Proposal for amendments to document GRSG /2023/21 (Proposal for Supplement 1 to the original version of UN Regulation No. 167 Vulnerable Road Users Direct Vision)

The text reproduced below was prepared by the experts of the IWG on VRU-Proxi to adapt the proposal as presented in document ECE/TRANSP/WP.29/GRSG/2023/21. The modifications to the current text of the proposal in document ECE/TRANSP/WP.29/GRSG/2023/21 are marked in red.

I. Proposal

Insert new paragraph 2.30., to read:

"2.30. **"Inter A-pillar distance (IAPD)" means the horizontal distance between the A-pillars, measured in the y-axis of the vehicle in a horizontal plane passing through the E-points, or the mean of the same measurement taken in two horizontal planes at heights equidistant from the E-point plane, one above and one below the plane containing the E-point. The selection shall be agreed between the manufacturer and the technical service and approved by type approval authority as the one best characterising the width of the front windscreen between the A-pillars at heights relevant to direct vision."**

Insert new paragraph 5.2.2.2., to read:

"5.2.2.2. High capacity vehicles and vehicles with competing objectives

~~**For**~~ **N_3 vehicles in Level 3 meeting the design and construction criteria as follows:**

(a) equipped with a coupling device, and;

(b) having 3 axles or more, and;

(c) with a maximum engine power of 320 kW or more, and;

(d) designed with a permissible maximum gross combination weight (GCW) mass exceeding 60 tons,

~~**[the Front Visible Volume may be reduced to [0.X] m3]**~~

~~**or**~~

~~**[**~~**do not need to meet the required Front Visible Volume.**~~**]**~~**"**

Paragraph 5.2.2.1., Table 1, amend to read:

"Table 1
Minimum Values of Visible Volume

		Minimum Volume (m^3) of Direct Vision			
		Level 1		Level 2	Level 3
Nearside Visible Volume		3.4		Not Specified	Not Specified
Front Visible Volume	**IAPD ≥ ~~[~~2156mm~~]~~**	1.8	**IAPD ≥ ~~[~~2154mm~~]~~**	1.0	1.0
	IAPD < ~~[~~2156mm~~]~~	**See paragraph 5.3**	**IAPD < ~~[~~2154mm~~]~~**	**See paragraph 5.3**	**See paragraph 5.3**

	Minimum Volume (m^3) of Direct Vision			
	Level 1		Level 2	Level 3
Offside Visible Volume	2.8		Not Specified	Not Specified
Total Visible Volume	11.2		8.0	7.0

"

Paragraphs 5.3. to 5.3.3., amend to read:

"5.3. ~~If it can be demonstrated that the reason that a vehicle cannot meet the limit to the front is because of an innovative design, for example where the A-pillars are closer together than in a conventional design, then the vehicle may be deemed to comply if it passes all other applicable limits in addition to the following requirement. This shall be demonstrated by positioning five test objects with equidistant spacing between the vehicle nearside and offside planes. The test objects shall be moved in the longitudinal plane until they are positioned such that the top of the object is just visible from the point E2, through any window/glazed area. The test object shall be a 1.40 m tall pole of 30 mm diameter. A marker point representing a VRU shoulder shall be positioned 0.130 m closer to the vehicle, in the longitudinal plane, than the centre of the pole. The average distance in the longitudinal plane between the vehicle frontal plane and the shoulder marker point for each pole when it is just visible, shall be calculated. For any test object where the shoulder marker point lies to the rear of the frontal plane, a distance of 0.0 m shall be used to calculate the average. The average distance shall be equal to or less than:~~

Where the inter- A-pillar distance is less than IAPD as defined in Table 1, the limit value for the Front Visible Volume (V, measured in mm^3) shall be determined for the applicable level by the formulae as defined in paragraphs 5.3.1 to 5.3.3 below.

5.3.1. Level 1:

~~[1.65m~~ **$V = 392.13379*IAPD^2 - 275907.57455*IAPD + 573475207.82932$**~~]~~

5.3.2. Level 2:

~~[1.97m~~ **$V = 329.82551*IAPD^2 - 480212.23549*IAPD + 504819967.89481$**~~]~~

5.3.3. Level 3:

~~[1.97m~~ **$V = 329.82551*IAPD^2 - 480212.23549*IAPD + 504819967.89481$**~~]~~"

II. Justification

1. The current method for assessment of the frontal visible volume in UN Regulation No. 167 depends on the geometry of the cab design (position of the A-pillars). Therefore, this method may disadvantage future cab designs with A-pillars closer to each other.

2. With this amendment, vehicles with narrower cabs or A pillars positioned inboard of the edge of the cab can be approved on a reduced limit value providing a level of safety equivalent to that offered by the 00 Series in this respect.

3. The model for determining the front volume requirement based on a reduction in Inter A-Pillar Distance (IAPD) was developed using data from existing vehicles. These vehicles representing a range of design features were set at a cab mounting height to achieve the two frontal volume limits: 1.8 m^3 (Level 1) and 1.0 m^3 (Level 2 and 3), in their default configuration. Frontal volume was then measured against a reduced IAPD across a 700mm range with the passenger side A-Pillar being moved inboard, parallel to the vehicle Y axis, in 100mm increments. The results were curves representing the relationship of frontal volume to IAPD with a start point of each curve equating the default IAPD to 1.0 m^3 or 1.8 m^3. For a given set of common IAPD the front volume results were averaged to create two new curves, one for the 1.8 m^3 limit and one for the 1.0 m^3 limits as shown in paragraph 5.3.1 and paragraphs 5.3.2 / 5.3.3. respectively. Second order polynomial curves were used for the

best fit, resulting in equations of the form $f(x) = ax^2 + bx + c$. The two equations were then used to calculate the common IAPD that achieves the threshold values of 1.8 m^3 and 1.0 m^3 respectively and thus set the limits shown in table 2.

4. The second part of phase 2 in the revised terms of references for IWG VRU-Proxi concerns vehicles, or rather applications for vehicles, where the Direct Vision requirements may lead to conflicting interests, i.e. specific vehicles may not be available for such purposes.

5. One application specifically mentioned is High Capacity Transport (HCT). HCT is a transportation concept with a clear objective to address the effects of road transport with an aim to make them more efficient, both for the purpose of improving energy efficiency but also for an overall reduction of transport undertakings. The HCT concept can most easily be described as use of heavier and longer vehicle combinations, or fewer motor vehicles moving more goods.

6. Finland and Sweden are already applying this concept. In Finland since 2013 and in Sweden since 2018. It was initially introduced as an allowance for heavier combinations with Permissible Gross Combination Weights (GCW) of 76 tons in Finland and 74 tons in Sweden. Both countries have since also added allowance for longer combinations, up to 34,5 meters in length. More countries are also looking into similar transport strategies.

7. Since the ambition is to reduce the impact of transport from an energy efficiency aspect this is an ambition for the future. Studies show that fuel consumption can be reduced by as much as 40 per cent, but a moderate median across different applications would estimate a fuel saving of 20-25 per cent.

8. The objective of introducing an alternative procedure for vehicles with competing objectives is based on two main reasons. Firstly, to make sure that such vehicles remain available on the market for their purpose, otherwise ambitions and solutions like HCT could be hampered. Secondly, it is important that such vehicles remain within the scope of the Direct Vision regulation in order to achieve as much as possible of the intended safety target of the Direct Vision ambition.

9. In order to narrow down as much as possible the alternative procedure for vehicles with conflicting interests it is based on a list of specific design criteria for its application based on the use-case at hand:

(a) As it is a use-case for use of vehicle combinations a coupling device must be installed. This is added since it is possible to use "Rigid" trucks for HCT-purposes, not only tractors for semi-trailers.

(b) Only motor vehicles with three axles or more. Practical experience show that the dynamics of the combination is favoured by the axle configuration of the motor vehicle.

(c) Engine power above a certain level in order to handle the masses involved for such applications. The approval criteria for within the European Union is at least an engine power of 5 kW/ton Gross Combination Weight. The value proposed is higher since experience show that some "over-powering" has a beneficial effect on optimising fuel consumption.

(d) The permissible Gross Combination Weight must be above a certain level. This is a criterium that will allow these vehicles approved according to the alternative procedure to be introduced in markets where they are allowed and equally to be rejected for use where they are not allowed, at the discretion of local requirements.

10. The issue and challenge for vehicles designed for these purposes in the current regulatory text is the visible volume to the front. It is therefore the only exemption proposed. As specified such a vehicle would need to either meet a lower value or to only meet the total volume value. Since this alterative procedure is limited to N3-vehicles of Level 3 that value is currently 1.0 m3.