# Can we give DCAS more authority without compromising safety?

# Background

UNECE Regulation 171 on Driver Control Assistance Systems (DCAS) has developed through a series of phases. The initial version, i.e. DCAS Phase 1, specified that:

* The driver must have hands on the steering wheel
* Manoeuvres (lane changes) must be driver-initiated or driver-confirmed

DCAS Phase 2 (01 Series of Amendments) is more permissive, at least for highway driving:

* On highways:
	+ Hands-off driving is allowed
	+ System initiated manoeuvres (SIM) are allowed, but only with hands-on
* On non-highway roads:
	+ Hands-off driving is not allowed
	+ SIM is not allowed

There is currently a discussion in TF-ADAS on a Phase 3 of the DCAS regulation which could potentially lift restrictions to allow system-initiated manoeuvres while driving hands-off on highways, and allow system-initiated manoeuvres while driving hands-on on non-highway roads, i.e. rural and urban roads.

# What are the safety risks in allowing expansion of hands-off driving and SIM?

## Hands-off driving

Urban driving, in particular, with its high levels of traffic intensity, interactions with vulnerable road users and rapidly changing traffic and situation dynamics, requires sustained attention from drivers. Any version of driver assistance that promotes even momentary inattention and lengthens driver reaction time is therefore a potential cause of elevated risk.

There is ample evidence that decoupling drivers from direct engagement with steering control can lead to both of these undesirable effects. Mary “Missy” Cummings, a professor and Director of the Mason Autonomy and Robotics Center at George Mason University and the former senior advisor for safety at the National Highway Traffic Safety Administration, has summed this up nicely. She states that “hands-free equals mind-free.” (<https://www.youtube.com/watch?v=Hz-kufFcE8E>). There is empirical support for this proposition from both experimental and real-world studies. In an experimental study on a driving simulator, Carsten at al. (2012) find that drivers were willing to engage in high levels of non-driving related activities, especially watching videos, in L2 highway driving. In a study of self-reported distraction activities by real-world drivers using SAE Level 2 driving assistance systems, Mueller et al. (2024) found that drivers with a hands-off system were substantially more likely to report engaging in various non-driving related activities and treating their systems as “self-driving” than drivers with a hands-on system that required continued active engagement with steering via shared haptic control. A third system that required hands-on driving supported by warnings to drivers when they removed both hands from the steering wheel also resulted in increased reports of non-driving related activities and was also treated as “self-driving”.

To prevent such effects, hands-off ADAS is entirely reliant for safe operation on the detection of driver inattention by the driver monitoring system (DMS). That means that the DMS must be 100% reliable with no misses in detection of any significant inattention, an impossible target. Even if inattention is detected, by the time a warning is issued and a driver responds to that warning, it may be too late. In many cases, a driver may only respond after a warning is escalated, resulting in even more delay (Mueller et al., 2021).

The removal of direct interaction with controlling the vehicle in hands-off Level 2 driving places drivers in supervisory control, required to watch closely for inappropriate actions of the system or for situations that the system is unable to handle. The driver is supposed to realise when an intervention is needed. There is a very large body of human factors literature on supervisory control; one major point from that literature is that it can be more onerous than direct control.

Therefore, hands-off driving should not be allowed on roads other than highways, and notably not in urban areas, which are comparatively more dynamic and where vulnerable road users are frequently encountered.

## System initiated manoeuvres

When a DCAS decides to make a lateral manoeuvre in urban driving such as steering around a parked vehicle or a turn onto a side road, a driver with their hands on the wheel will have the opportunity to override the manoeuvre by simply resisting the turning movement of the steering wheel. A driver who has their hands off the wheel will have no such immediate opportunity to override the vehicle’s action: they will instead have to realise from vestibular feedback or observation of an in-vehicle display what the vehicle is doing and when it has chosen to do it. In a situation that may well be time-critical, any opportunity for the driver to respond and override the vehicle’s action will be delayed. Therefore, lateral system-initiated manoeuvres on non-highway roads should only be allowed with hands-on driving.

However, longitudinal manoeuvres present very different challenges. Examples of such manoeuvres are:

* Entry into a roundabout
* Entry into an intersection from a minor road
* Restart when a traffic signal changes to green
* Handling of interaction at pedestrian (zebra) crossings

In such manoeuvres, drivers will only sense vehicle motion from longitudinal acceleration. There is little or no opportunity to override unless drivers already have their feet on the brake pedal and have very fast reaction times. Pure manual control would be far safer in these situations, i.e. the vehicle should require that the driver perform the manoeuvre. As such, these types of longitudinal manoeuvres should not be allowed to be initiated by the system.

# Recommendations

DCAS authority to initiate manoeuvres could be extended to non-highway driving environments. However, some protections to ensure safe driving need to be built in. A DCAS that operates on non-highway roads should:

1. Require the driver to be engaged in steering with hands on the wheel and preferably shared control;
2. Only perform system-initiated manoeuvres when these involve lateral motion;
3. Not have the authority to perform longitudinal manoeuvres, but rather require the driver to perform these manually.

# References

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