**WG2 conclusions/recommendations on road safety:**

**1) As recently amended, the 1968 Vienna Convention seems sufficient for upcoming systems, but a way needs to be found to assess safety with the human driver in the loop. Level 3 Driving is a special challenge. Member States should confirm in UNECE if these provisions of the Vienna Convention include levels 3 or 4 as defined by the SAE as long as there is a driver responsible for the vehicle and so able to take the control of the car when needed.**

**2) Tasks of the vehicles and the driver shall be clarified/regulated in the relevant instruments (e.g. vehicle legislation, driving licence and traffic rules). This is to be discussed as soon as possible in the relevant groups in UNECE (WP1/WP29). The vehicle shall be designed to ensure that the driver will be active/aware if needed. The driver shall be made aware of the limits of the system.**

**3) 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. HMI concepts have to be validated in front of human behaviour diversity and shared between car makers.**

**4) The rules could be drafted around the following main principles:**

a) There is an expectation by the public that automated vehicles at SAE Levels 2 are safer than manually driven vehicles. At higher levels of automation (Levels 3 and 4), there will be an expectation of far higher safety, from public but also from car makers whose responsibility can be involved, in line with the principle that robots shall not cause injury to humans[2].

b) When operating under vehicle control (vehicle as the driver), vehicles shall respect smartly relevant regulations, without risk to disturb other vehicles and create safety risks. 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.

c) 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, with HMI able to indicate to the driver, for example, who is responsible for decisions about changing lanes (vehicle or human). There is a strong case for standardisation of HMI concepts among car makers, so as to reduce the possibility of misunderstanding and confusion.

d) The vehicle shall be capable to inform other road users of its automated mode, and to indicate its intentions in interactions with them. This would of course include using its indicators where a human driver should activate the indicators or sounding the horn to alert other road users, but may also involve other "gestures" or indications to replace those of the human if it is not expected that the driver is going 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.

[2] This is the first of Isaac Asimov's Three Laws of Robotics.

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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.

**5) There needs to be a means to assess safety and to verify compliance with rules derived from these principles, taking into account the high diversity of driving situations and human behaviour.**

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