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Remote activities related to driving

Remote activities related to driving

Submitted by Finland, Germany, and the United Kingdom

This document revises Informal document No. 7 (September 2023) which describes safety considerations for remote management of automated vehicles which do not require a human driver inside the vehicle. WP.1 is invited to discuss it.

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I. Introduction

1. WP.1 has been discussing situations when a driver operates a vehicle from the outside of the vehicle since its seventy-eight session in 2019. This paper follows and replaces two discrete papers on remote driving and remote management of automated vehicles, tabled as informal papers at the 86th session of WP.1 (Informal document No. 1/Rev.2 (September 2021) and Informal document No. 16).
2. The concept of remote activities in the context of road vehicles in traffic has led to the emergence of two widely discussed concepts. The first concept is that of Remote Driving, which refers to situations where a human located outside of a vehicle is driving that vehicle. This concept is distinct from both, conventional driving (where a human inside the vehicle is driving it) as well as automated driving (where an automated driving system is performing the dynamic driving task). Since the location of a driver is not explicitly defined in the 1949 and 1968 conventions, it is necessary to consider requirements for ensuring road traffic safety in the deployment of remote driving technologies.
3. The second concept is distinct from remote driving and specific to automated vehicles only and is known as Remote Monitoring and Assistance, referring to a provision to offer information or advice to an automated vehicle, in the event that an automated vehicle encounters a situation that it cannot manage. A common understanding of this topic can enable globally harmonised expectations on aspects related to road traffic safety.
4. Both concepts can be considered under the umbrella of Remote Management, referring to activities undertaken outside and beyond line of sight of the vehicle to manage the vehicle without a human driver inside it. Remote Management will be needed to support safety, ensure traffic flow and/or provide a means of communication with passengers. A common understanding of the requirements of remote management within UNECE would therefore help contracting parties as the technologies develop and commercialisation continues.
5. Remote operation of road vehicles is not strictly prohibited in the conventions on Road Traffic. Furthermore, amendment to Articles 8 and 34Bis of the 1968 Convention on Road Traffic enables deployment of vehicles in domestic road traffic without a human driver (subject to compliance with certain domestic and international legislation), which can require remote management. At first sight, an enforcement officer will not be able to differentiate a vehicle that is driven by an automated driving system from a vehicle that is remotely driven. It is therefore timely to develop guidelines on remote operations – covering monitoring as well as remote driving.
6. Use of automated vehicles in road traffic should fulfil the requirements set out in the 2018 resolution on the deployment of highly and fully automated vehicles in road traffic. So far, further guidelines have only been provided on the operation of automated vehicles which issue transition demands; in the 2022 resolution on safety considerations for activities other than driving undertaken by drivers when automated driving systems issuing transition demands exercise dynamic control.
7. Remote management brings a distinct set of opportunities and challenges to road traffic, their regulators, drivers and other road users. This paper seeks to explore the safety challenges posed by remote management to support its development and safe deployment in road traffic.

II. Scope

8. The scope of this paper covers remote management, which comprises of: 1) remote monitoring and assistance; and 2) remote driving. The scope of remote driving is limited to situations where dynamic control of the vehicle is performed remotely by a human driver (the remote driver). The scope of remote monitoring and assistance is limited to situations where dynamic control of the vehicle is performed by an automated driving system.
9. This paper explores the issues that should be considered to ensure road traffic safety in the context of remote management. We acknowledge that there may be difficulty in

separating the various forms of remote management. Roles may overlap and one remote management agent could perform more than one role. Therefore, it is not clear if it is helpful to define the forms of remote management.

10. However, there is a clear distinction between remote driving and the other forms of remote management in terms of roles and responsibilities. The remote management agent becomes a remote driver and takes on the associated responsibilities when they perform dynamic control. It should be clear that automated vehicles which require remote management may not require remote driving for safe operation. The principles covered in this paper on remote driving will also apply to situations where the vehicle is not automated.

11. It is possible that the vehicle or system manufacturers may allow only certain forms of remote management, meaning that some automated vehicles may not be equipped to be remotely driven.

III. Definitions

12. For the purpose of this paper:

(a) “Remote monitoring and assistance” refer to the provision of information or advice by a human located outside a vehicle driven by an automated driving system (ADS), as well as monitoring the location and status of vehicles.

(b) “Remote driving” refers to situations where a person outside a vehicle exercises all or part of the dynamic control of that vehicle. Where they do so, they are considered to be the driver of the vehicle.

(c) “Remote Management” is a top-level term which refers to both remote monitoring and assistance, and to remote driving of vehicles without a human with responsibility for driving or safe operation inside.

(d) “Remote management provider” refers to the entity responsible for the remote management operations.

(e) “Remote Agent” refers to the individual human acting on behalf of the remote management provider.

IV. Recommendations for remote management providers (companies)

13. Given the fact that international regulatory provisions and standards on various aspects of remote management are lacking, the safety of remote management operations mainly depends on how the remote operations are designed and managed by the remote management providers as well as any domestic provisions relating to their activities. The Remote Management Providers are responsible for managing the possible risks associated with the remote management activities that are required for safe deployment of vehicles without a human driver inside. It is essential that the remote management providers implement and maintain a set of organisational structures, accountabilities, policies, and procedures (safety management system) to perform their duties. Below there are key issues that the remote management providers need to cover in their safety management systems.

14. General Responsibilities

(a) Ensure adequate staffing and support and supervise the remote management agent to meet the requirements imposed on them set out in Part V below.

(b) Operate the system in accordance with the manufacturer’s instructions.

(c) Ensure the safety of remote management activities, including physical security of the operational locations for remote management.

15 Responsibilities and tasks regarding the work management of remote agents

(a) Ensure that the remote management agents have and maintain the physical and mental capabilities required to accomplish their duties safely. Approaches for preventing impairment by alcohol or drug use or other circumstances deeming the agents unfit to perform their duties should be established in the safety management system.

(b) Ensure that the physical detachment of the remote management agent from the vehicle does not result in a decreased sense of risk, urgency, or a lack of empathy and sensitivity towards the vehicle surroundings, its occupants, and other road users.

(c) Ensure that the attention of the remote management agent is managed safely, and that adequate breaks are built into their schedules.

(d) Ensure that the workload of the remote management agent is managed appropriately, including through the allocation of tasks.

(e) Ensure safe transfer of management between remote management agents, e.g., through planned and careful execution of transfers of control where handovers occur at break times and at the end of shifts.

(f) Have a clear identification of who is remotely managing the vehicle at any given time, particularly where remote driving may be undertaken.

16. Responsibilities regarding the training, qualifications, and adequate health of remote agents

(a) Ensure that all remote management agents are adequately trained (in compliance with domestic requirements where applicable) to undertake their role under the specific remote operating framework, deployment scenario and operating conditions.

(b) Ensure that remote management agents hold the appropriate qualifications. For example, a valid licence for the territory in which the vehicle will be deployed, particularly where remote driving may be undertaken, and have the means to demonstrate their qualifications to traffic authorities).

(c) Consider the appropriateness of health checks for remote management agents, where this is required by their role such as in remote driving, as is the case already for other workers performing safety critical functions.

17. Vehicle and Workstation Maintenance

Ensure the technology and machinery used are properly maintained.

18. Inclusivity and Accessibility

Address the diverse needs of vehicle occupants, including those who are disabled, by ensuring that the service is provided inclusively, in compliance with domestic accessibility requirements, and incorporating features on vehicles to mitigate the absence of staff providing direct assistance.

19. System Operation

(a) Ensure adequate communications networks connections and IT-security of their operations.

(b) Consider how to safely address system failures, including those relating to connectivity and connection to the remote management workstation, where applicable.

(c) Consider the need for a safety case which covers all envisioned deployment scenarios.

(d) Consider the need for a back-up connection system.

20. Remote Management Workstation

(a) Enable the remote management agent to adjust the workstation appropriately, to ensure it is comfortable and adapted to their needs.

(b) Have strategies to support the remote management agent such as limiting the effects of motion sickness, information overload and change blindness (where that remote management agent may fail to detect relatively large changes in visual scene), where applicable

(c) Ensure that the remote workstation supports the role of the remote management agent, e.g. by providing appropriate situational awareness and control over the vehicle for remote driving. Ensure that the remote management agent can perform their required role through an intuitive human machine interface.

(d) Minimize the effects of latency on safety of the remote management operations, and on the remote management agent.

21. Passenger Transport

(a) Ensure that the vehicles used have solutions for passengers to request emergency stops as well as regular stop requests.

(b) Provide the ability to properly communicate any unexpected events, including any remote management-agent-initiated trip interruptions, to avoid passenger confusion.

(c) Provide human-machine interface (HMI) solutions and protocols between passengers and remote management agents to support communication and interaction for both daily and emergency operation. These should be designed inclusively, including for people who cannot see a visual display screen or hear audible announcements, for people with limited dexterity or reach, and for those with impaired cognition.

(d) Prevent passengers from interfering with vehicle controls; except where subject to appropriate safeguards.

22. Data Recording and Communication

(a) Maintaining a record that enables verifying the events relating to remote management activities, including separating the activities of remote assistance and remote driving.

(b) Ensure that remote management agents can communicate clearly and effectively with relevant authorities including the police, where requested to or required by traffic rules in the jurisdiction of operation. This includes provision of the data described in point 'a' above, where required.

23. Responsibilities regarding the management of emergencies and incidents during operation

(a) Have procedures and facilities to deal with medical emergencies and crashes involving the remotely managed vehicle. For example, these incidents may require stopping, securing the vehicle, attending the injured, coordinating passenger emergency exit and on-board communication with dispatch and emergency crew. This should apply even when passengers are not in the remotely driven vehicle itself, for example in instances where the vehicle injures another road user.

(b) Establish procedures for appropriate cooperation with the relevant authorities, enforcement officers and first responders in cases of incidents. The Remote Management Provider should provide clear information to the authorities on how to contact Remote Management Agents on duty, and on how to handle vehicles when incidents occur.

(c) The Remote Management Provider should report safety incidents involving vehicles under remote management to the relevant authorities.

(d) The Remote Management Provider should make available to the relevant authorities the necessary data from their records to assist the authorities in investigating an incident.

V. Recommendations for remote management agents (individuals)

24. The role of a remote management agent enables the safe operation of vehicles without a human driver inside but poses new challenges. Further specific training is required to perform remote management including remote driving, either to maintain appropriate situational awareness and control when remote driving or to determine the appropriate course of actions when alerted to a traffic situation by an automated driving system.

25. Remote management *agents* should:

- Have and maintain the physical and mental capabilities to perform remote management in all applicable scenarios and those set in domestic legislation and rules (including the possibility of health checks and special licence for remote driving (if required in domestic legislation));
- Ensure that their physical detachment from the vehicle does not result in a decreased sense of risk, urgency, or a lack of empathy and sensitivity towards the vehicle surroundings, its occupants, and other road users;
- Hold the appropriate qualifications and training to operate and/or assist the vehicle, in the country where the vehicle is driven, and if required in domestic legislation, a special licence for remote driving where it is undertaken;
- Be ready and able to provide remote management when required, and where remote driving is undertaken, minimise any other activity that would restrict or impair their ability to take dynamic control.

26. To safeguard the transport of passengers or goods in a remotely managed vehicle, the remote management *agent* should:

- Be aware of any passengers and cargo inside the vehicle which they are managing and their status. This may include how many passengers and if any children are on board, and ensure it is a safe environment for them;
- Be adequately trained and able to communicate with passengers and provide support for those in need where the system does not;
- Be adequately trained and able to communicate with police and other authorities when necessary and the emergency services following an incident.

27. In addition, when remote driving, the *agent* should:

- Comply with all relevant road traffic rules such as ensuring that the vehicle speed and driving style are appropriate for the vehicle and its load, and the road and weather conditions (including visibility);
- Pay necessary attention to the difference in legal obligations and responsibilities between remote assistance and remote driving.

VI. Recommendations for manufacturers

28. To safeguard road safety, the developer or manufacturer of remote solutions regarding vehicles without a human driver inside should design the systems to:

- (a) Enable compliance with the recommendations set out in relevant parts of this paper and requirements set in domestic legislation and rules.
- (b) Minimize the effects of latency on the remote management agent.
- (c) Provide a human-machine interface between the remote management agent and the vehicle, based on a proper assessment of human needs and limitations, including enabling the necessary situational awareness.
- (d) Consider the need for mechanisms to monitor remote management agent attentiveness and performance of the dynamic driving task.

(e) Have sufficient capability to ensure road safety at all times, and if necessary, bring the vehicle to a safe condition without the need for human intervention. The safe condition which the vehicle reaches should be compatible with the safety case.

29. The manufacturer should furthermore:

- Consider the need for public and consumer awareness and understanding of remote management in vehicles without a responsible human inside, including the accurate depiction of the capabilities and limitations of the technology;
- Specify the requirements for safe operation of the system;
- Ensure appropriate software updates are made available to the system as required to maintain safety and security.

30. Specific to remote driving, the manufacturer or developer should additionally design the system to:

- Enable a competent remote driver to exercise safe dynamic control of the vehicle in road traffic;
- The responsibilities mentioned here and under part IV. should be clarified between the remote management provider and manufacturer when they are jointly responsible for safe operation.

VII. Recommendations for Contracting Parties to the Convention on Road Traffic done at Geneva on 19 September 1949, and the Convention on Road Traffic done at Vienna on 8 November 1968

31. Noting that further discussion and research is required in this area, contracting parties should:

(a) Consider how to ensure automated vehicles without a driver inside the vehicle will be subject to remote management.

(b) Establish appropriate means to identify the Remote management providers and the responsible persons. Licensing or notification processes could be considered, for example. Furthermore, the Contracting Parties should establish appropriate means to identify the vehicles for which each Remote Management Provider is responsible.

(c) Consider how the location of the remote management agent, and whether they physically operate inside or outside of the jurisdiction in which the vehicle is driven, will impact on the enforcement of traffic laws against those performing the dynamic driving task relative to agents who are not performing such a task.

(d) Establish requirements designed to ensure that the Remote Management Providers have the necessary resources, abilities, and competence to meet their obligations.

(e) Consider how *authorities* will be able to access information on the responsible remote management provider, including contact details and a means to communicate with the responsible agents without delay.

(f) Consider how *authorities* will be able to access information on the current health state of the remote driver (for example under the influence of alcohol or drugs, fatigue etc.) and how to control and enforce any applicable legal requirements.

(g) Consider the need for rules regarding the workload according to the different types of remote management. It may be appropriate for these rules to distinguish between an agent who provides monitoring and assistance, and an agent who is driving a vehicle remotely.

(h) Consider the need for clarity on responsibility for roadworthiness of the remotely managed vehicle.

- (i) Consider the need for domestic, or multinational legislation, regulation or guidance concerning the contents of this paper.
- (j) Consider the development and maintenance of state-of-the-art connectivity infrastructure to enable the reliable operation of remote management systems.
- (k) Consider means for ensuring remotely managed vehicles can be brought into a safe condition without any human intervention.

VIII. Final provisions

32. This paper will be periodically reviewed and updated to address technological and/or regulatory developments concerning remotely driven vehicles, and automated driving systems which require remote management.

References:

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