South Florida Freight Advanced Traveler Information System

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Demonstration Plan — October 25, 2013
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16. Abstract

This Demonstration Plan has been prepared to provide guidance and a common definition to all parties of the testing program that will be conducted for the South Florida FRATIS Demonstration Project. More specifically, this document provides:

- Planning information that identifies all demonstration elements and site information;
- Experimental information to support the IA Team that includes demonstration hypotheses, testing protocols, and data elements collected; and
- Methods for providing data outputs from this project to the IA Team, and to the USDOT Research Data Exchange.

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1.0 Overview

1.1 Purpose of this Document

This Demonstration Plan has been prepared to provide guidance and a common definition to all parties of the testing program that will be conducted for the South Florida FRATIS Demonstration Project. More specifically, this document provides:

- Planning information that identifies all demonstration elements and site information;
- Experimental information to support the Impacts Assessment (IA) Team that includes demonstration hypotheses, testing protocols, and data elements collected; and
- A method for providing data outputs from this project to the IA Team, and to the U.S. DOT Research Data Exchange.

The collection of data during this test by the Cambridge Systematics development team will directly impact the ability of the IA Team to assess benefits and analyze the hypotheses presented in this document. Based on this key success factor, the IA Team was consulted during the development of this document so that their data needs and approaches were taken into account.

1.2 Background on the South Florida FRATIS Demonstration Project

The South Florida FRATIS demonstration test is focused on:

- Employment of an optimization algorithm which will allow for the technologies to work together in a way which optimizes the drayage fleet deliveries and movements based on several key constraints (e.g., time of day, predicted travel times between points on each truck's itinerary, container orders and available trucks, etc.).
- Improving the data reporting and information dissemination capabilities of public-sector emergency management officials and key supply chain partners for the delivery of disaster relief, and users of the transportation system.

The rest of this document is organized according to these two major components. A site plan and experiment plan are provided separately for each one. Section 2.0 discusses drayage optimization, while Section 3.0 describes the details of the emergency management test. Section 4.0 provides the CS team's approach to monitoring and managing the drayage optimization and emergency management tests, including keeping key stakeholders engaged and ensuring adequate use of the technology to provide useful data to the IA contractor.

Together, these areas of focus can result in significant improvements in intermodal efficiency, including reductions in truck trips and reductions in travel times. These benefits, in turn, will directly result in the public-sector benefits of congestion reduction and improved air quality. Better information flow following a natural disaster such as a hurricane, meanwhile, can lead to improved recovery times and efficient distribution of relief supplies to affected areas.[1]

The primary private-sector participant in the FRATIS South Florida demonstration project is the Florida East Coast (FEC) Railway, which is a regional railroad in Florida that also operates a fleet of drayage trucks. FEC will test the drayage optimization algorithm on 50 of their trucks operating in South Florida. FEC also will participate as a goods movement industry participant in the emergency management simulation test. Additional private firms who are typically engaged in disaster recovery efforts, such as Home Depot, Wal-Mart, and gas stations, also will be recruited to participate in the emergency management simulation.

The primary regional public-sector agencies that are supporting the test are the Florida DOT (Central Office, District 4, and District 6), the Broward and Miami-Dade Metropolitan Planning Organizations (MPO), PortMiami, Port Everglades, the Florida Division of Emergency Management, and Broward County and Miami-Dade County emergency management departments.

Technologies that will be utilized during the demonstration test include: advanced traveler information (from Nokia traffic applications), a specially designed Android application for emergency management simulation testing, and employment of an optimization algorithm which will optimize the FEC truck deliveries and movements based on several key constraints (e.g., time of day, truck/driver availability, predicted travel times, etc.).

The primary user interfaces for these technologies will be a web or Excel interface for drayage truck dispatchers to run the optimization algorithm (with a data transfer capability between the algorithm outputs and FEC's order management system, so order data need not be entered twice), and mobile device emergency status reporting for emergency management officials combined with basic reporting functionality for relief supply partners (e.g., Publix, Home Depot, etc.) as well as the general public to report on the status of key facilities such as gas stations.

This demonstration project currently is in the planning phase. Four months of baseline data collection is scheduled to begin on November 1, 2013. Following that, there will be six months of operational testing commencing on March 1, 2014.

[1] Although the emergency management component will be tested in a simulation exercise, it is expected to prove the concept of improved recovery efforts via better information gathering and dissemination.

1.3 Summary of the South Florida FRATIS Application Packages That Will be Tested

The following is a summary of the applications that will be deployed for FRATIS South Florida prototype testing:

1. **Drayage Optimization Algorithm Application.** The algorithm will optimize the daily use of FEC's trucks considering the following constraints: FEC container orders, truck inventory, and daily planning factors; time windows at each stop; driver availability including driving and duty time limits; and traffic conditions. Algorithm implementation will occur either through integration with FEC's existing systems (the preferred option) or via a simple web interface with FEC dispatchers providing the required inputs each day. If integration is possible given time and budget constraints, order entry data will be exchanged with FEC's existing order management system so that FEC staff do not have to enter the same order information twice. As part of this test, FEC dispatch staff will have access to real-time traffic and weather information. Separately, there will be a specially designed web interface for public-sector users to pull freight performance information during the test.
2. **Emergency Management Application.** This will be a specially designed Android mobile app that will facilitate information gathering and dissemination by both emergency management and nonemergency management personnel. The app will have two basic functions: the ability for app users to collect data and report conditions; and the ability to disseminate processed data to app users. App users will vary by each function. Emergency management personnel will be able to complete RECON reporting automatically instead of the paper-based method in place now. Only information deemed "need to know" to the public would be released to a wider audience; potentially sensitive data such as casualties would not be disseminated. The general public and logistics professionals, meanwhile, would be able to report on key factors such as business openings for relief supplies (e.g., Home Depot), gas station status, and status of key nodes in the freight system such as ports and rail yards. The app will be tested via a simulation exercise and will not be integrated with the larger FRATIS system (though real-time traffic via a NAVTEQ traffic feed will be incorporated into the dissemination capability).

1.4 Programmatic-Level Goals of the South Florida FRATIS Program

While the specific technical focus of this project was addressed previously, Cambridge Systematics, U.S. DOT, FDOT, PortMiami, Port Everglades, the Florida Division of Emergency Management, Broward County and Miami-Dade County emergency management departments, Broward and Miami-Dade MPOs, FEC Railway, and FCBF also hope to successfully achieve the following programmatic-level qualitative goals of this project:

- Leverage and integrate public- and private-sector data sources, and add the missing pieces;
- Test the benefits of added functionality – beyond what is readily available today;

- Support regional efforts to build trust and establish a new paradigm for cooperation within the intermodal freight industry – potentially leading to regionwide implementation;
- Build institutional support for freight-specific ITS applications; and
- Serve as an incubator for private industry – it is hoped that interested parties will further develop FRATIS functionalities and integrate them into their software offerings.

1.5 Overview of the Site and the Participants

South Florida is home to over four million residents, is visited by over 20 million tourists annually, and is the international trade gateway to the Americas. The greater Miami area is the leading U.S. port of entry for perishables, including flowers and produce. The region is home to two of the State's largest seaports that, combined, handle almost 2 million 20-foot equivalent units (TEU), over 6 million cruise passengers, and serves the petroleum needs of more than nine counties – including the jet fuel for three major international airports. The region is home to an established intelligent transportation system (ITS) program, managed by multiple traffic management centers (TMC), consisting of cameras, message boards, detectors, and analytical capabilities to give real-time information on congestion, construction, weather, and incidents.

U.S. DOT is sponsoring cutting-edge research into freight ITS solutions in the South Florida region that can help alleviate congestion, pollution, and delays while promoting improved freight mobility in the nation's major freight gateways. The purpose of project is to develop a prototype of the Freight Advanced Traveler Information System (FRATIS) bundle of applications, and conduct a small-scale prototype demonstration for assessing the effectiveness and impacts of a regional-based FRATIS implementation. "Before" and "after" data will be collected from the small-scale demonstration to support the FRATIS assessment activities. A range of public- and private-sector partners in the South Florida region are participating in FRATIS.

The key participants in the FRATIS South Florida test are summarized below (more detail on test participant roles can be found in Table 2-1).

1.5.1 Intermodal Freight and Private Industry Test Participants

- **Florida East Coast (FEC) Railway** is a Class II regional railroad operating between Miami and Jacksonville, and providing all intermodal rail service in South Florida. FEC Highway Services (a division of FEC) operates a fleet of about 100 trucks in the region, including the Broward and Hialeah intermodal ramps. (FEC also has trucks operating at its other facilities in Florida, but CS is focusing on the South Florida fleet for purposes of this test.) FEC has agreed to outfit 50 of their trucks operating primarily in South Florida with TomTom tracking devices to facilitate baseline data collection to support development of the drayage optimization component of FRATIS. Depending upon the configuration of their existing Qualcomm fleet management system and its potential interoperability with the drayage optimization algorithm being developed by team member Productivity Apex, FEC also may agree to install TomTom navigation units on these same trucks to facilitate testing of FRATIS freight traveler information and back office communications; otherwise, their existing Qualcomm units will be utilized. FEC also has agreed to participate in simulation

testing of an emergency management (EM) Android application designed to provide improved condition reporting and information collection/distribution in the event of a major natural disaster such as a hurricane.

- **Private companies that may be involved in disaster relief efforts.** After a major disaster such as a hurricane, retail consumer goods stores and gas stations often fulfill an important need for delivery of relief supplies. Examples include Lowe's, Home Depot, Publix Supermarkets, and gas stations. As part of the emergency management simulation test, the CS FRATIS team will recruit representatives from several such businesses (though not all in the region) to participate in the simulation. These officials will report simulated conditions via the Android app to facilitate proof of concept testing.
- **Florida Customs Brokers and Forwarders Association (FCBF)** is an advocacy group for the goods movement industry in South Florida. They provide access to key industry contacts to support successful testing of the FRATIS application packages in South Florida. They will primarily be an observer and advisor to the test.

1.5.2 Public-Sector Test Participants

- **Florida Department of Transportation (FDOT)** is a public-sector data user who can use the freight performance data outputs from FRATIS to help with goods movement planning and investment decision-making. FDOT District 4 also was instrumental in establishing the technical basis for a Virtual Freight Network (VFN) in South Florida. FDOT also can supply key ITS data feeds as needed, such as SunGuide roadway conditions and traffic data for the region. Officials from FDOT Districts 4 and 6 emergency operations also will support the emergency management application testing.
- **Broward and Miami-Dade Metropolitan Planning Organizations (MPO)** are the designated MPOs for Broward and Miami-Dade Counties respectively, and also are potential users of FRATIS data outputs.
- **Broward and Miami-Dade Emergency Operations Centers (EOC)** staff will participate in simulation testing of the emergency management Android app.
- **PortMiami and Port Everglades** will be expert advisors/active participants for the emergency management test.
- **Florida Division of Emergency Management** will be an expert advisor on the emergency management Android app development, and will observe simulation testing to help develop key performance metrics and lessons learned.

1.5.3 Development Team Participants

- **Cambridge Systematics, Inc.** is the prototype development (PD) contractor lead, responsible for overall task management and project coordination and ensuring that all data requirements to facilitate the impacts assessment are met.
- **Productivity Apex, Inc.** is the software development and systems engineering lead, responsible for all Agile software development and testing.
- **The University of Washington (UW)** is developing the emergency management Android app as a student capstone project through the University's Information School.

- **TomTom** is providing the fleet tracking and fleet management suite to facilitate the drayage optimization feature of FRATIS.
- **NAVTEQ** is providing traffic data to support the drayage optimization algorithm and traffic reporting features of FRATIS.

1.6 Document Organization

The remainder of this document is organized as follows:

1. **Drayage Optimization (Section 2.0).** This section provides a detailed demonstration site plan and demonstration experimental plan for the drayage optimization feature. In the demonstration site plan, the drayage optimization demonstration participants and their testing roles are described. Hardware and software necessary for successful testing are listed, including plans for installation and removal of test equipment. A site plan layout describing the test location, including key driver routes, the location of the FEC Hialeah terminal, and other key intermodal freight nodes in the region also is provided. Acceptance criteria for the drayage optimization component are described, and a high-level test schedule, including planning, preparation, and test activities is provided. The experiment plan identifies the test hypotheses for the small-scale demonstration (developed in conjunction with the IA contractor); defines the overall technical approach for optimization testing, including data needs and transmission protocols, data sharing with the IA contractor, and analytical tools needed for data collection during the demonstration; and describes the general approach for surveying FRATIS users regarding customer satisfaction and system usability.
2. **Emergency Management (Section 3.0).** This section provides a demonstration site plan and demonstration experimental plan for the emergency management test. For this component, the demonstration site plan lists the emergency management test participants and their roles; inventories any hardware and software needed to conduct the simulation; and lists the relevant acceptance criteria for the Android mobile app. The experiment plan lists key test hypotheses for emergency management (again, developed in consultation with the IA contractor); describes the approach to simulation testing, including participant recruiting and scenario development, data needs, and data sharing with the IA contractor; and preliminarily defines an approach for surveying test participants about the overall usability and suggested improvements to the Android app.
3. **Monitoring the FRATIS South Florida Region Test (Section 4.0).** This section provides detail on how the CS team intends to manage the operational test, including: monthly data reporting to the IA contractor; keeping FEC management and staff engaged throughout the drayage optimization test, including predeployment testing of the FRATIS applications packages as well as user training; regular communications with emergency management participants; and monitoring test participants' use of the applications during the test, and taking corrective action if needed to boost participation.

2.0 Drayage Optimization

2.1 Demonstration Site Plan

2.1.1 Demonstration Participants Roles

The main drayage optimization demonstration participants are presented in Table 2-1 below.

Table 2-1. FRATIS Drayage Optimization Participants, Roles, and Responsibilities

Participant	Roles and Responsibilities
Consultant Team PD contractor (Lead – Cambridge Systematics)	Project and systems engineering and development management and implementation, data collection, interfacing with the IA Team (CDM Smith) and U.S. DOT DMA Support Contractor (Noblis).
Productivity Apex, Inc.	Systems engineering and software development lead; developer of the Drayage Optimization Algorithm; deployment of TomTom devices.
Florida East Coast (FEC) Railway	Class II railroad operating from Jacksonville to Miami and providing all rail intermodal service to South Florida. Official drayage fleet test partner and key emergency management test participant.
FDOT	State DOT who can supply traffic and roadway conditions data; also public-sector freight data user who will use FRATIS data outputs for infrastructure planning and investment decision-making.
Florida Customs Brokers and Forwarders Association (FCBF)	Trade association representing the freight forwarding industry in South Florida. Provides access to industry representatives.
Broward MPO	MPO for Broward County. Potential public-sector freight data user who will use FRATIS data outputs for infrastructure planning and investment decision-making.
Miami-Dade MPO	MPO for Miami-Dade County with an active Freight Transportation Advisory Committee. Potential public-sector freight data user who will use FRATIS data outputs for infrastructure planning and investment decision-making.
GPS Tracking/Fleet Management and Traffic Information and Data Vendors (NAVTEQ and TomTom)	In-vehicle device and traffic services information vendors who will provide GPS tracking, fleet management software, historical traffic and incident data, and data support during the testing period.

2.1.2 Drayage Optimization Test Focus Area and Approach

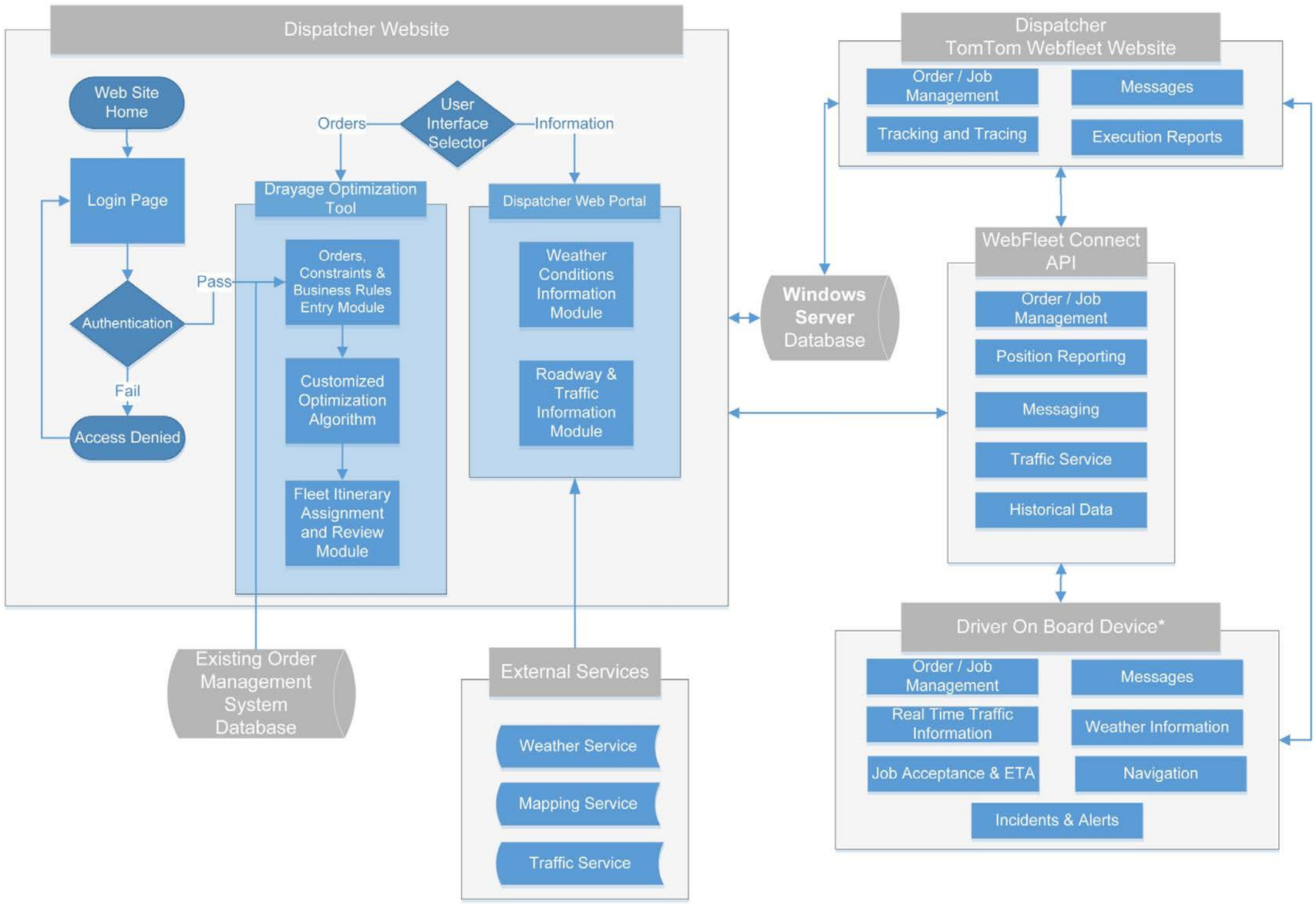
This component of the FRATIS deployment in South Florida will focus on drayage optimization. This application will provide drayage companies with daily route schedules for each driver based on customized predictive algorithms that factor in all stops and stop times associated with scheduled trips, and other constraints, including traffic/delay, average driving times, truck inventory, and driver availability. It also will improve the traveler information available to drayage fleets by way of a real-time traffic feed (provided by NAVTEQ) on the dispatcher's desktop. Additionally, there will be a weather module on the dispatch desktop with real-time weather information to assist with travel and dispatch planning. The system architecture for drayage optimization is provided in Figure 2-1.

The drayage optimization feature will involve employment of an Optimization Algorithm which will find and report to FEC dispatch staff the most efficient allocation of the 50 participating trucks to complete each day's work. The baseline starting point for this effort is the Productivity Apex (PAI) Drayage Optimization Algorithm, which was provided as a requirement in the FRATIS development RFP.

PAI is the lead systems engineer and software developer on the CS FRATIS Prototype Development (PD) team. PAI will therefore lead all algorithm development as part of the Agile software development effort, incorporating key lessons learned from the Memphis C-TIP test, as well as real-time traffic provided by NAVTEQ (an improvement over the Memphis deployment).

The constraints that the Drayage Optimization Algorithm will optimize are:

- FEC Highway Services container orders, FEC truck inventory, and daily planning factors;
- Time windows at each stop;
- Driver availability (driving hour limits and duty hour limits); and
- Predicted drayage travel times based on real-time and historical traveler information provided by NAVTEQ.



* These features are dependent upon FEC's use of TomTom in-cab navigation/communications units, or similar units that provide the same functionality and can be integrated with FRATIS.

Figure 2-1. Drayage Optimization System Architecture
(Source: Productivity Apex, Inc.)

Order entry for the algorithm will occur in one of two ways (depending upon the prospects for integration with FEC's existing order management system):

1. **Integrated order entry with file upload to PAI server (preferred option).** In this scenario, PAI staff will enter orders as they do now. Selected order data that is required for the algorithm will then be pulled from the system into a flat file or Excel spreadsheet as an input to the algorithm. Note that if FEC's system does not already capture all the data required for the algorithm to run, FEC staff will need to enter this additional information at the point of order entry (training would be provided to FEC staff prior to the onset of operational testing). Once this file is generated, it would either be directly or manually uploaded to PAI's server and processed by the algorithm, after which an optimized plan would be generated and sent back to FEC for review and implementation.
2. **Web-based interface (back-up option).** This option would be similar to the L.A. deployment in that FEC staff will enter orders into a web interface, which would then be processed by the algorithm. The disadvantage of this approach is that orders would have to be entered twice – once in FEC's order management system, and once in the web portal. Therefore, the PD team intends to pursue this option only if integration with the FEC order system proves unworkable.

In either case, the algorithm will provide an optimized plan for the day's moves that will accomplish all required moves in the most efficient manner possible, accounting for the business constraints outlined above. FEC dispatchers will have override authority at all times to respond to changing business needs. Dispatch orders will either be communicated to drivers over the phone or at the dispatch window, or pushed to drivers through in-cab navigation/communication systems.

The algorithm will utilize NAVTEQ traffic data to assist in developing an optimal daily plan. The NAVTEQ data include traffic speeds, travel times, and incidents for all Traffic Message Channel (TMC) coded roads in the South Florida region. The algorithm will use historical traffic, and real-time travel times with delays in developing the daily itinerary. These data will be made available through API call. (Note that NAVTEQ traffic data also will be displayed on the FRATIS web interface for dispatcher use in truck trip planning and resource allocation.)

An additional feature of the drayage optimization test will involve delivery of key real-time traveler information to drayage operators, as well as public-sector freight performance monitoring. More specifically, PAI will develop a traveler information "one-stop shop" web portal with real-time truck route information for FEC dispatchers. This will be a FRATIS web site which would include real-time traffic updates, incidents information, current and forecast local weather, and predictive travel time or arrival at destination information. FEC dispatchers will access the system via a desktop interface. Public-sector desktop users, for their part, will be able to generate reports describing truck routes, speeds, and congestion on major freight roadways by time of day and day of week – via the NAVTEQ information provided in FRATIS. Data of this type can be useful for freight infrastructure planning and investment decision-making.[2] This system will be largely based on NAVTEQ data, and a to-be-determined source of weather information.

[2] Please note that in a full FRATIS implementation, company-identifying data from participating firms that would be shown to the public sector would be cleansed to protect privacy.

2.2 Driver On-Board Device

The Driver On-Board Device to use in Option 1 consists of the TomTom WebFleet Tracking and Navigation System integrated with the TomTom WebFleet Web Site, the TomTom Pro 7150 Truck Navigation Device, and TomTom Link 510 GPS Tracking Device. This system creates a seamless way to manage orders, communicate with dispatchers, report positions, and provide dynamic routing all through the TomTom WebFleet Tracking and Navigation System.

The TomTom Pro 7150 Truck Navigation Device will be placed inside the vehicles and will receive the daily itinerary per truck coming from the Drayage Optimization Tool. The Pro 7150 Truck Navigation Device, in collaboration with the Link 510 GPS Tracking Device, also will receive messages from the dispatcher through the WebFleet web service (WebFleet Connect API). These messages will provide drivers with their scheduled order itineraries, which they can accept and update as they are executed through the touchscreen on the Pro 7150 Truck Navigation Device. These updates will let the dispatcher know whether or not the driver has started a job, if the job is in progress, and when the job is completed. Dispatchers also can send and receive unique messages and notifications through the WebFleet web site between themselves and the drivers. Once a driver accepts a job order, the Pro 7150 will guide the drivers to their destination using GPS technology. The device also will offer the capability of dynamic routing, rerouting the drivers in case there is an incident or traffic delay on the road, and will always take into consideration the best and fastest truck route to get to the final destination. The device also will be able to provide drivers with weather information, provided through the TomTom web service. The TomTom Link 510 GPS Tracking Device and TomTom Pro 7150 Truck Navigation Device will be installed in every truck and will be used to collect data regarding vehicle position, speed, and idling time, which may allow for stop-time data collection at specific locations for algorithm input.

2.2.1 Hardware and Software Components Required for FRATIS Drayage Optimization Testing

Hardware Components

The primary hardware component for this test is the TomTom Link 510 in-vehicle tracking device. This device will track vehicle location and key fleet metrics throughout the baseline and deployment test phases.

The other required hardware components relate to in-cab navigation and messaging. FEC is presently upgrading their Qualcomm fleet management system and plans to install new Qualcomm navigation units on all their trucks in the near future. It may be possible to integrate these with the FRATIS and TomTom systems, to enable two-way communications between dispatchers and drivers via FRATIS. If integration is not possible, another option is to purchase and use TomTom Pro 7150 navigation units, however installation of another in-cab device (beyond those already planned) is at FEC's discretion and is undecided at the time of this writing.

Software Components

A primary software component that will be developed and tested will be the FRATIS FEC dispatcher web site. This web site will provide the "one-stop shop" traveler information with real-time traffic information for FEC dispatchers. This will include real-time traffic updates, incidents information,

and predictive travel time or arrival at destination information. There also will be a weather information module with current and forecast weather conditions in the South Florida region. FEC dispatchers will access the system via a desktop web interface. This system will be largely based on NAVTEQ data. Weather information will come from a to-be-determined weather data source.

If integration with FEC's existing order management system is impractical, the dispatcher web site also will include an order entry module where FEC staff will enter each day's orders for processing by the optimization algorithm.

2.2.2 Plans for Equipment Installation, Testing, Use, and Removal

The schedule for installing and testing the required TomTom hardware is:

- Install/test Link 510 units (with support from PAI) – October 16-28, 2013;
- Begin baseline data collection – November 1, 2013;
- Install/test Pro 7150 truck units, if using (with support from PAI) – February 14-28, 2014; and
- Begin deployment test data collection – March 1, 2014.

PAI already has procured 50 TomTom Link 510 units. These will be installed on 50 trucks identified by FEC. FEC will advise PAI as to the best time to schedule installation. PAI will then install the devices (via an authorized TomTom installer) in coordination with FEC. The devices will be tested to ensure they are functioning correctly during the installation process. PAI and CS will jointly develop and furnish to U.S. DOT an equipment test/checkout report, per the statement of work.

If FEC elects to use the TomTom navigation units, FEC staff will be responsible for installing them prior to operational testing. PAI will provide appropriate guidance to complete this installation. An equipment test/checkout report will be provided for these units too, if they are used in the test.

Following the conclusion of FRATIS testing, we will abandon all equipment in place per the technical proposal and U.S. DOT guidance. This will support potential expansion of FRATIS in South Florida beyond this prototype test. Should test participants wish to continue using the TomToms, they would assume any associated subscription fees. (If permission is not granted to abandon the equipment in place, CS will work with FEC and PAI to collect the devices deliver them to U.S. DOT at the conclusion of the project.)

2.2.3 Demonstration Site

The following maps show the locations of the drayage optimization demonstration sites. Figure 2-2 is an aerial photo of the FEC terminal, located in Hialeah, Florida. Figure 2-3 shows the South Florida study area, including Broward and Miami-Dade Counties, with the associated major freight hubs (PortMiami, Port Everglades, the FEC yard, and Miami International Airport) and key freight corridors. Trucks access the FEC ramp via SR 934 and NW 69th Avenue. I-95 is the predominant north-south freight corridor. Connections to Port Everglades are provided by I-595 and SR 84, while I-395 connects to PortMiami. I-75, U.S. 27, SR 821, SR 826, and the Florida Turnpike provide access to the warehouses and distribution centers clustered in western Miami-Dade County.

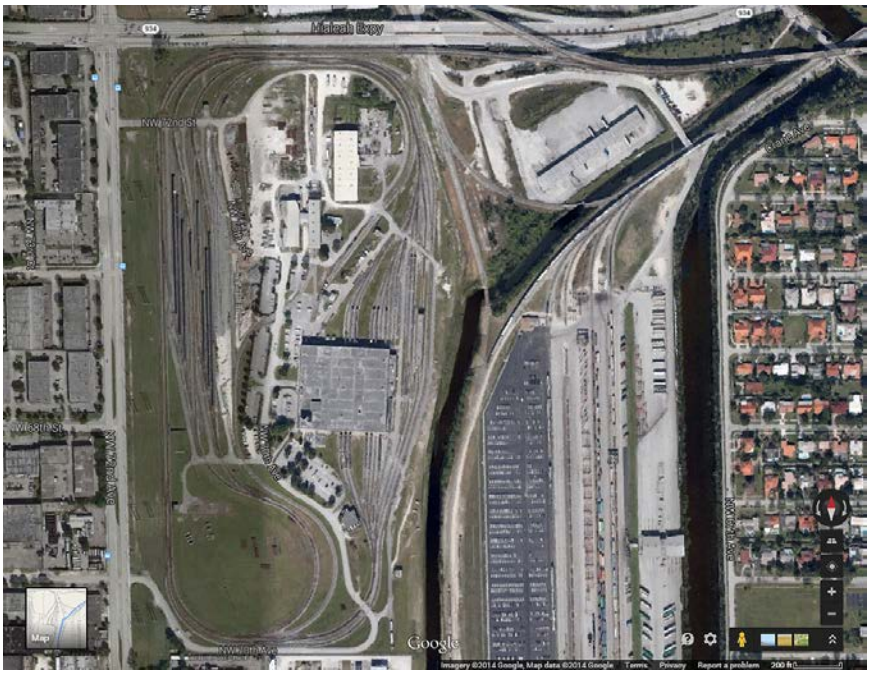


Figure 2-2. FEC Hialeah, *Aerial View*
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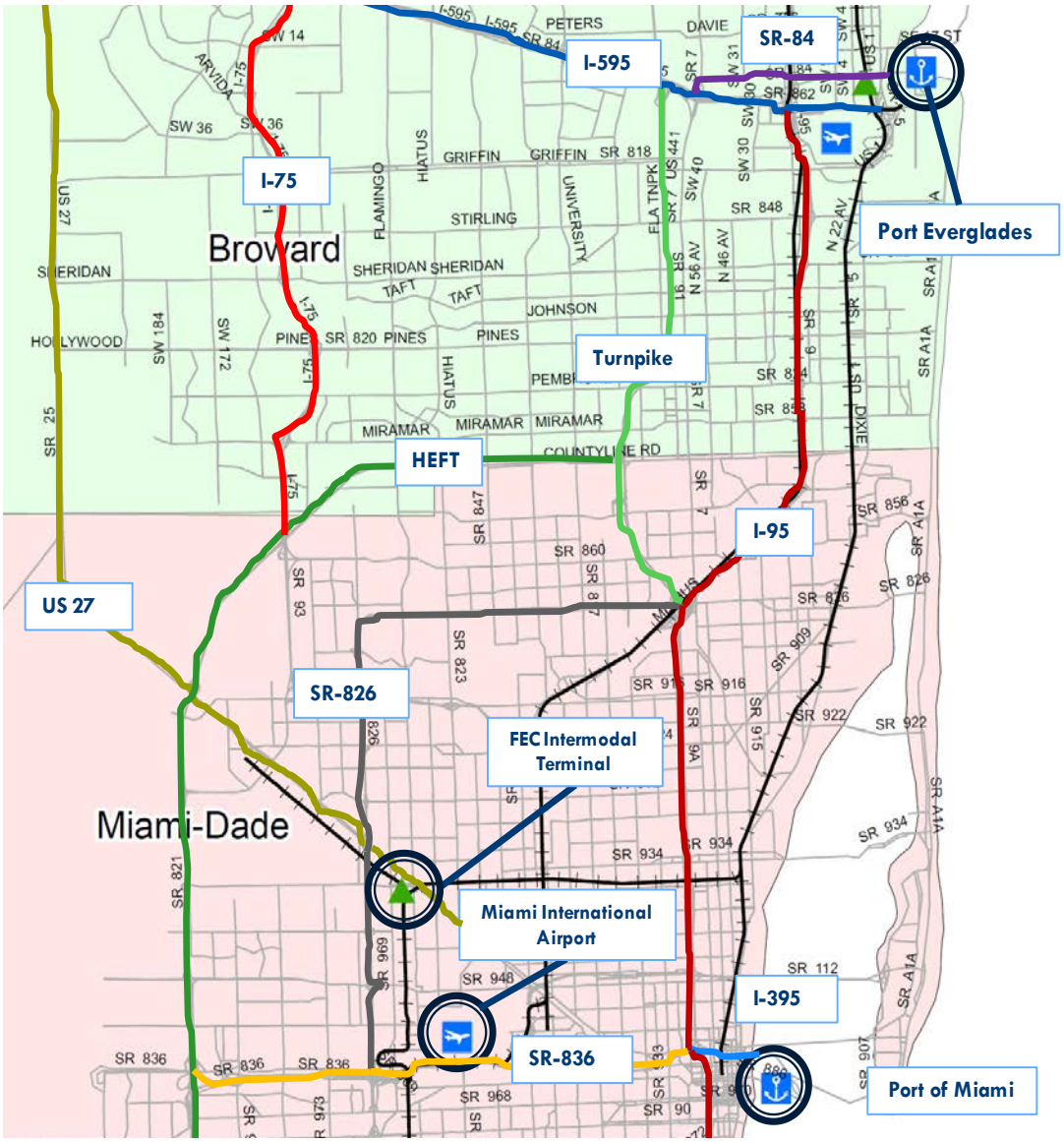


Figure 2-3. South Florida Drayage Optimization Study Area, Broward and Miami-Dade Counties (Source: Cambridge Systematics, Inc.)

2.2.4 FRATIS Drayage Optimization Acceptance Test Plans and Criteria

The CS team developed acceptance criteria for each user story contained in the backlog. These criteria will validate successful implementation of each user story through the Agile software development process. The FRATIS acceptance criteria related to drayage optimization are shown below in Table 2-2 and are grouped by user type. One key caveat here to note – many of these acceptance criteria assume that certain information is fully made available by terminals and dispatchers; in the event that this data is not made available from private sector participants to the CS Team, then the relevant acceptance criteria associated with those data issues shall be considered to be voided.

Table 2-2. FRATIS Drayage Optimization Acceptance Criteria

User	Acceptance Criteria
Dispatcher	Can view real-time traffic conditions and congestion on the desktop.
	Can track ability to meet scheduled pickups/dropoffs by linking vehicle location with time stamp to defined appointment windows.
	Can view current real-time traffic information for freeways, port and terminal intermodal connectors, and major freight arterials within the covered region from dispatcher's computer terminal.
	Can view tractor location and speed from dispatcher's computer terminal.
	Can view real-time weather information from dispatcher's computer terminal.
	Can sort available orders by appointment time from dispatcher's computer terminal.
	Can sort available orders by shipper from dispatcher's computer terminal.
	Can sort available orders by consignee from dispatcher's computer terminal.
	Can optimize the daily load plan to minimize unproductive moves.
	Can view reassignment options from dispatcher's computer terminal.
	Can obtain incident information on freeways, port and terminal intermodal connectors, and major freight arterials within the covered region from dispatcher's computer terminal.
	Can obtain historical traffic data by time of day and day of week for freeways, port and terminal intermodal connectors, and major freight arterials within the covered region from dispatcher's computer terminal.
Driver	Drivers can receive real-time incident information for incidents on freeways, port and terminal intermodal connectors, and major freight arterials within the region (when provided by dispatch).
	Drivers can receive notification from dispatch with potential alternate routes when the current/planned route coincides with newly discovered or predicted congestion.
Public Sector	Public-sector users will receive downloads of summary files in PDF format from the FRATIS TomTom system, which will include information on truck routes recommended, truck routes taken, and alternate routes taken.
	Public-sector users will receive login access to the FRATIS NAVTEQ system, which will allow for retrieval of a variety for transportation movement data for the South Florida region, including speed, congestion, and incident information.

2.2.5 Demonstration Schedule for Planning, Purchasing, Preparation, Testing, and Operation of FRATIS Equipment

- Install TomTom Link 510 on 50 FEC trucks (October 16-28, 2013).
- Impacts Assessment (IA) Team Baseline Raw Data Collection Feed from Project Team (November 1, 2013 through February 28, 2014):
  - TomTom WebFleet data (to be provided on or before November 1, 2013); and
  - NAVTEQ traffic data (currently pursuing contract; access to evaluation data already granted).
- Project Team Baseline Data for Drayage Optimization Development (November 1, 2013 through February 28, 2014):
  - Currently developing approaches to collect data from FEC; and
  - Also to be made available to Impacts Assessment Team.
- Data Collection/System Use Training at FEC (planned for the last two weeks of February 2014).
- Operational Test Data Collection (March 3-September 1, 2014):
  - PAI is developing automated approach (expected to be complete by September 15);
  - PAI may use special automated tool (note: this is being funded separately by U.S. DOT – please contact Randy Butler regarding the current status and plans for this tool);
  - IA Team to be provided monthly outputs; and
  - Major portions of data to support "with" and "without" evaluations by the IA Team.

Drayage Partner Business Process Maps

Business process maps for FEC were delivered to U.S. DOT previously under separate cover and are incorporated here by reference.

2.3 Demonstration Experiment Plan – Drayage Optimization

This Experiment Plan provides input to the IA Team to assist them in their conduct of the Impacts Assessment for the drayage optimization piece. The hypotheses and information provided here is the PD Contractor's recommended approach for the conduct of the drayage optimization Impacts Assessment. Finalizing this approach and assessing data to support or reject these hypotheses is the responsibility of the IA Team. The PD Team's responsibility is to provide the IA Team with access to the raw data, both baseline and operational, which will allow the IA Team to perform their assessment of impacts.

2.3.1 FRATIS Drayage Optimization Experiment Design

The FRATIS South Florida drayage optimization prototype test hypotheses were developed based on the prototype backlog user stories related to:

- Drayage Optimization;
- Roadway Traffic and Construction; and
- Public Sector Freight Performance Monitoring.

The hypotheses below were developed in full consultation with the IA team and as guided by the most current version of their *Impact Assessment Plan*. The FRATIS test hypotheses and the technical approach for prototype testing are described below.

2.3.2 Drayage Optimization Test Hypotheses

The proposed test hypotheses related to drayage optimization are summarized in Table 2-3.

Table 2-3. Proposed FRATIS Drayage Optimization Test Hypotheses

System	Elements	Test Hypothesis
Drayage Optimization	Order entry – integrated file transfer from FEC's existing system, or manual entry through a web portal. Optimization algorithm – Runs on PAI server and provides a daily plan that will maximize productive moves and minimize nonproductive ones, accounting for historical traffic and other factors. Dispatch – FEC dispatchers can accept or reject algorithm recommended moves based on business needs; they will communicate instructions as they do now or using TomTom devices.	The drayage optimization algorithm will provide an optimized plan for the day's moves that will accomplish all required moves in the most efficient manner possible, accounting for the business constraints – this will result in reduced miles traveled, reduced trips, fewer bobtails, less bobtail miles, and corresponding reductions in emissions. The traveler information web portal will provide dispatchers with better travel data which will improve drayage trip planning.
	Traveler information web site "one-stop shop" with real-time traffic information for dispatchers. Public sector freight performance monitoring – web site with freight movement data compiled throughout the test.	Public agencies will use data generated by FRATIS to assist in freight planning and investment decision-making.

2.3.3 Technical Approach

The key steps involved in conducting the FRATIS drayage optimization prototype test in the South Florida region are provided below.

Define Test Schedule

The test schedule is outlined Section 2.2.1 above.

Define Data Needs, Data Format, Data Transmission Protocols, Data Quality Procedures

Table 2-4 summarizes the data requirements and potential sources to support assessment of the FRATIS South Florida drayage optimization prototype, organized by test hypothesis.

Table 2-4. FRATIS South Florida Data Requirements and Sources

Hypothesis	Data Needed to Test	Source(s)
The drayage optimization algorithm will provide an optimized plan for the day's moves that will accomplish all required moves in the most efficient manner possible, accounting for the business constraints – this will result in reduced miles traveled, reduced trips, fewer bobtails, less bobtail miles, and corresponding reductions in emissions.	• Daily number of bobtail moves. • Daily number of bobtail miles. • Daily optimized plan – driver assignments and sequence. • Daily execution – driver assignments and sequence.	• FEC manifest records. • TomTom WebFleet, or Qualcomm fleet management if available/compatible. • Daily algorithm plans (spreadsheet, flat file, or other format). • Daily execution (TomTom or Qualcomm fleet management if available/compatible). • Interviews with dispatchers and operations managers.
Public agencies will use data generated by FRATIS to assist in freight planning and investment decision-making.	• Anonymous truck movement data – routes, speeds, alternate routes. • Congestion on truck routes. • Construction projects on truck routes.	• TomTom WebFleet PDF outputs. • NAVTEQ traffic feed access. • Interviews with officials.

Based on the testing hypotheses, the FRATIS team will work with the IA team on their data needs to develop the data format/data quality procedures and as guided by the Impact Assessment Plan.

The data will address the following performance measures and quantitative targets:

- Reduce number of bobtail trips by: 10 percent (near), 15 percent (mid), 20 percent (long). This is a count of the number of trips in which a truck is not carrying a chassis, trailer, or container. Typically drivers are not paid for bobtails, so they represent unproductive, albeit sometimes necessary, moves. A key objective of FRATIS is to reduce the number of bobtail trips in the test period compared with the baseline.
- Reduce Travel time by: 15 percent (near), 17.5 percent (mid), 20 percent (long). This represents the time from an origin (typically a customer with a loaded container) to a destination (a rail or ocean terminal, or the reverse trip of a load from the line haul carrier to a consignee site). Travel time can obviously vary by time of day and is affected by traffic conditions. The premise is that with better information and optimal routings based on FRATIS traveler information and optimization tools the average travel time for a drayage fleet will decrease.
- Reduce Fuel consumption by: 5 percent (near), 10 percent (mid), 15 percent (long). This is directly related to travel time, but also is affected by unexpected or long delays. The presumption is that fuel consumption will decrease because of optimal routings and the ability to find alternate routes in real time that may allow a truck to keep moving and avoid incidents or areas of major congestion.
- Reduce level of criteria pollutants and greenhouse gas equivalents criteria pollutants by: 5 percent (near), 10 percent (mid), 15 percent (long) This is directly related to

travel time, but also is affected by unexpected or long delays. The presumption is that fuel consumption will decrease because of optimal routings and the ability to find alternate routes in real time that may allow a truck to keep moving and avoid incidents or areas of major congestion.

- Reduce GHG by: 5 percent (near), 10 percent (mid), 15 percent (long). If fuel consumption is lower, then the related emissions from the trucks will be lower. In addition, shorter idling time or avoidance of sitting in traffic also will help to reduce emissions.

It is important to note here that FRATIS drayage optimization is by definition a "small-scale test." As such, a main function of the IA Team's assessment shall be to take limited data from this small-scale test, and extrapolate benefits based on a much wider potential use of this system. More specifically, this test involves just one trucking company. Thus, the IA team should plan on develop mathematical relationships or qualitative case study/interview approaches than can support development of benefits for a notional case that the entire South Florida intermodal community deployed FRATIS.

Define or Develop Analysis Tools Needed

The drayage optimization analysis tool will be based on data from:

- The FRATIS test drayage tool and resulting measurements. PAI's has developed codes for "Freight Actions" that might be performed at each stop which include:
  - PE: Pickup Empty;
  - PEWC: Pickup Empty with Chassis;
  - DE: Dropoff Empty;
  - DEWC: Dropoff Empty with Chassis;
  - PL: Pickup Loaded;
  - PLWC: Pickup Loaded with Chassis;
  - DL: Dropoff Loaded;
  - DLWC: Dropoff Loaded with Chassis;
  - LL: Live Load; and
  - LU: Live Unload.
- Truck and fleet travel statistics (travel time, travel distances, etc.) – this will be captured by the TomTom WebFleet system. These data include:
  - Truck ID;
  - Trip travel time;
  - Data and time stamps;
  - Stop time; and
  - Routing Information.

Dispatcher or drayage company daily operating statistics – these statistics will be drawn from data captured by the TomTom WebFleet system. This will assist in recording FEC dispatchers' adherence to the FRATIS recommended plan, and if alternative or improved routes suggested by the optimization tools are accepted (assuming FEC deploys and utilizes the TomTom Navigation units, or their Qualcomm units have a similar capability and can be accessed by API or similar).

- **Regional travel and weather statistics.** Traffic statistics will be as provided by the traffic data vendor NAVTEQ. These statistics will collect basic regional operating and location information and display summarized outputs that will be available to the assessment team. This information will provide route and corridor conditions that might be impacted by construction, crashes, and incidents. Historical weather data gathered during the test will support assessment by the IA team of any special weather conditions during the baseline or operational deployment phases that may have impacted freight operations.
- **Port authority freight volume statistics.** Where applicable, the assessment team will access publicly available web-based information about operations at PortMiami and Port Everglades, including the number of ship call and container movements. FEC also may provide volume statistics at their Hialeah ramp. These data can be used to adjust for seasonal patterns and/or to estimate potential FRATIS benefits from a regionwide implementation.

The PD contractor will assemble, package, and deliver to the IA team all fleet performance and other metrics necessary to support the Impacts Assessment. Data will be provided in Microsoft Excel format for the Optimization Algorithm and TomTom outputs, and direct login access for NAVTEQ. The IA contractor will be responsible for normalizing month-to-month freight volume data to isolate the impact of FRATIS on regional freight operations.

Define Expected Results

The expected results will be based on the test hypotheses as developed by the FRATIS and IA teams. The hypotheses are outlined in Section 2.3.2 above.

Conduct Beta Test With Selected Stakeholders and Refine Test Process

The beta test will be developed based on the concepts as outlined in the Agile software development approach.

Install Test Equipment

As detailed above, PAI will coordinate the hire of a TomTom certified installer who will install Link 510 units on 50 FEC trucks. Installation scheduling will be coordinated with FEC. If FEC elects to install the Pro 7150 navigation units, this installation will be conducted by FEC under the direction of PAI.

Archive and Analyze Test Data and Provide a Data Feed to the IA Contractor

A FRATIS project Dropbox account has been set up and is available to the IA and FRATIS team. The Dropbox account is a fully capable Dropbox for Business account, which provides access for one year for all test participants, U.S. DOT, the IA Team, and Noblis. All key stakeholders have received invitations to this premium account.

Share Data and Results with Impacts Assessment Contractor

There is ongoing coordination between the FRATIS team and IA contractor. The IA Team is responsible for establishing the context for daily operations, including obtaining real-time or historic traffic data and incident data from publicly available regional systems. The PD team will

support the IA team and provide daily or other regular access to TomTom WebFleet, other FEC data outputs, and the drayage optimization software. A member of the PD team (Roger Schiller) will coordinate data deliveries with the IA team lead.

2.3.4 Customer Satisfaction and Usability Survey Test Plan

The FRATIS team is working with IA contractor to develop a survey or interview instrument and a question set. This approach will depend, at least in part, on specifics of the operational test (for example, fleet penetration or use amongst the FRATIS test fleet).

1. Purpose and objectives of the test

The user needs analysis results will provide validation for the usability of FRATIS to the project stakeholders. The specific hypothesis questions that require validation by survey results are indicated in Table 2-4 and noted as either interview or survey data requirements.

2. Technical Approach

Key steps for the customer satisfaction and usability survey test are provided below.

Review Existing Feedback from Participants and Other Projects

This step will collect and review existing feedback from FRATIS participants using face to face meetings, if possible, or telephone interviews. Participants will include:

- Truck drivers selected from the FEC driver pool. There are 50 trucks participating in the test and the initial survey will involve 10 to 15 key drivers.
- FEC dispatchers. Each FEC dispatcher will be interviewed.
- Selected public-sector participants from the Broward and Miami-Dade MPOs, as well as FDOT Districts 4 and 6.

Develop a Survey Instrument for FRATIS Test Participants

The IA team is the lead for developing survey instrument but the FRATIS team will develop some questions to include in the survey. These questions would be related to the user interface and operational experience with FRATIS. A single survey will be sufficient for both teams and assumes that careful survey design will be able to explore FRATIS both for the baseline and after installation.

Develop Survey Methodology

The survey methodology will be selected by the IA and PD teams. Options include in an interview, mail back form, or on-line format. A small pilot survey will be completed to ensure the survey instrument is effective.

Define Expected Results

This step will be completed in conjunction with the previous step and will be guided by the test hypothesis.

Conduct Survey

The Impact Assessment contractor will conduct the survey.

Analyze and Report Results

The Impact Assessment contractor will analyze the survey results, with support as necessary from the Prototype Development contractor.

Document any Modifications Recommended for Future Deployments

Based on the results of the survey and any interviews conducted, the Prototype Development contractor will develop a list of recommended improvements, additions, or modifications for consideration in future FRATIS or similar deployments.

2.3.5 Data Sharing and Archiving

Implementation Plan for Working with the IA Contractor

The FRATIS team will have regular meetings with the IA team and will develop and implement the data sharing approach with the IA team. The FRATIS team will assist the IA in designing an approach to provide for transformative benefits measurement. The PD contractor lead interface with the IA team (Roger Schiller) will upload all periodic data deliveries to Dropbox and answer questions the IA team has about any of the data supplied.

Plan for Data Archiving

There is a project Dropbox account for exchanging documents and storing data. This account will be formatted so that any document placed in the Dropbox is a copy and if any data is lost it is easily replaceable. Backup copies of all data outputs will be stored on CS and/or PAI servers.

Use of U.S. DOT Research Data Exchange

As required, the FRATIS deployment team will transfer all nonproprietary and nonconfidential data to the U.S. DOT's Research Data Exchange at conclusion of the test. This is expected to involve a transfer of all data files from the FRATIS Dropbox for Teams Account to the U.S. DOT RDE web site. Data here means all major project deliverables, all data that was collected and provided to the IA team, and all open source software developed by PAI for FRATIS under this contract.

3.0 Emergency Management

3.1 Demonstration Site Plan

3.1.1 Demonstration Participants and Roles

The main emergency management demonstration participants are presented in Table 3-1 below.

Table 3-1. FRATIS Emergency Management Simulation Participants, Roles, and Responsibilities

Participant	Roles and Responsibilities
Consultant Team PD contractor (Lead – Cambridge Systematics)	Project and systems engineering and development management and implementation, data collection, interfacing with the IA Team (CDM Smith) and U.S. DOT DMA Support Contractor (Noblis).
University of Washington Information School	Student from UW will develop the emergency management Android app with support from CS.
Florida East Coast (FEC) Railway	Class II railroad operating from Jacksonville to Miami and providing all rail intermodal service to South Florida. Expert industry advisor and will participate in app simulation testing, reporting on key rail intermodal facilities.
FDOT (Districts 4 and 6, and Central Office)	State DOT engaged in disaster recovery efforts. District 4 and District 6 emergency management staff will be active participants in simulation testing of the mobile emergency management reporting and dissemination app.
Traffic Information and Data Vendor (NAVTEQ)	Traffic services information vendor who will provide real-time and historical traffic data, and data support during the testing period.
PortMiami and Port Everglades	Major seaports in the region. Officials will participate in the simulation test with port/terminal status reporting through the mobile app.
Broward and Miami-Dade Emergency Operations Centers (EOC)	Key disaster recovery and mitigation agencies in the South Florida region. Officials will participate in the simulation test.
Private businesses involved in disaster relief delivery (e.g., Home Depot/Lowe's, gas stations, Wal-Mart, supermarkets)	Will participate in simulation exercises and report on status of key business openings.
Florida Division of Emergency Management	State headquarters and operations center for disaster preparation and recovery. Will advise on mobile app development and observe simulation testing and results.

3.1.2 FRATIS Emergency Management Test Focus Areas and Approach

This component of the FRATIS deployment in South Florida will focus on emergency management. This application will enable a mobile reporting platform for emergency management officials, key regional businesses that distribute supplies, truck drivers, and the general public; information would then be distributed as required to a wider user community, providing near real-time dissemination of important disaster recovery updates. The mobile app (designed for Android devices) will allow emergency management staff to replace current paper-based reporting with real-time mobile reporting of infrastructure damage and other information. Other users (such as truck drivers and key businesses) will be able to report on business openings, relief supply availability, road status, and other features. It also will incorporate real-time traffic (via NAVTEQ), while tracking and mapping user locations to enable better road closure information reporting and distribution.

The emergency management component will be a standalone Android mobile app designed to facilitate more efficient gathering and dissemination of crucial transportation and other information after a major disaster such as a hurricane. Figure 3-1 provides an overview of how the app will work (this architecture may change slightly depending on UW needs during development, but the basic functionality will remain the same). The app will have two essential functions: the ability for app users to collect data and report conditions (left-hand side of Figure 3-1); and the ability to disseminate processed data to app users (right-hand side of the figure). These functions are described in greater detail in the following subsections.

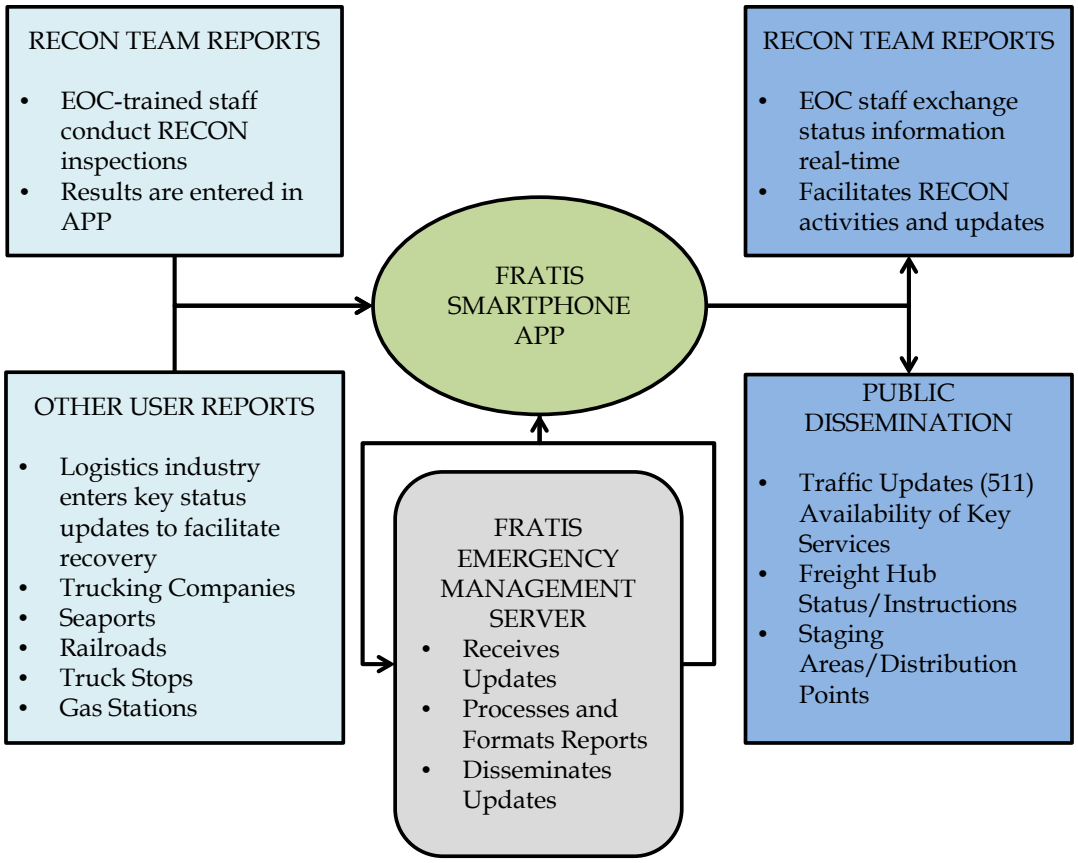
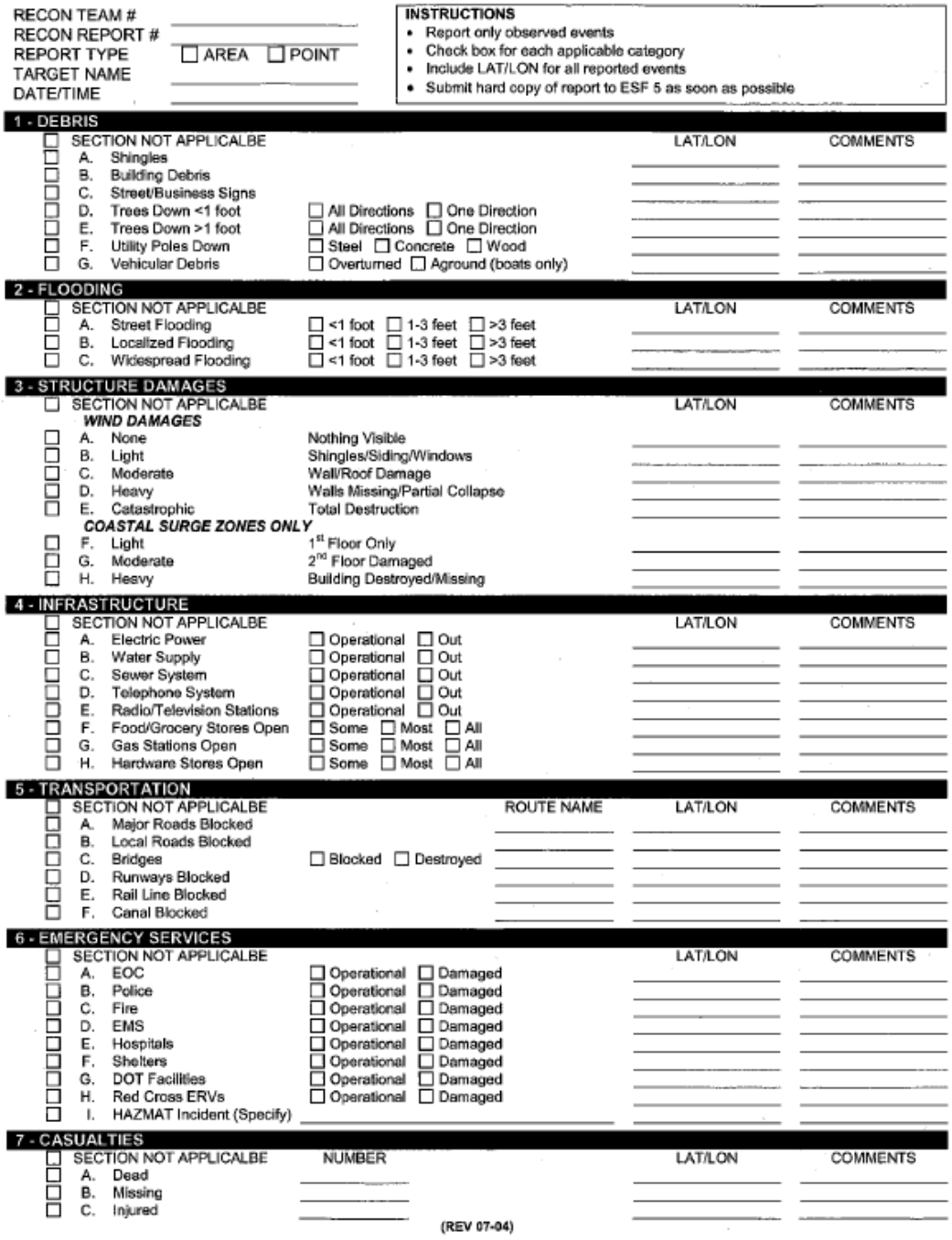


Figure 3-1. Overview of FRATIS Smartphone Application
(Source: Cambridge Systematics, Inc.)

Reporting of Information

There are two types of app users for reporting purposes: emergency management personnel and nonemergency management personnel. The emergency management personnel will be the primary group responsible for actively reporting roadway status. They will do this consistent with their current manual process. For this reporting, use of a user login will be required to ensure the RECON reports are being completed by trained and authorized personnel.

Currently, emergency management officials rely on a paper-based form of reporting by RECON teams. The disadvantage to this reporting is that no information can be processed until teams return to the emergency operations center. The information must then be manually entered into the system. By creating a mobile functionality, this information can be reported, processed, and addressed sooner. For instance, the mobile app will automatically record location information and timestamp without any user entry. Since the existing RECON teams already have been trained on the current reporting methods; the FRATIS app will mirror these methods albeit as an electronic form. One additional feature to enhance this reporting would be the ability to attach an image of the location. The emergency management personnel user interface will be modeled on the existing paper-based RECON reporting system, with potential additional data elements as deemed necessary. GPS mobile device 'pings', along with NAVTEQ traffic data, will show roads which already have been traveled and are therefore open without any effort on the users' part.



RECON TEAM # _____
RECON REPORT # _____
REPORT TYPE ☐ AREA ☐ POINT
TARGET NAME _____
DATE/TIME _____

INSTRUCTIONS
- Report only observed events
- Check box for each applicable category
- Include LAT/LON for all reported events
- Submit hard copy of report to ESF 5 as soon as possible

1 - DEBRIS

			LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE			
☐	A. Shingles			
☐	B. Building Debris			
☐	C. Street/Business Signs			
☐	D. Trees Down <1 foot	☐ All Directions ☐ One Direction		
☐	E. Trees Down >1 foot	☐ All Directions ☐ One Direction		
☐	F. Utility Poles Down	☐ Steel ☐ Concrete ☐ Wood		
☐	G. Vehicular Debris	☐ Overturned ☐ Aground (boats only)		

2 - FLOODING

			LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE			
☐	A. Street Flooding	☐ <1 foot ☐ 1-3 feet ☐ >3 feet		
☐	B. Localized Flooding	☐ <1 foot ☐ 1-3 feet ☐ >3 feet		
☐	C. Widespread Flooding	☐ <1 foot ☐ 1-3 feet ☐ >3 feet		

3 - STRUCTURE DAMAGES

			LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE			
	WIND DAMAGES			
☐	A. None	Nothing Visible		
☐	B. Light	Shingles/Siding/Windows		
☐	C. Moderate	Wall/Roof Damage		
☐	D. Heavy	Walls Missing/Partial Collapse		
☐	E. Catastrophic	Total Destruction		
	COASTAL SURGE ZONES ONLY			
☐	F. Light	1st Floor Only		
☐	G. Moderate	2nd Floor Damaged		
☐	H. Heavy	Building Destroyed/Missing		

4 - INFRASTRUCTURE

			LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE			
☐	A. Electric Power	☐ Operational ☐ Out		
☐	B. Water Supply	☐ Operational ☐ Out		
☐	C. Sewer System	☐ Operational ☐ Out		
☐	D. Telephone System	☐ Operational ☐ Out		
☐	E. Radio/Television Stations	☐ Operational ☐ Out		
☐	F. Food/Grocery Stores Open	☐ Some ☐ Most ☐ All		
☐	G. Gas Stations Open	☐ Some ☐ Most ☐ All		
☐	H. Hardware Stores Open	☐ Some ☐ Most ☐ All		

5 - TRANSPORTATION

			ROUTE NAME	LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE				
☐	A. Major Roads Blocked				
☐	B. Local Roads Blocked				
☐	C. Bridges	☐ Blocked ☐ Destroyed			
☐	D. Runways Blocked				
☐	E. Rail Line Blocked				
☐	F. Canal Blocked				

6 - EMERGENCY SERVICES

			LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE			
☐	A. EOC	☐ Operational ☐ Damaged		
☐	B. Police	☐ Operational ☐ Damaged		
☐	C. Fire	☐ Operational ☐ Damaged		
☐	D. EMS	☐ Operational ☐ Damaged		
☐	E. Hospitals	☐ Operational ☐ Damaged		
☐	F. Shelters	☐ Operational ☐ Damaged		
☐	G. DOT Facilities	☐ Operational ☐ Damaged		
☐	H. Red Cross ERVs	☐ Operational ☐ Damaged		
☐	I. HAZMAT Incident (Specify)	_____		

7 - CASUALTIES

			NUMBER	LAT/LON	COMMENTS
☐	SECTION NOT APPLICALBE				
☐	A. Dead				
☐	B. Missing				
☐	C. Injured				

(REV 07-04)

Figure 3-2. Existing RECON Report
(Source: Florida Department of Transportation.)

Nonemergency management users of the app will focus on other status reporting. Additional information of use to the trucking community and general public relates to port status, gas station availability, and other key business openings. Businesses such as gas stations, Publix, Home Depot, or Wal-Mart will be able to self-generate status updates indicating whether they have power, if they are open, what types of fuel they have (for gas stations), and any comments

regarding building damage, supply availability, etc. Other users also would be able to enter similar reports for wider distribution via the app.

The locations of major freight hubs in South Florida will be preloaded in the system to enable status reporting by app users. Users would be able to report on the overall status of a port or intermodal terminal (e.g., Open, Partially Open, Closed, or Damaged), as well as general information like staging locations for trucks or nearby hazards. Passively collected GPS pings also could be used to estimate wait times at hubs for distribution to the wider user group. If drivers encounter conditions which emergency personnel are not aware of but might like to know (such as Goods Available for Distribution, Goods Being Distributed, or Severe Roadway Damage), they also would be able to report that.

Dissemination of Information

Information collected through this app falls into one of three categories:

- **Information collected by emergency management.** This data must first be processed through the Emergency Operations Center (EOC) before being disseminated to the public. All data collected can be compounded into a single spreadsheet with each collection item in a different column; selected data deemed relevant for truck drivers would then be distributed to the wider user group. The app will not display any casualty information to the general public. Information related to roadway closures will be shown on a map (as determined by the latitude/longitude affiliated with that report) of the area with dots (unless lines can be drawn) indicating each report. Users can then click on a particular location to view more information.
- **GPS location data.** GPS pings do not need to be processed and can be automatically uploaded to the map (with some amount of delay to protect user privacy). A visual depiction of the number of pings received for a particular roadway can provide users with a confidence level in the reports and data accuracy. The combination of this with road closure reports will give users an overall picture of the connectivity of the network. The traffic feed data will supplement EOC condition/user reporting, for instance on roadways that are not priorities for EOC status reporting and reopening.
- **Information collected by nonemergency management users.** This data also can be disseminated immediately upon request by a user. Gas stations will be found by selecting a desired fuel type and displaying the nearest locations with that fuel availability. Once a station is selected, the app will give the option to view the location on the map of roadways. In doing so, a driver can determine if the station is accessible from their current location based on roadway closures. Similar to how it was collected, this information can only be accessed by a driver who is not in motion or a passenger in a vehicle. For other business types, users could search by name or by type of business to view open businesses with locations displayed on a map. For the freight hubs, all locations within a 100-mile radius will be shown, sorted by distance from the user. Each will indicate Open or Closed, distance (calculated by the difference between user pings and facility location), and average wait time (if available). Clicking on the name of a specific hub will display all alerts uploaded by users listed from newest to oldest. It is important to note here that not all gas stations, home improvement stores, supermarkets, and other related businesses will be involved in this test – rather,

several example businesses from these categories will be recruited to participate and will provide simulation data for their locations only. Therefore, the app will not have information for all businesses in the study region that are relevant for emergency management, with the exception of intermodal freight hubs since there are relatively few of them and their key attributes are readily available.

Note that the emergency management app will be simulation tested in a standalone fashion. There will be no integration with the South Florida FRATIS prototype, nor will there be a direct connection to Florida's Incident Command System (though such connections could potentially be added in future).

3.1.3 Hardware and Software Components Required for FRATIS Emergency Management Mobile Application Simulation Testing

Hardware Components

It may be necessary to purchase a limited number of prepaid Android smart phones to facilitate simulation testing of the emergency management mobile app – the PD contractor team is presently in discussions with key stakeholders to determine the best approach to this test.

Software Components

No special software is expected to be purchased at this time. It is assumed that UW has all of the required tools and software to develop a mobile application at its disposal. The purchase of some cloud-based server space (e.g., Rackspace or Amazon) may be needed to facilitate app testing.

3.1.4 Plans for Equipment Installation, Testing, Use, and Removal

If prepaid Android phones are required, they will be purchased in winter/spring 2014 to enable sufficient time for initial user training and any bug fixes. The devices will be prepaid sufficient to complete all simulation exercises (expected in May 2014).

Following the conclusion of FRATIS testing, we will abandon any equipment in place per the technical proposal and U.S. DOT guidance. This will support potential expansion of FRATIS in South Florida beyond this prototype test. Should test participants wish to continue using the phones, they would assume any associated subscription fees. (If permission is not granted to abandon the equipment in place, CS will collect the devices and deliver them to U.S. DOT at the conclusion of the project.)

3.1.5 Demonstration Site

Figure 3-3 shows the South Florida emergency management study area, including Broward and Miami-Dade Counties, with the associated major freight hubs (PortMiami, Port Everglades, the FEC yard, and Miami International Airport) and key freight corridors. The Broward and Miami-Dade EOCs also are shown. Note that this map provides examples of the types of businesses (gas stations, supermarkets, home improvement stores, etc.) that might be involved in app testing. Not all of these locations or those like them will be included in the app, nor will they all be participating in the test. However, users will be able to generate reports for these types of businesses as part of the proof of concept simulation test.

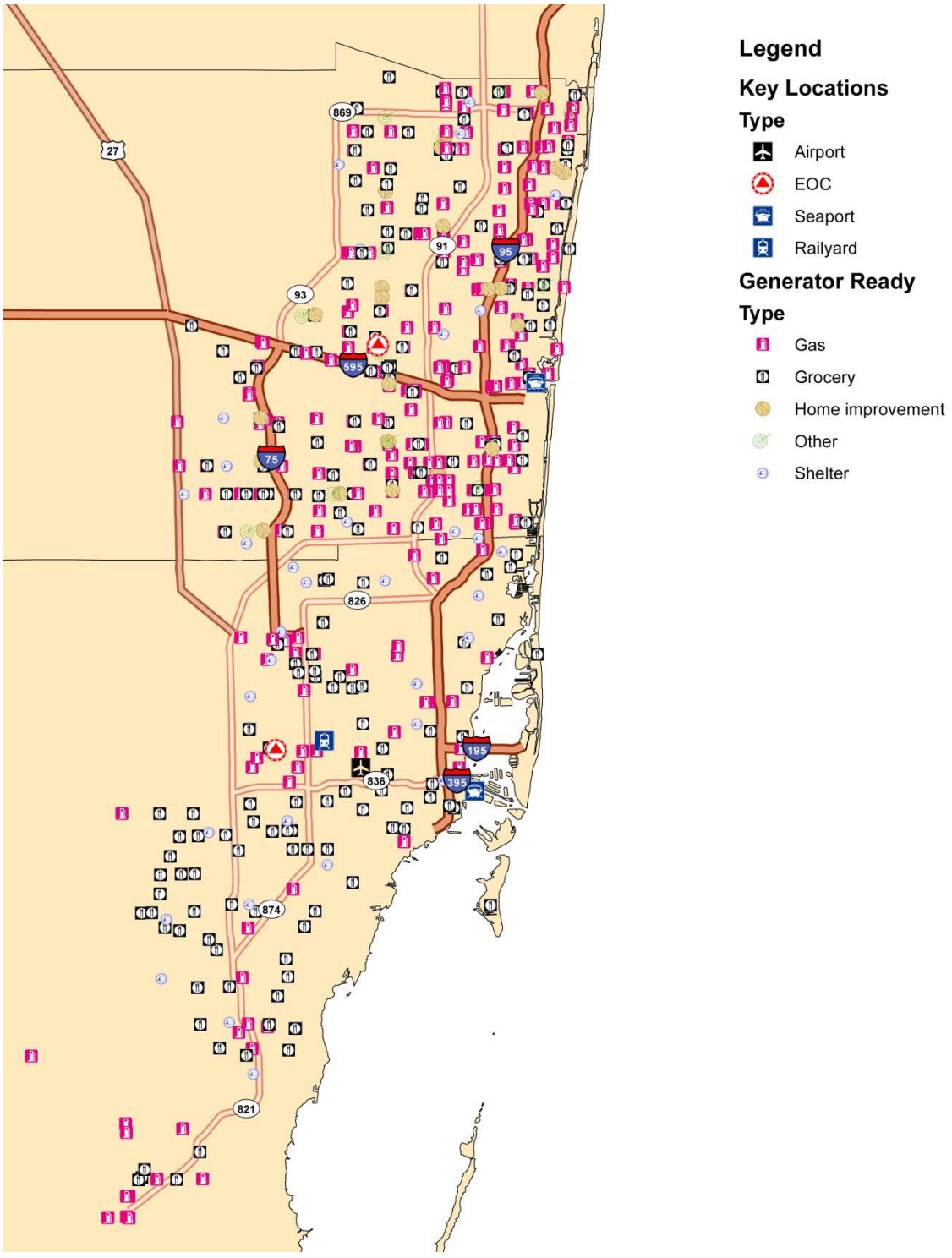


Figure 3-3. South Florida Emergency Management Study Area,
Broward and Miami-Dade Counties
(Sources: Cambridge Systematics, Inc. and InfoUSA)

3.1.6 FRATIS Emergency Management Acceptance Test Plans and Criteria

The CS team developed acceptance criteria for each user story contained in the backlog. These criteria will validate successful implementation of each user story through the Agile software development process. The FRATIS acceptance criteria related to drayage optimization are shown below in Table 3-2 and are grouped by user type.

Table 3-2. FRATIS Acceptance Criteria

Participant	Acceptance Criteria
Emergency Management	Drivers can report on road conditions through the app, when the vehicle is stationary.
	Emergency Management personnel can conduct RECON reporting on Android devices.
	Emergency Management personnel can attach an image to a RECON report.
	The emergency management app can automatically record location information and timestamp for user reports.
	Can display emergency management mobile app user GPS pings on a map.
	Nonemergency management users can report on port/terminal status, gas station availability, and other key business openings.
	Can display roadway closure information on a map.
	Can display traffic feed data on a map.
	Can view business status information by business type or by name on an interactive map.
	The app does not provide information on casualties to the general public.

3.1.7 Demonstration Schedule for Planning, Purchasing, Preparation, Testing, and Operation of FRATIS Equipment

As noted above, the PD team is not yet certain whether equipment purchases will be necessary for testing the emergency management app. Regardless, the overall schedule for this piece calls for emergency management app development to begin in the fall, with field testing expected in the winter (January/February 2014) and simulation testing in the spring (April to May 2014), after suitable time for bug fixes and software tweaks. If it is determined that devices will need to be purchased, they will be acquired in the late winter or early spring, leaving enough time for device delivery and user training.

3.2 Demonstration Experiment Plan – Emergency Management

This Experimental Plan provides input to the IA Team to assist them in their conduct of the Impacts Assessment. The hypothesis and information provided here is the PD Contractor's recommended approach for the conduct of the Impacts Assessment. Finalizing this approach, and assessing data to support or reject these hypotheses is the responsibility of the IA Team. The PD Team's responsibility is to provide the IA Team with access to all data arising from mobile app simulation testing, as well and appropriate public- and private-sector test participant contacts for postsimulation interviews. This will allow the IA Team to perform their evaluation of impacts and assess key lessons learned.

3.2.1 FRATIS Emergency Management Experimental Design

The FRATIS South Florida prototype test hypotheses are developed based on the prototype backlog user stories dealing with emergency management. The hypotheses below were developed in full consultation with the IA team and as guided by the most current version of their *Impact Assessment Plan*. The FRATIS test hypotheses and the technical approach for prototype testing are described below.

3.2.2 Emergency Management Test Hypotheses

The proposed emergency management test hypotheses are summarized in Table 3-3.

Table 3-3. Proposed FRATIS Emergency Management Test Hypotheses

System	Elements	Test Hypotheses
Emergency Management	Emergency management official mobile device RECON reporting and dissemination of selected information.	The app will allow emergency management officials to conduct more timely RECON reporting and information dissemination.
	Truck driver, intermodal terminal, general public, and business owner mobile device reporting of road status, gas station, key relief supply business, and port/intermodal terminal status with dissemination to the app user group.	The app will allow drivers to enter critical postevent recovery information, including gas status openings/fuel availability, and openings of key businesses that sell relief supplies.
	App user GPS pings displayed on a map.	The app will allow ports and intermodal terminals to report on their status after an event and note any special conditions or instructions.
	Real-time traffic and road status information displayed on a map.	Users will have better road opening/closure information through position reporting, pings, and real-time traffic.

3.2.3 Technical Approach

The key steps involved in conducting the FRATIS emergency management prototype test in the South Florida region are provided below.

Define Test Schedule

The test schedule for emergency management is:

- **Brief stakeholders (October 10, 2013 to October 30, 2013).** CS already has briefed several key stakeholders via webinar on October 10. The PD team will continue reaching out to other parties who could not attend the webinar to show them the overall testing plan and schedule, recruit participation, and identify next steps.
- **Brief U.S. DOT (October 31, 2013).** CS has scheduled a meeting at the end of October with key project stakeholders and U.S. DOT to summarize progress to date and finalize the overall technical approach (both emergency management and drayage optimization will be covered at this meeting).
- **Develop Android app (October 21, 2013 to December 31, 2013).** The PD team expects to recruit a student for app development by the end of October, after which development can begin.
- **Meet with stakeholders (mid to late January 2014).** The PD team will schedule another meeting with all participants and U.S. DOT in the latter half of January to brief them on progress and show them the app.
- **Train users (late January).** Concurrently with the above, CS will work to train all test participants on how to use the app, and introduce them to the scenario(s) to be simulated.
- **Conduct simulation (February to March 2014).** Users will report on key information, including RECON reporting for emergency management participants and other status reporting for drivers, business owners, etc.; this will form the basis for the proof of concept test.
- **Evaluate results (April to May 2014).** The PD team will assemble, package, and deliver all relevant data outputs for use by the IA team in their assessment. The PD team also will work with the IA contractor to develop appropriate survey or interview questions and provide participant contact information so the IA team can reach out to test participants.

Define Data Needs, Data Format, Data Transmission Protocols, and Data Quality Procedures

Table 3-4 summarizes the data requirements and potential sources to support assessment of the FRATIS South Florida emergency management mobile app, organized by test hypothesis.

Table 3-4. FRATIS South Florida Emergency Management Data Requirements and Sources

Hypothesis	Data Needed to Test	Source(s)
The app will allow emergency management officials to conduct more timely RECON reporting and information dissemination.	Reports entered by emergency management officials in the app during a simulation exercise.	• Android app. • User interviews.
The app will allow drivers to enter critical postevent recovery information, including gas status openings/fuel availability, and openings of key businesses that sell relief supplies.	Reports entered by drivers and business owners/managers in the app during a simulation exercise.	• Android app. • User interviews.
The app will allow ports and intermodal terminals to report on their status after an event and note any special conditions or instructions.	Reports entered by ports and intermodal terminals in the app during a simulation exercise.	• Android app. • User interviews.
Users will have better road opening/ closure information through position reporting, pings, and real-time traffic.	Maps generated by the app during simulations.	• Android app. • User interviews.

Based on the testing hypotheses the FRATIS team will work with the IA team on their data needs to develop the data format/data quality procedures and as guided by the Impact Assessment Plan.

Since the emergency management mobile app is structured as a proof of concept simulation, the PD team has not identified quantitative performance metrics for this component of the test. Rather, the impacts assessment will primarily rely on user interviews, along with any data reports generated during the simulation which can be shown as examples. This approach should enable a high-level assessment of probable impacts, e.g., more timely information dissemination, faster postevent recovery, and better distribution of relief supplies.

It is important to note here that the FRATIS emergency management demonstration is a small-scale simulation exercise with a limited pool of system users. Although CS plans to recruit select participants from the local business community (e.g., Home Depot, gas station owners, supermarkets), it will not be a comprehensive test involving all or most such entities in the region. Moreover, there will be no direct connection between FRATIS drayage optimization and the emergency management Android app, or between the Android app and any existing local or state emergency management systems. As such, a main function of the IA Team's assessment shall be to take limited data from this simulation exercise, and extrapolate benefits based on a much wider potential use of this system. Thus, the IA team should plan to develop mathematical relationships or qualitative case study/interview approaches than can support development of benefits for a notional case that that entire South Florida emergency management community deployed the app.

Define or Develop Analysis Tools Needed

Assessment of the emergency management app will rely on:

- Records of reports entered in the system by emergency management and nonemergency management personnel – this will include condition reporting by drivers and business owners, RECON reporting by emergency management officials, port or terminal status notifications and reports, and GPS ping location data gathered automatically during the simulation;
- Records of data and information disseminated through the mobile app via a cloud-based server; and
- Interviews with participants to identify strengths, weaknesses, and potential improvements to the app, as well as probable impacts and improvements from a wider deployment.

The PD contractor will assemble, package, and deliver these data (except for the interviews) to the IA team at the conclusion of simulation activities.

Define Expected Results

The expected results will be based on the test hypotheses as developed by the FRATIS and IA teams. The hypotheses are outlined in Section 3.2.2 above.

Conduct Beta Test with Selected Stakeholders and Refine Test Process

Beta testing of the emergency management app will occur after initial app development is complete but before the onset of formal testing, and will likely involve CS and UW staff, and select staff from partner agencies and firms, to identify and fix bugs or issues.

Install Test Equipment

No equipment installation is required, since the test will rely on a cloud server for processing needs and Android mobile devices for beta testing and simulation exercises. The only equipment that might be needed are prepaid, activated Android smart phones sufficient to provide all test participants with a compatible device.

Archive and Analyze Test Data and Provide a Data Feed to the IA Contractor

A FRATIS project Dropbox account has been set up and is available to the IA and FRATIS team. The Dropbox account is a fully capable Dropbox for Business account, which provides access for one year for all test participants, U.S. DOT, the IA Team, and Noblis. All key stakeholders have received invitations to this premium account.

Share Data and Results with Impacts Assessment Contractor

There is ongoing coordination between the FRATIS team and IA contractor. Data from the emergency management simulation exercise will likely be delivered after the simulation has occurred and all participants have entered information. A member of the PD team (Roger Schiller) will coordinate data deliveries with the IA team lead. Members of the PD team will sit in on

interviews conducted with emergency management participants after the test, but the IA team will lead these meetings.

3.2.4 Customer Satisfaction and Usability Survey Test Plan

The FRATIS team is working with IA contractor to develop a survey or interview instrument and a question set that will cover the emergency management piece. This interview process will be separate from that conducted for drayage optimization, however there will necessarily be some overlap amongst interviewees as some stakeholders are involved in both tests.

1. Purpose and Objectives of the Test

The user needs analysis results will provide validation for the usability of FRATIS emergency management to the project stakeholders. The specific hypothesis questions that require validation by survey results are indicated in Table 3-4 under Section 3.2.3 and noted as either interview or survey data requirements.

2. Technical Approach

Key steps for the customer satisfaction and usability survey test are provided below.

Review existing feedback from participants.

This step will collect and review existing feedback from FRATIS participants using face-to-face meetings, if possible, or telephone interviews. Participants will include:

- **South Florida emergency management staff.** Each participant from the South Florida emergency management community (DOT Districts 4 and 6, and Broward and Miami-Dade EOCs) will be interviewed.
- **Truck drivers.** Driver participants (likely from FEC) will be interviewed to gain feedback on their experience using the app.
- **Port and rail intermodal staff.** Officials from PortMiami, Port Everglades, and FEC will be interviewed for reporting on port and rail terminal status.
- **Business owners or managers.** Owners or operations managers from regional businesses participating in the test will be contacted to gather their feedback and initial reactions.

Develop a survey instrument for FRATIS emergency management test participants.

The IA team is the lead for developing survey instrument but the FRATIS team will develop some questions to include in the survey. These questions would be related to the user interface and operational experience with FRATIS. A single survey will be sufficient for both teams and will be structured to explore disaster mitigation processes and problems both with and without the app.

Develop survey methodology.

The survey methodology will be selected by the IA and PD teams. Options include an interview, mail back form, or on-line format. A small pilot survey will be completed to ensure the survey instrument is effective.

Define expected results.

This step will be completed in conjunction with the previous step and will be guided by the test hypotheses.

Conduct survey.

The Impact Assessment contractor will conduct the survey.

Analyze and report results.
The Impact Assessment contractor will analyze the survey results, with support as necessary from the Prototype Development contractor.
Document any modifications recommended for future deployments.
Based on the results of the survey and any interviews conducted, the Prototype Development contractor will develop a list of recommended improvements, additions, or modifications for consideration in future FRATIS emergency management or similar applications.

3.2.5 Data Sharing and Archiving

Implementation Plan for Working with the IA Contractor

The FRATIS team will have regular meetings with the IA team and will develop and implement the data sharing approach with the IA team.

Plan for Data Archiving

There is a project Dropbox account for exchanging documents and storing data. This account will be formatted so that any document placed in the Dropbox is a copy and if any data is lost it is easily replaceable.

Use of U.S. DOT Research Data Exchange

As required, the FRATIS deployment team will transfer all nonproprietary and nonconfidential data to the U.S. DOT's Research Data Exchange at conclusion of the test. This is expected to involve a transfer of all data files from the FRATIS Dropbox for Teams Account to the U.S. DOT RDE web site. Data here means all major project deliverables, all data that was collected and provided to the IA team, and the open source mobile app software code developed by UW for FRATIS emergency management under this contract.

4.0 Monitoring the FRATIS South Florida Test

This section provides detail on how the CS team intends to manage the FRATIS drayage optimization operational test and the emergency management simulation test, including:

- Monthly data reporting to the IA contractor;
- Keeping FEC management and staff engaged throughout the process, including predeployment testing of the FRATIS applications packages as well as user training;
- Keeping emergency management stakeholders engaged and updated on app development and key meetings, and coordinating user training prior to simulation testing; and
- Monitoring test participants' use of the applications during the test, and taking corrective action if needed to boost participation.

4.1 Monthly Data Reporting

Each month during the baseline and demonstration test periods, the CS team will collect all data necessary to support the efforts of the IA team. This data was described in the Demonstration Experiment Plans for each of the two components (Sections 2.3 and 3.2). These data will be packaged in a format agreed upon with the IA team and delivered periodically via the FRATIS Dropbox for Teams account.

Each month CS also will summarize (in bullet format) any known bugs or issues encountered with FRATIS software, hardware, or equipment; any planned maintenance or outages of the FRATIS web portal; and key interactions between the PD team and test participants. This information will be included in CS' Monthly Progress Report to FHWA.

4.2 Implementation Plan

During any technology demonstration, it is important to monitor system use by test participants. This mitigates the risk of nonuse on the part of participants which can result in having little meaningful data for test or evaluation purposes. Nonparticipation can be caused by many factors, including:

- Use of the technology is not convenient for the intended user groups;
- Users perceive the tool as a burden or additional responsibility outside of their normal activities; and
- Users distrust the outputs or recommendations of the technology.

FEC's drivers and dispatchers will be the primary users of the FRATIS application suite, hence our implementation plan focuses primarily on them. Once Agile development activities are complete, CS and PAI will use historical FEC movement data and current load plans provided by dispatchers to compare algorithm outputs with actual order execution. This will validate whether the algorithm result can improve on what FEC dispatchers currently are doing manually. Once this is established, and any bugs have been addressed, we will work directly with dispatch staff at FEC to raise awareness of the tool and its potential usefulness for their job. These meetings will be carried out ahead of the operational test period, to develop interest on the part of the dispatchers in using the optimization tool to make load assignments.

Prior to the emergency management app simulation test, we will meet with identified emergency management stakeholders who have agreed to participate in the simulation. At this meeting we will train them on using the app and provide an overview of the simulation scenario(s) to be tested. We also will direct them on the specifics of their roles in the simulation test. Finally, we will provide ongoing support to simulation users, and we will engage in regular communication with participants during the simulation to ensure continued use of the app for testing purposes and answer any questions.

Any required modifications to the optimization algorithm or freight traveler information dissemination pieces will be made by PAI and CS before the operational testing period commences. Any required bug fixes or modifications to the emergency management app will be completed by UW prior to the simulation test.

4.3 Monitoring Use of the FRATIS Prototype

During the operational test, it will be important to continuously monitor participant use of the prototype and take corrective action if needed to ensure adequate use of the system for testing and assessment purposes. To this end, the CS team will continue working with FEC dispatchers and drivers to ensure they are satisfied with the system's functionality and usefulness. During the test, CS will compare optimization algorithm load plans to daily executed loads during the pilot test to assess dispatcher adherence to plans. If there is significant deviation between optimized plans and execution, CS will work with the dispatch staff to determine the reasons. Based on this feedback the CS team can make modifications if necessary.

As noted above, use of the emergency management app for simulation testing will be monitored via regular calls and correspondence with simulation participants.

Appendix A: Documentation of Materials Purchased

Documentation of any prepaid Android phones that are purchased for the test will be furnished to U.S. DOT when the purchase is made.

PRODUCTIVITY APEX INC.

Invoice #8

Prime Contract #: DTFH61-11-D-00012
South Florida Prime Task Order #: T-12002; CSI-12-005
*PAI Task **Order #:** 8500.060 (South Florida)*
***INVOICE # :** 8*
***INVOICE DATE:** June 6, 2013*

Productivity Apex, Inc.
3505 Lake Lynda Drive, Suite 206 Orlando, Florida 32817
Phone (407) 384-0800 Fax (407) 384-0882
www.productivityapex.com
Attn: Dr. Sam Fayez
Tax ID #: 59-3727121

FRATIS South Florida Professional Services Support (TomTom Hardware and Service)

CLIENT

Mr. Mark A. Jensen
2715 Southview Avenue
Arroyo Grande, CA 93420
Phone: 805-474-8483
Fax: 805-456-3961
Email: mjensen@camsys.com

Mr. Roger Schiller
10415 Morado Circle, Building II, Suite 340
Austin, TX 78759
Phone: 512-691-8504
Fax: 512-691-3289
Email rschiller@camsys.com

PERIOD OF PERFORMANCE	PAYMENT TERMS	Contract Type
Tuesday, June 04, 2013	*15 day net (These terms have been agreed upon by Cambridge Systematcis for Hardware)*	

Description	Unit Price	Quantity	TOTAL AMOUNT
TomTom Link 510 - Item #: 1KL001700	$ 299.95	50.00	$14,997.50
1 Year Webfleet Subscription for 50 Trucks	$ 411.84	50.00	$20,592.00
Installation and Activation	$ 150.00	50.00	$7,500.00
Shipping and Handling	$ 300.00	1.00	$300.00
		Subtotal	$43,389.50

SUMMARY OF THIS INVOICE	LINE TOTAL
Deliverables Subtotal	$43,389.50
TOTAL	**$43,389.50**

CONTRACT SUMMARY TO DATE	
Total Contract Value ($280,000 Incremental funding)	$280,000.00
Previously Invoiced Amount	$68,959.50
Current Invoice Total	$43,389.50
Future work remaining to be Invoiced	$167,651.00
Percentage of Funds Remaining on Contract	59.88%
CURRENT TOTAL DUE	**$43,389.50**

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Signature

Sam Fayez
Sam Fayez, Ph.D.

Figure A-1. FRATIS South Florida Professional Services Support: TomTom Hardware and Service (Source: Productivity Apex, Inc.)

U.S. Department of Transportation
ITS Joint Program Office-HOIT
1200 New Jersey Avenue, SE
Washington, DC 20590

Toll-Free “Help Line” 866-367-7487
www.its.dot.gov

FHWA-JPO-14-182

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