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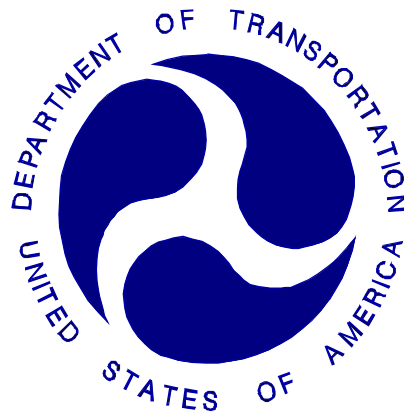
NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

2005 SUZUKI VERONA
FOUR-DOOR SEDAN

NHTSA NUMBER: M50504TWG2

CALSPAN CORPORATION TEST NUMBER: 8642-TWG-09

CALSPAN CORPORATION
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225



May 9, 2005

FINAL REPORT

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Rulemaking
Office of Crashworthiness Standards
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Washington, DC 20590

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Prepared By:

Patrick G. MacDiarmid, Jr., Project Engineer

Approved By:

David J. Travale, Program Manager
Transportation Sciences Center

Approval Date:

FINAL REPORT ACCEPTANCE BY:

Accepted By:

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16. Abstract This side impact out-of-position test was performed in conjunction with a New Car Assessment Program (NCAP). This test was conducted at the Calspan Corporation Crash Test Facility in Buffalo, New York, on May 9, 2005.							
Injury Summary							
HIC15	HIC36	Clip (g's)	Chest Displacement (mm)	NIJ NTF	NIJ NTE	NIJ NCF	NIJ NCE
125.3	128.5	61.5	-48.1	0.57	2.59	0.07	0.00
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SECTION 1

PURPOSE AND SUMMARY OF TEST M50504TWG2

1.1 PURPOSE

The purpose of this test was to obtain data in a static out-of-position side impact. These data constitute part of the general consumer information collected by the New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract No. DTNH22-01-D-32005.

1.2 SUMMARY

The effects of a seat mounted side airbag deployment in a 2005 Suzuki Verona with an out-of-position three-year-old child were evaluated. The test was performed by Calspan Corporation on May 9, 2005. Pre-and post-test photographs of the vehicle and dummy can be found in Appendix A.

One high-speed digital camera was used to document the side airbag deployment event. The camera was placed in perpendicular the right-front seat centerline as to capture the deployment event. The recorded image rate is 1000 frames per second.

One part 572, Hybrid III three-year-old child anthropomorphic test device (ATD), was placed in the right front seat situated in the rearward facing position 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 child dummy was instrumented with head, chest, and pelvic triaxial accelerometers. In addition upper six axial neck force and moment load cell sensors were utilized.

Seventeen 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 Hybrid III three-year-old child dummy's visible contact points were as follows: The airbag to the face, top and the left side of the head and the sternum, left clavicle and abdomen of the ATD.

The three-year-old child dummy was placed along the outboard edge of the seat cushion, kneeling and facing rearward. The dummy was aligned vertically so that its sternum was in contact with the leading edge of the seat back bolster. In order to achieve maximum sternum contact and avoid B-Pillar interference, the seat track was adjusted to detent 9 or 107 mm rearward of full forward. The dummy's head was placed in between the seat bolster and side trim in order to maximize sternum contact with the seatback. The head remained in its neutral orientation. The outboard leg was placed in order to contact the seat cushion along its outboard edge while remaining parallel to the seat centerline. The outboard knee and lower leg were moved toward the seat bight until the top edge of the upper rib was aligned horizontally with the top edge of the airbag module. The inboard leg was placed parallel to the centerline of the seat cushion in order to place the dummy's shoulder bolts perpendicular to the vehicle centerline. The inboard arm was positioned so the thumb contacted the seat back. The outboard arm and hand were allowed to hang down at vertical. This orientation complies with section 3.3.3.2 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

DATA SHEET NO. 1

TEST SUMMARY

TEST CONFIGURATION INFORMATION:

	TEST DATA	DESCRIPTION
Seating Position:	P2	Right Front Seating Position
Test:	3.3.3.2*	Rearward facing Hybrid-III three-year-old child dummy
Airbag:	Seat	Bolster mounted head and thorax combination side airbag
Booster Block	-	Not Required
ATD Type/Serial No.:	P572P/040	Hybrid III three-year-old child dummy

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

<u>Number of Data Channels</u>	17	
<u>Number of Cameras:</u>	0	<u>Real Time</u>
	1	<u>High Speed Digital</u>
	0	<u>High Speed Film</u>

VISIBLE DUMMY CONTACT POINTS

Head Contact:	The face, top and left side of the head were struck by the airbag during deployment
Upper Torso Contact:	Airbag to the sternum and left clavicle
Lower Torso Contact:	Airbag to the abdomen
Left Knee Contact:	None
Right Knee Contact:	None

DATA SHEET 2

VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2005 Suzuki Verona 4-Door Sedan

Vehicle Body Color: Red VIN: KL5VJ56L15B149052‡

Vehicle NHTSA No.: M50504 Month & Year of Manufacture: 09/04

Engine Data: 6 Cylinders; - CID; 2.5 Liters; - cc

Engine Placement: - Longitudinal; or X Lateral

Transmission: 4 Speed; - Manual; X Automatic; X Overdrive

Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive

Odometer Reading 58 km

Supplemental Airbag Restraints:

Front Occupant: X Frontal; - Knee; X Side; - Curtain

Rear Occupant: - Frontal; - Knee; - Side; - Curtain

Options:

- ADL; X A/C; X Power Steering; X Power Brakes; X Power Windows

DATA FROM TIRE PLACARD

Recommended Tire Size: P205/60R16 91H

*Recommended Cold Tire Pressure: 210 kPa FRONT; 210 kPa REAR

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P205/60R16 91H ; Manufacturer: Kumho

Tire Pressure with Maximum Capacity Vehicle Load: Front: 300 kPa; Rear: 300 kPa

Treadwear: 400 ; Traction: A ; Temperature: A

VEHICLE CAPACITY DATA:

Number of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 Total

Type of Front Seats: X Bucket; - Bench; - Split Bench

Type of Front Seat Back: - Fixed; X Adjustable with X Lever or - Knob

Vehicle Max Capacity Loading = 408.0 kg (A)

No. of Occupants x 68.04 kg. = 340.2 kg (B)

Vehicle Cargo Capacity = 67.8 kg (A-B)

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Left Front = 462.0 kg Left Rear = 311.0 kg

Right Front = 454.0 kg Right Rear = 310.0 kg

TOTAL FRONT = 916.0 kg TOTAL REAR = 621.0 kg

% of Total Weight = 59.6 % % of Total Weight = 40.4 %

TOTAL WEIGHT = 1537.0 kg

* Tire pressure used in test.

‡ This vehicle had previously been tested in an NCAP side impact on January 25, 2005.

DATA SHEET NO. 3

CHILD DUMMY POSITIONING IN VEHICLE

NHTSA No. M50504TWG2

Measurement		Value
Total Fore/Aft Travel (mm)		226
Test Distance Rearward of Full-Forward (mm)		107
Total Fore/Aft Travel (Detents)		20 (0-19)
Placed in Position #		9
Seat Back Angle	SA (°)	19
Airbag Module Width	AMW (mm)	100
Airbag Width	ABW (mm)	350
Airbag Module Length	AML (mm)	250
Airbag Length	ABL (mm)	580
Top of Airbag Module to Head/Neck Junction	AN (mm)	80
Head CG to Door Panel/Window	HD (mm)	125
Head to Seat Back Centerline	HSC (mm)	220
Head to B-Pillar (side of the head)	HB (mm)	10
Head to Roof, Z (top of the head)	HZ (mm)	183
Head to Header	HHD (mm)	-
Chest to Dash	CD (mm)	-
Chest to Seatback	CS (mm)	0
Right Arm to Seat Back Centerline	RACL (mm)	93
Right Arm to Seat Back Centerline	RACL (°)	70
Left Arm to Seat Back Centerline	LACL (mm)	-
Left Arm to Seat Back Centerline	LACL (°)	-
Right Arm to Door Panel	RA (mm)	-
Left Arm to Door Panel	LA (mm)	20
Knee to Knee	KK (mm)	120
Toe to Toe	TT (mm)	140
Right Knee to Seat Cushion Centerline	KSCR (mm)	90
Left Knee to Seat Cushion Centerline	KSCL (mm)	210
Right Toe to Seat Cushion Centerline	TSCR (mm)	38
Left Toe to Seat Cushion Centerline	TSCL (mm)	220
Nose to Dash	ND (mm)	-
Nose to Seatback	NS (mm)	0
Nose to Header	NR (mm)	-

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES

NHTSA No. M50504TWG2

		MAXIMUM VALUE			
		Position #2			
DESCRIPTION	Unit	Maximum	Time (ms)	Minimum	Time (ms)
Head X	g	15.1	16.1	-2.2	33.0
Head Y	g	2.7	58.8	-16.1	13.8
Head Z	g	10.6	15.4	-22.5	11.1
Head Resultant	g	27.2	13.0	0.0	-4.5
Upper Neck Fx	N	347.4	16.1	-49.4	160.1
Upper Neck Fy	N	156.5	58.2	-379.8	15.4
Upper Neck Fz	N	246.2	23.3	-513.8	10.9
Upper Neck F Resultant	N	594.5	13.3	0.0	-10.7
Upper Neck Mx	N-m	11.0	11.7	-22.0	21.7
Upper Neck My	N-m	22.5	16.1	-8.9	37.7
Upper Neck Mz	N-m	5.6	59.6	-8.7	26.8
Upper Neck M Resultant	N-m	25.2	20.4	0.0	-16.6
Chest X	g	45.7	7.5	-7.4	18.8
Chest Y	g	3.8	29.5	-34.0	10.7
Chest Z	g	6.5	19.6	-7.0	12.2
Chest Resultant	g	51.8	7.5	0.0	-35.1
Chest Displacement	mm	32.4	10.6	-3.2	9.1
Pelvic X	g	9.3	13.4	-2.1	9.4
Pelvic Y	g	4.0	11.1	-9.5	21.9
Pelvic Z	g	5.2	8.0	-23.1	10.6
Pelvic Resultant	g	23.1	10.6	0.0	-20.1

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

NHTSA No. M50504TWG2

	HEAD INJURY CRITERIA (HIC)							
	HIC15				HIC36			
	HIC	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂	HIC	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position #2 – Right Front	125.3	10.4	25.4	37.0 g	128.5	9.6	27.9	34.6 g

	CLIP SUMMARY*			
	CLIP (g's)	t ₁ (msec)	t ₂ (msec)	CSI
Position #2 – Right Front	61.5	9.8	12.8	273.7

* The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

Position 2 Neck Injury Summary (HIII 3 year old – Out of Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.57	11.3	892.7	262.9	10.2
Nte	2.59	19.3	1971.3	-1213.3	-44.7
Ncf	0.07	8.4	-55.5	58.1	2.8
Nce	0.00	-38.8	-0.3	-0.3	-0.0

Peak Tension (CFC1000) 2054.6 N

Peak Compression (CFC1000) -64.0 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120 N	Extension (mCVe)	27 N-m	Tension	1430 N
Compression (CVc)	2120 N	Flexion (mCVf)	68 N-m	Compression	-1380 N

Condyle Offset 0.0

APPENDIX A

PHOTOGRAPHS

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Figure A-1: Pre-Test Vehicle Left Side View



Figure A-2: Post-Test Vehicle Left Side View



Figure A-3: Vehicle Certification Placard



Figure A-4: Vehicle Tire Placard



Figure A-5: Pre-Test Dummy Frontal View



Figure A-6: Post-Test Dummy Frontal View



Figure A-7: Pre-Test Left Side of Dummy View



Figure A-8: Post-Test Left Side of Dummy View



Figure A-9: Pre-Test Right Side of Dummy View



Figure A-9: Post-Test Right Side of Dummy View

APPENDIX B

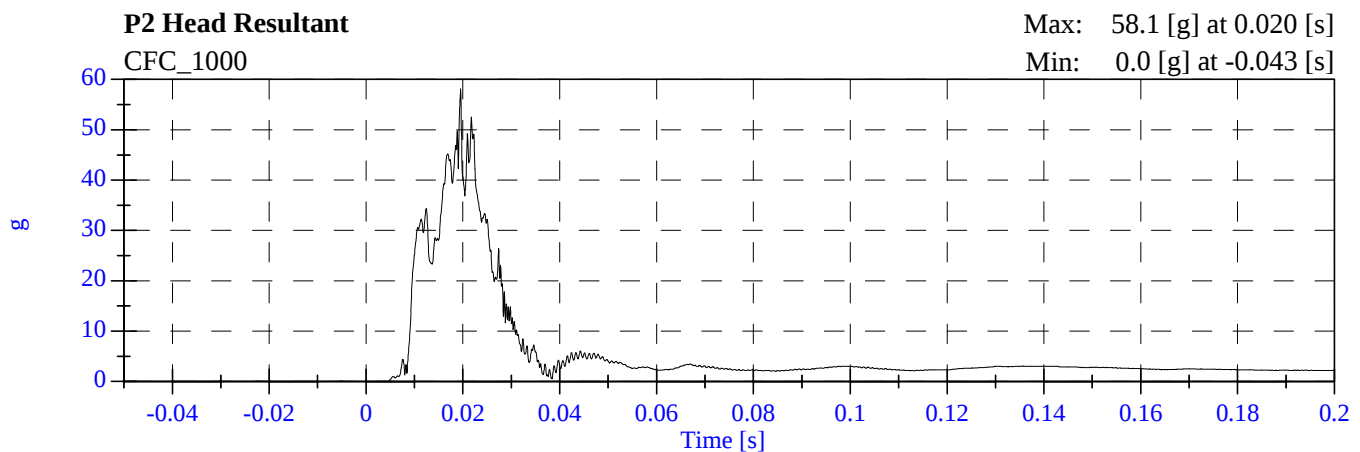
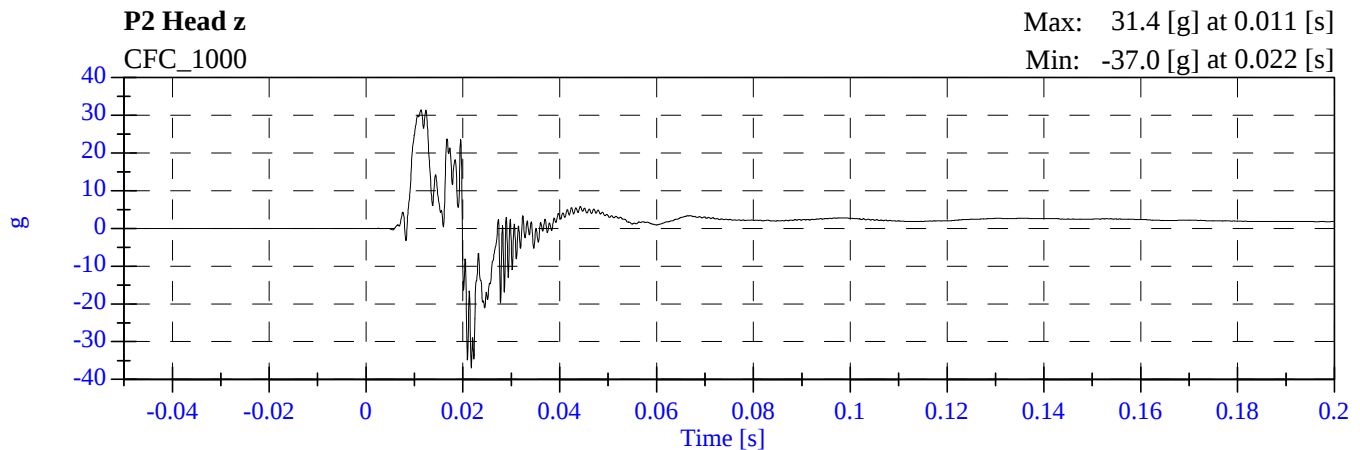
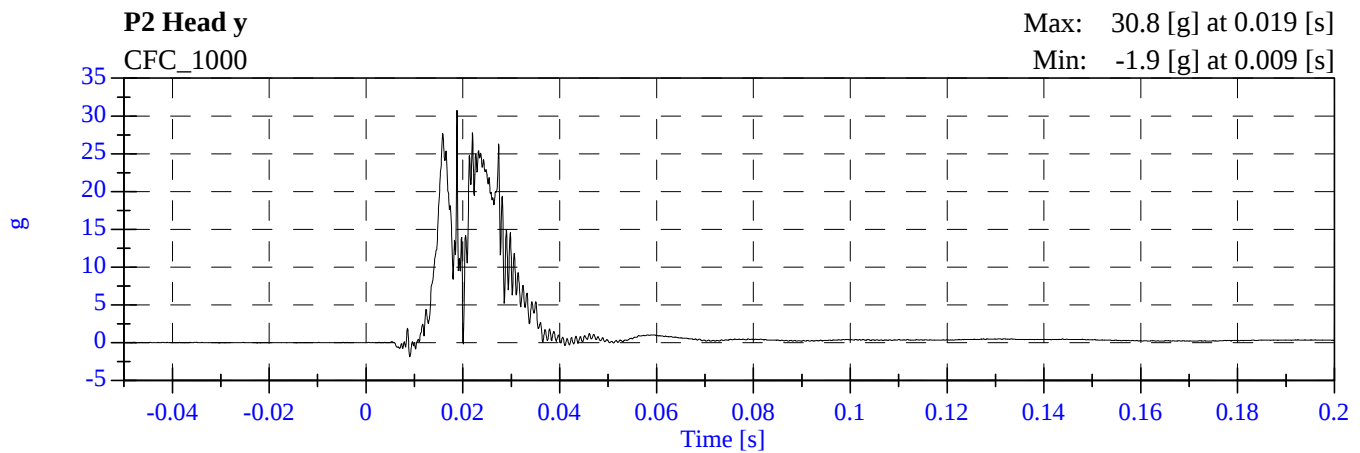
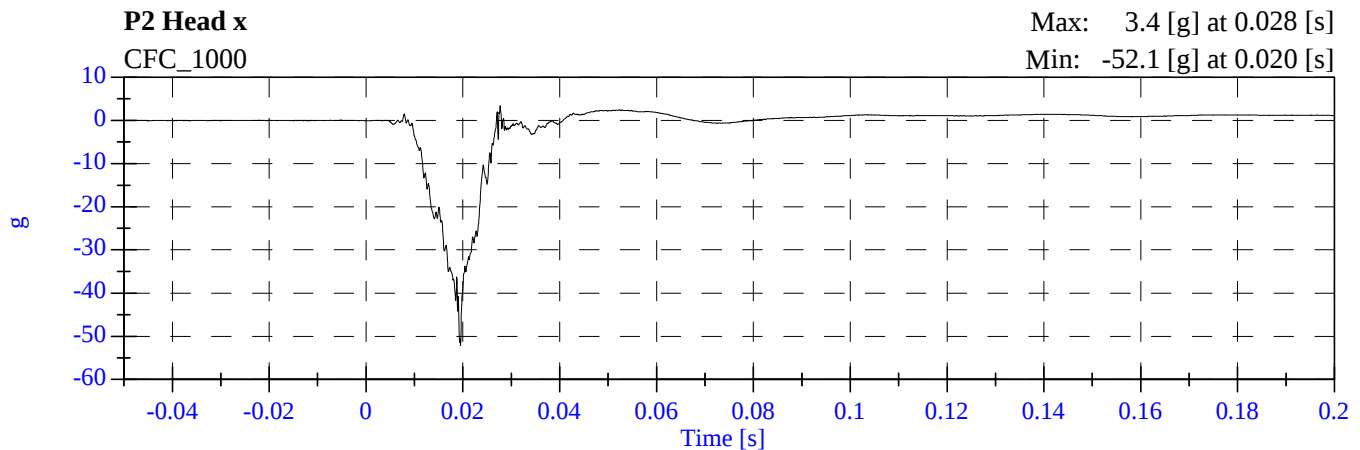
CHILD DUMMY RESPONSE DATA TRACES

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9	P2 Upper Neck Mx [N-m, CFC_600]	B-5
10	P2 Upper Neck My [N-m, CFC_600]	B-5
11	P2 Upper Neck Mz [N-m, CFC_600]	B-5
12	P2 Upper Neck M Resultant [N-m, CFC_600]	B-5
13	P2 Chest x [g, CFC_180]	B-6
14	P2 Chest y [g, CFC_180]	B-6
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19	P2 Pelvic y [g, CFC_1000]	B-8
20	P2 Pelvic z [g, CFC_1000]	B-8
21	P2 Pelvic Resultant [g, CFC_1000]	B-8

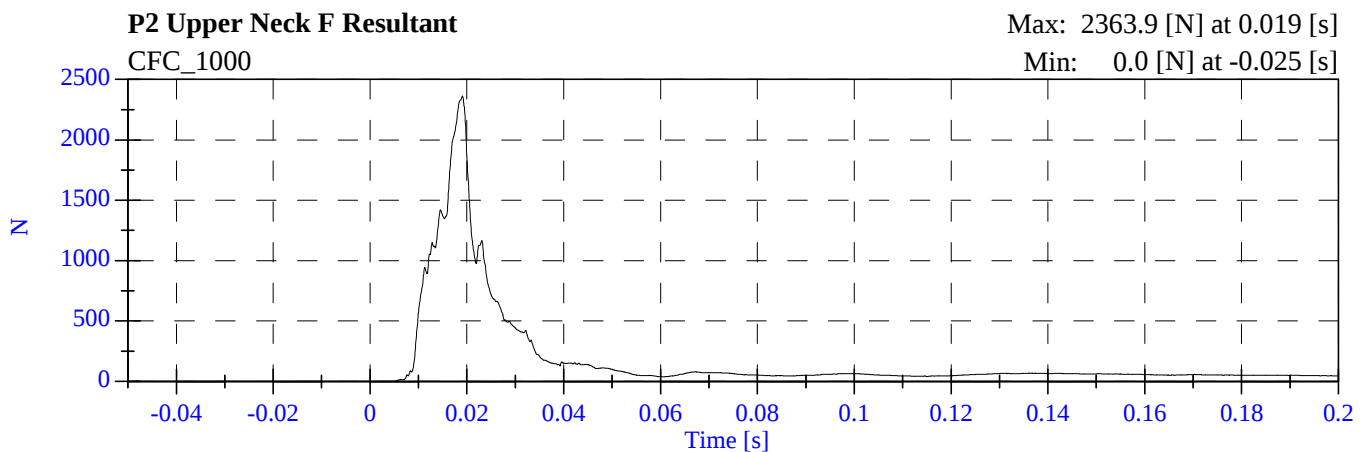
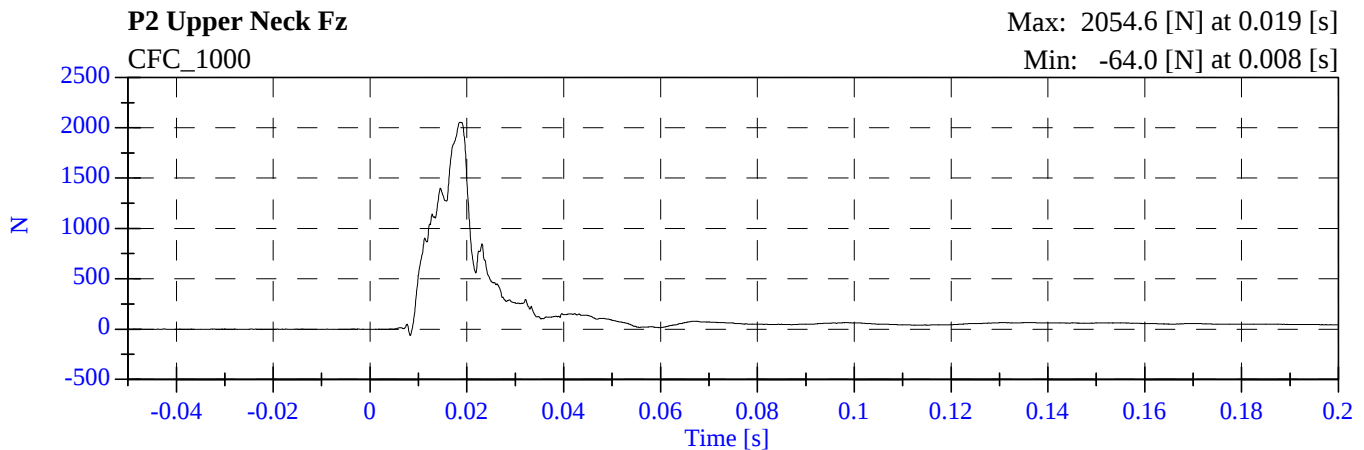
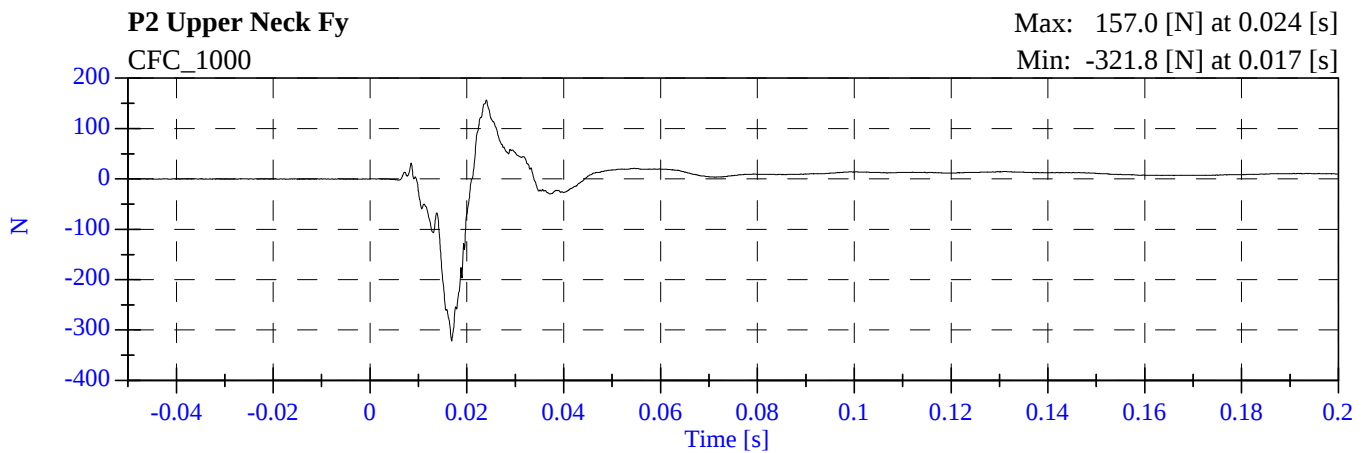
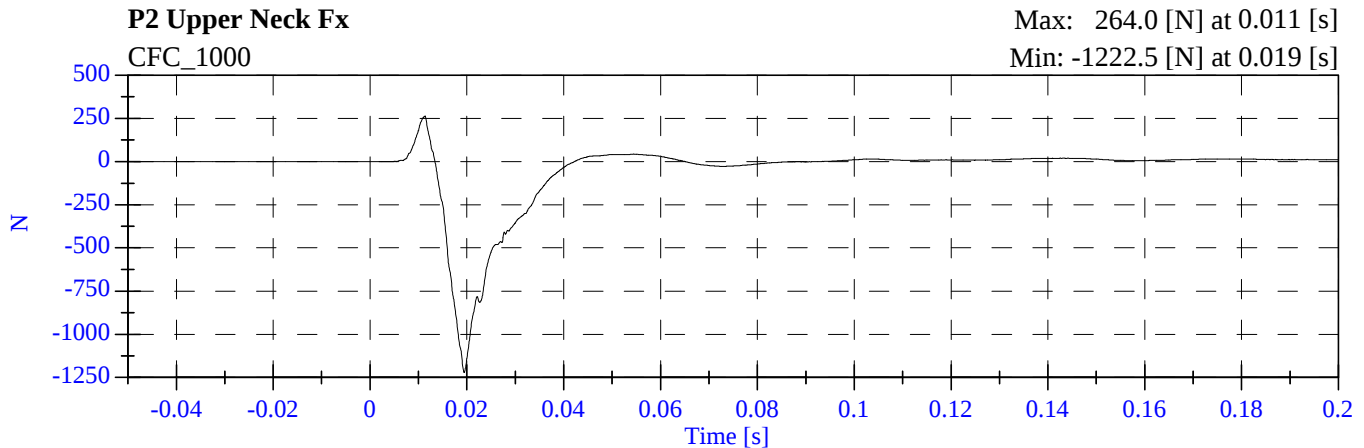
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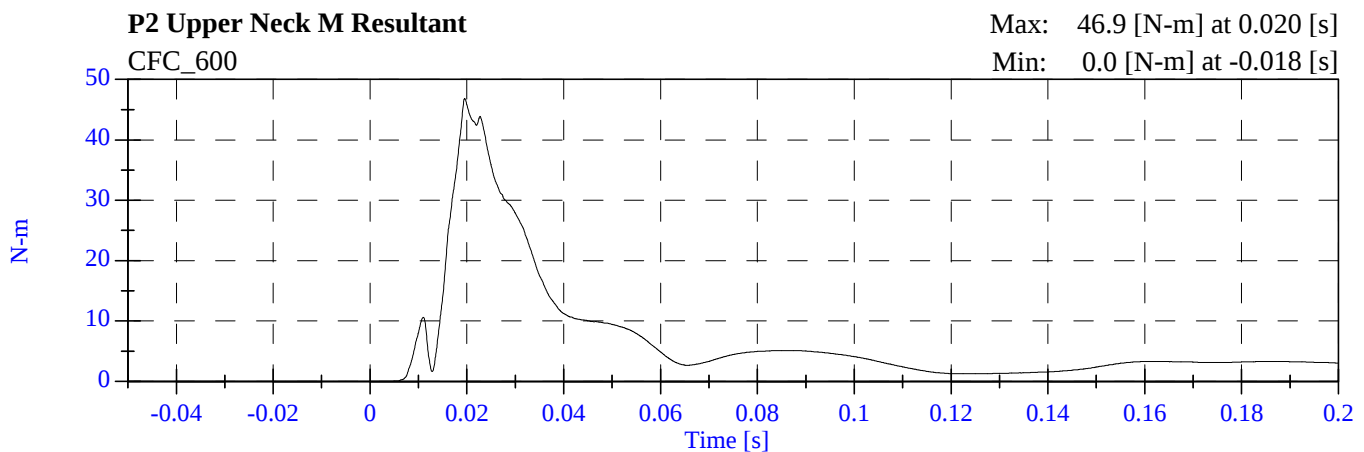
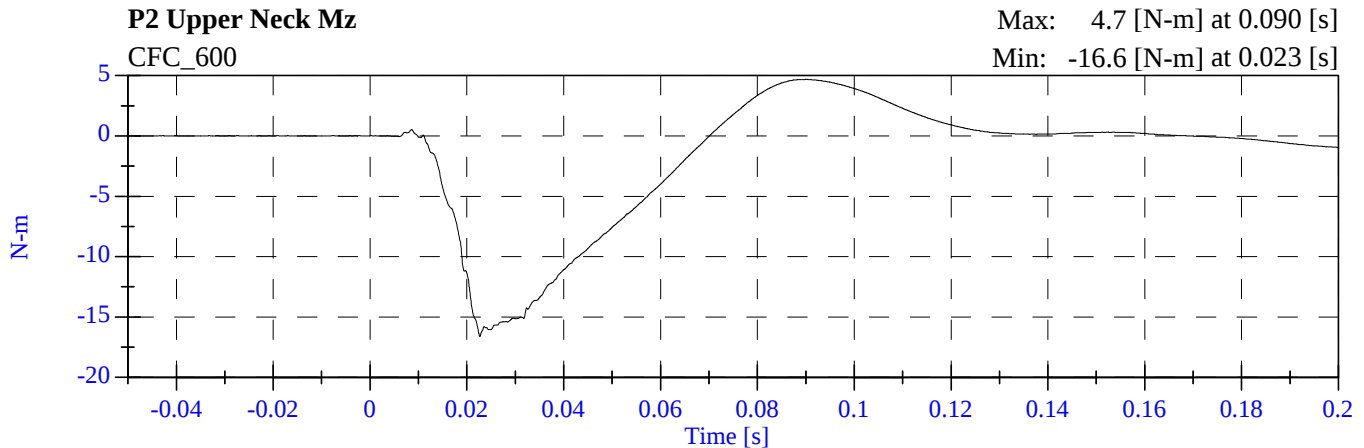
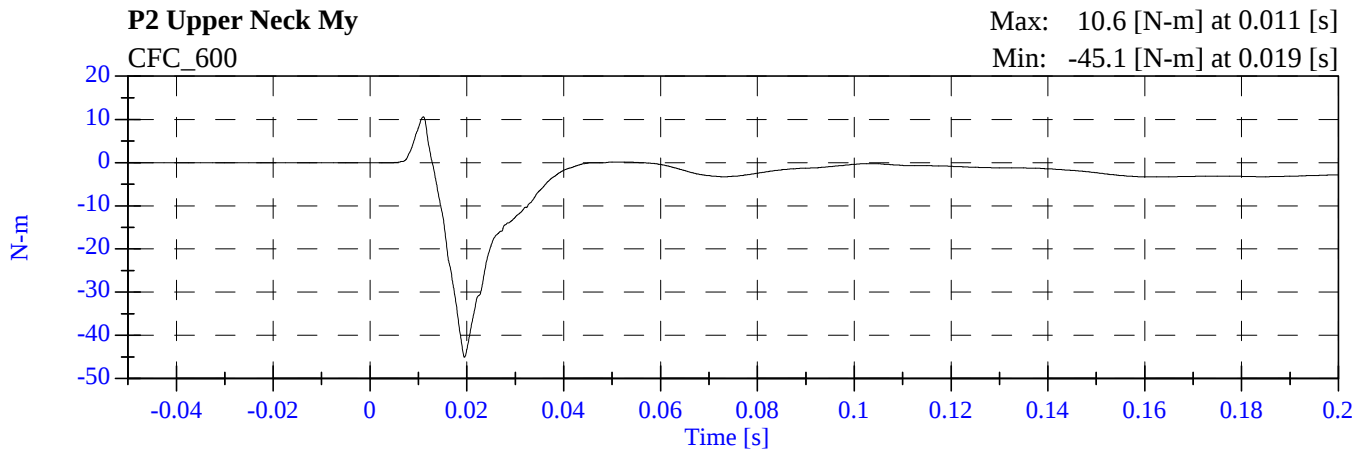
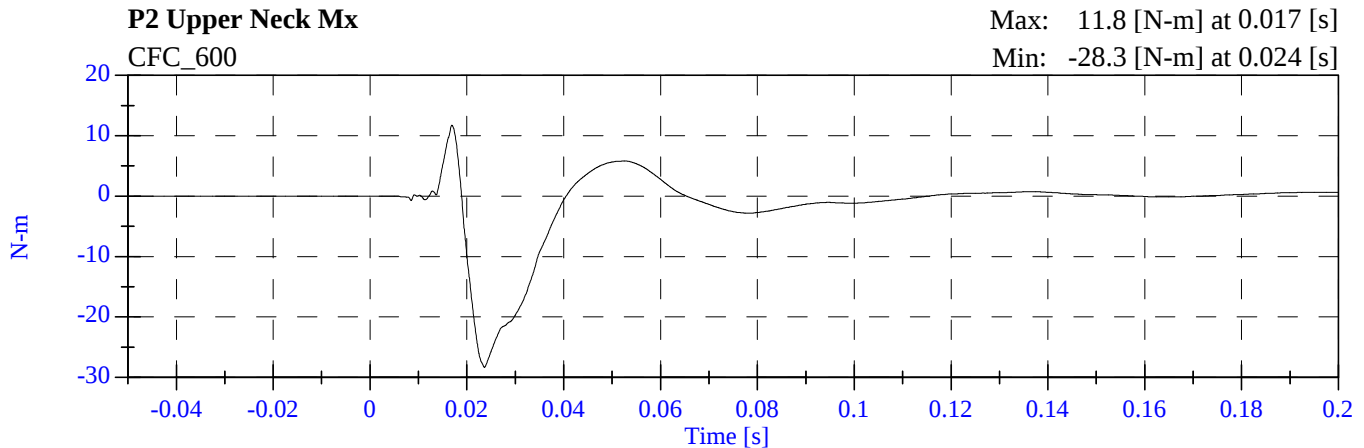


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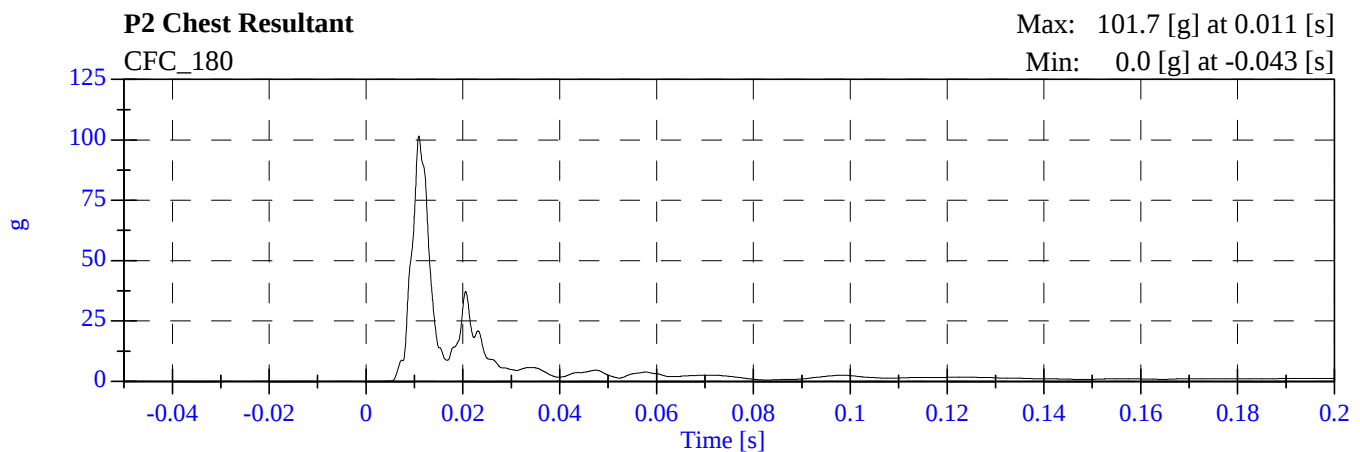
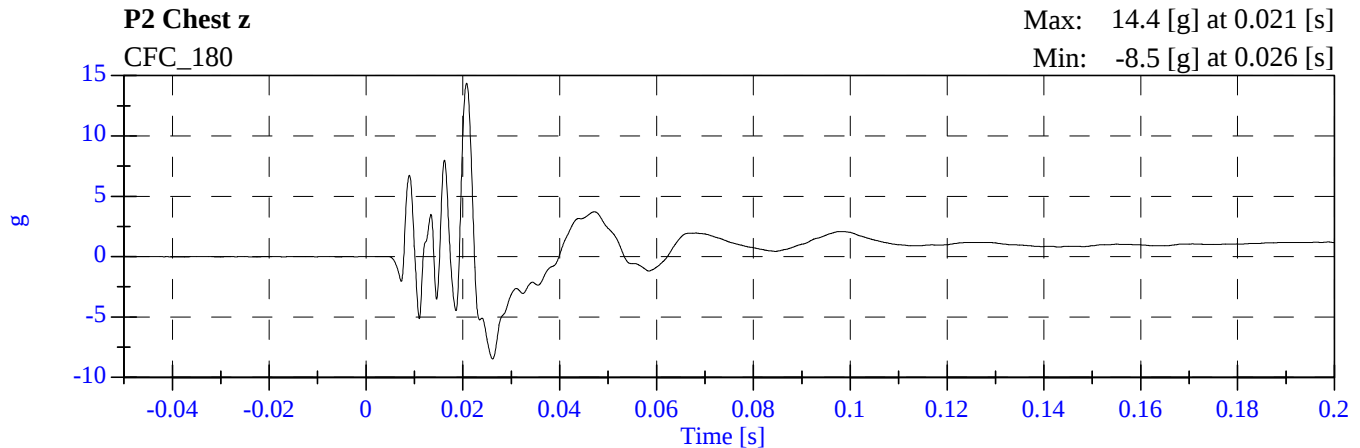
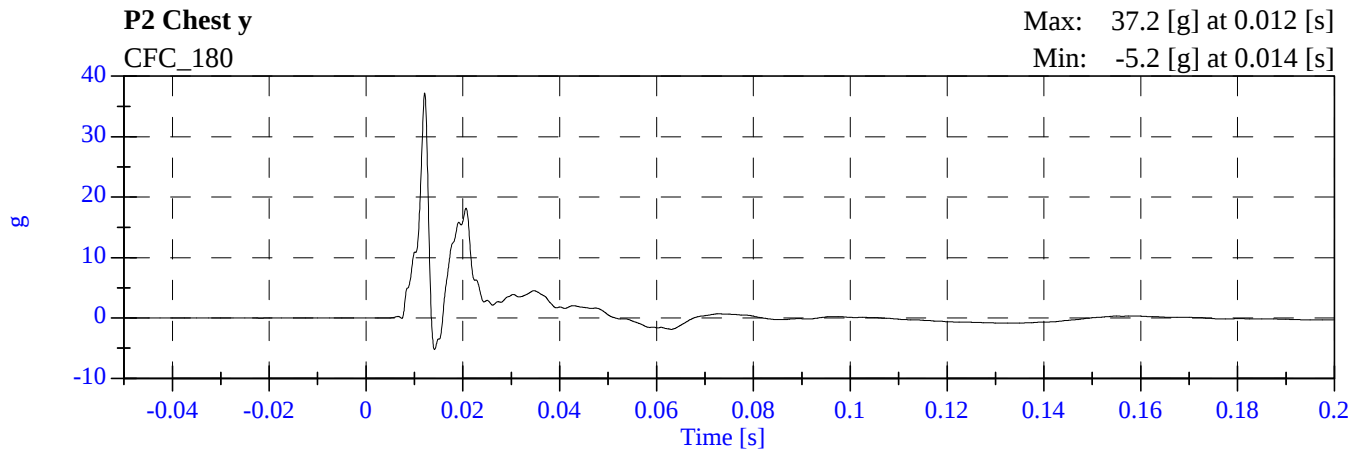
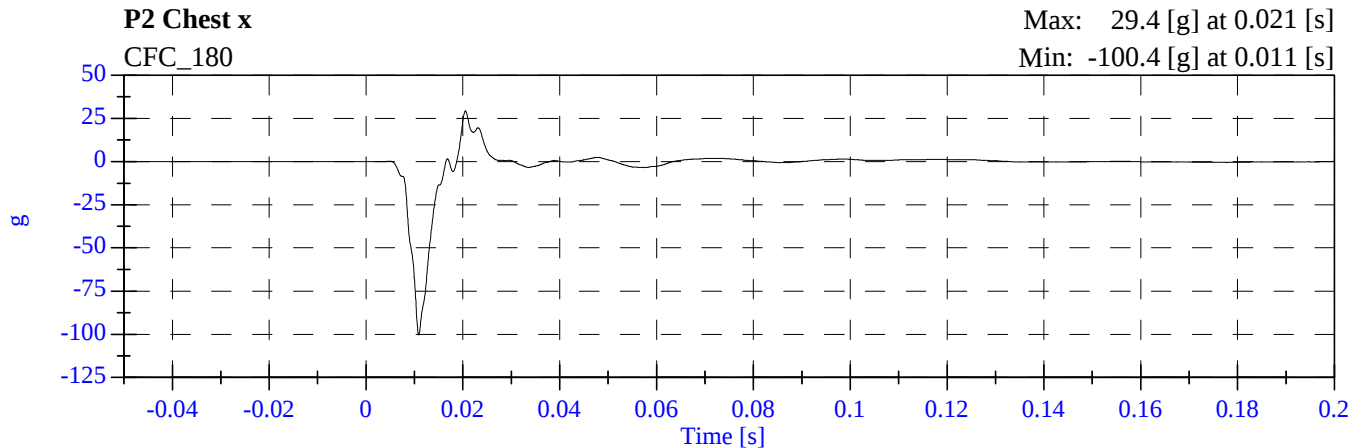


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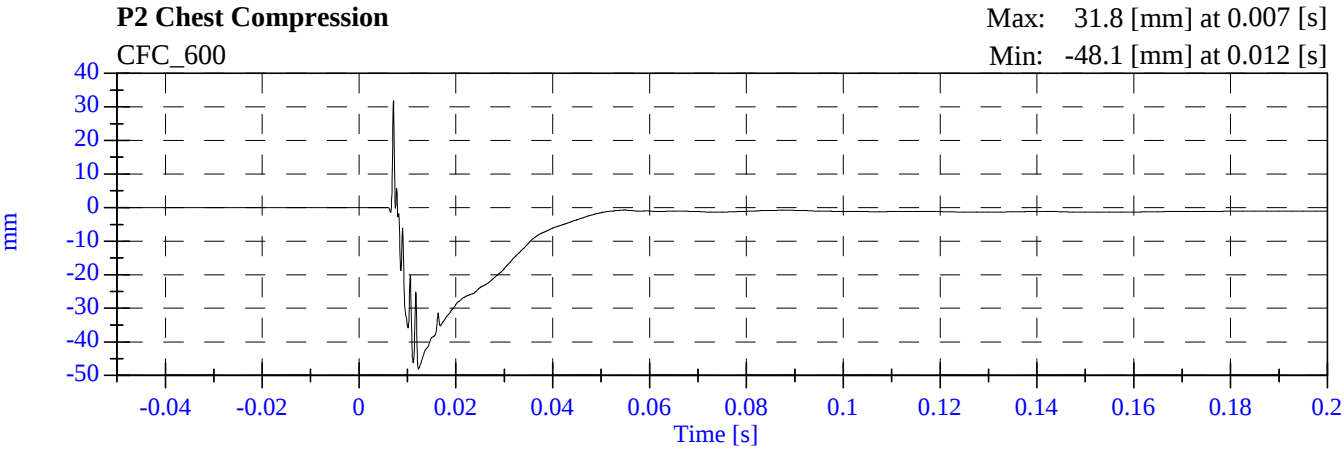


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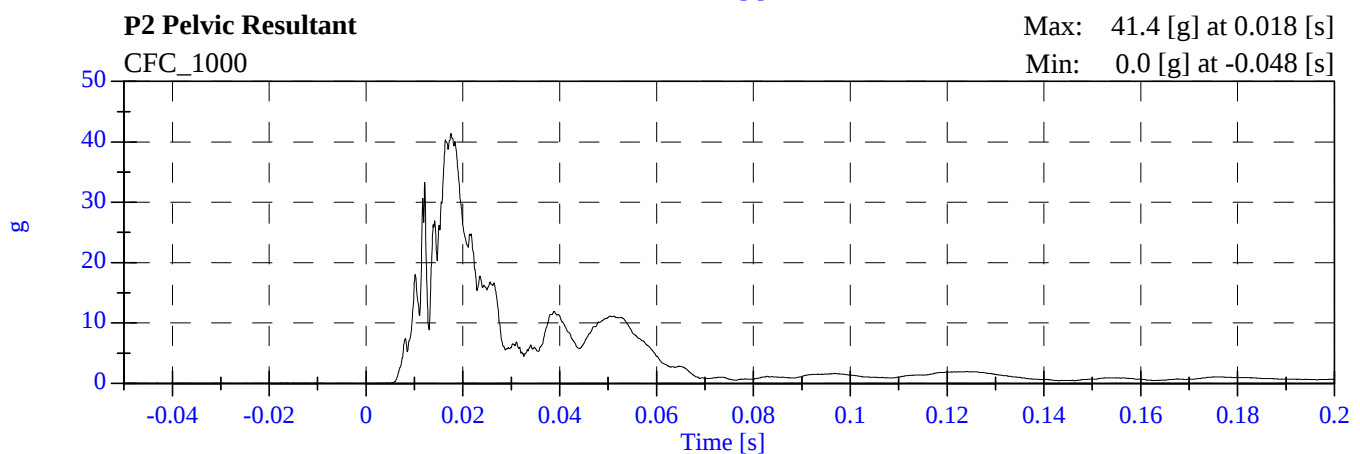
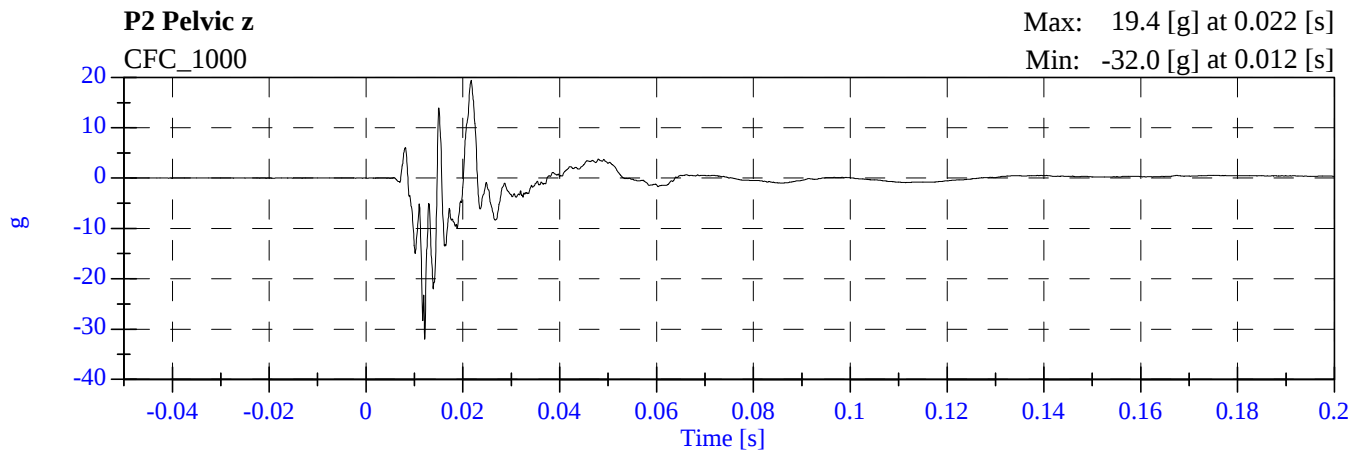
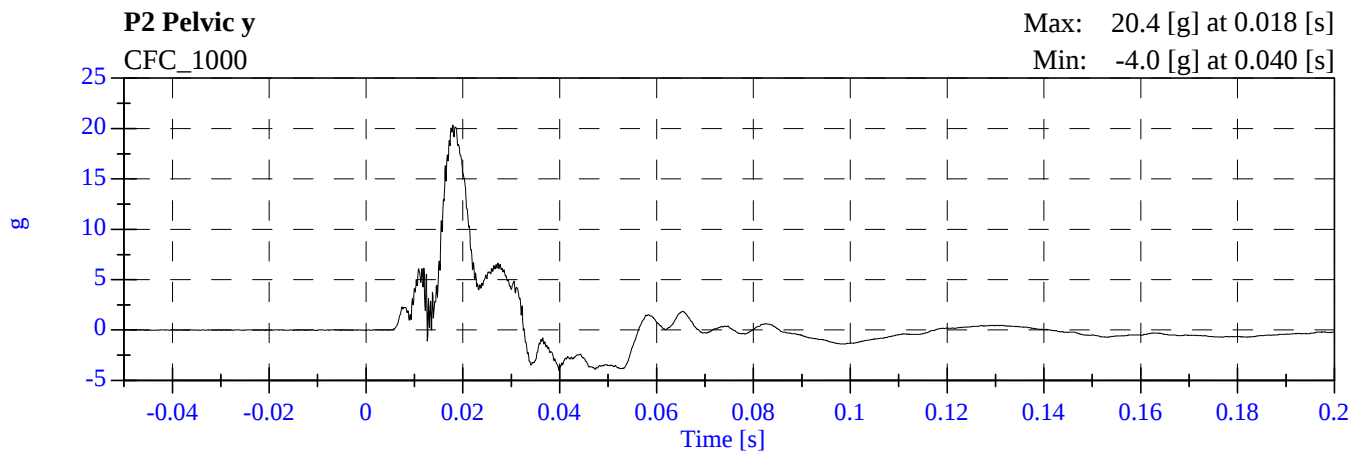
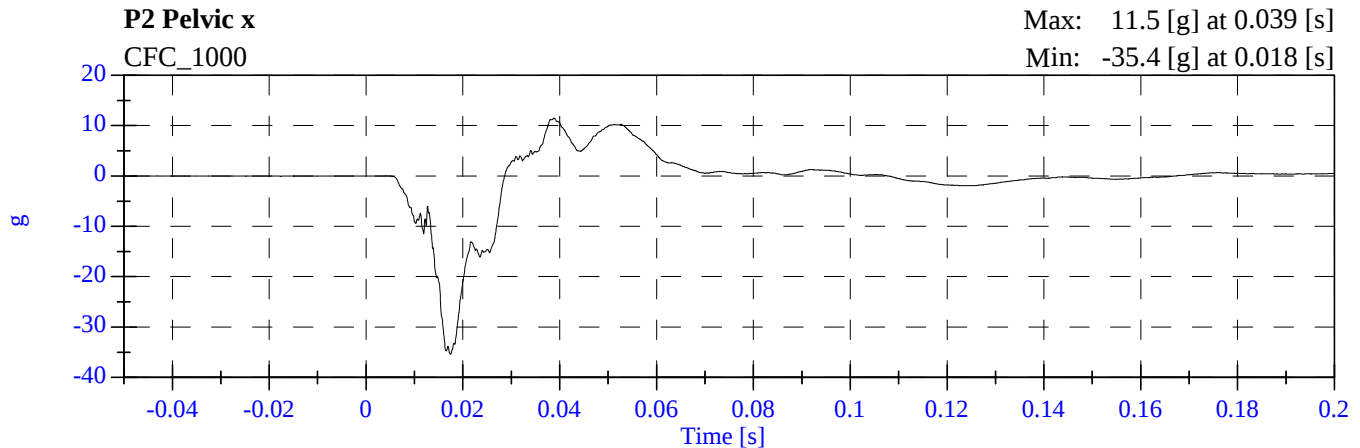


TWG01 - 2005 Suzuki Verona
M50504TWG2 - May 09, 2005



TWG01 - 2005 Suzuki Verona

M50504TWG2 - May 09, 2005



APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572P INSTRUMENTATION

	POSITION #2 (RIGHT FRONT) SERIAL NO.: 040		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD AX	AC-J36611	ENDEVCO	25-Jan-05
HEAD AY	AC-P35789	ENDEVCO	04-Jan-05
HEAD AZ	AC-J27466	ENDEVCO	25-Jan-05
UPPER NECK FX	LC-210Fx	Denton	02-Aug-04
UPPER NECK FY	LC-210Fy	Denton	02-Aug-04
UPPER NECK FZ	LC-210Fz	Denton	02-Aug-04
UPPER NECK MX	LC-210Mx	Denton	02-Aug-04
UPPER NECK MY	LC-210My	Denton	02-Aug-04
UPPER NECK MZ	LC-210Mz	Denton	02-Aug-04
CHEST AX	AC-P21399	ENDEVCO	02-Dec-04
CHEST AY	AC-CC92H	ENDEVCO	25-Jan-05
CHEST AZ	AC-J29006	ENDEVCO	25-Jan-05
CHEST DISPLACEMENT X	DS-040	SERVO	02-Aug-04
PELVIS AX	AC-01G18-F09	ENTRAN	25-Jan-05
PELVIS AY	AC-J27525	ENDEVCO	25-Jan-05
PELVIS AZ	AC-J17988	ENDEVCO	25-Jan-05