U.S. Department of Transportation

Commercial Vehicle Operations

ITS Benefits, Costs, and Lessons Learned: 2017 Update Report

Commercial Vehicle Operations

- Credentials Administration
- Safety Assurance
- Electronic Screening
- Carrier Operations & Fleet Management
- Security Operations

Highlights

- Dynamic mobility applications that improve data sharing among commercial vehicle drivers can improve freight travel times up to 20 percent.
- Truck Parking Information and Systems (TPIS) have benefit-to-cost ratios ranging from 4.2 to 7.
- With sufficient economies-of-scale, a network wide deployment of Smart Roadside applications can yield benefit-to-cost ratios ranging from 3.5 to 6.2.

Introduction

This factsheet is based on past evaluation data contained in the ITS Knowledge Resources database at: www.itskrs.its.dot.gov. The database is maintained by the U.S. DOT's ITS JPO Evaluation Program to support informed decision making regarding ITS investments by tracking the effectiveness of deployed ITS. The factsheet presents benefits, costs and lessons learned from past evaluations of ITS projects.

ITS applications for commercial vehicle operations (CVO) enhance communications between motor carriers and regulatory agencies, reduce administrative costs for public and private sector operations, and assure safe reliable movement of goods and services on the Nation's roadways. As part of the Motor Carrier Safety Improvement Act of 1999, the U.S. DOT commissioned the Federal Motor Carrier Safety Administration (FMCSA) to advance these goals and implement the Commercial Vehicle Information Systems and Networks (CVISN) program to fund state participation. As part of the Fixing America's Surface Transportation Act (FAST Act) of 2015, the CVISN Grant Program was restructured and renamed the Innovative Technology Deployment (ITD) Grant Program. The program continues to focus on "Core" and "Expanded" functions, where Core functions have priority for nationwide deployment.

The ITD Program (formerly known as CVISN) encourages data sharing to improve motor carrier safety and productivity

Core ITD

Electronic credentialing – Automates the application, processing, and issuance of motor carrier operating credentials.

Safety information exchange – Facilitates the collection, distribution, and retrieval of motor carrier safety information at the roadside.

Electronic screening – Enables commercial vehicles with good safety and legal status to bypass roadside inspections and weigh stations.

Expanded ITD

- Expanded electronic credentialing – Enables authorized stakeholders to access current and accurate credentials information.
- Smart roadside – Connects remote inspection sites and virtual weigh stations to ITD networks.
- Enhanced safety information sharing and data quality – Provides motor carrier access to Federal and state safety data and ITD updates.
- Driver information sharing – Enables enforcement personnel to access driver records and safety data.

In 2015, the FMCSA in conjunction with state and local stakeholders identified 40 new capabilities to be integrated into the ITD Program. As of November 2016, 39 states were certified as Core ITD compliant and 36 states were deploying Expanded ITD functions.

Benefits

Core ITD

Electronic credentialing allows carriers to register with state agencies online to improve turn-around times and lower labor costs associated with permit processing and approval.

Ninety-four (94) percent of motor carrier companies surveyed say that electronic credentialing is more convenient, 80 percent saw savings in staff labor time, and 58 percent achieved costs savings over manual methods (2011-00738).

With more rapid processing and reduced overhead and labor costs, carrier savings can be as high as $360,500 per year depending on fleet size (2009-00609).

A national evaluation of the CVISN deployment program indicated electronic credentialing has a benefit-cost ratio of 2.6 (2012-00787).

The safety information exchange (SIE) portion of the CVISN program integrates national and state databases enabling a coordinated review of registration and safety data. Enforcement personnel can access national database clearinghouses to review carrier regulatory compliance data and crosscheck safety assurance information. Electronic screening systems allow transponder equipped commercial vehicles to:

- Provide expedited information to inspection stations.
- Improve inspection efficiency.
- Allow safe and legal carriers to bypass roadside inspections and weigh stations.

An evaluation of the national CVISN program found that electronic screening has a benefit-cost ratio of 1.9 to 7.5. Results varied depending on the system configuration, level of deployment, and the benefits of crash avoidance gained through increased compliance (2012-00787).

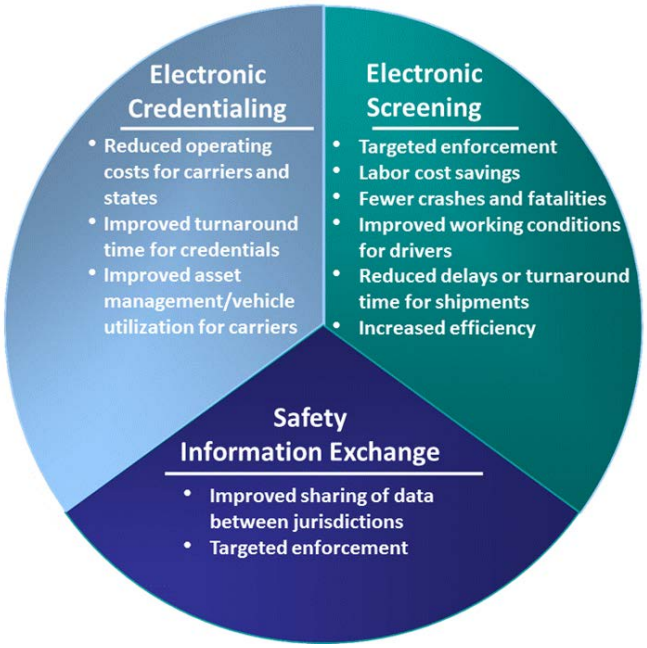


Figure 1: Summary of Benefits for Core ITD Functions (Source: U.S. DOT, 2008 [1])

Expanded ITD

Initial results from limited scale field operational tests show that ITS applications for Expanded ITD functions support Core ITD functions and improve mobility, safety, and productivity for commercial vehicle operations.

Real-time truck parking information technologies continue to be tested to improve the safe operation of large trucks and buses on interstate highways. With more than 11 percent of truck crashes associated with driver fatigue, safe truck parking has emerged as a priority for both carriers and state agencies. A recent study in Colorado found that interstate truck drivers face considerable delays while hunting for safe parking and waiting for access to chain-up areas during inclement weather. The deployment of a statewide Truck Parking Information Management System (TPIMS) covering several interstate freeways in Colorado was estimated to have a benefit-to-cost ratio of 7:1 resulting from increased safety, reduced delay, fuel savings, fewer emissions, and improved operations for motor carries and interstate travelers. The payback period for the investment was estimated at one year [2].

Wireless roadside inspection technologies continue to be developed and improved to support wireless communications between commercial vehicles, motor carriers, enforcement resources, highway facilities, intermodal facilities, toll facilities, and other nodes on the transportation network. An initial feasibility analysis conducted by the U.S. DOT suggested that with sufficient economies-of-scale, a network wide deployment of smart roadside applications can yield benefit-cost ratios ranging from 3.51:1 to 6.17:1 over a 10 year period [3]. In another study, improved data sharing among commercial vehicle drivers was estimated to improve freight travel times up to 20 percent (2013-00845).

Automated license plate reader (ALPR) technology is another area that continues to advance. In British Columbia, an ALPR system was added to an existing electronic screening system to enhance detection of high-risk carriers. The improved inspection process reduced overall commercial vehicle travel times and decreased fuel consumption and emissions resulting in an overall benefit-to-cost ratio of 26:1 (2013-00836).

Costs

Core ITD

Data collected from four states (Montana, New Jersey, New York, and South Dakota) show costs for Core ITD functionality vary widely depending on the size of the state and the level and type of systems deployed.

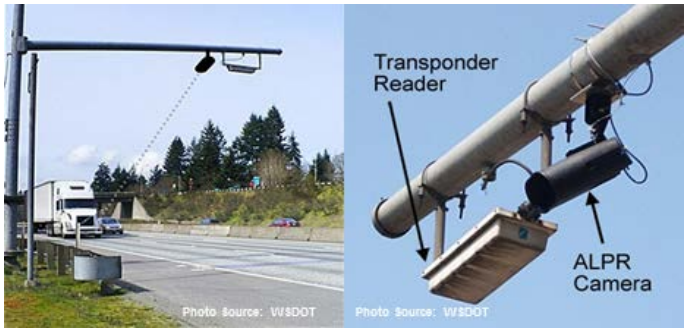
The average start-up cost for electronic credentialing was estimated at $1.35 million per state (with a range of $28,037 to $8.57 million) with annual operating and maintenance costs estimated at $250,000 per year ($22,645 to $1.09 million) (2011-00229).

The average per state start-up costs for safety information exchange systems were estimated at roughly $680,000 ($31,828 to $2.68 million) with operating costs estimated at $74,000 per year (2011-00230).

The average per state start-up cost for electronic screening systems varied from $1 million to $2.8 million (2011-00231).

Expanded ITD

Virtual weigh stations can monitor traffic in truck-only lanes without having to purchase extensive right of ways located adjacent to the mainline for weigh station construction. Funding requests suggest that virtual weigh station system costs range from $300,000 to $1.4 million (2013-00287).



Automated license plate reading systems (ALPR) can supplement Core ITD functions. The cost to add an ALPR system to eight inspection sites was estimated at $1.06 million (CAN).

Total hardware costs for sensors, cameras, and overview image capture equipment were estimated at $484,000.

Total software costs, including an enterprise software module and customized optical character recognition (OCR) and electronic screening software at eight inspection sites, were estimated at $382,000. (2013-00279)

ITS truck parking systems such as those implemented during the SmartPark initiative cost roughly $392,000 per site. As a planning level estimate for a basic conceptual design, the system included detectors/sensors, CCTV cameras, DMS units, communications and networking equipment, system integration, utilities, and static signage. Annual O&M costs were estimated at $5,500 per site [4].

Case Study – Regional Truck Parking Information and Management System

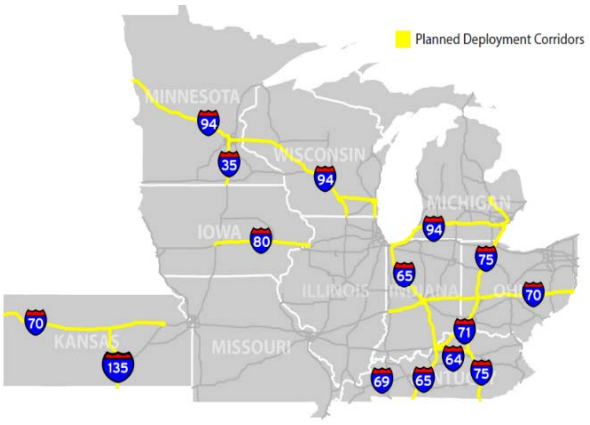


Figure 2: Regional TPIMS Deployment (Source: MAASTO, 2015 [6])

A lack of real-time information on truck parking availability has resulted in driver difficulties in finding safe and convenient parking areas within the FMCSA hours of services (HOS) requirements. As a result, although truck parking is available, truck drivers are often forced to park illegally and unsafely on rest area ramps, freeway ramps, and adjacent roads. In response to this issue, Kansas, in partnership with Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio and Wisconsin were awarded a $25 million Transportation Investment Generating Economic Recovery (TIGER) program grant to implement a regional Truck Parking Information and Management System (TPIMS), referred to as the Mid-America Association of State Transportation Officials (MAASTO) TPIMS Project. The MAASTO TPIMS, the first regional system to be implemented in the US, is designed to reduce parking search time and provide safer parking options through the collection and dissemination of real-time parking availability using smartphone applications, dynamic road signage, websites and parking facilities.

The system is currently in development and scheduled for a September 2018 deployment. It will be implemented using existing Intelligent Transportation Systems (ITS) technology along with vehicle detection and data collection technology on major freight routes along the region (Figure 2). These high-volume freight corridors, with over 25,000 trucks per day, include: I-35, I-64, I-65, I-70, I-71, I-75, I-80, I-94 and I-135). The technology will monitor the availability of truck parking across 150 parking sites in the region [5].

Table 2: TPIMS Deployment Corridors.

Corridor	State(s) Deployed Across	Number of Deployed Rest Areas
I-35	Minnesota	3 DOT
I-64	Kentucky	2 DOT, 2 Private
I-65	Indiana, Kentucky	13 DOT, 5 Private
I-70	Ohio, Indiana, Kansas	32 DOT, 21 Private
I-71	Kentucky	1 DOT, 3 Private
I-75	Michigan, Ohio, Kentucky	14 DOT, 23 Private
I-80	Iowa	14 DOT, 10 Private
I-94	Michigan, Indiana, Wisconsin, Minnesota	16 DOT, 11 Private
I-135	Kansas	4 DOT

The system is leveraging existing TPIMS efforts in Michigan, Wisconsin, and Minnesota.

- Michigan: TPIMS has been operating since mid-2014 along a 130-mile stretch of the state's southwest I-94 trade corridor (from Indiana to Parma, MI).
- Wisconsin: Building TPIMS along I-94 between Wisconsin and Minnesota, providing information through dynamic message signs, third party applications, and 511.
- Minnesota: Truck parking at three rest stops calculated using stereoscopic camera system with information provided through in-cab communications, 511, and the University of Minnesota's website.

The Benefit-to-Cost Analysis (BCA) for the MAASTO TPIMS (estimated as part of the 2015 TIGER Grant application using the TIGER BCA Resource Guide) was based on project performance data collected from the eight participating states. [5,7] Inputs to the analysis included:

- Benefit from reduction in crashes related to commercial driver fatigue
- Benefit from travel time savings due to reduced number of crashes
- Benefit from travel time savings for commercial drivers
- Benefit from reduced CO2 and other emissions.

Over the life of the system, the BCA calculated safety, travel time, and environmental benefits totaling over $403 million, with a Benefit-to-Cost Ratio of 4.27 (assuming deployment costs of approximate $37 million).

The BCA was calculated using the following assumptions:

- 10 percent annual reduction in number of driver-fatigue-related crashes
- 15 minutes per driver searching for parking
- 80 percent utilization of parking spaces under TPIMS deployment

Other benefits estimated included:

- Economic Competitiveness. TPIMS would lead to reductions in time spent searching for parking and decreases in fuel use. Current estimated yearly costs of wasted fuel and working hours is $7 billion. Current unsafe parking (e.g., low lighting, shoulders, ramps) result in estimated annual costs of $35 billion in damaged or stolen goods. Lastly, annual estimated driver time savings assuming 15 minutes spent searching for parking along the corridor were calculated at over $10 million.
- Environmental Sustainability. TPIMS would reduce the total amount of time a truck spends idling in traffic, consuming fuel, and creating emissions. With an average of two gallons of diesel fuel used in 15 minutes of searching for parking, over 176 metric tons of CO2 emissions will be reduced on a daily basis across the corridor.
- Safety. TPIMS would reduce overcrowding at rest areas and truck stops, reducing incidents involving trucks parked on highway ramps and shoulders. Safety benefits were estimated at $100 million.

Table 3: TPIMS Benefits [5]

Benefits Measure	($2013)
Safety	$107 M
Travel Time	$206 M
Environmental	$90 M
Total Benefits	$403 M

The BCA for the MAASTO TPIMS (estimated as part of the 2015 TIGER Grant application using the TIGER BCA Resource Guide) was based on project performance data collected from the eight participating states. [5,7] The analysis estimated total project costs of $94.3 million, including estimated capital and maintenance costs. Costs involving deployment included design, construction, and integration. Construction costs were estimated based on 2013 bid tabulations. Planning and design costs were estimated as 25 percent of construction, integration was estimated at 10 percent of the construction cost, and Construction, Engineering & Inspection (CEI) was estimated to be 12 percent of construction costs [5].

Table 4: TPIMS Costs [5]

Cost Measure	($2013)
Deployment	$36.66 M
Maintenance	$57.68 M
Total Costs	$94.34 M

References

[1] “Benefits of Commercial Vehicle Information Systems and Networks Program,” USDOT FMCSA. September 2008.

[2] *Colorado Truck Parking Information Management System,* Fastlane 2016, Colorado DOT. 14 April 2016. URL: https://www.codot.gov/programs/planning/documents/plans-projects-reports/projects/fastlane-applications/truck-parking-information.pdf

[3] “Wireless Roadside Inspections for Trucks and Buses,” Smart Roadside Workshop, U.S. DOT FMCSA. 2008.

[4] “Using FMCSA’s CVISN Grants to Deploy ITS for Truck Parking,” ITS America 25th Annual Meeting, U.S. DOT FMCSA. June 2015. URL: http://www.its.dot.gov/presentations/its_america2015/SmartPark_TR01.pdf

[5] MAASTO Regional Truck Parking Information Management System (TPIMS) TIGER Proposal 2015. URL: http://www.maasto.net/documents/TPIMS-Grant.pdf

[6] MAASTO Regional Truck Parking Information Management System (TPIMS) Executive Summary. 2015. URL: http://www.maasto.net/documents/TPIMS-Summary.pdf

[7] Tiger Benefit-Cost Analysis (BCA) Resource Guide. 2015. URL: https://www.transportation.gov/policy-initiatives/tiger/tiger-benefit-cost-analysis-bca-resource-guide

All other data referenced is available through the ITS Knowledge Resources Database, which can be found at http://www.itsknowledgeresources.its.dot.gov/