THE MOTOR CARRIER EFFICIENCY STUDY
2009 ANNUAL REPORT TO CONGRESS

Pursuant to Section 5503(d) of the
Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
(P.L. 109-59)
January 2011

BACKGROUND

Section 5503 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users set aside funding to examine the application of wireless technology to improve the safety and efficiency of trucking operations in the United States. The purpose of the funding is to promote government partnerships with the motor carrier and wireless technology industries, to identify and test promising applications and devices in a "real-world" environment, and to promote the adoption and use of successful wireless solutions by a broad array of motor carriers. The Secretary of the U.S. Department of Transportation (DOT) is also required to transmit an annual report to Congress on the programs and activities carried out under Section 5503.

The specific objectives of the Motor Carrier Efficiency Study (MCES) include the following:

- Identify inefficiencies in freight transportation.
- Evaluate safety and productivity improvements made possible through wireless technologies.
- Demonstrate wireless technologies in field tests.

In addition to the objectives, the scope of the MCES consists of the following five program elements:[1]

- Fuel monitoring and operations management systems.
- Radio frequency identification technology.
- Electronic manifest systems.
- Cargo theft prevention.
- Roadside safety inspection systems.

The Federal Motor Carrier Safety Administration (FMCSA) was delegated authority by the Secretary for administering this program and has completed specific actions pursuant to its provisions. The FMCSA organized the MCES into two phases. Phase I consists of identifying inefficiencies in motor carrier transportation and the evaluation of potential safety and

[1] As discussed in *The Motor Carrier Efficiency Study 2007 Annual Report to Congress*, FMCSA updated the minimum set of program elements listed in Section 5503(b) to include the modified Fuel Monitoring and Operations Management Systems and the new Roadside Safety Inspection Systems program element to broaden the wireless safety technology applications under this program.

productivity benefits from wireless technology solutions. Phase II consists of field demonstration tests of promising wireless technologies that address inefficiencies identified in Phase I. The inefficiencies identified in Phase I are listed in Table 1 of the Appendix.

Phase I was completed in January 2008 and the findings were documented in a final report.[2]

Activities of Phase II focused on applications within the broad program areas mentioned previously and were based on findings from Phase I as well as input from the multimodal team representatives from the Federal Highway Administration's (FHWA) Office of Freight Management and the Research and Innovative Technology Administration's (RITA) Joint Program Office for Intelligent Transportation Systems. This 2009 Annual Report summarizes the key activities in Phase II of the study.

In these demonstrations, promising wireless technologies are being deployed under realistic operating conditions, and industry and government partners are assessing the degree to which the solutions improve safety and operations consistent with the program objectives and elements. The goal for these pilot tests is to provide sufficient evidence to support investment decisions by the Federal Government, technology providers, and the user community.

By way of this report, FMCSA is reporting on four field demonstration projects initiated in 2008 and 2009, Wireless Drayage Updating (WDU), Wireless Roadside Inspection (WRI), fuel monitoring and operations management systems, and cargo theft prevention.

WIRELESS DRAYAGE UPDATING DEMONSTRATION PROJECT

As mentioned above, FMCSA partnered with FHWA and other DOT agencies in the Phase I research to identify inefficiencies and promising wireless technologies that address specific inefficiencies. This partnership proved so successful and beneficial that FMCSA continued it in some Phase II field demonstrations.

The FHWA has ongoing freight mobility field tests that provide a unique leveraging opportunity for Phase II demonstration funds. Specifically, FHWA is conducting the Cross-Town Improvement Program (C-TIP) in Kansas City, Missouri, in partnership with metropolitan planning organizations, several Class I railroads, the Port of Kansas City, the States of Missouri and Kansas, and several other public and private sector stakeholders. The C-TIP program provided a terrific opportunity to quickly demonstrate wireless technologies to address certain key Phase I MCES inefficiencies including empty intermodal truck trips, incident-related congestion, and waiting to load and unload truck trailers. Although estimated savings for incident-related congestion avoidance were unknown, the Phase I final report[3] estimated that motor carriers could save $2.7 billion annually in empty miles travelled and over $3 billion annually from not having to wait to load or unload shipments at distribution centers, ports, and other points of freight interchange.

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[2] The final report, *Motor Carrier Efficiency Study Phase I Final Report*, February 2009, is online at www.fmcsa.dot.gov/facts-research/research-technology/report/RRT_09_015_MCES.pdf.

[3] *Motor Carrier Efficiency Study Phase I Final Report*, page 20, www.fmcsa.dot.gov/facts-research/research-technology/report/RRT_09_015_MCES.pdf.

Through an agreement with FHWA, the WDU demonstration project was initiated in August 2008. The WDU is an open architecture solution that uses low-cost wireless technology as an interface between drayage (intermodal or port) truck drivers and dispatchers who access two other C-TIP components, Intermodal Exchange[4] and Real-Time Traffic Monitoring.[5]

In the WDU project, each participating truck will have a truck-mounted driver interface device (T-MDID) which will be linked wirelessly to the C-TIP system. The T-MDID will be the primary link for truck drivers to participate in the C-TIP pilot demonstration. Through the T-MDID, drivers will send location and trip status information and receive trip assignments and traffic information. The T-MDID will be able to send, receive, and enter data.

The devices will be wireless, Global Positioning System (GPS) enabled, and will have a viewing screen and interface capability for the motor carrier driver's use. Safety requirements for in-cab use will include the following: 1) the device will not allow the driver to interface while the vehicle is moving, 2) the device will not be mounted in a location that obstructs the driver's view outside the vehicle, and 3) the device will be mounted in a location within easy reach and not where it hinders or prevents any other aspects of vehicle operation.

Within the WDU project, the following associated field demonstrations will be conducted:

- Wireless Load Notification and Selection.
- Truck-Specific Congestion Avoidance.
- Wireless Facility Queuing Notification and Management.

The demonstrations will be performed in a concurrent and integrated fashion to allow a holistic evaluation of the WDU solution as a component of the overall C-TIP system. The following sections describe the field demonstrations and project team activities.

Wireless Load Notification and Selection

This application would allow railroads and motor carriers to coordinate operations so that trucks returning to the originating terminal could bring a return load, rather than returning empty, by employing a combined load matching application. Railroads would post their load movement needs in advance, and motor carriers would log onto a Web site and indicate which loads they could support within their resource constraints (i.e., the numbers of available trucks and drivers during the needed movement window). The system would apply business rules agreed upon by the participating railroads and motor carriers to provide the resulting load assignments (work orders) to each motor carrier in a combined dispatch format. The motor carrier dispatcher would then assign loads to individual truck and driver combinations based on current location, proximity to the originating facility, and estimated time of arrival information, and transmit the information wirelessly to the T-MDID in the cab of the truck.

[4] Intermodal Exchange (IMEX) – Open architecture software that enables a collaborative dispatch management model among rail lines, truckers, facility operators, and public traffic management systems.
[5] Real-Time Traffic Monitoring – Real-time monitoring and distribution of route-specific travel time and congestion information utilizing IMEX and the metropolitan area traffic management system.

Truck-Specific Congestion Avoidance

This application would provide a wireless link to existing and newly emerging traffic information. It would allow drivers to receive traffic data that is particularly applicable to their operations. In the event that alternatives exist, this application would provide truck-specific alternate routing information to reduce potentially costly delays. Recurring and updated data regarding the position of each motor carrier's vehicles would be accessed through the T-MDID and automatically provided to the C-TIP system. This data would then be used by the Real Time Traffic Monitoring (RTTM) - Dynamic Route Guidance (DRG) component of C-TIP to calculate the most efficient route from each vehicle's current location to its planned destination (using pickup and delivery requirements resident in the motor carrier's dispatch system) by applying traffic data obtained from the appropriate traffic operations center. Each vehicle's location would be obtained wirelessly through satellite-based (GPS) cellular technology capabilities resident in the T-MDID. Traffic updates and routing advisories would be generated by RTTM-DRG and relayed to the drivers through the same T-MDID.

Wireless Facility Queuing Notification and Management

This application would rely on the use of real-time location and trip status information obtained from the T-MDID of inbound trucks, coupled with automated arrival assignment software, to adjust arrival appointments and to provide the terminal operator a means to ensure continuous operations without the need to physically queue trucks at the facility gate. Changes in arrival appointments, including such information as parking space number, would then be transmitted back to the inbound truck drivers through the T-MDID, thereby alleviating the pressure associated with potentially missing appointments or waiting in long lines.

A contractor-led team, working in conjunction with the public and private sector stakeholders, completed the WDU system requirements work for the demonstrations in the fall of 2009 and are in the process of completing the integrated design requirements of WDU with the other C-TIP system components. Once integrated design testing is complete, the combined WDU field demonstration tests, with participating motor carriers, began in the late spring and early summer of 2010. Final evaluation results addressing the tests' outcomes and findings are expected to be available by April 2011.

WIRELESS ROADSIDE INSPECTION DEMONSTRATION PROJECT

Also in August 2008, FMCSA initiated the WRI demonstration project, which will evaluate how effectively current commercial mobile radio services (CMRS) – including onboard computers and wireless fleet management tracking systems, can check driver, vehicle, and motor carrier safety status while the commercial motor vehicle (CMV) is moving. The FMCSA is conducting the WRI project in partnership with several wireless technology providers, motor carrier companies, and the State of Tennessee Department of Safety.

According to a 2003 FMCSA study,[6] there were 3 million truck inspections with a violation rate of 73 percent (including a 23 percent out-of-service rate). In that same year, there were 177 million roadside truck weighs[7] with a violation rate of 0.29 percent (515,587 citations).

New technologies and enforcement strategies could dramatically increase the number of times a CMV and its driver are examined, leading to better-targeted enforcement, creating a greater deterrence to operating unsafely, and reducing the number of truck and bus crashes. The FMCSA's WRI project will evaluate the feasibility and value of assessing commercial drivers and vehicles up to 30 times more often than it is possible using current approaches.

A "wireless inspection" is a process where public sector entities (personnel and systems) examine the condition of the vehicle and driver by assessing data collected by onboard systems. The collected data, which are termed the Safety Data Message Set (SDMS), are delivered via wireless communications in real-time to public sector infrastructure. The SDMS will contain basic identification data (i.e., driver, vehicle, carrier, container, and cargo), record-of-duty status, and vehicle condition data that are typically collected manually by safety inspectors during current roadside inspections. The roadside enforcement sites that will query and receive SDMSs from CMVs are envisioned to include fixed roadside weigh stations, unmanned remote sites on bypass routes and State borders, and mobile police cruisers. Depending on the availability of enforcement resources, interdiction strategies acting on the SDMS will include real-time and non-real-time scenarios.

The program will evaluate the potential benefits to both the motor carrier industry and government. Potential benefits to industry include keeping safe and legal drivers and vehicles moving on the highways without having to stop at roadside stations. The Phase I final report[8] estimates that motor carriers could save $215 million annually by reducing the number of weigh station stops. Also, according to the FMCSA study cited above, potential annual safety benefits of a fully deployed WRI system are estimated to include 253 lives saved, 6,192 injuries avoided, and 17,611 property-damage-only crashes prevented.

Potential benefits to government also include the support this program would offer to the FMCSA's Comprehensive Safety Analysis (CSA) 2010 Program, which will begin nationwide deployment in late 2010. The purpose of the CSA 2010 initiative is to develop more effective and efficient methods for FMCSA, together with industry and State partners, to achieve its mission of reducing CMV crashes, fatalities, and injuries.

In addition to the CMRS testing in Tennessee, FMCSA is also working with other States to evaluate other wireless communications technologies for WRI. Under separate funding, FMCSA is working with the State of New York to test the WRI application using radio-frequency

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[6] "Development and Evaluation of Alternative Concepts for Wireless Roadside Truck and Bus Safety Inspections," FMCSA, 2003, www.fmcsa.dot.gov/facts-research/research-technology/report/wireless-inspection-report.pdf.

[7] 177 million truck weighs consist of 82 million conducted by roadside officers and 95 million conducted by weigh-in-motion machines.

[8] *The Motor Carrier Efficiency Study Phase I Final Report*, page 20, FMCSA, 2009, online at www.fmcsa.dot.gov/facts-research/research-technology/report/RRT_09_015_MCES.pdf.

identification technology, and with the State of Kentucky to test WRI by using high-speed cameras to read license plates and DOT number markings on moving CMVs.

The WRI project is currently in its pilot testing phase. In 2009, the WRI Concept of Operations document was updated and work began on the WRI architecture for a fully deployed system. The WRI testing of CMRS technologies began in August 2010 and will conclude in November 2010. An evaluation of the safety and productivity benefits for motor carriers and for government CMV safety agencies will be completed by July 2011 and followed by a decision on whether to proceed to a full field operational test involving several States and motor carriers. The purpose of the field operational test would be to evaluate the policy, information technology infrastructure, and economic viability of conducting tens of millions of wireless roadside inspections in support of CSA 2010 and other agency goals.

Fuel Monitoring and Operations Management Systems Demonstration Project

The MCES Phase I report estimated that wireless technology solutions could provide significant fuel savings for some motor carriers. For example, one motor carrier with 150 trucks was able to save $1.6 million in fuel and maintenance costs due to using technologies to monitor driver performance and reduce excessive speeds. In September 2009, FMCSA awarded a contract to test and evaluate the benefits of available fuel monitoring and operations management systems. A key safety question that will also be evaluated is whether a fleet's use of wireless technology to actively monitor driver fuel use also helps reduce driver fatigue. The FMCSA temporarily delayed the project to review the congressionally-mandated National Academy of Sciences report, "Assessment of Fuel Economy Technologies for Medium- and Heavy-Duty Vehicles" published March 31, 2010, to ensure that the project addressed the findings and recommendations of the report. The project is expected to conclude in January 2011.

Cargo Theft Prevention Demonstration Project

The MCES Phase I report estimated losses due to cargo theft to be $15 to $30 billion annually. In September 2009, FMCSA awarded a competitive procurement to conduct a field demonstration and evaluation of commercially available truck-based cargo theft prevention technologies. The FMCSA will use performance-based contracting for this effort. The product of the field demonstration will be an evaluation of the costs, benefits, advantages, and disadvantages of cargo theft prevention technologies. Similar to the fuel monitoring project above, the independent performance results from the evaluation will assist motor carriers considering purchasing this cargo theft prevention technologies. The project is expected to conclude in December 2010.

Summary

With these Phase II projects, FMCSA will address key inefficiencies identified in the Phase I study. Table 1 expands an existing table from the Phase I study by adding a column that maps the Phase II projects back to the inefficiencies.

The Phase II field demonstration activities (Wireless Drayage Updating and the Wireless Roadside Inspection initiated in 2008 and Fuel Monitoring and Operations Management Systems and Cargo Theft Prevention technologies initiated in 2009) will quantify the remaining unknowns listed in Table 1. Of the three remaining inefficiencies, the two related to border crossing will be a major focus area for 2010. Wireless demonstration projects at the Northern and Southern international borders will be initiated to quantify potential gains to carriers and the public. Activities to address the remaining inefficiency, Driver Turnover, are likely outside the scope of MCES but could be the subject of future research.

The FMCSA is committed to working with the wireless technology and motor carrier industries as well as with State CMV safety agencies to evaluate and promote wireless technology solutions that improve CMV safety and efficiency. Updates on all four of the Phase II initiatives will be provided in the 2010 annual report to Congress.

APPENDIX

Table 1. Identified Inefficiencies and Corresponding Phase II Demonstration Projects

Inefficiency	Potential Gain to Carriers	Potential Gain to Society	Phase II Project
Time Loading and Unloading	$3.08 billion annually	$6.59 billion annually	Wireless Drayage Updating
Waiting in Ports	$900 million annually	Unknown	Wireless Drayage Updating
Paperwork Delay at Borders	$23 million annually	$50 million annually	
Time in Weigh Stations	$215 million annually	$461 million annually	Wireless Roadside Inspection
Incident-Related Delay	Unknown	Unknown	Wireless Drayage Updating
Urban Routing Problems	Unknown	Unknown	Wireless Drayage Updating
Management Tools	Unknown	Unknown	Fuel Monitoring and Operations Management
Vehicle Safety	Unknown	$1.55 billion annually	Wireless Roadside Inspection
Driver Safety	Unknown	$1.35 billion annually	Wireless Roadside Inspection
Compliance Review Inspections	Unknown	$23.1 million annually	Wireless Roadside Inspection
Processing Capacity at Borders	$211K per Owner/Operator annually	Unknown	
Driver Turnover	$8,200 per driver	Unknown	
Excessive Speed	$1.6 million annually for one 150-truck carrier	Unknown	Fuel Monitoring and Operations Management
Cargo Theft and Pilferage	Unknown	$15-30 billion annually	Cargo Theft Prevention
Empty Intermodal Moves	$21 million annually in Chicago alone	Unknown	Wireless Drayage Updating
Empty Miles	$2.7 billion annually	Unknown	Fuel Monitoring and Operations Management
Vehicle Maintenance	$320 million annually	Unknown	Fuel Monitoring and Operations Management

LIST OF ACRONYMS

CMRS	Commercial Mobile Radio Services
CMV	Commercial Motor Vehicle
CSA	Comprehensive Safety Analysis
C-TIP	Cross-Town Improvement Program
DRG	Dynamic Route Guidance
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GPS	Global Positioning System
MCES	Motor Carrier Efficiency Study
RTTM	Real Time Traffic Monitoring
RITA	Research and Innovative Technology Administration
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SDMS	Safety Data Message Set
T-MDID	Truck-Mounted Driver Interface Device
DOT	U.S. Department of Transportation
WDU	Wireless Drayage Updating
WRI	Wireless Roadside Inspection