

REPORT NUMBER TR-P32011-12-NC

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

**TOYOTA MOTOR CORPORATION
2012 LEXUS ES350
4-DOOR SEDAN**

NHTSA NUMBER: MC5115TWG3

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

APRIL 4, 2012

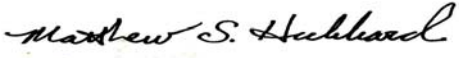
FINAL REPORT

PREPARED FOR:

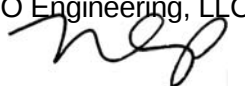
**ALPHA TECHNOLOGY ASSOCIATE, INC.
2810 OLD LEE HWY, SUITE 120
FAIRFAX, VA 22031**

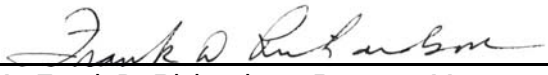
This final test report was prepared for the U.S. Department of Transportation, Alpha Technology Associate, Inc., in response to Contract Number DTNH22-06-D-00027.

This publication is distributed by the U.S. Department of Transportation, Alpha Technology Associate, Inc., 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 Alpha Technology Associate, Inc. 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.

Reviewed By: 
Mr. Kelsey Chiu, Engineering Department Supervisor
KARCO Engineering, LLC.


Mr. Michael L. Dunlap, Director of Operations
KARCO Engineering, LLC.

Approved By: 
Mr. Frank D. Richardson, Program Manager
KARCO Engineering, LLC.

Approval Date: _____

FINAL REPORT ACCEPTED BY:

Engineer, Alpha Technology Associate, Inc.

Date of Acceptance

TABLE OF CONTENTS

<u>Section</u>	<u>Description</u>	<u>Page</u>
1	Purpose and Summary of Test MC5115TWG3	1
2	Occupant and Vehicle Information	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	9

<u>Appendix</u>	<u>Description</u>	<u>Appendix</u>
A	Photographs	A
B	Data Plots	B
C	Instrumentation Data Channel Assignments	C
D	Pre-Test and Post-Test Hybrid III 3 year old Configuration and Performance Verification Data	D

SECTION 1

PURPOSE AND SUMMARY OF TEST MC5115TWG3

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 Alpha Technology Associate, Inc. under Contract No. DTNH22-06-D-00027. 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 roof mounted curtain airbag and a torso airbag deployment in a 2012 Lexus ES350 4-Door Sedan with an out-of-position Hybrid III 3 year old dummy were evaluated. The test was performed at KARCO Engineering LLC on April 4, 2012. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

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

A Hybrid III 3 year old anthropomorphic test device (ATD) was placed in the right rear passenger seating position facing rearward according to the dummy placement instructions (3.3.3.2) 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 3 year old ATD was instrumented with head tri-axial accelerometers, and upper and lower neck transducers.

Fifteen (15) 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. Appendix D contains Hybrid III 3 year old calibration sheets.

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

The Hybrid III 3 year old dummy's visible contact points were as follows: The curtain airbag contacted the ATD's head and the torso airbag contacted the ATD's chest.

OUT OF POSITION OCCUPANT DATA SUMMARY

ATD Position	HIC ₁₅
Passenger	19.3

Orientation of the Hybrid III 3 year old dummy was in the rearward facing position kneeling against the seat back. The dummy's sternum was aligned with the deploying trajectory of the torso airbag. This orientation complies with section 3.3.3.2 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: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3
Test Program: TWG 3.3.3.2 Test Date: 04/04/12

CONVERSION FACTORS

Quantity	Typical Application	Std Units	Metric Unit	Multiply By
Mass	Vehicle Weight	lb	kg	0.4536
Linear Velocity	Impact Velocity	miles/hr	km/hr	1.609344
Length or Distance	Measurements	in	mm	25.4
Volume	Fuel Systems	gal	liter	3.785
Volume	Small Fluids	oz	mL	29.574
Pressure	Tire Pressures	lbf/in ²	kPa	6.895
Temperature	General Use	°F	°C	$=(tf - 32)/1.8$
Force	Dynamic Forces	lbf	N	4.448
Moment	Torque	lbf-ft	N•m	1.355

DATA SHEET NO. 1

TEST SUMMARY

Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3

Test Program: TWG 3.3.3.2 Test Date: 04/04/12

TEST DUMMY INFORMATION

Description	Passenger Seat Rearward Facing
Dummy Type / Serial No.	Hybrid III 3 year old / 044
Head Contact	Yes
Chest Contact	Yes
Abdomen Contact	Yes
Pelvis	None
Left Knee Contact	None
Right Knee Contact	None

VIDEO COVERAGE

High Speed Digital	2
Real Time	1
Total	3

DATA CHANNELS

Hybrid III 3 YO ATD Sensors	15
Belt Assessment Sensors	0
Vehicle Structure Accelerometers	0
Total	15

DATA SHEET NO. 2**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3
 Test Program: TWG 3.3.3.2 Test Date: 04/04/12

TEST VEHICLE INFORMATION

Make	Lexus
Model	ES350
Body Style	4-Door Sedan
NHTSA No.	MC5115TWG3
VIN	JTHBK1EG2C2480046
Color	Deep Sea Mica
Delivery Date	December 26, 2011
Odometer (km./mi.)	14 / 9
Dealer	Longo Lexus
Transmission	Automatic
Final Drive	Front
Type/Number Cylinders	V6
Engine Displacement (L)	3.5
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	Yes
Tilt Steering Wheel	Yes
Power Windows	Yes
Power Seats	Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation	GVWR (kg)	2122
Date of Manufacture	October-11	GAWR Front (kg)	1210
		GAWR Rear (kg)	1070

DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	210	210
Recommend Tire Size	P215/55R17	P215/55R17
Tire Size on Vehicle	P215/55R17	P215/55R17
Tire Manufacturer	Michelin	Michelin

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				407

* Vehicle had undergone New Car Assessment Program Testing
 on January 11, 2012

DATA SHEET NO. 3

TEST VEHICLE INFORMATION

Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3
Test Program: TWG 3.3.3.2 Test Date: 04/04/12

NOMINAL DESIGN RIDING POSITION

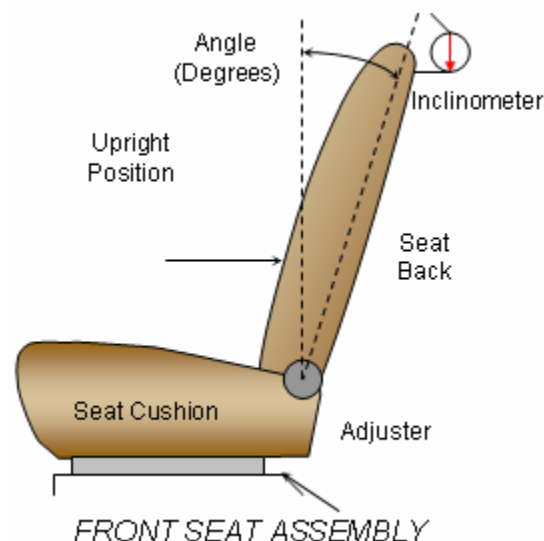
The passenger seat back is positioned to section 3.3.3.2 of the TWG recommendation in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags. Seat back angle is measured at the headrest post.

SEAT BACK ANGLES

Position	Deg.
Passenger w/ Dummy	3.7

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	Fixed	Fixed

DATA SHEET NO. 4

DUMMY POSITIONING INFORMATION

Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3
 Test Program: TWG 3.3.3.2 Test Date: 04/04/12

TEST DUMMY POSITION MEASUREMENTS

Code	Measurement Description	Hybrid III 3YO	
		Length (mm)	Angle (°)
SA	Seat Back Angle		3.7
AMW	Side Airbag Module Width (Torso / Curtain)	35 / 30	
ABW	Side Airbag Width (Torso / Curtain)	450 / 400	
AML	Side Airbag Module Length (Torso / Curtain)	140 / 300	
ABL	Side Airbag Length (Torso / Curtain)	350 / 1770	
AN	Top of Airbag Module to Head/Neck Junction	154	
HD	Head CG to Door Panel/ Window	37	
HSC	Head to Seat Back Centerline	235	
HB	Head to B-Pillar (first contact)	92	
HZ	Head to Roof (Z)	23	
HHD	Head to Header		
ND	Nose to Dash		
NS	Nose to Seat Back		
NR	Nose to Header		
CD	Chest to Dash		
CS	Chest to Seat Back	0	
RACL	Right Arm to Seat Back Centerline	142	
LACL	Left Arm to Seat Back Centerline	395	
RA	Right Arm to Door Panel	243	
LA	Left Arm to Door Panel	4	
KK	Knee to Knee	130	
TT	Toe to Toe	260	
KSCR	Right Knee to Seat Cushion Centerline	128	
KSCL	Left Knee to Seat Cushion Centerline	245	
	Head Level (X Direction)		36.8
	Head Level (Y Direction)		5.2

DATA SHEET NO. 5

HYBRID III ATD INJURY CRITERIA AND SENSOR DATA

Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3
 Test Program: TWG 3.3.3.2 Test Date: 04/04/12

HEAD PEAK ACCELERATIONS

Location	Axis	Units	Pass. 3 YO			
			Max	Time	Min	Time
Head CG	X	G's	4.5	58.5	-18.8	11.8
Head CG	Y	G's	10.1	25.0	-5.0	16.4
Head CG	Z	G's	32.7	13.0	-3.5	38.3
Head CG Resultant	N/A	G's	34.9	12.9		

UPPER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. 3 YO			
			Max	Time	Min	Time
Neck Force	X	Newtons	28.4	7.4	-268.0	16.2
Neck Force	Y	Newtons	150.5	22.8	-217.0	14.7
Neck Force	Z	Newtons	785.5	13.1	-212.0	0.0
Neck Force Resultant	N/A	Newtons	831.9	13.1		
Neck Moment	X	Nm	14.3	31.3	-12.1	19.3
Neck Moment	Y	Nm	10.1	90.0	-9.2	15.1
Neck Moment	Z	Nm	1.4	0.0	-11.4	18.3
Neck Moment Resultant	N/A	Nm	17.5	18.5		

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	Pass. 3 YO			
			Max	Time	Min	Time
Neck Force	X	Newtons	30.2	5.8	-454.5	12.5
Neck Force	Y	Newtons	37.2	24.3	-369.4	14.1
Neck Force	Z	Newtons	883.2	13.0	-55.7	220.6
Neck Force Resultant	N/A	Newtons	1034.1	12.9		
Neck Moment	X	Nm	19.9	33.3	-25.5	14.5
Neck Moment	Y	Nm	22.9	13.9	-1.7	299.0
Neck Moment	Z	Nm	2.2	195.7	-17.8	18.9
Neck Moment Resultant	N/A	Nm	37.3	14.3		

HEAD INJURY CRITERIA (HIC 15)

Location	Pass. 3 YO			
	HIC15	T ¹	T ²	Avg G
Head CG	19.3	7.3	15.3	22.4

UPPER NECK NIJ VALUES

Location	Pass. 3 YO			
	Ntf	Nte	Ncf	Nce
Upper Neck	0.18	0.69	0.08	0.06

DATA SHEET NO. 6**CAMERA LOCATIONS**Test Vehicle: 2012 Lexus ES350 4-Door Sedan NHTSA No.: MC5115TWG3Test Program: TWG 3.3.3.2 Test Date: 04/04/12

No.	Camera View	Location (mm)			Angle (Deg.)	Lens (mm)	Speed (fps)
		X	Y	Z			
1	Real Time	-15	-2680	-1030	-0.4	n/a	30
2	High Speed Side View	-15	-2660	-965	-0.4	35	1000
3	High Speed 3/4 View	-1840	-2095	-1060	3.6	50	1000

* All measurements are taken relative to CG of dummy's head.

APPENDIX A

PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Figure		Page
1	Right Front $\frac{3}{4}$ View, As Received	A-1
2	Vehicle Certification Label	A-1
3	Post-Test Front View of NCAP Frontal Impact Test	A-2
4	Post-Test Left Front $\frac{3}{4}$ View of NCAP Frontal Impact Test	A-2
5	Post-Test Right Front $\frac{3}{4}$ View of NCAP Frontal Impact Test	A-3
6	Post-Test Right Side View of NCAP Frontal Impact Test	A-3
7	Pre-Test Dummy Position, Left Side View	A-4
8	Post-Test Dummy Position, Left Side View	A-4
9	Pre-Test Dummy Position, $\frac{3}{4}$ View	A-5
10	Post-Test Dummy Position, $\frac{3}{4}$ View	A-5
11	Pre-Test Dummy Position, Front View	A-6
12	Post-Test Dummy Position, Front View	A-6
13	Post-Test Airbags, Left Side View	A-7
14	Post-Test Airbags, Left Front $\frac{3}{4}$ View	A-7



FIGURE 1. Right Front ¾ View, As Received



FIGURE 2. Vehicle Certification Label

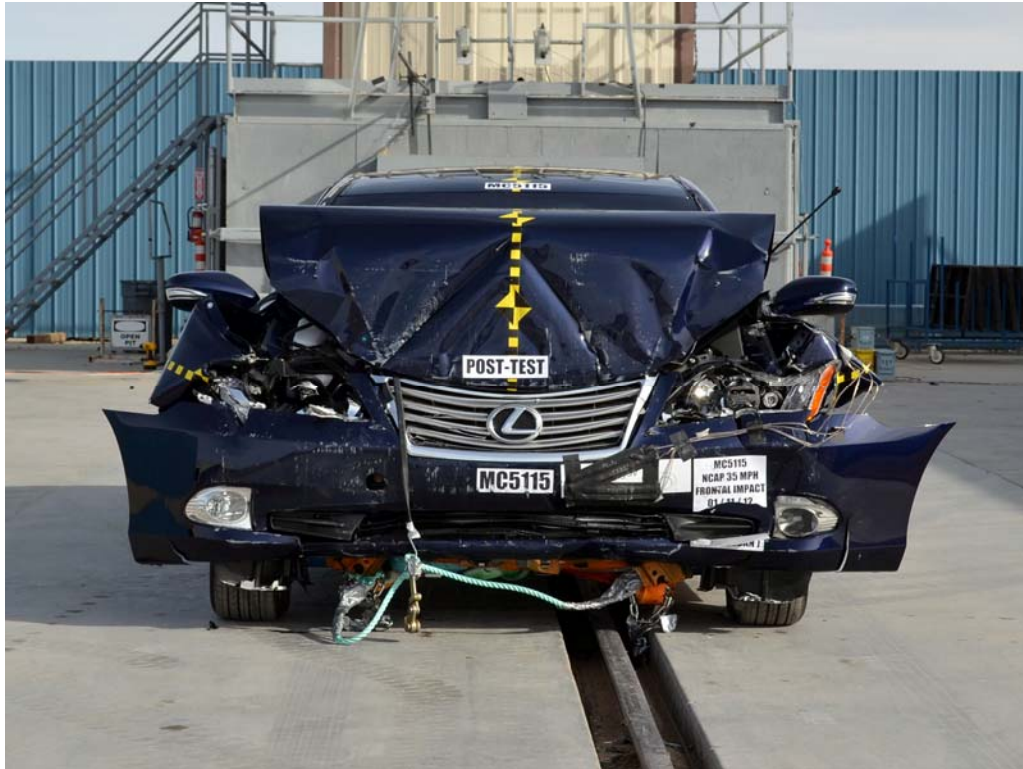


FIGURE 3. Post-Test Front View of NCAP Frontal Impact Test



FIGURE 4. Post-Test Left Front ¾ View of NCAP Frontal Impact Test



FIGURE 5. Post-Test Right Front 3/4 View of NCAP Frontal Impact Test



FIGURE 6. Post-Test Right Side View of NCAP Frontal Impact Test



FIGURE 7. Pre-Test Dummy Position, Left Side View



FIGURE 8. Post-Test Dummy Position, Left Side View



FIGURE 9. Pre-Test Dummy Position, ¾ View



FIGURE 10. Post-Test Dummy Position, ¾ View



FIGURE 11. Pre-Test Dummy Position, Front View



FIGURE 12. Post-Test Dummy Position, Front View



FIGURE 13. Post-Test Airbags, Left Side View



FIGURE 14. Post-Test Airbags, Left Front ¾ View

APPENDIX B

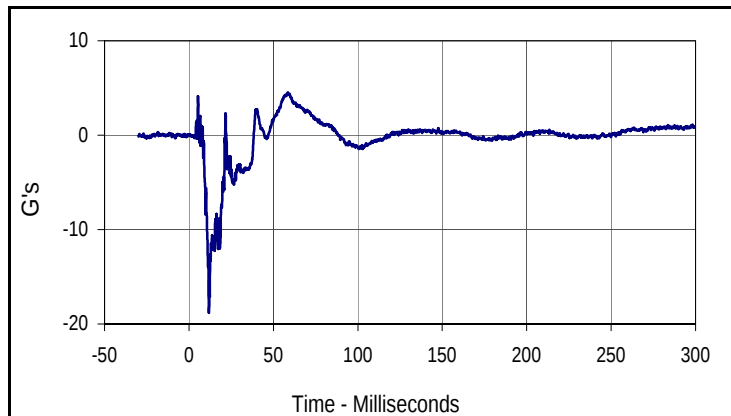
DATA PLOTS

TABLE OF DATAPLOTS

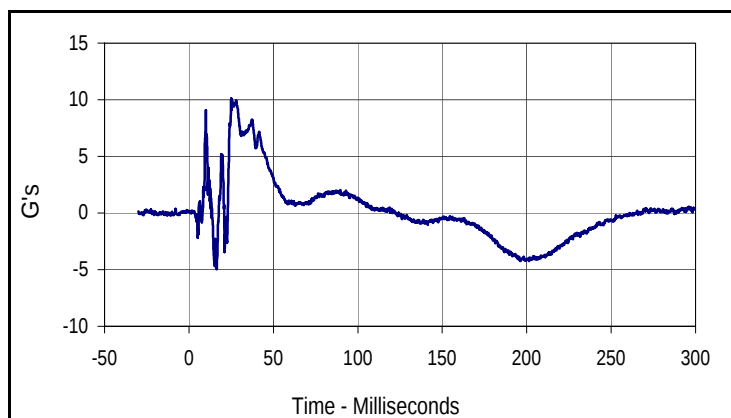
Plot		Page
1	Pass. (3 Yr. Old) Head X	B-1
2	Pass. (3 Yr. Old) Head Y	B-1
3	Pass. (3 Yr. Old) Head Z	B-1
4	Pass. (3 Yr. Old) Head Resultant	B-1
5	Pass. (3 Yr. Old) Upper Neck Force X	B-2
6	Pass. (3 Yr. Old) Upper Neck Force Y	B-2
7	Pass. (3 Yr. Old) Upper Neck Force Z	B-2
8	Pass. (3 Yr. Old) Upper Neck Force Resultant	B-2
9	Pass. (3 Yr. Old) Upper Neck Moment X	B-3
10	Pass. (3 Yr. Old) Upper Neck Moment Y	B-3
11	Pass. (3 Yr. Old) Upper Neck Moment Z	B-3
12	Pass. (3 Yr. Old) Upper Neck Moment Resultant	B-3
13	Pass. (3 Yr. Old) Lower Neck Force X	B-4
14	Pass. (3 Yr. Old) Lower Neck Force Y	B-4
15	Pass. (3 Yr. Old) Lower Neck Force Z	B-4
16	Pass. (3 Yr. Old) Lower Neck Force Resultant	B-4
17	Pass. (3 Yr. Old) Lower Neck Moment X	B-5
18	Pass. (3 Yr. Old) Lower Neck Moment Y	B-5
19	Pass. (3 Yr. Old) Lower Neck Moment Z	B-5
20	Pass. (3 Yr. Old) Lower Neck Moment Resultant	B-5

Test Vehicle: 2012 Lexus ES350 4-Door Sedan
 Test Program: TWG 3.3.3.2

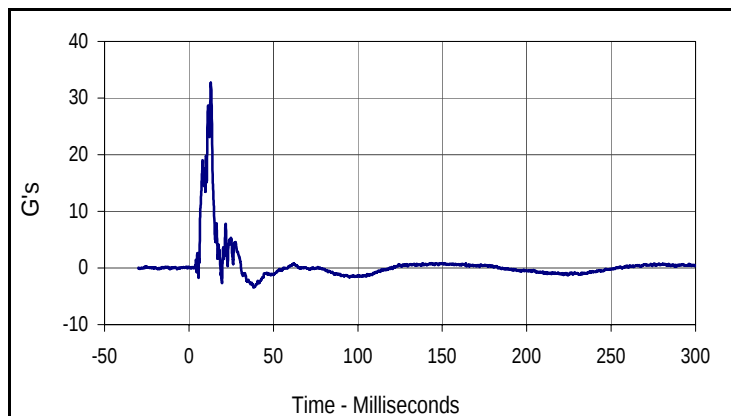
Test Date: 4/4/12
 NHTSA No.: MC5115TWG3



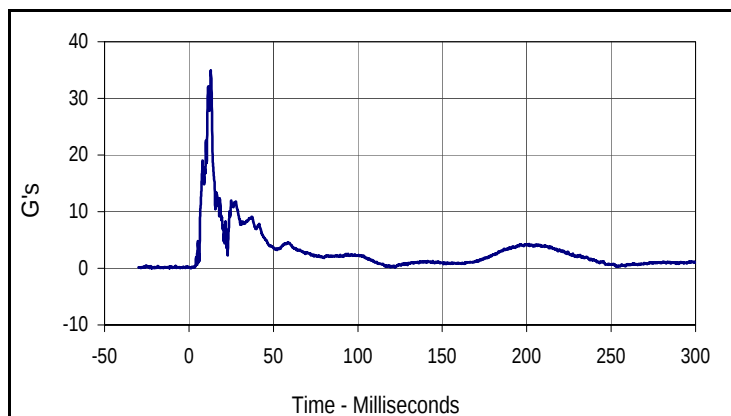
Curve Description			
3 Yr. Old Head X			
CURNO	Type	SAE Class	Units
001	FIL	1000	G's
Max	Time	Min	Time
4.5	58.5	-18.8	11.8



Curve Description			
3 Yr. Old Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
10.1	25.0	-5.0	16.4



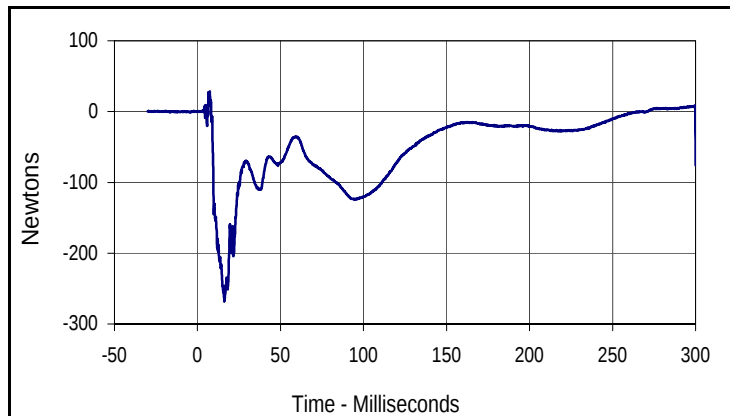
Curve Description			
3 Yr. Old Head Z			
CURNO	Type	SAE Class	Units
003	FIL	1000	G's
Max	Time	Min	Time
32.7	13.0	-3.5	38.3



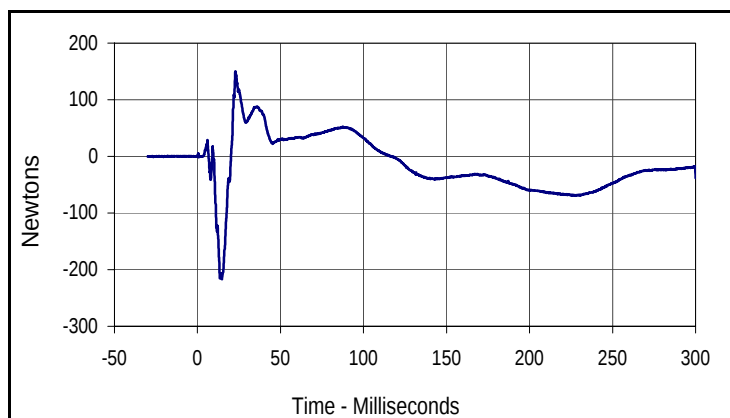
Curve Description			
3 Yr. Old Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
34.9	12.9	0.0	1.0

Test Vehicle: 2012 Lexus ES350 4-Door Sedan
 Test Program: TWG 3.3.3.2

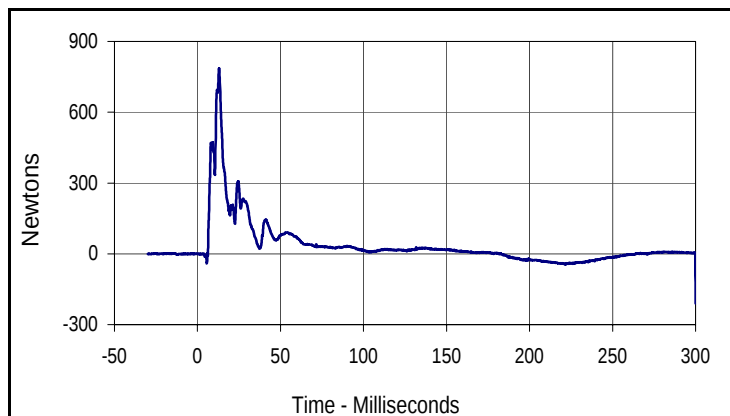
Test Date: 4/4/12
 NHTSA No.: MC5115TWG3



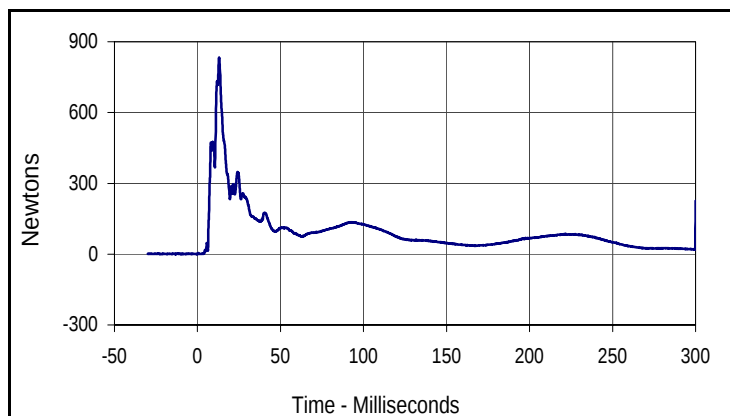
Curve Description			
3 Yr. Old Upper Neck Force X			
CURNO	Type	SAE Class	Units
004	FIL	1000	Newtons
Max	Time	Min	Time
28.4	7.4	-268.0	16.2



Curve Description			
3 Yr. Old Upper Neck Force Y			
CURNO	Type	SAE Class	Units
005	FIL	1000	Newtons
Max	Time	Min	Time
150.5	22.8	-217.0	14.7



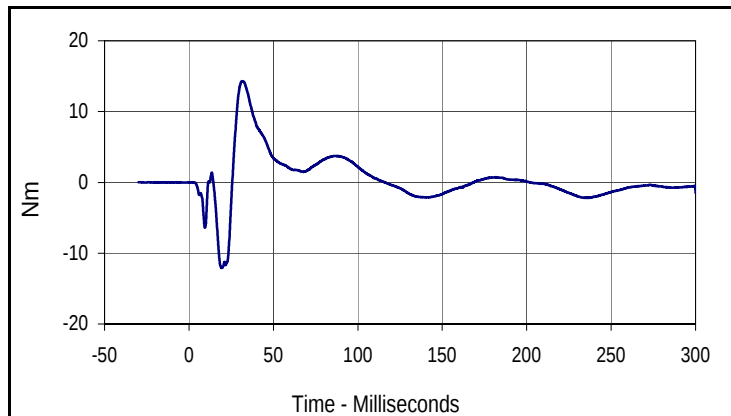
Curve Description			
3 Yr. Old Upper Neck Force Z			
CURNO	Type	SAE Class	Units
006	FIL	1000	Newtons
Max	Time	Min	Time
785.5	13.1	-212.0	0.0



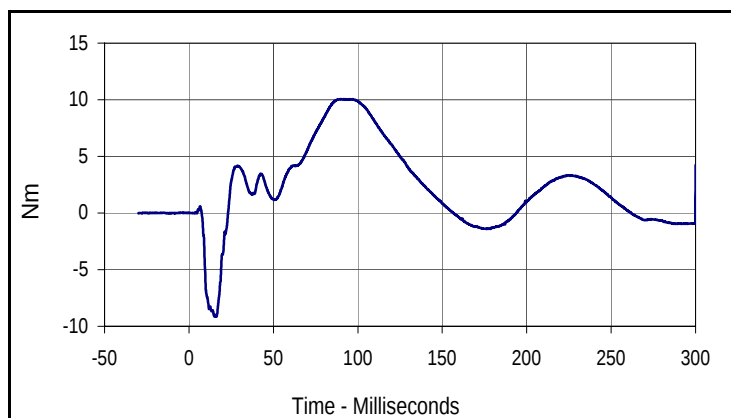
Curve Description			
3 Yr. Old Upper Neck Force Resultant			
CURNO	Type	SAE Class	Units
004	RES	1000	Newtons
Max	Time	Min	Time
831.9	13.1	0.4	0.9

Test Vehicle: 2012 Lexus ES350 4-Door Sedan
 Test Program: TWG 3.3.3.2

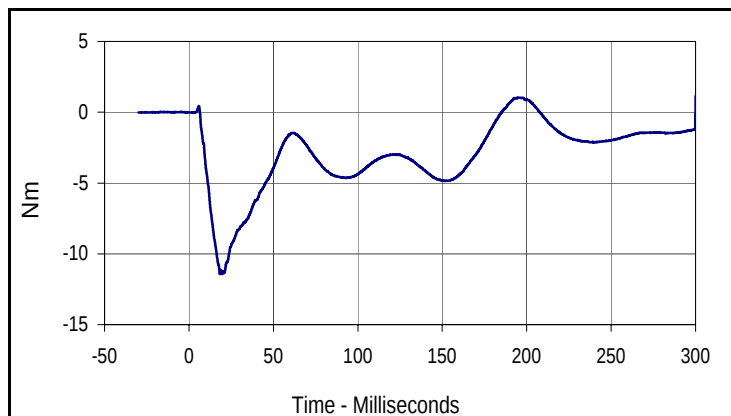
Test Date: 4/4/12
 NHTSA No.: MC5115TWG3



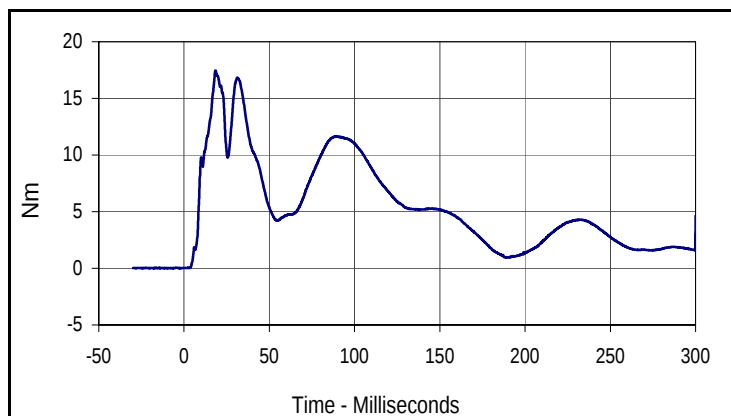
Curve Description			
3 Yr. Old Upper Neck Moment X			
CURNO	Type	SAE Class	Units
007	FIL	600	Nm
Max	Time	Min	Time
14.3	31.3	-12.1	19.3



Curve Description			
3 Yr. Old Upper Neck Moment Y			
CURNO	Type	SAE Class	Units
008	FIL	600	Nm
Max	Time	Min	Time
10.1	90.0	-9.2	15.1



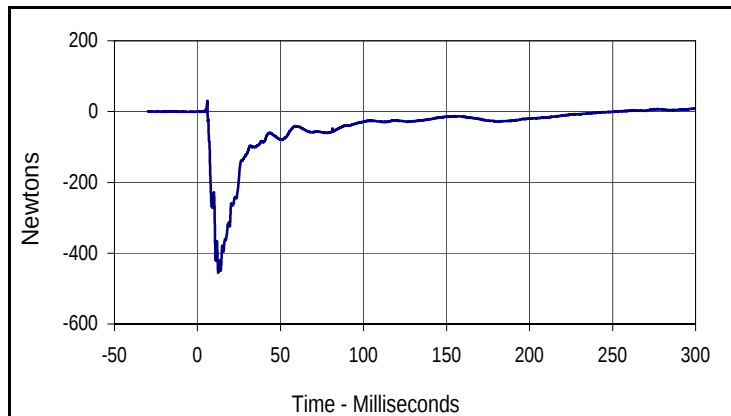
Curve Description			
3 Yr. Old Upper Neck Moment Z			
CURNO	Type	SAE Class	Units
009	FIL	600	Nm
Max	Time	Min	Time
1.4	0.0	-11.4	18.3



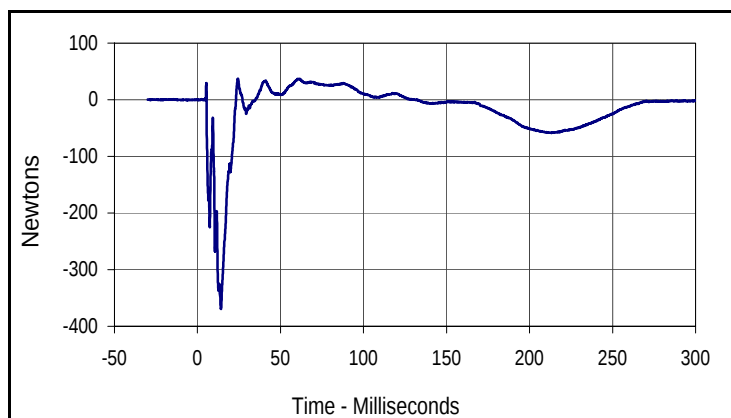
Curve Description			
3 Yr. Old Upper Neck Moment Resultant			
CURNO	Type	SAE Class	Units
007	RES	600	Nm
Max	Time	Min	Time
17.5	18.5	0.0	1.6

Test Vehicle: 2012 Lexus ES350 4-Door Sedan
 Test Program: TWG 3.3.3.2

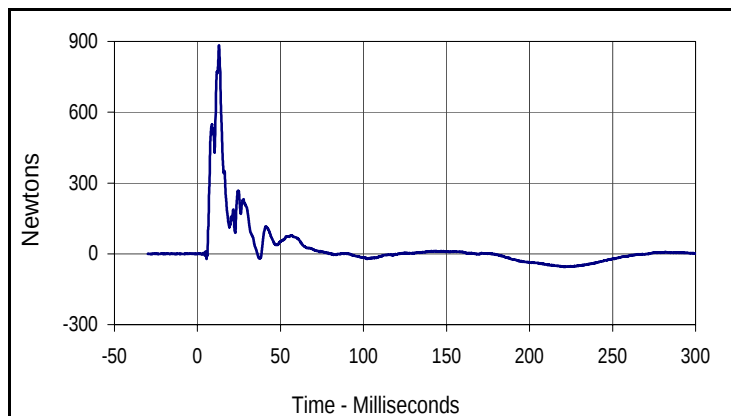
Test Date: 4/4/12
 NHTSA No.: MC5115TWG3



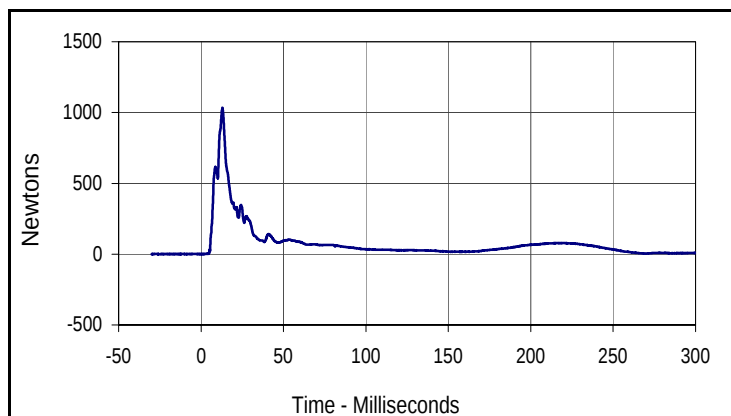
Curve Description			
3 Yr. Old Lower Neck Force X			
CURNO	Type	SAE Class	Units
010	FIL	1000	Newtons
Max	Time	Min	Time
30.2	5.8	-454.5	12.5



Curve Description			
3 Yr. Old Lower Neck Force Y			
CURNO	Type	SAE Class	Units
011	FIL	1000	Newtons
Max	Time	Min	Time
37.2	24.3	-369.4	14.1



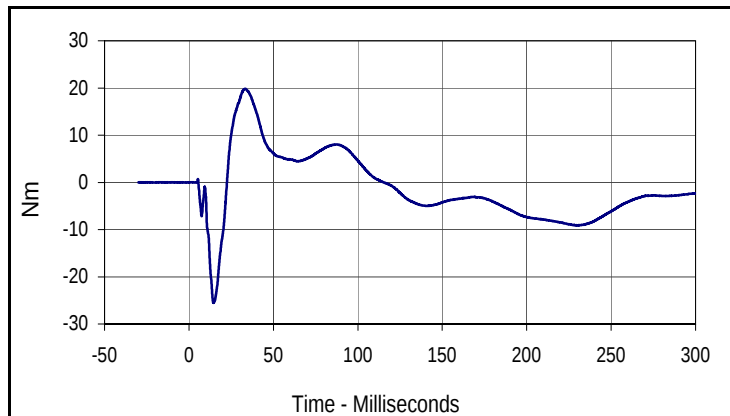
Curve Description			
3 Yr. Old Lower Neck Force Z			
CURNO	Type	SAE Class	Units
012	FIL	1000	Newtons
Max	Time	Min	Time
883.2	13.0	-55.7	220.6



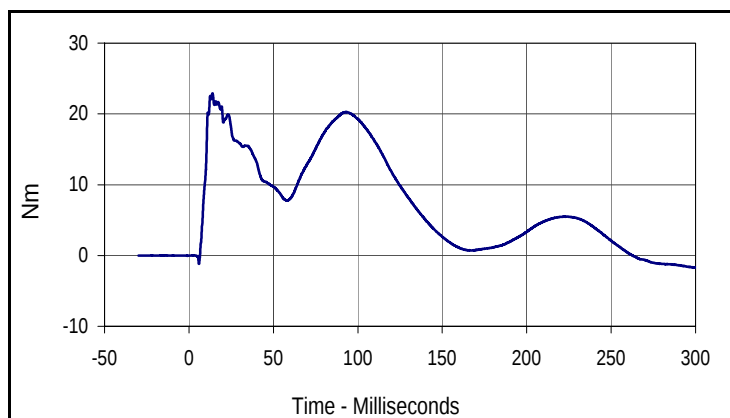
Curve Description			
3 Yr. Old Lower Neck Force Resultant			
CURNO	Type	SAE Class	Units
010	RES	1000	Newtons
Max	Time	Min	Time
1034.1	12.9	0.3	0.5

Test Vehicle: 2012 Lexus ES350 4-Door Sedan
 Test Program: TWG 3.3.3.2

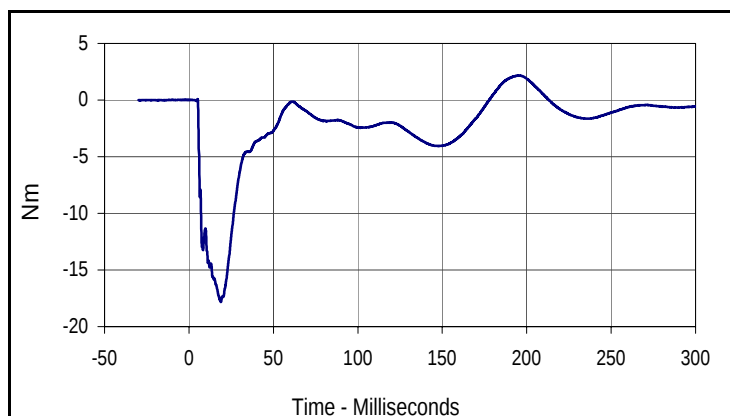
Test Date: 4/4/12
 NHTSA No.: MC5115TWG3



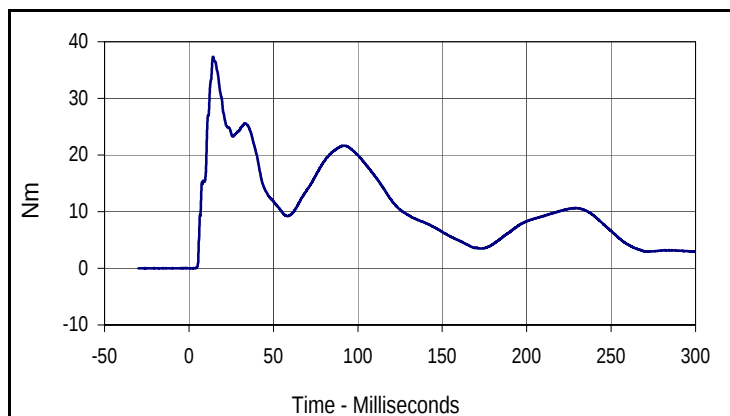
Curve Description			
3 Yr. Old Lower Neck Moment X			
CURNO	Type	SAE Class	Units
013	FIL	600	Nm
Max	Time	Min	Time
19.9	33.3	-25.5	14.5



Curve Description			
3 Yr. Old Lower Neck Moment Y			
CURNO	Type	SAE Class	Units
014	FIL	600	Nm
Max	Time	Min	Time
22.9	13.9	-1.7	299.0



Curve Description			
3 Yr. Old Lower Neck Moment Z			
CURNO	Type	SAE Class	Units
015	FIL	600	Nm
Max	Time	Min	Time
2.2	195.7	-17.8	18.9



Curve Description			
3 Yr. Old Lower Neck Moment Resultant			
CURNO	Type	SAE Class	Units
013	RES	600	Nm
Max	Time	Min	Time
37.3	14.3	0.0	0.4

APPENDIX C

INSTRUMENTATION DATA CHANNEL ASSIGNMENTS

TWG 3.3.3.2
Instrumentation Data Channel Assignments
A.T.D. Serial Number 044
4/4/12
2012 Lexus ES350 4-Door Sedan

CH.	LOCATION	AXIS	IDENT. NO.	DESCRIPTION	MFR	MODEL	UNITS
1	HEAD	X	P58808	Accel.,full bridge	ENDEVCO	7264C-2000	G
2	HEAD	Y	P49189	Accel.,full bridge	ENDEVCO	7264C-2000	G
3	HEAD	Z	P58861	Accel.,full bridge	ENDEVCO	7264C-2000	G
4	UPPER NECK FORCE	X	212	Load cell, six axis neck	R. A. Denton	3303	N
5	UPPER NECK FORCE	Y	212	Load cell, six axis neck	R. A. Denton	3303	N
6	UPPER NECK FORCE	Z	212	Load cell, six axis neck	R. A. Denton	3303	N
7	UPPER NECK MOMENT	X	212	Load cell, six axis neck	R. A. Denton	3303	Nm
8	UPPER NECK MOMENT	Y	212	Load cell, six axis neck	R. A. Denton	3303	Nm
9	UPPER NECK MOMENT	Z	212	Load cell, six axis neck	R. A. Denton	3303	Nm
10	LOWER NECK FORCE	X	93	Load cell, six axis neck	R. A. Denton	3303	N
11	LOWER NECK FORCE	Y	93	Load cell, six axis neck	R. A. Denton	3303	N
12	LOWER NECK FORCE	Z	93	Load cell, six axis neck	R. A. Denton	3303	N
13	LOWER NECK MOMENT	X	93	Load cell, six axis neck	R. A. Denton	3303	Nm
14	LOWER NECK MOMENT	Y	93	Load cell, six axis neck	R. A. Denton	3303	Nm
15	LOWER NECK MOMENT	Z	93	Load cell, six axis neck	R. A. Denton	3303	Nm

APPENDIX D

PRE-TEST AND POST-TEST HYBRID III 3 YEAR OLD CONFIGURATION AND PERFORMANCE VERIFICATION DATA

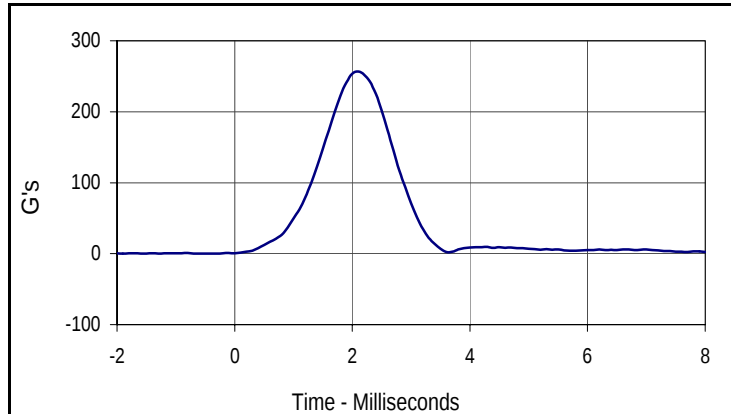
APPENDIX D
PRE-TEST / HIII CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Test Program: Hybrid III 3 Yr Old Head Drop Test
 ATD Serial No.: 044

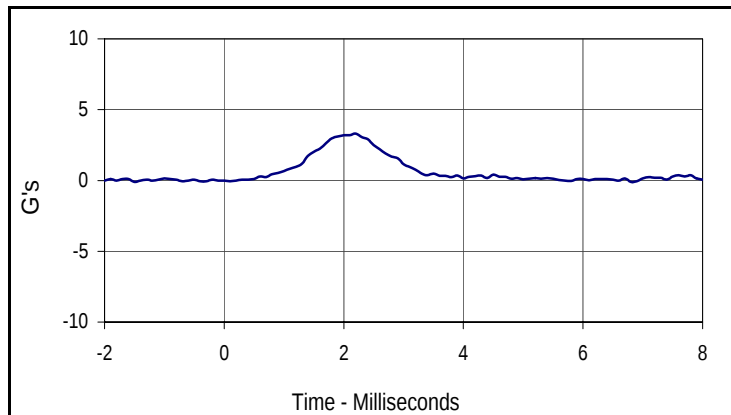
Test Date: 4/2/12
 Test I.D.: CHD04A



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	250.0 to 280.0	256.6	Pass
Peak Lateral Acceleration	G's	≤15.0	3.3	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
256.6	2.1	0.0	-0.7



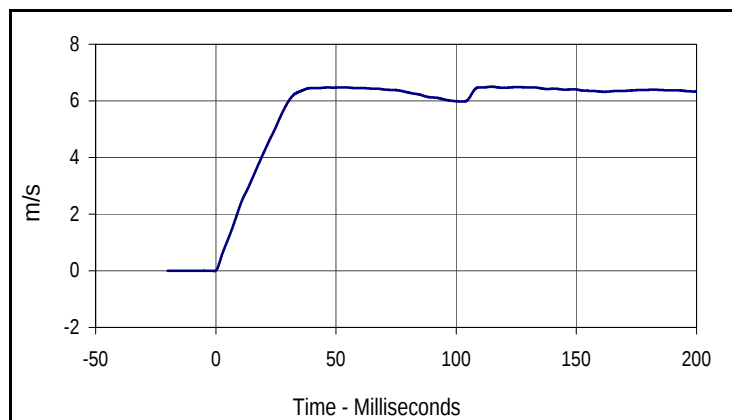
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
3.3	2.2	-0.1	-1.5

Test Program: Hybrid III 3 Yr Old Neck Flexion Test
 ATD Serial No.: 044

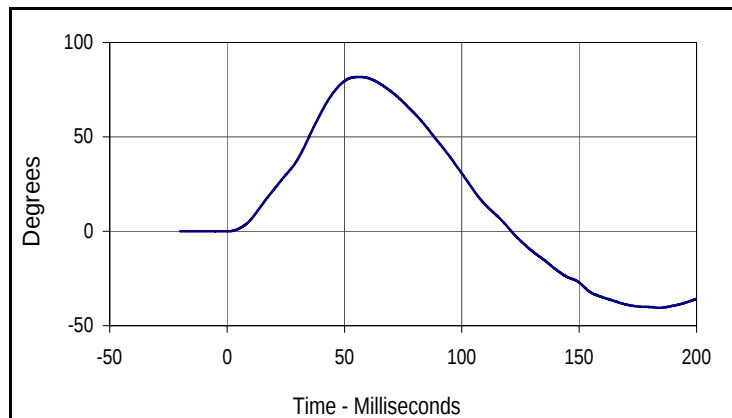
Test Date: 4/2/12
 Test I.D.: CNF04A



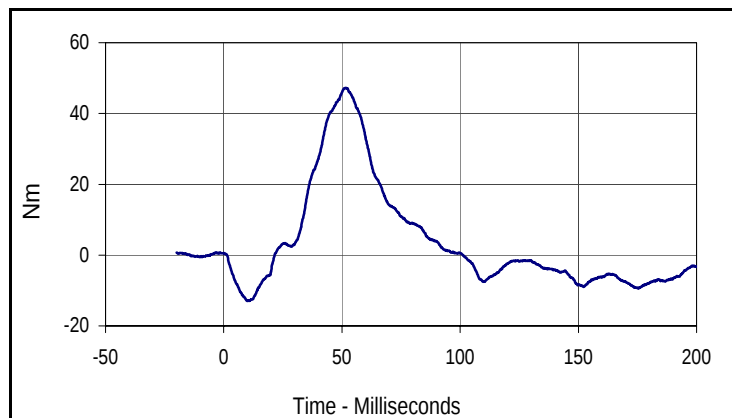
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.40 to 5.60	5.47	Pass
Pendulum Deceleration	10 Msec.	m/s	2.0 to 2.7	2.3	Pass
	15 Msec.	m/s	3.0 to 4.0	3.2	Pass
	20 Msec.	m/s	4.0 to 5.1	4.2	Pass
"D" Plane Rotation	Max	Degrees	70.0 to 82.0	81.7	Pass
Peak Moment in Rotation	Max	Nm	42.0 to 53.0	47.2	Pass
Positive Moment Decay, Time To 10 Nm		Msec.	60.0 to 80.0	76.7	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
6.5	114.8	0.0	-0.6



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
81.7	56.2	-40.5	184.3



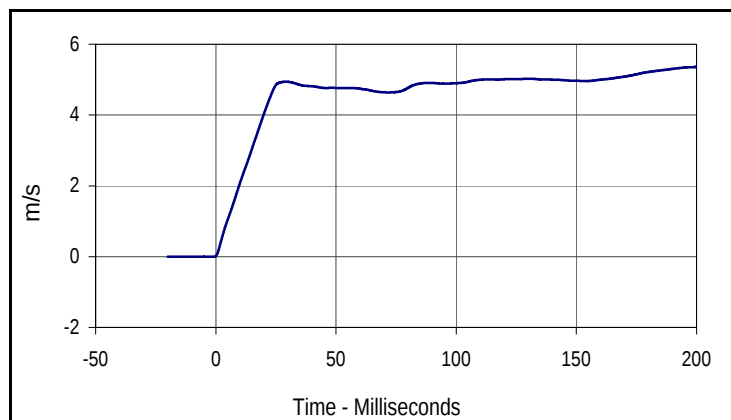
Curve Description			
Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
47.2	51.7	-13.0	10.0

Test Program: Hybrid III 3 Yr Old Neck Extension Test
 ATD Serial No.: 044

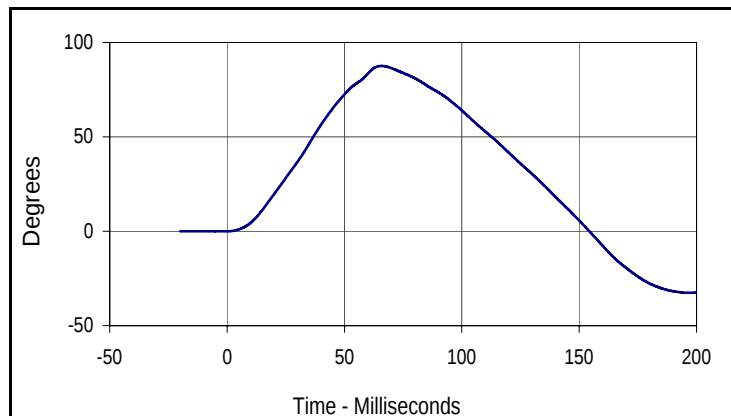
Test Date: 4/2/12
 Test I.D.: CNE04A



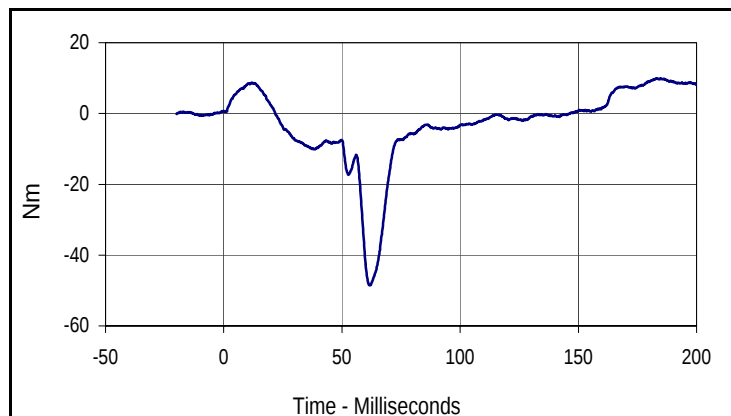
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	3.55 to 3.75	3.60	Pass
Pendulum Deceleration	6 Msec.	m/s	1.0 to 1.4	1.2	Pass
	10 Msec.	m/s	1.9 to 2.5	2.1	Pass
	14 Msec.	m/s	2.8 to 3.5	2.8	Pass
"D" Plane Rotation	Max	Degrees	83.0 to 93.0	87.6	Pass
Peak Moment in Rotation	Max	Nm	-43.7 to -53.3	-48.5	Pass
Positive Moment Decay, Time To -10 Nm		Msec.	60.0 to 80.0	71.8	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
5.4	200.0	0.0	-0.9



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
87.6	65.7	-32.6	200.0



Curve Description			
Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
10.0	183.3	-48.5	61.7

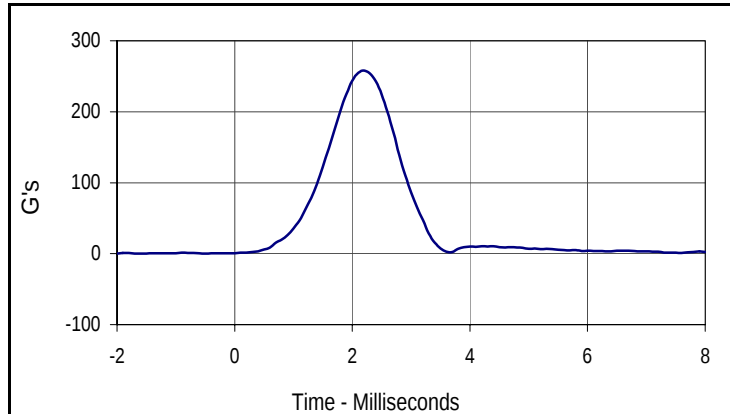
APPENDIX D
POST-TEST / HIII CONFIGURATION AND PERFORMANCE VERIFICATION DATA

Test Program: Hybrid III 3 Yr Old Head Drop Test
 ATD Serial No.: 044

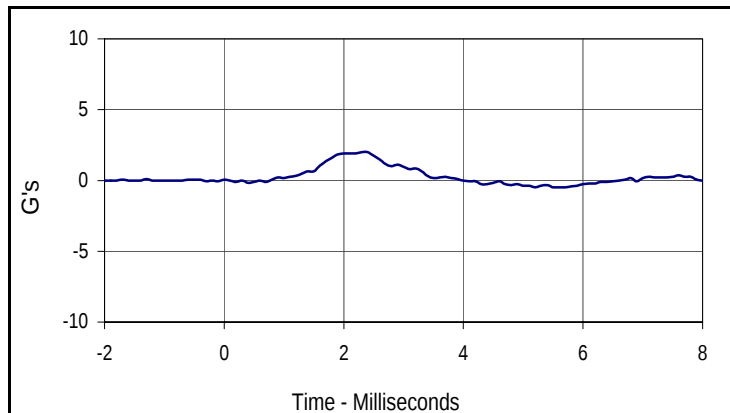
Test Date: 4/6/12
 Test I.D.: CHD04B



Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	°C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	30	Pass
Peak Resultant Acceleration	G's	250.0 to 280.0	258.1	Pass
Peak Lateral Acceleration	G's	≤15.0	2.0	Pass
Is Acceleration Unimodal?	Yes/No	Yes	Yes	Pass
Overall Test Results				Pass



Curve Description			
Head Resultant			
CURNO	Type	SAE Class	Units
001	RES	1000	G's
Max	Time	Min	Time
258.1	2.2	0.1	-0.5



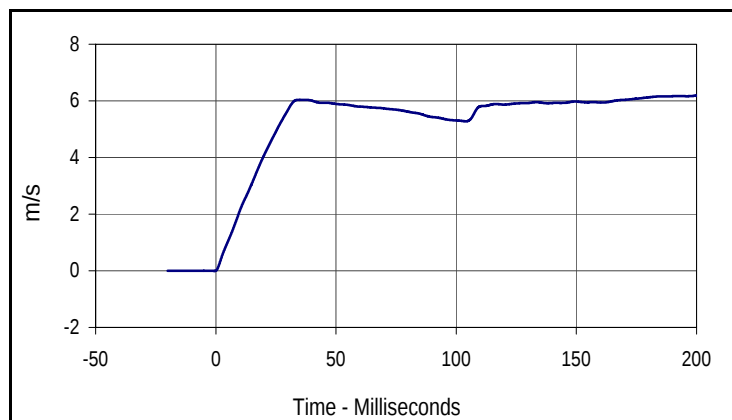
Curve Description			
Head Y			
CURNO	Type	SAE Class	Units
002	FIL	1000	G's
Max	Time	Min	Time
2.0	2.3	-0.5	5.2

Test Program: Hybrid III 3 Yr Old Neck Flexion Test
 ATD Serial No.: 044

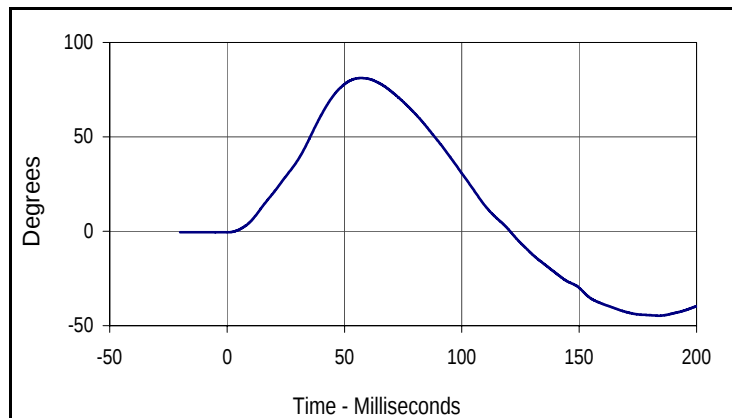
Test Date: 4/6/12
 Test I.D.: CNF04B



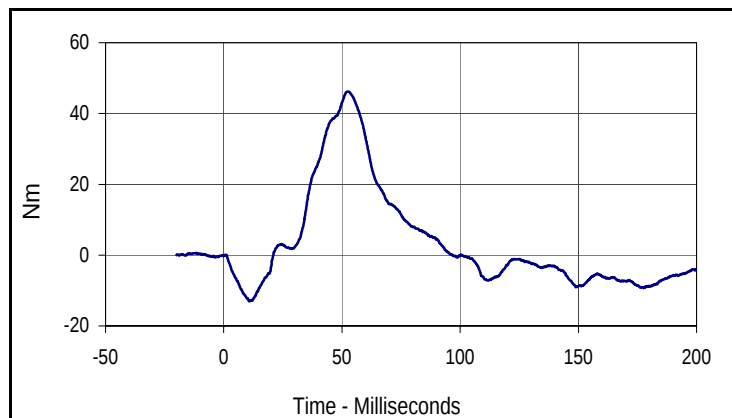
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	5.40 to 5.60	5.42	Pass
Pendulum Deceleration	10 Msec.	m/s	2.0 to 2.7	2.1	Pass
	15 Msec.	m/s	3.0 to 4.0	3.1	Pass
	20 Msec.	m/s	4.0 to 5.1	4.1	Pass
"D" Plane Rotation	Max	Degrees	70.0 to 82.0	81.1	Pass
Peak Moment in Rotation	Max	Nm	42.0 to 53.0	46.2	Pass
Positive Moment Decay, Time To 10 Nm		Msec.	60.0 to 80.0	76.5	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
6.2	200.0	0.0	-0.5



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
81.1	57.0	-44.7	183.9



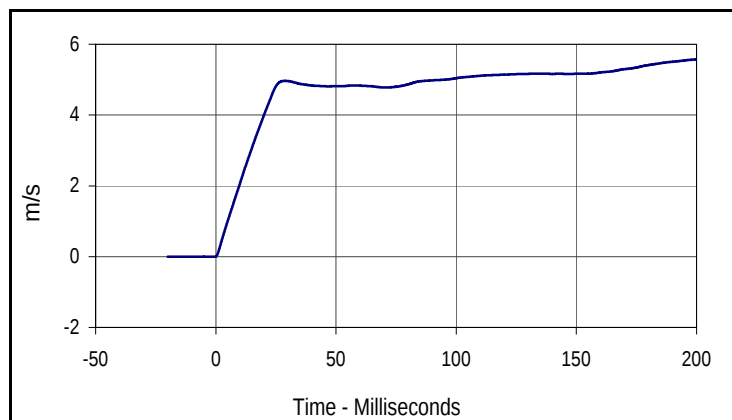
Curve Description			
Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
46.2	52.7	-13.0	10.8

Test Program: Hybrid III 3 Yr Old Neck Extension Test
 ATD Serial No.: 044

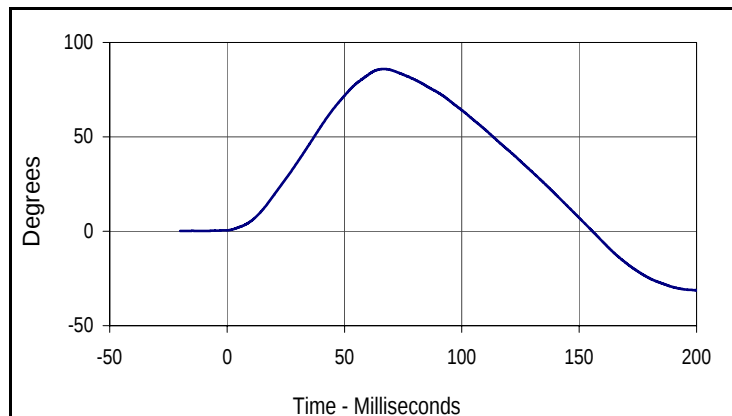
Test Date: 4/6/12
 Test I.D.: CNE04B



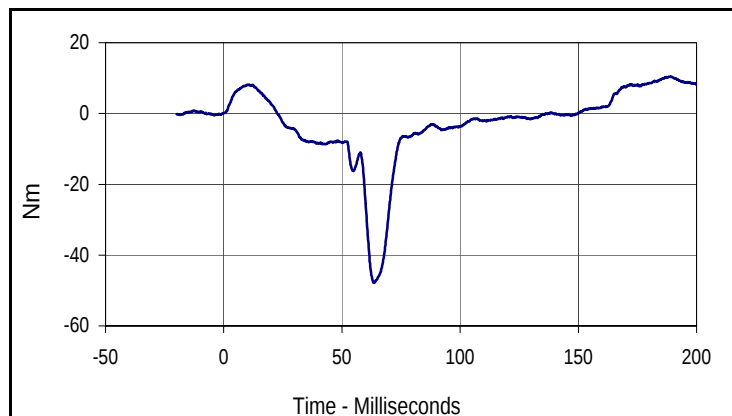
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		°C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Velocity		m/s	3.55 to 3.75	3.62	Pass
Pendulum Deceleration	6 Msec.	m/s	1.0 to 1.4	1.2	Pass
	10 Msec.	m/s	1.9 to 2.5	2.1	Pass
	14 Msec.	m/s	2.8 to 3.5	2.9	Pass
"D" Plane Rotation	Max	Degrees	83.0 to 93.0	85.9	Pass
Peak Moment in Rotation	Max	Nm	-43.7 to -53.3	-47.8	Pass
Positive Moment Decay, Time To -10 Nm		Msec.	60.0 to 80.0	73.5	Pass
			Overall Test Results		Pass



Curve Description			
Pendulum Velocity			
CURNO	Type	SAE Class	Units
001	FIL	180	m/s
Max	Time	Min	Time
5.6	200.0	0.0	-0.5



Curve Description			
"D" Plane Rotation			
CURNO	Type	SAE Class	Units
003	FIL	60	Degrees
Max	Time	Min	Time
85.9	66.7	-31.2	200.0



Curve Description			
Neck Moment Y			
CURNO	Type	SAE Class	Units
002	FIL	600	Nm
Max	Time	Min	Time
10.4	189.4	-47.8	63.5