A PRACTICAL GUIDE TO VIDEO-BASED SAFETY TECHNOLOGIES IN COMMERCIAL VEHICLE FLEETS

Understanding Safety Programs, Data Use, and Privacy Best Practices

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FUTURE OF PRIVACY FORUM

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EXECUTIVE SUMMARY

Vehicle collisions are a leading cause of death and injury in the United States. Commercial trucks can have an outsized impact on road safety because they are larger than passenger vehicles and typically travel more miles per year. Fleet operators have substantial regulatory, financial, and other incentives to implement safety programs.

As vehicle safety technologies have grown more sophisticated, commercial fleets are increasingly adopting Advanced Driver Assistance Systems, or ADAS. ADAS use cameras and sensors to enable adaptive cruise control, emergency braking systems, and other data-driven safety measures. Video-based safety systems, a type of ADAS, can reduce driver distraction, provide real-time feedback, improve training, and assist in post-collision investigations — all of which enhance safety, increase operational efficiencies, and lower costs.

At the same time, ADAS may create privacy risks for fleet drivers, passengers, and other road users. Privacy risks around location data, in-cabin video, and audio recordings are particularly sensitive and acute when drivers routinely eat, sleep, or have personal conversations in their vehicles. Policymakers, commercial fleet operators, and their technology partners must recognize these risks, and increasingly weigh data protection considerations when assessing the broader use of ADAS and related technologies.

We have an obligation to promote the operation of video-based safety systems that is consistent with privacy best practices. Systems can be designed and implemented in ways that are more or less privacy protective and secure. Below, the Future of Privacy Forum and Samsara describe how general ADAS systems work, identify the data used by video-based safety systems, and urge adoption of privacy best practices that go beyond compliance with existing privacy and data processing laws, including:

1. Implementation of privacy by design principles, privacy impact assessments, data minimization strategies, and privacy enhancing technologies;
2. Provision of enhanced transparency mechanisms to individuals;
3. Implementation of practical security safeguards appropriate for the sensitivity of the relevant data; and
4. Use of robust written policies and contracts to ensure that privacy protections remain attached to the data and all parties with access to data understand their obligations.

INTRODUCTION: THE CHALLENGE OF ROADWAY SAFETY

Road safety is a serious and persistent problem. Motor vehicle crashes are a leading cause of death in the United States, killing over 100 people a day.[1] Despite fewer vehicle miles traveled as a result of the COVID-19 pandemic, an estimated 38,680 individuals died in motor vehicle accidents in 2020—the largest projected number of fatalities in such accidents in over a decade.[2] Data from the first half of 2021 show that an estimated 20,160 people died in motor vehicle crashes, up 18.4% over 2020.[3] This is the largest number of projected fatalities in the first half of a year since 2006.[4] Citing these statistics, the Secretary of Transportation recently referred to this state of affairs as "a crisis on our roadways."[5]

Commercial vehicles are a key part of the roadway safety problem. Over 5,000 large trucks[6] and buses were involved in fatal crashes in 2018, an increase from 2017,[7] and from 2009 to 2018, fatal accidents involving large trucks and buses increased by 45%.[8] It is therefore not surprising that truck driving is among the most dangerous jobs in the United States.[9]

> "Commercial vehicles are a key part of the roadway safety problem. Truck driving is among the most dangerous jobs in the United States."

In November 2021, the federal government took steps to address the rise in motor vehicle fatalities by passing the landmark bipartisan Infrastructure Investment and Jobs Act (IIJA). The IIJA allocates billions of dollars in funding to transportation initiatives and directs the Secretary of Transportation to conduct various motor vehicle safety-related studies. These studies call for the use of ADAS technologies to better understand and address the current challenges of road safety. For example, the IIJA includes a directive to study commercial motor vehicle crash causation to help identify measures to reduce the frequency and severity of such crashes.[10] Other provisions require the implementation of certain federal motor vehicle safety and performance standards, including a rule prescribing a safety standard for vehicle technology that prevents drunk and impaired driving,[11] and a minimum performance standard for crash avoidance technology.[12]

The IIJA also includes provisions aimed at addressing driver distraction. Specifically, it requires research on the use of driver monitoring systems to minimize or eliminate (i) driver distraction, (ii) driver disengagement, (iii) automation complacency by drivers, and (iv) foreseeable misuse of ADAS.[13] The IIJA directs the Department of Transportation (DOT) to use this research to make rules, including ones incorporating privacy and data security safeguards, which could have significant implications for the transportation industry.[14]

The federal government's focus on roadway safety is further reflected in the DOT's recently released National Roadway Safety Strategy, which announces the "Safe Systems Approach as the guiding paradigm to addressing roadway safety."[15] Proactive safety is a key principle of the DOT's Safe Systems Approach. This principle emphasizes that proactive tools should be used to identify and address safety issues, rather than relying solely on reactive crash mitigation measures like airbags and vehicle crumple zones. The report goes on to highlight both behavioral interventions and vehicle safety features as key layers of a safety system, and states that the DOT will continue to leverage technologies that improve safety, including commercial motor vehicle equipment that address behavioral issues such as distracted driving systems. According to the report, "[i]ncentivizing the inclusion of technologies in new motor vehicles can help to reduce the frequency of crashes, and to reduce the severity of the outcomes when they do occur."[16]

The IIJA provisions calling for the use of ADAS and the DOT's National Roadway Safety Strategy demonstrate that the federal government is embracing the use of ADAS technologies to improve commercial vehicle and roadway safety. This, coupled with the directive in the IIJA that the DOT incorporate privacy and data security safeguards into any regulations or rules relating to the adoption of ADAS, highlights how important it is for all stakeholders to better understand how ADAS technologies work, what data they require to operate effectively, and what privacy risks may arise, and how those risks can be mitigated.

> "It is important to understand how advanced driver assistance technologies work, what data they require to operate effectively, and what privacy risks may arise."

This paper examines the use of one type of ADAS — video-based safety systems — in one particular context: commercial motor vehicles that typically operate in fleets.[17] **Section I** provides a high-level overview of ADAS, including key terminology, primary uses, and how advances in connected devices, cloud computing, and artificial intelligence (AI) are driving the evolution of the types of ADAS solutions adopted by commercial fleets. **Section II** focuses on a specific category of ADAS — video-based safety systems — and discusses how these systems are used in the commercial transportation industry. **Section III** describes the types of data that video-based safety systems process and summarizes the existing privacy landscape in the United States as it relates to the use of these technologies. This section also identifies privacy best practices to help organizations developing and deploying these technologies protect individuals' privacy while leveraging the use of video-based safety systems to improve road safety and meet the federal government's safety goals.

SECTION I: AN OVERVIEW OF ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS)

ADAS is an umbrella term used to refer to many vehicle safety technologies. This section breaks down the main categories of ADAS, describes how ADAS use data to prevent or reduce the severity of crashes, and identifies recent technological advancements that have led to the development of more sophisticated ADAS solutions.

A. ADAS Technologies Use Cameras and Sensors to Enable Data-Driven Safety Measures

ADAS are technological features that improve vehicle safety and efficiency.[18] Examples of ADAS include adaptive cruise control, anti-lock brakes, forward collision warning, lane departure warning, and traffic signal recognition.[19] ADAS can also include cameras and sensors that improve a driver's view of the road, detect driver distraction, and alert drivers and fleet managers in real-time to potential safety risks. Some of the most technologically advanced ADAS allow commercial fleets to actively monitor and record safety issues, and facilitate more effective driver coaching.

The following chart sets out the four main categories of ADAS:[20]

TYPE OF ADAS SYSTEM	DESCRIPTION	EXAMPLE OF ADAS TECHNOLOGY
Adaptive Systems	Adaptive systems help vehicles make adjustments (e.g., adjust vehicle speed and spacing) to drive more safely based on data from the surrounding environment.	**Adaptive cruise control** uses radar or laser sensors to detect the distance between vehicles and automatically adjust vehicle speed to maintain an optimal distance.
Automated Systems	Automated systems can take over and control the vehicle in case of an impending collision.	**Automatic emergency braking systems** can alert a driver to an imminent crash and automatically apply the brakes to help avoid a collision.
Warning Systems	Warning systems generate automated, in-cab alerts (e.g., warning lights and audio alerts) that help drivers anticipate possible safety risks in real-time.	**Forward collision warning** measures the distance, angle, and relative speed between vehicles and other objects in front of the vehicle on the road. These systems use audio alerts to warn drivers of impending collisions.
Video and Sensor-Based Systems	These systems use cameras and sensors to give drivers and administrators more awareness of safety-critical events, like harsh braking, rolling through stops, and collisions.	**Road-facing cameras** and **dual-facing cameras** (recording the road ahead and the driver in-cab), can help drivers actively avoid collisions by enhancing the field of view and signaling alerts to drivers in real-time when the systems detect external safety issues or distracted driving behaviors in the cab.

B. Commercial Fleets Have Substantial Incentives to Adopt ADAS Technologies that Improve Safety & Efficiency

Commercial fleets primarily use ADAS to improve safety,[21] a key feature of these technologies that has been recognized and embraced by the federal government. In October 2019, the Federal Motor Carrier Safety Administration launched Tech-Celerate Now, an initiative aimed at expanding the adoption of ADAS technologies by the trucking industry "because of their demonstrated potential to reduce fatalities, injuries, and crashes."[22] Tech-Celerate Now found that ADAS technologies can help avoid or mitigate the impact of safety incidents by improving a driver's view of the roadway, monitoring for driver training, alerting drivers in real-time to impending danger ahead or on the side of the vehicle, and maintaining safe travel distances between vehicles.[23]

Commercial fleets also use ADAS to increase operational efficiencies and lower costs. For example, a 20-vehicle fleet would save approximately $277,150 if its vehicles were equipped with ADAS at a cost of $54,491. That translates to $5 worth of savings for every $1 spent on ADAS technologies,[24] with savings generated through lower insurance premiums,[25] reductions in legal claims, improved driver retention,[26] lower operating costs, and improved vehicle repair and maintenance.[27]

C. Technological Advancements in Cloud Computing and Artificial Intelligence Have Improved ADAS Functionality and Effectiveness

ADAS technologies are not new. Indeed, features such as anti-lock braking, lane departure warnings, and electronic stability control are examples of ADAS solutions that have been around for decades and are likely familiar to both passengers and commercial drivers.[28] However, relatively recent advancements in Internet of Things (IoT) technology, cloud computing, and AI have transformed ADAS significantly, especially ADAS in the "Video and Sensor-Based" and "Warning Systems" categories described in the chart above.

Video-based safety technologies, the specific focus of this paper, are an example of ADAS solutions that can employ both video and sensor-based and warning systems, and have advanced tremendously due to the developments described in the chart on the following page.

Many of the latest ADAS technologies use IoT connectivity, cloud computing, and AI to generate, process, and analyze data for commercial fleets that fleet managers and drivers were not previously able to access. This data includes video upload and GPS tracking, safety indicators, vehicle diagnostics, and real-time insights into driver performance. Organizations can use this information to make better, data-driven decisions, including decisions around efficiency and safety.

Internet of Things	Cloud Computing	Artificial Intelligence
IoT is the network of many physical devices ("things") that are embedded with sensors, software, and other technology. These sensors, software, and other technology allow physical devices to exchange data with other devices and systems over the internet or other communication networks.[29] This IoT-enabled digital connectivity is crucial to commercial transportation companies[30] because it provides access to data that was previously siloed in physical objects and was difficult to aggregate and analyze. With IoT, organizations can upload large amounts of data from physical devices to a cloud environment, where it can be securely stored and processed. It also enables real-time analytics and monitoring to maximize operational efficiencies and reduce costs. By connecting vehicles and other physical objects to the digital world, IoT gives the commercial transportation industry greater insights into current operations, and creates opportunities for new ways to address problems like vehicle routing and dispatch, fuel efficiency management, preventative maintenance, and road safety.	**Cloud computing** is also relevant to ADAS. This technology enables the delivery of computing services, such as databases, networking, software, and analytics, over the internet or "cloud," rather than through individual data centers or servers. This allows key services to be provided centrally, accessible from anywhere and infinitely scalable. Cloud computing has significantly lowered computing and storage costs, enabling massive amounts of data to be efficiently processed and analyzed. Together, IoT and cloud computing can automate a business's systems and processes in a cost-effective way that supports real-time control and data monitoring.	**AI** is also a key enabler of new kinds of ADAS. AI refers to the science and engineering of making computers, machines, and systems that mimic the human mind's problem-solving and decision-making capabilities.[31] AI covers a variety of programming and system design sub-categories, including robotics, scheduling and planning systems, natural language processing, neural networks, computer sensing, and machine learning.[32] AI-powered systems that use machine learning can be trained to use specialized algorithms to study, learn, and make predictions and recommendations from large data sets. Machine learning (ML) is the "field of study that gives computers the ability to learn without being explicitly programmed."[33] ML involves teaching a computer to identify and recognize patterns by example, rather than programming specific, predetermined rules.[34] By ingesting image, video, and audio data from IoT, ML can identify and understand future and operational trends, detect anomalies, automate processes, and increase efficiency.

D. Many Commercial Fleets Use Video-Based Safety Systems, Employing Technologies from Basic Dash Cams to AI-Powered Video Telematics

As ADAS have become more affordable and widely available, it has become easier and more common for commercial fleets to adopt them. This is especially true for plug-and-play solutions such as video-based safety systems that can utilize cameras and sensors to track a vehicle, detect safety issues, and actively assist drivers. This section provides an overview of the different types of video-based safety solutions commonly adopted by commercial fleets and describes how these solutions can help fleets improve their safety programs, increase efficiency and visibility into operations, and reduce costs.

Types of Video-Based Safety Systems

Basic Dash Cams

The most common video-based safety system adopted by commercial fleets is the dash cam. Dash cams can be installed on a vehicle's dashboard or windshield to capture footage of the road ahead (front-facing), activity outside and inside the cab (dual-facing), or a 360° view of a vehicle and the surrounding road (multi-camera system). The most basic dash cam technology records footage, but does not analyze or process the data it captures to draw connections and inferences between that data and the vehicle's diagnostics (e.g., harsh brakes or accelerations). Basic dash cams use a capture-all data approach, while more advanced dash cams employ a process focused on limiting collection and retention only to relevant data. Basic dash cam technology often requires manual review of substantial amounts of footage to identify relevant events, making these recordings inefficient for driver training or for any real-time operational use. Advanced dash cams using video telematics can increase efficiency by minimizing manual review. At the same time, these more advanced systems can be configured in a more privacy protective way than basic dash cams, discarding video that is unrelated to a safety incident.

"Basic dash cams use a capture-all data approach, while more advanced dash cams employ a process focused on limiting collection and retention only to relevant data."

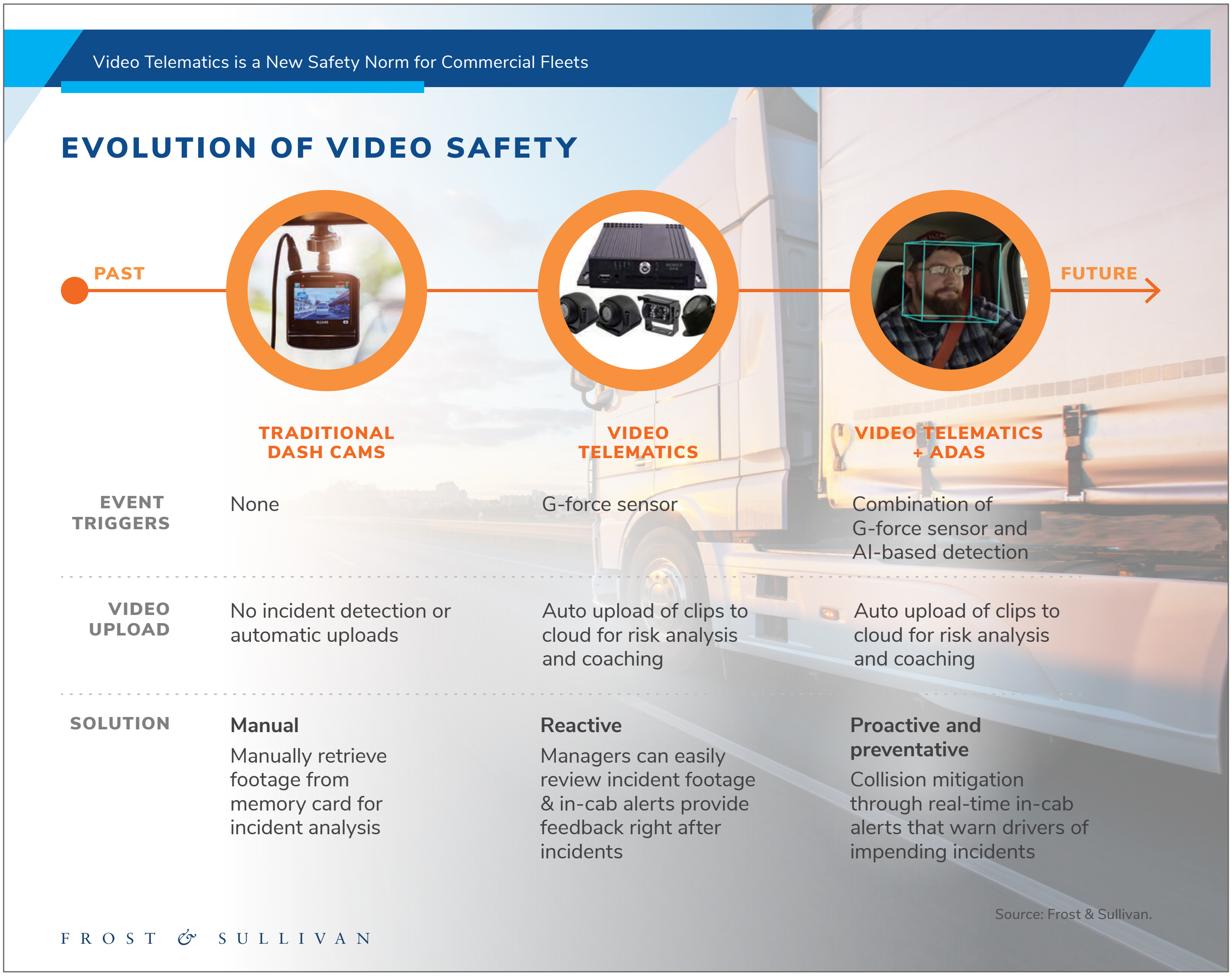
Video Telematics

The main difference between basic and more advanced dash cams is how the latter uses telematics. Telematics refers to systems that collect and transmit vehicle and driving data that can later be used to help fleet managers make decisions regarding driver training, vehicle maintenance, fuel management, and route planning.[35] When installed in a vehicle, a telematics system can collect and track many kinds of data, including vehicle data (e.g., vehicle location, trip status and purpose, driver information, trip time and date); driving performance data (e.g., speeding, harsh acceleration, idling times); and diagnostics data relating to vehicle condition (e.g., tire pressure, fuel efficiency, part malfunctions). Telematics systems can collect this data from a vehicle and transmit it to a cloud server where it can be accessed by various authorized end-users in different locations, including drivers and fleet managers.

Certain dash cams connect with a telematics system — a technology referred to as video telematics. Video telematics combine vehicle and driving data with video footage to provide more context around any driving incident, giving drivers and fleet managers greater insight into driver and vehicle performance. Video telematics typically have Wi-Fi or cellular connectivity, enabling them to transmit data to a secure cloud environment. By contrast, basic dash cams might not connect to the internet, meaning they store footage only on the dash cam device itself and cannot upload footage to the cloud. As a result, they require manual review and retrieval of footage, which is inefficient and often resource intensive.

AI-Powered Video Telematics

The most sophisticated video telematics solutions are powered by both on-device (edge computing) and cloud-based AI. Edge computing describes data processing on the dash cam device that occurs in decentralized storage locations (i.e., at or near the data source), which reduces latency.[36] Cloud computing refers to data processing in a centralized storage location with high processing and computing power, which supports larger-scale data analysis.[37] AI-powered video telematics use predictive and prescriptive



Video Telematics is a New Safety Norm for Commercial Fleets

EVOLUTION OF VIDEO SAFETY

PAST
FUTURE

	TRADITIONAL DASH CAMS	VIDEO TELEMATICS	VIDEO TELEMATICS + ADAS
EVENT TRIGGERS	None	G-force sensor	Combination of G-force sensor and AI-based detection
VIDEO UPLOAD	No incident detection or automatic uploads	Auto upload of clips to cloud for risk analysis and coaching	Auto upload of clips to cloud for risk analysis and coaching
SOLUTION	**Manual** Manually retrieve footage from memory card for incident analysis	**Reactive** Managers can easily review incident footage & in-cab alerts provide feedback right after incidents	**Proactive and preventative** Collision mitigation through real-time in-cab alerts that warn drivers of impending incidents

Source: Frost & Sullivan.

capabilities to improve driving behavior. For example, some of these systems use computer sensing, a field of AI that trains computers to understand the visual world to detect unsafe driving behavior, such as cell phone usage, distracted driving, and drowsiness, in real-time.

With both AI-powered and non-AI powered video telematics systems, driving performance can be improved with real-time notifications about harsh driving events and distracted driving behavior. Moreover, by honing in on relevant events (i.e., unsafe or risky driving incidents) these systems offer prescriptive tools fleets can use to coach drivers and improve training programs.

As reflected in the chart above, while basic dash cams can record event footage, they have limited capacity to identify harsh driving events or certain behaviors in real-time, efficiently record data, or help coach drivers. Moreover, unlike video telematics and AI-powered video telematics, basic dash cams cannot provide drivers with real-time notifications about risky driving behavior, such as harsh acceleration or, in the case of AI detection, distracted driving. These real-time notifications provide immediate feedback that can help a driver adjust their behavior in the moment, thereby proactively addressing unsafe conduct that could lead to a crash. Given these limitations, it is more technologically advanced video-based safety solutions — namely those connected to a telematics device and the internet, and powered by AI — that have the capacity to yield the most significant safety benefits for commercial fleets.

SECTION II: HOW VIDEO-BASED SAFETY SYSTEMS USE DATA TO REDUCE DRIVER DISTRACTION, DEVELOP MORE EFFECTIVE FEEDBACK AND TRAINING, AND INVESTIGATE ROAD INCIDENTS INVOLVING COMMERCIAL FLEET VEHICLES

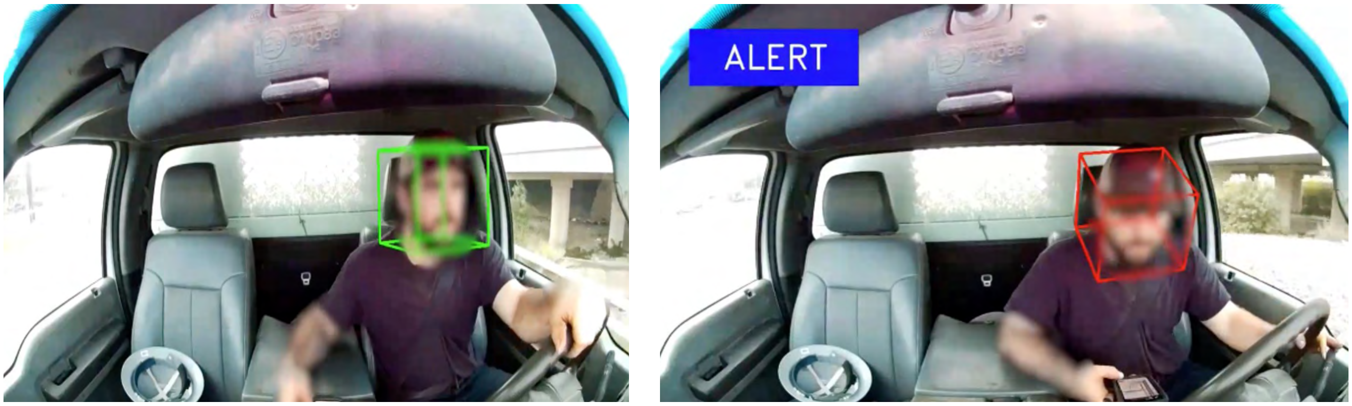
A. Improving Road Safety Through Reducing Driver Distraction and Other Dangerous Driving Behaviors

When combined with driver coaching and telematics, video monitoring systems can reduce safety-related events (e.g., harsh braking and collisions) by 52%.[38] Moreover, the use of dual-facing video monitoring systems can result in a 60% reduction in accidents.[39]

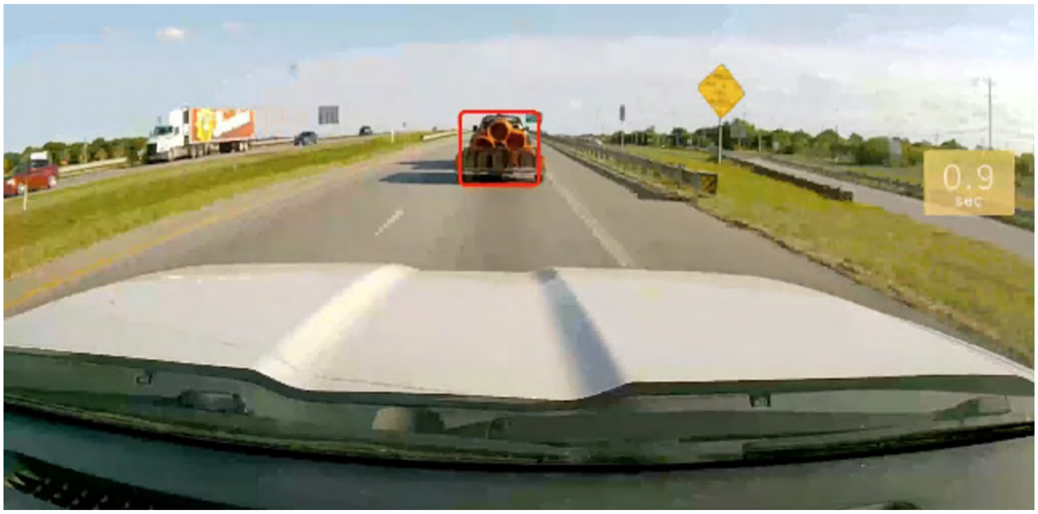
Two specific ways that AI-powered video telematics can improve safety are through detection of distracted driving behaviors and tailgating. Distracted driving detection works by using AI to analyze an individual driver's natural head positioning while they operate the vehicle. For example, the technology can use that positioning to develop a baseline for engaged driving head position. The system identifies deviations from this baseline, which indicate when a driver may be distracted. In addition, some AI-powered video telematics systems can detect conduct such as phone usage, eating, drinking, and seat belt usage.

Distracted driving prevention is one way AI-powered video telematics systems utilize predictive and prescriptive capabilities to improve safety. With these capabilities, the system can identify and notify drivers and fleet managers of potentially risky and unsafe behaviors in real time. For example, if the system detects a driver looking down to use his cellphone while driving, the on-device AI will classify this behavior as "distracted driving," and an audible in-cab alert will notify the driver so they can adjust their behavior. This information can also be shared instantaneously with the driver's fleet manager and stored to use for driver coaching, and managers can prioritize only collecting video footage for critical safety behavior for coaching purposes. An organization may also choose to give drivers an opportunity to correct their behavior after receiving an in-cab alert before the event is logged, providing drivers an extra element of control.

"The use of dual-facing video monitoring systems resulted in a 60% reduction in accidents."



Example of AI-powered distracted driving detection.



Example of tailgating detection.

Tailgating is another unsafe driving behavior that AI-powered video telematics systems can detect and mitigate through the use of algorithms that monitor how long a vehicle has maintained an unsafe following distance. For example, if a vehicle has been following the vehicle in front of it at an unsafe distance for longer than a certain period of time, the system can notify the driver with an in-cab audio alert, prompting the driver to adopt a safer following distance. The system can also capture and upload the event to the cloud for use for driver coaching. Some systems allow fleet managers to configure the settings to adjust the threshold following distance time to a longer or shorter period.

When a dash cam detects an event such as distracted driving or tailgating, data captured by the device can be automatically uploaded to the cloud environment. Some AI-powered video telematics systems also allow fleet managers to manually request to download segments of footage if the data remains on the device and has not been automatically overwritten. Data recorded and saved in the cloud can be protected by customizable data access controls, so that it is only accessible to authorized individuals (e.g., a fleet safety manager may need to see dash cam footage, whereas a maintenance manager may not). When reviewing uploaded footage or images, fleet managers can determine whether the event should be dismissed, addressed through driver coaching, or saved for another purpose, such as driver exoneration or for use in connection with an insurance claim.

In addition to identifying particular safety-related incidents, some video telematics systems can analyze data across numerous trips, vehicles and drivers, generating inferences to help fleets assess driver safety and track improvements and increase efficiency at both the driver and organizational levels.

Driver Safety Scores

Some systems give fleet managers the option of generating individualized safety scores for each commercial driver. Safety scores can be generated by assigning certain values to different driving events, such as harsh braking, acceleration, rolling stops, collisions, tailgating, and distracted driving. If an event is automatically detected by the device or manually identified by a fleet manager, it can adversely impact the driver's overall safety score. Video telematics systems may provide set default values for various driving events; however, organizations can often adjust these values to configure the relative importance of specific factors. This allows fleets to customize the methodology for calculating a safety score to reflect their particular organizational goals and priorities. For example, if a fleet manager is particularly focused on reducing a particular driving behavior, such as tailgating, the manager can attribute a greater value to that driving event to give it a greater impact on the overall safety score. Fleet managers can also elect to positively weigh certain driving behaviors, such as defensive driving, to offset negative scores and reward safe driving.

Some systems enable drivers to view their safety score and the safety events impacting that score, giving drivers insight into their performance and helping them identify habits and behaviors that might need improvement. Some systems also support the option of generating a leaderboard of an organization's driver safety scores; leading drivers can be identified or listed without using their names. Whether a leaderboard uses names or not, it allows drivers to see how they rank against others within their organization. Safety scores can be used to form the basis of an organization's safety program, honing in on areas that need coaching, helping to identify fleet-wide trends, and setting priorities based on how an organization decides to weigh factors that feed into the driver safety score.

Improving Operational Visibility

Data captured by video telematics systems also gives fleet managers greater insight into their operations to improve overall fleet safety and efficiency. For example, data can be used to help fleet managers identify areas where drivers might need more training (e.g., driving in inclement weather, driving in rush hour traffic, etc.) and areas where drivers are excelling. Data can also provide for better route optimization and planning by pinpointing routes that are congested, closed-off, or dangerous.

Unlike basic dash cams, video telematics systems do not continuously upload and store all of the data they record — these devices only upload relevant footage. This footage may be data that the device, through AI and sensors, identifies as relating to a risky or unsafe driving event (e.g., a harsh acceleration, sharp turn, or a collision). This means that fleet administrators do not have to review potentially large amounts of footage to identify relevant events. It also enables more targeted data uploads to limit data collection to what is necessary for the technologies to properly function.

B. Investigating Incidents and Driver Exoneration

There are substantial incentives for fleets to adopt video-based safety systems. As described above, these systems can reduce the frequency and severity of collisions, resulting in fewer injuries to fleet drivers and other road users. In addition, footage captured from basic dash cams or video telematics systems can be used in the event of a collision or insurance dispute, to reconstruct key events, exonerate not-at-fault drivers, and protect carriers from spurious claims and punitive verdicts. Using footage as evidence to shield drivers and carriers from large legal verdicts has become particularly appealing for the trucking industry, as research shows that the number and size of verdicts against commercial carriers are increasing significantly.[40]

In lawsuits involving accidents with large commercial vehicles where the verdict was over $1 million, the average verdict amount increased nearly 1000% from 2010 to 2018, rising from $2.3 million to $22.3 million.[41] These verdicts have a significant, often devastating impact on motor carrier operations, including substantially higher insurance premiums distributed among all motor carriers.[42] Footage collected by video telematics solutions can help clarify a disputed factual record and immediately eliminate baseless claims. Footage can also streamline the insurance claims process and help quickly resolve questions raised by enforcement authorities during audits or inspections. This translates into potentially significant savings for carriers and protection for drivers by ensuring they can quickly address and dismiss a fraudulent claim.

The potential for dash cams and video telematics systems to save lives, reduce operating expenses, and enhance safety programs are making these technologies increasingly popular with commercial fleets. At the end of 2020, there were an estimated 2.1 million installed, active video telematics systems in commercial fleets in North America.[43] This number is expected to grow to approximately 4.4 million units by 2025.[44]

SECTION III: PRIVACY RISKS CREATED BY VIDEO-BASED SAFETY SYSTEMS CAN BE MITIGATED BY ADOPTING DATA PROTECTION BEST PRACTICES

While video-based safety systems hold promising benefits for commercial fleets, they also create data protection risks. Organizations should implement thoughtful privacy and security best practices to mitigate these risks when employing video-based safety systems and other ADAS. Video telematics solutions in commercial fleets typically collect and process several types of data, as summarized in the following chart.

Video data	Video-based safety solutions can record the environment directly in front of, around, and inside the vehicle. This footage can pick up a variety of information, including images of road signs, other drivers, pedestrians, and cyclists, as well as data about a driver's performance and the behavior of drivers and passengers.
Sensor data	Devices can include motion and depth sensors, which collect information about the vehicle's immediate physical environment and movements.
Audio data	Devices can include microphones that can capture audio of the driver's voice, as well as acoustic sound from the device's surroundings.
Biometric data	Cameras may collect and process biometric data about drivers.
Location data	Telematics and other technologies that infer geolocation are common in commercial vehicles. Some devices can record approximate location information using the device's IP address. Devices may also derive precise geolocation information and other location information from GPS satellites, the dash cam, or location-based services that use Wi-Fi and Bluetooth technologies.
Driver behavior data	Driving events such as collisions, tailgating, harsh braking, rapid acceleration, rolling stops, and distracted driving can be automatically detected by the device, triggering an alert, or manually identified by a fleet manager.
Device data	Devices can generate log files that include information about hardware and software, device identifiers, and IP addresses.

A. Privacy and Data Processing Laws

Generally, there are few workplace privacy protections for workers in the United States. Workplace monitoring is fairly commonplace, and data use practices are primarily governed by company policies, not regulations or statutes. Still, organizations developing or deploying vehicle safety technologies may find themselves subject to various privacy and data protection laws depending on where the technology is used, what types of data is processed, and the nature of the employment relationship.

For example, some states have enacted statutes regulating employer processing of certain biometric information, like Illinois's Biometric Information Privacy Act ("BIPA"). BIPA establishes obligations for how employers may process an individual's biometric information in Illinois.[45] The law requires employers to obtain consent or a written release from an employee or an authorized representative before collecting the employee's biometric information. Other states, like Texas, regulate how biometric information may be used for a “commercial purpose.” There are also state and federal audio recording laws that may restrict employers’ ability to monitor employee communications in some circumstances. Some states, like California and Maryland, generally require all parties to consent to an audio recording, while others only require one party to consent.[46] In short, privacy and data processing laws vary — in some cases widely — from state to state.

These laws continue to evolve, making it especially important for organizations to plan ahead when implementing privacy practices. And additional rules may be on the horizon. The Federal Trade Commission (FTC) is considering a broad rulemaking effort to limit privacy abuses.[47] In addition, several states have passed new privacy laws, with more bills expected to be enacted this year, as well as forthcoming regulatory activity. For example, the California Privacy Protection Agency is in the process of making rules about profiling and automated decision-making under the California Privacy Rights Act (CPRA), which goes into effect in 2023, and may have important implications for companies’ obligations.[48] Organizations that operate internationally must comply with global privacy laws, such as the EU General Data Protection Regulation. When collecting and using data that is subject to various privacy and data processing laws, some organizations choose to follow the highest standards and apply these requirements across all geographies, regardless of whether a particular person or data set resides within the strictest jurisdiction.

B. Privacy and Security Best Practices

The volume and nature of personal data collected by video-based telematics in commercial fleets can give rise to privacy risks, including risks that are not addressed by the evolving landscape of privacy laws. To help navigate these challenges, this section provides privacy best practices for organizations building or implementing video-based safety technologies in fleet vehicles. By analyzing privacy considerations now, companies are able to comply with existing rules, stay ahead of the evolving regulatory and legal compliance landscape, and ensure that data-driven programs promote safety, trust, and respect for all stakeholders.

Privacy and Security Best Practices for Commercial Fleets Utilizing Video-Based Safety Technology

- Understand what data is being collected and the purpose for collecting and processing it;
- Select a solution equipped with built-in privacy and security protections;
- Conduct a Privacy Impact Assessment to understand the impact of the solution you are using;
- Employ data minimization strategies;
- Use secure storage;
- Be transparent (e.g., establish clear policies that explain how the solution is being used and how it might impact commercial drivers);
- Implement appropriate security safeguards (e.g., data retention and deletion, access controls, penetration testing, appropriate encryption and secure transmission);
- Use robust written contracts with third parties.

1. Implement Privacy by Design, Privacy Impact Assessments, Data Minimization Strategies, and Privacy Enhancing Technologies

Two important questions for organizations to ask whenever they consider collecting or processing personal data:

(1) Is there a clear, articulable purpose for collecting or processing this data?; and

(2) Is personal data being collected and processed only to the extent necessary?

Integrating and operationalizing privacy by design and privacy impact assessments allows organizations to answer these crucial questions and mitigate privacy risks.

A main objective of Privacy by Design,[49] or data protection by design and default,[50] is to design systems that retain the same functionality through the least-privacy-invasive means possible. Privacy by Design requires companies to think about privacy at the design stage of any product before it is built. It also means designing privacy into operational and business practices, including privacy checks in procurement operations, and creating processes to conduct privacy impact assessments. For technology providers, building privacy into the product from the beginning can help prevent incidents that may create legal risk for both the provider and the technology user; moreover, it can preserve individuals' confidence in the service and bolster brand reputation.

> "Integrating and operationalizing privacy by design and privacy impact assessments allows organizations to answer crucial questions and mitigate privacy risks."

Many video-based safety technologies have built-in privacy and security protections with customizable features that give organizations control over how to implement these technologies to achieve their particular privacy obligations and objectives.[51] This allows users to have control over camera placement, what type of information is collected and how, how long information is stored, who has access to what data, and what data may be shared with third parties.[52] For example, these features include customizable settings that control what data is uploaded and saved.[53] Rather than having video-based safety technologies upload data continuously, whenever the device is on, organizations can set the device to capture and upload only the data necessary to deliver stated safety benefits.[54] With this kind of customization, a carrier can set the device to transmit data to the cloud only when a harsh or unsafe driving event is detected.[55] Robust data access controls also play an important role in ensuring that privacy is properly protected. Such controls make it easy for organizations to align access to data collected by dash cams with company policies, so they can provide guardrails for the fair and proposed use of any footage.

Some video-based safety systems can be paired with privacy-protecting functionality. For example, leading services ensure that sensitive data is encrypted on device, in transit, and in cloud storage. Some solutions can connect with a device that allows a commercial driver to deactivate GPS data capture, temporarily shutting off the transmission of the vehicle's location coordinates to the cloud. This gives drivers a way to turn off location monitoring in circumstances where it may be unnecessary. Additionally, some dash cams come with physical lens covers, making it easy to cover internal or external facing lenses when the driver wants to also physically ensure that video is not recording. This can be useful to ensure the driver's privacy while he or she is off-duty in a truck's sleeper berth or to provide proof if the vehicle enters a secure location where video recording is prohibited.

When selecting a video-based safety system for a commercial fleet, it is important for carriers to understand whether the solution they are considering is equipped with these privacy and security protections. Solutions with these Privacy by Design features make it easier for carriers to maintain compliance and meet their privacy objectives while best serving their unique operational needs.

Privacy Impact Assessments (PIAs) are another important tool for identifying privacy risks and preparing mitigation strategies. A PIA is typically started any time there is a new product or service that processes personal data, or when there has been a substantial change to an existing product or service that impacts the processing of personal data. For example, when implementing a video-based safety solution across a commercial fleet, a PIA can help a carrier better understand the potential privacy and security impacts of the solution and identify possible compliance steps to balance against any potential impact on an individual's privacy. Effectively completing a PIA requires cross-disciplinary efforts from different stakeholders within and outside of an organization. When completed properly, PIAs serve as valuable resources that help organizations efficiently scale and ensure they are meeting their legal obligations any time the organization considers processing personal data in a new way.[56]

2. Provide Transparency

Organizations should provide full transparency and notice to drivers about what data is collected during their use of the commercial vehicle, how the data is being used, and whether the data is shared with third parties. Establishing a clear policy that addresses these points can help set drivers' expectations for how the technology will be used and how it might impact them.

A policy should address, among other things, why the technology is being used (e.g., to promote driver and road safety, to provide more effective driver coaching, in connection with insurance claims or legal proceedings including to exonerate drivers), individuals within the organization who are authorized to access footage, when footage is captured and saved, proper use of the footage, when footage may be disclosed to authorities or other third parties, and consequences for violating the policy. Putting a policy in place that specifically addresses how the organization will use dash cams, and consistently adhering to that policy, can help to earn the trust of drivers and promote a safety culture that is attuned to privacy concerns.

In addition to implementing relevant policies and procedures, organizations can provide transparency by leveraging technological features and tools. For example, driver applications on mobile phones or tablets can push real-time notices out to drivers. Where appropriate, they can also collect consent or other approvals. Another feature that helps provide transparency is in-cab audio alerts for particular types of recording or processing, such as live streaming. Live streaming establishes a peer-to-peer connection between a fleet manager's computer and the video telematics device, allowing the safety manager to communicate with the driver and see footage of the road, all in real time. By sounding an audio alert in-cab whenever live streaming is activated and ended, the driver and any passengers will always know when the feature is in use. Some video-based safety solutions do not allow this audio alert to be disabled.

Some video telematics solutions support transparency by granting drivers full visibility into their personal driving and safety statistics, giving drivers access to the same information as their managers so they can see exactly what is detected about their driving performance. Audit logs also support transparency by allowing fleet managers to review actions taken relative to specific videos and images within the organization, keeping a record of who within an organization is accessing footage and how it is being used. Such logs can serve as a valuable resource for resolving any concerns relating to potential misuse of any data collected by video-based safety technologies.

3. Ensure Security

Most privacy and data breach laws require organizations to implement adequate technical, organizational, and administrative security to protect personal information. For example, the FTC routinely requires companies to implement comprehensive data security programs, the California Privacy Rights Act refers to "reasonable security procedures and practices"[57] and the NY SHIELD Act lists "reasonable safeguards."[58] What is "reasonable" is often dictated by industry standards. Some important security safeguards include:

- Appropriate encryption and secure transmission;
- Third-party auditing of software provider's infrastructure: employee on-boarding and termination processes; internal access controls to production environments; and disaster recovery, data backup, and incident response processes;
- Penetration testing: application-level, infrastructure-level, and hardware-level penetration tests at least annually. Results are triaged, prioritized, and remediated in a timely manner;
- Role-based access controls: internal policies to determine which roles should have full or limited access to different pieces of information;
- Redundant hosted software;
- Data retention and deletion policies;
- Privacy and security awareness and training throughout the company; and
- Physical and environmental security of data centers.

Keeping up with new technologies and processes can become quite burdensome, especially for smaller businesses. Organizations may consider using a third-party, cloud-based solution that can significantly reduce compliance overhead and help maintain security over driver data. For example, many cloud-based technologies are routinely updated with security patches, and often include out-of-the-box role-based access control capabilities that allow organizations to limit who is able to view footage from internal-facing dash cams.

4. Employ Robust Written Contracts with Third-Party Providers

When using third-party providers, it is important to have robust written contracts that capture the shared responsibility model. Commercial fleets should consider which party is in a better position to take on the risks and responsibilities associated with each piece of the contract. For example, the provider of the product should be responsible for the security of the overall cloud and the user of the product is best suited to be responsible for internal use and access policies and security. Contracts should include any other organization or use-specific requirements and provide adequate coverage should a security incident occur. Also, contracts should ensure that privacy protections travel with the data, making clear that data use and access restrictions apply to downstream recipients of the data.

CONCLUSION

DOT's National Roadway Safety Strategy, initiatives such as FMCSA's Tech-Celerate Now program, and key provisions of the IIJA calling for the use of ADAS to understand and address commercial vehicle safety indicate that the federal government is prepared to embrace these technologies to address the country's serious road safety problem. Moreover, these actions by the federal government signal that these technologies will become increasingly common in the commercial transportation industry. Advancements in IoT, cloud computing, and AI continue to transform the capabilities of ADAS systems, turning them into powerful tools that give commercial fleets access to data that can transform the safety, efficiency, and sustainability of their operations. While these technologies continue to become more sophisticated, they have also become more affordable and easy to deploy (such as plug-and-play solutions like video-based safety systems), making them easier to adopt at scale.

As ADAS technologies become more prevalent, it is important that they be well understood. This is especially true for video-based safety solutions that implicate privacy concerns. Government studies required by IIJA that focus on the effectiveness of these systems and how they can best be leveraged in commercial fleets — with safety and privacy considerations top of mind — will be key in determining how policymakers and industry shape the future of data collection and use by commercial fleets. As the technology powering video-based safety solutions continues to evolve, it will be increasingly important for the federal government to continue to study how new technological advancements can be harnessed to address pivotal problems, such as road safety, and to consider how best to promote those benefits while mitigating risks to individual privacy.

Just as the technology will continue to develop, privacy and data processing laws will change as well. It is crucial for organizations to stay on top of — and ahead of — these developments by proactively implementing privacy best practices.

ENDNOTES

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[12] *Id*. 24208.

[13] *Id*. 24209.

[14] *See, e.g., Id*. § 24209(c)(2) (stating “Privacy.—A rule issued pursuant to paragraph (1) shall incorporate appropriate privacy and data security safeguards, as determined by the Secretary.”).

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