An Alternative Compliance Framework for Electronic Inspections to Support the FMCSA CSA Operational Model

WHITE PAPER

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INTRODUCTION

The Federal Motor Carrier Safety Administration (FMCSA) has developed its Operational Model through its Compliance, Safety, Accountability (CSA) program. The CSA goal is to implement more effective and efficient ways for FMCSA, its state partners, and the trucking industry to prevent commercial motor vehicle (CMV) crashes, fatalities, and injuries[1]. The program's overall benefits and challenges have been the topic of many articles and this white paper will not duplicate those efforts. Instead, this document aims to discuss the merits of utilizing a new concept of Electronic Inspections (e-Inspections) as an alternative compliance tool to support the Safety Measurement System (SMS) program within the CSA operating model. e-Inspections can improve an underlying challenge to the CSA program: data sufficiency.

This paper considers the opportunity to significantly enhance SMS data collection using existing mobile-based technology. It examines the current limitations of traditional SMS roadside data collection and agency constraints. It provides an overview of current day electronic screening practices and then explains how new Commercial Mobile Radio Service (CMRS) transponder technology enables a new "e-Inspection" proposition that can expand commercial vehicle enforcement capabilities to conduct real-time driver and vehicle safety and compliance checks while vehicles remain in motion. It concludes with thoughts on gaining industry support and shows how this new e-Inspection capability can benefit all stakeholders: state and federal regulatory and enforcement agencies as well as industry participants.

SMS LIMITATIONS

One of the characteristics of the SMS is that the calculation of a Behavioral Analysis Safety Improvement Categories (BASIC) measure depends on safety data collected from the roadside inspection program. This creates a reliance on the sourcing of up-to-date and accurate inspection data collected from vehicle inspections in the CSA operating model. This reliance on source data sufficiency is impacted by the number of inspections included as source data in the SMS program, and despite the approximately 3.5 million roadside inspections conducted annually there is insufficient data to compile complete BASIC percentiles for 89% of the carrier population[2]. According to FMCSA, 62% of carriers lack sufficient data to be assessed in even one BASIC. From

[1] http://csa.fmcsa.dot.gov/Documents/Evaluation-of-the-CSA-Op-Model-Test.pdf
[2] http://csa.fmcsa.dot.gov/Documents/Evaluation-of-the-CSA-Op-Model-Test.pdf

a positive perspective, the 17% of carriers that have enough negative information to have a percentile assigned to them do represent 83% of crashes that occurred. This means CSA is better at collecting data from vehicles involved in crashes, but it lacks sufficient data for the vast majority of carriers in the industry not involved in crashes. Within this environment, carriers with insufficient data to be profiled, or those who are trying to improve their current SMS profile under CSA, face a daunting challenge. They do not control the resources used to collect inspection data and feed the calculation of their profiles under CSA.

So what is a carrier with insufficient data or a safety profile that needs improving to do? Trucking companies have a vested interest in making CSA work for them, but outside factors can constrain translating daily investments in safety and compliance into measurable impacts on their safety profiles. The lag between carrier investments and ROI as measured in improved CSA scores weighs the CSA program down and is a flashpoint of industry criticism towards the program.

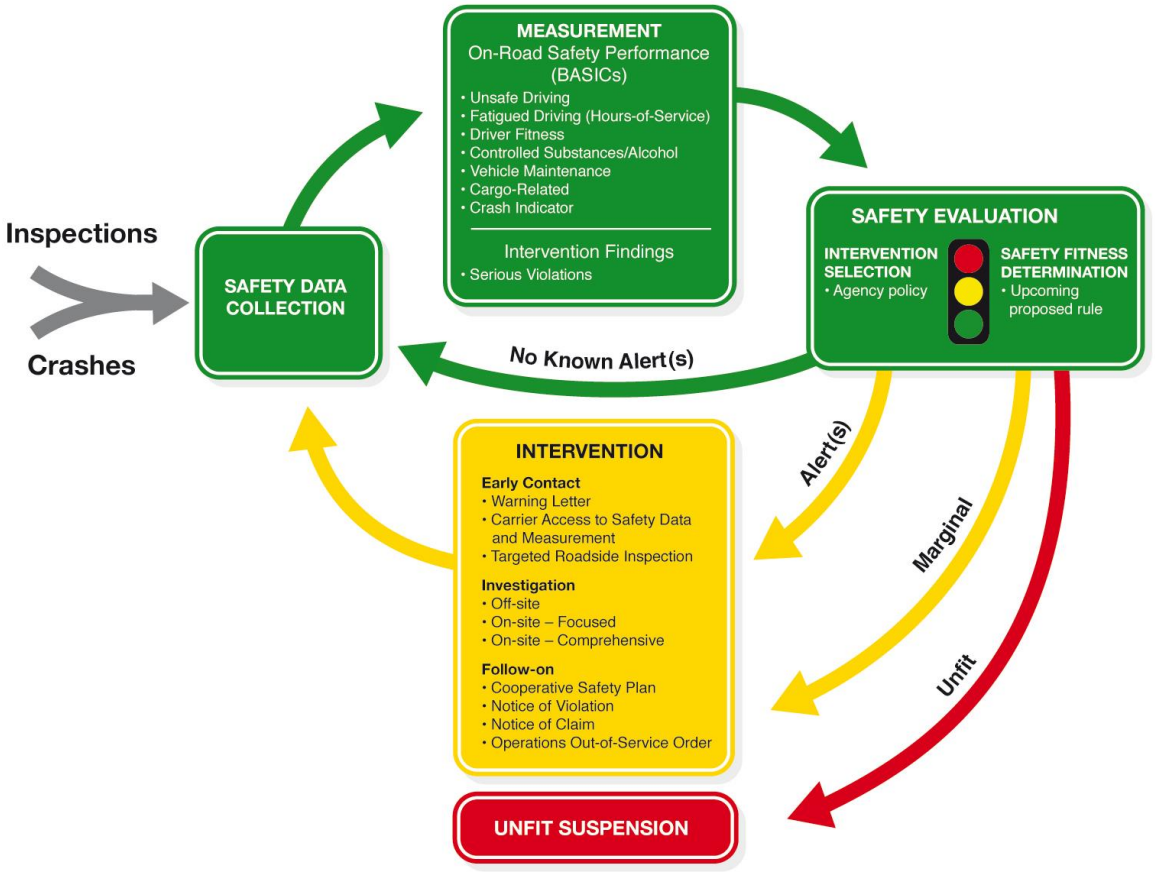


Fig 1. CSA 2010 Operational Model

AGENCY CONSTRAINTS

While there are approximately 4.5 million registered trucks required to report to weigh stations across North America, there are less than 13,000 inspectors certified by CVSA to conduct vehicle inspections. Front line Commercial Vehicle Enforcement (CVE) agencies are increasingly constrained by limited resources against an ever-increasing population of trucks.

Fewer boots on the ground puts pressure on the number of inspections an agency can complete in any given year. Over the last few years, the total number of manual inspections conducted across the United States has leveled out at around 3.5 million. This leveled inspection activity means the volume of source data from roadside inspections entering the SMS program is not expected to climb. The current constraints on any growth in the volume of manually collected carrier inspection data will not be relieved.

Long-term trends will only compound this situation as freight volume handled by trucks across the U.S. continues to grow a projected 60% by 2040[3]. Front-line CVE agencies need a better method of conducting inspection processes. Carriers need more available options to affect their CSA scores.

ELECTRONIC SCREENING OVERVIEW

Commercial vehicle automated electronic screening programs for weigh station bypass or preclearance have been in commercial use for over 20 years. Traditional Dedicated Short Range Communication (DSRC) transponder-based programs deliver Automated Vehicle Identification (AVI) at hundreds of weigh station bypass sites across the country. These programs utilize the 64 bit DSRC transponder ID collected at AVI sites to access open or proprietary databases (depending on the service provider) to identify carrier and vehicle information as a vehicle approaches a weigh station. Some jurisdictions integrate real-time vehicle weight and dimensions data into the screening process with the use of co-located weigh-in-motion (WIM) systems. This mix of real-time and historical carrier-based and vehicle-based safety and compliance data is used to process a preclearance request. Examples of programs that rely on these technologies include PrePass, NorPass, NCPass and Oregon Greenlight. Recently, there has also been an increase in the adoption of camera-based electronic screening systems that utilize automated license plate readers (ALPR), automated USDOT number readers (AUNR) in place of DSRC technology and automated thermal inspection (ATIS) technology to identify faulty brake/running gear equipment. These camera-based systems

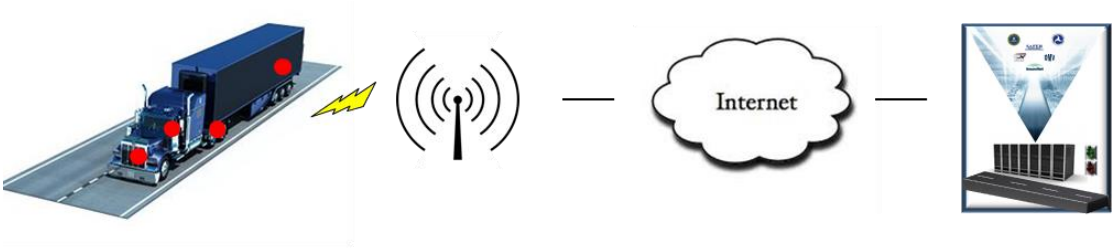
[3] http://www.ops.fhwa.dot.gov/freight/freight_analysis/nat_freight_stats/docs/12factsfigures/pdfs/fff2012_highres.pdf

leverage the regulatory authority of CVE agencies to screen vehicles, but they lack in-cab driver interfaces. This means they rely on roadside infrastructure to message drivers to pull over for inspection. The constraints and costs of camera-based systems limit their interdiction use to weigh station facilities that install traffic signals or manned roadside inspection operations.

Whether based on regulatory authority or voluntary participation, both camera-based and DSRC-based screening systems generally accomplish the same objective of providing law enforcement agencies with AVI capabilities at the roadside. Real-time vehicle information can also be added to both platforms, including vehicle weights and dimensions with integrated WIM and over-height detection. Camera-based ATIS can go one step further by identifying real-time vehicle equipment information. Neither platform supports driver information integration.

Camera-based systems provide value by identifying a segment of the truck population that is unwilling or unable to provide information wirelessly. DSRC-based systems, on the other hand, provide a channel to carriers willing and able to provide information wirelessly. The total number of camera-based screening systems deployed in the US for CVE is small due to limited funding and the total number of trucks that participate in bypass programs has stagnated at about 10% of the truck population. Both platforms are constrained by high costs and contain only enough real-time information to be considered screening tools, not inspection tools.

Electronic screening provides value to a responsible carrier because of the time and money saved not having to stop at weigh stations. Electronic screening provides benefits to participating agencies too, as they can focus resources on high-risk carriers. However, until the advent of a Commercial Mobile Radio Service (CMRS) transponder-based bypass program, there has been no opportunity for the CSA program to leverage the volume of roadside data being collected every day for weigh station bypass programs.



CMRS communication pathway

Fig 2. CMRS communication pathway

ELECTRONIC INSPECTION OPPORTUNITY EMERGES

The development and commercial deployment of CMRS transponders represents a breakthrough in the way that commercial motor vehicles and roadside operations can be connected. The three primary advantages provided by CMRS transponders over traditional DSRC transponders are:

1. *Less Infrastructure* – CMRS transponders do not require roadside investments in expensive infrastructure including poles, radio transceivers, and associated civil construction investments. Instead, CMRS transponders leverage the $365[4] Billion dollar infrastructure investments that the wireless cellular carriers have made making cellular data access nearly ubiquitous in the continental U.S. Now, vehicles can exchange data with any mobile or internet-enabled equipment (such as a laptop) at an inspection site. This eliminates traditional capital intensive barriers to state agency deployment of bypass programs and increases the potential number of wireless inspection sites across the country to include all fixed inspection facilities and all temporary mobile inspection sites used by CVE agencies. The addition of mobile inspection site operations is particularly noteworthy, as it represents the first time that many agencies with operations outside of traditional fixed facilities like weigh stations can receive advance information on approaching trucks and can provide them with opportunities to bypass the operation.

2. *More Data* -The amount of data that can be exchanged between the vehicle and the roadside operation is expanded beyond traditional vehicle and carrier-based data. This Vehicle to Infrastructure (V2I) capability now includes driver information, as well as real-time Hours of Service (HOS) data from currently deployed in-vehicle technology.

3. *More Security* – CMRS transponders support advanced security protocols to protect data privacy and to support any security related requirements that may be needed for future data certification and authentication requirements.

The expansion of traditional electronic screening to include real-time data elements on the driver and HOS information represents a seismic shift in an agency's access to information capabilities at the roadside. It can no longer be accurately represented as a traditional AVI data set transaction. It is

[4] http://files.ctia.org/pdf/CTIA_Survey_YE_2012_Graphics-FINAL.pdf

more appropriate to adopt the broader terminology of a Safety Data Message Set (SDMS) exchange utilized in the commercial vehicle aspects of the USDOT connected vehicle program, the NYSDOT Commercial Vehicle Infrastructure Integration (CVII) program, and the FMCSA Wireless Roadside Inspection program, to accurately describe the data exchange that CMRS transponder technology provides between the vehicle and the roadside.

The programs mentioned are all R&D programs that include the development of technologies to support a future vision of commercial vehicle to infrastructure (cV2I) connectivity. Each program is focusing on different cV2I applications. The CVII project is tying developmental on-board systems to commercial 5.9 Ghz roadside technologies and existing CVE screening software to scrutinize SDMS properties, deliver electronic screening and map out future applications like rail-crossing crash avoidance. The connected vehicle program is wide ranging and envisions multiple V2I applications, but is currently focusing on V2V safety-critical 5.9 Ghz DSRC technology research. The wireless roadside initiative already envisions wireless electronic inspections, but is trying to create its own technology from an architecture that predates both the commercial deployment of CMRS transponders and commercially available weigh station e-Inspection software. None of these programs is focused on policy development.

Now that CMRS transponders can support SDMS information, it no longer makes sense to limit the classification of these roadside transactions to traditional electronic screening events; instead, they should be reclassified as electronic inspections (e-Inspections).

INSPECTION VERSUS E-INSPECTION

The Commercial Vehicle Safety Alliance (CVSA) Level III inspection is based on the collection of carrier, vehicle and driver identification in addition to onboard documentation like registration, insurance, CDL, medical card, and driver logs[5]. The manual inspection model uses the collection of these identification and documentation data elements to conduct regulatory compliance checks. The investigation is not as intense as Level I or Level II CVSA inspections, but both the inspections and associated violations found during Level III inspections form an important part of the roadside inspection source data fed into the CSA SMS program.

e-Inspections can now collect 100% of the credential data traditionally collected manually at the roadside during Level III inspections, but it can do so in a fully automated manner. This capability to automatically collect the real-time data required to conduct a Level III CVSA inspection represents a

[5] http://www.cvsa.org/programs/nas_levels.php

paradigm shift in the capacity of roadside operations to conduct a vastly larger volume of inspections than is possible today with manual inspections. This does not mean that e-Inspections hold as much enforcement value as traditional Level III inspections, but it does compel agencies to consider the significant value they represent.

The challenge is how to value a manual inspection versus an e-Inspection. There is little debate that an automated e-Inspection removes the first hand dealings of an inspection officer with the vehicle and driver. This personal interaction is valuable in helping an officer ascertain the fitness of a vehicle and driver. e-Inspections collect all core carrier, vehicle and driver credentials by way of a single electronic SDMS data exchange. In contrast, the manual collection of data by inspection officers occurs alongside observational, experiential, intuitive and environmental input considerations. Often, the qualitative considerations can act to direct an inspector's decision on what level of inspection to conduct. e-Inspections do not support qualitative considerations leaving a qualitative gap between manual inspections and e-Inspections that must be considered when weighing the value of one against the other. So, if an e-Inspection cannot be measured at parity with a traditional inspection, how should it be measured and why is an e-Inspection important to the success of CSA?

ALTERNATIVE COMPLIANCE EXPANDS DATA COLLECTION POSSIBILITIIES

The notion of alternative compliance is a recent topic in research, industry and agency organizations involved in commercial vehicle safety. A 2011 ATRI report entitled "Assessing the Benefits of Alternative Compliance" expands on the realization that U.S.D.O.T and trucking industry research "included critical cost-benefit analyses providing documented and replicable evidence that certain non-traditional safety approaches can reduce truck-involved crashes, injuries and fatalities."[6] The report predates the development of CMRS transponders and identifies the challenge of "creating a technology to identify program-participating trucks at weigh stations." Today, that technical challenge has been removed, making it possible to readdress the alternative compliance model supported by new CMRS technology. It also makes sense that these discussions now extend the valuation of alternative compliance activities include e-Inspection. No doubt there will be a wide span of opinions on this topic, but the inclusion of e-Inspections in this important exploration will drive all stakeholders toward a resolution on how e-Inspections should be weighted compared to traditional inspections. The confluence of data sufficiency challenges in CSA and the advent of

[6] http://www.atri-online.org/research/results/ATRI_Assessing_the_Benefit_of_Alternative_Compliance_one_page.pdf

commercial technologies to deliver this solution demands new policies be developed to address these issues.

THE FUTURE TODAY

With the use of CMRS transponders and innovative bypass programs like Drivewyze, CVE agencies today can collect critical real-time SDMS data from CMVs that would not otherwise be accessible from moving vehicles. These solutions are delivered on commercial platforms and offer a compelling alternative to the traditional need to stop vehicles and the flow of commerce to collect this information. The fact that this real-time data is collected electronically, instead of manually should not deter from it being classified as an inspection event.

LOW BARRIER TO ENTRY

The ability to roll out an e-Inspection program while side-stepping the heavy infrastructure costs traditionally associated with DSRC solutions provides a low barrier to entry for all agency stakeholders. CMRS technology eliminates the need for roadside hardware. No hardware means no shovels in the ground, no construction permits, planning or standard delays associated with roadside hardware deployments. The entire V2I communication platform leverages the investments already made by both the telecommunications industry in cellular data access and the motor carrier industry's investments in deployed in-cab technologies. Agency access to secure, cloud-based screening software to process e-Inspection events has already solved how the SDMS data can be handled and processed by state CVE agencies. None of the system components listed above is yet to be developed or the product of a current FMCSA R&D program; these are all currently available, fully developed, commercial systems in wide use today.

THE INSPECTION REPORT

In order for e-Inspections to be included as source data for the SMS program, FMCSA needs to determine how e-Inspection data can be fed from the roadway to FMCSA's MCMIS database. We propose this pathway already exists and that the FMCSA utilizes the infrastructure, systems and programs it has already built for traditional roadside inspection data to also support e-Inspection data transmission.

This link is the existing FMCSA ASPEN (or equivalent) inspection system. These inspection systems are in use today by CVE inspectors across the country to process, document and create digital records of CVSA roadside inspections.

State agencies aggregate field inspection report data at the state level and then submit them to MCMIS using the FMCSA-managed ASPEN application or through other compliant 3rd party platforms like Iteris' Inspect. The data within these inspection reports feeds FMCSA algorithms to build each carrier's SMS profile.

It is currently possible for an e-Inspection event to automatically populate a CVSA Level III inspection report electronically and to automate the submission of this inspection report through existing state upload channels to MCMIS. Today, Drivewyze can automatically generate and complete a Level III inspection report based solely on a weigh station bypass e-Inspection event that contains the required SDMS credential data sets discussed.

ASPEN is an existing system already used to feed source data into MCMIS for the calculation of a carrier's SMS profile. This is not to say that there wouldn't be modifications required to the coding of e-Inspection data to make it unique from standard inspections. The fact that a digital pathway already exists and is readily available provides the FMCSA with a fast track opportunity to adopt e-Inspections as an available CSA data source.

INDUSTRY PARTICPATION

Industry participation in an e-Inspection program to support CSA cannot be taken for granted. The motor carrier industry support for safety and efficiency includes broad backing for FMCSA initiatives to increase safety, but they also include a requirement for effective and efficient processes to support these initiatives. The current data sufficiency challenges to the CSA program can be relieved with alternative compliance measures including e-Inspections to credit a carrier's SMS profile. This immediate link between real-time roadside e-Inspection events and the carrier safety profiles compiled by FMCSA will be a strong incentive for motor carriers to support and participate in e-Inspection programs deployed by agencies around the country. The incentive-based nature of an e-Inspection program that rewards carriers who choose to participate and volunteer their SMDS data to agencies is a critical success factor to achieving industry wide adoption. It involves state agencies and FMCSA offering carriers a real and tangible benefit in exchange for carriers sharing carrier, vehicle and driver data at e-Inspection sites. Without a valuable incentive, industry has no reason to volunteer this information to the roadside.

Each carrier's decision to bear the electronic data transmission cost to the roadside will be based solely on return on investment. The acceptance of e-Inspections and positive credits in CSA will make the investment worthwhile to the trucking industry. e-Inspections will solve carriers' data

sufficiency challenges accelerating the improvement of safety profiles in CSA. Without carrier participation, there will be no new source of additional inspection data to improve CSA and the systematic inefficiency of weigh station delays in our freight system will remain unsolved. The issue of data sufficiency will remain unsolved for FMCSA.

Without voluntary industry participation, state agency inspection officers will be left to the traditional random inspection statistic that nearly 80% of all vehicles inspected do not result in a vehicle being placed out of service, a waste for both government and industry.

e-Inspections are a true example of how a positive win-win relationship can be achieved between government and industry without the need for legislation or costly mandated programs.

THE NEED FOR POLICY

There is no question that the technology exists today to link weigh station bypass e-Inspections to carrier CSA scores. It does. From in-cab systems, to roadside screening interfaces; from back office connections to carriers, CVISN, PRISM and ultimately, the proposed e-Inspection ASPEN report pathway to SMS and CSA– they all exist and operate today. A coalition of industry and state partners are working together in the deployment of an integrated V2I ecosystem to improve safety and efficiency at the roadside. A ground-breaking demonstration of these commercial systems was demonstrated by the Maryland State Police on June 17th, 2013 at the West Friendship (Maryland) Weigh and Inspection station to the Administrators of FMCSA and FHWA, along with many industry leaders, illustrating the reality of these technical capabilities.

The real question is what will be the policies that govern alternative compliance practices to build on this new capability of connected trucks at the roadside? How can e-Inspections be leveraged by FMCSA to strengthen CSA and incentivize carriers to voluntarily participate in an e-Inspection program? Is an e-Inspection worth 1/2 of a Level III manual inspection, 1/3, 1/10? These are questions that FMCSA must tackle swiftly in the drive to lead the nation toward safer and more efficient highways. Federal R&D resources can be used more effectively in light of these fully developed commercial technologies and re-focused on policy development. It is not just FMCSA, but the USDOT Research and Innovative Technology Administration's ITS Joint Program Office that can deliver guidance on e-Inspection policy because it encompasses the integration of both intelligent infrastructure and intelligent vehicles.

The modern, digital world has rapidly accelerated the delivery of commercial technologies to deliver a real and tangible e-Inspection solution to resource-light agencies and a cost-conscious industry. Now it is time for e-Inspection policies. USDOT needs to maximize benefits for all stakeholders by developing policies that take advantage of these new capabilities.

SUMMARY

An electronic inspection opportunity is now emerging that represents a breakthrough in the way vehicles and roadside operations can be connected. And while electronic screening has been in commercial use for over 20 years, it has limited reach due to cost and data constraints. The development and commercial deployment of CMRS transponders and available e-Inspection software for state agencies expands traditional electronic screening to include real-time data elements on drivers and HOS in such a way it can be characterized as the first commercially available SDMS exchange.

This breakthrough helps on several fronts:

1. The current CSA operating model is hindered by data sufficiency issues;
2. There are limited resources and opportunities for physical inspections.
3. As a result, carriers with insufficient data or a safety profile that needs improving have few viable options to remedy their situation today.

This evolution warrants the emergence of a new class of automated wireless safety and compliance monitoring known as e-Inspections. This new breed of e-Inspection collects 100% of the credential data traditionally collected manually at a Level III roadside inspection, although it lacks the qualitative driver and vehicle assessment that can only be achieved with a physically inspection. Still, it warrants being classified as a new type of inspection event.

Both CVE agencies and Industry have much to gain from a regulatory environment that supports the electronic exchange of driver and vehicle safety and compliance information without requiring a vehicle to stop.

For CVE Agencies there is a very low barrier to entry. It is also feasible to implement while side-stepping the heavy infrastructure costs traditionally associated with DSRC solutions. e-Inspections leverage the investments made by both the telecommunications industry in cellular data access and the motor carrier

industry's investment in deployed in-vehicle technologies. e-Inspection data can be feed into the FMCSA MCMIS database through the existing ASPEN (or equivalent) inspection system.

Industry will be incented to voluntarily participate in the program with the positive reinforcement of an e-Inspection event immediately linked to the carrier safety profile compiled by FMCSA. This results in a positive win-win relationship between government and industry without the need for legislation or costly mandated programs.

These advances call for a need for updated policies. e-Inspections should be translated into some proportion of a Level III manual inspection. With that incentive, the FMCSA will maximize the benefits for all stakeholders including regulatory, enforcement agencies and commercial carriers.

Drivewyze™

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Authored by Brian Heath