

## **Proposal for amendment to informal document WP29-157-06 (Design principles for control systems of ADAS)**

### **I. Proposal**

*Paragraph 4.*, amend to read:

#### "4. Control Principles

The principles are divided into four sections:

- Control elements;
- Operational elements;
- Display elements and
- Supplementary elements.

We established a total of twelve principles. Each principle defines the ~~minimum~~ **recommended** requirements to be fulfilled for the HMI to allow the driver to easily and accurately understand and judge driving situations and effectively use the control system according to their intentions.

The sections on control ..." (remainder unchanged).

*Paragraph 4.2 (iv)*, amend to read:

"(iv) For systems that control the vehicle under critical driving situations, the initial set state of the system should be ON.

Explanation: For collision avoidance and/or mitigation, the first priority is to reduce trauma, therefore the system status ON should be maintained during driving ~~and should be clearly visible to the driver~~. However, accounting for driver preferences, the system can be equipped with a manual OFF switch. **In this case the system status should be recognizable to the driver.**"

*Paragraph 4.3 (vi) and (vii)*, amend to read:

"(vi) Drivers should be informed of the ~~conditions~~ **system status** when system operation is malfunctioning or ~~if~~ **when** there is a failure.

Explanation: When the system is malfunctioning or has failed, the driver should be informed of the system status. This is needed to avoid any misunderstanding by the driver that the system is still working.

(vii) Drivers should be informed ~~of the conditions~~ when system operation is ~~not guaranteed~~ **may be compromised by external conditions**.

Explanation: When the system is not fully functioning, for example, the sensor performance is impaired under certain driving conditions such as rain or when road markings are not visible, the driver should be informed of the status to allow a smooth transfer of control to the driver."

*Paragraph 4.4 (ix)*, amend to read:

(ix) In cases where systems automatically control the longitudinal and lateral behaviour of the vehicle, and the driver's task is to monitor system operations, appropriate arrangements should be considered to ~~ensure~~ **maintain** driver's **alertness with respect to** ~~continued monitoring of~~ the vehicle, road and traffic situation.

Explanation: When the driver is using highly automated systems such as ACC with LKS, which is the automation of longitudinal and lateral control, the driving tasks are reduced and the driver simply monitors the systems and surroundings. In these situations, it is important to ensure the driver's attention to the driving task is maintained. To ensure that the driver stays aware of the driving situation, appropriate measures should be considered to keep the driver in-the-loop."

Paragraph 4.4. (xii), amend to read:

- (xii) System actions **requiring the attention of other road users** should be ~~displayed~~ **signalized** to other road users.

Explanation: To help surrounding road users, such as other drivers, pedestrians, and cyclists, be aware of vehicle actions, the system's actions should be displayed when braking, changing lanes or for hazards. In consideration of the system functions and driving situation, the need for display might be determined on a case-by-case basis."

Paragraph 5., amend to read:

"5. Summary

ADAS control systems are still being developed and various new systems will emerge in the future. For the development of technologies, it is important to continuously improve the safety and user-friendliness of these systems for the average driver. If a negative effect is felt, these systems may lose credibility among the general public and subsequent development may be hindered. To prevent such an event and to encourage proper development of the systems, it is important to define the principles to be followed as a basic guideline.

These principles are limited to the ~~minimum requirements~~ **main recommendations considered to be** of critical importance.

However, systems that arrive on the market in the future may require guidance for aspects that are not covered. Changes over time may also make some of the principles obsolete or unnecessary. The present principles must therefore be revised as appropriate, and this task should be assigned to the ITS Informal Group (**in some cases in consultation with the respective GR group that may govern a specific system in question**), since the present principles deal with ADAS in general and not with specific systems.

As a future process, the UNECE WP.29 ITS Informal Group and other relevant working groups in the UNECE WP.29 will engage in comprehensive discussions on a mechanism that will ensure effective implementation of the control system principles. As the timeline, we plan to prepare a draft in 2011 to 2012, examine it at each GR in 2012, and prepare a revision for discussion at the WP.29 in 2013."

Annex, paragraph A1, amend to read:

"A1 Introduction

Automated control systems are becoming more common in new road vehicles. In general, automation is designed to assist with mechanical or electrical accomplishment of tasks (Wickens & Hollands, 2000). It involves actively selecting and transforming information, making decisions, and/or controlling processes (Lee & See, 2004). Automated vehicle control systems are intended to improve safety (crash avoidance and mitigation), comfort (decrease of driver's workload; improved driving comfort), traffic efficiency (road capacity usage; reduced congestion), and the environment (decreased traffic noise; reduced fuel consumption).

The automation of basic control functions (e.g., automatic transmission, anti-lock brakes and electronic stability control) has proven very effective, but the safety implications of more advanced systems **may be less known** ~~are uncertain in some cases (e.g., adaptive cruise control and lane keeping assistance)~~.

It is controversial that system safety will always be enhanced by allocating functions to automatic devices rather than to the drivers. ~~Of particular~~ **A potential concern is may be** the out-of-loop performance problems that have been widely documented as a potential negative consequence of automation (e.g., Weiner & Curry, 1980).

Advanced Driver Assistance Systems (ADAS) use sensors ..." (remainder unchanged).

*Annex, paragraph A3, fourth subparagraph, amend to read:*

"A3 Driver-In-The-Loop

The notion of driver-in-the-loop ...

...

Automation may be to likelihood for causation of out of the loop. ~~An example of an ADAS that could potentially remove the driver from the loop is Adaptive Cruise Control (ACC), which automatically adjusts the vehicle's speed to maintain a set distance to the vehicle in front. A tendency to over rely on the ACC function may lead to drivers becoming passive observers and losing a portion of their normal awareness of the driving situation. On the contrary, there is another view that ACC requires steering operation and that keeps driver in the loop.~~

A circumstance where ADAS ..." (remainder unchanged).

## II. Justification

### Paragraph 4

Some principles are rather far-reaching in their original wording. Therefore they may hinder the development of ADAS without any safety benefit. In individual cases it may be more reasonable to deviate from a principle than to follow it perfectly. To allow a justified flexibility, the principles should be understood as recommended practice and not as minimum legal requirements.

### Paragraph 4.2 (iv)

As the driver expects status ON as default for such systems, it brings no benefit to confirm his expectations by indicating status ON. Even the principle itself does not require this. In order to reduce driver's workload it could be more reasonable to indicate the OFF status only.

### Paragraph 4.3 (vi)

Informing the driver of the conditions causing system malfunction or failure does not seem to be warranted. For the driver, it is only important to know that the system is not available, rather than why.

### Paragraph 4.3 (vii)

Similar to item (vi) above, informing the driver of the conditions (causes) potentially causing the system not to operate properly does not seem to be warranted. The cause of the sensor's impairment is not always reliably detectable. In the case of the system limits being exceeded, the causing constellation may be rather complex. Therefore the driver should only be informed that there is an impairment of the system and that he should not/cannot use it.

The operation of ADAS can never be "guaranteed", as every ADAS has intrinsic performance limits beyond impaired sensor performance. Applying this principle would therefore lead to a permanent warning. Therefore such a warning should only be provided, when external conditions are detected, which are known as problematic for the sensor(s).

### Paragraph 4.4 (ix)

"Monitoring" implies not only "looking at" but also "processing the input". It is technically not possible to verify, that the driver is always tracking the traffic situation. Also in vehicles without ADAS drivers continued monitoring cannot be "ensured". Therefore vehicle manufacturers can only implement a system design, which does not try to hide the intrinsic system limits, so that the driver is not lulled into a false sense of safety and keeps alert.

### Paragraph 4.4. (xii)

To avoid distraction of the other road users, only such actions that require attention should be signaled ("displayed" may be not the right word), e.g. a system action performing speed reduction by throttling the fuel supply (not braking) needs not to be signaled, as such a vehicle behavior is very usual and has to be always expected by other road users.

Paragraph 5.

As already described in the introduction of chapter 4 these principles are not really minimum requirements that can be applied without exceptions. The final wording should express, that the principles can be no more than recommended practices.

Annex, paragraph A1, 2<sup>nd</sup> subparagraph

This statement, especially in conjunction with the cited systems, is a very negative view. As an example, investigations of the need for spare parts of the front structure have shown, that vehicles with ACC have significantly less structural damages in the front than vehicles without ACC.

Annex, paragraph A1, 3<sup>rd</sup> subparagraph

This statement indicates a generally negative attitude towards new technologies (many of which are actually not new at all!), especially based on a 1980 study (more than 30 years ago!). Very recent studies (EuroNCAP and IIHS) identified the significant accident avoidance potential. Past experience (ABS, ESC, etc.) has never been able to offer any real world evidence for the concerns expressed here. Therefore, the statements need to be much more carefully worded.

Annex, paragraph A3, 4<sup>th</sup> subparagraph

The whole last paragraph on ACC should be deleted from a guideline with scientific claim, because it is only a tendentious juxtaposition of unproven, hypothetical assumptions. Moreover, the last sentence clearly indicates that the statements lack scientific evidence. The reality shows that vehicles with ACC are involved in fewer rear-end collisions.

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