Guidelines for Using Technology to Address Road Safety Challenges

ADVANCING ROAD SAFETY BEST PRACTICES FOR COMPANIES AND THEIR FLEETS
As a private sector coalition, Together for Safer Roads (TSR) engages with governments, academia, and other stakeholders to identify top road safety challenges, and turn the vision of a world where roads are safer for all people into reality. TSR brings together members' knowledge, data, technology, and global networks to focus on five areas that will make the greatest impact globally and within local communities. TSR's focus areas align with the United Nations Decade of Action for Road Safety's Five Pillars by developing programs to address issues in: road safety management, safer roads and mobility, safer vehicles, safer road users, and post-crash response.

With a specific focus on fleet safety delivery and employee transportation programs, TSR has drawn upon the firsthand experience of its member companies to identify those areas where commercial entities can implement technology to limit the road-related risk posed to their employees and other road users.

In order to leverage the cumulative knowledge and insight of TSR's member companies, information on transportation technology challenges and solutions were collected, analyzed, and combined to develop a set of best practice guidelines for fleet delivery and employee transportation programs.

The following guidelines build upon best practices from member companies and existing literature on road safety and commercial transportation technologies, offering a comprehensive and practical guide for companies to employ.

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ADVANCING ROAD SAFETY BEST PRACTICES FOR COMPANIES AND THEIR FLEETS
TOGETHER FOR SAFER ROADS
MEMBERS
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World-renowned, international road safety leaders and experts from academic institutions, governments, and non-governmental organizations provide independent counsel to the coalition on priorities for action. The Expert Panel develops key recommendations that lay out actionable, concrete, and scalable ways the coalition can have the most impactful influence on road safety.
INTRODUCTION

The following is a landscape review by TSR’s Expert Panel, examining technology’s impact on road safety focused on three key areas:

› The Technology Horizon and the People/Technology Interface
› Using Information and Communication Technologies – and More – to Make Roads Safer
› Policy and Partnerships Supporting Road Safety Technologies

The Technology Horizon and the People/Technology Interface

The following provides an overview of the spectrum of both existing and emerging safety technologies, ranging from simple technologies such as seat belts and in-vehicle systems to more advanced safety features such as connected vehicles (CV) and autonomous vehicles (AV). Also discussed is how road users will respond to and interact with emerging safety technologies.

The Future of Transport: From Connected to Driverless Vehicles

The world’s roads are living in a transportation system that dates back a century. While there seems to be transformation and modernization of this system, there are three key factors to this change that must be considered within collaborative efforts toward road safety: safety, mobility, and environment. (Figure 1)

FIGURE 1: Today’s Transformation Challenges

SAFETY

- 32,675 DEATHS in 2014
- 6.1 MILLION ROAD CRASHES in 2014

MOBILITY

- 6.9 BILLION HOURS of travel delay
- USD $160 BILLION COST of urban congestion

ENVIRONMENT

- 3.1 BILLION GALLONS of wasted fuel
- 56 BILLION POUNDS of extra CO²

The world is at a technological tipping point, and how safety technologies are applied to fleet operations could result in a golden era for fleet road safety. Connected vehicles and infrastructure, autonomous vehicles and features, consumer electronics, and data collection and analytics are a few of the technologies paving the way for a safer private sector transportation landscape. During this transition phase, learning about the types of technologies available and understanding driver attitudes and behaviors will be crucial.

Technological advancement and innovation initiatives, such as the U.S. Department of Transportation (USDOT) Smart City Challenge, are paving the way to making transportation a key public health and safety factor. (Figure 2)

A Golden Era for Vehicle Safety Technology

While the world has seen great progress in road safety thus far, further steps can be taken. (Figure 3) One significant step will be how advancements in CV and AV systems are approached, including shifts between mandates and voluntary implementation of individual safety assistance features. For example, electronic stability control (ESC) was very successful after being mandated. However, automatic emergency braking (AEB) has been introduced through agreements rather than mandates. Additionally, recommendations are being made that the New Car Assessment Program (NCAP) ratings should also include advanced safety systems such as forward crash warnings, automated emergency breaking, and lane departure warning.

The USDOT named the following seven finalists for smart transportation system ideas

Understanding automated vehicles and individual features is an important aspect in building the future of road safety. The USDOT Volpe Center reviewed the current federal motor vehicle safety standards for automated vehicles to see where they might conflict with current safety rules. To organize the information and understand what the technologies will be used for, the Volpe Center considered multiple use cases for automated and driverless vehicles. (Table 1)

**Safety in the Transition Phase**

The road safety management system is evolving and technological change is impacting all aspects of the evolution. Understanding how the technology transition is impacting road safety is important during this phase. (Table 2) Achieving desired safety performance requires both the technical means and the managerial capacity to deliver it. For any given road network, there are limits to its level of safety. These limits are governed by the protective quality of the infrastructure and vehicles at prevailing speed limits, the degree of compliant behavior by road users, and the quality of crash victim recovery and rehabilitation services.

**Protecting Vehicle Occupants**

There are two main types of occupant protection: active and passive. Active safety systems are engaged during pre-crash and involve hazard prevention (risks that can be detected and avoided) and hazard mitigation (risks that cannot be avoided), while passive safety systems are engaged during post-crash and focus primarily on injury reduction. Examples of technologies that apply to both active and passive safety systems can be found in Table 3.
### TABLE 1: Review of Federal Motor Vehicle Safety Standards (FMVSS) for Automated Vehicles

<table>
<thead>
<tr>
<th>AUTOMATED VEHICLES</th>
<th>DRIVERLESS VEHICLES</th>
</tr>
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<tbody>
<tr>
<td>• Highway automation</td>
<td>• Highly-automated vehicle with advanced design</td>
</tr>
<tr>
<td>• Driverless valet</td>
<td>• Highly-automated vehicle with novel design</td>
</tr>
<tr>
<td>• Truck platooning</td>
<td>• Riderless delivery motorcycle</td>
</tr>
<tr>
<td>• Aftermarket highly-automated driverless vehicle kit</td>
<td>• Driverless delivery vehicle (light duty/heavy duty)</td>
</tr>
<tr>
<td>• Conventional vehicle with highly-automated original equipment manufacturer kit</td>
<td></td>
</tr>
<tr>
<td>• Highly-automated, conventionally designed vehicle</td>
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</table>

The current vehicle safety systems are optimized to protect standardized occupants. Crash test dummies are used to determine the extent of injury in the event of a crash; however, there are too many variables when it comes to drivers’ body types (age, gender, comorbidities) to rely on this one type of model. By incorporating adaptive restraint systems that can be tuned to the driver and occupants, the variables for injury are greatly reduced. Road crash injuries happen to people, and as such, safety technologies should be custom made to protect people.

**People and Technology**

Human nature changes much more slowly than technologies evolve. When considering technology, and its relation to people, there are three different problems to solve: driving aids, connectivity, and automation.

People are expected to receive important safety benefits from driving aids because they can help road safety on both a strategic and tactical level. From a strategic perspective, driving aids help to plan and organize a transportation journey and determine what routes to take. Typically, they help on the tactical level in deciding what driving maneuvers to use when confronted with an emergency situation. Challenges that often arise when using safety technologies stem from the fact that humans are prone to behavioral adaptation. Sometimes once a road safety technology is implemented, drivers will begin to rely too heavily on that technology or presume that the technology allows them to take risks they would not otherwise take. This can lead to drivers misunderstanding the level of skill needed to perform a task or maneuver. If this maneuver is too advanced for their current driving skills, it can result in drivers overcompensating with risky behaviors or even a crash.

### TABLE 2: How the Technology Transition Impacts Safety

<table>
<thead>
<tr>
<th>TRANSITION PHASE</th>
<th>END STATE</th>
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<tbody>
<tr>
<td>• CV increases the range of safety (warning) applications by orders of magnitude</td>
<td>• CV reduces serious, single-vehicle, unimpaired crashes by 80% (National Highway Traffic Safety Administration)</td>
</tr>
<tr>
<td>• CV effectiveness depends on deployment and density</td>
<td>• AV avoids driver error (present in the vast majority of crashes)</td>
</tr>
<tr>
<td>• AV features like Autonomous Emergency Braking</td>
<td>• AVs and conventional vehicles continue to interact on the same infrastructure</td>
</tr>
<tr>
<td>• Human factors issues with mid-level automation; machine reliability to improve</td>
<td></td>
</tr>
</tbody>
</table>
The second problem is connectivity. As a society, particularly in the social media era, humans are always connected. As society becomes more interconnected, vehicle manufacturers have developed ways to extend this connectivity into vehicles. For road safety, this level of connectivity leads to distraction from the moment people bring phones or devices into a vehicle, and extends to when those devices are connected to the vehicle (i.e., hand-free features). The risk factor is not solely limited to holding a device in your hand while driving, but rather it is the distraction of adding a secondary task. Even with hands-free features, attention is divided between driving and the discussion, and then peripheral vision and attention is subsequently diminished. For this kind of a problem in traffic safety, enforcement is not easy with traditional measures so focus must be on education.

The third problem area is the integration of autonation, which has five levels ranging from no automation to the vehicle being completely automated. While there seems to be a current global social acceptability, a major hurdle for automation is still trust. This current state of social acceptability rises from the fact that society has yet to reach the fifth level of automation, where the vehicle is fully automated. In the third and fourth levels, a certain amount of manual control is required of the driver, particularly in case of emergency. Considerations must be made for the consequences of differing levels of trust that drivers have in automation, including the resulting over-confidence and under-confidence. Over-confidence comes into play when people in vehicles at the third or fourth level of automation are not paying enough attention to the road or they are sleeping, in which case they will not be able to react if an emergency intervention is needed. Under-confidence in these situations would not allow the progress and smart capabilities of the vehicle to reach their full potential.

When considering these challenges, some potential solutions should be considered, including:

- Insurance measures
- Car sharing
- Driver training
- Alcohol interlocks
- Fatigue detection
- Event data recorders (black box)
- Interlock for seat belts

Using Information and Communications Technologies – and More – to Make Roads Safer

The following outlines many of the ways in which data collection and telematics can be used to improve road safety attitudes and behaviors. The importance of post-crash care is also highlighted as a vital aspect of road safety.
Star-rating Driver Behavior

Modern technologies allow for greater potential in monitoring and star-rated driving behavior. This is not limited to mobile phones; in fact, many technological advances allow for more efficiency in data collection, processing, and analysis.

Data collection and exploitation is easier and more accurate than ever before due to the almost-universal adoption of smartphones, efficient transmission of large data sets, powerful and evolving computing, and a greater emphasis on insightful big data analysis. This monitoring of behavior through data collection can be done simply through the utilization of both smartphones and vehicle on-board diagnostics (OBD) systems. Smartphones can be synchronized with sensors (GPS, gyroscope, accelerometer) and incorporate machine learning algorithms to translate the data into useful metrics. Vehicle OBD systems are an affordable and easily installed device through an existing plug in the vehicle, which collects very detailed information on the status of the various vehicle subsystems.

For best results, data should be continuously collected on the status of the various vehicle actions and driver behavior. (Table 4)

<table>
<thead>
<tr>
<th>TABLE 4: Safety Indicators</th>
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<table>
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<tr>
<th>DRIVER TRAVEL BEHAVIOR</th>
<th>DRIVING BEHAVIOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mileage and trips driven (risk exposure)</td>
<td>Speed</td>
</tr>
<tr>
<td>Type and specific segments of the road network used (risky roads)</td>
<td>Harsh braking</td>
</tr>
<tr>
<td>Time of the day driving (risky hours)</td>
<td>Harsh acceleration</td>
</tr>
<tr>
<td>Hours driving (fatigue)</td>
<td>Harsh cornering</td>
</tr>
<tr>
<td>Maintenance and safety performance of risky vehicles (on-board diagnostics)</td>
<td>Distraction from mobile phone use</td>
</tr>
<tr>
<td></td>
<td>Alcohol consumption (interlock devices)</td>
</tr>
<tr>
<td></td>
<td>Seat belt use (on-board diagnostics)</td>
</tr>
</tbody>
</table>
This highly-spacial, time-disaggregated requires the following before it can be translated into benchmarking and star-rating of driver travel and driving behavior:

› Special machine learning algorithms
› Powerful cloud computing
› High-end data mining techniques
› Efficient big data analytics
› Scientific traffic safety analysis

Driver safety behavior star-rating can be produced by combining two types of processing. First is the use of sophisticated weighting of the travel and driving behavioral indicators. Second is the continuous comparison to all other monitored drivers. This combination can then be translated into a scale of zero to 100 and communicated to the driver via mobile devices to provide the following:

› Information and monitoring on individual driving behavior and risks
› Feedback and tips on driving aspects that need improvement
› Benchmarking among all the other drivers or groups of drivers

This new application of mobile devices in monitoring driver behavior can ultimately lead to three levels of driver safety behavior improvements:

› Independently by the drivers, in which companies provide feedback and the drivers improve their behavior
› Through customized insurance schemes by correlating driving exposure and behavior with insurance premiums: pay-as-you-drive or pay-how-you-drive
› Through the identification of safety problems of the driver population (and of the vehicle fleet) at the different road networks

There are, however, several considerations in relation to data collection through mobile technologies, namely:

› Global penetration is easy, as no special prerequisites are needed, other than the smartphones
› Potential to extend this star-rating of driver safety behavior:
   › To other road users (pedestrians, cyclists, motorcyclists, bus passengers, truck drivers)
   › For energy consumption and eco-driving monitoring
› Amount and type of smart devices available (smartwatches, smart glasses)
› Special attention is needed for rigorous scientific data processing and driver safety behavior modeling
› Personal data and privacy management

Saving Lives After a Crash

In developing countries, many people die due to slow emergency response, few trained medical responders, and inadequate medical fatalities.

The mortality of severely injured trauma patients is decreased by 25 percent if they are sent to a Level I trauma center versus a non-trauma center.

There are a few goals to consider when addressing trauma care, including getting the right person to the right place in the right amount of time.
Advanced automatic collision notification systems could help, because they would provide early notification that an incident has occurred. The key is to get an appropriately triaged person to the right place. The mortality of severely injured trauma patients is decreased by 25 percent if they are sent to a Level I trauma center versus a non-trauma center.¹

The ability of well-trained emergency medical services (EMS) personnel arriving on the scene to detect crash occupants with severe injuries has consistently remained between 40 and 50 percent over the last three to four decades.¹ During this time, in the most developed countries in the world, the best medical professionals and educators train EMS personnel. EMS personnel are trained to do many things at once upon arriving at the scene, such as looking at the car, looking at the occupants of the vehicle, and examining the occupant and the situation as a whole.

This idea of getting the right person to the right place at the right time presents an opportunity for advancement based on currently-available safety technologies. For example, in-vehicle security systems can help provide the information necessary to address trauma care. If a vehicle is equipped with in-vehicle security systems when it crashes, it has the capabilities necessary to determine GPS location, communicate with a telematic center, establish communication with the occupants of the vehicle, and establish contact with the local emergency services provider.

Newer, more advanced automatic collision notification systems have been implemented over the last few years. These systems use telemetry to transmit data, such as crash severity, seat belt use, direction of the crash, and the age and gender of the occupant. Using this data together, it is then able to predict whether there was a high risk of injury.

**Policy and Partnerships Supporting Road Safety Technologies**

Lastly, the following discusses road safety from a governmental and global perspective, with an emphasis on the differences between developed and developing countries.

**Government’s Role in Advancing Safety Technologies**

To think about the government’s role in road safety, one needs to first look at the road safety management system that they operate within. Consider the following:

- Achieving desired safety performance requires both the technical means and the managerial capacity to deliver it
For any given road network, limits to the level of safety is governed by the protective quality of the infrastructure and vehicles at prevailing speed limits, the degree of compliant behavior by road users, and the quality of crash victim recovery and rehabilitation services.

The road safety management system is evolving and technological change is impacting elements.

From the government perspective, the current management system is evolving and technological change is impacting it quite profoundly, particularly noted by the evolution of how different governments approach road safety results. (Table 5)

Governments face multiple challenges in achieving road safety. (Table 6) Recognizing there is a distinction between high-income countries and low- to middle-income countries is at the foundation of these challenges. High-income countries have the capacity to transition up to the matrix approach, and ultimately find themselves in the complex system approach. Low-income countries have very low capacity to manage safety even at the individual road user level.

### TABLE 5: Evolution of Road Safety Results Approach

<table>
<thead>
<tr>
<th>INDIVIDUAL ROAD USER APPROACH</th>
<th>MATRIX APPROACH</th>
<th>SAFE SYSTEM APPROACH</th>
<th>COMPLEX SYSTEM APPROACH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In the 1960s</strong>, focus was on the individual road user. The idea was that fixing the driver fixes the system.</td>
<td><strong>In the 1980s</strong>, the individual road user approach morphed into the matrix approach, or the hidden matrix, in which many more aspects of road safety were recognized including roads, vehicles, people, pre-crash, in-crash, and post-crash. The world began to achieve quality results with this model.</td>
<td><strong>In the 2000s</strong>, the thinking is that it is unacceptable for any death or serious injury to happen on the network. The Safe System Approach involves managing the exchange of energy - entering the injury chain mechanism (road crash) and removing death and injury from the conflict within the system.</td>
<td><strong>In 2020</strong>, the road safety community will recognize that safety should be seen in the broader context of decisions relating to climate change and land use. This is what governments will wrestle with - trying to understand what this means and where it is heading.</td>
</tr>
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</table>
## TABLE 6: Government Challenges

<table>
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<tr>
<th>FOUR MAIN CHALLENGES GOVERNMENTS FACE</th>
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1. Integrating road safety goals with the more extensive set of transport goals seeks to improve economic productivity, competiveness and prosperity, and goals impacting future generations such as the environment, climate change, energy security, urbanization, and public health.

2. Understanding the new mobility, the demand for improved access and connectivity, and developing strategic tools to estimate and evaluate its impact on road safety. New mobility is characterized as connectivity between people, services, convergence of transport, land use, and digital communications.

3. Implementing regulatory and institutional capacity reforms that assure road safety performance requirements are met without stifling the benefits of innovation and business development, which is essential to the achievement of the broader set of goals.

4. Building new cross-agency, community, and business partnerships that meet mutual objectives and build sustainable development pathways for the long-term.

### Road Safety in Developing Countries

Using China as an example, urbanization is one of the first considerations for road safety. (Figure 4) From 2000 to 2015, the Chinese urbanization rate increased from 36.2 to 56 percent, which indicates a dramatic increase of motorized travel demands leading to more dangerous road situations.

### Conclusion

The global landscape for road safety is changing. It is no longer an effort that can be done in isolation from other factors and considerations. Take the issue of climate change for example. Many private entities and governments have made voluntary financial and operational commitments at a global level. Over 70 percent of countries are now targeting transport in their Nationally Determined Contribution (NDC) tracking, under their commitments. More than 80 cities worldwide are affiliated with the C40, headed by Michael Bloomberg, and are tracking climate change and climate risk. Additionally, more than 260 major or medium-sized private sector actors in transportation companies have pledged to reduce greenhouse gas emission. Overall, more than USD $200 billion worth of committed loans and grants in sustainable transport from the multilateral development bank community and more than 15 civil society major initiatives have been committed to reducing the carbon footprint across transport modes.

Society is in a rapidly evolving landscape where road safety is no longer an isolated subject.
FIGURE 4: 
ROAD SAFETY IN CHINA

China faces some certain challenges to road safety, including infrastructure and capacity gaps. Barriers to infrastructure in China are made up of elements such as Inconsistent lane shifts or directions, inappropriate lane markings, interaction and conflict among road users, and incorrect pedestrian crossings.

In China, the primary focus should be on capacity building for safety improvement. Current capacity gaps include:

1. Inadequate crash data collection and analysis techniques and lack of an impactful fatal crash database
2. Roadway design and improvements are not based on adequate safety evaluation standards
   - The TSR Shanghai Demonstration Project is the first of its kind in China, delivering hot spot roadway improvements based on evaluation standards
3. Lack best practices to address vehicle safety, particularly moped safety, application of advanced driver assistance systems, and commercial vehicle safety
4. Safety education is limited at public level
   - The TSR Shanghai Demonstration Project will implement commercial driver education
5. Developing countries, such as China, would also benefit from developed country guidance on how government agencies can work together effectively with the private sector

To see change, the private sector, academia, and non-governmental organizations (NGOs) can aid in road safety advancement for developing countries:

1. Collaborations between developed and developing countries, companies, and academia to bring best practices and knowledge transfer to developing countries with engagement from global bodies, such as the World Bank
2. Advocacy for government initiatives to improve roads, vehicles, data analysis, and public education
3. Broad public education to instill the importance of safety
4. Company fleet action plans to address gaps in commercial driving
In terms of sustainability, a more robust global vision encouraging ambitious actions and a global tracking framework that propels the vision forward are needed. Working together, the private and public sectors must understand what is needed to dive into that global tracking framework in order to measure progress.

Private sector champions are key as industry will likely continue to be at the forefront of the technology transition, remain in the cutting edge of innovations, and be a key investor for sustainable transport. Interactions between technology and road safety from the perspective of the private sector are important, including how technologies are already being implemented and what challenges remain for further advancement. This technology report outlines many of the ways small- to mid-sized companies that operate fleets can implement technological solutions for road safety.
The private sector is known for its innovative spirit, creative thinking, and nimbleness in approaching challenges. Every company has a responsibility to bring this philosophy to road safety.

Every year on the world’s roads 1.25 million people are killed and 50 million are injured. The private sector has an imperative to reduce these staggering numbers and improve road safety globally. Research shows that company or fleet drivers have an increased crash risk compared to privately registered vehicles – and as of 2014, there were more than 329 million commercial vehicles on the world’s roads.

TSR was founded because, as leaders of global companies, member companies believe they can make a measurable and sustainable impact in road safety. TSR is committed to bringing together its members’ data, analytical capabilities, and best practices to promote road safety within companies – and share with other companies in hopes they do the same. In alignment with the United Nations Decade of Action for Road Safety’s Five Pillars, this report aims to assist companies with best practices to employ technologies for road safety.
The first step in using technology to address road safety challenges is obtaining support from a company's highest leadership. Once a company receives leadership's full commitment, a road safety management team needs to be put into place to develop and implement an action plan. This report provides an overview of the technologies a management team should explore to help reduce road-related risks due to roads and mobility, vehicles, road users, and post-crash response.

Road safety technologies are only as successful as the attitudes and behaviors of the road users implementing them.

To ensure safer roads and mobility for drivers and fleets, this report provides guidance on how a company can help reduce risks by implementing adequate pre-journey planning technologies. A range of technologies, such as vehicle-to-vehicle (V2V) technologies and vehicle-to-infrastructure (V2I) technologies, can help a driver navigate dangerous roadways and bridges, congestion and construction areas, and weather. These technologies may include Global Positioning System (GPS), work zone warning, weather impact warning, and restricted lane warning.

Further guidance is provided for employing technologies to ensure a company's vehicles are at the highest safety standards. This report discusses key technologies from the needs of braking as a heavy fleet vehicle to basic safety standards such as seat belts for a company's consideration. Whether the vehicle is on the roads of a developed or developing country, companies can utilize collision mitigation braking systems, adaptive cruise control, spot mirrors and cameras, and more to address prominent road safety risks.

Road safety technologies are only as successful as the attitudes and behaviors of the road users implementing them. A company must support its employees by training them on a reoccurring basis on how to use safety technologies, as well as educating drivers on the safest road behaviors. This report discusses technologies to help management support their employees, including on-board technologies to limit distracted driving and driver fatigue, as well as technologies to help monitor driver behaviors. Employing telematics is an essential technology for a company to monitor and evaluate driver behaviors, which will inform education and training programs.

Lastly, this report shares how the use of V2I technologies, such as emergency vehicle alert systems and intersection movement assist, can help emergency personnel arrive at a crash scene as soon as possible. Technologies can also help reduce future risks if used during post-crash response. For example, cameras can help recreate a scene post-crash to truly understand what happened and how to ensure the cause does not happen again.
By using the latest technologies, the private sector can make a significant impact on ensuring their operations, fleets, and employee drivers are safe during transport. With these guidelines, TSR aims to support companies with the transition to best practice, allowing collaboration towards a united objective – a world where roads are safer for all people.
Implementing technology solutions into fleet road safety programs can be a challenging undertaking; however, the rewards often outweigh the risks. Instituting strong adherence plans in existing corporate safety policies is a defining step in ensuring successful fleet management. Processes for selecting, monitoring, measuring, and reporting the impact of road safety technologies within corporate road safety program management must be established to allow companies to reap all benefits from today’s technological advances.

Obtaining Leadership Support

Challenge

Whether a company is building a new road safety program or updating and optimizing an existing Motor Vehicle Safety (MVS) policy, a unified and strong management system is key. One of the biggest challenges when trying to adopt and integrate new safety technologies is getting management on board to ensure a long-term commitment of those agreed upon policies.

Solution

Initiating an open dialogue with top company leadership on the benefits and limitations of technologies is the first step in enhancing a company’s safety practices and policies. To receive support, leadership must first understand the types, abilities, and limitations of current technologies.

In addition to getting internal buy in, entering into and fostering existing relationships with third-party technology vendors can bolster the amount of support for the program management team in its introduction and implementation of technology solution strategies.

Execution Model

Road safety measures occur at every level; however, the stronger the support at the leadership level, the more successful the corporate road safety program will be. Consider the following:

› Attend private sector technology trade and product shows
› Explore relationships with professional associations, consortiums, and co-ops
› Host strategic planning sessions with company leadership

› Set up a criteria or request for proposal processes to determine priorities in selecting third-party vendors

› Explore TSR’s report on *Advancing Road Safety Best Practices for Companies and Their Fleets: Guidelines for Developing and Managing Transportation Programs* to help build a tailored MVS policy with leadership support

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**Developing and Implementing an Action Plan**

**Challenge**

Once company leadership commits to integrating technology into a corporate road safety program, the next step is to determine how the chosen technologies will reach employees at every level. For a technology solution to be successful, it must be accessible to and easily understood by everyone at the company. How a company communicates about and disseminates

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**Ryder’s SafetyNET Task List and Action Plans**

Ryder has recently implemented a new safety management system (SMS) titled Ryder SafetyNET. This system provides “one stop shopping” for all activities and functions related to the location’s safety management process throughout the year. Ryder SafetyNET has a modern look and feel and provides supervisors with mobile capability that allows smart phone access.

To support overall safety improvement, Ryder SafetyNET defines a location’s safety, security, compliance tasks, inspections, and observation types through the use of a Location Profile. Annually, a location defines themselves, and the type of operation they manage, utilizing this Location Profile, to create a web-based monthly and quarterly curriculum of safety activities. These activities include employee observations, training requirements, workplace inspections, and employee engagement activities. Each area of concern ensures the location is managing proactive safety measures and verifies compliance to applicable regulations.

Safety accountability is driven through the generation of performance scores for each operation, team, and division. These scores are reviewed monthly during an executive safety scorecard meeting that is held to ensure the highest level of safety involvement and focus.
information on road safety technology solutions can play a vital role in how they are adopted by its employees.

**Solution**

Web-based systems can deliver safety program plans across the organization, in differing levels of detail. These systems can tailor the information to fit the needs of every level and position in a company, and be disseminated accordingly. For example, an employee at the leadership level could receive an action plan that accounts for technology information, budget, and implementation strategy, while a fleet driver could receive technology information, a step-by-step guide on the integration of specific technologies that apply to his or her work, and guidelines on appropriate use of the technologies per the company’s MVS policy.

**Execution Model**

Action plans for the successful rollout of technologies in a company’s new or existing road safety program should reflect a thorough and thought-out communication strategy. Consider the following:

- Define an action plan with clear and effective goals, strategies, and intended audience
- Develop and roll out a web-based system that offers access to safety technology policies and program information
- Tailor the web-based system to fit the needs of specific job roles and responsibilities
- Mitigate potential damage costs by leveraging loss prevention expertise of an insurance company
Companies can limit the inherent risk of their fleet’s road activities through adequate pre-journey planning and careful selection of transportation routes. However, in addition to pre-journey planning, companies must also consider the driver’s role both before and during the transportation journey. Drivers must be equipped with the knowledge and capabilities to make real-time decisions, such as evaluating the designated route and altering from this route when safety is compromised.

### Navigating Dangerous Roadways and Bridges

#### Challenge

Driving on many roads around the world can be dangerous for any vehicle; however, the same road that a compact car easily passes could be nearly impossible for commercial fleet vehicles. Transportation journeys must be carefully and diligently planned to ensure both route security and efficiency. Many underlying factors can lead to a dangerous roadway or bridge, and each factor must be accounted for or acknowledged in the journey planning process.

#### Solution

Investing in route planning software can ensure transportation journey planning is as efficient and meticulous as possible. Software can range from Google Maps™ mapping service to complex and tailored third-party programs that can accommodate long journeys with multiple stops or destinations. Route mapping software offers employers the ability to build out detailed plans that incorporate driver safety and government compliances. Efficient route planning can also lead to cost savings by reducing delays, optimizing fuel use, and shortening delivery times.

When a company begins the route mapping stage, certain considerations specific to roadways and bridges must be incorporated, such as age, inferior design, construction, and traffic density. (Table 7)

For the traffic hurdles that route mapping cannot predict, a GPS allows fleet road users to play an active role in their transportation journeys. While companies can meticulously plan each transportation journey, they cannot account for traffic crashes, traffic jams, or ad hoc construction zones. A GPS can account for these hurdles by detecting road blocks and adjusting the route accordingly.

#### Execution Model

Incorporating route mapping in every transportation journey plan helps eliminate the risks associated with longer journeys with multiple stops. Consider the following:
Train employees dedicated to operating route planning software or liaising with third-party companies that run the route mapping programs, ensuring the correct level of planning and detail is achieved in the route mapping process.

Develop a contingency or secondary route map during the primary route mapping process to ensure drivers have a safe and reliable back-up journey plan in place.

Routinely monitor the condition of the roadways and bridges included in route mapping, as well as those in nearby areas in the instance a driver is directed to a secondary route.

In addition, drivers should be fully briefed on their transportation journeys, including contingency routing, as well as know the company policy for adhering to their designated route. If drivers come across impromptu traffic incidents, drivers must be equipped with the tools necessary to accommodate them, such as operating a GPS and informing their managers or operations of any route deviations.

### Understanding Congestion and Construction Areas

#### Challenge

Two of the most prominent traffic challenges fleet drivers contend with on a regular basis are congestion areas and construction zones. Often times, these challenges are out of the driver’s control and he or she must adapt as they arise. Areas of congestion, including those resulting from construction, take a toll on fleet vehicle drivers and in turn influence their behaviors, as well as drivers in surrounding traffic.

Hours of detailed planning and preparation go into transportation journey mapping, which take into account areas of planned construction.

<table>
<thead>
<tr>
<th>TABLE 7: Route Mapping Considerations for Roadways and Bridges</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AGE</strong> As roads and bridges get older, their structural integrity becomes more and more compromised. With each passing year, the toll of weather and continuous traffic becomes greater and the structure will begin to show signs of damage and wear.</td>
</tr>
<tr>
<td><strong>INFERIOR DESIGN</strong> Without proper planning, a driver is not given the necessary tools to determine the quality of the road or bridge construction upon arriving at the structure. Often times, drivers are met with a sign indicating the types of vehicles that can and cannot safely pass; however, these may not always be indicated in basic pre-journey planning. In extreme situations, a bridge or road does not meet modern regulations, and the driver runs the risk of greater issues as a result. Careful planning for proper road or bridge construction is a vital aspect of pre-journey planning.</td>
</tr>
<tr>
<td><strong>CONSTRUCTION</strong> Construction on roadways or bridges can mean a staggering delay in a transportation journey. Depending on the purpose of the company’s fleet, this could mean a late delivery, which in turn can hinder customer relationships. Identifying and planning around construction zones can mean the difference between the driver getting to the destination on time safely and the driver arriving hours late.</td>
</tr>
<tr>
<td><strong>TRAFFIC DENSITY</strong> One of the more common ways a road or bridge becomes compromised is years of heavy traffic. Over time, the number of vehicles that pass and the speed at which they do so, can greatly influence the lifespan of a road or bridge.</td>
</tr>
</tbody>
</table>
Abertis’ Smart Road Management

It is critical that road operators (including Abertis) permanently monitor the condition of road surfaces, bridges, and tunnels and provide proper and proactive maintenance, ensuring maximum safety to their users.

Abertis uses Light Detection and Radar (LiDAR) technologies, drones, and advanced asset management systems to remotely monitor and provide real-time information on the health of critical infrastructure.

In Spain, Abertis is using drones to perform detailed and regular aerial inspections of difficult to access structures, be it cliffs adjacent to the motorway or tunnel ceilings.

Roads are becoming more intelligent. The growth in data gathered from sensors embedded within infrastructure and from vehicles and road users provides the opportunity for increasingly predictive road maintenance.

AB InBev’s Route Mapping

To help ensure a culture of safety among its fleet, AB InBev works with its drivers to analyze roadways and avoid dangerous roads and areas, both during pre-transportation journey route mapping and in some areas during transport through real-time alerting.

The first step is to eliminate any hazardous routes during the pre-journey planning period. As drivers return to the distribution center each evening, they can share with their supervisor concerns with the route. The route planners can check to see if a safer route is available and make changes if possible. AB InBev is building routes daily, which are mapped into the telemetry system to help provide the safest route possible. In more hazardous areas, the system sounds an alert when approaching a designated hazardous section of the route. This is extremely important as drivers might not always have the same route each day and a different driver could be assigned that route.
Drivers approach congestion or construction areas differently based on their driving behavior and the type of vehicle being operated. While it may be easier for a compact car to navigate in and around construction zones, a fleet vehicle does not have that same flexibility. Drivers must understand and take the following into account when faced with these traffic hurdles:

› The time it takes the vehicle to accelerate and decelerate is considerably longer for fleet vehicles and is directly influenced by the speed and weight

› The impact time delays have on the transportation journey

Solution

It is often too difficult for the driver to go back and forth between navigation and safety systems to aid in maneuvering through congested areas or construction zones. Technology systems such as cameras, radar, or sensors can help the driver in determining speed and distance of surrounding traffic, allowing the driver to commit more focus on operations.
Congestion relief leads to a more efficient transportation journey due to drivers having access to their primary route. Real-time traffic awareness, with dynamic routing, will aid in situations in which congestion could be an issue.

V2V technologies can also be rolled out in fleets to bolster vehicle warning systems, including:

› Reduced speed or work zone warning
› Restricted lane warning
› Work zone warning

Execution Model
Companies can either devote a team of in-house personnel to monitor and adjust transportation journeys through real-time traffic monitoring, or they can seek the expertise of a third-party vendor specializing in dynamic route mapping. Whether in house or not, the team assigned to dynamic routing must be trained and aware of any and all requirements or nuances of each company or journey timeline. For example, any alterations from the primary route map should not divert traffic into communities or roadways that are not constructed to accommodate the volume and weight of fleet vehicles.

When driving in a congested area is unavoidable, installing safety technologies (cameras, radar, sensors, and other V2V technologies) on each fleet vehicle at strategic points of sight will help drivers maintain a safe distance or react according to other road user behaviors.

Managing the Impact of Weather

Challenge
Weather creates a variety of risks that otherwise would not be present in transportation journey planning. (Figure 5) On average, there are slightly more than 5.7 million road crashes per year, while an estimated 22 percent of these crashes are adverse weather related. Visibility can become drastically lowered as a result of rain, snow, fog, and other weather elements. Rain is the leading cause of weather-related crashes, claiming 73 percent of incidents in the U.S. For under-developed countries that do not have paved or structured roadways, rain can cause roadways to be nearly impassable by flooding or turning dirt or gravel into mud causing runoffs.

### FIGURE 5: In the U.S. alone, from 2005 – 2014, adverse weather resulted in:

<table>
<thead>
<tr>
<th></th>
<th>CRASHES</th>
<th>INJURIES</th>
<th>DEATHS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Averages</td>
<td>1,258,978</td>
<td>445,303</td>
<td>5,897</td>
</tr>
<tr>
<td>Percentages</td>
<td>22%</td>
<td>19%</td>
<td>16%</td>
</tr>
</tbody>
</table>

Reference:
High winds pushing against the larger surface area of a fleet vehicle can lead to swerving off a road or into another lane. Even a beautiful day with a clear sky can present certain obstacles, such as sunset or sunrise shining into a driver’s eye, causing visibility to be a much bigger challenge.

**Solution**

Programs or internet sources can be beneficial during the transportation journey planning process. Web-based services such as The Weather Channel, LLC™ or Google Earth™ mapping service can be used around the world to plan for the impending forecast. If certain risky weather conditions are anticipated, companies can develop contingency plans and equip drivers and vehicles with the resources necessary, such as sufficient windshield wipers, brake checks, and warning systems that alert the driver of a lane departure or distance from a vehicle ahead or beside them.

V2V and V2I technologies can also be rolled out in fleets to bolster the vehicles’ warning systems. These systems can include warnings for specific weather impacts, as well as issues that arise when visibility is compromised, including:

- Weather impact warning
- Restricted lane warning
- Control loss warning
- Emergency electronic brake lights
- Forward collision warning

In France, Abertis’ French subsidiary, Sanef, and the traffic and navigation app, Waze, have signed a data sharing agreement to provide accurate, real-time traffic and road information to drivers. This increases the speed at which road users receive alerts on congestion and hazards, and information on the condition of the roads, programmed roadworks, and work zone areas.

This data sharing partnership has also increased the speed and accuracy of Sanef’s response to incidents.
Execution Model

When implementing technologies to manage the impact of weather, consider the following:

› Maintain basic safety technologies within fleet vehicles to mitigate the dangers of adverse weather. For example, if a driver were to enter a severe thunderstorm, his or her vehicle should have quality headlights and windshield wipers to accommodate the lack of visibility from the rain.

› Develop a protocol that outlines ways in which technologies can be a detriment to specific weather conditions. For example, when it is raining, drivers should immediately take the vehicle off of cruise control, turn the headlights and windshield wipers on, and adjust speed according to the severity of the weather condition.

› Incorporate contingency plans, and empower drivers to utilize resources at hand. For example, trained drivers should have the ability to re-route according to the weather, either by contacting operations or using GPS installed in the vehicle. In addition, establishing a Stop Work policy within the existing safety policy and training drivers to gauge the potential danger will allow drivers to make informed decisions as to when to pull over and take a break while the weather passes.
Integration of safety technologies in fleet vehicles is a key component of a corporate road safety program. Vehicles should be fitted with optimal and tailored technologies based on the fleet's purpose and goal to maximize vehicle safety. Considering technology's rapid evolutionary timeline, companies must further commit to monitoring and preserving their respective technology standards via scheduled evaluations of the current technologies available to determine the necessary upgrades and transitions.

Braking as a Heavy Fleet Vehicle

Challenge
With vehicles ranging from 14,000 – 60,000 pounds, it is no surprise that braking is a significant factor in road crashes involving fleets. Collisions resulting from sudden stops that do not allow enough space and time to come to a complete stop can occur from the commercial vehicle colliding with the vehicle in front or from the vehicle behind colliding with the commercial vehicle's rear bumper.

Solution
Collision mitigation braking systems utilize data, cameras, and radar technology to determine the speed and proximity of vehicles in front of the fleet vehicle. These automatic brake systems are by default set to maintain a distance of no less than 3.6 seconds from other vehicles. In-vehicle collision mitigation technologies are useful in avoiding or addressing the impact of rear-end collisions, which account for nearly half of all two-vehicle collisions. Sensors and vehicle technology systems work together to brake automatically when that minimum distance is breached. If the system detects that it is approaching the forward vehicle too quickly or the vehicle suddenly brakes, collision mitigation technology will warn the driver of the impending obstacle through visual signals (flashing lights) or vibration (of the steering wheel or seat).

In addition, some manufacturing companies will arm fleet vehicles with necessary parts to minimize damage in the instance of a collision resulting from a lack of braking distance, such as underrun guards on tractor trailers. This extra piece of metal fastened below the rear bumper keeps smaller or more compact cars from going under the trailer in the event of a collision.

Execution Model
Depending on the size and necessities of the company, employers can choose what level of mitigation systems to integrate into their fleet.
AIG’s Deployment of Collision Mitigation Systems

With the professional guidance of AIG’s Risk Consulting team and a vehicle technology provider, one of AIG’s trucking clients adopted a strategy to install collision mitigation technology in their 6,500 unit fleet. All new truck orders now include collision mitigation as standard equipment. The technology combines LIDAR, RADAR, and in-cab audible notifications to detect and notify drivers of potential hazards. In extreme circumstances, the technology actually takes over the braking of the vehicle if driver reaction time is not sufficient.

Over the course of two years, 65 percent of power-units have been equipped with this innovative technology and the corresponding outcomes are staggering. Although total miles driven increased by 50 million road miles, rear-end collisions dropped by 17.5 percent and the frequency rate of rear-end collisions per 10 million miles dropped by 25 percent. Based on these results, the client plans to deploy this valuable technology on 100 percent of its trucks and looks to AIG’s Risk Consulting team for thought leadership on future strategies to reduce its Total Cost of Risk (TCoR).

Avoiding Speed and Rollovers

Challenge

Another dangerous position fleet vehicles find themselves in involves speed. Speeding not only increases the distance needed to come to a complete stop, but it also greatly increases the risk of the vehicle rolling over when taking a curve or overcorrecting from a lane deviation. Single car crashes, head-on and rollover crashes, and crashes involving multiple vehicles can all result from a vehicle driving too fast.
The likelihood of other road users being involved in these types of incidences is also higher considering the odds of the vehicle crossing lanes occupied by other users.

**Solution**

The success of electronic stability control (ESC) has led to it rapidly becoming mandatory in many high-income countries. At a global level, 46 countries adhere to the United Nations regulation on ESC technology. While some countries have more opportunity for attaining complex safety technology systems, additional solutions are devoted to reducing the risks involved with speed, including:

- Speed limiters, such as engine control systems, prevent vehicles from exceeding a set speed limit
- Roll stability systems evaluate a vehicle’s intended path and determine the likelihood of rollover or overcorrection based on gravitational force, direction, and speed. The system can correct orientation, reduce speed, and apply brakes to select wheels to avoid a crash

Ryder has reduced collision frequency by leveraging a vehicle safety package that includes collision mitigation, lane departure warning, adaptive cruise control, roll stability, and light-emitting diode (LED) headlights. Based on vendor information, Ryder is expecting up to an 87 percent reduction in rear-end collisions and up to 89 percent reduction in rear-end collision costs. Trucks equipped with collision mitigation use radar technology to maintain a following distance of no less than 3.6 seconds and will apply 50 percent braking power when the system senses that a collision is imminent with a slower moving or stopped vehicle. When the driver selects adaptive cruise control, a safe following distance is maintained while being protected by the collision mitigation system, which is always on for the driver’s protection.

Ryder’s Implementation of Mitigation Braking Systems

**Three levels of OnGuard defense:**

- **Collision Warning System (CWS)**
  - Audible and visual warnings provide detection of developing rear-end collisions
  - The system is not designed to operate below 15 mph

- **Adaptive Cruise Control (ACC) with Active Braking**
  - Provides adaptive cruise for both decel and resume
  - Maintains 3.6-second following distance
  - Provides sequential activation of engine:
    - Torque reduction
    - Retarder control
    - Foundation braking
  - Maximum deceleration is 0.25Gs (equivalent to 1/3 full brake power)

- **Collision Mitigation System (CMS)**
  - “Always On” emergency activation
  - Calculates to determine impending collision
  - Initial haptic warning
  - 0.35Gs deceleration (equivalent to 1/2 full brake power)
  - Automatically disengages if driver takes appropriate action
  - The system is not designed to operate below 15 mph
AB InBev’s Telemetry System

AB InBev utilizes telemetry technology in nearly 100 percent of its fleet to provide ongoing monitoring of driver behavior, with a focus on speed, rapid acceleration, rapid deceleration and gravitational-force (G-force). Speed limits are not always reflective of an acceptable speed for a fleet vehicle. For example, in more hazardous areas when one of AB InBev’s vehicles is approaching a critical route or place such as a steep hill at a dangerous speed (even if it is within the speed limit), the telemetry system will send an alert to the driver, who can then adjust the speed accordingly.

By focusing on speed and implementing telemetry technology, AB InBev has seen a decrease in truck crash related fatalities in its Tier 2 delivery fleet from nine in 2014, four in 2015, to zero in 2016.

Not only does the system alert drivers when their speed is reaching a dangerous level, but it also monitors the severity and frequency of speeding and sends this data to management. Coaching, retraining, and, if necessary, disciplinary action are used to create a safer culture in AB InBev’s fleet.

In one zone, if a driver sounds this alarm five times in a one-week period, management will pull the driver from the field and mandate completion of a safety training course before he or she is allowed behind the wheel again. This training occurs on a Saturday and his manager must attend as well. Managers also use this data to reward drivers who are performing well and showing safe driving behavior, such as maintaining appropriate speed while driving.

Ryder’s Implementation of Electronic Stability Control (ESC) Systems

Ryder limits company commercial vehicles to 65 mph. To address possible rollovers related to speed, roll stability control systems automatically apply the brakes to help “direct” the vehicle where the driver intends to go. This is particularly useful when a vehicle is traveling too fast through interstate on and off ramps, which are prone to rollover type events.
Adaptive cruise control is a simple solution that adjusts speed automatically to maintain a safe distance between vehicles ahead. The system utilizes radar to determine the distance between the front bumper and the vehicle ahead of it, applying the brakes as necessary once too much space has been breached.

V2V and V2I technologies such as curve speed warnings, forward collision warning, oversize vehicle warning, and situational awareness can help prevent rollovers by notifying the driver of potentially dangerous situations.

Eliminating Blind Spots and Increasing Visibility

Challenge

The larger or longer the commercial vehicle, the less visibility the driver has of the surrounding areas. Drivers who cannot see specific areas run the risk of crashing into objects, or running other vehicles off the road simply because they were not visible in the side- or rear-view mirrors. Some fleet vehicles have stickers attached to the bumper, warning passing traffic that the driver may not always be able to see them due to blind spots.

Solution

A myriad of technologies ranging from simple mirrors to more complex cameras can be installed in fleet vehicles to increase visibility, including:

- Spot mirrors
- Spot cameras
- Rear-view camera systems
- Reversing alarms
- Side and backup cameras
- Underrun guards

V2V and V2I technologies can assist in situations in which the driver does not have enough visibility, such as:

- Do not pass warning
- Left turn assist
As part of its efforts to always put safety first, PepsiCo is deploying telematics to track drivers’ speed and acceleration. The implementation of reverse cameras helps to enhance a driver’s ability to park and maneuver with greater ease and safety when reversing a vehicle.

The display is placed as a central mirror and provides drivers with a complete sight of the zone when backing (it is connected to the reverse gear).

› Intersection movement assist
› Stop sign warning
› Pedestrian in signalized crosswalk warning
› Railroad crossing warning
› Red light violation warning

**Execution Model**

Each piece of technology can be strategically placed around the vehicle to eliminate blind spots and ensure visibility for the driver. Selecting the technologies that best fit the visibility needs of vehicles will ensure that these technologies are being optimized to their full potential.

Once the systems are in place and operational, additional considerations include:

› Enforcing programmed maintenance inspections
› Installing safety system tampering prevention
› Encouraging driver acceptance and hosting training sessions
› Implementing effective road user coaching process

**Meeting Basic Safety Standards**

**Challenge**

Devoting as much time and resources into training drivers to be as safe as possible can only take a company so far. If the vehicles in operation do not meet basic country-level and United Nations safety standards, then companies’
Backing a large vehicle can be a difficult maneuver. For many years, back-up cameras have been available for commercial vehicles and are currently standard devices in many passenger vehicles.

To further assist the backing maneuver, Republic installs 3rd Eye, A Dover Company radar sensor devices to the back of their collection vehicles. The device provides an audio alert, indicated by a beeping noise. When an object gets closer to the backing vehicle, alerting the driver of a potential crash, the beeping cadence is accelerated, eventually moving to a steady tone.

When this radar device is paired with the 3rd Eye camera system, both audio and visual alerts are achieved. With the backing camera located on the rear of the vehicle, and the monitor located in the cab, the driver is able to see the hazard.

The combination of both devices (audio/visual) provide helpful tools in the drivers' collision avoidance arsenal.

The radar device includes:

- Doppler radar technology
- Object detection or collision avoidance
- Integration of existing 3rd Eye Camera Cable

Solution

Incorporating technologies that help fleet vehicles meet the safety standards set aside by The World Forum and United Nations regulations will help ensure companies are prioritizing the safety of their workforce and the members of the communities they operate in. A variety of technologies ranging from the structure of the vehicle to safety add-ons can be installed to help either prevent or reduce potential damage or severity of a crash, including:

Training and resources could be essentially worthless. Vehicles sold in 80 percent of countries around the world do not meet basic safety standards. Specific United Nations and The World Forum regulations created to protect both drivers and vulnerable road users are not always guaranteed in the vehicles on the market, particularly in developing countries.
- Softer bumpers, underrun guards, and bonnet area clearance
- Seat belts and proper anchorage
- Proper test procedures
- ESC systems

**Execution Model**

When requesting the manufacturing or purchase of a fleet vehicle, keep the following technology considerations in mind:

- Incorporating soft bumpers and bonnet areas to the front of the vehicles reduces damage to other objects or cars in the instance of a crash
- Installing underrun guards at the rear of the vehicles reduces damage to other vehicles in the event of a rear-end collision
- Installing seat belts and anchorage that are appropriate for the specific fleet vehicles. Ongoing testing of the anchorage to confirm it can withstand a crash is encouraged, and adherence to seat belt use is vital for every driver operating a vehicle
- Vetting third-party vendors ensures they meet basic safety standards during the manufacturing and safety testing process
- Installing and training drivers on the operations and benefits of ESC systems

**FIGURE 6:**

**Vehicles in 80% of all countries fail to meet safety standards**

<table>
<thead>
<tr>
<th>Amount of Countries That Have Safety Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian protection regulations</td>
</tr>
<tr>
<td>Seat belt and seat anchorage regulations</td>
</tr>
<tr>
<td>ESC regulations</td>
</tr>
<tr>
<td>Frontal impact test regulations</td>
</tr>
<tr>
<td>Side impact test regulations</td>
</tr>
</tbody>
</table>

For road safety technology rollouts to be successful, employee participation and commitment is essential. Companies must foster an environment that encourages and enforces proper adherence to safety technologies. Methods for influencing employee attitudes and behaviors towards road safety technologies begins with allowing time and resources to make users comfortable with the transition and integration of the products. Currently, no road safety technology can replace the importance of having a trained, skillful driver.

Curbing Distracted Driving

Challenge

Distracted drivers are four times more likely to be involved in a road crash than alert drivers. While most companies that operate fleets currently have safety policies in place that prohibit the use of handheld devices while operating a vehicle, there is no guarantee that once the driver begins the journey, that the policy will be honored.

Distracted driving is a growing problem that will not resolve itself. Distractions can range from something as simple and quick as spilling coffee to something as complex and dangerous as using a mobile phone. (Figure 7) While many things can be considered a distraction, the primary cause of a road crash from distraction is the use of a mobile device, including texting, social media, and internet surfing.

FIGURE 7: Mobile Phone Use

Drivers who admit to using the internet on their mobile devices while driving has risen from 13 percent in 2009 to 30 percent in 2016. Certain phone manufacturers have made steps toward improving road safety through developing a more hands-free design for mobile phones. However, these hands-free features and innovations are not the solution in eliminating distracted driving because they can falsely lead drivers to believe they are at a lower risk of a road crash.
To combat this misconception, the AAA Foundation for Traffic Safety reports that the level of cognitive distraction in drivers using hands-free technology is the same as that of drivers using handheld devices. To eliminate distraction, further steps must be taken in addition to integrating hands-free technology, with the consideration that even road safety technologies like cameras can be a distraction, which is why training is essential.

Solution

As the world continues its journey toward becoming more automated, companies are building technologies that can override incoming calls or text messages. Programs such as driving workload managers are being tested as a means to curb distracted driving. A workload manager is an on-board technology that utilizes vehicle sensors to determine the driver’s workload and block incoming mobile phone calls and other sources of distraction until the driver’s workload reduces. While this particular technology is not globally available, many other programs or apps offer the same concept.

Technologies that help address challenges such as driver fatigue can also help prevent crashes resulting from distractions. For example, lane departure warning systems alert drivers of unintended lane departures, such as a truck drifting into the shoulder or another lane. This system will detect this change (most commonly through lack of using a turn signal) and alert the driver with either an audible alert or vibrating the driver’s seat, giving optimal time to correct the situation and avoid a distraction-related road incident.

An increase in these types of autonomous features could have a significant impact in curbing distraction-related crashes, either by alerting drivers in advance of an incident or taking control of the vehicle for the driver when situations arise. When building a distracted driving policy, employers must consider how autonomous features could lead to overconfidence or reliance by drivers on those technologies, and in turn lead to a greater willingness to be distracted.

Execution Model

Utilizing these technologies for distracted driving is a process, including:

› Building a foundation by hosting extensive training and education programs for employees on the dangers and consequences of distracted driving

› Installing applications on drivers’ smart phones, or providing drivers a smart phone with the applications already installed

AB InBev’s Fight Against Distracted Driving

AB InBev is running a pilot project in which a device that blocks cell phone use is installed in the cabin of its fleet vehicles. This device will only allow navigation programs to run on the drivers’ phone, as well as single-touch, hands-free call answering. All other operations and programs are blocked from use, including texting, performing outgoing calls (apart from emergency numbers), and opening other apps.
› Developing an adherence procedure that outlines consequences of failing to abide by the distracted driving policy, and a rewards system for successfully following the correct procedure

› Expand the use of hands-free technology and bolster policies that enforce the use of these devices

Monitoring Driver Behaviors

Challenge

In a perfect world, fleet vehicles and drivers would always abide by the rules of the road and company policies. However, it is safe to say that does not always go as planned. Therefore, proper monitoring of fleet operations and driver behavior is necessary for a successful road safety program.

Driver fatigue is often underestimated in terms of its impact on driver behavior. When a driver does not receive the appropriate amount of sleep, his or her performance will significantly decline in many areas. As drivers become increasingly tired, reaction time slows, vision quality decreases, and judgment is not as sharp. A driver who is sleep deprived will either become a danger to other drivers, or will not have the ability and awareness needed to successfully avoid dangers from other drivers.

Solution

Telematics systems allow employers the opportunity to track and gather data on the performance of their fleet vehicle and drivers.
Some of the more advanced telematics systems allow employers to track driving behavior, including time of day, speed, sharp braking or acceleration, number of journeys, number of stops made during long journeys, types of roads used, and other vehicle health and safety factors.

Data collection on road traffic fatalities is an option for monitoring country-level trends, tailoring prevention efforts, and assessing the progress of existing safety programs. (Figure 8)

Allow time for drivers to have appropriate stops and time to rest. Monitoring drivers’ sleep schedules and having regular check-ins can mean the difference between a rested and alert driver and a driver who is a risk to his or her surroundings.

**Execution Model**

As the utilization of telematics becomes further integrated in fleet management, employers can take appropriate steps to successfully roll out this type of program, while ensuring minimal employee pushback or loss of service. (Figure 9) Once a telematics system is in place, companies can use the data to:

- Build educational and training programs to create safer fleet drivers
- Develop tailored collision prevention initiatives
- Measure the success of existing programs, and alter any aspects that fall short of the company’s safety goals
- Develop criteria for a rewards system for drivers who maintain safe driving behaviors long-term

Adhere to government requirements, including accounting for necessary stops needed to avoid driver fatigue, per the company’s existing Stop Work policy. If a Stop Work policy is not in place, incorporating a plan for necessary stops and breaks per government requirements should be step one. Companies should also consider creating or investing in programs that track and maintain sleep behaviors of its fleet drivers.

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**FIGURE 8: COUNTRIES REPORTING DATA IN 2009**

- **34** countries produced high-quality cause-of-death data
- **85** countries produced lower-quality cause-of-death data
- **74** countries produced no cause-of-death data

**ONLY 25 COUNTRIES** report the use of combined health and transport data for their official fatality numbers.

PepsiCo is continuously seeking new and innovative solutions to promote health, safety, and environmentally beneficial practices. For example, the global food and beverage company is piloting a program with Fatigue Science, which is a pioneer in sleep and its relationship to human performance and on-the-job risk mitigation.

By measuring employees’ sleep patterns with wristbands, PepsiCo is using best-in-class science and technology to predict critical fatigue risks, hours before they occur, as well as to promote better sleep habits with their workforce. The pilot is part of a broader initiative called Pursue Positive which promotes health and well-being for associates.

Driver behavior remains a major issue in road safety. In France, Abertis collaborates with a technical road laboratory to conduct an annual survey on road user behavior. With a representative sample of nearly 140,000 vehicles, the survey examines speed, distance between vehicles, signaling, behavior around work zones, and lane occupancy. More recently the survey has revealed a rise in the use of mobile phones while driving, leading to a targeted communication campaign to address this issue.
Ryder’s Telematics

Ryder uses Lytx DriveCam video event technology throughout its entire fleet of commercial vehicles. DriveCam is a video-based coaching and exoneration system that uses a palm-sized event recorder mounted on the windshield of the tractor cab. When activated by an unusual event such as hard braking, sudden acceleration, or vehicle impact, the system captures a short 12-second audio and video clip that is analyzed by DriveCam’s highly trained reviewers and forwarded to operations management only when a collision, recognition, or coaching opportunity occurs. The device continually runs but it only saves a short audio and visual clip captured eight seconds before and four seconds after a triggering event, and shows an inward- and outward-facing view of what happened.

If driver behavior resulting from a triggered event is deemed “risky” by a Lytx specialist, the driver’s supervisor is required to provide coaching and feedback as it relates to the event or behavior. Examples of coachable behaviors include handheld cell phone use, not utilizing a seat belt, following too close, speeding, late response to a road hazard, obstructing the internal-facing camera, or driving judgment errors. All coaching is managed through Lytx’s online dashboard and is scored for coaching effectiveness and timeliness.

Companies using video event technology can expect up to a 44 percent reduction in collision frequency and a 48 percent reduction in claim costs during the first year.
AIG’s Smooth Driving Index

AIG recently partnered with Europcar Ireland, a car rental company, to create a project testing whether it could:

› Incentivize smooth driving - that is, maintaining safe speeds, not accelerating harshly, and not using hard breaking
› Determine whether smooth driving was an indicator of safe driving

The project called Smooth Driving Index (SDI) uses vehicle telematics to help increase drivers’ safety on the road. Vehicle telematics, or the technology of sensing and communicating vehicle data, can give drivers feedback on their driving behavior and habits. The SDI uses telematics data to provide each driver with a daily safe driving dashboard that includes an overall safe driving score, the number of miles the driver has driven smoothly, and how many hard stops the driver has made.

Understanding their current behavior on the roads and comparing their scores daily helps fleet drivers adjust and avoid risky driving behaviors including speeding and harsh acceleration or breaking. To further encourage safer driving, AIG created a contest that rewards the “smoothest” drivers with prizes. Not only was this game extremely popular with drivers, (less than one percent of drivers opted out), the contest also succeeded in significantly reducing the number of claims for Europcar Ireland by incentivizing renters to drive more safely. The 2016 data below offers compelling insights to the power of combining telematics with “gamification” to improve driver behavior:

› 199,000 renters voluntarily enrolled in the Smooth Driving contest
› A total of 5.4 million trips were driven
› Older drivers were the smoothest drivers
› Drivers between 35 – 50 scored worse than drivers younger than 30

The study determined that high smooth-driving scores were linked to fewer crashes. In fact, the smart use of this data resulted in a reduction of claims by 23 percent. These innovative technologies and applications allow AIG to provide new data-driven insights that could help further improve the safety of clients.
FIGURE 9: Automotive Fleets’ Steps for a Successful Fleet Tracking Rollout

1. **Plan Accordingly**
   - Investing in a telematics system can be expensive and does need some time investment in first learning the system and in implementation. Define your goals, set expectations, and research how the software will help you. Don’t invest until you plan out a time and financial budget to make it happen.

2. **Know What Kind of Information You Want to Track**
   - Telematics can provide virtually endless data, which can be a drawback if you don’t know what information you want. It’s important to know your goals, whether it’s fuel savings or safety, so you don’t purchase a telematics system giving you reports you won’t use.

3. **Research Third-party Vendors**
   - Compare systems. Check out which program matches your company’s needs and is the most cost-effective for your budget. Trying to rework your fleet to fit the telematics system you purchased is much harder than finding a system that most closely fits your needs.

4. **Educate Your Team**
   - Educating and training employees will help garner support and prevent potential issues. A top-down training method, beginning with your management, is a surefire way to ensure employee confidence.

5. **Test Your System**
   - Pilot testing your system is a great way to make sure that it’s working within your fleet and that your employees are learning how to properly use the software. Before you rollout completely, do a pilot test to make sure everything runs smoothly.

6. **Employee Buy-in**
   - Often, employees can feel uneasy about telematics, when in actuality the systems are designed to help them and to make the roads safer by making them more diligent drivers. Basic education and approaching this culture change with transparency will result in more buy-in.

7. **Strategic Location Rollout**
   - If your company is in several locations, consider implementing the telematics technology location-by-location rather than having one or two vehicles at each facility. That way, you’ll have every vehicle in the vicinity properly equipped and you’ll be able to gauge your data against those locations without the system.

8. **Look for Ways to Improve**
   - Once your rollout is complete, don’t get complacent. Be on the lookout for ways to make your system and your practices better and continue to take advantage of all the features, one piece at a time. Encouraging staff feedback is a good option as well.

PILLAR FIVE
POST-CRASH RESPONSE

To optimize organizational road safety measures and help ensure the best care of employees, employers must take into consideration the need for advancing technology’s role in post-crash response. The moments after a road crash are critical to the survival of drivers and passengers, the amount of damage to the vehicle or products, and the growing risk of subsequent collisions from the resulting traffic. Post-crash response presents an opportunity for companies to gather valuable information that can later be implemented in driver safety trainings.

Responding in a Timely Manner

Challenge

A big challenge to a timely post-crash response is the subsequent congestion on the road that ultimately occurs in tandem with a crash. Not only does congestion greatly increase the risk of subsequent collisions from sudden halt in traffic, but it also creates a hurdle for emergency responders to access the crash. The sooner emergency personnel can be notified of a road incident, the sooner and more efficiently responders can arrive and mitigate the harm. While only 116 countries have access numbers for emergency service response (for example, the U.S. has 911 and the UK has 999), not all countries have responders readily available.

Solution

The most efficient way to request emergency responders is through a universal, centralized access number. However, when these are not available, certain technologies can advise passengers on the nearest hospital or offer alternate transport options, such as a GPS, smartphone apps, or electronic billboards.

Automated capabilities of vehicles could force other vehicles to the side or slow them down as first responders approach. In-vehicle technologies can summon first responders automatically or by the push of a button. Once a crash is verified, traffic systems could alert or divert drivers from the path of those first responders, allowing quicker access to the crash site.

V2I technologies can also aid in emergency response arriving at the scene in a timely manner by utilizing the following warning systems:

- Emergency vehicle alert
- Intersection movement assist
- Transit vehicle at station or stop warning
- Vehicle emergency response
Execution Model

People respond differently to the shock of being in a road crash. By training and educating drivers about the post-crash scenarios and installing V2I technologies in fleet vehicles, companies can help mitigate the impacts of a crash. Consider the following:

- Develop and provide a step-by-step post-crash action plan to all employees. Drivers should learn to evaluate the situation, including any health or safety risks, and should know how to proceed accordingly. For example, when possible, drivers should call for emergency responders either using the universal access number or through in-vehicle emergency contact technology.

- Install V2I technologies that assist in getting emergency responders to the scene in a timely manner, including:
  - Emergency vehicle alerts let drivers know when and where emergency personnel are approaching so they can move out of the way.
  - In-vehicle security mechanisms can alert company operations or emergency personnel (whether automatically or by the press of a button) of a road crash. Once the technology sends the alert, some systems can also pull diagnostic data on the incident.

Abertis’ Highway Operational Centers

Through their traffic control centers and dedicated staff, Abertis has the means to:

- Receive fast and accurate information about a collision through cameras and traffic information systems.
- Respond appropriately to any collision, calling the right emergency teams, providing medical treatment and evacuating victims.
- Protect other road users from further collisions with advance warning of the crash through dynamic message signs, activating variable speed limits, providing information to GPS-based geographical navigation providers, and putting in place appropriate diversions where necessary.

The quality of the post-crash response is particularly important in tunnels, where collisions are particularly dangerous. Road tunnel operators (including Abertis) have automatic incident detection systems and smart decision-making tools, plus in-depth experience, which enables them to respond quickly to such events.
Recreating the Scene

Challenge

The inability to accurately recount what occurred during a road incident leads to speculation. Not knowing exactly what happened severely impacts a company’s ability to not only correct potential unsafe behaviors, but also how to prevent the incident from occurring in the first place.

Crashes also involve liability, which can lead to litigation, which can in turn lead to expenses (both legal and actual incurred damages). If employees are involved in crashes, employers are often left with a one-sided statement.

Solution

A solution to determining or recreating a scene post-crash is to employ a now predominant safety technology: cameras. Cameras can be placed strategically to view any angle necessary, including forward-facing, on each side, and to the rear of the vehicle.

Cameras may also be positioned to view the inside of the vehicle cabin. Cameras facing the driver provide a myriad of benefits, including identifying behavioral traits such as seat belt usage, phone usage, and ergonomic body position. However, when placing a camera inside the vehicle cabin, privacy and other related considerations must be accounted for and addressed.

Execution Model

Cameras are primarily used as event recorders, meaning that if a certain force, such as hard braking, sudden steer, or a collision event, is experienced by the vehicle, the camera is activated. During this activation, the system records a short timeframe just before the event and a short timeframe after. This is achieved as the cameras are always functioning, so the activation prompts the camera to begin this specific recording period. The data is then transmitted via a wireless network, which can be used to recreate a road incident.

Camera technology generates video clips of driver behaviors during triggering events; and therefore, use of this technology requires consistent company commitment to managing the information gathered in the clips. Neglecting clips that show bad driving behaviors, by not documenting appropriate coaching and counseling, can increase company liability, especially if the driver is involved in a serious crash. On the other hand, when clips show positive driving behaviors, companies should evaluate opportunities to reward or showcase such drivers.

Using the cameras as a positive reinforcement tool can add to the ease of adoption of the technology. A well thought-out and communicated rollout of this technology is paramount. Companies that supply this camera technology also provide a monitoring service, whereby you can select from a buffet of services, such as monitoring for speeding or following too close. Industry leaders must make a commitment to technology to get a “visual” of the problem and empower safety leaders to make changes.

Ryder’s Post-crash Documentation

Ryder drivers are trained to immediately secure the scene and contact the authorities following any roadway crash. The driver’s next step is to document the crash details through the use of an Accident Photo “Pak.” Each driver is provided an Accident Photo “Pak” to help recreate the incident scene. The photo pack is stored inside every truck and its availability is confirmed during daily pre-trip inspections. The Accident Photo ‘Pak’ includes a disposable digital camera with flash, a crash documentation form, crash procedure document, hold harmless card, and pencil. At any time, Ryder management can obtain additional photo packs through Ryder’s own online procurement website.

Advancing Road Safety Best Practices for Companies and Their Fleets
In a normal, static manufacturing environment, observing and spotting hazards can happen relatively naturally. In the field of transportation, hazards are always in a state of flux. Supervisors observing drivers’ behaviors while riding in the vehicle is ideal and a common practice at Republic. Following drivers (sometimes incognito) is frequently perceived as adversarial, or “police-like,” whereby catching the driver doing something wrong sometimes becomes the goal. Republic has found that the “catching” part rarely builds trust, collaboration and behavioral change. However, riding in the cab all-day is not practical, and in the event of a crash, companies are sometimes challenged in collecting a full, unbiased account of what occurred. Crash investigations frequently result in two opposing accounts (he said, she said), making fault determination challenging. To assist with this challenge, Republic utilizes camera technology from 3rd Eye, A Dover Company, to capture video crash footage, helping to recreate the scene.

Some of the current in-cab camera technology features available include:

› Live video streaming
› Advanced video analytics to detect stop signs, lane departure, and tailgating
› Telemetry and idling time reports to help improve utilization
› Ever-expanding software platform with engine diagnostic integrations
› Reports that provide crash analysis and identify high-risk drivers, specific driver training needs, and supervisor effectiveness
› Videos that collect 30 frames per second and provide 30-second event clips
› On-demand Video requests to see crashes and assist in specific driver training needs

Most fleet drivers have access to training programs and procedures; however, these can potentially lack an element of immediate learning feedback from the time of a crash and the vital moments that follow.
Republic integrates the in-cab video footage and information provided by cameras installed in its fleet, into its defensive driver training. Republic uses these in-cab video clips as part of their fresh, monthly video and practical skills based training, as well as in their annual defensive driver training classes. The impact of drivers seeing their own coworkers making good decisions, as well as poor decisions, has lasting benefits. Watching another driver, from another company, in a different industry does not translate into the most effective learning. In addition to using the valuable learning from crash event footage, other video footage captured can highlight proper, as well as improper (no seat belt, mobile phone use) behaviors.

The post-crash benefits of video applied to risk mitigation is obvious, making the ROI of camera technology a no-brainer on this element alone. The training and behavioral component supplied from video makes this in-cab video option a necessity.

Camera footage, combined with robust, in-cab coaching by the driver’s supervisor, as well as a monthly, interactive training program, including tactile, skills based instruction makes for a comprehensive, proactive, result-driven approach to reducing roadway crashes and injuries.

Technology alone cannot solve all of your crash challenges; however, it makes for a fine supplement to a comprehensive, driver-based training program.
Octo Telematics’ Partnership with the American Automobile Association

Recognizing the value of a tool that would help people avoid breakdowns through prevention, American Automobile Association (AAA) partnered with Octo Telematics to offer telematics as a potentially valuable service to their members.

Early in the design of a telematics solution, AAA identified three key critical capabilities, including improving roadside assistance, supporting usage-based insurance, and integrating with AAA’s connected repair facilities. Knowing this, Octo worked hand-in-hand with AAA’s leadership to tailor a telematics solution to meet AAA’s needs.

Octo provided APIs that helped shape the infrastructure of AAA’s usage-based insurance program, AAA Insurance with SMARTtrek®, and Online Garage®, AAA’s website dedicated to providing personalized car maintenance help to members. Octo continues to work with AAA on highlighting the value of telematics to their members.

SMARTtrek has served tens of thousands of people and helps to improve road safety by reducing the amount of time a breakdown vehicle and its driver are roadside. Member engagement with Online Garage out performs industry metrics in terms of website visits and email open rates. Repair shop ratings and reviews have generated especially robust member engagement.

But even before a breakdown or crash, SMARTtrek is helping to reduce the number of breakdowns with its vehicle health notifications, ensuring that members are aware of maintenance needs in advance. Online Garage further helps by making maintenance and repair services easier than ever to secure. In addition, SMARTtrek reads Diagnostic Trouble Codes (DTCs) common to all vehicles and captures VIN, speed, and location in order to give members detailed information on how their driving habits affect fuel efficiencies. When members realize that better driving further stretches their fuel investments, they in turn create safer roads.

Employee Response Training

Challenge

After a road crash that results in minor, non-fatal injuries, drivers may be unaware of the correct protocol and may leave out important information or unknowingly exacerbate the impacts of a crash. For example, if a road crash occurred in which no one was injured, but the gas or oil tank began leaking, would employees know the correct procedure to address this issue as well as mitigate the damage to the vehicle?

Solution

When minor crashes occur, drivers who are trained and have access to the following resources can proactively begin the post-crash response process:
Ryder’s Fuel Spill Kit

Some collisions can result in a punctured fuel tank, cut fuel line, or other vehicle damage that results in a spill of fuel or other contaminants. Ryder drivers are trained to ensure that the contaminant released is contained, and the spread to areas off the roadway is mitigated. Containing contaminants such as diesel fuel can greatly alleviate the cost of a collision and protect the environment.

Ryder has made Fuel Spill Kits available in each vehicle. Each kit includes absorbent materials, putty, plugs for fuel lines, nitrile gloves, goggles, and disposable bags. Each driver is required to ensure this kit’s availability during their vehicle pre-trip inspection.

AB InBev’s Post-crash Response

In its Mexico fleets, AB InBev has installed a panic button within its vehicles’ telemetry and GPS systems. When pushed, this panic button notifies the operations team that there is a problem. Appropriate action can then be taken and assistance can be provided to the location of the vehicle. If the emergency was a crash, the data obtained from the telemetry system can help determine what occurred, the root causes more easily identified, and the appropriate corrective actions put in place to prevent future incidents with this team and other teams driving for AB InBev.

Execution Model

In relation to training employees on the appropriate post-crash response and actions, consider the following:

- Use a cell phone camera or crash photo kit to document all areas of damage to the fleet vehicle and any other vehicle or object involved in the crash for both company and insurance purposes.
- Develop and provide a spill response kit that addresses any toxic material spill, including gas, coolant, or oil spills.
- Train drivers on how to initiate a telematics or vehicle ECM data capture, if the installed system does not automatically do so.
- Perform root cause analysis using the data gathered from the vehicle’s telematics system.
- Create and communicate via an Incident Management System, which are systems that establish a process for organizations to report, respond, and appropriately analyze road crashes.
CONCLUSION

By utilizing modern safety technologies, the private sector can make a significant impact on ensuring their operations, fleets, and drivers are safer during every transport journey. Every company has a responsibility to further road safety within their organization. The rapidly expanding use of technology to improve the safety of corporate fleets and drivers not only benefits companies from a business and efficiency stand-point, but also helps to enhance their individual safety cultures. Combined with public and private sector collaboration, this transition effectively lends itself to creating a world where roads are safer for all people. As members of TSR, we encourage companies to use and share these best practices with partners and stakeholders to advance technologies for road safety around the globe.
REFERENCES


