

WG2 conclusions/recommendations on road safety:

0) There is a common expectation that automated vehicles will be significantly safer than manually driven vehicles.

1) There is a strong need to assess performance of upcoming systems as regard to road safety, and especially to assess performance with the human driver in the loop. In that respect, level 3 Driving is a special challenge.

2) Tasks of the vehicles and the driver should be clarified and, if necessary, regulated in the relevant instruments (e.g. vehicle legislation, driving licence and traffic rules). This clarification requires a case-by-case analysis, depending on automated functions, driving environment, modalities through which automated systems receive and give back control from / to the driver, available minimum risk manoeuvres. This clarification probably requires a common classification of use cases, for which SAE classification is not sufficient. The relevant forum for this discussion is UNECE (WP1/WP29). Section 5 thereafter proposes first common principle for designing tasks allocation between the vehicle and the driver.

3) The vehicle shall be designed to ensure that the driver is active/aware if needed. The driver shall be made aware of the limits of the system.

4) Human Machine Interface (HMI) is very important for partially and highly automated vehicles, particularly in relation to the level of attention required for a safe operation of an automated function and for the safe transfer of control between vehicle and driver. Full harmonisation of HMI's doesn't seem to be the right approach. However, needs to limit heterogeneity of HMIs' functionalities ("look and like") for drivers among cars and when crossing borders has to be taken into account. A relevant balance has to be found between OEM's know-how and innovation on one hand, needs for reproducible behaviors based on HMIs on the other hand. With these safeguards in mind, there is probably a case for a certain level of standardisation of some HMI indications, so as to reduce the possibility of misunderstanding and confusion.

5) At this stage, prior to an in depth case-by-case analysis, some common principles guiding tasks of the driver/vehicle could be :

a) When operating under vehicle control (vehicle as the driver), vehicles shall obey all relevant safety-related regulations. This would include, for example, speed limits (fixed, variable and dynamic), access restrictions, lane restrictions, traffic signal instructions, road works regulations and restraint use. They would also, if operating in urban areas, have to comply with rules for zebra and other crossings.

b) The vehicle shall be designed so that it is clear to the person in the driving seat what is the operational capability (authority) of the automated mode or modes currently enabled. There

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¹ This is the first of Isaac Asimov's Three Laws of Robotics.

needs to be an HMI able to indicate to the driver, for example, who is responsible for decisions about changing lanes (vehicle or human).

d) The vehicle shall be capable of appropriate indication of its intentions in interactions with other road users, ~~when~~ never a human driver would be supposed to carry out this task.

e) Automation shall not be enabled on roads, in situations or in circumstances that it is not capable of handling. Traffic rules may need to be adapted for that. The vehicle shall therefore restrict the use of automation to road types, road layouts and road geometry that it can handle. It shall also recognise environmental degradations which prevent safe operation, such as reduced visibility. On encountering situations that it cannot handle, it shall attempt to hand over driving to the human.

f) The vehicle shall ascertain that the driver is ready to take over when a take over by the driver is required by the system. The vehicle shall ascertain driver availability, e.g. not being asleep, and shall ascertain that the driver is engaged, i.e. hands on the steering wheel, and has attention to the road and traffic situation.

g) If the vehicle determines that the human is not able or willing to resume control when required to do so, then the vehicle shall take appropriate action. Depending on the SAE level, the vehicle shall warn the driver and/or perform a minimum risk manoeuvre in which it secures as little danger as possible to the vehicle occupants and other road users.

h) There needs to be a means to verify compliance with rules derived from these principles.

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