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Automated driving
Situations when a driver operates a vehicle from the outside of the vehicle

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This document is a discussion paper that addresses a number of issues related to situations when the driver is outside of the vehicle. The discussion takes into account both 1949 and 1968 Conventions on Road Traffic.

The driver out of the vehicle – discussion paper

Background

The role of the driver in traffic safety is paramount and continually evolves as motoring technology evolves (both increasing automation of the dynamic driving task[1], and connectivity). Although the 1949 Geneva and 1968 Vienna Conventions on Road Traffic are related to the role and obligations of the driver, neither convention specifies the location of the driver. Discussions in WP1 on remote-control parking functionality lead to the implicit conclusion that the Conventions do not prohibit a driver being located outside the vehicle if they remain able to control the vehicle. The location of the driver of a vehicle will continue to need careful consideration, especially as we see new technologies rapidly being developed and introduced. This discussion paper will propose that we can, within the current wording of the Geneva and Vienna Conventions on Road Traffic, encourage the development and deployment of new technologies, including ones where the driver is outside of the vehicle, with safeguards and requirements to benefit our citizens and road traffic safety.

Position of the driver

Throughout this discussion paper it is assumed and required that:

- The connectivity solution which enables dynamic control to be exercised remotely allows the driver to give appropriate and timely input to the vehicle and the vehicle to react to that input in an appropriate and timely manner.
- The combination of the remote driver and vehicle is able to exercise strategic[2] and dynamic control in a safe way as well as, or better than, a driver inside a vehicle.
- The connectivity solution and vehicle both meet appropriate technical standards and can be tested against these. These standards should include a minimum risk condition being automatically achieved if the connection between the remote driver and the vehicle fails or is degraded to the extent so as to prevent the remote driver carrying out their element of exercising control of the vehicle.
- As with a conventional driver, a remote driver has the appropriate capabilities and holds the necessary licenses. Various licenses may be needed depending on which remote functionality may be being used.

Remote control parking (driver assistance)

Current and developing technologies make it possible that in some situations the driver could be outside of the vehicle. In the 75th UNECE/WP 1 session, Contracting Parties to both the Geneva Convention and the Vienna Convention deemed that a remote-control parking device used by a driver outside of their vehicle "does not endanger road safety" provided that the system conforms with the UNECE technical regulations. Indeed, detailed work by the IGEAD could find no barrier to the use of remote-control parking functionality within the Conventions.

The remote-control parking function designed to be used by a driver outside of the vehicle is regulated by the work of WP.29. This is an example where the functionality meets the assumptions and requirements outlined above and WP1

[1] Definition from SAE J3016: The subtasks of the *DDT (dynamic driving task)* that include *monitoring the driving environment* (detecting, recognizing, and classifying objects and events and preparing to respond as needed) and executing an appropriate response to such objects and events (i.e., as needed to complete the *DDT* and/or *DDT fallback*).

[2] Strategic driving can include such tasks as, among others: rerouting of the vehicle; commanding the vehicle to perform a minimal risk manoeuvre; dispatching a rescue vehicle; and communicating with passengers.

deemed its use acceptable. If other remote systems have been demonstrated as meeting the assumptions above, and thus the road safety principles of the Road Traffic Conventions, it should be considered if they can be used safely.

Remote driving (conventional or driver assistance)

When driving a conventional vehicle or one with driver assistance features, the driver must be able to exercise strategic and dynamic control of the vehicle. The vehicle must be equipped with all the appropriate technical means to allow the driver to perform all necessary manoeuvres. Such technical means would include, for example, a steering wheel or joy-stick to exercise lateral control, acceleration and brake pedals to exercise longitudinal control, and appropriate fields of vision to provide situational awareness and a clear view of the road traffic environment.

Alternatively, if drivers have all the necessary technical means to overview or directly perform the driving task from a remote location as if they were situated in the conventional vehicle, and are still able to control the vehicle, they would be deemed to fulfil all requirements stemming from Article 8 of both the Geneva and Vienna Conventions on Road Traffic. For example, a camera on the vehicle linked to a display screen in the remote location would allow a clear view of the traffic environment, and a steering wheel and pedals linked wirelessly to actuators in the vehicle would enable lateral and longitudinal control.

A remote driver would, with reference to the Conventions, if not national law, be permitted to drive the vehicle if they:

- exercise dynamic control; and
- have an unrestricted view or such a view can be achieved by technical means.

If either of these two conditions are not met, then conventional drivers in a remote position will not be able to fulfil the requirements of Article 8 of the Geneva and Vienna Conventions on Road Traffic. Under these circumstances they would not be permitted to drive the vehicle on public roads.

Remote driving – automated vehicles

An automated driving system (ADS) would perform the object and event detection and response (OEDR)[3] and allow the driver to delegate dynamic control to their automated vehicle. A driver in the automated vehicle or a remote driver would still exercise the strategic driving task.

In automated vehicles where the driver is the fall-back ready user (in other words, they must be able to exercise dynamic control upon a takeover demand), the driver in a remote location is under the same requirements as the remote driver of conventional vehicle or one with driver assistance functions. It would not be appropriate for the remote driver to resume dynamic control of the vehicle if their view is not sufficient in combination with sufficient safeguards from the vehicle and connection itself.

If the ADS which does not require human fall back is only active for part of the journey because it is limited to a specified operational design domain (for example, in a motorway chauffeur ADS), the remote driver must be able to exercise dynamic and strategic control when the vehicle is operating outside of that domain. In such cases, they – much like the remote driver of a conventional or assisted vehicle - must:

- exercise dynamic control; and
- have an unrestricted view either by physical or by technical means.

In vehicles where the driver (in vehicle or remote) is not expected to respond to a system takeover demand, the driver's view is not a requirement while the ADS is active. The ADS would exercise dynamic control. Remotely *activated* parking functionalities may represent an example of such functionalities.

[3] http://jamichon.nl/jam_writings/1985_criticial_view.pdf

Other issues to consider

It is also important to consider latency and loss or degradation of connection when considering remote driving. If the latency becomes too great, the remote driver will no longer be able to give appropriate and timely input to the vehicle. And, the time lag caused by latency will become more important from a safety perspective, as speeds increase. The issue of loss or degradation of connection must be covered beforehand too, and this risk may be mitigated through backup connection systems. It is necessary to consider cybersecurity of the vehicle so as to prevent a malicious act.

This paper does not take into account other legal requirements (both national and international) like being able to identify yourself as the remote driver. This and other requirements will have to be fulfilled as well, although here again new connectivity technologies may provide new alternatives to meet the objective behind the requirement.

Conclusion

The Geneva and Vienna Conventions on Road Traffic do not prohibit remote drivers in the following situations:

i. A driver is outside the vehicle and they
   - have a clear direct view of the driving environment or they are provided with the same or better view indirectly by technical means; and
   - are able to exercise dynamic control.

ii. A driver is outside the vehicle and the ADS safely exercises dynamic control without the need for driver intervention. The driver must be able to activate and de-activate the automated driving system.

The construction requirements (for example, the UNECE regulations established by WP29 or national equivalents like the USA's Federal Motor Vehicle Safety Standards) applicable to remote control and automated systems should be consistent with the road safety principles of the Geneva and Vienna Conventions on Road Traffic. National laws may also need to be amended to enable the use of such remote functionalities.