Proposed Seat Design of Additional Third-Row Seats

Suratno, B.¹ Black, D.¹ Aquilina, P.² & Leavy, D.¹
¹ NSW Centre for Road Safety, Transport for NSW
² Crashlab, Roads and Maritime Services

Introduction

• Design and installation of After-market additional seats are regulated under the Vehicle Safety Bulletin 05. The seats are categorised as:
  – Category 1: For use by adults;
  – Category 2: For use by children up to 12 years of age; and
  – Category 3: For use by children up to 8 years of age.

• Previous study found that a child under 4 years old sitting in a child restraint on Category 2/3 seat was better protected than sitting directly, but was not as well protected as sitting in a child restraint on a standard vehicle seat.
Introduction (continued)

• It is impractical for children aged between 4 and 7 years old to use booster seat on Category 2 or 3 seat. Some states allow these children to occupy these seats without a booster seat.
• However, the space requirements for VSB 5 may not be sufficient for children aged between 4 and 12 years old.

Illustrating the issue

• The current VSB-5 requirements for head and leg spacing were tested using dummies representing 4, 6, 10 and 12 years old children.
• The results show the current spacing requirements are too short and too narrow for the larger occupants, increasing their risk of abdominal and head injuries in the event of a crash.
Matching Seat Geometries and Child Anthropometry

- Child Anthropometry data from the University of Michigan was used in this study.
- Head space (Radius A) and Leg Space (Radius B) as specified in VSB 5 were compared against the seated height and knee length of the intended seat occupants*.

* All dimensions were measured from the hip of the occupants plus allowances for head and leg movements in a crash.

Head Space

- The current head space requirements are too short to accommodate the intended occupants.
- Category 1 seat’s minimum head space (710mm) is shorter than that of an average 18 years old (900mm).
- Likewise for Categories 2 and 3 seats.

<table>
<thead>
<tr>
<th>CATEGORY OF SEAT</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current VSB 5 requirements (mm)</td>
<td>710 min</td>
<td>630 min; 710 max</td>
<td>630 max</td>
</tr>
<tr>
<td>Seated height of the intended occupant (mm)</td>
<td>900</td>
<td>774</td>
<td>700</td>
</tr>
</tbody>
</table>
Leg Space

- The current VSB 5 leg space requirements are too narrow to accommodate the intended occupants.
- Category 1 seat’s minimum leg space (460mm) is narrower than that of an average 18 years old (530mm).
- Likewise for Categories 2 and 3 seats.

<table>
<thead>
<tr>
<th>CATEGORY OF SEAT</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current VSB 5 requirements (mm)</td>
<td>460 min</td>
<td>370 min</td>
<td>300 min</td>
</tr>
<tr>
<td>Knee length of the intended occupant (mm)</td>
<td>530</td>
<td>453</td>
<td>394</td>
</tr>
</tbody>
</table>

Proposed Revisions of VSB 5

- Children younger than 4 years old are not allowed to use Category 2 and 3 seats, even with a child restraint.
Proposed Revisions of VSB 5

- The upper limit for Category 3 seat is limited to 7 years of age, for consistency with the Road Rules.
- The minimum head and leg space requirements are increased to accommodate the intended occupant.

<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>CATEGORY OF SEAT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Radius A</td>
<td>898 mm</td>
</tr>
<tr>
<td>Radius B</td>
<td>560 mm</td>
</tr>
</tbody>
</table>

Next Step

- Validate the proposed design.
Thank You