

Transmitted by the expert from Hungary

AHEG-33/Rev.1.  
August, 2002

**REPORT**

about the ad-hoc expert group (AHEG) meeting dealing with the development of  
Regulation 66.  
(Barcelona, 13-14 May, 2002)

**1. The participants of the meeting:**

Belgium (VAN HOOL)	Ms Reyntjens, Pascale
Czech Republic (UVMV)	Dr Hanke, Miroslav
	Mr Pavlata, Peter
Germany (EVOBUS)	Mr Steinmetz, Gregor
	Mr Becker, Michael
Hungary (GTE)	Dr Matolcsy, Mátyás
Netherlands (TNO)	Mr Huibers, Jos
Poland (MTI)	Mr Kownacki, Jerzy
Spain (INSIA)	Mr Sanchez, Miguel
(IDIADA)	Mr Nacenta, Jose
	Mr Lafuente, Ignatio
	Mr Ruiz, Salvador
UK (CIC)	Dr Sadeghi, Majid
(DTLR)	Mr Burch, Malcolm

The following persons indicated that they can not attend this AHEG meeting, but they are continuously participating in the work of the expert group and they need further information and documents:

OICA	Mr Biver, Michael
France, (MECALOG)	Mr Diet, Serge
(UTAC)	Mr. Minne, Francois
Spain, (INSIA)	Prof. Aparicio, Francisco
Italy, (IRISBUS)	Mr. Mendogni, Giulio

The host of the meeting was IDIADA (Automotive Technology Institute) and the chairman was Dr Matolcsy.

**2. Documents**

The new AHEG documents which were produced after the last (Frankfurt) meeting are listed in the Annex of this Report. These were the working documents of this meeting, they were distributed before or on the meeting.

**3. The agenda of the meeting**

The following subjects were discussed on the meeting (the related documents are in brackets)

- General exchange of information (AHEG-30)
- The Consolidated Document (CD) of the new version of Reg.66. (AHEG-18/Rev.1, AHEG-18/CZ, AHEG-32)
- Annex 8: Quasi-static calculation based on testing of components (AHEG-15/Rev.2., AHEG-27, AHEG-29)
- The effect of safety belts (AHEG-25, AHEG-31)
- The "worst case" solution (AHEG-26)
- Annex 9: Computer simulation of rollover test on complete vehicle (AHEG-17/DIF, AHEG-28)
- Future activity of AHEG

#### 4. General exchange of information

The chairman informed the group about the last GRSG and WP29 session related to the modification of Reg.66. The main things:

- Both WP29 and GRSG are waiting for the modified Reg.66. and underlined the importance of the safety belt issue.
- GRSG got two informal documents from AHEG (see Annex), the papers were introduced and briefly commented
- The chairman of AHEG gave a presentation to GRSG about the changes in the new version of Reg.66. (AHEG-30)
- The EU representative raised the question in GRSG: is it possible to extend the scope of Reg.66 to minibuses (Reg.52) EU is thinking on this possibility and they will ask the opinion of WP.29, too.

#### 5. Consolidated Document (CD) of the new Reg.66.

The first version of CD has been presented to GRSG on its 82<sup>nd</sup> Meeting. This version was not complete yet. To improve the CD, AHEG agreed in the followings:

- After this meeting a new, corrected and improved version of CD (AHEG-18/Rev.2) will be produced (UK experts and the chairman undertook this work) and presented to GRSG on its October meeting as a new informal document.
- A lot of corrections have been accepted during the discussion, these will be involved in the new CD. Czech experts had two written proposal, one of these (AHEG-18/CZ) was an earlier one, the chairman undertook to review it and consider the relevant issues.
- The new CD will be distributed among the experts in June and their comments, proposals are waited until 10<sup>th</sup> of September (They shall be sent to Mr Burch and to the chairman) Every comment shall have a title, reference to the related part, Annex of the CD, date and name of the proposer. GRSG will get the corrected version of CD
- There was a discussion about the required accuracy in Annex 3. when measuring the coordinates of the CG. The Polish expert undertook to work out a new proposal for the next AHEG meeting.
- The eccentricity of the GG ( $\pm e$ ) shall be related to the "centre plane" of the vehicle in Annex 3. and a definition shall be given for the "centre plane."
- The appendix of Annex 5. shall be taken out from this Annex and it will be discussed together with Annex 9. at the next AHEG meeting. The Hungarian expert undertook to prepare a new version of this Appendix.

#### 6. Annex 8: Quasi-static calculation based on component tests.

AHEG discussed this Annex on its Frankfurt meeting (AHEG-15) and a lot of modifications have been accepted. Only one subject (para.2: the load application) has not been agreed, there were two proposals: the Belgian-Hungarian and the Spanish (INSIA) proposals. Now three documents were on the table of AHEG: the revised text of Annex 8 (except para.2.) and two new proposals for para.2. These were very close to each other, there was no essential difference between them, therefore the discussion was not dealing with them, but with other subjects:

- The Czech experts informed the AHEG that they have made 16 rollover computer simulations with different body sections. They found a scatter between 0,78-1,00 for the energy absorption coefficient, which is now 0,75 in the regulation. The average value was 0,91, on the basis of which they proposed to change the value of 0,75 to 0,9.
- The Spanish expert (IDIADA) also informed the group about their results, based also on computer simulations and some rollover tests and they found 0,60-1,00 as values of energy absorption coefficient. High decker coaches had the lower values (0,60) while the traditional coaches produced a range of 0,9-1,0. He also pointed out that this value is strongly depending on the stiffness of the superstructure.
- The chairman called the attention of AHEG to the GRSG demand not to discuss those issues in the regulation which were not completely agreed to be changed (The energy absorption coefficient was not agreed yet) The German experts did not propose to change the value of this coefficient.

- The Belgian expert pointed out that in the new version of this Annex the  $\Delta h$  (drop of the CG) is bigger than it was earlier, because the deformation of the superstructure is also considered when determining it. This increased  $\Delta h$  increases the kinetic energy as well as the absorbed energy (the loads on the superstructure) and it has the same effect on the approval process as the increasing of the energy absorption coefficient 0,75.
  - The Dutch expert pointed out that the needed, exact value of  $\Delta h$  may not be determined in advance.
  - The Czech expert underlined that  $\Delta h$  and 0,75 are not independent from each other, they should be discussed and decided together. He also mentioned that this question is relevant to Annex 7, too.
  - The Spanish expert (IDIADA) suggested to delete Annex 7. and Annex 8. from the regulation, because their equivalence to the standard rollover test is questionable. UK, Belgian and Czech experts argued for keeping these Annexes, because they are relatively simple and cheap approval methods for the small body builders and bus manufacturers. Most of the experts can accept these quasi-static test methods, but on the other hand, some of them could accept their deletion. The chairman asked the experts to discuss this question at home and express their "official", national answers on the following two questions:
    - a) Can they accept the deletion of Annex 7. and Annex 8. from the regulation?
    - b) Can they accept the two quasi-static approval test methods as they stand now in the CD? (0,75,  $\Delta h$ ) If not what kind of realistic modification is acceptable which assures their equivalency to the standard rollover test?
- The answers shall be sent to the chairman until 15<sup>th</sup> of June.
- The expert from Netherlands raised an objection against the use of static plastic hinge curves in the calculation. UK, Spanish (INSIA) Hungarian experts emphasized that there are a lot of static hinge characteristics available and the dynamic tests, measurements are more complicated and expensive. The Czech expert pointed out that they did not find essential difference between the two kind of test results. The majority of the experts voted for keeping the static characteristics (10 yes, 1 no, 2 no opinion)
  - The expert from Netherlands proposed to take out the requirement about the rigid structural parts from para. 2.1.4. because this paragraph is not mentioning rigid structural parts. The contour of elements, which are not part of the superstructure, but which can intrude into the residual space after deformation should not be included in the computer model but they could be used in the post processing.

## 7. The effect of safety belts

This subject has been already discussed on the earlier AHEG meetings and based on the decision of the Frankfurt meeting, UK prepared a document which contains all the necessary changes, amendments in the regulation to involve the use of safety belts into the approval process. (AHEG-25) Although earlier there was a proposal (in GRSG, too) to consider the half of the belted passenger mass as addition to the empty vehicle mass, the UK proposal uses a "k" factor, this proportion to be decided by AHEG. Discussing the safety belt subject, the following interesting comments have been made:

- 7.1. Spanish expert (INSIA) informed the group about body section rollover tests and their computer simulation. They have studied:

- empty body section (with 8 empty seats in it)
- body section with dummies without seat belt
- body section with belted dummies. ( 3pt belt)

They measured and detected the changes of the diagonals of the body sections and knowing the characteristics of the plastic hinges formed in the body section, they could calculate the absorbed energy. From these energy values they could deduce the corresponding mass relations. The conclusion of this study: the mass increasing effect of unbelted passengers is neglectible but the mass of the belted passengers has a very strong, significant mass increasing effect. Although earlier they proposed  $k = 0,5$  mass increasing factor, on the basis of some previous test using 2pts belt, now, on the basis of the new results they think that  $k = 0,9$  value would be more appropriate in the regulation.

- 7.2. UK expert (CIC) had also a presentation about body section rollover tests and their computer simulation:
- empty body section, original construction (failed)
  - empty body section, reinforced construction (passed the test)
  - reinforced body section with belted dummies (failed)
- They used 2 pt seat belt in the test, but they simulated the 3 pt belts, too. Conclusion: very similar result to INSIA's one, but they did not make a derivation for the mass increasing factor.
- 7.3. The other Spanish institution (IDIADA) also gave a presentation about the computer simulation of body section rollover test (but without test):
- a) empty body section with 4 seats in one row
  - b) body section with unbelted dummies
  - c) body section with belted dummies (2 pt belt)
  - d) body section with belted dummies (3 pt belt)
  - e) body section with passenger masses (68 kg) fixed to the seats.
- Simulation "a" passed the "approval", the other four simulations failed. In case "b" the dummies as lumped masses dropped on the floor before the cantrail hit the ground. Their conclusion: the unbelted dummies have a significant mass increasing effect, but the safety belts have no significant contribution to the mass increasing, comparing to the unbelted dummies. The absorbed energy was the smallest in case "a", while "b", "c" and "d" showed approximately the same energy level (50% higher than in case "a") Case "e" had the highest energy absorption, almost twice as in case "b".
- 7.4. The Czech experts (UVMV) also informed the AHEG about their new results. They showed three complete rollover tests with a trolley bus, a low floor bus and a high decker coaches. After that they reviewed - similarly to the Frankfurt meeting - the results of their computer simulations:
- empty body section (without dummies)
  - body section with belted dummies (2 pt belt)
  - body section with belted dummies (3 pt belt)
- They emphasised again that the unbelted dummies flew away from their seats and they concluded that there is no significant difference between the 2 pt or 3 pt belts from the point of view of mass increasing. But in spite of their Frankfurt conclusion, now they established that there is no significant difference - related to the absorbed energy - between the belted and unbelted dummies.
- 7.5. There was a strong discussion about the mass increasing effect of safety belts, because of the new conclusions of IDIADA and UVMV. The German experts said that they need some time to discuss at home this subject, to analyse all the available information.
- 7.6. The majority of the experts agreed (9 yes and 4 no) to put the UK proposal (AHEG-25) into new version of CD putting "k" in square bracket without definite value. The expression "total mass" should be changed. (e.g. "effective mass")
- 7.7. The chairman asked the four experts having oral presentation on this subject, to prepare and circulate a written summary about their study containing the main assumption, methods they used and their conclusions related to the mass effect of the dummies. This could help to AHEG to compare the test results and to find a final conclusion. Every new information, new evaluations of known data are welcomed to determine the mass increasing factor "k".

## 8. The "worst case" solution

German experts earlier proposed to introduce the "worst case" solution into the new regulation. UK and Hungarian experts undertook the task to produce a document which contains all the necessary modifications and amendments to involve the worst case solution in Reg.66. The main points of the discussion:

- It shall be checked whether other ECE regulations have good, appropriate definition for "vehicle" and "vehicle type" and if so, these definitions shall be used in Reg.66.
- The Hungarian expert proposed a new, modified description of the residual space. (see in Appendix of AHEG-26) The dimensions, the character of this space remained the same, the new idea is that every seat or seating position has an individual residual space (IRS) and the complete space in the bus is built up from these IRS-s. The experts will study this concept and it will be discussed on the last AHEG meeting.

- The Czech expert proposed to put an additional requirement into para.5.2.3. of the main text of the regulation that no structural element or part of the front wall (and rear wall) shall be in the original residual space (before the test)
- AHEG accepted the worst case proposal and it shall be built into the new version of CD.

#### **9. Annex : Computer simulation of rollover test**

Czech, German, Spanish (IDIADA) and Holland experts prepared a new version of this Annex (AHEG-17/DIF) based on the earlier version. The concept of the version is that only general requirements should be given for the simulation. On the other hand, the Hungarian expert presented a new paper (AHEG-28) about the whole requirement system which shall be met if the computer simulation will be used as an approval method. The main points of the discussion were:

- AHEG went through the document AHEG-17//DIF and it was corrected and amended. It was agreed to put the modified text into the new version of the CD, but without the Appendix. Hungarian expert undertook the task to produce a new Appendix for the last AHEG meeting.
- The Hungarian expert emphasised the original agreement of AHEG that the computer simulation may be used (as a substituting approval method) only to simulate the standard rollover test and not to simulate other substituting method (e.g. rollover test of body sections) The main text of the regulation is built up on the basis of this concept, and Annex 9 does not say anything about the energy distribution and body sections. Therefore the words "... or sections of the superstructure" and the reference to Annex 6 in para.2. shall be deleted.
- The UK experts required some description about the plastic hinge characteristics, how to determine and use them.
- Czech expert proposed to allow the possibility to determine the moment of inertia of the vehicle by measurement, too.
- AHEG agreed that the requirement for archiving the documents of this approval method shall be deleted. This is an important question, but the right place of this kind of requirements is not this Annex.
- The Hungarian expert emphasised the present text of Annex 9. does not meet a lot of view points and requirements listed in AHEG-28, therefore he offered to make comments and proposals to this Annex for the next AHEG meeting.

#### **10. Future activity of AHEG**

As it was discussed already and preliminary agreed, on the Frankfurt AHEG meeting and also in GRSG that one more meeting is needed to complete and present the CD of the new Reg.66 to GRSG. The conclusion of this AHEG meeting supports this demand, because some parts of the CD are not finally agreed yet, they need further discussion.

The Polish expert invited AHEG to held its last meeting in Warsaw during 28-29 of October. The preliminary agenda of this meeting:

- The required accuracy when measuring the CG of the bus (Polish proposal is offered)
- Finalizing the seat belt issue, determining the "k" factor (the mass proportion of the belted passengers to be considered) for the new CD
- Final decision about Annex 7. and Annex 8. (parameters 0,75 and  $\Delta h$ )
- Finalizing the Annex 9: computer simulation of the standard rollover test
- Corrections and modifications in the CD
- Comments on the new, modified determination of the residual space proposed by Hungary (see para.8. in this Report)

05 08. 2002

Dr. Matolcsy Mátyás  
Chairman of AHEG

**I. Documents presented to AHEG, used and discussed on its Barcelona meeting**

AHEG-15/Rev2	Modified version of Annex 8 to the regulation (with the absence of para 2.2.)
AHEG-17/Rev1.	Revised document on computer simulation (Annex 9) together with the question of the French expert
AHEG-17-DIF	Modified document on computer simulation presented by the expert Germany Netherlands, Spain and Czech Republic
AHEG-18/Rev.1	Revised version of the Consolidated Document (CD) of the modified Reg.66 (made by UK)
AHEG-18/CZ	Working comments to the CD (made by Czech Republic)
AHEG-24/Rev1	Report about AHEG meeting in Frankfurt
AHEG-25	Recognition of the effect of restrained occupant mass in the revised R.66. (made by UK)
AHEG-26	Worst case problem (common proposal of UK and Hungary)
AHEG-27	Corrected version of the Belgian-Hungarian proposal to Annex 8. para.2.2.
AHEG-28	Hungarian opinion to the computer simulation of rollover
AHEG-29	Spanish (INSIA) proposal to Annex 8. para2.2.
AHEG-30	Unchanged and modified, improved ideas, matters in the new Reg.66 (The presentation of the AHEG's chairman in GRSG)
AHEG-31	A contribution to the discussion of the passenger influence in ECE R.66 rollover best (IDIADA, Spain)
AHEG-32	Comments to the GRSG INF.D-5 (made by Czech Republic)

**II. NEW DOCUMENTS, PRESENTED BY AHEG TO GRSG**

Following informal documents were presented by AHEG on the 82<sup>nd</sup> meeting of GRSG

INF.D.-2	Report about the AHEG meeting held in Frankfurt, 22-23 November 2001
INF.D-5	Consolidated Document of new Reg.66 containing the texts agreed in AHEG until the end of the Frankfurt meeting.