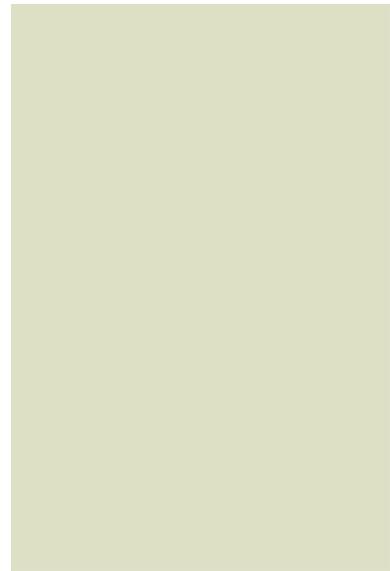


Greater Charlotte Region  
Intelligent Transportation Systems (ITS) and  
Traffic Incident Management (TIM)  

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Freight ITS & TIM Champion Group Report



July 27, 2017



Greater Charlotte Region

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July 27, 2017

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## Executive Summary

The freight transportation network in the greater Charlotte region is under pressure to provide safe, efficient, reliable and sustainable mobility with the reality of additional vehicles, aging and under-sized infrastructure, changing vehicle technologies and connectivity gaps. The Greater Charlotte Regional Freight Mobility Plan, led by Centralina COG, was completed in December 2016 and implementation has already started to take shape. Two high priority recommendations from the Plan include improvements to the region's Intelligent Transportation Systems (ITS) and Traffic Incident Management (TIM) system.

Centralina COG selected the ITS and TIM program recommendations from the Freight Mobility Plan to investigate in early 2017 because they were broad in scope and regionally focused. ITS and TIM have the potential to significantly enhance the efficiency of the current transportation system by integrating communication and information technology, while costing significantly less than an infrastructure improvement. These two systems are viable options for mitigating recurring congestion caused by normal traffic volumes and non-recurring congestion caused by incidents and significant events, and thus, are critical to the enhancement and efficiency of our region's Freight Mobility.

In February 2017, Centralina COG asked representatives from state and local DOTs, regional transportation planning organizations, transit providers and other stakeholders to join a Freight ITS & TIM Champion Group. This group was tasked with assessing the region's current ITS and TIM systems, identifying peers, and recommending approaches to improve these two regional systems. The Champion Group makes the following recommendations to the region and state's transportation planning organizations for consideration in future planning and investment activities.

## DEFINITIONS

### **Intelligent Transportation Systems (ITS):**

ITS is an operational system of various technologies that, when combined and managed, improve the operating capabilities of the overall system. ITS improves transportation safety and mobility, reduces environmental impact, and enhances productivity through the integration of advanced communications-based information and electronic technologies into the transportation infrastructure and vehicles.

### **Traffic Incident Management (TIM):**

TIM is a planned and coordinated program process to detect, respond to, and remove traffic incidents and restore traffic capacity as safely and quickly as possible. TIM improves the productivity and safety of the transportation system through improved training and coordination of public and private sector responders.

## **Value of ITS and TIM to Freight Mobility in the Greater Charlotte Region**

According to Texas A&M Transportation Institute in 2014, the total cost of congestion for the Charlotte NC-SC region was \$770 million. Truck congestion cost was \$131 million in 2014. These are monetized values of increased time, fuel and operating costs due to congested conditions rather than free-flow road conditions. Recognizing that we can no longer build our way out of our traffic woes and that businesses and residents are wasting time and money sitting in traffic, ITS and TIM provides a set of proven strategies for advancing transportation safety and mobility by integrating communication and information technology applications, and improving coordination among first responders.

### **Value of ITS for Freight Mobility:**

ITS is a set of tools that facilitates a connected, integrated, and automated transportation system that is information-intensive to better serve the interests of users and be responsive to the needs of travelers and system operators. Nearly every facet of our society is undergoing a shift of connecting the individual to the community.



*Figure 1: OTTO makes its first delivery of beer in CO. Wired.com*

And soon our vehicles will connect to the transportation infrastructure. A robust regional intelligent transportation system will facilitate the shift to improved information from, to, and between vehicles and infrastructure.

The freight industry and its customers are turning to information technologies and telecommunications to improve freight system efficiency and productivity, increase global connectivity, and enhance the security of the system. ITS helps freight operators use the transportation system more strategically. Currently deployed intelligent freight technologies are in the areas of: asset tracking, on-board status monitoring, gateway facilitation, freight status and network status information. In the future, ITS could support connected tractors and platooning, a method of increasing the capacity of roads using automation technology to decrease the distances between trucks.

Benefit-cost analysis of ITS show that these systems have a high return on investment. For example, Wireless Communications with GPS tracking capabilities for freight haulers have been as high as 4.9:1, Advanced Signal Systems projects have been as high as 62:1, while Ramp Metering can be in the 15:1 range.



Figure 2: Tractor-Trailer Platooning. Peloton

### Champion Group’s ITS Recommendations:

- **Identify a Regional Bi-State Vision & Baseline** – Currently, there are ITS plans developed by both NC and SC DOTs and local municipalities. There isn’t a single, unified vision for the whole bi-state Charlotte region. Local, regional, state, and national agencies need to plan together by developing a shared vision and architecture that sets parameters for coordinating installation, operations, maintenance and replacement of a regional system. The Champion Group recognizes this vision should intentionally integrate the ITS and TIM topics to move these highly interrelated issues forward comprehensively. Furthermore, this work must be prioritized for early attention so that it can strategically guide the implementation of the other recommendations included here, including the identification of key actors, outlining of funding gaps, and understanding required time and timing needs.
- **Improve Interoperability and Communications** – the regional system is comprised of local and state systems that operate on different platforms which makes it difficult if not impossible to share resources and data. It also complicates communication between system operators and maintainers. The future regional system must improve operations and communications across and among state, regional and local systems.
- **Address Transportation Technology Changes**– the adoption of autonomous and connected commercial and personal vehicles could change the way infrastructure and the

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Helena Connors, UNCC  
Bob Cook, CRTPO  
Tommy Feemster, SCDOT  
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Larry Kopf, CATS  
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Tony Tagliaferri, NCDOT

ITS architecture interact with users/vehicles. The regional system is at varying levels of preparedness for this change.

- **Improve Communications with Freight Operators and Travelers** – Communicating and relaying critical traveler information is vital to minimalizing the impacts of incidents and congestion on the system. Informing freight operators and travelers of delays and closures immediately could improve safety of all users and reduce the time to return the system to normal operations.

### **Value of TIM for Freight Mobility:**



*Figure 3: Truck Congestion*

TIM programs can significantly reduce the duration and clearance time of traffic incidents, resulting in significant reductions in vehicle delay, fuel consumption and secondary crashes. According to the USDOT, approximately 25% of all delay is the result of incidents on roadways. Traffic crashes are the most time-consuming of these incidents. Traffic incident management programs have

demonstrated success and shown high-value returns. Benefit-cost analysis of Incident Management Systems show that these systems have a high return on investment with B/C ratios ranging from more than 4:1 to over 38:1.

### **Champion Group’s TIM Recommendations:**

- **Need for Regional Bi-State Coordination** – Local, regional, state, and national agencies need to plan together by developing a shared vision and platform for coordination that identifies incident management champions from among local, regional, and statewide stakeholders and is integrated with long term transportation planning efforts already in place. The Champion Group recognizes this coordination should be a specific element of the Regional ITS Vision, integrating ITS and TIM, to ensure that specific strategies are in place to



*Figure 4: Heavy-Duty Towing*

support, long term, the recommendations included below.

- **Improve Interoperability and Communications** – A regional effort should seek to connect local and state systems currently operating on different communication platforms, making the coordination among highway assistance providers, dispatchers, first responders, wreckers, and other stakeholders very challenging and prone to unnecessary delays and confusion.
- **Training** – Coordinated training should be consistently developed and administered so that it honors the interests and perspectives across stakeholders and geographies. Additionally, a priority should be placed on the curriculum and trainers having credibility with the First Responder community.
- **Culture** – Given the critical value of top down support for proactive and coordinated TIM practices and programs, TIM stakeholder organizations must seek, identify, and cultivate specific champions, ideally supported and promoted via broader coordination efforts such as that proposed in recommendation #1.
- **Address Transportation Technology Changes** – The adoption of autonomous and connected commercial and personal vehicles could change the way TIM stakeholders interact with users/vehicles. The regional system is at varying levels of preparedness for this change, however, understanding the opportunities and challenges early on will help the region best take advantage of expected safety and efficiency gains, including opportunities to demonstrate and deploy freight specific opportunities (e.g.- geo-fenced freight bulk transfer activities and platooning), while mitigating unintended impacts to the transportation system.

A safe, efficient, and reliable transportation network is absolutely critical to the region's economy. Industries depend on the transportation network to move the goods that it produces, while also providing mobility for employees who are responsible for the production and transfer of those goods. When the transportation network is functioning well, people and goods are connected and efficiency is achieved resulting in reduced costs and congestion. When the transportation network isn't functioning well, our residents, industries, and economy suffer. ITS and TIM systems are viable options for maximizing the efficiency and operations of the existing transportation network through technology and coordination improvements often at a lower cost than infrastructure expansions.



## Background for ITS & TIM Efforts

In December 2016, the Greater Charlotte Regional Freight Mobility Plan was completed. The Freight Mobility Plan recommends infrastructure projects, regional programs and local policies to be implemented by transportation planning organizations, local governments, economic development organizations and others. The plan's recommendations are focused on improving the freight transportation network comprised of roads, rail lines, and intermodal and air cargo facilities. A robust freight transportation network is critical to the functioning and growth of the region's economy.

The freight transportation network in the greater Charlotte region is under pressure to provide safe, efficient, reliable and sustainable mobility with the reality of increasing number of vehicles, aging and under-sized infrastructure, rapid technology changes and connectivity gaps. Centralina COG selected two program recommendations from the Freight Mobility Plan to investigate in early 2017 because they were broad in scope and regionally focused. Improving the safety and efficiency of the transportation network with technology investments and improved incident response can potentially reduce recurring and non-recurring congestion with less financial investment than infrastructure investments.

### Greater Charlotte Regional Freight Mobility Plan: ITS & TIM Recommendations

The following ITS and TIM recommendations are from the 2016 Greater Charlotte Regional Freight Mobility Plan. These recommendations helped inform the development of the Freight ITS & TIM Champion Group and the group's investigation into the region's ITS and TIM systems.

- Expand the use of Intelligent Transportation Systems (ITS), technology, and innovation to improve the flow of freight such as: surveillance systems, variable message signs, and ramp control/metering.
- Identify opportunities to share information, best practices, and training as well as coordination to improve TIM and Emergency Response Management.
- Incident management should be prioritized for responding to increased congestion, safety issues during highway construction, and impacts of vehicular crashes.
- Develop a freight network resiliency plan.

### Intelligent Transportation Systems (ITS) and Traffic Incident Management (TIM)

Intelligent Transportation Systems (ITS) and Traffic Incident Management (TIM) are designed to improve the efficiency and safety of the existing freight transportation system through advancements in technology and coordination. ITS enhances efficiency through the integration of advanced communications-based information and electronic technologies into the transportation infrastructure and vehicles, while TIM enhances productivity and safety through a planned and coordinated process to detect, respond to, and remove traffic incidents and restore capacity as safely and quickly as possible.

ITS and TIM programs increase the efficiency and safety of the entire transportation network benefiting freight haulers as well as passenger vehicles and transit providers. The work undertaken by the Freight Champion Group and this report include broad recommendations to

both systems that will improve the efficiency, safety, and reliability of freight mobility across the region's transportation network while also benefiting other users. There are a few ITS and TIM recommendations that are freight specific.

### Freight ITS & TIM Champion Group

In February of 2017, Centralina COG asked representatives from diverse geographies, communities and technical backgrounds to meet to assess the region's current ITS and TIM systems, to identify leading peer regions, and recommend approaches to improve the region's ITS and TIM systems. This group was designated as the Freight ITS & TIM Champion Group. The Champion Group met monthly in-person or by webinar beginning in February and concluding in June with the group's recommendations presented in July to the Freight Advisory Committee and staff from the region and state transportation planning organizations for their consideration.

### Freight ITS & TIM Freight Champion Group Members

- Charles Abel, CDOT
- Helena Connors, UNCC
- Bob Cook, CRTPO
- Tommy Feemster, SCDOT
- Joe Geigle, FHWA
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- Larry Kopf, CATS
- Meredith McDiarmid, NCDOT
- Debbie Smith, CDOT
- Tony Tagliaferri, NCDOT

**Figure 5: Freight ITS & TIM Champion Group Schedule**

Information Gathering Phase		Assessment Phase		Recommendation Phase	
<b>Meeting 1</b> February 27, 2017 In-person	<b>Meeting 2</b> March 20, 2017 Webinar	<b>Meeting 3</b> April 24, 2017 In-person	<b>Meeting 4</b> May 15, 2017 Webinar	<b>Meeting 5</b> June 19, 2017 In-person	<b>Freight Advisory Committee (MPOs invited)</b> July 28, 2017
<b>Introduction to:</b> <ul style="list-style-type: none"> <li>Freight Mobility Plan</li> <li>ITS &amp; TIM Recommendations</li> <li>Champion Group Members</li> </ul> <b>Discussion on:</b> <ul style="list-style-type: none"> <li>Region's Capabilities and Status of systems</li> <li>Region's needs</li> <li>Peer Regions to research for best practices</li> </ul>	<b>Review of:</b> <ul style="list-style-type: none"> <li>Region's capabilities and needs</li> <li>Peer Region's practices, policies, programs, technology etc.</li> </ul> <b>Assessment of:</b> <ul style="list-style-type: none"> <li>Best Practices for application in Charlotte region</li> <li>Regional needs ranking/priority criteria</li> </ul>	<b>Review of:</b> <ul style="list-style-type: none"> <li>Region's capabilities and needs</li> <li>Peer Region's practices, policies, programs, technology etc.</li> </ul> <b>Discussion of:</b> <ul style="list-style-type: none"> <li>Initial Gaps</li> </ul>	<b>Presentation of:</b> <ul style="list-style-type: none"> <li>ITS/TIM peer examples</li> <li>ITS/TIM best practices</li> </ul> <b>Discussion of:</b> <ul style="list-style-type: none"> <li>Gaps</li> <li>Ranking/Priority of needs?</li> <li>Recommendations process</li> </ul>	<b>Development of:</b> <ul style="list-style-type: none"> <li>Draft Recommendations</li> </ul> <b>Finalization of:</b> <ul style="list-style-type: none"> <li>Recommendations for ITS and TIM improvements to region</li> </ul>	<b>Presentation of:</b> <ul style="list-style-type: none"> <li>Recommendations for improvements to the region's ITS/TIM systems</li> <li>Partnerships needed</li> </ul>
Interviews of ITS/TIM Experts					
<b>September Summit</b>					

The Champion Group was asked to:

- **Assess the current ITS and TIM systems** – research the functionality, capabilities, and performance of the current systems and identify needed improvements to the systems to provide an efficient, reliable, and safe transportation system.

- **Review exemplary peer region's ITS or TIM systems** – research and review peer region's that have been recognized for exemplary ITS or TIM systems and identify key aspects which could be adopted and or improved on for the Charlotte region.
- **Recommend approaches to improve the ITS or TIM systems** –identify methods to improve the ITS or TIM systems and give recommendations to the Freight Advisory Committee and the region's transportation planning organizations.

### Local Transportation Planning: A Review of CRPTO Congestion Management Process & Performance Measures

Prior to explaining the intricacies of ITS and TIM, the Champions Group recognized early on that there are many activities already underway that address congestion relative to our region's transportation systems. Here we highlight one of many examples that serve to illustrate the broader context within which the ITS/TIM discussion must take place. Specifically, this section reviews local transportation planning efforts that directly interrelate with ITS/TIM strategies through congestion management planning activities ongoing at the Charlotte Regional Transportation Planning Organization (CRTPO).

MPOs with a population exceeding 200,000 are required to carry out congestion management processes, or CMPs. CMPs are described in Federal law, and are intended to examine the sources of congestion, evaluate alternative strategies for alleviating congestion, and monitor the performance of these strategies. MPOs are required to assess strategies that are not traditional single-occupant vehicle (SOV) expansion projects (such as roadway widenings and new construction of general purpose travel lanes) before programming roadway capacity expansion construction projects.

Federal law further requires the evaluation and monitoring of system performance across the two distinct, yet related activities of the CMP and Performance Management. The CRTPO, as the Metropolitan Planning Organization (MPO) for the Charlotte urbanized area, is responsible for developing and implementing strategies to carry out the requirements associated with each, in coordination with other federal, state, and regional transportation agencies.

Previous CMP efforts have been ongoing and can be reviewed at <http://www.crtpo.org/plans-programs/congestion-management-process> for details. Recently, specific regulations for performance management have been introduced and are incorporated into the Congestion Management Process being undertaken by the CRTPO.

Key features of each process are highlighted as follows:

#### *Congestion Management Process*

- Develop goals, objectives, and measures to monitor and evaluate system performance as it relates to the extent and causes of congestion.
- Identify congested corridors, along with strategies to manage congestion.
- Define an implementation schedule and potential funding for each proposed strategy.

### Performance Management

- Establish measures and targets consistent with national goals and NCDOT targets.
- Conduct system performance evaluation based on a combination of quantitative and qualitative metrics to determine if targets are being met.
- Monitor and report system performance over time.
- Collaborate with FHWA, NCDOT, and other regional MPOs

With this background, process, and the CRTPO example in mind, the tremendous ability MPOs and transportation planners have to influence and guide the congestion conversation in our region is evident. Therefore, the ITS/TIM Champion Group recognized that the ability of transportation planning efforts to support efficient freight movement in our region is directly tied to freight industry stakeholders being engaged in local transportation planning organization congestion management and planning activities on an ongoing basis.

## Charlotte Region’s Intelligent Transportation Systems (ITS)

### Assessment of Region’s Current System

The greater Charlotte region and state DOTs have made significant investments in the deployment of ITS. ITS enhances efficiency of the transportation system by integrating technology and communication into transportation infrastructure and vehicles. Regional and local agencies rely primarily on investments made by the NC and SC Department of Transportation and local municipalities.

Example ITS Applications in the greater Charlotte region:

NC & SC DOTs ITS	Some Local Municipal ITS
Dedicated Traffic Management Centers (TMC)	Centralized Traffic Signal Systems
CCTV Cameras	Field Sensors
Dynamic Message Signs (DMS)	CCTV Cameras
Variable Message Sign (VMS)	

NC and SC DOTs have dedicated Traffic Management Centers (TMC) to manage and operate ITS within the region. Integrated signals, field sensors, CCTV cameras, Dynamic Message Sign (DMS) and Variable Message Sign (VMS) units have been deployed by both state DOTs and local municipalities. ITS system deployments in the Charlotte region by NCDOT and SCDOT can be found in Appendix A and B. In addition, the TMCs can deploy motorist assistance patrols to assist stranded motorists and with incident clearance and management.

A few of the municipalities in the greater Charlotte region have installed centralized traffic signal systems, and deployed field sensors and CCTV cameras. The Charlotte Area Transit System (CATS) is in the process of deploying ITS to assist with vehicle tracking, security, fare payments and passenger counting.

## Challenges & Limitations of Current Intelligent Transportation System

While recognized as one of the better systems in North Carolina, the greater Charlotte region's Intelligent Transportation System is not as robust as is needed to adequately serve transportation needs. The Champion Group expressed a need to expand the system and deploy additional technologies and services. Specifically, a few of the systems' challenges and limitations are identified here:

- **System Integration among state, regional & local agencies:** system devices range from analog to digital and system operators cannot seamlessly share or link to other agencies systems to identify and monitor incidents.
- **System Operations & Maintenance:** systems in the region are owned, operated, and maintained by numerous agencies both public and private. This causes challenges with sharing data and access as well as the responsibility for maintenance. Some operators are not the owners of the systems and so maintenance and repair can be challenging. Obsolete equipment may not be replaced in a timely manner which cause interoperability issues for agencies.
- **System Life-Cycle Planning:** Properly planning for total life-cycle costs is imperative to maintain a robust system that serves both the operators and users. Current funding does not adequately support maintenance and replacement of equipment. *Figure 2 outlines the ideal life-cycle of planning for, implementing, and maintaining a high performing ITS program.*
- **Transportation/Highway infrastructure is inadequate to meet current demands:** Major interstate infrastructure in the greater Charlotte region does not meet current demand and makes it difficult to install ITS devices to help systems operate more efficiently.

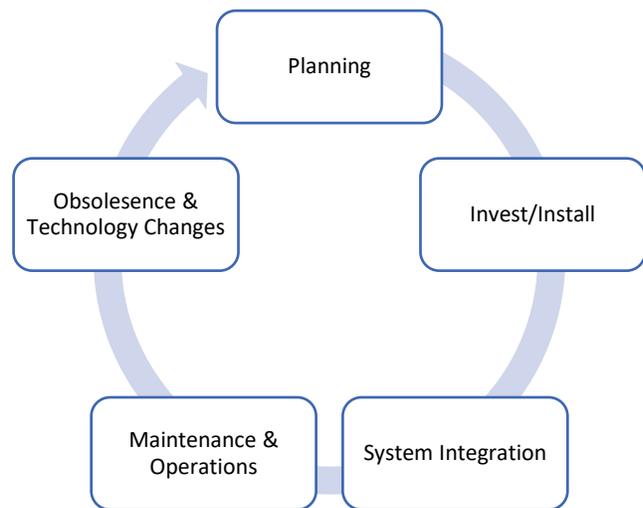


Figure 6: Ideal Life-cycle Planning for ITS

## Critical Intelligent Transportation System Regional Needs

Although state, local and regional agencies are actively deploying ITS within the greater Charlotte region, the Champion Group noted a strong need for system integration across jurisdictions and organizations to meet regional needs. Regional needs generally focused on improving communications, and operations and maintenance of the system's components.

- **Establishing a Regional System Vision:** The first Metrolina ITS plan was completed in 2001 and full plan updates have not occurred but NCDOT has updated the installation of devices to meet FHWA requirements. The region lacks a shared vision for what a regional intelligent transportation system should be to support mobility, enhance safety and security and support economic growth.
- **Improved Communications and Partner sharing:** Improved communications and operations among partner agencies is needed to develop a regional system that supports regional transportation and mobility.
- **Addressing Network Deficiencies:** Improved and or enhanced level of agreement among partners is needed. In addition, a standard for system security and data retention should be established.
- **Need for a Digital Network:** Upgrading systems to digital devices and expanding fiber networks or wireless capabilities to support equipment, devices, and emerging vehicle technologies.
- **Tools for Technology Changes:** The system needs to be improved to support changing vehicle technologies such as connected vehicles. A connected vehicle refers to the capability of the various elements of the modern surface transportation system (personal, transit, and freight vehicles, roadside infrastructure, transportation management centers, etc.) to electronically communicate with each other on a rapid and continuous basis. Dedicated short-range communications (DSRC) allow rapid communications (up to 10 times per second) among elements of a connected vehicle network, particularly for safety critical applications. Coordination between vehicles and infrastructure is required for this technology application.
- **Identifying Funding & Support:** Obtaining political support and funding for system installations, operations and maintenance is challenging. There is a need for the region to put a value on a robust system.

#### Ideal Components of a Regional Intelligent Transportation System

The Champion Group identified key components of an ideal regional system to guide them in discussions for regional needs and recommendations.

- **System Planning:** Collaboration among federal, state and local agencies that plan for, install, own, operate, and maintain system needs to occur as planning for investments and additions occur. In addition, performance measures must be a component of evaluating the system from planning through operations.
- **Reporting Capabilities:** Access to real-time information is critical. Gathering data, analyzing data and then reporting results to operators and/or users is imperative. The system must be capable of processing 'big data' and operators must be able to understand and implement needed system responses.

- **Interoperability & Communications:** Regionally, interoperability and information/data shared among all concerned agencies must be quick and seamless. Communication networks must have multiple redundant paths and integrated communications systems. It is vital that communications and operations are shared/open to all partners and agencies.
- **Response to New Technologies:** Capable of interacting and communicating with autonomous and connected vehicles.

#### Review of Intelligent Transportation System Peers:

Research was done on peer regions selected by the Champions to examine ITS best practices and to see what can be adapted for use in North Carolina. The reviewed regions include Orlando, FL; Disney World, FL; Los Angeles, CA; Phoenix, AZ; Hampton Roads, VA; and the Greater Philadelphia, NJ & PA area.

#### Summary of ITS Peer Region Research

The Champion Group identified six peer regions to investigate for their efforts in ITS development, deployment, and utilization. These regions are located across the county and range in geographic scale and population size. Below is a summary of the research with additional information in Appendix C.

City/Region/State	Geographic Area	Population Size	Lead Organization
<b>Orlando Region, FL</b>	Orange, Osceola, and Seminole Counties	1.87 million	MetroPlan Orlando
<b>Disney World, FL</b>	Orlando area	~19 million visitors (annually)	Walt Disney World Resort
<b>Phoenix, AZ</b>	Maricopa County, Valley Metro, Pinal County	4.5 million (metro area, 2015)	Maricopa Association of Governments
<b>Hampton Roads area, VA</b>	Gloucester, Isle of Wight, James City, Southampton, Surry and York Counties	~236,922 (2014)	Hampton Roads Transportation Planning Organization
<b>Los Angeles, CA</b>	Ventura, Los Angeles, San Bernardino, Riverside, and Orange Counties	3.9 million (2014)	Southern California Association of Governments
<b>Greater Philadelphia Region, NJ &amp; PA</b>	Burlington, Camden, Gloucester, and Mercer counties in New Jersey, and Bucks, Chester, Delaware, Montgomery, and	5.7 million (2015)	Delaware Valley Regional Planning Commission (DVRPC)

	Philadelphia counties in Pennsylvania		
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#### ITS System Characteristics – Key Findings

**Management:** Most of the researched regions rely on a state(s) DOTs for management assistance and half of the regions rely on help from a regional organization such as an MPO or COG.

**Planning:** There is much collaboration between local governments, the state DOT and on occasion, the FHWA. Most regions have some form of ITS, though typically the local governmental organization does not own it.

**Execution:** Many of the regions were the first in their area to utilize ITS and now have some of the most integrated systems available, specifically Virginia and Los Angeles. Disney is a unique example in that they are private company with a more-flexible-than-average fleet and have a very integrated system within their parks and hotels to move guests around as safely and efficiently as possible. When asked who they look to for inspiration the regions/organization identified were: Utah DOT, Colorado DOT, National Operation Center of Excellence, ITS America, North Central Texas COG, Iowa, and FHWA.

**Reporting Capabilities and Network:** All of the regions have real-time reporting capabilities or can report back within a few hours. All six regions have multiple networks and struggle with interoperability. Many use digital message boards to convey information to drivers ahead of issues or incidents. Furthermore, integration with surrounding or newer systems remains a challenge for many regions, especially when they go to upgrade. Little to no communication between contractors for construction projects has also resulted in network lines being cut due to ignorance of location or it is cheaper to replace cable than move it or work around it.

**Successes:** Coordination and integration across all users and providers of the regional system whether the system is comprised of individual state, regional or local systems. Interoperability, flexibility, responsibility and reporting capabilities are key characteristics of a high functioning ITS system.

#### Key Individual Findings

*Key terms and acronyms used in this section may be found in the glossary at the back of this document*

#### Orlando, FL:

- *Management:* The system is maintained by the Florida Department of Transportation (FDOT) Division 5.
- *Planning:* Efforts continue to improve interoperability and communication, both within FDOT and between the Transportation Systems Management & Operations (TSM&O). ITS is an integrated aspect of their transportation system.
- *Execution:* They have uniquely implemented ITS through data integration and connectivity, an operation center, dynamic messaging signs (DMS) and a traveler information website.
- *Reporting Capabilities and Network:* Reports are designed to be developed within minutes, though aren't always 100% accurate because of the turnaround time. There is

access to real-time information and is subsequently redistributed to the public via dynamic messaging signs (DMS) and a traveler information call system/website.

- *Success:* A Concept of Operations was developed during the update to the ITS Master Plan which defines the enhancements required for Seminole, Orange, and Osceola counties — and the municipalities in these counties — to effectively manage ITS assets and operations as a part of the regional system. A scoring method for new projects focuses on linking proposed projects with the goals and objectives of the ITS Master Plan to address local priorities.

#### **Disney World, FL:**

- *Management:* The only private company examined who can efficiently move around two fleets; of people and cargo.
- *Planning:* They have a modified ITS system since their needs are unique as a private company with thousands of customers daily. Their fleets are flexible in where they can be due to the nature of their riders and the consistent evaluation of efficiency within their system.
- *Execution:* As a private company, they do not interact much, if at all, with the other systems in the region. Limited in how they can respond to large-scale incidents on their property/roadways.
- *Reporting Capabilities and Network:* Reports are generated daily, but not necessarily used since the fleet is so large. There are no plans for autonomous connected vehicles (ACV) since whole sections of fleet (bus, monorail, etc.) would have to be upgraded all at once.
- *Success:* Achieved through flexibility, consistency, and reporting.

#### **Los Angeles, CA:**

- *Management:* LA has a self-reliant, high-level program that handles all aspects of ITS called the Automated Traffic Surveillance and Control program (ATSAC), run by the LADOT.
- *Planning:* LADOT partner with the Southern California Association of Governments (SCAG) to maintain and expand their extensive network. LA has a website that is partnered with Google to show real-time congestion and posted accident delays.
- *Execution:* They have an established and sophisticated system; with multiple ITS networks in the area that share real-time information. This integration is handled by the Regional Integration of Intelligent Transportation Systems (RIITS), the Los Angeles County Department of Public Work's Information Exchange Network (LACDPW IEN) and the rail and bus operating centers (ROC and BOC).
- *Reporting Capabilities and Network:* There is further planned integration with the public California transportation system (CalTrans) to increase sophistication and coverage of the California region.
- *Success:* Success is attributed to a multi-modal, sustainable but single technology adaptable platform and infrastructure host application (ATSAC) usable to all ITS projects in the city.

#### **Phoenix, AZ:**

- *Management:* There is a partnership between AZDOT and Maricopa Association of Governments (MAG) for a higher-level ITS program.
- *Planning:* They had foresight in laying fiber network throughout the buildup of the surrounding area.
- *Execution:* Arizona has a shared standard across the multiple ITS networks in the Phoenix metro area and they use a regional network established by MAG.
- *Reporting Capabilities and Network:* There is access to real-time data and reports are generated quickly.
- *Success:* A constant commitment to improvement of the TIM system and many pilot projects as well as expansion of their fiber network and identifying best technologies for increased integration/communication are key factors to their success.

#### **Hampton Roads, VA:**

- *Management:* Virginia has constant collaboration among state and regional authorities and transportation officials due to the way roads are uniquely owned in Virginia.
- *Planning:* Planning for ITS goes through the Hampton Roads Transportation Operations (HRTTO) Subcommittee which meets twice a month and is more regionally-focused, rather than local.
- *Execution:* They were one of the first regions in the nation to use ITS and have a comprehensive regional architecture plan. They also have state-of-the-art centrally controlled traffic signal systems.
- *Reporting Capabilities and Network:* Reports are generated at specific intervals for regional use, though ability to access real-time data is unknown.
- *Success:* Virginia said that their planning as well as the formation of the Regional Concept for Transportation Operations for Transportation Incident Management (RCTO-TIM) Committee (which also helps with ITS) has benefitted them. In addition, cooperation between cities and jurisdictions and continued maintenance and upkeep of infrastructure as well as their motorist information systems were Virginia's best aspects of the program for success.

#### **Greater Philadelphia Region, NJ & PA:**

- *Management:* The Delaware Valley Regional Planning Commission (DVRPC) has a dedicated 4-man team on their Transportation Systems Management and Operations (TSM&O) committee that handles everything ITS. Devices are locally owned, while their TSM&O plan is an outgrowth of their long-range plan for the region.
- *Planning:* ITS is integrated into DVRPC planning in terms of construction projects.
- *Execution:* Both those who own the devices and those who utilize the information are unusually well coordinated and integrated into each other's process.
- *Reporting Capabilities and Network:* They are not the first to access new information from the devices but are able to receive that ITS information through a web-based database and traffic information system. Delaware Valley is unaware if they have a shared standard among the multiple networks in the area.

- *Success:* According to DVRPC, there are four key elements to their success: quarterly agency taskforce group meetings; shared regional ITS architecture; buy-in from stakeholders; and funding are the most important for successful deployment and integration and a regional ITS program.

### Recommendations for the Region’s Future System:

Investments and changes to the greater Charlotte region’s future Intelligent Transportation System should focus on four areas outlined below. These were identified by comparing the current system with the Champion Group’s ideal components of a high performing ITS.

1. **Identify a Regional Bi-State Vision & Baseline** – local, regional, state, and national agencies need to plan together by developing a shared regional vision and architecture, as well as coordinating installation, operations, maintenance and replacement. The Champion Group recognizes this vision should intentionally integrate the ITS and TIM topics to move these highly interrelated issues forward comprehensively. Furthermore, this work must be prioritized for early attention so that it can strategically guide the implementation of the other recommendations included here, including the identification of key actors, outlining of funding gaps, and understanding required time and timing needs.
2. **Improve Interoperability and Communications** – the regional system is comprised of local and state systems that operate on different platforms which makes it difficult if not impossible to share resources and data. It also complicates communication between system operators and maintainers. The future regional system must improve operations and communications across and among state, regional and local systems.
3. **Address Transportation Technology Changes**– the adoption of autonomous and connected commercial and personal vehicles could change the way infrastructure and the ITS architecture interact with users/vehicles. The regional system is at varying levels of preparedness for this change.
4. **Improve Communications with Freight Operators and Travelers** – Communicating and relaying critical traveler information is vital to minimalizing the impacts of incidents and congestion on the system. Informing freight operators and travelers of delays and closures immediately could improve safety of all users and reduce the time to return the system to normal operations.

## Charlotte Region’s Traffic Incident Management (TIM)

### Assessment of Region’s Current Conditions

TIM is valued for its ability to enhance productivity and safety of the transportation system through a planned and coordinated process to detect, respond to, and remove traffic incidents. With this foundation in mind, experts familiar with the greater Charlotte region report that the region is generally being well served by its local first responders, Incident Management Assistance Patrols (IMAP) in NC and State Highway Emergency Program (SHEP) in SC, and the data pushed out to end users (such as HERE Technologies data for the trucking industry regarding traveler information) at present. Further, in many jurisdictions of the region, “planned incidents”

are viewed as being handled well. However, facilitated discussions, interviews, and research tell us that there is room for improvement.

What quickly becomes evident to those not familiar with TIM is that there are many stakeholders that must partner in multiple ways before, during, and after incidents to achieve a high performing TIM program for a given area. These stakeholders consist of Departments of Transportation, local and state transportation planning and front-line staff, fire departments, EMS officials, wrecking companies, state highway patrol, local law enforcement, and hazardous materials contractors, to name some of the many critical players active in the TIM realm. Furthermore, the scenarios of where and when these stakeholders may find themselves abound, and thus dictate the need for several types of coordination and cooperation that must be accounted for if the many TIM scenarios occur. Examples of the varied circumstances where TIM stakeholders may encounter each other include:

- Accidents (medical assistance, traffic control, fire suppression, etc.),
- Public safety communications,
- Providing updated motorist information (e.g.- travel times, alternative routes),
- HAZMAT response/ containment, and
- Numerous “ad-hoc” situations such as disasters, homeland security threats, and weather events

Finally, the greater Charlotte region is split-up in terms of jurisdictional and political boundaries. These include 4 MPOs and an RPO that conduct varying degrees of transportation planning relative to TIM related issues, 2 state DOTs, 14 counties, and variable integration of emergency communication and Intelligent Transportation System device capabilities among these many jurisdictions.

### Challenges & Limitations of Current Traffic Incident Management

Several concepts emerged regarding the current challenges facing the greater Charlotte region’s Traffic Incident Management program. The Champion Group and other interviewed experts expressed a need to review and incorporate the following issues into any future recommended solutions.

- **Communication**
  - Cross-state and cross-jurisdictional communication is not consistent.
    - In some cases, this communication can be functionally limited (e.g.- phone use and not radio contact due to licensing issues).
  - Structural limitations also appear to exist, such as coordination meetings may take place at county or sub-regional levels, however, higher level leadership are more likely to attend these events than the “front line” responders.
  - After Action Reviews or similar assessments that include standard expectations for what triggers these, who will attend, and how improvements for future TIM protocols are implemented are sporadic or non-existent across the region.

- **Training**
  - The foundational interests/core values from which TIM training is developed and shared along with limited opportunities for various stakeholders to interact and share in training opportunities are top factors impacting the success of training programs in a given area.
    - First responders are trained to “protect the scene,” including the victims of an incident and all personnel responding to the incident.
    - Incident Management personnel are trained to “clear the scene,” opening travel lanes and restoring the flow of traffic as quickly as possible.
  - Training that integrates the above groups does not always take place, resulting in inconsistent information/protocols being shared over time and limiting the chance to appreciate both “protect the scene” and “clear the scene” perspectives. Furthermore, such collaborative training can help to grow an understanding of what role each organization and individual should expect to play at an incident scene, and perhaps more importantly, not play.
  - Trainers must possess credibility with the first responder community otherwise messages will not be heard.
- **Culture**
  - Champions and critical personnel that promote highly functioning TIM programs are severely impacted by turnover,
  - Law enforcement can rotate duty assignments and roles within their departments regularly; turnover of call center dispatchers tends to be frequent.
  - Is directly related to consistent top down support and promotion of the value of strong TIM coordination with allied stakeholders.
- **Investment approach**
  - Several areas are finding that adding new network capabilities is attainable, however, with funding stopped or stagnant, long term maintenance of equipment and devices and hiring of personnel such as IMAP/SHEP drivers or call center operators needed for TIM to be successful, is stymied.
  - Funding for direct (e.g.- “quick clearance” incentives) and indirect (e.g.- improved transit coverage and service) actions to improve TIM seem to lag for our region.

#### Critical Traffic Incident Management Regional Needs – Identified by Champions

Flowing out of the Champion Group’s above identified challenges, some key needs for the region were highlighted. These regional needs focused on removing jurisdictional barriers and creating a comprehensive understanding and approach to TIM for the region. As one Champion Group member articulated, we do well individually but struggle when we “cross lines”, akin to being very good as “soloists” while lagging when performing as an “orchestra.”

- **Cross-jurisdictional coordination:** Political lines and the mixture of TIM disciplines responding to an incident must be removed as a barrier to communication and efficacy.

- In short, incident complexity, location and impact (i.e.-NC vs. SC, which city or county, disaster response vs. automobile accident), should not alter the efficiency and consistency of incident response across the region.
- Intentional coordination must regularly integrate all TIM disciplines and organizational levels/roles, recognizing that turnover and culture play a tremendous role in the success of TIM regionally.
- Training and associated curriculum must be consistently deployed so that there is a shared understanding of goals and expectations across disciplines, stakeholders, and jurisdictions.
- Formalize relationships through agreements (e.g.- MOU) and existing processes (e.g.-MPO planning)
- **Funding:** Adequate funding and support should be prioritized for the expansion of IMAP and SHEP programs/drivers, addition of increased regional call center staff, and the support of processes required to grow and maintain relationships and trust among parties over the long term.

#### Ideal Components of Regional Traffic Incident Management – Identified by Champions

Champion Group discussions across several meetings ultimately identified key components of an ideal regional system. The following can serve as a guide for directing our region’s efforts in the future.

- 1) **Planning:** Transportation planning organizations and planning activities among local and state organizations should incorporate incident management needs into their work. This would range from assuring the latest digital network capabilities and systems are available across jurisdictions to assessing and preparing for the impacts emerging technology might have on the transportation system generally and TIM specifically, for a region.
- 2) **Training:** Collective training among all disciplines that involves all levels of each organization. Furthermore, this training must incorporate a quick clearance culture that honors safety for all involved, that is authentically supported by leadership across all organizations.
- 3) **Interoperability and coordination:** All partners must be able to communicate immediately and effectively across jurisdictional lines and across incident types. Coordination to ensure success would likely have some sort of pre-agreed upon administrative structure.
- 4) **Comprehensive Capabilities:** The ability to pinpoint and clear incidents with greater efficiency via access to real-time information and data is critical. Further folded into this topic is the quick and accurate incident reporting to freight operators and drivers in the transportation network.

#### Review of Traffic Incident Management Peers:

Research was done on selected peer regions of TIM determined by the Champions to examine best practices of their TIM systems and to see what can be adapted for use in North Carolina. The regions are Phoenix, AZ; Tennessee; and Greater Philadelphia region, NJ & PA. The Atlanta TIME Task Force was also contacted for this study but subsequent requests for information resulted in no response.

## Summary of TIM Peer Region Research

The Champion Group identified four peer regions to investigate for their efforts in TIM program development and deployment. These regions are located across the country, range in geographic scale and population size, and ultimately three responded for inclusion in this report. Below is a summary of the research with additional information in Appendix D.

<u>City/Region/State</u>	<u>Geographic Area</u>	<u>Population Size</u>	<u>Lead Organization</u>
<b>Phoenix, AZ</b>	Maricopa County, Valley Metro, Pinal County	4.5 million (metro area, 2015)	Maricopa Association of Governments
<b>Greater Philadelphia Region, NJ &amp; PA</b>	Burlington, Camden, Gloucester, and Mercer counties in New Jersey, and Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania	5.7 million (2015)	Delaware Valley Regional Planning Commission (DVRPC)
<b>Tennessee</b>	State of Tennessee	6.5 million (2014)	Tennessee DOT

### TIM System Characteristics – Key Findings

**Management:** The regions and states all coordinated with their respective state DOTs and had an established committee or organization that was charged with improving TIM and identifying resources and opportunities for improvement. Specialized staff have access to resources and external partners. When asked who they look to in the TIM field the Tennessee’s TIM training facility, Colorado’s Quick Clearance Training, the Atlanta TIME Taskforce, and specific DOTs came up.

**Training:** Beginning with experienced, trained staff to conduct training exercises with first responders and others. The next step was to begin training trainers to expand the training and increase the opportunity for frequent classes in the area. Training opportunities included representatives from all disciplines as well as situation-specific classes.

**Culture:** Educating organization management about the importance, need for TIM and establishing a baseline understanding and familiarity of the goals and tactics of TIM has proven to be invaluable to effectively promote TIM programs and acceptance.

**Success:** Establishing partnerships and the complete buy-in of upper management has been the key to successful TIM programs.

## Key Individual Findings

*Key terms and acronyms used in this section may be found in the glossary at the back of this document*

### Phoenix, AZ:

- *Management:* Arizona has the TIM Coalition through AZTech which is a multi-disciplinary partnership established in 2010 that includes state and local police, fire, EMS, towing companies, transportation agencies and metropolitan planning organizations. Specialized staff with direct access to resources are also a big help. They see Tennessee's TIM facility and Colorado's training as leaders in incident management.
- *Training:* Arizona always invites whomever the topic concerns.
- *Culture:* AZDOT and their management understand the goals of and the gaps of TIM. They are working to tailor existing and future strategies to fill the gaps.
- *Success:* Arizona considers their DOT's partnership with AZ state troopers as a major contributor to their success.

### Tennessee:

- *Management:* Tennessee relies upon the TDOT HELP Unit and the Tennessee Department of Safety and Homeland Security (TDSHS) for carrying out TIM.
- *Training:* Training includes DOT members, state-wide first responders, state-wide transportation employees, and law enforcement individuals. Multiple classes are held each year. In Tennessee, more specific situation issues have formed training targeted to specific responders.
- *Culture:* They were the first in the country to have a TIM pilot class in 2012 and as a result, the "Protect the Queue" program successfully averted 30% more secondary crashes its first year.
- *Success:* They believe that strong partnerships and availability to abundant resources which can then be utilized effectively have uniquely affected them and their level of success.

**(TIME Task Force) Atlanta, GA:** No responses received prior to the drafting of this document.

### Greater Philadelphia Region, NJ & PA:

- *Management:* Delaware Valley Regional Planning Commission (DVRPC) is the administrator of all TIM teams in their area.
- *Training:* They prefer to invite all partners to every training. DVRPC tailors their training around problems or situations that crop up from previous meetings and then discussion revolves around a case study of a post-incident report.
- *Culture:* The DVRPC serves as the champion in their area because they manage several TIM groups and furthermore, the public has come to expect them to take on this leadership role. DVRPC also fills the role of third-party mediator, not telling others what to do, but rather, seeking to understand perspectives for each situation and help with coordination.
- *Success:* DVRPC recognizes that putting the right people in the right room and having dedicated staff and funding allocated to consistently deliver results earns the trust of the region.

## Recommendations for Future Regional Traffic Incident Management

Comparing the region's current system challenges and critical needs with the identified components of ideal systems, the following gaps emerge.

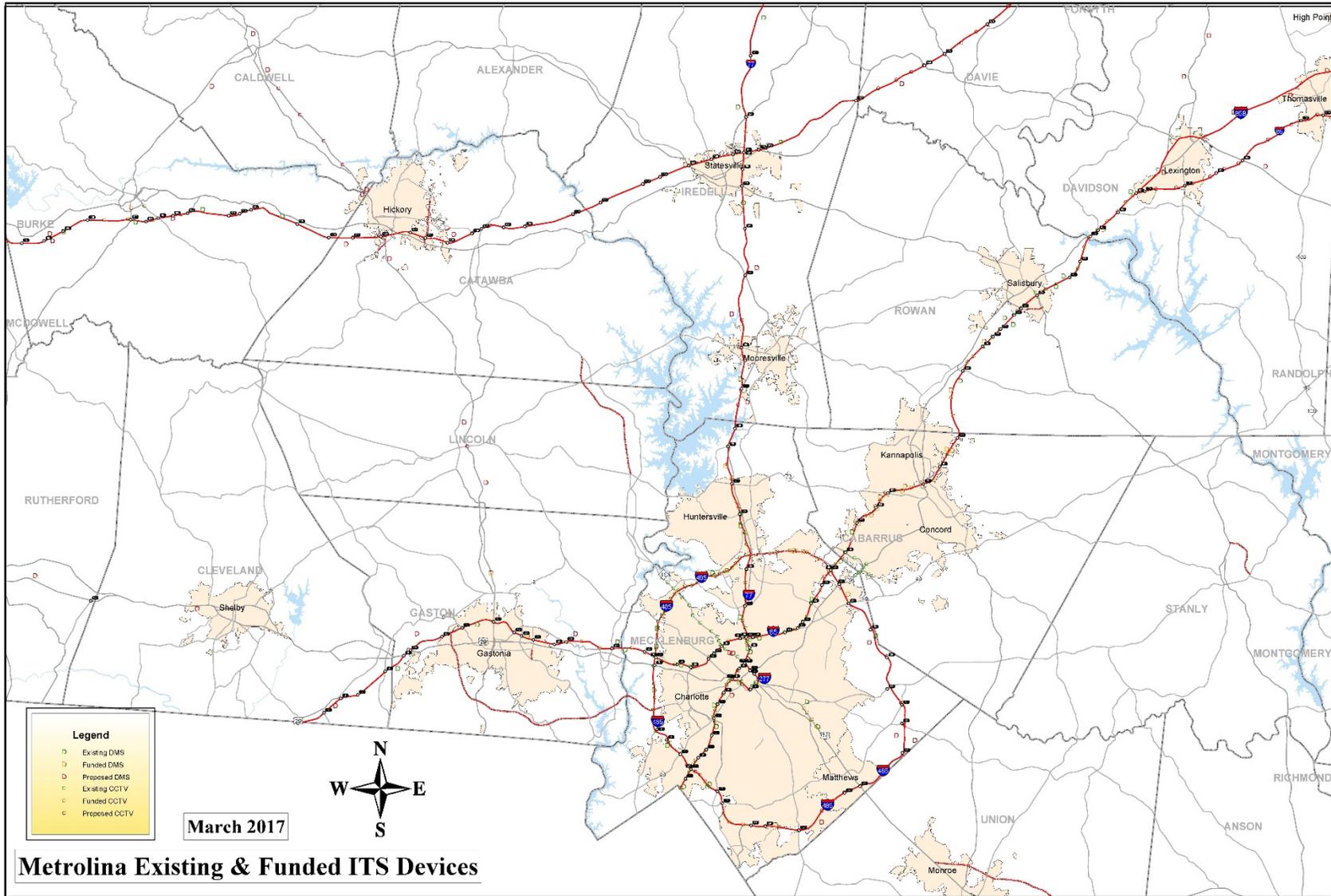
1. **Need for Regional Bi-State Coordination** – Local, regional, state, and national agencies need to plan together by developing a shared vision and platform for coordination that identifies incident management champions from among local, regional, and statewide stakeholders and is integrated with long term transportation planning efforts already in place. The Champion Group recognizes this coordination should be a specific element of the Regional ITS Vision, integrating ITS and TIM, to ensure that specific strategies are in place to support, long term, the recommendations included below.
2. **Improve Interoperability and Communications** – A regional effort should seek to connect local and state systems currently operating on different communication platforms, making the coordination among highway assistance providers, dispatchers, first responders, wreckers, and other stakeholders very challenging and prone to unnecessary delays and confusion.
3. **Training** – Coordinated training should be consistently developed and administered so that it honors the interests and perspectives across stakeholders and geographies. Additionally, a priority should be placed on the curriculum and trainers having credibility with the First Responder community.
4. **Culture** – Given the critical value of top down support for proactive and coordinated TIM practices and programs, TIM stakeholder organizations must seek, identify, and cultivate specific champions, ideally supported and promoted via broader coordination efforts such as that proposed in recommendation #1.
5. **Address Transportation Technology Changes** – The adoption of autonomous and connected commercial and personal vehicles could change the way TIM stakeholders interact with users/vehicles. The regional system is at varying levels of preparedness for this change, however, understanding the opportunities and challenges early on will help the region best take advantage of expected safety and efficiency gains, including opportunities to demonstrate and deploy freight specific opportunities (e.g.- geo-fenced freight bulk transfer activities and platooning), while mitigating unintended impacts to the transportation system.

## Summary

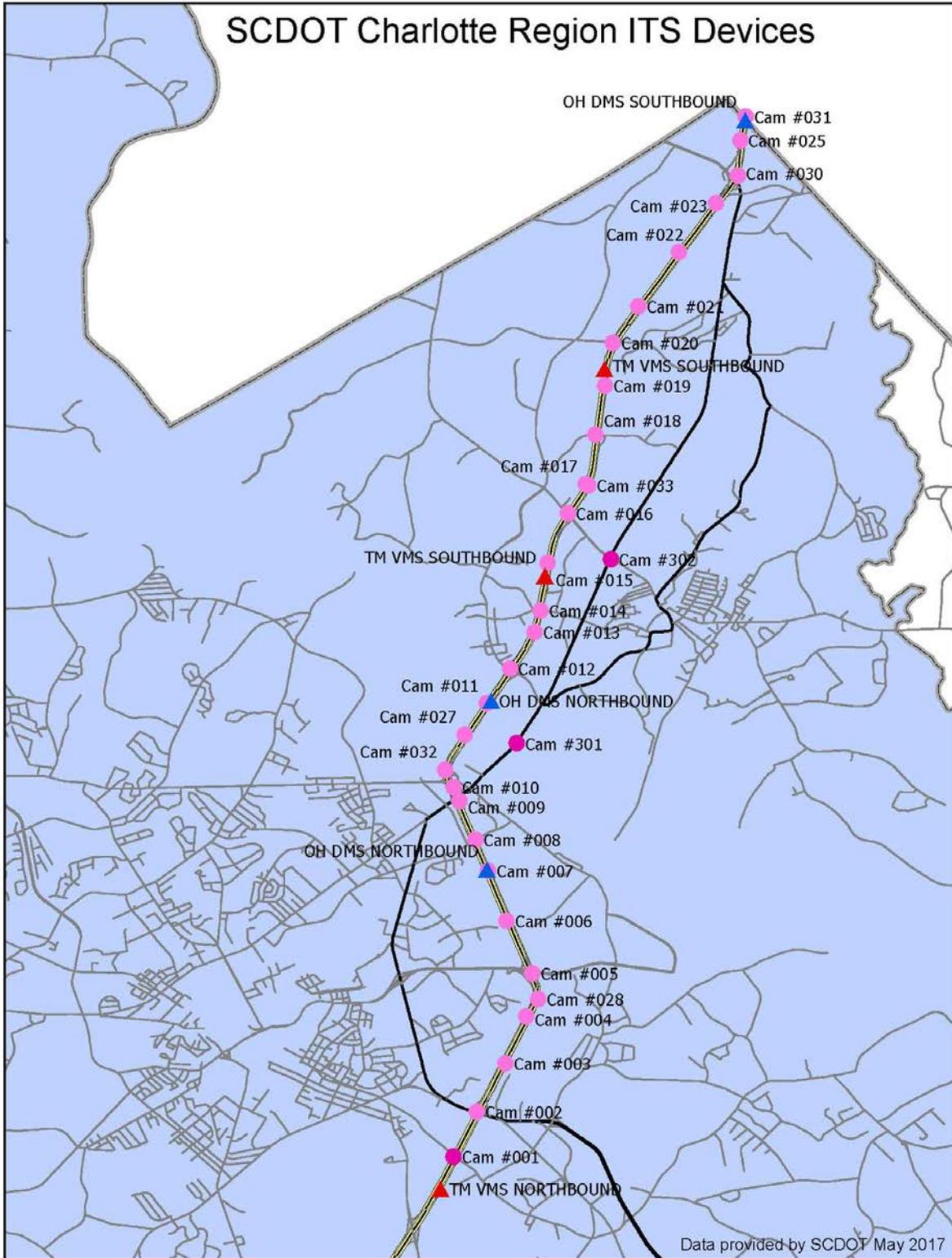
The freight transportation network in the greater Charlotte region is under pressure to provide safe, efficient, reliable and sustainable mobility with the reality of additional vehicles, aging and under-sized infrastructure, and connectivity gaps. Operating within a framework of ITS and TIM investments having the potential to significantly enhance the efficiency of the current transportation system through technology and coordination when compared to the cost of physical infrastructure improvements, the ITS/TIM Champion Group has assessed the status of these systems, reviewed what is working and not working in other regions, identified gaps in our region, and set forth recommendations for consideration. With this path laid out, transportation

system stakeholders and leaders must now decide on the allocation of resources required to sustain and grow the tools that highly functioning ITS and TIM systems represent for our region's mobility and ultimately, economic success and quality of life.

# Appendix A: NCDOT ITS Strategic Deployment in the Charlotte Region



Appendix B: SCDOT ITS Strategic Deployment in the Charlotte Region



## Appendix C: Summary of ITS Peer Research by Region

### Orlando, FL:

- Their lead organizations are MetroPlan Orlando and Florida DOT Division 5. They also partner with the FHWA, and the Orlando-Orange County Expressway Authority (OOCEA).
- Their ITS program was designed around the FDOT, not around a council of governments.
- They don't really look up to anyone as they pride themselves on having an advanced system that is constantly being updated. In addition, ITS is integrated into their local transportation planning processes, which determines that it is not forgotten in everyday work.
- Orlando uses dynamic messaging signs, a traveler information website, data integration and connectivity and an operations center among other various projects.
- Reporting capabilities are robust for Orlando with near-instantaneous reports made if needed, though not always 100% accurate. They have access to real-time information and can reroute and advise motorists regarding congestion through dynamic messaging signs, and a 511 call/website system.
- There are multiple networks within the region and right now there is difficulty in integrating those systems, due to the silos they are currently in.
- While they struggle with interoperability, MetroPlan Orlando is also busy planning the proper environment for connected and autonomous vehicles.
- A future of increasing interoperability and who is responsible for what resources has given them success in the past, and will continue to do so into the future. The biggest challenges they've faced have been communication and creating a sustainable integrated program and system for ITS.

### Disney World, FL:

- At Disney, Walt Disney World Transportation is the lead transportation authority within the organization. They do partner with Clever Devices but are currently in a bid process. They do not use ITS, but have a very similar process, which is why they were included.
- They are unique amongst those picked because this is a private company. They have essentially two fleets: one for people and one for cargo.
- They feel they are one of the leaders within the industry because they are so efficient at moving people and goods around quickly.
- They don't use ITS in everyday planning, but their fleets are flexible in where they need to be. They have consistent evaluation of efficiency in their system.
- Access to reports daily and history occurs weekly, while real time information is available instantly but it is only used on an exception basis.
- To move people around, they use dynamic message signs with a traffic radio information station for immediate needs. However, they don't have many roadway options for visitor reroutes unless they are planned.

- They have staff and law enforcement on property who can react to major traffic accidents.
- There are multiple networks in the area, but because Disney is a private company, they do not have a shared communication system. There are mutual aid agreements in place though. There has been no thought of ACV and if they ever do change to it, they will have to upgrade whole fleet sections (such as all buses, all monorail cars) in order to properly integrate them.
- Their success stems from flexibility, frequency, and reporting. And they aim for consistency along with their flexibility.

#### Los Angeles, CA:

- The Automated Traffic Surveillance and Control (ATSAC) Program of the Los Angeles DOT (LADOT) leads the ITS program within the City of Los Angeles. This program is self-dependent and is the umbrella for everything ITS. ITS is the basis of ATSAC, which is a main feature of the LADOT.
- The LADOT ATSAC program prides itself on being the first to use technology to support its transportation system. and coordination of ITS and therefore does not look to anyone else as a leader. ATSAC software is self-developed so that the city of Los Angeles owns the intellectual property rights for it and may use it however they want. ATSAC also is the multi-modal single-source infrastructure and technology platform for all projects involving traffic signal systems and ITS systems. They partner with CalTrans, FHWA, the State of California, METRO, Los Angeles County Department of Public Works (LACDPW), and other local governmental authorities.
- Their reporting abilities are near instantaneous, as long as it is information that the ATSAC has or that relevant sensors have. They do have access to real-time information within their system. In terms of re-routing traffic, the City of Los Angeles and Metro Regional Integration of Intelligent Transportation Systems (RIITS) have begun a website that is partnered with Google-WAZE for real-time traffic and congestion updates. In addition, METRO RIITS (with approval from one of its member agencies, LADOT) has agreements with news media, and other venues and outlets for real-time traffic information dissemination.
- There are multiple sophisticated ITS networks in the area and they do all share real-time information through LACDPW's Information Exchange Network (IEN), and METRO's Rail and Bus Operations Centers (ROC and BOC). In addition, there are plans to further integrate with the CalTrans District 7 Traffic Management Center (TMC), as part of CalTrans' Dynamic Congestion Corridor Management (DCCM) proposals, similar to the federal Integrated Corridor Management (ICM) efforts. LADOT has started examining the ACV technology and how they will integrate it into their current and future system.
- ATSAC and the LADOT attribute their success to a multi-modal but single technology platform and infrastructure host application usable to all ITS projects in the city (through ATSAC). They hope to continue their success through the ability to create a sustainable and adaptable system.

#### Phoenix Region, AZ:

- The leading organizations for the Phoenix, Arizona area are the Maricopa Association of Governments (MAG) and AZDOT. AZDOT created a Transportation Systems Management and Operations (TSM&O) Division and MAG has a current Systems Management & Operations study to integrate ITS into planning in the future. Their partner agencies are the Utah and Colorado DOTs. Currently, ITS projects receive funding from the local MPO or COG but MAG is including ITS within their daily planning operations in the future. There is commitment to constant improvement and projects reflect that with many pilots in progress. They also remain committed to ITS planning through constant coordination with partners as well. Their partners include MPOs' and COGs', surrounding counties and cities and the consultant industry.
- Reports can be generated quickly and there is access to real-time information. There is now a push by the DOT for more government entities to have access to the information provided through ITS. Information is distributed through the AZ511 platform. However, their current capabilities consist of dynamic message signs (DMS) as their primary method of communication, but the DOT is looking to pursue Integrated Corridor Management (ICM) strategies in partnership with local municipalities that are adjacent to their system. These DMS exist mostly in cities; the DOT and MAG are working to extend coverage to rural corridors as well. There are multiple ITS networks across the Phoenix metro area and there is a shared standard called the Regional Communication Network (RCN) established by MAG.
- Phoenix currently has a fiber network that will support ACVs, but once those vehicles go beyond current fiber boundaries, then they will experience problems. AZDOT aims to address this issue now by expanding the fiber network. They know that expanding their fiber network and identifying best practices and technology for increased integration and communication are keys to success for them. They would say that some of their best decisions would be having the foresight in laying fiber network throughout the buildup of the surrounding area.

#### Hampton Roads Area, VA:

- The leading organization for Virginia ITS is the VDOT with the Hampton Roads Transportation Operations (HRTO) Subcommittee. The state of Virginia is unique in that cities own and maintain nearly all roads within their boundaries, including designated US and state routes but not interstates. VDOT maintains all others. This means constant collaboration among state and regional authorities and transportation officials due to the way roads are owned there. They define VDOT and the HRTO subcommittee as leaders in ITS in their region.
- The HRTO Subcommittee is responsible for ITS (and) planning and they meet twice a month. They have done more at a regional level than at a local level though. They were some of the first in the country to use ITS and have a relatively complete plan in terms of data collection. They also have top end technology resources available. They partner with the Hampton Roads Planning District Commission (HRPDC), VDOT, Virginia State Police, and Williamsburg Area Transport.

- Reports are generated at specific intervals for regional use and they declined to tell if they had access to real-time information. They utilize detailed incident detour plans for all the freeway systems in the area and use DMS. They can inform motorists regarding congestion through the DMS, radio advisory system, traveler information call system and the accompanying website and phone app.
- VDOT maintains their regional ITS network and while most cities have their own ITS infrastructure, they are collectively working towards integration. Virginia is preparing the environment for ACV right now by maintaining facilities, creating a data portal, preparing statewide strategic plans, hiring an ACV program manager, and HRTPO is studying integration of the ACVs into the regional planning process.
- Success has been dictated by cooperation between cities and jurisdictions, continued maintenance and upkeep of the infrastructure and the motorist information systems listed above. They would like to think that planning, as well as the formation of the RCTO-TIM Committee has played key roles in their success.

#### Greater Philadelphia region, NJ & PA:

- The leading organization is the Delaware Valley Regional Planning Commission (DVRPC) which is also the region's MPO. DVRPC handles all coordination, while the devices are owned either locally, by county, or by the state. They are unique in that they have four full-time employees solely dedicated to the TSM&O committee that oversees ITS. They do look to the National Operation Center of Excellence, ITS America, local chapters of ITS, FHWA, North Central Texas COG, and Iowa for TSM&O inspiration that is tailored for their ITS program.
- TSM&O planning is an outset of their long-range plan for the region. It is integrated in terms of construction projects and planning. They have no control over what the states do, but the states are slowly recognizing the importance and improving. They are a champion for that integration in the region.
- The MPO implements much policy, direction, and coordination for ITS and whomever owns the devices are deeply integrated into the planning process. NJDOT, PennDOT, transit providers, the DHS, FHWA, and turnpike authorities are all considered partners to DVRPC.
- They don't have immediate access to information from devices since they do not own them, however, there is relatively immediate access to real-time information through a web-based database, Regional Integrated Multi-Modal Information Sharing Project (RIMIS) device and traffic information system that goes out to responders who can then utilize the information. They typically don't have much ability to advise motorists regarding congestion or routing since they do not own the devices.
- There are multiple ITS networks in the region, but the contact was unsure of whether or not there is a shared standard across them. There is preparation right now for the ITS network to be able to handle connected and autonomous vehicles, but how that will happen is unknown.
- Quarterly task force group for agencies, a regional ITS architecture written and followed for 18 years by the DVRPC to keep everyone connected, the RIMIS system,

and TIM teams have all contributed greatly to success. That they have their own ITS unit under the TSM&O committee, buy-in from the MPO board of directors, dedication and consistency have all underpinned their system that stands out from others.

## Appendix D: Summary of TIM Peer Research by Region

### Phoenix, AZ:

- AZTech is a regional traffic management partnership in the Phoenix Metropolitan area that guides the application of ITS technologies for managing regional traffic. They have specialized staff with direct access to resources through the AZDOT's TOC staffed with an AZ State Trooper for 20 hours, 6 days a week. AZTech has established a TIM Coalition. They look to Tennessee for their TIM training facility and Colorado for their quick clearance training.
- Now that they've just hired a TIM manager, they've done a round of train-the-trainers who're now spread throughout the state hosting their own training sessions. Training happens among DOT staff, DPS State Troopers, state-wide first responders and transportation employees. Whomever the situation concerns, they invite. There is anticipation for more detailed training regarding TIM, as it has not happened yet. TIM champions act as collaboration partners in establishing a statewide TIM program amongst all the groups concerned with TIM. Management understands what the goals of TIM are and the gap that needs to be filled. They are trying to figure out how to tailor existing and future strategies to fill that gap.
- Elements of their system that have contributed to success have been AZDOT's partnership with the AZ state troopers. Arizona desires to be a leading state for TIM and therefore, their actions and decisions are tailored to achieving that goal.

### Tennessee:

- Tennessee Department of Transportation HELP Unit and the TDHS are the leading organizations in Tennessee for TIM. They have the support of the Tennessee Highway Safety Office in obtaining Quick Clearance memorandums of understanding (MOUs). They look to TDOT Commissioner John Schroer and TDOSHS Colonial Tracy Trott as leaders in incident management.
- They hold multiple TIM classes per year, have had several train-the-trainer classes and two advanced TIM classes. Training includes the DOT, state-wide first responders, towing & recovery employees, media and law enforcement. All partners are invited to every class to bring diverse views on the situations. Detailed HAZMAT issues, some electric/hybrid vehicle training and heavy recovery training may be more targeted to certain responders. Tennessee was the first to have a TIM pilot class in 2012. As a result, the resulting "Protect the Queue" program successfully averted 30% more secondary crashes its first year. Management has familiarity with the people, resources, and training necessary for effective TIM programs.
- The fact that there is total buy-in of upper management, partnerships, excellent people, equipment and continuous interdisciplinary training has contributed towards their success. Strong partnerships, availability to abundant resources and their subsequent effective utilization has promoted success from within their program.

### Atlanta (TIME Task Force):

No responses received prior to the drafting of this document.

#### Greater Philadelphia region, NJ & PA:

- The Delaware Valley Regional Planning Commission (DVRPC) administers TIM teams who span 8-corridors and two states. They tend to look to Atlanta's TIME Task Force as a leader, saying Atlanta is very progressive.
- Training happens at every quarterly meeting, so with 8 task forces each having different meeting times, there are a minimum of 32 training classes held throughout the year. All participating stakeholders attend quarterly meetings plus any additional training classes that are outside of standing meetings. At the end of each meeting is a case study of a post-incident report.
- The role of DVRPC as TIM champion is that of managing the groups and there is an expectation from other agencies that they will continue to do so. Management at the DVRPC have total buy-in to this role, including financially. For instance, the Regional Integrated Multi-Modal Information Sharing project (RIMIS) was Congestion Mitigation and Air Quality CMAQ-funded so the opportunity to see the project through to completion, including long term maintenance was made possible through this commitment.
- The DVRPC acts as a regional third-party mediator which consists of being the consistent stakeholder coordinator and knowledge keeper for the region. By fulfilling this role, they have gained the trust of the community. This role is viewed as their most important within the TIM program.

## Glossary

**ACV:** Autonomous and Connected Vehicle(s)

**AZTech:** A regional traffic management partnership in the Phoenix Metropolitan area that guides the application of ITS technologies for managing regional traffic.

**CalTrans:** California Department of Transportation

**CATS:** Charlotte Area Transit System

**DMS:** Dynamic Messaging Signs

**DVRPC:** Delaware Valley Regional Planning Commission

**FHWA:** Federal Highway Administration

**Google-WAZE:** World's largest community-based traffic and navigation application

**HERE Technologies:** A company that transmits information from devices, vehicles, infrastructure and other sources into real-time location services. HERE data is widely used in ITS and TIM applications.

**IEN:** Information Exchange Network, Los Angeles, CA

**IMAP:** Incident Management Assistance Patrols, NC

**ITS:** Intelligent Transportation Systems

**LAATSAC/ATSAC:** Los Angeles Automated Traffic Surveillance and Control Program

**LACDPW:** Los Angeles County Department of Public Works

**MAG:** Maricopa Association of Governments, based in Phoenix, Arizona

**METRO:** Los Angeles County Metropolitan Transportation authority, a designated regional transportation planning agency

**Metrolina region:** The Charlotte metropolitan area including the principal cities of Charlotte, NC; Concord, NC; Gastonia, NC; and Rock Hill, SC

**METRO RIITS:** LA Metro Regional Integration of Intelligent Transportation Systems, which is sponsored by the County of LA, CalTrans, and LADOT among others.

**METRO ROC and BOC:** Rail and Bus Operations Centers in Los Angeles, CA

**MOU:** Memorandum of Understanding

**National Operations Center for Excellence:** A center based in Washington, D.C. designed to offer a suite of resources to serve the transportation systems management and operations (TSM&O) community, including technical services such as peer exchange workshops and

webinars, ongoing assessments of best practices in the field, and on-call assistance as well as a web portal.

**OOCEA:** Orlando-Orange County Expressway Authority, FL

**RCN:** Regional Communication Network in Phoenix, AZ

**RCTO:** Regional Concept for Transportation Operations

**RIMIS:** Regional Integrated Multi-Modal Information Sharing project is a web-based information exchange network connecting highway operation centers, transit control centers, and 911 call centers in the Delaware Valley region.

**SCAG:** Southern California Association of Governments

**SHEP:** State Highway Emergency Program, SC

**TIM:** Traffic Incident Management

**TDOT HELP Unit:** Tennessee Department of Transportation operates HELP trucks to minimize traffic congestion, promote the safe movement of people and products, and improve the travel environment.

**TDSHS:** Tennessee Department of Safety and Homeland Security

**TMC:** Traffic Management Centers

**TSM&O:** Transportation Systems Management and Operations