

BESZÁMOLÓ

az IG/R.66 szakértői csoport 6. üléséről
(Varsó, 2008. 06. 17-18)

1. Az autóbuszok borulások baleseteinél az utas-biztonság növelésével foglalkozó szakértői csoportot a lengyel ITS intézet látta vendégül. Az ülést – mint a csoport elnöke – én vezetem. A résztvevők listája az 1. Mellékletben található, 11 országból 21 szakértő vett részt az ülésen.
2. Az ülés végső napirendjét – az általam előterjesztett előzetes napirend alapján – a helyszínen határoztuk meg. Négy megtárgyalandó témakört a hozzátartozó munkaanyagokkal a 2. Melléklet tartalmazza. A munkaanyagok teljes listáját a 3. Melléklet foglalja össze. A több, mint 70 munkaanyag is mutatja, hogy a csoport igyekezett széleskörű, alapos munkát végezni. A következőkben az egyes témakörökben végzett munka lényegét foglalom össze.

3. Baleseti adatok, információk gyűjtése

- 3.1. Francia szakértő bemutatta a német DEKRA intézet autóbusz baleseteket elemző publikációját, amelyből kiderül, hogy Európában mintegy 1 millió autóbusz üzemel és található adatok arról, hogy az autóbusz balesetek (amelyekben autóbusz utas megsérült) hogyan oszlanak meg 25 európai ország között. A borulások busz balesetek 18%-át teszik ki azon busz baleseteknek, amelyekben utasok súlyos vagy halálos sérülést szenvedtek, és a buszbalesetben meghalt utasok 66%-a borulások balesetben vesztette életét.
- 3.2. A spanyol szakértő kiegészítette az előző ülésen bemutatott elemzését, amelyben 1800 olyan autóbusz geometriáját, tömeg és súlypont magasság adatait vizsgálták, amelyeket az R.66 előírás alapján 1993-2007 között jóváhagytak. Ebből is kiderült, hogy az alsó és felső határ (kis autóbuszok és emeletes autóbuszok) a ma érvényben lévő hatályt illetően (nagy autóbuszok) műszaki szempontból nem éles: tömeg és geometriai adatok alapján nem húzható meg:
 - Magaspadlós turistabuszok külső magassága sok esetben eléri a 3,9 m-t, az emeletes buszoké 4,0 m. Mind két esetben az utastér pozíciója gyakorlatilag azonos.
 - A 22 utas adta elválasztás (kis buszok) sem hossz, sem tömeg alapján nem indokolható, ugyanaz a konstrukció (jármű) egyik esetben 23 utast, a másikban 20 utast fogad be az ülésosztás függvényében.
 - Bár a jóváhagyott autóbuszok között értelemszerűen nem volt sem kis autóbusz, sem emeletes busz, a vizsgált autóbuszok adatainak nagy szóródásából is arra lehet következtetni, hogy a két kérdéses kategória nem választható el éles határszámokkal a most jóváhagyásra kötelezett kategóriáktól.

4. Beszámoló lengyel-amerikai team munkájáról

Lengyel szakértő beszámolt a team tevékenységéről, amely a kis autóbuszok (paratransit bus) tetőszilárdságára vonatkozó szabvány kidolgozását és bevezetését célozza. A munka négy fázisát emelte ki:

- A FEM elemzés módszerének, technikájának kialakítása. Ez megoldott probléma.

- Háromszintű vizsgálati technika kidolgozása (anyagjellemzők mérése, csomópontok, csatlakozások vizsgálata és tényleges borítóvizsgálat) Ez is kidolgozott.
- Szabvány kidolgozása, elfogadása. Ez folyamatban van
- További aktivitás a szabvány kötelező alkalmazása érdekében. Van tennivaló.

A szakértő beszámolt arról, hogy az USA-ban autóbusz balesetekről folyik az adatgyűjtés, úgy tűnik, hogy a borulások gyakorisága a sérüléssel járó autóbusz baleseteken belül 29%. Ugyancsak elemzés folyik az ECE R.66 előírás és az FMVSS 220-as szabvány hatékonyságának összehasonlítására.

5. Javaslat kidolgozása GRSG részére az R.66 hatályának kiterjesztését illetően.

- 5.1. A német szakértő az elmúlt ülésen kidolgozott tervezetet az időközben beérkezett javaslatok alapján módosította (GRSG-IG/R.66-4-18/Rev.2) Hét szakértőtől (köztük két magyar: Vincze-Pap Sándor és én) jött be észrevétel. Ez a dokumentum adta ennek a munkafázisnak az alapját.
- 5.2. Az IG/R.66 szakértői csoport több feladatot is kapott GRSG-től, ezek három nagy csoportra oszthatók:
 - a) baleseti statisztikák, információk összegyűjtése és elemzése
 - b) javaslat tétel az R.66 előírás hatályának kiterjesztésére további autóbusz kategóriákra.
 - c) Javaslat tétel további területeken az utasok biztonságának növelése érdekében autóbuszok borulásos baleseteinél.

A szakértői csoport úgy döntött, hogy az „a” feladat elvégzése után csak a „b” témakörben terjeszt elő javaslatot GRSG-nek az októberi ülésre. Bár a „c” témakörben is készült egy sor értékes munkaanyag, javaslat, ezek vitáját IG/R.66 még nem tudta befejezni, még nincsenek kiérlelt, közösen elfogadott javaslatok.

- 5.3. Az elkészült javaslat (Summary Document) majdnem végleges formája az 5. Mellékletben található. A nyár folyamán még e-mail egyeztetéssel lehetőség van nem érdemi (inkább stilisztikai) módosítások elvégzésére. A szakértői csoport többségi vélemény alapján (nem egyhangúan) javasolja GRSG-nek:
 - Terjessze ki kötelező jelleggel az R.66 előírás hatályát kis buszokra [16 fős befogadóképesség fölött]
 - Terjessze ki választható (opcionális) jelleggel az R.66 előírás hatályát emeletes buszokra.

Kis buszoknál GRSG-nek kellene eldöntenie, hogy minden kis buszra, vagy csak a 16 főnél nagyobb befogadóképességűekre terjesztették ki az előírás hatályát. Emeletes buszokkal kapcsolatban nincs tisztázva, hogy ki választhat: a Szerződő Felek (kormányok) vagy a gyártók. Ebben a kérdésben folyik a „Scope” vita magyar kezdeményezésre GRSG-ben (és WP.29-ben)

- 5.4. Egy francia szakértővel (Dr. Botto) ketten írásban rögzítjük különvéleményünket: nem látjuk indokoltnak bármiféle „korlátozás” alkalmazását egyik kategóriánál sem, emeletes és kis buszokra is a kötelező kiterjesztést javasoljuk. Még nem döntöttük el, hogy külön, vagy közös dokumentumban rögzítjük álláspontunkat. A 4. Mellékletben a közös nyilatkozat tervezete található, amelynek egyeztetését megkezdtük, a végső forma kialakulása nyár végére várható.

- 5.5. Az egyik angol szakértő (IRU) nem tudott résztvenni a varsói ülésen, de írásban küldte meg aggályát az emeletes buszokkal kapcsolatban, mi szerint a felső szint utasai jóval a jármű súlypontja fölött helyezkednek el tovább emelve a súlypont magasságát.
- 5.6. Amennyiben a GRSG elfogadja a szakértői csoport javaslatát, a döntésnek megfelelően IG/R.66 kész az előírás szövegében a szükséges módosítások előkészítésére és GRSG elé terjesztésére, megvitatásra és elfogadásra. Ehhez a szakértői csoportnak még legalább egy ülésre van szüksége.

6. Utasok növelt biztonsága autóbusz borulás esetén.

- 6.1. A 2. Melléklet mutatja, hogy ebben a témakörben öt munkaanyag várt megvitatásra, idő hiányában ezekre azonban nem került sor. A munkaanyagok a következő témákkal foglalkoznak:
 - Az utasbiztonság növelésének lehetséges területei borulásos balesetekkel kapcsolatban.
 - Vészkijáratok szerepe, számuk és elhelyezésük követelményének lehetséges újragondolása minden baleseti szituációt figyelembevéve.
 - Laminált oldalablakok alkalmazásának lehetőségei, feltételei.
 - Biztonsági övek szerepe, hatásossága a nem kívánt utasmozgások (részleges és teljes kiesés, belső ütközések) megakadályozásában.
- 6.2. Amennyiben GRSG úgy dönt, hogy témakörökben is hasznos lenne javaslatok megfogalmazása, a további kutatások fő irányainak meghatározására, IG/R.66 csoport kész ezt a munkát befejezni és javaslatait előterjeszteni. Ehhez előreláthatóan két ülésre lenne szükség.

7. Egyebek.

- 7.1. Megállapodtunk, hogy a GRSG felé menő javaslat tervezetet (Summary Document) a német szakértő mindenkinek megküldi további átolvasásra és kisebb módosító javaslatok megtételére. Lényegi változtatást már nem lehet javasolni. A korrekciók után a végleges javaslatot a német szakértő megküldi nekem és én az ülés jegyzőkönyvével együtt szeptemberben kiküldöm Genfben a Titkárságra.
- 7.2. Én július végéig elkészítem az ülés jegyzőkönyvének (Report) tervezetét és megküldöm a résztvevőknek észrevételezésre. A javaslatok figyelembevételével szeptemberben küldöm ki a végleges változatot a Titkárságnak.
- 7.3. Minkét anyagból nem hivatalos dokumentum lesz a következő GRSG ülésen, ahol én terjesztem elő őket.
- 7.4. A következő ülésről nem született megállapodás, mert arról a következő GRSG ülésen várható döntés.

Budapest, 2008. július 2.

Dr. Matolcsy Mátyás

LIST OF PARTICIPANTS

Name	Country	Institution, company, organization
Harry Jongenelen	Netherlands	RDW
Pascal Reyntjens	Belgium	Van Hool
Alan Davis	France	IRISBUS
Dariusz Michalak	Poland	SOLARIS
Leslaw Kwasniewski	Poland	Warsaw Techn. Univ.
Jean-Paul Delneufcourt	EU	European Commission
Petr Pavlata	Czech Republic	VCA
Teresa Vicente	Spain	INSIA-UPM
Patric Botto	France	CEESAR
Michael Becker	Germany	EVOBUS
Allan McKenzie	UK	SMMT
Annie Luchie	Belgium	CLCCR/AGORIA
Mátyás Matolcsy	Hungary	GTE
Jerzy W. Kownacki	Poland	ITS
Cristophe Delleville	France	PSA Peugeot Citroen
Ondrej Vaculin	Czech Republic	Tüv Süd Auto Cz
Parshant K Benerjee	India	Tata Motors
Zbigniew Barszcz	Poland	Pimot
Wojciech Przybylski	Poland	ITS
Slawomir Cholewinski	Poland	ITS
Filip Skibinski	Poland	ITS

The following experts excuse themselves by e-mail

Sándor Vince-Pap	Hungary	JÁFI-AUTÓKUT
Giulio Mendogni	Italy	VECO
Francisco Aparicio	Spain	INSIA
Colin Copelin	UK	IRU

SUBJECT GROUPS AND BELONGING WORKING DOCUMENTS

A) Collecting further information

GRSG-IG/R.66 - 6 - 1	Accident overview and selection of scenarios In Germany and Europe ... (French)
- 6 - 3	Geometrical analysis of current coaches: implication in roll-over tests ... (Spanish)

B) Information about the work of the Polish-American team

GRSG-IG/R.66 - 6 - 4	(Polish)
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C) Preparation of the final report to GRSG

GRSG-IG/R.66 - 4 - 18/Rev.2	Summary document (German)
- 6 - 2	Commission position paper regarding (EC) the extension of the scope of Reg.66

D) Enhanced safety of occupants in rollover

GRSG-IG/R.66 - 5 - 1	Possibilities to enhance... (Chairman)
- 5 - 2	Emergency exits and their use... (Hungarian)
- 5 - 10	Draft communication regarding emergency windows. (EC)
- 5 - 5	Some thoughts about... (Hungarian)
- 4 - 9	Information to the discussion of the safety belts (Hungarian)

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

Budapest meeting

GRSG-IG/R.66-2-5/Rev.1	Accidents with buses/coaches in Germany	German expert
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

Prague meeting

GRSG-IG/R.66-4-1	Preventing passenger ejection from buses, coaches and minibuses	UK expert
GRSG-IG/R.66-4-2/rev.1	Considerations to the extension of the scope of R.66 to all bus categories	Chairman
GRSG-IG/R.66-4-3	Applicability of the approval tests to DD coaches and small buses	Hungarian expert
GRSG-IG/R.66-4-4	Summarized statistical information about DD and SB rollover accidents	Hungarian expert

GRSG-IG/R.66-4-5	Some experiences with windows and windscreens in bus rollovers	Hungarian expert
GRSG-IG/R.66-4-6	Dutch overall statistical data with regard to buses and coaches	Dutch expert
GRSG-IG/R.66-4-7	Emergency exits and their use on buses focusing on rollover accidents	Hungarian expert
GRSG-IG/R.66-4-8	Buses and coaches – running park and new registrations	Italian expert
GRSG-IG/R.66-4-9	Information to the discussion of the effectiveness of 2pts versus 3 pts belts	Hungarian expert
GRSG-IG/R.66-4-10	Not finished and not circulated	
GRSG-IG/R.66-4-11	Data about the number of registered buses, bus categories and bus rollover accidents	Chairman
GRSG-IG/R.66-4-12	Official statistical data on minibuses, buses and coaches	Belgian expert
GRSG-IG/R.66-4-13	Questionnaire for European experts on coaches and buses	Spanish expert
GRSG-IG/R.66-4-14	Comparative study for coach accidents (Standard and DD coaches)	French expert
GRSG-IG/R.66-4-15	Large passenger, goods and agricultural vehicle safety...	UK expert
GRSG-IG/R.66-4-18	Summary document	German expert

Madrid meeting

GRSG-IG/R.66-5-1	Possibilities to enhance safety in bus rollover accidents	Chairman
GRSG-IG/R.66-5-2	Emergency exits and their use on buses, focusing on the rollover, but considering every accident situation	Hungarian expert
GRSG-IG/R.66-5-3	Some new rollover information	Hungarian expert
GRSG-IG/R.66-5-4	Viewpoints to the extension of the scope of R.66 to all bus categories	Hungarian expert
GRSG-IG/R.66-5-5	Some thoughts about the side windows from laminated glazes	Hungarian expert
GRSG-IG/R.66-5-6	French statistics on the vehicle park and accidents	French expert
GRSG-IG/R.66-5-6 /Add1	Bus and coach general accidentology data	French expert
GRSG-IG/R.66-5-7	Possible frame (structure) to the scope of R.66 in the future	Hungarian expert
GRSG-IG/R.66-5-8	Dynamic response and crashworthiness of paratranzit buses	Polish expert
GRSG-IG/R.66-5-9	Bus and coach market in Poland	Polish expert
GRSG-IG/R.66-5-10	Draft communication regarding emergency windows	EC expert
GRSG-IG/R.66-5-11	Proposals to working document GRSG-IG/R.66-4-18	Hungarian expert

GRSG-IG/R.66-5-12	Geometrical analysis of current coaches	Spanish expert
GRSG-IG/R.66-5-13	Coach rollover crash, Arboga	Swedish expert
GRSG-IG/R.66-5-14	Minibus M2. Fatal accident reports	French expert
GRSG-IG/R.66-5-15	Total number of bus registrations in Czech Republic between 2002-2008	Czech expert
<i>Warsaw meeting</i>		
GRSG-IG/R.66-6-1	Accident overview and selection of scenerios in Germany and Europe DEKRA presentation on DEKRA symposium	French expert
GRSG-IG/R.66-6-2	Commission position paper regarding the extension of the scope of R.66.	EC expert
GRSG-IG/R.66-6-3	Geometrical analysis of current coaches: implications in rollover tests	Spanish expert
GRSG-IG/R.66-6-4	Structural integrity and safety of public transit buses. (2008 update on papers)	Polish expert
GRSG-IG/R.66-4-18 /Rev.2.	Summary document, revised version	German expert

DISSENTING OPINION

of Hungarian (and French) expert(s) on the extending of the scope of Regulation 66.

Single deck vehicles not exceeding passenger capacity of 22.

Beyond the arguments listed in para. 6.1. of the “Summary Document” the following should be also considered:

- Every bus passenger – independently whether travelling on bus having a passenger capacity less or more than 16 – needs the same safety (life protection)
- The passenger capacity limit (border) 16 does not have any kind of technical, biometrical, etc. meaning in respect of the endangerment of passengers.
- The available accident information, data did not provide any evidences to introduce this limitation in extension of the scope to small buses.

Therefore (we) can not accept the use of this limit value (16) and strongly propose to GRSG to extend the scope to all small Class B buses independently from their passenger capacity.

Double deck vehicles

Beyond the arguments listed in para. 6.2 of the Summary Document, the following should be also considered:

- Every coach passenger – independently whether travelling on a single deck HD coach or on a DD coach – needs the same safety level (life protection)
- The existing version of Regulation 66. applies to HD coaches having a total height of 3,9 m, but DD coaches with a total height of 4,0 m are out of the scope. The passengers (passenger compartments) are in similar position in both cases.
- No technical, biometrical, etc. reasons to distinguish these categories in respect of rollover
- The fleet of double deck vehicles in the total coach fleet is small, but it is not negligible considering only the fleet of the luxury tourist coaches and their population is increasing. The accident information shows that they could be overrepresented in the rollover accidents compared to their fleet representation (weaker lateral stability because of the higher CG position)
- The casualty figures from the accident information shows that DD coaches have similar or even worse casualty rates in rollover, than the other categories.

Therefore (we) can not accept the extension of the scope of Regulation 66 on a voluntary basis only to this category but strongly propose to GRSG to do that obligatory.

Dr Patrick Botto French expert
Dr Mátyás Matolcsy Hungarian expert

Summary Document

Informal Group of UN ECE GRSG on Reg.66: Strength of Superstructure

1. Task/terms of reference

In the course of action to adapt UN-ECE Regulation 66 “Strength of Superstructure” to technical progress, the need was felt to continue the research with regard to the necessity to extend the scope of the regulation R 66 to other vehicles than the current single-deck rigid or articulated vehicles with more than 22 passengers.

WP 29 decided to hand over this task to an informal group (IG/R66) on basis of the initiative of the European Union, as it seemed more appropriate to concentrate the necessary efforts to a smaller circle than the whole group of GRSG.

The aim of the group is to:

1. Collect and evaluate accident statistics and relevant analysis
2. Define the required protection level for all bus categories in rollover, including small buses and double deck coaches
3. Propose technical research, if needed
4. Propose the bus categories to be included in the scope, if needed
5. Draft a proposal for modification of the regulation, as a consequence of no.4
6. Propose other possible action to enhance safety in rollover accidents

The informal group has the responsibility of preparing and bringing forward a possible proposal for an amendment of the scope, if justified by the research and development work done so far by different institutions and take account of any additional work that is being undertaken.

2. Regulatory background

UNECE Regulation No. 66 „Uniform provisions concerning the approval of large passenger vehicles with regard to the strength of their superstructure” came into force in 1986. Compulsory application started in 1986 to 1993 in a few countries in Europe and is now; widely spread throughout the Contracting Parties of the UNECE 1958 Agreement. Whilst the requirements for the different categories of buses and coaches were originally separated into UNECE Regulations 36, 52 and 107, WP.29 approved the GRSG-proposal to align the scope of UNECE Regulation No. 66 with the scope of UNECE Regulation No. 36.

Due to the coming into force of EC Directive 2001/85/EC, which contains the same technical requirements as UNECE Regulation No. 66, some of the Member States of the European Union currently apply it on a mandatory basis. When Framework directive 2007/46/EC (EC-

WVTA) becomes mandatory for M2 and M3 many Contracting Parties will be obliged to mandate UNECE Regulation No. 66.

The Australian and South African legislations cover small buses on basis of UNECE Regulation No.66.

In the United States of America there are some efforts to improve safety of motor coaches including strength of superstructure (NHTSA-2007-28793).

After the introduction of the fitting of safety belts into vehicles of class III and B, it became evident that the influence of belted passengers on the performance of superstructures, in case of an accident, needed to be examined. The result of this action led to Revision 01, which came into force in 2005. Compliance is mandatory from 2010 for new ECE Type-approvals.

3. Vehicle fleet data

The informal group decided to collect data on the number of vehicles in service focused on the ratio of small buses and double-deck vehicles in the total fleet. This data should be incorporated in the process of deciding on the necessity of enlarging the scope of UNECE Regulation No. 66 by evaluating the representation of the different vehicle types in certain accident scenarios. The documents distributed to the members of the informal group give a general overview but show that the different statistics follow very different concepts and mostly do not take into account the UNECE vehicle classification system. Therefore the question of comparability of data needs to be considered.

4. Statistics / accident data (1995-to date) / Accident analysis

A wide range of national and international statistics was collected by the members of the informal group. Further accident analysis by different technical institutes was made available to be discussed and evaluated. Even if bus and coach accidents often lead to a high perception among the public and the media, the reliability of the information as reported by the media with regard to the injury figures, the severity of the injuries, the injury mechanism, etc. seems inappropriate, so this information cannot be used as a basis for this kind of consideration. Therefore the informal group decided to only use those statistics and analyses that did not include media data. To reflect the technical progress only data from 1995 on were taken into account.

4.1 Scientific data

During the course of the meetings the IG/R 66 collected available data on single accidents, accident statistics and analyses of accidents that incorporate small buses and double-deck vehicles, where appropriate in comparison with information on single deck vehicles that are already covered by the scope of UN ECE Regulation No. 66, Rev. 1. The data showed that the total number of rollover accidents, where small buses and double deck coaches are involved, do not occur that frequently. There is not enough information to determine on general level their relevant proportion in rollover accidents compared to their representation in the total fleet being in service.

As mentioned in paragraph 2, UNECE Regulation No. 66 is applied on a mandatory basis in only a few countries. However, some manufacturers apply the Regulation to their vehicles even if they are not obliged to do so; others use the UNECE Regulation No. 66 approval for marketing reasons to show the superior level of safety of their buses or coaches. Looking at the accidents and the respective vehicles involved in those accidents, the question of whether the vehicle complies or not with UNECE Regulation No. 66 could not be answered in most cases.

The available statistics are based on very different concepts. Vehicle categories are often defined on the basis of national vehicle classifications, e.g. based on the gross vehicle mass or the engine power of the buses or coaches. Others refer to the number of passengers, but do not use the UNECE classification system. The question how to compare data from different sources cannot be answered satisfactorily.

The consolidation of the discussed documents incorporated the following questions:

- What is the frequency of bus/coach rollover accidents in relation to other accident types for buses/coaches, and for the vehicle fleet as a whole?
- What is the frequency for each bus/coach type (e.g. single deck, double deck, large, small, etc.) involved in rollover accidents?
- What is the frequency for each level of injury for each bus/coach type in rollover accidents?
- By what mechanism are occupants injured in rollover accidents (e.g. thrown around in vehicle, roof crush (protrusion), full or partial ejection, etc.)?

A European project, ECBOS, initiated within the 5th framework research programme of the European Commission, was conducted from the year 2000 on. This research project looked at bus and coach strength of superstructure. The summary report of ECBOS was made available to UNECE-GRSG (GRSG-86-4).

ECBOS recommended extending the scope of UNECE Regulation No. 66 to small buses. Regarding double deck vehicles ECBOS recommended “to analyse how resistant the actual designs are and the economical and social impact of including those vehicles inside the requirements of regulations and directives on rollover. That is especially important if the mass of the belted passengers is taken into account, because the increase of the energy to be absorbed during rollover increased with the number of passengers and the height of the centre of gravity”.

Further research is being conducted in APSN. The outcome of the research remains open.

The TRL Report, indicates that between 1994 and 2005, 27 double-deck buses and coaches were known to have rolled over in the UK. However, in 27% of cases of rollover accidents the body type (single or double-deck) was unknown so it is possible that some additional double-deck rollover accidents occurred during this period. In the 27 double-deck rollover accidents that were reported, 1 person was killed and 242 were injured. The report then analysed all

road accidents in the UK during the period 2003 - 2005: a period when double-deck rollover accidents were not severe compared with the overall period, and concluded that “Extension to double deck highly unlikely to be cost beneficial. Zero fatality cases in the time period for analysis”. With regards to minibuses the report concluded that “Extension to minibuses may prove cost beneficial but will depend on assessment of effectiveness – lack of seat belt wearing likely to limit effectiveness”.

A study of bus and coach accidents that happened in Spain between 1995 and 2004 concluded that whilst rollover/overturning accidents do not happen very often, when they do the number of seriously injured occupants can be high. The database showed that accidents involving M3 category vehicles represented 2% of all accidents and that for accidents involving M3 category vehicles, rollover accidents of intercity buses represented 4%. Of the 8 buses involved in rollover accidents 1 was a double-decker.

An analysis of the vehicle types involved in 105 rollover accidents that took place in Hungary between 2000 and 2006 showed that small buses and high-deck/double-deck buses were over represented. Small buses were involved in 50% of the accidents and high-deck/double-deck buses represented 60% of the number of Class II and Class III vehicles involved.

In Germany, the GIDAS database containing 12647 reconstruction of road accidents that took place in the Hanover and Dresden area between 1999 and 2005 showed that only 5 accidents involved large buses in which passengers were injured, of which only 2 involved bus rollover accidents, including one double-decker. 16 passengers were slightly injured in that rollover accident. No severe injuries and no fatalities were reported. The GIDAS database also contains details of 6 accidents involving M2 category, Class B vehicles, of which 3 were rollover accidents. No severe injuries were suffered by the driver or passengers.

Norwegian statistics showed that between 2002 and 2005 there were 33 rollover accidents involving buses of Class II and III in which 5 occupants were killed and 11 seriously injured. During the same period 9 buses of class A and B were involved in rollover accidents with 0 fatalities and only 2 severe injuries.

The CEESAR/Irisbus database containing details of 94 coach accidents showed that rollovers accounted for 43% of these accidents and that the risk of being killed in a double-deck coach was twice as high as in a single deck. A detailed study of the roof structure deformation using 14 rollover accidents, including 2 double-deck coaches, concluded that it is essential that the passengers remain correctly belted within the vehicle and with adequate survival space. In the case of double-deck coaches the majority of passengers killed or seriously injured were in the upper deck: 83% in the case of an accident involving lateral deformation of the roof and 72% in the case of an accident involving roof crush. The LAB database reported on 6 accidents involving fatalities in vehicles of category M2. Only 1 of these accidents was a rollover.

Statistics from the Netherlands concluded that bus and coach transport is the safest form of passenger transport. Between 1987 and 2006, 26 people were killed in buses (0.113% of all road fatalities) and 353 people were hospitalised (0.151% of road accident hospitalisations).

Special consideration was given to the Swedish authority’s communication on a single-deck rollover accident in January 2006 which caused 9 passengers to die and 42 to be injured.

4.2 Media information

In cases when a severe accident with a bus or coach does happen, high media attention is given. Therefore, the rollover accident is considered to be one of the most severe road accidents that happen to coaches.

An analysis of media information on 314 worldwide rollover accidents that took place between 1990 and 2006 showed that Class III vehicles were involved in 43% of rollover accidents and that 41% of these were high-deck/double-deck coaches. During this period, in Europe, 13 double-deck coach rollover accidents were reported. Information of accidents involving small buses has only been collected during the last 4 years and 63 accidents were reported.

In the period between December 2006 and October 2007 the media reported on 4 double-deck rollover accidents that took place in Europe. 13 people were killed and 115 were injured, many seriously.

5. Other aspects considered

The following items were part of the considerations of the IG/R66:

- The frequency of bus/coach rollover accidents in relation to other accident types for buses/coaches, and for the vehicle fleet as a whole.
- The frequency for each bus/coach type (e.g. single deck, double deck, large, small, etc.) involved in rollover accidents.
- The frequency for each level of injury for each bus/coach type in rollover accidents.
- The mechanism by which occupants were injured in rollover accidents (e.g. thrown around in vehicle, roof crush (protrusion), full or partial ejection, etc.).
- The deformation mechanism of different superstructures.
- The applicability of the existing approval test methods.

6. Conclusions

6.1. Single-deck vehicles not exceeding 22 passengers

For vehicles of category M2 or M3, class B, [exceeding 16 passengers] the majority of the group proposed to extend the scope of UNECE Regulation No. 66, because:

- The severity of the recorded accidents indicates risk for the passengers of these vehicles in case of rollover.
- The main injury mechanism indicates that R66 could help in the protection of the passengers by providing an adequate residual space.
- The dynamics of the rollover test will be similar to the smaller M3 vehicles.
- The existing approval tests are applicable to M2 vehicles.
- The mechanism of deformation for M2, class B vehicles is similar to that for M3 vehicles

6.2. Double-deck vehicles

For double-deck vehicles of category M3, class II, III and B, the majority of the experts proposed to extend the scope of UNECE Regulation No. 66 and to apply the Regulation on an optional basis for double-deck vehicles, because:

- The fleet of double-deck vehicles of category M3 is small.
- The severity of reported accidents indicates a higher risk for the passengers of these vehicles in case of rollover.
- The main injury mechanism indicates that R66 could help in the protection of the passengers.
- The dynamics of the rollover test will be similar to single deck high deck vehicles
- The existing approval tests can be applied to double-deck vehicles
- The mechanism of deformation will be similar to single deck vehicles.
- Special consideration should be given to the possible increase of the height of the centre of gravity resulting from the reinforcement of the superstructure and to the possible associated stability of the vehicle.

7. Recommendation to GRSG

For vehicles of category M2 or M3, class B, [exceeding 16 passengers] the majority of the group proposed to extend the scope of UNECE Regulation No. 66. The informal group asks GRSG to decide if the scope of the Regulation should include all class B vehicles or only those exceeding 16 passengers.

For double-deck vehicles of category M3, class II, III and B, the majority of the experts proposed to extend the scope of UNECE Regulation No. 66 and to apply the Regulation on an optional basis for double-deck vehicles. The informal group asks GRSG to amend the text of the regulation on basis of the informal group's recommendation. In addition, research is needed on the influence of belted passengers in double-deck vehicles.