Appendix B

Appendix B: National Highway Traffic Safety Administration's Deformation Evaluation

1) ANALYSIS OF CRASH ET31-30 BY NHTSA

Engineers and scientists from the Office of Vehicle Crashworthiness Research at the National Highway Traffic Safety Administration (NHTSA), with expertise in crash analysis and injury causation, reviewed the videos and test report for crash test ET31-30. Crash dummy kinematics were consistent with offset center narrow object impact that resulted in forward and lateral motion of the dummy. The secondary collision of the vehicle to the guardrail resulted in a lateral intrusion of 6.75 inches in the lower driver's side door in the area forward and just below the seat. There was no video indicating if the intruding door made contact with the dummy's lower leg nor did the dummy contain any instrumentation in the lower leg area, thus only a qualitative assessment of injury risk from the test can be given. Because intrusion of vehicle structure into the occupant compartment has been shown to be associated with an elevated risk of injury, a low risk of serious injury is possible to a person's lower leg based on location and amount of intrusion.

2) ANALYSIS OF DOOR INTRUSION FROM NASS-CDS DATA

To support that analysis of the ET31-30 crash data, the National Automotive Sampling System-Crashworthiness Data System (NASS-CDS) database of crashes was queried for case years 1997 through 2013 to document the relationship between door panel intrusion and lower leg injury. Serious leg injury was defined as any below knee injury (not including the foot and ankle) of Abbreviated Injury Scale (AIS) 3 or greater. In this case, all targeted injuries were at the AIS 3 level.

Methods

For the purposes of this study, the occupant target population was limited to those seated in the driver seat in a passenger car or light truck. The highest or second highest deformation location had to be located on the left side of the vehicle and the specific location of damage needed to overlap the passenger compartment. The intrusion of interest had to be located at the driver's seating position and the intruding component was limited to the door panel. Additionally, the assigned injury source for the AIS 3+ lower leg injury had to be assigned to left panel or left interior.

Results

Table 1 shows the total case counts (raw and weighted) for a driver having one or more AIS 3 lower leg versus no AIS 3 lower leg injury for the six ranges of intrusion shown. The risk of serious lower leg injury, based on the weighted data, is shown for each range of intrusion.

Table 1: Results of AIS 3 leg injury vs. intrusion amount

	AIS 3 Lwr Leg		**AIS < 3**		**Wtd Risk**
Instrusion Amount	Raw	Weighted	Raw	Weighted	**%**
3-7 cm	0	0	767	373025	0.0%
8-14 cm	6	759	828	287625	0.3%
15-29 cm	8	679	963	205251	0.3%
30-45 cm	12	768	543	54930	1.4%
46-60 cm	6	414	177	10960	3.6%
61 cm+	4	150	37	2550	5.6%

For the range of door intrusion, in side impacts, similar to the 6.75 inches (17.1 cm) to what was observed in test ET31-30, there is a 0.3% risk of serious lower leg injury. This finding is consistent with the qualitative assessment of injury risk based on the test data.