CONCEPT OF OPERATIONS

Decision Support System and Advanced Transportation Management System Software

FINAL

7/22/2016

Produced by Kapsch TrafficCom Transportation for:

Florida Department of Transportation, District 5
719 S Woodland Blvd
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Acronyms

AAM	Active Arterial Management
APC	Automatic Passenger Counter
ATIS	Advanced Traveler Information Systems
ATS	ATMS Traffic Signal System
ATMS	Advanced Transportation Management System
AVI	Automatic Vehicle Identification
AVL	Automatic Vehicle Location
C2C	Center to Center
CCTV	Closed Circuit Television
CFRC	Central Florida Rail Corridor
CFX	Central Florida Expressway Authority
DMS	Dynamic Message Sign
DSS	Decision Support System
FDOT	Florida Department of Transportation
FDOT D5	Florida Department of Transportation District 5
FHWA	Federal Highway Administration
FRA	Federal Rail Administration
FTA	Federal Transit Administration
FTE	Florida Turnpike Enterprise
HAR	Highway Advisory Radio
I-4	Interstate 4
ICM	Integrated Corridor Management
INCOSE	International Consortium of Systems Engineering
ITS	Intelligent Transportation Systems
JTOC	Joint Traffic Operations Center
LEO	Law Enforcement Officer
MPO	Metropolitan Planning Organization
MS/ETMCC	Message Set for External TMC to TMC Communication
NCHRP	National Cooperative Highway Research Program
OIA	Orlando International Airport
RFP	Request for Proposals
RITSA	Regional ITS Architecture
RTMC	Regional Transportation Management Center
RWIS	Road Weather Information System
SIS	Strategic Intermodal System
TIS	Traveler Information System
TMC	Traffic Management Center
TMDD	Traffic Management Data Dictionary
TSCS	Traffic Signal Control System
TSM	Traffic Signal Maintenance
TSM&O	Transportation Systems Management & Operations
TSP	Transit Signal Priority

1 Overview

This document is intended as a high-level Concept of Operations (Con Ops) for a Decision Support System (DSS) and Advanced Traffic Management System (ATMS) for Regional Integrated Management of the Orlando region consisting of freeway, arterial, bus and rail networks, and serving a central business district. This document is a living document, and will be updated three times during the initial concept study. This version of the document is the first draft.

The purpose of this Con Ops is to answer the questions of who, what, when, where, why and how for the application of a DSS and ATMS Software System to support an Integrated Corridor Management System (ICM) within the Orlando region, named the Orlando Regional Integrated Operations Network (ORION). Given that an ICM is a “system of systems,” involving multiple agencies and stakeholders, this Con Ops also defines the roles and responsibilities of the participating agencies and other involved entities. Purposes of the Con Ops include:

- To ensure that stakeholder needs and expectations are captured early
- To ensure that the implementation is linked to agency mission, goals, and objectives
- To identify existing operational environment and operations
- To identify where the system could enhance existing operations
- To illustrate the future environment with the system
- To establish a list of operational requirements
- To begin the traceability of the Systems Engineering Process. (The operational requirements will set benchmarks for system testing)

In essence, the Con Ops will define:

- Goals, objectives, and capabilities of each existing and planned system in the project corridor
- Roles and responsibilities of the participating agencies and stakeholders associated with the project

Secondly, the Con Ops is the first step in the structured systems engineering process recommended by the Federal Highway Administration (FHWA) for ITS projects.

For this project, the Con Ops will provide a “snapshot” of the existing operations and a preview of what future systems could do to enhance this corridor’s operations. When a system or operation is changed, the Con Ops will be revisited or new scenario developed.

1.1 System Overview

The envisioned operation is defined from multiple viewpoints, with special attention to be paid to how the new ORION software will impact the Orlando region and the I-4 corridor. This document identifies specific project stakeholders, goals and objectives, and scenarios of operations that can be used to validate the final system designed and deployed. The basic premise behind the ICM initiative is that independent, individual network-based transportation management systems, and their cross-network linkages, can be operated in a more coordinated and integrated manner, thereby increasing overall corridor throughput and enhancing the mobility of the corridor users.

2 References

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ITS, Operations, Architecture, Other

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3 Scope and Summary

3.1 Introduction

Congestion is an issue affecting U.S. cities of all sizes. Traffic congestion causing traffic delay occurs when the number of vehicles trying to use a road exceeds the design capacity of the traffic network. Congestion can have a wide range of negative effects on people and the economy, including impacts on air quality, quality of life, and business activity. The Orlando region and transportation stakeholders continue to emphasize transportation system management and operations (TSM&O) strategies as a cost-effective method to relieve traffic congestion. Integrated Corridor Management is the ultimate implementation of TSM&O, by managing the transportation system in a multi-modal, multi-agency approach which optimizes the flow of people and goods through the region in an efficient and reliable manner.

The ORION system for the Orlando region is a system of systems which will be used by stakeholder agencies to coordinate responses to incidents and non-recurring congestion within the Orlando Region.

4 System Overview and Operational Description

4.1 Project Boundaries and Networks

The following descriptions of the project boundaries were defined through the stakeholder discussions as part of developing the Con Ops; the project boundaries have been identified as the Orlando Region, centered on the Interstate 4 (I-4) freeway. The following sections describe some of the features and reasoning of the corridor selected.

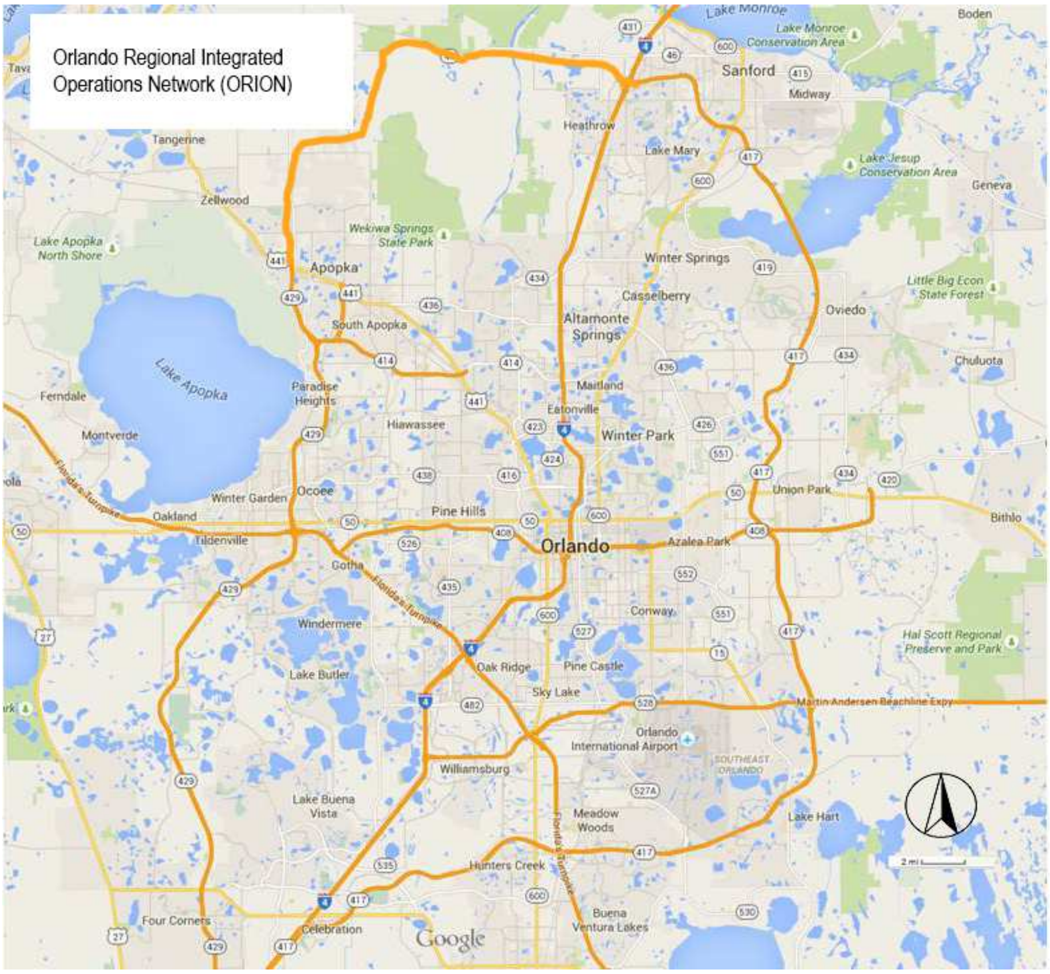

Figure 1: Orlando Region

4.1.1 Corridor Description and Boundaries

This Con Ops is defined for the Orlando Regional Integrated Management System, centered on the I-4 Corridor. The I-4 Corridor is a major east-west corridor (which travels cardinal northeast/ southwest in the region). The I-4 Corridor and influence area contains a primary freeway, a commuter-rail line, transit bus service, park-and-ride lots, major regional arterial streets, toll roads, bike trails, and significant Intelligent Transportation System (ITS) infrastructure. The following figure shows the corridor along I-4 as the yellow area, with the influence area shown by the dark line around the metropolitan area. However, this project will develop a modular approach to Integrated Management System that is initial focused on the Orlando region, but will be scalable to the entire Florida Department of Transportation (FDOT) District 5 area.

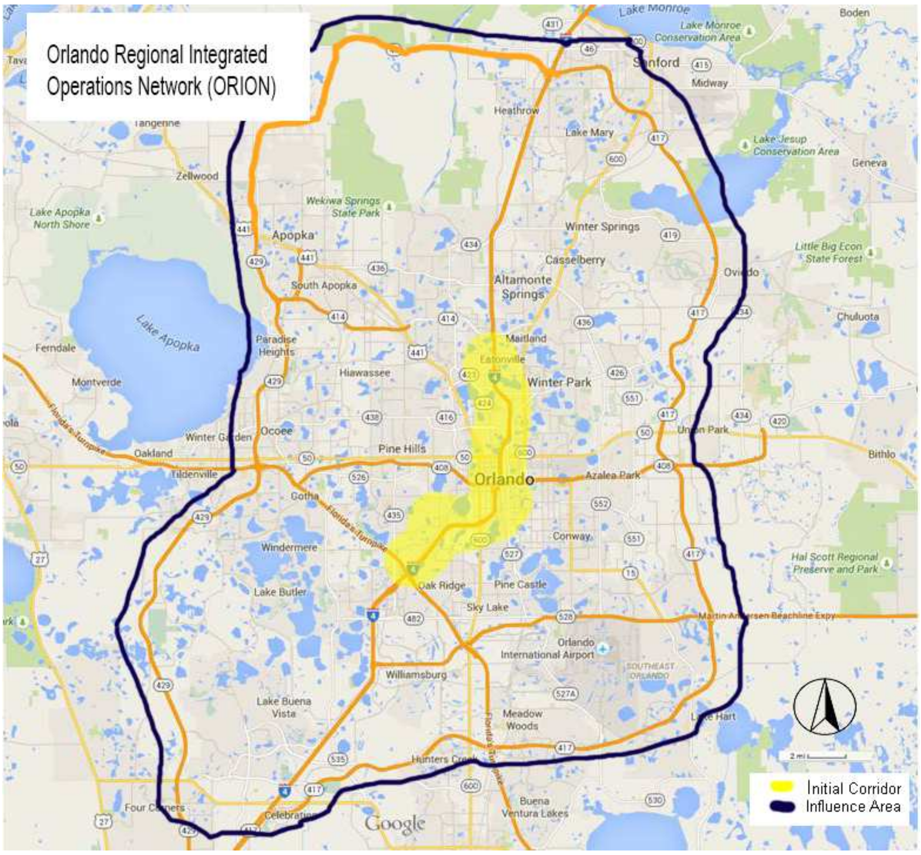

Figure 2: Orlando Regional Integrated Management System

4.1.2 Corridor Networks

This section describes the Networks contained within the corridor. A network is defined for the purposes of this Con Ops as a system of transportation infrastructure that is independent of agency or jurisdictional boundary. A description of each network is provided in more detail below. Table 1 below provides a summary of the transportation facilities in the metropolitan area.

Table 1: Orlando Transportation Facilities

Transportation Facility (With Corresponding Agency(ies)) within the Orlando region	Summary Total
Transportation Management Centers	8 TMCs (FDOT/CFX, City of Orlando, Orange County, Seminole County, Osceola County, LYNX, SunRail, FTE)
Commuter Rail Transit System	61.5 miles (SunRail)
Bus Transit System	63 Routes (LYNX)
Computer Controlled Traffic Signal Systems	
Seminole County	380 signalized intersections
Orange County	600 signalized intersections
Osceola County	177 signalized intersections
City of Orlando	500 signalized intersections
Park and Ride Lots	12 SunRail Stations
Interstate Highway (I-4)	~ 72 miles (FDOT), 21 miles of express lanes
Toll Roads	~ 55 miles (Florida Turnpike) ~ 109 miles(CFX)

The Orlando region and I-4 in particular is a true multimodal corridor, supporting a transportation network that includes vehicular traffic on its highways, public transportation routes via bus and commuter rail, air passenger travel, and freight services creating linkages to major metropolitan population and employment and entertainment centers like International Drive, and the Major Theme Parks (Disney, Universal, and Sea World).

4.1.3 Freeway & Toll Road Networks

I-4 maintains a diagonal, northeast/ southwest route for much of its length. The I-4 corridor passes through the greater Orlando area running predominantly north/south. The route provides access to all of Orlando's theme parks including, Disney World, Sea World Orlando, and Universal Studios, as well as nearly all of Orlando's toll roads, including Florida's Turnpike Enterprise network and the Central Florida Expressway Authority network, as shown in Figure 3 below. I-4 is often called the backbone of transportation in Central Florida; I-4 provides a crucial link between Tampa on the west coast and Daytona Beach on the east coast. I-4 consist of seventy-three (73) miles of roadway in Central Florida and accommodates an average of 1.5 million trips daily in Osceola, Orange, Seminole, and Volusia counties. The I-4 corridor is also considered a designated Strategic Intermodal System (SIS) Highway Corridor link of the state's intermodal transportation network.

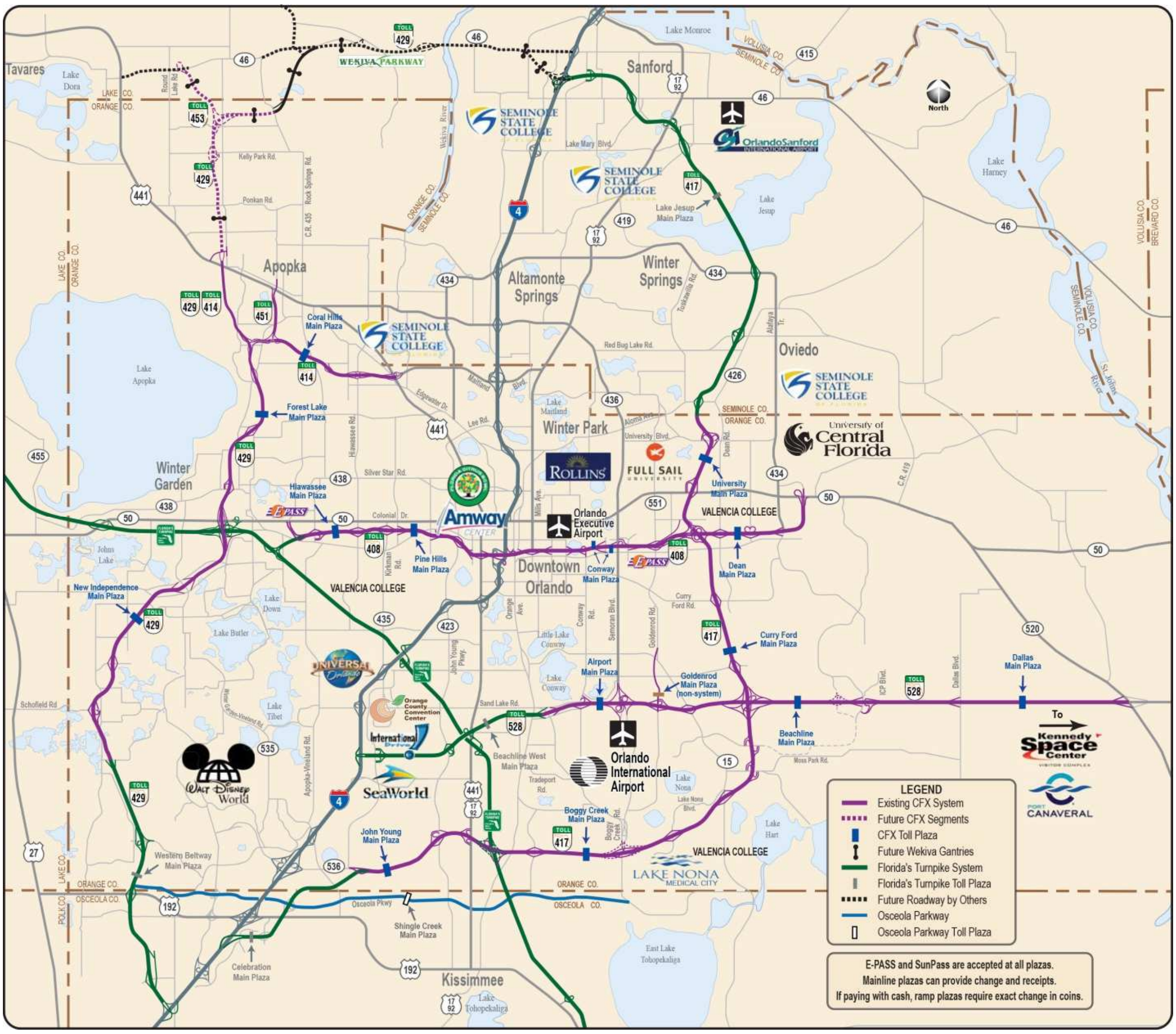

Figure 3: Orlando Interstate and Toll Roads

The Central Florida Expressway Authority (CFX) and Florida's Turnpike Enterprise (FTE) operate and maintain the toll roads in the Orlando region, which includes 109-miles of toll roads operated by CFX and approximately 35-miles of toll road in the corridor operated by FTE.

4.1.3.1 Road Rangers

The Road Rangers sponsored by State Farm program is a partnership between LYNX and the Florida Department of Transportation. The Road Ranger fleet roams a 74-mile stretch of I-4 to help stranded motorists and minimize traffic congestion caused by breakdowns. The seven vehicles that are part of the Road Rangers are equipped to make minor car repairs, assist with non-injury accidents and communicate with law enforcement and emergency services.

The services provided by the Road Ranges include:

- Minor vehicle repairs (tire changes, fuel/fluid replacement, belt and hose replacement, etc.)

- Removal of vehicles from travel lanes
- Securing minor, non-injury accident scenes
- Debris removal from the roadway
- Free use of a cell phone to contact assistance

The 74 miles of vehicle coverage span along I-4 from I-95 (Exit 132) in Volusia County to CR 532 (Exit 58) in Osceola County. The service operates Monday thru Wednesday 6 a.m. to midnight and Thursday thru Sunday 6 a.m.-3:30 a.m.

4.1.4 Arterial Networks

The arterial street system consists of several major east-west arterial streets. These primary streets are typically spaced at one-mile intervals and serve as primary travel routes and potentially serve as alternate routes for traffic diverted from freeways and toll roads, however they are also major traffic generators and need to be considered for response plan development. The key east-west arterials in the corridor are included in the following Table.

Table 2: Primary East-West Arterials

Colonial Drive (SR 50)	Lake Mary Blvd
SR 536	SR 434
Lee Road (SR 423)	Maitland Blvd (SR 414)
Aloma Av (SR 426)	Sand Lake Road (SR 482)

There are also several key north-south arterials. While many of these carry significant traffic, these arterials are critical for moving traffic between the north-south routes, including for diversion purposes. They are also major traffic generators and need to be considered for response plan development. The key north-south arterials are included in the following Table.

Table 3: Primary North-South Arterials

Orange Blossom Trail (US 441)	Kirkman Road (SR 435)
John Young Parkway (SR 423)	Semoran Boulevard (SR 436)
International Drive	Apopka Vineland Road (SR 535)
Orange Avenue (SR 527)	Goldenrod Road (SR 551)
US 17/92	Alafaya Trail (SR 434)

As part of the Active Arterial Management (AAM) project - the traffic signals and other key ITS devices along key corridors within the region will be used to actively manage these key roadways. The following map shows the roadways within the ICM corridor that are a part of the AAM project.

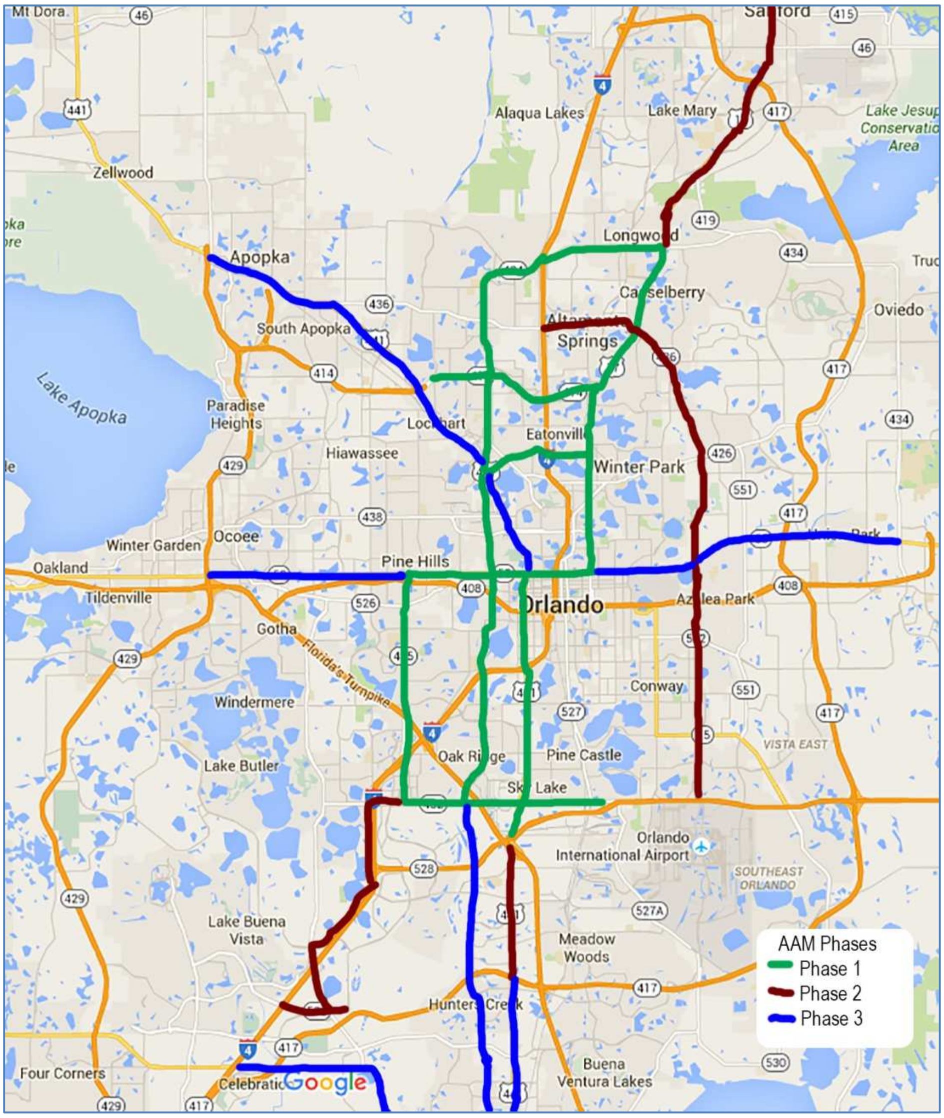

Figure 4: AAM Project Phases within the Corridor

As part of the I-4 Ultimate project, several detour routes were developed which include parts of the following roads near I-4.

Table 4: East-West Detour Roads

Maitland Blvd (SR 414)	SR 46
Semoran Blvd (SR 436)	Dirksen Drive
SR 434	US 17 - 92
Lake Mary Blvd	Lee Road (SR 423)
SR 46A (H.E. Thomas Blvd)	Fairbanks Ave (SR426)
Princeton St (SR 438)	Colonial Dr (SR 50)
Anderson St	W Kaley St
Michigan St	LB McLeod Road
33rd St	35th St

39th St	Beachline Expwy
Millenia Blvd	Conroy Rd
Sand Lake Rd (SR 482)	Universal Blvd
SR 536	Buena Vista Dr
Ronald Reagan Pkwy	Osceola Polk Line Rd
US 192	Epcot Center Rd

There are also several north-south arterials involved with the detour of traffic when incidents occur on I . While many of these carry significant traffic, these arterials are critical for moving traffic between the north-south routes, including for diversion purposes. They are also major traffic generators and need to be considered for response plan development. The key north-south arterials are included in the following Table.

Table 5: North-South Detour Roads

Maitland Ave	Longwood-Lake Mary Blvd
Forest City Road (SR 434)	Rinehart Road
Montgomery Blvd	International Pkwy
Poinciana Blvd	US 17 - 92
Markham Woods Road	John Young Parkway (SR 423)
Wymore Road	Orange Ave (SR 527)
Magnolia Ave	Orange Blossom Trail (SR 441)
Garland Ave	N Hughey Ave
Rio Grande Ave	Orlando-Vineland Rd
Kirkman Rd (SR 435)	Turkey Lake Rd
Universal Blvd	World Dr
US 27	Lake Wilson Rd

4.1.5 Transit Network – Bus

LYNX provides public transportation services for Orange, Seminole and Osceola counties. There are 77 daily local bus routes (called Links) that provide more than 105,000 passenger trips each weekday spanning an area of approximately 2,500 square miles with a resident population of more than 1.8 million. Small portions of Polk and Lake Counties are served as well.

Other LYNX services include FASTLINK, a new weekday morning and afternoon commuter service designed to provide quicker service by reducing stops along specific corridors; LYMMO, a free downtown Orlando circulator; a commuter assistance Vanpool program; ACCESS LYNX paratransit service which provides more than 2,100 scheduled passenger trips each weekday, using a variety of vehicles equipped for individuals with various disabilities; nine PickUpLine community circulators; and Xpress service from Osceola and Lake counties.

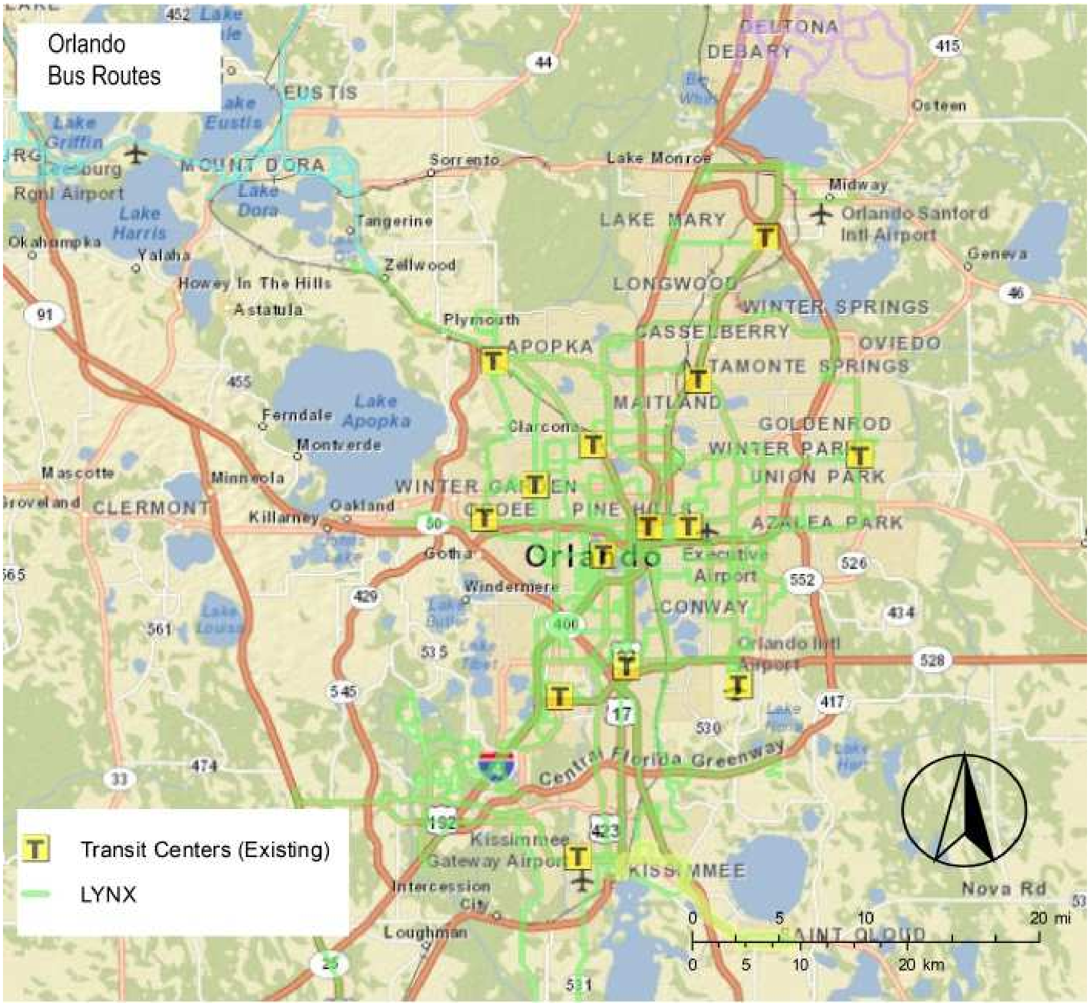

Figure 5: LYNX Bus Routes

4.1.5.1 Real-time Bus Information

LYNX is putting the technology in place to provide real-time bus automatic vehicle location (AVL) data. Kiosks with real-time bus information have been placed at heavily used stops, including the OIA-Airport, University of Central Florida, Apopka , Colonial Plaza, Osceola Square Mall, Washington Shores, and Destination Parkway. Additionally, customers will be able to obtain information in the future on their smart phones or through a simple phone call to find the location of the next bus and the expected arrival time at their stop. Potential enhancements could also assist customers by ringing an alert on their cell phones as they approach the bus stop nearest to their destination.

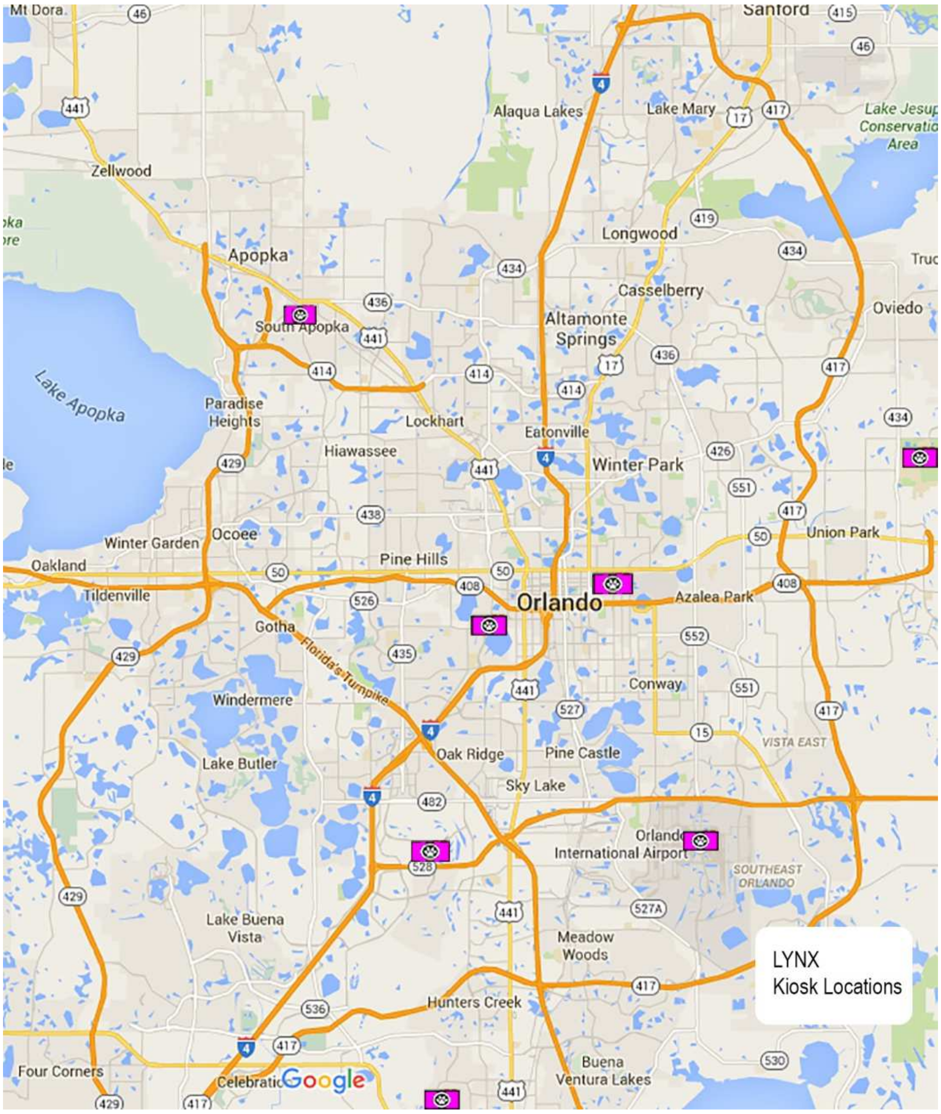

Figure 6: LYNX Kiosks

LYNX has developed an internet application to allow ACCESS LYNX customers to directly interact with the scheduling system. Now customers will have the option to reserve, update, or cancel trips through the internet without having to call a phone representative. Social workers will also be able to assist their customers' trip booking needs through this new application. Customers who still choose to speak with a phone representative will experience shorter hold times during busy call times as some choose to use the internet option. A future enhancement will allow customers to receive trip reminders and vehicle arrival notices by e-mail or by telephone call. Registered ACCESS LYNX customers will receive login information in the mail.

4.1.6 Transit Network – Commuter Rail

SunRail is a new commuter rail line being developed in Central Florida that provides a reliable mobility alternative to I-4. Phase 1 of SunRail runs from Debary to Sand Lake Road. Phase 2 will increase the coverage to 61.5 miles from beginning to end with 17 station stops along the way. SunRail trains are running every 30 minutes during peak rush hour periods. During non-peak service, trains are running every 2 hours.

There is no weekend service scheduled at this time, but special event trains are available. The SunRail website (www.sunrail.com) provides information on schedules, maps, tickets, and future expansion plans.

Figure 7: SunRail Routes

Recently, SunRail has received approval from the Federal Rail Administration to add Phase 3 which will provide service from Sand Lake Road to the Orlando International Airport.

4.2 Corridor Stakeholders and Users

The operating agencies located in the I-4 Corridor are all shown below, all of which were involved to some extent in the development of this Concept of Operations. Each agency has a designated lead staff member along with the technical staff in key areas of responsibility.

Table 6: Traffic Related Responsibilities of the Orlando Region below shows the current responsibilities and infrastructure that each agency within the Orlando region currently provides to the region.

Table 6: Traffic Related Responsibilities of the Orlando Region

Traffic Related Roles	Florida Central Office	Florida DOT District 5	Florida Turnpike Enterprise	MetroPlan	Central Florida Expressway	SunRail	Orange County	Osceola County	Seminole County	City of Kissimmee	City of Maitland	City of Orlando	City of Winter Park	Florida Highway Patrol	LYNX	Universities
Police											X	X		X		
Fire							X	X	X	X	X	X	X			
Emergency Services							X	X	X	X	X	X	X	X		
Road Ranger/ Courtesy Patrol		X	X		X											
Traffic Signal System		X					X	X	X	X	X	X	X			
Detectors		X	X		X		X	X	X	X	X	X	X			
DMS		X	X		X		X	X	X	X	X	X	X			
Public Works							X	X	X	X	X	X	X			
CCTV		X	X		X		X	X	X	X	X	X	X			
Electronic Toll /Fare /Parking equipment			X		X	X						X			X	
Transit – Bus/ Commuter Rail						X									X	
Parking Management												X				
Maintenance/ Construction		X	X		X	X	X	X	X	X	X	X	X		X	
Data Warehouse/ Analytics	X	X		X												X
Modeling		X	X	X	X											
Internet Traveler Information	X	X	X		X	X									X	
Congestion Pricing		X	X													

4.2.1 Florida Department of Transportation District 5

The Regional Traffic Management Center (RTMC) serves as the command post that monitors and manages District 5 technologies to provide motorists with reliable traveler information. The RTMC coordinates with incident responders in Brevard, Flagler, Lake, Marion, Orange, Osceola, Seminole, Sumter and Volusia counties to maintain the information flow throughout the District.

The facility has a multi-screen video wall with eight workstations running the SunGuide Intelligent Transportation System Software and is manned by FDOT operations staff that monitors traffic, disseminates information and provides the district with incident management services 24 hours per day, 7 days per week. The role of the RTMC staff is to work closely with emergency responders and various transportation agencies to administer procedures that allow for the quick and safe clearance of traffic incidents that affect the highways. As discussed in Section 4.1.4, FDOT D5 is leading the Active Arterial Management (AAM) project - the traffic signals and other key ITS devices along key corridors within the region will be managed by the FDOT D5 RTMC operations.

Figure 8: FDOT D5 SunGuide Screen

The RTMC is co-located with the Florida Highway Patrol Troop "D" and this enhances agency coordination during incident management. From large-scale crashes to roadside debris, operators manage these traffic-related incidents and dispatch the appropriate resources to reduce the impacts these events have along the highways. The RTMC also serves to broadcast important traffic information via its public dissemination tools, such as the Dynamic Message Signs (DMS) and the FL511 website. It provides motorists with up-to-the-minute traffic reports and keeps the highways moving while supporting the ITS Program Mission to optimize capacity and provide motorists with safe and efficient travel conditions along the regional highway systems.

The RTMC uses SunGuide Intelligent Transportation System Software to monitor District 5 technologies to provide motorists with reliable traveler information. The Center's operations staff interacts with the software and handle incidents as they occur. When an alert is received by an operator, they will investigate the area of the alert by checking the camera in that location. Once they determine the issue, they will inform the proper agency so they can react to the problem. They will also start an incident so those using the FL511.com website can have the latest traffic information. The SunGuide Software also monitors traffic speed and volume so it can post travel times to the numerous DMS. Road Rangers locations are also indicated within the software so the operators can send the closest one to an incident requiring their attention. Figure 8 is a screen shot of the software with an overview of the District Five area.

In addition, the RTMC is the home of FDOT D5's Active Arterial Management (AAM) project, which as described in Section 4.1.4, the traffic signals and other key ITS devices along key corridors within the region will be used to actively manage the arterial corridors.

4.2.2 Florida's Turnpike Enterprise

Florida's Turnpike Enterprise (FTE) is a business unit of the Florida Department of Transportation, employing private sector business practices to operate its 483-mile system of limited-access toll highways across the State of Florida. The FTE system includes the Mainline from Miami to Central Florida, as well as the Homestead Extension, the Sawgrass Expressway, the Seminole Expressway, the Beachline Expressway, the Southern Connector Extension of the Central Florida GreeneWay, Veterans Expressway, the Suncoast Parkway, the Polk Parkway, the Western Beltway and the I-4 Connector. On average, 1.8 million motorists use Florida's Turnpike each day.

4.2.2.1 Turnpike Mainline (SR 91)

State Road 91 is a user-financed, limited-access toll road that runs 312 miles, through 11 counties, beginning near Florida City in Miami-Dade County and terminating near Wildwood in Sumter County. Within the corridor, FTE starts around Exit 272 Winter Garden/Clermont and runs southeast through the area to Exit 240 Kissimmee Park Rd.

4.2.2.2 Martin Andersen Beachline Expressway (SR 528)

Within the Orlando Region, the Martin Andersen Beachline Expressway (formerly known as the Bee Line) is a 53.5-mile east-west tolled, limited-access transportation corridor serving Central Florida and the Space Coast. The road is owned and operated by FTE, District 5, and CFX.

FTE operates the western-most eight miles as the Beachline Expressway West and the eastern 22 miles as the Beachline East Expressway, while CFX operates from milepost eight to milepost 31.

The Beachline West begins at I-4 near the International Drive resort area. As a result, traffic is primarily tourists traveling around the various hotels, tourist attractions and restaurants, as well as the Orlando International Airport (OIA).

4.2.2.3 Greeneway and Seminole Expressway (SR 417)

Toll Road 417 is a 55-mile, tolled, limited-access transportation corridor serving Osceola, Orange and Seminole counties, and is a joint project of the CFX and FTE.

FTE operates the northern 17 miles of Toll Road 417 as the Seminole Expressway, beginning at the Seminole County line and extending north to its terminus at I-4 in Sanford. The southern 6.5 miles are operated as the Southern Connector, beginning at I-4 and extending to the International Drive interchange.

4.2.2.4 Daniel Webster Western Beltway (SR 429)

The Daniel Webster Western Beltway extends nearly 40 miles from U.S. Highway 441 in Apopka south to Interstate 4 in Osceola County, providing West Orange and Osceola counties with an alternate north-south route to heavily traveled Interstate 4.

State Road 429, a limited access toll road, was developed in partnership between CFX and FTE. The roadway was dedicated in honor of State Senator Daniel Webster, who served in the Florida Legislature from 1981-2008 and was instrumental in ensuring the funding of SR 429 and helping to see the project to fruition.

4.2.3 MetroPlan

Also known as the Orlando Urbanized Area Metropolitan Planning Organization (MPO), MetroPlan Orlando is one of 26 MPOs in the State of Florida and was one of the first multi-county MPOs in the state. MetroPlan Orlando is the MPO for Orange, Osceola and Seminole counties, and the Cities within those Counties to include City of Orlando, City of Winter Park, City of Maitland, and City of Kissimmee – which makes up the Orlando Urban Area. As a regional MPO, MetroPlan Orlando provides the forum for local elected officials, their staff, citizens, and industry experts to work together to improve transportation in Central Florida. A key responsibility under federal law is the development of a Long Range Transportation Plan (LRTP) for the region.

With guidance from a 19-member governing Board consisting of local elected officials and transportation operating agencies, and with input from its advisory committees, MetroPlan Orlando is responsible for fostering relationships and providing a forum for representatives to review, prioritize, and approve investments in the region's transportation network. Federal and state laws mandate the adoption of four key planning and programming documents: (1) LRTP, (2) Transportation Improvement Program (TIP), (3) a Unified Planning Work Program (UPWP) and (4) Prioritized Project List. These planning documents are ultimately used by FDOT as part of the overall transportation planning process. The process for developing these plans and programs is required to consider all modes of transportation and to be a continuing, cooperative, and comprehensive transportation process.

4.2.4 Central Florida Expressway Authority

The Central Florida Expressway Authority (CFX) is responsible for the construction, maintenance and operation of a 109-mile limited-access expressway system. It may also acquire, construct and equip rapid transit, trams and fixed guideways within its rights-of-way. CFX's system includes SR 408 (Spessard Holland East-West Expressway), SR 528 (Martin Andersen Beachline Expressway), SR 417 (Central Florida GreeneWay), SR 429 (Daniel Webster Western Beltway), SR 414 (John Land Apopka Expressway) and State Road 451.

CFX's jurisdiction includes Orange, Lake, Osceola and Seminole counties. The governing board reflects the jurisdictions with a majority of local elected officials that includes representation from each county, along with the City of Orlando. The board also includes three gubernatorial appointees. The Executive Director of Florida's Turnpike Enterprise serves as a non-voting advisor.

4.2.5 Orange County

Orange County has a population of 1,145,956 according to the 2010 United States Census, making it the fifth-most populous county in Florida. Located in Central Florida, Orange County includes the City of Orlando and a dozen other incorporated municipalities.

The International Drive Resort Area is the heart of economic activity for Orange County's tourism industry and is home to the Orange County Convention Center, major theme parks, hotels, restaurants and shopping venues. Moving visitors and employees within this dynamic activity center is key to its continued economic vitality. Orange County is working on several transportation initiatives to accomplish this.

The traffic signals within Orange County, which are not operated and maintained by the local cities, use Eagle controllers and the central software is Siemens Tactics. Orange County also currently uses SCOOT for adaptive signal control, but are trying to phase that out in favor of the Rhythm Engineering InSync system. Orange County operates and maintains their signals. Local cities within Orange County operate and maintain their own signals, all cities in Orange County except the City of Orlando use Eagle controllers and Siemens Tactics software.

4.2.6 Osceola County

Osceola County is located in the state of Florida. As of the 2010 census, the population was 268,685. Its county seat is Kissimmee. The Traffic Engineering Department is a part of the Public Works Division and conducts traffic studies, analyzes crash data, performs signal design reviews, manages the annual traffic count program, issues signal warrants, performs special event reviews, and participates in the development review process. The Traffic Operations Department installs and operates County signs, signals, roadway lighting, striping, and pavement markings.

Osceola County's signal system is maintained by the City of Kissimmee, and uses Econolite ASC3 controllers. There are no plans to upgrade the controllers to a different manufacturer in the near future. The signal system is controlled by the Econolite Centracs software.

4.2.7 Seminole County

Seminole County is located in the state of Florida. As of the 2010 census, the population was 422,718. Its county seat is Sanford. The transportation system of Seminole County brings people and goods into the County, accommodates traffic passing through the County, and provides the mobility and accessibility that allows residents to participate in the community's social and economic activities. Historically, the County's transportation system had been dominated by a single transportation mode - the private automobile. Public transit had played a relatively minor role, and walking and biking played purely recreational roles. As the County continues to evolve from a bedroom community to an economically self-sufficient community, a wider choice of transportation options will be needed to maintain economic and population growth while conserving valuable environmental lands.

There are approximately 2,320 centerline miles of roadways in Seminole County. These roadways have been assigned to the State Highway System, the County Road System and the City Street Systems based on the functional classification of individual roadway segments as determined by FDOT.

Most of the roadways assigned to the State Highway System are four or more lanes wide within the urban boundary, while the County roadways are generally two or four lane facilities. In large part, this reflects the higher traffic volumes generally found on State highway facilities within the County. Congestion on State highways causes traffic to be diverted to County arterial and collector roadways which, in turn, become more congested.

The County maintains about 874 miles of roadways. Approximately 861 miles are paved while the remaining miles are unpaved. Approximately 380 signalized intersections are operated and maintained by Seminole County, as shown in the Figure below, the county uses Naztec controllers, and the ATMS.Now software both provided by TrafficWare.

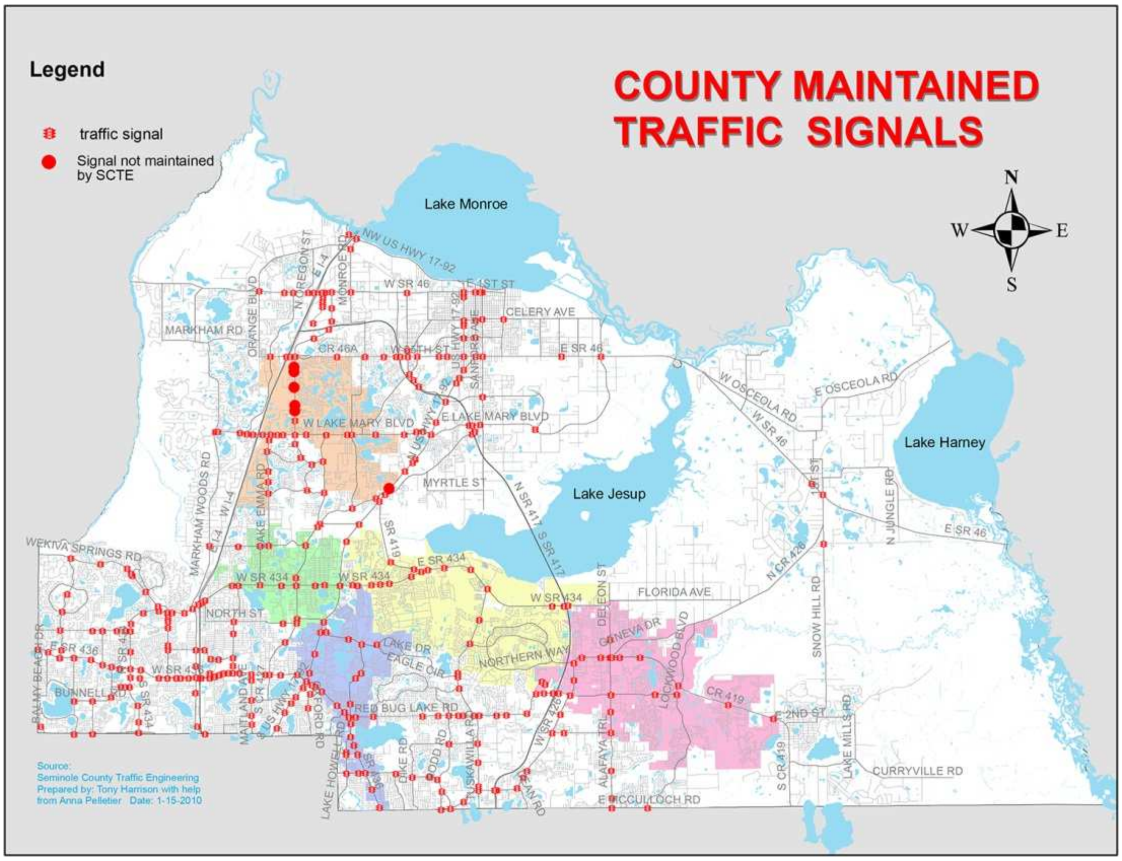

Figure 9: Seminole County Traffic Signals

4.2.8 City of Kissimmee

Kissimmee is a suburban city in County, Florida. As of the 2010 United States Census, the population was 59,682. City of Kissimmee Traffic Division is responsible for the maintenance of signalized intersections for the City of Kissimmee and Osceola County. The Traffic Division consists of 10 team members: a Superintendent, a Foreman, a Secretary, six Signal Technicians, and a Utility Worker. The Traffic Division has many functions and areas for which the staff has the responsibility of managing.

The City of Kissimmee operates and maintains and operates theie traffic signal system. The City of Kissimmee maintains both its own controllers and Osceoa County's controllers. There are no plans to upgrade the controllers to a different manufacturer in the near future. The signal system is controlled by the Econolite Centracs software.

4.2.9 City of Maitland

Maitland is a suburban city in Orange County, Florida, part of the Greater Metro Orlando area. The population was 15,751 at the 2010 United States Census. The Maitland Transportation Engineer is responsible for transportation related movements in the City with regard to automobiles, pedestrians, bicycles/bike paths, rail systems and bus routes. The objective is to coordinate these facilities into an integrated system that best serves the citizens of Maitland. In coordinating this broad spectrum of responsibility, the Transportation Engineer also has City specific responsibilities including liaison with Transportation Advisory Board; liaison with MetroPlan Orlando for transportation planning issues; Central Florida Commuter Rail Technical Advisory

Committee liaison; liaison with design consultants for Maitland Quality Neighborhood Programs; coordination with FDOT; coordination with Orange and Seminole counties on common transportation issues; coordination with adjacent cities of Altamonte Springs, Eatonville, and Winter Park on common transportation issues; administer the Neighborhood Sidewalk Program; administer the Right-of-Way Utilization permit process; review building and development permit applications; conduct traffic analyses; and coordinate with the citizens.

The City of Maitland, as mentioned previously, uses Eagle controllers. The signals are operated and maintained by the City.

4.2.10 City of Orlando

In 2010, Orlando had a city-proper population of 238,300, making it the 77th largest city in the United States, the fifth largest city in Florida, and the state's largest inland city. Orlando is also known as "The Theme Park Capital of the World" and, in 2014, its tourist attractions and events drew more than 62 million visitors. The Orlando International Airport (MCO) is the thirteenth busiest airport in the United States and the 29th busiest in the world.

City of Orlando Traffic Signal Maintenance (TSM) is responsible for the maintenance of 500 signalized Intersections, 21 School Zone Flashers, and 21 Warning Flasher Locations. The Operations Center services the traffic signals in the City 24 hours per day, 7 days per week. The city of Orlando uses Naztec controllers with ATMS.Now software.

4.2.11 City of Winter Park

Winter Park is a suburban city in Orange County, Florida. The population was 27,852 at the 2010 United States Census. The Engineering Division within the Public Works Department manages all work in the city's rights-of-way including road design, parking and site improvements for city structures, traffic analysis and control, signal analysis and design, coordination and implementation of streetlights, administration of the city's streetlight, brick street and sidewalk policies, survey and mapping, inspection of construction activities, permitting of right-of-way uses, and utility connections.

This Division also performs traffic studies, infrastructure improvement designs, drainage studies and surveying, using qualified in-house staff and equipment. Construction management for all city construction projects is provided by this Division, ensuring responsiveness to city residents' concerns and needs. The city utilizes Eagle controllers for their signalized intersections. The City maintains their signals.

4.2.12 LYNX

The Central Florida Regional Transportation Authority, known as LYNX, provides bus transit service for Orange, Seminole, and Osceola counties. This includes 63 local bus routes including the LYMMO downtown circulator, FastLink commuter service, Xpress service from Orlando to Volusia and Lake Counties, and ACCESS LYNX which serves disabled customers.

The LYNX Operations Center is at 2500 Lynx Lane in Orlando near John Young Parkway and Princeton Street.

4.3 Need for Integrated Corridor Management (ICM)

The Orlando region is ranked as the 31st largest city in the US, and ranks 28th in person-hours of delay as well as in the total cost of congestions. According to the 2014 *TTI Urban Mobility Scorecard*, Orlando has 52.723 million hours of travel delay per year, which averages to about 46 hours of delay per auto commuter per year. The mobility data for Orlando is provided in Table 7 below.

Table 7: Orlando Mobility Data

Inventory Measures	**2014**	**2013**	**2012**	**2011**
Urban Area Information				
Population (1000s)	1,615	1,600	1,555	1,515
Rank	31	31	32	32
Commuters (1000s)	797	804	782	775
Daily Vehicle-Miles of Travel (1000s)				
Freeway	12,928	12,825	12,285	13,353
Arterial Streets	17,251	16,732	16,240	16,909
Cost Components				
Value of Time ($/hour)	17.67	17.39	17.14	16.79
Commercial Cost ($/hour)	94.04	89.60	89.56	86.81
Gasoline ($/gallon)	3.27	3.47	3.50	3.24
Diesel ($/gallon)	3.60	3.90	3.87	3.65
System Performance	**2014**	**2013**	**2012**	**2011**
Congested Travel (% of peak VMT)	28	-	-	-
Congested System (% of lane-miles)	22	-	-	-
Congested Time (number of “rush hours)	2.80	-	-	-
Annual Excess Fuel Consumed				
Total Fuel (1000 gallons)	23,938	23,352	22,883	22,686
Rank	31	31	31	31
Fuel per Peak Auto Commuter (gallons)	21	20	20	20
Rank	32	40	36	30
Annual Delay				
Total Delay (1000s of person-hours)	52,723	51,433	50,400	49,967
Rank	28	28	28	28
Delay per Peak, Auto Commuter (pers-hrs)	46	44	45	45
Rank	27	30	25	25
Travel Time Index	1.21	1.21	1.21	1.21
Rank	34	33	32	32
Commuter Stress Index	1.25	1.25	1.25	1.25
Rank	38	38	38	37
Freeway Planning Time Index (95th Percentile)	2.34	-	-	-
Rank	37	-	-	-
Congestion Cost (constant 2014 $)				
Total Cost ($ millions)	1,207	1,196	1,189	1,237
Rank	28	28	28	28
Cost per Peak Auto Commuter ($)	1,044	1,035	1,029	1,070
Rank	34	35	35	32

The Orlando Regional Integrated Operations Network (ORION) consists of multiple independent networks:

- Freeway
- Toll Roads
- Arterials
- Bus
- Commuter Rail

Each of these corridor networks are experiencing congestion to some extent during peak hours. "Integrated Corridor Management" focuses on the operational, institutional, and technical coordination of multiple transportation networks and cross-network connections comprising a corridor. Moreover, ICM can encompass several activities which address the problems and needs identified in the previous section (e.g., integrated policy among stakeholders, communications among network operators and stakeholders, improving the efficiency of cross-network junctions and interfaces, real-time traffic and transit monitoring, real-time information distribution, congestion management, incident management, public awareness programs, and transportation pricing and payment).

This project has identified multiple areas and strategies that would assist in operating the region in a more efficient and safe manner and has a positive impact to the overall economy of the region. Performance measures for the project have been discussed at a high-level, and the stakeholders prefer to use person-trip travel time through the corridor as the primary measure, so that multiple modes are considered.

One of the areas that multiple agencies identified as needed is coordinated response plans and a decision support system to assist with the on-going operations of the region. This decision support system would be integrated with the various agencies, and provide multi-agency responses to scenarios that have been modeled, agreed to, or meet certain criteria.

Another area identified as needed is coordinated traffic signal plans during events, and the ability for FDOT to coordinate control of specific signals along arterials in the I-4 corridor, especially during the reconstruction of the I-4 interstate, and during major incidents and special events.

Another potential element of ICM involves enhanced mobility opportunities, including shifts to alternate routes and modes. Currently, any shifts that do occur are based on traveler knowledge and past experience. Using integrated real-time information, the various networks working in an integrated fashion could influence traveler network shifts; especially promoting, when appropriate, shifts to the LYNX bus or SunRail network with its unused capacity. The one problem with influencing a shift to transit is parking availability. However, parking notifications applications could be implemented in order to direct travelers to available parking.

Clearly, there is great potential to enhance current and near-term operations by implementing selected ICM and cross-network strategies. All of these enhancements would not be possible from an independent network operational perspective. The potential strategies identified above indicate that further investigation and design concerning integrated corridor management is warranted.

4.4 Existing Transportation Management/ ITS Assets

4.4.1 Transportation Assets and Management Tactics

The following are descriptions of assets and travel management tactics within each separate Transportation Mode within the Corridor.

4.4.1.1 *Arterial Street Network*

The City of Orlando, City of Kissimmee, City of Maitland, City of Winter Park and the Counties of Orange, Seminole and Osceola operate centrally-managed computerized signal control systems.

- All systems are capable of traffic responsive plan selection.
- All systems are capable of manual override in response to special events and circumstances (weather, major crashes, or spillages, etc.).

4.4.1.2 *Freeway and Toll Road Management Network*

The FDOT D5, Turnpike, and CFX monitor all freeways and toll roads within the region via CCTV, field units (enforcement and courtesy patrols), and other available sources within the region. The CFX and Turnpike operate multiple toll roads within the Corridor. Toll plazas are equipped with electronic toll sensors and over 80 percent of all transactions are from toll tags.

- FDOT D5, Turnpike and CFX respond to incidents with appropriate messages on DMSs, and FL 511.
- Road Rangers program is run by LYNX on behalf of the region.

4.4.1.3 *Transit Network*

SunRail operates a commuter rail route in the I-4 corridor, and LYNX operates 63 local bus routes in the region.

- GPS-based technology on all rail vehicles
- Bus fleet currently has in place AVL technology, and some APC equipment has been installed.

4.4.2 Corridor Management Tactics

The following are descriptions of travel management tactics within the Orlando Region as a whole – applying operational management across two or more transportation modes.

4.4.2.1 *Regional Center-to-Center (C2C) Functionality*

Center-to-center (C2C) communications spans the entire ITS domain, covering the exchange of data between computers physically located in different transportation management center facilities. Such facilities include: traffic management centers, transit management centers, public safety, incident management centers, parking management centers, and so forth. C2C standards enable this data exchange, specifying what information is exchanged, how and when it is exchanged, and the underlying transport mechanisms. C2C standards can be divided into two categories: (1) the message and data content, and (2) the rules for exchanging the messages and data. The two categories of standards work together to successfully exchange meaningful ITS-related information.

The primary mission of the statewide ITS network is to enable C2C communications and interoperability between the FDOT districts' transportation management systems software installed at the FDOT districts' RTMCs, and to share traffic management data and CCTV traffic-camera video between the FDOT districts and other users. It is important to note that the districts autonomously manage their own ITS networks within their respective boundaries. The C2C system provides Events, Speed, Travel Times, Floodgates, DMS, CCTV, Highway Advisory Radio (HAR), Environmental Sensors (RWIS), and Roadway Data from other sources.

4.4.2.2 *Cross-Jurisdictional Traffic Signal Retiming*

Each year, traffic signal timing plans are reviewed and new timing plans implemented on selected State Routes in Orange, Seminole and Osceola counties. FDOT oversees the contract for regional traffic signal timing so that the motoring public experiences a seamless travel experience along cross jurisdictional State Roads, and MetroPlan prioritizes them on an annual basis. A study is conducted on these corridors to collect data such as level of service, travel speeds, and travel times. After implementation of a new plan, a follow-up study is conducted to quantify travel time improvements through the corridor.

4.4.2.3 Florida 511

The FL 511 system provides up-to-date traffic information – crashes, congestion, construction and more – on all of Florida's interstates, most toll roads, and other major metropolitan roadways. FL 511 features include:

- Traffic information on all interstate highways, toll roads and many other metropolitan roadways.
- Commuter travel times and reports on crashes, congestion and construction.
- Public transit, airport and seaport information.
- AMBER, Silver and LEO Alerts (America's missing: Broadcast Emergency Response (AMBER) Alerts notify the public of the most serious child-abduction cases. Silver Alerts notify the public when law enforcement agencies are searching for missing adults or citizens with cognitive impairments, including Alzheimer's disease or other forms of dementia. Law Enforcement Officer (LEO) Alerts notify the public when law enforcement officers are searching for an offender(s) who has seriously injured or killed a law enforcement officer.)
- Travel information, traffic camera views and free personalized services, including customized travel routes and email, text and phone call alerts, available on FL511.com.
- Voice-activated and touch-tone navigation available when calling 511.
- The 511 phone calls and FL511.com website are available in English and Spanish.

4.4.2.4 FDOT District 5 Regional Traffic Management Center

The District 5 RTMC is currently co-located with the FHP Troop D Headquarters and the FDOT District 5 Orlando Urban Office at 133 South Semoran Boulevard, in Orlando. There are plans for the RTMC to move to a new location, with FHP dispatch moving as well. The RTMC is the regional hub for the Central Florida ITS and operates 24-hours/7-days a week. In operation since 1999, the RTMC provides operations for CCTV cameras, DMSs, and vehicle detector sensors on I-4, I-95, and other arterial state roads via an extensive fiber optic network. FDOT D5 has pioneered the connected vehicle deployment with 28 roadside equipment sites on I-4 and International Drive. SunGuide operations uses connected vehicle data to post traveler advisory messages to motorists and collect traffic speed data from vehicles.

4.4.2.4.1 Central Florida Expressway Authority

Through an agreement with FDOT D5, operators at the FDOT D5 RTMC control, monitor, operate, and manage traffic along all CFX system roadways. The Traffic Management Center of CFX controls, monitors, operates and manages traffic along all CFX system roadways 24 hours a day, seven days a week and is operated and maintained by FDOT D5, and is located at the FDOT RTMC location in Orlando. CFX also has their own TMC, but is not currently used for operations.TMC

4.4.2.5 FTE Traffic Management Centers

With two facilities and centralized operations, the Traffic Management Center of FTE controls, monitors, operates, and manages traffic along FTE and all system roadways 24 hours a day, seven days a week.

Located at the Turnpike Operations Center in Pompano Beach (mile post 65) and at the Turkey Lake Headquarters complex in Orlando (mile post 263), the Traffic Management Centers employs dedicated staff trained to monitor and respond to the changing traffic conditions along Florida's Turnpike. The staff works closely with the Florida Highway Patrol, the State Farm Safety Patrol, FDOT districts, the statewide 511 traveler information service, contracted tow service companies, traffic media, construction and maintenance personnel, the Public Information Office, and other agencies to provide the motorists with accurate and timely information.

The TMC operates ITS field devices to enhance safety, services and traffic flow, and monitors traffic through 536 CCTV Cameras (526 mounted on roadside concrete poles and 10 located on existing microwave towers along the roadway). In addition, the Traffic Management Center operates 113 DMSs, 16 HAR transmitters and six CB radio transmitters to help disseminate information to Florida's Turnpike customers.

4.4.2.6 City and County Transportation Management Centers

The City of Orlando, City of Winter Park and Counties of Orange, Seminole, and Osceola all have TMCs that operate the transportation network in their jurisdictional areas. The centers focus on arterial street management and emergency response. The City of Orlando is currently the only City or County in the region that operates on a 24/7 basis. The TMCs work with other city and county services such as maintenance, police, and emergency response.

The existing city and county traffic signal systems include:

1. City of Orlando – ATMS.Now software, Naztec Controllers
2. City of Winter Park, City of Maitland –Eagle controllers
3. Orange County – Siemens Tactics Central System Guide, Version 2.2.8, Eagle model M03, M04, M10, M40, M42 and M52 controllers
4. Seminole County – ATMS.Now Software, Naztec Controllers
5. Osceola County – Econolite Centracs software, ASC3 Controllers
6. City of Kissimmee - Econolite Centracs software, ASC3 Controllers

4.5 Institutional Agreements

There are institutional agreements related to freeway management software sharing, communication sharing, C2C software sharing, and media relations. Each of these agreements are highlighted below and detailed as to their purpose, term, and effectiveness.

Table 8: Institutional Agreements

Agreement	Description
Central Florida Regional Transportation Operations Consortium	The Central Florida Regional Transportation Operations Consortium is an agreement among the members of the Central Florida ITS Working Group. The MOU establishes the organizational structure to promote coordinated decision making and information sharing in planning, developing, and funding a Regional Transportation Operations Consortium of operating agencies within the Central Florida Region for the deployment, operations and maintenance of ITS initiatives.
FDOT and Orange County Fiber Sharing Agreement	This agreement covers fiber sharing between Orange County and FDOT.
FDOT and Seminole County Fiber Sharing Agreement	This agreement covers fiber sharing between Seminole County and FDOT.
FDOT/CFX Fiber Sharing Agreement	This agreement covers the shared use of fiber for FDOT D5 and CFX. This agreement is between the Central Florida Expressway Authority (CFX) and FDOT D5.
FDOT/CFX Regional Traffic Management Center Video Wall Controller Agreement	This agreement covers the purchase of upgraded video wall controller equipment for the FDOT D5 RTMC. This agreement is between FDOT D5 and CFX.
LYNX SunRail Letter of Understanding	Document LYNX's commitment to the Central Florida Commuter Rail Transit project and identifies feeder bus services that LYNX will provide for the first 7 years of the project.
LYNX – VOTRAN Letter of Understanding	Document Volusia County's commitment to the Central Florida Commuter Rail Transit project and identifies feeder buss services that Volusia County will provide in support of Phase 1 of the SunRail project.

5 System Operational Concept

This chapter describes the operational concept for the DSS and ATMS Software Project. The proposed concepts explain how things are expected to work once the ORION software is in operation, and identifies the responsibilities of the various stakeholders for making this happen. The chapter defines the project goals and objectives (Section 5.1); the operational approaches and strategies to be implemented in response to the regional problems and needs (Section 5.2); alignment of the project with the Regional ITS Architecture (Section 5.3.3).

5.1 Goals and Objectives

As part of the first stakeholder workshop, goals and objectives were discussed by modal grouping (arterial, freeway, transit); the following table provides a listing and ranking of the goals by agency, with 1 being the highest priority and 6 being the lowest priority.

Table 9: Goal Ranking by Agency

Typical Goals	FDOT D5	FTE	CFX	Orange	Seminole	Orlando	MetroPlan	LYNX	**AVE (rank)**
Increase corridor throughput	5	3	3	5	5	5	4	2	**4.0 (5)**
Improve travel time reliability	1	2	2	4	6	6	1	1	**2.9 (2)**
Improved incident management	4	4	4	3	4	3	5	5	**4.0 (4)**
Enable intermodal travel decisions	2	5	5	6	3	1	2	3	**3.4 (3)**
Improve Information Sharing	3	1	1	1	2	2	3	4	**2.1 (1)**
Improve Infrastructure Coverage	6	6	6	2	1	4	6	6	**4.6 (6)**

From these goals, several objectives were developed for each as shown in Table 10: Goals and Objectives below, with the priority based on the average of the priorities above and ranked based on the average.

Table 10: Goals and Objectives

Priority	Goals	Objectives
1	**Improve information sharing –** Agencies in the region provide data and information on the state and status of their devices, and event information to the other agencies in the region.	• Share results of incident detection through the data fusion project for the entire region
2	**Improve travel time reliability** - The transportation agencies within the corridor have done much to increase the mobility and reliability of their individual networks, and will continue to do so. The integrated corridor perspective builds on these network initiatives, managing delays on a corridor basis, utilizing any spare capacity within the corridor, and coordinating the junctions and interfaces between networks, thereby providing a multi-modal transportation system that adequately meets customer expectations for travel time predictability.	• Through the use of historical crash data, identify key corridors that experience higher than normal incidents and place a focus on these corridors for DSS/ATMS. • Use historical travel time data collected by Bluetooth devices to determine normal travel times in order to assess reliability over time. • Individuals transferring between modes or within a mode should be able to routinely make connections without delaying the connecting mode. • Travel time through the corridor should remain consistent with no more than a 10% deviation in time.

Priority	Goals	Objectives
3	**Enable intermodal travel decisions** - Travelers must be provided with a holistic view of the corridor and its operation through the delivery of timely, accurate and reliable multimodal information, which then allows travelers to make informed choices regarding departure time, mode and route of travel. In some instances, the information will recommend travelers to utilize a specific mode or network. Advertising and marketing to travelers over time will allow a greater understanding of the modes available to them.	• Use of mobile phone apps that predict travel times from origin to destination based on different mode choices. • Facilitate intermodal transfers and route and mode shifts • Increase transit ridership • Expand existing ATIS systems to include mode shifts as part of pre-planning • Expand coverage and availability of ATIS devices • Obtain accurate real-time status of the corridor network and cross-network connections Provide information that is easy to locate and easy to understand by casual users including those not familiar with the area. • Facilitate intermodal connections that are easy to access and that allow quick intermodal vehicle access into the corridor (not 5 or 10 minutes diversion out of the corridor or delay to reenter the flow of travel) • Provide dynamic decision support information that changes the recommended options based upon the information provided to the system.

Priority	Goals	Objectives
4	**Improved incident management** - Provide a corridor-wide and integrated approach to the management of incidents, events, and emergencies that occur within the corridor or that otherwise impact the operation of the corridor, including planning, detection and verification, response and information sharing, such that the corridor returns back to "normal."	• Use of travel time data by FDOT's RTMC to more quickly identify need for incident response. Coordinate with local agency TMCs on activation of special signal timing plans as needed. • Provide/expand means for communicating consistent and accurate information regarding incidents and events between corridor networks and public safety agencies. • Provide an integrated and coordinated response during major incidents and emergencies, including joint-use and sharing of response assets and resources among stakeholders, and development of common policies and processes. • Continue comprehensive and on-going training program – involving all corridor networks and public safety entities – for corridor event and incident management.
5	**Increase corridor throughput** – The agencies within the corridor have done much to increase the throughput of their individual networks both from a supply and operations point of view, and will continue to do so. The integrated corridor perspective builds on these network initiatives, managing delays on a corridor basis, utilizing any spare capacity within the corridor, and coordinating the junctions and interfaces between networks, in order to optimize the overall throughput of the corridor.	• Increase transit ridership, with minimal increase in transit operating costs. • Maximize the efficient use of any spare corridor capacity, such that delays on other saturated networks may be reduced. • Facilitate intermodal transfers and route and mode shifts • Improve pre-planning (e.g., developing response plans) for incidents, events, and emergencies that have corridor and regional implications.
6	**Improve infrastructure coverage** – Provide improved detection and surveillance of the region	• Provide redundant communication systems • Improve arterial data collection for travel times • Deploy arterial DMSs • Deploy CCTV on arterials used for diversion routes

5.2 User Needs

User needs identify the high-level system needs; these user needs are developed to focus on the operational aspects of the project, and defining the functional requirements of the proposed system. These needs are based upon the system goals and objectives provided above, and the future operational conditions and scenarios defined. The user needs will be utilized during the requirements development of the next phase of the systems engineering process to develop the high-level system requirements document.

5.2.1 User Needs Development

The following needs represent the identified needs of the ORION System, as defined by the stakeholders and are used as the basis for the system requirements of the ORION system and its requirements on external systems. While each stakeholder Agency does have some additional needs for operational improvements and efficiency, they are not included below since they do not relate directly to the project.

Table 11: User Needs

#	User Needs	User Need Description
1	Need for interactive communication among agencies	Corridor agencies need to work together in order to plan for incident remediation and efficiently execute actions to clear incidents in a timely manner, in order to improve the collective response to events.
2	Need to obtain current status of ITS devices in the corridor	Corridor agencies need to obtain current status of ITS devices and transportation network information (e.g. speed, travel time) within the corridor in order to make informed decisions on actions to be made to improve performance
3	Need to provide current status of ITS devices to the corridor agencies	Corridor agencies need to provide current status of their ITS devices to other agencies within the corridor in order for corridor agencies to make informed decisions on actions to be made to improve performance
4	Need to provide current performance of the transportation network to corridor agencies	Corridor agencies need to provide current conditions of their transportation network (e.g. speed, travel time) to other agencies within the corridor in order for corridor agencies to make informed decisions on actions to be made to improve performance of the corridor
5	Need to provide current performance of the transportation network to the public	Corridor agencies need to provide current conditions of the performance of the transportation network to the public in order to allow the public to make informed decisions
6	Need to provide travel time information to travelers	Corridor agencies need to provide travel time information to the public for planning trips and modifying trip plans enroute, in order to allow travelers to make informed decisions about their trips
7	Need to provide roadway event information to travelers	Corridor agencies need to provide event information to the public for planning trips and modifying trip plans enroute, in order to allow travelers to make informed decisions about their trips,
8	Need to provide transit event information to travelers	Corridor agencies need to provide transit information to the public for planning trips and modifying trip plans enroute, In order to allow travelers to make informed decisions about their trips,

#	User Needs	User Need Description
9	Need to store pre-agreed incident response plans	Corridor agencies need a means to collect and store pre-agreed response plans in order to allow corridor agencies to understand collective roles and responsibilities communicate effectively and improve response times in reacting to events within the corridor.
10	Need to coordinate incident responses among agencies to ensure that conflicting responses are not enacted	Corridor agencies need to coordinate responses and understand roles and responsibilities as well as jurisdictional boundaries, such that conflicting responses are not enacted and the correct information is being provided to the public.
11	Need to coordinate incident responses among agencies to ensure prompt response to events	Corridor agencies need to coordinate responses such that agencies understand roles and responsibilities and jurisdictional boundaries in order to ensure prompt response to events and accurate information is provided to the public.
12	Need to provide alternate route options to travelers	In order to reduce congestion and improve efficiency of the entire corridor, alternate route options need to be provided to the traveling public to allow them to make informed decisions about their trips.
13	Need to provide detour route options to travelers	In order to reduce congestion and improve efficiency of the entire corridor, detour routes need to be provided to the public to allow them to make informed decisions about their trips due to roadway closures.
14	Need to provide information on alternate modes of transportation to travelers	In order to reduce congestion and improve efficiency of the entire corridor, alternate modes of travel options need to be provided to the public to allow them to make informed decisions when planning trips or enroute.
15	Need to track and store history of enacted response plans	Corridor agencies need to be able to track and store history of actions associated with a pre-approved response plans after they have been enacted, in order to determine if any changes are required to improve the response plans.
16	Need to assess the impact of an enacted response plan on the transportation network	During the response to an event in the corridor, the corridor agencies need to be able to determine if the pre-planned response is effective and if the response is having the intended effect. This includes verifying what conditions exist after implementation of the response. If the operators of the systems determine that their response is not effective, they should be able to change components of their response plans or implement a new response plan.
17	Need to maintain and modify enacted response plans	As an event progresses and conditions change, agency operators should be able to modify the current response, and communicate changes with other agencies within the corridor in order to effectively adjust to changing conditions and improve conditions in the corridor.

#	User Needs	User Need Description
18	Need to maintain and modify stored pre-approved response plans	Corridor agencies need to be able to make recommendations and modify pre-approved response plans, and communicate ideas with other agencies within the corridor, in order to improve response to conditions that will impact the corridor.
19	Need to coordinate traffic signal systems	Corridor agencies need to be able to view traffic signal system status, and when approved conditions have occurred request signal timing plans to be implemented.

5.3 Concept Operational Description

The Decision Support System (DSS) is the heart and soul of Integrated Corridor Management (ICM). It is the rule set by which the data from local agencies, FDOT D5, LYNX, FTE, SunRail, and CFX are converted into actions. The system would push out recommended plans to react to existing and/or predicted conditions.
The ATMS software, is a system that would sit on top of the local agencies various ATMS software creating a unified interface to collect information and provide it to the DSS. Additionally, the software could allow for centralized control of the traffic signal systems.

The daily operation of the corridor will be coordinated through the existing arrangements and information will be exchanged through the data fusion project, along with a DSS which will provide 2 levels of coordination, the first at a local level for traffic signals and ramp meters, and the second level to distribute response plan requests and utilize the ATMS software or the center-to-center interface to communicate to the various agency systems. The central point of coordination for the corridor will be the FDOT D5 RTMC, who will host the system.

All coordinated operations among corridor agencies (e.g., activation of specific response strategies) will be coordinated via the ORION software system.

Communications, systems, and system networks will be integrated to support the virtual corridor command center. Voice, data, video, information, and control will be provided to all agencies based on the adopted protocols and standards for the sharing of information and the distribution of responsibilities. The ORION software system will support the virtual nature of the corridor by connecting the member agency staff on a real-time basis via communications and other ITS technologies. .

The stakeholder agencies will prepare, train and refine pre-agreed response plans for recurring and non-recurring events within the region, this includes response plans for major and minor traffic and transit incidents, special events, and congestion. All the agency/service operations officers and staff will know their respective roles and responsibilities for any of the various situations the corridor may face and will be aided by the DSS and the evaluation model results.

Traveler information via FL 511, mobile applications, agency websites, DMS, and through the media and ISPs will be corridor-based, providing information on corridor trip alternatives complete with current and predicted conditions. Travelers will have access to or be given real-time corridor information so they can plan or alter their trips in response to current or predicted corridor conditions. Each traveler will be able to make route and modal shifts between networks easily due to integrated and real-time corridor information. Using one network or another will be dependent on the preferences of the traveler, and not the nuances of each network. Travelers will be able to educate themselves about the corridor so they can identify their optimal travel alternatives and obtain the necessary tools to facilitate their use of corridor alternatives when conditions warrant.

The Orlando region will be an integrated transportation system – managed and operated collectively – to maximize its efficiency to corridor travelers. All corridor assets will be attuned to obtain the goals and objectives of the corridor as discussed in section 5.1, as well as the goals of each individual traveler as their preferences prescribe. The region's travelers will recognize the transportation network as a multimodal, integrated, efficient, and safe transportation system that provides them with multiple viable alternatives that they can select based on their specific travel circumstances and needs.

5.3.1 Conceptual System

The concept for the ORION Software is a system of systems which receives data from the data fusion system, and from SunGuide, and utilizes this information in the DSS subsystem. Figure 10 shows the overall FDOT D5 system of systems.

The DSS receives real-time data and models conditions within the region to select coordinated response plans for events (incidents, congestion) which require a multi-agency response. The data includes freeway, arterial, transit, weather, parking and other data available in the region which could have an impact on the corridor. When local traffic signal corridors are operating outside of expected conditions, the DSS will provide recommended changes to the timing plans within the active arterial management corridors. For the ramp metering systems along I-4, the DSS will utilize the conditions on the approaching arterials and on I-4 to calculate the ramp metering rates for the ramp meters. The DSS will also provide multi-agency pre-agreed response plans for major events within the region, which may overrule the traffic signal and ramp meter recommendations.

The Information Exchange network allows stakeholder agencies to view events within the region, and to provide information on events in the region. It also provides the notification and interface for coordination of response plans that the DSS generates.

Lastly, the ATMS software will provide interfaces to the stakeholder traffic signal systems. The ATMS software should have the flexibility to provide multiple modes of operation, depending on the individual agency's level of comfort. The ATMS software would preferably be able to interface to the existing agencies Traffic Signal Software or its controllers. The existing systems include:

1. City of Orlando – ATMS.Now software, Naztec Controllers
2. City of Winter Park, City of Maitland – Eagle controllers
3. Orange County – Siemens Tactics Central System Guide, Version 2.2.8, Siemens/Eagle model M03, M04, M10, M40, M42 and M52 controllers
4. Seminole County – ATMS.Now Software, Naztec Controllers
5. Osceola County – Econolite Centracs software, ASC3 Controllers
6. City of Kissimmee - Econolite Centracs software, ASC3 Controllers

Data collected from stakeholder systems will be integrated into the Data Fusion system for use by the ORION software system. ORION will have a data interface into the Data Fusion system, which will subscribe to data from the Data Fusion system and provide an interface to the Data Fusion system to provide Traffic Signal data and response plan data from ORION.

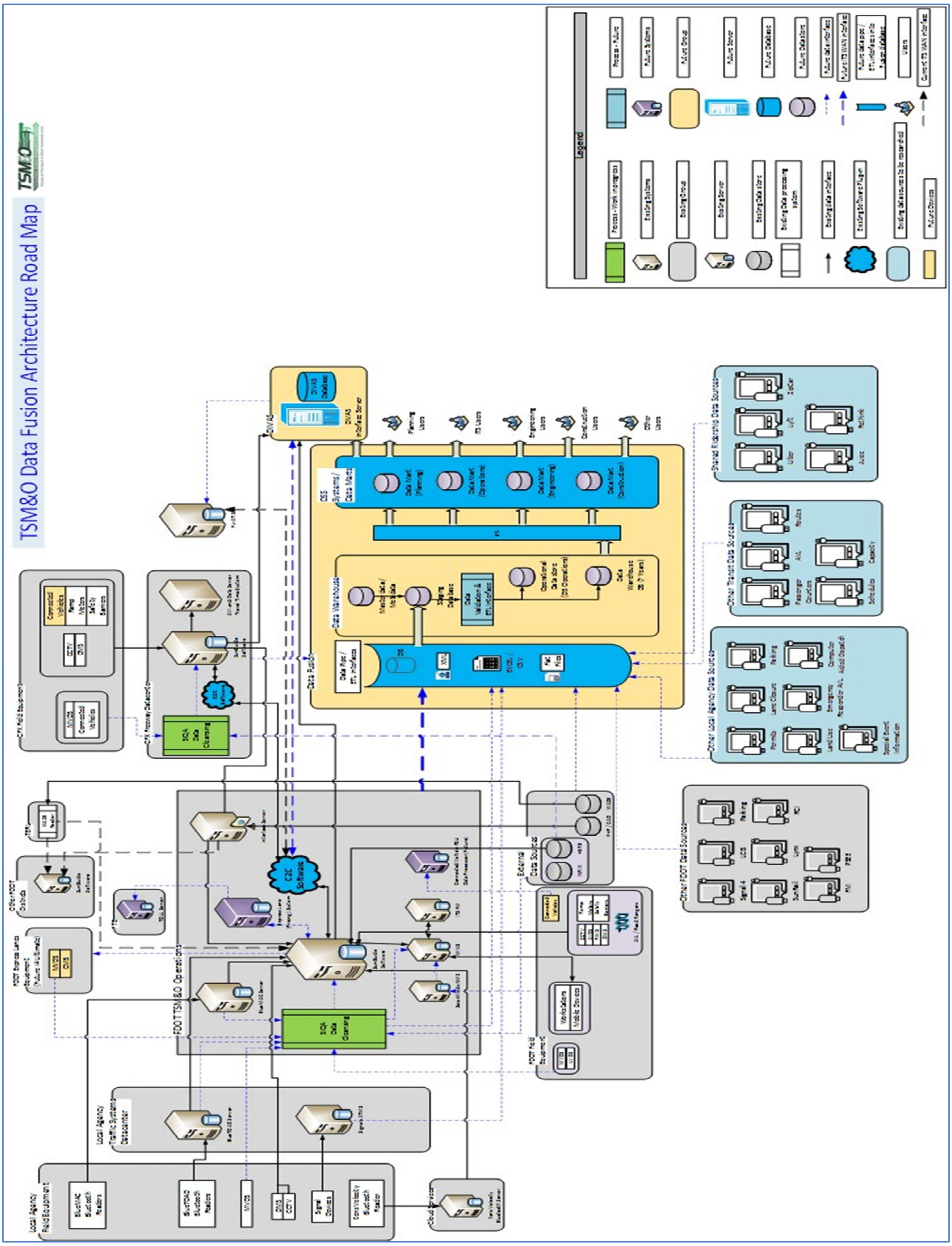

Figure 10: Data Fusion Architecture

5.3.2 Staffing Requirements

The staffing required by the ORION Software operational concept is dependent on many factors which will be defined as the system is designed and deployed.

First, additional staffing will be required for the operations and maintenance of the ORION systems (software, hardware, and networking). This is a new system, and is not replacing any existing functionality.

For operations of the corridor – FDOT D5 will provide a lead operator for the ORION system. The lead operator will be responsible for monitoring the health of the system, provide coordination with stakeholders, and contact agencies to ensure response plans are implemented.

Additional staffing at the agencies is dependent on the amount of automation that each agency decides is appropriate for them. The ORION system has the potential to require additional personnel at each agency, or as the system becomes more automated, it will potentially reduce the need for operators.

5.3.3 Alignment with Regional ITS Architecture

As part of the project, the project team conducted a high-level overview of the Orlando Regional ITS Architecture (RITSA). The Orlando RITSA provides a means for effective management of ITS assets within the Orlando region. Major points of the assessment are as follows:

- The focus of the Regional ITS Architecture is on the real-time integration of systems for effective transportation management. The ORION system concept includes real-time integration, but takes the effort a step further by emphasizing the need for stakeholder integration. Stakeholder integration includes real-time system integration for data collection and information to facilitate decision making in response to fluctuating transportation conditions.

- The ORION system concept encompasses system integration and influence in a sub-regional area. This area may consist of parts or whole, separate ITS architectures. A potential area of integration previously discussed includes the utilization of C2C concepts and systems. Systems may include status type data and in some cases the ability to control devices from other centers to facilitate corridor mobility.

- Expanding on the previous point, interagency coordination and agreements differ in the ORION system concept from their relationships in the Regional ITS Architecture. The ORION system concept provides full integration to include decision making and system control versus the Regional ITS Architecture concept of interagency agreement but with agency operational autonomy. The ORION system will blend these two concepts. Corridor management is integrated, while the individual agencies will maintain autonomous system control.

6 Operational Scenario

6.1 Future Operational Conditions

This section provides operational condition assumptions set forth by the stakeholders for use during scenario tabletop exercises carried out as part of developing this operational concept document. As such, these assumptions define a baseline operating environment that were needed for stakeholders to clearly identify operational roles and responsibilities, as well as needed data exchange and infrastructure improvements necessary for the DSS and ATMS Software Project. The baseline operational assumptions were developed using the needs and strategies identified in earlier stakeholder sessions, and in the development of this Operational Concept.

6.2 Scenarios

When deciding upon locations of events that drive operational scenarios for the I-4 DSS and ATMS Con Ops, it was decided that varying locations would require varying response scenarios depending on both location and time-of-day.

The Daily Operations scenario was developed based on typical operations with some minor incidents and congestion. The remaining scenarios were developed based on deviation from the baseline of "Daily Operations" – since many of the agencies deal with minor incidents on a routine basis, they decided that they are a part of daily operations.

The underlying assumptions for all scenarios are that: (1) the required network improvements have been completed; (2) response plans have been developed and approved by network operators; (3) institutional agreements have been established so that the ICMS coordinator and supporting staff are properly authorized to respond according to the agreed response plans and improvise as situations may dictate; and (4) sufficient training and exercises have been conducted.

We have identified the following representative scenarios for the ORION System:
1. Daily operations;
2. Freeway incident;
3. Commuter rail incident;
4. Arterial incident;
5. Non-recurring congestion; and
6. Special event.

6.2.1 Decision Support System

The operations and coordination of the corridor will utilize a DSS as part of the daily operation of the corridor, and will be coordinated through the existing arrangements between the agencies with information exchanged through the C2C project. The DSS will distribute response plan requests and utilize an ATMS Software platform and the C2C interface to communicate to the various agency systems.

The DSS will utilize existing C2C standards based communication infrastructure, using the Traffic Management Data Dictionary (TMDD) and Message Set for External TMC (MS/ETMCC) standards. It will also be able to have direct connections to agencies not on the C2C network. The existing systems of each member agency would share ITS data with the corridor, and the DSS would recommend responses to all affected agencies.

The DSS would be initially populated by response plans developed by the stakeholder agencies.

6.2.1.1 High-level Functionality and Capability

The DSS will distribute response plan requests and utilize a browser-based interface to communicate to the various agency systems. For instance, if FDOT D5 has an incident on the I-4 freeway, when the operator at the FDOT D5 RTMC facility inputs data in their ATMS incident management system (SunGuide), the information from this subsystem will send basic information on the incident (such as location, number of lanes, severity) to the DSS via the C2C subsystem. The DSS will then query its database based on this criteria, and model potential pre-approved response plans.

The DSS will then select and send response plan recommendations to all affected agencies. The agencies in the region will accept, decline, or modify the recommended pre-agreed response planes, based on current conditions within their network. An agency may decline a response plan for various reasons, such as equipment malfunctions, existing local incidents that may be adversely impacted by the proposed response plan, and due to current workload of its operators. As the conditions of the incident change and the agency systems are updated, the DSS will also be notified and send out updated pre-approved responses.

In addition, the DSS will send out updated responses based on other criteria. One potential response during the peak could be to increase the number of Bus or SunRail vehicles in operation. If a certain time of day was reached before any updates were provided, the DSS may send LYNX and SunRail an update that notifies them that additional transit vehicles are not required.

The DSS will have the functionality to interface to the DMSs of the agencies, and change messages if the agency has agreed to allow command and control.

6.2.1.1.1 Modes of Operation

An additional feature requested by the stakeholders is the ability to change their participation permissions for the system, similarly to the San Diego ICM. These modes of participation include the following five situations, where “XX” is definable in the system and can be changed by each agency to meet their operational needs:

1. Request for action (text, e-mail, system notification to operators to make a change), command and control is done by agency systems without any integration.
2. Timeout on action after XX minutes (notification to operators which is cancelled after XX minutes if no response is received), command and control of devices approved by agencies.
3. Implement on action after XX minutes (notification to operators which is enacted once confirmation is received, or XX minutes elapses) command and control of devices approved by agencies.
4. Implement on request during XX hours of operation (for agencies with less than 24/7 operation), command and control of devices approved by agencies.
5. Implement on request, command and control of devices approved by agencies.

6.2.1 ATMS Traffic Signal Platform

The ATMS software will provide a single interface for all vendor traffic signals within the region. The ATMS software would provide the DSS a way to coordinate traffic signal operations among the agencies during events, and provide FDOT a platform for signal control during the stakeholder’s off hours.

The ATMS software will have the flexibility to provide multiple modes of operation described above, depending on the individual agency's level of comfort. The ATMS software will interface to the existing agencies Traffic Signal Software.

6.2.2 Scenario 1: Daily Operations

Daily operations are primarily concerned with recurrent congestion caused by traffic demand exceeding the roadway capacity and temporal variations of traffic volumes. It is assumed that there are no accidents (roadway, transit, or arterial), road or track maintenance, weather events, or other random events that impact the networks and require an active response. The daily operations scenario forms the baseline for daily freeway, arterial, and transit operations in the I-4 corridor.

Each stakeholder monitors and operates their respective systems in accordance with their network-specific operational procedures and implements collaboration agreements (signal timing plans, DMS messages, etc.) that address routine traffic variations. No "lead" agency is required for this scenario.

FDOT D5 collects real-time freeway data from the surveillance system (loop detectors, radar, and other sensors) on varying intervals based on the data source and uses data for monitoring, ramp metering, incident detection, reporting, and travel time calculations.

Traffic on arterials is managed by the cities and counties, and by the AAM contractor, whose monitoring and control networks are interconnected by the FDOT fiber optic network, and the FDOT SunGuide system monitors the state and status of each signal system, with data being provided to the FDOT D5 Data Fusion system.

As shown in the figure below, the scope of this project is the DSS and ATMS System; however linkages between other systems and modifications to other systems are needed to make the entire system of systems work as desired.

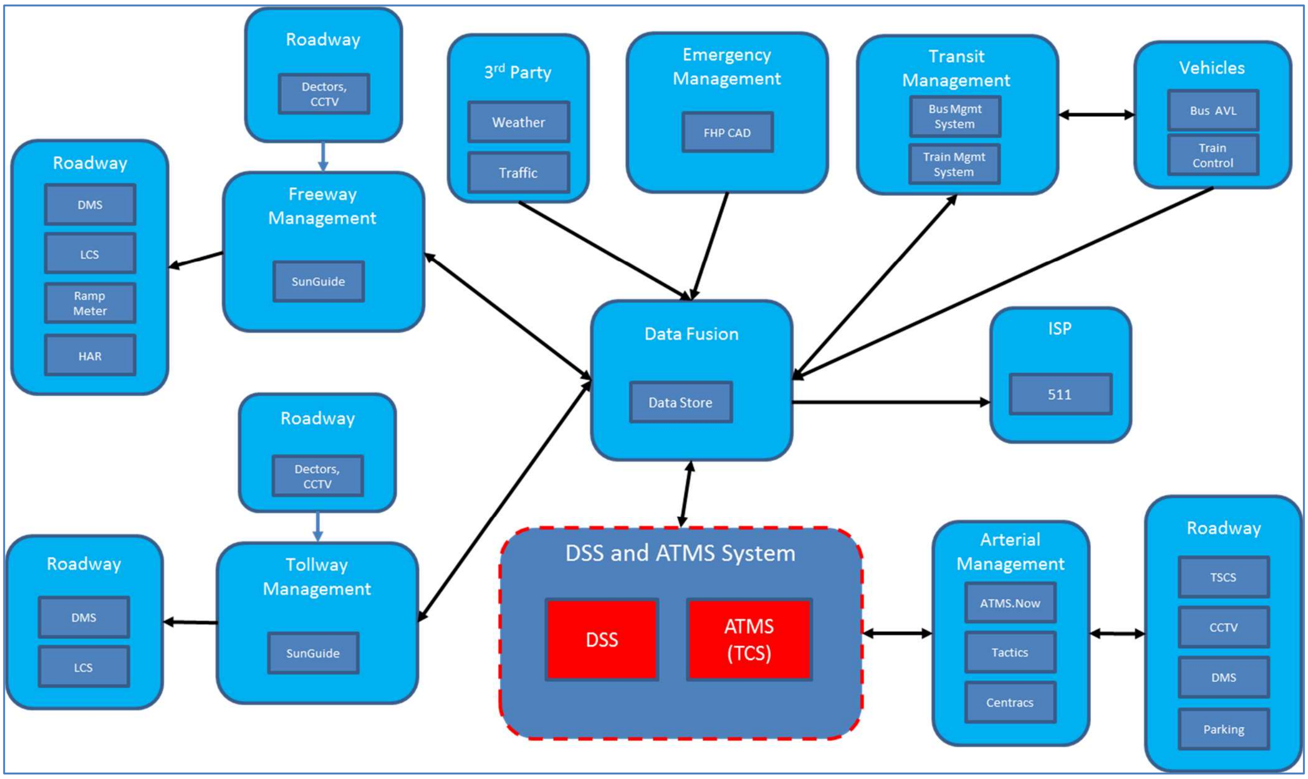

Figure 11: I-4 Corridor Baseline Operations

6.2.2.1 ICMS Strategies and Agency Roles/Responsibilities

The DSS and ATMS system focus during daily operations is on automated information sharing/distribution and the operational efficiency at network junctions and interfaces. These strategies are "baseline" strategies that will also be applicable in other scenarios.

In addition, accommodating or promoting modal and network shifts may become necessary under heavy congestion. The long-term strategies to manage the demand-capacity relationship are an ongoing activity.

Baseline ICMS strategies, as well as roles and responsibilities of each agency, are shown in the following Table.

Table 12: Baseline Operations Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Automated information sharing • Advanced traveler information (511) • En-route traveler information (3rd party, 511 and field devices) • Access to corridor	FDOT	511
		SunGuide ATMS
	FDOT D5 RTMC	Coordinate corridor operations
		Monitor corridor performance
		SunGuide ATMS
		Monitor freeway traffic flow
		Operate and maintain arterial and freeway field devices
		Conduct corridor technical management and development

ICM Strategies	Agency/Entity	Roles and Responsibilities
information by information service providers (ISPs) • Value pricing for managed lanes • Smart parking • Coordinated operation of arterial traffic signals • Signal priority for transit • Accommodate cross-network shifts for unusually heavy congestion	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Operate arterial field devices
		Maintain arterial field devices, and software
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Maintain arterial field devices, and software
		Operate arterial field devices
	LYNX	Operate bus service
		Bus operation management system
		Operate Road Ranger program
	SunRail	Operate commuter rail
		Commuter rail management system
	FHP	Receive incident notification calls and respond to incidents
		Notify other agency responders
	FTE	Monitor tollway traffic flow
		Operate tollway field devices
		Conduct toll operations
	CFX	Monitor tollway traffic flow
		Operate tollway field devices
		Conduct toll operations
	Local First Responders and Law Enforcement	Respond to incidents; Fire suppression; Medical assistance; Scene clearance

The remaining scenarios were developed based on deviation from the baseline of "Daily Operations" – since many of the agencies deal with minor incidents as a routine, it was decided that they are a part of daily operations.

6.2.3 Scenario 2: Freeway Incident (Minor and Major)

When deciding upon locations for scenarios multiple locations would require multiple response scenarios depending on location and time of day. In order to capture the various response strategies for a major incident, the corridor was divided into multiple sections and directions. Then based on time of day, the impact and necessary strategies could be determined.

6.2.3.1 Incident Description:

A commercial vehicle jackknifed on westbound I-4 just south of the Maitland Boulevard interchange at 6 a.m., spilling its load of boxes onto the freeway and closing the freeway in the westbound direction. The jurisdiction of the incident is the City of Maitland.

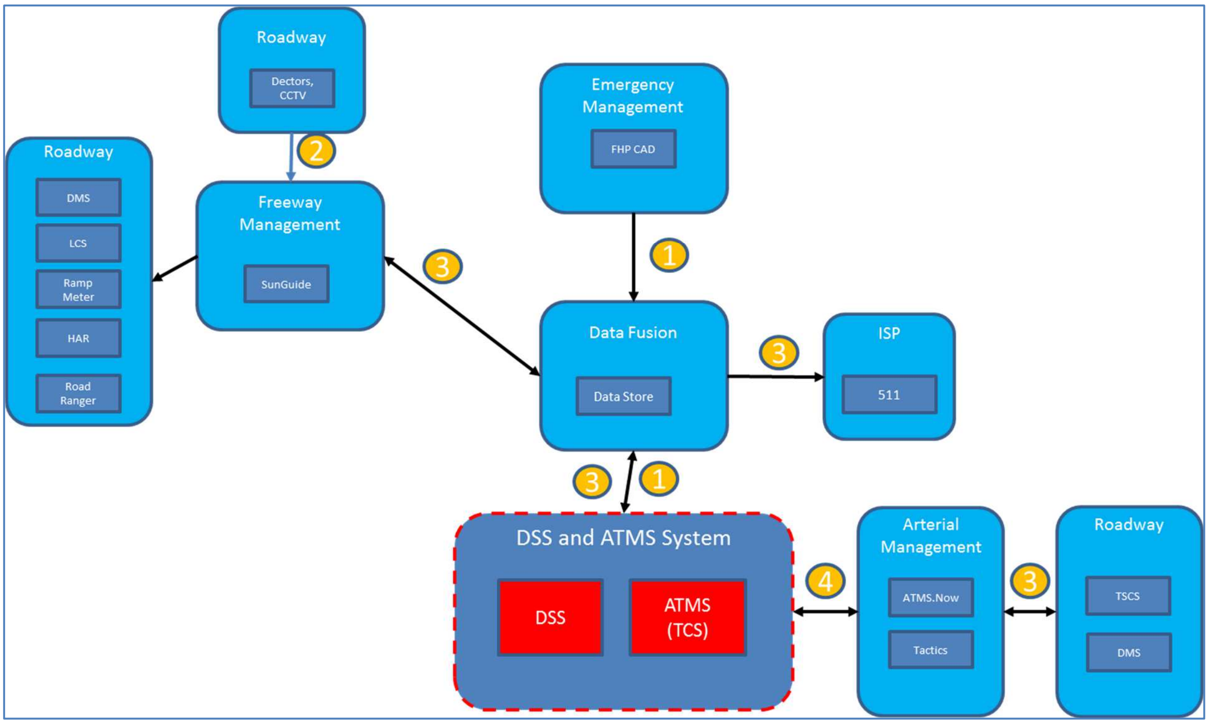

Figure 12: Major Freeway Incident Scenario

6.2.3.1.1 Assumptions:

The assumptions used for this scenario are:

- No fatalities
- Hazardous materials spill due to at least 50 gallons of diesel fuel spilled
- Long-term closure requiring mode shift and arterial diversions
- Multiple coordinated responses needed to optimize the corridor

6.2.3.2 Incident Description and Timeline:

1. I-4 Westbound traffic is flowing normally for the time of day, as commuters begin traveling into downtown and other areas for work. Incident occurs; drivers immediately contact 911 to report the incident. Since the various 911 Computer Aided Dispatch (CAD) systems are integrated into the regional data fusion system, the corridor agencies are immediately notified of the potential incident (through the Information Exchange Network (IEN) alerting subsystems) and approximate location.

2. City of Maitland police arrive on scene and begin initial determination of severity and approximate time for resolution. FDOT Road Ranger arrives on scene to assist with traffic control. FDOT D5 uses video cameras to verify type of incident and number of lanes closed, and inputs incident information into SunGuide. FDOT D5 displays preliminary information on their DMS's north of the incident location. FHP arrives on scene are assumes incident command. Maitland Fire Department arrives on scene and assumes incident command. DEP dispatched for hazmat clean up.

3. FDOT D5 RTMC operator updates SunGuide to indicate major incident with a closure of more than 90 minutes. The corridor agencies are alerted through ICM alerting subsystem, and a previously approved response plan is recommended by the DSS. Each agency's traffic signal system is modified either manually or automatically by the DSS, as determined by the Agency's profile. DMSs are updated on I-4 at major diversion locations by FDOT D5; the DSS modifies DMS on I-4 automatically based on the pre-agreed response plan. 511 systems is updated with the latest incident information.

4. As part of the pre-planned response contained in the DSS, commuters are advised to utilize SunRail as an alternative, via VMS and traveler information sources. Higher ridership could occur, so SunRail and LYNX would be notified. Congestion builds in both directions from drivers slowing to view the incident. Drivers begin to use arterials to get around incident location, and the City of Winter Park, City of Maitland and Orange County implement timing plans for the freeway diversions.

5. FHP completes investigation and contacts wrecker rotation.

6. HazMat response has begun to clean up the fuel spill.

7. The commercial vehicle has been removed by a heavy wrecker, and clearance of the incident debris in the roadway has begun.

8. Clearance of incident is completed, and some capacity is restored to the freeway, interchange ramps have all re-opened. The SunGuide system is updated

To relieve traffic congestion caused by the incident, the DSS and ATMS system focuses on information dissemination, accommodating network shifts, and conduct short-term, capacity-demand management. For major incidents that require elevated coordination between corridor networks, the FDOT D5 lead operator takes the lead for coordination between agencies.

Applicable strategies, as well as roles and responsibilities of each agency, are shown in Table 13: Major Freeway Incident Scenario

Table 13: Major Freeway Incident Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Information sharing and distribution (as in baseline scenario) • Operational efficiency at network junctions (as in baseline scenario) • Common incident reporting system and asset management system • Promote route/ network/ mode shifts via traveler information, (e.g., providing travel times on different networks) • Opening freeway shoulders to traffic at certain locations • Restrict/ reroute/ delay commercial traffic • Modify arterial signal timing to accommodate	FDOT	Update 511 information
	FDOT D5 RTMC	Respond to and assist with incident clearance
		Monitor freeway conditions
		Operate field elements
		Coordinate information dissemination
		Suggest capacity-demand management measures
		Monitor corridor conditions
	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Adjust arterial signal timing
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Adjust arterial signal timing
	LYNX	Monitor transit service
		Reroute if necessary
		Provide Road Ranger to assist with incident clearance
	SunRail	Monitor commuter rail
		Commuter rail management system
	FHP	Receive incident notification calls, enter into CAD, and respond to incident
		Notify other agency responders
	FTE	Monitor tollway traffic flow

ICM Strategies	Agency/Entity	Roles and Responsibilities
traffic shifting from freeway		Operate field elements to assist with rerouting and informing travelers
	CFX	Monitor tollway traffic flow
		Operate field elements to assist with rerouting and informing travelers
	Local First Responders and Law Enforcement	Respond to accident for victim extraction, fire suppression, medical assistance

6.2.4 Scenario 3: Commuter Rail Incident

The SunRail system is a fixed route commuter rail with at-grade crossings, if there are incidents at the crossings, or a failure of a train there are potential responses that need to be coordinated.

6.2.4.1 Incident Description:

After leaving the Orlando Avenue crossings, just south of North Orange Avenue, a vehicle stops partially blocking an at-grade crossing. Shortly after 6:40 pm, after leaving the Winter Park station, a southbound SunRail Train, unable to stop, clips the back of vehicle. No injuries were reported. The train, which was carrying 42 passengers, started moving shortly before 8 p.m. The Winter Park Police Department is investigating the crash. Because of the crash, the 8 p.m. southbound SunRail train from DeBary and the 9:15 p.m. northbound train from Sand Lake Road were canceled. The 7:30pm northbound train, the same train involved in the crash, is also cancelled as a result of the crash. Removing all service for the remainder of the day.

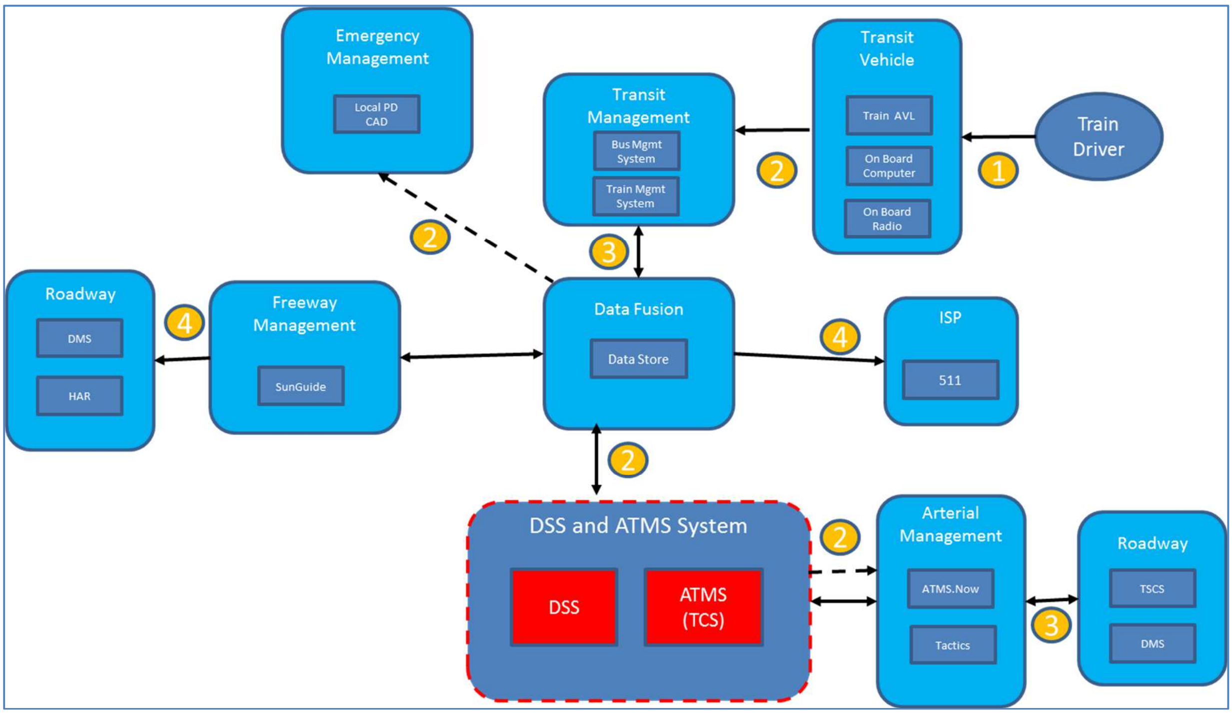

Figure 13: Commuter Rail Scenario

6.2.4.1.1 Assumptions:

The assumptions used for this scenario are:

- No fatalities
- Trains shutdown in both directions
- Bus bridge is needed to keep SunRail operational

6.2.4.1.2 Timeline:

1. A southbound SunRail train is involved in a crash with a vehicle, due to a vehicle stopped partially on the track at the at-grade crossing. The SunRail Train driver notifies the SunRail operations center of the incident

2. Local police are dispatched for the incident. The data fusion system received notification of the incident from the SunRail Rail Management System with the local, description and estimated duration, and the stakeholders in the vicinity are notified via the IEN subsystem.

3. Since both directions of the SunRail line are shut down for an extended period of time, LYNX is notified to provide a Bus bridge between the stations north and south of the crossing. The Winter Park and Orange County traffic signal systems receive notification through SunGuide to change to a specific signal timing plan to facilitate the bus bridges.

4. FDOT and local agencies provide information about the SunRail delays to local media, and the 511 system is updated with the information.

6.2.4.2 Changes to Baseline Strategies:

Commuter rail incident information is relayed via the data fusion system to local operators. Certain DSS and ATMS strategies facilitate emergency responses, such as bus signal preemption. Since the closure of the at-grade crossing affects both the operation of the train, and the traffic flow on the arterial, strategies for the arterial incident may also apply. Local PD takes the lead in identifying the arterials affected, the FDOT lead operator provides coordination of the regional response.

Table 14: Commuter Rail Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Information sharing and distribution (as in baseline scenario) • Common incident reporting system and asset management system • Emergency vehicle signal preemption • Transit Vehicles connection protection • Emergency road closure	FDOT	Update 511 information
	FDOT D5	Monitor freeway conditions
		Operate field elements
		Coordinate information dissemination
		Suggest capacity-demand management measures
		Monitor corridor conditions
	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
	LYNX	Provide bus bridge
		Relay information
		Accommodate passengers affected by incident
	SunRail	Monitor commuter rail
		Commuter rail management system

ICM Strategies	Agency/Entity	Roles and Responsibilities
	FHP, City PD	Receive incident notification calls, enter into CAD, and respond to incident
		Notify other agency responders
	Local First Responders and Law Enforcement	Respond to accident for victim extraction, fire suppression, medical assistance

6.2.4.2.1 Additional Data and Infrastructure Needs:

Table 8, identifies the data needs by agency and if the asset is currently deployed or available.

6.2.5 Scenario 4: Arterial Incident

The arterial incident scenario is illustrated in Figure 14: Arterial Incident. This figure covers both minor and major incidents, with dotted lines indicating additional communications and data exchanges required for major incidents. A major incident is defined as an event with one or more of the following characteristics:

- One or more fatalities or major injuries (e.g., requiring victim extraction and/or Life Flight missions);
- Arterial closure;
- HAZMAT incident; and
- Law enforcement action.

All other arterial incidents are categorized as minor.

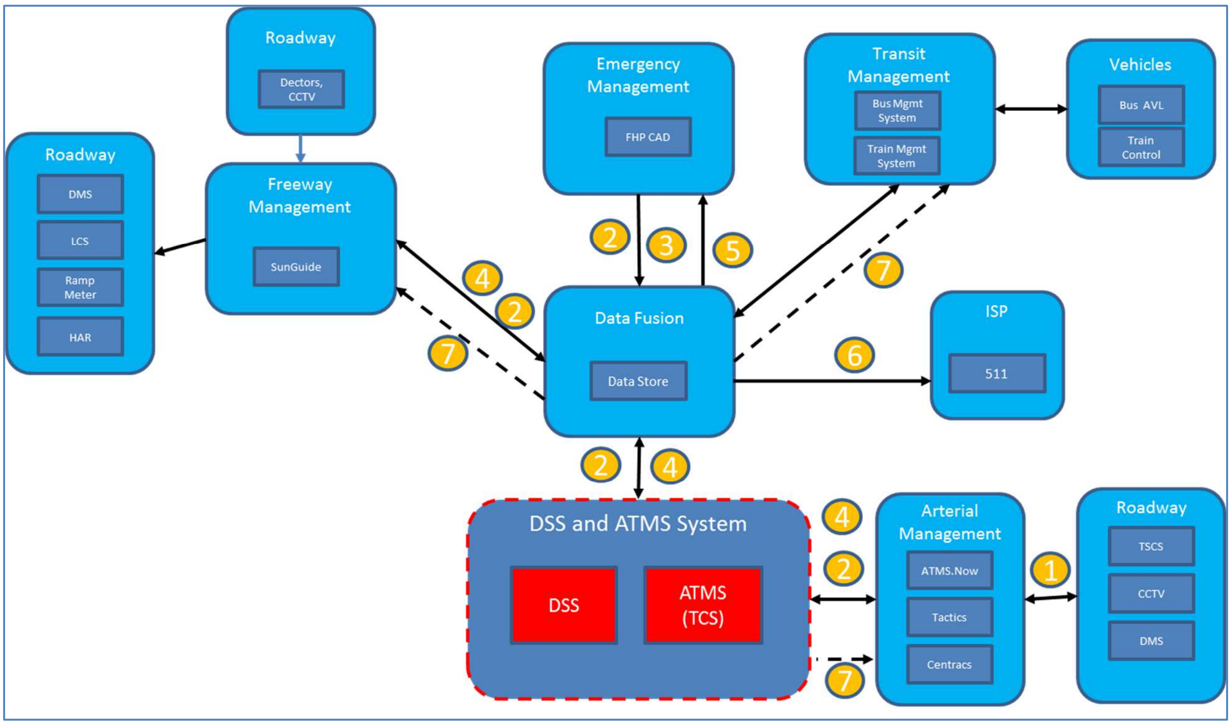

Figure 14: Arterial Incident Scenario

6.2.5.1 Assumptions:

The assumptions used for this scenario are:

- No fatalities
- Multiple coordinated responses needed to optimize the corridor

6.2.5.2 Incident Timeline:

The incident timeline is the following:

1. From cellular or landline 911 reports, the local police department (PD) is alerted to a possible incident on an arterial within their jurisdiction. The PD dispatch creates a new incident and transfers the incident to a dispatcher for PD response. In the event of injuries or possible injuries, paramedic units (typical response is one paramedic truck and a transport ambulance) are notified via telephone.
    a. An alternate incident reporting source may be an arterial closed-circuit television (CCTV).
    b. Another alternate incident reporting source may be LYNX transit dispatchers receiving reports from bus drivers on routes. These reports become transit "incidents" in the DSS and ATMS system and are passed to the Data Fusion system for further dissemination via 511 and regional Web servers.
2. The data fusion system acquires the incident data from the CAD system. The local jurisdiction TMC operator receives an automatic incident notification from the IEN. The IEN disseminates law enforcement CAD data (traffic-related only) to all subscribed stakeholders as an "external" event for information only (until notified otherwise).
3. The PD dispatcher confirms the existence of the incident, exact incident location, and associated supplementary information as received from investigating officers. The data fusion system receives periodic CAD updates as they occur. Tow and recovery resources are called based on police officer radio reports.
4. FDOT D5 and the local jurisdiction exchange congestion and field device status information throughout incident (via the IEN), including any nearby freeway incidents that might exacerbate the arterial incident.
5. IEN provides local stakeholders with current congestion information from surrounding freeways and any freeway device activation and associated messages.
6. Filtered information concerning the arterial incident and the response actions is disseminated to 511.
7. The following additional actions are taken for major arterial incidents – the specific need for and order of action depends on the specific incident situation.
    a. The PD may activate emergency road closures to isolate the incident. This may include freeway on-ramps and off-ramps. This, in turn, requires coordination with the FHP and FDOT D5.
    b. For extended arterial blockages or closures (major incident) pre-computed Signal Timing Plans may be activated on diversion routes by individual affected cities along the corridor.

6.2.5.3 Changes to Baseline Strategies:

Emergency management for arterial incidents is handled through local police and other emergency service. When the incident is minor, the ICMS focuses on information dissemination. When there is a major incident, the ICMS focuses on information dissemination, cross-jurisdictional coordination, and freeway/arterial operation coordination. The FDOT D5 lead operator takes the lead in this ICM scenario.

Applicable strategies, as well as roles and responsibilities of each agency, are shown in the Table below.

Table 15: Arterial Incident Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Information sharing and distribution (as in baseline scenario) • Operational efficiency at network junctions (as in baseline scenario) • Common incident reporting system and asset management system • Emergency road closure (including freeway off ramps) • Modify arterial signal timing to accommodate traffic shifting from the incident location • Reroute Transit Vehicles	FDOT	Update 511 information
	FDOT D5 RTMC	Respond to off-ramp closure requests
		Monitor freeway conditions
		Operate field elements
		Coordinate information dissemination
		Suggest capacity-demand management measures
		Monitor corridor conditions
	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
	LYNX	Monitor transit service
		Reroute if necessary
	SunRail	Monitor commuter rail
		Commuter rail management system
	FHP	Receive incident notification calls, enter into CAD, and respond to incident
		Notify other agency responders
	Local First Responders and Law Enforcement	Respond to accident for victim extraction, fire suppression, medical assistance

6.2.6 Scenario 5: Non-recurring Congestion

6.2.6.1 Incident Description:

During various times of day, unusual congestion may occur for various reasons, in some cases the congestion is not caused by any traffic related incident, construction, or special event.

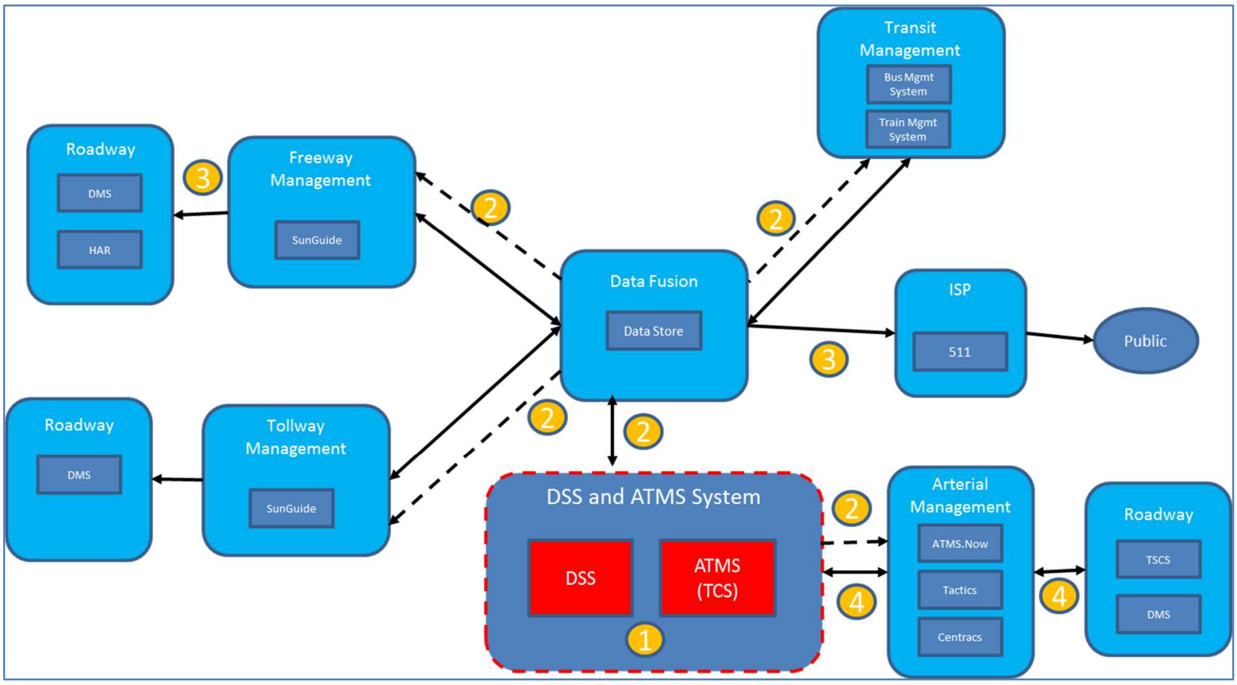

Figure 15: Non-recurring congestion Scenario

6.2.6.1.1 Timeline:

The incident timeline is the following:

1. The Prediction subsystem of the DSS is constantly monitoring current network and future predicted network conditions. As congestions builds in a certain area of I-4, the model shows that person-trip through the corridor is being impacted, and one of the pre-existing response plans would improve the performance of the corridor

2. The DSS selects a new set of signal timing plans for some arterials due to travel times being much greater than normal, but no incidents are entered into the system.

3. The DSS selects a response plan and notifies the affected corridor agencies that a response plan is recommended to alleviate non-recurring congestion. As part of the response plan, the predicted network conditions suggest a diversion of traffic onto several arterials within the county and city networks.

4. FDOT D5 provides suggestions on the DMS signs upstream of the congested area, and the 511 system is updated. The IEN sends notification to the stakeholder agencies that a response plan is being requested.

5. City and County signal plans are selected by the SunGuide system and requests are sent to the traffic signal software systems for the City and County to implement.

6. As conditions change, the DSS recommends to end the response plan, and the IEN notifies the affected agencies to end their responses and return to normal conditions.

6.2.6.2 Changes to Baseline Strategies:

The Prediction subsystem provides the capability to respond to non-recurring congestion, by modeling the impact of the various response plans against current and predicted network conditions. Without a model, non-recurring congestion is not recognized by the operators, because an incident is not causing the congestion.

Table 16: Non-recurring Congestion Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Information sharing and distribution (as in baseline scenario) • Pre-agreed response plans • Real-time Model of the Corridor • Predicted performance of the corridor	FDOT	Update 511 information
	FDOT D5	Monitor freeway conditions
		Operate field elements
		Coordinate information dissemination
		Suggest capacity-demand management measures
		Monitor corridor conditions
	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Inform travelers via field devices
		Adjust arterial signal timing
		Notify other agency responders
	Local First Responders and Law Enforcement	Respond to accident for victim extraction, fire suppression, medical assistance

6.2.7 Scenario 7: Special Event

6.2.7.1 Incident Description:

The distinguishing characteristic of a special-event scenario is the elevated need for coordination between corridor networks. A Joint Traffic Operations Center (JTOC) may be formed well in advance for centralized coordination of transportation and public safety operations during the special event. Typical special events affecting the I-4 corridor would include the Orlando Magic NBA basketball games, and events at the Orange Bowl, among many others.

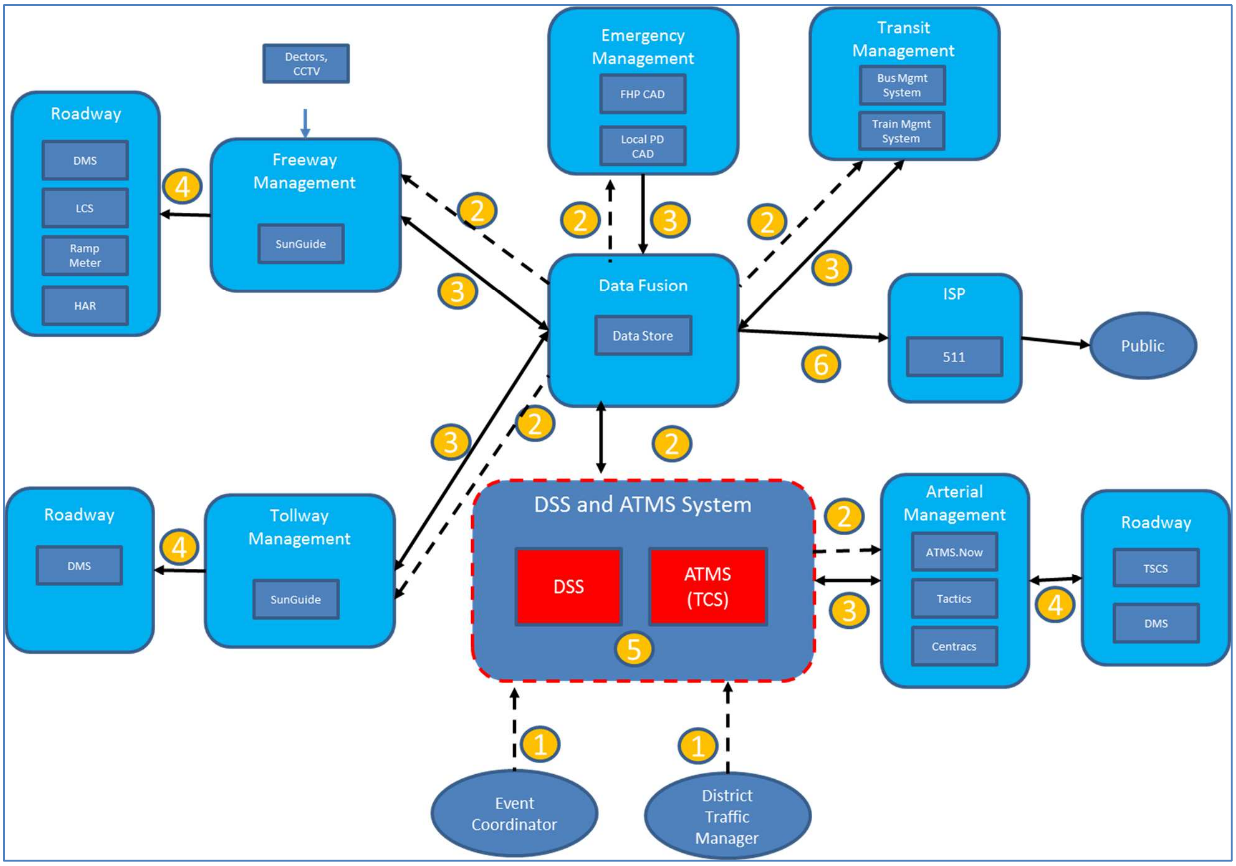

Figure 16: Special Event Scenario

6.2.7.1.1 Timeline:

The special event timeline is the following:

1. The event coordinator and other affected agencies develop a special event plan outlining traffic control strategies, security needs, etc. Special events are entered into the DSS and ATMS from multiple sources depending on event needs.

2. The DSS and ATMS disseminate planned special event data to affected public safety agencies, transit agencies, FDOT D5, and local jurisdiction traffic control systems.

3. The Data Fusion system receives special event inputs from affected agencies (public safety, transit, and traffic), which are sent to the DSS and ATMS system.

4. FDOT D5, transit, and local traffic agencies implement event services and traffic control strategies including field device activation and portable sign deployment, etc.

5. FDOT D5 and local jurisdictions use the DSS and ATMS to exchange device control and real time congestion and incident data as agreed by the plan.

6. The Data Fusion system provides special event data and traffic plans to the 511 system. The regional 511 operator disseminates real-time traffic conditions to the motoring public and other subscribers.

Special events require well-coordinated plans for managing expected traffic, as well as emergency response plans.

6.2.7.2 *Changes to Baseline Strategies:*

Tabletop scenario sessions should be conducted to define the plans and train involved personnel. During the event, short-term, demand-capacity management, especially addition of transit capacity and priority for transit vehicles, are often needed. Information dissemination in advance, as well as during the event is important. The Event TOC is the lead for this scenario.

Applicable strategies, as well as roles and responsibilities of each agency, are shown in the Table below.

Table 17: Special Event Scenario

ICM Strategies	Agency/Entity	Roles and Responsibilities
• Information sharing and distribution (as in baseline scenario) • Distribution of event management plan to the public in advance • Operational efficiency at network junctions (as in baseline scenario) • Coordinated scheduled maintenance activities on corridor networks to ensure available capacity at event • Joint Transportation Operations Center • Desktop sessions for enacting event plans • Add transit capacity • Reroute transit vehicles • Provide transit priority (exclusive lanes, transit priority at traffic signals) • Planned road closure and restrictions • Modify ramp metering rates to accommodate	FDOT	Update 511 information
	Event TOC	Lead Role in coordination
		Develop operational agreements between agencies and prepare event plan and incident response plan
		Conduct desktop training sessions
		Parking Management
	FDOT D5 RTMC	Monitor corridor conditions
		Coordinate information dissemination
		Close ramps, if necessary
		Monitor freeway conditions
		Operate field devices
		Plans deployment of vehicles, portable DMSs, and appropriate DMS signing
	City Traffic Divisions (Kissimmee, Maitland, Orlando, Winter Park)	Monitor arterial traffic flow
		Inform travelers via field devices
		Implement road closure/ restrictions
		Plan parking access
		Adjust arterial signal timing
	County Traffic Divisions (Osceola, Orange, Seminole)	Monitor arterial traffic flow
		Inform travelers via field devices
		Implement road closure/ restrictions
		Plan parking access
		Adjust arterial signal timing
	LYNX	Add temporary transit capacity and services
		Monitor transit service
		Coordinate schedules among service providers
		Reroute if necessary
	SunRail	Monitor commuter rail
		Add additional trains, if needed
		Coordinate schedules with other transit agencies
	Local Police	Street Patrol
		Assisting in directing traffic

ICM Strategies	Agency/Entity	Roles and Responsibilities
traffic • Implement special traffic signal timing plans • Parking management • Police assistance in directing traffic	Local First Responders and Law Enforcement	Respond to accident for victim extraction, fire suppression, medical assistance

Appendix A – Preliminary Requirements

The following requirements are found throughout this Con Ops and will be used as the basis for the Systems Requirements document. The first table (Table 18) is a listing of the high-level system requirements based on the User Needs identified in section 5.2, and are allocated to the specific subsystems within the DSS and ATMS Software system (ICM System) or to External Systems (i.e. data fusion, 511). The other tables in this section are for the 4 main subsystem areas of the project (DSS, ATMS Signal System, IEN, Data Interface)

Table 18: High-Level System Requirements

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	ICM System	External System	Notes
1.0.0.10	The DSS and ATMS System Shall provide interactive communication among agencies	Functional	1		Con Ops §5.2	IEN		
1.0.0.20	The DSS and ATMS System Shall receive current status of ITS devices in the region	Interface	2		Con Ops §5.2	DI		Feed from Data Fusion System, and Traffic Signal System
1.0.0.25	The DSS and ATMS shall receive current status of the transportation network in the region	Interface	2		Con Ops §5.2	DI		
1.0.0.30	The DSS and ATMS System Shall send current status of ITS devices to the stakeholder agencies	Interface	3		Con Ops §5.2.1	IEN/ DI	Data Fusion	
1.0.0.40	The DSS and ATMS System Shall provide current performance of the transportation network to stakeholder agencies	Functional	4		Con Ops §5.2.1	IEN/ DI	Data Fusion	
1.0.0.50	The DSS and ATMS shall provide current performance of the transportation network to the public	Functional	5		Con Ops §5.2.1	DI	511	

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	ICM System	External System	Notes
1.0.0.60	The DSS and ATMS shall provide travel time information to travelers	Interface	6		Con Ops §5.2	DI	Data Fusion	
1.0.0.70	The DSS and ATMS shall provide roadway event information to travelers	Interface	7		Con Ops §5.2	DI	Data Fusion	Feed from IEN to Data Fusion and to 511/ Agency systems
1.0.0.80	The DSS and ATMS shall provide transit event information to travelers	Interface	8		Con Ops §5.2	DI	Data Fusion	Feed from IEN to Data Fusion and to 511/ Agency systems
1.0.0.90	The DSS and ATMS shall store pre-agreed incident response plans	Data	9		Con Ops §5.2	DSS		
1.0.0.100	The DSS and ATMS shall send incident response plans to agency users to ensure that conflicting responses are not enacted	Interface	10		Con Ops §5.2	DSS		
1.0.0.110	The DSS and ATMS shall send incident response plans to agency users to ensure prompt response to events	Interface	11		Con Ops §5.2	IEN		
1.0.0.120	The DSS and ATMS shall provide alternate route option information to traveler	Functional	12		Con Ops §5.2	DI	Data Fusion	
1.0.0.130	The DSS and ATMS shall provide detour route option information to travelers	Functional	13		Con Ops §5.2	DI	511	
1.0.0.140	The DSS and ATMS shall provide information on alternate modes of transportation to travelers	Functional	14		Con Ops §5.2	DI	511	
1.0.0.150	The DSS and ATMS shall store history of enacted response plans	Data	15		Con Ops §5.2	DSS		

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	ICM System	External System	Notes
1.0.0.160	The DSS and ATMS shall evaluate the impact of enacted response plans on the transportation network	Functional	16		Con Ops §5.2	DSS		
1.0.0.170	The DSS and ATMS shall send updated incident response plans to agency users	Interface	17		Con Ops §5.2	DSS		
1.0.0.180	The DSS and ATMS shall store updated pre-approved response plans	Data	18		Con Ops §5.2	DSS		
1.0.0.190	The DSS and ATMS shall coordinate traffic signal timing plans	Functional	19		Con Ops §5.2	ATMS		

Table 19: DSS Subsystem Requirements

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
2.0.10.10	The DSS subsystem shall store pre-agreed incident response plans	Data	9	1.0.0.90		
2.0.20.10	The DSS subsystem shall send incident response plan requests to agency users to ensure that conflicting responses are not enacted	Interface	10	1.0.0.100		
2.0.30.10	The DSS subsystem shall store history of enacted response plans	Data	15	1.0.0.150		

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
2.0.40.10	The DSS subsystem shall send updated incident response plans to agency users	Functional	16	1.0.0.160		
2.0.50.10	The DSS subsystem shall send updated incident response plans to agency users	Interface	17	1.0.0.170		
2.0.6.10	The DSS subsystem shall store updated pre-approved response plans	Data	18	1.0.0.170		

Table 20: ATMS Signal Subsystem Requirements

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
3.0.10.10	The ATMS Signal Subsystem shall coordinate traffic signal timing plans	Functional	19	1.0.0.190		
3.0.10.11	The ATMS Signal Subsystem shall receive data from the Siemens Tactics software	Interface	19	1.0.0.190		
3.0.10.12	The ATMS Signal Subsystem shall receive data from the ATMS.Now software	Interface	19	1.0.0.190		
3.0.10.13	The ATMS Signal Subsystem shall receive data from the Econolite Centracs software	Interface	19	1.0.0.190		
3.0.10.14	The ATMS Signal Subsystem shall send timing plan requests to the Siemens Tactics software	Interface	19	1.0.0.190		

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
3.0.10.15	The ATMS Signal Subsystem shall send timing plan requests to the ATMS.Now software	Interface	19	1.0.0.190		
3.0.10.16	The ATMS Signal Subsystem shall send timing plan requests to Econolite Centracs software	Interface	19	1.0.0.190		
3.0.10.17	The ATMS Signal Subsystem shall store current status data for all traffic signals in the region, received from the various signal software systems	Data	19	1.0.0.190		

Table 21: IEN Subsystem Requirements

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
4.0.10.10	The IEN Subsystem shall provide interactive communication among agencies	Functional	1	1.0.0.10		
4.0.20.10	The IEN Subsystem shall send current status of ITS devices to the stakeholder agencies	Interface	3	1.0.0.30		
4.0.30.10	The IEN Subsystem shall provide current performance of the transportation network to stakeholder agencies	Functional	4	1.0.0.40		
4.0.40.10	The IEN Subsystem shall send incident response plans to agency users to ensure prompt response to events	Interface	11	1.0.0.110		

Table 22: Data Interface Requirements

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
5.0.10.10	The Data Interface shall receive current status of ITS devices in the region from the Data Fusion System	Interface	2	1.0.0.20		
5.0.20.10	The Data Interface shall store current status of ITS devices in the region	Interface	2	1.0.0.20		Traffic Signals
5.0.30.10	The Data Interface shall send the current status of ITS devices in the region to the Data Fusion System	Interface	3	1.0.0.30		Traffic Signal data
5.0.40.10	The Data Interface shall receive current performance data of the transportation network from the Data Fusion System	Interface	4	1.0.0.40		
5.0.50.10	The Data Interface shall store current performance data of the transportation network	Interface	4	1.0.0.40		
5.0.60.10	The Data Interface shall send current performance data of the transportation network to agency users	Functional	4	1.0.0.40		
5.0.70.10	The Data Interface shall send current performance of the transportation network to the Data Fusion System	Functional	5	1.0.0.50		Local Agency Events (incidents, construction, special events)
5.0.80.10	The Data Interface shall provide travel time information to travelers to the Data Fusion System	Interface	6	1.0.0.60		

Requirement ID	Requirement Description	Type	User Needs	Parent	Source	Notes
5.0.90.10	The Data Interface shall send roadway event information to the Data Fusion System	Interface	7	1.0.0.70		Local Agency Events (incidents, construction, special events)
5.0.100.10	The Data Interface shall send transit event information to the Data Fusion System	Interface	8	1.0.0.80		Transit Agency Events (incidents, construction, special events)
5.0.110.10	The Data Interface shall send alternate route option information to the Data Fusion System	Functional	12	1.0.0.120		
5.0.120.10	The Data Interface shall send detour route option information to the Data Fusion System	Functional	13	1.0.0.130		
5.0.130.10	The Data Interface shall send information on alternate modes of transportation to the Data Fusion System	Functional	14	1.0.0.140		