Freight Advanced Traveler Information System (FRATIS)

Freight Connected Vehicles
Five Step Approach to Deployment

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Parsons
Freight Technology Research Projects

- Intelligent Transportation Systems (ITS) development and implementation across the US and internationally
- Developing Concepts and Prototypes to Improve Freight Efficiency and Safety for more than 20 years
  - 2005 – Kansas City Cross Town Improvement Project
  - 2009 – Memphis – Drayage Optimization
  - 2012 – Freight Advanced Traveler Information (FRATIS) Port of Los Angeles Prototype
  - 2012 – FRATIS Prototype – Dallas/Fort Worth
  - 2012 – FRATIS Prototype – Miami
  - 2015 – GO 81 Corridor Freight Information System
Next Step... What is the role of CV in Freight Operations?

Can Connected Vehicles provide efficiency in the Supply Chain?
Step 1 – Understand the Problems and Choke Points in the Supply Chain

What are the Problems?
What are the User Requirements?
Beyond Manufacturing and Distribution Efficiencies
Highway Operations Weakest Supply Chain Link

Truck Highway Operations
Highest Area of Opportunity
Improve Safety and Efficiency
In the Supply Chain
Step 2 – Capture User Requirements

- I-81 Corridor forwarded surveys to over 100 participants
- Received a response rate of over 60% from the participants
- The same survey was sent to a group of government agency employees and the second group was comprised of state trucking associations.
- The focus was to capture the responses from both the public and private sectors. This assured the research team that we were getting a good distribution of answers from sectors.
- Developed 30 user requirements based on the responses.
- The following tables contain the questions and responses from each sector. In some questions there were considerable differences in opinion.
## Example of differences between Groups

What information do you consider necessary to operate trucks safer and with higher efficiency on I-81? (check all that apply)

<table>
<thead>
<tr>
<th>Table 1 Survey Responses – Questions 1-3</th>
<th>Trucker Response Percent</th>
<th>Agency Response Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Specific I-81 weather information</td>
<td>47.8%</td>
<td>77.5%</td>
</tr>
<tr>
<td>b. Truckers interested in secure parking along I-81</td>
<td>52.2%</td>
<td>42.5%</td>
</tr>
<tr>
<td>c. Truckers interested in safe parking along I-81</td>
<td>78.3%</td>
<td>55.0%</td>
</tr>
<tr>
<td>d. Current travel speeds on I-81</td>
<td>26.1%</td>
<td>70.0%</td>
</tr>
<tr>
<td>e. Current congestion locations on I-81</td>
<td>65.2%</td>
<td>92.5%</td>
</tr>
<tr>
<td>f. Notification of alternate routes that may be available to route around congestion and incidents</td>
<td>69.6%</td>
<td>75.0%</td>
</tr>
<tr>
<td>g. Truck parking availability in the vicinity of I-81</td>
<td>82.6%</td>
<td>65.0%</td>
</tr>
<tr>
<td>h. Predictive arrivals at destination based on network constraints</td>
<td>13.0%</td>
<td>37.5%</td>
</tr>
</tbody>
</table>
Step 3 – Leverage Data Streams ……
*Where, When, and How do they occur!*

- **Capture the Data**
  - Traffic delays by time of day & day of the week
  - Weather condition and expected delays
  - Construction schedules on routes
  - Waiting time at each deliver or pickup by time of day & day of the week
  - Drivers Hours of Service/Duty
  - Available off peak delivers
  - Available truck parking locations
  - Queue time at Marine Terminal and Railroad Intermodal gates
Shared Data Integration and Dissemination

**Regional ITS Data**

**Sources**
- Regional 511 Systems
- MPO
- State DOT
- Cities

**Types**
- Real-Time Freeway Speeds and Volumes
- Real-Time Key Arterial Speeds and Volumes
- Incident Information
- Road Closure Information
- Route Restrictions/Bridge Heights

**Third Party Truck-Specific Movement Data**

- Real-Time Speed Data from Fleet Management Systems GPS Data
- Cell Phone and/or Bluetooth Movement/Speed Data
- Truck Parking Availability

**Intermodal Terminals Data**

- Queue Length (Including Video)
- Container Availability Status

**FRATIS IT Toolkit**

- ConOps, Architecture, Use Cases
- FRATIS Baseline API's
- FRATIS Baseline Web and AED Apps
- FRATIS Testing Best Practices Guide and Performance Criteria
- FRATIS Business Plan

**FRATIS Basic Applications**

- Dynamic Travel Planning and Performance
- Intermodal Drayage Operations Optimization
  - *Based on Open Source Data and Services*

**FRATIS Commercial Applications**

- Dynamic Travel Planning and Performance
- Intermodal Drayage Operations Optimization
  - *Value Added Services with Target Markets (For Profit)*

**Future U.S. DOT Connected Vehicle Data**

- Road Weather Management – Route Specific Conditions and Forecasts
- “Probe Data” From V-V and V-I Connected Vehicle Technologies
- V-IV & V-I Safety Applications Data

**API’s and/or Web Services**

**USDOT Open Source Web Portal**
Step 4 -- Use the Available Data to Design Applications

Provide Decision Making Capabilities with One-Click

- Predictive Travel Time Algorithms
  - Truck Parking Reservation
  - Determine the best time to operate
- Alternate Route Options
  - Avoid Congestion
  - Determine Off Hour/Off Peak Deliveries
- Share information on predicted arrivals
  - Notify customers of delays in transit
  - Provide status updates predicted arrivals
- Improve Marine and Railroad Intermodal Terminal Turn Times
  - Historical Data
  - Real Time Monitoring of Turn Times
Create Decision Support Applications that provide the User Access with a **One-Click Approach**

Here is a hypothetical GO-81 CFIS User Interaction Sequence:

1. Truck driver launches application to choose destination and route
2. Application requests travel information from system
3. Application retrieves current information for the driver’s chosen route
4. An event occurs and information is captured by existing systems
5. Application continuously polls existing systems for additional events.
6. Application evaluates options for diversion/parking and pushes to driver
7. Application notifies driver and dispatcher of options/implications
Find Truck Parking with Amenities

Scenario 1: A driver is headed south on his first trip down I-81 with a load of alternators from Canada bound for an auto factory in Georgia. He wants to find a truck stop with showers and hot food along his route through Pennsylvania. Provide information about truck stop facilities available at specific points/locations along the highway system.

Use Case Actions, Capability, Data Sources Required, and Outputs to support Scenario User Requirements

<table>
<thead>
<tr>
<th>Step</th>
<th>Action by User</th>
<th>CFIS Portal Capability</th>
<th>Data Sources Required</th>
<th>Output</th>
<th>User Requirements Supported from Table 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Truck Driver activates a CFIS application in truck before departure that will use the GPS to determine truck location.</td>
<td>CFIS Location Detection Capability using GPS</td>
<td>I-81 GPS Map Data Base</td>
<td>Location of Truck shown on screen</td>
<td>No. 1 No. 4 No. 5 No. 9 No. 14 No. 15 No. 16 No. 17 No. 19 No. 22 No. 24 No. 27</td>
</tr>
<tr>
<td>B</td>
<td>One-Click action by Truck Driver to activate a query of the CFIS Truck Stop Data Base to locate truck stop amenities in route.</td>
<td>CFIS Location Detection Capability using GPS CFIS Query of TSPS Truck Stop Amenities Database using location to determine best option to choose. CFIS HERE Predictive Traffic</td>
<td>I-81 GPS Map CFIS TSPS Truck Stop Amenities Database CFIS HERE Predictive Traffic API</td>
<td>Truck Stop Amenities • Fuel Prices • Showers • Food Summary of Travel Time with alternative options to choose</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>One-Click action by Truck Driver makes selection.</td>
<td>CFIS provides driver a map display, driving directions, and predictive arrival time</td>
<td>I-81 GPS Map CFIS TSPS Truck Stop Amenities Database CFIS HERE Predictive Traffic API</td>
<td>Map display, driving directions, and predictive arrival time</td>
<td></td>
</tr>
</tbody>
</table>
**Find Truck Parking**

Scenario 2: A truck driver with a load of electrical transformers has crossed the border from Canada on I-81 and is heading south for a delivery in Knoxville, TN. He is one hour away from his drive time limit, and needs to find parking, but has not driven this route before and has no idea where he might find parking one hour away. Provide accurate and timely information about parking availability at truck stops along the expected route.

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<td>Location of Truck shown on screen</td>
<td>No. 1 No. 4 No. 5 No. 9 No. 14 No. 15 No. 16 No. 17 No. 19 No. 22 No. 27</td>
</tr>
<tr>
<td>B</td>
<td>One-Click Action by Truck Driver to activate a query of the CFIS TSPS Truck Parking Data Base to determine available truck parking slots in route.</td>
<td>CFIS Location Detection Capability using GPS CFIS Query of TSPS Truck Parking Database using location to determine best option to choose. CFIS HERE Truck Predictive Travel determines route and travel time to location</td>
<td>I-81 GPS Map CFIS TSPS Truck Parking Database CFIS HERE Predictive Traffic API</td>
<td>Truck Parking Availability and driving time shown to driver for selecting the best option for driver to make reservation.</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>One Click Action by Truck Driver makes selection of parking from availability.</td>
<td>CFIS provides driver a map display, driving directions, and predictive arrival time</td>
<td>I-81 GPS Map CFIS TSPS Truck Parking Database CFIS HERE Truck Predictive Travel Data Base</td>
<td>Map display, driving directions, number of available parking spots, and predictive arrival time</td>
<td></td>
</tr>
</tbody>
</table>
### Find Truck Parking and make a Reservation for Parking

Scenario 3: A truck loaded with electrical transformers has crossed into the US from Canada is heading down I-81 to Knoxville. The driver has four more hours to drive before he needs to stop to comply with his hours of service. This will mean that he will be stopping at 10:00 pm, and he is concerned that his target truck stop will be too crowded to allow him to park and he would like to make a reservation for a guaranteed spot. Reserve parking space at specified truck stop for a planned time of arrival.

### Use Case Actions, Capability, Data Sources Required, and Outputs to support Scenario User Requirements

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<td>CFIS Location Detection Capability using GPS</td>
<td>I-81 GPS Map Data Base</td>
<td>Location of Truck shown on screen</td>
<td>No. 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CFIS HERE Truck Predictive Travel Data Base</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>One-Click Action by Truck Driver to activate a query of the CFIS TSPS Truck Parking Data Base to determine available truck parking slots in route.</td>
<td>CFIS Location Detection Capability using GPS, CFIS Query of TSPS Truck Parking Database using location to determine best option to choose, CFIS TSPS Truck Parking Reservation Application recommends reservation, CFIS HERE Truck Predictive Travel determines route and travel time to location</td>
<td>I-81 GPS Map, CFIS TSPS Truck Stop Amenities Database, CFIS HERE Truck Predictive Traffic API</td>
<td>Truck Parking Availability shown to driver, Summary of driver with alternative options to choose</td>
<td>No. 2, No. 4, No. 5, No. 9, No. 14, No. 15, No. 16, No. 19, No. 22, No. 27</td>
</tr>
<tr>
<td>C</td>
<td>One Click Action by Truck Driver makes selection of reservation</td>
<td>CFIS provides driver a map display, driving directions, and predictive arrival time</td>
<td>I-81 GPS Map, CFIS TSPS Truck Parking Database, CFIS HERE Truck Predictive Travel Data Base</td>
<td>Map Display, driving directions, reservation number, slot number, and predictive arrival time.</td>
<td></td>
</tr>
</tbody>
</table>
Example Truck Parking Reservations……

**Predictive Algorithms Provide Best Solution**

**Truck Traveling on I-26/I-526/I-385 Driver Checks (one-click):**
- Current ingate status
- Predicted ingate status
- Current Terminal Turn Time
- Predicted Terminal Turn Time
- Incident and Weather Warnings
- Uses Predicted Travel Application
- Hours of Service left in trip

**Makes a decision to reserve parking reservation or continue to terminal**
Scenario 6: Driver leaves carrier terminal in Harrisburg, PA headed south to Memphis, TN. Driver notices that the sky is very dark ahead on the trip and wants to make sure weather will not affect the trip. Driver also wants to know that if he must delay where the closest parking location to take rest and avoid the weather.

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No. 2  
No. 4  
No. 9  
No. 15  
No. 16  
No. 19  
No. 22  
No. 27 |
| B    | One-Click Action by Truck Driver to activate a query of the CFIS TSPS Truck Parking Data Base to determine available secure truck parking slots in route. | CFIS Location Detection Capability using GPS  
CFIS Query of Real Time Predictive Weather using API to State DOT RWIS  
CFIS Query of TSPS Truck Parking Database using location to determine best option to choose | I-81 GPS Map  
State DOT RWIS  
TSPS Truck Parking availability | Current and Predicted Weather for current location and forecasted weather on the route. | |
| C    | One Click Action by Truck Driver from menu of weather information choices (temperature, precipitation forecast, pavement conditions, etc.) | CFIS provides driver a map display with weather information displayed based on selection. | I-81 GPS Map  
State DOT RWIS | Map display with weather information displayed based on selection  
Location of available truck parking. | |
## Find Alternate Routing

**Scenario 8:** Driver stops for fuel south of Winchester, VA. Once he returns to I-81 going south he is notified by highway message sign that there is a major accident that will delay or the trip by 3 hours. Driver has to make a decision either to park and rest or choose an alternate route.

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<td>Location of Truck shown on screen</td>
<td>No. 1 No. 6 No. 7 No. 9 No. 13 No. 14 No. 15 No. 16 No. 19 No. 22 No. 23 No. 25 No. 27</td>
</tr>
<tr>
<td>B</td>
<td>One-Click Action by Truck Driver to activate a query of the from CFIS to State DOT 511 traveler information system</td>
<td>CFIS Location Detection Capability using GPS CFIS Query of State DOT 511 system and use API to query potential accidents and congestion CFIS Query of TSPS truck parking system to determine available truck parking near the driver’s current location. CFIS Query HERE Truck Database to determine legal alternate routes.</td>
<td>I-81 GPS Map State DOT event and congestion system HERE Truck Database to determine legal restrictions – contains detailed information on exact areas or roads where legal restrictions apply. HERE Predictive Traffic</td>
<td>Alternate legal route for trucks Planned arrival time based on HERE Predictive Traffic</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>One Click Action by Truck Driver from menu of possible legal routes and available parking</td>
<td>CFIS provides driver a map display with alternate routes displayed based on selection with predicted travel times. CFIS presents truck parking locations with amenities.</td>
<td>I-81 GPS Map State DOT 511 Travel Information HERE Truck Data HERE Predictive Traffic TSPS available parking database.</td>
<td>Map display with route and drive time information displayed based on selection Location of available truck parking with driving time to parking location.</td>
<td></td>
</tr>
</tbody>
</table>
Deliver CFIS on Multiple Types of Devices

State DOTs
Road Weather Information Systems (RWIS)

Here Predictive Traffic
Denver Airport to Vail, 1-70 Example
Trip Distance: 105 miles
Light Traffic Travel Time: 115 min
What are the expected travel times in an hour when I plan to leave?
Friday, Feb 7, 2014 10:15am
<table>
<thead>
<tr>
<th>Historical Traffic</th>
<th>124 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time traffic</td>
<td>170 min</td>
</tr>
<tr>
<td>Predictive traffic</td>
<td>135 min</td>
</tr>
<tr>
<td>Actual Travel Time</td>
<td>137 min</td>
</tr>
</tbody>
</table>

Sunday, Feb 9, 2014 2:15pm
<table>
<thead>
<tr>
<th>Historical Traffic</th>
<th>152 min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-time traffic</td>
<td>285 min</td>
</tr>
<tr>
<td>Predictive traffic</td>
<td>220 min</td>
</tr>
<tr>
<td>Actual Travel Time</td>
<td>225 min</td>
</tr>
</tbody>
</table>

CFIS “Cloud”

CFIS User

State DOTs
Real Time Traffic Information

CFIS User

CFIS User
Step 5 – Create an Adoption Plan

- Understand the Cost Implications for Deployment
- Create a Business Case for an acceptable Rate of Return
- Apply the Technology Acceptance Model
  - Perceived Usefulness – How users recognize how a system would improve their job performance.
  - Perceived Ease of Use – The perception users have if using a specific system, which would result in less effort.
- Provide Training for Future Users
Deploy the Applications
Connected Vehicles Connecting the Supply

Freight Connected Vehicles
Connecting the Supply Chain

A framework of virtual connections allowing complete collaboration between supply chain partners.
Thank You

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