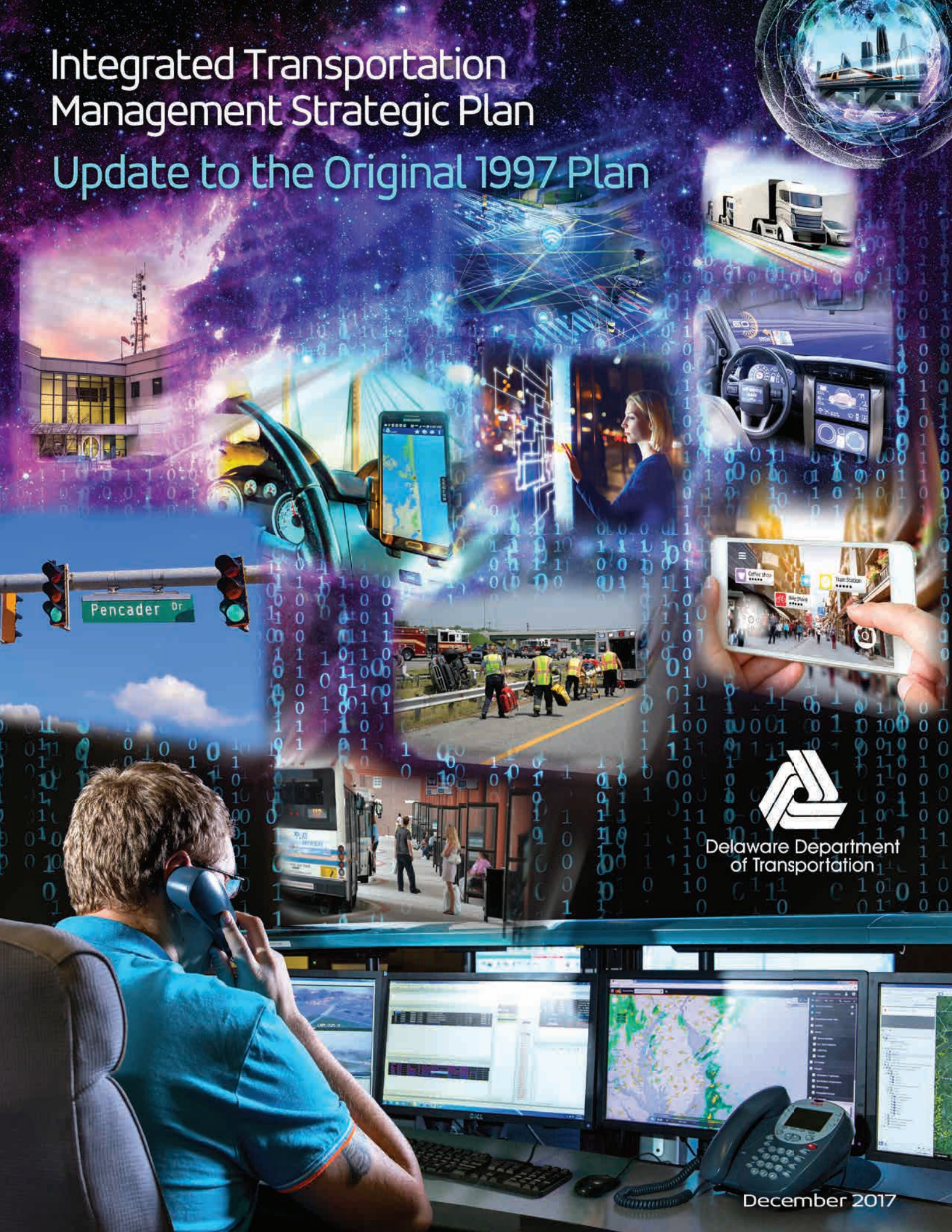


# Integrated Transportation Management Strategic Plan Update to the Original 1997 Plan



Delaware Department  
of Transportation

December 2017

## EXISTING ITMS DEVICES & TELECOMMUNICATIONS



### LEGEND

- Traveler Information Devices
- Systems Monitoring Devices
- Operations / Control Devices
- Telecommunications

# Delaware Department of Transportation Integrated Transportation Management Strategic Plan

2017

Production of this document made possible with the help of these consultants:

Rybinski Engineering    Jacobs    Remline

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# I. EXECUTIVE SUMMARY

## What is integrated transportation management?

Integrated transportation management is the Delaware Department of Transportation's (DelDOT) way of doing business – integrating technology, infrastructure and people to achieve mobility, safety and security goals. The program is designed to support all modes throughout the Department.

## Key attributes

### Making the most of the transportation system

Managing infrastructure to fully realize the greatest return on investment

### Ease of implementation

Rapid deployment solutions producing immediate return on investment with limited system disruptions

### Customer experience

Providing real-time traveler information, allowing for informed mode, route and travel choices

### Safety

The ability to monitor, control and inform provides a critical foundation

### Innovation

Organizational and technological solutions that go beyond traditional approaches

### Flexibility

Easily adapted to technological and environmental changes

### Affordable

Estimated less than 4% of the state's annual capital transportation budget

### Positions us for the future

Adaptable nature allows for easy transition to future needs. Innovation and creativity are encouraged to enhance mobility. Positions Delaware to readily facilitate connected and autonomous vehicles and integration with future information technologies.

## Key elements

DelDOT's transportation management program is complex, involving the integration of numerous systems, concepts and programs, which are discussed in Chapter VI.

- Collaborative Approach
- Transportation Management Center
- Traveler Information
- App / Social Media
- Transit
- Transitioning to Operations and Maintenance
- Telecommunications and Information Technology
- Computerized Traffic Signal System
- Monitoring
- Transportation Weather and Flood Monitoring and Warning System
- Integration of Operations and Planning
- Congestion and Mobility Management
- Incident and Event Management
- Transportation Management Team
- Emergency Response Units / Motorist Assistance Patrol
- Transportation Homeland Security



## History of transportation management in Delaware

In 1997, DeIDOT published its initial Integrated Transportation Management Strategic Plan, with the vision to:

- Reduce congestion and delay
- Improve safety
- Reduce operating costs
- Improve system performance

## Today's plan recommends continuation of the same strategies, which are still relevant in 2017

- Create the necessary infrastructure to support transportation management
- Disseminate real-time, accurate information and allow customers to make informed decisions regarding travel route, travel time and mode choice
- Develop partnerships to support transportation management activities
- Develop internal capacity to support transportation management

Specific next steps for each strategy are recommended in today's plan to represent current conditions and opportunities.

## Recommendations

Researchers and practitioners agree that successful transportation management programs are integrated and standardized. In pursuit of transportation management excellence, DeIDOT should implement the following recommendations:

- Expedite implementation to accelerate transportation management return on investment
- Establish a succession plan for transportation management leadership
- Allocate resources to enable operations and maintenance
- Support a culture of continuous improvement with clear targets and incentives
- Maintain awareness of industry best practices and new developments beyond existing conventions

## Integrated transportation management approach

DeIDOT continues to advance transportation management in priority order of maintaining what we have, finishing what we started and integrating new opportunities.



## II. WHAT IS TRANSPORTATION MANAGEMENT AND WHY IS IT IMPORTANT?



# What is Transportation Management and Why is it Important?

The Delaware Department of Transportation's (DelDOT) Integrated Transportation Management program is designed to support all modes throughout the Department.

## Quoting the Federal Highway Administration's (FHWA) 2015 Benefit Cost Analysis for Transportation Systems Management & Operations (TSMO)

"Large infrastructure construction projects are typically characterized by: long construction periods; complex and uncertain costs; and high levels of transportation system disruption. These factors and others typically result in project benefits exceeding project costs by small margins. Decision makers are used to seeing benefit cost ratios (BCR) for these projects in the single digit range. On the contrary, TSMO projects have relatively lower costs, short construction periods and few dis-benefits. BCRs for TSMO projects are often in the two and three digit range."

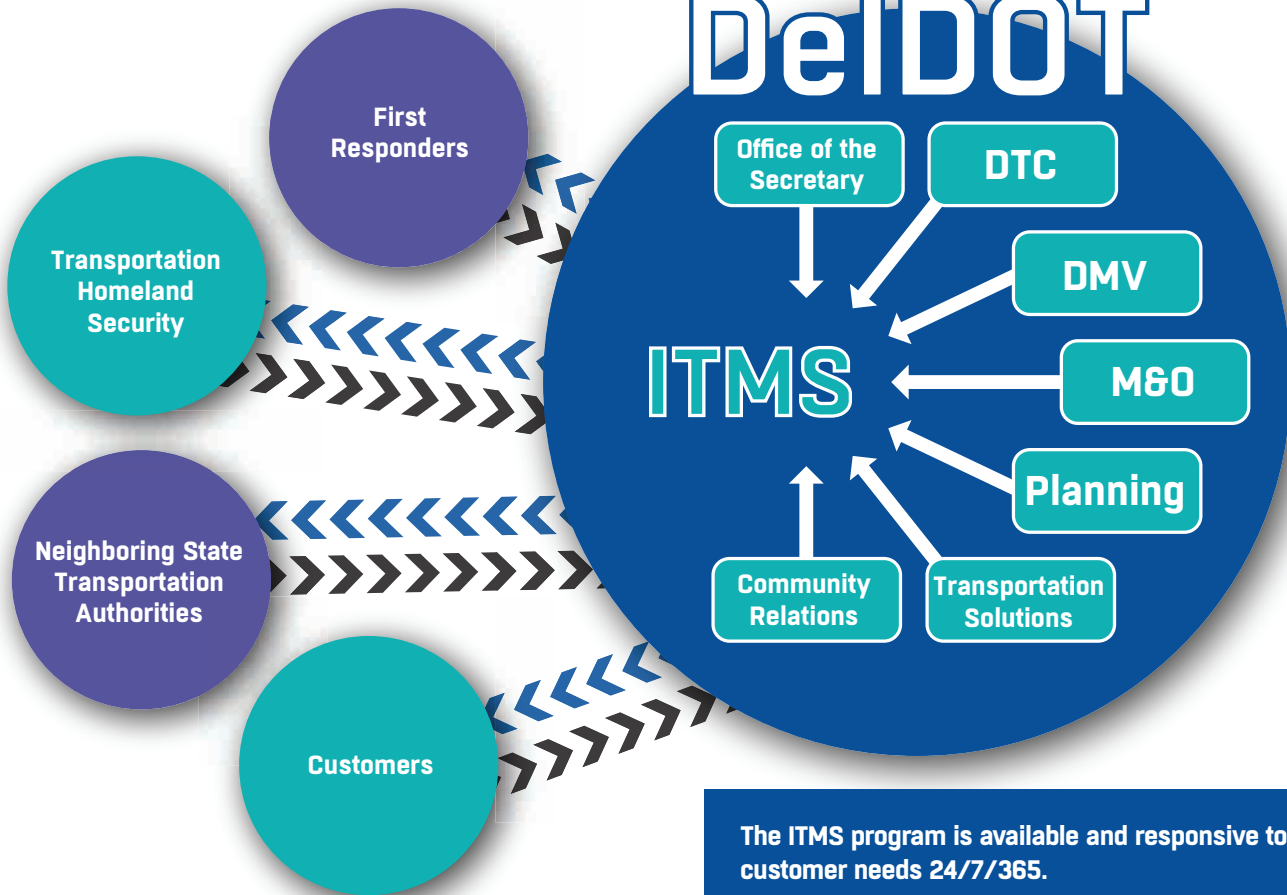
Transportation management is DelDOT's way of doing business – integrating technology, infrastructure and people to achieve mobility, safety and security goals. Transportation management is also a quick and adaptive tool that yields immediate results.

Many people think of the Integrated Transportation Management program as the Transportation Management Center (TMC). It is true – the TMC is both the visible brick and mortar center as well as the symbolic center of Delaware's Integrated Transportation Management program – but transportation management is also so much more than the TMC itself. It is the hundreds of projects, programs and daily collaborative team accomplishments that make the most of Delaware's multimodal transportation system. By using technology to monitor and exchange real-time information, and employing innovation as standard practice, a variety of teams manage the entire state's multimodal system around-the-clock. Data is collected constantly to keep track of the dynamic nature of travel conditions, and decisions are made frequently to control the transportation system. Information is shared so that DelDOT's customers themselves are part of the solution.

A leader in the nation when it comes to transportation systems management and operations (TSMO), DelDOT embraces the collaborative approach. DelDOT is unique in the ways it does business, as integrated transportation management is built into many things the department does. Each and every aspect of the transportation management program – from the infrastructure and technology, to the people, to the data and information – touches all other aspects of the program. The program has been built into planning, capital project development and design so that every program and project, when appropriate, includes technology and telecommunications.



# DeIDOT



**The ITMS program is available and responsive to customer needs 24/7/365.**

Internally, the transportation management program is hardwired into every aspect of DeIDOT. Rather than operating as a separate division, it is an integral part of all aspects of the department from planning and design to operations, maintenance and services.

Externally, the Integrated Transportation Management System (ITMS) program enjoys cooperative integration with Police, Fire and EMS; coordinates directly with federal, state and local authorities in response to security threats; and neighboring state transportation authorities to effectively manage transportation-related events and incidents across state lines.

That's not all... transportation management addresses recurring congestion as well! By monitoring multimodal transportation conditions real-time statewide, DeIDOT provides travelers with the information they need to make informed decisions. At the time of this writing, over a dozen types of traveler information are provided real-time on DeIDOT's website and DeIDOT App.

## For Delaware, why does transportation management make sense?

### 1. Making the most of the transportation system

No matter what DeIDOT builds, it needs to be managed. Even when we build new infrastructure, we still have to manage it in order to fully realize the benefits of the investment. The chance of non-recurring incidents and events will always be a consideration.

Transportation management is DeIDOT's #1 tool for mitigating non-recurring congestion. In December 2014, the News Journal reported that the region brought in \$68 million attributable to the Firefly Music Festival 2014. The managers of Firefly scrutinized the event's mobility carefully to ensure customers would tolerate travel times. DeIDOT continues to effectively manage the event's non-recurring traffic.



# What is Transportation Management and Why is it Important?

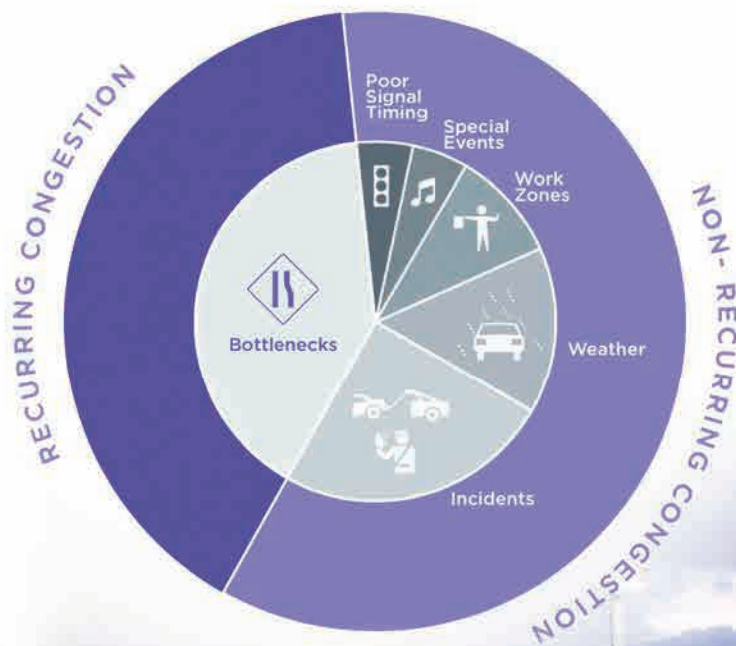
The same information is used in-house to perform proactive transportation management:

- Technicians at the TMC continuously monitor conditions and adjust traffic controls and/or manage resources and provide real-time information around the state to optimize mobility
- The traffic signal system adjusts its operation based on demand and delay

Another example of making the most of DeIDOT's resources is the Integration of Operations and Planning. Through the transportation management program, DeIDOT brings together its planners and operators to co-create and share data collection strategies. For as long as any of us can remember, planners and designers have commissioned project-specific traffic counts, or simply have gone without fresh data, in estimating existing and future conditions. Today, through the work of the Integration of Operations and Planning Advisory Committee and its

working groups, it is routine business for project teams to save thousands of dollars by conveniently pulling shared data from the DeIDOT Extranet rather than commissioning new data collection. Beyond just sharing data, DeIDOT is innovating the role of operations data in supporting major planning decisions.

The TMC experiences the state's recurring traffic congestion issues hands-on with fresh data every day. By using operations data to perform project prioritization, DeIDOT can evaluate the whole state consistently with continuous 24/7/365 data such as travel times, traffic demand and capacity. This continuous approach neutralizes the issues of a peak period in one county not being the same as another or incident frequencies being worse at some locations. With continuous data streams, we can study not only how bad congestion gets at various locations, but how often congestion gets bad.



**For the DE 141 Transportation and Land Use Plan, the project team used nearly 100% data collected by the TMC or shared by the Extranet. The TMC's ability to provide travel time, traffic volume, truck percentages, and trip distribution data 24/7/365, throughout the project, totally revolutionized the project team's ability to more accurately represent travel conditions along the corridor.**

Source: Federal Highway Administration



## 2. Ease of implementation

With transportation management, we can do something today! Even as we plan and design long-term solutions, we can invest today and see an immediate return on investment. Quoting FHWA's 2015 "Benefit Cost Analysis for Transportation Systems Management & Operations," transportation management solutions are characterized as having "rapid deployment with limited system disruption."

One great example of an easy and effective transportation management tool is traffic signal timing improvements. DeIDOT's computerized traffic signal system is the most powerful tool for transportation management on a day-to-day basis. DeIDOT has state-of-the-art traffic signal software that integrates with its other data systems such as traffic monitoring, incident management and in the near future, transit operations. DeIDOT has reliable, remote connectivity to most of its traffic signals to monitor and adjust timings real-time.

**In 2017, DeIDOT's Signal Timing Team retimed 20 corridors encompassing 164 traffic signals. DeIDOT also brought 23 intersections on to the computerized traffic signal system.**

Most everyone drives through traffic signals in Delaware; it is unusual to get around without passing through one! For this reason, the traffic signal system is the state's single most impactful tool for affecting mobility. With a small, dedicated team, signal timings on a single corridor can be fully implemented in as fast as two weeks.

If two weeks seems fast, think of two minutes! During incidents and events, the TMC is DeIDOT's single point of response for managing impacts to the transportation system. When Hurricane Irene brought unprecedented amounts of rain and wind in August 2011, there was a great deal of public anxiety leading up to the storm. It was difficult, if not impossible, to travel during the storm, and the resulting damage to the transportation system was significant. Foiling the negative aspects of the experience, DeIDOT's transportation management system shone bright. The Governor was able to make good decisions about evacuations and bridge closures based on real-time road surface and traffic data. The TMC optimized mobility with traffic signal control to aid evacuations across state lines. Long-nurtured relationships within emergency response teams were called on for extraordinary teamwork and cooperation.

The ease of implementation will only get easier. DeIDOT's entire transportation management program was built with a strong foundation that is relatively easy to enhance. DeIDOT has held firm in its resolve to build an open information architecture. Despite software and data packages offered through the industry, for which agencies pay third parties for transportation data, and which can be tempting for a "quick win," DeIDOT has insisted on owning and processing its own information to ensure accuracy and sustainability. As a result, the options to view, analyze and store the transportation data are limitless, with the ability to add additional functionality as DeIDOT owns the source code without having to pay the high cost of having a third party vendor to modify the software.

**The return on DeIDOT's investment in fiber optic telecommunications is beyond measurement. It is profoundly beneficial to DeIDOT, all state agencies and the region.**

Equally important, Delaware's Department of Technology and Information (DTI), Division of Communications (DivComm) and DeIDOT have co-created a robust state-owned telecommunications network. Telecommunications is behind everything we do (and will do), from moving enormous amounts of real-time data to enabling critical executive management communications during severe incidents. A critical part of the approach is ensuring cyber security, which is a priority at the federal and state levels. Investment in state-owned fiber and wireless solutions is a future-proof investment that provides long-term control over cost and outstanding government services.



## 3. Safety

Safety has always been and will always be of paramount importance to DeIDOT's transportation management program.

Traffic signals are very visible tools that are used to promote a safe environment. Having a well-timed and coordinated signal system with appropriate cycle lengths, green times, change and clearance intervals reduces the risk of accidents caused by red light running and rear-end collisions at intersections. The TMC monitors traffic signals to ensure they are operating appropriately, and dispatches field support in case of power outages. Having the ability to detect and respond to conditions in real-time, including an organized approach to incident management, is critical for both day-to-day operations as well as in times of large-scale event management.

Detecting and responding to incidents as soon as possible not only helps those involved in the incident, but also reduces the risk of secondary incidents occurring. Transportation management includes using both technology, such as detectors, and human inputs, such as from stakeholders, field personnel and the public to identify areas in need of response.

**DeIDOT will safely manage the transportation system, from planning and design, to operations and maintenance.**

DeIDOT has strong relationships with police and fire, and has direct computer-aided dispatch (CAD)-to-CAD connections with these partners. Direct CAD-to-CAD connection allows for faster incident notification.

Managing day-to-day safety includes deployment of technology such as cameras and detection to monitor construction and work zones. An example was the implementation of the ITMS strategies for the Newport Viaduct project on Route 141 in advance of project construction. Monitoring the real-time travel conditions during construction allowed DeIDOT to make adjustments, such as signal timing to manage off-ramp queuing and modified signage to guide drivers safely through the work

zone. DeIDOT also uses variable speed limit signs to adjust to real-time travel conditions such as weather or congestion and incidents.

Through the Transportation Management Team (TMT) program, DeIDOT involves emergency responders in the planning for large scale construction projects which may impact emergency response and allows for adjustments to be made in dispatching and responding.

As the vehicle-to-infrastructure aspect of connected vehicle technologies evolves, a key DeIDOT role is to provide and receive transportation information related to the safety and efficiency of the transportation system. New vehicle-to-infrastructure deployments may require close coordination with vehicle manufacturers.

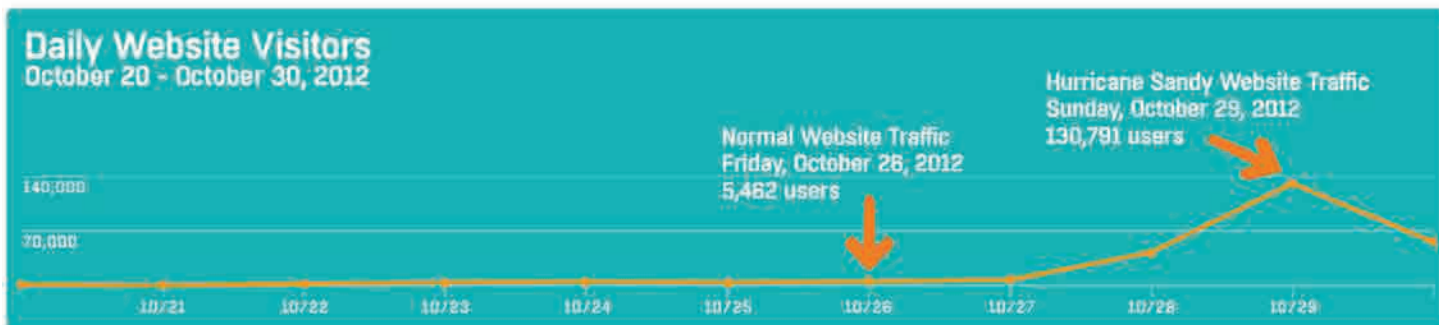
## 4. Customer experience

The transportation management program is DeIDOT's front line. DeIDOT's TMC handled over 48,000 calls in 2016, ranging from debris in the road, to traffic signal complaints to traffic incident support. Addressing these matters as expeditiously as possible reduces the chance for secondary incidents, resulting in a safer transportation system for the traveling public including emergency responders.

When customers are not on a call with DeIDOT, they may well be online. Traveler information is accessible through the website, radio and DeIDOT App. Normal website users are in the 5,000 range per day; in the case of a severe incident impacting the transportation system (e.g. Hurricane Sandy), multiply that by a factor of 25—more like 130,000 users in a day! The advancement of the DeIDOT App has also been a huge accomplishment and customer surveys indicate trust and continued interest in getting more and more information.

DeIDOT is also getting more proficient at two-way communication with the public. The public has easy access to "Report an Issue" through the DeIDOT App. Additionally, a lot can be learned in real-time just by tracking comments on DeIDOT's Twitter, Instagram or Facebook pages.

For customers needing help in person, DeIDOT has a Motorist Assistance Patrol that operates seven days a week during rush hour on interstates and select routes.



To supplement this service during major incidents or weather events, DelDOT has a team of skilled transportation specialists who staff Emergency Response Units (ERUs).

ERUs are ready to be deployed at short notice to provide specific support or direct services to motorists that need assistance during events that affect the transportation system. ERUs patrol the transportation system in assigned areas and report any and all incidents or disruptions to traffic, including traffic delays and roadway condition information to the TMC. Travel delays have both safety, quality of life, environmental and economic ramifications, which is why having response forces in the field is so important.

As if these customer experiences aren't enough, transportation management also puts money in peoples' pockets! Time is money. With the build-out of monitoring devices statewide that track real-time travel times, we are increasingly able to measure the savings with great accuracy.

Just quickly looking at the signal retiming program alone, it is common to save minutes of travel time along a corridor by optimizing its signal timings. Time saved during travel can translate to decreased travel costs and increased quality of life for Delaware's travelers.

Not only is value of time a key metric, fuel savings, impacts on economy (efficiency of goods movement), and environmental benefits are too.

## 5. Innovation

One could argue the very purpose of the transportation management program is to be innovative, and to use innovative solutions, both organizationally and technologically, to manage transportation in ways traditional approaches cannot. The result is a cost-effective, maintainable and expandable transportation system. Transportation management involves the application of 21st century technology and teamwork to get the most out of our transportation system. While the list goes on and on, the following are a few choice examples of innovation in transportation management:

- Due to technology and the way we do business, for special events DelDOT uses continuous data that allows us to adjust the system and the routes to manage changes in demand. DelDOT's comprehensive monitoring system provides the historical data to enable effective studies in advance of the event.
- By integrating transit operations with highway operations, transit gets advantages that enhance individual experiences and may ultimately enhance ridership. Two-way communication of real-time

Corridor Retiming	
Time Savings: 1-3 minutes per vehicle in rush hour conditions	
Old Baltimore Pike	August 2017
State Street	November 2016
DuPont Parkway US 13 Middletown	June 2016
Limestone Road DE 7	April 2016
Division Street DE 8	November 2015
Naamans Road DE 92	July 2015
Concord Pike US 202	February 2015
Pulaski Highway US 40	August 2014
Salem Church Road	April 2014

information can enable operators to make en-route adjustments based on traffic conditions, and can enable direct and efficient notifications of security issues.

- By focusing resources in a non-traditional manner on web services and social media, DelDOT developed a multimodal, trusted traveler information App for personal devices. The DelDOT App is effective and will be continuously enhanced. It has a much greater chance at reaching high percentages of travelers in the region compared to individual signs in the field. Managing vehicles around a bottleneck by providing travelers with information during extreme conditions can mitigate traffic at a far lesser cost than removing the bottleneck altogether. And let's face it, we will always have to live with bottlenecks.
- By leading collaborative efforts with other state agencies, DelDOT is building a robust state-owned fiber and wireless telecommunications network that is highly reliable, even during severe storms that disrupt other telecommunications systems provided by private carriers. By coordinating this work with neighboring states, Delaware is working to facilitate a regional telecommunications system, which by design will provide the capability to connect public agencies from northern Virginia to New York City.
- Real-time monitoring and control – fundamentals of transportation management – are necessary for pushing the envelope with solutions such as part-time shoulder use, which effectively adds capacity by using shoulders as travel lanes.

## 6. Flexibility

The flexibility of DeIDOT's transportation management system has allowed it to take shape over the years true to its original vision stated in the 1997 Strategic Plan, while adapting to technological and environmental changes. Delaware has had phenomenal execution of its original transportation management goals to: reduce congestion and delay, improve safety, reduce operating costs and improve system performance.

One thing not known in 1997 was the profound impact 9/11/01 would have on transportation. We realized that our nation's transportation system could be used as a weapon and a target. DeIDOT's transportation management program easily adapted to the changes and new requirements that came after 9/11.

Today, on a day-to-day basis, security threats can trump all other business in the transportation management program, and the team at the TMC adjusts dynamically to meet needs as they arise. In a category all its own, DeIDOT managers work with local and national partners to build, maintain and operate a resilient transportation system with redundancy and flexibility.

**After 9/11/01, new tasks required were adaptations of business already going on in the transportation management program: monitoring, information sharing, incident management planning, hardening and securing transportation infrastructure and teamwork in operations.**

An example of the flexibility of DeIDOT's transportation management program was the closure of Bridge 1-813 on I-495 over the Christina River in 2014. The role of DeIDOT's TMC was emphasized as the focal point for managing incidents. Even with an incident this severe, the TMC's routine protocols were flexed to manage the situation. The Department's monitoring program, including permanent and portable devices, was used to collect real-time traffic conditions. Then, traffic signal timings and intersection configurations were adjusted at several intersections throughout the City of Wilmington to accommodate increases in demand. This was an interactive process with the TMC serving as the focal point of communications, coordinating locally and regionally and working closely with Community Relations to field public inquiries with factual information. The TMC used the monitoring system that was already in place to obtain and disseminate timely and accurate information. The reason we could communicate so effectively is because we have the system. Without ITMS, it would have been a totally different story.

The DeIDOT transportation managers adjust and readjust priorities constantly based on what's going on at the moment. The program has everyday duties and projects that are planned in advance, plus additional work comes and goes in varying degrees as a variety of incidents occur throughout the state. Constant adaptation is just part of the job.



## 7. Affordable

The benefits of transportation management come on a relatively low budget. Historically, DelDOT's transportation management program (listed as Transportation Management Improvements (TMI) in the capital transportation program) has comprised 1-4% of the state's capital transportation budget.

ITMS impacts the whole state; all future projects will benefit from it. ITMS includes a variety of beneficial projects and daily operations each year for this relatively small amount of money.

Also important is the source of funds – much of ITMS is eligible for federal funding – in particular, Congestion Mitigation and Air Quality Improvement Program (CMAQ) funding because of the direct benefits ITMS brings to mitigating congestion and improving air quality.

While large infrastructure construction strategies are typically used to add system capacity to address mostly recurring delay, transportation management strategies often employ multiple synergistic strategies to reduce recurring and non-recurring delay and improve system reliability. ITMS can help to delay the need for major projects.

Due to the integration that occurs throughout DelDOT's transportation program, strategies have synergistic benefits. The whole system gets stronger whenever an individual element is enhanced or added. With the appropriate minds at work in a supported manner, the full potential of the program will eventually be realized. Performance we see today is really just a margin of what DelDOT's transportation management program is equipped to do.

<b>Transportation Systems Management and Operations (TSMO) Compared to Large Infrastructure Construction Strategies</b>		
<b>Benefit/Cost Factors</b>	<b>TSMO Strategies</b>	<b>Large Infrastructure Construction Strategies</b>
<b>Life Cycle Costs</b>	Periodic low cost infrastructure replacement required	Most cost incurred with initial construction
<b>Deployment Time</b>	Rapid deployment with limited system disruption	Often multi-year projects with high system disruption
<b>Maintenance/Upgrades</b>	Requires on-going operations and maintenance with associated staff and software for real time monitoring and control. Lower relative costs of system upgrades compared with traditional civil infrastructure projects, but done more frequently.	Recurring maintenance of assets, major improvement 15-20 year period
<b>Synergies from Applying Multiple Strategies</b>	Synergistic benefits realized from multiple projects	Commonly a single project, may have multiple phases

*From FHWA's 2015 "Benefits Cost Analysis for Transportation Systems Management & Operations"*

## 8. Positions us for the future

Because of its adaptable nature, DeIDOT's transportation management program is well-positioned to transition into whatever the future holds. DeIDOT will continue to stay abreast of industry trends and research; this forward-thinking philosophy will help Delaware to maintain competitiveness in the global economy. DeIDOT will always focus on innovation and creativity, striving to find better, more efficient ways to enhance mobility.

**We are implementing the first connected corridor along US 13 in Smyrna and implementing machine learning (artificial intelligence) for incident detection and operational adjustments (e.g., signal timing changes and alternate routing) in the I-95/DE 1/US 40/DE 896 area in Newark.**

DeIDOT's latest explorations in emerging technology include unmanned aerial vehicles (UAVs), connected and automated vehicles, and machine learning (artificial intelligence).

The use of unmanned aerial vehicles (UAVs), or drones, may be game-changer in the transportation world. DeIDOT has developed a UAV program, purchased UAVs, and has begun using them for incident and emergency management purposes. Anticipated future uses include traffic/incident monitoring, data collection, verification for wireless suitability, equipment/infrastructure inspections, hazard assessments, and the integration of thermal imaging/infrared technology.

In September 2017, Governor Carney signed Executive Order 14, establishing the Advisory Council on Connected and Autonomous Vehicles. The executive order calls for the establishment of an Advisory Council tasked with developing recommendations for innovative tools and strategies that can be used to prepare Delaware's transportation network for connected and autonomous vehicles. Subcommittees for each of the following topic areas have been established and the Advisory Council will report back to the Governor in September 2018 with findings and recommendations in these areas:

- Promoting economic development
- Technology, security, and privacy
- Transportation network infrastructure
- Impacts on public and highway safety

DeIDOT is uniquely able to be a test bed and early achiever in the realm of connected and automated vehicles. The state-owned telecommunications system has robust existing and planned coverage, bandwidth and performance which will be able to accommodate



*Artist's rendering of connected and autonomous vehicles in Delaware*

the transmission of the large amounts of data expected from connected and automated vehicles (CAV) integration. The strength and reliability of the telecommunications backbone will be key success criteria for connecting infrastructure and vehicles. DeIDOT is planning to deploy both roadside infrastructure and on-board vehicle units in fleet vehicles to begin validating the technology and implementing the infrastructure and applications that will allow DeIDOT to utilize connected vehicle data. The DeIDOT App is another way to take in useful data and distribute it back to transportation users. The hope is to improve the transportation system's performance and the vehicle's control system in real time to improve mobility, reduce congestion, improve fuel economy and reduce emissions.

DeIDOT is exploring machine learning (artificial intelligence) traffic management and control software which would be integrated into TMC operations. The software will detect traffic anomalies, send warnings, find solutions and predict impacts for future events. This technology will ultimately allow DeIDOT to be quicker and more nimble in response to varying conditions within the system by automating monitoring and control functions within the TMC.



### III. PLAN OVERVIEW



This document is many things to many people. First of all, this Strategic Plan is a comprehensive summary of Delaware's Integrated Transportation Management program. Secondly, this document provides status on individual elements within the program. Thirdly, this document is designed to provide individual quick-reference sheets on featured topics. Lastly, this Plan is a call to action for investments and teamwork for Delaware to continue realizing the value of its Integrated Transportation Management program – a value that grows exponentially as the system is further built and integrated.

It is important to note that today's plan recommends continuation of the same strategies identified in the original 1997 Strategic Plan. Specific next steps for each strategy are recommended in today's plan to represent current conditions and opportunities.

The Delaware Department of Transportation (DelDOT) has done a lot of things right to get us to this point. First of all, the state's transportation team has an advantage of "operating under one roof" – both functionally and geographically. Since most transportation functions in the state are performed by DelDOT (e.g. aeronautics, rail, tolls, transit, vehicle registration), and nearly all roads are owned, operated and maintained by DelDOT, the Department is able to make positive changes without the organizational obstacles other states struggle with.

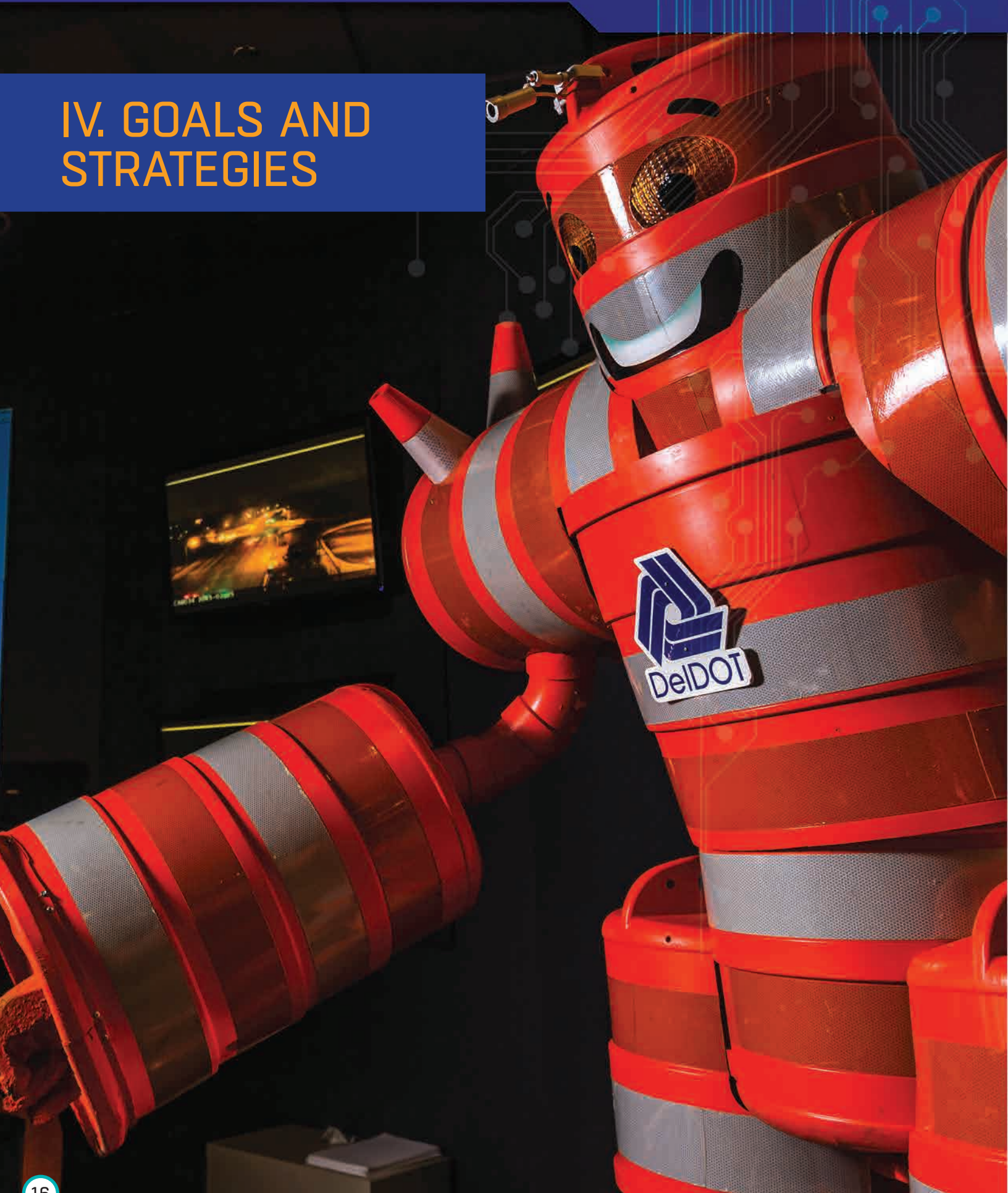
Another key to DelDOT's success has been mainstreaming the program, so that all stakeholders are involved. Instead of growing the number of personnel in the Transportation Management Center (TMC) (where the overall program is managed), DelDOT has continued to coordinate and train existing planning, design, construction and maintenance resources throughout the Department to perform Integrated Transportation Management System (ITMS) work. DelDOT has made similar commitments to regularly coordinate with its external partners (e.g. Delaware Emergency Management Agency (DEMA), police, fire, Division of Communications (DivComm), etc.), so that the program is truly a team effort.

A third key to DelDOT's success has been the philosophy of building an open information architecture. The options to view, analyze and store transportation data are limitless. The prime reason DelDOT built the monitoring system is to operate the system and to effectively operate, we need a variety of data. A tremendous secondary benefit of our monitoring system is the valuable data that benefits planning.

This Plan describes the original vision, goals and strategies for DelDOT's ITMS program, maps the successes and identifies what's left to do. Because of the integrated nature of the program, investments should not be considered a menu of options. To be successful and truly achieve the original vision, we have to do it all.



## IV. GOALS AND STRATEGIES



The purpose of the 1997 Delaware Integrated Transportation Management Strategic Plan was to guide the implementation of the integrated transportation management system and traveler information projects in a way that meets the state's transportation needs. The purpose of this 2017 Strategic Plan Update is to carry out the same goals and strategies in the context of current conditions and opportunities.

## Strategies

The 1997 Strategic Plan identified the following four strategies with associated actions to guide the implementation of transportation management in Delaware.

### 1. Create the necessary infrastructure to support transportation management

- Implement a centralized Transportation Management Center (TMC)
- Implement real-time transportation control systems that reduce congestion and increase mobility
- Monitor the transportation network to assess system performance
- Establish a dependable communications infrastructure

### 2. Disseminate real-time, accurate information and allow customers to make informed decisions regarding travel route, travel time and mode choice

### 3. Develop partnerships to support transportation management activities

- Implement coordinated, timely incident response and special event management
- Work closely with partners, counties and local agencies

### 4. Develop internal capacity to support transportation management

- Develop staff training and organizational structure to support implementation
- Remain active in regional and national initiatives, and share new technologies to ensure the Delaware Department of Transportation (DelDOT) transportation system is continually enhanced

## 1997 ITMS GOALS

- Reduce congestion and delay
- Improve the safety of the transportation system
- Reduce operating costs by improving the efficiency of planning, operations and maintenance
- Improve system performance

- Mainstream transportation management activities with existing transportation planning, pre-construction, construction and operations activities

## Critical miles




At the inception of the Integrated Transportation Management System (ITMS) program, we knew there were 700 miles that needed to be equipped with ITMS devices. To realize the best benefit to the transportation network, keeping in mind budget constraints, 250 critical miles of the primary network were identified as top priority. These critical miles represent the core network to enable transportation management to work in Delaware. Investment areas were selected based on six factors: congestion, traffic volumes, presence of transit routes, extent of goods movement activity, seasonal and recreational travel demands and use as an alternate or bypass route.

## What we've accomplished per the original strategies

The four strategies and associated actions identified in 1997 still hold true today. The following tables provide a progress update (what's been accomplished) to address the original strategies, as well as the next steps.



# 1. Create the necessary infrastructure to support transportation management

 <b>Action</b>	 <b>Accomplishments</b>	 <b>Next Steps</b>
<p><b>Implement a centralized TMC</b></p>	<ul style="list-style-type: none"> <li>● Established full-time, centralized TMC in 2002</li> <li>● The TMC provides DelDOT a consistent first line of communication to the public and other agencies</li> <li>● Built Mobile TMC for operations</li> <li>● Established state-owned fiber optic connections to PA and MD</li> <li>● Added redundant elements to the TMC network room</li> </ul>	<ul style="list-style-type: none"> <li>● The focus is shifting from building the TMC to operating and maintaining</li> <li>● Establish state-owned fiber optic connection to NJ</li> </ul>
<p><b>Implement real-time control system</b></p> <ul style="list-style-type: none"> <li>● Traffic responsive signals</li> <li>● Bus priority systems</li> <li>● On-demand transit</li> <li>● High-speed toll collection</li> <li>● Lane use strategies</li> <li>● Commercial vehicle management</li> </ul>	<ul style="list-style-type: none"> <li>● 876 out of 900 traffic signals on computerized signal control system</li> <li>● Started a statewide computerized traffic signal system in 1999</li> <li>● Established signal retiming program with a goal of retiming 20 corridors per year</li> <li>● Implemented transit automated vehicle location and schedule adherence systems</li> <li>● Implemented high-speed E-ZPass lanes to speed toll collection</li> <li>● Established emergency gate control from TMC, enabling efficient emergency response</li> <li>● Implemented variable speed limit (VSL) system on I-495</li> <li>● Implemented core Commercial Vehicle Information Systems and Networks (CVISN) in Delaware</li> <li>● Responsive corridors, meaning traffic signal timings adjust automatically to traffic demand</li> </ul>	<ul style="list-style-type: none"> <li>● Complete connectivity of all traffic signals to the statewide computerized signal control system</li> <li>● Responsive traffic control based on real-time system capacity and demand changes</li> <li>● Implement bus priority by integrating bus automated vehicle location (AVL) with signal system</li> <li>● Speed the collection of transit fares</li> <li>● Implement dynamic lane use control</li> <li>● Pursue expanded CVISN program and grant opportunities</li> <li>● Open road tolling</li> </ul>
<p><b>Monitor the transportation network to assess system performance</b></p> <ul style="list-style-type: none"> <li>● Sensors</li> <li>● Detectors</li> <li>● Cameras</li> <li>● People</li> </ul>	<ul style="list-style-type: none"> <li>● Implemented statewide traffic and weather detection systems, including a variety of real-time data types:             <ul style="list-style-type: none"> <li>● Wavetronix (traffic volume, vehicle class, speed)</li> <li>● Bluetooth (travel time)</li> <li>● System loops (traffic volume and occupancy)</li> <li>● Roadway Weather Information System (road and atmospheric conditions)</li> <li>● Rail crossing monitoring</li> <li>● Hydrology monitoring system is in progress</li> </ul> </li> <li>● Video monitoring system             <ul style="list-style-type: none"> <li>● Permanent cameras (150)</li> <li>● Portable trailer cameras (22)</li> <li>● Vehicle dash cameras (42)</li> <li>● UAV Cameras (9)</li> </ul> </li> <li>● Transportation database has been set up with infinite flexibility to be queried and used for a variety of real-time and historical applications:             <ul style="list-style-type: none"> <li>● Traffic database (TranStat)</li> <li>● Internal user interface (EOps)</li> <li>● External user interface (Extranet)</li> <li>● Incident management system (Tracker)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Expand Tracker for optimal incident management and associated recordkeeping to enhance performance management</li> <li>● Monitor transit performance as it relates to signal performance</li> <li>● Partner with State Police on license plate reader (LPR) system (travel time, origin-destination)</li> <li>● Advance machine vision to acquire traffic data and implement incident detection from video</li> <li>● Connected and autonomous vehicles</li> <li>● Bridge monitoring systems</li> <li>● High resolution signal data</li> <li>● Roadway weather integrated mobile observation</li> </ul>

## 1. Create the necessary infrastructure to support transportation management (continued)

Action	Accomplishments	Next Steps
<p><b>Establish dependable communications infrastructure</b></p> <ul style="list-style-type: none"> <li>Voice, data and video systems communicating with each other</li> </ul>	<ul style="list-style-type: none"> <li>Significant progress has been made in the construction of a statewide, state-owned telecommunications system</li> <li>Fiber optic backbone exists on major roadways (323 miles)</li> <li>Wireless systems have been implemented where feasible, providing a low-cost, reliable option</li> <li>Computer Aided Dispatch (CAD) with Police and Fire</li> </ul>	<ul style="list-style-type: none"> <li>Final build-out of fiber, resulting in robust/redundant fiber "rings" throughout state and regionally to support not only transportation, but also state government telecommunications</li> <li>Minimize dependency on leased lines and cellular modems</li> <li>Build out advanced wireless system in cooperation with Division of Communications (DivComm) and Department of Technology and Information (DTI)</li> </ul>

## 2. Disseminate real-time, accurate information and allow customers to make informed decisions regarding travel route, travel time and mode choice

Action	Accomplishments	Next Steps
<p><b>Disseminate real-time, accurate information and allow customers to make informed decisions regarding travel route, travel time and mode choice</b></p> <ul style="list-style-type: none"> <li>Real-time travel schedules</li> <li>Transit schedules</li> <li>Incident information</li> <li>Tourist information</li> <li>Track system performance</li> <li>Travel mode decisions</li> <li>Variable Message Signs (VMS)</li> <li>Traveler Advisory Radio (TAR)</li> <li>Telephone</li> <li>Television (TV)</li> <li>Radio</li> <li>Internet</li> <li>Personal digital assistants</li> </ul>	<ul style="list-style-type: none"> <li>Available Information Sources: <ul style="list-style-type: none"> <li>WTMC 1380 AM/Traveler Advisory Radio</li> <li>DelDOT App</li> <li>DelDOT Website</li> <li>Interactive Traffic Map</li> <li>Social media (Twitter, Facebook, YouTube, Flickr)</li> <li>Variable message signs (VMS)</li> </ul> </li> <li>Information available: <ul style="list-style-type: none"> <li>Live traffic video</li> <li>Travel time</li> <li>Travel advisories (incidents)</li> <li>Travel restrictions and closures</li> <li>Delay</li> <li>Roadway weather</li> <li>Snow plow tracking</li> </ul> </li> <li>DelDOT App accessible to all modes</li> <li>Real-time transit information</li> <li>Partnerships (e.g. Waze)</li> </ul>	<ul style="list-style-type: none"> <li>Voice recognition</li> <li>Personalized route information</li> <li>Seamless information across state lines</li> <li>System reliability</li> <li>Enhanced electronic toll plaza signing</li> <li>Parking information system</li> <li>Expand repeater system to increase access to WTMC 1380 AM</li> </ul>

### 3. Develop partnerships to support transportation management activities

#### Action

##### Implement coordinated, timely incident response and special event management

- Incident management team
- Interagency coordination

##### Work closely with partners, counties and local agencies

#### Accomplishments

- 24/7/365 TMC operations
- Centralized statewide control and management of the CAD to CAD connections with County Emergency Operations Centers (EOCs) and State Police
- On-call Emergency Response Units (ERUs)
- Safe, Quick Clearance and Move Over legislation passed
- Developed National Incident Management System (NIMS) Transportation incident management and emergency response plans:
  - Evacuation Plans
  - Bridge Closure Plan
  - Continuity of Operations Plan
  - Debris Management Plan
  - Snow Emergency Plan
  - Toll Plaza Modified Operations Plan
  - Transportation Incident and Event Management Plan
  - Transportation Security Plan
- Developed incident management detour routes for major roadways in the state
- Support major special events through coordination meetings and event transportation management:
  - Firefly Music Festival
  - NASCAR
  - Punkin' Chunkin'
  - State Fair
  - Other events


- Implemented Transportation Management Team (TMT) program to coordinate and collaborate with incident responders throughout Delaware
- Implemented regional operations coordination meetings with adjacent states of MD, NJ and PA
- Developed and implemented a multi-agency on-scene incident management training program
- Developed Extranet to share information with partner agencies, universities and/or consultants
- Built partnerships with academia
- Built partnerships with metropolitan planning organizations
- State-of-the-art weather system planning, involving DelDOT Bridge, Delaware Emergency Management Agency (DEMA), University of Delaware
- Building awareness of the TMC as an information hub:
  - Gathering information from DelDOT field staff & incident responders
  - Polices/practice of notifying the TMC of lane closures, incidents, etc

#### Next Steps

- Expand Motorist Assistance Patrol (MAP) and ERU to 24/7 operation and expanded coverage area
- Enhance Transportation Homeland Security program
- Update/create incident and event plans as conditions warrant
- More training, exercises to ensure staff are familiar with plans, generate ideas for updates, etc.

- Continue interstate coordination meetings with MD, NJ and PA
- Continue expansion of Extranet to provide more data to partners

## 4. Develop internal capacity to support transportation management

 Action	 Accomplishments	 Next Steps
<p><b>Develop staff training and organizational structure to support implementation</b></p> <ul style="list-style-type: none"> <li>● Highly-skilled, well-equipped staff</li> <li>● Training and resources</li> </ul>	<ul style="list-style-type: none"> <li>● Conducted “Developing a Curriculum” (DACUM) process with diverse group, mixing DeIDOT managers with other regional experts</li> <li>● Documented for TMC Technicians:               <ul style="list-style-type: none"> <li>● Knowledge, skills, abilities</li> <li>● Curriculum</li> </ul> </li> <li>● Trained:               <ul style="list-style-type: none"> <li>● TMC Technicians (variety of topics)</li> <li>● Integrated Transportation System (ITS) Maintenance staff (telecommunications)</li> <li>● Field personnel (incident management training)</li> </ul> </li> <li>● Developed Delaware Signal Timing Enhancement Program (DSTEP) with academia</li> </ul>	<ul style="list-style-type: none"> <li>● Emphasize training as a continuous, ongoing priority. Emphasize Operations and Maintenance training</li> <li>● On-the-job training, scenario training</li> <li>● Knowledge, skill and ability assessments</li> <li>● Enable each position to be filled at the career ladder level</li> <li>● Establish a succession plan for transportation management leadership</li> <li>● Support culture of continuous improvement with clear targets and incentives for individuals and units</li> <li>● Maintain and develop standard operating procedures (SOPs) as needed</li> <li>● Assess in-house and consultant staff levels and responsibilities, and hire accordingly</li> </ul>
<p><b>Remain active in regional and national initiatives and share new technologies to ensure continual enhancement</b></p> <ul style="list-style-type: none"> <li>● Participate in professional organizations</li> <li>● Information sharing with other jurisdictions</li> </ul>	<ul style="list-style-type: none"> <li>● Transportation Management System Managers participate in a variety of regional and national initiatives, including but not limited to:               <ul style="list-style-type: none"> <li>● I-95 Corridor Coalition</li> <li>● ITS America</li> <li>● ITS MD</li> <li>● Institute of Transportation Engineers</li> <li>● American Association of State Highway and Transportation Officials (AASHTO)</li> <li>● Transportation Research Board</li> <li>● Women’s Transportation Seminar</li> <li>● DE/MD/NJ/PA regional operations meetings</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>● Partner with Community Relations to track and organize opportunities</li> <li>● Develop a mechanism to maintain awareness of industry best practices and developments beyond existing conventions</li> <li>● Position DeIDOT for the future connected and autonomous vehicle revolution</li> </ul>
<p><b>Mainstream transportation management activities with existing transportation planning, pre-construction, construction and operations activities</b></p> <ul style="list-style-type: none"> <li>● Integrate transportation management with planning, design, construction and purchases of new equipment</li> </ul>	<ul style="list-style-type: none"> <li>● All DeIDOT capital projects are reviewed for ITMS as part of the way we do business</li> <li>● The Integration of Operations and Planning Advisory Committee includes a cross section of DeIDOT, Metropolitan Planning Organizations (MPOs), Federal Highway Administration (FHWA) and academia. The Committee guides business decisions and practices related to transportation data</li> <li>● The ITMS Telecommunications Committee includes DeIDOT, DivComm and DTI</li> <li>● The Transportation Weather and Flood Monitoring of Warning System Committee includes DeIDOT, Department of Natural Resources and Environmental Control (DNREC), DEMA, United States Geological Survey (USGS), academia</li> <li>● The overwhelming majority of statewide plans, agency policy documents, comprehensive land-use and transportation plans, and federal-level MPO plans already recognize the vital role ITMS should play at present and in the future</li> </ul>	<ul style="list-style-type: none"> <li>● Include transportation management staff leadership in all program discussions</li> <li>● Show the relative level of investment in transportation management in the published budget</li> </ul>

## V. BEST PRACTICES





Effective management of nonrecurring congestion presents new challenges for agency policy, organization and staffing, resources and partnerships, as well as for basic agency culture and leadership. Transportation Research Board’s (TRB) 2012 report, *Guide to Improving Capability for Systems Operations and Management*<sup>1</sup> focuses on special institutional challenges using a form of change management called the Institutional Capability Maturity Model. The guide is based on real-world experiences of transportation agencies, especially state Departments of Transportation (DOTs). Systems Operations and Management<sup>2</sup> strategies present special challenges because of their real-time, event-responsive nature, and the need to combine technology, adopted procedures and organized interagency roles.

In its integrated transportation management approach, DeIDOT embraces the management approach the report refers to as “systems operation and management”. Researchers and practitioners found that agencies with more comprehensive strategy applications (integrated, standardized) are distinguished from agencies with less well-developed transportation management activities in terms of:

- Culture/leadership
- Organization/staffing
- Resource allocation
- Partnerships

<sup>1</sup> Transportation Research Board, *Institutional Architectures to Improve Systems Operations and Management*, Strategic Highway Research Program Report S2-L06-RR1, 2012 and SR-L06-RR2, 2011.

Researchers and practitioners identified the following objectives that a DOT should pursue in order to achieve integrated and standardized transportation management (see table below). Many of these nationally recognized best practice objectives are ones that the Delaware Department of Transportation (DeIDOT) has already achieved, while others are ones DeIDOT hopes to achieve in the coming years.

The report includes many strategies for achieving the objectives that are relevant to, and should be pursued by, DeIDOT in pursuit of transportation management excellence. The most relevant include:

- Including transportation management staff leadership in all program discussions
- Establishing a succession plan for transportation management leadership
- Showing the relative level of investment in transportation management in the published budget
- Supporting culture of continuous improvement with clear targets and incentives for individuals and units
- Develop a mechanism to maintain awareness of industry best practices and new developments beyond existing conventions

<sup>2</sup> For purposes of this plan, the federal nomenclature of Systems Operations and Management can be equated to Delaware’s nomenclature of Transportation Management.

**Objectives for Improving Capability for Systems Operations and Management**

Culture/Leadership	Organization/Staffing	Resource Allocation	Partnership
<ol style="list-style-type: none"> <li>1. Undertake educational program</li> <li>2. Exert senior leadership</li> <li>3. Establish formal core program</li> <li>4. Rationalize transportation agency authority</li> <li>5. Internalize continuous improvement as agency mode/ethic</li> </ol>	<ol style="list-style-type: none"> <li>1. Establish top-level transportation management executive structure</li> <li>2. Establish appropriate organizational structure</li> <li>3. Determine core competencies and training needs</li> <li>4. Establish accountability system</li> </ol>	<ol style="list-style-type: none"> <li>1. Develop program-level budget estimate</li> <li>2. Introduce transportation management as a top-level agency budget line item</li> <li>3. Develop acceptance of sustainable resourcing from state funds</li> <li>4. Develop methodology for trade-offs</li> </ol>	<ol style="list-style-type: none"> <li>1. Agree on operational roles and procedures with public safety agencies</li> <li>2. Identify opportunities for joint operations activities with local government/Metropolitan Planning Organizations (MPOs)</li> <li>3. Develop procedures that accommodate partners’ goals and maximize mobility (minimum disruption)</li> <li>4. Rationalize staff versus outsourcing activities, responsibilities and oversight</li> </ol>

# VI. TRANSPORTATION MANAGEMENT PROGRAM OF TODAY AND TOMORROW



The Delaware Department of Transportation's (DelDOT's) Integrated Transportation Management program is designed to support all modes throughout the Department. Transportation management is Delaware's way of doing business – integrating technology, infrastructure and people to achieve mobility, safety and security goals. Starting as just a vision in 1997, the Integrated Transportation Management System (ITMS) program has come a long way. The flexibility of the system has allowed it to take shape over the years, holding true to the original vision, while adapting for technological and environmental changes. The transportation management program is comprised of four integrated elements:

- 1. 24-hour Transportation Management Center (TMC)** – The TMC is both the visible brick and mortar center as well as the symbolic center of ITMS. It is classified as a critical facility for DelDOT's operations. On the clock 24/7/365, the people at the TMC are DelDOT's "front line."
- 2. Integrated Transportation Management System (ITMS) Field Infrastructure** – Equipment, devices, software and a state-owned telecommunications system are required to monitor, control and transmit millions of data bytes real-time, around the clock. Planning, design, construction, training, operations and maintenance are required for numerous systems and subsystems.
- 3. Incident and Event Management** – Planned and unplanned incidents occur daily and many individual incidents span multiple days or even months. Intensive teamwork in the development of plans and policies, and in the practice of those policies, is required to perform at top efficiency. Hundreds of key stakeholders interact daily within DelDOT, within Delaware, within the region.
- 4. Transportation Homeland Security** – Security threats can trump all other business in the transportation program. DelDOT managers work with local, state and national partners to build, maintain and operate a resilient transportation system with redundancy and flexibility.



DelDOT's transportation management program is complex; involving the integration of numerous systems, concepts and programs. This chapter provides an overview of the following topics, including both today's status as well as a look ahead to the future:

- |  |   |
|--|---|
| <b>A. Collaborative Approach</b>   | <b>K. Integration of Operations and Planning</b>                              |
| <b>B. Transportation Management Center</b>                               | <b>L. Congestion and Mobility Management</b>                                  |
| <b>C. Traveler Information</b>   | <b>M. Incident and Event Management</b>                                       |
| <b>D. App/Social Media</b>   | <b>N. Transportation Management Team</b>                                      |
| <b>E. Transit</b>  | <b>O. Emergency Response Units and the Motorist Assistance Patrol Program</b> |
| <b>F. Transitioning to Operations and Maintenance</b>                    | <b>P. Transportation Homeland Security</b>                                    |
| <b>G. Telecommunications and Information Technology</b>                  |   |
| <b>H. Computerized Traffic Signal System</b>                             |   |
| <b>I. Monitoring</b>   |   |
| <b>J. Transportation Weather and Flood Monitoring and Warning System</b> |   |



# COLLABORATIVE APPROACH

*A leader in the nation when it comes to transportation management, the Delaware Department of Transportation (DelDOT) embraces a collaborative approach. DelDOT is unique in the ways it does business, with a focus on four principles:*

- *Data-driven*
- *Multimodal*
- *Integration of operations and planning*
- *Ready for the future*

Although much of the day-to-day technology-related management is centered at the Transportation Management Center (TMC), everyone at DelDOT is a member of the integrated transportation management team. Transportation management is integrated into all of DelDOT's divisions and throughout the transportation lifecycle: planning, design, construction, operations, maintenance and training. In addition, the integrated transportation management system (ITMS) exchanges information and acts cooperatively with the public safety community and other agencies.

For ITMS, DelDOT has collaborated with other state agencies such as the Department of Technology and Information (DTI) and the Division of Communications (DivComm) for years. DelDOT has additionally collaborated with local planning organizations such as WILMAPCO and Dover/Kent County MPO.

Transportation doesn't stop at state boundaries and as such, DelDOT coordinates with adjacent states and agencies to effectively manage transportation. Participating in the I-95 Corridor Coalition, as well as regional operations meetings, allows for information exchange to better prepare for, respond to and recover from transportation issues.

## How is DelDOT Unique?

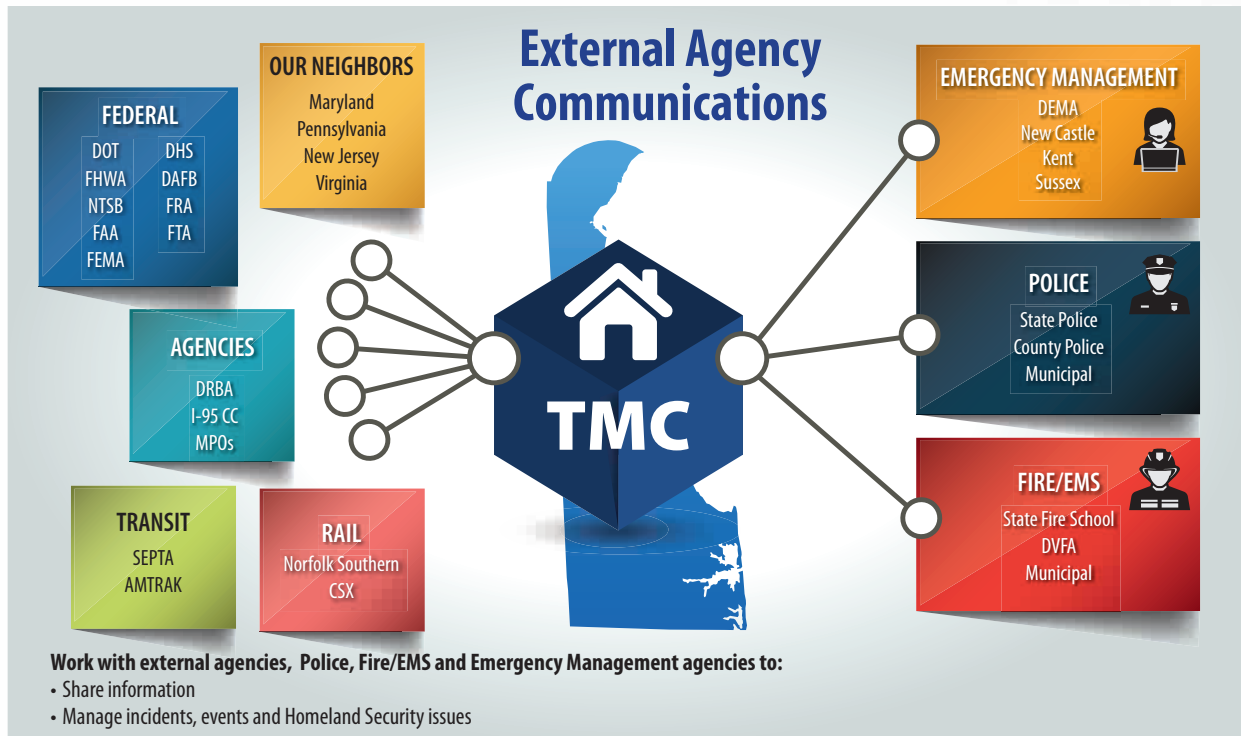
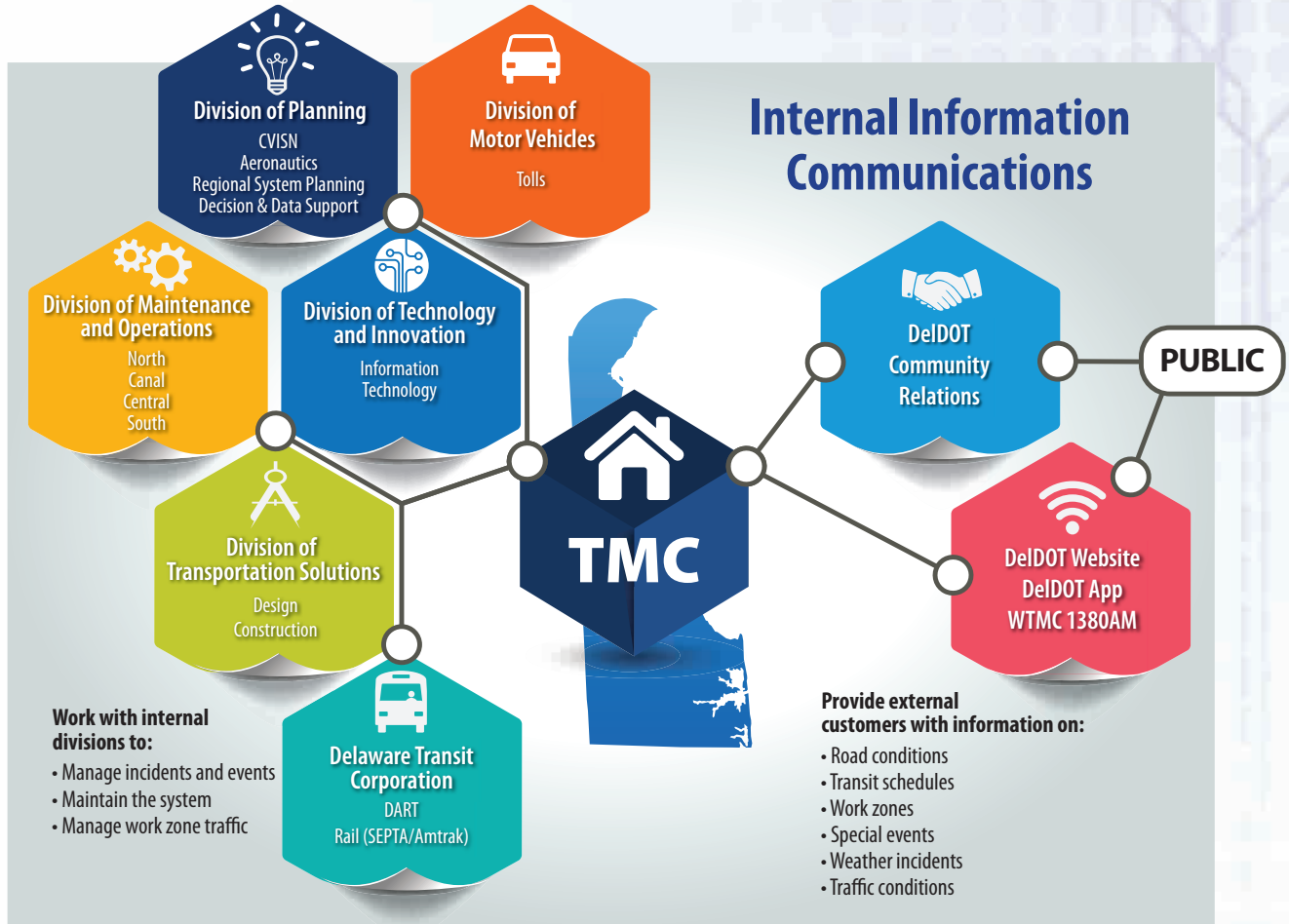
- Owns 90% + of roads
- Owns most traffic signals
- Operates the transit system
- Operates the tolls
- Truly multimodal
- Integration of planning and operations

DelDOT works hard to maximize the efficiency of the system to get the most out of it every single day. Focus is placed on maintaining the existing technology and infrastructure in a good state of repair, as well as investing in new technology to remain economically competitive. Because ITMS requires many specialized skillsets to develop, maintain and plan for future enhancements, DelDOT staff is supplemented with contractor support as needed to get the work done as efficiently as possible.

DelDOT's TMC is collocated with the Delaware Emergency Management Agency (DEMA) and Delaware State Police (DSP), aiding in interagency communications. Further, DelDOT has improved direct communications with computer aided dispatch (CAD)-to-CAD connections to the Public Safety Answering Points (911 Centers).



The diagrams below demonstrate how DeIDOT's TMC facilitates a collaborative approach with internal and external applications.



*First envisioned in the 1997 Integrated Transportation Management System (ITMS) Strategic Plan, further defined in the Transportation Incident and Event Management Plan (TIEMP), and solidified through its reputation and track record, the Transportation Management Center (TMC) is a single point of contact for statewide transportation operations. It is where the central management of the transportation management program occurs, and all transportation issues are reported to the TMC with the faith that they will be handled.*

The TMC is a statewide 24/7/365 operation that coordinates and manages the Delaware Department of Transportation's (DelDOT)'s response to any incident or event that impacts the multimodal transportation system. It monitors and controls all ITMS intelligent transportation systems. It leads transportation incident and emergency management planning and operations and transportation Homeland Security planning and operations. Centrally located in Smyrna, the TMC is part of the statewide emergency operations center and collocated with the Delaware Emergency Management Agency (DEMA) and Delaware State Police (DSP) Communication Headquarters.

The TMC is the one place that talks to everyone and coordinates and manages the operation of the transportation system. The TMC works with internal divisions to manage incidents and events, maintain the system, and manage work zone traffic during construction. It manages the system in accordance with weather events. It provides external customers with information on road conditions, transit schedules, work zones, special events, weather incidents and traffic conditions. In addition, it works with external agencies such as police, fire/EMS, and emergency management to manage incidents, events and Homeland Security issues. In fact, DelDOT has direct computer-aided dispatch (CAD)-to-CAD connections with the Public Safety Access Points (PSAPs)/all centers in the state for communication. DelDOT has undergone essential stakeholder planning processes in regards to incident and event management, which has helped build these successful relationships.

The TMC performs three critical functions: monitoring, control and information. As such, it must be staffed with those possessing the necessary knowledge, skills and abilities to run this 24/7/365 operation as well as major events. The TMC is both the visible brick and mortar center, as well as the symbolic center of ITMS. It is classified as the #1 critical facility for DelDOT's operations, making system redundancy a top priority. DelDOT's TMC handled over 48,000 calls in 2016, ranging from debris in the road, to traffic signal complaints, to traffic incident support and major weather events. Addressing these matters as expeditiously as possible reduces the chance for secondary incidents, resulting in a safer transportation system for the traveling public. Approximately 20% of all incidents are secondary incidents.

DelDOT also has a Mobile TMC with portable control, monitoring and information capabilities. The Mobile TMC can be used during planned special events as well as unplanned emergencies.

DELAWARE DEPARTMENT OF TRANSPORTATION



TRANSPORTATION MANAGEMENT CENTER





# TRAVELER INFORMATION

*Delaware Department of Transportation's (DelDOT) Real-Time Traveler Information Program provides current transportation system information to the traveling public through a variety of media including the DelDOT App, online interactive maps and WTMC 1380 AM. This information complies with Section 511 under Title 23 of the Code of Federal Regulations, which required that states establish a real-time information program for interstates by November 2014 and for routes of significance (to be defined by the state) by November 2016.*

Delaware travelers have a lot of information available to them, accessible in a variety of ways. Empowering the public with this information enables them to make informed choices. Thousands of travelers are in touch with DelDOT at any given time; this is a key strategy for making the most out of the transportation system we have.

DelDOT currently provides information on construction activity, incidents, weather and travel time on the public website.

A key achievement that showcases the integrated aspect of the program is the ability for the public to choose which layers of traveler information they want to view. This advanced capability shows just how far the state has really come.

- Construction activity reporting is contingent on workers reporting the information to the Transportation Management Center (TMC) operators, who then manually input the information into the traveler information system.
- Information about incidents is gained in a variety of ways including roadway detectors and an interface to Police/Fire Computer Aided Dispatch (CAD). Once an incident is confirmed, it is manually input into the traveler information system.
- Weather and travel time information is collected automatically from devices in the field and is constantly available to the public.
- Transit system information is provided, including schedule changes and incidents, for bus and rail.

Once data is in the DelDOT database, DelDOT is able to verify that the correct procedures are followed and that the data is made available to the public. DelDOT is automating the validation process of construction and incident information with a data system named Tracker.

Recent initiatives include identifying the real time positions of buses as well as obtaining real-time information from system users.

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*DelDOT should continue to empower the public with the information to make informed transportation choices.*

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*Much of transportation management is an iterative practice that involves the actions and reactions of travelers. The Delaware Department of Transportation (DelDOT) shares the diverse, multimodal data we gather with the public to help travelers make educated decisions on mode, route and travel time choices. By looking ahead and watching trending technology, DelDOT realized personal devices (e.g. smart phones) are key to reaching the traveling public.*

As a result of thoughtful planning and design, DelDOT's entire pool of real-time information, including streaming radio, video, congestion levels and incident information, is available through the DelDOT App. As we teach the public about this App that they have constant access to, its effectiveness grows daily. Not only are we able to communicate information to many thousands of travelers on a real-time basis, we also invite these travelers to provide useful information that helps manage the transportation system.

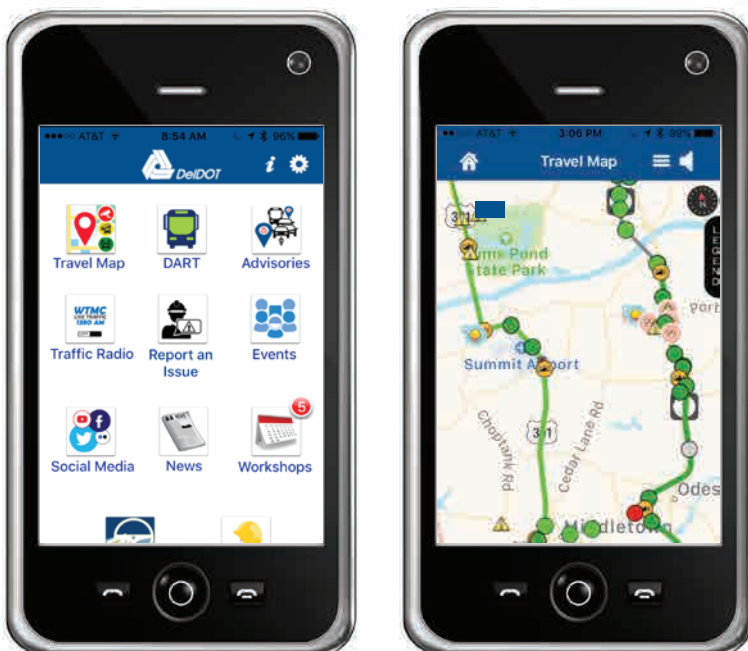
DelDOT has a following on Facebook, Twitter, and Instagram. The University of Delaware has performed market research and conducted focus groups for valuable feedback on the most desirable features of the DelDOT App and on the aspects that should be improved. One key finding was maintaining a united "face" of DelDOT while still separating the real-time information for quick access.

The DelDOT App is a breakthrough in that it optimizes DelDOT's access to people. The DelDOT App can be used throughout an entire multimodal trip – to aid driving, riding transit and walking. Users can listen to WTMC 1380 AM through the App, just like listening to the radio.

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*Future goals for the DelDOT App include two-way communication, personalized options and voice-responsiveness.*

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*Transit is an integral component of a well-balanced, multimodal transportation system. To manage both fixed route and paratransit service, the Delaware Transit Corporation (DTC) has implemented the Delaware Advanced Transportation Management System (DATMS). This system provides real-time vehicle locations and schedule adherence status of the transit fleet, along with status messages such as notifications of mechanical issues or breakdowns to help DTC better manage their fleet and improve operational efficiency. The DATMS is now fully installed in the DTC fleet and preparing for system acceptance.*

Fully integrating the DATMS with the Integrated Transportation Management System (ITMS) will enhance the transit operations and safety. The expanded system will be capable of providing real-time information to the ITMS in support of traveler information as well as on-board video in support of emergency event management. Fully integrating the DATMS and ITMS will also provide for implementation of a Transit Signal Priority (TSP) system that is centrally controlled by ITMS. A TSP system will further improve DTC operational efficiency by maintaining scheduled route transit times and will make public transit a more attractive alternative to the public.

A multimodal transportation management approach can help improve transit ridership, get vehicles off the road and decrease traffic congestion. Integrating DATMS and ITMS will improve the efficiency of transit operations by improving operational efficiency and reliability, and by providing to the public accurate and reliable bus arrival

information to support educated mode, route and travel time choices. At the same time, bus drivers can serve as eyes on the system, both receiving information from and feeding information into the system.

The TMC is equipped to support transit operations in the event of a major incident. DTC personnel can operate the system from the TMC. Recently, real-time schedule status and actual bus arrival times have been made available on the web and on the DeIDOT App.

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*DeIDOT should continue a multimodal transportation management approach including full integration of DATMS with ITMS, TSP and two-way information.*

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*Much of the emphasis of the transportation management program since the original Strategic Plan has been on the act of building. Not only has there been a need to build significant infrastructure, but also policies, relationships, awareness and knowledge. Year after year, designs have been documented and construction has occurred. Committees have formed and met faithfully to co-create a truly integrated system. Plans and policies have been developed, published and updated. The result is, some 20 years later, a well-established practice of transportation management in Delaware, supported by a robust and integrated system of telecommunications, devices and information technology, operated and maintained by a diverse team throughout the Delaware Department of Transportation (DelDOT) and beyond, all led out of the Transportation Management Center (TMC) in Smyrna.*

**DelDOT's current Integrated Transportation Management System (ITMS) is an achievement of international significance.**

There are numerous examples of DelDOT doing transportation management "right," many of which are highlighted throughout this document. So much hard work has gone into reaching today's state; it is important now for DelDOT to shift its focus to sustaining the system and its operation.

One practical consideration in the shift to operations and management (O&M) is funding. Federal Highway Administration (FHWA) has historically supported design and construction of new integrated transportation management infrastructure. However, O&M is not as well supported by national programs and warrants continued attention at the state level. One system stands out as a special exception – the traffic signal system. Based on thorough research, FHWA has long supported traffic signal operations with 100% funding due to proven findings of return on investment.

Several lessons have been learned over the years; these lessons should be taken to heart in planning future resources. For example, while it has always been desired to mainstream transportation management within everyday DelDOT business, it has also been observed that the rapid pace of technology evolution has warranted specialty services from trained consultants and contractors. Regardless of how much, or how little, contracted help DelDOT continues to employ, the knowledge, skills and abilities of DelDOT's in-house team will need to be an everyday priority.

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*DelDOT should engage in continual training to optimize the knowledge, skills and abilities of those supporting the transportation management program.*

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Skills include, but are not limited to:

## Operations

- Understanding the purpose of ITMS and its individual components
- Watching the gauges and making real-time decisions to proactively manage transportation
- Signal System
- Traffic Engineering Concepts
- ITMS Infrastructure
- Operations
- Homeland Security and Emergency Management

## Maintenance

- Calibration of well over 1,000 monitoring devices to perform at required levels
- Software development
- Database management
- Wireline and wireless telecommunications troubleshooting and repair
- Collaboration and consensus on protocols and procedures
- Workflow management
- Teamwork
- Information tracking and project management

Positions should be filled in a manner that emphasizes key strengths, and then knowledge can be trained on the job for promotional opportunities. The leaders of the transportation management program should be the best-skilled so they may lead by example and provide valuable on-the-job training on an everyday basis.





# TELECOMMUNICATIONS AND INFORMATION TECHNOLOGY

*The Delaware Department of Transportation (DelDOT) and our partner the Division of Communications (DivComm), with the support of the Federal Highway Administration (FHWA) and the Department of Technology and Infrastructure (DTI), have built a robust state-owned telecommunications network. Telecommunications is behind everything we do (and will do), from moving enormous amounts of real-time data to enabling critical executive management communications during severe incidents. Investment in fiber is a future-proof investment that provides long-term control over cost and outstanding government services.*

In transportation and beyond, people are moving towards using multiple devices. Demand for data will continue to increase. Transportation-related mobile data is a big part of that demand. As a result, the need for telecommunications bandwidth and reliability is growing with no end in sight. We need to build telecommunications corridors that will not have to be rebuilt later. The telecommunications system is the new transportation information superhighway.

In the case of a severe incident or disaster, the ability to communicate reliably within and outside of the state is paramount. Incidents such as 9/11 and Hurricane Irene confirmed that private networks can fail us due to over-demand when we need them the most. The functional demands of critical public safety applications alone weigh strongly against the use of leased services, regardless of cost. A government-owned telecommunications network enables priority and preemption capabilities during emergencies. For state government, control over telecommunications resources means reduced costs, greater functionality and independence from private networks.

**Delaware's state-owned network is robust, with sufficient bandwidth and reliability to function at peak performance even in the worst conditions.**

## Fiber

State construction of robust fiber optics is a national best practice. While DelDOT has paved the way in building much of this network, all state agencies realize and support its benefits. For example, states and regions that have deployed robust fiber networks have enabled schools to reduce their telecommunications costs while delivering exponentially enhanced broadband services for students, staff and faculty.

**Building fiber now is necessary to protect the public interest, serve the western parts of the state and manage right-of-way along roadway corridors.**

DelDOT has also partnered with neighboring states to make similar state-owned connections for optimal coordination. DelDOT has a redundant fiber telecommunications connection to the Pennsylvania Department of Transportation. DelDOT is working on the completion of a redundant fiber telecommunications ring through both Maryland and Delaware. This will allow both states to continue operations in the event of telecommunications failures. With a planned connection to New Jersey, Delaware will have effectively joined together New York to Washington D.C.

This interconnectivity within Delaware and within the region provides unparalleled efficiency and quality of communications of both voice and data. In extreme, disastrous situations, the ability to communicate seamlessly to neighboring states may not be possible without a state-owned network. The high quality and coverage provided by fiber telecommunications also benefits the state's everyday economy and Delawareans' quality of life.



## Wireless

A supporting statewide wireless network interconnects the statewide fiber optic network for the purpose of monitoring and controlling equipment and supporting mobile or voice communication. Reasons for investing in a statewide wireless network include cost, security and uptime availability. Looking ahead, completing the build-out across the state and maintaining the telecommunications system must always remain a priority. Leased circuits and Code Division Multiple Access (CDMAs) have a recurring cost. At the time of this writing, DeIDOT uses just over 600 CDMAs to support the Integrated Transportation Management System (ITMS); the goal is to use less than 100. The day-to-day reliability and functionality of any leased service is beyond DeIDOT's control, which is a real concern for the transportation management system. Private (leased) telecommunications services such as CDMAs may not be available during an extreme emergency.

## Information Technology

We must always remember the entire ITMS system depends on the state's information system, comprised of telecommunications, computer network, database servers and web services. The state's information system has to be robust enough to work during extreme events to ensure capacity and speed, sufficient support, redundancy and 24/7/365 reliability. We need to continue sizing and securing the information system for the worst-case scenarios. DeIDOT relies on other departments to support the system. A critical part of the approach is ensuring cyber security, which is a priority at the federal and state levels. DeIDOT participates in the development and implementation of cyber security standards.

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*DeIDOT should complete and maintain the state-owned fiber network to ensure reliable communications at a predictable cost.*

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# COMPUTERIZED TRAFFIC SIGNAL SYSTEM

*People may take traffic signals for granted because they have been around far longer than most transportation technology, and certainly for as long as today's drivers have been driving. However, people may not realize what a powerful tool the traffic signal system can be to manage multimodal transportation! The data that comes in to support traffic signal functionality is often the same data that alerts us to real-time issues in the transportation system. Due to advanced software that relates real-time data to signal timing settings, signals can be much "smarter" today than they used to be, automatically adjusting to changes in traffic demand. The Delaware Department of Transportation's (DelDOT) signal system will be enhanced to recognize individual buses traversing the system to provide priority to bus movements.*

Most of Delaware's highly traveled roadways contain intersections controlled by traffic signals. Think of any major roadway aside from the relatively small sections of interstate highway in the northern part of the state, and sections of DE 1. Experience has taught us that the performance of these roadways can be determined by the performance of their signalized intersections. Signal timings that are run through the computerized traffic signal system can be changed whenever necessary.

In the case of a special event or incident, one of the single best ways for a transportation manager to help traffic in Delaware is to use the state's traffic signal system. Traffic signals play an important role in accommodating larger than normal volumes of traffic due to traffic diversions as a result of incidents and evacuations.

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*DelDOT's traffic signal system should be both traffic and capacity responsive.*

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The benefits of well-designed and operated traffic signals have long been studied and understood to include efficient travel times (which translate directly into environmental friendliness and economic vitality) and optimal safety. The difficulty most agencies have in realizing these benefits is twofold: keeping up with the real-time, fluctuating nature of traffic, and being able to make changes quickly when needed. DelDOT does not have the difficulties other agencies have, and performs well in both of these areas.

One of the state's most important transportation management goals is for all signals to be on the computerized traffic signal system. Being on this system means transportation managers in DelDOT's Transportation Management Center (TMC) can control the signal settings from the DelDOT TMC in Smyrna. Adjustments would otherwise need to be made in the field. Currently, most of the state's signals are on the system, and all new signals built are put on system as standard practice.

**DelDOT has state-of-the-art traffic signal software that integrates with its other data systems such as traffic monitoring, incident management and transit operations. DelDOT has reliable, remote connectivity to its signals, to monitor and adjust timings real-time.**

Furthermore, the state aims to have all corridors (logical groupings of traffic signals) in traffic responsive operation. Being in traffic responsive operation means the computer automatically adjusts signal system timing parameters to changes in traffic demand. DelDOT's state-of-the-art signal software system, named TACTICS, has the functionality needed to accomplish both of these goals.

Optimizing all of the state's signals at all times is a tremendous opportunity and priority. DelDOT is responsible for nearly all traffic signals in the state. The current status of traffic signals is as follows:

- 876 out of 900 of DelDOT's signals are currently on system
- Re-evaluation and retiming of the state's traffic signals is a continuous program, with approximately 20 corridors retimed every year out of 100 corridors
- System detectors are being installed statewide to enable traffic responsive operation and collection of real-time data
- 22 corridors are properly equipped to run in traffic responsive mode, wherein the traffic control software combines traffic monitoring with advanced algorithms to adjust timings in accordance with changes in traffic demand. As more signals get online with more reliable telecommunications, the state can look forward to more corridors with traffic responsive operations.

Progress in each of these areas must continue as a high priority for DelDOT. Continued achievements will require continued funding, skilled resources and teamwork.

## Corridor Retiming

**Time Savings: 1-3 minutes per vehicle  
in rush hour conditions**

Old Baltimore Pike	August 2017
State Street	November 2016
DuPont Parkway US 13 Middletown	June 2016
Limestone Road DE 7	April 2016
Division Street DE 8	November 2015
Naamans Road DE 92	July 2015
Concord Pike US 202	February 2015
Pulaski Highway US 40	August 2014
Salem Church Road	April 2014

Delaware's ultimate vision of its traffic signal system exceeds the capabilities of traffic signal software available today. We not only want traffic responsive intelligence in the software we want capacity responsive capability as well. Carrying as much traffic as they do, Delaware's signalized corridors are prone to incidents and emergency lane closures. Ultimately, traffic signal software should adapt to changes in lane reductions just as swiftly as it adapts to traffic increases.

*The traffic signal system is the most critical control system, and DeIDOT needs to continue investment in all aspects of enhancement, maintenance and operations.*

## Delaware Signal Timing Enhancement Partnership

The Delaware Signal Timing Enhancement Partnership (DSTEP) was formed between DeIDOT and academia to promote knowledge about traffic signals at an early point in people's careers.

*DeIDOT should continue to partner with academia to develop critical specialized skills needed to support transportation management.*

Initiating this knowledge in school provides a unique opportunity to develop critical specialized skills that are needed throughout Delaware and throughout the world. Over the past decade, numerous University of Delaware students have contributed to data collection in support of traffic signal timing projects. Each year one student has been assigned a lead position for the program, responsible for working directly with DeIDOT managers and engineers, working hands-on with state-of-the-art traffic signal systems and software, developing recommendations based on analysis and engineering, implementing changes in the field and performing before/after studies to quantify improvements.

Not only have students learned a great deal about timing traffic signals, but the program has also generated useful protocols, analysis tools and methods. What has helped the students academically has in turn helped DeIDOT gain efficiencies in the program. Several students have used their DSTEP experience to win competitive positions in the profession, performing this exact kind of traffic signal timing work for DeIDOT and others in the region.



The Delaware Department of Transportation (DelDOT) has extensive existing and growing monitoring systems across the state. Much of the information DelDOT gathers for transportation system management is shared with the public in real-time. Data is collected with both automated methods and manual methods. Examples of automated data collection include:

### 1. Traffic Conditions

- a. traffic volume
- b. occupancy
- c. speed
- d. classification
- e. travel time
- f. origin and destination

### 2. Weather Conditions

- a. air temperature
- b. barometric pressure
- c. relative humidity
- d. precipitation type and volume
- e. pavement temperature
- f. subsurface temperature
- g. pavement surface (dry, wet, ice)

### 3. Hydrology Conditions

- a. stream and river depths
- b. water velocity
- c. tide height

**“Real-time monitoring” means at the same time as condition occur. DelDOT considers real-time to be within 5 minutes.**

Many types of devices are used to collect automated data. The main purpose of the monitoring system is incident detection. The system of devices is a mix of fixed and portable sites, including:

- Video Monitoring System (VMS)
  - Permanent
  - Portable
- Automatic vehicle location (snow plows)
- Vehicle-mounted live video (Dash Cams)
- Roadway Weather Information System (RWIS)
- Signal System Loop Detectors
- Microwave (Radar) Detection
- Automatic Traffic Recorders (ATRs)
- Bluetooth Detection

Portable units enable temporary operations to be set up at work zones, for emergencies and at planned events. Additionally, construction and operations personnel manually track construction and incident information. Some of that information is shared with the public, such as what it is, where it is, the impacts and detours.

#77 is an additional source of incident information. Within Delaware, people can dial #77 toll free to communicate with DelDOT’s Transportation Management Center (TMC).

The monitoring system collects data in real-time, around the clock, statewide. DelDOT has developed its very own Electronic Operations (EOps) software to track information and implement algorithms to relate different types of information to one another. By relating real-time trends

to historic patterns, the TMC can predict future conditions and take actions to benefit travelers.

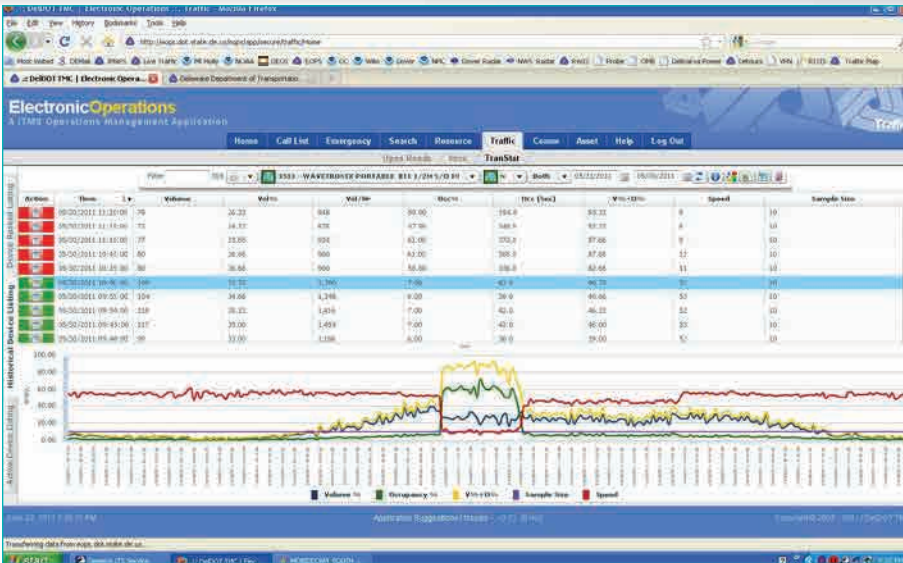
The snow plow tracker feature, established in late 2015, uses global positioning system (GPS) sensors installed in each of the more than 300 plows, to transmit their locations to a program that will display each plow’s position on any smart phone or computer.

Secretary Cohan stated, “Offering this information to the public is part of a larger effort to show how DelDOT utilizes its resources. I’m a huge proponent of transparency in government, and the snow plow tracker is a great way for us to show the people of Delaware how hard we work on their behalf during a snow storm.”

*DelDOT has signed an agreement with the United States Geological Survey (USGS) to build and maintain a real-time hydrology monitoring system for stream and river depths, velocity and tide height information.*







Screenshot of DeLDOT's Electronic Operations Application, showing volume, speed, and occupancy trends.

By relating real-time trends to historic patterns, the TMC can predict future conditions and take actions to benefit travelers.

The continuity of data enables a "heartbeat" to be created for each location measured. Normal traffic data trends, based on historical data, are patterned out for use in comparison to actual real-time conditions. Abnormal traffic patterns (such as incidents and special events) can be seen as anomalies in the normal heartbeat.

Furthermore, there is great power in pulling a variety of data types at points throughout the state for any timeframe needed. DeLDOT can, (and has):

- Answer citizen inquiries with historical data, providing credibility in understanding conditions, and helping to educate
- Show that with transportation improvements, a location can experience decreased travel times while carrying greater traffic volumes
- Pull data at various milestones throughout a project's planning and design phases, such as a fresh set of data for each public meeting, or before/after early-action improvements such as traffic signal timing improvements

**E**Ops is available to transportation management team members within DeLDOT; it is a great place to refer to real-time data and information about Integrated Transportation Management System (ITMS) business and assets. The **Extranet** is available to collaborative team members outside of DeLDOT; it is a great place to access historical traffic count data. The **interactive maps on DeLDOT's public website (www.deldot.gov)** are a great place to see all the various types of data and data collection locations.



Radar traffic detection is unobtrusive, meaning out of the lanes.



# TRANSPORTATION WEATHER AND FLOOD MONITORING AND WARNING SYSTEM

*Water is a big threat to Delaware’s transportation system. Delaware has the lowest mean elevation in the country and is subject to flooding that can threaten a variety of functions travelers normally take for granted.*

Executive Order 41 was issued in 2013 to prepare Delaware for emerging climate impacts by requiring a plan to improve the business of state agencies.

**“...as a low-lying coastal state with the lowest average land elevation in the United States and significant population living along 381 miles of shoreline, Delaware is vulnerable to coastal erosion, storm surge, flooding, saltwater intrusion, and tidal wetland losses, all of which will be exacerbated by sea-level rise; and...”**

**“...Delaware’s critical infrastructure, including roads, bridges, dams, dikes, impoundments... are at-risk to climate change impacts.”**

A committee involving the Delaware Department of Transportation (DelDOT) is preparing “agency-specific actionable recommendations for improving Delaware’s preparedness and resiliency.” Prior to Executive Order 41, DelDOT had already been collaborating with the Department of Natural Resources and Environmental Control (DNREC), United States Geological Survey (USGS), Delaware Emergency Management Agency (DEMA) and the University of Delaware. DelDOT has had a roadway weather information system that has evolved over the years and keeps expanding. Through the Integrated Transportation Management System (ITMS) system, DelDOT has a functional system of:

- Sensors on and near roadways for real-time surface and subsurface information

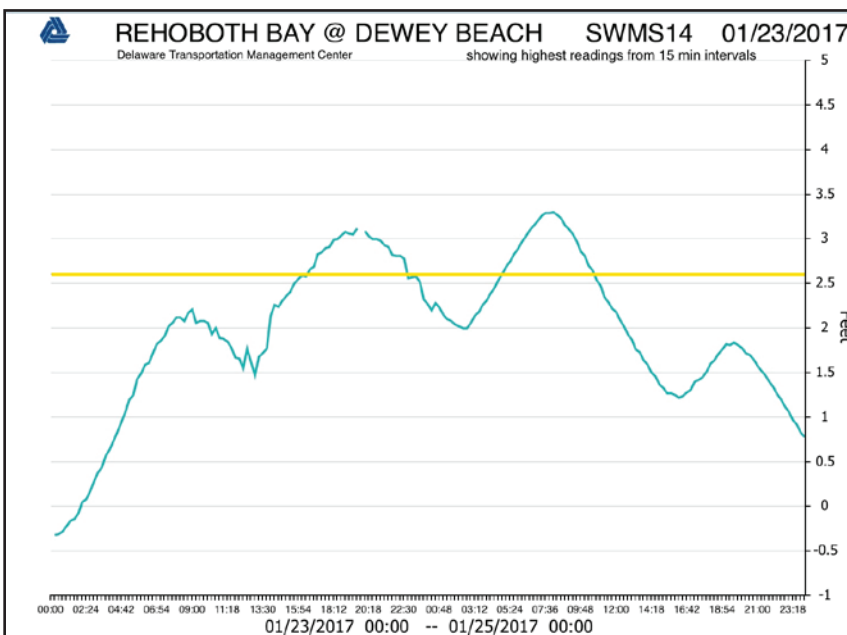
- Hydrology tide gauges measuring water levels
- Atmospheric sensors for winds and important weather information

Future sites are being prioritized to integrate with the National Highway System (NHS). DelDOT is leading the team to expand and integrate this system with its partners’ additional sites and predictive capabilities. The fully integrated system will monitor:

- A variety of locations including roadways, dams and bridges
- A variety of topology such as inland, coastal and back bay
- Road surface conditions and water characteristics such as level, discharge and velocity

Major decisions during severe weather events are supported by this real-time data system. For example, deployment of salt trucks are prioritized based on surface and subsurface temperatures. The need for closing bridges is determined from wind speeds. The need for closing roadways is based on water levels.

*As a large threat to Delaware’s transportation system, water must be monitored and flooding predicted to maximize response and resiliency planning.*



The software system is designed to share the monitoring data among all stakeholders and predict impacts to optimize effective response. It involves visualization and is web-browser based for optimal sharing and flexibility. As with all of DelDOT’s real-time monitoring systems, weather information is also shared with the public at **deldot.gov**, the DelDOT App and WTMC 1380AM.

Water levels compared to road elevation



# INTEGRATION OF OPERATIONS AND PLANNING

*Transportation data is used by a variety of people for a variety of reasons in Delaware. Depending on the job responsibility, each type of data is collected in certain formats, at certain locations, at select times and durations. The collection of data has evolved significantly over recent years, with technology used more and manual methods less.*

The Integration of Operations and Planning Advisory Committee integrates planning and operations functions to maximize data sharing and track system performance: Together, planners and operators are:

- Defining the types of transportation data needed
- Specifying equipment to collect transportation data
- Locating the equipment throughout the state
- Integrating the data in a database
- Sharing the data through a common interface

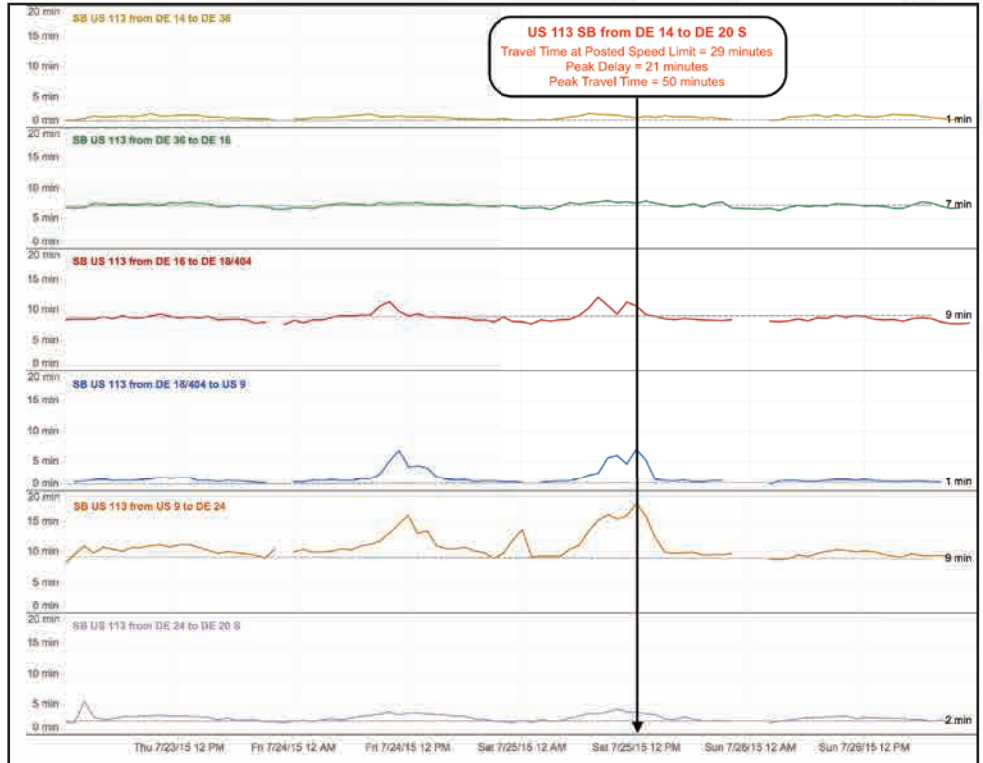
**DelDOT has a large amount of big data.** For example, it might take 15 minutes to pull average hourly volumes at 1,000 sites for five years, and this would be 43,800,000 measurements.

Working groups were formed to delve into technical details and develop recommendations for overall committee consideration. Working groups and their tasks include travel time, capacity, truck data and end user integration and availability.

New working groups will be created as appropriate to embark on future work activities.

In one project example, the DE 141 Corridor 20-Yr Land Use and Transportation Plan, a collaborative team of DelDOT, WILMAPCO and New Castle County, used data in new ways to thoroughly understand and communicate existing conditions along the corridor:

- Microwave detectors for length-based class data at select locations



Three days of average travel times on series of segments

- Traffic signal system loops for volume data at numerous locations
- Bluetooth Travel Time system for travel times and trip distributions
- 24/7/365 continuous data for multiple seasons throughout the project

This corridor project has demonstrated the sophistication a well-coordinated operations system can bring to a planning effort. The quality of data used for this project was quickly recognized by team members and the public.

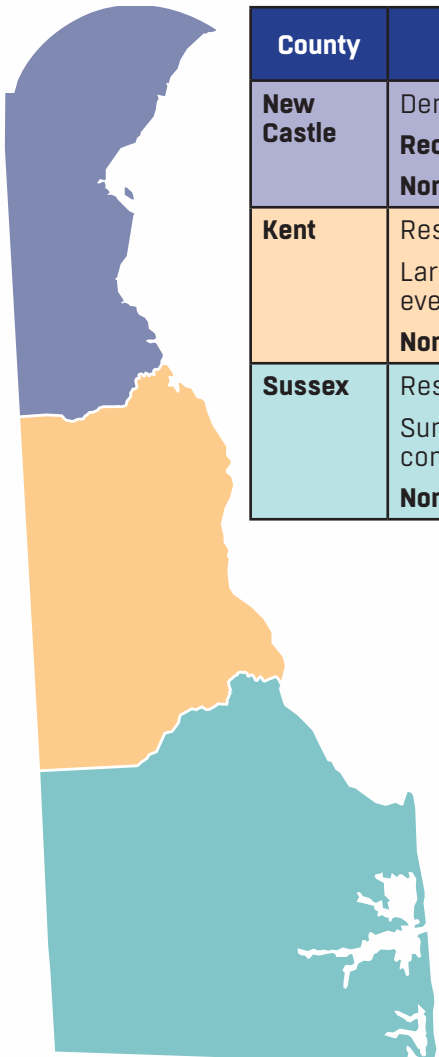
**Buildout of the Extranet is an important ongoing initiative to allow DelDOT to share information with people outside the state network.**



*Just as Delaware needs to know the condition of its roads and bridges, and the locations and causes of its transportation safety issues, the state also needs a comprehensive, consistent statewide approach to understanding its mobility. The ability to move around Delaware in a reliable manner without experiencing major delays is a cornerstone of the state's success in providing a good place to live and conduct business.*

Emerging data sources are enabling Delaware's transportation planning and operations team to monitor and manage mobility better than ever before. Our team is using data to:

- Monitor with agreed-upon measures of effectiveness
- Evaluate reliability statewide
- Identify needs and options for improvements
- Assess return on investment
- Prioritize funding
- Assess performance with before-and-after studies



County	Traffic Congestion Characteristics
New Castle	Densely populated <b>Recurring</b> congestion <b>Non-recurring</b> congestion
Kent	Resort thru-traffic Large-scale special events (Firefly, NASCAR) <b>Non-recurring</b> congestion
Sussex	Resort traffic Summer season <b>recurring</b> congestion <b>Non-recurring</b> congestion

Minimizing traffic congestion is critical in the movement of people and goods. Traffic congestion occurs for a variety of reasons on a recurring or non-recurring basis.

The Transportation Management Center (TMC) experiences the state's recurring traffic congestion issues hands-on with fresh data every day. With a goal to use operations data to enhance project prioritization, DelDOT can evaluate the whole state consistently with continuous 24/7/365, meaningful data such as travel times, traffic demand and capacity. This continuous approach neutralizes the issues of a peak period in one county not being the same as another, or incident frequencies being worse at some locations. With continuous data streams, we can study not only how bad congestion gets at various locations, but how often congestion gets bad.

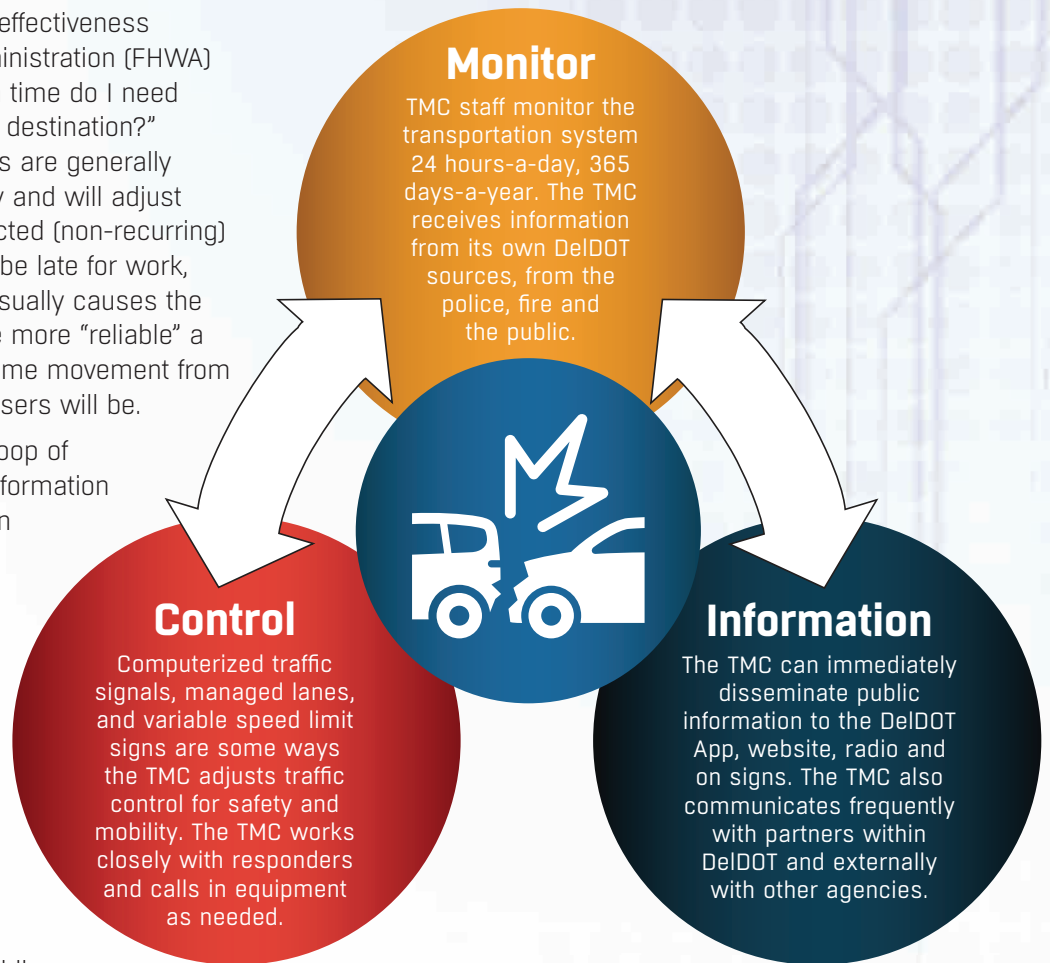
Combining these concepts of severity and frequency revolutionizes the Delaware Department of Transportation's (DelDOT) approach to prioritizing investments.

Recurring traffic congestion occurs on a regular basis during peak demand periods at capacity bottlenecks. In addition, the system breaks down where capacity changes occur at intersections, interchanges, loss of lanes and merges.

Recurring Congestion: Predictable	Non-Recurring Congestion: Unpredictable
<ul style="list-style-type: none"> <li>● Daily rush hour</li> <li>● Summer beach traffic</li> </ul>	<ul style="list-style-type: none"> <li>● Disabled vehicle</li> <li>● Debris on roadway</li> <li>● Vehicle accident</li> <li>● Flooding</li> <li>● Construction</li> <li>● Events</li> </ul>

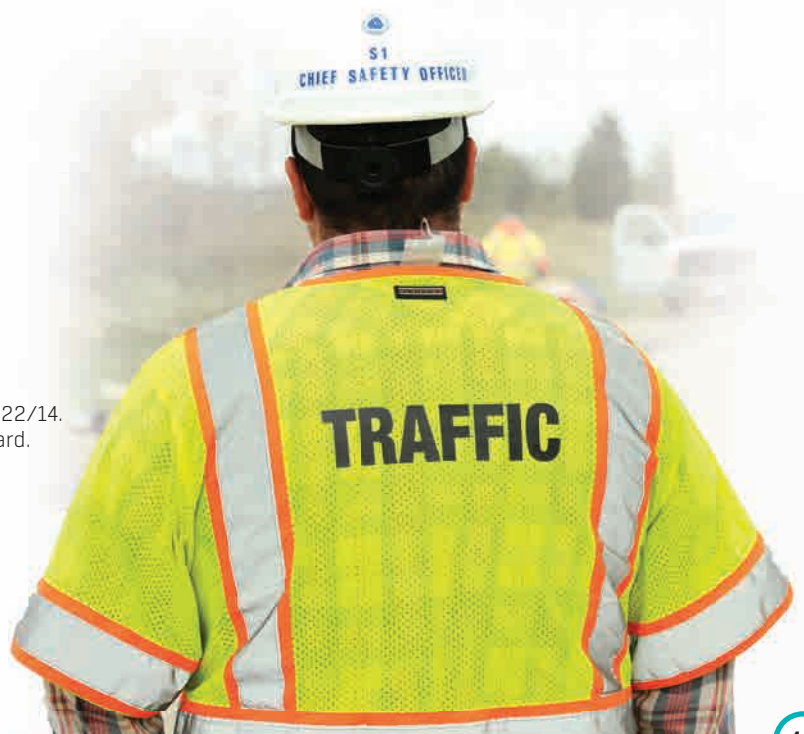
Travel Time Reliability is a measure of effectiveness endorsed by the Federal Highway Administration (FHWA) and answers the question, "How much time do I need to plan to ensure on-time arrival at my destination?" Studies have shown that most travelers are generally accepting of expected (recurring) delay and will adjust their schedules accordingly. Non-expected (non-recurring) delay is what usually causes users to be late for work, late for appointments, etc., and what usually causes the most angst for the traveling public. The more "reliable" a roadway segment is in facilitating on-time movement from Point A to Point B, the more satisfied users will be.

DelDOT must engage in a continuous loop of monitoring, controlling and providing information to effectively manage the transportation system. Every minute an interstate lane is blocked causes four minutes of travel delay after the incident is cleared<sup>1</sup>. Shoulder and lane closures impact roadway capacity more than one might guess. As an example, research has shown that blocking one out of three lanes on an interstate actually reduces capacity by over 50 percent. The TMC is uniquely able to minimize the impact of non-recurring congestion by detecting, dispatching, informing and aiding in incidence clearance.



Number of Lanes Blocked	Capacity Reduction <sup>2</sup>
Normal Flow (3 lanes)	N/A
Shoulder Blocked	17%
One Lane Blocked	51%
Two Lanes Blocked	83%

<sup>1</sup>National Traffic Incident Management Coalition. <http://ntimc.transportation.org/Pages/AboutUs.aspx>. Accessed 12/22/14.  
<sup>2</sup>Highway Capacity Manual 2010 by the Transportation Research Board.





# INCIDENT AND EVENT MANAGEMENT

*One of the most interesting aspects of the Delaware Department of Transportation's (DelDOT) transportation management program is that it's "on" all the time. Moreover, it is extremely dynamic in nature, reacting and adapting to information received not only from devices transmitting over state-of-the-art telecommunications, but also information received from people. Any incident that impacts Delaware's multimodal transportation system is managed through the Transportation Management Center (TMC).*

The TMC serves as a two-way communication center within DelDOT, and also between DelDOT and a variety of stakeholders. Not a lot of jurisdictions outside of Delaware have direct Computer Aided Dispatch (CAD) connectivity like we do with police, fire and rescue responders throughout the state. This information flow reduces response times and benefits police, fire and rescue responders and DelDOT. We are also in the business of two-way information exchange with the traveling public. People call, e-mail and comment through social media. This information can be extremely valuable in detecting issues and expediting our response; we need to communicate in both directions to keep the trust and information flowing.

Whether we like them or not, major incidents and events showcase the value of Delaware's transportation system. Some recent examples include:

- When Hurricane Irene brought unprecedented amounts of rain and wind in August 2011, there was a great deal of public anxiety leading up to the storm. It was difficult, if not impossible, to travel during the storm, and the resulting damage to the transportation system was significant. Foiling the negative aspects of the experience, DelDOT's transportation management system shone bright. The Governor was able to make good decisions about evacuations and bridge closures based on real-time road surface and traffic data. The TMC optimized mobility with traffic signal control to aid evacuations across state lines. Long-nurtured relationships within emergency response teams were called on for extraordinary teamwork and cooperation.

- In the Winter of 2013/2014, Delaware was buried in snow for many months. Not only were individual storms severe, several storms piled snow on top of prior accumulations. Much of Delaware's public discovered DelDOT's interactive website that winter – the number of hits exceeded all prior measurements. The website, and now the App too, are key tools for DelDOT to maintain highly accessible two-way communications with the traveling public.
- It was reported the Firefly Music Festival added \$68 million to the region's economy in 2014. This major event simply would not be possible without a functional transportation system. To prepare for the inevitable traffic surges that go along with huge ticket sales, DelDOT pulled data from the Integrated Transportation Management System (ITMS) sensors, performed a variety of studies and employed special management techniques to control the flow of traffic. Incident response strategies were also key to success. DelDOT received praise in both the newspapers and throughout social media.



- During the closure of Bridge 1-813 on I-495 over the Christina River in 2014, the role of DeIDOT's TMC was emphasized as the focal point for managing incidents. Even with an incident this severe, the TMC's routine protocols were effective in coordinating with partners, communicating with all stakeholders and managing the impact of the bridge closure on the transportation system. The TMC served as the focal point of communications, coordinating locally and regionally and working closely with Community Relations to field public inquiries with factual information. Information was disseminated up and down the East Coast allowing for informed route decisions by motorists and commercial carriers. The TMC used the monitoring system that was already in place to obtain and disseminate timely and accurate information. The reason we could communicate so effectively is because we have the system. Without ITMS, it would have been a totally different story.

During on-scene incident response, DeIDOT typically takes the lead at Scene 2, or the larger area surrounding the main incident area. For example, in the event of a typical highway multiple vehicle crash, fire and rescue would respond to Scene 1, addressing life safety and rescue activities. DeIDOT, with assistance from police would manage the larger Scene 2 area, keeping traffic out of Scene 1 by implementing traffic control and detour routes.



*The concept of the Transportation Management Team (TMT) was introduced in the 1997 Strategic Plan. The Strategic Plan recognized that effective transportation management requires the cooperation and coordination of people and agencies, and recommended that the Delaware Department of Transportation (DelDOT) implement an incident management team composed of police, fire and rescue, natural resources and transportation agencies. The TMT was envisioned as a dynamic group that works together, not only for planning purposes but also for field operations, to support the management of incidents and events that impact the transportation system.*

The Transportation Incident and Event Management Plan (TIEMP), developed in 2004, identified roles and responsibilities for the coordinated management of transportation resources. Further, it used the concept of levels of impact to determine levels of response. The use of levels allows the amount and assignment of resources (i.e., people, vehicles, equipment and materials) to be more readily defined and can reduce the times associated with incident identification, response and clearance.

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*Interagency relationships are vital to DelDOT's incident and event management success and should be maintained through regular planning, training and after-action meetings.*

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On September 14, 2004, representatives from state and local police, fire and rescue, natural resources and transportation agencies met at the Delaware Emergency Operations Center in Smyrna for the Statewide TMT Kickoff Meeting. At the meeting, the attendees agreed to move forward with TMTs for each county. Countywide kickoff meetings were held January-March, 2005, and six TMTs were formed: North New Castle, South New Castle, Kent, Western Sussex, Central Sussex and Eastern Sussex.

The goal of the TMT program is to improve response to transportation-related incidents by improving interagency training, communications, operations and resources. From the initial meetings in 2005 through today, the TMTs have worked together to improve transportation incident and event management throughout Delaware. Some of the TMT achievements include:

- Detour routes for major roadways statewide
- All-hazards evacuation plans, including evacuation route identification statewide

- Communications working group
- Multi-agency incident management training and exercises
- Special event coordination
- Safe, quick clearance legislation
- Good forum to disseminate information and obtain feedback on major capital projects

Today, TMTs have been consolidated into three countywide groups that meet as necessary to discuss incident and event management planning, response and lessons learned. Not only are TMT participants critical members of our first responder community, but they also function as an important network of eyes and ears to DelDOT on real-time transportation conditions and issues.







# EMERGENCY RESPONSE UNITS & THE MOTORIST ASSISTANCE PATROL PROGRAM

*Travel delays have both safety and environmental ramifications, which is why having response forces in the field is so important.*

The Motorist Assistance Patrol (MAP) patrols rush hour and construction-related congestion areas in specially equipped vehicles. They offer motorist assistance, assist at incident scenes and communicate problems to the Transportation Management Center (TMC). On average, MAP vehicles make 25-30 assists per week.

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*The Delaware Department of Transportation (DelDOT) should expand the MAP program into a 24/7/365 ERU operation to expedite incident and emergency response.*

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Emergency response units (ERUs) are a team of trained transportation specialists, ready to be deployed at short notice to provide specific support or direct services to motorists that need assistance during events that affect the transportation system. ERU patrollers patrol the transportation system in assigned areas and report any and all incidents or disruptions to traffic, including traffic delays and roadway condition information to the TMC. Duties of the patroller are varied and may include, but are not limited to, the following:

- Setting up traffic control and/or detour routes at scenes of major incidents
- Relocating stalled vehicles from potentially hazardous situations
- Providing road and travel information
- Reporting or removing debris from the roadway
- Performing minor mechanical repairs to disabled vehicles as abilities allow
- Providing coolant or other engine fluids
- Providing small quantities of fuel
- Jump starting vehicles
- Changing flat tires
- Assisting motorists out of snow banks
- Reporting of weather conditions

- Reporting of malfunctioned/dark traffic signals and downed traffic control devices
- Deploying and activating portable message boards

All MAP and ERU personnel participate in incident response training. Currently, the MAP and ERU programs shrink and expand as necessary. DelDOT should expand the MAP program into a 24/7/365 ERU operation.

Similar programs to DelDOT's ERU and MAP have proven benefits as follows:

- Florida Department of Transportation's (FDOT) Road Runner Program has reported reduced incident duration, delay savings, reduced fuel consumption and emissions, improved traffic flow, and reduced secondary incidents<sup>1</sup>. The Road Runner program is cited as one of the most effective elements of FDOT's Traffic Incident Management Program.
- The benefits attributed to Maryland State Highway's Coordinated Highway Action Response Team (CHART) operations include assistance to drivers and reductions in driver delay times, fuel consumption, emissions and secondary incidents.<sup>2</sup>

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*"Both men assisted in moving the vehicle to a safer location and ensured that cones were in place to safely divert traffic. My wife was extremely impressed with their degree of professionalism, exceptional assistance and the courtesy they displayed."*

*- Warren Mabey, Salem County Sheriff's Office regarding DelDOT's patrol service, 11/20/14*

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<sup>1</sup> Center for Urban Transportation, University of South Florida, prepared for Florida Department of Transportation, BDK84 977-15 Final Report. January 2012.

<sup>2</sup> Maryland State Highway Administration and University of Maryland, CHART Input and Analysis, Performance Evaluation and Benefit Analysis for CHART in Year 2012, July 2013.

*A need that wasn't necessarily anticipated for in 1997 when the program began, and yet is one of the Delaware Department of Transportation's (DelDOT) biggest accomplishments over the last decade, is that of the Transportation Homeland Security program. Events such as the 9/11 terrorist attacks, as well as climate change, have forced DelDOT to change the way we do business; demanding a finer integration with the emergency management function and a focus on transportation infrastructure vulnerabilities and protection.*

DelDOT is responsible for the safety and security of the transportation system, including preparing for, responding to and recovering from both natural and manmade threats. DelDOT has incorporated these added responsibilities within its existing headcount, adding to the dynamic nature of the Transportation Management Center (TMC) environment and impacting day-to-day business operations.

The United States Department of Homeland Security, as well as the Delaware Department of Safety and Homeland Security (DSHS), provide strategic guidance to promote the security and resilience of critical infrastructure. The Delaware Emergency Management Agency (DEMA), a division of DSHS, is the lead state agency for coordination of comprehensive emergency preparedness, training,

response, recovery and mitigation services. DelDOT works closely with these agencies to address transportation homeland security issues; supports the Delaware Information and Analysis Center (DIAC - Delaware's Fusion Center) as requested; and employs a full-time homeland security planner to support the Integrated Transportation Management System (ITMS) program. DelDOT's Continuity of Operations Plan designates the TMC as a critical facility.

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*DelDOT must continuously plan, mitigate, respond to and recover from natural and manmade threats.*

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The Transportation Incident and Event Management Plan (TIEMP) developed in 2004 set the stage for DeIDOT's incident and event management program. The plan defines the communication, response, resource and responsibility procedures and guidelines for response to any event or incident that impacts the transportation system. Over the years, DeIDOT has developed annexes to the TIEMP, as well as additional plans to prepare for various man-made and natural disasters, including:

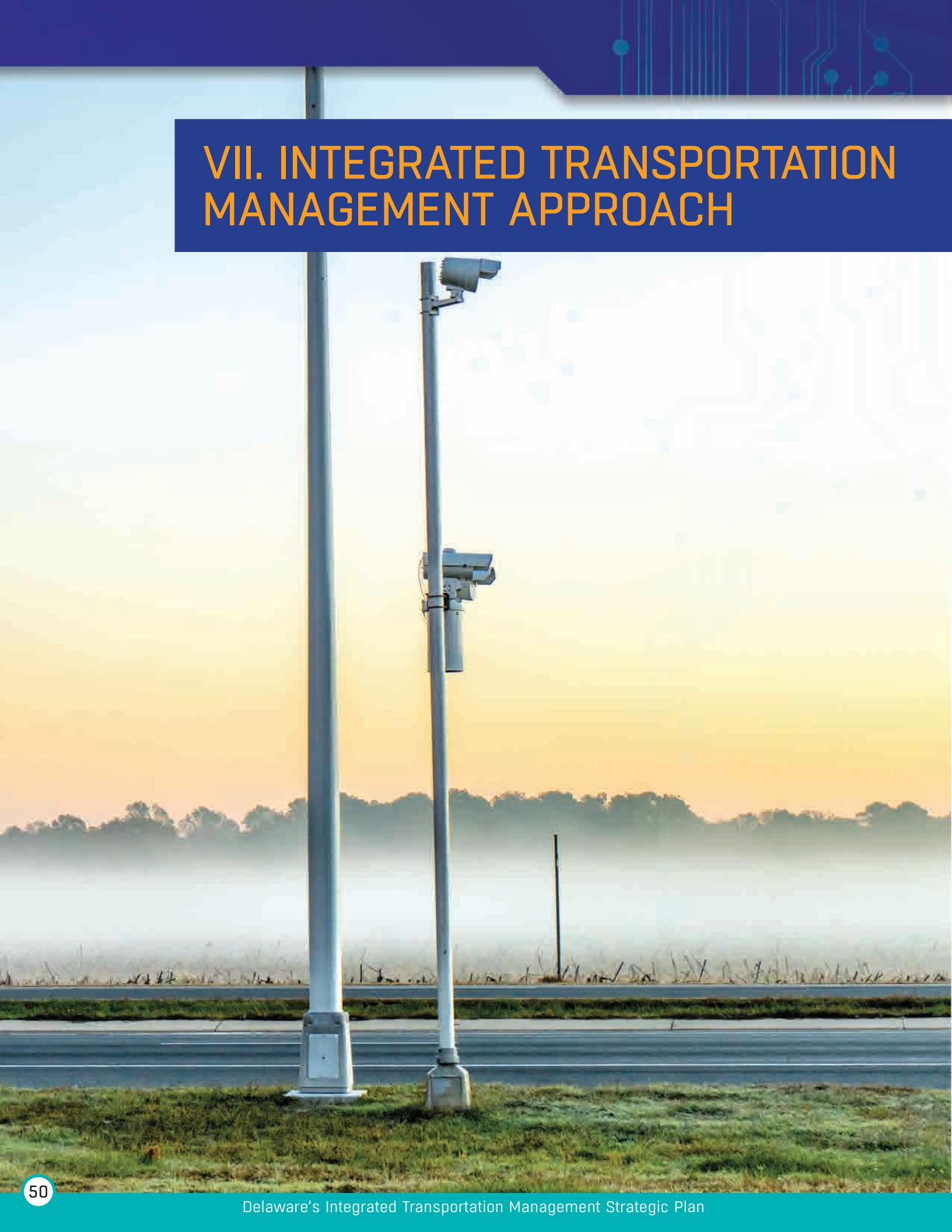
- Evacuation Plans
- Bridge Closure Plan
- Continuity of Operations Plan
- Incident Plans
- Debris Management Plan
- Snow Emergency Plan
- Toll Plaza Modified Operations Plan
- Transportation Security Plan

DeIDOT has also delivered training and exercises to enhance transportation response capabilities, and regularly conducts after-actions reviews of major incidents and events, striving for continual improvement.

Transportation resilience entails adapting to changing conditions, as well as preparing for, withstanding and rapidly recovering from disruptions. DeIDOT has shown leadership in our transportation Homeland Security mitigation, planning, response and recovery efforts.



# VII. INTEGRATED TRANSPORTATION MANAGEMENT APPROACH



What makes DeIDOT's program unique is the interrelatedness of its ITS and technology, incident and event management, 24-hour Transportation Management Center (TMC) and Homeland Security efforts. Each and every aspect of the transportation management program – from the infrastructure and technology, to the people, to the data and information, touches all other aspects of the program.

DeIDOT has built a very large, sophisticated system with thousands of devices. We need to take care of what we have, finish what we started and remain ready and able to take advantage of emerging technologies and innovation.

## Maintain what we have

In addition to the infrastructure and technology, DeIDOT has made investing in its people a priority. Maintaining the knowledge, skills and abilities to manage the system is critical for future success and will require ongoing training, education and improvement planning. At the same time, relationships have been built with external stakeholders including other agencies and states, which are imperative to maintain. With natural staff turnover this is a challenge, but it can be overcome through careful documentation of data, systems and procedures, coupled with ongoing knowledge exchanges.

## Finish what we started

Beginning with the 1997 ITMS Strategic Plan as a guide, DeIDOT began development and continual enhancement of our transportation management program. As documented in this plan, so much has been accomplished, but there is still more to do. Implementing the goals and strategies highlighted in this plan will ensure a fully functional integrated transportation management system, positioning DeIDOT to realize the full potential of its multimodal transportation network with innovative solutions.

## Integrate new opportunities

Because of its adaptable nature, DeIDOT's integrated transportation management program is well-positioned to transition into whatever the future holds. DeIDOT must stay abreast of industry trends and research to anticipate future needs, and adapt or grow accordingly to help Delaware maintain competitiveness in the global economy. DeIDOT should always place some focus on innovation and creativity; striving to find better, more efficient ways to enhance mobility.



## Summary of next steps

The four strategies identified in the original plan to guide the implementation of goals are still relevant today. Following are the next steps identified in Section IV of this plan for each of these strategies, plus additional next steps beyond the original four strategies:

### Next Steps for Strategy #1 Create the necessary infrastructure to support transportation management

- Shift focus from building the Transportation Management Center (TMC) to operating and maintaining
- Complete connectivity of all traffic signals to the statewide computerized signal control system
- Responsive traffic control based on real-time system capacity and demand changes
- Implement bus priority by integrating bus automated vehicle location (AVL) with signal system
- Speed the collection of transit fares
- Implement dynamic lane use control
- Pursue expanded Commercial Vehicle Information Systems Network (CVISN) program and grant opportunities
- Expand "Tracker" for optimal incident management and associated record keeping to enhance performance management
- Monitor transit performance as it relates to signal performance
- Partner with State Police on license plate reader (LPR) system to provide information on travel time, origin-destination
- Advance machine vision technology to acquire traffic data and perform incident detection from video
- Open road tolling
- Connected and autonomous vehicles
- Build out fiber, resulting in robust/redundant fiber "rings" throughout state
- Minimize dependency on leased lines and cellular modems
- Build out an advanced wireless system in cooperation with the Division of Communications (DivComm) and the Department of Technology and Information (DTI) on both 700MHz and 4.9 GHz
- Establish state-owned fiber optic connection to New Jersey
- Bridge monitoring systems
- High resolution signal data
- Roadway weather integrated mobile observation



### Next Steps for Strategy #2

#### Disseminate real-time, accurate information and allow customers to make informed decisions regarding travel route, travel time and mode choice

- Voice recognition
- Personalized route information
- Seamless information across state lines
- System reliability
- Enhanced electronic toll plaza signing
- Parking information system
- Expand repeater system to increase access to WTMC 1380 AM

### Next Steps for Strategy #3

#### Develop partnerships to support transportation management activities

- Expand Motorist Assistance Patrol (MAP) and Emergency Response Unit (ERU) to 24/7/365 operation and expanded coverage area
- Enhance transportation homeland security program
- Update/create incident/event plans as conditions warrant
- More training and exercises to ensure staff are familiar with plans and to generate ideas for updates
- Continue Transportation Management Team (TMT) meetings and interstate coordination meetings with MD, NJ and PA



## Next Steps for Strategy #4

### Develop internal capacity to support transportation management

- Emphasize training as a continuous, ongoing priority. Emphasize operations and maintenance training
- On-the-job training, scenario training
- Maintain and develop Standard Operating Procedures (SOPs) as needed
- Knowledge, skill and ability assessments
- Enable each position to be filled at the career ladder
- Establish a succession plan for transportation management leadership
- Support culture of continuous improvement with clear targets and incentives for individuals and units
- Partner with community relations to track and organize opportunities
- Develop a mechanism to maintain awareness of industry best practices and developments beyond existing conventions
- Include transportation management staff leadership in all program discussions
- Show the relative level of investment in transportation management in the published budget
- Position DelDOT for the future connected and autonomous vehicle revolution
- Assess in-house and consultant staff levels and responsibilities, and hire accordingly





## Additional Next Steps Beyond the Original Four Strategies

In addition, the following forward-thinking statements found throughout Section VI provide future direction for DeIDOT's Integrated Transportation Management program:

- DeIDOT has, and should continue to stay on top of the ever changing technology that people use to get information. This adaptability is what keeps DeIDOT relevant and valuable to the transportation system user
- DeIDOT strives to integrate planning and operations functions to maximize data sharing and track performance
- DeIDOT strives for travel time reliability by identifying, understanding, and mitigating both recurring and non-recurring congestion
- DeIDOT will safely manage the transportation system, from planning and design, to operations and maintenance
- DeIDOT should continue to partner with academia to develop critical specialized skills needed to support transportation management
- DeIDOT must continuously plan, mitigate, respond to and recover from natural and manmade threats
- Interagency relationships are vital to DeIDOT's incident and event management success and should be maintained through regular planning, training and after action meetings
- As a major threat to Delaware's transportation system, water must be monitored, and flooding predicted, to maximize response and resiliency planning
- DeIDOT must continue to engage in a continuous loop of monitoring, controlling and providing information to effectively manage the transportation system
- DeIDOT should focus on maintaining the existing technology and infrastructure in a state of good repair, as well as investing in new technology to remain economically competitive
- DeIDOT should continue a multimodal transportation management approach including full integration of Delaware Advanced Transportation Management System (DATMS) with ITMS, transit system priority and two-way information
- By relating real-time trends to historic patterns, the TMC can predict future conditions and take actions to benefit travelers
- Building on current software capabilities, the TMC can relate monitoring and control systems to automate predictive transportation management



## VIII. INTEGRATED TRANSPORTATION MANAGEMENT COST



Since integrated transportation management uses technology, and technology is known to evolve continuously, costs vary. On one hand, computer memory has gotten cheaper. On the other hand, we're storing unprecedented amounts of data. Each year, the program's outlook needs to be revisited to ensure future budgets are secured appropriately.

The costs of integrated transportation management are typically comprised of human resources, equipment (including vehicles), infrastructure (including telecommunications, information technology and devices) and facilities. Costs are incurred and managed in the full life cycle of project costs, including research, planning, design, software development, construction, implementation, operations, maintenance and reevaluation.

The Delaware Department of Transportation (DelDOT) maintains a variety of multi-year statewide contracts that support adding to or enhancing the system. To date, the majority of operations and maintenance costs of integrated transportation management have been covered with in-house DelDOT resources. As the program has become more established, the need for specific niche help in operations and maintenance has become more clear, and future contracts are expected in these areas.

New projects are sure to arise beyond the original plan, as there will always be a new technology available, possibly whole new ways of doing business such as connected and automated vehicles and machine learning (artificial intelligence). As more devices get turned on, and more telecommunications equipment is deployed to cover the state's needs, there is an important shift going on – more things to manage. It is important that we maintain what we build. While we expect to see capital costs decrease in coming years, we also know more investment is needed in keeping people qualified and supported with the resources they need to operate and maintain the program.

Important to consider in integrated transportation management budgeting is not just the cost, but also the source of funds. One part of the program, the traffic signal system, is 100% supported by Federal Highway Administration (FHWA) due to recognized returns on investment in areas such as congestion management and air quality. On the other hand, it is not as straightforward to secure federal funds for the other elements of the system. Normally expansion and enhancement can be federally funded, but operations and maintenance is expected to be paid for at the state level. That is an important point as DelDOT's integrated transportation management emphasis shifts more toward operations and maintenance.

The integrated transportation management program completes a variety of beneficial projects and daily operations each year for a relatively small amount of money. Historically, DelDOT's transportation management program (listed as Transportation Management Improvements (TMI) in the capital transportation program) has comprised 1-4% of the state's capital transportation budget. In addition to the TMI budget, DelDOT has done an excellent job of including integrated transportation management systems (ITMS) in the department's overall project review process so that ITMS elements are included in all capital projects when appropriate.

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*A big cost of the ITMS system is telecommunications, and much of the investment has already been made. You can't really put a value on the return on investment - it is profoundly beneficial to DelDOT and all state agencies.*

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## IX. RELATIONSHIP TO OTHER PLANS



The overwhelming majority of statewide plans, agency policy documents, comprehensive land use and transportation plans and federal-level Metropolitan Planning Organization (MPO) plans already recognize the vital role Integrated Transportation Management System (ITMS) should play at present and in the future.

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*The University of Delaware conducted a policy review in 2011. Today in 2017, the integrated transportation management program continues to participate in county and statewide policy updates.*

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### Local policy support for integrated transportation management

To understand the importance of ITMS in Delaware, a review of important county and statewide policy documents was conducted. This policy review examined key planning documents to identify goals and objectives that could be accomplished through the use of ITMS strategies and technologies, as well as those that explicitly call for its utilization.

Along with transportation related sections, the policy review also included an examination of economic development and livability goals to determine if ITMS strategies and technologies could be applied to these fields. The policy review included the following documents:

- 2007 New Castle County Comprehensive Plan
- WILMAPCO Regional Transportation Plan 2030
- Delaware Strategies for State Policy and Spending
- 2001 New Castle County TOMP Data Collection
- 2010 Delaware Long-Range Transportation Plan
- Dover/Kent County Metropolitan Planning Organization Regional Transportation Plan (2009-2030)
- 2008 Sussex County Comprehensive Plan Update

The review of these policy documents identified several reoccurring goals and objectives that could be accomplished through the use of ITMS. Although these policy documents covered a varied array of topics and interest areas, the reoccurring goals and objectives can be grouped into four major policy themes:

- 1) Promoting Intergovernmental Coordination
- 2) Enhancing System Performance and Capacity
- 3) Promoting the Movement of People and Goods
- 4) Enhancing Multimodal Facilities and Travel

### Promoting intergovernmental coordination

Improving and promoting intergovernmental coordination was a policy theme found in virtually every policy document reviewed for the ITMS project. Through the use of new strategies and technologies, policy makers and planners hoped to increase communication between various government entities. Throughout the reviewed documents, there was an emphasis on implementing new and existing technologies to increase communications with emergency services to decrease response time. For example, the Section VII-F of the 2007 New Castle County Comprehensive Plan states the need to “Maintain the performance of emergency call takers, police, fire and EMS dispatchers through the maintenance of effective technology systems and equipment.”

Several policy documents noted the need to promote and increase coordination between transportation planners and managers to ensure that new growth utilized existing resources. These goals also spoke to the need to promote smart growth in their respective jurisdictions. There was a general enthusiasm regarding the incredible amount of data ITMS systems are capable of gathering, leading to a heavy emphasis on exploring how best to put this information to use in a planning context. An example of this can be found in the strategic approach guiding principles outlined in the 2010 Delaware Department of Transportation (DelDOT) Long Range Transportation Plan. Among these principles is the need to “direct programs, services and facilities to support smart growth initiatives” and to “maintain planning and coordination as an integral part of our activities.”



## Enhancing system performance and capacity

Improving the performance and capacity of the region's transportation system was another major theme found in the reviewed policy documents. Many of the reviewed documents noted the need to use new strategies and technologies to better manage the existing transportation system and increase system performance. There was also an emphasis on implementing cost-effective transportation solutions to increase system capacity as opposed to capital-intensive investments. For example, the implementation of highway speed E-ZPass lanes would be relatively inexpensive compared to a capital-intensive project like expanding or adding lanes to the highway. This comes as no surprise, as governments at all levels have striven for years to reduce the impact of congestion and delay to their constituents; however, ITMS has effectively given policy-makers another potential tool in addressing this dilemma.

There are several examples of this policy theme at both the state and county level. In the Dover/Kent County Metropolitan Planning Organization's Regional Transportation Plan's (2009-2030) Executive Summary is a list of recommendations for the region. Among these recommendations is the improvement of transportation management by "implementing Intelligent Transportation Systems, which use technology to increase the efficiency and capacity of transportation infrastructure by managing congestion."

At the statewide level, the 2010 DeIDOT Long Range Transportation Plan includes Policy Principle #4: Cost-Effective Objectives. Each of the objectives listed under policy principle #4 is related to enhancing system performance and capacity:

- "Use cost-effectiveness as a key indicator when prioritizing projects or choosing among alternatives optimizing the investment of resources across all modes and balancing fiduciary responsibilities"

- "Maintain and use existing resources and equipment as a means toward cost effectiveness"
- "Take advantage of technology as a means of providing efficient service"

## Promoting the movement of people and goods

Though ITMS is often looked upon as a problem-solving tool, increasingly it is being viewed as an asset in its own right. A number of the documents reviewed encouraged the adoption of ITMS as an economic development strategy, noting the efficiencies it may provide could well result in a competitive edge for areas where it was implemented well.

The reviewed policy documents repeatedly state the need to improve the transportation system to promote the movement of people and goods throughout the region. In many of the policy documents, improving the movement of people and goods was considered to be a necessary action to maintain or increase economic competitiveness. Several of the policy documents also noted that the region's transportation system should be considered as an economic development asset. Just as Delaware may compete well with neighboring states because it has no sales tax or because of its comparatively lower property-tax rates, so too could it benefit from offering lower costs and increased efficiencies as they relate to transit and the transport of goods.

For example, WILMAPCO's RTP recognizes that "the timely, efficient and cost-effective movement of people and goods is essential for the region to remain competitive." The WILMAPCO RTP also mentions that implementing elements of the plan "would result in a future where our transportation system is an economic development asset." Sections of the Delaware Strategies for State Policies and Spending also highlight this policy theme, including Strategy #9: "Promote mobility for people and goods through a balanced system of transportation options."



## Enhancing multimodal facilities and travel

The State, in fact the entire nation, has steadily shown interest in non-automotive travel. High fuel prices, congestion, environmental issues and a host of other concerns have driven this trend.

A final theme found in many of the reviewed policy documents were goals and objectives related to enhancing multimodal facilities and travel. Many of the policy documents stated the importance of improving conditions for pedestrians, bicyclists, public transit users, ride share users and all other multimodal facilities. In the instances that the policy documents mentioned the use of new strategies and technologies to improve multimodal facilities, there was an emphasis on increasing information available to multimodal travel users. For example, providing real-time information to public transit users would better inform the decisions of users.

Several highlights of this theme come from the WILMAPCO Regional Transportation Plan 2030 (RTP), especially under its goal to efficiently transport people. The WILMAPCO RTP notes the need to “Work with transit providers to expand Regional Transit and Ridesharing Information through implementation of real-time travel information via telephone, on-site, and computer based systems. Technology can be used both to increase transit’s operational efficiency and to provide new information to transit customers, resulting in an overall improved transit experience.” The 2008 Sussex County Comprehensive Plan Update also notes the need to promote multimodal facilities, especially pedestrian facilities. For instance, the plan states the need to “promote land use and traffic patterns that encourage walking and reduce air pollution.”

## ITMS from the MPO perspective

During the ITMS Public Policy Forum held by the University of Delaware’s Institute for Public Administration and DeIDOT, WILMAPCO provided input on ITMS from the MPO Perspective.

For years, WILMAPCO has been recording and reporting on transportation system performance and roadway congestion in New Castle and Cecil County. This information has been used to identify several key corridors with significant traffic congestion. In many of these corridors, WILMAPCO has been able to identify several commonalities. First, the key congestion corridors are often mature corridors. Second, these corridors are often developed enough that traditional capacity improvements (adding lanes, widening lanes, etc.) are not possible. Without the ability to implement traditional capacity improvements, WILMAPCO has recognized that there is a need to maximize the performance of the existing system to facilitate the movement of people and goods through these congested corridors. WILMAPCO has also recognized that ITMS strategies and technologies can be used to maximize system performance.

An example of implementing ITMS strategies and technologies in a key congestion corridor would be their deployment on US 202 in New Castle County. According to WILMAPCO, between 2001 and 2010, traffic increased by 5% along the corridor. Despite this increase, average drive time has remained the same. According to WILMAPCO, the average drive time remained the same due to the implementation of ITMS strategies and technologies along this corridor, which improved system performance and capacity without implementing traditional capacity improvements. WILMAPCO also noted that it is important that the public is made more aware of ITMS, and examples such as the US 202 ITMS deployment, so that the public knows that the transportation system can be improved at a fraction of the cost of traditional methods of adding capacity.



## ITMS from the statewide emergency management perspective

The Delaware Emergency Operations Plan (DEOP) establishes the framework through which the state of Delaware prepares for, responds to and recovers from the impacts of a wide variety of disasters and emergencies that could adversely affect the state or its citizens. It defines the roles and responsibilities of the agencies involved in response to emergencies and disasters in Delaware. DelDOT is designated as the lead agency for transportation and debris management within the DEOP.

### 2011 public forum

On April 20, 2011, an ITMS Forum was held at the University of Delaware. It was attended by over 30 participants from a variety of backgrounds and professions – academics, planners, transportation operations personnel, private consultants, state, county and local police, emergency responders, AAA and others. The forum is available for viewing online as an audio/video webcast, including stakeholder feedback. All PowerPoint presentations are available as well at [ipa.udel.edu/transportation/itms/podcast.html](http://ipa.udel.edu/transportation/itms/podcast.html)

Forum participants were first briefed on the current status and future of ITMS implementation in Delaware by DelDOT. The Institute for Public Administration at the University of Delaware presented research on performance measures for ITMS and existing and future policy support for the program found in a number of state-wide and regional policy documents (both available in the appendix of this document). WILMAPCO then presented on ITMS from a

regional planning perspective. The main part of the forum, however, was targeted toward soliciting feedback and opinions from those in attendance. In a moderated two-plus hour session, stakeholders were given the chance to express what value they saw in ITMS. The stakeholder feedback tended to fall within common categories:

- Integration of land-use and transportation planning
- Cooperation between transportation planners and developers
- Increase scope and range of impact studies
- Better implementation and adherence to policy plans
- Better delivery of real-time data to emergency services
- Better delivery of real-time data to transportation customers
- Design and build “smart roads” that include ITMS strategies and technologies
- Access or lack thereof to ITMS Data

Few forum attendees were practiced transportation engineers, managers or operations personnel. This was by design, in an effort to gain the broadest level of feedback possible and to ensure that the resultant inputs would be useful in the wider range of transportation policy.

Accordingly, many of the participants were less interested in commenting on the technical nuances of ITMS than in discussing how the effective implementation and adaptation of ITMS could serve to address what they saw as long-standing issues in transportation/land-use planning, intergovernmental coordination and fiscal responsibility.





### Integration of land-use and transportation planning

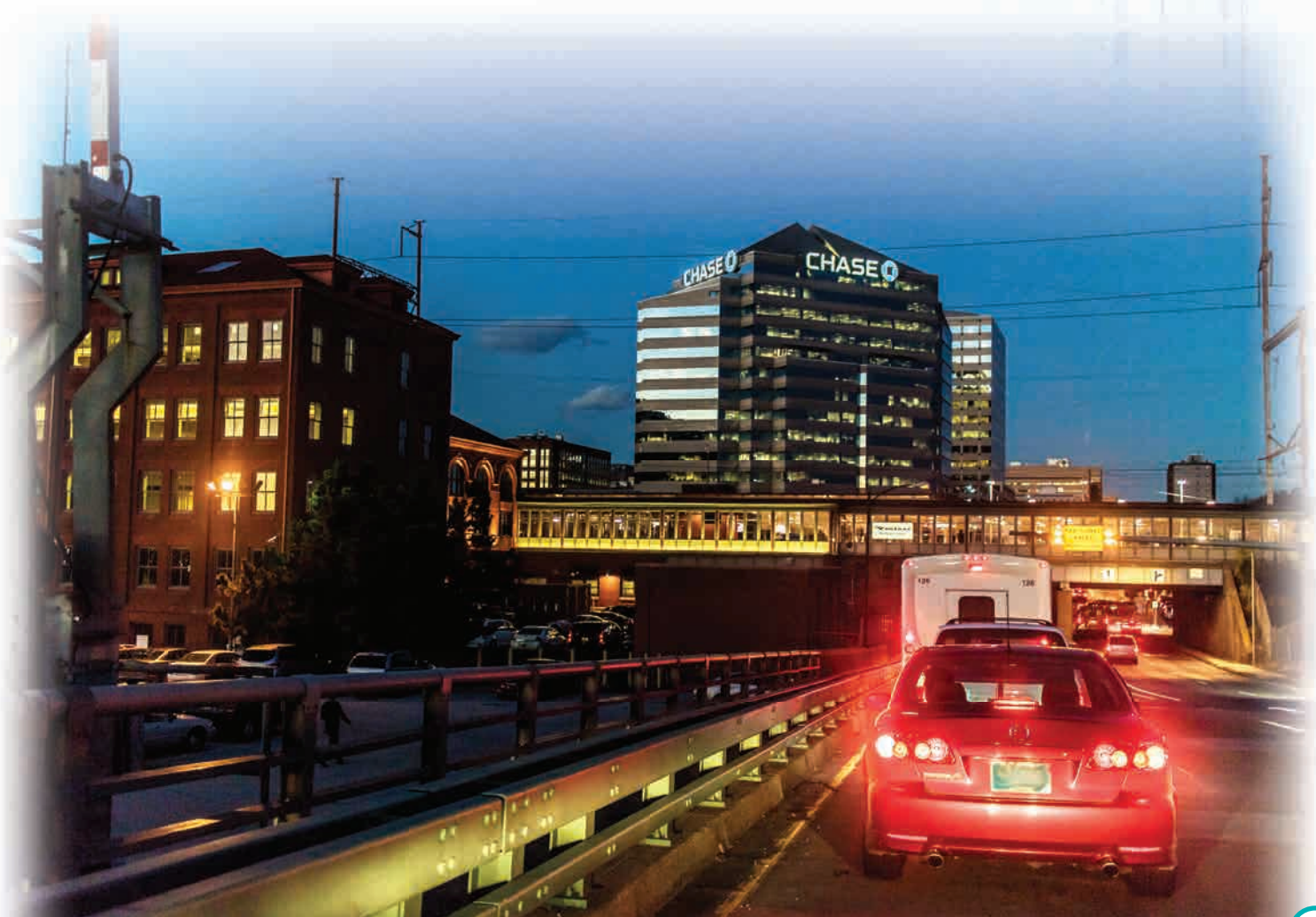
In Delaware, in particular, there is a sense of disconnect between land-use and transportation planning. Land-use decisions are made at the municipal and/or county level, while the vast majority of transportation infrastructure and funding comes from the state. Participants tended to view the vast data generated by the ITMS system as a means towards bridging this perceived gap. They essentially argued that plentiful and unambiguous data detailing unfavorable growth and development trends could be used to help reshape the state's land-use policies.

### Cooperation between transportation planners and developers

In a similar theme, participants also felt that the vast amounts of data developed by the ITMS system could be of use to the development community. They felt that transportation planners, armed with this data, would be in a better position to work more effectively, and more fully review proposals submitted by the development community. This discussion eventually turned to the topic of impact studies (which follows).

### Increase scope and range of impact studies

Following the discussion of cooperation, the conversation turned towards impact studies, transportation impact studies (TIS) in particular. Attendees felt that ITMS data and ITMS remote sensors could bring increased efficiency and uniformity to the process. Typically, larger development proposals will require a TIS. It is used to model the likely impacts of the increased demand for transportation associated with the project to; 1) determine its feasibility and 2) identify improvements to the system that may be required. These are typically then included with the cost of the project. Attendees noted that TISs are often performed in the same areas, even the same roadways, by different developers – often concurrent with data collection efforts or ITMS sensors in the region. Stakeholders felt that the data collected by developers should be incorporated into the data system. More importantly, they felt that the data system itself could be used in-lieu of some of these time-intensive efforts. They also felt that relying on the state system for data inputs could add more transparency and uniformity to the TIS methodology.



### Better implementation and adherence to policy plans

While attendees were generally enthusiastic regarding the efficiency and capacity increases ITMS may provide, some were hesitant to see such a system applied uniformly across the transportation system. Viewing ITMS as a tool to realize initiatives such as smart and sustainable growth, some participants felt its implementation should be limited to, or at least heavily focused on, areas the state and counties have identified for growth. The consensus seemed to be not to use an efficient, cost-saving system to encourage expensive, unsustainable growth.

### Better delivery of real time data to Emergency Services

All participants were impressed and pleased with the performance of DeIDOT's TMC, agreeing it was a significant improvement in getting important information out quickly to emergency personnel. Police agencies noted they would be interested in using ITMS-derived data proactively, rather than in response to an incident. An example given was using the system to target enforcement based upon observed incidents of speeding or areas prone to accidents. Another thought was to more fully utilize ITMS's ability to quickly disseminate information to the motoring public regarding traffic incidents, potentially reducing the burden of redirecting traffic around an incident from emergency responders.

### Better delivery of real-time data to transportation customers

A common refrain was how no one likes to be stuck in traffic inching toward a variable message sign (VMS) dutifully notifying them of congestion ahead. The group was impressed with DeIDOT's array of methods of relaying important information to travelers (radio station, internet, VMS and the anticipated Mobile App). The group brainstormed the likely changes to be brought about by the widespread acceptance of smart phones. Some expressed concerns regarding social equity (less affluent citizens could have less access to expensive technology). Others wondered how to safely incorporate this new avenue of communication into a driving environment without undue distraction to the driver. Public transit was a major point of discussion, as attendees saw ITMS technology, particularly as it relates to smart phones, as a potential watershed for transit ridership and ease of use. Some envisioned a system where one's phone would tell the customer precisely when the next bus was arriving and where it was going. Attendees felt a "Google-maps-like" system that could direct the transit user to the closest mode and along the most efficient route would be highly desirable.



## Design and build “smart roads” that include ITMS strategies and technologies

Following comments from DelDOT, the group felt strongly that retrofitting the existing transportation network to incorporate ITMS was desirable, but that additional steps should be taken. The group felt that any new roadway construction or existing roadway rehabilitation should incorporate ITMS components up-front in the project budget, as it was shown that the cost of retrofitting was significantly higher than the cost of including the elements in initial design and construction.

## Access or lack thereof to ITMS data

Having seen the sheer enormity and scope of data that the state’s ITMS system is capable of collecting and storing, the attendees repeatedly wondered how best to disseminate and make use of it. The group discussed the different protocols various state agencies and municipalities utilize in their planning activities and searched for ways to format ITMS data to fit these needs.

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*2017 Update: DelDOT makes data readily accessible through database connections that serve individuals, companies, developers and academia.*

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## Federal policy support

The United States Department of Transportation (USDOT) released their Intelligent Transportation System (ITS) Strategic Plan for 2015-2019 in 2014. The plan outlines the following program categories that will guide the ITS program’s operational focus and decisions:

- **Connected vehicles** - transition from heavy investment in the research phase to more investment in the development and adoption phases
- **Automation** - focus on research about automated road-vehicle systems and related technologies that transfer some amount of vehicle control from the driver to the vehicle
- **Emerging capabilities** - focus on future generations of transportation systems
- **Enterprise data** - focus on enabling effective operational data capture from ITS-enabled technologies, including Connected Vehicles (CV), mobile devices and infrastructure, as well as data integration
- **Interoperability** - focus on effective connectivity among devices and systems
- **Accelerating deployment** - having a structured and standardized process in place for transitioning between adoption and deployment



# ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials	DIAC	Delaware Information and Analysis Center
AVL	Automatic Vehicle Location	DivComm	Department of Safety and Homeland Security: Division of Communications
ATDM	Active Transportation and Demand Management	DNREC	Delaware Department of Natural Resources
ATR	Automatic Traffic Recorder	DSHS	Delaware Department of Safety and Homeland Security
CAD	Computer Aided Dispatch	DSTEP	Delaware Signal Timing Enhancement Partnership
CAV	Connected and Automated Vehicles	DTC	Delaware Transit Corporation
CDMA	Code Division Multiple Access	DTI	Department of Technology and Information
CHART	Maryland State Highway's Coordinated Highway Action Response Team	EMS	Emergency Medical Services
CMAQ	Congestion Mitigation and Air Quality	EOC	Emergency Operations Center
CV	Connected Vehicle	EOps	Electronic Operations
CVISN	Commercial Vehicle Information Systems and Networks	ERU	Emergency Response Unit
DACUM	Developing a Curriculum	FDOT	Florida Department of Transportation
DATMS	Delaware Advanced Transportation Management System	FHWA	Federal Highway Administration
DelDOT	Delaware Department of Transportation	HAWK	High-Intensity Activated Crosswalk
DEMA	Delaware Emergency Management Agency	ITMS	Integrated Transportation Management System
DEOP	Delaware Emergency Operations Plan	ITS	Intelligent Transportation Systems
		LPR	License Plate Reader
		MAP	Motorist Assistance Patrol

MD	Maryland
MPO	Metropolitan Planning Organization
NASCAR	National Association for Stock Car Auto Racing
NIMS	National Incident Management System
NJ	New Jersey
PA	Pennsylvania
PSAP	Public Safety Answering Point
RSS	Rich Site Summary
RWIS	Road Weather Information System
SOP	Standard Operating Procedure
SPR	State Planning and Research
STP	Surface Transportation Program
TAR	Traveler Advisory Radio
TEAM	Transparent, Efficient, Accountable, Measured
TIEMP	Transportation Incident and Event Management Plan
TMC	Transportation Management Center
TMT	Transportation Management Team
TRB	Transportation Research Board

TSMO	Transportation Systems Management and Operations
TSP	Transit Signal Priority
TV	Television
UD	University of Delaware
USGS	United States Geological Survey
UAV	Unmanned Aerial Vehicle
VMS	Variable Message Sign
VSL	Variable Speed Limit
WILMAPCO	Wilmington Area Planning Council



DELAWARE DEPARTMENT OF TRANSPORTATION



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