NHTSA’s Initial Evaluation of Child Side Impact Protection – Update

Susan Meyerson
March 11, 2008
Takata Side Impact Sled

- Sled pulse – $\frac{1}{2}$ sine with pk~28g
- Reach pk. velocity in 250 mm
- Sled velocity – 20 mph, based on small vehicle FMVSS 214 tests (door accelerometers)
- Honeycomb stiffness
- Door padding stiffness
  - Takata’s foam (stiffer)
  - Ethafoam type (softer)
- Lateral ($0^\circ$) impact angle; option to change impact angle
Initial CRS SI Sled Testing

• Previously presented at the May 2008 GRSP meeting
  • Two series of tests with Q3s dummy
  • Sled at two impact angles – 0° and 10°
  • Five different CRS models

• Takata sled exhibited good repeatability

• Able to distinguish between carseat models using injury levels
Sled Tests at Varying Impact Angles

• Test at 0°, 10°, 15° and 20° Impact Angle
  • Rotated Takata sled buck relative to HYGE impactor
Sled Tests at Various Impact Angles

• Selected 3 of previous 5 CRS models tested
  • Graco SafeSeat Step2
  • Evenflo Triumph
  • Maxi-Cosi Priori
    • Did not select Graco Logico M (lack of availability) nor Safety 1st All-in-One CRS (due to head contact at 10° impact angle)

• Selection primarily based on side wing design
  • SafeSeat Step2 and Maxi-Cosi Priori – wings essentially perpendicular to the CRS seatback
  • Evenflo Triumph – wings slightly more angled outward from seat back
CRS Side Wing Designs

Graco SafeSeat Step2

Evenflo Triumph
15° Impact Angle

Graco SafeSeat Step2

Maxi-Cosi Priori
20º Impact Angle

-19.0 ms

Graco SafeSeat Step2

Evenflo Triumph
HIC$_{15}$ Values for Angled Sled Tests

HIC$_{15}$ Values
Q3s Dummy

<table>
<thead>
<tr>
<th></th>
<th>Buck 0 deg</th>
<th>Buck 10 deg</th>
<th>Buck 15 deg</th>
<th>Buck 20 deg</th>
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</thead>
<tbody>
<tr>
<td>Graco SafeSeat Step2</td>
<td>800</td>
<td>700</td>
<td>600</td>
<td>500</td>
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<tr>
<td>Evenflo Triumph</td>
<td>600</td>
<td>500</td>
<td>400</td>
<td>300</td>
</tr>
<tr>
<td>Maxi-Cosi Priori</td>
<td>400</td>
<td>300</td>
<td>200</td>
<td>100</td>
</tr>
</tbody>
</table>
Neck Tension for Angled Sled Tests

Neck Tension
Q3s Dummy

force (N)

Buck 0 deg
Buck 10 deg
Buck 15 deg
Buck 20 deg

Graco SafeSeat Step2
Evenflo Triumph
Maxi-Cosi Priori

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Spine y-axis Acceleration for Angled Sled Tests

Spine Y Acceleration
Q3s Dummy

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Acceleration (G)
Pelvis y-axis Acceleration for Angled Sled Tests

Pelvis Y Acceleration
Q3s dummy

Graco SafeSeat Step2
Evenflo Triumph
Maxi-Cosi Priori

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Chest Displacement for Angled Sled Tests

Chest Displacement
Q3s Dummy

Displacement (mm)

Graco SafeSeat Step2  Evenflo Triumph  Maxi-Cosi Priori

Buck 0 deg  Buck 10 deg  Buck 15 deg  Buck 20 deg

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Angled Sled Test Summary

• Upper torso and head increasingly rotated forward in CRS as impact angle increased

• Increased neck tension appeared to be due to
  • increased impact angle
  • CRSs’ wing design

• Spine and pelvis y-axis accelerations
  • highest at 0° impact angle for the SafeSeat Step2 and Triumph
  • virtually identical across the impact angle range for Maxi-Cosi Priori

• Impact angle appeared to have minimal effect on lateral chest displacement for the 3 CRS models
CRS SI Crash Test Objectives

- Conduct CRS near-side full-scale FMVSS No. 214 side impacts to obtain more accurate info:
  - Amount of door intrusion
  - Door velocity at time of CRS/dummy contact
  - Amount of vehicle rotation at CRS/dummy location
  - Dummy responses to evaluate sled test severity and parameters

- Determine similarities between crash tests and sled tests
CRS SI Crash Tests

• ’08 Nissan Sentra & ’08 Nissan Versa
  • One Sentra test
    • FMVSS No. 214D test conditions
  • One Sentra and two Versa tests
    • impact point 228.6 mm (9 inches) rearward of that specified in FMVSS No. 214D in effort to more directly load door at occupant location

• Graco SafeSeat Step2 and Maxi-Cosi Priori seats

• Q3s (near-side) and Hybrid III 3Cs (far-side)
Crash Tests Compared to Sled Tests

4 MDB Tests Combined
Right Side Sill at Rear Seat Y-Axis Acceleration
Average with Upper and Lower Boundaries

Sliding Seat Pulse Parameter
4 MDB Tests Combined
Right Side Sill at Rear Seat Y-Axis Velocity
Average with Upper and Lower Boundaries

Sliding Seat Pulse Parameter

TIME [ms]

NA [Mph]

0 10 20 30 40

0 10 20 30

-10
CRS Locations Relative to Door Panel / Armrest

Sentra Struck Side Door Panel

Versa Struck Side Door Panel
Summary

• Sled and crashed vehicle responses comparable

• Dummy and CRS kinematics in crash tests similar to those in sled tests
  • Armrest issue needs further investigation

• Some dummy responses similar, while others differed, between sled and crash tests

• Additional evaluation of results required to refine side impact sled test parameters
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Thank You