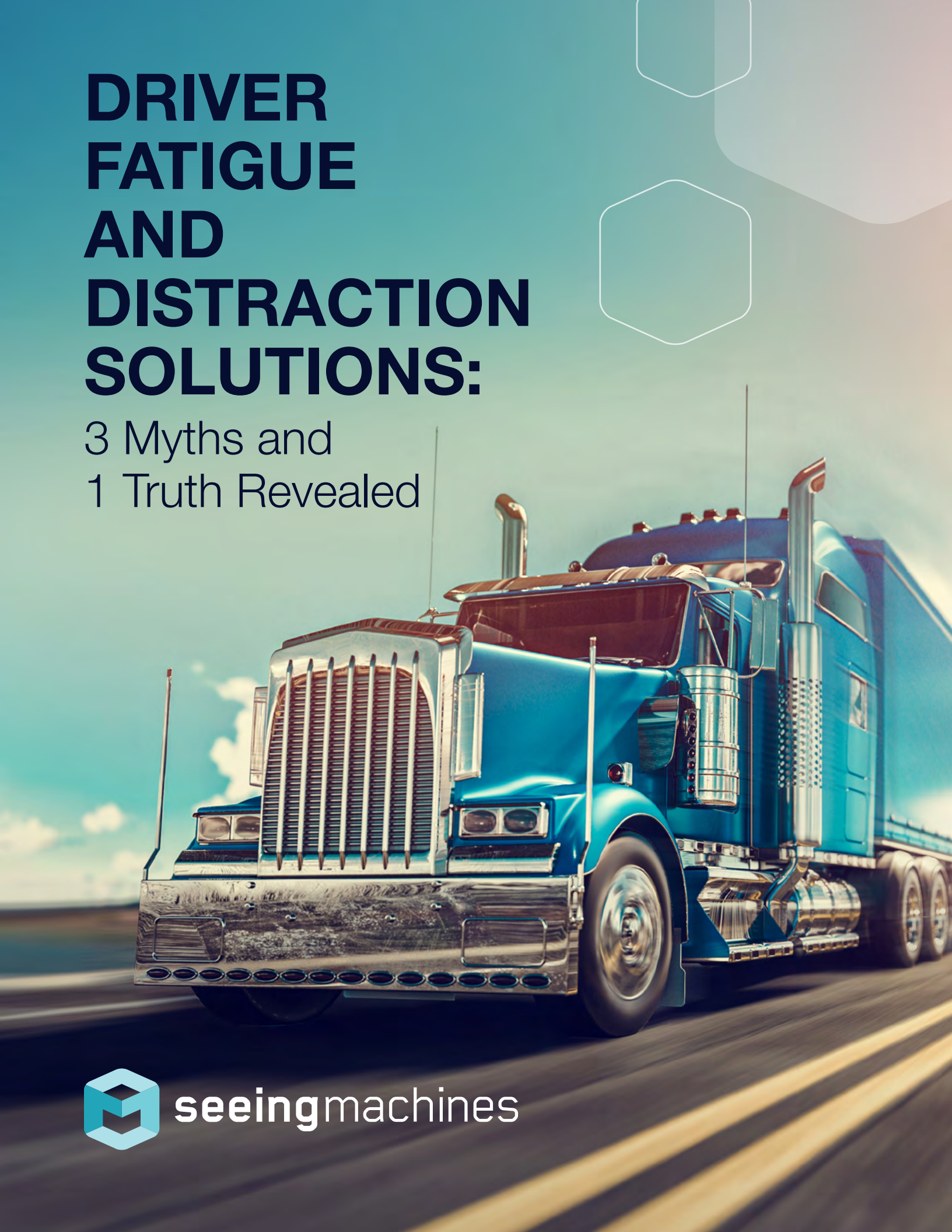
DRIVER FATIGUE AND DISTRACTION SOLUTIONS:

3 Myths and 1 Truth Revealed



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Drowsy and distracted driving are major causes of crashes. Is today's safety technology doing its part to remedy them?

In 2022, 823 truck occupants were killed in crashes, an 8% increase over 2021.[1] In addition to the risk of injuries and deaths, truck crashes expose drivers and fleet owners to the risk of nuclear verdicts — which means preventing them is paramount.

Driver distraction and fatigue are frequent culprits of crashes.

- In 2022, an average of 9 deaths and more than 792 injuries were attributed to distracted driving every day.[2]
- Drivers are 3 times more likely to be in a crash if they are fatigued.[3]
- Drivers falling asleep or being fatigued accounts for 46% of all driver impairment-related factors in truck-involved fatality crashes.[4]

Many heavy-duty fleets turn to video telematics and camera-based safety systems to identify and address drowsy and distracted driving. But does this technology accurately detect distraction and fatigue? Do all fatigue and distraction solutions deliver the kind of protection needed to keep drivers safe and reduce crashes? Uncovering the three myths that follow provides answers to these questions and more.

THE IMPACT OF NUCLEAR VERDICTS

Nuclear verdicts — court awards or settlements exceeding $10 million — are on the rise, and they're growing more costly.

- Nuclear verdicts reached a 15-year high in 2023.[5]
- Between 2022-2023, the number of nuclear jury verdicts increased by 27%.[5]
- Between 2020-2023, the median nuclear verdict more than doubled from $21 million to $44 million.[5]
- The number of thermonuclear verdicts, those above $100 million, reached a record in 2023, up nearly 400% from 2013.[6]

Being on the wrong end of a nuclear verdict is enough to shut down a trucking fleet. If the business does survive, it can face exorbitant insurance rates and reputational damage that can also threaten to put the company out of business.

MYTH #1: All Fatigue and Distraction Solutions Detect Events the Same Way

The way a fatigue and distraction solution detects risky driving behaviors can be an indicator of its effectiveness.

If the system isn't picking up on all the signs of drowsiness or distraction, those gaps can be the difference between a safe trip and a crash or rollover.

For example, most windshield-mounted video telematics systems use vehicle and driving data to trigger video recordings and driver alerts. So, if a driver is distracted and slams on the brakes to avoid a crash, the harsh braking event triggers the system to begin recording and issue an alert. Unfortunately, once an event like harsh braking occurs, it may be too late to prevent a crash.

Intelligent systems that use AI to measure, assess, and detect driver distraction and fatigue in real time aim to alert them *before* a dangerous driving action occurs. However, as you will learn, not all camera-based safety systems are created equal.

So, what do most camera-based safety systems track?

Driving has always been a highly visual task, so it makes sense to assume all camera-based safety systems track eye movement.

The reality is that many detect head pose (i.e., the orientation of the driver's head) and are incapable of tracking eye movement.

The problem with relying on head pose alone is that the system is acting on incomplete information. This increases the likelihood that it will incorrectly assess some 'normal' behaviors as being unsafe, while at the same time it will miss other behaviors that are genuinely unsafe. An example of the former are glances downward where the driver's head tilts forward but their eyes remain open. Conversely, off-road glances that are made with minimal or no head movement, also known as 'lizard' glances (distinct from 'owl' glances where the eyes and head tend to move together) will be overlooked.

If a driver is continually taking their eyes off the road but not turning their head to do so (which is common with cell phone use), a camera-based safety system that solely monitors head pose won't detect the distraction.

Tracking driver eye movements and gaze direction, in addition to head pose, will pick up on subtler indicators of fatigue and distraction, including closing one's eyes longer than normal and glances that are made without much associated head movement. In addition, it will be less likely to give drivers false positive alerts — when their head behavior could be indicative of fatigue, but their eye behavior shows they are in fact alert.

> Most camera-based safety systems track head movement, but the most effective technology monitors eye movement as well.

While most camera-based safety systems track head movement, the most effective technology monitors eye movement as well.

Research shows that eye tracking — which measures blink rates, eye closure, and gaze direction — is an effective way to detect early signs of fatigue and is more precise than systems focused solely on head pose.[7] Eye tracking can detect microsleeps or drowsiness more effectively because it directly observes physiological signs of fatigue.

Eye tracking is important for distraction, too. When cell phones are used in vehicles they are often positioned near the forward roadway, for example in cradles near the windshield or held around the steering wheel region.[8] As we found in our research with a level 2 automated vehicle on a test track, drivers typically move their eyes independently of their head — performing lizard glances — when interacting with phones.[9] This highlights a major drawback of using a system that relies solely on head pose to detect distraction.

In addition to being aware of what the systems detect, it's also important to ensure they work in all lighting conditions and can see eye and facial movements even when drivers are wearing glasses, sunglasses, hats, or even face masks.

A system with sophisticated computer vision algorithms, optics, and processing technologies can accurately measure, assess, and detect whether the driver has passed a threshold of risk, in real time, under the full spectrum of lighting conditions and driver appearances. The accuracy of the camera-based safety system is of vital importance to intervene and protect drivers in real time.

Furthermore, an advanced system will distinguish between normal and dangerous driving behaviors to avoid false alerting (also known as false positives). Normal behaviors, like brief glances at mirrors or adjusting posture, should be recognized as non-threatening or 'normal driving' while dangerous behaviors, such as frequent eye closures, prolonged distraction, or erratic head movements, should be flagged as signs of drowsiness or distraction. These systems make use of AI and machine learning during their development to learn these patterns and differentiate between harmless habits and serious risks like fatigue or inattentiveness, which are critical for preventing accidents.

MYTH 2: All Fatigue and Distraction Solutions Detect Drowsiness

Most fatigue and distraction solutions detect yawning and/or microsleeps (sleeping for a few seconds at a time), not actual drowsiness.

When a driver has a microsleep, the risk of a fatal event increases significantly as they are simply unable to concentrate on the road ahead. This is the state during which drivers may veer into the oncoming lane, drive off the road, and experience rollovers or crashes.

Early drowsiness detection technology continuously monitors and evaluates a driver's level of drowsiness and intervenes in real time to help drivers avoid dangerous microsleeps.

The Karolinska Sleepiness Scale (KSS)

1	Extremely alert
2	Very alert
3	Alert
4	Rather alert
5	Neither alert nor sleepy
6	Some signs of sleepiness
7	Sleepy, but no effort to keep awake
8	Sleepy, some effort to keep awake
9	Sleepy, great effort to keep awake, fighting sleep

By the time a microsleep is detected, it may already be too late to intervene and prevent an accident from happening. In addition, drowsy drivers have delayed reaction times and are at risk of making errors they normally wouldn't make, which can also result in crashes. For this reason, it's important to look for a camera-based safety system that has early drowsiness detection.

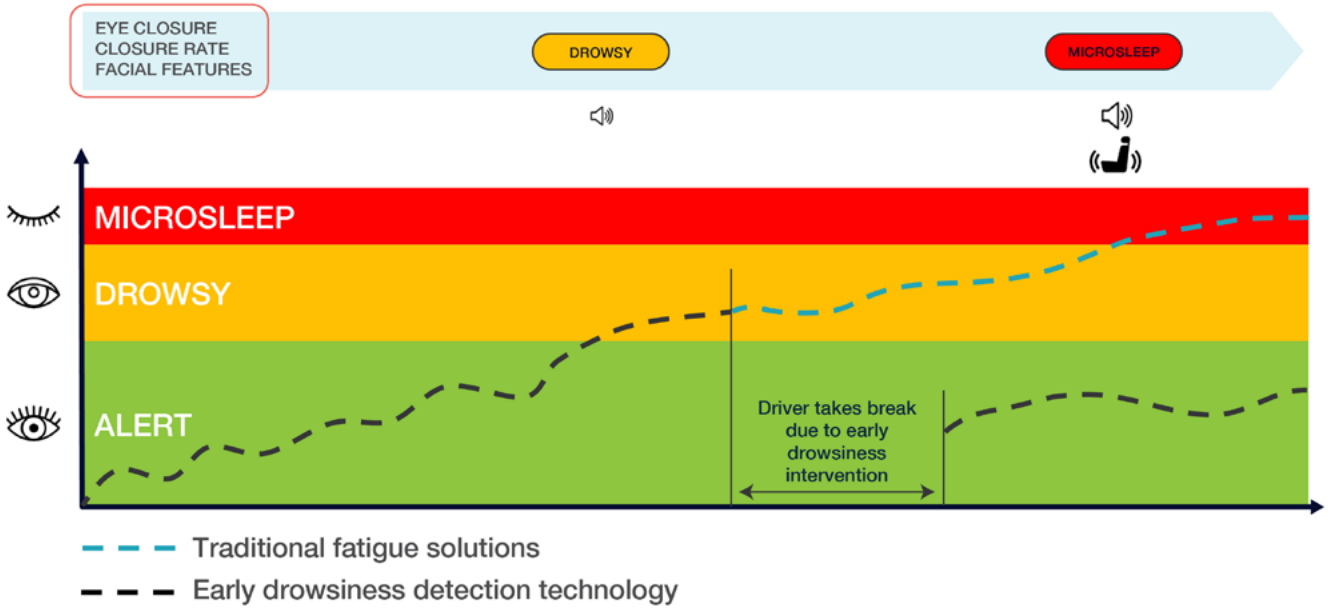
Early drowsiness detection technology continuously monitors and evaluates a driver's level of drowsiness. This technology has a correlation with scientific measures of sleepiness, such as the Karolinska Sleepiness Scale (KSS). The KSS, for example, quantifies a person's level of drowsiness and spans from fully alert to fighting hard to stay awake, when microsleeps may occur.

Tracking eye closure, eye closure rate, and facial features, a sophisticated system will continuously measure a driver's level of drowsiness and intervene in real time if they are displaying signs of drowsiness.

By intervening pre-emptively, drivers are made aware of their increased risk and can act before they tire further and reach the stage of microsleep. Should a microsleep occur, the system should still intervene with audio, visual and/or haptic alerts; however, the pre-emptive warning is designed to help drivers avoid reaching this dangerous level of drowsiness in the first place.

Early Drowsiness Detection vs Traditional Fatigue Detection

By intervening pre-emptively, early drowsiness detection can prevent drivers from entering a microsleep.



MYTH #3: All Fatigue and Distraction Solutions Prevent Risky Driving Events

Perhaps the biggest myth is that all video telematics and camera-based safety systems intervene in real time to prevent risky driving events — not just record them. In reality, most just record instances of fatigue and distraction, rather than intervening as it occurs.

If a driver is at risk of falling asleep, real-time intervention is critical for preventing a crash or rollover. Video footage is an effective driver coaching tool, but without real-time intervention, you can't address distracted and drowsy driving until long after the trip is over. Video telematics collect footage for review after the fact, but don't ordinarily make it possible to intervene in real time.

> Using real-time audio, visual, and haptic alerts together reduce the chances of a driver missing a potentially lifesaving warning.

Post-trip footage may help with litigation and retrospective training, but it doesn't prevent accidents or assist the driver when they're dangerously close to a crash or rollover.

Real-time detection that dangerous behaviors are happening makes it possible to intervene almost immediately and encourage the driver to respond appropriately, for example, by taking a break.

Similarly, the type of alerts that camera-based safety systems use also matters.

Some systems issue audible and/or visual alerts. However, in a noisy environment, audio alerts might be drowned out. In situations where the driver's attention is focused elsewhere, they also may not notice visual alerts.

A superior driver fatigue and distraction solution will employ audio and visual alerts as well as haptic alerts to snap the driver back to attention. Haptic alerts like seat vibration are often more effective than audio and visual alerts alone because they provide a tactile response that can be felt directly by the driver, reducing the chances of missing the warning.

TRUTH: Human Intervention Makes a Difference

What makes a driver fatigue and distraction solution, like Seeing Machines' Guardian, truly unique is the power of human intervention.

Guardian is supported by a team of highly trained analysts who monitor and classify fatigue and distraction events. If they verify a driver is at risk of falling asleep, a representative notifies the fleet manager, allowing them to take immediate action to manage the situation and keep their driver safe. Providing this feedback to the driver's manager as it happens, significantly reduces the incidence of fatigue-related incidents, and therefore crashes.

A study published in *Traffic Injury Prevention Journal* found that providing an in-cab fatigue alert to a driver reduced the incidence of events by 66.2%. Adding real-time direct feedback to the driver's employer or fleet manager increased this number to 94.4%.[10]

Guardian is a superior driver fatigue and distraction solution that:

- Tracks eye movements and is effective in all conditions.
- Provides early drowsiness detection, in addition to traditional fatigue and distraction techniques.

- Operates a 24/7 center that monitors and analyzes fatigue and distraction events to validate them and, if needed, intervene while a driver is still on the road.

Guardian uses industry-leading technology trusted by some of the biggest global automotive brands to accurately detect distraction and fatigue events, alerting drivers earlier and more effectively, and allowing for intervention before a crash or rollover happens — all of which result in better outcomes than traditional driver fatigue and distraction solutions.

References:

1. https://www.iihs.org/topics/fatality-statistics/detail/large-trucks#trends
2. https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/813559
3. https://www.nsc.org/work-safety/safety-topics/fatigue
4. https://seeingmachines.com/the-importance-of-real-time-in-cab-and-external-feedback-in-managing-fatigue-in-commercial-transport-operations/
5. https://www.insurancejournal.com/news/national/2024/05/10/773721.htm
6. https://www.wsj.com/articles/nuclear-jury-verdicts-rise-alongside-american-anger-f63b94b3
7. Liang, Y., Horrey, W. J., Howard, M. E., Lee, M. L., Anderson, C., Shreeve, M. S., ... & Czeisler, C. A. (2019). Prediction of drowsiness events in night shift workers during morning driving. *Accident Analysis & Prevention*, 126, 105-114.
8. Roady, T., Wilson, K., Kuo, J., & Lenné, M. G. (2020, December). How Do Drivers Hold Their Phone? Age, Prevalence, & Handedness. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 64, No. 1, pp. 1254-1257). Sage CA: Los Angeles, CA: SAGE Publications.
9. Yang, S., Shiferaw, B., Roady, T., Kuo, J., & Lenné, M. G. (2021, September). Drivers Glance Like Lizards during Cell Phone Distraction in Assisted Driving. In Proceedings of the Human Factors and Ergonomics Society Annual Meeting (Vol. 65, No. 1, pp. 1410-1414). Sage CA: Los Angeles, CA: SAGE Publications.
10. Fitzharris, M., Liu, S., Stephens, A. N., & Lenné, M. G. (2017). The relative importance of real-time in-cab and external feedback in managing fatigue in real-world commercial transport operations. *Traffic Injury Prevention Journal*, 18(sup1), S71-S78.