SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 216
ROOF CRUSH RESISTANCE

FORD MOTOR CO.
2003 FORD WINDSTAR, MPV
NHTSA NO. C30208

GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443

AUGUST 19, 2003

FINAL REPORT

PREPARED FOR
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
SAFETY ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW
ROOM 6111 (NVS-220)
WASHINGTON, D.C. 20590
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Prepared By: [Signature]
Approved By: [Signature]
Approval Date: 8/9/03

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Accepted By: [Signature]
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**Technical Report Documentation Page**

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<tr>
<td>Grant Farrand, Project Engineer</td>
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<td>Debbie Messick, Project Manager</td>
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<td>Compliance tests were conducted on the subject, 2003 Ford Windstar MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-216-05 for the determination of FMVSS 216 compliance. Test failures identified were as follows:</td>
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<td>Copies of this report are available from NHTSA Technical Reference Div., Rm. 5108 (NPO-230) 400 7th St., S.W. Washington, DC 20590 Telephone No. (202) 366-4946</td>
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1.0 PURPOSE OF COMPLIANCE TEST

A 2003 Ford Windstar MPV was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 216 testing to determine if the vehicle was in compliance with the requirements of the standard. The purpose of this standard is to reduce deaths and injuries due to the crushing of the roof into the occupant compartment in rollover crashes.

1.1 The test vehicle was a 2003 Ford Windstar MPV. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: 2FMZA63493BA03994

B. NHTSA No.: C30208

C. Manufacturer: FORD MOTOR CO.

D. Manufacture Date: 08/02

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 216 testing on July 30, 2003.
SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

2.0 TEST RESULTS

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure, TP-216-05 and General Testing Laboratories Procedure, TP-216-05B with the following modifications requested by the COTR:

1) The vehicle was rigidly mounted in the test fixture by welding vertical supports to the vehicle jack points to prevent any vehicle movement. Chains were not used in an effort to reduce and/or eliminate "pre-stressing" of the vehicle due to the tightening of chains.

2) Dial gauges were placed at the vehicle corners and at the passenger door to track overall vehicle motion and the ability of the alternate tie-down procedure to restrict motion of the vehicle.

3) String potentiometers were placed at the driver's designated seat position and attached to the interior surface of the roof above a normally positioned 50th percentile Hybrid III ATD head. The string potentiometers tracked the interior motion of the roof.

4) Performed the roof crush test to a loading ram displacement of 127 mm or 44,482 N force, whichever comes first.

The data for this portion of the test can be found on Data Sheets 6 and 7.

Based on the test performed, the 2003 Ford Windstar appears to meet the requirements of FMVSS 216 testing.
3.0 TEST RESULTS

The following data sheets document the results of testing on the 2003 Ford Windstar.
DATA SHEET 1
FMVSS 216
SUMMARY OF RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV
VEH. NHTSA NO: C30208; VIN: 2FMZA53493BA03994
VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

A. VISUAL INSPECTION OF TEST VEHICLE

Upon receipt, inspect vehicle for completeness, function, and discrepancies or damage which might influence the testing.

RESULTS:

B. VEHICLE DATA

(1) Vehicle type as shown on certification label: MPV
(2) Vehicle UVW as recorded on Data Table 2: 1952.2 kg

C. STATIC LOAD TEST OF DRIVER SIDE OF ROOF

Minimum roof crush resistance required by FMVSS 216 for the vehicle tested:
MCCR as recorded on Data Table 2: 28,807 N
Maximum roof crush resistance measured during test was
42,132 N at 75.7 mm

PASS FAIL

D. POST TEST VISUAL INSPECTION

Driver's side roof flattened from "A" pillar rearward approximately 2010 mm and approximately 500 mm wide. "A" pillar, "B" pillar and "C" pillar are bent in and down. Windshield, driver door glass and side door glass are shattered. Driver's door opening pushed down approximately 70 mm.

RESULTS:

REMARKS:

RECORDED BY: [Signature]
DATE: 07/30/03

APPROVED BY: [Signature]
DATA SHEET 2
FMVSS 216
RECEIVING INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV

VEH. NHTSA NO: C30208; VIN: 2FMZA53493EA03994

VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Upon receipt, the vehicle will be examined visually for completeness, function, and damage. The roof and supporting structures such as the doors and windows should be checked for proper operation and any discrepancies which may influence the testing. The vehicle will be weighed and the minimum roof crush resistance determined.

RESULTS:

(1) Unloaded Vehicle Weight (UVW)

<table>
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<th>Weight (kg)</th>
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<td>581.9</td>
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<tr>
<td>Right Front</td>
<td>567.9</td>
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<tr>
<td>Front Axle</td>
<td>1149.3</td>
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<td>Left Rear</td>
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<td>Right Rear</td>
<td>396.8</td>
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<td>Rear Axle</td>
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TOTAL UVW = 1952.2 kg

(2) Vehicle type as shown on vehicle certification label: MPV

(3) Minimum Roof Crush Resistance (MCRR):

Passenger Car:

\[ UVW \times 1.5 \times 9.8 = \text{N/A} \text{ N} \]

MCRR = \text{N/A} \text{ N} (UVW \times 1.5 \times 9.8 or 22,241 N whichever is less)

MPV, Truck or Bus:

\[ MCRR = UVW \times 1.5 \times 9.8 = 28,697 \text{ N} \]

(4) Other Comments: ___________________________________________________________

REMARKS:

RECORDED BY: [Signature] DATE: 07/30/03

APPROVED BY: [Signature]
DATA SHEET 3
FMVSS 216
PRE-TEST PREPARATION

VEH. MOD VR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV
VEH. NHTSA NO: C30208; VIN: 2FMZA53493BA03994
VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Prior to testing, the following will be accomplished:

A. Secure any convertible top, movable or removable roof structure in their weather tight positions ___________________________ Roof Rack Removed

B. Close all windows ______ OK _____________________________

C. Close and lock all doors ______ OK ____________________________

D. State Side of Roof Tested ______ Driver _____________________________

E. Measure the lateral angle of the test device at sufficient points to determine that it has a 25 degree (plus zero degree, minus one degree) angle ______ 25°

F. Measure the longitudinal angle of the loading device at sufficient points to determine that is has a 5 degree (plus zero minutes, minus 20 minutes) ______ 5°

G. The test device will initially contact the roof at 318 mm aft of windshield ____________

H. If the test device was relocated based on the requirements of Chapter 12.3 paragraph F, describe where the test device will initially contact the roof as relocated ______ N/A

I. Ambient temperature 51 mm from the vehicle roof in the immediate area of the test device: ______ 25 _______ degrees C.

REMARKS:

RECORDED BY: ___________________________ DATE: 07/30/03
APPROVED BY: ___________________________
DATA SHEET 4
FMVSS 216

VEH. MOD YR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV
VEH. NHTSA NO: C30208; VIN: 2FMZA53493BA03994
VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

RESULTS: Plots of load versus displacement and time versus displacement showed that:

(1) The maximum roof crush resistance was 42,132 N at 75.7 mm
(2) The rate of loading was 5.08 mm/sec (.2 in/sec)
(3) The required roof crush resistance of 28,697 N was at 43.2 mm

REMARKS:

RECORDED BY: [Signature] DATE: 07/30/03
APPROVED BY: [Signature]
Upon completion of testing, a detailed visual inspection of the vehicle shall be made. Describe all damage and deformation that occurred during the test.

RESULTS: Driver's side roof flattened from "A" pillar rearward approximately 2010 mm and approximately 500 mm wide. "A" pillar, "B" pillar and "C" pillar are bent in and down. Windshield, driver door glass and side door glass are shattered. Driver's door opening pushed down approximately 70 mm.
DATA SHEET 6
FMVSS 216 MODIFIED PORTION PRE-TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV
VEH. NHTSA NO: C30208; VIN: 2FMZA53493BA03994
VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003

TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Driver Seat Torso Angle: 21°

Driver Seat "H" Point Location at Mid Travel:
X = 205 mm aft from centerline of front outboard seat mounting bolt
Y = 180 mm inboard from centerline of front outboard seat mounting bolt
Z = 350 mm up from centerline of front outboard seat mounting bolt

Point VRL (Vertical Measurement from H-Point to Headliner): 894.1 mm
Point VR (Vertical Measurement from H-Point to Structure Above Headliner): 927.1 mm
Point RE (Distance from H-Point to a point 112 mm behind point VRl): 927.1 mm

#1 LVDT (R.F.) Length: 925 mm
#2 LVDT (R.R.) Length: 892 mm
#3 LVDT (L.R.) Length: 892 mm

Distance from LVDT #1 (R.F.) to LVDT #2 (R.R.) = 270 mm
Distance from LVDT #2 (R.R.) to LVDT #3 (L.R.) = 250 mm
Distance from LVDT #1 (R.F.) to LVDT #3 (L.R.) = 370 mm

All LVDT's are located on a 185 mm radius from a vertical line passing through the seat "H" point. Using the forward direction as 0° reference and measuring clockwise, LVDT #1 is located at 43°, LVDT #2 is located at 137° and LVDT #3 is located at 222°.

NOTES:

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RECORDED BY: _________________________ DATE: 07/30/03
APPROVED BY: _______________________
DATA SHEET 7
FMVSS 216 MODIFIED PORTION POST TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 FORD WINDSTAR MPV
VEH. NHTSA NO: C30208; VIN: 2FMZA63493BA03994
VEH. BUILD DATE: 08/02; TEST DATE: JULY 30, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Maximum Load Applied = 42,132 N @ 75.7 mm
Maximum Displacement = 139.0 mm @ 33.044 N

#1 LVDT (RF) Displacement = 55.4 mm
#2 LVDT (RR) Displacement = 61.4 mm
#3 LVDT (LR) Displacement = 52.0 mm

Left Front Dial Indicator Displacement = 2.6 mm
Right Front Dial Indicator Displacement = 0.7 mm
Left Rear Dial Indicator Displacement = 0.0 mm
Right Rear Dial Indicator Displacement = 8.6 mm
Right Door Sill Dial Indicator Displacement = 7.4 mm

NOTES:

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SECTION 5

PHOTOGRAPHS
SECTION 6

TEST PLOTS