Dynamic Mobility Applications Policy Analysis

Policy and Institutional Issues for Freight Advanced Traveler Information Systems (FRATIS)

www.its.dot.gov/index.htm
Final Report — October 30, 2014
FHWA-JPO-14-139

Photo Source: Thinkstock

U.S. Department of Transportation

Produced by the John A. Volpe National Transportations Systems Center
U.S. Department of Transportation
Intelligent Transportation Systems Joint Program Office
Federal Highway Administration

Notice

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-JPO-14-139		

4. Title and Subtitle	5. Report Date
Dynamic Mobility Applications Policy Analysis: Policy and Institutional Issues for Freight Advanced Traveler Information Systems (FRATIS)	October 30, 2014
	6. Performing Organization Code
7. Author(s) Caitlin Bettisworth, Josh Hassol, Cynthia Maloney, Amy Sheridan and Suzanne Sloan	8. Performing Organization Report No.
9. Performing Organization Name And Address U.S. Department of Transportation John A. Volpe National Transportation Systems Center 55 Broadway Cambridge, MA 02142	10. Work Unit No. (TRAIS)
	11. Contract or Grant No. HW4AA8 and HW4AA9
12. Sponsoring Agency Name and Address U.S. Department of Transportation Intelligent Transportation Systems Joint Program Office 1200 New Jersey Ave., S.E. Washington, D.C. 20590	13. Type of Report and Period Covered Policy analysis and white paper; Summer 2012 – Fall 2014
	14. Sponsoring Agency Code HOIT - I

15. Supplementary Notes

16. Abstract

This report documents policy considerations for the Freight Advanced Traveler Information System, or FRATIS. FRATIS applications provide freight-specific route guidance and optimize drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips.

The analysis identified the following potential policy issues:

- Data Privacy. There may be inherent trade-offs for users between the desired functionality of FRATIS and the need to protect confidential information, such as location data, company proprietary information (e.g., pricing, customer lists), and financial transaction data. A privacy impact assessment using the National Institute of Standards and Technology (NIST) Special Publication 800-53 Rev 4 is underway to identify the minimal amounts of data necessary for FRATIS functionality, and to assess any data sensitivities.
- Data Security. Given the multiple existing systems involved in generating FRATIS data (including the vehicle themselves), FRATIS faces the threat of spoofing or hacking that is intended to corrupt, falsify, disrupt, disable, or end-run the system. Examination as to whether existing freight logistics security offers enough protection against these common security threats is underway.
- Data Quality and Compatibility. As use of FRATIS expands to involve more carriers and larger geographic regions, the system may find it beneficial to integrate both proprietary and public data from varying sources and formats to have a common set of protocols for data exchange. This raises three potential concerns. First, some needed data elements may be unavailable, reducing the overall quality and usefulness of the data. Second, in cases where data are available, they may exist in incompatible formats. Finally, certain limitations may exist on the collection and use of data.
- Oversize/Overweight (OSOW) Permitting and Routing. The FRATIS ConOps identified OSOW permitting as a possible capability. However, this capability is not being tested as part of the FRATIS demonstrations. Based on stakeholder outreach, there is some industry interest in exploring use of OSOW for route planning in FRATIS. This capability could be demonstrated with states that already have OSOW routing maps that could be incorporated into FRATIS. This would likely be a technical issue moving forward and would not have any policy implications, but would require institutional coordination to enable any demonstration.
- Assigning Loads to Unsafe Drivers or Carriers. In theory, the container-load matching capabilities of FRATIS could result in loads being assigned to carriers, drivers, or vehicles that have safety violations or poor overall safety records. Existing FMCSA safety regulations are effectively used by enforcement personnel to identify unsafe drivers, vehicles, and carriers.
- Conflicts with Existing Intermodal Terminal Policies. Initially, there were concerns that the variable gate capacity needed at intermodal terminals to enable FRATIS drayage optimization would conflict with union shift-work rules. This issue has been resolved by the development team by modifying the FRATIS drayage optimization algorithms to ensure that they do not result in schedules that conflict with established terminal work rules.

Based on the results of this analysis, the policy team does not foresee a need for any new policies to be enacted or any major issues that will stand in the way of successful market adoption and use by industry. Ultimately, guidance on installation, integration, operations, and maintenance will be produced by the technical teams when completing their technology transfer to the marketplace.

17. Key Words	18. Distribution Statement
connected vehicles, intelligent transportation systems, dynamic mobility applications, transportation	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	28	

Table of Contents

List of Tables

List of Figures

Executive Summary

Dynamic Mobility Applications Program

The Dynamic Mobility Applications (DMA) Program is prototyping applications that are anticipated to be transformative to public sector transportation system management and modal integration. This technical research is a part of the U.S. Department of Transportation's (USDOT) research into new technologies supporting the emergence of an intelligent and connected vehicle (CV) environment.

The objective of the DMA research is to foster the release of high-value, open-source applications that use synthesized, multisource Intelligent Transportation Systems (ITS) data to transform surface transportation management and information. The DMA Program research is also focused on developing tools (for instance, an open source portal), metrics, and concepts to support additional application development.

The Intelligent Transportation Systems Program's role within the USDOT is to facilitate high-risk/high-reward research in cooperation with industry and academia to meet transportation needs. Investments in new research are based on policy analysis that determines that the technology concepts meet the following threshold criteria:

- They advance the state-of-the-practice and, if successful, will deliver transformational transportation benefits to the Nation.
- They are unlikely to be pursued in industry given the nature of the risks compared to the required investment.
- The advancements are desired by stakeholders, who will champion the transfer of results into use.
- The advancements are significant enough to take precedence over other investment choices.

A decision to pursue research is followed by the development of prototypes and demonstration and testing under real-world conditions. Successful results advance the process of transferring new technologies into market adoption and use. They set the stage for planning and preparing for technology implementation, operations and maintenance, and, eventually, upgrades and evolution. Throughout this technology life cycle, policy and institutional issues can often become the major stumbling blocks to realizing success.

Thus, identification of, and research into, the policy issues and practical options and solutions is an important step that raises the assurance that the Federal investment will result in adoption and use by agencies, organizations, the private sector, and travelers. It is an iterative process with the technical research teams—identification of policy challenges early in the development stage can change the nature of technical decisions; envisioning and addressing policy challenges throughout the life cycle supports preparation for robust technology transfer to the market.

Purpose of this Report: Document FRATIS Policy Issues

The Connected Vehicle Mobility Policy team (herein, policy team) developed this report to document policy considerations for the Freight Advanced Traveler Information System, or FRATIS. FRATIS comprises a "bundle" of mobility applications that leverage existing and new connected vehicle data sets to provide freight-specific route guidance and optimize drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips. The analysis is based on the policy team's review of a wide range of materials that include:

- The FRATIS Concept of Operation (ConOps).[1]
- The Connected Vehicle Reference Implementation Architecture (CVRIA) diagrams for FRATIS.[2]
- Discussions with the technical team overseeing development of the prototype applications within the FRATIS bundle and a review of the prototype documents.
- Industry best practices and standards in information technology, security and privacy, and data exchange.
- Existing regulatory, legal, and insurance regimes that apply with the freight logistics industry.

As policy or institutional issues emerged during the review, they were categorized into one of four categories (not every bundle had issues in all four categories) and were further paired with recommended actions for resolution, if options were available. Where they were not available, additional research is recommended. The four issue categories are:

- *High priority* issues need immediate attention and resolution as they may obstruct deployment.
- *Medium priority* issues have potentially serious consequences but clear, if challenging, paths to resolution; which should be accomplished prior to technology transfer.
- *Low priority* issues have policy implications but also have solutions underway or represent current best practices that can be implemented before FRATIS applications are introduced to the marketplace.
- *Emerging* issues have some probability of obstructing deployment over time, as FRATIS implementations grow in complexity or geographic coverage.

Policy Issues Common to FRATIS and Other Mobility Applications

Certain policy issues are relevant to mobility applications in multiple bundles. While these issues impact the ultimate success of FRATIS, USDOT is working to resolve them within each bundle and also across all mobility applications simultaneously. They include:

[1] See Appendix B, reference 1.
[2] See Appendix B, reference 12.

High Priority Common Issues

- Data Privacy. There may be inherent trade-offs for users between the desired functionality of FRATIS and the need to protect confidential information, such as location data, company proprietary information (e.g., pricing, customer lists), and financial transaction data. Thus, it is essential that the data exchanges for FRATIS be designed to minimize data exposure. A privacy impact assessment using the National Institute of Standards and Technology (NIST) Special Publication 800-53[3] Rev 4 is underway to identify the minimal amounts of data necessary for FRATIS functionality, and to assess any data sensitivities.
- Data Security. Like all connected vehicle bundles, FRATIS requires authenticated data exchange from trusted sources. Given the multiple existing systems involved in generating the data (including the vehicle themselves), FRATIS faces the threat of spoofing or hacking that is intended to corrupt, falsify, disrupt, disable, or end-run the system. Therefore, FRATIS will need to incorporate robust security measures. Examination as to whether existing freight logistics security offers enough protection against these common security threats is underway. If a higher level of security is deemed necessary with any part of the FRATIS application, options are available and may include the opportunity to become part of the dedicated short-range communications (DSRC) environment.

Policy Issues Unique to FRATIS

The policy team documented three issues unique to FRATIS.

High Priority Unique Issue

- Data Quality and Compatibility. As use of FRATIS expands to involve more carriers and larger geographic regions, the system may find it beneficial to integrate both proprietary and public data from varying sources and formats to have a common set of protocols for data exchange. This raises three potential concerns. First, as the scope and scale of FRATIS increase, some needed data elements may be unavailable, reducing the overall quality and usefulness of the data. Second, in cases where data are available, they may exist in incompatible formats. Finally, certain limitations may exist on the collection and use of data. All of these concerns will need to be addressed simultaneously as FRATIS is used by additional carriers. This issue is not resident with the current prototyping, but may emerge in the future. The USDOT may need to take the lead in resolving these and other related concerns by, among other things, identifying the minimum set of data elements required to enable full FRATIS functionality (simulation modeling and field testing will be useful in determining this), and using this information as the basis for developing national standards for data formats and data communication platforms.

[3] http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r4.pdf

Low Priority/Resolved Unique Issues

The following potential policy issues were identified early in the analysis, but subsequently determined to have been resolved or to have clearly identified solutions:

- Oversize/Overweight (OSOW) Permitting and Routing. The FRATIS ConOPs identified OSOW permitting as a possible capability. However, this capability is not being tested as part of the FRATIS demonstrations. Based on stakeholder outreach, there is some industry interest in exploring use of OSOW for route planning in FRATIS. This capability could be demonstrated with states that already have OSOW routing maps that could be incorporated into FRATIS. This would likely be a technical issue moving forward and would not have any policy implications, but would require institutional coordination to enable any demonstration.

  If, in the future, FRATIS were used to assemble OSOW loads with interstate routes, third-party "transmission companies" would continue to serve in their current capacity of obtaining state OSOW permits on behalf of shippers and freight haulers. Potentially, FRATIS could link to transmission companies to help streamline OSOW permit requests, but this would not be required. This issue is resolved as it relates to the FRATIS application.

- Assigning Loads to Unsafe Drivers or Carriers. In theory, the container-load matching capabilities of FRATIS could result in loads being assigned to carriers, drivers, or vehicles that have safety violations or poor overall safety records. Existing Federal Motor Carrier Safety Administration (FMCSA) safety regulations are effectively used by enforcement personnel to identify unsafe drivers, vehicles, and carriers. Carriers must then improve their safety performance or, in the most serious cases, they are taken off the road. FRATIS will not supplant or circumvent existing safety regulations and procedures. However, there is a potential opportunity, in the future, to link the FRATIS applications to the FMCSA systems. To date, this opportunity has not been discussed within the USDOT and will need to be analyzed to understand the role that FRATIS might play within the parameters of the regulatory framework.

- Conflicts with Existing Intermodal Terminal Policies. Initially, there were concerns that the variable gate capacity needed at intermodal terminals to enable FRATIS drayage optimization would conflict with union shift-work rules. This issue has been resolved by the development team by modifying the FRATIS drayage optimization algorithms to ensure that they do not result in schedules that conflict with established terminal work rules.

Conclusions and Next Steps

It is expected that this report will support a dialogue with stakeholders. Stakeholders may comment on:

- Any additional policy or institutional issues that may present challenges to the successful market adoption and use of FRATIS and that are not documented but for which new or additional research and analysis is recommended.
- Whether the policy options identified for resolution of the issues are appropriate.

Based on the results of this analysis, the policy team does not anticipate any major issues that will stand in the way of successful market adoption and use by industry. Ultimately, guidance on installation, integration, operations, and maintenance will be produced by the technical teams when completing their technology transfer to the marketplace.

At this juncture, this report identifies some early guidance to the different entities that may choose to participate in FRATIS. This guidance includes recognizing that FRATIS may increase the "complexity" of drayage operations—including narrower arrival windows at the terminal, more trips in which trucks are routed to pick up inbound loads before returning to the terminal or container yard, and increased use of dynamic routing to avoid congestion.

Finally, it should be noted that data privacy and security have been raised as key policy concerns for all of the dynamic mobility applications. Research is ongoing in this area to develop options to address these new applications as well as to standardize security for future applications that have yet to emerge. To develop optional approaches for security and privacy, analysis using National Institute of Standards and Technology (NIST) standards (Special Publication 800-53[4] Rev 4) is underway to assess any policy or institutional challenges[5]. This analysis explores the minimal data set that is necessary for FRATIS functionality, and to assess any public concerns or policy challenges associated with the data set. Notably, FRATIS applications will be transferred to market adopters and the private sector is expected to play a major role in setting privacy and data access policies. However, if FRATIS is used by Federal agencies, there will likely be additional reviews of practices for data collection, access, and storage; handling of any personally-identifiable information (PII); and/or security practices.

[4] http://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r4.pdf
[5] USDOT research and analysis results are made available through the ITS Joint Programs Office website at www.its.dot.gov.

Chapter 1 Introduction

This report documents policy considerations for the Freight Advanced Traveler Information System, or FRATIS. FRATIS applications provide freight-specific route guidance and optimize drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips.

FRATIS is one of several mobility applications that the Intelligent Transportation Systems Joint Program Office (ITS JPO) of the U.S. Department of Transportation (USDOT) and its partners are prototyping as part of its Connected Vehicle Program. The ITS JPO is advancing new connected vehicle technologies through innovative research, and FRATIS applications are being piloted currently in California, Florida and Texas.

Dynamic Mobility Applications

In the future, cars, trucks, buses, roads, and smartphones will talk to each other. They will share valuable safety, mobility, and environmental information over a wireless communications network that is already transforming our transportation system as we know it. This system of connected vehicles, mobile devices, and roads will provide a wealth of transportation data, from which innovative applications will be built. These applications will make travel not only safer, but more efficient and greener.

The USDOT's Dynamic Mobility Applications program is exploring these possibilities, specifically focusing on reducing delays and congestion and thus significantly improving mobility. The following six mobility application bundles are being prototyped to make this possible:

- *Enabling Advanced Traveler Information Systems (EnableATIS)* provides a framework to develop multisource, multimodal data into new advanced traveler information applications and strategies.
- *Freight Advanced Traveler Information System (FRATIS)* provides freight-specific route guidance and optimizes drayage operations so that load movements are coordinated between freight facilities to reduce empty-load trips.
- *Integrated Dynamic Transit Operations (IDTO)* facilitates passenger connection protection, provides dynamic scheduling, dispatching, and routing of transit vehicles, and promotes dynamic ridesharing.
- *Intelligent Network Flow Optimization (INFLO)* aims to optimize network flow on freeway and arterials by: informing motorists of existing and impending queues and bottlenecks; providing target speeds by location and lane; and allowing the capability to form ad hoc vehicle platoons of uniform speed.
- *Multi-Modal Intelligent Traffic Signal Systems (MMITSS)* is a comprehensive traffic signal system for use on complex arterial networks that include passenger vehicles, transit, freight, and emergency vehicles, as well as pedestrians.

- *Response, Emergency Staging and Communications, Uniform Management, and Evacuation (R.E.S.C.U.M.E.)* involves advanced vehicle-to-vehicle safety messaging over dedicated short-range communications (DSRC) to improve the safety of emergency responders and travelers.

The USDOT's Connected Vehicle Mobility Policy team is performing the analysis needed to document policy and institutional issues and recommend options for resolution for each of these bundles in separate reports.

Policy Considerations for New Connected Vehicle Technologies

Throughout the process of developing new connected vehicle technology, various policy or institutional issues can become stumbling blocks. Examples include changes brought about by an application and its operations that could possibly affect established norms for liability; governance interoperability of hardware, software, and data; and other issues that may preclude adoption and use by industry.

Policy analysis is an iterative process that proceeds in concert with research and development. Hence, identification of policy challenges early in the development stage can change the nature of technical decisions. Envisioning policy challenges throughout the lifecycle enables smooth technology transfer and system deployment.

The remainder of this report is structured as follows:

- Chapter 2: Description of FRATIS
- Chapter 3: Policy Analysis Approach for Analyzing New Connected Vehicle Applications
- Chapter 4: Policy Analysis Results on FRATIS Applications
- Chapter 5: Considerations for Stakeholders Deploying or Using FRATIS
- Chapter 6: Conclusion
- Appendix A: Source Materials
- Appendix B: List of Acronyms

Chapter 2 Description of FRATIS

The FRATIS bundle of mobility applications will use existing and emerging data sources and connected vehicle technologies to improve the efficiency of freight operations and to help mitigate freight-related congestion and air pollution. Currently freight routing, scheduling, and dispatch decisions are sometimes made in an ad hoc fashion, with inadequate data to make fully informed decisions. This is particularly the case for small- to medium-sized firms (this category includes many drayage operators and over-the-road haulers) that may not be able to invest in information technologies and systems at the level of larger firms. There are numerous public and private sources of data relevant for freight scheduling, routing, and dispatch, but there is currently no single information portal. Additionally, often times the data are lacking in coverage or quality. FRATIS applications will integrate and improve the various data sources and will use connected vehicle technologies to provide comprehensive information for each freight trip, including real-time traffic conditions and integrated information about intermodal freight shipments.

The FRATIS bundle consists of two applications, each of which contains several essential functions. These applications are described below. It should be noted, however, that the FRATIS demonstrations in progress were scaled down from those outlined in the full concept of operations.

Freight-Specific Dynamic Travel Planning and Performance

This application seeks to include all the traveler information, dynamic routing, and performance monitoring elements that freight handlers and haulers need. It is expected that this application will draw upon existing data in the public domain, as well as emerging private-sector applications, to provide benefits to both sectors. Data will include real-time freeway and key arterial speeds and volumes, incident information, road closure information, route restrictions, bridge heights, truck parking availability, cell phone and/or Bluetooth movement/speed data, weather data, and real-time speed data from fleet management systems. The application will use these data to provide a variety of information to drayage operators, over-the-road haulers, and other freight operators. This information will include:

- Real-time travel estimates with route guidance to freight facilities
- Safety information for drivers such as incident alerts, road closures, and work zones
- Enhanced freight-specific information such as routing restrictions (e.g., hazardous materials, oversize/overweight), weather information, regulatory and enforcement information (such as speed limit reductions), “concierge” services, and maintenance locations
- Freight management information for freight operators such as train arrival and departure updates and availability of containers and loads.
- Freight operations performance monitoring information such as experienced travel times, selected routes, delays, number of bobtails, operating costs, etc.

Intermodal Drayage Operations Optimization (DR-OPT)

This application will combine container load matching and freight information exchange systems to help individual companies optimize drayage operations, thereby minimizing bobtails/dry runs and the wasted miles and additional pollution associated with them, as well as spreading out truck arrivals at intermodal terminals throughout the day to help mitigate congestion and emissions around these facilities.

Delays incurred by motor carriers picking up and delivering freight at freight facilities result in excessive idling, decreased vehicle productivity, and increased costs. Queued trucks consume drivers' available hours of service, and their engines burn fuel and emit pollutants without being productive. The DR-OPT app assigns time windows to individual trucks within which they will be expected to arrive at a pickup or drop-off location. As a truck proceeds with its trip, its location is monitored and the appointment slot is adjusted based upon the latest estimated time of arrival (ETA) data. If a truck is running late, the system will calculate a new ETA, find a new time slot, and seek opportunities to move another truck into the vacated appointment.

Additionally, it is envisioned that a a web-based forum could provide an opportunity for shippers and receivers to post their loads in need of transport, and a load-matching function uses that information to match loads with empty trucks, helping to reduce the number of unproductive "bobtail" trips to and from freight facilities.

While web-based container load-matching systems such as Loadmatch.com are in high use today, such systems lack connection to the container and chassis availability/information maintained by railroad terminals and marine shipping terminals. The DR-OPT application aims to provide these linkages among all intermodal parties, including current drayage truck load matching and container availability and appointment scheduling at railroad and marine terminals.

FRATIS Demonstrations

In June 2012, a request for proposals (RFP) resulted in a range of innovative ideas to prototype and demonstrate a FRATIS application under real world conditions. The proposals include strong public-private partnerships and participation from planning associations, freight forwarder associations, private sector owner/operators, port and inland port associations, and local DOT and planning agencies. The FRATIS prototypes are building off of a previous, 2009-2010 research effort—the Cross-Town Improvement Project (C-TIP)[6]—which prototyped a system and algorithm that sought to demonstrate the benefits of travel demand management, dynamic routing, and drayage optimization for the Kansas City inland port. The FRATIS prototypes are expected to address the gaps identified in C-TIP. The three sites chosen to demonstrate FRATIS offer the following:

- The Los Angeles-Gateway Region site is developing the FRATIS applications to address the dynamic travel planning around marine terminals and queues to move cargo out of the port more efficiently.

[6] See: http://ops.fhwa.dot.gov/FREIGHT/technology/best_practice/index.htm

- The Dallas-Fort Worth, Texas site is prototyping the FRATIS applications to incorporate the integrated corridor management capability along with size and weight permitting. This site is also testing the Connected Vehicle Basic Safety Message (SAE Standards J2735-2009). It is additionally looking to optimize drayage opportunities in coordination with rail and local truck drayage companies.
- The South Florida site is focused in a similar manner as the other sites, but will be adding an emergency response capability to FRATIS that would realign the purpose of freight transportation to coordinate movements of supplies during an emergency such as a hurricane.

All three demonstration sites will integrate data from existing sources and will collect data to measure success at achieving FRATIS performance goals. The performance metrics include reductions in:

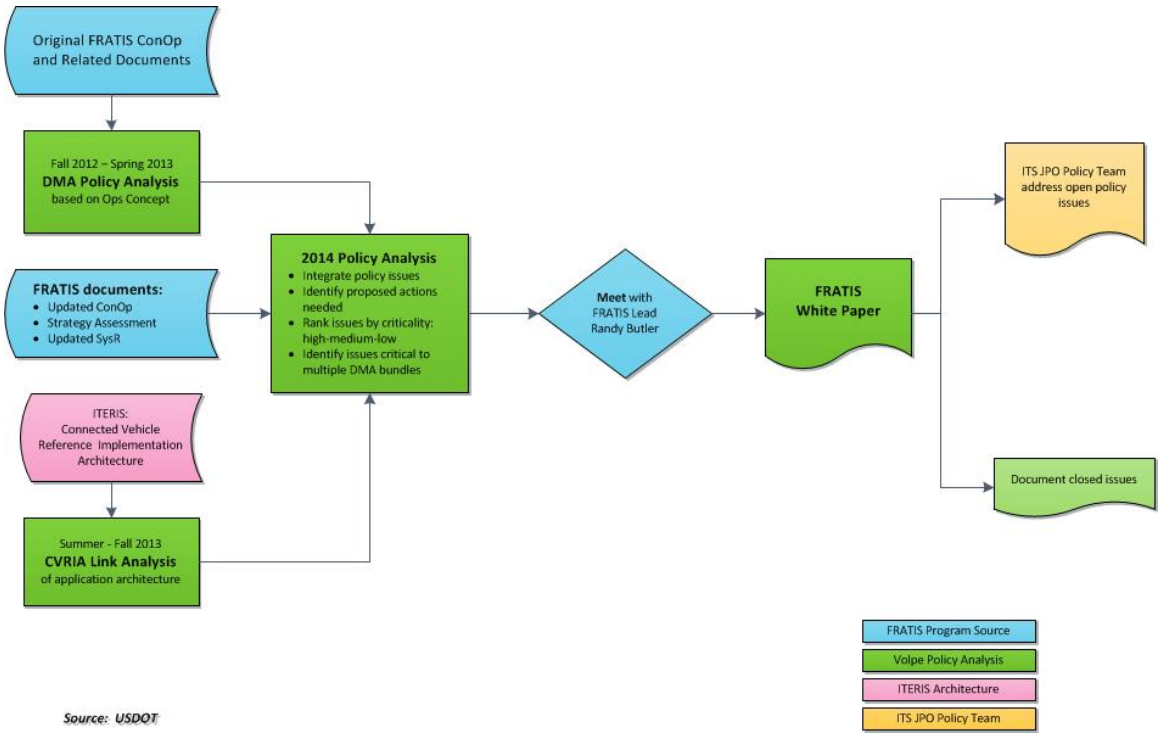
- Number of bobtail trips
- Terminal queue time
- Travel time
- Number of freight-involved incidents
- Fuel consumption
- Level of criteria pollutants and greenhouse gas equivalents

The prototype development process has included establishing baseline data for each area. Prototype demonstrations were launched in 2013 and 2014, and evaluation results are expected in 2014.

Chapter 3 Policy Analysis Approach for Analyzing New Connected Vehicle Applications

The policy analysis for this report was conducted in the steps outlined in this section and illustrated in Figure 3-1.

Figure 3-1. FRATIS Policy Analysis Process



1. Review Operations Concept: The policy team reviewed the original Concept of Operation for FRATIS. The team documented potential policy issues at each stage of the development and deployment process, identified known policy options and solutions, and recommended areas for further investigation. Policy issues included consumer acceptance, partnership requirements, governance challenges, interoperability and standards, and possible conflicts with existing regulations. Updated Operations Concepts were also reviewed to see if new policy issues had emerged, and to see if identified issues were still present or had been resolved.

2. Review Connected Vehicle Reference Implementation Architecture (CVRIA): The policy team conducted a detailed analysis of the Connected Vehicle Reference Implementation Architecture. The CVRIA provides a set of system architecture viewpoints that describe the functional, physical, and logical interfaces; enterprise relationships; and communications dependencies for each technology and application within the connected vehicle environment.[7] These viewpoints serve as a common reference to help identify and prioritize standards development and to support policy considerations for the connected vehicle environment.

   The policy team used the CVRIA viewpoints to identify both the entities sharing data in each application and the specific data elements being transmitted. By doing so, the team was able to surface potential issues for FRATIS.

3. Integrate Results: Having completed the Operational Concepts analysis and the CVRIA analysis, the policy team undertook a process of integrating the results of those two efforts. This was important because the Operational Concepts analysis tended to focus on broader issues, while the CVRIA analysis in many cases identified issues that related to specific types of data being exchanged between specific entities within a given application. Integrating the results from both analyses enabled the policy team to develop a complete picture of all the potential issues for each DMA bundle.

4. Review New Materials: Additional materials for FRATIS were reviewed and assessed against the results of the first level analysis. Detailed information from the three prototype demonstration sites were reviewed.

5. Eliminate Non-Policy Challenges: After integrating the results of the two efforts, the policy team identified and eliminated any issue that was purely technical or logistical in nature and therefore did not have direct policy impacts. For example, the issue of malicious hacking of hardware or software was eliminated, as that must be solved by technical means long before it could require policy guidance to address liability.

6. Prioritize Policy Issues: The team assigned a priority to each of the remaining issues on the following basis:

   a. *High priority* issues need immediate attention and resolution as they may obstruct deployment.

   b. *Medium priority* issues have potentially serious consequences but clear, if challenging, paths to resolution. These should be resolved prior to technology transfer.

   c. *Low priority issues* have policy implications but also have solutions underway. These solutions can likely be implemented before FRATIS applications are introduced to the marketplace.

   d. *Emerging* issues have some probability of obstructing deployment over time, as FRATIS implementations grow in complexity or geographic coverage.

[7] The ITS JPO defines Connected Vehicle Environment as: "A connected, data-rich travel environment. The network captures real-time data from equipment located on-board vehicles (automobiles, trucks, and buses) and within the infrastructure. The data are transmitted wirelessly and are used by transportation managers in a wide range of dynamic, multi-modal applications to manage the transportation system for optimum performance." http://www.its.dot.gov/connected_vehicle/connected_vehicle.htm accessed 7/1/14

7. Meet with Technical Team: After completing the preceding steps, the policy team summarized the policy issues and discussed them with the FRATIS technical lead. This allowed them the opportunity to agree or disagree about the veracity and criticality of each issue, and to provide more information on each issue—information the policy team used to refine the policy analysis.
8. Stakeholder Outreach: Once the results were discussed with the technical team, presentations were made to external stakeholder groups for validation. The results were presented by USDOT representatives at the Intermodal Freight Technology Working Group meetings in Memphis, Fort Lauderdale and Miami. Stakeholders validated the findings in this report.
9. Document Results: This report includes the results of that analysis and identifies issues that have been resolved and concerns that are recommended for additional USDOT research.

Chapter 4 Policy Analysis Results on FRATIS Applications

This chapter describes the policy issues identified for the FRATIS bundle. Policy issues are characterized as "high priority" if they could impede the development, implementation, or market adoption of the FRATIS mobility bundle if left unresolved and also if there do not appear to be clear paths to resolving them, at present. The following table provides an inventory of the FRATIS policy issues.

As table 4-1 below illustrates, the policy team did not identify any low or medium-priority policy issues for FRATIS. The team identified three high-priority issues, and three resolved issues. In the following descriptions, the policy team notes whether the analysis to date has identified options for resolving the issues, or whether further analysis may be needed as part of the Federal role in supporting FRATIS implementation.

Table 4-1. FRATIS Policy Issues

Issue	Priority	Common to Other DMA Bundles?
Data Privacy	High	Yes
Data Security	High	Yes
Data Quality and Compatibility	High	No
OSOW Permitting and Routing	Resolved	No
Assigning Loads to Unsafe Drivers or Carriers	Resolved	No
Conflicts with Exisitng Intermodal Terminal Policies	Resolved	No

Policy Issues Common to FRATIS and Other Mobility Applications

Certain policy issues are relevant to mobility applications in multiple bundles. While these issues impact the ultimate success of FRATIS, USDOT is working to resolve them within each bundle and also across all mobility applications simultaneously. They include:

High Priority Common Issues

The analysis identified two high priority issues common to many of the connected vehicle mobility applications. Work is proceeding to resolve these issues across all mobility application bundles. Solutions reached for one bundle are likely to influence other bundles. Therefore, there may be changes to each bundle, including FRATIS, based on how these cross-cutting issues are ultimately resolved.

- Data Privacy. There may be inherent trade-offs between the desired functionality of FRATIS and the need to protect personal information, such as location data, company-proprietary information (e.g., pricing, customer lists), and financial transaction data. As currently configured, the FRATIS applications do not share information between carriers, and each company is responsible for the security of its own data so personally identifiable information is not exposed. However, future configurations may include data exchanges visible to more than one private company. Thus it is critical that FRATIS communications be designed to minimize data exposure.

  A formal Privacy Impact Assessment is underway to fully evaluate potential data privacy risks in FRATIS and to ensure that FRATIS data collection, handling, and storage practices comply with government privacy policies.

- Data Security. Like all connected vehicle bundles, FRATIS faces the threat of spoofing or hacking that is intended to corrupt, falsify, disrupt, disable, or end-run the system. Like all connected vehicle applications, FRATIS must have robust system security measures in place, and must comply with government data security policies.

  Industry practices and guidelines exist to ensure security of data sets, data environments, and the hardware and software associated with both. In many instances, industry has learned from and employs security measures based on the Federal Information Security Management Act (FISMA),8 as well as data security guidelines from the National Institute of Standards and Technology (NIST). At the moment, analysis of security risks associated with the connected vehicle environment is underway. With those results, the policy team will identify those risks associated with FRATIS to determine whether any new actions or policies are needed.

Policy Issues Unique to FRATIS

The policy team documented three issues unique to FRATIS.

High Priority Unique Issue

- Data Quality and Compatibility. As FRATIS expands beyond initial deployment and testing and involves increasing numbers of carriers and larger geographic regions, it will need to integrate both proprietary and public data from varying sources and formats. This raises three potential concerns.
  - First, as the scope and scale of FRATIS increase, some needed data elements may be

[8] http://csrc.nist.gov/groups/SMA/fisma/overview.html

unavailable. For example, some cities or states within a region may lack traffic incident data or road conditions data, reducing the overall quality and usefulness of the data. Although this issue should subside over time as more data sets become available, the USDOT may need to take an active role, working with state DOTs, MPOs, to ensure that data gaps are filled quickly and that data sources are maintained to keep them current.

- Second, in cases where data are available, they may exist in incompatible formats. Establishing data standards—and the outreach and partnerships behind those standards—could be a significant task facing FRATIS.
- Finally, certain limitations may exist on the collection and use of data. These include:
  - Security concerns, which might limit certain freight-related data from being shared
  - Competitive and proprietary concerns with public-sector agencies having access to private-sector data
  - Confidentiality clauses in supply chain contracts which may impede data sharing

The USDOT may need to take the lead in resolving these and other related concerns by, among other things, identifying the minimum set of data elements required to enable full FRATIS functionality (simulation modeling and field testing will be useful in determining this), and using this information as the basis for developing national standards for data formats and data communication platforms. Also, USDOT outreach to the ocean shipping and drayage industries may be needed to help resolve competitive concerns and, if needed, to help draft alternative language for confidentiality clauses in supply chain contracts that is acceptable to all parties.

Low Priority/ Resolved Common Issues

Among the potential policy issues initially identified are several that further research indicates have already been resolved, or to have clear paths to resolution:

- OSOW Permitting and Routing. The drayage operations initially envisioned to employ FRATIS will be local or intra-state. Consequently, carriers hauling oversize/overweight shipments will need to obtain permits for only a single jurisdiction or state. This process will occur just as it does currently; FRATIS will not be involved in OSOW permitting.

  The FRATIS ConOps identified OSOW permitting as a possible capability. However, this capability is not being tested as part of the FRATIS demonstrations. Based on stakeholder outreach, there is some industry interest in exploring use of OSOW for route planning in FRATIS. This capability could be demonstrated with states that already have OSOW routing maps that could be incorporated into FRATIS. This would likely be a technical issue moving forward and would not have any policy implications, but would require institutional coordination to enable any demonstration.

  Currently, third-party “transmission companies” work on behalf of freight haulers and shippers to obtain OSOW permits on a state-by-state basis for each load requiring them. In the future, if FRATIS is used to assemble OSOW loads with interstate routes, transmission companies would continue to serve in their current capacity. Potentially, FRATIS could link to transmission companies to help streamline OSOW permit requests, but this would not be required.

At present, it appears unlikely that FRATIS will incorporate OSOW permitting into its functionality. While there is great interest nationally in streamlining the state OSOW permitting process, it is not being addressed through this application. Policy and institutional barriers for nationalizing OSOW permitting would be significant, but they are unrelated to FRATIS.

- Assigning Loads to Unsafe Drivers or Carriers. In theory, the container-load matching capabilities of FRATIS could result in loads being assigned to carriers, drivers, or vehicles that have safety violations or poor overall safety records. In reality, however, existing FMCSA safety regulations are effective at identifying unsafe drivers, vehicles, and carriers, and helping them to improve their safety performance or, in the most serious cases, taking them off the road. FRATIS will not supplant or circumvent existing safety regulations and procedures. Drivers, vehicles and carriers participating in FRATIS will be subject to the same FMCSA safety oversight, regulation and inspection as their peers elsewhere in the industry.

  FRATIS could improve safety, because its load-matching algorithms could be tailored to use FMCSA data to screen out unsafe drivers, vehicles, or carriers.

- Conflicts with Existing Intermodal Terminal Policies. Initially, there were concerns that the variable gate capacity needed at intermodal terminals to enable FRATIS drayage optimization would conflict with union shift-work rules. This issue has been resolved, by modifying the FRATIS drayage optimization algorithms to ensure that they do not result in schedules that conflict with established terminal work rules.

Chapter 5 Considerations for Stakeholders Deploying or Using FRATIS

The issues identified in the policy analysis, while not likely to delay or disrupt successful FRATIS market adoption, do suggest considerations that certain stakeholders will need to be aware of if they deploy or participate in FRATIS. This chapter briefly outlines potential considerations (or the lack thereof) for three groups of stakeholders: drayage operators, freight owners/consignees, and intermodal terminal operators.

- Drayage Operators: FRATIS will provide additional revenue opportunities and cost savings for drayage operators, by matching loads to some trips that would otherwise be unproductive (i.e., bobtails), by reducing terminal queue times, and by cutting fuel consumption. Nevertheless, drayage operations are likely to encounter operational changes under FRATIS. Daily operations are likely to become more "complex" in the sense that they will involve narrower arrival windows at the terminal, more trips in which trucks are routed to pick up inbound loads before returning to the terminal or container yard, and increased use of dynamic routing to avoid congestion. Drayage operators will need to become accustomed to these new procedures.
- Freight Owners/Consignees: It appears that companies with freight to ship will face no new considerations due to FRATIS. For them, the intermodal freight process will work as it does today, although they are likely to benefit from the enhanced efficiency that FRATIS provides: more timely pick-up and delivery of shipments, expanded shipment scheduling opportunities, and better tracking of shipments, including improved notifications on esxtimated time of arrival.
- Intermodal Terminal Operators: The policy team concluded there are no special considerations for terminal operators. Terminals will benefit from more timely pick-up of containers once they are on the dock—due to the advanced, container-load matching that FRATIS provides—and from the ability to schedule and coordinate both inbound and outbound shipments more precisely and further in advance—due to the enhanced information on the locations of individual, en-route shipments available via FRATIS.

Chapter 6 Conclusions

FRATIS faces three potentially high-priority policy issues. Two of these issues—data privacy and data security—are shared by all the mobility bundles and are therefore a central focus of the connected vehicle policy research and analysis that is underway with the USDOT, industry experts, and stakeholders. Ultimately, the policy and FRATIS teams will understand the risks through the completion of the detailed Privacy Impact Assessments. The results will point to 1) areas where existing industry practices can be used to prevent system security breaches and to safeguard personally-identifiable information and other sensitive data will suffice for FRATIS, and 2) where security and privacy issues may exist that require further investigation to resolve. The other potentially high priority policy issue, data quality and compatibility, is recommended for additional research to determine what actions, if any, will be needed to resolve it.

The policy issues identified in this report as having been resolved or having identified solutions will not be pursued further. They are documented herein in case stakeholders raise them in the future and need to know how the DMA program has addressed them.

It is expected that this report will support a dialogue with stakeholders. Stakeholders may comment on:

- Any additional policy or institutional issues that may present challenges to the successful market adoption and use of FRATIS and that are not documented but for which new or additional research and analysis is recommended.
- Whether policy options identified for resolution of the issues are appropriate.

Based on the results of the analysis, further privacy and security research is needed to ensure successful private sector adoption of FRATIS.

APPENDIX A. Source Materials

In conducting this analysis, the policy team used the following documents and information sources about FRATIS:

1. *Freight Advanced Traveler Information System: Concept of Operations. Final Report. April 20, 2012.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics, RMI, LLC, INRIX, University of Washington TRAC, and Loadmatch.com/Drayage.com.

2. *Freight Advanced Traveler Information System: Functional Requirements. Final Report. May 17, 2012.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Southwest Research Institute and Cambridge Systematics

3. *FRATIS Concept of Operations: Assessment of Relevant Prior and Ongoing Research and Industry Practices. Final Report. June 13, 2012.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics, RMI, LLC, INRIX, University of Washington TRAC, and Loadmatch.com/Drayage.com.

4. *FRATIS Concept of Operations: Assess Test Readiness of FRATIS. Technical Memorandum.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics, RMI, LLC, INRIX, University of Washington TRAC, and Loadmatch.com/Drayage.com.

5. *Freight Advanced Traveler Information Systems (FRATIS): Demonstration Plan (Dallas). June 2013.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by SAIC.

6. *Freight Advanced Traveler Information Systems (FRATIS): Software Architecture Design and Implementation Options (Dallas). May 2013.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by SAIC.

7. *Freight Advanced Traveler Information Systems (FRATIS): Release Plan for FRATIS Dallas-Fort Worth Region (DFW). June 2013.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by SAIC.

8. *Los Angeles – Gateway Freight Advanced Traveler Information System: Prototype Development and Small-Scale Demonstration of FRATIS. Demonstration Plan (Final). June 28, 2013.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics and Productivity Apex, Inc.

9. *Los Angeles – Gateway Freight Advanced Traveler Information System: Architecture and Implementation Options. Summary Report (Final). July 31, 2013.*

   Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics and Productivity Apex, Inc.

10. *South Florida Freight Advanced Traveler Information System: Demonstration Plan (Draft). October 25, 2013.*

    Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics and Productivity Apex, Inc.

11. *South Florida Freight Advanced Traveler Information System: Architecture and Implementation Options Summary Report (Final). July 19, 2013.*

    Prepared for the United States Department of Transportation, Research and Innovative Technology Administration, Intelligent Transportation Systems Joint Program Office. Prepared by Cambridge Systematics and Productivity Apex, Inc.

12. *FRATIS Connected Vehicle Reference Implementation Architecture physical viewpoints, at: http://www.iteris.com/cvria/html/applications/applications.html*

APPENDIX B. List of Acronyms

ConOps	Concept of Operations
CV	Connected Vehicles
C-TIP	Cross Town Improvement Project
CVO	Commercial Vehicle Operations
CVRIA	Connected Vehicle Reference Implementation Architecture
DMA	Dynamic Mobility Applications
DOT	Department of Transportation
DR-OPT	Drayage Optimization
DSRC	Dedicated Short-Range Communications
EnableATIS	Enabling Advanced Traveler Information Systems
ETA	Estimated Time of Arrival
FISMA	Federal InformationSecurity Management Act
FMCSA	Federal Motor Carrier Safety Administration
FRATIS	Freight Advanced Traveler Information System
IDTO	Integrated Dynamic Transit Operations
INFLO	Intelligent Network Flow Optimization
ITS	Intelligent Transportation Systems
JPO	Joint Program Office
MMITSS	Multi-Modal Intelligent Traffic Signal Systems
MPO	Metropolitan Planning Organization
NIST	National Institute of Standards
OSOW	Oversize-Overweight
PII	Personally Identifiable Information
R.E.S.C.U.M.E	Response, Emergency Staging and Communicatons, Uniform Management, and Evacuation
RFP	Request for Proposals
SAE	Society of Automotive Engineers
USDOT	United States Department of Transportation

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-14-139

U.S. Department of Transportation