

**Draft report of the 9th Session
GRSG informal group on
awareness of Vulnerable Road Users proximity
in low speed manoeuvres (VRU-Proxi)**

Dates: 26-28 March 2019
Venue: European Commission
Breydel Building (Meeting Room 12/A ‘M. Ayrat’)
45 Avenue d'Auderghem
1040 Brussels

Contact (host): Mr. Broertjes (European Commission)

Chairs: Mr. Matsui (Japan) and Mr. Broertjes (EC)
Secretary: Mr. Broeders (OICA)

The meeting started with a nice welcome to the group and introduction by the Chair Mr. Matsui.

1. Adoption of the agenda

Document: VRU-Proxi-09-01 (Chair)

The running order of the agenda was explained by the Chair and accepted by the group.

2. Adoption of the report of the 8th VRU-Proxi session (Yokohama, Japan)

Document: VRU-Proxi-08-15 (Chair)

There were no comments to the draft report of the 8th VRU-Proxi session, the report was adopted by the group.

3. State of play of close-proximity vision and detection rulemaking in the contracting parties

EC presented the status and outcome of the negotiations concerning the General Safety Regulation Phase 2 between European Parliament, Member States and European Commission. A principle agreement on the textual GSR proposal was just achieved on the 26th of March and EC remarked the following:

- Reversing safety not required for O categories (trailers), GSR Phase 2 focusses only on motor vehicles concerning this topic;
- Blind spots on heavy vehicles shall be eliminated to “the greatest possible extend” although it is not fully clear what this actually means. Differentiation on direct vision requirements for trucks and buses only between vehicle categories, no differentiation

within a vehicle category and not based on different vehicle applications (like the VECTO approach). It will not be possible to compensate insufficient direct vision by implementing active safety systems. VRU-Proxi members are asked to think about possible ways for differentiation between different vehicle categories M2/M3/N2/N3.

- Expected implementation dates:
 - GSR Phase 2 entry into force expected in November 2019 and application date will be 30 months later;
 - 1st package: May 2022 for new type of vehicles, May 2024 for all vehicles;
 - 2nd package: May 2024 for new type of vehicles, May 2026 for all vehicles;
 - 3rd package: November 2025 for new type of vehicles, November 2028 for all vehicles.

4. Accidentology

Document: VRU-Proxi-09-03 (TRL)

TRL presented an update and further elaboration of the collision landscape analysis and proposed scope for the regulations.

- Analysis is now upscaled from GB to EU28 for total and target population through extrapolation based on different distributions in data from France, Germany and UK.
- Category M1 seems most significant and M2 least significant but it was remarked that this is still not reflecting the situations from other Contracting Parties which are not included (like Japan).
- Off-road accidents (on non-public roads) were not included. UK stated that off-road could be significant for specific accident situations as the nature of off-road collisions might be different to on-road. Definition of off-road not really clear, this could be subject of further debate.
- OICA suggested TRL to provide a clear format for other CPs with indicators and data format so that it can be easily added to the existing landscape (in-depth analysis like GIDAS CEASAR). **TRL** will prepare a proposal together with D, FR, OICA.
- Contributing factors were taken into account but may be subject of interpretation of the police officer that has attended the scene. One has to be careful with drawing specific conclusions as e.g. “Failed to look properly” will not be solved by improved direct vision.
- Proposed regulatory approach for MOIS (Moving Off Information System) for moving off and driving at low speed in forward direction is an information system only.
- Proposed regulatory approach for Direct Vision is a vision-based approach only.
- G raised the issue that DV and MOIS will cover the same type of accidents, why not considering an “or” legislation? TRL responded that that for heavy vehicles the DV- and MOIS-regulation have different introduction dates. First MOIS will be mandatory and some years later DV. Also target population of direct vision and MOIS are not the same, although there is an overlap. For next meeting **TRL** tries to understand what is going on in this type of collisions and identify what kind of collisions are typical.
- The accident landscape analysis shows that M1 vehicles also play a significant role in near side turn collisions, therefore TRL suggests to consider a “BSIS” or city turn

assistant regulation for M1. Probably other mechanisms for M1 than for heavy vehicles? **G (BAST)** will check.

- Scope considerations/subjects for debate:
 - Reversing: N2/M2 considered to be in scope with possibly some N2/N3 exclusions based on GVW.
 - MOIS: -> if N2/N3 are in scope then also consider M1/N1/M3 to be in scope. Furthermore N2/N3 scope exclusions based on GVW could be considered.
 - DIR: should N1/M1/M3 also be considered in scope?
- OICA questioned what if a VRU is standing or moving in the area of Class VI Field of View? TRL explained that VRUs in Class VI FoV are included (so driver not looking correctly). According UK there is no difference in accidents before and after the mandatory installation of the Class VI mirror (around 2007) as drivers don't look in this front view mirror.
- Discussion on blind spot accidents with M1 vehicles which supposed to have good direct vision. Probably most of time drivers don't look properly? TRL explained that police officers noted these as blind spot accidents possibly due to obscuration by the A-pillars or mirrors? **CPs** were asked to look for "blind spot accidents" for M1.
- UK: will TRL have off-road info available for next meeting? **TRL** will try to have this update for next meeting including data from D.

5. Status and developments of detection and vision technologies

Document: VRU-Proxi-08-07 (CLEPA)

There was no update from CLEPA on sensor capabilities compared to the presentation of the previous 8th VRU-Proxi meeting in Yokohama.

6. Reversing motion

Document: VRU-Proxi-09-05 (Japan)
VRU-Proxi-09-06 (Japan)

J presented the status of the work of the Reversing Motion Taskforce:

- 8 questions were added to the first 8 questions as formulated in the 8th VRU-Proxi.
- The questions are categorized in 7 groups, see summary on slide 4.
- Below the topics are described that were discussed in the meeting:

Q1 & Q9. Detection area:

- Detection of poles and requirements for detecting fallen persons has been discussed:
 1. J stated that this is not significant based on data.
 2. UK indicated that persons can fall after hitting first. The Taskforce responded that REV is focusing on first hit so this will be covered. UK mentioned that many accidents occur while reversing in off-road areas (out of parking garage) and emphasized the need for significant statistics for accidents cases just behind the vehicle.
 3. CLEPA preferred to take it out, also G did not see fatalities among small children in accident statistics.
 4. TRL: especially off-road collision can contain reversing collisions. TRL will

wait for data including off-road accidents. Conclusion to be made if we have the off-road data (now only NHTSA report available ca 30% of fatalities are children of 5 years or younger).

- The object height was discussed based on analysis from TRL in 9th meeting. Industry raised a concern on the opening angle of cameras if it is required to look close, far and wide behind the vehicle. This requires fish eye optics and may result in wrong driver's perception and estimations.
- Industry strongly wants harmonization of the requirements globally.

Conclusions:

- The judgment whether a fallen/small person within 1 meter is significant or not shall be discussed next time considering off-road data that is expected from G.
- Current proposal of detection area:
 1. 30 cm free zone behind vehicle's rear-most point.
 2. First row of poles shall be detectable or an area of 15x15 cm shall be visible on the side of the pole independent from viewing angle of the camera (also applicable for high mounted cameras as there is always 30 cm free zone).
 3. On second and third row the complete poles shall be visible or detectable but row by row as the view on the second and third row might be blocked by other row(s) located in front of the row in question.
 4. Height of poles for now defined at 1m (may be lowered in a later stage if justified by off-road data from G).

Q2. Audible and/or optical warning for sensor systems:

- Research from J was based on audible only. Audible shall be mandatory and optical may be optional. It depends on the definition and this shall not be design descriptive.
- Concern about effectiveness in case of different HMI's:
 1. Understanding of the driver;
 2. Location of optical warning might not be where the driver's attention should be.

Conclusion: provisional agreement is both audible and optical warning for detection system (taking into account remark from EP about people with bad hearing capabilities of disabilities). Not too descriptive, some flexibility shall be given (parking aid system that not fulfills regulation together with CMS that fulfills requirements is allowed). **VRU-Proxi members** to reflect on this in next meeting.

Q3. Is direct vision (turning head) allowed?

Conclusion: For the moment no direct vision allowed but to be decided later. **OICA** to provide a proposal for this, e.g. exemption for convertibles. To be presented to contracting parties for reflection in the next meeting.

Q4 & Q5. Combination of devices allowed?

- Do we need to define maximum number of devices? May requirements be fulfilled by a combination of mirrors, direct vision, detection system and/or CMS?

Conclusion: Co-Chair referred to the discussion in the 8th VRU-Proxi session: each separate row of 3 poles shall be visible / detectable by one type of system.

Q6. Is mirror-to-mirror (periscope) allowed?

Conclusion: No.

Q7. Test method for detection systems:

- Test methods and number of allowed misdetections (as defined in ISO) were discussed. With ultra-sonic sensors on a row blind spots may occur between and at the end of the range.
- Proposal from Japan can cause a big blind spot between the poles. TRL proposed that the blind spot might not be bigger than the area where a person can stand and not being detected.

Conclusion: Discussion postponed to the next session.

Q8. Shall exemptions be implemented in UN regulation?

- The Co-Chair stated that there are difficult cases and impossible cases. Cases that are difficult or inconvenient shall not be exempted, only impossible cases.
- **OICA** to propose what can be described for exemptions (special equipment).
- Why not make reversing beep mandatory? Co-Chair responded that Member States changed “reversing safety” into “reversing detection” which focusses only on CMS or sensor systems to inform the driver.

Conclusion: impossible cases might be exempted, **OICA** to propose description for exemptions.

Q10. Detection system / camera latency:

- CLEPA proposed maximum detection latency (not start-up latency) of 500 ms similar to the ISO standard (as bare limit as some systems will detect faster). According research from Japan this corresponds to an efficiency of 41% as used in GSR for effectiveness of a camera system.
- Camera latency proposed to be 200 ms (in line with ECE R46).

Conclusion on latency: Maximum latency for detection system 500 ms, maximum latency for camera 200 ms.

Q12. What category should be mandatory?

- Current proposal is vehicle category M and N.
- European Parliament removed the obligation for the O category of vehicles in the GSR agreement (GSR only focusses on motor vehicles for this measure).
- OICA raised the issue of N3 tractors as these vehicles are driven most of the time with a semi-trailer connected to the vehicle. Co-Chair is open for considering further exemption for N3 tractors only. **CPs** and **OICA** look for accident data with solo N# tractors and to what extent these vehicles are driving as solo vehicle.

Conclusion: current scope is M and N, N3 tractors might be excluded if justified by data.

Q15. Is it allowed to switch off detection system, as a pause function?

- FMVSS111 allows driver to “modify the view” of the rear view image. **Taskforce Reversing** shall check the meaning of “modifying the view” and if a fully switch-off is allowed in this standard.
- The opinion of the Co-Chair is that system shall be on by default at key-on and a full

de-activation by the driver shall be avoided. For CMS a certain view shall always be available (some flexibility in changing views can be considered), for detection the audible warning may be switched off but the optical warning shall always be activated. If a trailer is connected an automatic de-activation may be allowed. If the reverse mode is not engaged anymore or the vehicle is moving forward above a speed threshold, the system may switch off. Issue for trucks: also Class VI may be used with same monitor: what shall be shown to the driver at standstill?

Conclusion: **Taskforce Reversing** will make a draft proposal for switch on and off conditions for camera-monitor systems and detection systems.

Q16. Display view can be changed or not by user?

- In R46 a limited transparent overlay is allowed in the legal field of view, outside legal view there is no limitation.

Conclusion: proposal to align basically with FMVSS (no overlays in mandatory field of view, except for relevant useful supporting information regarding VRU presence during the backing event). **Taskforce Reversing** to define a compromise proposal with as much as possible flexibility.

J presented the draft regulation document as submitted to GRSG April session and the following subjects were explained or discussed:

- R46 is basis, naming and introduction were changed.
- Definitions to be added for Audible Warning, Optical Warning and Detection System.
- Definition for Surveillance camera-monitor systems to be replaced by Surveillance detection system.
- 6.2.1.2 Start-up time for rendering and scanning 2s in square brackets, to be defined (latency shall be max. 200 ms).
- Overlay with safety related info should be allowed, “safety-related” (object distance info, expected lines for vehicle trajectory, etc.) to be defined. Other not-safety related information may be overlaid outside the legal field of view.
- Further changes to be made to the Annexes (task for Taskforce Reversing).
- CLEPA questioned why not referring to R46 as there are many duplications in the proposal. J responded that this draft is now just in a starting phase. FR stated that WP.29 is not in favor of many references between regulations due to fact of complexity with later amendments; furthermore also CPs may apply this regulation and not R46.
- Distinguish shall be made between required object size and parts on the pole that has to be seen (especially in case of high camera positions). An explanation is needed that a top down viewing angle is allowed if top and bottom of the first row of poles is visible; the 2nd and 3rd row of poles shall be completely visible (to be discussed in the Taskforce). **OICA** to investigate if this is feasible without misinterpretation of the view by the driver.
- CLEPA proposed to be consistent to Class V and VI requirements in R46 whereas an object of 30 cm has to be seen. To be considered in the Taskforce Reversing.

7. Forward motion Vehicle turning - Blind Spot Information System

Document: ECE/TRANS/WP.29/2019/28
VRU-Proxi-09-02 (OICA)

OICA presented VRU-09-02 with proposal for amendment on external projection which is in line with R46 external projections:

- D supports the proposal if it will help on system performance, **D** will check.
- EC preferred to go a step further regarding the 250 mm width exemption below 2 m as it shall not be required to be integrated into the mirror housing, this shall be permitted for a standalone BSIS component as well. UK and CLEPA supported this. also questioned whether the limit should be up to 250 mm as currently allowed in R46 for indirect vision devices. OICA stated that this can be considered but it is not the aim not to have a large external projection.
- EC questioned whether it would make more sense to put this in R46 instead of BSIS.
- FR supports approach that requirement is needed but was keen to note that all associated requirements from R46 (inclination and radius requirements etc.) shall be taken into account as well.

OICA to think about the options and ideas and to present the preferred solution in next session as input for GRSG October session.

OICA explained a second proposal for amendment on suspending the information signal:

- Consolidated detection data up to 30 m behind front of vehicle will be collected by manufacturers. Also driver behavior and acceptance of a continuous activation of the information signal (in dense city areas) need to be investigated.
- The Co-Chair stated that driver is informed in time so comfortable time for brake and react. The Co-Chair questioned of it is a technical problem or a HMI problem? OICA: technical limitation is investigated, also better understanding from HMI point of view. Furthermore systems that meet the requirements are currently not available in the market.
- BAST: sensor range has been calculated in speeds, positions and collisions. CLEPA did not reject. From HMI perspective the driver will rely on the system, therefore the warning signal is in place.
- OICA: in addition to this, what about lighter vehicles, shall BSIS be adapted for smaller vehicles? GSR Phase 2 also contains VRU detection at the side for N2 and M2 vehicles. BAST: the “dc” figures may be different for smaller vehicles. Data needed that could justify this. Also impact zone can be different.
- **OICA** to present an update and evidence concerning this 2nd amendment for next session.

D indicated that the current BSIS proposal contains an error in section 6.5.10 where 5km/h needs to be replaced by 7 km/h as 5km/h results in 40m detection range to the rear from the front of the vehicle. Applying 7 km/h would reduce the detection range to about 30m. **OICA** and **CLEPA** is asked to look if this is acceptable and to give feedback to D before next meeting. **D** will check if drafting group is needed to define a proposal for early June.

UK raised a concern about timing if amendments are submitted to GRSG October 2019 (considering adoption by WP29 march 2020 and entry into force in October 2020). OICA stated that this should work for EU (GSR is 2022) but what about other contracting parties? If a manufacturer has an approval on the current BSIS regulation what are the

consequences? This system would have a better performance which is apparently not required anymore after implementation of the amendments.

8. Forward motion Vehicle driving straight or taking off from standstill

This subject has not been discussed in this VRU-Proxi meeting.

9. Direct Vision

Document: VRU-Proxi-09-04 (TFL-LDS)

Transport for London (TFL) presented the latest status of the Direct Vision Standard (DVS):

- Permit to London as from 2020: \geq 1 star or “safe system”, permit length until 2024
- Permit to London as from 2024: \geq 3 stars or “progressive safe system”, permit length 10 years
- Consultation 1, 2a, 2b finalized and 2c (=statutory consultation) is planned for Spring 2019
- Other cities might follow as well.

Loughborough Design School (LDS) presented a new proposal on rating the direct vision scores of a vehicle without calculations based on CAD:

- CAD based method shall be the standard and the physical technique is back-up for old-dated vehicles or vehicles where no CAD data can be obtained.
- LDS investigated how to quantify the cubic volume in relation to safety for the VRU where the head and shoulder must be visible (correlation has been investigated). When VRU is visible to a distance (in average) of 2m at the front, 2m to right and 4,5m to the left the vehicle would pass the test.
- Example test method stages (tests performed on scale):
 - Stage 1: investigator sets up the physical rig with 3 cameras mounted at the driver’s eye points in the cabin (left, forward and side looking direction).
 - Stage 2: a moveable wall with markers (similar to QR-codes) that can be detected by a camera. Wall will be put on front and both sides of the vehicle.
 - Stage 3: an automated script determines the distance of the wall based on the position and size of the markers as detected by the camera. The camera will measure the visibility based on the vision contours.
 - Stage 4: based on the different contrast (by illuminating the wall) a script will fit a spline around the visible part from the driver’s eye points.
 - Stage 5: the splines will be translated in CAD and the apertures can be determined.
 - Stage 6: the volumetric intersection and the assessment volume will be calculated (the vehicle width will be determined by putting the walls against the vehicle first).
- A physical rig will be 3D printed in April for validation of the algorithm.
- Probably a high margin needed, the score with this method might be significantly higher.
- This new method can be used for a whole range of a truck model (by only a single measurement).

Discussion:

Several questions were raised after the presentation; LDS was kind to give the appropriate answers as given below:

Question	Answer LDS
Why step away from the dummy measurement approach as this easier, cheaper, no post-processing needed, etc.? (TRL)	There is a correlation issue as a same average VRU distance can result in different volumetric scores for different cabs.
Is it open source software? (EC, G)	Yes, it is freely available open source software
Is method also useable for N2 vehicle categories? (ECF)	Some manufacturers also analyzed N2 vehicles which probably achieve 5 stars more easily. Approach for different categories to be discussed in next VRU-Proxi sessions.
Has this proposal been discussed with Technical Services?	Not yet but agree that this should be discussed with Technical Services
Shall pitching of vehicle to be taken into account?	Challenging as data from manufacturer is not available. Variables are being considered, to be thought about.
Why 1 star boundary? (TRL)	This equals the average distance of the VRU-s (5 th percentile) at 2m, 2m and 4.5m.
What is the benefit of the 1 star requirement, why not a higher ambitious level? (ETSC)	From the 56 assessed truck models, half of those cannot meet 1 star. The rate of change for the Industry is extremely high for this short term (life cycle of truck cabins is in general more than 20 years).
Vehicle categorization possible (like VECTO)?	<i>OICA stated that this is not usable for type approval, should be 1 regulation within 1 vehicle model.</i>

The Co-Chair proposed to discuss in the next meeting how to differentiate and what ambition level shall be aimed for. Question to **OICA** to prepare on this subject.

10. Evaluation of Pedestrian and Cyclist Warning Systems for Trucks

There was no update from CA and/or Mobileye regarding this subject.

11. Next meetings

10th meeting: 17, 18, 19 June 2019 at Verband der Automobilindustrie (VDA) in Berlin (Germany)

11th meeting: [current proposal around 24, 25 and 26 September 2019 in London or Moscow TBD]

12. Any Other Item

Terms of Reference:

The deliverables and timing as noted in the Terms of Reference were discussed and reviewed:

- For Forward Motion Vehicle Turning the regulation (BSIS) has been submitted to 115th session of GRSG (October 2018) according the ToR.
- For Reversing Motion it was discussed to ask GRSG for a postponement of the target completion date from the 116th session (April 2019) to the 118th session of GRSG (April 2020).
- For Forward Motion Driving Straight or Taking off from Standstill and for Direct Vision no changes to deliverables or timing are needed.