"Saul, Roger " <Roger.Saul@nhtsa.dot.gov>

29/12/2005 16:54

In thinking toward our next GRSP pedestrian safety ad hoc meeting in January and what would make it the most productive in reaching a good conclusion, I thought it might be helpful if I could elaborate on some of the items we've presented at the last two ad hoc meetings [e.g., Inf GR PS 132, Inf GR PS 165, Inf GR PS 166, and Inf GR PS 122]. Hopefully this will assure that we have the specific information we think is necessary to support the gtr and preamble justifications according to the requirements of the 1998 agreement.

I've again reviewed the TRL feasibility report (PS 89) and have focused many of the questions toward that study assuming that it is the primary basis. However, if the information is contained in other PS documents, please provide the PS citation and location within the document so that we can properly focus the preamble discussion. I've found it difficult to generate an exhaustive list of questions, since we first need to have the baseline data as a basis for discussion. Hopefully these questions will provide an understanding of why we've asked for this information at the past meetings, and with this information we can include in the preamble discussion describing our analysis and rationale for the proposed requirements. We'll need this information in order to conclude the preamble at our January meeting. Also, have other regions done analyses similar to PS 89 to assure there is agreement that similar cost, benefit, feasibility are anticipated? We'll need to address all regions, not just Europe and the US, in the preamble.

Head test
In Inf GR PS 166, we offered the following information that we feel is necessary to complete the preamble regarding the head protection.

* Baseline performance of current fleet and projection of benefits to be derived from this gtr
* Cost to meet head requirements
* Implications on other standards/regulations

We believe this information is needed for the preamble to be able to provide current and future contracting parties the basis of the safety need, rationale for the proposed or established gtr requirements, and effectiveness of the head test requirements for reducing head injuries. Knowing the performance of the current baseline fleet is necessary to demonstrate and explain these things. From our limited testing, the US baseline performance seems to be fairly good relative to the performance criteria, meaning that we'd have few head injury benefits with the currently proposed requirements.

- Is there a compilation of baseline fleet head performance test available? If so, where?
- Inf GR PS 89 discusses in very general terms the EuroNCAP data, but I don't find HIC results and where they would fall within the test

or relaxation zone. Do we have EuroNCAP, KNCAP, and JNCAP data for the gtr test area that we can use as a baseline response? We wouldn't need to have it listed by make/model as in PS 166; a compilation of the HIC results by WAD and general impact location (e.g., in or out of a likely relaxation area) would suffice.

- o Does it have the HIC15 measurement and some indication as to whether or not the test location would have been in a relaxation zone? Can it be scaled to the gtr impact velocity and test conditions?
- o Section 7.2.5.1 (pg. 92) of PS 89 discusses failure to comply and difficult areas, and appears to be the basis for needing relaxation zones. Is there any further data available? For example, the headform relaxation appears to be based solely on testing of a Honda Civic at 40 km/h.
- o Also, Section 7.4 (beginning at pg. 97 of PS 89) describes implications of feasibility issues and introduces less demanding protection requirements that are "thought to significantly improve the feasibility of the second phase of the Directive." Are there data to support these, other than the concepts described in Section 2?

Leg test

In Inf GR PS 165, we offered the following information that we feel is necessary to complete the preamble regarding the leg/bumper test procedure.

- * Relationship between leg biofidelity, injury parameters, and injury risk
- * Current fleet baseline performance
- * Feasibility data and cost to meet leg requirements
  - * Any sources besides TRL report?
  - * Implications on damageability and other standards/regulations

Section 3.3.1.4 of Inf GR PS 89 (pgs., 39 - 42) appears to provide injury risk level justifications for bending angle and tibial acceleration. It also cites a Matsui transfer coefficient for the TRL legform of 0.314 yielding 7.9 mm displacement corresponding to 50% risk of ligament injury.

- o How did we get a shear requirement of 6 mm from this, especially given the assessment in PS 147 "that it is almost impossible to precisely determine knee shearing motion in PMHS tests?"
- o From PS 165, it appears in baseline testing that the knee shear requirement is nearly met without countermeasures. It also appears in PS 89 that meeting the knee shear was not considered in providing cost benefit. Given the uncertainty of this measure, do we have a strong justification for maintaining it in the gtr?
- o Is the baseline testing shown in PS 165 similar to fleet test results in Europe, Japan, and Korea?
- o Where have we demonstrated that the countermeasures described in PS 89 will lead to leg responses that meet the gtr requirements? What are the costs to do so? Are the costs listed in PS 89 feasible in real world production?

High bumper upper leg test

Section 3.3.3.4 of PS 89 (pg. 50) describes accident reconstructions with the upper leg to determine that a 50% probability of AIS 2+ femur or pelvis injury corresponded to 7.5 kN and 510 Nm; and 20% probability at 6.3 kN and 417 Nm. However, it goes on to say that EEVC WG 17 had concerns with this and then conducted further reconstructions leading to injury risk curves and a transfer function for the test device.

- Where are these further EEVC reconstructions and analysis described?
- How do the femur/pelvis injury probability curves relate to knee injury probability?
- Can we demonstrate that meeting the high bumper upper leg test will lead to a reduction in pedestrian knee joint injuries?

If I correctly understand the argument for requiring the high bumper test, it is out of concern that the lower leg test could readily be met by simply allowing the leg to slide and/or rotate beneath the high bumper. This could have an unintended consequence of encouraging high bumpers as a way to meet the requirements, and lead to more pedestrian injury due to run-over.

- If the upper leg bumper test were incorporated, how would this encourage protection of pedestrian knees, which are more important to protect?
- How would it discourage production of high bumper vehicles, particularly if the upper leg test requirements were easier to meet than the lower leg test?

Costs/benefits

- Section 9 of PS 89 has cost estimates. Is a correct interpretation that the added cost per vehicle to meet the pedestrian requirements would be an average of about EUR 45? What costs are associated with each of the test requirements, i.e., leg-to-bumper, upper leg-to-bonnet leading edge, and head-to-bonnet?
- MEL (PS 89, section 8, pg. 18 of 1st MEL insert) suggests that the theory of the cost estimates be substantiated by OEMs and that there could be negative impact on emissions, fuel economy, and performance that should be considered. Has that been done? Do we have studies showing that the pedestrian gtr requirements can be met without conflict to existing regulations as listed in PS 35?
- In section 10 of PS 89, it is not clear how estimated reductions in pedestrian fatal & serious injuries were obtained without knowing the underlying baseline fleet performance relative to the proposed gtr requirements. Can further explanation be provided to clarify? What is the benefit derived for each of the impact requirements (i.e., child head, adult head, adult knee)? As per above, do we have either EuroNCAP, JNCAP, or KNCAP baseline performance information of the current fleet?
- PS 89 notes that "the estimates of injuries saved are sensitive to some of the assumptions made about how well cars that are designed to meet the test procedures will protect vulnerable road users from injury," (pg. 198) and that "benefits from preventing head injuries will be over-stated as the injury risk curve used [was] for AIS 4+ injuries rather than AIS 2+" (pg. 199). Do we have a way to estimate these effects, such as knowing the baseline fleet performance?

o The preamble will need to reflect cost, benefit, and feasibility for all regions. Do we have studies from Japan and Korea that we'll be able to cite?

I hope that this information can be available prior to our next meeting so that we can have fruitful discussions allowing us to complete our pedestrian gtr and preamble.

Best wishes for a Happy New Year in 2006! We look forward to seeing you in January.

Best regards,
Roger

^^

Roger A. Saul, Ph.D.
Director, Office of Crashworthiness Standards
National Highway Traffic Safety Administration
400 7th St., S.W.
Washington, D.C. 20590

ph.: +1(202)366-1740
fax: +1(202)493-2739
Roger.Saul@nhtsa.dot.gov
^^