Remained questions with regard to the presentation of the L2H-off research project by fka GmbH with Institute for Automotive Engineering (ika) of RWTH Aachen University, Chair of Ergonomics (LfE) of the Technical University of Munich and fka SV Inc., **consolidated after presentation in the TF ADAS #17, January 2023**

Question 1: Which of below standing questions can be considered as most applicable?

1. **Is H-off equally safe as H-on?**
2. **Under which circumstances is H-off equally good (safe) as H-on?**

Answer: As question 1 cannot be univocally answered by a single experimental undertaking, the project targets rather question 2. The goal was to identify design criteria that address foreseeable adverse driver behavior when monitoring the driver's attention by analyzing glance behavior instead of the contact to the steering wheel. The functions that were directly compared to each other in the studies were thus implemented following specific state-of-the-art designs, regarding, e.g., HMI or driver monitoring criteria.

Question 2: The tests have been executed under highway conditions only?

Answer: Yes, only highway scenarios have been considered in accordance with the operational design domain (ODD) of current L2H-off functions.

Question 3: The project goal was 'to generate a reliable set of data, information and knowledge by combination of different methods to derive recommendations for L2H-off in order to address challenges and questions that have been raised regarding the use of L2H-off functions'. **What were these actual recommendations (not taking into account the conclusions on the five CQs)?**

Comment: The recommendations derived from the data collections have been aggregated in a guideline document as part of the project documentation and can be shared by VDA.

Question 4: Which requirements have been set for head/eye/gaze-tracking DMS and how were those derived?

Answer: The requirements were derived from the first three subprojects, in which DMS employed in published research, series-production vehicles and prototypes were analyzed. Derived criteria for camera-based DMS with the corresponding areas of interest (AOI) and the timing of alerts were further discussed within the project team, with VDA members and the scientific advisory board. The goal was to reliably identify relevant driver behavior (defined by gaze duration and orientation to AOIs and hand position relatively to the steering wheel).

Question 5: What DMS technology was used?

Answer: All DMS in the field tests were subject to the manufacturers' design. For the simulator studies, different implementations of DMS were used:
For L2H-off systems, prototypical camera-based DMS were designed using either state-of-the-art remote (Study 1) or head-mounted eye-tracking systems in combination with an additional camera tracking driver's head orientation (Study 2-4). Eye-tracking systems used IR cameras while the head orientation detection was based on a single RGB camera.

Simulated L2H-on systems worked with (series-production) touch-sensitive steering wheels using capacitive sensors.

Question 6: The amount of driver engagement systems to-date is rather limited. **Could one confirm the used DMS warning strategy to detect driver distraction?**

Answer: The DMS of L2H-off functions in the project targeted visual attention attributed to driving relevant AOIs. Data show that activities withdrawing visual resources from driving-relevant areas of interest were detected within the boundary conditions set for the DMS and drivers alerted accordingly.

Question 7: To assess mode confusion, why didn't the researchers compare H-off DCAS with ALKS, to ensure that drivers clearly understand the difference between DCAS and ADS?

Answer: The implementation of (any) ALKS and DCAS within one vehicle with frequent mode changes between L3 and L2 was considered a currently theoretical question (amongst others as no series-production ALKS function was available at the beginning of the project). The question whether changes between L0 (manual), L1 and L2 driving as well as changing between L2H-on and L2H-off functions elicit changes in driver behavior is however a current question arising from today's implementations and was thus addressed in the project.

Question 8: What was the difference between the behavior of the drivers with and without L2 experience?

Answer: We directly compared drivers with and without prior (ACC or L2H-on) experience in one of the four studies for a subsample of German drivers (Study 4: Anchor Study). Acceptance of L2 functions and system understanding was higher for experienced ADAS users compared to novice users. Behavioral differences between experienced and novice users, regarding, e.g., visual attention to the road or intervention times, were either non-existent or small.

Question 9: Any effects of demographics, experience, familiarity, and trust in automation on the drivers' behavior?

Answer: Apart from Study 4 (see above), driver characteristics were not in the primary focus of the analyses conducted. In most studies, demographics and attitudes towards ADAS were documented solely to be able to provide additional explanations and to control for potential differences between automation groups or ensure a sufficiently diverse sample.

Question 10: Was there any scenario where the same participants participated?

Answer: No participant was allowed to partake in more than one study of the project (with the exception of providing answers on current L2 use in the online survey and participating in the anchor study (Study 4) afterwards). However, each study included more than one scenario of interest. Thus, the same participants provided data for the scenarios tested within one study.

Question 11: If so, did you find any 'learning effect' or 'less attentiveness due to more familiarity and building up trust during the experiment'?

Answer: For predictable intervention needs (scenario: lane end), drivers showed learning effects and partly explained earlier/later interventions in repeated situations of use with their available knowledge of system behavior. To avoid influences of time-of-use on non-predictable scenarios, the order of conditions was balanced over participants where feasible.

Question 12: To what extend can it be guaranteed there was no participants' bias in terms of trust, experience and familiarity when comparing H-off and H-on?

Answer: Prior ADAS experience (or familiarity with similar systems) and other driver characteristics were part of the screening procedure and thus being controlled for during the recruiting process to reduce potential differences between L2 groups. Other potentially relevant attitudes such as technical affinity were compared post-hoc to estimate or rule out their influence on results.

Question 13: Did the researchers observe any difference in understanding of the driver's H-off role between more and less experienced L2 drivers? I.e. did one observe a certain learning effect?

Answer: In the experimental study targeting driver characteristics (Study 4), driver role and system understanding were high in both experience groups albeit descriptive differences. The online survey revealed descriptive tendencies for a slight decrease in (subjective) monitoring effort with increased experience, lesser contact to the steering wheel (for both l2 groups) and higher trust in the functions. In the FOT data, ratings indicated small changes in system understanding regarding lateral support between first contact and later use for L2H-on users.

Question 14: What info was given to the participants? Were they e.g. notified about the aim of study (hands off, minds off)? Knowing one is being monitored for a specific reason can affect a participant's behaviour.

Answer: Participants were <u>not</u> informed about the specific challenges and questions behind each study, but only about the general study context (L2 driver assistance, i.e., a combination of longitudinal and lateral assistance). Informational and instructional material made sure not to bias participants towards expected behavior or opinions. In owner's manual-like information booklets (based on the current state of the art), all participants were informed about the assistance's capabilities including the general DMS functionality and the driver's general responsibility to supervise the system as well as the surrounding traffic**.**

Question 15: The tests in the CQ2 study were conducted in scenarios with sufficient margins, such as obstacles to be avoided being visible to the driver with sufficient margin and no other vehicles in the adjacent lanes, but we expect the difference between hands-off and hands-on to occur in more urgent scenarios. **What are your thoughts on evaluating the situation in a more urgent scenario?** Do you plan to conduct additional surveys in the future?

Answer: Scenarios with different timings / urgencies have been implemented in the studies and revealed similar tendencies for the comparison of L2 functions (see similar questions below). Immediate, non-predictable intervention needs have further already been part of prior research (Josten, Zlocki & Eckstein, 2016), albeit with non-adapted DMS for L2H-off functions.

Question 16: It is difficult to understand why this conclusion on P89 was drawn from this presentation alone, although a summary of the survey results is provided there. **If you have any papers on which you based this presentation material, please share them with us**.

Answer: The exemplary design guidance presented on Slide 89 is a result of discussions and definitions of the project, e.g., the definition of attention as used within the project's context. It is therefore not a conclusion drawn directly from the project results and has to be considered as one aspect within the complete guidance document (not included in January's presentation).

Question 17: Page 9: In the simulator studies, they were conducted by the different participant groups. **What is the reason why both L2H-on and L2H-off tests were not conducted by the same participants?**

Answer: As detailed above, learning effects/expectation effects need to be avoided, making it difficult to find a trade-off between considering a sufficient amount of different test scenarios with a sufficiently large sample and a feasible duration of testing per participant. Complementary to a careful sample selection process, our decision was to make use of the advantages of a between-sample design to compare L2H-on and L2H-off.

Question 18: Page 12: **Why any other vehicles did not appear in the adjacent lane in Cut-out, Road works and Lane end of the scenarios?** It is considered normal that some other vehicles are running in the adjacent lane when the ego-vehicle changes the lane in the actual traffic situation. So, it is considered that the tasks were easier for the participants compared to the actual traffic situations.

Answer: Our focus was to measure whether and at which point in time drivers became aware of the need to intervene. We did not want surrounding traffic to interfere with their (observable) decision to intervene and change lanes. Therefore, we timed surrounding traffic accordingly.

Question 19: Page 12: It is considered that occurring an unexpected system failure (the system cannot continue steering control any more) during the vehicle running on a curve is one of the most severe case for the driver who is using L2H-off because the angle of the steering wheel might return to the neutral position immediately. **Why such kind of the most severe case was not conducted?**

Answer: The project focused on driver-system-interaction in normal conditions of operation and, more specifically, on potential differences between monitoring the driver´s attention by analyzing gaze direction versus hand position. Furthermore, the failure type/occurrence is subject to the specific technical solution implemented by the OEM. Thus, failure-specific controllability was not investigated.

Question 20: Page 13: **What is the reason that the different test routes were used between L2H-on and L2H-off in FOT DE?**

Answer: The defined test route for the L2H-on group was only used for familiarization with the vehicle, not for collecting data for analysis. After familiarization, participants of the L2H-on group took the vehicle home for free use during their one week of participation in the FOT. For all L2H-off vehicles, due to their prototypical status in Germany, a defined test route was agreed upon, which each participant in the FOT drove once accompanied by a safety driver, either with or without prior experience with a L2H-on vehicle.

Question 21: Page 15: **What is the reason why NDRT which is not allowed for L2 system was conducted?** If my understanding is correct, NDRT during the tests had big influences to the test result (ex. reaction time, proportion of Eyes on road, the number of warning). It is considered that the test cases without NDRT were also necessary in order to avoid mistaking the fact.

Answer: NDRT were offered to participants only in some, but not all data collections of the project. The project results thus also cover cases without secondary task engagement. Offering (visual) NDRT in addition to ensuring ideal conditions of use without any distraction present provided the opportunity to challenge the prototypical DMS.

In accordance with the ESoP, the NDRT in our studies were designed to allow for a combination with the monitoring and driving task: The tasks were well interruptible, voluntary and positioned in line with according standards.

Question 22: Page 26: I can understand that there is no significant difference of intervention timing between L2H-on and L2H-off. On the other hand, just after the driver intervenes, whether the driver can conduct appropriate interaction with other traffic is also important. **Could you show such kind of data?**

Answer: We analyzed the success of the driver intervention (in terms of lane departures or collisions with objects and surrounding traffic) as well as metrics to conclude on the quality of the intervention. The interaction with other traffic participants was considered in the FOT data, whereas the handling of different driving maneuvers was in the focus of the driving simulator studies. For results, see slides 76 to 85.

Question 23: Page 49: The left side figure (FOT DE) shows that L2H-off users have their hands on the steering wheel on average approximately 45%. **Does it mean that L2H-off users don't fully rely on L2H-off system?**

Answer: In general, taking the hands off the steering wheel constitutes an option which the driver may make use of – why he or she sometimes doesn't take the hands off the steering wheel has not been explicitly investigated, and may have different reasons. A certain percentage of hands-on wheel during L2H-off use might indicate an awareness of situations of use where system behavior cannot be predicted without prior experience. Hands-on wheel during L2H-off use can thus not be interpreted only in terms of reliance.

As literature and our online survey show, the hands-off percentage can be expected to increase with prolonged use of the system. Furthermore, also users of L2H-on systems tend to take their hands off the wheel as shown by, e.g., our online survey.

Question 24: What is the consideration/prerequisite regarding the ODD where L2H-off function could be made available? What would define its ODD for L2H-off?

Answer: Next to the necessity to monitor the driver, discussions within the project determined the need for an ODD monitoring. This means that L2H-off functions should monitor and evaluate whether the function is going to be able to cope with the upcoming driving task within the defined ODD or at its boundaries.

If the ODD monitoring predicts a mismatch between requirements of the driving task and the capabilities of the function, the function needs to change its behavior (e.g. reduce speed before an upcoming curve) or ask the driver to take direct control before switching off.

The ODD definition has been based on available L2H-on and L2H-off functions, designed to operate only on defined sets of divided highways. Merge lanes, on and off ramps were excluded from the ODD as a simplification made for investigations of driver behavior in the project context.

Question 25: The condition enabling a L2H-off operation may change over the time while driving. Weather condition, change, occasional partial occlusion of perception sub-system of the ADAS, combination of minor system degradation which would require driver intervention are just examples that may trigger the system L2H-off deactivation besides the listed transition scenario. These changes in the system availability boundary are not necessarily perceivable by the driver. as leaving its “ODD”. **How these concerns are covered in this study and where are the guidance around the fluctuating boundary that may occur in real world operation.**

Answer: Our online survey confirmed existing findings that many of today’s L2 users are not aware of ODD limitations and did not read the owner’s manual. In our experiments, the use of non-predictable (occluded) scenarios targeted the drivers capabilities to intervene when becoming aware of the need to do so, e.g., because lane position is no longer adequate, similar to erroneous system behavior outside the ODD. Guidance on system design, as an outcome of the project, recommends the necessity for the function to monitor the ODD and take appropriate measures.

Question 26: Issues on non-attentive driver missing warning traffic warning signs while engaged in L2H-off might also be another topic unclear from this presentation. **Driver may go missing warning traffic sign (described as signage in the presentation) under L2H-off but is there any study around such risk.** Traffic sing along a road may be well missed under L2H-off if driver occasionally deviates his attention to a NDRA no matter whether permitted or not. **Are there any results coming from this study?**

Answer: The detection of warning signs (being a subject to monitoring quality) is supposedly not the most critical point in this regard as drivers in interaction with L2 would need to decide whether the function’s behavior is adequate for the situation at hand and whether they would need to intervene or increased attention to the road would be sufficient. Next to scenarios comparing the effect of predictable and unpredictable intervention needs (relating to detection of signs; see Slide 12), study 1 and 3 required drivers to detect a failure of the function to adapt to a new speed limit. For this, drivers needed to perceive the new speed limit and subsequently the missing adaptation of the function and decide whether or not to overrule the function. There was no clear difference between L2H-on and L2H-off in the number of corrective actions and some participants did not react at all, which might either be due to the detection of the sign or the subjectively low criticality of the non-adapted driving behavior of the function.

Question 27: There is an important question regarding the conclusions that one can draw from the research. In most scenarios the amount of time before a collision is larger than what is considered to be a conflict in relevant traffic safety studies (TTC can be as low as 1.5s) and the TTC when active safety features activate (also around 1.5s or even lower). The researchers in the discussion have explained that the scenarios tested are indeed safety critical. However, it is better for the group, to have this explanation in writing. **If the researchers can provide additional information regarding the criticality of the situations, supporting the claim that indeed the conditions are safety critical, that would be a valuable addition.** Otherwise, there is a risk of improper generalization of the findings in critical situations.

Answer: Depending on the study, the available time budget for the driver after the situation has been revealed (i.e., visual perception of the obstacle became possible, but no warning was given) ranges between 5 and 6 seconds for the scenarios “cut-out” (study 1-3), “roadworks” (study 1, 3) and “traffic jam” (study 2). If drivers did not react based solely on visual input, FDCRs (a visual and acoustic signal) in study 3 were issued 2.7 s before collision. In study 1, a braking maneuver was initiated 36 m before the roadworks at 80 km/h or 95 m before collision at 120 km/h if the driver had not intervened by then.

The “lane drift” scenario (study 4; silent failure) left either 3.5 or 6.3 s for the driver to recognize the erroneous system behavior from failure onset until the lane marking to the hard shoulder was crossed.

In Study 1, 17 out of 19 participants in each group, including the manual driving group, did not react in the cut-out scenario before the braking maneuver was triggered. Only slightly lower values of system-initiated braking maneuvers were observed in the roadworks scenario of this study. Given the fact that participants of the simulator studies were not always able to avoid an accident in the scenarios tested logically means that those scenarios obviously have been safety critical.

Question 28: When simulating a failure in which the vehicle drifted outside of the lane, was there also a movement in the steering wheel of the vehicle? In this case, there should be feedback from the simulation software to the steering wheel. If that is the case, the human driver would have an additional source of stimuli in case of hands-on driver, as they could feel the steering wheel turning during the failure. How can other stimuli influence reaction time and handling precisions?

Answer: The drift was designed in a continuous, jerk-free manner to enable a valid investigation of handling performance in this scenario in the static driving simulator used. There was movement of the steering wheel, but the change was continuous and very slow, thus not drawing attention to the erroneous steering behavior. Nonetheless, no benefit for L2H-on functions was observed, so the motion of the steering wheel was not sufficient to serve as an additional cue.

Question 29: In the Hoff FOT in Germany there was a safety driver. Which I fully understand. But there was none in Hon. **May this have had an influence?**

Answer: Instructions (e.g., no communication with the safety driver) were provided before the drive to reduce the influence of the safety driver on driver behavior. Nonetheless, participants indicated a higher influence of the setting on their behavior with the safety driver present. Although the direct comparison between L2H-on and L2H-off functions was not the primary goal of the FOT and comparisons targeted different phases of use (L2 use with and without familiarization, comparisons within and between subjects), direct comparisons regarding NDRT use and monitoring behavior between L2H-on and L2H-off need to consider the experimental setting.

Question 30: How was the performance of the voluntary NDRT and how was this distributed over the participants / conditions.

Answer: Relevant for analysis was whether drivers interacted with the NDRT or not, whereas (individual) performance in the secondary task was not of primary interest. However, listed below are values for secondary task completion in two studies between conditions:

- Study 1: 63.05% (SD = 9.76) tasks completed in the L2H-off group, 71.10% (SD = 9.80) in the L2H-on group and 62.35% (SD = 9.41) in the manual driving group.
- Study 4: 74.73% tasks completed (SD = 21.9) in the L2H-off group and 78.44% tasks completed in the L2H-on group (SD = 15.19).

Question 31: Was the earlier intervention in HOff due to a better visual presence (thank to DMS) or may be because of a feeling of a lack of controlability - with hands off the road - that urged driver to react faster? And have you checked side mirror control?

Answer: Comparing hands-on times and intervention times in the L2H-off group of Study 1, it can be observed that L2H-off users established contact to the steering wheel based on roadworks signs on average 5.73 s before the blocked lane became fully visible. Interventions followed later, on average 0.91 s after the lane became fully visible. The difference between preparing for intervention (i.e., establishing the same level of control as in L2H-on condition) and the intervention itself speaks rather for a positive effect of visual anticipation.

Gaze paths (e.g., side mirror glances before lane change) have not been analyzed in the scenarios due to time available for data analysis and the low level of surrounding traffic realized in the lane change scenarios.

Question 32: If my understanding is correct, average reaction time is around 10s or more. It means this scenario is not emergent situation. I think reaction difference between hands-on and off will occur more emergent situation. **Why you select such relax situation.**

Answer: A variety of scenarios was selected for investigation (see answers to similar questions above). This specific non-occluded and predictable scenario was implemented to compare the behavior of experienced and novice users facing a potential system limit. The aim was to analyze system understanding, potential preparatory actions such as hand posture changes or NDRT engagement and potential effects of different amounts of attention attributed to the road. Intervention times in themselves are not considered an insightful metric for this scenario.

Question 33: Slide 15 or 17 or 18. **How the driving time before the event was determined?** 7 min driving before the event is rather short. We (JRC) found in the literature that the hand-off driving time has an influence on the reaction time just above 30-40 min (I'm not sure what kind of DMS they used in that study). **What could be the effect of the hands-off driving time before the event on the reaction time and controllability?**

Answer: The overall average time of use of the L2 function within the studies was mostly well above 30 minutes in addition to a familiarization drive of about 10 minutes. The important point for the study design was to provide an immersive setting and allow users to rely on the function before the first intervention scenario. In some studies, conditions were furthermore counterbalanced to reduce effects of time-on-task on results for specific scenarios. Higher reliance might potentially reduce monitoring behavior and increase intervention times. Relative comparisons between L2 designs remain valid, although the time of use within the studies was overall rather short (i.e., indicative for first contact scenarios).

Question 34: Slide 30: **Why early intervention depends on hand status?**

Answer: The timing of interventions is not attributed to hand status, but to DMS type. With a DMS enforcing visual attention to the road, earlier lane changes can only be observed when the scenario is occluded, but predictable. Without the possibility to visually anticipate the intervention, i.e., when visual attention to the road is not beneficial to prepare for the upcoming, occluded need for intervention, no difference between L2 groups can be observed.

Question 35: In case of lane change scenarios (cut-out, Roadworks, Lane end) just after the transition, in the actual traffic scene, some other vehicles might approach in the target lane, and the driver has to avoid a collision with the other traffic. **Do you have some additional data which evaluates driving performance just after the transition?**

Answer: In addition to lane departures and collisions, we analyzed metrics for the quality of driver interventions such as the minimum lateral distances to obstacles or resulting (maximum) lateral accelerations (to be interpreted in the static driving simulator solely as a relative indicator of driver input). Lateral accelerations in the predictable, non-occluded roadworks scenario (Study 4) fluctuated with intervention times. In Study 1, lateral accelerations in the roadworks scenario were significantly higher for the L2H-on group compared to the L2H-off and manual driving group.

Question 36: I also have a question related to Study 3. According to the last slide, it was a study without automatic braking maneuver to avoid crash, and including a last warning issued 2.7s before collision with obstacle (FDCR). **How often was a FDCR issued by group (L2 Hands on / Hands off)? Were there crashes and if so how many crashes were there by group (L2 Hands on vs. L2 Hands-off)?**

Answer:

FDCR issued per group in the cut-out scenario of Study 3:
L2H-on: n = 7; L2H-off 5 s: n = 4; L2H-off 3 s: n = 8
Collisions observed per group in the cut-out scenario of Study 3:
L2H-on: n = 1; L2H-off 5 s: n = 3; L2H-off 3 s: n = 2

Question 37: Brief methods question regarding the FOT in Germany: was the predefined route used for L2H-off a familiar or an unfamiliar route for the participants? And the same question for the L2H-on route? Was that a familiar or an unfamiliar route to the participants? (as I understood this route was self-chosen?)

Answer: As participants partaking in the FOT were recruited from the Munich area, it can be assumed that they did not drive on (parts of) the selected route for the first time. However, both L2H-off groups (with or without prior L2H-on in the FOT) only drove the predefined route once with a test vehicle in the FOT. Speaking in terms of system use, the route was unfamiliar to participants.
The L2H-on routes were self-chosen by the participants within the constraints that they needed to cover sufficient distances on highways after gathering defined levels of L2 experience.

Additional questions, e.g., questions outside the project's scope, answered by the project report / guideline document or answered elsewhere in this Q&A document

Question: Suggestion to perform a statistical 'power analysis' to grasp the 'false negative', i.e. to indicate the probability of non-observed effects in the test sample that however do exist in reality (if any).

Question: How do these requirements relate to those set in the EU on ADDW (via the GSR)? I.e., would the anticipated ADDW for market application suffice as H-off DMS?

Question: Do the researchers believe the requirements used for the head/eye/gaze-tracking DMS can be further improved? If so, how?

Question: Regarding the HMI for H-off DCAS: can the study demonstrate that the driver unmistakably understands that H-off DCAS is ADAS and not an ADS such as ALKS, even without the warnings of the head/eye/glaze-tracking DMS?

Question: The study focusses on a relative comparison between:
o H-off + head/eye/gaze tracking with a first inattention warning of 3-5 sec and
o H-on + hands-off detection via a capacitive steering wheel with a first hands-off warning of 15 sec
What would have been the comparison results if the first hands-off warning of H-on would reduce to - for example - 3-5 sec? Or more extremely: what if H-on were to be equipped with the same head/eye/gaze tracking system as H-off rather than a capacitive steering wheel?

Question: Similarly as with ADS vehicles: how to ensure that e.g. the police is able to determine a vehicle is equipped with H-off ADAS, in case a driver is indeed driving without hands on the steering wheel?

Question: Are accident statistics available from the US and Japanese market on H-off ADAS systems?

Question: How do the results, in general, relate to the existing literature and studies?

Question: Although this survey does not include analysis of accident data in the market, accident data analysis is an effective evaluation method for safety systems. We can find similar accident data for AEBS. We think it is important to analyze accidents, including a comparison of hands-off and hands-on ADAS systems, many of which are already on the market in the US, China, and Japan. What do you think about the importance of such a study, and do you have plans to conduct additional studies in the future?

Question: There are many roads or road segment where shoulder lane is not available for any possible safe MRM hard stop. MRM activated in location with no shoulder lane, (e.g., over narrow bridge, tunnel, at curvy road) could create high risk of rear-end collision if not traffic congestion and should be avoided from social perspective even if it could make safe that specific vehicle in critical situation.

Question: Is there any guidance in terms of pre-requisite like a static ODD map data further compensated with additional occupancy/availability information of evacuation shoulder lane or evacuation spots to enable L2H-off function to become active? If so, some attention should be paid on the needs to require availability of shoulder lane information as enabler on the Local Map which defines the L2H-off ODD. What would be minimum requirement of Local Map information which could be missing in present scheme. Disabler of L2H-off on location where overreliance on MRM function could increase risk to other road user.

Question: We do recognize that the latter goes multiple layers deeper than the first one. However it still indicates that further studies are needed. Further studies should include extensive exposure to real-life spontaneous situations alongside individually pinpointed situations.

- For instance what happens if the AEBS initiates a full emergency braking at 60 km/h before the driver has his/her hands on the steering wheel? How capable the driver is to steer the car if necessary?
- Especially if the driver is not able to grab the steering wheel properly under a strong deceleration and his/her hands hits the wheel awkwardly. Is there a risk of an unwanted steer?
- Is there a risen risk of injury to the hands or wrists of the driver comparing to hands-on under decelerations?

Question: We clearly see from the results that a simple DMS is not adequate for any ways of driving and a more advanced, i.e. eye-on type DMS is needed. However, to jump to the conclusion about hands-off driving is less clear, since during the tests both the DMS and the driving style have been varied, i.e. two factors (or even 3 when automation is also taken as a reference) in the same time and we do not see how these two factors can be separated. Maybe eye-on hands-on would represent the safest solution? Also the time of warning for hands-on was 15 s while the time of warning for hands-off was 3-5 s so this is another hidden factor which has been varied in the same step, so the conclusion about only one factor (i.e. hands-off) needs perhaps more data and explanation.

Question: Edge, safety critical scenarios and systems failures were not simulated? In case of phantom braking, -steering the additional time to move the hands, which was determined to be 0.4s can be crucial. Since future DCAS systems will not be perfect we would like to see the tests results in case of system failure.

Question: In our previous literature summary showed (ADAS 15-04 (EC) JRC_DCAS_Summary_v2.pptx) that the autonomous hands-off driving time affected the driving behaviour just after 30-45 min. In all the experiments the total driving time was 30-40 min with few minutes hands-off driving in the beginning. How the prolonged hands-off driving time influence the outcome and KPIs?

Question: The important question for me is what is the long-time outlier upon take over request. The safety issues are the one in a thousand occurrences, not the majority.