ITS Deployments for Freight Specific Applications

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Table of Contents

Executive Summary

The value and volume of freight movements in the State of Rhode Island and across the New England region continues to increase year after year. The 2016 Rhode Island Freight and Goods Movement Plan forecasts an annual increase in total truck freight value of $1.62 billion from 2013 to 2030. The total value of truck freight flows in 2013 was $66.04 billion and the forecast for the total value of truck freight in 2030 is expected to be $95.32 billion[1].

Moving freight by trucks is a critical component of our state and regional economy and are disrupted by increasing congestion on our highway. Furthermore, a lack of available truck parking facilities, and a lack of advanced planning and real-time travel information on the highways make it even more challenging to move goods by truck. In Rhode Island 71 percent of all freight is moved via truck throughout the highway transportation network. Freight related Intelligent Transportation Systems (ITS) technologies have the potential of improving these problems and providing solutions to reduce congestion, provide for more efficient movement of freight, reduce energy consumption, reduce environmental impacts, and improve the safety of the traveling public. Freight ITS has the ability to improve transportation resource management, improve the speed and efficiency of port and terminal operations and management, and administer freight vehicle tracking and tracing to help improve congestion on the freight network.

Intelligent Transportation Systems (ITS) are defined by the Federal Highway Administration (FHWA) as the application of advanced sensor, computer, electronics, and communication technologies and management strategies, in an integrated manner, to improve the safety and efficiency of the surface transportation system. Existing ITS provides the Rhode Island Department of Transportation (RIDOT, the state highway System Operator), the ability to better manage (via technology that helps detect, verify, and respond to) roadway incidents; the ability to provide the public with travel related information that reduces congestion and improves safety; and the ability to report on the state's highway system operational performance (e.g., via the collection of traffic-related data by technology deployed in the field)..

In recent years, different fields of technology such as communications, computing hardware, global positioning systems, telecommunications, vehicle technologies, electronics and sensors have advanced and become more readily-available, integrated and/or cost-effective, altering the opportunities available for ITS deployment. Highway system operators struggle to keep pace with these developments as best they can, but in the freight realm the utilization of new technologies the private sector truck drivers and fleet operators should be noted as such offer potential opportunities to more efficiently manage the surface transportation system in Rhode Island. Additionally, increasing the efficiency and effectiveness of the transportation system can lead to economic advantages such as, reducing the travel time of trucks or reducing error rates. These reductions lead to greater efficiency for the transportation system and at the same time, increased economic advantages for supply chain actors.

For all these reasons, this technical paper explores the latest truck related ITS deployments in other states and regions across the United States and identifies what technologies and deployments may be applicable for use in Rhode Island. This paper also surveys the latest smartphone applications and

[1] 2016 State of Rhode Island Freight and Goods Movement Plan, Appendix 3 "Commodity Flows and Forecasts by Freight Transportation Mode, Page 3.

services available to truck drivers and fleet managers to gain greater understanding of the real-time decision-making data and tools available within the trucking industry to better understand how truck drivers make their decisions and what tools they use for route guidance.

Project Objectives

This paper is meant, in part, to supplement the information provided in the Rhode Island Department of Transportation 2015 – 2020 ITS Strategic Deployment Plan by including a survey of various freight specific ITS deployments being utilized in other states, other regions, and by the provide sector. In providing this survey of freight ITS, it is anticipated that new ITS investments can be made to address freight specific challenges such as congestion, bottlenecks, and lack of truck parking facilities outlined in the 2016 State of Rhode Island Freight and Goods Movement Plan. This paper also aims to provide a survey of the latest technologies and applications used by truck drivers, fleet operators, states, and regions and ways to incorporate them into our existing ITS infrastructure.

This paper will analyze issues relating to ITS deployment and truck driver alerts for freight specific applications. It provides a cursory review of the current Rhode Island Department of Transportation ITS Strategic Deployment Plan and identify some gaps for freight movement and suggest new freight specific ITS recommendations to improve the performance of freight mobility in Rhode Island and across the Northeast region. This paper will provide a series of ideas and recommendations on how to jumpstart ITS enhancements and new deployments in Rhode Island to improve freight and goods movement.

Division of Statewide Planning Staff Involved in this Paper

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- Benjamin Jacobs, Principal Research Technician

Stakeholder Involvement with the Freight Advisory Committee

In the development of this Technical Paper, occasional updates and presentations were given to the Rhode Island Freight Advisory Committee on the research and discussion topics addressed in this technical paper. The Freight ITS Technical Paper was initially introduced to the Freight Advisory Committee with an overview of the scope of the paper at the September 18, 2019 meeting which was held at Hope Global manufacturing in Cumberland. As drafts of the technical paper were being developed, the committee was given presentations on the information and ITS examples from other regions that were being incorporated into the paper. At the December 4, 2019 Freight Advisory Committee, which was held at the Quonset Development Corporation, the committee received a presentation outlining several of the key Freight ITS developments from other state dot's and other regions of the country. Additionally, the presentation summarized the utilization of smartphone apps by truck drivers and fleet managers and ways that states have shared public data with app developers and current platforms used by the industry. This paper was then refined based on feedback from the Freight Advisory Committee and freight planning experts who were consulted from other states during the research for this paper.

A third presentation on the technical paper was slated to be provided to the Freight Advisory Committee on March 25, 2020 however due to the COVID-19 Pandemic related meetings restrictions this paper was circulated by email to certain Freight Advisory Committee members involved in the trucking and shipping industry. It is anticipated that the full Freight Advisory Committee will have the opportunity to be briefed and offer comments on this paper in the coming months. This paper was presented to the Transportation Advisory Committee at their June 25, 2020 meeting and the State Planning Council at their August 13, 2020 meeting for adoption as Technical Paper #169.

Introduction

Truck transport provides surface transportation connectivity important to serving short, regional and long-haul markets. It also provides intermodal connectivity allowing for international, domestic, and regional supply chains to operate efficiently. In many instances, truck transport provides the "first" or "last" mile, whereby another mode is the principal means of transport. The net effect is that almost all commodities eventually move via truck, at least for part of the trip, between points of production and consumption.

Rhode Island's state and regional economy are heavily dependent upon the efficient movement of freight for its energy supplies, raw materials, and final delivery of goods to consumers. Our freight network is the lifeblood of our economy, and when it does not perform well due to roadway congestion, safety incidents, or failing infrastructure, it affects businesses by delaying shipments to warehouse and distribution centers. A late shipment or unreported delay can have a ripple effect on the productivity of a supply chain. Freight network congestion is also a major cause of delays in construction projects and tends to raise costs for construction firms of all types. These delays decrease worker productivity, waste fuel and manpower resources.

According to the 2016 State of Rhode Island Freight and Goods Movement Plan, over 44 million tons of freight moved by truck in Rhode Island in 2013, the base year for the plan's analysis. In 2030 almost 59 million tons is expected to move by truck, representing a compound annual growth rate of 2.0%[2]. Through and inbound truck tonnage are forecasted to grow at average annual growth rates of 2.1% and 2.7%, respectively, whereas outbound tonnage is anticipated to grow at 1.2%[3].

The total value of all of this truck freight movement in 2013 (base year) was $66.04 billion, in 2019 the value is expected to be $75.76 billion, and by 2030 we can expect a total of $95.32 billion in value for all of the freight truck flows in Rhode Island[4]. These freight flows are an integral component of our state and regional economy. Any delays or system disruptions on our freight network can have serious economic impacts.

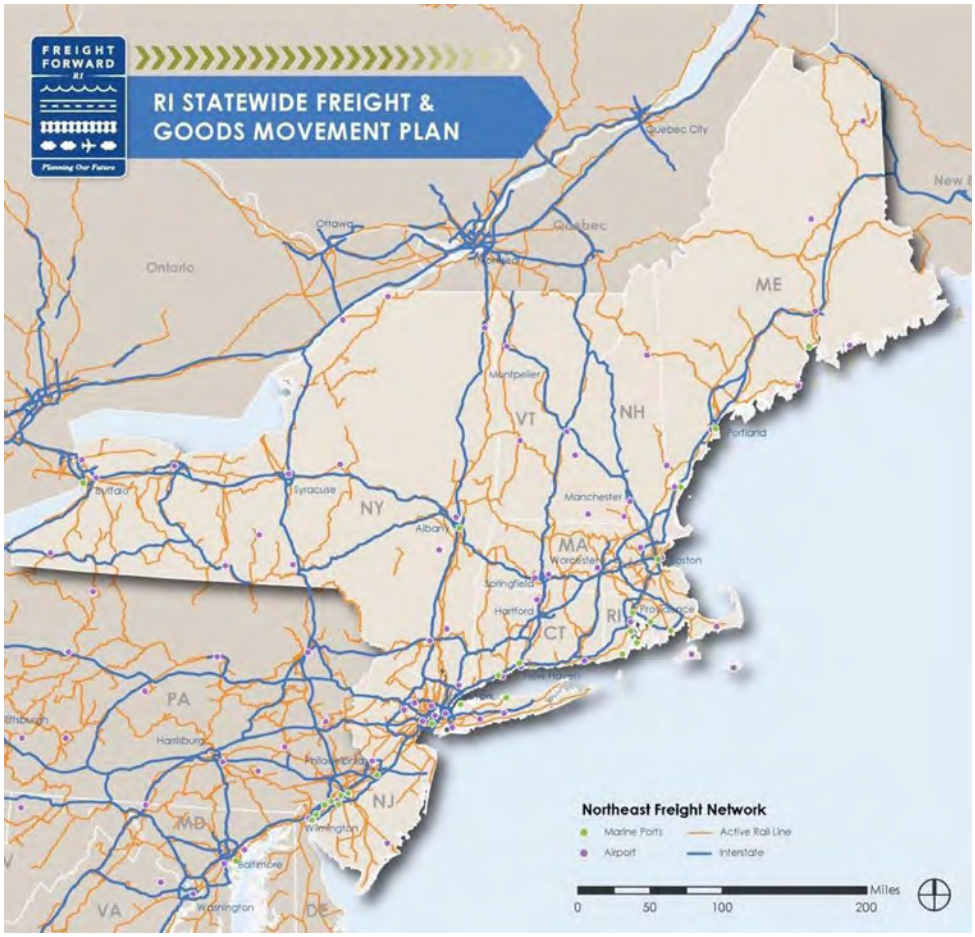
To help alleviate these problems and increase the efficiency of the freight network, some states, regions, and cities are exploring various new technologies and systems to help improve freight movement, provide real time system information to truck drivers, fleet managers and freight enterprises of all sizes, and leverage current transportation ITS deployments to include information about truck parking availability, network congestion, port queuing and management, and weather hazards in a real time system environment. These Freight ITS solutions help to provide freight operators with the most accurate, real-time information to help them make smarter decisions about freight routing and truck parking.

In addition to these newer public sector freight its initiatives, private sector entities have also been developing and refining newer and more integrated smartphone applications for truck drivers, fleet managers, and freight operators of all sizes. These applications are now providing truck drivers and fleet

[2] Rhode Island Freight and Goods Movement Plan, 2016 Table 30 "Rhode Island Truck Flows 2013 -2030 Thousand Tons".
[3] Ibid.
[4] Rhode Island Freight and Goods Movement Plan, 2016 Table 31 "Rhode Island Truck Flows 2013 -2030 Millions Value".

managers with greater real time situational awareness of available truck parking, status of weigh stations, fuel prices, truck wash locations, trip planning, navigation and routing, low clearances, locations of restaurants and hotels, big-box retail locations, repair shops, and dealer centers. The top private sector smartphone applications charge an annual subscription fee, but the information provided is much more in-depth and salient than free applications available for non-commercial drivers such as Google maps or Waze. Common features now include the leveraging of big data and customized algorithms that produce optimized truck routing solutions and predictive truck parking availability.

Real time freight data can be understood as data that is delivered immediately to the end user, processed using real-time computing, and utilized on location-enabled and wireless technology devices or displayed on public infrastructure deployments such as dynamic messaging signs. It is expected that connected and autonomous vehicles will greatly expand real-time data applications for the public and private sectors in the near future. As the technology available for freight ITS rapidly advances, the State of Rhode Island should continue to research and analyze best practices and examples of freight related ITS deployments in other regions of the country as well as stay connected with the needs of the trucking industry. To that end, the state should survey truckers and fleet operators from time to time on the technology needs and systems in place currently that address increasing efficiency of goods movement on the freight network.



New England Regional Freight Network, RI Statewide Freight and Goods Movement Plan, Page 35, 2016.

Technology in any subfield on the transportation sector will continue to rapidly advance in the years ahead, however, freight ITS has the potential to provide efficiencies in a sector that has tremendous

economic value to the state and the region. For that reason, the technology related to the improvement of freight movement in Rhode Island is the focus of this technical paper.

Federal and State Goals and Requirements

Freight ITS deployments and new system technology exists in an overarching environment of federal and state goals and requirements relating to freight movement. The national goals outlined below which relate to the reliability of freight transportation and the use of innovation and advanced technology to improve the efficiency of the national freight network provide the context for the research and survey of the latest freight related ITS deployments and technologies being utilized by the public and private sector described in this technical paper. Additionally, the State of Rhode Island in its 2016 Freight and Goods Movement Plan, outlined the utilization of new technologies as a potential action to encourage freight innovation. The goals, objectives, and actions below are the context in which freight ITS should be implemented to coordinate with the overarching National Freight Program and National Freight Strategic Plan

National Freight Goals

As set forth in Section 167 of Title 23 of the United States Code, the goals of the national freight policy are:

1. To identify infrastructure improvements, policies, and operational innovations that: strengthen the contribution of the national freight network to the economic competitiveness of the United States; reduce congestion and eliminate bottlenecks on the National Multimodal Freight Network; and increase productivity, particularly for domestic industries and businesses that create high value jobs;
2. To improve the safety, security, and resilience of freight transportation;
3. To achieve and maintain a state of good repair on the National Multimodal Freight Network;
4. To use innovation and advanced technology to improve the safety, efficiency, and reliability of the National Multimodal Freight Network;
5. To improve the economic efficiency and productivity of the National Multimodal Freight Network;
6. To improve the reliability of freight transportation
7. To improve the short- and long-distance movement of goods that: travel across rural areas between population centers, travel between rural areas and population centers, and travel from the Nation's ports, airports, and gateways to the National Multimodal Freight Network
8. To improve the flexibility of States to support multi-State corridor planning and the creation of multi-State organizations to increase the ability of States to address multimodal freight connectivity
9. To reduce the adverse environmental impacts of freight movement on the National Multimodal Freight Network; and
10. To pursue the goals described in this subsection in a manner that is not burdensome to State and local governments.

State of Rhode Island Freight Goals

Three overarching goals of operational efficiency, economic growth and competitiveness, and connectivity have been established in *Freight Forward: State of Rhode Island Freight and Goods Movement Plan, 2016*. Within each goal, a number of objectives have been identified. For each objective, a set of potential actions is also provided. Table 1 presents the goals, objectives, and associated actions.

Goal 1 - Operational Efficiency

Improvements in operational efficiency will ensure that sufficient freight transportation capacity exists to support economic growth and the safe and secure flow of traffic throughout the state. Better operational efficiency also enhances reliability for all users of the Rhode Island's transportation system, including freight carriers. Operational efficiency also mitigates potential environmental impacts by reducing emissions produced by idling traffic on the state's roadways. This Rhode Island goal supports a number of national freight goals, including state of good repair, preservation and enhancement of safety and security.

Goal 2 – Economic Growth/Competitiveness

The plan seeks to support economic growth/competitiveness in Rhode Island through strategic improvements to the freight system that are supported by predictable and flexible funding, partnerships with the private sector, and a streamlined regulatory environment. An adequately funded freight transportation system can provide enhanced efficiency and reliability, potentially reducing transportation costs for businesses that move freight. Additionally, policies that support preservation of industrial land may encourage expansion of existing businesses and attract new businesses to the state.

Goal 3 - Connectivity

The plan seeks to improve connectivity through policies and strategic investments that reduce congestion and increase reliability on the state's roadways and its rail, marine, air, and intermodal systems. Improved connectivity for each of these modes, as well as between these modes, supports the more efficient movement of freight in Rhode Island.

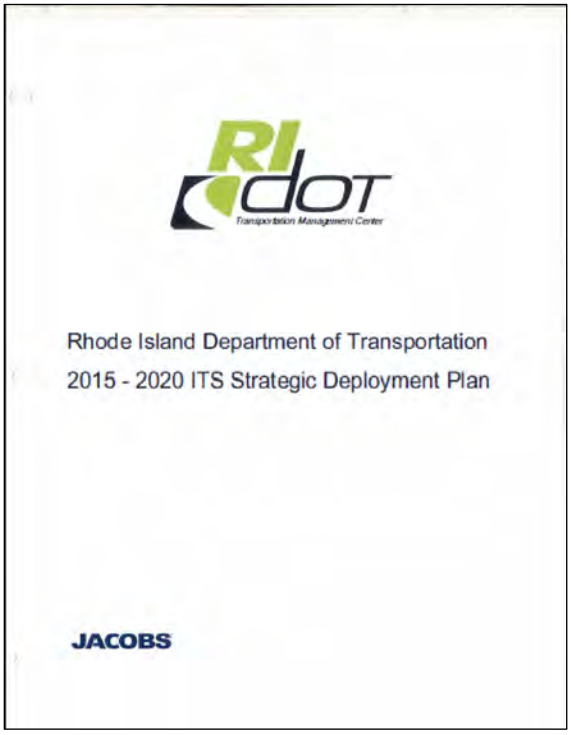
Table 1. Rhode Island Freight Goals and Objectives

Goals and Objectives	Potential Actions
Goal 1: Operational Efficiency	
1. Maintain existing freight infrastructure and keep assets in a state of good repair	Repair bridges, piers, etc.
2. Increase the efficiency of the freight system	Actions to improve reliability and reduce congestion
3. Expand capacity of the freight system	New infrastructure to accommodate growth
4. Improve safety and security	Build redundancy into the system; ensure adherence to federal regulations on HAZMAT movement, increase highway safety
5. Improve Resiliency	Harden, adapt or relocate infrastructure out of coastal impact areas
6. Encourage Innovation	Utilize new technologies
7. Monitor System Performance	Establish metrics, identify staff
Goal 2: Economic Growth & Competitiveness	
1. Identify sustainable, flexible funding for freight priorities	Educate public and policy makers on the importance of freight
2. Pursue Public/Private Partnerships	Collaborate with private sector; offer incentives
3. Improve regional and global competitiveness	Streamline regulatory environment; improve our workforce
4. Mitigate Environmental Impacts	Protect sensitive water resources
Goal 3. Connectivity Objectives	
1. Improve regional connectivity	Actions to reduce congestion, improve reliability, address regional bottlenecks, build redundancy into the freight system
2. Enhance intermodal access to national and global markets	Facilitate new services to increase connectivity; Monitor trends to pursue new market opportunities
3. Build regional partnerships/planning	Coordinate regional policies (e.g., weight restrictions

Current State of Rhode Island ITS Programs Relating to Freight Movement

In 2015, The RIDOT and Jacobs Engineering, completed a five year ITS Strategic Deployment Plan as a planning tool for RIDOT and the Division of Statewide Planning. The purpose of this plan was to coordinate efficient deployment of ITS devices and technology in Rhode Island through clearly defined criteria to provide the building blocks for a system designed to improve safety and reduce congestion. While this plan describes ITS deployments that are geared towards providing general benefits to all types of roadway travelers, other than system components associated with weigh-in-motion systems, no specific ITS focused solely on improved freight movement or trucker safety is included. The Plan assumed an annual budget of roughly $5 million would be available for ITS capital spending/contracts from 2015 – 2020. Unfortunately, the Plan also highlights in Section 1.8 that previous (2010-2015) spending on ITS fell far short of the desired goals, and despite the Plan's assumed budget for capital improvements, as of June 2020 far less than the $5 million annual dollars has actually been available, reserved, or used for ITS purposes as initially hoped. .

Since the completion of this Plan, ITS deployments and contracts are now included as discrete projects within the Statewide Transportation Improvement Plan (STIP). Prior to the existing STIP, ITS infrastructure was added to construction projects through the process of "mainstreaming," meaning they were added to construction projects during the design process without much documentation and without a defined overall plan or secure annual budget, which is no longer the case. However, ITS devices remain a very small portion of overall annual transportation network spending. The current system of ITS devices along the state's (RIDOT-owned/maintained) highway system is composed of roadway cameras systems, closed circuit television cameras, changeable message signs (permanently-mounted and portable varieties), radar vehicle detection sensors, conventional count stations and sensors, and wrong- way driver detection systems all utilized for the primary purpose of improving overall transportation system safety and/or reducing congestion.



In some cases, these ITS devices and deployments can be better utilized to improve freight movement and efficiency. Real time information based on data collected by existing ITS equipment could be fed to changeable message signs or to third party platforms for smartphone apps. While most of RIDOT's ITS have been primarily utilized to provide traveler information, for incident management, and/or to fulfill federal data requirements, these ITS devices and technology could potentially be used to provide real-time information to truck drivers, fleet operators, and third-party app providers for the trucking industry.

The RIDOT ITS Strategic Deployment Plan also mentions the possible investment into a regional intermodal traveler information system. This type of system could relieve some of the highway network

congestion by displaying travel time information including alternative travel times for transit options, as well as real-time truck parking information. A totally integrated system like this would work toward addressing multiple issues (congestion, truck parking, transit utilization) while providing continuous reliable data to the RIDOT Traffic Management Center. Today, a traveler information system is in place for several sections of Rhode Island's Interstate highways (I-95, I-195, I-295) and key state routes (Rt. 146, Rt. 4, Rt. 138), but they do not primarily include transit or freight related travel time information.

A Survey of Public and Private Sector Freight ITS Programs in Other Regions

Across the country several states and regions are implementing new freight ITS deployments for projects as diverse as state and regional truck parking information systems, port drayage optimization, and federal performance measurement requirements. Many state's transportation networks have seen an increase in commercial vehicle traffic in recent years and this higher percentage of freight transported by trucks illustrates the importance of managing congestion and freight movement as it relates to just in time deliveries.

This increase in commercial vehicle traffic has exacerbated several issues such as compliance with hours-of-service rules and safe truck parking locations. When a truck driver is getting close to his service hours limit (11 hour driving limit) he must then take 8 hours off from driving. This rule, plus limited and oversubscribed popular truck stop locations on heavily utilized roadways sometimes leads to truck drivers resorting to unsafe and illegal methods of parking on roadway shoulders, ramps, or in vacant parking lots.

Truck illegally parked on shoulder. Image derived from Overdriveonline.com article "The time is now to build truck parking capacity" – Clifford Peterson, February 18, 2019.

Some trucking operations, such as drayage and less-than-truckload, have more defined hours and their drivers return home at night. On the other hand, some drivers are on the road for long distances and may not see home for months at a time. Some drivers of these trucks, especially those who are employed by private fleets, are able to use company terminals instead of dedicated truck parking facilities. However, many drivers, especially owner-operators, need truck parking spaces in convenient locations along their routes. To this end, states have been implementing new ITS technology for truck parking availability systems to meet user demand and ensure more efficient and safer freight movement along their roadway network.

Truck Freight traffic at the Port of New Jersey April 4, 2019.

In addition to the availability of truck parking on the interstate, managing port system congestion and drayage operations has become a critical concern at our major port facilities across the country such as Long Beach/Los Angeles California, Newark/Elizabeth New Jersey, and Savannah, Georgia. How these regions have been utilizing freight ITS applications has implications for Rhode Island in possible technologies that could be utilized for drayage optimization and freight specific travel planning and performance. Improving communications and sharing intermodal logistics information between the truck drayage industry operators and port terminal operators can reduce congestion during peak hours. Real-time information processing and display is a key component of the effectiveness of these newer technologies to help drive effective decision-making by public and private facility operators.

In the following pages, we survey freight specific ITS deployments being utilized by states, regions, and port areas to provide real time system awareness and communications between system users and system operators. This is by no means a complete or exhaustive survey of all freight ITS being utilized across the United States today, but it highlights some of the key initiatives and deployments that are being used and may be available. Many of these examples could be appropriate for Rhode Island as we continue to plan for more efficient freight movement in our state.

Mid-America Association of State Transportation Officials (MAASTO) Truck Parking Management Information System

I. What is the MAASTO System?

To improve the efficiency, economic competitiveness and safety of the national freight network, the State of Kansas in partnership with Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, Wisconsin and the Mid America Association of State Transportation Officials (MAASTO), developed a proposal for a multi-state Truck Parking Information and Management System (TPIMS) in 2015. This proposal was submitted to FHWA for Transportation Investment Generating Economic Recovery (TIGER) grant funding and secured an award of $25 million. As of 2019, This project has been fully deployed and created a new and collaborative way for the Midwest region to address truck parking information and availability needs along its busiest freight corridors.

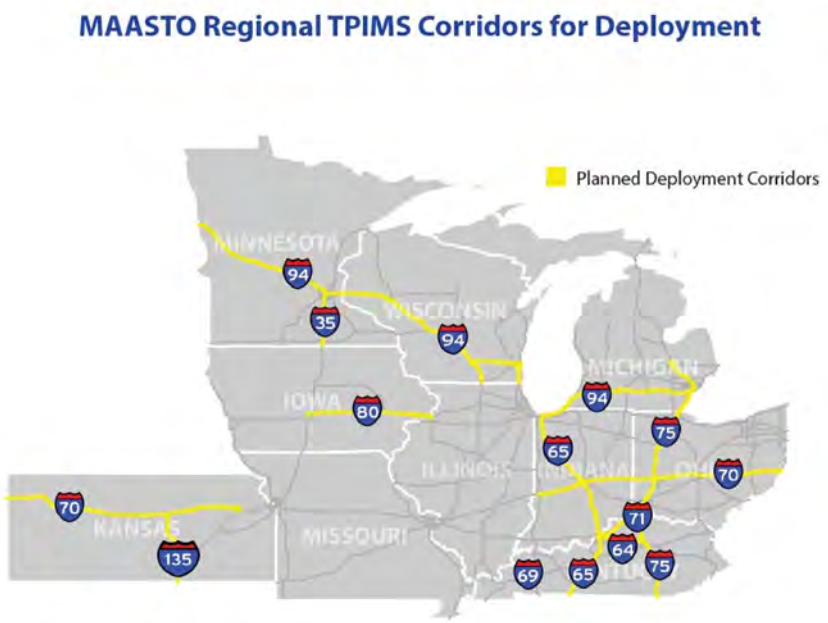


Image derived from MAASTO TPIMS Summary document located at http://www.maasto.net/documents/TPIMS_Summary.pdf

A TPIMS is a regional network of safe, convenient parking areas with the ability to collect and broadcast real-time parking availability to drivers through a variety of media outlets including changeable message signs, smartphone applications, traveler information websites, and others through a data system. This enables drivers to proactively plan their routes and make safer smarter parking decisions. Safe and reliable access to truck parking reduces overcrowding at rest areas and truck stops. It also decreases the number incidents involving commercial vehicles unsafely parked on the shoulders and ramps of highways.
Additionally, the multi-state coalition using the system across an eight-state region represents one of the largest geographic areas of freight ITS deployments of truck parking technology in the United States. The TPIMS Project provides real-time information through multiple platforms to commercial vehicle operators for over 150 parking sites across the MAASTO region.

II. The Components of the MAASTO System

The ITS architecture for TPIMS in the MAASTO region includes both the flexibility to allow each state to run their own parking system, and common standards to provide interoperability across state lines. This allows for seamless integration while allowing standards for future truck parking efforts nationwide. An ITS Architecture is a high-level framework that describes and illustrates how existing and planned ITS elements interconnect to exchange information to collectively deliver a transportation service or function. To this extent, ITS Architecture can be viewed as a blueprint that shows the existing and future

state of ITS integration within a particular area. The TPISM ITS Architecture consists of many functions, subsystems, information, and data flows that work together in an integrated system. The main elements of the MAASTO TPIMS ITS Architecture are; An advanced traveler information system website, an advanced traveler information system server, a data management system, changeable message signs, informational kiosks, on-board truck systems, private sector and public sector parking management systems and sensors, personal computing devices, TMC operators, truck parking websites, and dynamic truck parking hybrid signs.

As shown in the figure below, the technology deployed at parking facilities and roadside signs integrates with each state's existing ITS network and software platform. The TPIMS Partnership allows for the dissemination of information on websites, smartphone applications, and in-cab systems. Truck drivers (independent, contracted, and company fleet) receive truck parking information from multiple platforms including roadside signs, websites, smartphone applications, dispatchers, and in-cab systems. With the information, they are able to make better decisions regarding their stopping points. Additionally, a common Application Programming Interface (API) has been developed to exchange parking availability information between all parties, both public and private. This architecture will allow for quick project startup while being scalable to include additional sites, states, and data service platforms in the future.

The primary dissemination method for truck parking availability are dynamic truck parking information signs upstream from project rest areas and weigh stations. Additionally, signs bring awareness to the system while showing alternate parking facilities near problems areas.

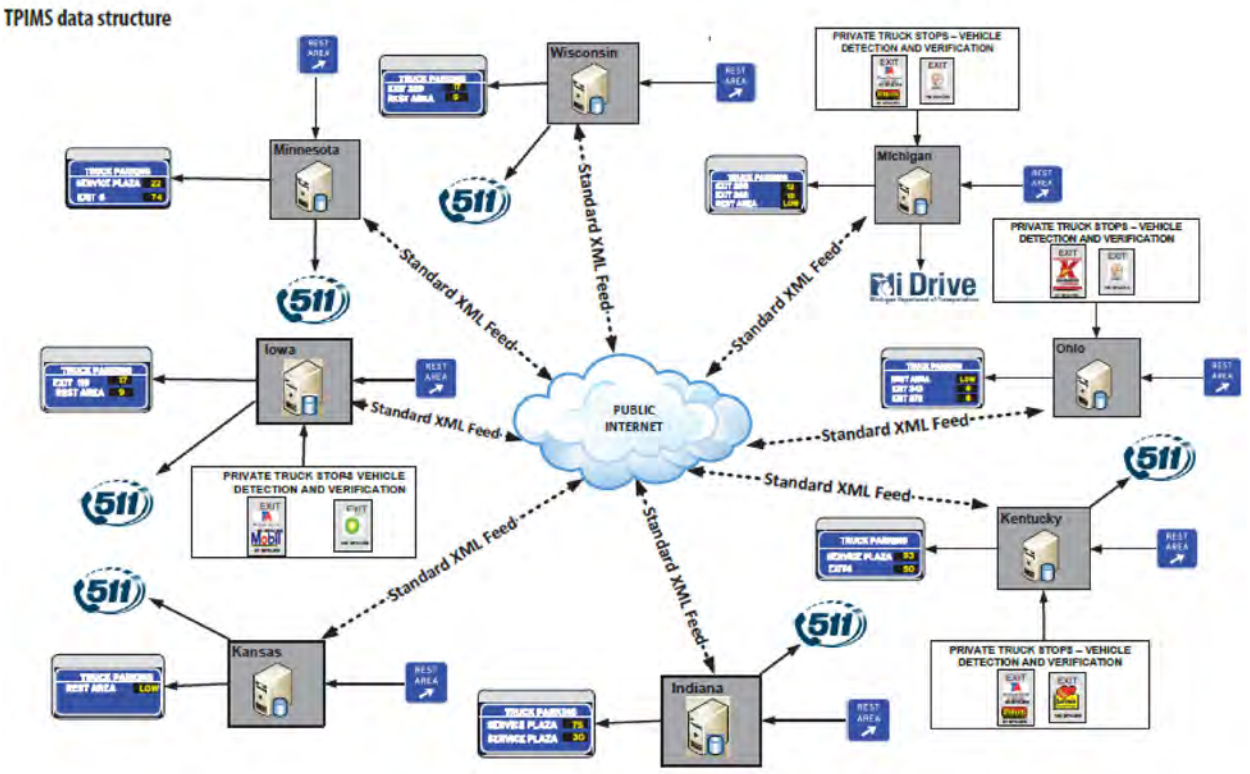


Image derived from MAASTO TPIMS Tiger grant application, 2015.

III. Benefits of the MAASTO System

There are many benefits of a Truck Parking Management Information System that accrue to system operators, truck drivers, website and app developers, and the public. Having a system like this in place can provide positive economic and safety impacts as a result of enhanced freight competitiveness and provides a safer environment for truck drivers. For system operators at traffic management centers the benefits of such a system would include improved distributed truck parking that could reduce overcrowding in unsafe locations resulting in a safer highway network for all users. For contractors and third-party website and application developers there could be financial benefits for providing a service that integrates into the system for partnering agencies. Additionally, for fleet managers and dispatchers this type of system would make it easier to assist truck drivers in finding safe, reliable parking options and enable increased efficiencies in the movement of freight goods. Lastly, for truck drivers a system such as this would make it much easier to find safe, reliable parking and have a more productive trip as the driver will not have to spend as many service hours looking for a place to park and lose productivity.

A Truck Parking Management Information System in Rhode Island that is shared and also deployed in the five other New England States would greatly benefit the regional highway system and truckers frequently crossing state lines. Unlike states in the Midwest and the South, the New England states have not been increasing available public truck parking and rest areas, rather, we have been closing down rest areas, weight stations and welcome centers due to funding limitations. That is why it makes sense for the New England states to pool our resources collectively to solve the regional truck parking availability problem as publicly available truck parking is increasingly reduced. Utilizing a freight ITS system akin to MAASTO that includes information on private truck parking as well as public truck parking availability would help reduce freight congestion along the heavily utilized I-95 freight corridor from New York City to Boston and provide better options and decision makers to all truck freight operators throughout the New England region. This is a regional problem that requires a regional solution.

Freight Advanced Traveler Information System (FRATIS)

In 2012, the Federal Highway Administration (FHWA) and the U.S. DOT Joint Intelligent Transportation Program Office initiated the Freight Advanced Traveler Information System (FRATIS) pilot project to test technologies in three different metropolitan regions with major port and intermodal facilities: Los Angeles, Dallas/Fort Worth, and South Florida.

The goals of these pilots were to improve intermodal truck utilization; improve and automate the process in which containers are transferred between marine/rail terminals and drayage companies; and improve regional freight mobility and air quality.

FRATIS is intended to help with these issues by allowing technologies to work together to optimize drayage fleet movements.

Two applications comprise FRATIS. While envisioned as separate applications, both must be present and deployed in an integrated fashion. The applications are:

- **Freight Specific Dynamic Travel Planning and Performance**: This application bundle seeks to include all of the traveler information, dynamic routing, and performance monitoring elements that users need. This application leverages existing data in the public domain, as well as emerging private sector applications, to provide benefits to both sectors. Other data points include freeway and key arterial speeds and volumes, incident information, road closure information, route restrictions, bridge heights, truck parking availability, cell phone and/or Bluetooth movement/speed data, weather data, and real-time speed data from fleet management systems.

- **Drayage Optimization**: This application bundle seeks to combine container load matching and freight information exchange systems to fully optimize drayage operations, thereby minimizing bobtails/ dry runs and wasted miles, as well as spreading out truck arrivals at intermodal terminals throughout the day. With this application, the US DOT and industry also have an opportunity to address some key industry gaps — to truly optimize a freight carrier's itinerary, extensive communication is required from a wide range of entities (including rail carriers, metropolitan planning organizations, traffic management centers, customers, and the freight carriers themselves) in a manner that assesses all of the variables and produces an optimized itinerary. This requires the development of a powerful set of algorithms that leverage data from multiple sources. In addition to optimization, these improvements are expected to lead to benefits in terms of air quality and traffic congestion.

Both bundles consist of two application levels — a basic application, developed from open-source data and services and available in the public realm; and a "value-added" commercial application, targeted at existing subscriber user groups. The system improves communications between the truck drayage industry and port terminals. In addition, improved traveler information allows intermodal truck drayage fleets to plan around traffic and port congestion.

FRATIS utilizes an optimization algorithm that reduces the number of unproductive freight moves. It does this by analyzing daily container movement orders and creating optimal dispatching plans that consider factors such as traffic conditions, order location, and time windows. Dispatchers customize schedules and drivers receive plans and routes using real-time traffic information. FRATIS includes real-

time information exchange for arrival, departure, and status information on container movements. FRATIS integrates data sources in a manner that is oriented toward freight's unique operational characteristics to provide the following tools:

FRATIS Architecture

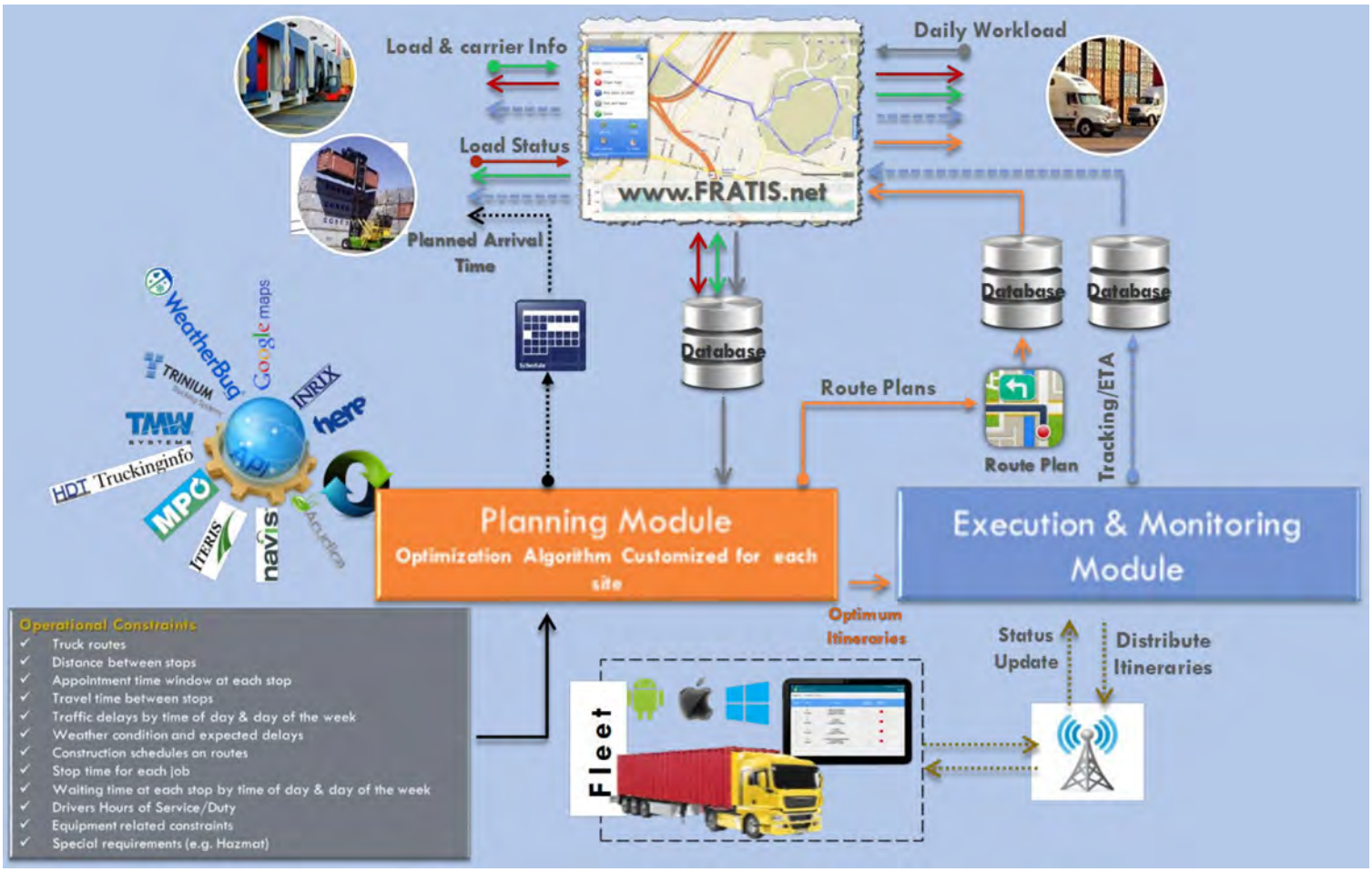


Image courtesy of Jeff Purdy, Federal Highway Administration, Office of Freight Management and Operations. Image provided June 2019.

FRATIS technologies show promise of more efficient drayage operations. Overall travel time can be reduced by avoiding traffic congestion and having better information about wait-time and status at intermodal container terminals.

According to a 2019 American Transportation Research Institute (ATRI) study of driver detention problems across the country[5], one of the major factor's that impacts a truck driver's available hours-of-service is driver delay or detention at customer facilities. Detention has a clear economic impact on a

[5] "Driver Detention Impacts on Safety and Productivity" study commissioned by the American Transportation Research Institute (ATRI) September 2019.

shipper's or receiver's product as being delayed at a customer facility often creates cascading impacts on subsequent pick-ups and deliveries. Technologies like FRATIS can help reduce the occurrence of these problem's by helping shipper's and receivers to avoid overbooking appointments, having trucks loaded in time for shipping, and provided real-time information on things that can effect detention such as congestion and weather. According to the ATRI study, detention times and the frequency of detention have both increased from 2014-2018

In Rhode Island, FRATIS or a similar technology could be utilized at Quonset Business Park/Port of Davisville or the Port of Providence to help achieve efficiencies to reduce congestion, idling, and detention times at customer facilities. The benefits to trucking companies in Rhode Island if a technology like this is implemented includes improved productivity and efficiency of the fleet by providing optimal truck itineraries that consider travel times with traffic, waiting times at the terminal, and weather conditions. The system empowers dispatchers with real-time information, such as terminal waiting times, for faster and better decisions. It also allows for dynamic routing to avoid heavy traffic congestion and incidents.

Ports and intermodal facilities benefit by receive pre-notifications from trucking companies, which allows them to reduce waiting time and turnaround time at the facility as well as unproductive pickups/drop-offs. They can also communicate directly with dispatchers to notify them about terminal closures, incidents, and other operational status. If FRATIS or similar technology were utilized in Rhode Island, the technology would have the potential to ultimately save time and money by reducing travel time, terminal queue, wait and turn times, fuel consumption, and emissions. These benefits, in turn, can also benefit the public through improved air quality and better utilization of existing roadway capacity.

With the increasing volume of freight moving through ports and intermodal facilities, the potential for improvement is great. All these efforts should continue to be refined and advanced to ease congestion around intermodal facilities, improve transportation safety and efficiency, and protect the quality of life for communities surrounding ports.

Florida Truck Parking Availability System

In a proactive approach to address the issue of truck parking shortage, the Florida Department of Transportation (FDOT) initiated a research project in 2011 with Florida International University (FIU) to determine the supply and demand characteristics for commercial truck parking in Florida. The research determined that a technology solution could be used to improve parking management. Based on the FIU study and test deployment projects, in June 2015 the FDOT received an Accelerated Innovation Deployment (AID) grant for a $1 million from the Federal Highway Administration (FHWA) for a demonstration project on a Truck Parking Availability System (TPAS).

As part of the initial AID project, the FDOT undertook project development to deploy TPAS throughout all of Florida's interstate highway system public parking areas, welcome centers, rest areas, and weigh stations. The effort included concept plan development, cost estimates, environmental evaluation, utility coordination, and right-of-way requirements. Following this effort, in 2016 Florida was awarded a FHWA FASTLANE grant for $10.7 million for the full deployment of TPAS throughout Florida's interstate system.

As of 2019, Florida's statewide implementation of TPAS has been achieved. This system consists of real time information on the availability of parking spaces along the interstates at three (3) welcome centers, forty-five (45) rest areas, and twenty (20) weigh stations displayed via roadside changeable message signs. The TPAS detects parking availability through sensors embedded in the parking areas as well as through vehicle detection counters. This information is then aggregated through the existing Intelligent Transportation Systems (ITS) fiber optic network at each of the District Regional Transportation Management Centers (RTMC). The information in this system is disseminated to the public via the roadside changeable messaging signs, the Florida 511 application, as well as third party data feeds.

The Florida Department of Transportation (FDOT) considers this to be the first stage of project delivery. Over the next few years, FDOT will begin stage 2, which will consist of the development of predictive analysis for future parking availability, and then stage 3 which will consist of the incorporation of private parking locations for systemwide resource utilization. Stage 3 will require ongoing coordination with third party vendors to integrate private parking facilities into TPAS.

Three-stage approach to statewide comprehensive truck parking solution

Image derived from a Florida DOT PowerPoint presentation entitled "Truck Parking Availability System, Florida's Unique Approach" located at http://www.floridatruckinginfo.com/Docspubs.htm

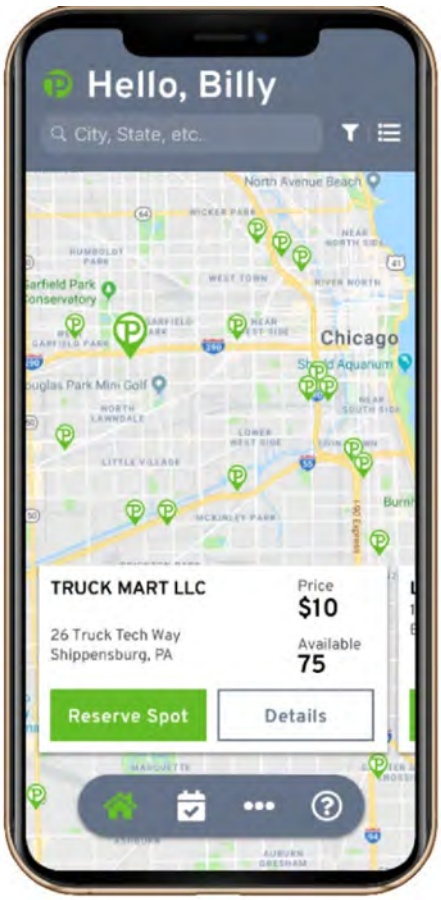
Truck Parking Availability System Deployment as of 2019

Image derived from a Florida DOT PowerPoint presentation entitled "Truck Parking Availability System, Florida's Unique Approach" located at http://www.floridatruckinginfo.com/Docspubs.htm

As with the MAASTO system, the Florida TPAS is another example of a system that could benefit Rhode Island but would likely require a New England wide partnership to be feasible and provide benefits to multiple users and operators. It is recommended that the New England state DOT's and MPO's work together to explore planning for a regional solution to truck parking which could utilize the technology and systems mentioned above.

Private Sector Truck Parking Solutions

In addition to the public sector freight ITS initiatives described above, there are several newer initiatives being launched by freight technology companies to address the truck parking shortage across the country. One such initiative is by a technology start up business launched in 2017 called Truck Park Inc. This company is based out of Chicago and has been working with other companies and property managers to identify and build a regional inventory of privately available truck parking spaces available for a fee. The application they have developed allows truck drivers to reserve parking spots in real-time from private lot owners who are looking to derive an additional source of revenue.



Recently, the company has expanded to ensure that their network will become national and in October 2019 they announced a new partnership with truck and trailer parking company storemytruck.com which has been in business since 2009 as a parking company serving the southeast United States. This new partnership will expand the parking availability from the Truck Park app to over 10,000 parking spaces across the country over the next two years.

While business and technology companies have been creating newer applications to address the issue of parking availability, national retailer Wal-Mart has been allowing truck parking at their facilities for years and has played an integral role in filling the need for overnight truck parking and general availability for trucks and trailers. Unfortunately, the availability of truck parking at Wal-Mart locations is somewhat unpredictable because Wal-Mart allows truck parking rules to be set on a store by store basis. Add to this, some stores which have allowed overnight truck parking may be in violation of local regulations and/or approved parking plans for their developments which has led to fines and legal disputes between municipalities and Wal-Mart.

In the section below, we will survey a handful of smartphone applications which include the locations of Wal-Mart stores that allow overnight parking by policy. App providers such as Trucker Path called every Wal-Mart store in the country and found out which locations allowed truck parking when they included it as an option on their smartphone app. Today, out of roughly 5,400 Wal-Mart stores in the United States, 2,700 allow truck parking.

Smartphone and In-Cab Applications for Truck Fleets and Truck Drivers

Popular commercial cell phone-based applications for passenger vehicle driving information are widely utilized by the driving public today to make decisions about trips for work and leisure, shopping, fuel stops, and commuting. Applications such as Google Maps, Waze, INRIX, Roadtrippers, SpotHero, and Gas Buddy are commonly utilized.

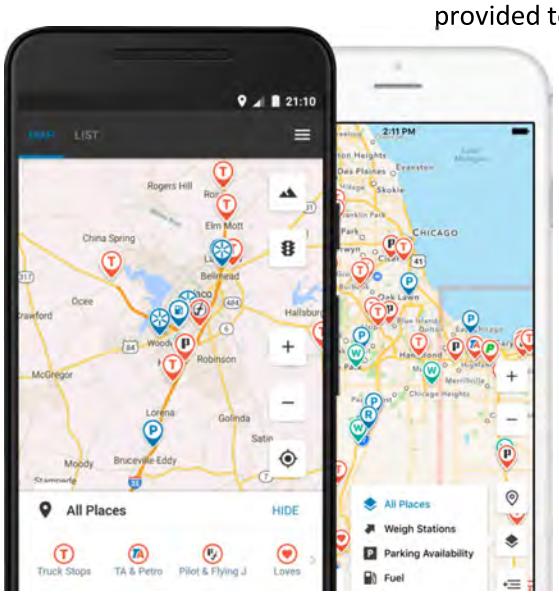
What is less well understood is how truck drivers, fleet managers, and system operators utilize commercial smartphone applications to make similar decisions about routing fleets and where to take break or decide upon the availability of truck parking. There are several commercially available applications which charge the user a monthly or yearly fee. The section below gives a brief overview of some of the most utilized commercial trucking apps and what services they provide. These applications are a built-on content provided via crowdsourced data, publicly available data, and commercial data.

Real time freight data has become more important to the trucking industry and to the public sector for findings ways to reduce congestion, improve safety, optimize truck parking, and improve port operations. Real time freight data is data that can be delivered immediately, processed using real-time computing, and can be utilized with location enabled and wireless technology devices.

Most Utilized Truck Freight Applications:

1. **Trucker Path Pro**

Trucker Path is a transportation network company that specializes in online and mobile services for the trucking industry. In 2013, the company first released its trip planning and resource locating mobile app "Trucker Path". By 2016 the number of active monthly users surpassed 450,000, which represents 30% of all Class 8 truckers in the United States[6]. Independent truckers and small operators are the target market for Trucker Path's application. To date, this application has over 1.5 million downloads. The application features over 6,000 locations where drivers can find available truck parking in real time. The crowd sourced data creates over 400,000 monthly parking updates. Some of the key information provided to users of this application are truck parking availability, weigh station locations, low clearances, truck dealerships, as well as user review of all facilities. The application also provides factor invoicing so that drivers can upload bills of lading and get paid within one to two business days.



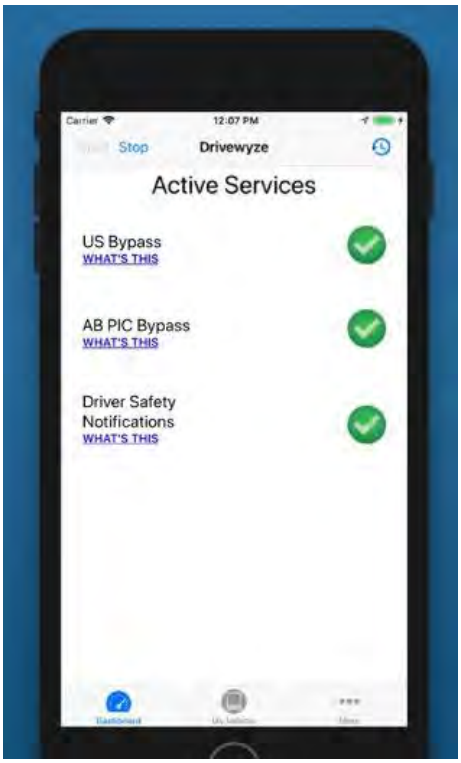
[6] "Trucking? There's finally an app for that", Fortune Magazine online. July 9, 2015.

2. Drivewyze

Drivewyze is a smartphone weight station bypass app that saves truck drivers time and money by providing information that allows for automated bypass of weigh stations. This application is an intelligent transportation system (ITS) service that provides bypasses to commercial vehicles as they approach participating state highway weigh stations. With this application, the participating vehicle's safety record, credentials and weight are verified automatically, and if they comply with that state's screening rules for automated bypass, the vehicles are authorized to bypass these facilities rather than pull in for manual inspection.

The equipment on the commercial vehicle or truck can be either the driver's smartphone or an electronic on-board recorder (EOBR) or an electronic logging device (ELD). The device is usually mounted on the dashboard of the truck. Because the device communicates over the cellular phone network, no "reader" is required at the weigh station to identify the vehicle. If the vehicle's credentials, safety, and weight data are all in order, a green indicator on the phone or EOBR/ELD advises the driver to bypass the facility.

There is a monthly fee for users of the application which is $17.99 for drivers. As of 2019, Drivewyze is currently available at over 750 facilities in 42 American states and two Canadian provinces[7].



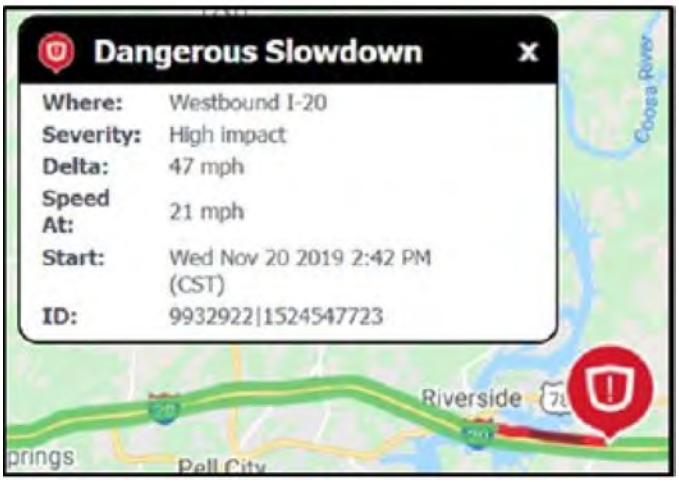
In addition to this application for truck fleet managers and drivers there are other applications that the State of Rhode Island could provide to truckers to help them make more informed travel decisions. A likely application would be through the Division of Statewide Planning contract with INRIX (through the I-95 Corridor Coalition) for vehicle probe travel time data. INRIX provides commercial vehicle alerts through a joint offering with Drivewyze. The Division of Statewide Planning and RIDOT would have to provide additional funds to INRIX to support this added level of information to truckers.

This option aims to reduce crashes and fatalities related to secondary crashes, work zones and emergency events involving commercial vehicles on interstates by leveraging existing capabilities in a novel way to provide real-time alerts to trucks traveling on certain corridors and locations.

This option is a joint offer of INRIX and its partner Drivewyze and leverages Drivewyze's Safety Notifications service. Drivewyze Safety Notifications service is available to carriers on supported Electronic Logging Devices (ELDs) and other in-cab devices, through the Drivewyze partner network. Presently, Drivewyze reaches roughly 2.1 million commercial vehicles, heavily skewed to long haul interstate highway users. INRIX has a binding agreement with Drivewyze to support this service extending through the I-95 Corridor Coalition's Vehicle Probe Project (VPP) contract term with INRIX of July 31, 2022. This

[7] https://drivewyze.com/for-drivers/, accessed on 9/25/19

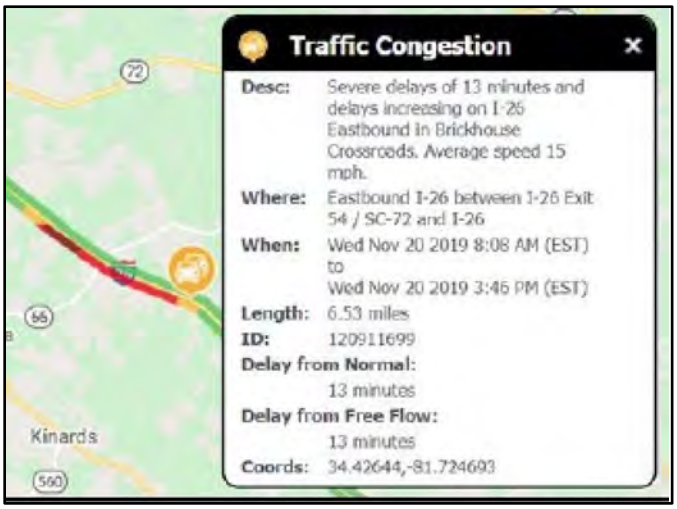
option leverages INRIX's Congestion and Dangerous Slowdown (DSD) messages to disseminate warnings direct to drivers of commercial vehicles in events that reach agency-designated severity levels. Additionally, agency specific motor carrier safety messages (e.g., interstate travel bans, etc.), can also be disseminated.



This service has three key elements:

Automated Queue Warnings: Drivewyze will call INRIX APIs in real-time to obtain the location and details for all active DSDs/Congestion Events on the selected corridors in the licensed region; Drivewyze will geo-locate active events and share a single notification with drivers as they approach an event in their direction of travel. The licensing agency will set configuration parameters for the service in its region including severity thresholds that trigger warnings. Only events that meet or exceed threshold severity would be disseminated to drivers. Also, the licensing agency has the option to include simple messaging or agency sponsorship – subject to the need to minimize message complexity for drivers. All relevant configuration items are addressed in a 30-day start-up phase.

Agency Generated Safety/Regulatory Messages: The service also includes a mechanism by which the licensing agency can provide important truck-specific safety/regulatory messages within its region or approaching its region. These messages could include emergency weather-related restrictions, weight-related detours, etc. Note that this element is not expected to be used often and messages must be short to prevent driver distraction. INRIX/Drivewyze expect to work with initial licensing agencies to establish the framework, processes, and message formats.



Alert Logging and Reporting: To enable the impact of this service to be understood by users, this service provides a record of all messages (content, location, date/time) and the number of vehicles/devices that were received each message.

3. Overdrive's Trucker Tools

Like Trucker Path Pro, Overdrive created and launched a trip planning and resource locating mobile app called Trucker Tools in 2013 which since then has been downloaded by over 500,000 truckers. This smartphone app provides real time fuel prices, real time truck stop information, truck specific routing, weigh stations, rest areas. The app also allows for factor invoicing, provides a message board for users, and a job posting site. The application has a load track functionality which drivers can use to track the load he is hauling for the broker, shipper, or carrier. Using this functionality, the driver decides when to start and end the track and the brokers, shipper or carrier dispatcher will see the route maps with the location pints for that route[8].

Since 2018 Trucker Tools has added features on their mobile application to include booking, predictive freight-matching, and detention alerts. All these features together provide real time situational awareness for the truck driver and real time communication and collaboration tools to connect trucks, available loads, and brokers.

[8] https://www.truckertools.com/home/mobile-driver-app.html, accessed on 9/25/19

4. CoPilot Truck Navigation

CoPilot has created an in-cab navigation system for truck routing which includes a number of real time data points and information for drivers including real time traffic displays, accidents reports, incident conditions, and ensures that drivers are constantly routes on truck-legal routes. This application is primarily a GPS device for truck driver routing, visualization, and navigation; however, CoPilot also provides a fleet management platform as a back-office companion to connect home-based staff with drivers utilizing the in-cab technology. Many small and medium sized enterprise truck companies utilize similar technology for their fleets and logistics solutions.

COPILOT® Truck

5. Allstays

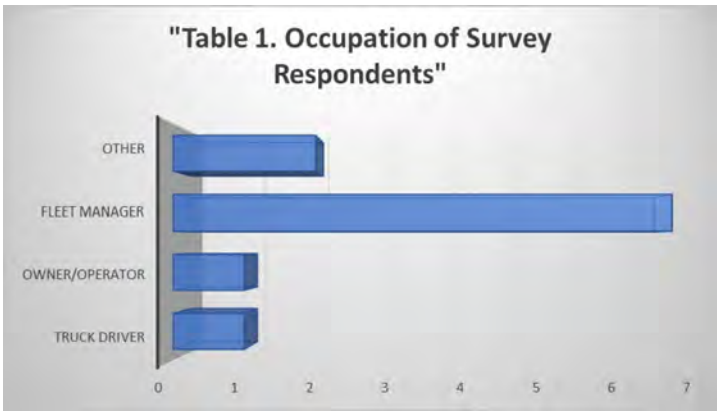
The Allstays Truck and Travel app is available only on Apple devices but is one of the longest running available smartphone apps relating to truck parking locations for drivers and fleets. The app has been available for smartphone devices since its launch in 2012 and prior to the app being available, similar information has been available on the Allstays.com website since 2003. This app provides truck drivers with locations for truck parking, weigh stations, Walmart locations, hotels that advertise truck parking, truck stop details and reviews. This app can partially work in manual mode when cell service is lost or disrupted but will not have full GPS functionality.

One of the unique functions available to truck drivers with this app is the ability to sort truck stops by amenities such as assorting by restaurants or stops with laundry and shower facilities.

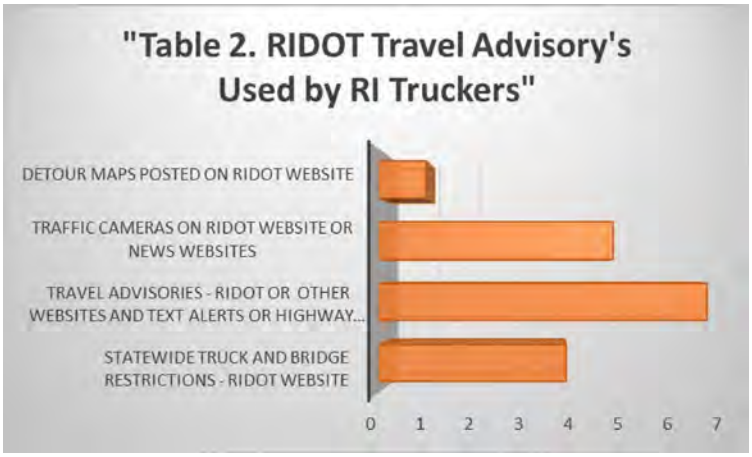
Rhode Island Trucking Association Freight ITS Survey

In March 2020, the Rhode Island Division of Statewide Planning and the Rhode Island Trucking Association partnered to conduct a survey of fleet managers and truck owner operators to ascertain the current state of technologies and applications used by the Rhode Island trucking industry. We wanted to hear back from some the top fleet managers and industry experts about how they are making decisions for truck and fleet routing, locating truck parking, and the overall movement of freight within the region.

This survey analyzed truck driver and truck fleet managers to see what information is currently used to make decisions and what platforms that information is gathered. This survey will help the Rhode Island Trucking Association and the State of Rhode Island determine what investments can be made in the future to provide real time information to our truck freight industry partners.



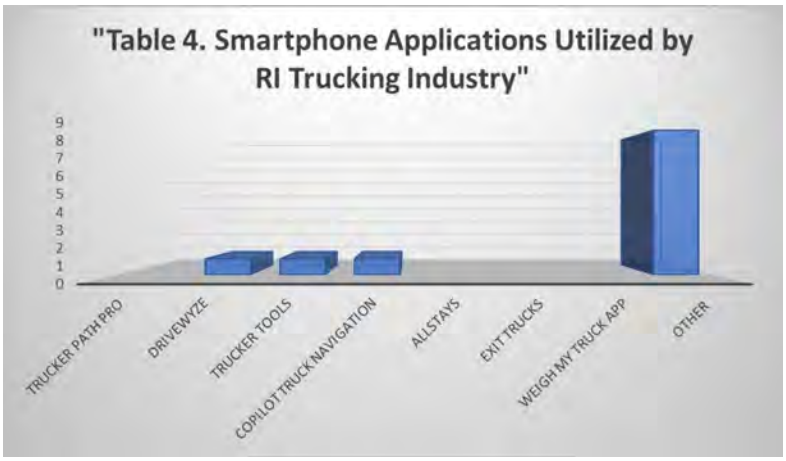
Most of the respondents to the survey were Rhode Island fleet managers with a few owner operators responding as well. The intent was to garner feedback from experts in the field who utilize freight ITS in their day to day operations. Although total respondents were limited due to the COVID 19 Pandemic disrupting the time and availability of members to respond, we were still able to get valuable responses from some members of the Rhode Island Trucking Association.



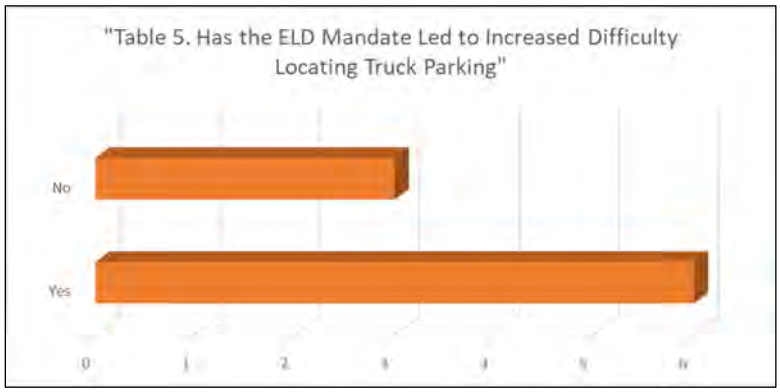
Of the existing suite of public information readily available to the trucking industry provided by the State of Rhode Island including websites, radio, and highway signs, travel advisories were the most utilized public data source. Traffic cameras and statewide bridge restrictions came in a close second. Much of this information is provided through a RIDOT webpage and some of it is utilized by app providers for the trucking industry as described in the survey of smartphone applications in the section above.

According to Table 3, several respondents indicated that they used a technology system that handles regulatory compliance issues, billing and invoice management, as well as dispatching and truck routing. This finding is not surprising since we had heard from several freight committee members throughout this process that although the app technology was advancing rapidly, fleet managers still wanted vehicle telematics or fleet management software that could track fleet maintenance, driver management, and truck routing as well as handle the business end of productivity and compliance. Fleet tracking and ELD compliance have become more important and finding the right software or technology system has been increasingly seen as an integral capital expenditure for companies.

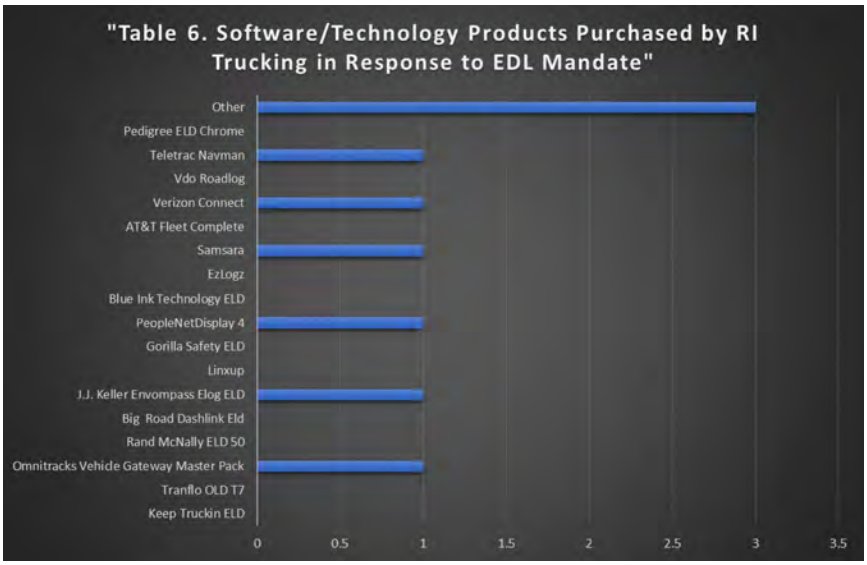
There is an extremely long list of truck and fleet management software currently available in the marketplace for trucking firms, the image to the left lists some of the software systems used by fleet managers and owner operators in Rhode Island. This is by no means and exhaustive list but gives a snapshot of software programs currently being utilized as well as their capabilities. With this list, state agencies could conduct further research into how these platforms can integrate with State data to improve freight and goods movement in Rhode Island.



As depicted in Table 4, respondents to the Rhode Island based survey indicated that they did not utilize some of the most popular trucking software applications. Therefore, this question merits further study as the State of Rhode Island may want to better integrate its data and make it more accessible to the more nationally used application developers via XML feeds or other methods. Also, the State should further examine which applications would be most effective for dissemination of information by truck drivers and fleet managers in Rhode Island.

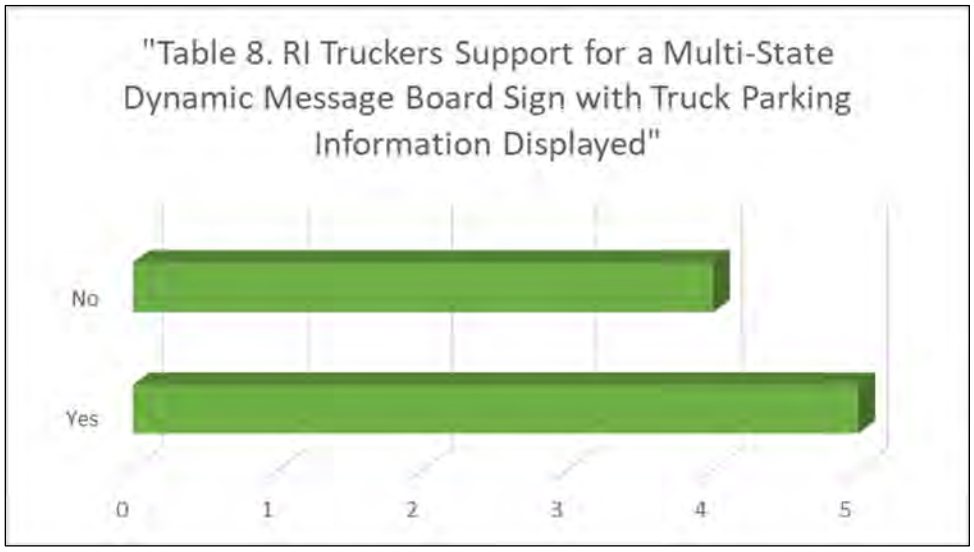


As depicted in Table 5, most respondents indicated that the federal ELD mandate has led to changes in hours of service for truck drivers and has increased uncertainty regarding parking and predictable traffic congestion periods. Respondents also stated that the ELD Mandate has led to less productivity and become problematic due to a lack of computer knowledge amongst the workforce. Two respondents said that it had not changed their ability to find truck parking throughout the region.



Based on the responses depicted in Table 6 regarding software/technology products purchased in response to compliance with the EDL mandate, the responses were varied for the software products purchased. Since the federal ELD mandate went into effect in December of 2019, additional time is needed to determine which software/technology platform will come to emerge as a marker leader and utilized as an industry norm for ELD compliance for truck driver and fleet managers. While electronic logging devices are not a new technology, the federal mandate has certainly driven innovation in new software and hardware products available to meet the new EDL compliance regime. There are still many products available and it seems that the responses attained do not show any clear trend favoring one product over another.

As depicted in Table 7, the Rhode Island Trucking Industry indicated that they would like to see greater collision mitigation technology implemented to increase truck driver safety. In addition, there was a lot of interest in expanding upon dynamic routing and alerting technology either through smartphone applications or in-house fleet management software systems.



Based on the responses depicted in Table 8, respondents to the survey were supportive of a multi-state truck parking availability system utilizing dynamic message board signs. However, the responses did not indicate a strong sense of support with slightly less than half indicating that they did not think these signs would be beneficial. Truck parking availability systems like this have been successfully implemented in other regions of the country. The Rhode Island Freight Advisory Committee also expressed in interest in a system at one of their 2020 meeting as several Committee members mentioned that planning breaks and parking in advance would be useful to their employees. Therefore, it is still recommended that state transportation agencies in New England, New York, and New Jersey explore the merits of a regional truck parking availability system and commission further surveys of state trucking associations.

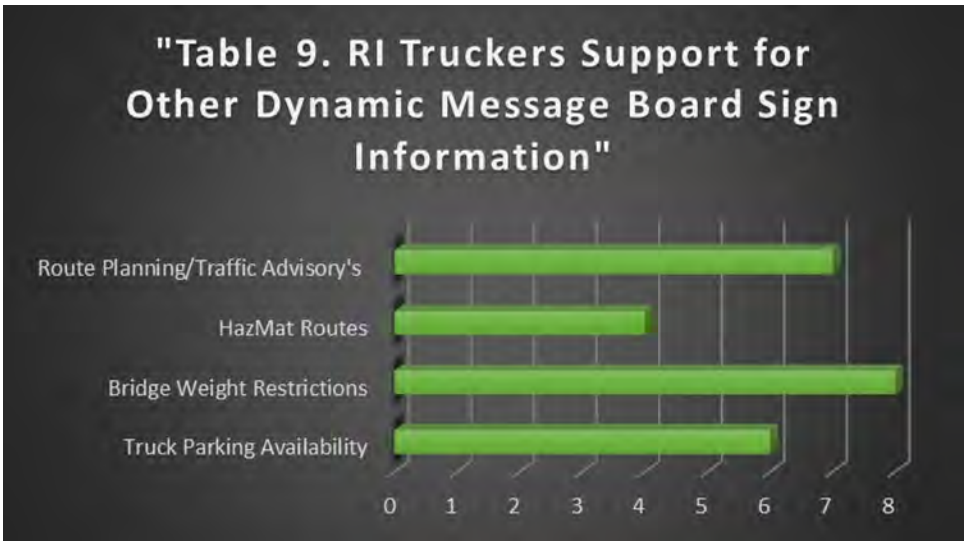
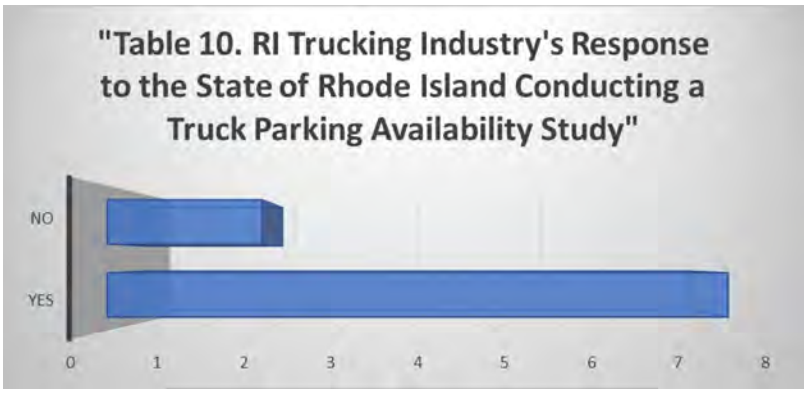


Table 9 reveals that respondents to the survey were very supportive of the dynamic message board signs providing bridge weight restrictions. They were also supportive of the message boards displaying information regarding route planning/ traffic advisory's, followed by truck parking availability, and finally hazardous routing. As freight traffic continues to grow along our highway freight corridors, it will become increasingly important that the state explore ways to get real time information out to truck drivers and fleet managers.



As Table 10 indicates, respondents to the survey are very supportive of the State of Rhode Island conducting further study on public and private sector truck parking availability. Several other states have commissioned truck parking studies in recent years utilizing vehicle probe data, ELD data, and data collected from smartphone applications such as Trucker Path and Trucker Tools. The Division of Statewide Planning, in collaboration with the Rhode Island Department of Transportation in planning on conducting a statewide truck parking analysis as part of the update to the State's Freight and Goods Movement Plan. This update is planned to occur from 2020 to 2022. Information from this technical paper will help shape the approach and data used in this future truck parking study effort.

As depicted in Table 11, survey respondents were overwhelmingly supportive of additional truck parking locations along the interstate highways. Providing additional parking that is safe, secure, and easily accessible along the highway will be difficult in the years ahead as Rhode Island, and many other New England States have scaled back available public truck parking and rest areas as a form of budget cutting after the Great Recession and many of these parking areas remain closed today. As freight volumes and freight traffic continue to grow in the years ahead as forecast in the 2016 Rhode Island Freight and Goods Movement Plan, there will be a greater need for truck parking and for the state to work with the private sector to find innovative solutions to the truck parking shortage.

Freight ITS Needs in Rhode Island

Other than sensors associated with traditional weight-in-motion systems, freight specific Intelligent Transportation Systems are not currently utilized as part of the State of Rhode Island's ITS Strategic Deployment Plan. That Plan focuses primarily upon investments in cameras, portable, and permanent changeable message signs, sensors and supporting and supporting communications network equipment, such as fiber optic cables. These investments are to provide public services such as traveler information, and incident management, as well as data collection to comply with performance measure tracking and reporting. Some of this existing and planned equipment deployment could possibly be utilized to provide freight specific information such as truck parking availability information on changeable message board signs or freight specific information on existing traveler information platforms.

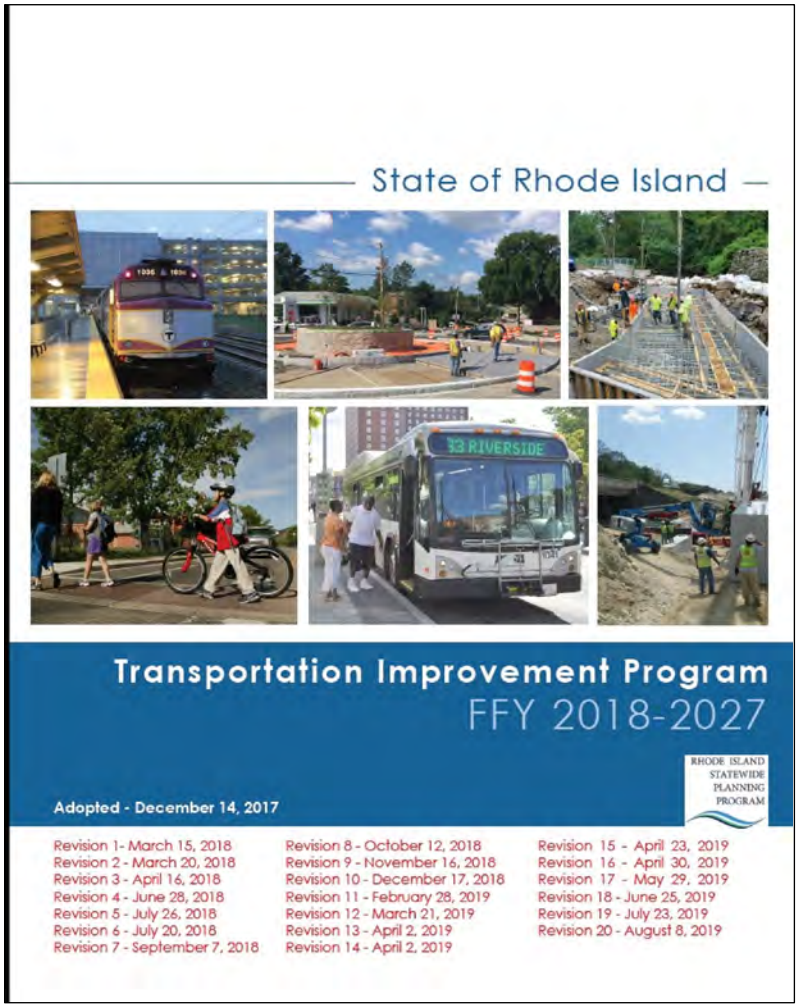
Many states, as discussed in the "Survey of Public and Private Sector Freight ITS Programs in Other Regions" have developed their own freight specific ITS deployments and systems relating to truck parking and Rhode Island should explore a regional system cooperatively with the other New England states in a similar fashion to the MAASTO system. The research and development needed to begin determining if a system like this would be feasible in New England could start through existing partnerships such as the Northeast Association of State Transportation Officials (NASTO) or the New England Transportation Consortium (NETC). The NETC was specifically established decades ago to help the New England states meet their special research needs by pooling resources and expertise and seems like a good starting point for exploring a regional truck parking availability system.

In relation to this concept Rhode Island would also need to conduct a statewide truck parking study to determine capacity issues and locations where trucks currently park in private lots or even in illegal locations to gauge the degree of the truck parking problem. To this end, the Division of Statewide Planning is planning on commissioning a statewide truck parking study as part of its planned update of the State Freight and Goods Movement Plan. The Plan update will begin in fiscal year 2021 and the Truck Parking Study may be started in fiscal years 2021 or 2022 depending on funding availability.

As the Division of Planning begins this update, RIDOT will likely be in the planning stages of updating it ITS Strategic Deployment Plan. RIDOT should begin thinking about how to incorporate freight specific ITS deployments over the next five years period (2020 – 2025) that would align with these studies and the needs of the truck freight industry. RIDOT should utilize the Rhode Island Freight Advisory Committee as a sounding board for how to incorporate freight needs into the next iteration of the ITS Strategic Deployment Plan. Going forward, a proper understanding of freight ITS needs will necessitate great involvement of private sector stakeholders in the planning process.

Freight ITS Deployment Funding and the STIP

In previous iterations of the State Transportation Improvement Program (STIP), ITS deployments were not included as separate line items in the program of projects and all new ITS systems were achieved through RIDOT's Mainstreaming Process. With the current, FFY 2018 – 2027 (STIP), ITS related funding is included in several line item projects. These STIP projects amount to roughly $5 million per year for ITS infrastructure and equipment.



Despite providing line item budgeting for the few limited ITS projects in Rhode Island, noted above, the "mainstreaming" process is sometimes still used (or is sometimes not considered at all, even though there may be an opportunity to help freight movement within a project's limits via an ITS improvement), and the existing funding and projects are primarily used to serve and benefit all types of highway travelers without any dedicated benefits to or focus on freight operators. Specific freight ITS applications and deployments should be considered, although research as to the cost and location of deployments, as well as potential public private partnerships should be explored first before any system should be included as a STIP project. Rhode Island should also consider emulating the research partnerships and federal grant funding that other states such as Florida utilized in its multi-year approach to researching and attaining federal dollars for its statewide truck parking availability system.

Recommendations for Freight ITS Improvements

The analysis and survey of freight specific applications in the sections above provide a brief overview of some options available for consideration to help improve the freight network and freight and good movement system in Rhode Island for system operators, freight fleet operators and truck drivers, as well as the general public. The following recommendations have been divided up into four categories to help provide guidance for possible next steps to be considered for the state, as well as private sector fleet operators and truck drivers to improve ITS capabilities and planning relating to freight ITS in the years ahead. This is by no means an exhaustive list, but it should serve as a starting point for further discussion, research, and planning to improve upon freight and goods movement in Rhode Island.

Recommendations have been classified in the following ways:

- Recommendations for the system (DOT) operator and partner agencies
- Recommendations for the freight fleet manager
- Recommendations for the freight vehicle operator
- Recommendations for the general system user

Recommendations for the System (DOT) Operator and Partner Agencies such as Statewide Planning

1. Commission a full update of the Rhode Island Department of Transportation ITS Strategic Deployment Plan, to include ITS deployment strategies and costs assessments for freight specific ITS integration.
2. Collaborating with regional and local officials, the business community, and the public to identify potential ITS strategies for implementation over a 5-10-year timespan. This could include direct community outreach at neighborhood and industry gatherings.
3. Evaluating the ITS proposals that come out of the outreach process for consistency with statewide goals and developing feasibility analyses for the preferred options.
4. Begin a multi-state working group on freight specific ITS applications with state DOT's, MPO's Port Authorities and Operators, and freight industry representatives.
5. Within the context of this working group, explore the research and funding needed for a multi-state parking availability and reservation system.
6. Try to stay abreast of developments and research regarding freight related ITS in the private sector and in academia, with hopes of ensuring that information on potential technologies that can improve freight movement is shared between the state and freight industry operators.
7. Continue to integrate ITS deployments within the context of the State Transportation Improvement Program (STIP) multiyear planning and financing.
8. Consider creating a Freight specific ITS line item(s) within the State Transportation Improvement Program (STIP).

Recommendations for the Freight Fleet Manager

1. Leverage connected vehicle technology to maximize en-route efficiency.
2. Continue to explore cost effective fleet management software for wholistic management of truck fleets for efficiency and regulatory compliance.

3. Continue to explore the best apps for freight matching to improve connections between shippers and carriers to avoid empty trucks on the road.
4. Explore different ways that trucks can share information with system operators and fleet managers concerning traffic congestion, crashes and other incidents, weather and other information that could be communicated automatically and improve real time information flow.
5. Work closely with State DOT and the Rhode Island Trucking Association to share information on utilization of ITS technologies and its effectiveness for freight operators.
6. Provide input to state agencies to help refine planning for freight ITS via the Rhode Island Trucking Association and Rhode Island Freight Advisory Committee

Recommendations for the Freight Vehicle Operator

- Stay up to date on the latest software and hardware technology solutions by attending a trucking conference.
- Work with your fleet manager to make sound investments decisions in platforms and technology that will increase efficiency, provide drivers with real time information, and improve safety.
- Work with your fleet manager to frequently test out new equipment offered by companies and sales reps that improve technology solutions in areas such as dynamic routing, forward looking camera systems, electronic logging devices, trailer tracking, and record keeping.
- Attend any in class or simulation trainings offered that provide opportunities to explore the latest technology solutions available to trucker drivers.

Recommendations for the General System Users and the Public

1. The general user of the roadways should always use caution when driving near trucks and avoid blind spots to prevent crashes, but to also allow trucks to move safely and efficiently on our highways. Increased freight trucks and volumes necessitates a higher need for increased awareness from all system users.
2. Recognizing that the truck parking shortage problem is a public safety issue and slows the safe distribution of goods. Work with local and state officials to improve access to truck parking in underutilized parking lots in rural, suburban, and urban communities.
3. As many people already do, continue to utilize Google Maps, Waze, and other free smartphones apps that help avoid driving on congested corridors at peak times, which will help relieve congestion and free up space for freight operators on our already congested roadways.
4. Recognize that the increased use of E-commerce and delivery of goods from retail locations or warehouses directly to households is creating congestion on highway networks and increased truck traffic on local roads. Consider using “locker” locations and package drop box locations to help ease this traffic and congestion.

Conclusion

State agencies, private sector fleet managers, and truck drivers all have a role to play in improving the safety and efficiency of freight and goods movement in Rhode Island. The technology systems, hardware, software, smartphone applications and related infrastructure systems are changing so rapidly in how they interact and help guide decision-making in the truck freight industry that public policy may be falling behind. As we have discussed in this paper, the changes in available technology within the truck freight industry are evolving and state transportation planners need to constantly analyze and understand ways that existing and planned ITS investments and deployments will interact with new technology solutions utilized by freight managers and operators. Understanding this new technology environment will allow for more effective ITS planning by RIDOT and partners and investments that will ensure more efficient movement of freight which will positively impact our state and regional economy.

We must strive to address the great leaps in technological change in the freight industry in our long-range planning documents such as the State Long Range Transportation Plan, State Transportation Improvement Plan, the RIDOT Strategic ITS Deployment Strategy, State Freight and Goods Movement Plan, and State Rail Plan. Additionally, the state must incorporate private sector stakeholders in these processes if we are to properly address the growth in freight volume expected over the next decade. Freight movement is a growing challenge that can only be solved through new public private partnerships and a greater emphasis on improving outcomes for all stakeholders.

There is an opportunity for the state to provide private sector freight fleet managers and truck drivers with additional real time information via data feeds ELD's, smartphone applications, or existing web platforms that can help improve truck routing decisions, truck parking decisions, and decisions that improve compliance with state and federal law. The examples provided in this technical paper serve as a starting point for discussion, planning, and research to help move Freight ITS forward as a major topic of transportation planning in Rhode Island in the years ahead.

Appendix 1: Truck Driver Hours-of-Services Rules and Electronic Logging Device Mandate

To ensure safety on the highways, the number of hours a trucker (and any commercial vehicle operator) may drive is controlled by the United States Department of Transportation. The hours-of-service regulations are found in Part 395 of the Federal Motor Carrier Safety Regulations (FHCSR). These regulations are developed and enforced by the Federal Motor Carrier Safety Administration (FMCSA), which is part of the United States Department of Transportation (US DOT).

The hours-of-service regulations focus on when and how long a truck driver is allowed to drive by placing specific limits on the amount of time a truck driver drives and how many total hours they can work before they are no longer permitted to drive a commercial motor vehicle. Truck drivers must follow three maximum duty limits at all times. They are the 14-hour "driving window" limit, the 11-hour driving limit, and 60-hour/7-day and 70-hour/8-day duty limits.

Once drivers have reached their driving limit, they must stop their trucks and go off-duty. This is the most direct determinant as to when a driver needs a parking facility. Every truck driver must carry a logbook to record when they are "off duty," in the "sleeper berth," "driving," or "on duty (not driving)." A trucker must use the logbook to account for every 15-minute interval of the day and, if requested, show the log to enforcement officers. The hours-of-service requirements are based on scientific research and are intended to ensure that truckers get sufficient rest.

14-Hour Driving Window

This window is usually thought of as a "daily" limit even though it is not based on a 24-hour period. A truck driver is allowed a period of 14 consecutive hours in which to drive up to 11 hours after being off duty for 10 or more consecutive hours. The 14-consecutive-hour driving window begins when the driver starts any kind of work. Once the driver has reached the end of this 14-consecutive-hour period, that driver cannot drive again until he or she has been off duty for another 10 consecutive hours, or the equivalent of at least 10 consecutive hours off duty. A drive is limited to the 14-consecutive-hour period even if you take some off-duty time, such as a lunch break or a nap, during those 14 hours. This regulation is found in Section 395.3(a)(2).

11-Hour Driving Limit

During the 14-consecutive-hour period explained above, a truck driver is only allowed to drive his or her truck for up to 11 total hours. Once the truck driver has driven a total of 11 hours, they have reached the driving limit and must be off duty for 10 consecutive hours (or equivalent) before driving the truck again. This regulation is found in Section 395.3(a)(3).

Thirty-Minute Rest Break

The hours-of-service regulations require that if more than 8 consecutive hours have passed since the last off-duty (or sleeper-berth) period of at least half an hour, a driver must take an off-duty break of at least 30 minutes before driving. For example, if the driver started driving immediately after coming on duty, he or she could drive for 8 consecutive hours, take a half-hour break, and then drive another 3 hours for a total of 11 hours. In another example, this driver could drive for

3 hours take a half-hour break, and then drive another 8 hours, for a total of 11 hours. Meal breaks or any other off-duty time of at least 30 minutes qualify as a break. This time does count against the 14-hour driving window, as allowing off-duty time to extend the workday would allow drivers to drive long past the time when fatigue becomes extreme.

60/70-Hour Duty Limit

An addition to the limits that are explained above is the 60/70-hour limit. This limit is based on a 7 or 8-day period, starting at the time specified by the motor carrier for the start of a 24-hour period. This limit is sometimes thought of as a "weekly" limit. However, this limit is not based on a "set" week, such as Sunday through Saturday. The limit is based on a "rolling" or "floating" 7-day or 8-day period. The oldest day's hours drop off at the end of each day when the driver calculates the total on-duty time for the past 7 or 8 days. For example, if a driver operates on a 70-hour/8-day schedule, the current day would be the newest day of your 8-day period and the hours worked nine days ago would drop out of the calculation.

34-Hour Restart

The hours-of-service regulations allow a driver to "restart" his or her 60- or 70-hour clock calculations by taking 34 or more consecutive hours off duty (or in the sleeper berth) or some combination of both. After a driver has taken at least 34 consecutive hours off duty, he or she can have the full 60 or 70hours available again. The use of a "valid" 34-hour restart resets a driver's "weekly" hours back to zero. In addition, an individual may perform other on-duty tasks, such as loading or unloading and paperwork, after reaching the 60/7 or 70/8 hour limits. They simply may not legally drive a commercial motor vehicle (CMV) on a public road when the limit has been reached. The 34-hour restart is an optional, not a mandatory regulatory provision.

"On Duty Time" includes all the following activities:

- All time at a plant, terminal, facility, or other property of a motor carrier or shipper, or on any public property, waiting to be dispatched, unless the driver has been relieved from duty by the motor carrier;
- All time inspecting, servicing, or conditioning any truck, including fueling it and washing it at any time;
- All driving time, as defined in the term driving time;
- All other time in or on a commercial motor vehicle other than: (i) Time spent resting in or on a parked vehicle, except as otherwise provided in Section 397.5 of the Federal Motor Carrier Safety Regulations; (ii) Time spent resting in a sleeper berth; (iii) Up to 2 hours riding in the passenger seat of a property-carrying vehicle moving on the highway immediately before or after a period of at least 8 consecutive hours in the sleeper berth;
- All time loading, unloading, supervising, or attending to the truck; or handling paperwork for shipments;
- All time taking care of a truck when it is broken down;
- All time spent providing a breath, saliva, or urine sample for drug/alcohol testing, including travel to and from the collection site;
- All time spent doing any other work for a motor carrier, including giving or receiving training and driving a company car; and

- All time spent doing paid work for anyone who is not a motor carrier, such as a part-time job at a local restaurant. The bottom line is that on-duty time includes all time a driver is working for a motor carrier, whether paid or not, and all time the driver is paid doing work for anyone else.

Governmental agencies are responsible for enforcing hours-of-service rules. Such agencies include state and local law enforcement, state Departments of Transportation, and the FMCSA. The state Department of Transportation and the FMCSA are responsible for conducting truck inspections. In addition, the FMCSA is responsible for routine investigations of businesses that employ truckers. Both inspections and investigations include review of drivers' logbooks.

For more information consult the "Interstate Truck Driver's Guide to hours of Service" Guidebook developed by the Federal Motor Carrier Safety Administration October 2016. This publication can be downloaded at:
https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Drivers_Guide_to_HOS_2016.pdf

Electronic Logging Device Mandate

In 2012, the United States Congress enacted the "Moving Ahead for Progress in the 21st Century" (MAP-21). MAP-21 outlined the criteria for highway funding, included a provision requiring the FMCSA to develop a rule mandating the use of electronic logging devices (ELDs). The Federal Motor Carrier Safety Administration (FMCSA) published the final electronic logging device rule or ELD Mandate in December 2015, and the first deadline to comply with the ELD mandate passed in December 2017.

In its simplest form, an electronic logging device, or ELD, is used to electronically record a truck driver's Record of Duty Status (RODS), which replaces the old paper logbooks drivers used to use to record their compliance with federal Hours of Service (HOS) requirements. Fleets had until December 2017 to implement certified ELDs to record HOS.

Fleets that were already equipped with electronic logging technology such as automatic onboard recording devices (AOBRDs) before December 2017 had until December 2019 to ensure compliance with the published specifications for the ELD mandate.

Appendix 2: Index of Terms

Conventional Count Stations – The physical location of the counter used to collect transportation data along a roadway, intersection, or ramp. Permanent sites that collect volume, speed, vehicle classification and truck weight data 24 hours per day, 365 days per year. Information from these sites is used to determine traffic growth and trends as well as develop seasonal adjustment factors used in determining estimates of annual average daily traffic (AADT) and directional design hour volume (DDHV). The sites utilize a variety of sensors and arrays to collect data including inductive loops, axle sensors, and non-intrusive acoustic sensors.

Changeable Message Signs (CMS) – Changeable Message Signs are large electronic signs which appear along select highways in Rhode Island, typically along freeways. The signs are typically used to display information about traffic conditions, travel times, construction, and road incidents. Real-time-travel time information is sometimes displayed CMS in Rhode Island.

Freight Intelligent Transportation Systems (ITS) – Freight ITS are advanced information and communications technologies that are or will be used in the future for the management of logistics, transportation, and materials handling operations. Freight ITS can also be understood as the combined application of information and communications technologies and its related infrastructure and policy framework to optimize transportation efficiency and sustainability. Freight ITS consists of technologies that provide users with traffic and infrastructure information, vehicle and freight location information, weight-in-motion-systems, freight condition information, freight positioning information, vehicle location and condition monitoring systems, route planning systems, and freight location monitoring systems.

Electronic Logging Device (ELD) – is an electronic hardware that is attached to a commercial motor vehicle engine to record riving hours. The driving hours of a commercial truck driver are regulated by a set of rules known as the hours of service rules. An ELD monitors a vehicle's engine to capture data on whether the engine is running, whether the vehicles is moving, miles driven, and duration of engine operation. Many ELD's are now linked to fleet management systems that provide real time travel information such as congestion, safety, and rest stops for fleet managers.

Electronic On-Board Recorder (AOBRD) – An Automatic On-Board Recording Device, is essentially an earlier version of the modern ELD. The main difference is that an AOBRD records and displays far less data compared to ELD's. ELD's are more synched to modern Freight ITS technologies whereas AOBRD's are being phased out as modern ELD's become the industry standard.

Intelligent Transportation Systems (ITS) – Intelligent Transportation Systems (ITS) are defined by the FHWA as the application of advanced sensor, computer, electronics, and communications technologies, and management strategies, in an integrated manner, to improve the safety and efficiency of the surface transportation system. ITS gives the State of Rhode Island the ability to detect, verify, and respond to roadway incidents; the ability to provide public information that reduces congestion and improves safety; and the ability to collect data to allow reporting on system performance and sustainability.

Third-Party Logistics or 3PL -in logistics and supply chain management is an organization's use of third-party businesses to outsource elements of its distribution, warehousing, and fulfillment services.

Small or Medium Sized Enterprise (SME) – The definition of an SME can vary widely depending on what industry the SME operates in, but in a general sense, an SME is a businesses or firm with less than 500 employees and less than $10 million in revenue. SME's make up the large majority of firms in the United States and within the freight and logistics sectors of the economy.

Closed-Circuit Television – a television system in which the video signals are transmitted from one or more cameras by cable to a restricted set of monitors. In the context of transportation planning and management closed circuit television monitoring is used to monitor traffic conditions, traffic safety, accidents, and special events and is utilized out of a Transportation Management Center (TMC).

Portable Changeable Message Signs - Changeable message signs that are portable and typically temporarily deployed with other temporary traffic control devices with the flexibility to display a variety of messages

Radar Vehicle Detection - use frequency-modulated continuous-wave (FMCW) radar to reliably detect moving or stationary targets, including cars, trains, trucks, and cargo,

Transportation Management Center – Transportation Management Centers (TMCs) serve as the central transportation control and management center for a state or smaller regional area's major street and highway network. TMC's may monitors traffic signals, intersections, and roads in order to reduce congestion and coordinate state and local authorities during special events, emergencies, or daily stop-and-go traffic.

Vehicle to Infrastructure V2I - V2I technologies capture vehicle-generated traffic data, wirelessly providing information such as advisories from the infrastructure to the vehicle that inform the driver of safety, mobility, or environment-related conditions. State and local agencies are likely to install V2I infrastructure alongside or integrated with existing ITS equipment.

Vehicle to Everything V2X – V2X communication is the passing of information from a vehicle to any entity that may affect the vehicle, and vice versa. It is a vehicular communication system that incorporates other more specific types of communication as V2I (vehicle-to-infrastructure), V2N (vehicle-to-network), V2V (vehicle-to-vehicle), V2P (vehicle-to-pedestrian), V2D (vehicle-to-device) and V2G (vehicle-to-grid). The main motivations for V2X are road safety, traffic efficiency, and energy savings.

Weigh-In-Motion WIM – (WIM) devices are designed to capture and record the axle weights and gross vehicle weights as vehicles drive over a measurement site. Unlike static scales, WIM systems are capable of measuring vehicles traveling at a reduced or normal traffic speed and do not require the vehicle to come to a stop. This makes the weighing process more efficient, and, in the case of commercial vehicles, allows for trucks under the weight limit to bypass static scales or inspection.

Wrong Way Detection System – A wrong way detection system is a system of radar signals, warning detectors, and interconnected ITS systems that alert both the driver and the TMC operators that a vehicle has approached a ramp in the wrong direction and is heading into oncoming vehicular traffic. These systems can warn the wrong way vehicles by using either flashing beacons, audible alerts and/or a small DMS electronic sign. These systems also use CCTV cameras installed in both directions to provide visual verification of wrong way vehicle events. When a wrong way vehicle is detected, video from cameras will be sent to a TMC to show the wrong way vehicle.