NHTSA’s Compatibility Research Program

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Overview

Test Program Overview

Vehicle to Barrier Test Program
  • Status, schedule, and updates

Vehicle to Vehicle Test Program
  • Status, schedule, and updates

Full width deformable barrier testing
  • Planned for this summer
Testing Goals

Test vehicles of similar mass and varying compatibility characteristics
- Include rigid barrier testing with 125 mm load cells
- Same target vehicle for all VTB tests

Evaluate if VTB compatibility measures relate to reduced VTV partner injury measures

18 VTV tests, 7 VTB tests
- 3 bullet vehicle pairs (SUV, pickup, mini van)
- 3 Test procedures
  ‣ Front-Front collinear full overlap
  ‣ Front-Front collinear 50% overlap
  ‣ Front-Side FMVSS 214 configuration
Vehicle Selection Criteria

For each bullet vehicle class

- Similar size and mass
- High / Low AHOF from NCAP testing
- High / Low initial stiffness

Target vehicle was selected to have:

- Representative compatibility measures
- Good safety ratings
- Side curtain airbags
Average Height of Force

Compute the effective height of the applied force on the barrier face

\[
\text{Average Height Of Force} = \frac{\sum_{i=1}^{N} F_i H_i}{\sum_{i=1}^{N} F_i}
\]
Distribution of NCAP Test Results
Test Data 1982 to 2002

<table>
<thead>
<tr>
<th>Test Weight (kg)</th>
<th>Average Height of Force (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000</td>
<td>400</td>
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<tr>
<td>1500</td>
<td>500</td>
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<tr>
<td>2000</td>
<td>600</td>
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<tr>
<td>2500</td>
<td>700</td>
</tr>
<tr>
<td>3000</td>
<td>800</td>
</tr>
</tbody>
</table>

- Car
- LTV
Selected Test Vehicles

<table>
<thead>
<tr>
<th>Test Weight (kg)</th>
<th>AHOF (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1400</td>
<td>400</td>
</tr>
<tr>
<td>1600</td>
<td>450</td>
</tr>
<tr>
<td>1800</td>
<td>500</td>
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<tr>
<td>2000</td>
<td>550</td>
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<tr>
<td>2200</td>
<td>600</td>
</tr>
<tr>
<td>2400</td>
<td></td>
</tr>
<tr>
<td>2600</td>
<td></td>
</tr>
</tbody>
</table>

- 99 CARAVAN
- 01 VENTURE
- 02 TUNDRA
- TRAILBLAZER
- EXPLORER
- 02 RAM1500
- ACCORD
Initial Stiffness

The initial slope of the Force-Deflection profile varies considerably between LTV’s and passenger cars

- May be significant for side impact

Linear fits estimated from force deflection data

- Must have $R^2 > 0.95$
- Start with 1st 200 mm of deflection
- Fit for > 150 mm of deflection
- Use longest linear fit that meets criteria
Test 3553, 2001 CHEVROLET SUBURBAN
R2 0.950, Slope = 5445.7, Y Intercept = -73270.0
Vehicle Selections

- 2002 Ford Explorer and 2002 Chevrolet Trailblazer
- 2002 Toyota Tundra and 2002 Dodge Ram 1500
- 1999 Dodge Grand Caravan and 2001 Chevrolet Venture
- Passenger car for target vehicle
  - 2004 Honda Accord, 4 door
Vehicle to Barrier Program

NHTSA has purchased 2 high resolution load cell barriers

- 8 by 16 array of 125 mm load cells
- Negotiations are underway with first vendor involving load cell calibrations
- 125 mm ground clearance
- Additional partial row of 6 load cells were added to accommodate larger vehicles
  - Originally purchased as spares
134 Load Cell Barrier
Alignment with Dodge Ram Pickup
Status of Vehicle to Barrier Testing

Completed all 6 of 7 VTB tests

- Initial data checks look good
- Peak force on a load cell around 170 kN
- Additional Concorde test for calibration

Engineering evaluation underway

- To be complete this summer
- Comparison to NCAP results (4 by 9 barrier)
  - Evaluate increased measurement resolution
Vehicle-to-Vehicle Test Schedule

Testing began in April and should complete in August

- Tests conducted at MGA Research
- Agency review is planned for September
- Compare injury and intrusion for the struck vehicle
  - Does the higher / stiffer vehicle generate increased consequences for collision partner?
V to V Test Status

2 full frontal tests complete (33%)

2 50% offset tests complete (33%)

Side impact tests to begin in June

Testing should complete in August
FWDB Testing

4 1996 Chrysler Concorde vehicles

- 1 was used for first rigid barrier test
- Repeat test with deformable face
  - 1000 mm height
- Reproducibility testing
  - Depends upon resolution of 1st LC procurement
  - Repeat rigid and deformable test

2 Ford Taurus vehicles

- Evaluate deformable face manufacturers
- Planned for FY 2005
Extra Slides
Pickup Trucks MY >= 1999

Test Weight (kg)
1600 1800 2000 2200 2400 2600

Initial Stiffness (N/mm)
500 1000 1500 2000 2500 3000 3500

00 TUNDRA
00 SILVERADO
00 S-10
99 RAM
99 F150
99 S-10
00 TUNDRA
00 SILVERADO
01 TUNDRA
01 RAM1500
01 F150
01 S-10
01 FRONTIER
01 TACOMA
01 RANGER
02 TUNDRA
02 RAM1500
02 DAKOTA
02 TUNDRA
01 DAKOTA
03 TUNDRA
03 FRONTIER
03 SILVERADO
03 F150 XLT
01 F150 XLT
01 TACOMA
00 S-10
01 RANGER
00 TUNDRA
00 S-10
99 S-10
99 F150

Test Weight (kg)

Initial Stiffness (N/mm)
Vans MY >= 1999

Test Weight (kg)
1600 1700 1800 1900 2000 2100 2200 2300 2400

Initial Stiffness (N/mm)
500 1000 1500 2000 2500 3000 3500

00 CARAVAN
01 CARAVAN
00 VILLAGER
GRAND CARAVAN
01 VENTURE
01 WINDSTAR
01 RAM VAN
02 MPV
00 MPV
02 ODYSSEY
01 ODYSSEY
03 ODYSSEY
99 ODYSSEY
99 ASTRO
01 MPV
00 MPV
99 ASTRO