

SAFETY AND EFFICIENCY EFFECTS OF REPLACING TRANSPONDERS WITH LICENSE PLATE READERS TO SCREEN TRUCKS AT INSPECTION OR WEIGH STATIONS REPORT TO CONGRESS

Pursuant to House Report 115-750 accompanying House Bill 6072
and the Joint Explanatory Statement accompanying the
Consolidated Appropriations Act, 2019 (P.L. 116-6)

June 2020

The Joint Explanatory Statement accompanying the Consolidated Appropriations Act, 2019, (P.L. 116-6) requested the U.S. Department of Transportation (USDOT) to submit certain reports included in House Report 115-750 accompanying House Bill 6072. This includes submission of the report “Safety and Efficiency Effects of Replacing Transponders with License Plate Readers to Screen Trucks at Inspection or Weigh Stations: Report to Congress.” House Report 115-750 accompanying House Bill 6072 requested the Federal Motor Carrier Safety Administration (FMCSA) to study the safety and efficiency effects of replacing existing electronic screening (e-screening) transponder systems with license plate readers at truck inspection or weigh stations and to submit a report containing study findings to the House and Senate Committees on Appropriations.

BACKGROUND

The Innovative Technology Deployment (ITD) grant program, formerly known as the Commercial Vehicle Information Systems and Networks (CVISN) grant program, is a key component of FMCSA’s drive to improve commercial motor vehicle (CMV) safety through technology and information connectivity. More information can be found on the website at <https://www.fmcsa.dot.gov/grants/itd-grant/innovative-technology-deployment-itd-grant>. The ITD Program supports this safety mission by providing grant funds to States for:

- Improving safety and productivity of motor carriers, CMVs, and their drivers.
- Improving efficiency and effectiveness of CMV safety programs through targeted enforcement.
- Improving CMV data sharing among States and between States and FMCSA.
- Reducing Federal, State, and industry regulatory and administrative costs.

There are two levels of ITD functionality: Core and Expanded. Core ITD capabilities exist in three program areas: safety information exchange, electronic credentials administration, and e-screening. Once a State is certified as having deployed all three Core ITD capabilities, the State may apply for ITD grant funding to deploy Expanded ITD functionality typically in four program areas: driver information sharing, enhanced safety information sharing, smart roadside, and expanded electronic credentialing. This report focuses on the Core ITD e-screening requirements.

E-SCREENING OVERVIEW

E-screening systems identify CMVs while they are in motion and approaching a fixed truck weigh or inspection station on the highway, verifying size, weight, and credentials information (e.g., International Registration Plan and International Fuel Tax Agreement credentials) and reviewing associated motor carriers' past safety performance. The e-screening systems then communicate safely to drivers to either pull in or bypass the weigh station or inspection location. Vehicles that are properly credentialed, operated by a motor carrier with a history of safe operations, and within weight limits (if the site is instrumented for weight measurements) may bypass inspection facilities although such vehicles are still subject to random inspection. Figure 1 provides a basic overview of the e-screening concept.

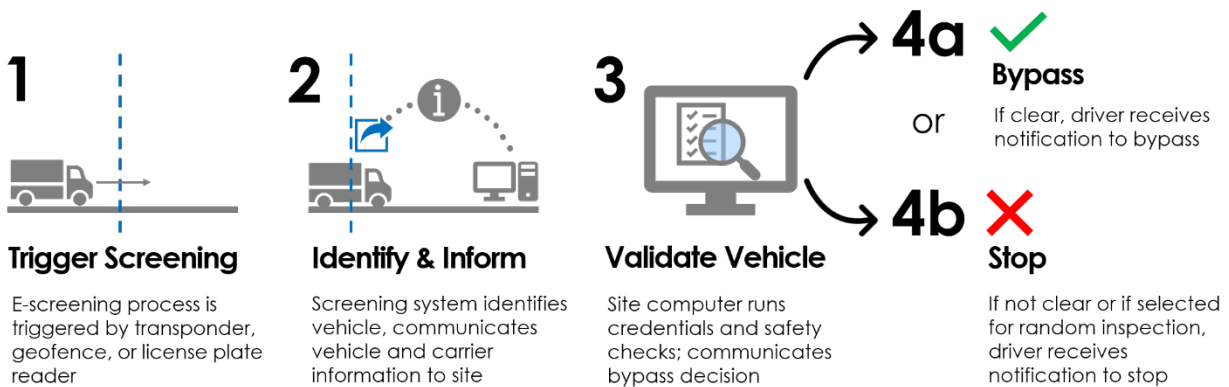


Figure 1. Diagram. Basic e-screening concept.

E-screening systems use FMCSA's Inspection Selection System (ISS) algorithm to inform vehicle selection based on safety factors. ISS assigns an inspection value based on a motor carrier's available safety data (e.g., crash history, violations, out-of-service orders), which in turn forms the basis for the inspection recommendation. E-screening systems pull this information for carriers or vehicles that pass the system and direct vehicles to bypass or pull in based on pre-set ISS inspection values or other criteria, such as credential status.

There are three types of technologies available on the market that can be used for e-screening purposes, summarized in Table 1. USDOT and FMCSA are technology-neutral and do not promote one type of e-screening system over another.

Table 1. Key features of available e-screening technologies.

Technology	Key Features
Transponders	<ul style="list-style-type: none"> • Carriers opt in and pay dues; services provided by transponder vendors. • Trucks are equipped with a small wireless transponder, typically mounted on the windshield. • An electronic reader mounted over the roadway (mainline) automatically scans the transponder and identifies the vehicle; communicates information to site. • Roadside operations computer receives information, runs credentials and safety checks, and makes bypass determination. • As the truck passes beneath a second reader, a signal indicating whether the vehicle may bypass the station is transmitted back to the transponder. • Lights on the transponder notify drivers to bypass (green light) or stop (red light) at the site.

Technology	Key Features
Wireless mobile data devices	<ul style="list-style-type: none"> • Carriers opt in and pay dues; services provided by mobile application (app) providers. • Drivers download and install an e-screening app on their mobile device. • App alerts the driver when they cross a geo-fence (i.e., a boundary drawn in a mapping program) for a weigh station or inspection location. • App identifies the vehicle, communicates information to site. • Roadside operations computer receives information, runs credentials and safety checks, makes bypass determination, and communicates decision to the mobile app. • App notifies driver to bypass or stop at the upcoming facility via cell phone alert.
License plate reader/recognition (LPR) and USDOT number reader	<ul style="list-style-type: none"> • Carriers do not opt in; no special equipment or apps required. • Camera-based systems use optical character recognition software to read a CMV's license plate or USDOT number. • Roadside system (either in a bypass lane or on the mainline) often includes both a LPR and a USDOT number reader; scans and identifies the vehicle, communicates information to site. • Roadside operations computer receives information, runs credentials and safety checks, makes bypass determination, and communicates decision to variable message sign (VMS). • System typically includes weigh-in motion (WIM) integrated into screening decision. • VMS notifies the driver to bypass or report to the station.

States may choose to deploy one or more of these technologies, depending on their e-screening needs. Many States deploy a combination of e-screening technologies, although FMCSA is aware of one State that is exclusively deploying LPR/USDOT number reader e-screening functionality.⁽¹⁾

While e-screening is a useful tool, it is not the only factor inspectors consider when selecting vehicles to pull-in for inspection. Inspection selection factors vary among States, sites, and individual inspectors. In some cases, data from the e-screening system provides input to that decision. At other times, the decision is based on visual cues or other factors that do not incorporate data (e.g., driver not using a safety belt or appearing intoxicated, random selection, etc.). The location of e-screening technology can also affect the flow of trucks around and through the site. If there is a queue of trucks affecting traffic flow, a site may close temporarily to prevent traffic from backing up onto the highway.

FMCSA E-SCREENING REQUIREMENTS

As noted in Table 2, the e-screening technology requirements have become progressively broader over time. Originally, to meet Core CVISN requirements, States had to implement Dedicated Short-Range Communication (DSRC)-enabled transponders. By 2013, technologies had advanced sufficiently to justify inclusion of wireless mobile data devices as “transponders.” To reduce the burden associated with frequently modifying the definition of a “transponder” to accommodate technological advances, FMCSA opted to define e-screening more broadly in 2016 within Agency policy, when consolidating the ITD Program into the Motor Carrier Safety Assistance Program (MCSAP). This technology-neutral approach reduces the burden and cost associated with frequent policy modifications and provides States with market-based flexibility, allowing them to implement innovative, effective solutions that meet their e-screening needs.

Table 2. Evolution in e-screening requirements.

Statute/Policy	Description
Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), Section 4126 (Pub .L. No. 109-59)	Under 4126(g)(3)(C), Core deployment included “roadside electronic screening to electronically screen transponder-equipped commercial vehicles at a minimum of one fixed or mobile inspection site in the State,” with the ability “to replicate this screening at other sites in the State.”
Use of Wireless Mobile Data Devices as Transponders for CVISN Electronic Screening Systems, 78 FR 139 (July 19, 2013)	FMCSA announced that wireless mobile data devices, such as smartphones, tablets, fleet management systems, global positioning system navigational units, and onboard telematics devices, could be used as transponders for e-screening. Specifically, FMCSA stated that these devices “have the capability of transmitting and receiving the same information between the driver and the inspection site as the dedicated short-range communication (DSRC)-enabled transponders” used to fulfill the Core CVISN e-screening requirement.
MCSAP Comprehensive Policy 3.0	Pursuant to the Fixing America’s Surface Transportation Act, 2015 (Pub. L. No. 114-94), CVISN was replaced with the ITD Grant Program and consolidated into the overall MCSAP High Priority (HP) Grant Program at 49 U.S.C. § 31102. In June 2016, FMCSA released the MCSAP Comprehensive Policy 3.0, which defines e-screening projects as those that “electronically identify a commercial vehicle, verify its size, weight, and credentials information, and review its carrier’s past safety performance while the vehicle is in motion and then communicate safely to the driver to either pull in or bypass the roadside inspection station.” The policy does not reference specific technologies.

TECHNOLOGY ACCURACY AND PERFORMANCE

Accuracy rate in an e-screening system context is defined as the rate at which it correctly identifies passing CMVs and their associated records (e.g., motor carrier details, safety data, credentials, etc.) at highway speeds. Transponders have consistently high screening and identification accuracy rates, near 100 percent.⁽²⁾ Accuracy rates for wireless mobile data devices vary, ranging from 81.5 percent to 93.9 percent according to a vendor-sponsored study conducted by the Texas A&M Transportation Institute,⁽³⁾ and closer to 99 percent according to another vendor’s website.⁽⁴⁾ In recent discussions at the Commercial Vehicle Safety Alliance’s meetings, States have noted that accuracy rates for LPR/USDOT number screening technologies were improving above 80 percent (some significantly higher), based on their experiences. This is consistent with published research on LPR accuracy rates.⁽⁵⁾ Table 3 summarizes e-screening technology accuracy rates and performance considerations.

Table 3. E-screening technology vehicle identification accuracy rates and performance considerations.

Technology	Accuracy	Performance Considerations
Transponders	>99% accurate ⁽⁶⁾	<ul style="list-style-type: none"> • System utilizes FMCSA’s ISS safety algorithm for inspection selection. • System only identifies vehicles equipped with a transponder. • Any vehicle not equipped with a transponder is ineligible for transponder-based bypass and required to pull in if the inspection or weigh station is open. • Only works in States where there is a contractual relationship with provider. • Transponder providers do not typically share system resources with other e-screening providers.

Technology	Accuracy	Performance Considerations
Wireless mobile data devices	81.5–99% accurate ^(7,8)	<ul style="list-style-type: none"> • System utilizes FMCSA’s ISS safety algorithm for inspection selection. • System only identifies vehicles equipped with an app. • Any vehicle not equipped with an app is ineligible for mobile-based bypass and required to pull in if the inspection or weigh station is open. • Mobile e-screening apps may not work in all areas of the country, depending on cell tower infrastructure and their contractual relationship with a given State. • Mobile e-screening providers do not typically share system resources with other e-screening providers.
LPRs/USDOT number readers	~80-85% accurate ⁽⁹⁾	<ul style="list-style-type: none"> • System utilizes FMCSA’s ISS safety algorithm for inspection selection. • System attempts to identify every passing CMV. • Quality of equipment (camera, strobe, controller, communications), license plate/USDOT number readability, and environmental conditions (fog, snow, rain) can impact accuracy. • Requires a reliable database of CMV license plates and USDOT numbers from across the United States.

SAFETY AND EFFICIENCY IMPACTS OF TECHNOLOGY-NEUTRAL E-SCREENING APPROACH

FMCSA has received correspondence from private e-screening service providers and select motor carriers, citing concerns about the safety and efficiency implications of the Agency’s technology-neutral e-screening approach. These concerns are discussed in Table 4.

Table 4. Discussion of safety and efficiency concerns related to technology-neutral e-screening requirements.

Concern	Discussion
<ul style="list-style-type: none"> • Less accurate screening technologies, such as LPRs, could result in more vehicles being flagged into weigh facilities, interrupting highway flow. • Some weigh facilities close when the traffic queue backs up to the highway. This could result in unsafe vehicles bypassing while the facility is closed. 	At many inspection and weigh stations, thousands of trucks pass by each day, with just a few inspectors managing operations. Inspectors are trained to modify site operations (e.g., wave trucks through, turn off e-screening systems, adjust e-screening criteria) to ensure safe traffic flows in and around the site. This happens at many stations, regardless of e-screening technologies in use.
<ul style="list-style-type: none"> • Using LPRs instead of transponders for e-screening purposes could diminish the safety incentives associated with transponder-based e-screening. • LPRs will increase pull-ins for carriers that meet State credential and safety requirements, resulting in delays and increased carrier costs. 	LPRs use the same ISS algorithm as transponder and app-based systems. Carriers with strong safety records, compliant credentials, and in-limit weights are still more likely than poorly performing carriers to bypass inspection or weigh stations that utilize LPR e-screening consistent with transponders or mobile apps.
<ul style="list-style-type: none"> • LPRs require the use of message boards along the roadway, which distract drivers. 	FMCSA, the States, motor carriers, and e-screening technology providers are committed to reducing driver distraction. Properly designed e-screening systems minimize the distraction issue with optimum placement of transponders, mobile devices, or message boards, with the goal of keeping drivers’ eyes on the forward road.

Concern	Discussion
<ul style="list-style-type: none"> Increased number of vehicles flagged into stations will result in less efficient operations and fewer inspections because personnel will have to verify more information manually. 	<p>Inspectors do not rely solely on e-screening technologies to inform their inspection decisions. Manual review of carrier information is a common practice, regardless of e-screening technologies in use, and likely will not affect inspection outputs or efficiencies.</p>
<ul style="list-style-type: none"> Maintenance costs associated with non-transponder e-screening technologies will become a burden to States that utilize these technologies. Failure to use existing transponder-based infrastructure wastes taxpayer dollars. 	<p>States have flexibility in deciding what tools can best be used to address their commercial vehicle safety plans.</p>

ADDITIONAL DISCUSSION

To enroll in the larger and widely used transponder- or app-based e-screening programs, motor carriers must meet minimum safety performance (i.e., good ISS scores), registration, and credentialing criteria. Poorly performing carriers cannot enroll in these larger programs, and therefore are not screened at enforcement sites equipped solely with transponder- or app-based e-screening systems, but rather are directed into the weigh station. Smaller transponder programs may not require a similar safety threshold for participation.

Because a limited number of eligible motor carriers have opted in for transponder- and app-based e-screening, these two technologies capture only about 13 percent of the interstate carrier population—a population that is already compliant with a minimum level of safety, registration, and credentialing criteria. This constitutes about 750,000 out of 2.7 million registered power units weighing more than 26,000 pounds (about 27 percent of all interstate trucks). Facilities that rely on transponders and/or mobile apps for e-screening thus cannot screen over 70 percent of registered non-participating trucks that are ineligible for a bypass.

LPRs, on the other hand, have the ability to scan every vehicle that passes, correctly identifying about 80–85 percent of all trucks that pass by—including poorly performing carriers. Further, they typically identify overweight violations, something that transponder- and app-based systems historically have not done (although some vendors are beginning to integrate that functionality in a few locations). States install and maintain weigh stations to enforce truck weight and Federal Motor Carrier Safety Regulations (FMCSRs), to reduce the risk of crashes and protect the infrastructure from excessive wear and tear caused by overweight trucks. Because LPR-based systems have the ability to identify overweight violations when integrating with weigh-in-motion technology, they can strengthen States’ efforts to protect their highway investments.

While bypass capability exists in most States, not all inspection locations within each State have a bypass capability. States may elect to contract with one e-screening provider with a singular ability (transponder, mobile app, or LPR, etc.), while others elect to contract with all three capability areas. This deployment limitation may reduce the total number of carriers capable of receiving a bypass signal.

CONCLUSION

Under current FMCSA policy, States may use ITD funds from the Agency's High Priority grant program to deploy and maintain inspection or weigh station bypass systems using any e-screening technology that meets the functional definition of e-screening in the Agency's MCSAP Comprehensive Policy, including transponders, wireless mobile data devices, and LPRs/USDOT number readers. Each of these items can be used to electronically identify and communicate relevant identifying information about the motor carrier and vehicle to the inspector. The definition of e-screening as it relates to ITD compliance is a technology-neutral approach requiring any bypass system to identify a vehicle and safely communicate with a driver. This provides safety and market-based flexibility to the States, by allowing the States to choose the e-screening technology they determine to be most effective and to make use of new technologies entering the market.

Based on the information presented herein, FMCSA has not identified significant safety or efficiency impacts to CMV enforcement operations associated with the replacement of transponder- or app-based e-screening systems with LPRs/USDOT number readers used for the same purpose. Transponder- and app-based systems offer improved identification accuracy for a limited portion (13 percent) of the carrier population—a population that already meets minimum safety criteria. LPRs/USDOT number readers accurately identify the majority of the carrier population (at least 80 percent), including carriers with poor safety records and those enrolled in a traditional bypass system. Each of these systems uses the same ISS algorithm to inform inspection selection based on safety factors, and regardless of the e-screening system in use at a weigh or inspection station, inspectors still often rely on visual cues and other factors (e.g., site layout and capacity) to inform inspection decisions. All of these technologies have a number of benefits and limitations, as described in this report, and they are some of a variety of many different tools and strategies used by States for e-screening within inspection or weigh station operations.

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