

**Vehicle Research and Test Center  
FMVSS 213 Side Impact Testing  
CRABI 12 Month Old**

**Prepared By:  
Transportation Research Center Inc.  
10820 State Route 347  
P. O. Box B-67  
East Liberty, OH 43319**



**Summary Report**

**October 2021**

**Prepared For  
Vehicle Research and Test Center  
P. O. Box 37  
East Liberty, OH 43319**

**SECTION 1**  
**PURPOSE AND SUMMARY FOR 12 MONTH OLD CRABI**

The purpose of this test series was to evaluate current CRS side impact protection measures in the FMVSS 213 side impact testing condition.

**SUMMARY**

A CRABI 12 month old dummy (serial number 094) was secured in the left rear occupant position (position 4 or P4) in a rearward facing child restraint system (CRS) and a forward facing child restraint system (CRS). The CRABI 12 month old was instrumented with head, chest, and pelvic triaxial accelerometers, and upper neck force and moment load cells. During this test series, the dummy was restrained with a 3-point seatbelt (SB3PT), 3-point seatbelt & top tether (SB3PT&T) or lower anchors and top tether (LATCH).

Section 2 contains testing performed using a forward facing CRS. Section 3 contains testing using a rearward facing CRS. Section 4 contains the dummy certification information.

**SECTION 2**  
**FORWARD FACING CRS TEST SUMMARY**

**TEST DUMMY INFORMATION**

Description	Position # 4 CRS
ATD Type/Serial No.	CRABI 12 Month Old/094
Restrain System	SB3PT&T, LATCH
CRS Direction	Forward Facing
Foam Cushion	WB15, WB16

**CAMERA POSITIONING FARO MEASUREMENTS**

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
Overhead Wide	mm	-572.56	401.94	-1221.89
Front	mm	1086.11	558.44	214.06

## DUMMY POSITIONING

CRS: Cosco Scenera Next – Forward Facing Convertible – SB3PT&T

TRC Test Number: S211018-1

VRTC Test Number: SIDE\_381



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	0.11	-0.16	0.05
Front of Sliding Seat	mm	-155.22	671.22	576.46
Sliding Seat Corner	mm	-162.83	371.67	561.06
Point S1	mm	-148.41	390.67	621.89
Point S2	mm	-150.91	1049.09	625.64
Honeycomb Corner	mm	-315.93	96.02	579.73
Z point	mm	-772.38	1068.80	688.00
Back of Sliding Seat	mm	-894.27	976.73	5.10
CRS top of the seat	mm	-820.21	670.28	22.04
CRS bottom Center	mm	-184.20	670.23	396.12
Top of Head	mm	-646.89	671.38	58.58
Front of Face	mm	-556.25	673.26	93.33
Head CG	mm	-613.87	611.30	123.63
Shoulder	mm	-585.57	570.05	241.11
Chest Clip	mm	-496.50	670.05	226.06
Buckle	mm	-382.57	669.35	315.72
Right Knee	mm	-329.47	750.95	341.53
Right Ankle	mm	-208.04	754.59	258.15
Left Knee	mm	-330.02	590.88	338.86
Left Ankle	mm	-211.19	587.63	260.30

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
CRS 1	mm	-699.94	538.68	127.86
CRS 4	mm	-632.97	539.70	393.27
CRS 2	mm	-423.52	504.12	394.55
CRS 3	mm	-274.82	538.07	412.63

**DUMMY INJURY**

HIC (15 ms)	802
Chest Clip (3 ms)	74.85 g

## DUMMY POSITIONING

CRS: Graco Nautilus 65 – Forward Facing Combination – SB3PT&T

TRC Test Number: S211018-2

VRTC Test Number: SIDE\_382



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	0.08	-0.32	-0.22
Front of Sliding Seat	mm	-154.70	671.08	576.12
Sliding Seat Corner	mm	-162.60	371.35	560.76
Point S1	mm	-148.19	390.63	621.43
Point S2	mm	-150.15	1048.89	625.11
Honeycomb Corner	mm	-315.55	97.15	587.21
Z point	mm	-771.43	1069.15	685.73
Back of Sliding Seat	mm	-895.20	976.67	5.67
CRS top of the seat	mm	-794.91	669.44	19.53
CRS top of the headrest	mm	-779.74	669.21	-81.89
CRS bottom Center	mm	-215.41	670.03	427.89
Top of Head	mm	-596.63	673.11	-13.89
Front of Face	mm	-522.01	672.10	46.23
Head CG	mm	-585.98	609.77	55.13
Shoulder	mm	-593.46	565.28	175.87
Chest Clip	mm	-512.28	668.08	172.32
Buckle	mm	-438.41	669.32	286.82
Right Knee	mm	-389.61	748.30	340.25
Right Ankle	mm	-264.68	761.71	264.68
Left Knee	mm	-381.17	586.79	338.60
Left Ankle	mm	-259.85	590.62	263.62

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
CRS 1	mm	-712.00	537.06	168.71
CRS 4	mm	-615.24	538.05	424.90
CRS 2	mm	-524.03	460.86	373.72
CRS 3	mm	-378.15	433.76	347.69

**DUMMY INJURY**

HIC (15 ms)	632
Chest Clip (3 ms)	83.94 g

## DUMMY POSITIONING

CRS: Evenflo Chase – Forward Facing Combination – LATCH

TRC Test Number: S211019-1

VRTC Test Number: SIDE\_383



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	-0.50	-0.31	0.15
Front of Sliding Seat	mm	-154.82	672.75	576.28
Sliding Seat Corner	mm	-162.70	373.03	561.15
Point S1	mm	-148.29	392.29	622.01
Point S2	mm	-150.22	1050.70	625.55
Honeycomb Corner	mm	-324.08	95.67	575.39
Z point	mm	-771.28	1070.92	685.77
Back of Sliding Seat	mm	-893.96	978.56	5.08
CRS top of the seat	mm	-837.34	671.25	-69.64
CRS top of the headrest	mm	-833.12	669.97	-108.78
CRS bottom Center	mm	-243.66	670.28	421.31
Top of Head	mm	-654.38	670.47	29.26
Front of Face	mm	-573.14	671.52	79.98
Head CG	mm	-634.51	608.77	97.17
Shoulder	mm	-627.09	565.20	219.88
Chest Clip	mm	-555.75	670.47	197.33
Buckle	mm	-452.27	669.10	287.48
Right Knee	mm	-373.69	743.28	350.18
Right Ankle	mm	-240.67	747.59	285.37
Left Knee	mm	-368.31	599.28	353.60
Left Ankle	mm	-239.64	604.90	291.63

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
CRS 1	mm	-766.63	546.71	105.71
CRS 4	mm	-670.02	541.85	358.02
CRS 2	mm	-524.40	506.26	419.77
CRS 3	mm	-378.16	454.91	388.50

**DUMMY INJURY**

HIC (15 ms)	793
Chest Clip (3 ms)	80.00 g

**SECTION 3**  
**REARWARD FACING CRS TEST SUMMARY**

**TEST DUMMY INFORMATION**

Description	Position # 4 CRS
ATD Type/Serial No.	CRABI 12 Month Old/094
Restrain System	SB3PT
CRS Direction	Rearward Facing
Foam Cushion	WB15, WB16

**CAMERA POSITIONING FARO MEASUREMENTS**

Description	Units	X	Y	Z
Origin	mm	0.00	0.00	0.00
Overhead Wide	mm	-572.56	401.94	-1221.89
Front	mm	1086.11	558.44	214.06

## DUMMY POSITIONING

CRS: Evenflo LiteMax – Rearward Facing Infant – SB3PT

TRC Test Number: S211013-1

VRTC Test Number: SIDE\_379



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	-0.15	-0.30	0.04
Front of Sliding Seat	mm	-154.98	674.02	576.45
Sliding Seat Corner	mm	-162.79	374.52	561.15
Point S1	mm	-148.27	393.66	621.79
Point S2	mm	-150.33	1052.21	625.41
Honeycomb Corner	mm	-315.11	94.99	569.00
Z point	mm	-771.30	1072.69	685.65
Back of Sliding Seat	mm	-891.69	673.71	3.78
CRS base center top	mm	-87.24	667.94	302.84
CRS base center bottom	mm	-105.33	667.25	461.80
CRS mid height	mm	-150.06	669.71	204.94
CRS handle	mm	15.61	668.28	65.12
CRS top of the seat	mm	-57.01	670.65	15.35
CRS top of base	mm	-627.24	670.13	420.71
CRS handle side	mm	-318.70	448.56	225.26
CRS bottom Center	mm	-627.48	673.40	371.79
Top of Head	mm	-199.88	671.61	-1.06
Front of Face	mm	-286.43	669.43	43.07
Head CG	mm	-225.30	607.52	66.66
Chest Clip	mm	-309.67	675.06	156.71

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
Buckle	mm	-430.08	675.35	280.09
Right Knee	mm	-512.15	594.68	343.19
Right Ankle	mm	-659.34	585.40	321.45
Left Knee	mm	-512.90	754.78	340.32
Left Ankle	mm	-655.05	759.74	323.28
CRS 1	mm	-155.09	526.44	202.10
CRS 4	mm	-277.50	473.53	401.63
CRS 2	mm	-366.53	515.45	331.60
CRS 3	mm	-642.28	494.72	419.63

**DUMMY INJURY**

HIC (15 ms)	479
Chest Clip (3 ms)	76.49 g

## DUMMY POSITIONING

CRS: Graco Snug Ride Snug Lock 35 – Rearward Facing Infant – SB3PT

TRC Test Number: S211014-1

VRTC Test Number: SIDE\_380



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	-0.16	-0.15	0.12
Front of Sliding Seat	mm	-154.98	670.94	576.07
Sliding Seat Corner	mm	-162.64	371.31	561.21
Point S1	mm	-148.20	390.56	622.16
Point S2	mm	-150.48	1049.13	625.95
Honeycomb Corner	mm	-317.81	95.76	580.34
Z point	mm	-771.53	1068.64	686.68
Back of Sliding Seat	mm	-891.62	670.63	4.35
CRS base center top	mm	-142.35	669.52	417.00
CRS mid height	mm	-113.98	671.76	255.90
CRS handle	mm	-55.50	675.07	69.36
CRS top of the seat	mm	-84.92	672.85	92.99
CRS handle side	mm	-373.08	442.05	264.82
CRS bottom Center	mm	-693.23	669.07	293.85
Top of Head	mm	-209.51	669.15	29.30
Front of Face	mm	-300.11	667.75	63.96
Head CG	mm	-241.68	605.09	95.52
Chest Clip	mm	-348.96	672.29	178.53
Buckle	mm	-475.16	671.23	273.04
Right Knee	mm	-548.61	594.29	296.93

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
Right Ankle	mm	-659.41	591.26	198.85
Left Knee	mm	-559.10	735.15	294.99
Left Ankle	mm	-676.13	724.17	213.60
CRS 1	mm	-172.95	517.66	191.98
CRS 4	mm	-278.44	496.28	447.85
CRS 2	mm	-415.54	510.44	360.21
CRS 3	mm	-645.39	507.97	383.76

**DUMMY INJURY**

HIC (15 ms)	578
Chest Clip (3 ms)	85.15 g

## DUMMY POSITIONING

CRS: Evenflo LiteMax – Rearward Facing Infant– SB3PT

TRC Test Number: S211028-1

VRTC Test Number: SIDE\_394



### DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Origin Post	mm	-0.02	-0.25	0.07
Front of Sliding Seat	mm	-154.83	671.19	576.35
Sliding Seat Corner	mm	-162.57	371.46	561.02
Point S1	mm	-148.17	390.80	621.84
Point S2	mm	-150.34	1049.21	625.34
Honeycomb Corner	mm	-317.23	95.32	574.86
Z point	mm	-771.39	1068.87	686.95
Back of Sliding Seat	mm	-892.17	670.44	4.32
CRS base center top	mm	-87.75	670.52	307.95
CRS base center bottom	mm	-110.98	667.36	467.50
CRS mid height	mm	-145.28	670.39	209.06
CRS handle	mm	14.55	676.00	70.10
CRS top of the seat	mm	-52.79	673.86	20.30
CRS top of base	mm	-637.03	671.21	410.49
CRS handle side	mm	-317.51	448.65	221.25
CRS bottom Center	mm	-625.46	673.48	366.81
Top of Head	mm	-193.84	673.23	2.00
Front of Face	mm	-279.14	670.97	46.08
Head CG	mm	-217.45	609.83	70.42
Chest Clip	mm	-302.47	672.96	156.65
Buckle	mm	-427.29	670.91	275.34

**DUMMY POSITIONING FARO MEASUREMENTS, CONTINUED**

Description	Units	X	Y	Z
Right Knee	mm	-516.59	597.08	331.60
Right Ankle	mm	-663.11	595.85	319.77
Left Knee	mm	-515.73	743.88	333.30
Left Ankle	mm	-659.28	745.92	315.27
CRS 1	mm	-151.54	529.41	205.34
CRS 4	mm	-281.13	475.13	396.38
CRS 2	mm	-366.81	519.18	355.59
CRS 3	mm	-641.03	494.35	409.22

**DUMMY INJURY**

HIC (15 ms)	508
Chest Clip (3 ms)	80.67 g

**SECTION 4**  
**DUMMY CALIBRATION DATA**

# Transportation Research Center Inc. ATD Certification Report

Customer:

Vehicle Research and Test Center  
10820 State Rout 347  
East Liberty, Ohio 43319

Anthropomorphic Device:

CRABI (12) Month Old  
Serial No. 094  
Certification No. 23



**Transportation Research Center Inc.  
P.O. Box B-67  
10820 St. Rt. 347  
East Liberty, OH 43319-0367**

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# Introduction

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Customer Name: VRTC  
Customer Contact: Bryan Crabtree  
Email: Bryan.Crabtree.CTR@dot.gov  
Phone: (937) 666-2011  
Date Received: October 6, 2021  
Date Completed: October 6, 2021

Special Instruction: N/A

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This Certification Report meets the requirements set forth by the ANSI National Accreditation Board ISO/IEC 17025:2017 accreditation under the scope of Mechanical Testing for Crash Test Dummy Certification Testing (ANAB Certificate #L2187). **This testing certification shall not be reproduced, except in full, without written approval of TRC Inc.**


The evidence measurements of this Certification Report are traceable by the Serial Number and Certification Number located at the top of the first section for each certification.

Each certification test was conducted by an authorized Transportation Research Center Inc. (TRC Inc.) employee within the requirements of the ISO/IEC 17025:2017 standards and adheres to CFR Part 572 Subparts B, E, N, O, P, R, T, U, V, SAE J2860, J2856, J2862; depending on ATD type. Any statements of conformity in this report are made using the shared risk method.


Each component of the ATD to be tested was contained in a temperature controlled environment for a period of at least 4 hours before the test. The temperature in the ATD Certification Laboratory was between 20.6°C and 22.2°C (69.08°F – 71.96°F). The relative humidity in the ATD Certification Laboratory was between 10% and 70%.

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Date Testing Requested: 10/06/2021

Testing Conducted by:   
Robert Benavides, Engineering Technician III

Date: 10/06/2021

Testing Approved by:   
Ian Sharp, Team Leader

Date: 10/07/2021

## Appendix A – Incoming Inspection



# TRC ATD Laboratory As Received Inspection Report

Name: Robert Benavides

Date: 10/6/2021

Customer: VRTC

ATD S/N: 094

HEAD / NECK		
No.	Comments	Photo No.
1	None to report.	
2		
3		

THORAX / ABDOMEN		
No.	Comments	Photo No.
4	None to report.	
5		
6		

SHOULDERS / ARMS		
No.	Comments	Photo No.
7	None to report.	
8		
9		

PELVIS / LUMBAR		
No.	Comments	Photo No.
10	None to report.	
11		
12		

FEMUR / KNEES		
No.	Comments	Photo No.
13	None to report.	
14		
15		

LOWER LEGS / FEET		
No.	Comments	Photo No.
16	None to report.	
17		
18		





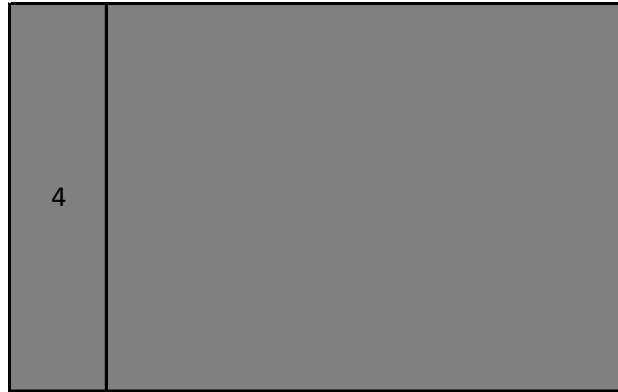
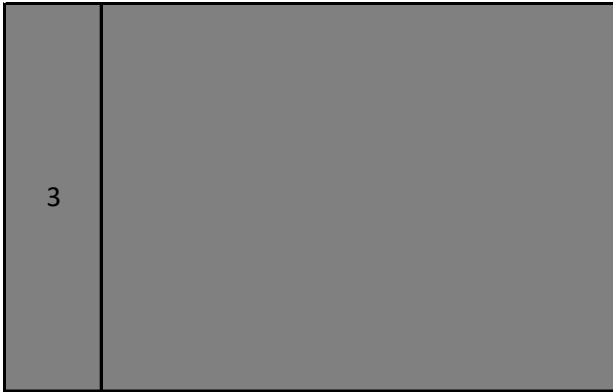
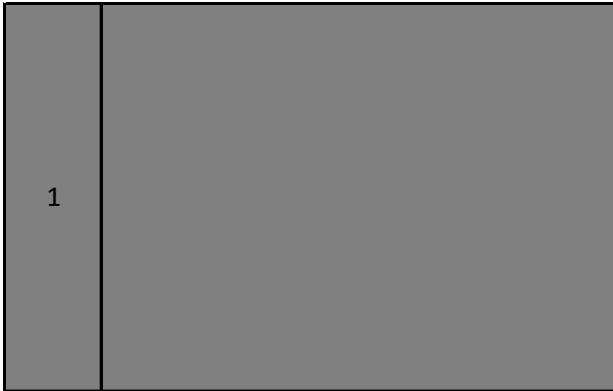
TRC ATD Laboratory As Received Inspection Photos

Name: Robert Benavides

Date: 10/6/2021

Customer: VRTC

ATD S/N: 094





# TRC ATD Laboratory Inspection Report Action Items

Name: Robert Benavides

Date: 10/6/2021

Customer: VRTC

ATD S/N: 094

Action #1	None to report.
Resolution #1	
Action #2	
Resolution #2	
Action #3	
Resolution #3	
Comments	



## Appendix B – Test Results

# Transportation Research Center Inc.

Front Head Drop

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	18.9 - 25.6 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	66 %	Yes
Peak Head Resultant Acceleration	100 - 120 g	108.7 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	3.2 g	Yes
Is Acceleration Curve Unimodal within 17% of Peak?	< 17 %	9.28 %	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

**Head Skin S/N: DN0340**

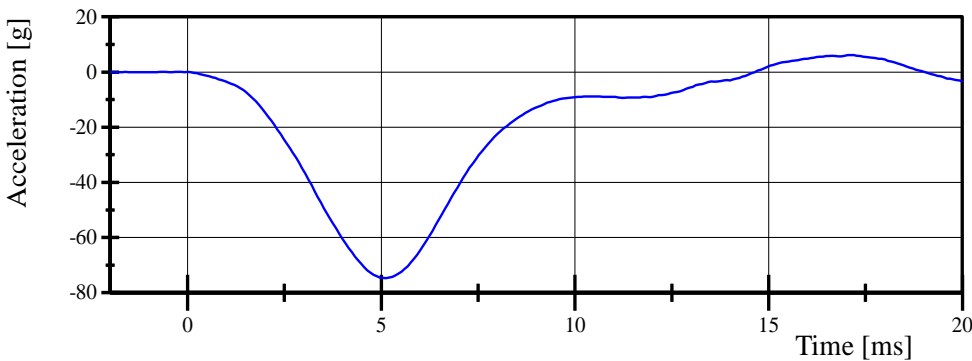
# Transportation Research Center Inc.

Front Head Drop

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

Head X-Axis Acceleration

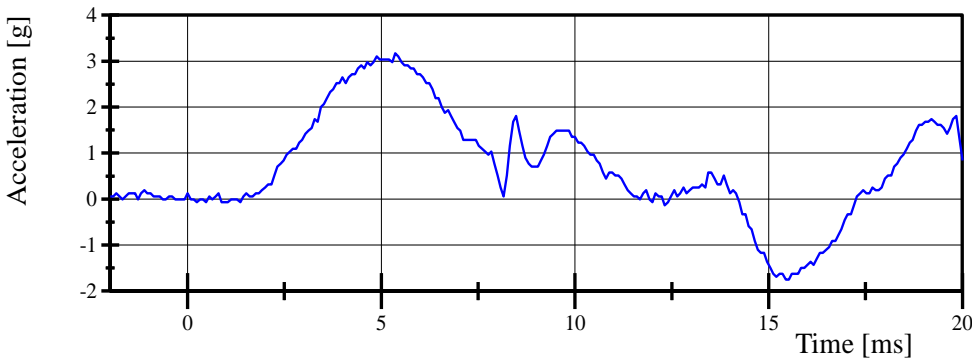


Filter Class: CFC\_1000

Max: 6.2 g at 17.1 ms

Min: -74.7 g at 5.1 ms

Head Y-Axis Acceleration

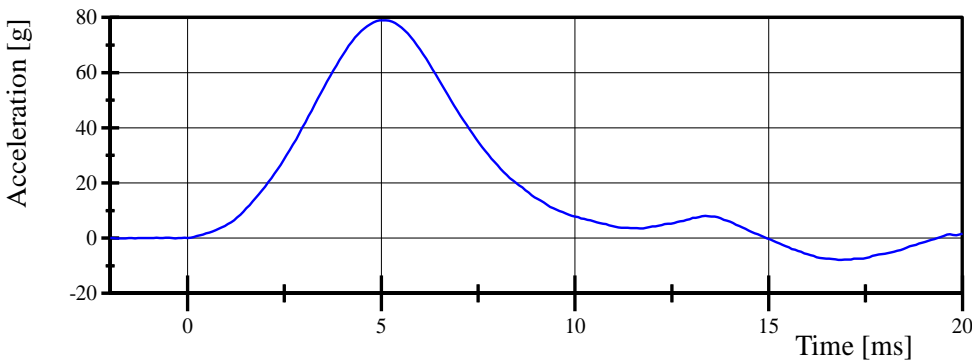


Filter Class: CFC\_1000

Max: 3.2 g at 5.4 ms

Min: -1.8 g at 15.4 ms

Head Z-Axis Acceleration

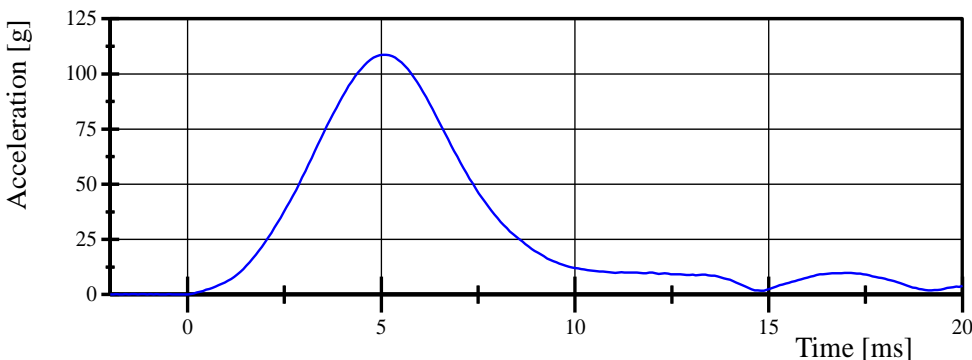


Filter Class: CFC\_1000

Max: 78.9 g at 5.0 ms

Min: -7.9 g at 16.9 ms

Head Resultant Acceleration



Filter Class: CFC\_1000

Max: 108.7 g at 5.1 ms

Min: 0.0 g at -0.2 ms

# Transportation Research Center Inc.

Rear Head Drop

CRABI 12 MO Serial No. 094 Certification No. 23-2

Test Date: 10/6/2021

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	18.9 - 25.6 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	68 %	Yes
Peak Head Resultant Acceleration	55 - 71 g	63.8 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	2.6 g	Yes
Is Acceleration Curve Unimodal within 17% of Peak?	< 17 %	10.94 %	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

**Head Skin S/N: DN0340**

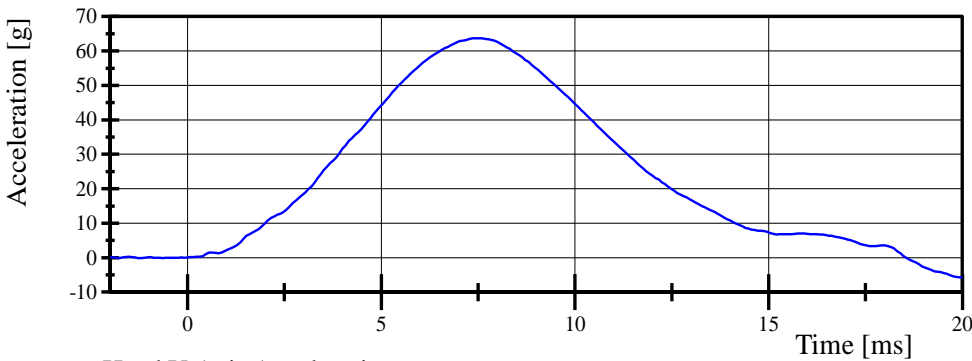
# Transportation Research Center Inc.

Rear Head Drop

CRABI 12 MO Serial No. 094 Certification No. 23-2

Test Date: 10/6/2021

Head X-Axis Acceleration

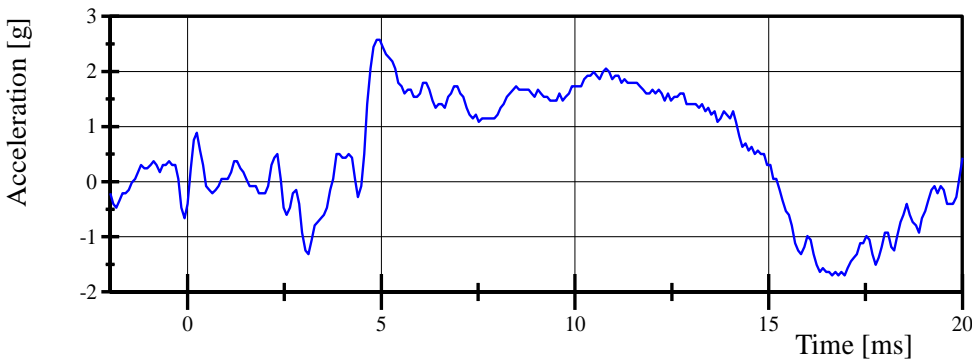


Filter Class: CFC\_1000

Max: 63.7 g at 7.4 ms

Min: -5.7 g at 20.0 ms

Head Y-Axis Acceleration

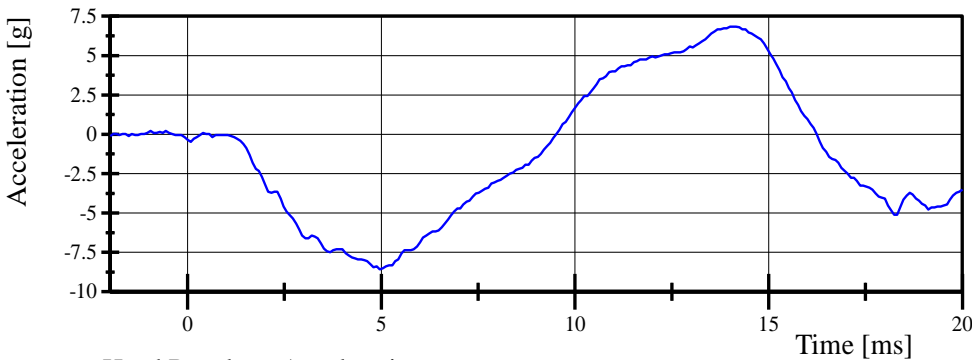


Filter Class: CFC\_1000

Max: 2.6 g at 4.9 ms

Min: -1.7 g at 16.6 ms

Head Z-Axis Acceleration

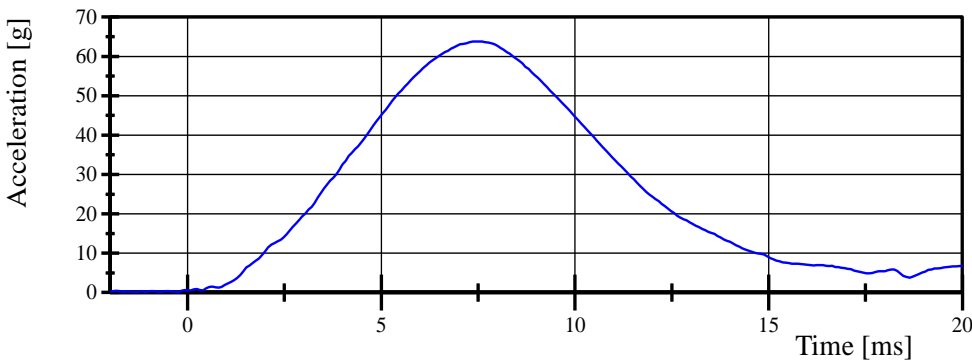


Filter Class: CFC\_1000

Max: 6.8 g at 14.0 ms

Min: -8.6 g at 5.0 ms

Head Resultant Acceleration



Filter Class: CFC\_1000

Max: 63.8 g at 7.4 ms

Min: 0.1 g at -0.2 ms

# Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 23-2

Test Date: 10/6/2021

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	65 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.30 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-1.6) - (-2.3) m/s	-1.95 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-3.4) - (-4.2) m/s	-3.92 m/s	Yes
Pendulum Integrated Velocity Change at 25ms	(-4.3) - (-5.2) m/s	-4.76 m/s	Yes
Total Head D-Plane Rotation	(-75) - (-86) °	-78.5 °	Yes
Total Neck Occipital Condyles Moment	36 - 45 N·m	37.2 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 5 Nm	60 - 80 ms	72.8 ms	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

**Neck S/N: 307**

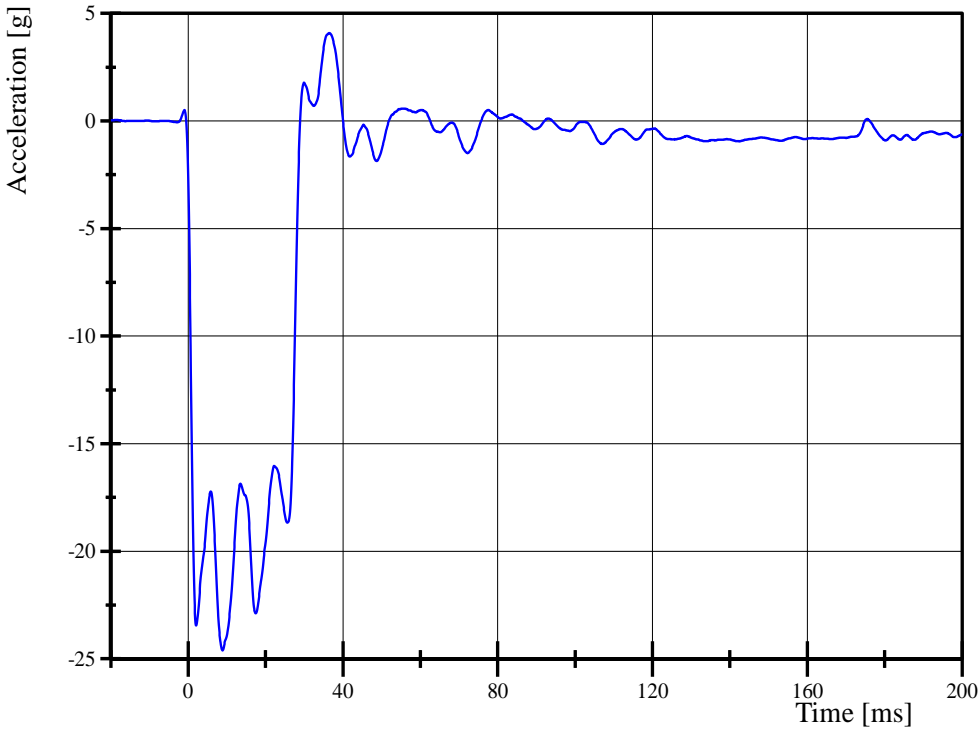
# Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 23-2

Test Date: 10/6/2021

Pendulum Acceleration

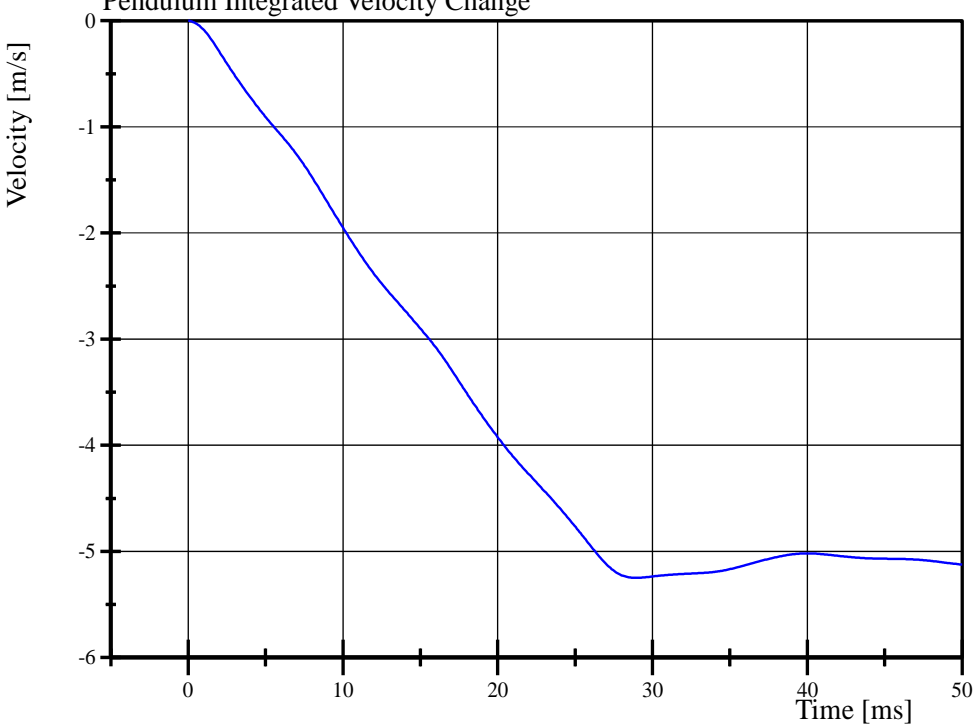


Filter Class: CFC\_180

Max: 4.1 g at 36.5 ms

Min: -24.6 g at 8.9 ms

Pendulum Integrated Velocity Change



Filter Class: CFC\_180

Max: 0.0 m/s at 0.0 ms

Min: -5.2 m/s at 29.0 ms

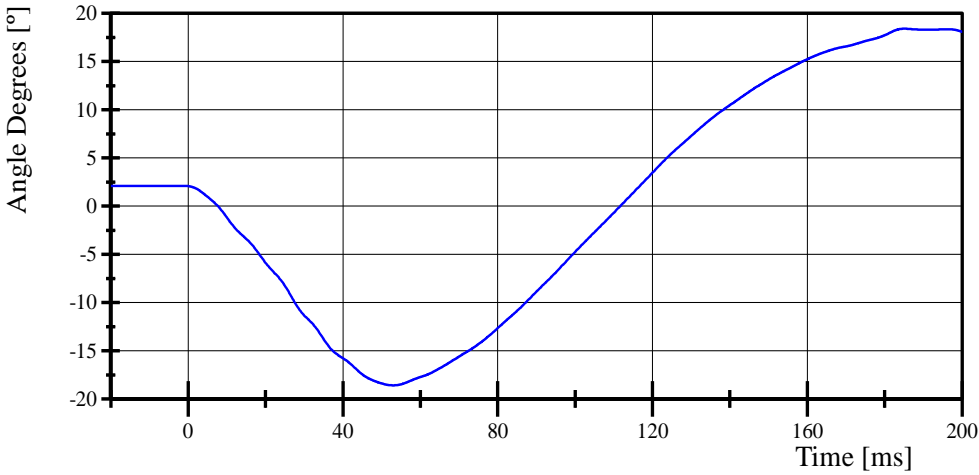
# Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 23-2

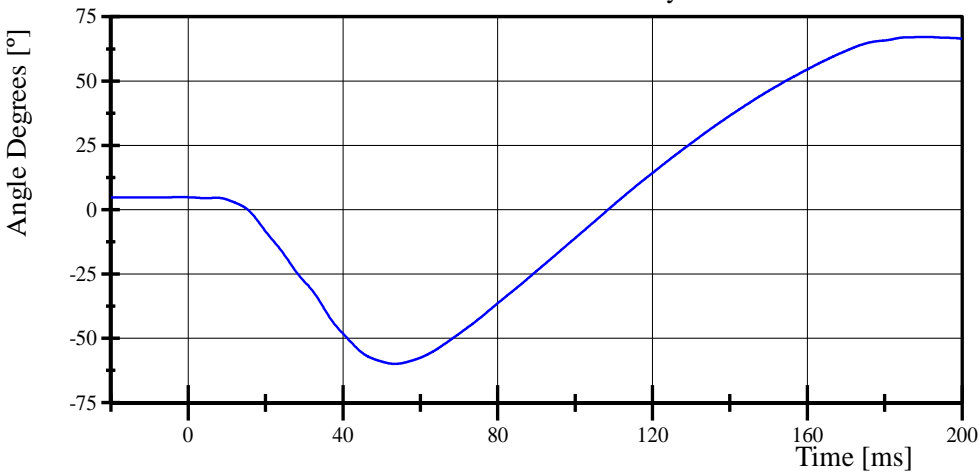
Test Date: 10/6/2021

### Forward Pot Rotation at Base of Pendulum



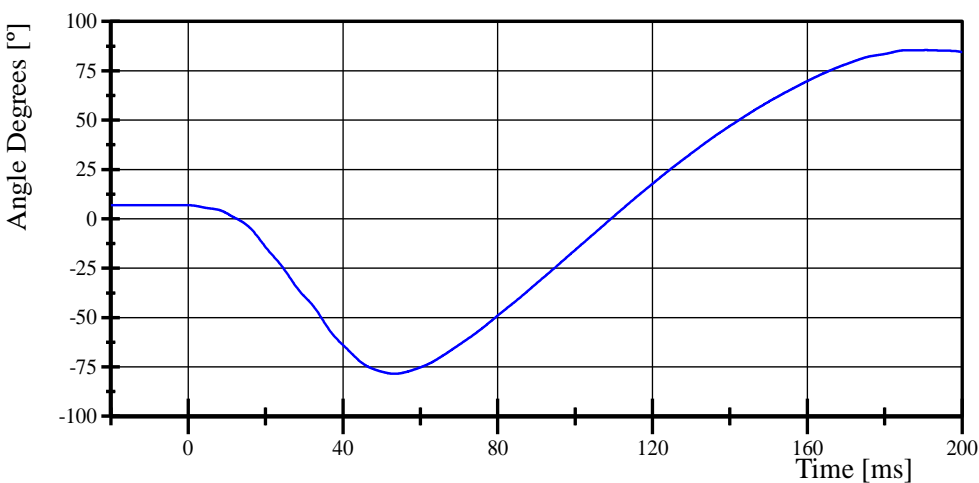
Filter Class: CFC\_60  
Max: 18.4 ° at 185.1 ms  
Min: -18.6 ° at 53.0 ms

### Center Headform Pot Rotation at Center of Gravity



Filter Class: CFC\_60  
Max: 67.1 ° at 190.7 ms  
Min: -59.9 ° at 53.4 ms

### Total Head D-Plane Rotation



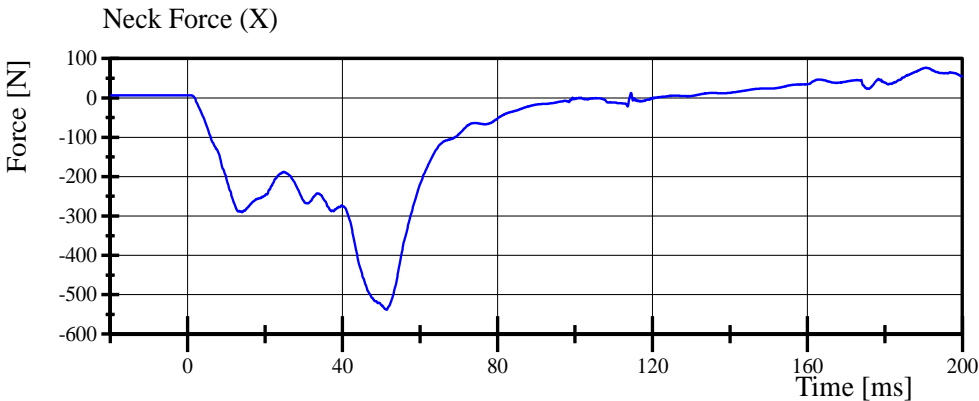
Filter Class: CFC\_60  
Max: 85.5 ° at 190.6 ms  
Min: -78.5 ° at 53.4 ms

# Transportation Research Center Inc.

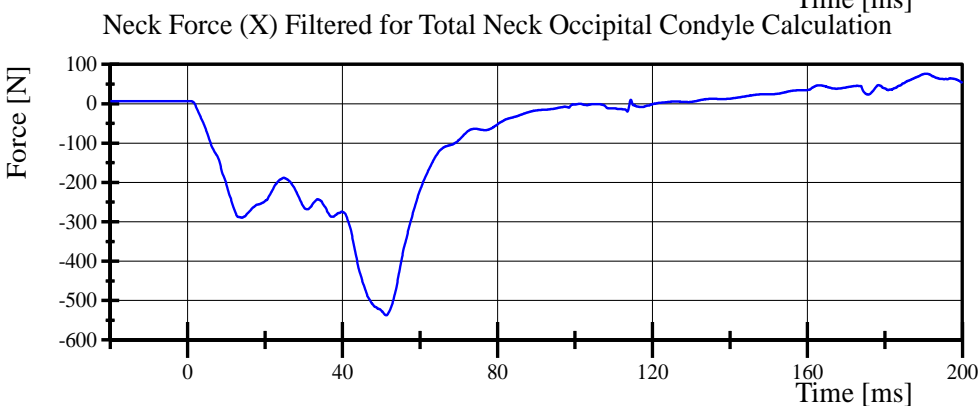
## Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 23-2

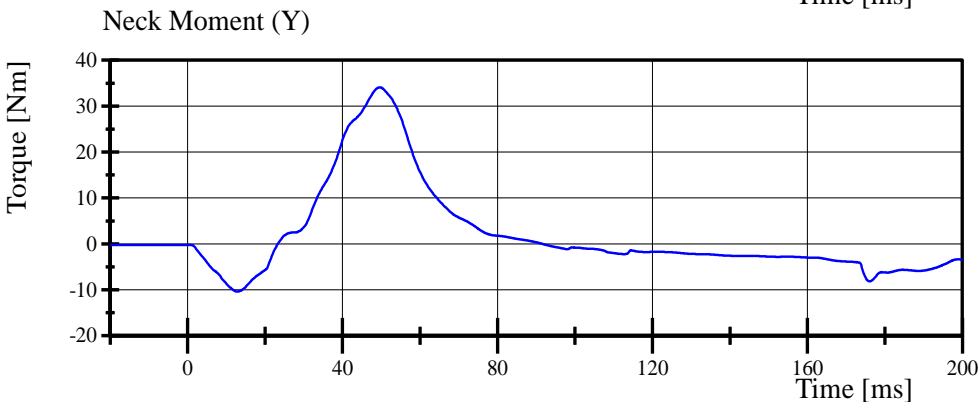
Test Date: 10/6/2021



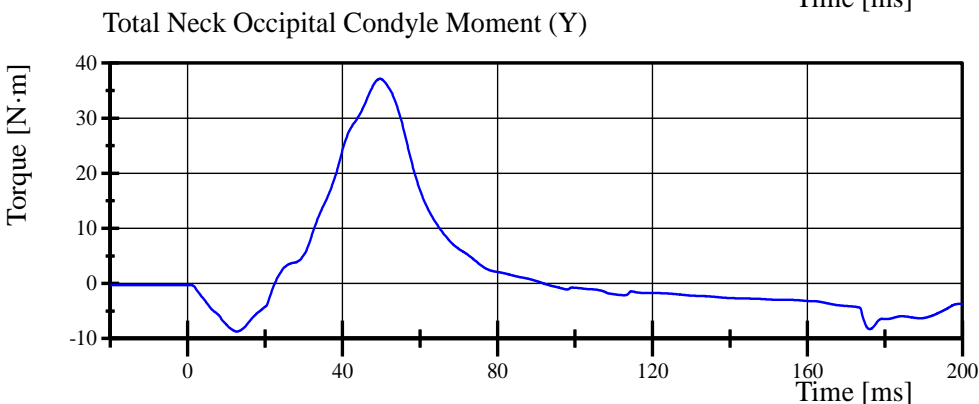
Filter Class: CFC\_1000  
Max: 76.6 N at 190.6 ms  
Min: -537.5 N at 51.4 ms



Filter Class: CFC\_600  
Max: 76.5 N at 190.6 ms  
Min: -537.4 N at 51.3 ms



Filter Class: CFC\_600  
Max: 34.1 Nm at 49.7 ms  
Min: -10.4 Nm at 12.9 ms



Filter Class: Without\_(Constar  
Max: 37.2 N·m at 49.7 ms  
Min: -8.7 N·m at 12.7 ms

# Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Pendulum Velocity	(-2.4) - (-2.6) m/s	-2.54 m/s	Yes
Pendulum Integrated Velocity Change at 6ms	0.8 - 1.2 m/s	0.80 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 2.1 m/s	1.54 m/s	Yes
Pendulum Integrated Velocity Change at 14ms	2.2 - 2.9 m/s	2.29 m/s	Yes
Total Head D-Plane Rotation	80 - 92 °	85.4 °	Yes
Total Neck Occipital Condyles Moment	(-12) - (-23) N·m	-15.1 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -5 Nm	76 - 90 ms	81.6 ms	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

**Neck S/N: 307**

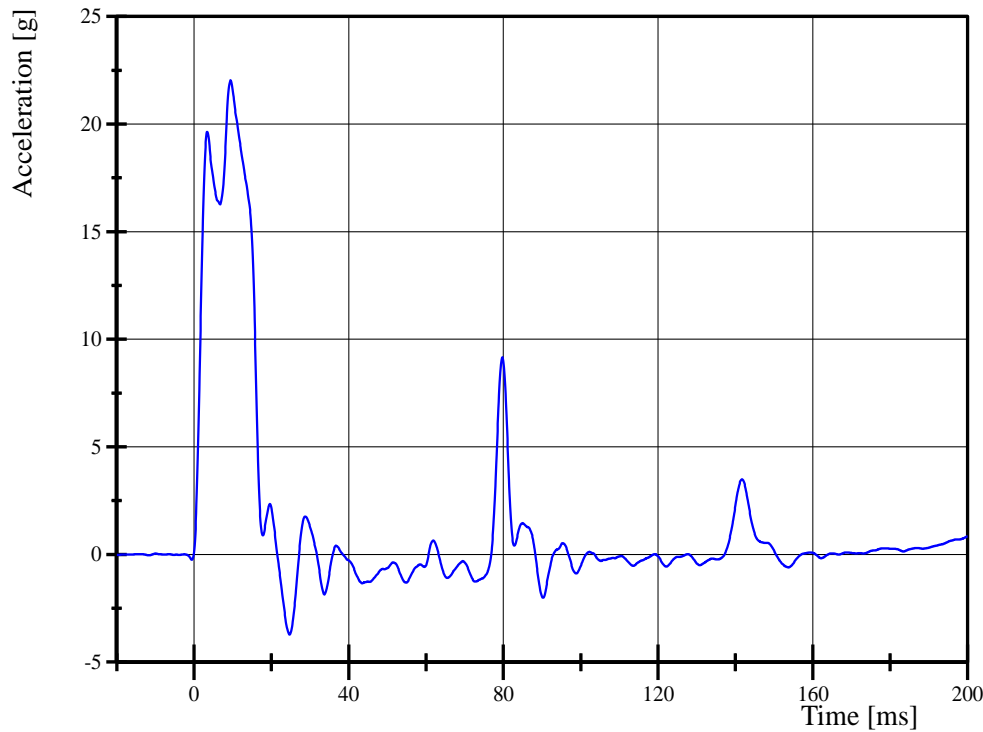
# Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

### Pendulum Acceleration

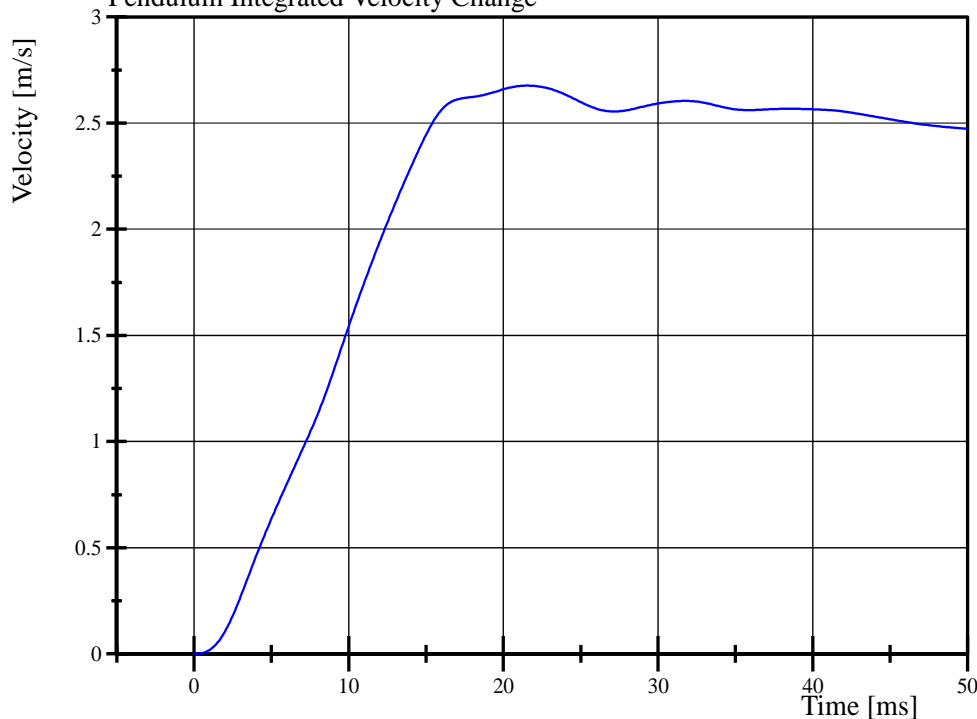


Filter Class: CFC\_180

Max: 22.0 g at 9.4 ms

Min: -3.7 g at 24.7 ms

### Pendulum Integrated Velocity Change



Filter Class: CFC\_180

Max: 2.7 m/s at 21.5 ms

Min: 0.0 m/s at 0.0 ms

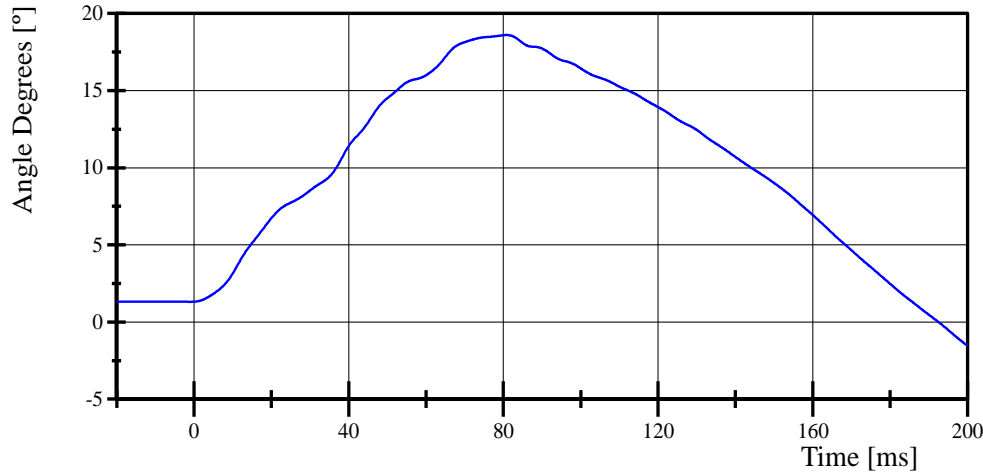
# Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 23-1

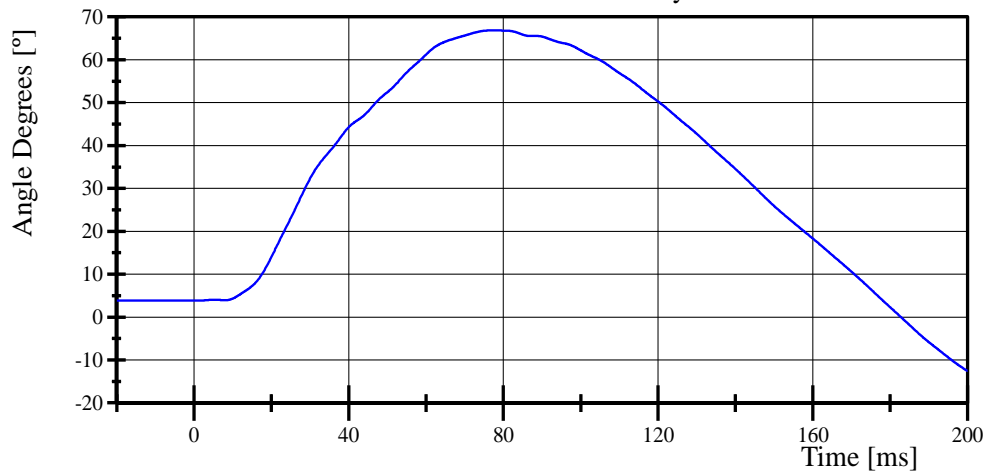
Test Date: 10/6/2021

### Forward Pot Rotation at Base of Pendulum



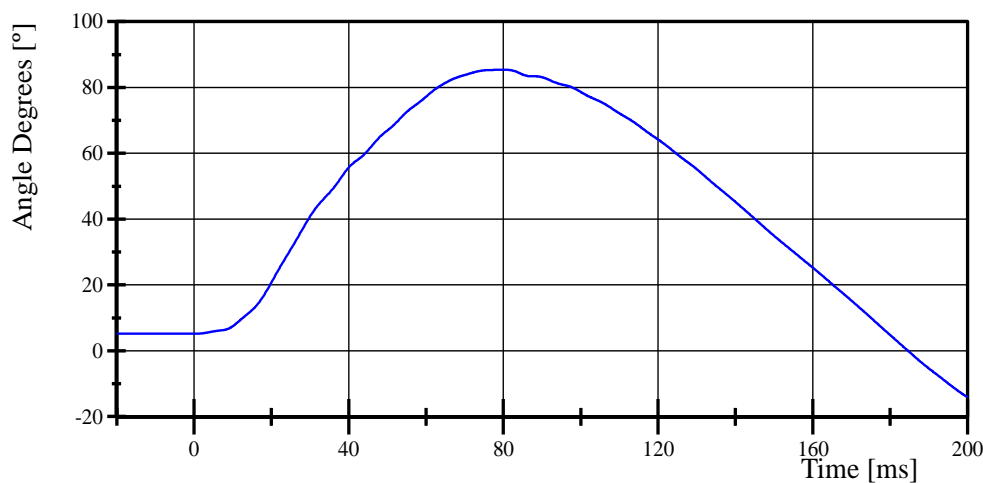
Filter Class: CFC\_60  
Max: 18.6 ° at 80.8 ms  
Min: -1.5 ° at 200.0 ms

### Center Headform Pot Rotation at Center of Gravity



Filter Class: CFC\_60  
Max: 66.8 ° at 77.0 ms  
Min: -12.6 ° at 200.0 ms

### Total Head D-Plane Rotation



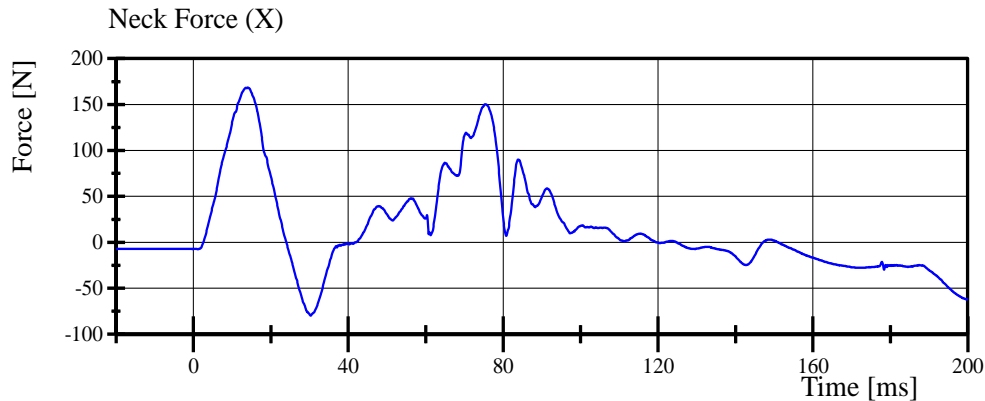
Filter Class: CFC\_60  
Max: 85.4 ° at 80.2 ms  
Min: -14.1 ° at 200.0 ms

# Transportation Research Center Inc.

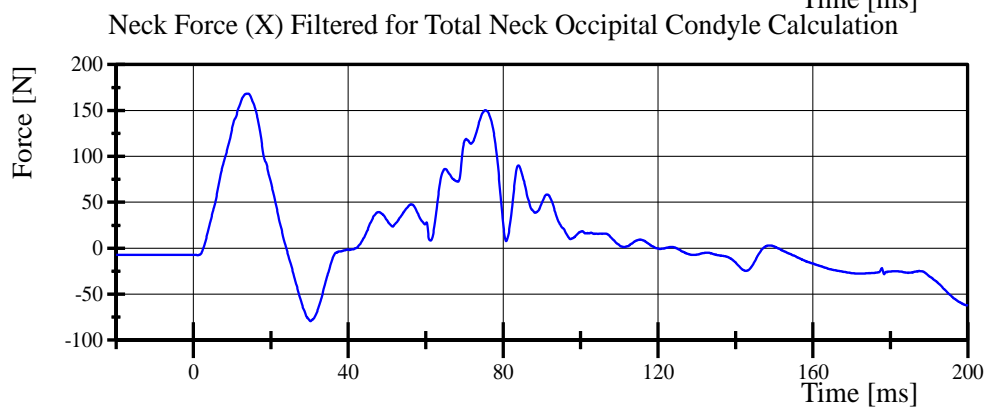
Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 23-1

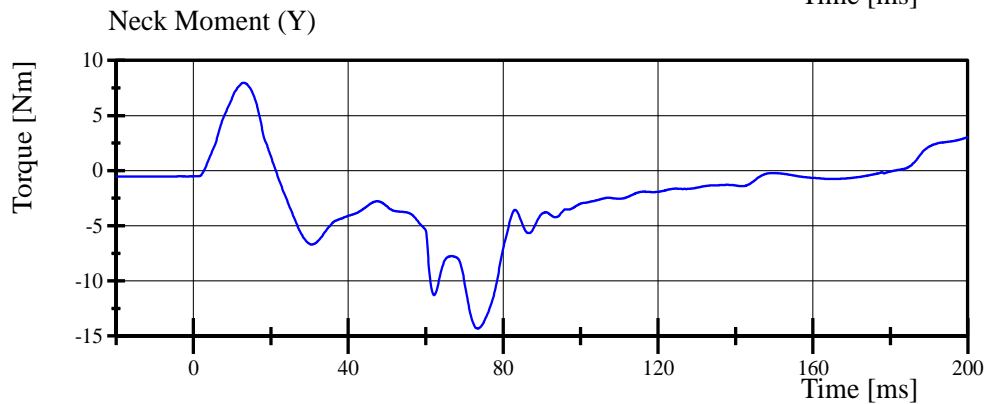
Test Date: 10/6/2021



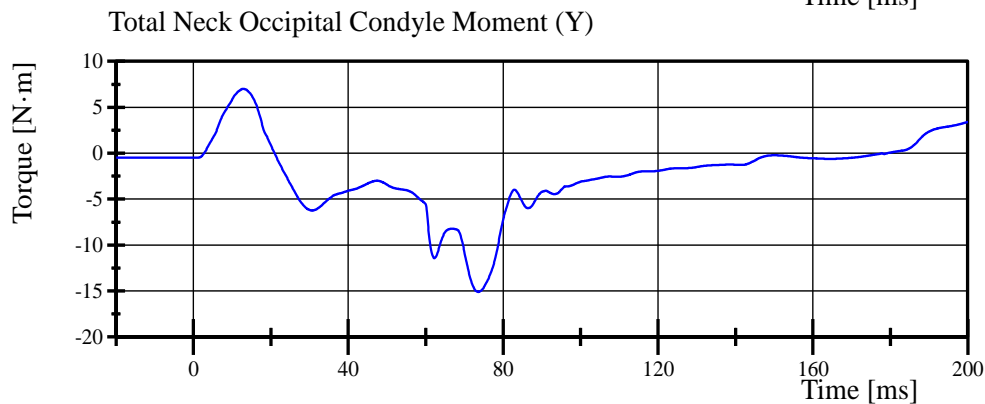
Filter Class: CFC\_1000  
Max: 168.4 N at 14.1 ms  
Min: -79.7 N at 30.2 ms



Filter Class: CFC\_600  
Max: 168.3 N at 14.1 ms  
Min: -79.4 N at 30.2 ms



Filter Class: CFC\_600  
Max: 8.0 Nm at 13.0 ms  
Min: -14.3 Nm at 73.4 ms



Filter Class: Without\_(Consta  
Max: 7.0 N·m at 12.9 ms  
Min: -15.1 N·m at 73.6 ms

# Transportation Research Center Inc.

Front Thorax

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

<b>Test Parameter</b>	<b>Specification</b>	<b>Test Results</b>	<b>Pass</b>
Temperature	20.6 - 22.2 °C	21.5 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Impactor Velocity	4.9 - 5.1 m/s	4.92 m/s	Yes
Impactor Force	(-1,514) - (-1,796) N	-1,615.2 N	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

**Torso Flesh S/N: N/A**

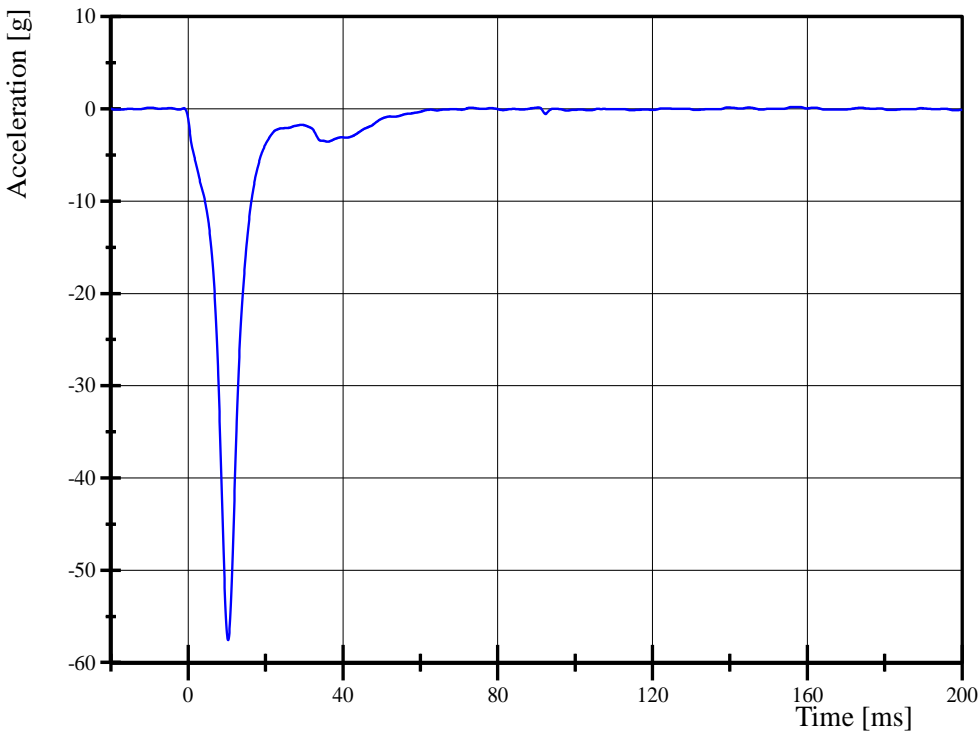
# Transportation Research Center Inc.

Front Thorax

CRABI 12 MO Serial No. 094 Certification No. 23-1

Test Date: 10/6/2021

### Impactor Acceleration

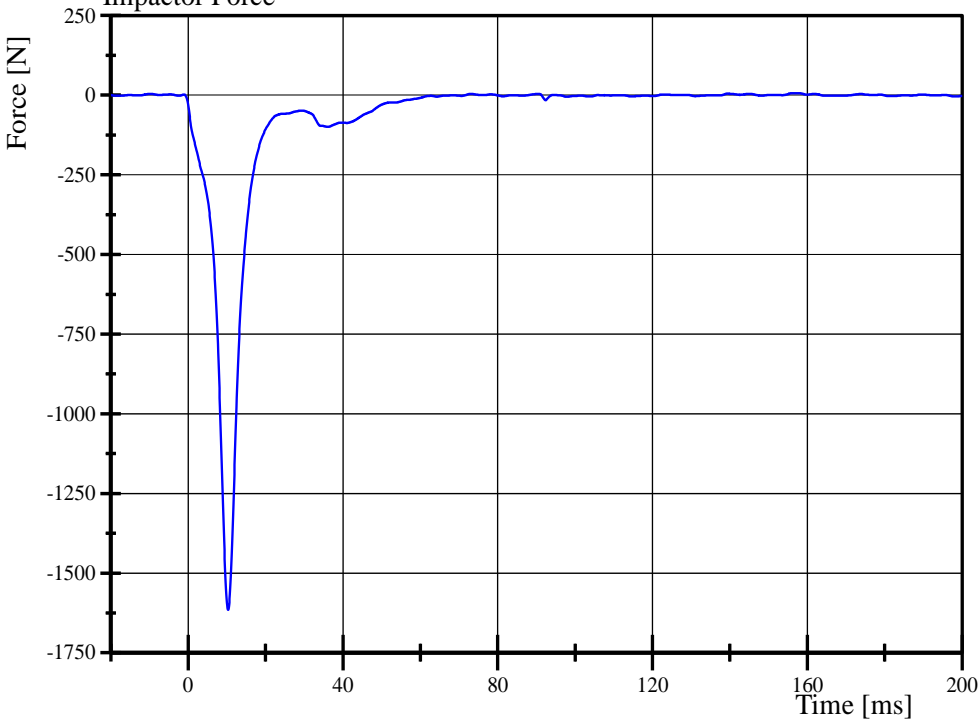


Filter Class: CFC\_180

Max: 0.2 g at 157.6 ms

Min: -57.6 g at 10.3 ms

### Impactor Force



Filter Class: CFC\_180

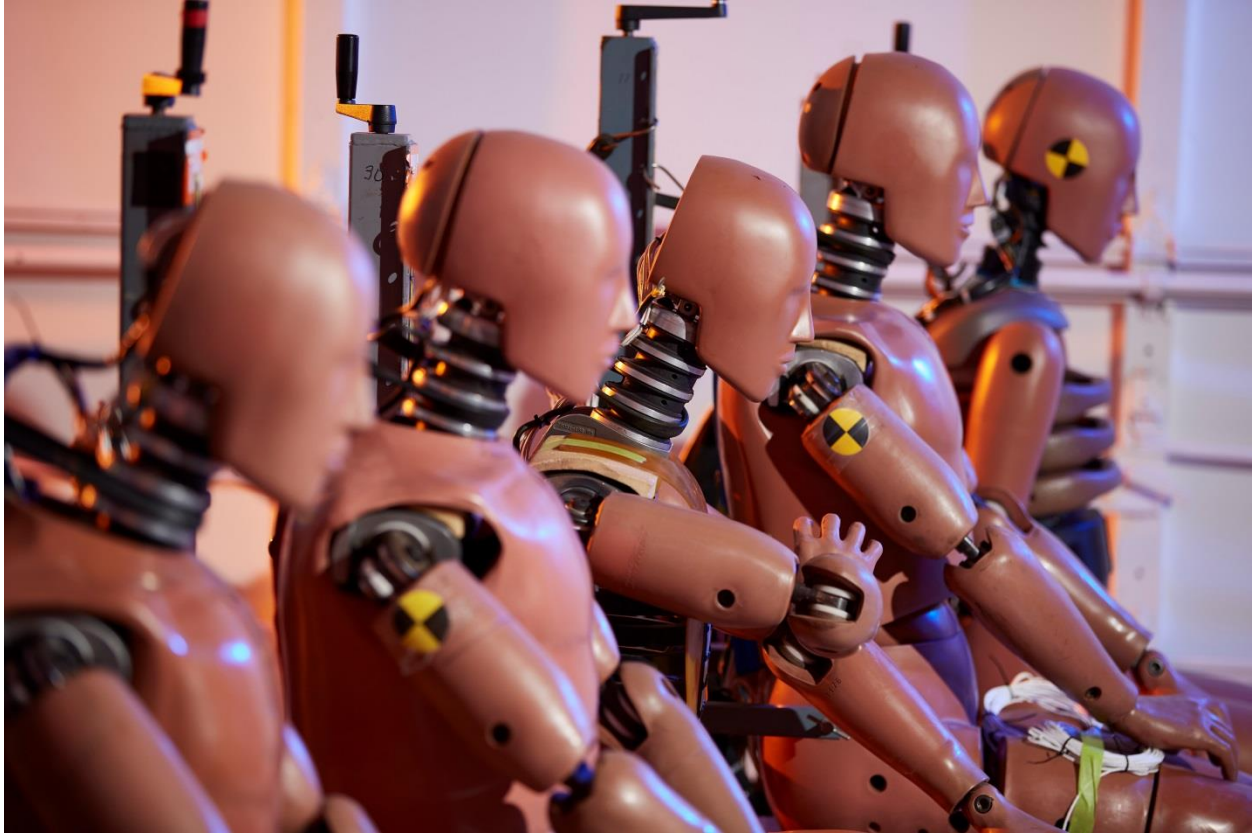
Max: 5.8 N at 157.6 ms

Min: -1,615.2 N at 10.3 ms

## Appendix C – Quality Assurance

# Quality Assurance

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## ATD Assembly & Final Inspection

ATD Type: CRABI (12) Month Old

ATD Serial Number: 094

Assembled by: *Rat Benda*

Inspected by: *Ben Lin*

Date Inspected: 10/06/2021