

**Vehicle Research and Test Center
FMVSS 213 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

August 2023

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

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

The purpose of this test series was to evaluate buck durability and ATD responses when installing various CRSs with a 2 point belt configuration.

SUMMARY

A CRABI 12-Month-Old dummy (serial number 094) was secured in the right rear occupant position (position 3 or P3) in a rearward-facing infant child restraint system (CRS). The CRABI 12-Month-Old was instrumented with head and chest accelerometers. During this test series the dummy was restrained with a 2-point seatbelt (SB2PT).

Section 2 contains the testing performed using a rearward-facing infant child restraint system (CRS) in the right rear seating position. Section 3 contains the dummy certification information.

SECTION 2
REARWARD FACING CRS TEST SUMMARY

TEST DUMMY INFORMATION

Description	Position # 3 CRS
ATD Type/Serial No.	CRABI 12-Month-Old/094
Restrain System	SB2PT
CRS Direction	Rearward Facing
Foam Cushion	WB7

CAMERA POSITIONING FARO MEASUREMENTS

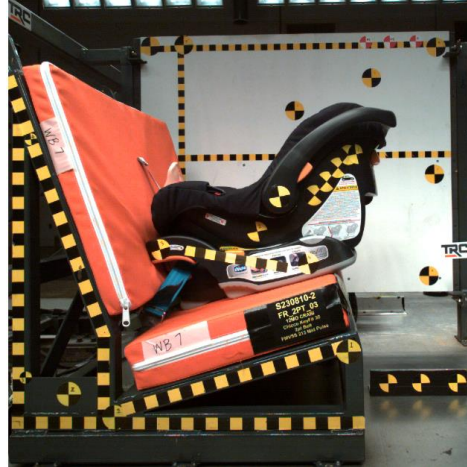
Description	Units	X	Y	Z
Origin	mm	0	0	0
PA Front	mm	536.60	924.64	-386.87
PA Side	mm	1848.67	-320.73	-515.91

DUMMY POSITIONING

CRS: Chicco KeyFit 30 – Infant – 2PT Belt

TRC Test Number: S230810-2

VRTC Test Number: FR_2PT_03



DUMMY POSITIONING FARO MEASUREMENTS

Description	Units	X	Y	Z
Z point	mm	-0.09	-0.71	-0.98
Center of the seat frame bottom	mm	615.34	-351.30	-103.83
CRS base center	mm	91.31	-348.76	-336.88
Center of seat frame back	mm	-119.65	-352.11	-679.57
Top of seat	mm	735.39	-349.58	-646.31
Top of headrest	mm	679.98	-346.15	-630.06
Top of the head	mm	577.29	-348.69	-646.25
Bridge of nose	mm	490.23	-350.44	-601.95
Head CG outboard	mm	550.54	-288.16	-578.75
Neck center	mm	515.21	-351.13	-512.27
Chest Clip	mm	437.58	-352.16	-479.39
Buckle	mm	340.66	-351.39	-400.22
Knee Outer	mm	265.77	-275.81	-377.71
Ankle Outer	mm	135.12	-270.69	-435.53
CRS 1	mm	627.02	-213.19	-519.79
CRS 4	mm	502.23	-153.43	-248.29
CRS 2	mm	374.78	-186.79	-326.14
CRS 3	mm	134.91	-170.38	-285.09

DUMMY INJURY

HIC (36 ms)	568
Chest Clip (3 ms)	49.8g
Max Seatback Angle (from vertical)	52.2 deg

SECTION 3
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. 24



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

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Introduction

Customer Name: VRTC
Customer Contact: Bryan Crabtree
Email: Bryan.Crabtree.CTR@dot.gov
Phone: (937) 666-2011
Date Received: June 22, 2023
Date Completed: July 11, 2023

Special Instruction: N/A


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.

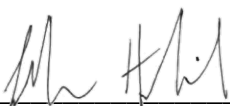
Each certification test was conducted by an authorized Transportation Research Center Inc. (TRC Inc.) employee within the requirements of the ISO/IEC 17025:2017 standards and adheres to CFR Part 572 Subparts B, E, N, O, P, R, T, U, V, SAE J2860, J2856, J2862; depending on ATD type. Any statements of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

Date Received: 06/22/2023

Testing Conducted by: 
Robert Benavides

Date: 07/11/2023

Testing Approved by: 
Josh Hendricks

Date: 07/18/2023



Appendix A – Incoming Inspection





TRC ATD Laboratory As Received Inspection Report

Name: Robert Benavides

Date: 7/10/2023

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		





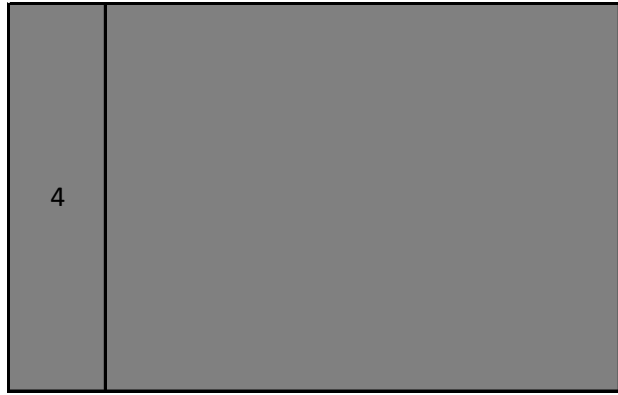
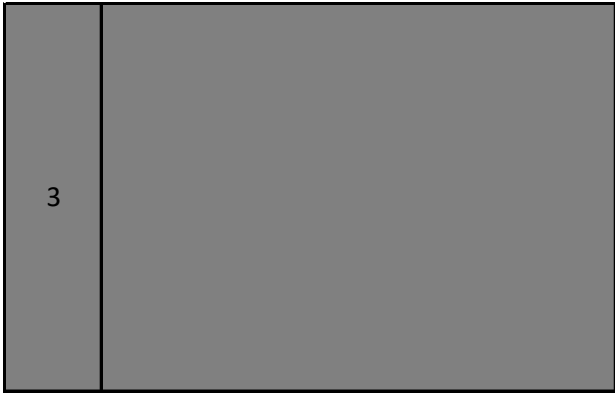
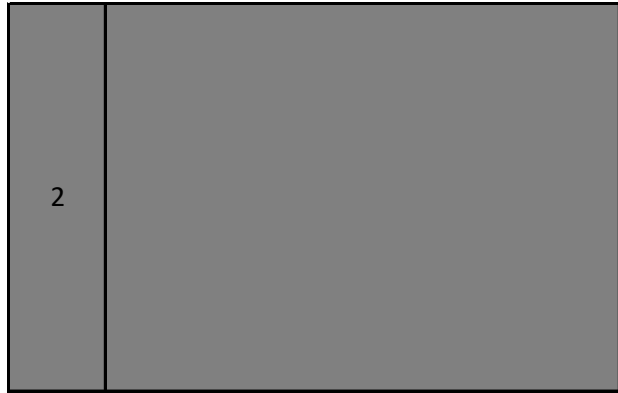
TRC ATD Laboratory As Received Inspection Photos

Name: Robert Benavides

Date: 7/10/2023

Customer: VRTC

ATD S/N: 094





TRC ATD Laboratory Inspection Report Action Items

Name: Robert Benavides

Date: 7/10/2023

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. 24-1

Test Date: 7/10/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	66 %	Yes
Peak Head Resultant Acceleration	100 - 120 g	109.8 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-2.9 g	Yes
Is Acceleration Curve Unimodal within 17% of Peak?	< 17 %	10.56 %	Yes

Test meets specifications.

Condition: Used

Comments:

Head Skin S/N: DN0340

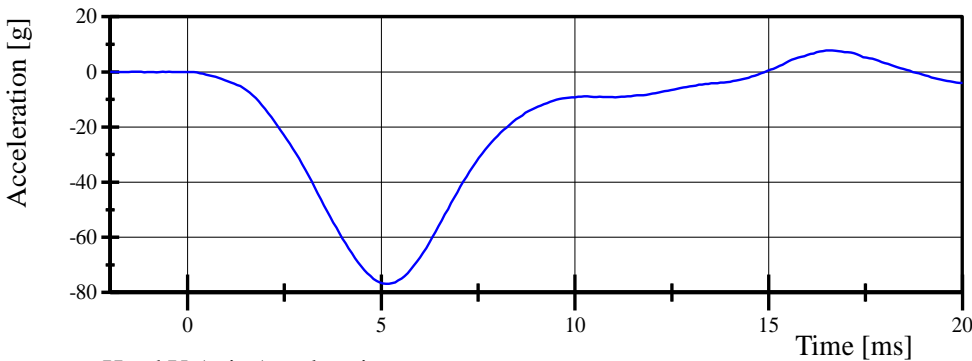
Transportation Research Center Inc.

Front Head Drop

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/10/2023

Head X-Axis Acceleration

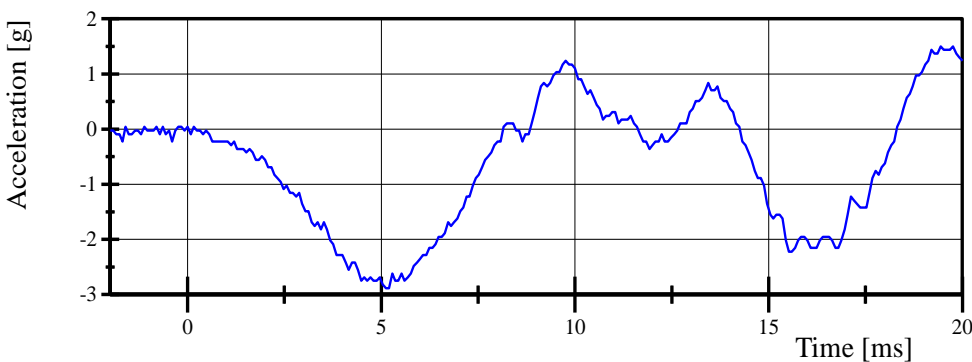


Filter Class: CFC_1000

Max: 7.8 g at 16.6 ms

Min: -76.9 g at 5.1 ms

Head Y-Axis Acceleration

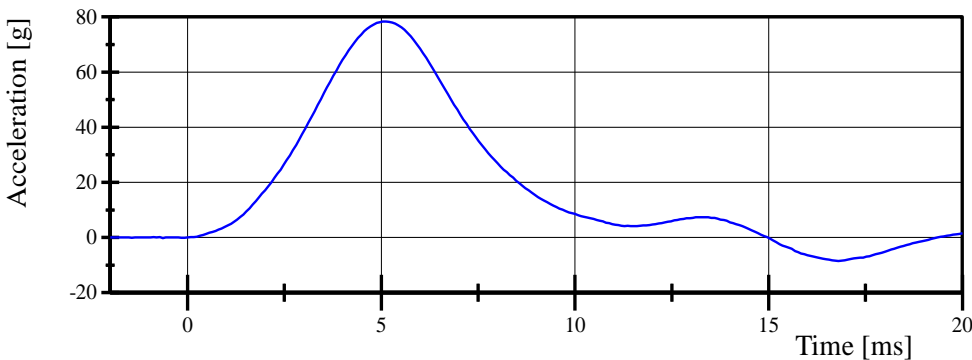


Filter Class: CFC_1000

Max: 1.5 g at 19.4 ms

Min: -2.9 g at 5.1 ms

Head Z-Axis Acceleration

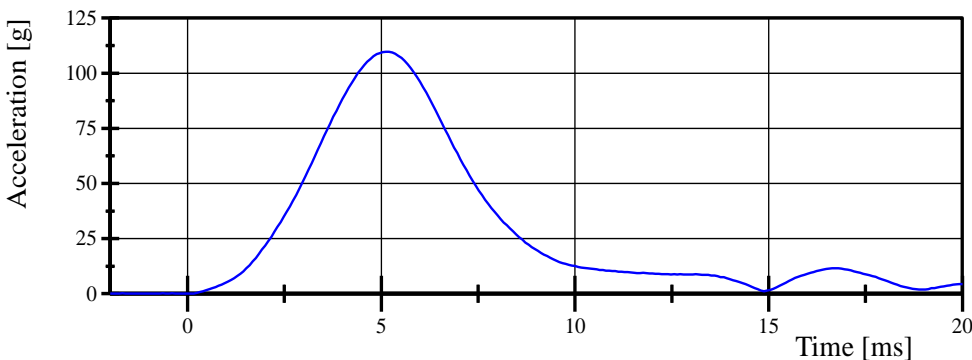


Filter Class: CFC_1000

Max: 78.3 g at 5.0 ms

Min: -8.5 g at 16.8 ms

Head Resultant Acceleration



Filter Class: CFC_1000

Max: 109.8 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. 24-1

Test Date: 7/10/2023

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	64 %	Yes
Peak Head Resultant Acceleration	55 - 71 g	66.5 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	1.7 g	Yes
Is Acceleration Curve Unimodal within 17% of Peak?	< 17 %	11.40 %	Yes

Test meets specifications.

Condition: Used

Comments:

Head Skin S/N: DN0340

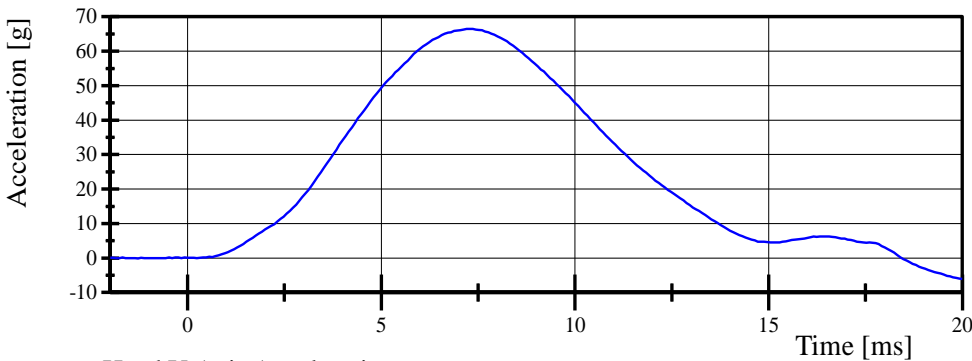
Transportation Research Center Inc.

Rear Head Drop

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/10/2023

Head X-Axis Acceleration

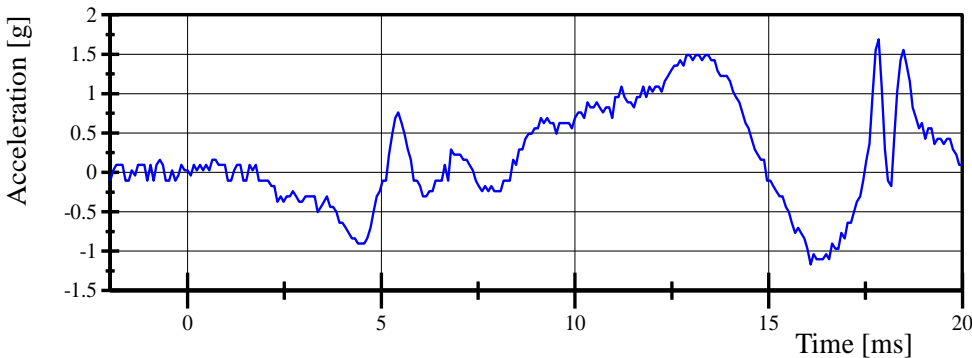


Filter Class: CFC_1000

Max: 66.5 g at 7.3 ms

Min: -6.1 g at 20.0 ms

Head Y-Axis Acceleration

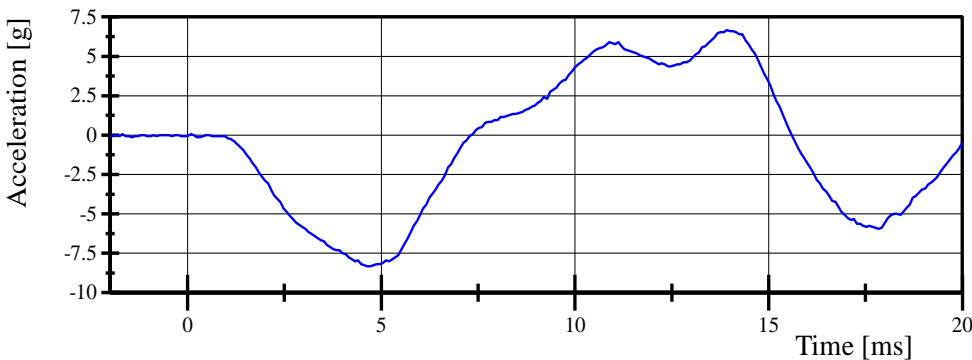


Filter Class: CFC_1000

Max: 1.7 g at 17.8 ms

Min: -1.2 g at 16.1 ms

Head Z-Axis Acceleration

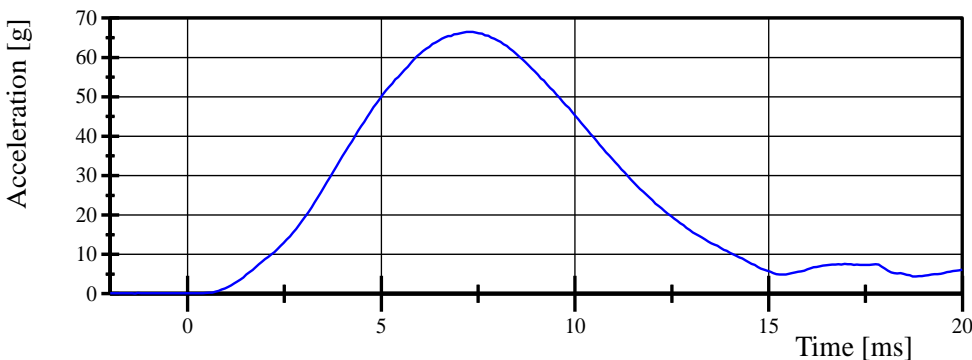


Filter Class: CFC_1000

Max: 6.7 g at 13.9 ms

Min: -8.3 g at 4.6 ms

Head Resultant Acceleration



Filter Class: CFC_1000

Max: 66.5 g at 7.3 ms

Min: 0.1 g at -1.4 ms

Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 24-2

Test Date: 7/11/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	69 %	Yes
Pendulum Velocity	5.1 - 5.3 m/s	5.12 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-1.6) - (-2.3) m/s	-2.00 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-3.4) - (-4.2) m/s	-4.19 m/s	Yes
Pendulum Integrated Velocity Change at 25ms	(-4.3) - (-5.2) m/s	-5.09 m/s	Yes
Total Head D-Plane Rotation	(-75) - (-86) °	-81.7 °	Yes
Total Neck Occipital Condyles Moment	36 - 45 N·m	40.8 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 5 Nm	60 - 80 ms	71.9 ms	Yes

Test meets specifications.

Condition: Used

Comments:

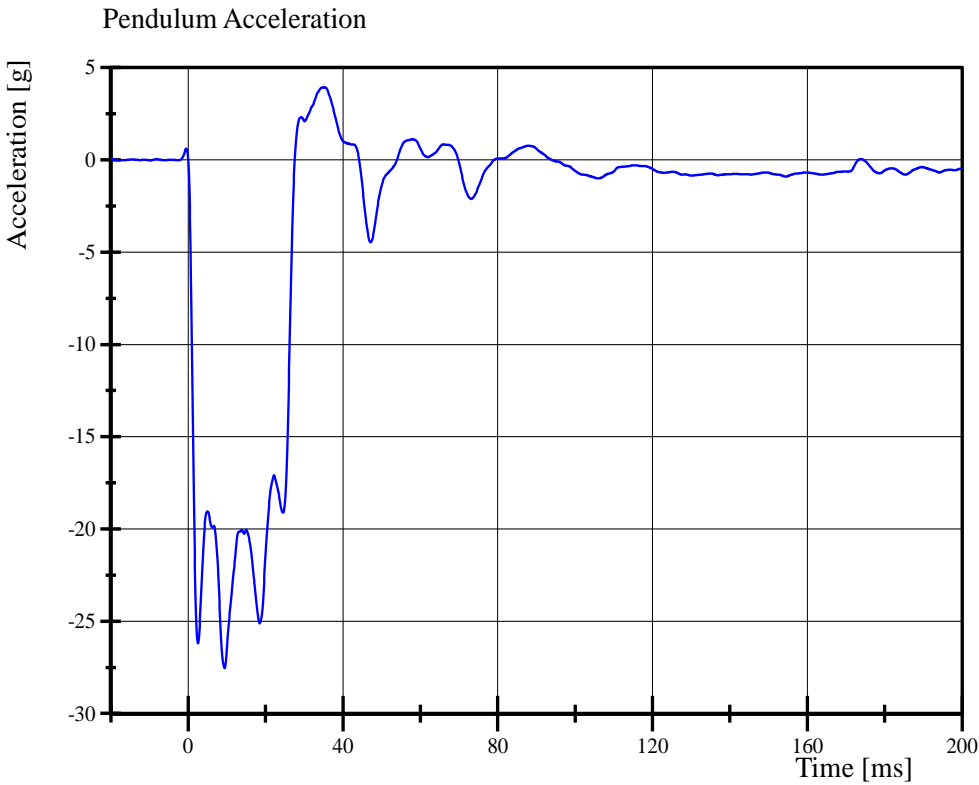
Neck S/N: 307

Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 24-2

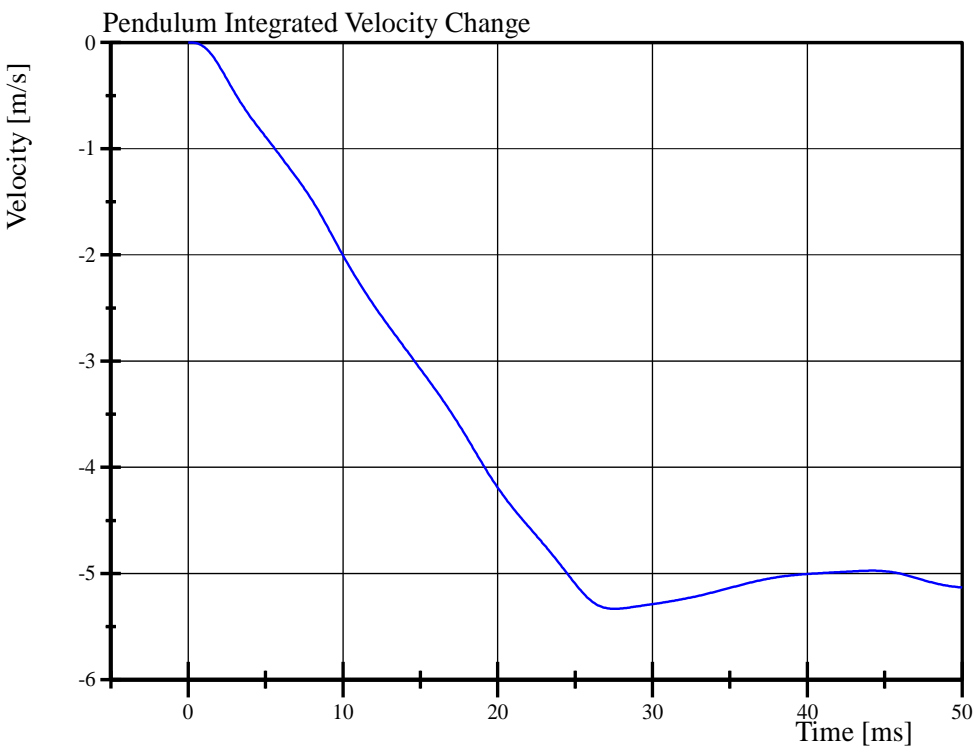
Test Date: 7/11/2023



Filter Class: CFC_180

Max: 3.9 g at 35.3 ms

Min: -27.5 g at 9.4 ms



Filter Class: CFC_180

Max: 0.0 m/s at 0.0 ms

Min: -5.3 m/s at 27.5 ms

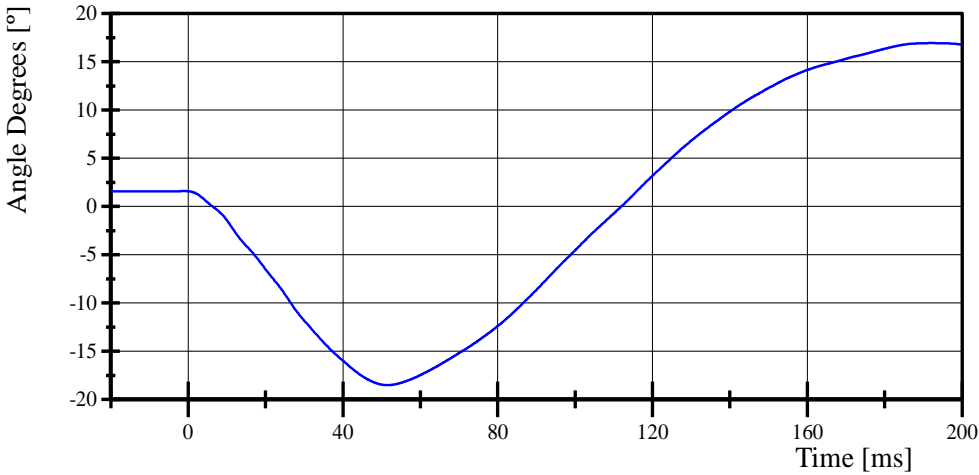
Transportation Research Center Inc.

Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 24-2

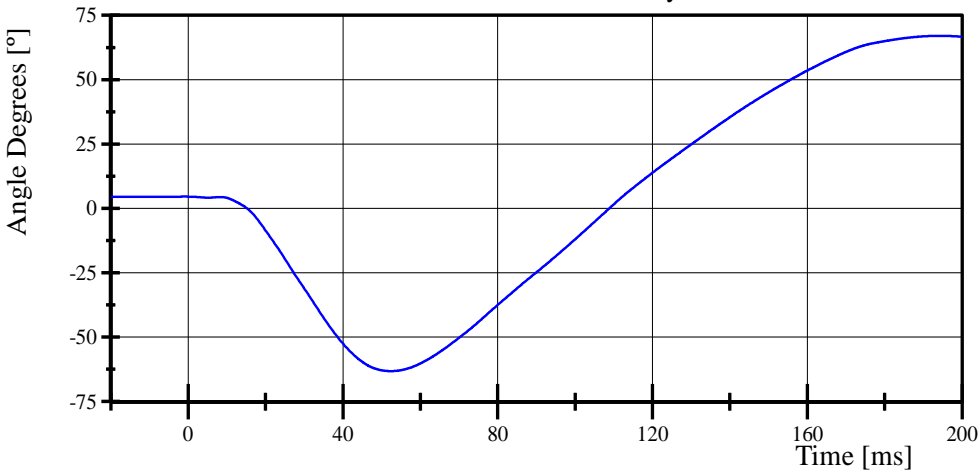
Test Date: 7/11/2023

Forward Pot Rotation at Base of Pendulum



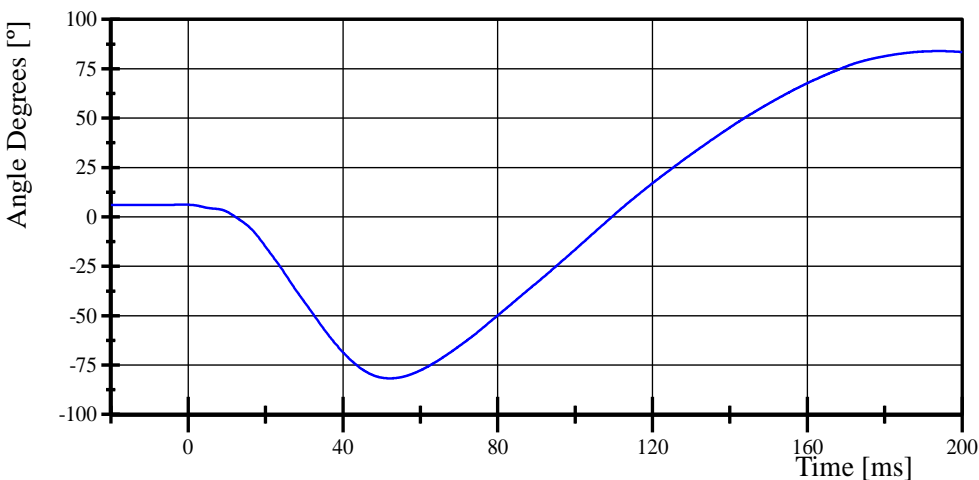
Filter Class: CFC_60
Max: 17.0 ° at 192.0 ms
Min: -18.5 ° at 51.4 ms

Center Headform Pot Rotation at Center of Gravity



Filter Class: CFC_60
Max: 67.0 ° at 194.2 ms
Min: -63.2 ° at 52.4 ms

Total Head D-Plane Rotation



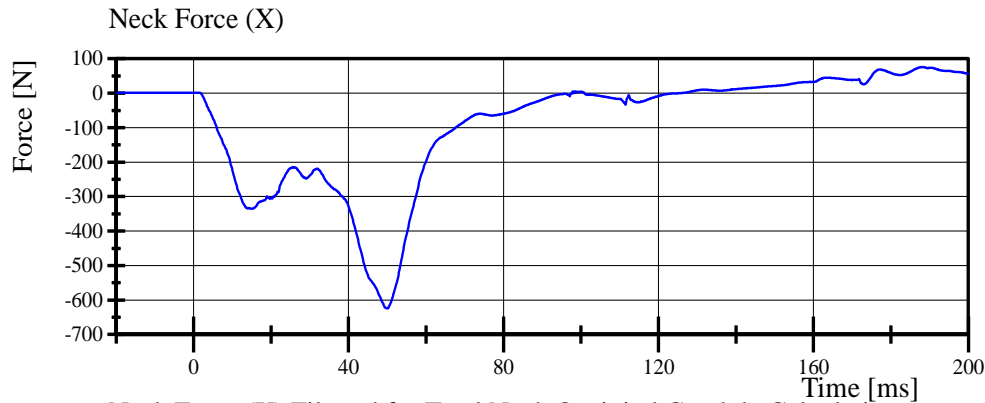
Filter Class: CFC_60
Max: 83.9 ° at 194.0 ms
Min: -81.7 ° at 52.2 ms

Transportation Research Center Inc.

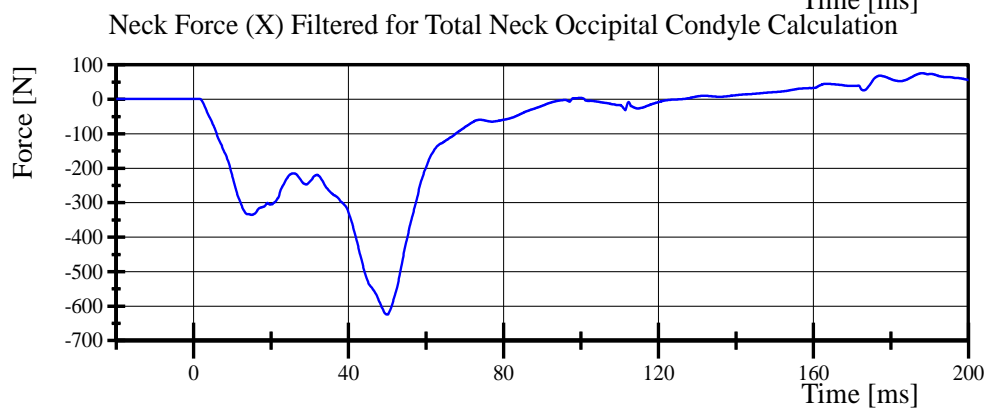
Neck Flexion

CRABI 12 MO Serial No. 094 Certification No. 24-2

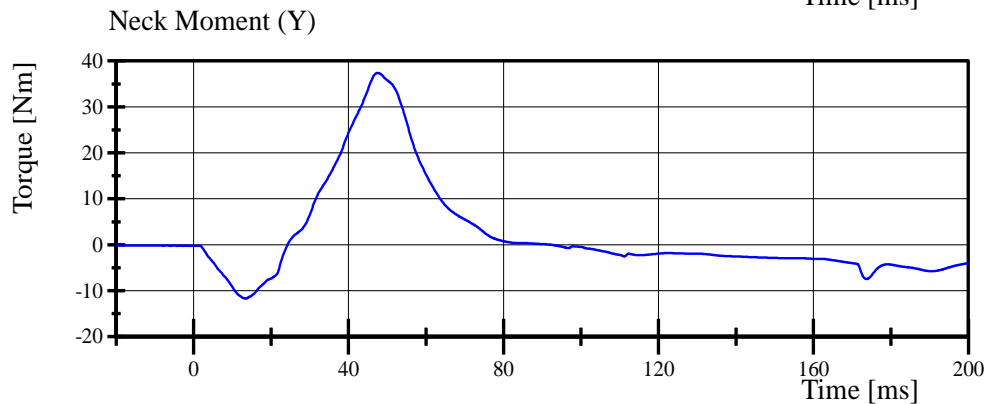
Test Date: 7/11/2023



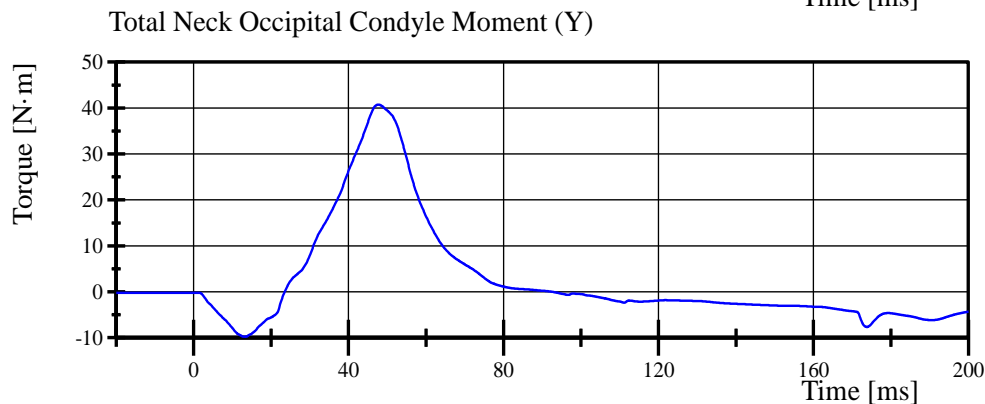
Filter Class: CFC_1000
Max: 75.6 N at 188.0 ms
Min: -624.5 N at 50.0 ms



Filter Class: CFC_600
Max: 75.6 N at 188.1 ms
Min: -624.4 N at 50.0 ms



Filter Class: CFC_600
Max: 37.4 Nm at 47.5 ms
Min: -11.7 Nm at 13.4 ms



Filter Class: Without_(Constar
Max: 40.8 N·m at 47.7 ms
Min: -9.8 N·m at 13.4 ms

Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/11/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	67 %	Yes
Pendulum Velocity	(-2.4) - (-2.6) m/s	-2.44 m/s	Yes
Pendulum Integrated Velocity Change at 6ms	0.8 - 1.2 m/s	0.92 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 2.1 m/s	1.71 m/s	Yes
Pendulum Integrated Velocity Change at 14ms	2.2 - 2.9 m/s	2.47 m/s	Yes
Total Head D-Plane Rotation	80 - 92 °	85.1 °	Yes
Total Neck Occipital Condyles Moment	(-12) - (-23) N·m	-16.1 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -5 Nm	76 - 90 ms	86.2 ms	Yes

Test meets specifications.

Condition: Used

Comments:

Neck S/N: 307

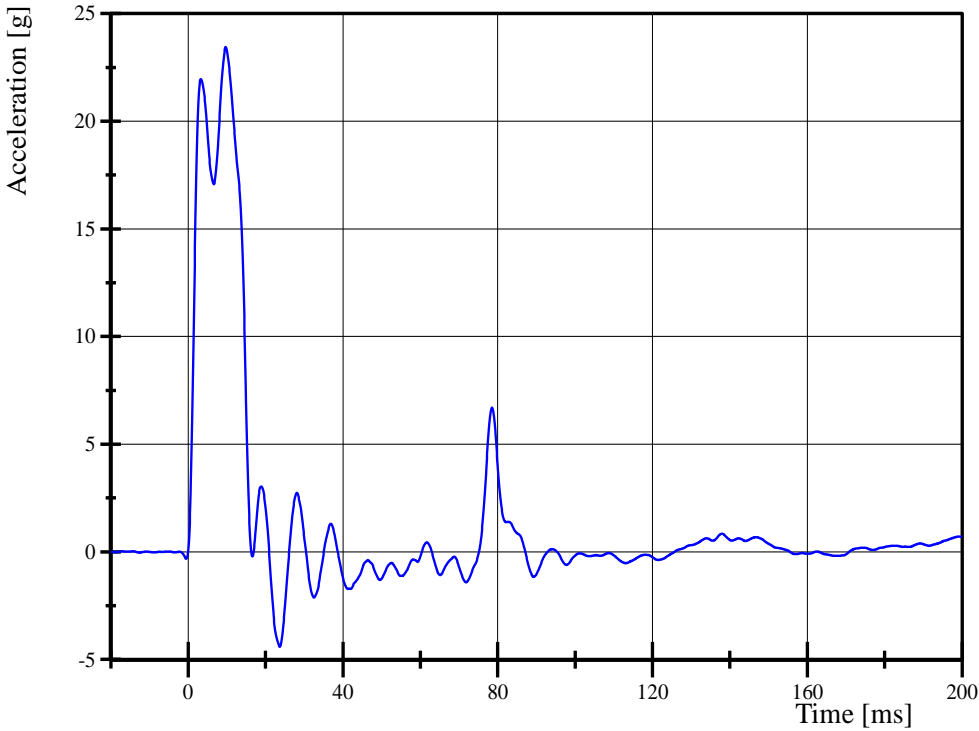
Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/11/2023

Pendulum Acceleration

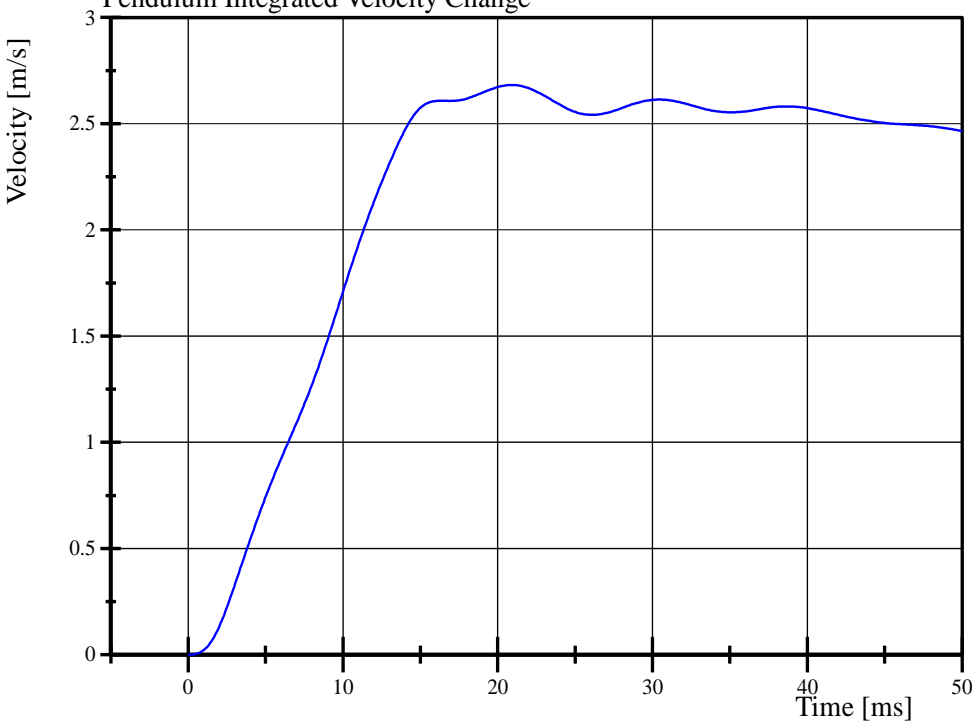


Filter Class: CFC_180

Max: 23.4 g at 9.7 ms

Min: -4.4 g at 23.7 ms

Pendulum Integrated Velocity Change



Filter Class: CFC_180

Max: 2.7 m/s at 21.0 ms

Min: 0.0 m/s at 0.0 ms

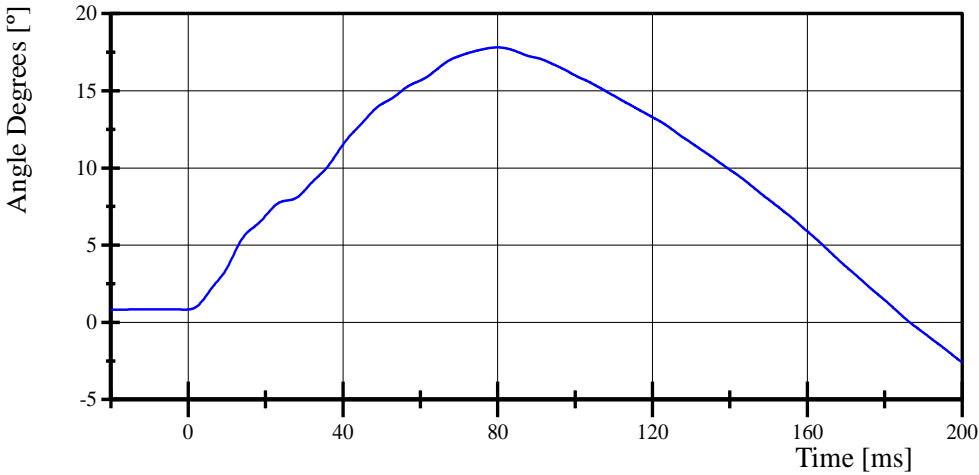
Transportation Research Center Inc.

Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 24-1

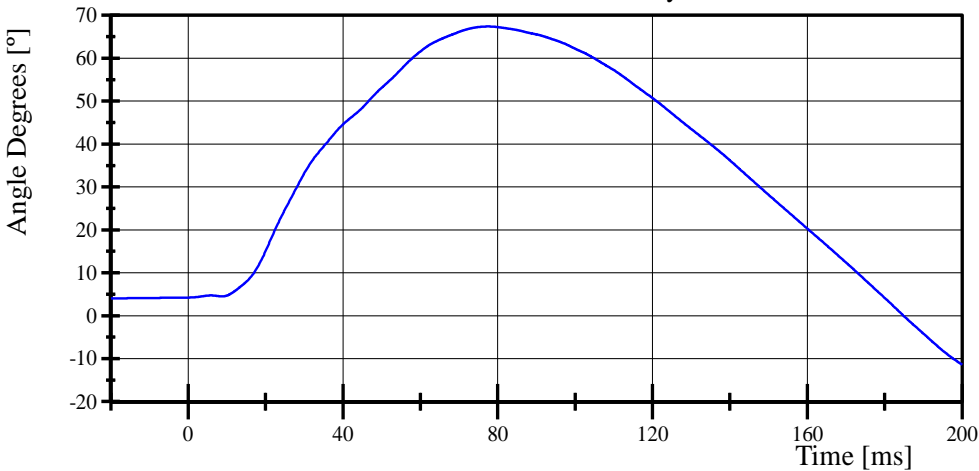
Test Date: 7/11/2023

Forward Pot Rotation at Base of Pendulum



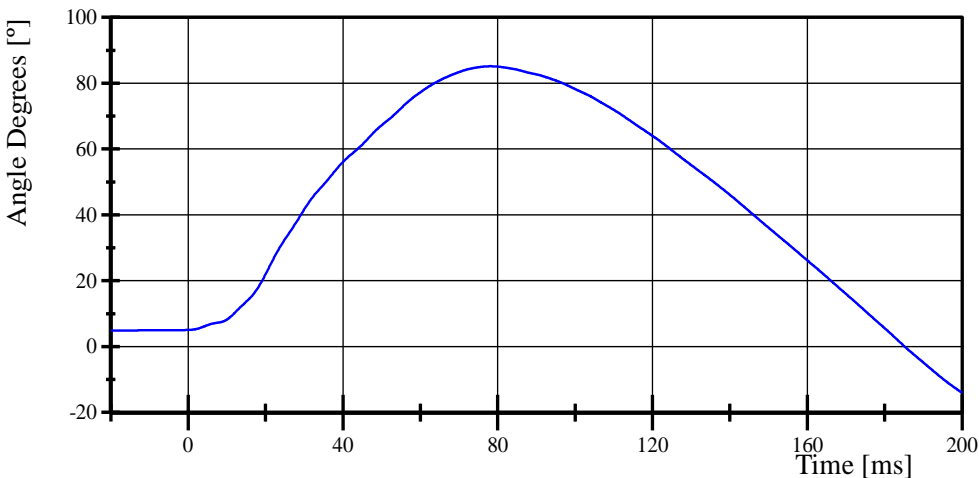
Filter Class: CFC_60
Max: 17.8 ° at 79.8 ms
Min: -2.6 ° at 200.0 ms

Center Headform Pot Rotation at Center of Gravity



Filter Class: CFC_60
Max: 67.4 ° at 77.5 ms
Min: -11.4 ° at 200.0 ms

Total Head D-Plane Rotation



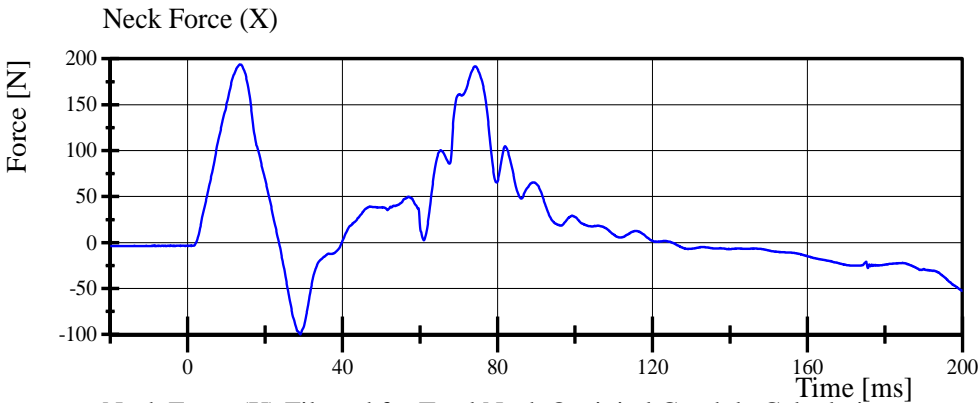
Filter Class: CFC_60
Max: 85.1 ° at 78.2 ms
Min: -14.0 ° at 200.0 ms

Transportation Research Center Inc.

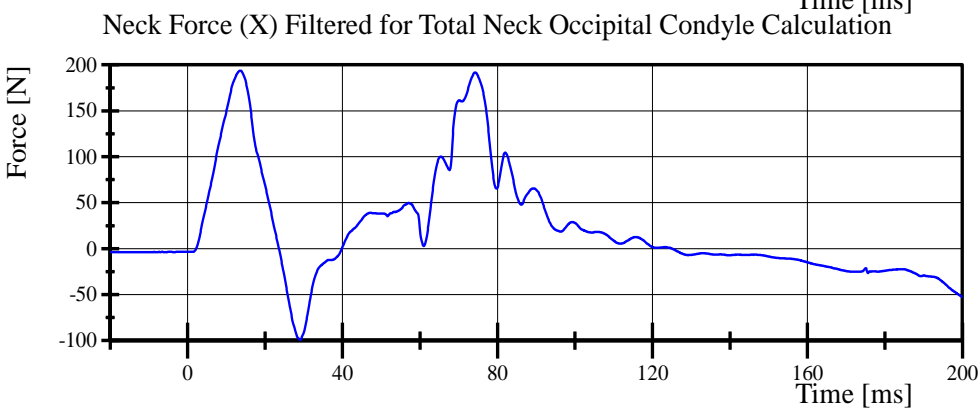
Neck Extension

CRABI 12 MO Serial No. 094 Certification No. 24-1

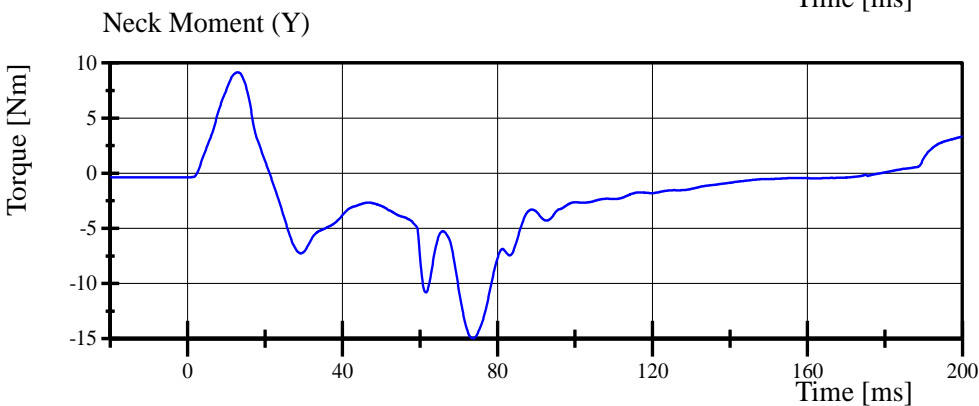
Test Date: 7/11/2023



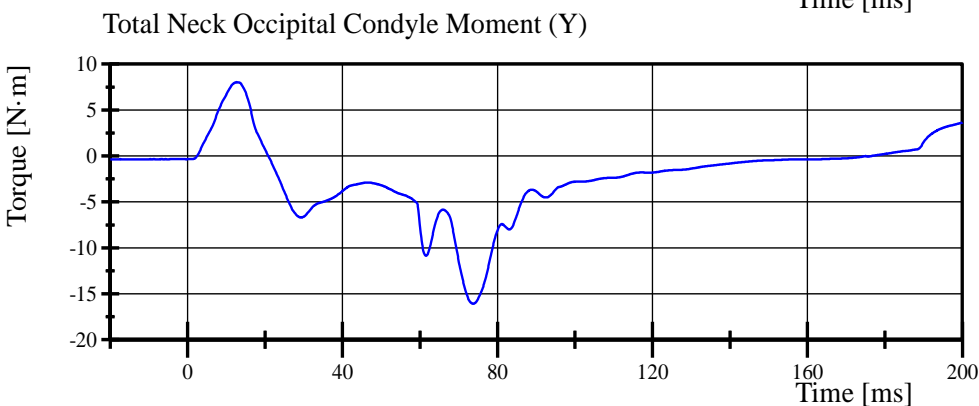
Filter Class: CFC_1000
Max: 193.7 N at 13.4 ms
Min: -99.8 N at 29.0 ms



Filter Class: CFC_600
Max: 193.6 N at 13.5 ms
Min: -99.4 N at 29.0 ms



Filter Class: CFC_600
Max: 9.1 Nm at 12.8 ms
Min: -15.0 Nm at 73.6 ms



Filter Class: Without_(Constar
Max: 8.0 N·m at 12.6 ms
Min: -16.1 N·m at 73.7 ms

Transportation Research Center Inc.

Front Thorax

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/10/2023

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	65 %	Yes
Impactor Velocity	4.9 - 5.1 m/s	4.91 m/s	Yes
Impactor Force	(-1,514) - (-1,796) N	-1,761.7 N	Yes

Test meets specifications.

Condition: Used

Comments:

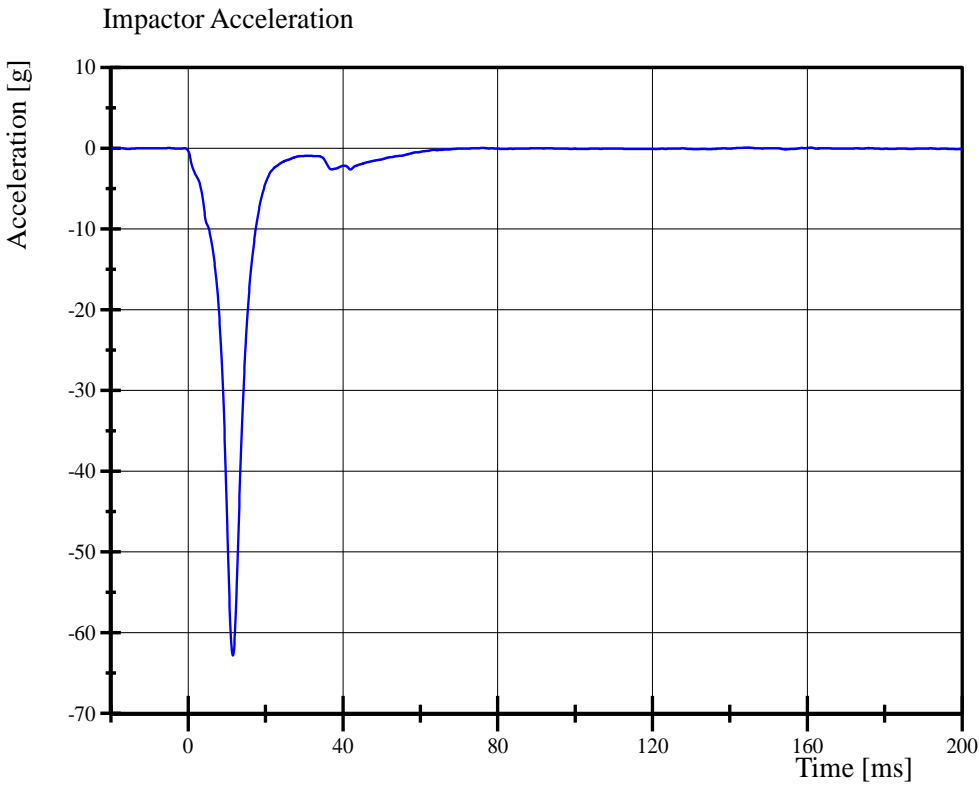
Torso Flesh S/N: N/A

Transportation Research Center Inc.

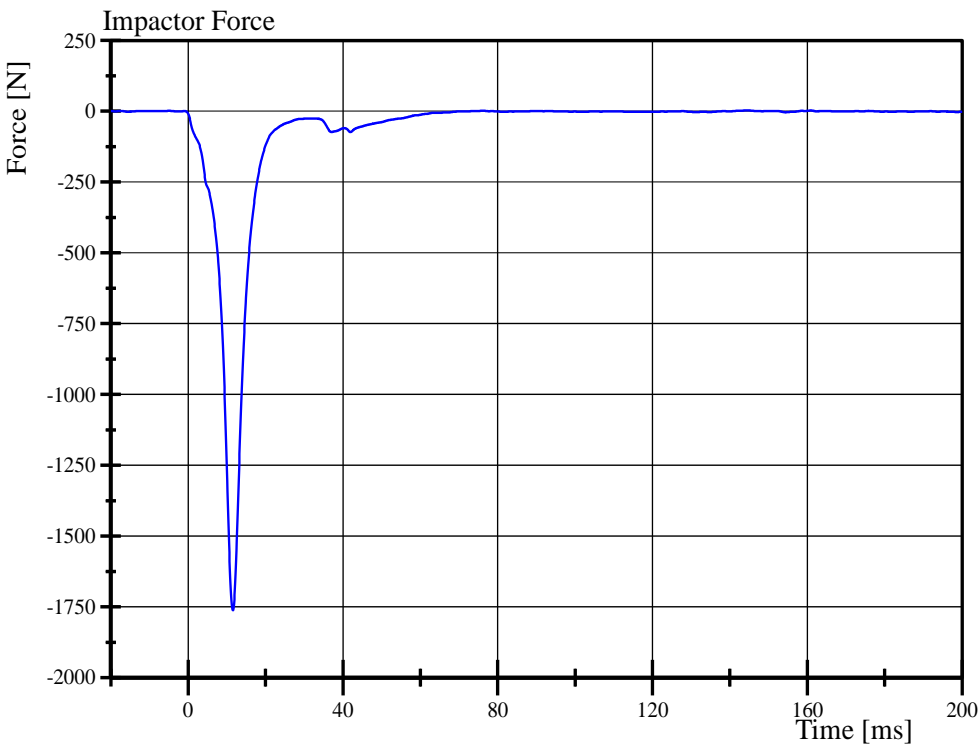
Front Thorax

CRABI 12 MO Serial No. 094 Certification No. 24-1

Test Date: 7/10/2023



Filter Class: CFC_180
Max: 0.1 g at 144.6 ms
Min: -62.8 g at 11.5 ms

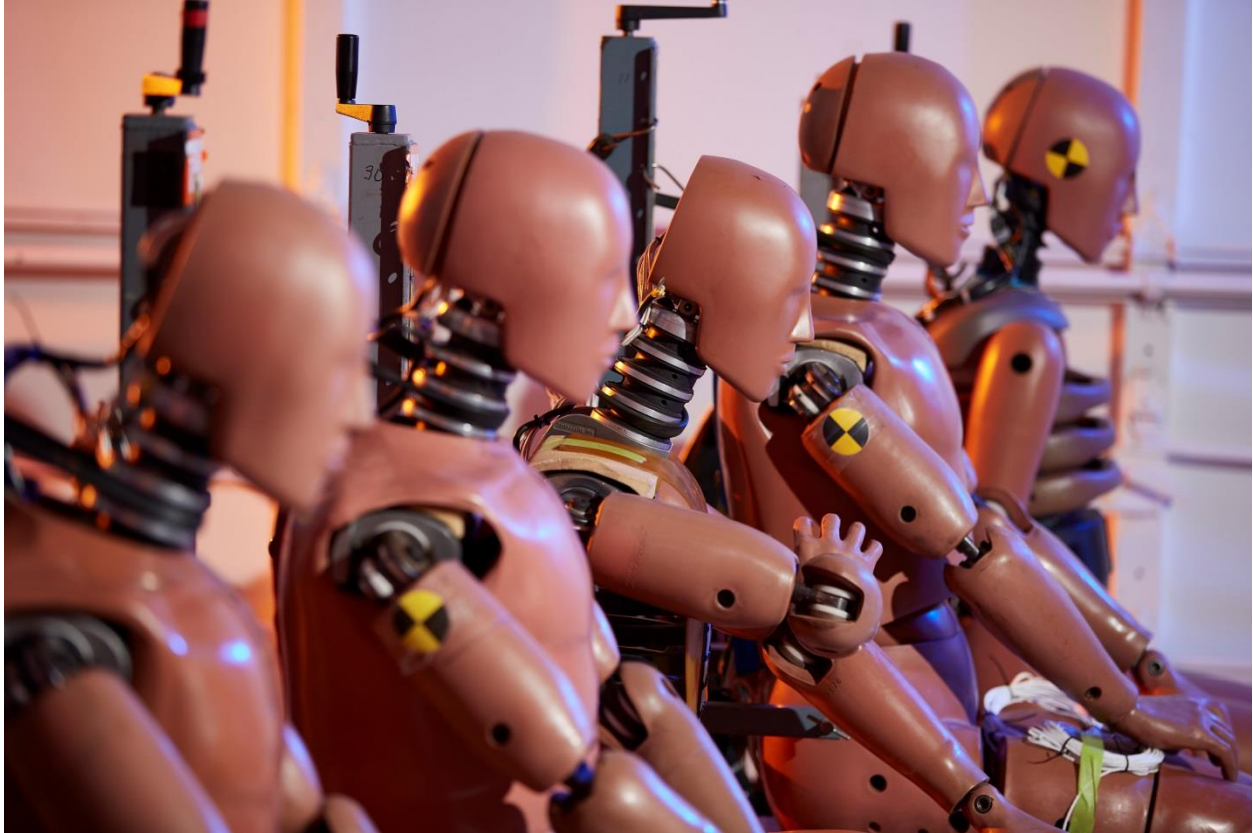


Filter Class: CFC_180
Max: 3.0 N at 144.6 ms
Min: -1,761.7 N at 11.5 ms

Appendix C – Quality Assurance



Quality Assurance



ATD Assembly & Final Inspection

ATD Type: CRABI (12) Month Old

ATD Serial Number: 094

Assembled by: *Paul Beards*

Date Inspected: 07/11/2023