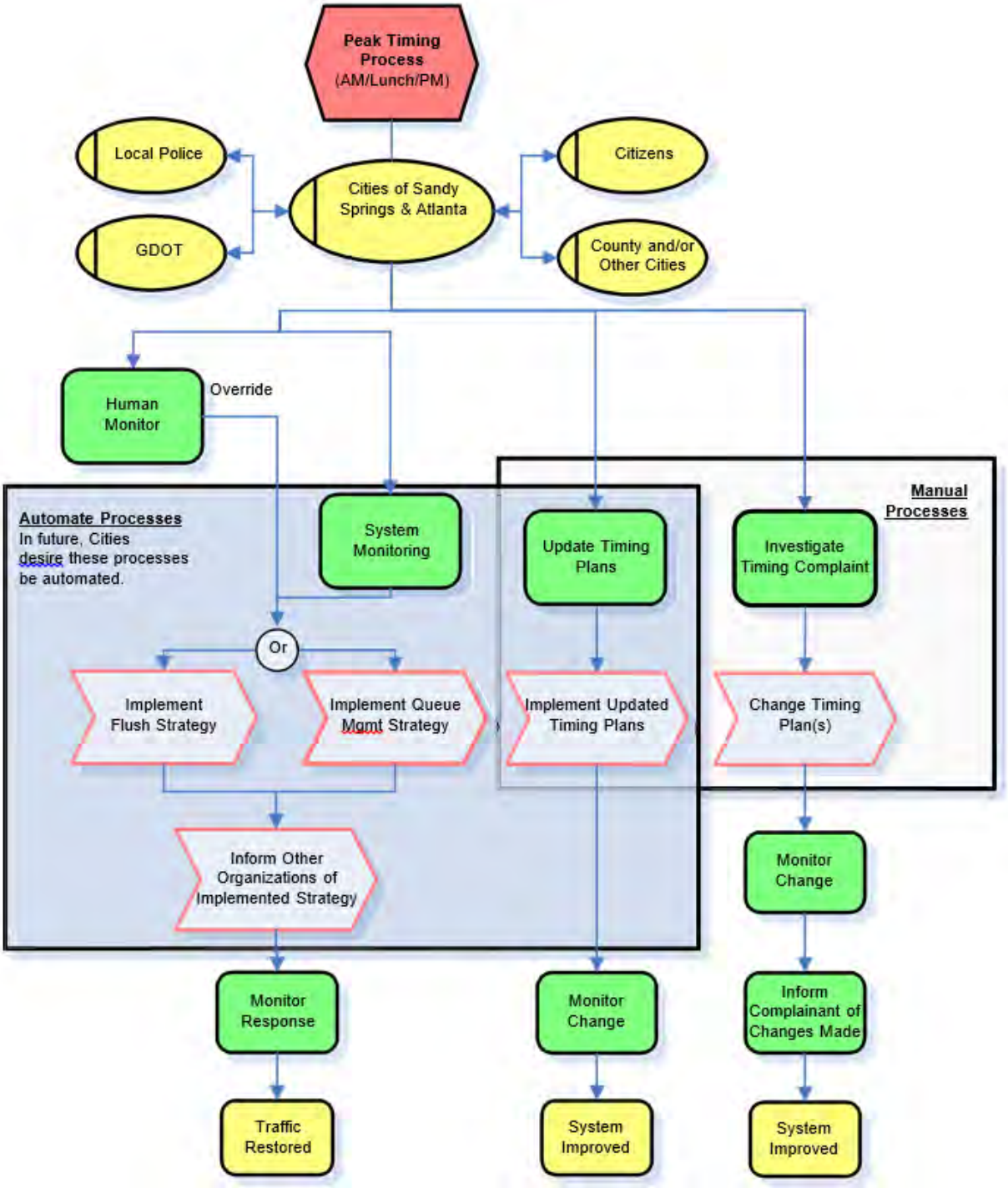

Figure 1. Peak (AM/Lunch/PM) Timing Process

3.2 Off-Peak Signal Timing Process

Figure 2 illustrates the timing process followed for the off-peak period. Typically the off-peak signal timing plans are developed, implemented, and fine-tuned at the same time the peak period plans are done as described in Section 3.1. Once the off peak plans are implemented, they are not revisited until a complaint is registered. The cities desire to automate the off-peak timing plans to improve the level of service motorists experience during off-peak periods.

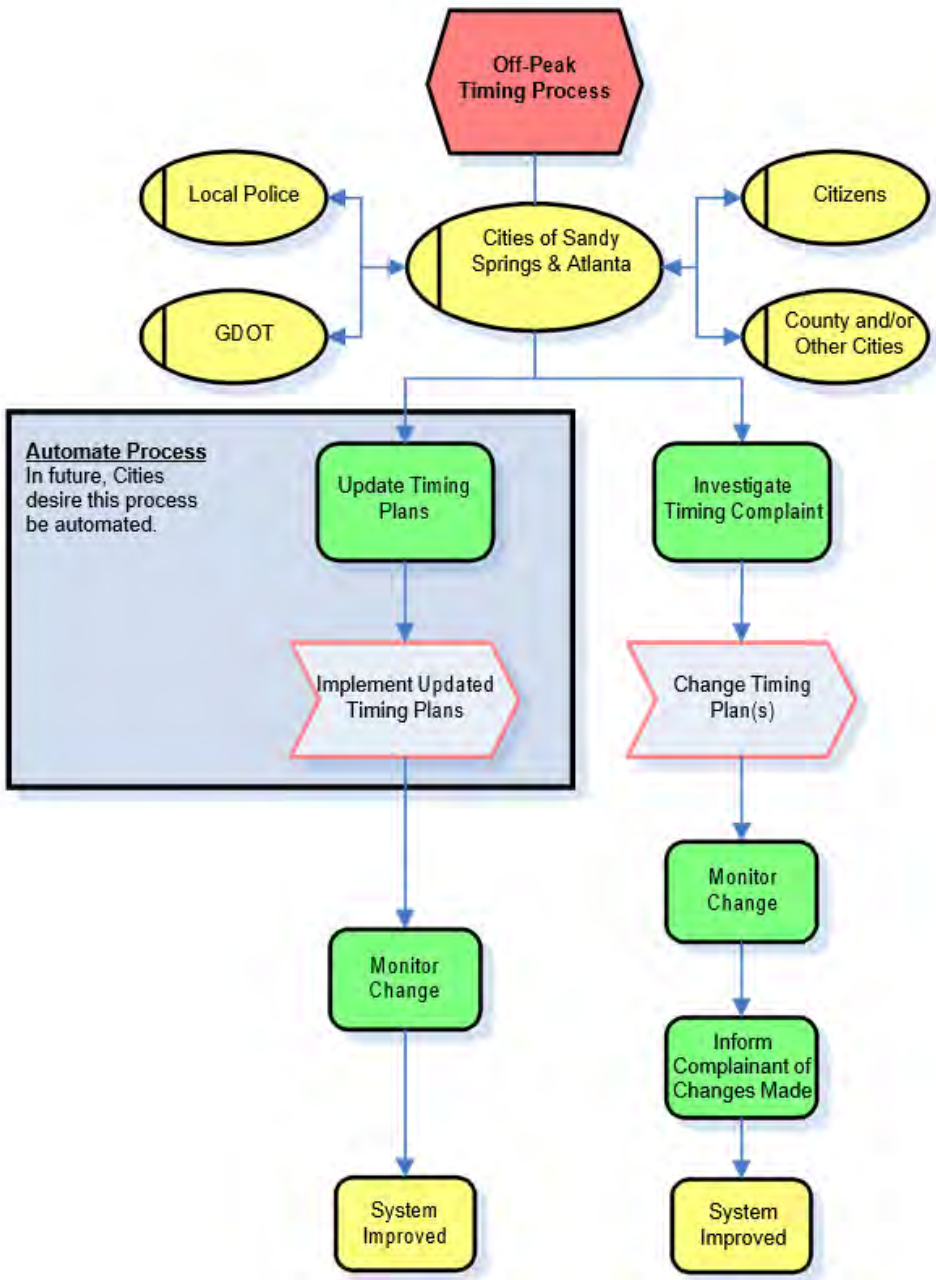

Figure 2. Off-Peak Timing Process

3.3 Incidents Signal Timing Process

In Figure 3, the process for implementing timing plans in response to incidents is illustrated. Developing a signal timing strategy in response to an incident when it occurs is difficult. Flush strategies will need to be developed in advance to respond quickly to incidents on GA 400. At off-peak times, a queue management strategy will be effective at key bottleneck intersections. The cities desire to automate this process to significantly reduce the time it takes to implement a plan, thereby reducing the delay experienced by motorists stuck in the incident traffic.

Georgia State Route 400 (GA 400) is a north-south freeway that parallels SR 9 to its east. If an incident occurs on GA 400, it heavily impacts the operation of SR 9. For instance, if an accident occurs on northbound GA 400 at the Chattahoochee River during the PM peak, the northbound traffic will back up for miles. Once this occurs, traffic will exit GA 400 at Glenridge Connector, I-285, Abernathy Road, and Northridge Road to travel west and connect with SR 9. The typical timing plans running on SR 9 will no longer be able to accommodate the increase in traffic, and therefore congestion will occur quickly and soon becomes irrecoverable until the incident is cleared. The City of Sandy Springs has developed flush plans for SR 9 to manage incident traffic; however, they have had limited success implementing their flush plans quickly enough to offset the impact of the increased volume of traffic. Because of the cities desire to maintain optimal traffic flow on SR 9, they want a system that can quickly and automatically adapt to changing conditions.

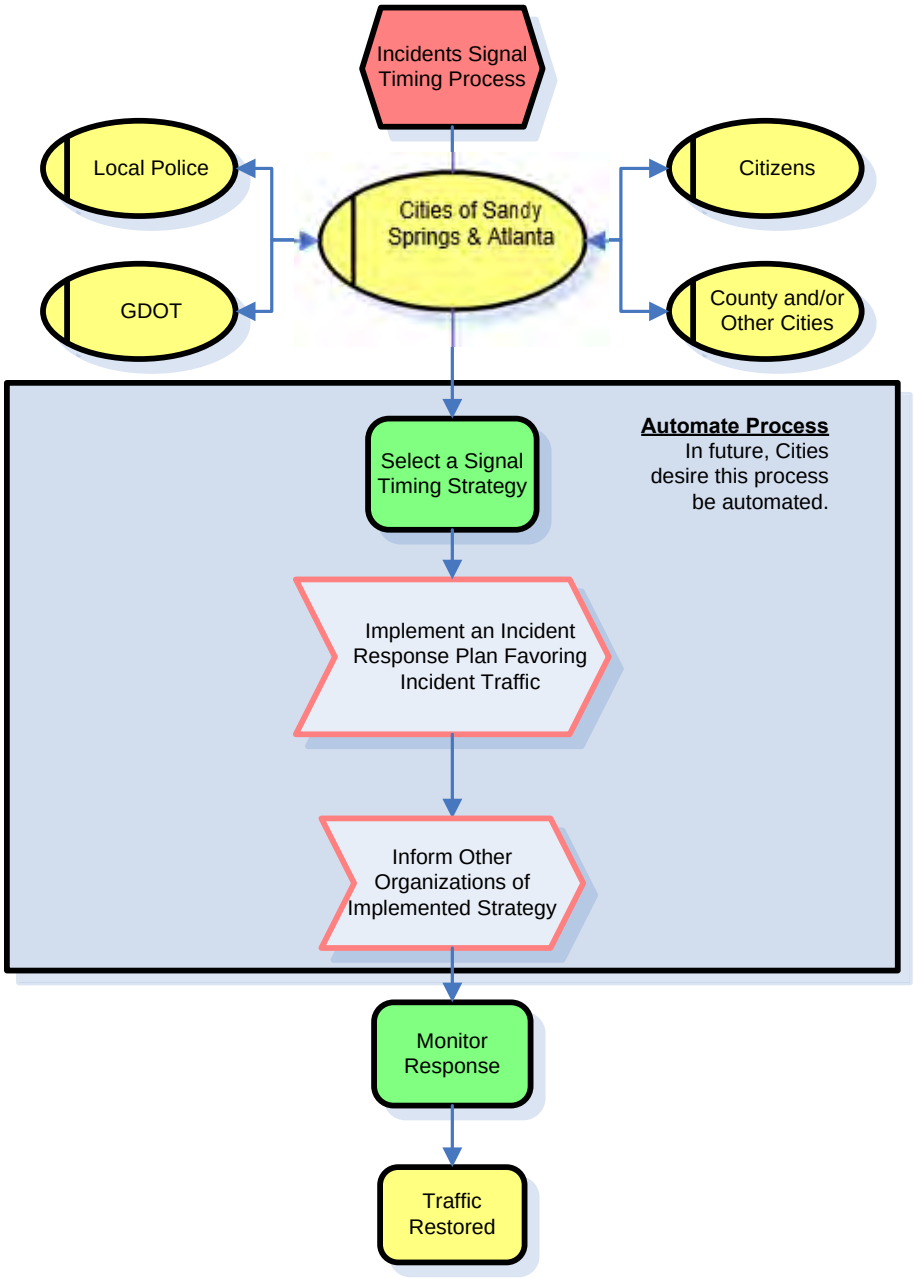

Figure 3. Incidents Signal Timing Process

3.4 Construction/Special Events Signal Timing Process

Figure 4 illustrates the signal timing process for construction and special events. Typically each City's Community Development department is responsible for permitting and planning for special events. The Community Development staff work closely with Police and Traffic Department staff on major events where traffic control is required. GDOT is also engaged if any state routes are being impacted. The Traffic Department is typically responsible for pre-planning assistance. If the event is anticipated to significantly impact the roads, the Traffic Department will prepare special timing plans. Additionally, the Traffic Department will work in the TMC on the day of the event to monitor the effectiveness of timing plans.

3.5 Constraints to Signal Timing Processes

The following are constraints to the cities' signal timing processes.

- With 25 signalized intersections within the project limits, in addition to hundreds of other signals within the two cities, the cities cannot manually monitor all the signals in the network. It is not practical, nor do they have the manpower to actively monitor all the signals in the network during all peak periods each day of the week.
- Implementing real-time timing-plan changes across a number of adjacent intersections is difficult to do manually and is often not effective. Significant, unpredictable traffic fluctuations on SR 9 are common, but currently the cities lack the means to identify the changes and rapidly adjust timing plans.
- Over the past 10 years, GDOT has implemented an advanced traffic controller program with the goal of creating statewide uniformity and interoperability of traffic signal controllers.
    - GDOT purchased a statewide ACTRA central system license, and now GDOT has purchased the upgrade to ACTRA which is TACTICS central system version 2.1.3. ACTRA and TACTICS are free to local agencies.
    - GDOT purchased a statewide license for 2070 controller firmware – Siemens SEPAC version 3.32g in ECOM EPAC configuration. SEPAC is free to local agencies.
    - GDOT provides free training programs on ACTRA and SEPAC.
- The system needs dual coordination between SR 9 and major cross streets. This can only be achieved if the SR 9 system and cross street system are controlled by the same central signal system (ACTRA/TACTICS).
- The system is oversaturated at most major intersections in peak periods.

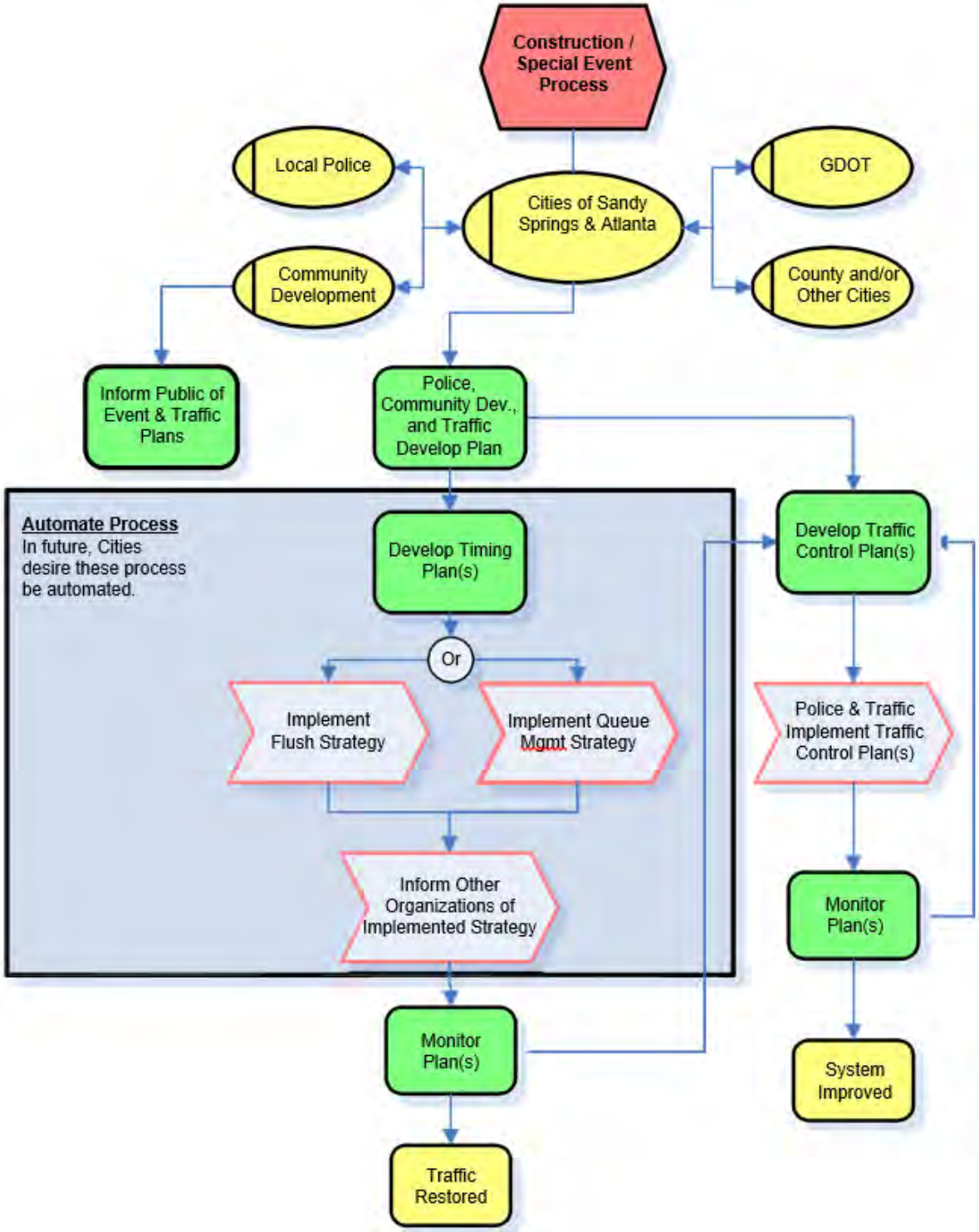

Figure 4. Construction/Special Events Signal Timing Process

4 Signal Timing System Needs

The central focus of the *Concept of Operations* document was the need for multi-jurisdictional coordination and cooperation, particularly as it related to the signal system operating along the SR 9 corridor. Multi-jurisdictional coordination will help achieve smoother, more balanced traffic operations along the SR 9 corridor. In addition, assistance through federal grant programs is often more readily available for projects that meet regional needs rather than the needs of just one community.

Table 1 provides a list of prioritized signal system needs that were identified by one or more of the jurisdictions along the SR 9 corridor. The table also shows the relevant user service category from the *ITS Architecture* and the proposed measures that could be employed to address each need. The check boxes listed under each city indicate whether the listed need applies to them.

Table 1. Identified Signal System Needs from Concept of Operations

ID	User Services	Needs	Sandy Springs	Atlanta	Proposed Measures or Strategies
1.	Traffic Management	Reduce delay and improve throughput on SR 9 and cross streets	☑	☑	• Implement cross-jurisdictional signal timing • Re-time signals every 2 to 3 years • Regularly measure the effectiveness of existing signal timing plans • Implement adaptive control system
2.	Traffic Management	Minimize delays due to non-recurring congestion and changes in travel patterns	☑	☑	• Develop traffic responsive plans • Implement adaptive control system
3.	Traffic Management	Reduce duration of oversaturated conditions on SR 9 and major cross streets	☑	☑	• Develop traffic responsive plans • Implement adaptive control system
4.	Traffic Management	Provide effective management of maintenance and construction activities	☑	☑	• Implement electronic tracking of all maintenance activities • Automate fault reporting, such as reporting of loop failures • Develop an inventory tracking system
5.	Incident / Emergency Management	Develop queue and progression management for SR 9 during GA 400 incidents	☑	☑	• Develop diversion timing plans in coordination with the other cities • Develop traffic responsive plans • Implement adaptive control system

ID	User Services	Needs	Sandy Springs	Atlanta	Proposed Measures or Strategies
6.	Incident / Emergency Management	Implement response to incidents after normal work hours	☑	☑	• Share after-hours access to signal system • Share control of predetermined signal timing plans for after-hours • Develop Standard Operating Procedure (SOP) for after-hours access • Implement adaptive control system
7.	Special Events Management	Enhance Special Events Management	☑	☑	• Enhance coordination between the agencies for special events • Provide CMS, CCTV, and pre-event traveler information • Develop SOP between the local cities and their Police Departments regarding the ability to manually override traffic signals during special events.

5 High-Level Signal Timing System Requirements

The high-level signal system requirements are defined in this section. Requirements 1 through 7 below map directly to the needs identified in Table 1. Requirements 8 and higher are additional requirements that are based on the signal timing objectives, processes, and other parameters typical to a signal system. "System" refers to the adaptive control portion of the traffic signal system.

1. The system shall improve operation on SR 9 and cross streets

1.1. The system shall be able to apply a progression-based timing solution during uncongested periods

1.2. The system shall be able to apply timings that are designed to maximize throughput during congested conditions

1.2.1. The system shall be able to implement timing strategies that maximize throughput inbound and outbound during peak periods

1.2.2. The system shall be able to implement timing strategies that balance throughput during noon and weekend peak periods.

1.3. The system shall be able to apply timings that seek to avoid backing queues into adjacent intersections and facilities

1.4. The system shall be able to automatically choose the appropriate timing strategy given the conditions

1.4.1. The system shall monitor sensors to identify the conditions

1.4.2. The system shall initiate response to identified conditions within one signal cycle

1.4.3. The system shall implement a response to changing conditions within three signal cycles

1.4.4. The system shall allow the operator to constrain the changes made by the system to a defined range

1.5. Override and failure operation

1.5.1. The system shall allow the operator to override the operation

1.5.2. The system shall allow the central system to override adaptive operation by time of day

1.5.3. The system override shall be implemented intersection by intersection or for the whole network

1.5.4. The system override operation shall allow local intersection control (according to the stored time-of-day schedule)

1.5.5. The system override operation shall allow central system control modes, including actuated free, coordinated, and traffic responsive modes

1.5.6. The system shall automatically operate a user-designated central system control mode in case of failure of the adaptive operation

1.5.7. The system shall monitor the integrity of adaptive-control sensors

1.5.7.1. The system shall monitor detectors for failure

1.5.7.2. The system shall provide alternative measurement values for failed detectors

1.5.7.3. The system shall determine that adaptive mode has failed if a user-specified number of detectors used for adaptive control have failed

1.5.8. The system shall automatically operate in local intersection control in case of failure of the central system control modes

2. Monitoring and Reporting

2.1. The system shall provide real-time display indicating which timing strategy is in effect

2.2. The system shall provide real-time report of failure mode conditions and overrides

2.3. The system shall make all reporting available on any workstation attached to the central signal system

2.4. System Log

2.4.1. The system shall maintain a log for the most recent 30 days.

2.4.2. The system log shall include when timing strategies were in effect

2.4.3. The system log shall include failure mode conditions and overrides

2.4.4. The system log shall be automatically archived at user-defined intervals

2.4.5. The system log shall be stored in a comma-delimited text file

3. Respond to network incidents affecting operation on SR 9

3.1. The system shall be able to detect increased flows on westbound approaches and GA 400 exit ramps in the affected direction.

3.1.1. The system shall allow the operator to set thresholds for increased flows that identify an incident condition

3.1.2. The system shall treat the incident condition identification as an alarm condition within the traffic signal system

3.2. The system shall implement timings that restrict eastbound flow to provide additional capacity for westbound and southbound/northbound flows on SR 9.

4. External constraints

4.1. System Size

4.1.1. The system shall accommodate a minimum of 25 intersections on installation

4.1.2. The system shall be expandable to a minimum of 250 intersections without additional software modification

4.2. Compatibility

4.2.1. The system shall fulfill all requirements using 2070 traffic signal controllers running the Siemens SEPAC in the version used by GDOT, in ECOM EPAC configuration

4.2.2. The system shall fulfill all requirements when implemented in a Siemens TACTICS traffic signal system in the version used by GDOT

4.2.3. The system shall operate over a partially existing Ethernet network installed on a fiber-optic plant. (The plant will be extended to cover all of the project area.)

5. System Contractor Requirements

5.1. The system contractor shall provide new detection required for adaptive control of all signal phases at all intersections

5.2. The system contractor shall recommend locations and technologies for adaptive control

5.3. The system contractor shall design, install, test, and certify operation for all recommended and approved adaptive control detectors

6. Provide proven system with maintenance support

6.1. The system contractor shall demonstrate that the proposed system fulfill all requirements at time of bid

6.2. The system contractor shall provide a submittal demonstrating fulfillment of all requirements.

6.3. The system contractor shall submit a test plan that demonstrates and certifies that all requirements are fulfilled before acceptance

6.4. The system contractor shall submit a validation plan demonstrating that the system supports the needs and processes before acceptance

6.5. The system contractor shall provide five years of on-call customer support and upgrades after installation is complete and accepted.

6.6. The system contractor shall provide five days annually of training provided in Atlanta area for period of five years.

6 Evaluate Signal Timing System Strategies

Currently there are four levels of signal timing system strategies to consider ranging from the most common, Level 1 – Time Base Coordination, to the most powerful but least common, Level 4 – Adaptive Control. In this section, all four levels are discussed in regards to how well each satisfies the goals, objectives, and requirements previously defined.

6.1 Level 1 – Time Base Coordination (TBC)

City of Sandy Springs currently uses Level 4 – Adaptive Control via SCOOT on 9 intersections along SR 9 (Dunwoody Place – Abernathy Road). For other 16 intersections on SR 9 (Vernon Woods Drive – Windsor Parkway), it operates its signals at Level 2 – Interconnected Control. The City has already installed fiber running to each cabinet and fiber modems which operate from its TMC's central ACTRA server. The 4 intersections in City of Atlanta (West Wieuca Road – Chastain Drive) are operating at Level 2 – Interconnected Control. Fiber connection through these four signals are currently under construction. Sandy Springs and Atlanta operate their SR 9 signals using Level 1 – Time Base Coordination only when their central computer or communication fails.

The limitation of Level 1 – TBC is that equipment status is not provided. Therefore, equipment failure or failure to display the appropriate signal timing cannot be automatically identified at the TMC or in the maintenance facility. With the importance of SR 9 as a regional significant corridor, a Level 2 or higher approach is needed.

6.2 Level 2 – Interconnected Control

As mentioned above, Sandy Springs and Atlanta operate their SR 9 signals at Level 4 – Adaptive Control and Level 2 – Interconnected Control. Level 2 enables the agencies to monitor their signals from their TMCs and make real-time changes when desired.

Sandy Springs and Atlanta also have CCTV cameras at key locations and are able to use their cameras for observations and to make remote adjustments using their ACTRA (Sandy Springs)/TACTICS (Atlanta) systems. However, neither city can monitor and make dynamic changes on a continuous basis. This is because they have a large number of intersections on their system that would need to be monitored, and it is not cost-effective to spend each AM, noon, and PM peak period monitoring the system. Staff typically has other activities requiring their attention for much of the day. Consequently, the cities are proud they have achieved Level 2, but a higher level of performance is desired to meet their goal to minimize congestion and promote smooth flow on SR 9 while also providing reasonable service to the cross-street traffic.

6.3 Level 3 – Traffic Responsive Control

Level 3 – Traffic Responsive Control requires system detectors and it provides the capability to achieve the following:

- Traffic-responsive timing plan selection.
- Traffic data to establish timing plans specifically tailored to recurrent traffic variations. This requires additional systems and traffic engineering capability.

- Enables the system to monitor traffic conditions and automatically select an alternative pre-defined timing plan.

Disadvantages to Level 3 control are that it requires a lot of expertise to develop and requires considerable maintenance to keep it operating effectively. In particular, the following functions must be maintained:

- Updating of timing plan sequences. Traffic-responsive operations also require the development of signatures or detector thresholds.
- Partial or complete automation of timing plan development with particular attention to avoiding manual collection of turning movement counts.
- Migration of timing plans and detector signatures into the traffic control system database.

Because of the time commitment to implement and maintain Level 3 – Traffic Responsive Control, and the limited available time of staff, Level 3 control is not seen as feasible by the local agencies.

6.4 Level 4 – Adaptive Control

Level 4 – Adaptive Control consists of a family of techniques that collectively have been termed "adaptive systems." Typically, adaptive systems apportion intersection green time based on prediction of platoon arrivals. Timing decisions are made within each traffic cycle or during each signal phase. Adaptive systems have the capability to respond to traffic variations by rapidly changing timing and do not require the same level of manual participation in database and signal timing revisions necessary in Level 3 systems.

The goals and objectives, existing/desired processes, existing constraints, and high-level requirements defined in this report support Level 4 – Adaptive Control as an appropriate strategy for the Cities of Sandy Springs and Atlanta. Adaptive control works best in conditions with high levels of non-recurring congestion, such as incidents and special events, and in areas with fluctuating traffic demand. SR 9 is known for having these exact conditions. In addition, the cities desire a system that will reduce delay and improve throughput on SR 9 and its cross streets, and Level 4 will help them achieve these key goals within the framework of their current organizational structure.

The following Level 4 – Adaptive Control systems are available from suppliers in the United States and were considered for this project:

- InSync
- SCOOT
- SCATS
- ACSLite
- OPAC

In Table 2 on the following pages, these five adaptive systems are compared with how well they meet the high-level system requirements developed in Section 5. The table also provides traceability of the high-level requirements with the Section 2 - Goals and Objectives, Section 3 – Processes and Constraints, and Section 4 - Needs.

Table 2. Adaptive Control Products Comparison

Traceability			High-Level Requirements		Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)		InSync	SCOOT	SCATS	ACSLite	OPAC
			1	The system shall improve operation on SR 9 and cross streets					
1	3.2	1	1.1.	The system shall be able to apply a progression-based timing solution during uncongested periods	Yes	Yes	Yes	Yes	Yes
			1.2.	The system shall be able to apply timings that are designed to maximize throughput during congested conditions					
1,4	3.1	1,2,3	1.2.1.	The system shall be able to implement timing strategies that maximize throughput inbound and outbound during peak periods	Yes, but tested poorly	Yes	Yes	Yes	Yes
1,4,5	3.2	1,2	1.2.2.	The system shall be able to implement timing strategies that balance throughput during noon and weekend peak periods.	Yes	Yes	Yes	Yes	Yes
1,5	3.1 - 3.4	3	1.3.	The system shall be able to apply timings that seek to avoid backing queues into adjacent intersections and facilities	Yes, but tested poorly	Yes	Poor	Depends on coordi-nation plan	Yes
1,2,3,4,5,7	3.1 - 3.4	1-7	1.4.	The system shall be able to automatically choose the appropriate timing strategy given the conditions	Yes	Yes	Yes	Yes	Yes
6,7	3.1 - 3.4	1-7	1.4.1.	The system shall monitor sensors to identify the conditions	Yes	Yes	Yes	Yes	Yes
1,2,3,7	3.1 - 3.4	1-7	1.4.2.	The system shall initiate response to identified conditions within one signal cycle	Yes	Yes	Yes	**No**	Yes

Traceability			High-Level Requirements	Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)	InSync	SCOOT	SCATS	ACSLite	OPAC
1,2,3,7	3.1 - 3.4	1-7	1.4.3. The system shall implement a response to changing conditions within three signal cycles	Yes	Yes	Yes	May require plan transi-tion	Yes
1,5	3.1 - 3.4	1-7	1.4.4. The system shall allow the operator to constrain the changes made by the system to a defined range	Yes	Yes	Yes	Yes	Yes
			1.5. Override and failure operation					
1,8	3.1	1,3,7	1.5.1. The system shall allow the operator to override the operation	Manual control only at the phase level	Yes	Yes	Yes	Yes
1,3,4	3.1	1-7	1.5.2. The system shall allow the central system to override adaptive operation by time of day	**No**	Yes	Yes	**No**	Yes
1,3	3.5	1-7	1.5.3. The system override shall be implemented intersection by intersection or for the whole network	**No**	Yes	Yes	**No**	Yes
1,2,7,8	3.1,3.5	1-7	1.5.4. The system override operation shall allow local intersection control (according to the stored time-of-day schedule)	**No**	Yes	Yes	Yes	Yes
1,4,7	3.1,3.3	1-7	1.5.5. The system override operation shall allow central system control modes, including actuated free, coordinated, and traffic responsive modes	**No**	Yes	Yes	**No**	Yes
1,8	3.1	1-7	1.5.6. The system shall automatically operate a user-designated central system control mode in case of failure of the adaptive operation	**No**	Yes	Yes	Yes	Yes

Traceability			High-Level Requirements	Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)	InSync	SCOOT	SCATS	ACSLite	OPAC
			1.5.7. The system shall monitor the integrity of adaptive-control sensors					
1,8	3.1	1-7	1.5.7.1. The system shall monitor detectors for failure	Yes	Yes	Yes	Yes	Yes
1,8	3.1	1-7	1.5.7.2. The system shall provide alternative measurement values for failed detectors	Yes	Yes	Yes	In Enhanced version only	
1,8	3.1,3.2	1-7	1.5.7.3. The system shall determine that adaptive mode has failed if a user-specified number of detectors used for adaptive control have failed	**No**	**No-** SCOOT will use historical or prede-fined Data	**No**	**No**	**No**
1,8	3.1,3.2	1-7	1.5.8. The system shall automatically operate in local intersection control in case of failure of the central system control modes	**No**	Yes	Yes	Yes	Yes
			2 Monitoring and Reporting					
6	3.1, 3.3, 3.4	4,6,7	2.1. The system shall provide real-time display indicating which timing strategy is in effect	**No**	Yes	Yes	Yes	Yes
6,8	3.1, 3.3, 3.5	4,6,7	2.2. The system shall provide real-time report of failure mode conditions and overrides	Yes	Yes	Yes	Yes	Yes
6	3.1, 3.3, 3.6	4,6,7	2.3. The system shall make all reporting available on any workstation attached to the central signal system	**No**	Yes	Yes	Only when integrated with central system	Yes
			2.4. System Log					

Traceability			High-Level Requirements	Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)	InSync	SCOOT	SCATS	ACSLite	OPAC
6	3.1-3.4	1-7	2.4.1. The system shall maintain a log for the most recent 30 days.	No	Yes	Yes	Yes	Yes
6	3.1-3.4	1-7	2.4.2. The system log shall include when timing strategies were in effect	No	Yes	Yes	Yes	Yes
6,8	3.1-3.4	1-7	2.4.3. The system log shall include failure mode conditions and overrides	No	Yes	Yes	Yes	Yes
6	3.1-3.4	1-7	2.4.4. The system log shall be automatically archived at user-defined intervals	No	Yes	Yes	Yes	Yes
6	3.1-3.4	1-7	2.4.5. The system log shall be stored in a comma-delimited text file	No	Yes	Yes	Yes	Yes
			3 Respond to network incidents affecting operation on SR 9					
			3.1. The system shall be able to detect increased flows on westbound approaches and GA400 exit ramps in the affected direction.					
2,7	3.3,3.4	5,6	3.1.1. The system shall allow the operator to set thresholds for increased flows that identify an incident condition	No	Yes	Yes	No	?
2,7	3.3,3.4	5,6	3.1.2. The system shall treat the incident condition identification as an alarm condition within the traffic signal system	No	Yes	Yes	No	?
1,2,7	3.3,3.4	5,6	3.2. The system shall implement timings that restrict eastbound flow to provide additional capacity for westbound and southbound/northbound flows on SR9.	No	Yes	Yes	No	Yes
			4 External constraints					

Traceability			High-Level Requirements		Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)		InSync	SCOOT	SCATS	ACSLite	OPAC
			4.1.	System Size					
1,4	3.5	1-7	4.1.1.	The system shall accommodate a minimum of 31 intersections on installation	Yes	Yes	Yes	**No**	Yes
1,4	3.5	1-7	4.1.2.	The system shall be expandable to a minimum of 250 intersections without additional software modification	**No**	Yes	Yes	**No**	**No** (220)
			4.2.	Compatibility					
1,4	3.5	1-7	4.2.1.	The system shall fulfill all requirements using 2070 traffic signal controllers running the Siemens SEPAC in the version used by GDOT, in ECOM EPAC configuration	Yes, for the requirements INSYNC fulfills	Yes	**No**	**No**	**No**
1,4	3.5	1-7	4.2.2.	The system shall fulfill all requirements when implemented in a Siemens TACTICS traffic signal system in the version used by GDOT	**No**	Yes	**No**	Anticipated	**No**
1,4	3.5	1-7	4.2.3.	The system shall operate over a partially existing Ethernet network installed on a fiber-optic plant. (The plant will be extended to cover all of the project area.)	Yes	Yes	Yes	Yes	Yes

Traceability			High-Level Requirements		Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)		InSync	SCOOT	SCATS	ACSLite	OPAC
			5	**System Contractor Requirements**					
1,2,3,6	3.1-3.4	1-7	5.1.	The system contractor shall provide new detection required for adaptive control of all signal phases at all intersections	Yes	Yes	Yes	Yes	Yes
1,2,3,4,6	3.1-3.4	1-7	5.2.	The system contractor shall recommend locations and technologies for adaptive control	Yes	Yes	Yes	Yes	Yes
1,2,3,4,6	3.1-3.4	1-7	5.3.	The system contractor shall design, install, test, and certify operation for all recommended and approved adaptive control detectors	Yes	Yes	Yes	Yes	Yes
			6	**Provide proven system with maintenance support**					
1 - 8	3.1-3.4	1-7	6.1.	The system contractor shall demonstrate that the proposed system fulfill all requirements at time of bid	Yes	Yes	Yes	Yes	Yes
1 - 8	3.1-3.4	1-7	6.2.	The system contractor shall provide a submittal demonstrating fulfillment of all requirements.	Yes	Yes	Yes	Yes	Yes
1 - 8	3.1-3.4	1-7	6.3.	The system contractor shall submit a test plan that demonstrates and certifies that all requirements are fulfilled before acceptance	Yes	Yes	Yes	Yes	Yes
1 - 8	3.1-3.4	1-7	6.4.	The system contractor shall submit a validation plan demonstrating that the system supports the needs and processes before acceptance	Yes	Yes	Yes	Yes	Yes

Traceability			High-Level Requirements		Adaptive Control Products				
Goals (Sect. 2) [1]	Processes / Constraints (Sect. 3) [2]	Needs (Sect. 4) [3]	(Sect. 5)		InSync	SCOOT	SCATS	ACSLite	OPAC
1 - 8	3.1-3.4	1-7	6.5.	The system contractor shall provide a five years of on-call customer support and upgrades after installation is complete and accepted.	Yes	Yes	Yes	Yes	Yes
1 - 8	3.1-3.4	1-7	6.6.	The system contractor shall provide a five days annually of training provided in Atlanta area for period of five years.	Yes	Yes	Yes	Yes	Yes
				Total No's	19	1	3	11	4

Notes:
1. Numbers shown in column 1 reference the eight goals defined in Section 2.
2. Numbers shown in column 2 reference processes and constraints shown in subsections 3.1 through 3.5.
3. Numbers shown in column 3 reference the seven needs identified in Table 1 in Section 4.

Shaded rows are header rows.

7 Recommendations and Conclusion

Implementing a Level 4 – Adaptive Control System on the SR 9 corridor is recommended. Adaptive control systems are known to have several advantages over traditional traffic signal timing operations with time-of-day plans. Adaptive control systems work best in conditions like those commonly experienced on SR 9, including high levels of non-recurring congestion due to incidents and special events combined with ever fluctuating traffic demand. An adaptive control system is not necessarily the solution for every traffic signal system. The Cities are aware that it will not completely resolve all traffic congestion issues, and it may not help significantly during oversaturated traffic conditions. Instead, the Cities envision adaptive traffic control as the best tool currently available to enhance their timing practices. Because the Cities are implementing adaptive control across their jurisdictional boundaries, the reduction of delays, stops, and improved operational performance will be a benefit to the region.

Although three of the systems satisfy the majority of the requirements shown in Table 2, only one system, SCOOT, meets all of the key external constraints indicated in requirements 4.1 through 4.2. These requirements are critical in meeting the cities' goals to not only improve throughput and reduce delay, but to continue to provide dual coordination between SR 9 and its major crossing arterials; thus achieving east-west throughput across SR 9 during oversaturated traffic conditions. As indicated in Table 2, Requirement 4.2, only the SCOOT system can run in parallel to the existing GDOT statewide signal system, TACTICS, and the SCOOT adaptive mode can be activated by time of day which allows dual coordination to be achieved when desired with major crossing arterials.

One of the few limitations of adaptive control systems is their ability to appropriately adapt to oversaturated conditions as well as an experienced timing engineer can manage the system by applying personal knowledge and experience. With SCOOT, the timing engineer has the opportunity to use its preferential features to influence oversaturated timing plans, but if those features prove unsatisfactory, the timing engineer still has the option to revert to the existing dual coordination plans by temporarily running the intersection in a Level 2 – Interconnected Control mode. In addition, selection of the SCOOT system will greatly reduce the cities' learning curve because the SEPAC local controller firmware and TACTICS central system will remain the same. The cities will only have to learn the new SCOOT adaptive software. Operations and maintenance training will be included with the system as well as five years of annual user training and support.