Submitted by the expert from Hungary

Informal document No. **GRSG-99-04**
(99th GRSG, 19-22 October 2010
Agenda item 2)

Lower level of double deck buses and coaches. Extended justification

1. This document is strongly related to the proposal given in the doc. ECE/TRANS/WP.29/ GRSG/2010/2. After the discussion of this document GRSG requested some further evidences that the lower level (LL) of double deck (DD) buses can be considered as rigid part, therefore no test is required on it, the residual space (RS) should not be checked. This would result a much simpler, cheaper approval test and clear, unified calculation approval methods (quasi-static calculation and dynamic computer simulation)

2. Among the definitions of R.66 it is listed:

   2.28. "Rigid part" means a structural part or element which does not have significant deformation and energy absorption during the rollover test.

3. The LL of a DD vehicle is reinforced by a lot of strong structural elements coming from the design and arrangement of this kind of vehicles:

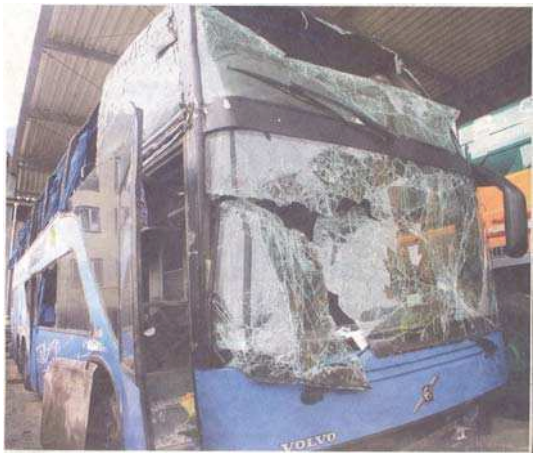
   - Engine compartment in the rear part
   - Driver compartment in the front part
   - Wheel arches in the front part
   - Staircase(s) in the mid of the vehicle
   - Toilet in the mid
   - Baggage compartment(s) in the mid-rear

4. The bus rollover is a rather rare road accident type and the rollover of DD buses is extremely rare (because of the small, but increasing number of DD coaches in the whole bus fleet). So the 12 examples shown below give very strong argument in the question discussed. These accidents are not discussed in details, only the general deformation characteristics of UL and LL are shown.

5. The rollover accidents are grouped into three essential types:

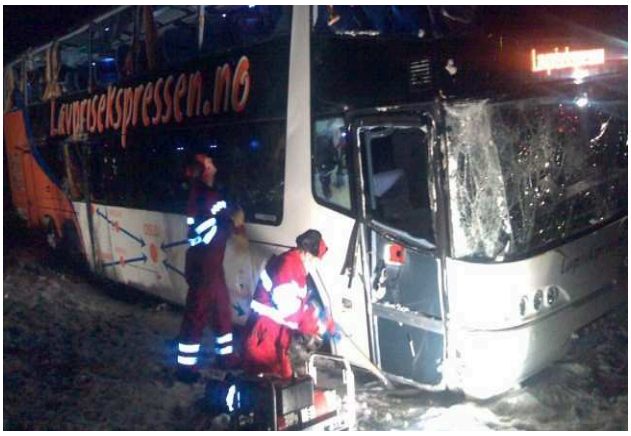
   - Tip over (turn on side) on a flat ground (In this case the angle of rotation $\alpha \approx 90^{o}$) This is the less dangerous rollover type in respect of the possible superstructure deformation: no reaction force on the cantrail.
   - Tip over from the road the cantrail hits the other side of a ditch or a hilly, inclining ground ($\alpha \approx 45^{o} – 60^{o}$). Reaction force on the cantrail is possible.
   - Roll down from the road on a slope ($\alpha \approx 90^{o} – 180^{o}$) with not more than one rotation. Reaction force on the cantrail is surely acting.

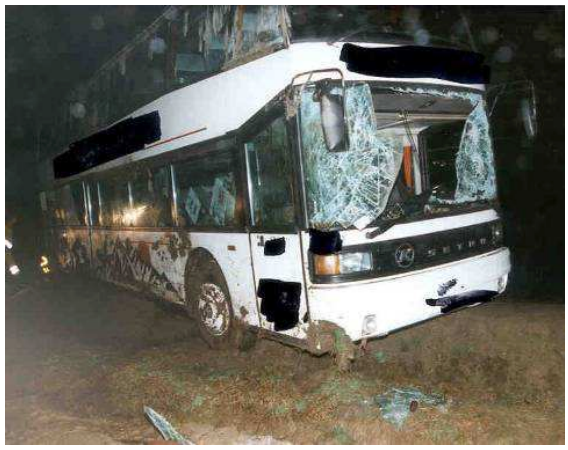
6. Tip over accidents on a flat ground



Slight deformation on the upper level (intact RS); rigid LL

No significant deformation on the UL, rigid LL





No significant deformation on the UL, rigid LL

7. After tip over the cantrail hits the other side of a ditch or inclining ground

Slight deformation on the UL,

Rigid LL

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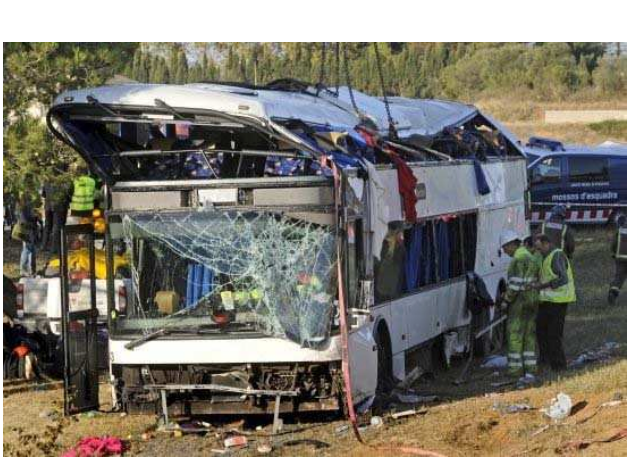
Considerable deformation on the front part of UL, rigid LL

8. **Roll down from the road on a slope** ($\alpha \approx 90^{o}$-180^{o})



Collapsed UL, the RS disappeared.

Rigid LL

RS disappeared; UL collapsed

Rigid LL

Considerable deformation on the UL

Rigid LL

Considerable deformation on UL, rigid LL

One side collapse on the UL; rigid LL, but severe damage on the driver's cab due to a frontal collision with a car

9. If somebody can show a DD rollover accident (belonging to the three accident types listed in paragraph 5.) in which the LL put up considerable structural deformation due to the rollover, Hungary will withdraw the proposal.