SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 216
ROOF CRUSH RESISTANCE

KIA MOTORS CORPORATION
2003 KIA SORENTO, MPV
NHTSA NO. C30505

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

AUGUST 4, 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: Delegate Musich
Approved By: 
Approval Date: 1/4/03

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: 
Acceptance Date: 

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2003 Kia Sorento 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 Kia Sorento MPV. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KNDJD733635081536

B. NHTSA No.: C30505

C. Manufacturer: KIA MOTORS CORPORATION

D. Manufacture Date: 11/25/02

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 216 testing on July 18, 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 Kia Sorento appears to meet the requirements of FMVSS 216 testing.
SECTION 3
COMPLIANCE TEST DATA

3.0 TEST RESULTS

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

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30505; VIN: KNDJD733635081536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 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: 1906 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: 28,018 N

Maximum roof crush resistance measured during test was 36,878 N at 69 mm

PASS FAIL

D. POST TEST VISUAL INSPECTION

Roof pushed down on driver's side from "A" pillar to "C" pillar. Roof is pushed down approximately 5" and "B" pillar is pushed in approximately 4" toward the passenger side. Windshield, driver's window and driver side rear passenger windows are shattered.

RESULTS:

REMARKS:

RECORDED BY: [Signature] DATE: 07/18/03
APPROVED BY: [Signature]
DATA SHEET 2
FMVSS 216
RECEIVING INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30505; VIN: KNDJD73635081536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LÁTANE, 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>
<thead>
<tr>
<th></th>
<th>Left Front</th>
<th>508 kg</th>
<th>Left Rear</th>
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<td>Right Front</td>
<td>528 kg</td>
<td>Right Rear</td>
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<td></td>
<td>Front Axle</td>
<td>1036 kg</td>
<td>Rear Axle</td>
<td>870 kg</td>
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TOTAL UVW 1906 kg

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

(3) Minimum Roof Crush Resistance (MCRR):

Passenger Car:

UVW x 1.5 x 9.8 = \( \text{N/A} \) N

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

MPV, Truck or Bus:

MCRR = UVW x 1.5 x 9.8 = 28,015 N

(4) Other Comments:

REMARKS:

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

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30505; VIN: KNDJID733635081536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 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

B. Close all windows

C. Close and lock all doors

D. State Side of Roof Tested

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

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)

G. The test device will initially contact the roof at 330 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

I. Ambient temperature 51 mm from the vehicle roof in the immediate area of the test device: 28.3 degrees C.

REMARKS:

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DATE: 07/18/03
APPROVED BY: [Signature]
DATA SHEET 4
FMVSS 216

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30595; VIN: KNDJD733635281536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 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 36,878 N at 69 mm
(2) The rate of loading was 5.08 mm/sec (.2 in/sec)
(3) The required roof crush resistance of 28,018 N was at 42 mm

REMARKS:

RECORDED BY: [Signature] DATE: 07/18/03
APPROVED BY: [Signature]
DATA SHEET 5
FMVSS 216
POST TEST VISUAL INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30505; VIN: KNDJD733635081536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

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: Roof pushed down on driver’s side from “A” pillar to “C” pillar. Roof is pushed down approximately 5” and “B” pillar is pushed in approximately 4” toward the passenger side. Windshield, driver’s window and driver side rear passenger windows are shattered.

RECORDED BY: [Signature]  DATE: 07/18/03
APPROVED BY: [Signature]
DATA SHEET 6
FMVSS 216 MODIFIED PORTION PRE-TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30509; VIN: KNJJD733635081536
VEH. BUILD DATE: 11/25/02; TEST DATE: JULY 18, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Driver Seat Torso Angle: ____________23°___________

Driver Seat "H" Point Location at Mid Travel:
X= 205 mm aft from centerline of front outboard seat mounting bolt
Y= 245 mm inboard from centerline of front outboard seat mounting bolt
Z= 280 mm up from centerline of front outboard seat mounting bolt

Point VRL (Vertical Measurement from H-Point to Headliner): __861 mm_________
Point VRH (Vertical Measurement from H-Point to Structure Above Headliner): __907 mm_________
Point RE (Distance from H-Point to a point 112mm behind point VRH): __925 mm_________

#1 LVDT (R.F.) Length: __920 mm_________
#2 LVDT (R.R.) Length: __890 mm_________
#3 LVDT (L.R.) Length: __890 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: [Signature] DATE: 07/18/03
APPROVED BY: [Signature]
DATA SHEET 7
FMVSS 216 MODIFIED PORTION POST TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2003 KIA SORENTO MPV
VEH. NHTSA NO: C30585:	VIN: KNJD6733635081536
VEH. BUILD DATE: 11/25/02;	TEST DATE: JULY 18, 2003
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Maximum Load Applied = 36,878 N @ 69.0 mm
Maximum Displacement = 137.0 mm @ 29.223 N

#1 LVDT (RF) Displacement = 39.8 mm
#2 LVDT (RR) Displacement = 47.0 mm
#3 LVDT (LR) Displacement = 34.3 mm

Left Front Dial Indicator Displacement = 4.7 mm
Right Front Dial Indicator Displacement = 4.6 mm
Left Rear Dial Indicator Displacement = 29.8 mm
Right Rear Dial Indicator Displacement = 23.5 mm
Right Door Sill Dial Indicator Displacement = 1.9 mm

NOTES:

__________________________________________________________

_________________________  ____________________________
RECORDED BY:             DATE: 07/18/03

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APPROVED BY:
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INC.
SECTION 5

PHOTOGRAPHS
SECTION 6

TEST PLOTS