Issues to be resolved in evaluation of R94 modifications (with respect to use of PDB barrier)

Self Protection Issues

1. **Is an accident analysis needed to update information on changing vehicle fleet?**

   Background: R94 is based on a reference crash of 50 km/h car-car crash 50% overlap. Does this reference need to be updated to reflect other frontal crash conditions? For example, how relevant are crashes between passenger cars and heavy goods vehicles, roadside obstacles etc.
   Action: National/European analysis of accident distributions and collision speeds. Sources. PENDANT, CCIS, RISER, GIDAS, etc.
2. **Identify critical injury mechanisms (in particular relevance of thorax injuries in high deceleration pulse type accidents)**
   Background: Information presented was presented from the UK to EEVC WG15 in 2006. The information showed an increase in chest injuries for newer vehicle models. Does this information suggest specific restraint system tests are necessary (for example a high pulse test)?
   Action: Collection of national and European injury statistics, preferably grouped with collision severity. Sources: CCIS, GIDAS, Pendant, STRADA, etc
3. **Assess potential for harmonisation for frontal impact procedures**.
   Background: The USA and Japan both require a full frontal impact test procedure and Japan also requires an offset test procedure (R94). Changes to R94 that can be incorporated into a global frontal impact standard would be beneficial for European industry and would allow for better frontal impact protection.
   Action: The introduction of a full frontal impact test in Europe could allow better harmonisation with the US and Japan. A combined offset and full frontal test procedure should be analyzed for suitable test speeds.
4. **Finalise the test severity for regulation test – determine acceptable minimum values for vehicles.**
   Background: The reference car-car test in R94 assumes a collision partner identical to the test vehicle. Compatibility research shows that the energy absorption demands for small cars and large cars are different in a fixed barrier test procedure. A test severity metric (such as Equivalent Energy Speed –EES) should be determined for the test vehicle based on the vehicles mass. One example is to use a reference collision partner of a set mass so that small cars have higher EES speeds than heavy vehicles. Accident analysis and collision probability models could define a minimum required EES for all vehicles in the test category. As example, a median vehicle mass for the European fleet (approx 1500 kg) could be used.
   Action: Collision speed and vehicle mass distribution scenarios evaluating the collision violence for different vehicle categories and the risk of collisions. Sources: EU Project Improver, GIDAS, CCIS.
5. **Validate the PDB EES calculation method**
   *Background: PDB test results to date are reported with the EES experienced by the test vehicle. The data is based on a calculation of the energy absorbed by the PDB. This calculation cannot be directly verified. Thus the EES value determined in **Point 3** cannot be positively confirmed for the PDB.*
6. **Validate that the PDB test guarantees a minimum EES test severity for all vehicles.**
   *Background: The test severity defined under **Point 4** must be ensured to be enforced with the PDB. Sufficient test and simulation data does not exist to confirm the PDB can achieve this. The PDB energy absorbing capacity will allow a completely rigid vehicle (a steel block) to have acceptable test results for occupant protection. Although these*

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vehicles are unlikely to be designed, there is the theoretical potential for an acceptable test result with an unacceptable vehicle.
Actions: Investigate potential to misuse PDB. Investigate application of Full Width Barrier test.

7. **Validate that PDB provides the required test requirements for interior restraints**
   *Background: In connection to **Point 2** and **Point 4** the PDB may produce a test that does not sufficiently test the restraint system to address certain injuries.*
   Action: Investigate need to complement the PDB with a Full Width Barrier test.

Compatibility Issues (in terms of PDB characteristics) (if needed)

There is an interest to monitor the changes of R94 to address self protection while facilitating improvements in compatibility. The informal group could address the following issues if sufficient resources are available. Alternatively, compatibility issues could be addressed by a parallel working group.

8. **Investigate the vehicle force deflection characteristics that may be generated in future vehicle designs which are based on the PDB test approach.**
   Background: The previous EEVC barrier has been shown to produce increasingly stiffer vehicles which may not serve to improve vehicle safety for all car occupants. In particular, the overcrushing of small cars by larger cars. Although the PDB can change the loading requirements based on the vehicle mass, future vehicles should not adapt to the new barrier in such a manner that undesirable force characteristics are produced.
   Action: Conduct analyses attempting to misuse the PDB, conduct modified vehicle tests. Sources: VC-Compat, National projects, Industry projects,
9. **Identify the potential use of the PDB to evaluate geometric characteristics of vehicles to encourage compatibility.**
   Background: The current PDB has been under development for geometric compatibility purposes without successfully showing an objective assessment criteria for geometric characteristics (structural interaction).
   Action: Monitor the latest activities for PDB applications in compatibility and application of full width barrier tests to assess geometrical properties of vehicles. VC-Compat, National projects, Industry projects,
10. **Determine reproducibility and repeatability of measuring honeycomb barriers in crash tests**
    Background: All test methods must possess robust behaviour so that reproducibility and repeatability among accredited laboratory facilities is guaranteed. This item is more critical for compatibility issues as the test criteria are still unknown. Limited PDB reproducibility test data is available via WG15 and VC-Compat..
    Action: Reproducibility/repeatability test program.
11. **Confirm vehicle structures are objectively measured in PDB. In particular the barrier deformations due to vehicle rotation around the barrier should not affect the compatibility assessment procedures.**
    Background: The assessment criteria from the PDB depend on the static measurement of the barrier deformation after a test. As the vehicle rotates around the test barrier during the crash, some of the barrier deformation may not be suitable for analysis.
    Action: Conduct simulation/experimental research of modified vehicles with known properties to observe consistent response of PDB barrier deformations.

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