Summary Project Report

Status of Driver State Monitoring Technologies and Validation Methods

A review of technology maturity, legislation, and standards

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Driver state monitoring – the need today and tomorrow

Driver fatigue and distraction are highly associated with increased risk of a collision.

This is especially true in serious collisions due to late or absent pre-crash braking response from the driver. Recent STATS19 police-reported collision data shows that fatigue was a contributory factor in 3.3% of fatal collisions (and 2.2% of killed and seriously injured (KSI) collisions), and distraction was a contributory factor in 6.4% of fatal (and 4.3% of KSI) collisions.

These percentages are almost certainly underestimated due to the difficulty of identifying these contributory factors in road collisions.

The challenge:

NOW: Identify the current status of technologies that could complement driver's hours and tachograph legislative requirements in commercial heavy vehicle fleets to minimise the risk of drowsy and inattentive driving.

FUTURE: Identify requirements, test and validation methods for driver availability monitoring for application in conditionally automated self-driving vehicles (also known as Level 3 automated vehicles).

Importantly, DVSA requested a review of the current status of standards and other test and validation protocols for establishing the performance of DSM systems that would help fleet operators to select high-performing systems for heavy duty vehicle fleets.

Vehicles, especially passenger cars (M1), have been fitted with fatigue monitoring systems for many years. The first system in a production car – the Volvo Driver Alert System – used a forward-facing camera to assess changes in lane position for signs of drowsy driving and inattention. Subsequently, many vehicles have had systems that primarily rely on interpretation of steering wheel inputs by the driver that are characteristic of fatigue and microsleeps, often with other parameters such as journey time and time of day. These systems have recently been made mandatory for all M- and N-category vehicles in the EU by Regulation (EU) 2021/1341.

Camera-based driver state monitoring (DSM) systems have undergone rapid development in recent years, covering a range of driver states related to fatigue and distraction, as well as driver availability. Basic driver distraction monitoring systems have been required for all new M- and N-category types in the EU since July 2024 and will be required for all vehicles in the EU from July 2026, implemented by Regulation (EU) 2023/2590.

Image courtesy of Volvo

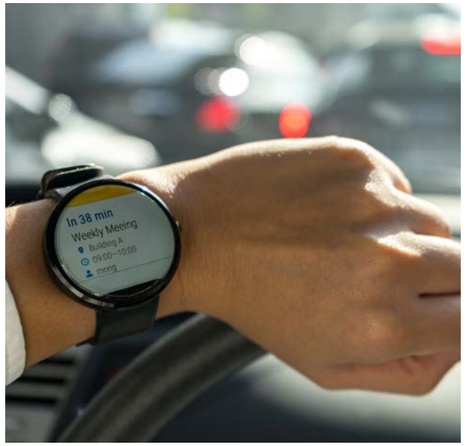
Euro NCAP has been testing and rating DSM systems (called driver engagement monitoring) for passenger cars for several years, and updated protocols will be introduced in January 2026. These build on the foundations provided by the EU regulations and extend both the performance and testing of those systems. Euro NCAP also introduced basic driver monitoring requirements in their new Safer Trucks programme in late 2024.

Conclusions & Recommendations

Some camera-based systems, and particularly hybrid systems which use driver and vehicle metrics, are highly developed in terms of being able to detect fatigue and distraction states. However, performance across the market is still developing and concerns remain over high rates of false alerts.

Procedures to evaluate DSM system performance are less well developed and often rely on dossiers of evidence from the vehicle manufacturer with spot checks performed by the test laboratory.

No standards for evaluating aftermarket systems exist yet. While the benefits of fitting DSM systems in heavy duty fleets is clear, further work (potentially by collaborating



with suppliers) is needed to understand how to set and evaluate minimum performance requirements.

For driver availability systems for Level 3 automated vehicles, no specific test standards, protocols and requirements have yet been proposed

Activities to monitor closely to track progress of technology:

- NHTSA research programme in USA which has wide scope of relevant work
- Euro NCAP Safer Trucks programme
- UN working groups on vehicle design
- Research into how to optimise the HMI of systems to achieve the most effective driver engagement
- R&D of user-friendly biological / body-worn sensors, e.g. integrated in smart watches or dedicated wristbands
- Improvement in detection rates vs reduction in false-positive rates

In the full report

The report identifies and summarises active research and development activities relating to the validation of the effectiveness of DSM systems and the timescales associated with them.

Based on this evidence, the report includes a roadmap for the implementation of standards (regulatory or technical) for the performance of DSM.

Recommendations are also made for further studies that could

- Encourage future use of the technology to complement current commercial vehicle driver's hours legislation and monitoring via digital tachographs.
- Accelerate the development of standards that could support the introduction of high-performance DSM systems in heavy duty fleets, and potentially be integrated into the DVSA earned recognition scheme in the future.

For a copy of the full report search for PPR2068 on www.trl.co.uk