

**PROPOSAL FOR A NEW DRAFT REGULATION ON DRIVER AND CREW
PROTECTION IN FRONTAL COLLISION OF BUSES**
ECE/TRANS/WP.29/GRSG/2007/33

The proposed regulation is very important, dealing with a current problem¹. GRSG's goal should be to produce a good, well-based, clear solution instead of producing a quick one. Before the final wording of the new Regulation (paragraph by paragraph), GRSG should discuss and agree on certain basic issues belonging to this subject. These issues are listed below with proposals and references as basis of the proposals.

1. Title of the Regulation

The title shall be specific and simple and fit to the UN/ECE practice.

Proposal: "Uniform provisions concerning the approval of large passenger vehicles with regard to the driver and crew protection in frontal collisions."

2. Scope

Accident statistics were collected and presented to GRSG² which showed that more Class I vehicles are involved in frontal collision than Class II and Class III.

Note: not the high speed frontal impacts are the subjects of this regulation. It will be shown later in relation to the energy input (impact energy)

Proposal: The scope should cover category M3 with all belonging classes, including Class I., too.

3. Definitions

To produce a well-based, clear regulation, more definitions are needed than it is listed now in the draft. A more detailed list was drafted for GRSG³

Proposal: after discussing and agreeing the basic issues belonging to this regulation, GRSG should come back to the definitions.

4. Superstructure; surrounding of the residual space

Requirements shall make clear for the manufacturer how to describe the load-bearing, energy absorbing structure of the bodywork and also the surrounding of the residual space containing parts, components, elements which may intrude into the residual space. This is very important in respect of the modification of the type, extension of the approval and also when checking the conformity of the production (CoP). These requirements could be given in an Annex to the Regulation as it was done in Reg.66/Rev.1.

Proposal: GRSG should study and discuss this issue and agree on an Annex to be formulated.

5. Requirements

The paragraph should be extended by two further requirements:

¹ GRSG-92- 7 Frontal collision of buses

² GRSG 86 – 11 Accident statistics (Frontal collision of buses)

³ GRSG – 95 – 13 Comments and proposals to the document ECE/TRANS/WP.29/GRSG/2007/33

- independent test is needed for the crew compartment, if any
- if the driver compartment (DC) has door(s), after the test at least one way shall be usable for the driver to leave the DC

One test (full width impact test on the front wall) is meaningless, see later in relation to the test method and the energy input.

The driver shall be able to leave the DC after the test (the accident), therefore the door(s) shall be openable if there is no other way to do that. A draft was presented to GRSG² about these additional requirements.

Proposal: After discussing the draft, modifying it if necessary, GRSG should accept this concept.

6. The use of the concept of worst case, group of vehicles. (In relation to the modification of the type; the extension of approval; as well as the check of the CoP).

This is one of the most important questions of the regulation in respect of the manufacturers and the authorities (Technical Services) A detailed draft was presented to GRSG² based on the philosophy used in Reg.66/Rev.1. (This solution was proposed by German experts and formulated by the ad hoc expert group AHEG, working on the modification of Reg.66)

Proposal: GRSG should study the proposed draft and accept it (with modifications, if necessary) because without this concept the regulation will be very poor (almost useless in the everyday practice)

7. Residual space

The driver (crew) could have different size (5-50-95 percentile male body) sitting in different position on the driver seat (being adjusted to the pedals and steering wheels) and also to the personal comfort when driving (with different trunk and limbs positions) Therefore the 50% manikin is not appropriate, does not serve the safety. Simple geometrical space has to be specified, based on the original Spanish idea, modified by Hungarian expert.⁴

Proposal: GRSG should study and discuss this subject and advise the experts how to finalize the specification.

8. Dynamic impact test.

The impact test with full-width (2500 mm) plate is meaningless as it is shown and proved to GRSG⁴. To specify the test(s), the following should be considered⁵

- partial impact test shall be specified
- independent tests on both sides if there is crew compartment
- the impact should act above the rigid underframe (chassis) level, above the floor level of DC, impacting the “softer” part of the front wall
- two possible impact directions shall be specified ($\alpha = 0^\circ$ and $\alpha = 45^\circ$) on the discretion of the Technical Service (consulting with the manufacturer), the more dangerous impact direction shall be chosen.

⁴ GRSG – 96 –x Driver and crew protection on buses in frontal collisions

⁵ GRSG – 86 – 23 Typical bus frontal collision

Proposal: GRSG should study and discuss these items and advise the experts to prepare draft accordingly.

9. Impact energy, energy input

The impact energy, used in Reg.29 and proposed in the new draft Regulation is 44kJ. Theoretical considerations⁴ and experimental results⁴ are shown to GRSG to prove that this figure is very low. This energy is equivalent with the kinetic energy introduced into an M3 vehicle, when:

- A 16 t bus running into a rigid wall with a speed of 8 km/h (full-width impact), or
- A 5 t small bus hit the standing large bus on its one side with a speed of 20 km/h (partial impact)

The kinetic energy of a 16t bus having a speed of 35 km/h is 769 kJ. The energy input into the DC of the same bus when impacting a rigid wall under an angle $\alpha = 45^\circ$ (partial impact) is around 210-220 kJ.

Proposal: GRSG should study and discuss this question and conclude a realistic energy input in the range of 75-80 kJ. But the following conditions are belonging to this figure:

- partial impact under an angle of $\alpha = 0^\circ$ or $\alpha = 45^\circ$
- impact above the underframe level, above the floor of the DC

10. What to be tested? Test-piece.

Theoretically there are three basic test possibilities:

- on complete (or incomplete) vehicle
- only on the front part of the bodywork as a test-piece
- only on the superstructure (specified by the manufacturer) representing the front part of the bodywork, together with the surrounding of the survival space.

Three essential criteria shall be considered

- a) if complete vehicle is tested, the suspension (springing) shall be excluded, otherwise the energy input is out of control.
- b) the anchorages must be rigid and must not have any permanent deformation, otherwise the energy input is out of control.
- c) the modification of the type, the extension of the approval and the check of CoP strongly depends on the test-piece being the basis of the approval.

Proposal: GRSG should study and discuss this subject and make clear decision on the basis of which the experts can produce a draft.

The history of the frontal collision of buses in GRSG

1. Spain raised the problem on the 84th session (2003, April), Hungary supported the idea to work out new regulation(s)
2. Two voluntary expert meetings were organised in Madrid (under the co-chairmanship of Prof. Aparicio and Dr. Matolcsy) to collect accident information and to clear the major problems belonging to the frontal collision of buses.
3. Report and many working documents were presented to GRSG on its 86th session (2004, April)
4. Proposals were made and presented on the 87th session (2004, October) about the possible regulatory work with priority order.
5. Meantime the bus experts were working in an informal group on the extension of the scope of Reg.66.
6. On the 92nd session (2007, April) Hungary urged to start the work with the regulation about the driver (crew) protection and proposed two possible ways of work.
7. On the 93rd session (2007, October) Germany presented a draft regulation, which is now under discussion.

The history of Reg.66 in GRSA (rollover of buses)

1. Hungary raised the rollover problem of buses in 1974, but GRSA refused it.
2. In 1975 UK – after a severe rollover accident – supported the Hungarian initiative and a very active international expert work was started in GRSA.
3. During the years 1976-1984 three different test methods were tried (Hungarian method, UK method, combined methods) with complete buses in Hungary, UK, Germany, Sweden and the experts visited all of these tests.
4. Many laboratory tests (pendulum tests, static loading tests, component tests), theoretical calculations were performed in these countries and the results were discussed.
5. To clear up the technical issues took 7-8 years, to produce the final wording needed 1-1,5 year, so the Regulation come into force in 1986.

Conclusion

1. There are a lot of technical similarities in the two regulations
2. Reg.29. is an old regulation with a lot of deficiencies, problems, it is not a good basis for buses
3. GRSG's goal should be to produce a good, up to date, clear regulation for buses, instead of to produce something quickly.
