Evaluating the Effectiveness of Video-Based Driver Risk Management Systems on Transit Safety

November 15, 2012

Michael Litschi
Orange County Transportation Authority
600 S. Main St.
Orange, CA 92863
Phone: 714-560-5581
Fax: 714-560-5734
mlitschi@octa.net

Peter Haas, Ph.D. – corresponding author
Mineta Transportation Institute
210 N. 4th Street, 4th Floor
San Jose, CA 95112
Phone: 408-924-7560
Fax: 408-924-7565
peter.haas@sjsu.edu

Word Count: 6,804 words + 2 Tables = 7,304 words
ABSTRACT

In the mid-2000s, public transit agencies began testing a new form of onboard video event recorder technology on buses. These video-based driver risk management systems capture a video clip when triggered by an unusual event, such as hard braking, a sharp turn, or impact with an object. This represented the first time that onboard cameras were intentionally focused on transit operators as a safety strategy.

The objective of this study was to determine whether video-based driver risk management systems have enhanced passenger safety by reducing the frequency and severity of collisions and injuries, while also identifying lessons learned from the implementation of such systems. Data collected from National Transit Database reports and DriveCam, Inc. -- one of the video system manufacturers -- were analyzed for trends in safety performance that could be linked to adoption of the systems. Additionally, interviews were conducted with the six U.S. transit agencies and three contract operators using the systems to assess the issues faced in implementing the technology and results thus far.

The study shows that video-based driver risk management systems appear to have a positive impact on transit safety achieved through a reduction in collisions and injuries, as well as the risky driving behaviors that contribute to them. The systems provide transit managers with a wealth of information about their employees’ driving habits that was not previously available. Transit agencies should strongly consider investing in video-based driver risk management systems as one component of an overall safety and training program.
INTRODUCTION

In the mid-2000s, a handful of public transit agencies in the United States began installing video recording devices in buses specifically intended to monitor transit operator performance and adherence to safety regulations. Though this technology has been used on commercial fleet vehicles for a number of years, its application in the public transit industry is still relatively recent and comparatively much less pervasive. Proponents of video-based driver risk management systems argue that the systems help to identify and correct potentially dangerous driving behavior before it leads to a collision or injury. The cameras also serve to deter operators from violating transit-specific safety regulations such as bans on use of personal electronic devices. Manufacturers of the camera systems claim they can lead to significant reductions in the frequency and severity of accidents, as well as the number of workers’ compensation and personal injury claims (1).

However, the video systems have prompted objections from union officials, and transit operators themselves, who believe these cameras constitute an invasion of privacy and are not a cost-effective solution to improve transit safety. Though anecdotal evidence provided by the manufacturers of the camera systems shows that video-based driver risk management systems reduce accidents and cut costs, there have been no formal studies examining the effectiveness of these types of systems on improving safety in the transit industry through a reduction in the frequency and severity of accidents and injuries.

There are currently two primary companies that manufacture video-based driver risk management systems used by transit operators: DriveCam, Inc., and SmartDrive Systems, Inc., both based in San Diego, California. This research project evaluates the effectiveness of the DriveCam system currently being used by five public transit operators and three private contractors, and develops lessons learned in implementing the system. The Los Angeles County Metropolitan Transportation Authority’s (Metro) experience with the SmartDrive system in Los Angeles is also discussed. DriveCam and SmartDrive are both used by trucking firms, private motorcoaches, taxi cabs and a wide variety of other fleet vehicles; however, this study focuses specifically on use of the systems in transit buses. Similar systems also are in limited use on transit buses in Europe and South Africa, though the authors could not find any studies on their effectiveness.

Although several past research studies have explored the impact of using behavior-based techniques, including video recording devices, to improve safety in the trucking and motorcoach industries, there have been no published reports regarding the use of such technology in the public transit industry. This study examines whether video-based driver risk management systems have been successful in enhancing safety in the transit industry by reducing the frequency and severity of collisions and injuries.

METHODOLOGY

Data for this project was gathered from a variety of sources, including publicly available documents and reports from each of the transit agencies studied, information provided by the manufacturers of the camera systems, and a variety of academic and government reports. The study synthesizes data from the U.S. transit agencies currently utilizing video-based driver risk management systems to determine if there is a pattern that indicates the cameras are an effective tool to enhance safety by preventing risky driving behaviors, and in turn reducing the frequency
and severity of collisions and injuries. The two data sources used to evaluate effectiveness are the National Transit Database (NTD) accident and injury statistics, and results reported directly by transit operators in interviews.

National Transit Database (NTD) accident and injury statistics were examined for each of the five public transit operators using the DriveCam system to look for any trends in the safety performance of directly operated bus services that could be correlated with adoption of video-based driver risk management systems (2). However, NTD data was not analyzed for the three contracted operators using DriveCam – First Transit, MV Transportation and Veolia Transportation – due to the complexity of tracking which of the firms’ transit clients were using DriveCam, and on which portion of the fleet, during a particular time period. NTD safety data for each transit client is segregated into two groups: directly operated and purchased transportation. Because some transit agencies use multiple contract operators to provide service under the purchased transportation category, it was not possible to use NTD data to track the effectiveness of the systems being used on contracted services. Finally, data tracking the number of monthly scored events and collisions per event recorder was obtained from DriveCam, Inc., for its transit-industry clients in order to analyze safety trends following the launch of the DriveCam system.

Information was gathered through phone interviews with managers at each transit agency. Some agencies provided specific metrics on results seen since implementation of the camera systems, while others provided more anecdotal information. The interviews also explored what policies and procedures each transit agency put in place when implementing the new video systems in order to identify a set of best practices and lessons learned.

BACKGROUND

Overview of Video-Based Driver Risk Management Technology

The video-based driver risk management systems currently used by transit industry clients use a small, palm-sized dual-lens video camera that is mounted on the vehicle windshield, usually behind the interior review mirror of the bus. A wide-angle camera captures both the view out the front windshield of the bus, as well as an interior view, including a clear view of the operator, and typically the farebox and at least a portion of the passenger seating area. The cameras also include a microphone to capture audio inside and outside the vehicle (Cohen, Botnen, Parra unpublished data).

Though the cameras are continuously recording, the system is set to save video clips only when triggered by gravitational forces (g-forces) on the vehicle that exceed a predetermined level. These movements are measured by an accelerometer that triggers the camera system when atypical vehicle movements occur, such as sudden braking or acceleration, swerving, sharp turns, or the impact of a collision. Transit clients using the DriveCam system receive video clips of 8 seconds before and 4 seconds after each triggered event. The transit operator can also press a button to manually trigger a clip to be saved if there is a particular event he or she wants recorded.

When the DriveCam video driver risk management system is triggered, a light on the camera equipment flashes, indicating that a g-force has triggered a clip to be sent for review. This provides the driver with immediate feedback and awareness that an action he or she took activated the recorder. This is intended to encourage self-evaluation and can signal behaviors that the driver should work to avoid, even before formal review and coaching takes place.
Under DriveCam’s “managed services” program, all triggered events are downloaded via mobile network, analyzed via computer software, then by DriveCam personnel at a call center, and assigned a “risk score”. This event is then labeled a “scored event.” Transit industry clients can review the scored events, including video clips, via an Internet-based “dashboard,” which also allows transit agency managers to run reports on the riskiest drivers or driving behaviors, and includes mechanisms to track coaching and disciplinary actions related to each event. Transit managers are encouraged to follow up with individual bus operators on scored events by providing coaching within four days (Botnen unpublished data).

Each scored event includes an explanation of what triggered the event to be captured (braking, impact with object, etc.), as well as an analysis by DriveCam staff of the specific driver behaviors that contributed to the event. DriveCam reports that its transit-industry clients have seen dramatic decreases in the frequency and severity of collisions year-over-year, resulting in an overall reduction in claims cost of 30 percent to 80 percent, and a 40 percent to 80 percent reduction in accident frequency (Cohen unpublished data). Across all industries, DriveCam says it has reduced vehicle damages, and workers’ compensation and personal injury costs, by more than 50 percent in more than 150,000 commercial and government vehicles (3).

**Role of Video Surveillance in Behavior-Based Safety**

A 2003 Transportation Research Board (TRB) report discusses the recommended use of behavior-based safety techniques to improve safety in the trucking and private motorcoach industry, including on-board video systems (4). The TRB report defines behavior-based safety as, “a set of methods to improve safety performance by teaching workers to identify critical safety behaviors, perform observations to gather data, provide feedback to each other to encourage improvement, and use gathered data to target system factors for positive change” (4). It found that behavior-based safety has been used successfully for decades in industrial settings to reduce risky behaviors, encourage safe behaviors, and prevent occupational injuries and compensation claims (4). However, there have not been many studies of use of the same techniques in the trucking and motorcoach industries, where it is much more difficult to conduct direct behavioral observation and feedback.

Truck drivers, motorcoach drivers and transit operators generally operate their vehicles independently, without direct supervision. Supervisors cannot personally monitor each driver’s actions to provide real-time feedback, unlike in the manufacturing industry where many workers are based in the same location and can be overseen directly by managers. As a result, transit operators resemble “street-level bureaucrats,” which have frequent, direct interaction with the public, but enjoy a relatively high degree of independence in their work due to the difficulty of providing direct supervision (5).

The TRB report also discusses the use of on-board monitoring and recording devices as a safety tool in the trucking and motorcoach industry. On-board monitoring escalates the ubiquitous “How’s my driving?” placard, and is not reliant on the potentially biased testimony of other drivers. Because drivers know their behavior is constantly being monitored, on-board monitoring systems have the potential to reduce risky driving behaviors that the driver may have engaged in if there was a perception that no one was watching, in much the same way that many drivers check their speedometer and tap the brakes when they see a police car. On-board video systems also eliminate the subjectivity of relying on other drivers, or in the case of the transit industry, passengers, to report unsafe driving behavior.
The most important challenge in applying on-board safety monitoring systems is achieving driver acceptance (4). “On-board safety monitoring is the ultimate in behavioral observation, but the challenges are to win driver acceptance and establish a positive reward system to reinforce desired performance” (4). An earlier study by Penn + Schoen Associates found that commercial drivers were “wary of technologies perceived as invasions of privacy or as diminishing the role of driver judgment,” and were skeptical of new technology (6). The study also showed that on-board monitoring was “the least accepted technology by the drivers, even though they generally acknowledged its potential safety benefits” (6). A 2002 study by Hickman and Geller found that instructing short-haul truck drivers to use self-management strategies to monitor their driving behavior resulted in “significant decreases in at-risk driving behaviors (extreme braking and overspeed)” (7). However, the report also acknowledges that video footage could increase liability if the driver is at fault (7).

The authors of the TRB study conclude that “[On-Board Safety Monitoring] technology and behavioral applications are underused in truck and bus transport in relation to their safety potential,” and that the technology should be used in safety training programs to demonstrate that unwanted driving behaviors that are likely to increase the likelihood of an accident (4).

Effectiveness of Video-Based Driver Risk Management Systems

Though there have been no formal studies to date examining the effectiveness of video-based driver risk management systems on improving safety in the transit industry, at least one formal study has examined the technology’s impact on safety in the trucking industry. In April 2010, the Federal Motor Carrier Safety Administration (FMCSA) funded a study that conducted an independent evaluation of the DriveCam system at two private trucking firms (8).

The study found that participating drivers at the two firms reduced the mean frequency of recorded safety-related events per 10,000 vehicle miles traveled by 37 percent and 52.2 percent, respectively, during a 13-week “intervention” after implementation of DriveCam compared to a four-week “baseline” phase before the system was in place. Though installation of the DriveCam system alone provided safety benefits, the recommended coaching program improved the results even further. “The coaching sessions where drivers reviewed a video of a safety-related event resulted in significant safety benefits, whereas the feedback light alone and/or coaching sessions without videos were less robust” (8). The authors of the study concluded that, “Safety benefits on the scale found in this study highlight the potential for [video-based driver risk management systems] to have a robust impact in reducing truck crashes on our nation’s highways” (8).

In 2009, Loomis Armored conducted a six-month pilot study of the SmartDrive system involving more than 2,800 drivers and more than 1,000 vehicles. Loomis saw a 53 percent reduction in collision frequency during the pilot program. They reported “significant per-driver improvements across four important metrics that are leading factors in collisions.” Distracted driving dropped 54 percent, fatigue behind the wheel dropped 56 percent, non-use of seatbelts dropped 68 percent and speeding dropped 53 percent (9).

Finally, a 2007 study by the University of Iowa examined the impact of installing the DriveCam system in the cars of newly licensed drivers. The DriveCam equipment used in this study was similar, but not identical, to that used in transit buses. The study found a significant reduction in the number of safety-relevant events, with drivers reducing their rate of safety-related events from an average of 8.6 events per 1,000 miles during the Baseline phase to 3.6 events per 1,000 miles, or approximately 58 percent during the Intervention phase. The group further reduced its rate of safety-related events to 2.1 per 1,000 miles in the following nine weeks.
(weeks 10 through 18), achieving a 76 percent reduction from the Baseline. The study’s authors conclude that an event-triggered video system, paired with feedback in the form of a weekly graphical report card and video review, can result in a significant decrease in unsafe driving behaviors (10).

**CASE STUDIES**

The following section summarizes the relevant characteristics of the six U.S. public transit agencies and three private contract operators currently using video-based driver risk management systems on transit buses.

**TABLE 1** List of U.S. transit agencies using video-based driver risk management systems

<table>
<thead>
<tr>
<th>Agency</th>
<th>City</th>
<th># of Vehicles</th>
<th>Date installed</th>
<th>Camera system</th>
<th>Used for Training or Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td>MV Transportation</td>
<td>Multiple</td>
<td>4,700</td>
<td>2004* 2009</td>
<td>DriveCam</td>
<td>Primarily training</td>
</tr>
<tr>
<td>New Jersey Transit</td>
<td>Multiple</td>
<td>800</td>
<td>2005** 2007</td>
<td>DriveCam</td>
<td>Primarily training</td>
</tr>
<tr>
<td>Veolia</td>
<td>Multiple</td>
<td>3,400</td>
<td>2005-2010</td>
<td>DriveCam</td>
<td>Training</td>
</tr>
<tr>
<td>Pace Bus</td>
<td>Suburban Chicago</td>
<td>700</td>
<td>2006** Early 2010</td>
<td>DriveCam</td>
<td>Both</td>
</tr>
<tr>
<td>First Transit</td>
<td>Multiple</td>
<td>6,000</td>
<td>Late 2006***</td>
<td>DriveCam</td>
<td>Primarily training</td>
</tr>
<tr>
<td>Capital Metro</td>
<td>Austin, Texas</td>
<td>400</td>
<td>Late 2007</td>
<td>DriveCam</td>
<td>Primarily training</td>
</tr>
<tr>
<td>San Francisco Municipal Transit Agency (SFMTA)</td>
<td>San Francisco</td>
<td>860</td>
<td>Late 2009</td>
<td>DriveCam</td>
<td>Both</td>
</tr>
<tr>
<td>Metro</td>
<td>Los Angeles</td>
<td>2,411</td>
<td>Late 2009</td>
<td>SmartDrive</td>
<td>Training</td>
</tr>
<tr>
<td>Washington Metropolitan Area Transit Authority (WMATA)</td>
<td>Washington, D.C.</td>
<td>1,500</td>
<td>Late 2010</td>
<td>DriveCam</td>
<td>Both</td>
</tr>
</tbody>
</table>

*Began with self-review model in 2004, transitioned to managed services model in 2009

**Initial installation as pilot program with limited number of vehicles

***Began with self-review model, in process of transitioning all vehicles to managed services model

**Capital Metro**

Capital Metro uses DriveCam primarily as a training and coaching tool, but also imposes disciplinary measures for egregious unsafe driving behaviors captured by the system. Capital Metro instituted a program to reward “event-free” driving, and relies heavily on DriveCam footage in its quarterly safety meetings. The frequency of “scored events” at Capital Metro has been reduced since DriveCam was implemented, and the system has captured operators falling asleep, violating traffic laws, and using personal electronic devices while driving that likely would not have been caught otherwise. In 2010, Capital Metro transitioned from DriveCam’s managed services program to a self-review model. Officials at Capital Metro emphasized the
importance of clearly communicating with operators about what DriveCam is and how it will be used, and providing continuing education about how to improve driving habits (Whelan unpublished data).

The average number of collisions per million vehicle revenue miles on Capital Metro’s directly operated fixed-route fleet initially fell by nearly 50 percent after DriveCam was implemented, from 2.4 in 2007 to 1.2 in 2009, then increased back to 2007 levels in 2010 and 2011. Passenger injuries per million vehicle revenue miles decreased from an average of 5.3 in the four years before DriveCam was implemented to 3.7 in the three years after it was in place, a 35 percent decrease, but then spiked above 2007 levels in 2011 (2).

Los Angeles County Metropolitan Transportation Authority
The Los Angeles County Metropolitan Transportation Authority (Metro) has 2,411 buses equipped with the SmartDrive camera system. Metro officials state that the main objective of Metro’s program was to improve operational safety and reduce traffic accidents by increasing operators’ awareness of their unsafe driving habits and coaching them to modify these unsafe driving behaviors. Since SmartDrive was installed, the number of triggered events at Metro says it has declined significantly, with up to a 30 percent reduction in events with safety concerns. However, they have not yet seen a significant or consistent reduction in accidents that can be attributed to implementation of SmartDrive (Martinez unpublished data).

The average number of collisions per million vehicle revenue miles on Metro’s fixed-route fleet fell by nearly 16 percent after SmartDrive was implemented, from 2.0 in 2006-09 to 1.6 in 2010-11, while the number of passenger injuries per million vehicle revenue miles increased slightly during the same period, from 4.0 to 4.3, a 7.5 percent increase (2).

New Jersey Transit
Approximately 800 of New Jersey Transit’s (NJ Transit) 2,150 buses are equipped with DriveCam, though the agency eventually plans to equip its entire fleet. Since implementation, NJ Transit officials report a “significant” decrease in scored events, and noted they have seen an especially noticeable reduction in “egregious” safety violations. Before DriveCam, NJ Transit staff had to follow up on complaints about risky driving by sending staff on undercover rides. They stated that NJ Transit has approximately 3,700 bus operators and only two staff members doing undercover ride-alongs. Officials at NJ Transit noted that DriveCam is a very effective training tool, and clips are used as a “show and tell” exhibit at regular safety meetings that all bus operators are required to attend (Suply unpublished data).

The average number of collisions per million vehicle revenue miles on NJ Transit’s fixed-route fleet fell by nearly 54.5 percent after DriveCam was implemented, from 3.3 in 2004-07 to 1.5 in 2008-11, while the number of passenger injuries per million vehicle revenue miles decreased by 55.1 percent during the same period, from 4.4 to 2.0 (2).

Pace Suburban Bus Service
Pace Suburban Bus Service (Pace) initially introduced DriveCam as a training tool for bus operators. A safety manager at each of the nine Pace operating divisions is assigned to review DriveCam clips on a daily basis and provide coaching to operators on scored events, ideally within four days. Pace uses DriveCam to recognize good behavior as well as bad, and has a “Zero Accident Challenge” with prizes to the safest operators. Pace reports 15 consecutive months of reductions in preventable accidents compared with the same month the previous year,
as well as a “dramatic decrease in number and frequency of risky driving behaviors,” which Pace officials say “plummeted” after DriveCam was installed on the entire fixed-route fleet. Pace reports that DriveCam footage has been useful in combating fraudulent claims from passengers and operators, and that it has even helped dismiss traffic tickets (Grish unpublished data). Pace Bus did not fully deploy DriveCam on its bus fleet until mid-2010, so NTD data did not yet show a meaningful trend.

San Francisco Municipal Transportation Agency
The San Francisco Municipal Transportation Agency (SFMTA) began using DriveCam on its fleet of 860 fixed-route buses in November 2009. SFMTA staff reported that during the first several months DriveCam was in place, they saw 200 to 300 scored events per day due to operators exhibiting risky behavior. After word got out to operators that SFMTA was serious about following up on scored events, the number dropped to between 20 and 30 incidents per day (Shine unpublished data).

Discipline has been the key to seeing results, according to SFMTA staff. SFMTA acknowledges that video can be a liability in some instances but the agency has found that the majority of the time, video footage exonerates SFMTA and helps reduce costs (Shine unpublished data). In July 2010, SFMTA stated that the agency experienced a 33 percent reduction in the number of “scored events” captured by DriveCam and a 35 percent decrease in the severity of the incidents (11).

The average number of collisions per million vehicle revenue miles on SFMTA’s fixed-route fleet fell by nearly 41.2 percent after DriveCam was implemented, from 2.5 in 2006-09 to 1.5 in 2010-11, while the number of passenger injuries per million vehicle revenue miles decreased by 32.4 percent during the same period, from 8.1 to 5.5 (2).

Washington Metropolitan Area Transit Authority
The Washington Metropolitan Area Transit Authority (WMATA) began installing the DriveCam to monitor bus driver performance and improve safety (12) WMATA officials were looking for a tool that would make a “positive impression” on the safety culture of the agency, reduce accidents and exposure to claims, and positively affect the agency’s image, which had been tarnished by its past safety record (Harris unpublished data).

After the first three months using DriveCam, WMATA officials reported a “dramatic drop” in risky driving behavior, which they believe will lead to a reduced number of collisions and passenger injuries in the future. The agency saw a 23 percent reduction in frequency and 25 percent reduction in the severity of scored events between November-December 2010 and January-February 2011 (Harris unpublished data). During the same time period, leading indicators of behaviors likely to cause accidents at WMATA declined, including a 33 percent reduction in “not looking far enough ahead,” a 31 percent reduction in traffic violations, and a 17 percent reduction in “following too close,” while collisions decreased 7 percent and near collisions declined by 36 percent (Harris unpublished data).

WMATA officials emphasized the importance of training and coaching in achieving results. They also believed there needed to be a progressive discipline process tied to the implementation of DriveCam in order to spur behavior change, coupled with leadership metrics that recognized positive behaviors (Harris unpublished data). WMATA did not fully deploy DriveCam on its bus fleet until August 2010, so NTD data did not yet show a meaningful trend.
First Transit
First Transit began using DriveCam in late 2006, just prior to purchasing competitor Laidlaw Transit in 2007, and currently has DriveCam installed on approximately 6,000 vehicles based at transit agencies throughout the United States. First Transit uses DriveCam primarily for coaching and training purposes and has created “leagues” that allow each transit operator to see how he or she compares with peers at the same agency based on DriveCam driving performance data (Catapano unpublished data). First Transit’s senior vice president of safety said he believes “very strongly” in DriveCam and stated that it can have “transformational power” when implemented correctly (Catapano unpublished data). First Transit has seen up to a 50 percent reduction in risky driving behavior at transit agencies clients that have implemented DriveCam. For example, First Transit properties that had an accident frequency rate of 10 collisions per million miles traveled saw a decrease to 6 collisions per million miles traveled after the implementation of DriveCam (Catapano unpublished data).

First Transit points to the city of Houston’s fixed-route bus system as an example of a “smashing success” where DriveCam helped to improve safety and drive down accident rates. Before DriveCam was implemented, Houston was one of the worst-performing transit properties in the First Transit system with a high number of collisions. After DriveCam was implemented on Houston’s fixed-route fleet in 2007, Houston’s accident frequency rate dropped nearly in half. First Transit stated, “Without a doubt, DriveCam reduced accidents [in Houston] in a significant way” (Catapano unpublished data). NTD data supports this assertion, as the number of collisions dropped steadily from 40 in 2006 to 20 in 2009 while vehicle revenue miles remained consistent across the four-year period (2).

MV Transportation
MV Transportation (MV) began installing DriveCam in its vehicles in 2004, and currently operates approximately 4,700 fixed-route and paratransit vehicles equipped with DriveCam at dozens of transit agencies throughout the United States. MV uses DriveCam clips during both for individual coaching sessions with operators, as well as at group safety meetings. MV reports a significant reduction in accidents since implementation of DriveCam, though actual results vary by property. MV’s vice president of safety said, “There is no question in my mind that we have seen a 30 percent to 40 percent reduction in accidents since DriveCam” (Guariento unpublished data). MV also stated that DriveCam has been useful in litigation by providing valuable evidence that has allowed MV to settle or dismiss claims faster and at a lower overall cost (Guariento unpublished data).

MV’s vice president of safety said the introduction of DriveCam at MV caused “a quantum change,” and was the most significant development in the transit safety industry in years. In 2010, MV actually received a refund on its insurance premiums due in part to the implementation of DriveCam (Guariento unpublished data).

Veolia Transportation
Veolia Transportation (Veolia) began using DriveCam in 2004-05 and currently has approximately 3,400 vehicles equipped with DriveCam at 62 transit properties throughout the United States. In 2011, Veolia awarded a contract to SmartDrive, and will be transitioning all its vehicles from DriveCam to the SmartDrive system in the coming years (Hall unpublished data). Veolia incorporated DriveCam into a comprehensive companywide safety program called “300:29:1”, which “focuses employee attention on identifying and eliminating the small, unsafe
Michael Litschi, Peter Haas

acts that can accumulate and can lead to an accident” (13). This is based on a theory by H.W. Heinrich that says for every 300 unsafe acts that do not result in an accident or injury, there will be 29 minor to moderate injuries and one major injury or fatality (14). Veolia has motivational programs in place tied to DriveCam that reward operators for “keeping the light green” by not engaging in risky driving behaviors (Hall unpublished data).

Veolia calls DriveCam “an invaluable safety training tool,” and uses DriveCam clips in driver training and safety meetings to illustrate risky driving behaviors (Hall unpublished data). Veolia initially introduced DriveCam as a behavior modification tool, and did not tie it to disciplinary measures. In retrospect, officials at Veolia say that rolling out DriveCam without a disciplinary component was probably not best way to use the system, causing them to see less than optimal results in the early years of the program. Officials at Veolia stated that the key to the success of DriveCam was not simply installing the cameras in buses, but how well and frequently managers used DriveCam to provide feedback to operators (Hall unpublished data).

Since the introduction of DriveCam and the associated “300:29:1” safety initiative, accident frequency and severity at Veolia have decreased, though officials note it is difficult to pinpoint if DriveCam alone, or Veolia’s overall safety program, caused the improvement. DriveCam video clips also have helped clear Veolia of liability in several “huge litigious events,” which alone more than paid for the DriveCam system (Hall unpublished data).
## TABLE 2 Summary of Findings

<table>
<thead>
<tr>
<th>Transit Agency</th>
<th>Reduction in Frequency of Collisions, Passenger Injuries per NTD data (2)</th>
<th>Results reported by transit agency managers interviewed</th>
<th>Key Lesson(s) Learned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Metro</td>
<td>Yes; 50 percent reduction in collisions and 35 percent reduction in injuries after implementation of DriveCam before increase to pre-DriveCam levels in 2010-11</td>
<td>Noticeable reduction in frequency of scored events and severity of collisions</td>
<td>Use DriveCam to incentivize “event free” driving; provide continuing education on how to improve driving</td>
</tr>
<tr>
<td>LA Metro</td>
<td>Yes/No; 16 percent reduction in collisions, but 7.5 percent increase in injuries in two years after SmartDrive installed</td>
<td>30 percent reduction in “events with safety concern” in first year of program; no significant reduction in collisions</td>
<td>Ensure bus operators understand intent of system is training, not discipline</td>
</tr>
<tr>
<td>New Jersey Transit</td>
<td>Yes; 54.5 percent reduction in collisions and 55.1 percent reduction in injuries over four years since DriveCam installed</td>
<td>“Significant” decrease in scored events; noticeable reduction in “egregious” safety violations</td>
<td>Program not as effective if 100 percent of fleet not equipped with DriveCam</td>
</tr>
<tr>
<td>Pace Bus</td>
<td>N/A; implementation too recent for NTD data analysis</td>
<td>“Dramatic decrease” in number and frequency of risky driving behaviors</td>
<td>Use incentives to recognize safe, defensive driving coupled with timely coaching</td>
</tr>
<tr>
<td>SFMTA</td>
<td>Yes; 41.2 percent reduction in collisions and 32.4 percent decrease in injuries over two years since DriveCam installed</td>
<td>33 percent reduction in scored events and 35 percent decrease in severity of incidents after 10 months</td>
<td>Using DriveCam in coordination with progressive discipline policy is key to seeing fewer incidents</td>
</tr>
<tr>
<td>WMATA</td>
<td>N/A; implementation too recent for NTD data analysis</td>
<td>23 percent reduction in frequency and 25 percent reduction in severity of scored events after six months</td>
<td>Timely training/coaching key to seeing results; should combine progressive discipline with recognition of good driving</td>
</tr>
<tr>
<td>First Transit</td>
<td>N/A; NTD data not analyzed due to multiple transit clients</td>
<td>50 percent reduction in scored events; reduction in collision frequency from 10 per million vehicle revenue miles to 6</td>
<td>Ensure management team is prepared to monitor wealth of information DriveCam provides and take appropriate action</td>
</tr>
<tr>
<td>MV Transportation</td>
<td>N/A; NTD data not analyzed due to multiple transit clients</td>
<td>30 to 40 percent reduction in collisions</td>
<td>Managers should use DriveCam to observe and correct risky driving behaviors before they lead to an accident</td>
</tr>
<tr>
<td>Veolia</td>
<td>N/A; NTD data not analyzed due to multiple transit clients</td>
<td>“Clear decrease” in accident frequency and severity”</td>
<td>Need to tie motivational program for good driving with disciplinary component for risky driving</td>
</tr>
</tbody>
</table>
FINDINGS

Safety Impacts of Driver Risk Management Systems

Based on the feedback provided by transit agencies that have installed video-based driver risk management systems, as well as the data obtained from NTD reports and DriveCam records, video-based driver risk management systems have clearly enhanced transit safety through a reduction in risky driving behaviors, as well as the frequency of collisions and injuries that ultimately result from those risky behaviors. In some cases, accident rates appear to actually increase slightly immediately after the systems are installed; however, this is likely due to the fact that minor accidents that previously went unreported are now being captured and logged at several transit agencies.

A reduction in the number of collisions per million miles traveled of up to 50 percent has occurred following implementation of DriveCam at agencies that have had DriveCam in place for at least two years. Not all transit agencies profiled experienced clear declines in the number of collisions and passenger injuries following implementation of a video-based driver risk management systems. However, interviews with officials at each transit agency revealed that all agencies believed the frequency and severity of “scored events” captured by video-based driver risk management systems had declined, indicating that transit operators were adapting their driving habits to avoid risky behaviors, even if the agencies had not yet seen quantifiable reductions in accidents and injuries.

Information provided by DriveCam, but not included as an exhibit in this study, supports that conclusion, as it shows that the number of monthly “scored events” per event recorder at five transit agency clients has declined at a relatively steady pace since the implementation of DriveCam. This indicates that transit operators are changing their behavior because of the DriveCam system and learning to avoid the risky driving behaviors that cause an event to be captured and scored. Other data provided by DriveCam tracks the number of scored events and collisions per active event recorder among DriveCam’s transit industry clients from 2009 to 2011. The number of scored events captured over time is declining consistently, with a slightly less consistent downward trend in number of collisions. A reduction in scored events should ultimately lead to an improvement in overall safety, as these risky behaviors are the precursors to more serious accidents and injuries.

The transit agencies utilizing video-based driver risk management systems were nearly universal in their view that adoption of the system must include a comprehensive training and coaching component. Though the sheer act of installing cameras may have some safety benefits, most agencies cite the ability to use video footage as a training tool – both on an individual and group basis – as one of its main benefits. The majority of the transit agencies profiled in this study downplayed the use of DriveCam for disciplinary purposes. However, it appears that agencies experience the best results when they use DriveCam not only to recognize and reward desirable driving behavior, but also to impose discipline to discourage undesirable or risky behavior.

Video-based driver risk management systems can be effective at encouraging safer driving on a number of levels:

1. As a group training tool showing peers engaging in risky driving behaviors, as well as commendable ones
2. As an incentive to drive safer due to the awareness that any risky behaviors will be captured on video
3. As a self-training tool by encouraging operators to engage in self-evaluation by using the lights on the camera equipment that notify the operator when the system has captured a risky driving behavior.

4. As an individual training tool to help transit managers identify and correct chronic risky driving behaviors that eventually will lead to accidents and injuries.

5. As a means to observe clear traffic code or transit policy violations committed by operators such as running a red light, not wearing a seatbelt, or using a personal electronic device in order to take disciplinary measures.

Though there is an upfront capital cost and ongoing operation and maintenance cost associated with implementing video-based driver risk management systems like DriveCam and SmartDrive, the transit agency officials interviewed in this study were nearly unanimous in their view that, over time, the systems would more than pay for themselves through reduced costs and claims associated with accidents and injuries. However, none of the agencies were able to provide a specific calculation of return on investment.

Addressing Privacy Concerns

One of the main barriers to implementing video-based driver risk management systems was the perception, particularly by transit operators and unions that represent them, that installing cameras to monitor driving behavior is an invasion of privacy. However, these systems are actually much less intrusive than other types of video surveillance systems found in banks, hotels, department stores, and countless other public places. The footage provided by video-based driver risk management systems cannot be viewed real-time by transit managers and cannot be randomly inspected; it must be triggered by a potentially risky event, or manually by the transit operator. This arguably offers transit operators a greater degree of privacy than video surveillance systems used in most other settings.

In the transit industry, managers cannot constantly monitor each bus operator in the field. Before implementing video-based driver risk management systems, transit agencies used ride-alongs by administrative staff or “secret shopper” programs to observe transit operators. However, at most transit agencies, the number of staff assigned to observe transit operators was dwarfed by the number of transit operators. As a result, ride-alongs typically occur only with transit operators who have already been singled out by passenger complaints for risky behaviors, and there is very little random monitoring for potentially risky behaviors. Transit operators already work in a very public setting, so it is difficult to understand the argument that video-based driver risk management systems somehow “violate” a transit operators right to privacy. Any perceived privacy concerns may be outweighed by the public safety benefits of video-based driver risk management systems.

Impacts on Risk Management

One of the frequently-touted benefits of video-based driver risk management systems is their ability to reduce claim costs by exonerating operators in the case of a collision or other incident that results in a driver or passenger injury. The TRB report observes that, “In situations of litigation, the data could be used to exonerate or lessen the liability of drivers. Unfortunately, event-data recorders could also be a liability threat to commercial drivers and their companies in at-fault crash situations, and this perceived vulnerability has limited the use of event-data recorders by commercial fleets” (4)

Transit officials currently using video-based driver risk management systems stated that
the systems have been useful in combating fraudulent claims and exonerating transit operators after collisions. There was general consensus among those interviewed that, at least thus far, footage from the systems has helped dismiss claims, fight traffic tickets and reduce liability more often than it has posed a liability to transit agencies. Several officials noted that, even if the video footage showed the transit agency was at fault, they would rather have all the facts upfront and settle at-fault situations quickly, rather than pay accident reconstruction and legal fees to fight it out in court.

RECOMMENDATIONS

Video-based driver risk management systems have proven to be an effective safety enhancement tool for each transit agency that has implemented them to date. Based on transit agency interviews and the quantitative data currently available, these video systems have helped to drive down the frequency of collisions and injuries, and to an even greater extent, the risky driving behaviors that act as a precursor to an incident. The systems serve as valuable training tools that provide real-world examples of both desirable and risky driving behaviors. Based on academic research regarding the use of on-board video systems in behavior-based safety programs in the trucking and motorcoach industry, as well as the experiences of public transit agencies that have implemented video-based driver risk management systems, a number of insights into the most effective way to implement the systems have emerged.

1. Transit agency managers should communicate early and often with transit operators about the purpose of the video-based driver risk management systems to combat misperceptions and resentment, as well as equipment tampering. Managers should emphasize the benefits to bus operators, particularly as a defense in the event of accidents and customer complaints.

2. Simply installing cameras is not enough. The camera systems are most effective when tied to a comprehensive coaching and training program that recognizes safe driving habits and provides timely coaching to prevent repetition of risky behaviors.

3. Video-based driver risk management systems are valuable training tools that reinforce both desired and undesired driving behaviors. Video clips can be used as effective visuals in group training meetings, though individual driver identities should be concealed to avoid embarrassment.

4. Though video-based driver risk management systems are valuable solely as a training tool, safety statistics will likely improve if use of the system is also tied to a progressive discipline program that imposes penalties on transit operators for violations of agency safety policies like use of electronic devices, and flagrant traffic violations.

5. In addition to taking disciplinary action, transit agencies should use video-based driver risk management systems as a tool to recognize and reward transit operators who demonstrate exemplary driving skills, and to encourage competition among bus operators by implementing an incentive program with rewards to the safest drivers.

6. Transit agencies should ensure there is clear management and union buy-in about how video-based driver risk management systems will be used (training, discipline, etc.) and who will have access to the footage (chain of custody).

7. Transit agencies should carefully weigh the potential liabilities and benefits of implementing video-based driver risk management systems from a risk management perspective, though there appears to be general consensus that cameras have generally reduced transit agency liability where they have been implemented, rather than increased it.
Based on the experiences of transit agencies that have implemented video-based driver risk management systems thus far, it appears the technology is a promising addition to the transit industry’s arsenal of potential safety measures. Public transit agencies should strongly consider investing in video-based driver risk management systems as one component of an overall safety and training program. However, additional research should be conducted to better quantify the longer-term impact of the systems on accident and injury rates, as well as the return on investment that transit agencies have seen due to reductions in claims and insurance premiums.
REFERENCES


