Prepared For:

West Virginia Department of Transportation
Division of Highways

Advanced Traffic Management System (ATMS)

TECHNICAL PROPOSAL
CRFP No. DOT1900000001

Prepared By:

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May 29, 2019

Cover Letter (CRFP Section 5.3.3)

May 29, 2019

Attn: Crystal G. Hustead
West Virginia Department of Transportation Division of Highways
2019 Washington Street, East Charleston, WV 25305
RE: Response to CRFP No. DOT1900000001 - Advanced Traffic Management System

Dear Ms. Hustead,

Thank you for the opportunity to respond to Request for Proposal CRFP No. DOT1900000001 for an Advanced Traffic Management System solution. The following Technical Response illustrates how Q-Free, Infologistics ("ILOG"), Skyline Technology Solutions ("Skyline"), and Environmental Systems Research Institute, Inc. ("ESRI") (together "Team Q-Free") are positioned to offer a cost-efficient, fully integrated, configurable, and mature ATMS and 511 platform to the West Virginia Department of Transportation Division of Highways ("WVDOH"). Our team understands the critical nature of this project to WVDOH and is fully committed to delivering a complete technical and business solution that is the lowest technical risk while positioning WVDOH for the future. Our key personnel have partnered with WVDOH beginning in 2008 and have helped WVDOH grow their operations capabilities by providing tools that help lower incident clearance times and increase public situational awareness. In addition, working in partnership with WVDOH, we have increased critical connections to West Virginia Public Service Access Points (PSAP e911 centers) with 25 active integrations. Team Q-Free already has deep knowledge of WVDOH's ITS infrastructure, Transportation Management Center, sparse telecommunications, cyber security policies, unique weather needs and demanding freight challenges.

Team Q-Free is committed to providing the highest quality service and we are extremely proud of our record of deploying, operating, and maintaining WVDOH's ATMS and traveler information platform. With Team Q-Free, WVDOH can look forward to having a dedicated partner who will provide the following advantages:

- **Experienced Project Team and Subcontractors** – Team Q-Free has a demonstrated working relationship and deep experience working with WVDOH;

- **Major Reduction of Schedule/Cost Risk** – Team Q-Free's off-the-shelf ATMS platform is already implemented. Working proactively with WVDOH and employing the latest software development methodologies (Agile), Team Q-Free will incrementally develop key enhancements (i.e. Events Manager Module) and a cost-effective 511 platform; and

- **Best Value** – Team Q-Free's deployment and operations/maintenance costs have been minimized by relying on off-the-shelf capabilities of our ATMS platform and ILOG's cost-effective Integrated Voice Response (IVR) solution. We will utilize ERSI to also leverage existing WVDOH GIS data.

Thank you for your time in reviewing our proposal. As requested in the CRFP, our proposal and pricing will remain firm a minimum of 180 days from May 29, 2019. If we can be of additional help in the review process, please feel free to call me at 757-262-9988 or email me at Daniel.Skiffington@q-free.com. We look forward to participating in the proposal process and working with WVDOH in the future.

Sincerely,

Daniel Skiffington
Executive Vice President, Inter-Urban Division
Q-Free America, Inc.

Title Page (CRFP Section 5.3.4)

Q-FREE AMERICA REQUIRED INFORMATION

CRFP Subject:	Advanced Traffic Management System (ATMS)
CRFP Number:	CRFP NO. DOT1900000001
Vendor's Name:	Q-Free America, Inc.
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Date:	May 29, 2019
Vendor Signature:	*Daniel Skiffington*

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1.0 Project Goals and Mandatory Requirements (CRFP Section 4.2)

Q-Free, Infologistics ("ILOG"), Skyline Technology Solutions ("Skyline"), and Environmental Systems Research Institute, Inc. ("ESRI") (together "Team Q-Free") are positioned to offer a cost-efficient, fully integrated, configurable, and mature Advanced Traffic Management System (ATMS), Video Distribution System (VDS), and 511 Traveler Information System (ATIS) to the West Virginia Department of Transportation, Division of Highways ("WVDOH"). Although we will fully meet *all* of WVDOH's mandatory requirements and 92 of 124 desirable requirements, we would also like to emphasize the long and successful partnership Team Q-Free has had under the leadership of WVDOH.

4.2 Project Goals and Mandatory Requirements

4.2 Vendor should describe its approach and methodology to providing the service or solving the problem described by meet the goals/objectives identified below. Vendor's response should include any information about how the proposed approach is superior or inferior to other possible approaches.

Q-Free has partnered with WVDOH since 2008 (as Open Roads Consulting, Inc.) and has a thorough understanding of WVDOH's business needs. Throughout this proposal Team Q-Free will present a vision and roadmap for a partnership with WVDOH to design, implement, maintain, and operate an ATMS and 511 Traveler Information System that will fulfill all desired base functionality and most of the desirable functionality while simultaneously allowing WVDOH to be well positioned to leverage advanced Transportation System Management & Operations (TSMO) strategies such as:

- Decision Support Systems (DSS);
- Truck Parking;
- Smart Work Zones;
- Hard Shoulder Running;
- Variable Speed Limits;
- Weather-Responsive automation;

- Multi-modal integration;
- Integrated Corridor Management (ICM);
- Automatic Vehicle Location (AVL) Integration;
- Connected Vehicle data ingestion (SAE J2735 compatible);
- Integrated Freeway-Arterial Operations (signal integration);
- Public Safety Access Point integration.

These advanced functionalities are not "wish-list" items but are being actively developed by Team Q-Free *today!*

By modifying our team of subcontractors and consolidating our 511 Traveler Information System providers, Team Q-Free can provide a more cost-effective solution and more consistent data presentation across Web, IVR, Mobile and Social Media. In addition, by moving to a single Advanced Traveler Information System (ATIS) provider, Team Q-Free will provide information where and when it is needed or requested, using the most reliable networking and systems possible, in a fiscally responsible manner. Q-Free's partner, ILOG, uses the newest technologies available so that not only are advanced 511 services provided, but WVDOH is also positioned with tools that support new applications, assist with pilot programs, and that adapt to changing information sources and delivery mechanisms.

Q-FREE DEPLOYMENT SUCCESS AND APPROACH

Team Q-Free fully understands that the successful deployment of a mature and fully featured ATMS and 511 Traveler Information System is one of WVDOH's core operational objectives. We also understand that to be successful it takes more than just providing existing software products. A successful ATMS and 511 Traveler Information System deployment requires dedicated staff working in partnership with WVDOH staff to deliver a fully integrated suite of technology that fits WVDOH's unique, complex, and mission-critical environment and requires strong adherence to FHWA System Engineering processes. Finally, it requires a team that is deeply integrated and has documented experience working together on similar projects. In Section 4.2.1 below is a summary of our approach to ensure all WVDOH goals and objectives are met.

PAST PERFORMANCE PREDICTS FUTURE SUCCESS

In the ATMS/ATIS industry, past performance is the *SINGLE MOST IMPORTANT FACTOR* in predicting future success.

Q-Free excels with a perfect record;

NO OTHER VENDOR CAN MAKE THIS CLAIM.

4.2.1. Goals and Objectives

4.2.1.1 Provide an Advanced Transportation Management System (ATMS), a 511 Traveler Information System, associated software development, and support services that will provide improved functionality to the West Virginia Department of Transportation for the purpose of managing the transportation system throughout the state and partnering with stakeholder agencies to improve emergency and event response and the overall transportation experience in West Virginia.

Team Q-Free will deliver a fully integrated ATMS, VDS and ATIS to WVDOH that not only satisfies the business needs and requirements stated, but also offers the *Best Value and Lowest Risk.*

Best Value

Utilizing and enhancing WVDOH's existing ATMS platform (Q-Free's ***OpenTMS***) along with our subcontractor's complementary technology will offer the best value over the lifetime of the investment. These proven platforms provide a wide range of capabilities, and their modular and extensible technology platform will enable WVDOH to expand functionality in the years to come. Some of the key advantages of Team Q-Free's offerings are:

Proven Commercial Off-the-Shelf (COTS) ATMS Platform

OpenTMS is the most fully featured, highly productized, and easy-to-use ATMS solution on the market. Version 8 of the system has been field-proven and successful statewide in four different states with regional

deployments in two additional states. WVDOH staff are already familiar with the product and the technical teams supporting WVDOH. Based upon WVDOH's mandatory requirements and working in partnership with key WVDOH stakeholders Team Q-Free will design and develop OpenTMS v9 and a completely revamped ILOG ATIS platform utilizing Agile Methodology.

Innovative Video Distribution

Skyline will continue to provide leading edge video capabilities and their demonstrated ability to manage thousands of internet protocol (IP)-based devices efficiently and provide video distribution for very large DOT customers. As part of the new platform Q-Free will fully integrate Skyline's VERO solution to better manage video.

Fully Integrated Solution

Q-Free, ILOG, Esri and Skyline already provide combined services for multiple state DOT's and have a long working relationship with seamless, highly integrated products.

> Our solution has never been replaced by a competitor's system

Easy to Use and Intuitive User Interface

OpenTMS has been continuously refined and in use since 2002 (with VDOT) and is in use in Virginia and Pennsylvania. WVDOH will get the benefit of this long-term system refinement, and efficient user interface. WVDOH staff are already trained and manage traffic today with OpenTMS.

Modular Architecture

OpenTMS consists of a set of independent modules that can be customized and configured to meet West Virginia's operational needs. Modules can be added, removed, or modified as WVDOH's needs change. This scalable and extensible architecture ensures long-term viability.

Lowest Lifecycle Ownership Cost

Designing and deploying an ATMS platform is a small portion of the overall lifecycle cost. Long-term value is created by minimizing the cost to maintain, upgrade, and enhance the ATMS platform. With changes to IVR and full development of OpenTMS v9, the new platforms will provide a stable base for WVDOH's Traffic Operations for the entire period of performance of this contract.

Adding New Devices

Team Q-Free makes it easy and affordable to integrate new ITS Devices. OpenTMS enables our clients to add an unlimited number of new devices quickly and easily.

Maintenance

Team Q-Free minimizes maintenance costs by having the most reliable and scalable ATMS solution, as well as providing training and tools to enable our clients to maintain and administer the solutions.

Integrating External Systems

The modular architecture of OpenTMS supports standards-based integrations with external systems. WVDOH has completed PSAP integration with 25 counties. The system includes a data integration platform which supports multiple data standards and exchange models.

Lowest Risk

Team Q-Free is invested in WVDOH's long-term success. Team Q- Free's combined experience and knowledge will reduce project risk and ensure WVDOH's ATMS and 511 Traveler Information System is deployed on-schedule.

- **Strong ATMS Delivery Record** – Team Q-Free has an excellent record of delivering ATMS projects on-time and within budget. Our ability to successfully plan, design, implement, and deploy stems from a combination of experienced technical leadership and an ATMS platform that is modular and extensible;

- **Dedication to Long-Term System Maintenance** – Team Q-Free is dedicated to long-term client satisfaction, so much so that we have never lost a client. Part of this is due to the strong focus on system maintenance with regular software updates (patches) applied after delivery; and

- **Core Values** – Integrity, Partnership, and Innovation.

Team Q-Free works to establish long-term client partnerships by maintaining open and honest lines of communication, maintaining our project schedule, delivering on-time, and listening to our clients' needs. Our successful record is attributable to our core corporate values: Integrity, Partnership, and Innovation.
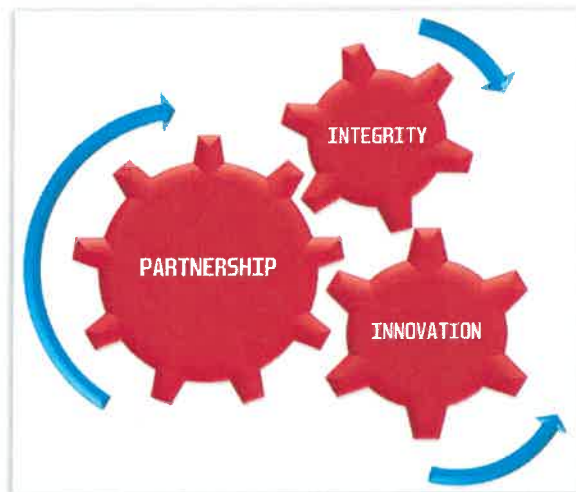
Figure 1 - Team Q-Free Core Values

Integrity

Our project team will maintain an open, transparent relationship with WVDOH. We will do what is necessary to meet WVDOH's requirements and deliver the system on-time and within budget;

Partnership

We create long-term partnerships with our clients. WVDOH plans to invest significant resources in their ATMS and it is only fair that Team Q-Free provides a return on their investment beyond the system wide deployment. By continuing with our network of existing ATMS clients, WVDOH will receive cost-effective implementation and system maintenance, sharing of data with other state DOT systems, and access to quarterly software updates with new functionality deployed for our other customers.

Innovation

WVDOH has unique ITS operational needs. Team Q-Free will deploy OpenTMS v9 with 12 new modules and customize and configure our OpenTMS software to create an innovative ATMS platform that addresses all of WVDOH's operational needs. Team Q-Free's integrated ATMS platform will enhance WVDOH's ability to manage traffic more effectively and provide actionable traffic information to the traveling public. The solution will provide the ability to control all existing and planned ITS devices along with the ability to aggregate all the disparate field data into a central database.

Enhanced 511 and Traveler Information System (ATIS)

Along with the proposed ATMS, the ATIS proposed for WVDOH will improve existing services, similar to the improvement in ATIS services experienced in Pennsylvania when they moved to the ILOG ATIS solution. The proposed ATIS rests on a platform that can accept, process and distribute virtually any relevant data source. ILOG has specific experience with incorporating data feeds from multiple interstate and intrastate agencies; from partners/stakeholders such as Waze and NOAA; and from commercial providers such as Vaisala and INRIX. This multi-faceted approach to ATIS means that the mobile app can cross state boundaries and continue to provide travel information, and the IVR can address destinations just outside of state borders.

The new ILOG platform proposed for the ATIS also supports advanced, non-traditional modules such as a two-way emergency communications system for trapped travelers (deployed as 511PAConnect in Pennsylvania) and connected corridor components and has even been used for a connected vehicle pilot program. One unique feature that has been included is "*FIND MY ROUTE*" (see Section 4.11.1.23 on page 191), a simple button on the web page and mobile app where a user can view their pre-defined routes quickly and efficiently. While other non-traditional 511 components are not included as part of the 511 ATIS proposed, WVDOH can rest assured that if they wish to move into these other programs, they can leverage this 511 ATIS platform to provide new advanced services to the public. Each component of the proposed ATIS assists the WVDOH with directing the public during daily travel activities and especially in times of emergency. Consequently, a scalable and robust system is proposed.

TEAM Q-FREE'S ATMS SOLUTION WILL ADDRESS THE
CURRENT NEEDS OF WEST VIRGINIA
&
BE ADAPTABLE TO THE STATE'S FUTURE
TRANSPORTATION MANAGEMENT AND OPERATIONS
STRATEGIES

4.2.1.2 Provide a seamless transition between the current operating environment and user experience to any new software or system version implemented so as not to disrupt transportation operations and management activities within the West Virginia Department of Transportation and partner agencies.

Successful Migration

Team Q-Free will develop and submit a detailed Software and System Deployment Transition Plan for review and approval by the WVDOH. Team Q-Free understands the need for a well thought out transition plan being key to providing a seamless transition.

Team Q-Free is experienced in transitioning from legacy systems. Q-Free has successfully transitioned four of five VDOT TMCs from legacy ATMS to OpenTMS and all regions of Pennsylvania DOT from legacy ATMS and vendor applications to a statewide version of OpenTMS. ILOG has successfully transitioned ATIS systems for the Pennsylvania Turnpike and the Pennsylvania Department of Transportation. Most recently, ILOG has merged functions for the two agencies, creating a joint TIS.

Key Components for a Successful Migration Strategy

- Software and System Deployment Transition Plan provides a detailed timeline on pre-transition activities and system transition from legacy systems to the new ATMS-ATIS system
- Identify stakeholders and their role in the transition
- Utilizing an OpenTMS upgrade strategy allows for access to historical production data
- Conduct device verification
- Conduct end to end testing for integrated systems
- Plan to populate production databases with general configuration
- Public website and services ready to go
- Training

In West Virginia, the team will be upgrading the current version of OpenTMS to version 9. This upgrade will roll out the new features as well as allowing the WVDOH to keep their production data. Having access to this data will provide the WVDOH with access to historical information for reporting and analytics. As part of this upgrade the WVDOH will be transitioning to a new 511 web site and IVR system vendor. The plan for this transition will be well documented and reviewed with the WVDOH prior to transition.

Currently, ILOG uses WVDOH data feeds for information that populates the Drive Safe WV mobile app. This means there will be few adjustments for the public to make in navigating the mobile app. The mobile app will be updated to incorporate a new set of features. ILOG is very familiar with website DNS changes and propagation, as well as porting numbers to the new IVR system. The public should make a swift and happy transition to the new ATIS services by tapping into the experienced staff at WVDOH to work on the actual design for the website.

Team Q-Free will be on-site supporting the WVDOH and WVTPA leading the transition and to support operations staff:

- In the weeks leading up to the deployment, Team Q-Free will meet with stakeholders to finalize the transition plan and review action items;

- Transition will be planned around a detailed schedule with clearly defined activities and strategies;

- Transition will be scheduled for a low-activity period. Team will develop a Go/No-Go checklist to ensure that there are no major traffic events and that the ATMS, VDS and ATIS Systems are ready to go; and

- The Q-Free project manager will work with the WVDOH to finalize the Operations Support and Maintenance Plan before transition so there is a seamless transition to Maintenance.

4.2.1.3 Provide a cost-effective solution that meets the needs of the West Virginia Department of Transportation and has low, overall ongoing life-of-ownership costs for the term of the contract.

Team Q-Free has examined cost, scope, schedule and risk to minimize software development life-cycle costs and maintenance/operations activities. Team Q-Free has modified the project team (consolidated the ATIS providers and added geo-spatial capabilities to leverage West Virginia's existing investment in spatial data) to ensure delivery of the most cost-effective ATMS, VDS and ATIS solutions possible for WVDOH. One aspect involves using ILOG's advanced IVR to avoid recording fees for minor changes and add increased flexibility and modern "Alexa" like user experience. In addition, Team Q-Free will introduce OpenTMS v9 that will include 12 new modules (See CRFP requirement 4.5.1.2 in Section 4.0 - General System Requirements of this proposal). and consolidate Incidents and Planned Events into a seamless "Events Manager Module" (See Section 9.0 Event/Incident Management & Reporting (CRFP Section 4.10)) that will make data input much more efficient. Team Q-Free will meet 100% of all mandatory requirements for the ATMS, VDS and ATIS components while ensuring full compliance with the required West Virginia IT policies and FHWA system engineering requirements. OpenTMS v9 will also meet 92 of 124 (74%) of the desirable requirements "out of the box". Thus, 74% of WVDOH's desirable requirements will be met under the price submitted in this proposal with minimal additional work required as WVDOH adds field devices and more advanced operational capabilities.

In every component, we have selected the best services, software, and created the best methods to provide the functionality and reliability required by the RFP. Given the extreme weather conditions experienced in the last several years, and their impact on travelers, we have selected the most scalable and robust components at the best possible price.

> **WITH OPENTMS V9, Q-FREE WILL MEET**
> - **100% OF ALL MANDATORY REQUIREMENTS**
>
>   **AND**
> - **92 OUT OF 124 DESIRABLE REQUIREMENTS**

4.2.2. Mandatory Project Requirements

The following mandatory requirements relate to the goals and objectives and must be met by the Vendor as a part of its submitted proposal. Vendor should describe how it will comply with the mandatory requirements and include any areas where its proposed solution exceeds the mandatory requirement. Failure to comply with mandatory requirements will lead to disqualification, but the approach/methodology that the vendor uses to comply, and areas where the mandatory requirements are exceeded, will be included in technical scores where appropriate. The mandatory project requirements are listed below.

4.2.2.1 Functionality of the proposed ATMS and 511 software and systems must meet or exceed the current functionality of the existing WVDOH system and elements described in the Background and Current Operating Environment Document, meet the accompanying mandatory high-level Functional Requirements, and respond as necessary to any specific answers to questions submitted to WVDOH through this RFP process.

Having partnered with WVDOH for the last 10 years, Team Q-Free fully understands WVDOH's business needs and has worked proactively to ensure our systems meet WVDOH's ATMS, VDS and ATIS requirements. In Proposal Sections 8.0 through 16.0 (RFP 4.5.1 through RFP 4.17.3) Team Q-Free has included 163 pages of documentation demonstrating our proposed methodology to meet or exceed all of

WVDOH's mandatory requirements. Team Q-Free will roll out v9 and a totally enhanced ATIS platform that will be 100% compliant with all mandatory requirements and, in addition, compliant with 92 out of 124 (74%) of WVDOH's desirable requirements out-of-the-box. Details of how the proposed ATMS, VDS and ATIS platforms will meet or exceed the current functionalities is described in the section for each functional requirement.

4.2.2.2 The period of service for this contract is 4 years with two optional 2-year renewals.

Team Q-Free will fully support the period of service for this contract as we have done since 2008.

4.2.2.3 The Vendor shall submit a formal Software Development Process proposal and schedule to the WVDOH for their approval prior to beginning any work. Consideration should be given to including an iterative process by which the WVDOH representatives are able to review progress, review GUI mock-ups, provide input to the development team, and participate in acceptance testing and requirements verification. Project progress meetings will be required monthly at a minimum, either in person or by teleconference. Project progress reports shall be submitted monthly.

The Q-Free project manager will work with the team to submit a formal Software Development Process proposal and schedule. WVDOH will be an active participant in the Agile process and have the opportunity to provide feedback during the sprint review meetings in support of the project's iterative design and implementation process. An overview of the process is provided in requirement 4.3.1.6.

The project manager will prepare an agenda and run monthly progress meetings on-site and/or via teleconference. All sub-contractors will participate in the progress meeting. The project manager will prepare and submit monthly a progress report.

4.2.2.4 Vendor must provide on-site and remote technical support to the WVDOH for the purpose of maintaining and upgrading the proposed ATMS and 511 System software and providing other TMC support services for an initial period of 3 years with two optional 2-year renewals. The initial 3-year O&M period is to commence following a 1-year software and system development period and final software and system acceptance by WVDOH. The necessary on-site support for the Year 1 system development period is to be included in the base system costs for the ATMS and 511 System. The O&M support periods will include one person on- site for 40 hours per week (standard work days, excluding holidays and vacation) plus on-call hours as necessary to resolve issues in a timely manner, which may include but not be limited to troubleshooting and resolution of issues related to field devices, communications, networks, software and hardware. In addition, 24/7 phone support shall be provided for the ATMS and 511 System software and associated systems to assist the WVDOH during hours when on-site support is not available. Vendor to include a cost component, if any, for ATMS and 511 System software upgrade/maintenance services and contracts for the term of the contract and renewals. During the system development period (Year 1) and for one year following final acceptance, these upgrade/maintenance costs will be part of the Base System Package costs.

Q-Free will provide an Operations Support and Maintenance Plan that provides a comprehensive plan for providing 24/7/365 on-call support. Components of the plan will include at a minimum:

- Clearly outlined SLAs;
- Process for obtaining 24/7/365 support – Q-Free provides a 24/7 toll free support line that is staffed by our system engineers;
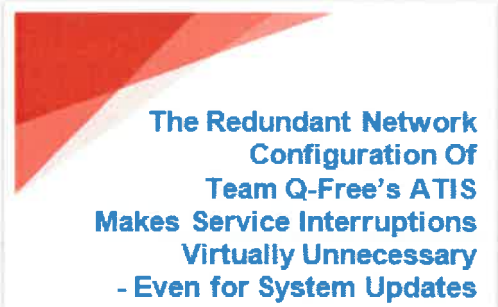
- Process for reporting / tracking issues – Q-Free uses JIRA Service Desk (JSD) for reporting and tracking issues;

- Software Release Process;

- Detailed On-site System Engineer Role and Responsibilities; and

- Configuration Management.

Q-Free will provide an on-site support personnel. Q-Free has found this to be a successful model. On-site support personnel assigned to the WVDOH will be knowledgeable in ITS technologies as well as the Q-Free ATMS platform, VDS and 511 solution. This resource will be flexible in shifting hours to support critical events. Some of the expected duties of the system engineer to support TMC operations are as follows:

- Troubleshoot all reported issues;

- Perform preventive maintenance activities as outlined in the system engineer checklist within the Operations Support and Maintenance Plan;

- Monitor floor operations and solicit feedback from supervisors to ensure there are no training issues with system users or administrators;

- Provide support statewide related to ATMS, ATIS, video distribution and networking;

- Provide on-site training and demonstrations;

- Provide field device integration;

- Keep the WVDOT PM apprised of all system related issues; and

- Attend project meetings as the WVDOH's ITS subject matter expert as required.

Support via email and telephone for the ATIS components will be available 24x7. The support staff at ILOG are systems engineers who try to troubleshoot and resolve the problem. When/if needed, these system staff call in programming/database staff to assist in the problem resolution.

4.2.2.5 Vendor is required to not interrupt connectivity and key data transfer functionality without notice and prior approval, during the ATMS software and 511 system installations, between the WVDOH TMC located in Charleston, WV and the remote users and offices that provide information to and/or receive information from the TMC and the current ATMS and 511 software and systems. This includes the E-911 centers located across the state that provide accident data directly to the current WVDOH ATMS platform and the West Virginia Parkways Authority.

The Redundant Network Configuration Of Team Q-Free's ATIS Makes Service Interruptions Virtually Unnecessary - Even for System Updates

The Software and System Deployment Transition Plan will address these concerns and include a notification and approval process in the plan. The transition plan will identify key stakeholders and transition notification procedures.

Continuous ATIS service availability to the public is critical so that public confidence in the 511 information is not compromised. The redundant network configuration of the ATIS makes service interruptions virtually unnecessary - even for system updates.

4.2.2.6 The proposed Vendor software and systems must have the ability to be integrated with current WVDOH field devices, including 109 CCTV, 64 DMS, and 41 RWIS. The list of devices is included as Attachment B.

OpenTMS fully meets this requirement today. OpenTMS currently supports all protocols in use by the WVDOH identified in Attachment B.

4.2.2.7 The 511 systems proposed shall maintain the capability for information retrieval via telephone access using voice recognition, the WV511.org website and the WV511 Drive Safe mobile application. The 511 system shall also have a road condition reporting system associated with it that allows for remote user data entry and master user data entry of road conditions from partner agencies and the TMC.

The proposed ATIS system shall include the specified IVR, website and mobile application.

Users will use the new integrated AMTS Road Conditions Module to enter and manage road conditions. Road conditions will be distributed to the 511 systems. For partner agencies, permissions can be set to provide access to only the Road conditions module.

4.2.2.8 The 511-website development and product shall adhere to the requirements noted in the Functional Requirements. In addition, the Vendor shall include and/or provide the following:

- WVDOH to have administrative rights and control over any public facing websites and applications;
- WVDOH personnel shall have the administrative ability to modify links, graphics, language, etc. on the website;
- A resources tab/link shall be included for linking to other WVDOH pages, resource documents, and partner agencies. Resource links might include information/links to construction updates, significant project websites, tolling information, truck permits, rest areas, social media, etc.;
- Ability to place advertising on the website and track advertising metrics;
- Tracking of analytics/usage of the 511 website and the 511 application by the public; and
- Annual review of the 511 website and the 511 application between the Vendor and WVDOH to update design, content, graphics, links, features, etc. This work will be part of the annual maintenance costs. Costs for items, design or equipment upgrades above and beyond normal maintenance will be paid through the materials or IDIQ budget provided by WVDOH.

The ATIS system will have a standalone web portal that will allow WVDOH authorized staff to control the availability of the public website, to modify identified components of the website, and to access statistics that track site and application usage. This administrative site will also provide a number of reports and other features, and it will be modified to include advertising metrics and placement of advertising as determined during design phase of the project.

The public-facing site will include tabs with links to other resources, tolling, social media, rest areas and other items as identified during design.

It is important to note that site design in general, like most other creative enterprises, goes through trends. Consequently, a site that is several years old may look "dated" compared with current web site trends. An

annual review to identify which links, graphics or design elements need to be updated will be included as part of the proposed annual maintenance costs.

4.2.2.9 The Vendor shall provide training on the ATMS and 511 software and systems to operators and supervisors initially and then as specified below for new personnel and upgrades. During the first year, Vendors should plan on two training sessions to be provided at two locations in Charleston. One will be at the WVDOH TMC and the other will be at the West Virginia Parkways Authority office. Facilities will be arranged for by the host agency. Up to 20 trainees should be planned for at the WVDOH TMC site with training to take place across two shifts. Up to 10 trainees should be planned for at the WV Parkways Authority site with training to take place across two shifts. Each ATMS training session will be accomplished within one 8-hour period. In each of the following years, including renewal years, the Vendor shall provide a training session to new employees and software updates/refresher to previously trained employees at the same locations in a similar format. At every training session, training manuals shall be supplied for trainees as well as prepared presentations and live training on host supplied workstations. The training period should be quoted to include time, materials and travel expenses associated with this task. Alternatives to this training plan can be submitted by the Vendor, but the Vendor shall provide a quote based on the training plan specified above and an alternative bid if desired for consideration by WVDOH.

Team Q-Free will provide training as required. Included with the deployment is a Staging environment that can be utilized for Training. Our Trainer has over 10 years of experience training at various TMCs. Our Trainer will be on-site for a week to conduct 4 training sessions between the two sites for the initial deployment. Training materials will be supplied.

Training for WVDOH staff who will be managing the ATIS website through the administrative portal will be provided as part of the on-site training. The preview environment will be used for training.

In subsequent years, each year the Trainer will be on-site for a week to conduct new employee and refresher training at both sites. Materials will be provided.

Our Trainer will work with the WVDOH and WV Parkway Authority to develop and execute the training plan as specified in the requirement.

4.2.2.10 The Vendor shall provide a list of servers, computers, workstations, 3rdparty software, and other hardware required to successfully implement their proposed solution. No hardware/software cost data is to be included in the technical proposal. If the hardware or software is to be included with or is already absorbed into the base software cost, that should be noted in the cost proposal response.

Q-Free intends to utilize the hardware and software list provided in the RFP. Capitalizing on the infrastructure provided Q-Free will be able to provide a staging environment to be used for testing and training as well as the production platform.

In addition, Q-Free will be adding the following 3rd party software:

- OsTIcket, https://osticket.com/ . This software will be integrated to provide maintenance ticket support;

- Tableau, https://www.tableau.com/. This software will provide analytics package;

- Jasper Reports Server Professional, https://www.jaspersoft.com/ . This software will be integrated to provide Reporting functionality through our Reporting module;
- The ATMS Database used will be PostgreSQL; and
- The hosting and software for the ATIS system is included in the price.

4.2.2.11   The WVDOH will provide a test environment location within the same building and general location of the existing TMC for the Vendor. The Vendor may propose an alternate solution which will be subject to WVDOH approval after award.

Q-Free will deploy a staging environment within the same facility currently hosting the statewide ATMS platform. This environment can be used to stage releases for testing and training prior to production release.

The test/preview environment for the ATIS will be hosted in the Amazon cloud, as will the production ATIS.

4.2.2.12   The Vendor should develop a comprehensive System Security Plan (SSP) for review and approval by the WVDOH and the West Virginia Office of Information Technology prior to system design acceptance. The purpose of the system security plan is to provide an overview of the security requirements of the system and describe the controls in place or planned for meeting those requirements, in addition to delineating security control responsibility as it pertains to the vendor and the state. At a minimum, the SSP should address:

- *Defense-in-depth (layered security) methodology*
- *Risk management, risk assessment, risk analysis*
- *Standards compliance*
- *Access control - user authentication, authorization, permissions and accounting*
- *Network boundary and remote access security*
- *Endpoint security*
- *Application Security*
- *Vulnerability management*
- *Cybersecurity & operations system monitoring*
- *Incident response/management*
- *Logging and log management*
- *Change management*
- *Contingency of operations & disaster recovery*

The ATMS Vendor shall procure, install, configure, manage, maintain, and monitor the Next-Generation Firewall (NGFW) protection at the boundaries of the ATMS network including public Internet and partner network connections. NGFW equipment shall, at a minimum, be capable of traditional firewall functionality (e.g., NAT, PAT, VPN), inline deep packet inspection, intrusion detection systems (IDS), next-generation intrusion prevention systems (NGIPS), SSH/SSL inspection, advanced malware protection, website monitoring, and QoS/bandwidth management.

Team Q-Free will develop and submit a System Security Plan (SSP) for review and approval by the WVDOH and WV Office of Information Technology. SSP will contain the elements identified above.

The ATIS is included in the System Security Plan and will be supported by cloud-hosted web servers, processing servers, IVR servers, and database servers. All of these will reside behind a firewall. These servers

interact with WVDOH processes for three general purposes: automated data exchange(s), an administrative manual data interface, and an administrative web portal to manage the site and generate reports.

Team Q-Free has 18+ years of network security management. Providing maximum protection utilizing state of the art technology. As part of the WVDOH infrastructure; team Q-Free will manage the core network infrastructure, employing the latest in NGFW technology behind and application level firewall protecting the systems from zero-day attacks. Employing Geo Fencing access to web capable applications restricting traffic to the continental US and Canada.

4.2.2.12.1   Vendor shall develop a comprehensive cyber risk reporting procedure to ensure identified cyber risks are reported to both WVDOH and Office of Technology. The reporting procedure shall address the nature of the risk, as well as a detailed plan of action and milestones to address the risk.

Team Q-Free will develop a cyber risk reporting procedure and train staff on the reporting procedure.

4.2.2.12.2   The Vendor shall inform both WVDOH and the Office of Technology of any confirmed security incident or data breach. The Vendor should report a confirmed security incident as soon as practicable.

Team Q-Free will immediately report all security incidents or data breaches immediately to the WVDOH and Office of Technology.

4.2.2.12.3   The vendor shall comply with the Office of Technology software standards and security policies as outlined in section 4.5.

Team Q-Free will comply with the Office of Technology software standards and security policies.

4.2.2.12.4   The state reserves the right to conduct a cybersecurity audit or to contract a third party to conduct such an audit on the information system, to include the operational management and support provided by the Vendor. The findings shall be shared with both representatives of both WVDOH and OT.

Team Q-Free will support the state's right to conduct a cybersecurity audit.

4.2.2.13   The Vendor shall develop a Software and System Deployment Transition Plan for approval by WVDOH at the project start and update at least quarterly through final acceptance testing. The plan should consider and include:
- *Communications service development for ITS field devices, 911 center connectivity, telephony service for 511, and website access*
- *Development and cut over of public websites, mobile applications and 511 services to existing access methods, phone numbers and URLs.*
- *Development of ATMS/511 software, databases and systems*
- *Installation and testing of ATMS/511 software, databases and systems*
- *Transition from existing ATMS/511 to new ATMS/511 including overlap to ensure functionality is maintained at a satisfactory operating level (Can be done system by system)*
- *Advance notice periods to WVDOH of software/system transitions (minimum 1-week notice, prefer 2 weeks' notice)*
- *Transition approval by WVDOH (Provide minimum 3 days for WVDOH approvals in schedule)*

Team Q-Free will develop and submit a Software and System Deployment Transition Plan for review and approval by the WVDOH. Team Q-Free understands the need for a well thought out transition plan being key to a successful transition. There are several key components critical to the success of an ATMS/VDS/ATIS system migration. These key components include business processes, impacted systems, system data, and system users. Team Q-Free has successfully transitioned four of five VDOT TMCs from legacy ATMS to OpenTMS and all regions of Pennsylvania DOT from legacy ATMS and vendor applications to a statewide version of OpenTMS. The Plan will contain at a minimum the elements identified above.

The ATIS plan for the public-facing components and associated site administrative portal will be included in the transition plan. Q-Free's partner, ILOG, is experienced with coordinating DNS cutovers for websites and number porting for IVR systems. Both the preview and production environments for the new system will be operational prior to the cutover date so that all connections are confirmed. The cutover will involve propagation of the new IP address for the website URL and the coordinated change of the IVR telephony numbers.

4.2.2.14 Communication Services:
- *The State contracts for and provides wireless communications services between the TMC and all ITS field devices through AT&T. Currently, all ITS field devices are connected to the TMC through wireless telecommunications.*
- *The Vendor shall provide 511 IVR hosting and telephony services.*
- *The Vendor shall provide for WV 511 Drive Safe application hosting and service agreements.*
- *The Vendor shall provide for data communications between the TMC and the 911 centers across the state and the West Virginia Parkway Authority dispatch center.*

OpenTMS and the Skyline Video Distribution System (VDS) will be deployed on premises at the Data Center located at Building 6000 at the Tech Park located in south Charleston. The Data Center is a central junction for several internet service providers. Using this network node allows for redundant paths to the TMC internet, field devices and e911 centers around the state. This is to ensure that the system has multiple core network providers to route traffic through to ensure maximum uptime for the ATMS, Partner Connections and Video systems. Connectivity to the TMC and TPA will be provided utilizing the Charleston 'Metro Ring' for redundant highspeed connectivity. The use of cloud computing has redefined business continuity, disaster recovery and backup testing. The ILOG ATIS will be housed in the Amazon cloud, load-balanced across multiple servers in multiple locations, each location supported by RDS databases. ILOG builds redundancy in each of its technology solutions.

The 511 IVR Telephony services are included in this proposal. The Drive Safe mobile app is also included in this proposal.

The below figure is a high-level diagram of the network architecture.

Figure 2 - High-Level Diagram of the Network Architecture

4.2.2.15 Vendor shall provide a comprehensive information system design document, outlined the intended information system physical and logical topology with complete hardware, Operating System (OS) and software lists. All hardware, operating systems, and software must be supported versions throughout the contract term, including any extensions. Required updates and patches will be performed at an agreed upon schedule to maintain system integrity. Vendor shall test upgrades and patches in their own test environments to verify compatibility with the WVDOH systems. If for any reason in the future during the contract term (not including State of West Virginia requirements), the Vendor needs to change hardware, OS, or software it will be the Vendor's responsibility to maintain the operational capability of the WVDOH system at no additional cost.

Team Q-Free will develop and submit a System Design Document for review and approval by the WVDOH. Plan will contain the elements identified above. The ATIS will be cloud hosted with most component in the Amazon cloud in multiple geographic areas. AWS server specifications and the topology will be provided.

4.2.2.15.1 Vendor shall outline in detail hardware infrastructure that will be provided. All hardware components shall be supported by the hardware manufacturer throughout the term of the contract, including any extensions. Hardware provided shall be current supported model equipment. Vendor is required to maintain all hardware components to ensure high availability of the system throughout the life of the contract at no additional cost to WVDOH.

Team Q-Free will include a detail hardware infrastructure with the System Design Document for review and approval by the WVDOH. All hardware components will be maintained for the life of the contract at no additional cost.

The ATIS will not use physical hardware for the system but will use Amazon Web Services (AWS) instances. There will be a virtual backup of the system at a colocation facility in Philadelphia for use in the event of a catastrophic failure at Amazon. All systems will be maintained for the life of the contract at no additional cost.

4.2.2.16 Other Equipment, Systems and Services:

There are current typical expenses incurred annually for systems, software, services and equipment that need to be accounted for in the Vendor's cost proposal, or not included because the Vendor's proposed solution does not require it. If there are any additional systems, software, services and equipment that the Vendor requires as part of their solution, these should be included in the cost proposal and described in the Vendor's proposal. As information, the list below is an example of materials and equipment, including computers, servers, workstations, miscellaneous hardware, 3rd party software, etc. that the vendor may be expected to supply as part of their solution during a typical year. Include a cost component for the materials and equipment the Vendor feels are necessary to provide a complete and accepted solution for the term of the   contract and renewals.

   TMC Items:
- *Alpha Technologies Network Data Line*
  - *Rack Rental in Building 6000*
  - *Server Storage in Building 6000*
- *InterAct Interface Maintenance Costs (CAD Integrations with InterAct Systems)*
- *LifeSize Maintenance Costs (Video Conferencing)*
- *CitILOG Maintenance/Service (Video Analytics)*

   511 Items:
- *IVR Hosting Maintenance*
- *IVR Phone Usage Charges*
- *Drive Safe Service Agreement*
- *Skyline Maintenance/Service*

   Miscellaneous Hardware Items:
- *Satellite Phones Data Plan*
- *Ipad Data Plans*
- *Cisco ASA 515x (x1)*
- *Cisco 3560x (x2)*

   Service Agreements and Software Licenses:

- *Domain Name: Roadsummary; includes .com; .net*
- *SSL Certificate (Digicert): WVDOH.Roadsummary.com for 1 year*
- *Cisco SMARTnet Premium - Extended service agreement - replacement - 24x7 - 4h*
- *Syslog Daemon Software for Firewall and network Gear logfile capture*
- *SAP Crystal Reports Server, 5 named user license, 1 year maintenance renewal*
- *Java Service Wrapper Development License (Java Service Wrapper Standard Edition 32/64-bit TSIMS)*
- *Symantec Endpoint 12.1*
- *Symantec GOVT UPG-V 12MO BACKUP EXEC 2014 AGT VW AND HV WIN SVR BS ES*
- *Symantec GOVT UPG-V 12MO BACKUP EXEC 2014 SVR WIN BNDL LIC BS ESS*
- *LogMeIn licensing*
- *Cisco SMARTnet 1 Year Extended Service - Service 24x7x4hour*
- *Cisco SMARTnet Premium - Extended service agreement 8X5 - 4h*
- *VMWare vSphere Essentials Kit Support*
- *Barracuda Energized Updates*
- *Barracuda Web App Firewall 460 1YR*
- *VMWare Essentials Support*
- *Windows 2008 R2 Server License*
- *Oracle Enterprise Named User (Data Base)*
- *Windows 7 Pro License*
- *VMWare Essentials*
- *Dell Hardware (r320 *5)*
- *ESRI License*
- *Dell Hardware Service Plans*

Below is a list of hardware that is currently in use and owned by WVDOH for the ATMS and 511 System. This hardware is available for use with this contract.:

Data Center Count	Brand	Memory	Hard Drive	Purpose	Comments
14	Dell	TBD	TBD	511 Video Distribution	Redistributes video feeds to 511 users and Media outlets
7	Dell r320	8gb	2TB	Video Analytics	
1	Dell r710	128GB	2TB	VMCORE	Hardware face for Virtualized Servers. Covers Productions/Staging/511 systems
1	Dell r720	128GB	2TB	VMCORE	Hardware face for Virtualized Servers. Covers Productions/Staging/511 systems

Data Center Count	Brand	Memory	Hard Drive	Purpose	Comments
1	Dell r730	256GB	16gb Flash	VMCORE	Hardware face for Virtualized Servers. Covers Productions/Staging/511 systems
1	Dell MD3200i		7 TB	VM Storage - old	Storage for Virtual system, houses the individual servers used for the above. Old
1	Dell MD3800i		10TB	VM Storage - new	Storage for Virtual system, houses the individual servers used for the above. New
1	Dell r720	32GB	1TB	DB Server 1	Oracle 11g Database Server - Production
1	Dell r730	256GB	2TB	DB Server 2	Oracle 11g Database Server
1	Dell NX300	6GB	6TB	Backup Storage	Storage Device - Symantec Backup Exec - Backup location
1	Dell			Truck Parking	TCS Truck Parking System server
1	Dell r410	12GB	100GB	Staging DB	Oracle 11g Database Server - Staging/test system

TMC Count	Brand	Memory	Hard Drive	Purpose	
6	Dell T5810	8GB	500GB	Operator Workstations	Current ATMS workstations for Operators
2	Dell T5810	32GB	500GB	SE Workstation	SE Support workstation

Team Q-Free intends to utilize the hardware and COTS listed above for the ATMS and VDS. The ATIS services and equipment that will be used in the AWS cloud hosted production environment will be:

- AWS web servers (2 locations);
- AWS processing servers (2 locations);
- AWS database servers (2 locations);
- AWS RDS databases as needed based on demand (2 locations);

- AWS IVR servers (2 locations);
- Telephony charges for IVR phone calls;
- AWS logging server;
- AWS stats server;
- AWS S3 snapshot storage;
- AWS licensing servers for voice recognition software;
- Email servers (2 locations);
- Text to speech licensing/usage;
- Speech to text licensing/usage;
- Google base map licensing with Google Traffic;
- Google API calls supporting required functions;
- Secure certificate (SSL cert); and
- Supporting AWS networking (elastic load balancer, firewalls, VPN server if needed).

4.2.2.17   IDIQ Time & Materials Cost: In order to allow for equitable comparisons of received cost proposals, each Vendor will be required to list a cost item in the amount of $1,000,000 in their cost proposal as an Indefinite Delivery/Indefinite Quantity Time & Materials line item, with use to be determined after contract award. The purpose of this line item is to minimize any advantage one vendor may have over another vendor with regard to existing hardware, software, systems, interfaces or existing system knowledge; 2) rectify any unknowns encountered after award that may not have been foreseen by the WVDOH; and 3) rectify complications with integration efforts that are determined solely by WVDOH to be no fault of the Vendor. Additional use of this line item may be for the upgrade or replacement of WVDOH owned hardware and software that may currently be in existence, but that needs to be modified/replaced to meet specifications required by the Vendor. If the Vendor has specific Vendor owned hardware and software that is required to plan, design, program, install, operate and/or maintain their systems, these items shall be included in their overall costs. Any use of State funds for the purposes noted above is solely at the discretion of the WVDOH and should not be assumed.

Team Q-Free acknowledges this for the ATMS, VDS and ATIS components. Team Q-Free will provide a time and cost estimate for any additional work contracted beyond the scope of this project.

2.0 Qualifications and Experience (CRFP Section 4.3)

4.3. Qualifications and Experience

4.3 Vendor should provide information and documentation regarding its qualifications and experience in providing services or solving problems similar to those requested in this RFP. Information and documentation should include, but is not limited to, copies of any staff certifications or degrees applicable to this project, proposed staffing plans, descriptions of past projects completed (descriptions should include the location of the project, project manager name and contact information, type of project, and what the project goals and objectives where and how they were met.), references for prior projects, and any other information that vendor deems relevant to the items identified as desirable or mandatory below.

4.3.1. Qualification and Experience Information

4.3.1. Vendor should describe in its proposal how it meets the desirable qualification and experience requirements listed below.

4.3.1.1 Prime and subconsultant firm profiles

Q-FREE AMERICA

Q-Free is a global supplier of class-leading Traffic Management and Connected ITS/Connected Vehicle solutions. To us, a society with less congestion, pollution and accidents is achievable through smart and innovative transportation solutions.

Since the time Q-Free founding, rapid urbanization has required new partnerships and solutions to maintain and improve the flow in an increasingly complex traffic environment. Optimizing the multitude of global mobility systems, Q-Free has built a modular product portfolio that covers a broad range of ITS sectors. Our open standard solutions allow for seamless integration with our clients and partners, allowing Q-Free to provide tailored robust and enhanced hard- and software components that meet the project needs, no matter the size. Under the vision "Changing the movements of life", Q-Free continues to evolve our solutions to meet the needs of a modern world, ensuring efficient, safe, and environmentally friendly transportation, from region to neighborhood, shaping tomorrow's movements of life.

Founded in 1984, Q-Free is headquartered in Trondheim, Norway and has approximately 400 employees with 18 offices around the world. With an annual revenue around 1 billion NOK/ 130 million USD, the company is listed on Oslo Stock Exchange and certificated in accordance with ISO-9001 and ISO 14001. We have references from more than 50 countries, providing innovative solutions with high capability, flexibility and quality.

As a company, Q-Free is focused solely on transportation with market leading solutions for roadway user charging, parking guidance and management, freeway and urban traffic management, info-mobility, and connected and autonomous vehicles.

To meet West Virginia's needs and expectations we have assembled a strong team of technology firms for this project including Q-Free America, Infologistics, and Skyline (together "Team Q-Free"). Our primary goal is to ensure that all of West Virginia's transportation technology needs can be met now and in the future.

INFORMATION LOGISTICS (ILOG)

Information Logistics (ILOG) is a privately held technology company that was incorporated in 1997 in Pennsylvania, USA. The company's office is in Pennsauken, NJ, just outside Philadelphia. ILOG's corporate objective is to develop and support innovative traveler information delivery methods for its primary market: the transportation industry. ILOG has been serving this market for the past 14 years.

ILOG provides mobile and web application development and design, and leverages cloud technologies to deliver cost-effective products and services. ILOG is a Woman-Owned Small Business and recognized as a Disadvantaged/Small Business Enterprise in New Jersey, Pennsylvania, Virginia, California, Colorado, Iowa, as an SPSF in North Carolina and as a SWAM in West Virginia.

ILOG has developed both public and private mobile apps. Based on ILOG's GeoTalker platform, ILOG provides mobile applications for 511/Traveler Information Services delivery for several agencies including WVDOH, NJTPA/NJDOT, PA Turnpike Commission (PTC), and PennDOT. The GeoTalker platform is also being used for connected vehicle/connected corridor pilot programs. Other mobile apps assist motorists with congestion pricing for tolls (such as the 66 Express Lanes and 64 Express Lanes in Virginia). ILOG has also developed private mobile apps to support internal maintenance functions and roadway reporting for the PTC.

ILOG's mobile app for traveler information provides a hands-free, eyes-free component, as well as the more conventional components found in most transportation apps. The mobile app platform allows travelers to continue to get agency alerts even as they drive across state boundaries (for participating states). Additionally, the app platform allows agencies to deliver alerts to drivers when they cross a geo-fenced boundary. Referred to as "fast track" alerts, drivers can hear travel information that is relevant only when they are VERY near to an area where special information should be provided – when speed limits change, when dangerous curves approach, when maintenance crews are ahead, or other similar situations. App notifications are being added to the platform to enhance/augment general and fast track alerting. Recent additions to the platform has been an integration with both Google navigation and WAZE, so that drivers can simultaneously use their favorite navigation app, while also hearing the important messages that the agency issues.

This team also developed and hosts web portals for incident/event management and agency adaptive websites. ILOG's ATIS integrates with multiple data sources, including static camera image feeds, streaming camera feeds, weather feeds, roadway condition data, DMS data, RWIS feeds, plow truck tracking, etc. and produces an assortment of tools for travelers. The data is used in a multitude of ways. Each data source is analyzed, and special business rules are followed based on the flags in the feed – for example, a data component indicates when an event should be made into a special attention ticker on the web site or made into a floodgate message on the IVR. From presentation of winter roadway conditions, to turn-by-turn directions for detour routes for the PTC, to the "check my route" feature of the PennDOT website, ILOG works with the agency to adapt the ATIS to deliver the services and functions required today or imagined tomorrow.

Over the years, ILOG has developed a number of other web-based management tools for various agency functions including over-dimensional vehicle permitting, employment application and management, RFP/Bid posting automation, payment processing, and contract administration for Right-to-Know compliance and has integrated contact management software with each of these applications. ILOG has also created specialized interfaces for posting both to and from social sites, and software for project tracking that has both public-facing and internal-admin components.

Many of these products and services have been recognized by professional organizations throughout the transportation industry with awards:

- ILOG's communications suite of services, which links traveler information services with internal communications programs, won the 2011 International Bridge Tunnel and Toll Association (IBTTA) Toll Excellence award for Customer Service & Marketing Outreach as well as the IBTTA President's Award;

- The TRIP program for a comprehensive suite of traveler information services, developed by ILOG staff for the PTC won the 2012 IBTTA Toll Excellence Technology Award;

- ILOG's TripTalk mobile app for the PTC won the 2012 IBTTA Toll Excellence Technology Award and the IBTTA President's Award. TripTalk also won the 2012 Smart CEO Volt award;

- ILOG's SafeTrip NJ mobile app won the ITS NJ technology award.; and

- ILOG's newest product, 511PAConnect, which includes a dynamically created, event specific website, and emergency notification to trapped travelers (without requiring a mobile app), received 5 awards in 2017 from the Institute of Transportation Engineers (ITE) *2017 Transportation Achievement Award for Operations;* the IBTTA *2017 Toll Excellence Award for Technology;* the Intelligent Transportation Society of New Jersey (ITS NJ) *2017 Outstanding ITS Project;* the Mid-Atlantic Section of the Institute of Transportation Engineers (MASITE) *2017 Project of the Year;* and ITS Pennsylvania *2017 Project of the Year.*

Messages from End Users

"You have developed a great app. I just now downloaded it and am amazed. I am a cab driver, so this is a lifeline for me. will tell all my co-workers and friends." - 511PA

"This is by far the best Traffic/Travel site I have ever seen! The information provided is accurate and up to date and allows for an easy trip both on the Turnpike and surrounding roads......wish there were sites like this to cover the whole country." - TRIP Talk

"I like this !!" - TrafficMate (NTTA)

"Love this app. Thanks" - Drive Safe WV

"So far love the app. need to find the current construction place. but great app" – 511PA

While Team Q-Free certainly appreciates industry recognition, our true measure of success is our customer service. ILOG's services are provided to two types of customers: the transportation agencies who contract for our services, and the travelers who use the services. Agencies have been satisfied with the products and services we supply. Contracts have been generally renewed to the full allowable term or extended beyond contracted terms.

"Thank you for being great partners and making the West Virginia ITS program a success. BTW we are getting rave reviews about the changes we made at the beginning of the year."

"I have enjoyed working with you and your team. I really appreciate all you have done for PTC."

Traveler approval can be more difficult to obtain. If travelers are angry or disappointed with the agency for any reason, they are quick to express dissatisfaction with every

agency service – and yet, travelers do not generally take time to complement the agency on something that they like or appreciate. While there have been messages with suggestions for new features, or to report problems on the roadway, we have also seen supportive messages from end-users.

SKYLINE

Skyline, a Maryland based company, was established in July 2004, and is headquartered in Glen Burnie, Maryland. Skyline has provided the Video Sharing, Network, System and Infrastructure Products and Services to meet our customer's needs since our inception over 14 years ago. We strive to serve the public sector through effective technology development and management. In 2008, Skyline expanded into the commercial market space and added several other solutions to round out its portfolio.

Skyline's approach is to first understand the business requirements of our customers and then focus on designing and delivering the appropriate technical solutions. We believe this approach brings incredible value to our customers and sets us apart from our competition.

Skyline has a vast array of services we provide to our customers. These diverse services allow us to provide excellent value and maintain long-lasting relationships with our customers.

Skyline has a solid presence in the State of Maryland which serves as our base of operations for customer service delivery. Our Headquarters in Glen Burnie, Maryland provides us extensive capabilities to deliver projects and demonstrates to our customers our commitment to IT management. The Skyline 24x7x365 Service Desk (NOC and SOC) monitors network elements, coordinates break/fix, performs maintenance, and manages escalations to our engineering resources. The Service Desk, in our 40,000-square foot facility, is located just 10 miles south of Baltimore City, adjacent to the Baltimore /Washington International (BWI) Thurgood Marshall Airport. This central Maryland location allows the Skyline team to quickly deploy across the State to support our customer base and effectively manage projects.

Skyline utilizes our headquarters located at 6956-F Aviation Boulevard, Glen Burnie, Maryland 21061, to successfully deliver our services. Skyline headquarters includes the following features that are utilized in support of our customers:

- **Service Desk** – Provide network operations and security operation services 24x7x365 from our 1,000 square foot facility. The Service Desk includes 14 Tier-1 workstations, 2 Tier-2 workstations and a management office for two (2) Service Desk Managers;

- **Technology Lab** – 950 square foot facility with staging racks and work benches with flexible power distribution and 12 tons of redundant Liebert HVAC;

- **Staging Warehouse** – Our 1,200 square foot warehouse allows for short-term storage during the implementation of customer projects. Skyline also has an adjacent facility with 6,500 square feet of storage for larger projects;

- **Training Center** – Our 1,750 square foot training room allows Skyline to provide in-house technical training, management training and host customer stakeholder meetings with seating for 40+ people;

- **Conference Rooms** – Multiple conference rooms are available to support project and customer meetings;

- **Office Space** – The facility supports over 120 in-house technical, project management and administrative resources, ensuring plenty of space to support State and County's technical needs;

- **Fleet** – Skyline has a fleet of over 50 vehicles to support our technical staff. Specialized vehicles like bucket trucks allow us to perform fiber optic installation and maintenance on aerial fiber or install video surveillance cameras safely on high mounting points. Our organization is well equipped to deliver on projects and maintenance services; and

- **Warehouse Space** – The storage and logistics operations for Skyline include five (5) full-time resources, segregated customer equipment storage areas and multiple receiving bays. With 6,500 square feet of space in our logistics center, Skyline has the capacity to manage any size project. Clients today trust us with over $5 Million dollars in IT hardware that we receive, inventory, and release utilizing government audited processes.

Skyline has been delivering interoperable video sharing solutions of similar type and size for nearly ten (10) years to state and local government agencies. Skyline currently supports ten (10) state DOT's with their video sharing systems, including some of the largest systems at the Virginia DOT (1,200+ cameras, 5 TOC's), the Maryland State Highway Administration (1,200 + cameras, 20 source agencies and 70 consumer agencies) and New York State DOT (1,100 cameras, nine (9) regional TOC's). These projects demonstrate Skyline's ability to greatly expand from the base system to include many cities, counties, and other agencies on a secure, hosted platform. Skyline's experience delivering large scale, multi-agency, multi-platform integrated video and data solutions along with our network and systems engineering expertise is unparalleled in the ITS market.

Further, Skyline Technology Solutions provides an unmatched depth and breadth of IT and ITS services that allows us to understand our customers' complete network environment. Our combined expertise and experience deliver video sharing solutions that fit seamlessly into any network while not compromising security or performance. Skyline delivers IT and ITS solutions across a broad technical base as summarized below.

- Network and Systems Engineering;
- IT Consulting & Professional Services;
- Project Management;
- IT Security Services;
- CCTV, Video Surveillance, Access Control;
- Fiber Optic/Copper/Coax System design and install;
- Centralized Authentication;
- Industry partners: Cisco (Premier); Juniper (Elite); Aruba (Platinum); Palo Alto (Gold); Extreme (Gold);
- IT and ITS System Monitoring;

- Interoperability video, voice and data solutions;
- Managed 24x7 Service Desk and remote monitoring;
- Network and IT security services;
- Application/Product software development;
- Application hosting / CDN services;
- Outside and Inside Plant Construction;
- Storage and virtual infrastructure;
- Managed / Hosted Services (IAAS); and
- Managed backup solutions.

ENVIRONMENTAL SYSTEMS RESEARCH INSTITUTE, INC. (ESRI)

ESRI develops the world's leading GIS technology. For nearly half a century, we have been dedicated to advancing geographic science and building the software and tools that let people apply that science in their work. As an enterprise software company, ESRI helps organizations of all sizes implement GIS solutions that allow them to improve their business practices and deliver better outcomes.

Through our work with most Departments of Transportation across the US, we understand that location information is key to making informed decisions in the transportation industry. Fully understanding the geographic context of your transportation network is crucial to decision-making, effective program implementation, and efficient allocation of resources. This is true whether you need to monitor roads during a winter storm, inform the public of traffic conditions, track a fleet workforce in real time, or maintain a safe and secure transportation network.

ESRI, the global market leader in geographic information systems (GIS), offers the most powerful mapping and spatial analytics technology available. Since 1969, ESRI has helped customers unlock the full potential of data to improve operational and business results. Today, ESRI software is deployed in more than 350,000 organizations including the world's largest cities, most national governments, 75 percent of Fortune 500 companies, and more than 7,000 colleges and universities. ESRI engineers the most advanced solutions for digital transformation, the Internet of Things (IoT), and location analytics to inform the most authoritative maps in the world.

Environmental Systems Research Institute, Inc. (ESRI)
380 New York Street, Redlands, CA 92373
Ph: 909-793-2853
Fax: 909-793-5953
Email: info@ESRI.com

ESRI employs a carefully chosen group of professionals who are dedicated to supporting our users' GIS objectives. Our staff includes individuals versed in geography, computer science, education, cartography, landscape architecture, geology, forestry, oceanography, and many other disciplines. This broad collective experience distinguishes ESRI in the GIS industry.

Our team members are committed to supporting our full range of industry-leading GIS software and services. Their responsibilities include:

- Developing high-quality software and services.
- Educating users about GIS methods and techniques.
- Helping users implement GIS technology.
- Supporting GIS use on a daily basis.
- Providing a wide variety of related services.

4.3.1.2 Company and staff qualifications and experience in completing similar projects

Q-FREE COMPANY AND STAFF QUALIFICATIONS

Q-Free has extensive experience implementing, operating, and maintaining web-based, high availability Advanced Transportation Management Systems ("ATMS") for its clients and has consistently met or exceeded their expectations.

Q-Free has been a recognized leader in real-time traffic operations and management for over 17 years and boasts one of the largest dedicated ITS software engineering and technology staffs of all companies who currently provide ATMS solutions. Q-Free employs nearly 50 full-time staff who are exclusively involved in supporting ATMS deployments for our clients.

OpenTMS is the most fully-featured, highly productized, and easy-to-use ATMS solution on the market. Version 8 of the system has been field- proven and successful statewide in Virginia, Pennsylvania, West Virginia, and Delaware and regional deployments in Ohio and Illinois. Also, we were recently selected to provide the statewide traffic management solution for Iowa. Please find our references and a description of our similar experiences in the proposal response to *RFP section 4.3.2. Mandatory Qualification/Experience Requirements* below.

ILOG COMPANY AND STAFF QUALIFICATIONS

ILOG's staff comes from the systems, networking, programming, and electrical engineering sectors and are experienced, top-notch professionals. The ILOG development group is proficient in .NET, MVC, MS-SQL, MySQL, Java, Perl, C++, C#, Objective C, Oracle, VMware, JavaScript, ASP, JSP, Visual Studio, 3DS Max, ActionScript, Adobe Creative Suite, Quark Xpress, CSS and numerous other development and design languages and tools. The systems and network engineering group is focused on security and reliability, as they build redundant and high availability networks. The core ILOG team has been working together for more than a decade, and the key staff are invested in the company. Resource continuity has never been a problem, and none is anticipated.

The ILOG team has been responsible for the design, development and implementation of literally dozens of programs and special applications for the transportation industry.

ILOG builds redundancy into our staffing plan, which is made possible by the nature of cloud computing. Because none of the machines for the WVDOH ATIS are located at our business office or in any single facility, our staff does not need to be in a central location to access the systems.

The ILOG team performs the majority of our work from our Pennsauken, NJ office, but each ILOG employee is equipped to work remotely from off-site locations, as needed. While ILOG has identified key staff below, the ability to work remotely includes management, programmers, systems engineers, designers, and even the quality control and administrative teams. This gives our team the ability to continue staffing critical operations from almost any location, and for any reason. There have been several times when this plan has been exercised, including in times of severe weather, and during power and internet outages at our main office. This same plan would be applied in times of pandemics, and other situations where physical travel to our office is impossible or inadvisable.

SKYLINE COMPANY AND STAFF QUALIFICATIONS

Skyline has been delivering interoperable video sharing solutions of similar type and of significantly larger size for nearly ten (10) years to state and local government agencies.

Skyline has developed the expertise to become the Department of Transportation (DOT) industry leader in providing live streaming video sharing systems. Skyline currently supports ten (10) State DOT's with their video sharing systems, utilizing both on-premise (or locally hosted) solutions and solutions hosted completely or partially in the cloud by Skyline. Skyline has developed a consistent approach to delivering hosted video sharing systems over the years and is well versed in the following requirements:

- Designing and Implementing complex IP networks include LAN and WAN designs to provide stable and secure transport of video stream;

- Video Collection from diverse cameras, networks, and locations;

- Normalizing video to a common format that is easy to transport and share;

- Secure and efficient video distribution to the public, media, partners and first responders;

- Integrating with multiple source and destination networks;

- Change Management, Documentation, and Reporting;

- Consistent and Proven Project Implementation Approach;

- Web based portals providing secure access to partners and operational support;

- Innovative products to enhance the video sharing system;

- Support for smart phones and tablets;

- 24/7 Monitoring and Support in our Service Desk; and

- Proven enterprise level products.

Skyline has the experience, expertise, and reliability to perform the requested services in the RFP. To document our experience of identical or similar in scope, Skyline offers the following past performance examples:

Skyline experience includes:

- **New York** – 1,100+ cameras (MGEG2, MPEG4, H.264), 20 source agencies, 70+ consumer agencies;

- **Maryland** - 1,000+ cameras (MGEG2, MPEG4, H.264), 20 source agencies, 70+ consumer agencies;

- **Virginia** - 1,000+ cameras (MGEG2, MPEG4, H.264), 10+ source agencies, 50+ consumer agencies, hosted solution;

- **Tennessee** - 525 Cameras (MGEG2, MPEG4, H.264), 4 regions, 20+ consumer agencies, hosted solution;

- **Pennsylvania** - 900+ cameras (MGEG2, MPEG4, H.264), 12 regions, 50+ consumer agencies;

- **Missouri** - 391 cameras (MGEG2, MPEG4, H.264), 2 regions, on-premise, locally hosted;

- **Washington D.C.** - 140+ cameras, (MGEG2, MPEG4, H.264);

- **West Virginia** - 50+ cameras;

- **South Carolina** - 333 cameras, 4 regions, hosted solution;

- **Michigan** – 500+ cameras, 4 regions, 30+ consumer agencies;

- **Maryland Coordination and Analysis Center (MCAC)** – 12,000+ cameras, 1,700 agency users across Virginia, District of Columbia and Maryland; 30 state, local and federal agency partners, including local school districts;

- **Iowa DOT** – (Under contract) – 7 regions, 500 cameras;

- **Dallas Region Pilot Project** – 100 cameras, source cameras from 2 TxDOT district TMC's and Cities of Arlington and Grand Prairie. Hosted and on-premise solution.

Skyline employees have been supporting the IT needs of Public Sector Transportation Agencies since our inception. Skyline has built a government focused organization dedicated to providing design, implementation and operational services across a wide breadth of technology. Skyline's organization is currently composed of approximately 240 full-time employees with 7 part-time and no temporary employees, based centrally in Maryland.

Skyline continually invests in training and educational courses for our engineers and non-technical staff to ensure our clients are well served by a team that's on the cutting edge of the latest technologies. Skyline also works closely with vendors that provide the best of breed products to create optimal solutions utilizing the appropriate technology.

Skyline consists of highly qualified resources, each having unique experience in supporting both public and private enterprise systems and networks. Skyline's leadership is comprised of Brian Holsonbake, who has extensive experience working with public and private sector customers. Leveraging this experience, Skyline provides our customers with a cost effective and technically superior solution.

The following bullet points identify our team's unique qualifications:

- **Network Hardware Experience:** Skyline is a leading integrator in the Mid-Atlantic for Cisco, Juniper, Aruba, Palo Alto, and others.

- **Project Management Capabilities:** Skyline has demonstrated the ability to scale up or down the project management and technical staffing needs of our customers across a variety of project sizes, complexity, and disciplines; networks, systems, and infrastructure.

- **Personnel:** Skyline provides an unmatched depth of experience in supporting the goals of our customers operational and engineering needs. Our experience in working with a broad base of customers allows us to share the knowledge and experiences gained for the benefit of all customers. With success in the Government and Non-profit areas, we believe our employees understand the IT needs of our customers and demonstrate both a technical and cultural match that is unique among Managed Service Providers.

4.3.1.3 Project understanding and approach/methodology to achieving project objectives

Based upon Team Q-Free's experience with similar large scale, statewide deployments and *our long history of partnering with WVDOH*, we understand the complexities and importance of a collaborative working relationship and have employed innovative methods to ensure agreement and stakeholder buy-in. For example, with some customers we are utilizing advanced, FHWA approved system engineering practices and process outlined in *"Applying Scrum Methods to ITS Projects - Final Report - August 2017 Publication Number: FHWA- JPO-17-508"*. This allows flexibility and more input from key stakeholders earlier in the project lifecycle while reducing issues at later stages of the development process. Team Q-Free will work proactively with WVDOH staff on their preferred software development methodology. Some aspects of our solution may be developed in traditional waterfall or hybrid development models if that is WVDOH's preference. Below, we have included some of the high-level areas of focus and some of the pre-delivery documents to be developed to ensure successful project/program delivery. Within these highlights are references to other areas of our response that define the processes in more granular detail.

APPLYING SCRUM METHODS TO ITS PROJECTS

www its dot gov/index htm
Final Report August 2017
Publication Number
FHWA-JPO-17-508

DEDICATED AND EXPERIENCED PROJECT MANAGEMENT

Successful project delivery requires an experienced delivery team and sound project management practices. Team Q-Free's project management approach is fully compliant with FHWA system engineering policies and strongly relies on Project Management Institute principles and practices. We also have extensive experience successfully delivering statewide systems within other complex State DOT environments. Our core Project Management principles are:

- **Emphasis on Risk Mitigation** – our entire approach is designed to minimize project risk and maximize value throughout the project delivery;

- **Centralized Accountability** – Team Q-Free will take full responsibility for managing our exceptional partners, Skyline, ILOG and ESRI to ensure seamless delivery and streamlined communication;

- **Responsiveness and Flexibility** – every project is unique. Our PM will work closely with the WVDOH PM to tailor the execution process that works best for WVDOH, while meeting projects goals; and

- **Open Communication** – Team Q-Free believes in transparency and collaboration as keys to successful execution. Our management team will facilitate information exchange with the WVDOH PM and key stakeholders while keeping project execution on track.

ENSURE A CLEAR SCOPE OF WORK

Regardless of methodologies, a clear and agreed upon scope of work is critical to project success. Team Q-Free's dedicated Project Manager (Chris Butler) and the technical leads from different disciplines will work closely with key WVDOH stakeholders during all project phases to ensure all questions of scope are clearly resolved. Clear and effective communication are critical to project success.

DEVELOP REQUIREMENTS TRACEABILITY MATRIX

The purpose of the Requirements Document is to describe everyone's understanding of the various software requirements for the WVDOH ATMS/VDS/ATIS project. It describes "what" the software must/will do, not the "how". It keeps us all on the "same sheet of music". Team Q-Free will create the baseline Requirements Document based on WVDOH's requirements as well as information gathered from key stakeholders. This Requirements Document will serve as the **Requirements Traceability Matrix** (RTM) on the project and will be used to track the requirements from design to testing across the project lifecycle. The RTM will be a living project artifact that is continually updated and refined throughout the project lifecycle.

The RTM will also document the method of verification for each test and provide the linkage between requirements and testing. The RTM will track the number of test cases Run, Passed, Failed or Blocked for every requirement as well as classify the requirements into types and sub-types.

Team Q-Free will map requirements to preliminary design components. As the project progresses, the project team will expand the traceability to include mapping to the design elements in the Software Design Document (SDD), ATMS system components, and to the test cases. The Requirements Document will comply with WVDOH's specifications, including unique identification number, cross-reference to the RFP, requirement classification, and compliance verification method. Team Q-Free will utilize **SpiraTeam™** software to capture system requirements and link them to test cases, so full traceability will be maintained from acceptance testing back to the originating requirements. The Q-Free PM will submit the initial draft, as well as every update of the RTM to the WVDOH Project Manager for review and acceptance. See CRFP requirement 4.3.1.6 further in this section for more information how SpiraTeam is used in tracking requirements and ensuring tracebility.

DEVELOP CHANGE MANAGEMENT PLAN

An equally important aspect of scope management involves the Change Management Process. It is very difficult to define every single variable on a major project such as this and deliver it without making minor changes to the scope of work. With Team Q-Free's experience delivering ATMS/ATIS/VDS platforms, we understand the importance of effective Change Management and allowing our customers to have flexibility in scope prioritization. Team Q-Free understands the complex environment where legislative or political business needs may require the project team to make changes. Team Q-Free's Agile approach avoids long duration, "big reveal" deployments. In addition, once the project enters the Operations and Maintenance phase we will roll-out releases on a 60-90-day cycle to accommodate minor fixes, minimize training and reduce TMC impacts. See See CRFP requirement 4.3.1.7 further in this section for more information on Change Management.

REFINE PROJECT SCHEDULE

As you can see in CRFP requirement 4.3.1.5 further in this section, Team Q-Free has developed a detailed development schedule. The schedule and the RTM will be continuously refined during the life of the project.

CREATE SYSTEM DESIGN DOCUMENTATION

Team Q-Free will create a System Design Document (SDD) that offers a top-down conceptual design of the combined ATMS/VDS/ATIS system. The SDD will identify graphical representations of sub-systems, data integration points, and communications layers. Each element of the ATMS/VDS/ATIS solution will then be further defined at a detailed level, with communications protocols, logical and physical system diagrams, video delivery system architecture, data storage, disaster recovery and failover scenarios, security, and workflow model of the major modules and subsystems, including telephone services, public website, and mobile applications. The SDD document shall be developed such that it includes both internal and external elements of the system, to ensure it represents an accurate representation of WVDOH's entire system including cloud-based hosting services, and other external systems. Additionally, the document will contain any references to requirements and/or user stories contained in the RTM. Team Q-Free will conduct multiple working sessions with the WVDOH

Team Q-Free's PRELIMINARY ENGINEERING AND DESIGN PHASE will be a CRITICAL SUCCESS FACTOR for the WVDOH ATMS Project

business and technical subject matter experts identified by the WVDOH Project Manager. Beginning with an outline of the SDD, successive drafts will deepen the concepts and design through additional sessions, resulting in a Final Draft, that is ready for review and approval by the WVDOH PM. More detail on method of verification for all requirements will be provided within the SDD and cross-referenced back to the RTM. In addition, see CRFP requirement 4.2.2.15 further in this section for more information on System Design.
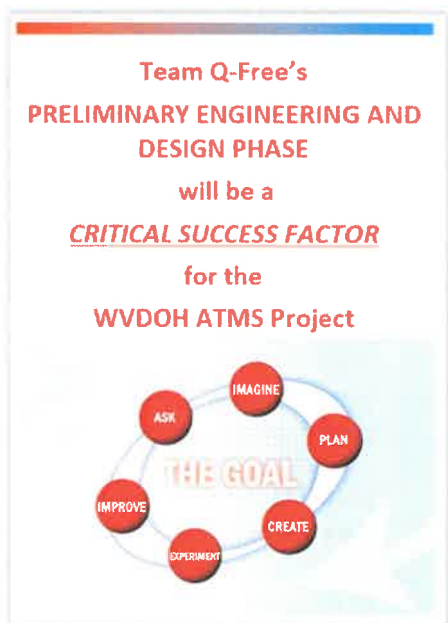
DEVELOP ACCEPTANCE TEST PLANS

One of Team Q-Free's core strategies for ensuring the quality of the ATMS/VDS/ATIS platform is having our **Quality Assurance (QA) Team** be 100% independent of the software customization and development team.

Team Q-Free's QA Team is

100% Independent

From the Software Development Team!
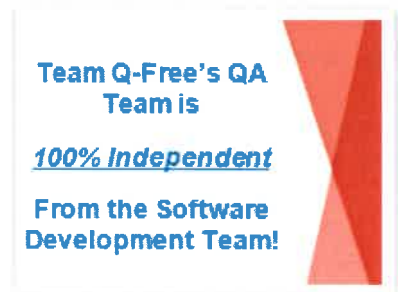
The Q-Free QA Team, led by Mr. Moises Lopez, will be responsible for the planning and execution of the test plans.

Team Q-Free's QA Team will document the plans and procedures for verifying that the resulting system meets all the defined system requirements and objectives, as detailed in the RTM. It will define the testing objectives and needs (e.g., data, location, methods, resources, and detailed testing procedures) and expected outcomes for each test. The Q-Free QA Team will develop comprehensive Test Plans that will cover all aspects of testing; internal testing, component testing, end-to-end testing, and acceptance criteria. Team Q-Free will develop detailed acceptance test plans that specifies the methods and timing for the tests. The Test Plan will describe in detail the procedures to verify each scenario and requirement, validate the integration with external systems, and confirm connection of all ITS field devices, ATIS functionality and the entire video architecture. We will also perform end-to-end testing with WVDOH staff. The plan will also include specifications for ATMS performance testing and cyber security testing. Testing will be conduct by development and/or the QA team, as appropriate. QA will oversee all testing

and work directly with WVDOH. See CRFP requirement 4.3.1.7 further in this section for more information on Acceptance Testing.

EXTENSIVE EXPERIENCE WITH TRANSITIONING EXISTING SYSTEMS

When looking at any project risk, a smooth migration is very critical. WVDOH cannot have downtime are not be 100% ready for any major event to happen at any time. With OpenTMS v8 in place, ILOG consuming our

MIGRATION RISKS ARE DRASTICALLY REDUCED WITH TEAM Q-FREE

data feed already and Skyline's technology already functioning, migration risk (cost, schedule risks) is drastically reduced for WVDOH. The only minor risk is transitioning IVR. An ATMS migration is typically VERY challenging. However, migrating to OpenTMS v9 with be a relatively simple upgrade and will minimize training and changes made to TMC staff. Any migration still requires a detailed plan. There are several key components critical to the success of an ATMS/VDS/ATIS system migration. These key components include business processes, impacted systems, system data, and system users. Team Q-Free has successfully transitioned four of five VDOT TMCs from legacy ATMS to OpenTMS and all regions of Pennsylvania DOT from legacy ATMS and vendor applications to a statewide version of OpenTMS. This capability ensures an easy and worry-free transition for WVDOH to an improved ATMS/VDS/ATIS platform with continuity and confidence in maintaining or exceeding the performance of current elements.

Team Q-Free will develop a deployment Transition Plan that will describe the method and timing of installation and cutover. This plan will outline the general strategy for how Team Q-Free will configure the system and how we will create a customized transition plan for bringing the system online with minimal disruptions to normal operations. See Section 4.2.1.2 for more information on our Transition Deployment Planning process.

DEVELOP OPERATIONS AND SUPPORT AND MAINTENANCE PLAN

Team Q-Free has provided 24/7/365 support to numerous customers performing real-time operations over many years. This experience will help guide the development of the WVDOH Operations Support and Maintenance Plan. The plan will be the underpinning and will describe all activities to maintain the ATMS, VDS and ATIS systems during the operations and support period.

The Operations and Support OSM Plan shall contain a comprehensive approach to OSM including a User Training Plan, System Administrator Training Plan, Operations Support Plan, System Maintenance Plan, Software Maintenance Plan, Issues Management Plan, Communications Plan, and Quality Assurance Plan at a minimum. The OSM Plan shall be incorporated into the overall Project Management Plan and describe all activities to maintain the system during the operations and support period. A companion set of detailed training materials will be developed and provided to the WVDOH PM for review prior to training delivery to WVDOH.

The OSM Plan will also define:

- Project staff roles and responsibilities and key points of contact that need to receive training and define which type of training (ATMS/VDS/ATIS)

- Training objectives, content, strategies, and audience

- Logistics needed (e.g., location, equipment needs, data preparations, etc.)

- "Train the Trainer" sessions

TEAM Q-FREE WILL PROVIDE TRAINING DURING *EACH AND EVERY* O&M YEAR.

- Public facing training of ATIS related information (i.e. YouTube videos and information on website)

Additional information and how Team Q-Free will be fully compliant with all operations and support requirements are included in Sections 4.2.2.4 and 4.3.1.6.

4.3.1.4 Proposed Staffing Plan and Organizational Chart

Team Q-Free is comprised of staff from Q-Free America together with our partners Infologistics, ESRI and Skyline. The Project Manager (Christopher Butler) will be assisted by a team of professionals who will lead the project tasks and ensure on-time delivery of the ATMS/VDS/ATIS, while meeting and exceeding WVDOH specifications.

West Virginia Division of Highways Project Manager

Project Management Team

Daniel Skiffington — Principal-In-Charge (Q-FREE)	Christopher Butler — Team Q-Free Project Manager (Q-FREE)	Gary Waters — Geospatial Data Liaison (esri)
Mary Farrell — ATIS - Executive Sponsor (ilog)		Tom Burgoon — Video Account Manager (SKYLINE)

System Engineering/Software Development

- Colleen Bond — AVP Project Delivery (Q-FREE)
- Jason Coakley — ATMS Solutions Architect (Q-FREE)
- Casey Krout — ATIS Technical Support — Database and Data Interfaces (ilog)
- Matt Farrell — ATIS Technical Support — Mobile Apps & GIS Specialist (ilog)
- Michael Brannan — Video Management Lead (SKYLINE)

System Deployment

- Mitch Terry — ATMS Deployment Lead (Q-FREE)
- Moises Lopez — ATMS QA/QC Lead (Q-FREE)
- John Farrell — ATIS Implementation Manager (ilog)
- Beth Abruscato — ATIS QA/QC Lead (ilog)
- Michael Brannan — Video Management Deployment (SKYLINE)

System Maintenance, Operations & Support

- Billy Bartram — ATMS On Site O&M Support Lead (Q-FREE)
- Paul Hlasnicek — ATMS Training Delivery (Q-FREE)
- John Farrell — ATIS O&M Support Lead (ilog)
- Roman Sokolov — ATIS O&M Support — Web, App Layout and Design (ilog)
- Matt Szostek — Video Management Maintenance (SKYLINE)

The details of the staff qualifications and high-level description in the table in the pages to follow provides the basics of the structure and the roles and responsibilities of the team.

Table 1 - Staffing Qualifications

Name/Company	Project Role	Responsibility
Project Management Team		
Christopher Butler Q-FREE	Team Q-Free Project Manager	• Take the responsibility for the overall success of the project and serve as the main POC between Team Q-Free and the WVDOH. • Manage day-to-day activities and communication on the project. Support the task leads by providing clear guidance on project objectives, resource allocation, project scheduling, and setting client expectations. • Coordinate project resources, activities, and subcontractors, so that schedule milestones are met in an efficient manner. • Develop and maintain project schedule and issue/risk log and provide regular updates on project performance to the WVDOH PM. Collaborate with the WVDOH PM on changes to the work plan and schedule. • Submit monthly project status reports detailing progress toward fulfilling objectives in the Work Plan and its project schedule, and highlighting items on the critical path. • Participate in person progress meetings and conference calls with project stakeholders and as requested by the WVDOH Project Manager • Maintain a high standard of professionalism on the project, with competent and skillful employees doing the work and meeting WVDOH's requirements
Daniel Skiffington Q-FREE	Principal-In-Charge	• Executive at Q-Free, responsible for project oversight

Name/Company	Project Role	Responsibility
Gary Waters	Geospatial Data Liaison	• Responsible for executive oversight for all aspects of the project with regards to the Geospatial Data.
Mary Farrell	ATIS Executive Sponsor	• Responsible for executive oversight for all aspects of the project with regards to the ATIS system.
Tom Burgoon	Video Account Manager	• Responsible for executive oversight for all video management aspects of the project.

System Engineering/Software Development Team

Colleen Bond	AVP Project Delivery	• Manage the integration of OpenTMS with external applications and third-party data provider services; and • Manage OpenTMS software release process including feature/release management. • Provide the oversight for the overall ATMS delivery, • Direct the transition and deployment of activities. • Technical lead who will direct all transition activities for ATMS.
Jason Coakley	ATMS Solutions Architect	• Develop and own the technical solution for the ATMS project including IT infrastructure and interfaces with external systems and data sources; • Direct the detailed design of the ATMS solution and oversee the progress of the implementation team; • Will work closely with WVDOH to understand the business needs, interpret the requirements, and develop the functional design of the ATMS solution; and • During implementation and validation, will work with the implementation team to ensure the delivered system satisfies the requirements and meets WVDOH's needs.

Name/Company	Project Role	Responsibility
Casey Krout 1log	ATIS Technical Support Database and Data Interfaces	• Senior Software Developer, and Database and Date Interfaces
Matt Farrell 1log	ATIS Technical Support Mobile Apps & GIS Specialist	• Senior Software Developer, Mobile Apps & GIS Specialist
Michael Brannan SKYLINE TECHNOLOGYSOLUTIONS	Video Management Lead	• Skyline Solutions Architect responsible for designing the video network to delivery of video to the ATMS system and all partner agencies, public 511 and media partners as necessary; • Primary architect for Skyline's video network and video wall products; and • Oversees all integration requirements.

System Deployment Team

Name/Company	Project Role	Responsibility
Mitchell Terry Q-FREE	ATMS Deployment Lead	• Execute procurement planning, hardware environment setup, and deployments of the ATMS; • Works with WVDOH to capture all network and topology information and represents in appropriate diagrams and specifications; • Direct all activities to test and integrate WVDOH ITS field devices into the ATMS solution; • Responsible for software configuration management; and • Direct software deployment and deployment planning activities.
Moises Lopez Q-FREE	ATMS QA/QC Lead	• Provide and direct all testing, system validation, and quality assurance audits; and • Oversee the development of test cases, execution of manual and automated tests and preparation of testing results reports.

Name/Company	Project Role	Responsibility
John Farrell ilog	ATIS Implementation Manager	• Assists in oversight of all phases the project, • Serves as the ILOG project manager. • Responsible for making sure that all aspects of the system meet WVDOH requirements and work together seamlessly. • Responsible for handling of all administrative/paperwork items, including billing.
Beth Abruscato ilog	ATIS QA/QC Lead	• Oversees ILOG QA/QC program and will manage the team that does internal testing of each ATIS component for ILOG.
Michael Branan SKYLINE TECHNOLOGY SOLUTIONS	Video Management Deployment	• Skyline Solutions Architect responsible for designing the video network to delivery of video to the ATMS system and all partner agencies, public 511 and media partners as necessary; • Primary architect for Skyline's video network and video wall products; and • Oversees all integration requirements.

System Maintenance, Operations & Support

Name/Company	Project Role	Responsibility
Billy Bartram Q-FREE	ATMS On Site O&M Support Lead	• Will manage the team that does internal testing of each ATMS component for Q-Free.
Paul Hlasnicek Q-FREE	ATMS Training Delivery	• Prepare and manage the training program; • Will collaborate with WVDOH to define the training needs, create the training plan, oversee preparation of all training materials, and deliver on-site training;
John Farrell ilog	ATIS O&M Support Lead	• Assists in oversight of all phases the project, • Serves as the ILOG project manager. • Responsible for making sure that all aspects of the system meet WVDOH requirements and work together seamlessly. • Responsible for handling of all administrative/paperwork items, including billing.

Name/Company	Project Role	Responsibility
Roman Sokolov	ATIS O&M Support Web, App Layout and Design	• Will manage the team that does internal testing of each ATIS component for ILOG.
Matt Szostek	Video Management & Maintenance Lead	• Oversees the scheduling of equipment procurement and installation, start-up and testing for the Skyline video group; and • Manages the regular maintenance and upgrades and ticket response for the video delivery system.
Clive Reese	**ESRI Project Manager**	• Supports the Transportation Practice leading the project management and technical • Implementation of ESRI Roads and Highways projects and solutions. This includes analyzing a client's • Business domain, documenting operational processes, and assessing technical integration opportunities with ESRI technology

4.3.1.5 Proposed Project Schedule

Team Q-Free is ready to begin work on the next generation ATMS/ATIS/VDS solution for West Virginia. The project schedule will be closely tracked across the project duration. The Team Q-Free Project Manager will update the project schedule weekly and realign all project tasks, milestones, timelines, dependencies, and resources. The most-up-to-date schedule will be delivered with the monthly progress report and reviewed at the progress meeting.

The below figure is a high-level schedule overview of the year 1 software development period. Upon NTP the team will work with the WVDOH to schedule a project kick off, followed by the requirements workshop. During the requirements workshop, Team Q-Free along with the WVDOH will validate that all teams have a clear understanding as to the vision WVDOH. Once the requirements workshop is complete Team Q-Free will enter

into the iterative development cycle, meeting on a 3-week agile cycle to ensure the team is developing in line with WVDOH feedback.
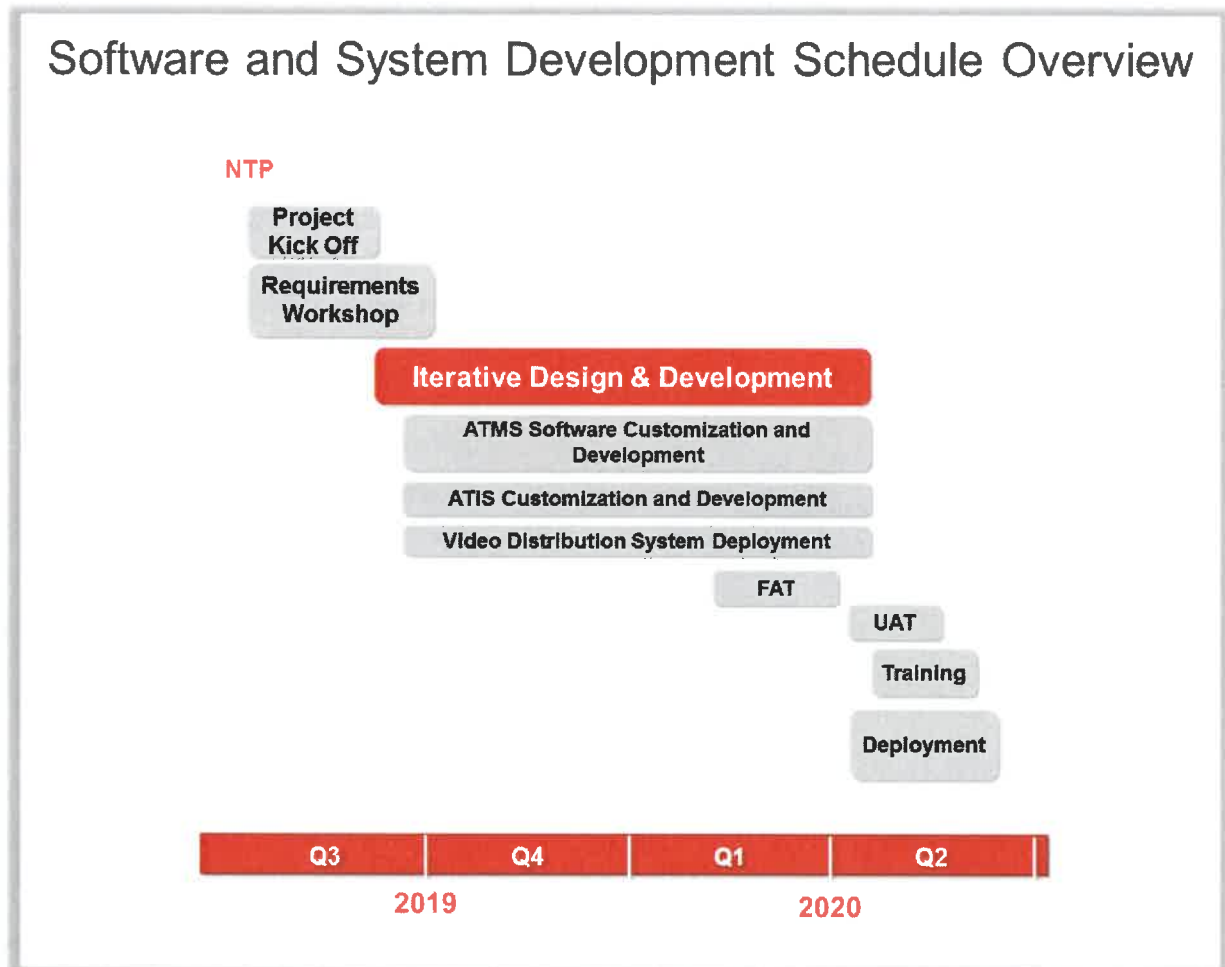
Figure 3 - Software and System Development Schedule

The proposed project schedule is included below.

Task Name	Duration	Start	Finish
⁴ System Development Period	262 days	Mon 7/1/19	Tue 6/30/20
Prepare Detailed Work Plan	30 days	Mon 7/1/19	Fri 8/9/19
Document Software Development Process - Iterative	30 days	Mon 7/1/19	Fri 8/9/19
⁴ Project Kickoff	16 days	Mon 8/12/19	Mon 9/2/19
Onsite Kick Off Meeting	1 day	Mon 8/12/19	Mon 8/12/19
⁴ Requirements Workshop	16 days	Mon 8/12/19	Mon 9/2/19
Requirements Workshop	3 days	Mon 8/12/19	Wed 8/14/19
Deliver Requirements Document	15 days	Mon 8/12/19	Fri 8/30/19
Requirements Document Approved	1 day	Mon 9/2/19	Mon 9/2/19
⁴ Iterative Design and Implementation	149 days	Tue 9/3/19	Fri 3/27/20
Sprint Prep and Back Log	14 days	Tue 9/3/19	Fri 9/20/19
Create User Stories and Acceptance Criteria	15 days	Tue 9/3/19	Mon 9/23/19
Incidents/Events Sprints & Sprint Reviews	135 days	Mon 9/23/19	Fri 3/27/20
Sprints & Sprint Reviews - MAPS, DMS, Integrations, etc.	135 days	Mon 9/23/19	Fri 3/27/20
⁴ Document Deliverables	202 days	Tue 9/3/19	Wed 6/10/20
System Design Document (SDD) / Architecture / Hardware-Software List	61 days	Tue 9/3/19	Tue 11/26/19
User Interface Customizations Document - Iterative	61 days	Tue 9/3/19	Tue 11/26/19
Develop System Security Plan (SSP)	61 days	Tue 9/3/19	Tue 11/26/19
Develop Cyber Risk Reporting Proceedure	21 days	Wed 11/27/19	Wed 12/25/19
Software and System Deployment Transition Plan	202 days	Tue 9/3/19	Wed 6/10/20
Quality Management / Test Plan	36 days	Mon 2/17/20	Mon 4/6/20
Develop UAT test cases	61 days	Mon 2/24/20	Mon 5/18/20
Operations Support and Maintenance Plan (OSM)	61 days	Thu 12/26/19	Thu 3/19/20
Build Creation/Internal Q/A - Regression Testing	45 days	Mon 2/17/20	Fri 4/17/20
Bug Fix and Re-Test	30 days	Mon 4/20/20	Fri 5/29/20
FAT/End to End	76 days	Mon 2/17/20	Mon 6/1/20
UAT	11 days	Tue 6/2/20	Tue 6/16/20
⁴ Training	55 days	Mon 3/30/20	Fri 6/12/20
Training Materials	25 days	Mon 3/30/20	Fri 5/1/20
Deliver Training Plan	15 days	Thu 5/7/20	Wed 5/27/20
Training Plan Approved	1 day	Thu 5/28/20	Thu 5/28/20
Conduct Training	5 days	Mon 6/8/20	Fri 6/12/20
Deployment	10 days	Wed 6/17/20	Tue 6/30/20
PM Tasks-Monitor/Monthly Progress Reporting & Meetings - Initial 4 years	1045 days	Mon 7/1/19	Fri 6/30/23
Maintenance/Warranty - Year 2	261 days	Wed 7/1/20	Wed 6/30/21
Maintenance - Year 3	261 days	Thu 7/1/21	Thu 6/30/22
Maintenance - Year 4	261 days	Fri 7/1/22	Fri 6/30/23
Optional Maintenance - Years 5-6	521 days	Mon 7/3/23	Mon 6/30/25
Optional Maintenance - Years 7-8	522 days	Tue 7/1/25	Wed 6/30/27

Figure 4 - Proposed Project Schedule

4.3.1.6 Software Development Process and how it will be employed on this project (e.g. functional requirement development, requirement traceability, software/system development and client review process, test procedure development, acceptance testing, etc.)

Our proposed Work Plan for the ATMS/ATIS deployment lays out a path for a low risk transition that keeps WVDOH engaged throughout the software and system development period. We propose to take an iterative approach to the software development process. This approach is proven to lower the risk of the project and better meets the users' expectations.

The Agile diagram here is an overview of the proposed software development process.

Project Kick-Off: Team Q-Free proposes to start the project by holding an on-site kick-off meeting that will include key WVDOH stakeholders and Q-Free's project leadership. Upon Notice to Proceed, the Team Q-Free PM will work with the WVDOH PM to coordinate the time and location of the meeting.

At the kick-off meeting, Team Q-Free will engage the WVDOH in discussions related to the project software development process approach, scope of work, schedule, deliverable review

Figure 5 - Proposed Software Development Process

processes, and approach to communication. The goal of the meeting is to ensure all project leaders and key stakeholders agree on the project goals, objectives, scope, and roles and responsibilities from day one.

Meeting "in person" will allow the key personnel from WVDOH and Team Q-Free to get acquainted from which working relationships and trust can be built.

Requirements Workshop: During the first two to three months of the project, Team Q-Free will review project requirements and begin preparing for a series of requirement working sessions, we will illustrate key functions and concepts of our system, while simultaneously reviewing and clarifying the requirements. This approach allows WVDOH to become familiar with our ATMS/ATIS and lets our technical team to quickly identify the required configurations and customizations based on user feedback. The WVDOH PM shall review and approve the Requirements Document prior to proceeding to the other Preliminary Engineering and Design tasks. At the end of this phase Q-Free will deliver a Requirement document which the WVDOH shall review and approve.

Iterative Design and Implementation: Upon Requirements document sign-off, Team Q-Free will begin breaking down the requirements into user stories and assigning to sprints. As the sprints kick-off, the WVDOH will be engaged in reviewing and providing feedback for GUI mock-ups. We will start implementing customizations, configurations and enhancements for the WVDOH review and feedback in small iterations. This incremental design- implement approach provides for an efficient mechanism to solicit end-user feedback early and often. Sprints run-in three-week cycles ending with a Spring review that the WVDOH will be invited to. At this review the team demonstrates the functionality implemented during the sprint and discuss the features being implemented for the next sprint. This Agile development approach has proven to be very beneficial for large projects, as it substantially reduces the risk and complexity on the project, and results in a higher customer satisfaction.

Agile is an iterative and incremental development methodology that is used to manage software development. It provides a structure of roles and responsibilities, meetings, processes, and artifacts. Agile uses fixed-length iterations, called Sprints, which generally last from one to four weeks. Each Sprint consists of four types of meetings: (1) Sprint Planning, (2) Daily Scrums, (3) Sprint Review, and (4) Sprint Retrospective. Each meeting happens at a specific time and has a set purpose. Each Sprint incrementally builds on the functionality already completed in the last product increment. The following figure shows the Sprint workflow:
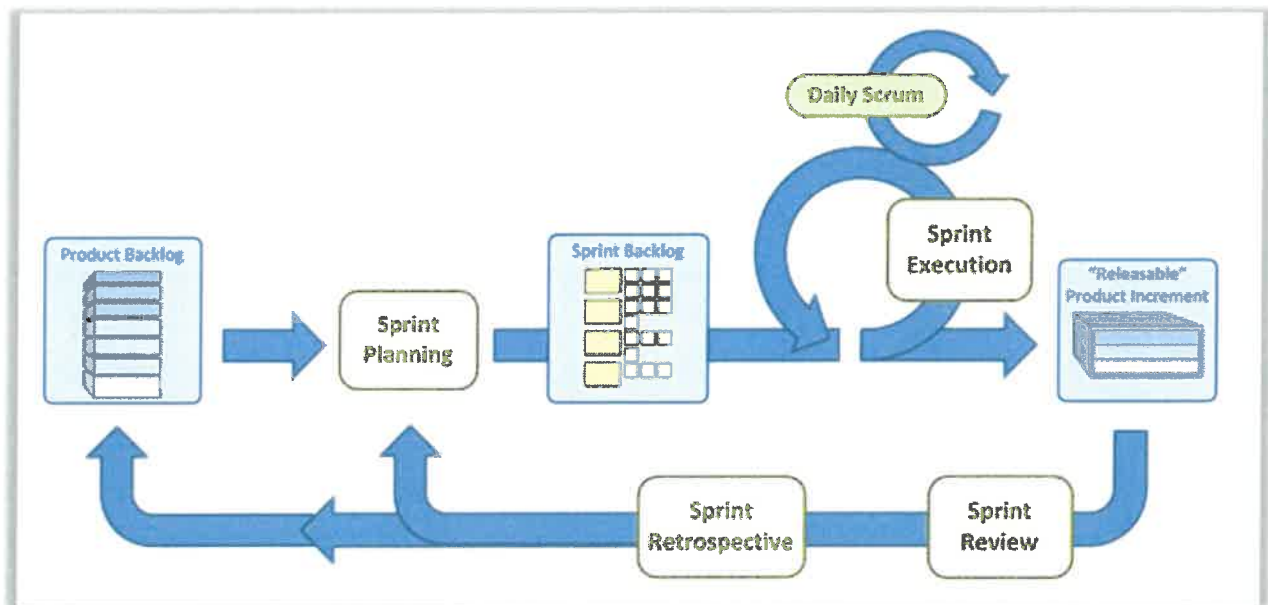
Figure 6 - Sprint Workflow

Acceptance Testing: Q-Free will develop test cases and once the sprints are complete Q-Free QA/QC team will be on-site to work with the WVDOH representatives to conduct User Acceptance Testing (UAT) and requirements verification. During the testing period the ATMS staging and ATIS preview environments will be utilized.

SpiraTest is an on-line requirements and test management tool. During implementation, QA writes test cases in SpiraTest per a documented standard. The standard is designed to create consistent test cases with accurate sample data. Using SpiraTest provides the traceability from functional requirements to requirements to

test cases. During the testing period, we provide our clients access to SpiraTest to execute the test cases during the acceptance testing process. Testing results will be provided.

Training: Our Trainer will work with the WVDOH and WV Parkway Authority to develop and execute the training plan Our Trainer will be on-site for a week to conduct 4 training sessions between the two sites for the initial deployment. Training materials will be supplied.

Deployment: Once the system has been accepted and training completed the software will be deployed to Production as outlined in the Software and System Deployment Transition Plan. A detailed work plan will be submitted at the project kick-off.

ATIS Development: In deploying the ATIS components of the system, ILOG will adhere to the principles outlined below for customizing the ATIS to WVDOH requirements.

The process will begin with clarification of the requirements for each component of the ATIS and how they will be modified to meet each preference or requirement. This initial process will specifically include establishing access to various external (non-ATMS provided) data sources that will be used to populate the 511 system. The final list of functional requirements for each ATIS component (IVR, website, travel alerts, mobile apps) will then be revised and presented to WVDOH for approval.

- The initial IVR structure can be based on the existing WV 511 dial plan, or can use ILOGs new artificial intelligence engine, SAM.

- The subscriber services for travel alerts will be based on current subscription services and will retain the current subscriber base, if one is available.

Once the requirements clarifications are approved, ILOG's networking team will create the network infrastructure necessary to support all the environments (development, preview and production), and will begin establishing connections to external data sources.

With this infrastructure in place, the design and development team can begin to work on initial drafts of the graphical user interface (GUI) for the web site, subscriber services and mobile app. A GUI design will be provided as a standard version of the ILOG ATIS. Utilizing Agile methods, ILOG will work proactively with WVDOH to customize the user experience for the web and mobile applications.

After the design is finalized, work will begin on the back-end system processes, meaning the web services that support the functions will be wired up to the UI elements. Bi-weekly updates or demonstrations of new features will be presented on a preview system as they become available. This preview system will be IP-restricted for testing by WVDOH. Similarly, the IVR will be demonstrated through a preview system, which will be assigned a test phone number. Through the bi-weekly demonstrations, each of the items on the final list of functional requirements will be fulfilled, which should facilitate UAT by WVDOH.

When the system nears the go-live date, the WV 511 line will be ported to the new IVR system, the current WV 511 web site URL DNS will be changed to point to the new website, and the mobile apps will be released to their respective stores so that all live systems become available to the public.

4.3.1.7 Quality Management/Change Management Plan details and how it will be employed on this project

Team Q-Free is committed to providing the highest quality service to our clients and we are extremely proud of our record of successfully deploying, operating, and maintaining ATMS and ATIS solutions. We are committed to continuous quality improvement through involvement of all personnel in a systematic, logical process to continually improve work practices and procedures. The overall continuous quality improvement process is managed by the Q-Free QA/QC Director working with the ILOG Product Management Director and Skyline Product Management Director.

Quality Management / Test Plan

Q-Free will provide a Quality Management, Test Plan, describing our approach for testing the proposed solution. The plan will describe the testing that takes place during each phase of the project, approach to Factory Acceptance Testing (FAT), approach to User Acceptance Testing (UAT), schedule and resource requirements and acceptance criteria. Test cases will be created verify the requirements and these will be executed with the WVDOT on-site as part of acceptance testing. The following describes our approach to testing.
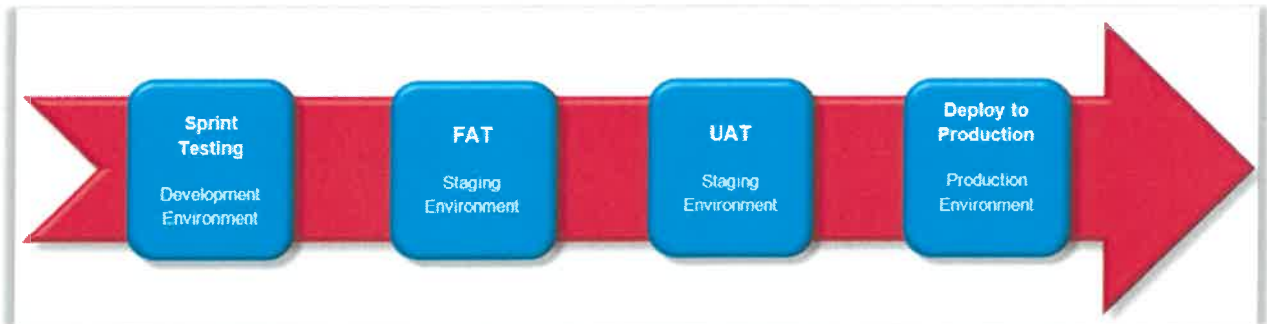
Figure 7 - Sprint Testing

Sprint Testing is conducted during the implementation phase by QA and the development team. This includes peer review, unit testing, integration testing, automated testing, and performance testing. QA utilizes Selenium and Apache JMeter for automated testing and performance related testing. Automated testing has proven to be a valuable investment in our product. Tests are run nightly to ensure no new bugs are introduced and any issues found are addressed immediately. Following the agile model, QA has an integral role throughout the entire sprint testing process/lifecycle;

- *FAT* is conducted in the WV Staging environment. Testing is conducted by Team Q-Free QA leads. Staging environment will mimic production. During this test phase the team will verify the ATMS/ATIS software components and modules, public websites, IVR and mobile applications, and functionality of the elements contained.

- *ITS Device Testing* is a critical aspect of testing. Team Q-Free will work with the WVDOT on any field device testing necessary. OpenTMS currently communicates with the existing devices so this should be minimal impact.

- *UAT* is conducted in the WV Staging environment with the WVDOT designated representatives. Team Q-Free QA will be on-site to execute the test cases verify that the requirements have been met. The DOT will also have the opportunity to do ad-hoc testing as well. UAT will test all aspects of

the software being deployed; ATMS, 511, and Video. Q-Free will provide test results that will be reviewed with the WVDOT and if they meet the acceptance criteria identified in the test plan the software will be scheduled for deployment.

Q-Free uses SpiraTest an on-line requirements and test management tool throughout this process. During the testing period, we provide our clients access to SpiraTest to execute the test cases. This on-line tool provides the WVDOT visibility into the entire testing process.
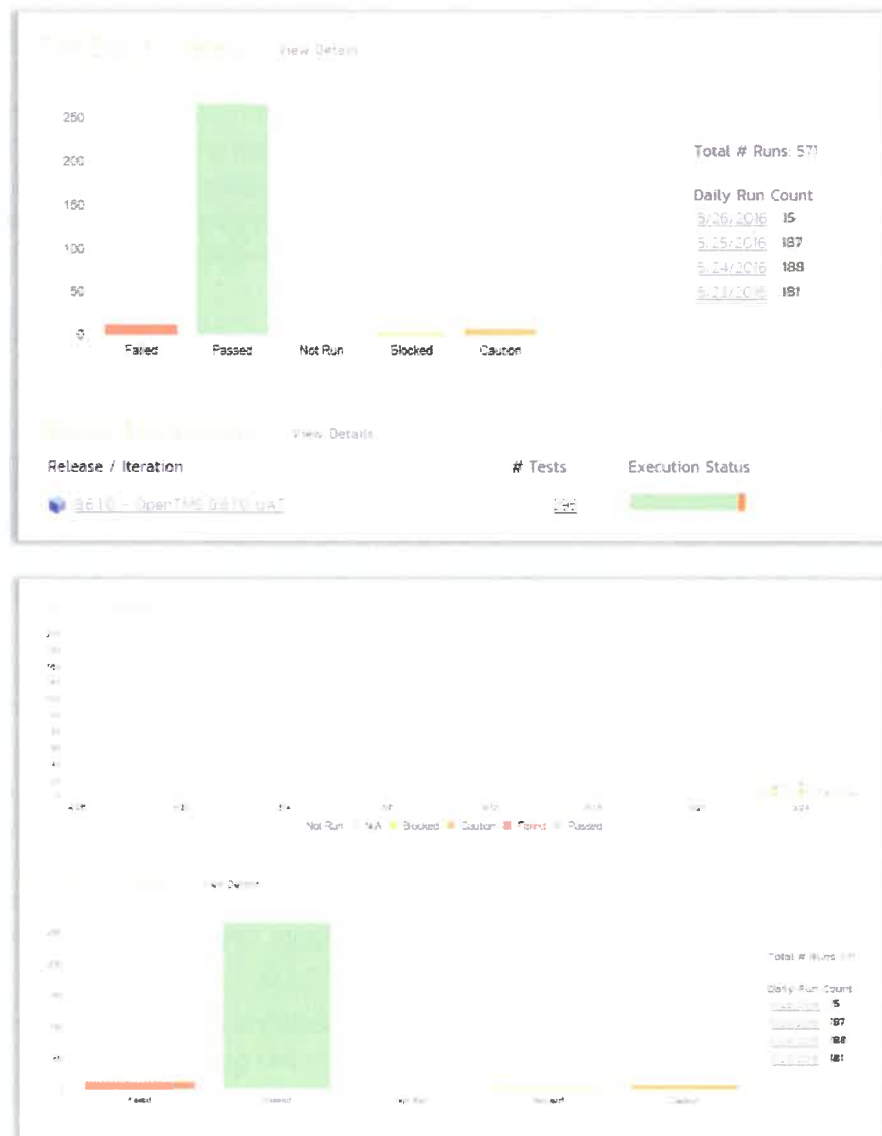
Figure 8 - SpiraTest

Our approach to testing throughout the project lifecycle incorporates the following best practices and key strategies:

- Test Plan provides a well-documented process to that will be followed. The WVDOT reviews and approves the plan so they are part of the process. The QA Director is responsible for ensuring that this plan is followed.

- Availability of ATMS device simulators provide the QA team the ability to test the applications without actual field devices. We have a National Transportation Communications for Intelligent Transportation System Protocol (NTCIP) Simulator (DMS / Detectors / RWIS / VSL / LCS).

- All programming is performed using the operating system and database being deployed.

- QA Team leverages automated testing to ensure new development isn't introducing new issues and bugs introduced are caught quickly. These automated tests can be used for end to end testing as well.
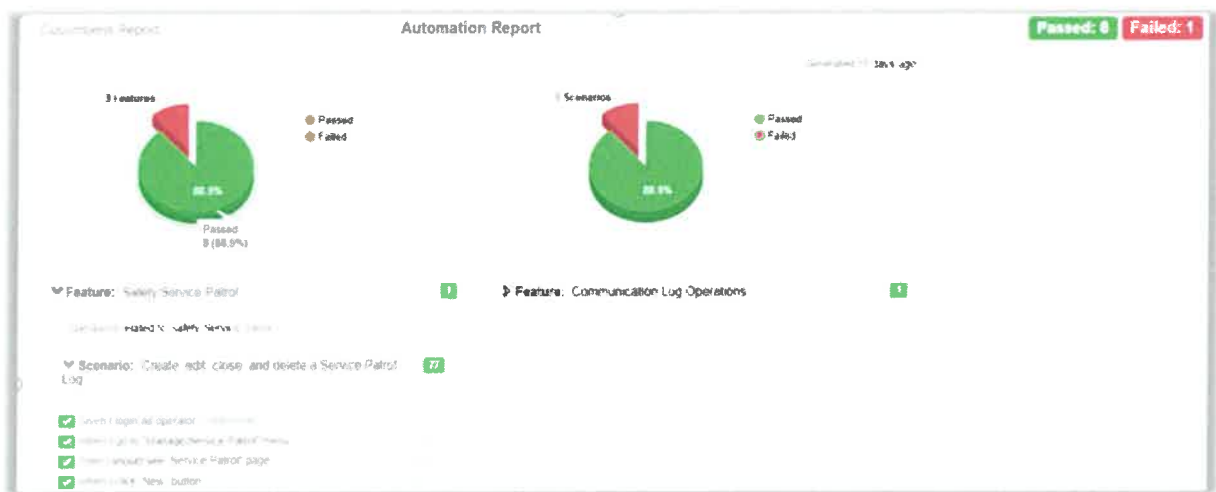
Figure 9 - Automation Report

Change Management

Based on lessons learned, Team Q-Free recommends that the WVDOT consider forming a Change Management Board of key ATMS/ATIS/VDS stakeholders that are responsible for managing changes to the platform.

All changes to production will be coordinated with the on-site system engineer and recorded in our JIRA Service Desk. JIRA Service Desk is available via the web and is used to report and track reported system issues.

The Operations Support and Maintenance Plan will contain configuration management details.

4.3.1.8 Issue Resolution Process

Team Q-Free's Ticket Resolution Process is shown in the figure below. The on-site system engineer typically takes ownership of investigating and works with the WVDOT prioritizing reported issues.

- If the issue can be resolved without technical support, the system engineer acts to resolve the ticket, logs the action in the JIRA Service Desk, and verifies that it is resolved with the reporter.

- If further technical support is needed,

- For ATMS issue, Team Q-Free's System Engineering staff investigates the issue, reports findings, and schedules the fix with an upcoming maintenance release, depending on the defect priority.

- For VDS or 511 application issues, the on-site or on-call system engineer reached out to the appropriate vendor for support.

- The SE closes the loop, reports the findings to the reporter and documents the actions in the JIRA Service Desk. Recurring issues are linked together for tracking and information gathering.
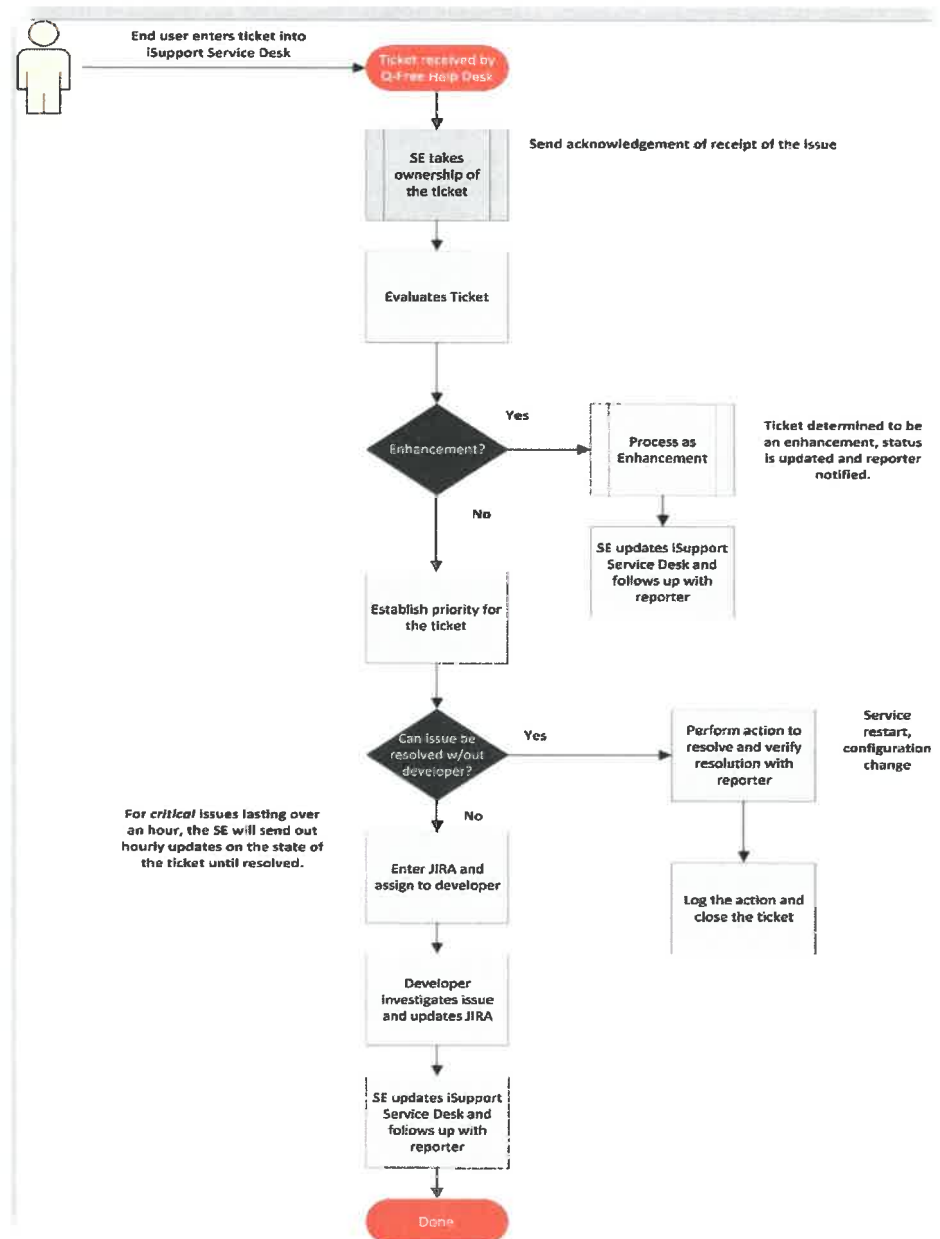
Figure 10 - Team Q-Free's Ticket Resolution Process

PRO-ACTIVE SYSTEM MONITORING

Team Q-Free proactively monitors the system state, health and performance of the platform.

ATMS/VDS Monitoring

ATMS/VDS uses Logic Monitor to monitor the system health 24x7. A collector will be deployed at the site. The collector watches the configured parameters on the servers and forwards the alert to Logic Monitor using SSL. Logic Monitor maintains a database that includes a history of alerts. Logic Monitor supports a reporting module that provides the admin the ability to create reports to monitor alerts over the past week or past month. Logic Monitor applies filtering rules to alerts as they arrive. A rule can trigger a notification, such as an e-mail, to notify an administrator of a problem that can be corrected before causing downtime in production

ATIS Monitoring

ILOG has 24x7 systems monitoring and response protocol. On-call systems support staff are notified when performance thresholds are crossed. The reported problem is triaged, and customer-impacting issues are immediately addressed by appropriate support staff. ILOG provides the Q-Free support team with a toll-free number, answered by systems support staff that can be called to make a service request.

The cloud-hosted system is monitored by two sources; AWS and ILOG systems support center. AWS utilizes a wide variety of automated monitoring tools to detect unusual or unauthorized intrusion attempts at ingress and egress communications points. Alarms are configured to alert AWS systems staff when early warning thresholds are crossed, and on-call staff rapidly respond. AWS monitors for a number of threats including denial of service, man in the middle, packet sniffing, etc.

ILOG also monitors the network and systems using Nagios monitoring tools. ILOG staff are paged when a performance threshold is crossed, and corrective action is taken.

Systems are scanned monthly by Comodo, a third-party provider for detection of vulnerabilities. Patches and updates are made regularly, and reported vulnerabilities are corrected as soon as they are identified. Support staff are available 24x7 and will contact additional staff as needed for problem resolution.

4.3.1.9 Risk Identification process

The Key Team Members and managers who have experience and insight are primarily responsible for risk identification. The Q-Free project manager along with the ILOG and Skyline project managers to identify and track risks in a Risk Register. The Risk Register will be provided with the monthly project progress report.

The impact of realized risks on dependent processes are also identified and are mitigated to the degree possible. Where applicable, additional resources may be needed. At these junctures, the project manager will draft an impact statement showing the effect of the risk on schedule, costs, etc. for the project.

4.3.1.10 Bios/Resumes of key personnel (PM, Tasks Leads, On-Site Staff) (2-page maximum for each)

Team Q-Free staff resumes can be found in the pages to follow.

Christopher Butler
Team Q-Free Project Manager

Education	Electronics Technology Training, OCC 1993
	PL High School, Woodland Hills, CA, Diploma
Certifications	LMCP
Expertise	ITS Systems, Networks, Implementation, and Deployment
Professional Affiliations	ACM Member: 2136593
Years of Experience	17

Mr. Butler has over 17 years of experience in the development and delivery of leading edge technologies, system applications, and operations to support challenging business demands. He has extensive qualifications in all facets of project development, from initial feasibility analysis and conceptual layout/design, through setup, implementation, user training, and enhancement.

Q-Free Experience
(4/2007– Present)

Systems Engineer II; West Virginia 511/e911 Integration
Mr. Butler is a key asset in the configuration, and deployment in the e911 and West Virginia Division of Highways (WVDOH) Traffic Management Center integration. His role is in part to meet with the proposed 911 center management staff, county boards, city council, e911 council; educating city officials on the integration, and then Mr. Butler works with the e911 center(s) to install hardware, configure networks, and deploy to the WVDOH ATMS system.

Systems Engineer II; West Virginia 511
Mr. Butler was a key asset with the design, configuration, and deployment in the West Virginia Division of Highways (WVDOH) Traffic Management Center in Charleston and the West Virginia Turnpike Authority.

Network/Systems Engineer II; West Virginia 511
Mr. Butler designed, configured, and managed the West Virginia DOH 100MB fiber mesh network. He also designed, configured, and implemented an IPVPN from the WVDOH TMC to the West Virginia Turnpike Authority, to facilitate application, device, and information sharing. Mr. Butler designed and implemented the WVDOH ITS Mesh network, incorporating four remote facilities across the state utilizing a single centralized redundant system. Mr. Butler is currently designing the network portion of the state 511 system for deployment in the fall of 2012.

LEADING THE WAY

Daniel Skiffington
Principal-In-Charge

Education	B.S., in Computer Science, Virginia Tech, 2002
Expertise	Software Engineering, System Architecture and Design, Integration, Agile Methodologies, Project Management, Web Services(SOAP, REST), Messaging(JMS), Java, JavaScript, HTML, GWT, AngularJS, SQL, Oracle, PostgreSQL, GIS, Application Security
Years of Experience	12 +

Mr. Skiffington leads the research and development and product development group at Q-Free with over 12 years of experience. As the AVP of ITS Technology, he has the responsibility to lead and manage the development and implementation strategies for all Q-Free's products including the cutting edge image review solution, Intrada Synergy Server and the enterprise ATMS product, OpenTMS. Additionally, Mr. Skiffington supports project solution architecture and all aspects of the software lifecycle process to include: requirements analysis, system design, development, testing, deployment, maintenance, configuration management, and documentation for both web-based applications.

Q-Free Experience

Director or Product Development
As Director of Product Development, Mr. Skiffington managed the product roadmaps and project architecture solution for all Open Road's products. He led the design and development of the next generation of the enterprise ATMS product that is a completely web-based, scalable, high availability solution that can support centralized statewide deployments with many Traffic Operations Centers.

Lead Software Engineer; VDOT Transportation Operations Technology System Services
Mr. Skiffington led the implementation task to virtualize the existing ATMS hardware platforms and upgrade the ATMS software to OpenTMS Version 7 for four Traffic Operations Centers operating in Virginia. The effort included establishing consistency of hardware and software between the operations centers and configuring and deploying onto a virtual environment that utilizes VMware Infrastructure.

Software Engineer; WVDOT Statewide ATMS Implementation
Mr. Skiffington was responsible for the implementation and deployment of the statewide OpenTMS Enterprise System. Deployment was an off the shelf system integrating numerous legacy and new field devices well as a desktop video management system. Project was completed in seven months.

LEADING THE WAY

Technical Maintenance Liaison; Q-Free Open Road Transportation Division
Mr. Skiffington provides technical software supported for Q-Free products operating within the Transportation Operations Centers nationally. Mr. Skiffington is responsible for reviewing and responding to technical maintenance support requests related to any supported software product deployed in any of the Transportation Operations Centers. Currently this includes deployments in nine locations which reside in four different states. This responsibility includes facilitating communication between project managers, system administrators, developers and the end users as well as addressing the resolution of the submitted requests.

Product Manager; OpenTMS Enterprise
Mr. Skiffington is responsible for managing the OpenTMS product. This includes prioritizing, scheduling, and assessing the risk of all software changes including future research and development. Mr. Skiffington reviews requirements and design for all major functionality changes or additions to OpenTMS in order to access their feasibility and impact to the system. Mr. Skiffington also oversees release preparation for OpenTMS to ensure quality assurance procedures are executed.

Software Engineer; VDOT I-81 Corridor Systems Integrator
Mr. Skiffington was part of the development team that provided field device protocol integration, field device communication protocols, software and database support, client interaction, usability improvements for the user interface, GIS implementations, and reporting using Crystal Reports. This effort was completed using iterative deployments in both the VDOT NW and SW regional TOCs and was delivered on-time and within budget.

LEADING THE WAY

Colleen Bond
AVP Project Delivery

Education	BS, Computer Science/Scientific Concentration, Utica College of Syracuse University, Utica, New York
Training	Quality Improvement through Defect Prevention Software Engineering Training Program
	Six Components of the Bullet Proof Manager Series
	Agile Estimating and Planning
	The Agile Product Owner
	Communication Fundamentals
Expertise	Software engineering and system integration including the Software Engineering Institute Capability Maturity Model (SEI CMM); System design, development, deployment, and maintenance for numerous types of systems including ATMS, Archive Data Management Systems (ADMS), Traveler Information, and Data Sharing Systems.
Years of Experience	30+ years

Colleen Bond is the Director of Inter Urban Operations / Portfolio Director at Q-Free Open Roads. Ms. Bond works across departments in Operations to maximize the value delivered across IT investments and oversee the day-to-day delivery of IT services and project delivery. Ms. Bond has served as Technical Director for several major Advanced Transportation Management Systems (ATMS) deployments.

Ms. Bond is also a Portfolio Director providing high level oversight on multiple projects in her portfolio.

Ms. Bond is a results-oriented technical manager with comprehensive expertise, in-depth experience, and a broad knowledge of software engineering and system integration including the Software Engineering Institute Capability Maturity Model (SEI CMM). She has a strong background in system design, development, deployment, and maintenance for numerous types of systems including ATMS, Archive Data Management Systems (ADMS), Traveler Information, and Data Sharing Systems. Ms. Bond is an excellent technical manager and is gifted at team mentorship, as well as implementing quality control (QC) procedures. She is self-motivated, decisive, and committed to the highest standards of performance and excellence.

Q-Free Experience

(June 2002 – Present)

Pennsylvania Department of Transportation (PennDOT), Next Generation Advance Transportation Management System

In September 2012 Q-Free Open Roads kicked off the Next Gen ATMS Project for PennDOT. As the Technical Manager on this project, Ms. Bond is responsible for the requirements, design, and development of our state of the art web based ATMS. As part of the effort she is managing tasking to include integration with new legacy ITS devices as well as upgrading the incident module to include automated incident response recommendations. Team has completed the deployment of the Statewide ATMS. Focus is on enhancements in the upcoming year.

LEADING THE WAY

Virginia Department of Transportation (VDOT), ATMS Deployment at McConnell Public Safety and Transportation Operations Center in Northern Virginia

In 2008 Q-Free Open Roads deployed its premiere ATMS solution, OpenTMS, at the McConnell Public Safety and Transportation Operations Center (MPSTOC) in Fairfax, VA. OpenTMS was selected by VDOT to replace an aging, legacy Traffic Management System with a modern, Commercial Off-the-Shelf (COTS) solution that would easily integrate its extensive set of Intelligent Transportation Systems (ITS) field devices and provide a scalable and extensible architecture to support future system expansion and integration with other stakeholder systems within Virginia, Maryland and Washington D.C. As the Technical Manager on this project, Ms. Bond was responsible for procurement, requirements, design, and development of the OpenTMS deployment. She managed tasking to include integration with new legacy ITS devices as well as upgrading functionality deployed in their new Transportation Operations Center (TOC). She managed the software rollout and transition planning for the project including the deployment of hardware and software supporting the ATMS. Transition planning included the migration from a legacy ATMS as well as moving operations to a new location. Ms. Bond provided oversight for the integration of Lane Control, Ramp Meters, and Gate Control modules into OpenTMS, as well as managing tasking to include integration of travel time and device upgrades.

Virginia Department of Transportation (VDOT), I-81 Corridor ATMS

Q-Free Open Roads deployed OpenTMS at two regional transportation operation centers on the I-81 Corridor in Virginia and have subsequently staffed, operated and maintained these facilities since 2004. Ms. Bond was the Technical Manager on this project and responsible for the requirements definition, design, and development of the next generation OpenTMS Enterprise System. She managed the $750,000 investment to upgrade numerous capabilities including adding new modules, integrating with new and legacy ITS devices, and upgrading functionality within all existing modules. This effort was completed using iterative deployments in both the VDOT Northwest and Southwest regional TOCs and was delivered on-time and within budget.

West Virginia Division of Highways (WVDOH), Statewide Advanced Transportation Management System Deployment

Q-Free Open Roads provided a statewide ATMS solution as the backbone of the WVDOH statewide ITS program. Open Roads also integrated Computer-aided Design (CAD) data from ten independent 911 CAD systems across the state to provide comprehensive coverage of a majority of the interstate throughout West Virginia. Ms. Bond was responsible for overseeing the OpenTMS customization and configuration for the West Virginia Deployment. She worked with the project manager to coordinate technical resources and manage the development and integration of the ATMS. She provided programmatic Quality Assurance/Quality Control to ensure that OpenTMS was delivered as specified.

Virginia Department of Transportation (VDOT), Richmond/Tri-cities System Manager

As the Senior Software Engineer, Ms. Bond provided a supporting key role in the maintenance of the VDOT Richmond TOC system where she upgraded the system from Windows NT to Windows 2000. She designed and prototyped a web-based equipment repair tracking system. Ms. Bond was responsible for overseeing the requirements, design, and deployment of the OpenTMS v4 upgrade which include a COTS upgrade and enhancement package.

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Virginia Department of Transportation (VDOT), Centralized Data Archival Management System

Ms. Bond was the Technical Manager and supported the development of the concept of operations, stakeholder involvement, functional requirements specification, prototype screens, system design specification, development, testing, deployment, and maintenance of the software for this web-based system. This effort was accomplished in an iterative, phased deployment approach where each phase included stakeholder involvement, full requirements analysis, development, and deployment. This was a rapid development and deployment effort with four full phases conducted over a two year period resulting in a deployment every six months.

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LEADING THE WAY

Jason Coakley
ATMS Solutions Architect

Education	Bachelor of Computer Science for College of Engineering (2009)
	Virginia Polytechnic Institute and State University, Blacksburg, Virginia
	With a Minor in Mathematics.
Expertise	Java, Angular, JavaScript, SQL, HTML, Angular, SCSS, Docker, Typescript, Kubernetes, React
Years of Experience	9.5+

Q-Free Experience
(February 2016– Present)

Software Engineer III — OTMS VDOT
Design and implement new UI features utilizing Angular 2, Typescript, and HTML. Implement RESTful web services in a Java EE framework.

Software Engineer II/Technical Lead — MIR MassDOT
Communicate to the customer on new builds, bug fixes, and any other issues. Design and implement new UI features utilizing Angular, JavaScript, and HTML. Implement RESTful web services in a Java EE framework.

Software Engineer II — MIR MDX
Work with the SCRUM team on implementing new features and fixing bugs. Created custom real time Dashboards using Angular NVD3. Interface with the client's SOAP protocol to accept incoming work into the system.

Prior Professional Experience

Consultant; CGI Federal (January 2011-July 2015)
- Provided continued maintenance and development of bug fixes and patch sets in C++;
- Performed effort estimation for development of new and existing technical objects; and
- Development and unit testing of software applications using Rational ClearCase and ClearQuest, SQL Developer, and Microsoft Visual Studio.

Co-Owner; Elite Mobile Squad (March 2012– March 2013)
- Designed and implemented web based appointment scheduling software utilizing Javascript, PHP, HTML5, and MYSQL; and
- Created an android application that utilizes web services that connects to an existing web application.

LEADING THE WAY

Software Engineer I; Cape Henry Associates (June 2008– November 2010)

- Developed an all in one time sheet web application in C# which Cape Henry Associates uses on a daily basis. The time sheet application features contracts, tasks, administrators, and program manager support;

- Built detailed statistics and graphs based upon time sheet data for administrator needs; and

- Developed a Web interface using ASP.NET to search database using dynamic SQL based upon user selection(s).

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LEADING THE WAY

Mitchell Terry, Jr.
ATMS Deployment Lead

Education	Associate of Applied Science: Information Systems Technology
Expertise	System Administration, Network Administration, Software Management
Years of Experience	6+ years in Network and System Administration

Q-Free Experience
(March 2016– Present)

Systems Engineer / CM&D Coordinator – VDOT Statewide
The VDOT statewide project requires the Q-Free team to collaborate with multiple parties and vendors to support the statewide effort. Daily interactions with VDOT TOC's, Skyline (PAAS vendor), and Iteris (Supports VDOT statewide) to collaborate on requirements from our Client. Mitchell works with VDOT's local TOC's to perform device integration and testing as part of the multiple releases for the contract.

Systems Engineer / CM&D Coordinator – PennDot
As part of the PENNDOT Contract the Western Region deployment has required the development and testing of various devices to be deployed to the ATMS system. This effort includes working with the local TOC's, Network Administrators from PENNDOT, and on-site QFREE embedded resource.

Prior Professional Experience

Systems Engineer; General Dynamics NASSCO-Norfolk | (2013 – Mar 2015)
- Analyze, resolve, and document issues in a 800+ user LAN environment Consolidated two separate domains to a single integrated domain while implementing security measures to ensure cyber security meets CIS standards;
- Continuous monitoring of systems and LAN to ensure operation and security compliance;
- Implementation and administration of SCCM 2012 to manage enterprise assets;
- Knowledge and experience with Cisco, Juniper, Aerohive, Solarwinds, Symantec, SQL, Powershell, VMWare, SCCM, Linux, windows, and various other IT specific software solutions; and
- Supported various Audits including Sarbanes-Oxley and Cyber Security based on CIS standards.

Technical Support Analyst; Metro Machine Corp. DBA. NASSCO-Norfolk | (2010 – 2013)
- Analyze, resolve, and document issues in a 300+ user LAN environment;
- Integration from a primarily Linux based infrastructure to a Windows Active Directory;

LEADING THE WAY

- Provide support to End Users from a Help Desk environment;
- Assist and backup current network administrator on Windows and Linux Servers; and
- Assist and support as needed with Sarbanes-Oxley audits.

PC Technician; Best Buy - Geek Squad | (2010 – 2011)

- Responsible for diagnosing hardware and software issues on Mac and Windows systems;
- Interact with consumers in a professional and courteous manner while working to resolve issues; and
- Ensure efficient and timely resolutions/repairs in accordance with company standards.

Tech Support Representative; Liberty Tax Technical Support via Headway Staffing | (2009 – 2010)

- Troubleshoot OS, Hardware, Networking, Printers, Software, etc.;
- Help create KB articles for re-occurring issues; and
- Provide remote support to franchise owners across the United States.

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Moises H. Lopez Jr.
ATMS QA/QC Lead

Education	B.S., Computer Studies, Christopher Newport University, 1997
Certifications	ITIL V3 Foundation, 2010

Moises Lopez is an accomplished and driven information technology professional specializing in all aspects of the software development life cycle, including quality assurance (QA)/quality control (QC) methodologies, and network administration. Mr. Lopez has proven strengths in meeting project requirements and producing high quality software applications through excellent analytical, leadership, and communication skills.

Q-Free Experience
(August 2012 – Present)

Alaska 511 Traveler Information System & Alaska 511 Roadway Information Data Entry (RIDE), Alaska Department of Transportation and Public Facilities
Mr. Lopez is the QA Lead for the Alaska 511 public website and 511 RIDE website (Entry Tool) projects. Q-Free created a fully-featured, highly customizable traveler information solution designed around a scalable Intelligent Transportation Systems (ITS) Architecture. This latest release includes an updated user interface, an origin destination trip tool, and dynamic message signs to provide additional real-time information on the status of Alaska's roadway network. 511 RIDE is a web-based tool that is used for managing incidents, planned events, and road conditions.

Transportation Video & Data (TV&D) Deployment, Virginia Department of Transportation (VDOT)
Mr. Lopez is the QA Lead responsible for figuring out pink tile production issues, website problems when there were too many users on the website at once. He was able to create JMeter script to reproduce and validate the issue. Q-Free successfully deployed a comprehensive, self-sustaining solution for sharing video and data that can readily adapt to rapidly evolving technologies and information dissemination through the TV&D project for VDOT. Q-Free was responsible for data fusion, management and distribution of related information to VDOT and the traveling public, as well as to other VDOT public partners. This multi-year project establishes a business model designed to generate revenue to support the 511 system's operations and data distribution service.

i-TINS, Abu Dhabi Department of Transport, United Arab Emirates

The i-TINS project consists of designing, implementing and maintaining an Integrated Travel Information & Navigation Services (I-TINS) system for the Abu Dhabi Department of Transport. The traveler information system is built using the OpenTMS Web product as a data-entry and middleware component. Mr. Lopez is the QA Lead assigned to validate requirements for the OpenTMS release. OpenTMS is Q-Free's premiere software product, the most fully-featured and easy-to-use off-the-shelf ATMS solution on the market, enabling intelligent and automated transportation operations.

LEADING THE WAY

Billy Bartram
ATMS On Site O&M Support Lead

| Education | Marshall Community and Technical College - Computer and information sciences, Web Programming, 2005 – 2010 |
| | **Course:** LPI Linux Essentials, 2018 |

Q-Free Experience

(2017 – Present)

SE Level 1

- Respond to operational questions and issues;

- Troubleshoot and resolve hardware, software, and communications issues by identifying options for the most expedient resolution of the problem. This may include contacting the vendor for support, ordering parts, installing parts, and verifying the system is operational;

- Participate in client mandated meetings and change control processes;

- Document network/system architecture, configuration settings, and troubleshooting procedures;

- Design, install, configure and maintain a Windows Server environment including Active Directory, DNS, DHCP, and IIS;

- Install, configure, and troubleshoot the company's application software and associated databases;

- Perform hardware and software upgrades as needed on the network, server, and workstations to ensure 24/7 business continuity;

- I am responsible for the configuration, monitoring, and security of clients' data network;

- Provide immediate response to monitored events that indicate a failure in a mission-critical system;

- Perform system backups and recovery using applicable backup software;

- Provide on-call support during off-hours;

- Provide resolution of critical issues by determining and implementing the best course of action to restore the system to operational status;

- Responsible for all server and workstation functionality, security, and analysis as it relates to support of the Traffic Management System application. Ensuring that the system is available 24/7;

- Work with customer's IT staff to comply with all related regulations and duties;

- Install, configure, and maintain the organization's file servers and PC platforms;

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- Act as primary liaison with vendors;

- Analyze current operations for opportunities to improve operational efficiency;

- Design and recommend hardware, software, or process improvements;

- Manage the performance of multiple hardware and software platforms;

- Recommends upgrades or improvements and supports development of technical standards and applications;

- Resolve server/PC problems and offers technical assistance to users;

- Manage the acquisition, installation and maintenance of the organization's file servers, database servers, and desktop computers;

- Perform primary Help Desk function;

- Work jointly with Database Administrator(s) and Software Engineers(s) to define needs and requirements for continued operation, upgrade, and security of clients' systems; and

- Document all work as server and PC system components are modified, updated or installed.

Prior Professional Experience

CDI Corporation, NOC supervisor
I supervised the Network Operations Center at my last position. I had 2 locations that I supervised. The clients that I had were Higher Education, Secure Research Environment, Corporate technology Enterprise Level, and Level 1 and 2 Helpdesk. I had started as an analyst on the L2 helpdesk and moved into different roles. I once supervised the contract for a helpdesk of about 100 employees and 4 team leads.

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Paul Hlasnicek
ATMS Training Delivery

Education	The Pennsylvania State University, B.S., Applied Mathematics, 1987
Expertise	Software engineering, business analyst, and web-based training.
Years of Experience	30+ years

Paul Hlasnicek is Q-Free's Business Analyst with over thirty years' experience in software engineering. Mr. Hlasnicek builds and maintains strong trust-based relationships with key stakeholders; including internal and external stakeholders. He works closely with business and technical teams to improve the design, development, and maintenance of our technical assets. Within this position, Mr. Hlasnicek manages the training department. In addition to delivering the training sessions, he oversees development of all training materials, including users' manuals, training guides, and cheat sheets for Q-Free's ITS and Physical Security implementations. Mr. Hlasnicek works closely with Q-Free's Business Development and Technical Development teams to ensure that the training materials and programs include the most recent deployment status. In the past three years, Mr. Hlasnicek has developed comprehensive training programs for Q-Free's 511/Traveler Information Systems and ATMS clients. He has provided on-site and remote web-based training for clients in Pennsylvania, Virginia, West Virginia, Delaware, and Alaska.

Q-Free Experience
(July 2004 – Present)

Senior Business Analyst
VDOT ATMS Deployment

Mr. Hlasnicek managed and delivered the training program for the VDOT Traffic Operations Centers. He worked with VDOT management in implementing the training plan for the traffic center supervisors and operators. He works with operators and encourages an open dialog to identify enhancements and process improvements in transportation operations centers. He provides onsite support during the application deployment to insure a high level of customer support.Service Assurance Manager.

PennDOT ATMS Deployment

Mr. Hlasnicek managed the overall training program for the PennDOT Traffic Operations Centers. He worked closely with the trainer and insured that all training materials were up to date and relevant for the customer. He works directly with the customer during and after the application deployment to insure the highest level of customer support. Mr. Hlasnicek creates and maintains an open dialog with the customer and encourages them to share feedback. He works with the project manager and the development staff to identify areas of improvement.

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LEADING THE WAY

Mary Farrell
ATIS - Executive Sponsor

Education	Bachelor of Science, Mathematics; St. Peters University, Jersey City, NJ
	Graduate Studies in Operations Research; Steven's Institute of Technology, New Jersey
	Graduate Studies in Mathematics; Courant Institute of NYU, New York
Years of Experience	41+

Ms. Farrell has worked in technology since 1977 when she started her career with Bell Laboratories as a researcher, supporting new telecom developments and customer interface analysis. She moved to working for ISSS, a custom software development firm serving the insurance industry. From there, Mary moved to the U.S. Navy Exchange System where she developed and programmed their first Executive Information System followed by automating the annual $2B budget planning process. Mary moved into the technology consulting field where she designed and programmed custom software. She has served as project manager for literally hundreds of projects. She focuses now on managing customer and business relationships, making sure client expectations are met or exceeded. Of her 35+ years working in technology, she has been involved specifically with technology for the transportation industry since 2004.

Relevant Experience

Account Executive – Pennsylvania Turnpike Commission (PTC)
Mary serves as the Account Executive for the Pennsylvania Turnpike Commission (PTC). Information Logistics developed and hosts the PTC's Emergency Notification System, adaptive website, toll free Interactive Voice Response (IVR) system, traveler email subscription services, TripTalk hands-free, eyes-free mobile app as well as other applications integrated with internal PTC programs. Mary listens to the needs of agency staff, and brings these insights back to the Information Logistics team, where they have devised new/innovative methods and technologies to solve the problems. By leveraging the traveler information IVR system to be used in reverse, the PTC was able to have roving maintenance crews automatically called by the IVR. This allows crews to report actual roadway conditions safely via voice recognition services. By leveraging an operator console, a mobile app was developed that could dispatch technicians to repair roadway facilities, and track their progress until repair completion.

Understanding that drivers need information about their route and also understanding that access to information must be mobile-focused has been apparent industry wide. However, delivering that information to travelers in a fashion that minimized distraction was a challenge. In 2011, under Mary's direction, Information Logistics invented GeoTalker, a platform that supports hands-fee, eyes-free traffic alerts via mobile apps and is interoperable across agencies and across geographic boundaries. Current deployments include Trip Talk for the PTC, 511PA for PennDOT, Drive Safe West

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Virginia for WVDOT, Safe Trip NJ for NJ Turnpike Authority/NJ DOT, and Traffic Talker England for Highways England. The app has evolved to accommodate smart work zones, truck parking, speed limit changes, beacon messaging and other V2I initiatives.

Mary plays a key role in the 511PA ATIS program which has been twice awarded to Information Logistics (2013 and 2018). The project included design and implementation of the mobile-focused 511PA website, traveler email subscriber services, a phone system supporting interactive voice response (IVR) and a hands-free, eyes-free mobile app with accompanying agency management console. The 511PA system continues to advance into new functions and features to facilitate traveler information services including plow-tracker capabilities, special event planning sites, and custom event-driven IVR. The mobile app is in an evolution toward more rapid delivery of micro-localized conditions, with advancements working to bridge the gap as we move toward connected vehicles.

511PAConnect is Pennsylvania's implementation of revolutionary development for ATIS. In a cooperative effort with PTC, PennDOT, the Pennsylvania Emergency Management Agency and the PA State Police, Mary worked to very rapidly design and implement this new, two way communications tool for travelers trapped in long-duration queues on the highway. This FEMA tested and approved product has been in use for two years in Pennsylvania, and is currently being launched with NJDOT.

Innovations – In addition to the new technologies devised by Information Logistics, Mary encourages the team to think innovatively. Under her leadership, the company has developed:

- A highway emergency alerting platform; an automated internet radio station product;
- A tolling app that can be used by drivers with no transponder and which can be used by cash-paying customers (those who are underbanked or who choose not to use credit cards); and
- A new AI program that will soon have initial testing at one or more agencies.

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Casey Krout
ATIS Technical Support - Database and Data Interfaces

Years of Experience	20+

Casey Krout has been a database designer and programmer for almost 20 years. The base to any interactive program or app often involves a database and related programs, and Casey has designed more than 100 web-based interactive programs/sites. His first work in transportation was in 2004 when he began working on the Pennsylvania Turnpike Emergency Notification System. His ideas to link an operations center interface with a master database that could then disseminate a consistent public message helped win two international awards for the Pennsylvania Turnpike. On a personal note, Casey is a Scoutmaster who is a merit badge counselor for computers, digital technology, and programming.

Relevant Experience

- **511PAConnect** – Casey created the GIS interfaces for the 511PAConnect program so that operations staff could easily draw a designated impact area for a trapped queue situation, and have the system automatically generate the corresponding shape file that is used by PEMA to issue an IPAWS alert to impacted travelers and residents. He was responsible for building the interface with PEMA;

- **GeoTalker** – Casey developed the manual alert interface for GeoTalker. With this interface, alerts pertinent to static geo-located events can be entered and then announced to travelers when the get near the specified geolocation. He has adapted this interface to accommodate speed limit changes, runaway truck ramps, truck parking data, and moving work zone announcements;

- **Pennsylvania Turnpike Commission (PTC)** – The ability for the Pennsylvania Turnpike Commission to enter traffic event information into the ENS system was programmed by, and has been enhanced with multiple upgrades by Casey. Casey has been the primary programmer for interfacing this system with a number of third party data feeds including NOAA, INRIX and WAZE. He has also created portals for construction managers to enter lane closures, and then to pass this information to other systems that red-flag conflicting planned and unplanned closures. Casey develops APIs for accepting data and for delivering data. He has written the databases and programs that generate data feeds for the PTC to provide to the public. Casey also developed and maintains the toll calculator and the over dimensional truck permitting programs for the PTC;

- **Pennsylvania 511 System** – Casey was responsible for creating the web map and all the web map layers for the 511PA system. A key challenge for the system was to accept single video streams from each camera and securely reflect these streams to the public, and Casey developed the programming that made the video reliably delivered to PCs and mobile devices. As additional enhancements were requested,

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Casey designed and built the plow-truck tracker data interface and GIS layers. His final product is a dynamic, interactive plow truck layer that changes views at different zoom levels. Casey's ability to manage and display GIS data was instrumental in this implementation; and

■ Casey is assisted by Francisco Estevez, who has experience in software development for law enforcement and the legal community.

LEADING THE WAY

Matt Farrell
ATIS Technical Support - Mobile Apps & GIS Specialist

Education	Master of Computer Science; University of Illinois (Urbana-Champaign), Champaign, Illinois
	Bachelor of Science in Information Systems, Minor in Management; New Jersey Institute of Technology, Newark, NJ

Matthew Farrell has previously worked as a developer for the financial institutions Dow Jones and Vanguard, but during his past 8+ years he has been responsible for developing many innovative programs for the transportation sector. While he is responsible for the creation of the GeoTalker apps, he has also created a series of private apps which are used primarily by agency/business staff to help the organization achieve greater efficiencies and expense reductions. Matt has studied and actually developed cloud technologies. He works adeptly with systems and cloud provisioning technicians, offering guidance and devising new ways of leveraging cloud capabilities to achieve greater levels of automated provisioning making apps respond more rapidly to spiked demand.

Matt is the key person who develops geocentric advisory alert applications for both iPhone and Android that are utilized by domestic and international traffic agencies (Drive Safe WV, 511PA, SafeTrip NJ, etc.). He also provides entirely new modules and maintains major Pennsylvania Turnpike advisory-related programs. He developed traffic data processing systems for use on the back-end of the map, IVR, and mobile services which have been used for the PTC, PennDOT, VDOT and for the 511-in-a-Box product. Matt has also leveraged GeoTalker features for a connected corridor app with SUNY Avail and NJDOT.

Relevant Experience

- **Pennsylvania Turnpike Commission (PTC)** – Matt developed several systems for various aspects of central management, including an integration of website credit card payment processing, modules of the emergency notification system, human resources management system, SCORE commissioner secure document sharing, and others. His work to date has given him a clear understanding of what it takes to integrate tolled and non-tolled agencies into a single, cohesive ATIS;

- **Virginia DOT** – Matt developed the mobile apps for the I66 and I64 dynamic, congestion based tolling;

- **Distributed Systems** – Developed a distributed storage cloud system with socket programming, hash-based indexing for storage selection and rudimentary bloom filters for retrieval;

- **Advanced CS Research** – Conducted a usability and enhancement analysis on the Julia programming language to offer insight into current usage patterns of popular functions and syntax in Julia;

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- **Advanced Data Management** – Created a new index type for MongoDB (an R-Tree for n-dimensional polygons) and partially integrated it with the MongoDB source for research analysis; and

- Matt is assisted by Zarana Parmar who specializes in communications and data interfaces.

LEADING THE WAY

John L. Farrell, MPA, PMP
ATIS Implementation Manager - ATIS O&M Support Lead

Education	Ph.D. Candidate, Criminal Justice; Temple University, Philadelphia, PA
	Master of Arts in Security Studies (Homeland Defense & Security); Naval Postgraduate School, Monterey, CA
	Master of Public Administration; Villanova University, Villanova, PA
	Bachelor of Arts in Political Science; Villanova University, Villanova, PA
Certifications	Project Management Professional; Project Management Institute
	PMP Number: 1812474; Project Management Institute

John's tenure in the US Marine Corps (2000-2007) and local government (2005-2014) comes with an unrivaled knowledge of management practices for the public sector and how to apply them for an efficient implementation. Having served as a Deputy Managing Director for the City of Philadelphia, John is expert at developing and executing cross-agency and cross-departmental projects. At the City, John helped coordinate the delivery of city services in high-crime communities, managed a budget in excess of $20 million, oversaw the administrative functions for the Managing Director's Office, and was frequently assigned to integrate new programs in city operations. John's passion for technology, coupled with his in-depth knowledge of Information Logistics products makes him an ideal project manager for this 511 implementation. He has overseen the implementation of mobile applications for the Illinois Tollway (pilot program), the North Texas Tollway Authority (TrafficMate), and serves as the current project manager for 511PA. He has also overseen development & deployment of 511PAConnect. John brings a wealth of organizational government project management experience, as well as a passion to use technology to facilitate emergency preparedness and generally communicate with the local community.

Relevant Experience

Project Manager – PTC & PennDOT, 511PAConnect
John took the lead implementing Pennsylvania's new system for establishing two-way communications during trapped queue events. John was heavily involved in requirements gathering, overseeing development, and training agency staff.

Prior Professional Experience

Project Manager – Pennsylvania Department of Transportation 511PA
John took over as project manager shortly after the system was implemented, and has overseen the system's expansion. John has managed a host of upgrades, including: a major update of the 511PA mobile application; an expansion of winter service information that includes tracking individual plow trucks via the 511PA website; the development of project-specific, adaptive websites with real-time traffic data; the creation of custom sites for special events including the 2015 Papal visit to Philadelphia and the 2016 Democratic National Convention.

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Project Manager – Pennsylvania Turnpike Commission, via AECOM
As part of a larger contract with AECOM, Information Logistics was hired to build a custom project management tracking site for traffic operations projects. John served as the project manager for this complex build. The site incorporates user-friendly interfaces with a robust back-end system to manage and report progress on large, multi-year projects.

Project Manager – North Texas Tollway Authority
In 2015, the NTTA contracted with Information Logistics to provide our GeoTalker mobile app services. Marketed as TrafficMate, John oversaw the implementation of the app, which included several discussions to be sure that accurate information was conveyed, and proper mapping was applied to the geo-location services.

Military Experience

United States Marine Corps Reserve (2000 – 2007)
- E-6 / Staff Sergeant; and
- Combat tour in Operation Iraqi Freedom.

LEADING THE WAY

Beth Abruscato
ATIS QA/QC Lead

Education	Master of Business Administration, with a concentration in MIS; Temple University, Philadelphia, PA
	Bachelor of Science, Chemistry; University of Delaware, Newark, DE

Since 2000, Beth has been working with Mary Farrell, and has helped assure that quality products are accompanied by quality business and administrative management. Beth is also responsible for testing and documentation. Under her guidance and direction, implementation testing for the 511PA project was thorough and smooth, helping the short time-frame launch to happen with confidence that the deployment would work as expected. Beth also serves as project manager for the many ad-hoc custom programming projects that are requested by both PennDOT and the PTC, and assures correct functionality through her testing procedures.

Relevant Experience

Project Manager – Pennsylvania Turnpike Commission (PTC)
Since 2012, Beth has been the lead project manager for Information Logistics on most work for the PTC. Her scope of projects have included the development of websites, management consoles, emergency notification systems, procurement administration, human resources systems, secure communications channels for commissioner planning, and managed performance metrics. She has overseen the technological implementation of many high-visibility projects, including the original Trip Talk implementation, the redesign of www.paturnpike.com, several cashless tolling initiatives, Operation Orange Squeeze, internal safety initiatives, PTC University, All Ideas Matter, and a host of others. Beth's experience with the PTC gives her a unique knowledge and perspective of operations, and how a mobile cashless tolling application will need to integrate with existing systems, so that it does not overtax existing staff.

Prior Professional Experience

Project Manager – Pennsylvania DOT (PennDOT)
Information Logistics has sub-contracted to other vendors on projects for PennDOT. On several of these, Beth has been the project manager. She has managed web and mobile app development projects, including work for the State Transportation Innovation Council, and the implementation of a survey tool that was used to assist in garnering feedback on capital project plans for the Commonwealth. Her projects were known for delivering high degrees of quality, with intuitive, user-friendly interfaces. Her experience with these kinds of public-interfacing projects makes her an ideal addition to the team for implementing the mobile cashless tolling solution.

- **Admin and QC Management** – Beth and her QC team make sure that testing is done before passing the initial product for customer review and oversees test plan

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completion. She works closely with the project manager so that administrative and billing tasks are completed, documented and billed appropriately.

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Roman Sokolov
ATIS O&M Support - Web, App Layout and Design

Education	Associates Degree in Multimedia Design and Animation; Camden County College, Blackwood, NJ
	Studies in Programming – Visual Basic, SQL, Oracle, HTML; CSC Institute
Years of Experience	18+

Roman has more than 18 years of experience in web design, graphics, and animations. From web page to mobile applications, Roman produces creative and intuitive user interface designs.

Relevant Experience

- **Pennsylvania Turnpike Commission (PTC)** – Roman has done extensive design work for the PTC on a variety of projects. His design style and influence can be seen throughout www.paturnpike.com, including the main style sheet. He has also done project-specific work, ranging from iterations of Turnpike Mike, to animated videos for cashless tolling communications, to providing the web design to some of the Operation Orange Squeeze websites. He's also the force behind several of the PTC website's holiday and promotional animations;

- **GeoTalker** – Roman was the driving force behind the re-design of the GeoTalker mobile apps. Trip Talk, 511PA, and the others have received extensive modifications, and their user-friendly interface is there thanks to Roman's ingenuity. While each of the apps have similar layouts, Roman ensured that each had a look and feel that matched each agency's style and preferences;

- **Pennsylvania DOT** – Roman has also been responsible for high visibility projects with PennDOT, including: the evolving layout of www.511pa.com, the presentation of new features (like plow truck tracking) on the web map, and the implementation of an interactive survey tool that was used to assist in garnering feedback on capital project plans for the Commonwealth;

- Roman designs using a wide variety of tools, including: HTML5, JavaScript, Flash, Action Script, jQuery, AJAX/XML/JSON, CreateJS, HTML5 Canvas, Bootstrap, Adobe Suite (Photoshop, Illustrator, Premier, InDesign, After Effects, and Dreamweaver), Quark, Autodesk 3DS Max, and Microsoft Visual Studio; and

- Roman is assisted by Pankaj Makwana, a web designer and quality control specialist.

LEADING THE WAY

Thomas Burgoon
Video Account Manager

Education	Bachelor of Science, Economics 1995, Towson University, Maryland
Years of Experience	20+

Mr. Burgoon has more than 20 years' experience designing and apply comprehensive sales, marketing and distribution strategies to increase product visibility and market share. Mr. Burgoon has built a retail distribution network in mid-Atlantic and Northeast regions, and recruit dealers and provide the training and resources necessary to achieve maximum sales volume. He also led a professional 9-member team of analysts and auditors.

- Optimized performance of sales staff through the development of a competitive commission structure closely aligned with corporate revenue goals;

- Spearheaded multiple process improvement projects which streamlined operations, cut costs and improved profit margins; and

- Generate and implement creative marketing plans to drive new business.

Professional Experience
(March 2007 – Present)

Skyline Technology Solutions, Business Developer / Account Manager
Mr. Burgoon is responsible for developing, managing and supporting new and existing client relationships in the Transportation, Emergency Management and Public Safety markets around the country. Mr. Burgoon also lead efforts to develop statewide network and video sharing solutions for the State Departments of Transportation in Virginia, Pennsylvania, Tennessee, South Carolina, West Virginia and Washington DC. He currently supports the Pennsylvania Turnpike Commission, video sharing solutions and mobile video solutions.

Mr. Burgoon has worked with JHU/APL to help develop the National Capitol Region Video Sharing Framework.

His current and past clients include the Pennsylvania, Virginia, South Carolina, West Virginia, Tennessee, Michigan, Maryland, and Washington DC Departments of Transportation; Pennsylvania Turnpike Authority; Prince Georges County.

Prior Professional Experience

T & M Enterprises, Sales Executive
Designed and apply a comprehensive sales, marketing and distribution strategies to increase product visibility and market share. Built retail distribution network in mid-Atlantic and Northeast regions and recruit dealers and provided the training and resources necessary to achieve maximum sales volume. Mr. Burgoon also generated and

LEADING THE WAY

implemented a creative marketing plans to drive new business and gather data on competitive products and pricing. He visited key markets to provide supervision, leadership and product training to distributors and provide manufacturers with tactical recommendations for new product development based on comprehensive analysis of market.

Teksystems Inc. / Allegis Group
Premier provider of information technology and communications staffing and services.

Business Analyst, Quality Assurance / Organizational Development
Directed and coordinated operational activities for 80 field sales offices consistent with corporate goals, objectives, and policies. Implemented programs to ensure attainment of business plans for growth and profit and assure positive ROI. Audited and evaluated a broad variety of business functions to provide strategic recommendations for streamlining processes and improving profitability. Determined optimal support sequences. Evaluated possible savings and service improvements through use of new and improved methods and procedures.

Business Analyst, Innovations Team
Chosen to spearhead multiple projects targeting firms' long term goals, key performance indicators, management review processes, and communication models. Identified cost drivers and interviewed employees to generate strategic process improvement plans. Led multiple project teams providing members with the resources and training to ensure optimal performance.

- Elevated profits $3M through the conception and application of a comprehensive Purchase Order Tracking System tying contract hours directly to purchase orders; and

- Key contributor in deployment of a full upgrade of information systems to PeopleSoft.

Strategy / IT Manager of Operational Support
Developed technology solutions to address firm's operational needs. Conceived and implemented innovative programs which reduced operational expenses and increased profit margins.

- Served as resident expert and provided comprehensive training on PeopleSoft applications; and

- Architected a strategic project prioritization system which identified projects with optimal ROIs and allocated resources based on potential revenue.

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LEADING THE WAY

Michael Branan
Video Management Lead and Deployment

Education	Bachelor of Science in Information Systems (BS) with a concentration in Security, Johns Hopkins University
	Associates of Science in Information System Security (AS), Anne Arundel Community College, Magna Cum Laude
Certifications	Internet and Computing Core Certification (IC3)
	Microsoft Office User Specialist (MOUS) - Word 2002(XP)
	Cisco Certified Network Associate (CCNA)
Years of Experience	10+

Mr. Branan has over 10 years of experience in network engineering and software development. Michael is responsible for leading the software design, implementation, and testing of the Skyline appliance products and custom software developments provided by Skyline.

Mr. Branan also has over 3 years of Network and Systems Management for large scale commercial customers. He is a results-driven IT professional with Enterprise-level experience in the engineering, administration, and support of information systems. Mr. Branan has experience in the migration, troubleshooting, implementation, and documentation of small-scale to large-scale high availability networks. He has strong "hands on" technical knowledge with Cisco routers and switches (7600, 1700, 6500, 2900, and 3500 Series), Cisco PIX (500 series), Cisco WAE (512 & 612), SuperMicro Servers, Dell Servers, ISP1100 servers, Apple Xserve and Xserve RAID SAN, Hatteras (HN4000, and HN400 series) and Netopia, Flowpoint, Broadxent, Westell, and Efficient Networks routers and bridges. He also has strong interpersonal and communication skills with the ability to interpret complex topics.

Professional Experience
April 2007 – Present)

Skyline Network Engineering, LLC d/b/a Skyline Technology Solutions, Network Engineer
Mr. Branan is responsible for supporting network and systems related requirements for Skyline customers. He performs security vulnerability assessments and develops detailed analysis and reports of findings. He also provides network and systems support for a large ISP / datacenter in Baltimore city.

Mr. Branan leads a team of developers and testers who are responsible for the continuous evolution of the Skyline products and services and will ensure the implementation for MDOT follows the latest revision and design criteria.

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Prior Professional Experience

Layer8 Consulting, Network Engineer
As a Network Engineer Mr. Branan provided various security and network consulting services to companies in the Baltimore Washington area. He provided cross-vender testing, analysis, and recommendations for custom WAN Accelerator solutions. Tested WAN accelerator equipment from Juniper, Cisco, BlueCoat and RiverBed. Assisted in the deployment of WAN accelerators across a global network which include Data Centers in both the US and Europe. Solution enabled server consolidation, which resulted in a significant reduction of IT support costs. Performed security vulnerability assessments and provided detailed analysis and reports of findings. He worked with the customers IT staff to design a new global IP scheme; set forth a migration plan to new MPLS based backbone. In addition, he also designed, implemented, and documented a node configuration and IP management solution.

DataPoint, Network Engineer
As a Network Engineer Mr. Branan maintained the WAN network which included multiple upstream and downstream BGP peers and used IBGP and OSPF within the autonomous system. He monitored DataPoint's network using SNIPS, Syslog, and SNMP. Designed, tested, documented and deployed custom managed firewalls, VPNs, servers, routers, and SAN backup solutions. He developed product training material to be used by the Network Operations Center (NOC). Mr. Branan developed and implemented security policies for the internal office network. He maintained Honeywell Closed Circuit Video (CCTV) monitoring system. He maintained HID ProxCard system and access lists. Mr. Branan also maintained DataPoint's Email Servers and shared web hosting servers (both UNIX and Windows). He generated custom security, billing, and PBX reports as needed and provided Tier 3 support to the Network Operation Center.

Mr. Branan was also awarded as Employee of the Month for September 2005. In addition, he was recognized for consistently going "Above and Beyond" normal duties.

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LEADING THE WAY

Matt Szostek
Video Management Maintenance

SKYLINE
TECHNOLOGY**SOLUTIONS**

Education	Towson University – Computer Information Systems / Minor, Economics
Certifications	Production software deployments (Java, WebLogic, WebSphere, etc);
	SDLC models of Agile/Scrum, Waterfall, CI/CD, and RAD;
	Apache configurations;
	Monitoring and reacting to system alerts;
	Systems architecture and potential failure points;
	Familiarity with Cloud systems; AWS, AOL, Google Drive, etc;
	Educated/experienced in fundamentals of OOP using Java, C++, C#, .NET, PERL, PL/SQL, and VB;
	Source code editors (emacs, eclipse, VI);
	Development through HTML & XML as well as DOS/UNIX shell scripting; and
	JavaScript for ad tags and ServiceNow system deployments.
Expertise	**Technical Skills:**
	Operational Duties: Production software deployments (Java, WebLogic, WebSphere, etc)., SDLC models of Agile/Scrum, Waterfall, CI/CD, and RAD, Apache configurations, Monitoring and reacting to system alerts, Systems architecture and potential failure points, Familiarity with Cloud systems; AWS, AOL, Google Drive, etc.
	Operating Systems: Effective with Windows, Mac OSX, and UNIX/LINUX, Windows – 3.x, 95/98/2000/ME NT, XP, Vista, 7/8, 2003/2008 Server, UNIX/LINUX – Solaris SPARC, Redhat, Cent OS.
	Tools & Applications: Database management & tools: Oracle 9i/10g/11g, IBM's DB2, MS Access, & MySQL, Productivity: Google Docs (Drive), MS Office, MS Visio, Acrobat, Ticketing systems: JIRA, ServiceNow, ZenDesk and Remedy Web debugging tools: Fiddler, Wireshark, and Firebug.
	Engineering: Educated/experienced in fundamentals of OOP using Java, C++, C#, .NET, PERL, PL/SQL, and VB, Source code editors (emacs, eclipse, VI),Development through HTML & XML as well as DOS/UNIX shell scripting, JavaScript for ad tags and ServiceNow system deployments.
	Hardware support: Windows PC/Server & SUN maintenance, upgrades, repair, and troubleshooting, Basic network troubleshooting, analysis, and component/topology knowledge, Management of devices at remote data centers.
Years of Experience	10+

Mr. Szostek is a dedicated technology professional with 10 years of experience in Operations, Tech Support, and QA practiced in all SDLC aspects of production applications from design to post-release, including product sunset. He has a Passion for continuous improvement and operational excellence through the creation of technology efficiencies allowing proactive enhancements.

Mr. Szostek is resourceful and organized multi-tasker adaptable to the rapid introduction of new technologies and cited by executive management for excellent oral and written communication ability. He also practiced in core management disciplines of ITIL including Incident, Change, Request, Reporting, and Problem.

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Professional Experience
(November 2014 – Present)

Skyline Technology Solutions, Operations Manager
Mr. Szostek is Skyline's Product Operations Manager with his responsibilities including, managing a team of 6, building and maintaining relationships across Skyline's external DOT clients, oversees support of external clients on Skyline software/hardware in North America. He also is involved in recruitment and training of new employee team members. He applies ITIL policies in relation to Incident, Service, Knowledge, RCA, and Post Mortem management and serves as the steward in the role of Video Service Owner.

He composes weekly status and staffing reports regarding the state of operational wellness across Skyline product customers, review, edits, and enhancements of existing SLAs and writes Executive level (CEO, CTO, EVP's, etc.,) communications regarding high visibility issues. He also authors customer documentation including infrastructure/network diagrams, operating procedures, and systems and provides reporting and analysis of incidents and service work.

He also maintains relationships with Skyline's local and nationwide clients, procures new hardware and stewardship of hardware installed at remote data center(s) for both internally hosted and external clients and reviews Change Management requests, defines policy, and participate in CCB review meetings. Mr. Szostek also is responsible for maintaining and tracking available data center space and represents Skyline as a Senior representative at Summit Team meetings. Mr. Szostek has supplemented his knowledge through coursework, on/off site training seminars, and self-improvement books.

Prior Professional Experience

Advertising.com/Aol, Sr. Tech Manager
Mr. Szostek was the Sr. Tech Manager, for the Advertising Technical Support division. As the Sr. Technical Manager, he built and maintain relationships across AOL's internal advertising leadership stretching company verticals and international boundaries and oversee support of external/internal clients on Advertising products in North America, Europe, & Asia. His responsibilities included adherence to requirements for legal, regulatory, information security, and compliance.

He formed and managed an international team of 13 employees across 5 offices, 4 time zones, and 3 continents and was responsible for shepherding the safe and accurate flow of Billions transactions/day through the various ad systems utilizing a Hadoop/Big Data apparatus.

Advertising Technical Support, Associate Manager
Mr. Szostek was promoted to management after six months and granted supervision of three direct reports. His duties included, managing daily operations, providing expertise to external/internal clients on all products internationally. He also provided Tier 2 escalation support to internal customers, as well as members of Technical Support and

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guided members of Technical Support with business communications as operational issues arise.

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Clive Reece
Project Manager / Consultant / Technical Advisor

Education	PhD, Soil Science, Washington State University, Pullman, WA, USA, 1991
	MS, Agronomy, Cornell University, Ithaca, NY, USA, 1988
	BS, Plant and Soil Biology, University of California, Berkeley, CA, USA, 1983
Certifications	ArcGIS Desktop Associate 10.3
Years of Experience	27+

Dr. Reece joined Esri's Professional Services Division as a Project Manager / Consultant in 2004. Currently, Dr. Reece supports the Transportation Practice leading the project management and technical implementation of Esri Roads and Highways projects and solutions. This includes analyzing a client's business domain, documenting operational processes, and assessing technical integration opportunities with Esri technology. He has a background that combines scientific knowledge and technical expertise with business and organizational skills. Dr. Reece has been a consultant / project manager for many GIS projects around the United States and internationally.

Technical Capabilities:

Dr. Reece is an expert in technical consulting on geospatial projects involving: Business systems and gap analysis, GIS system design and architecture, ArcGIS desktop and online solutions, Geospatial database modeling, and Enterprise business system integration. His specific technical skills include the following:

- **GIS:** ArcGIS for Desktop, ArcGIS for Server, ArcGIS Geodatabase design and management, Geoportal Server.

Career Highlights:

- Senior project manager for implementation of Esri Roads and Highways and other transportation practice solution projects; and

- Technical Advisor for the Esri Enterprise Advantage Program.

Professional Experience
(2016 – Present)

Roads and Highways Implementation, Idaho Transportation Department (ITD)
Dr. Reece is managing a comprehensive Roads and Highways implementation project covering project planning, requirements and gap analysis, external business systems integration, geodatabase design, data conversion of Linear Referencing System (LRS) and road inventory data, LRS workflows, user acceptance testing, user training and documentation, and production rollout and support.

Prior Professional Experience

Roads and Highways Implementation, Georgia Department of Transportation (GDOT)

Dr. Reece managed and provided technical guidance on the first phase of an enterprise implementation of Esri Roads and Highways at GDOT. The scope included developing a comprehensive project plan, an enterprise system architecture design, business system requirements, data requirements, and gap analysis documents. The next phase of Linear Referencing System (LRS) data modeling, geodatabase design, and LRS maintenance workflow modeling is underway.

Roads and Highways Implementation, Indiana Department of Transportation (INDOT)

Dr. Reece managed this large Roads and Highways implementation project covering project planning, requirements and gap analysis, geodatabase design, data conversion of 6 years of Linear Referencing System (LRS) and road inventory data, external business systems integration, LRS workflows, user acceptance testing, user training and documentation, and production rollout and support.

Consulting, Departments of Transportation (DOTs)

Dr. Reece has provided consulting services to other departments of transportation (DOT). He provided a

Roads and Highways prototype, HPMS modeling, and project prioritization web application for the Idaho Transportation Department; HPMS modeling and prototyping for the Michigan Department of Transportation; Roads and Highways project coordination for the Minnesota Department of Transportation; Roads and Highways prototype for the Utah Department of Transportation; Roads and Highways prototype for the Carver County Public Works; Linear Referencing consulting for the Pennsylvania Turnpike Authority; geoprocessing tools design and development, and field collection tools for the Indiana Department of Transportation. He was the Technical Advisor for the BNSF Railway, Iowa Department of Transportation, and Maricopa County DOT.

GIS Support, Multiple Clients

Prior to supporting the Esri Transportation Practice, Dr. Reece lead many GIS projects involving complex implementation of Esri commercial off the shelf (COTS) and third-party technology. Dr. Reece also provided geospatial consulting in the area of Spatial Data Infrastructures, especially leveraging Esri desktop, server, and web technologies including ArcGIS Server, ArcGIS Online, and Esri Geoportal Server.

Geoplatform.gov and Geo.data.gov programs, U.S. Government

Dr. Reece provided project management and consulting services for the U.S. Government's Geoplatform.gov and Geo.data.gov programs. He coordinated with the prime contractor, REI Systems to achieve end-client goals. He led the team to customize ArcGIS Portal and Esri Geoportal Server in a cloud-based, high-availability environment.

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Geoplatform Website, National Oceanic and Atmospheric Administration (NOAA)

Dr. Reece assisted in developing and implementing the NOAA Geoplatform website. He led the team to customize ArcGIS Portal in an Esri Managed Services hosted environment.

Project Management, Smartronix

Dr. Reece supported project management and consulting services for Smartronix. He assisted in the Recovery Accountability and Transparency Board with enhancing the use of Geographic Information System (GIS) technology in the Recovery.gov website and back-end business processes. Work activities comprised of providing technical support to Smartronix on Recovery.gov enhancements, supporting development and hosting of Needs Maps to support Recovery.gov applications, managing development of a Recovery.gov mobile iPhone/iPad application (Awarded "Government Mobile App of the Year" for 2012 by GovTEK), and providing geospatial analyst support.

NCOneMap Website, North Carolina Center for Geographic Information

Dr. Reece provided Geoportal Consulting Services (training, implementation support, and customization) to North Carolina Center for Geographic Information for an upgrade to the NCOneMap site. He implemented a raster data download tool for statewide imagery.

GIS Products Platform Manager, Meteorlogix, LLC

Dr. Reece was a GIS products platform manager for Meteorlogix, LLC, in Minneapolis, Minnesota. He established and maintained the business growth of GIS-based weather applications from early market to the establishment of million-dollar annual revenues. He supported strategic business development and high-profile sales with solution-oriented consulting, technical marketing, and research for the following markets: water management, public safety, defense/intelligence, electric utilities, and transportation. He coordinated product management internal processes across departments (sales, marketing, development, accounting, and customer service). He established overall product development plans aligned with sales goals and long-term business growth. He created application prototypes, and he increased company brand awareness through oral presentations and written articles.

GIS Research Specialist, Kavouras Inc.

Dr. Reece worked for Kavouras, Inc., in Minneapolis, Minnesota, first as a GIS research specialist and then as the developer of GIS weather software. In the latter position, he developed the concept of weather-enabled decision support, conducting custom consultations with clients for GIS-based weather decision support applications. He also co-developed a GIS-based weather alerting and decision support application for Union Pacific Railroad. In the former position, he increased sales by developing and implementing procedures for utilizing high-resolution, low-cost satellite imagery and digital elevation models into broadcast media workstation products. He also reduced operating costs by implementing new data contracting and software procedures.

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Assistant Professor, University of Minnesota

Dr. Reece was an assistant professor of environmental biophysics at the University of Minnesota, Saint Paul. He planned and directed basic and applied research on biometeorology, water and chemical transport in soils, and the environmental impacts of agriculture. He later published the results of this research. He taught courses and seminars to undergraduate, graduate, and adult students in the Environmental Science and Soil Science programs. As a member of the Bush Program for Faculty Excellence in Diversity and Teaching, he also provided training on diversity issues, conflict resolution, and teaching methods. He participated in 14 project teams. As the project leader in eight of these teams, he coordinated and supervised employees to accomplish project goals within budget and on time. He also prepared grant proposals in response to requests for proposals, generating more than $650,000 in external.

Employment History

- **Esri:** Consultant / Project Manager (2004 – Present);

- **Meteorlogix, LLC:** GIS Products Platform Manager (2001 – 2004);

- **Kavouras Inc.:** GIS Research Specialist (1999 – 2001); and

- **University of Minnesota:** Assistant Professor (1991 – 1999).

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James McAbee
Solution Engineer/Enterprise Architect

Education	MS (Systems Engineering), Harrison University, Harris, IL 1999
	BS (Major): Computer Systems Engineering, University of Gloucester, Gloucester, VA, 1999
Certifications	ArcGIS Desktop Associate;
	Enterprise Geodatabase Management Associate;
	Enterprise Geodatabase Management Professional;
	Enterprise Administration Associate; and
	Enterprise System Design Associate.
Years of Experience	32+

Mr. McAbee joined Esri in 1994. Currently, Mr. McAbee works on the Transportation Practice team assisting transportation focused customers with ArcGIS Platform, Enterprise GIS, and Geodata Management architectures and workflows. He has over 28 years of experience in projects that use GIS and remote sensing technologies, with 18 of those years specializing in Enterprise GIS platform architectures and Geodata management technologies relating to spatial data editing, storage, and management. He has also assisted in the development of the Esri Enterprise Geodata Management Associate, Professional and Enterprise Administration Associate Certifications.

Technical Capabilities:

Mr. McAbee has significant experience in solution architecture specifically for transportation clients. He has designed and programmed custom database applications, provided technical support, and conducted Esri certified training courses, including the introductory and advanced courses related to editing and managing the Geodatabase and supported RDBMS platforms. This includes participating in the creation of the Esri Enterprise Geodata Management Associate professional certification being introduced in 2011. His specific technical experience includes the following:

- **GIS:** ArcGIS Desktop, ArcSDE;

- **Programming:** Visual Basic, Python; and

- **Operating Systems/Servers/Database technology:** Windows Server, Redhat/SUSE Linux and UNIX platform versions, including the Solaris, Hewlett-Packard–UNIX (HP–UX), and Advanced IBM UNIX (AIX) platforms Oracle, SQL Server, and Web server spatial application configuration and tuning include the tuning of indices, spatial indices, I/O, and hardware (SAN and storage devices). Private and cloud virtualization platforms including VCE Vblock, Amazon and Azure. Oracle SQL, SQL Server T-SQL, DB2 SQL. Oracle 10g thru 12c; SQL Server 2005 through 2014; DB2 Universal Database (UDB) 7.x thru 9.x databases, and PostgreSQL.

Career Highlights:

- Extensive Geodatabase and ArcSDE experience assisting customers worldwide;

- Specializing in Enterprise and Geodatabase Architectures and data management workflows;

- Emphasis on Transportation, Architecture, Engineering, and Construction (AEC), and Commercial industries;

- Virtualization technologies and Cloud Deployments; and

- Oracle, SQL Server, PostgreSQL, and DB2 advanced configurations and performance tuning.

Professional Experience

(2011 – Present)

Transportation Practice – Senior Architect, Esri
Mr. McAbee is the Senior Architect for the Transportation Practice for the ArcGIS Platform, Transportation Solutions, and Geodatabase and related Geodata Management technologies. Mr. McAbee does consulting and provides technical support for numerous projects that manage geographic data and location in combination with Oracle 10g thru 12c; SQL Server 2005 through 2014; DB2 Universal Database (UDB) 7.x thru 9.x databases, and PostgreSQL.

Prior Professional Experience

Health check and Enterprise Architecture Reviews, Multiple Departments of Transportation (DOT) and Engineering Firms
These health check and enterprise architecture reviews included the assessment of all GIS technology assets, applications, and data management workflows. These have included workshops with CA DOT (Caltrans), Virginia DOT, New York State DOT, Alabama DOT, Rhode Island DOT, Oregon DOT, Nevada DOT, Alaska DOT, Idaho DOT, District of Columbia DOT, and Kentucky DOT (Transportation Cabinet). Mr. McAbee has also provided health check, architecture, and data management guidance to Ohio DOT, Colorado DOT, Pennsylvania DOT (PennDOT), Vermont DOT, Maine DOT, Delaware DOT, Massachusetts DOT (MassDOT), New Hampshire DOT, New Jersey DOT, Connecticut DOT, Georgia DOT, Maryland State Highway Administration, and several Turnpike Authorities and Railway companies. These were done through single to multi-day interactive workshops conducted covering various tasks including: troubleshoot existing performance issues, review current architecture and configurations, gather business unit needs, technology needs, and provide knowledge transfer. This included a 3-day data management workshop at one of the major state DOT's in the southeast United States, a 4-day health check enterprise GIS architecture workshop with AK DOT, and continuation of previous work with PennDOT on a mobile field data collection application for local roads and bridges information. This work also involved advisement to DOTs on their current asset management systems integration with their spatial data

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assets managed in geodatabases and implementation of Esri's Roads and Highways Solution.

Geodatabase replication, A major world-wide inter-governmental organization
This work included cross continent Geodatabase replication and synchronization architecture, testing and workflows. Other work included development of upgrade and migration plans for various customers of ArcGIS Server and Geodatabase architectures. This included assistance to some of the major cities and counties across the United States, including assistance to the 4th largest county in the U.S. and their management of approximately 2 million parcels in a Parcel Fabric in a Postgres based Enterprise Geodatabase. Assistance was also provided to the New Hampshire (NH) Department of Public Safety on their Geodatabase and server architectures and field data management workflows, including assistance in configuring a highly available environment for a road closure application. Versioned Geodatabase advisement and performance tuning assistance for the U.S. Forest Service and other customers related to management of versioned geodatabases and performance tuning of their databases. This included the development and tuning of SQL queries for various spatial analytic functions using RDBMS spatial data types and views.

Employment History
- **Esri:** Solution Engineer/Architect (1994–Present);
- **Intergraph:** Product Marketing Manager (1988–1994);
- **Stone and Webster Engineering:** GIS Analyst (1987–1988); and
- **State of Massachusetts, Metropolitan District Commission:** GIS Analyst (1986–1987).

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Robert Meyering
Technical Lead

Education	PhD, Soil Science, Washington State University, Pullman, WA, USA, 1991
	MS, Agronomy, Cornell University, Ithaca, NY, USA, 1988
	BS, Plant and Soil Biology, University of California, Berkeley, CA, USA, 1983
Certifications	ArcGIS Desktop Associate 10.3
Expertise	**Skills:**
	Project management;
	Graphical user interface design;
	Software development; and
	Information technology/system architecture infrastructure design.
Years of Experience	27+

Mr. Meyering is a senior technical lead with Esri. He is responsible for managing the technical aspects of large projects and associated teams. Mr. Meyering also serves as the technical program manager for Esri's Roads and Highways projects.

Technical Capabilities:

Mr. Meyering is a well-rounded technical expert in application design and development. His specific technical skills include the following:

- **Esri Arc Technologies:** desktop, extensions, server, AGOL, AGOL for Organizations, and mobile (ArcGIS for iOS/Android SDKs), Collector for ArcGIS, Esri Maps for SharePoint;

- **Programming:** Microsoft C#, VB, VC++, WPF, WCF (Hosted/Self-hosted), REST, SOAP, PHP, Apple iPhone/iPad / Objective C, Android development; and

- **Design:** Adobe Flex, Flash Builder, Creative Suite, tergraph/MicroStation/TurboCAD.

Career Highlights:

- Technical program manager for Esri's Roadsand Highways projects; and

- Technical lead for the Gates Foundation Polio Immunization Project, overseeing and managing all technical aspects of the project.

Professional Experience
(2015 – Present)

MaPPS, Massachusetts Department of Transportation (MassDOT)
Mr. Meyering directly developed deliverables as well as supervised the development team that designed and built a solution to enable environmental project submittal, and screening of DOT projects relevant to the MassDOT MaPPS application. He is managing and overseeing all technical aspects of the project.

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Prior Professional Experience

SpotOnline, North Carolina Department of Transportation (NCDOT)
Mr. Meyering directly developed deliverables for the NCDOT SpotOnline Project. He supervised the development team that designed and built a solution to enable strategic project submittal, scoring, costing and prioritization of DOT projects. He managed and oversaw all technical aspects of the project.

Transportation Projects, Multiple DOT Clients
Mr. Meyering supports numerous Esri customers through direct onsulting, technical design, and project delivery as a Technical Program Manager. In this capacity, he supports Esri project team members and DOT customers such as NYSDOT, MnDOT, GDOT, AKDOT, NVDOT, INDOT, ALDOT, WVDOT, CDOT, RiDOT, MassDOT, OHDOT and VDOT. He ensures that technical resources are aligned, system architecture, design, and external system integration can be supported, and alignment between the Roads and Highways product roadmap and DOT project needs are balanced. All of these engagements have involved LRS, Road Inventory, HPMS, and Web GIS requirements, design, and prototyping support. In Ohio, Mr. Meyering led the design of an in-vehicle Crash Location Application and in Alaska he led the development of a Safety Analysis and Location Coding Application.

Polio Immunization, Gates Foundation
Mr. Meyering directly developed deliverables as well as supervised the development team that designed and built a solution to capture, analyze, and visualize data relevant to the Gates Foundation Polio Immunization Project. He managed and oversaw all technical aspects of the project.

Land Use Solution, Department of the Government of the Hong Kong Special Administrative Regions
Mr. Meyering led a development team that successfully designed and built a solution for the Lands Department of the Government of the Hong Kong Special Administrative Regions to manage some of the most complex land use in the world. The project supports more than 500 users in 11 district offices, thousands of business transactions, and more than 14,000 maps and plans created monthly.

Employment History

- **Esri:** Technical Lead (2000–Present);

- **C.F. Braun, Inc.:** CADD Systems Manager (1982–1990); and

- **Fleetwood Enterprises, Inc.:** CADD Developer (1977–1982).

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4.3.1.11   *Copies of any staff certifications or degrees applicable to this project*

Team Q-Free staff certifications can be found in the page to follow.

THIS IS TO CERTIFY THAT

John L. Farrell
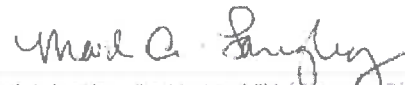
HAS BEEN FORMALLY EVALUATED FOR DEMONSTRATED EXPERIENCE, KNOWLEDGE AND PERFORMANCE
IN ACHIEVING AN ORGANIZATIONAL OBJECTIVE THROUGH DEFINING AND OVERSEEING PROJECTS AND
RESOURCES AND IS HEREBY BESTOWED THE GLOBAL CREDENTIAL

Project Management Professional (PMP)®

IN TESTIMONY WHEREOF, WE HAVE SUBSCRIBED OUR SIGNATURES UNDER THE SEAL OF THE INSTITUTE

Caterina La Tona · Chair, Board of Directors

Mark A. Langley · President and Chief Executive Officer

PMP® Number:

PMP® Original Grant Date: 30 April 2015

PMP® Expiration Date: 29 April 2021

PMI.
Project Management Institute

4.3.2. Mandatory Qualification/Experience Requirements

The following mandatory qualification/experience requirements must be met by the Vendor as a part of its submitted proposal. Vendor should describe how it meets the mandatory requirements and include any areas where it exceeds the mandatory requirements. Failure to comply with mandatory requirements will lead to disqualification, but areas where the mandatory requirements are exceeded will be included in technical scores where appropriate. The mandatory qualifications/experience requirements are listed below.

4.3.2.1 References (minimum 3, maximum 5 references) (no WVDOH references permitted), including name, agency, address, phone and email.

Q-FREE REFERENCES

Pennsylvania Department of Transportation (PennDOT) ATMS/ATIS Deployment

Terrell M. Martin
IT Project Manager
400 North Street 8th Floor
Harrisburg, PA 17120
T: 717-705-1575
Email: terrellmar@pa.gov

Ryan McNary
Acting Manager TMC Operations
Bureau of Maintenance & Operations
1310 Elmerton Ave
Harrisburg, PA 17110
T: 717-3464404
Email: rymcnary@pa.gov

Scott Benedict
Functional Architect – Consultant
Bureau of Maintenance and Operations
400 North Street 6th Floor, Harrisburg, PA 17120
T: 717-783-1903
Email: c-sbenedic@pa.gov

Virginia Department of Transportation (VDOT) Northern Virginia ATMS/VDS and Data Gateway Deployment / Statewide ATMS Implementation

Ken Earnest, P.E.
Assistant Division Administrator
Virginia Department of Transportation
1401 East Broad Street,
Richmond, VA 23219
T: 804-786-9743 / 804-263-4867 (cell)
Email: Ken.Earnest@vdot.virginia.gov

Name: John Shaw, Transportation Technology Manager
VDOT Central Office
1401 E. Broad St.
Richmond, VA 23219
T: 804-786-2839
Email: John.shaw@vdot.virginia.gov

Illinois Department of Transportation (IDOT) District 4 OpenTMS Deployment

Eric Howald
Operations Engineer
Illinois Department of Transportation District 4
2300 S Dirksen Pkwy, Springfield, IL 62764
T: (309) 671-4481
Email: eric.howald@illinois.gov

ILOG REFERENCES

Pennsylvania Turnpike Commission

Lorie Gray
700 S. Eisenhower Blvd.
Middletown, PA 17057
T: 717-831-7720
Email: lgray@paturnpike.com

SKYLINE REFERENCES

Maryland State Highway Administration (SHA)

Name: Rick Dye, CHART Systems Administrator
707 North Calvert Street
Baltimore, Maryland 21202
T: 410-582-5619
Email: rdye@sha.state.md.us

4.3.2.2 Descriptions of past projects completed entailing the location of the project, project manager name and contact information, type of project, and what the project goals and objectives were and how they were met. (minimum 3 projects completed/in operation in the past 5 years)

PENNSYLVANIA DEPARTMENT OF TRANSPORTATION (PENNDOT) ATMS DEPLOYMENT

Dates:

September 2012 - Present

Project Manager:

Jeff Stowe

Description of Project:

In 2012, Q-Free was selected to design and implement the ATMS/ATIS platform for PennDOT around OpenTMS. The project began in September 2012 and over the course of three deployment phases, Q-Free transitioned all 11 districts over to the new statewide ATMS.

The ATMS/ATIS platform project includes services to design, develop, implement, test, maintain, and support a single statewide platform to promote coordinated traffic management and operations across the Commonwealth. The project has deployed to all the Pennsylvania regions achieving their goal of a statewide system. The initial contract completed on time and on budget at the end of August 2017. We are currently in a two-year renewal period. The system supports intelligent responses to incidents and planned events, shared control of all existing and future ITS field devices, data fusion and travel time computation, and integration with existing PennDOT systems, business partners, and adjacent state systems. In addition to managing the ATMS deployment, the project has also included various task orders, such as an Integrated Corridor Management module, and scheduled enhancements.

The PennDOT ATMS/ATIS platform is a fully centralized web-based solution accessible by PennDOT staff across the state. The system is hosted at the PennDOT Server Farm in Harrisburg and maintained by PennDOT IT Staff who are responsible for providing the hosting platform, handle all installations, and provide tier 1 support. So far, OpenTMS controls over 1600 ITS field devices with modules deployed for dynamic message signs, highway advisory radio, traffic detector stations, and CCTV. OpenTMS is integrated with the statewide condition reporting system (RCRS) to coordinate planned event and incident management. Events are managed within RCRS, but operators use functionality in OpenTMS for resource planning (device scheduling) and rules-based automated incident response. The OpenTMS travel time engine generates statewide travel times that are displayed on message boards.

Enhancements to the system include a freeway service patrol log, data fusion hub for EZPass tag readers, and an integrated corridor management module that will be used by District 6 to better manage congestion associated with major construction projects along I-95.

VIRGINIA DEPARTMENT OF TRANSPORTATION (VDOT) NORTHERN VIRGINIA ATMS AND DATA GATEWAY DEPLOYMENT / STATEWIDE ATMS IMPLEMENTATION

Dates:

2002-Present

Project Manager:

Dan Skiffington

Description of Project:

In September 2016, Q-Free was awarded a sole-source contract by VDOT to develop their statewide ATMS platform around OpenTMS after a significant contract default by one of VDOT's service providers. This ATMS project has a very aggressive schedule and highly complex business requirements. The Statewide ATMS project includes services to design, develop, implement, test, maintain, and support the statewide platform. The VDOT Statewide ATMS is a fully centralized web-based solution accessible across the state (5 TMCs operating off a centralized database structure). The system is implemented on a high-availability, fully redundant architecture, including a secondary hosting site (in Atlanta, GA), designed for 99.99% annual uptime. Q-Free is the process of transitioning VDOT's ATMS solution from disparate regional systems to a fully integrated statewide system and decommissioning several legacy systems (Parsons, I-66 corridor system and Kapsch's, Hampton Roads System, Dynac) and migrating other external applications previously built by Q-Free (including statewide Condition Reporting System and Lane Closure Management System) by integrating their functionality into OpenTMS. In 2017, Q-Free has transitioned 3 out of 5 TMCs onto the statewide platform and is on track to transition the remaining 2 regional centers in 2018. Q-Free provides on-site service assurance managers at each regional center, as well as the 24/7 Tier 2/Tier 3 on-call support. Several of VDOT's Statewide ATMS enhancements will be included in I-66 OTB's ATMS solution.

Q-Free has been providing ATMS services to VDOT since 2002 having deployed OpenTMS at the Richmond TMC in 2002, Staunton in 2004, Salem in 2005, and Northern Virginia (Fairfax MPSTOC) in 2009. Q-Free has provided numerous system integrations and deployed additional statewide systems including the Lane Closure Advisory Management System (LCAMS) and statewide condition reporting system (VaTraffic) and 511 integration working with Iteris.

- Dynamic Message Signs (Fixed and portable);
- Closed Circuit Television (CCTV);
- Video Wall Control;
- Traffic Sensors;
- Truck Parking;
- Work Zone Management;

- Congestion Pricing Interface;
- Incident Management and Response;
- Roadway Weather Information System (RWIS);
- 911/CAD Integration – Virginia State Police;
- Integration with RITIS (Maryland); and
- Data Warehousing and Reporting.

Table 2 - Northern Virginia Enhancement Projects

VDOT Enhancements Work	Description
Gate Control System	Q-Free designed and implemented a gate module to control and manage gate groups along I-495, I-95, and I-395 in northern Virginia.
Lane Control System	Q-Free designed and implemented a lane control module to control and manage lane control signs along I-66 to support hard shoulder running.
Ramp Meter Module	Q-Free designed and implemented a ramp meter module.
I-495 Express Lanes TMC Data Integration	Q-Free created a bi-directional integration between the I-495 Express Lanes TMC data and the Norther Virginia TMC. This integration enables real-time data sharing between VDOT and TransUrban, the operator of the Express Lanes.
911/CAD Integrations	Q-Free has integrated 16 separate CAD systems from VA State Police and 911 centers across the state into our Virginia OpenTMS deployments to support statewide operations. The integration included new CAD systems in Northern Virginia over the past three years.
Transportation Video Distribution (TVD) Enhancements	TVD is a statewide, integrated data warehouse. It collects and normalizes a wide range of traffic date in near real- time. Q-Free, as a subcontractor to the project, provides the backbone of the TVD system. As the integrators and managers of all TVD data, Q-Free supports all aspects of the project including the ATMS/ATIS platform 511 system (IVR/Web/Mobile), statewide data and video sharing, and revenue generation. Q-Free' role on the TVD project included deployment of a statewide data hub and travel time engine.

ILLINOIS DEPARTMENT OF TRANSPORTATION (IDOT) DISTRICT 4 OPENTMS DEPLOYMENT

Dates:

July 2009-Present

Project Manager:

Christopher Evans

Description of Project:

The 12-mile reconstruction of I-74 through Peoria and East Peoria was the largest road construction project outside the Chicago area undertaken by the Illinois Department of Transportation (IDOT). ITS technologies and strategies were planned, designed, and implemented to enhance the operations and management efficiency of the corridor, both during and after construction. In 2008, IDOT sought to integrate of all field components of the Peoria area ITS, including DMS, surveillance cameras, highway/rail interface, and detector stations into a central Advanced Transportation Management System (ATMS) software package. The requirements for the ATMS solution included:

- Video and data consolidation and distribution to ITS operators and stakeholders;
- ITS data consolidation and distribution to the traveling public using DMS, an external web page with congestion maps and video images, and the media; and
- A mechanism to export incident data from the Peoria and East Peoria CAD systems for use with the ATMS software.

IDOT undertook a procurement process with extremely aggressive milestones for deploying and testing the new ATMS. Within 120 days of contract award, the contractor was expected to install the ATMS with a minimum 50% functionality for initial testing and verification. The full system was expected to be operational within ten months of contract award.

Q-Free submitted the winning solution by developing an aggressive project plan around the installation and configuration of OpenTMS Enterprise, the industry leading off-the-shelf ATMS. OpenTMS provides out-of-the-box support for all major ITS device protocols and is designed to quickly integrate with ITS field-devices including video cameras, DMS, traffic detectors, and weather stations.

Q-Free deployed a fully functional and secure system that enables Department of Transportation operators as well as system users from East Peoria Public Works, East Peoria Emergency Services, Peoria Public Works, and Peoria Emergency Services full access to system functions. The solution was built around OpenTMS Enterprise and includes a public traffic web page, incident and work zone management, and device command and control.

System Elements:

- OpenTMS Enterprise Rapid Deployment;
- 911 Integration;
- Regional ITS Systems Integration;
- Interface with Existing Video Wall;

- Traveler Information Web Site; and
- Remote Workstations Deployed at Partner Agencies.

Cost-Effective, Scalable Architecture:

- Hosted solution; and
- Fully maintained.

Support and Maintenance:

- 24x7x365 Support; and
- System Maintenance.

We are currently under Task to upgrade their OpenTMS version 7 system to our latest web-enabled version of OpenTMS. This wraps up late Spring of 2018.

ILOG EXPERIENCE

PennDOT – 511PA

The company's most comprehensive traveler information integration to date is the statewide 511PA website, IVR, subscriber services and mobile app suite, provided as Software-as-a-Service (SaaS). The 511PA system launched for the Pennsylvania Department of Transportation (PennDOT) in February of 2014 in just 76 calendar days from the notice to proceed. Each component of the PA511 suite of services scales-on-demand to handle large increases in traffic, ranging from weather events (such as the blizzard in January 2016) to special events (such as the visit of Pope Francis to Philadelphia).

Prior to the ILOG relaunch of the 511PA site, there had been a maximum annual unique visitor count of fewer than 200,000. In the next full year after the ILOG relaunch (2015), the site had approximately 700,000 unique visitors. In 2018, the website had more than two million unique visitors. The increased usage can be attributed to making the site mobile responsive and adding new features that were useful to the public. Details of these new functions that are part of the 511PA program will be outlined in further detail in this response.

Of greater significance for the relaunched 511PA system is the impact of a major state-wide weather event and the ability of the system to respond to the increased demand. On just one day of the January 2016 blizzard (Saturday the 23rd), the website recorded more than 173,000 sessions, with almost 70% coming from mobile devices. That morning, the site was supporting nearly 1,800 simultaneous users. The following day, IVR usage spiked to 5,433 calls - a 578% increase over the average daily call volume for 2015. The ILOG systems scaled appropriately and remained responsive throughout. The single day session record has been broken each successive year, peaking in November 2018 with a single day of over 266,000 sessions, which included 4,000 simultaneous users.
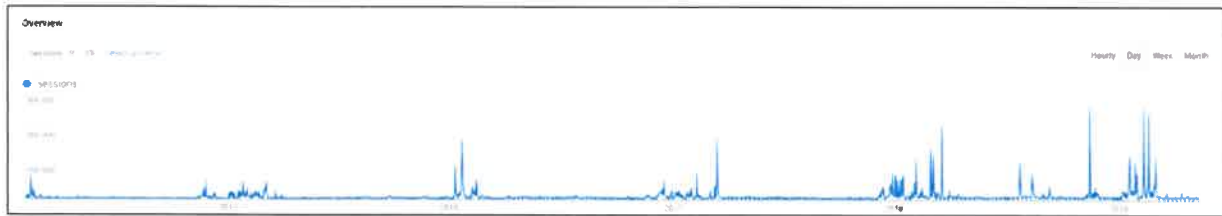
Figure 11 - 511PA Website Sessions, Feb. 2014 – May 2019

The mobile app component of the 511PA Program is another hands-free, eyes-free mobile app, which uses the same GeoTalker platform used by the Pennsylvania Turnpike TripTalk app, and by all other agency GeoTalker mobile apps. Since initiation, the 511PA program has been enhanced to include features such as the ability to track plow trucks on the 511PA web map and being able to check a driving route for traffic events, including last plow truck visit through trip segments.

In 2016, the 511PAConnect program was developed by Information Logistics as part of a joint initiative with PennDOT, the Pennsylvania Turnpike, PEMA and PSP. The objective of 511PAConnect was to establish two-way emergency communications to assist travelers impacted by a trapped queue/closure, without the need for a mobile app, but using a mobile device.

Pennsylvania Turnpike Commission

Information Logistics is responsible for many aspects of the PTC's traveler information infrastructure, including www.paturnpike.com. While ILOG has held the contract since 2012, a major overhaul of the site's design and UI happened in 2015. The current version is user-friendly and has many of the same features that requested in the PennDOT 511 RFP. ILOG also designed and maintains the PTC intranet, which included an integration with the traveler alert ticker from the PTC traveler information web site.

ILOG has also created both public and private mobile apps for the PTC: public mobile apps for interagency/interoperable 511/Traveler Information Services (TIS) delivery, and private mobile apps to support internal maintenance functions and roadway reporting. The TripTalk mobile app was developed for the Pennsylvania Turnpike to deliver real-time travel alerts to drivers as they approach the affected area by using the device's geo-location capabilities to determine which roadway events are relevant to each driver, as the drivers move across the highway. The mobile app system includes a manual entry web application, which can be used for everyday travel alerts, or for "fast track" alerts, which are information delivered to drivers when they are very close to a specific geography, regardless of the settings that the driver has selected on the app. These fast track alerts are currently being used to announce curve warnings and speed limit changes and reflect the system's ability to identify and act accordingly on the user's geographic location.

The ILOG team also developed and hosts other services and applications for the PTC, including; a web portal for incident/event management (Emergency Notification System) including WAZE data feeds; adaptive websites for special projects (e.g. cashless tolling, major construction projects); a bi-directional Interactive Voice Response (IVR) telephone system including an IVR toll calculator module; an automated traveler subscription services (with automatic Twitter postings); an authenticated portal for sharing information among agencies and vendors; commercial over-dimensional vehicle permitting; online payments; employment application and management; RFP/Bid posting automation; contract administration for Right-to-Know

compliance; and a web-based project management tool to organize/track/report on traffic engineering and operations initiatives. ILOG has also integrated a contact management program with most of these applications.

New Jersey Turnpike Authority

While Information Logistics' resume contains a variety of projects for transportation agencies, the team may be best known for mobile applications that comply with anti-distracted driving regulations by supporting hands-fee, eyes-free information delivery. One unified geo-centric platform (called the GeoTalker™ platform) supports apps such as Trip Talk for the Pennsylvania Turnpike Commission (PTC), 511PA for PennDOT, Drive Safe West Virginia for WVDOH, Safe Trip NJ for NJ Turnpike Authority/NJ DOT, and Traffic Talker England for Highways England. Each implementation of these mobile apps brought with it unique challenges to integrate the data for each agency, and unique opportunities for providing specialized traveler information services. The New Jersey Turnpike Authority has added expanded features to their mobile app including streaming cameras, integration with Google and Waze, and cross jurisdictional alerting.

State University of New York (SUNY)

ILOG is also involved in a connected corridor project with the State University of New York and NJDOT. The project involves gathering information from multiple sources along the New Brunswick Rt. 1 and Rt. 18 corridors and providing a comprehensive travel experience and decision support package. ILOG's GeoTalker platform is being used as the consumer distribution mechanism for this pilot program. This app, based off the Safe Trip NJ app, has features for parking, transit locations and schedules geocentric to the user, and virtual DMS. All of these projects were implemented by the ILOG staff who will also design and maintain the WVDOH ATIS services required in this RFP.

SKYLINE VIDEO SHARING EXPERIENCE

Skyline Technology Solutions provides the most qualified, experienced video expertise in the ITS market to deliver video sharing infrastructures. Skyline has delivered statewide video sharing systems for ten (10) states and many cities and counties within those states and a regional emergency management video network for the Mid-Atlantic region. Our experience includes:

- **New York** – 1,100+ cameras (MGEG2, MPEG4, H.264), 20 source agencies, 70+ consumer agencies;
- **Maryland** - 1,000+ cameras (MGEG2, MPEG4, H.264), 20 source agencies, 70+ consumer agencies;
- **Virginia** - 1,000+ cameras (MGEG2, MPEG4, H.264), 10+ source agencies, 50+ consumer agencies, hosted solution;
- **Tennessee** - 525 Cameras (MGEG2, MPEG4, H.264), 4 regions, 20+ consumer agencies, hosted solution;
- **Pennsylvania** - 900+ cameras (MGEG2, MPEG4, H.264), 12 regions, 50+ consumer agencies;
- **Missouri** - 391 cameras (MGEG2, MPEG4, H.264), 2 regions, on-premise, locally hosted;
- **Washington D.C.** - 140+ cameras, (MGEG2, MPEG4, H.264);
- **West Virginia** - 50+ cameras;

- **South Carolina** - 333 cameras, 4 regions, hosted solution;

- **Michigan** – 500+ cameras, 4 regions, 30+ consumer agencies;

- **Maryland Coordination and Analysis Center (MCAC)** – 12,000+ cameras, 1,700 agency users across Virginia, District of Columbia and Maryland; 30 state, local and federal agency partners, including local school districts;

- **Iowa DOT** – (Under contract) – 7 regions, 500 cameras; and

- **Dallas Region Pilot Project** – 100 cameras, source cameras from 2 TxDOT district TMC's and Cities of Arlington and Grand Prairie. Hosted and on-premise solution.

SKYLINE - DESCRIPTIONS OF PAST PROJECTS

Virginia Department of Transportation

Virginia DOT (VDOT) is a leader in providing ITS information to the traveling public. In an effort to consolidate this information into one contract, VDOT issued a competitive RFP to select a new team to provide Video, Data, and other information to the public. The goal was to select a team that could provide cutting edge technology for IVR, Website, Mobile Video and data distribution. Since completion, additional cities and agencies throughout Virginia have continued to share cameras on the state platform and also benefit from viewing cameras from other agencies, resulting in a system that has grown to over 1,100 cameras.

Challenge:

- Initially Ingest 700+ Traffic Management Cameras from five (5) Traffic Operations Centers dispersed through the State of Virginia. Total now over 1,000 cameras.

- Distribute Live Video to the Public via a 511 Website and Mobile Application

- Distribute Live Video to the Media Partners, via a secure web portal and provide a viewing platform and access to a Dynamic API

- Distribute Live Video to the Media, agency Partners and first responders, within the State of Virginia and bordering States via a secure portal
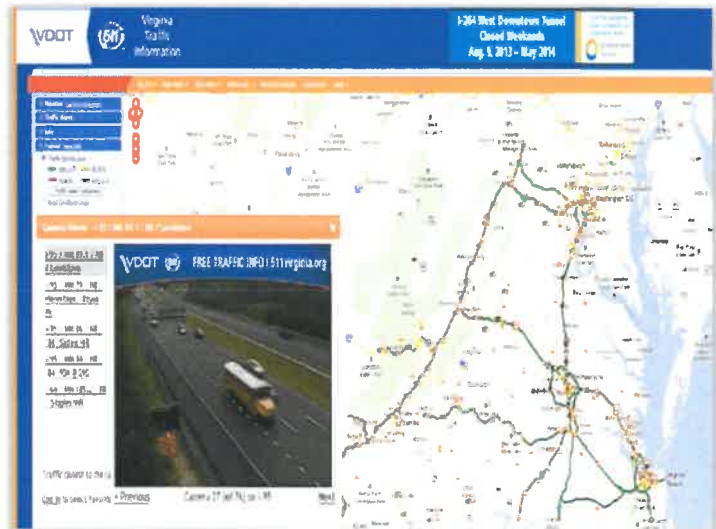
Solution:

Skyline was able to navigate and address all these challenges utilizing our background in Network Engineering and our video sharing appliances. Skyline established private MPLS network to each Traffic operations center in the state, installed network and video appliance equipment outside the firewalls in partnership with the local VDOT staff, and established a distribution point in Tier-1 Data Center. Skyline monitors and maintains the entire solution from end to end utilizing our 24/7/365 staffed Network Operations Center.

Results:

- Transitioned from a picture every 2-4 seconds to Live Streaming video at 15 Frames per second for all 700+ cameras

- Video is available on a VDOT 511 website and Mobile App

- Live Video is now in a standard format that can be ingested by any partner agency, media, law enforcement or first responders, free of charge

- Skyline One View provides virtual video wall access to all networked cameras via PC, tablet or smart phone and management of user groups

- Access for new partners can now be granted in a matter of minutes, not weeks or months

- First Responders have access to the video via an SSL Portal that is free of charge and can be accessed with the proper login information from any internet connection

- Live Streaming video integrated into the Iteris 511 website and mobile app.

- No pending legal actions related to this project.

Maryland SHA CHART

CHART (Coordinated Highways Action Response Team) is a joint effort of the Maryland Department of Transportation, Maryland Transportation Authority and the Maryland State Police, in cooperation with other federal, state and local agencies. Since 2010, the State of Maryland has been engaged with Skyline in creating a Statewide Interoperability Architecture to support video sharing around the state. Since completion, additional cities and agencies throughout Maryland have continued to share cameras on the state platform and also benefit from viewing cameras from other agencies, resulting in a system that has grown to over 1,200 cameras and 20+ agencies.

Challenge:

- Ingest 800+ Traffic Management Cameras from over 20 State, County and Local Agencies dispersed throughout the State of Maryland

- Integrate live video from various source hardware and software platforms

- Distribute Live Video to the Public via a Website and Mobile Application

- Distribute Live Video to the Media, agency Partners and first responders, within the State of Maryland and bordering States via a secure portal

Solution:

Skyline interconnected local counties, cities, law enforcement and trusted partners utilizing Maryland's Statewide Government Intranet. Once the connections were made, Skyline installed network and video appliance equipment to efficiently share live video between trusted partners and CHART and stream live video to the public and media.

Results:

- Transitioned from a picture every 2-4 seconds to Live Streaming video at 15 frames per second for over 800 State, County and local cameras
- Live Video is now in a standard format that can be ingested by any partner agency, media, law enforcement or first responders, free of charge
- Skyline One View administrative portal provides virtual video wall access to all networked cameras via PC, tablet or smart phone, and management of user groups
- Access for new partners can now be granted in a matter of minutes, not weeks or months
- Video content now available from mobile cameras mounted on first responder units
- No pending legal actions related to this project.

Tennessee DOT

Tennessee Department of Transportation needed video sharing solution that could easily share video between regions in the state and provide decision makers at all levels of government insight into what was happening on the roads anywhere in the state. The DOT previously had no way of sharing video between its four (4) regions, each with their own Traffic Management Centers (TMC's) and partners. Further, leaders in the state government and the DOT wanted to be able to see a live view into all of the trouble areas throughout the state without having to go to a TMC or relay information through third parties or media. The goal was to provide a scalable architecture that would significantly increase the use and sharing of video throughout the DOT and highest levels of government in Tennessee.

Challenge:

- Integrate over 500 cameras being fed into four (4) regional TMC's throughout the state. These cameras are a mix of analog and digital formats with multiple manufacturers.
- Provide a live video dashboard of 24 simultaneous live feeds that represent the six (6) cameras in each of the four (4) regions that are focused on the main areas of congestion and incidents. The dashboard needs to be viewable in the Commissioner's and Governor's office 24 x 7.
- Provide a live video dashboard of the video wall in each TMC, consisting of 18 simultaneous camera views, to be viewable in the Commissioner's and Governor's office 24 x 7.
- Provide a web-based interface so that managers and operators can remotely see video from any camera in the state on any web-enabled device.
- Deliver live video to agency partners including other government departments, first responders, media outlets and the 511 website.

Solution:

Skyline designed a video sharing network that utilized a combination of locally hosted and remotely hosted equipment and services. Because many of the camera feeds provide analog output, the video streams had to be normalized locally at each TMC. Skyline installed transcoding appliances at each TMC that normalized the video into a common format for distribution. Skyline then distributes the normalized streams from a cloud hosting center. These streams are available in two group: publicly available streams and partner streams, giving the DOT the ability to red-button any camera(s) to the public while maintaining feeds partners.

Results:

- Over 500 cameras are available for viewing by internal stakeholders and external partners (State police, fire departments, 911 centers, federal agencies.) securely through Skyline's video sharing platform.

- The Governor and DOT Commissioner can see what is going on in each region first hand without having to travel to a TMC or even their office.

- Skyline OneView allows TDOT to manage user access rights for sets and subsets of cameras throughout the state, allowing access to selected content in a matter of minutes.

- The DOT no longer has to provide direct access to their network for media outlets to receive live streaming video. Now, the media can access video of their choice using standard definition feeds or have the option for higher definition content.

- The Skyline video platform for Tennessee allows the DOT to grant access to the platform such that other public safety cameras from agencies, such as schools, local police and emergency management, can be cost effectively added to the platform and use a common user interface for all.

3.0 Oral Presentations (CRFP Section 4.4)

4.4.   Oral Presentations (Agency Option)

4.4. The Agency has the option of requiring oral presentations of all Vendors participating in the RFP process. If this option is exercised, it would be listed in the Schedule of Events (Section 1.2) of this RFP. During oral presentations, Vendors may not alter or add to their submitted proposal, but only clarify information. A description of the materials and information to be presented is provided below.

Materials and Information Requested at Oral Presentation:

4.4.1 Introduction of Project Team Personnel: Vendor's representatives at the oral presentation should include the Principal-in-Charge, Project Manager, and key System Integration Leads. At the Vendor's option, they may add other team members as deemed necessary, but the oral presentation team shall consist of no more than 6 people.

4.4.1 Proposal Overview: Provide a brief overview of the project requirements and the solution proposed by the Vendor in their submitted proposal.

4.4.2 Software Demonstration: Vendor is to provide a demonstration of the ATMS software being proposed in the Vendor's submitted response to this RFP. The purpose of this demonstration is to clarify the functionality of the ATMS software for the evaluation committee. The vendor may use a live version of an existing application running at a public agency site that is comparable to the WVDOH transportation management system requirements in functionality, size and features. A suitable internet connection will be provided upon request. Vendors are reminded to not alter or add to the responses stated in their written proposals during the demonstration or oral interviews. Vendors should proceed with a demonstration of each feature or the key features of their ATMS software solution detailed in their proposal, as time permits.

4.4.3 Questions & Answers: The WVDOH evaluation committee and key support staff may ask questions throughout the oral presentation.

Team Q-Free will gladly visit West Virginia and give an oral presentation and demonstration of our ATMS, VDS and ATIS platforms and their capabilities if shortlisted to do so.

4.0 General System Requirements (CRFP Section 4.5)

4.5 General System Requirements

4.5.1. Mandatory System Requirements

4.5.1.1. The ATMS solution shall be compatible with State of West Virginia software standards and security policies. The ATMS Solution shall be compatible with Microsoft products and State of West Virginia's acceptable user policy. Here's the link for those policies: West Virginia IT Policies: https://technology.wv.gov/security/Pages/policies-issued-by-the-cto.aspx Security Policy: ttps://technology.wv.gov/SiteCollectionDocuments/Policies%20Issued%20by%2 0the%20CTO/2017/PO1001_Security_Sept2017.pdf

Team Q-Free will fully comply with the State of West Virginia software standards and security policies.

4.5.1.2. Functionality of the proposed ATMS and 511 software and systems must be equivalent to or exceed the current functionality as described in the Background and Current Operating Environment Document and in any specific answers to questions submitted to WVDOH through this RFP process.

Team Q-Free offers the best value for a fully integrated ATMS/VDS/ATIS software solution that meets and exceeds the functionality currently deployed.

OpenTMS is the most fully featured, highly productized, and easy-to-use ATMS solution on the market. Q-Frees' off-the-shelf, cloud capable ATMS is an independent solution built around open, modular architecture. The intuitive interface combines a feature-rich interact map with both list views and data entry screens. Through the interface, it is easy to monitor the operational status of the network, control ITS devices, and manage both planned and unplanned events. Being web-based, OpenTMS will operate on any desktop or laptop using standard (not modified browsers like many other ATMS providers) browsers. This scalable and extensible architecture ensures long-term viability.

In addition to the base system that provides the GIS and mapping functions, the base system includes a host of traffic management modules as well as ITS device modules to choose from based on the responsibility of the DOT and the deployed devices in the field. The diagram below identifies the modules that will be licensed to the WVDOH. OpenTMS version 9 will be deployed to the WVDOH as part of this proposal. This version provides all the modules deployed in WVDOH today plus several additions:

- **Detectors** - Detector module collects and distributes traffic condition data (volume-occupancy-speed) and vehicle classification data gathered from detectors and provides the collected data to the Incident Detection (ID) module and the user for monitoring traffic conditions.

- **Travel Time** - Using input from travel time data sources, the Advanced Traffic Management System (ATMS) Travel Time (TT) Module collects current travel information in monitored areas. Travel Time reports the time it takes to travel from one point to another (the start node to the end node), commonly referred to as a travel time segment.

- **Lane Control Signals** – Lane Control module provides the capability to view, manage and control lane control signal devices being used within the operational environment. Consisting of overhead lane signals denoting a red "X" if travel in the lane is prohibited, and a green arrow if travel is

permitted, these signals symbolically display the status of each freeway lane to inform motorists of the condition of the lanes downstream so that they may take appropriate action.

- **Variable Speed Limits** – Variable Speed Limits module allows the user to update speed limits along the roadway.

- **Corridor Management** – The Integrated Corridor Management (ICM) module, referred to as the Corridors module, provides the operator the ability to asses and respond to travel conditions across a designated area of interest, also known as a corridor.

- **Weather Responsive Corridor** – A weather response corridor monitors weather conditions and based on threshold settings provides automated DMS and VSL messaging to inform the traveling public of the upcoming hazardous road conditions. This corridor is deployed in Ohio along the I-90 corridor.

- **Queue Detection/Warning Corridor** – Based on detector and/or travel time thresholds users are alerted if a traffic queue is forming and in response the system recommends DMS and VSL messaging to inform the traveling public of congestion and potentially stopped vehicles.

- **Vehicle Tracking & Dispatch** – Vehicle Tracking and Dispatch module provides an interface to dispatch, log and track motorist assistance vehicles. For vehicles equipped with GPS, there movement can be tracked.

- **Center-2-Center** – An NTCIP Center-to-Center interface is available for integration with third party systems.

- **Maintenance Ticketing** - Version 9 integrates osTicket for maintenance ticket support. Users will be able to generate maintenance tickets from the devices maintenance tab and view the device's open tickets.

- **Analytics Package** – An Analytics Package will be available that will allow the slicing and dicing of data. Version 9 also includes a new Event module that consolidates Incidents, Weather Incidents and Planned Events into a single management module with consistent functionality.

- **Road Conditions** – OpenTMS has a Road Conditions module where users can manage road conditions. This information is distributed to the 511.

ATMS PLATFORM OVERVIEW

USER INTERFACE

SYSTEM ADMINISTRATION PLATFORM

| Administration | Call Log | Contact List | Reporting | Security |

Desktop

TRAFFIC MANAGEMENT

| Travel Times | Alerts | Video Analytics | Incident Management | Planned Events | Corridor Management |

GIS and Mapping

| Traveler Information | Vehicle Tracking and Dispatching | | | Parking Management | Road Conditions |

ITS DEVICES

| Message Signs | Traffic Detectors | Weather Stations | Variable Speed Limit | Video |

Lane Control

DATA FUSION AND SYSTEM INTERFACE

Data Gateway

E911 Centers

Center to Center

Web Service API

Center to Center

Video Distribution

Figure 12 - ATMS Platform Overview

Access will be available to the West Virginia Turnpike (WVTPA) using a standard web browser, via a metro ring connection. This will allow the WVTAP to directly connect to the ATMS environment. With this dual routed network, downtimes should be limited to facility maintenance events.

Q-Free has been a leader in CAD integration for over the last 10+ years. Q-Free has integrated over 12 separate CAD systems from State Police and 911 centers. Q-Free has three clients actively using CAD alerts as a primary component of incident detection. We've integrated over 40+ centers between these clients. Traffic CAD events are integrated into OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert tracking the two together. As updates come in the users have the most update to date information within minutes of being entered by the 911 center.

The proposed ATIS will meet and exceed the current functionality that is described in this RFP. Details of how the proposed ATIS will meet or exceed the current functionalities is described in the section for each functional requirement.

4.5.1.3. The ATMS Vendor is required to maintain connectivity and key data transfer functionality, during any new or upgraded ATMS software and 511 system installations, between the WVDOH TMC located in Charleston, WV and the remote users and offices that provide information to and/or receive information from the TMC and associated ATMS and 511 software and systems. This includes the current E-911 centers located across the state the provide incident data directly to the ATMS platform and the event/incident window.

Q-Free will maintain connectivity and key functionality during the transition.

Migrating legacy systems to the new ATMS/VDS/ATIS platform can be a challenging effort without a detailed plan. There are several key components critical to the success of an ATMS/VDS/ATIS system migration. These key components include business processes, impacted systems, system data, and system users. Team Q-Free has successfully transitioned four of five VDOT TMCs from legacy ATMS to OpenTMS and all regions of Pennsylvania DOT from legacy ATMS and vendor applications to a statewide version of OpenTMS. This capability ensures an easy and worry-free transition for WVDOH to a new WVDOH ATMS, VDS and ATIS with continuity and confidence in maintaining or exceeding the performance of current elements.

During any new upgrades or installations of the ATMS and ATIS systems, connectivity and data transfer functionalities will be maintained. By having a test/preview environment that mirrors the production environment, a migration path can be fully tested in the preview system before cutting over to the production system. Similarly, the redundancy built into the production system can make migrations and upgrades seamless to end users.

Q- Free will prepare a Software and System Deployment Transition Plan documenting the transition and steps leading up to the transition. The document is described in more detail in Requirement 4.2.2.13.

4.5.1.4. The Vendor must provide a non-revocable and perpetual license to the WVDOH and its current in-state partner agencies for the use of the ATMS software and its associated systems.

WVDOH will receive an Enterprise license. Licensor grants to Licensee, and Licensees accepts, a non-revocable, perpetual license for Licensee to use the licensed software within the scope of the project.

The ATIS component of the proposed solution is offered as software as a service (SaaS) and will grant WVDOH and its current in state partners unlimited usage of the system for the duration of the contract.

4.5.1.5. The ATMS Vendor will be required to develop agreements with third party data providers, software providers, or other system providers required to make the ATMS functional.

Q-Free is the prime and will manage our subcontractors. We will develop and execute any necessary agreements with our subcontractors to deliver the ATMS/ATIS. The Q-Free proposed Project Manager (PM) and Project Management Team has experience in managing multiple subcontractors today. Many of our contracts today have subcontractors that we have initiated agreements with and managed throughout the project lifespan. Th proposed PM has coordinated their activities so that schedule milestones and support are met in an efficient manner. Q-Free is working with both Skyline and ILOG on our current contracts.

ILOG has entered into third party agreements with providers such as Google and Amazon, to provide the services in the ATIS solution.

4.5.1.6. A copy of all manuals, diagrams, design documents, requirements documents, testing documentation, training materials, change configuration documentation, upgrades and other material associated with the ATMS software and all associated connections shall be provided to the WVDOH at Final Acceptance and as necessary through the term of the contract.

Q-Free will provide an electronic copy of all documentation associated with the ATMS and ATIS to the WVDOH throughout the term of the contract.

5.0 Traffic Display Maps/GUI (CRFP Section 4.6)

4.6. Traffic Display Maps/GUI

4.6.1. Mandatory Traffic Display Map/GUI Requirements

4.6.1.1. The ATMS shall display responder information tied to appropriate highway segment on the TMC operator GUI/traffic conditions map.

OpenTMS meets this requirement. Suspected incidents are displayed on the map at the location of the potential incident. Users can interact with the incident by hovering over and viewing a tool tip and selecting the incident to display its detailed view. Closures are displayed on the map at the location specified. Users can interact with the closure by hovering over and viewing a tool tip and selecting from the map to view its detail view.

4.6.1.2. The ATMS shall support an interactive base map for displaying the ITS devices statewide.

OpenTMS meets this requirement. Q-Free is working with ESRI on multiple projects and is looking to leverage ESRI in West Virginia as well. This approach leverages the work that the WVDOH has done with their on-line GIS Web Services in working with ESRI technology.

Q-Free can leverage existing maps such as the ESRI Street Map to provide a base map that includes adjoining states and local roadways. See below for an example of the map around the Charleston area.

Figure 13 - Street Map of the Charleston Area

Satellite data can be made available as another base map option. See below for a view of Charleston.

Figure 14 - Satellite Map of the Charleston Area

In addition to the two layers above, OpenTMS can bring in any layer available through an ArcGIS Rest query.

ESRI offers a speed layer through its World Traffic Service available through ArcGIS on-line for organizations with an ArcGIS Online subscription. This layer allows users to visualize traffic speeds relative to free flow as well as congestion due to traffic incidents. The speed layer is shown below for the Charleston area.
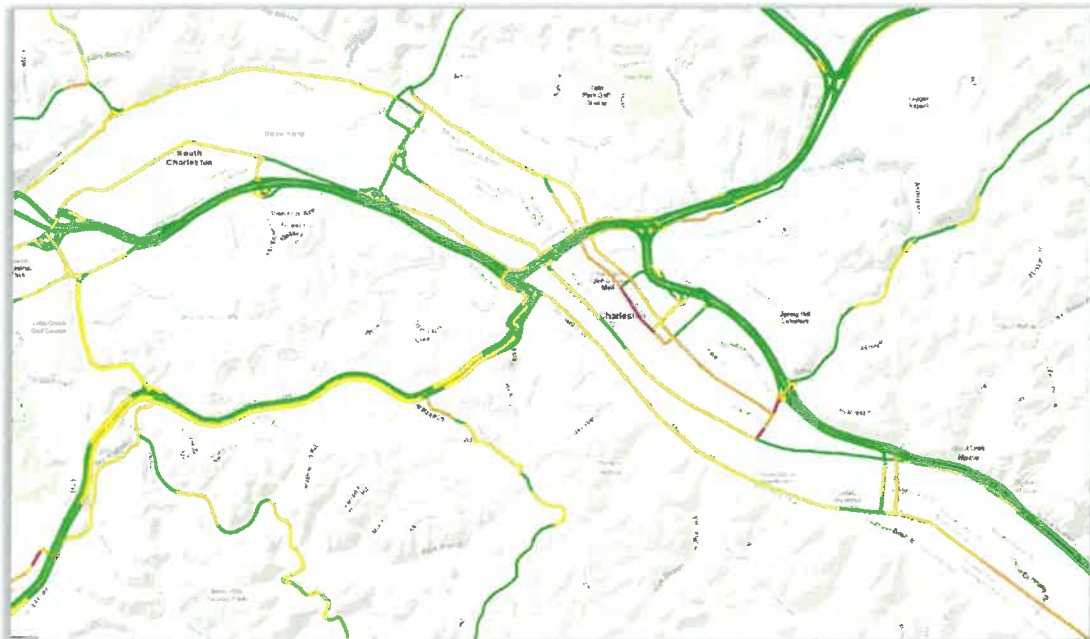
Figure 15 - ESRI Speed Layer Map of Charleston
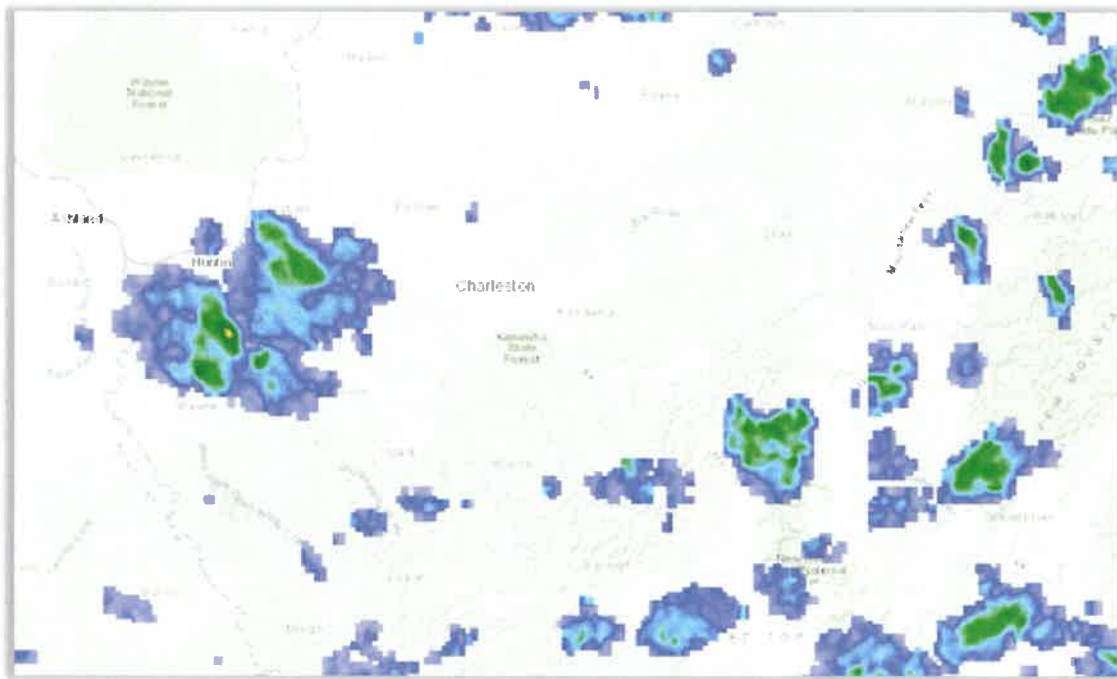
Figure 16 - Nowcoast NWS Feed Map of Charleston

Nowcoast provides a National Weather Service (NWS) feed through ESRI that can available through a map layer. The view in the image above shows the weather in the Charleston area.

For underlying GIS data used for incident/event management and device location, Q-Free will utilize the West Virginia Transportation Roads and Highway Linear Reference data and linear referencing services hosted by ArcGIS server. Integration of the web services into the OpenTMS location services will provide for automatic updates once the data is available in the base dataset.

The OpenTMS Map Interface optimizes the user experience and operational process. It consists of several integrated components that provide a feature-rich, easy-to-use interface. Users can monitor the operational status of the transportation network, control ITS devices, and manage events. OpenTMS web-based GUI runs on standard web browsers including Chrome, Firefox, Internet Explorer, and Safari. The controls to manipulate the map are consistent with most commercial mapping interfaces:

- Pan and Zoom can be accomplished with the control widgets on the left side of the map or by using the mouse. Navigation is supported by dragging the map with the mouse while clicking the mouse;

- A Layers Widget in the upper right corner, enables users to toggle the view of specific layers; and

- Hovering over an icon brings up information about that icon in a Toaster Popup at the bottom of the map; Clicking on a device icon opens the command and control view for that device.
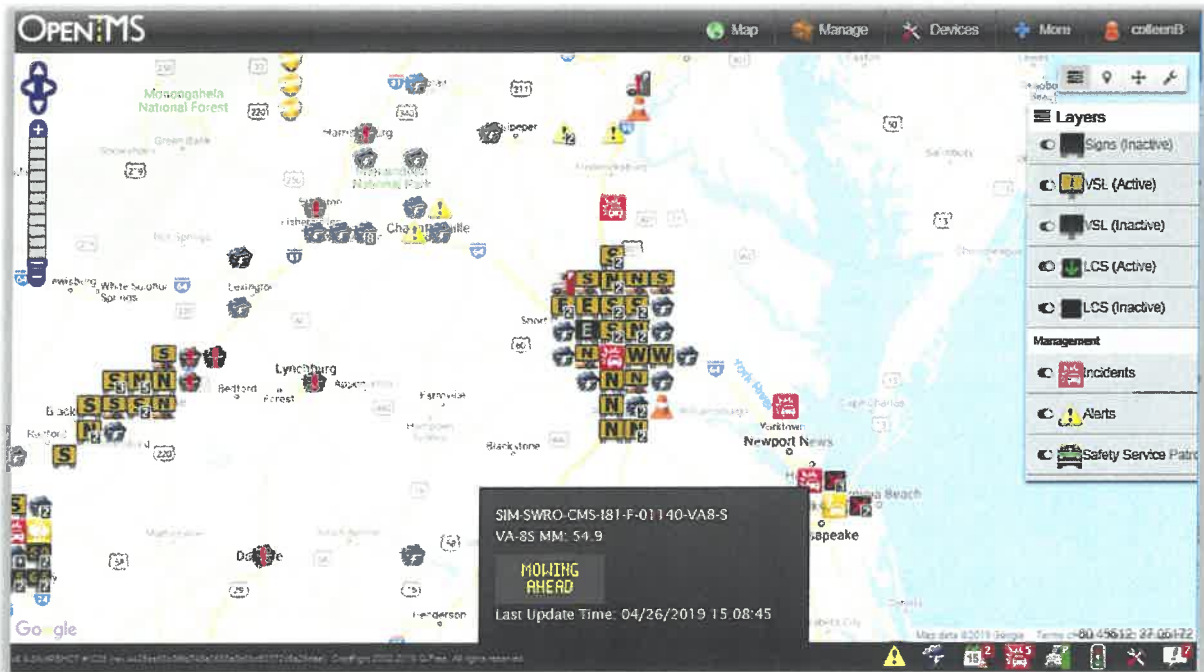
Figure 17 - OpenTMS Map Interface

The map GUI consists of a base map. Q-Free will customize the map layers to meet the WVDOH's requirements. Aerial images and/or orthophotography are easily incorporated into the map interface. The display map is updated at least every 5 seconds to reflect real-time changes.

The map interface can integrate a variety of spatial information organized by layers that can be toggled on and off by the operator. Specialized icons are used to distinguish between various map elements, including ITS devices.

Support for rendering multiple WMS layers:

- Interactive display of roadway network and current status of ITS devices, incidents, and planned events;

- Map tools that allow users to display or hide map layers and change the map view via zoom and pan controls. A summary window provides additional information about a specific device or event;

- Many layers including state and local routes, road conditions, events, and other layers of interest to WVDOH;
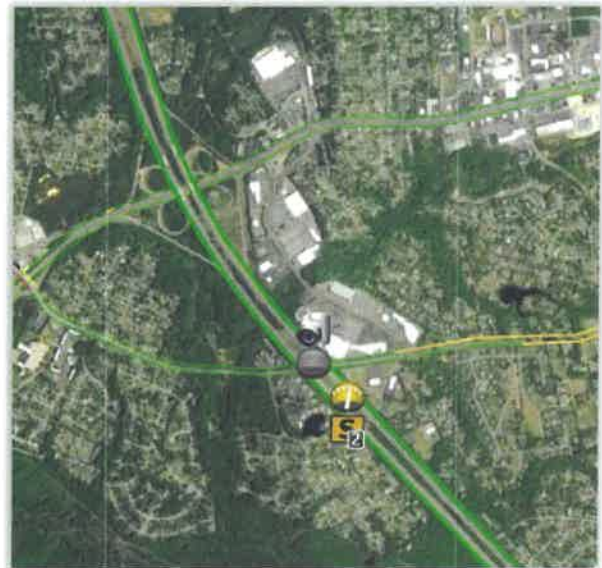
Figure 18 - WMS Layers Map Interface

- Configurable color overlays for real-time travel times/traffic flow conditions, winter road conditions;

- Icons to represent unique features static features including bridges, mile markers, exit numbers, and landmarks;

- Real-time updates of incidents, closures, and ITS device status;

- Third party data; and

- Maintenance Mode map tool that filters the map to only show devices that are not in normal condition. Devices are considered not normal if they have communications that are suspect or failed and/or the device is reporting an error such as a pixel error.

4.6.1.3. The ATMS map shall support pan and zoom capabilities throughout the State of West Virginia and into adjoining states.

OpenTMS meets this requirement. ATMS map will support pan and zoom capabilities throughout the West Virginia map and including adjoining states. The proposed base map, ESRI Street, includes adjoining states.

4.6.1.4. The ATMS shall display real-time traffic conditions using a standard color coding of green for uncongested conditions through yellow and amber for moderate congestion to red for high congestion on freeways and roadways shown on the map. Real-time latency shall be no more than 5 minutes.

OpenTMS meets this requirement. The ATMS speed layer will be integrated from a third-party like the ESRI World Traffic Service. This speed map uses green to indicate free flow then as congestion builds yellow, orange and finally red for stop and go traffic.

4.6.1.5. The ATMS shall provide an icon for each type of ITS device identified as part of WVDOH ITS.

OpenTMS meets this requirement. OpenTMS provides an icon for each ITS device type listed in RFP Attachment B – List of ITS devices.

	Cameras		Truck Parking		Detectors
	Permanent Signs		Variable Speed Limit Signs		Weather
	Portable Signs				

Note: Portable device icons sit on a trailer.

OpenTMS icons also reflect communication status. Devices in communications failure have an '!' point (🐞).

4.6.1.6. The ATMS shall provide a layer for each type of ITS device identified as part of the WVDOH ITS.

OpenTMS meets this requirement. Each ITS device type has its own map layer that can be enabled or disabled.

In additional to ITS devices, many other layers can be managed here such as overlays, incidents, alerts, and planned events.

OpenTMS also supports a Maintenance tool (🔧) that displays only devices in an error state. The Move tool (✛) allows the user to move a portable device.

4.6.1.7. The ATMS map shall provide declutter features to provide appropriate number or size of icons as maps are zoomed in or out consistent with layer selection.

OpenTMS meets this requirement. The OpenTMS map includes a smart icon grouping feature. When multiple devices are in close proximity, OpenTMS automatically clusters the icons and indicates the number of devices with a number indicator on the icon. When a user hovers over a clustered icon, the map interface will provide a popup of all devices included in that cluster. To select one the user can click on the device name.

Figure 19 - OpenTMS Smart Icon Grouping Feature

The system can also be configured to display layers at different zoom levels. For example, the active signs at a higher zoom level than blank signs. As the user zooms in the blank signs will appear at the configured zoom level. This is done in the Admin Portal Map module.

4.6.2. Traffic Display Map GUI Desirables

4.6.2.1. The ATMS should have the ability to integrate and share data with neighboring states including CCTV video.

OpenTMS will have the ability to integrate and share data with neighboring states, including video. The video architecture is designed specifically to support easy and secure sharing with any trusted partner. Surrounding states Virginia, Maryland and Pennsylvania use the same video architecture to support their sharing efforts.
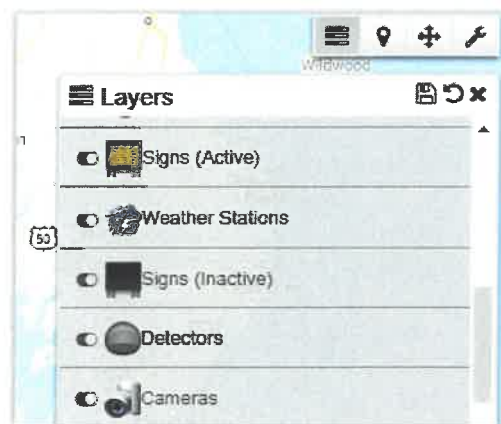
Figure 20 - Map Layer Tool

4.6.2.2. The ATMS map should display all major freeways and streets with graphical representation for each roadway classification.

Out of the box, the ESRI Street Map provides coloring based on roadway classification as shown below.

Figure 21 - ESRI Street Map Roadway Classification

4.6.2.3. The ATMS should allow user selection of type of traffic measurement for near real-time traffic condition display including speeds, volume, occupancy, and (optionally) a combined traffic metric.
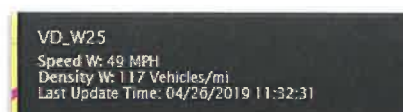
In order to display volume, occupancy, and speed the ATMS needs a source of data. Our OpenTMS Detector module continuously monitors and ingests real-time traffic data from detectors. Data for individual detectors can be accessed through the detector view.

Figure 22 - OpenTMS Detector Module

On the map view, the detector icon looks like a speedometer and provides visual cues for the data being returned. The color coding of the detector icons is configurable in the administration portal and enables users to quickly see which detectors are reporting free flow or congested conditions. Congestion levels can be set to color based on speed or occupancy.

Hovering over a detector displays a tool tip with additional traffic metrics.

The Detectors detailed view Lanes tab displays lane by lane data. For detectors that report classification data that will be displayed as well. The Current Status tab display the detector average speed, volume, and occupancy by direction.

4.6.2.4. The ATMS should allow selection of numerical limits associated with each display color for each type of traffic measurement by a user with sufficient authorization. These parameters should be applied to all traffic condition map/GUI displays.

Out of the box, the color-coding thresholds of the detector icons on the map is configurable in the administration portal by the administrator.

Figure 24 - Configurable Detector Icons

4.6.2.5. The ATMS should depict summary device status using coloration of appropriate ITS device icon with the corresponding ITS field device.

Out of the box, OpenTMS icons are colored to represent the communication status of a field device and provide an indication as to whether the device is reporting an error. Icons are shown below.

- Normal Communications
- Normal Communications, but device is reporting errors
- Suspect Communications
- Failed Communications
- Disabled Communications
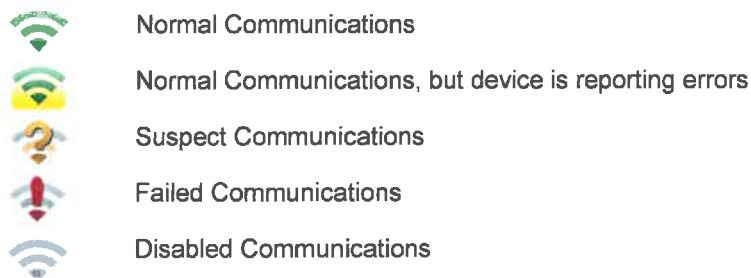
4.6.2.6. The ATMS should be able to display detailed device information appropriate to the individual type of device upon selection of an icon from the map/GUI.

Out of the box, selecting an icon from the map displays the devices detailed view. The detailed view contains up to date information on data readings, poll data, allows the user to execute other commands such as posting messages for signs, accessing logs and maintenance functions.

4.6.2.7. The ATMS base map should display neighboring states a minimum of 25 miles outside of state border or have the ability to pan to adjacent states.

The proposed base map, ESRI Street, includes adjoining states. ESRI Street will be used for the WVDOH base map.

4.6.2.8. The user interface map display should display icons representing locations of traffic data sensors connected to the ATMS.

Out of the box, traffic data sensors are displayed on the map at their location as entered through the Admin Portal.

Figure 25 - ESRI Street Base Map

4.6.2.9. The user interface map should enable operators to select traffic data sensors to view the most recent data recorded from the sensor.

Out of the box, all real-time data collected by OpenTMS is accessible via the map, list view or a graphical representation of historical data. The detector view is the same regardless of the type of detector or manufacturer. Clicking on a detector from the map or list view display's its detailed view.
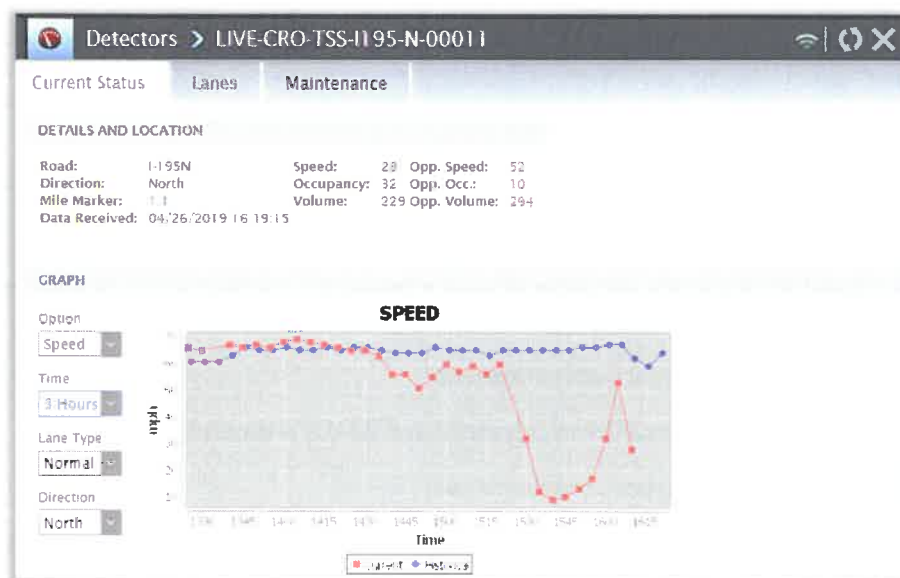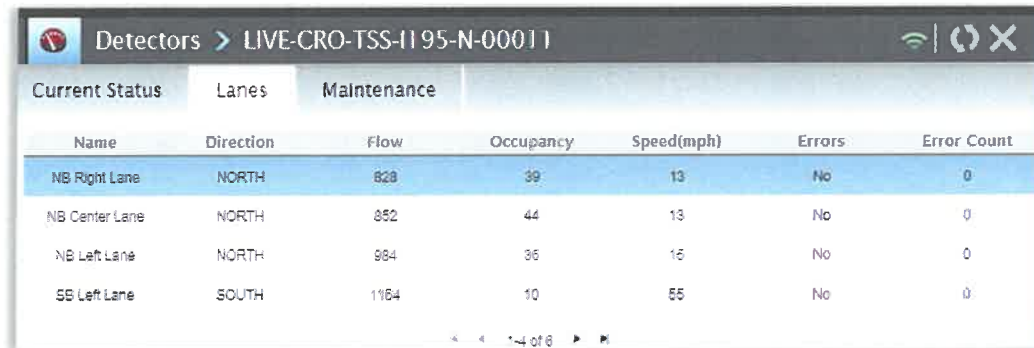
Figure 26 - Detector Detailed View

The Detailed View:
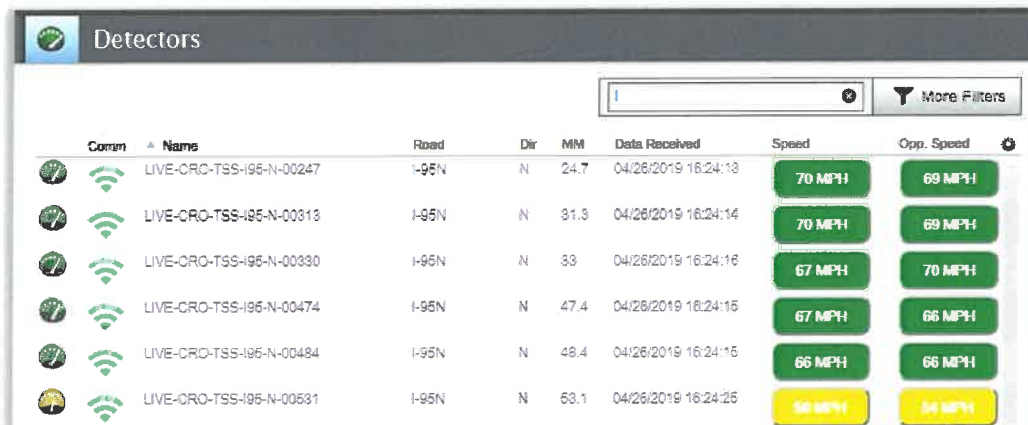
- Displays most recent data recorded from the sensor;
- Real-time vs. historical graphic display of speed, volume, occupancy, and volume looking back over past one to six hours; and
- Clicking on the Lanes tab, displays data by lane.

Name	Direction	Flow	Occupancy	Speed(mph)	Errors	Error Count
NB Right Lane	NORTH	828	39	13	No	0
NB Center Lane	NORTH	852	44	13	No	0
NB Left Lane	NORTH	984	36	15	No	0
SB Left Lane	SOUTH	1164	10	55	No	0

Figure 28 - Detector Lanes Tab

Accessing the Detectors module from the Devices menu displays the list view. This view provides a summary of the most recent data recorded colored by congestion level. Speeds and/or occupancy readings can be displayed.

Comm	Name	Road	Dir	MM	Data Received	Speed	Opp. Speed
	LIVE-CRO-TSS-I95-N-00247	I-95N	N	24.7	04/26/2019 16:24:18	70 MPH	69 MPH
	LIVE-CRO-TSS-I95-N-00313	I-95N	N	31.3	04/26/2019 16:24:14	70 MPH	69 MPH
	LIVE-CRO-TSS-I95-N-00330	I-95N	N	33	04/26/2019 16:24:16	67 MPH	70 MPH
	LIVE-CRO-TSS-I95-N-00474	I-95N	N	47.4	04/26/2019 16:24:15	67 MPH	66 MPH
	LIVE-CRO-TSS-I95-N-00484	I-95N	N	48.4	04/26/2019 16:24:15	66 MPH	66 MPH
	LIVE-CRO-TSS-I95-N-00531	I-95N	N	53.1	04/26/2019 16:24:25	58 MPH	54 MPH

Figure 27 - Detector List View

4.6.2.10.   The user interface map should enable operators to select traffic data sensors to view archived data recorded from the sensor within user defined parameters.

Out of the box, the detector's detailed view provides access to historical data from a graph. The user can select to view from one to hours in the past.

Jasper reports can also access historical data for selected detectors over a selected time period.

Figure 29 - Detector's Detailed View Provides Access to Historical Data from a Graph

4.6.2.11.   The ATMS base map should show traffic speeds by lane or as an average across all lanes in each direction (station) at user option.

Out of the box, traffic speeds are shown as an average across all lanes in each direction.

4.6.2.12.   The ATMS base map should show traffic volume by lane or as a total across all lanes in each direction (station) at user option.

Out of the box, traffic speeds are shown as a total across all lanes in each direction.

4.6.2.13.   The ATMS base map should show traffic occupancy by lane or as an average across all lanes in each direction (station) at user option.

Out of the box, traffic speeds are shown as an average across all lanes in each direction.

4.6.2.14.   The user interface map display should display icons representing locations of all ramp meters connected to the ATMS.

Q-Free has ramp meter experience with an earlier version of OpenTMS that contained a Ramp Metering module that was deployed in Northern Virginia. At this time the module is on our Product Road Map.

6.0 Device Control - Dynamic Message Sign (CRFP Section 4.7)

4.7. Device Controls-Dynamic Message Sign

4.7.1. Mandatory Requirements

4.7.1.1. The ATMS shall include and interface for Dynamic Message Sign (DMS) control and management.

OpenTMS meets this requirement. The OpenTMS Sign module provides operators with a common interface to control all their fixed and portable signs, regardless of manufacturer. All fixed and portable signs are managed through the sign module that contains both a list view and a device view.

4.7.1.2. The ATMS shall communicate with each DMS connected to the ATMS to receive all parameters describing the DMS, as contained in NTCIP messages (as defined by NTCIP Object Definitions).

OpenTMS meets this requirement. OpenTMS supports the NTCIP protocol.

4.7.1.3. The ATMS shall display the parameters for each DMS as received from the standardized NTCIP message. The ATMS will adapt entered text and message library text to fit the specific DMS configuration, unless restricted by size.

OpenTMS meets this requirement. OpenTMS displays the parameters received for each DMS in the Sign module. Examples of parameters displayed include:

- Posted messages are confirmed by reading the current message from the controller and displayed back to the user in the font selected;
- Firmware is read and displayed to the user on the current status tab;
- For portables, voltage readings are displayed; and
- Reports on Power, Pixel, Fan, Lamp, Controller, Attached device, Photocell, Temperature, Door Open, RAM, Program, PROM, Message and Power errors.

OpenTMS maintains a message library for each sign type, this ensures messages are properly formatted to the sign dimensions. Any attempt to define a message which does not fit on the sign type will generate an error notice.

SIGN VALIDATION ERROR

This message does not fit the sign. Would you like to edit the message?

Edit   Discard Changes

Figure 30 - Sign Validation Error

4.7.1.4. The ATMS shall include the capability for operators to control the messages that are displayed on fixed and portable DMS connected to the ATMS.

OpenTMS meets this requirement. OpenTMS supports both fixed and portable signs through a common user interface. To the end user there is no difference between fixed and portable message postings.

4.7.1.5. The ATMS shall include logic to manage multiple agencies and users who might simultaneously attempt to control a common DMS.

OpenTMS meets this requirement. Q-Free will meet this requirement by implementing a priority scheme where the owning agency will have priority in posting messages. Message priority processing will give the device owning agency priority. Non-owning agency requests will be put in the message queue, order by message priority.

4.7.1.6. DMS control shall be dependent on appropriate user permissions.

OpenTMS meets this requirement. Control access is available to those users with the correct permissions. Permissions are configured by the administrator in the Admin portal.

4.7.1.7. If a conflict between requested messages arise, the owning agency will have priority.

OpenTMS meets this requirement. Q-Free will meet this requirement by implementing a priority scheme where the owning agency will have priority in posting messages. Message priority processing will give the device owning agency priority. Non-owning agency requests will be put in the queued. Priority will be evaluated as follows:

Select the highest priority message of the device owning agency if none are available then select the highest priority message of the non-owning agency.

4.7.1.8. If a conflict between requested messages arise and all conflicting requests are from the same agency, the system will grant the request of the user with the highest priority.

OpenTMS meets this requirement. OpenTMS maintains a message priority queue. All messages are assigned a priority level, for example, 1 – Most Critical to 10 – Least Critical. OpenTMS does not limit the number of priorities. When a message with higher priority is posted, any lower-priority messages are pushed down the queue. When a message times out, the next highest-level priority message on the queue will be automatically posted. The priorities of the device owning agency are evaluated first. Message priority levels are configurable through the Administration Portal.

Within the same agency message priority, the user with the highest priority message will post and other messages are pushed to the message queue.

4.7.1.9. The ATMS shall have the capability to alert an operator with an agency that owns a DMS if another agency posts a message to the DMS.

OpenTMS meets this requirement. OpenTMS will generate a notification when a message is posted from a device non-owning agency to the owning agency.

4.7.1.10. The ATMS shall have the capability to alert an operator who has posted a DMS message if another operator has overridden the message by posting another message.

OpenTMS meets this requirement. OpenTMS will generate a notification to the device's owning agency when a message is posted from a non-owning agency overriding a message from the owning agency.

4.7.1.11. The ATMS shall provide a mechanism for authorized users to control the messages displayed on DMS from remote locations.

OpenTMS meets this requirement. OpenTMS is a web application any user with a standard web browser can access the application. Application can be accessed from any user on the network or through Virtual Private Network (VPN) connection. Further, OpenTMS can be made available through the ATMS network utilizing 2-factror authentication allowing for non-VPN access managed through the firewall.

4.7.1.12. The ATMS shall include the capability for automated message creation.

OpenTMS meets this requirement. OpenTMS provides the ability for the system to recommend DMS messages in response to an event based on a set of configurable business rules. OpenTMS further allows for the operator to modify the recommendation before accepting the message for posting.

4.7.1.13. The ATMS shall include logic to manage conflicts between automatically generated messages (e.g. travel time displays etc.) and manually generated messages.

OpenTMS meets this requirement. OpenTMS maintains a message priority queue. All messages are assigned a priority level, for example, 1 – Most Critical to 10 – Least Critical. OpenTMS does not limit the number of priorities. When a message with higher priority is posted, any lower-priority messages are pushed down the queue. When a message times out, the next highest-level priority message on the queue will be automatically posted. The priorities of the device owning agency are evaluated first then non-owning.

If a system event kicks off such as a resource plan or incident response and a message is in conflict the user is presented with a Resource Plan Conflict Notification and given the opportunity to resolve the conflict.

4.7.1.14. The ATMS shall include the capability to automatically generate messages for DMS to display Travel Times, as collected/calculated by the ATMS.

OpenTMS meets this requirement. Travel time messages are configured with a specially formatted travel time template configured through the sign module devices' travel time message tab. Creating a travel time message is similar to creating a standard message with the exception of a double hashtag (##) that represents the travel time to be automatically pulled and updated from an assigned segment. If the message is active it will be reposted.
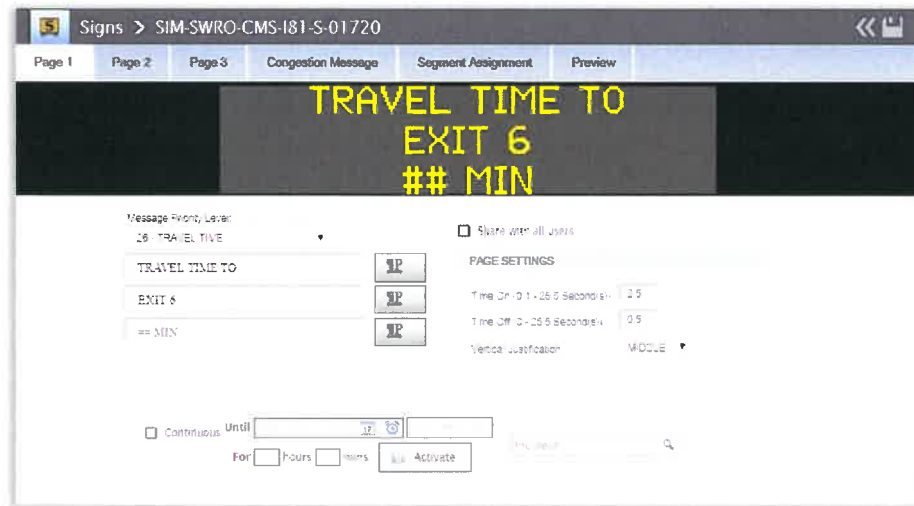
Figure 31 - Travel time Messages

As part of creating a travel time message there is also a congestion message tab which allows the user to configure a generic congestion message to replace the travel time message when the travel time exceeds a configured threshold. When the travel time falls below the threshold the travel time message resumes.

Segments are created in the admin portal and linked to a sign and associated to the message at the time the message is created from the Segment Assignment Tab.

Figure 32 - Segment Assignment Tab

Once the message is activated, travel times will automatically update on the sign as the travel time changes.

OpenTMS provides a Travel Time module that collects the travel time for configured segments. These travel times are visible from the Travel Time list view.

Figure 33 - Travel Time Module

4.7.1.15. The ATMS shall include DMS message libraries.

OpenTMS meets this requirement. OpenTMS maintains a message library for each sign type, this ensures messages are properly formatted to the sign dimensions. Authorized users can create, edit, and save messages to the library. All messages can be copied. The message editor uses fonts downloaded from the sign to provide the what you see is what you get (WYSIWYG) view, and operators can select from among the available fonts. Messages selected from the library can be quickly posted by clicking on the message and indicating whether to post continuously or for a specified duration.

Selecting the message tab from a sign's detailed view shows a list of the messages in the library as shown below. List shows the default priority and text of the message. The user can search the library to narrow down the list. From this list the user can post the message using the default priority or overriding for a selected duration or continuous and associated to an incident as part of the posting process.

Figure 34 - DMS Message Libraries

If an existing message doesn't work, the user can create a new message, copy an existing or edit a message using the message editor shown below.

The message editor is a full featured editor providing the user the ability to customize the justification, font, and page settings. The editor provides the ability to preview the message before posting directly from the editor, saving the user time.
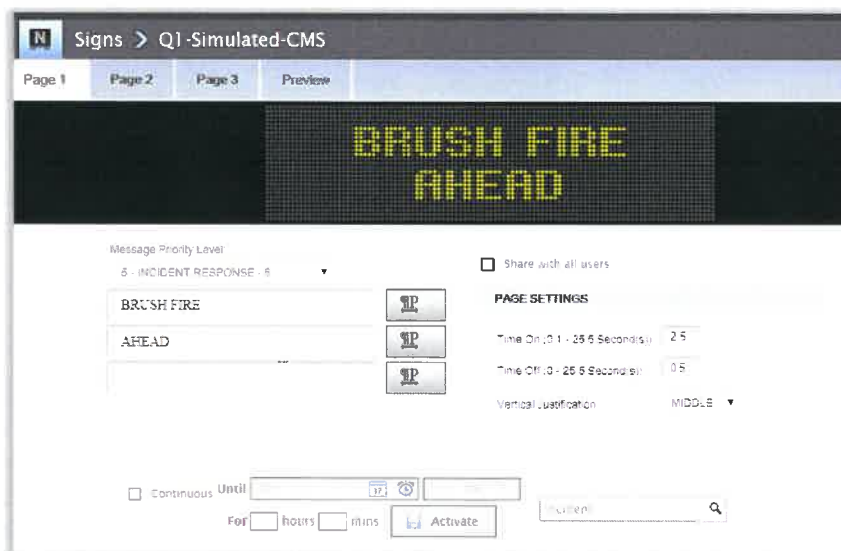
Figure 35 - Message Editor

4.7.1.16. The ATMS shall allow authorized users to select a message from any of the DMS message libraries.

OpenTMS meets this requirement. Control access is available to those users with the correct permissions. Permissions are configured by the administrator in the Admin portal.

4.7.1.17. The ATMS shall allow authorized users to generate a message from free text.

OpenTMS meets this requirement. From the sign's detailed view, the user can post a free text message without saving to the library. The basic view uses the default settings for the sign, but if a different font or justification is required then clicking on the Advanced button will bring up the full featured message editor.
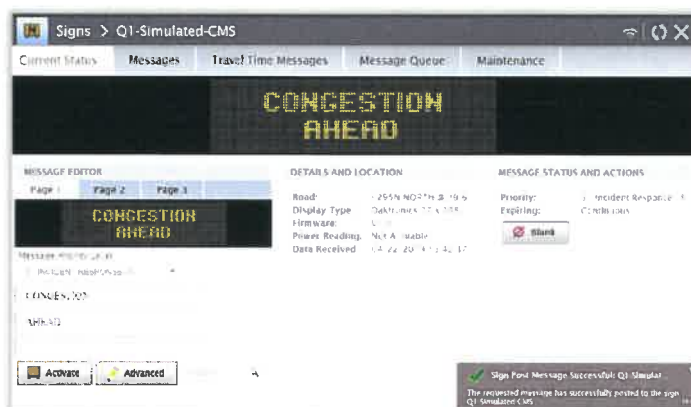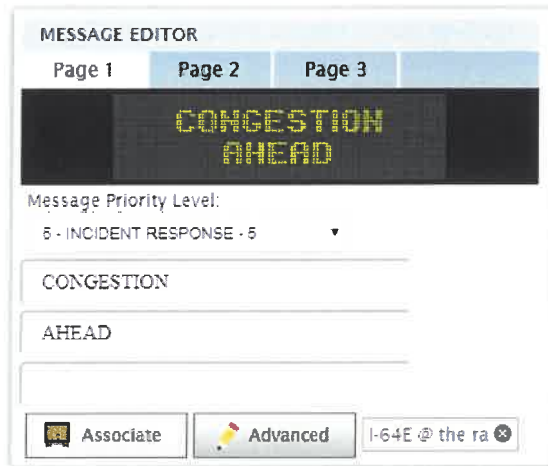
Figure 36 - Message from Free Text

From this view, you can associate an incident to the posted message by selecting the incident and clicking Associate as shown below.

Figure 37 - Associate an Incident to a Posted Message

4.7.1.18. The ATMS shall allow for additional DMS message libraries to be generated by authorized users or edits to be made to the DMS message libraries.

OpenTMS meets this requirement. Ability to add, edit, and delete a message is available to those users with the correct permissions. Permissions are configured by the administrator in the Admin portal.

4.7.1.19. All messages from all the DMS message libraries shall be accessible from a master DMS message library.

OpenTMS meets this requirement. Authorized users will be able to access a master DMS library. The user will be provided with a list view that will allow users to remove messages from the library.

4.7.1.20. The ATMS shall allow authorized users to select that a DMS message be displayed on multiple selected DMS without needing to re-enter the message for each sign selected.

OpenTMS meets this requirement. The sign list view enables users to perform the same action on multiple signs. An authorized user clicks on the checkboxes to select one or more signs. Controls on the list view enable users to simultaneously post messages (standard or travel time) or blank multiple signs. When posting to multiple signs of different size, OpenTMS automatically groups the sign by sign type, enabling users to

select the right message configuration for each sign type. In the figure below, the selected signs are grouped into 3 sign-type families. OpenTMS notifies the operator if there is any error when posting a message.
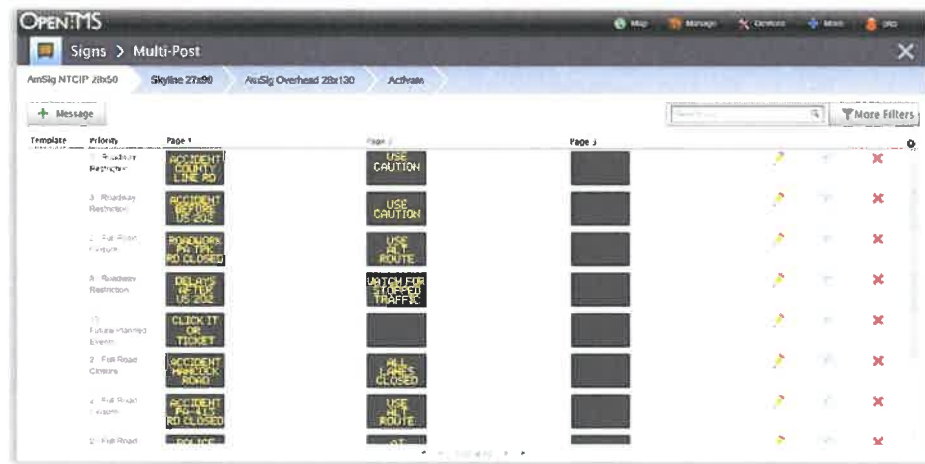
Figure 38 - Perform the Same Action on Multiple Signs

4.7.1.21. The ATMS shall allow authorized users to select a DMS message, either standard or custom, for display on all signs controlled by the ATMS.

OpenTMS meets this requirement. The sign list view enables users to perform the same action on multiple signs. An authorized user clicks on the checkboxes to select one or more signs. Controls on the list view enable users to simultaneously post messages (standard or travel time) or blank multiple signs. When posting to multiple signs of different size, OpenTMS automatically groups the sign by sign type, enabling users to select the right message configuration for each sign type. In the figure below, the selected signs are grouped into 3 sign type families. OpenTMS notifies the operator if there is any error when posting a message.

OpenTMS also provides the ability to select permanent and portable DMS from the map and post standard or travel time messages as well as blank or poll the selected signs. Devices are selected by holding down the Ctrl button on the keyboard and using your mouse to click on signs. The device manager is shown below.
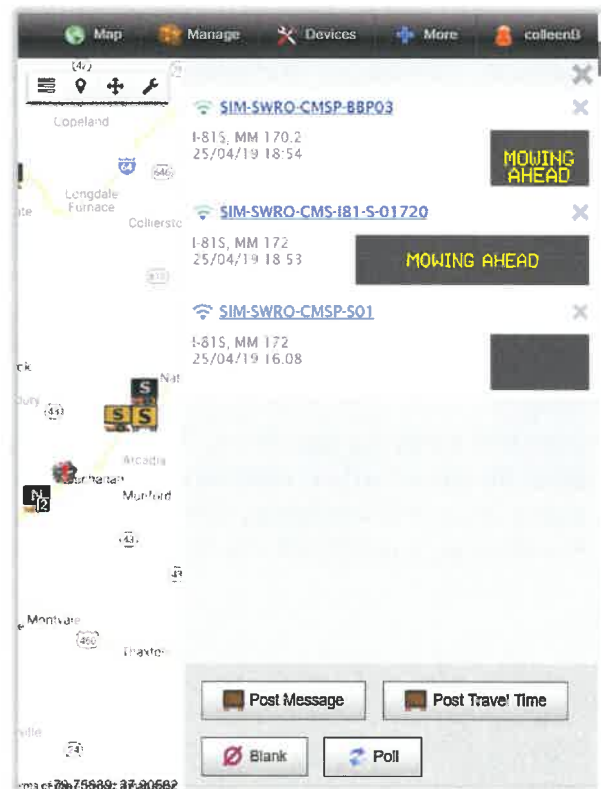
Figure 39 - Posting to Multiple Signs from Map

4.7.1.22. *The ATMS shall communicate with all legacy field devices currently used by WVDOH and future DMS procurements.*

OpenTMS meets this requirement. OpenTMS currently supports all protocols in use by the WVDOH and will support future DMS procurements.

4.7.1.23. *The ATMS shall be able to display a predefined travel time message to a selected set of DMS and update the travel time estimate dynamically without user interaction.*

OpenTMS meets this requirement. The sign list view enables users to perform the same action on multiple signs. An authorized user clicks on the checkboxes to select one or more signs. Controls on the list view enable users to simultaneously post travel time to multiple signs. OpenTMS displays each sign enabling users to select the right travel time message for each selected sign. OpenTMS notifies the operator if there is any error when posting a message.

Figure 40 - Post Travel Times to Permanent and Portable DMS

OpenTMS also provides the ability to select permanent and portable DMS from the map and post travel time messages to one or more signs. Devices are selected by holding down the Ctrl button on the keyboard and using your mouse to click on signs.

4.7.1.24. *The ATMS user shall be able to save a new message in a message library.*

OpenTMS meets this requirement. Authorized users can create a new message and save to the message library.

4.7.1.25. *The ATMS user shall be able to choose a predefined message from message library, edit, and resave the message.*

OpenTMS meets this requirement. Authorized users can select a predefined message from the library, edit and resave, copy to create a new message. Controls for message editing are shown below.

Figure 41 - Predefined Messages

4.7.1.26. The ATMS shall provide assistance in selecting standard DMS messages from the message library.

OpenTMS meets this requirement. When adding a sign to an active incident, the Incident Response Plan will determine the best message. This is accomplished by utilizing a rules engine to select the best message based on; Type, Location, Severity and Impact. These rules can be tailored to WVDOH's specific use cases.

4.7.1.27. The ATMS shall be able to send a message to one or more signs simultaneously.

OpenTMS meets this requirement. The sign list view enables users to perform the same action on multiple signs. An authorized user clicks on the checkboxes to select one or more signs. Controls on the list view enable users to simultaneously post messages (plain or travel time) or blank multiple signs. When posting to multiple signs of different size, OpenTMS automatically groups the sign by sign type, enabling users to select the right message configuration for each sign type. In the figure below, the selected signs are grouped into 3 sign type families. OpenTMS notifies the operator if there is any error when posting a message.
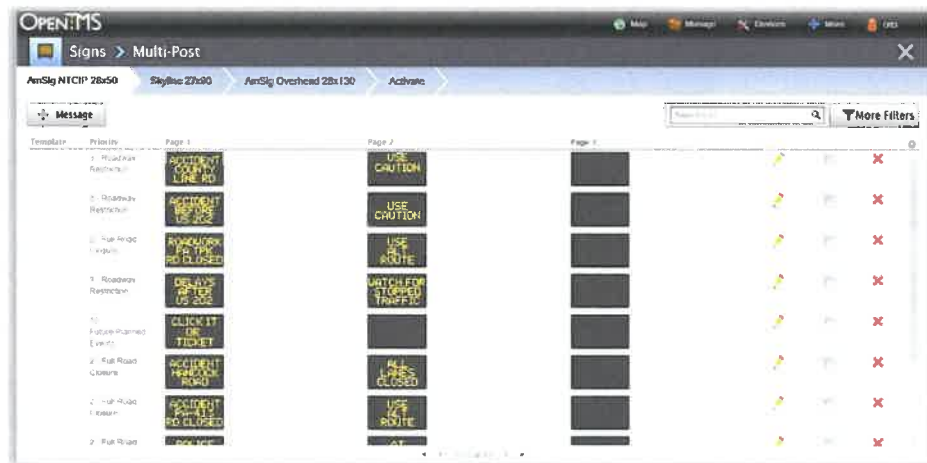
Figure 42 - Sign List View

OpenTMS also provides the ability to select permanent and portable DMS from the map and post standard or travel time messages as well as blank or poll the selected signs. Devices are selected by holding down the Ctrl button on the keyboard and using your mouse to click on signs. The Device Manager is shown below.

4.7.1.28. ATMS users shall be able to delete a message from the message library.

OpenTMS meets this requirement. Authorized users can select a predefined message from the library and delete ✖ a message. The user is prompted to confirm the delete action and the action is logged in the audit log. Control for message deletion is shown below.
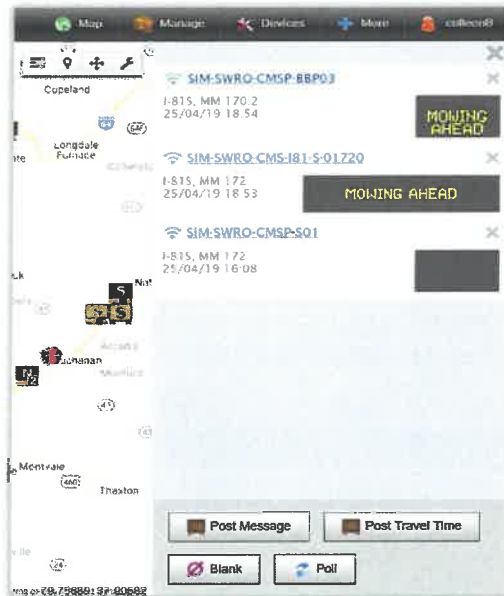
Figure 43 - Device Manager

4.7.1.29. The ATMS shall be able to terminate messages.

OpenTMS meets this requirement. Messages can be blanked from a signs detailed view or from the sign list. From the sign list the user can select one or multiple signs to blank.

Detailed view is shown below.
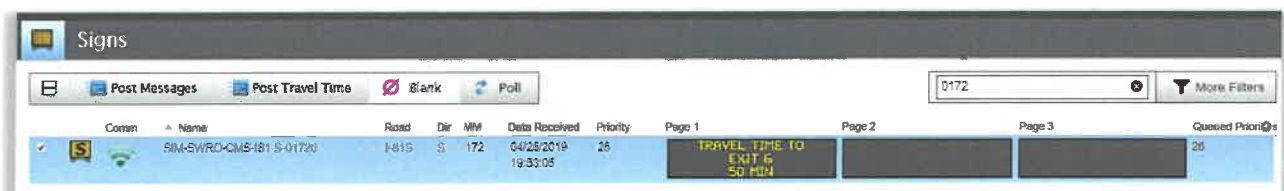
Figure 44 - Signs Detailed View

OpenTMS also provides the ability to select permanent and portable DMS from the map to blank. Devices are selected by holding down the Ctrl button on the keyboard and using your mouse to click on signs. The device manager is shown to the right.

Active messages are automatically removed when they expire by the system.

4.7.1.30. The ATMS shall support daily automated diagnostic of DMS, including alarm generation based on diagnostic results, results logging, and results archival.

OpenTMS meets this requirement. OpenTMS will provide the ability for a user to schedule diagnostic tests such as pixel and fan tests. When the tests are run, the results will be logged in the event log accessible from the maintenance tab. If errors are found a notification will be generated.

Figure 45 - Automated Diagnostic of DMS

4.7.1.31. *The ATMS shall provide the ability to control and retrieve information from a DMS via NTCIP 1203v1.*

OpenTMS meets this requirement. OpenTMS support NTCIP 1203v1 protocol. The DMS module also supports NTCIP 1203v2 graphics capabilities.

4.7.1.32. *The ATMS shall provide the ability to control and retrieve information from a DMS using permanent DMS protocol(s).*

OpenTMS meets this requirement. OpenTMS supports control and polling of permanent DMS message sign protocols. In OpenTMS capabilities are enabled on a sign by sign basis to allow for the reporting different controller conditions as well as enabling any standard or enhanced functionality the DMS is capable of such as Full Color Graphics. OpenTMS supports many permanent NTCIP DMS vendors such as Daktronics, SWARCO, WANCO, Ledstar, and SES America.

4.7.1.33. *The ATMS shall provide the ability to control and retrieve information from a DMS using portable DMS protocol(s).*

OpenTMS meets this requirement. OpenTMS supports control and polling of portable DMS message signs. In OpenTMS with NTCIP the signs share the same protocol, but capabilities are enabled on a sign by sign basis.

OpenTMS supports many NTCIP portable DMS vendors such as Vermac, Daktronics, Precision Solar and SolarTech.

4.7.1.34. The ATMS shall support storage and display of messages including uppercase alphanumeric characters and at minimum the following special characters: #@&8+< >!?./- and arrows.

OpenTMS meets this requirement. OpenTMS will supports special characters (#@&8+< >!?./- and arrows) included in the font.

4.7.1.35. The DMS Interface shall provide an interface for sequencing up to three-line message panels as well as full matrix DMS, including graphics.

OpenTMS meets this requirement. OpenTMS supports both line matrix and full matrix DMS. This is a configurable option per sign. Messages for line matrix are displayed as shown below in row1 and full matrix on row 2.
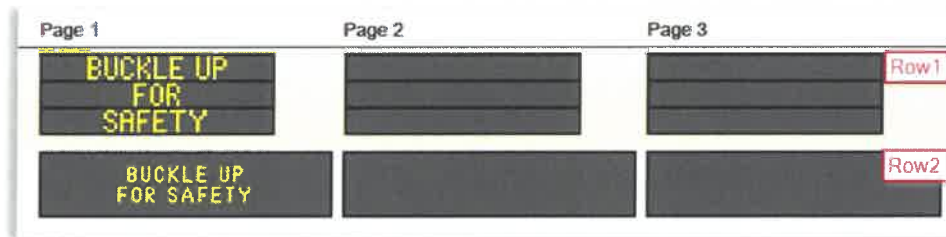
Figure 46 - Three-Line Message Panels

4.7.1.36. The ATMS shall support the use of full color DMS and graphics.

OpenTMS meets this requirement. OpenTMS supports NTCIP 1203v2 along with graphics and symbols. If a sign is configured with the graphics capability the Message Editor includes additional graphic options as shown below.
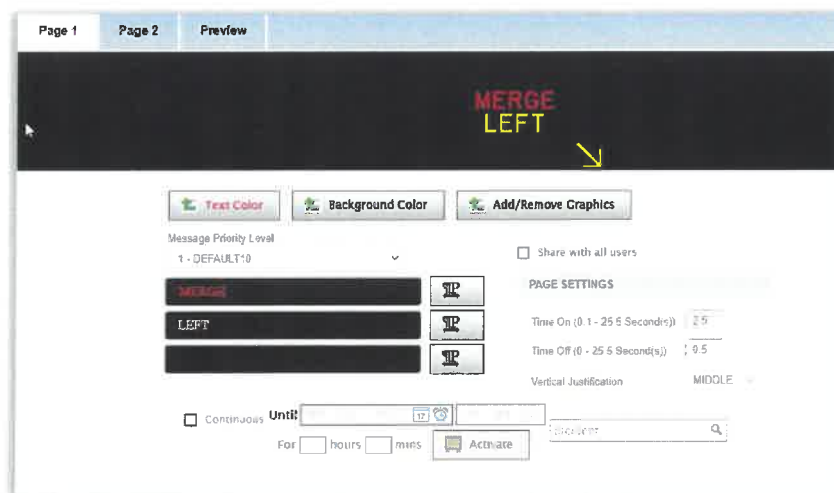
Figure 47 - Message Editor

Images are uploaded through the Admin portal, signs module. When creating messages, the user can specify the location of the graphic image as shown below.
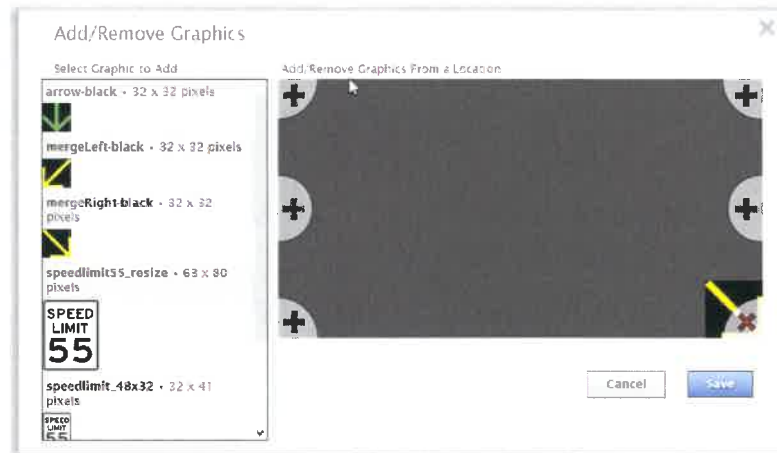
Figure 48 - Add or Remove Graphics

In addition to graphics the user can enter text with the graphic. The text color can also be changed as shown below. The sign background color can also be updated as shown below.

Figure 49 - Text and Background Color

As with standard messages the user can associate an incident and activate from this view.

4.7.2. Device Control – DMS Desirables

4.7.2.1. The ATMS may have a master library of DMS messages that may be sorted by the capability of DMS that an operator is placing a message on. When the operator selects a certain DMS, the message library available to that DMS may be restricted by the size and capability of that DMS.

OpenTMS provides an alternative approach detailed in this section. The OpenTMS library can searched by free text. Entering Brush Fire in the Search box will narrow down the list to all messages with Brush and Fire in the message.
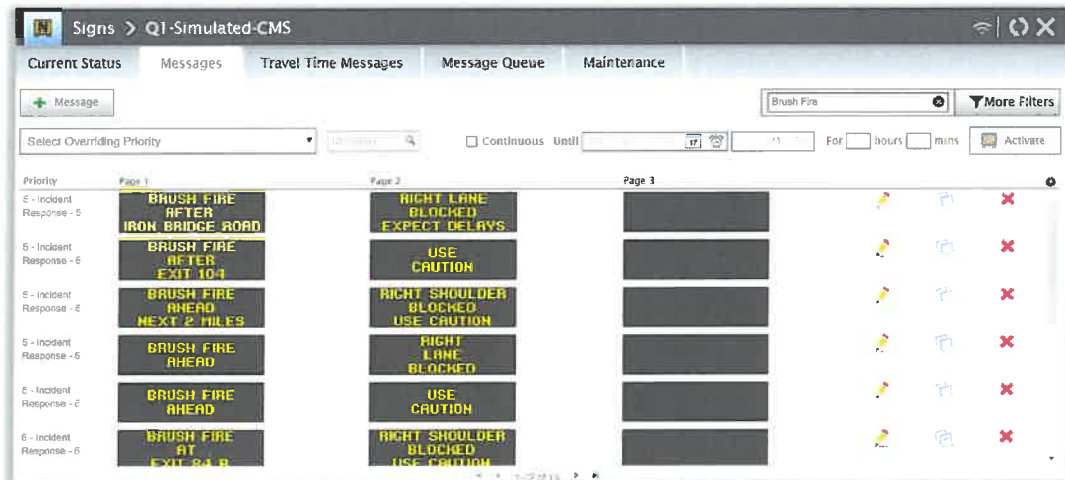
Figure 50 - Search and Sort Signs

4.7.2.2. The ATMS should support retrieval and display DMS status reports including at a minimum sign display content, illumination, pixel failures, power status communication status, and temperature. Fan error and humidity are highly desired, if available from field hardware.

Out of the box, OpenTMS supports the retrieval of DMS status on sign display content, illumination, pixel failures, power status communication status, fan and temperature. Status is visible from the Maintenance Tab. The system polls in the background and generates a notification when and error is found as well as logs the state in the status log.

OpenTMS Out of the box, has a Field Device and Health Report that can be scheduled to run nightly and emailed to the maintenance staff. The Health report identifies the failed devices and those with errors. The Field Device report provides device counts, communication state information. Below is a snippet of the Field Device report.

Device Communication State by Type

Signs (VMS/DMS)

Region	Total Devices	Operational Count	% of Total Devices	Operational w/Error Count	% of Total Devices	Suspect Count	% of Total Devices	Failure Count	% of Total Devices	No Data Count	% of Total Devices
I-90	59	59	100.00%		0.00%		0.00%		0.00%		0.00%
Device Type Totals	59	59	100.00%	0	0.00%	0	0.00%	0	0.00%	0	0.00%
Report Totals	59	59	100.00%	0	0%	0	0.00%	0	0.00%	0	0.00%
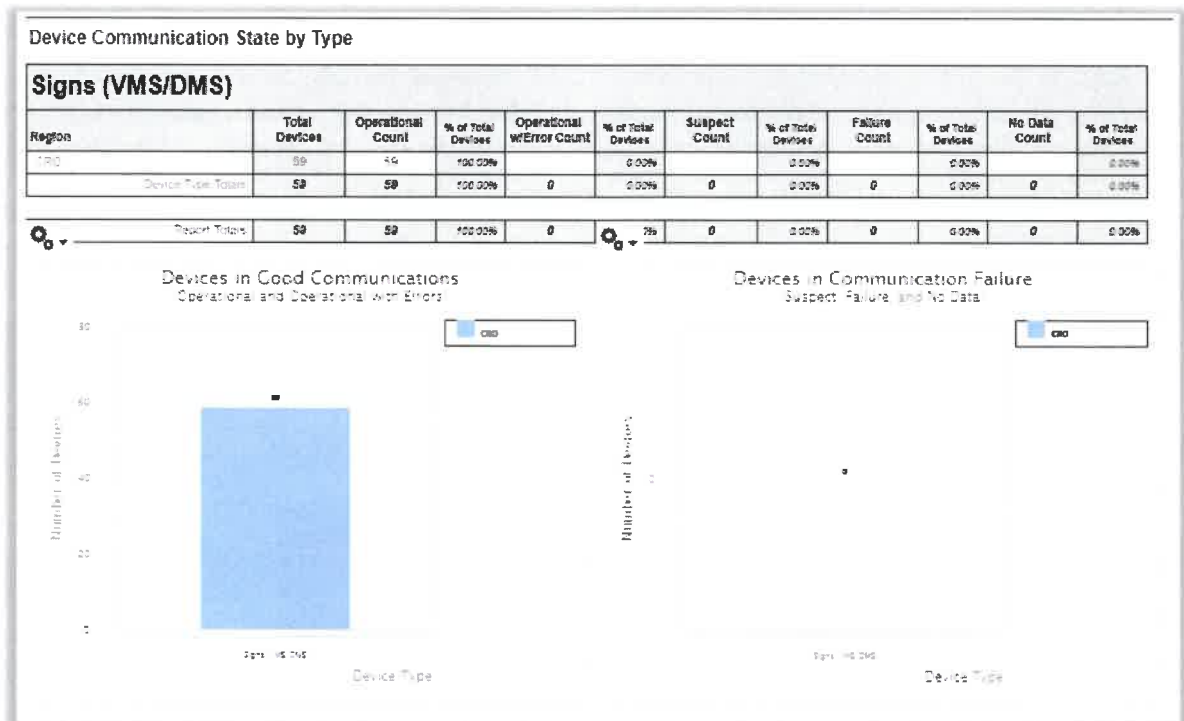
Figure 51 - Field Device Report

7.0 Device Control - CCTV/Camera (CRFP Section 4.8)

4.8. DEVICE CONTROL-CCTV/CAMERA

In June 2018 Skyline and Q-Free made a strategic decision to share technologies natively and integrate Skyline's Vero video solution into OpenTMS. Vero provides operators a powerful, highly configurable web platform for getting the most out of the DOTs video content. Vero allows operators to effectively and efficiently view video content in a way that helps them best manage an incident.

Vero is tightly integrated and is accessed through the OpenTMS menu bar which will open the Camera module.

4.8.1. MANDATORY REQUIREMENTS

4.8.1.1. The ATMS shall provide a mechanism for operators to view real-time video from CCTV cameras.

Camera Module

The Camera module provides a listing of all available cameras organized by operational area as well as a dynamic display to enable the viewing of multiple video streams (See figure below). Individual cameras or predefined tours can be selected and displayed on the interface. Viewing slots can also be used for external websites or other media sources. Clicking on the camera's control button will open the control view and provide pan-tilt-zoom (PTZ) control.

Figure 52 - The Camera Module

Customizable Personal Video Wall Configurations

Operators can configure one or multiple operator workstation monitors as their own personal video walls that they use to monitor/manage accidents and congested areas. They can configure and save many different video walls based upon user and use case. Personal video walls are also configurable to up to 16 simultaneous camera views.

Added content: Information displayed on and operators personal video wall includes one or more of the following at any given time:

- Video streams from any camera
- Map-based applications (ex. 511)
- Web applications
- Twitter Feeds
- Weather
- Cable TV feeds (if available)

- Map-based and list-based selection of cameras

Figure 53 - Personal Video Walls

OpenTMS will provide multiple ways to display video in the web interface. The Video will be provided in CLSP video protocol which is HTML5 Compliant and provide sub-second latency performance. Views will include video in incident management use cases and in a virtual video wall.

4.8.1.2. The ATMS shall provide a mechanism for operators to control CCTV cameras (pan, tilt, zoom).

OpenTMS will provide a mechanism for operators to control the CCTV (pan, tilt, zoom).

4.8.1.3. The ATMS shall include capability to set camera pre-sets.

OpenTMS will provide the capability to set camera pre-sets.

4.8.1.4. The ATMS will allow an operator to develop camera tours made up of views and presets from operator configurable cameras.

OpenTMS will allow an operator to develop camera tours made up of views and presets from operator configurable cameras.

4.8.1.5. The ATM shall include fine control of pan, tilt and zoom for CCTV cameras.

OpenTMS shall include fine control of pan, tilt and zoom for CCTV cameras.

4.8.1.6. The ATMS shall enable all users and TMC partner agencies with an ATMS client or workstation to view and control CCTV, according to their assigned user permissions.

OpenTMS shall enable all users and TMC partner agencies with an ATMS client or workstation to view and control CCTV, according to their assigned user permissions.

4.8.1.7. The ATMS shall determine rights and privileges of camera control based on permission and priority assigned to users by an administrator.

OpenTMS shall determine rights and privileges of camera control based on permission and priority assigned to users by an administrator.

4.8.1.8. *The ATMS shall provide video recording capabilities.*

Team Q-Free meets this requirement by utilizing the Video Analytics solution provided by Citilog. The system is setup to record at a minimum 72 hours of footage on a rotating loop. The recording system, timestamps alarm periods for easy retrieval. The system is designed to record 60 camera feeds. Team Q-Free, working with WVDOH will ensure that the system is recording those feeds the WVDOH determines are most critical.

4.8.1.9. *The ATMS shall control and allow viewing from both digital and analog cameras.*

OpenTMS shall control and allow viewing from both digital and analog cameras, assuming that the analog cameras are connected to an IP encoder that allows commands to be passed to the camera.

4.8.1.10. *The ATMS shall interface with the workstation and video wall controller for the TMC video wall for viewing capability by operators.*

OpenTMS is designed to allow any operator, with permission, to interface with any display wall and control the layout and content that is displayed. The TMC Video all will be driven by dedicated PC's that will display the WVDOT TMC Video Wall layout shown below in the image. Operators will select the wall and will then choose the content for each panel
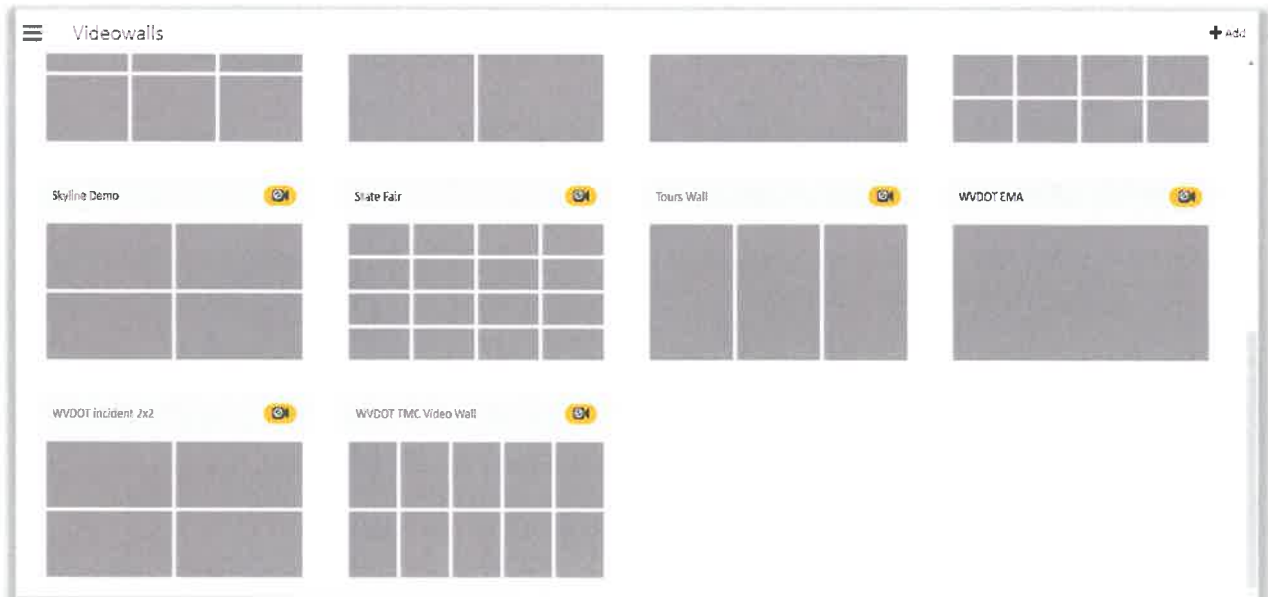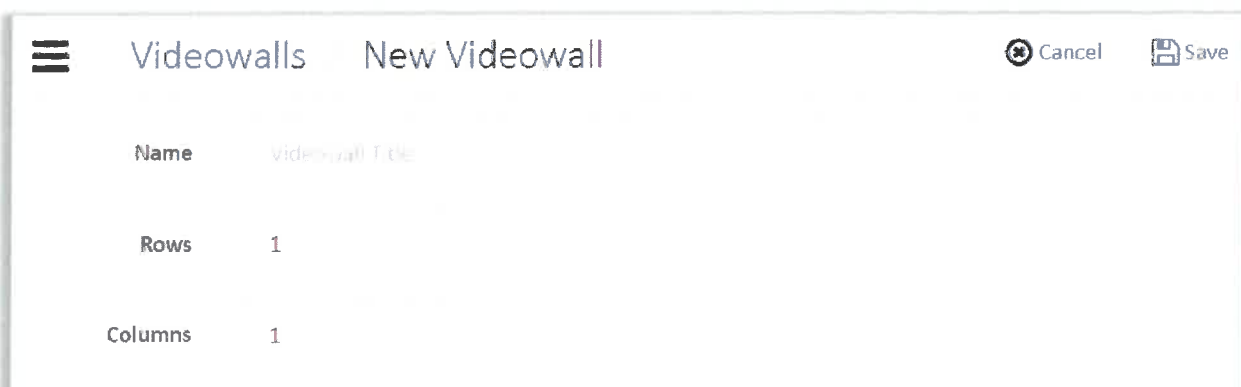
Figure 54 - Interface with Any Display Wall

Figure 55 - WV Video Walls

4.8.1.11. The ATMS shall enable operators to select the configuration of the video wall.

OpenTMS will allow operators to select the overall configuration of multiple video walls, as shown below. Once the layout of the overall wall is selected the operator can then select the layout within each section of the video wall.

Figure 56 - New Video Wall
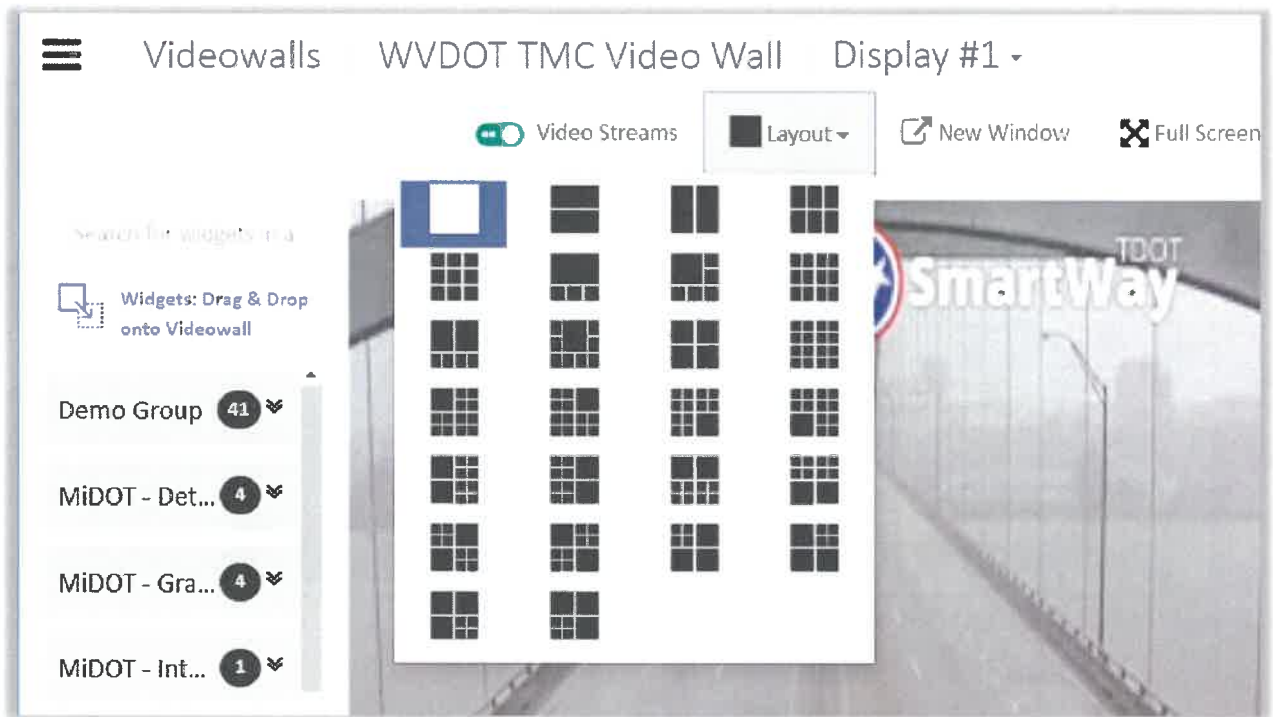
Figure 57 - Video Wall Layouts

4.8.1.12. The ATMS shall enable operators to select what camera feeds are displayed on specific portions of the video wall.

OpenTMS will allow operators the ability to select the camera feeds that are displayed on specific portions of the video wall. This can be done by clicking on a camera feed on the left menu or by dragging a dropping a camera or widget into a specific cube on the wall.
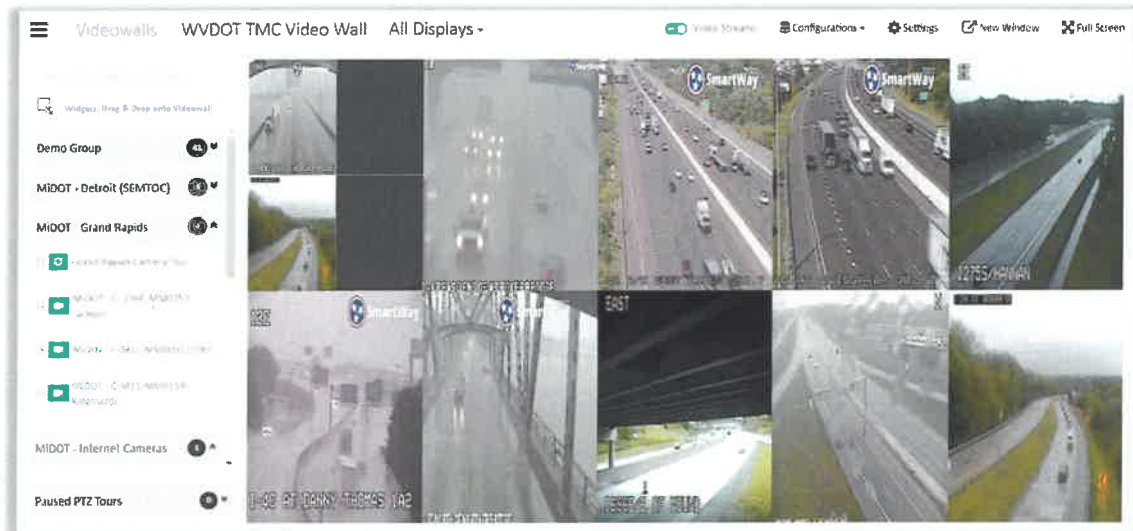
Figure 58 - Control Camera Feeds

4.8.1.13. The ATMS shall include capability to block selected cameras from selected viewers, while enabling other viewers to continue to view the camera video.

OpenTMS will provide the ability to block any camera stream from selected viewers while allowing other, usually trusted partners, to view the video streams. this feature will be available to any operator with permissions.

4.8.1.14. The ATMS shall communicate with all legacy field devices currently used WVDOH.

OpenTMS shall communicate with all legacy IP cameras or encoders currently used by WVDOH.

4.8.1.15. The ATMS solution shall control the distribution of all traffic images for internal and external use on the public website and 511 app.

OpenTMS solution will control the distribution of all traffic images for internal and external use on the public website and 511 app.

4.8.1.16. The ATMS solution shall collect and report current camera status, e.g. communication, image status, and PTZ status.

OpenTMS will collect and report the current camera status, communication, image and PTZ status.

4.8.1.17. The operator shall be able to select a camera from the CCTV menu or GUI map.

OpenTMS will allow the operator to select a camera from the CCTV menu or GUI map.

4.8.1.18. The ATMS shall provide a demand indicator on the user's screen that will display when another authorized user requires control of the camera PTZ.

OpenTMS will provide a demand indicator on the user's screen that will display when another authorized user requires control of the camera PTZ. If a user has a PTZ camera locked and another user with a higher priority level takes control, then the original user receives a message indicating that the camera control was taken over by the other user.

4.8.1.19. The ATMS shall provide preset positions and the capability of programming a minimum of four (4) PTZ preset positions. The presets shall not be deleted/lost if the ATMS or camera software loses connection to the device.

OpenTMS will exceed the ability to provide preset positions and the capability of programming a minimum of four (4) PTZ preset positions. The presets shall not be deleted/lost if the ATMS or camera software loses connection to the device. The number of presets will only be limited by the capacity of the camera.

4.8.1.20. The ATMS shall display camera ID within the video image consisting of the name of the camera location at administrator option.

OpenTMS shall display camera ID within the video image consisting of the name of the camera location at administrator option.

4.8.1.21. The ATMS shall provide for the display of a camera control ID of the party controlling the camera control ID of the party controlling the camera when not in a preset position at administrator option.

OpenTMS shall provide for the display of a camera control ID of the party controlling the camera control ID of the party controlling the camera when not in a preset position at administrator option. If a camera's PTZ controls are locked, you can see which user has locked the camera by hovering your mouse over the lock symbol.

4.8.1.22. The ATMS shall provide a selectable time-out feature which is a programmable interval (range of 2 to 30 minutes) or event identification in which the camera must automatically return to a preset default position after the last camera control commands is received or the event is terminated.

OpenTMS shall provide a selectable time-out feature which is a programmable interval (range of 2 to 30 minutes) or event identification in which the camera must automatically return to a preset default position after the last camera control commands is received or the event is terminated.

4.8.1.23. The ATMS shall be capable of at least four independent camera tours consisting of display to a user-selected video monitor consisting of a user-selected camera and (optional) preset for display of a user-selected duration.

OpenTMS shall exceed this requirement allowing an unlimited number of independent camera tours consisting of display to a user-selected video monitor consisting of a user-selected camera and allows the operator to select the preset for display of a user-selected duration.

4.8.1.24. The ATMS shall allow pan-tilt-zoom (PTZ) and focus and iris control by any authorized user.

OpenTMS shall allow pan-tilt-zoom (PTZ) and focus and iris control by any authorized user.

4.8.1.25. The ATMS shall validate that users have authorized access and priority for full camera control.

OpenTMS shall validate that users have authorized access and priority for full camera control.

4.8.1.26. The ATMS interface shall provide a mechanism for capturing still and moving video images from CCTV video streams in standard format such as JPEG and publishing them to the traffic web page.

OpenTMS solution will allow the DOT the ability to capture still images (JPEG) at a selected interval and display those images on any location given permission. The Solution will also allow live streaming video to be distributed in multiple video protocols without impact to the DOT's internal operations. Mobile phone users will receive HLS protocol which can be seen on the native viewer on the devices. PC users will receive either HLS or CLSP protocol depending on the requirements of the DOT. HLS has inherent latency of 20-30 seconds and is typically use for general public and media distribution. CLSP or Claris Live Streaming Protocol, was developed by Skyline to be a Flash/RTMP replacement. Offering agencies, the ability to distribute low latency video to users that is HTML5 compliant and does not require security permissions to view the video on modern browsers.

4.8.1.27. The ATMS shall allow for camera view access by television media with appropriate rights and restrictions.

OpenTMS solution will allow for camera view access by television media with appropriate rights and restrictions

4.8.2. Device Control – CCTV/Camera Desirables

4.8.2.1. The ATMS should include capability to set camera pre-sets by time of day / day of week, season of the year, and by independent user.

OpenTMS should include capability to set camera pre-sets by time of day / day of week, season of the year, and by independent user.

4.8.2.2. The ATMS should manage conflicts between pre-sets selected by multiple users.

OpenTMS will manage conflicts between pre-sets selected by multiple users.

4.8.2.3. CCTV control from users accessing the ATMS from within the TMC should have a latency of no more than 0.5 second as defined by the time an operator executes a control command and when an operator is able to visually verify the command was completed on a workstation or video wall.

OpenTMS CCTV control from users accessing the ATMS from within the TMC will have a latency of no more than 0.5 second as defined by the time an operator executes a control command and when an operator is able to visually verify the command was completed on a workstation or video wall.

4.8.2.4. CCTV control from users accessing the ATMS from remote access should have a latency of no more than 0.5 second as defined by the time an operator executes a control command and when an operator is able to visually verify the command was completed on a workstation or video wall.

OpenTMS CCTV control from users accessing the ATMS from remote access will have a latency of no more than 0.5 second as defined by the time an operator executes a control command and when an operator is able to visually verify the command was completed on a workstation or video wall. Note that issues with the users connection to the ATMS or the network will not be included in the time requirement.

4.8.2.5. The ATMS should interface to cameras operated by TMC partners on arterial roadways.

OpenTMS will interface to cameras operated by TMC partners on arterial roadways if provided with the correct access rights to those devices and their network.

4.8.2.6. The ATMS should incorporate view restriction protocols (blackout zones).

Currently, OpenTMS doesn't support the blackout zone capability, but the design does allow for us to expand in the future.

4.8.2.7. The ATMS should provide an interface that allows operators to manage, control, and display multiple closed-circuit television cameras including pan-tilt-zoom functions and manual camera functions available from the camera vendors where applicable. Camera image display must include simultaneous display of all cameras up to the number of monitors in the TMC.

OpenTMS will provide an interface that allows operators to manage, control, and display multiple closed-circuit television cameras including pan-tilt-zoom functions and manual camera functions available from the camera vendors where applicable. Camera image display must include simultaneous display of all cameras up to the number of monitors in the TMC.

4.8.2.8. The ATMS should allow reclamation of control of a camera being demanded by other users based on user privilege levels.

OpenTMS will allow reclamation of control of a camera being demanded by other users based on user privilege levels.

4.8.2.9. The ATMS should display the name of camera preset selected within the video image when pointed using the preset capability at administrator option.

OpenTMS will display the name of the camera preset selected within the video image when pointed using the preset capability at the administrator option.
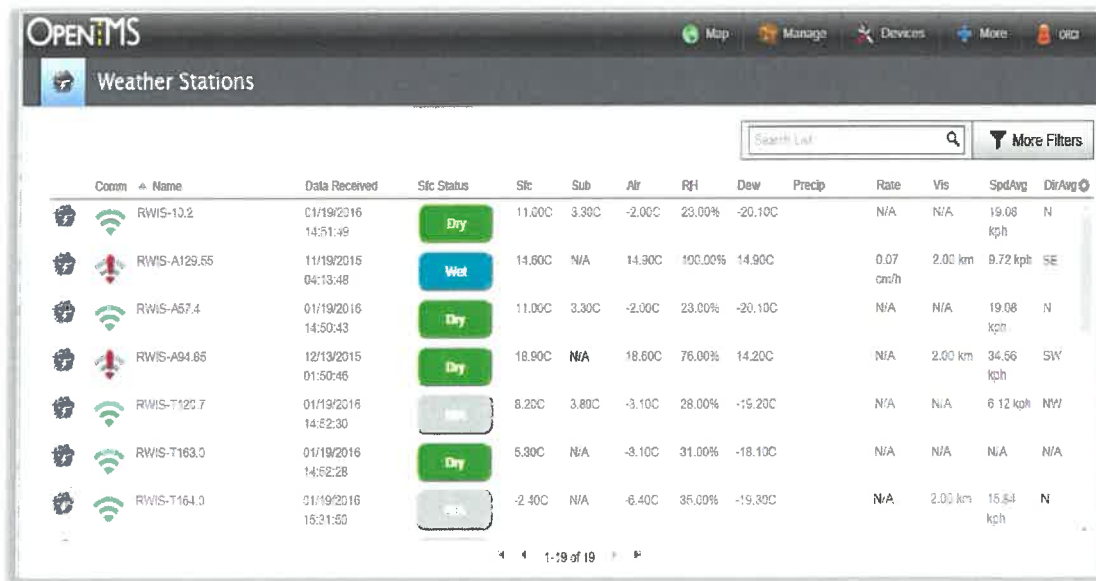
8.0 Device Control - RWIS (CRFP Section 4.9)

4.9. Device Control - RWIS

4.9.1. Mandatory Requirements

4.9.1.1. *The ATMS shall monitor weather data from the field devices and set threshold levels for conditions that must be posted on the GUI and integrated with the notification system.*

OpenTMS meets this requirement. The OpenTMS <u>Weather module</u> provides operators with a common interface to control all their weather stations, regardless of manufacturer. The weather module that contains both a list view and a device view. The list view shown below provides a summary of the communication status and key data provided by the RWIS devices.

Figure 59 - Weather Stations

The data view, as shown below provides real time information on the current device status and data readings, images from cameras mounted on the RWIS, and maintenance information. OpenTMS can ingest and display data from any sensor on the RWIS that is transmitting data.

When setting up the RWIS, administrators can configure thresholds on each sensor for triggering system alarms. Configured thresholds are displayed in the detailed view. In the figure below thresholds are set for temperature. As the temperature drops and a threshold is crossed an Alert in the Alert Management system will be created.

Figure 60 - Weather Stations-Configured Thresholds

Below is an example of an Alert Notification. To view details on the alert, access through the Alerts module.
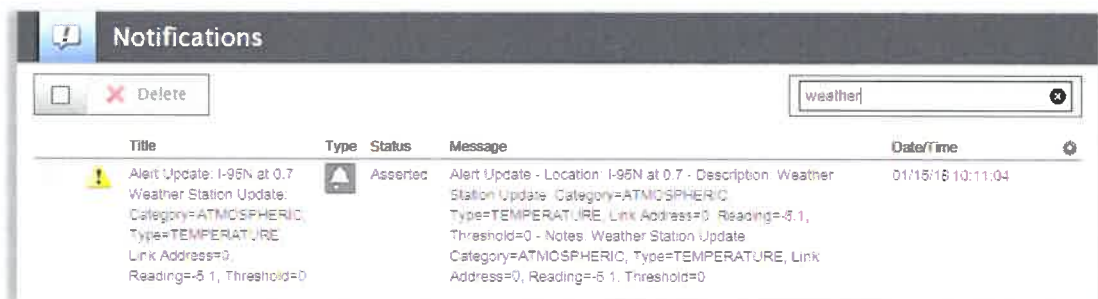
Figure 61 - Example of an Alert Notification

4.9.1.2. The ATMS shall accept weather sensor data coming from existing and future environmental sensors and systems.

OpenTMS meets this requirement. OpenTMS support the existing RWIS deployed in WV today. OpenTMS supports the following RWIS protocols: Vaisala 3, Vaisala FTP, Vaisala 2, Vaisala ROSA, Vaisala PWD, NTCIP, SSI, DTN v1 & v2, HSE IceSight, and HSE StormLink.

4.9.1.3. The ATMS shall log RWIS data for operational retrieval and reporting purposes.

OpenTMS meets this requirement. OpenTMS logs all RWIS data in the database. From the GUI, the data is accessible from one of the Atmospheric, Pavement, and Subsurface Logs in the device detailed view's Maintenance tab. The user can enter a start and end time to look at historical data.

Figure 62 - The Reporting Module

The Reporting module supports access to the data for reports or download.

4.9.1.4. The ATMS shall support daily automated diagnostics for field RWIS devise, including alarm generation based on diagnostic results and results logging.

OpenTMS will provide the ability for a user to schedule diagnostic tests. When the tests are run, the results will be logged in the event log accessible from the maintenance tab. If errors are found a notification will be generated. Tests available are dependent on the integration and protocol implemented.

The system polls in the background and generates a notification when and error is found as well as logs the state in the status log. Status to the right changes to a red **X** when an error is reporting. Diagnostic data available may vary based on protocol.

4.9.2. Device Control – RWIS Desirables

4.9.2.1. The ATMS should enable viewing of RWIS cameras.

OpenTMS meets this requirement. OpenTMS supports pulling RWIS images from Vaisala 3 and Vaisala FTP protocols. WV uses Vaisala 3 today.

SENSOR STATUS	
Comm	✓
Weather Sensor	✓
Ext. Weather Sensor	✓
Road Sensor	✓
Subsurface Sensor	✓
Ext. Subsurface Sensor	✓
Traffic Sensor	✓
Video Board	✓

Figure 63 - RWIS images

4.9.2.2. The ATMS should provide an alert to operators when user defined thresholds are met. e.g. The pavement temperature drops below 32 degrees F.

OpenTMS meets this requirement. OpenTMS supports thresholds. To set a pavement temperature threshold the user would configure the thresholds in the admin portal. A threshold could be set to trigger when the temperature drops below 32. When the threshold drops below 32 an Alert will be created. The user will receive a notification. Clicking on the Notification will bring up the Alert in the Alerts module. The user can review the notes for the update to view the reading that triggered the alert.

From the Alerts module, a user can create a weather event from the threshold crossing.
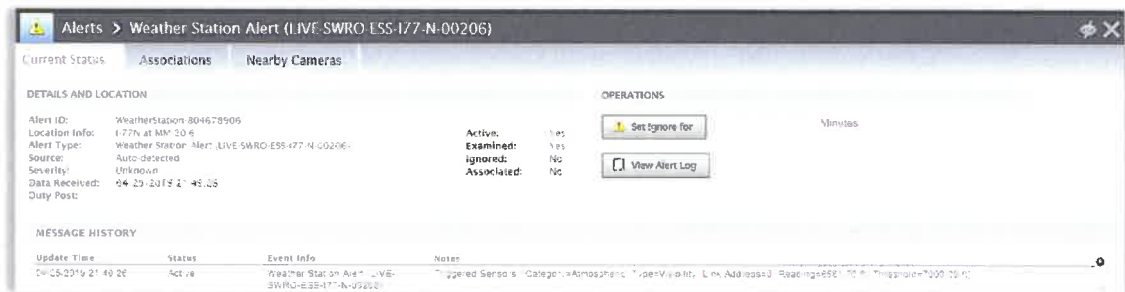
Figure 64 - Alerts Module and Thresholds

4.9.3. Device Control Data Sensors – Desirables

4.9.3.1. Although WVDOH does not currently have any data collection sensors in use, they desire this functionality in the future. A detector device control application should be available if and when WVDOH installs detectors.

Out of the box, OpenTMS has a Detectors module with a full set of protocols available; NTCIP, EIS-RTMS, Wavetronix, Peek, SSI to name a few. This module is deployed at multiple client sites today.

4.9.3.2. The ATMS should have the ability to integrate with and accept data from 3rd party data providers such as Waze, HERE, Inrix, etc. or approved equal.

The OpenTMS open modular architecture provides us the ability to integrate additional travel time and incident detection data sources. OpenTMS integrates with INRIX today in two of our client sites to provide travel times. The ATMS solution has a travel time engine that pulls statewide XD Segments from INRIX and makes the data available to the OpenTMS Travel Time module for posting travel times on DMS. Waze integration is on the road map for another client.
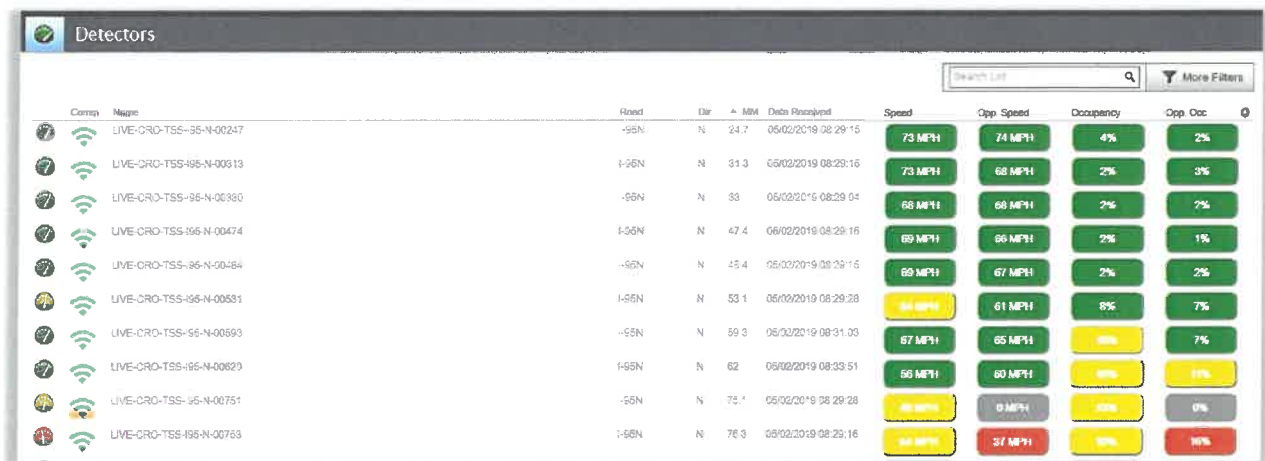
Figure 65 - OpenTMS Travel Time module

4.9.3.3. *The ATMS should provide an interface that allows operators to manage and view a summary of information from roadway sensors to the present status of the entire roadway network including a summary of individual traffic variables (speed, volume, occupancy, or a combined congestion metric) and the status (functional or nonfunctional) of all traffic sensors.*

Out of the box, the detectors list view provides an at a glance summary of all detectors with the most recent data recorded colored by congestion level. Speed is displayed by default, but Occupancy columns can be enabled. The current communication status is also displayed. From the figure below we see that all detectors are in good communications, but one of the detectors is reporting an error ( ) that needs to be investigated.

Figure 66 - The Detectors List View

4.9.3.4. *The ATMS should display an alarm notification when traffic speeds drop, volume rises, or occupancy increases beyond configurable thresholds.*

Out of the box, OpenTMS supports speed thresholds for detectors. Traffic data is used to generate alerts based on a configurable speed threshold that compares real-time to historical data to determine when to automatically trigger an alert. Historical data is calculated over the previous 60 days in 5-minute increments by day of the week. The threshold settings are configurable in the Admin Portal.

4.9.3.5. *The ATMS should update the 511-website interface with information including a summary of individual traffic variables (speed, volume, occupancy, or a combined congestion metric).*

Out of the box, the ATMS provides a Detector Feed that third parties can pull. Feed contains speed, volume, and occupancy.

The ATMS will provide the 511-website interface with the traffic variables requested, and these will become part of the ATIS master database. WVDOT will discuss how they would like this information displayed during the design phase of the implementation.

4.9.3.6.   The ATMS should update the ATMS traffic conditions map/GUI with measurements from traffic sensors and derived traffic variables on a frequency of once per minute or more frequent with data that have been collected two minutes or less prior.

Out of the box, OpenTMS updates detector data in real-time for display in the map/GUI.

4.9.3.7.   The ATMS should automatically measure or calculate volume, traffic speeds, and occupancy.

Out of the box, the OpenTMS detector module continuously polls and ingests real-time traffic data from detectors. This data is made available to the user on user interface and is used in the background to provide incident detection.

4.9.3.8.   The ATMS should calculate and be able to display vehicle classification information.

Out of the box, our some of our detector protocols support the reading of classification data and making it available on the user interface.
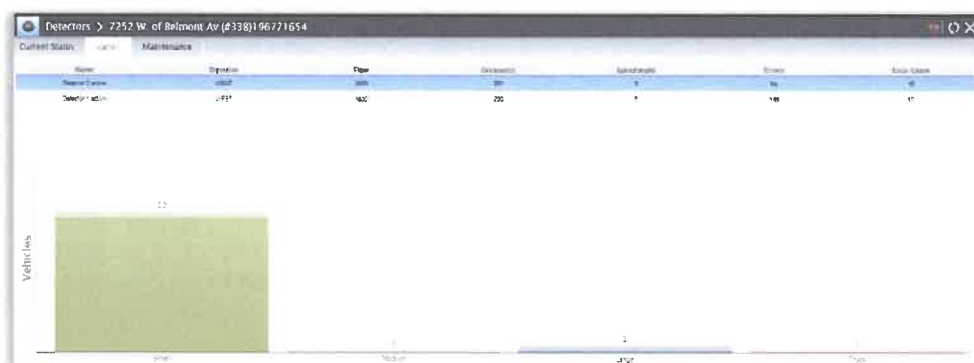
Figure 67 - Classification Data

9.0 Event/Incident Management & Reporting (CRFP Section 4.10)

4.10. Event/Incident Management & Reporting

On the Q-Free Product Road Map for the next version of OpenTMS is a consolidation of our Incidents, Planned Events and Weather Incidents into a single Events module. This consolidated module will focus users on consistent look and feel for event management with consistent features like Incident Response. Based on feedback from our clients they want to take our current event management and extend functionality to include many of the features available in the incident module today such as – business rules for message posting and notifications, timeline views, consolidated incident/event reporting and management from a single view. As this module is developed the WVDOH will participate in the design process by providing input at the sprint review meetings.

All the mandatory requirements below will be incorporated into the module. Below is a mockup of the Events Dashboard.
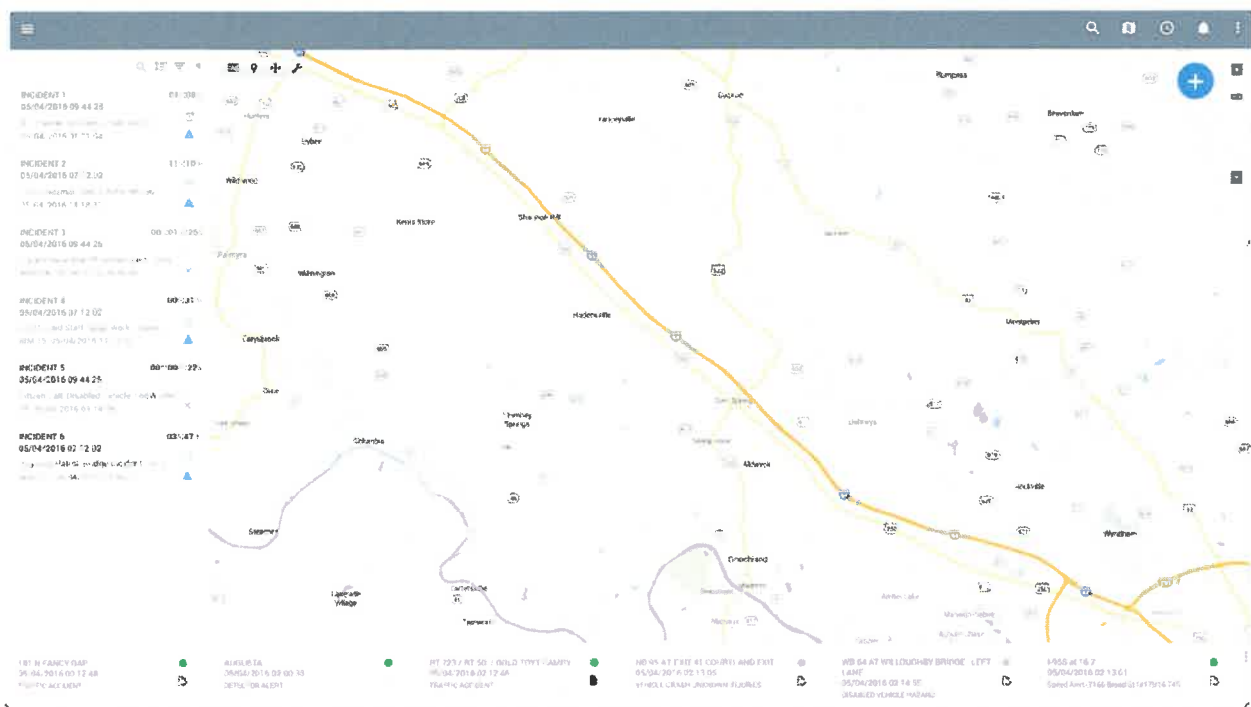
Figure 68 - Events Dashboard

Responses below will discuss our current functionality that will be incorporated into the new module.

4.10.1. Mandatory Requirements

4.10.1.1. The ATMS shall provide a mechanism for operators to manage incidents and events through a dialog box or user interface.

MANAGING INCIDENT DATA

OpenTMS fully meets this requirement. OpenTMS provides a rich user interface for managing incidents. The GUI leads the operator through a workflow to log critical information about the incident and agency/stakeholder activities. The rules-based DSS automatically generates an incident response based on the incident attributes such as incident duration, road or lane closure. The incident response recommends ITS devices, 511 messaging, and email notifications. OpenTMS provides comprehensive logging of all events and provides an interactive graphical timeline. Fields are available for users to comment on the incident status and track relevant information regarding the incident.

The interface is structured to allow operators to quickly enter the minimum required fields so that the initial response and notices to the public can happen rapidly. It also provides a larger palette for more detailed information as needed. Data validation processes are context dependent such that, for example, some incident types may have different required fields from other types.

One element that has been a big success with clients is the configurability of the Incident Management module. An authorized user, via the Administration page, can configure various data elements for selection by operators while managing incidents. A few of these examples are:

- Incident Types;
- Entities Impacted (e.g. School Bus Involved, Hazmat, DOT Employee, etc.);
- Response Agencies (e.g. Highway Helper, Tow Trucks, Law Enforcement, etc.);
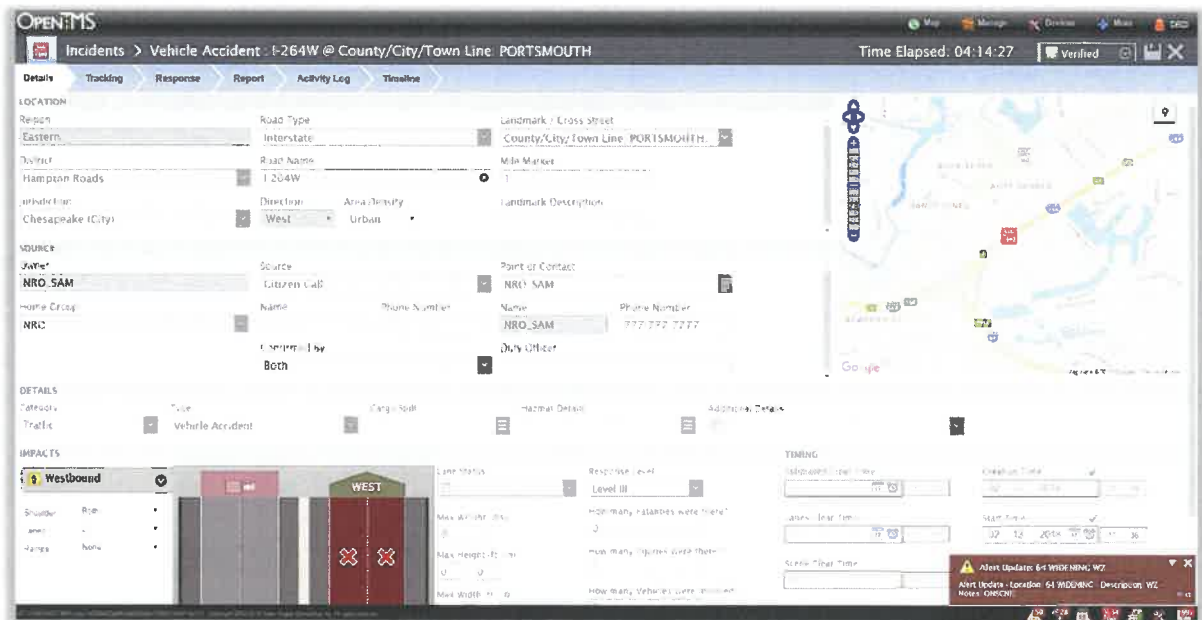
Figure 69 - Incident Management Module

- Severity / Response Level; and

- Incident Sources (e.g. CAD, Waze, Citizen Call, etc.).

OpenTMS uses a natural language processing algorithm to create the base 511 message for an incident based on the incident attributes including severity, impacts, and details. Controls on the user interface allow system users to customize the message in several ways:

- Indicate whether or not to send the message to IVR;

- Add internal information not to be disseminated;

- Add additional text to be displayed on website or social media;

- Add custom text phrases;

- Overwrite the location with more descriptive phrasing;

- Add additional predefined responses such as: Alternating Lane impacts, Watch for stopped vehicles, etc.

- Example 511 response form is shown below.
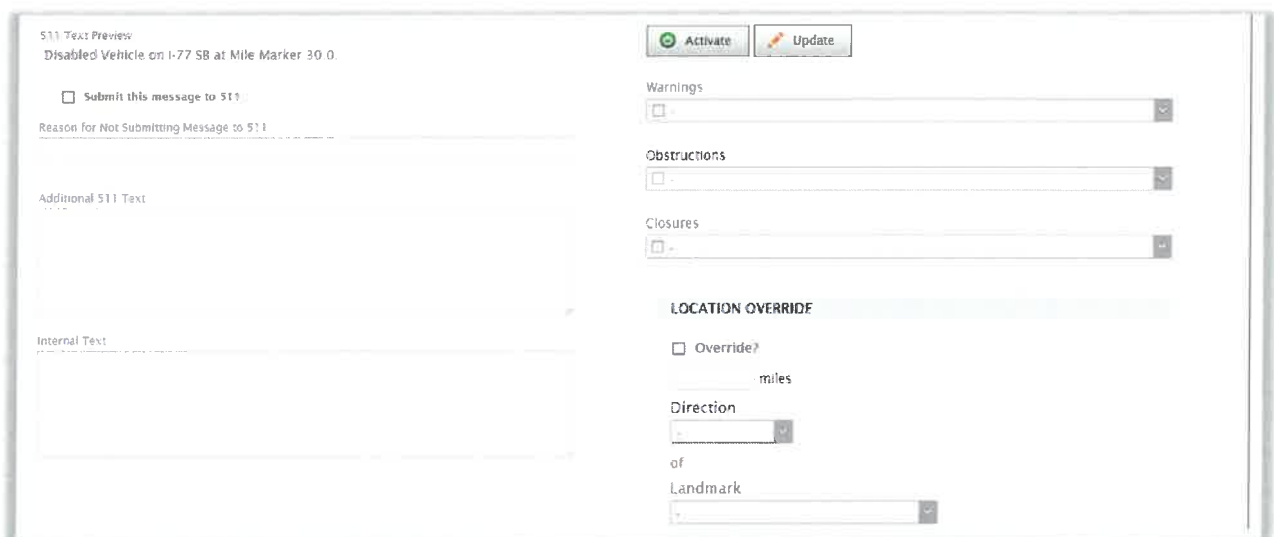
Figure 70 - Example 511 Response Form

Incident Timeline

The incident timeline provides a graphical representation of the incident and its associated activities. The image below shows the start of the incident, the impacted lanes, when signs were posted, and when the 511 message was activated.

- **Devices** – Access to the ITS device command and control modules;

- **More** – Reporting and dashboards; and

- **User Name** – Access to customize use accounts, link to the administration portal, available documentation.
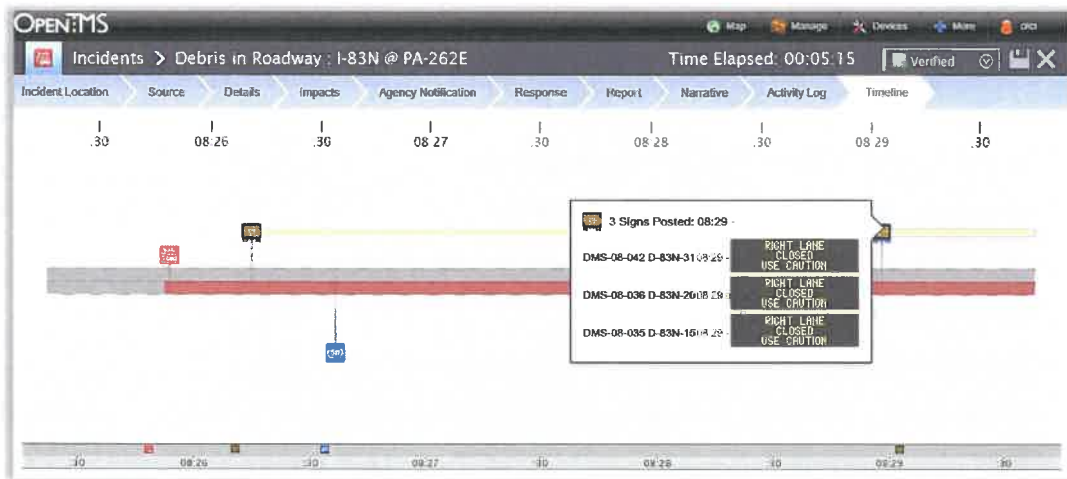
4.10.1.2. The ATMS shall store and provide operators with access to event information (incidents, construction/maintenance, parking, etc.) as entered by users.

OpenTMS meets this requirement. OpenTMS stores all event information in the database. Access to this information is provided through a list view where the user can view a summary of the information for the event. Selecting an event from the list view or map displays the detailed view with additional information.

4.10.1.3. The ATMS shall provide a mechanism for operators to enter/create new incidents or events. Data to be entered may include, but not be limited to: type, location (jurisdiction, route, milepost, direction, lat-long, exit number), source, details, impacts, agencies to notify, response, narrative/comments, activity log, lane configuration, lane impacts, and severity.

OpenTMS meets this requirement. The user can create new incidents or events in a few different ways. An incident can be created from the map by dragging a Pin to the location on the map.

An incident can be created by clicking the *New* button from the Incidents list view. Incidents can be created from an incoming CAD, CitILOG video analytics or RWIS alert as well.
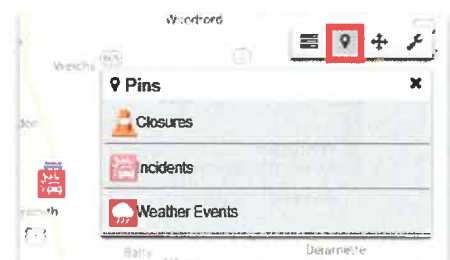
The Incident view is broken down into several tabs:

- **Details** – This tab the user enters all the information to verify an incident, send to 511 and initiate a response plan;

- **Tracking** – This tab is where the user enters all the information for agency notifications, writes free text internal notes, associate alerts and communication logs;

- **Response** – This tab provides the tools for managing field devices, notifications, and recommended responses;

- **Report** – This tab provides a report of all the events that have occurred during this incident. It is a textual report that can be copied and pasted;

- **Activity Log** – This tab provides access to the activity log which records every change made and response to the incident; and

- **Timeline** – This tab provides a graphical view of the incident over its lifespan.

4.10.1.4. Users shall have the option to select from pre-defined phrase to describe the incident or event.
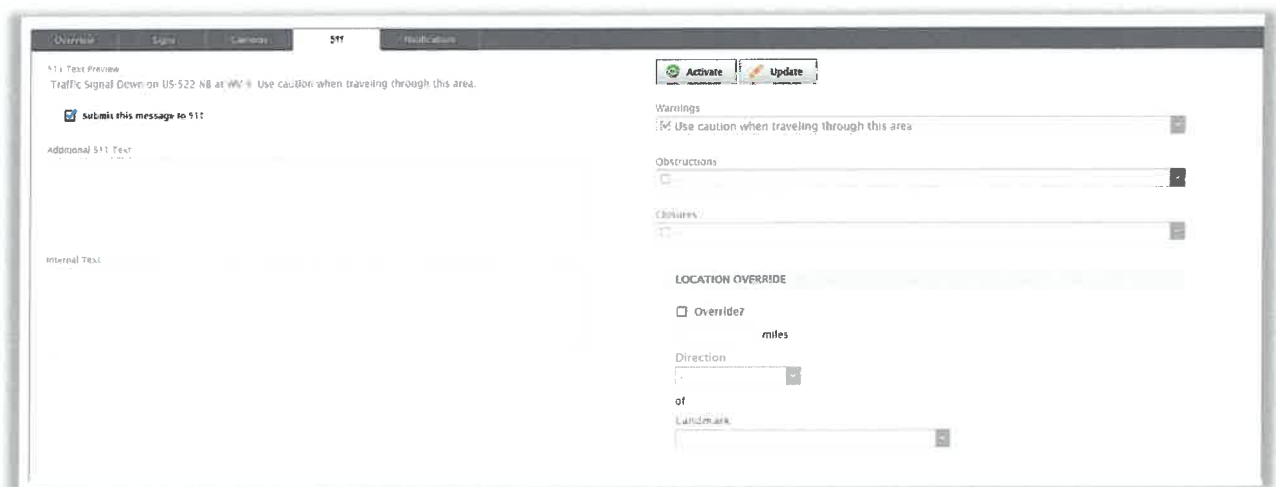
OpenTMS meets this requirement. The user can select a Type of Incident to describe the event. Incident Types are configurable by the administrator in the Admin Portal.

4.10.1.5. Users shall have the option to enter free text to describe the incident or event.

OpenTMS meets this requirement. The user has a few options with entering free text. As part of the Location there is a free text Landmark Description, Tracking tab there is a free text internal notes area. If these options are not optimal, Q-Free will work with the WVDOH on a solution to meet their requirement.
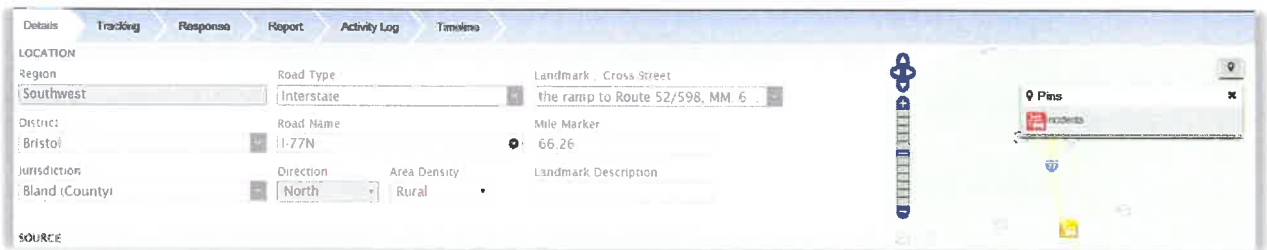
4.10.1.6. Users shall have the option to enter free text to describe the incident or event for descriptions posted to 511.

OpenTMS meets this requirement. Below is a figure of the Incident location section The user shall have the ability to review and enter additional free text for incidents or events posted to 511.
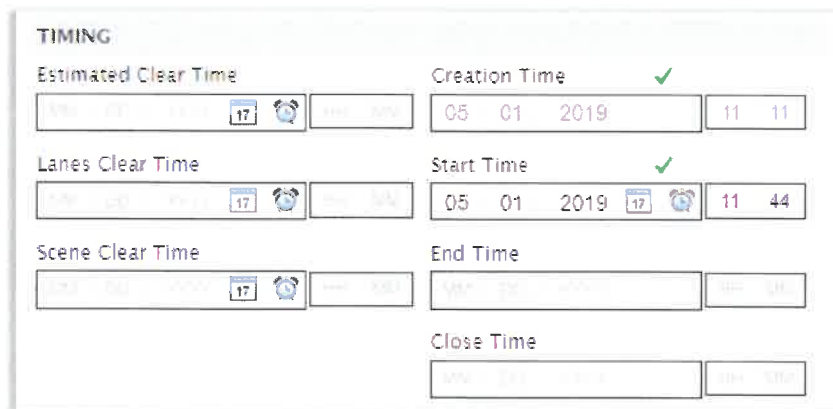
4.10.1.7. Users shall be required to specify the location of the incident either through data entry or pin-dropping on a map such that the ATMS can capture the location of the incident relative to the route, direction and location (milepost and/or lat-long).

OpenTMS meets this requirement. The user has the option of entering the location in the Location section of the form or to use the map to drop a pin on the roadway. The location panel will automatically update based on the pin drop.

4.10.1.8. Users shall be required to enter the start and end time of the incident or event.
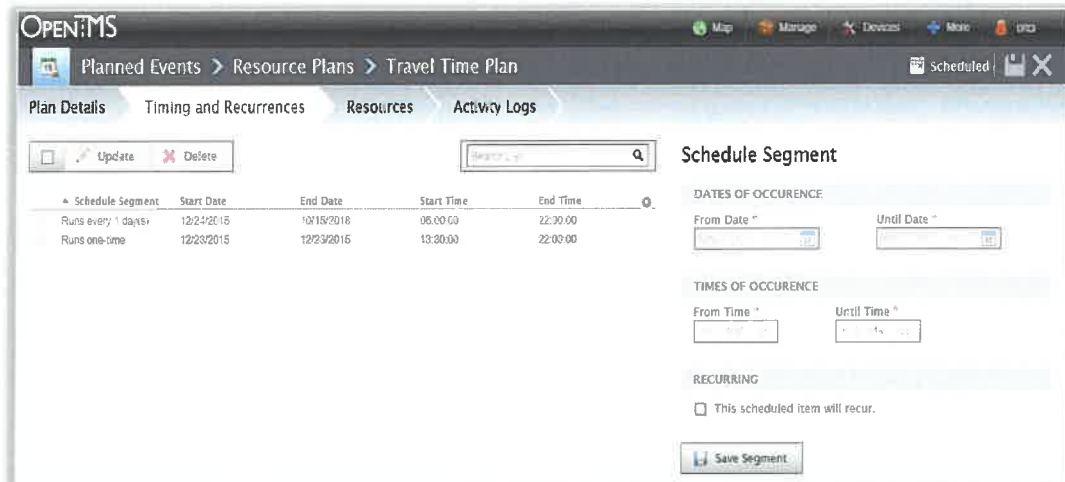
OpenTMS meets this requirement. The Incident details tab contains a Timing section where the user can enter start and end time of the incident. Some of these fields are defaulted base on certain actions but can be updated by the user before saving.

For scheduled events the start and end times are recorded when the schedule kicks off and terminates in the activity log.

4.10.1.9. *The ATMS shall allow incident or event start times in the future to be entered and pre-defined actions to take place (e.g. construction events are often entered before the start time).*

OpenTMS meets this requirement. Using the Planned Event module, WVDOH will have the ability to create custom schedules for special events, routine maintenance, emergency Work zones, or long-term projects. The interface allows the users to associate field devices, track the POC or responsible parties, and assign the event to a specific home group. This allows multiple agencies using the same platform, to filter out what is only important to that agency or home group.

Figure 71 - Travel Time Plans

4.10.1.10. *Authorized users shall be able to edit incident reports.*

OpenTMS meets this requirement. Privileges are configurable and only those users with the correct permissions will be allowed to edit incidents. In addition, some privileges can be restricted by home group.

4.10.1.11. *Authorized users shall be able to edit incident reports created by any user in the system.*

OpenTMS meets this requirement. Privileges are configurable and only those users with the correct permissions will be allowed to edit incidents.

4.10.1.12. *Authorized users shall be able to edit incident reports received by the ATMS from external systems.*

OpenTMS meets this requirement. Privileges are configurable and only those users with the correct permissions will be allowed to edit incidents.

4.10.1.13. *The ATMS shall provide a mechanism for entry and edit of construction information as a specific type of incident/event.*

OpenTMS will meet this requirement. The user can select a Type of incident/event to describe the event. Incident/Event Types will be configurable by the administrator in the Admin Portal.

4.10.1.14. Authorized users shall be able to create construction/maintenance event reports in the ATMS.

OpenTMS meets this requirement. Privileges are configurable and only those users with the correct permissions will be allowed to edit construction/maintenance events. In addition, some privilege can be restricted by home group.

4.10.1.15. Authorized users shall be able to edit construction/maintenance event reports, including changing the status from active to inactive.

OpenTMS meets this requirement. Privileges are configurable and only those users with the correct permissions will be allowed to edit construction/maintenance events.

4.10.1.16. The ATMS shall include capability for operators to enter and update construction and maintenance activities for private utilities that will impact travel on public roads.

OpenTMS meets this requirement. Users can enter and update construction and maintenance events for any third party. These events can be sent to 511 or schedule the posting of DMS.

4.10.1.17. The ATMS event management system shall include capability to generate and send alerts to WVDOH partner agencies and personnel.

OpenTMS will meet this requirement. Our Incident module supports notifications to partners Out of the box,. As mentioned in the introduction to this section our new Events module will support notification to partners for scheduled events.

4.10.1.18. The ATMS shall provide a mechanism for operators to edit incidents, regardless of the source of the incident.

OpenTMS meets this requirement. All incidents can be edited by authorized users regardless of the source of the incident.

4.10.1.19. The ATMS shall display the location of fixed ITS devices that are integrated in to the ATMS.

OpenTMS meets this requirement. All ITS devices are shown on the map at the configured location. ITS devices when presented in a list include the location.

4.10.1.20. The ATMS shall display the location of portable devices that are either reporting data to the ATMS (including location) or have been entered/configured in the ATMS by operator.

OpenTMS meets this requirement. All ITS devices are shown on the map at the configured location. ITS devices when presented in a list include the location. ATMS has integrated with the NTCIP location commands for DMS and can automatically move a DMS as it is moved in the field if the device is equipped with a GPS.

4.10.1.21. The ATMS shall maintain an incident log that records the date/time stamps of operator's actions and data entry.

OpenTMS meets this requirement. All incident activity and responses are logged. A sample log is shown below.

Figure 72 - Sample Incident Log

4.10.1.22. The ATMS shall provide a mechanism for entry and edit of truck parking information from existing truck parking systems on 1-81 and future systems.

OpenTMS meets this requirement. OpenTMS has a Parking Guidance module that provides the ability to monitor and report the availability of parking from parking areas that are instrumented with vehicle counting devices. Parking availability data is disseminated to the traveling public via a roadway sign indication if the truck parking area is "Open", "Full" or "Closed" as well as delivering the status of the truck parking lots to 3rd party public notification systems, such as the 511 Travelers Information System, alerting drivers of the state of the parking area.

The parking guidance module contains both a list view, shown below, and a detailed view.

Figure 73 - Parking Guidance Module List View

The Parking Guidance Admin module provides an administrator with the ability to administer existing parking sites as well as configure new sites as they are brought on-line.

4.10.1.23. The ATMS shall include capability of accepting truck parking occupancy data for parking lots.

OpenTMS meets this requirement. The Parking Guidance module polls for occupancy data at regular intervals.

4.10.1.24.The ATMS shall accept and handle truck parking occupancy data for multiple lots and distinguish the lots in display to operators.

OpenTMS meets this requirement. The Parking Guidance module provides for the system to configure multiple parking sites. Each parking site has its own icon on the map and is distinctly identified in the module's list view.

4.10.1.25.The ATMS shall include capability to receive incident reports from external systems.

OpenTMS meets this requirement. OpenTMS supports the ability to detect incidents from external systems such as State Police, 911 centers, CitILOG video analytics, and through monitoring RWIS and Detector threshold crossings. Notification of potential incidents are integrated into the OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert.

4.10.1.26.The ATMS shall include functionality to receive incidents from various 911 centers and law enforcement CAD systems and software.

OpenTMS meets this requirement. Q-Free has been a leader in CAD integration for over the last 10+ years. Q-Free has integrated over 12 separate CAD systems from State Police and 911 centers. We support all the CAD systems identified in this RFP. Q-Free has three clients actively using CAD alerts as a primary component of incident detection. We've integrated over 40+ centers between these clients. Traffic CAD events are integrated into OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert tracking the two together. As updates come in the users have the most update to date information within minutes of being entered by the 911 center.

4.10.1.27.The ATMS shall include functionally to detect incidents using incident detection algorithms and available data.

OpenTMS meets this requirement. OpenTMS offers automated incident detection to help notify users about changing traffic conditions that warrant further inspection. Possible sources of incident detection include:

- Incidents reported by 911/CAD;
- Incidents reported through video analytics – presence of wrong way driver, stopped vehicle, debris;
- Incidents / congestion reported through detector threshold crossing; and
- Potential for incidents reported through RWIS threshold crossings such as low visibility.

4.10.1.28.The ATMS shall include capability to process active incidents against internal logic to determine action plans to be performed.

OpenTMS meets this requirement. OpenTMS provides a rich user interface for managing incidents and response to incidents. The GUI leads the operator through a workflow to log critical information about the incident and agency/stakeholder activities. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS devices, 511 messaging, and email notifications. Q-Free will work with the WVDOH to customize the rules to meet their standard operating procedures.

4.10.1.29. The ATMS shall provide a mechanism for operators or administrators to create and edit action plans to include recommended activities to be performed for a variety of types of incidents and other events (special events, weather events, construction activities, maintenance activities).

OpenTMS meets this requirement. The first generation OpenTMS DSS is constructed around DROOLS (www.drools.org), the open source Business Rules Management System (BRMS).This DSS is currently in use for our clients in Pennsylvania (incident response planning, integrated corridor management), Virginia (incident response planning, West Virginia (incident response planning), and Ohio (ntegrated corridor management).

The Q-Free Business Rules Engine (BRE) enables us to generate response plans that were previously managed with table driven rules with fewer than 30 business rules. The beauty of the DSS is that our clients can focus on managing their business policies for incident management to ensure a consistent approach for selecting ITS devices and formatting consistent messages across the state. Q-Free will work with the WVDOH to customize the rules to meet their standard operating procedures.

Once a response is recommended users can edit the response. Note the blue stars 🔵 in the figure below. These indicate devices recommended in the response. Clicking on the star removes the device from the response and clicking on a devices adds it to the response. This provides the user the ability to quick edit recommended action plans by adding or removing devices. When a DMS is activated a blue check 🔵 is displayed.
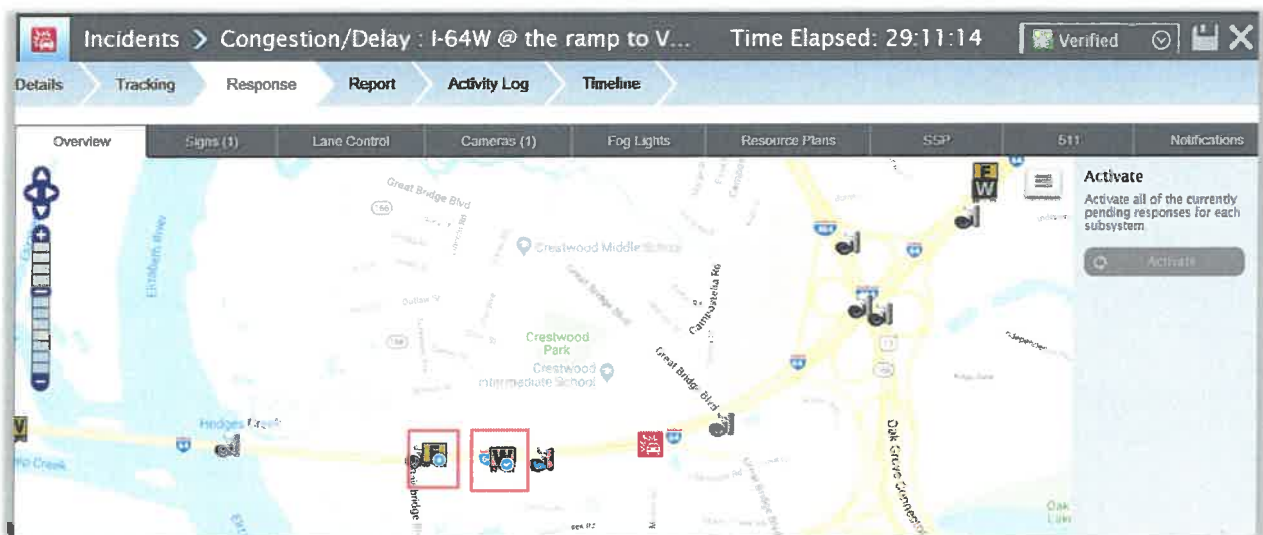
As mentioned in the introduction to this section our new Events module will support automated response plans.

4.10.1.30. The ATMS event management plans shall include both automated and manual activities (manual are displayed to operators for them to perform).

OpenTMS meets this requirement. The OpenTMS rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS

devices, 511 messaging, and email notifications. All generated responses are presented to the user for review. Users can remove or add DMS from a response before activating.

4.10.1.31.The event management plans shall evaluate current incident/event reports against thresholds and recommended one or more activities to operators.

OpenTMS meets this requirement. The OpenTMS rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS devices, 511 messaging, and email notifications.

4.10.1.32.When activities are recommended to operators, operators shall have a mechanism to accept, decline, or edit and accept the recommendations.

OpenTMS meets this requirement. Users can modify the recommended plan by adding/removing signs from the plan and altering any messaging or editing email recipients and the email message. Once the user has reviewed the recommendation the response can be activated or not.

4.10.1.33.The ATMS shall perform the activities that are recommended and accepted (with or without editing) by operators.
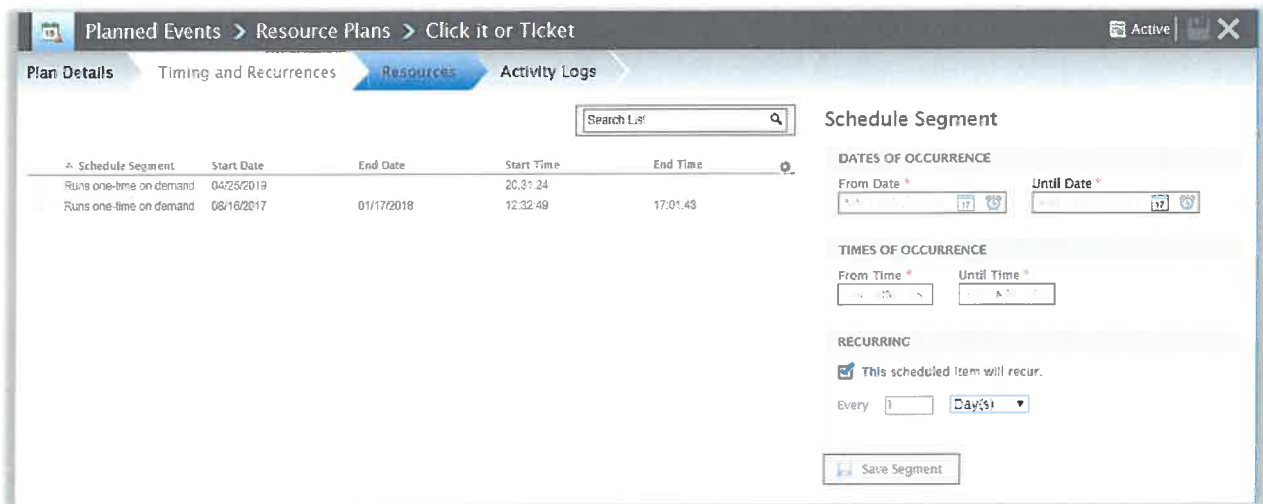
OpenTMS meets this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. Users can modify the recommended plan by adding/removing signs from the plan and altering any messaging or editing email recipients and the email message. Once the user has reviewed the recommendation the response can be activated.

4.10.1.34.The thresholds controlling the ATMS event management plans shall be adjustable by operators or administrators.

OpenTMS meets this requirement. The OpenTMS rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS devices, 511 messaging, and email notifications. Based on current roadway conditions or special event in progress the user can modify the response or choose not to activate.

4.10.1.35. The thresholds controlling the ATMS event management plans shall allow for time of day, day of week, time of year settings.

OpenTMS meets this requirement. The Planned Event module, shown below, will enable WVDOH users to schedule upcoming events for posting traveler information via roadside devices or 511. Events will activate at the scheduled time and perform the scheduled actions such as posting messages.

Figure 74 - The Planned Event Module

Events can be scheduled by time of day, every X day, every X week, or every X month. Refer to the figures below for recurring segments.

4.10.1.36. ATMS events can be programmed for future events and associate DMS devices and messages to be used with that future event.

OpenTMS meets this requirement. The Planned Event Module Resources tab, shown below, will enable WVDOH users to schedule future events and associate DMS message to be posted when the schedule activates.
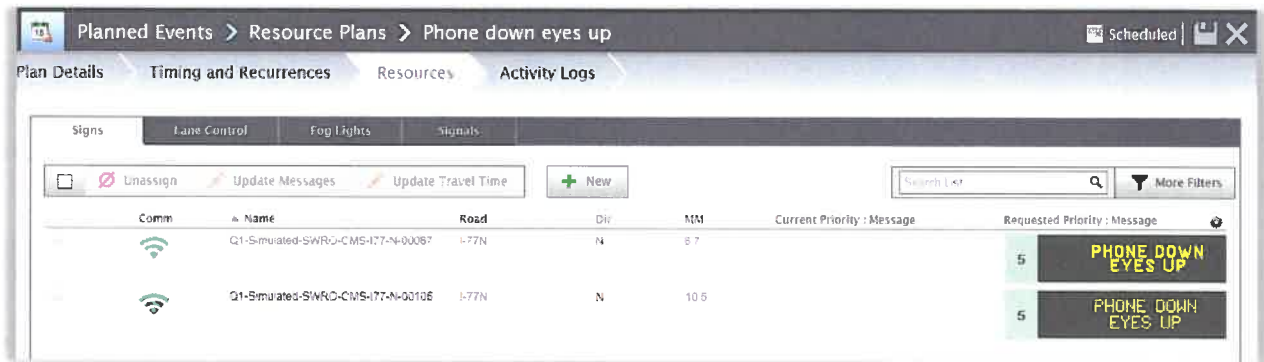
4.10.1.37. The ATMS event management plans shall include control of DMS.

OpenTMS meets this requirement. The Planned Event Module Resources tab, shown below, will enable WVDOH users to schedule future events and associate DMS message to be posted when the schedule activates.
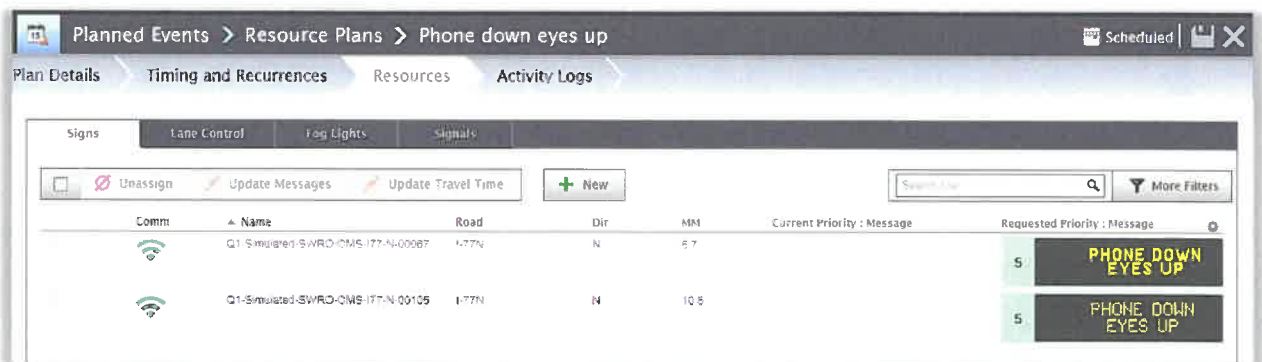
Figure 75 - The Planned Event Module Resources Tab

4.10.1.38. The DMS event management plans shall automatically recommend messages to be displayed on signs based on incident and event attributes.

OpenTMS meets this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create a response plan automatically recommending DMS messages.

4.10.1.39. The ATMS event management plans shall allow authorized users to program messages for DMS and 511 to be presented by time of day.

OpenTMS will meet this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends

ITS devices, 511 messaging, and email notifications. OpenTMS further allows for the operator to modify the recommendation before accepting the suggested ITS devices. ITS devices can be added or removed from the response and DMS messages used as recommended or updated. As mentioned in the introduction to this section our new Events module will support automated response plans. Response would activate when the schedule kicks off.

4.10.1.40. The time of day messages in event management plans shall be able to be overridden by authorized users.
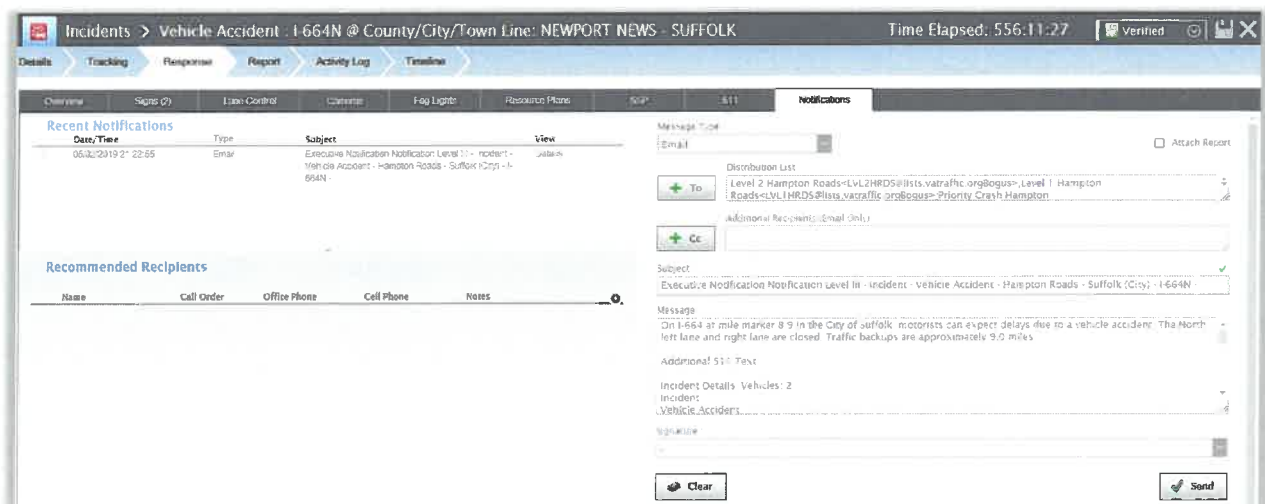
OpenTMS will meet this requirement. Users will the correct privileges will be able to edit the event plan.

4.10.1.41. The ATMS event management plans shall include standard operating procedures to operators to follow, based on the type and location of the event.

OpenTMS will meet this requirement. Leveraging the automated incident response recommendations will help to standardize responses, Q-Free will work with the WVDOH to customize rules to meet their standard operating procedures. As mentioned in the introduction to this section our new Events module will support automated response plans.

4.10.1.42. The ATMS shall have the ability to automatically send an event alert message to selected recipients upon incident confirmation via automated event notification.

OpenTMS meets this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends email notifications. The response notifications tab is shown below. Messages sent are logged on the left and the recommended email is shown on the right. The user can modify the email and add or remove recipients.

Figure 76 - Incident Response Notifications Tab

4.10.1.43. The ATMS shall display active events as symbols (icons) located next to the associated link on the traffic Conditions map/GUI.

OpenTMS meets this requirement. The event icon is placed at the starting location of the event.

4.10.1.44. The ATMS shall provide users the ability to initiate the editing, confirmation, and termination of events by selecting the graphic object from the traffic conditions map/GUI.

OpenTMS meets this requirement. The user can select the planned event icon (⚠) from the map to display the Event's detailed view. The user can edit the event information and update the status to Active, Scheduled, Approved, Conflicted, Inactive, and Unapproved. The Event's detailed view is shown below.

Figure 77 - Event's Detailed View

4.10.1.45. The ATMS shall provide the ability to view an active event report containing a listing of all events active at the time of the report request including summary information about each event.

OpenTMS meets this requirement. Accessing the Planned Events module from the Manage menu displays the list view. This view provides a summary of all the resource plans their current status and description.

Q-Free will provide a Jasper Report that provides a summary of the active resource plans. Team Q-Free will work with the WVDOH on the contents of that report.

4.10.1.46. The ATMS shall provide users the ability to assign (add/remove) field devices to an event. The field device shall remain assigned to that event until the event is terminated, the device is removed, or the device is added to another event.

OpenTMS meets this requirement. The user can click the *Unassign* button to remove a DMS from an event and click *New* to add a DMS to an event. The DMS will remain assigned to the event until it is removed.

4.10.1.47. The ATMS shall provide users the ability to reactivate a terminated event.

OpenTMS meets this requirement. To reactivate a terminated event the user can *Run Plan* on demand or *Edit* the plan and create or update the schedule timing.
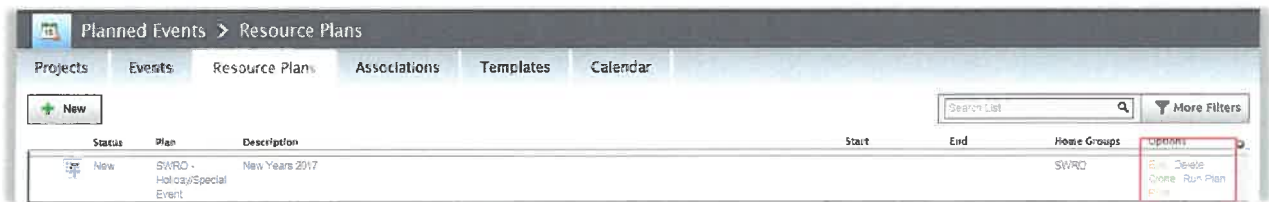
4.10.1.48. The ATMS shall distribute all event data to WVDOH authorized users.

OpenTMS meets this requirement. All authorized users will have access to the event.
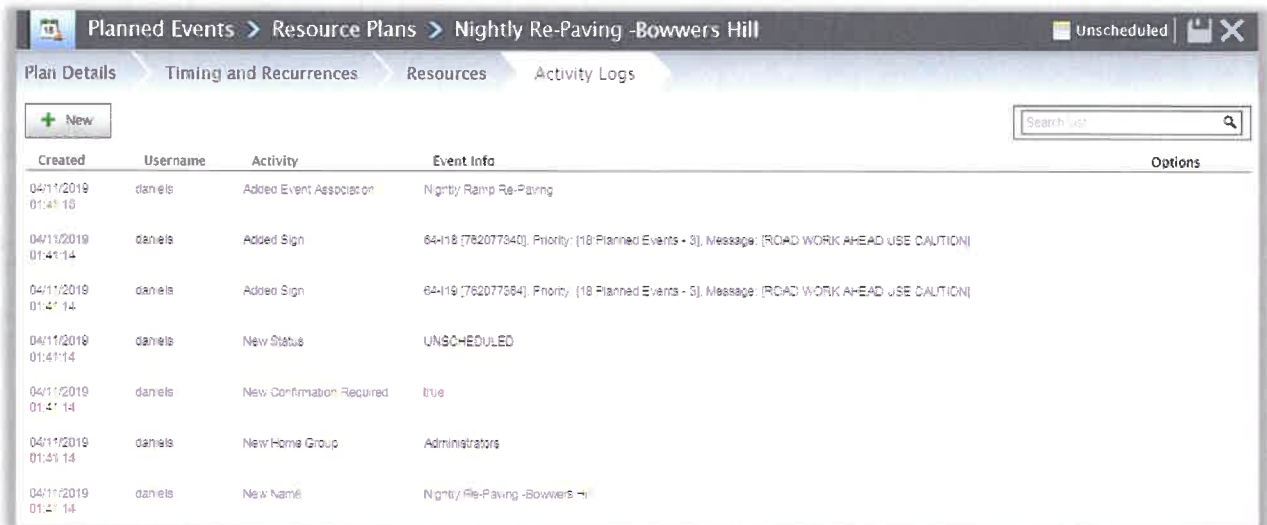
4.10.1.49. The ATMS shall provide the user with a request to confirm before an event is terminated.

OpenTMS meets this requirement. When a schedule is about to terminate, the user receives a resource Plan Expiration Reminder. Clicking on the reminder provides the user the ability to extend the plan. An example reminder is shown below.
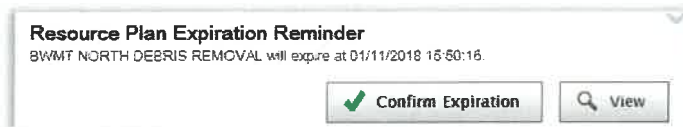
4.10.1.50. The ATMS shall record date and time of device access, system user, action taken, messages posted to device and error logs by event or by operator.

OpenTMS meets this requirement. The event activity log records every change and action taken by users, system actions, messages posted and any errors posting those messages or activating the schedule. Below is an example of an event activity log.

4.10.1.51. The ATMS shall identify DMS devices for use in display of specific message set(s) in response to an event.

OpenTMS will meet this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends DMS messaging.

4.10.1.52. The ATMS shall provide a user interface to accept, modify or decline the identified ITS devices suggested by the system in response to an event.

OpenTMS will meet this requirement. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS devices, 511 messaging, and email notifications. OpenTMS further allows for the operator to modify the recommendation before accepting the suggested ITS devices. ITS devices can be added or removed from the response and DMS messages used as recommended or updated. As mentioned in the introduction to this section our new Events module will support automated response plans.

4.10.1.53. The ATMS shall provide a user interface to initiate or inhibit display of DMS messages with and allow user modification of DMS messages in response to an event.

OpenTMS meets this requirement. The user can unassign DMS, update both standard and travel time messages when managing an event. If additional DMS are needed at a later date, the user can add new DMS and save.

4.10.1.54. The ATMS shall provide the ability to create test events that are not transmitted outside of the TMC or to devices for the purpose of training of operators.

OpenTMS will meet this requirement. The Incident Types are configurable in the Admin Portal. As far as configuring Incident/Event type there is a default Public Mode that can be set to Never.

As part of this deploying, Q-Free will be deploying a Staging environment that the WVDOH can access for training new users.

4.10.2. Event/Incident Management Reporting Desirables

4.10.2.1. The ATMS should provide a mechanism for automated interface with RWIS and entry and edit of weather reports as a specific type of incident/event.

Out of the box, the RWIS module will automatically poll RWIS for sensor data. Using the Admin Portal administrators can configure thresholds on each sensor for triggering RWIS alerts. For example, if you have a visibility threshold, as the visibility drops, and a threshold is crossed an alert in the Alert Management system will be created. This alert can be used to create a weather incident that users can manage by posting DMS, for example.

4.10.2.2. The ATMS should provide a mechanism for entry and edit of holiday-based restrictions as a specific type of incident/event.

Out of the box, incident types are configurable by the administrator in the Admin Portal. As mentioned in the introduction to this section our new Events module will support configurable incident/event types as well.

4.10.2.3. The ATMS should allow multiple authorized users to edit event data at the same time and save dynamically. A conflict resolution scheme is to be proposed.

The current release of OpenTMS does not have conflict resolution for multiple users editing the same event.

4.10.2.4. The ATMS should provide a mechanism for entry and edit of permanent freight specific information related to height, width, and load rating as it pertains to specified routes, locations and/or direction of travel.

Out of the box, the ATMS provides the ability for users to enter weight, width, and height restrictions that are associated with single incidents or construction events. This information is provided to the 511 web site through a data feed. The ATMS does not have a permanent method for entering the restriction information in our current release.

4.10.2.5. The ATMS should include capability for operators to enter temporary weight, width, and height restrictions for commercial vehicles.

Out of the box, the ATMS provides the ability for users to enter weight, width, and height restrictions that are associated with single incidents or construction events. These restrictions are configured when entering an incident/event and are included in the data feed. Entry form is shown to the right.

This information will appear on the 511 web site as shown below.

Roadwork
Roadwork on PA 283 eastbound between Exit 247 I 283 NORTH · HARRISBURG and Exit PA 230/PA 341 - TOLL HOUSE ROAD There is a hauler restriction Max width of 10 feet Max height of 14 42 feet
Last Updated Mar 12 2019 10 13 AM
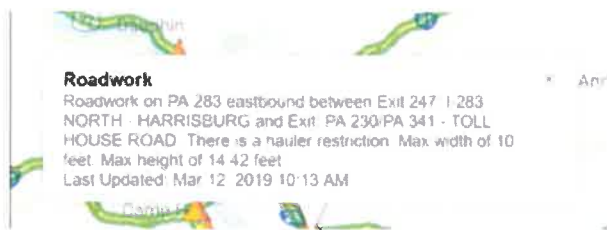
4.10.2.6. The ATMS event management plans should include user creation of detour routes.

If pre-planned detour routes are available in a supported map layer the layer can be added. Out of the box, the OpenTMS map interface supports the display of WMS and ArcGIS Rest end points. User created detour routes are not available. For our PennDOT client OpenTMS pulls their pre-defined detour routes in the ATMS as a map layer. PennDOT also provides the user the ability to incorporate detours in DMS messaging as part of a response plan.

4.10.2.7. The ATMS should allow users to drag and drop event icons within the traffic conditions map/GUI and associate the event with the nearest roadway and/or cross street.

Out of the box, the user can use the Pin map tool to create a new incident or event. To create the new incident, drag the Pin to the location on the map. A pop-up will be presented for the user to confirm the roadway selection. Once confirmed, an incident will be created and the location including the roadway and cross street of the incident populated.
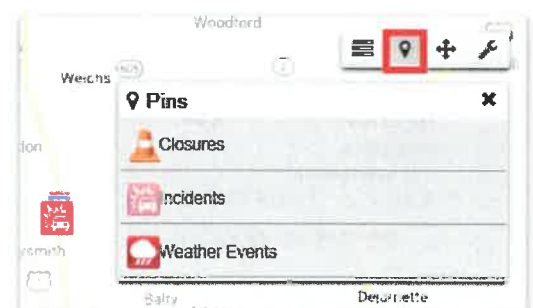
10.0 Traveler Information (CRFP Section 4.11)

4.11. Traveler Information

4.11.1. Mandatory Requirements

4.11.1.1. The ATMS shall provide a data stream to be accessed by the 511 websites to share data for display on the 511 website and 511 app.

OpenTMS meets this requirement. The modular architecture of OpenTMS supports standards-based integrations with external systems. The system includes a data integration platform which will facilitate exchange of data with the 511 through a REST API. An Interface Control Document (ICD) is available to third parties that consume our feeds. The ICD details the contents of the feeds. OpenTMS provides a data export feed in VDOT and PennDOT today. We've integrated with 511 systems in Alaska, VDOT and West Virginia. The figure below is a high-level architecture of the data feed distribution system.
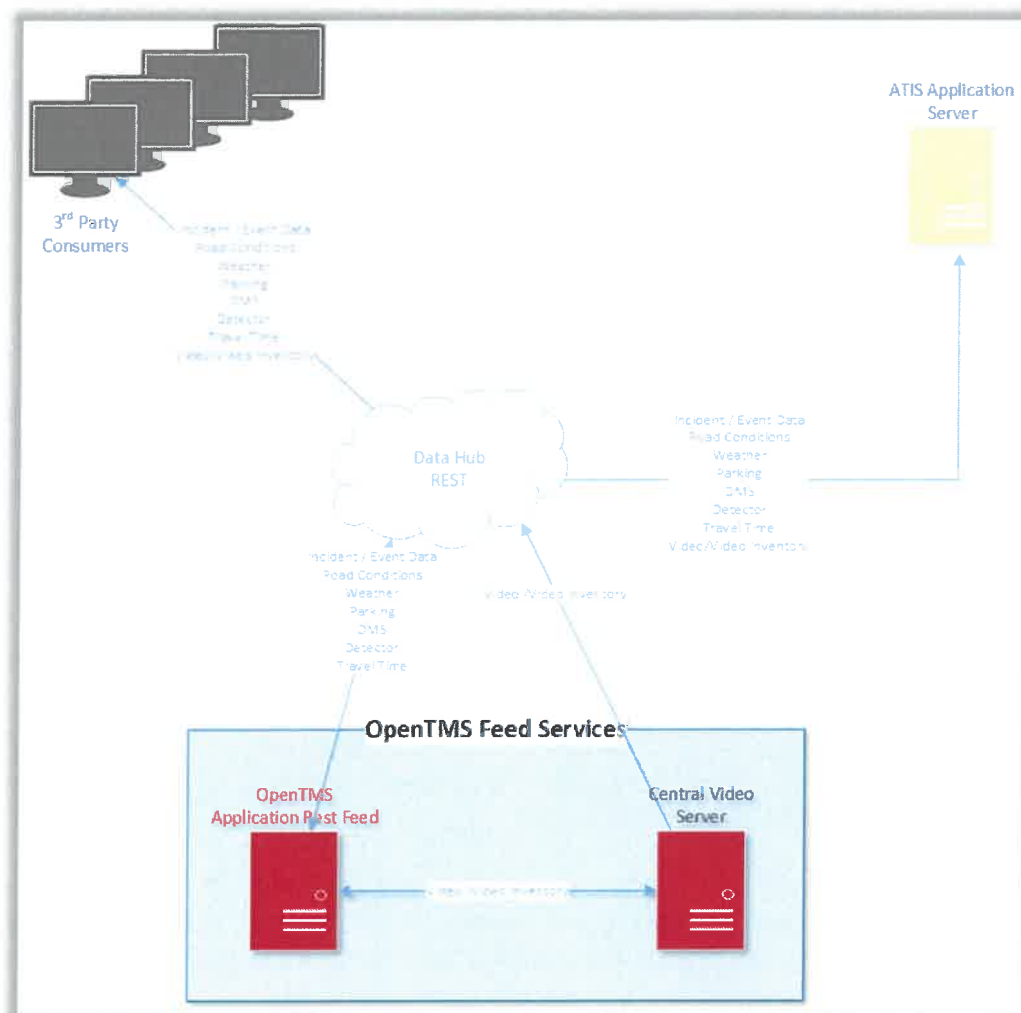
The ILOG ATIS collects data in a variety of ways with periodic pushes and/or pulls of information and can include a virtually unlimited number of data sources. The system accommodates a wide variety of data formats and uses many different programming languages/techniques to interface with data providers. Some agency data is collected over secure VPNs, some through public feeds, and some through secure, authenticated sites. The system also collects information from 3rd party providers (e.g. INRIX, National Weather Service, WAZE), 3rd party AVL feeds, 3rd party speed sensor feeds, 3rd party parking feeds, agency data pumps, and can ingest or share data from the system's own mobile app.

The centralized ATIS system will accept, filter, and distribute data from the ATMS for distribution to the 511 components including the website, IVR, and the mobile app. During the processing of the data, WV business rules will be applied that can de-duplicate repetitive information, triage/prioritize information, and assign distribution channels, depending on WVDOH preferences. As part of the processing, each piece of data is tagged with its required geo-specific characteristics. For example, the latitude and longitude in the raw data can be used to assign the data with other geospatial reference information such as a city tag, point-of-interest tag, etc. The stored data is converted into all formats needed by the specifics required in the ATIS solution: e.g. formatted for text display, formatted for audio output, formatted for distribution to publicly available data feeds, etc. By converting processed data to all formats, the information is immediately available for all components of the ATIS. This way, regardless of how the traveler receives the information, and regardless of how other parties use the public data feeds, WVDOH can be sure that all distribution channels contain the same information – updated simultaneously.

4.11.1.2. *The data sharable with the 511 website and 511 app shall include all traveler information reports Incidents, construction, events, freight, parking) entered, received, or edited in the ATMS.*

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by 511 systems. Feeds will be available for incidents, construction events, freight and parking.

The centralized ATIS system will accept, filter, and distribute data from the ATMS for distribution to the 511 components including the website, IVR, and the mobile app. During the processing, business rules can be applied that can de-duplicate repetitive information, triage/prioritize information, and assign distribution channels, depending on WVDOH preferences. As part of the processing, each piece of data is tagged with its required geo-specific characteristics. For example, the latitude and longitude in the raw data can be used to assign the data with a city tag, a roadway tag, point-of-interest tag, etc. The stored data is converted into all formats needed by the solution: formatted for text display, formatted for audio output, and formatted for distribution to publicly available data feeds. By converting processed data to all formats, the information is immediately available for all components of the ATIS. Regardless of how the traveler receives the information, and regardless of how other parties use the public data feeds, WVDOH can be sure that all distribution channels contain the same information – updated simultaneously.

4.11.1.3. *The data sharable with the 511 website and 511 app shall include CCTV video images captured by cameras connected to the ATMS.*

The data sharable with the 511 website and 511 app will include live streaming video captured by cameras connected to the ATMS. The private source data stream locations provided by Skyline will be accessed by ILOG via URLs. These streams will be provided to the public through the website and mobile application.

The 511 website and mobile app can display both streaming camera video and static camera images. Camera images will be brought into the ATIS system and processed to add a watermark. Simultaneously the database

will mark the timestamp of the image. If an updated still image is not received after a preset period of time, a message stating that the image is not available can be displayed, and/or the camera icon can be disabled and turned gray.

A challenge for web map visuals is the inequitable distribution of ITS devices, such as cameras, across the state geography. Cameras generally are not distributed uniformly, which means some areas have dense pockets with many cameras, while other areas do not have any. To create map views that are convenient for end-users, two methods are used. The first method is related to the mobile-adaptive nature of the website, which makes certain map features are only available at particular zoom levels. The second method is icon clustering to indicate where zooming in will provide greater granularity. An example can be seen in the figure below, with the camera icons clustered and expanded on a web map. Notice that each cluster icon indicates the number of cameras that are available in that cluster. When a user clicks on a clustered camera icon, the web map zooms to that area at a level where individual cameras may be selected.
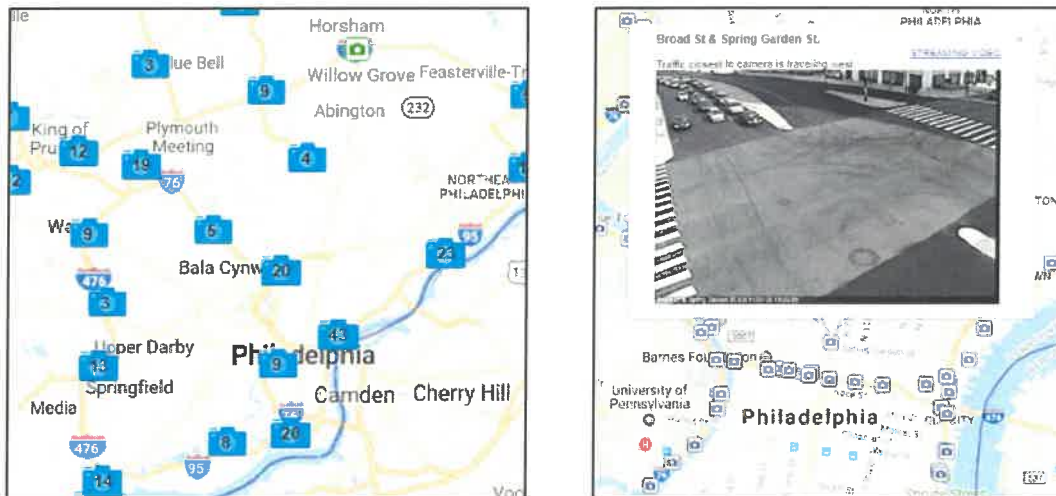
Additionally, the ATIS provides a "text" view of cameras so that users can select a region, road or camera (depending on the preferences of WVDOH), and quickly scan through a list of the series of cameras that can be streamed or viewed in current snapshot mode. This list view can be saved for later quick access by the user.

The ILOG ATIS administrative portal provides a simple interface where admin users can disable specific WVDOH cameras from being displayed on the website and mobile app, but still have the cameras available for internal agency viewing. This feature has been particularly useful when departments of transportation have needed to disable public viewing of selected cameras during accident responses, and during high profile events, such as the Pope's visit to Philadelphia.

LATITUDE	LONGITUDE	STREAMING CAM	STREAM OK	SNAPSHOT CAM	SNAPSHOTS OK	ENABLED
41.37962	-80.17674	Yes	No	Yes	Yes	Yes
42.10439	-80.09840	Yes	Yes	Yes	Yes	Yes
42.1109	-80.12017	Yes	Yes	Yes	Yes	Yes
41.14321	-80.15544	Yes	Yes	Yes	Yes	Yes
42.06944	-80.04000	Yes	Yes	Yes	Yes	Yes
41.94912	-80.50145	Yes	No	Yes	Yes	Yes
42.2496	-79.7562	Yes	No	Yes	Yes	Yes
42.0951	-80.11952	Yes	No	Yes	Yes	Yes
42.06525	-80.10560	Yes	Yes	Yes	Yes	Yes
42.06542	-80.09341	Yes	Yes	Yes	Yes	Yes
42.11912	-79.95065	Yes	Yes	Yes	Yes	Yes

Figure 78 - Camera Management Screen

4.11.1.4. The data sharable with the 511 website and 511 app shall include DMS messages posted to DMS connected to the ATMS.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by 511 systems. A feed is available for DMS message activity.

The web map will contain the consolidated list of categories of information (map layers, text, links, etc.) requested by WVDOH, including DMS messages. The figure to the right shows a DMS message as seen when looking at the website from a mobile device. Notice how there are two different color icons for DMS boards – one for those that are active, and another for those that are inactive.

4.11.1.5. The ATMS shall provide a data stream to be accessed by third party traveler information dissemination entities.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by third party traveler information entities. An Interface Control Document (ICD) is available to third parties that consume our feeds. The ICD details the contents of the feeds. OpenTMS provides a data export feed in VDOT and PennDOT today.

Figure 79 - Mobile View of Active DMS

The ILOG ATIS is also capable of providing data feeds to third parties. Team Q-Free has extensive experience with customizing data exports for a wide variety of sources, including Waze. Providing data from the ATIS allows for the flexibility of customizing a data feed, along with the added security buffer of not having third parties directly access the ATMS, consuming local WVDOH resources.

If desired by WVDOH, the 511 website can contain a page with a list of all publicly-available data feeds. In some cases, ILOG has seen agencies provide a data access agreement that must be completed and approved before full access to the feeds is granted. However, it is also possible to simply list the feeds, links, and documentation, so that they may be accessed without any DOT action.

4.11.1.6.   The data sharable with the 3rd Party Information Dissemination entities shall include all traveler information reports (incidents, construction, events, freight, parking) entered, received, or edited in the ATMS.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by third party traveler information entities. Feeds will be available for incidents, construction events, freight and parking.

The ATIS is capable of providing feeds for all reports that are passed to the system. In the case of the Pennsylvania Turnpike, ILOG provides over a dozen feeds. Many of these feeds contain very similar information, but are formatted in different ways, and with different combinations of data, to adjust for various use cases. These uses cases range from Waze distribution, to third-party data integration, to dashboards used internally for reporting on performance metrics.

4.11.1.7.   The data sharable with the 3rd Party Information Dissemination entities shall include CCTV camera images captured by cameras connected to the ATMS.

The DOT will determine the 3rd Party Information Dissemination entities that will receive live streaming video captured by cameras connected to the ATMS. Each CCTV image will be access on the 511 website via a link provided for each camera by Skyline. Skyline will also provide envelope information to the ATIS for each camera. The envelope information and corresponding link will be stored in the ATIS master database and will be used to present CCTV images and streams. In addition, the envelope information and camera link can be provided to third party users in a data feed hosted by the ILOG ATIS.

4.11.1.8.   The data shareable with the 3rd Party Information Dissemination entities shall include DMS messages posted to DMS connected to the ATMS.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by third party traveler information entities. A feed is available for DMS message activity. DMS messages, along with the locations of the DMS showing those messages, are available as a data feed that can also be provided by the ATIS.

4.11.1.9.   The ATMS shall be upward expandable to cover increased coverage areas.

The ILOG ATIS solution is scalable/expandable in several ways. It is scalable to handle increased demand during storms, and other times of high usage. It is also scalable in terms of being able to add increasing amounts of data. In the case of 511PA, both types of scalability have been exercised. During large storms, the 511PA system has seen its usage spike to 4,000 simultaneous users on the website. From a data perspective, ILOG's time supporting 511PA has seen the addition of large numbers of traffic cameras, plow trucks, and expanded roadway coverage. While these added a considerable amount of ITS data to the 511PA system (particularly the plow trucks, for which the site displays both historical and current data), the system handled the expansion with ease. This is partially due to the architecture used to design the site, and partly due to the expandable nature of the cloud-computing backbone that supports the ATIS.

Expandability is also true of the IVR portion of the ATIS. Many traditional IVR systems are constrained by the provisioning of physical trunks and access to available ports on provider switches. The ILOG traditional IVR and SAM are both virtual, natively VoIP, and provisioned based on licensing and bandwidth, rather than physical trunks. These systems are scalable within minutes, not weeks. The system can also accommodate the inclusion of additional roads in a variety of ways.

4.11.1.10. The ATMS shall provide for a highway conditions, including trend data, reporting system that can be accessed by authorized users with ATMS software or application access.

OpenTMS meets this requirement. Authorized user can access the Road Condition module to enter road conditions. The Analytics package will provide the user the ability to slice and dice road condition data to look at trends. Q-Free will work with the WVDOH to customize a report template for the Jasper Reports module.

ILOG also has extensive experience presenting road conditions and reports in a variety of formats. For various current clients, we present this data as map layers, text listings, and charts. ILOG will work with WVDOH to determine which information should be available via the ATIS, and then together decide the most appropriate method for distributing this information to the proper stakeholders. As one example of distributing trend data reports to the public, the image to the right shows the average tolls over the last several weeks on a particular stretch of I-66 in Virginia. The report was customized based on several options chosen by the user, but the parameters and methods of calculation were determined by Virginia DOT. This allowed VDOT to present information that was helpful to travelers, but still control the method by which the information was attained. The ATIS also has an associated administrative portal which provides usage reports and other metrics/trends.

4.11.1.11. The ATMS highway conditions reporting system shall have the ability to enter road conditions for multiple locations or the entire state or an entire district all at once versus having to enter conditions for each segment of road one by one.

OpenTMS meets this requirement. The OpenTMS Road Condition module provides the user the ability to respond to a weather event quickly by providing an easy to user interface for creating and editing road conditions. Users can create localized conditions on road or create conditions over an area.

The list view shown below allows the user to quickly and efficiently assess the current status and location for entered road conditions.
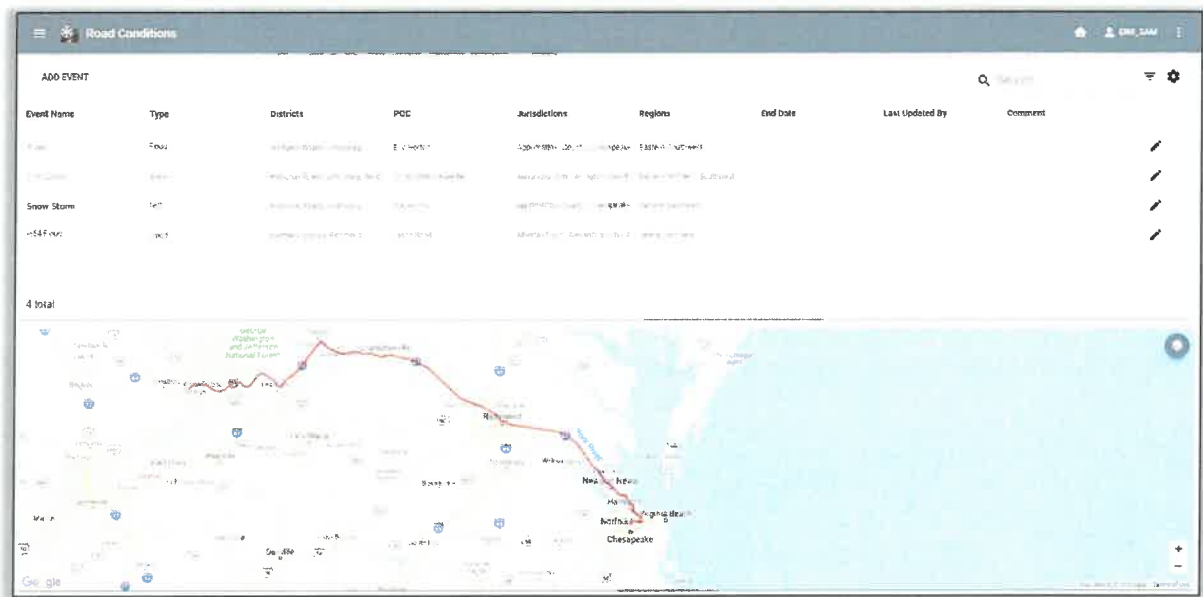
Figure 80 - OpenTMS Road Condition Module List View

Clicking on a road condition opens its detailed view shown below. A road condition feed will be available for the 511 system.
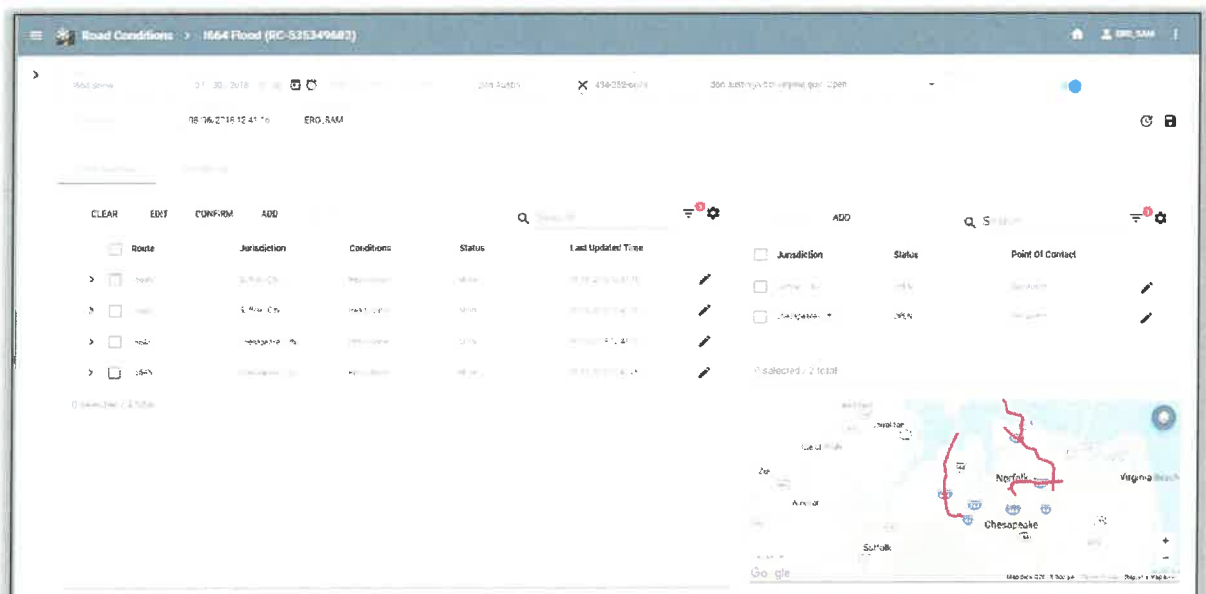
Figure 81 - OpenTMS Road Condition Module Detailed View

The ILOG ATIS is capable of displaying roadway conditions to the public in a variety of ways. The most common method is through roadway coloring. Based on the information entered about the condition of a roadway (or portion of a roadway), the ATIS is capable of color-coding the appropriate stretch of roadway. On the 511PA website, a roadway conditions layer is available on the web map during winter months. As seen in the image below, different colors indicate different conditions. A legend is present to decipher the condition of each roadway. This is also currently done in the Drive Safe mobile app. Although they use different keys for what the conditions mean, the layer is valuable on each because it draws the user's eye to locations where the roadways are not dry and/or clear. Text listings of roadway conditions can be included on the website and mobile app if desired by WVDOH.
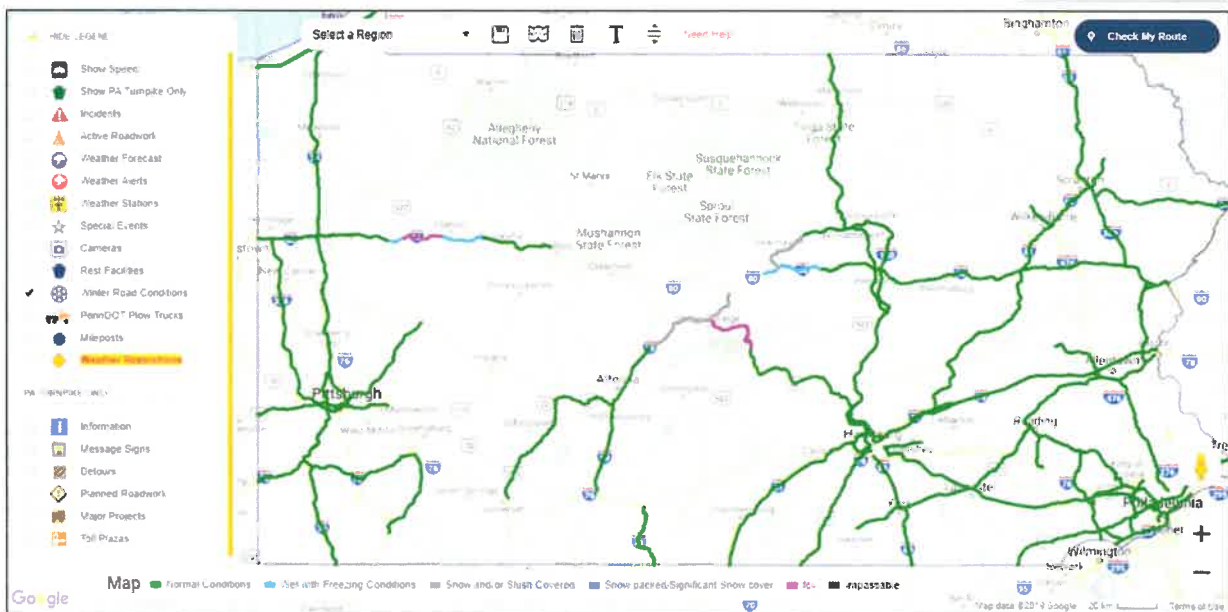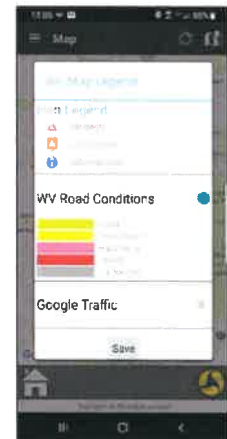
4.11.1.12. The ATMS shall have the ability to create warnings of commercial vehicle and oversize/overweight restrictions due to closures, width restrictions/height restrictions, construction and maintenance.

The ILOG ATIS excels at displaying roadway restrictions. The 511PA implementation of the system alerts drivers to restrictions using different methods, depending on the nature of the restriction. Each of these methods may be used interchangeably by WVDOH, depending on how they think they information will be clearest to their travelers.

The first type of restrictions discussed here are those that apply to long stretches of roadway, typically caused by bad weather. These sometimes involve all types of vehicles, but almost always at least apply to commercial vehicles. To display these types of restrictions, PennDOT opted to have them shown as a layer on the web map, much like the winter road conditions, but as a separate layer. In the image below, you will notice that the legend item for this layer is highlighted. This is because PennDOT wants to draw significant attention to this layer when it is active, as it often indicates a travel ban of some nature. Note that, as shown in the second image, that any portion of the roadway that is clicked will reveal more details about the restriction.
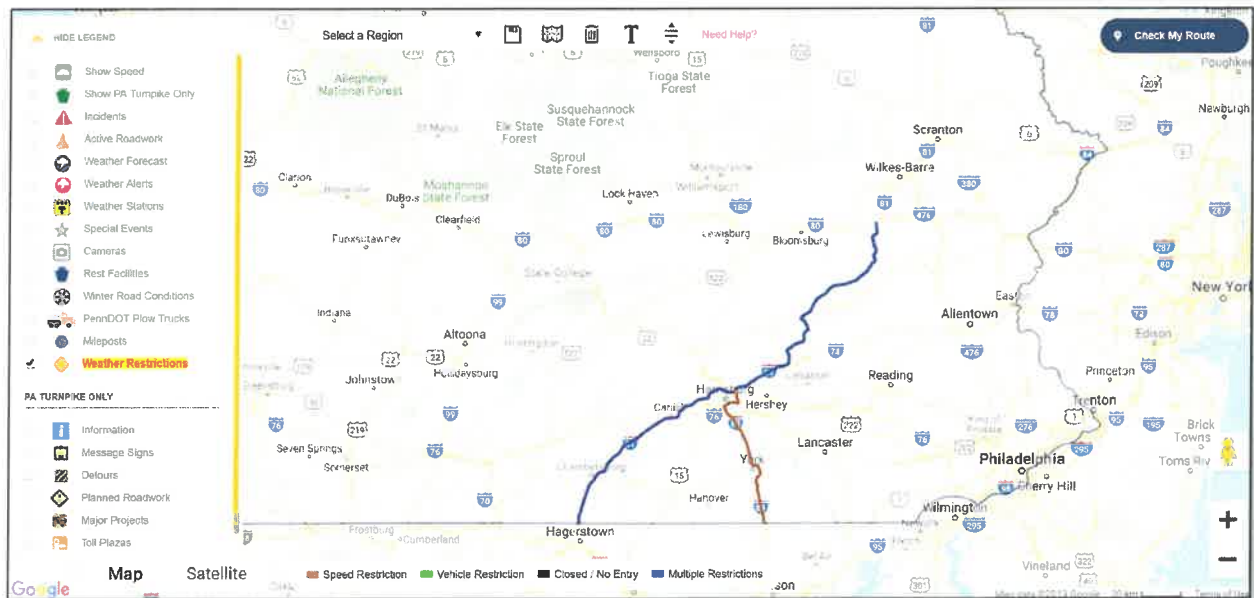
The second type of restrictions found in 511PA are those that are associated with single incidents or construction events. These tend to be related to vehicle size restrictions, or lane restrictions through emergency or construction patterns. On 511PA, PennDOT elected to have this information contained in the

details of each incident or construction icon that appears on the map. To provide more detail, their map does offer options to choose whether the user wants to see events that simply have a restriction/disruption, or a full closure of all lanes.
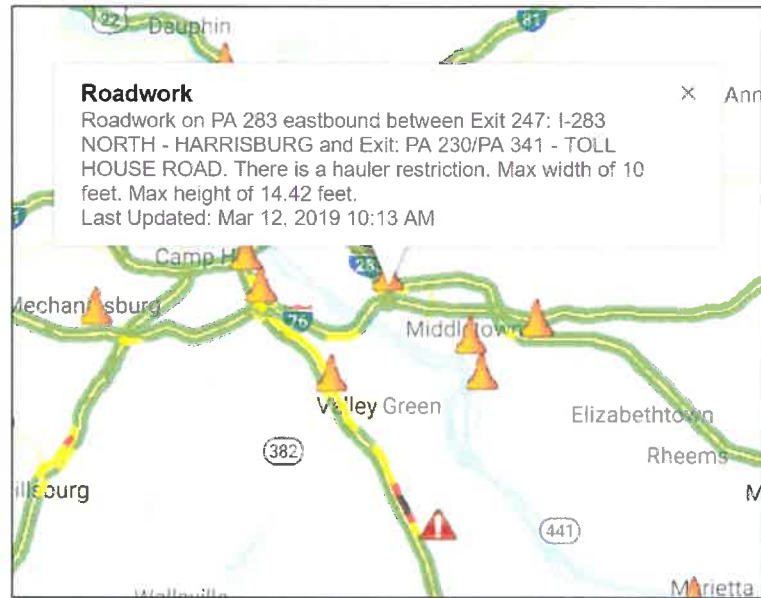
For both types of restrictions, text listings of the data are available through the ATIS. Additionally, the information for restrictions can also automatically trigger an alert on the scrolling banner of the website. The business rules for which types of alerts trigger an entry on the banner will be determined with WVDOH during setup.

ATMS provides those restrictions that are associated with single incidents or construction events. These restrictions are configured when entering an incident/event and are included in the data feed.

4.11.1.13. The ATMS Vendor shall provide a telephony and web-based 511 system to meet or exceed the capabilities of the current 511 system used by WVDOH.

This ATIS system will meet or exceed the capabilities of the existing 511 system used by WVDOH. ILOG's approach to ATIS is a single source, data-driven system that natively contains the core functionalities of the 511 services. This means all components, including the IVR, are virtual and united by a single master data store. By taking this virtual environment to the cloud, ILOG was able to provide the cost savings of a usage-based model – meaning that no portion of the system needs to be provisioned to the maximum anticipated usage year-round. Instead, the platform expands, and contracts based on demand, and performance remains optimal.

For the web-based components of this RFP, we propose the ILOG ATIS, which is a proven solution that has delivered extremely large amounts of data to the traveling public during times of incredible demand. The details of this system are described throughout the various requirements outlined in this proposal.

The telephony portion of this proposal offers two approaches IVR; a traditional IVR or SAM – a digital assistant IVR. WVDOH can select either approach with no change to data requirements or pricing. Either system will meet and exceed all WVDOH requirements.

What is SAM then? SAM was created after years of listening to travelers getting frustrated with IVR systems. Despite new efficiencies in systems underlying traditional IVRs, they still can suffer from poor voice recognition due to background noise in the vehicle, regional accents, inadequate synonyms for popular "hot spots" requested by travelers. Furthermore, hotspot or point of interest (POI) lists provided by agencies can exclude new POI locations. The drill-down, menu-based approach for information can frustrate drivers. It is generally accepted that 511 IVR usage is dropping, and some agencies have omitted IVR as part of their traveler information offerings or have radically changed the information offered.

On the other side, the voice assistant market is becoming more popular – people are now accustomed to talking with Alexa and Google Home without using structured menu systems. Team Q-Free thought that adopting a personal assistant approach for IVR would be a convenient and safe way for drivers to request travel information hands free. ILOG has been developing what we believe to be the first digital voice assistant IVR, which leverages Google and Amazon voice recognition and speech generation, to create a state of the art IVR platform, which we call SAM. For the user, it is a simple, effective and familiar way of communicating with the IVR using natural speech (e.g. "What's the traffic like in Morgantown?") versus a series of very specific command set (e.g. "Press or say one for Morgantown traffic").

Sam has several interesting features that we would like WVDOH to explore:

- Instead of plodding through old-fashioned menus, users can make a request in plain English. SAM, using our own artificial intelligence engine, as well as that from some APIs, will glean the caller's intent.
- SAM uses geo-coding to identify roadways – so there is no need to pre-define a list of POIs, acceptable selections or locations.

Traffic can be requested in three ways:

- Users can ask for traffic near any location or landmark;
- Users can ask for traffic with or without directionality on any road, near a location, or statewide; or
- Users can ask for traffic on a roadway between two locations – again, with or without directionality.

- SAM will figure out the geography surrounding your request and give the user relevant information as provided from the agency approved data feeds.

- SAM incorporates floodgates, just like a traditional IVR system. Floodgates may be marked as "interruptible," or "not interruptible".

- SAM is customizable – users can set a default location; which SAM will translate into the appropriate WVDOH region. When the user calls back, he can opt to have the traffic and/or weather alert automatically read for the customized area.

- SAM also knows when a caller is using profanity and will warn the user to be careful about their language. If the caller persists, the call may be terminated. If a caller repeatedly uses profanity at different times, SAM has the ability to automatically block their phone number.

- Finally, SAM retains transaction records for everything that callers do when they are using the system. This can provide helpful analytics.

SAM can provide the speech recognition and text to speech announcements that are now experienced in services like Alexa and Google. SAM can offer traveler information in a safe fashion that is no more dangerous than a hands-free phone call. SAM eliminates the need for agencies to maintain lists of hotspots and POI. SAM can give information on any road that is in the approved data feeds and does not restrict users to any preset list of roadways.

SAM also has the ability to make connection via an icon on a web page, to announce relevant traffic for an area. With a single click, Sam's voice will announce traffic conditions, which can help with visually impaired site visitors.

4.11.1.14. The 511 system shall the ability to provide public safety alerts and announcements at the beginning of a call based on the location entered or statewide on all calls.

In both the traditional and SAM IVR models, floodgate announcements (for public safety or other DOT-approved messages) can be announced at the beginning of a call.

Floodgate messages can be entered in two different ways – they can be automatically triggered by certain conditions presented in the data feed, or through manual entry in the administrative portal. Business rules that can be determined for automated floodgate messages include whether or not they are interruptible, whether they should be played for a certain region or statewide, and many other details.

When using the manual entry system, the administrative panel gives the user several abilities with regard to floodgates:

- To preview the message before it is made live;
- To schedule messages in advance;
- To prioritize messages;
- To edit active messages; and
- To assign a message to multiple regions.

For the most serious messages, floodgates can also be flagged so that the system will terminate a call immediately after the floodgate is heard.

4.11.1.15.The ATMS shall transfer data useful for traveler information into WVDOH's 511 system for access by the general public. Data shall include at a minimum event-related data provided by the highway condition reporting system, relevant data obtained from ITS field devices, NWS weather alerts, weather forecast, and estimated travels times.

All data layers and information provided from the ATMS will be displayed on the ILOG ATIS. This will include events, road conditions, travel restrictions, ITS devices, alerts and forecasts from the National Weather Service, and estimated travel times. This information will be provided, as possible, to the various components of the 511 system (website, IVR, mobile app). Where practical, the information will be provided visually (e.g. NWS shape files for weather alerts will be displayed as a translucent overlay on the web map), as an audio advisory through text-to-speech translation, and as a text listing.

4.11.1.16.The ATMS shall provide a mobile application with a hands-free option for the 511 system in order to maintain adherence to restrictions on use of phones while driving in West Virginia.

This proposal includes the continuation of the hands-free, eyes-free, interoperable Drive Safe mobile app based on the GeoTalker™ platform. The app will continue to be available on both Android and iOS platforms, with ILOG handling all of the logistics for ensuring that the latest version is available to users through the app stores.

As with the other traveler information components, the app receives consistent traveler information from the common data platform. This means that all the apps will receive and publish all WVDOH incidents, events, and detours from the ATMS. Data from New Jersey and Pennsylvania will continue to be integrated in the app, and additional states may be added, as long as WVDOH is able to secure access to the data.

The GeoTalker™ platform was deigned to support mobile apps that could provide a safe method for hearing nearby traffic alerts while driving. To accomplish this, the app obtains the user's current position, and audibly announces advisories that are located within a user-defined range and direction of travel, without requiring additional interaction from the user. This format works well for a wide variety of alerts, including floodgates/tickers, NWS weather alerts/advisories, winter road conditions, Waze alerts, incidents, roadwork, slowdowns, DMS messages, rest area locations, commercial vehicle information, and detour information. It should also be noted that the GeoTalker platform allows audio alerts to be paused when a phone call is active.

Other types of information, however, are best heard when the alert location is imminent – such as when a runaway truck ramp, or dangerous curve is approaching – and ILOG has addressed these with Fast Track Alerts. The app has the ability to announce Fast Track alerts within a few yards of a geographic point. This feature is currently being explored as a component "next step" in connected vehicle pilots, and as a feature in the PTC's Trip Talk.

GeoTalker is a flexible, geocentric platform. It is being used as a traveler information system for a pilot connected corridor. The project is being undertaken by ILOG as a subcontractor to the University at Albany Visualization and Informatics Lab (AVAIL) for New Jersey DOT. The connected area is focused on the Route 1 and 18 corridors near New Brunswick, NJ. The app has already integrated multi-modal travel info, including real-time information about train and bus arrivals, as well as parking availability. Customized virtual DMS messages, and corridor-specific travel times have also been integrated to provide a comprehensive overview of travel in the region.

While the Drive Safe app offers a host of features in the hands-free, eyes-free "Drive Mode," users have the ability to configure several of these parameters. Users can determine:

- The range for which alerts are read;

- The time interval between when the app will check for new or updated alerts;

- Whether or not a user wants to have alerts repeated at set intervals, or only read once; and

- The types (categories) of alerts that the user wants to hear, as determined by WVDOH.

- The Drive Safe mobile app will contain a link to the adaptive web map, where travelers can see all the features and functions offered by the website. The map is automatically centered on the user's position, based on the GPS reading from the user's device.

Team Q-Free is currently completing a new method for integrating detours into GeoTalker™ mobile apps. For pre-defined detour routes, the mobile app can now give the user turn-by-turn directions along the prescribed route. This is particularly valuable to the commercial vehicle sector, who needs to be mindful of size and weight limits when detouring from major highways. This is currently being done for Trip Talk and can be incorporated into the next Drive Safe build if underlying preset detour data is available from WVDOH.

The new layout design to GeoTalker apps (as seen in 511PA, TripTalk, DriveSafe, and SafeTrip NJ) has evolved to create blended apps, meaning that some functions of the app are native app components, and other functions are links to the responsive web site – all seamlessly presented to the user. This is an efficient format which eliminates the need to "triple program" functions for both web and apps. The blended approach accommodates a wide variety of functions, including context-sensitive help and the ability to use the same map functions (like Check My Route and snow plow tracking) that are available on the 511PA website.

The mobile app is also now integrated with Google Maps so that travelers can simultaneously hear navigation instructions and agency travel alerts. As an alternative, Waze can be offered as an integrated feature. In either case, users activate the Drive Mode function of the app, and then select the Google Maps/Waze button that appears on the screen. This cross-launches the third-party app, but allows WVDOH alerts to continue to be heard interspersed with the navigation directions from the Google/Waze app. As seen in the Safe Trip NJ mobile app, when the route planning (directions) function is selected, the system will have available all the features of Google Maps directions, which includes multi-modal planning (including train, bus, plane, hailing services - Uber, Lyft -cycling and walking directions) as available. These features include the ability to enter starting/ending and waypoints and information about selected routes, including travel times and schedule information. The Waze interface offers a more direct link to the Waze app.

Figure 82 - Route Navigation via App

While all the functionality of the current app will be retained, ILOG also recommends that, in conjunction with the design discussion about the website (discussed as part of 4.11.1.20 below), the WVDOH team consider a refresh to the design of the mobile app to align with the new 511 site. The refresh may include both design elements, as well as the inclusion of additional data on the mobile app. Minimally, ILOG recommends adding access to the traffic cameras, as this feature is frequently requested by mobile app users. Other data layers or text listings from the website that may be added will also provide additional value.

The refresh will also get the benefit of GeoTalker features that were improved for the 511PA deployment, including the announcement of National Weather Service weather notifications when the user approaches the alert area.

4.11.1.17. The ATMS shall provide a mechanism for automatically publishing data and video images from multiple sources to the WVDOH 511 as well as various traveler information web sites at specific intervals.

The ILOG ATIS will ingest the feed from the ATMS at prescribed intervals. Due to the centralized nature of the ATIS processing (described further in 4.11.1.1), each pull will refresh the data in the various ATIS components, keeping data consistent across delivery methods. Simultaneously, data feeds to other 3rd party providers will also refresh with the new data.

4.11.1.18. The ATMS shall transmit highway conditions reporting data to the 511 system.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by the 511 system. A feed is available for highway road conditions.

The ATIS will display all highway conditions sent by the ATMS, as described in the response to requirement 4.11.1.11.

4.11.1.19. The ATMS shall display condition and device data for 511 website distribution with maximum of 5 minutes of data latency.

OpenTMS meets this requirement. The data feeds are available through a REST API and can be accessed by the 511 system. The feeds are updated in real time within 5 minutes of receiving the data from the device or upon saving a road condition.

The ATIS will request a refresh of the data from the ATIS at least every 5 minutes. This information will then be processed and published to the various components as soon as it is available.

4.11.1.20. The ATMS shall provide a graphical map of the state or selected region for displaying the WVDOH's ITS devices and select summary and status information suitable for 511 website display compatible with common web browsers.

The focus of the web site is an interactive web map – it serves as the main landing page for the ATIS. This main page can be superseded by a landing page, and the layout may be modified. As part of this proposal, ILOG includes a design period, where WVDOH, Q-Free, and ILOG personnel will discuss design preferences. ILOG envisions this to be an Agile-type process:

- Meet to discuss WVDOH initial thoughts on design, and inspiration for style preferences.
- ILOG drafts several examples of what the design changes could look like.
- WVDOH provides feedback, likely mixing elements of several proposed designs.
- ILOG then combines these preferences into a final design, subject to tweaks from WVDOH.

This will allow the WVDOH team to take the functionality of the ILOG ATIS system and customize the layout so that it will optimally meet the needs of West Virginia travelers.

Figure 83 - Landing Page for www.paturnpike.com

4.11.1.21. The 511 map shall display for internet distribution all major freeways and streets within the state's boundaries with distinct graphical representation for each roadway classification.

The interactive web map will use Google as a base map. By using Google, major roadways and arterials will be seen, as will most smaller streets. This also means that WVDOH gets the benefit of the pre-existing Google roadway coloring configurations, which differ according to roadway classification.

The 511PA system also uses a thick border to denote the boundaries of Pennsylvania on the web map. This layout may also be used by WVDOH, or other options, such as shading the areas outside West Virginia, may also be incorporated. This will be part of the design discussion referenced in the response to requirement 4.11.1.20.

4.11.1.22. The 511 map shall display near real-time traffic speeds using a standard color coding of green for uncongested conditions through yellow and amber for moderate congestion to orange and reds for high congestion on freeways located within the state. This data can come from 3rd party providers.

The centerpiece of the web site is an interactive web map, which will include the Google Traffic data as a layer. This is intended to allow users to see traffic "at-a-glance" with no interaction required. However, as discussed in 4.11.1.20, the default experience for users visiting the site will ultimately be determined through the design process during the setup phase of the project.

4.11.1.23. The 511-map display shall provide map navigation tools (zoom in/out icons, window box, layer control toggles, status of equipment).

Adaptive in nature, the interactive 511 map includes several standard functionalities, such as panning, zooming (with in/out icons), auto-scaling based on the user's zoom level, and an interactive legend. The interactive legend allows user to zoom to preset regions of the state, select map layers, and save their customized map view, including their selections of various data layers. The legend indicates which layers are currently active, and different icons may be used to indicate equipment status, such as active/inactive ITS devices (e.g. DMS).
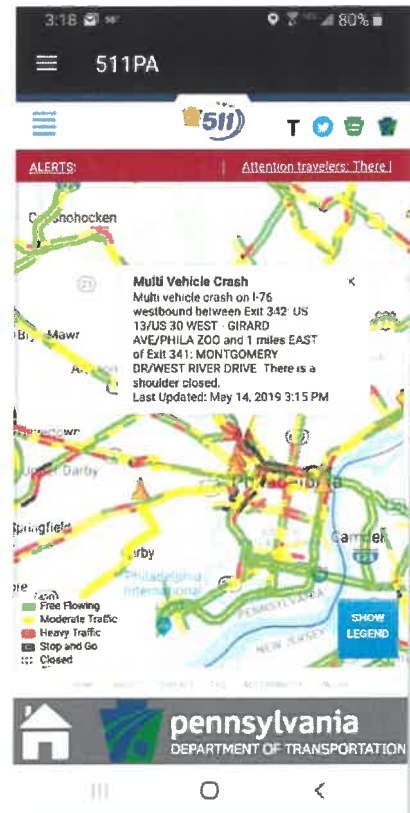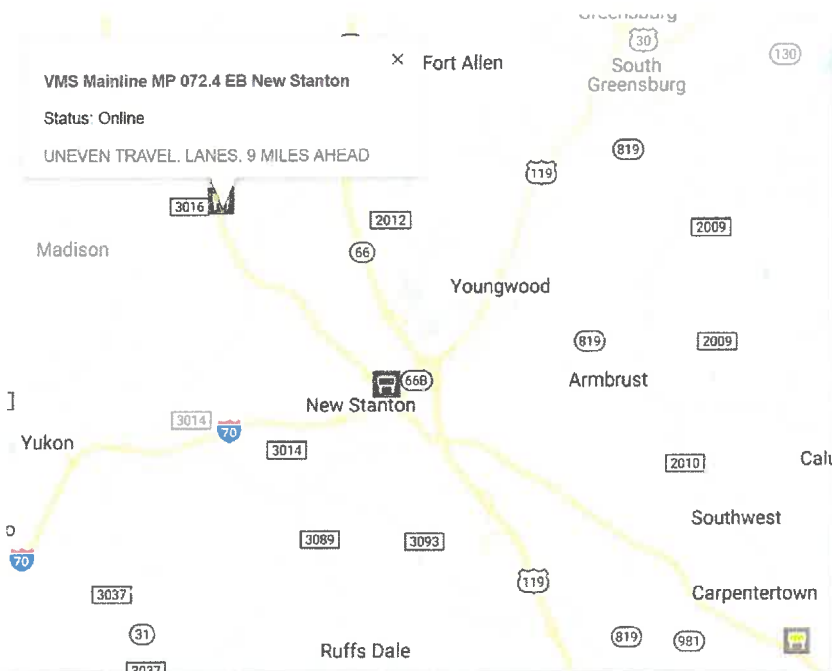
To save web map views and layers or save text listing travelers use simple controls above the web map and text listing of alerts. To save a map view, for instance, a user might zoom to a particular city or town and select several map layers that they would like to see (e.g. incidents, cameras, DMS). The user then presses the "Save Map View" button, and the map can default to the same view when the user returns again from that device.

Of particular note is the recent refresh/renewal of the 511PA system. A new requirement was to blend the existing 511PA map features with the data/features from the Pennsylvania Turnpike. The challenge was to address the needs of both agencies, without overwhelming the public with layers of menus and legend selections. The result was a good compromise. The legend automatically changes the data filters once a user selects "PA Turnpike only". ILOG can work with the WVDOH to make sure critical items for both agencies are represented clearly on the 511 system.

"CHECK MY ROUTE" SERVICE DESCRIPTION FOR WVDOT ATIS (ADDITIONAL FUNCTIONALITY)

With PennDOT, ILOG developed an innovative take on route planning, which PennDOT has called "Check My Route." As is typical with other route planners, the user can enter starting, ending, and waypoints. However, rather than provide directions, the tool informs users of what "events" are along their route. In the PennDOT example, this includes incidents, construction, and the last-plowed-time for segments along their route. While WVDOT may not currently provide information about plow trucks, the system is capable of integrating that data at any time, along with additional data sets that WVDOT may wish to include.

Due to the mobile website being adaptive, this feature will be available when users access the 511 website through desktop computers as well as on their mobile devices. Since the mobile app will use the webmap, Check My Route will be available there as well.

The Check My Route feature is included in this proposal for WVDOT and will be made available to the public during winter months. Winter months have typically included November through April, but any 6-month period chosen by WVDOT is acceptable.
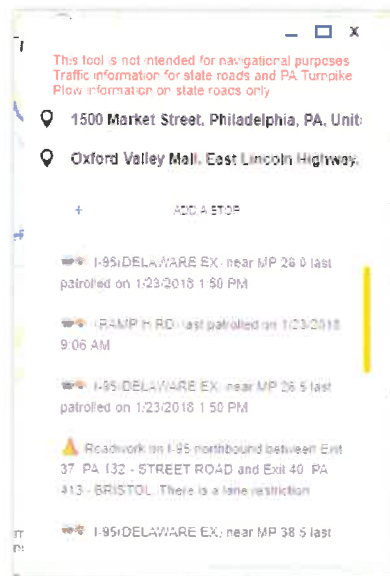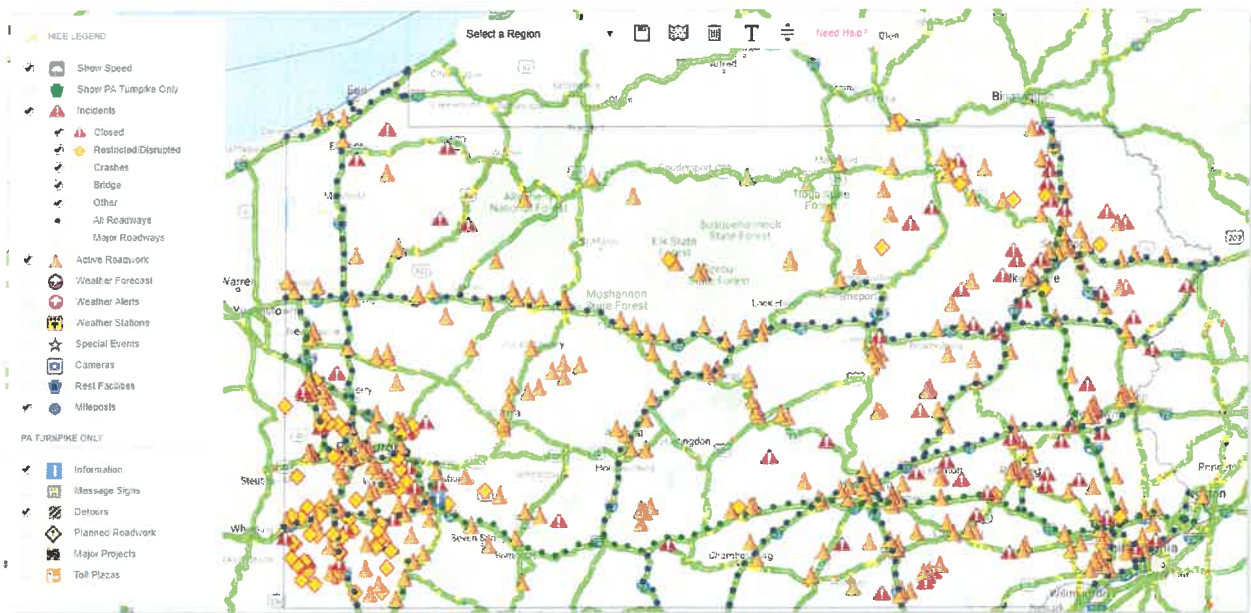
Figure 85 - 511PA map with all statewide roads selected
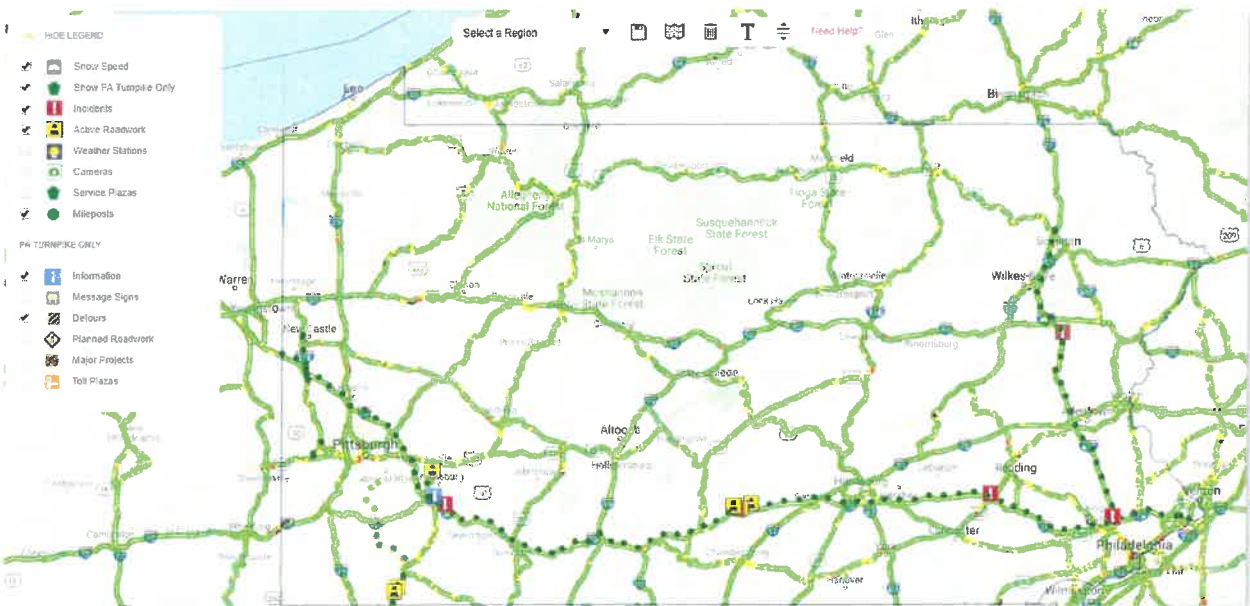
Figure 84 - 511PA map with "Turnpike Only" selected.

4.11.1.24.The 511 map shall display for internet distribution the appropriate information being supplied by corresponding ITS devices including at minimum full motion video images from cameras, sign display for DMS, and data from RWIS.

The ILOG ATIS has full capabilities for displaying a number of different types of data within map layers, including full motion video images from cameras, sign information from DMS, and RWIS data. The following images demonstrate how these layers appear on the 511PA and Pennsylvania Turnpike websites. The way the information is displayed, as well as associated icons and graphics, may all be modified during the setup phase if desired by WVDOH.
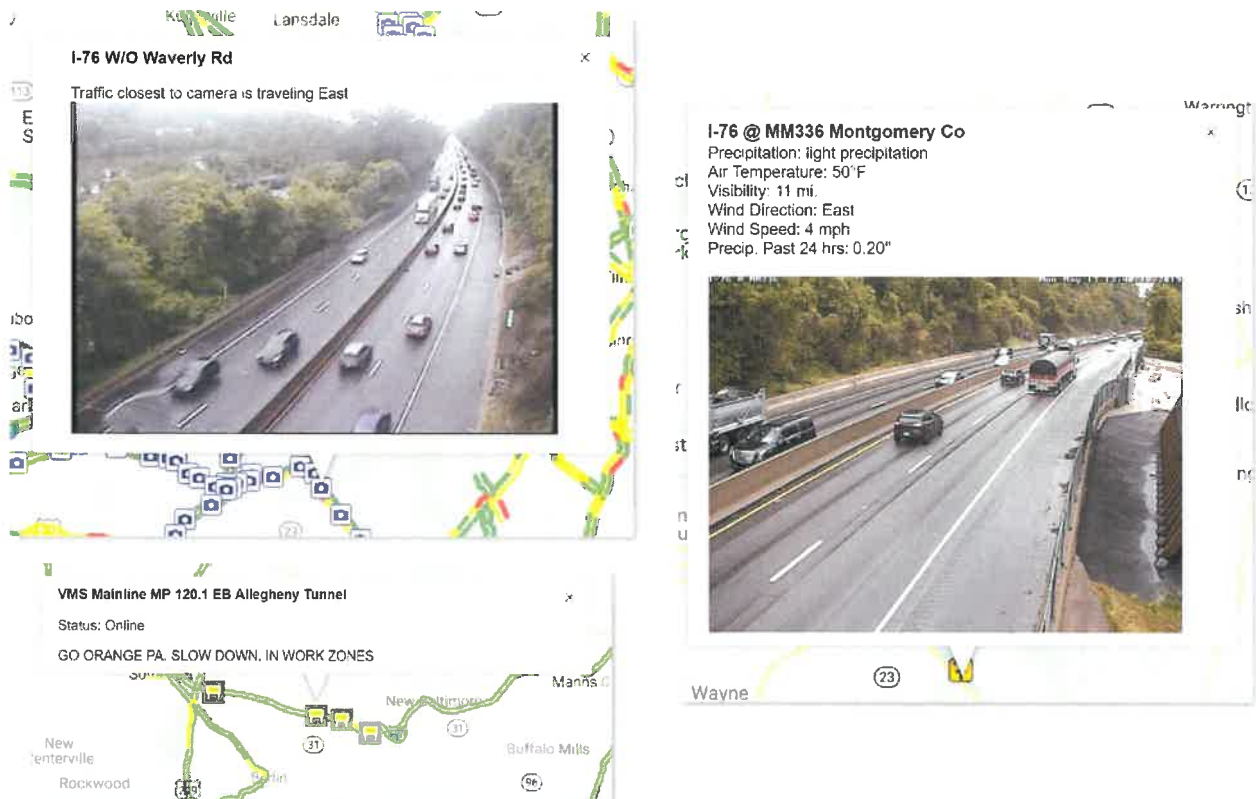
4.11.1.25.The 511 website shall provide a menu to select which ITS devices to display (layer controls).

All layers displayed on the ATIS website are controlled through a simple legend. The legend lists both the titles of each layer and the symbol that represents the data or devices. As part of the initial design process, several options for how the legend may be formatted will be presented. Some options will include the coloring, placement, shape, whether or not the legend may be hidden by the user, and any controls associated with how the legend appears or is hidden. In the case of 511PA, the legend may be hidden, so that more of the map may be seen on the screen. The PA Turnpike website, however, uses a fixed legend at the bottom of the screen, which is always visible. ILOG will also guide the WVDOH through requirements related to the need for the legend to work well on mobile devices. This may mean a slightly different appearance, or minimally the ability to hide the legend when the site is viewed from a mobile device.

4.11.1.26. The 511 website shall provide a legend to explain which ITS devices are being displayed.

The legend will include information about each icon that is available on the web map, defining what the icon represents. This will be true for ITS devices, as well as for data such as incidents, construction areas, etc.

4.11.1.27. The 511 map shall provide a legend to explain the near real-time traffic speed colors being displayed.

While the legend will always contain the type of information described in 4.11.1.24 and 4.11.1.25 related to layers and icons, additional information may also be present depending on which layers are active. For example, when the speed layer is active, a legend will be visible that explains the colors being displayed. Similarly, when road conditions are displayed, a legend will be visible to define the roadway coloring pertinent to that layer. Below are some examples of layer definitions on 511PA that only appear when particular layers are active.
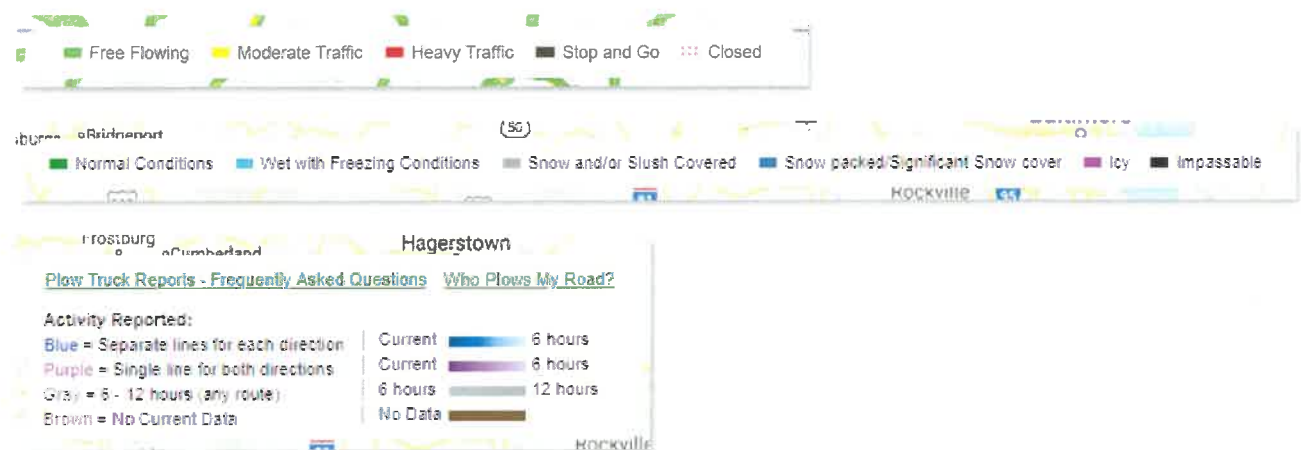
To make this information clearer, Team Q-Free recommends not allowing users to view more than one roadway coloring layer at a time on the web map. This means that users could either view real time traffic speed data, or roadway conditions, but not both at the same time.

4.11.1.28. The ATMS shall automatically refresh the real-time traffic speed display on 511 at a minimum frequency of 30 seconds.

The ATIS maps on the website and the mobile app can automatically refresh the real-time traffic speed display at least every thirty seconds.

4.11.1.29. The ATMS shall be capable of distributing color and black and white video images to WVDOH's 511 website.

The ILOG ATIS is capable of displaying both color and black and white images, as well as streaming video. For a more robust description of the ATIS camera display capabilities, please see the response to requirement 4.11.1.3.

The OpenTMS video solution provides the ability to stream the camera feed in day mode and night mode, as long as it's supported by the camera manufacturer.

4.11.1.30.Blank

4.11.1.31.The 511-telephony system, including the 511 system as well as the communication capability, shall have the ability to handle an average of 200 to 300 calls per day and allow for a peak usage of 5, 000 to 6,000 calls per day. Vendor is to propose how they would meet this requirement or provide an alternate solution.

The IVR component of the ILOG ATIS (both the traditional and SAM versions) will easily handle 200-300 calls per day, accommodating spikes to 6,000 calls per day. To accomplish this, ILOG has abandoned the old IVR model, in which systems are constrained by the provisioning of physical trunks and access to available ports on provider switches.

The ILOG IVR is virtual, natively VoIP, provisioned based on licensing and bandwidth, rather than physical trunks, and scalable within minutes, not weeks. When ILOG's system technicians receive system monitor alerts letting them know that system usage has exceeded pre-defined notification levels, they are able to quickly log in to the system and increase the capacity for as long as necessary. ILOG proactively increases capacity before large storms, or other events when there is an expected surge in usage.

The ILOG IVR complies with national standards and guidance, including that published by the 511 Deployment Coalition. The system has been tested with TTY operators to be sure that it complies with Section 255 of the Telecommunications Act of 1996 and Title II of the ADA.

4.11.1.32.The 511 shall graphically provide the location of each camera and a representation to show the user what direction the camera is facing.

The ATIS web map and mobile app will provide icons for the location of each camera, and different icons when many cameras are densely clustered at a particular location on the map, as described in the response to requirement 4.11.1.3 in section . ILOG can provide the DOT with several options to indicate how the direction of the camera may be indicated. The most straightforward way is to include a description of the direction the camera is facing once the user clicks on the icon, as seen in the image below. However, the icons for cameras may be modified to indicate the direction they are pointing, as long as that information is available in a spreadsheet or database. For instance, the camera icons might be facing different directions, or colored differently, if they are pointing eastbound versus westbound. This is a decision that would be discussed with WVDOH during system setup.

4.11.1.33. The 511 system shall have the ability to add additional routes in the future beyond what is covered by current 511 system now.

There are virtually no limits to the route capacity of the ATIS system; any number of additional routes may be added to what is currently covered in the WV 511 system.

4.11.1.34. The 511 website shall provide a linked text-based list of primary website content for selection by users.

The ILOG ATIS is configured to provide text listings of information whenever possible. This alternative to map-based data is beneficial both to users who have low bandwidth, as well as those with visual impairments. ILOG has experience providing the following types of data as text listings, and the system is capable of handling more:

- Travel alerts for incidents, construction, special events, and other dynamic information. In the case of construction and special events, this is done for both active and planned work.
- Travel restrictions.
- Weather alerts & forecasts.
- Listings of RWIS stations/cameras.
- Listings of traffic cameras.
- Rest facilities and service plazas.
- Selection options for toll calculators.

In each of the text listings, agencies have provided preferences for how the information is organized. Typically, the data is categorized by roadway, county, and/or region. For example, in the 511PA text listing of cameras,

the user can first select a region of Pennsylvania, and then the roadway for which they would like the cameras. The traffic camera names/locations are then listed as links, in the order in which they appear on the roadway.
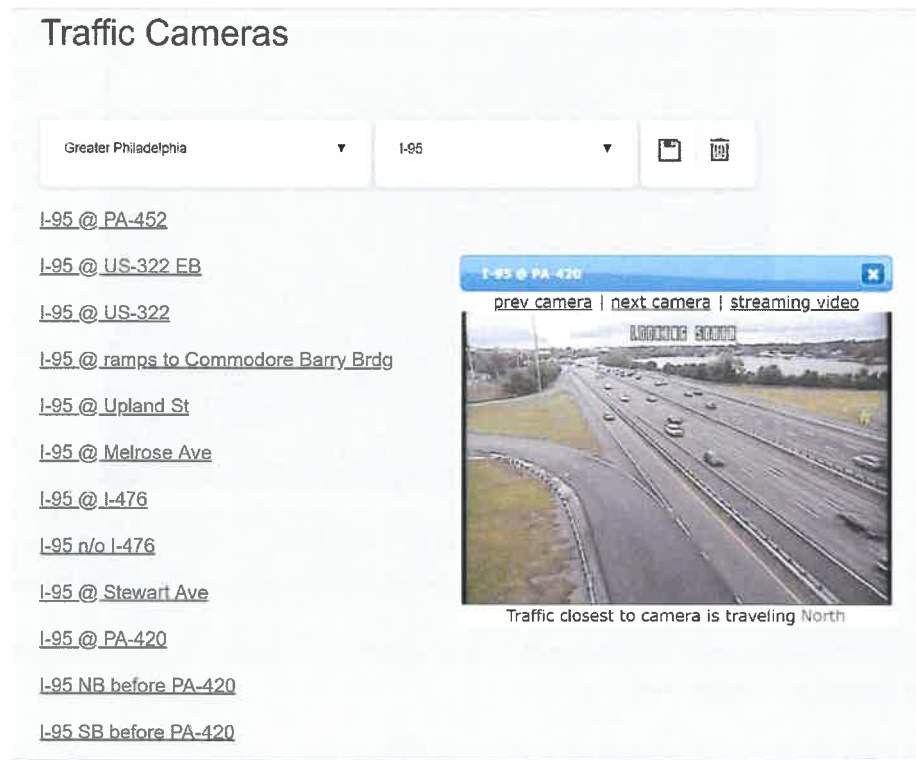
4.11.1.35. *The 511 website shall allow users to select cameras and DMS for a specified region of the state or by major roadway and accident or construction/work zone information for a specified region of the state or by major roadway.*

All data in the ILOG ATIS may be selected by first filtering by a criterion, such as a region or roadway. This is true for both the text listing and map pages of the website.

As seen in the response to requirement 4.11.1.32, the text listing of traffic cameras has first been filtered by region, and then by roadway, before producing the list of options available for the user to choose from. This same methodology applies to text listings for other types of information, such as DMS, incidents, and construction/work zones. Text listings can also be provided with combinations of ITS devices. The specifics for the text listing of the site can be determined during design.

The web map portion of the website can be used in a similar fashion. Using 511PA as an example, the top of the web map has an option available for selecting a particular region of Pennsylvania. When a region is chosen, the map zooms to a pre-defined center point and zoom level, which helps to filter the information for all layers available on the web map. Additional boundary lines may also be drawn, by whichever level of organization is chosen by WVDOH (e.g. county, region, etc.). The solid, thin blue line running north-south in the image below marks the Pennsylvania-Ohio boundary, as seen on 511PA. These pre-defined regional zooms help to focus the perspective of the user on the map and may be saved for later viewing.
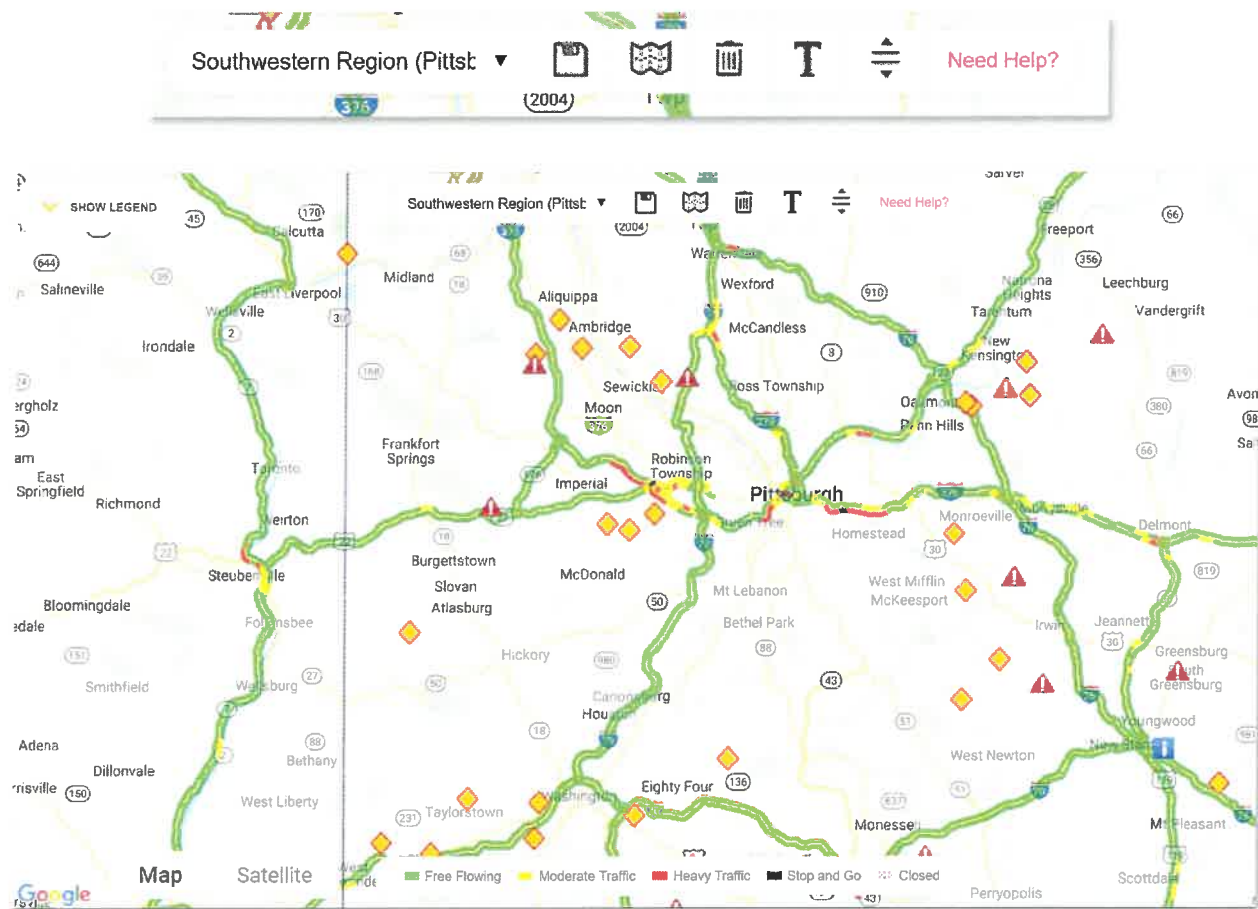
4.11.1.36.No Adobe flash content is to be used on the 511 website, 511 mobile website or 511 application.

The ILOG ATIS does not use Adobe flash content in any component.

4.11.1.37.The 511 website shall provide a link to specific WVDOH construction projects/special projects/studies information sites.

The website portion of the ILOG ATIS is capable of handling any number of links to specific WVDOH projects. The system currently provides this for the Pennsylvania Turnpike, the site for which can be accessed at https://www.paturnpike.com/travel/major_design_construction_projects.aspx.

MAJOR DESIGN & CONSTRUCTION PROJECTS

Other links can also be accommodated for special events or projects. Team Q-Free typically sets up and links multiple special event pages each year for 511PA, including sites for the Little League World Series, Pennsylvania Farm Show, and historical traffic videos for major travel holidays.
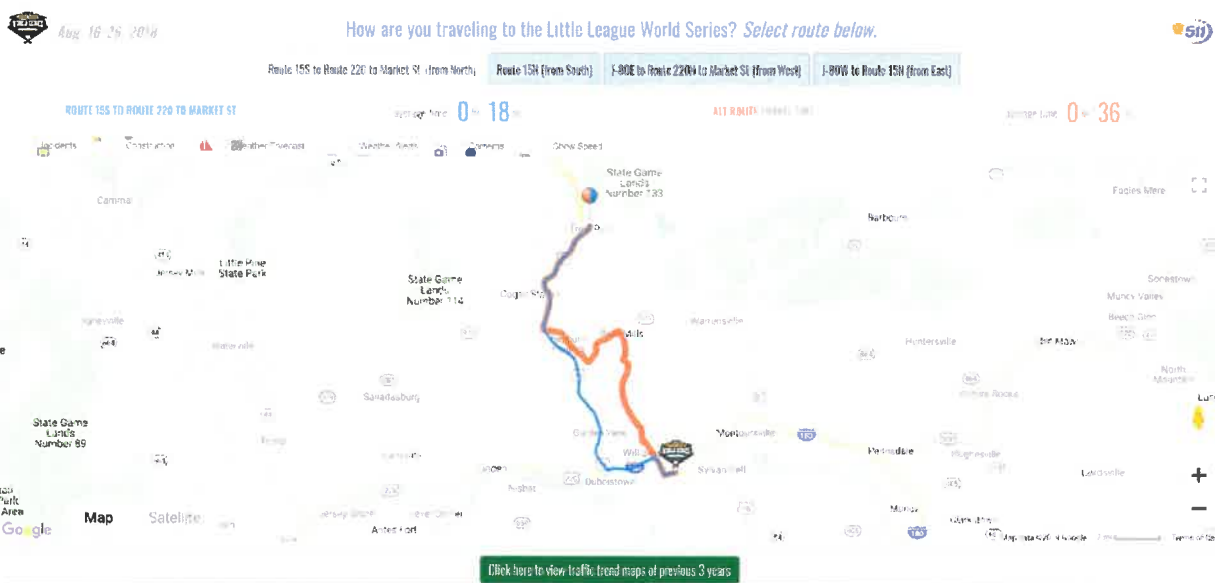
4.11.1.38. The 511 website shall be smart-phone/mobile phone accessible and shall be adapted to work in both a desktop and mobile format with all content that is available on desktop version available on mobile version.

The ILOG ATIS website was specifically created with an adaptive design, meaning that the site automatically adjusts to accommodate the size limitations of the device being used. With adaptive design, only one site is maintained, but the appearance of the site on a desktop PC will be different from the appearance on a mobile device. This gives users the ease of learning a single feature navigation that is available on both desktop and

mobile devices and gives the agency the assurance that consistency is maintained as one update applies to all devices that access the site.

4.11.1.39. The 511 mobile website and the 511 app shall have a warning banner regarding use while driving and disclaimer similar to one used on the current WV511 app.

The Drive Safe mobile application will continue to have a warning banner regarding use while driving, as well as a disclaimer. The look and precise text of the warning and disclaimer may be changed by WVDOH if desired during the design portion of the system setup.

4.11.1.40. The 511 website and 511 app shall be updated as necessary as operating systems used by mobile phone providers are updated. Vendor is to verify impacts to functionality if new OS releases are anticipated and maintain functionality through updates to software as required with new OS updates or versions.

The mobile application will continue to be maintained, tested, and updated as new operating systems are released for iOS and Android, or if a symptom indicating a programming bug is reported by users. ILOG proactively monitors customer feedback and crash reports and will address issues with app updates as needed. Due to the redundancy built into the ATIS network structure, most maintenance activities (for both the mobile app and other components) can be performed without service interruption.

4.11.1.41. The 511 website shall be capable of being imbedded into other HTML documents, or mirrored by other websites, with 511 logos intact as an Inline Frame (Iframe) or similar.

The ILOG ATIS website is capable of being embedded into other HTML documents/mirrored with 511 logos intact as an iframe. ILOG would work cooperatively to provide code to a third party that is interested in integrating the website in this manner, to assure a smooth implementation.

4.11.1.42. The camera image displayed on the 511 website and exported to external users shall have a customizable graphic overlay that will identify the source of the images.

The ILOG ATIS is capable of handling this requirement in two different ways. If the image has a customized graphic overlay (is watermarked) before coming to the ATIS, then the image with the watermark will be displayed as-is. The system is also capable of adding a watermark to images that are received without one. ILOG currently adds watermarks to camera images for the PA Turnpike.
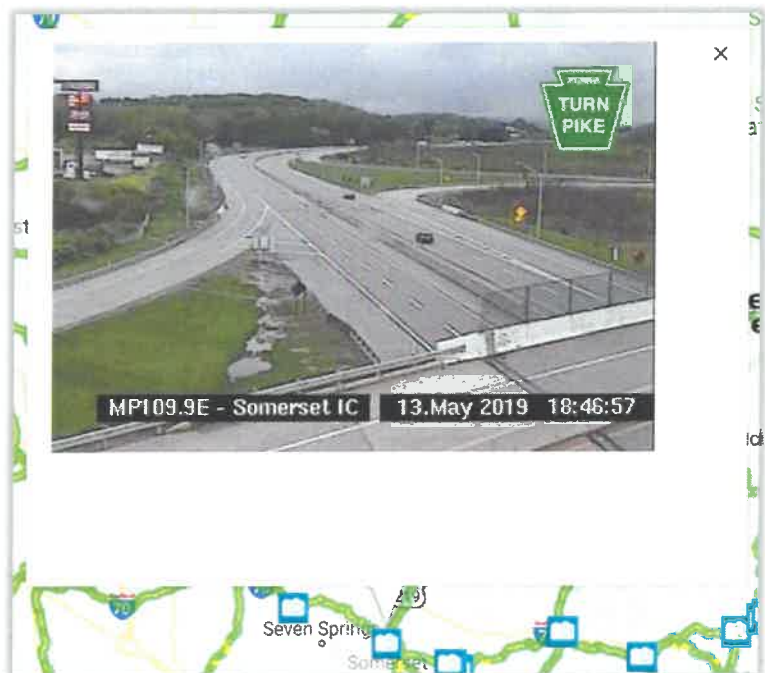
4.11.2. Traveler Information – Desirables

4.11.2.1. The data sharable with the 511 website and 511 app should include freeway traffic speed indicators.

Out of the box, data feeds are available through a REST API and can be accessed by the 511 system. A feed is available for detector data. The feed includes volume, occupancy, and speed.

The ILOG ATIS website and mobile app are capable of displaying freeway traffic speed indicators, as provided by the ATMS. The method by which these indicators are displayed will be discussed during the design period of the system setup.

4.11.2.2. The data sharable with the 511 website and 511 app should include arterial traffic speed information gathered by the ATMS or 3rd party provider.

Out of the box, data feeds are available through a REST API and can be accessed by the 511 system. A feed is available for detector data. The feed includes volume, occupancy, and speed.

The ILOG ATIS website and mobile app are capable of displaying arterial traffic speed information, as provided by the ATMS. If speed data from the ATMS is desired in addition to Google Traffic, then the method by which these indicators are displayed will be discussed during the design period of the system setup.

4.11.2.3. The data sharable with the 3rd Party Information Dissemination entities should include freeway occupancy. (if available)

Out of the box, data feeds are available through a REST API and can be accessed by 3rd parties. A feed is available for detector data. The feed includes volume, occupancy, and speed.

The ILOG ATIS is capable of distributing this data to third-party entities, if WVDOH does not want it to be accessed directly from the ATMS.

4.11.2.4. The data sharable with the 3rd Party Information Dissemination entities should include arterial traffic speed information gathered by the ATMS. (if available)

Out of the box, data feeds are available through a REST API and can be accessed by 3rd parties. A feed is available for detector data. The feed includes volume, occupancy, and speed.

The ILOG ATIS is capable of distributing this data to third-party entities, if WVDOH does not want it to be accessed directly from the ATMS.

4.11.2.5. The ATMS should include capability of generating the messages to display travel time estimates for DMS locations in the network.

Out of the box, OpenTMS has the ability to display travel times on DMS. Travel time messages are configured with a specially formatted travel time template configured through the sign module devices' travel time message tab. Creating a travel time message is similar to creating a standard message with the exception of a double hashtag (##) that represents the travel time to be automatically pulled and updated from an assigned segment. If the message is active it will be reposted.
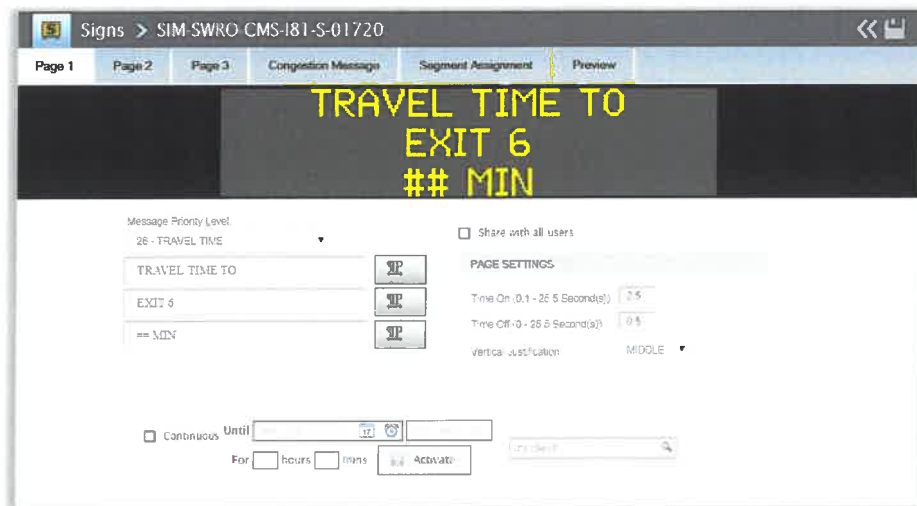
Figure 86 - Display Travel Times on DMS

Segments are created in the admin portal and linked to a sign and associated to the message at the time the message is created from the Segment Assignment Tab.
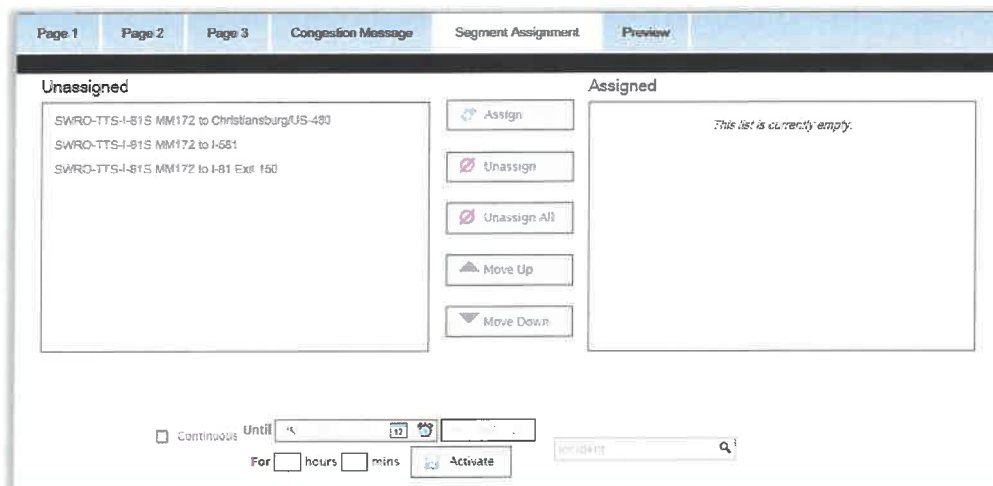
Figure 87 - Segment Assignment Tab

Once the message is activated, travel times will automatically update on the sign as the travel time changes.

The ILOG ATIS is capable of displaying any active message on DMS icons. This is true regardless of whether this is a safety message, travel time, or information relevant to a specific incident. As noted in the response to requirement 4.11.1.23, different icons will be used on the web map to indicate active versus inactive DMS.

4.11.2.6. The ATMS should provide a mechanism to automatically post travel time estimates to DMS.

Out of the box, travel times can be posted manually through the sign module or a resource plan. With a resource plan the WVDOH can activate travels times from 6 AM to 11 PM for example Monday through Friday and 9 AM to 10 PM on Saturday and Sunday if desired. DMS displaying travel times are automatically updated with the latest travel times at a configurable interval.

All DMS messages available in the ATIS feed will be automatically posted to the ATIS components.

4.11.2.7. The ATMS should have the ability to push commercial vehicle and OS/OW restrictions to subscribers.

Team Q-Free's proposal for WVDOH includes a subscriber services portion in the ILOG ATIS. Behind a credentialed login, this portion of the system has an integrated personalized alert component so that users can provide areas/roadways and days/times of day during which they wish to receive email alerts about particular portions of the state. This feature can be expanded to providing commercial vehicle and OS/OW restrictions as well as all other alerts in the ATIS. Alerts received from the ATMS are automatically translated into email alerts, and distributed to travelers who have subscribed to receive notifications for alerts matching their user profile.

Users are able to manage the various features of their accounts from the website. After logging in,

- Users may edit their personal info/user profile.
- Users may subscribe/unsubscribe from alerts or change the types of alerts they wish to receive.
- Alerts may be configured so they are only sent during particular days and times. Furthermore, these configurations may be different for each route entered by a user.
- As a new feature, users can select the area of their focus by drawing a shape on a map, rather than clicking through roadway dropdown options. This gives great flexibility when a user wants alerts near a specific region, or along a commute that involves multiple roadways. It also gives the user the opportunity to incorporate roads near their primary route, which may have a secondary impact on their commute.

Traffic Profile Area

Select by route

Check the days you wish to be notified

☐ Entire Week
☐ Weekend
☑ Week Days

☐ Mon ☐ Tue ☐ Wed ☐ Thu ☐ Fri ☐ Sat ☐ Sun

Profile Details - Last Updated

Choose the time periods for which you want to receive traffic reports

* Beginning Time   [08:00 AM ▼]

* Ending Time   [10:00 AM ▼]

Other Details

* Where would you like alerts to be sent?   [johnf@ilogcorp.com ▼]

* Please enter a name to associate with this profile   [Morning Commute]

[Add Profile]

Incorporation of the notification function into the mobile app can also be done by linking the app to the subscriber services and providing app notifications.

For users who have subscribed to email alerts, the ILOG ATIS administrative portal allows authorized agency users to search for subscribers, and to modify subscriber information, routes and other parameters

Figure 88 - Subscription Services Management

4.11.2.8. *The ATMS highway conditions reporting system should be able to provide roadway condition reporting to local roads in addition to major US and state routes.*

As outlined in the response to requirement 4.11.1.11, the ILOG ATIS is capable of displaying any roadway conditions provided by the ATMS. This is not restricted to major US and state routes; local roads may also be accommodated.

4.11.2.9. *The 511 website should provide for individual public users to create user accounts and customize travel route alerts to notify them of incident, events or unusual congestion along their designated travel route(s) and display specified camera images related to that route.*

The ILOG ATIS proposal includes a traveler subscription service (i.e. user accounts) and is outlined in detail in requirement 4.11.2.7. The system will provide email alerts related to any events provided through the ATMS along their route. The user may then login to the website where they would be presented with their personal routes list, and when one is selected, the map would zoom into the subscriber's pre-defined route and display events and camera layers for the route.

4.11.2.10. *The ATMS should allow selection of numerical limits associated with each display color for each type of traffic measurement by an ATMS user with sufficient authorization. These parameters should be applied to display generation for the 511 website.*

All business rules related to ATIS display, including numerical limits associated with display colors and types of traffic measurements, will be carried to the ATIS so that only approved information will be distributed to the public in a way that is compatible with the metric to be presented.

4.11.2.11. The 511 website should incorporate a banner scrolling along the bottom of the WV511.org page that will allow ATMS operators to enter text for unique events and emergency notifications.

The ILOG ATIS incorporates a scrolling banner on the website as part of the basic system. This banner may be populated through a manual input process, or with automatic triggers from the ATMS data feed. The manual banner announcements are created and edited through an administrative interface. The text in the ticker can be edited to display boldface and italicized text, and hyperlinks can be included. Alerts may be instantly activated or scheduled for activation in the future.

The banner can also be automatically populated from the ATMS data, according to pre-defined business rules such as when events hit a particular severity level. For automated banner alerts, hyperlinks may be connected to a specific closure on the map, so that when they are clicked, details are displayed on the map.

4.11.2.12. The 511-phone system to have a comprehensive vocabulary for text to voice system or more intuitive interpretation of what the operator types in to the system. (e.g. if the operator types "SB", 511 system should know that means southbound versus having to type the words out.)

The ILOG ATIS IVR and mobile app share a common text-to-speech translation process. This means that when an audio version is created for an alert, it will sound the same on the mobile app as it does on the IVR. To ensure that common abbreviations are read correctly (such as SB meaning southbound), and to account for local accents and pronunciations, the system also has a translation database. This database allows for custom pronunciations which correct the pronunciation of words that may not sound quite right from the initial text-to-speech conversion. This database already has many common conversions, as it benefits from both the experiences of other states, as well as ILOG's existing relationship working with WVDOH's roadway names. The image below shows a handful of the pronunciation adjustments that have already been made for the Drive Safe mobile app, which will be carried to the IVR. To further aid WVDOH, the system has several areas where an audio preview button may be clicked, so that an administrator entering an alert can hear a message before it is sent to the public.

Appr	Approach	WVDOH	VW Julie	Pronun	No
Ceredo	Sir ee duh	WVDOH	VW Julie	Pronun	No
Chelyan	shill yane	WVDOH	VW Julie	Pronun	No
Ghent	geeat	WVDOH	VW Julie	Pronun	No
Kanawha	kahnahwah	WVDOH	VW Julie	Pronun	No
Kenova	ken no va	WVDOH	VW Julie	Pronun	No
Mahan	may haine	WVDOH	VW Julie	Pronun	No
Medina	muh dye na	WVDOH	VW Julie	Pronun	No
Oglebay	ogg el bee	WVDOH	VW Julie	Pronun	No
Poca	puck uh	WVDOH	VW Julie	Pronun	No
Poca Talico	puck uh tay'licko	WVDOH	VW Julie	Pronun	No
Robert C. Byrd	Robert C Bird	WVDOH	VW Julie	Pronun	No
Sebraton	say bray tun	WVDOH	VW Julie	Pronun	No
Staunton	Stunton	WVDOH	VW Julie	Pronun	No
Sun	Sunday	WVDOH	VW Julie	Pronun	Yes
Sun.	Sunday	WVDOH	VW Julie	Pronun	Yes
Teays Vally	tays valley	WVDOH	VW Julie	Pronun	No
Thurs	Thursday	WVDOH	VW Julie	Pronun	No
Tues	Tuesday	WVDOH	VW Julie	Pronun	No
wv	west virginia	WVDOH	VW Julie	Pronun	No

4.11.2.13. The ATMS should require varying levels of administration rights on the 511 website from view only to super user.

The ILOG ATIS has the ability to provide for varying levels of access to administrative website functions, ranging from super users to read-only access. The levels of access to this admin portal for either/both agencies will be discussed and determined during the implementation phase.

4.11.2.14. The data sharable with the third-Party Information Dissemination entities should include freeway traffic speed. (if available)

Out of the box, data feeds are available through a REST API and can be accessed by 3rd parties. A feed is available for detector data. The feed includes volume, occupancy, and speed.

The ILOG ATIS is capable of distributing this data to third-party entities, if WVDOH does not want it to be accessed directly from the ATMS.

11.0 Integration with Other Systems (CRFP Section 4.12)

4.12. Integration with Other Systems
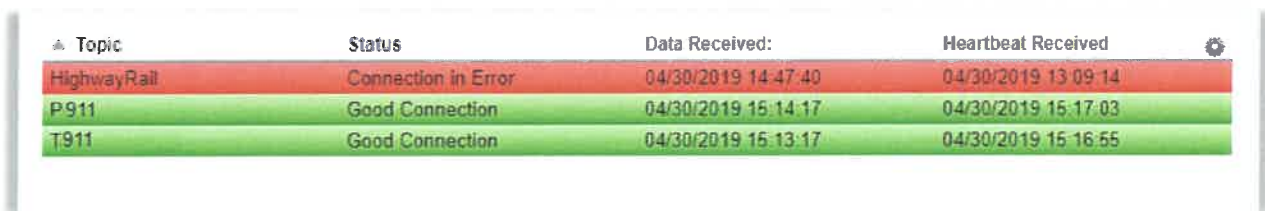
4.12.1. Mandatory Requirements

4.12.1.1. *The ATMS shall establish and maintain connections with existing external systems.*

OpenTMS meets this requirement. The modular architecture of OpenTMS supports standards-based integrations with external systems. ATMS will establish and maintain connections with all existing external systems; CCTV, DMS, RWIS, 22 County E-911, truck parking sites, and 511 systems.

4.12.1.2. *The ATMS shall operate and report system diagnostics to enable operators to confirm that communications to external systems are functioning properly.*

OpenTMS meets this requirement. For external systems connected to the Alerts module, a Status button is available on the Alerts list view that opens a dialog that shows the state of the connection.

⏶ Topic	Status	Data Received:	Heartbeat Received	⚙
HighwayRail	Connection in Error	04/30/2019 14:47:40	04/30/2019 13:09:14	
P911	Good Connection	04/30/2019 15:14:17	04/30/2019 15:17:03	
T911	Good Connection	04/30/2019 15:13:17	04/30/2019 15:16:55	

Figure 89 - Alerts Module

4.12.1.3. *The ATMS shall operate and report system diagnostics to enable operators to confirm that communications to external field devices are functioning properly.*

OpenTMS meets this requirement. The system continuously polls in the background. When a poll fails, the communication status is changed to Suspect. The system retries polling and after a set number of attempts, the device is marked as Failed. The number of polls until the device is marked as Failed is configurable. Communication status icons shown below and are visible from the map and list view. The Device reporting errors icon is visible on the list view only, but from the map the user can click on the Maintenance Mode map tool that filters the map to only show devices that are not in normal condition. Devices are considered not normal if they have communications that are suspect or failed and/or the device is reporting an error such as a pixel error.

- Normal Communications
- Normal Communications, but device is reporting errors
- Suspect Communications
- Failed Communications
- Disabled Communications
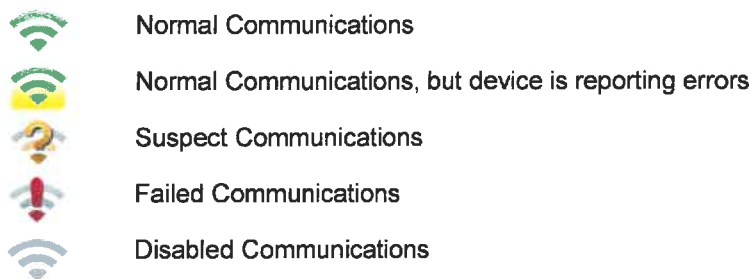
Reports are available to be run on-demand or scheduled to automatically run that report on ITS device health.

4.12.1.4. The ATMS shall incorporate center to center standards enabling standardized data exchange with other systems and agencies.

OpenTMS meets this requirement. ATMS supports NTCIP center-to-center (C2C) communications with other systems and agencies. Q-Free has implemented C2C with our VDOT client to integrate two other ATMS vendors managing Toll Roads in Northern Virginia. This integration pulls in the other center's devices and displays in the list views and on the map. In the figure below, external devices have a different icon and the map layer can be toggled off. This list view shown below, has external devices enabled.
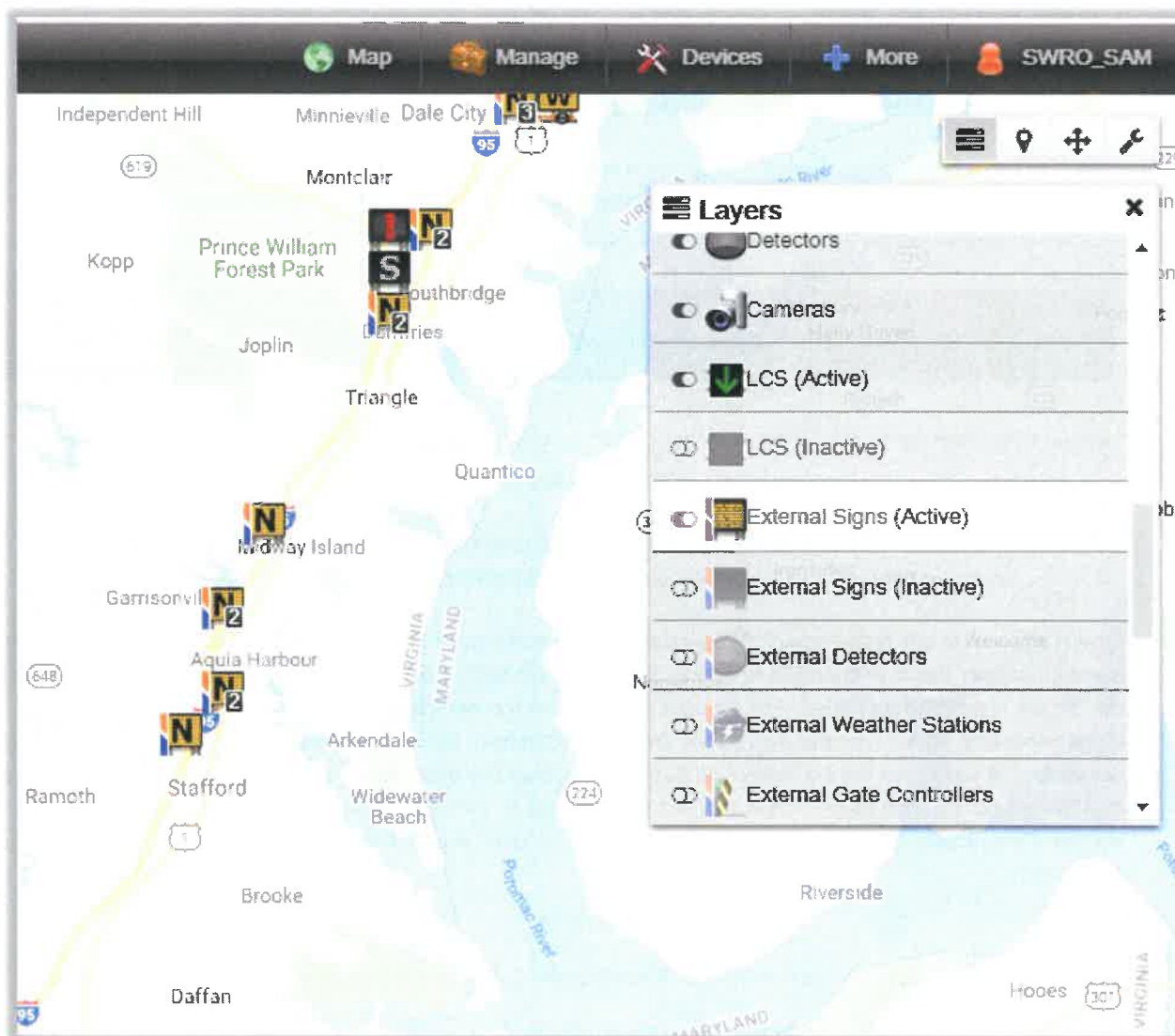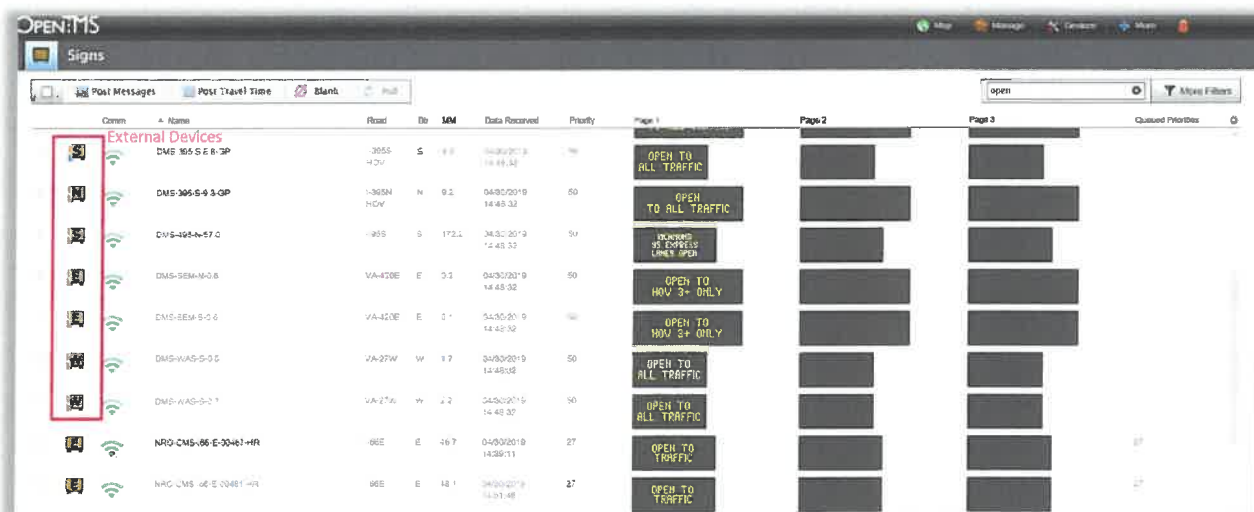
Figure 90 - ATMS supports NTCIP Communications with External Devices

4.12.1.5. The ATMS shall provide traffic data to West Virginia 511 system, website and 511 app.

OpenTMS meets this requirement. ATMS provides traffic data to multiple 511 systems in our current production deployments. The modular architecture of OpenTMS supports standards-based integrations with external systems. The system includes a data integration platform which supports multiple data standards and exchange models; REST API, and Java Message Service (JMS). ATIS vendor will pull data from the ATMS REST API.

The ILOG ATIS currently accepts traffic data from the Q-Free ATMS in West Virginia, and uses that data to populate the Drive Safe mobile app. While the amounts and types of data may expand in the new setup, the ability to receive and processing data will not. ILOG is capable and experienced accepting data using VPNs, secure web services, secure FTP transmissions, and most other transmission methods and supporting multiple data standards and exchange models.

As it does today, the centralized ATIS system will accept, filter, and distribute data from the ATMS. Instead of preparing the data for the mobile app alone, it will also prepare the data for distribution to the website and IVR. During the processing, business rules can be applied that can de-duplicate repetitive information, triage/prioritize information, and assign distribution channels, depending on WVDOT preferences. As part of the processing, each piece of data is tagged with its required geo-specific characteristics. For example, the latitude and longitude in the raw data can be used to assign the data with a city tag, a roadway tag, point-of-interest tag, etc. The stored data is converted into all formats needed by the solution: formatted for text display, formatted for audio output, and formatted for distribution to publicly available data feeds. By converting processed data to all formats, the information is immediately available for all components of the ATIS. Regardless of how the traveler receives the information, and regardless of how other parties use the public data feeds, WVDOT can be sure that all distribution channels contain the same information – updated simultaneously.

4.12.1.6. The ATMS shall have the ability to establish, maintain, and exchange data with CAD systems operated by 911 centers and law enforcement agencies within the State of West Virginia.

OpenTMS meets this requirement. Q-Free has been a leader in CAD integration for over the last 10+ years. Q-Free has integrated over 12 separate CAD systems from State Police and 911 centers. Q-Free has three clients actively using CAD alerts as a primary component of incident detection. We've integrated over 40+ centers between these clients. Traffic CAD events are integrated into OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert tracking the two together. As updates come in the users have the most update to date information within minutes of being entered by the 911 center.

4.12.1.7. The ATMS shall receive CAD incident reports and make them available to authorized users through the ATMS user interface.

OpenTMS meets this requirement. Traffic CAD events are integrated into OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert tracking the two together. As updates come in the users have the most update to date information within minutes of being entered by the 911 center. Access is available to users with the correct privileges.

4.12.1.8. The ATMS shall be able to share ATMS functionality with the WVPA (West Virginia Parkway Authority) offices.

OpenTMS meets this requirement. OpenTMS is deployed as a Statewide solution in Virginia and Pennsylvania where there are multi-Transportation Management Centers (TMC) in operation. OpenTMS has a feature called "Home Groups" which can be used to define different operational areas within the agency, state, or province. This allows clients control data accessibility across groups of users. For example, in Pennsylvania, each TMC is defined as its own operational area and users assigned to that group can only see those events or devices within their jurisdiction. Notifications can be customized to home group as well. In the event that access to the other TMC's devices are needed their home group can be enable in a user's preferences.

4.12.1.9. The ATMS shall integrate with the current CitILOG video analytics system in order to provide data related to wrong-way driver, incident and stopped vehicle detection.

OpenTMS meets this requirement. Q-Free integrates with CitILOG video analytics system to provide data related to wrong-way driver, incidents and stopped vehicles. Events are integrated into OpenTMS Alerts module. When an event is received, the user receives a notification and can create an incident from the alert tracking the two together. Below is an example of an alert received due to a stopped vehicle.

4.12.2. Integration with Other Systems – Desirables

4.12.2.1. The ATMS should integrate with external agencies' systems using standardized Center to Center communication protocols.

Out of the box, the ATMS supports NTCIP center-to-center (C2C) communications with other systems and agencies. Q-Free has implemented C2C with our VDOT client to integrate two other ATMS vendors managing Toll Roads in Northern Virginia.
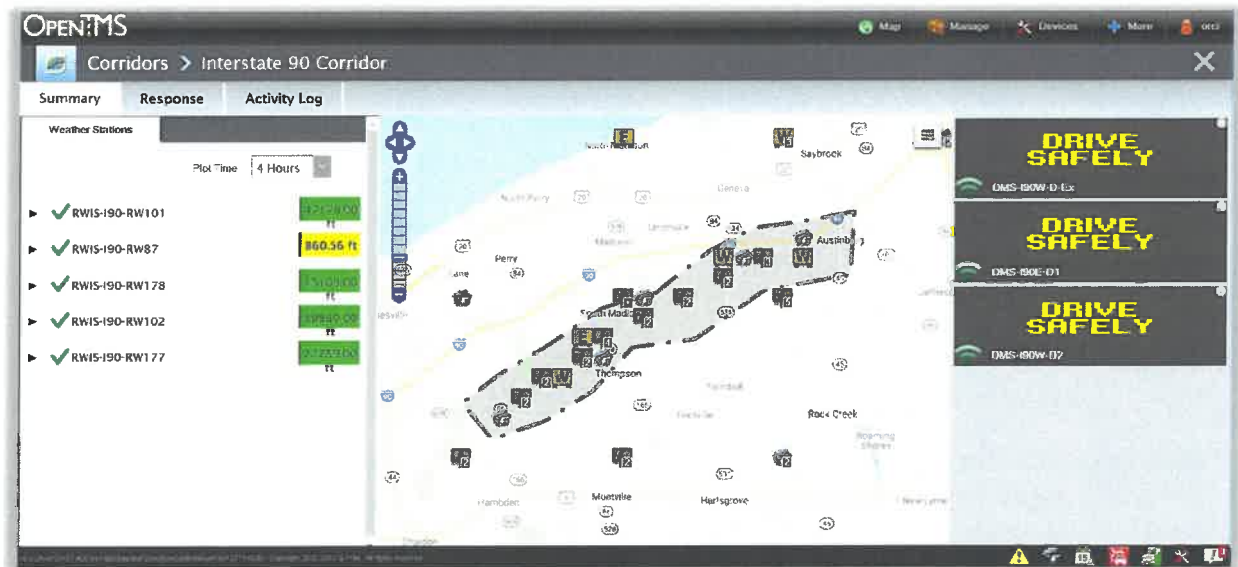
4.12.2.2. The ATMS should have the ability to integrate the fog warning/conditions system to activate a DMS.

OpenTMS has a Corridor Management module which provides rule-based traffic management in corridors of particular interest to the client. A corridor is configured to respond to traffic data from a number of sources (RWIS, traffic sensors, travel times, etc.) and automatically activate control mechanisms (DMS, VSL) based on agency specific business rules. The module is highly flexible and can be configured to consume multiple data sources and drive multiple traffic control devices. The response can be configured to be fully or semi-automated. Fully automated corridors update traffic controls with no actions from the operators whatsoever. Semi-automated corridors require operator approval before executing the system-generated response plan.

Q-Free has implemented and deployed a weather corridor along the Ohio I-90 Corridor. The Corridor uses weather station data to identify when a corridor is experiencing low visibility. When visibility drops below the threshold a DMS and VSL response is recommended to slow down drivers in advance of fog conditions. The system updates on regular cycles based on changing visibility conditions providing a level of responsiveness which would be virtually impossible without automation.

Q-Free is currently working on a Queue Detection / Warning Corridor for Pennsylvania where the system monitors detector or travel time data and when a slowdown is detected DMS and VSL response is recommended to slow down drivers in advance of the slowed or stopped traffic.

Other Fog sensors could be integrated in lieu of RWIS visibility monitoring.

4.12.2.3. The ATMS should have the ability to access to OES flood gauge monitoring system. (IFLOWS)

While OpenTMS does not integrate flood gauges in our latest version, our open modular architecture provides us the ability to do so in the future.

4.12.2.4. For optional interfaces not incorporated into the ATMS, the ATMS should provide a means to initiate the external software from within the ATMS and must log the initiation and termination of the external software.

Skyline's VERO will be accessible from the OpenTMS Devices Camera option. VERO will implement single sign on capability.

4.12.2.5. The ATMS should be able to share ATMS functionality with the West Virginia State Police Troop locations and dispatch centers.

West Virginia State Police Troop and dispatch center staff can be provided 'Guest' access to OpenTMS. Using the Guest Role, the WVDOH can assign view only privileges to those modules that they want the third-party to view. If not on the TMC network, access would be through a secure Virtual Private Network (VPN).

4.12.2.6. The ATMS should have the ability to integrate West Virginia weigh station offices through on-site video monitoring and providing access to the ATMS software application.

While OpenTMS does not integrate weight stations in our latest version, our open modular architecture provides us the ability to do so in the future. Third parties can be provided 'Guest' access to OpenTMS. Using the Guest Role, the WVDOH can assign view only privileges to those modules that they want the third-party to view. If not on the TMC network, access would be through a secure Virtual Private Network (VPN).

Video from on-site cameras can be brought back to the video distribution system and made available to the TMC.

4.12.2.7. The ATMS should have the ability to control and manage ramp meters and ramp meter systems.

Q-Free has ramp meter experience with an earlier version of OpenTMS that contained a Ramp Metering module that was deployed in Northern Virginia. At this time the module is on our Product Road Map.

12.0 Operator and User Features (CRFP Section 4.13)

4.13. Operator and User Features

4.13.1. Mandatory Requirements

4.13.1.1. The ATMS shall enable multiple users to be logged in simultaneously.

OpenTMS meets this requirement. ATMS does not limit the number of simultaneous users. Current PennDOT requirements require 100 simultaneous user users and 20 simultaneous administrators. As the number of users increase the number of multiple webservers sitting behind a load balancer can be scaled provide the ability to distribute load. VDOT requirements require 500 simultaneous users. Our system load tests are done utilizing these numbers as a minimum.

4.13.1.2. The ATMS shall enable users to access the system from locations remote from the TMC.

OpenTMS meets this requirement. OpenTMS is a fully web-enabled ATMS. The architecture is designed to run on a desktop/laptop through a conventional browser. As a web application, users can access the ATMS inside or external to the client's Traffic Management Center (TMC) if they have network access.

Several of our clients support a secure Virtual Private Network (VPN) to remotely access the DOT hosted hardware platform and/or ATMS application from outside the TMC.

4.13.1.3. The ATMS user interface shall display alerts and notifications to users.

OpenTMS meets this requirement.

Alert-based – The Alerts module provides notifications of events detected internally by OpenTMS or externally through integrations with partner systems. Alerts can be viewed from the Alerts module list view or by clicking on the Alerts icon in the notification toolbar for new notifications.

Non-alert-based – The ATMS contains a built-in notification system that alerts users to urgent and ongoing events concerning devices, services, and requests. Notifications are organized into urgent notifications and new notifications. *Urgent Notifications* indicate that events should be confirmed or acknowledged and will appear in the lower right-hand corner of the screen. *New Notifications* simply let the user know about action results or events. These notifications are generated by the client (rather than the service itself) and they will only appear to the user rather than everyone.

The Notification Tray provide a current list of recent notifications. This quick view is located a in the lower right corner of the OpenTMS window.

Clicking on a notification tray opens the notification tray. In the figure below, the user clicked on the Planned Events tray.
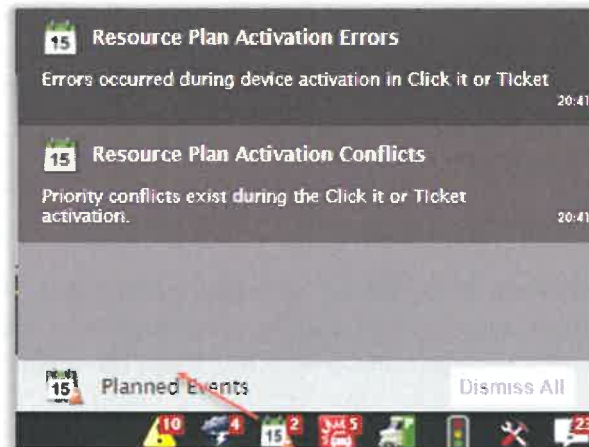
Immediate feedback, such as the success of a user posting a message is displayed in the bottom right.
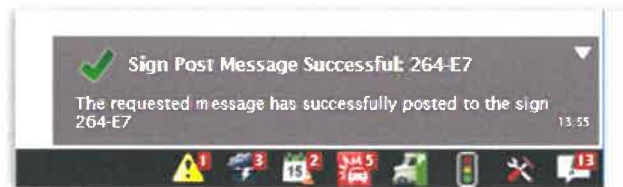
In addition to the toolbar, the user can access notifications through the Notifications module.

4.13.1.4. The ATMS user interface shall enable users to view the identification of other users that are logged in to the system.

OpenTMS meets this requirement. OpenTMS will provide a view of the users currently logged into the system from the main More menu.

4.13.1.5. The ATMS shall alert operators when users log in or log off the system.

OpenTMS meets this requirement. OpenTMS will provide a notification when users log in or log off the system.

4.13.1.6. The activities performed in the ATMS by other users shall be visible to all other users with the appropriate authority.

OpenTMS meets this requirement. The system updates in real time to provide the most recent status. For example, if a user posts a message on a sign, all users with privileges to view signs will see the change in real time.

4.13.1.7. The ATMS user interface shall include map display for both local and remote work stations.

OpenTMS meets this requirement. The same map is provided for both local and remote work stations.

4.13.1.8. User interface maps shall be GIS based to enable smooth and continuous scrolling and zooming.

OpenTMS meets this requirement. The OpenTMS Map Interface optimizes the user experience and operational process. It consists of several integrated components that provide a feature-rich, easy-to-use interface. The system provides responsive maps with a target update rate within 1 second.

4.13.1.9. User interface maps shall include functionality to hide layers or attributes at wide zoom levels to avoid map clutter.

OpenTMS meets this requirement. The OpenTMS map includes a smart icon grouping feature. When multiple devices are in close proximity, OpenTMS automatically clusters the icons and indicates the number of devices with a number indicator on the icon. When a user hovers over a clustered icon, the map interface will provide a popup of all devices included in that cluster. To select one the user can click on the device name.

The system can also be configured to display layers at different zoom levels. For example, the active signs at a higher zoom level then blank signs. As the user zooms in the blank signs will appear at the configured zoom level. This is done in the Admin Portal Map module.

4.13.1.10. The ATMS shall provide a mechanism for operators and users to select what is displayed on the map (e.g. make DMS visible or not visible on the map, make CCTV visible or not visible on the map).

OpenTMS meets this requirement. A Layers Widget in the upper right corner, enables users to toggle the view of specific layers on the map.
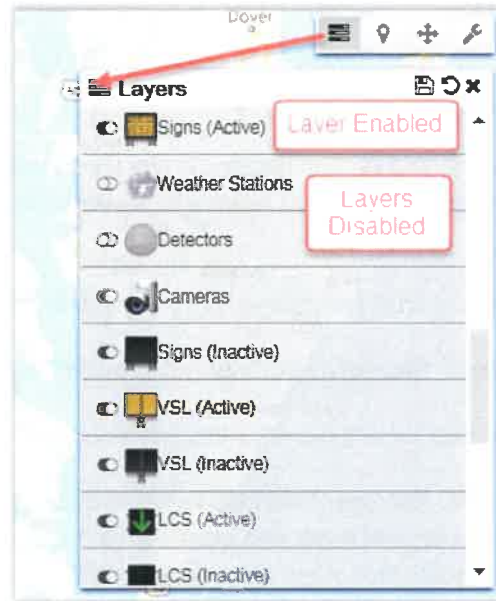

Figure 91 - Layers Widget

4.13.1.11.The ATMS user interface maps shall display active incidents (construction, incidents, etc.).

OpenTMS meets requirement. OpenTMS displays all active incidents and closures on the map.

4.13.1.12.The ATMS user interface maps shall enable operators to select an incident icon to open and view information describing the incident.

OpenTMS meets requirement. Clicking on an incident icon from the map opens the Incidents detailed view. The detailed view provided more in-depth information on the incident.

4.13.1.13.The ATMS user interface maps shall display icons representing both fixed and portable device locations.

OpenTMS meets this requirement. Portable devices use the same icon as the device type, but sit on a trailer as shown below. This icon displays on the map as well as the list views.
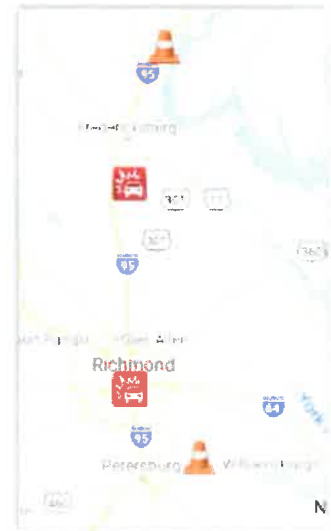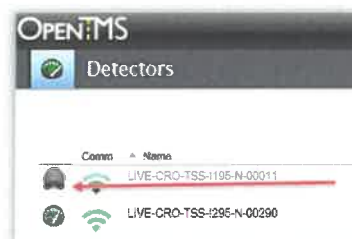
4.13.1.14.The user interface map display of DMS shall distinguish DMS that are not currently connected or operational from those that are operational and connected to the ATMS and ready to receive a message from the ATMS.

OpenTMS meets this requirement. OpenTMS icons also reflect communication status. Devices in communications failure have an '!' point ( ). This is standard among all field devices.

4.13.1.15.The on-screen map shall distinguish between fixed and portable DMS.

OpenTMS meets this requirement. Portable devices use the same icon as the device type, but sit on a trailer as shown below. This icon displays on the map as well as the list views.
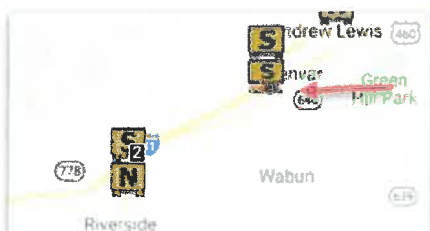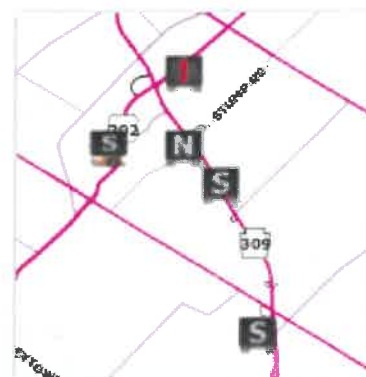
4.13.1.16.   The user interface maps shall enable operators to select DMS to view current messages displayed on the signs.

OpenTMS meets this requirement. The map provides a visual, gold background, that a message is posted on a sign. If you hover over the icon, the tooltip will display the current message.
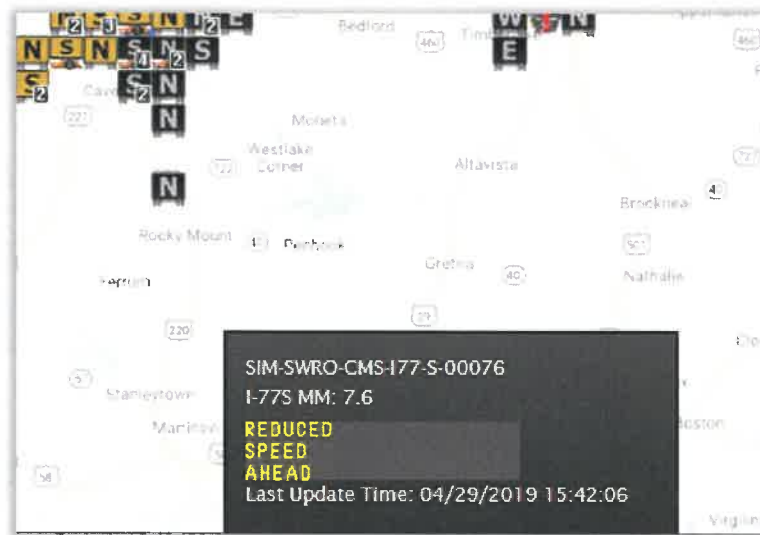
Clicking on the icon will display the sign's detailed view. The current message is displayed on the detailed view.
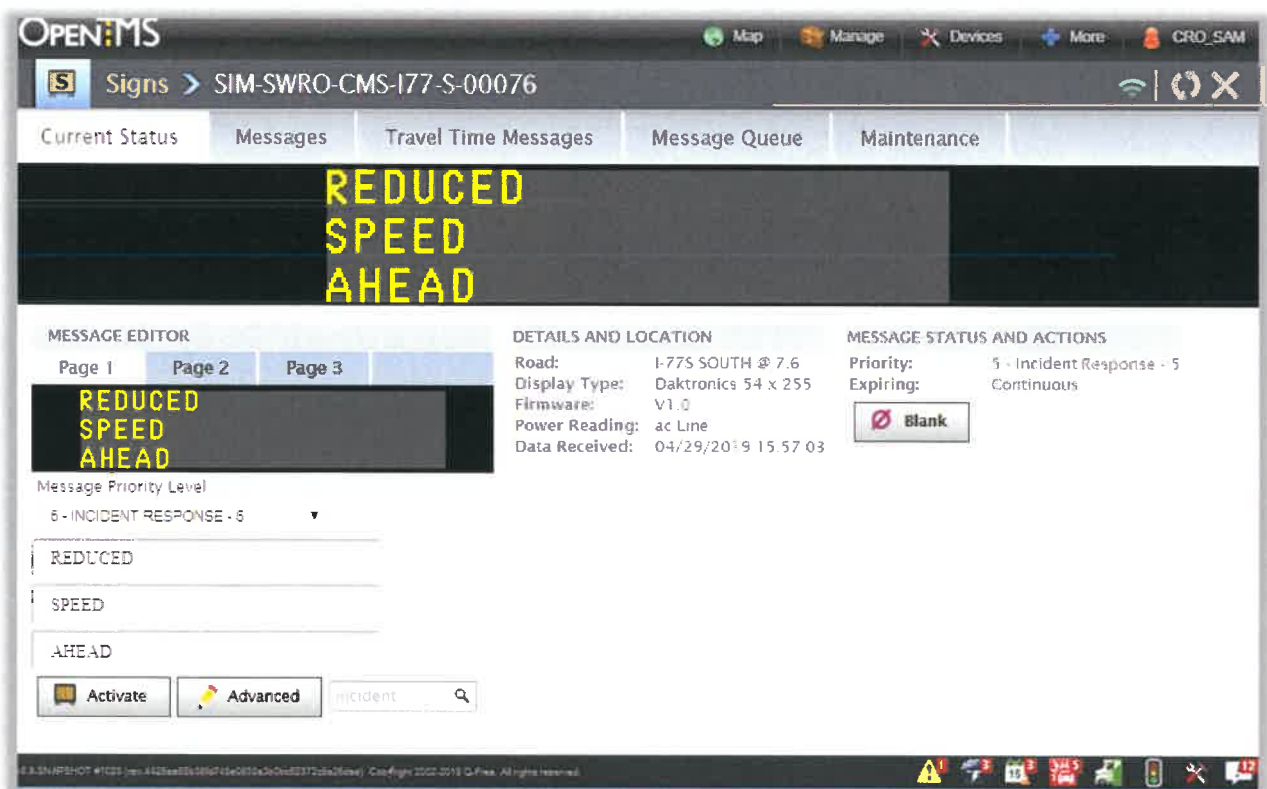
4.13.1.17. *The user interface maps shall enable authorized users to select DMS to control the current messages displayed on the signs.*

OpenTMS meets this requirement. OpenTMS also provides the ability to select permanent and portable DMS from the map and post standard or travel time messages as well as blank or poll the selected signs. Devices are selected by holding down the Ctrl button on the keyboard and using your mouse to click on signs. The device manager is shown below. Users with the Sign control privilege can control message posting.
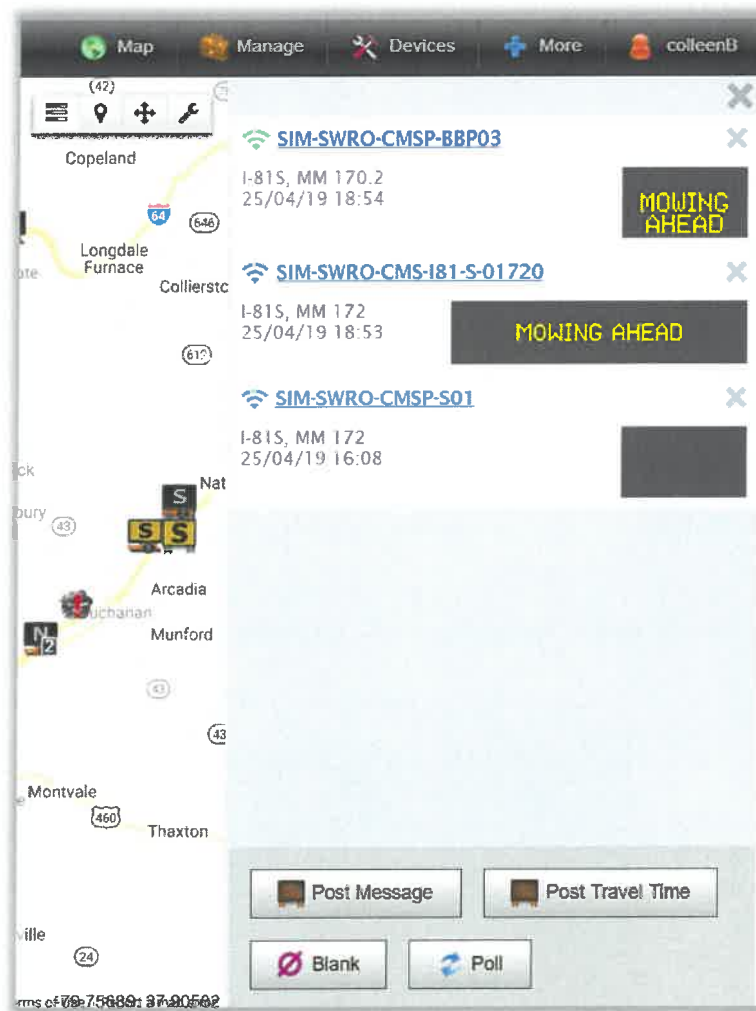
4.13.1.18. *The user interface map display shall display icons representing locations of all CCTV connected to the ATMS.*

The OpenTMS interface map will display icons representing locations of all CCTV connected to the ATMS.

OpenTMS meets this requirement. OpenTMS displays all CCTV on the map at the configured location.
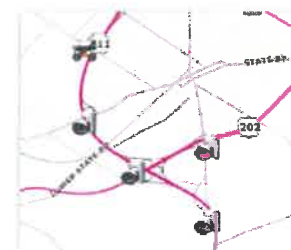
4.13.1.19. The user interface shall enable authorized users to select CCTV to pan, tilt, and zoom the CCTV cameras.

The OpenTMS interface will enable authorized users to select CCTV to pan, tilt, and zoom the CCTV cameras.
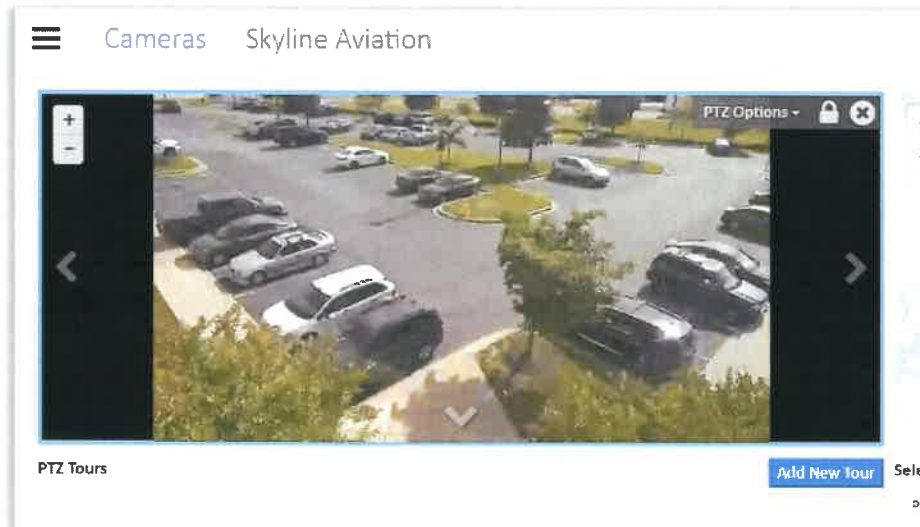
Figure 92 - Pan, Tilt, and Zoom CCTV Cameras

4.13.1.20. The user interface shall enable operators to select CCTV cameras to view real-time video from the cameras.

The OpenTMS interface will enable operators to select CCTV cameras to view real-time video from the cameras.

Figure 93 - CCTV Cameras Allow Real-Time Video

4.13.1.21. The user interface shall enable operators to open multiple cameras simultaneously, viewing real-time video from each camera.

The OpenTMS interface will enable operators to open multiple cameras simultaneously, viewing real-time video from each camera.
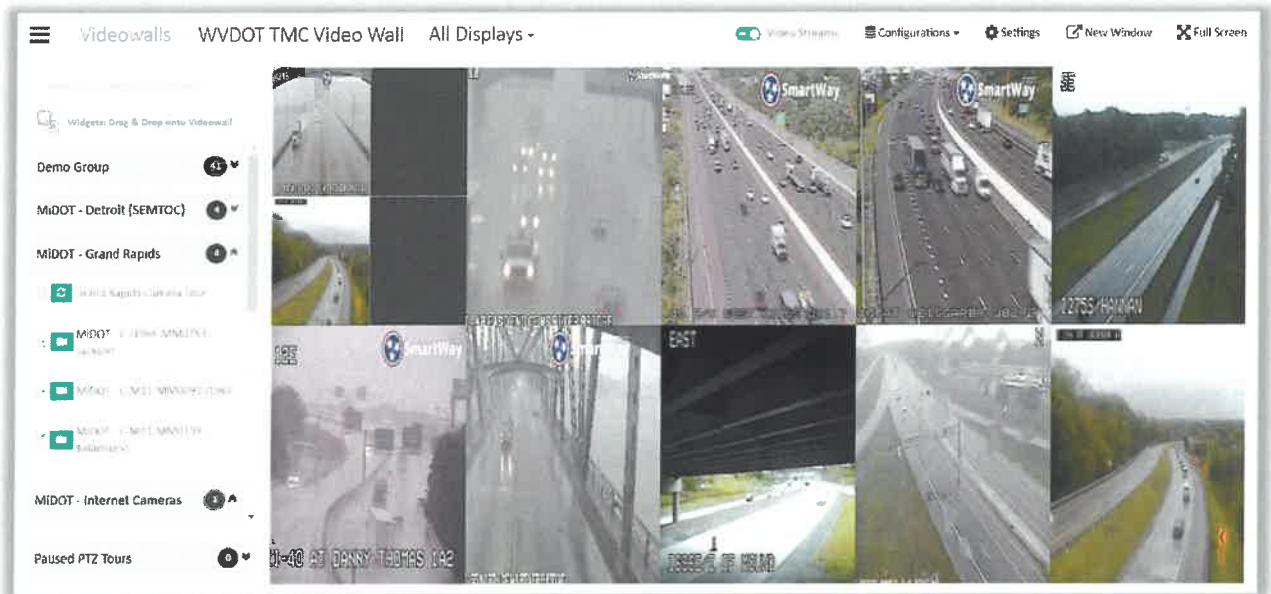
4.13.1.22. The user interface shall allow operators to turn map layers on and off.

OpenTMS meets this requirement. A Layers Widget in the upper right corner, enables users to toggle the view of specific layers on the map.
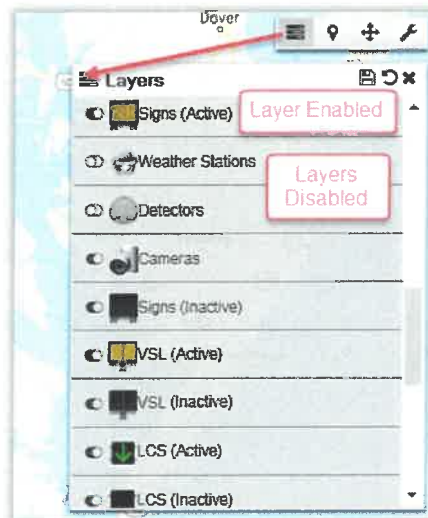
4.13.1.23. The user interface map display shall display icons representing locations of weather stations supplying information to the ATMS.

OpenTMS meets this requirement. OpenTMS displays all weather stations on the map at the configured location.

4.13.1.24. The user interface shall enable operators to select weather stations to view the current status of the weather station.

OpenTMS meets this requirement. Hovering over the icon will display a tool tip with a summary of important readings.
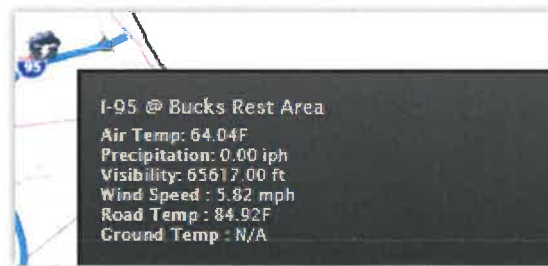
Clicking on the icon will display the weather station's detailed view. The current sensor readings are displayed on the detailed view.

4.13.1.25. The user interface shall enable operators to view the locations and status of portable ITS devices.

OpenTMS meets this requirement. How a user views the location and status of portable ITS devices is the same as fixed with the following exceptions:

- On the map the user can access a Move tool (✛) that allows the user to move portable devices as they are moved in the field;

- ATMS has integrated with the NTCIP location commands for DMS and can automatically move a DMS as it is moved in the field if the device is equipped with a GPS; and

- User have the ability to update the location of the portable device from the Maintenance tab in the device's detailed view.

4.13.1.26. The ATMS shall display device status data on the map display.

OpenTMS meets this requirement. OpenTMS icons are colored to represent the communication status of a field device and provide an indication as to whether the device is reporting an error. Icons are shown below.

Normal Communications

Normal Communications, but device is reporting errors

Suspect Communications

Failed Communications

Disabled Communications
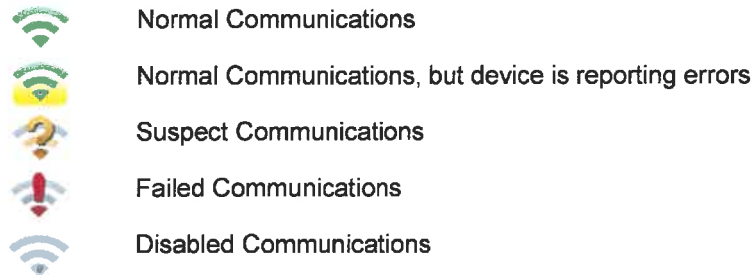
4.13.1.27. The ATMS shall have the capability of displaying real-time data that is collected by field devices and made available to the ATMS.
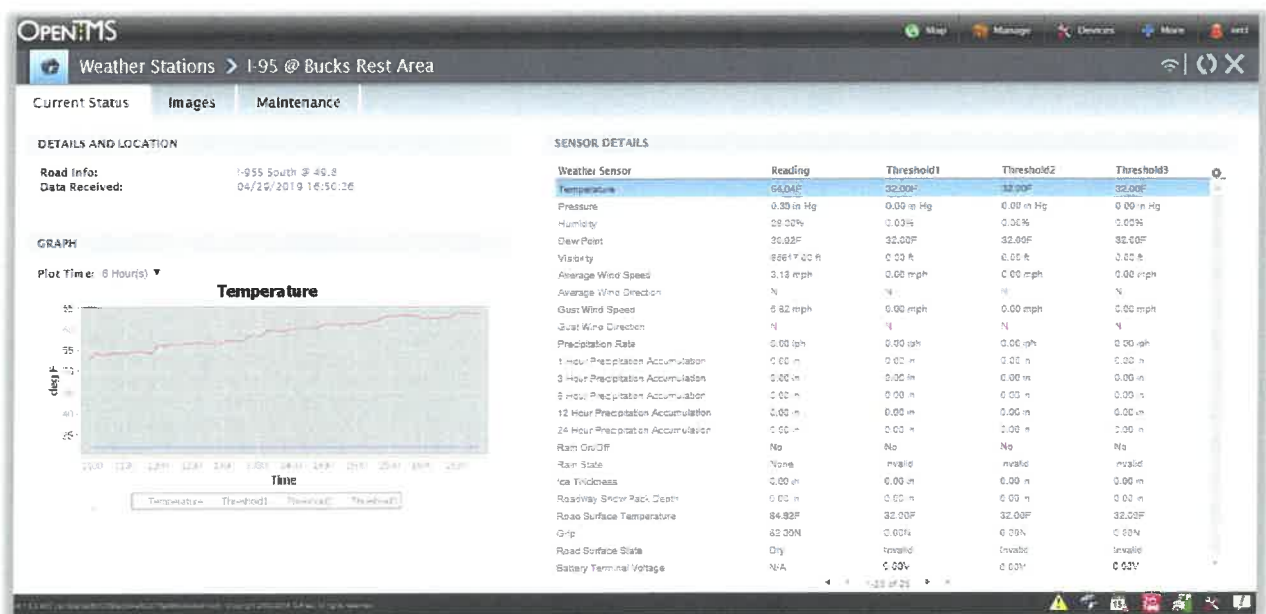
OpenTMS meets this requirement. OpenTMS continuously polls field devices for real-time data that is made available to the ATMS. In most cases data, can be viewed on the list view of the device type, device's detailed view or by hovering over and icon to display its tool tip.

4.13.1.28. The ATMS user interface shall provide a mechanism for operators to manage multiple events simultaneously (e.g. toggling back and forth between).

OpenTMS meets this requirement. The application is launched in a browser and users can open multiple tabs or peel off additional windows to have multiple views concurrently running on multiple monitors. Below are two events each open its their own tab.

4.13.1.29.The ATMS user interface shall enable operators to request and view diagnostics of the System.

OpenTMS meets this requirement. Available diagnostics can be requested from the Maintenance tab on a device's detailed view. DMS supports diagnostics such as temperature, power, pixel errors, door open, and fan errors. Reports are available for users to view the current state of a device. OpenTMS has a Field Device and Health Report that can be scheduled to run nightly and emailed to the maintenance staff. The Health report identifies the failed devices and those with errors. The Field Device report provides device counts, communication state information.
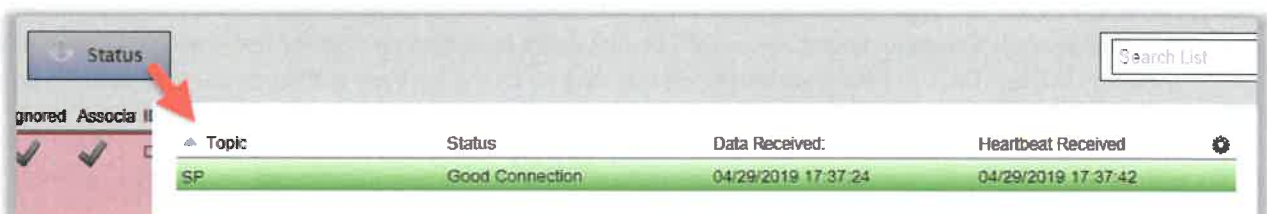
4.13.1.30.The ATMS user interface shall enable users to view the operational status of field devices and other systems connected to the ATMS.

OpenTMS meets this requirement. Users can view the operational status of field devices from a map. Devices in communications failure have an '!' point ( ). The operational status is also shown on the list view.

For external systems connected to the Alerts module, a Status button is available on the Alerts list view that opens a dialog that shows the state of the connection.

4.13.1.31.Operators shall have a mechanism to initiate the ATMS to ping field devices to detect if communications and field devices are responding properly.

OpenTMS meets this requirement. The messages for polling and posting failures in the Event log will more clearly indicate if there is a connection error which indicates that the system cannot connect to the field devices versus a timeout where the system can connect, but no response is received to the message sent.

It will be documented in the troubleshooting guides on how to respond to each of these errors.

4.13.1.32. The ATMS administrators shall be able to set minimum thresholds, such that operators cannot set their thresholds below the value.

OpenTMS meets this requirement. OpenTMS supports the setting of thresholds for RWIS sensors, detectors and travel time. For RWIS if a threshold is set for RWIS visibility, as visibility drops and a threshold is crossed an Alert is in the Alert Management system will be created.

The ATMS supports tailoring of notifications by home group and device.

4.13.1.33. The ATMS user interface shall enable administrators to assign permissions to users.

OpenTMS meets this requirement. Through the Admin Portal Security module user interface, administrators can quickly manage the set of privileges assigned to a Role. Users are typically assigned a role such as Guest, Operator, Supervisor or Administrator and privileges are assigned to that Role. There is no limit in the number of Roles defined. Users are assigned to a Role.
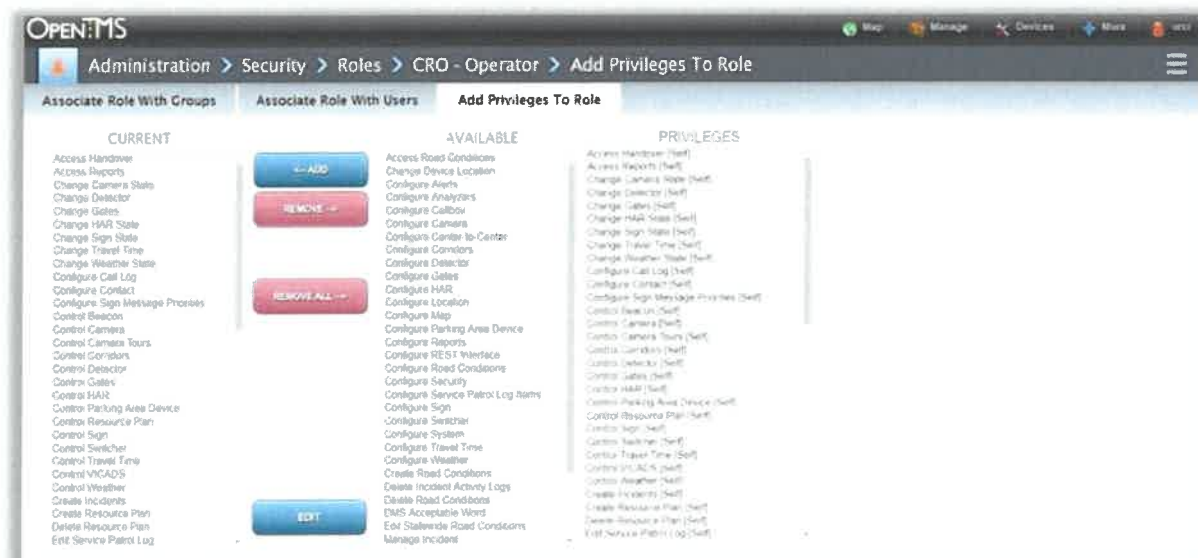
4.13.1.34. The ATMS shall import specific traffic operations related CAD data so that it can be made available to the ATMS user and used to create events within the ATMS.

OpenTMS meets this requirement. Q-Free has integrated over 40+ centers throughout 3 states. Those OpenTMS deployments all feature CAD integration as a primary source of incident detection. ATMS users see CAD alert information directly in the ATMS and relevant data is imported into the incident management system automatically. When an CAD alert comes into the system the user receives a notification in the bottom right corner and clicks on it displaying the Alerts detailed view. The user reviews the alert and creates an incident from the alert. Once associated alert updates will be fed into the incident so the user has the most recent updates.
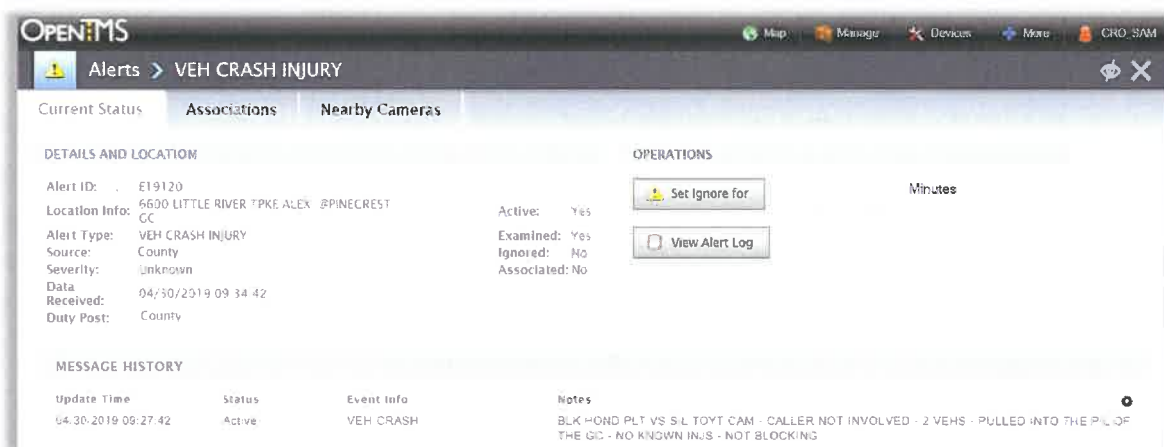
4.13.1.35. The user interface shall enable operators to view parking information made available to the ATMS.

OpenTMS meets this requirement. The OpenTMS Parking Guidance module provides the ability to monitor and report the availability of parking from parking areas that are instrumented with vehicle counting devices. Parking availability data is disseminated to the traveling public via a roadway sign indication if the truck parking area is "Open", "Full" or "Closed" as well as delivering the status of the truck parking lots to 3rd party public notification systems, such as the 511 Travelers Information System, alerting drivers of the state of the parking area.

The parking guidance module contains both a list view and a detailed view. The list view shown below provides a summary of the communication status and parking area state at a glance.

The detailed view, as shown below provides real time information on the parking area. Key features include:

- Ability to run in Automatic or Manual mode;

- In Automatic mode, automatically post open/closed and/or parking spaces available;

- View status of associated signs and manually post if in manual mode;

- Close the parking area;

- Review activity logs for the selected parking area; and

- Review status logs which shows historical data on parking spaces.
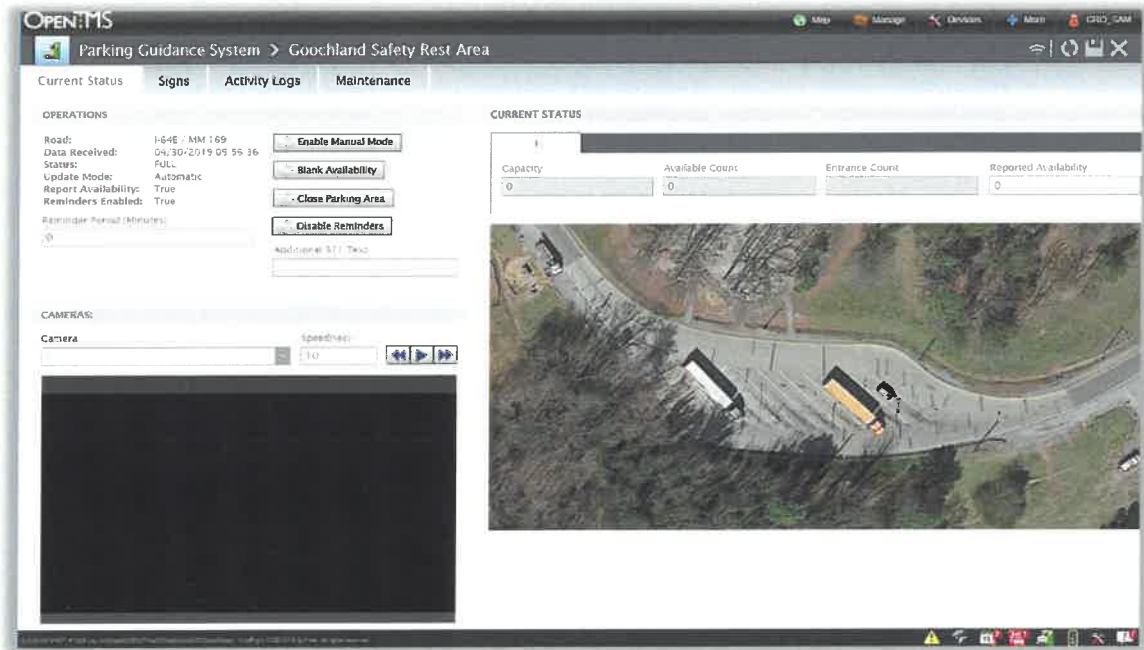
Map display includes icons and hovering over the icon displays a tool tip with the parking area status and spaces available.
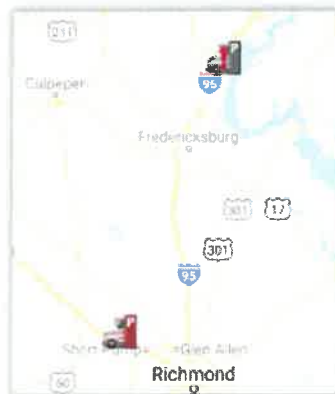
4.13.1.36. The ATMS user interface shall provide a mechanism for operators to view standard operational procedures to be used while responding to events or incidents.

OpenTMS meets this requirement. A help button will be added to the event/incident view that is linked to a PDF. Clicking on the button will display a PDF of the standard operating procedure. The PDF can be updated as needed.

4.13.1.37.The ATMS shall provide prescribed response scenarios or automation tools to assist users in controlling multiple devices quickly, consistently, and with limited manual input.

OpenTMS meets this requirement. OpenTMS provides a rich user interface for managing incidents. The GUI leads the operator through a workflow to log critical information about the incident and agency/stakeholder activities. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends ITS devices, 511 messaging, and email notifications. Q-Free will work with the WVDOH to customize the rules to meet their standard operating procedures.

The figure below provide an overview of the incident response.
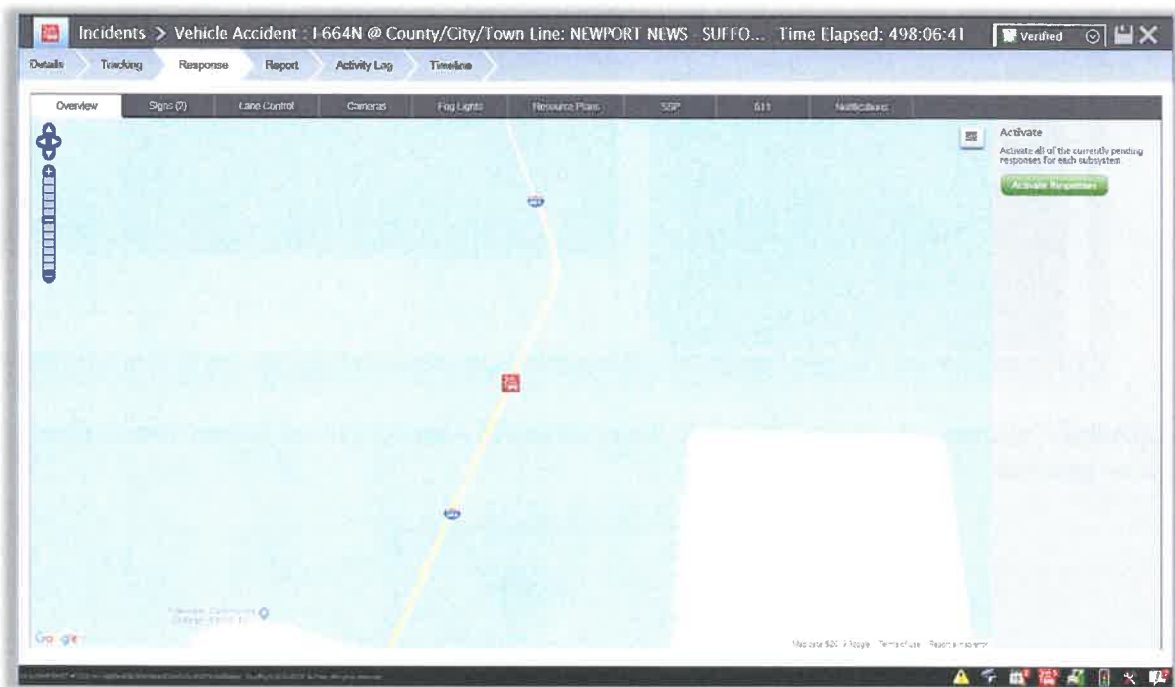
The figure below provides a view of the DMS posting recommended based on business rules.

4.13.1.38. The ATMS shall provide a means of organizing devices into logical groupings or zones.

OpenTMS meets this requirement. Devices are assigned a home group when they are configured. End users by default view devices in their home group, but can enable the view of other home groups. For example, the WVDOH and Turnpike would have device assigned to their own home groups. DMS will further support another level of grouping. On the Signs page a Groups tab will be added similar to the one implemented for VSL. This group tab will support posting, blanking and polling at the group level.

4.13.1.39. The ATMS shall provide spell check, text wrapping, and copy/cut/paste capabilities for all operator typed entry.

OpenTMS meets this requirement. Typed entry fields support copy/cut/paste capabilities. Spell check is supported through the browser and DMS has its own spell checking capability. Free text note fields wrap.

4.13.1.40. The ATMS user interface shall enable users to view the status of communication with field devices and other system connected to the ATMS.

OpenTMS meets this requirement. Users can view the communication status of field devices from a map. Devices in communications failure have an '!' point ( ). The communication status is also shown on the list view.

For external systems connected to the Alerts module, a Status button is available on the Alerts list view that opens a dialog that shows the state of the connection.
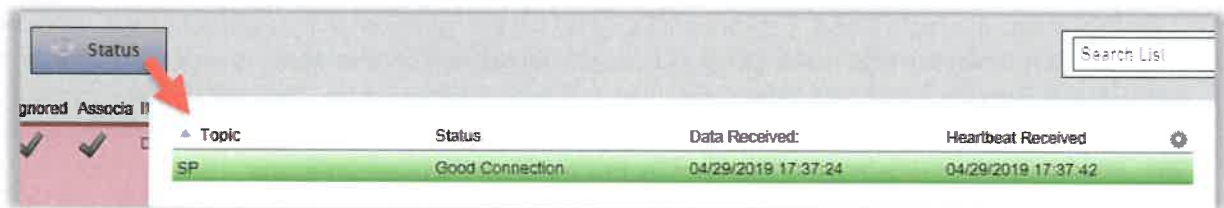
4.13.2. Operator and User Features – Desirables

4.13.2.1. *The ATMS user interface should include tailored windows for each user, based on login.*

Out of the box, the user can save a map extent as their default location that is automatically selected when they log in.

4.13.2.2. The user preferences to determine the interface presented should be set by users.

Out of the box, the map is adjusted to the users default extent and the views default to the user's selected home group(s).

4.13.2.3. Alerts and notifications should be tailored to each user based on preferences established by each user.

Out of the box, the ATMS support tailoring of notifications by home group and device. During a user's login session filters are saved within the session.

4.13.2.4. The ATMS should provide a mechanism for authorized users to send and receive instant messages with other users while logged into the system. These messages should be capable of allowing attachments.

The ATMS does not have an integrated instant message module. Q-Free can work with the WVDOH to install and configure an off the shelf solution.

4.13.2.5. The ATMS user interface maps should display traffic flow maps.

Out of the box, the ATMS supports a speed layer. The ATMS speed layer will be integrated from a third-party like the ESRI World Traffic Service.

4.13.2.6. Flow maps displayed on the ATMS user interface should integrate freeway and arterial conditions on one common map display.

Out of the box, the ATMS supports a speed layer. The ATMS speed layer will be integrated from a third-party like the ESRI World Traffic Service.

4.13.2.7. Flow maps should have the capability to display speed data.

On the map view, the detector icons look like a speedometer and provides visual cues for the data being returned. The color coding of the detector icons is configurable in the administration portal and enables users to quickly see which detectors are reporting free flow or congested conditions. Congestion levels can be set to color based on *speed* or occupancy.

4.13.2.8. Flow maps should have the capability to display freeway occupancy data.

On the map view, the detector icons look like a speedometer and provides visual cues for the data being returned. The color coding of the detector icons is configurable in the administration portal and enables users to quickly see which detectors are reporting free flow or congested conditions. Congestion levels can be set to color based on speed or *occupancy*.

4.13.2.9. The ATMS should integrate information between incident reports and construction maintenance reports.

In the current version of the software the functionality to associate a work zone to an incident is not available.

4.13.2.10.The user interface should enable operators to select ramp meters to view the current status of the ramp meter.

Q-Free has ramp meter experience with an earlier version of OpenTMS that contained a Ramp Metering module that was deployed in Northern Virginia. At this time the module is on our Product Road Map.

4.13.2.11.The user interface should enable operators to select ramp meters and edit the ramp meter parameters (e.g. minimum metering rate, maximum metering rate, ramp meter algorithm parameters, etc.)

Q-Free has ramp meter experience with an earlier version of OpenTMS that contained a Ramp Metering module that was deployed in Northern Virginia. At this time the module is on our Product Road Map.

4.13.2.12.The ATMS user interface map display should provide a mechanism for operators to view the location of systems and field devices monitored but not controlled by the ATMS.

Out of the box, the OpenTMS map interface supports the display of WMS and ArcGIS Rest end points. If a map layer is available for the desired systems, it can be added as a layer. Field devices can be added in the appropriate field device module and marked off-line.

4.13.2.13.Real-time display should include volume data.

Out of the box, the Detector module pulls lane by lane volume data and displays lane by lane or aggregated by station direction.

4.13.2.14.Real-time volume data display should be able to be displayed by individual lane.

Out of the box, the Detector module pulls lane by lane volume data and displays lane by lane or aggregated by station direction.

4.13.2.15.The ATMS should display aggregated real-time volume data by direction at a station's location.

Out of the box, the Detector module pulls lane by lane volume data and displays lane by lane or aggregated by station direction. The detailed view shown below in the details and location section shows aggregated traffic data,

Clicking on the Lanes tab shows lane by lane traffic data.

4.13.2.16. Real-time display should include occupancy data.

Out of the box, the Detector module pulls lane by lane occupancy data and displays lane by lane or aggregated by station direction.

4.13.2.17. Real-time occupancy data display should be able to be displayed by individual lane.

Out of the box, the Detector module pulls lane by lane occupancy data and displays lane by lane or aggregated by station direction.

4.13.2.18. The ATMS should be able to display average real-time occupancy data for all lanes by direction at a station's location.

Out of the box, the Detector module pulls lane by lane occupancy data and displays lane by lane or aggregated by station direction.

4.13.2.19. The ATMS should be able to display average real-time speed data for all lanes by direction at a detector's location.

Out of the box, the Detector module pulls lane by lane speed data and displays lane by lane or aggregated by station direction.

4.13.2.20. Operators should be able to adjust threshold values for when to receive notices and alerts.

Out of the box, the ATMS support tailoring of notifications by home group and device. For example, the system can be configured so users at the WVDOH TMC do not receive notifications for WVPA field devices. Threshold settings for RWIS, Detector and Travel Time thresholds are configurable in the Admin Portal.

4.13.2.21. Operators / users should use thresholds to control what types of alerts they receive. For example, operators may decide not to receive alerts of technical failures while technical support may opt to receive technical failure alerts.

Out of the box, the ATMS support tailoring of notifications by home group and device.

4.13.2.22. The ATMS user interface maps should display pre-planned detour routes.

Out of the box, the OpenTMS map interface supports the display of WMS and ArcGIS Rest end points. If pre-planned detour routes are available in a supported map layer the layer can be added. For our PennDOT client OpenTMS pulls their pre-defined detour routes in the ATMS as a map layer. These detour routes are incorporated into their response plans if a detour is active.

4.13.2.23. The user interface map display should display icons representing locations of all variable speed displays connected to the ATMS.

Variable Speed Limit (VSL) Sign module is part of the OpenTMS offering and is currently deployed for two of our clients and shortly three. The VSL module enables operators to control a single variable speed sign or a group of signs. The list view provides access to the signs and sign groups to quickly update speed limits. Selecting an individual sign from the map or list provides a more detailed view to view historical data, conduct diagnostics, and view logs.

The map displays the VSL as icons with the speed limit displayed. Hovering over the icon provides the user with a tool tip.

4.13.2.24. The user interface should enable operators to select variable speed displays and view the current status of the sign.

The list view provides an overview of the current status for each device at a glance. The user can filter the list by roadway, display state, or free text filter.

The VSL sign can be selected from the map or list view to view a more detailed current status. Selecting an individual sign allows the user to view addition details on the current status tab.

The Maintenance tab provides access to status logs, message history logs, event logs, and sign errors.

4.13.2.25. The user interface should enable authorized users to select variable speed display sign icons and change the status of the variable speed display.

Out of the box, control access is available to those users with the correct permissions. Permissions are configured by the administrator in the Admin portal.

4.13.2.26. The ATMS should provide the ability for the operator to display snap shot images from RWIS camera or other digital still image sources on any combination of workstation or video display monitors within the TMC.

The OpenTMS will provide the ability for the operator to display snap shot images from RWIS camera or other digital still image sources on any combination of workstation or video display monitors within the TMC.

Out of the box, OpenTMS supports pulling RWIS images from Vaisala 3 and Vaisala FTP protocols in our latest version. WVDOH uses Vaisala 3 today.

The ILOG ATIS has full capabilities for displaying a snap shot images from RWIS cameras and other digital still image sources. ILOG is specifically experienced in displaying data and images from Vaisala RWIS stations, as their information is currently displayed on the 511PA webmap, an example of which can be seen in the image below. The type of data, as well as way the information is displayed to the public (including associated icons and graphics), may all be customized during the setup phase if desired by WVDOH.
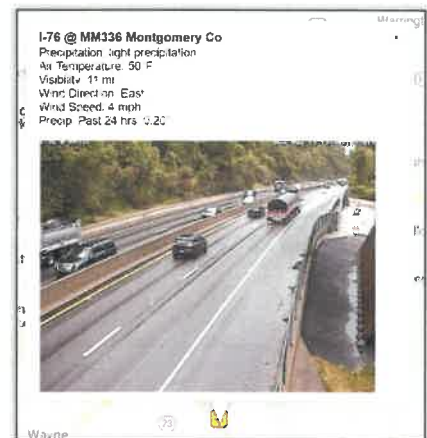
13.0 Data Collection & Archiving (CRFP Section 4.14)

4.14. Data Collection & Archiving

4.14.1. Mandatory Requirements

4.14.1.1. The ATMS shall have a data archiving capability that stores and provides access to historical data. Data is to be collected from ITS field devices and from system users both in normal operation and during the management of planned and unplanned events. WVDOH has a 5 year data retention requirement.

The OpenTMS will have a data archiving capability that stores and provides access to historical data. Data is to be collected from ITS field devices and from system users both in normal operation and during the management of planned and unplanned events. WVDOH has a 5-year data retention requirement.

OpenTMS meets this requirement. Q-Free will stand up an archival database and archive from production at regular intervals. The archived data will be retained for at least a period of 5 years as requested by the WVDOH. The data can be accessed by users through Jasper Reports. Jasper Reports provides the ability to run pre-defined reports or create ad-hoc reports. It also allows for data to be exported in multiple formats such as CSV. The Analytics Package, described below, will be able to access the archived data. Q-Free will remove archived data from production at an agreed upon period.

4.14.1.2. The ATMS shall provide operational data to calculate performance measures for both system utilization (including such items as number of events managed, amount of public access, and amount of staff access) and system performance (including such items as server up time, field device up time, communication reliability, and field device command responsiveness).

OpenTMS meets this requirement. OpenTMS stores all data in a database. OpenTMS is bundled with a license for Jasper Reports Server Professional. Jasper Reports is a leading enterprise reporting system. It is fully integrated with OpenTMS so that users can create new reports, run existing reports, or view past reports from within the OpenTMS GUI. In addition, the Jasper server can also be accessed from outside OpenTMS if so configured. Numerous pre-defined reports are included with the installation of Jasper. A few reports are described below.

Incident Type Report – This report provides information on incidents by type over a selected time. Sample sections on the report are shown below.
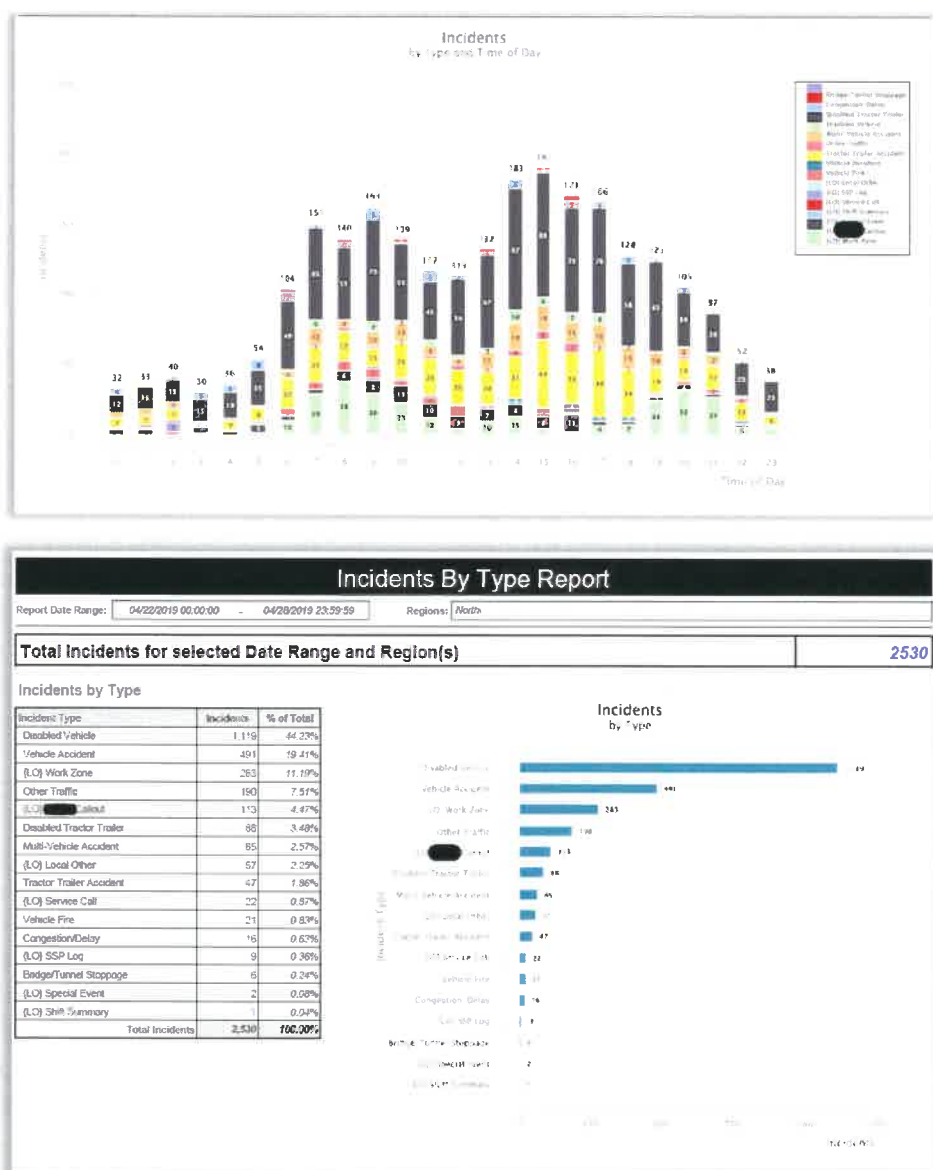
Figure 94 - Incident Type Report

Incident Location Report -- This report provides incident breakdown by roadway type, roadway name and region. Sample section of the report is shown below.

Incidents Location Report

Report Date Range: 04/22/2019 00:00:00 - 04/28/2019 23:59:59   Regions:

Incident Breakdown by Roadway Type, Roadway Name and Incident Type

		Bridge/Tunnel Stoppage	Congestion/Delay	Disabled Tractor Trailer	Disabled Vehicle	Multi-Vehicle Accident	Other Traffic	Tractor Trailer Accident	Vehicle Accident	Vehicle Fire	(LO) Local Other	(LO) SSP Log	(LO) Service Call	(LO) Shift Summary	(LO) Special Event	(LO) Callout	(LO) Work Zone	Totals
Interstate	I-64J Ramp 99A				1													1
	I-64/9			3	77	3	9	1	18	2			2				22	129
	I-64W Dist/Obit at mp200				1													1
	I-65E				46	8	6	6	22								2	93
	I-65W		1	5	69	8	11		20				2				3	118
	I-77N			6	23		2	1	2	1	1						13	52
	I-77S	2			16		2	2	1						2	1	3	29
	I-81N			4	100	3	18	3	14		2	3	3				33	176
	I-81N Ramp 213A				1													1
	I-81N Ramp 245A								1									1
	I-81N Ramp 251A			1														1
	I-81S		2	6	91	2	13	3	20	2	3	1	2			1	29	174
	I-81S Ramp 321A				1													1
	I-83N				1	1	1	1	3								6	12
	I-83S				1		1										2	6
	I-95N			6	14	244	8	29	8	61			1				23	397
	I-95N Ramp 49A															1		1
	I-95N Ramp 51E				1													1
	I-95S				12		7		1									20

Heat Map Color Code : [1] 1 Incident [2] 2 Incidents [3] 3 Incidents [ ] 4 Incidents [5] 5 Incidents [6] >5 Incidents

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Field Device Report - The Field Device report provides device counts, communication state information, and uptime. Sample section of the report is shown below.

Field Device Report

Report Date Range: 04/22/2019 00:00:00 - 04/28/2019 23:59:59   Groups:

Signs (VMS/DMS) Device Polling Details

Device Name	Successful Polls	% of Total Polls	Failed Polls	% of Total Polls	Suspect Polls	% of Total Polls	Total Polls
NRO-BOS-I86-S-00646-CFR-5956	673	100.00%		0.00%		0.00%	673
NRO-BOS-I66-F-00667-AD-VAT-E-5517	1,963	97.23%	50	2.48%	6	0.30%	2,019
NRO-BOS-I66-F-00667-AD-VAT-W-5328	1,992	98.61%	19	0.94%	5	0.25%	2,016
NRO-BOS-I66-F-00667-CF-VAT-E-5432	672	100.00%		0.00%		0.00%	672
NRO-BOS-I66-FE-00667-CF-VAT-E-5117	560	83.23%	73	10.88%	9	0.89%	671
NRO-BOS-I66-FE-00667-CF-VAT-W-5120	392	58.23%	279	41.45%	2	0.30%	673
NRO-BOS-I66-FE-33673-AD-VA397-E-5338	672	100.00%		0.00%		0.00%	672
NRO-BOS-I66-E-00633-AD-5314	673	100.00%		0.00%		0.00%	672

Planned Events Report – This report provides information on planned event by event type. Sample section of the report is shown below.
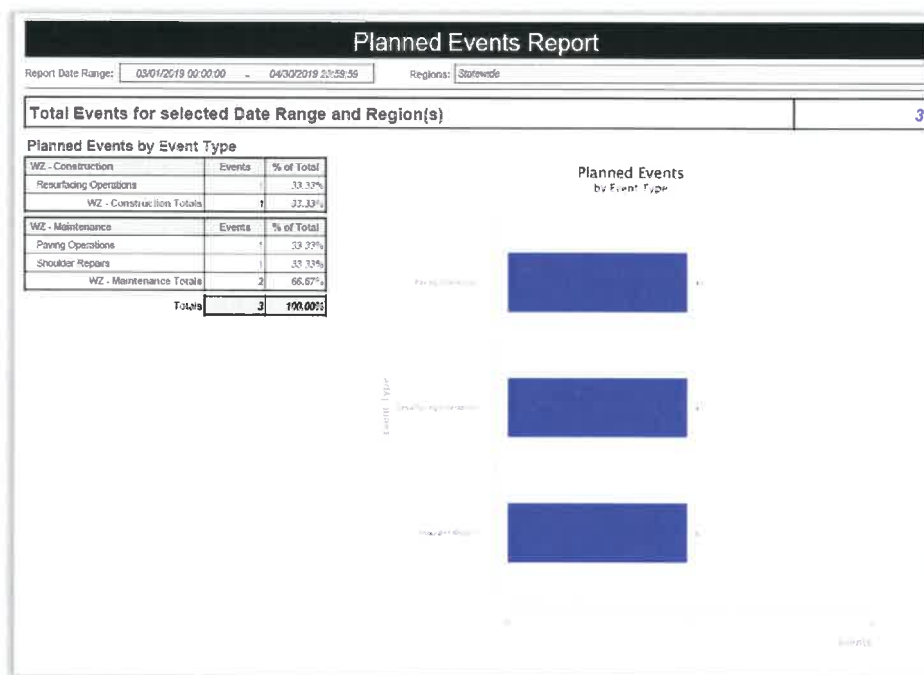
Figure 95 - Planned Events Report

4.14.1.3. The ATMS shall have the ability to import data from third party providers.

OpenTMS meets this requirement. The ATMS has the ability to import data from third party providers. Any documented API can be implemented to bring data from a third party.

4.14.1.4. The ATMS shall have the ability to display and use real-time third-party data similar to data collected from field devices.

OpenTMS meets this requirement. The ATMS will display all data entered into the system in real-time.

4.14.1.5. The ATMS data archive shall have an analytics package.

OpenTMS meets this requirement. Q-Free will deploy Tableau, https://www.tableau.com/, as the analytics package. Tableau is one of the fastest evolving data visualization tools. It is very fast to deploy, easy to learn and very intuitive to use. Team Q-Free will deploy and train the WVDOH on using this analytics package. Q-Free will provide two Creator and three Explorer subscriptions. Explorers will be able to interact with visualizations. Creator will administer the analytics package.

4.14.1.6. The Analytic Package shall enable users to access and view the archived data.

OpenTMS meets this requirement. The Analytics Package can be configured to connect to any database.

4.14.1.7. *The Analytics Package shall enable users to request and view data analyses and specify a time-slice over an operator defined time period.*

OpenTMS meets this requirement. The Analytics package will allow users to visualize data

4.14.1.8. *Data analytics shall include functionality to compute and display 24 hours traffic volumes.*

OpenTMS meets the requirement. All of the data will be accessible through the Analytics Package.

4.14.1.9. *The ATMS shall enable portions of data to be excluded from public access.*

OpenTMS meets this requirement. A public data feed option can be available. Team Q-Free will work with the WVDOH on what fields need to be restricted from third party data recipients identified as public.

4.14.1.10. *The ATMS shall enable manual loading of collected data through an operator entry mechanism.*

OpenTMS meets this requirement. Some data like events can be entered after the fact via the event data entry form. For field device data, the on-site system engineer can develop scripts to enter data as needed.

4.14.2. Data Collection and Archiving – Desirables

4.14.2.1. *The historical data in the archive should include traffic volume data, whether from sensors or third-party data sources.*

Out of the box, historical traffic volume data will be available from all data sources.

4.14.2.2. *Traffic volume data should be stored by individual lane.*

Out of the box, the Detector module pulls lane by lane volume data and stores it by individual lane.

4.14.2.3. *The historical data in the archive should include traffic occupancy data.*

Out of the box, historical traffic occupancy data will be available.

4.14.2.4. *Traffic occupancy data should be stored by individual lane.*

Out of the box, the Detector module pulls lane by lane occupancy data and stores it by individual lane.

4.14.2.5. *The historical data in the archive should include traffic speed data*

Out of the box, historical traffic speed data will be available.

4.14.2.6. *Traffic speed data should be stored by individual lane.*

Out of the box, the Detector module pulls lane by lane speed data and stores it by individual lane.

4.14.2.7. *The historical data in the archive should include traffic travel time data.*

Out of the box, historical travel time data will be available.

4.14.2.8. The historical data in the archive should include traffic data that is collected and made available by any roadway within the TMC partner jurisdictions.

Out of the box, historical traffic data will be available by roadway.

4.14.2.9. The historical data in the archive should include location and status of portable ITS devices for times when the devices are providing data to or being controlled by the ATMS.

OpenTMS does not log the location of the portable ITS devices when used to respond to an event.

4.14.2.10. Archive ATMS data should be available to partner agencies for download from an on-line access location.

The Analytics Package supports download of data used for the visualization. Jasper Reports provides the ability to create an ad-hoc report and download the data. Jasper Reports can also be accessed from outside OpenTMS if so configured. The WVDOH can provide access to these tools as needed.

4.14.2.11. The ATMS should calculate and store travel times based on available speed data.

Out of the box, the ATMS calculates and stores travel times based on several data sources; INRIX, detectors, tag reader and Traffax blue tooth readers. The ATMS travel time solution has a travel time engine that pulls data from multiple sources and makes the data available to the OpenTMS Travel Time module for posting travel times on DMS based on data a source priority.

4.14.2.12. The ATMS should calculate and store Travel Time Index, based on available speed data and free flow data. WVDOH has a 5-year data retention requirement.

In the current release the ATMS does not calculate and store the Travel Time Index.

4.14.2.13. The ATMS should have a parameter for each third-party provider that can be set to use or not use the third party data as if it was collected from field detectors.

Out of the box, the travel time engine provides the ability to prioritize travel time data. For example, if INRIX and detectors where both data source the system could be prioritized to use INRIX first then detectors or vice versa.

4.14.2.14. Data analytics should include functionality to compute and display Travel Time Reliability information.

The Analytics Package will be available to access and visualize travel time data.

4.14.2.15. Travel Time Reliability displays should include reliability by different vehicle classifications, as they are reported to the ATMS.

The Analytics Package will be available to access and visualize travel time data. Association with vehicle classifications is not available in our latest release.

4.14.2.16. Data analytics should be automated to the extent possible to support established performance measure reporting needs of the TMC and/or partner agencies.

The Analytics Package will be available to access and visualize data from the ATMS. The user will be able to select incident statistics such as Incident Duration or Incident Location statistics. The OpenTMS Reporting module has templates for some of this data as well. Below are report snippets that show how the data can be leveraged with Analytics.

Incident Duration by Incident Type

Incident Type	Incidents	Avg Duration (min)	Total Duration (min)
Congestion/Delay	1	9.4	9.4
Disabled Tractor Trailer	21	28.8	604.6
Disabled Vehicle	381	22.6	8,600.2
Multi-Vehicle Accident	16	68.4	1,094.1
Other Traffic	103	25.4	2,619.9
Tractor Trailer Accident	13	57.3	745.1
Vehicle Accident	169	62.5	10,556.5
Vehicle Fire	10	40.7	407.2
{LO} Local Other	1	0.1	0.1
{LO} Service Call	9	18.8	169.4
{LO} VDOT Callout	32	13.6	435.4
{LO} Work Zone	112	410.7	46,002.9
Totals	**868**	**82.1**	**71,246.9**

Average Incident Duration by Incident Type

Incident Duration Counts by Year

Year	< 15 Mins	15 - 30 Mins	30 - 45 Mins	45 - 60 Mins	60 - 75 Mins	75 - 90 Mins	90 - 105 Mins	105 - 120 Mins	2 - 3 Hrs	3 - 4 Hrs	> 4 Hrs	Totals
2019	5,332	2,110	1,388	1,130	800	520	308	198	314	167	1,317	13,584
Totals	**5,332**	**2,110**	**1,388**	**1,130**	**800**	**520**	**308**	**198**	**314**	**167**	**1,317**	**13,584**

4.14.2.17. The ATMS should include multiple data reporting formats/templates.

OpenTMS is bundled with a license for Jasper Reports Server Professional. Jasper Reports is a leading enterprise reporting system. It is fully integrated with OpenTMS so that users can create new reports, run existing reports, or view past reports from within the OpenTMS GUI. Out of the box, the Reporting module includes a large set of report templates.
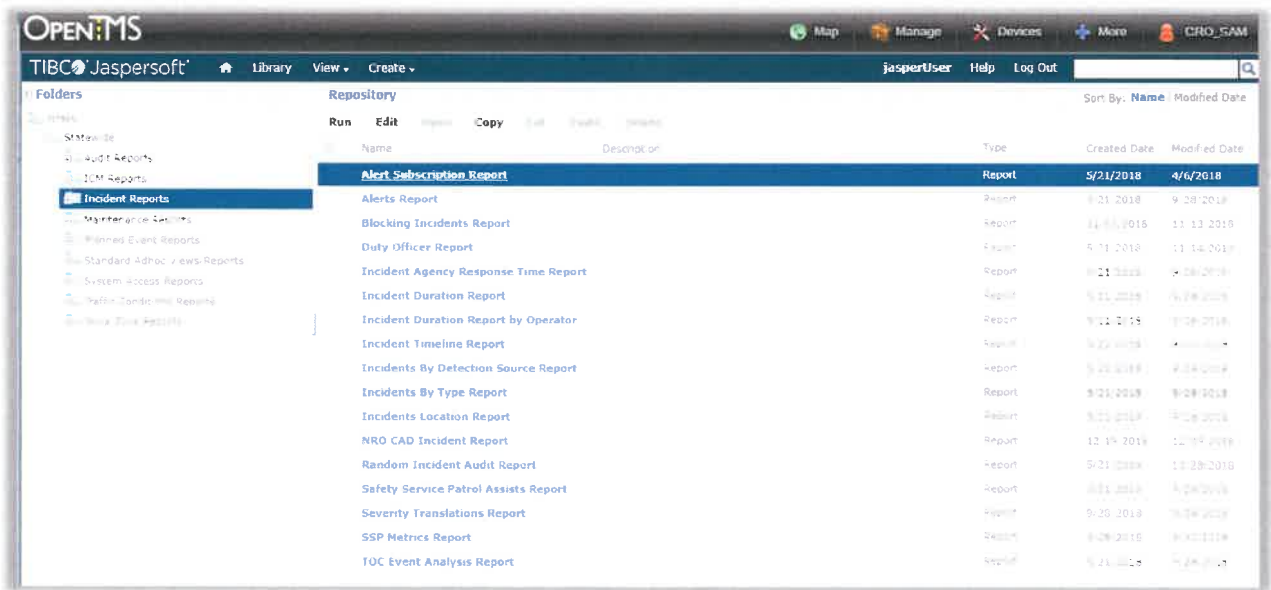
WVDOH will be able to use Tableau for data visualization.

4.14.2.18. The ATMS should accept data for long term storage on a continuous basis without operation action.

OpenTMS stores all data in a database. Q-Free will archive from production at regular intervals. This process will be done in the background without operator action. The archived data will be retained for at least a period of 5 years as requested by the WVDOH.

4.14.2.19. The ATMS should make achieved data available in an online database for a user definable period.

The archival database will be accessible through Jasper Reports Server or the Analytics Package.

4.14.2.20. Data analytics should include functionality to compute and display mobile source emissions information if data is collected and provided to the ATMS.

All data integrated will be saved to the database and can be access through Jasper Reports Server or the Analytics Package. Mobile source emissions information is not available in the current release.

4.14.3. Notifications & Alarms

4.14.3.1. Mandatory Requirements

4.14.3.1.1. The ATMS shall have and notification built into the system.

OpenTMS meets this requirement. The ATMS contains a built-in notification system that alerts users to urgent and ongoing events concerning devices, services, and requests. Notifications are organized into urgent notifications and new notifications. *Urgent Notifications* indicate that events should be confirmed or acknowledged and will appear in the lower right-hand corner of the screen. *New Notifications* simply let the user know about action results or events. These notifications are generated by the client (rather than the service itself) and they will only appear to the user rather than everyone.

The Notification Tray provide a current list of recent notifications. This quick view is located in the lower right corner of the OpenTMS window.

Clicking on a notification tray opens the notification tray. In the figure below, the user clicked on the Incidents tray.
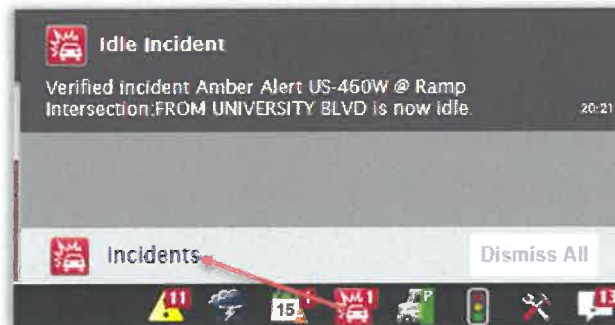
Immediate feedback, such as the success of a user posting a message is displayed in the lower right corner.
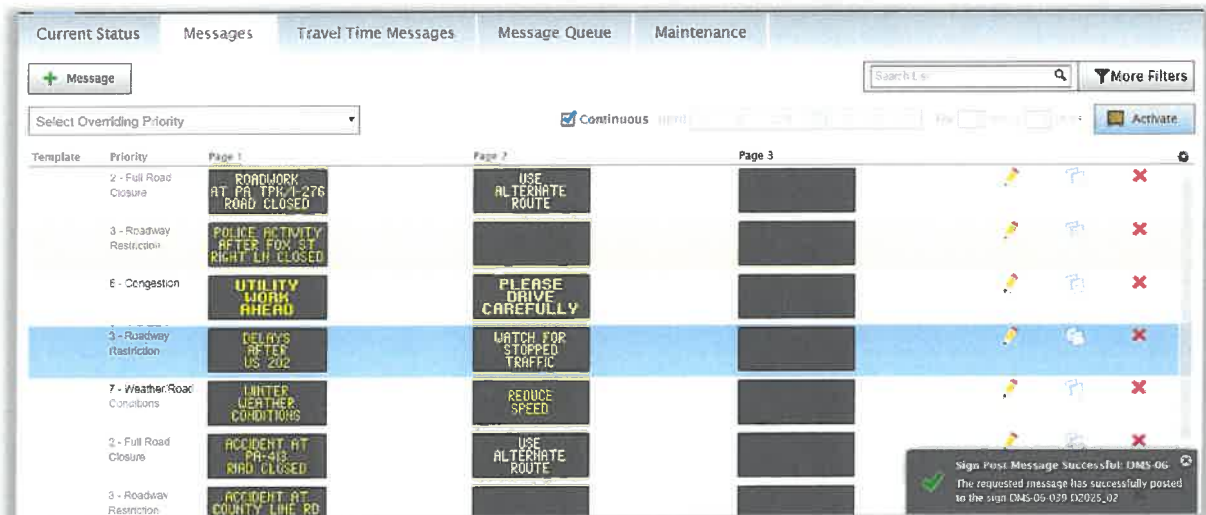
In addition to the toolbar, the user can access notifications through the Notifications module as shown below.
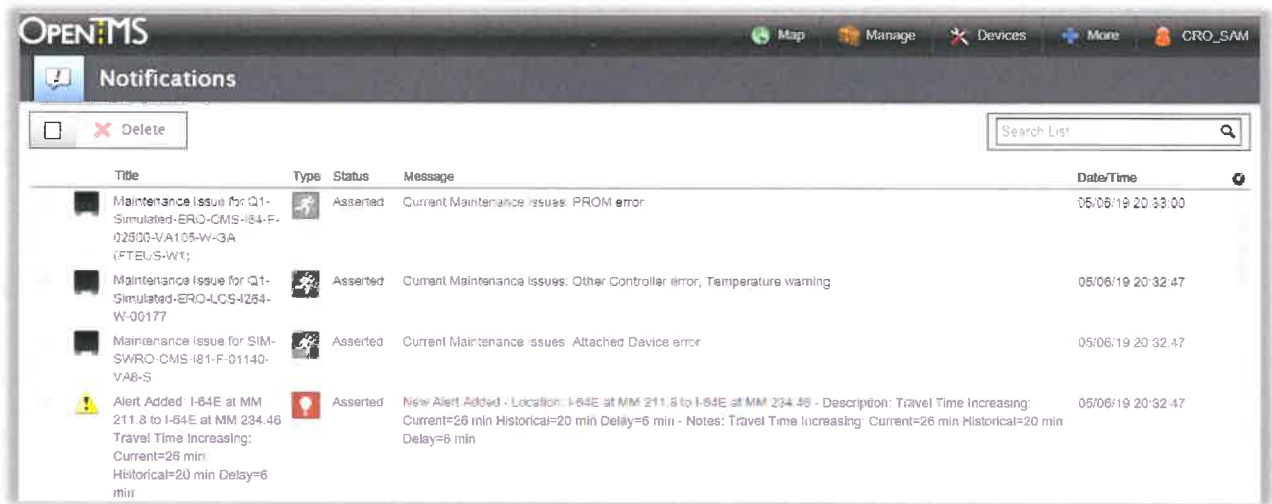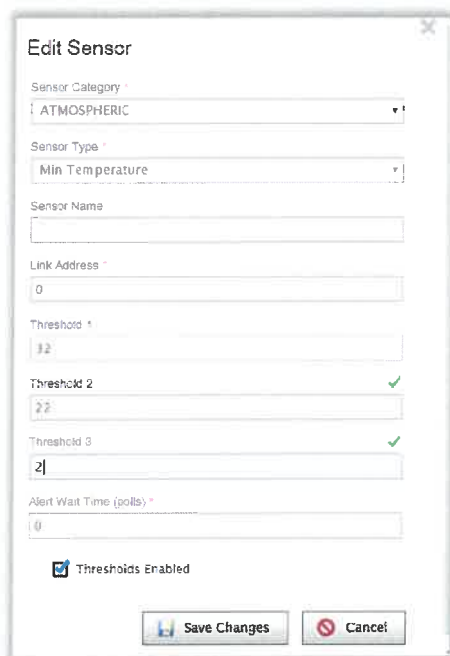
4.14.3.1.2. The ATMS shall provide a single integrated interface, available from any TMC workstation, that allows operators to set threshold conditions for various devices or other user definable conditions such that when threshold conditions are met or exceeded, alarms will be generated notifying the operator of the presence of such condition. At a minimum, data elements available for alarm generation will include traffic measurements, detected incidents, weather measurements, and device status.

OpenTMS meets this requirement. Thresholds for alarms can be set from OpenTMS which is a web browser-based application accessible from any TMC workstation. All incoming alerts notifying the user of a potential incident come in through the Alerts module. In the figure below, we have a travel time threshold crossing and a CAD alert.
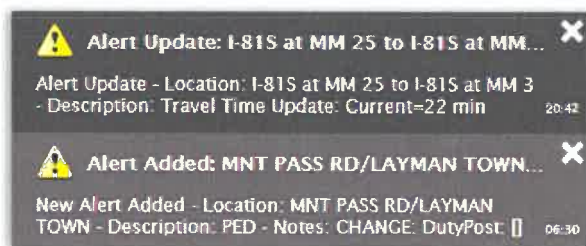
Thresholds can be set for detector traffic measurements, detected incidents, weather measurements and device status. Thresholds are set in the Admin Portal. Thresholds can be set for devices for a set number of retries before putting a device in communications failure. In the figure below the administrator enters weather threshold settings and enables.

4.14.3.1.3. The ATMS shall provide the mechanism for users to select filters for alerts and notifications.

OpenTMS meets this requirement. OpenTMS will provide the user the ability to set their user preferences to filter alerts and notifications. The filters will include device, type of device, time of day, jurisdiction, and geographic area.

4.14.3.1.4. The alert and notification filters shall be based on type of filter, device, type of device, time of day, and jurisdiction.

OpenTMS meets this requirement. OpenTMS will provide the user the ability to set their user preferences to filter alerts and notifications. The filters will include device, type of device, time of day, jurisdiction, and geographic area.

4.14.3.1.5. Users shall be able to set alert and notification filters based on geographic area as an option.

OpenTMS meets this requirement. OpenTMS will provide the user the ability to set their user preferences to filter alerts and notifications. The filters will include device, type of device, time of day, jurisdiction, and geographic area.

4.14.3.1.6. The ATMS shall allow authorized users to set alert and notification thresholds by time of day.

OpenTMS meets this requirement. OpenTMS will provide the user the ability to set their user preferences to filter alerts and notifications. The filters will include device, type of device, time of day, jurisdiction, and geographic area.
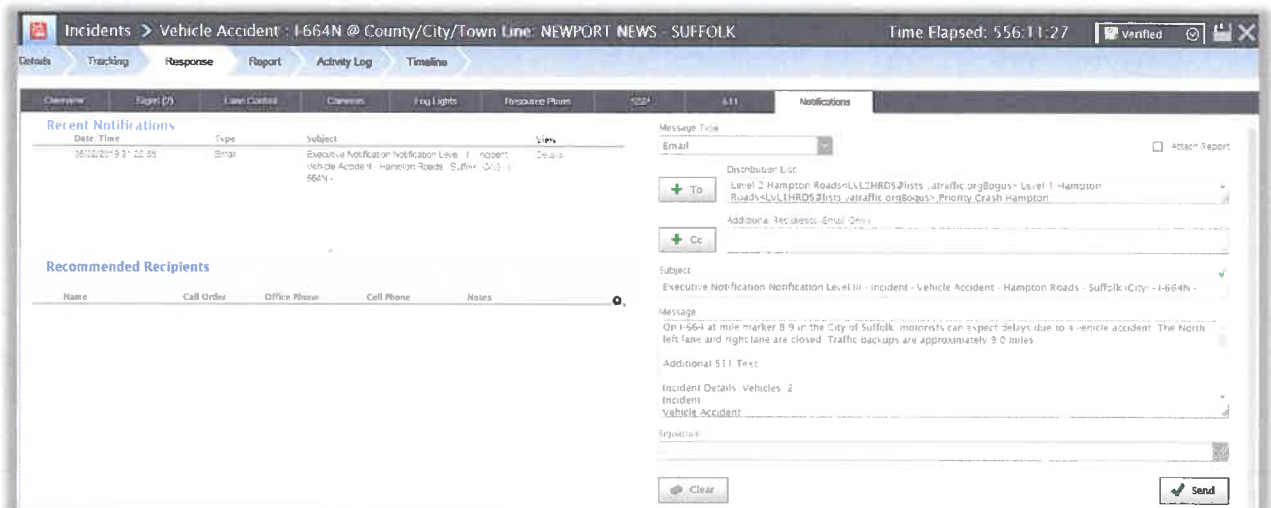
4.14.3.1.7. The system shall be able to generate alerts and notification based on traffic conditions (traffic speeds, volume levels, congestion levels) and event triggers (incidents, construction and maintenance activities, special event activities, etc.)

OpenTMS meets this requirement. OpenTMS supports speed thresholds for detectors. Traffic data is used to generate alerts based on a configurable speed threshold that compares real-time to historical data to determine when to automatically trigger an alert. Historical data is calculated over the previous 60 days in 5-minute increments by day of the week. The threshold settings are configurable in the Admin Portal.

- Scheduled events such as special event activities or construction generate an activation alert and can be set to require user confirmation to activate or not.

- Maintenance activities such as pixel errors create notifications.

- Alerts are generated from multiple detection sources (RWIS, Detectors, Travel Time, CAD). Notification are generated when an alert is created or updated.

4.14.3.1.8. The ATMS shall be able to send out internal notifications regarding an event to up to 100 recipients. Notification to include select information captured in the event log. Notifications shall be completed within 5 minutes of initiation of procedure (process only, not inclusive of conveyance method and receiver's email system delays).

OpenTMS meets this requirement. Our Incident Response Notification supports notifications to partners. The rules-based Decision Support System (DSS) automatically generates an incident response based on the incident/event attributes. The DSS is triggered when specific fields in the incident/event that would trigger business rules are modified such as severity or lanes closed. At this point OpenTMS invokes the DSS to create an updated response plan. The incident response recommends email notifications. The response notifications tab is shown below. Messages sent are logged on the left and the recommended email is shown on the right. The user can modify the email to add 100 recipients or remove recipients. Notifications are sent within 5 minutes.

14.0 Log Reports System Reports (CRFP Section 4.15)

4.15. Log Reports System Reports

4.15.1. Mandatory Requirements

4.15.1.1.1. The ATMS shall be capable of generating reports from ATMS generated data.

OpenTMS meets this requirement. OpenTMS is bundled with a license for Jasper Reports Server Professional. Jasper Reports is a leading enterprise reporting system. It is fully integrated with OpenTMS so that users can create new reports, run existing reports, or view past reports from within the OpenTMS GUI. In addition, the Jasper server can also be accessed from outside OpenTMS if so configured. This approach allows access to reports by users without OpenTMS credentials, regularly scheduled automatic execution and delivery of standard reports and other enterprise reporting features.
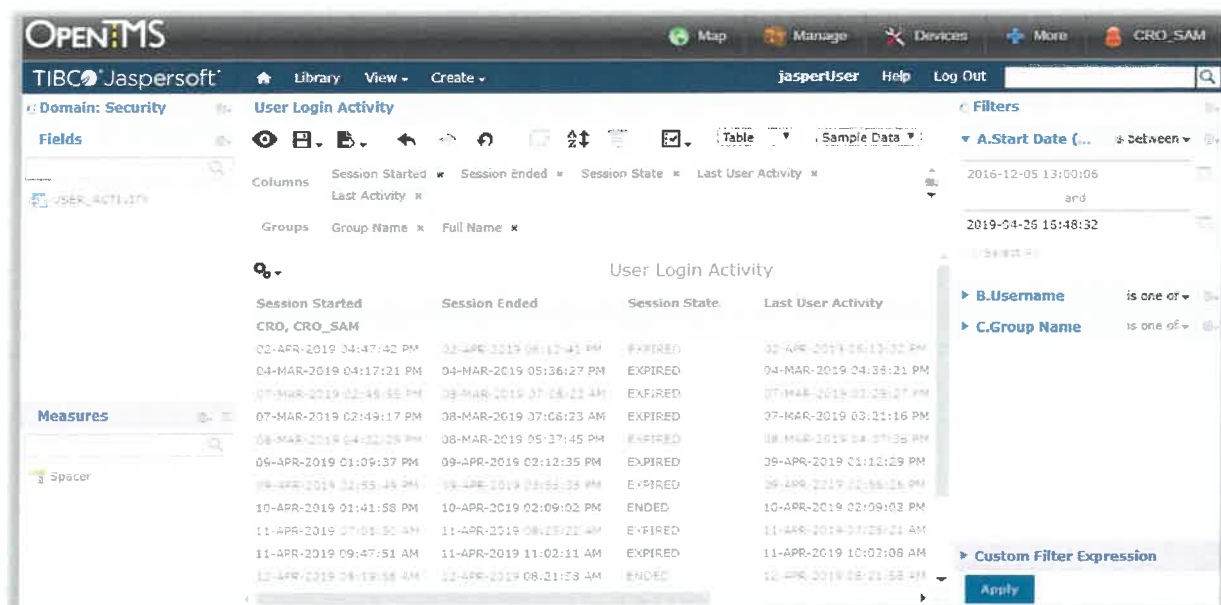
Figure 96 - Jasper Reports Server Professional

The reporting interface includes a simple graphic interface for building ad-hoc reports. Jasper Reports enables users to set up simple tables and charts by dragging and dropping pre- defined fields. Reports created in the ad-hoc viewer can be saved and reused as needed. Once a report has run it can be exported in a variety of formats including PDF, Excel, and Word formats. OpenTMS has a large library of predefined reports that can be edited to suit WVDOH's needs. Q-Free will work with the WVDOH on tweaking any reports to meet your needs.

4.15.1.1.2. Pre-selected, pre-formatted, reports shall be included in the system, e.g. daily/weekly/monthly/annual reports reporting devices in operation, work orders/trouble tickets tracking, incidents, events, etc. These shall be provided in list and graphical formats.

OpenTMS meets this requirement. OpenTMS has a large library of predefined reports that can be edited to suit WVDOH's needs. Q-Free will work with the WVDOH on tweaking any reports to meet your needs and creating new ones to meet the needs of any new requirements that will be implemented. Reports can use tables or graphical elements. In the Incidents by Type Report shown below data is presented in a list and graphically.

The osTicket integration being proposed will provide access to work order/trouble ticket reports.
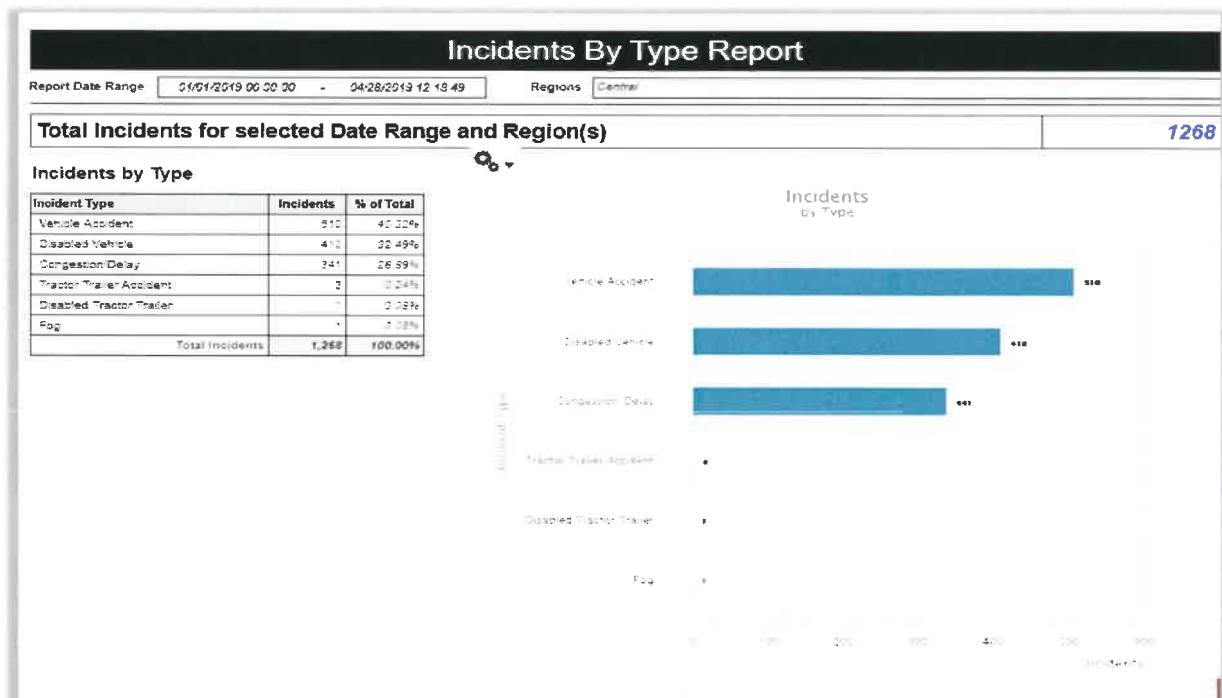
4.15.1.1.3. Users shall be able to generate ad hoc reports, specified by the user, viewable using off the shelf software.

OpenTMS meets this requirement. The reporting interface includes a graphic interface for building ad-hoc reports. Jasper Reports enables users to set up simple tables and charts by dragging and dropping pre-defined fields.

4.15.1.1.4. Users shall be able to save the ad hoc report to become a permanent report.

OpenTMS meets this requirement. Users can save ad-hoc reports as shown below. Save as an 'ad-hoc view and create report' allows the user can go back and edit the view as requirements change as opposed to a report which is a permanent report that can be run as needed. In this option you get both.
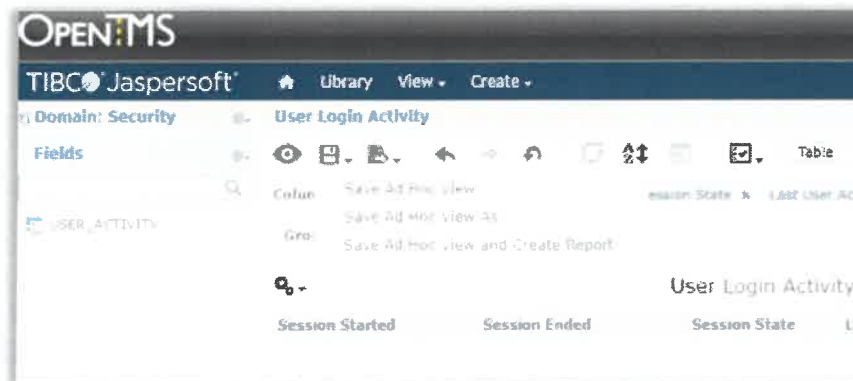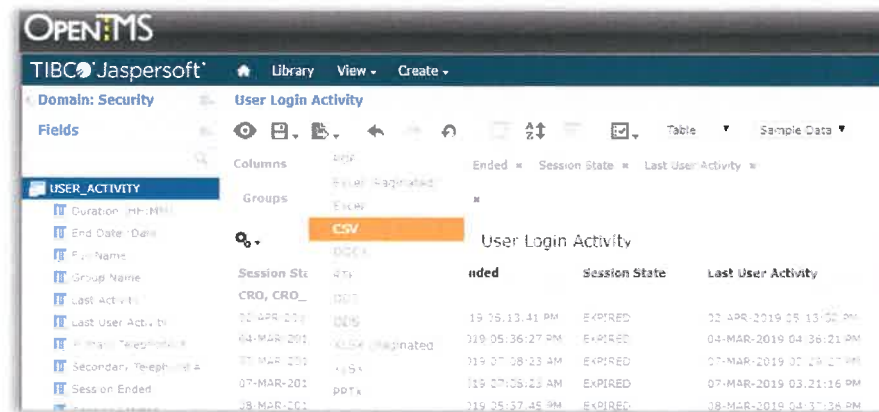
4.15.1.1.5. *The ATMS shall be capable of automatically generating repots via time of day scheduling.*

OpenTMS meets this requirement. Jasper Reports provides the ability for a user to schedule a report at specific time of day to execute one time or recurring and email the report or save to a pre-determined location.
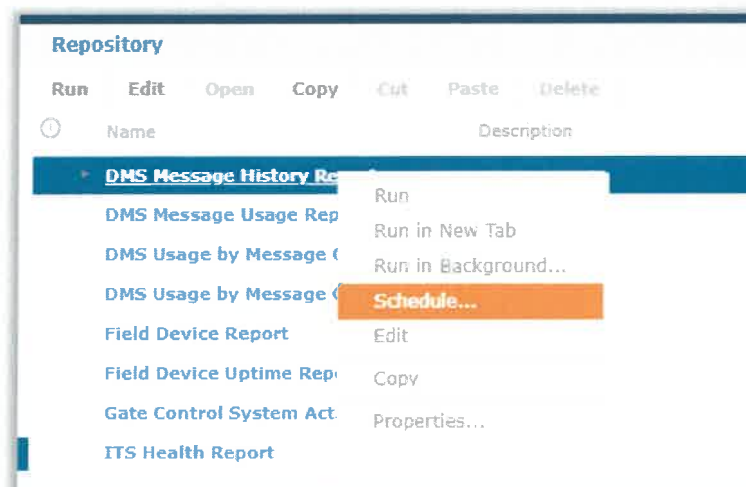
4.15.1.1.6. *The ATMS shall be able to export reports or data base information with comma, space and/or tab between fields to allow import into other programs such as Excel.*

OpenTMS meets this requirement. Once a report has run it can be exported in a variety of formats including PDF, Excel, and Word formats as shown below.

4.15.1.1.7. *The ATMS shall generate information every 24-hours indicating device/system failures. A maintenance report suitable for staff shall be generated.*

OpenTMS meets this requirement. OpenTMS has a Field Device and Health Report that can be scheduled to run nightly and emailed to the maintenance staff. The Health report identifies the failed devices and those with errors. The Field Device report provides device counts, communication state information. Below is a snippet of the Health Report.

While there are no errors reporting at this time any errors, such as pixel or fan, they are presented in the format shown below in the Health Report.

ITS Health Report

Groups: | Administrators, CRO, Central Office, ERO, Guest, NRO, NWRO, SWRO, VSP Alerts |

Signs (VMS/DMS) Reporting Errors

Region		
Device Name	**Location**	**MM**
Reported Errors		

4.15.1.1.8. The maintenance report shall indicate type of device, device ID, and jurisdictional responsibility for maintenance.

OpenTMS meets this requirement. The Field Device and Health Reports are broken down by owning group, device type, device name, and location. Q-Free can work with the WVDOH on customizing this report to meet any additional requirements.

4.15.1.1.9. The ATMS shall maintain a log of all users' activities relating to field device control, system administration, and user access.

OpenTMS meets this requirement. User access is logged, and System Access Reports are available to view invalid login attempts and user login activity. Audit reports are available to view changes to user accounts, field devices, sign message library, properties, and groups/roles. For field device control for DMS there is a message activity log and an event log. Below is a snippet from the DMS Message History Report.

DMS Message History Report

Q1-Simulated-CMS

Time Posted	Time Blanked	Posted By	Blanked By	Priority	Message ID
27-APR-2019 05:17:41		System		5	837741061

CONGESTION AHEAD

Time Posted	Time Blanked	Posted By	Blanked By	Priority	Message ID
26-APR-2019 11:06:37	27-APR-2019 05:07:13	System	System	5	836517350

CONGESTION AHEAD

Below is a snippet from a DMS event log which provides a log of significant sign events.

4.15.1.1.10. The ATMS shall provide event logging such that events can be searched on any unique field or combination of fields.

OpenTMS meets this requirement. Reports can be filtered by any or a combination of the fields. For example, the DMS Message History Report today is filtered by a date range, owning group, and sign. For adhoc report views, the user can drag a field to the filter area to add additional field filters. In the User Telephone List Report below the user can filter by Group Name or Status. If desired, they can drag the Username field to the filter area and further filter by a user or users. Jasper is a very flexible tool.
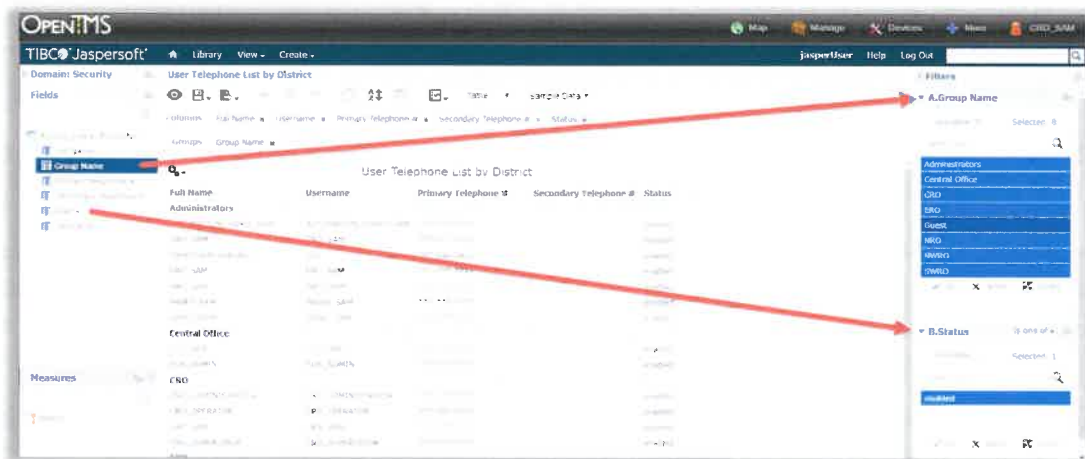
4.15.1.1.11. The ATMS shall be capable of generating reports of logs covering user-define time periods and including user-selected event types at the direction of the TMC authorized users.

OpenTMS meets this requirement. Reports can be filtered by any or a combination of the fields. Access to the Reports module is controlled by permissions so only authorized users can access. In the DMS Device Event Log adhoc report below, the user can drag the Event Type field to the filters area and then select SIGN_MESSAGE_DISPLAYED to filter the log to display only this event as shown below.
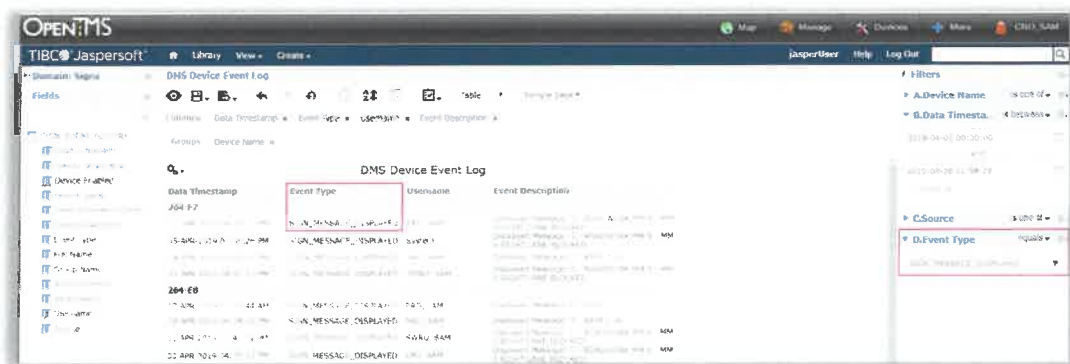
4.15.2. Log Reports/System Reports – Desirable Requirements

4.15.2.1. The ATMS data should have a GUI to configure collection and storage of user activity log data and to generate and display activity reports.

Out of the box, the system automatically collects and stores user activity log data and access to these tables is available in the Reporting module through a report template.

4.15.2.2. The ATMS should be able to archive all data from the activity log to the data archive subsystem.

Out of the box, OpenTMS stores all data in a database. Q-Free will stand up an archival database and archive from production at regular intervals.

4.15.2.3. The ATMS should be able to archive log data in the data archiving system at predefined times to generate a continuous archival record.

Out of the box, OpenTMS stores all data in a database. Q-Free will stand up an archival database and archive from production at regular intervals in the background.

15.0 Security and Administration (CRFP Section 4.16)

4.16. Security and Administration

4.16.1. Mandatory Requirements
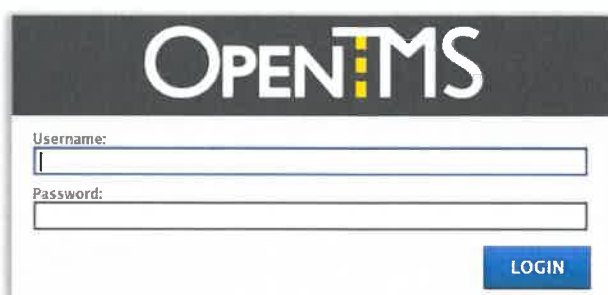
4.16.1.1. The ATMS shall provide security and administration functions.

OpenTMS meets this requirement. OpenTMS has a full featured Administration Portal that enables administrators to manage the system configuration and user profiles. The administration portal front-end is a series of boxes representing each of the modules within OpenTMS as well as system-level and user-level configuration options.

4.16.1.2. The ATMS shall provide a log-in, log-out, and exit function.

OpenTMS meets this requirement. OpenTMS supports login in with two options. The traditional login box that requires a user to enter their username and password or OpenTMS authentication can be linked to an agency's active directory to support single sign-on.

A logout option is available from the Users menu on the Main menu bar.

4.16.1.3. The ATMS shall provide a security (ID/password or approved equivalent) function.
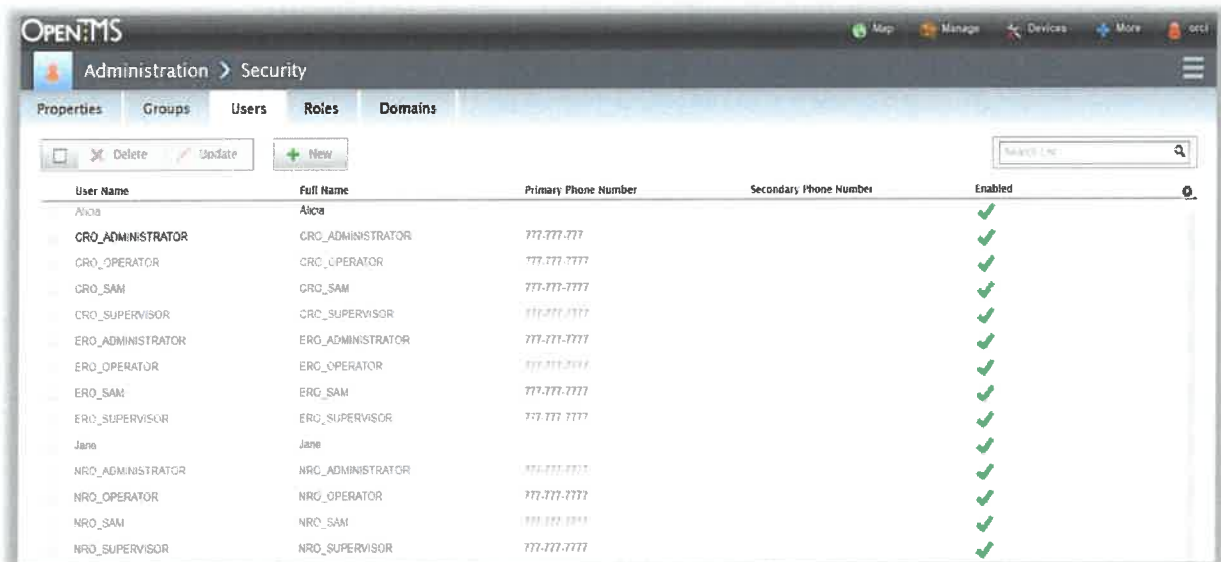
OpenTMS meets this requirement. The ATMS requires a valid username and password to access the application. There are two types of user accounts available.

- The first is local user accounts. These local accounts are managed within the ATMS; and

- The second is authentication using a client's active directory. OpenTMS is configured to take the entered username and authenticate against the active directory server. The advantage here is that all the access and password security is controlled by the WVDOH. Single sign on can be implemented so when a user logs into their workstation they are automatically logged into OpenTMS.

Users can be disabled locally and in active directory when access to the ATMS is no longer required. Skyline will use a protocol to pass a token from the OpenTMS login that will automatically log the user into VERO.

4.16.1.4. The ATMS shall provide a capability to add or delete users by an administrator.

OpenTMS meets this requirement. The Admin Portal Security module enables administrators to add, edit, or delete users and manage groups, roles, profiles, and privileges. The ATMS comes pre-configured with a series of privileges and basic roles that can be expanded upon to create a wide range of user profiles. The Users Tab as shown below presents a list of registered users and an indication of whether their accounts are active or inactive.

4.16.1.5. The ATMS shall maintain log and be able to generate reports of administrative actions and all log-in/log-out activity.

OpenTMS meets this requirement. User access is logged, and System Access Reports are available to view invalid login attempts and user login activity. Below is an example of the User Login Activity Report.

4.16.1.6. The ATMS shall allow for the specification of user's rights by an administrator.

OpenTMS meets this requirement. Through the Admin Portal Security module user interface, administrators can quickly manage the set of privileges assigned to a Role. Users are typically assigned a role such as Guest, Operator, Supervisor or Administrator and privileges are assigned to that Role. There is no limit in the number of Roles defined. Users are assigned to a Role.
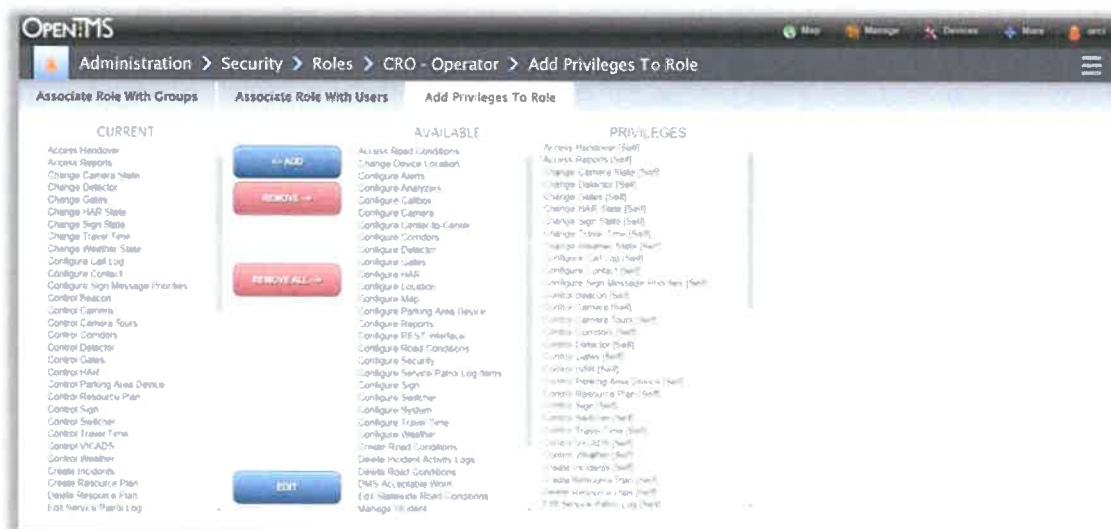
4.16.1.7. User's rights shall be designated by function and specific equipment.
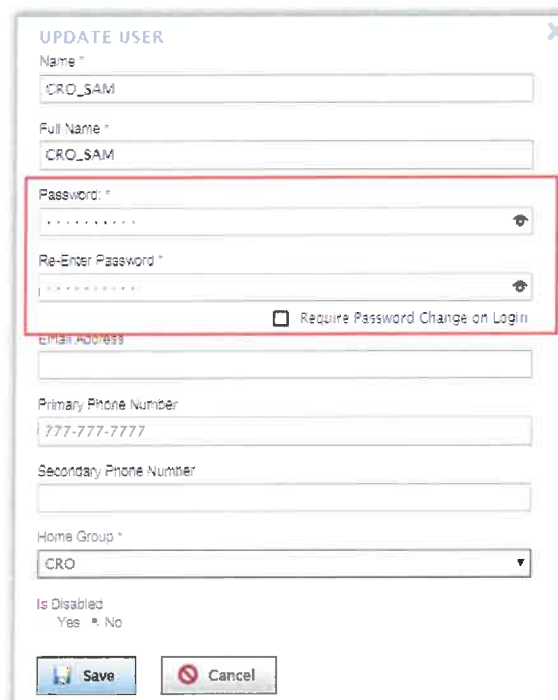
OpenTMS meets this requirement. Privileges are available for functionality within each module. Privileges like Control provide the administrator the ability to assign control by individual device or home group. The administrator is presented with a create restriction view and can either select individual devices from a list or select the groups that can control this device. The create restriction view is shown below.

4.16.1.8. The ATMS shall allow a system administrator to change a user's password.

OpenTMS meets this requirement. For local accounts the administrator can update their password and optionally require them to change on login.
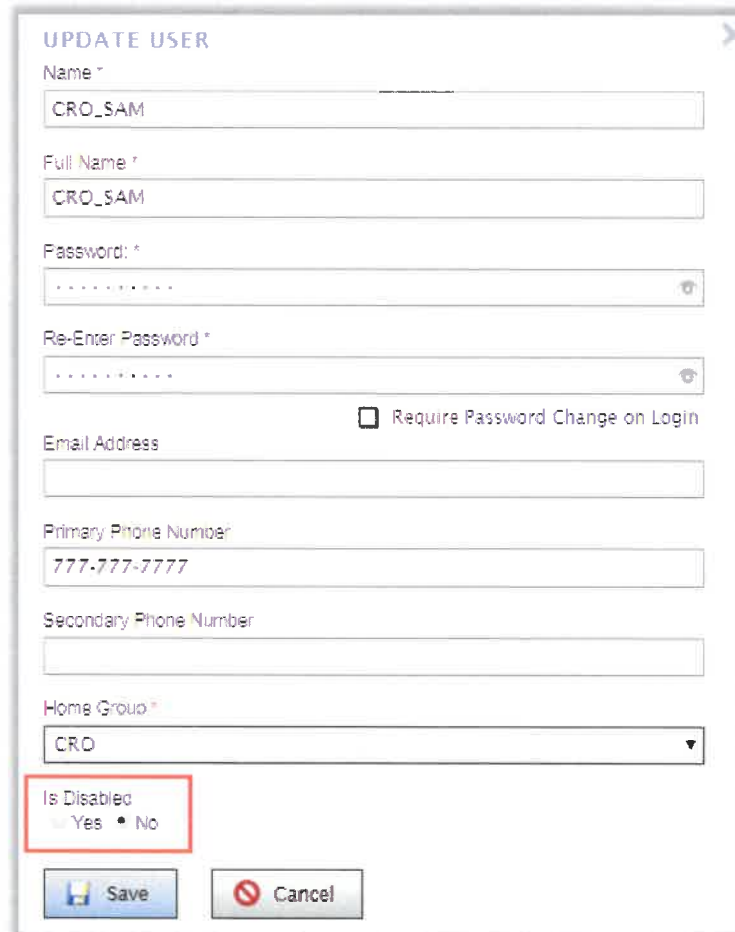
For active directory integration, the passwords would need to be updated in the domain controller.

4.16.1.9. The ATMS shall allow a system administrator to disable a user.

OpenTMS meets this requirement. The administrator can disable a user's account by setting Is Disabled to Yes. This will prevent access for both local and active directory login.

For active directory integration, the administrator can disable their account which prevents them from access the ATMS regardless of their account status in the software.

4.16.1.10. The ATMS shall allow a system administrator to change the status of a user to "expired".

OpenTMS meets this requirement. For active directory integration, the administrator can set their account to expire at a set time in the future.

4.16.1.11. The ATMS shall allow a user to change their own password.

OpenTMS meets this requirement. For active directory users, the user would change their password from their desktop. From the desktop, press Ctrl+Alt+Del and select Change a password.

For local accounts users, can be required them to change their password on login.

4.16.1.12. The ATMS shall allow a user access to the ATMS from any workstation on the system.

OpenTMS meets this requirement. OpenTMS is a fully web-enabled ATMS. The architecture is designed to run on a desktop/laptop through a conventional browser. As a web application, users can access the ATMS inside or external to the client's Traffic Management Center (TMC) if they have network access. The application is launched in a browser and users can open multiple tabs or peel off additional windows to have multiple views concurrently running on multiple monitors.

4.16.1.13. The ATMS workstation / server communications shall be able to function over VPN or firewall traversal.

OpenTMS meets this requirement. Several of our clients support a secure Virtual Private Network (VPN) to remotely access WVDOH hosted hardware platform and/or ATMS application from outside the TMC. OpenTMS is a fully web-enabled ATMS. The architecture is designed to run on a desktop/laptop through a conventional browser.

4.16.1.14. The ATMS shall provide a method to manage users and groups of users within the software such that only ATMS authorized users are allowed to access the system. A minimum of four (4) levels of security are required (external agency, TMC operator, supervisor, and administrator).
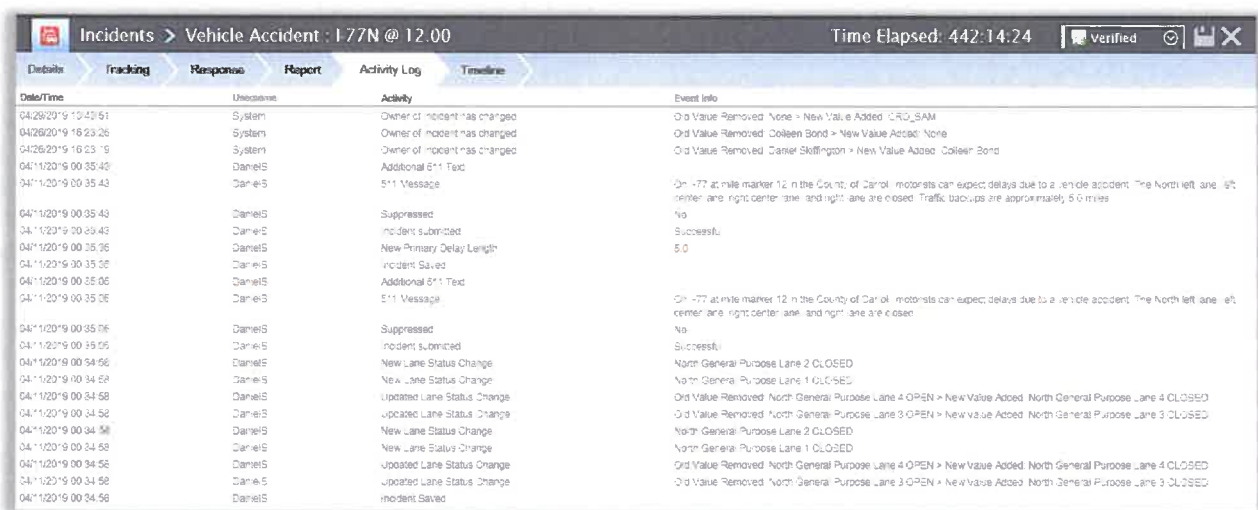
OpenTMS meets this requirement. Through the Admin Portal Security module user interface, administrators can create, update and delete Roles and quickly manage the set of privileges assigned to a Role. There is no limit in the number of Roles defined. Users are assigned to a Role. Team Q-Free will work with WVDOH on setting up the roles that are needed.

4.16.1.15. The ATMS shall support appropriate security and firewalls necessary to safeguard internal operational information from unauthorized access.

OpenTMS meets this requirement. The ATMS platform utilizes state of the art technology to monitor for 'zero day' attacks and updates the firewall security definitions several times a day. The ATMS further secures the environment using and domain infrastructure that requires users to routinely change their passwords, enforcing industry standard enforcement policies and practices.

4.16.1.16. The ATMS shall provide an audit trail capturing the user's ID, date and time stamp, transaction type, and before/after values whenever changes are posted to system database.

OpenTMS meets this requirement. The audit trail captures the timestamp, username, activity, and detail information on changes. Below is an example of the incident activity log.

4.16.1.17. The ATMS shall support full system backups while maintaining 24/7 operational status.

OpenTMS meets this requirement. Using industry best practices, the ATMS platform is incrementally backed up daily with full backups occurring once a week. The backups are then tested to ensure as part of the 'System Recovery Process' testing.

4.16.2. Security and Administration – Desirables

4.16.2.1. The ATMS should provide rules-based administration for access and security at all levels of use.

OpenTMS meets this requirement. The Admin Portal Security module enables administrators to add, edit, or delete users and manage groups, roles, profiles, and privileges. The ATMS comes pre-configured with a series of privileges and basic roles that can be expanded upon to create a wide range of user profiles. Privileges are available for functionality within each module. Privileges can typically be assigned to a group or individual device.

Team Q-Free recommends active directory integration for system access. In this case all users are authenticated against the client's active directory.

Team Q-Free will work with WVDOH on setting up access and the roles that are needed.

4.16.2.2. The ATMS should provide data locking or buffering routines in a multi-user environment.

The ATMS is updated in real-time ensuring each user has the most up to date data. OpenTMS does not have conflict resolution for multiple users editing the same event.
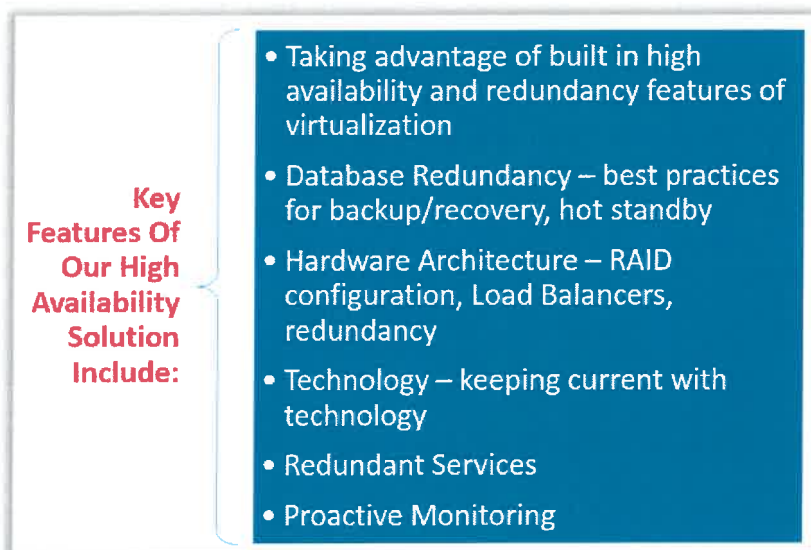
16.0 Performance (CRFP Section 4.17)

4.17. Performance

4.17.1. Mandatory Requirements

4.17.1.1. *The ATMS shall not require system restarts or reboots except for major system upgrades.*

OpenTMS meets this requirement. Q-Free will provide a high-availability and fully redundant platform to provide 24x7 operations. High-availability is discussed in requirement 4.17.1.2 in more detail. A summary is provided below.

Key Features Of Our High Availability Solution Include:
- Taking advantage of built in high availability and redundancy features of virtualization
- Database Redundancy – best practices for backup/recovery, hot standby
- Hardware Architecture – RAID configuration, Load Balancers, redundancy
- Technology – keeping current with technology
- Redundant Services
- Proactive Monitoring

4.17.1.2. *The ATMS shall be available 24 hours a day, 7 days a week, except during scheduled maintenance.*

OpenTMS meets this requirement. Q-Free will provide a high-availability and fully redundant platform to provide 24x7 operations. Key Features of our high availability solution include:

Taking Advantage of Built-In High Availability and Redundancy Features of Virtualization

The ATMS applications will run on a virtualized environment spread across multiple host servers. A virtualized platform allows us to take advantage of built in high availability and redundancy features without additional cost. Virtualized servers look and act like real servers but are not constrained to a single piece of hardware. A virtualized server can run on any number of physical servers (hosts) and multiple virtualized servers can run on a single hardware server. This virtualized environment also provides for the automatic moving of virtual machines (VM) from one host to another, should a host machine fail or need to be taken "off-line for maintenance, without shutting down the application. Virtualization allows for the quick provisioning of new machines to support the standing up production or test servers.

Database

Database redundancy can be achieved by using the following configuration and processes:

- Best practices for backup and recovery; and
- Deploying a hot standby for redundancy.

Hardware Architecture

Deploying best practices in hardware achieved through RAID configuration, load balancers, and redundancy. Multiple webservers sitting behind a load balancer provide the ability to distribute load in addition to allowing for running on a single instance of a web server in the event that one goes down.

Technology

Q-Free continually invests in technology to keep the platform current with latest versions of COTS products and technology changes. Keeping with the latest versions allows us to take advantage of the latest application Security improvements in an ever-changing time, moving our products forward, and new more efficient features that result in better performance. Our module design and service-oriented architecture allows us to easily add new modules to meet the needs of the future.

Redundant Services

With redundant services a single service can be restarted in the background without bringing the system down.

Proactive Monitoring

ATMS system is proactively monitored including application metrics through a monitoring platform, LogicMonitor.

4.17.1.3. *The ATMS shall not let its performance and operation be impacted adversely by the malfunction, removal, or addition of interfaces.*

OpenTMS meets this requirement. Performance and operation are not impacted by interface operation. In our production systems today, interfaces experience period issues and do not impact the overall ATMS.

4.17.1.4. *The ATMS system up time goal shall be 99.9%.*

OpenTMS will meet the 99.9% uptime goal. Q-Free currently runs in Highly Available Architecture configurations in 3 major states including VDOT which has an uptime requirement of 99.99%.

4.17.1.5. *The ATMS refresh rate for the largest map shall be a maximum of 1 second.*

OpenTMS meets this requirement. The system provides responsive maps with a target update rate within 1 second. Number of themes/layers will impact map response time.

4.17.1.6. *The ATMS refresh rate for all other displays shall be a maximum of 1 second.*

OpenTMS meets this requirement. The system provides responsive views with a target update rate within 1 second.

4.17.1.7. The ATMS vendor response shall define how many devices and type the ATMS is capable of supporting. (Minimum: 500 CCTV, 250 DMS, 1000 Detectors).

OpenTMS meets this requirement. OpenTMS does not limit the number of field devices configured into the system. The table below shows the production load for two of our clients.

Device Type	Site 1 Production Count	Site 2 Production Count
CCTV	451	994
DMS	575 996* including external C2C devices	691
Detectors	483 1149* including external C2C devices	530
RWIS	92	69

Our system load tests are done utilizing client maximum requirements. For example, PennDOT has requirements for 2,000 CCTV, DMS and Detectors to be supported so those are the values that will be load tested. For West Virginia we plan on testing with the max device requirements for our product.

4.17.1.8. The ATMS vendor shall indicate if all components necessary to make the ATMS functional will be installed on-premise or off-site and the reason/benefit to WVDOH.

OPENTMS AND VIDEO DISTRIBUTION

OpenTMS and the Skyline Video distribution system will be deployed on premises at the Data Center located at Building 6000 at the Tech Park located in south Charleston. The reason for this choice is due to the high uptime requirement and the State capitol network instabilities. The benefits of hosting in this location include:

- The Data Center is a central junction for several internet service providers. Using this network node allows for redundant paths to the TMC internet, field devices and e911 centers around the state. This is to ensure that the system has multiple core network providers to route traffic through to ensure maximum uptime for the ATMS, Partner Connections and Video systems. The Data center currently load balances across the following networks:
    - Frontier
    - Lumos (Segra)
    - AT&T
    - Sprint
    - Suddenlink
    - Zayo
    - Windstream
- Connectivity to the TMC and TPA will be provided utilizing the Charleston 'Metro Ring' for redundant highspeed connectivity. Though a complete outage may still occur at the TMC or TPA end of the

network, the underlying ATMS platform will still remain functional allowing for remote access from a non-impacted network to manage the states ATMS infrastructure and continue to serve the traveling public with real time traveler information.

511 System (ATIS)

The use of cloud computing has redefined business continuity, disaster recovery and backup testing. The ILOG ATIS will be housed in the Amazon cloud, load-balanced across multiple servers in multiple locations, each location supported by RDS databases. ILOG builds redundancy in each of its technology solutions.

There are many benefits to WVDOH in virtual, cloud-hosted systems:

- There is no hardware procurement and installation required to add computing resources for the system (web servers, database capacity, data ingestion/processing power, etc.). Additional resources can generally be provisioned and available for use within minutes – a great benefit when natural disasters or other emergencies bring sudden surges in usage.

- Having the entire 511 system replicated and accessed across multiple Amazon data centers means that if one system or node fails, the event does not cause an interruption in service – other nodes simply take on the extra traffic until the errant node is placed back in service. This is also a feature that enables ILOG to update and patch servers without interruptions in service.

- Virtual cloud-based systems can be easily backed up with server snapshots created and stored at inexpensive and easily accessed Amazon storage. Backups can also be kept in a standby mode and turned up almost instantly.

- All servers and services are remotely accessible so that weather, road conditions, congestion or other impediments to travel are immaterial in accessing servers for maintenance, upgrade or expansion. This ability to access cloud servers from multiple remote points renders business continuity issues virtually irrelevant.

- Hardware updates have no impact to users in this context. Amazon cloud services notify you when underlying hardware needs to be changed. Virtual systems mean that the supporting host can be changed with no end-user impact. By having multiple systems in service at all times, the hardware underlying the virtual system can be changed - all while end-user requests are still fulfilled by other servers in the network.

Below is an overview of the proposed architecture.
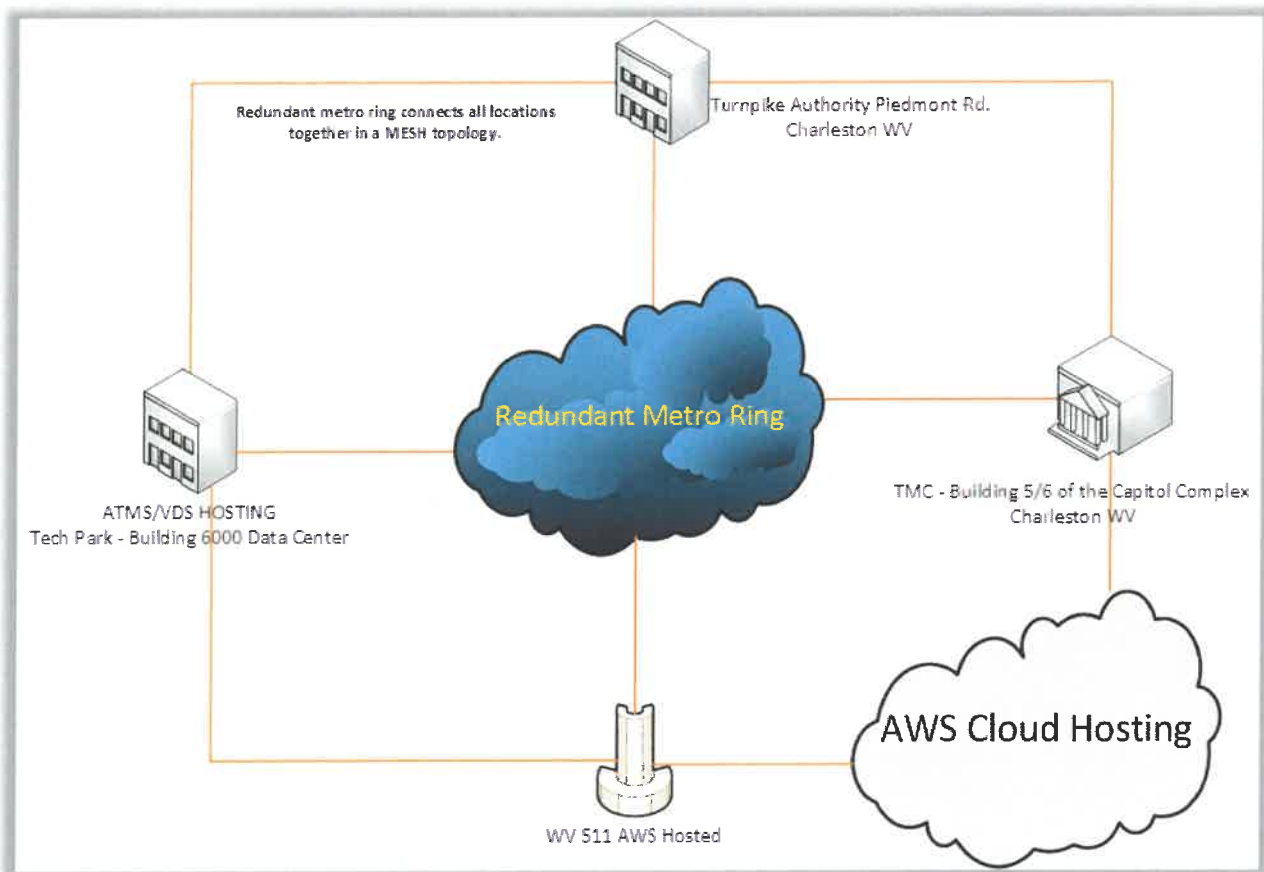
4.17.2. Performance - Desirables

4.17.2.1. The ATMS should provide for "operator-free" operation so that the system performs all minimally necessary control and monitoring processes unattended.

Out of the box, OpenTMS provides automated incident response based on a set of business rules. The rules-based DSS automatically generates an incident response based on the incident attributes such as incident duration, road or lane closure. The incident response recommends ITS devices, 511 messaging, and email notifications. All generated responses are presented to the user for review, modification if required and activation.

Travel times can be scheduled through schedules and activate daily for a defined period without user intervention. Travel times posted on DMS continuously update in the background.

Detection algorithms such as detector, travel time and RWIS are automatically monitored in the background and alerts are automatically created as thresholds are crossed. CAD alerts automatically come in as roadway issues occur.

In summary, in OpenTMS the "operator-free" operation comes from alerts users as congestion/weather monitoring occurs in the back ground and the automatic recommendation of responses to incidents/events.

4.17.3. Other ATMS Operations

4.17.3.1. Mandatory Requirements

4.17.3.1.1. The ATMS shall include capability to generate real-time travel times for defined roadway segments on Interstate and Expressway routes.

OpenTMS meets this requirement. OpenTMS system contains two distinct components to manage travel times. The Travel Time Engine (TTE) is a server-side data fusion engine to collect data from multiple sources and intelligently fuse those values to produce composite travel times. The Travel Time Module (TTM) is an operational management module within the OpenTMS that gives operators status information, notifications for deviations from historical norms, and controls for managing travel times automatically posted to DMS. Decoupling these two functions facilitate integration with other systems and maximizes flexibility for deployment and configuration. Taken together, these two components provide a full featured system for travel time calculation, management, and dissemination.

Travel Time Engine

The TTE fuses data from multiple sources. Existing deployments gather data from fixed detectors, third- party probe data such as INRIX, Bluetooth systems, and toll tag readers. The fusion algorithm is configurable and can be tuned to suit particular needs. If contributing data sources provide historical data, then the TTE can provide that information when nothing else is available. Local knowledge is always critical to understand the relative strengths and weaknesses of rival data sources. Empirical validation of individual data sources, if possible, will provide a better foundation for the fusion algorithm.

One of the biggest advantages to separating the TTE from the ATMS is that travel times may be accessed from approved and authenticated third party systems. Secure web services are available which provide travel times upon request. The requesting system specifies the route and end points, and the TTE returns travel time information. For example, the state of Virginia uses a statewide TTE to provide travel times to traveler information websites and to operational systems other than OpenTMS.

Travel Time Module

The TTM within OpenTMS is the operator's management tool for travel times. It includes a list view (see figure below) which shows current and historical speed, delay, communication, and data quality among other values. The detail view for travel time segments includes graphs showing how travel times are trending over time.

Travel Time Administration

Travel time segments are created and maintained in the Administration Portal. The administrator specifies the route and mile markers for the desired travel time segment. The system automatically queries the TTE using the information supplied when the segment was created. The administrator can also identify one or more DMS associated with the travel time segment. Those DMS can be set to automatically post travel times for the given segment.

4.17.3.1.2.   The ATMS shall provide a mechanism for operators to select and implement pre-defined operations response plans for incidents.

OpenTMS meets this requirement. OpenTMS provides automated incident response based on a set of business rules. Utilizing a Business Rules Engine enables us to generate response plans to promote consistent response and provides for selection of new field devices automatically. Q-Free will work with the WVDOH to customize their business rules. The figure below shows the business logic for posting a DMS message for a road closure.
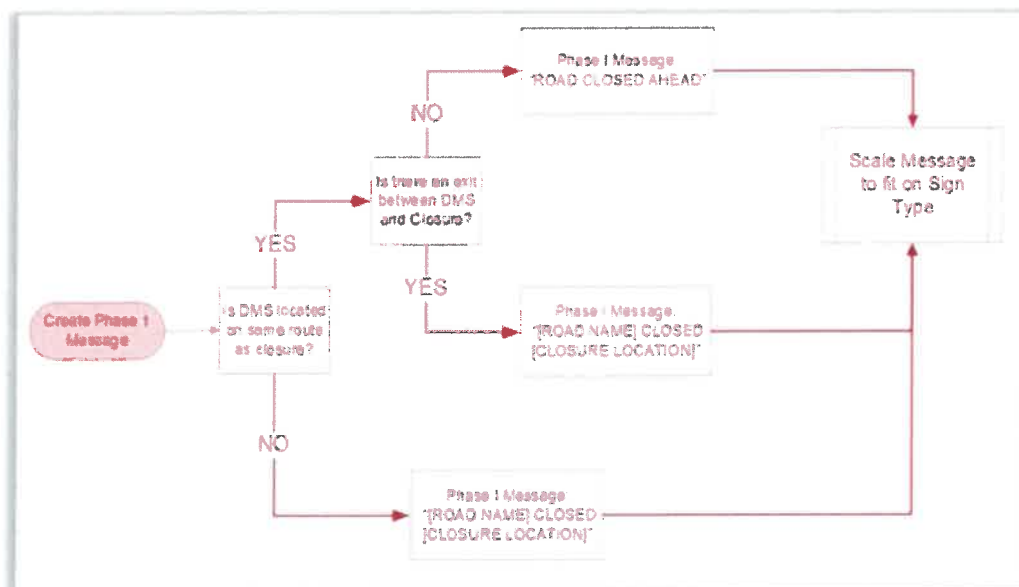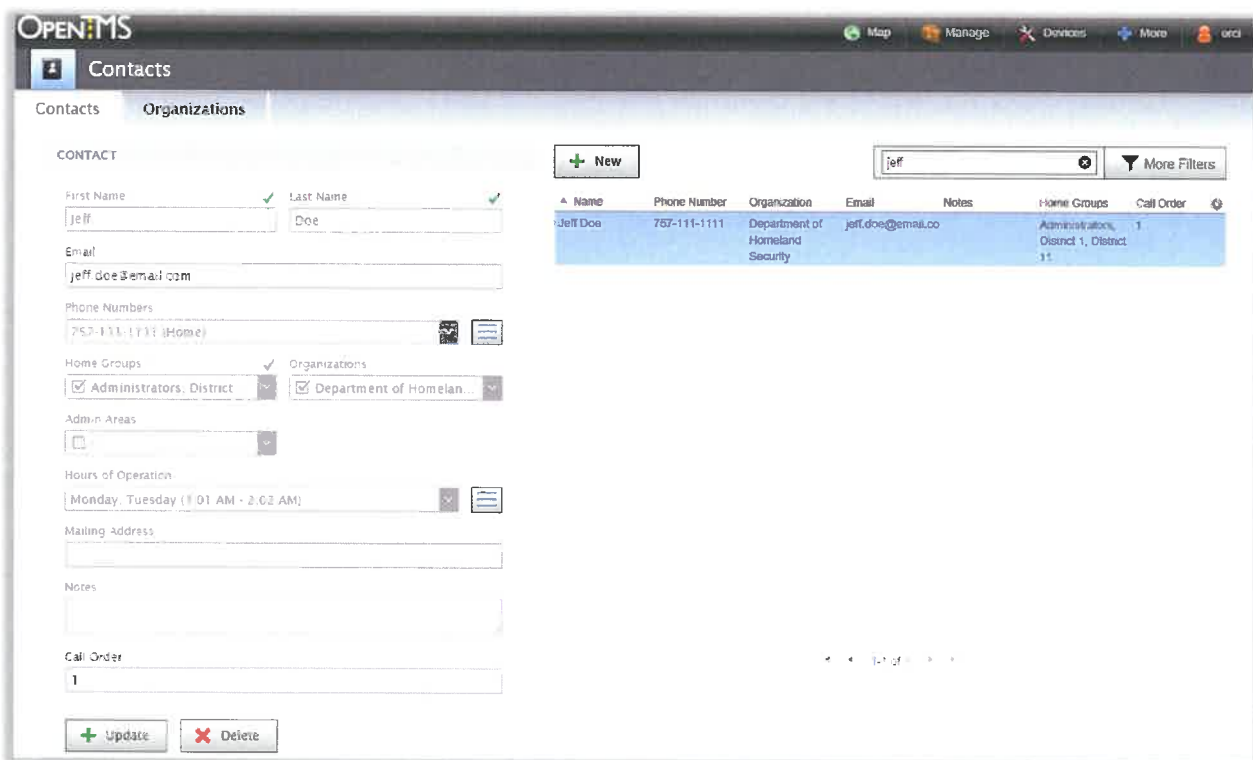
Figure 97 - Business Logic for Posting a DMS Message for a Road Closure

4.17.3.1.3.   The ATMS shall maintain a local emergency response agency contact list.

OpenTMS meets this requirement. OpenTMS provides a Contact module which provides the ability to store and use contact information throughout of the application. The contacts can be associated to organizations, which then are returned with the incident response plan system when the contact/origination falls within the zone of control. The figure below is the entry form for managing contacts. OpenTMS also maintains a list of Organizations that contacts can be grouped by.

Figure 98 - Contact Module

4.17.3.1.4.   The ATMS shall provide access to the contact lists to authorized users.

OpenTMS meets this requirement. Contact list access is available to those users with the correct permissions. Permissions are configured by the administrator in the Admin portal.

4.17.3.1.5.   Trouble ticket generation capability for system and device service and maintenance needs.

OpenTMS meets this requirement. OpenTMS will integrate with cloud-hosted osTicket software, https://osticket.com/, to provide support ticketing. Ten agent licenses will be provided. osTicket provides ticket management including email and dashboard to track tickets. From the OpenTMS user interface a list view will be available to show active tickets. Tickets can be created from OpenTMS. A link from the More menu will open osTicket in the web browser.

4.17.3.2. Other ATMS Operations - Desirables

4.17.3.2.1.   The ATMS should include capability to use archived data and real-time data together with predictive algorithms to generate travel forecasts for display to operators.

OpenTMS v9 will have algorithm support in the "Corridors Module" for Decision Support. The current module produces real-time response based upon real-time data from RWIS sensors, Detection and data such as INRIX. The current DSS does not predict future conditions.

Q-Free is working with a start-up called WayCare that claims they can make certain predictions such as:

- Crash predictions & pro-active response
- Head of Queue analysis from in-vehicle data
- Irregular Congestion Detection
- Incident Impact Analysis

None of these functionalities have been tested in a real-world setting. Q-Free recommends testing the results prior to any implementation and would be glad to work with WVDOH to test the viability of predictive algorithms.

4.17.3.2.2.   The ATMS should maintain a call-out list of private industry contractors of equipment resources.

OpenTMS meets this requirement out of the box, the Contact list can be used to maintain a list of contractors of equipment resources. Further OpenTMS allows for organization(s) to be associated with the contacts.

4.17.3.2.3.   The ATMS should provide a commuter route app so users can enter a frequent route and receive a specific update for their route including incidents, construction, congestion, events, etc.

As described in the responses to requirements 14.11.2.7 and 14.11.2.9, the Q-Free proposal for WVDOH includes a subscriber services portion in the ILOG ATIS. Behind a credentialed login, this portion of the system has an integrated personalized alert component so that users can provide areas/roadways and days/times of day during which they wish to receive email alerts about particular portions of the state. The system will provide email alerts related to any events provided through the ATMS along their route.

In existing deployments of the system, alerts received from the ATMS are automatically translated into email alerts and distributed to travelers with the appropriate settings. The system may also incorporate advisories such as Amber Alerts and detour information.

Users are able to manage the various features of their accounts from the website. After logging in,

- Users may edit their personal info/user profile.
- Users may subscribe/unsubscribe from alerts.
- Alerts may be configured so they are only sent during particular days and times. Furthermore, these configurations may be different for each route entered by a user.

- As a new feature, users can select the area of their focus by drawing a shape on a map, rather than clicking through roadway dropdown options. This gives great flexibility when a user wants alerts near a specific region, or along a commute that involves multiple roadways. It also gives the user the opportunity to incorporate roads near their primary route, which may have a secondary impact on their commute.

Incorporation of this feature into the mobile app can also be done by linking the app to the subscriber services and providing app notifications.

In the current release the ATMS does not provide a commuter route app.

4.17.3.2.4. The ATMS should populate social media mechanisms with event data automatically.

Out of the box, the ATMS provides a data feed to the 511 which populates social media.

The ILOG ATIS automatically posts advisories to agency-specified Twitter accounts, including regional or subject-specific accounts. Different Twitter accounts are linked to the preview and production systems so that new Twitter functions can be tested before being pushed to the general public.

Sometimes agencies find that their tweets are blocked by Twitter because they are too similar to prior tweets. For example, tweets for an initial alert, an update and a cleared event may look very similar. To prevent agency tweets from being blocked from Twitter due to their similarity to a previous tweet, ILOG uses oauth1.0 for authentication. We use a consumer key/consumer secret to build a token and token secret for each tweet. Each tweet is signed with HMAC-SHA1.

ILOG also follows each agency's Twitter accounts so that our quality assurance staff can confirm that tweets have not been blocked.

511PA Harrisburg @511PAHarrisburg · 14m
UPDATE: Turnpike Traffic Alert on Pennsylvania Turnpike I-76 westbound between Exit 189 - PA 75 and Exit 180 - US 522 affecting all lanes
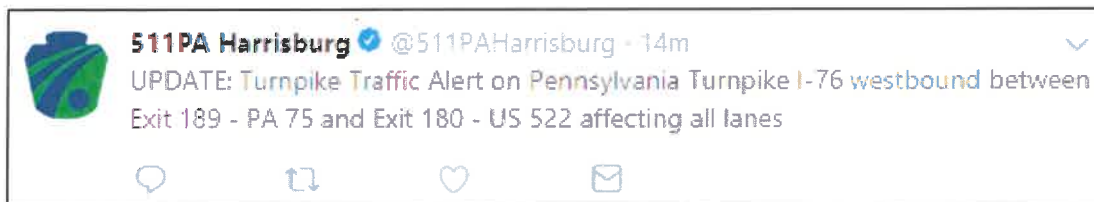
Figure 99 - Automatically-Generated Tweet

4.17.3.2.5.   The ATMS should provide for enhanced social media capabilities to allow for easier use of Twitter, Facebook, etc. for events or emergencies.

OpenTMS meets this requirement out of the box, the ATMS provides a data feed to the 511 system which populates social media.

The ILOG ATIS administrative portal will provide a feature that will allow authorized staff to enter customized and free-form messages that will post to WVDOH Twitter account(s). ILOG currently provides this service for the PA Turnpike, where we developed a portal page that could post to any of their development or production Twitter accounts. Since the PA Turnpike has separate accounts for travel alerts and more social aspects of the agency, there are times when ad-hoc tweets are sent to one or both of these accounts.

4.17.3.2.6.   Operator manuals should be intuitive and key operations should be on flip cards that are easy to access and understand during an emergency.

Team Q-Free will develop a set of flip cards for key ATMS and ATIS operations.

4.17.4. Tunnel Systems – Desirables

4.17.4.1.   The ATMS should be capable of controlling and monitoring lane signals in tunnels controlled by WVDOH.

Out of the box, OpenTMS has a Lane Control Signals module. This module supports NTCIP devices. The figure below shows the lane control signals detailed view. This view provides the ability to open and close lanes while viewing an image of the area.

Figure 100 - Lane Control Signals Module

4.17.4.2.   The ATMS should be capable of controlling and monitoring DMS associated with the tunnels controlled by WVDOH.

Out of the box, the ATMS is capable of controlling and monitoring any DMS protocol that is currently implemented. The Sign module is architected to allow the addition of additional protocols.

4.17.4.3.   The ATMS should be capable of monitoring and receiving alerts from air quality sensors associated with the tunnels controlled by WVDOH.

OpenTMS does not integrate with air quality sensors in our current release. The OpenTMS is designed so that additional protocols can be easily added in the future.

4.17.5. Connected Vehicle/Autonomous Vehicle Systems – Desirables

4.17.5.1. Although not part of the WVDOH ATMS at this time, the ATMS should have the capacity to include future control and access to roadside units associated with connected and autonomous vehicle technologies.

Team Q-Free has extensive Connected and Automated Vehicle (CAV) experience that can help WVDOH plan and execute various strategies to implement roadside, in-vehicle or signal based (SPaT) technologies. Team Q-Free has staff that has worked in both European and US standards development (SAE J2735) and also deep experience in Connected Intelligent Transportation Systems (C-ITS) utilizing 4g and in the future 5g instead of 5.9 Ghz Dedicated Short Range Communications (DSRC). Q-Free has staff deploying a FHWA "SPaT Challenge system in Florida and over 1000 signal-based DSRC units in Georgia currently. Q-Free also has a proprietary unit that can seamlessly transit/receive J2735 message sets via DSRC or 4g that can be used as a roadside unit or mounted in a vehicle.

Q-Free has developed a methodology to ingest J2735 message sets into OpenTMS and their flagship signal management system MaxView. As of today, there are few valid use cases outside of SPaT messaging to utilize the data in operations. Q-Free has a pilot project with Cisco to have Cisco manage the data "at the edge" and transmit more meaningful data back to the ATMS platform without flooding telecommunications networks or storing massive amounts of data.

Figure 101 - Q-Free's Roof Mount DSRC Unit

4.17.6. Traffic Signal Control Systems – Desirables

4.17.6.1. Although not required at this time, the ATMS should have the capability of adding a traffic signal control module or third-party application for the centralized control of WVDOH traffic signal systems across the state with communication capabilities.

Q-Free has the capability of adding a traffic signal control module in the future. We are currently in development of a module with our client PennDOT that will be deployed in the summer of 2019.

The OpenTMS Signals module integrates with INTELIGHT's MAXVIEW Central Software to provide operators with the ability to incorporate pre-defined action sets (timing plans) in their incident response. MAXVIEW organizes incident responses using pre-configured objects called

action sets. MAXVIEW operators can create and configure action sets, within MAXVIEW, to temporarily implement a variety of signal control objects from a single command.

OpenTMS fetches the action sets from MAXVIEW and displays them in the signals module. Signals interface provides the operator the following features:

- Visualize the controllers in the action set in a list or map;
- Interactive Map;
- Notes field, entered in MAXVIEW, provide operators the intended impact of the action set;
- Provides the ability to run and stop one or more action sets from a single view;
- Action set deconflicting; and
- List Searching and Filtering.

Figure below shows the Signal Module Action Set List View.
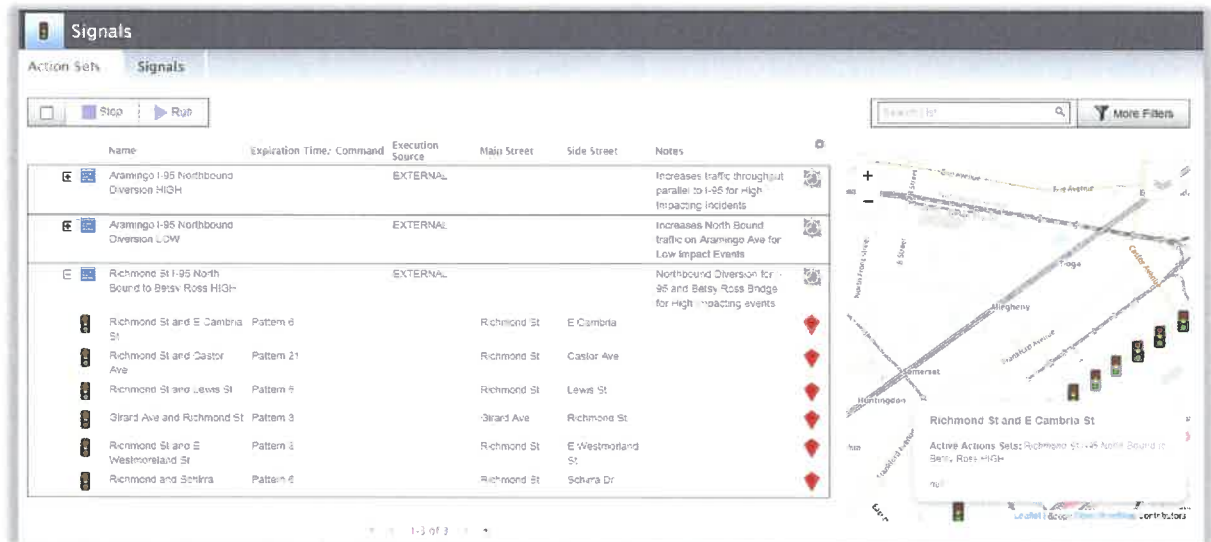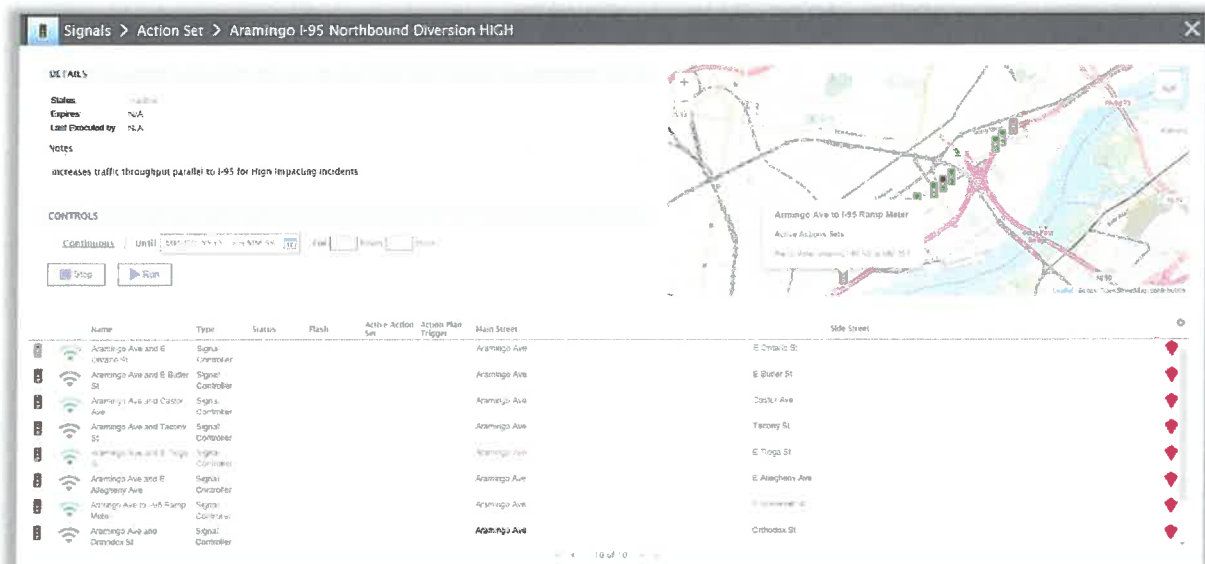
Figure 102 - Signal Module Action Set List View

Clicking on an action set opens a more detailed view of the action set. From this view the operator has a more detailed look at signal controllers within the action set. The detailed view is shown below.

To respond to an incident, OpenTMS will fetch the list of available action sets according to business rules and make them available in the Incident Response module. Once the action sets are returned, the operator will be able to select or de-select recommended action sets. To the OpenTMS operator, the action sets will appear as just another part of a response plan. When the operator invokes a response, which includes a MAXVIEW action set, the system will send the command back to MAXVIEW for execution. OpenTMS operators can run pre-defined plans on the signal system without having access to or knowledge of MAXVIEW. As part of activation, Operators are alerted to action set conflicts that require deconfliction within the ATMS.

Signal action sets are also integrated with the Corridor module and Response Plans. The image below shows the activation of an action set.

17.0 Appendices

17.1 Appendix I - Designated Contact Page, Certification, and Signature

See the page to follow.

DESIGNATED CONTACT: Vendor appoints the individual identified in this Section as the Contract Administrator and the initial point of contact for matters relating to this Contract.

Daniel Skiffington

(Name, Title)

Executive Vice President, Inter-Urban Division

(Printed Name and Title)

4660 La Jolla Village Drive, Suite 100 San Diego, CA 92122, USA

(Address)

+17572629988 / 757-546-1832

(Phone Number)/ (Fax Number)

Daniel.Skiffington@q-free.com

(email address)

CERTIFICATION AND SIGNATURE: By signing below, or submitting documentation through wvOASIS, I certify that I have reviewed this Solicitation in its entirety; that I understand the requirements, terms and conditions, and other information contained herein; that this bid, offer or proposal constitutes a."l offer to the State that ca.,not be unilaterally withdrawn; that the product or service proposed meets the mandatory requirements contained in the Solicitation for that product or service, unless otherwise stated herein; that the Vendor accepts the terms and conditions contained in the Solicitation, unless otherwise stated herein; that I am submitting this bid, offer or proposal for review and consideration; that I am authorized by the vendor to execute and submit this bid, offer, or proposal, or any documents related thereto on vendor's behalf; that I am authorized to bind the vendor in a contractual relationship; and that to the best of my knowledge, the vendor has properly registered with any State agency that may require registration.

Q-Free America

(Company)

(Authorized Signature) (Representative Name, Title)

Daniel Skiffington, Executive Vice President, Inter-Urban Division

(Printed Name and Title of Authorized Representative)

May 29, 2019

(Date)

+17572629988 / 757-546-1832

(Phone Number) (Fax Number)

Revised 01/24/2019

17.2 Appendix II - Addenda Acknowledgment

See the page to follow.

ADDENDUM ACKNOWLEDGEMENT FORM
SOLICITATION NO.: DOT1900000001

Instructions: Please acknowledge receipt of all addenda issued with this solicitation by completing this addendum acknowledgment form. Check the box next to each addendum received and sign below. Failure to acknowledge addenda may result in bid disqualification.

Acknowledgment: I hereby acknowledge receipt of the following addenda and have made the necessary revisions to my proposal, plans and/or specification, etc.

Addendum Numbers Received:
(Check the box next to each addendum received)

[✓] Addendum No. 1   [ ] Addendum No. 6

[✓] Addendum No. 2   [ ] Addendum No. 7

[✓] Addendum No. 3   [ ] Addendum No. 8

[ ] Addendum No. 4   [ ] Addendum No. 9

[ ] Addendum No. 5   [ ] Addendum No. 10

I understand that failure to confirm the receipt of addenda may be cause for rejection of this bid. I further understand that any verbal representation made or assumed to be made during any oral discussion held between Vendor's representatives and any state personnel is not binding. Only the information issued in writing and added to the specifications by an official addendum is binding.

Q-Free America
_____
Company

Daniel Shifflett
_____
Authorized Signature

May 29, 2019
_____
Date

NOTE: This addendum acknowledgement should be submitted with the bid to expedite document processing.
Revised 6/8/2012

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Proposal
21 - Info Technology

Proc Folder: 506645

Doc Description: ADDENDUM 1 ADVANCED TRAFFIC MANAGEMENT SYSTEM (6319C0040)

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No		Version
2019-04-11	2019-05-29 13:30:00	CRFP 0803 DOT1900000001		2

BIO RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON   WV   25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Q-Free America

4660 La Jolla Village Dr. Ste 100, San Diego, CA 92122

757-262-9988

FOR INFORMATION CONTACT THE BUYER
Crystal Rink
(304) 558-2402
crystal.g.rink@wv.gov

Signature X _Daniel Shufflt_   FEIN# 45-4337530   DATE May 29, 2019

All offers subject to all terms and conditions contained in this solicitation

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Proposal
21 - Info Technology

Proc Folder: 506645

Doc Description: ADDENDUM 2 ADVANCED TRAFFIC MANAGEMENT SYSTEM (6319C0040)

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No	Version
2019-05-13	2019-05-29 13:30:00	CRFP 0803 DOT1900000001	3

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON STE
CHARLESTON   WV   25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Q-Free America

4660 La Jolla Village Dr. Ste 100, San Diego, CA 92122

757-262-9988

FOR INFORMATION CONTACT THE BUYER
Crystal G Hustead
(304) 558-2402
crystal.g.hustead@wv.gov

Signature X _Daniel Shifflett_   FEIN# 45-4337530   DATE May 29, 2019

All offers subject to all terms and conditions contained in this solicitation

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Proposal
21 - Info Technology

Proc Folder: 506645			
Doc Description: ADDENDUM 3 ADVANCED TRAFFIC MANAGEMENT SYSTEM (6319C0040)			
Proc Type: Central Master AQreement			
Date Issued	Solicitation Closes	Solicitation No	Version
2019-05-21	2019-05-29 13:30:00	CRFP 0803 DOT1900000001	4

BID.RECEIVi'NGLOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON STE
CHARLESTON   VV   25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Q-Free America

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757-262-9988

FOR INFORMATION CONTACT THE BUYER
Crystal G Hustead
(304) 558-2402
crystal.g.hustead@wv.gov

Signature X *Daniel Shufft*   FEIN# 45-4337530   DATE May 29, 2019

All offers subject to all terms and conditions contained in this solicitation

17.3 Appendix III - Commercial Liability Insurance Documentation

See the page to follow.

CERTIFICATE OF LIABILITY INSURANCE

ACORD®

DATE (MM/DD/YYYY)
5/9/2019

PRODUCER	CONTACT NAME:	Elizabeth Stackowitz		
JLT Specialty USA 350 Madison Avenue, 7th Floor New York, NY 10017 www.jltus.com	PHONE (A/C, No. Ext):		FAX (A/C, No):	
	E-MAIL ADDRESS:	elizabeth.stackowitz@jltus.com		
	INSURER(S) AFFORDING COVERAGE			NAIC #
	INSURER A : American Guarantee and Liability Ins Co			26247
INSURED	INSURER B : Zurich American Insurance Company			16535
Q-Free America Inc. 4660 La Jolla Village Dr. Suite 100 San Diego CA 92122	INSURER C : Hartford Casualty Insurance Company			29424
	INSURER D : Indian Harbor Insurance Company			36940
	INSURER E :			
	INSURER F :			

COVERAGES CERTIFICATE NUMBER: 48600029 REVISION NUMBER:

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
B	✓ COMMERCIAL GENERAL LIABILITY CLAIMS-MADE ✓ OCCUR			GLo020604001	6/1/2018	6/1/2019	EACH OCCURRENCE	$2,000,000
							DAMAGE TO RENTED PREMISES (Ea occurrence)	$300,000
							MED EXP (Any one person)	$10,000
							PERSONAL & ADV INJURY	$1,100,000
	GEN'L AGGREGATE LIMIT APPLIES PER: POLICY ✓ PRO-JECT LOC OTHER:						GENERAL AGGREGATE	$3,000,000
							PRODUCTS - COMP/OP AGG	$3,000,000
								$
B	AUTOMOBILE LIABILITY ANY AUTO OWNED AUTOS ONLY / SCHEDULED ✓ AUTOS HIRED ✓ AUTOS ONLY / NON-OWNED ✓ AUTOS ONLY			BAP 0383378 01	6/1/2018	6/1/2019	COMBINED SINGLE LIMIT (Ea accident)	$1,000,000
							BODILY INJURY (Per person)	$
							BODILY INJURY (Per accident)	$
							PROPERTY DAMAGE (Per accident)	$
								$
A	✓ UMBRELLA LIAB ✓ OCCUR EXCESS LIAB CLAIMS-MADE DED RETENTION $			AUC038455301	6/1/2018	6/1/2019	EACH OCCURRENCE	$5,000,000
							AGGREGATE	$5,000,000
								$
C	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY Y/N ANYPROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? N (Mandatory in NH) If yes, describe under DESCRIPTION OF OPERATIONS below		N/A	13WECBS9076	9/5/2018	9/5/2019	✓ PER STATUTE / OTH-ER	
							E.L. EACH ACCIDENT	$1,000,000
							E.L. DISEASE - EA EMPLOYEE	$1,000,000
							E.L. DISEASE - POLICY LIMIT	$1,000,000
D	E&O- Technology			MTP903403302	10/1/2018	10/1/2019	Limit: $5,000,000; SIR: $50,000 (including Cyber Extension)	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

CERTIFICATE HOLDER	CANCELLATION
Broad Run Acquisitions LLC c/o Buchanan Partners, LLC 9841 Washingtonian Blvd Suite 300 Gaithersburg MD 20878	SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS. AUTHORIZED REPRESENTATIVE *Andre Eichenholtz* Andre Eichenholtz

ACORD 25 (2016/03) The ACORD name and logo are registered marks of ACORD

48600029 | Master Certificate | Elizabeth Stackowitz | 5/9/2019 2:49:24 PM (EDT) | Page 1 of 1

17.4 Appendix IV - WVDOH Official CRFP Cover Page

See the pages to follow.

Purchasing Divison
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

State of West Virginia
Request for Proposal
21 — Info Technology

Proc Folder: 506645

Doc Description: ADDENDUM 1 ADVANCED TRAFFIC MANAGEMENT SYSTEM (6319C0040)

Proc Type: Central Master Agreement

Date Issued	Solicitation Closes	Solicitation No	Version
2019-04-11	2019-05-29 13:30:00	CRFP 0803 DOT1900000001	2

BID RECEIVING LOCATION

BID CLERK
DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
2019 WASHINGTON ST E
CHARLESTON   WV   25305
US

VENDOR

Vendor Name, Address and Telephone Number:

Q-Free America

4660 La Jolla Village Dr. Ste 100, San Diego, CA 92122

757-262-9988

FOR INFORMATION CONTACT THE BUYER
Crystal Rink
(304) 558-2402
crystal.g.rink@wv.gov

Signature X _Daniel Shufft_   **FEIN #** 45-4337530   **DATE** May 29, 2019

All offers subject to all terms and conditions contained in this solicitation

THE STATE OF WEST VIRGINIA PURCHASING DIVISION FOR THE AGENCY, WEST DIVISION OF HIGHWAYS, IS SOLICITING
PROPOSALS FOR AN ADVANCED TRAFFIC MANAGEMENT SOFTWARE, A 511-TRAVELER INFORMATION SYSTEM, AND SOFTWARE
SUPPORT SERVICES PER THE ATTACHED DOCUMENTS.

*ONLINE RESPONSES FOR THIS SOLICITATION ARE PROHIBITED***

INVOICE TO		SHIP TO	
DIVISION OF HIGHWAYS		DIVISION OF HIGHWAYS	
INFORMATION SERVICE DIVISION		INFORMATION SERVICE DIVISION	
1900 KANAWHA BLVD E, BLDG 5 RM 920		1900 KANAWHA BLVD E, BLDG 5 RM 920	
CHARLESTON	WV 25305-0430	CHARLESTON	WV 25305-0430
US		US	

Line	Comm Ln Desc	Qty	Unit Issue	Unit Price	Total Price
1	SYSTEM DEVELOPMENT, MIGRATION, SOFTWARE				

Comm Code	Manufacturer	Specification	Model #
81111504			

Extended Description :

SYSTEM DEVELOPMENT, MIGRATION SERVICES, MAINTENANCE, SUPPORT FOR ADVANCED TRANSPORTATION MANAGMENT
SYSTEM

SCHEDULE OF EVENTS

Line	Event	Event Date
1	VENDOR QUESTION DEADLINE	2019-04-26

ADDITIONAL TERMS AND CONDITIONS

See attached document(s) for additional Terms and Conditions

17.5 Appendix V - Availability of Information Form (CRFP Section 6.8)

See the page to follow.

Proposal 1:   Step 1-$1,000,000 / $1,000,000 = Cost Score Percentage of 1 (100%)
Step 2 - 1 X 30 = Totai Cost Score of30

Proposal 2:   Step 1- $1,000,000 / $1,100,000 = Cost Score Percentage of0.909091 (90.9091 %)
Step 2 - 0.909091 X 30 = Total Cost Score of27.27273

6.8.   **Availability ofInformation:** Proposal submissions become public and are available for review immediately after opening pursuant to West Virginia Code §SA-3-1 l(h). All other information associated with the RFP, includmg but not limited to, technical scores and reasons for disqualification, will not be available until after the contract has been awarded pursuant to West Virginia Code of State Rules §148-1-6.3 .d.

By signing below, I certify that I have reviewed this Request for Proposal in its entirety; understand the requirements, terms and conditions, and other information contained herein; that I am submitting this proposal for review and consideration; that I am authorized by the bidder to execute this bid or any documents related thereto on bidder's behalf; that I am authorized to bind the bidder in a contractual relationship; and that, to the best of my knowledge, the bidder has properly registered with any State agency that may require registration.

Q-Free America

(Company)   _Daniel Shifflet_   EVP Inter-Urban Division

(Representative Name, Title)

757-546-3401/757-546-1832

(Contact Phone Fax Number)

May 29, 2019

(Date)

17.6 Appendix VI - Acronyms

Acronym	Definition
ATIS	Advanced Traveler Information System
ATMS	Advanced Traffic Management System
AVL	Automatic Vehicle Location
AWS	Amazon Web Services
CAD	Computer Aided Dispatch
COTS	Commercial off-the-shelf
DMS	Dynamic Message Sign
DOT	Department of Transportation
DSS	Decision Support System
EBS	Elastic Block Store
EA	Enterprise Agreement
FAT	Factory Acceptance Test
FHWA	Federal Highway Administration
ICM	Integrated Corridor Management
IP	Internet Protocol
ITS	Intelligent Transportation System
IVR	Interactive Voice Response/Responsive
JMS	Java Messaging Service
NTCIP	National Transportation Communications for Intelligent Transportation System Protocol
NTP	Notice to Proceed
POC	Point of Contact
PSTOC	Public Safety Transportation Operations Center
QA	Quality Assurance
QC	Quality Control
RDS	Relational Database Service
RFP	Request for Proposal
RTM	Requirements Traceability Matrix
SaaS	Software as a Service
SAT	Software Acceptance Test
SCAT	System Component Acceptance Test

Acronym	Definition
SE	System Engineer
SLA	Service Level Agreement
TIS	Traveler Information System
TMC	Traffic Management Center
TSMO	Transportation System Management and Operation