REPORT NUMBER: 208-MGA-2004-010

VEHICLE SAFETY COMPLIANCE TESTING
FOR
FMVSS 208, OCCUPANT CRASH PROTECTION
FMVSS 212, WINDSHIELD MOUNTING
FMVSS 219, WINDSHIELD INTRUSION (PARTIAL)
FMVSS 301, FUEL SYSTEM INTEGRITY

Toyota Motor Corporation
2004 Toyota Highlander Limited
NHTSA No.: C45111

PREPARED BY:
MGA RESEARCH CORPORATION
5000 WARREN ROAD
BURLINGTON, WI 53105

Test Date: August 18, 2004
Final Report Date: September 27, 2004

FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Prepared _____________________________ Date: September 27, 2004
Jeff Lewandowski, Project Engineer

Reviewed by: _____________________________ Date: September 27, 2004
David Winkelbauer, Facility Director

FINAL REPORT ACCEPTED BY OVSC:

Accepted By: _____________________________

Acceptance Date: ___________________________
Compliance tests were conducted on the subject 2004 Toyota Highlander in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP208-12 for the determination of FMVSS 208 compliance. Test failures identified were as follows:

TEST FAILURES: None

17. Key Words
Frontal Impact
40 kmph Vehicle Safety Compliance Testing
FMVSS 208, “Occupant Crash Protection”
FMVSS 212, “Windshield Mounting”
FMVSS 219, (partial), “Windshield Zone Intrusion”
FMVSS 301, “Fuel System Integrity”

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</tr>
</tbody>
</table>

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<th>Appendix</th>
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</tr>
<tr>
<td>C</td>
<td>Instrumentation Calibration</td>
</tr>
</tbody>
</table>
SECTION 1
PURPOSE OF COMPLIANCE TEST

This Federal Motor Vehicle Safety Standard (FMVSS) 208 compliance test is part of a program conducted for the National Highway Traffic Safety Administration (NHTSA) by MGA Research Corporation (MGA) under Contract No. DTNH22-03-D-11002. The purpose of this test was to determine whether the subject vehicle, a 2004 Toyota Highlander MPV, NHTSA No. C45111, meets certain performance requirements of FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; FMVSS 219, "Windshield Zone Intrusion"; and FMVSS 301, "Fuel System Integrity". The compliance test was conducted in accordance with OVSC Laboratory Test Procedure No. TP208-12 dated January 14, 2003.
SECTION 2
TESTS PERFORMED

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Dates: 8/18/04

The following checked items indicate the tests that were performed:

1. Rear outboard seating position seat belts (S4.1.1.2(b) & (S4.2.4)
2. Air bag labels (S4.5.1)
3. Readiness indicator (S4.5.2)
4. Passenger air bag manual cut-off device (S4.5.4)
5. Lap belt lockability (S7.1.1.5)
6. Seat belt warning system (S7.3)
7. Seat belt contact force (S7.4.4)
8. Seat belt latch plate access (S7.4.4)
9. Seat belt retraction (S7.4.5)
10. Seat belt guides and hardware (S7.4.6)
11. Suppression tests with 12-month-old CRABI dummy (Part 572, Subpart R)
12. Suppression tests with newborn infant (Part 572, Subpart K)
13. Suppression tests with 3-year-old dummy (Part 572, Subpart P)
14. Suppression tests with 6-year-old dummy (Part 572, Subpart N)
15. Test of reactivation of the passenger air bag system with an unbelted 5th percentile female dummy
16. Low risk deployment test with 12-month-old dummy (Part 572, Subpart R)
17. Low risk deployment test with 3-year-old dummy (Part 572, Subpart P)
18. Low risk deployment test with 6-year-old dummy (Part 572, Subpart N)
19. Low risk deployment test with 5th female dummy (Part 572, Subpart O)

20. Impact Tests
   - Frontal Oblique
     - Belted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.1.(a))
     - Unbelted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.2(a)(1))
     - Unbelted 50th male dummy driver and passenger (32 to 40 kmph) (S5.1.2(a) (1) or S5.1.2(b))
   - Frontal 0°
     - Belted 50th male dummy driver (0 to 48 kmph) (S5.1.1.(b)(1) or S5.1.1(a))
     - Belted 50th male dummy passenger (0 to 48 kmph) (S5.1.1.(b)(1) or S5.1.1(a))
     - Belted 5th female dummy driver (0 to 48 kmph) (S16.1(a))
     - Belted 5th female dummy passenger (0 to 48 kmph) (S16.1(a))
     - Belted 50th male dummy driver and passenger (0 to 56 kmph) (S5.1.1.(b)(2))
     - Unbelted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.2(a) (1))
     - Unbelted 50th male dummy driver (32 to 40 kmph) (S5.1.2.(a)(2) or S5.1.2(b))
     - Unbelted 50th male dummy passenger (32 to 40 kmph) (S5.1.2.(a)(2) or S5.1.2(b))

X
Unbelted 5th female dummy driver (32 to 40 kmph) (S16.1(b))
Unbelted 5th female dummy passenger (32 to 40 kmph) (S16.1(b))
40% Offset 0° Belted 5th male dummy driver and passenger (0 to 40 kmph) (S18.1)

21. Sled Test: unbelted 50th male dummy driver and passenger (S13)
22. FMVSS 204 Indicant Test
23. FMVSS 212 Test
24. FMVSS 219 Indicant Test
25. FMVSS 301 Frontal Test

For the crash tests, the vehicle was instrumented with 8 accelerometers. The accelerometer data from the vehicle and dummies were sampled at 10,000 samples per second and processed as specified in SAE J211/1 MAR95 and FMVSS 208, S4.13.

The dynamic tests were recorded using high-speed film and high-speed digital video.

The post test FMVSS 301 rollover was not conducted at the request of the COTR.
SECTION 3

INJURY RESULT SUMMARY FOR FMVSS 208 TESTS

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Date: 08/18/04

40 kmph Frontal Crash

Impact Angle: Zero degrees

Belted Dummies: Yes (Rear Passenger)  No (Driver and Front Passenger)

Speed Range: 0 to 40 kmph  32 to 40 kmph

Test Speed: 39.8 kmph  Test Weight: 2064.7 kg

Driver Dummy: 5th female  50th male
Passenger Dummy: 5th female  50th male
Center Rear Passenger Dummy: 5th female  50th male

5th Percentile Female Frontal Crash Test
Vehicles certified to S16.1(a), S16.1(b), or S18.1

<table>
<thead>
<tr>
<th>Injury Criteria</th>
<th>Max. Allowable Injury Assessment Values</th>
<th>Driver</th>
<th>Passenger</th>
</tr>
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<tbody>
<tr>
<td>HIC15</td>
<td>700</td>
<td>72</td>
<td>67</td>
</tr>
<tr>
<td>N\text{te}</td>
<td>1.0</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>N\text{tf}</td>
<td>1.0</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>N\text{ce}</td>
<td>1.0</td>
<td>0.1</td>
<td>0.2</td>
</tr>
<tr>
<td>N\text{cf}</td>
<td>1.0</td>
<td>0.1</td>
<td>0.5</td>
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<tr>
<td>Neck Tension</td>
<td>2620 N</td>
<td>898</td>
<td>396</td>
</tr>
<tr>
<td>Neck Compression</td>
<td>2520 N</td>
<td>66</td>
<td>683</td>
</tr>
<tr>
<td>Chest g</td>
<td>60 g</td>
<td>44</td>
<td>29</td>
</tr>
<tr>
<td>Chest Displacement</td>
<td>52 mm</td>
<td>23</td>
<td>6</td>
</tr>
<tr>
<td>Left Femur</td>
<td>6805 N</td>
<td>3306</td>
<td>4483</td>
</tr>
<tr>
<td>Right Femur</td>
<td>6805 N</td>
<td>3828</td>
<td>3842</td>
</tr>
</tbody>
</table>
SECTION 4
DISCUSSION OF TESTS

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Date: 8/18/04

The vehicle was tested in a 25 mph frontal impact only. FMVSS 208 Datasheets not used for this test have been removed from the report.

The test vehicle was incorrectly ballasted for the test. A Designated Seating Capacity (DSC) of 5 was used to measure Fully Loaded Weight and Test Weight. This resulted in the Rated Cargo and Luggage Weight (RCLW) to be 136kg rather than the 50kg if the DSC of 7 had been used. The vehicle Test Weight was approximately 86kg over the value that would have been used in the correct procedure.

The post test FMVSS 301 rollover was not conducted at the request of the COTR.

Partial data was collected for the Top of Engine X. It was truncated at 75 msec.
SECTION 5
TEST DATA SHEETS

Test Vehicle: 2004 Toyota Highlander MPV   NHTSA No.: C45111
Test Program: FMVSS 208 Compliance   Test Dates: 8/18/04
### DATA SHEET 1
#### COTR VEHICLE WORK ORDER

**Test Vehicle:** 2004 Toyota Highlander MPV  
**NHTSA No.:** C45111  
**Test Program:** FMVSS 208 Compliance  
**Test Dates:** 8/18/04  
**COTR Signature:** Charles R. Case

Test to be performed for this vehicle are checked below:

1. Rear Outboard Seating Position Seat Belts (S4.1.2(b)) & (S4.2.4)
2. Air Bag Labels (S4.5.1)
3. Readiness Indicator (S4.5.2)
4. Passenger Air Bag Manual Cut-off Device (S4.5.4)
5. Lap Belt Lockability (S7.1.1.5)
6. Seat Belt Warning System (S7.3)
7. Seat Belt Contact Force (S7.4.4)
8. Seat Belt Latch Plate Access (S7.4.4)
9. Seat Belt Retraction (S7.4.5)
10. Seat Belt Guides and Hardware (S7.4.6)
11. Suppression tests with 12-month-old CRABI dummy (Part 572, Subpart R) using the following indicated child restraints.

#### Section B

<table>
<thead>
<tr>
<th>Child Restraint</th>
<th>Position</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Handle with Care 191</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Century Assura 4553</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Century Avanta SE 41530</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Century Smart Fit 4543</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Cosco Arriva 02727</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Cosco Opus 35 02603</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Evenflo Discovery Adjust Right 212</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Evenflo First Choice 204</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Evenflo On My Way Position Right V 282</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Graco Infant 8457</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
</tbody>
</table>

#### Section C

<table>
<thead>
<tr>
<th>Child Restraint</th>
<th>Position</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roundabout 161</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Century Encore 4612</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Century STE 1000 4416</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Cosco Olympian 02803</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Cosco Touriva 02519</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Evenflo Horizon V 425</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
<tr>
<td>Evenflo Medallion 254</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
</tbody>
</table>

12. Suppression tests with newborn infant (Part 572, Subpart K) using the following indicated child restraints.

#### Section A

<table>
<thead>
<tr>
<th>Child Restraint</th>
<th>Position</th>
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<tbody>
<tr>
<td>Cosco Dream Ride 02-719</td>
<td>Full Rearward</td>
<td>Mid Position</td>
</tr>
</tbody>
</table>

13. Suppression tests with 3-year-old dummy (Part 572, Subpart P) using the following indicated child restraints where a child restraint is required.
### Section C

<table>
<thead>
<tr>
<th>Product</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Position 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roundabout 161</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century Encore 4612</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century STE 1000 4416</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Cosco Olympian 02803</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Cosco Touriva 02519</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Evenflo Horizon V 425</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Evenflo Medallion 254</td>
<td>Full Rearward</td>
<td>Mid Position</td>
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### Section D

<table>
<thead>
<tr>
<th>Product</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Position 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roadster 9004</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century Next Step 4920</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Cosco High Back Booster 02-442</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Evenflo Right Fit 245</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
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</table>

### 14. Suppression tests with representative 3-year-old child using the following indicated child restraints where a child restraint is required. (Appendix H, Data Sheet 16H and 17H)

### Section C

<table>
<thead>
<tr>
<th>Product</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Position 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roundabout 161</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century Encore 4612</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century STE 1000 4416</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Cosco Olympian 02803</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
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<tr>
<td>Cosco Touriva 02519</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Evenflo Horizon V 425</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
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<tr>
<td>Evenflo Medallion 254</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
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### Section D

<table>
<thead>
<tr>
<th>Product</th>
<th>Position 1</th>
<th>Position 2</th>
<th>Position 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roadster 9004</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Century Next Step 4920</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Cosco High Back Booster 02-442</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
<tr>
<td>Evenflo Right Fit 245</td>
<td>Full Rearward</td>
<td>Mid Position</td>
<td>Full Forward</td>
</tr>
</tbody>
</table>

### 15. Suppression tests with 3-year-old dummy (Part 572, Subpart P) in the following Forward, Middle, and Rearward seat track positions

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting on seat with back against seat back (S22.2.2.1)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat with back against reclined seat back (S22.2.2.2)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat with back not against seat back (S22.2.2.3)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat edge, spine vertical, hands by the child’s side (S22.2.2.4)</td>
<td></td>
</tr>
<tr>
<td>Standing on seat, facing forward (S22.2.2.5)</td>
<td></td>
</tr>
<tr>
<td>Kneeling on seat facing forward (S22.2.2.6)</td>
<td></td>
</tr>
<tr>
<td>Kneeling on seat facing rearward (S22.2.2.7)</td>
<td></td>
</tr>
<tr>
<td>Lying on seat (S22.2.2.8)</td>
<td></td>
</tr>
</tbody>
</table>

### 16. Suppression tests with representative 3-year-old child in the following positions

<table>
<thead>
<tr>
<th>Position</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sitting on seat with back against seat back (S22.2.2.1)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat with back against reclined seat back (S22.2.2.2)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat with back not against seat back (S22.2.2.3)</td>
<td></td>
</tr>
<tr>
<td>Sitting on seat edge, spine vertical, hands by the child’s side (S22.2.2.4)</td>
<td></td>
</tr>
<tr>
<td>Standing on seat, facing forward (S22.2.2.5)</td>
<td></td>
</tr>
<tr>
<td>Kneeling on seat facing forward (S22.2.2.6)</td>
<td></td>
</tr>
<tr>
<td>Kneeling on seat facing rearward (S22.2.2.7)</td>
<td></td>
</tr>
<tr>
<td>Lying on seat (S22.2.2.8)</td>
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</tr>
</tbody>
</table>

### 17. Suppression tests with 6-year-old dummy (Part 572, Subpart N) using the following indicated child restraints where a child restraint is required.
18. Suppression tests with representative 6-year-old child using the following indicated child restraints where a child restraint is required.

<table>
<thead>
<tr>
<th>Section D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roadster 9004</td>
</tr>
<tr>
<td>Century Next Step 4920</td>
</tr>
<tr>
<td>Cosco High Back Booster 02-442</td>
</tr>
<tr>
<td>Evenflo Right Fit 245</td>
</tr>
</tbody>
</table>

19. Suppression tests with 6-year-old dummy (Part 572, Subpart N) in the following Forward, Middle, and Rearward seat track positions.

| Sitting on seat with back against seat back (S22.2.2.1) |
| Sitting on seat with back against reclined seat back (S22.2.2.2) |
| Sitting on seat edge, spine vertical, hands by the child’s side (S22.2.2.4) |
| Sitting back in the seat and leaning on the right front passenger door (S24.2.3) |

20. Suppression tests with representative 6-year-old child in the following positions.

| Sitting on seat with back against seat back (S22.2.2.1) |
| Sitting on seat with back against reclined seat back (S22.2.2.2) |
| Sitting on seat edge, spine vertical, hands by the child’s side (S22.2.2.4) |
| Sitting back in the seat and leaning on the right front passenger door (S24.2.3) |

21. Test of Reactivation of the Passenger Air Bag System with an Unbelted 5th percentile female dummy (S20.3, 22.3, S24.3). Perform this test after the following suppression tests: After each restraint.

22. Test of Reactivation of the passenger air bag system with a representative 5th percentile female (S20.3, 22.3, S24.3). Perform this test after the following suppression tests:

23. Low risk deployment test with 12-month-old dummy (Part 572, Subpart R) using the following indicated child restraints.

<table>
<thead>
<tr>
<th>Section B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Handle with Care 191</td>
</tr>
<tr>
<td>Century Assura 4553</td>
</tr>
<tr>
<td>Century Avanta SE 41530</td>
</tr>
<tr>
<td>Century Smart Fit 4543</td>
</tr>
<tr>
<td>Cosco Arriva 02727</td>
</tr>
<tr>
<td>Cosco Opus 35 02603</td>
</tr>
<tr>
<td>Evenflo Discovery Adjust Right 212</td>
</tr>
<tr>
<td>Evenflo First Choice 204</td>
</tr>
<tr>
<td>Evenflo On My Way Position Right V 282</td>
</tr>
<tr>
<td>Graco Infant 8457</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Section C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Britax Roundabout 161</td>
</tr>
<tr>
<td>Century Encore 4612</td>
</tr>
<tr>
<td>Century STE 1000 4416</td>
</tr>
<tr>
<td>Cosco Olympian 02803</td>
</tr>
<tr>
<td>Cosco Touriva 02519</td>
</tr>
<tr>
<td>Evenflo Horizon V 425</td>
</tr>
<tr>
<td>Test Description</td>
</tr>
<tr>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Low risk deployment test with 3-year-old dummy (Part 572, Subpart P)</td>
</tr>
<tr>
<td>Low risk deployment test with 6-year-old dummy (Part 572, Subpart N)</td>
</tr>
<tr>
<td>Low risk deployment test with 5th percentile female dummy (Part 572, Subpart O)</td>
</tr>
</tbody>
</table>

27. Impact Tests

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Speed Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frontal Oblique</strong> – Test Speed:</td>
<td>Belted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.1(a))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.2(a)(1))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 50th male dummy driver and passenger (32 to 40 kmph) (S5.1.2(a)(1) or S5.1.2(b))</td>
</tr>
<tr>
<td><strong>Frontal 0°</strong> – Test Speed: 39.8 kmph</td>
<td>Belted 50th male dummy driver (0 to 48 kmph) (S5.1.1.(b)(1) or S5.1.1(a))</td>
</tr>
<tr>
<td></td>
<td>Belted 50th female dummy driver (0 to 48 kmph) (S16.1(a))</td>
</tr>
<tr>
<td></td>
<td>Belted 5th female dummy passenger (0 to 48 kmph) (S16.1(a))</td>
</tr>
<tr>
<td></td>
<td>Belted 50th male dummy driver and passenger (0 to 56 kmph) (S5.1.1.(b)(2))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 50th male dummy driver and passenger (0 to 48 kmph) (S5.1.2(a)(1))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 50th male dummy driver (32 to 40 kmph) (S5.1.2.(a)(2) or S5.1.2(b))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 5th female dummy passenger (32 to 40 kmph) (S16.1(b))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 5th female dummy driver (32 to 40 kmph) (S16.1(b))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 5th female dummy passenger (32 to 40 kmph) (S16.1(b))</td>
</tr>
<tr>
<td><strong>40% Offset 0°</strong> Belted 5th male dummy driver and passenger (0 to 40 kmph) (S18.1) – Test Speed:</td>
<td>Belted 50th male dummy driver and passenger (0 to 40 kmph) (S18.1)</td>
</tr>
<tr>
<td></td>
<td>Unbelted 5th male dummy driver (32 to 40 kmph) (S16.1(b))</td>
</tr>
<tr>
<td></td>
<td>Unbelted 5th female dummy passenger (32 to 40 kmph) (S16.1(b))</td>
</tr>
</tbody>
</table>

28. Sled Test: Unbelted 50th male dummy driver and passenger (S13)

29. FMVSS 204 Indicant Test

30. FMVSS 212 Indicant Test

31. FMVSS 219 Indicant Test

32. FMVSS 301 Indicant Frontal Test
DATA SHEET 2
REPORT OF VEHICLE CONDITION

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Dates: 8/18/04

CONTRACT NO. DTNH22-03-D-11002  Date: 7/28/04
FROM (Lab and rep name): MGA Research Corporation
TO: NHTSA, OVSC (NVS-220)

PURPOSE: (X) Initial Receipt    ( ) Received via Transfer    (X ) Present vehicle condition

MODEL YEAR/MAKE/MODEL/BODY STYLE: 2004 Toyota Highlander MPV
MANUFACTURE DATE: 12/03
NHTSA NO.  C45111  GVWR:  2430 kg (5360 lbs)
BODY COLOR: Indigo Blue  GAWR (Fr): 1300 kg (2865 lbs)
VIN: JTEEP21A940025615  GAWR (Rr): 1340 kg (2950 lbs)

ODOMETER READINGS: ARRIVAL (miles): 95  DATE: 7/28/04
                     COMPLETION (miles): 96  DATE: 8/18/04
PURCHASE PRICE: ($) 35,867
DEALER’S NAME: Elmhurst Toyota; 440 West Lake Street; Elmhurst, IL 60128

A. All options listed on window sticker are present on the test vehicle:
   _X_ Yes    ___No
B. Tires and wheel rims are new and the same as listed:  _X_ Yes    ___No
C. There are no dents or other interior or exterior flaws:  _X_ Yes    ___No
D. The vehicle has been properly prepared and is in running condition:
   _X_ Yes    ___No
E. Keyless remote is available and working:  _X_ Yes    ___No
F. The glove box contains an owner’s manual, warranty document, consumer information, and extra set of keys:
   _X_ Yes    ___No
G. Proper fuel filler cap is supplied on the test vehicle:  _X_ Yes    ___No
H. Using permanent marker, identify vehicle with NHTSA number and FMVSS test type(s) on roof line above driver door or for school buses, place a placard with NHTSA number inside the windshield and to the exterior front and rear side of bus:
   _X_ Yes    ___No
I. Place vehicle in storage area:  _X_ Yes    ___No
J. Inspect the vehicle’s interior and exterior, including all windows, seats, doors, etc. to confirm that each system is complete and functional per the manufacturer’s specifications. Any damage, misadjustment, or other unusual condition that could influence the test program or test results shall be recorded. Report any abnormal condition to the NHTSA COTR before beginning any test:
   _X_ Vehicle OK    ___Conditions reported below

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
NHTSA No.: C45111
Test Dates: 8/18/04
REPORT OF VEHICLE CONDITION AT THE COMPLETION OF TESTING

LIST OF FMVSS TESTS PERFORMED BY THIS LAB: FMVSS 208, 212, 219, 301

VEHICLE: 2004 Toyota Highlander MPV

NHTSA NO. C45111

REMARKS:

Equipment that is no longer on the test vehicle as noted on previous page:
Tool and jack, luggage door inner trim, luggage room side trim, deck board and tray, luggage cover, third seat

Explanation for equipment removal:
Components removed for instrumentation installation and to meet target weight.

Test Vehicle Condition:
25 mph frontal impact damage- front suspension & structure damaged, hood & front quarter panels damaged, radiator damaged, air bags & pretensioners deployed, Stoddard in fuel system

RECORDED BY: Jeff Lewandowski DATE: 8/18/2004
APPROVED BY: David Winkelbauer DATE: 8/18/2004

# # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # # #

RELEASE OF TEST VEHICLE

The vehicle described above is released from MGA to be delivered to:

Date: Time: Odometer:

Lab Rep’s Signature:
Title:
Carrier/Customer Rep:
Date:
<table>
<thead>
<tr>
<th>Certification Label</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer: Toyota Motor Corp.</td>
</tr>
<tr>
<td>Date of Manufacture: 12/03</td>
</tr>
<tr>
<td>VIN: JTEEP21A940025615</td>
</tr>
<tr>
<td>Vehicle Certified As (Pass. Car/MPV/Truck/Bus): MPV</td>
</tr>
<tr>
<td>Front Axle GVWR: 1300 kg (2865 lbs)</td>
</tr>
<tr>
<td>Rear Axle GVWR: 1340 kg (2950 lbs)</td>
</tr>
<tr>
<td>Total GVWR: 2430 kg (5360 lbs)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tire Placard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable, vehicle is not a passenger car and does not have a tire placard.</td>
</tr>
<tr>
<td>This is not a passenger car, but all or part of this information is still contained on a vehicle label and is reported here.</td>
</tr>
<tr>
<td>Vehicle Capacity Weight: 526 kg (1159 lbs)</td>
</tr>
<tr>
<td>Designated Seating Capacity Front: 2</td>
</tr>
<tr>
<td>Designated Seating Capacity Rear: 5</td>
</tr>
<tr>
<td>Total Designated Seating Capacity: 7</td>
</tr>
<tr>
<td>Recommended Cold Tire Inflation Pressure Front: 210 kpa (30 psi)</td>
</tr>
<tr>
<td>Recommended Cold Tire Inflation Pressure Rear: 210 kpa (30 psi)</td>
</tr>
<tr>
<td>Recommended Tire Size: P225/65R17</td>
</tr>
</tbody>
</table>

Signature: [Signature]

Date: 08/18/04
DATA SHEET 14
MARKING OF REFERENCE POINTS FOR VARIOUS TEST POSITIONS AND POINTS

Test Vehicle: 2004 Toyota Highlander MPV  
Test Program: FMVSS 208 Compliance  
Test Technician: Eric Peschman  
NHTSA No.: C45111  
Test Date: 8/18/04

1. Driver Designated Seating Position:
   1.1 Position the seat’s adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment positions. (S16.2.10.1)  
      N/A – No lumbar adjustment
   1.2 Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position (S16.2.10.2)  
      N/A – No additional support adjustment
   1.3 Mark a point (seat cushion reference point) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion.
   1.4 Draw a line (seat cushion reference line) through the seat cushion reference point.
   1.5 Using only the controls that primarily move the seat in the fore-aft direction, move the seat cushion reference point to the rearmost position.
   1.6 If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the seat cushion reference point to the rearmost position (S16.2.10.3)  
      N/A – No independent fore-aft seat cushion adjustment
   1.7 Using any part of any control, other than the parts just used for fore-aft positioning, determine the range of angles of the seat cushion reference line and set the seat cushion reference line at the mid-angle.
      Maximum Angle: 6.0 Degrees, Nose Up
      Minimum Angle: 3.7 Degrees Nose Down
      Mid-angle: 1.2 Degrees, Nose Up
   1.8 If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the seat cushion reference point in its lowest position with the seat cushion reference line angle at the mid-angle found in 1.7.
      N/A – No seat height adjustment
   1.9 Using only the controls that primarily move the seat in the fore-aft direction, verify the seat is in the rearmost position.
   1.10 Using only the controls that primarily move the seat in the fore-aft direction, mark for future reference the fore-aft seat positions. Mark each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and mark each detent. For power seats, mark only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.
   1.11 Use only the controls that primarily move the seat in the fore-aft direction to place the seat in the rearmost position.
1.12 Using any controls, other than the controls that primarily move the seat and/or seat cushion in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.7.

1.13 Using only the controls that primarily move the seat and/or seat cushion in the fore-aft direction, place the seat in the mid-fore-aft position.

1.14 Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.7.

1.15 Using only the controls that change the seat in the fore-aft direction, place the seat in the foremost position.

1.16 Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 1.7.

1.17 Visually mark for future reference the seat back angle, if adjustable, at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer.

N/A – No seat back angle adjustment

Manufacturer’s design seat back angle: 3° on Headrest

1.18 Is the seat a bucket seat?

Yes, go to 1.18.1 and skip 1.18.2

No, go to 1.18.2 and skip 1.18.1

1.18.1 Bucket seats:

Locate and mark for future reference the longitudinal centerline of the seat cushion. The longitudinal centerline of a bucket seat cushion is determined at the widest part of the seat cushion. Measure perpendicular to the longitudinal centerline of the vehicle. (S16.3.1.10)

Record the width of the seat cushion: 520 mm

One half the width of the seat cushion is: 260 mm

Record the distance from the edge of the seat cushion to the seat mark: 260 mm

1.18.2 Bench seats:

Locate and mark for future reference the longitudinal line on the seat cushion that marks the longitudinal vertical plane through the centerline of the steering wheel.

2. Passenger Designated Seating Position

2.1 Is the seat adjustable independent of the driver seating position?

Yes, go to 2.2

No, go to 2.18

2.2 Position the seat’s adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment positions (S16.2.10.1, S20.1.9.1, S22.1.7.1)

N/A – No lumbar adjustment

2.3 Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. (S16.2.10.2, S20.1.9.2, S22.1.7.2)

N/A – No additional support adjustment
2.4 Mark a point (seat cushion reference point) on the side of the seat cushion that is between 150 mm and 250 mm from the front edge of the seat cushion.

2.5 Draw a line (seat cushion reference line) through the seat cushion reference point.

2.6 Using only the controls that primarily move the seat in the fore-aft direction, move the seat cushion reference point to the rearmost position.

2.7 If the seat cushion adjusts fore-aft, independent of the seat back, use only the controls that primarily move the seat cushion in the fore-aft direction to move the seat cushion reference point to the rearmost position (S16.2.10.3, S20.1.9.3, S22.1.7.3)

N/A – No independent fore-aft seat cushion adjustment.

2.8 Using any part of the control, other than the parts just used for fore-aft positioning, determine the range of angles of the seat cushion reference line and set the seat cushion reference line at the mid-angle.

Maximum Angle: Zero Degrees
Minimum Angle: Zero Degrees
Mid-angle: Zero Degrees

2.9 If the seat and/or seat cushion height is adjustable, use any part of any control other than those which primarily move the seat or seat cushion fore-aft, to put the seat cushion reference point in its lowest position with the seat cushion reference line angle at the mid-range angle.

N/A – No seat height adjustment

2.10 Using only the controls that primarily move the seat and/or seat cushion in the fore-aft direction, verify the seat is in the rearmost position.

2.11 Using only the controls that primarily move the seat in the fore-aft direction, mark for future reference the fore-aft seat positions. Mark each position so that there is a visual indication when the seat is at a particular position. For manual seats, move the seat forward one detent at a time and mark each detent. For power seats, mark only the rearmost, middle, and foremost positions. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the closest adjustment position to the rear of the mid-point), and R for rearmost.

2.12 Using only the controls that primarily move the seat in the fore-aft direction, place the seat in the rearmost position.

2.13 Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 2.8.

N/A – No seat height adjustment Go to 2.18

2.14 Using only the controls that primarily move the seat in the fore-aft direction, place the seat in the mid-fore-aft position.

2.15 Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 2.8.

2.16 Using only the controls that change the seat in the fore-aft direction, place the seat in the foremost position.

2.17 Using any controls, other than the controls that primarily move the seat in the fore-aft direction, find and visually mark for future reference the maximum, minimum, and middle height of the seat cushion reference point with the seat cushion reference line at the mid-angle determined in 2.8.
2.18 Visually mark for future reference the seat back angle, if adjustable, at the manufacturer's nominal design riding position for a 50th percentile adult male in the manner specified by the manufacturer.

- N/A – No seat back angle adjustment
- N/A – The seat back angle adjustment is controlled by the setting of the driver seat back angle.

Manufacturer’s design seat back angle: 3 ° on headrest post
Actual seat back angle: 3 ° on headrest post

2.19 Is the seat a bucket seat?
- Yes, go to 2.19.1 and skip 2.19.2
- No, go to 2.19.2 and skip 2.19.1

2.19.1 Bucket seats:
- Locate and mark for future reference the longitudinal centerline of the seat cushion. (S20.2.1.3, S22.2.1.3) The longitudinal centerline of a bucket seat cushion is determined at the widest part of the seat cushion. Measure perpendicular to the longitudinal centerline of the vehicle. (S20.1.10)

- Record the width of the seat cushion: 525 mm
- One half the width of the seat cushion is: 262 mm

2.19.2 Bench seats:
- Locate and mark for future reference the longitudinal centerline of the passenger seat cushion. The longitudinal centerline is the same distance from the longitudinal centerline of the vehicle as the center of the steering wheel. (S20.2.1.3, S22.2.1.3)

- Record the distance from the longitudinal centerline of the vehicle to the center of the steering wheel:
- Record the distance from the longitudinal centerline of the vehicle to the longitudinal centerline of the seat cushion. (The vertical plane through this longitudinal centerline is Plane B for suppression.)

3. Head Restraints

- N/A, vehicle contains automatic head restraints
- N/A, there is no head restraint adjustment

3.1 Left outboard
- Adjust the head restraint to its lowest position. (S16.3.4.2)

3.1.1 Any adjustment of the head restraint shall be used to position it full forward. For example, if it rotates, rotate it such that the head restraint extends as far forward as possible. Mark the foremost position.

3.1.3 Measure the vertical distance from the top most point of the head restraint to the bottom most point. Locate and mark a horizontal plane through the midpoint of this distance.

- Vertical height of head restraint (mm): 200
- Mid-point height (mm): 100

3.2 Right outboard

3.2.1 Adjust the head restraint to its lowest position. (S16.3.4.2)
3.2.2 Any adjustment of the head restraint shall be used to position it full forward. For example, if it rotates, rotate it such that the head restraint extends as far forward as possible. Mark the foremost position.

3.2.3 Measure the vertical distance from the top most point of the head restraint to the bottom most point. Locate and mark a horizontal plane through the midpoint of this distance.

Vertical height of head restraint (mm): 190

Mid-point height (mm): 95

4. Steering Wheel

4.1 Is the steering wheel adjustable up and down and/or in and out?

Yes, go to 4.2
No, this form is complete

4.2 Find and mark for future reference each up and down position. Label three of the positions with the following: H for highest, M for mid-position (if there is no mid-position, label the next lowest adjustment position), and L for lowest.

N/A, steering wheel is not adjustable up and down

4.3 Find and mark for future references each in and out position. Label three of the positions with the following: F for foremost, M for mid-position (if there is no mid-position, label the next rearmost adjustment position), and R for rearmost.

N/A, steering wheel is not adjustable in and out

5. Driver Low Risk Deployment

N/A, no low risk deployment tests scheduled

5.1 Position the steering wheel so the front wheels are in the straight-ahead position. (S26.2.1)

5.2 Position any adjustable parts of the steering controls to the mid-position as determined in item 3 above. If a mid-position adjustment is not achievable, position the controls to the next lowest detent position. (S26.2.1)

5.3 Locate the vertical plane parallel to the vehicle longitudinal centerline through the geometric center of the opening through which the driver air bag deploys into the occupant compartment. This is referred to as “Plane E”. (Check determination method below.) (S26.2.6)

Plane E determined using manufacturer’s information supplied by the COTR. (Found in Appendix D on page D-47)

Plane E determined by test lab personnel and approved by the COTR. (Include supporting documentation in the test report.)

<table>
<thead>
<tr>
<th>&quot;Plane E&quot; Measurement::</th>
<th>Ey (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured:</td>
<td></td>
</tr>
<tr>
<td>Specified:</td>
<td></td>
</tr>
<tr>
<td>Verify Measured Equals Specified +/- 6mm:</td>
<td></td>
</tr>
</tbody>
</table>

5.4 Locate the horizontal plane through the highest point of the air bag module cover. This is referred to as “Plane F.” (Check determination method below.) (S26.2.6)

Plane F determined using manufacturer’s information supplied by the COTR. (Found in Appendix D on page D-47)

Plane F determined by test lab personnel and approved by the COTR. (Include supporting documentation in the test report.)

<table>
<thead>
<tr>
<th>&quot;Plane F&quot; Measurement::</th>
<th>Fz (mm)</th>
</tr>
</thead>
</table>
### 6. Passenger Low Risk Deployment – Planes C and D

**X** N/A, no low risk deployment tests scheduled

### 6.1 Locate the horizontal plane through the geometric center of the opening through which the right front air bag deploys into the occupant compartment. This is referred to as "Plane C." (Check location method below.) (S22.4.1.3)

- **Plane C** located using manufacturer’s information supplied by the COTR.  
  (Include manufacturer’s information in the test report.) OR
- **Plane C** located by test lab personnel and approved by the COTR.  
  (Include supporting documentation in the test report.)

<table>
<thead>
<tr>
<th>Cz (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured:</td>
</tr>
<tr>
<td>Specified:</td>
</tr>
<tr>
<td>Verify Measured Equals Specified +/- 6mm:</td>
</tr>
</tbody>
</table>

### 6.2 Locate the vertical plane parallel to the vehicle longitudinal centerline through the geometric center of the opening through which the right front air bag deploys into the occupant compartment. This is referred to as "Plane D." (Check determination method below.) (S22.4.1.2)

- **Plane D** determined using manufacturer’s information supplied by the COTR.  
  (Include manufacturer’s information in the test report.) OR
- **Plane D** determined by test lab personnel and approved by the COTR.  
  (Include supporting documentation in the test report.)

<table>
<thead>
<tr>
<th>Dy (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measured:</td>
</tr>
<tr>
<td>Specified:</td>
</tr>
<tr>
<td>Verify Measured Equals Specified +/- 6mm:</td>
</tr>
</tbody>
</table>

### 6.3 Mark the intersection of Planes C and D on the instrument panel.

### 7. 5th Female Dummy

**Mark** a point on the chin of the dummy 40 mm below the center of the mouth. (Chin Point) (S26.2.6)

### 8. 6-Year-Old Dummy

Locate and **mark** a point on the front of the dummy’s chest jacket on the midsaggital plane which is 139 mm (5.5 in) ± 3 mm (± 0.1 in) along the surface of the skin down from the top of the skin at the neck line.  Designate this point as "Point 1." (S24.4.1.1)

### 9. 3-Year-Old Dummy

Locate and **mark** a point on the front of the dummy’s chest jacket on the midsaggital plane which is 114 mm (4.5 in) ± 3 mm (± 0.1 in) along the surface of the skin down from the top of the skin at the neck line.  Designate this point as "Point 1." (S22.4.1.1)

**REMARKS:**

I certify that I have read and performed each instruction.

**Signature:** ____________________  **Date:** 08/18/04
DATA SHEET 30
VEHICLE WEIGHT, FUEL TANK, AND ATTITUDE DATA

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Date: 8/18/04
Test Technician: Wayne Dahlke

IMPACT ANGLE: Zero Degrees
BELTED DUMMIES (YES/NO): No – Front Occupants
TEST SPEED:  
| X | 32 to 40 kmph | 0 to 48 kmph | 0 to 56 kmph |
DRIVER DUMMY:  
| X | 5th female | 50th Male |
PASSENGER DUMMY:  
| X | 5th female | 50th Male Ctr Rear |

1. Fill the transmission with transmission fluid to the satisfactory range.
2. Drain fuel from vehicle
3. Run the engine until fuel remaining in the fuel delivery system is used and the engine stops.
4. Record the useable fuel tank capacity supplied by the COTR
   Useable Fuel Tank Capacity supplied by COTR: 72.5 liters (19.2 gallons)
5. Record the fuel tank capacity supplied in the owner’s manual.
   Useable Fuel Tank Capacity in owner’s manual: 72.5 liters (19.2 gallons)
6. Using purple dyed Stoddard solvent having the physical and chemical properties of Type 1 solvent or cleaning fluid, Table 1, ASTM Standard D484-71, “Standard Specifications for Hydrocarbon Dry-cleaning Solvents,” or gasoline, fill the fuel tank.
   Amount Added: 72.5 liters (19.2 gallons)
7. Fill the coolant system to capacity.
8. Fill the engine with motor oil to the Max. mark on the dip stick.
9. Fill the brake reservoir with brake fluid to its normal level.
10. Fill the windshield washer reservoir to capacity.
11. Inflate the tires to the tire pressure on the tire placard. If no tire placard is available, inflate the tires to the recommended pressure in the owner’s manual.
   Tire placard pressure:  
   | RF: 30 psi | LF: 30 psi | RR: 30 psi | LR: 30 psi |
   Owner’s manual pressure:  
   | RF: 30 psi | LF: 30 psi | RR: 30 psi | LR: 30 psi |
   Actual inflated pressure:  
   | RF: 30 psi | LF: 30 psi | RR: 30 psi | LR: 30 psi |
12. Record the vehicle weight at each wheel to determine the unloaded vehicle weight (UVW), i.e. "as delivered" weight.
   Right Front (kg): 504.8  Right Rear (kg): 403.3
   Left Front (kg): 526.2  Left Rear (kg): 402.8
   Total Front (kg): 1031.0  Total Rear (kg): 806.1
   % Total Weight: 56.1  % Total Weight: 43.9
   UVW = TOTAL FRONT PLUS TOTAL REAR (KG): 1837.1
13. UVW Test Vehicle Attitude: (All dimensions in millimeters)
13.1 Mark a point on the vehicle above the center of each wheel.
13.2 Place the vehicle on a level surface.
13.3 Measure perpendicular to the level surface to the 4 points marked on the body and record the measurements

RF: 807 LF: 800 RR: 809 LR: 810

14. Calculate the Rated Cargo and Luggage Weight (RCLW): 186 kg. The RCLW was incorrectly calculated; the correct calculation appears below.

14.1 Does the vehicle have the vehicle capacity weight (VCW) on the certification label or tire placard?

X Yes, go to 14.3

No, go to 14.2

14.2 VCW = Gross Vehicle Weight – UVW

VCW = _____ - _____ = _____

14.3 VCW = 526 kg (1159 lbs)

14.4 Does the certification or tire placard contain the Designated Seating Capacity (DSC)?

X Yes, go to 14.6

No, go to 14.5 and skip 14.6

14.5 DSC = Total number of seat belt assemblies = __________

14.6 DSC = 5

The DSC was incorrectly interpreted as 5; it should have been 7.

14.7 RCLW = VCW – (68 kg x DSC) = 526 kg - (68 kg x 5 ) = 186 kg

The RCLW was incorrectly calculated; the correct calculation appears below.

RCLW = VCW – (68 kg x DSC) = 526 kg - (68 kg x 7 ) = 50 kg

14.8 Is the vehicle certified as a truck, MPV or bus (see the certification label on the door jamb)?

X Yes, if the calculated RCLW is greater than 136 kg, use 136 kg as the RCLW. (S8.1.1)

No, use the RCLW calculated in 14.7 (This option should have been used)

15. Fully Loaded Weight (100% fuel fill): 2071.1 kg

15.1 Place the appropriate test dummy in both front outboard seating positions.

Driver:  X 5th female  50th male

Passenger: X 5th female  50th male

15.2 Load the vehicle with the RCLW from 14.7 or 14.8 whichever is applicable.

15.3 Place the RCLW in the cargo area. Center the load over the longitudinal centerline of the vehicle. (S8.1.1 (d))

15.4 Record the vehicle weight at each wheel to determine the Fully Loaded Weight.

<table>
<thead>
<tr>
<th>Weight (kg)</th>
<th>Right Front</th>
<th>Right Rear</th>
</tr>
</thead>
<tbody>
<tr>
<td>532.5</td>
<td></td>
<td>493.5</td>
</tr>
<tr>
<td>552.1</td>
<td>1084.6</td>
<td>986.6</td>
</tr>
<tr>
<td>52.4</td>
<td>44.6</td>
<td>40.6</td>
</tr>
<tr>
<td>2071.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

16. Fully Loaded Test Vehicle Attitude: (All dimensions in millimeters)

16.1 Place the vehicle on a level surface.
16.2 Measure perpendicular to the level surface to the 4 points marked on the body (see 13.1 above) and record the measurements

<table>
<thead>
<tr>
<th>RF</th>
<th>LF</th>
<th>RR</th>
<th>LR</th>
</tr>
</thead>
<tbody>
<tr>
<td>802</td>
<td>795</td>
<td>785</td>
<td>784</td>
</tr>
</tbody>
</table>

17. Drain the fuel system

18. Using purple dyed Stoddard solvent having the physical and chemical properties of Type 1 solvent or cleaning fluid, Table 1, ASTM Standard D484-71, “Standard Specifications for Hydrocarbon Dry-cleaning Solvents,” fill the fuel tank to 92 - 94 percent of useable capacity.

Fuel tank capacity x .94 = 72.5 liters (19.2 gallons) x .94 = 68.1 liters (18.0 gallons)

Amount added 68.1 liters (18.0 gallons) .94%

19. Crank the engine to fill the fuel delivery system with Stoddard solvent

20. Calculate the test weight range.

20.1 Calculated Weight = UVW (see 12 above) + RCLW (see 14 above) + 2x(dummy weight)

2071.1 kg = 1837.1 kg + 136.0 kg + 98.0 kg

20.2 Test Weight Range = Calculated Weight (- 4.5 kg, - 9 kg.)

Max. Test Weight = Calculated Test Weight – 4.5 kg = 2066.6 kg

Min. Test Weight = Calculated Test Weight – 9 kg = 2062.1 kg

21. Remove the RCLW from the cargo area.

22. Drain transmission fluid, engine coolant, motor oil, and windshield washer fluid from the test vehicle so that Stoddard solvent leakage from the fuel system will be evident.

23. Vehicle Components Removed For Weight Reduction:

Tool and jack, luggage door inner trim, luggage room side trim, deck board and tray, luggage cover, third seat

24. Secure the equipment and ballast in the load carrying area and distribute it, as nearly as possible, to obtain the proportion of axle weight indicated by the gross axle weight ratings and center it over the longitudinal centerline of the vehicle.

25. If necessary, add ballast to achieve the actual test weight.

26. Ballast, including test equipment, must be contained so that it will not shift during the impact event or interfere with data collection or interfere with high-speed film recordings or affect the structural integrity of the vehicle or do anything else to affect test results. Care must be taken to assure that any attachment hardware added to the vehicle is not in the vicinity of the fuel tank or lines.

27. Record the vehicle weight at each wheel to determine the actual test weight.

| Right Front (kg): | 526.6 | Right Rear (kg): | 483.1 |
| Left Front (kg):  | 560.6  | Left Rear (kg):  | 494.4 |
| Total Front (kg): | 1087.2 | Total Rear (kg): | 977.5 |
| % Total Weight:   | 52.7   | % Total Weight:  | 47.3  |
| % GVW             | 44.7   | % GVW            | 40.2  |

(% GVW = Axle GVW divided by Vehicle GVW)

TOTAL FRONT PLUS TOTAL REAR (kg): 2064.7

*The Test Weight was over by approximately 86kg due to the incorrect DSC being used for Test Weight Calculation.*
28. Is the test weight between the Max. Weight and the Min. Weight (See 20.2)?
   Yes
   [ ] No, explain why not.

29. Test Weight Vehicle Attitude: (all dimensions in millimeters)
   29.1 Place the vehicle on a level surface
   29.2 Measure perpendicular to the level surface to the 4 points marked on the body (see 13 above) and record the measurements

   RF: 804  LF: 797  RR: 785  LR: 784

30. Summary of test attitude
   30.1 AS DELIVERED:

   RF: 807  LF: 800  RR: 809  LR: 810

   AS TESTED:

   RF: 804  LF: 797  RR: 785  LR: 784

   FULLY LOADED:

   RF: 802  LF: 795  RR: 785  LR: 784

30.2 Is the “as tested” test attitude equal to or between the “fully loaded” and “as delivered” attitude?
   Yes
   [ ] No, explain why not.

REMARKS: The test vehicle was incorrectly ballasted for the test. The RCLW was calculated on a Designated Seating Capacity (DSC) of 5 instead of the actual DSC of 7. The result was a Rated Cargo and Luggage Weight (RCLW) of 136 kg instead of 50 kg. Therefore, the wrong RCLW was used to calculate the test weight and the test weight was 86 kg heavier than it was supposed to be.

I certify that I have read and performed each instruction.

Signature: [Signature]

Date: 08/18/04
DATA SHEET 31

VEHICLE ACCELEROMETER LOCATION AND MEASUREMENT

Test Vehicle: 2004 Toyota Highlander MPV  
Test Program: FMVSS 208 Compliance  
Test Technician: Clark Subrt

IMPACT ANGLE: Zero Degrees
BELTED DUMMIES (YES/NO): No – Front Occupants
TEST SPEED: X 32 to 40 kmph  
DRIVER DUMMY: X 5th female  
PASSENGER DUMMY: X 5th female

1. Find the location where the vertical plane parallel to the longitudinal centerline of the vehicle and through the center of the left front outboard seating position intersects the left rear seat cross member. Install an accelerometer at this intersection on the rear seat cross member to record x-direction accelerations. Record the location on the following chart.

2. Find the location where the vertical plane parallel to the longitudinal centerline of the vehicle and through the center of the right front outboard seating position intersects the right rear seat cross member. Install an accelerometer at this intersection on the rear seat cross member to record x-direction accelerations. Record the location on the following chart.

3. Find the location where a vertical plane through the longitudinal centerline of the vehicle and a vertical transverse plane through the center of the two wheels on opposite sides of the engine intersect at the top of the engine. Install an accelerometer at this intersection to record x-direction accelerations. Record the location on the following chart.

4. Find the location where a vertical plane through the longitudinal centerline of the vehicle and a vertical transverse plane through the center of the two wheels on opposite sides of the engine intersect the bottom of the engine. Install an accelerometer at this intersection to record x-direction accelerations. Record the location on the following chart.

5. Install an accelerometer on the right front brake caliper to record x-direction accelerations. Record the location on the following chart.

6. Find the location where a vertical plane through the longitudinal centerline of the vehicle intersects the top of the instrument panel. Install an accelerometer at this intersection to record x-direction accelerations. Record the location on the following chart.

7. Install an accelerometer on the left front brake caliper to record x-direction accelerations. Record the location on the following chart.

8. Find the location where a vertical plane through the longitudinal centerline of the vehicle intersects the floor of the trunk. Install an accelerometer on the trunk floor at this intersection to record z-direction accelerations. Record the location on the following chart.

REMARKS:

I certify that I have read and performed each instruction.

Signature: Clark Subrt  Date: 08/18/04
Dimensions Corresponding To The Letters “A” Through “K” (Excluding “I”) Are Recorded In The Table On The Following Page. Accelerometers Corresponding To The Numbers 1 Through 8 Are Specified On The Preceding Page.
<table>
<thead>
<tr>
<th>DIMENSION</th>
<th>LENGTH (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PRETEST VALUES</strong></td>
<td></td>
</tr>
<tr>
<td>A (LH Rear Seat Xmbr)</td>
<td>365</td>
</tr>
<tr>
<td>B (RH Rear Seat Xmbr)</td>
<td>365</td>
</tr>
<tr>
<td>C (Engine Top)</td>
<td>4105</td>
</tr>
<tr>
<td>D (Engine Bottom)</td>
<td>3920</td>
</tr>
<tr>
<td>E (Caliper)</td>
<td>Right Side 3863</td>
</tr>
<tr>
<td>F (Left Caliper)</td>
<td>698</td>
</tr>
<tr>
<td>G (IP)</td>
<td>3084</td>
</tr>
<tr>
<td>H (Seat)</td>
<td>1848</td>
</tr>
<tr>
<td>J (Right Caliper)</td>
<td>698</td>
</tr>
<tr>
<td>K (Trunk)</td>
<td>235</td>
</tr>
<tr>
<td><strong>POST TEST VALUES</strong></td>
<td></td>
</tr>
<tr>
<td>A (LH Rear Seat Xmbr)</td>
<td>365</td>
</tr>
<tr>
<td>B (RH Rear Seat Xmbr)</td>
<td>365</td>
</tr>
<tr>
<td>C (Engine Top)</td>
<td>3961</td>
</tr>
<tr>
<td>D (Engine Bottom)</td>
<td>3898</td>
</tr>
<tr>
<td>E (Caliper)</td>
<td>Right Side 3843</td>
</tr>
<tr>
<td>F (Left Caliper)</td>
<td>700</td>
</tr>
<tr>
<td>G (IP)</td>
<td>3084</td>
</tr>
<tr>
<td>H (Seat)</td>
<td>1848</td>
</tr>
<tr>
<td>J (Right Caliper)</td>
<td>700</td>
</tr>
<tr>
<td>K (Trunk)</td>
<td>235</td>
</tr>
</tbody>
</table>
DATA SHEET 32
PHOTOGRAPHIC TARGETS

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
Test Technician: Clark Subrt
NHTSA No.: C45111
Test Date: 8/18/04

IMpACT ANGLE: Zero Degrees
BELTED DUMMIES (YES/NO): No – Front Occupants
TEST SPEED: X 32 to 40 kmph | 0 to 48 kmph | 0 to 56 kmph
DRIVER DUMMY: X 5th female | 50th Male
PASSENGER DUMMY: X 5th female | 50th Male Ctr Rear

1. FMVSS 208 vehicle targeting requirements (See Figures 28A and 28B)
   1.1 Targets A1 and A2 are on flat rectangular panels.
   1.2 Three circular targets at least 90 mm in diameter and with black and yellow quadrants are mounted at the front on the outboard sides of A1 and A2. The center of each circular target is 100 mm from the one next to it.
   1.3 Three circular targets at least 90 mm in diameter and with black and yellow quadrants are mounted at the back on the outboard sides of on A1 and A2. The center of each circular target is 100 mm from the one next to it.
   1.4 The distance between the first circular target at the front of A1 and A2 and the last circular target at the back of A1 and A2 is at least 915 mm.
   1.5 Firmly fix target A1 on the vehicle roof in the vertical longitudinal plane that is coincident with the midsagittal plane of the driver dummy.
   1.6 Firmly fix target A2 on the vehicle roof in the vertical longitudinal plane that is coincident with the midsagittal plane of the passenger dummy.
   1.7 Two circular targets (C1 and C2) at least 90 mm in diameter and with black and yellow quadrants are mounted on the outside of the driver door. The centers of each circular target are at least 610 mm apart.
   1.8 Two circular targets (C1 and C2) at least 90 mm in diameter and with black and yellow quadrants are mounted on the outside of the passenger door. The centers of each circular target are at least 610 mm apart.
   1.9 Place tape with squares having alternating colors on the top portion of the steering wheel.
   1.10 Chalk the bottom portion of the steering wheel
   1.11 Is this an offset test?
      Yes, continue with this section
      No, go to 2.
   1.12 Measure the width of the vehicle.
      Vehicle width (mm):
1.13 Find the centerline of the vehicle. (½ of the vehicle width)
1.14 Find the line parallel to the centerline of the vehicle and 0.1 x vehicle width from the centerline of the vehicle.
1.15 Apply 25 mm wide tape with alternating black and yellow squares parallel to and on each side of the line found in 1.14. The edge of each tape shall be 50 mm from the line found in 1.14. The tape shall extend from the bottom of the bumper to the front edge of the windshield. (Figure 28D)

2. Barrier Targeting
2.1 Fix two stationary targets D1 and D2 to the barrier as shown in the Figure 28A. One target is in the vertical longitudinal plane that is coincident with the midsagittal plane of the driver dummy. The other is in the vertical longitudinal plane that is coincident with the midsagittal plane of the passenger dummy.
2.2 Targets D1 and D2 are on a rectangular panel.
2.3 Three circular targets at least 90 mm in diameter and with black and yellow quadrants are mounted on the sides of the rectangular panel away from the longitudinal centerline of the vehicle. The center of each circular target is 100 mm from the one next to it.

Distance between circular targets on D1 (mm): 100mm
Distance between circular targets on D2 (mm): 100mm

3. FMVSS 208 Dummy Targeting Requirements
3.1 Place a circular target with black and yellow quadrants on both sides of the driver dummy head as close as possible to the center of gravity of the head in the x and z direction (relative to the measuring directions of the accelerometers).
3.2 Place a circular target with black and yellow quadrants on both sides of the passenger dummy head as close as possible to the center of gravity of the head in the x and z direction (relative to the measuring directions of the accelerometers).
3.3 Place a circular target with black and yellow quadrants on the outboard shoulder of the driver dummy. Place the target as high up on the arm as possible at the intersection of the arm and shoulder. The sleeve of the shirt on the dummy may be cut to make the target visible, but do not remove any material.
3.4 Place a circular target with black and yellow quadrants on the outboard shoulder of the passenger dummy. Place the target as high up on the arm as possible at the intersection of the arm and shoulder. The sleeve of the shirt on the dummy may be cut to make the target visible, but do not remove any material.

4. FMVSS 204 Targeting Requirements
4.1 Is an FMVSS 204 indicant test ordered on the “COTR Vehicle Work Order?”
   - Yes, continue with this form.
   - No, this form is complete. (Removed at manufacturer’s request with COTR approval)
4.2 Reection panel (Figure 28C)
4.2.1 The panel deviates no more than 6 mm from perfect flatness when suspended vertically
4.2.2 The 8 targets on the panel are circular targets at least 90 mm in diameter and with black and yellow quadrants.
4.2.3 The center of each of the 4 outer targets are placed within 1 mm of the corners of a square measuring 914 mm on each side.
4.2.4 Locate another square with 228 mm sides and with the center of this square coincident with the center of the 914 mm square.
4.2.5 The center of the 4 inner targets are placed at the midpoints of each of the 228 mm sides.
4.3 Place a circular target at least 90 mm in diameter and with black and yellow quadrants on a material (cardboard, metal, etc.) that can be taped to the top of the steering column.

4.4 Tape the target from 4.3 to the top of the steering column in a manner that does not interfere with the movement of the steering column in a crash

REMARKS:

I certify that I have read and performed each instruction.

Signature: __________________

Date: 08/18/04
REFERENCE PHOTO TARGETS

CONCRETE BARRIER

915 mm

100 mm  100 mm

A1

B

C1

C2

610 mm

MONORAIL

COVERED PHOTO PIT

LEFT SIDE VIEW
RESECTION PANEL TARGETING ALIGNMENT

C1  C2

RESECTION CONTROL POINTS PANEL

STEERING COLUMN TARGET B

REAR VIEW

A1  A2

STEERING WHEEL

TEST RUN STEERING COLUMN CAMERA VIEW OF TYPICAL TIME ZERO VEHICLE POSITION

CAR TOP TARGETS A1 & A2

LEFT SIDE VIEW

RESECTION PANEL TARGETING ALIGNMENT

A1  A2

STEERING COLUMN TARGET B

REAR VIEW

TEST RUN STEERING COLUMN CAMERA VIEW OF TYPICAL TIME ZERO VEHICLE POSITION

LEFT SIDE VIEW
PRE-RUN STEERING COLUMN HIGH SPEED CAMERA VIEW

LEFT SIDE VIEW

914 mm

914 mm
### DATA SHEET 33

#### CAMERA LOCATIONS

**Test Vehicle:** 2004 Toyota Highlander MPV  
**NHTSA No.:** C45111  
**Test Program:** FMVSS 208 Compliance  
**Test Date:** 8/18/04  
**Time:** 11:10 am

<table>
<thead>
<tr>
<th>CAMERA NO.</th>
<th>VIEW</th>
<th>CAMERA POSITIONS (mm) *</th>
<th>LENS (mm)</th>
<th>SPEED (fps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Real Time Left Side View</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Left Side View (Barrier face to front seat backs)</td>
<td>950 -8260 1323</td>
<td>25</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>Left Side View (Driver)</td>
<td>1625 -6260 1505</td>
<td>19</td>
<td>1000</td>
</tr>
<tr>
<td>4</td>
<td>Left Side View (B-post aimed toward center of steering wheel)</td>
<td>5560 -5090 1980</td>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>5</td>
<td>Left Side View (Steering Column)</td>
<td>1990 -7170 1575</td>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>6</td>
<td>Left Side View (Steering Column)</td>
<td>1990 -7170 1040</td>
<td>19</td>
<td>1000</td>
</tr>
<tr>
<td>7</td>
<td>Right Side View (Overall)</td>
<td>2546 6660 1492</td>
<td>19</td>
<td>1000</td>
</tr>
<tr>
<td>8</td>
<td>Right Side View (Passenger)</td>
<td>1570 5270 1410</td>
<td>28</td>
<td>1000</td>
</tr>
<tr>
<td>9</td>
<td>Right Side View (Angle)</td>
<td>5595 5170 1970</td>
<td>50</td>
<td>1000</td>
</tr>
<tr>
<td>10</td>
<td>Right Side View (Front door)</td>
<td>890 8620 1450</td>
<td>24</td>
<td>1000</td>
</tr>
<tr>
<td>11</td>
<td>Front View Windshield</td>
<td>-470 0 2865</td>
<td>19</td>
<td>1000</td>
</tr>
<tr>
<td>12</td>
<td>Front View Driver</td>
<td>80 -440 1770</td>
<td>13</td>
<td>1000</td>
</tr>
<tr>
<td>13</td>
<td>Front View Passenger</td>
<td>140 460 1720</td>
<td>13</td>
<td>1000</td>
</tr>
<tr>
<td>14</td>
<td>Overhead Barrier Impact View</td>
<td>940 0 5050</td>
<td>24</td>
<td>1000</td>
</tr>
<tr>
<td>15</td>
<td>Pit Camera Engine View</td>
<td>1320 0 -3150</td>
<td>19</td>
<td>1000</td>
</tr>
<tr>
<td>16</td>
<td>Pit Camera Fuel Tank View</td>
<td>3300 0 -3150</td>
<td>19</td>
<td>1000</td>
</tr>
</tbody>
</table>

*COORDINATES:  
+X – forward of impact plane  
+Y – right of monorail centerline  
+Z – above ground level
APPENDIX G
DUMMY POSITIONING PROCEDURES
FOR 5th% DRIVER TEST DUMMY CONFORMING TO SUBPART O OF PART 572

Test Vehicle: 2004 Toyota Highlander MPV  
Test Program: FMVSS 208 Compliance  
Test Technician: Eric Peschman

**IMPACT ANGLE:** Zero Degrees

**BELTED DUMMIES (YES/NO):** No – Front Occupants

**TEST SPEED:**  
- X 32 to 40 kmph  
- 0 to 48 kmph  
- 0 to 56 kmph

**DRIVER DUMMY:**  
- X 5th female  
- 50th Male

**PASSENGER DUMMY:**  
- X 5th female  
- 50th Male Ctr Rear

X 1. Position the seat’s adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment position. (S16.2.10.1)  
   __ N/A – No lumbar adjustment

X 2. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. (S16.2.10.2)  
   ___ N/A – No additional support adjustment

X 3. If the seat cushion adjusts fore and aft, independent of the seat back, set this adjustment to the full rearward position. (S16.2.10.3.1)  
   ___ N/A – No independent fore-aft seat cushion adjustment

X 4. Use the seat markings determined during the completion of Data Sheet 14 to set the rearmost fore-aft position, mid-height position and the seat cushion mid-angle. (S16.3.2.1.1)

X 5. If the vehicle has an adjustable accelerator pedal, place it in the full forward position. (S16.3.2.2.1)  
   ___ N/A accelerator pedal not adjustable

X 6. Set the steering wheel hub at the geometric center of the full range of driving positions including any telescoping positions as determined in data sheet 14. (S16.2.9)

X 7. Fully recline the seat back. (S16.3.2.1.2)  
   ___ N/A seat back not adjustable

X 8. Place the dummy in the seat with the legs at an angle of 120 degrees to the thighs. The calves should not be touching the seat cushion. (S16.3.2.1.2)

X 9. Position the dummy in the seat such that the midsagittal plane is coincident with the longitudinal seat cushion markings as determined in item 1.18 of Data Sheet 14 (S16.3.2.1.3 and S16.3.2.1.4)

X 10. Hold down the dummy’s thighs and push rearward on the upper torso to maximize the pelvic angle. (S16.3.2.1.5)

X 11. Set the angle between the legs and the thighs to 120 degrees. (S16.3.2.1.6)

Test Vehicle: 2004 Toyota Highlander MPV  
NHTSA No.: C45111  
Test Program: FMVSS 208 Compliance  
Test Technician: Eric Peschman  
Test Date: 8/18/04
12. Set the transverse distance between the centers of the front of the knees at 160 to 170 mm. (6.3 to 6.7 inches) Center the knee separation with respect to the longitudinal seat cushion marking as determined in item 1.18 of Data Sheet 14. (S16.3.2.1.6) Record Knee Separation 167 mm

13. Push rearward on the dummy's knees until the pelvis contacts the seat back, or the backs of the calves contact the seat cushion, whichever occurs first. (S16.3.2.1.6) Pelvis contacted seat back. Calves contacted seat cushion.

14. Gently rock the upper torso ± 5 degrees (approximately 51 mm (2 inches)) side to side three times. (S16.3.2.1.7)

15. If needed, extend the legs until the feet do not contact the floor pan. The thighs should be resting on the seat cushion. (S16.3.2.1.8)

16. Position the right foot until the foot is in line with a longitudinal vertical plane passing through the center of the accelerator pedal. Maintain the leg and thigh in a vertical plane. (S16.3.2.1.8)

17. Rotate the left leg and thigh laterally to equalize the distance between each knee and the longitudinal seat cushion marking as determined in item 1.18 of Data Sheet 14. (S16.3.2.1.8)

18. Attempt to return the seat to the foremost fore-aft position, mid-height, and seat cushion mid-angle. The foot may contact and depress the accelerator and/or change the angle of the foot with respect to the leg. (S16.3.2.1.8) Foremost position achieved. Proceed to step 23. Foremost not achieved because of foot interference. Proceed to step 20. Foremost not achieved because of steering wheel contact.

19. If the dummy's legs contact the steering wheel, move the steering wheel up the minimum amount required to avoid contact. If the steering wheel is not adjustable separate the knees the minimum required to avoid contact. (S16.3.2.1.8) N/A- there was no leg contact Steering wheel repositioned Knees separated

20. If the left foot interferes with the clutch or brake pedals, rotate the left foot about the leg to provide clearance. If this is not sufficient, rotate the thigh outboard at the hip the minimum amount required for clearance. (S16.3.2.1.8) N/A, No foot interference with pedals. Foot adjusted to provide clearance. Foot and Thigh adjusted to provide clearance.
21. Continue to move the seat. Use seat controls to line up the seat markings determined during the completion of Data Sheet 14 to set the foremost fore-aft position, mid-height position and the seat cushion mid-angle. If the dummy contacts the interior move the seat rearward until a maximum clearance of 5 mm (0.2 inches) is achieved or the seat is in the closest detent position that does not cause dummy contact. (S16.3.2.1.8)

- Foremost, mid-height position and the seat cushion mid-angle reached

- Dummy contact. Clearance set at maximum of 5mm
  Measured Clearance ______________

- Dummy Contact. Seat set at nearest detent position.
  Seat position ___ detent positions rearward of foremost
  (Foremost is position zero)

22. If the steering wheel was repositioned in step 19, return the steering wheel to the original position. If the steering wheel contacts the dummy before reaching the original position, position the wheel until a maximum clearance of 5mm (.2 inches) is achieved, or the steering wheel is in the closest detent position that does not cause dummy contact. (S16.3.2.1.8)

- N/A Steering wheel was not repositioned.

- Original position achieved.

- Dummy contact. Clearance set at maximum of 5mm
  Measured Clearance ______________

- Dummy Contact. Steering wheel set at nearest detent position.
  Steering wheel position ___ detent positions upward of original position.
  (Original position is position zero)

23. If the seat back is adjustable, rotate the seat back forward while holding the thighs in place. Continue rotating the seat back forward until the transverse instrument platform of the dummy head is level ± 0.5 degrees. If the head cannot be leveled using the seat back adjustment, or the seat back is not adjustable, use the lower neck bracket adjustment to level the head. If a level position cannot be achieved, minimize the angle. (S16.3.2.1.9)

- Head Level Achieved. (Check all that apply)
  \checkmark Head leveled using the adjustable seat back
  \checkmark Head leveled using the neck bracket.
  Head Angle \text{____0.2____} degrees

- Head Level NOT Achieved. (Check all that apply)
  \checkmark Head adjusted using the adjustable seat back
  \checkmark Head adjusted using the neck bracket.
  Head Angle \text{________} degrees

24. Verify the pelvis is not interfering with the seat bight. (S16.3.2.1.9)

- No interference
  \checkmark Pelvis moved forward the minimum amount so that it is not caught in the seat bight.
X 25. Verify the dummy abdomen is properly installed. (S16.3.2.1.9)
   Abdomen still seated properly into dummy
   Abdomen was adjusted because it was not seated properly into dummy

X 26. Head Angle
   N/A, neither the pelvis nor the abdomen were adjusted.

26.1 Head still level (Go to 27)

26.2 Head level adjusted
   Head Level Achieved. (Check all that apply)
   Head leveled using the adjustable seat back
   Head leveled using the neck bracket.
   Head Angle ____________ degrees

   Head Level NOT Achieved. (Check all that apply)
   Head level adjusted using the adjustable seat back
   Head level adjusted using the neck bracket.
   Head Angle ____________ degrees

X 27. If the dummy torso contacts the steering wheel while performing step 23, reposition the
   steering wheel in the following order to eliminate contact.
   N/A, No dummy torso contact with the steering wheel.

27.1 Adjust telescoping mechanism.
   N/A No telescoping adjustment.
   Adjustment performed (fill in appropriate change)
   Steering wheel moved ____ detent positions in the forward direction.
   Steering wheel moved ____ mm in the forward direction.

27.2 Adjust tilt mechanism.
   N/A No tilt adjustment.
   No adjustment performed.
   Adjustment performed.
   Steering wheel moved ____ detent positions Upward/Downward.
   (circle one)
   Steering wheel moved ____ degrees Upward/Downward

27.3 Adjust Seat in the aft direction.
   No Adjustment performed.
   Seat moved aft ____ mm from original position.
   Seat moved aft ____ detent positions from the original position.

X 28. Measure and set the pelvic angle using the pelvic angle gage TE-2504. The pelvic
   angle should be 20.0 degrees ± 2.5 degrees. If the pelvic angle cannot be set to the
   specified range because the head will not be level, adjust the pelvis as closely as
   possible to the angle range, but keep the head level.
   Pelvic angle set to 20.0 degrees ± 2.5 degrees.
   Pelvic angle of 20.0 degrees not achieved, the angular difference was minimized.
   Record the pelvic angle. ____ 25.8 ______ degrees
29. Check the dummy for contact with the interior after completing adjustments.
   X No contact.
   **Dummy in contact with interior.**
   _Seat moved aft ___ mm from the previous position._
   _Seat moved aft ___ detent positions from the previous position._

30. Check the dummy to see if additional interior clearance is obtained, allowing the seat to be moved forward.
   X N/A, Seat already at foremost position.
   _Clearance unchanged. No adjustments required._
   _Additional clearance available_
      _Seat moved Forward ___ mm from the previous position._
      _Seat moved Forward ___ detent positions from the previous position._

31. Driver’s foot positioning, right foot. Place the foot perpendicular to the leg and determine if the heel contacts the floor pan at any leg position. If the heel contacts the floor pan proceed to step 32 otherwise, proceed to step 33.

32. Perform the following steps until either all steps are completed, or the foot contacts the accelerator pedal. Step 32.6 shall be completed in all cases.

   32.1 With the rear of the heel contacting the floor pan, move the foot forward until pedal contact occurs or the foot is at the full forward position.

   32.2 If the vehicle has an adjustable accelerator pedal, move the pedals rearward until pedal contact occurs or the pedals reach the full rearward position. **Not Applicable**

   32.3 Extend the leg, allowing the heel to lose contact with the floor until the foot contacts the pedal. Do not raise the toe of the foot higher than the top of the accelerator pedal. If the foot does not contact the pedal, proceed to the next step. If pedal contact does occur, place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

   32.4 Angle the foot to achieve contact between the foot and the pedal. If the foot does not contact the pedal, return the foot to the perpendicular orientation. If pedal contact does occur, place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

   32.5 Align the centerline of the foot with the vertical-longitudinal plane passing through the center of the accelerator pedal. Place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

32.6 Record foot position
   X Pedal Contact achieved. Contact occurred at step 32.1.
      _Heel contacts floor pan_
      _Heel set _____ mm from floor pan._

   _Pedal Contact not achieved. Heel set _____ mm from the floor pan._
FIGURE G1

33. Perform the following steps until either all steps are completed, or the foot contacts the accelerator pedal. Step 33.5 shall be completed in all cases.

33.1 Extend the leg until the foot contacts the pedal. Do not raise the toe of the foot higher than the top of the accelerator pedal. If the foot does not contact the pedal, proceed to the next step. If pedal contact does occur, place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

33.2 If the vehicle has an adjustable accelerator pedal, move the pedals rearward until pedal contact occurs or the pedals reach the full rearward position. If pedal contact does occur, place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

33.3 Angle the foot to achieve contact between the foot and the pedal. If the foot does not contact the pedal, return the foot to the perpendicular orientation. If pedal contact does occur, place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.

33.4 Align the centerline of the foot in the same horizontal plane as the centerline of the accelerator pedal. Place a tapered foam block as shown in Figure G1 under the heel with the shallow part of the taper facing forward.
33.5 Record foot position
- Pedal Contact achieved. Contact occurred at step ____.
  - Heel set _____ mm from floor pan.
- Pedal Contact not achieved. Heel set _____ mm from the floor pan.

34. Driver’s foot positioning, left foot.

34.1 Place the foot perpendicular to the leg and determine if the heel contacts the floor pan at any leg position. If the heel contacts the floor pan proceed to step 34.2, otherwise position the leg as perpendicular to the thigh as possible with the foot parallel to the floor pan.

34.2 Place the foot on the toe board with the heel resting on the floor pan as close to the intersection of the floor pan and the toe board as possible. Adjust the angle of the foot if necessary to contact the toe board. If the foot will not contact the toe board, set the foot perpendicular to the leg, and set the heel on the floor pan as far forward as possible. Do not place the foot on the wheel well projection or footrest. If the pedals interfere with the placement of the foot, reposition the foot by rotating the foot about the leg, or rotate the leg outboard about the hip if necessary.
  - Foot rotated about the leg
  - Foot rotated about the leg, and the leg rotated about the hip.

34.3 Record foot position.
- Heel does not contact floor pan.
  - Foot placed on toe board.
  - Foot placed on floor pan.

35. Driver arm/hand positioning.

35.1 Place the dummy’s upper arms adjacent to the torso with the arm centerlines as close to a vertical longitudinal plane as possible. (S16.3.2.3.1)

35.2 Place the palms of the dummy in contact with the outer part of the steering wheel rim at its horizontal centerline with the thumbs over the steering wheel rim. (S16.3.2.3.2)

35.3 If it is not possible to position the thumbs inside the steering wheel rim at its horizontal centerline, then position them above and as close to the horizontal centerline of the steering wheel rim as possible. (S16.3.2.3.3)

35.4 Lightly tape the hands to the steering wheel rim so that if the hand of the test dummy is pushed upward by a force of not less than 9 N (2 lb) and not more than 22 N (5 lb), the tape releases the hand from the steering wheel rim. S16.3.2.3.4

36. Adjustable head restraints
- N/A, there is no head restraint adjustment

36.1 If the head restraint has an automatic adjustment, leave it where the system positions the restraint after the dummy is placed in the seat. (S16.3.4.1) Go to 37.
X 36.2 Adjust each head restraint vertically so that the horizontal plane determined in item 3 of Data Sheet 14 is aligned with the center of gravity (CG) of the dummy head. (S16.3.4.3)

X 36.3 If the above position is not attainable, move the vertical center of the head restraint to the closest detent below the center of the head CG. (S16.3.4.3)
   - N/A midpoint position attained in previous step
   - X Headrest set at nearest detent below the head CG

X 36.4 If the head restraint has a fore and aft adjustment, place the restraint in the foremost position or until contact with the head is made, whichever occurs first. (S16.3.4.4)

X 37. Driver and passenger manual belt adjustment (for tests conducted with a belted dummy). (S16.3.5) **Unbelted Test**

   - 37.1 If an adjustable seat belt D-ring anchorage exists, place it in the manufacturer’s design position for a 5th percentile adult female.
     *This information will be supplied by the COTR.*
     Manufacturer’s specified position ________________________________
     Actual Position ________________________________________________

   - 37.2 Place the Type 2 manual belt around the test dummy and fasten the latch. (S16.3.5.2)

   - 37.3 Ensure that the dummy’s head remains as level as possible. (S16.3.5.3)

   - 37.4 Remove all slack from the lap belt. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 N (2 lbf) to 18 N (4 lbf) tension load to the lap belt. If the belt system is equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor. (S16.3.5.4)

REMARKS: NONE

I certify that I have read and performed each instruction.

Signature: ___________________________ Date: 08/18/04
APPENDIX G
DUMMY POSITIONING PROCEDURES
FOR 5th% PASSENGER TEST DUMMY CONFORMING TO SUBPART O OF PART 572

| Test Vehicle: | 2004 Toyota Highlander MPV | NHTSA No.: | C45111 |
| Test Program: | FMVSS 208 Compliance | Test Date: | 8/18/04 |
| Test Technician: | Wayne Dahlke |

| IMPACT ANGLE: | Zero Degrees |
| BELTED DUMMIES (YES/NO): | No – Front Occupants |
| TEST SPEED: | X 32 to 40 kmph | 0 to 48 kmph | 0 to 56 kmph |
| DRIVER DUMMY: | X 5th female | 50th Male |
| PASSENGER DUMMY: | X 5th female | 50th Male Ctr Rear |

(Check this item ONLY if it applies to this vehicle.)

The passenger seat adjustments are controlled by the adjustments made to the driver’s seat. Therefore, positioning of the passenger dummy is made simultaneously with the driver dummy. Adjustments made to the seat to position the driver will over ride any adjustments that would normally be made to position the passenger. (S16.2.10.3)

1. Position the seat’s adjustable lumbar supports so that the lumbar supports are in the lowest, retracted or deflated adjustment position. (S16.2.10.1)

   X N/A – No lumbar adjustment

2. Position any adjustable parts of the seat that provide additional support so that they are in the lowest or most open adjustment position. (S16.2.10.2)

   X N/A – No additional support adjustment

3. If the seat cushion adjusts fore and aft, independent of the seat back, set this adjustment to the full rearward position. (S16.2.10.3.1)

   X N/A – No independent fore-aft seat cushion adjustment

4. Use the seat markings determined during the completion of Data Sheet 14 to set the rearmost fore-aft position, mid-height position and the seat cushion mid-angle. (S16.3.3.1.1)

5. Fully recline the seat back. (S16.3.3.1.2)

   __ N/A seat back not adjustable.

6. Place the dummy in the seat with the legs at an angle of 120 degrees to the thighs. The calves should not be touching the seat cushion. (S16.3.3.1.2)

7. Position the dummy in the seat such that the midsagittal plane is coincident with the longitudinal seat cushion marking that was determined in item 2.19 of Data Sheet 14 (S16.3.3.1.3 and S16.3.3.1.4)

8. Hold down the dummy’s thighs and push rearward on the upper torso to maximize the pelvic angle. (S16.3.3.1.5)

9. Set the angle between the legs and the thighs to 120 degrees. (S16.3.3.1.6)
X 10. Set the transverse distance between the centers of the front of the knees at 160 to 170 mm. (6.3 to 6.7 inches) Center the knee separation with respect to the longitudinal seat cushion marking that was determined in item 2.19 of Data Sheet 14. (S16.3.3.1.6) Record Knee Separation 168 mm

X 11. Push rearward on the dummy’s knees until the pelvis contacts the seat back, or the backs of the calves contact the seat cushion, whichever occurs first. (S16.3.3.1.6) __Pelvis contacted seat back.  
X  Calves contacted seat cushion.

X 12. Gently rock the upper torso ± 5 degrees (approximately 51 mm (2 inches)) side-to-side three times. (S16.3.3.1.7)

X 13. If needed, extend the legs until the feet do not contact the floor pan. The thighs should be resting on the seat cushion. (S16.3.3.1.8)

X 14. Use seat controls to line up the seat markings determined during the completion of Data Sheet 14 to set the foremost fore-aft position, mid-height position and the seat cushion mid-angle. If the dummy contacts the interior move the seat rearward until a maximum clearance of 5 mm (0.2 inches) is achieved or the seat is in the closest detent position that does not cause dummy contact. (S16.3.3.1.8)  
X Foremost, mid-height position and the seat cushion mid-angle reached

__Dummy contact.  Clearance set at maximum of 5mm  
Measured Clearance______________

__Dummy Contact. Seat set at nearest detent position.  
Seat position ___ detent positions rearward of foremost  
(Foremost is position zero)

X 15. If the seat back is adjustable, rotate the seat back forward while holding the thighs in place. Continue rotating the seat back forward until the transverse instrument platform of the dummy head is level ± 0.5 degrees. If head cannot be leveled using the seat back adjustment, or the seat back is not adjustable, use the lower neck bracket adjustment to level the head. If a level position cannot be achieved, adjust the head as closely as possible to the ± 0.5 degree range. (S16.3.3.1.9 and S16.3.3.1.10)  
(Check All That Apply)  
__Seat back not adjustable

__Seat back not independent of driver side seat back

X Head Level Achieved. (Check all that apply)  
X Head leveled using the adjustable seat back  
__Head leveled using the neck bracket.  
Head Angle 0.1 degrees

__Head Level NOT Achieved. (Check all that apply)  
__ Head adjusted using the adjustable seat back  
__ Head adjusted using the neck bracket.  
Head Angle _______________ degrees
16. Verify the pelvis is not interfering with the seat bight. (S16.3.3.1.9)
   - No interference
   - Pelvis moved forward the minimum amount so that it is not caught in the seat bight.

17. Verify the dummy abdomen is properly installed. (S16.3.3.1.9)
   - Abdomen still seated properly into dummy
   - Abdomen was adjusted because it was not seated properly into dummy

18. Head Angle
   - N/A, neither the pelvis nor the abdomen were adjusted.

18.1 Head still level (Go to 19)
18.2 Head level adjusted
   - Head Level Achieved. (Check all that apply)
     - Head leveled using the adjustable seat back
     - Head leveled using the neck bracket.
     - Head Angle ____________ degrees
   - Head Level NOT Achieved. (Check all that apply)
     - Head adjusted using the adjustable seat back
     - Head adjusted using the neck bracket.
     - Head Angle ____________ degrees

19. Measure and set the pelvic angle using the pelvic angle gage TE-2504. The pelvic angle should be 20.0 degrees ± 2.5 degrees. If the pelvic angle cannot be set to the specified range because the head will not be level, adjust the pelvis as closely as possible to the angle range, but keep the head level.
   - Pelvic angle set to 20.0 degrees ± 2.5 degrees.
   - Pelvic angle of 20.0 degrees not achieved, the angular difference was minimized.
   - Record the pelvic angle. 25.2 degrees

20. Check the dummy for contact with the interior after completing adjustments.
   - No contact.
   - Dummy in contact with interior.
     - Seat moved aft ___ mm from the previous position.
     - Seat moved aft ___ detent positions from the previous position.

21. Verify the transverse instrument platform of the dummy head is level +/- 0.5 degrees. Use the lower neck bracket adjustment to level the head. If a level position cannot be achieved, minimize the angle. (S16.3.3.1.9, S16.3.3.1.10, and S16.3.3.1.11)
   - Head Level Achieved
     - Head Angle 0.1 degrees
   - Head Level NOT Achieved
     - Head Angle ____________ degrees
X 22. Check the dummy to see if additional interior clearance is obtained, allowing the seat to be moved forward. (S16.3.3.1.12)
   _N/A Bench Seat
   X N/A Seat already at full forward position.
   _Clearance unchanged. No adjustments required.
   _Additional clearance available
      _Seat moved Forward ___ mm from the previous position.
      _Seat moved Forward ___ detent positions from the previous position.
      _Seat moved Forward, Full Forward position reached.

X 23. Passenger foot positioning. (Indicate final position achieved) (S16.3.3.2)
   _23.1 Place feet flat on the toe board; OR

X 23.2 If the feet cannot be placed flat on the toe board, set the feet perpendicular to the lower leg, and rest the heel as far forward on the floor pan as possible; OR
   _23.3 If the heels do not touch the floor pan, set the legs to vertical and set the feet parallel to the floor pan.

X 24. Passenger arm/hand positioning. (S16.3.3.3)
   _24.1 Place the dummy’s upper arms adjacent to the torso with the arm centerlines as close to a vertical longitudinal plane as possible. (S16.3.2.3.1)

X 24.2 Place the palms of the dummy in contact with the outer part of the thighs (S16.3.3.3.2)
   _24.3 Place the little fingers in contact with the seat cushion. (S16.3.3.3.3)

X 25. Adjustable head restraints
   _N/A, there is no head restraint adjustment

X 25.1 If the head restraint has an automatic adjustment, leave it where the system positions the restraint after the dummy is placed in the seat. (S16.3.4.1) Go to 26.

X 25.2 Adjust each head restraint vertically so that the horizontal plane determined in item 3 of Data Sheet 14 is aligned with the center of gravity (CG) of the dummy head. (S16.3.4.3)

X 25.3 If the above position is not attainable, move the vertical center of the head restraint to the closest detent below the center of the head CG. (S16.3.4.3)
   _N/A midpoint position attained in previous step
   X Headrest set at nearest detent below the head CG

X 25.4 If the head restraint has a fore and aft adjustment, place the restraint in the foremost position or until contact with the head is made, whichever occurs first. (S16.3.4.4)

X 26. Manual belt adjustment (for tests conducted with a belted dummy) S16.3.5
   _N/A, Unbelted test
26.1 If an adjustable seat belt D-ring anchorage exists, place it in the manufacturer’s design position for a 5th percentile adult female. 
This information will be supplied by the COTR.
Manufacturer’s specified position ________________________________
Actual Position ________________________________________________

26.2 Place the Type 2 manual belt around the test dummy and fasten the latch. (S16.3.5.2)

26.3 Ensure that the dummy’s head remains as level as possible. (S16.3.5.3)

26.4 Remove all slack from the lap belt. Pull the upper torso webbing out of the retractor and allow it to retract; repeat this operation four times. Apply a 9 N (2 lbf) to 18 N (4 lbf) tension load to the lap belt. If the belt system is equipped with a tension-relieving device, introduce the maximum amount of slack into the upper torso belt that is recommended by the manufacturer. If the belt system is not equipped with a tension-relieving device, allow the excess webbing in the shoulder belt to be retracted by the retractive force of the retractor. (S16.3.5.4)

REMARKS: NONE

I certify that I have read and performed each instruction.

Signature: ____________________  Date: 08/18/04
DATA SHEET 35
DUMMY MEASUREMENTS

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
Test Technician: Eric Peschman

DUMMY MEASUREMENTS FOR FRONT SEAT OCCUPANTS

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<td>Chest to Steering Wheel Hub</td>
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<td>HH</td>
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<td>H-Point to Door</td>
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</table>

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
Test Technician: Eric Peschman

Test Date: 8/18/04
NHTSA No.: C45111
<table>
<thead>
<tr>
<th>Code</th>
<th>Measurement Description</th>
<th>Driver SN 506</th>
<th>Passenger SN 511</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Length (mm)</td>
<td>Angle (°)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length (mm)</td>
<td>Angle (°)</td>
</tr>
<tr>
<td>WA</td>
<td>Windshield Angle</td>
<td>31.3</td>
<td></td>
</tr>
<tr>
<td>SWA</td>
<td>Steering Wheel Angle</td>
<td>63.0</td>
<td></td>
</tr>
<tr>
<td>SCA</td>
<td>Steering Column Angle</td>
<td>26.6</td>
<td></td>
</tr>
<tr>
<td>SA</td>
<td>Seat Back Angle*</td>
<td>3.2</td>
<td>8.8</td>
</tr>
<tr>
<td>HZ</td>
<td>Head to Roof (Z)</td>
<td>218</td>
<td>90</td>
</tr>
<tr>
<td>HH</td>
<td>Head to Header</td>
<td>327</td>
<td>44.6</td>
</tr>
<tr>
<td>HW</td>
<td>Head to Windshield</td>
<td>609</td>
<td>0</td>
</tr>
<tr>
<td>HR</td>
<td>Head to Side Header (Y)</td>
<td>274</td>
<td>287</td>
</tr>
<tr>
<td>NR</td>
<td>Nose to Rim</td>
<td>287</td>
<td>6.8</td>
</tr>
<tr>
<td>CD</td>
<td>Chest to Dash</td>
<td>438</td>
<td>410</td>
</tr>
<tr>
<td>CS</td>
<td>Chest to Steering Hub</td>
<td>203</td>
<td>2.5</td>
</tr>
<tr>
<td>RA</td>
<td>Rim to Abdomen</td>
<td>80</td>
<td>0</td>
</tr>
<tr>
<td>KDL</td>
<td>Left Knee to Dash</td>
<td>95</td>
<td>38.7</td>
</tr>
<tr>
<td>KDR</td>
<td>Right Knee to Dash</td>
<td>89</td>
<td>94</td>
</tr>
<tr>
<td>PA</td>
<td>Pelvic Angle</td>
<td>25.8</td>
<td>25.2</td>
</tr>
<tr>
<td>TA</td>
<td>Tibia Angle</td>
<td>51.0</td>
<td>50.3</td>
</tr>
<tr>
<td>KK</td>
<td>Knee to Knee (Y)</td>
<td>220</td>
<td>169</td>
</tr>
<tr>
<td>SK</td>
<td>Striker to Knee</td>
<td>693</td>
<td>84.3</td>
</tr>
<tr>
<td>ST</td>
<td>Striker to Head</td>
<td>495</td>
<td>25.2</td>
</tr>
<tr>
<td>SH</td>
<td>Striker to H-Point</td>
<td>368</td>
<td>106.4</td>
</tr>
<tr>
<td>SHY</td>
<td>Striker to H-Point (Y)</td>
<td>307</td>
<td>319</td>
</tr>
<tr>
<td>HS</td>
<td>Head to Side Window</td>
<td>367</td>
<td>338</td>
</tr>
<tr>
<td>HD</td>
<td>H-Point to Door (Y)</td>
<td>223</td>
<td>219</td>
</tr>
<tr>
<td>AD</td>
<td>Arm to Door (Y)</td>
<td>156</td>
<td>161</td>
</tr>
<tr>
<td>AA</td>
<td>Ankle to Ankle</td>
<td>253</td>
<td>139</td>
</tr>
</tbody>
</table>

*Measured on the headrest post
### SEAT BELT POSITIONING DATA

**DUMMY’S CENTERLINE**

**TBI**

**'D' RING**

**SHOULDER BELT PORTION**

**1/8” THICK ALUMINUM PLATE**

**EMERGENCY LOCKING RETRACTOR**

**LAP BELT PORTION**

**MALE BLADE**

**BUCKET ASSEMBLY**

**INBOARD ANCHORAGE**

**FLOORPAN**

**REEL**

### FRONT VIEW OF DUMMY

**SEAT BELT POSITIONING MEASUREMENTS**

<table>
<thead>
<tr>
<th>Measurement Description</th>
<th>Units</th>
<th>Driver</th>
<th>Passenger</th>
<th>Rear Passenger</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBU - Top surface of reference to belt upper edge</td>
<td>mm</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>PBL - To surface of reference to belt lower edge</td>
<td>mm</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Test Vehicle:</td>
<td>2004 Toyota Highlander MPV</td>
<td>NHTSA No.:</td>
<td>C45111</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------------</td>
<td>------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Test Program:</td>
<td>FMVSS 208 Compliance</td>
<td>Test Date:</td>
<td>8/18/04</td>
<td></td>
</tr>
<tr>
<td>Test Technician:</td>
<td>Eric Peschman</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### IMPACT ANGLE:
- Zero Degrees

### BELTED DUMMIES (YES/NO):
- No – Front Occupants

### TEST SPEED:
- X 32 to 40 kmph
- _ 0 to 48 kmph
- __ 0 to 56 kmph

### DRIVER DUMMY:
- _ 5TH female
- __ 50th Male

### PASSENGER DUMMY:
- X 5TH female
- __ 50th Male Ctr Rear

1. Vehicle underbody painted
2. The speed measuring devices are in place and functioning.
3. The speed measuring devices are _10_ m from the barrier (spec. 1.5m) and _30_ cm from the barrier (spec. is 30 cm)
4. Convertible top is in the closed position.
5. Instrumentation and wires are placed so the motion of the dummies during impact is not affected.
6. Tires inflated to pressure on tire placard or if it does not have a tire placard because it is not a passenger car, then inflated to the tire pressure specified in the owner information.

- 210 kpa front left tire
- 210 kpa front right tire
- 210 kpa rear left tire
- 210 kpa rear right tire

7. Time zero contacts on barrier in place.
8. Pre test zero and shunt calibration adjustments performed and recorded
9. Dummy temperature meets requirements of section 12.2 of the test procedure.
10. Vehicle hood closed and latched
11. Transmission placed in neutral
12. Parking brake off
13. Ignition in the ON position
14. Doors closed and latched but not locked
15. Posttest zero and shunt calibration checks performed and recorded
16. Actual test speed 39.8 kmph
17. Vehicle rebound from the barrier 411 cm
18. Describe whether the doors open after the test and what method is used to open the doors.

- Left Front Door: Door remained closed and latched; Door opened without tools
- Right Front Door: Door remained closed and latched; Door opened without tools
- Left Rear Door: Door remained closed and latched; Door opened without tools
Right Rear Door: Door remained closed and latched; Door opened without tools

19. Describe the contact points of the dummy with the interior of the vehicle.
   Driver Dummy: Head to air bag, sun visor and headrest; Chest to air bag; Knees to knee bolster and steering column.
   Passenger Dummy: Head to air bag; Chest to air bag; Knees to instrument panel

REMARKS:

I certify that I have read and performed each instruction.

Signature: [Signature] Date: 08/18/04
## Accident Investigation Division Data

**Test Vehicle:** 2004 Toyota Highlander MPV  
**NHTSA No.:** C45111  
**Test Program:** FMVSS 208 Compliance  
**Test Date:** 8/18/04  
**Test Technician:** Eric Peschman

<table>
<thead>
<tr>
<th>IMPACT ANGLE:</th>
<th>Zero Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELTED DUMMIES (YES/NO):</td>
<td>No – Front Occupants</td>
</tr>
</tbody>
</table>
| TEST SPEED: | X 32 to 40 kmph  
0 to 48 kmph  
0 to 56 kmph |
| DRIVER DUMMY: | X 5th female  
50th Male |
| PASSENGER DUMMY: | X 5th female  
50th Male Ctr Rear |

### Vehicle Specifications

| Vehicle Year/Make/Model/Body Style: | 2004 Toyota Highlander MPV |
| VIN: | JTEEP21A940025615 |
| Wheelbase: | 2720 mm |
| Build Date: | 12/03 |
| Vehicle Size Category: | 3 |
| Test Weight: | 2064.7 kg |
| Front Overhang: | 920 mm |
| Overall Width: | 1829 mm |
| Overall Length Center: | 4657 mm |

### Accelerometer Data

| Location: | As per measurements on Data Sheet 31 |
| Linearity: | >99.9% |
| Integration Algorithm: | Trapezoidal |
| Vehicle Impact Speed: | 39.8 kmph |
| Time of Separation: | 119.5 ms |
| Velocity Change: | 46.1 kmph |
## CRUSH PROFILE

**Collision Deformation Classification:** 12FDEW6  
**Midpoint of Damage:** Vehicle Longitudinal Centerline  
**Damage Region Length (mm):** 1222  
**Impact Mode:** Frontal Barrier

<table>
<thead>
<tr>
<th>No.</th>
<th>Measurement Description</th>
<th>Units</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>Crush zone 1 at left side</td>
<td>mm</td>
<td>4567</td>
<td>4327</td>
<td>240</td>
</tr>
<tr>
<td>C2</td>
<td>Crush zone 2 at left side</td>
<td>mm</td>
<td>4632</td>
<td>4335</td>
<td>297</td>
</tr>
<tr>
<td>C3</td>
<td>Crush zone 3 at left side</td>
<td>mm</td>
<td>4651</td>
<td>4341</td>
<td>310</td>
</tr>
<tr>
<td>C4</td>
<td>Crush zone 4 at right side</td>
<td>mm</td>
<td>4651</td>
<td>4342</td>
<td>309</td>
</tr>
<tr>
<td>C5</td>
<td>Crush zone 5 at right side</td>
<td>mm</td>
<td>4632</td>
<td>4342</td>
<td>290</td>
</tr>
<tr>
<td>C6</td>
<td>Crush zone 6 at right side</td>
<td>mm</td>
<td>4567</td>
<td>4335</td>
<td>232</td>
</tr>
</tbody>
</table>

**REMARKS:**

I certify that I have read and performed each instruction.

Signature: [Signature]

Date: 08/18/04
## DATA SHEET 39
### WINDSHIELD MOUNTING (FMVSS 212)

<table>
<thead>
<tr>
<th>Test Vehicle:</th>
<th>2004 Toyota Highlander MPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Program:</td>
<td>FMVSS 208 Compliance</td>
</tr>
<tr>
<td>Test Technician:</td>
<td>Clark Subrt</td>
</tr>
<tr>
<td>NHTSA No.:</td>
<td>C45111</td>
</tr>
<tr>
<td>Test Date:</td>
<td>8/18/04</td>
</tr>
</tbody>
</table>

#### IMPACT ANGLE:
- **Zero Degrees**

#### BELTED DUMMIES (YES/NO):
- **No – Front Occupants**

#### TEST SPEED:
- **X** 32 to 40 kmph
- **___** 0 to 48 kmph
- **___** 0 to 56 kmph

#### DRIVER DUMMY:
- **X** 5th female
- **___** 50th Male

#### PASSENGER DUMMY:
- **X** 5th female
- **___** 50th Male Ctr Rear

1. **Pre-Crash**
   - **X**
   1.1 Describe from visual inspection how the windshield is mounted and describe any trim material.
      - Retained with glue
      - Rubber and plastic trim

   1.2 **Mark the longitudinal centerline of the windshield**
   1.3 **Measure pre-crash A, B, and C for the left side and record in the chart below.**
   1.4 **Measure pre-crash C, D, and E for the right side and record in the chart below.**
   1.5 **Measure from the edge of the retainer or molding to the edge of the windshield.**
      - Dimension G (mm): 16

2. **Post Crash**
   - **X**
   2.1 **Can a single thickness of copier type paper (as small a piece as necessary) slide between the windshield and the vehicle body?**
      - **X** No – Pass. Skip to the table of measurements, complete it by repeating the pre-crash measurements in the post crash column, and calculate the retention percentage, which will be 100%.
      - **___** Yes, go to 2.2

   2.2 **Visibly mark the beginning and end of the portions of the periphery where the paper slides between the windshield and the vehicle body.**
   2.3 **Measure and record post-crash A, B, C, D, E, and F such that the measurements do not include any of the parts of the windshield where the paper slides between the windshield and the vehicle body.**
   2.4 **Calculate and record the percent retention for the right and left side of the windshield.**
   2.5 **Is total right side percent retention less than 75%?**
      - **___** Yes, Fail
      - **___** No, Pass
   2.6 **Is total left side percent retention less than 75%?**
      - **___** Yes, Fail
      - **___** No, Pass
## WINDSHIELD RETENTION MEASUREMENTS

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Pre-Crash (mm)</th>
<th>Post-Crash (mm)</th>
<th>Percent Retention (Post-Test ÷ Pre-Crash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>607</td>
<td>607</td>
<td>100%</td>
</tr>
<tr>
<td>B</td>
<td>746</td>
<td>746</td>
<td>100%</td>
</tr>
<tr>
<td>C</td>
<td>759</td>
<td>759</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>2112</td>
<td>2112</td>
<td>100%</td>
</tr>
</tbody>
</table>

**Left Side**

**Right Side**

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Pre-Crash (mm)</th>
<th>Post-Crash (mm)</th>
<th>Percent Retention (Post-Test ÷ Pre-Crash)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>607</td>
<td>607</td>
<td>100%</td>
</tr>
<tr>
<td>E</td>
<td>746</td>
<td>746</td>
<td>100%</td>
</tr>
<tr>
<td>F</td>
<td>759</td>
<td>759</td>
<td>100%</td>
</tr>
<tr>
<td>Total</td>
<td>2112</td>
<td>2112</td>
<td>100%</td>
</tr>
</tbody>
</table>

Indicate area of mounting failure. NONE

---

**FRONT VIEW OF WINDSHIELD**

INDICATE WIDTH OF MOLDING

![Front View of Windshield Diagram](image)

---

**REMARKS:**

I certify that I have read and performed each instruction.

Signature: [Signature]

Date: 08/18/04
DATA SHEET 40
WINDSHIELD ZONE INTRUSION (FMVSS 219)

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
Test Technician: Clark Subrt

<table>
<thead>
<tr>
<th>IMPACT ANGLE:</th>
<th>Zero Degrees</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELTED DUMMIES (YES/NO):</td>
<td>No – Front Occupants</td>
</tr>
<tr>
<td>TEST SPEED:</td>
<td>X 32 to 40 kmph, 0 to 48 kmph, 0 to 56 kmph</td>
</tr>
<tr>
<td>DRIVER DUMMY:</td>
<td>X 5th female, 50th Male</td>
</tr>
<tr>
<td>PASSENGER DUMMY:</td>
<td>X 5th female, 50th Male Ctr Rear</td>
</tr>
</tbody>
</table>

1. Place a 165 mm diameter rigid sphere, with a mass of 6.8 kg on the instrument panel so that it is simultaneously touching the instrument panel and the windshield. (571.219 S6.1(a))
2. Roll the sphere from one side of the windshield to the other while marking on the windshield where the sphere contacts the windshield. (571.219 S6.1(b))
3. From the outermost contactable points on the windshield draw a horizontal line to the edges of the windshield. (571.219 S6.1(b))
4. Draw a line on the inner surface of the windshield that is 13 mm below the line determined in items 2 and 3
5. After the crash test, record any points where a part of the exterior of the vehicle has marked, penetrated, or broken the windshield.

Provide all dimensions necessary to reproduce the protected area.

FRONT VIEW OF WINDSHIELD
WINDSHIELD DIMENSIONS

<table>
<thead>
<tr>
<th>Item</th>
<th>Units</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>mm</td>
<td>1214</td>
</tr>
<tr>
<td>B</td>
<td>mm</td>
<td>497</td>
</tr>
<tr>
<td>C</td>
<td>mm</td>
<td>1518</td>
</tr>
<tr>
<td>D</td>
<td>mm</td>
<td>746</td>
</tr>
<tr>
<td>E</td>
<td>mm</td>
<td>486</td>
</tr>
<tr>
<td>F</td>
<td>mm</td>
<td>504</td>
</tr>
</tbody>
</table>

AREA OF PROTECTED ZONE FAILURES:

B. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one which is normally in contact with the windshield.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>

C. Provide coordinates of the area beneath the protected zone template that the inner surface of the windshield was penetrated by a vehicle component.

<table>
<thead>
<tr>
<th>X</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>

REMARKS:

I certify that I have read and performed each instruction.

Signature:  
Date:  08/18/04
DATA SHEET 41
FUEL SYSTEM INTEGRITY (FMVSS 301)

Test Vehicle: 2004 Toyota Highlander MPV  NHTSA No.: C45111
Test Program: FMVSS 208 Compliance  Test Date: 8/18/04
Test Technician: Eric Peschman

**TYPE OF IMPACT:** 25 mph Unbelted Flat Frontal

**Stoddard Solvent Spillage Measurements**

A. From impact until vehicle motion ceases: 0 grams  
   (Maximum Allowable = 28 grams)
B. For the 5 minute period after motion ceases: 0 grams  
   (Maximum Allowable = 142 grams)
C. For the following 25 minutes: 0 grams  
   (Maximum Allowable = 28 grams/minute)
D. Spillage: 0

**REMARKS:** The post test FMVSS 301 rollover was not conducted at the request of the COTR.
DATA SHEET NO. 41
FMVSS 301 STATIC ROLLOVER DATA

Test Vehicle: 2004 Toyota Highlander MPV
Test Program: FMVSS 208 Compliance
NHTSA No.: C45111
Test Date: 8/18/04

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage locations: The post test FMVSS 301 rollover was not conducted at the request of the COTR.

<table>
<thead>
<tr>
<th>Test Phase</th>
<th>Rotation Time (sec.)</th>
<th>Hold Time (sec.)</th>
<th>Spillage (grams)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0° to 90°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90° to 180°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>180° to 270°</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>270° to 360°</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX A

CRASH TEST DATA
TABLE OF DATA PLOTS

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Description</th>
<th>Page No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Driver Head X Acceleration vs. Time</td>
<td>A-1</td>
</tr>
<tr>
<td>2.</td>
<td>Driver Head Y Acceleration vs. Time</td>
<td>A-1</td>
</tr>
<tr>
<td>3.</td>
<td>Driver Head Z Acceleration vs. Time</td>
<td>A-1</td>
</tr>
<tr>
<td>4.</td>
<td>Driver Head Resultant Acceleration vs. Time</td>
<td>A-1</td>
</tr>
<tr>
<td>5.</td>
<td>Driver Head X Velocity vs. Time</td>
<td>A-2</td>
</tr>
<tr>
<td>6.</td>
<td>Driver Head Y Velocity vs. Time</td>
<td>A-2</td>
</tr>
<tr>
<td>7.</td>
<td>Driver Head Z Velocity vs. Time</td>
<td>A-2</td>
</tr>
<tr>
<td>8.</td>
<td>Driver Neck Force X vs. Time</td>
<td>A-3</td>
</tr>
<tr>
<td>11.</td>
<td>Driver Neck Force Resultant vs. Time</td>
<td>A-3</td>
</tr>
<tr>
<td>12.</td>
<td>Driver Neck Moment X vs. Time</td>
<td>A-4</td>
</tr>
<tr>
<td>13.</td>
<td>Driver Neck Moment Y vs. Time</td>
<td>A-4</td>
</tr>
<tr>
<td>14.</td>
<td>Driver Neck Moment Z vs. Time</td>
<td>A-4</td>
</tr>
<tr>
<td>15.</td>
<td>Driver Neck Moment Resultant vs. Time</td>
<td>A-4</td>
</tr>
<tr>
<td>20.</td>
<td>Driver Chest X Velocity vs. Time</td>
<td>A-6</td>
</tr>
<tr>
<td>21.</td>
<td>Driver Chest Y Velocity vs. Time</td>
<td>A-6</td>
</tr>
<tr>
<td>22.</td>
<td>Driver Chest Z Velocity vs. Time</td>
<td>A-6</td>
</tr>
<tr>
<td>23.</td>
<td>Driver Chest Displacement vs. Time</td>
<td>A-6</td>
</tr>
<tr>
<td>24.</td>
<td>Driver Left Femur Force vs. Time</td>
<td>A-7</td>
</tr>
<tr>
<td>25.</td>
<td>Driver Right Femur Force vs. Time</td>
<td>A-7</td>
</tr>
<tr>
<td>26.</td>
<td>Passenger Head X Acceleration vs. Time</td>
<td>A-8</td>
</tr>
<tr>
<td>27.</td>
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2004 TOYOTA HIGHLANDER (C45111)  
Test Date: 08/18/04  
Speed: 24.7 mph (39.8 km/h)

**DRIVER HEAD X (G's) vs TIME (ms)**
- Max: 7.3 G's
- Tmax: 174.6 ms
- Min: -29.3 G's
- Tmin: 87.1 ms
- CFC 1000

**DRIVER HEAD Y (G's) vs TIME (ms)**
- Max: 3.8 G's
- Tmax: 54.3 ms
- Min: -9.8 G's
- Tmin: 100.4 ms
- CFC 1000

**DRIVER HEAD Z (G's) vs TIME (ms)**
- Max: 11.6 G's
- Tmax: 92.6 ms
- Min: -2.5 G's
- Tmin: 53.0 ms
- CFC 1000

**DRIVER HEAD Resultant (G's) vs TIME (ms)**
- Max: 32.2 G's
- Tmax: 87.1 ms
- Min: 0.0 G's
- Tmin: 0.0 ms
- CFC 1000
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)
Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 40.1 kph
Tmax: 44.1 ms
Min: -17.6 kph
Tmin: 173.5 ms
CFC 180

Max: 0.0 kph
Tmax: 12.1 ms
Min: -16.0 kph
Tmin: 290.9 ms
CFC 180

Max: 16.1 kph
Tmax: 300.0 ms
Min: -1.1 kph
Tmin: 54.5 ms
CFC 180
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 415.5 N
Tmax: 79.7 ms
Min: -170.3 N
Tmin: 127.8 ms
CFC 1000

Max: 170.5 N
Tmax: 80.4 ms
Min: -80.8 N
Tmin: 118.4 ms
CFC 1000

Max: 897.7 N
Tmax: 88.0 ms
Min: -65.6 N
Tmin: 42.4 ms
CFC 1000

Max: 931.6 N
Tmax: 88.0 ms
Min: 0.7 N
Tmin: 0.0 ms
CFC 1000
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)
Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

DRIVER NECK MX (Nm) vs TIME (ms)
Max: 2.3 Nm
Tmax: 161.0 ms
Min: -13.2 Nm
Tmin: 80.0 ms
CFC 600

DRIVER NECK MY (Nm) vs TIME (ms)
Max: 16.0 Nm
Tmax: 80.0 ms
Min: -12.0 Nm
Tmin: 67.9 ms
CFC 600

DRIVER NECK MZ (Nm) vs TIME (ms)
Max: 10.9 Nm
Tmax: 105.2 ms
Min: -4.2 Nm
Tmin: 163.8 ms
CFC 600

DRIVER NECK MResultant (Nm) vs TIME (ms)
Max: 21.7 Nm
Tmax: 80.1 ms
Min: 0.0 Nm
Tmin: 0.0 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 2.2 G's
Tmax: 274.0 ms
Min: -43.7 G's
Tmin: 79.5 ms
CFC 180

Max: 2.1 G's
Tmax: 98.3 ms
Min: -4.4 G's
Tmin: 69.3 ms
CFC 180

Max: 13.2 G's
Tmax: 78.3 ms
Min: -4.6 G's
Tmin: 50.9 ms
CFC 180

Max: 45.5 G's
Tmax: 79.2 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 180
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

DRIVER CHEST X Velocity (kph) vs TIME (ms)

Max: 39.8 kph
Tmax: 0.0 ms
Min: -13.1 kph
Tmin: 118.2 ms
CFC 180

DRIVER CHEST Y Velocity (kph) vs TIME (ms)

Max: 0.1 kph
Tmax: 38.2 ms
Min: -1.9 kph
Tmin: 75.0 ms
CFC 180

DRIVER CHEST Z Velocity (kph) vs TIME (ms)

Max: 6.7 kph
Tmax: 256.2 ms
Min: -3.5 kph
Tmin: 67.2 ms
CFC 180

DRIVER CHEST DISPLACEMENT (mm) vs TIME (ms)

Max: 0.4 mm
Tmax: 36.0 ms
Min: -23.0 mm
Tmin: 83.5 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 118.1 N
Tmax: 113.2 ms
Min: -3305.6 N
Tmin: 56.5 ms
CFC 600

Max: 117.3 N
Tmax: 114.5 ms
Min: -3828.3 N
Tmin: 61.0 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

PASSENGER HEAD X (G's) vs TIME (ms)
Max: 4.6 G's
Tmax: 38.2 ms
Min: -35.3 G's
Tmin: 147.0 ms
CFC 1000

PASSENGER HEAD Y (G's) vs TIME (ms)
Max: 3.3 G's
Tmax: 48.0 ms
Min: -11.5 G's
Tmin: 29.6 ms
CFC 1000

PASSENGER HEAD Z (G's) vs TIME (ms)
Max: 12.4 G's
Tmax: 83.9 ms
Min: -9.7 G's
Tmin: 29.6 ms
CFC 1000

PASSENGER HEAD Resultant (G's) vs TIME (ms)
Max: 36.9 G's
Tmax: 147.0 ms
Min: 0.0 G's
Tmin: 0.0 ms
CFC 1000
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

PASSENGER HEAD X Velocity (kph) vs TIME (ms)
Max: 39.8 kph
Tmax: 27.4 ms
Min: -18.6 kph
Tmin: 197.7 ms
CFC 180

PASSENGER HEAD Y Velocity (kph) vs TIME (ms)
Max: 0.0 kph
Tmax: 0.0 ms
Min: -10.6 kph
Tmin: 300.0 ms
CFC 180

PASSENGER HEAD Z Velocity (kph) vs TIME (ms)
Max: 22.1 kph
Tmax: 300.0 ms
Min: -0.7 kph
Tmin: 49.3 ms
CFC 180
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

PASSENGER NECK FX (N) vs TIME (ms)

Max: 1088.7 N  
Tmax: 84.8 ms  
Min: -64.2 N  
Tmin: 129.8 ms  
CFC 1000

PASSENGER NECK FY (N) vs TIME (ms)

Max: 88.9 N  
Tmax: 100.6 ms  
Min: -32.4 N  
Tmin: 150.1 ms  
CFC 1000

PASSENGER NECK FZ (N) vs TIME (ms)

Max: 396.1 N  
Tmax: 30.9 ms  
Min: -682.6 N  
Tmin: 89.9 ms  
CFC 1000

PASSENGER NECK FResultant (N) vs TIME (ms)

Max: 1263.7 N  
Tmax: 88.0 ms  
Min: 0.5 N  
Tmin: 0.0 ms  
CFC 1000
25MPH FRONTAL IMPACT  
2004 TOYOTA HIGHLANDER (C45111)  

Test Date: 08/18/04  
Speed: 24.7 mph (39.8 km/h)

PASSENGER NECK MX (Nm) vs TIME (ms)

Max: 5.4 Nm  
Tmax: 151.9 ms  
Min: -4.6 Nm  
Tmin: 71.3 ms  
CFC 600

PASSENGER NECK MY (Nm) vs TIME (ms)

Max: 82.8 Nm  
Tmax: 71.7 ms  
Min: -12.8 Nm  
Tmin: 125.8 ms  
CFC 600

PASSENGER NECK MZ (Nm) vs TIME (ms)

Max: 5.2 Nm  
Tmax: 94.7 ms  
Min: -0.9 Nm  
Tmin: 247.2 ms  
CFC 600

PASSENGER NECK MResultant (Nm) vs TIME (ms)

Max: 83.0 Nm  
Tmax: 71.8 ms  
Min: 0.0 Nm  
Tmin: 0.0 ms  
CFC 600
25 MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

PASSENGER CHEST X Velocity (kph) vs TIME (ms)
Max: 39.8 kph
Tmax: 0.0 ms
Min: -14.4 kph
Tmin: 300.0 ms
CFC 180

PASSENGER CHEST Y Velocity (kph) vs TIME (ms)
Max: 0.6 kph
Tmax: 111.3 ms
Min: -0.5 kph
Tmin: 58.3 ms
CFC 180

PASSENGER CHEST Z Velocity (kph) vs TIME (ms)
Max: 7.4 kph
Tmax: 300.0 ms
Min: -3.1 kph
Tmin: 63.8 ms
CFC 180

PASSENGER CHEST DISPLACEMENT (mm) vs TIME (ms)
Max: 0.8 mm
Tmax: 17.8 ms
Min: -6.4 mm
Tmin: 70.8 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 98.0 N
Tmax: 161.3 ms
Min: -4482.5 N
Tmin: 63.3 ms
CFC 600

Max: 98.6 N
Tmax: 13.3 ms
Min: -3841.6 N
Tmin: 48.3 ms
CFC 600
Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Drv. nij (NTF) (\(\mathbf{\cdot}\)) vs TIME (ms)
Max: 0.2
Tmax: 83.1 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NTE) (\(\mathbf{\cdot}\)) vs TIME (ms)
Max: 0.4
Tmax: 68.3 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NCF) (\(\mathbf{\cdot}\)) vs TIME (ms)
Max: 0.1
Tmax: 135.5 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Drv. nij (NCE) (\(\mathbf{\cdot}\)) vs TIME (ms)
Max: 0.1
Tmax: 31.6 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Pass. nij (NTF) () vs TIME (ms)
Max: 0.2
Tmax: 64.3 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Pass. nij (NTE) () vs TIME (ms)
Max: 0.2
Tmax: 126.4 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Pass. nij (NCF) () vs TIME (ms)
Max: 0.5
Tmax: 88.1 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600

Pass. nij (NCE) () vs TIME (ms)
Max: 0.2
Tmax: 118.1 ms
Min: 0.0
Tmin: 0.0 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)
Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Drv. Occipital Condyle Moment (Nm) vs TIME (ms)

Max: 18.5 Nm
Tmax: 135.0 ms
Min: -13.1 Nm
Tmin: 67.9 ms
CFC 600

Pass. Occipital Condyle Moment (Nm) vs TIME (ms)

Max: 64.4 Nm
Tmax: 71.5 ms
Min: -12.3 Nm
Tmin: 124.7 ms
CFC 600
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

LEFT REAR SEAT CROSSMEMBER X (G's) vs TIME (ms)
Max: 1.5 G's
Tmax: 98.7 ms
Min: -32.7 G's
Tmin: 46.2 ms
CFC 60

LEFT REAR SEAT CROSSMEMBER X Velocity (kph) vs TIME (ms)
Max: 39.8 kph
Tmax: 0.0 ms
Min: -6.0 kph
Tmin: 118.4 ms
CFC 180

RIGHT REAR SEAT CROSSMEMBER X (G's) vs TIME (ms)
Max: 2.3 G's
Tmax: 98.4 ms
Min: -35.4 G's
Tmin: 46.2 ms
CFC 60

RIGHT REAR SEAT CROSSMEMBER X Velocity (kph) vs TIME (ms)
Max: 39.8 kph
Tmax: 0.0 ms
Min: -6.5 kph
Tmin: 120.5 ms
CFC 180
TOP OF ENGINE X (G's) vs TIME (ms)

Max: 24.5 G's
Tmax: 53.7 ms
Min: -71.4 G's
Tmin: 33.2 ms
CFC 60

No Valid Data After Approximately 75 msec.

TOP OF ENGINE X Velocity (kph) vs TIME (ms)

Max: 39.8 kph
Tmax: 6.9 ms
Min: -6.9 kph
Tmin: 49.7 ms
CFC 180

No Valid Data After Approximately 75 msec.

BOTTOM OF ENGINE X (G's) vs TIME (ms)

Max: 8.5 G's
Tmax: 56.9 ms
Min: -71.2 G's
Tmin: 37.2 ms
CFC 60

BOTTOM OF ENGINE X Velocity (kph) vs TIME (ms)

Max: 39.8 kph
Tmax: 0.0 ms
Min: -6.3 kph
Tmin: 104.0 ms
CFC 180

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

**LEFT BRAKE CALIPER X (G's) vs TIME (ms)**
- Max: 7.6 G's
- Tmax: 89.1 ms
- Min: -49.0 G's
- Tmin: 47.5 ms
- CFC 60

**LEFT BRAKE CALIPER X Velocity (kph) vs TIME (ms)**
- Max: 40.0 kph
- Tmax: 6.7 ms
- Min: -7.3 kph
- Tmin: 138.5 ms
- CFC 180

**RIGHT BRAKE CALIPER X (G's) vs TIME (ms)**
- Max: 5.7 G's
- Tmax: 74.0 ms
- Min: -45.7 G's
- Tmin: 53.9 ms
- CFC 60

**RIGHT BRAKE CALIPER X Velocity (kph) vs TIME (ms)**
- Max: 39.8 kph
- Tmax: 0.0 ms
- Min: -6.9 kph
- Tmin: 116.5 ms
- CFC 180
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)
Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

Max: 65.8 kn
Tmax: 34.4 ms
Min: -0.9 kn
Tmin: 0.0 ms
CFC 60

Max: 136.8 kn
Tmax: 37.6 ms
Min: -0.9 kn
Tmin: 0.0 ms
CFC 60

Max: 96.8 kn
Tmax: 36.5 ms
Min: -2.2 kn
Tmin: 75.4 ms
CFC 60
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

**BARRIER FORCE - LOWER LEFT (kn) vs TIME (ms)**

Max: 144.3 kn  
Tmax: 45.6 ms  
Min: -1.6 kn  
Tmin: 3.8 ms  
CFC 60

**BARRIER FORCE - LOWER CENTER (kn) vs TIME (ms)**

Max: 155.5 kn  
Tmax: 43.4 ms  
Min: -0.5 kn  
Tmin: 0.1 ms  
CFC 60

**BARRIER FORCE - LOWER RIGHT (kn) vs TIME (ms)**

Max: 115.9 kn  
Tmax: 43.1 ms  
Min: -1.0 kn  
Tmin: 0.0 ms  
CFC 60
25MPH FRONTAL IMPACT
2004 TOYOTA HIGHLANDER (C45111)

Test Date: 08/18/04
Speed: 24.7 mph (39.8 km/h)

**BARRIER FORCE - SUM LEFT (kn) vs TIME (ms)**
- Max: 186.5 kn
- Tmax: 45.4 ms
- Min: -2.0 kn
- Tmin: 0.0 ms
- CFC 60

**BARRIER FORCE - SUM CENTER (kn) vs TIME (ms)**
- Max: 281.9 kn
- Tmax: 42.0 ms
- Min: -0.9 kn
- Tmin: 0.0 ms
- CFC 60

**BARRIER FORCE - SUM RIGHT (kn) vs TIME (ms)**
- Max: 178.2 kn
- Tmax: 44.0 ms
- Min: -0.9 kn
- Tmin: 115.4 ms
- CFC 60

**BARRIER FORCE - SUM ALL (kn) vs TIME (ms)**
- Max: 632.1 kn
- Tmax: 43.8 ms
- Min: -2.5 kn
- Tmin: 0.0 ms
- CFC 60
BARRIER FORCE - SUM ALL (kn) vs Average Rear Seat X-mem Displacement (mm)

Max: 632.1 kn
Tmax: 401.2 mm
Min: -2.5 kn
Tmin: -219.6 mm
CFC 60
APPENDIX B

CRASH TEST PHOTOGRAPHS
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<td>Pre-Test Driver Dummy Front View (head position)</td>
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<td>Post-Test Driver Dummy Front View (head position)</td>
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<td>Pre-Test Driver Dummy Position Left Side View (Door Open)</td>
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<td>Post-Test Driver Dummy Position Left Side View (Door Open)</td>
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<td>Pre-Test Driver Dummy Seat Position</td>
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<td>Pre-Test Driver Side Knee Bolster View</td>
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<td>Post-Test Driver Dummy Head Contact</td>
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<td>Post-Test Driver Dummy Airbag Contact</td>
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<td>Post-Test Passenger Dummy Front View (head position)</td>
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<td>Pre-Test Passenger Dummy Position Right Side View</td>
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<td>Post-Test Passenger Dummy Position Right Side View</td>
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<td>Pre-Test Passenger Dummy Position Right Side View (Door Open)</td>
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<td>Post-Test Passenger Dummy Position Right Side View (Door Open)</td>
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<td>Pre-Test Passenger Side Knee Bolster View</td>
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<td>56</td>
<td>Temperature Plot</td>
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</table>
TIRE AND LOADING INFORMATION
SEATING CAPACITY: TOTAL 7
FRONT 2: REAR 5
The combined weight of occupants and cargo should never exceed 526 kg or 1159 lbs.

ORIGINAL TIRE SIZE
COLD TIRE INFLATION PRESSURE
225/65R17 FRONT 210kPa,30PSI
REAR 210kPa,30PSI

INFORMATION SUR LES PNEUS ET LE CHARGEMENT
NOMBRE DE PLACES ASSISES: TOTAL 7
AVANT 2: ARRIÈRE 5
Le poids total des occupants et du chargement ne doit jamais être supérieur à 526 kg ou 1159 lb.

DIMENSION DES PNEUS D'ORIGINE
PRESSION DE GONFLAGE À FROID
225/65R17 AVANT 210kPa,30PSI
ARRIÈRE 210kPa,30PSI

SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION

POUR DE PLUS AMPLES INFORMATIONS,
VOIR LE MANUEL DU PROPRIÉTAIRE

4 F

Tire Placard
Pre-Test Front View of Test Vehicle
Post-Test Front View of Test Vehicle
Post-Test Left Side View of Test Vehicle
Post-Test Right Side View of Test Vehicle
Pre-Test Right Front Three-Quarter View of Test Vehicle
Post-Test Right Front Three-Quarter View of Test Vehicle
Pre-Test Left Rear Three-Quarter View of Test Vehicle
Post-Test Left Rear Three-Quarter View of Test Vehicle
Pre-Test Rear View of Test Vehicle
Post-Test Rear View of Test Vehicle
Pre-Test Windshield View
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Post-Test Engine Compartment View
Post-Test Front Underbody View
Pre-Test Front Mid Underbody
Pre-Test Rear Mid Underbody
Post-Test Mid Underbody
Pre-Test Rear Underbody View
Post-Test Rear Underbody View
Pre-Test Driver Dummy Front View (head position)
Post-Test Driver Dummy Front View (head position)
Pre-Test Driver Dummy Position Left Side View (Door Open)
Post-Test Driver Dummy Position Left Side View (Door Open)
Pre-Test Driver Dummy Seat Position
POST-TEST
C45111
25 MPH FRONTAL UNBELTED
04081801
MGA RESEARCH CORP.
2004 TOYOTA HIGHLANDER

Post-Test Driver Dummy Seat Position
Post-Test Driver Dummy Feet Position
Post-Test Driver Side Knee Bolster View
Post-Test Driver Dummy Knee Contact
Post-Test Driver Dummy Airbag Contact
Post-Test Passenger Dummy Front View (head position)
Pre-Test Passenger Dummy Position Right Side View (Door Open)
Post-Test Passenger Dummy Position Right Side View (Door Open)
Pre-Test Passenger Dummy Seat Position
Post-Test Passenger Dummy Seat Position
Post-Test Passenger Dummy Feet Position
Pre-Test Passenger Side Knee Bolster View
Post-Test Passenger Side Knee Bolster View
Post-Test Passenger Dummy Knee Contact
APPENDIX C

INSTRUMENTATION CALIBRATION
### INSTRUMENTS FOR DRIVER DUMMY NO. 506

<table>
<thead>
<tr>
<th>SERIAL NO.</th>
<th>MANUFACTURER</th>
<th>CALIBRATION DATE</th>
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<td>Head Y</td>
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### INSTRUMENTS FOR PASSENGER DUMMY NO. 511

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