

REPORT NUMBER TR-P27082-04-NC

**SIDE AIRBAG OCCUPANT RISK PROGRAM
OCCUPANT OUT-OF-POSITION TESTS**

**MITSUBISHI MOTORS CORPORATION
2008 MITSUBISHI LANCER
4-DOOR SEDAN**

NHTSA NUMBER: M85600TWG2

**PREPARED BY:
KARCO ENGINEERING, LLC
9270 HOLLY ROAD
ADELANTO, CALIFORNIA 92301**



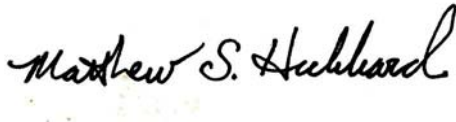
APRIL 25, 2007

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
RULEMAKING
OFFICE OF CRASHWORTHINESS STANDARDS
MAIL CODE: NVS-111
400 SEVENTH STREET, SW, ROOM 5311
WASHINGTON, D.C. 20590**

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-03-D-32005.

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.



Prepared by: _____
Mr. Matthew S. Hubbard, Test Engineer
KARCO Engineering, LLC

Date: 06/15/07



Reviewed by: _____
Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC

Date: 06/15/07



Approved by: _____
Mr. Frank D. Richardson, President
KARCO Engineering, LLC

Date: 06/15/07

FINAL REPORT ACCEPTED BY:

Manager, New Car Assessment Program

Date of Acceptance

COTR, NCAP Frontal Impact Program

Date of Acceptance

Technical Report Documentation Page

1. Report No. TR-P27082-04-NC	2. Government Accession No.	3. Recipients Catalog No.	
4. Title and Subtitle Final Report of New Car Assessment Program Technical Working Group Side Airbag Risk Program 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No. MB5600TWG2		5. Report Date April 25, 2007	
		6. Performing Organization Code KAR	
7. Authors Mr. Matthew S. Hubbard, Test Engineer, Karco Mr. Michael L. Dunlap, Director of Operations, Karco		8. Performing Organization Report No. TR-P27082-04-NC	
9. Performing Organization Name and Address KARCO Engineering, LLC 9270 Holly Road Adelanto, CA 92301		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-03-D-32005	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Rulemaking Office of Crashworthiness Standards Mail Code: NVS-111 400 Seventh Street, SW, Room 5311 Washington, D.C 20590		13. Type of Report and Period Covered Final Test Report	
		14. Sponsoring Agency Code DOT/NHTSA/NRM/OCS/NVS-111	
15. Supplementary Notes			
16. Abstract A static side airbag deployment was conducted on a 2008 Mitsubishi Lancer 4-Door Sedan at KARCO Engineering, LLC on 4/25/2007. This test was conducted to obtain data indicant of TWG Side Airbag Out-of-Position Injury criteria.			
Measurement Description	Units	Threshold	Hybrid III 6 Year Old ATD
Head Injury Criteria (HIC ₁₅)		700	9.7
17. Key Words TWG Occupant Out-of-Position Test Section 3.3.3.5 New Car Assessment Program (NCAP) 2008 Mitsubishi Lancer 4-Door Sedan NHTSA NO. M70500TWG2		18. Distribution Statement Copies of this report available from: NHTSA Technical Reference Division National Highway Traffic Safety Admin. 400 Seventh St., SW, Room 5111 Washington, D.C. 20590	
19. Security Classification (this report)	20. Security Classification (this page)	21. No. Pages	22. Price
Unclassified	Unclassified	32	

TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1	Purpose and Summary of Test M85600TWG2	1
2	Occupant and Vehicle Information/Data Sheets	3

<u>Data Sheet</u>	<u>Description</u>	<u>Page</u>
1	Test Summary	4
2	General Test and Vehicle Parameter Data	5
3	Test Vehicle Information	6
4	Dummy Positioning Information	7
5	Hybrid III ATD Injury Criteria and Sensor Data	8
6	Camera Locations	10

<u>Appendix</u>	<u>Description</u>	<u>Appendix</u>
A	Photographs	A
B	Data Plots	B
C	Instrumentation Data Channel Assignments	C

LIST OF PHOTOGRAPHS

<u>Figure</u>	<u>Description</u>	<u>Page</u>
A-1	Right Front $\frac{3}{4}$ View, As Received	A-1
A-2	Vehicle Certification Label	A-2
A-3	Post-Test Right Front $\frac{3}{4}$ View of Frontal NCAP Test	A-3
A-4	Post-Test Right Side View of Frontal NCAP Test	A-4
A-5	Pre-Test Dummy Position, Left Side View	A-5
A-6	Pre-Test Dummy Position, $\frac{3}{4}$ View	A-6
A-7	Pre-Test Dummy Position, Front View	A-7
A-8	Post-Test Dummy Position and Airbag, Left Side View	A-8
A-9	Post-Test Airbags, Left Side View	A-9
A-10	Post-Test Airbags, Close-up View	A-10

LIST OF DATA PLOTS

Data Plot		Page
B-1	Passenger (P2) Head X	B-1
	Passenger (P2) Head Y	B-1
	Passenger (P2) Head Z	B-1
	Passenger (P2) Head Resultant	B-1
B-2	Passenger (P2) Upper Neck Force X	B-2
	Passenger (P2) Upper Neck Force Y	B-2
	Passenger (P2) Upper Neck Force Z	B-2
	Passenger (P2) Upper Neck Force Resultant	B-2
B-3	Passenger (P2) Upper Neck Moment X	B-3
	Passenger (P2) Upper Neck Moment Y	B-3
	Passenger (P2) Upper Neck Moment Z	B-3
	Passenger (P2) Upper Neck Moment Resultant	B-3

SECTION 1

PURPOSE AND SUMMARY OF TEST M85600TWG2

1.1 PURPOSE

This occupant out-of-position static side airbag deployment test is part of the Technical Working Group Occupant Injury Risk from Deploying Side Airbags Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-03-D-32005. The purpose of this test was to obtain occupant injury data for a side airbag deployment.

The occupant out-of-position side airbag test was conducted in accordance with the Technical Working Group Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

1.2 SUMMARY

The effects of a seat mounted torso airbag and a roof mounted curtain airbag deployment in a 2008 Mitsubishi Lancer 4-Door Sedan with an out-of-position Hybrid III 6 Year-Old Child dummy were evaluated. The test was performed at Karco Engineering, LLC on April 25, 2007. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed digital cameras were used to document the torso and curtain airbag deployment. Camera locations and other pertinent camera information can be found on Data Sheet No.1 and Data Sheet No.6.

One Part 572N, Hybrid III 6-Year old child anthropomorphic test device (ATD) was placed in the right front passenger seating position facing forward according to the dummy placement instructions (3.3.3.5) in the July 2003 Revision of the Technical Working Group's 'Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags'.

The Hybrid III 6-Year old ATD was instrumented with head tri-axial accelerometers, and upper neck transducers.

Nine (9) channels of data were recorded using an on-board data acquisition system. Appendix A contains Photographs. Appendix B contains dummy response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The front passenger side door remained closed during the deployment and was operable after the deployment.

The Hybrid III 6-Year-Old Child Dummy's visible contact points were as follows: The torso airbag contacted the ATD's back. The curtain airbag contacted the ATD's head.

OUT OF POSITION OCCUPANT DATA SUMMARY

ATD Position	HIC ₁₅
Passenger	9.7

Orientation of the Hybrid III 6 Year-old Child Dummy was in the inboard facing position leaning against the front passenger door. The dummy's spine was aligned with the deploying trajectory of the torso airbag. The lower legs were extended. Synthetic foam was used to raise the dummy. This orientation complies with section 3.3.3.5 of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SECTION 2

OCCUPANT AND VEHICLE INFORMATION/DATA SHEETS

Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2
Test Program: TWG 3.3.3.5. Test Date: 04/25/07

CONVERSION FACTORS USED IN THIS REPORT*

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	mile/h	km/h	1.609
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.573
Pressure	Tire Pressures	lbf/in ²	kPa	7.0
Volume	Liquid	gal	liter	3.785
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf/ft	Nm	1.355

* Based on the Recommended Practice in SAE J916, May 85

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2

Test Program: TWG 3.3.3.5. Test Date: 04/25/07

TEST DUMMY INFORMATION

Description	Passenger Seat Forward Facing
Dummy Type / Serial No.	Hybrid III 6 year old / 144
Head Contact	Yes
Chest Contact	None
Abdomen Contact	None
Pelvis	Yes
Left Knee Contact	None
Right Knee Contact	None

MOVIE COVERAGE

High Speed Digital	2
Total	2

DATA CHANNELS

Child ATD Sensors	9
Belt Assessment Sensors	0
Vehicle Structure Accelerometers	0
Total	9

DATA SHEET NO. 2**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2Test Program: TWG 3.3.3.5. Test Date: 04/25/07**TEST VEHICLE INFORMATION**

Make	Mitsubishi
Model	Lancer
Body Style	4-Door Sedan
NHTSA No.	M85600TWG2
VIN	JA3AU16UX8U001846
Color	Charcoal Grey
Delivery Date	March 3, 2007
Odometer Reading (mile)	35
Dealer	Southcoast Mitsubishi
Transmission	5-Speed Manual
Final Drive	Front
Type/Number Cylinders	Inline 4
Engine Displacement (L)	2.0
Engine Placement	Transverse

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Airbag	Yes
Driver Side Curtain Airbag	Yes
Pass. Front Airbag	Yes
Pass. Side Airbag	Yes
Pass. Curtain Airbag	Yes
Power Brakes	Yes
Power Steering	Yes
Disc Brakes, Front	Yes
Disc Brakes, Rear	Yes
Anti-lock Brakes	No
Tilt Steering Wheel	Yes
Power Windows	Yes
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Mitsubishi Motors Corporation	GVWR (kg)	1850
Date of Manufacture	Jan-07	GAWR Front (kg)	1010
		GAWR Rear (kg)	910

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	220	220
Recommend Tire Size	P205/60R16	P205/60R16
Tire Size on Vehicle	P205/60R16	P205/60R16
Tire Manufacturer	Yokohama	Yokohama

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				375

* Vehicle had undergone New Car Assessment Program Frontal Impact Testing on April 4, 2007

DATA SHEET NO. 3

TEST VEHICLE INFORMATION

Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2
Test Program: TWG 3.3.3.5. Test Date: 04/25/07

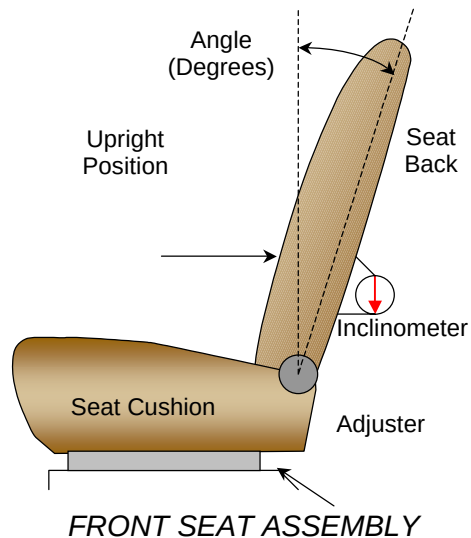
NOMINAL DESIGN RIDING POSITION

The passenger seat back is positioned to section 3.3.3.5. of the Technical Working Group (TWG) recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags.

SEAT BACK ANGLES

Position	Deg.
Passenger w/ Dummy	4*

* Seat back angle taken at headrest



SEAT FORE/AFT POSITIONS

The first or forward most position is counted as number one (1). The fore/aft position is set aft of the middle position for the passenger seat.

SEAT FORE/AFT POSITIONING

	Total Fore/Aft Travel	Placed in Position #
Passenger Seat	22	10

DATA SHEET NO. 4

DUMMY POSITIONING INFORMATION

Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2
 Test Program: TWG 3.3.3.5. Test Date: 04/25/07

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Hybrid III 6-Year-Old Child Dummy	
		Length (mm)	Angle (°)
SA	Seat Back Angle		4
AMW	Side Airbag Module Width (Torso / Curtain)	70 / 40	
ABW	Side Airbag Width (Torso / Curtain)	250 / 460	
AML	Side Airbag Module Length (Torso / Curtain)	290 / 1660	
ABL	Side Airbag Length (Torso / Curtain)	600 / 1530	
AN	Top of Airbag Module to Head/Neck Junction (Curtain)	48	
HD	Head CG to Door Panel/ Window	150	
HSC	Head to Seat Back Centerline	85	
HB	Head to B-Pillar (first contact)	35	
HZ	Head to Roof (Z)	215	
HHD	Head to Header	495	
ND	Nose to Dash	662	
NS	Nose to Seat Back	265	
NR	Nose to Header	560	
CD	Chest to Dash	633	
CS	Chest to Seat Back	213	
RACL	Right Arm to Seat Back Centerline	340	
LACL	Left Arm to Seat Back Centerline	65	
RA	Right Arm to Door Panel	0	
LA	Left Arm to Door Panel	285	
KK	Knee to Knee	105	
TT	Toe to Toe	110	
KSCR	Right Knee to Seat Cushion Centerline	98	
KSCL	Left Knee to Seat Cushion Centerline	5	
TSCR	Right Toe to Seat Cushion Centerline	-70	
TSCL	Left Toe to Seat Cushion Centerline	-125	

DATA SHEET NO. 5
HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2007 Mitsubishi Lancer 4-Door Sedan

NHTSA No.: M85600TWG2

Test Program: TWG 3.3.3.5

Test Date: 4/25/07

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Pass. (6 Yr.)			
			Max	Time	Min	Time
Head CG	X	G's	20.1	14.4	-3.6	31.8
Head CG	Y	G's	7.3	8.0	-14.6	14.3
Head CG	Z	G's	17.2	14.1	-22.2	9.5
Head CG Resultant	N/A	G's	27.4	14.1		

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. (6 Yr.)			
			Max	Time	Min	Time
Neck Force	X	Newtons	242.0	11.8	-62.9	149.2
Neck Force	Y	Newtons	193.7	8.3	-10.3	199.9
Neck Force	Z	Newtons	112.8	125.9	-1384.8	8.3
Neck Force Resultant	N/A	Newtons	1416.7	8.3		
Neck Moment	X	Nm	5.7	16.1	-8.5	7.9
Neck Moment	Y	Nm	23.7	11.7	-11.0	33.5
Neck Moment	Z	Nm	5.1	125.2	-11.4	57.9
Neck Moment Resultant	N/A	Nm	23.8	11.7		

DATA SHEET NO. 5...(CONTINUED)Test Vehicle: 2007 Mitsubishi Lancer 4-Door SedanNHTSA No.: M85600TWG2Test Program: TWG 3.3.3.5Test Date: 4/25/07**HEAD INJURY CRITERIA (HIC 15)**

Location	Pass. (6 Yr.)			
	HIC15	T ¹	T ²	Avg G
Head CG	9.7	7.0	17.3	14.6

UPPER NECK NIJ VALUES

Location	Pass. (6 Yr.)			
	Ntf	Nte	Ncf	Nce
Upper Neck	0.18	0.18	0.41	0.39

DATA SHEET NO. 6**CAMERA LOCATIONS**Test Vehicle: 2008 Mitsubishi Lancer 4-Door Sedan NHTSA No.: M85600TWG2Test Program: TWG 3.3.3.5. Test Date: 04/25/07

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	High Speed Digital Side View	-360	-3250	-70	1.0	50	1000
2	High Speed Digital Front View	-2250	-345	380	10.0	50	1000

* Cameras aligned to the CG of dummy's head as reference.

APPENDIX A

PHOTOGRAPHS



Figure A-1: Right Front $\frac{3}{4}$ View, As Received

MFD. BY MITSUBISHI MOTORS CORPORATION

JAPAN

GVWR 4079LBS/ 1850KG

GAWR FR 2227LBS/1010KG GAWR RR 2007LBS/ 910KG

JAN 2007

**THIS VEHICLE CONFORMS TO ALL APPLICABLE
FEDERAL MOTOR VEHICLE SAFETY, BUMPER, AND
THEFT PREVENTION STANDARDS IN EFFECT ON
THE DATE OF MANUFACTURE SHOWN ABOVE.**



JA3AU16UX8U001846

VEHICLE TYPE: PASSENGER CAR

MU000883

Figure A-2: Vehicle Certification Label



Figure A-3: Post-Test Right Front $\frac{3}{4}$ View of Frontal NCAP Test



Figure A-4: Post-Test Right Side View of Frontal NCAP Test



Figure A-5: Pre-Test Dummy Position, Left Side View



Figure A-6: Pre-Test Dummy Position, $\frac{3}{4}$ View



Figure A-7: Pre-Test Dummy Position, Front View



Figure A-8: Post-Test Dummy Position and Airbags, Left Side View

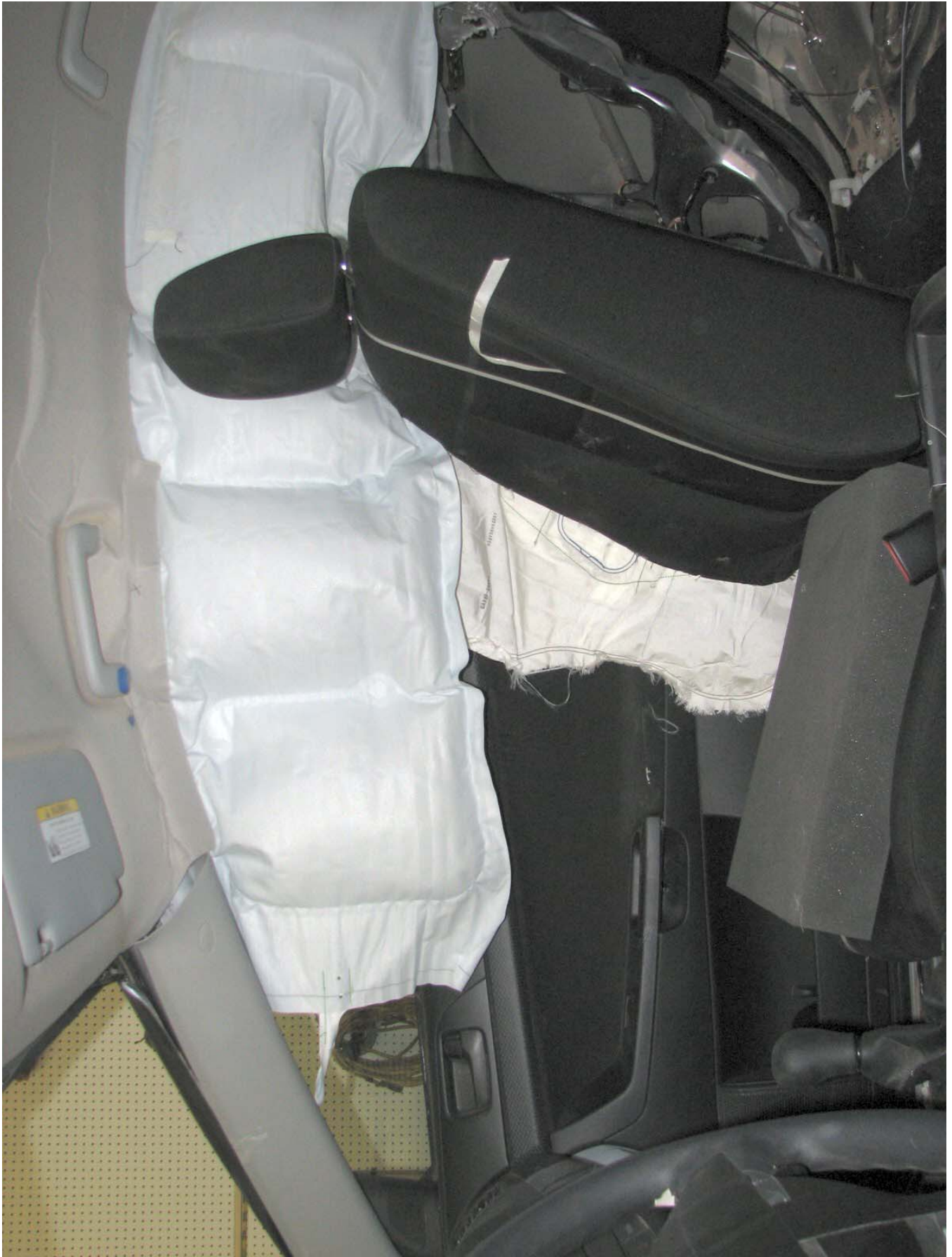


Figure A-9: Post-Test Airbags, Left Side View



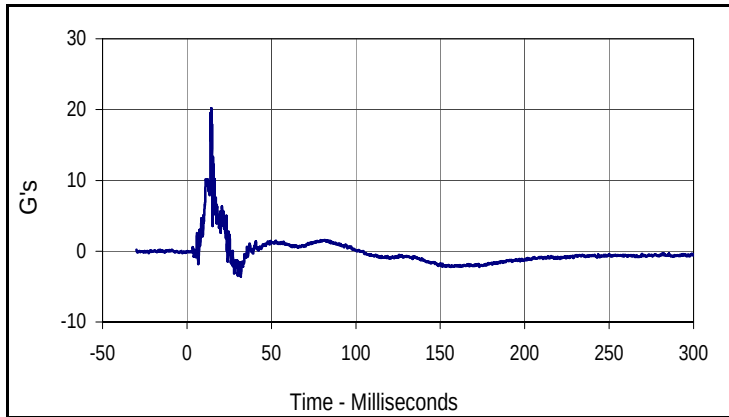
Figure A-10: Post-Test Airbags, Close-up View

APPENDIX B

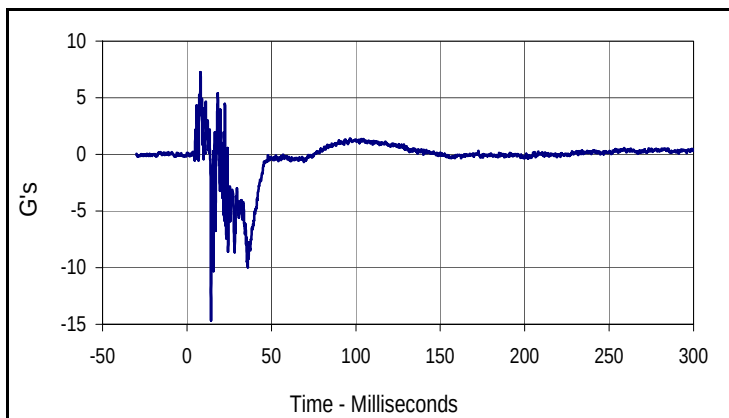
DATA PLOTS

Test Vehicle: 2007 Mitsubishi Lancer 4-Door Sedan
 Test Program: TWG 3.3.3.5

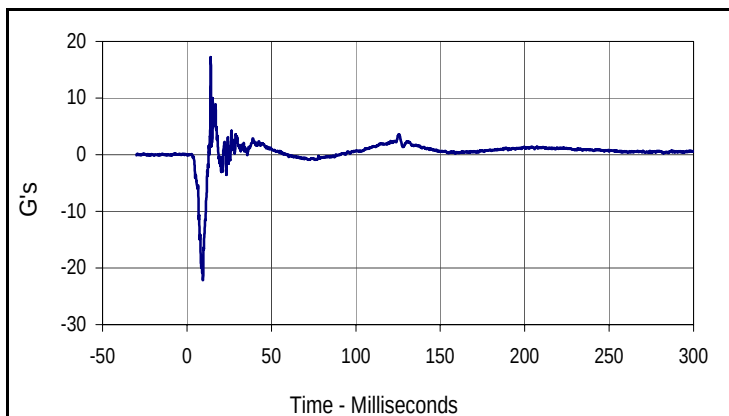
Test Date: 4/25/07
 NHTSA No.: M85600TWG2



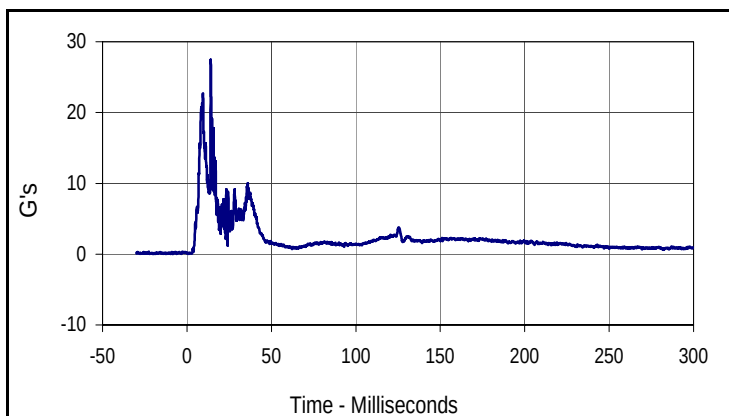
Curve Description			
Pass. (6 Yr.) Head X			
CURNO	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
20.1	14.4	-3.6	31.8



Curve Description			
Pass. (6 Yr.) Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
7.3	8.0	-14.6	14.3



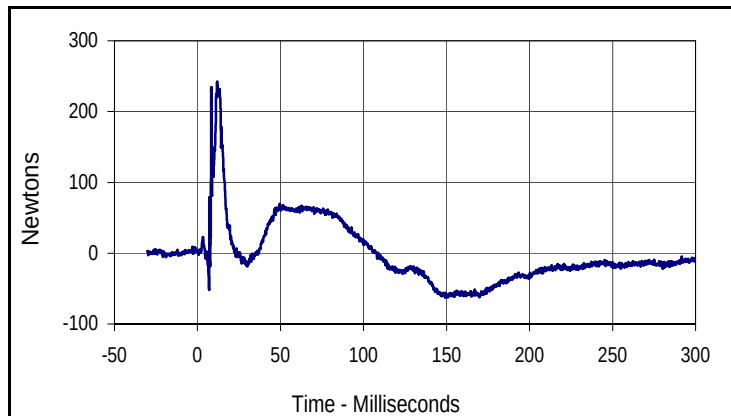
Curve Description			
Pass. (6 Yr.) Head Z			
CURNO	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
17.2	14.1	-22.2	9.5



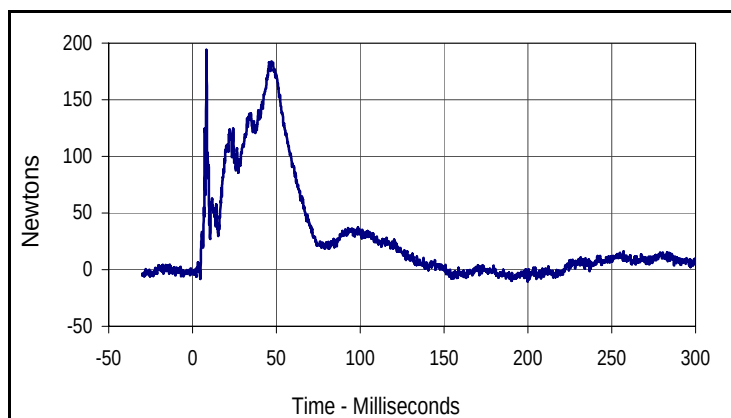
Curve Description			
Pass. (6 Yr.) Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
27.4	14.1	0.1	1.1

Test Vehicle: 2007 Mitsubishi Lancer 4-Door Sedan
 Test Program: TWG 3.3.3.5

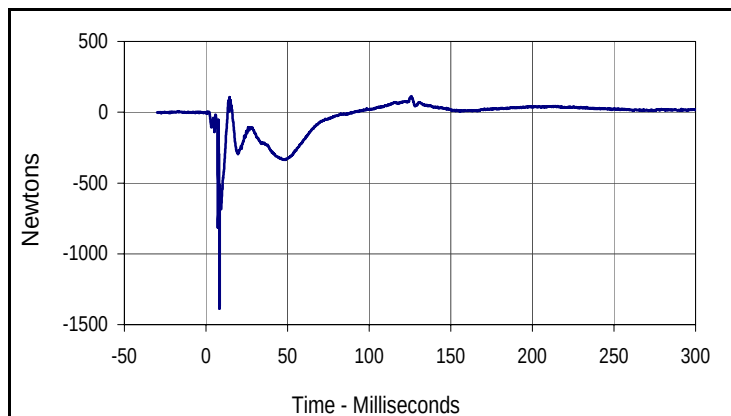
Test Date: 4/25/07
 NHTSA No.: M85600TWG2



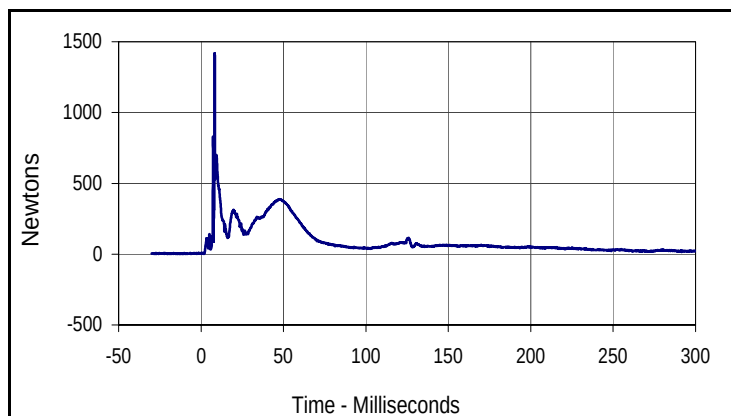
Curve Description			
Pass. (6 Yr.) Upper Neck Force X			
CURNO	Type	SAE Class	Units
001	FIL	1000	Newtons
Max	Time	Min	Time
242.0	11.8	-62.9	149.2



Curve Description			
Pass. (6 Yr.) Upper Neck Force Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	Newtons
Max	Time	Min	Time
193.7	8.3	-10.3	199.9



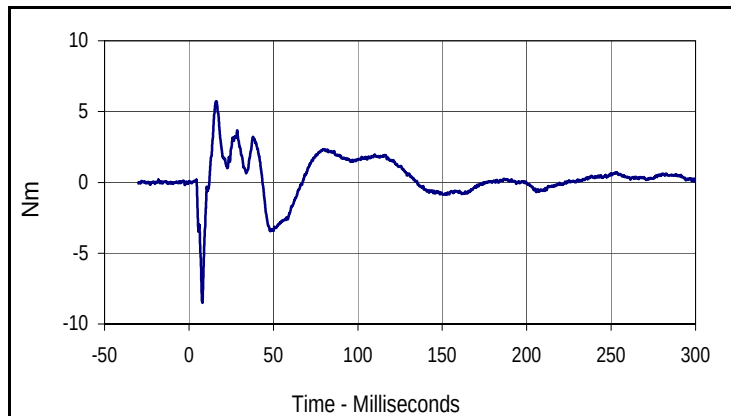
Curve Description			
Pass. (6 Yr.) Upper Neck Force Z			
CURNO	Type	SAE Class	Units
003	FIL	1000	Newtons
Max	Time	Min	Time
112.8	125.9	-1384.8	8.3



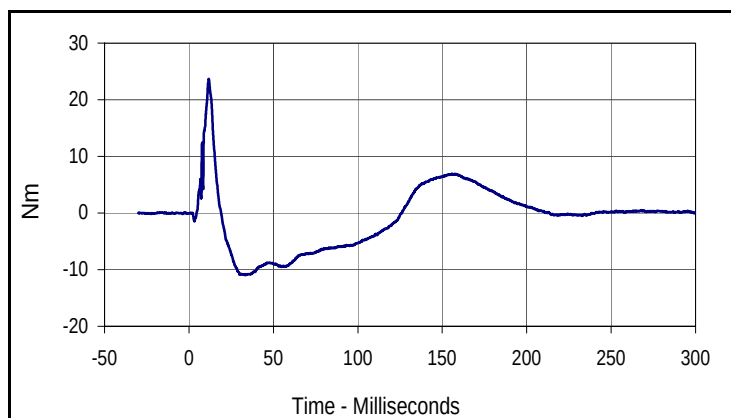
Curve Description			
Pass. (6 Yr.) Upper Neck Force Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	Newtons
Max	Time	Min	Time
1416.7	8.3	1.9	1.8

Test Vehicle: 2007 Mitsubishi Lancer 4-Door Sedan
 Test Program: TWG 3.3.3.5

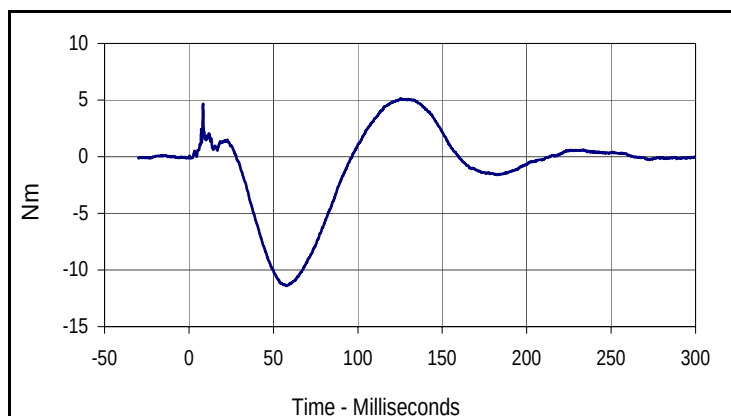
Test Date: 4/25/07
 NHTSA No.: M85600TWG2



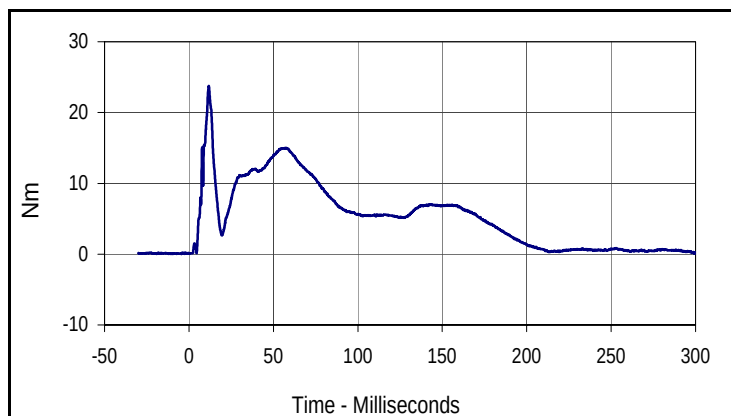
Curve Description			
Pass. (6 Yr.) Upper Neck Moment X			
CURNO	Type	SAE Class	Units
004	FIL	600	Nm
Max	Time	Min	Time
5.7	16.1	-8.5	7.9



Curve Description			
Pass. (6 Yr.) Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
005	FIL	600	Nm
Max	Time	Min	Time
23.7	11.7	-11.0	33.5



Curve Description			
Pass. (6 Yr.) Upper Neck Moment Z			
CURNO	Type	SAE Class	Units
006	FIL	600	Nm
Max	Time	Min	Time
5.1	125.2	-11.4	57.9



Curve Description			
Pass. (6 Yr.) Upper Neck Moment Resultant			
CURNO	Type	SAE Class	Units
004	RES	600	Nm
Max	Time	Min	Time
23.8	11.7	0.1	299.3

APPENDIX C

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG 3.3.3.5
Instrumentation Data Channel Assignments
A.T.D. Serial Number 144
4/25/07
2007 Mitsubishi Lancer 4-Door Sedan

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD	X	J32884	Accel.,full bridge	ENDEVCO	7264-2000	G
2	HEAD	Y	J19925	Accel.,full bridge	ENDEVCO	7264-2000	G
3	HEAD	Z	J35560	Accel.,full bridge	ENDEVCO	7264-2000	G
4	UPPER NECK FORCE	X	810 FX	Load cell, six axis neck	R. A. Denton	IF-234	N
5	UPPER NECK FORCE	Y	810 FY	Load cell, six axis neck	R. A. Denton	IF-234	N
6	UPPER NECK FORCE	Z	810 FZ	Load cell, six axis neck	R. A. Denton	IF-234	N
7	UPPER NECK MOMENT	X	810 MX	Load cell, six axis neck	R. A. Denton	IF-234	Nm
8	UPPER NECK MOMENT	Y	810 MY	Load cell, six axis neck	R. A. Denton	IF-234	Nm
9	UPPER NECK MOMENT	Z	810 MZ	Load cell, six axis neck	R. A. Denton	IF-234	Nm