

Report of the informal group IG/R.66 on its third meeting

(Held in Budapest, 18-19 January, 2007)

1. The expert group IG/R.66 was invited by Hungary to hold its 3rd meeting in Budapest, in the Institute for Transport Sciences. The list of participants (19 experts) is given in Annex 1
2. 16 new working documents have been prepared, 12 of them were circulated before the meeting, and the last 4 of them were presented on the meeting and circulated after it. The list of the new working documents is shown in Annex 2, together with the former documents.
3. The final agenda of the meeting was agreed at the scene, the discussed working documents and presentations were arranged in 6 subject groups (see Annex 3) The main ideas and results of the presentations and discussions in these subject groups are listed below.
4. The Hungarian expert gave a regulatory background to the problem of strength of bus superstructures. He showed the chronology of the preparation of the bus regulations which explained the reason of the recent scope of R.66. He mentioned:
 - The demand of covering all bus categories by a good, appropriate regulation about their strength of superstructure was present during the whole work (1970 – 1998) of GRSA and GRSG, but during this period there was no opportunity to overview and discuss the three bus regulations (R.36, R52, R.107) and R.66 together.
 - The scope of the ADR.59 (Australian Design Rule) covers all the single deck buses having a passenger capacity more than 12. The South African national standard SABS.1563 covers all single deck buses independently from their passenger capacity. Both regulations are strongly based on ECE R.66.
 - The Summary Report of the ECBOS project (Informal doc. GRSG-86-4) in its “Results and Conclusions” suggests the extension of the scope of R.66 to small buses (SB) and new superstructure regulation for double deck (DD) coaches.
5. The EC expert stated that the previous scope of R.66.00 was fine for the Commission.
6. General information regarding to bus rollovers:
 - German expert introduced his revised working document GRSG – IG/R.66 – 2 -5/Rev.1 in which some minor corrections has been made.
 - Norwegian expert informed the group about bus rollover accidents in Norway between 2002 – 2005. The total number of the presented rollovers was 42, among which 9 happened to SB-s and one was a DD coach. He showed photos about 6 accidents and completed his presentation with the numbers of different categories of buses in Norway.
 - Hungarian expert (from JAFI – AUTOKUT) presented the main results of a midi bus rollover test:
 - The measured friction coefficient between the bus roof and concrete ground was 0,35.

- The measured elastic deformation of the superstructure was the same as the plastic one. This underlines the importance of measuring and recording the total deformations in every possible critical place during the approval tests, because considerable elastic deformations “disappear” after the test.
- In case of small buses the available room for the passengers is generally smaller than in large buses
- French expert completed in written form his former power point presentation in Warsaw, in which he showed a very detailed analysis of 17 bus rollover accidents (pointing out the typical rollovers, the deformation mechanisms of the superstructures as well as the injury mechanisms). Two of these accidents happened to DD coaches. Among his conclusions he underlined that R.66 regulation is required for all coach types and especially for DD coaches.
- Hungarian expert presented a detailed analysis about the way of superstructure deformations and proved with real accidents that these kinds of deformation mechanisms are generally valid for all bus categories. This also supports the same (or similar) roof strength requirements for all bus categories.
- The Department for Transport from UK promised – in an e-mail message – that they will inform the group about their research project going on since two years. In this project they study the accident statistics and in depth analysis of more vehicle categories including the buses, too and their rollovers. The group welcomed this offer and is waiting for the presentation.
- The Belgian expert suggested that every information regarding bus rollovers and presented in the group should state the source of the information (police, media, accident researches, etc.)

7. The experts pointed out that it is difficult to find comparable accident statistics in different countries, in which all bus categories are considered (especially the SB-s and DD coaches). It is also difficult to find data about the different classes and categories of buses registered in different countries.

As requested during the Warsaw meeting, the representative of SMMT, CLCCR, IRU and experts from Germany, Czech Republic, Norway, Belgium, Hungary provided some figures concerning the percentage of DD coaches and SB-s in the fleets registered in different countries. Annex 4 collects these figures and information. Further information would be welcomed.

8. Information regarding the rollover of SB-s and DD coaches:

- German expert presented two working documents about the rollover accident of 6 SB-s and one DD coach, showing the injuries, the way of the accidents. The presentation was based on GIDAS accident data (1999 – 2005)
- Hungarian expert presented a document concentrating on the rollover of SB-s and DD coaches. In a summary of a large scale statistics (more than 400 bus rollover accidents from different countries) in which 26 DD coaches and 67 SB-s rollovers were recorded He underlined that both categories seem to be overrepresented in the rollover statistics.
- UK and Hungarian experts informed the group about the two newest DD coach rollovers happened in Austria (2006, December) and in UK (2007, January)
- Czech expert promised some information about a DD coach rollover accident happened in 2003 in the Czech Republic.

9. Based on three working documents the Polish expert informed the group about the activity of the Polish – American team:

- The State University of Florida together with the state authorities and Polish experts is working on a standard about the strength of the superstructure of paratransit buses (their passenger capacity is around 16 – 20). The draft of this standard is based on ECE R.66. (300 paratransit buses are yearly registered in State Florida)
- The approval would be based mainly on computer simulation supported by laboratory test results as input data. (strength and stiffness data of the floor-sidewall, the roof-sidewall connections, sidewall itself at the cantrail, etc.) The test would be both static or dynamic (pendulum)
- The team would carry out computer simulations and also laboratory and rollover tests to validate the FEM modelling of these kinds of structures. They offered cooperation to the manufacturers, asking their representatives (MB, SMMT, OICA, etc.) to provide the most important technical data of existing SB-s (mass, geometry, the material properties of the load bearing structures, etc.) the help of which these validating tests and calculations may be done.
- Czech and Hungarian experts proposed – as a first step possibility – to start the validations with simplified (not real) structures.
- In the discussion the SMMT expert called the group's attention to the practice that SB-s could be also chassis type or monocoque structures, which could mean essential differences both in the strength of superstructure and in the approval. It was brought up that the chassis manufacturers could give written instructions to the small body builders how to construct strong superstructure.

10. The chairman pointed out two subjects next in line:

10.1. The expert group got the task from GRSG and WP.29 in its ToR to collect and study all the subjects which can increase the passenger safety in rollover accident of busses. The working document GRSG – IG/R.66 – 3 – 5/Rev.1 summarizes all the questions which came up during the discussions and suggests a general frame for the further work considering three phases of the accident process (before, during and after the rollover) and the four basic injury mechanisms. The chairman asked the experts to study, amend and develop this document. The German experts – in this respect, too – underlined the importance of the results and conclusions of the UK research which will be presented on the next meeting of the group.

10.2. Based on the information, accident statistics collected by the group during the last two meetings, the experts should start to think about their standpoint in the extension of the scope of R.66. In the work-plan of IG/R.66 the first period (estimated for one year) was dedicated for this task. The chairman collected the possible view points (which were earlier raised up and discussed) in the working document GRSG – IG/R.66 – 3 – 8 asking the experts to comment, complete, amend this document. On the next meeting, having some offered new information (Czech, UK, etc.) the group will come back to this question.

11. On the request of the secretary in Geneva the group discussed again the publication of its working documents on the website of the secretary. The common opinion of the group is that this publication is not necessary, because:

- The working documents may contain information about accidents, or expert opinions which could be easily misunderstood for the public without further explanations (these explanations are given orally on the meeting)

- Every IG/R.66 meeting has a written report, which is informal document of GRSG and so it is published on the secretary website. These reports list all the working documents. If an expert or delegate would to have some of them, the chairman of the group will send them to the inquirer.
- The working documents of other informal groups of GRSG generally are also not published on the internet.

12. The next meeting of IG//R.66 will be held on 12 – 13 of June (Tuesday - Wednesday). The scene is not finally decided yet (it could be Prague or Warsaw). The chairman asked the experts to examine the possibility of organizing one of the following meetings in their countries

20.03.2007.

LIST OF PARTICIPANTS.

Name	Country	Institution/Company/Organization
Annie Luchie	Belgium	CLCCR
Jean-Paul Delneufocourt	EU	European Comision
Michael Becker	Germany	Evobus
Alan Davis	France	IRISBUS
Patrick Botto	France	CEESAR
Allan McKenzie	UK	SMMT
Asbjorn Hagerupsen	Norway	Directorate of Public Roads
Mátyás Matolcsy	Hungary	GTE
Petr Pavlata	Czech Republic	Independent expert
Colin Copelin	UK	IRU
Jerzy Kownacki	Poland	ITS
Leslaw Kwasniewski	Poland	Techn. Univ. of Warsaw
Zbigniew Barszcz	Poland	PIMOT
János Deák	Hungary	KTI
Sándor Szabó	Hungary	KTI
Sándor Vincze-Pap	Hungary	JÁFI-AUTÓKUT
Pascale Reyntjens	Belgium	Van Hool
Johanes Lukaszewicz	Germany	BMVBS
Harry Jangenelen	Netherlands	RDW

The following experts excuse themselves by e-mail:

Louise Turner	UK	Dept of Transport
Giulio Mendogni	Italy	IVECO
Juhani Intosalmi	Finland	Vehicle Administration
Teresa Vicente	Spain	INSIA/UPM
Ras Hashemi	UK	CIC Cranfield
Bohuslav Kovanda	Czech Republic	TÜV SÜD

LIST OF WORKING DOCUMENTS

Number	Title	Document by
<i>Madrid meeting</i>		
GRSG-IG/R.66-1-1	The working method of IG/R.66	Chairman
GRSG-IG/R.66-1-2	Preliminary time-table of IG/R.66	Chairman
GRSG-IG/R.66-1-3	Accident statistics and accident analysis (Available sources)	Chairman
GRSG-IG/R.66-1-4	Required protection level for all bus categories in rollover (Possible approach)	Hungarian expert
GRSG-IG/R.66-1-5	The rollover process and the severity of rollover accidents, considering all bus categories	Hungarian expert
GRSG-IG/R.66-1-6	Requirements on extending the scope of R.66 (The first reflections, starting to think about it)	Hungarian expert
GRSG-IG/R.66-1-7	Agenda of the Madrid meeting	Chairman
GRSG-IG/R.66-1-8	Spanish accidents with buses involved injury mechanism analysis	Spanish expert (INSIA)
<i>Warsaw meeting</i>		
GRSG-IG/R.66-2-1	Bus rollover accident analysis (Children injury mechanisms...)	French expert
GRSG-IG/R.66-2-2	Bus rollover statistics from Hungary	Hungarian expert
GRSG-IG/R.66-2-3	World wide information about bus rollovers	Hungarian expert
GRSG-IG/R.66-2-4	Available technical publications	Hungarian expert
GRSG-IG/R.66-2-5	Accidents with buses in Germany	German expert
GRSG-IG/R.66-2-6	German bus accidents, reported by the Hungarian media	Hungarian expert
GRSG-IG/R.66-2-7	Remarks to the ECBOS summary report	Hungarian expert
GRSG-IG/R.66-2-8	Czech Overall Statistic Data	Czech expert
GRSG-IG/R.66-2-9	APSN Workshop (Bus and Track Safety)	Czech expert
GRSG-IG/R.66-2-10	Structural response of paratransit buses in rollover accidents	Polish expert
GRSG-IG/R.66-2-11	Spanish rollover statistics 1995-2004	Spanish expert
GRSG-IG/R.66-2-12	In depth analysis of DD coach rollover	Spanish expert
<i>Budapest meeting</i>		
GRSG-IG/R.66-2-	Accidents with buses/coaches in Germany	German expert

5/Rev.1		
GRSG-IG/R.66-3-1	Regulatory background to the scope of R.66	Hungarian expert
GRSG-IG/R.66-3-2	Deformation mechanism of bus superstructures in rollover	Hungarian expert
GRSG-IG/R.66-3-3	Rollover accidents in Norway	Norwegian expert
GRSG-IG/R.66-3-3/Add.1	Extended Norwegian working document	Norwegian expert
GRSG-IG/R.66-3-4	More detailed analysis of DD coach and SB rollover accidents	Hungarian expert
GRSG-IG/R.66-3-5	Possibilities to enhance occupant safety in bus rollover accidents	Hungarian expert
GRSG-IG/R.66-3-5/Rev.1	Improved version of the original doc.	Hungarian expert
GRSG-IG/R.66-3-6	Double deck bus accident in Germany	German expert
GRSG-IG/R.66-3-7	Accident investigation on minibuses (M2 Class B)	German expert
GRSG-IG/R.66-3-8	Considerations to the extension of the scope of R.66	Chairman
GRSG-IG/R.66-3-9	Test results and remarks on midi bus rollover safety	Hungarian expert
GRSG-IG/R.66-3-10	Crash and safety assessment program for paratransit buses	Polish expert
GRSG-IG/R.66-3-11	Draft crash and safety standard for paratransit buses	Polish expert
GRSG-IG/R.66-3-12	US-Polish task group for small bus rollover simulation address to the Informal Group	Polish expert
GRSG-IG/R.66-3-13	UK contribution to IG/R.66 meeting in 2007 Budapest	UK expert
GRSG-IG/R.66-3-14	Coach roof structure deformation analysis for real world coach accidents to ECE R.66 regulation	French expert
GRSG-IG/R.66-3-15	Some information about two new DD coach accidents	UK and Hungarian experts
GRSG-IG/R.66-3-16	Bus sales and registrations in Czech Republic	Czech expert

SUBJECT GROUPS OF THE AGENDA

A. Regulatory background of R.66

GRSG-IG/R.66-3-1 (Hungarian)

B. General information about bus rollovers

GRSG-IG/R.66-2-5/Rev.1 (German)
 -3-3 (Norwegian)
 -3-2 (Hungarian)
 - 3-9 (Hungarian)
 -3-13 (UK)
 -3-14 (French)
 -3-16 (Czech)

C. DD coaches and SB-s

GRSG-IG/R.66-3-4 (Hungarian)
 -3-6 (German)
 -3-7 (German)
 -3-15 (UK and Hungarian)

D. Information from the cooperating team

3-10 (Polish)
 3-11 (Polish)
 3-12 (Polish)

E. Further tasks of IG/R.66

GRSG-IG/R.66-3-5 (Hungarian)
 -3-8 (Chairman of IG/R.66)

F. Administrative subjects

Publication of WD-s
 Next meeting (Place, time, agenda)

**DATA ABOUT THE NUMBER OF REGISTERED BUSES, BUS CATEGORIES
AND ABOUT BUS ROLLOVER ACCIDENTS**

1. Norway (GRSG-IG/R.66-3-3 and -3-3/Add.1)

Total number of buses (2005)	28.783
Class I.	1.809
Class II	3.876
Class III	2.024
Small bus	
17<PC<22	2.832
PC<17	18.242

Rollover accidents (2002-2005)

Class II and III	33
Class A and B	9

Casualties in rollover

Fatality	5
Serious injury	13
Slight injury	166

In the presentation 6 bus rollover accidents were shown, one among these happened to a DD coach in 2006.

2. Czech republic (GRSG-IG/R.66-3-16)

The yearly bus registration figures in Czech Republic

	2004	2005	2005
All new and used buses	1037	908	1129
Only new buses	954	816	944
Class I.	237	159	279
Class II	569	489	476
Class III	57	67	91
M2	63	51	39
Others	28	50	59

3. Germany

The number of registered DD buses and coaches together in Germany is 1850 (January, 2007). The estimated ratio of DD city buses in this figure could be 2-3 %, the high majority is tourist coach. The production of DD coaches is in the range of 180-200 units/year. The number of small buses (M2) is under investigation.

4. Belgium

During the last 10 years (1997-2006) Van Hool produced 8550 buses and coaches, 4,7% of them were DD coaches (\approx 400 units)

5. UK (the data were given by SMMT, at end 2005)

Number of registered large buses (M3)	101054
among these DD bus and coach	19600
(DD coach around 5%)	
Large bus yearly registration	6000-7500
Number of registered small buses (< 17 passengers)	88500
Small bus yearly registration	5000-6500

6. Hungary (GRSG-IG/R.66-3-4)

6.1. The total bus fleet in Hungary (2005)	17.855	
Estimated values for different categories		
Class I	3500-4000	
Class II	9000-9500	
Class III	1400-1450	
among these HD	300-350	
DD	20-25	
Class A	-	
Class B	3100-3200	
Others, not specified	100-200	
New registrations per year	800-900	
DD ratio in fleet of Class II and III	25/10.600	≈ 0,23%
DD accident ratio in all rollovers	3/97	≈ 3,20%
SB ratio in total fleet	3200/17,855	≈ 7,90%

6.2. Bus rollover accidents in Hungary

All bus rollovers (2001-2006)	94	
DD rollovers	3	
Small bus (SB) rollovers (2002-2006)	50	
DD ratio in the total fleet	25/17.855	≈ 0,15%
DD accident ratio among Class II and III	3/37	≈ 8,10%
SB accident ratio in all rollovers	50/94	≈ 53,2%

7. Florida (USA)

The number of newly registered paratransit buses (passenger capacity 16-20) in Florida is around 300 unit/year.

8. CLCCR information

The ratio of DD coaches and SB-s in the total fleet is different country by country according to their traditions, passenger transportation systems, and their market demand. There are no generally valid figures for all countries. As a first approach, for Western Europe:

DD ratio in total fleet	5%
M2 ratio in total fleet	6%
22 seater's ratio in total fleet	10%

9. IRU information

DD coaches are mostly in service on international long distance travels and are using motorways, which explains why they appear to be more present on the roads than as it is the case in reality and why they are less involved in rollover accidents than the other vehicles.

10. World wide figures (GRSG-IG/R.66-3-4)

The Hungarian expert collected a lot of statistics and information published by different authors which were available and published, presented since 1973. The total number of these bus rollover accidents is 570. During the first 25 years DD coaches were not in operation, so 400 rollover accidents may be considered, in which 29 DD coach rollovers happened:

DD accident ratio in all rollovers 29/400 $\approx 7,25\%$

The SB's rollover investigations started in 2002, 67 rollover accidents were reported since that time (including the Hungarian ones, too) while the total number of bus rollovers during this period is 249.

SB accident ratio in all rollovers 67/249 $\approx 26,9\%$
