National Highway Traffic Safety Administration
Motorcoach Tests
GRSP – 43rd Session
Mary Versailles
Background

• NHTSA is conducting a research and analysis program to provide a comprehensive review of motorcoach safety issues and possible courses of action.
• The program will evaluate frontal crashes, rollovers, roof crush, flammability and evacuation.
• Documents are available at www.regulations.gov in NHTSA Docket 2007-28793.
Full Frontal Crash Test

- Obtain crash pulse from severe frontal crash event
- Obtain dummy readings for
  - Different dummy sizes
  - Different seat types
    - No belts
    - Lap and shoulder belts (3 – point belts)
    - Lap belts (2 – point belts)
    - Different seat manufacturers
- Study seat and seat attachment strength for different dummy sizes and rear occupant loading
- The test was conducted at the Vehicle Research and Test Center in December 2007.
Motorcoach Details

- 2000 MCI 102EL3 Renaissance
- Series 60 diesel engine
- B500 Allison Automatic transmission
- 54 seats
- 14 meters long, 381 cm tall
- 19,377 kg test weight
Seats on the Motorcoach

- Baseline seats
  - No belts
  - American Seating
- Seats with Belts
  - MCI/Amaya
    - 3 point belts – 4 rows (dual seats)
    - 2 point belts – 1 row (dual seats)
  - Freedman Seating
    - 3 point belts – 1 row (dual seats)
Seats (Continued)

- Baseline (No belts)
- MCI/Amaya/FAINS A
  - 3 – point
  - 2 – point
- Freedman 3 – point
Seat Attachments

- 9 occupied, 13 unoccupied rows using OEM equipment
- 2 occupied rows reinforced
Test Conditions

- Speed: 48.3 km/h (30 mph)
- Frontal impact: 0 degrees; full overlap
- Fixed Rigid Barrier
- Data channels: 355 dummy; 26 vehicle channels @ 12500 samples/sec
Occupants

- Hybrid III 50\textsuperscript{th} percentile male – 17 dummies
  - 175 cm (5 ft 9 in) tall and 77 kg (170 lb)
- Hybrid III 5\textsuperscript{th} percentile female – 3 dummies
  - 150 cm (5 ft) tall and 50 kg (110 lb)
- Hybrid III 95\textsuperscript{th} percentile male\textsuperscript{**} – 2 dummies
  - 188 cm (6 ft 2 in) and 100 kg (220 lb)
- Each dummy has
  - Accelerometers in head and chest
  - Load cells in upper neck and femur
  - Chest displacement potentiometer

\textsuperscript{**} The 95\textsuperscript{th} percentile male dummy is not in FMVSS
Dummy Seating Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
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<tbody>
<tr>
<td>1L</td>
<td></td>
</tr>
<tr>
<td>2L</td>
<td></td>
</tr>
<tr>
<td>3L</td>
<td></td>
</tr>
<tr>
<td>4L(MCI)</td>
<td></td>
</tr>
<tr>
<td>5L</td>
<td></td>
</tr>
<tr>
<td>6L</td>
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<td>13L</td>
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<tr>
<td>14L</td>
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Accel Locations
- 95th Unbelted
- 50th Unbelted
- 5th Unbelted
- 50th Lap Belt Only
- 5th Lap Belt Only
- 95th 3-Point Belted
- 50th 3-Point Belted
- 5th 3-Point Belted

- Reinforced Attachment
- OEM Attachment
Frontal Crash Videos – Normal Speed
Frontal Crash Videos – Slow Speed
Post Test Pictures
Crash Data

- Speed: 48.86 km/h (30.36 mph)
- Dynamic Crush: 198 cm (6.5 ft)
- Peak deceleration: 10g at 125 msec
Head Accelerations
50th Male – Front Seats

HIC’s for NHTSA Mid-Sized Adult Male Dummies in Rows 4R, 5R, 6R and 7R

Filter Class: CFC_1000

<table>
<thead>
<tr>
<th>Dummy</th>
<th>Seat</th>
<th>Aisle</th>
<th>3-Point Belt</th>
<th>Filter Class</th>
<th>TIME [ms]</th>
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<tr>
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<td>5R</td>
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<td>#643</td>
<td>7R</td>
<td>Window</td>
<td>Unbelted</td>
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</table>

Unbelted (Dotted Line)
Belted (Solid Line)
Head Accelerations
50th Male – Rear Seats
Observation - Restraints

- Unbelted dummies:
  - High head and neck accelerations
- Dummies with 2-pt belts:
  - High head and neck accelerations
- Dummies with 3-pt belts:
  - Low head and neck accelerations
- All dummies have low chest accelerations and chest displacements and femur loads
Observation - Unbelted Dummies

- Unbelted dummies typically made head contact with the backseat in front within 150-180 ms
- Dummies on the aisle seats ended up on the floor and dummies on the window seats ended up on the front seats or on the floor
Observation - Belted Dummies

- Dummies stayed in seats
- Head/Knee contact with front backseat for 95th male dummies
Observation - Seat Hardware

- All seat attachments including baseline stayed intact
- Baseline seats and Freeman seatback broke/bent when impacted by unbelted dummies from behind
Rollover Tests

• Tests were done on 2 motorcoach models: MCI and Prevost
• ECE-R66 test procedures
• Data is being analyzed
Roof Crush Tests

- Tests were done on 2 motorcoach models: MCI and Prevost
- FMVSS 220 test procedures
- Data is being analyzed
Future Plans

• Conduct evacuation and flammability tests
• Evaluate research data for rulemaking recommendations
• Complete information can be found at www.regulations.gov; docket # NHTSA-2007-28793