Evaluation of Kentucky's Driver Focus Camera System

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16. Abstract

Commercial motor vehicle (CMV) drivers who engage in federally prohibited activities such as not wearing safety belts, using hand-held mobile phones, or texting while driving endanger themselves and imperil the well-being of everyone who occupies the surrounding roadway environment. Unfortunately, conventional CMV inspection routines fail to detect many of these violations because inspectors have difficulty obtaining a clear view of truck cab interiors from inspection facilities. Recognizing it is critical to improve enforcement of Federal Motor Carrier Safety Regulations, this project evaluated the performance of a Driver Focus Camera System (DFCS) at an inspection facility on Interstate 75 northbound in Laurel County, Kentucky. This camera system captures high-resolution images of truck cab interiors and lets Kentucky State Police – Commercial Vehicle Enforcement (KSP-CVE) officers and inspectors quickly determine if a driver is not wearing a safety belt or handling a mobile phone. If they detect a violation, they can direct a vehicle to stop and conduct an inspection. To evaluate if the DFCS improved detection of violations, researchers compared the number of violations recorded over a three-year period leading up to camera installation (2018 – 2020) to the number of violations in the year following installation (2022). In the three years prior to DFCS implementation, just 10 safety belt use, phone use, and texting violations were spotted. In the year following implementation, this jumped to 446, with 417 violations being related to safety belt use. The DFCS also helped inspectors spot violations related to license restrictions, reckless driving, and careless driving. Based on the results of this pilot study, broader adoption of DFCS at inspection facilities across Kentucky is warranted.

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driver focus camera, safety belt, cell phone use, texting, violations, truck weigh station, system performance	Unlimited with approval of the Kentucky Transportation Cabinet

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Executive Summary

Federal Motor Carrier Safety Regulations (FMCSRs) require commercial motor vehicle (CMV) drivers to wear safety belts when operating a vehicle and prohibit the use of mobile phones and texting while driving. The purpose of these regulations is to prevent CMV drivers from engaging in behaviors detrimental to their safety and to protect other roadway users. A recent survey pegged the safety belt usage rate among drivers of medium/heavy trucks and buses at 86% — high, but far from universal adoption. This is troubling because failure to wear a safety belt can have dire consequences during crashes as unbelted drivers are more likely to lose control of their vehicles. Mobile phone usage also significantly increases a CMV driver's odds of being involved in safety-critical events (e.g., crash, near-crash, unintentional lane deviation) because it diverts their attention from the downstream roadway.

Enforcement of federal regulations is critical for increasing compliance. Kentucky State Police – Commercial Vehicle Enforcement (KSP-CVE) officers and inspectors use the Kentucky Automated Truck Screening (KATS) system to electronically screen vehicles that enter inspection facilities. Enforcing regulations focused on driver behaviors is challenging, however, because it relies on firsthand observations of drivers. Behaviors such as not wearing a safety belt or grasping a mobile phone are difficult to see from inspection buildings, and they are unlikely to be observed by inspectors after they ask a driver to stop.

Recognizing the need to improve enforcement of regulations pertaining to driver behaviors, the goal of this study was to determine whether a Driver Focus Camera System (DFCS) can improve visibility of truck cab interiors at inspection sites and therefore bolster the ability of inspectors to detect FMCSR violations. To assess DFCS performance, researchers installed a camera system at an inspection facility on I-75 northbound in Laurel County. Co-located with KATS equipment on the ramp, the DFCS was positioned to offer clear views of drivers. Images captured by the DFCS are linked to records for individual vehicles and integrated into the KATS display. These images can be used by KSP-CVE inspectors to determine whether a vehicle should be stopped and appropriate enforcement action taken.

To evaluate if the DFCS improved detection of violations, researchers compared the number of violations recorded over a three-year period leading up to camera installation (2018 – 2020) to the number of violations in the year following installation (2022). The average number of safety belt and phone violations detected annually from 2018 through 2020 was 2.3 and 1.0, respectively; zero texting violations were logged (Table E1). Following DFCS implementation, the number of violations dramatically increased. While the number of inspections in 2022 was 25% higher than the 2018 – 2020 average, the 13,415% increase in violations was disproportionately larger. The DFCS also let inspectors spot violations related to license restrictions, reckless driving, and careless driving.

Table E1 Violations Before and After DFCS Installation

Calendar Year	Safety Belt	Phone	Texting	# Inspections
2018 – 2020 Average	2.3	1.0	0.0	4,805
2022	417	24	5	6,048

Based on this study's findings, all inspection facilities in Kentucky would benefit from DFCS installation. To prioritize sites for installation of cameras, KSP-CVE can review inspection data to identify locations that currently record the most violations. Beginning with sites where violations are most frequent is a good option to uncover violations which are being missed under current inspection routines.

Chapter 1 Background

A 2016 survey of nearly 40,000 commercial motor vehicles (CMVs) estimated the safety belt usage rate for drivers of medium and heavy-duty trucks and buses at 86.1% — 3% higher than in 2013, but still well short of universal adoption.[1] When a CMV driver does not wear their safety belt, they endanger themselves and all other roadway users because they are more likely to lose control of their trucks following a crash. In 2020, among occupants of large trucks involved in fatal crashes, 14% were not wearing a safety belt. Of those, 43% were killed.[2]

Using a mobile phone (dialing, talking, texting) is similarly detrimental to roadway safety. Research commissioned by Federal Motor Carrier Safety Administration (FMCSA) found the odds of being involved in a safety-critical event (e.g., crash, near-crash, unintentional lane deviation) are 23.2 times greater for CMV drivers who engage in dialing a mobile phone while driving than for those who do not.[3] Dialing a phone causes drivers to shift their attention from the forward roadway for an average of 3.8 seconds.[4]

FMCSA regulations prohibit these dangerous behaviors while operating a CMV. As per Section 392.16 of the Federal Motor Carrier Safety Regulations (FMCSRs), "…a CMV which has a seat belt assembly installed at the driver's seat shall not be driven unless the driver has properly restrained himself/herself with the seat belt assembly."[5] Sections 392.80 and 392.82 prohibit the use of mobile phones and texting while driving a CMV. Unfortunately, law enforcement and inspection personnel find it difficult to detect violations of these regulations due to truck cabs being elevated well above eye level. This blocks much of the interior of the vehicle from view and diminishes the effectiveness of inspection activities.

1.1 Kentucky CMV Inspection Procedures

Kentucky State Police – Commercial Vehicle Enforcement (KSP-CVE) officers and inspectors use the Kentucky Automated Truck Screening (KATS) system to electronically screen CMVs that enter inspection facilities. Cameras installed on KATS systems capture U.S. Department of Transportation (USDOT) and license plate information to identify the motor carrier and vehicle. Identifying data obtained by KATS systems are checked against multiple databases to determine if a vehicle is in compliance with tax and registration regulations as well as to retrieve safety performance information. KSP-CVE officers or inspectors can stop a vehicle for an investigation if they suspect violations or deficiencies.[a]

When inspectors stop a CMV for inspection, they complete a Driver-Vehicle Examination Report (DVIR). A completed DVIR contains details on the carrier, driver, trip, and violations of state or federal regulations. DVIRs are submitted to FMCSA for use in the Safety Measurement System (SMS), a tool that quantifies the safety performance of carriers and drivers. Inspectors have the authority to complete a state Uniform Citation for violations of state law. Although a DVIR lists all violations noted by inspectors, not all violations result in a state citation. As such, violations analyzed in this study were taken from violations listed on the DVIR rather than citations. KSP-CVE mandates that all CMV inspections be documented with a DVIR.

Along with electronic screening, KSP-CVE inspectors observe CMVs entering inspection facilities to identify obvious FMCSR violations related to vehicle safety (e.g., brakes, tires, securement of loads) and driver safety (e.g., proper

[a] KSP-CVE employs sworn officers and civilian inspectors to enforce state and federal CMV statutes and regulations. Officers and civilian inspectors are trained to conduct inspections under criteria established by the Commercial Vehicle Safety Alliance (CVSA). In this report, the term *inspector* encompasses both sworn and civilian North American Standard–certified KSP-CVE CMV inspectors.

qualifications, medical fitness, fatigue, driver behaviors). Enforcement of regulations related to driver behavior most often hinge on direct observation by inspectors. Yet behaviors such as not wearing a safety belt or holding a mobile phone are difficult to see from the inspection building — and they are unlikely to be observed after the driver has been directed to stop.

1.2 Study Objective

The goal of this study was to determine whether a Driver Focus Camera System (DFCS) can improve visibility of truck cab interiors at inspection sites and therefore bolster the ability of inspectors to detect FMCSR violations. We installed a DFCS at an inspection facility on I-75 (northbound) in Laurel County. The camera is co-located with KATS equipment on the ramp and positioned to provide a clear view of drivers. Images captured by the DFCS are linked to records for individual vehicles and integrated into the KATS display. KSP-CVE inspectors can use images captured by the camera system to direct vehicles to stop and take appropriate enforcement action — photographic evidence is available for later use in court if needed.

To determine if the DFCS improved detection of violations, we compared the number of violations over a three-year period leading up to camera installation (2018 – 2020) to the number of violations in the year following installation (2022). These results are presented in Chapter 3. However, before turning to this assessment, in Chapter 2 we discuss DFCS installation and its integration with the KATS system.

Chapter 2 DFCS System Capabilities and Installation

2.1 DFCS Components and Characteristics

At the inspection facility on I-75 (northbound) in Laurel County we installed a DFCS as an add-on component to the KATS system. It consists of the following items:

- Ultra-high-resolution imager with pre-selected and pre-set lens
- Software and software license specific to driver camera systems
- Stroboscopic illuminator with front panel filter kit
- Post-mounting arm kit and cable kit
- Optional trigger sensors, posts, and junction boxes

2.2 DFCS Capabilities

The DFCS captures ultra-high resolution color images (up to 2,560 x 1,920 pixels) of truck cab interiors as they approach the weigh station during the daytime and nighttime. Using these images, inspectors can spot whether a truck driver is:

- Wearing a safety belt
- Using a cellphone to make phone calls
- Texting while driving

Inspectors can identify other details from images, including a driver's use of corrective lenses or whether a driver and passenger switched places after being stopped for an inspection. KSP-CVE inspectors used the DFCS to monitor truck drivers for violations related to safety belt use and phone use in real time. If they spotted violations, inspectors could stop trucks for inspection.

2.3 Site Preparation and System Installation

Prior to DFCS installation in October 2020, we visited the Laurel County I-75 northbound inspection facility to assess site conditions and infrastructure. This assessment focused primarily on electrical connections, roadside infrastructure (i.e., the mounting pole and traffic loops in the pavement), and computer availability. Based on the findings of this assessment, we purchased and installed the DFCS on the existing camera pole on the entrance ramp (see Figure 2.1).

Figure 2.1 Configuration of DFCS (Red Outline) at Laurel County Inspection Facility

2.4 System Integration

Following installation, we integrated the DFCS into the KATS system. Enhancements made to the KATS system programming allow personnel to quickly enlarge images so potential violations can be detected. Figure 2.2 is a screen capture of the KATS system interface, which shows photos captured by DFCS (red box).

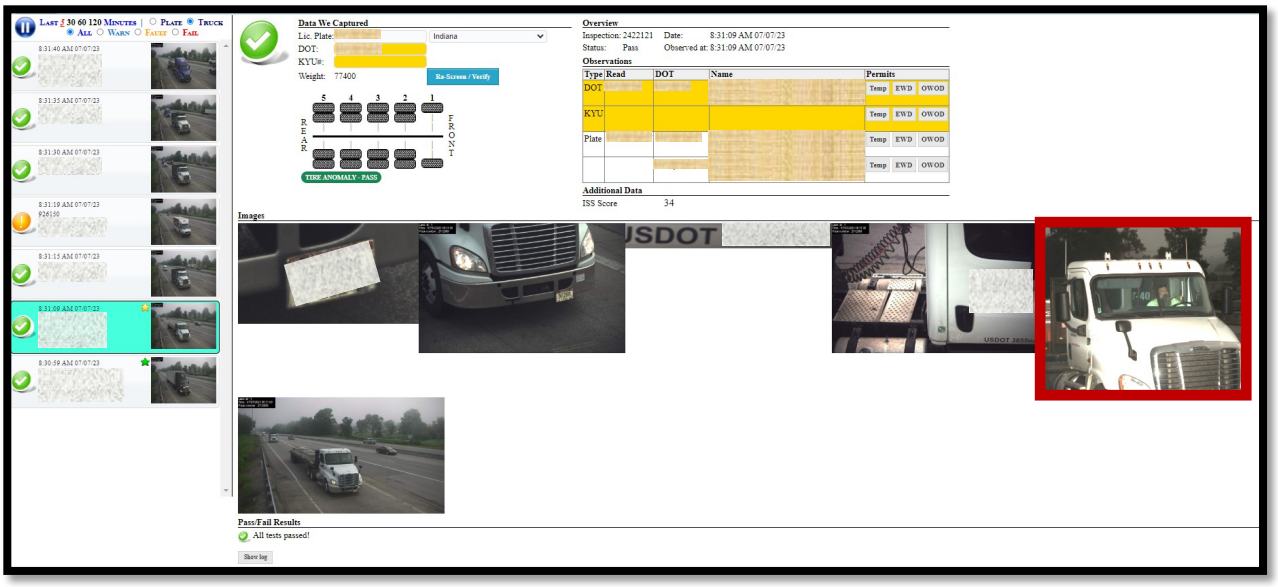

Figure 2.2 KATS User Interface with DFCS Image Outlined in Red
Note: Information that could be used to identify individual vehicles is masked in the image.

Figure 2.3 shows four enlarged images captured by the DFCS of drivers not wearing safety belts. Faces have been blurred, and red boxes indicate where a safety belt — if worn — would be visible.

Figure 2.3 Example Images from the DFCS
Red boxes indicate where a safety belt would be visible if the drivers had been wearing them.

Chapter 3 DFCS System Performance

In this chapter, we summarize findings from our data analysis. We evaluated truck violation data acquired before and after DFCS installation to determine if the camera achieved a level of performance that would justify further implementation across Kentucky.

3.2 Data Collection and Analysis

We obtained Laurel County I-75 Northbound inspection facility data for 2018 – 2023 from KSP. The 2018 – 2020 data (prior to DFCS installation) served as the baseline and were compared to data from 2022. Additionally, we used data from November 2021 – March 2023 to quantify the contribution of DFCS to inspection activity.

3.2.1 Truck Driver Violations at Laurel NB inspection Facility

Few violations related to safety belt, phone use, and texting were spotted in calendar years 2018 – 2020. In no year were more than **four** violations logged in any category. In 2022 (following DFCS installation), violations in all categories jumped markedly. Most notably, there were 417 violations related to safety belt use. While it is true the number of inspections in 2022 was 25% higher than the 2018 – 2020 yearly average, we observe a disproportionately larger 13,415% increase in violations.

Table 3.1 Safety Belt, Phone, and Texting Violations at Laurel County NB Inspection Facility (CYs 2018 – 2020 and 2022)

Calendar Year	Safety Belt	Phone	Texting	# Inspections
2018	0	1	0	5,913
2019	4	2	0	3,592
2020	3	0	0	4,910
3-Year Average	2.3	1.0	0.0	4,805
2022	417	24	5	6,048

3.2.2 Additional Types of Violations

As part of this pilot project, inspectors were asked to mention in a supplemental description when the DFCS captured images used to observe a violation. During conversations, enforcement personnel commented the DFCS is useful for spotting other types of violations. While data presented in Table 3.1 originated from only inspections coded as *facility* inspections, additional inspections coded as *roadside* were related to information obtained using the camera as were some other violations.

To better understand the DFCS's utility, we reviewed all inspections performed on I-75 northbound between November 2021 and March 2023 near the Laurel County inspection facility to identify records that noted use of the DFCS. We eliminated all records that mentioned cameras in a manner clearly unrelated to the DFCS (e.g., dash cameras). This resulted in 603 violations (Table 3.2). In addition to safety belt, phone use, and texting violations, we identified:

- 9 violations for not wearing corrective lenses
- 1 violation for license restriction — not being the required age (i.e., a co-driver came into the facility as the driver, but the camera had captured the image of the underage driver)
- 1 violation for reckless driving (no hands on wheel, gesturing at the camera)
- 2 violations for inattentive (careless) driving

Ninety (15%) of these violations were on inspections coded as *roadside*, however, the inspections resulted from an observation made with assistance of the DFCS.

Table 3.2 Safety Belt, Phone, and Texting Violations at Laurel County NB Inspection facility November 2021 – March 2023 Attributed to the DFCS

Safety Belt	Phone	Texting	License Restrictions	Other	Total
558	27	5	10	3	603

Chapter 4 Conclusion and Recommendations

When CMV drivers violate federal regulations by not wearing their safety belts, using mobile phones, or texting while driving, they endanger both themselves and everyone in the surrounding roadway environment. Unfortunately, traditional inspection routines fail to detect many of these violations. But as this pilot study demonstrated, installing DFCS at inspection facilities significantly improves enforcement of regulations. Images captured by the DFCS allow inspectors to conduct more rigorous oversight of CMV drivers. At the I-75 northbound Laurel County inspection facility, in the three-year period before DFCS installation, inspectors spotted **10** safety belt use, phone use, and texting violations. During the first year of DFCS use, this number climbed to **446**. As such, it is clear widespread implementation of DFCS could significantly improve enforcement and, eventually, deter drivers from engaging in behaviors that violate federal regulations. Motor carriers will also benefit since they can use information on non-compliant drivers to better manage their safety performance.

Based on this study's findings, we recommend installing DFCS at all inspection facilities in Kentucky. To prioritize sites for installation, KSP-CVE can review inspection data to determine which sites currently record the most violations. Beginning with sites where violations are most frequent is a good option to uncover violations which are being missed under current inspection routines.

References

[1] Federal Motor Carrier Safety Administration. *Safety Belt Usage by Commercial Motor Vehicle (SBUCMVD) 2016 Survey - Executive Summary*. https://www.fmcsa.dot.gov/safety/safety-belt/safety-belt-usage-commercial-motor-vehicle-sbucmvd-2016-survey-executive-summary. Accessed July 21, 2023.

[2] *Large Truck and Bus Crash Facts 2020*. Federal Motor Carrier Safety Administration Analysis Division. September 2022.

[3]Federal Motor Carrier Safety Administration. *No Texting Rule Fact Sheet*. https://www.fmcsa.dot.gov/driver-safety/distracted-driving/no-texting-rule-fact-sheet. Accessed July 21, 2023.

[4] Federal Motor Carrier Safety Administration. *Mobile Phone Restrictions Fact Sheet*. https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/docs/Mobile_Phone_Rule_Fact_Sheet.pdf. Accessed October 17, 2024.

[5]National Archives. *§ 392.16 Use of seat belts*. https://www.ecfr.gov/current/title-49/subtitle-B/chapter-III/subchapter-B/part-392/subpart-B/section-392.16. Accessed July 21, 2023.