

adult female driver dummy were nearly double the Nij values registered for the 50th percentile adult male driver dummies tested in the same vehicle. The higher injury measures may result from the proximity of the female dummy to the steering wheel or instrument panel. The seating procedure for testing with the 5th percentile female dummy places the dummy closer to the steering wheel than the 50th percentile adult male dummy, reducing the distance between the dummy and the deploying air bag. A major factor in air bag-induced fatalities has been the proximity of the occupant to the air bag module at deployment. Therefore, this amendment is intended to ensure that belted small-stature drivers and any belted passengers seated close to the air bag are adequately protected in a high speed crash.

These eighteen tests indicate both a need for and the feasibility of extending the 56 km/h (35 mph) maximum belted test speed to include the 5th percentile adult female dummy. If adopted, the new requirement would improve the equality of belted crash protection for occupants of different sizes by requiring the 5th percentile female and the 50th percentile male belted rigid barrier crash tests to use the same maximum speed. As described above, compliance with this amendment will likely lead to further improvement of air bag and/or seat belt systems.

### III. Benefits and Costs Associated With the Proposed Rule

NHTSA estimates that today's proposal, if adopted, could prevent between five and six small occupant fatalities per year and could also reduce two to three moderate to severe injuries (MAIS 2+).<sup>3</sup> Compliance with the proposal would reduce fatalities for drivers by reducing fatal HIC values by 1.4–2.3 percent, fatal Nij values by 3.8 percent, and fatal chest g values by 2.8 percent. When applying these reduction rates to the corresponding target population, this translates to a reduction in driver fatalities from head, neck and chest injuries of 1–2, 1, and 2, respectively. For passengers, compliance would reduce fatalities by reducing fatal HIC values by 0.9–1.5 percent. This translates to a reduction in passenger fatalities by 1. The total reduction in fatalities would be between

five and six drivers and passengers combined. Compliance with this proposal would also reduce MAIS 2–5 injuries to drivers by reducing the associated HIC values by 0.2–0.4 percent and the associated chest g values by 0.2 percent. When applying these reduction rates to the corresponding target population, this would result in a reduction in head MAIS 2–5 head and chest injuries of 1–2 and 1 respectively, or a total reduction of MAIS 2–5 injuries of 2–3. A complete discussion of how NHTSA arrived at its estimates may be found in the Preliminary Regulatory Evaluation located in the docket for this rulemaking.

Beyond reducing the rates of injury and fatality to small-stature occupants, increasing the maximum belted test speed for testing with the 5th percentile adult female dummy would expand belted crash protection to occupants of different sizes. The amendment would address the potential hazard to all belted occupants who are very close to both the air bag module and the steering wheel or instrument panel. By phasing in a maximum test speed of 56 km/h (35 mph) for belted testing with the 50th percentile adult male dummy, the Advanced Air Bag Rule should improve occupant protection for belted occupants whose seats are positioned in the mid-track position or further back. Increasing the test speed to 56 km/h (35 mph) for 5th percentile female dummies would oblige occupant protection designers to concurrently focus on improving the safety of small stature belted drivers as well as other individuals who for some reason have the seat positioned closer to the instrument panel or steering wheel.

Compliance with the proposal would result in a nominal additional cost to vehicle manufacturers. The test procedure itself is already required at a lower impact speed in FMVSS No. 208; only the maximum impact speed would be raised. Likewise, agency compliance tests would use the same procedures that will be used for the 48 km/h (30 mph) belted barrier test. Additionally, as indicated by twelve vehicles that met all IARVs in NHTSA's test program, many vehicles already meet the proposed requirement. Measures implemented to meet the 48 km/h (30 mph) crash test requirements for the 5th percentile adult female test dummies may also result in compliance with the proposed 56 km/h (35 mph) requirement with no additional changes.

To the extent additional measures may prove necessary, improving performance beyond the 48 km/h (30 mph) requirement could involve

relatively simple changes. Air bag inflation characteristics could be redesigned through changes to the fold pattern, vents, or the air bag algorithm that would effectively modify the timing between primary and secondary stages of deployment. Changes could be made to the electronic control module, which controls the dual stage air bag. Possible changes could include seat track sensors and/or modified seat track lengths to position the full forward seating position further away from the steering assembly. Safety belt pretensioners could be used to remove the slack from the safety belt and provide restraining forces on the occupant earlier in the crash, reducing forward excursion into the steering wheel or deploying air bag. Manufacturers may decide to use a combination of technologies to maximize the performance of the entire occupant protection system.

Based on vehicle production numbers, about 20 percent of new light vehicles would have to change either driver side or passenger side performance to comply with the proposal. Assuming a new light vehicle fleet in 2005 of 15.9 million, 3.32 million vehicles would need to improve driver side performance, with 0.92 million of these vehicles also having to improve passenger side performance.

Manufacturers may be able to comply with this proposal by changing the air bag characteristics as described above. There would be minimal costs associated with this alternative. If manufacturers were to comply with the proposal by modifying the electronic control module, 3.32 million driver side and 0.92 million passenger side air bags would need to be improved. At a unit cost of \$3.12 per vehicle, the total cost for this implementation strategy would be \$10.36 million.

Of the vehicles that would need improved performance, about 40 percent were equipped with a driver seat track sensor and 60 percent were not. Under a compliance strategy incorporating seat track sensors, 1.32 million vehicles that would not comply with the proposed requirements would already be equipped with seat track sensors. These 1.32 million vehicles would need to modify the driver side air bag inflation characteristics and electronic control module, at a cost of \$3.12 per vehicle, or a total of \$4.12 million. Two million of the vehicles that would not comply with the proposal would not be equipped with a seat track sensor. These two million vehicles would need to install a driver side seat track sensor and change the air bag characteristics. The cost of a sensor and modification of the air bag

<sup>3</sup> MAIS (Maximum Abbreviated Injury Scale) represents the maximum injury severity at an Abbreviated Injury Scale (AIS) level, regardless of the nature or location of the injury. The AIS ranks individual injuries by body region on a scale of 1 to 6 as follows: 1=minor, 2=moderate, 3=serious, 4=severe, 5=critical, and 6=maximum/currently untreatable.