



REPORT NUMBER: TWG-MGA-2009-001

**SIDE AIRBAG OUT-OF-POSITION INJURY
TECHNICAL WORKING GROUP**

**TOYOTA MOTOR CORPORATION
2009 TOYOTA YARIS
NHTSA NUMBER: M95108TWG2**

TEST DATE: SEPTEMBER 14, 2009

FINAL REPORT DATE: DECEMBER 8, 2009

FINAL REPORT

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The results presented in this report relate only to the specified test items.

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SECTION 1

PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain data in a static out-of-position side air bag deployment. These data constitute part of the general consumer information collected by Alpha Technology Associate, Inc.

SUMMARY

The effects of both a curtain and torso airbag deployment in a 2009 Toyota Yaris with an out-of-position SID-IIs Build Level D were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on September 14, 2009. Pre and post test photographs of the vehicle and dummy can be found in Appendix A.

Three high-speed cameras (1000 fps) were used to document the side airbag deployment event. The following camera locations were used:

- Left Side Through Removed Driver Door
- Front Through Windshield (video was lost)
- Left Side $\frac{3}{4}$ View Through Windshield

One SID-IIs Build Level D dummy (Serial Number 296) was placed in the right front passenger seat situated in the inboard-facing position per Section 3.3.5.3 according to dummy placement instructions specified in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG).

The dummy was instrumented with the following instrumentation:

- | | |
|-----------------------------|------------------------------|
| • Head Accelerations | • Rib Accelerations |
| • Upper Neck Load Cell | • Left Ilium Crest Load Cell |
| • Lower Neck Load Cell | • Left Acetabulum Load Cell |
| • Upper Spine Accelerations | • Spine Box Accelerations |
| • Lower Spine Accelerations | • Pelvic Accelerations |
| • Rib Displacements | |

The 41 channels of data were recorded on an on-board data acquisition system. Appendix B contains the dummy data traces.

The SID-IIs dummy's visible contact points were as follows:

- Curtain airbag to top and front of head
- Torso bag to left shoulder and left torso

The SID-II's dummy was placed in the right front passenger seat facing toward the center of the vehicle with its arm against the seatback. The arm was rotated horizontally in the forward direction with respect to the dummy. The seat was left in the rearmost position. The dummy's pelvis was slid outboard until the dummy's back contacted the door trim panel or armrest and the CG of the head was centered in the deployment trajectory of the airbag. The vertical plane through the centerline of the dummy's rib-stiffener and shoulder bolt was parallel to the centerline of the vehicle. Masking tape was wrapped around the dummy's neck bracket to hold the dummy in place.

This orientation complies with Section 3.3.5.3 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
TEST SUMMARY

	Test Data	Description
Seating Position	P2	Right Front Seating Position
Test	3.3.5.3*	Side-facing SID-IIs dummy
Curtain Airbag	Roof-Rail Mounted	Side Airbag
Torso Airbag	Seat Mounted	Side Airbag
ATD Type/Serial No.	SID-IIs Build Level D / 296	5 th Percentile Adult Female

* Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Data Channels	41
Number of High-Speed Video	3

Visible Dummy Contact Points	
Head Contact	Curtain airbag to top and front of head
Left Shoulder Contact	Torso bag
Left Torso Contact	Torso bag
Left Pelvis Contact	None

DATA SHEET NO. 2**TEST VEHICLE INFORMATION**

Please note that this vehicle had previously been tested in an
NCAP Side Impact on November 14, 2008.

TEST VEHICLE INFORMATION

Manufacturer	Toyota
Model	Yaris
Body Style	Sedan
NHTSA No.	M95108TWG2
VIN	JTDBT903491297523
Color	Silver Streak
Delivery Date	11/04/2008
Odometer Reading (mile)	28
Dealer	Basil Toyota
Transmission	Manual Overdrive
Final Drive	Front
Number of Cylinders	4
Engine Displacement (L)	1.5
Engine Placement	Lateral
Automatic Door Lock (ADL)	No
Owners Manual Details Instructions on Disabling ADLs	N/A
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	Yes
Rear Passenger Side Curtain Airbag	Yes
Rear Passenger Side Torso Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	No
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	No
All Wheel Drive	No
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Corporation
Date of Manufacture	08/08

GVWR (kg)	1497
GAWR Front (kg)	835
GAWR Rear (kg)	826

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				383
Cargo Wt. (RCLW) (kg)				43

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position		Rearmost
Seat Height Position		Non-Adjustable
Placed in Position No. 2		---
Seat Back Angle	SA (°)	25
Top of Airbag Module to Head/Neck Junction	AN (mm)	305
Head CG to Door Panel/Window	HD (mm)	152
Head to Seat Back Centerline	HSC (mm)	162
Chest to Dash	CD (mm)	585
Chest to Seatback	CS (mm)	227
Right Arm to Seat Back Centerline	RACL (mm)	---
Left Arm to Seat Back Centerline	LACL (mm)	---
Right Arm to Door Panel	RA (mm)	---
Left Arm to B-Post	LA (mm)	108
Knee to Knee	KK (mm)	123
Toe to Toe	TT (mm)	98
Right Knee to Seat Cushion Centerline	KSCR (mm)	---
Left Knee to Seat Cushion Centerline	KSCL (mm)	---
Right Toe to Seat Cushion Centerline	TSCR (mm)	---
Left Toe to Seat Cushion Centerline	TSCL (mm)	---
Nose to Dash	ND (mm)	710
Nose to Seatback	NS (mm)	204
Top of Head to Headliner	HH (mm)	44

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. M95108TWG2

		MAXIMUM VALUE			
		Position No. 2			
DESCRIPTION	UNIT	MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	11.6	20.9	-12.1	54.5
Head Y	g	16.5	20.5	-3.9	10.2
Head Z	g	9.6	9.0	-4.9	16.2
Head Resultant	g	19.7	20.6		
Upper Neck Fx	N	484.3	22.3	-92.9	59.0
Upper Neck Fy	N	191.9	56.0	-20.3	297.1
Upper Neck Fz	N	49.4	7.1	-965.8	24.1
Upper Neck F Resultant	N	1081.7	24.1		
Upper Neck Mx	Nm	23.2	81.8	-11.7	13.7
Upper Neck My	Nm	50.3	22.5	-5.0	64.3
Upper Neck Mz	Nm	10.3	32.7	-0.3	10.4
Upper Neck M Resultant	Nm	51.4	22.5		
Lower Neck Fx	N	492.2	20.1	-130.2	8.1
Lower Neck Fy	N	337.0	10.8	-188.4	32.5
Lower Neck Fz	N	35.7	6.9	-941.6	24.5
Lower Neck F Resultant	N	1010.3	24.5		
Lower Neck Mx	Nm	36.3	58.7	-4.4	300.0
Lower Neck My	Nm	33.6	56.1	-13.9	21.1
Lower Neck Mz	Nm	13.2	13.2	-4.6	78.9
Lower Neck M Resultant	Nm	48.9	56.1		

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES

NHTSA No. M95108TWG2

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 2 Right Front	8.0	16.6	31.6	10.7	19.7	55.7

Position 2 Neck Injury Summary (SID-IIs Build Level D – Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.01	7.0	48.79	1.55	0.32
Nte	0.01	8.0	1.59	-6.58	-0.44
Ncf	0.51	24.0	-960.24	465.91	49.11
Nce	0.13	66.5	-267.28	-50.57	-4.93
Peak Tension (CFC1000)		49.4 N	Peak Compression (CFC 1000)		-965.8 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	3880 N	Extension (mCVe)	61 N-m	Tension	2070 N
Compression (CVc)	3880 N	Flexion (mCVf)	155 N-m	Compression	2520 N
Condyle Offset	0.01778 m				

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PHOTOGRAPHS

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Front ¾ View of Vehicle, As Received



Vehicle Certification Placard



Pre-Test Vehicle Left Side View



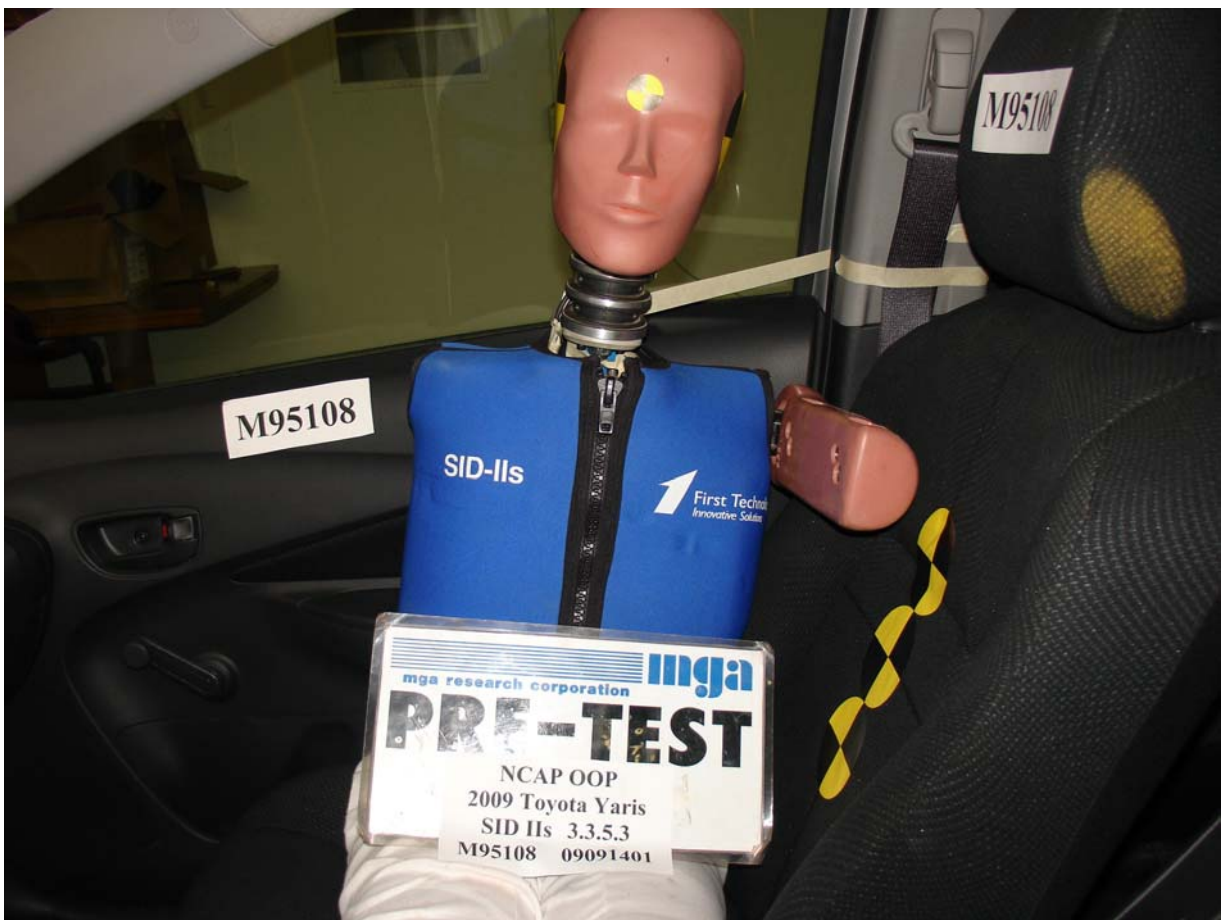
Post-Test Vehicle Left Side View



Pre-Test SID-IIs Dummy Left Side View



Post-Test SID-IIs Dummy Left Side View



Pre-Test SID-IIs Dummy Left Side Closeup View



Post-Test SID-IIs Dummy Left Side Closeup View



Pre-Test SID-11s Dummy Left $\frac{3}{4}$ Front View



Post-Test SID-11s Dummy Left $\frac{3}{4}$ Front View



Pre-Test SID-IIs Dummy Left $\frac{3}{4}$ Front Closeup View



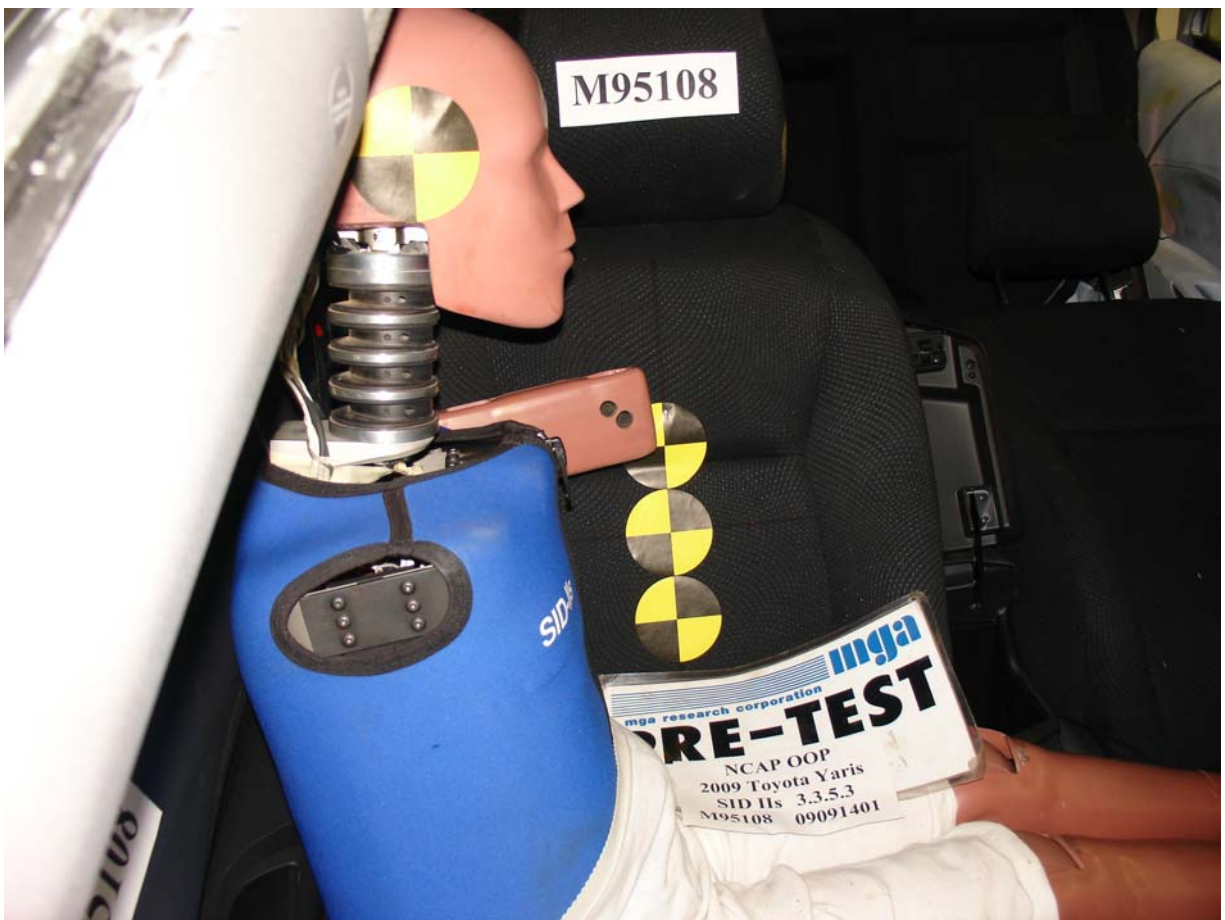
Post-Test SID-IIs Dummy Left $\frac{3}{4}$ Front Closeup View



Pre-Test SID-IIs Dummy Front View



Post-Test SID-IIs Dummy Front View



Pre-Test SID-IIs Dummy Front Closeup View



Post-Test SID-IIs Dummy Front Closeup View



Pre-Test SID-IIs Dummy Right ¾ Front View



Post-Test SID-IIs Dummy Right ¾ Front View



Post-Test SID-IIs Dummy Right Side Closeup View



Post-Test Right Front Passenger Compartment View



Post-Test Curtain and Torso Airbag Front View

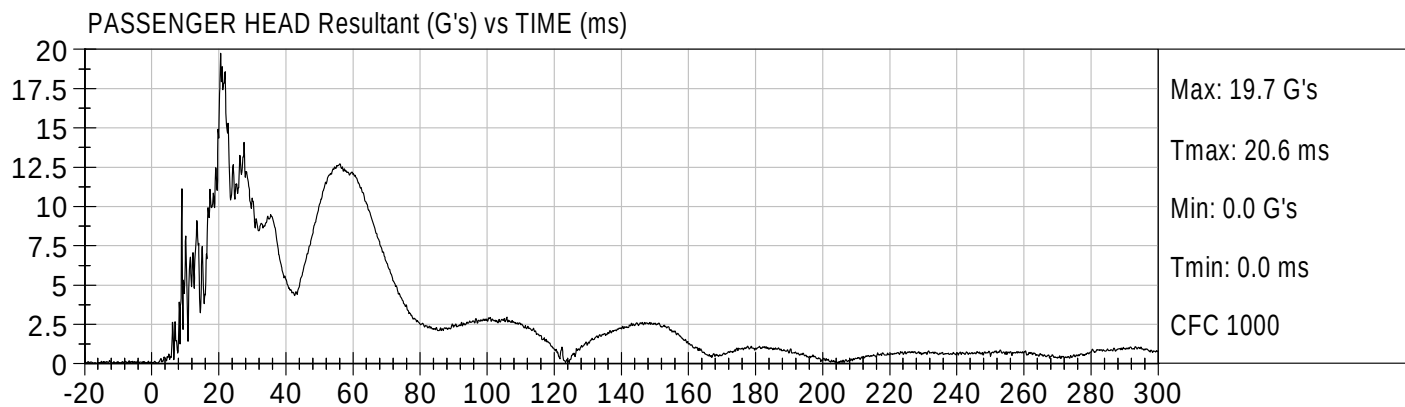
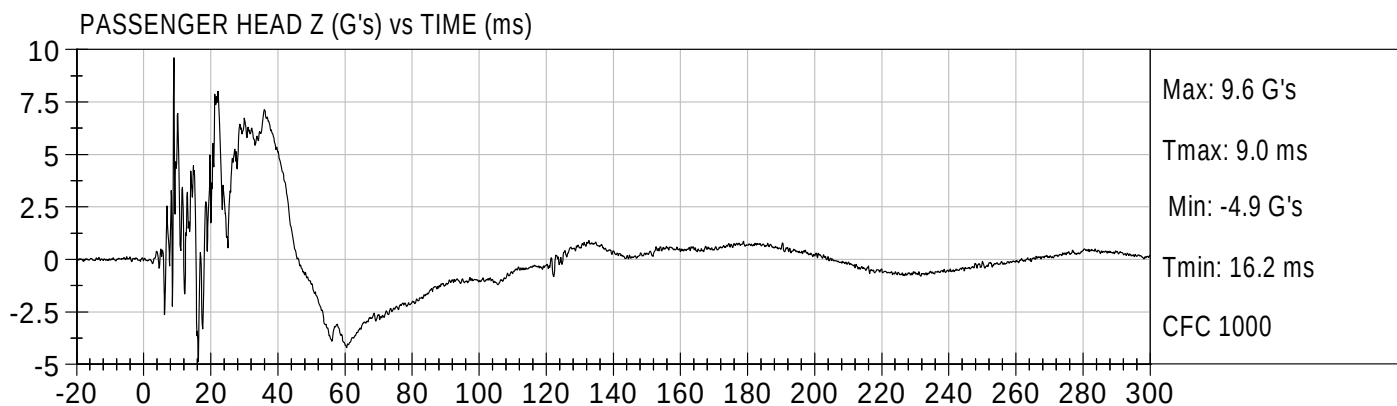
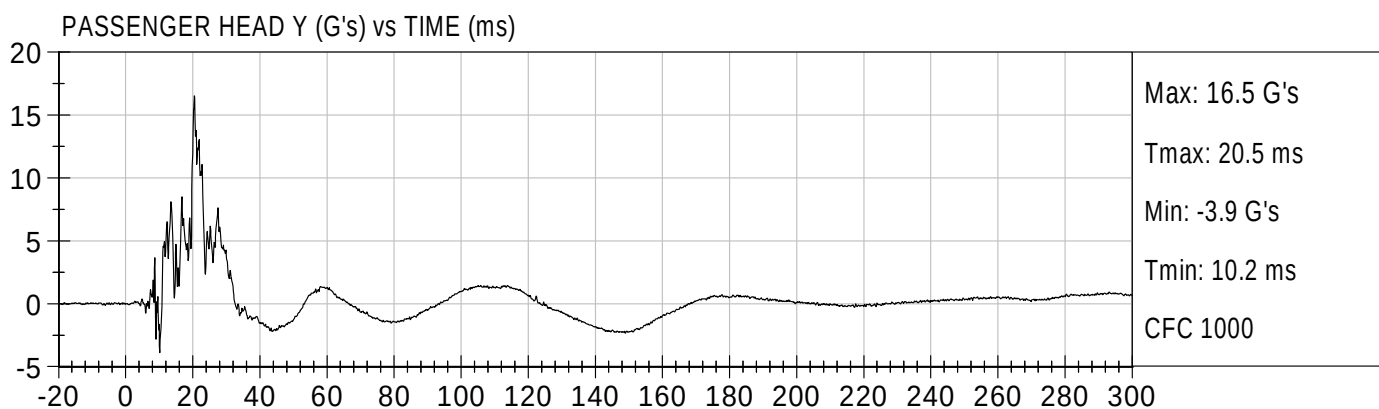
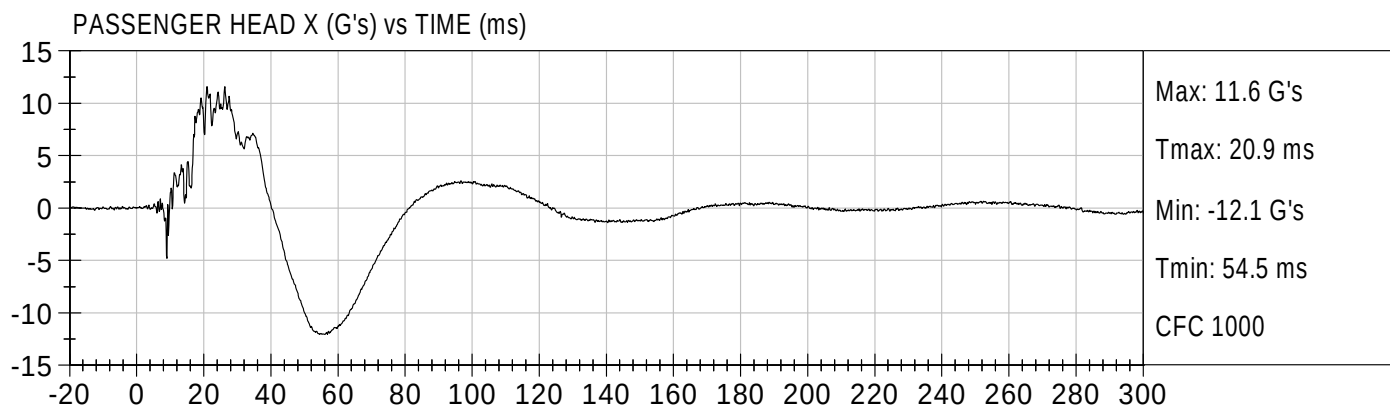


Post-Test Curtain and Torso Airbag Right $\frac{3}{4}$ View

APPENDIX B
DUMMY RESPONSE DATA TRACES

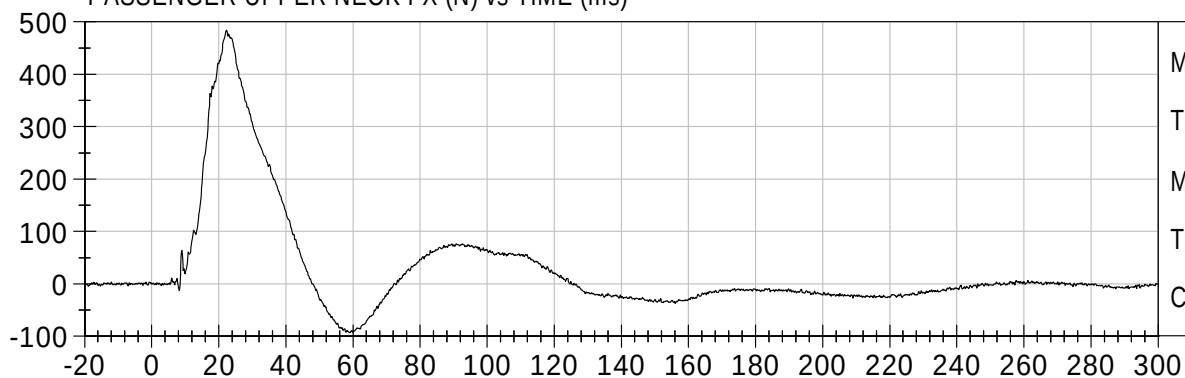
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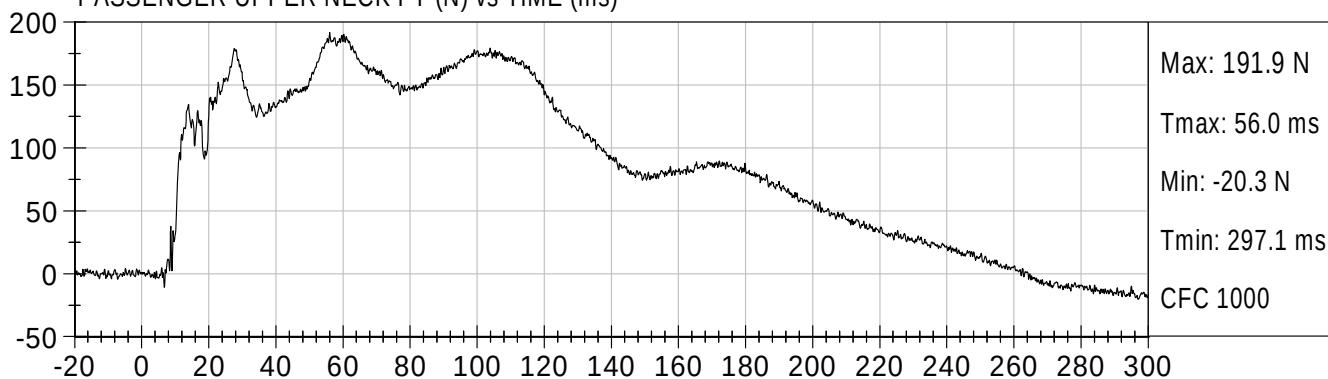




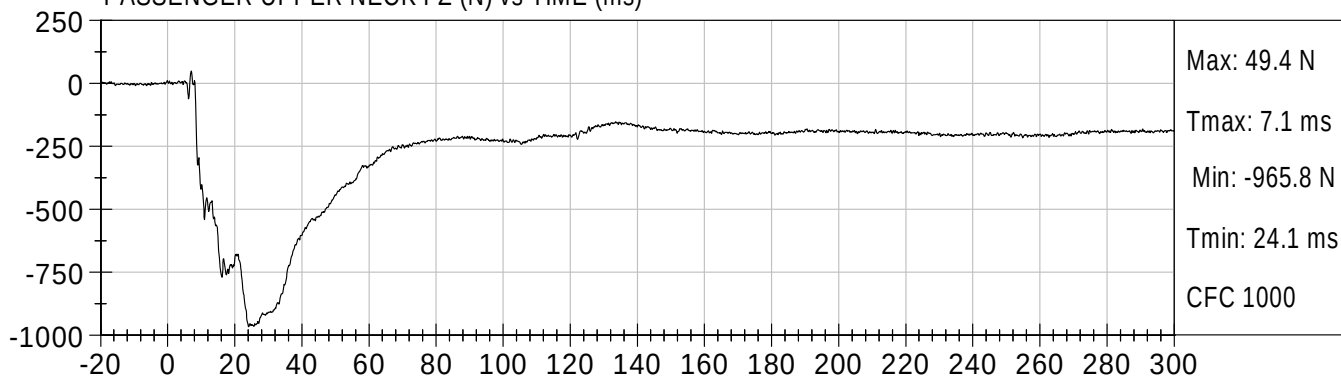
PASSENGER UPPER NECK FX (N) vs TIME (ms)



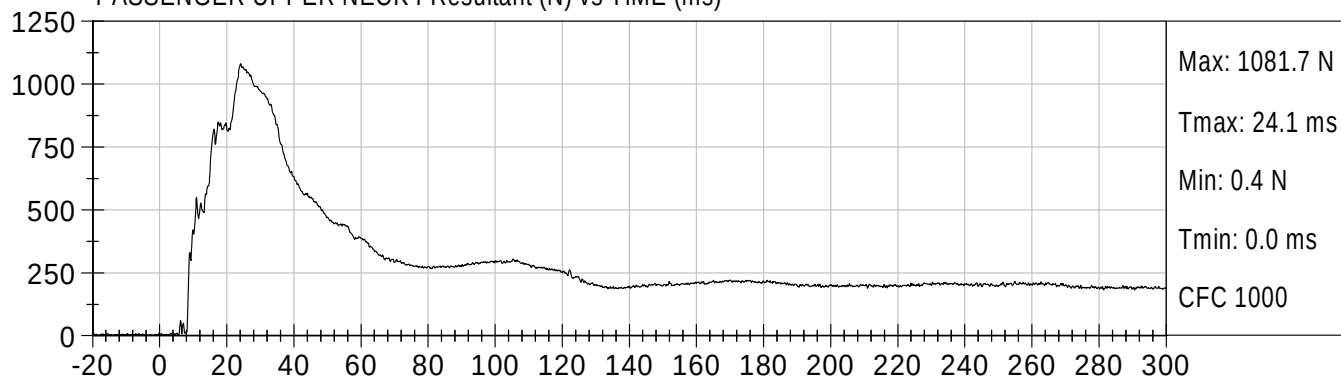
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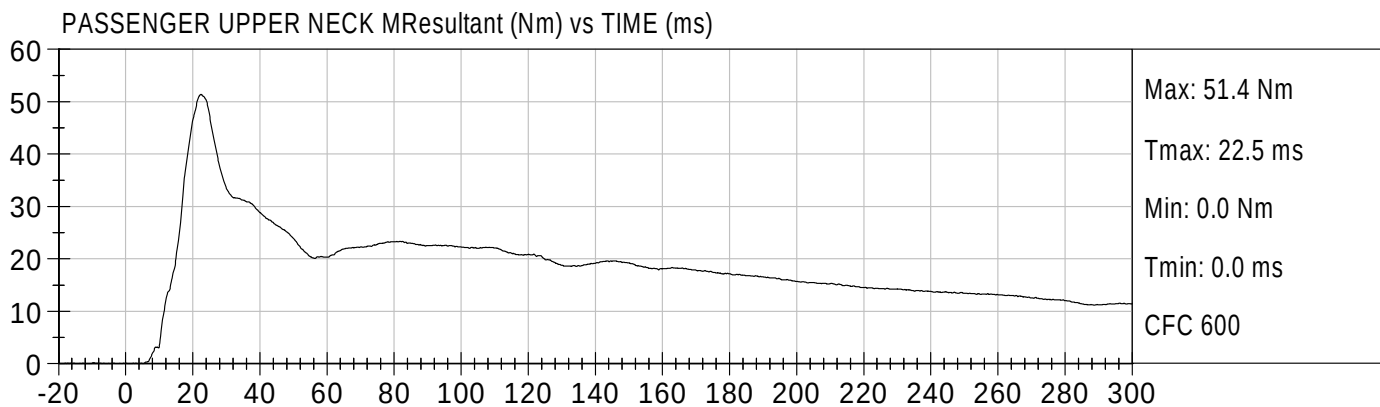
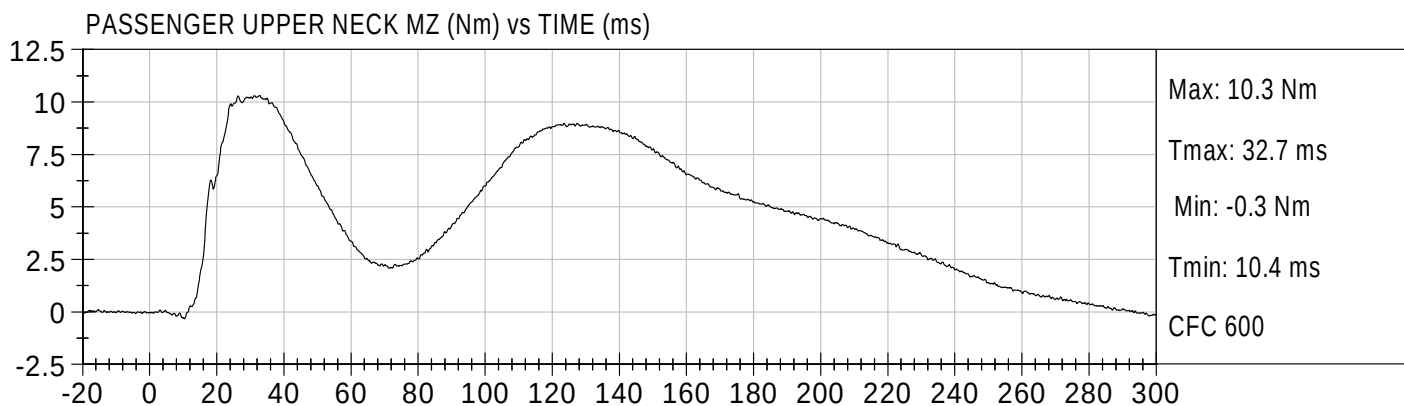
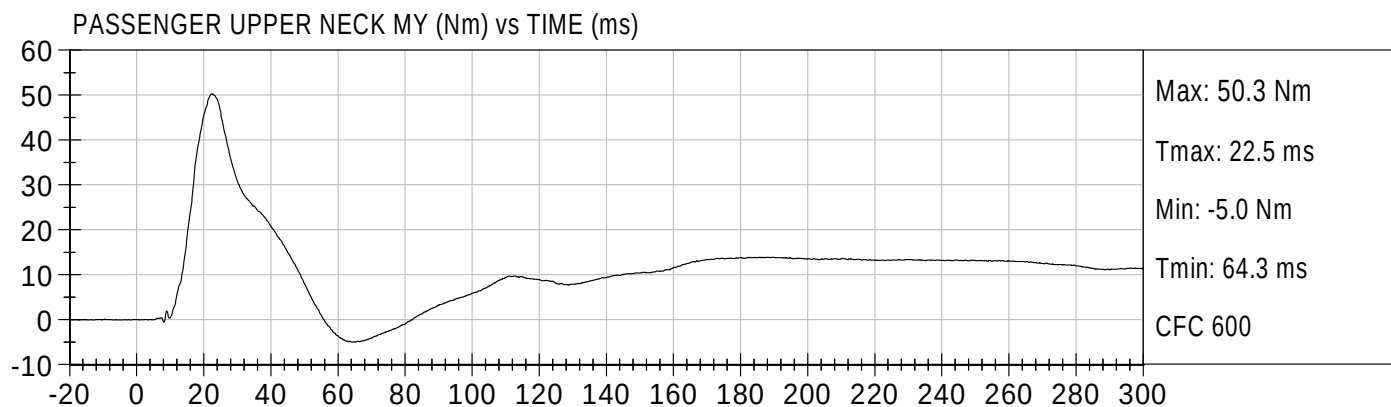
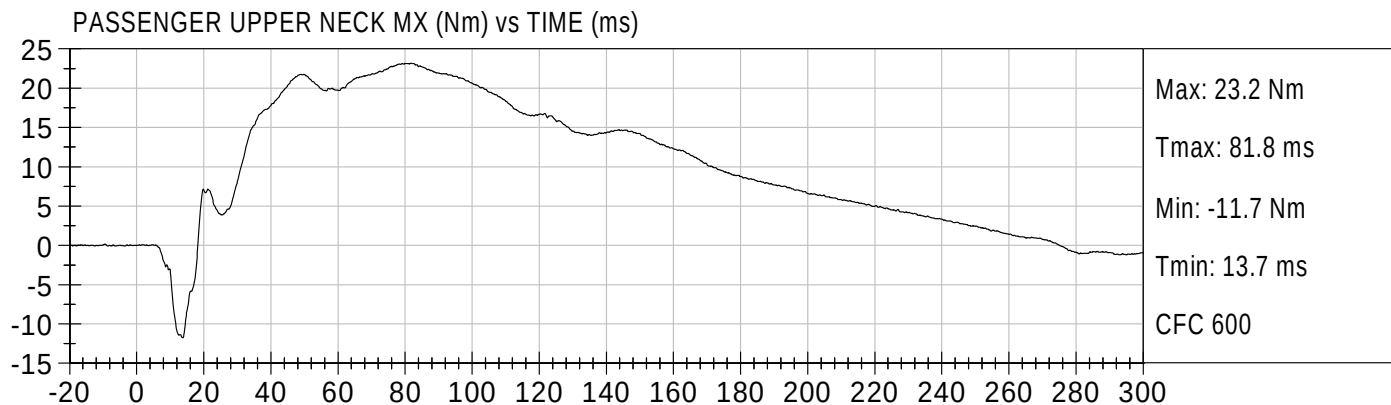


PASSENGER UPPER NECK FZ (N) vs TIME (ms)



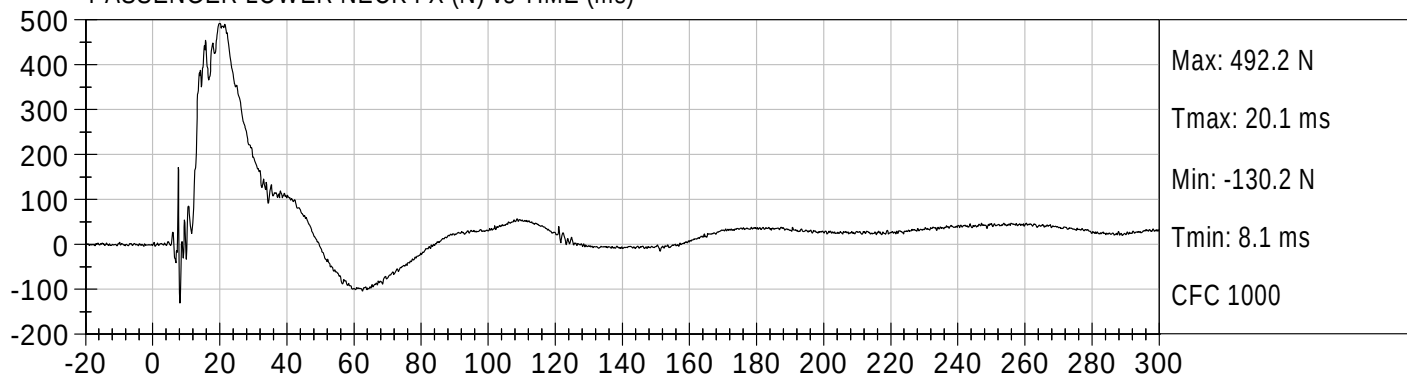
PASSENGER UPPER NECK FResultant (N) vs TIME (ms)



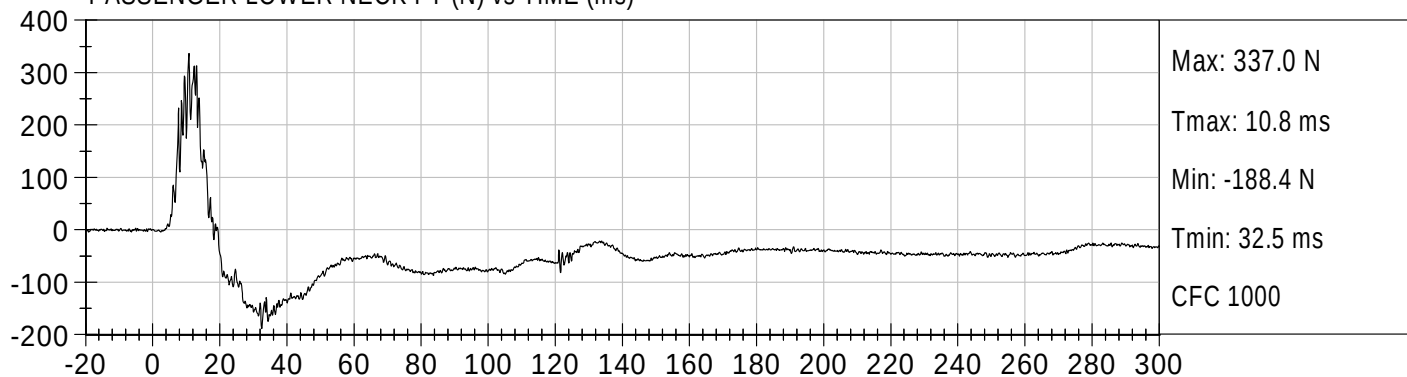




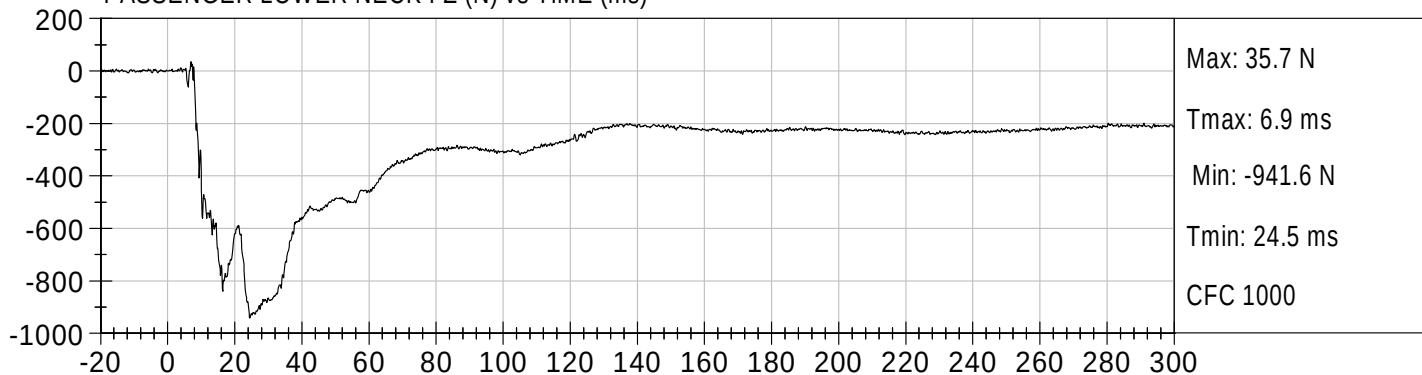
PASSENGER LOWER NECK FX (N) vs TIME (ms)



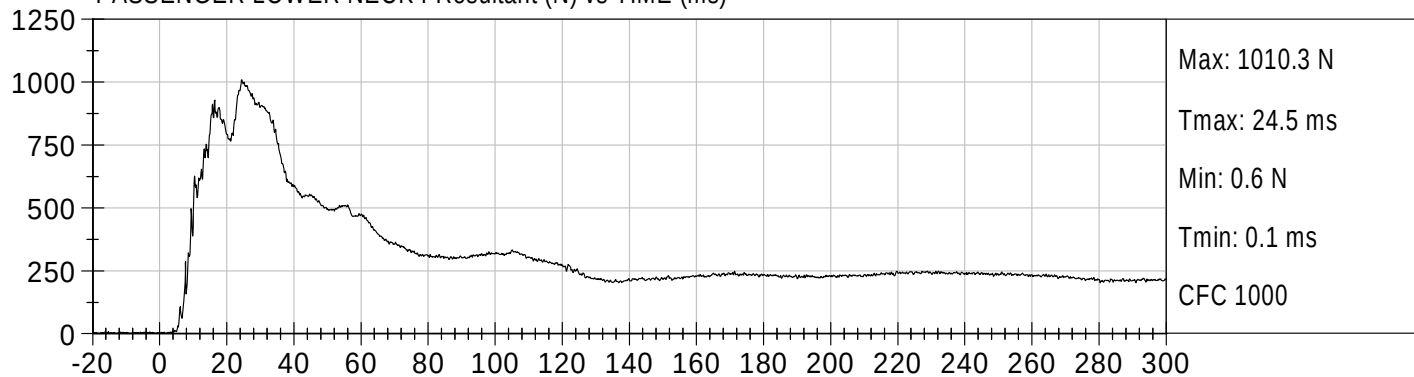
PASSENGER LOWER NECK FY (N) vs TIME (ms)

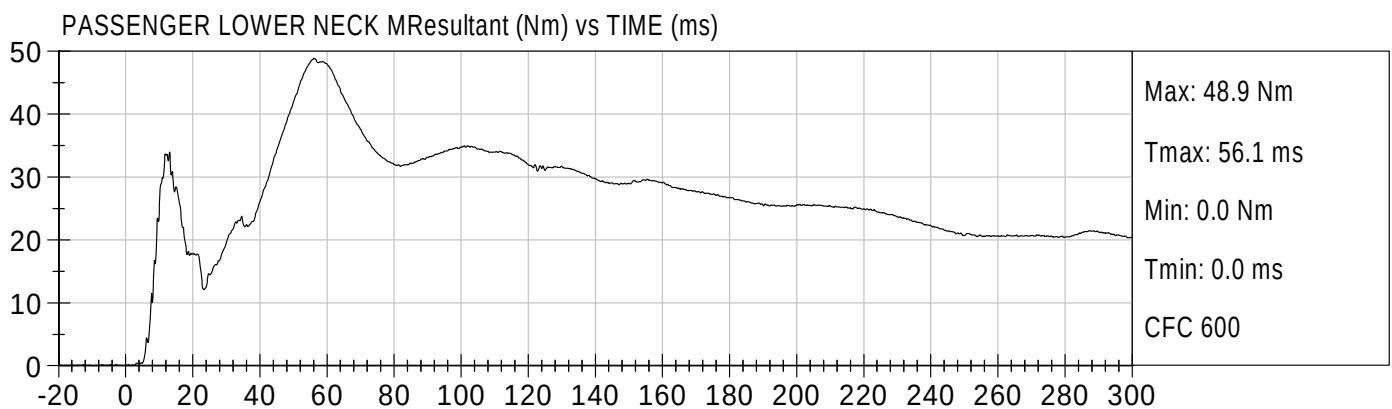
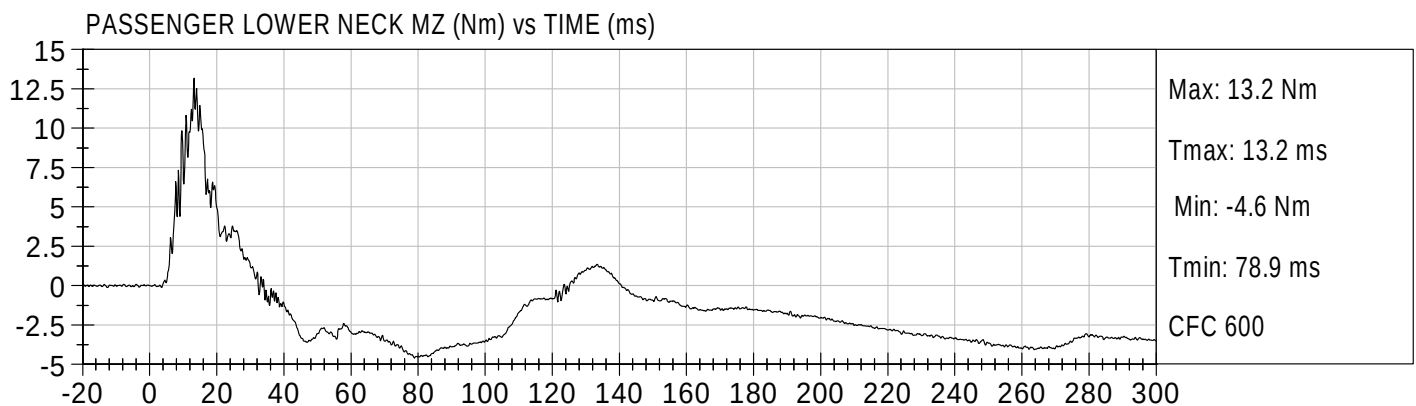
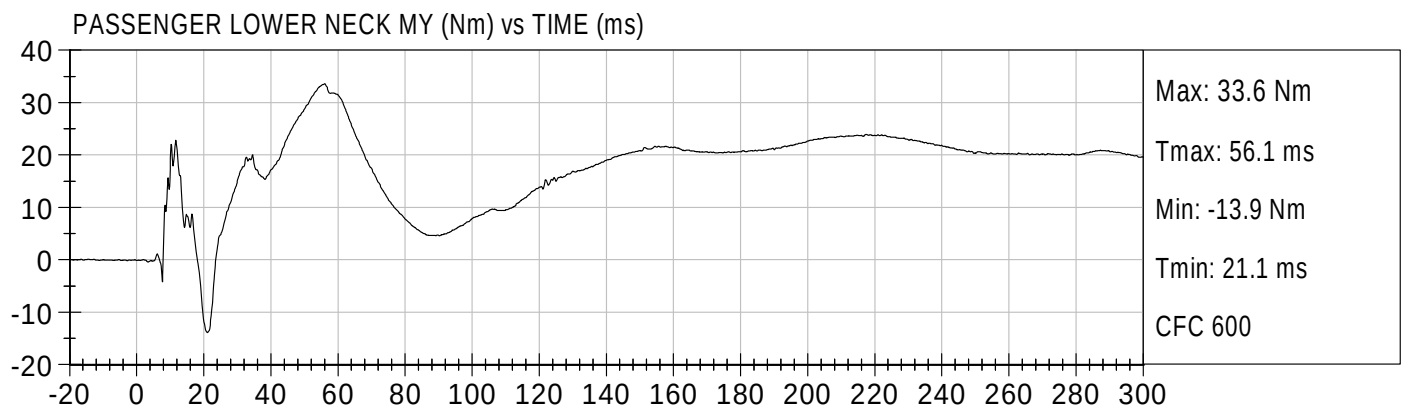
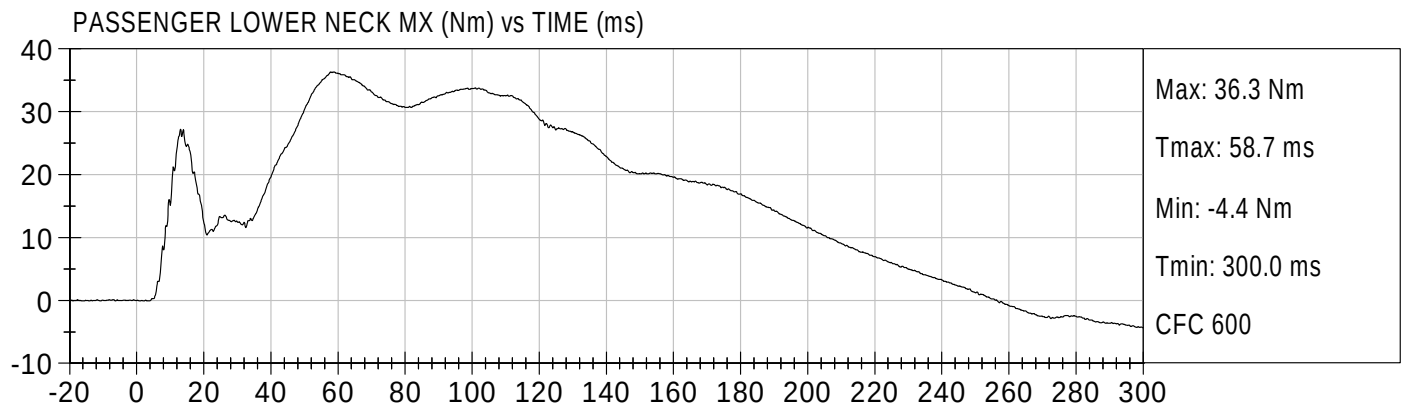


PASSENGER LOWER NECK FZ (N) vs TIME (ms)



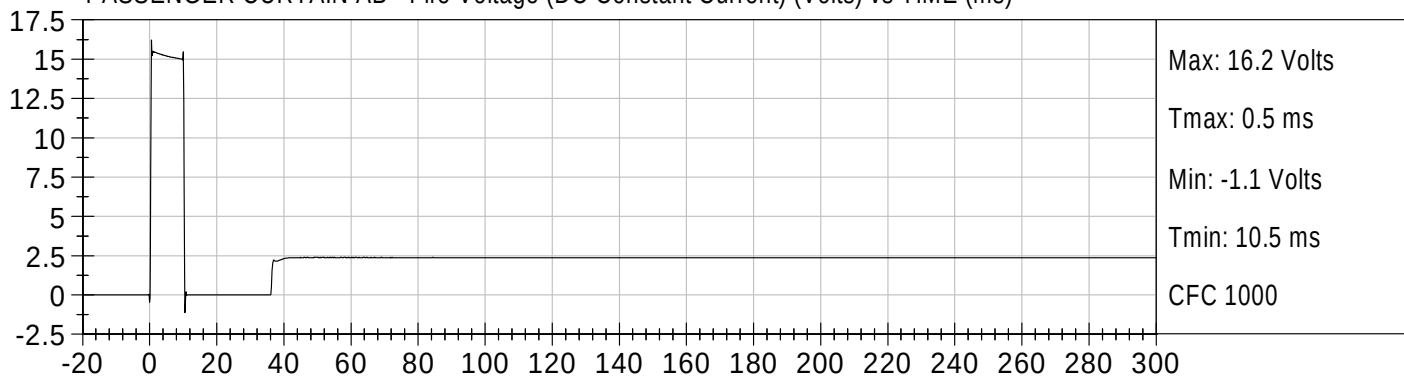
PASSENGER LOWER NECK FResultant (N) vs TIME (ms)



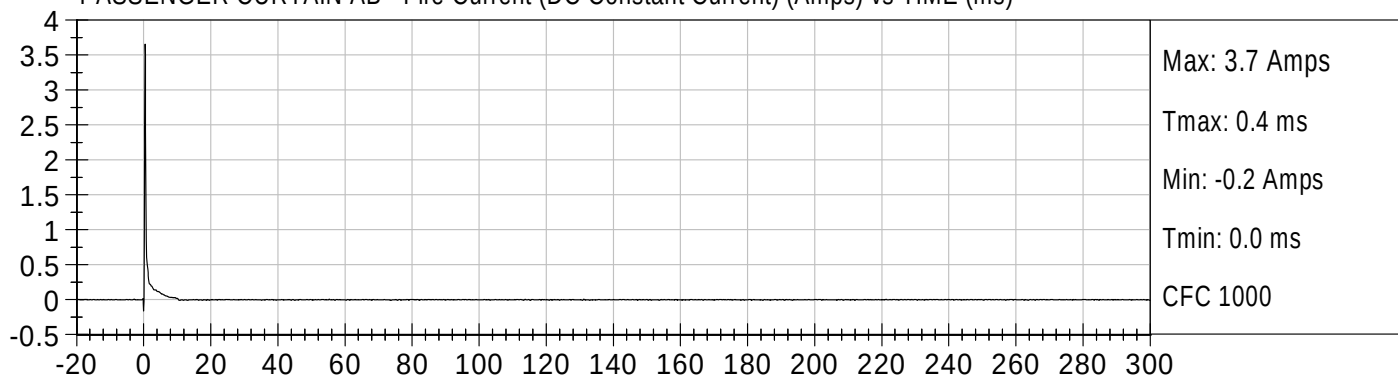




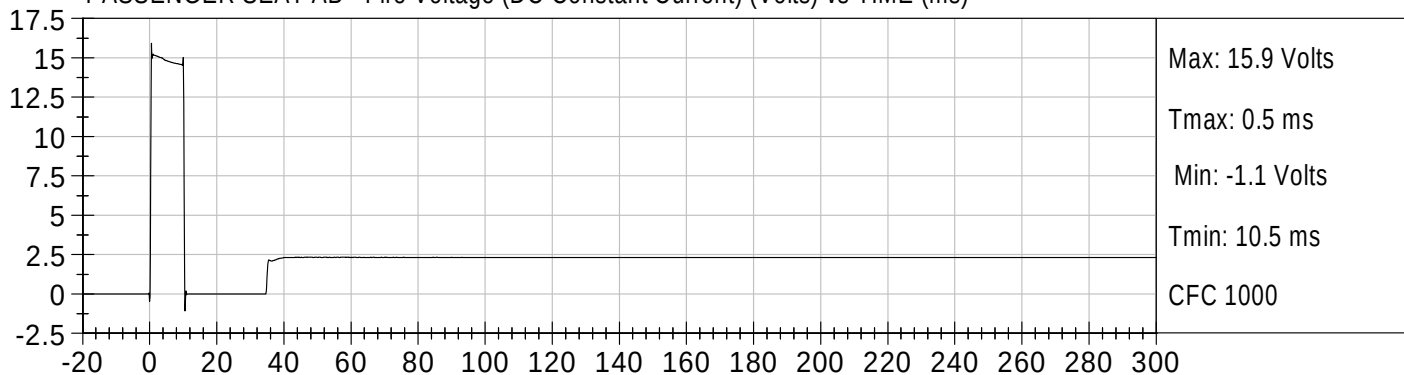
PASSENGER CURTAIN AB - Fire Voltage (DC Constant Current) (Volts) vs TIME (ms)



PASSENGER CURTAIN AB - Fire Current (DC Constant Current) (Amps) vs TIME (ms)



PASSENGER SEAT AB - Fire Voltage (DC Constant Current) (Volts) vs TIME (ms)



PASSENGER SEAT AB - Fire Current (DC Constant Current) (Amps) vs TIME (ms)

