DRAFT REPORT

6th meeting of the GRRF informal group on

Advanced Emergency Braking and Lane Departure Warning Systems

Venue: OICA Offices, 4 rue de Berri, Paris
Chairman: Mr. Johan Renders (EC) (johan.renders@ec.europa.eu)
Secretariat: Mr. Olivier Fontaine (OICA) (ofontaine@oica.net)

1. Welcome and Introduction

The Chair summarized the status of the discussions on Lane Departure Warning Systems (LDWS) and Advanced Emergency Braking Systems (AEBS). He congratulated the group for the good work achieved to date on LDWS, for which only minor details were still to be fixed, and he shared the hope to finalize the work on this item during this meeting. The Chair however expressed his disappointment with regard to the state of progress in the work on AEBS, due to the failure on reaching consensus on the main principles. He hoped that all parties had taken the opportunity of the delay between the 5th meeting of the informal group held in Berlin and the present meeting to carefully re-assess their positions and to take into account the positions put forward by the other stakeholders, with a view to make meaningful progress on AEBS during this meeting.

The Chair re-iterated his two main concerns:

- The first concern addresses the remaining time left for the informal group to achieve its work on AEBS. As a matter of fact, the Terms of Reference of the informal group (document AEBS-LDWS-01-07-rev2) requests the group to provide GRRF with a draft regulatory text on AEBS at its 69th session in February 2011. This draft text should cover and address the three agreed scenarios (1 = moving target scenario for M3 + N3 vehicles, 2 = stationary target scenario for M3 + N3 vehicles, 3 = moving + stationary target scenarios for vehicles of category M2 + N2), taking into account that scenario 3 can be accomplished only if the work on scenarios 1&2 is sufficiently advanced, which is not the case yet today. The Chair therefore concluded that there was an urgent need to achieve substantial progress during the present meeting.
- The Chair confirmed his strong preference to achieve consensus within the informal group on technically acceptable solutions rather than having to revert to GRRF as "parent body" to do so, as the best technical expertise on AEBS is available amongst the members of this informal group. If the informal group would fail to reach consensus, it cannot be excluded that decisions to be taken by GRRF would be based on political considerations rather than on technical grounds.

The informal group acknowledged the statements of the Chair.

2. Approval of the agenda

Document: AEBS/LDWS-06-05 (Chair)

The agenda was adopted with no modification.

3. Outcome of the 5th meeting of the AEBS/LDWS IG

Report by the Chair and approval of the draft minutes

Document: AEBS/LDWS-05-09 (draft minutes)

The Chair reminded the commitments of the different parties as per document AEBS/LDWS-06-09.
The report of the 5th meeting of the informal group was adopted with no modification.

4. LDWS:

Documents: ECE/TRANS/WP.29/GRRF/2010/29
AEBS/LDWS-06-03 (D)
AEBS/LDWS-06-04 (CLEPA)
AEBS/LDWS-06-06-Rev.2 (CLEPA/OICA)
AEBS/LDWS-06-09 (UK)
AEBS/LDWS-06-07 (S)

Background:

- GRRF/2010/29 : final LDWS draft regulatory text as adopted by the informal group.
- AEBS/LDWS-06-03: proposal to introduce provision for Periodic Technical Inspection (PTI) into the text of the LDWS Regulation
- AEBS/LDWS-06-04: proposal to improve the wording for the general requirements and the warning strategy (tell-tale operation mode, colour, mandatory usage)
- AEBS/LDWS-06-06-Rev.2: proposal for a warning indication for AEBS. Supersedes documents AEBS/LDWS-06-03 and AEBS/LDWS-06-04
- AEBS/LDWS-06-09: in-depth revision of the complete text of the draft regulation (warning strategy, test procedure when there are different variants, addition of the "CEL" annex)

Discussions:

The group firstly held an in-depth discussion based on document AEBS/LDWS-06-06-Rev.2., with the aim to apply for LDWS, as far as possible, the same general principles of the warning strategy to be agreed for AEBS. All experts were of the opinion that the general principles of the warning strategy should be common to AEBS and LDWS.

The group agreed to add a definition of "common space" as in paragraph 2.7. in order to avoid possible misinterpretation caused by a reference to UNECE R121 (controls, tell-tales and indicators).

The group also agreed to replace "malfunction warning signal" by "failure warning signal" throughout the text.

The group considered it appropriate to add provisions covering PTI, based on the proposals in document AEBS/LDWS-06-06-Rev.2. and as improved following the discussions in the meeting (Paragraph 5.5.1.).

The group reviewed document AEBS/LDWS-06-09 and agreed to improve the definition of lane, in particular with regard to its width, through a graphic reference in Annex 3 (outlines of the national lane markings). For this purpose, a new row was added to the diagram of lane marking outlines, providing a clear indication of what is meant by "lane width".

Paragraph 5.2.1.: performance requirement. The proposal by the UK to refer to "system interventions" in order to avoid any ambiguity was not withheld by the informal group because the draft LDWS Regulation does not address active lane keeping systems.

Paragraph 5.3.: system de-activation. The UK proposed to open the possibility of including an LDWS deactivation control which should be illuminated when the driver chooses to deactivate the system. The UK considered it useful to use the illumination of the control as a warning of de-activation. The experts raised some practical problems with this proposal, e.g. in the case of a rotary control and the fact that the electronic systems are usually active by default. The generalization of the UK proposal to all the electronic driving help systems would make it impossible to have a dedicated control for each system. OICA voiced the opinion that the design of Human/Machine Interface (HMI) should remain in the hands of the manufacturer.

Paragraph 5.3.1.: UK proposal for a symbol identifying the LDWS status. OICA argued that the definition of the symbol should find its place in the Regulation UNECE R121 rather than in the dedicated system Regulation. D and S were not keen to consider this UK proposal. ROK had no position on this issue, CLEPA found the proposal not necessary and J remained neutral on this. The UK agreed to re-consider their position about the illumination of the control, but insisted that a dedicated symbol be applied to LDWS. The UK committed to present a relevant proposal for UNECE R121.

Paragraph 5.3.2.: automatic re-instatement. The UK requested that the automatic reinstatement be achievable even without removing the key, in order to cover the case when the driver does not remove the key from the dashboard. This proposal however was not withheld as it would be not consistent with the ESC provisions. The group agreed to re-consider this item when reviewing paragraph 6.8. (de-activation test).

Paragraph 5.4.1. minimum warning indication. The UK proposal to mandate a spatial indication about the direction of unintended drift of the vehicle in the case there is one warning means only, was adopted by the informal group.

Paragraph 5.4.1.1.: specification for the use of an optical warning means. The UK proposed to qualify the optical warning means as "secondary means". The experts however considered this suggestion more confusing than clarifying.

Paragraph 5.4.2.: proposal for displaying the failure warning signal as long as the failure persists. The group supported the proposal, and corresponding requirements were added in paragraphs 5.2.2. and 6.6.2.

Paragraphs 5.4.3. and 5.4.5.: editorial improvement. The proposals were accepted for the sake of clarification.

Paragraph 6.2.3.2.: demonstration of compliance with all lane markings through the use of documentation. The UK were keen to have a clarification of the meaning of "documentation" in the text of the draft Regulation, whether it means a test report or a simple declaration from the manufacturer, with the aim of merging the requirements of paragraph 6.2.3.2. (compliance with the markings of the countries identified in Annex 3) and paragraph 6.2.3.3. (compliance with the markings of the countries identified in Annex 3 for all possible variants). CLEPA were of the opinion that the word "demonstrate" is addressing the question. The Chair pointed out that the issue of demonstration through the use of documentation is a subject which is wider than this particular Regulation, and is to be addressed as well in the frame of the discussions about Whole Vehicle Type Approval. The group agreed to specify in the draft Regulation the meaning of

"through documentation". OICA reluctantly accepted that approach as LDWS is only an informative system. The UK were keen to ensure confidence that a false alert does not lead to safety concern, and insisted that the case of failure detection be included in the documentation as well. After lengthy debates, in spite of their wish for a text requesting more detailed information, in particular about the possibility that a false warning via the haptic means would provoke the driver to start a wrong reaction, the UK accepted the wording proposed in the new paragraph 6.1. As a consequence, the original wording was kept for the paragraphs 6.2.3.2. and 6.2.3.3.

Paragraph 6.4.1.: test weight. The UK were keen to ensure that the system will provide safe functioning in all conditions of load. OICA found such a specification unnecessary as the paragraph already starts with the provision that "The vehicle may be tested at any condition of load", and a manufacturer would never take the risk of presenting a non complying vehicle to the Authorities. Negotiations with the Technical Service should determine what is the worst case. The group finally agreed that such demonstration would be performed with the help of documentation.

Paragraph 6.6.1.: lane departure warning test. The UK withdrew their proposal.

Paragraph 6.6.2.: requirement for the latest lane departure warning indication. The UK found it necessary to clarify the direction to which the vehicle should be drifted. The informal group agreed with this improved clarification of the text.

Paragraph 6.8.: De-activation test (see also the debates concerning the paragraph 5.3.2. above). The group agreed with the text proposed by the UK, with some clarification for the cases where the system is activated by means of a conventional "key".

The group then reviewed the document AEBS/LDWS-06-07 submitted by Sweden.

The expert from Sweden suggested to reduce the value of the latest warning drift from 0.3 m to 0.1 m, taking into account that the ISO Standard 17361 refers to the centre of the lane marking, rather than to its outside edge. The informal group however was hesitant to support that change, because the value previously selected by the experts is already more severe than the ISO Standard value of 1.0 m for heavy vehicles. It was also argued that in practice the ditch is not that close to the lane marking that the value of 0.3 m would provoke loss of control before the alert. In addition, the value required by the current text of the draft regulation addresses the latest warning time, meaning that the vehicle will always alert the driver before that latest time. The expert from Sweden was ready to accepted the positions of the other informal group experts provided that the system adjustability would be made mandatory in the draft Regulation. This suggestion did not receive support from the informal group.

Conclusion:
The GRRF informal group on AEBS/LDWS adopted the text for a draft regulation on LDWS as presented in document GRRF/2010/29.

5. AEBS:

While there was a general consensus that the warning signal should use at least two different means to be selected between visual, acoustic and haptic, the UK raised the concern that this could lead to the situation where the latest warning is optical only and occurs just before the emergency braking phase. The group however considered that such situations might occur in reality depending on the latest warning time and the traffic scenario (very late obstacle detection).

A new paragraph providing provisions addressing the situation where the starter interlock is in operation was added for ensuring consistency with the Stability Control (ESC) requirements, covering the cases of automatic gearboxes where mandatory starter interlock provisions are such that there is no reaction at all if the key is turned in e.g. "D" position.

5.1. Presentation of and exchange of views on new documents submitted:

AEBS/LDWS-06-01 - (CLEPA) Proposed amendments to AEBS "skeleton" document following the 5th informal group meeting
DOT HS 810 697 - (Chair) NHTSA Report DOT HS 810 697 "Crash warning system interfaces: human factor insights and lessons learnt"
AEBS/LDWS-06-06- & Rev.1 (CLEPA /OICA) HMI proposal
AEBS/LDWS-06-08 (Chair)
AEBS/LDWS-06-10 (UK)
AEBS/LDWS-06-12 (J) Warning timing
AEBS/LDWS-06-11 + Annexes "Japanese document about AEBS activation – owner's manual" (J)

AEBS/LDWS-06-01: CLEPA proposal to limit the draft text to some general requirements, some performance requirements, PTI requirements, test procedure with maintenance of a 3rd test (2 tests when positive results, 1 test with system non-activation). The expert suggested to address item 5.2. (performance requirements) at an early stage of the discussions.

DOT HS 810 697: Source of information on warning strategy, pros/cons of warning modes, data about HCV collisions, etc. Contains references to researches in fields of interest to the informal group.

AEBS/LDWS-06-06: Warning strategy for AEBS. Adaptation from LDWS to AEBS, in particular for what concerns spatial cues, hence agreement to have always 2 different means of warning. Definition of "common space" is added .

AEBS/LDWS-06-08: Driver's response time analysis, generated by an incoherence revealed a the 5th meeting (Berlin) between some J data and some researches referred to in the ITS guidelines .

AEBS/LDWS-06-10: Recognition of the fact that the group is running out of time. UK is ready to compromise and agrees to reduce the burden to Industry. The system does not exist e.g. for M2/N2 vehicles. Dates in the document are in [ ]. The expert accepted his document to be considered "later". He recognized it is challenging to meet some requirements by 2013. The idea is to combine the issues with their implementation schedule i.e. to introduce a technical phase-in to permit the manufacturers to have time to adapt the technology to some categories of vehicles and some level of requirements within the UNECE platform. He stressed that the question of EC acceptance will be raised. J welcomed the UK document.

AEBS/LDWS-06-12: Proposal for an analysis warning timing consequences.

AEBS/LDWS-06-11: Recognizes there are discrepancies between the CPs, but necessary to put the differences in writing. The technical choices for each system are based on different philosophies. The expert from Japan recognized the difficulty to

discuss the document at this meeting, he hence requested response for a consolidation later. He stressed that the collision avoidance is philosophically a challenge for Japan.

Review of document DOT HS 810 697:

The Chair presented page 7-3 of DOT document, in particular with regard to the warning timing and false alerts; he highlighted that the 2 seconds are the proposed figure for driver reaction.
The OICA experts pointed out that the document gives a timing for warning as a Time To Collision (TTC) and that the USA experience is based on the Passenger Cars (reaction time usually is recognized shorter for light vehicles than for heavy vehicles). In addition they assumed that the 2s TTC of USA contain the braking, otherwise the US study would make no sense.

Japan recognized that an early warning is better to avoid the crash, but the danger is that the driver may switch off the system if he perceives the warnings as a nuisance. The warning aims also to let the driver avoid the accident. J favours the same warning time for all vehicle categories and all speed ranges: while 2 seconds is perhaps long for Passenger Cars it may be quite appropriate for vehicles of category 2. In addition, 2 seconds TTC for M3/N3 is quite short.

The Chair wondered how this statement by Japan should be understood taking into account that in document AEBS/LDWS-05-08, Japan is recommending a warning time of 1.6 s. Japan considered that the different background of the data showed the limits for comparison of the recommendations. J insisted in addition that the Type Approval requirements have an influence on the real world. J insisted that the driver acceptance is part of the equation.

The Chair recalled the different philosophies about warning time:

- J wants to have the warning issued at the latest possible time, which means that the driver would depress the brake pedal at the time the AEBS will already intervene. The approach is based on the concern to avoid false alerts and overreliance by the driver.
- The other philosophy is to advance the warning time, so that the driver can take action prior to AEBS intervention.

The Chair insisted on the need to clarify the philosophy that the group wants to follow, i.e. what situation the draft Regulation should address: the sleepy driver or the attentive driver?

Daimler informed that real world data show that less than 1% of the drivers switch off the collision avoidance designed AEBS. False alert rates depend on the traffic aggressiveness.
J pointed out that there is no "average behaviour" of the driver and feared that the Regulation could impose a new task to the driver when mandating the AEBS. The expert from J requested to get those data from Daimler about the nuisance rate: false alert rate and switch-off percentage. Daimler committed to provide the requested data under the condition that Japan would also provide the corresponding data from their side.

CLEPA considered that a late warning timing would increase the liability on the system. The Chair pointed out that this problem can be extended to the Vienna convention compliance.

The group then started a debate about the definition of "overriding".

OICA raised that it seems that there is a misunderstanding about the J philosophy: one Japanese manufacturer subsidiary of a European make has an AEBS on the market with 2 warning times, the 0,8s delay and an earlier one, making the total at about 1,5s + time for warning braking. In view of that information, the Chair suggested to the group to reconsider its preliminary agreement that the draft Regulation should only specify requirements for the LATEST warning time.

The group agreed to open the discussions on extending the requirements to a possible previous warning signal and Dr. Zastrow independently presented a proposal as per the scheme presented in figure 1 below.

Figure 1

This suggestion was welcomed by NL and CLEPA.
The UK insisted that the latest warning time should be based on scientific grounds. The expert informed that the UK could support 2.0s or even 1.4s as the first of the latest warning times based on ITS guideline.
F supported the proposal as well, with no indication about the warning time values that could possibly be introduced.
S could accept the philosophy as well.
D supported the proposal and stressed that the acceptance of the driver is good when the warning cascade is good.
ROK supported the idea and any figure between 0,8 and 2 seconds.
J explained that, at 2 seconds, one warning means generates the same nuisance as two means. Hence J found it difficult to accept the proposal.

The Chair clarified that he did not request IG members already to take a position about the proposed idea, but was seeking confirmation whether the group agreed to continue the discussion by specifying also a preliminary warning preceding the latest warning. He did neither request already a response about the warning means nor about the time values. However the discussion was open taking into account that some vehicles in the market in J comply with that philosophy.
J insisted that, for a Regulation, the simpler is the better.

As an outcome of informal discussions, OICA presented some preliminary position per the figure 2 below.

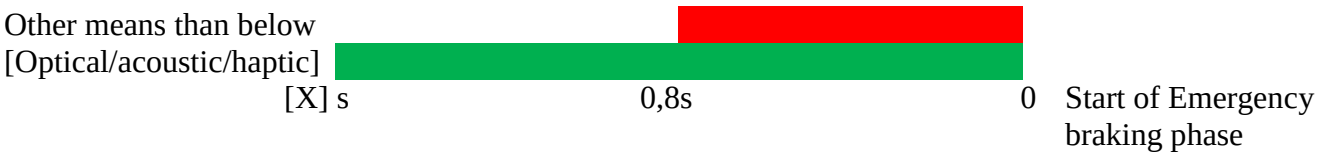

Figure 2

The group agreed to base future discussions on this scheme
J insisted that 0,8s as the latest warning time is a must. The expert summarized his understanding of the scheme as follows: the existence of the 1st "green" means is mandatory, however the nature of this first "green" means is 1 out of 3 at the minimum, and time "X" is optional.
UK agreed in principle with the OICA approach. However the expert insisted on the need to see evidence that the time for the 1st means is sufficient to allow the driver to react. He added that the means of the 1st warning must be "suitable". He agreed with the time of 0,8 s for 2nd means and committed to propose evidence for a reasonable "[X]" at the next meeting.
F supported UK, but was of the opinion that the value of "0,8" should still be discussed and put between [ ]. The expert said that the 1st warning means "Green" can be optical if accompanied by haptic braking in the same time.
ROK had no comment.

Conclusion:

- All to reflect carefully about the above approach for a warning cascade
- Positions to be provided in writing 2 weeks before the next meting (1st of September at the latest)
- All parties to well justify their position

5.2. Outstanding issues from previous meeting

Proposed test scenarios for moving and stationary targets

Documents: AEBS/LDWS-04-08-Rev.1 – (Secretariat) AEBS proposed test scenario Table
AEBS/LDWS-04-10-Rev.1 – (CLEPA) Stopping distance – TTC

Review of document AEBS/LDWS-04-08-Rev.1:
Sweden provided their position, as reproduced in document AEBS/LDWS-04-08-Rev.2

5.2.1.1. Review of Driver Reaction Time data for establishing latest warning time before emergency braking phase

AEBS/LDWS-06-12: Japan added some pages to previously submitted document.

- Slide 3 is a response to a question from the Chair about the inconsistencies with some other researches: 224 cases. Simulator tests.
- Reaction time: Time between signal release and the strike of braking pedal.

While J officially requested data from Daimler to provide evidence about driver's reaction time, the Chair recommended to firstly use the publically available data.
CLEPA reminded that J stated that the data are not vehicle category relevant. The CLEPA expert logically concluded that the data from the PCs could then be used by the group. To the expert's knowledge, 2 seconds reaction time is the value currently used on some Japanese passenger cars.
The J expert however raised the issue of the consistency of the ITS guidelines versus the J data: ITS guidelines make endless references to other references, while the J data refer to reaction time to event with no warning.

5.2.1.2. Test Performance criterion for the Emergency braking phase and associated pass/fail criteria

Criteria:

J: related to "overreliance" issue. Ready to discuss the issue with another parameter: overreliance. Want to avoid a very low deceleration during the braking phase.
The Chair then asked the question to the informal group: should overreliance be addressed?
NL: keen to have a time limit before which the emergency braking may not start. OICA stressed that this limits the speed reduction capabilities and that this reduces a lot the flexibility for the manufacturer.
CLEPA made clear that they do not want to see any limitation.
France: only one criterion among time/speed reduction should be defined in the draft Regulation because there is no stable relationship between the two, e.g. on low adhesion.
D: no change in the position
UK: no change in position

Conclusion: all to reflect on that.

Obstacle speed:

J reminded the debate of the last meeting about 10 vs. 15 km/h. After further investigation, J can agree with 10km/h as a minimum. The expert suggested the value of 10^{+4}_{-0} km/h constant. UK, D, CLEPA and OICA supported that proposal.

Conclusion: the group agreed that proposal.

Test speed

The group held a debate on the fact that the test conditions cannot guarantee covering all the real world conditions

Some experts were of the opinion that the highest energy reflects the worst conditions. In EU, the system is the same for highways and secondary roads, while this is not the case in J. All experts agreed that the text should not multiply the tests for economical reasons. J was keen that the test conditions can guarantee collision avoidance in real world.

Conclusion:

- J to provide a wording for covering the evidence to be provided by the manufacturer that the system complies with the requirements in the other test conditions.
- Chair requested the same from the UK

6. **Other business**

AEBS implementation (document AEBS/LDWS-06-10)

The UK suggested to consider a phased introduction, with no further negotiation. The expert stressed that this aims UNECE framework only.

CLEPA raised two concerns:

- The proposed 2013 target with collision mitigation on moving target is a simple ACC, hence does not deliver the government needs.
- The 2016 target means that the manufacturers can ask their suppliers high performances earlier than 2016, while production volumes are not yet reached, but high investments are nevertheless requested. The suppliers would have to put on the table some IP secrets earlier than necessary.

J considered the UK suggestion a valuable proposal. The expert pointed out that the 2013 target is much more than ACC.

Mr. Cicilloni (ACEA) said that, as M2/N2 have currently no AEBS system at all, this UK proposal would leave the vehicle Industry some time to develop the system for this category of vehicles. He agreed that some technology can be pushed by the Regulation, but insisted about the limits to the process.

OICA: no position for the moment. Dr. Zastrow however welcomed that the UK proposal takes the reality into account that no M2/N2 will have defined system in 2013. He understood that this is a kind of roadmap where the UK do not define today the details of the system required in the future.
The UK expert insisted that the proposal concerns performance targets, i.e. defining the different generations of the system. Need to see whether this can help the group to reach a consensus. This paper is an attempt to fix an UK paper for next GRRF session.

The Chair recalled that the EC want to implement AEBS/LDWS via the UNECE platform, but in any case by end of 2011. If the UNECE cannot meet the target, then other means will be used by the EC to achieve the requested implementation dates. The Chair reminded also the date of 2015 for all new commercial vehicles.
D reminded that it is the 1st time that something for which there is no experience (contrary to ESC, ABS, etc) is regulated. The expert could not support the UK proposal because there is no need for dates.
F, NL had no position.
OICA recalled that the worst case for OEMs is a non harmonized list of dates and performance in a UNECE Regulation.
Chair stressed that the 58 Agreement is such that it is up to the Contracting Parties to decide to mandate the systems and when to mandate them.
J recalled their plan to apply the regulation at the same time as the EU. J supported the UK compromise.

Conclusion:

- UK will present a more complete document, and make it available well in time before the next meeting.
- Possibility to set up a staggered implementation following the phases defined in the group.
- Possibility to the Contracting Parties to decide whether to mandate the system and when to mandate them
- All to establish a position on this for the next meeting..