INTERMODAL FREIGHT

THE HAZMAT TRANSPORTATION SAFETY AND SECURITY FIELD OPERATIONAL TEST FOUND THAT BASIC IN-VEHICLE TRACKING EQUIPMENT RANGED FROM $429 TO $995 PER VEHICLE.

FREIGHT

The dramatic growth in freight movement over the last several years has severely strained the transportation network. Landside access to U.S. ports, congestion on highways around major gateways, delays at border crossings, and congestion at major east-west rail interchanges have created major freight bottlenecks.

With increasing threats to productivity (i.e., shortage of drivers, high insurance rates, highway congestion, and increasing fuel and labor costs[501]), ITS technologies that support efficient and reliable freight transportation along the supply chain and can help the freight industry benefit from just-in-time, lean-inventory business models.

Freight tracking applications can monitor, detect, and communicate freight status information to ensure containers remain sealed while en route. In addition, asset tracking technologies can monitor the location and identity of containers in real time. ITS freight terminal processes can improve operations at freight transfer stations, using information technology to expedite procedures often carried out using paper records. These technologies combined can provide an electronic freight manifest, reducing shipment processing time and increasing the productivity of freight carriers and the freight transportation system. Security can be augmented by tracking devices that confirm the location and condition of freight as it is sealed for transfer. ITS support for drayage operations can promote the efficient transfer of cargo by truck around major port facilities, using information technology to provide dispatchers and truck drivers with information on vessel traffic, container/cargo availability, on- and off-port traffic conditions, and delay times at terminal entrances. At international border crossings, automating revenue transactions and faster, more efficient confirmation of cargo manifest information can reduce delays associated with customs and tax collection processing. In addition, ITS applications that optimize traffic control and coordinate transfers near intermodal ports of entry can help reduce the strain of increased freight movement on the Nation's freight-highway connector system.

Related to intermodal freight technologies are technologies that facilitate safe and efficient motor carrier operations, which are discussed in the commercial vehicle operations chapter.

To support the U.S. DOT Congestion Initiative and reduce congestion at ports and terminals, the U.S. DOT developed the *Framework for a National Freight Policy* and implemented the Electronic Freight Management (EFM) initiative.

The EFM, a major ITS initiative being conducted by U.S. DOT, seeks to develop service-oriented Web-based technologies that have the potential to improve information exchange between multiple entities (both government and commercial) and increase the efficiency of cargo transfer.

The *Framework for a National Freight Policy* lays out a vision and objectives, then details strategies and tactics that the U.S. DOT and its partners in the public and private sectors can pursue to achieve these objectives. A draft was developed in 2006. Since that time, the U.S. DOT has been soliciting feedback on the policy, in order to building support among stakeholders.

For more information, visit the ITS JPO and *Framework for a National Freight Policy* Web sites: *www.its.dot.gov* and *ostpxweb.dot.gov/freight_policy_framework.html*.

INTERMODAL FREIGHT CATEGORIES IN THE ITS KNOWLEDGE RESOURCES

Freight Tracking

Asset Tracking

Freight Terminal Processes

Drayage Operations

Freight-Highway Connector System

International Border Crossing Processes

ELECTRONIC SUPPLY CHAIN MANIFEST SYSTEMS CAN REDUCE DOCUMENT PROCESSING TIME FOR AIR CARGO SHIPMENTS BY OVER 50 PERCENT.

Findings

Benefits

Electronic supply chain manifest (ESCM) systems that automate the transfer of intelligent freight data between supply chain partners and government agencies have enabled freight operators to reduce administrative burdens, shorten processing times, and lower the cost of cargo movement. Initial field operational tests indicate that these automated tools, when applied to a domestic supply chain, can reduce the time it takes to accept and process cargo transfer documents by more than 50 percent.[502]

For international shipments, where multiple freight transactions and customs are required, ESCM systems can have even greater potential. An evaluation study conducted in Taiwan showed that approximately 70 percent of the paperwork required for international air cargo shipments included redundant data entry that could have been handled by automated ESCM systems.[503]

An evaluation of the potential impacts of a nationwide ESCM network estimated that there are about 0.17 billion air cargo shipments each year in the United States that could benefit from ESCM.[504] With potential cost saving benefits ranging from $11.77 to $16.20 per air-freight shipment,[505] ESCM could save the freight industry more than $2 billion per year.[506] Additional data on the cost to build a nationwide network should become available as the system develops.

Table 17 provides an overview of evaluation findings for a variety of ITS strategies for intermodal freight. Most results indicate improvements in the mobility and corresponding productivity benefits for freight transportation companies.

OTHER ITS KNOWLEDGE RESOURCE CATEGORIES RELATED TO INTERMODAL FREIGHT

Refer to other chapters in this document.

Commercial Vehicle Operations

- Credentials Administration
- Carrier Operations and Fleet Management
- Security Operations

Table 17—Intermodal Freight Benefits Summary						
	Safety	Mobility	Efficiency	Productivity	Energy and Environment	Customer Satisfaction
Freight Tracking						
Asset Tracking				✚		
Freight Terminal Processes		●		●	✚	
Drayage Operations						
Intermodal Border Crossing Processes		●		●		

● Substantial positive impacts
❍ Negligible impacts
✖ Negative impacts
✚ Positive impacts
✱ Mixed results
blank Not enough data

Costs

The Hazardous Materials (HAZMAT) Transportation Safety and Security Field Operational Test (FOT) was conducted to assess commercially-available, off-the-shelf technology that could be deployed in the near term to enhance the safety and security of HAZMAT transportation operations. Part of the assessment included collecting cost data for the different technologies. Of those technologies, many support efficient and reliable freight transportation. For instance, asset tracking technologies can monitor the location and identity of containers in real time. The study found that basic in-vehicle tracking equipment ranged from $429 to $995 per vehicle. Advanced in-vehicle tracking equipment (multiple sensors) ranged from $1,290 to $2,275 per vehicle. Basic costs for asset tracking—tracking of trailers whether tethered or untethered—ranged from $139 to $500 per unit. Mid-range costs ranged from $375 to $450 per unit.[507]

LESSONS LEARNED

Use an interoperable transponder to maximize benefits to both the private and public sector.

The Washington State-British Columbia International Trade and Mobility Corridor program deployed ITS technologies to improve border crossing operations on the U.S.-Canadian border between Washington and British Columbia.

Interoperable transponders provided a variety of benefits to both the private and public sectors, and alleviated motor carriers from having to buy multiple transponders. This benefit was especially important as transponder-based services were expanded in the corridor. Interoperability of transponders allowed participants to successfully administer the regional trucking fleets and improve truck safety by sharing credentialing information electronically.

- Encourage freight carriers to install electronic transponders that enable faster border crossing.

(*Continued on next page.*)

OPERATIONS/ITS HELPLINE

1-866-367-7487

ITS APPLICATION OVERVIEW

www.itsoverview.its.dot.gov

Selected Highlights from the ITS Knowledge Resources on Intermodal Freight

Freight Tracking

Freight tracking applications can monitor, detect, and communicate freight status information such as the condition and location of goods while ensuring that containerized cargo remains sealed within shipping containers while en route.

Freight Tracking	
Benefits	
ITS Goals	**Selected Findings**
Customer Satisfaction	An air cargo security and logistics tracking system was evaluated from 2000 to 2002. The goal was to assess the potential security and efficiency benefits of a Web-based electronic manifest system compared to a traditional paper-based manifest system. Manufacturers, carriers, and airports that used the Web-based system felt it was easy to use and were very satisfied with the system's performance with respect to business functions.[508]
Costs	
Unit Costs Data Examples (See Appendix A for more detail)	
Commercial Vehicle On-Board subsystem: • Electronic Cargo Seal Disposal: $0.01K-$0.024K • Electronic Cargo Seal Reusable: $0.034K-$0.42K Fleet Management Center subsystem: • Electronic Cargo Seal Reader: $0.3K-$1.4K	

Asset Tracking

Asset tracking technologies can monitor the location, identity, and status of mobile or stored freight containers, chassis, or other transportation assets in real time.

Asset Tracking
Costs
Unit Costs Data Examples (See Appendix A for more detail)
Commercial Vehicle On-Board subsystem: • Autonomous Tracking Unit: $0.34K-$0.8K • Autonomous Tracking Unit: $0.14K-$0.4K (annual service charge) • Global Positioning System (GPS)/Differential GPS (DGPS): $0.5K-$1.8K
Sample Costs of ITS Deployments
United States: The HAZMAT Transportation Safety and Security FOT was conducted to assess commercially-available, off-the-shelf technology that could be deployed in the near term to enhance the safety and security of HAZMAT transportation operations. Basic in-vehicle tracking equipment ranged from **$429 to $995 per vehicle**. Advanced in-vehicle tracking equipment (multiple sensors) ranged from **$1,290 to $2,275 per vehicle**. Basic costs for asset tracking, tracking of trailers (tethered and untethered) ranged from **$139 to $500 per unit**. Mid-range costs ranged from **$375 to $450 per unit**.[510]

LESSONS LEARNED

(*Continued from previous page.*)

The deployment proved that automatic vehicle identification transponders could be used to monitor the legal compliance of trucks. These transponders enabled eligible carriers to bypass weigh stations within the corridor. The cross-border bypass provided significant time savings for private motor carriers, as well as resource savings for regulatory personnel. As an added benefit, because transponder-equipped trucks bypassed border crossing queues, the border crossing times for non-transponder equipped trucks decreased.

- Be cognizant that the rate of return is dependent on the rate of participation.

Similar ITS deployments at regular roadside weigh stations may require a longer time period for payback of investment and are more sensitive to participation than border crossing deployments. Border crossing deployments could realize a return on investment the first year of deployment because of the high volume of transponder-equipped trucks.[509]

Freight Terminal Processes

ITS freight terminal processes can improve the efficiency of freight transfers or freight storage by activating transponder tags to track cargo containers within the terminal as they are processed and sealed for transfer or storage.

Freight Terminal Processes	
Benefits	
ITS Goals	**Selected Findings**
Productivity	The U.S. DOT evaluated a Web-based ESCM system and compared its performance with a traditional paper-based manifest system. ESCM delivered labor cost savings and time-on-task reductions in manifest preparation, paperwork handling, communications between partners, and actual load transfer times. Manufacturers reportedly saved more than 6 minutes per shipment, trucking companies saved more than 15 minutes per shipment, and airlines saved almost 12 minutes per shipment. The cost savings to air carriers was significant, considering the relatively small size of most air freight shipments compared to truckload highway shipments.[512]

LESSONS LEARNED

Have a management-level champion to facilitate recruitment of participants and retain operational staff.

With the support of the Office of the Secretary of Transportatioβn, the Federal Aviation Administration, the Federal Highway Administration Office of Freight Management and Operations, the American Trucking Associations Foundation led the formation of a public-private partnership to develop and test the electronic supply chain manifest (ESCM), the first operational electronic air cargo manifest and security system in the United States. This project demonstrated the improvements in efficiency and security of a Web-based electronic air cargo security system compared to traditional processes and paper-based manifest systems.

- Realize that lack of participation by enough supply chain partners will restrict use of an ESCM.

ESCM project participants reported that few of their transportation partners enrolled in the system. Without a larger number of participants, the benefits are difficult to quantify. Several participants stated that they did not have enough air freight shipments to adequately test the system.

The ESCM operational test successfully demonstrated the use of technology to create a secure intermodal electronic manifest system and participants reported overall satisfaction with the ESCM system. However, staff turnover and the lack of participation by supply chain partners significantly limited the usefulness.[511]

OPERATIONS/ITS HELPLINE

1-866-367-7487

ITS APPLICATION OVERVIEW

www.itsoverview.its.dot.gov

Drayage Operations

ITS for drayage operations can promote the efficient loading, unloading, sorting, and transfer of cargo by implementing automated systems and robotics to optimize limited dock and port space.

Drayage Operations	
Benefits	
ITS Goals	**Selected Findings**
Mobility	An analytical demand model estimated the impacts of implementing an appointment system designed to expedite cargo handling at transfer stations by pre-registering truck arrival times at terminal gates. The model indicated that if all trucks used the appointment system, total in-terminal time across all vehicles would decrease by 48 percent.[513]
Productivity	Regional intelligent freight data networks and terminal gate scheduling systems reduce non-productive waiting time, emissions, and wasted fuel during idling. Evaluation data collected from the Freight Information Real-time System for Transport project estimated that savings per drayage trip to an ocean terminal would range from $21.36 to $247.57.[514]
Energy and Environment	In Chicago, a 2004 feasibility study indicated that automated truckway technologies (automatic truck steering, speed, and platoon spacing control) would save travel time and reduce fuel consumption.[515]

International Border Crossing Processes

At international border crossings, automating tax revenue transactions and faster, more efficient verification of cargo manifest information can reduce delays associated with multi-agency processes.

International Border Crossing Processes	
Benefits	
ITS Goals	**Selected Findings**
Mobility	Simulation models of traffic at the U.S.-Canadian border on the Ambassador Bridge connecting Detroit, Michigan with Windsor, Ontario showed that electronic border clearance could save equipped trucks 50 percent of the delay through customs.[516]
International Border Crossing Processes	
Costs	
Unit Costs Data Examples (See Appendix A for more detail)	
Commercial Vehicle Electronic Credentialing/Administration subsystem: • State Employee Labor International Registration Plan (IRP) Credentialing: $46K-$163K (annually) • Contractor Labor for IRP Credentialing: $6.4K-$17K (annually) • State Employee Labor International Fuel Tax Agreement (IFTA) Credentialing: $13.8K-$111.8K (annually) • Vendor Labor for IFTA Credentialing: $1K-$19.2K (annually)	
International Border Crossing Processes	
Benefit-Cost Studies	
United States: A study of electronic border clearance technologies in the mid-continent transportation corridor from Minnesota to Texas found that benefit-to-cost ratios for motor carriers range from 85:1 to 718:1.[517]	

OPERATIONS/ITS HELPLINE
1-866-367-7487

ITS APPLICATION OVERVIEW
www.itsoverview.its.dot.gov

501 *Evaluation of* U.S. *Commercial Motor Carrier Industry Challenges and Opportunities: Final Report*, ICF Consulting, Fairfax, VA. 31 March 2003.

502 *Electronic Intermodal Supply Chain Manifest Field Operational Test Evaluation Final Report*, U.S. DOT Federal Highway Administration, EDL No. 13769. December 2002. Benefits ID: 2003-00254

503 Shon, Zhengyi, Jinn-Tsai Wong, and Teng-Wei Wang. "Measuring the Cost Savings of Applying Electronic Supply Chain Manifest in Air Cargo," Paper Presented at the 85th Annual Meeting of the Transportation Research Board. Washington, DC. 22–26 January 2006. Benefits ID: 2008-00566

504 *Electronic Supply Chain Manifest Benefit Calculations—Revised* 2005, U.S. DOT Federal Aviation Administration and Federal Highway Administration. December 2005.

505 Sources that support these findings:

Electronic Supply Chain Manifest Benefit Calculations—Revised 2005, U.S. DOT Federal Aviation Administration and Federal Highway Administration. December 2005. Benefits ID: 2008-00567

The Freight Technology Story: Intelligent Freight Technologies and Their Benefits, U.S. DOT Federal Highway Administration, Report No. FHWA-HOP-05-030, EDL No. 14118. June 2005. Benefits ID: 2008-00568

506 *Electronic Supply Chain Manifest Benefit Calculations—Revised* 2005, U.S. DOT Federal Aviation Administration and Federal Highway Administration. December 2005. Benefits ID: 2008-00567

507 *Hazardous Material Transportation Safety and Security Field Operational Test: Final Report—Deployment Team*, U.S. DOT Federal Motor Carrier Safety Administration. 31 August 2004. Costs ID: 2006-00100

508 *Electronic Supply Chain Manifest Benefit Calculations—Revised* 2005, U.S. DOT Federal Aviation Administration and Federal Highway Administration. December 2005. Benefits ID: 2008-00569

509 *Washington State—British Columbia: International Mobility and Trade Corridor* (IMTC), U.S. DOT Federal Highway Administration, EDL No. 13952. October 2003. Lesson ID: 2006-00211

510 *Hazardous Material Transportation Safety and Security Field Operational Test: Final Report—Deployment Team*, U.S. DOT Federal Motor Carrier Safety Administration. 31 August 2004. Costs ID: 2006-00100

511 *Electronic Intermodal Supply Chain Manifest Field Operational Test Evaluation Final Report*, U.S. DOT Federal Highway Administration, EDL No. 13769. December 2002. Lesson ID: 2006-00202

512 Sources that support these findings:

Electronic Supply Chain Manifest Benefit Calculations—Revised 2005, U.S. DOT Federal Aviation Administration and Federal Highway Administration. December 2005. Benefits ID: 2008-00567

Sedor, Joanne and Michael Onder. "A High-Tech Route for Freight Efficiency," *Public Roads*, Vol. 69, No. 6. May/June 2006.

513 *Freight Information Real-Time System for Transport* (FIRST): *Evaluation Final Report*, U.S. DOT, EDL No. 13951. October 2003. Benefits ID: 2004-00275

514 *The Freight Technology Story: Intelligent Freight Technologies and Their Benefits*, U.S. DOT Federal Highway Administration, Report No. FHWA-HOP-05-030, EDL No. 14118. June 2005. Benefits ID: 2008-00568

515 Shladover, Steven E., et al. *Assessment of the Applicability of Cooperative Vehicle-Highway Automation Systems to Bus Transit and Intermodal Freight: Case Study Feasibility Analyses in the Metropolitan Chicago Region*, University of California PATH Program, Report No. UCB-ITS-PRR-2004-26. Berkeley, CA. 19 August 2004. Benefits ID: 2007-00461

516 *Final Evaluation Report: Ambassador Bridge Border Crossing System* (ABBCS) *Field Operational Test*, Prepared by Booz Allen Hamilton for the ABBCS FOT Partners, EDL No. 13072. Detroit, MI. May 2000. Benefits ID: 2000-00129

517 Maze, T. and C. Monsere. "Analysis of a Multi-State Corridor Deployment of Intelligent Transportation Systems for Commercial Vehicle Operations," Paper Presented at the 6th World Congress Conference on ITS. Toronto, Canada. 8–12 January 1999. Benefits ID: 2007-00448

518 Sources that support these findings:

Carnell, Robert C. and Nancy J. McMillan. "Conditional Analysis of Safety Benefits of a Collision Warning System and Adaptive Cruise Control in Commercial Trucks," Paper Presented at the 86th Annual Meeting of the Transportation Research Board. Washington, DC. 21–25 January 2007. Benefits ID: 2008-00570