

How to Research Stiffness Data and Calculate Stiffness Values

- Stiffness values through Calculation By Hand

By
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How to Research Stiffness Data

Researching the Data

Objective - Obtain Frontal, Side and Rear Stiffness Data for a 2018 Toyota Corolla.

First Step - determine the year range for the 2018 Toyota Corolla where the vehicle is essentially the “same”.

How to Research Stiffness Data

Researching the Data

To determine the appropriate year range in which to search, the most common tool is the Vehicle Interchange List which is maintained by Greg Anderson.

This list is more commonly referred to as the “Sister-Clone List”. The list for 1974-2012 vehicles is still available for download from a variety of web sites. For more current models, you need to go to Greg Anderson’s web site. See -

[**http://www.scaliaanderson.com/clones/**](http://www.scaliaanderson.com/clones/)

How to Research Stiffness Data

Researching the Data

Other possible tools are the N.S.D.C. (No Significant Dimensional Change) range in Expert AutoStats for those who have that program, or web sites like Car and Driver.

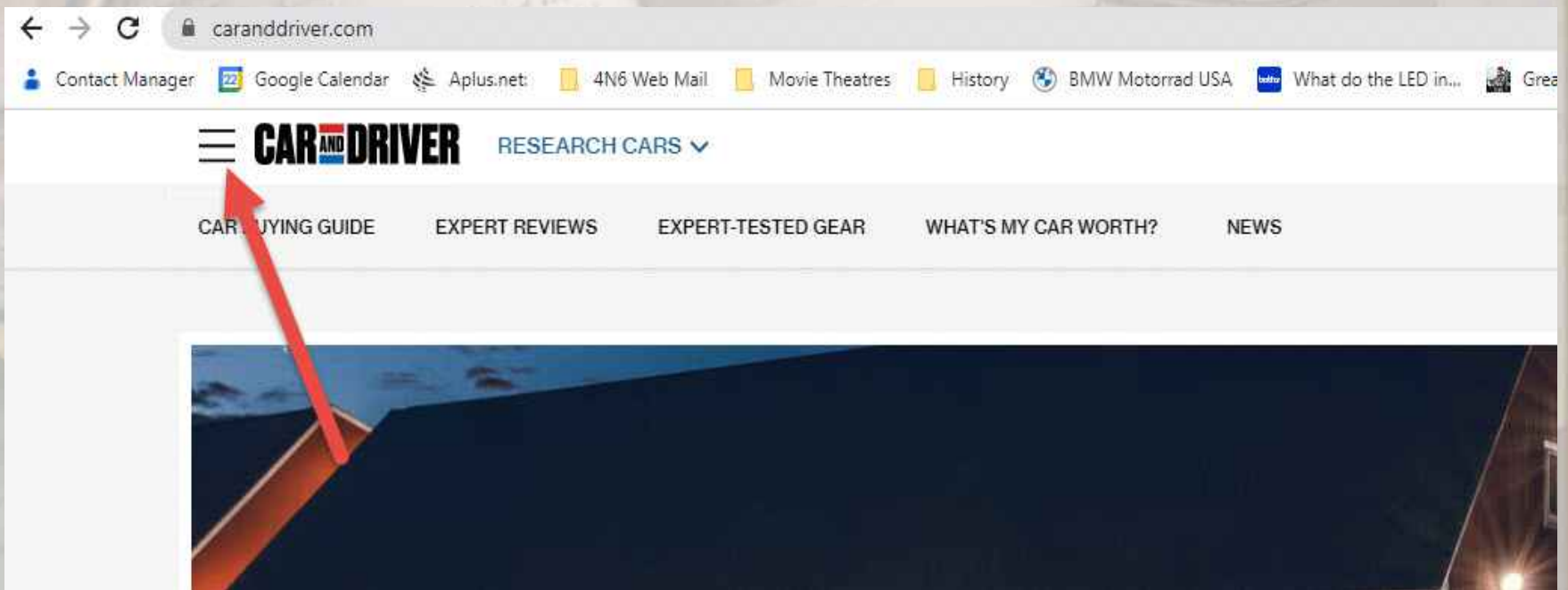
Keeping this presentation to a totally “no out of pocket cost” work flow, we will look at the Car & Driver web site.

<https://www.caranddriver.com/>

How to Research Stiffness Data

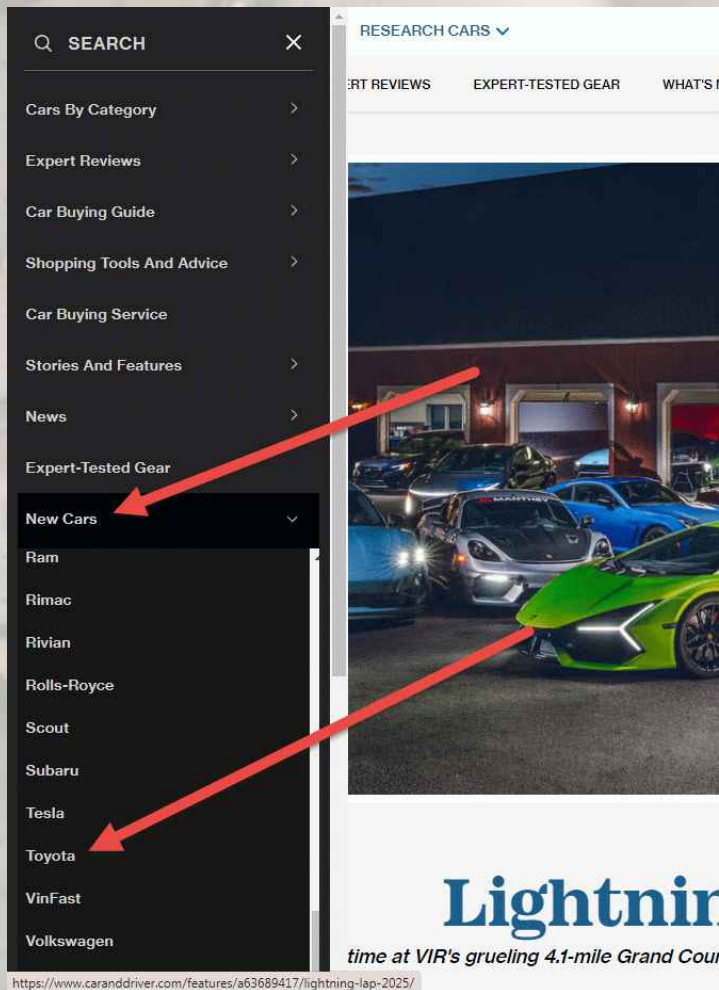
Researching the Data

Upon researching the Home Page, click on the menu to get to the New Cars area



How to Research Stiffness Data

Researching the Data



After Clicking on NEW CARS
Scroll down to TOYOTA
Click on it.

How to Research Stiffness Data

Researching the Data


CAR BUYING GUIDE EXPERT REVIEWS EXPERT-TESTED GEAR WHAT'S MY CAR WORTH? NEWS


Research Cars


Explore Car and Driver's trusted reviews with exclusive test data and expert insights:


Car and Driver Rating and Accolades


Look for these icons to identify which models are at the top of their class.

 10Best

 EV of the Year

 Editors' Choice


 10/10 C/D Rating

 [Features](#) [Offers](#) [Build & Price](#) [Find a Dealer](#) [Learn More](#)


Cars

Sedans, coupes, convertibles, and wagons

2025 Toyota Camry **9/10**
C/D RATING



2025 Toyota Corolla **7.5/10**
C/D RATING



Either scroll down to the model of interest, or search using the drop down menus.

We will use the drop down menus for this exercise.

How to Research Stiffness Data

Researching the Data

CAR AND DRIVER RESEARCH CARS ▾

CAR BUYING GUIDE EXPERT REVIEWS EXPERT-TESTED GEAR WHAT'S MY CAR WORTH? NEWS

Research Cars

Explore Car and Driver's trusted reviews with exclusive test data and expert insights

Toyota ▾ Corolla ▾ 2018 ▾ **GO**

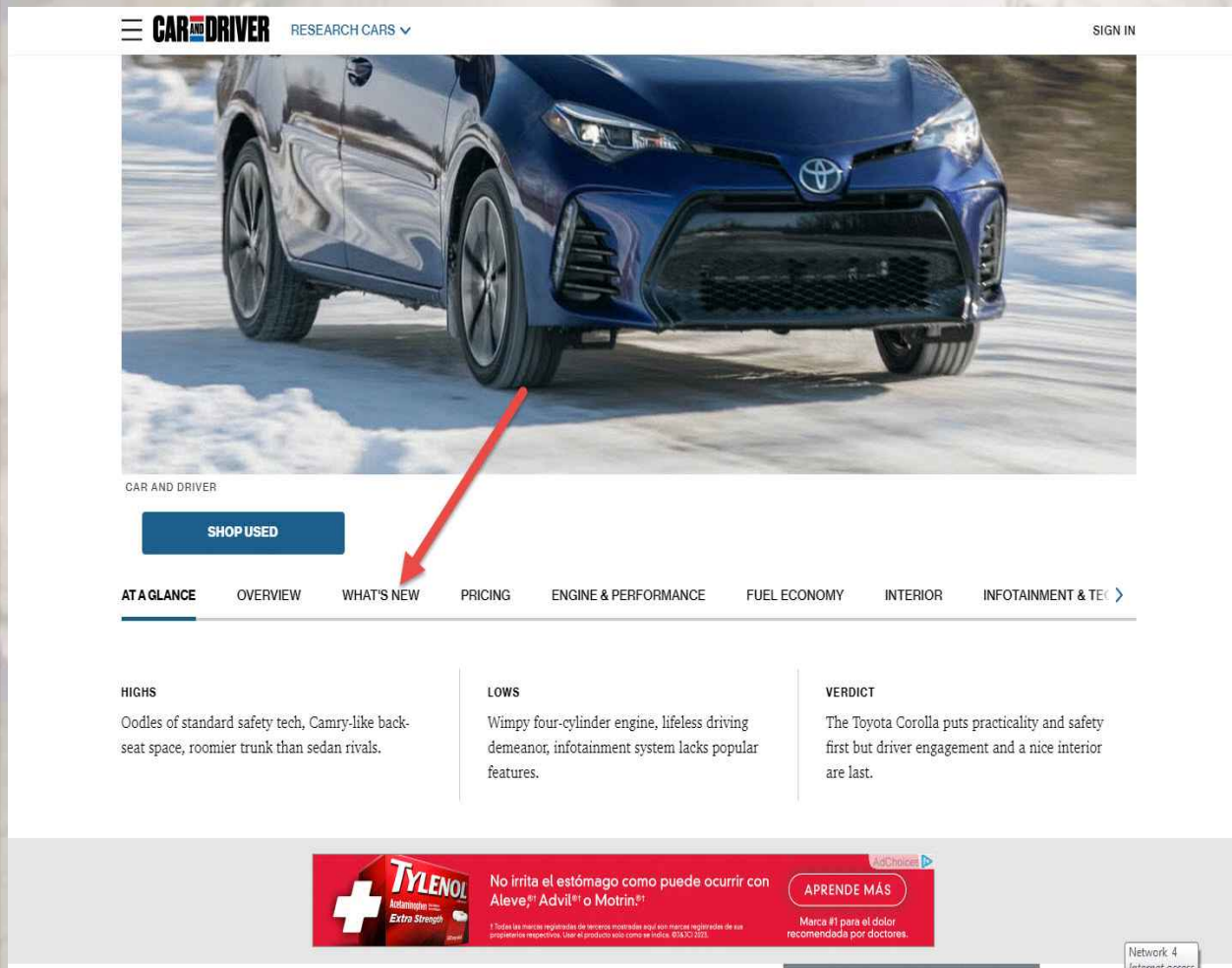
After entering the information in the appropriate drop down boxes, click **GO**.



You will then get to the model of interest.

How to Research Stiffness Data

Researching the Data



The screenshot shows the Car and Driver website interface for a Toyota Corolla. At the top, there's a navigation bar with the Car and Driver logo, a 'RESEARCH CARS' dropdown, and a 'SIGN IN' link. Below the navigation bar is a large image of a blue Toyota Corolla driving on a snowy road. Underneath the image is a 'SHOP USED' button. Below that is a horizontal navigation bar with tabs: 'AT A GLANCE', 'OVERVIEW', 'WHAT'S NEW', 'PRICING', 'ENGINE & PERFORMANCE', 'FUEL ECONOMY', 'INTERIOR', and 'INFOTAINMENT & TECH'. A red arrow points to the 'WHAT'S NEW' tab. Below the navigation bar, there are three columns of text: 'HIGHS', 'LOWS', and 'VERDICT'. The 'HIGHS' column mentions standard safety tech and back-seat space. The 'LOWS' column mentions a wimpy four-cylinder engine and a lifeless driving demeanor. The 'VERDICT' column states that the Toyota Corolla puts practicality and safety first but driver engagement and a nice interior are last. At the bottom of the page, there is a red banner for Tylenol Extra Strength with text in Spanish and English.

Scroll down and click on the **WHATS NEW** tab, or continue to scroll down until you get to that area.

How to Research Stiffness Data

Researching the Data



WHAT'S NEW

PRICING

ENGINE & PERFORMANCE

FUEL ECONOMY

INTERIOR

What's New for 2018?

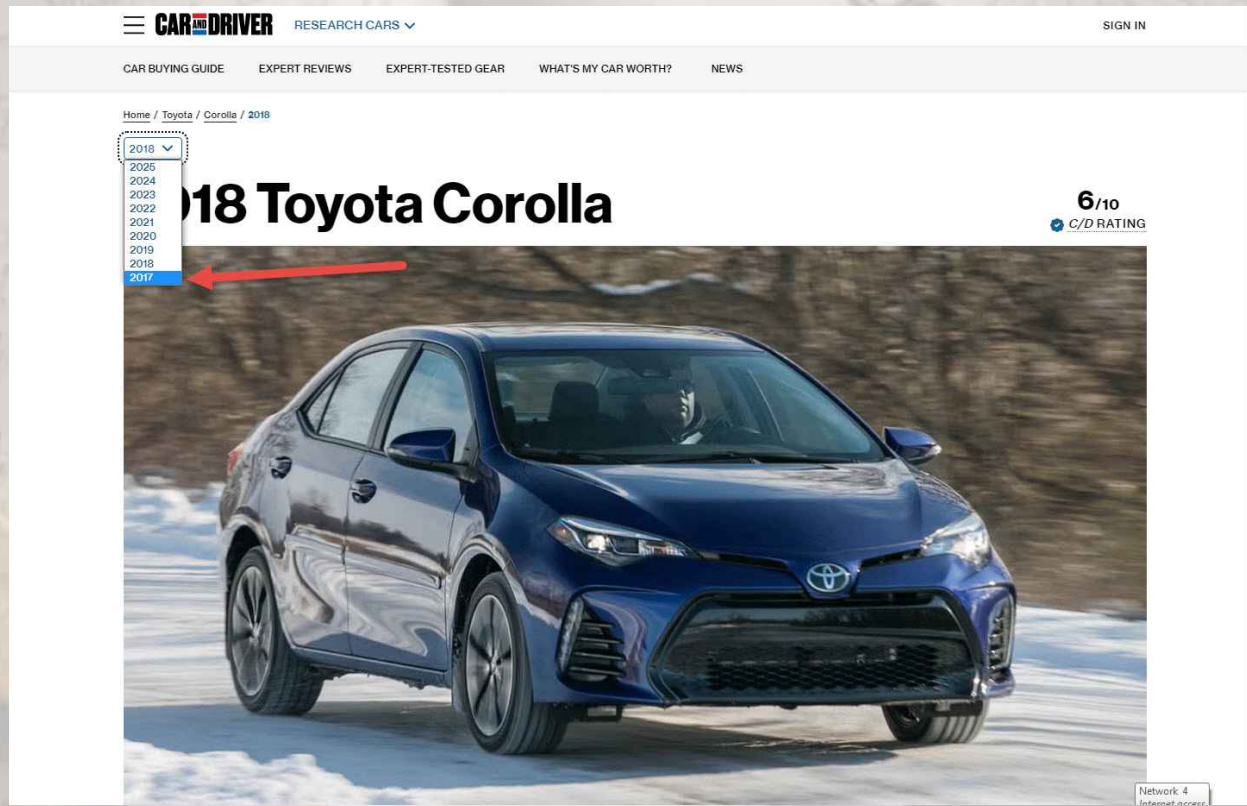
The Corolla enters 2018 with the most minimal of changes. The front-seat sun visors now feature illuminated vanity mirrors, and XLE and stick-shift SE models receive a leather-trimmed steering wheel. The upgraded helms have controls for the driver information display, audio adjustments, Bluetooth operation, and active safety settings.

For our purposes, no significant changes in 2018. We will now look for what the first year is that there were significant changes.

How to Research Stiffness Data

Researching the Data

Scroll to the top of the page, change the year to 2017 by using the drop down box and clicking on the year.



How to Research Stiffness Data

Researching the Data

 2017 Toyota Corolla

[OVERVIEW](#) [WHAT'S NEW](#) [PRICING](#) [ENGINE & PERFORMANCE](#) [FUEL ECONOMY](#)

Consider the Toyota Corolla as mere transportation, and its impressive features at an affordable price outweigh its dull demeanor. A bundle of standard collision-avoidance technologies and excellent safety ratings make this Toyota one of the safest cars in its class. Class-leading back-seat legroom benefits passengers, but driving dynamics and fuel economy are disappointing.

What's New for 2017?

For 2017, the Corolla's front end is redesigned, and the interior has a revised instrument panel and climate controls. The special 50th Anniversary Edition wears special Black Cherry Pearl paint and unique badging. Every Corolla has the Toyota Safety Sense system, which includes adaptive cruise control, automatic high-beams, lane-departure warning, lane-keeping assist, forward-collision warning, and automated emergency braking.

For Sale Near You

Repeat the process to get down to the 2017 WHATS NEW area.

It can be seen that the front end was redesigned for 2017.

How to Research Stiffness Data

Researching the Data

2019 Corolla is a segment staple that will satisfy those who just want to get to their destination. Thankfully, the completely redesigned 2019 Corolla [hatchback](#) is based on an all-new platform that kicks off the next-generation models.

What's New for 2019?

The 2019 Corolla has no changes whatsoever. This current generation has been around for several years, but Toyota lightly refreshed its exterior and interior styling for 2017. Every Corolla also added the company's suite of driver assists that year. While the sedan stays the same for now, an [all-new Corolla hatchback was released for 2019](#), which rides on a separate platform. An [all-new 2020 Corolla sedan](#) is also now on sale, but we have yet to test one at the track.

Pricing and Which One to Buy

Repeating the process for year change to get to the 2019 model, then looking at WHATS NEW, the Corolla Hatchback was ALL NEW for 2019, and the SEDAN was ALL NEW for 2020. Therefore, our year range is 2017-2019 as a SAME SIMILAR vehicle.

How to Research Stiffness Data

Researching the Data

Now go to the NHTSA basic search page -

<https://www.nhtsa.gov/research-data/research-testing-databases#/vehicle>

The screenshot shows the NHTSA Vehicle Crash Test Database search page. It features a navigation bar with links to Home, Vehicle, Biomechanics, Component, and Crash Avoidance. The main section is titled 'Vehicle Crash Test Database' and includes a 'Download Test Reference Guide' link. Below this are search filters for Test Number, Performer, Contract/Study Title, Reference Number, and Test Date Range. There are also 'Vehicle Information' filters for Make, Model, and Year. To the right, 'Test Parameters' include Test Type, Configuration, Impact Angle, Closing Speed, Offset Distance, and Occupant Type. Search buttons for 'RESET' and 'SEARCH' are located below the filters. The results section, titled '10 Newest Results', shows a table with columns for TEST #, YEAR/MAKE/MODEL, TEST TYPE, CLOSING SPEED (kph), IMPACT ANGLE (°), OFFSET DISTANCE (mm), PERFORMER, CONTRACT/STUDY TITLE, REF #, CRUSH DIS., and TEST CONTENT. Two results are visible: 13314 for a 2024 Tesla Cybertruck and 15813 for a 2024 Tesla Cybertruck.

TEST #	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°)	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
13314	2024 TESLA CYBERTRUCK	OPTIONAL NEW CAR ASSESSMENT TEST	61.42	270	0	KARCO ENGINEERING	NCAP SIDE IMPACT 2024 TESLA CYBERTRUCK BEAST 4-DOOR TRUCK	020244502	93	
15813	2024 TESLA CYBERTRUCK	OPTIONAL NEW CAR ASSESSMENT TEST	32.05	270	0	KARCO ENGINEERING	NCAP SIDE IMPACT POLE 2024 TESLA CYBERTRUCK BEAST 4-DOOR TRUCK	020244501	188	

How to Research Stiffness Data

Researching the Data

Upon reaching the Basic Search page, scroll down and enter the **MAKE**, **MODEL**, and **YEAR RANGE** in the appropriate boxes, then click **SEARCH**

National Highway Traffic Safety Administration, part of the U.S. Department of Transportation

Search [REPORT A SAFETY PROBLEM](#)

NHTSA Ratings Recalls Risky Driving Road Safety Vehicle Safety More

Home Vehicle Biomechanics Component Crash Avoidance

Vehicle Crash Test Database [Download Test Reference Guide](#)

Test Number To

Performer

Contract/Study Title

Reference Number

Test Date Range 01/01/1070 To 02/22/2025

Vehicle Information

Make TOYOTA

Model COROLLA

Year 2017 To 2019

Test Parameters

Test Type

Configuration

Impact Angle To

Closing Speed To (kph)

Offset Distance To (mm)

Occupant Type

[RESET](#) [SEARCH](#)

10 Newest Results

PREVIOUS 1 NEXT

TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°)	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
Network 4 Information										

How to Research Stiffness Data

Researching the Data

Reference Number

Test Date Range To

Vehicle Information

Make

Model

Year To

Home Vehicle Biomechanics Component Crash Avoidance

Impact Angle To

Closing Speed To (kph)

Offset Distance To (mm)

Occupant Type

RESET SEARCH

11 Results

PREVIOUS **1** NEXT

TEST ↑	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°)	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0	
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0	

Network 4 Internet access

Search Results for Toyota Corolla between 2017-2019.

How to Research Stiffness Data

Researching the Data

Sort based on Impact Angle to see the available tests.

Home Vehicle Biomechanics Component Crash Avoidance										
TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°) ↑	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738	
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0	
10651	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	56.41	0	0	MGA RESEARCH	OPTIONAL NCAP - 2019 TOYOTA COROLLA HATCHBACK SE 5-DR HATCHBACK	BT19011131	506	
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011021	169	
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK 5-DR HATCHBACK	BT19011141	305	
10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602	

How to Research Stiffness Data

Researching the Data

An angle of “0” is in theory a Frontal Test

<div>Home Vehicle Biomechanics Component Crash Avoidance</div>										
TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°) ↑	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738	
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0	
10651	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	56.41	0	0	MGA RESEARCH	OPTIONAL NCAP - 2019 TOYOTA COROLLA HATCHBACK SE 5-DR HATCHBACK	BT19011131	506	
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011021	169	
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK 5-DR HATCHBACK	BT19011141	305	
10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602	

Network 4
Internet access

How to Research Stiffness Data

Researching the Data

Impact angles of 180 can be either a FRONT or a REAR test. More on this later in the exercise.

Home Vehicle Biomechanics Component Crash Avoidance									
TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°) ↑	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	TEST CRUSH DIS. CONTENT
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0
10651	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	56.41	0	0	MGA RESEARCH	OPTIONAL NCAP - 2019 TOYOTA COROLLA HATCHBACK SE 5-DR HATCHBACK	BT19011131	506
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011021	169
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK 5-DR HATCHBACK	BT19011141	305
10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602

How to Research Stiffness Data

Researching the Data

Angles of 270 or 90 are almost certainly Side Impacts

Home Vehicle Biomechanics Component Crash Avoidance										
		ASSESSMENT TEST								
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO	0		
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011021	169	
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011141	305	
10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY VEHICLE, OVERLAP=35 PERCENT	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602	
10134	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY VEHICLE, OVERLAP=35 PERCENT	90.72	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0002	538	
10824	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY VEHICLE, OVERLAP=35 PERCENT	89.62	345	0	KARCO ENGINEERING	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	R20175149	593	

How to Research Stiffness Data

Researching the Data

Angles of 345-15 can be classified as a Frontal Test if no better tests are available.

<div>Home Vehicle Biomechanics Component Crash Avoidance</div>										
		ASSESSMENT TEST								
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO	0		
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19011021	169	
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270	0	MGA RESEARCH	OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK 5-DR HATCHBACK	BT19011141	305	
10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY VEHICLE, OVERLAP=35 PERCENT	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602	
10134	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY VEHICLE, OVERLAP=35 PERCENT	90.72	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0002	538	
10824	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE	89.62	345	0	KARCO ENGINEERING	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL	R20175149	593	

How to Research Stiffness Data

Stiffness Calculations - Summary

Front Stiffness

How to Research Stiffness Data

Researching the Data

An angle of “0” is in theory a Frontal Test

<div>Home Vehicle Biomechanics Component Crash Avoidance</div>										
TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°) ↑	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONTENT
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738	
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0	
10651	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	56.41	0	0	MGA RESEARCH	OPTIONAL NCAP - 2019 TOYOTA COROLLA HATCHBACK SE 5-DR HATCHBACK	BT19011131	506	
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
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10133	2017 TOYOTA COROLLA	RMDB INTO FRONT 15 DEGREE STATIONARY	90.75	345	0	CALSPAN	RESEARCH AND DEVELOPMENT LEFT OBLIQUE OFFSET FRONTAL IMPACT	CV1702.0001	602	

Network 4
Internet access

How to Research Stiffness Data

Researching the Data - Frontal

For the Frontal Test we will pick test 9984. Some data can be gleaned from the results page. On the top half you can get Year/Make/Model, Impact Angle, and Speed. You can also view the photographs for this test.

National Highway Traffic Safety Administration, part of the U.S. Department of Transportation

Search [REPORT A SAFETY PROBLEM](#)

NHTSA Ratings Recalls Risky Driving Road Safety Vehicle Safety More

Home Vehicle Biomechanics Component Crash Avoidance

[Back to Results](#)

Vehicle Crash Test Database: Test Number 9984 NOVEMBER 14, 2016

Test Type
NEW CAR ASSESSMENT TEST

Configuration
VEHICLE INTO BARRIER

Make
TOYOTA

Model
COROLLA

Year
2017

Impact Angle
0°

Closing Speed
56 (kph)


Offset Distance
0 (mm)

Performer
TRC OF OHIO

Contract/Study Title
NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING

Reference Number
161114

Test Objectives
REDUCE THE RISK OF SERIOUS & FATAL INJURY IN FRONTAL IMPACT



[View All 88 Images](#)

How to Research Stiffness Data

Researching the Data - Frontal

From the bottom half of the screen we can see the videos for download, the contractor report for download, some summary data, and in the far bottom left, the number 1. Click this to get detailed data for the vehicle.

Back to Results Home Vehicle Biomechanics Component Crash Avoidance

Vehicle Crash Test Database: Test Number 9984 NOVEMBER 14, 2016

Performer
TRC OF OHIO

Contract/Study Title
NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING

Reference Number
161114

Test Objectives
REDUCE THE RISK OF SERIOUS & FATAL INJURY IN FRONTAL IMPACT CRASHES

Contract Number
DTNH22-12-D-00257

Test Track Surface
CONCRETE

Test Track Surface Condition
DRY

Reports
M20165104 2017 Toyota Corolla 4DR Sedan NCAP Final Report.pdf

Download Instrumentation Data
NHTSA UDS-1992
NHTSA EV5 ASCII X-Y
Altair Binary Format (ABF)
NHTSA ISO_MME
DIAdem TDMS

Download Metadata

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2	02 DRIVER CLOSE-UP.wmv	(46.25 MB)
3	03 LEFT FRONT HALF.wmv	(75.32 MB)
4	04 LEFT ANGLE.wmv	(65.08 MB)
5	05 STEERING COLUMN - TOP.wmv	(72.26 MB)
6	06 STEERING COLUMN - BOTTOM.wmv	(61.39 MB)
7	07 RIGHT OVERALL.wmv	(56.84 MB)
8	08 PASSENGER CLOSE-UP.wmv	(64.33 MB)
9	09 RIGHT ANGLE.wmv	(52.69 MB)
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11	11 WINDSHIELD.wmv	(46.8 MB)
12	12 DRIVER WINDSHIELD.wmv	(43.74 MB)
13	13 PASSENGER WINDSHIELD.wmv	(62.43 MB)
14	14 PIT FRONT.wmv	(41.36 MB)
15	15 PIT REAR.wmv	(53.75 MB)
16	16 DRIVER ONBOARD.wmv	(40.94 MB)
17	17 PASSENGER ONBOARD.wmv	(32.67 MB)
18	REAL-TIME DOCUMENTARY.wmv	(102.64 MB)
19	M20165104 2017 Toyota Corolla 4DR Sedan NCAP Frontal Impact for Web.wmv	(340.93 KB)

VEHICLE		BARRIER	INSTRUMENTATION			OCCUPANT	
#	YEAR/MAKE/MODEL	ENGINE	WEIGHT(Kgrams)	SPEED(kph)	LENGTH(mm)	WIDTH(mm)	CRUSH DIS.(mm)
1	2017 TOYOTA COROLLA	4 CYLINDER TRANSVERSE FRONT	1488	56.65	4650	1765	738

Network 4
Internet access

How to Research Stiffness Data

Researching the Data - Frontal

Vehicle Crash Test Database: Test Number 9984

NOVEMBER

Vehicle Detail Information	
Vehicle	TOYOTA COROLLA 2017
Body Type	FOUR DOOR SEDAN
Engine	1.8L 4 CYLINDER TRANSVERSE FRONT
Weight Tested	1488(kg)
Vehicle Size w x l	1765 x 4650 (mm)
NHTSA #	M20175104
Commentary	MAX CRUSH @ CRUSH CENTERLINE
VIN	2T1BURHE9HC747230
Modification Indicator	PRODUCTION VEHICLE
Description of Vehicle Modification	UNMODIFIED
Maximum Crush Distance	738

After Clicking on the “I”, you get details that are important for the calculations. Working down -
Year/Make/Model/Body Style - Test Weight (kg)
- Width (mm) - Maximum Crush (mm)

How to Research Stiffness Data

Researching the Data - Frontal

Vehicle Crash Test Database: Test Number 9984 NOVEMBER

NHTSA ISO_MME	Vehicle Center of Gravity Distance Behind Front Axle	1139	X
DIAdem TDMS	Steering Column Shear Capsule Separation	NOT APPLICABLE (N)	
Download Metadata	Steering Column Collapse Mechanism	NOT APPLICABLE (N)	
	Vehicle Speed	56.65	
	Crabbed Angle	0	
	Principal Direction of Force	0	
# YEAR/MAKE	Bumper Engagement	DE	
1 2017 TOYOTA	Sill Engagement	NOT APPLICABLE	
	A-Pillar Engagement	NOT APPLICABLE	
	Vehicle Damage Index (Collision Deformation Classification)	12FDEW2	
	Angle of Moving Test Cart	0	
	Vehicle Orientation of Moving Cart	0	
	Total Length of Indentation	1524	
	Distance between center of Damaged area and C.G. Axis	0	

Vehicle Closing Speed (kph)

Vehicle Damage Index - Confirms impact is a frontal
Indentation Length (mm)

How to Research Stiffness Data

Researching the Data - Frontal

Vehicle Crash Test Database: Test Number 9984

NOVEMBER

NHTSA ISO_MME	Distance between center of Damaged area and C.G. Axis	0
DIAdem TDMS	Damage Profile Distances One	417
Download Metadata	Damage Profile Distances Two	588
	Damage Profile Distances Three	686
	Damage Profile Distances Four	675
	Damage Profile Distances Five	592
	Damage Profile Distances Six	402
# YEAR/MAKE	Pre-test - Total Length of Vehicle at centerline:	4650
1 2017 TOYOTA	Pre-test - Rear Surface of Vehicle to Front of Engine:	4135
	Pre-test - Rear Surface of Vehicle to Firewall:	3707
	Pre-test - Rear Surface of Vehicle to Upper Leading Edge of Right Door:	3232
	Pre-test - Rear Surface of Vehicle to Upper Leading Edge of Left Door:	3231
	Pre-test - Rear Surface of Vehicle to Lower Leading Edge of Right Door:	3165
	Pre-test - Rear Surface of Vehicle to Lower Leading Edge of Left Door:	3167

Damage Profile Distance Measurements 1-6 (mm)
Pre-Test Centerline measurement (mm)

How to Research Stiffness Data

Researching the Data - Frontal

Vehicle Crash Test Database: Test Number 9984

NOVEMBER

NHTSA ISO_MME	Pre-test - center of Steering Column to Headliner:	407
DIAdem TDMS	Pre-test - Rear Surface of Vehicle to Right Side of Front Bumper:	4366
Download Metadata	Pre-test - Rear Surface of Vehicle to Left Side of Front Bumper:	4367
	Pre-test - Length of Engine Block:	550
	Post-test Total Length of Vehicle at centerline:	3912
	Post-test - Rear Surface of Vehicle to Front of Engine:	3861
	Post-test - Rear Surface of Vehicle to Firewall:	
	Post-test - Rear Surface of Vehicle to Upper Leading Edge of Right Door:	3231
	Post-test - Rear Surface of Vehicle to Upper Leading Edge of Left Door:	3223
	Post-test - Rear Surface of Vehicle to Lower Leading Edge of Right Door:	3166
	Post-test - Rear Surface of Vehicle to Lower Leading Edge of Left Door:	3158
	Post-test - Rear Surface of Vehicle to Upper Trailing Edge of Right Door:	2167
	Post-test - Rear Surface of Vehicle to Upper Trailing Edge of Left Door:	2159
	Post-test - Rear Surface of Vehicle to Lower Trailing Edge of Right Door:	2162

Pre-Test Right and Left Corner measurement (mm)

Post-Test Centerline measurement (mm)

How to Research Stiffness Data

Researching the Data - Frontal

Vehicle Crash Test Database: Test Number 9984

NOVEMBER

NHTSA ISO_MME
DIAdem TDMS

Download Metadata

YEAR/MAKE

1 2017 TOYOTA

Post-test - Rear Surface of Vehicle to Upper Trailing Edge of Left Door:	2162
Post-test - Rear Surface of Vehicle to Lower Trailing Edge of Right Door:	2162
Post-test - Rear Surface of Vehicle to Lower Trailing Edge of Left Door:	2160
Post-test - Rear Surface of Vehicle to Bottom of A Post of Right Side:	3223
Post-test - Rear Surface of Vehicle to Bottom of A Post of Left Side:	3215
Post-test - Rear Surface of Vehicle to Firewall Right Side:	3730
Post-test - Rear Surface of Vehicle to Firewall Left Side:	3715
Post-test - Rear Surface of Vehicle to Steering Column:	2780
Post-test - center of Steering Column to A Post:	300
Post-test - center of Steering Column to Headliner:	400
Post-test - Rear Surface of Vehicle to Right Side of Front Bumper:	3964
Post-test - Rear Surface of Vehicle to Left Side of Front Bumper:	3950
Post-test - Length of Engine Block:	550

Post-Test Right and Left Corner measurement (mm)

How to Calculate Stiffness Values

Calculating Frontal Stiffness

◆ Conversion Factors - Metric to Imperial

- ★ 1 inch = 25.4 millimeters
- ★ 1 mile = 1.609344 kilometers
- ★ 1 pound = 0.4535924 kilograms
- or
- ★ 1 kilogram = 2.20462 pounds

◆ Constants

- ★ 1 mph = 17.6 inch/sec
- ★ $g = 32.2 \text{ feet/sec}^2 = 386.4 \text{ inch/sec}^2$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

When working with essentially equally spaced crush measurements, the AVERAGE CRUSH formula can be calculated as:

$$\text{Crush}_{\text{avg}} = (c_1 + \dots + 2*c_{n-1} + c_n) / (2*[number of zones])$$

Where:

n = the number of crush measurements

[number of zones] = (the number of crush measurements) - 1

How to Research Stiffness Data

Researching the Data - Frontal Stiffness

The Distance Profile Distances are:

$$\text{DPD1} = 417 \text{ mm} / 25.4 = 16.4 \text{ in}$$

$$\text{DPD2} = 588 \text{ mm} / 25.4 = 23.1 \text{ in}$$

$$\text{DPD3} = 686 \text{ mm} / 25.4 = 27.0 \text{ in}$$

$$\text{DPD4} = 675 \text{ mm} / 25.4 = 26.6 \text{ in}$$

$$\text{DPD5} = 592 \text{ mm} / 25.4 = 23.3 \text{ in}$$

$$\text{DPD6} = 402 \text{ mm} / 25.4 = 15.8 \text{ in}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

When working with essentially equally spaced crush measurements, the **AVERAGE CRUSH** based upon the six Damage Profile Distance measurements can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (c_1 + 2*c_2 + 2*c_3 + 2*c_4 + 2*c_5 + c_6) / (2*5)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (16.4 + 2*23.1 + 2*27.0 + 2*26.6 + 2*23.3 + 15.8) / (2*5)$$

$$\text{Crush}_{\text{avg}} = 232.3 / 10 = \mathbf{23.2 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

Variables:

Δv_{test} = Closing Speed * 17.6 = in/sec

c_{avg} = calculated average crush = inches

W = vehicle weight = pounds

g = acceleration due to gravity = 386.4 inch/sec²

b_0 = No Damage Speed (Damage Threshold). If no specific knowledge of the vehicle is available, the beginning frontal NO DAMAGE SPEED is assumed to be ~4.5-5.0 mph. For calculations we will use 5.0 mph = 88 in/sec

L_{test} = Damage Width = inches

How to Calculate Stiffness Values

Calculating Frontal Stiffness

(Damage Profile Distances)

$$\Delta v_{\text{test}} = 56.65 \text{ kph} / 1.609 = 35.2 \text{ mph}$$

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} \cdot \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as 1/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([35.2 * 17.6] - 88) / 23.2$$

$$b_1 = 22.9$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

$$W = 1488 \text{ kg} * 2.205 = 3280.5 \text{ lbs}$$

$$L_{\text{test}} \text{ Width} = 1765 \text{ mm} * 25.4 = 69.5 \text{ inches}$$

$$L_{\text{test}} \text{ Indentation Length} = 1524 \text{ mm} * 25.4 = 60.0 \text{ inches}$$

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \underline{\text{vehicle width}}$

$$A = (3280.5 * 88 * 22.9) / (386.4 * 69.5)$$

$$\mathbf{A = 246.0}$$

If you choose a $L_{\text{test}} = \underline{\text{indentation length}}$

$$A = (3280.5 * 88 * 22.9) / (386.4 * 60)$$

$$\mathbf{A = 284.9}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

If you choose a L_{test} = vehicle width

$$B = (3280.5 * 22.9 * 22.9) / (386.4 * 69.5)$$

$$\mathbf{B = 64.0}$$

If you choose a L_{test} = indentation length

$$B = (3280.5 * 22.9 * 22.9) / (386.4 * 60.0)$$

$$\mathbf{B = 74.1}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Damage Profile Distances)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$G = (246.0 * 246.0) / (2 * 64.0)$$

$$\mathbf{G = 473.1}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$G = (284.9 * 284.9) / (2 * 74.1)$$

$$\mathbf{G = 547.9}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

Sometimes, the Damage Profile Distance measurements are not taken/reported/available.

In that case, in Frontal and Rear tests the
[Pre Test] - [Post Test]

measurements might be available, and if so, used.

Left = $4367 - 3950 = 417 \text{ mm} / 25.4 = 16.4 \text{ inches}$

Centerline = $4650 - 3912 = 738 \text{ mm} / 25.4 = 29.1 \text{ inches}$

Right = $4366 - 3964 = 402 \text{ mm} / 25.4 = 15.8 \text{ inches}$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

When working with essentially equally spaced crush measurements, the **AVERAGE CRUSH** based upon the three [Pre Test] -[Post Test] measurements can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (\text{LeftBumper} + 2 * \text{Centerline} + \text{RightBumper}) / (2 * 2)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (16.4 + 2 * 29.1 + 15.8) / (2 * 2)$$

$$\text{Crush}_{\text{avg}} = 90.3 / 4 = \mathbf{22.6 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} \cdot \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as **l/in***

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([35.2 \cdot 17.6] - 88) / 22.6$$

$$b_1 = 23.5$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$A = (3280.5 * 88 * 23.5) / (386.4 * 69.5)$$

$$\mathbf{A = 253.0}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$A = (3280.5 * 88 * 23.5) / (386.4 * 60.0)$$

$$\mathbf{A = 293.0}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_l * b_l) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$B = (3280.5 * 23.5 * 23.5) / (386.4 * 69.5)$$

$$\mathbf{B = 67.7}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$B = (3280.5 * 23.5 * 23.5) / (386.4 * 60.0)$$

$$\mathbf{B = 78.3}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$G = (253.0 * 253.0) / (2 * 67.7)$$

$$\mathbf{G = 473.1}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$G = (293.0 * 293.0) / (2 * 78.3)$$

$$\mathbf{G = 547.9}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Maximum Crush Distance)

When working with the following equations, one should note that only ONE crush measurement is used to calculate the A & B Stiffness values. This is important, because at times, the only crush depth recorded is the MAXIMUM CRUSH. However, some people are concerned that because the equations call for a “Crush_{avg}” measurement, use of only one crush measurement is not permitted. For those people, the AVERAGE CRUSH based upon the Maximum Crush Distance measurement can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (c_{\text{Max}}) / (1)$$

Which, feeding in values, equates to:

$$\text{Maximum Crush} = 738 \text{ mm} / 25.4 = 29.1 \text{ inches}$$

$$\text{Crush}_{\text{avg}} = (29.1) / (1)$$

$$\text{Crush}_{\text{avg}} = 29.1 \text{ inches}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Maximum Crush Distance)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} * \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as l/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([35.2 * 17.6] - 88) / 29.1$$

$$b_1 = 18.3$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Maximum Crush Distance)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$A = (3280.5 * 88 * 18.3) / (386.4 * 69.5)$$

$$\mathbf{A = 196.7}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$A = (3280.5 * 88 * 18.3) / (386.4 * 60.0)$$

$$\mathbf{A = 227.8}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Maximum Crush Distance)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

If you choose a L_{test} = vehicle width

$$B = (3280.5 * 18.3 * 18.3) / (386.4 * 69.5)$$

$$\mathbf{B = 40.9}$$

If you choose a L_{test} = indentation length

$$B = (3280.5 * 18.3 * 18.3) / (386.4 * 60.0)$$

$$\mathbf{B = 47.4}$$

How to Calculate Stiffness Values

Calculating Frontal Stiffness (Maximum Crush Distance)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$G = (196.7 * 196.7) / (2 * 40.9)$$

$$\mathbf{G = 473.1}$$

If you choose a $L_{\text{test}} = \text{indentation length}$

$$G = (227.8 * 227.8) / (2 * 47.4)$$

$$\mathbf{G = 547.9}$$

NHTSA Crash Test #	9984			
Vehicle	2017 Toyota Corolla			
	mm	inches		
Indentation Length	1524	60.0		
Width	1765	69.5		
	kilograms	pounds		
Vehicle Weight	1488	3280.5		
Barrier Weight		0.0		
	kph	mph	in/sec	
Closing Speed	56.65	35.2	619.5	
No Damage Speed		5	88.0	b0 = 88.0
Gravity - ft/s/s		32.2	386.4 <-- in/s/s	

	Crush Depth (mm)	Crush depth (in)	6 measurement avg	Trapezoidal Avg	
DPD 1	417	16.4	16.4		
DPD 2	588	23.1	46.3	19.8	
DPD 3	686	27.0	54.0	25.1	
DPD 4	675	26.6	53.1	26.8	
DPD 5	592	23.3	46.6	24.9	
DPD 6	402	15.8	15.8	19.6	
		crush depth =	23.2	23.2	b1= 22.9

	Pre Test (mm)	Post Test (mm)	Crush Depth (mm)	Crush depth (in)	
Left corner	4367	3950	417	16.4	
Center Line	4650	3912	738	29.1	
Right Corner	4366	3964	402	15.8	
			crush depth =	22.6	22.6 b1= 23.5

	Crush Depth (mm)	Crush depth (in)	
Maximum	738	29.1	crush depth = 29.1 b1= 18.3

Front Stiffness

	A	B	G
DPD Width	246.0	64.0	473.1
DPD Indentation	284.9	74.1	547.9
Pre-Post Width	253.0	67.7	473.1
Pre-Post Indentation	293.0	78.3	547.9
Max Width	196.7	40.9	473.1
Max Indentation	227.8	47.4	547.9

How to Research Stiffness Data

Stiffness Calculations - Summary

Side Stiffness

How to Research Stiffness Data

Researching the Side Data

Now that we have obtained Frontal Stiffness values for the Toyota, let's look for the Side and Rear Stiffness data for the 2017 Toyota Corolla. The first thing we will look for are Side tests from which to calculate Side Stiffness values.

So, back to NHTSA and the tests for the 2017-2019 Toyota Corolla -

<https://www.nhtsa.gov/research-data/research-testing-databases#/vehicle>

How to Research Stiffness Data

Researching the Data - Side Data

Home Vehicle Biomechanics Component Crash Avoidance									
		TEST							
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180				HATCHBACK	
								FMVSS 301 TEST REPORTS/PHOTOS/VIDEO	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0		TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	1611
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0		TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	1611
10646	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	62.14	270				OPTIONAL NCAP SIDE - 2019 TOYOTA COROLLA HATCHBACK SE 5-DOOR HATCHBACK	BT19
10650	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	32.25	270				OPTIONAL NCAP SIDE POLE - 2019 TOYOTA COROLLA HATCHBACK 5-DR HATCHBACK	BT19
10133	2017 TOYOTA	RMDB INTO	90.75	345				RESEARCH AND	CV17

Test 9986 is the test of choice for this exercise. If you have a pole impact, 9985 would perhaps be preferred. 10646 and 10650 could be used for side and rear tests, but could also open the user to “smoke screen” issues.

How to Research Stiffness Data - Side Data

Researching the Data - Side Data

Home Vehicle Biomechanics Component Crash Avoidance

Back to Results

Vehicle Crash Test Database: Test Number 9986

NOVEMBER 16, 2016

Test Type
NEW CAR ASSESSMENT TEST

Configuration
IMPACTOR INTO VEHICLE

Make
TOYOTA

Model
COROLLA

Year
2017

Impact Angle
270°

Closing Speed
62 (kph)

Offset Distance
0 (mm)

Performer
TRC OF OHIO

Contract/Study Title
MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA

Reference Number
161116

Test Objective

Test Type - General


Vehicle Confirmation

Impact Angle

Test Type - General

Test Type - "Specific"

Photos



View All 106 Images

How to Research Stiffness Data

Researching the Data - Side Data

[Back to Results](#) [Home](#) [Vehicle](#) [Biomechanics](#) [Component](#) [Crash Avoidance](#)

Vehicle Crash Test Database: Test Number 9986 NOVEMBER 16, 2016

161116 [View All 106 Images](#)

Test Objectives
REDUCE RISK OF SERIOUS & FATAL INJURY TO OCCUPANT OF PASSENGER CARS

Contract Number
DTNH2214D00354

Test Track Surface
CONCRETE

Test Track Surface Condition
DRY

Reports
M20175106 2017 Toyota Corolla 4DR Sedan SINCAP Final Report.pdf

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Video Downloads

#	Video Name	Size
1	01 Overhead Wide View.wmv	(21.48 MB)
2	02 Overhead Close-Up View.wmv	(20.84 MB)
3	03 Impact Point.wmv	(66.59 MB)
4	04 Struck-Side View at Impact.wmv	(75.25 MB)
5	05 Rear Impact View of Struck Side.wmv	(75.37 MB)
6	06 Front Oblique Impact View of Struck Side.wmv	(64.24 MB)
7	07 Driver Dummy Front View (Onboard).wmv	(51.13 MB)
8	08 Driver Dummy Side View (Onboard).wmv	(50.66 MB)
9	09 Rear Passenger Dummy Side View (Onboard).wmv	(38.18 MB)
10	10 Real-Time Rear View of Impact.wmv	(1.65 MB)
11	11 Real-Time Pan View of Impact.wmv	(3.78 MB)
12	Real-Time Documentary.wmv	(149.96 MB)
13	M20175106 2017 Toyota Corolla 4DR Sedan MDB Impact for Web.wmv	(380 KB)

Details for vehicle and Barrier

Summary data - Weight, Speed, Crush

#	VEHICLE	ENGINE	WEIGHT(Kgrams)	SPEED(kph)	LENGTH(mm)	WIDTH(mm)	CRUSH DIS.(mm)
1	NHTSA DEFORMABLE IMPACTOR	NOT APPLICABLE	1363	62.55	4115	1252	373
2	2017 TOYOTA COROLLA	4 CYLINDER TRANSVERSE FRONT	1474	0.00	4650	1768	205

Click on the 1 and 2 to get the detail information for Barrier and Vehicle.

How to Research Stiffness Data

Researching the Data - Side Data - Barrier

Vehicle Crash Test Database: Test Number 9986

NOVEMBER

161116

Test Objectives

REDUCE RISK OF SERIOUS

Contract Number

DTNH2214D00354

Test Track Surface

CONCRETE

Test Track Surface Co

DRY

Reports

M20175106 2017 Te

Download Instrument

NHTSA UDS-1992

NHTSA EV5 ASCII X-1

Altair Binary Format

NHTSA ISO_MME

DIAdem TDMS

Download Metadata

YEAR/MAKE

1 NHTSA DEFO

Vehicle Detail Information

Vehicle	NHTSA DEFORMABLE IMPACTOR
Body Type	NOT APPLICABLE
Engine	0.0L NOT APPLICABLE
Weight Tested	1363(kg)
Vehicle Size w x l	1252 x 4115 (mm)
NHTSA #	
Commentary	MAX CRUSH 200 MM LEFT AND RIGHT OF CENTER
VIN	
Modification Indicator	RESEARCH VEHICLE
Description of Vehicle Modification	VEHICLE WAS A 214 CART WITH DEFORMABLE BARRIER FACE
Maximum Crush Distance	373
Transmission	NOT APPLICABLE
Vehicle Center of Gravity Distance Behind Front Axle	1109
Steering Column Shear Capsule Separation	NOT APPLICABLE (N)

Vehicle Weight = 1363 kg * 2.205 = 3004.9 pounds

How to Research Stiffness Data

Researching the Data - Side Data - Barrier

Vehicle Crash Test Database: Test Number 9986			NOVEMBER
161116	Steering Column Shear Capsule Separation	NOT APPLICABLE (N)	
Test Objectives	Steering Column Collapse Mechanism	NOT APPLICABLE (N)	
REDUCE RISK OF SERIOUS INJURY	Vehicle Speed	62.55	
Contract Number	Crabbed Angle	27	
DTNH2214D00354	Principal Direction of Force	0	
Test Track Surface	Bumper Engagement	NA	
CONCRETE	Sill Engagement	NOT APPLICABLE	
Test Track Surface Coefficient of Friction	A-Pillar Engagement	NOT APPLICABLE	
DRY	Vehicle Damage Index (Collision Deformation Classification)		
Reports	Angle of Moving Test Cart	0	
M20175106 2017 Test Report	Vehicle Orientation of Moving Cart	0	
Download Instrumentation Data	Total Length of Indentation	1600	
NHTSA UDS-1992	Distance between center of Damaged area and C.G. Axis	0	
NHTSA EV5 ASCII X-Data	Damage Profile Distances One	149	
Altair Binary Format	Damage Profile Distances Two	140	
NHTSA ISO_MME	Damage Profile Distances Three	373	
Diadem TDMS	Damage Profile Distances Four	373	
Download Metadata			
#	YEAR/MAKE		
1	NHTSA DEFECT		

Barrier Closing Speed = $62.55 \text{ kph} / 1.609 = 38.9 \text{ mph}$

How to Research Stiffness Data

Researching the Data - Side Data - Barrier

Vehicle Crash Test Database: Test Number 9986 NOVEMBER

161116	Sill Engagement	NOT APPLICABLE
Test Objectives	A-Pillar Engagement	NOT APPLICABLE
REDUCE RISK OF SERV	Vehicle Damage Index (Collision Deformation Classification)	
Contract Number	Angle of Moving Test Cart	0
DTNH2214D00354	Vehicle Orientation of Moving Cart	0
Test Track Surface	Total Length of Indentation	1600
CONCRETE	Distance between center of Damaged area and C.G. Axis	0
Test Track Surface Co	Damage Profile Distances One	149
DRY	Damage Profile Distances Two	140
Reports	Damage Profile Distances Three	373
M20175106 2017 To	Damage Profile Distances Four	373
Download Instrument	Damage Profile Distances Five	212
NHTSA UDS-1992 -	Damage Profile Distances Six	236
NHTSA EV5 ASCII X-	Pre-test - Total Length of Vehicle at centerline:	0
Altair Binary Format	Pre-test - Rear Surface of Vehicle to Front of Engine:	0
NHTSA ISO_MME	Pre-test - Rear Surface of Vehicle to Firewall:	0
DIAdem TDMS	Pre-test - Rear Surface of Vehicle to Upper Leading Edge of Right Door:	0
Download Metadata		
# YEAR/MAKE		
1 NHTSA DEF		

Many tests do not contain this data for the barrier. Even with it ... what are the barrier Stiffness Values??

For that reason, I ignore them. Result? Slightly higher than actual stiffness values for the vehicle.

Barrier crush is included in this test, however, often times it is not included, especially in the earlier years of the NHTSA Crash Testing.

How to Research Stiffness Data

Researching the Data - Side Data - Vehicle

Vehicle Crash Test Database: Test Number 9986 NOVEMBER

161116	Vehicle Detail Information	
Test Objectives: REDUCE RISK OF SERIOUS INJURY	Vehicle	TOYOTA COROLLA 2017
Contract Number DTNH2214D00354	Body Type	FOUR DOOR SEDAN
Test Track Surface CONCRETE	Engine	1.8L 4 CYLINDER TRANSVERSE FRONT
Test Track Surface Condition DRY	Weight Tested	1474(kg)
Reports M20175106 2017 Toyota Corolla	Vehicle Size w x l	1768 x 4650 (mm)
Download Instrumentation NHTSA UDS-1992 NHTSA EV5 ASCII X-Data Altair Binary Format NHTSA ISO_MME DIAdem TDMS	NHTSA #	M20175106
Download Metadata	Commentary	MAX CRUSH AT H-POINT
# YEAR/MAKE	VIN	2T1BURHEXHC750301
1 NHTSA DEFECT	Modification Indicator	PRODUCTION VEHICLE
	Maximum Crush Distance	205
	Transmission	AUTOMATIC - FRONT WHEEL DRIVE
	Vehicle Center of Gravity Distance Behind Front Axle	1121
	Steering Column Shear Capsule Separation	NOT APPLICABLE (N)
	Steering Column Collapse Mechanism	NOT APPLICABLE (N)

Vehicle Test Weight = 1474 kg * 2.205 = 3249.6 pounds

Max Crush = 205 mm / 25.4 = 8.1 inches

How to Research Stiffness Data

Researching the Data - Side Data - Vehicle

Vehicle Crash Test Database: Test Number 9986

NOVEMBER

161116	Steering Column Collapse Mechanism	NOT APPLICABLE (N)
Test Objectives: REDUCE RISK OF SERIOUS INJURY	Vehicle Speed	0.00
Contract Number: DTNH2214000354	Crabbed Angle	0
Test Track Surface: CONCRETE	Principal Direction of Force	270
Test Track Surface Coefficient of Friction: DRY	Bumper Engagement	NA
Reports: M20175106 2017 Test Report	Sill Engagement	DIRECT ENGAGEMENT
Download Instrument Data: NHTSA UDS-1992 NHTSA EV5 ASCII X-Data Altair Binary Format NHTSA ISO_MME DIAdem TDMS	A-Pillar Engagement	NO DIRECT ENGAGEMENT
Download Metadata	Vehicle Damage Index (Collision Deformation Classification)	09LPEW2
# YEAR/MAKE/MODEL	Angle of Moving Test Cart	0
1 NHTSA DEFENDER	Vehicle Orientation of Moving Cart	0
	Total Length of Indentation	2700
	Distance between center of Damaged area and C.G. Axis	-341
	Damage Profile Distances One	2
	Damage Profile Distances Two	156
	Damage Profile Distances Three	159
	Damage Profile Distances Four	201
	Damage Profile Distances Five	182

Vehicle Speed = 0

PDOF and VDI confirm side impact

How to Research Stiffness Data

Researching the Data - Side Data - Vehicle

Vehicle Crash Test Database: Test Number 9986 NOVEMBER

161116	Vehicle Orientation of Moving Cart:	0
Test Objectives REDUCE RISK OF SERIOUS INJURY	Total Length of Indentation	2700
Contract Number DTNH2214D00354	Distance between center of Damaged area and C.G. Axis:	-341
Test Track Surface CONCRETE	Damage Profile Distances One	2
Test Track Surface Coefficient of Friction DRY	Damage Profile Distances Two	156
Reports M20175106 2017 Test Report	Damage Profile Distances Three	159
Download Instrumentation Data NHTSA UDS-1992 NHTSA EV5 ASCII X-Data Altair Binary Format NHTSA ISO_MME DIAdem TDMS	Damage Profile Distances Four	201
Download Metadata	Damage Profile Distances Five	182
# YEAR/MAKE	Damage Profile Distances Six	4
1 NHTSA DEPT OF TRANSPORT	Pre-test - Total Length of Vehicle at centerline:	0
	Pre-test - Rear Surface of Vehicle to Front of Engine:	0
	Pre-test - Rear Surface of Vehicle to Firewall:	0
	Pre-test - Rear Surface of Vehicle to Upper Leading Edge of Right Door:	0
	Pre-test - Rear Surface of Vehicle to Upper Leading Edge of Left Door:	0
	Pre-test - Rear Surface of Vehicle to Lower Leading Edge of Right Door:	0
	Pre-test - Rear Surface of Vehicle to Lower Leading Edge of Left Door:	0
	Pre-test - Rear Surface of Vehicle to Upper Trailing Edge of Right Door:	0

"0's" for the rest of data fields

Indentation length = $2700 \text{ mm} / 25.4 = 106.3 \text{ inches}$

DPD1 = $2 \text{ mm} / 25.4 = 0.1 \text{ in}$ DPD4 = $201 \text{ mm} / 25.4 = 7.9 \text{ in}$

DPD2 = $156 \text{ mm} / 25.4 = 6.1 \text{ in}$ DPD5 = $182 \text{ mm} / 25.4 = 7.2 \text{ in}$

DPD3 = $159 \text{ mm} / 25.4 = 6.3 \text{ in}$ DPD6 = $4 \text{ mm} / 25.4 = 0.2 \text{ in}$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Complication - Calculations:

The speed to be used in the stiffness calculations IS NOT the closing speed, rather an estimation of the **KEES** speed needs to be calculated. For further discussion of why, see Mr. Vomhof's paper on why the **KE Equivalent Speed (KEES) [500K]** needs to be calculated for side and rear impact tests in the NHTSA Crash Test database which can be downloaded from the 4N6XPRT Systems web site at: **<http://www.4n6xpert.com/papers.htm>**.

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Complication - Calculations (cont.):

The KEES speed can be calculated as follows:

$$\text{KEES} = \text{SQR}([W_{\text{barrier}} * \text{Speed}_{\text{Closing}}^2] / [W_{\text{barrier}} + W_{\text{vehicle}}])$$

With data becomes -

$$\text{KEES} = \text{SQR}([3004.9 * 38.9^2] / [3004.9 + 3249.6])$$

$$\text{KEES} = \text{SQR}([4547045] / [6254.5])$$

$$\text{KEES} = \text{SQR}(727.0)$$

$$\text{KEES} = 26.9 \text{ mph}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

When working with essentially equally spaced crush measurements, the **AVERAGE CRUSH** based upon the six Damage Profile Distance measurements can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (c_1 + 2*c_2 + 2*c_3 + 2*c_4 + 2*c_5 + c_6) / (2*5)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (0.1 + 2*6.1 + 2*6.3 + 2*7.9 + 2*7.2 + 0.2) / (2*5)$$

$$\text{Crush}_{\text{avg}} = 55.2 / 10 = \mathbf{5.5 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Variables:

$$\Delta v_{\text{test}} = \text{KEES Speed} * 17.6 = \text{in/sec}$$

$$c_{\text{avg}} = \text{calculated average crush} = \text{inches}$$

$$W = \text{Target Vehicle weight} = \text{pounds}$$

$$g = \text{acceleration due to gravity} = 386.4 \text{ inch/sec}^2$$

b_0 = No Damage Speed (Damage Threshold). If no specific knowledge of the vehicle is available, the beginning frontal NO DAMAGE SPEED is assumed to be ~2.0 mph. For calculations we will use 2.0 mph = 35.2 in/sec

$$L_{\text{test}} = \text{Damage Length} = \text{inches}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} \cdot \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as 1/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([26.9 * 17.6] - 35.2) / 5.5$$

$$b_1 = 79.5$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

L_{test} = indentation length

$$A = (3249.6 * 35.2 * 79.5) / (386.4 * 106.3)$$

$$A = 221.5$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

L_{test} = indentation length

$$B = (3249.6 * 79.5 * 79.5) / (386.4 * 106.3)$$

$$\mathbf{B = 500.3}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Damage Profile Distances)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

$$L_{\text{test}} = \textit{indentation length}$$

$$G = (221.5 * 221.5) / (2 * 500.3)$$

$$\mathbf{G = 49.0}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Maximum Crush Distance)

When working with the following equations, one should note that only ONE crush measurement is used to calculate the A & B Stiffness values. This is important, because at times, the only crush depth recorded is the MAXIMUM CRUSH. However, some people are concerned that because the equations call for a “Crush_{avg}” measurement, use of only one crush measurement is not permitted. For those people, the AVERAGE CRUSH based upon the Maximum Crush Distance measurement can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (c_{\text{Max}}) / (1)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (8.1) / (1)$$

$$\text{Crush}_{\text{avg}} = \mathbf{8.1 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Maximum Crush Distance)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} \cdot \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as 1/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([26.9 * 17.6] - 35.2) / 8.1$$

$$b_1 = 54.4$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Maximum Crush Distance)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

L_{test} = indentation length

$$A = (3249.6 * 35.2 * 54.4) / (386.4 * 106.3)$$

$$\mathbf{A = 151.5}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Maximum Crush Distance)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

L_{test} = indentation length

$$B = (3249.6 * 54.4 * 54.4) / (386.4 * 106.3)$$

$$\mathbf{B = 234.0}$$

How to Calculate Stiffness Values

Calculating Side Stiffness (Maximum Crush Distance)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

$$L_{\text{test}} = \textit{indentation length}$$

$$G = (151.5 * 151.5) / (2 * 234.0)$$

$$\mathbf{G = 49.0}$$

NHTSA Crash Test #	9986							
Vehicle	2017 Toyota Corolla							
	mm	inches						
Indentation Length	2700		106.3					
Width	1768		69.6					
	kilograms	pounds						
Vehicle Weight	1474		3249.6					
Barrier Weight	1363		3004.9					
	kph	mph	in/sec					
Closing Speed	0		0.0	0.0			mph	in/sec
Barrier Speed	62.55		38.9	684.1	KEES =		26.94	474.1
No Damage Speed		2		35.2	b0 =			35.2
Gravity - ft/s/s			32.2	386.4	<-- in/s/s			

	Crush Depth (mm)	Crush depth (in)	6 measurement avg	Trapezoidal Avg
DPD 1	2	0.1	0.1	
DPD 2	156	6.1	12.3	3.1
DPD 3	159	6.3	12.5	6.2
DPD 4	201	7.9	15.8	7.1
DPD 5	182	7.2	14.3	7.5
DPD 6	4	0.2	0.2	3.7
	1363	53.7	crush depth = 5.5	5.5
				b1= 79.5

	Crush Depth (mm)	Crush depth (in)			
Maximum	205	8.1	crush depth =	8.1	b1= 54.4

Side Stiffness

	A	B	G
DPD Indentation	221.5	500.3	49.0
Max Indentation	151.5	234.0	49.0

How to Research Stiffness Data

Stiffness Calculations - Summary

Rear Stiffness

How to Research Stiffness Data

Researching the Data - Rear Data







Now lets look for the Rear Stiffness data for the 2017 Toyota Corolla. An important thing to be aware of is that post 1998 there are very few Rear Tests, and even fewer that have sufficient data to calculate Stiffness Values

To look for any Rear tests, we go back to NHTSA and the tests for the 2017-2019 Toyota Corolla -

<https://www.nhtsa.gov/research-data/research-testing-databases#/vehicle>

How to Research Stiffness Data

Researching the Data - Rear Data

Home Vehicle Biomechanics Component Crash Avoidance										
PREVIOUS 1 NEXT										
TEST	YEAR/MAKE/MODEL	TEST TYPE	CLOSING SPEED (kph)	IMPACT ANGLE (°) ↑	OFFSET DISTANCE (mm)	PERFORMER	CONTRACT/STUDY TITLE	REF #	CRUSH DIS.	TEST CONEN
9984	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	56.65	0	0	TRC OF OHIO	NEW CAR ASSESSMENT PROGRAM FRONTAL IMPACT TESTING	161114	738	
10078	2017 TOYOTA COROLLA	OUT OF POSITION (TWG) SIDE AIRBAG DEPLOYMENT TESTS	0	0	0	TRC OF OHIO	2017 TOYOTA COROLLA STATIC SAB OOP TEST	M20175106TWG2	0	
10651	2019 TOYOTA COROLLA	OPTIONAL NEW CAR ASSESSMENT TEST	56.41	0	0	MGA RESEARCH	OPTIONAL NCAP - 2019 TOYOTA COROLLA HATCHBACK SE 5-DR HATCHBACK	BT19011131	506	
10125	2017 TOYOTA COROLLA	FMVSS 301 FUEL SYSTEM INTEGRITY	0	180	0	CALSPAN	FMVSS 301 TEST REPORTS/PHOTOS/VIDEO		0	
9985	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	32.18	270	0	TRC OF OHIO	75 DEGREE OBLIQUE RIGID POLE SIDE NCAP IMPACT	161115	330	
9986	2017 TOYOTA COROLLA	NEW CAR ASSESSMENT TEST	62.55	270	0	TRC OF OHIO	MOVING BARRIER INTO LEFT SIDE OF 2017 TOYOTA COROLLA	161116	205	

Impact angle = 180, so a possible Rear Test, but 180 is also used/entered for frontal tests by the test contractors.

How to Research Stiffness Data

Researching the Data - Rear Data

Back to Results

Home Vehicle Biomechanics Component Crash Avoidance

Vehicle Crash Test Database: Test Number 10125

Test Type
FMVSS 301 FUEL SYSTEM INTEGRITY

Configuration
IMPACTOR INTO VEHICLE

Make
TOYOTA

Model
COROLLA

Year
2017

Impact Angle
180°


Closing Speed
0 (kph)

Offset Distance
0 (mm)

Performer
CALSPAN

Contract/Study Title
FMVSS 301 TEST REPORTS/PHOTOS/VIDEO

Reference Number



View All 126 Images

When looking at test 10125, the Test Type and Impact Angle are consistent with a Rear Test.

How to Research Stiffness Data

Researching the Data - Rear Data

[Back to Results](#) [Home](#) [Vehicle](#) [Biomechanics](#) [Component](#) [Crash Avoidance](#)

Vehicle Crash Test Database: Test Number 10125

Contract/Study Title
FMVSS 301 TEST REPORTS/PHOTOS/VIDEO

Reference Number

Test Objectives
NO INSTRUMENTATION OR OCCUPANT DATA

Contract Number
XXXX

Test Track Surface
CONCRETE

Test Track Surface Condition
DRY

Reports
[C20175102-2017 Toyota Corolla- 301R Final Report.pdf](#)

[Download Instrumentation Data](#)

[Download Metadata](#)

Video Downloads

1	C20175102 - Impact Point.avi	(8 MB)
2	C20175102 - Left Side View.avi	(17.48 MB)
3	C20175102 - Overhead View.avi	(42.22 MB)
4	C20175102 - Right Side View.avi	(19.61 MB)
5	C20175102 - 2017 Toyota Corolla Real-Time.avi	(10.73 MB)

VEHICLE		BARRIER		INSTRUMENTATION			OCCUPANT	
#	YEAR/MAKE/MODEL	ENGINE	WEIGHT(Kgrams)	SPEED(kph)	LENGTH(mm)	WIDTH(mm)	CRUSH DIS.(mm)	
1	NHTSA DEFORMABLE IMPACTOR	NOT APPLICABLE	0	0.00	0	0	0	
2	2017 TOYOTA COROLLA	NOT APPLICABLE	0	0.00	0	0	0	

Click on the 1 & 2 in the bottom left corner to get detail info on the barrier and the vehicle. However, the lack of data in the barrier and Vehicle rows is not promising. The contractor Report can also be downloaded.

How to Research Stiffness Data

Researching the Data - Rear Data - Barrier

Back to Results Home Vehicle Biomechanics Component Crash

Vehicle Crash Test Database: Test Number 10125

Contract/Study Title: FMVSS 301 TEST
Reference Number:
Test Objectives: NO INSTRUMENTA
Contract Number: XXXX
Test Track Surface: CONCRETE
Test Track Surface: DRY
Reports: C20175102-2017
Download Instrum
Download Metada

YEAR/MA

Vehicle Detail Information

Vehicle	NHTSA DEFORMABLE IMPACTOR
Body Type	NOT APPLICABLE
Engine	0.0L NOT APPLICABLE
Weight Tested	0(kg)
Vehicle Size w x l	0 x 0 (mm)
NHTSA #	
Commentary	NHTSA REAR MDB
VIN	
Modification Indicator	RESEARCH VEHICLE
Maximum Crush Distance	0
Transmission	NOT APPLICABLE
Vehicle Center of Gravity Distance Behind Front Axle	0

All Calc Data are 0

All Barrier Data needed for calculating stiffness data is "0".

How to Research Stiffness Data

Researching the Data - Rear Data

Vehicle Crash Test Database: Test Number 10125

Vehicle Detail Information	
Vehicle	TOYOTA COROLLA 2017
Body Type	NOT APPLICABLE
Engine	0.0L NOT APPLICABLE
Weight Tested	0(kg)
Vehicle Size w x l	0 x 0 (mm)
NHTSA #	C20175102
Commentary	2017 TOYOTA COROLLA C20175102 645100
VIN	
Modification Indicator	PRODUCTION VEHICLE
Maximum Crush Distance	0
Transmission	NOT APPLICABLE
Vehicle Center of Gravity Distance Behind Front Axle	0

All data for Calcs
are 0

As with the barrier, all data for calculating stiffness data is "0".

How to Research Stiffness Data

Researching the Data - Rear Data

REPORT NUMBER: 301R-CAL-17-004

SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT

Toyota Motor Manufacturing, Canada, Inc.
2017 Toyota Corolla

NHTSA NUMBER: C20175102

PREPARED BY:
CALSPAN CORPORATION
TRANSPORTATION TEST OPERATIONS
P.O. BOX 400
BUFFALO, NEW YORK 14225



Given the lack of data in the online database, let's look at the Contractor Report.

How to Research Stiffness Data

Researching the Data - Rear Data

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1,510 kg 2017 Toyota Corolla four door sedan was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.24 kph (49.23 mph). The test was performed by Calspan Corporation on June 2, 2017

The test vehicle was equipped with a 50.3 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (37 kg) was secured in the vehicle's rear passenger foot well. Two ballast Part 572E 50th percentile male Anthropomorphic Test Devices (ATD) were placed in the front occupant seating positions.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information can be found on page 3-7 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact and including all portions of the static rollover test. The maximum vehicle longitudinal crush was 740 millimeters of which the average was 588 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

Summary contains weights for the barrier, the Toyota Corolla, and the barrier Closing Speed. Also Maximum and Average Crush to the Toyota.

How to Research Stiffness Data

Researching the Data - Rear Data

Totals	kg	801	511	1312	904	606	1510
--------	----	-----	-----	------	-----	-----	------

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1312	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	49.8	(B)
Weight of two P572E ATDS @ 74kg each	kg	155.4	(C)
Target Vehicle Test Weight (TVTW)	kg	1517.2	(A+B+C)

*As tested Weight = (TVTW -10kg) <=ATW < (TVTW -5kg); TVTW = Weight of Test Vehicle with 2 dummies and 49.8kg of Cargo Weight

MDB WEIGHTS

	Units	Front	Rear	Total
Left	kg	358.0	322.0	680.0
Right	kg	404.0	273.0	677.0
Ratio	%	56.2%	43.8%	100.0%
Totals	kg	762.0	595.0	1357.0

Weights for the Toyota and the Barrier

Toyota = 1517.2 kg * 2.205 = 3344.8 pounds

Barrier = 1357.0 kg * 2.205 = 2991.7 pounds

How to Research Stiffness Data

Researching the Data - Rear Data

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2701
Vehicle Length (at Centerline)	mm	4646
Vehicle Width	mm	1761
Weight of Ballast Secured in Cargo Area ¹	kg	37
Type of Ballast		Lead Shot
Method of Securing Ballast		Rear Foot Well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1775
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	355
Filler neck side (left/right)		Left

¹ Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

Vehicle Width = 1761 mm / 25.4 = 69.3 in

There is no recorded Indentation length, so the full vehicle width will be used.

How to Research Stiffness Data

Researching the Data - Rear Data

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Left Side	Centerline	Right Side
Pre-Test	4543	4646	4546
Post-Test	3803	4013	4156
Crush	-740	-633	-390

Vehicle Crush Depths - Pre-Test - Post-Test

Left Side: $4543 - 3803 = 740 \text{ mm} / 25.4 = 29.1 \text{ in}$

Centerline: $4646 - 4013 = 633 \text{ mm} / 25.4 = 24.9 \text{ in}$

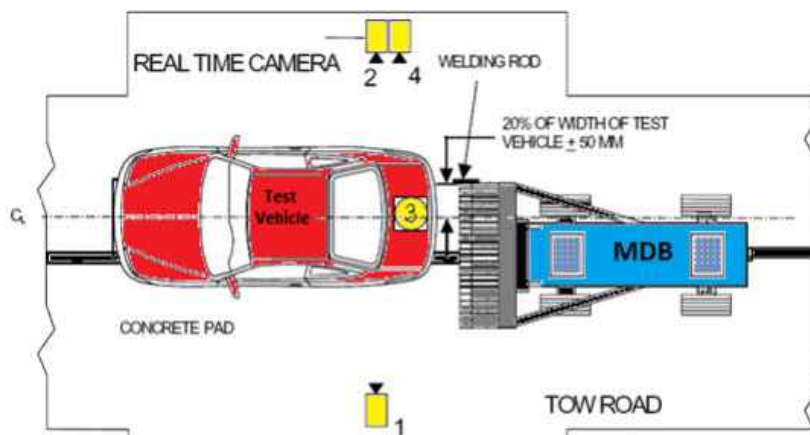
Right Side: $4546 - 4156 = 390 \text{ mm} / 25.4 = 15.4 \text{ in}$

How to Research Stiffness Data

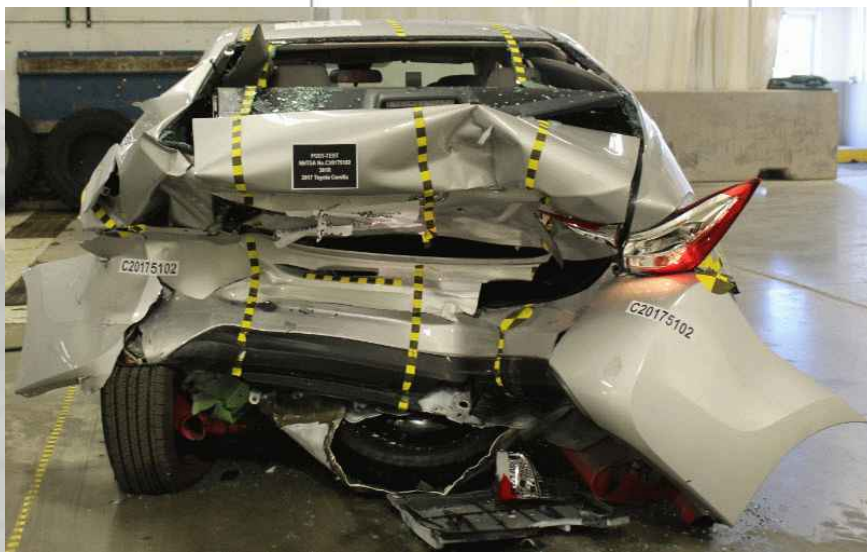
Researching the Data - Rear Data

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017



Test configuration
And damage



How to Research Stiffness Data

Researching the Data - Rear Data

DATA SHEET NO. 5 POST-TEST DATA

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

VIN: 2T1BURHE8HC754623

REQUIRED IMPACT VELOCITY RANGE: 78.5 to 80.1 km/h

ACTUAL IMPACT VELOCITY (WITHIN 1.5 M OF IMPACT PLANE)

Measurement Description	Units	Speed
Trap No. 1	km/h	79.24
Trap No. 2	km/h	79.14

The barrier impact speed is recorded as 79.24 and 79.14 kph. 79.24 will be used for this exercise since that is what is in the summary

Barrier speed = 79.24 kph / 1.609 = 49.2 mph

How to Calculate Stiffness Values

Calculating Rear Stiffness

Calculations:

The speed to be used in the stiffness calculations IS NOT the closing speed, rather an estimation of the **KEES** speed needs to be calculated. For further discussion of why, see Mr. Vomhof's paper on why the **KE Equivalent Speed (KEES) [500K]** needs to be calculated for side and rear impact tests in the NHTSA Crash Test database which can be downloaded from the 4N6XPRT Systems web site at: **<http://www.4n6xpert.com/papers.htm>**.

How to Calculate Stiffness Values

Calculating Rear Stiffness

Calculations (cont.):

The KEES speed can be calculated as follows:

$$\text{KEES} = \text{SQR}([W_{\text{barrier}} * \text{Speed}_{\text{Closing}}^2] / [W_{\text{barrier}} + W_{\text{vehicle}}])$$

With data becomes -

$$\text{KEES} = \text{SQR}([2991.7 * 49.2^2] / [2991.7 + 3344.8])$$

$$\text{KEES} = \text{SQR}([7241828.7] / [6336.5])$$

$$\text{KEES} = \text{SQR}(1142.9)$$

$$\text{KEES} = 33.8 \text{ mph}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Damage Profile Distances)

Variables:

$$\Delta v_{\text{test}} = \text{KEES Speed} * 17.6 = \text{in/sec}$$

$$c_{\text{avg}} = \text{calculated average crush} = \text{inches}$$

$$W = \text{Target Vehicle weight} = \text{pounds}$$

$$g = \text{acceleration due to gravity} = 386.4 \text{ inch/sec}^2$$

b_0 = No Damage Speed (Damage Threshold). If no specific knowledge of the vehicle is available, the beginning frontal NO DAMAGE SPEED is assumed to be ~4.7-5.0 mph. For calculations we will use 5.0 mph= 88 in/sec

$$L_{\text{test}} = \text{Damage Width} = \text{inches}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness ([Pre Test] - [Post Test] Distances)

When working with essentially equally spaced crush measurements, the **AVERAGE CRUSH** based upon the three [Pre Test] -[Post Test] measurements can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (\text{LeftBumper} + 2 * \text{Centerline} + \text{RightBumper}) / (2 * 2)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (29.1 + 2 * 24.9 + 15.4) / (2 * 2)$$

$$\text{Crush}_{\text{avg}} = 94.3 / 4 = \mathbf{23.6 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} * \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as 1/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([33.83 * 17.6] - 88) / 23.6$$

$$b_1 = 21.5$$

How to Calculate Stiffness Values

Calculating Rear Stiffness
([Pre Test] - [Post Test] Distances)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$A = (3344.8 * 88 * 21.5) / (386.4 * 69.3)$$

$$A = 236.4$$

How to Calculate Stiffness Values

Calculating Rear Stiffness ([Pre Test] - [Post Test] Distances)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_l * b_l) / (g * L_{\text{test}})$$

If you choose a L_{test} = vehicle width

$$B = (3344.8 * 21.5 * 21.5) / (386.4 * 69.3)$$

$$\mathbf{B = 57.8}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness
([Pre Test] - [Post Test] Distances)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

If you choose a L_{test} = vehicle width

$$G = (236.4 * 236.4) / (2 * 57.8)$$

$$\mathbf{G = 483.4}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Maximum Crush Distance)

When working with the following equations, one should note that only ONE crush measurement is used to calculate the A & B Stiffness values. This is important, because at times, the only crush depth recorded is the MAXIMUM CRUSH. However, some people are concerned that because the equations call for a “Crush_{avg}” measurement, use of only one crush measurement is not permitted. For those people, the AVERAGE CRUSH based upon the Maximum Crush Distance measurement can be calculated as follows:

$$\text{Crush}_{\text{avg}} = (c_{\text{Max}}) / (1)$$

Which, feeding in values, equates to:

$$\text{Crush}_{\text{avg}} = (29.1) / (1)$$

$$\text{Crush}_{\text{avg}} = \mathbf{29.1 \text{ inches}}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Maximum Crush Distance)

Calculations:

$$b_1 = \text{slope} = \text{inches} / [\text{inch} * \text{sec}]$$

*Note - depending upon the author the unit notation could also appear as
[inch/sec]/inch or as 1/in*

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$b_1 = ([33.8 * 17.6] - 88) / 29.1$$

$$b_1 = 17.4$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Maximum Crush Distance)

Calculations:

A coefficient = pound/inch

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

If you choose a $L_{\text{test}} = \text{vehicle width}$

$$A = (3344.8 * 88 * 17.4) / (386.4 * 69.3)$$

$$\mathbf{A = 191.4}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Maximum Crush Distance)

Calculations:

B coefficient = pound/inch²

$$B = (W * b_l * b_l) / (g * L_{\text{test}})$$

If you choose a L_{test} = vehicle width

$$B = (3344.8 * 17.4 * 17.4) / (386.4 * 69.3)$$

$$\mathbf{B = 37.9}$$

How to Calculate Stiffness Values

Calculating Rear Stiffness (Maximum Crush Distance)

Calculations:

G coefficient = pound

$$G = (A * A) / (2 * B)$$

If you choose a L_{test} = vehicle width

$$G = (191.4 * 191.4) / (2 * 37.9)$$

$$\mathbf{G = 483.4}$$

NHTSA Crash Test #	10125		
Vehicle	2017 Toyota Corolla		
	mm	inches	
Indentation Length		0.0	
Width	1761	69.3	
	kilograms	pounds	
Vehicle Weight	1517.2	3344.8	
Barrier Weight	1357	2991.7	
	kph	mph	in/sec
Closing Speed	0	0.0	0.0
Barrier Speed	79.24	49.2	866.6
No Damage Speed		5	88.0
Gravity - ft/s/s		32.2	386.4 <-- in/s/s

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KEES =
b0 =

	Crush Depth (mm)	Crush depth (in)	6 measurement avg	Trapezoidal Avg
DPD 1		0.0	0.0	
DPD 2		0.0	0.0	0.0
DPD 3		0.0	0.0	0.0
DPD 4		0.0	0.0	0.0
DPD 5		0.0	0.0	0.0
DPD 6		0.0	0.0	0.0
		crush depth =	0.0	0.0
				b1=

	Pre Test (mm)	Post Test (mm)	Crush Depth (mm)	Crush depth (in)			
Left corner	4543	3803	740	29.1	29.1		
Center Line	4646	4013	633	24.9	49.8	27.0	
Right Corner	4546	4156	390	15.4	15.4	20.1	
			crush depth =	23.6	23.6	b1=	21.5

	Crush Depth (mm)	Crush depth (in)				
Maximum	740	29.1	crush depth =	29.1	b1=	17.4

Rear Stiffness

	A	B	G
DPD Width			
DPD Indentation			
Pre-Post Width	236.4	57.8	483.4
Pre-Post Indentation			
Max Width	191.4	37.9	483.4
Max Indentation			



How to Research Stiffness Data

Stiffness Calculations - Summary

Stiffness Calculation Summary

How to Research Stiffness Data

Stiffness Calculations - Summary

Front Stiffness			
	A	B	G
DPD Width	246.0	64.0	473.1
DPD Indentation	284.9	74.1	547.9
Pre-Post Width	253.0	67.7	473.1
Pre-Post Indentatio	293.0	78.3	547.9
Max Width	196.7	40.9	473.1
Max Indentation	227.8	47.4	547.9

As can be seen from the Frontal Values, the data available potentially allows for up to 6 sets of Stiffness values in a given test.

Potentially 2 different crush lengths for Front and Rear Tests, 1 crush length for Side.

Potentially 3 sets of crush measurements for Front and Rear Tests, 2 sets for Side.

How to Calculate Stiffness Values

Stiffness Calculations - Summary

When examining the previous comparison table, some general trends should be noted:

- The wider the Crush Length that is used, the lower the A-B values will be
- The deeper the Crush_{avg} depth is, the lower the A-B values will be

And

- The lower (or softer) the A-B values are, the more conservative your final speed from crush estimates will be in your reconstruction.

How to Research Stiffness Data

Stiffness Calculations - Summary

I have downloaded and provided the Contractor Reports for the 3 selected tests. Feel free to review to see the similarities and differences between the reports and the online database values.

To try and lessen “the pain” of doing these calculations by hand, a spreadsheet which does these calculations has also been provided with the PDF’s. Feel free to modify it as you see fit.

You can also find this presentation and the spreadsheet on my web site at -

https://www.4n6xpert.com/NAPARS_3-2025.htm

How to Research Stiffness Data

Stiffness Calculations - Summary

The “easy” way to get to the page is -

The screenshot shows the 4N6XPRT website. On the left, there is a sidebar with a blue textured background. The main content area has a white background with text about accident reconstruction software. On the right, there is a vertical menu with dark blue buttons. A red callout box with white text points to the 'Conference Presentation Material' button in the menu.

cessible. 4N6XPRT Systems' accident reconstruction software helps you to reliably evaluate and analyze accident information with some of the easiest, most trusted, and most cost-efficient software you can find in the industry today.

Vehicle accident investigation software involves a multitude of studies and comprehensive reports that can be confusing to someone who isn't properly trained. Our system breaks down the information so you can digest it quickly. Learn about vehicle data, crush data, ABG stiffness values, and more with these programs.

Experts in law enforcement, insurance, and risk analysis have utilized the crucial information available through our system. For over ten years, GM risk analysts have been using these services! Both civil and criminal attorneys have based their defenses on the results we provide.

Contact us today to learn how we can provide you with accurate and invaluable data regarding vehicle accident investigation.

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- What Every Motorist Should Know About Defensive Driving
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Got it!

How to Research Stiffness Data

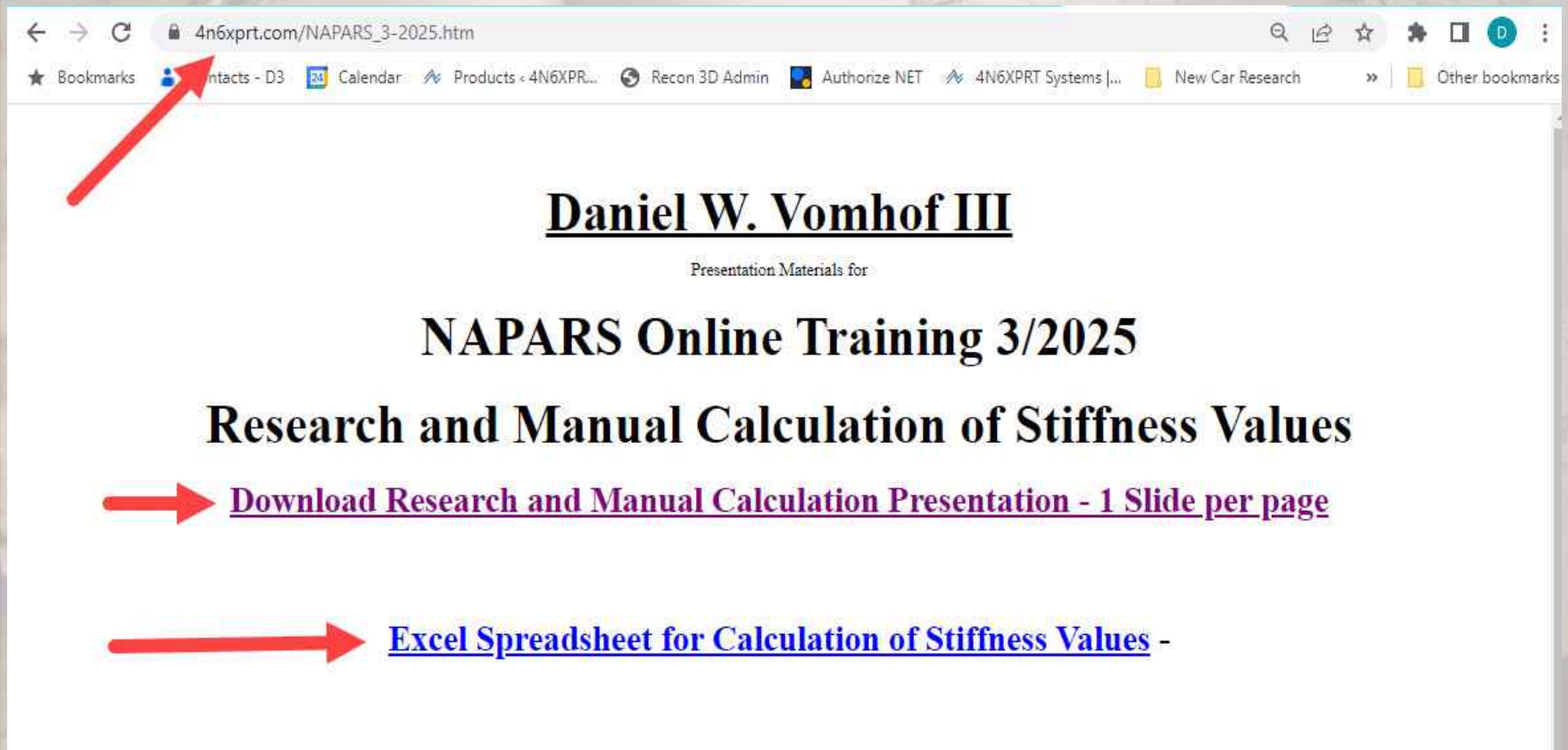
Stiffness Calculations - Summary

and Presentations

Conference	Conference Material Page	Material on Page
Illinois Association of Technical Accident Investigators - September 2022	IATAI-2022	Speed from Crush Considerations
Midwest Association of Technical Accident Investigators - September 2022	MATAI-2022	Conference Video Force-Balance Analysis of Crush 4N6XPRT Systems vehicle Data
South Carolina Accident Reconstruction Specialists/Southeastern Collision Reconstruction Conference - July 2023	SCARS-2023	Recon-3D and Cloud Compare Speed from Crush Considerations
IPTM Symposium - June 2024	IPTM-2024	Conference Video 4N6XPRT Systems vehicle Data
SATAI 2024 Fall Conference - October 2024	SATAI_2024	Recon-3D and Cloud Compare Speed from Crush Considerations
NAPARS Online Trasing - March 2025	NAPARS 2025	Research and Calculation of Stiffness Values Manually

How to Research Stiffness Data

Stiffness Calculations - Summary



The screenshot shows a web browser window with the address bar displaying "4n6xpert.com/NAPARS_3-2025.htm". A red arrow points to the address bar. The browser's bookmark bar is visible with several items including "Contacts - D3", "Calendar", "Products < 4N6XPR...", "Recon 3D Admin", "Authorize NET", "4N6XPRT Systems |...", "New Car Research", and "Other bookmarks".

Daniel W. Vomhof III
Presentation Materials for

NAPARS Online Training 3/2025

Research and Manual Calculation of Stiffness Values

➔ [Download Research and Manual Calculation Presentation - 1 Slide per page](#)

➔ [Excel Spreadsheet for Calculation of Stiffness Values](#) -

How to Research Stiffness Data

Stiffness Calculations - Summary

Some notes on the Spreadsheet -

- ◆ The boxes for data entry are in **green**
- ◆ IF you have a frontal test where the vehicle was impacted by a moving barrier, it is suggested that you use the REAR test tab and change the title where appropriate to FRONT before printing out so that you use the appropriate speed for your calculations.
- ◆ In the same way, if you have a Side or Rear test where the vehicle impacts a solid barrier, use the FRONT test and change the title to SIDE or REAR where appropriate

How to Calculate Stiffness Values

Calculating Stiffness - Constants & Conversions

◆ Conversion Factors - Metric to Imperial

- ★ 1 inch = 25.4 millimeters
- ★ 1 mile = 1.609344 kilometers
- ★ 1 pound = 0.4535924 kilograms
- or
- ★ 1 kilogram = 2.20462 pounds

◆ Constants

- ★ 1 mph = 17.6 inch/sec
- ★ $g = 32.2 \text{ feet/sec}^2 = 386.4 \text{ inch/sec}^2$

How to Calculate Stiffness Values

Calculating Stiffness - Variables

Variables:

Δv_{test} = On Side and Rear tests generally the speed to be used is the KEES speed. On Frontal Tests generally the speed to be used is Closing speed = in/sec

c_{avg} = calculated average crush = inches

W = Vehicle weight = pounds

g = acceleration due to gravity = 386.4 inch/sec²

b_0 = No Damage Speed (Damage Threshold). If no specific knowledge of the vehicle is available, the beginning frontal NO DAMAGE SPEED is assumed to be ~4.7-5.0 mph. For calculations generally 5.0 mph = 88 in/sec is used for Front and Rear tests, and 2.0 mph = 35.2 in/sec is used for Side tests.

L_{test} = Damage Width = inches

How to Research Stiffness Data

Stiffness Calculations - Formulas

$$KEES = \text{SQR}([W_{\text{barrier}} * \text{Speed}_{\text{Closing}}^2] / [W_{\text{barrier}} + W_{\text{vehicle}}])$$

$$b_1 = (\Delta v_{\text{test}} - b_0) / c_{\text{avg}}$$

$$A = (W * b_0 * b_1) / (g * L_{\text{test}})$$

$$B = (W * b_1 * b_1) / (g * L_{\text{test}})$$

$$G = (A * A) / (2 * B)$$

How to Research Stiffness Data

Stiffness Calculations - Terms & Units

C = crush measurement

Crush zone = area between two crush measurements

$Crush_{avg}$ = inches

W = weight of vehicle or barrier = pounds

g = acceleration due to gravity = 386.4 inch/sec^2

L_{test} = Damage Length (*Also called WIDTH for front and rear tests*) = inches

ΔV_{test} = On Side and Rear tests generally the speed to be used is the KEES speed. On Frontal Tests generally the speed to be used is Closing speed = in/sec

How to Research Stiffness Data

Stiffness Calculations- Terms & Units (cont)

b_0 = No Damage Speed (Damage Threshold). If no specific knowledge of the vehicle is available, the beginning frontal NO DAMAGE SPEED is assumed to be ~4.7-5.0 mph. For calculations generally 5.0 mph = 88 in/sec is used for Front and Rear tests, and 2.0 mph = 35.2 in/sec is used for Side tests.

b_1 = slope (*increase in speed per inch of crush*)
= inches / [inch*sec]

Note - depending upon the author the unit notation could also appear as [inch/sec]/inch or as I/in

A coefficient = pound/inch

B coefficient = pound/inch²

G coefficient = pound

How to Research Stiffness Data

Stiffness Calculations - Contractor Report

Contractor Report

NHTSA Test

9984

Final Report Number: NCAP-TRC-17-003

**New Car Assessment Program (NCAP)
Frontal Barrier Impact Test**

**Toyota Motor Manufacturing
2017 Toyota Corolla 4DR Sedan
NHTSA Number: M20175104**

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



Report Date: December 15, 2016

FINAL REPORT

**Prepared For:
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
1200 New Jersey Ave, SE Room W43-410
Washington, DC 20590**

Notice

Transportation Research Center Inc. does not endorse or certify products of manufacturers. The manufacturer's name appears solely to identify the test article. Transportation Research Center Inc. assumes no liability for the report or use thereof. It is responsible for the facts and the accuracy of the data presented herein. This report does not constitute a standard, specification, or regulation.

Prepared By: ILO Project Operations Group

Approved By: John Shultz

Approval Date: December 15, 2016

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date _____

COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date _____

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16. Abstract A 56.0 km/h NCAP Frontal Impact Test was conducted on a 2017 Toyota Corolla 4DR Sedan, in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), 301 and foot well intrusion performance. This test was conducted at the Transportation Research Center Inc. in East Liberty, Ohio on November 14, 2016. The impact velocity was 56.65 km/h, and the ambient temperature at the barrier face at the time of impact was 21.7° C. The target vehicle post-test maximum crush was 738 millimeters at crush centerline. The test vehicle's performance is as follows: <table border="1"> <thead> <tr> <th></th> <th colspan="3">Driver ATD</th> <th colspan="3">Passenger ATD</th> </tr> <tr> <th>Measurement Description</th> <th>Units</th> <th>Threshold</th> <th>Result</th> <th>Units</th> <th>Threshold</th> <th>Result</th> </tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₁₅)</td> <td>NA</td> <td>700</td> <td>210</td> <td>NA</td> <td>700</td> <td>201</td> </tr> <tr> <td>Maximum Chest Compression</td> <td>mm</td> <td>63</td> <td>-24.6</td> <td>mm</td> <td>52</td> <td>-20.4</td> </tr> <tr> <td>3ms Chest Clip</td> <td>Gs</td> <td>60</td> <td>45.5</td> <td>Gs</td> <td>60</td> <td>46.5</td> </tr> <tr> <td>Nij</td> <td>NA</td> <td>1</td> <td>0.26</td> <td>NA</td> <td>1</td> <td>0.54</td> </tr> <tr> <td>Neck Tension</td> <td>Newtons</td> <td>4170</td> <td>1379.3</td> <td>Newtons</td> <td>2620</td> <td>730.1</td> </tr> <tr> <td>Neck Compression</td> <td>Newtons</td> <td>4000</td> <td>-145.7</td> <td>Newtons</td> <td>2520</td> <td>-167.8</td> </tr> <tr> <td>Left Femur Force</td> <td>Newtons</td> <td>10000</td> <td>-1459.3</td> <td>Newtons</td> <td>6800</td> <td>-1086.7</td> </tr> <tr> <td>Right Femur Force</td> <td>Newtons</td> <td>10000</td> <td>-2358.2</td> <td>Newtons</td> <td>6800</td> <td>-194.5</td> </tr> </tbody> </table>								Driver ATD			Passenger ATD			Measurement Description	Units	Threshold	Result	Units	Threshold	Result	Head Injury Criteria (HIC ₁₅)	NA	700	210	NA	700	201	Maximum Chest Compression	mm	63	-24.6	mm	52	-20.4	3ms Chest Clip	Gs	60	45.5	Gs	60	46.5	Nij	NA	1	0.26	NA	1	0.54	Neck Tension	Newtons	4170	1379.3	Newtons	2620	730.1	Neck Compression	Newtons	4000	-145.7	Newtons	2520	-167.8	Left Femur Force	Newtons	10000	-1459.3	Newtons	6800	-1086.7	Right Femur Force	Newtons	10000	-2358.2	Newtons	6800	-194.5
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1: PURPOSE AND SUMMARY OF THE TEST

PURPOSE

This 56 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-12-D-00257. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

This 56 km/h frontal barrier impact test was conducted in accordance with the Office of Crashworthiness Standards Front NCAP Laboratory Test Procedure dated October 2015.

SUMMARY

A 2017 Toyota Corolla 4DR Sedan impacted the barrier wall at a velocity of 56.65 km/h. The test was performed at Transportation Research Center, Inc. on November 14, 2016. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

One real-time camera and 16 high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female ATD was placed in the right-front passenger position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck load cells, right/left femur load cells, and lower leg instrumentation. Seat belt load cells were also on the driver's and the passenger's lap belts to measure dummy pelvic section loading.

The driver (position 1) ATD (Serial No. 037), and the right-front passenger (position 2) ATD (Serial No. 426) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 100 channels of data were recorded on an on-board data acquisition system. The 288 barrier channels of data were recorded on an off-board high resolution barrier data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

There was 100.0 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 738 mm and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: front airbag, side curtain airbag, headrest, and knee airbag. The passenger's visible contact points were as follows: front airbag, side curtain airbag and headrest.

The occupant data is summarized below:

ATD Position	HIC₁₅	Nij	Neck Tension (N)	Neck Compression (N)	3 ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50 th Male)	210	0.26	1379.3	-145.7	45.5	-24.6	-1459.3	-2358.2
Passenger (5 th Female)	201	0.54	730.1	-167.8	46.5	-20.4	-1086.7	-194.5

2: OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

TEST VEHICLE INFORMATION

NHTSA No.	M20175104
Model Year	2017
Make	Toyota
Model	Corolla
Body Style	Sedan
VIN	2T1BURHE9HC747230
Body Color	Barcelona Red
Odometer Reading (km/mi)	9 mi.
Engine Displacement (L)	1.8
Type/No. Cylinders	Inline/4
Engine Placement	Front/Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADLs)	Yes

TEST VEHICLE OPTIONS

Traction Control System (TCS)	Yes
Power Steering	Yes
Power Window Auto-Reverse	Yes
Driver Frontal Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Front Pass. Frontal Airbag	Yes
Front Pass. Curtain Airbag	Yes
Front Pass. Head/Torso Airbag	No
Front Pass. Torso Airbag	No
Front Pass. Torso/Pelvis Airbag	Yes
Front Pass. Pelvis Airbag	No
Front Pass. Knee Airbag	No
Driver Pretensioner	Yes
Driver Load Limiter	Yes
Front Pass. Pretensioner	Yes
Front Pass. Load Limiter	Yes
Other: Pass. Seat Cushion Airbag	Yes

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured by	Toyota Motor Manufacturing	GVWR (lbs)	3820
Date of Manufacture	08/16	GAWR Front (lbs)	2070
		GAWR Rear (lbs)	1850

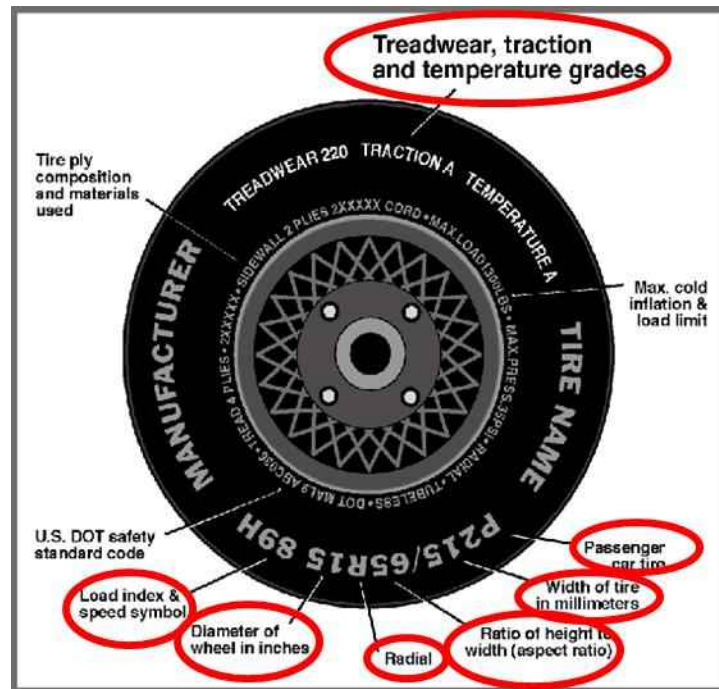
VEHICLE SEATING AND WEIGHT CAPACITY

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Split Bench	N/A	
Number of Occupants	2	3	N/A	5
Capacity Wt. (VCW) (kg)				381
Cargo Wt. (RCLW) (kg)				40.8

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold / Test Pressure (kPa)	220	220
Recommended Tire Size	P205/55R16	P205/55R16
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy MXV4	Primacy MXV4
Treadwear	620	620
Traction Grade	A	A
Temperature Grade	A	A
Tire Plies Sidewall	1	1
Tire Plies Body	4	4
Load Index/Speed Symbol	89H	89H
Tire Material	Polyester, Polyamide & Steel	Polyester, Polyamide & Steel
DOT Safety Code Right	B3WC 02NX 2716	B3WC 02NX 2716
DOT Safety Code Left	B3WC 02NX 2716	B3WC 02NX 2716

DATA SHEET NO. 1 (CONTINUED)**GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW) (Axle)			As Tested (ATW) (Axle)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	415.0	267.8		446.4	320.0	
Right	kg	387.4	245.2		414.0	307.4	
Ratio	%	61.0	39.0		57.8	42.2	
Totals	kg	802.4	513.0	1315.4	860.4	627.4	1487.8

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	1315.4
Weight of 1 P572E ATD & 1 P572O ATD	kg	139.3
Rated Cargo/Luggage Weight (RCLW)	kg	40.8
Vehicle Target Weight (TVTW)	kg	1495.5

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front)
As Delivered	mm	690	693	715	712	1053
As Tested	mm	675	683	679	683	1139
Post Test	mm	713	679	712	709	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Test Vehicle Wheel Base	mm	2700
Total Vehicle Length at Left Side	mm	4367
Total Vehicle Length at Centerline	mm	4650
Total Vehicle Length at Right Side	mm	4366
Weight of Ballast in Cargo Area	kg	0.0
Weight of Vehicle Components Removed	kg	62.0
Amount of Stoddard Solvent in Fuel Tank	liters	45.4

LIST OF COMPONENTS REMOVED TO MEET TEST WEIGHT: Rear bumper beam and fascia, rear door windows, panels and speakers, tail lights, hubcaps, rear shelf panel and speakers, C-pillar trim, rear seat belts, exterior mirrors, rear brake drums and rear deck lid.

DATA SHEET NO. 1 (CONTINUED)**GENERAL TEST AND VEHICLE PARAMETER DATA**Test Vehicle: 2017 Toyota Corolla 4DR SedanNHTSA No.: M20175104Test Program: NCAP Frontal ImpactTest Date: 11/14/16**TARGET VEHICLE STRUCTURAL MEASUREMENT**

	Elements	Pre-Test (mm)
1	Total Length	4650
2	Total Width	1765
3	Bumper Top Height	541
4	Bumper Bottom Height	429
5	Longitudinal Member Top Height	541
6	Distance Between Longitudinal Members	915
7	Longitudinal Member Width	100
8	Engine Top Height	870
9	Engine Bottom Height	200
10	Engine and Gearbox Width	760
11	Front Bumper-Engine Distance	510
12	Front Shock Absorber Fixing Height	865
13	Bonnet Leading Edge Height	710
14	Front Shock Absorber Fixing Width	1140
15	Front Bumper – Front Axle Distance	470
16	Front Axle – A-Pillar Distance	445
17	A-Pillar – B-Pillar Distance	1070
18	B-Pillar – Rear Axle Distance	1185
19	B-Pillar – C-Pillar Distance	1040
20	Roof Sill Bottom Height	1308
21	Roof Sill Top Height	1382
22	Floor Sill Bottom Height	327
23	Floor Sill Top Height	375

DATA SHEET NO. 2

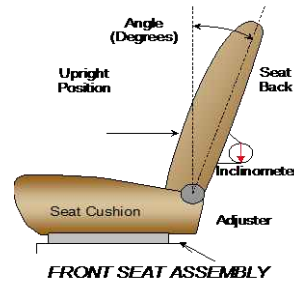
SEAT ADJUSTMENT, FUEL SYSTEM AND STEERING WHEEL DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

NORMAL DESIGN RIDING POSITION

For adjustable driver and passenger seat back. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable. Inclinometer measurement at the top of the backrest at the seat centerline, according to Form 1 attachment.



	Degree
Driver Seat back angle:	3.1
Passenger Seat back angle:	1.4

SEAT FORE/AFT POSITIONS

Describe the method used of determining seat for/aft positions.

Driver: Mid position, Positioned according to Form 1

Passenger: Full forward, Positioned according to Form 1

	Total Fore/Aft Travel	Placed in Position No.
Driver Seat	240	10
Passenger Seat	240	0

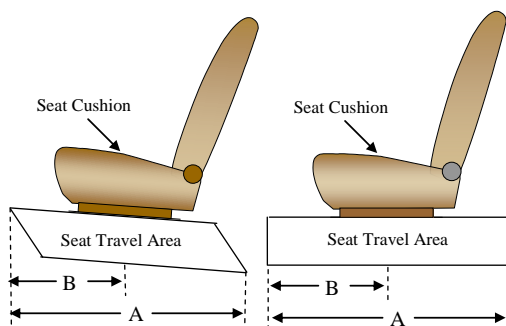
SEAT BELT UPPER ANCHORAGE

Describe the method of positioning seat belt upper anchorages.

Driver: Uppermost, Positioned according to Form 1

Passenger: Uppermost, Positioned according to Form 1.

	Total No. of Positions	Placed in Position No.
Driver Seat	4, numbered from 0 to 3	3, Uppermost
Passenger Seat	4, numbered from 0 to 3	3, Uppermost



DATA SHEET NO. 2 (CONTINUED)

SEAT ADJUSTMENT, FUEL SYSTEM AND STEERING WHEEL DATA

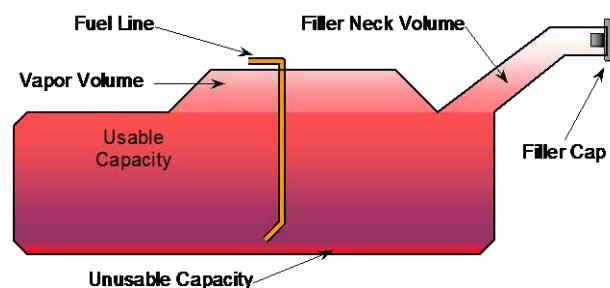
Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16

FUEL TANK CAPACITY

	Liters
Usable Capacity of "Standard Tank"	48.8
Usable Capacity of "Optional Tank"	N/A
92%-94% of Usable Capacity	45.4
Actual Amount of Solvent Used	45.4
1/3 of Usable Capacity	16.3

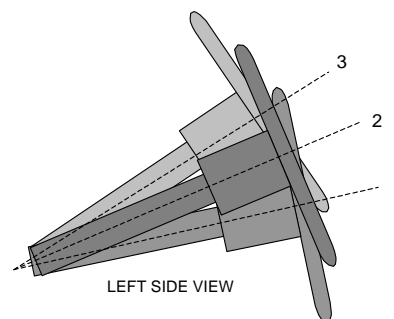
The vehicle is equipped with an electric fuel pump. The fuel pump is activated when the ignition is turned to "on".



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. Steel square was placed across the rim of the steering wheel, an inclinometer was placed on the plate and the angle was measured. Telescope travel was measured full in and full out and set at the midpoint.



STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITIONS

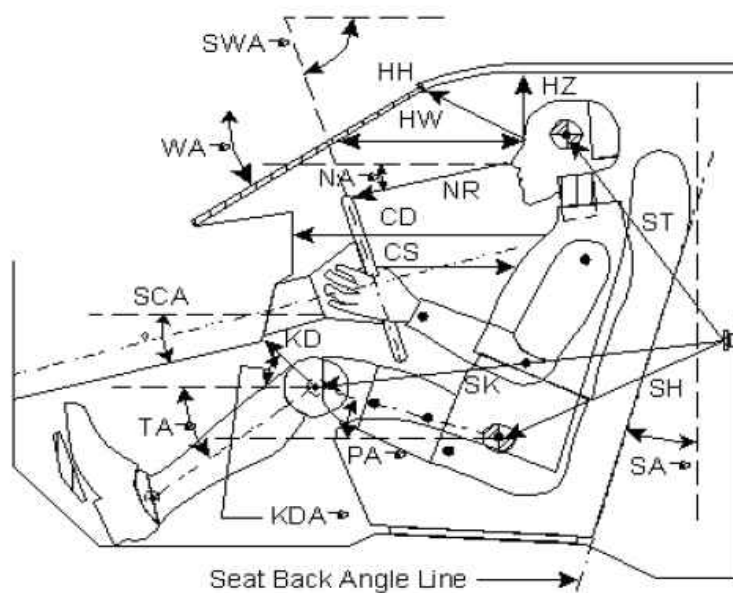
	Degrees	Fore/Aft Position (mm)
Lowermost Position No. 1	20.4	
Geometric Center Position No. 2	22.2	
Uppermost Position No. 3	23.9	
Telescoping Steering Wheel Travel		70
Test Position	22.2	35

DATA SHEET NO. 3

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16



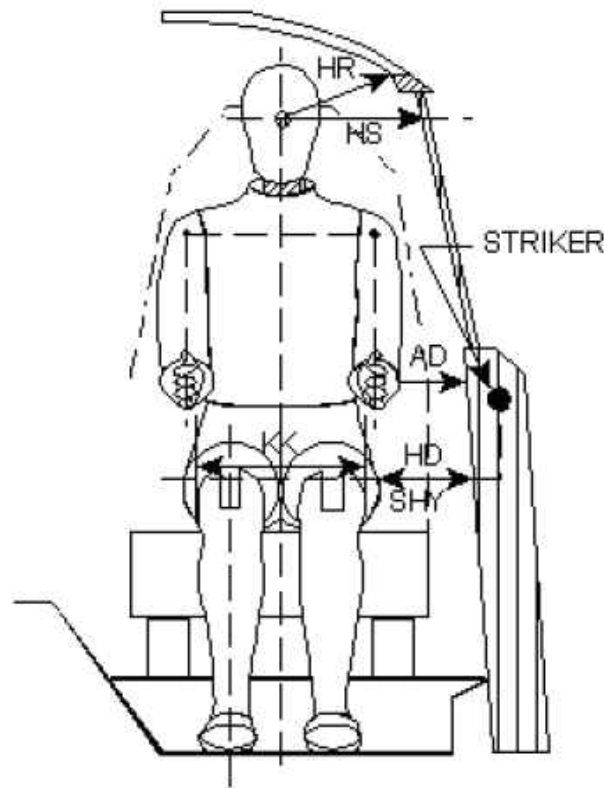
Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		24.9		
SWA°	Steering Wheel Angle		22.2		
SCA°	Steering Column Angle		67.8		
SA°	Seat Back Angle (on headrest post)		3.1		1.4
HZ	Head to Roof (Z)	201		220	
HH	Head to Header	351		276	
HW	Head to Windshield	696		723	
NR	Nose to Rim	370	9.6		
CD	Chest to Dash	496		388	
CS	Chest to Steering Hub	280			
RA	Rim to Abdomen	188			
KDL	Left Knee to Dash	137	24.4	104	38.5
KDR	Right Knee to Dash	129	24.3	114	38.5
PA°	Pelvic Angle		23.5		19.9
TA°	Tibia Angle		50.1		53.1
SK	Striker to Knee	585	9.6	710	15.1
ST	Striker to Head	407	-73.5	397	-59.1
SH	Striker to H-Point	340	50.1	412	32.5

DATA SHEET NO. 4

DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16



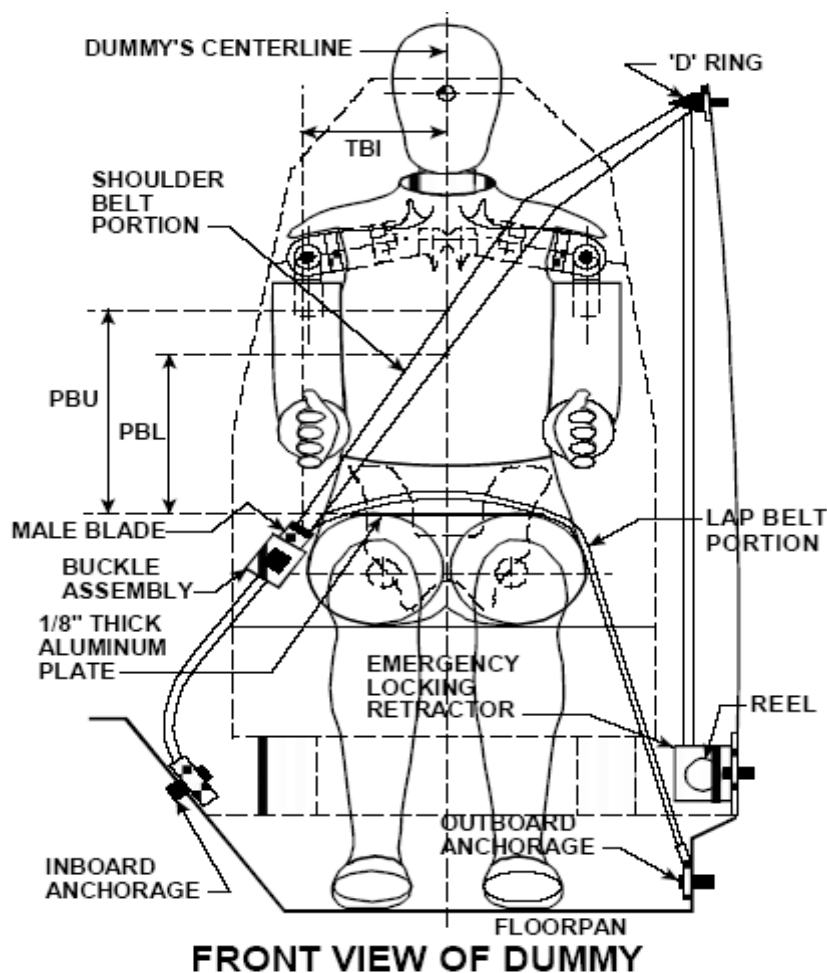
Code	Measurement Description	Driver	Passenger
AD	Arm to Door	151	102
HD	H-Point to Door	145	178
HR	Head to Side Header	215	240
HS	Head to Side Window	327	326
KK	Knee to Knee	360	170
SHY	Striker to H-Point (Y Direction)	240	300
AA	Ankle to Ankle	360	182

DATA SHEET NO. 5

SEAT BELT POSITIONING DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16



SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU – Top surface of reference to belt upper edge	mm	298	310
PBL – Top surface of reference to belt lower edge	mm	214	205

BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder belt length as measured on ATD	mm	870	964
Lap belt length as measured on ATD	mm	802	908
Remainder of belt on reel	mm	968	718
Total belt length for continuous webbing systems	mm	2640	2590

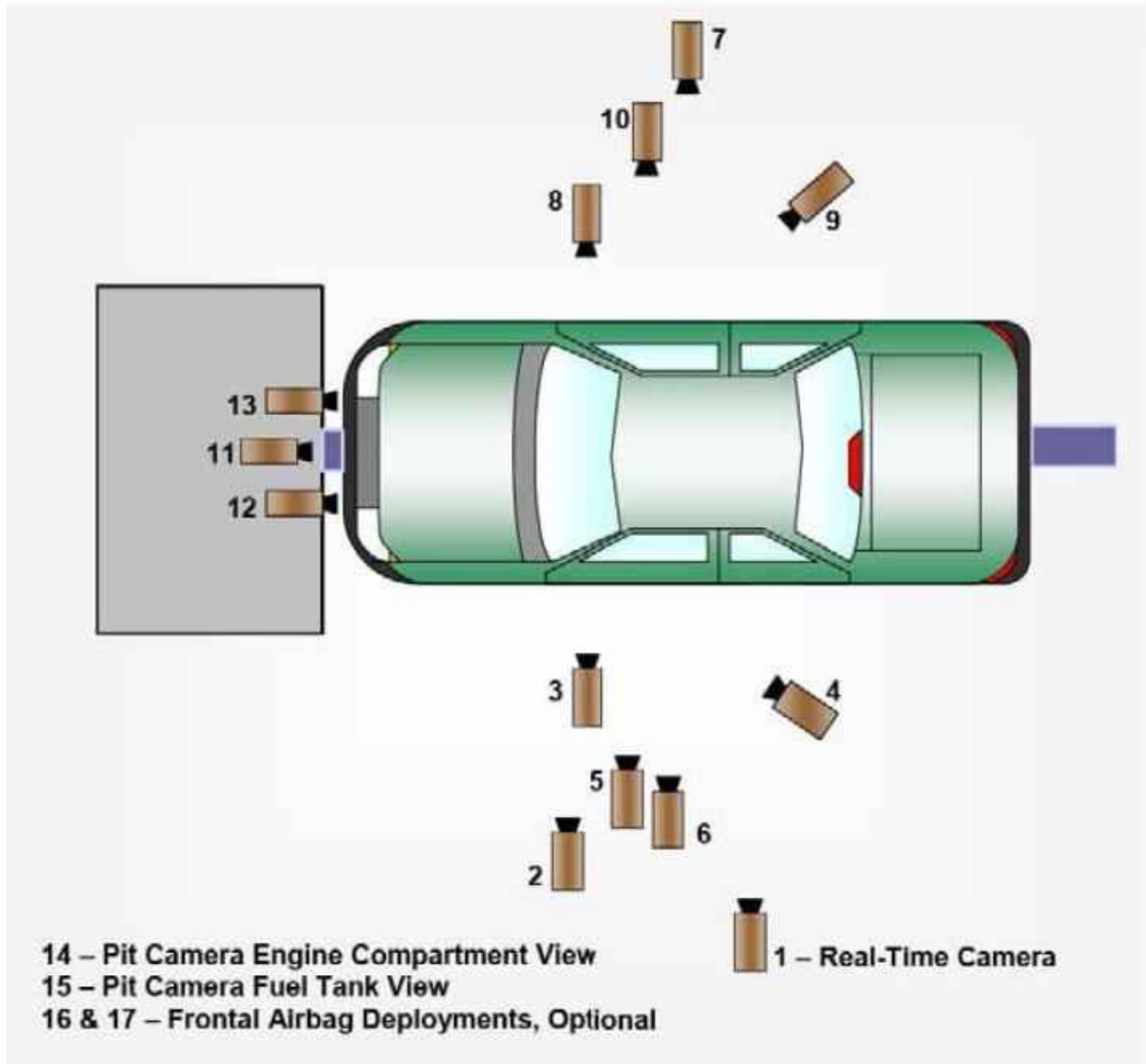
DATA SHEET NO. 6

HIGH SPEED CAMERA LOCATIONS AND DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)**HIGH SPEED CAMERA LOCATIONS AND DATA**

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16

CAMERA LOCATIONS

No.	Camera View	Location (mm)			Lens (mm)	Frame Speed (fps)
		X	Y	Z		
1	Real-Time Left Overall	2376	5612	1410	Zoom	30
2	Driver Close-Up	1578	-4902	1200	50	1000
3	Left Front Half	1289	-4769	1200	28	1000
4	Left Angle	4017	2176	1950	35	1000
5	Steering Column - Top	1858	-5364	2380	50	1000
6	Steering Column – Bottom	1839	-5044	1220	50	1000
7	Right Overall	2135	5549	1210	20	1000
8	Passenger Close-Up	1657	4891	1090	50	1000
9	Right Front Half	4187	2201	1930	35	1000
10	Right Angle	1548	5235	990	28	1000
11	Windshield	0	0	2680	20	1000
12	Driver Windshield	0	-310	2680	25	1000
13	Passenger Windshield	0	470	2680	25	1000
14	Pit Front	1240	0	3077	25	1000
15	Pit Rear	3043	0	3228	12.5	1000
16	Onboard Driver Airbag (Optional)				12.5	1000
17	Onboard Passenger Airbag (Optional)				12.5	1000

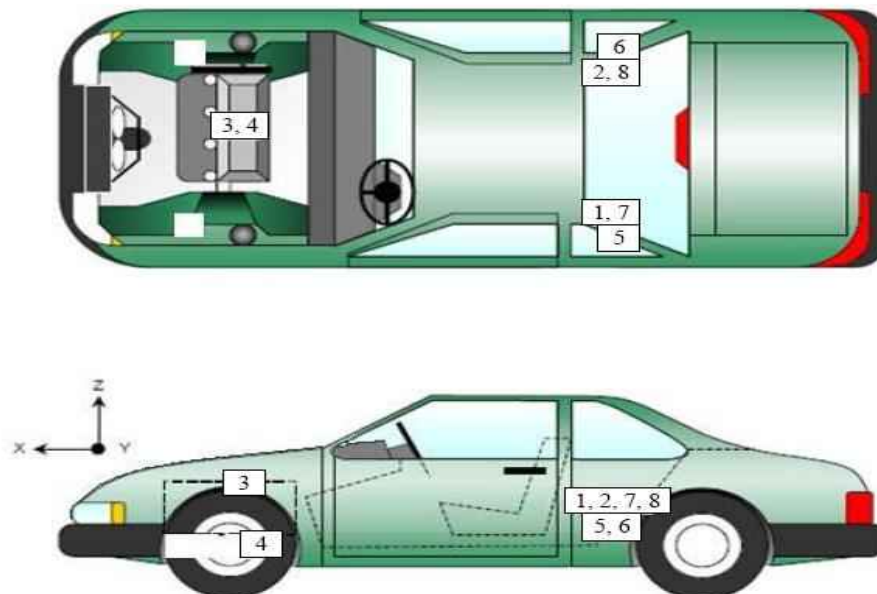
Reference Points: +X – forward of impact plane
+Y – right of monorail center
+Z – into ground

DATA SHEET NO. 7

VEHICLE ACCELEROMETER DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16



VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Location (mm)		
		X	Y	Z
1	Left Rear Accelerometer – X Direction	1782	-222	-424
2	Right Rear Accelerometer – X Direction	1782	215	-427
3	Engine Top X	3882	25	-820
4	Engine Bottom X	3810	175	-233
5	Left Rear Accelerometer – Z Direction	1782	-222	-424
6	Right Rear Accelerometer – Z Direction	1782	215	-427
7	Left Rear Accelerometer – X Direction Redundant	1782	-165	-424
8	Right Rear Accelerometer- X Direction Redundant	1782	157	-427

Reference Points: X – Rear Surface of Vehicle (+ forward)
Y – Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

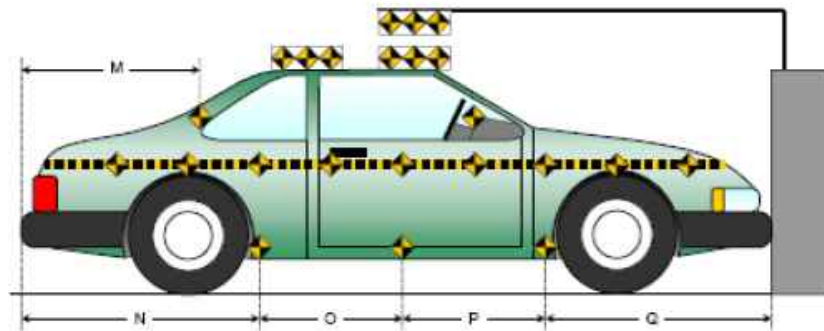
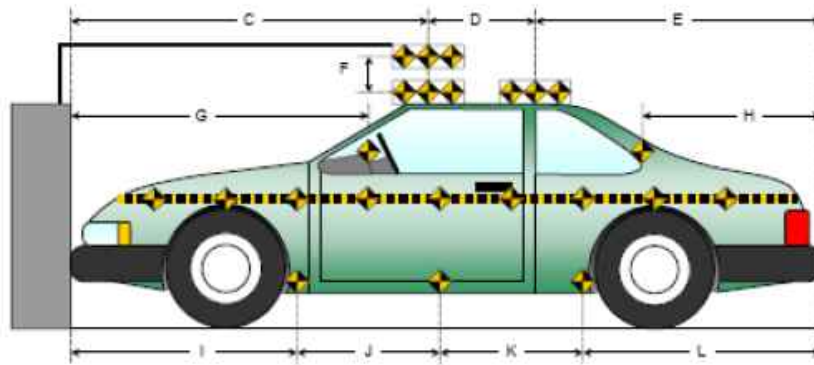
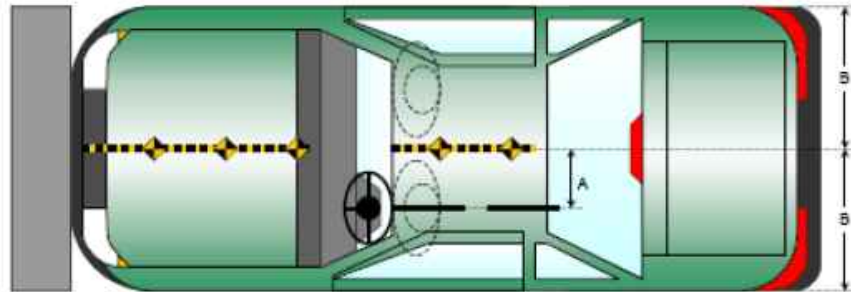
DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

Item	Value
A	350
B	883
C	2300
D	625
E	1716
F	213
G	1719
H	1227
I	1441
J	884
K	923
L	1402
M	1226
N	1395
O	923
P	883
Q	1449



All units in millimeters

DATA SHEET NO. 9

LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

								Centerline							
A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

DATA SHEET NO. 10

TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16

INSTRUMENTATION

Instrumentation	Number of Channels Collected
Driver Dummy Accelerometers	44
Passenger Dummy Accelerometers	44
Vehicle Structure Accelerometers	8
Total	96

CAMERA COVERAGE

Type of Camera	Number Used in this Test
High-Speed Vehicle Onboard	2
High-Speed Offboard	14
Real-Time Panning	1
Total	17

DATA SHEET NO. 11**POST-TEST OBSERVATIONS**Test Vehicle: 2017 Toyota Corolla 4DR SedanNHTSA No.: M20175104Test Program: NCAP Frontal ImpactTest Date: 11/14/16**TEST DUMMY INFORMATION AND CONTACT LOCATIONS**

Description	Driver	Passenger
Dummy Type / Serial No.	Hybrid III 50th/ 037	Hybrid III 5th/ 426
Head Contact	Frontal Airbag, Head Restraint, SCAB	Frontal Airbag, Head Restraint, SCAB
Upper Torso Contact	Frontal Airbag	Frontal Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Airbag	Glove Box
Right Knee Contact	Knee Airbag	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Front	Rear
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Remained closed & latched, operational	Remained closed & latched, operational
Rear Door Opening	Remained closed & latched, operational	Remained closed & latched, operational
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	Lower right side at cowl
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

Measured Parameter	Units	Value
Left Side	mm	1917
Center	mm	1848
Right Side	mm	1944
Average	mm	1903

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

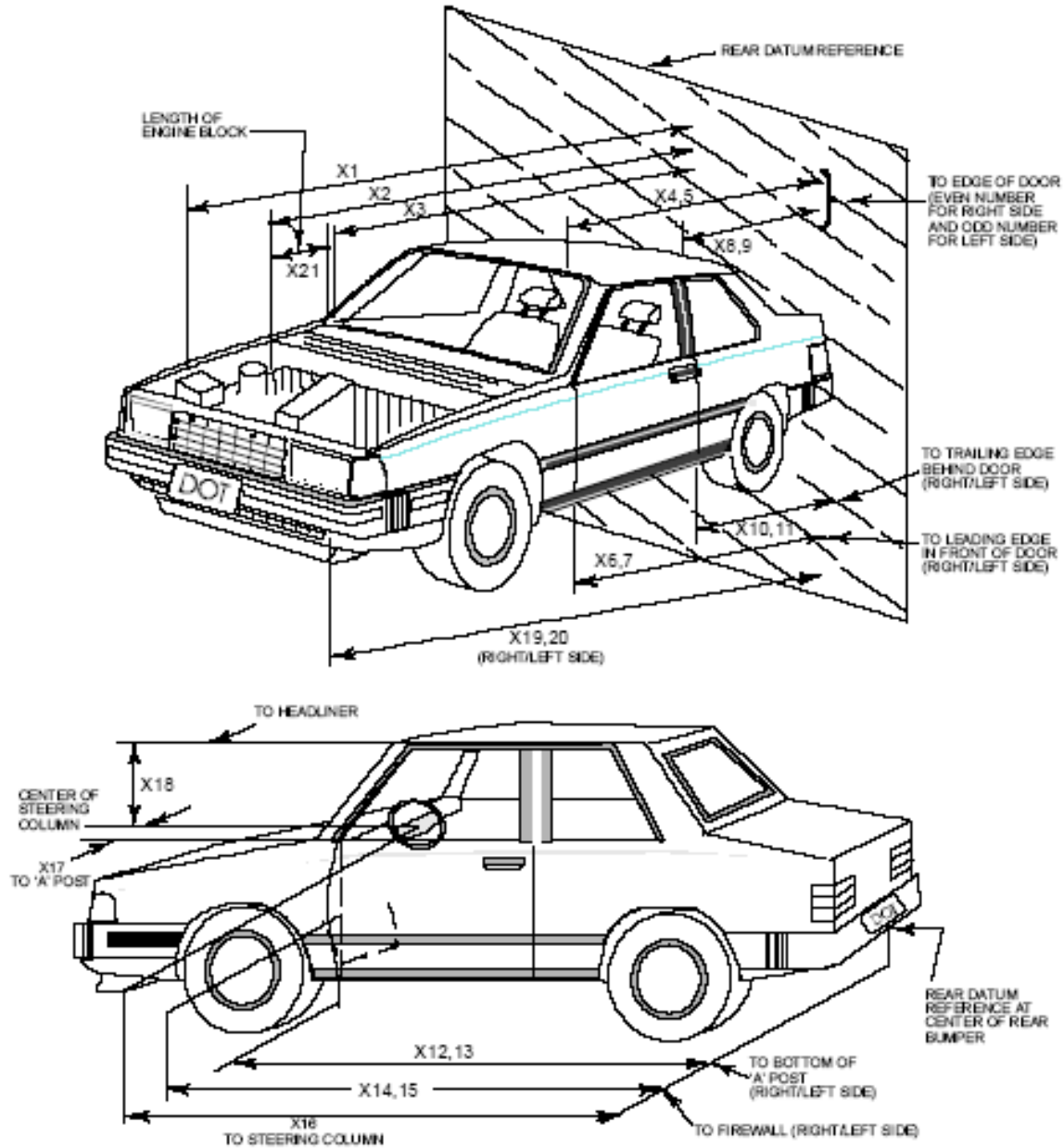
Restraint Type	Driver (Occupant 1)		Passenger (Occupant 2)	
	Installed	Deployed	Installed	Deployed
Front Airbag	Yes	Yes	Yes	Yes
Side Curtain Airbag	Yes	Yes	Yes	Yes
Torso/Pelvis Airbag	Yes	Yes	Yes	Yes
Pelvis Airbag	No	N/A	No	N/A
Knee Airbag	Yes	Yes	No	N/A
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes	Unknown	Yes	Unknown
Seat Cushion Airbag	No	N/A	Yes	Yes

DATA SHEET NO. 12

VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

No.	Measurement Description	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	4650	3912	738
2	Rear Surface of Vehicle (RSOV) to Front of Engine	4135	3861	274
3	RSOV to Firewall	3707	3650	57
4	RSOV to Upper Leading Edge of Right Door	3232	3231	1
5	RSOV to Upper Leading Edge of Left Door	3231	3223	8
6	RSOV to Lower Leading Edge of Right Door	3165	3166	-1
7	RSOV to Lower Leading Edge of Left Door	3167	3158	9
8	RSOV to Upper Trailing Edge of Right Door	2168	2167	1
9	RSOV to Upper Trailing Edge of Left Door	2166	2159	7
10	RSOV to Lower Trailing Edge of Right Door	2160	2162	-2
11	RSOV to Lower Trailing Edge of Left Door	2168	2160	8
12	RSOV to Bottom of "A" Post-of Right Side	3225	3223	2
13	RSOV to Bottom of "A" Post-of Left Side	3224	3215	9
14	RSOV to Firewall, Right Side	3586	3730	-144
15	RSOV to Firewall, Left Side	3587	3715	-128
16	RSOV to Steering Column	2749	2780	-31
17	Center of Steering Column to "A" Post	283	300	-17
18	Center of Steering Column to Headliner	407	400	7
19	RSOV to Right Side of Front Bumper	4366	3964	402
20	RSOV to Left Side of Front Bumper	4367	3950	417
21	Length of Engine Block	550	550	0
RD	RSOV to Right Side of Dash Panel	3006	3010	-4
CD	RSOV to Center of Dash Panel	2943	2950	-7
LD	RSOV to Left Side of Dash Panel	3010	3000	10

All Dimensions in mm

DATA SHEET NO. 13

ACCIDENT INVESTIGATION DIVISION DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16

VEHICLE INFORMATION

VIN: 2T1BURHE9HC747230
Vehicle Size Category: Passenger Car

Wheelbase: 2700
Test Weight (kg): 1487.8

ACCELEROMETER DATA

Accelerometer Locations: As listed on Page 15 of this report.

Cal. Procedure/Interval: TRC procedure / 6 month interval

Integration Algorithm: Trapezoidal

Linearity: > 99%

Impact Velocity (km/h): 56.65

Velocity Change (km/h): 69.59

Time of Separation (ms): 120

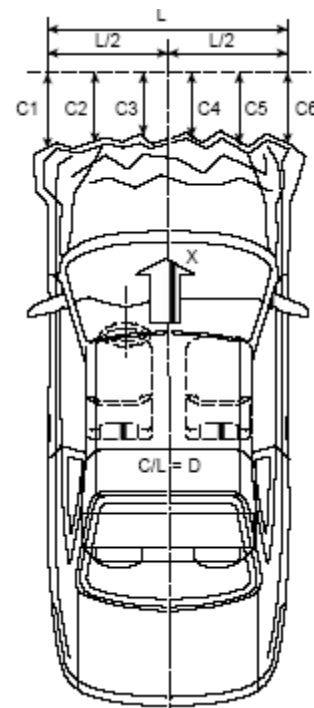
CRUSH PROFILE

Collision Deformation Classification: 12FDEW2

Midpoint of Damage: Centerline

Damage Region Length (mm): 1524

Impact Mode: Frontal



No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	4367	3950	417
C2	Crush zone 2 at left side	mm	4548	3960	588
C3	Crush zone 3 at left side	mm	4611	3925	686
C4	Crush zone 4 at right side	mm	4610	3935	675
C5	Crush zone 5 at right side	mm	4548	3956	592
C6	Crush zone 6 at right side	mm	4366	3964	402
L	C1 to C6	mm	1524	1080	444

DATA SHEET NO. 14

VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

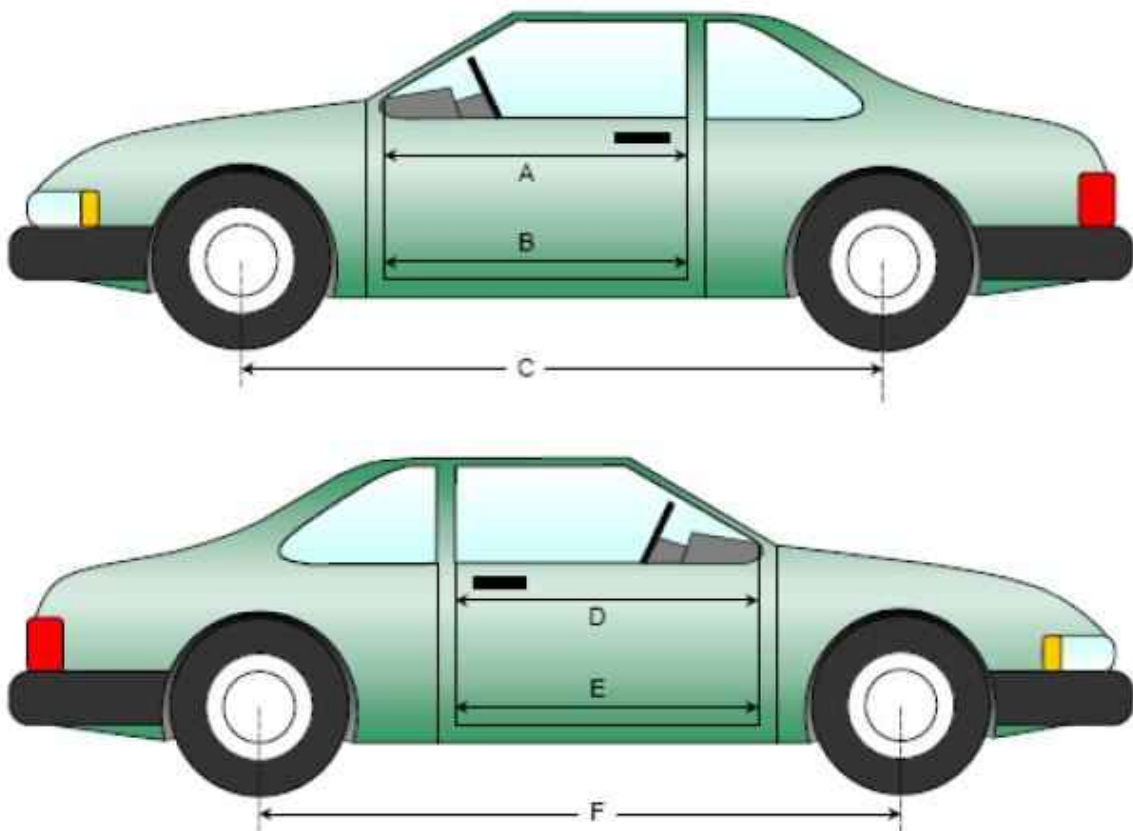
NHTSA No.: M20175104
Test Date: 11/14/16

DOOR OPENING WIDTH

No.	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1033	1032	1
B	Left Side Lower	mm	852	852	0
C	Right Side Upper	mm	1033	1033	0
D	Right Side Lower	mm	852	852	0

WHEELBASE MEASUREMENTS

No.	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	2700	2635	65
F	Right Side Wheelbase	mm	2700	2662	38



DATA SHEET NO. 14 (CONTINUED)

VEHICLE INTRUSION MEASUREMENTS

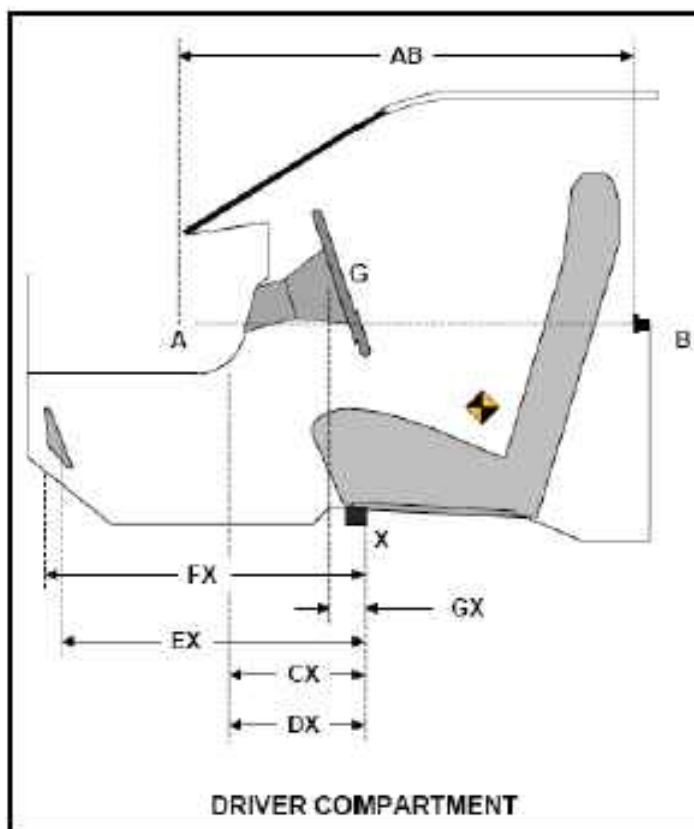
Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	1020	1020	0
CX	Left Knee Bolster to X	mm	308	318	-10
DX	Right Knee Bolster to X	mm	305	340	-35
EX	Brake Pedal to X	mm	545	545	0
FX	Foot Rest to X	mm	530	515	15
GX	Center of Steering Column Wheel Hub to X	mm	55	115	-60

X = Front of Seat Track (Stationary)



DATA SHEET NO. 15

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

Please provide windshield mounting details.

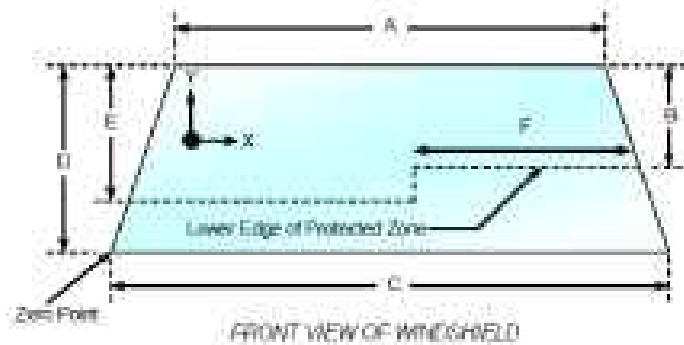
The standard requires that the post-test retention measurement be a minimum of 75% of the pre-test total periphery measurement for vehicle not equipped with occupant passive restraint and 50% for each side of the windshield for vehicle which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.7° C

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% Retention
Left Side	2094	2094	100.0
Right Side	2117	2117	100.0
Total	4211	4211	100.0

Item	Units	Value
A	mm	1100
B	mm	473
C	mm	1440
D	mm	840
E	mm	489
F	mm	415



AREAS OF PROTECTED ZONE FAILURES

A. Provide coordinates of the area that the protected zone was penetrated more than .25 inches by a vehicle component other than one that is normally in contact with the windshield.

X	Y
NA	NA
NA	NA
NA	NA
NA	NA

B. The inner surface of the windshield was penetrated by the hood support beneath the protected zone.

X	Y
NA	NA
NA	NA
NA	NA
NA	NA

DATA SHEET NO. 15 (CONTINUED)

SUMMARY OF FMVSS 212, 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan

NHTSA No.: M20175104

Test Program: NCAP Frontal Impact

Test Date: 11/14/16

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

Temperature at Time of Impact: 21.1°C

Test Time: 17:03

Stoddard Solvent Spillage Measurements

- A From impact until vehicle motion ceases: 0 oz.
(maximum allowable – 1 oz.)
- B For the 5-minute period after motion ceases: 0 oz.
(maximum allowable – 5 oz.)
- C For the following 25 minutes: 0 oz.
(maximum allowable – 1 oz./minutes)
- D Spillage: None

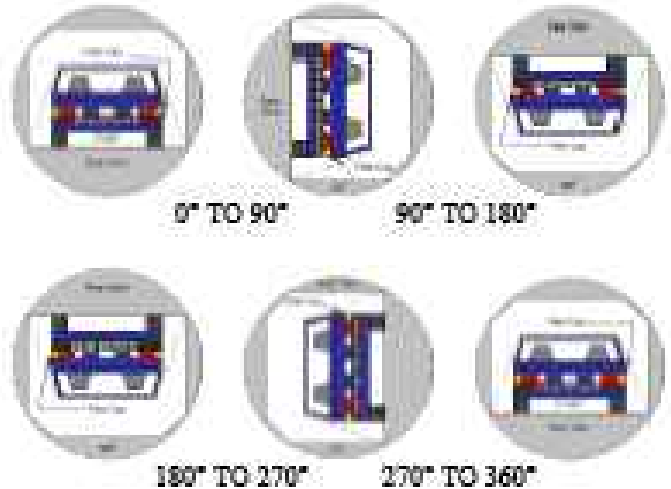
DATA SHEET NO. 16

FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
 Test Date: 11/14/16

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage:
 None



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	90	330	420
90° to 180°	90	330	840
180° to 270°	90	330	1260
270° to 360°	90	330	1480

FMVSS 301 SPILLAGE TABLE

Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0° to 90°	0	0	0	N/A
90° to 180°	0	0	0	N/A
180° to 270°	0	0	0	N/A
270° to 360°	0	0	0	N/A

SOLVENT SPILLAGE LOCATION TABLE

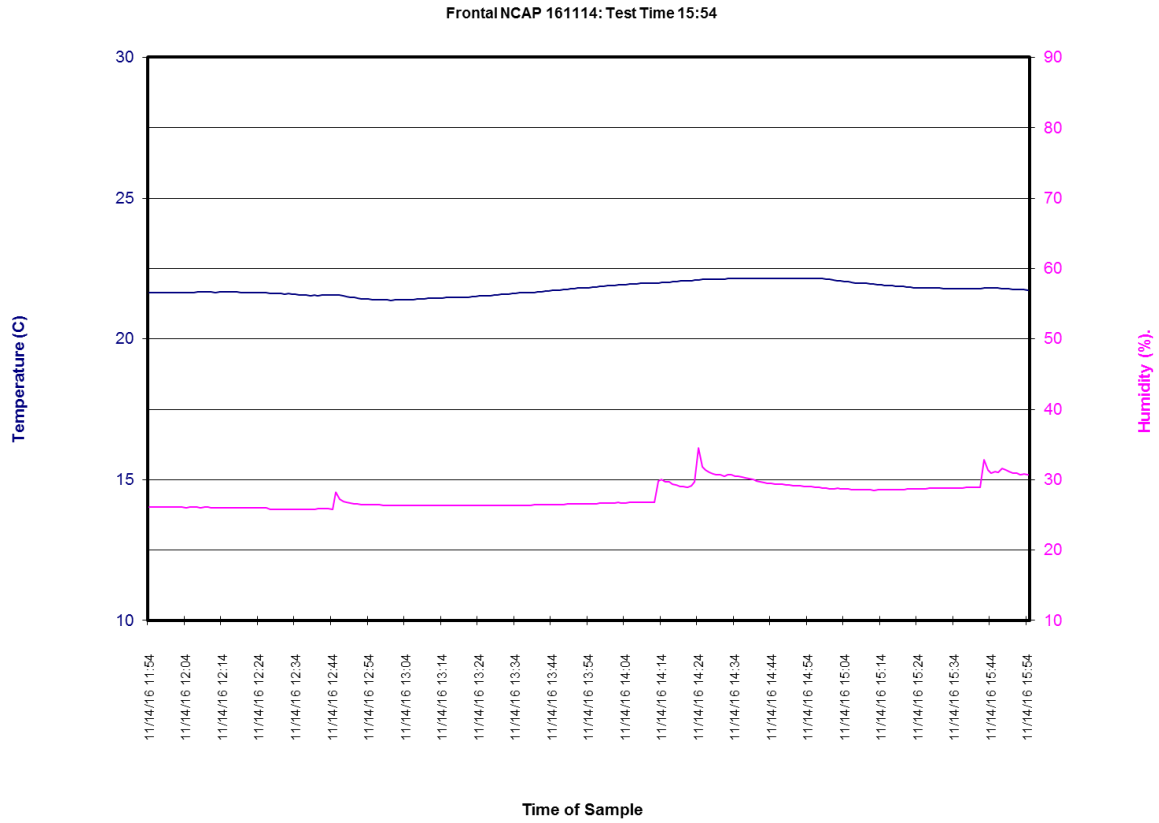
Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

DATA SHEET NO. 17

DUMMY/VEHICLE TEMPERATURE STABILIZATION

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: NCAP Frontal Impact

NHTSA No.: M20175104
Test Date: 11/14/16



APPENDIX A
PHOTOGRAPHS

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001 Load Cell Location



002 Pre-Test Load Cell Wall



003 Post-Test Load Cell Wall



004 Manufacturer's Label



004a Reduced Load Carrying Capacity Label



005 Tire Placard



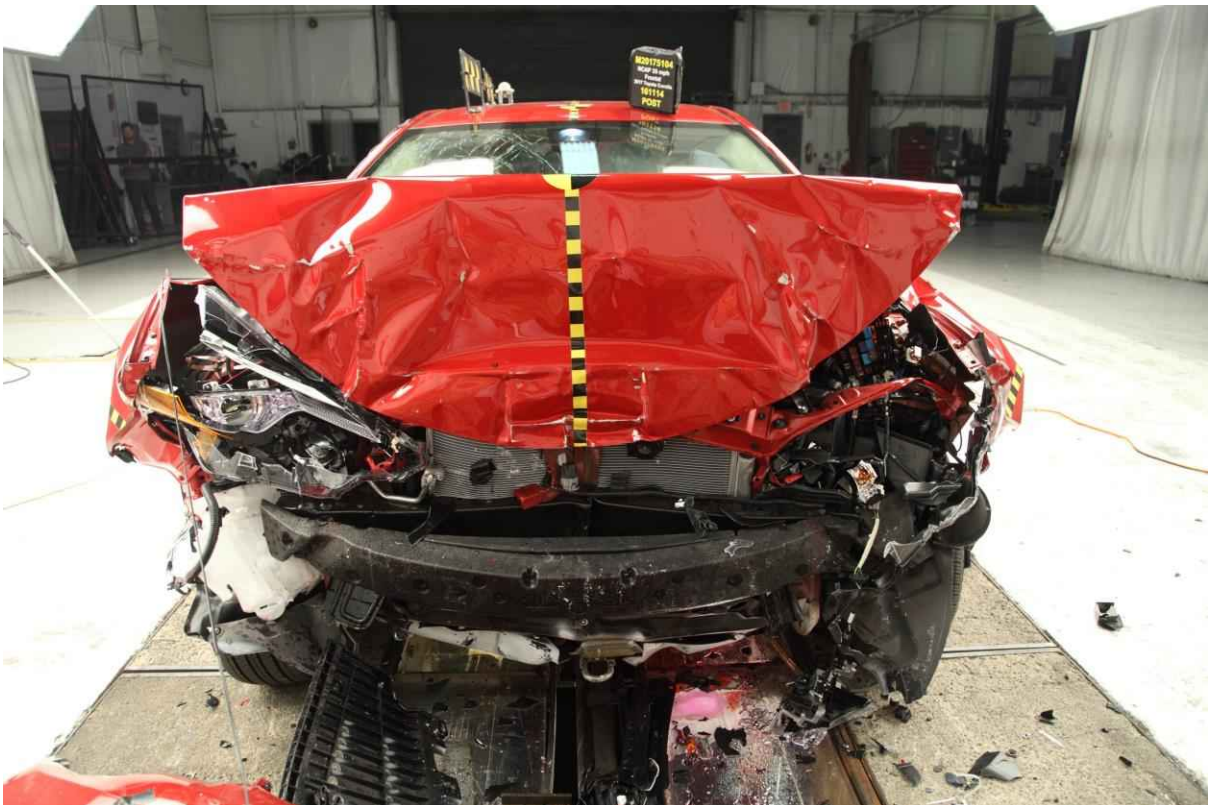
006 2017 Toyota Corolla 4DR Sedan Frontal as Delivered



007 Right Rear 3-4 View, as Received



008 Pre-Test Front View of Test Vehicle



009 Post-Test Front View of Test Vehicle



010 Pre-Test Left View of Test Vehicle



011 Post-Test Left View of Test Vehicle



012 Pre-Test Right View of Test Vehicle



013 Post-Test Right View of Test Vehicle



014 Pre-Test Right Front 3-4 View



015 Post-Test Right Front 3-4 View



016 Pre-Test Left Rear 3-4 View



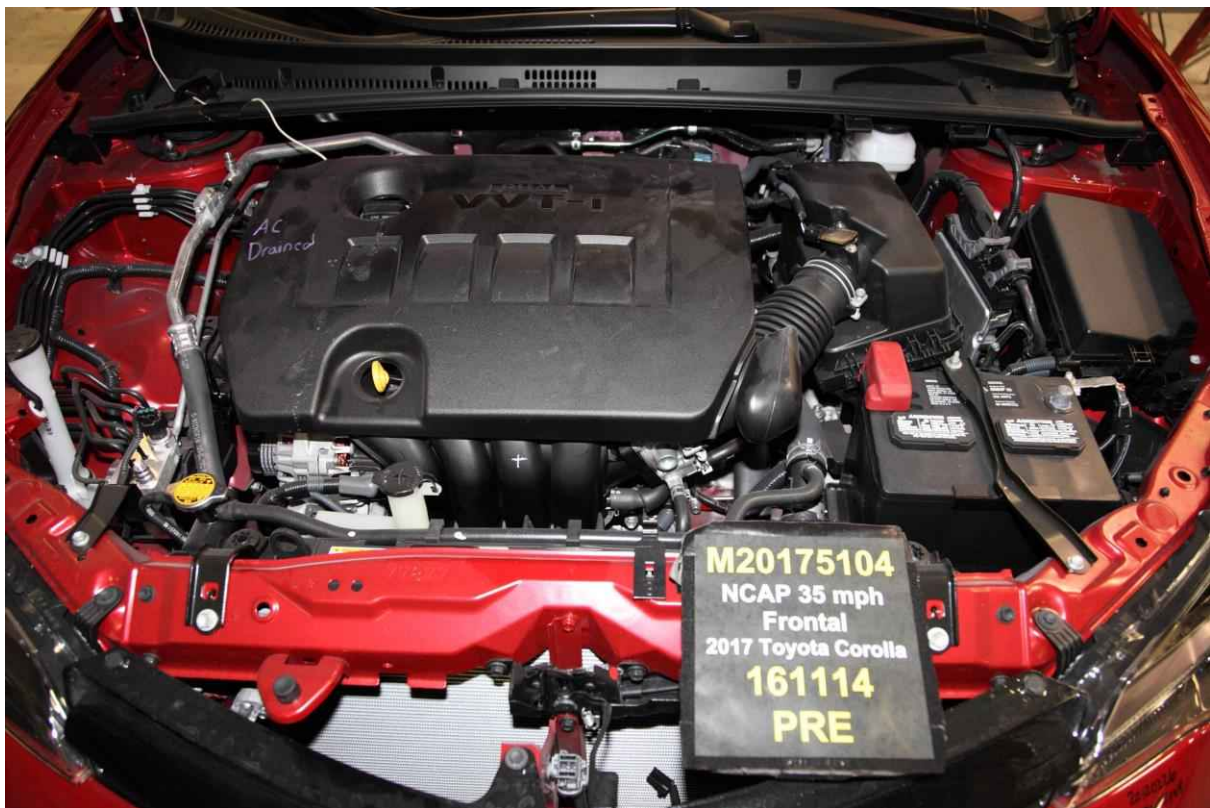
017 Post-Test Left Rear 3-4 View



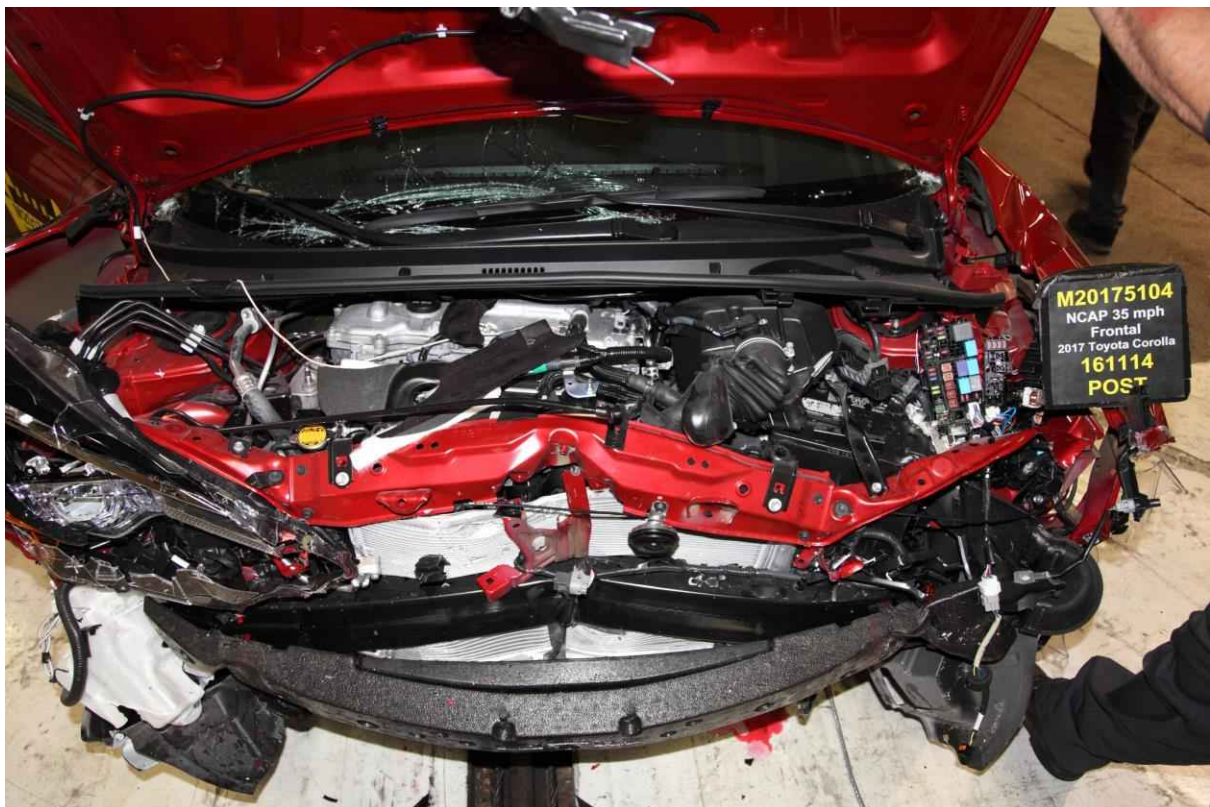
018 Pre-Test Windshield View



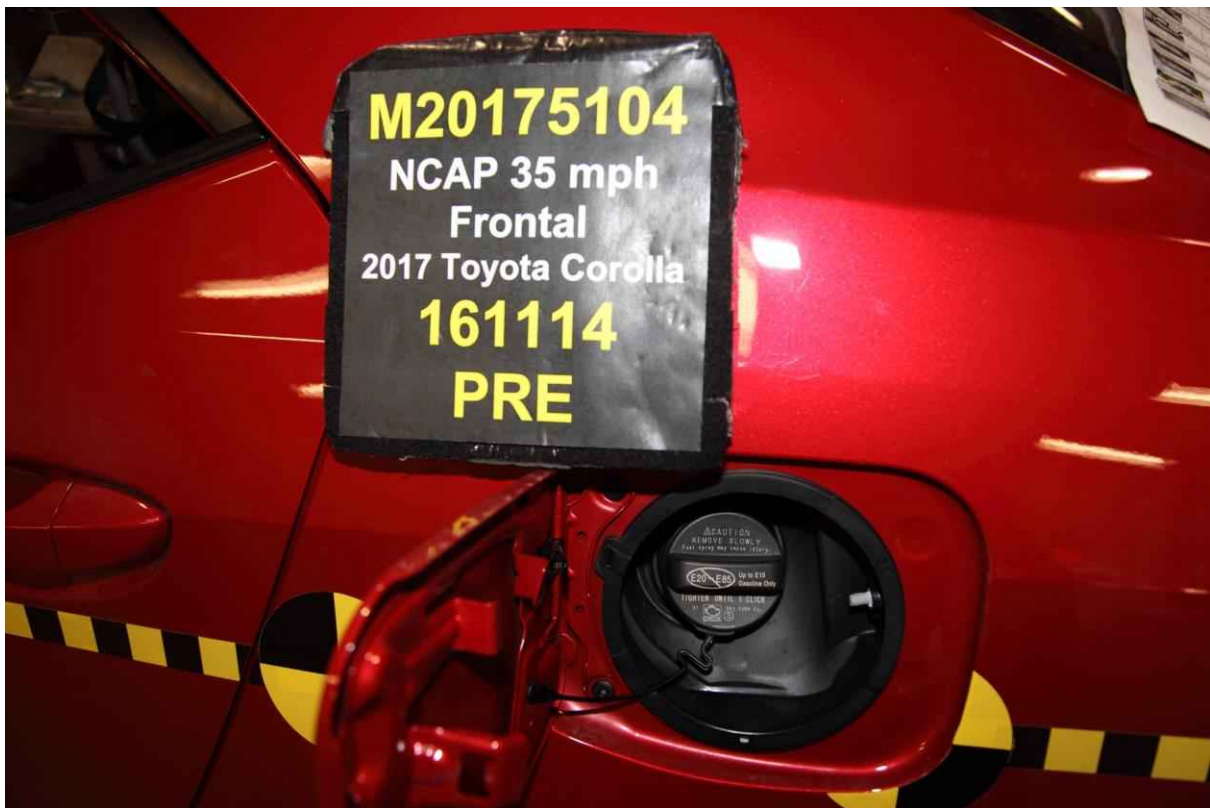
019 Post-Test Windshield View



020 Pre-Test Engine Compartment View



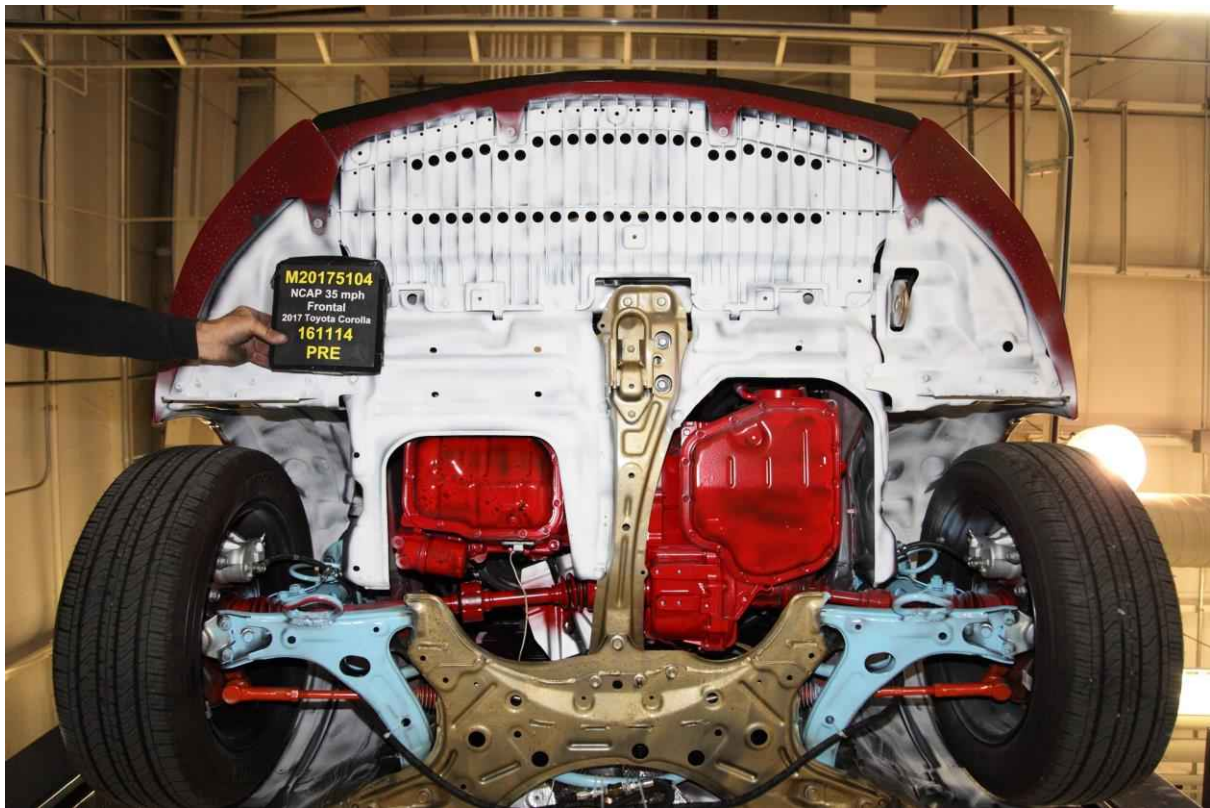
021 Post-Test Engine Compartment View



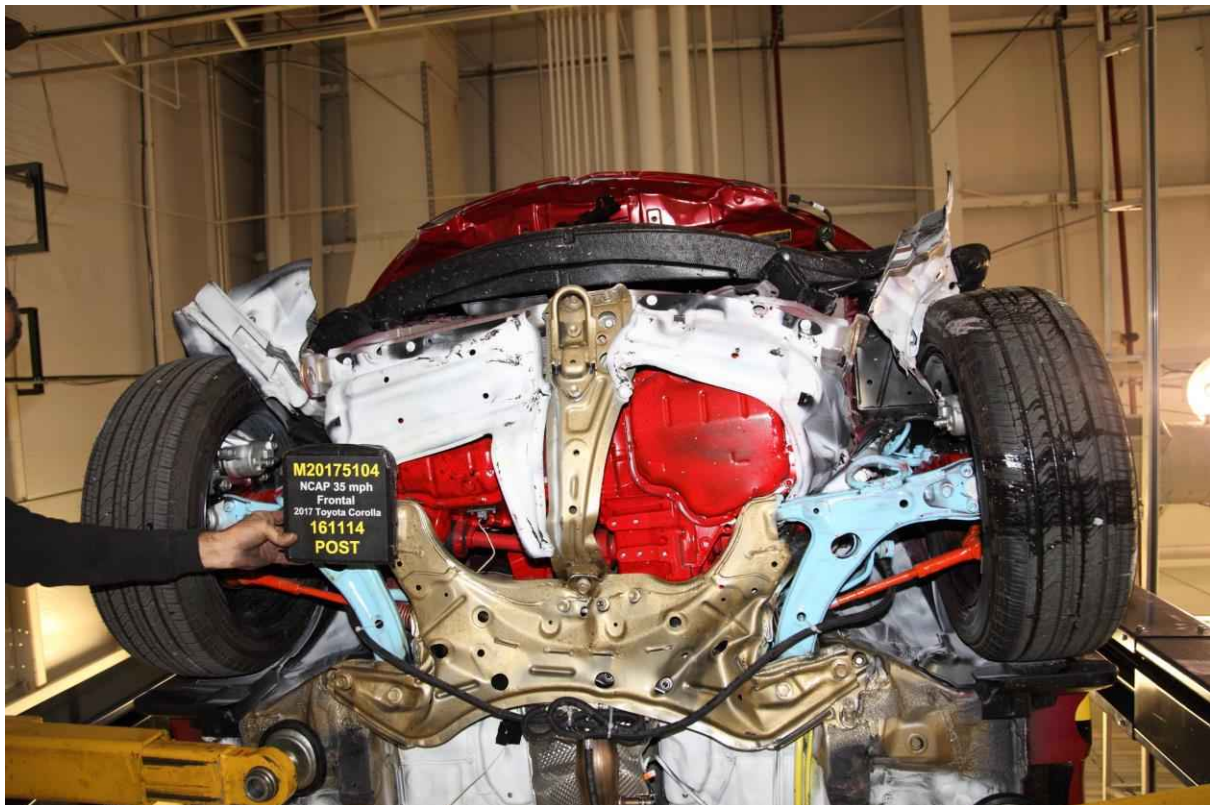
022 Pre-Test Fuel Filler Cap View



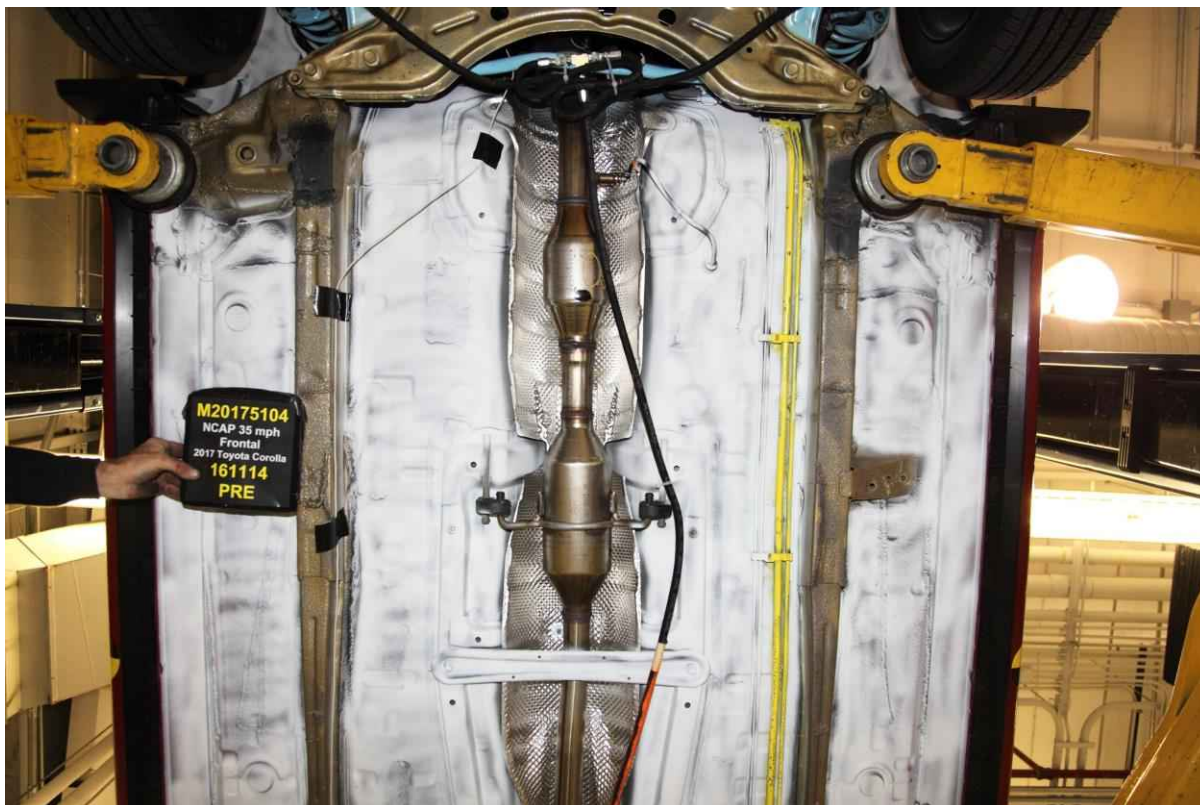
023 Post-Test Fuel Filler Cap View



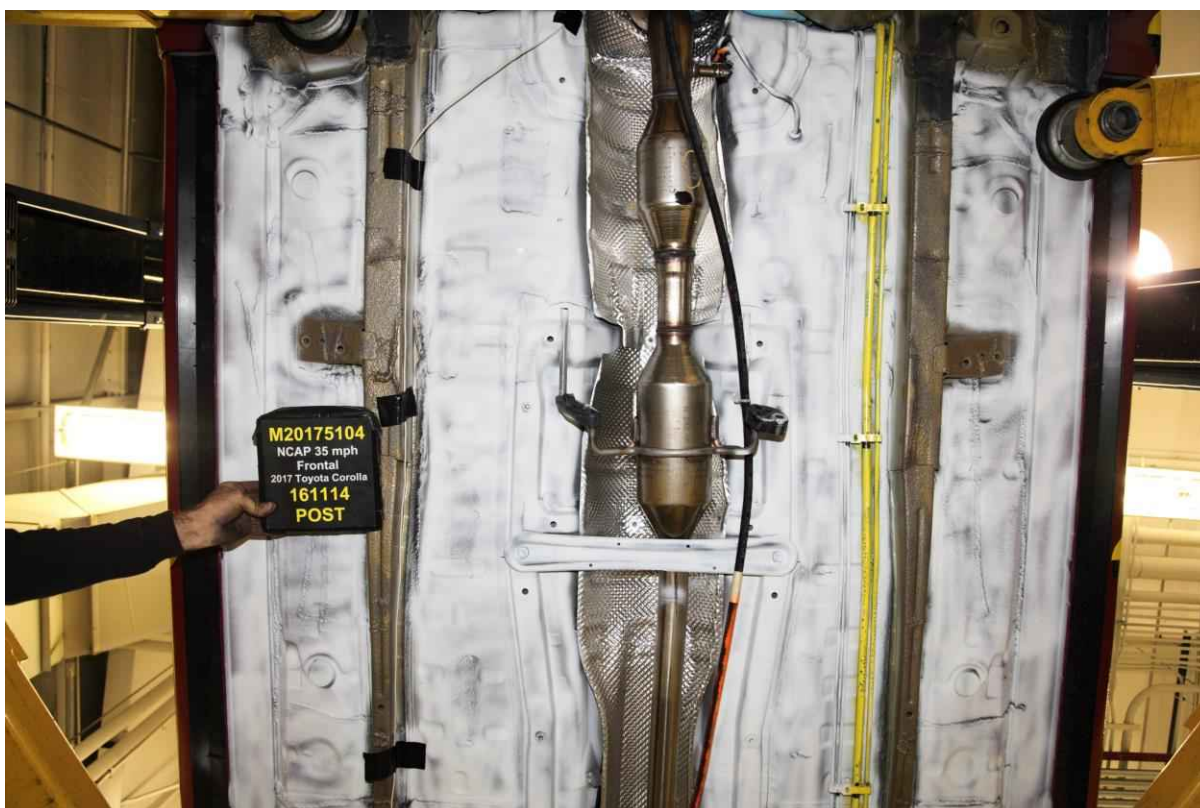
024 Pre-Test Front Underbody View



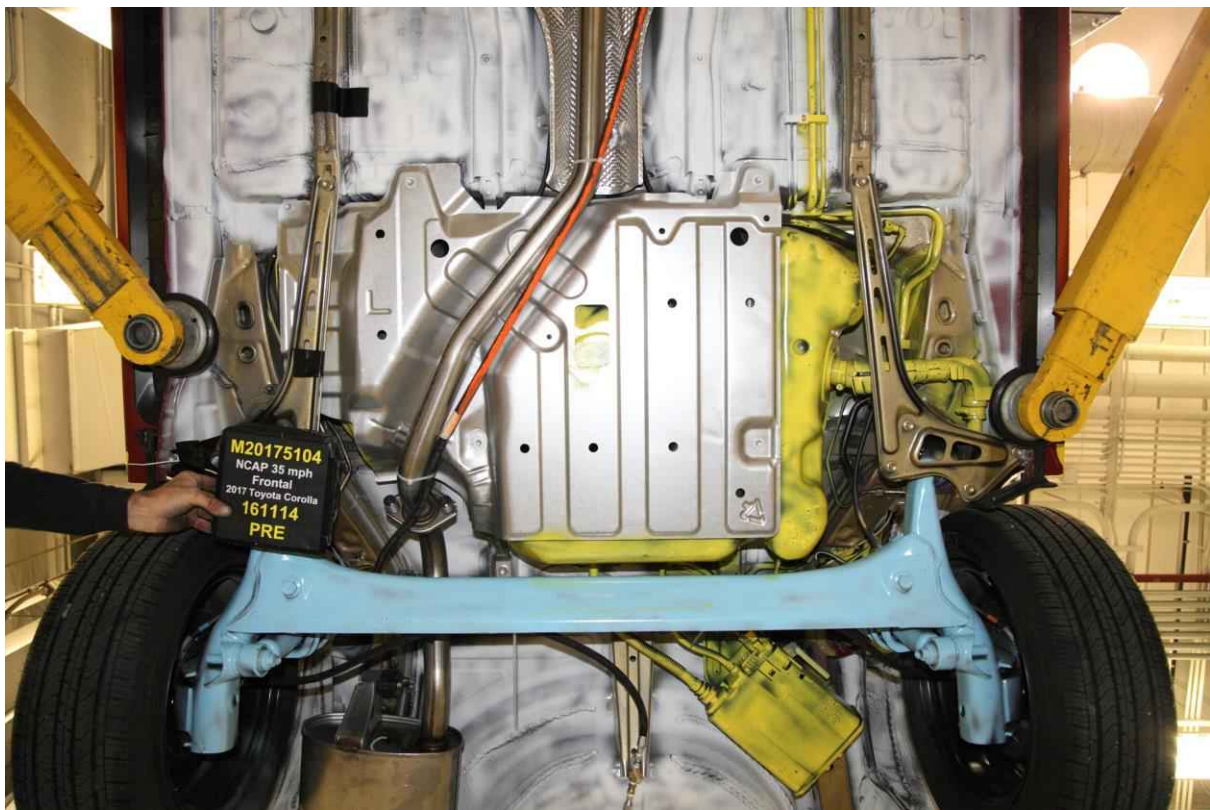
025 Post-Test Front Underbody View



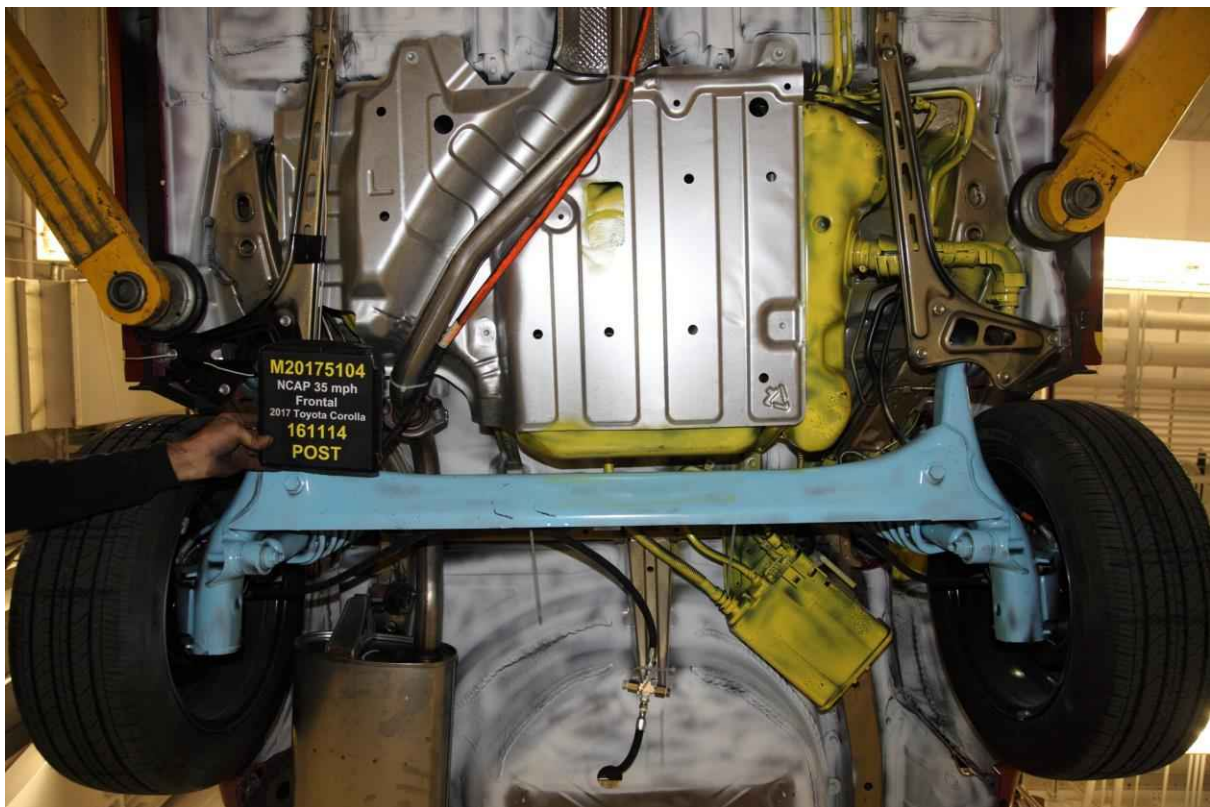
025a Pre-Test Mid Front Underbody View



025b Post-Test Mid Front Underbody View



025c Pre-Test Mid Rear Underbody View



025d Post-Test Mid Rear Underbody View



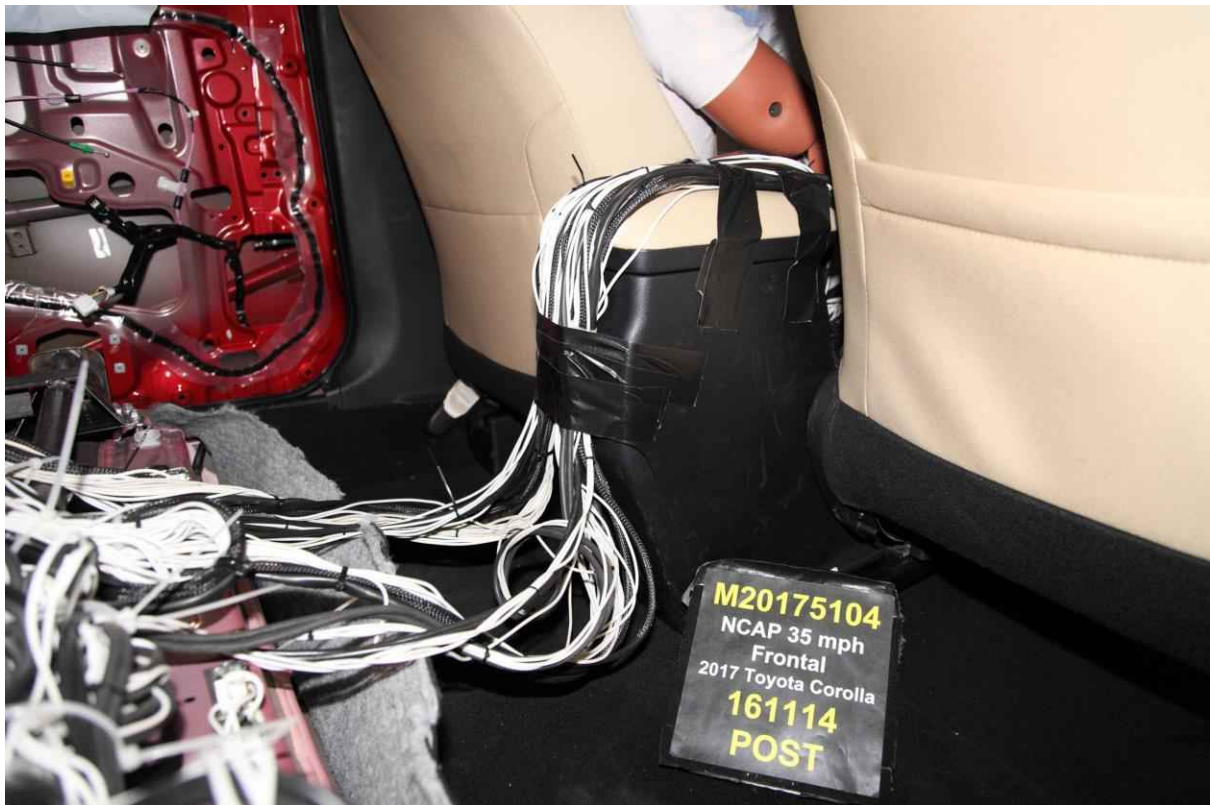
026 Pre-Test Rear Underbody View



027 Post-Test Rear Underbody View



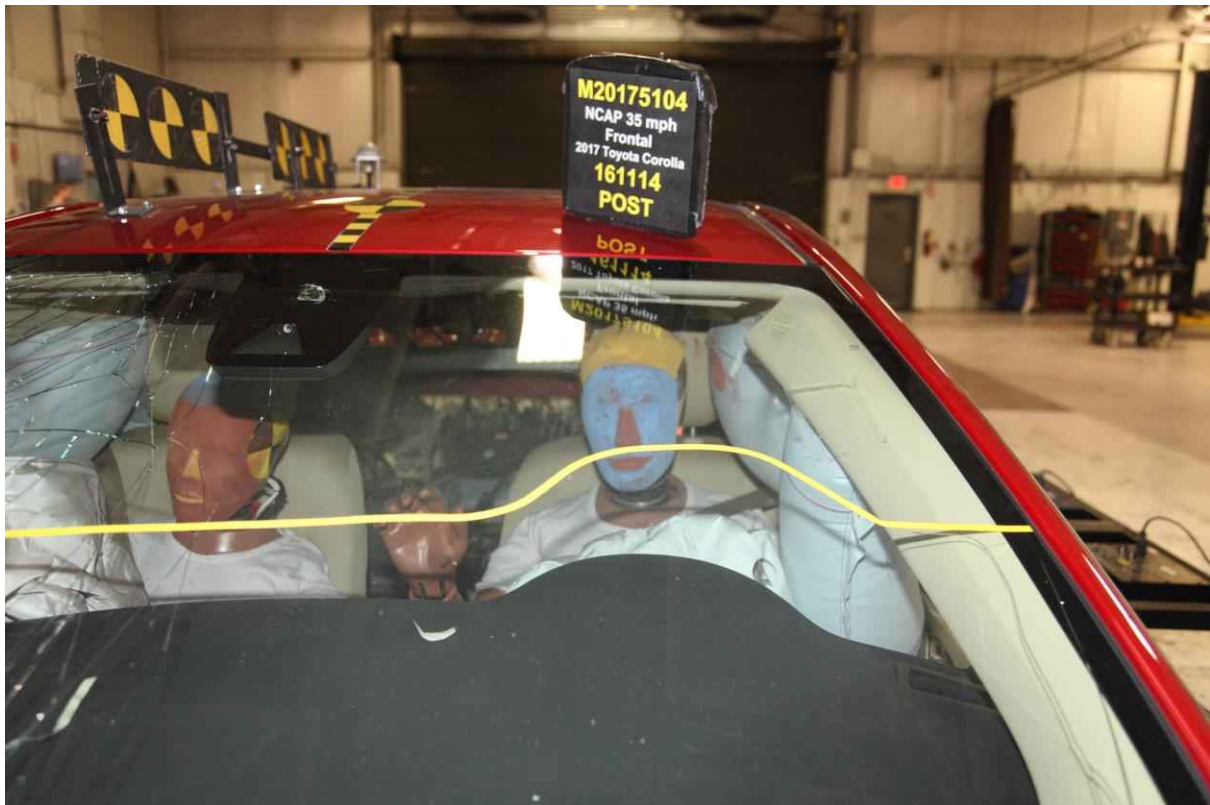
028 Pre-Test Dummy Cable Routing



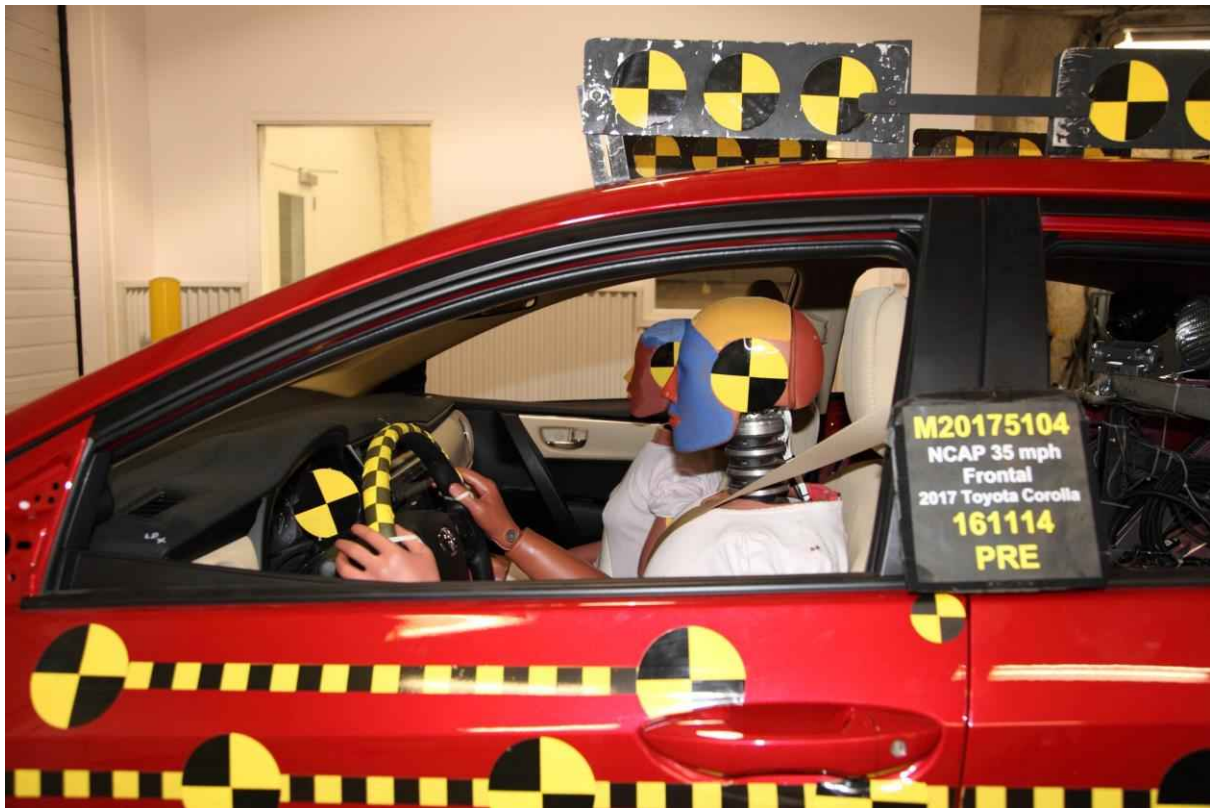
029 Post-Test Dummy Cable Routing



030 Pre-Test Driver Dummy Front View



031 Post-Test Driver Dummy Front View



032 Pre-Test Driver Dummy Window View



033 Post-Test Driver Dummy Window View



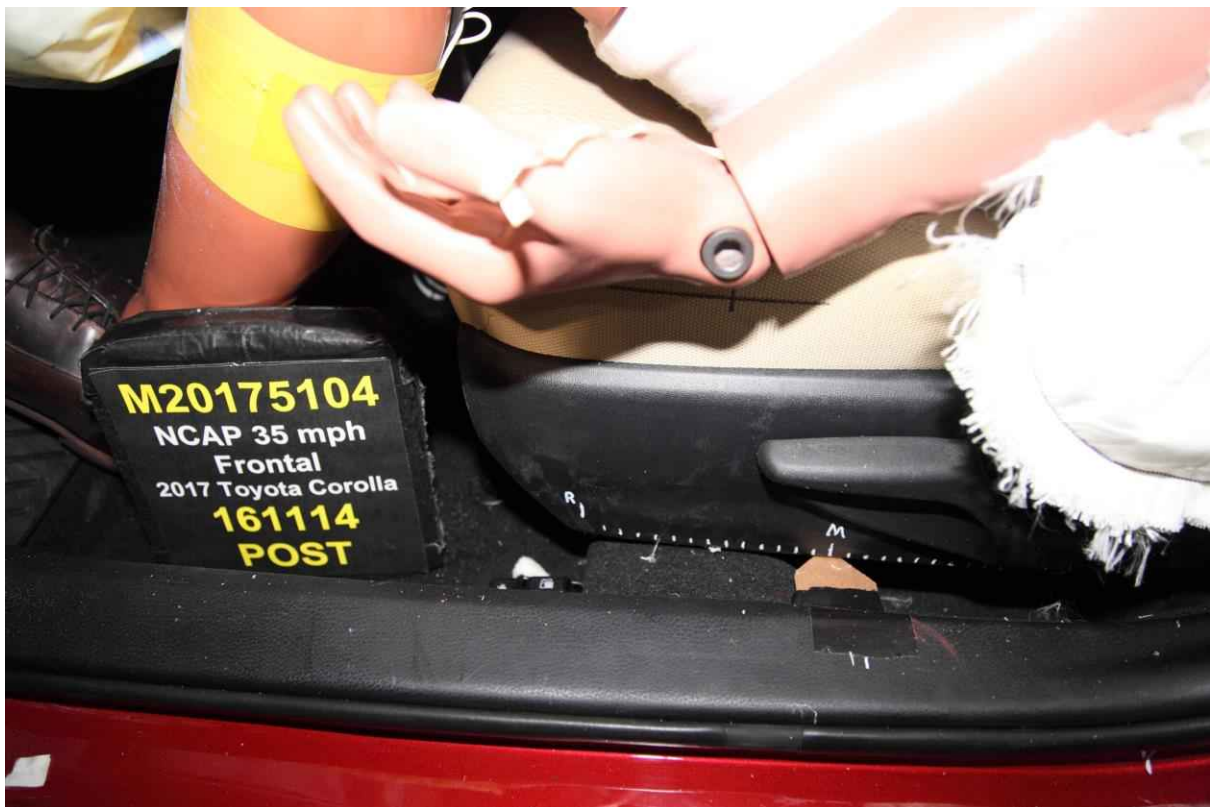
034 Pre-Test Driver Dummy and Vehicle Interior View



035 Post-Test Driver Dummy and Vehicle Interior View



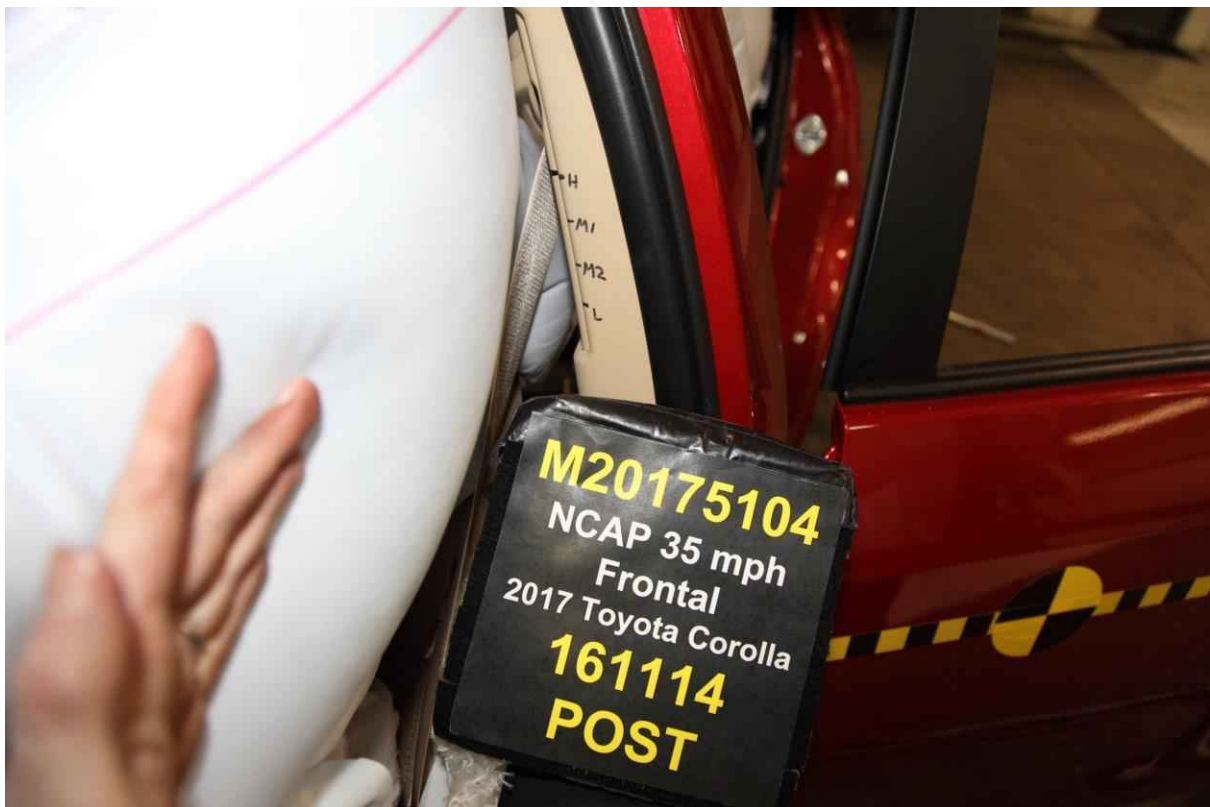
036 Pre-Test Driver's Seat Fore-Aft Markings



037 Post-Test Driver's Seat Fore-Aft Markings



038 Pre-Test View of Belt Anchorage for Driver Dummy



039 Post-Test View of Belt Anchorage for Driver Dummy



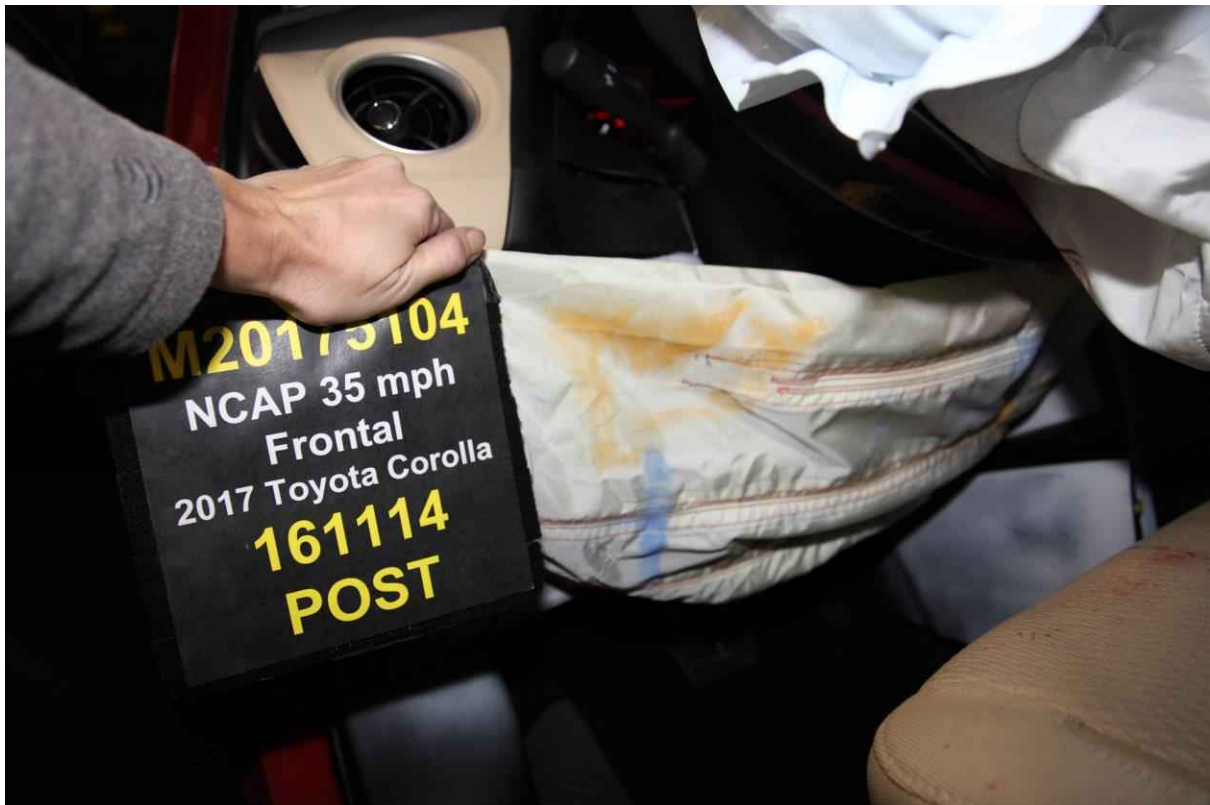
040 Pre-Test Driver Dummy Feet



041 Post-Test Driver Dummy Feet



042 Pre-Test Driver's Side Knee Bolster



043 Post-Test Driver's Side Knee Bolster



044 Pre-Test Driver's Side Floorpan



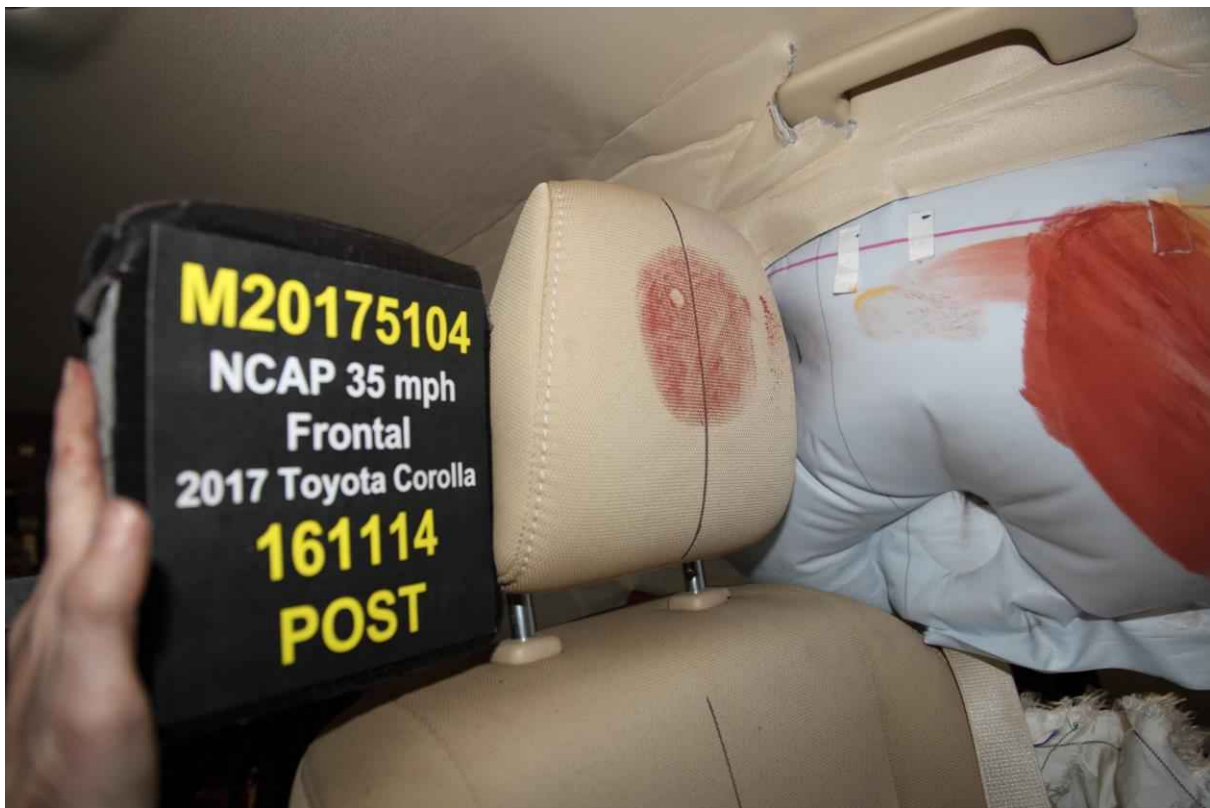
045 Post-Test Driver's Side Floorpan



046 Post-Test Driver Dummy Face



047 Post-Test Driver Dummy Contact with Airbag



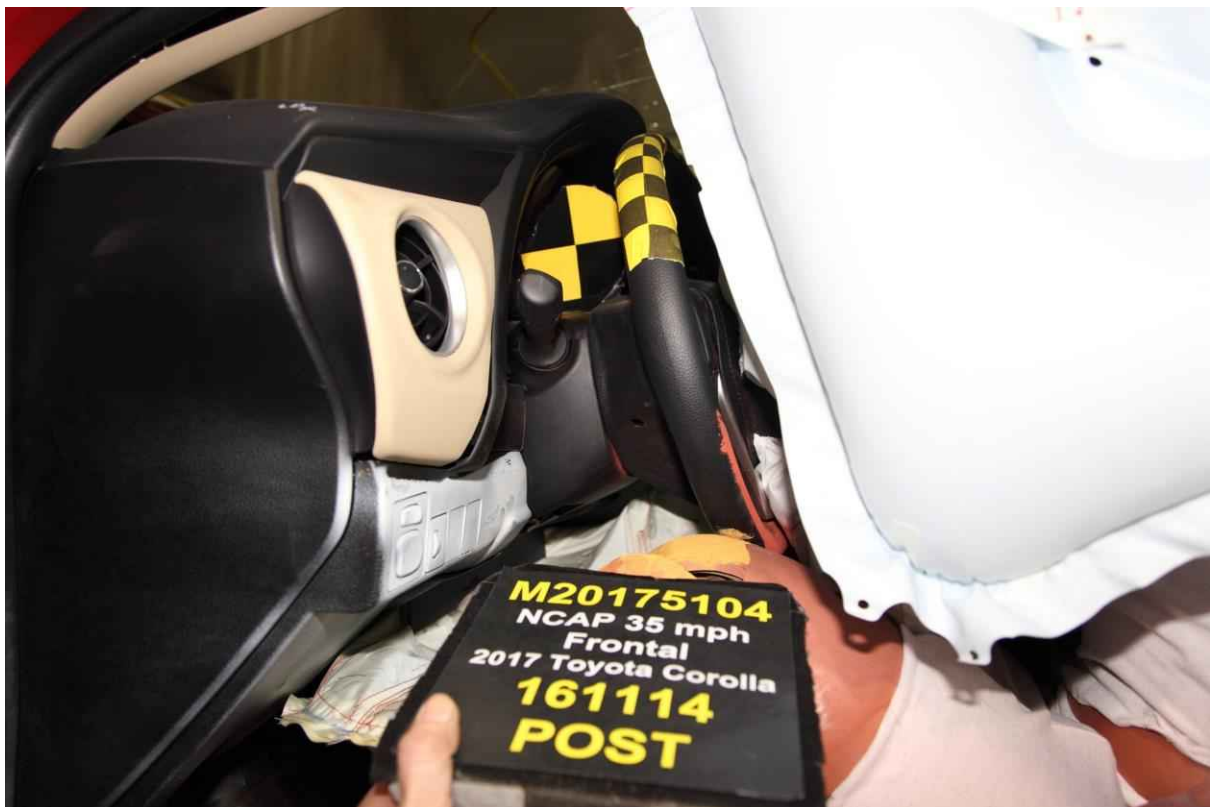
048 Post-Test Driver Dummy Contact with Headrest



048a Post-Test Driver Dummy Contact with Side Curtain Airbag



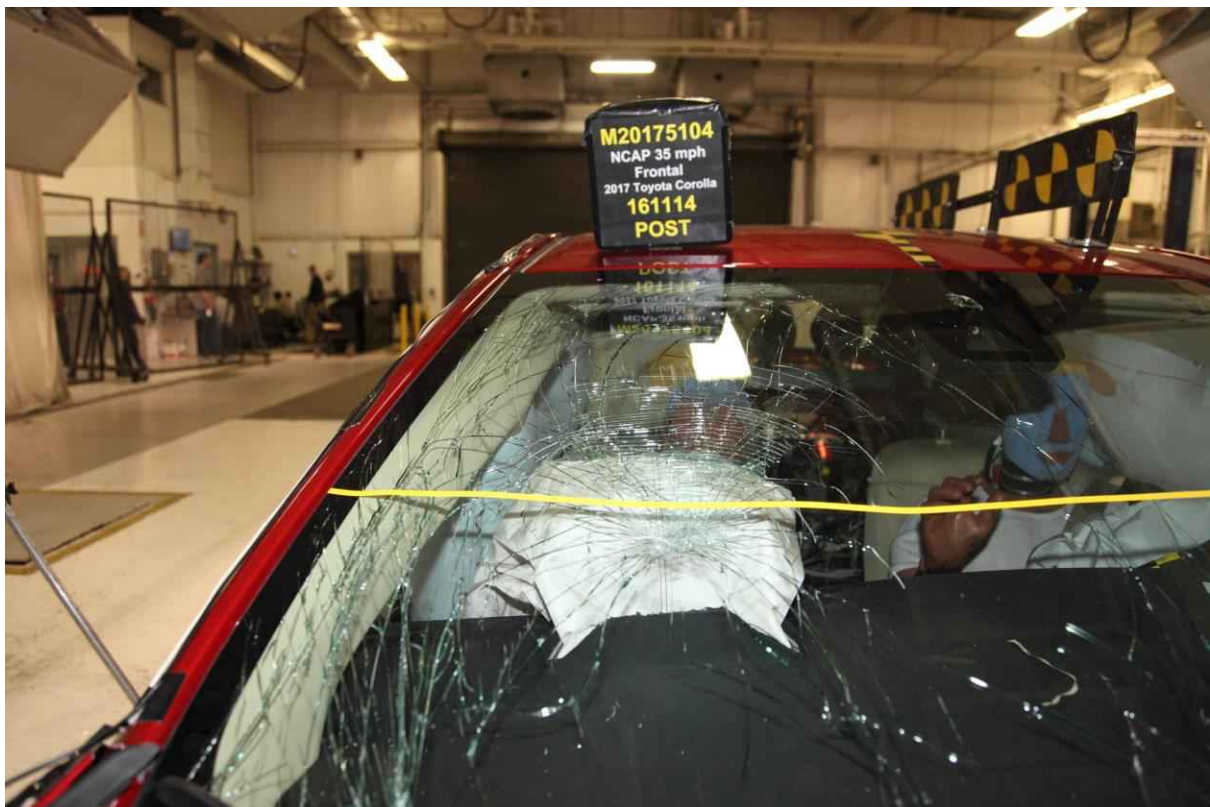
049 Pre-Test View of the Steering Wheel



050 Post-Test View of the Steering Wheel



051 Pre-Test Passenger Dummy Front View



052 Post-Test Passenger Dummy Front View



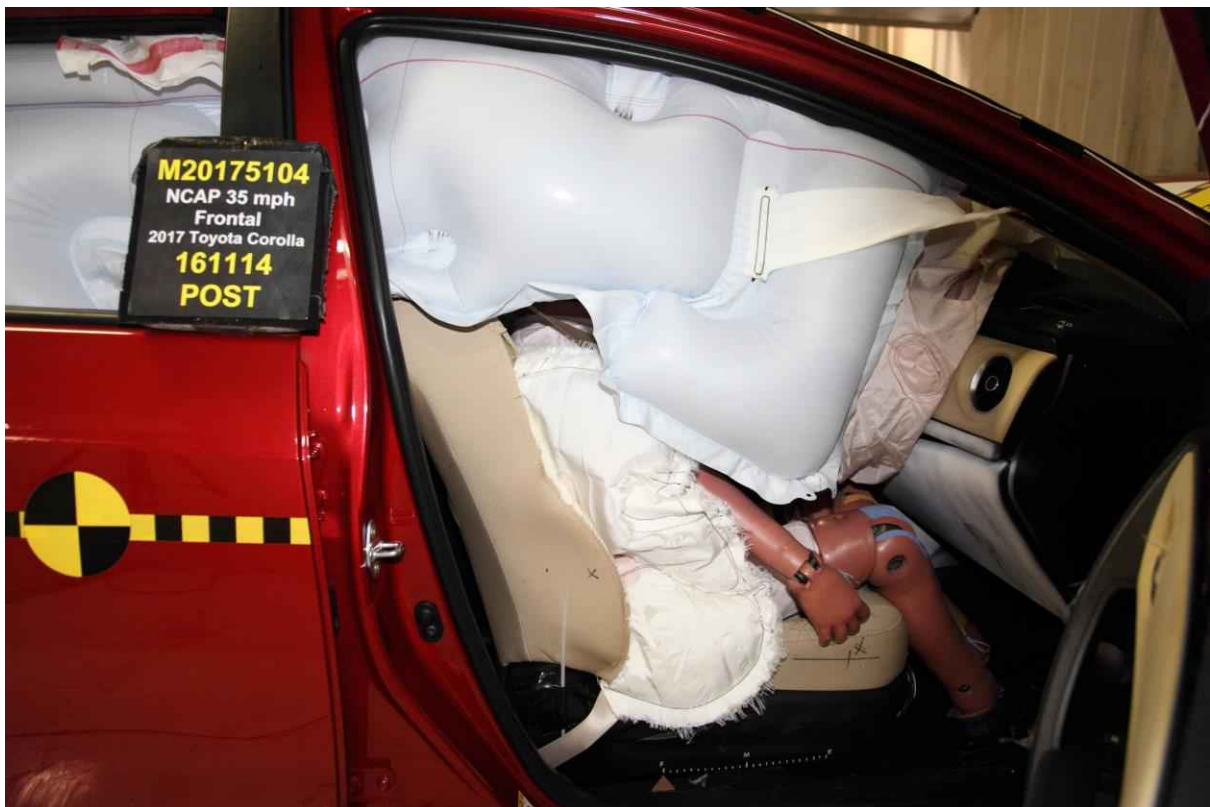
053 Pre-Test Passenger Dummy Window View



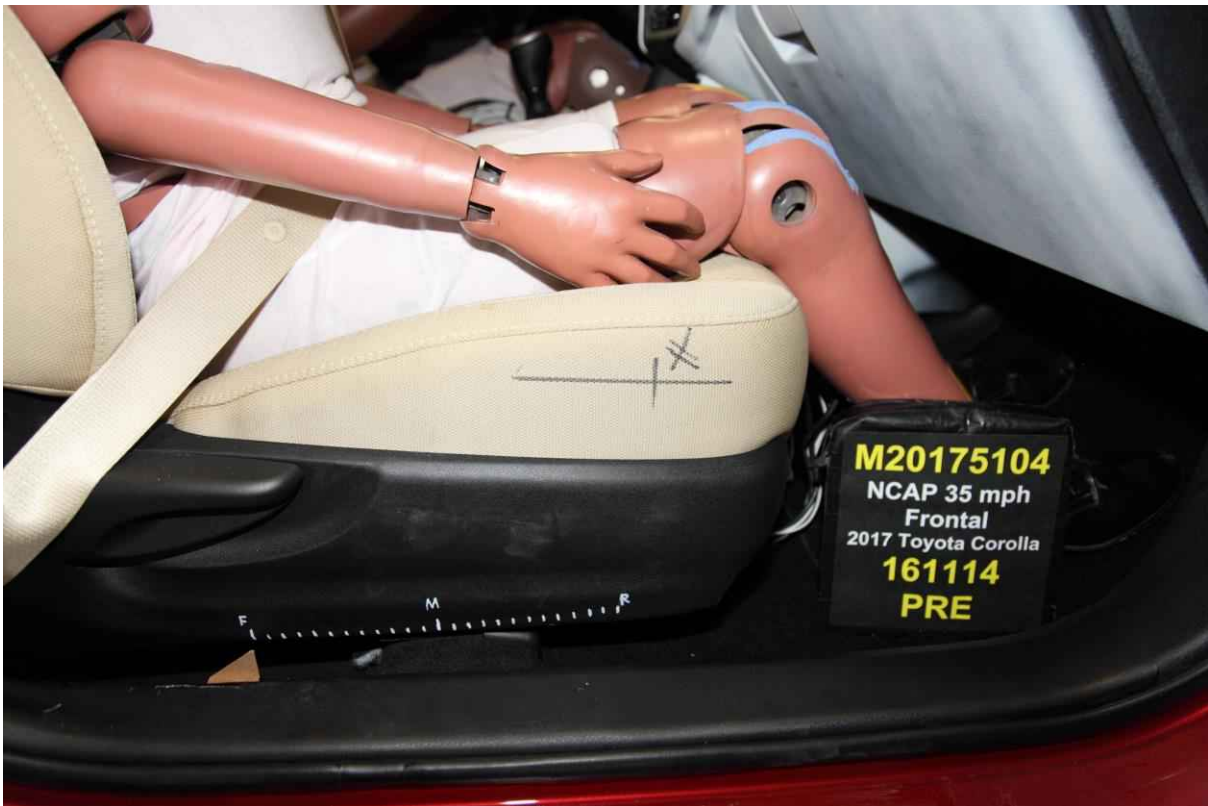
054 Post-Test Passenger Dummy Window View



055 Pre-Test Passenger Dummy and Vehicle Interior View



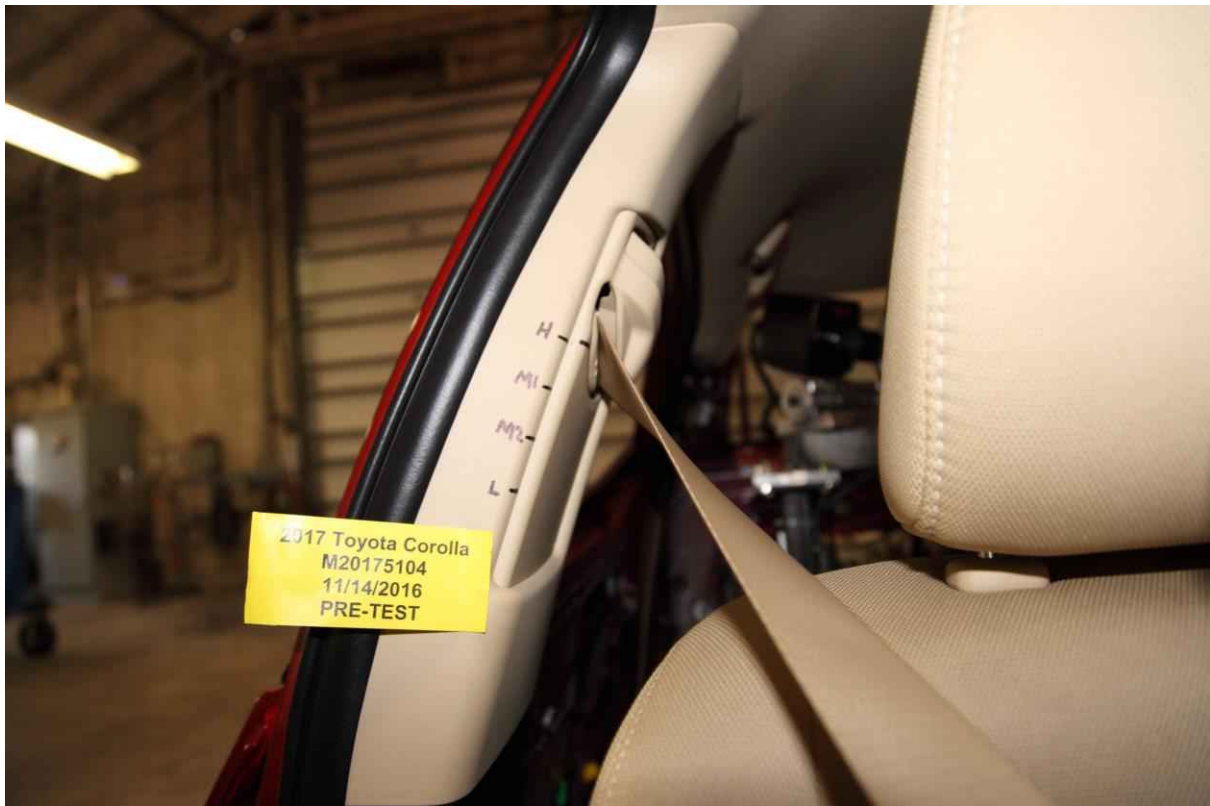
056 Post-Test Passenger Dummy and Vehicle Interior View



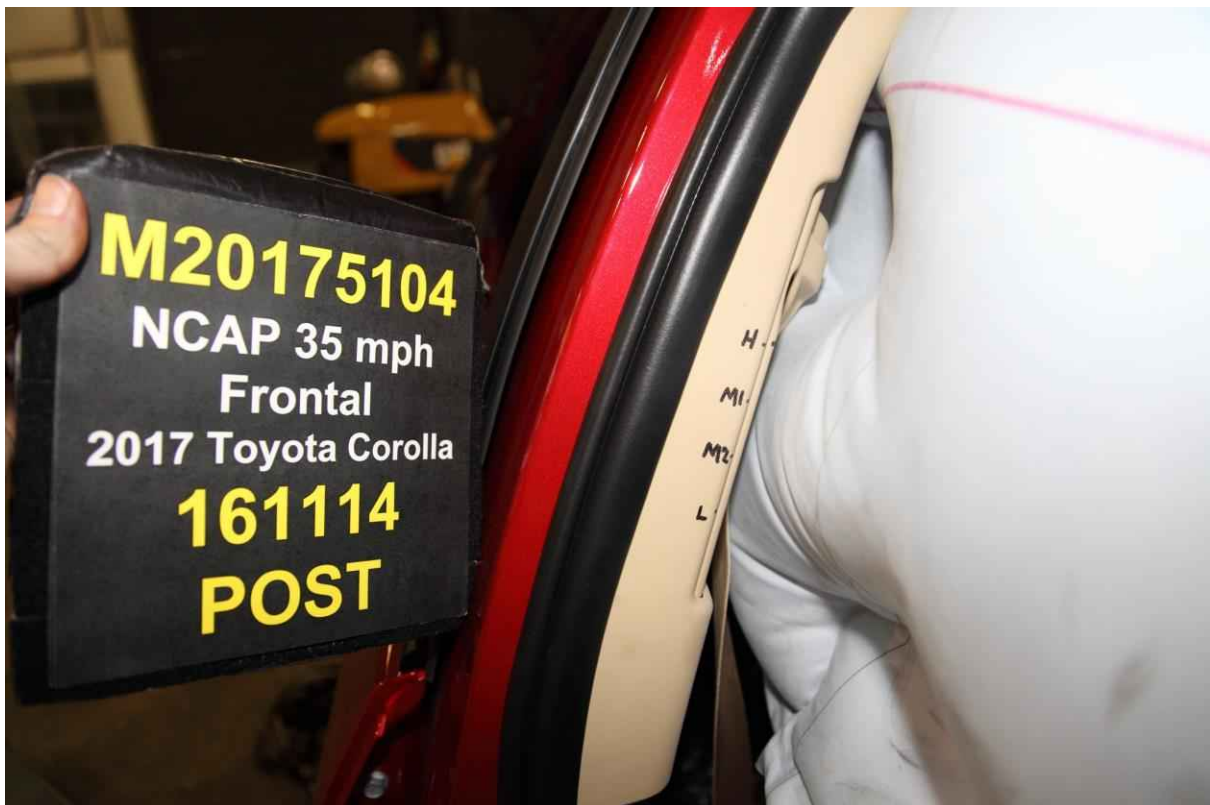
057 Pre-Test Passenger's Seat Fore-Aft Markings



058 Post-Test Passenger's Seat Fore-Aft Markings



059 Pre-Test View of Belt Anchorage for Passenger Dummy



060 Post-Test View of Belt Anchorage for Passenger Dummy



061 Pre-Test Passenger Dummy Feet



062 Post-Test Passenger Dummy Feet



063 Pre-Test Passenger's Side Knee Bolster



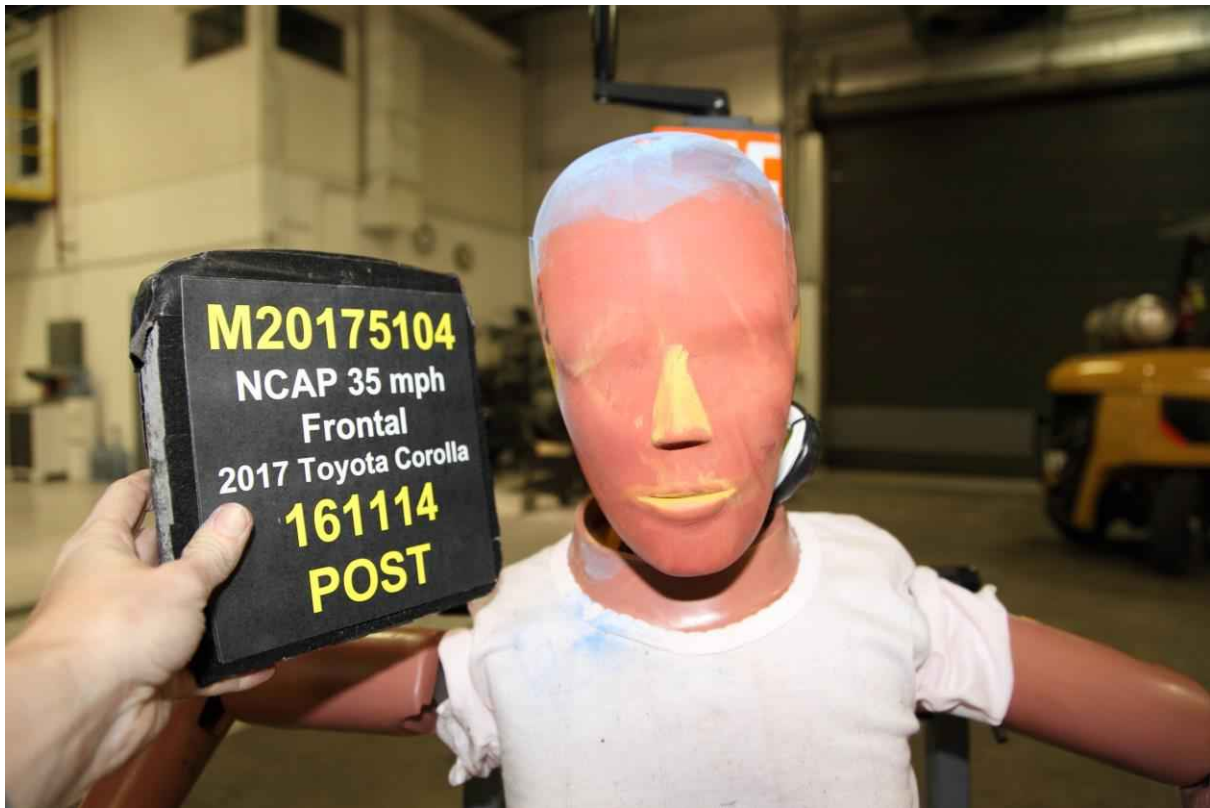
064 Post-Test Passenger's Side Knee Bolster



065 Pre-Test Passenger's Side Floorpan



066 Post-Test Passenger's Side Floorpan



067 Post-Test Passenger Dummy Face



068 Post-Test Passenger Dummy Contact with Airbag



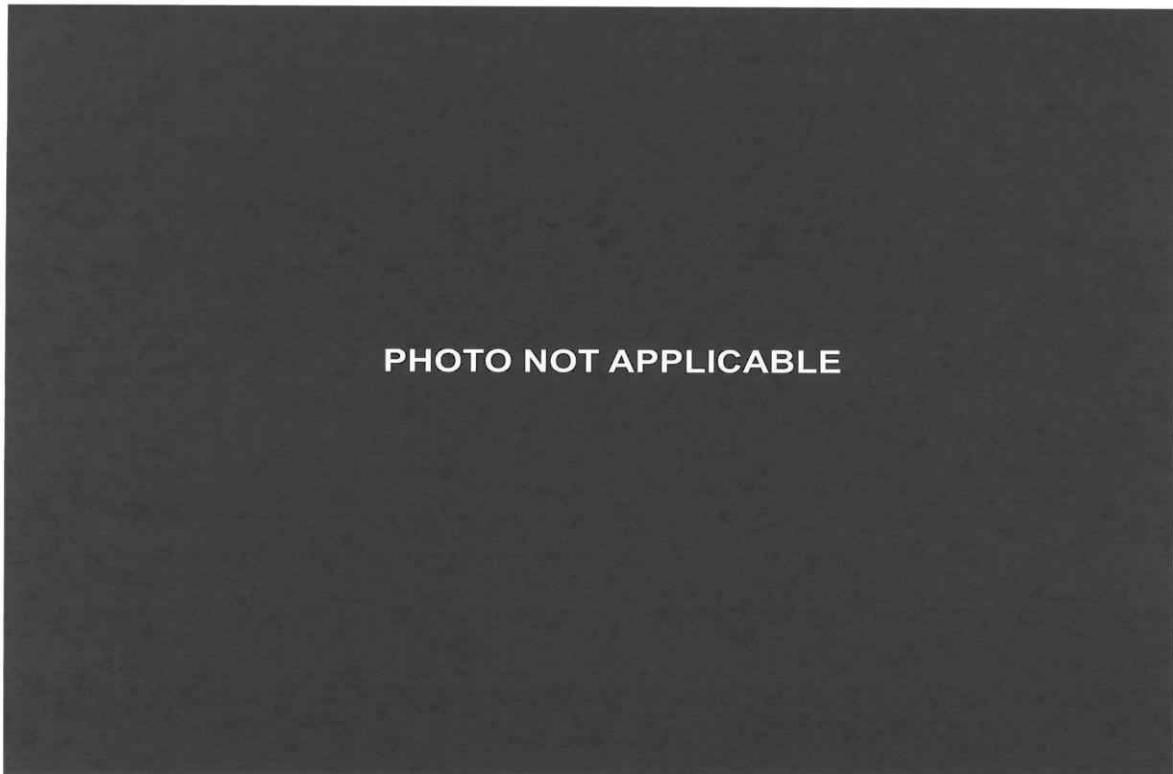
069 Post Test Passenger Dummy Contact with Headrest



069a Post Test Passenger Dummy Contact with Side Curtain Airbag



070 Photograph of Ballast Installed in Vehicle View



071 Post-Test Stoddard Solvent Spillage Location View



072 Post-Test Speed Trap Readout



073 Vehicle at 0° on Static Rollover Device



074 Vehicle at 90° on Static Rollover Device



075 Vehicle at 180° on Static Rollover Device



076 Vehicle at 270° on Static Rollover Device



077 Vehicle at 360° on Static Rollover Device



078 2017 Toyota Corolla 4DR Sedan Frontal Impact Event

TOYOTA
Let's Go Places

DESC: **COROLLA** LE
VIN: **2T1BURHE9HC747230**
YR/MDL: 2017/1852A
CLR: BARCELONA RED MET./IVORY (03R3/01)
FINAL ASSEMBLY POINT: CAMBRIDGE, ONTARIO, CANADA

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score Not Rated
Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

Frontal Crash	Driver Passenger	Not Rated
Based on the risk of injury in a frontal impact.		

Side Crash Not Rated
Based on the risk of injury in a side impact.

Front seat	Rear seat	Not Rated

Rollover ★★★★★
Based on the risk of rollover in a single-vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

STANDARD EQUIPMENT

MECHANICAL & PERFORMANCE

- 1.8L 4-cyl DOHC 16-Valve Dual VVT-i
- Continuously Variable Transmission
- 16-in Wide Vent Steel Wheels
- And P205/55R16 Tires

SAFETY & CONVENIENCE

- Toyota Safety Sense-P: Pre-Collision Sys w/ Pedestrian Detection, Dynamic Radar Cruise Control, Lane Departure Alert w/ Steering Assist, Automatic High Beams
- Star Safety System includes: VSC, TRAC, Anti-lock Brake System, EBD, Stable Assist & Smart Stop Technology
- Airbags: Dr & Ft Pass Adv Airbag Sirt, Dr & Ft Pass Seat-Mounted Side Airbags, Dr Knee Airbag, Pass Seat Cushion Airbag, Front & Rear Side Curtain Airbags
- LATCH (Lar Anchors&Tethers for Children) for Outboard Rear Seating Positions Only
- Whiplash-Injury Lessening Front Seats

EXTERIOR

- Bi-LED Headlights
- LED Daytime Running Lights in Headlight
- Color-Keyed Heated Power Outside Mirrors

INTERIOR

- Premium Fabric-Trimmed 6-Way Adj Dr Seat
- 4-Way Adj Ft Pass Seat w/Seatback Pocket
- Entune Audio w/1-in Touch-screen Inci
- Entune Multimedia Bundle (AUX/USB/3.5mm) Adv Voice Recognition, Siri Eyes Free
- 3.5-in Monochrome TFT Multi-info Display
- Integrated Backup Camera w/Projected Pin
- Steering Wheel w/ Audio & Bluetooth
- Hands-Free Phone Voice Command Controls
- Auto Climate Control w/ Pollen Filter
- Push Button Controls
- Remote Keyless Entry System
- Power Door Locks and Windows
- **Full Tank of Gas**

MANUFACTURER'S SUGGESTED RETAIL PRICE \$18,935.00

OPTIONAL EQUIPMENT	PRICE
FE 50 State Emissions	
ZT All Weather Floor Liners/Cargo Tray	\$49.00
MF Mudguards	\$29.00

EPA DOT Fuel Economy and Environment

Fuel Economy

32 MPG combined city/hwy
28 city 36 highway
3.1 gallons per 100 miles

You save \$1,250 in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost \$1,150

Fuel Economy & Greenhouse Gas Rating (subject only)

Smog Rating (subject only)

DELIVERY PROCESSING AND HANDLING FEE \$65.00

TOTAL \$20,175.00

The New Vehicle Limited Warranty provides 3-year/50,000-mile basic coverage, 5-year/100,000-mile powertrain coverage, plus 24-hour roadside assistance coverage. See Warranty and Maintenance Guide for details. An extended service contract may be available for the vehicle.

Manufacturer's suggested retail price includes manufacturer's recommended pre-delivery service. Dealer, taxes and title fees, registration fees, and other taxes and dealer and franchise fees are extra.

ToyotaCare, which covers normal factory scheduled maintenance for two years or 25,000 miles, whichever occurs first, is included as part of the sales price of the vehicle for qualifying buyers. See associated dealer for details and restrictions.

Delivered by Truck to: 31175 WEST HERShey/Williamsville 8129 MAIN STREET WILLIAMSVILLE NY14221

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

079 Monroney Label Photograph

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

No.	List of Data Plots Provided in the Test Report	Page
1	Driver Head X Acceleration vs. Time Primary	B-5
2	Driver Head Y Acceleration vs. Time Primary	B-5
3	Driver Head Z Acceleration vs. Time Primary	B-5
4	Driver Head Resultant Acceleration vs. Time Primary	B-5
5	Driver Chest X Deflection vs. Time	B-6
6	Driver Chest X Acceleration vs. Time Primary	B-7
7	Driver Chest Y Acceleration vs. Time Primary	B-7
8	Driver Chest Z Acceleration vs. Time Primary	B-7
9	Driver Chest Resultant Acceleration vs. Time Primary	B-7
10	Driver Upper Neck Force X vs. Time	B-8
11	Driver Upper Neck Force Z vs. Time	B-8
12	Driver Upper Neck Moment Y vs. Time	B-8
13	Driver Nij vs. Time	B-9
14	Driver Left Femur Force vs. Time	B-10
15	Driver Right Femur Force vs. Time	B-10
16	Passenger Head X Acceleration vs. Time Primary	B-11
17	Passenger Head Y Acceleration vs. Time Primary	B-11
18	Passenger Head Z Acceleration vs. Time Primary	B-11
19	Passenger Head Resultant Acceleration vs. Time Primary	B-11
20	Passenger Chest X Deflection vs. Time	B-12
21	Passenger Chest X Acceleration vs. Time Primary	B-13
22	Passenger Chest Y Acceleration vs. Time Primary	B-13
23	Passenger Chest Z Acceleration vs. Time Primary	B-13
24	Passenger Chest Resultant Acceleration vs. Time Primary	B-13
25	Passenger Upper Neck Force X vs. Time	B-14
26	Passenger Upper Neck Force Z vs. Time	B-14
27	Passenger Upper Neck Moment Y vs. Time	B-14
28	Passenger Nij vs. Time	B-15
29	Passenger Left Femur Force vs. Time	B-16
30	Passenger Right Femur Force vs. Time	B-16

The following additional dummy and vehicle response data can be found in the R & D section of the NHTSA website at: www.nhtsa.dot.gov.

Driver Head Acceleration X Redundant
Driver Head Acceleration Y Redundant
Driver Head Acceleration Z Redundant
Driver Upper Neck Force Y
Driver Upper Neck Moment X
Driver Upper Neck Moment Z
Driver Chest X Acceleration Redundant
Driver Chest Y Acceleration Redundant
Driver Chest Z Acceleration Redundant
Driver Pelvis X Acceleration
Driver Pelvis Y Acceleration
Driver Pelvis Z Acceleration
Driver Left Femur Force Redundant
Driver Right Femur Force Redundant
Driver Left Upper Tibia Moment X
Driver Left Upper Tibia Moment Y
Driver Left Upper Tibia Force Z
Driver Left Lower Tibia Moment X
Driver Left Lower Tibia Moment Y
Driver Left Lower Tibia Force Z
Driver Right Upper Tibia Moment X
Driver Right Upper Tibia Moment Y
Driver Right Upper Tibia Force Z
Driver Right Lower Tibia Moment X
Driver Right Lower Tibia Moment Y
Driver Right Lower Tibia Force Z
Driver Left Foot Fore Z
Driver Left Foot Aft X
Driver Left Foot Aft Z
Driver Right Foot Fore Z
Driver Right Foot Aft X
Driver Right Foot Aft Z
Driver Shoulder Belt Force
Driver Lap Belt Force
Passenger Head Acceleration X Redundant
Passenger Head Acceleration Y Redundant
Passenger Head Acceleration Z Redundant
Passenger Upper Neck Force Y

Passenger Upper Neck Moment X
Passenger Upper Neck Moment Z
Passenger Chest X Acceleration Redundant
Passenger Chest Y Acceleration Redundant
Passenger Chest Z Acceleration Redundant
Passenger Pelvis X
Passenger Pelvis Y
Passenger Pelvis Z
Passenger Left Femur Force Redundant
Passenger Right Femur Force Redundant
Passenger Left Upper Tibia Moment X
Passenger Left Upper Tibia Moment Y
Passenger Left Upper Tibia Force Z
Passenger Left Lower Tibia Moment X
Passenger Left Lower Tibia Moment Y
Passenger Left Lower Tibia Force Z
Passenger Right Upper Tibia Moment X
Passenger Right Upper Tibia Moment Y
Passenger Right Upper Tibia Force Z
Passenger Right Lower Tibia Moment X
Passenger Right Lower Tibia Moment Y
Passenger Right Lower Tibia Force Z
Passenger Left Foot Fore Z
Passenger Left Foot Aft X
Passenger Left Foot Aft Z
Passenger Right Foot Fore Z
Passenger Right Foot Aft X
Passenger Right Foot Aft Z
Passenger Shoulder Belt Force
Passenger Lap Belt Force
Left Rear Seat Crossmember X
Left Rear Seat Crossmember Z
Right Rear Seat Crossmember X
Right Rear Seat Crossmember Z
Left Rear Seat Crossmember X Redundant
Right Rear Seat Crossmember X Redundant
Vehicle Engine Top X
Vehicle Engine Bottom X
Load Cell Barrier Forces and Moments

NHTSA

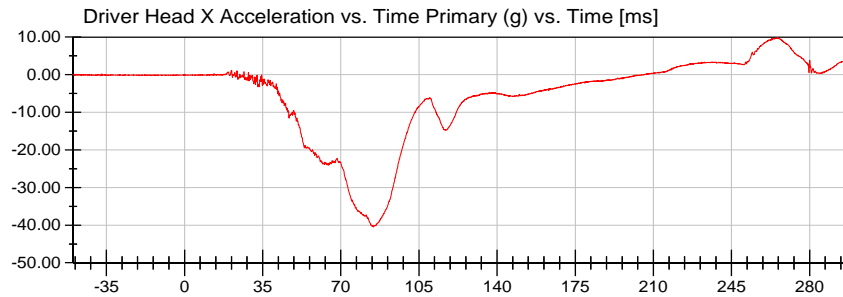
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



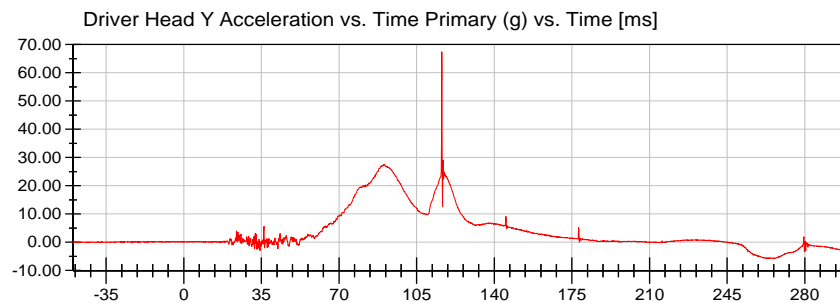
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CFC_1000



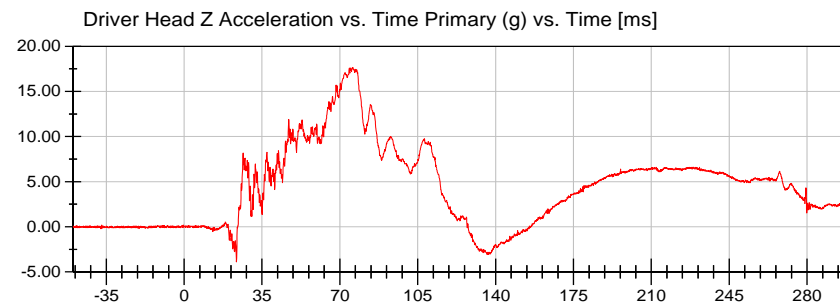
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67.45 g at 116.32 ms

<Min>

-5.89 g at 266.00 ms

CFC_1000



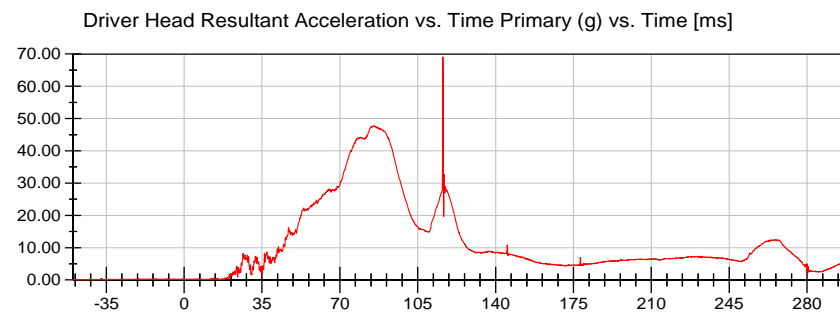
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17.65 g at 75.84 ms

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-3.89 g at 23.52 ms

CFC_1000



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69.12 g at 116.32 ms

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0.03 g at -48.48 ms

CFC_1000



NHTSA

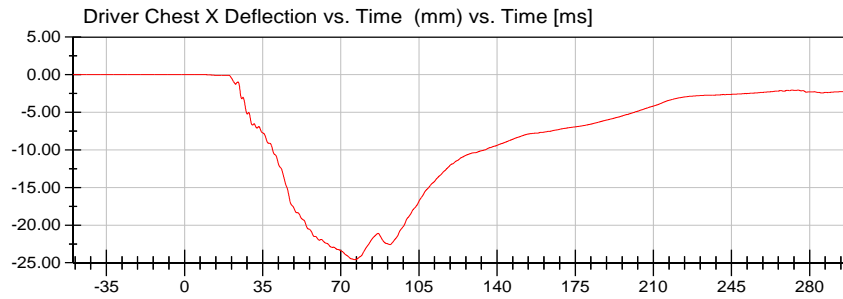
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Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



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0.01 mm at -20.00 ms

<Min>

-24.57 mm at 76.16 ms

CFC_600



NHTSA

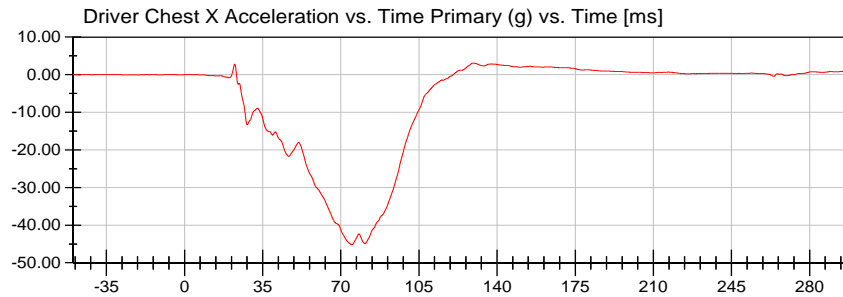
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Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



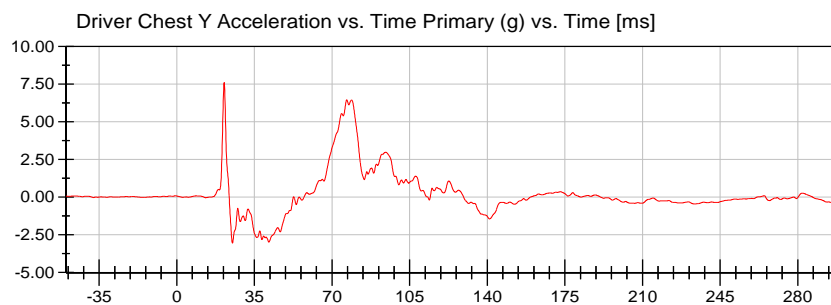
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3.08 g at 129.12 ms

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-45.25 g at 74.88 ms

CFC_180



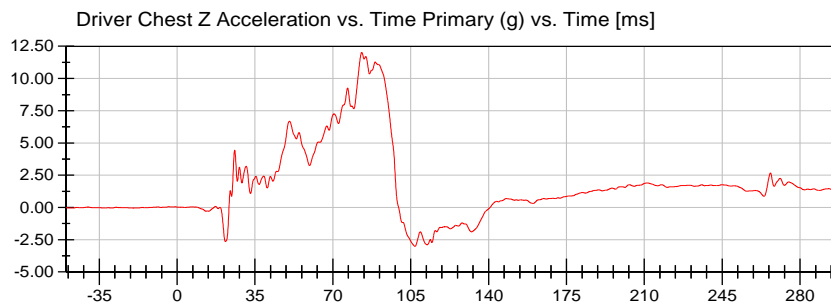
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7.60 g at 21.36 ms

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-3.05 g at 25.12 ms

CFC_180



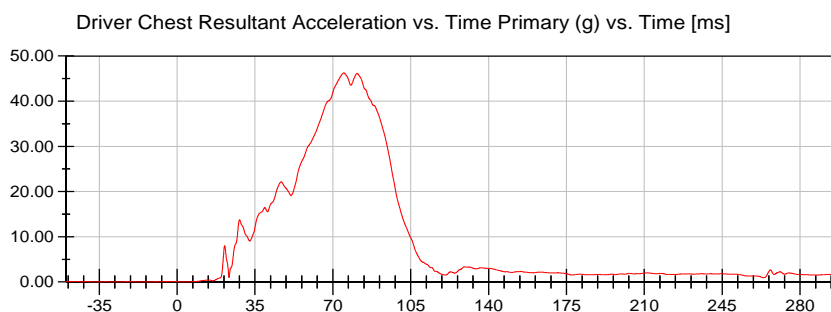
<Max>

12.02 g at 82.96 ms

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-3.02 g at 106.88 ms

CFC_180



<Max>

46.27 g at 74.88 ms

<Min>

0.01 g at -15.52 ms

CFC_180



NHTSA

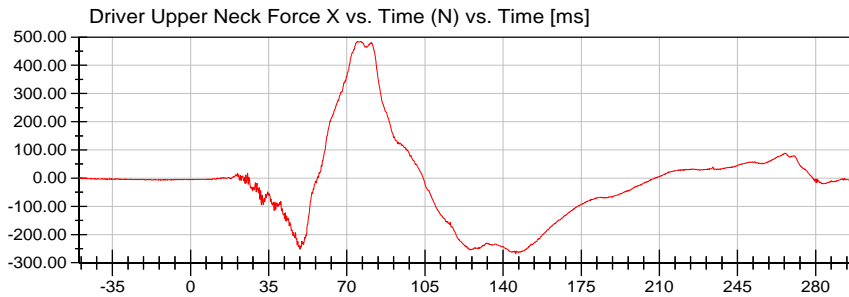
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



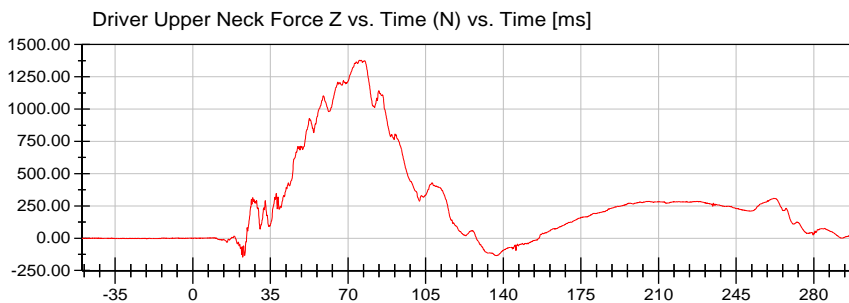
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484.24 N at 76.08 ms

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CFC_1000



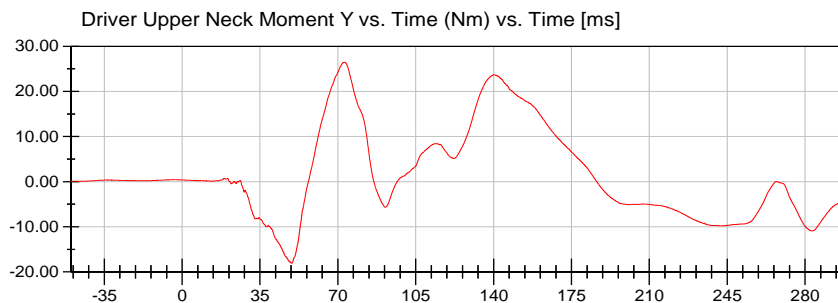
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1,379.28 N at 75.12 ms

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-145.73 N at 22.56 ms

CFC_1000



<Max>

26.43 Nm at 72.72 ms

<Min>

-18.08 Nm at 49.20 ms

CFC_600





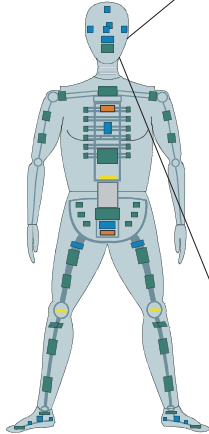
2017 Toyota Corolla NCAP 35 mph Frontal Impact Neck Injury Predictor (NIJ)

Date: 11/14/2016
Time: 15:54

Customer: NHTSA

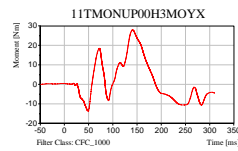
Test Number: M20175104

Test Orientation = Frontal
Fzc(Tension) = 6806
Fzc(Compression) = 6160
Myc(Extension) = 135
Myc(Flexion) = 310

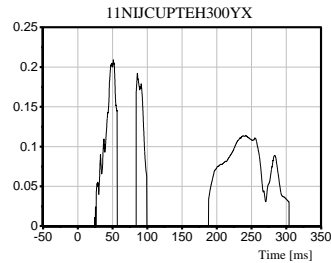


Dummy: HIII 50th Male
Seating Position:
Driver

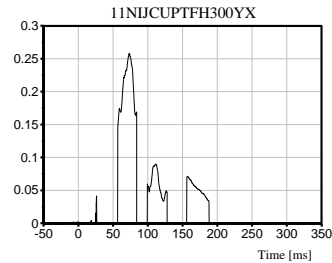
NIJ Source Code: (Fz/Fzc)+(Myc/Myc)



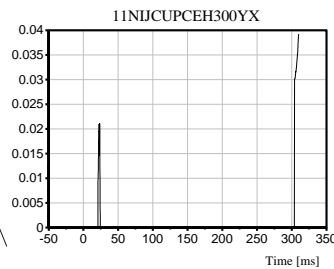
TRC Inc. Test Lab: CTF
Test Number: 161114



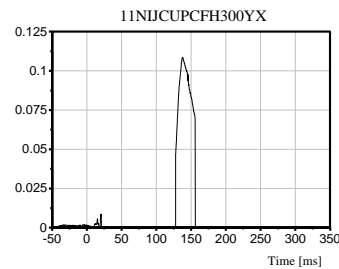
Max [NTE] 0.2090 at 51.20 ms



Max [NTF] 0.2583 at 73.60 ms



Max [NCE] 0.0393 at 310.00 ms



Max [NCF] 0.1086 at 137.92 ms

NHTSA

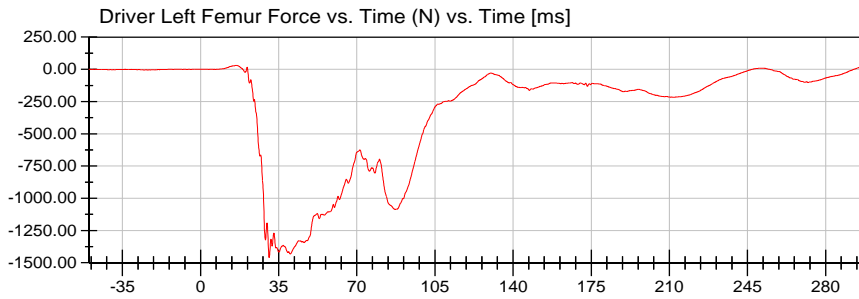
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Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



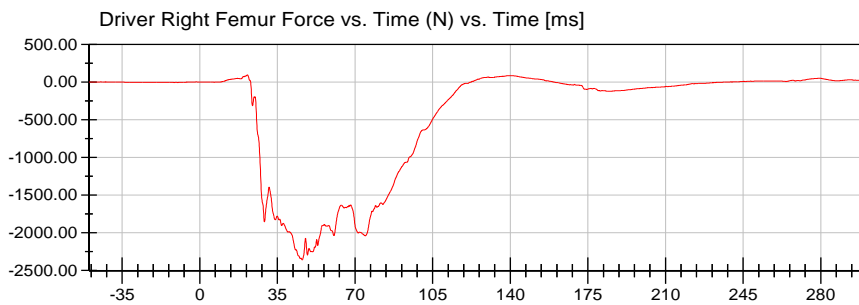
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34.44 N at 300.00 ms

<Min>

-1,459.27 N at 30.72 ms

CFC_600



<Max>

97.97 N at 21.44 ms

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-2,358.16 N at 46.16 ms

CFC_600



NHTSA

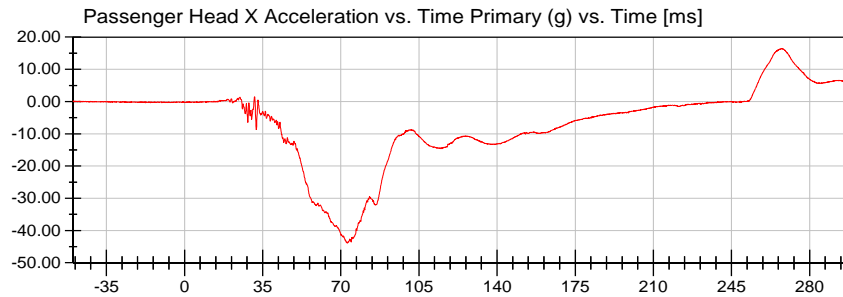
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Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



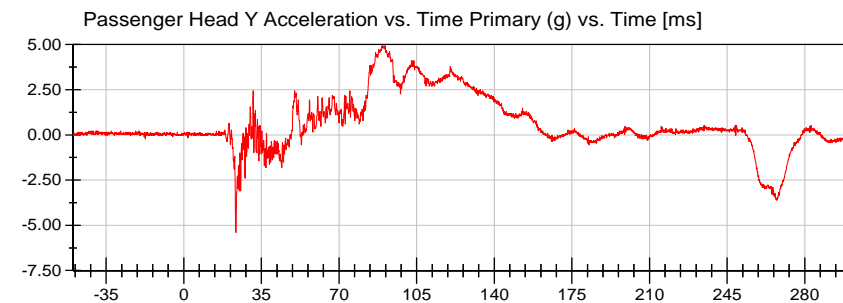
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-43.90 g at 72.88 ms

CFC_1000



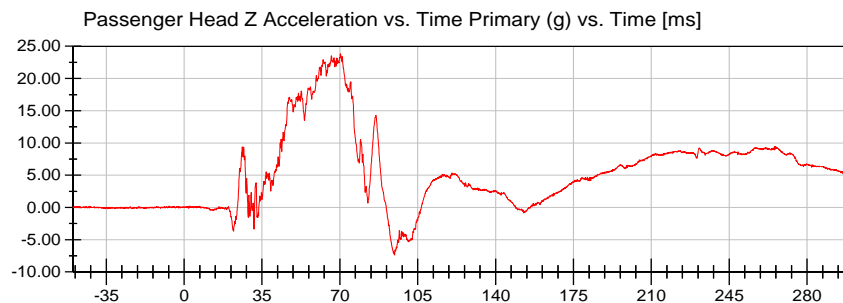
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4.94 g at 89.44 ms

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-5.40 g at 23.44 ms

CFC_1000



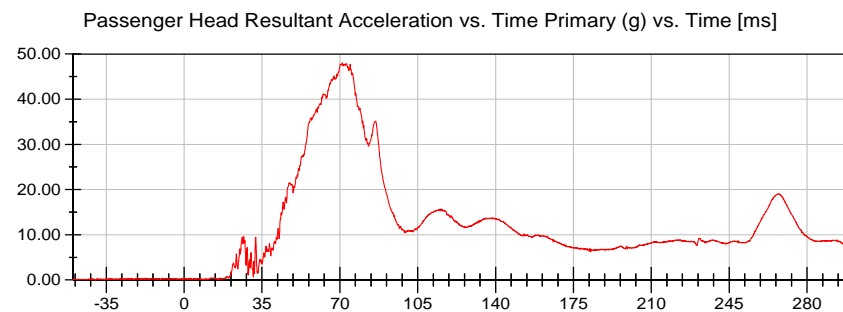
<Max>

23.84 g at 70.24 ms

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-7.37 g at 94.56 ms

CFC_1000



<Max>

48.07 g at 71.12 ms

<Min>

0.03 g at -48.48 ms

CFC_1000



NHTSA

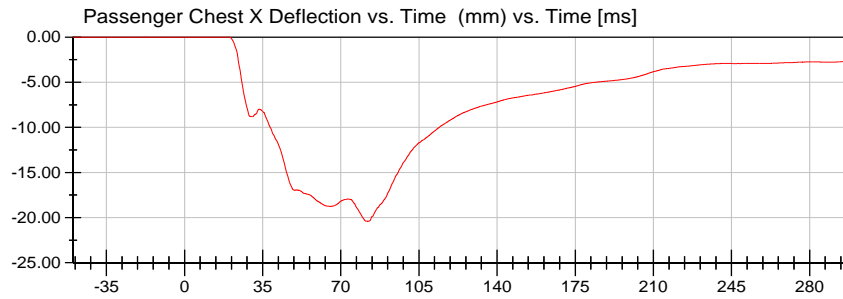
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



<Max>

0.00 mm at -17.92 ms

<Min>

-20.41 mm at 82.00 ms

CFC_600



NHTSA

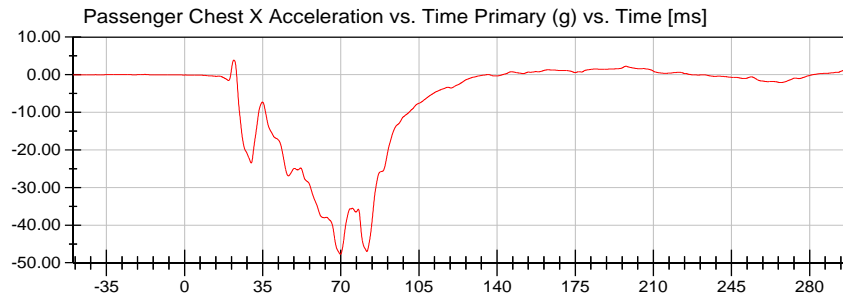
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)

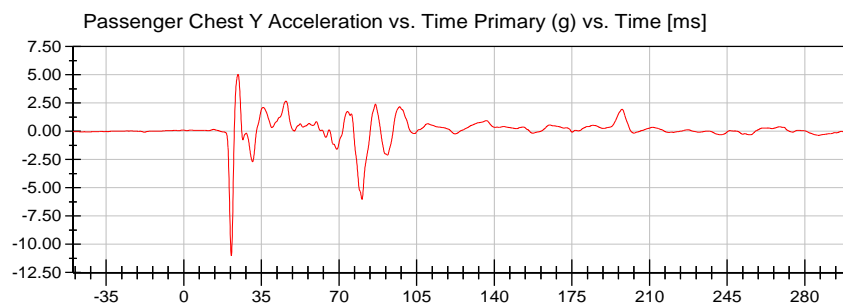


<Max>

3.86 g at 22.08 ms

<Min>

-47.75 g at 69.84 ms

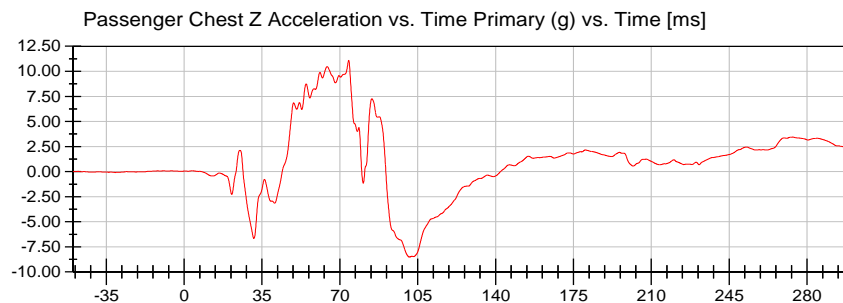


<Max>

5.04 g at 24.48 ms

<Min>

-11.00 g at 21.44 ms

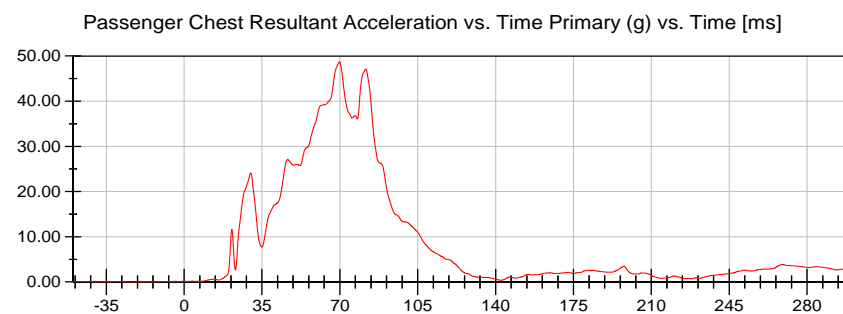


<Max>

11.08 g at 74.00 ms

<Min>

-8.51 g at 101.28 ms



<Max>

48.71 g at 69.84 ms

<Min>

0.01 g at -20.48 ms



NHTSA

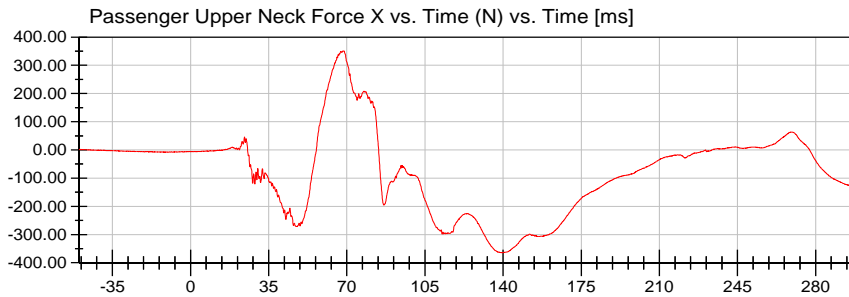
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



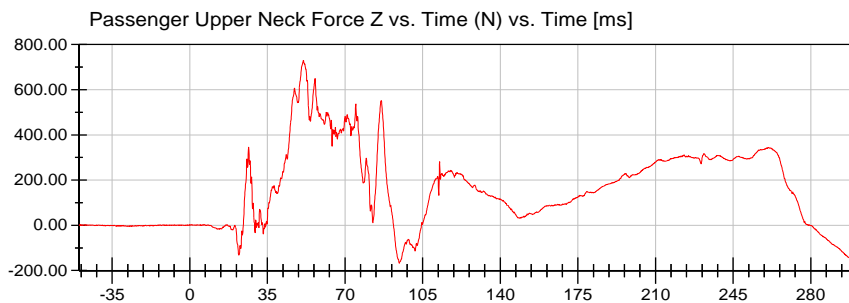
<Max>

351.28 N at 68.24 ms

<Min>

-364.98 N at 139.68 ms

CFC_1000



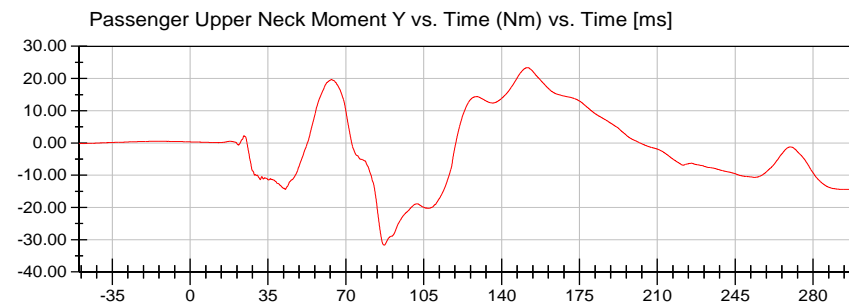
<Max>

730.08 N at 51.20 ms

<Min>

-167.84 N at 94.40 ms

CFC_1000



<Max>

23.35 Nm at 151.60 ms

<Min>

-31.71 Nm at 87.28 ms

CFC_600





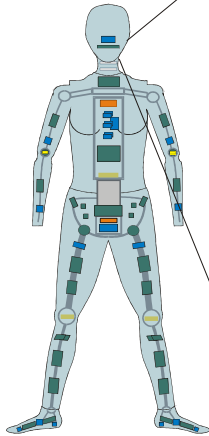
2017 Toyota Corolla NCAP 35 mph Frontal Impact Neck Injury Predictor (NIJ)

Date: 11/14/2016
Time: 15:54

Customer: NHTSA

Test Number: M20175104

Test Orientation = Frontal
Fzc(Tension) = 4287
Fzc(Compression) = 3880
Myc(Extension) = 67
Myc(Flexion) = 155

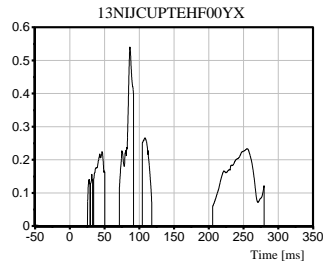


Dummy: HIII 5th Female
Seating Position:
Right Front Passenger

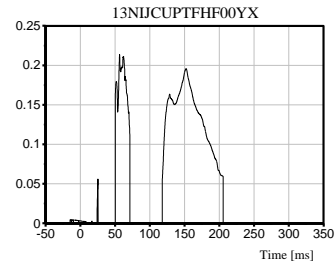
NIJ Source Code: (Fz/Fzc)+(Myc/Myc)



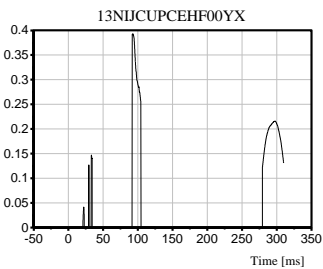
TRC Inc. Test Lab: CTF
Test Number: 161114



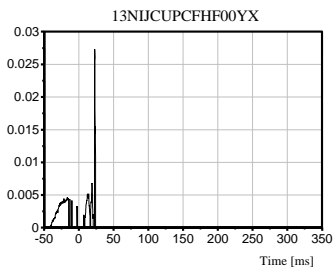
Max [NTE] 0.5399 at 86.48 ms



Max [NTF] 0.2135 at 56.48 ms



Max [NCE] 0.3934 at 92.80 ms



Max [NCF] 0.0273 at 22.96 ms

NHTSA

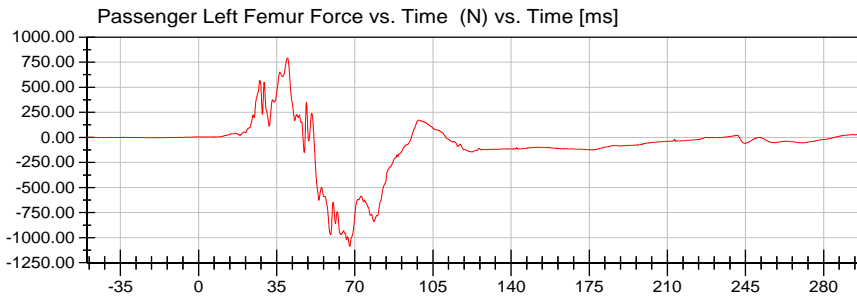
Test Lab: CTF

Test Number: 161114 (M20175104)

Test Date: 11/14/2016

Position #1 Hybrid III Mid-Sized Adult Male Dummy (037)

Position #2 Hybrid III Small Adult Female (426)



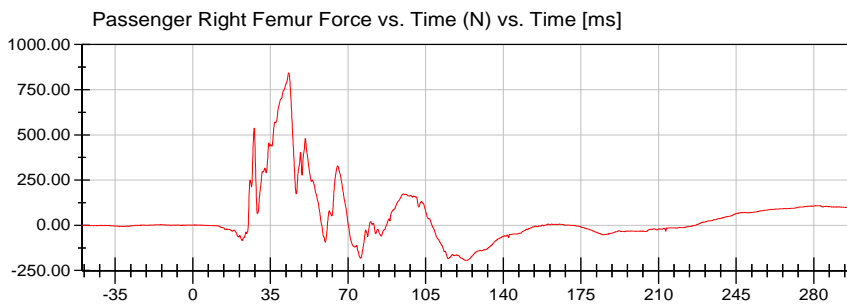
<Max>

790.45 N at 39.84 ms

<Min>

-1,086.67 N at 67.68 ms

CFC_600



<Max>

843.10 N at 43.20 ms

<Min>

-194.51 N at 123.36 ms

CFC_600



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION

Pre-Test Calibration Sheets

Driver S/N 037

Transportation Research Center Inc.
572E HIII 50th Male Dummy
External Dimensions
Serial No. 037
Calibration No. 40

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	878.8 - 889.0	880	Yes
B	Shoulder Pivot Height	505.5 - 520.7	514	Yes
C	H-Point Height	83.8 - 88.9	87	Yes
D	H-Point From Seatback	134.6 - 139.7	138	Yes
E	Shoulder Pivot From Backline	83.8 - 94.0	92	Yes
F	Thigh Clearance	139.7 - 154.9	150	Yes
G	Back Of Elbow To Wrist Pivot	289.6 - 304.8	295	Yes
H	Skull Cap To Backline	40.6 - 45.7	45	Yes
I	Shoulder-Elbow Length	330.2 - 345.4	340	Yes
J	Elbow Rest Height	190.5 - 210.8	198	Yes
K	Buttock Knee Length	579.1 - 604.5	599	Yes
L	Popliteal Height	429.3 - 454.7	440	Yes
M	Knee Pivot Height	485.1 - 500.4	495	Yes
N	Buttock Popliteal Length	452.1 - 477.5	470	Yes
O	Chest Depth	213.4 - 228.6	225	Yes
P	Foot Length	251.5 - 266.7	264	Yes
V	Shoulder Breadth	421.6 - 436.9	429	Yes
W	Foot Breadth	91.4 - 106.7	97	Yes
Y	Chest Circumference	970.3 - 1000.8	990	Yes
Z	Waist Circumference	835.7 - 866.1	865	Yes
AA	Location For Chest Circumference	429.3 - 434.3	430	Yes
BB	Location For Waist Circumference	226.1 - 231.1	230	Yes

Comments:



Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 037 Certification No. 40-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	265.0 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	5.7 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 08:14:30 614

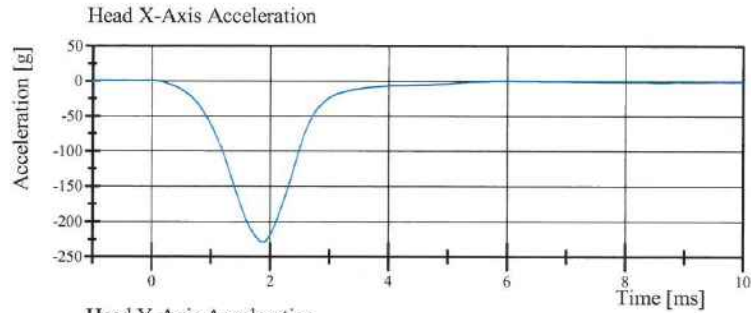


Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 037 Certification No. 40-1

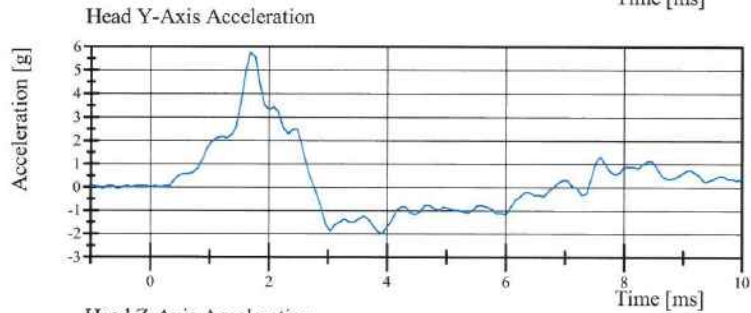
Test Date: 10/11/2016



Filter Class: CFC_1000

Max: 0.1 g at -1.0 ms

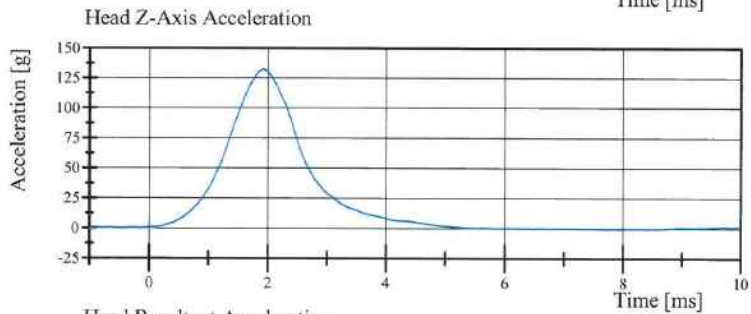
Min: -229.8 g at 1.8 ms



Filter Class: CFC_1000

Max: 5.7 g at 1.7 ms

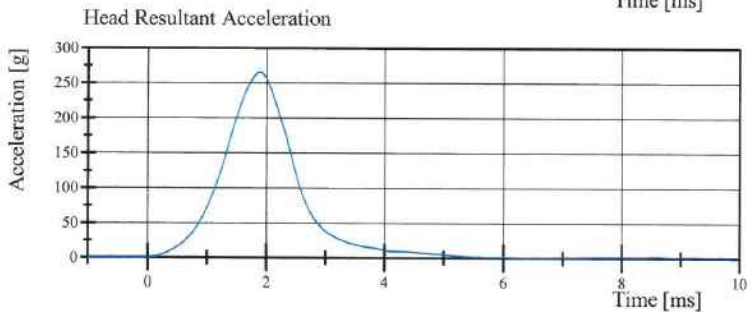
Min: -2.0 g at 3.9 ms



Filter Class: CFC_1000

Max: 132.5 g at 1.9 ms

Min: -0.8 g at 7.9 ms



Filter Class: CFC_1000

Max: 265.0 g at 1.9 ms

Min: 0.0 g at -0.4 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 08:14:39 614



Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 037 Certification No. 40-3

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	35 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	6.941 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	38.9 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-23.47 g	Yes
Pendulum Acceleration at 20ms	(-17.6) - (-22.6) g	-19.84 g	Yes
Pendulum Acceleration at 30ms	(-12.5) - (-18.5) g	-15.74 g	Yes
Pendulum Acceleration > 30ms	>= (-29.0) g	-15.74 g	Yes
Total Head D-Plane Rotation			
Peak	(-64) - (-78) °	-67.7 °	Yes
Time of Peak	57 - 64 ms	60.4 ms	Yes
Total Head D-Plane Rotation Decay to 0°	113 - 128 ms	121.0 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	88 - 108 N-m	101.6 N-m	Yes
Time of Peak	47 - 58 ms	51.6 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N-m	97 - 107 ms	101.6 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 12:43:24 3039

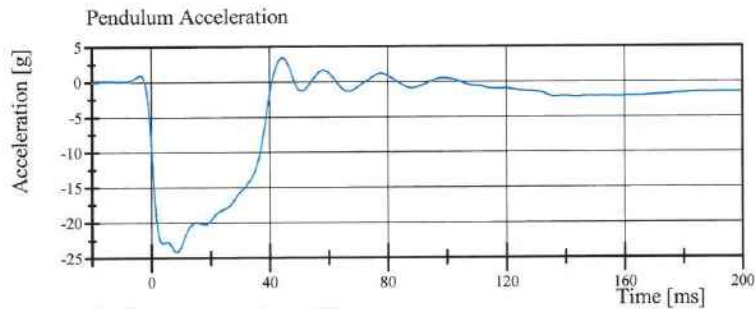


Transportation Research Center Inc.

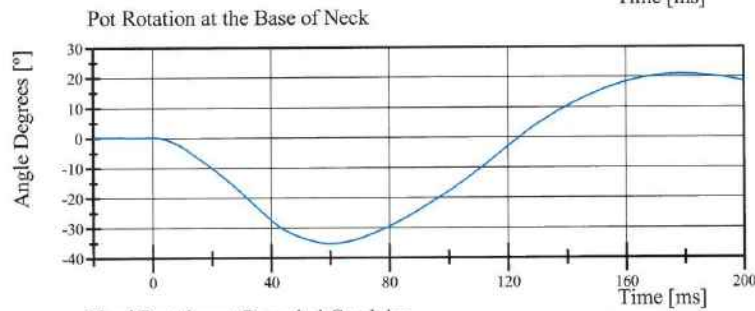
Neck Flexion

HIII 50th Serial No. 037 Certification No. 40-3

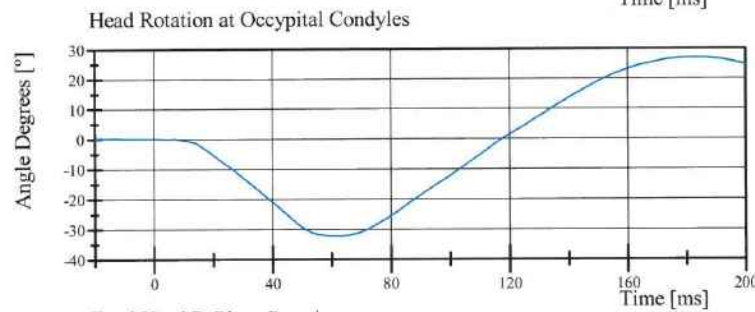
Test Date: 10/11/2016



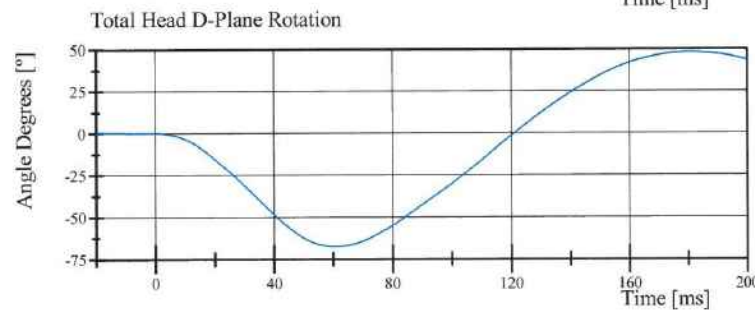
Filter Class: CFC_60
Max: 3.4 g at 44.4 ms
Min: -24.2 g at 8.6 ms



Filter Class: CFC_60
Max: 21.0 ° at 178.7 ms
Min: -35.4 ° at 59.8 ms



Filter Class: CFC_60
Max: 27.0 ° at 183.0 ms
Min: -32.4 ° at 61.4 ms



Filter Class: CFC_60
Max: 48.0 ° at 180.6 ms
Min: -67.7 ° at 60.4 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 12:43:50 3039

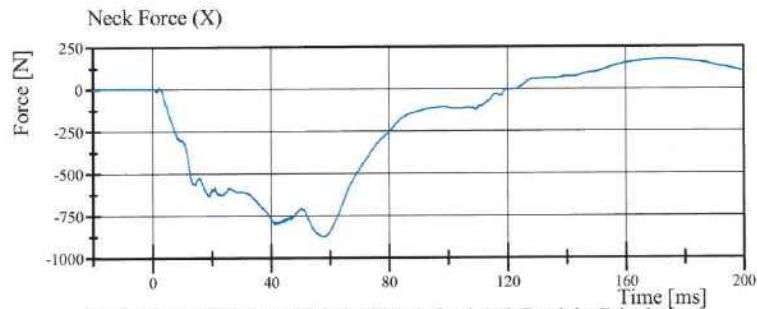


Transportation Research Center Inc.

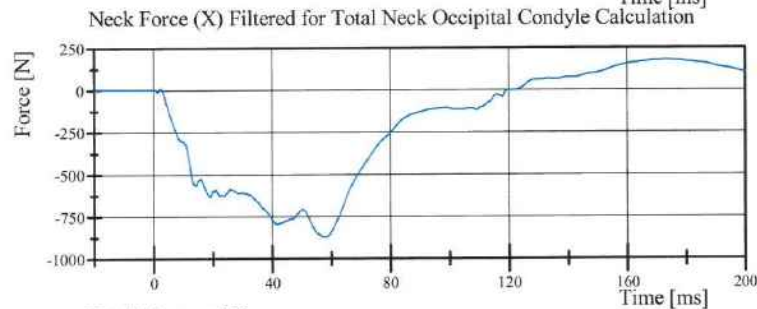
Neck Flexion

HIII 50th Serial No. 037 Certification No. 40-3

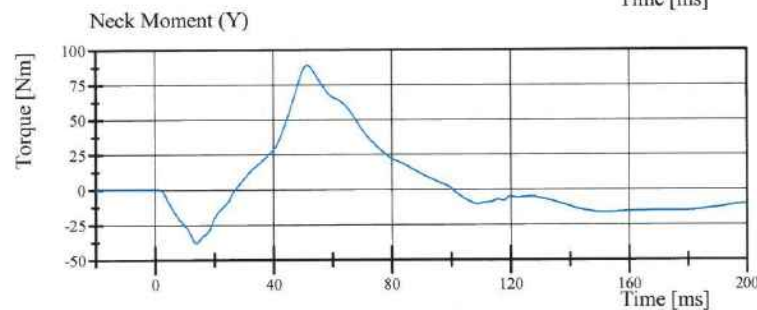
Test Date: 10/11/2016



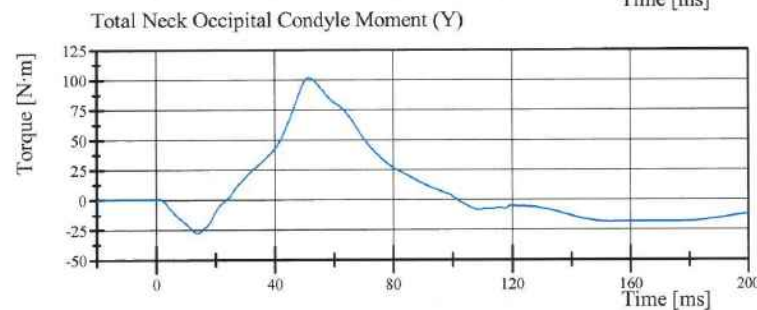
Filter Class: CFC_1000
Max: 177.5 N at 173.5 ms
Min: -874.7 N at 57.9 ms



Filter Class: CFC_600
Max: 177.2 N at 173.6 ms
Min: -874.2 N at 57.8 ms



Filter Class: CFC_600
Max: 88.8 Nm at 51.4 ms
Min: -38.2 Nm at 13.9 ms



Filter Class: Without_Constant
Max: 101.6 N·m at 51.6 ms
Min: -28.2 N·m at 13.8 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 12:43:51 3039



Transportation Research Center Inc.

Neck Extension

HHH 50th Serial No. 037 Certification No. 40-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-6.005 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	42.1 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	18.35 g	Yes
Pendulum Acceleration at 20ms	14.0 - 19.0 g	16.97 g	Yes
Pendulum Acceleration at 30ms	11.0 - 16.0 g	13.25 g	Yes
Pendulum Acceleration > 30ms	<= 22.0 g	13.25 g	Yes
Total Head D-Plane Rotation			
Peak	81 - 106 °	93.0 °	Yes
Time of Peak	72 - 82 ms	78.2 ms	Yes
Total Head D-Plane Rotation Decay to 0°	147 - 174 ms	159.8 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	(-53) - (-80) N·m	-67.6 N·m	Yes
Time of Peak	65 - 79 ms	72.0 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	120 - 148 ms	145.6 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 13:13:24 3126

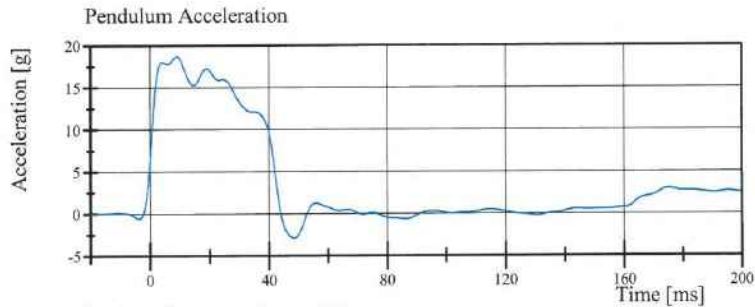


Transportation Research Center Inc.

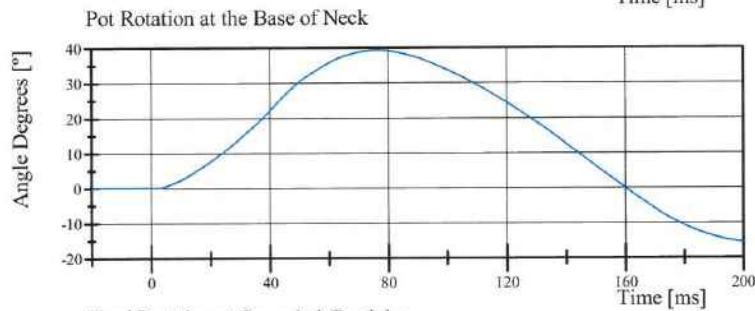
Neck Extension

HIH 50th Serial No. 037 Certification No. 40-1

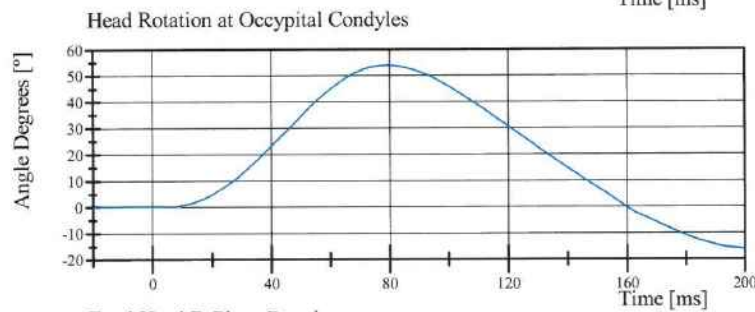
Test Date: 10/11/2016



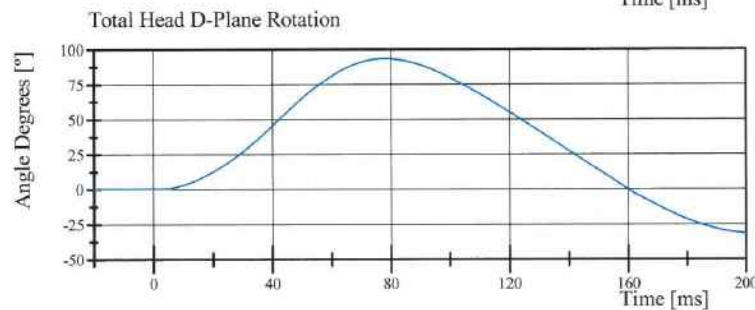
Filter Class: CFC_60
Max: 18.6 g at 9.0 ms
Min: -2.9 g at 48.4 ms



Filter Class: CFC_60
Max: 39.3 ° at 76.3 ms
Min: -15.6 ° at 200.0 ms



Filter Class: CFC_60
Max: 53.8 ° at 79.2 ms
Min: -16.0 ° at 200.0 ms



Filter Class: CFC_60
Max: 93.0 ° at 78.2 ms
Min: -31.6 ° at 200.0 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 13:13:35 3126

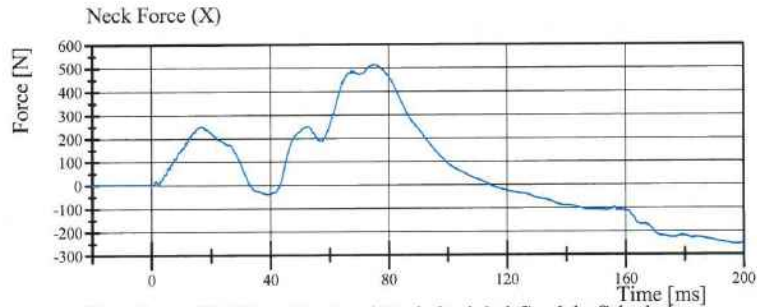


Transportation Research Center Inc.

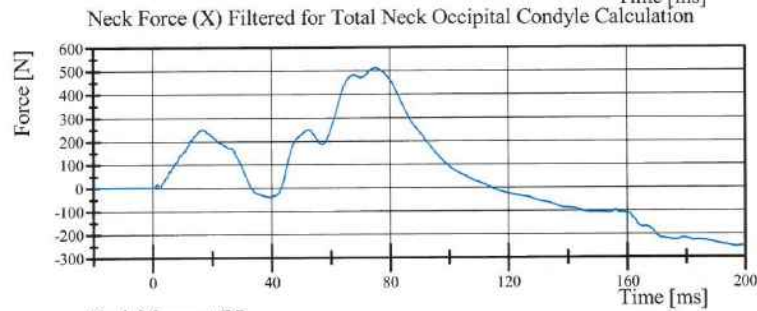
Neck Extension

HIII 50th Serial No. 037 Certification No. 40-1

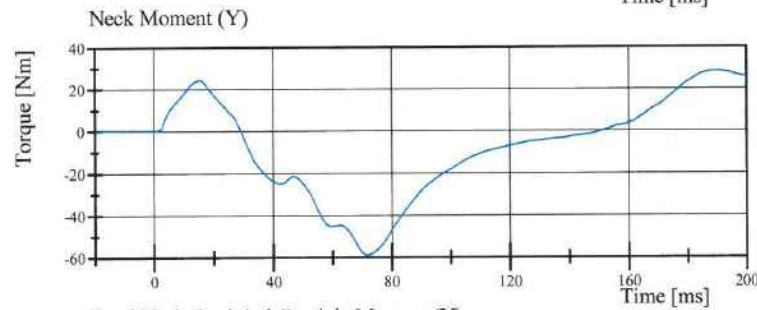
Test Date: 10/11/2016



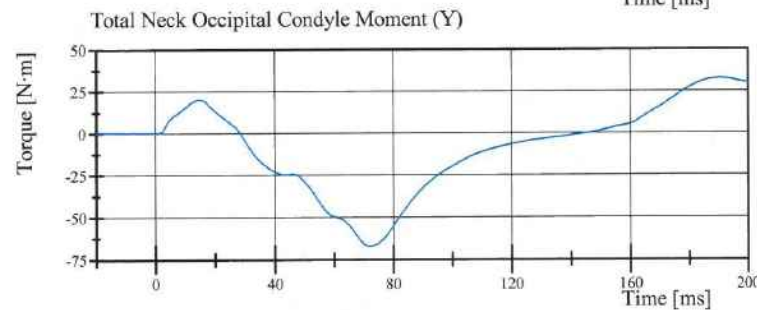
Filter Class: CFC_1000
Max: 511.7 N at 75.0 ms
Min: -253.6 N at 196.8 ms



Filter Class: CFC_600
Max: 511.3 N at 75.1 ms
Min: -253.2 N at 196.9 ms



Filter Class: CFC_600
Max: 28.3 Nm at 189.8 ms
Min: -59.1 Nm at 71.8 ms



Filter Class: Without_Constant
Max: 32.6 N·m at 190.7 ms
Min: -67.6 N·m at 72.0 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 13:13:35 3126



Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 037 Certification No. 40-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.644 m/s	Yes
Probe Force Peak	(-5,160) - (-5,893) N	-5,460.8 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-71.07 mm	Yes
Internal Hysteresis	65 - 85 %	72.8 %	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 09:43:08 437

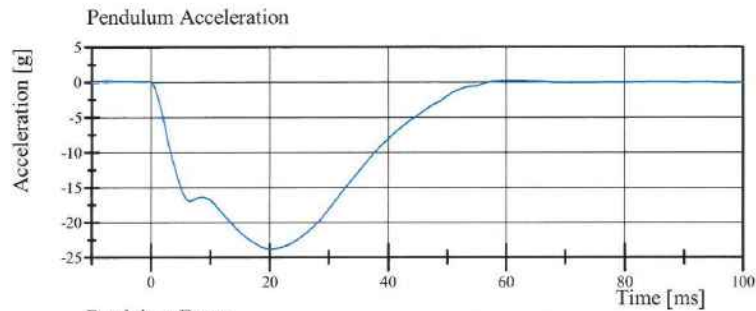


Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 037 Certification No. 40-1

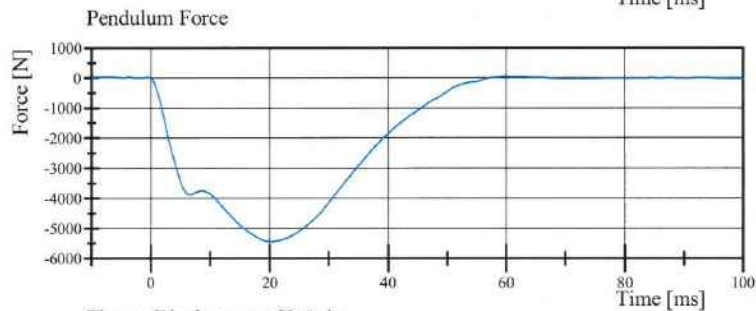
Test Date: 10/11/2016



Filter Class: CFC_180

Max: 0.2 g at 59.8 ms

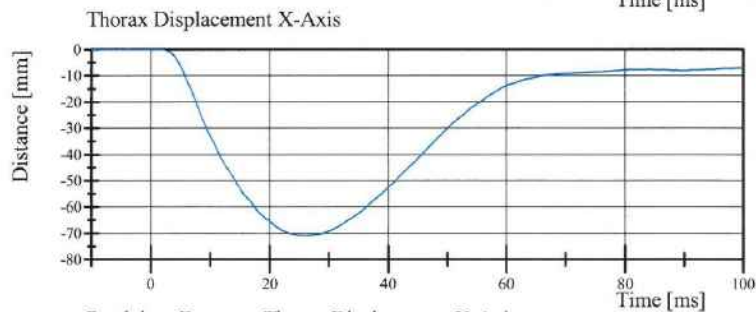
Min: -23.8 g at 20.2 ms



Filter Class: CFC_180

Max: 41.2 N at 59.8 ms

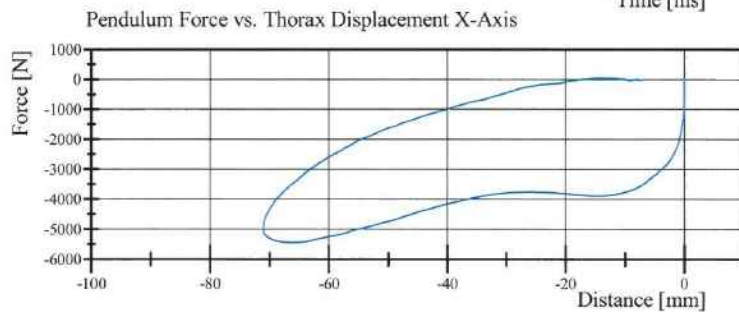
Min: -5,460.8 N at 20.2 ms



Filter Class: CFC_600

Max: 0.0 mm at -9.8 ms

Min: -71.1 mm at 25.8 ms



Filter Class: CFC_180

Max: 41.2 N at -14.1 mm

Min: -5,460.8 N at -66.0 mm

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 09:43:22 437



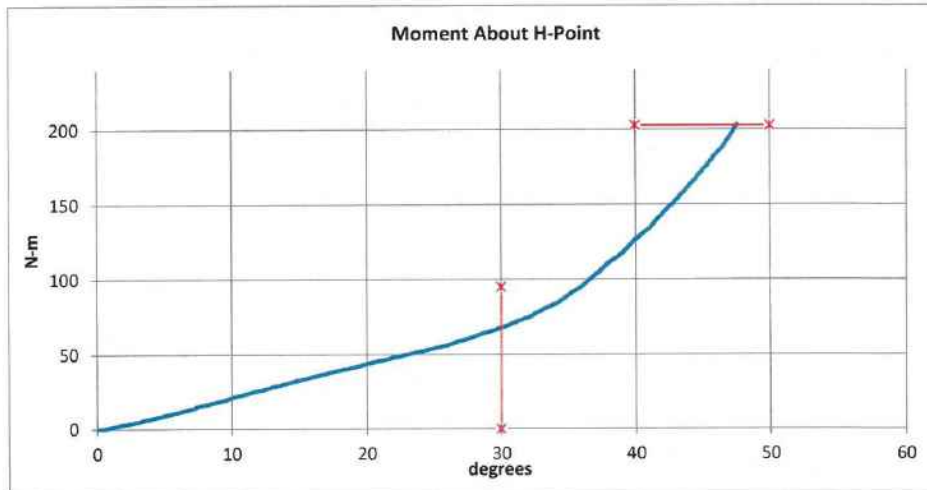
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

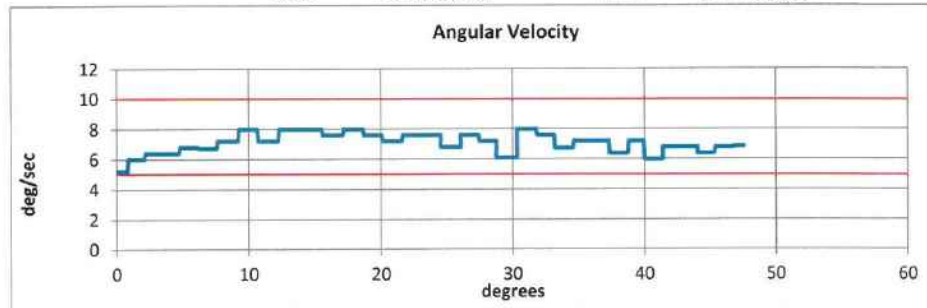


Serial Number: 037 Date: 10-Oct-2016
Side Tested: Left Hip Time: 15:39
Test Number: 1 Comments:

TEST PARAMETER	SPECIFICATION		TEST RESULTS		
Temperature	18.9	- 25.6	21.7	°C	Pass
Humidity	10	- 70	38	%	Pass
Moment at 30°	0	≤ 94.9	67.86	N-m	Pass
Angle at 203 Nm	40	- 50	47.56	deg	Pass
Average Velocity	5	- 10	7.04	deg/sec	Pass



Max: 7.99 deg/sec Min: 5.19 deg/sec



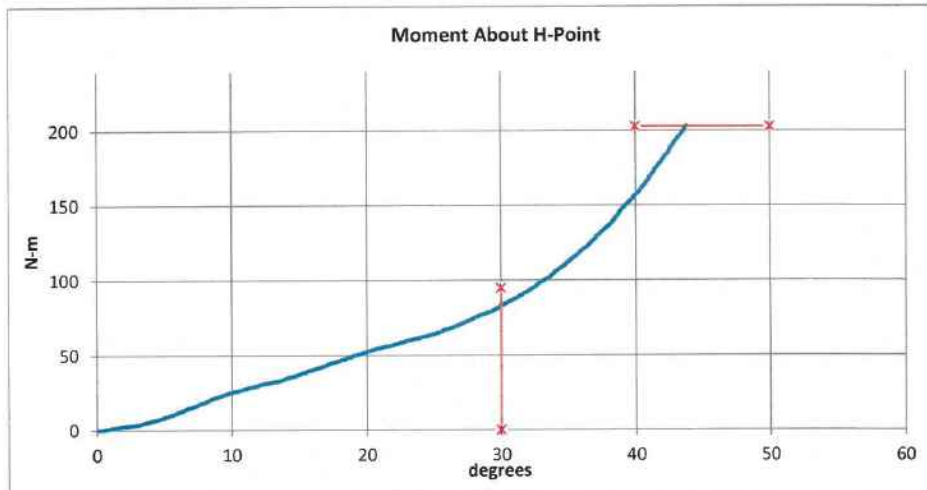
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion

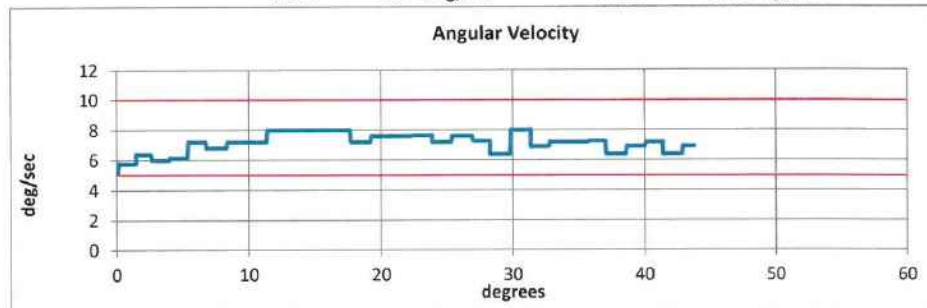


Serial Number: 037 Date: 11-Oct-2016
Side Tested: Right Hip Time: 6:49
Test Number: 1 Comments:

TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 - 25.6	21.7 °C Pass
Humidity	10 - 70	35 % Pass
Moment at 30°	0 ≤ 94.9	83.27 N-m Pass
Angle at 203 Nm	40 - 50	43.8 deg Pass
Average Velocity	5 - 10	7.1 deg/sec Pass



Max: 7.99 deg/sec Min: 5.19 deg/sec



Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 50th Serial No. 037 Certification No. 40-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.117 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,718.16 N	Yes

Test meets specifications.

Comments:

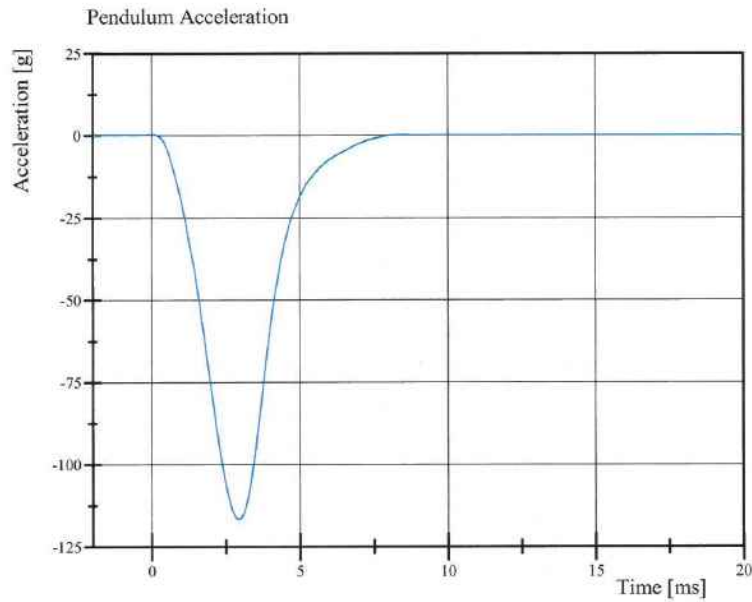
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 07:26:54 1746

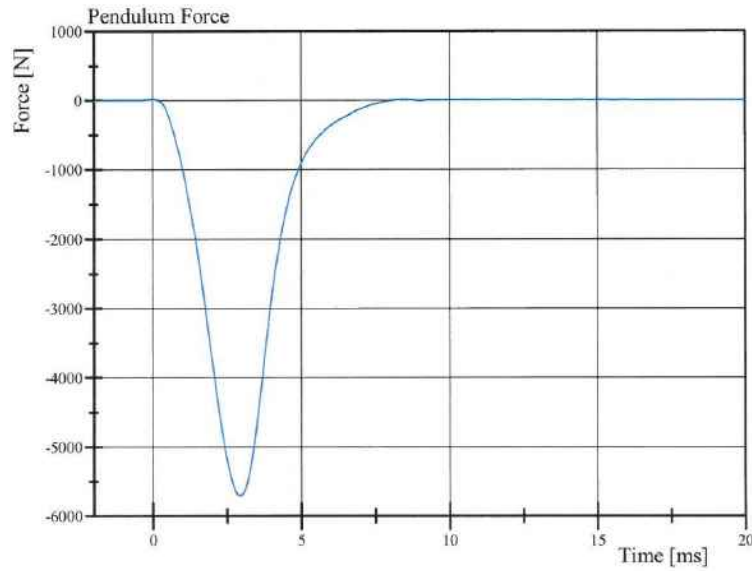


Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 40-1
Test Date: 10/11/2016



Filter Class: CFC_600
Max: 0.2 g at 8.5 ms
Min: -116.9 g at 3.0 ms



Filter Class: CFC_600
Max: 10.2 N at 8.5 ms
Min: -5,718.2 N at 3.0 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 07:27:07 1746



Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 40-1
Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.118 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,573.60 N	Yes

Test meets specifications.

Comments:

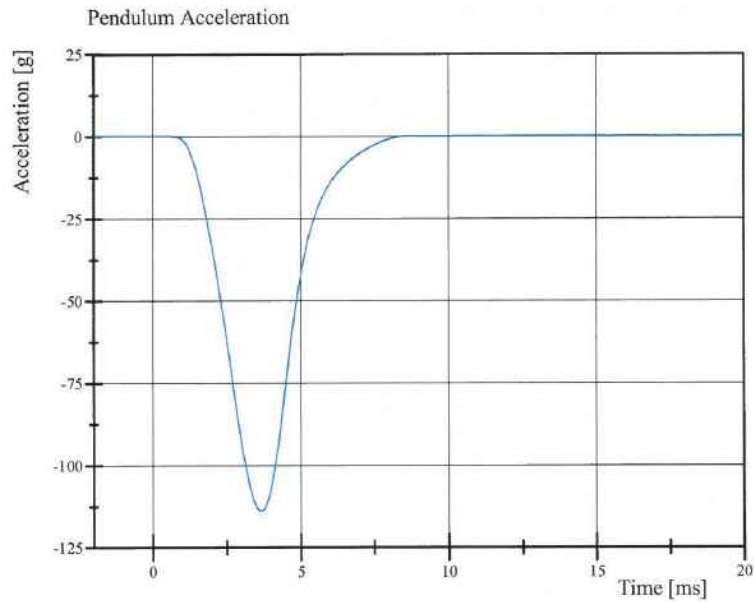
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 07:30:02 1735

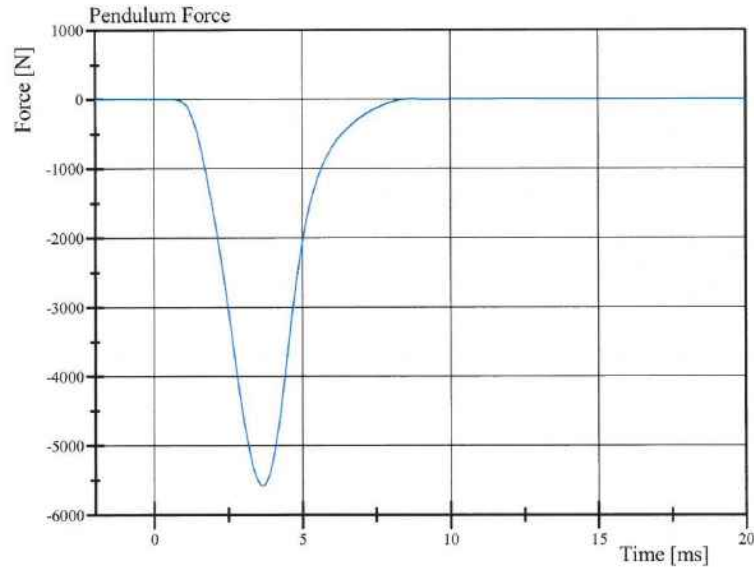


Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 40-1
Test Date: 10/11/2016



Filter Class: CFC_600
Max: 0.1 g at 12.7 ms
Min: -113.9 g at 3.7 ms



Filter Class: CFC_600
Max: 4.8 N at 12.7 ms
Min: -5,573.6 N at 3.7 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

10.11.2016 07:30:12 1735



Post-Test Calibration Sheets

Driver S/N 037

Transportation Research Center Inc.
572E HIII 50th Male Dummy
External Dimensions
Serial No. 037
Calibration No. 41

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	878.8 - 889.0	880	Yes
B	Shoulder Pivot Height	505.5 - 520.7	514	Yes
C	H-Point Height	83.8 - 88.9	87	Yes
D	H-Point From Seatback	134.6 - 139.7	138	Yes
E	Shoulder Pivot From Backline	83.8 - 94.0	92	Yes
F	Thigh Clearance	139.7 - 154.9	150	Yes
G	Back Of Elbow To Wrist Pivot	289.6 - 304.8	295	Yes
H	Skull Cap To Backline	40.6 - 45.7	45	Yes
I	Shoulder-Elbow Length	330.2 - 345.4	340	Yes
J	Elbow Rest Height	190.5 - 210.8	198	Yes
K	Buttock Knee Length	579.1 - 604.5	599	Yes
L	Popliteal Height	429.3 - 454.7	440	Yes
M	Knee Pivot Height	485.1 - 500.4	495	Yes
N	Buttock Popliteal Length	452.1 - 477.5	470	Yes
O	Chest Depth	213.4 - 228.6	225	Yes
P	Foot Length	251.5 - 266.7	264	Yes
V	Shoulder Breadth	421.6 - 436.9	429	Yes
W	Foot Breadth	91.4 - 106.7	97	Yes
Y	Chest Circumference	970.3 - 1000.8	990	Yes
Z	Waist Circumference	835.7 - 866.1	865	Yes
AA	Location For Chest Circumference	429.3 - 434.3	430	Yes
BB	Location For Waist Circumference	226.1 - 231.1	230	Yes

Comments:



Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 037 Certification No. 41-1

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	28 %	Yes
Peak Head Resultant Acceleration	225 - 275 g	249.1 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-8.7 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 13:25:57 614

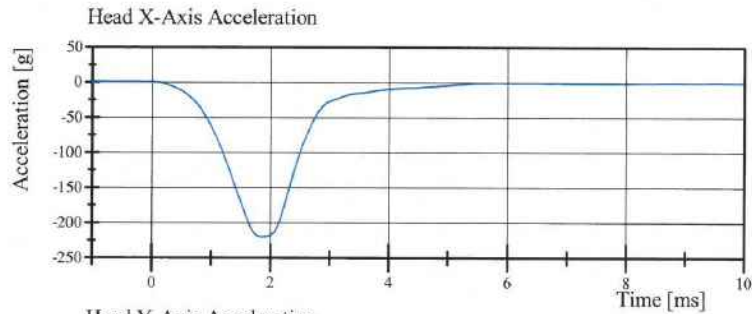


Transportation Research Center Inc.

Front Head Drop

HIII 50th Serial No. 037 Certification No. 41-1

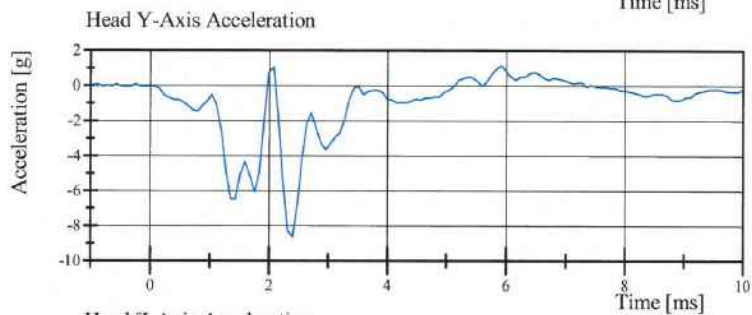
Test Date: 11/15/2016



Filter Class: CFC_1000

Max: 0.1 g at -0.2 ms

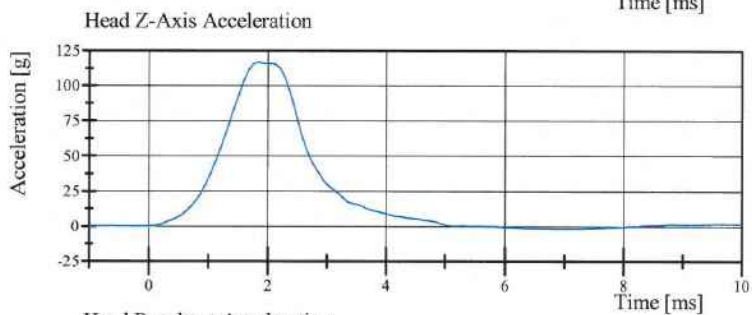
Min: -220.0 g at 1.8 ms



Filter Class: CFC_1000

Max: 1.1 g at 5.9 ms

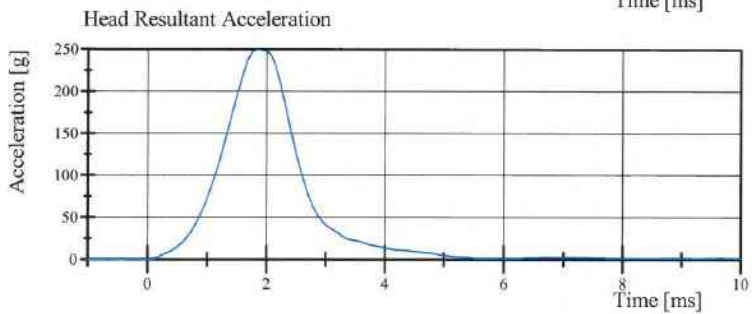
Min: -8.7 g at 2.4 ms



Filter Class: CFC_1000

Max: 116.7 g at 1.8 ms

Min: -1.8 g at 7.0 ms



Filter Class: CFC_1000

Max: 249.1 g at 1.8 ms

Min: 0.1 g at -0.6 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 13:26:06 614



Transportation Research Center Inc.

Neck Flexion

HIII 50th Serial No. 037 Certification No. 41-2

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	28 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	6.941 m/s	Yes
Pendulum Acceleration Decay Crossing -5g	34 - 42 ms	37.6 ms	Yes
Pendulum Acceleration at 10ms	(-22.5) - (-27.5) g	-24.70 g	Yes
Pendulum Acceleration at 20ms	(-17.6) - (-22.6) g	-19.83 g	Yes
Pendulum Acceleration at 30ms	(-12.5) - (-18.5) g	-14.38 g	Yes
Pendulum Acceleration > 30ms	>= (-29.0) g	-14.38 g	Yes
Total Head D-Plane Rotation			
Peak	(-64) - (-78) °	-76.3 °	Yes
Time of Peak	57 - 64 ms	59.5 ms	Yes
Total Head D-Plane Rotation Decay to 0°	113 - 128 ms	119.0 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	88 - 108 N·m	102.5 N·m	Yes
Time of Peak	47 - 58 ms	50.7 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	97 - 107 ms	99.9 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 14:23:30 3039

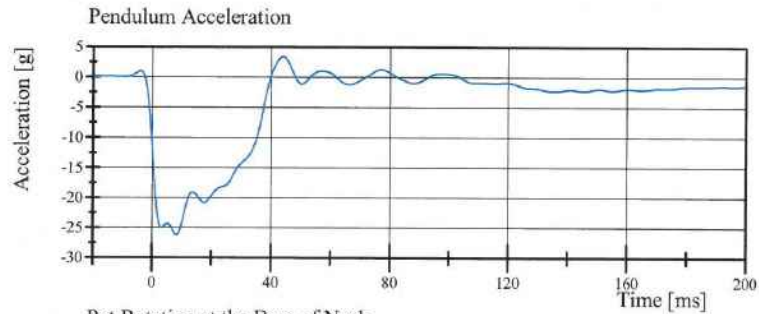


Transportation Research Center Inc.

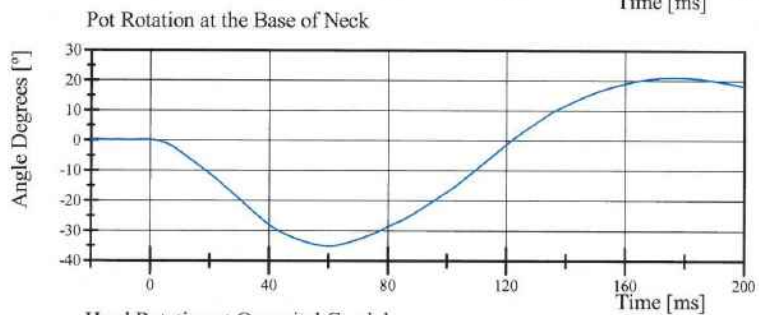
Neck Flexion

HIII 50th Serial No. 037 Certification No. 41-2

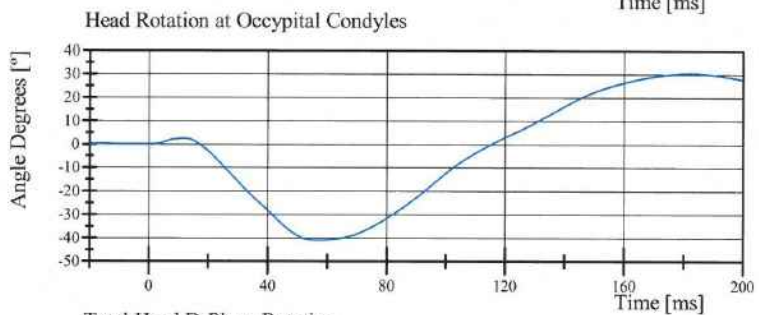
Test Date: 11/15/2016



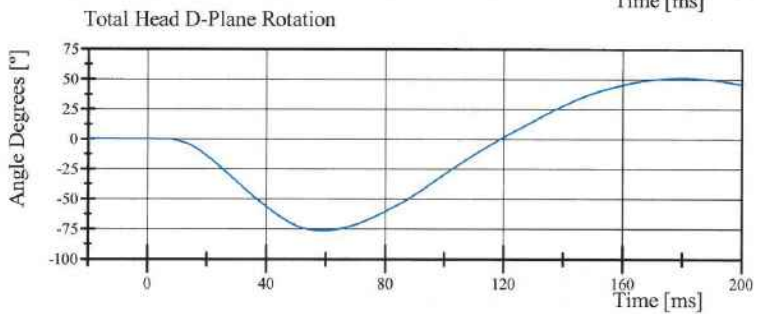
Filter Class: CFC_60
Max: 3.3 g at 44.1 ms
Min: -26.3 g at 8.4 ms



Filter Class: CFC_60
Max: 21.0 ° at 176.3 ms
Min: -35.3 ° at 60.4 ms



Filter Class: CFC_60
Max: 30.5 ° at 182.2 ms
Min: -41.2 ° at 56.5 ms



Filter Class: CFC_60
Max: 51.4 ° at 180.2 ms
Min: -76.3 ° at 59.5 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 14:23:55 3039

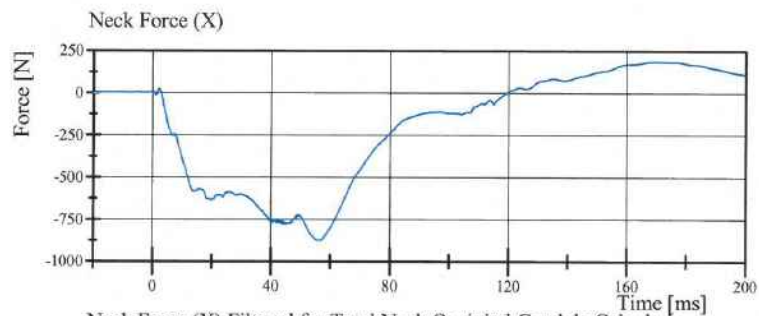


Transportation Research Center Inc.

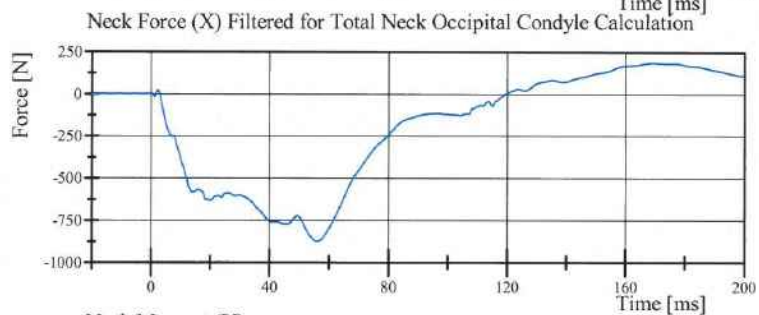
Neck Flexion

HIII 50th Serial No. 037 Certification No. 41-2

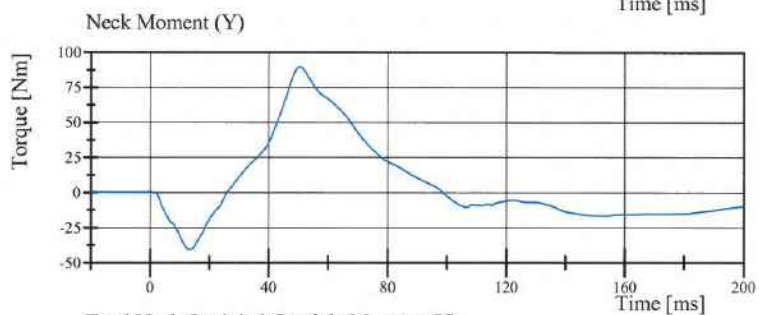
Test Date: 11/15/2016



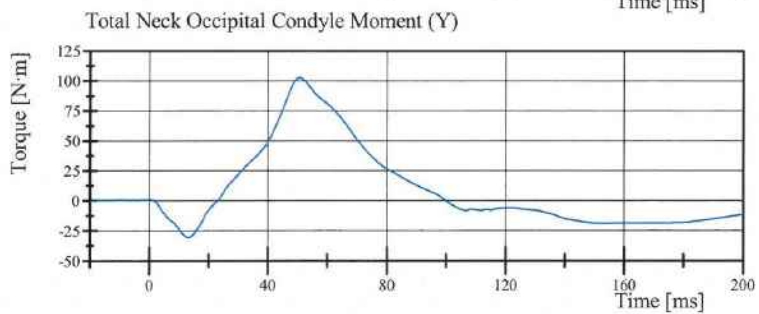
Filter Class: CFC_1000
Max: 187.3 N at 170.0 ms
Min: -876.3 N at 56.6 ms



Filter Class: CFC_600
Max: 186.6 N at 169.9 ms
Min: -875.8 N at 56.6 ms



Filter Class: CFC_600
Max: 89.4 Nm at 50.5 ms
Min: -41.1 Nm at 13.7 ms



Filter Class: Without_Constai
Max: 102.5 N·m at 50.7 ms
Min: -30.9 N·m at 13.2 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 14:23:56 3039



Transportation Research Center Inc.

Neck Extension

HIII 50th Serial No. 037 Certification No. 41-2

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	29 %	Yes
Pendulum Velocity	(-5.95) - (-6.18) m/s	-5.984 m/s	Yes
Pendulum Acceleration Decay Crossing 5g	38 - 46 ms	41.0 ms	Yes
Pendulum Acceleration at 10ms	17.2 - 21.2 g	19.11 g	Yes
Pendulum Acceleration at 20ms	14.0 - 19.0 g	16.00 g	Yes
Pendulum Acceleration at 30ms	11.0 - 16.0 g	13.01 g	Yes
Pendulum Acceleration > 30ms	<= 22.0 g	13.01 g	Yes
Total Head D-Plane Rotation			
Peak	81 - 106 °	98.6 °	Yes
Time of Peak	72 - 82 ms	77.4 ms	Yes
Total Head D-Plane Rotation Decay to 0°	147 - 174 ms	159.2 ms	Yes
Total Neck Occipital Condyles Moment			
Peak	(-53) - (-80) N·m	-72.0 N·m	Yes
Time of Peak	65 - 79 ms	71.9 ms	Yes
Total Neck Occipital Condyles Moment Decay to 0 N·m	120 - 148 ms	145.6 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 15:26:04 3128

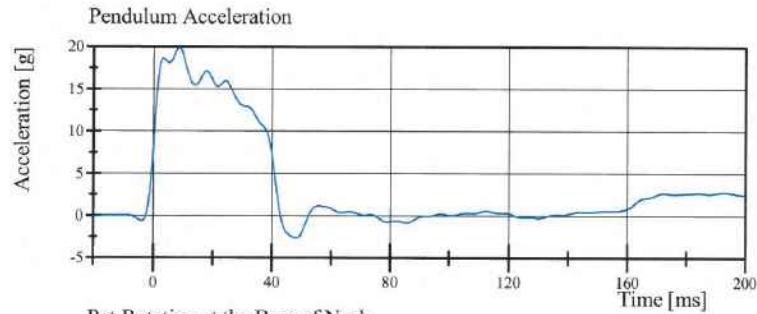


Transportation Research Center Inc.

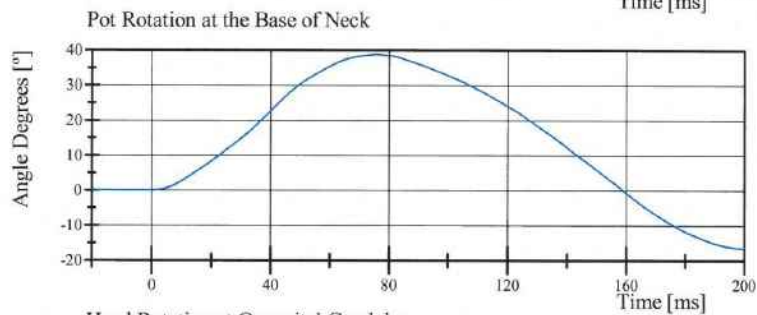
Neck Extension

HIII 50th Serial No. 037 Certification No. 41-2

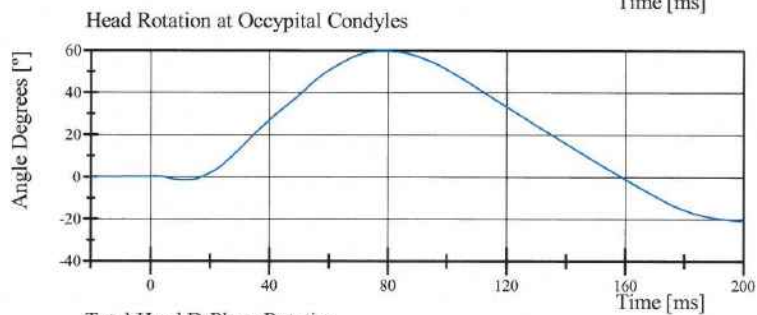
Test Date: 11/15/2016



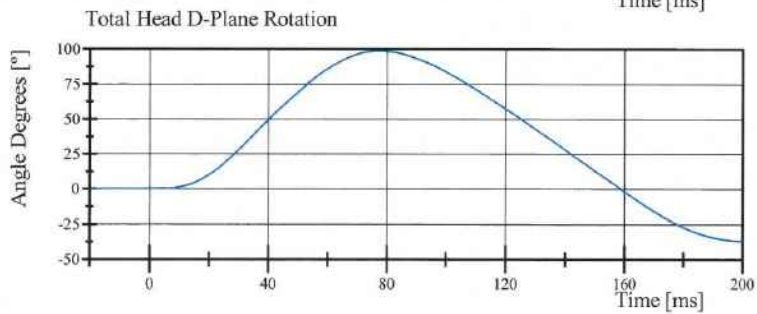
Filter Class: CFC_60
Max: 19.9 g at 8.7 ms
Min: -2.7 g at 48.2 ms



Filter Class: CFC_60
Max: 38.8 ° at 75.8 ms
Min: -16.5 ° at 200.0 ms



Filter Class: CFC_60
Max: 59.9 ° at 78.4 ms
Min: -20.5 ° at 200.0 ms



Filter Class: CFC_60
Max: 98.6 ° at 77.4 ms
Min: -37.0 ° at 200.0 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 15:26:15 3128

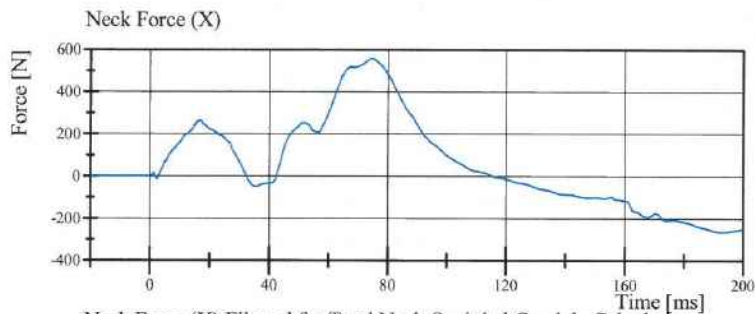


Transportation Research Center Inc.

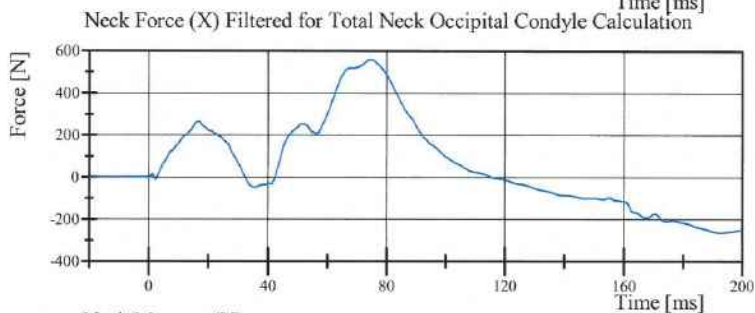
Neck Extension

HIII 50th Serial No. 037 Certification No. 41-2

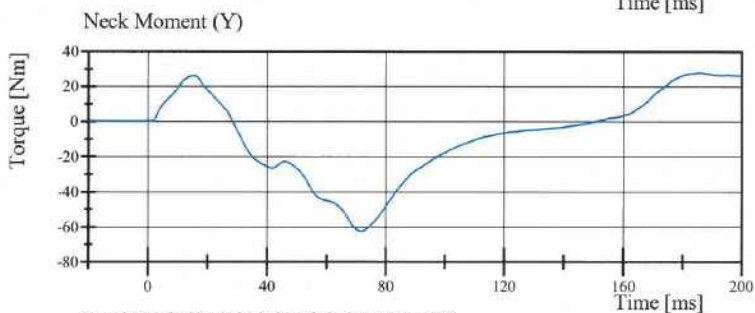
Test Date: 11/15/2016



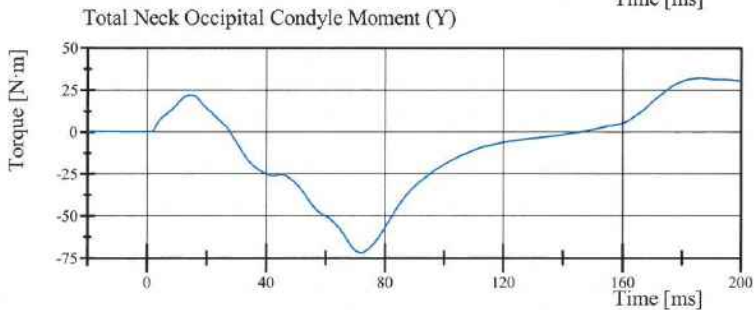
Filter Class: CFC_1000
Max: 558.9 N at 74.4 ms
Min: -263.7 N at 193.0 ms



Filter Class: CFC_600
Max: 558.6 N at 74.5 ms
Min: -263.4 N at 193.0 ms



Filter Class: CFC_600
Max: 27.9 Nm at 186.1 ms
Min: -62.5 Nm at 71.7 ms



Filter Class: Without_Constai
Max: 32.2 N·m at 186.1 ms
Min: -72.0 N·m at 71.9 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 15:26:16 3128



Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 037 Certification No. 41-3

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	30 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.680 m/s	Yes
Probe Force Peak	(-5,160) - (-5,893) N	-5,550.3 N	Yes
Maximum Chest Compression	(-63.5) - (-72.6) mm	-71.96 mm	Yes
Internal Hysteresis	65 - 85 %	72.7 %	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 16:14:54 381

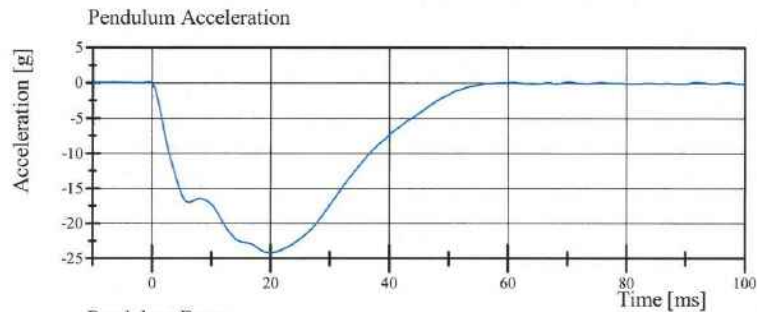


Transportation Research Center Inc.

Front Thorax

HIII 50th Serial No. 037 Certification No. 41-3

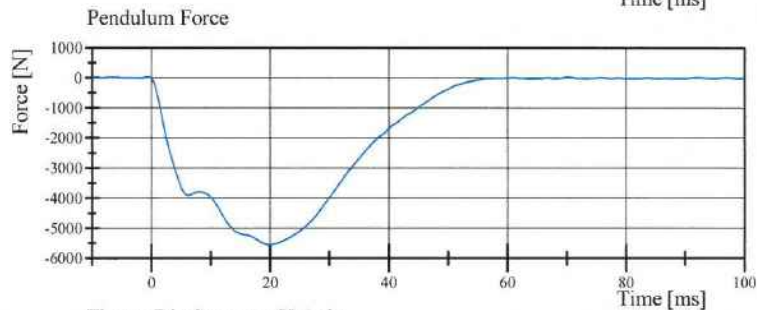
Test Date: 11/15/2016



Filter Class: CFC_180

Max: 0.2 g at 70.3 ms

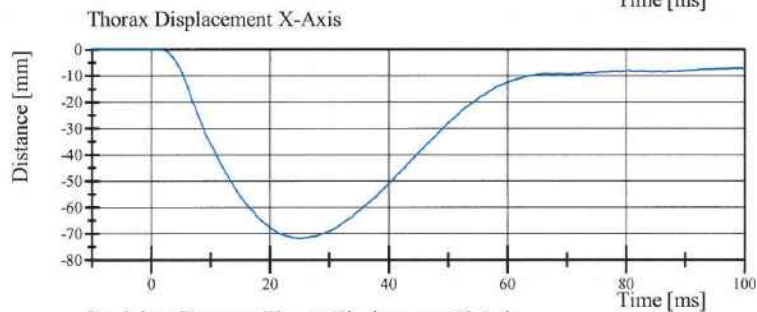
Min: -24.2 g at 19.9 ms



Filter Class: CFC_180

Max: 37.8 N at 70.3 ms

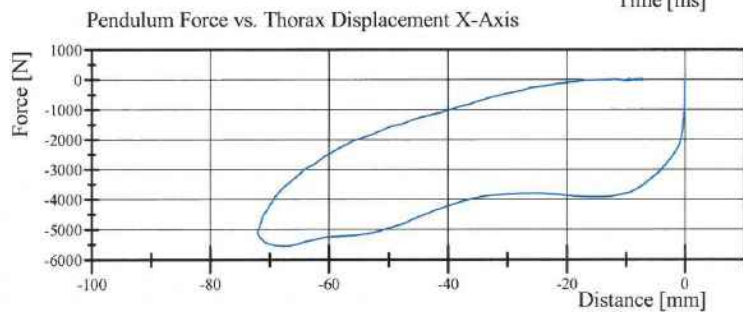
Min: -5,550.3 N at 19.9 ms



Filter Class: CFC_600

Max: 0.0 mm at -9.8 ms

Min: -72.0 mm at 25.1 ms



Filter Class: CFC_180

Max: 37.8 N at -9.4 mm

Min: -5,550.3 N at -67.6 mm

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 16:15:09 381



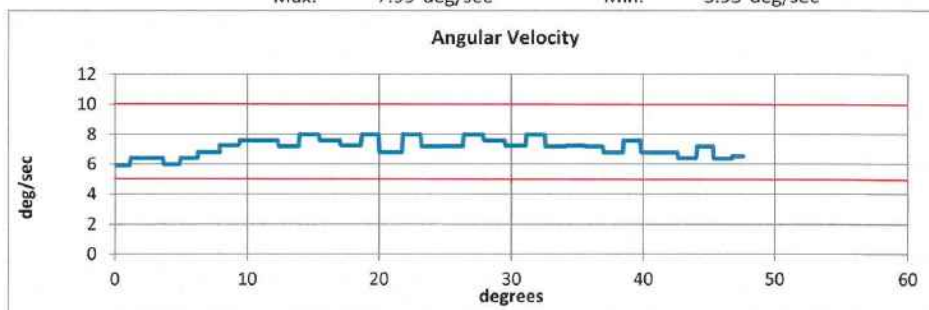
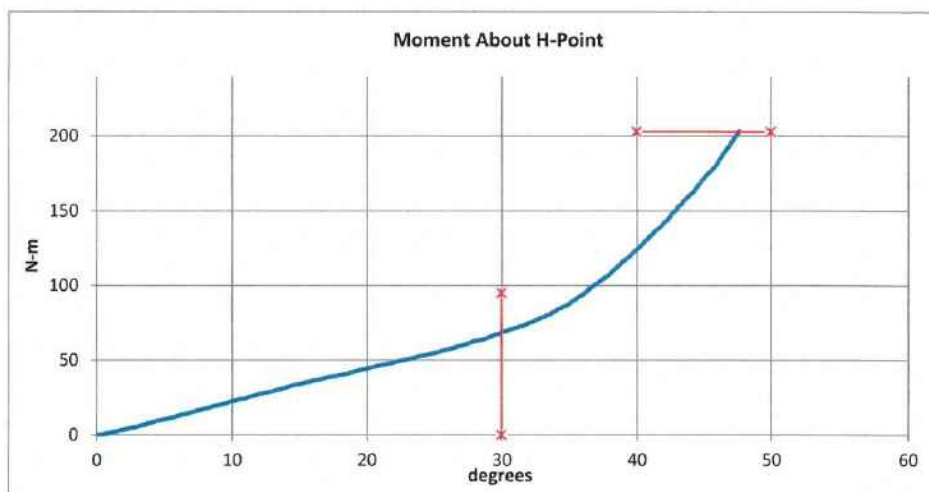
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion



Serial Number: 037 Date: 15-Nov-2016
Side Tested: Left Hip Time: 11:27
Test Number: 1 Comments:

TEST PARAMETER	SPECIFICATION		TEST RESULTS	
Temperature	18.9	- 25.6	21.8 °C	Pass
Humidity	10	- 70	25 %	Pass
Moment at 30°	0	≤ 94.9	68.75 N-m	Pass
Angle at 203 Nm	40	- 50	47.64 deg	Pass
Average Velocity	5	- 10	7.11 deg/sec	Pass



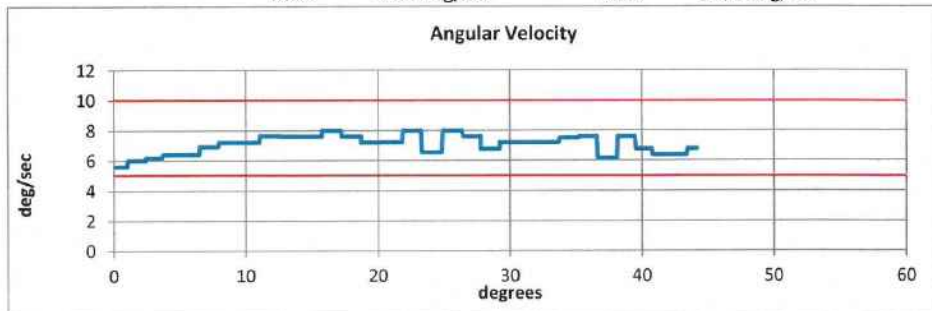
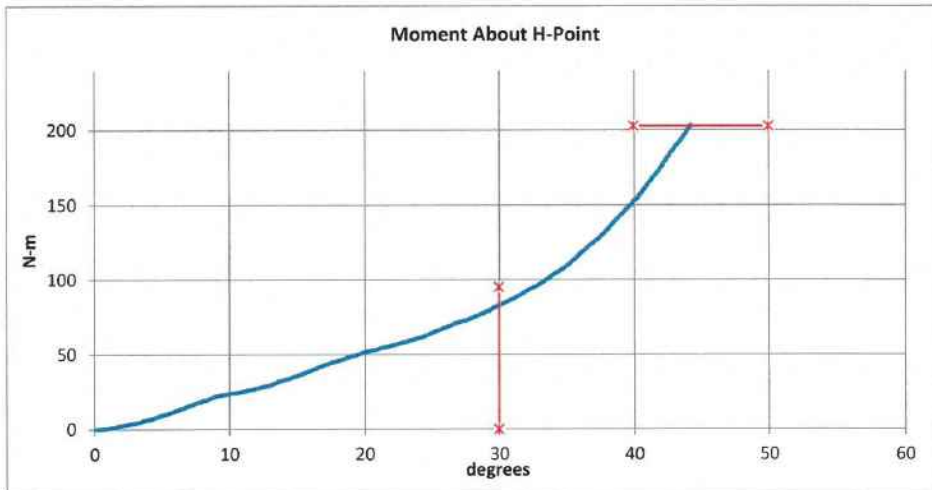
Transportation Research Center Inc.

Hybrid III 50th Male Hip Range of Motion



Serial Number: 037 Date: 15-Nov-2016
 Side Tested: Right Hip Time: 12:29
 Test Number: 1 Comments:

TEST PARAMETER	SPECIFICATION		TEST RESULTS		
Temperature	18.9	- 25.6	21.8	°C	Pass
Humidity	10	- 70	26	%	Pass
Moment at 30°	0	≤ 94.9	83.27	N-m	Pass
Angle at 203 Nm	40	- 50	44.2	deg	Pass
Average Velocity	5	- 10	7.05	deg/sec	Pass



Transportation Research Center Inc.

Left Knee Femur Response Test

HIH 50th Serial No. 037 Certification No. 41-2

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	23 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.098 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,472.02 N	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 09:49:58 1780

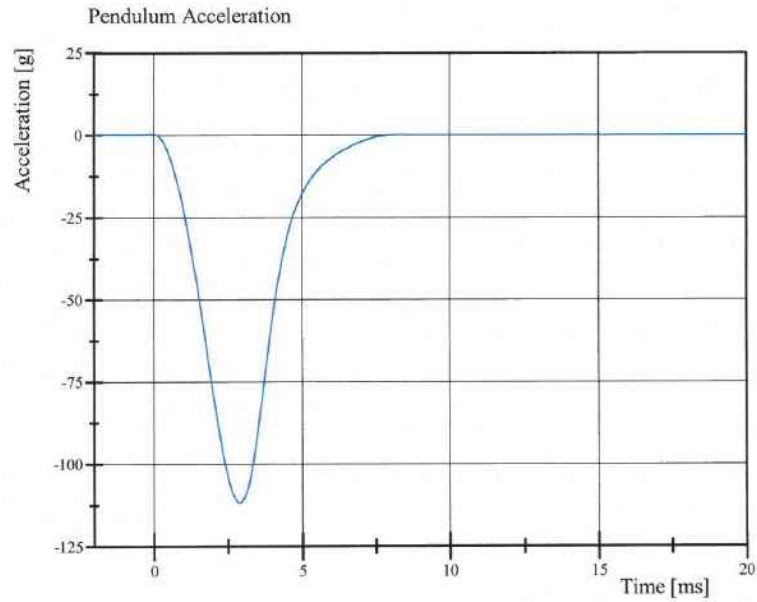


Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 50th Serial No. 037 Certification No. 41-2

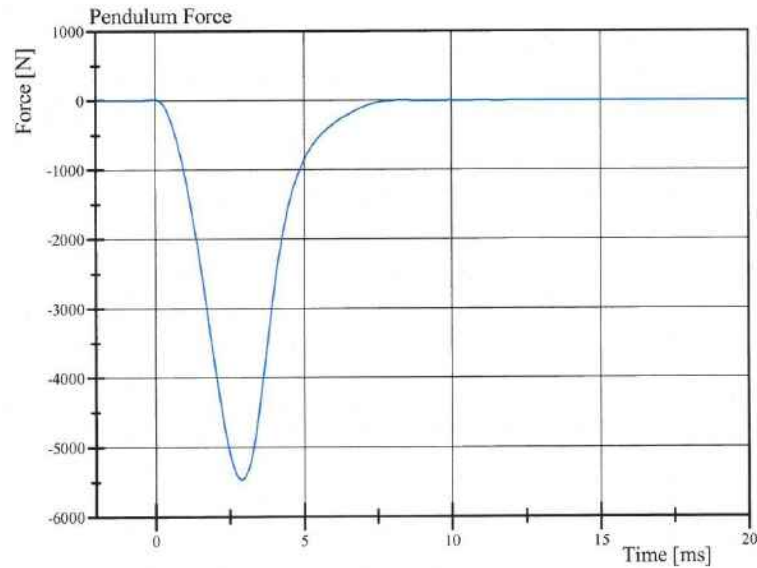
Test Date: 11/15/2016



Filter Class: CFC_600

Max: 0.2 g at -0.1 ms

Min: -111.8 g at 2.9 ms



Filter Class: CFC_600

Max: 7.4 N at -0.1 ms

Min: -5,472.0 N at 2.9 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 09:50:35 1780



Transportation Research Center Inc.

Right Knee Femur Response Test

HIII 50th Serial No. 037 Certification No. 41-1

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.084 m/s	Yes
Peak Femur Force	(-4,715.2) - (-5,782.6) N	-5,468.86 N	Yes

Test meets specifications.

Comments:

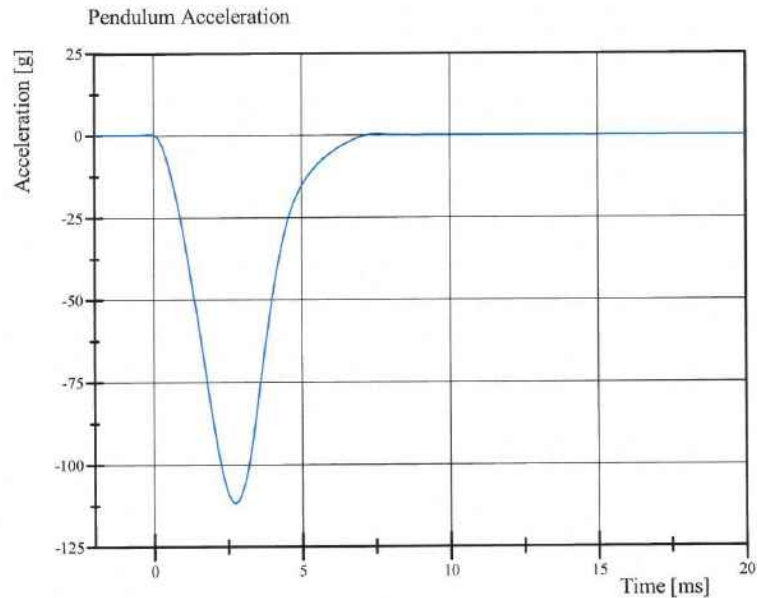
Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 09:31:22 1789

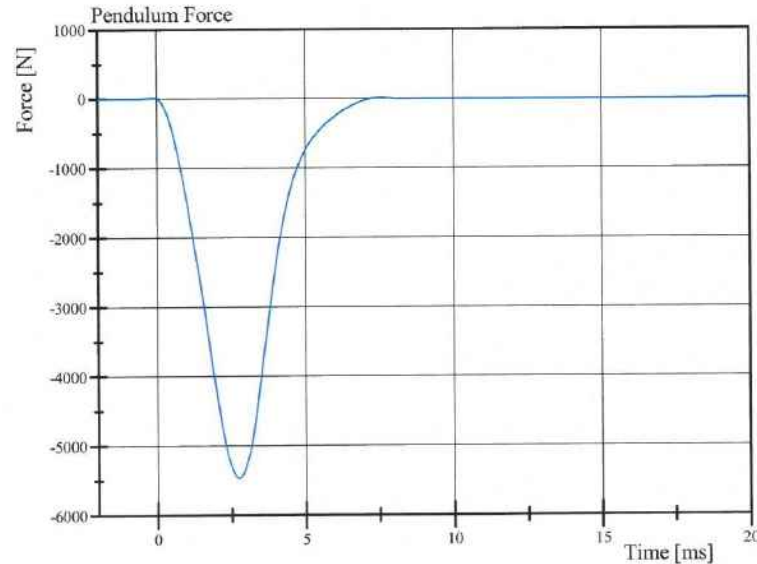


Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 50th Serial No. 037 Certification No. 41-1
Test Date: 11/15/2016



Filter Class: CFC_600
Max: 0.3 g at 7.6 ms
Min: -111.8 g at 2.7 ms



Filter Class: CFC_600
Max: 14.9 N at 7.6 ms
Min: -5,468.9 N at 2.7 ms

Specification Source: CFR49 Part 572 Subpart E
with Polarity in accordance with J211

11.15.2016 09:32:20 1789



Pre-Test Calibration Sheets

Front Passenger S/N 426

Transportation Research Center Inc.
5720 HIII 5th Dummy
External Dimensions
Serial No. 426 Calibration No. 38

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	774.7 - 800.1	781	Yes
B	Shoulder Pivot Height	431.8 - 457.2	445	Yes
C	Hip Pivot Height	81.3 - 86.3	85	Yes
D	Hip Pivot from Backline	144.8 - 149.8	147	Yes
E	Shoulder Pivot from Backline	68.6 - 83.8	78	Yes
F	Thigh Clearance	119.4 - 134.6	129	Yes
G	Back of Elbow to Wrist Pivot	243.9 - 259.1	250	Yes
H	Head Back to Backline	43.2 - 48.2	45	Yes
I	Shoulder to Elbow Length	276.8 - 297.2	286	Yes
J	Elbow Rest Height	182.8 - 203.2	196	Yes
K	Buttock Knee Length	520.7 - 546.1	535	Yes
L	Popliteal Height	355.6 - 376.0	367	Yes
M	Knee Pivot Height	393.7 - 419.1	409	Yes
N	Buttock Popliteal Length	414.0 - 439.4	431	Yes
O	Chest Depth without Jacket	175.3 - 190.5	182	Yes
P	Foot Length	218.5 - 233.7	224	Yes
R	Buttock to Knee Pivot Length	457.2 - 482.6	473	Yes
S	Head Breadth	137.1 - 147.3	141	Yes
T	Head Depth	177.8 - 188.0	182	Yes
U	Hip Breadth	299.7 - 314.9	306	Yes
V	Shoulder Breadth	350.5 - 365.7	357	Yes
W	Foot Breadth	78.8 - 94.0	83	Yes
X	Head Circumference	528.3 - 548.7	539	Yes
Y	Chest Circumference with Jacket	850.9 - 881.3	870	Yes
Z	Waist Circumference	759.5 - 789.9	775	Yes
AA	Reference Location for Chest Circumference	332.7 - 358.1	345	Yes
BB	Reference Location for Waist Circumference	160.0 - 170.2	165	Yes

Transportation Research Center Inc.

Front Head Drop

HIII 5th Serial No. 426 Certification No. 38-1

Test Date: 10/10/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.5 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Peak Head Resultant Acceleration	250 - 300 g	282.2 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	-1.2 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572, Subpart O
with Polarity in accordance with J211

10.10.2016 15:09:40 609

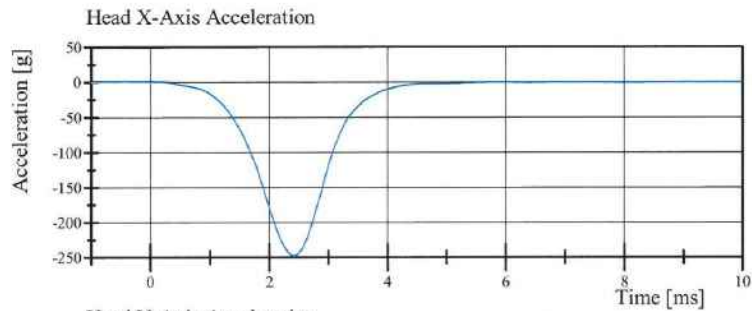


Transportation Research Center Inc.

Front Head Drop

HIII 5th Serial No. 426 Certification No. 38-1

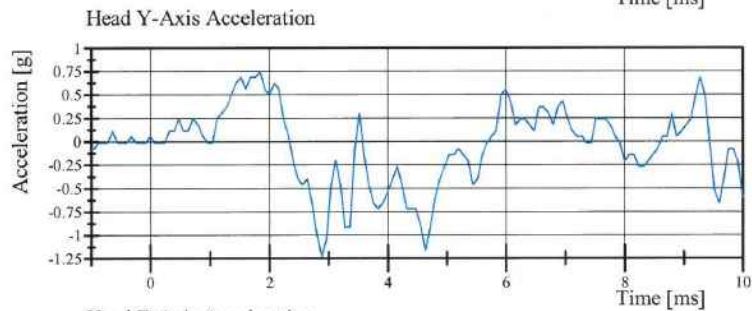
Test Date: 10/10/2016



Filter Class: CFC_1000

Max: 0.1 g at -0.2 ms

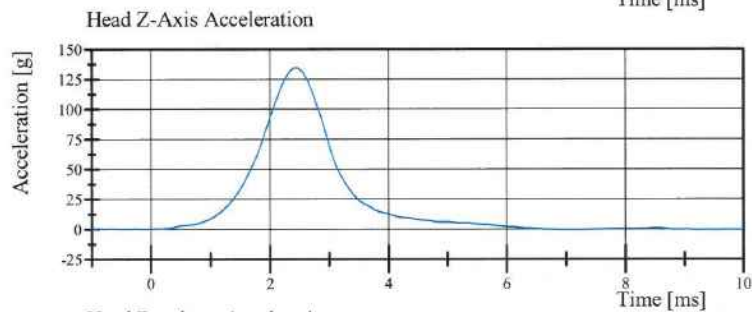
Min: -248.3 g at 2.4 ms



Filter Class: CFC_1000

Max: 0.8 g at 1.8 ms

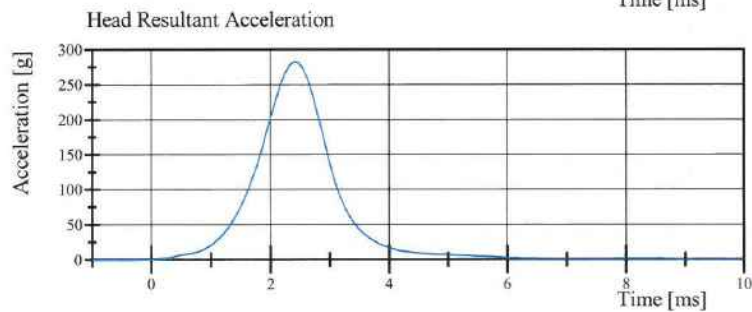
Min: -1.2 g at 2.9 ms



Filter Class: CFC_1000

Max: 134.1 g at 2.4 ms

Min: -0.5 g at 6.9 ms



Filter Class: CFC_1000

Max: 282.2 g at 2.4 ms

Min: 0.0 g at -0.8 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.10.2016 15:09:53 609



Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 38-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	7.089 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-2.1) - (-2.5) m/s	-2.45 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-4.0) - (-5.0) m/s	-4.67 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	(-5.8) - (-7.0) m/s	-6.48 m/s	Yes
Total Head D-Plane Rotation	(-77) - (-91) °	-79.5 °	Yes
Total Neck Occipital Condyles Moment Between -77° and -91° Rotation	69 - 83 N·m	72.9 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 10 N·m	80 - 100 ms	87.2 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:34:28 1848

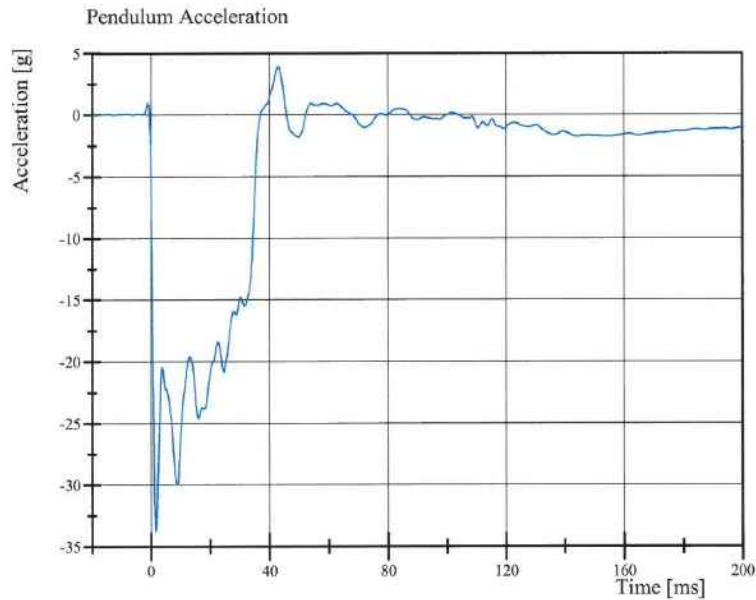


Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 38-1

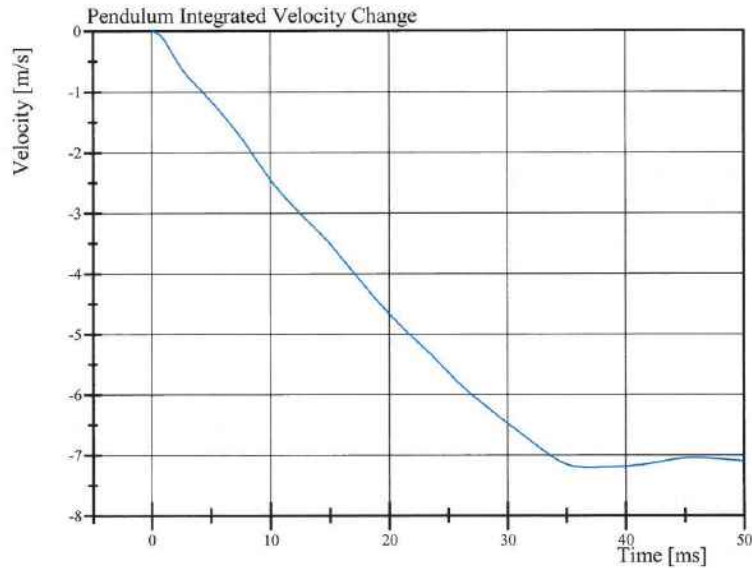
Test Date: 10/11/2016



Filter Class: CFC_180

Max: 3.8 g at 43.1 ms

Min: -33.8 g at 1.8 ms



Filter Class: CFC_180

Max: 0.0 m/s at 0.0 ms

Min: -7.2 m/s at 37.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:34:46 1848



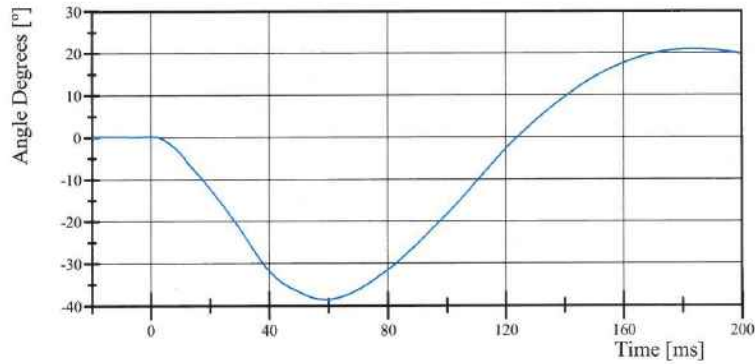
Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 38-1

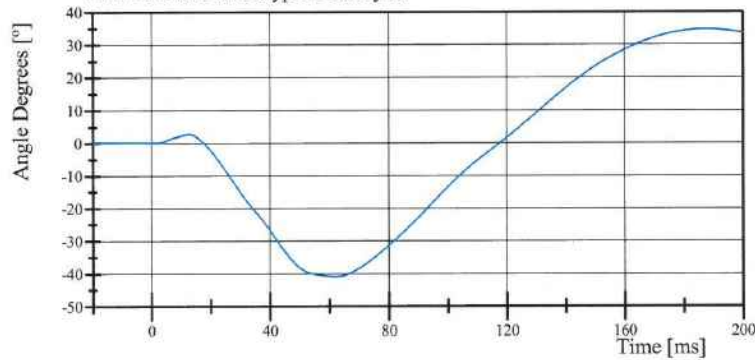
Test Date: 10/11/2016

Pot Rotation at the Base of Neck



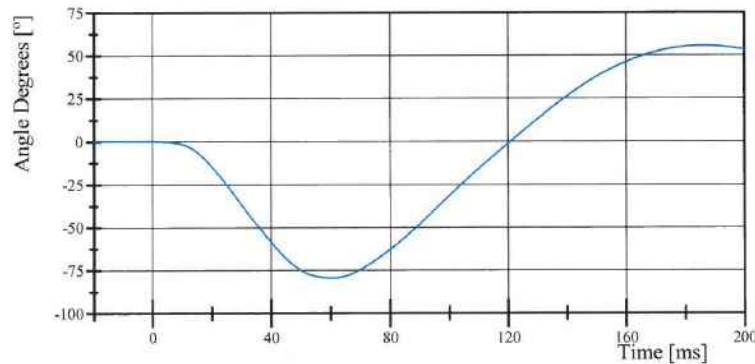
Filter Class: CFC_60
Max: 20.9 ° at 183.3 ms
Min: -38.6 ° at 59.1 ms

Head Rotation at Occipital Condyles



Filter Class: CFC_60
Max: 34.8 ° at 187.3 ms
Min: -41.0 ° at 62.0 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 55.6 ° at 186.0 ms
Min: -79.5 ° at 60.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:34:47 1848

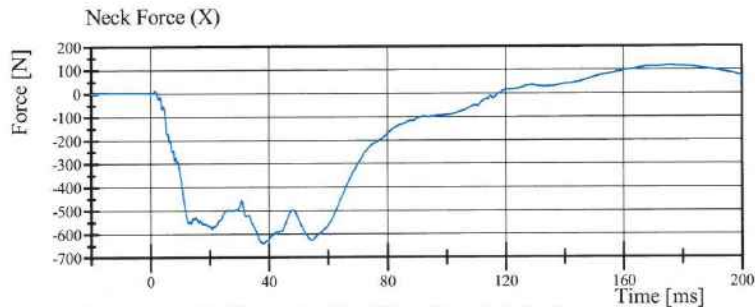


Transportation Research Center Inc.

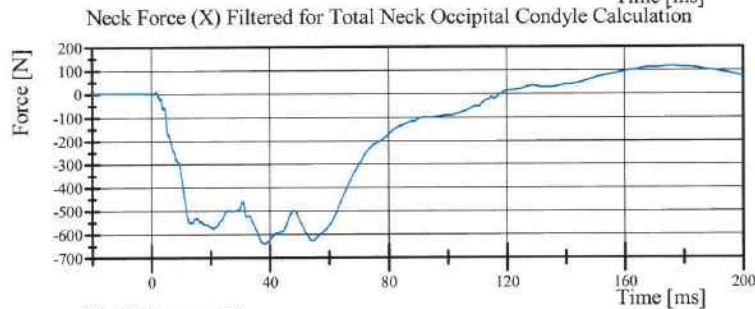
Neck Flexion

HIII 5th Serial No. 426 Certification No. 38-1

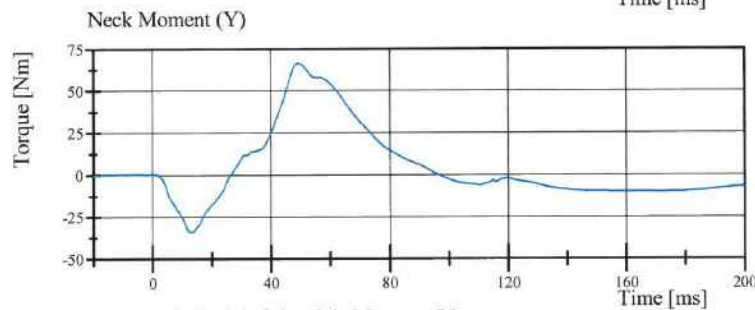
Test Date: 10/11/2016



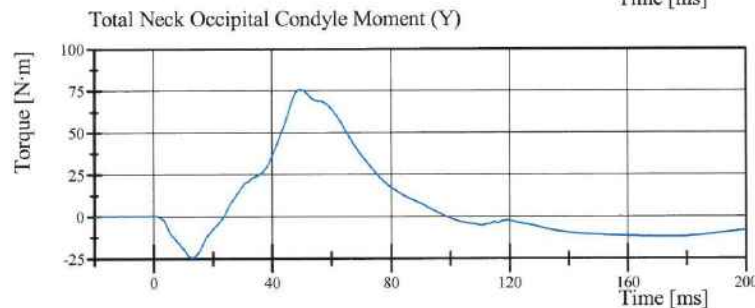
Filter Class: CFC_1000
Max: 117.9 N at 176.2 ms
Min: -642.5 N at 38.1 ms



Filter Class: CFC_600
Max: 117.4 N at 176.1 ms
Min: -641.8 N at 38.1 ms



Filter Class: CFC_600
Max: 66.3 Nm at 49.3 ms
Min: -34.5 Nm at 12.9 ms



Filter Class: Without_(Consta
Max: 75.6 N·m at 49.7 ms
Min: -24.6 N·m at 12.9 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:34:48 1848



Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 38-3

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Pendulum Velocity	(-5.95) - (-6.19) m/s	-6.140 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 1.9 m/s	1.86 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	3.1 - 3.9 m/s	3.75 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	4.6 - 5.6 m/s	5.40 m/s	Yes
Total Head D-Plane Rotation	99 - 114 °	109.2 °	Yes
Total Neck Occipital Condyles Moment Between 99° and 114° Rotation	(-53) - (-65) N·m	-59.4 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -10 N·m	94 - 114 ms	100.6 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 15:30:48 3116

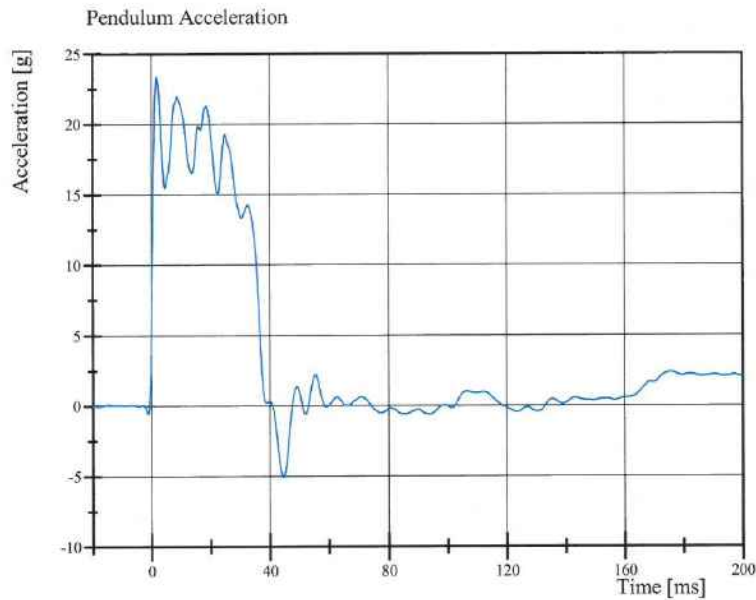


Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 38-3

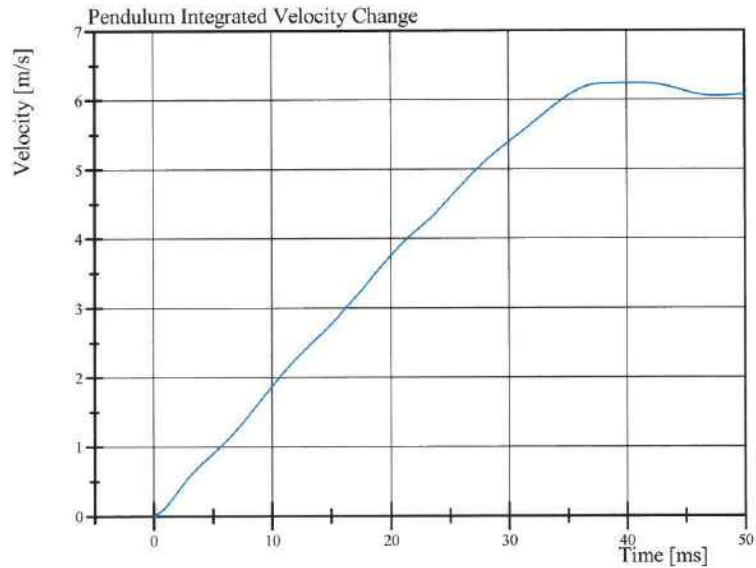
Test Date: 10/11/2016



Filter Class: CFC_180

Max: 23.3 g at 1.8 ms

Min: -5.1 g at 44.6 ms



Filter Class: CFC_180

Max: 6.2 m/s at 40.9 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 15:30:58 3116



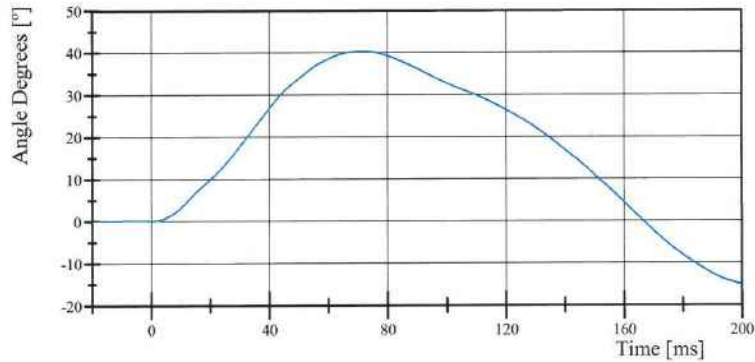
Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 38-3

Test Date: 10/11/2016

Pot Rotation at the Base of Neck

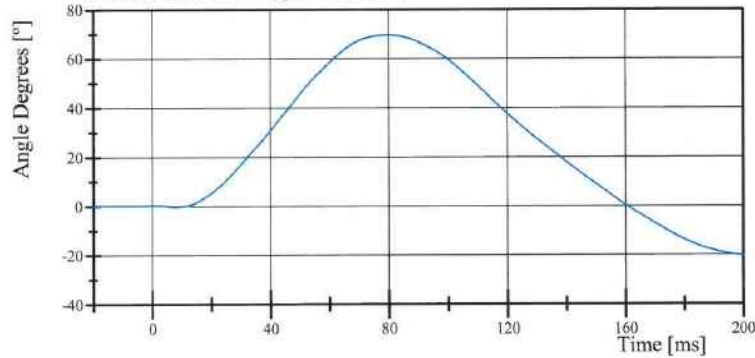


Filter Class: CFC_60

Max: 40.2 ° at 71.4 ms

Min: -15.1 ° at 200.0 ms

Head Rotation at Occipital Condyles

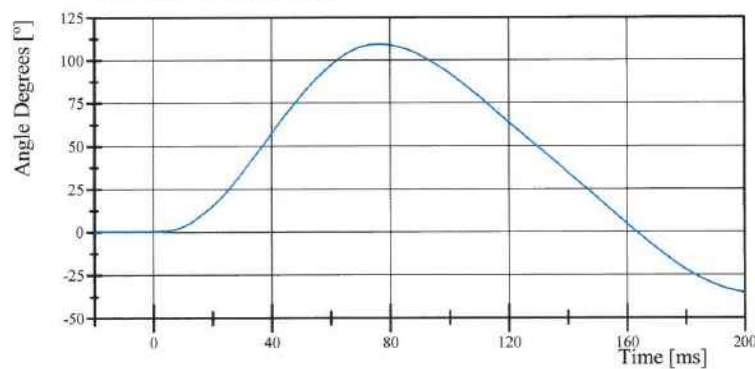


Filter Class: CFC_60

Max: 69.5 ° at 79.9 ms

Min: -20.3 ° at 200.0 ms

Total Head D-Plane Rotation



Filter Class: CFC_60

Max: 109.2 ° at 76.2 ms

Min: -35.4 ° at 200.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 15:30:59 3116

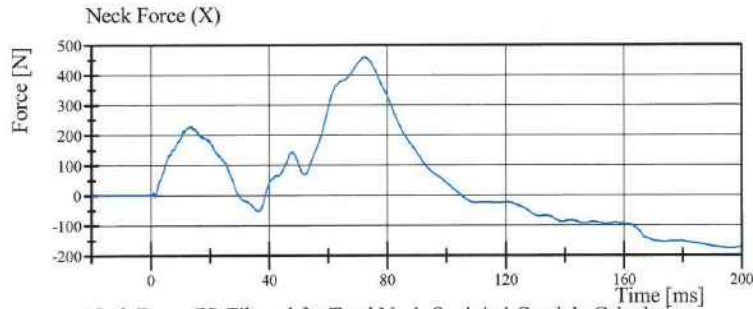


Transportation Research Center Inc.

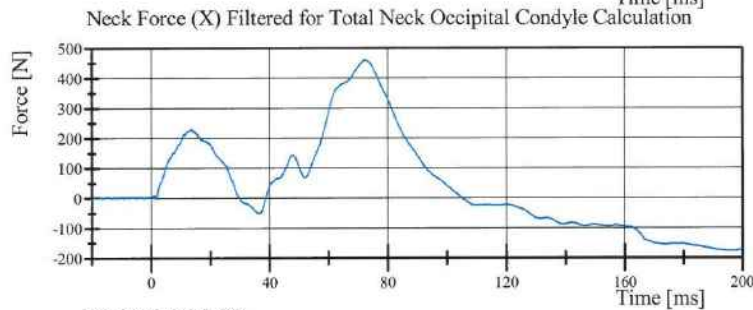
Neck Extension

HIII 5th Serial No. 426 Certification No. 38-3

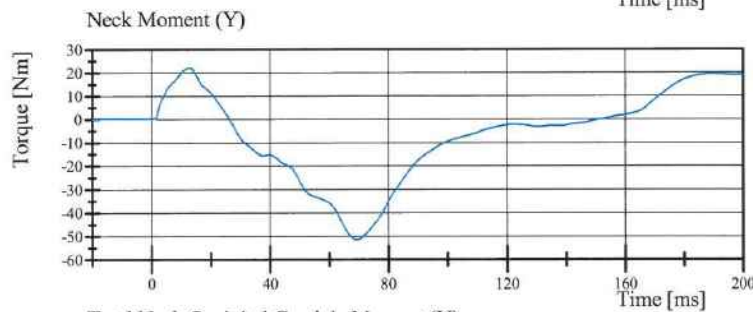
Test Date: 10/11/2016



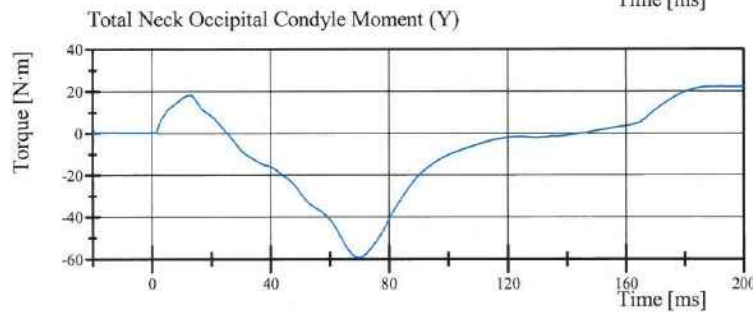
Filter Class: CFC_1000
Max: 458.7 N at 72.6 ms
Min: -175.9 N at 195.0 ms



Filter Class: CFC_600
Max: 458.3 N at 72.2 ms
Min: -175.8 N at 196.6 ms



Filter Class: CFC_600
Max: 21.9 Nm at 12.5 ms
Min: -51.7 Nm at 69.4 ms



Filter Class: Without_(Consta
Max: 22.3 N·m at 192.1 ms
Min: -59.4 N·m at 69.8 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 15:31:00 3116



Transportation Research Center Inc.

Front Thorax

HIII 5th Serial No. 426 Certification No. 38-1

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.616 m/s	Yes
Probe Force Peak Between 50.0 mm and 58.0 mm Chest Deflection	(-3,900) - (-4,400) N	-4,273.7 N	Yes
Probe Force Peak Between 18.0 mm and 50.0 mm Chest Deflection	\geq (-4,600) N	-4,301.2 N	Yes
Maximum Chest Compression	(-50) - (-58) mm	-51.4 mm	Yes
Internal Hysteresis	69 - 85 %	75.2 %	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:35:46 420

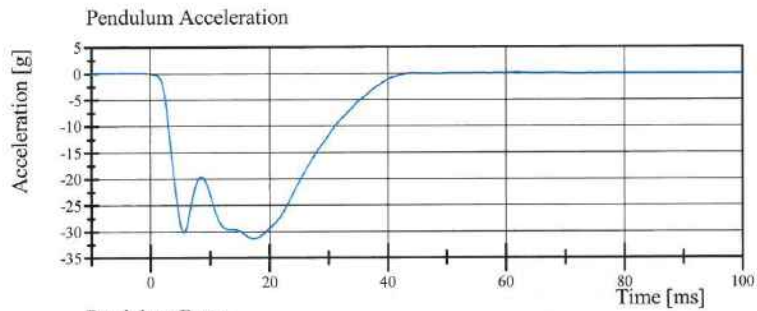


Transportation Research Center Inc.

Front Thorax

HIII 5th Serial No. 426 Certification No. 38-1

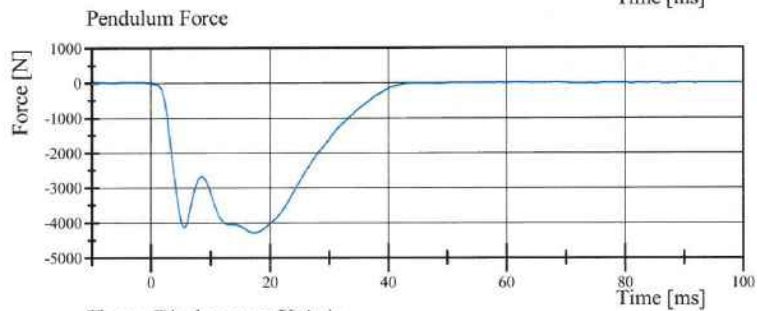
Test Date: 10/11/2016



Filter Class: CFC_180

Max: 0.1 g at 61.8 ms

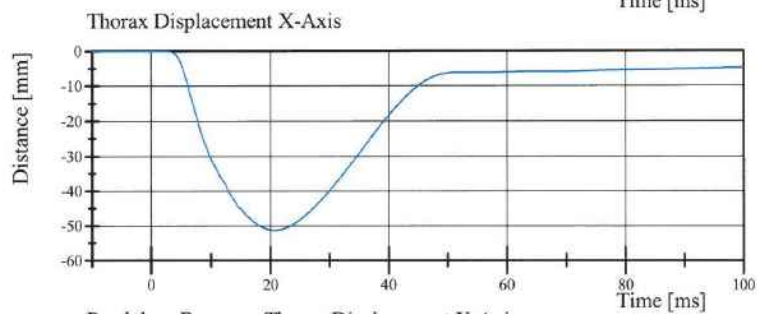
Min: -31.4 g at 17.3 ms



Filter Class: CFC_180

Max: 14.2 N at 61.8 ms

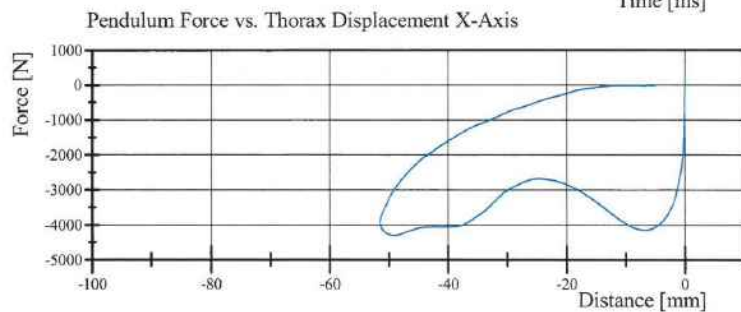
Min: -4,301.2 N at 17.3 ms



Filter Class: CFC_600

Max: 0.0 mm at -5.2 ms

Min: -51.4 mm at 20.6 ms



Filter Class: CFC_180

Max: 14.2 N at -6.1 mm

Min: -4,301.2 N at -49.1 mm

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 13:35:58 420



Transportation Research Center Inc.

Hybrid III Small Female Torso Flexion

NHTSA

Serial Number: 426

Date: 10/12/2016

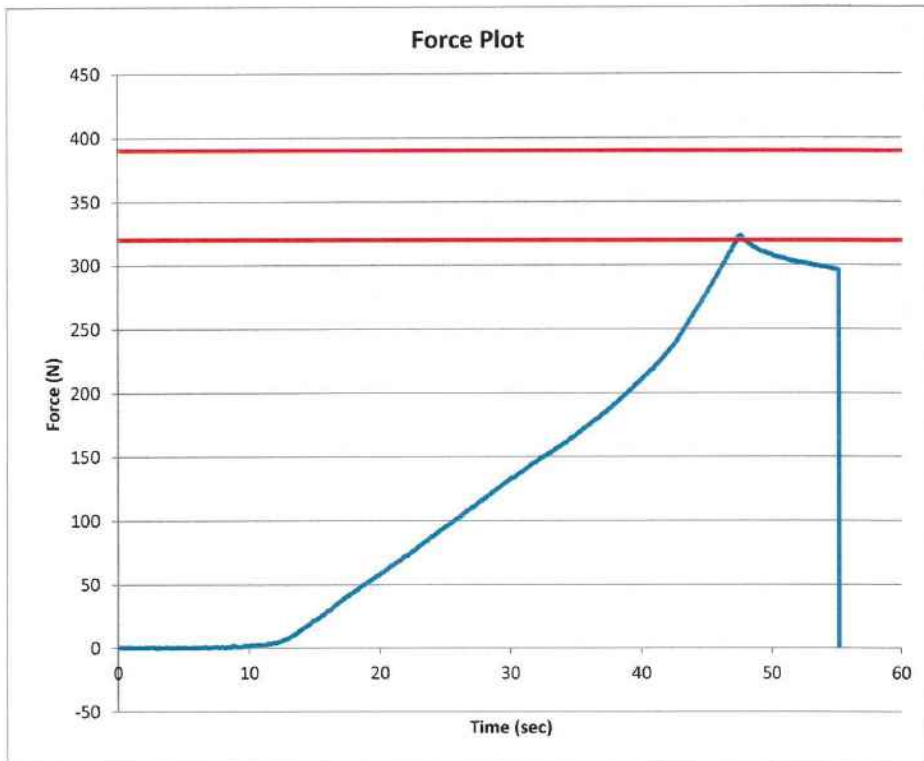
Test Number: 01

Time: 7:39

Comments:



TEST PARAMETER	SPECIFICATION		TEST RESULTS		
Temperature	18.9	- 25.6	21.6	°C	Pass
Humidity	10	- 70	41	%	Pass
Average Angular Velocity	0.5	- 1.5	0.82	deg/sec	Pass
Initial Angle	0	- 20	15.76	deg	Pass
Peak Force at 45.12°	320	- 390	323.15	N	Pass
Final Angle	-8	- 8	4.94	deg	Pass



Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 5th Serial No. 426 Certification No. 38-4

Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	22.0 °C	Yes
Relative Humidity	10 - 70 %	36 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.114 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,788.0 N	Yes

Test meets specifications.

Comments:

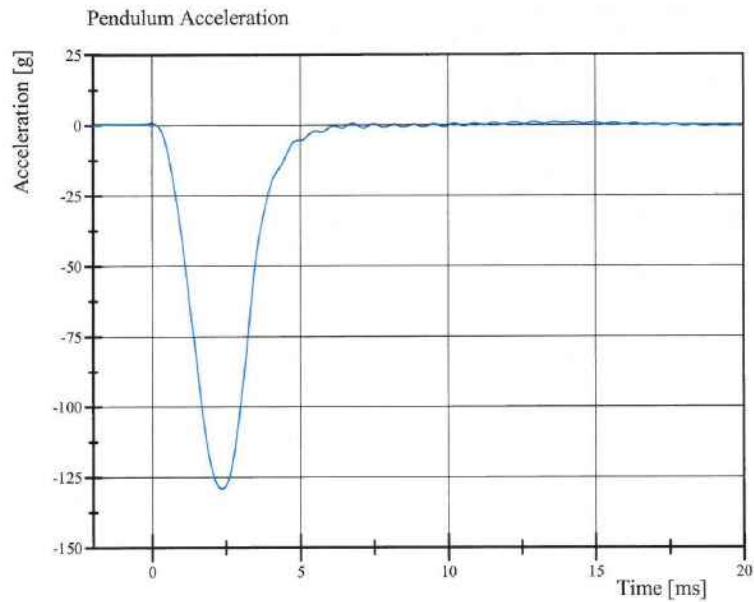
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 11:45:16 1766

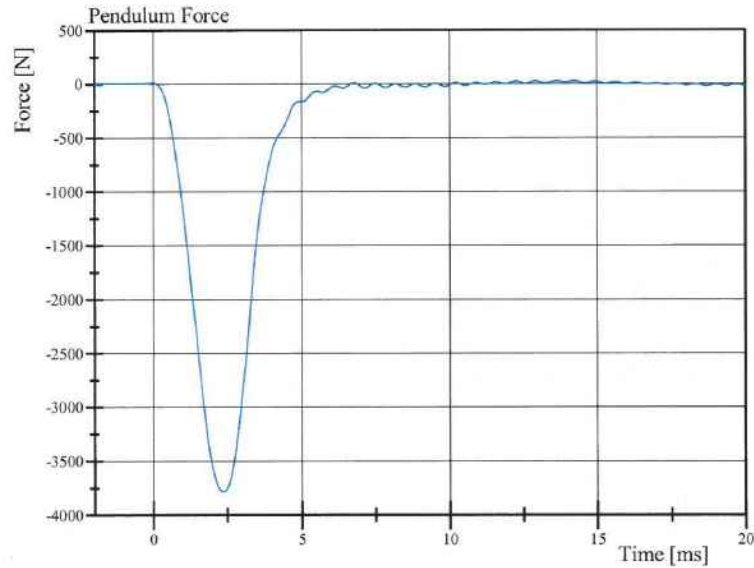


Transportation Research Center Inc.

Left Knee Femur Response Test
HIII 5th Serial No. 426 Certification No. 38-4
Test Date: 10/11/2016



Filter Class: CFC_600
Max: 0.9 g at 13.6 ms
Min: -129.2 g at 2.4 ms



Filter Class: CFC_600
Max: 26.8 N at 13.6 ms
Min: -3,788.0 N at 2.4 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 11:45:26 1766



Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. 426 Certification No. 38-1
Test Date: 10/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.2 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.114 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,785.1 N	Yes

Test meets specifications.

Comments:

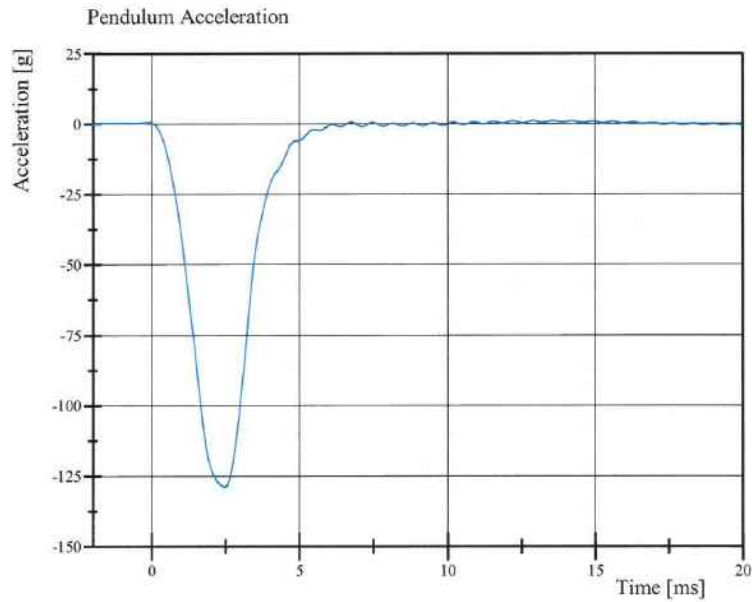
Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 10:20:01 1768

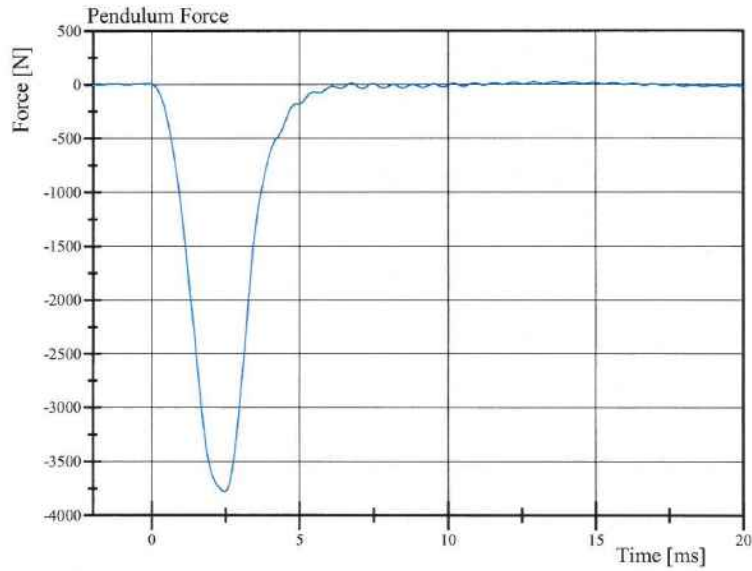


Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. 426 Certification No. 38-1
Test Date: 10/11/2016



Filter Class: CFC_600
Max: 0.9 g at 13.6 ms
Min: -129.1 g at 2.5 ms



Filter Class: CFC_600
Max: 27.2 N at 13.6 ms
Min: -3,785.1 N at 2.5 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

10.11.2016 10:20:12 1768



Post-Test Calibration Sheets

Front Passenger S/N 426

Transportation Research Center Inc.
5720 HHH 5th Dummy
External Dimensions
Serial No. 426 Calibration No. 39

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Total Sitting Height	774.7 - 800.1	780	Yes
B	Shoulder Pivot Height	431.8 - 457.2	444	Yes
C	Hip Pivot Height	81.3 - 86.3	85	Yes
D	Hip Pivot from Backline	144.8 - 149.8	147	Yes
E	Shoulder Pivot from Backline	68.6 - 83.8	78	Yes
F	Thigh Clearance	119.4 - 134.6	130	Yes
G	Back of Elbow to Wrist Pivot	243.9 - 259.1	250	Yes
H	Head Back to Backline	43.2 - 48.2	45	Yes
I	Shoulder to Elbow Length	276.8 - 297.2	286	Yes
J	Elbow Rest Height	182.8 - 203.2	196	Yes
K	Buttock Knee Length	520.7 - 546.1	535	Yes
L	Popliteal Height	355.6 - 376.0	367	Yes
M	Knee Pivot Height	393.7 - 419.1	409	Yes
N	Buttock Popliteal Length	414.0 - 439.4	431	Yes
O	Chest Depth without Jacket	175.3 - 190.5	182	Yes
P	Foot Length	218.5 - 233.7	224	Yes
R	Buttock to Knee Pivot Length	457.2 - 482.6	473	Yes
S	Head Breadth	137.1 - 147.3	141	Yes
T	Head Depth	177.8 - 188.0	182	Yes
U	Hip Breadth	299.7 - 314.9	306	Yes
V	Shoulder Breadth	350.5 - 365.7	357	Yes
W	Foot Breadth	78.8 - 94.0	83	Yes
X	Head Circumference	528.3 - 548.7	539	Yes
Y	Chest Circumference with Jacket	850.9 - 881.3	870	Yes
Z	Waist Circumference	759.5 - 789.9	775	Yes
AA	Reference Location for Chest Circumference	332.7 - 358.1	345	Yes
BB	Reference Location for Waist Circumference	160.0 - 170.2	165	Yes

Transportation Research Center Inc.

Front Head Drop

HIII 5th Serial No. 426 Certification No. 39-1

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.5 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	27 %	Yes
Peak Head Resultant Acceleration	250 - 300 g	284.9 g	Yes
Peak Head Lateral Acceleration	(-15) - 15 g	4.0 g	Yes
Is Acceleration Curve Unimodal within 10% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 13:57:55 608

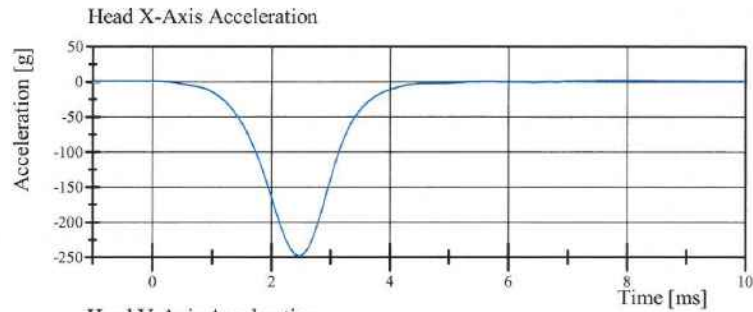


Transportation Research Center Inc.

Front Head Drop

HIII 5th Serial No. 426 Certification No. 39-1

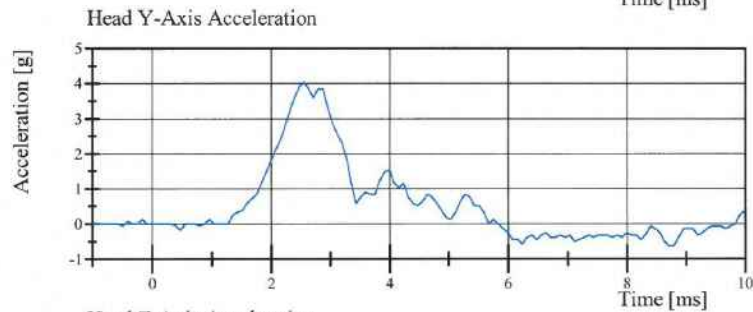
Test Date: 11/15/2016



Filter Class: CFC_1000

Max: 1.5 g at 7.8 ms

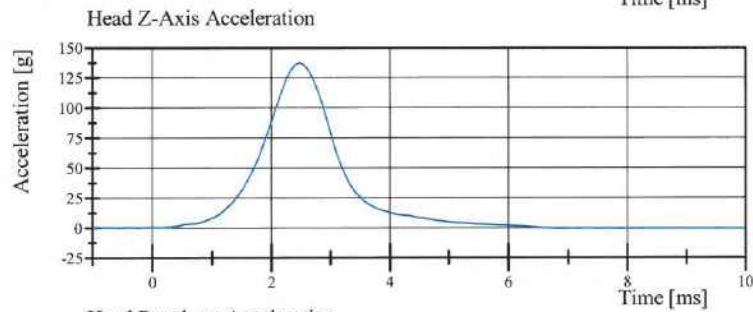
Min: -249.5 g at 2.5 ms



Filter Class: CFC_1000

Max: 4.0 g at 2.6 ms

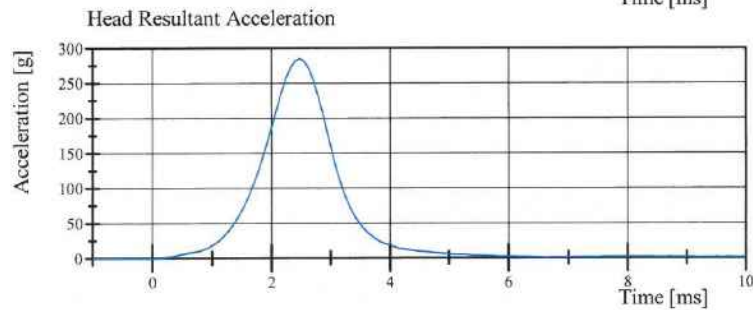
Min: -0.6 g at 8.7 ms



Filter Class: CFC_1000

Max: 137.5 g at 2.5 ms

Min: -0.7 g at 6.9 ms



Filter Class: CFC_1000

Max: 284.9 g at 2.5 ms

Min: 0.0 g at -1.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 13:58:04 608



Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 39-2

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	30 %	Yes
Pendulum Velocity	6.89 - 7.13 m/s	7.092 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	(-2.1) - (-2.5) m/s	-2.39 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	(-4.0) - (-5.0) m/s	-4.68 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	(-5.8) - (-7.0) m/s	-6.73 m/s	Yes
Total Head D-Plane Rotation	(-77) - (-91) °	-82.6 °	Yes
Total Neck Occipital Condyles Moment Between -77° and -91° Rotation	69 - 83 N·m	75.7 N·m	Yes
Total Neck Occipital Condyles Moment Decay to 10 N·m	80 - 100 ms	87.0 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 16:48:02 1845

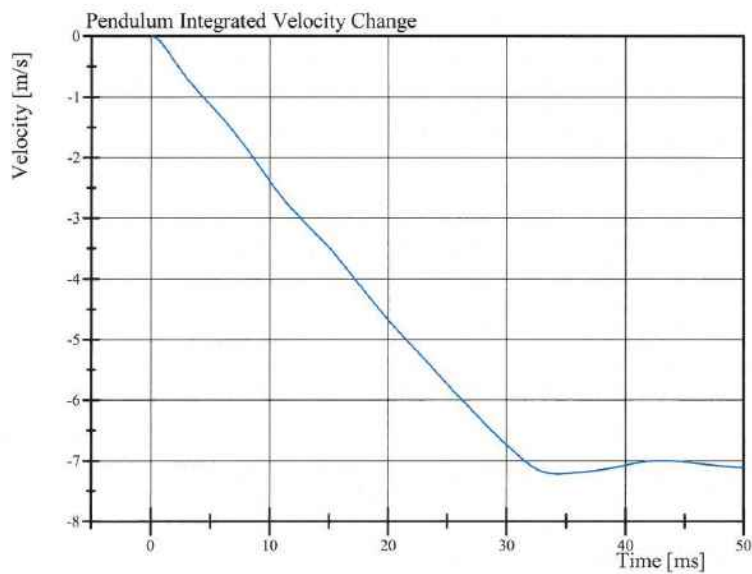
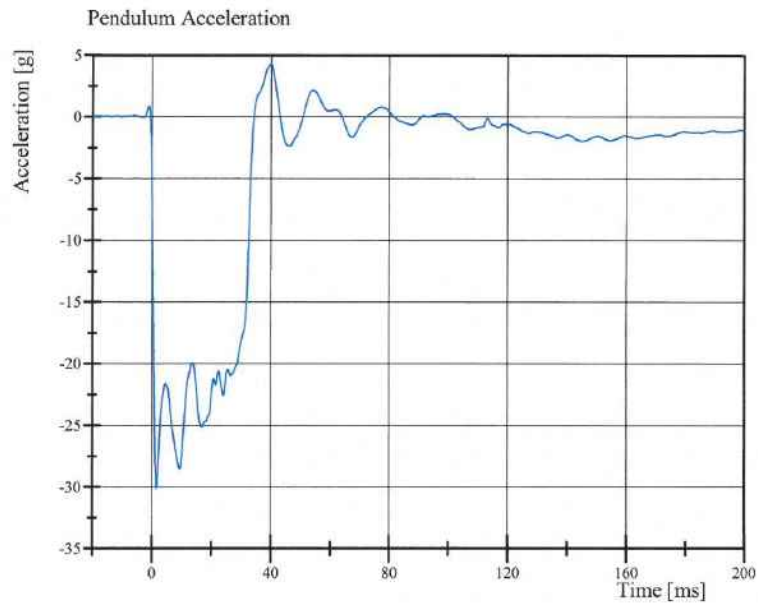


Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 39-2

Test Date: 11/15/2016



Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 16:48:12 1845



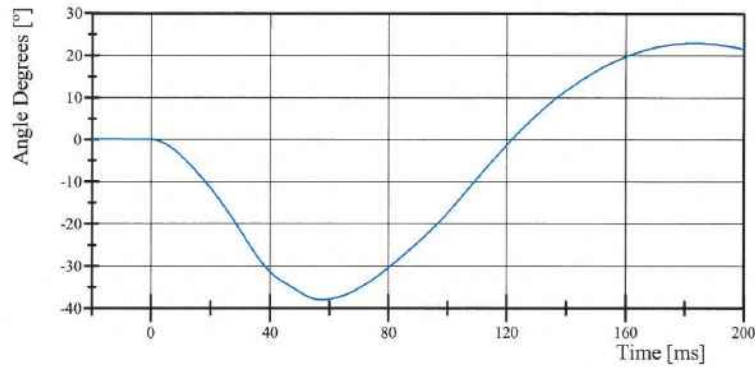
Transportation Research Center Inc.

Neck Flexion

HIII 5th Serial No. 426 Certification No. 39-2

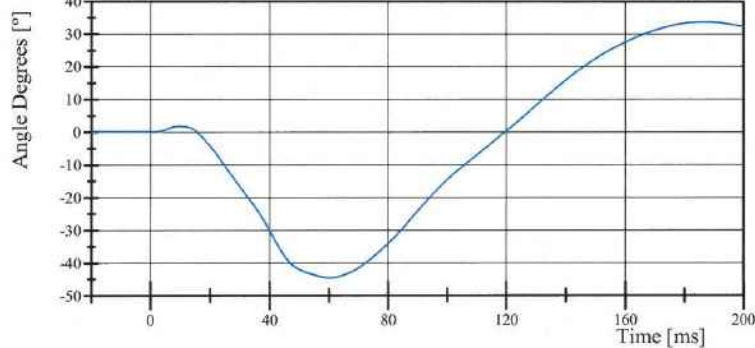
Test Date: 11/15/2016

Pot Rotation at the Base of Neck



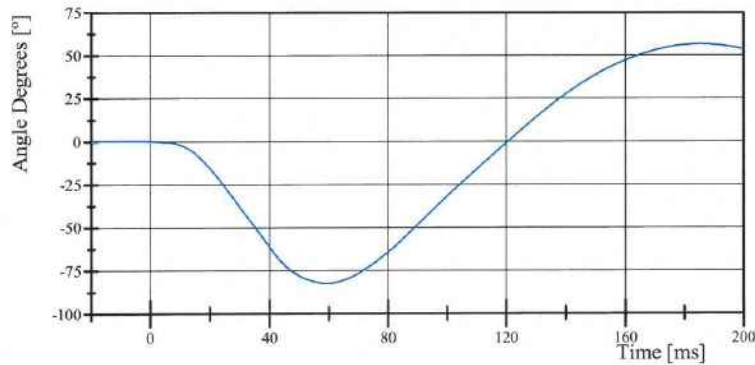
Filter Class: CFC_60
Max: 23.0 ° at 183.6 ms
Min: -38.1 ° at 57.6 ms

Head Rotation at Occipital Condyles



Filter Class: CFC_60
Max: 33.7 ° at 187.0 ms
Min: -44.7 ° at 60.4 ms

Total Head D-Plane Rotation



Filter Class: CFC_60
Max: 56.7 ° at 185.5 ms
Min: -82.6 ° at 59.5 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 16:48:13 1845

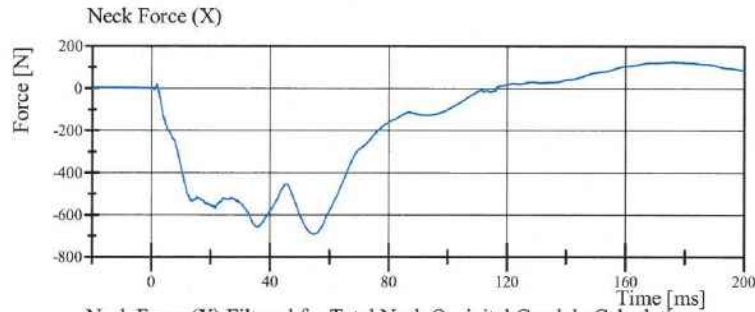


Transportation Research Center Inc.

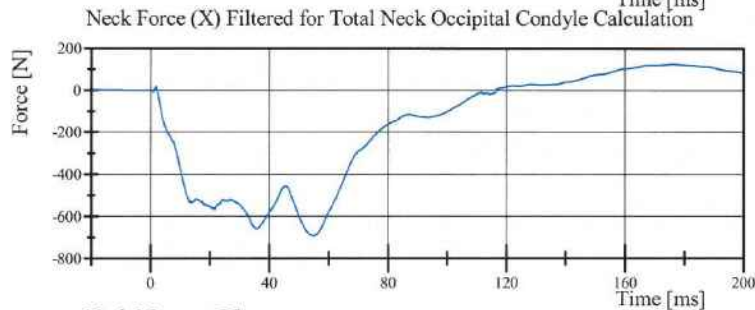
Neck Flexion

HIII 5th Serial No. 426 Certification No. 39-2

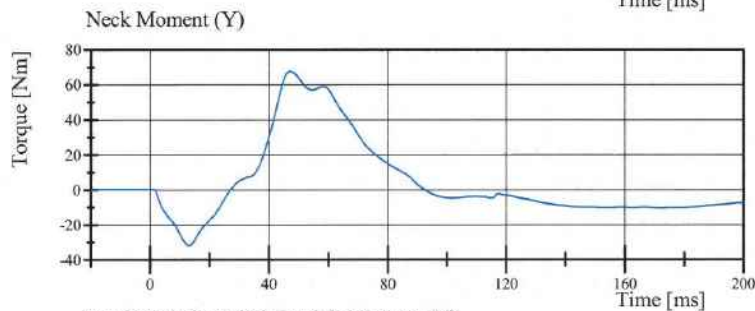
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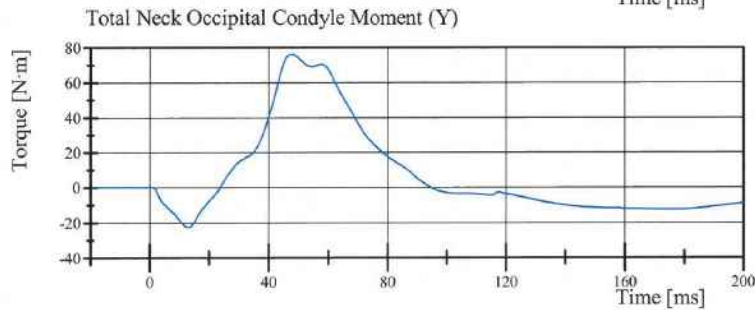
Filter Class: CFC_1000
Max: 126.6 N at 176.4 ms
Min: -693.4 N at 54.9 ms



Filter Class: CFC_600
Max: 126.1 N at 176.2 ms
Min: -692.9 N at 54.9 ms



Filter Class: CFC_600
Max: 67.4 Nm at 47.2 ms
Min: -32.3 Nm at 13.4 ms



Filter Class: Without_(Consta
Max: 76.2 N-m at 47.9 ms
Min: -22.8 N-m at 13.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 16:48:14 1845



Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 39-1

Test Date: 11/16/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	31 %	Yes
Pendulum Velocity	(-5.95) - (-6.19) m/s	-6.096 m/s	Yes
Pendulum Integrated Velocity Change at 10ms	1.5 - 1.9 m/s	1.81 m/s	Yes
Pendulum Integrated Velocity Change at 20ms	3.1 - 3.9 m/s	3.63 m/s	Yes
Pendulum Integrated Velocity Change at 30ms	4.6 - 5.6 m/s	5.25 m/s	Yes
Total Head D-Plane Rotation	99 - 114 °	102.2 °	Yes
Total Neck Occipital Condyles Moment Between 99° and 114° Rotation	(-53) - (-65) N·m	-59.3 N·m	Yes
Total Neck Occipital Condyles Moment Decay to -10 N·m	94 - 114 ms	101.3 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.16.2016 07:01:09 3115

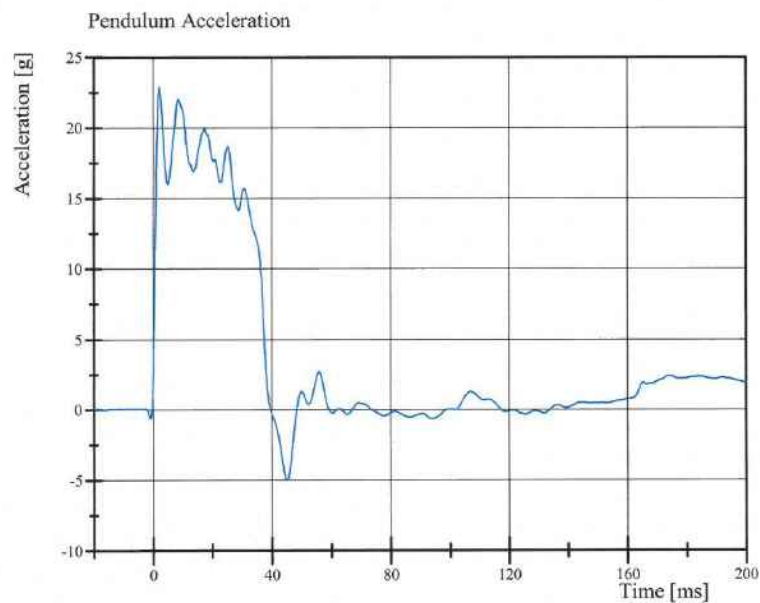


Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 39-1

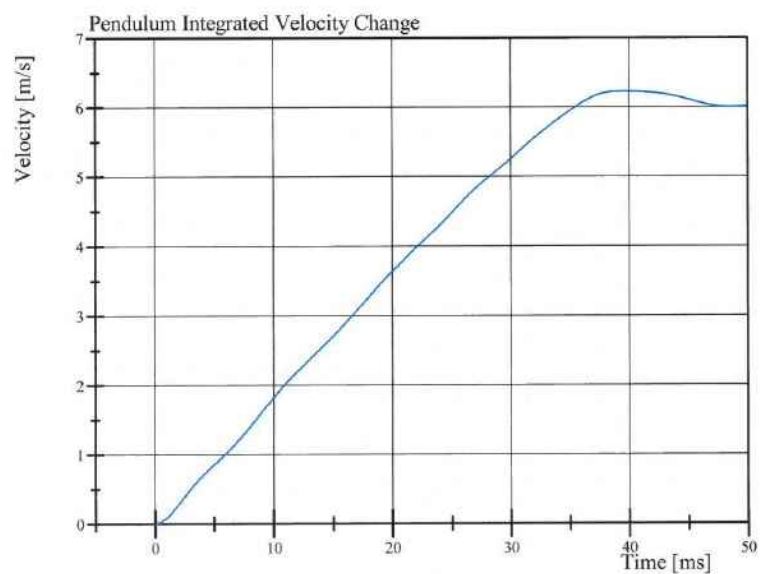
Test Date: 11/16/2016



Filter Class: CFC_180

Max: 22.8 g at 2.2 ms

Min: -5.0 g at 45.3 ms



Filter Class: CFC_180

Max: 6.2 m/s at 39.6 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.16.2016 07:01:26 3115



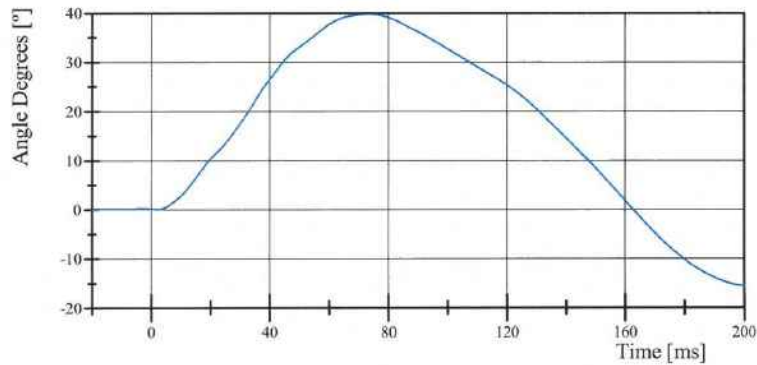
Transportation Research Center Inc.

Neck Extension

HIII 5th Serial No. 426 Certification No. 39-1

Test Date: 11/16/2016

Pot Rotation at the Base of Neck

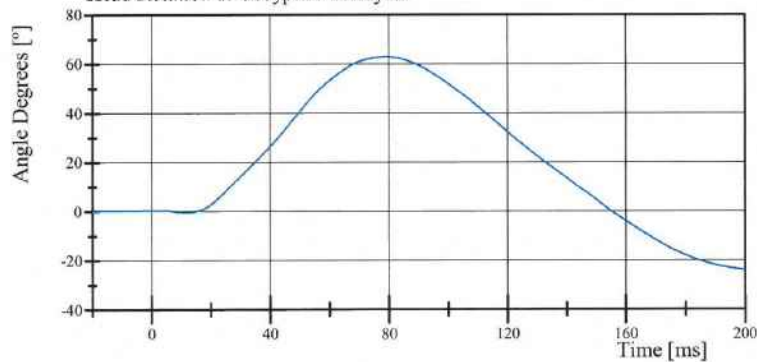


Filter Class: CFC_60

Max: 39.6 ° at 73.3 ms

Min: -15.5 ° at 200.0 ms

Head Rotation at Occypital Condyles

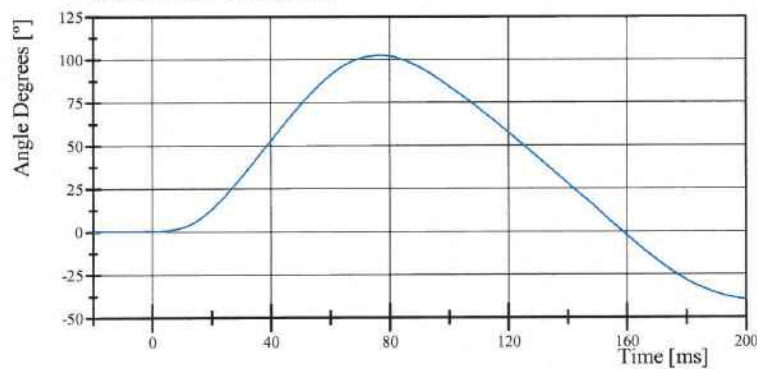


Filter Class: CFC_60

Max: 62.8 ° at 79.1 ms

Min: -24.0 ° at 200.0 ms

Total Head D-Plane Rotation



Filter Class: CFC_60

Max: 102.2 ° at 76.9 ms

Min: -39.5 ° at 200.0 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.16.2016 07:01:27 3115

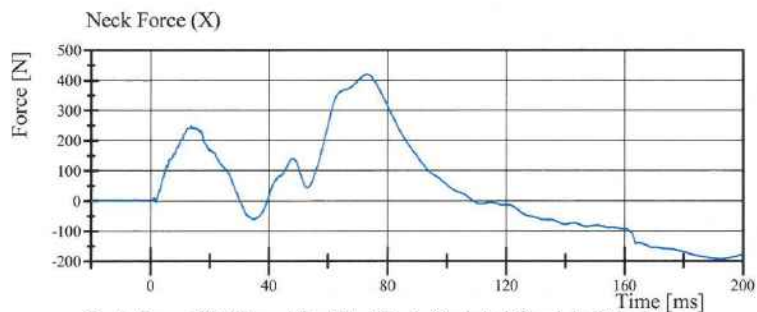


Transportation Research Center Inc.

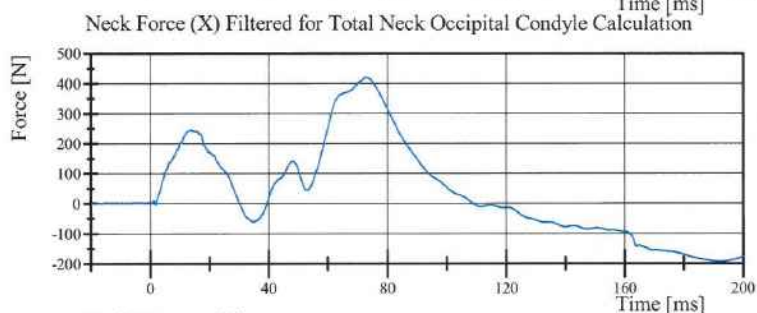
Neck Extension

HIII 5th Serial No. 426 Certification No. 39-1

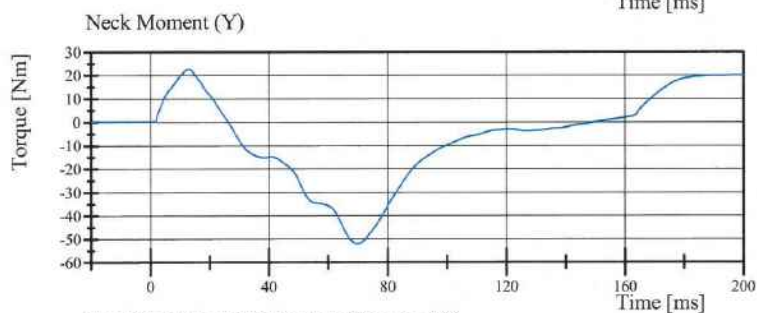
Test Date: 11/16/2016



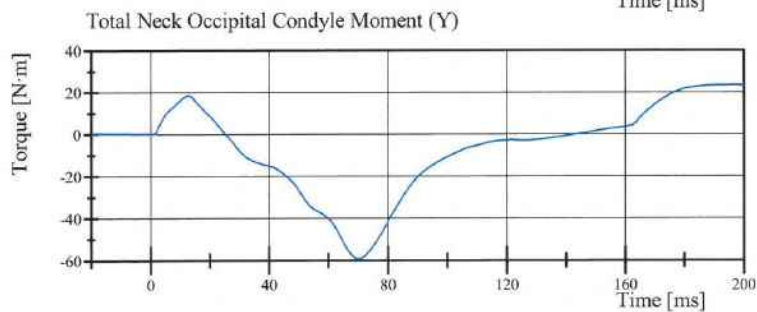
Filter Class: CFC_1000
Max: 419.3 N at 72.8 ms
Min: -193.3 N at 192.0 ms



Filter Class: CFC_600
Max: 419.2 N at 72.9 ms
Min: -193.1 N at 192.3 ms



Filter Class: CFC_600
Max: 22.5 Nm at 12.7 ms
Min: -52.2 Nm at 69.8 ms



Filter Class: Without (Consta
Max: 23.5 N·m at 195.7 ms
Min: -59.3 N·m at 70.2 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.16.2016 07:01:28 3115



Transportation Research Center Inc.

Front Thorax

HIII 5th Serial No. 426 Certification No. 39-3

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	26 %	Yes
Probe Velocity	6.59 - 6.83 m/s	6.687 m/s	Yes
Probe Force Peak Between 50.0 mm and 58.0 mm Chest Deflection	(-3,900) - (-4,400) N	-4,320.9 N	Yes
Probe Force Peak Between 18.0 mm and 50.0 mm Chest Deflection	\geq (-4,600) N	-4,541.7 N	Yes
Maximum Chest Compression	(-50) - (-58) mm	-50.2 mm	Yes
Internal Hysteresis	69 - 85 %	74.2 %	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 12:39:14 404

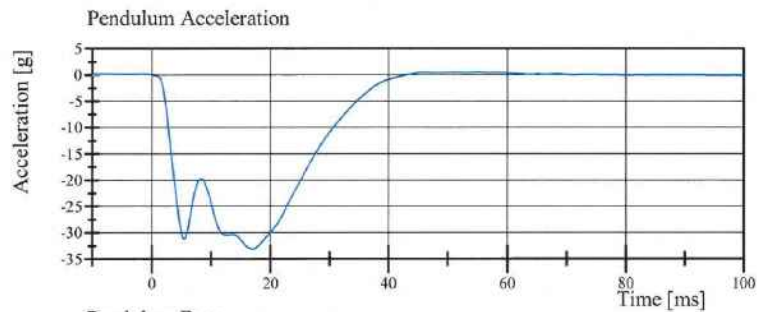


Transportation Research Center Inc.

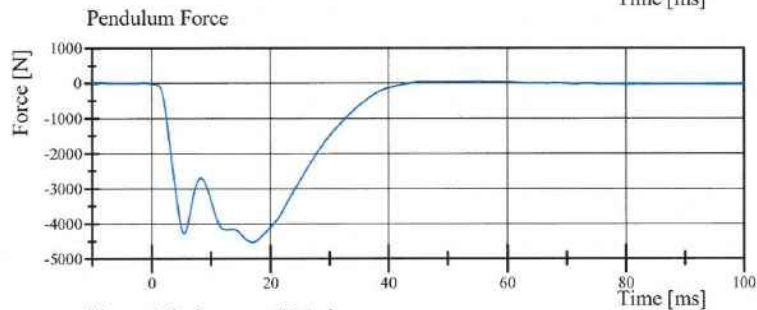
Front Thorax

HIII 5th Serial No. 426 Certification No. 39-3

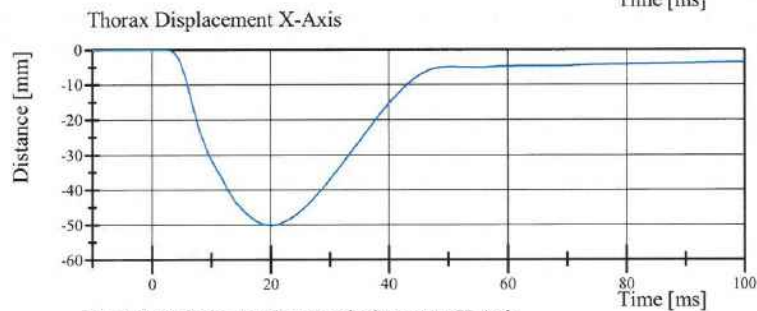
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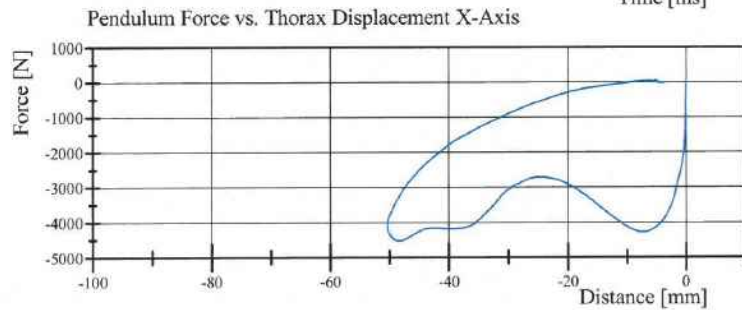
Filter Class: CFC_180
Max: 0.4 g at 55.1 ms
Min: -33.2 g at 17.0 ms



Filter Class: CFC_180
Max: 59.8 N at 55.1 ms
Min: -4,541.7 N at 17.0 ms



Filter Class: CFC_600
Max: 0.0 mm at -4.2 ms
Min: -50.2 mm at 20.2 ms



Filter Class: CFC_180
Max: 59.8 N at -5.2 mm
Min: -4,541.7 N at -48.4 mm

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 12:41:58 404



Transportation Research Center Inc.

Hybrid III Small Female Torso Flexion

NHTSA

Serial Number: 426

Date: 11/15/2016

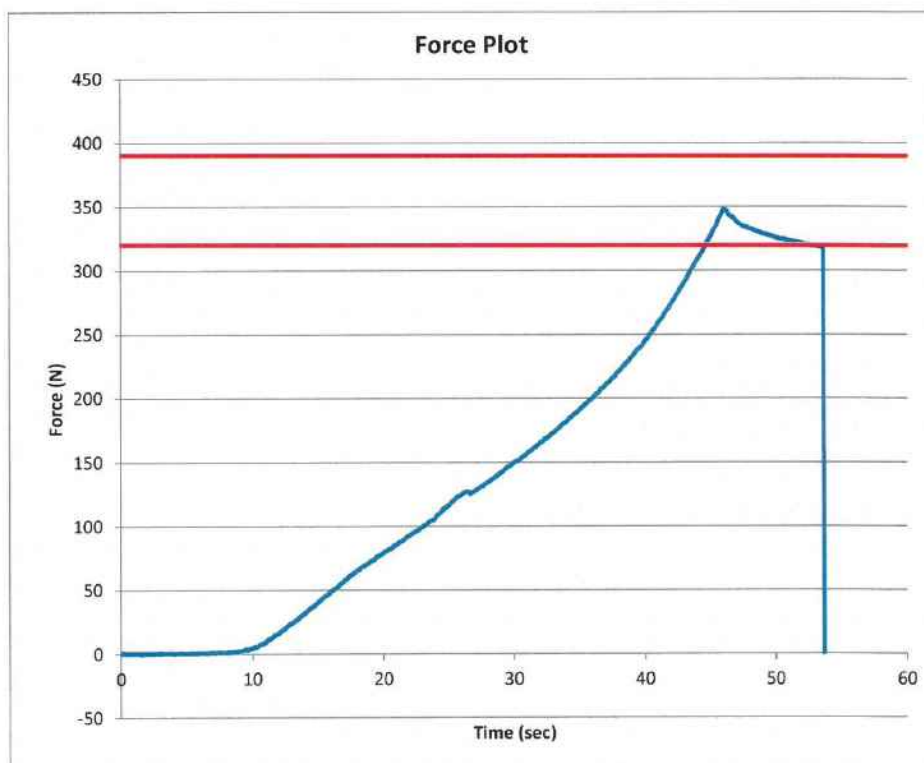
Test Number: 1

Time: 17:25

Comments:



TEST PARAMETER	SPECIFICATION	TEST RESULTS
Temperature	18.9 - 25.6	21.7 °C Pass
Humidity	10 - 70	30 % Pass
Average Angular Velocity	0.5 - 1.5	0.86 deg/sec Pass
Initial Angle	0 - 20	13.91 deg Pass
Peak Force at 45.12°	320 - 390	348.34 N Pass
Final Angle	-8 - 8	4.64 deg Pass



Transportation Research Center Inc.

Left Knee Femur Response Test

HIII 5th Serial No. 426 Certification No. 39-1

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.101 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,967.2 N	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 08:33:34 1732

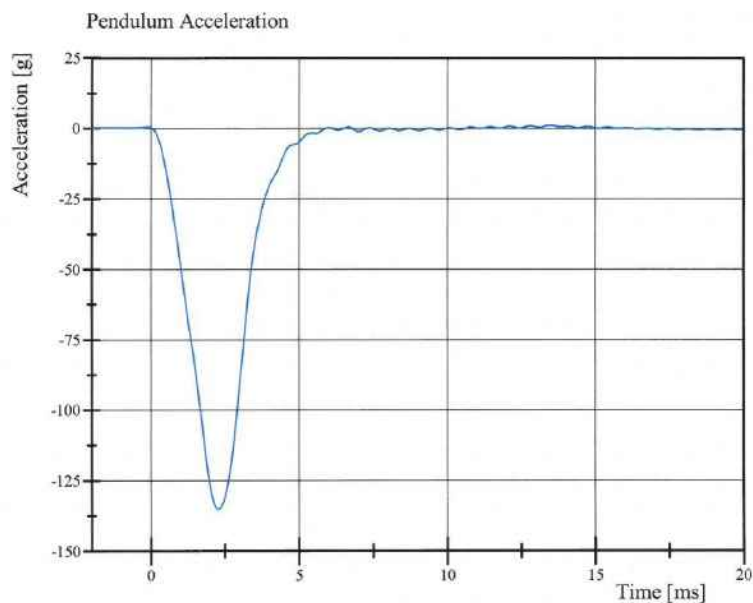


Transportation Research Center Inc.

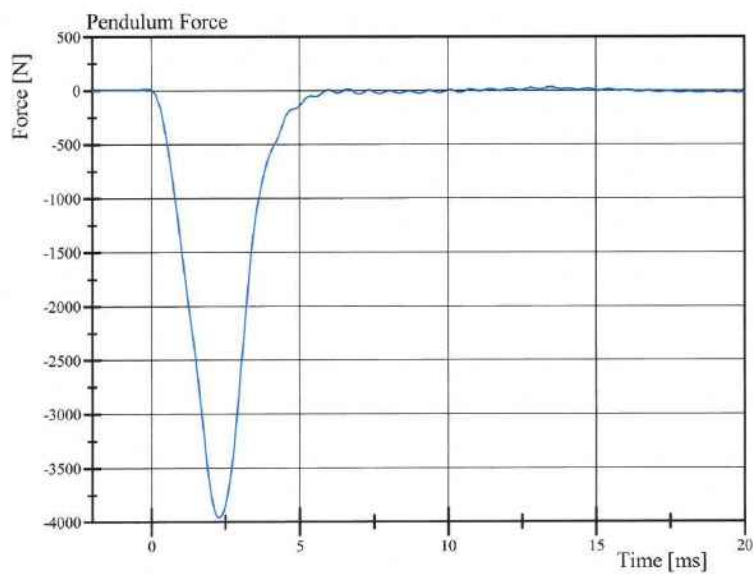
Left Knee Femur Response Test

HIII 5th Serial No. 426 Certification No. 39-1

Test Date: 11/15/2016



Filter Class: CFC_600
Max: 1.1 g at 13.4 ms
Min: -135.3 g at 2.3 ms



Filter Class: CFC_600
Max: 32.1 N at 13.4 ms
Min: -3,967.2 N at 2.3 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 08:34:52 1732



Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. 426 Certification No. 39-1
Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Probe Velocity	2.08 - 2.13 m/s	2.112 m/s	Yes
Peak Femur Force	(-3,450) - (-4,060) N	-3,749.3 N	Yes

Test meets specifications.

Comments:

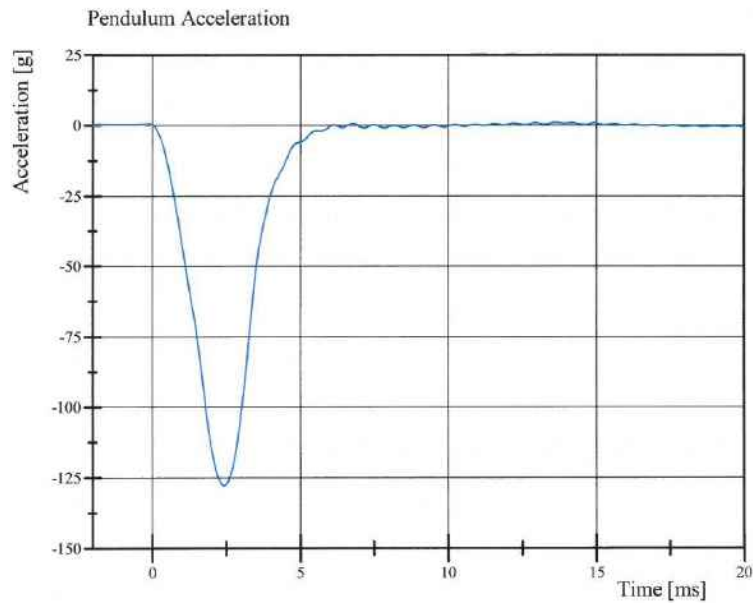
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11.15.2016 08:46:07 1727

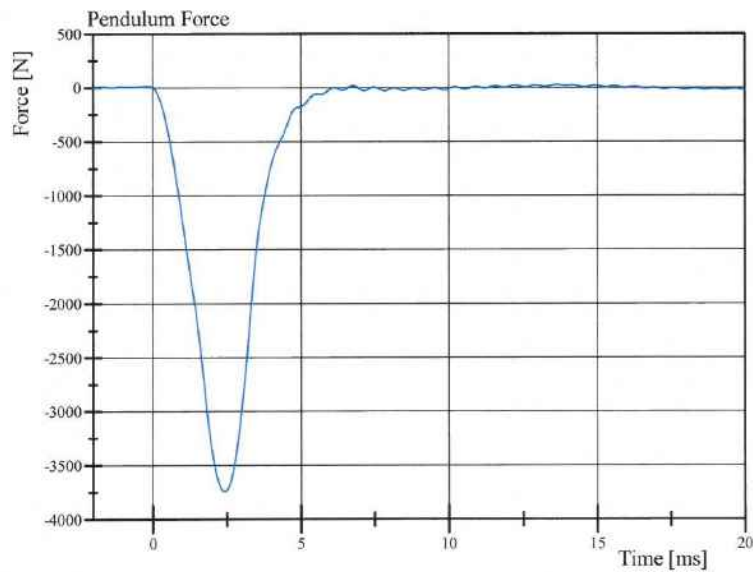


Transportation Research Center Inc.

Right Knee Femur Response Test
HIII 5th Serial No. 426 Certification No. 39-1
Test Date: 11/15/2016



Filter Class: CFC_600
Max: 0.9 g at 13.6 ms
Min: -127.9 g at 2.4 ms



Filter Class: CFC_600
Max: 26.0 N at 13.6 ms
Min: -3,749.3 N at 2.4 ms

Specification Source: CFR49 Part 572 Subpart O
with Polarity in accordance with J211

11.15.2016 08:47:13 1727



How to Research Stiffness Data

Stiffness Calculations - Contractor Report

Contractor Report

NHTSA Test

9986

FINAL REPORT NUMBER: SINCAP-TRC-17-004

**NEW CAR ASSESSMENT PROGRAM (NCAP)
MOVING DEFORMABLE BARRIER SIDE IMPACT TEST**

**Toyota Motor Manufacturing Canada, Inc.
2017 Toyota Corolla 4DR Sedan
NHTSA NUMBER: M20175106**

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



Report Date: December 20, 2016

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE, Room W43-410
Washington, D.C. 20590**

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Report Prepared By: ILO Project Operations Group

Report Approved By: 

John Shultz

Approval Date: December 20, 2016

FINAL REPORT ACCEPTANCE BY OCWS:

Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590		13. Type of Report and Period Covered Final Test Report November 16, 2016 – December 20, 2016																																																									
		14. Sponsoring Agency Code NRM-110																																																									
15. Supplemental Notes																																																											
16. Abstract <p>This 55 / 28 km/h 90° Moving Deformable Barrier SINCAP Side Impact Test was conducted on the subject 2017 Toyota Corolla 4DR Sedan, in accordance with the specifications of the Office of Crashworthiness Standards Test Procedure for the generation of consumer information on vehicle side crash protection. This test was conducted by Transportation Research Center Inc. in East Liberty, Ohio, on November 16, 2016.</p> <p>The impact velocity of the Moving Deformable Barrier (MDB) was 62.55 km/h, and the ambient temperature at the struck (left) side of the target vehicle at the time of impact was 21.4° C. The target vehicle post-test maximum crush was 205 mm at Level 2. The test vehicle's performance was as follows:</p> <table border="1"> <thead> <tr> <th colspan="4">Driver ATD (ES-2re)</th> </tr> <tr> <th>Measurement Description</th><th>Units</th><th>IARV</th><th>Result</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td><td>N/A</td><td>1000</td><td>130</td></tr> <tr> <td>Maximum Thoracic Rib Deflection</td><td>mm</td><td>44</td><td>18.9</td></tr> <tr> <td>Total Abdominal Force</td><td>N</td><td>2500</td><td>577.1</td></tr> <tr> <td>Pubic Symphysis Force</td><td>N</td><td>6000</td><td>-1,571.1</td></tr> <tr> <td>Lower Spine Acceleration</td><td>G</td><td>82*</td><td>29.6</td></tr> </tbody> </table> <table border="1"> <thead> <tr> <th colspan="4">Passenger ATD (SID-IIs)</th> </tr> <tr> <th>Measurement Description</th><th>Units</th><th>IARV</th><th>Result</th></tr> </thead> <tbody> <tr> <td>Head Injury Criteria (HIC₃₆)</td><td>N/A</td><td>1000</td><td>392</td></tr> <tr> <td>Lower Spine Resultant Acceleration</td><td>g's</td><td>82</td><td>73.9</td></tr> <tr> <td>Total Pelvic Force (sum of acetabular and iliac forces)</td><td>N</td><td>5525</td><td>3,477.0</td></tr> <tr> <td>Maximum Thoracic Rib Deflection</td><td>mm</td><td>38*</td><td>39.2</td></tr> <tr> <td>Maximum Abdominal Rib Deflection</td><td>mm</td><td>45*</td><td>27.1</td></tr> </tbody> </table> <p>* Proposed IARV</p> <p>The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.</p>				Driver ATD (ES-2re)				Measurement Description	Units	IARV	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	130	Maximum Thoracic Rib Deflection	mm	44	18.9	Total Abdominal Force	N	2500	577.1	Pubic Symphysis Force	N	6000	-1,571.1	Lower Spine Acceleration	G	82*	29.6	Passenger ATD (SID-IIs)				Measurement Description	Units	IARV	Result	Head Injury Criteria (HIC ₃₆)	N/A	1000	392	Lower Spine Resultant Acceleration	g's	82	73.9	Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3,477.0	Maximum Thoracic Rib Deflection	mm	38*	39.2	Maximum Abdominal Rib Deflection	mm	45*	27.1
Driver ATD (ES-2re)																																																											
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SECTION 1
TEST PURPOSE AND PROCEDURE

TEST PURPOSE AND PROCEDURE

This moving deformable barrier side impact test was conducted as part of the MY 2017 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-14-D-00354. The purpose of this test is to generate comparative side impact performance in a 2017 Toyota Corolla 4DR Sedan. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure dated October 2015.

SECTION 2

SUMMARY OF TEST RESULTS

A 2017 Toyota Corolla 4DR Sedan was impacted on the left (driver's) side by a Moving Deformable Barrier (MDB) which was moving forward in a 27° crabbed position to the tow road guidance system at a velocity of 62.55 km/h (38.87 mph). The target vehicle was stationary and was positioned at an angle of 63° to the line of forward motion. The side impact test was conducted by the Transportation Research Center Inc. in East Liberty, Ohio, on November 16, 2016. Pre-test and post-test photographs of the test vehicle and the MDB and the dummies (ES-2-re and SID-IIs) are included in this report.

Dummies were placed in the driver and left rear designated seating positions according to instructions specified in the OCWS Side Impact Laboratory Test Procedure, dated October 2015. The side impact event was documented by 11 cameras. Camera locations are included in this report.

The dummies were instrumented in the following manner:

DRIVER ATD (ES-2re)

Primary and redundant head CG tri-axial accelerometers

Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers

Abdomen forward, middle, and rear y-axis load cells

Lower spine (T12) tri-axial accelerometers

Pubic symphysis y-axis load cell

PASSENGER ATD (SID-IIs)

Primary and redundant head CG triaxial accelerometers

Chest upper rib, middle rib, and lower rib y-axis displacement potentiometers

Abdomen upper rib and lower rib y-axis displacement potentiometers

Lower spine (T12) tri-axial accelerometers

Acetabulum and iliac wing y-axis load cells

APPENDIX B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in APPENDIX C of this report. APPENDIX D of this report contains the test equipment and instrumentation calibration data.

Dummy injury readings were recorded as follows:

Measurement Description	Driver ATD (ES-2-re)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	130
Maximum Thoracic Rib Deflection	mm	44	18.9
Combined Abdominal Force	N	2500	577.1
Pubic Symphysis Force	N	6000	-1,571.1
Lower Spine (T12) Resultant Acceleration	G	82*	29.6

* Proposed IARV

Measurement Description	Passenger ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC ₃₆)	N/A	1000	392
Lower Spine (T12) Resultant Acceleration	G	82	73.9
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	3,477.0
Maximum Thoracic Rib Deflection	mm	38*	39.2
Maximum Abdominal Rib Deflection	mm	45*	27.1

* Proposed IARV

Supplemental Restraint Information is given below:

Restraint Type	Left Front (Driver) Occupant Location 1		Left Rear (Passenger) Occupant Location 4	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	N/A
Side Pelvis Airbag	No	N/A	No	N/A
Knee Airbag	Yes	No	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Unknown	No	N/A
Other	No	N/A	No	N/A

GENERAL COMMENTS

All doors remained closed throughout the test. No fuel spillage occurred during the impact or the static rollover test which followed. Injury values for the Driver ATD (ES-2-re) were within the established performance thresholds. The Passenger ATD (SID-IIs) Upper Thorax Rib Deflection exceeded the threshold value.

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	M20175106
Model Year	2017
Make	Toyota
Model	Corolla LE
Body Style	4 Door
VIN	2T1BURHEXHC750301
Body Color	Slate Metallic
Odometer Reading (km/mi)	9
Engine Displacement (L)	1.8
Type/No. Cylinders	Inline/4
Engine Placement	FRT/ Transverse
Transmission Type	Automatic CVT
Transmission Speeds	N/A
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	Yes
Other Optional Feature	No
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head/Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso/Pelvis Airbag	No
Rear Passenger Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	No
Driver Load Limiter	Yes
Rear Passenger Load Limiter	No
Other Safety Restraint	Yes

Does owner's manual provide instructions to turn off automatic door locks?

Yes

DATA FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing Canada, Inc.
Date of Manufacture	09/16
Vehicle Type	Passenger Car

GVWR (lb)	3820
GAWR Front (lb)	2070
GAWR Rear (lb)	1850

VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	N/A	5
Capacity Weight (VCW) (kg)				381
DSC x 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				40.8

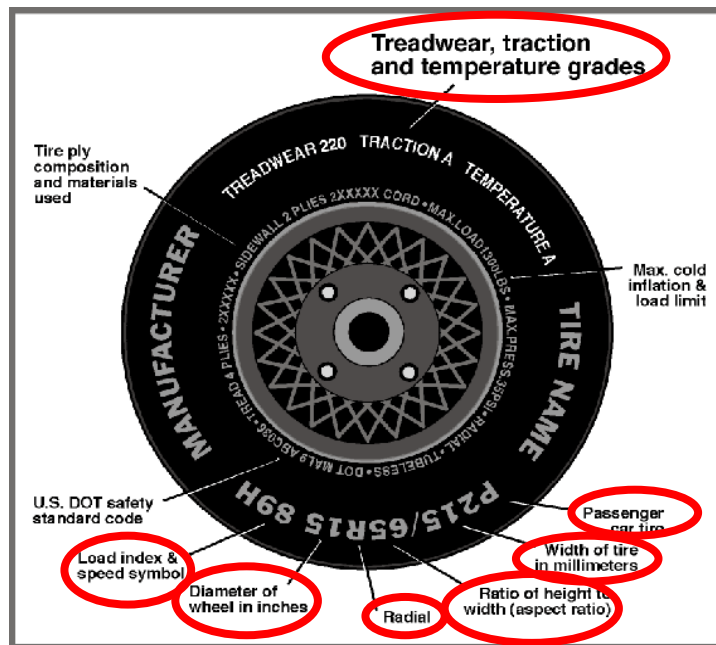
VEHICLE SEAT TYPE

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						w/ Lever	w/ Knob
Front Seat	Yes	N/A	N/A		N/A	Yes	N/A
Rear or Second Row Seat	N/A	N/A	Yes	Yes	Yes	N/A	N/A
Third Row Seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



DATA FROM TIRE PLACARD

Measured Parameter	Front	Rear
Maximum Tire Pressure (kPa)	350	350
Cold Pressure (kPa)	220	220
Recommended Tire Size	P205/55R16	P205/55R16
Tire Size on Vehicle	P205/55R16	P205/55R16
Tire Manufacturer	Michelin	Michelin
Tire Model	Primacy MXV4	Primacy MXV4
Treadwear	620	620
Traction	A	A
Temperature Grades	A	A
Tire Plies Sidewall	1	1
Tire Plies Body	4	4
Load Index/Speed Symbol	89H	89HM
Tire Material	Polyester/Polyamide/Steel	Polyester/Polyamide/Steel
DOT Safety Code Left	B3WC 02NX 3216	B3WC 02NX 3216
DOT Safety Code Right	B3WC 02NX 3216	B3WC 02NX 3216

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

TIRE PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kPa	234	241	262	255
Tire Placard	kPa	220	220	220	220
Owner's Manual	kPa	N/A	N/A	N/A	N/A
As Tested	kPa	220	220	220	220

MDB TIRE SPECIFICATIONS

	Units	Requirement	LF	RF	LR	RR
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21 kPa	207	207	207	207

TEST VEHICLE AXLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total	Front Axle	Rear Axle	Total
Left	kg	404.6	267.8		460.0	321.8		451.8	335.4	
Right	kg	395.2	247.0		403.0	289.6		400.8	292.4	
Ratio	%	60.8	39.2		58.5	41.5		57.6	42.4	
Totals	kg	799.8	514.8	1314.6	863.0	611.4	1474.4	852.6	627.6	1480.4

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total As Delivered Weight (UVW)	kg	1314.6	(A)
Actual Weight of 1 P572V ATD (SID-IIs) Dummy Used	kg	125.0	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	40.8	(C)
Calculated Vehicle Target Weight (TVTW)	kg	1480.4	(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? ☒ YES ☐ NO

TEST VEHICLE ATTITUDES AND CG

Measurement Description	Units	Fully Loaded	As Tested	Meets Requirement
LF	mm	700	699	Yes
RF	mm	710	708	Yes
RR	mm	717	718	Yes
LR	mm	703	705	Yes
Vehicle CG (Aft of Front Axle)	mm	1146	1120	
Vehicle CG (Left+)/Right(-) from Longitudinal Centerline)	mm	+49	+46	

***The "As Tested" vehicle attitude measurements must be equal to or within ± 10 mm of the "Fully Loaded" vehicle attitude measurements at each wheel well. Indicate "Yes" or "No" for "Meets Requirement".

Test height adjustable suspension setting, if applicable:

N/A

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Ballast: None	0.0
Removed: Right tail light, rear bumper fascia and trunk liner	5.2

¹ Rated cargo and luggage weight limited to 41 kg or 90 lbs.

DATA SHEET NO. 2

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

SEAT POSITIONING

The driver seat, front center seat (if applicable), and right front passenger's seat should be set to the mid-track, lowest, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL(°)		
	Max.	Min.	Mid
Driver Seat	16.0	19.4	17.7
Front Passenger Seat	N/A	N/A	15.7
Front Center Seat*	N/A	N/A	N/A
Struck Side Rear Seat	N/A	Fixed	17.9
Non-Struck Side Rear Seat	N/A	Fixed	17.1
Rear Center Seat*	N/A	Fixed	15.9

* If applicable.

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCR P Height (mm)	SCR P Height Position	SCR P Height (mm)		
				Rearmost	Mid- Fore/Aft	Forward- Most
Driver Seat	17.7	156	Max	N/A	N/A	N/A
			Mid	146	156	165
			Min	N/A	N/A	N/A
Front Passenger Seat	15.7	140	Max	N/A	N/A	N/A
			Mid	130	140	150
			Min	N/A	N/A	N/A
Front Center Seat*	N/A	N/A	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	N/A	N/A	N/A
Struck Side Rear Seat	17.9	Fixed	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	N/A	N/A	N/A
Non-Struck Side Rear Seat	17.1	Fixed	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	N/A	N/A	N/A
Rear Center Seat*	15.9	Fixed	Max	N/A	N/A	N/A
			Mid	N/A	N/A	N/A
			Min	N/A	N/A	N/A

* If applicable.

DATA SHEET NO. 2 (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEM DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan

NHTSA No.: M20175106

Test Program: SINCAP Side Impact

Test Date: 11/16/16

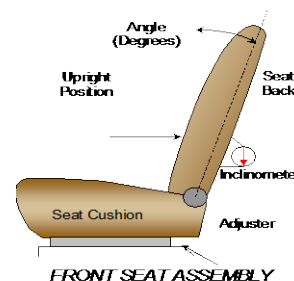
SEAT FORE/AFT POSITION

Seat	Total Fore/Aft Travel		Test Position from Forwardmost Position	
	mm	Detents	mm	Detent
Driver Seat	240	25	120	12
Front Passenger Seat	240	25	120	12
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat	Fixed	N/A	Fixed	N/A
Non-Struck Side Rear Seat	Fixed	N/A	Fixed	N/A
Rear Center Seat*	Fixed	N/A	Fixed	N/A

* If applicable

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned to the manufacturer's designated seat back angle. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck side rear seat back is positioned such that the dummy's head is level. The rear center and non-struck side rear outboard seat backs are positioned in a similar manner as the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Most Upright	
	Degrees	Detents	Degrees	Detent
Driver Seat w/ Seated Dummy	55.7	29	2.4	3
Front Passenger Seat	55.4	29	2.6	3
Front Center Seat*	N/A	N/A	N/A	N/A
Struck Side Rear Seat w/ Seated Dummy	Fixed	N/A	Fixed	N/A
Non-Struck Side Rear Seat	Fixed	N/A	Fixed	N/A
Rear Center Seat*	Fixed	N/A	Fixed	N/A

* If applicable

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1.

	Total # of Positions	Placed in Position #
Driver Seat	4, Numbered from 0 to 3	3, Uppermost
Rear Seat	1, Fixed	1, Fixed

HEAD RESTRAINT ADJUSTMENT

The driver's head restraint is adjusted to the highest and most full forward in-use position. The struck-side rear passenger's head restraint is adjusted to the lowest and most full forward in-use position.

	Total # of Positions	Placed in Position #
Driver Seat	3, Numbered from 0 to 2	2, Uppermost
Rear Seat	3, Numbered from 0 to 2	2, Uppermost

DATA SHEET NO. 2 (CONTINUED)

SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT AND FUEL SYSTEMS DATA

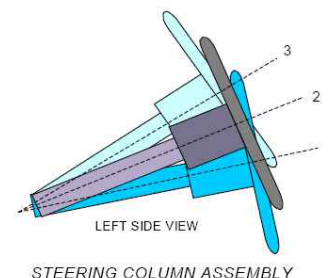
Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

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STEERING COLUMN ADJUSTMENT

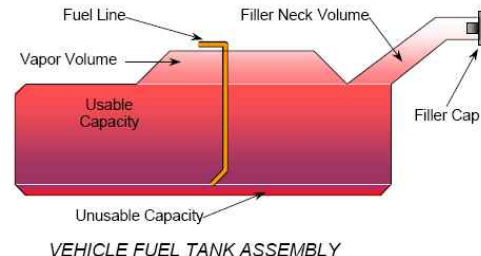
Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.

	Degrees	Fore/Aft Position (mm)
Lowermost, Position No. 1	20.8	
Geometric Center, Position No. 2	22.5	
Uppermost, Position No. 3	24.2	
Telescoping Steering Wheel Travel		34
Test Position	22.5	17



FUEL PUMP

The electric fuel pump is activated when the ignition is turned on.



FUEL TANK CAPACITY

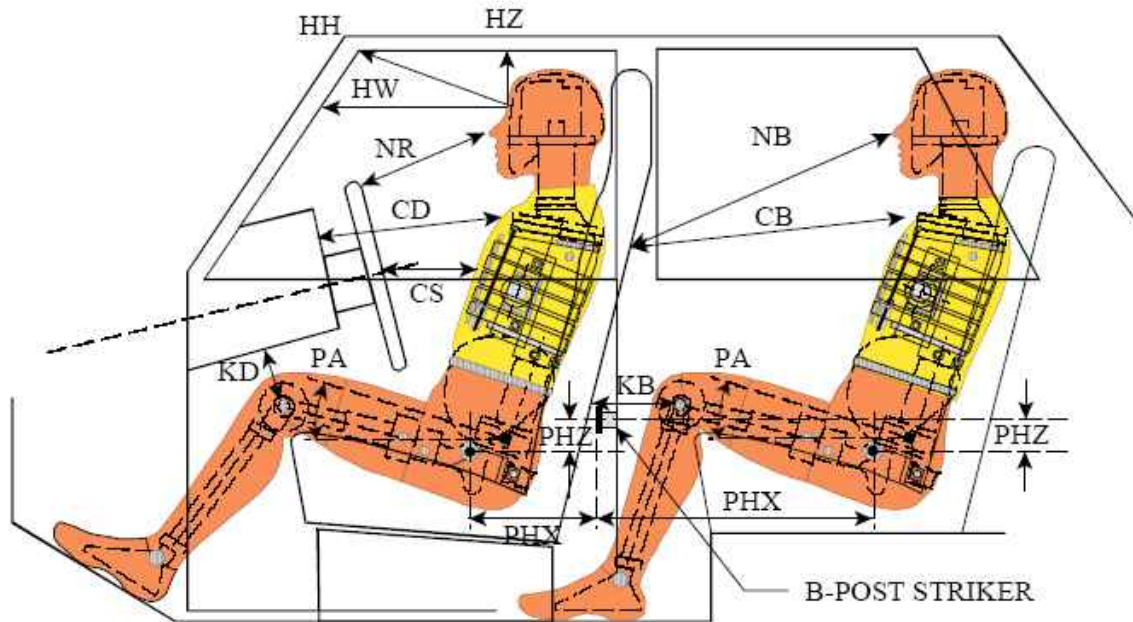
	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	48.8
Usable Capacity of "Optional Tank" (see Form No. 1)	N/A
Usable Capacity of Standard Tank (see Owner's Manual)	50.0
Usable Capacity of Optional Tank (see Owner's Manual)	N/A
93% of Usable Capacity	45.4
Actual Amount of Solvent Used in Test	45.4
1/3 of Usable Capacity	16.3

Is the Actual Amount of Solvent Used in the test equal to 93% \pm 1% of the Usable Capacity stated in on Form No. 1? ☒ YES ☐ NO

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



LEFT SIDE VIEW

NOTE: 2-DOOR VEHICLE SHOWN.
 REAR DUMMY PHX & PHZ
 MEASUREMENTS FOR A 4-DOOR
 VEHICLE WOULD USE THE C-POST
 STRIKER AS A REFERENCE POINT

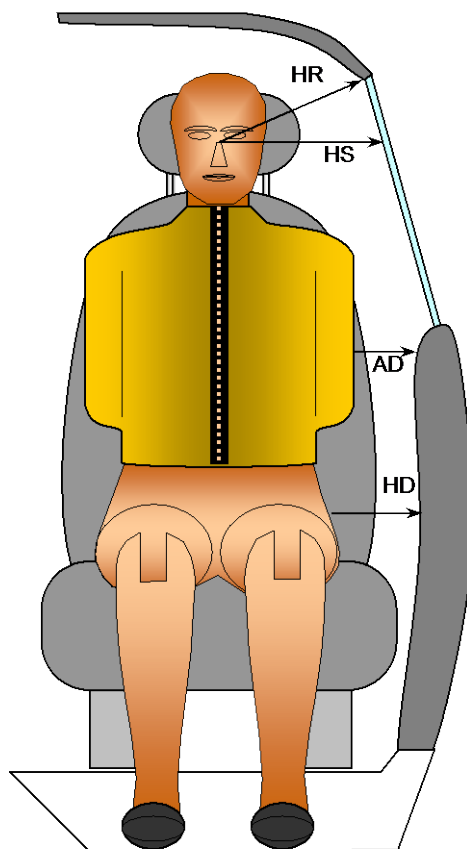
DUMMY LONGITUDINAL CLEARANCE DIMENSION INFORMATION

Driver Code	Pass. Code	Measurement Description	Driver		Passenger	
			Length (mm)	Angle	Length (mm)	Angle
HH		Header to Header	344			
HW		Header to Windshield	602			
HZ	HZ	Head to Roof Liner	153		237	
NR	NB	Nose to Rim/Seat Back	415		673	
CD	CB	Chest to Dash/Seat Back	518		626	
CS		Chest to Steering Wheel	292			
KD(L)/KDA(L) [°]	KB(L)/KBA(L) [°]	Left Knee to Dash/Seat Back	120	23.7	335	0.0
KD(R)/KDA(R) [°]	KB(R)/KBA(R) [°]	Right Knee to Dash/Seat Back	117	25.0	337	0.0
PAX [°]	PAX [°]	Pelvic Tilt Angle X		0.1		0.0
	PAY [°]	Pelvic Tilt Angle Y				21.7
PHX	PHX	Hip Point to Striker (X-Axis)	219		333	
PHZ	PHZ	Hip Point to Striker (Z-Axis)	203		342	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



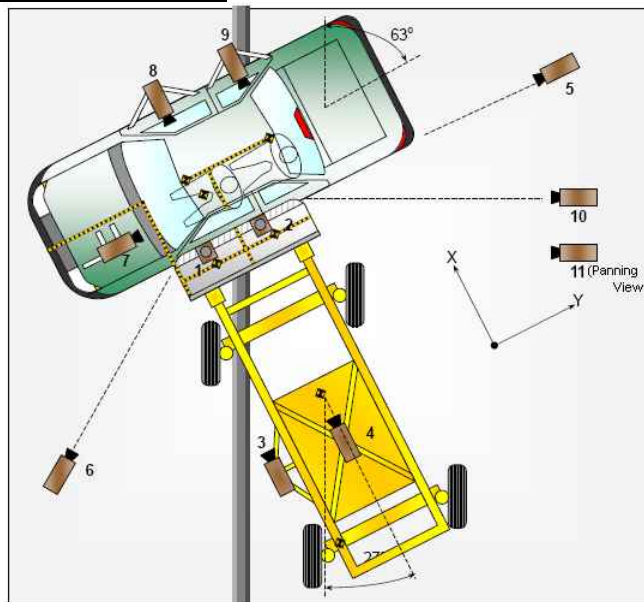
FRONT VIEW OF DUMMY

Code	Description	Units	Driver	Passenger
HR	Head to Side Header	mm	117	231
HS	Head to Side Window	mm	200	349
AD	Arm to Door	mm	80	152
HD	H-Point to Door	mm	164	167

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



CAMERA LOCATIONS AND DATA

No.	Camera View	Coordinates (mm)			Lens Length (mm)	Operating Frame Rate (fps)
		X	Y	Z		
1	Overhead Overall	-160	1150	5692	8.5	1000
2	Overhead Close-up	0	770	5692	16	1000
3	Left Impact Point (MDB)	1811	890	860	25	1000
4	Side Overall (MDB)	2625	0	1500	12.5	1000
5	Rear	0	5646	1080	20	1000
6	Left Front	2438	4339	1070	20	1000
7	Driver Front (OB)				25	1000
8	Driver Side (OB)				12.5	1000
9	Passenger Side (OB)				12.5	1000
10	Real-time Left Rear				Zoom	30
11	Real-time Inrun				Zoom	30

Reference: Impact Point projected to Ground; +X = To Front of MDB +Y = To Right of MDB; +Z = Down

*All measurements accurate to ± 6 mm.

If applicable, explain why camera(s) did not operate as intended: N/A

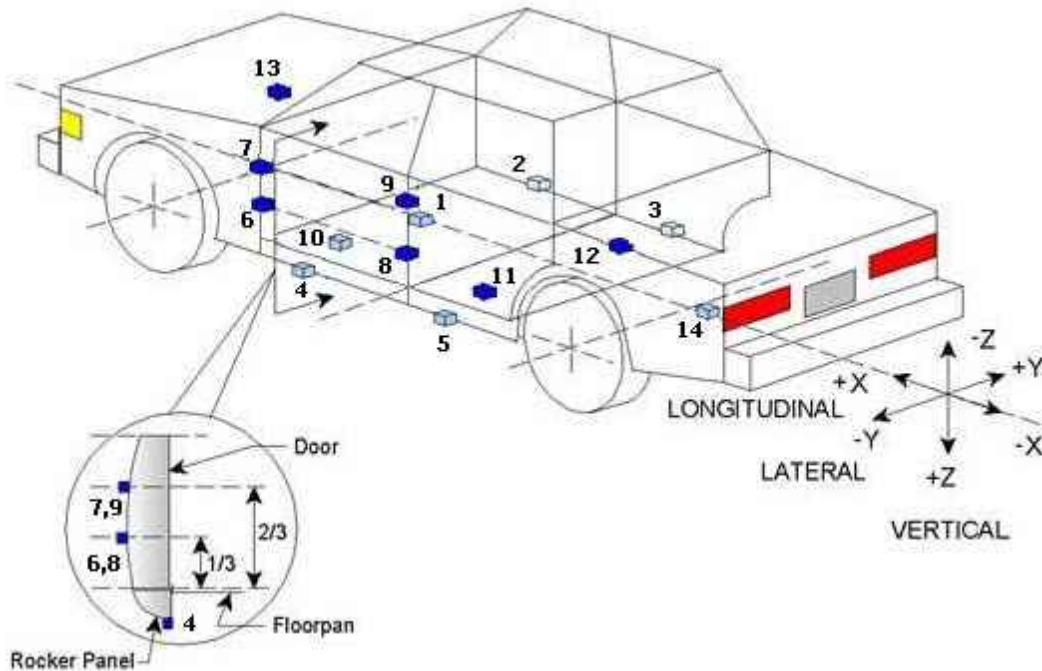
INSTRUMENTATION

Driver Dummy Channels	16
Passenger Dummy Channels	16
Vehicle Structure Accelerometers	23
MBD Accelerometers	5
TOTAL	60

DATA SHEET NO. 6
TEST VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



TEST VEHICLE ACCELEROMETER LOCATIONS

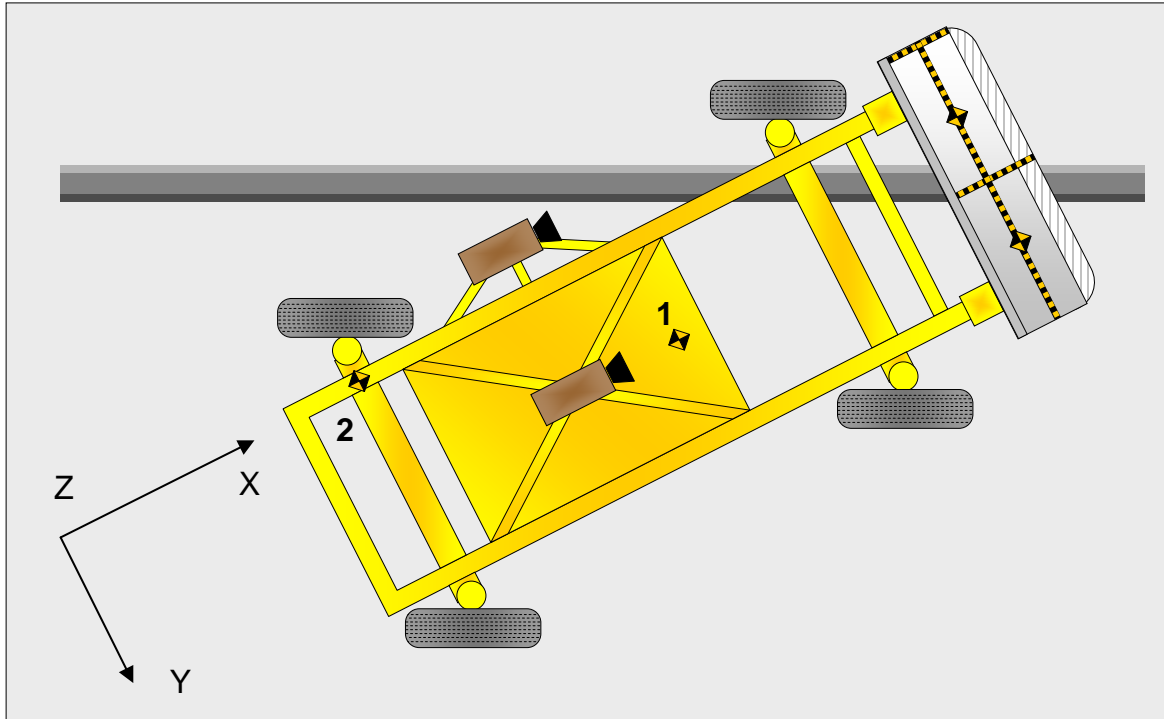
Loc. No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	2842	11	-812
2	Right Sill at Front Seat	2820	705	-306
3	Right Sill at Rear Seat	1955	705	-312
4	Left Sill at Front Door	2758	-700	-305
5	Left Sill at Rear Door	1935	-705	-320
6	A-Post Lower	3220	-815	-485
7	A-Post Middle	3245	-815	-802
8	B-Post Lower	2142	-805	-520
9	B-Post Middle	2105	-795	-880
10	Front Seat Track	2390	-540	-310
11	Rear Seat Structure	1498	-595	-350
12	Right Rear Occ. Compartment	1700	710	-316
13	Engine Block	3880	25	-297
14	Rear Above Axle	1080	0	-482

Reference: X - Rear surface of vehicle (+ forward)
 Y - Vehicle Centerline (+ to right)
 Z - Ground Plane (+ down)

**DATA SHEET NO. 7
MDB ACCELEROMETER LOCATIONS**

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: SINCAP Side Impact

NHTSA No.: M20175106
Test Date: 11/16/16



MDB ACCELEROMETER LOCATIONS

Loc. No.	Accelerometer Location	Coordinates (mm)		
		X	Y	Z
1	MDB CG	-2179	0	-505
2	MDB Rear	-3648	-650	-618

Reference : X - Face of MDB (+ forward)
Y - MDB Centerline (+ to right)
Z - Ground Plane (+ down)

**DATA SHEET NO. 8
POST-TEST OBSERVATIONS**

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: SINCAP Side Impact

NHTSA No.: M20175106
Test Date: 11/16/16

TEST DUMMY INFORMATION AND CONTACT POINTS

Dummy Body Part	Front Seat Dummy (ES2-re)	Rear Seat Dummy (SID-IIs)
Face	SCAB	SCAB
Top of Head	Assist handle, Head liner	SCAB, Head liner
Left Side of Head	SCAB	SCAB
Back of Head	None	SCAB
Left Shoulder	SCAB, SAB, Door panel	SCAB
Upper Torso	Seat back bolster, SAB	None
Lower Torso	Seat back bolster	Door panel
Left Hip	Seat cushion bolster, Door panel	Seat cushion bolster, Door panel
Left Knee	Door panel	Door panel

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Trunk Lid
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Record Width of Opening at Striker (mm)	N/A	N/A	N/A	N/A	N/A

POST-TEST SEAT PERFORMANCE

Description	Struck Side		Non-Struck Side	
	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	N/A	No	N/A
Seat Disengagement from Floor pan	No	N/A	No	N/A
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	Good
Sill Separation	None
Windshield Damage	None
Side Window Damage	Driver and passenger window shattered
Other Notable Effects	None

DATA SHEET NO. 8 (CONTINUED)
POST TEST OBSERVATIONS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	Yes	No		
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	N/A
Side Pelvis Airbag	No	N/A	No	N/A
Seat Belt Pretensioner	Yes	Yes	No	N/A
Seat Belt Load Limiter	Yes	Unknown	No	N/A
Other	No	N/A	No	N/A

IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vehicle Wheel Base	mm		2703
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		412
Actual Impact Point (Aft of Front Axle)	mm		418
Horizontal Offset (+ forward / - rearward)	mm	+/- 50 of Intended Impact point	-6
Vertical Offset (+ down / - up)	mm	+/- 20 of Intended Impact point	-5

DATA SHEET NO. 9
MDB SUMMARY OF RESULTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: SINCAP Side Impact

NHTSA No.: M20175106
Test Date: 11/16/16

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1252
Overall Length Including Honeycomb Face	4115
Wheel Base of Framework Carriage	2591
C.G. Location aft of Front Axle	1109

MDB WEIGHTS

	Units	Front Axle	Rear Axle	Total
Left	kg	420.0	256.4	676.4
Right	kg	359.6	327.0	686.6
Ratio	%	57.2	42.8	100.0
Totals	kg	779.6	583.4	1363.0

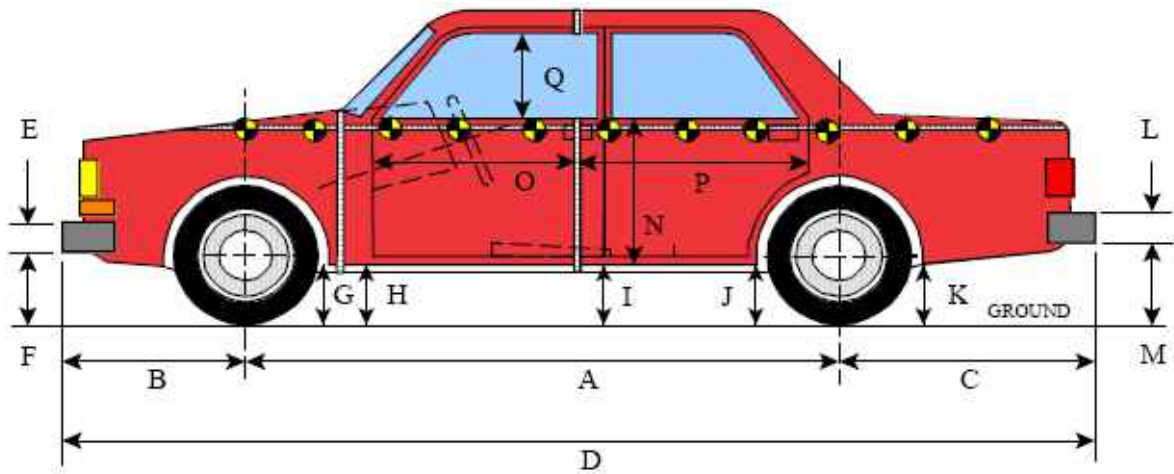
SPEED AND IMPACT ANGLE DATA

Measured Parameter	Units	Requirement	Value
Trap No. 1 Velocity (Primary)	km/h	61.1 to 62.7	62.55
Trap No. 2 Velocity (Redundant)	km/h	61.1 to 62.7	62.56
MDB CL to Target Vehicle CL	degrees	88.5 to 91.5	90
MDB Forward Line of Motion to Target Vehicle CL	degrees	62.5 to 63.5	63
MDB Crabbed Angle to MDB Forward Line of Motion	degrees	26 to 28	27

DATA SHEET NO. 10
TEST VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



LEFT SIDE VIEW

ALL MEASUREMENTS IN (mm) WITH TOLERANCE OF $\pm 3\text{mm}$

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	2703	2703	0
B	Front Axle to Front Surface of Vehicle	980	950	30
C	Rear Axle to Rear Surface of Vehicle	970	1002	-32
D	Total Length at Centerline	4650	4655	-5
E	Front Bumper Thickness	102	102	0
F	Front Bumper Bottom to Ground	418	408	10
G	Sill Height at Front Wheel Well	203	240	-37
H	Sill Height at Front Door Leading Edge	201	240	-39
I	Sill Height at B-Pillar	238	240	-2
J1	Sill Height at Rear Wheel Well	218	246	-28
J2	Pinch Weld Height at Rear Wheel Well	156	189	-33
K	Sill Height Aft of Rear Wheel Well	260	310	-50
L	Rear Bumper Thickness	165	165	0
M	Rear Bumper Bottom to Ground	423	472	-49
N	Sill Height to Window Bottom Sill	715	460	255
O	Front Door Leading Edge to Impact CL	831	697	134
P	Rear Door Trailing Edge to Impact CL	1401	1110	291
Q	Front Window Opening	418	380	38
R	Right Side Length	4521	4540	-19
S	Left Side Length	4520	4555	-35
T	Vehicle Width	1768	1765	3

DATA SHEET NO. 11

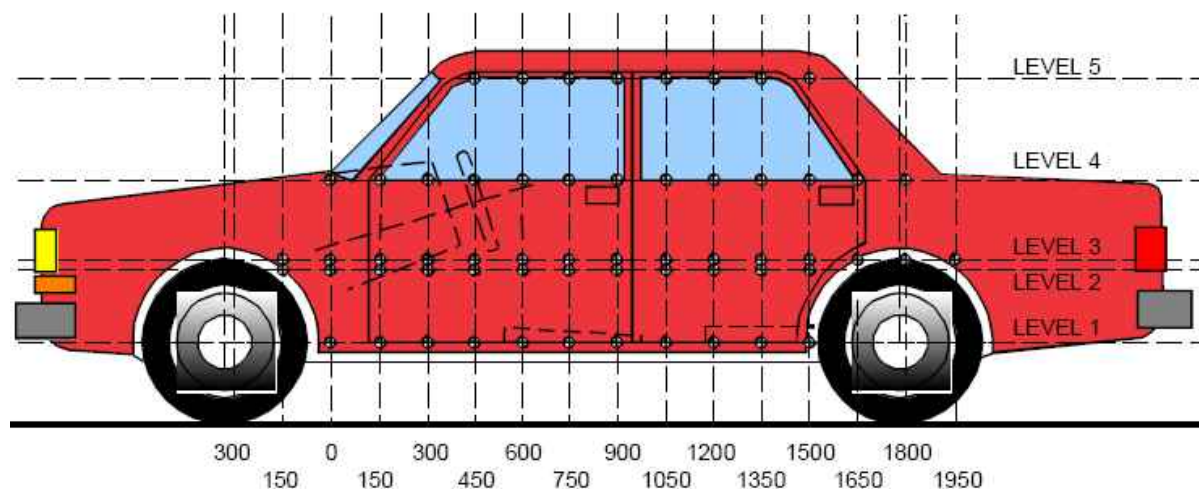
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan

NHTSA No.: M20175106

Test Program: SINCAP Side Impact

Test Date: 11/16/16



LEFT SIDE VIEW

MAXIMUM EXTERIOR CRUSH MEASUREMENTS

Level	Measurement Description	Height Above Ground	Maximum Exterior Static Crush	Distance From Impact
1	Sill Top	265	31	1050
2	Driver Hip Point	538	205	600
3	Mid-Door	610	189	600-750
4	Window Sill	905	160	1650
5	Window Top	1395	9	1350-1500

NOTE: The above measurements were taken along the vertical impact reference line.
Vehicle measurements forward of the vertical impact reference line are negative.

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

EXTERIOR CRUSH MEASUREMENTS AT EACH LEVEL

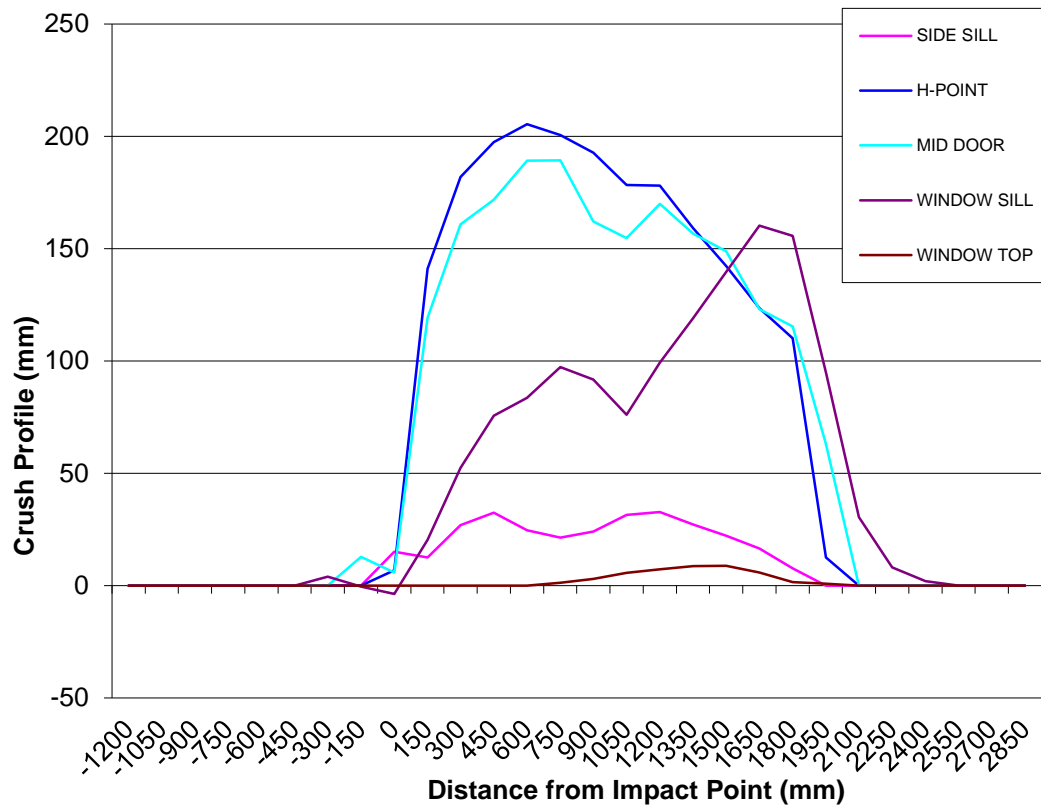
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-750	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-450	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
-300	0	0	0	776	0	0	0	0	772	0	0	0	0	4	0
-150	0	0	876	781	0	0	0	863	782	0	0	0	13	-1	0
0	838	872	870	783	0	823	865	864	787	0	15	7	6	-4	0
150	832	869	870	794	0	820	728	750	774	0	12	141	120	20	0
300	834	870	871	802	0	807	688	710	750	0	27	182	161	52	0
450	836	870	872	810	0	803	673	701	734	0	33	197	171	76	0
600	836	870	873	817	0	811	665	684	734	0	25	205	189	83	0
750	834	870	873	824	534	812	669	684	726	533	22	201	189	98	1
900	833	869	872	830	556	809	676	710	739	553	24	193	162	91	3
1050	832	867	871	835	563	801	688	716	758	558	31	179	155	77	5
1200	834	865	870	838	567	802	687	700	739	559	32	178	170	99	8
1350	836	862	867	841	567	808	703	710	722	558	28	159	157	119	9
1500	836	860	864	842	566	814	718	715	703	557	22	142	149	139	9
1650	835	860	861	840	565	819	736	737	680	559	16	124	124	160	6
1800	833	865	863	837	556	825	755	748	681	555	8	110	115	156	1
1950	0	872	873	824	535	0	859	811	730	534	0	13	62	94	1
2100	0	0	0	822	0	0	0	0	792	0	0	0	0	30	0
2250	0	0	0	822	0	0	0	0	814	0	0	0	0	8	0
2400	0	0	0	811	0	0	0	0	809	0	0	0	0	2	0
2550	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2700	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2850	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

NOTE: Pre-test measurements are taken when the vehicle is in the "As Tested" weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush profile grid is established prior to the test based on an estimated impact point.

DATA SHEET NO. 11 (CONTINUED)
TEST VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
Test Program: SINCAP Side Impact

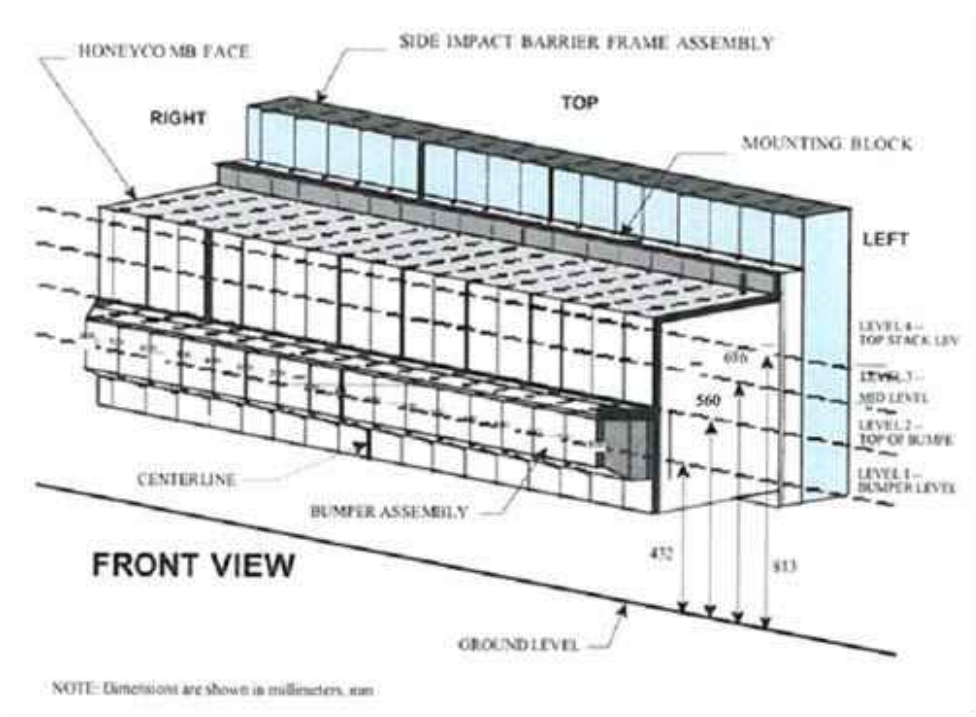
NHTSA No.: M20175106
Test Date: 11/16/16



DATA SHEET NO. 12
MDB EXTERIOR STATIC CRUSH MEASUREMENTS

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE

Vertical Location			From Centerline		Maximum Crush
Row	Description	Height	Distance	Direction	
A	Center of Bumper	432	800	Right	236
B	Top of Bumper	560	300-300	Right-Left	373
C	Mid-Level	686	800	Left	88
D	Top of Stack	813	100	Right	108

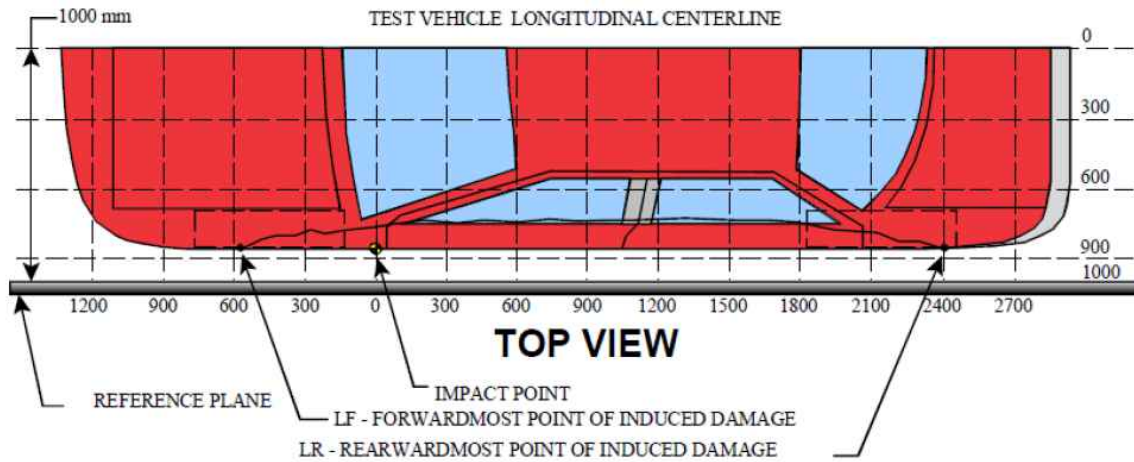
DEFORMABLE BARRIER STATIC CRUSH

Stack Level	Distance Right of Center								C/L	Distance Left of Center							
	800	700	600	500	400	300	200	100		100	200	300	400	500	600	700	800
1	236	236	227	212	199	195	191	182	175	165	158	151	145	140	136	138	149
2	147	141	132	126	122	373	373	373	373	373	373	373	79	74	71	72	94
3	66	60	55	53	50	49	56	87	73	45	32	26	29	33	42	57	88
4	30	14	17	26	39	53	91	108	93	81	58	34	43	48	54	71	99

DATA SHEET NO. 13
VEHICLE AND MDB DAMAGE PROFILE DISTANCES

Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16



MEASUREMENT CONVENTIONS:
 Forward of the impact point (towards front of vehicle) is considered negative (—).
 Rearward of the impact point (toward rearend of vehicle) is considered positive (+).

VEHICLE DAMAGE PROFILE DISTANCES¹

DPD	Distance From Impact Point (mm)	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	2400	4	811	809	2
2	1800	4	837	681	156
3	1350	2	862	703	159
4	750	2	870	669	201
5	150	2	869	728	141
6	-300	4	776	772	4

MDB DAMAGE PROFILE DISTANCES

DPD	Distance From Center of MDB	Level	Post-Test (mm)	Pre-Test (mm)	Crush (mm)
1	800 mm Left of Center	1	327	475	149
2	500 mm Left of Center	1	346	486	140
3	200 mm Left of Center	2	11	384	373
4	200 mm Right of Center	2	11	384	373
5	500 mm Right of Center	1	274	486	212
6	800 mm Right of Center	1	236	472	236

DATA SHEET NO. 14
FMVSS NO. 301 STATIC ROLLOVER RESULTS

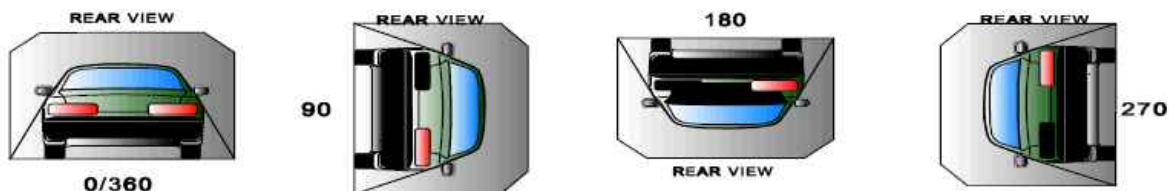
Test Vehicle: 2017 Toyota Corolla 4DR Sedan
 Test Program: SINCAP Side Impact

NHTSA No.: M20175106
 Test Date: 11/16/16

Test Time: 13:41 **Temperature:** 21.3°C

- A. From impact until vehicle motion ceases: 0 oz.
 (Maximum allowable is 1 ounce)
- B. For the 5 minute period after motion ceases: 0 oz.
 (Maximum allowable is 5 ounces)
- C. For the following 25 minutes: 0 oz.
 (Maximum allowable is 1 ounce/minute)
- D. Spillage Details: None

FMVSS 301 STATIC ROLLOVER DATA



ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0 to 90	90	330	420
90 to 180	90	330	840
180 to 270	90	330	1260
270 to 360	90	330	1680

FMVSS NO. 301 ROLLOVER SPILLAGE TABLE

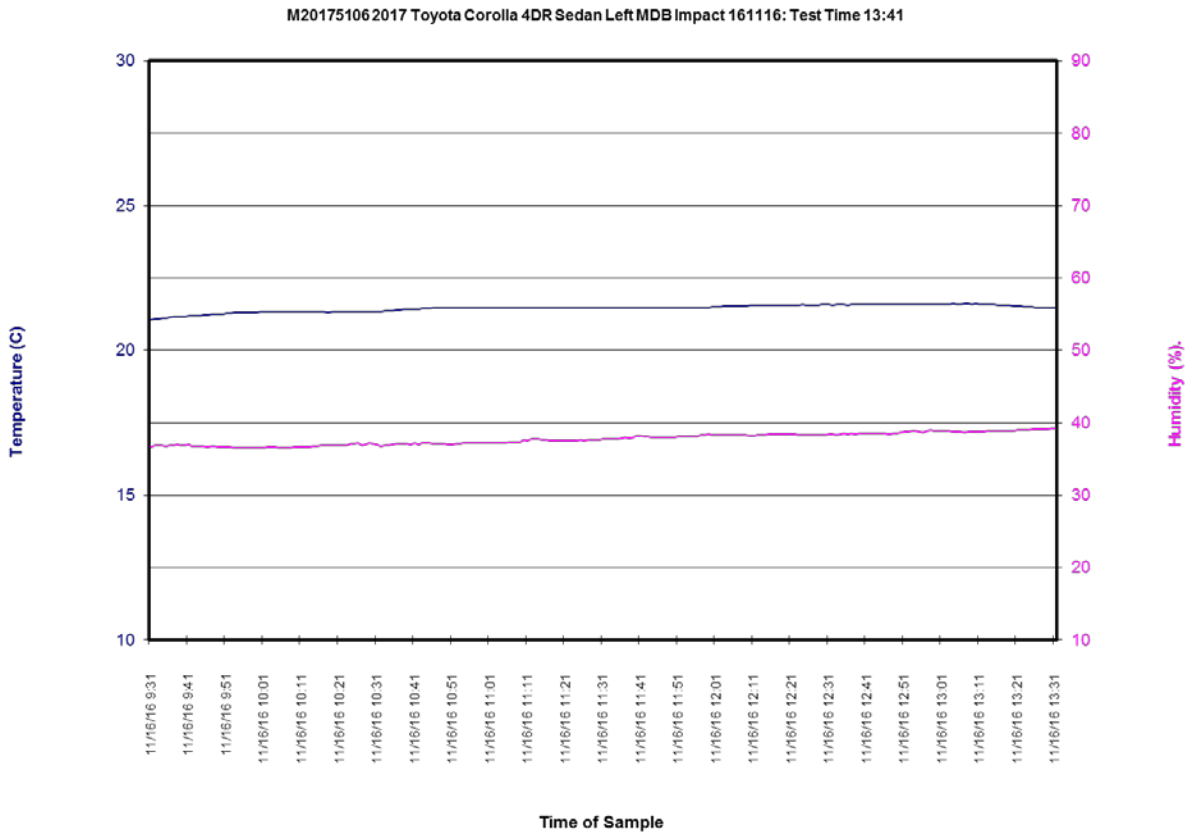
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eighth Minute
0 to 90	0	0	0	N/A
90 to 180	0	0	0	N/A
180 to 270	0	0	0	N/A
270 to 360	0	0	0	N/A

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0 to 90	None
90 to 180	None
180 to 270	None
270 to 360	None

DATA SHEET NO. 15
DUMMY/VEHICLE TEMPERATURE AND HUMIDITY STABILIZATION DATA

Test Vehicle: 2017 Toyota Corolla 4DR Sedan NHTSA No.: M20175106
Test Program: SINCAP Side Impact Test Date: 11/16/16



APPENDIX A
PHOTOGRAPHS

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001 As-Delivered Right Front $\frac{3}{4}$ View of Test Vehicle



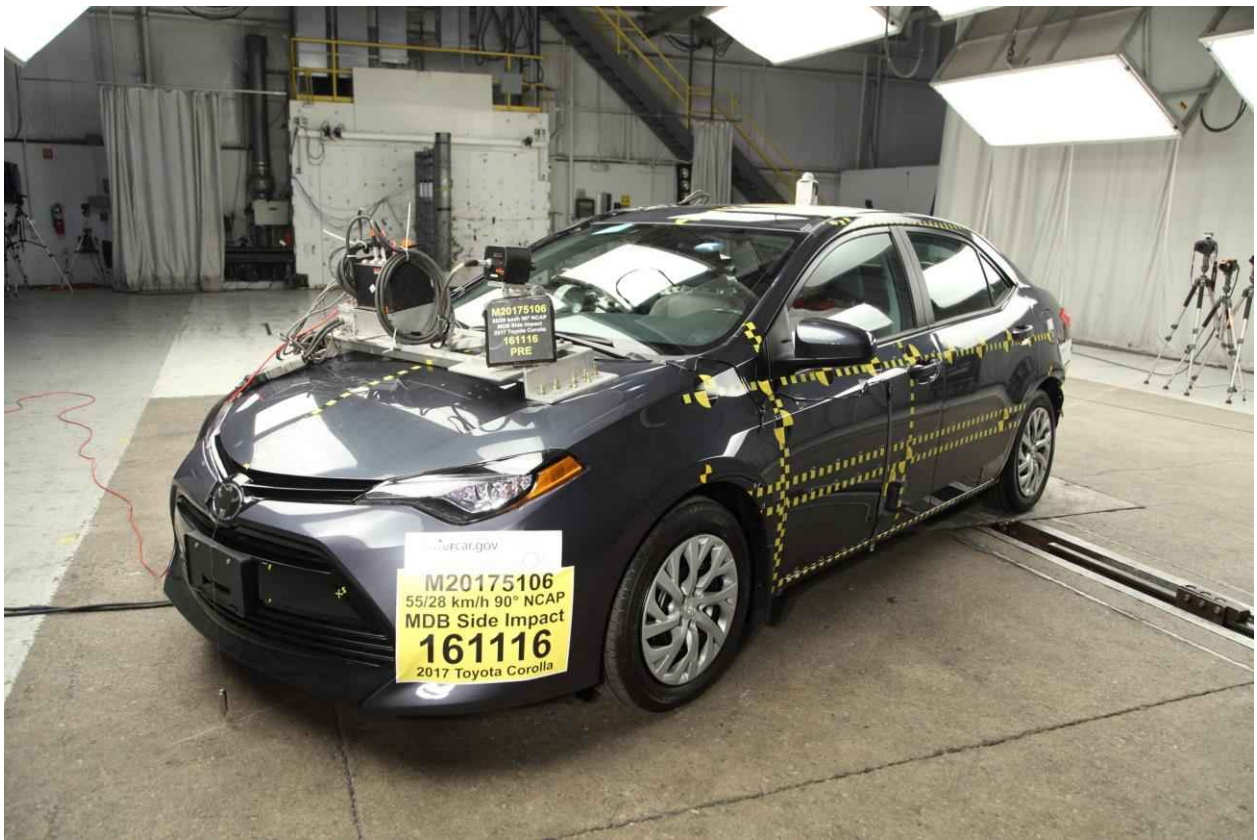
002 As-Delivered Left Rear $\frac{3}{4}$ View of Test Vehicle



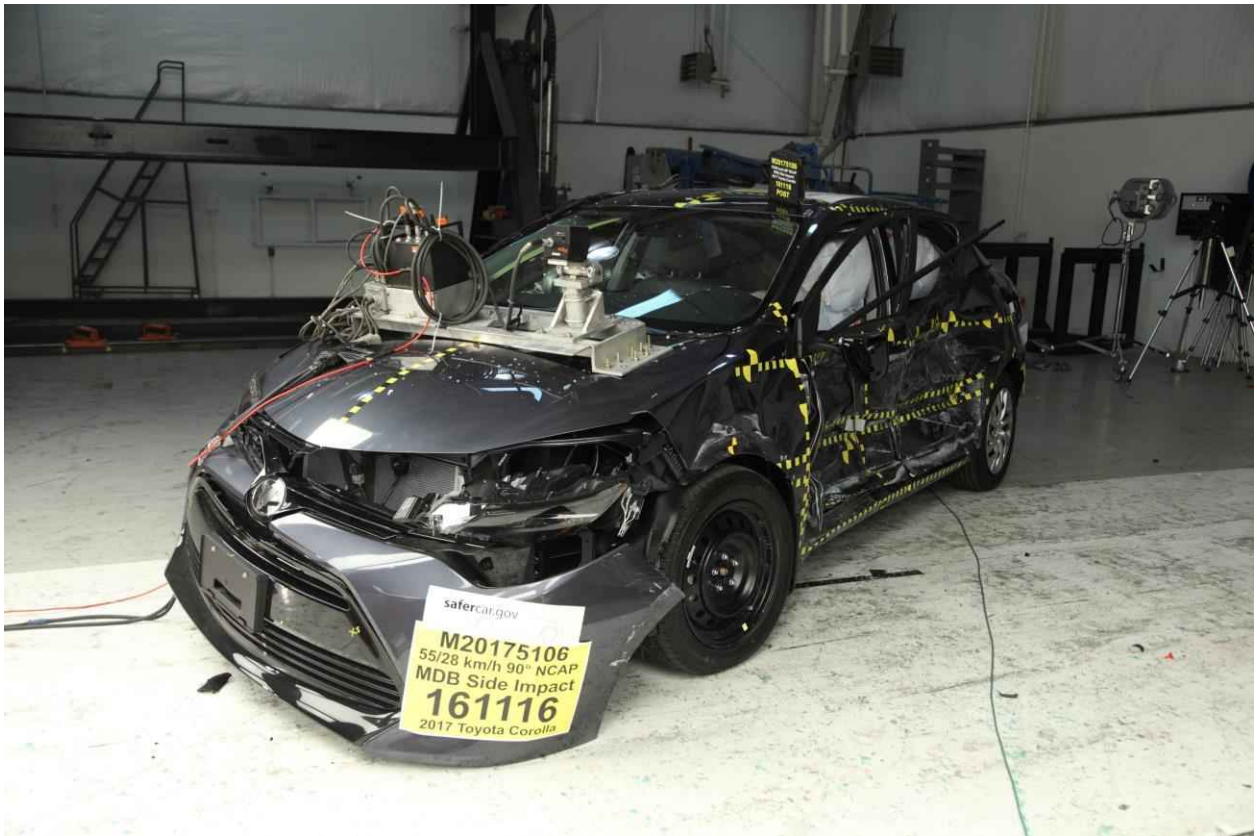
003 Pre-Test Frontal View of Test Vehicle



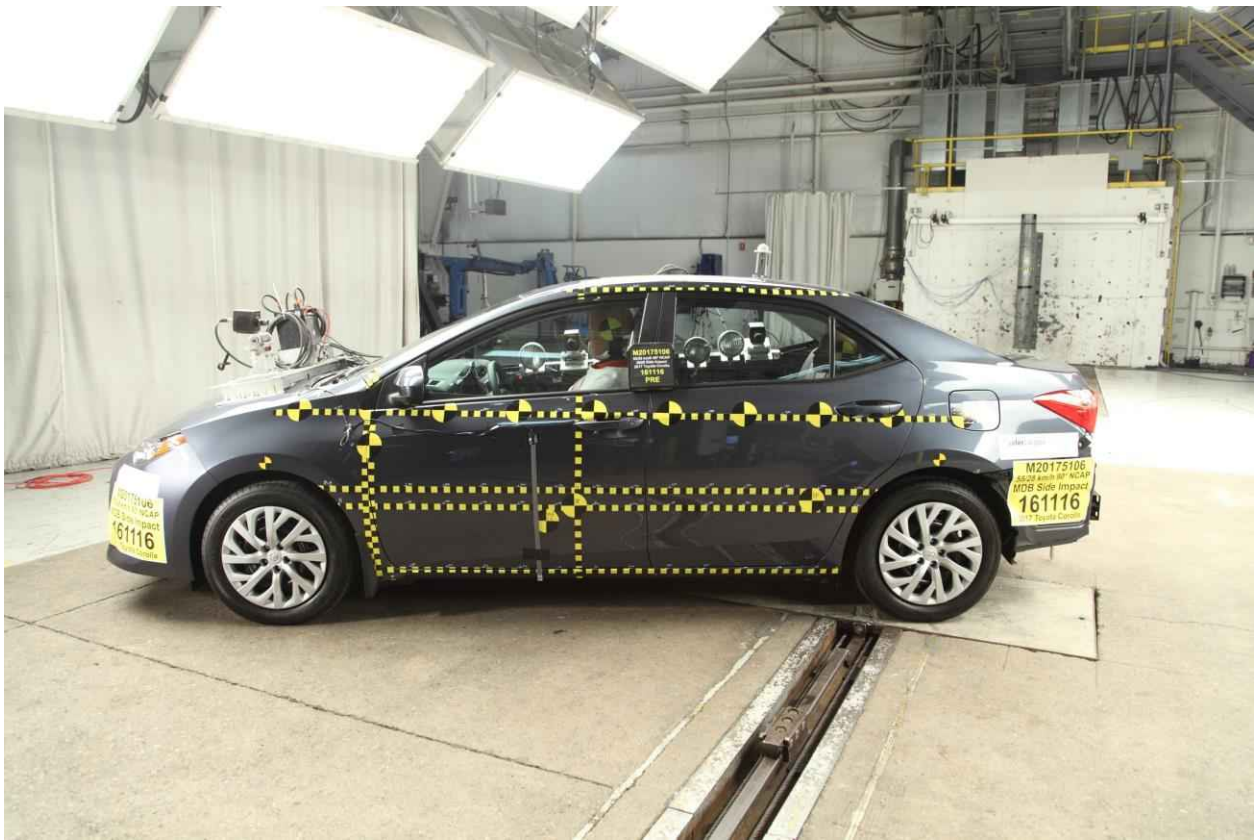
004 Post-Test Frontal View of Test Vehicle



005 Pre-Test Left Front $\frac{3}{4}$ View of Test Vehicle



006 Post-Test Left Front $\frac{3}{4}$ View of Test Vehicle



007 Pre-Test Left Side View of Test Vehicle



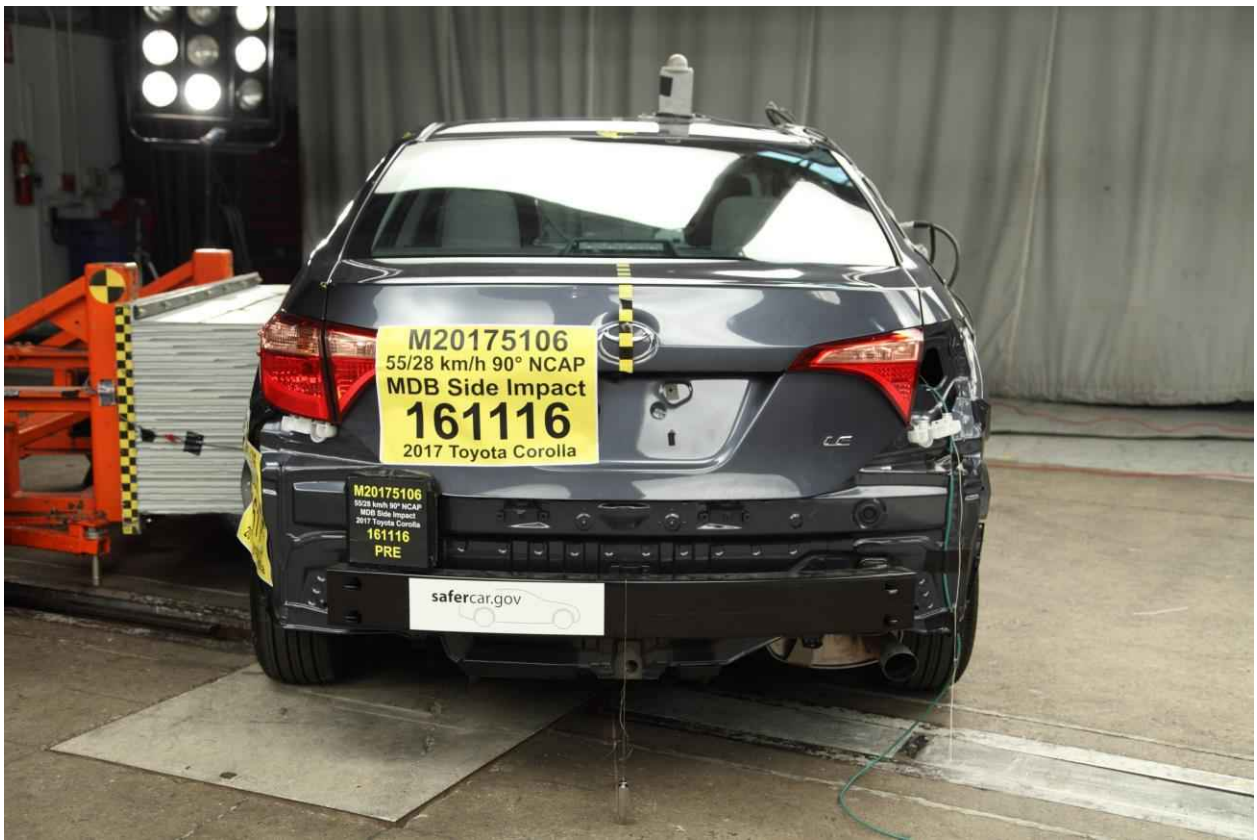
008 Post-Test Left Side View of Test Vehicle



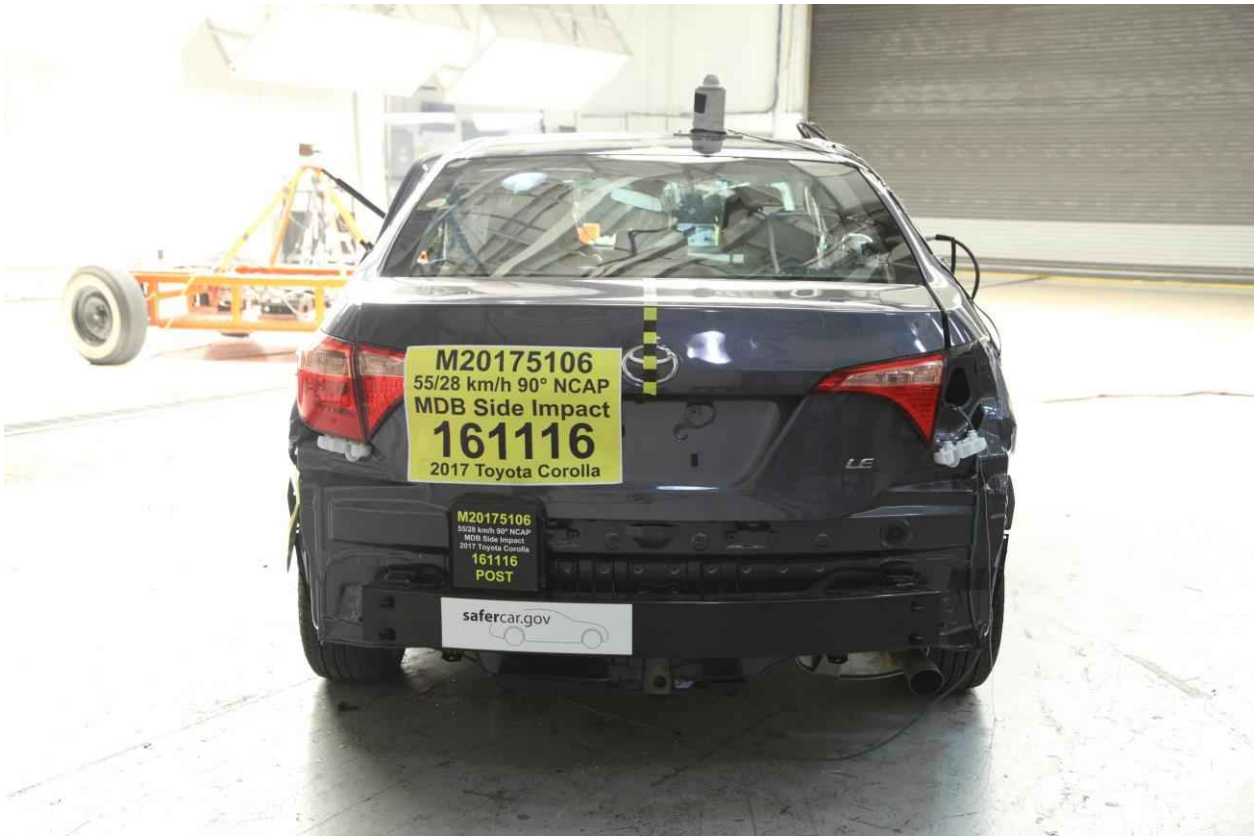
009 Pre-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



010 Post-Test Left Rear $\frac{3}{4}$ View of Test Vehicle



011 Pre-Test Rear View of Test Vehicle



012 Post-Test Rear View of Test Vehicle



013 Pre-Test Right Side View of Test Vehicle



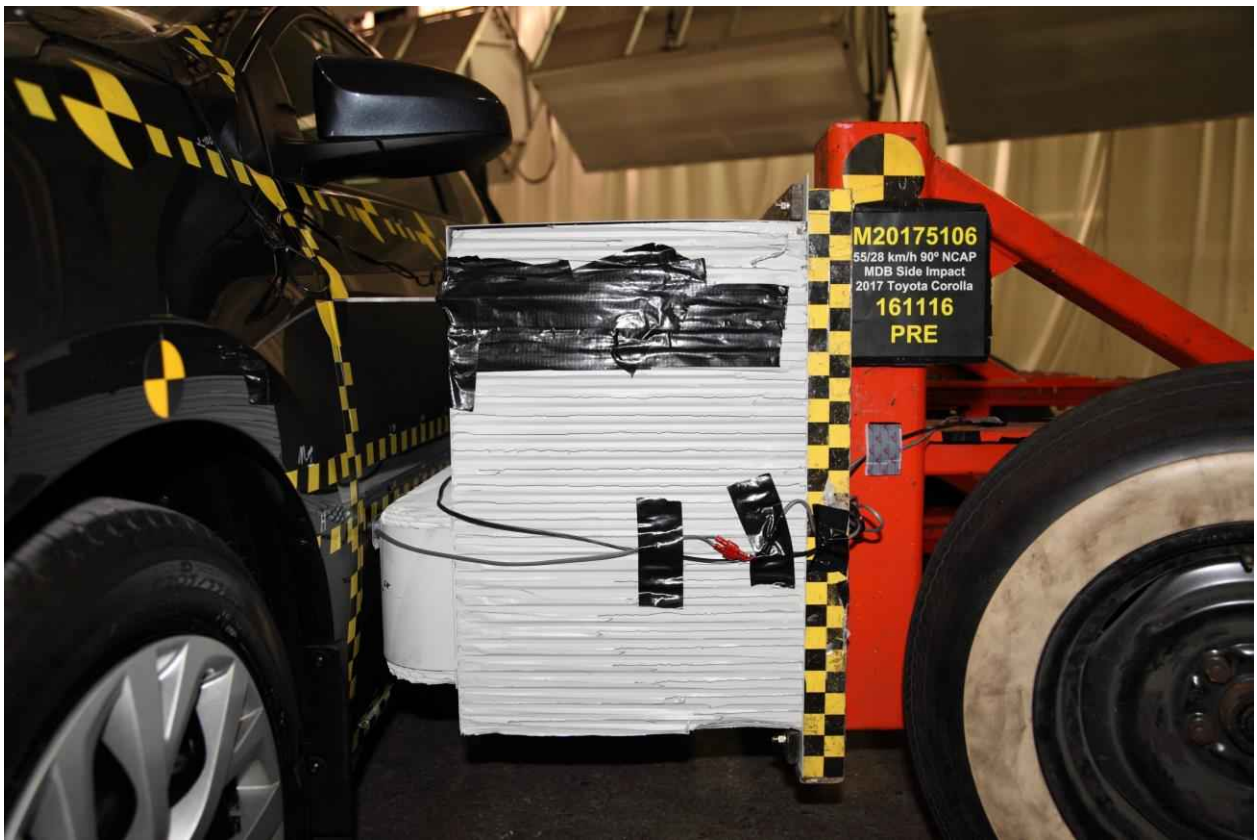
014 Post-Test Right Side View of Test Vehicle



015 Pre-Test Overhead View of Test Area



016 Post-Test Overhead View of Test Area



017 Pre-Test Left Side View of MDB Positioned Against Side of Test Vehicle



018 Pre-Test Right Side View MDB Positioned Against Side of Test Vehicle



019 Pre-Test Close-Up View of Impact Point Target



020 Post-Test Close-Up View of Impact Point Target



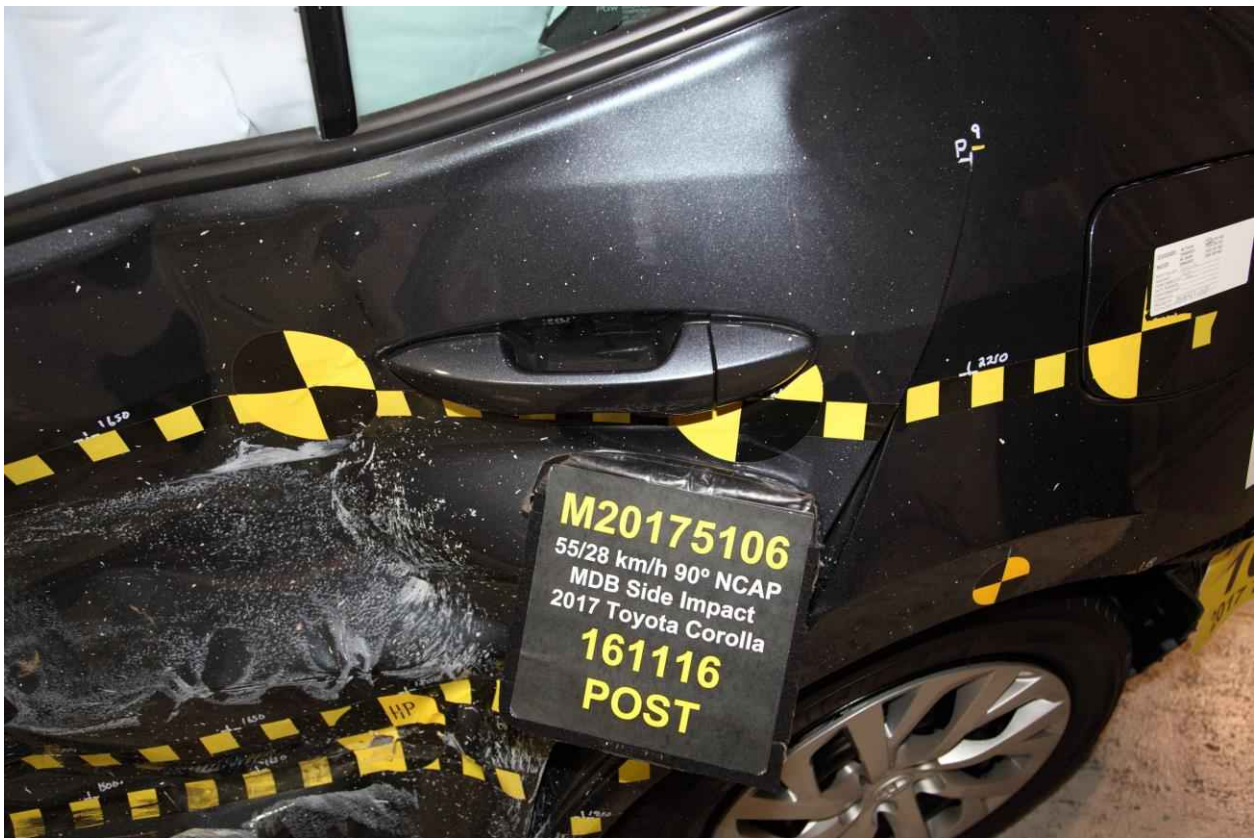
021 Pre-Test Left Front Door Latch Close-Up



022 Post-Test Left Front Door Latch Close-Up



023 Pre-Test Left Rear Door Latch Close-Up



024 Post-Test Left Rear Door Latch Close-Up



025 Pre-Test Front Close-Up View of Driver Dummy



026 Post-Test Front Close-Up View of Driver Dummy



027 Pre-Test Left Side View of Driver Dummy Showing Belt and Chalking

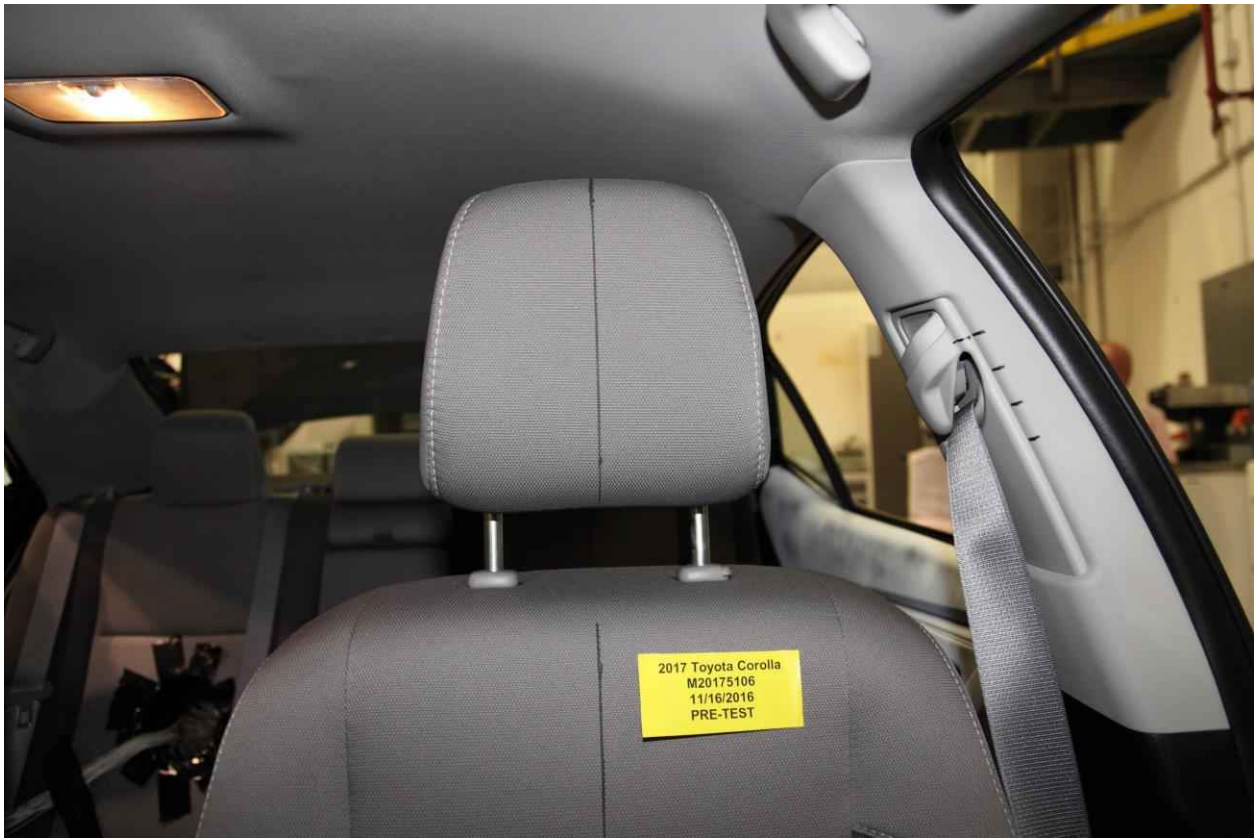
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028 Pre-Test Left Side View of Driver Dummy Shoulder and Door Top



029 Post-Test Left Side View of Driver Dummy Shoulder and Door Top



030 Pre-Test Frontal View of Driver Seat Back Prior to Dummy Positioning



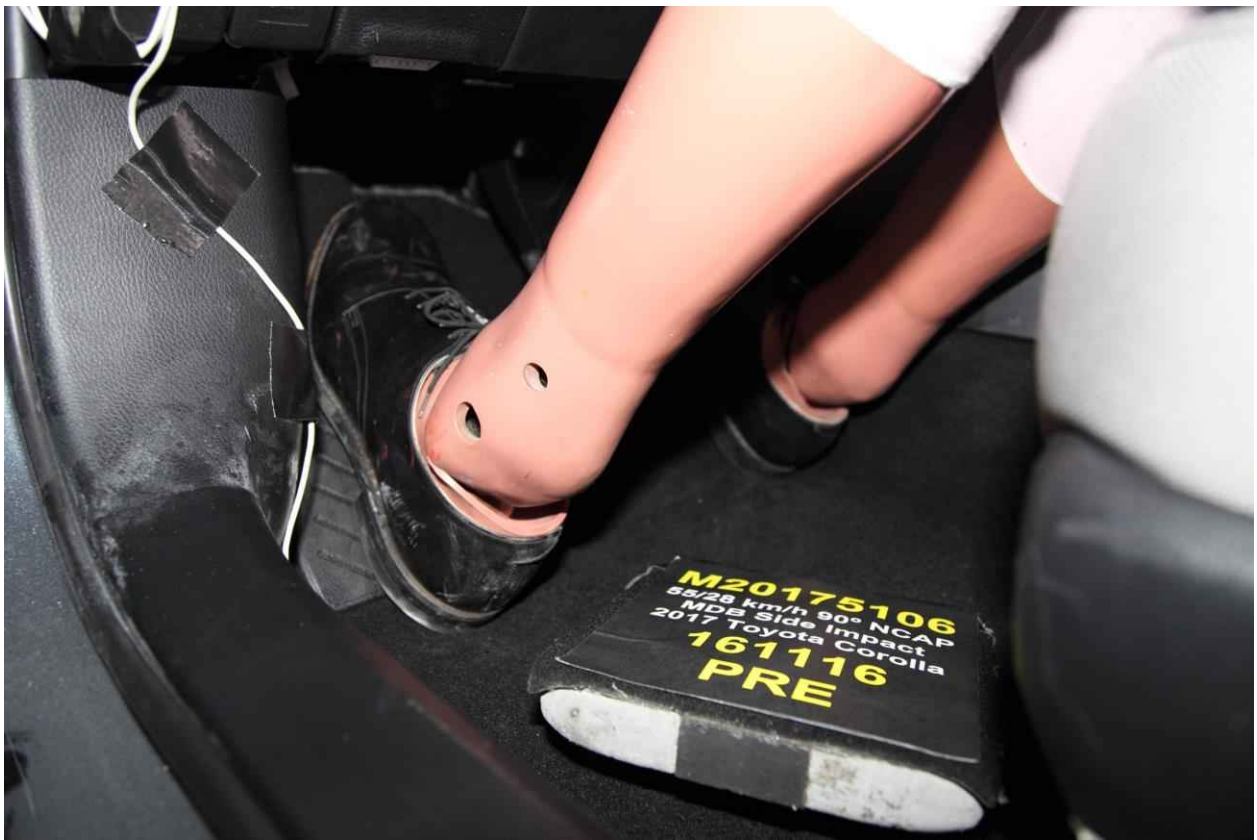
031 Pre-Test Frontal View of Driver Dummy Head and Shoulders in Relation to Head Restraint



032 Pre-Test Frontal View of Driver Seat Pan Prior to Dummy Positioning



033 Pre-Test Overhead View of Driver Dummy Thighs on Seat Pan



034 Pre-Test Placement of Driver Dummy Feet



035 Pre-Test View of Belt Anchorage for Driver Dummy

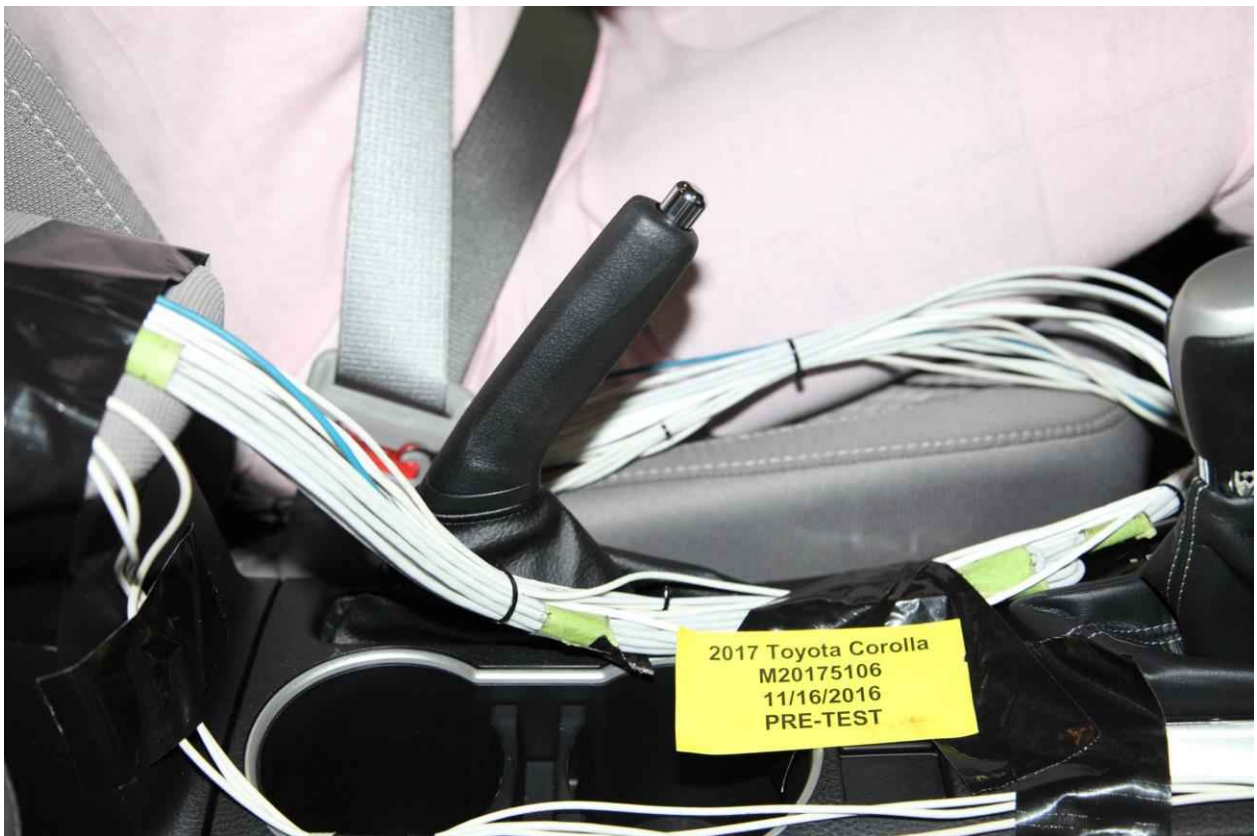


036 Pre-Test Left Side View of Steering Wheel

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037 View of Disengaged Parking Brake



038 Pre-Test View of Parking Brake



039 Pre-Test Close-Up Left Side View of Driver Seat Track



040 Pre-Test Close-Up Left Side View of Driver Seat Back



041 Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Intentionally Left Blank



042 Pre-Test Driver Dummy and Door Clearance View



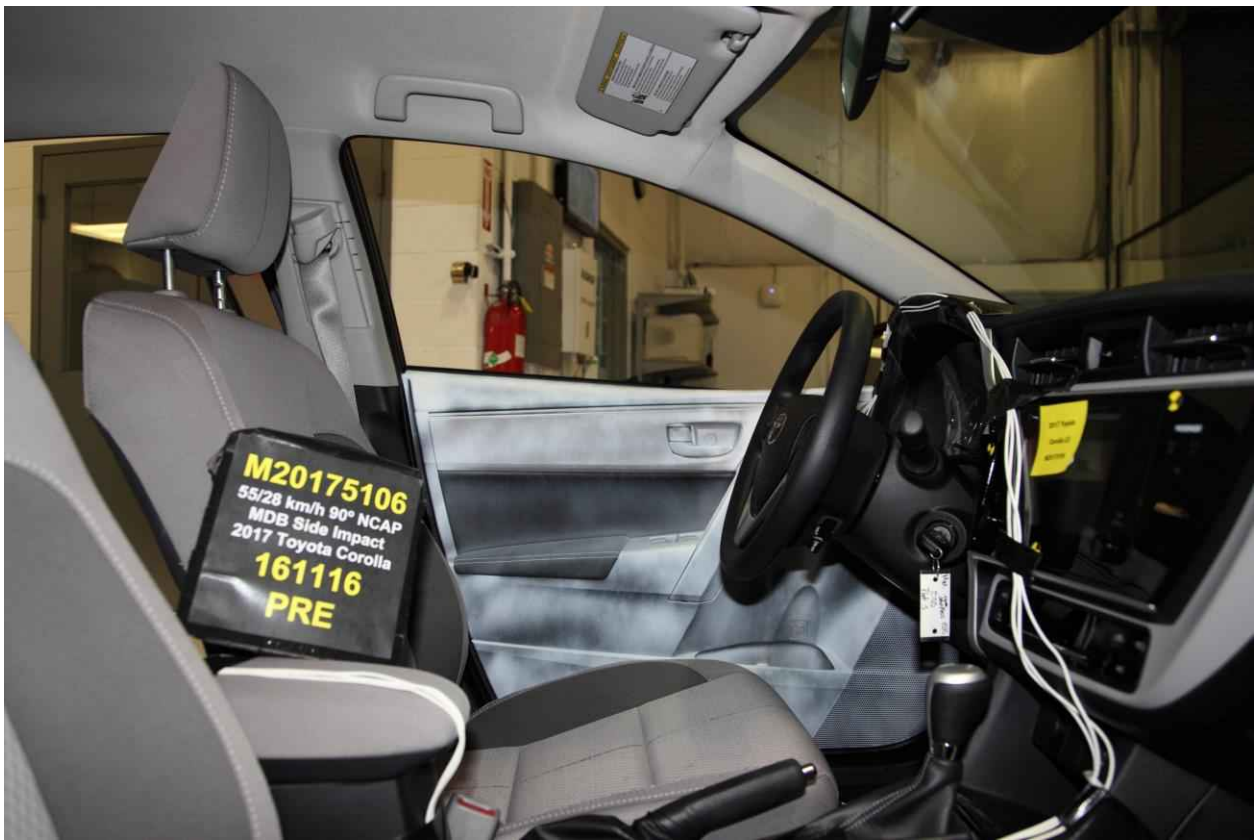
043 Post-Test Driver Dummy and Door Clearance View



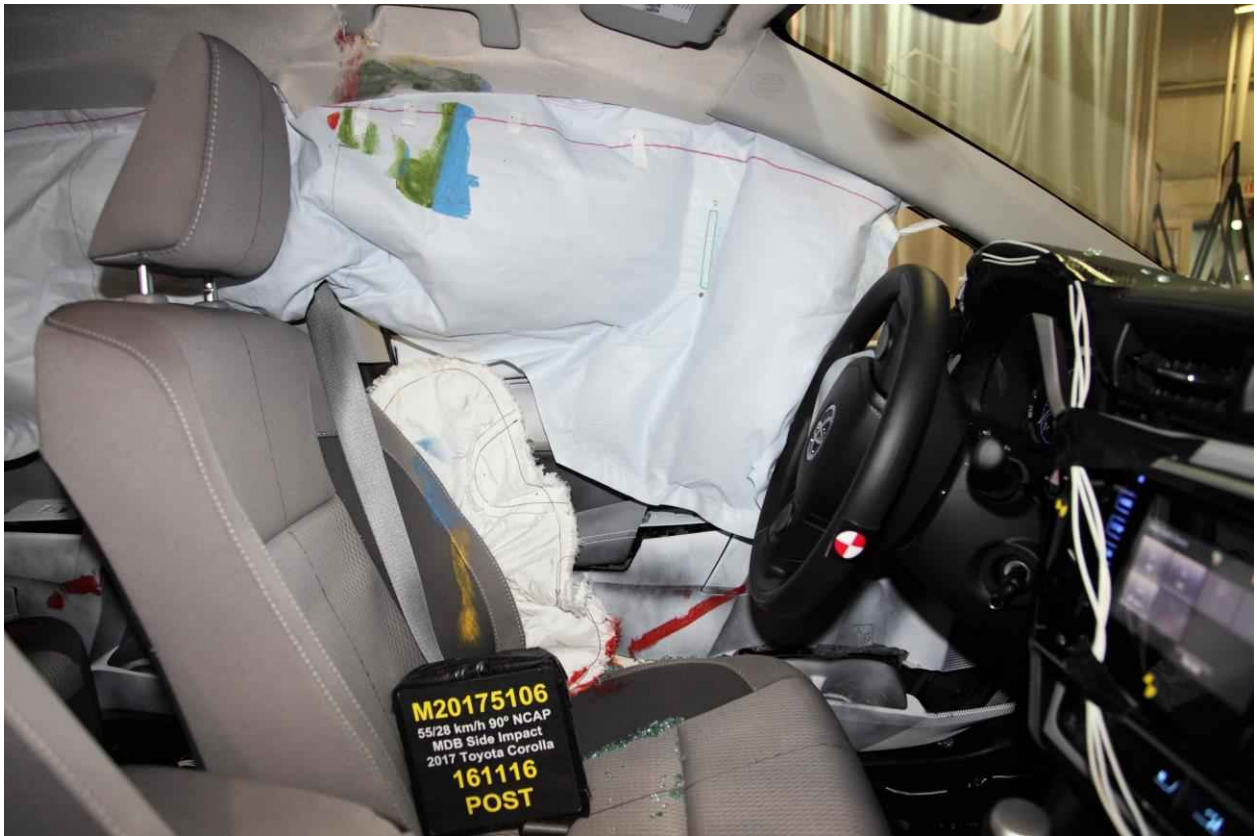
044 Pre-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



045 Post-Test Right Side View of Driver Dummy and Front Seat of Occupant Compartment



046 Pre-Test Driver Inner Door Panel View



047 Post-Test Driver Inner Door Panel View



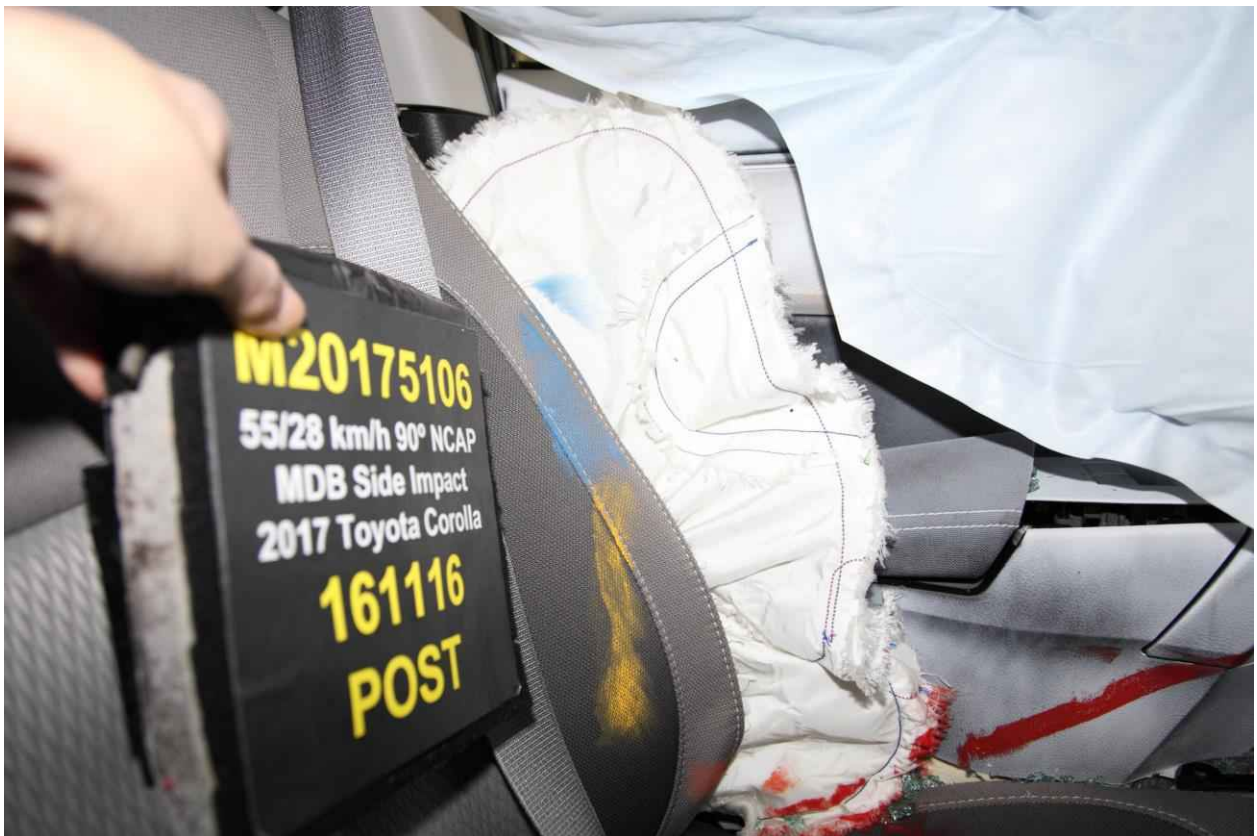
048 Post-Test Driver Dummy Close-Up Head Contact with Vehicle View



049 Post-Test Driver Dummy Close-Up Head Contact with Side Airbag View



050 Post-Test Driver Dummy Close-Up Torso Contact with Vehicle Interior View



051 Post-Test Driver Dummy Close-Up Torso Contact with Side Airbag View



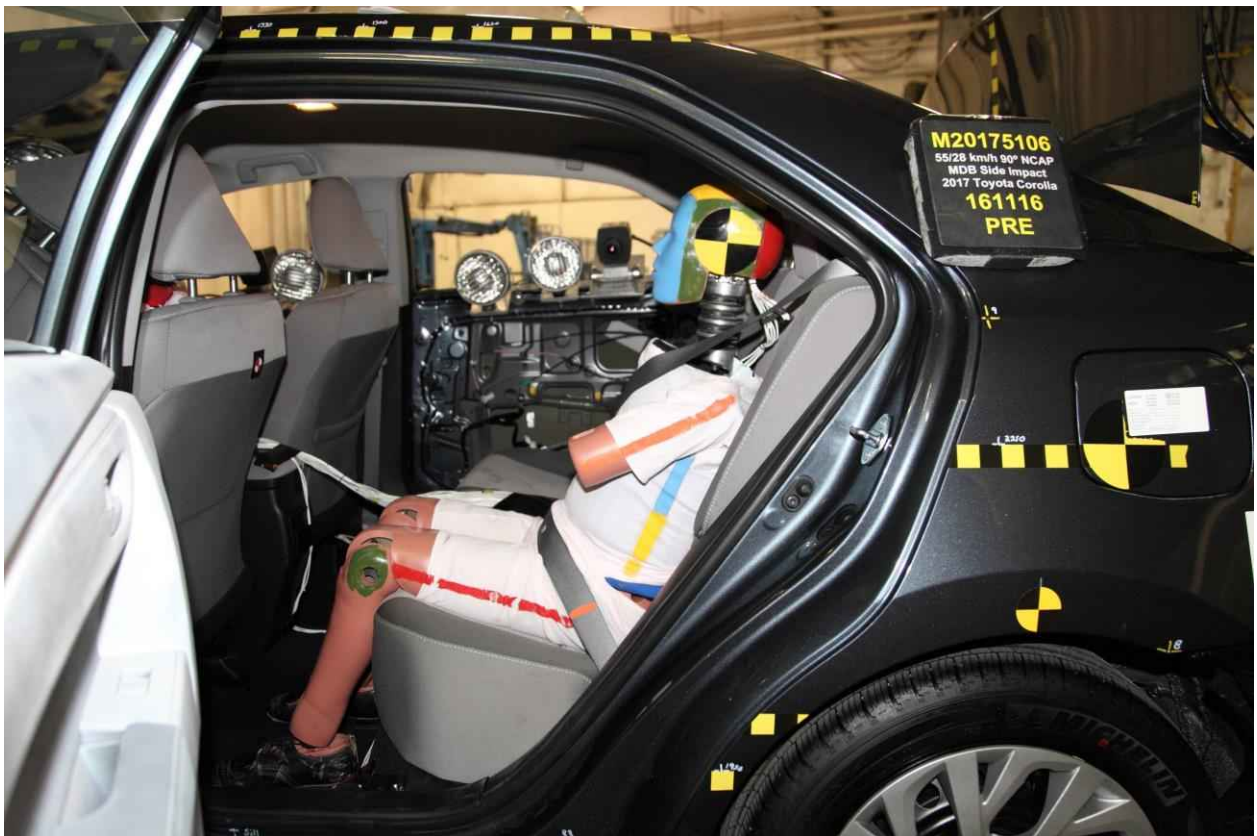
052 Post-Test Driver Dummy Close-Up Pelvis Contact View



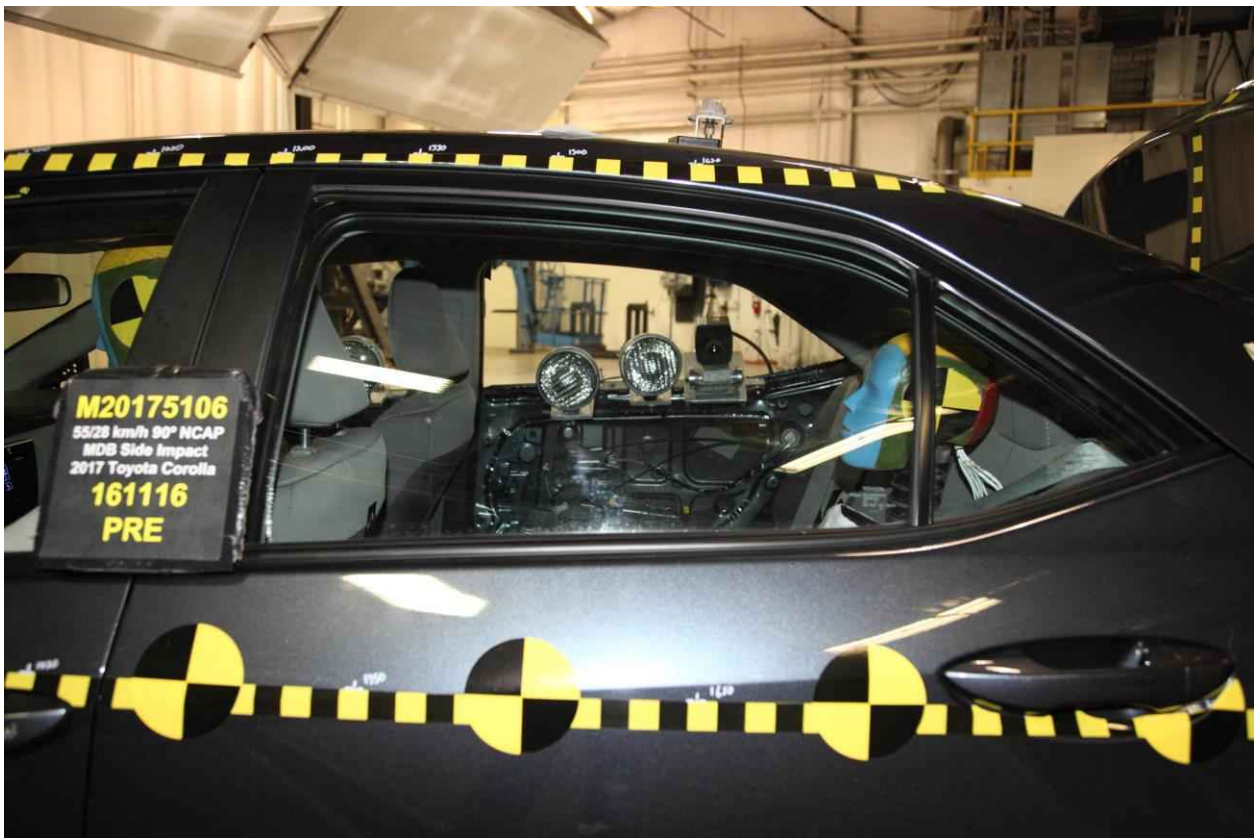
053 Post-Test Driver Dummy Close-Up Pelvis Contact with Side Airbag View



054 Post-Test Driver Dummy Close-Up Knee Contact View



055 Pre-Test Left Side View of Passenger Dummy Showing Belt and Chalking



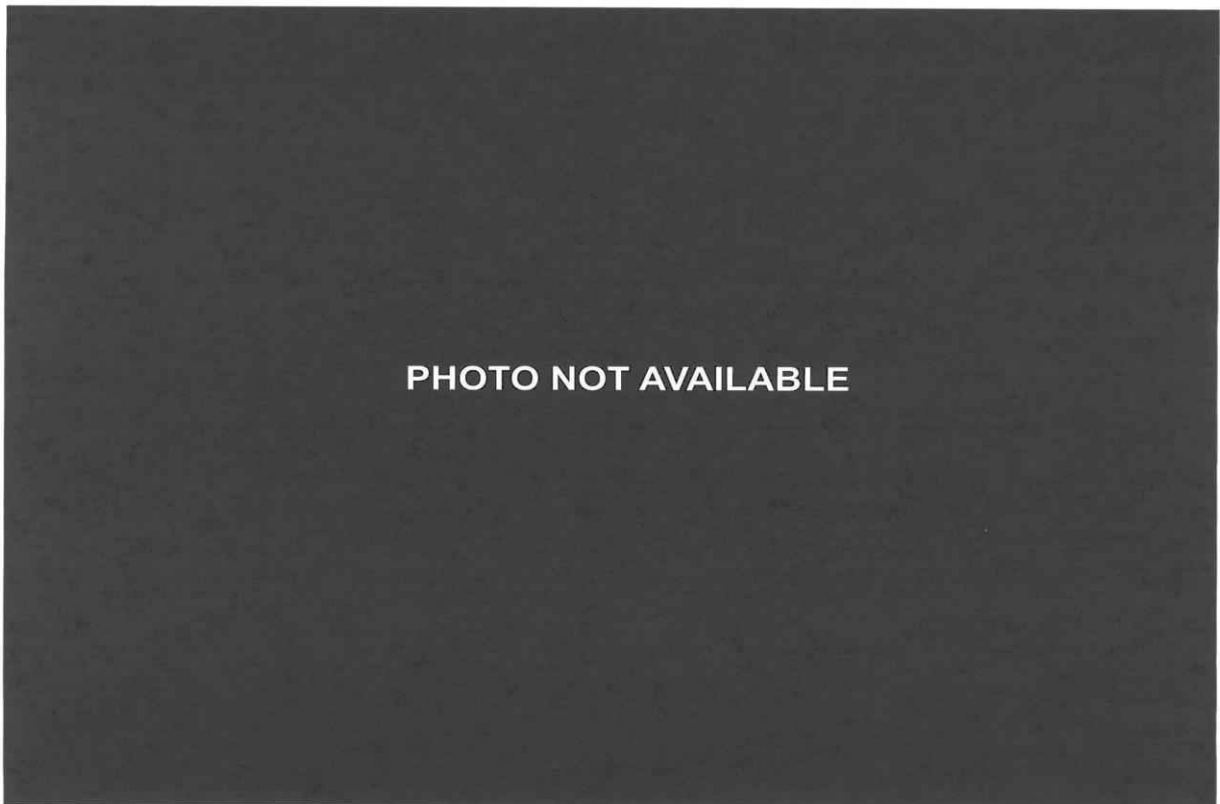
056 Pre-Test Left Side View of Passenger Dummy Shoulder and Door Top View



057 Post-Test Left Side View of Passenger Dummy Shoulder and Door Top View



058 Pre-Test Frontal View of Rear Passenger Seat Back Prior to Dummy Positioning



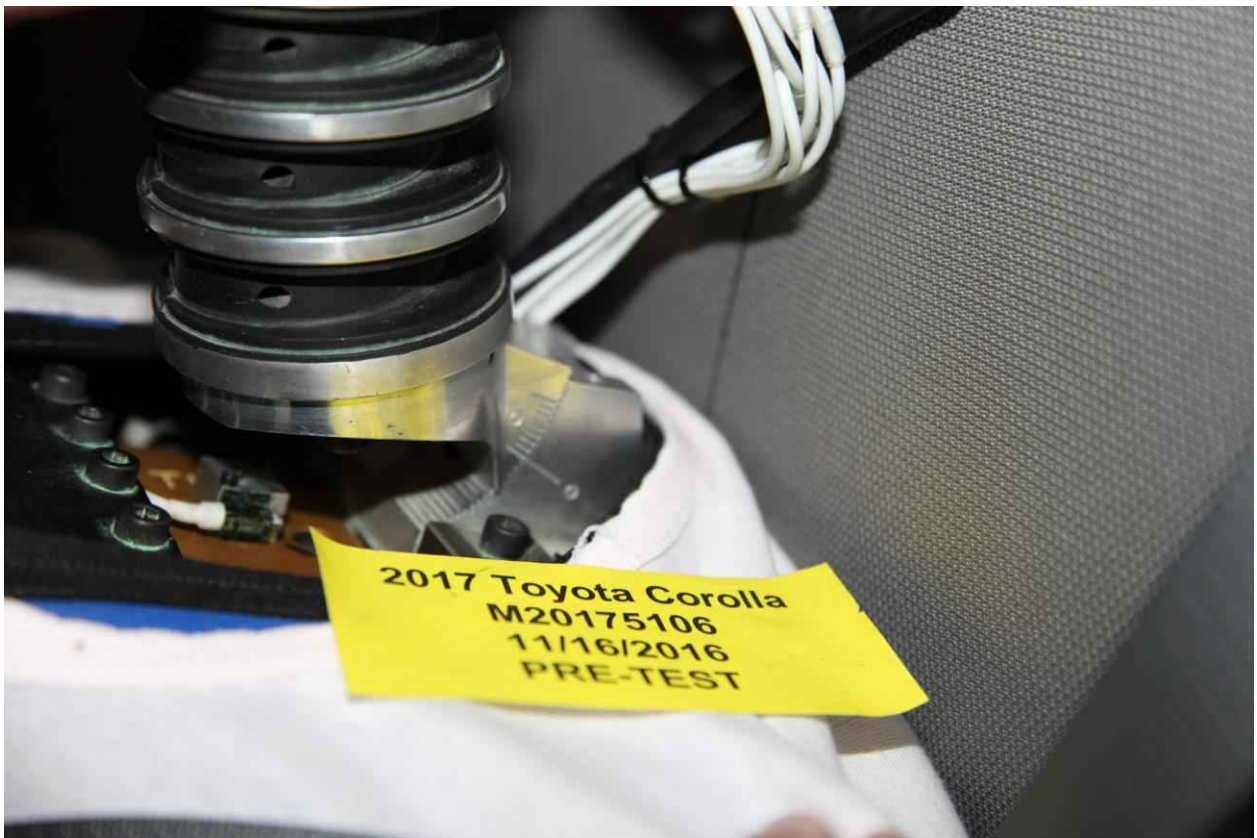
059 Pre-Test Frontal View of Rear Passenger Dummy Head and Shoulders in Relation to Head Restraint



060 Pre-Test Overhead View of Rear Passenger Seat Pan Prior to Dummy Positioning



061 Pre-Test Overhead View of Rear Passenger Dummy Thighs on Seat Pan



062 Pre-Test View of Rear Passenger Dummy Neck Showing Position of Adjustable Neck Bracket



063 Pre-Test View of Rear Passenger Dummy Head Showing Dummy Head is Level



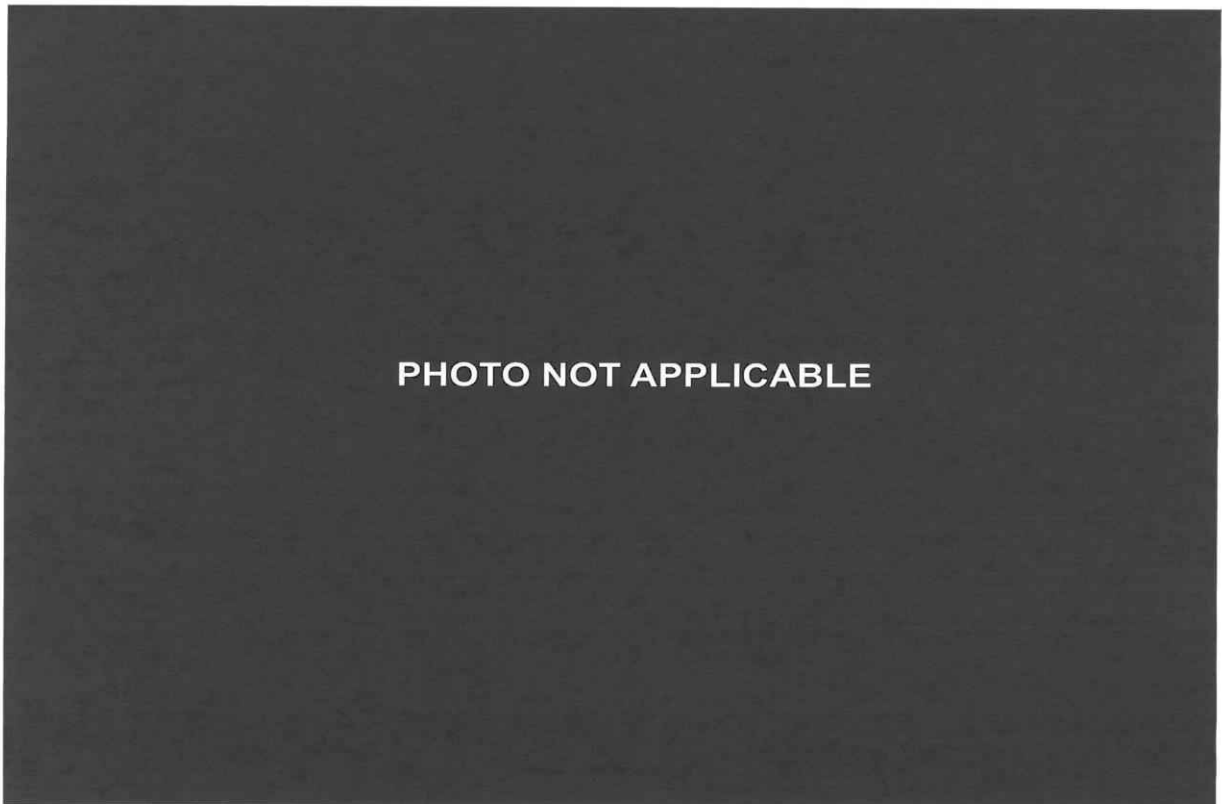
064 Pre-Test Placement of Rear Passenger Dummy Feet



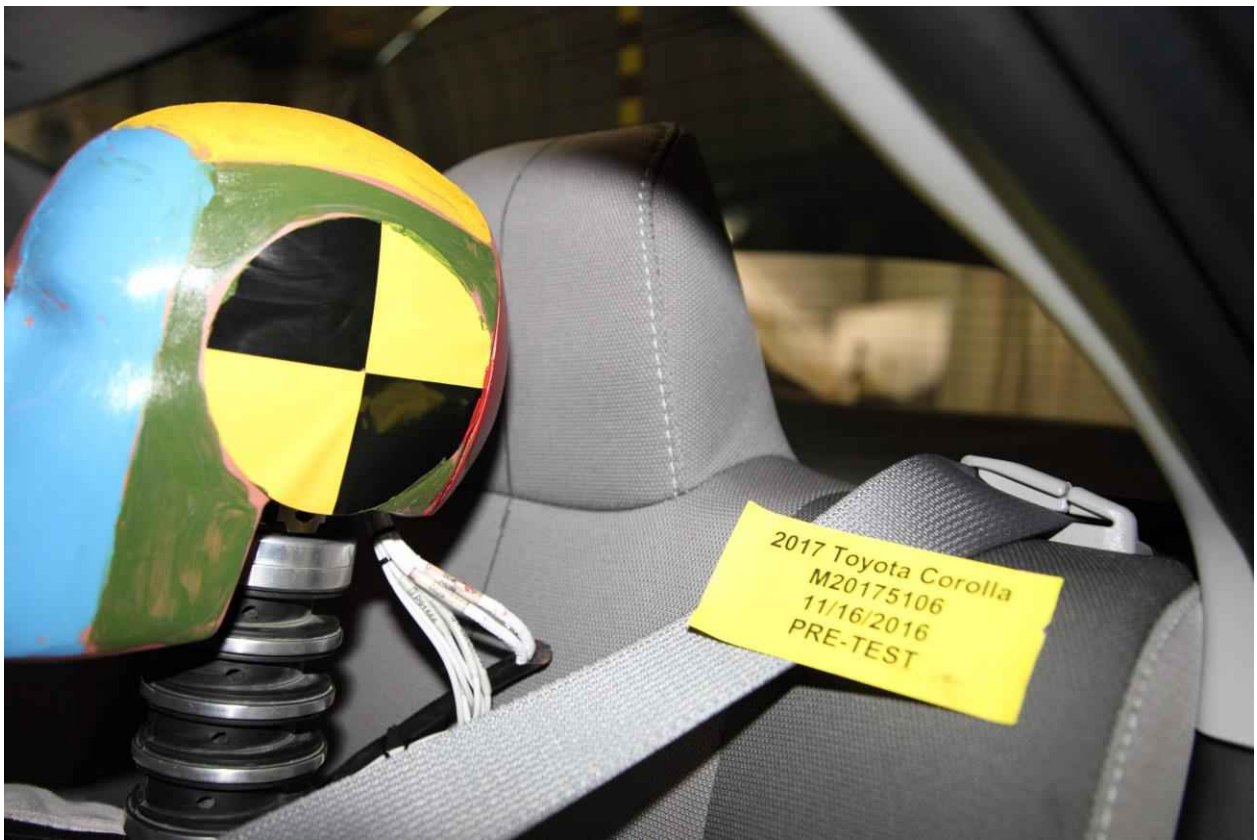
065 Pre-Test View of Belt Anchorage for Rear Passenger Dummy



066 Pre-Test Close-Up Left Side View of Rear Passenger Seat Track



067 Pre-test Close-Up Left Side View of Rear Passenger Seat Back



068 Pre-Test Close-Up View of Rear Passenger Seat Back or Head Restraint

Intentionally Left Blank



069 Pre-Test Passenger Dummy and Door Clearance View



070 Post-Test Passenger Dummy and Door Clearance View



071 Pre-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



072 Post-Test Right Side View of Rear Passenger Dummy and Rear Seat Occupant Compartment



073 Pre-Test Passenger Inner Door Panel View



074 Post-Test Passenger Inner Door Panel View

PHOTO NOT APPLICABLE

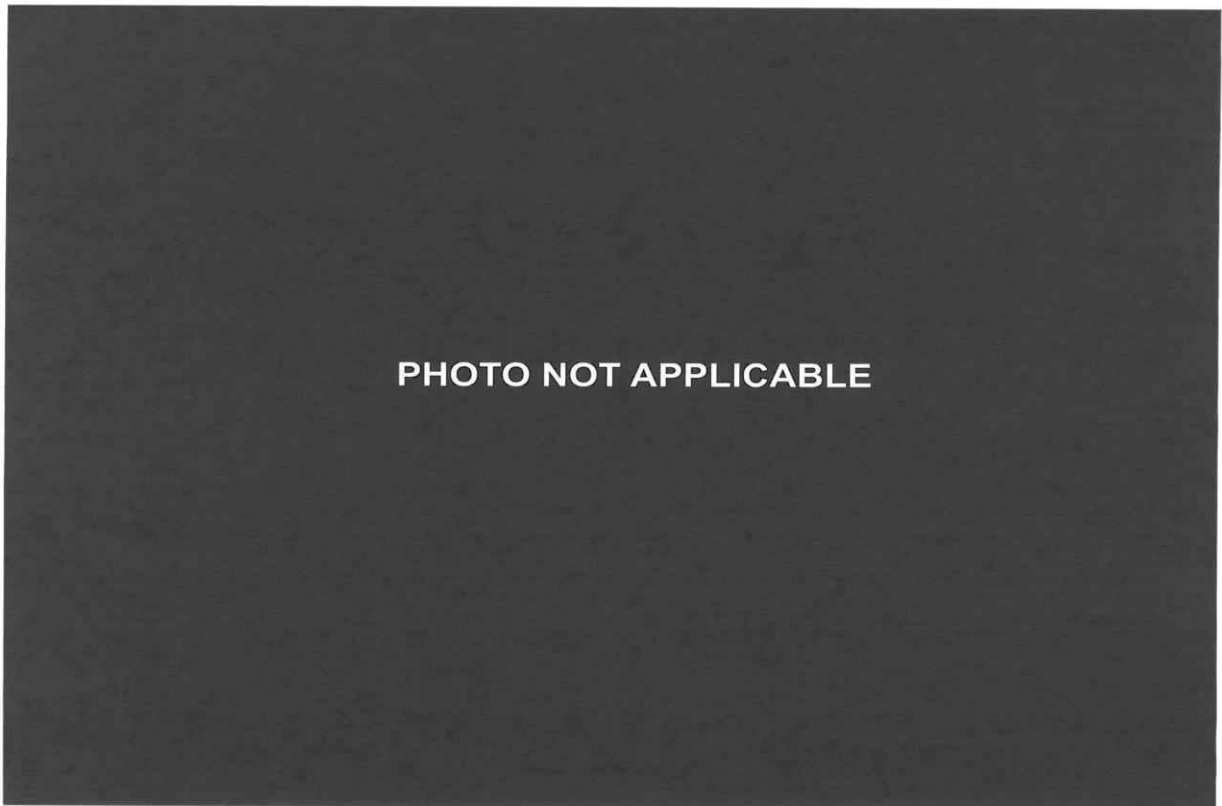
075 Post-Test Rear Passenger Dummy Close-Up Head Contact with Vehicle View



076 Post-Test Rear Passenger Dummy Close-Up Head Contact with Side Airbag View



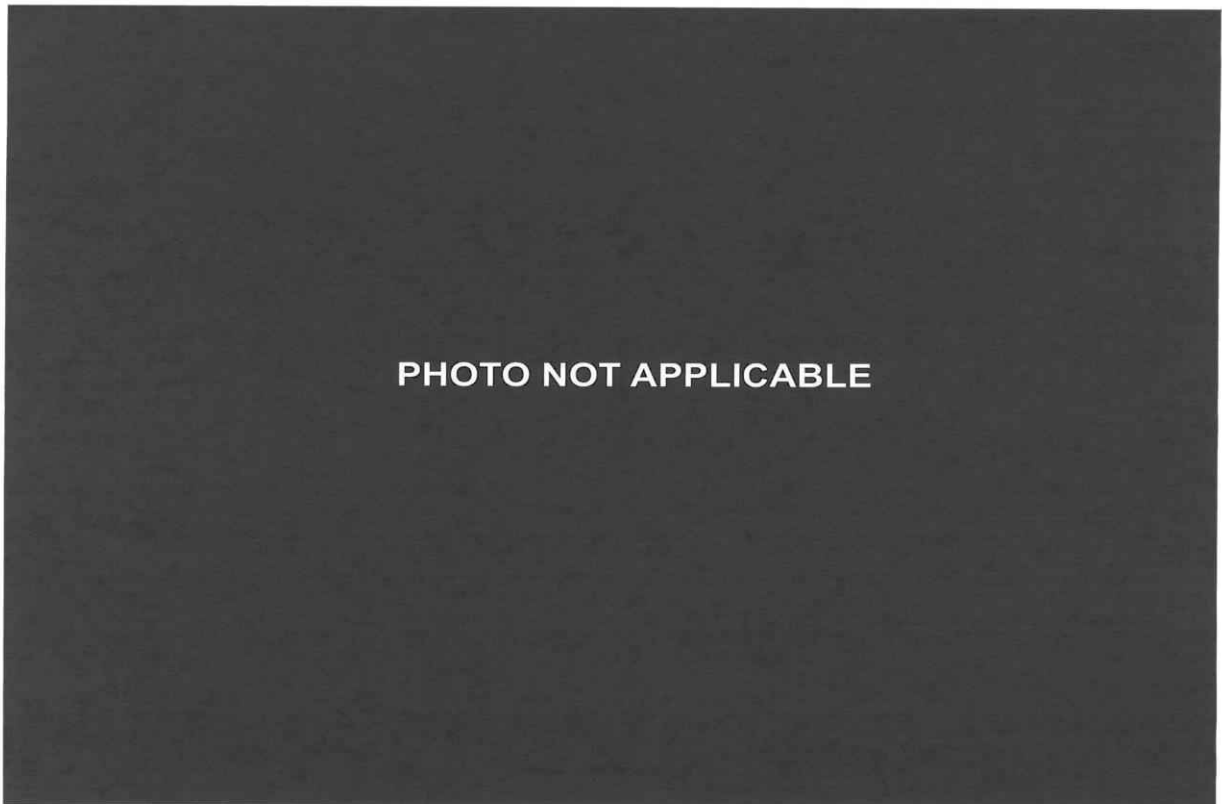
077 Post-Test Rear Passenger Dummy Close-Up Torso Contact with Vehicle Interior View



078 Post-Test Rear Passenger Dummy Close-Up Torso Contact with Side Airbag View



079 Post-Test Rear Passenger Dummy Close-Up Pelvis Contact View



080 Post-Test Rear Passenger Dummy Close-Up Pelvis Contact with Side Airbag View



081 Post-Test Rear Passenger Dummy Close-Up Knee Contact View

Intentionally Left Blank



082 Pre-Test View of Fuel Filler Cap or Fuel Filler Neck



083 Post-Test View of Fuel Filler Cap or Fuel Filler Neck



084 Pre-Test Front View of MDB Impactor Face



085 Post-Test Front View of MDB Impactor Face



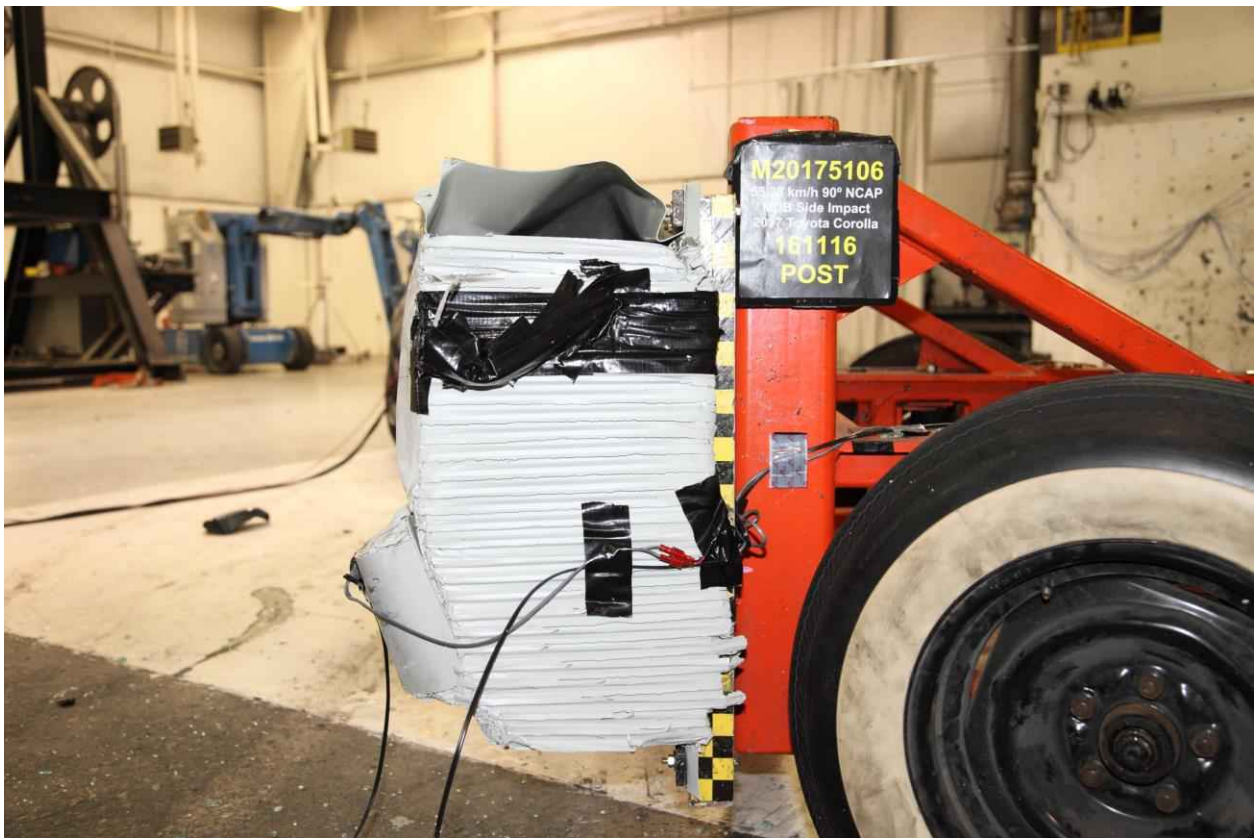
086 Pre-Test Top View of MDB Impactor Face



087 Post-Test Top View of MDB Impactor Face



088 Pre-Test Left Side View of MDB Impactor Face



089 Post-Test Left Side View of MDB Impactor Face



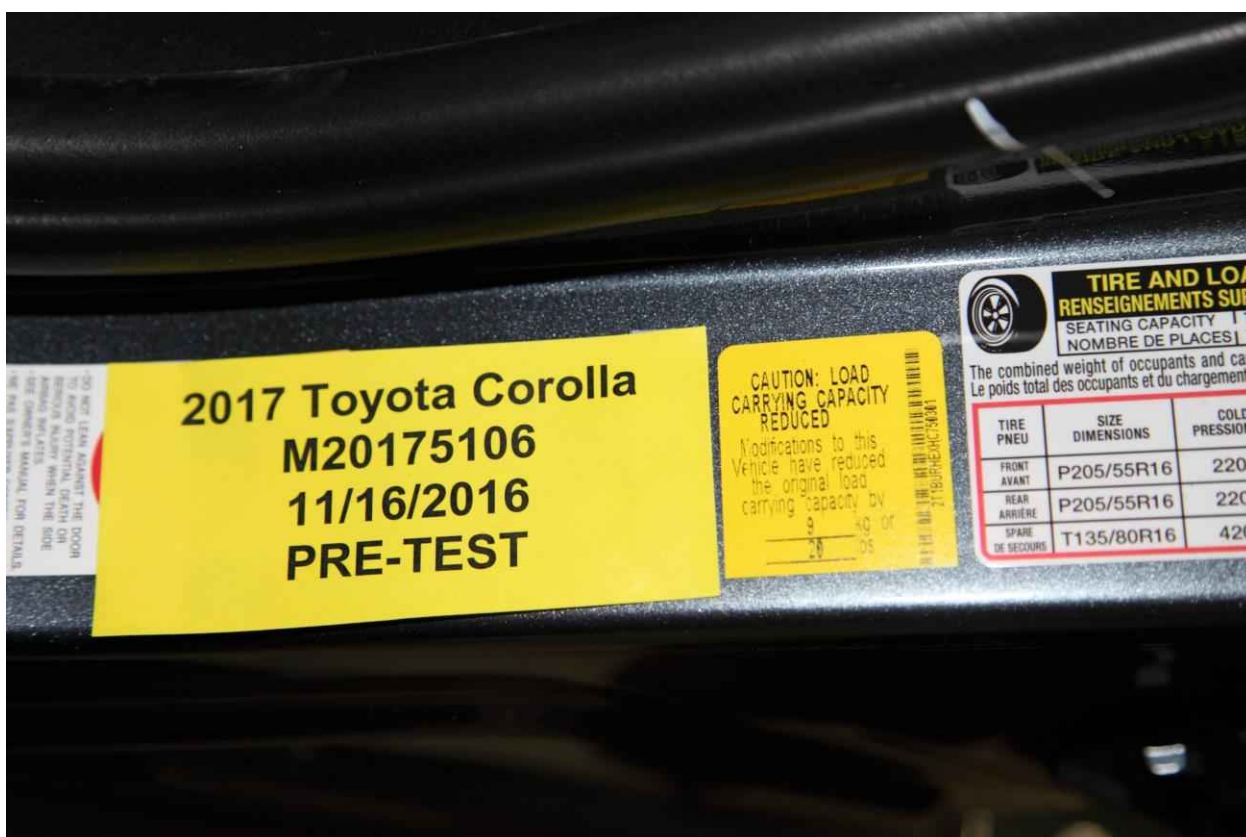
090 Pre-Test Right Side View of MDB Impactor Face



091 Post-Test Right Side View of MDB Impactor Face



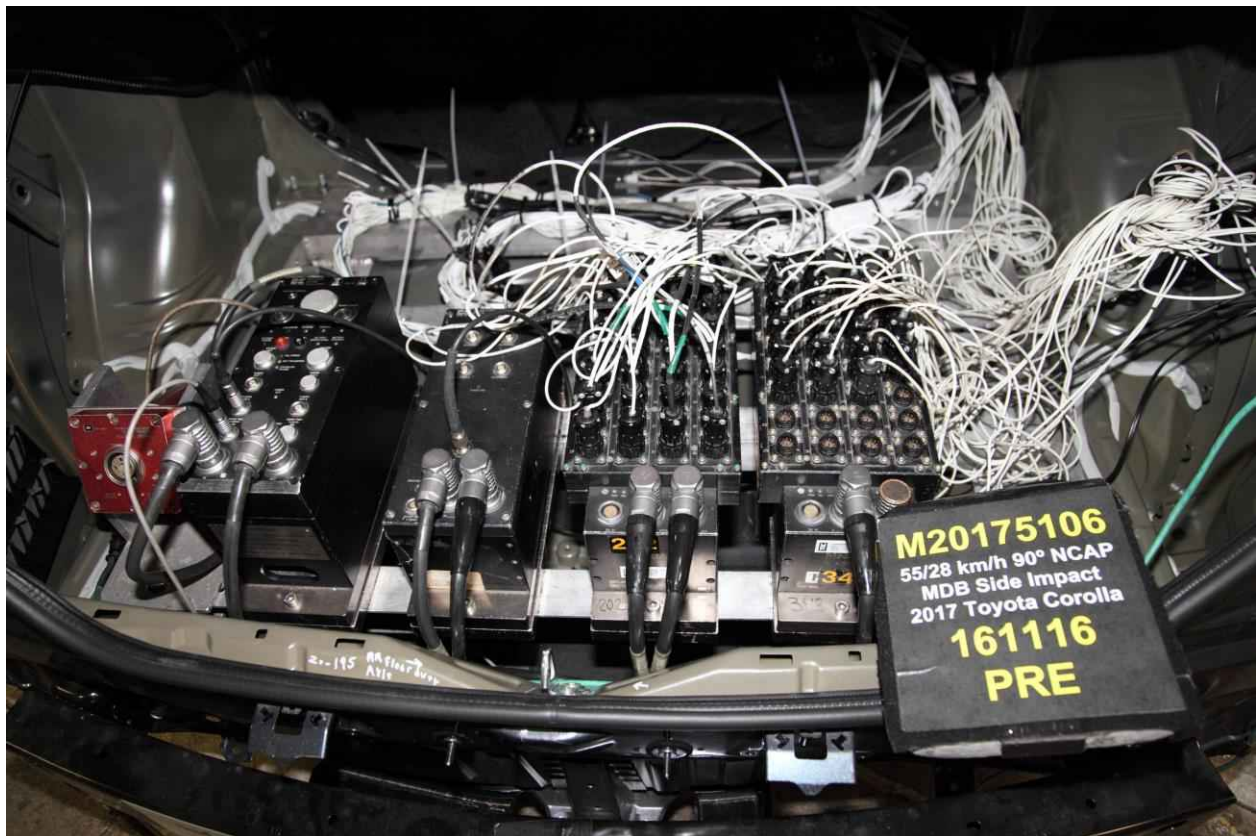
092 Close-Up View of Vehicle Certification Label



092a Close-Up View of Reduced Load Capacity Label



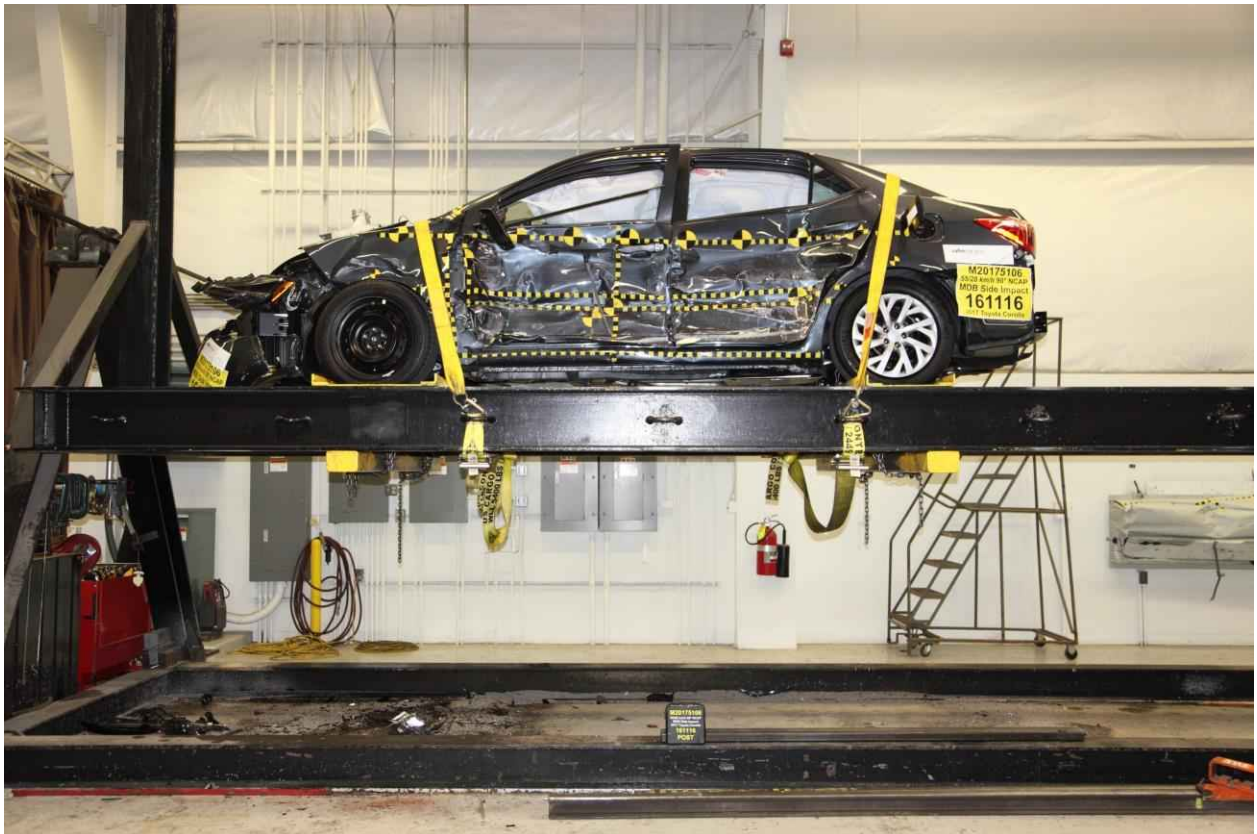
093 Close-Up View of Vehicle Tire Information Placard or Label



094 Pre-Test Ballast View



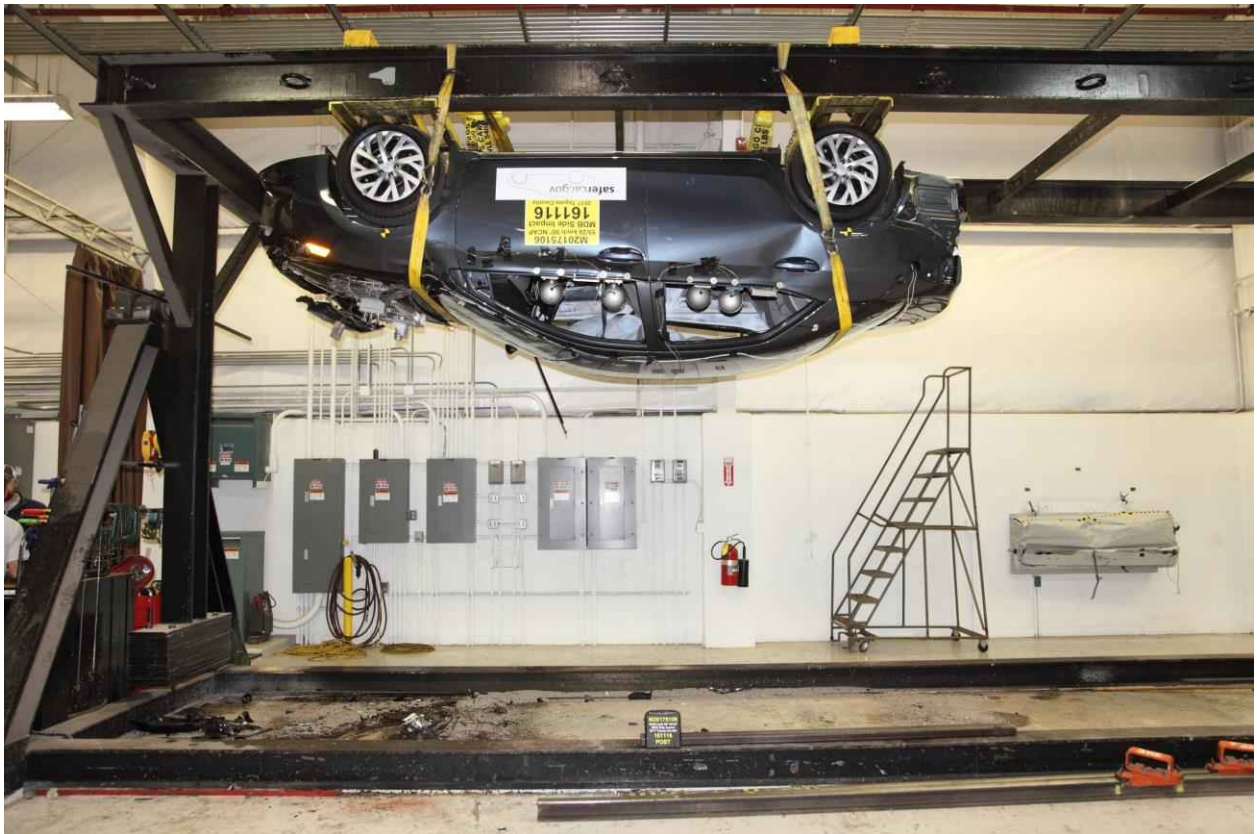
095 Post-Test Primary Speed Trap Read-Out



096 FMVSS No. 301 Static Rollover 0 Degrees



097 FMVSS No. 301 Static Rollover 90 Degrees



098 FMVSS No. 301 Static Rollover 180 Degrees



099 FMVSS No. 301 Static Rollover 270 Degrees



100 FMVSS No. 301 Static Rollover 360 Degrees

Head restraints

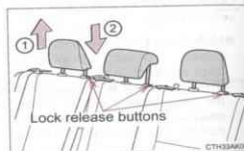
Head restraints are provided for all seats.

Front seats

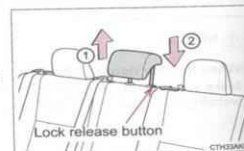
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**Rear seats****► Type A**

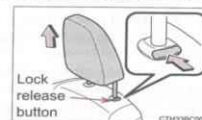
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**► Type B**

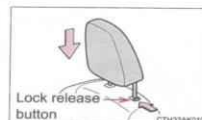
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**■ Removing the head restraints (except for fixed rear head restraints)**

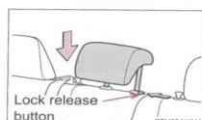
Pull the head restraint up while pressing the lock release button.

**■ Installing the head restraints (except for fixed rear head restraints)****► Front seats and rear outside seats**

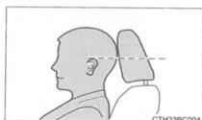
Align the head restraint with the installation holes and push it down to the lock position. Press and hold the lock release button when lowering the head restraint.

**► Rear center seat**

Align the head restraint with the installation holes and push it down to the lowest lock position while pressing the lock release button.

**■ Adjusting the height of the head restraints (except for fixed rear head restraints)**

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.

**■ Adjusting the rear center seat head restraint**

Always raise the head restraint one level from the stowed position when using.

103 Driver Head Restraint Use and Adjustment Information from Vehicle Owner's Manual**Head restraints**

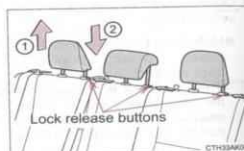
Head restraints are provided for all seats.

Front seats

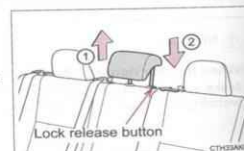
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**Rear seats****► Type A**

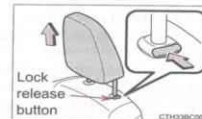
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**► Type B**

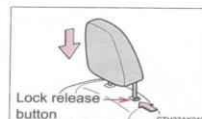
- ① Up
Pull the head restraints up.
- ② Down
Push the head restraint down while pressing the lock release button.

**■ Removing the head restraints (except for fixed rear head restraints)**

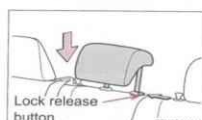
Pull the head restraint up while pressing the lock release button.

**■ Installing the head restraints (except for fixed rear head restraints)****► Front seats and rear outside seats**

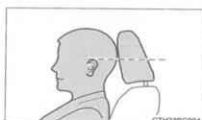
Align the head restraint with the installation holes and push it down to the lock position. Press and hold the lock release button when lowering the head restraint.

**► Rear center seat**

Align the head restraint with the installation holes and push it down to the lowest lock position while pressing the lock release button.

**■ Adjusting the height of the head restraints (except for fixed rear head restraints)**

Make sure that the head restraints are adjusted so that the center of the head restraint is closest to the top of your ears.

**■ Adjusting the rear center seat head restraint**

Always raise the head restraint one level from the stowed position when using.

104 Left Rear Passenger Head Restraint Use and Adjustment Information from Vehicle Owner's Manual

APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS

Driver & Passenger Dummy Instrumentation Plots

No.	Description	Page
1	Driver Head Acceleration (X) Primary vs. Time	B-5
2	Driver Head Acceleration (Y) Primary vs. Time	B-5
3	Driver Head Acceleration (Z) Primary vs. Time	B-5
4	Driver Head Resultant Acceleration Primary vs. Time	B-5
5	Driver Upper Thorax Rib Deflection (Y) vs. Time	B-6
6	Driver Middle Thorax Rib Deflection (Y) vs. Time	B-6
7	Driver Lower Thorax Rib Deflection (Y) vs. Time	B-6
8	Driver Thorax Rib Deflection Maximum vs. Time	B-6
9	Driver Anterior Abdominal Force (Y) vs. Time	B-7
10	Driver Middle Abdominal Force (Y) vs. Time	B-7
11	Driver Posterior Abdominal Force (Y) vs. Time	B-7
12	Driver Total Abdominal Force (Y) vs. Time	B-7
13	Driver Pubic Symphysis Force (Y) vs. Time	B-8
14	Passenger Head Acceleration (X) Primary vs. Time	B-9
15	Passenger Head Acceleration (Y) Primary vs. Time	B-9
16	Passenger Head Acceleration (Z) Primary vs. Time	B-9
17	Passenger Head Resultant Acceleration Primary vs. Time	B-9
18	Passenger Lower Spine T12 Acceleration (X) vs. Time	B-10
19	Passenger Lower Spine T12 Acceleration (Y) vs. Time	B-10
20	Passenger Lower Spine T12 Acceleration (Z) vs. Time	B-10
21	Passenger Lower Spine T12 Resultant Acceleration vs. Time	B-10
22	Passenger Iliac Force on Impact Side (Y) vs. Time	B-11
23	Passenger Acetabulum Force on Impact Side (Y) vs. Time	B-11
24	Passenger Total Pelvic Force on Impact Side (Y) vs. Time	B-11

The following additional data can be obtained from the Research and Development section of the NHTSA website (<http://www.nhtsa.dot.gov>)

Additional Driver & Passenger Dummy Instrumentation Data

Driver Lower Spine T12 Acceleration (X)
Driver Lower Spine T12 Acceleration (Y)
Driver Lower Spine T12 Acceleration (Z)
Passenger Upper Thorax Rib Deflection (Y)
Passenger Middle Thorax Rib Deflection (Y)
Passenger Lower Thorax Rib Deflection (Y)
Passenger Upper Abdomen Rib Deflection (Y)
Passenger Lower Abdomen Rib Deflection (Y)
Driver Head Acceleration Redundant (X)
Driver Head Acceleration Redundant (Y)
Driver Head Acceleration Redundant (Z)
Passenger Head Acceleration Redundant (X)
Passenger Head Acceleration Redundant (Y)
Passenger Head Acceleration Redundant (Z)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)
Vehicle Center of Gravity Acceleration (Y)
Vehicle Center of Gravity Acceleration (Z)
Right Side Sill at Front Seat Acceleration (X)
Right Side Sill at Front Seat Acceleration (Y)
Right Side Sill at Front Seat Acceleration (Z)
Right Side Sill at Rear Seat Acceleration (X)
Right Side Sill at Rear Seat Acceleration (Y)
Right Side Sill at Rear Seat Acceleration (Z)
Left Side Sill at Front Seat Acceleration (Y)
Left Side Sill at Rear Seat Acceleration (Y)
Lower A-Post Acceleration (Y)
Middle A-Post Acceleration (Y)
Lower B-Post Acceleration (Y)
Middle B-Post Acceleration (Y)
Front Seat Track Acceleration (Y)
Rear Seat Structure Acceleration (Y)
Right Rear Occupant Compartment Acceleration (Y)
Engine Block (X)
Engine Block (Y)
Rear Floorpan Above Axle Acceleration (X)
Rear Floorpan Above Axle Acceleration (Y)
Rear Floorpan Above Axle Acceleration (Z)

MDB Instrumentation Data

MDB Center of Gravity Acceleration (X)
MDB Center of Gravity Acceleration (Y)
MDB Center of Gravity Acceleration (Z)
MDB Rear Acceleration (X)
MDB Rear Acceleration (Y)
Left MDB Contact Switch
Right MDB Contact Switch

NHTSA

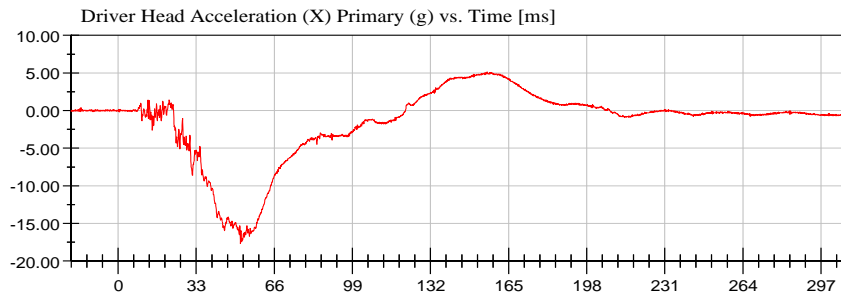
Test Lab: CTF

Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)



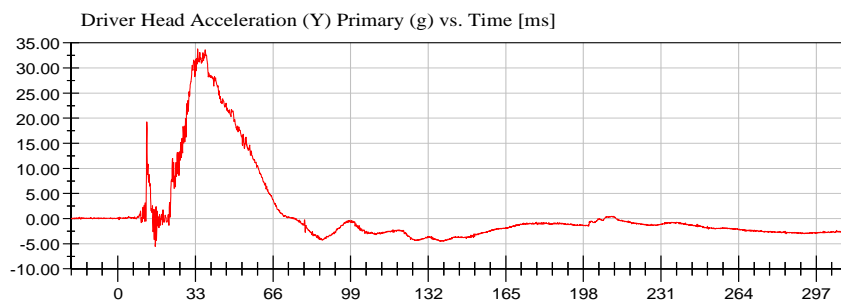
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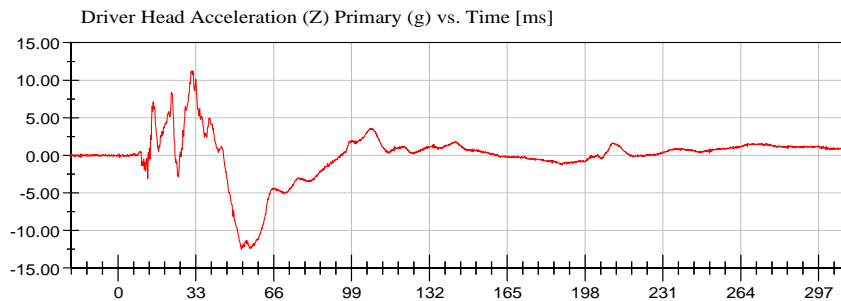
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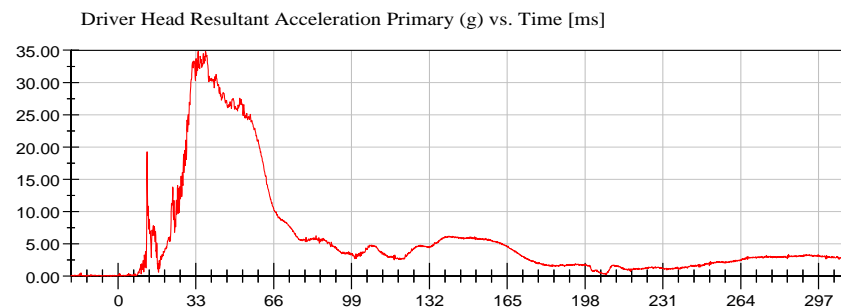
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-12.49 g at 52.24 ms

CFC_1000



<Max>

34.86 g at 37.12 ms

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0.02 g at -18.80 ms

CFC_1000



NHTSA

Test Lab: CTF

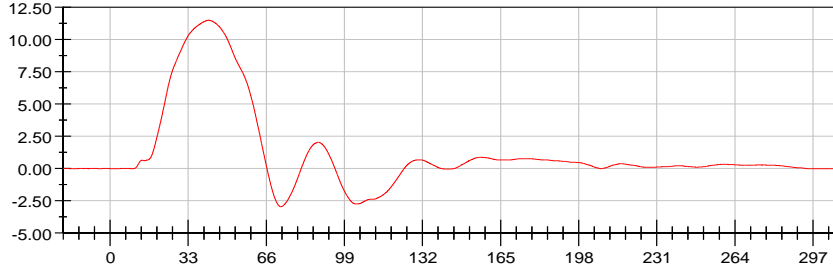
Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)

Driver Upper Thorax Rib Deflection (Y) (mm) vs. Time [ms]



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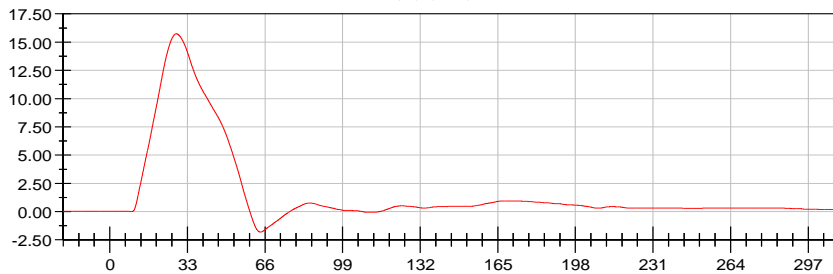
11.50 mm at 41.60 ms

<Min>

-2.96 mm at 72.16 ms

CFC_180

Driver Middle Thorax Rib Deflection (Y) (mm) vs. Time [ms]



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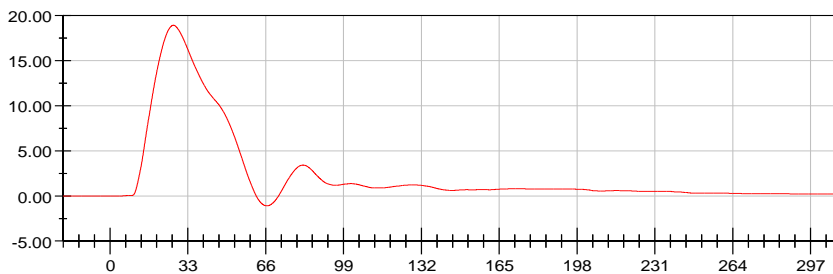
15.74 mm at 28.32 ms

<Min>

-1.83 mm at 64.08 ms

CFC_180

Driver Lower Thorax Rib Deflection (Y) (mm) vs. Time [ms]



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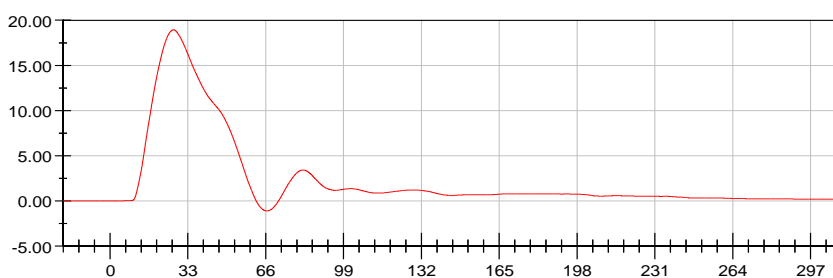
18.94 mm at 26.88 ms

<Min>

-1.09 mm at 66.56 ms

CFC_180

Driver Thorax Rib Deflection Maximum (mm) vs. Time [ms]



<Max>

18.94 mm at 26.88 ms

<Min>

-1.09 mm at 66.56 ms

CFC_180



NHTSA

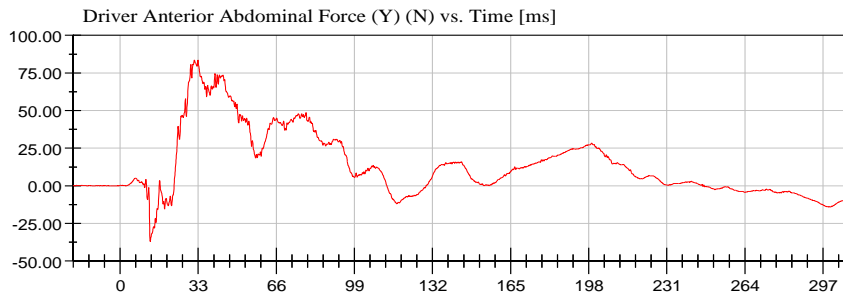
Test Lab: CTF

Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)



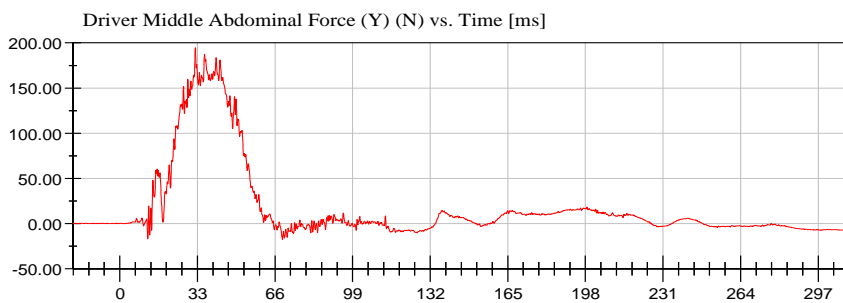
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83.61 N at 32.88 ms

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-36.99 N at 12.72 ms

CFC_600



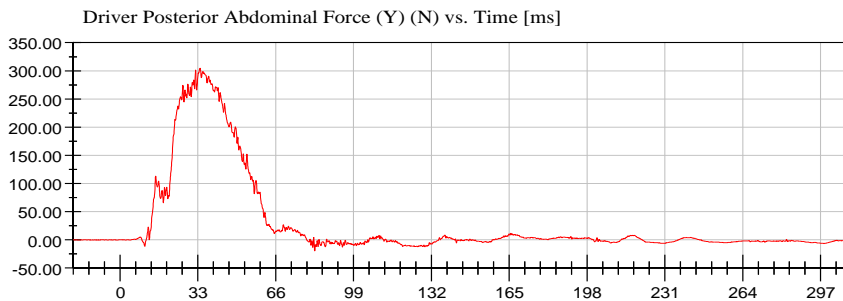
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-17.62 N at 69.12 ms

CFC_600



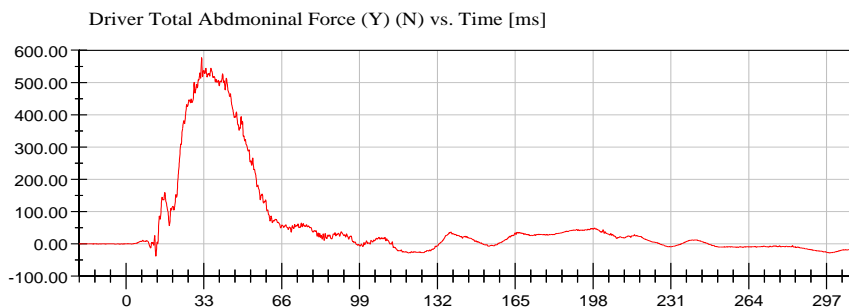
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304.56 N at 33.92 ms

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-19.35 N at 82.56 ms

CFC_600



<Max>

577.05 N at 32.08 ms

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-38.16 N at 12.64 ms

CFC_600



NHTSA

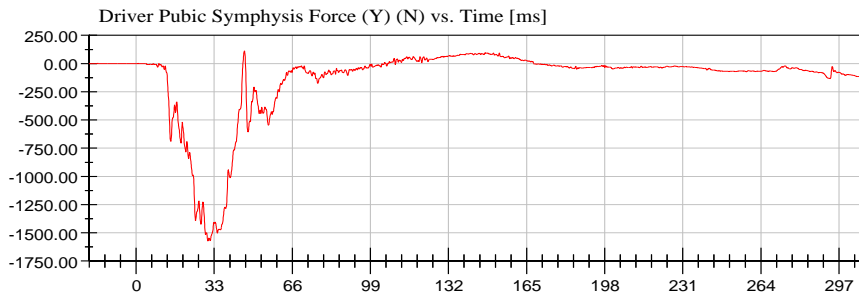
Test Lab: CTF

Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)



<Max>

111.89 N at 45.76 ms

<Min>

-1,571.14 N at 30.32 ms

CFC_600



NHTSA

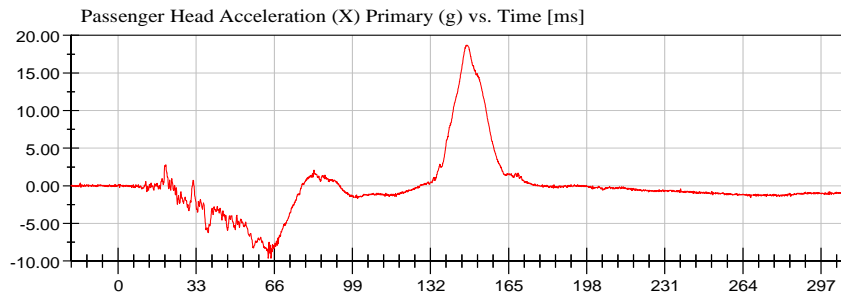
Test Lab: CTF

Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)



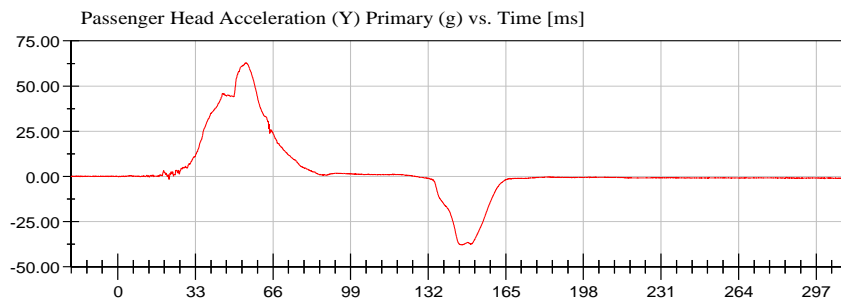
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CFC_1000



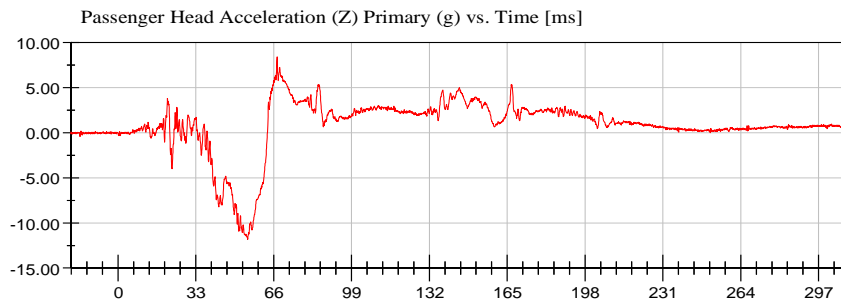
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62.89 g at 54.56 ms

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-38.08 g at 146.32 ms

CFC_1000



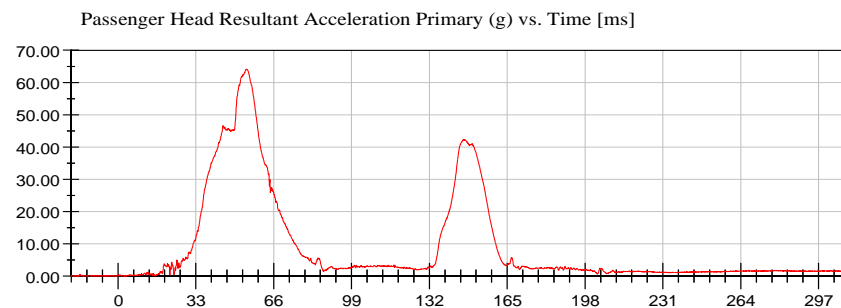
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8.42 g at 67.44 ms

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-11.82 g at 54.96 ms

CFC_1000



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0.03 g at -19.04 ms

CFC_1000



NHTSA

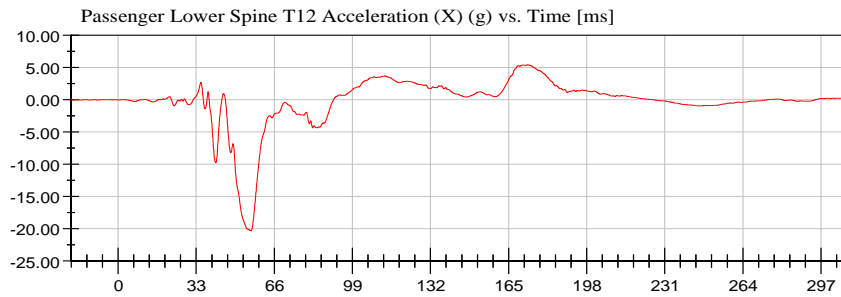
Test Lab: CTF

Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)



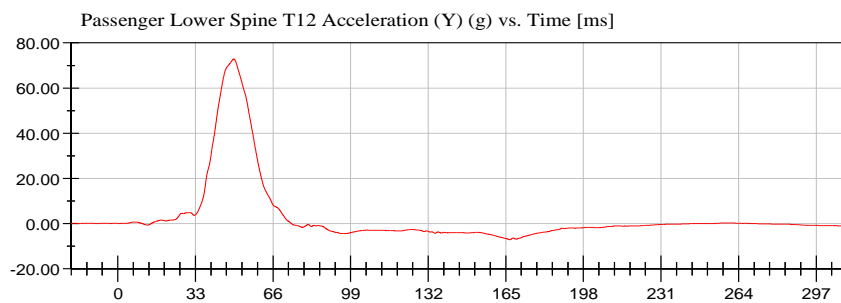
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CFC_180



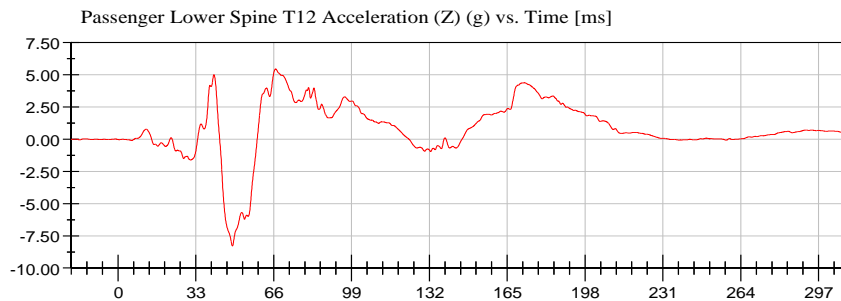
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-7.20 g at 166.80 ms

CFC_180



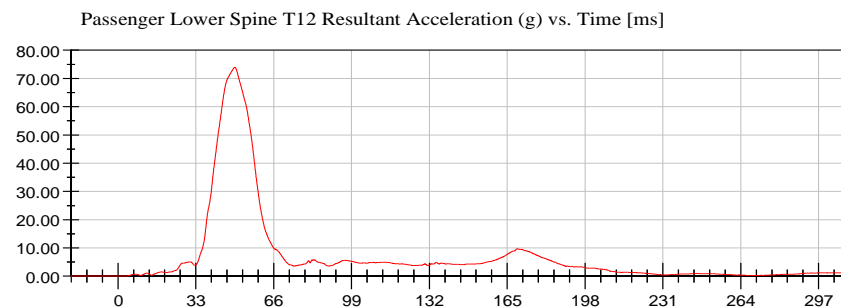
<Max>

5.46 g at 66.80 ms

<Min>

-8.29 g at 48.56 ms

CFC_180



<Max>

73.92 g at 49.44 ms

<Min>

0.01 g at -2.48 ms

CFC_180



NHTSA

Test Lab: CTF

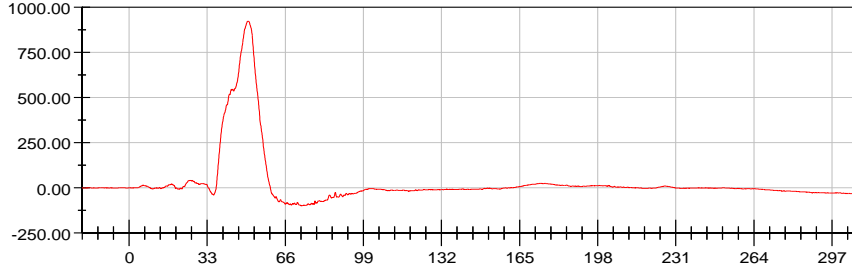
Test Number: 161116 (M20175106)

Test Date: 11/16/2016

Position #1 ES-2 Dummy with Rib Extension (F030)

Position #4 SID IIs Dummy (305)

Passenger Iliac Force on Impact Side (Y) (N) vs. Time [ms]



<Max>

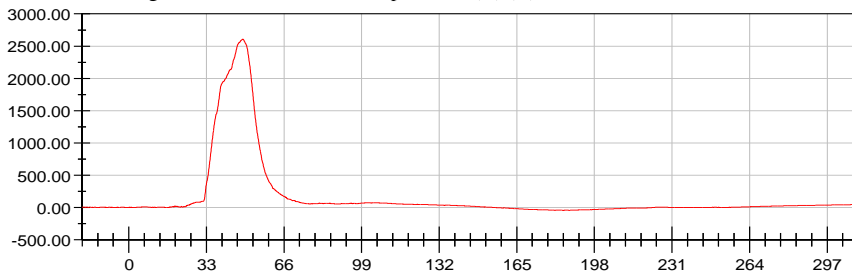
923.00 N at 50.24 ms

<Min>

-99.05 N at 72.72 ms

CFC_600

Passenger Acetabulum Force on Impact Side (Y) (N) vs. Time [ms]



<Max>

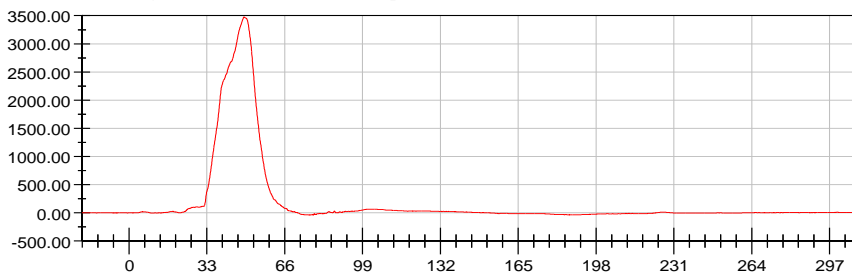
2,607.66 N at 48.48 ms

<Min>

-47.49 N at 184.72 ms

CFC_600

Passenger Total Pelvic Force on Impact Side (Y) (N) vs. Time [ms]



<Max>

3,477.02 N at 48.80 ms

<Min>

-38.71 N at 76.56 ms

CFC_600



APPENDIX C
DUMMY PERFORMANCE CALIBRATION TEST DATA

TABLE OF CALIBRATION MEASUREMENTS AND PLOTS

ES-2re (Driver) Dummy

Description

Table 1. External Measurements

Table 2. Head Drop Test

Head (X) Acceleration (G's) vs. Time (ms)
Head (Y) Acceleration (G's) vs. Time (ms)
Head (Z) Acceleration (G's) vs. Time (ms)
Resultant Head Acceleration (G's) vs. Time (ms)

Table 3 Neck Pendulum Test

Pendulum Velocity (m/s) vs. Time (ms)
Flexion Angle (°) vs. Time (ms)
Potentiometer A (°) vs. Time (ms)
Potentiometer B (°) vs. Time (ms)
Potentiometer C (°) vs. Time (ms)

Table 4. Shoulder Impact Test

Impactor Acceleration (G's) vs. Time (ms)

Table 5. Thorax – Upper Rib Drop Test

Upper Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)
Upper Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 6. Thorax – Middle Rib Drop Test

Middle Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)
Middle Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 7. Thorax – Lower Rib Drop Test

Lower Rib Displacement @ 459 mm Drop Height (mm) vs. Time (ms)
Lower Rib Displacement @ 815 mm Drop Height (mm) vs. Time (ms)

Table 8. Thorax – Full Body Impact Test

Pendulum Acceleration (G's) vs. Time (ms)
Impactor Force (kN) vs. Time (ms)
Upper Rib Displacement (mm) vs. Time (ms)
Middle Rib Displacement (mm) vs. Time (ms)
Lower Rib Displacement (mm) vs. Time (ms)

Table 9. Abdomen Impact Test

Impactor Force (kN) vs. Time (ms)
Front Abdomen Force (kN) vs. Time (ms)
Middle Abdomen Force (kN) vs. Time (ms)
Rear Abdomen Force (kN) vs. Time (ms)
Total Abdomen Force (kN) vs. Time (ms)

Table 10. Lumbar Spine Flexion Test

Pendulum Velocity (m/s) vs. Time (ms)
Spine Flexion Angle (°) vs. Time (ms)
Potentiometer A (°) vs. Time (ms)
Potentiometer B (°) vs. Time (ms)
Potentiometer C (°) vs. Time (ms)

Table 11. Pelvis Impact Test

Pendulum Acceleration (G's) vs. Time (ms)
Impactor Force (kN) vs. Time (ms)
Pubic Symphysis (Y) Force (kN) vs. Time (ms)

TABLE OF CALIBRATION MEASUREMENTS AND PLOTS

SID-IIs (Rear Passenger) Dummy

Description

Table 1. External Measurements

Table 2. Head Drop Test

Head (X) Acceleration (G's) vs. Time (ms)
Head (Y) Acceleration (G's) vs. Time (ms)
Head (Z) Acceleration (G's) vs. Time (ms)
Resultant Head Acceleration (G's) vs. Time (ms)

Table 3. Lateral Neck Pendulum Test

Pendulum Velocity (m/s) vs. Time (ms)
Flexion Angle (°) vs. Time (ms)
Moment About Occipital Condyle (Nm) vs. Time (ms)

Table 4. Shoulder Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Shoulder Displacement (mm) vs. Time (ms)
Upper Spine Acceleration (G's) vs. Time (ms)

Table 5. Thorax (With Arm) Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Shoulder Displacement (mm) vs. Time (ms)
Upper Rib Displacement (mm) vs. Time (ms)
Middle Rib Displacement (mm) vs. Time (ms)
Lower Rib Displacement (mm) vs. Time (ms)
Upper Spine Acceleration (G's) vs. Time (ms)
Lower Spine Acceleration (G's) vs. Time (ms)

Table 6. Thorax (Without Arm) Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Upper Rib Displacement (mm) vs. Time (ms)
Middle Rib Displacement (mm) vs. Time (ms)
Lower Rib Displacement (mm) vs. Time (ms)
Upper Spine Acceleration (G's) vs. Time (ms)
Lower Spine Acceleration (G's) vs. Time (ms)

Table 7. Abdomen Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Upper Abdominal Rib Displacement (mm) vs. Time (ms)
Lower Abdominal Rib Displacement (mm) vs. Time (ms)
Lower Spine Acceleration (G's) vs. Time (ms)

Table 8. Pelvis Plug Quasi-Static Test (Optional*)

Table 9. Pelvis Acetabulum Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Pelvis (Y) Acceleration (G's) vs. Time (ms)
Acetabulum Force (N) vs. Time (ms)

Table 10. Pelvis Iliac Impact Test

Impactor Acceleration (G's) vs. Time (ms)
Pelvis (Y) Acceleration (G's) vs. Time (ms)
Iliac Force (N) vs. Time (ms)

Pre-Test Calibration Sheets
Driver S/N F030

Transportation Research Center Inc.
572U ES-2re Dummy
External Dimensions
Serial No. F030 Calibration No. 42

Symbol	Description	Specification	Results	Pass
		mm	mm	
1	Sitting Height	900.0 - 918.0	910	Yes
2	Seat to Shoulder Joint	558.0 - 572.0	559	Yes
3	Seat to Lower Face of Thoracic Spine Box	346.0 - 356.0	350	Yes
4	Seat to Hip Joint (center of bolt)	97.0 - 103.0	98	Yes
5	Sole to Seat, Sitting	433.0 - 451.0	444	Yes
6	Head Width	152.0 - 158.0	155	Yes
7	Shoulder/Arm Width	461.0 - 479.0	475	Yes
8	Thorax Width	322.0 - 332.0	326	Yes
9	Abdomen Width	273.0 - 287.0	280	Yes
10	Pelvis Lap Width	359.0 - 373.0	365	Yes
11	Head Depth	196.0 - 206.0	204	Yes
12	Thorax Depth	262.0 - 272.0	263	Yes
13	Abdomen Depth	194.0 - 204.0	200	Yes
14	Pelvis Depth	235.0 - 245.0	240	Yes
15	Back of Buttocks to Hip Joint (center of bolt)	150.0 - 160.0	158	Yes
16	Back of Buttocks to Front of Knee	597.0 - 615.0	605	Yes

Baseline 10/07/05



Transportation Research Center Inc.

Left Lateral Head Drop

ES-2re Serial No. F030 Certification No. 42-4

Test Date: 11/15/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	24 %	Yes
Peak Resultant Acceleration	125 - 155 g	142.0 g	Yes
Peak Longitudinal Acceleration	(-15) - 15 g	7.5 g	Yes
Is Resultant Acceleration Curve Unimodal within 15% of Main Pulse?	Yes	Yes	Yes

Test meets specifications.

Comments:

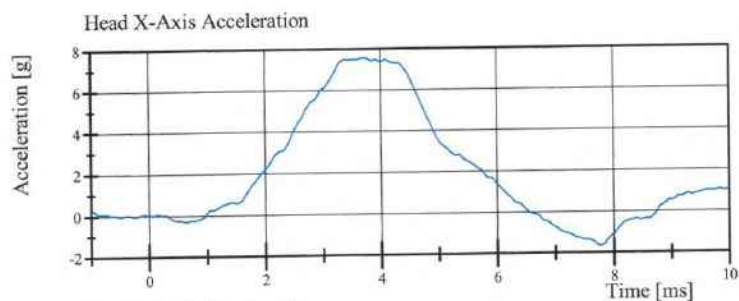
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.15.2016 10:10:09 361

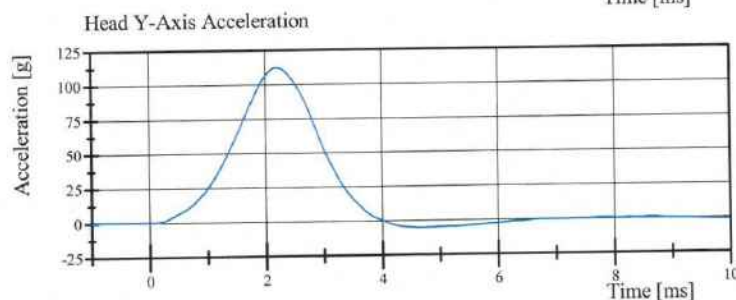


Transportation Research Center Inc.

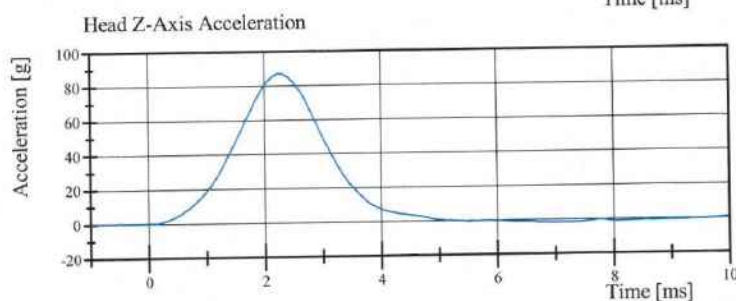
Left Lateral Head Drop
ES-2re Serial No. F030 Certification No. 42-4
Test Date: 11/15/2016



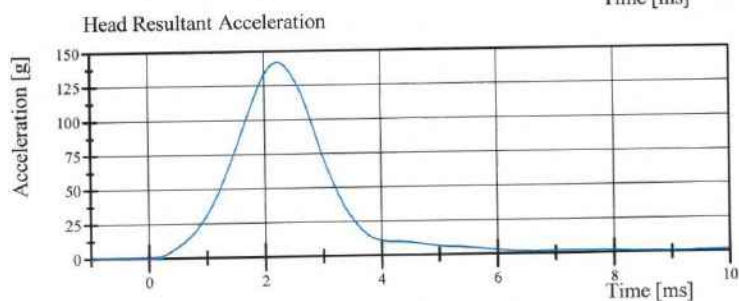
Filter Class: CFC_1000
Max: 7.5 g at 3.7 ms
Min: -1.7 g at 7.8 ms



Filter Class: CFC_1000
Max: 112.3 g at 2.2 ms
Min: -5.4 g at 4.7 ms



Filter Class: CFC_1000
Max: 86.9 g at 2.2 ms
Min: -1.5 g at 7.0 ms



Filter Class: CFC_1000
Max: 142.0 g at 2.2 ms
Min: 0.0 g at -0.6 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.15.2016 10:10:18 361



Transportation Research Center Inc.

Left Lateral Neck

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	23 %	Yes
Pendulum Integrated Velocity Change within Corridor	Yes	Yes	Yes
Pendulum Velocity	(-3.3) - (-3.5) m/s	-3.37 m/s	Yes
Maximum Headform Flexion			
Peak	(-49) - (-59) deg	-54.1 deg	Yes
Time of Peak	54 - 66 ms	60.4 ms	Yes
Headform Flexion Decay			
- Peak to Zero	53 - 88 ms	63.8 ms	Yes

Test meets specifications.

Comments:

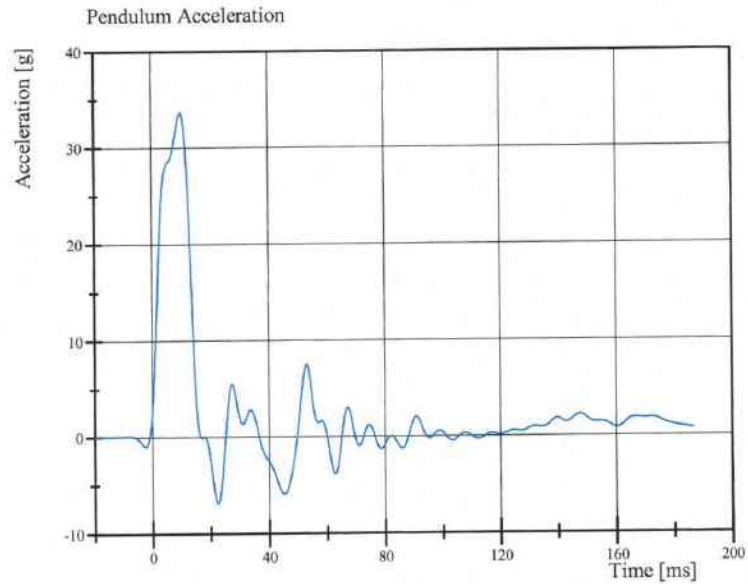
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:42:03 1494

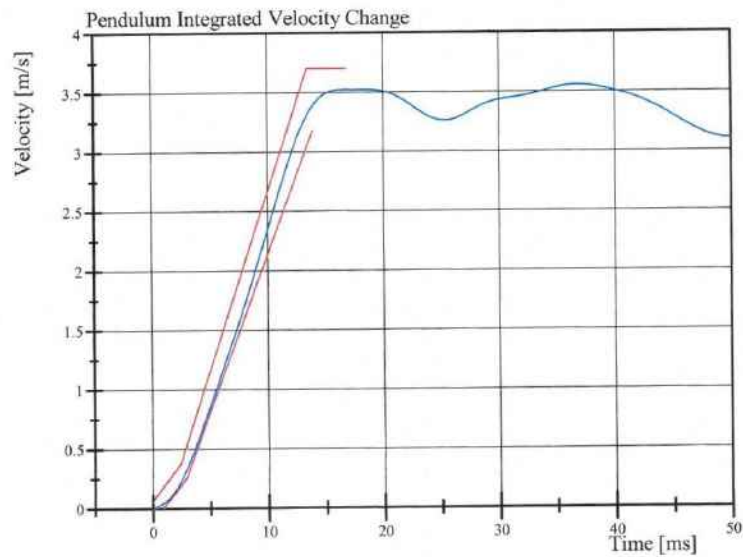


Transportation Research Center Inc.

Left Lateral Neck
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_60
Max: 33.6 g at 10.1 ms
Min: -7.0 g at 22.6 ms



Filter Class: CFC_60
Max: 3.6 m/s at 36.8 ms
Min: 0.0 m/s at 0.0 ms

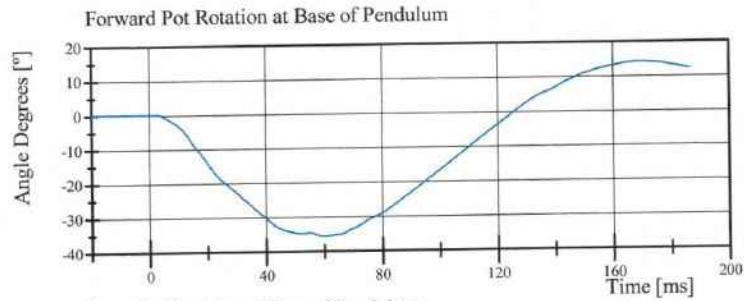
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:42:34 1494

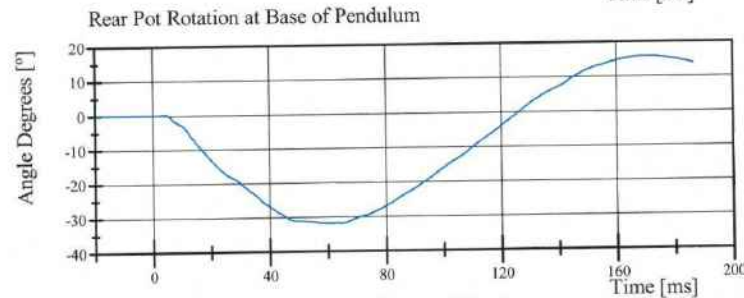


Transportation Research Center Inc.

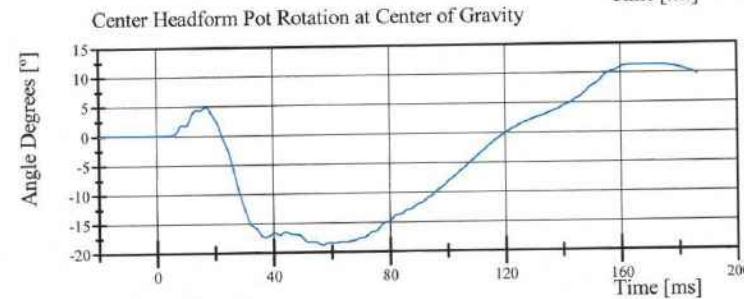
Left Lateral Neck
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



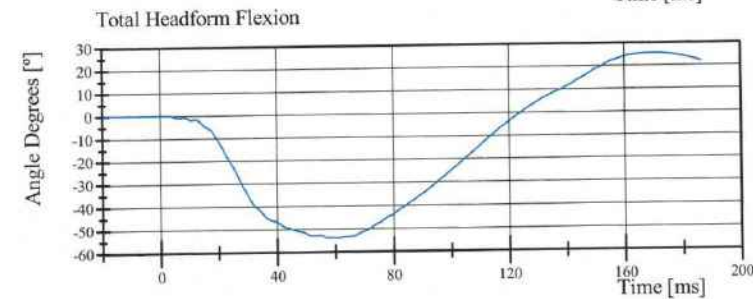
Filter Class: CFC_180
Max: 14.1 ° at 169.0 ms
Min: -35.7 ° at 60.0 ms



Filter Class: CFC_180
Max: 16.0 ° at 170.8 ms
Min: -31.9 ° at 61.0 ms



Filter Class: CFC_180
Max: 11.3 ° at 169.6 ms
Min: -18.9 ° at 56.9 ms



Filter Class: CFC_180
Max: 25.5 ° at 169.1 ms
Min: -54.1 ° at 60.4 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:42:35 1494



Transportation Research Center Inc.

Left Lateral Shoulder

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Test Probe Velocity	4.2 - 4.4 m/s	4.28 m/s	Yes
Test Probe Acceleration	(-7.5) - (-10.5) g	-10.29 g	Yes

Test meets specifications.

Comments:

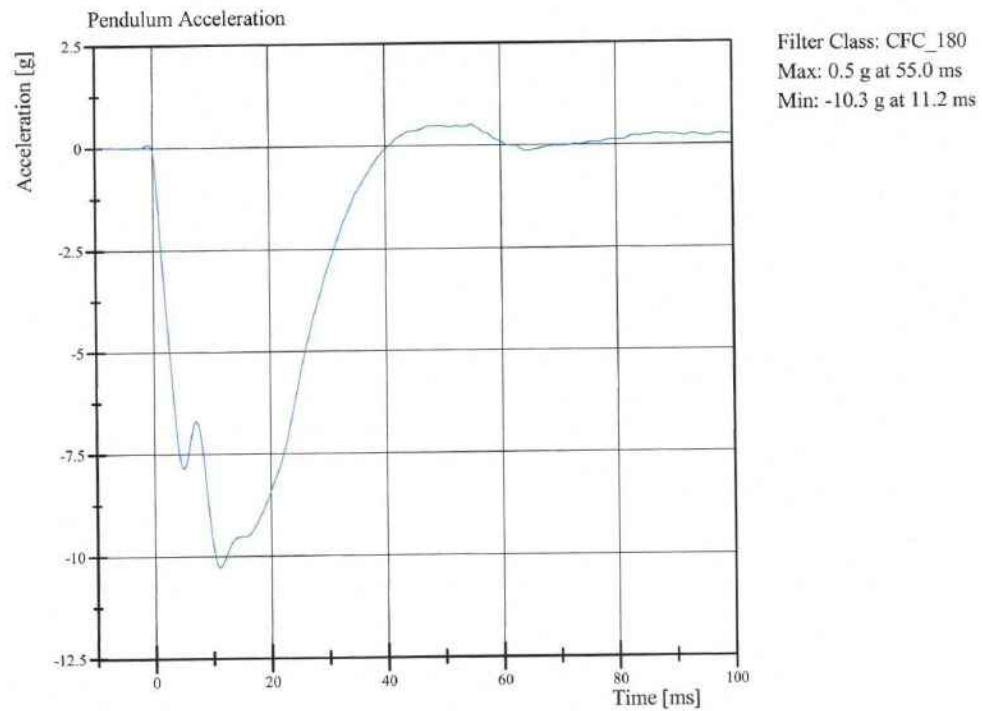
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:38:15 542



Transportation Research Center Inc.

Left Lateral Shoulder
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:38:56 542



Transportation Research Center Inc.

3.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	21 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	36.4 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

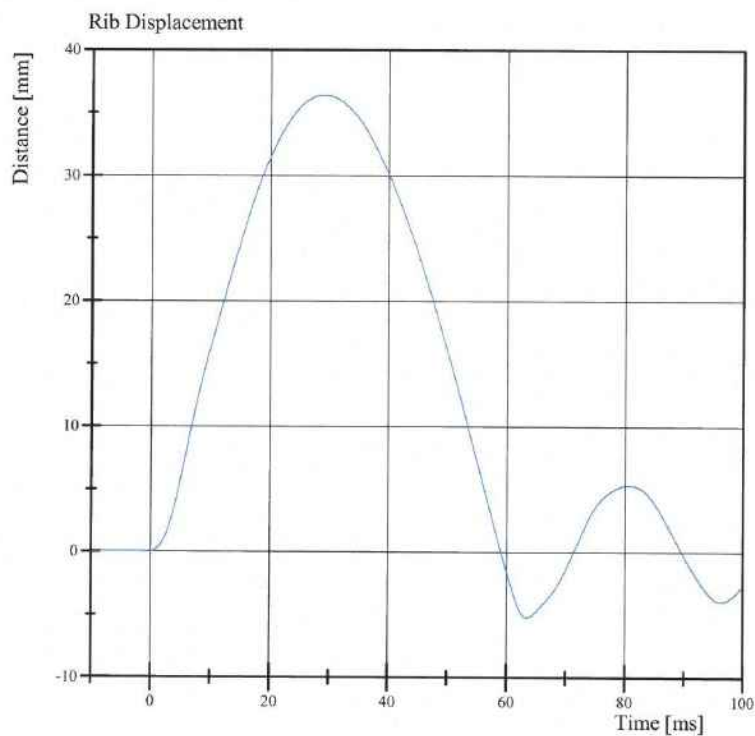
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 12:58:57 859



Transportation Research Center Inc.

3.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 36.4 mm at 29.0 ms
Min: -5.2 mm at 63.5 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 12:59:32 859



Transportation Research Center Inc.

4.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	21 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	46.4 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

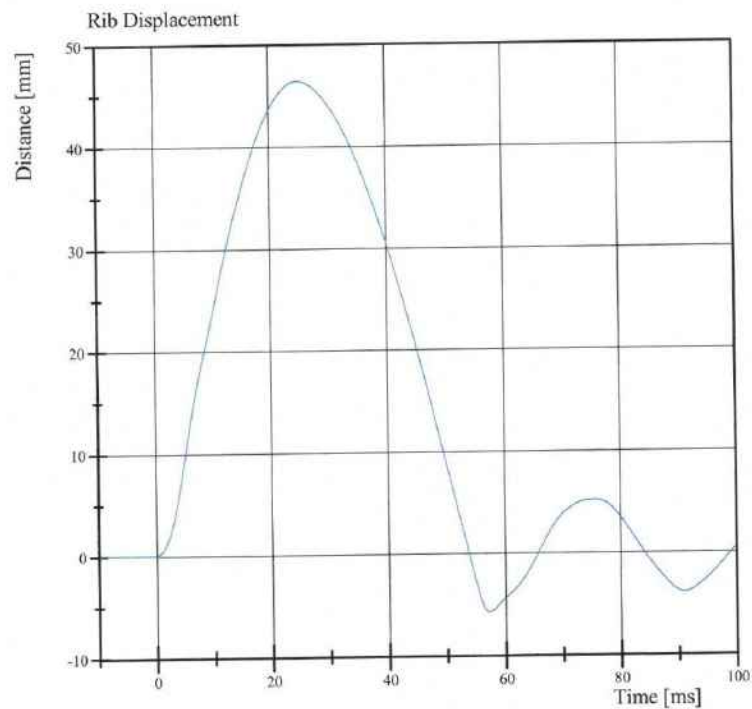
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 12:51:54 703



Transportation Research Center Inc.

4.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 46.4 mm at 25.1 ms
Min: -5.7 mm at 57.3 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 12:52:32 703



Transportation Research Center Inc.

3.0 m/s Center Full Rib Module

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	36.7 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

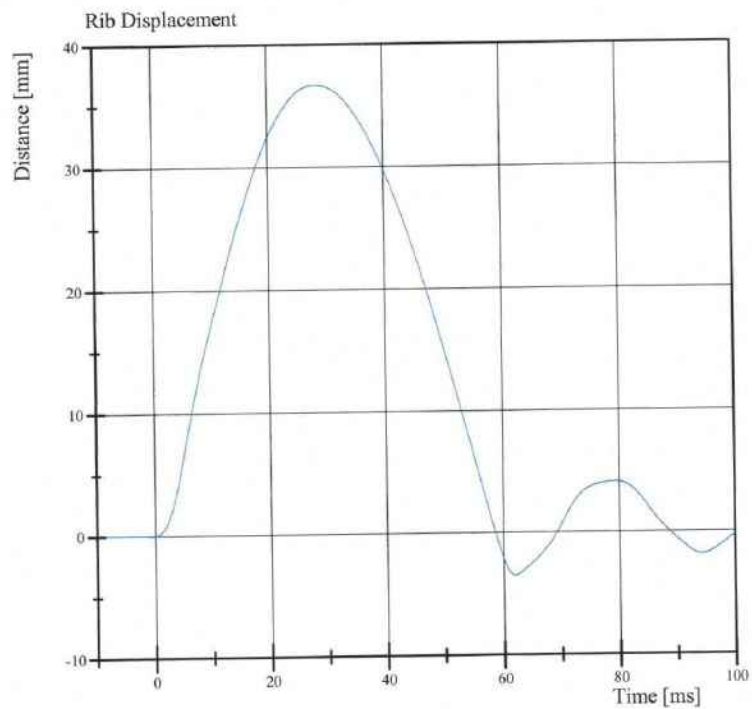
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:16:16 879



Transportation Research Center Inc.

3.0 m/s Center Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 36.7 mm at 28.5 ms
Min: -3.5 mm at 62.0 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:16:52 879



Transportation Research Center Inc.

4.0 m/s Center Full Rib Module

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	21 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	47.9 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

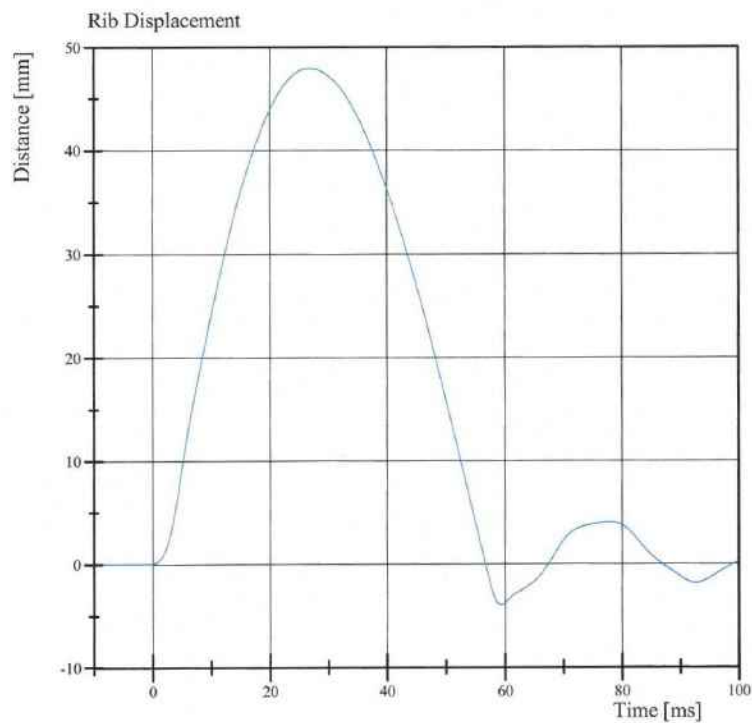
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:08:32.693



Transportation Research Center Inc.

4.0 m/s Center Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 47.9 mm at 26.9 ms
Min: -3.9 mm at 59.4 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:09:05 693



Transportation Research Center Inc.

3.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	36.3 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

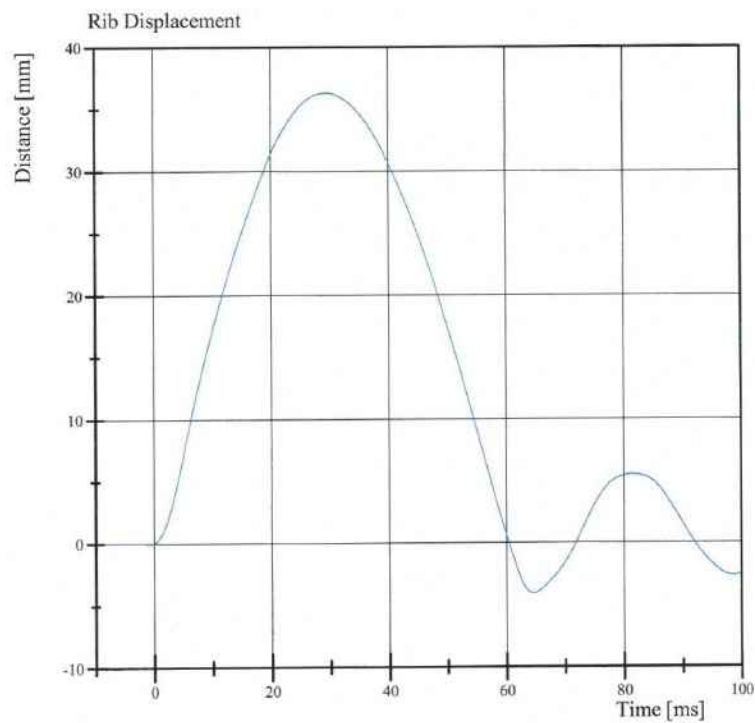
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:32:56 870



Transportation Research Center Inc.

3.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 36.3 mm at 29.6 ms
Min: -4.0 mm at 64.6 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:33:39 870



Transportation Research Center Inc.

4.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	47.5 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

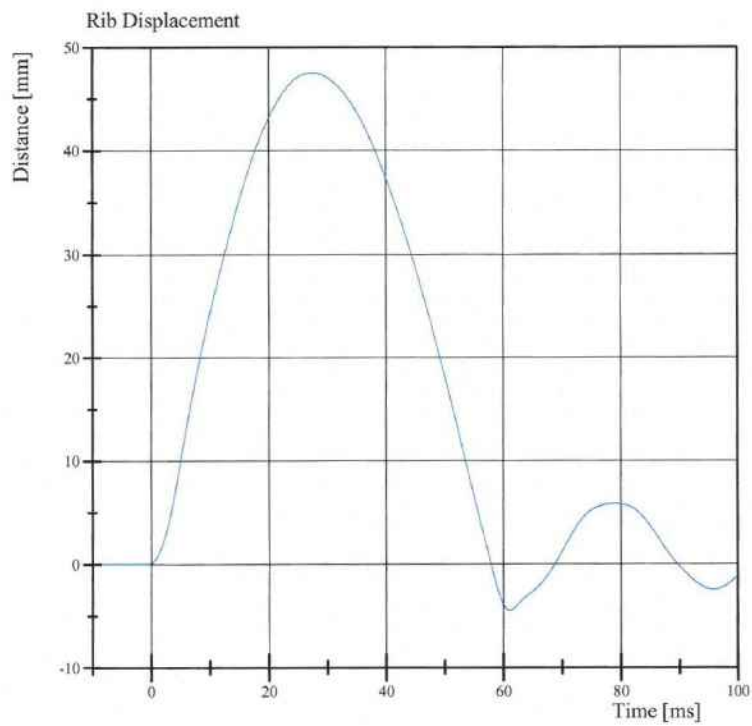
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:24:18 679



Transportation Research Center Inc.

4.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 47.5 mm at 27.6 ms
Min: -4.5 mm at 61.1 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 13:25:14 679



Transportation Research Center Inc.

Left Lateral Thorax

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Impactor Velocity	5.4 - 5.60 m/s	5.553 m/s	Yes
Peak Impactor Force after 6 ms	(-5,100) - (-6,200) N	-5,172.6 N	Yes
Upper Rib Displacement	34 - 41 mm	36.8 mm	Yes
Center Rib Displacement	37 - 45 mm	41.9 mm	Yes
Lower Rib Displacement	37 - 44 mm	41.1 mm	Yes

Test meets specifications.

Comments:

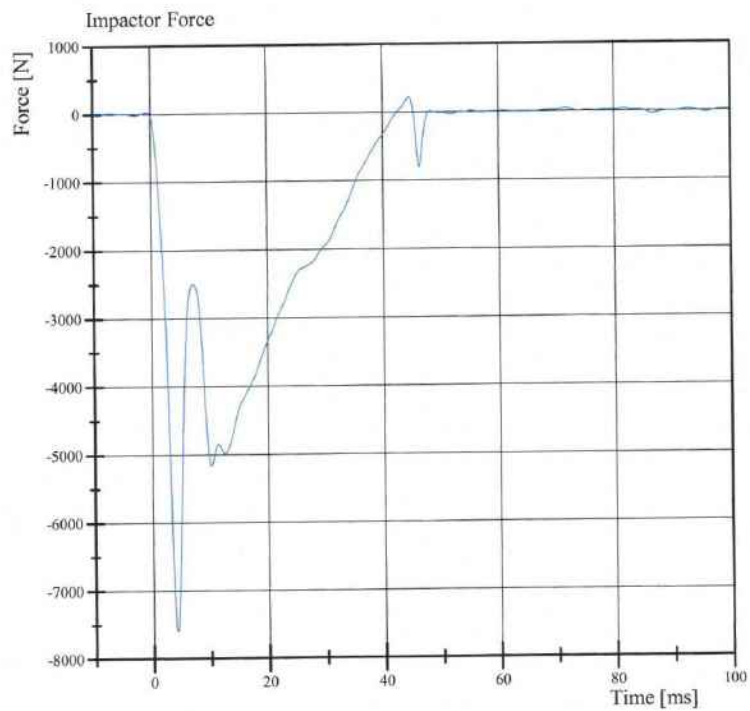
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:47:03 432



Transportation Research Center Inc.

Left Lateral Thorax
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 220.1 N at 44.6 ms
Min: -7,608.6 N at 4.2 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:47:53 432

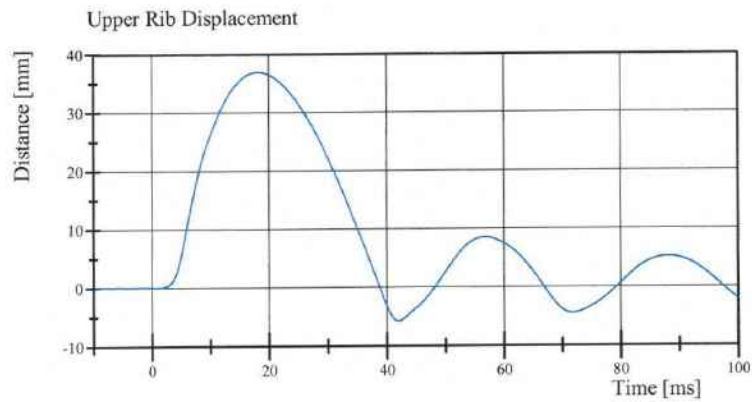


Transportation Research Center Inc.

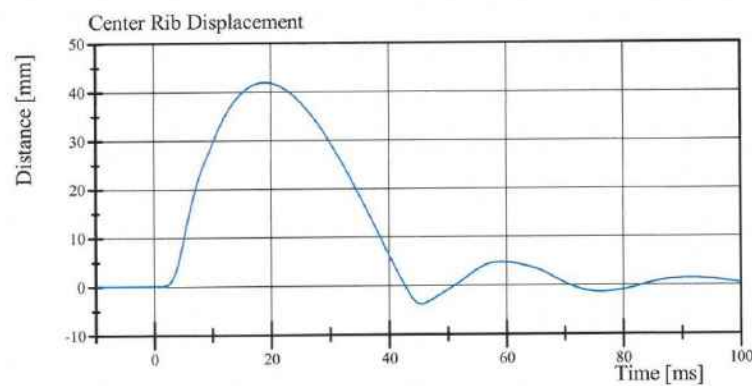
Left Lateral Thorax

ES-2re Serial No. F030 Certification No. 42-1

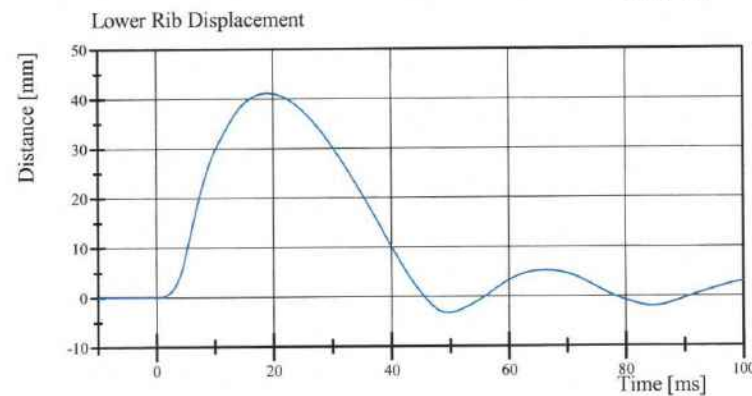
Test Date: 11/14/2016



Filter Class: CFC_180
Max: 36.8 mm at 18.2 ms
Min: -5.8 mm at 42.0 ms



Filter Class: CFC_180
Max: 41.9 mm at 19.0 ms
Min: -3.8 mm at 45.4 ms



Filter Class: CFC_180
Max: 41.1 mm at 19.1 ms
Min: -3.3 mm at 49.7 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:47:55 432



Transportation Research Center Inc.

Left Lateral Abdomen

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Test Probe Velocity	3.9 - 4.1 m/s	4.06 m/s	Yes
Test Probe Force			
Peak	4,000 - 4,800 N	4,010.6 N	Yes
Time of Peak	10.6 - 13.0 ms	11.36 ms	Yes
Total Abdominal Force			
Peak	2,200 - 2,700 N	2,382.3 N	Yes
Time of Peak	10.0 - 12.3 ms	11.04 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:56:25 552

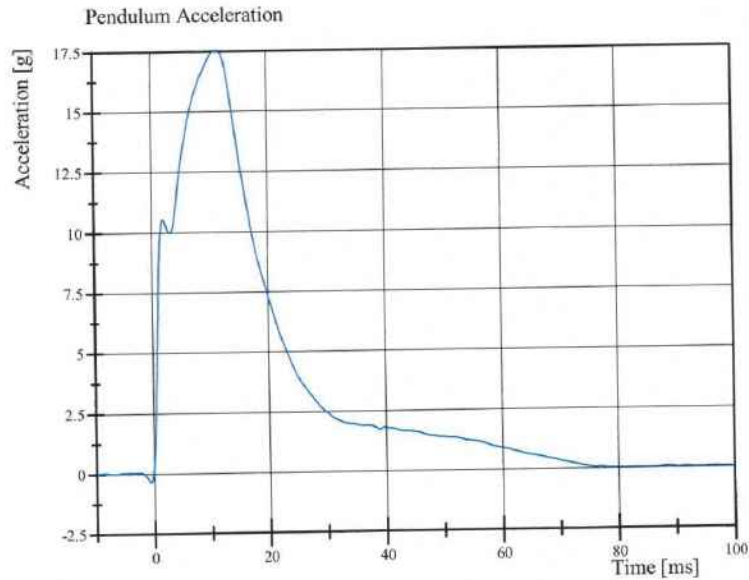


Transportation Research Center Inc.

Left Lateral Abdomen

ES-2re Serial No. F030 Certification No. 42-1

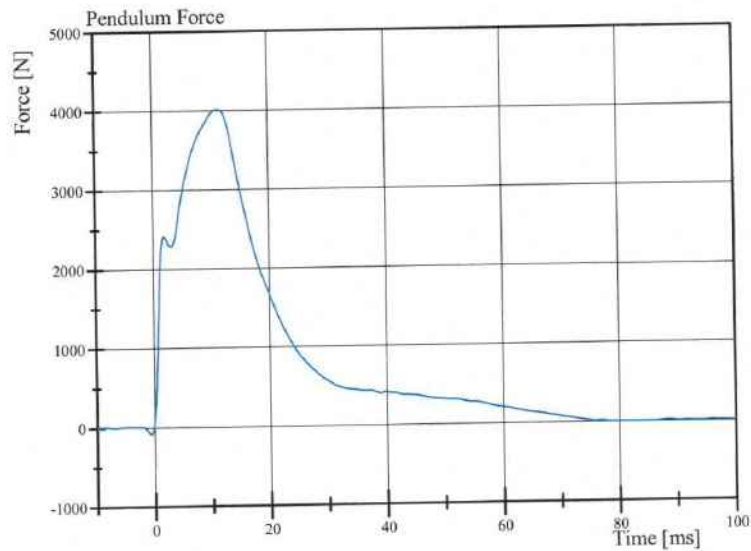
Test Date: 11/14/2016



Filter Class: CFC_180

Max: 17.5 g at 11.4 ms

Min: -0.4 g at -0.6 ms



Filter Class: CFC_180

Max: 4,010.6 N at 11.4 ms

Min: -85.7 N at -0.6 ms

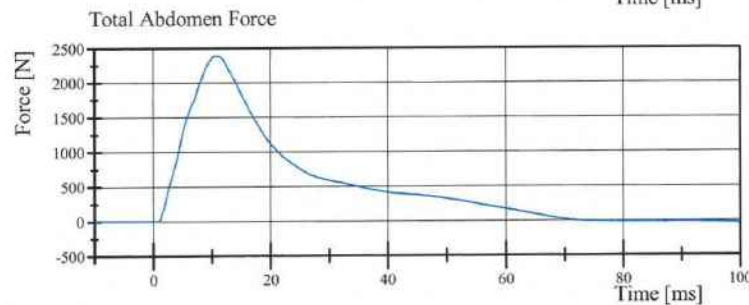
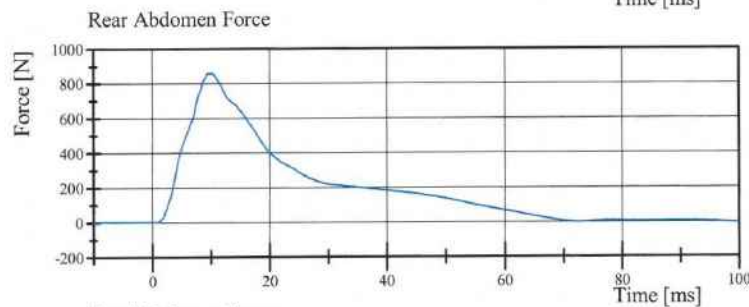
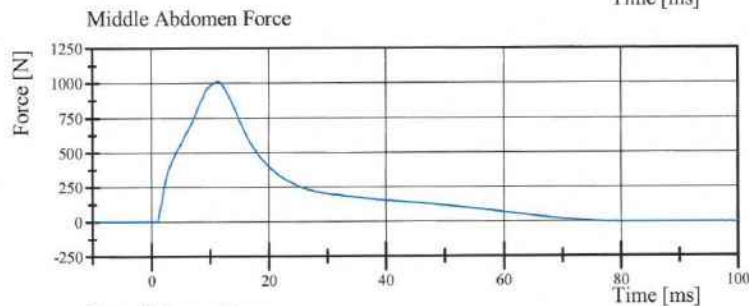
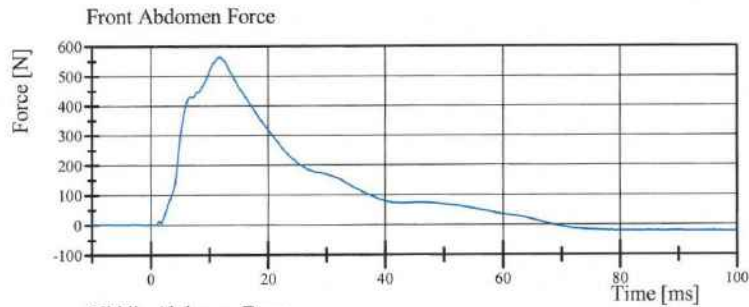
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:56:49 552



Transportation Research Center Inc.

Left Lateral Abdomen
ES-2re Serial No. F030 Certification No. 42-1
Test Date: 11/14/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 15:56:51 552



Transportation Research Center Inc.

Left Lateral Lumbar

ES-2re Serial No. F030 Certification No. 42-6

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	22.0 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Pendulum Integrated Velocity Change within Corridor	Yes	Yes	Yes
Pendulum Velocity	(-5.95) - (-6.15) m/s	-6.114 m/s	Yes
Maximum Headform Flexion			
Peak	(-45) - (-55) deg	-51.2 deg	Yes
Time of Peak	39 - 53 ms	45.5 ms	Yes
Headform Flexion Decay			
- Peak to Zero	37 - 57 ms	37.1 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:29:44 668

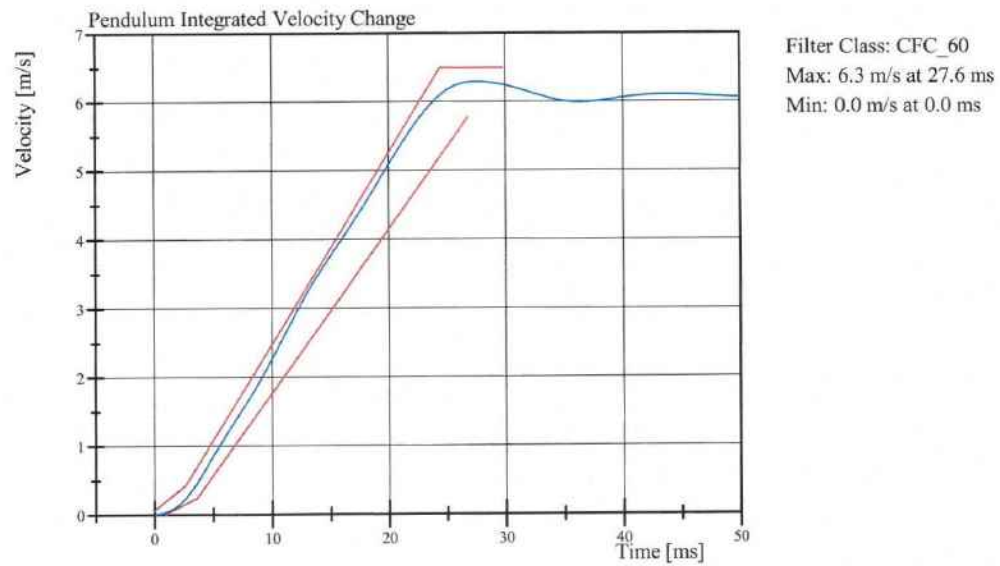
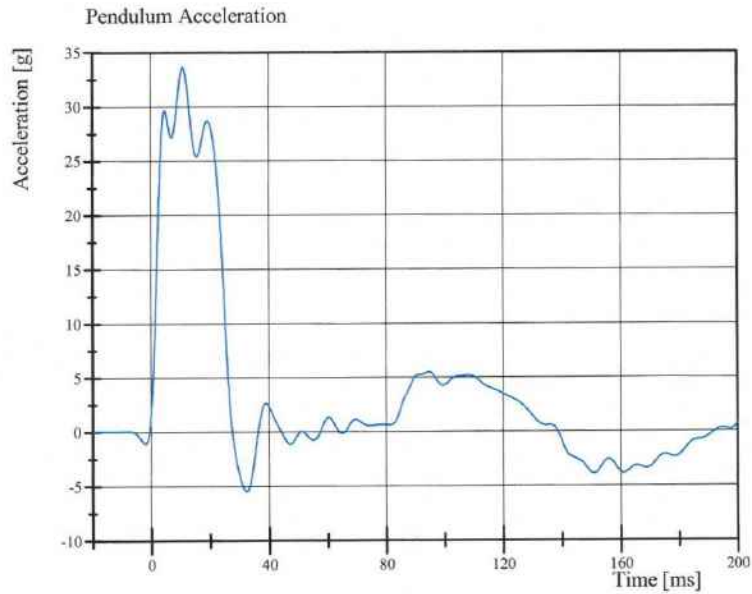


Transportation Research Center Inc.

Left Lateral Lumbar

ES-2re Serial No. F030 Certification No. 42-6

Test Date: 11/14/2016



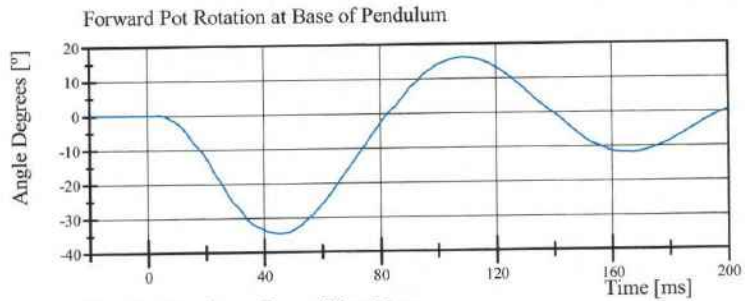
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:30:14 668

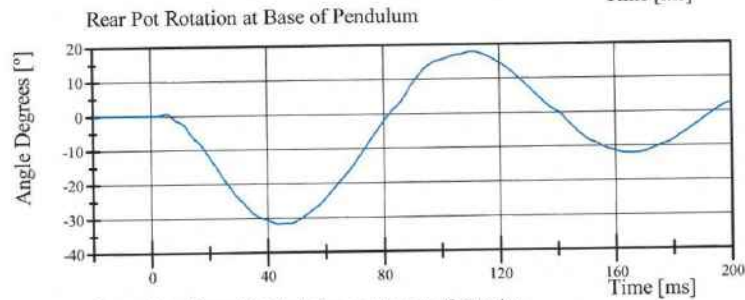


Transportation Research Center Inc.

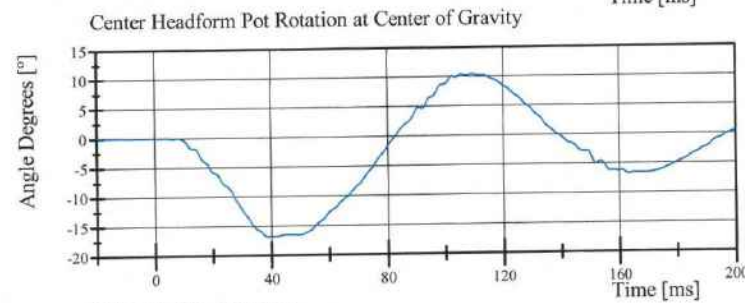
Left Lateral Lumbar
ES-2re Serial No. F030 Certification No. 42-6
Test Date: 11/14/2016



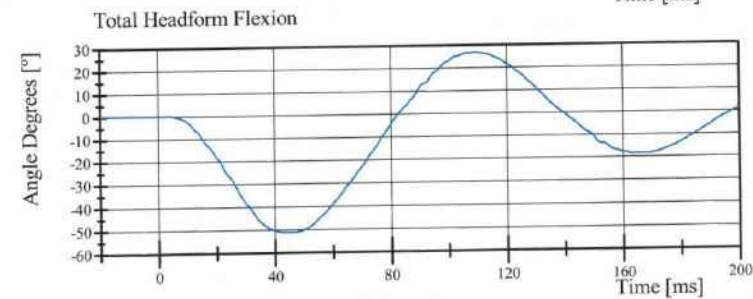
Filter Class: CFC_180
Max: 16.3 ° at 108.9 ms
Min: -34.6 ° at 45.4 ms



Filter Class: CFC_180
Max: 17.9 ° at 110.8 ms
Min: -31.7 ° at 44.0 ms



Filter Class: CFC_180
Max: 10.5 ° at 109.4 ms
Min: -16.9 ° at 39.0 ms



Filter Class: CFC_180
Max: 26.7 ° at 109.2 ms
Min: -51.2 ° at 45.5 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 14:30:15 668



Transportation Research Center Inc.

Left Lateral Pelvis

ES-2re Serial No. F030 Certification No. 42-1

Test Date: 11/14/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	22 %	Yes
Test Probe Velocity	4.2 - 4.4 m/s	4.32 m/s	Yes
Test Probe Force			
Peak	4,700 - 5,400 N	5,118.4 N	Yes
Time of Peak	11.8 - 16.1 ms	12.80 ms	Yes
Pubic Symphysis Force			
Peak	(-1,230) - (-1,590) N	-1,297.4 N	Yes
Time of Peak	12.2 - 17.0 ms	13.28 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 16:01:58 524

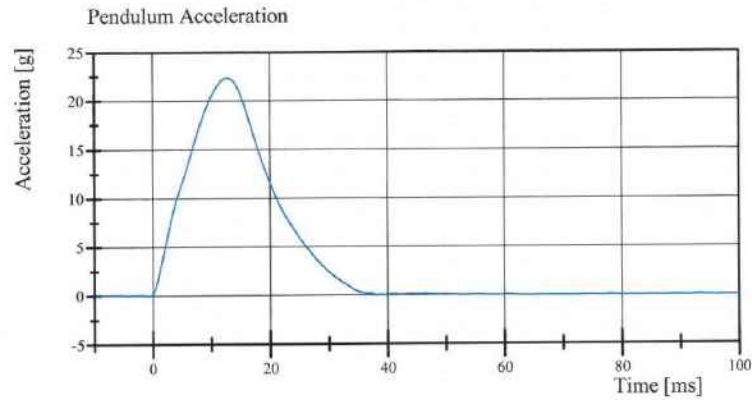


Transportation Research Center Inc.

Left Lateral Pelvis

ES-2re Serial No. F030 Certification No. 42-1

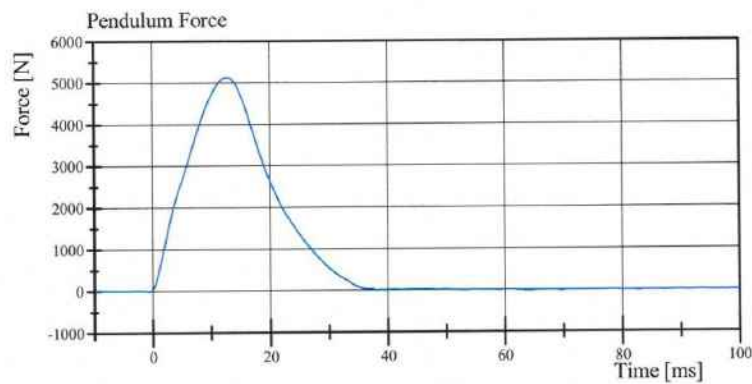
Test Date: 11/14/2016



Filter Class: CFC_180

Max: 22.3 g at 12.8 ms

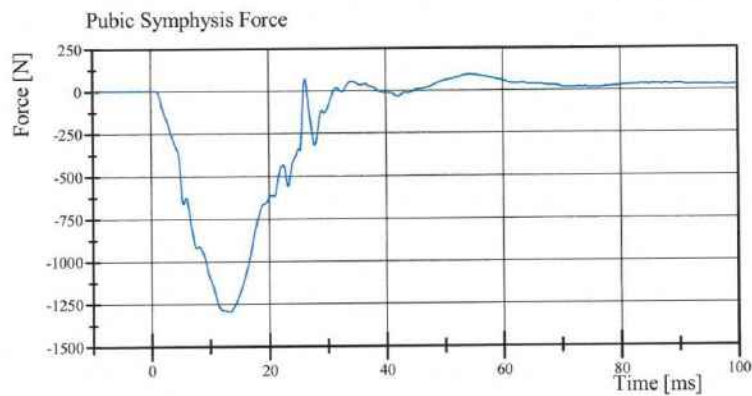
Min: -0.1 g at 64.2 ms



Filter Class: CFC_180

Max: 5,118.4 N at 12.8 ms

Min: -13.0 N at 64.2 ms



Filter Class: CFC_600

Max: 93.0 N at 54.4 ms

Min: -1,297.4 N at 13.3 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.14.2016 16:02:48 524



Post-Test Calibration Sheets
Driver S/N F030

Transportation Research Center Inc.
572U ES-2re Dummy
External Dimensions
Serial No. F030 Calibration No. 43

Symbol	Description	Specification	Results	Pass
		mm	mm	
1	Sitting Height	900.0 - 918.0	910	Yes
2	Seat to Shoulder Joint	558.0 - 572.0	559	Yes
3	Seat to Lower Face of Thoracic Spine Box	346.0 - 356.0	350	Yes
4	Seat to Hip Joint (center of bolt)	97.0 - 103.0	98	Yes
5	Sole to Seat, Sitting	433.0 - 451.0	444	Yes
6	Head Width	152.0 - 158.0	155	Yes
7	Shoulder/Arm Width	461.0 - 479.0	475	Yes
8	Thorax Width	322.0 - 332.0	326	Yes
9	Abdomen Width	273.0 - 287.0	280	Yes
10	Pelvis Lap Width	359.0 - 373.0	365	Yes
11	Head Depth	196.0 - 206.0	204	Yes
12	Thorax Depth	262.0 - 272.0	263	Yes
13	Abdomen Depth	194.0 - 204.0	200	Yes
14	Pelvis Depth	235.0 - 245.0	240	Yes
15	Back of Buttocks to Hip Joint (center of bolt)	150.0 - 160.0	158	Yes
16	Back of Buttocks to Front of Knee	597.0 - 615.0	605	Yes

Baseline 10/07/05



Transportation Research Center Inc.

Left Lateral Head Drop

ES-2re Serial No. F030 Certification No. 43-3

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Peak Resultant Acceleration	125 - 155 g	139.4 g	Yes
Peak Longitudinal Acceleration	(-15) - 15 g	9.5 g	Yes
Is Resultant Acceleration Curve Unimodal within 15% of Main Pulse?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.18.2016 10:12:15 362

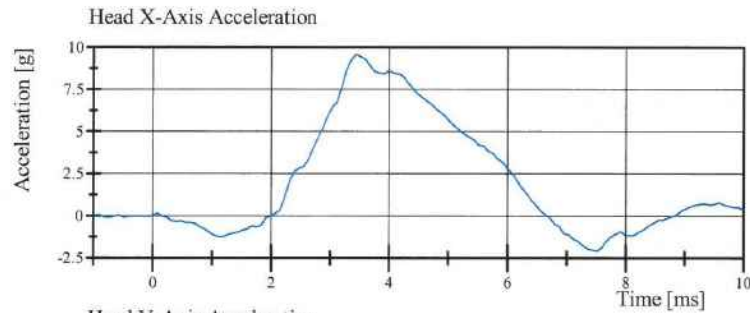


Transportation Research Center Inc.

Left Lateral Head Drop

ES-2re Serial No. F030 Certification No. 43-3

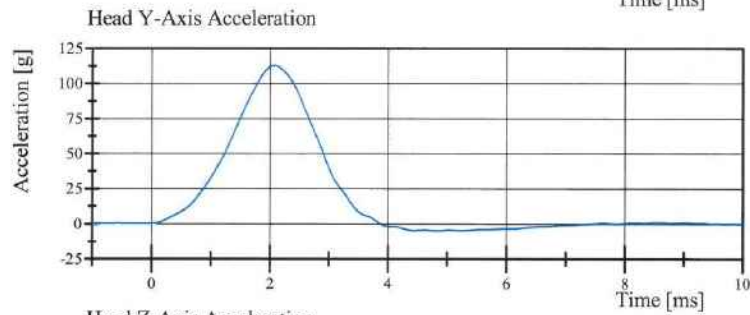
Test Date: 11/18/2016



Filter Class: CFC_1000

Max: 9.5 g at 3.4 ms

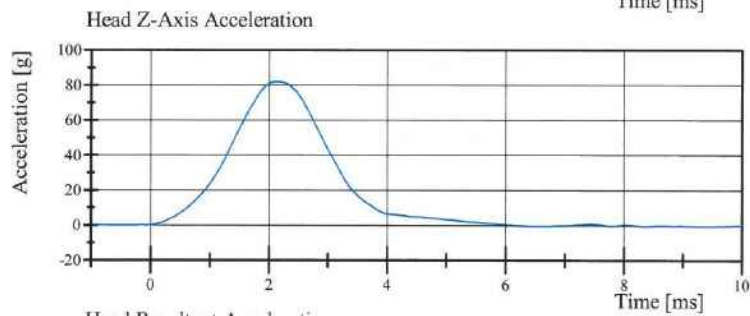
Min: -2.1 g at 7.5 ms



Filter Class: CFC_1000

Max: 112.8 g at 2.1 ms

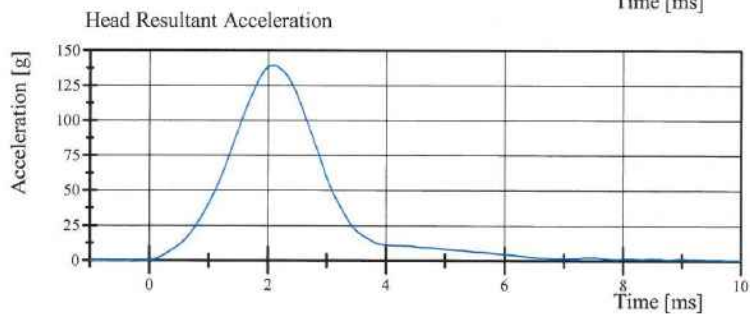
Min: -5.1 g at 4.8 ms



Filter Class: CFC_1000

Max: 81.9 g at 2.1 ms

Min: -0.4 g at 6.6 ms



Filter Class: CFC_1000

Max: 139.4 g at 2.1 ms

Min: 0.0 g at -0.6 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.18.2016 10:12:27 362



Transportation Research Center Inc.

Left Lateral Neck

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Integrated Velocity Change within Corridor	Yes	Yes	Yes
Pendulum Velocity	(-3.3) - (-3.5) m/s	-3.37 m/s	Yes
Maximum Headform Flexion			
Peak	(-49) - (-59) deg	-55.9 deg	Yes
Time of Peak	54 - 66 ms	56.9 ms	Yes
Headform Flexion Decay			
- Peak to Zero	53 - 88 ms	67.4 ms	Yes

Test meets specifications.

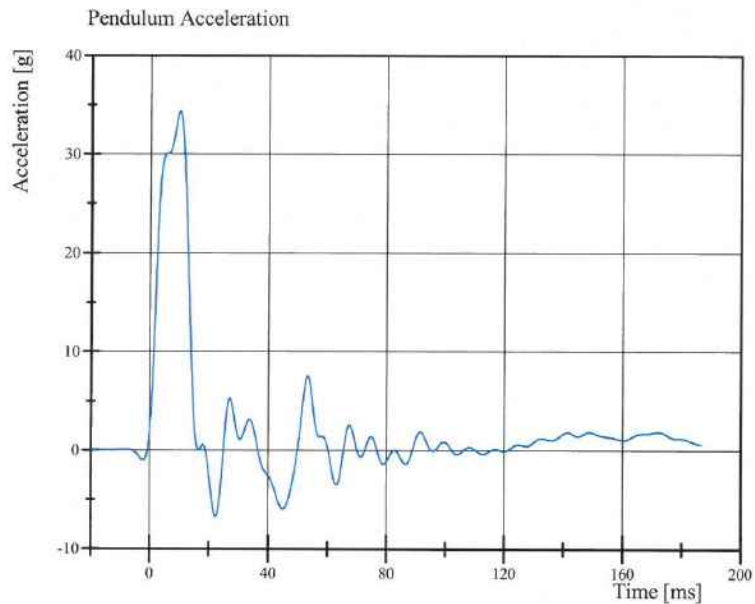
Comments:

Transportation Research Center Inc.

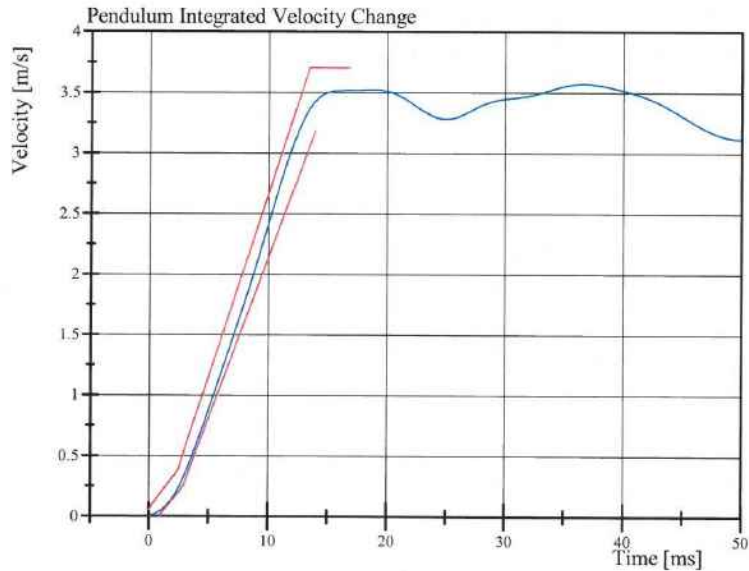
Left Lateral Neck

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Filter Class: CFC_60
Max: 34.3 g at 10.1 ms
Min: -6.8 g at 22.4 ms



Filter Class: CFC_60
Max: 3.6 m/s at 36.6 ms
Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:21:22 1493

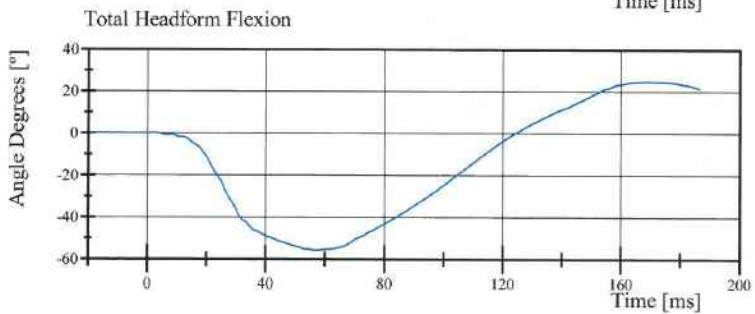
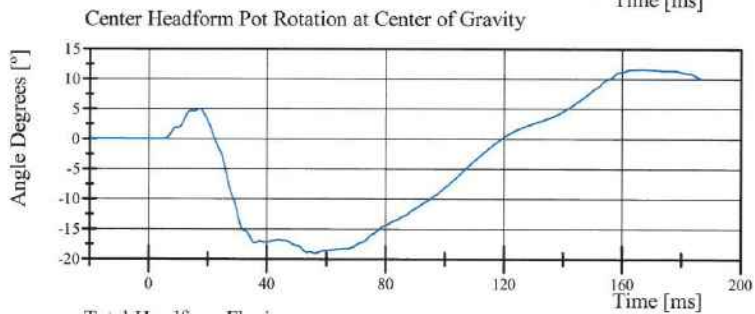
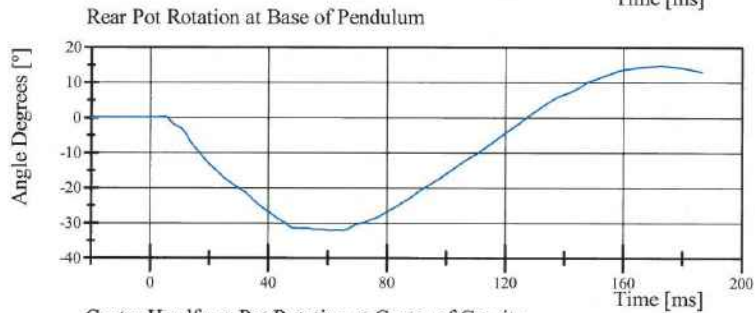
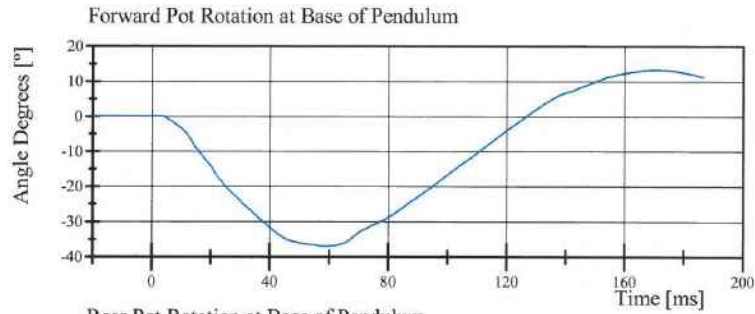


Transportation Research Center Inc.

Left Lateral Neck

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:21:23 1493



Transportation Research Center Inc.

Left Lateral Shoulder

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Test Probe Velocity	4.2 - 4.4 m/s	4.28 m/s	Yes
Test Probe Acceleration	(-7.5) - (-10.5) g	-9.79 g	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:22:38 541

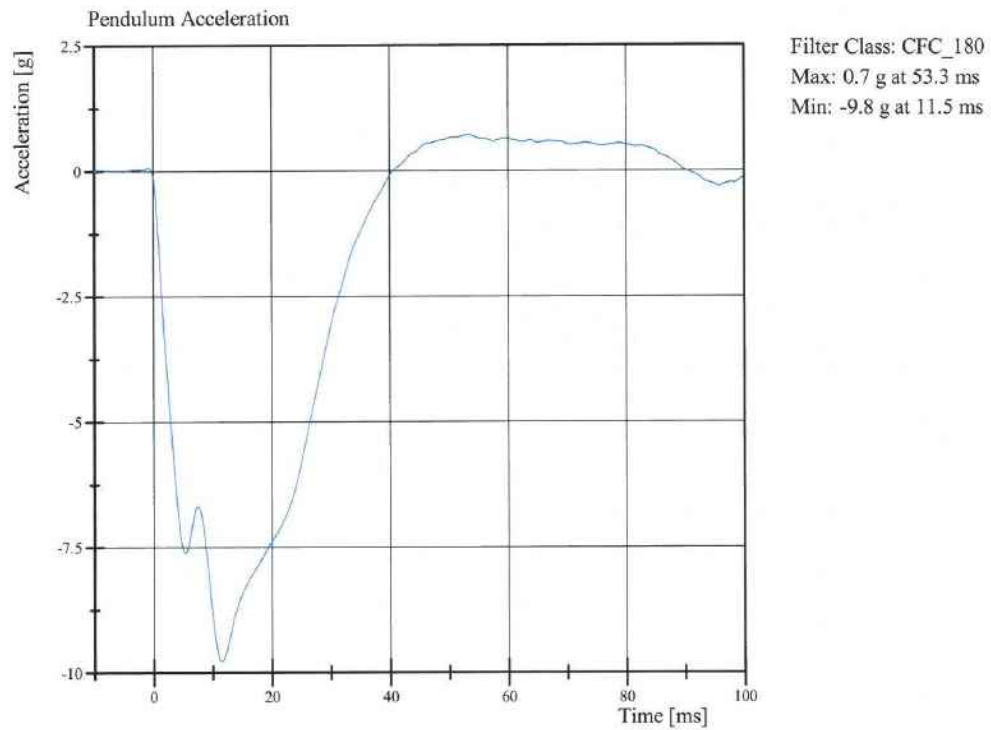


Transportation Research Center Inc.

Left Lateral Shoulder

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:23:14 541



Transportation Research Center Inc.

3.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	36.7 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

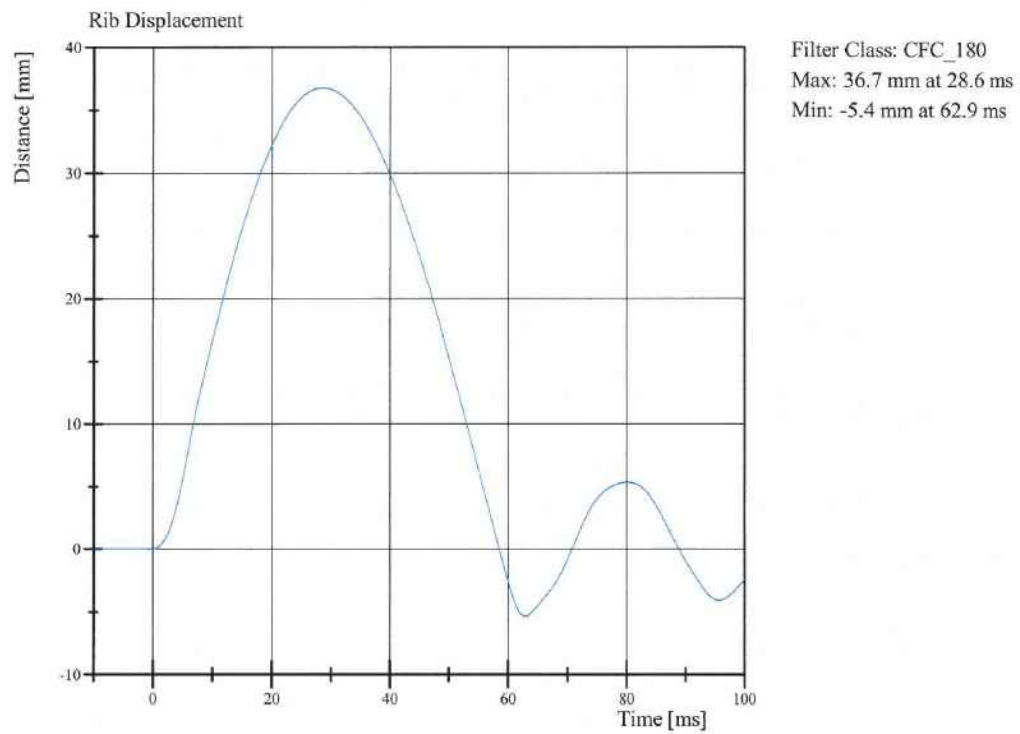
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:45:10 869



Transportation Research Center Inc.

3.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:45:23 869



Transportation Research Center Inc.

4.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 43-2
Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	46.3 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

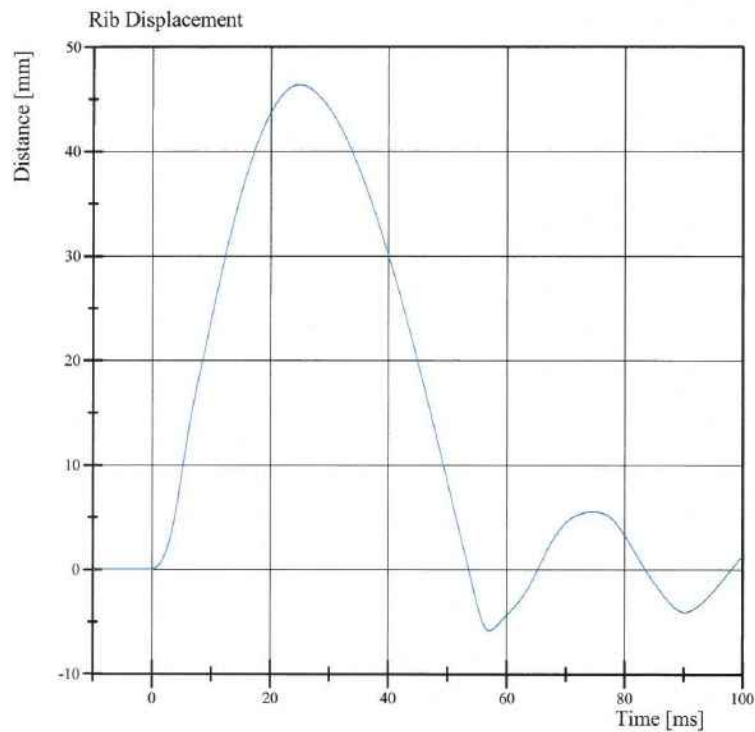
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:35:45 699



Transportation Research Center Inc.

4.0 m/s Upper Full Rib Module
ES-2re Serial No. F030 Certification No. 43-2
Test Date: 11/17/2016



Filter Class: CFC_180
Max: 46.3 mm at 25.0 ms
Min: -5.9 mm at 57.1 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:36:27 699



Transportation Research Center Inc.

3.0 m/s Center Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	36.8 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:57:16 890

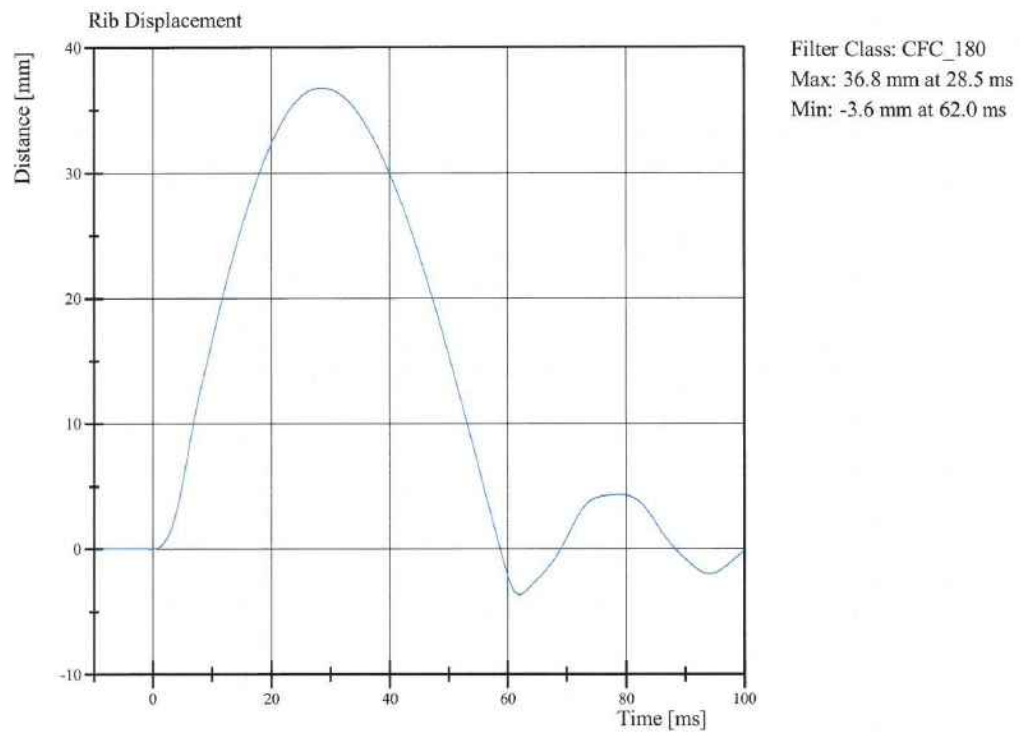


Transportation Research Center Inc.

3.0 m/s Center Full Rib Module

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:57:23 890



Transportation Research Center Inc.

4.0 m/s Center Full Rib Module

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	48.2 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

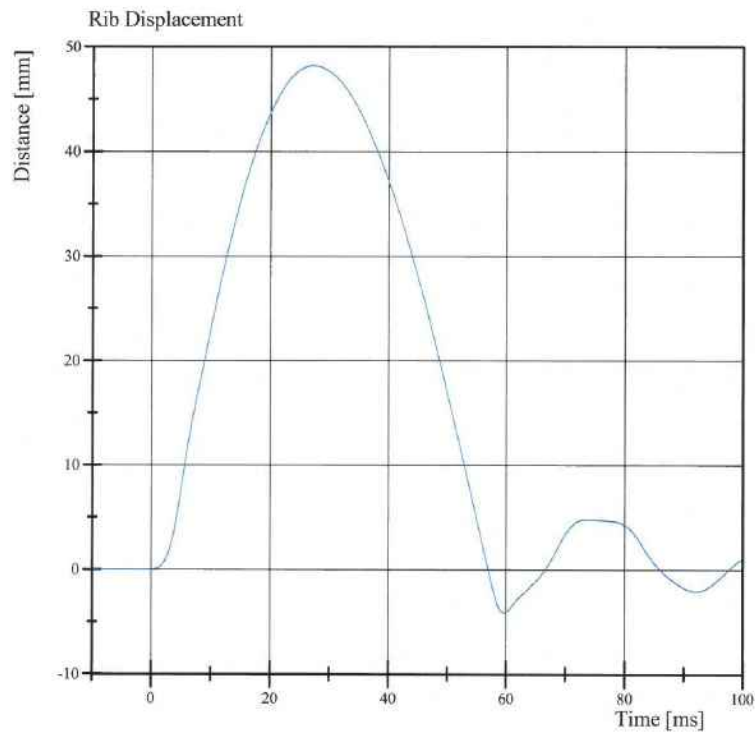
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:51:44 702



Transportation Research Center Inc.

4.0 m/s Center Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016



Filter Class: CFC_180
Max: 48.2 mm at 27.2 ms
Min: -4.1 mm at 59.7 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:51:53 702



Transportation Research Center Inc.

3.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
3.0 m/s Test Rib Displacement (454 mm to 464 mm)	36 - 40 mm	37.0 mm	Yes

Test meets specifications.

Comments:

Drop Height: 462

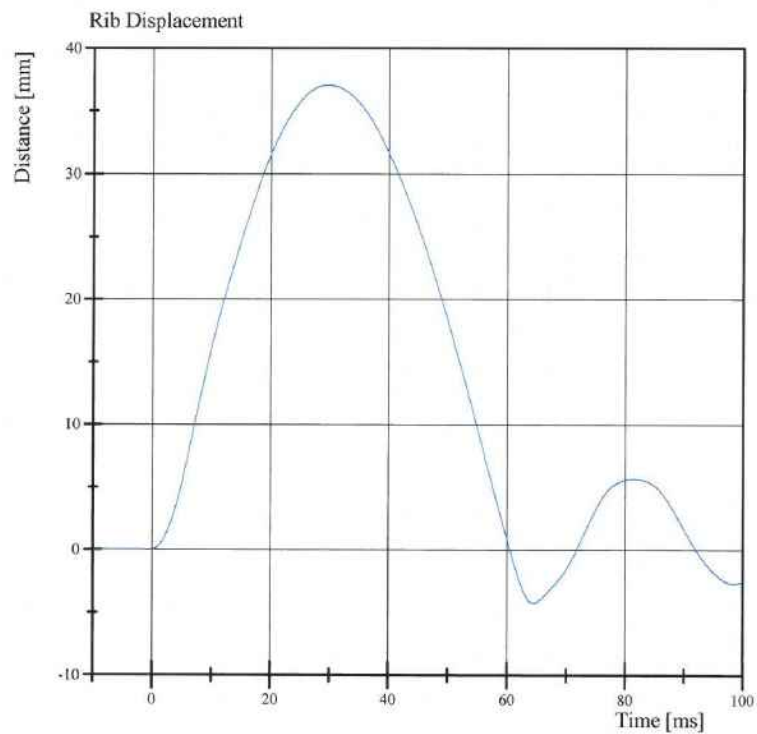
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:11:03 866



Transportation Research Center Inc.

3.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016



Filter Class: CFC_180
Max: 37.0 mm at 29.6 ms
Min: -4.2 mm at 64.5 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:11:14 866



Transportation Research Center Inc.

4.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.9 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
4.0 m/s Test Rib Displacement (807 mm to 823 mm)	46 - 51 mm	48.0 mm	Yes

Test meets specifications.

Comments:

Drop Height: 816

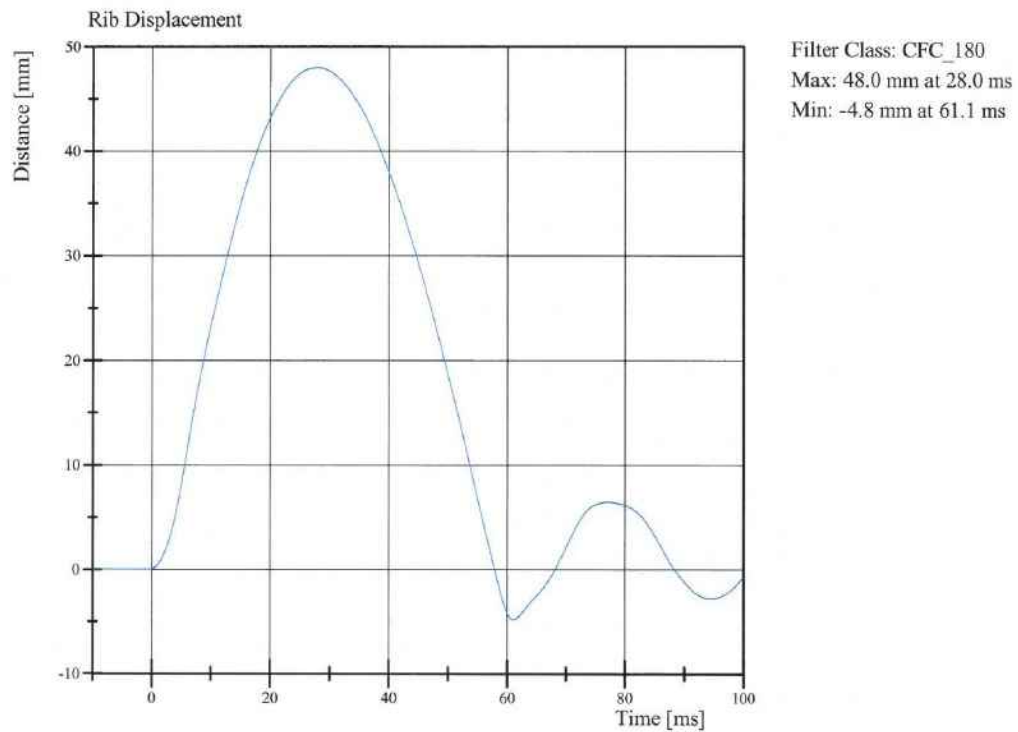
Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:03:17 697



Transportation Research Center Inc.

4.0 m/s Lower Full Rib Module
ES-2re Serial No. F030 Certification No. 43-1
Test Date: 11/17/2016



Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 14:03:29 697



Transportation Research Center Inc.

Left Lateral Thorax

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	5.4 - 5.60 m/s	5.547 m/s	Yes
Peak Impactor Force after 6 ms	(-5,100) - (-6,200) N	-5,172.6 N	Yes
Upper Rib Displacement	34 - 41 mm	37.7 mm	Yes
Center Rib Displacement	37 - 45 mm	42.1 mm	Yes
Lower Rib Displacement	37 - 44 mm	40.9 mm	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211.

11.17.2016 15:29:07 445

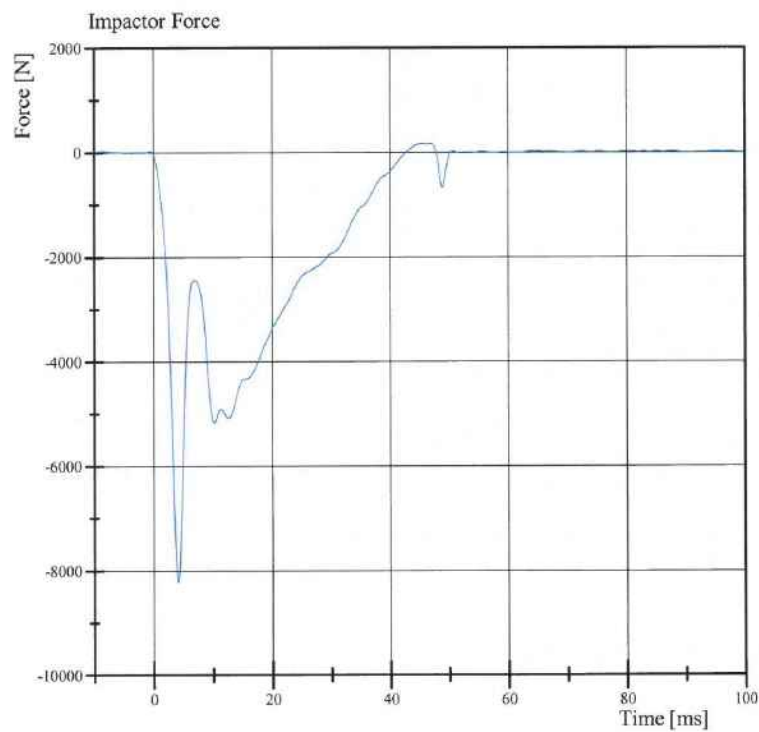


Transportation Research Center Inc.

Left Lateral Thorax

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Filter Class: CFC_180
Max: 164.2 N at 46.9 ms
Min: -8,241.4 N at 4.1 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:29:53.445

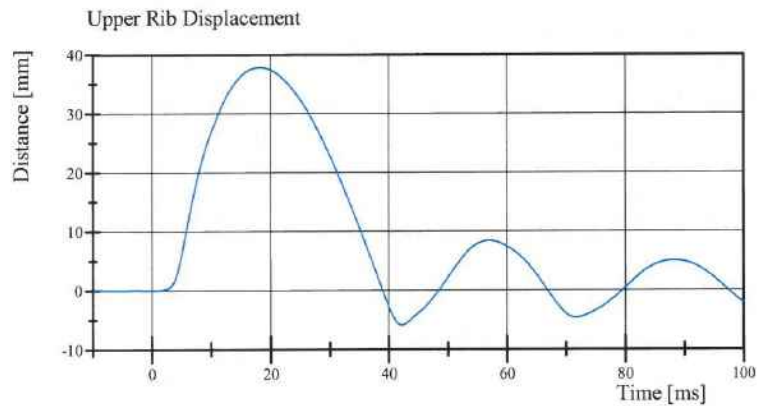


Transportation Research Center Inc.

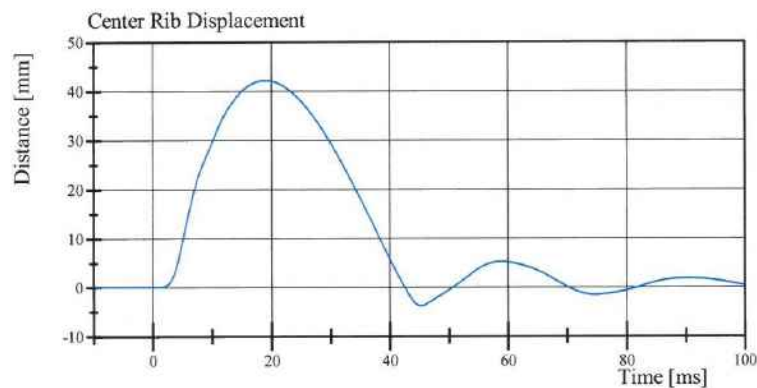
Left Lateral Thorax

ES-2re Serial No. F030 Certification No. 43-1

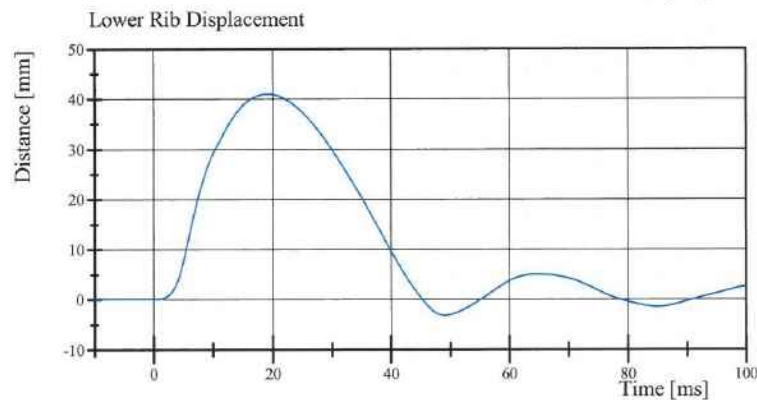
Test Date: 11/17/2016



Filter Class: CFC_180
Max: 37.7 mm at 18.2 ms
Min: -5.9 mm at 42.2 ms



Filter Class: CFC_180
Max: 42.1 mm at 19.0 ms
Min: -3.8 mm at 45.2 ms



Filter Class: CFC_180
Max: 40.9 mm at 19.2 ms
Min: -3.2 mm at 49.1 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:29:54.445



Transportation Research Center Inc.

Left Lateral Abdomen

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	22.0 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Test Probe Velocity	3.9 - 4.1 m/s	4.06 m/s	Yes
Test Probe Force			
Peak	4,000 - 4,800 N	4,006.9 N	Yes
Time of Peak	10.6 - 13.0 ms	12.16 ms	Yes
Total Abdominal Force			
Peak	2,200 - 2,700 N	2,418.1 N	Yes
Time of Peak	10.0 - 12.3 ms	10.64 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:36:22 576

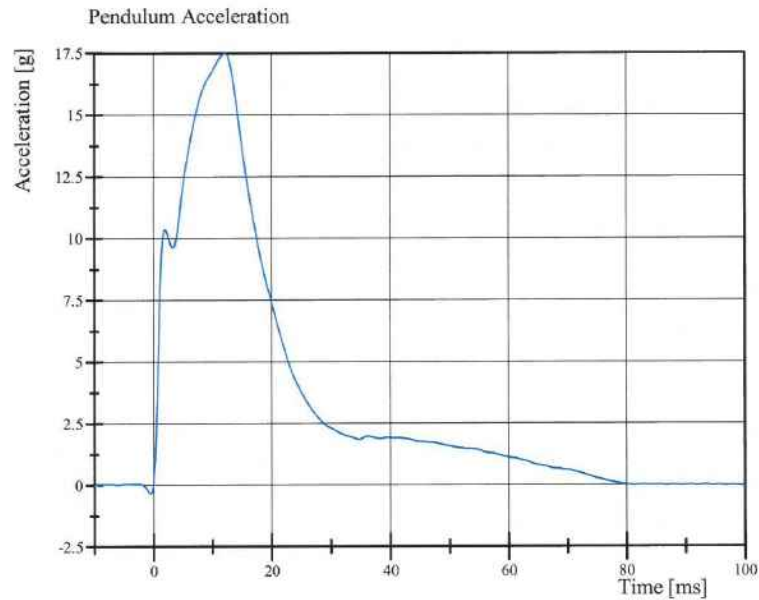


Transportation Research Center Inc.

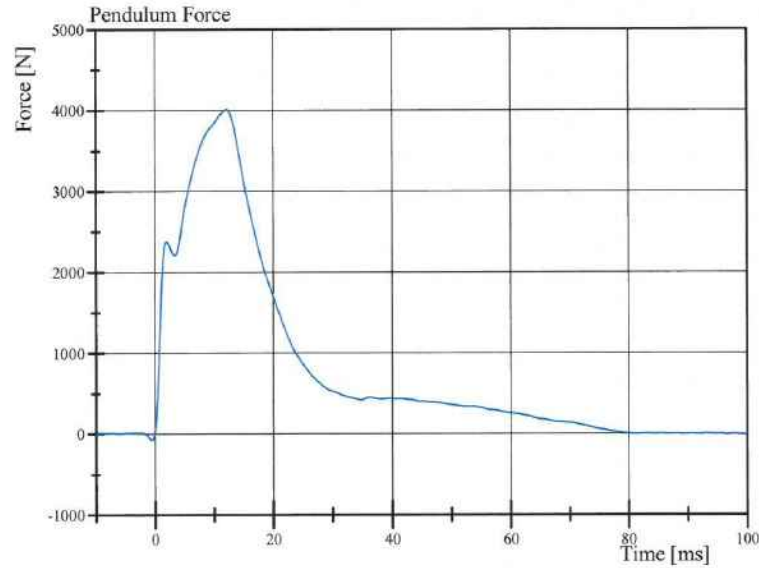
Left Lateral Abdomen

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Filter Class: CFC_180
Max: 17.5 g at 12.2 ms
Min: -0.4 g at -0.5 ms



Filter Class: CFC_180
Max: 4,006.9 N at 12.2 ms
Min: -81.5 N at -0.5 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:36:52 576

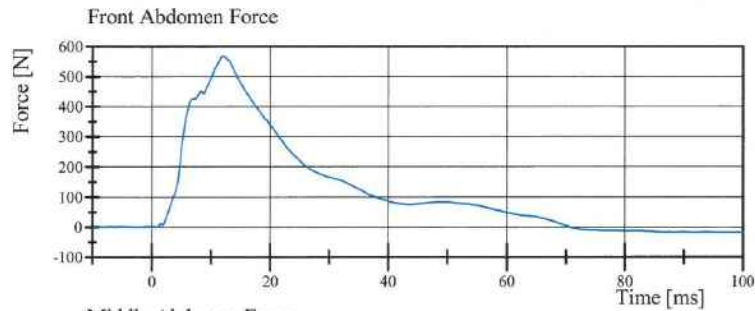


Transportation Research Center Inc.

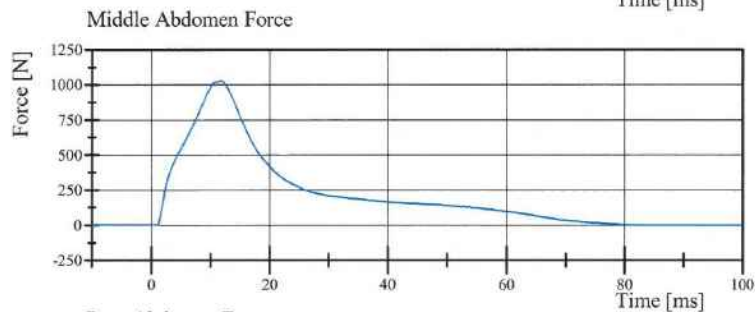
Left Lateral Abdomen

ES-2re Serial No. F030 Certification No. 43-1

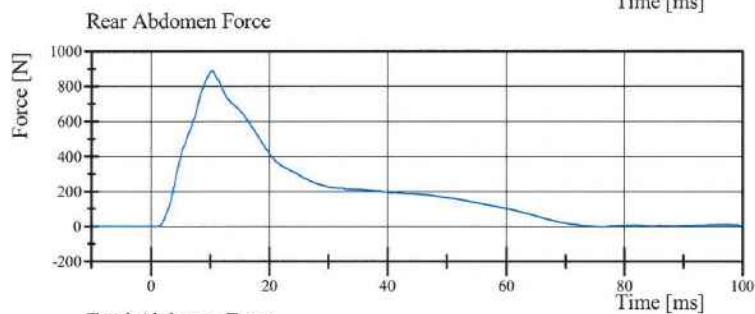
Test Date: 11/17/2016



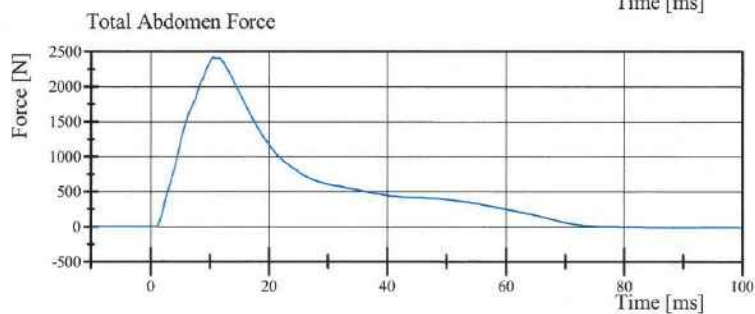
Filter Class: CFC_600
Max: 565.1 N at 12.0 ms
Min: -17.1 N at 99.8 ms



Filter Class: CFC_600
Max: 1,028.2 N at 11.8 ms
Min: -2.2 N at 1.0 ms



Filter Class: CFC_600
Max: 885.6 N at 10.3 ms
Min: -0.3 N at 1.0 ms



Filter Class: CFC_600
Max: 2,418.1 N at 10.6 ms
Min: -12.2 N at 88.4 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:36:52 576



Transportation Research Center Inc.

Left Lateral Lumbar

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Integrated Velocity Change within Corridor	Yes	Yes	Yes
Pendulum Velocity	(-5.95) - (-6.15) m/s	-6.105 m/s	Yes
Maximum Headform Flexion			
Peak	(-45) - (-55) deg	-52.7 deg	Yes
Time of Peak	39 - 53 ms	44.7 ms	Yes
Headform Flexion Decay			
- Peak to Zero	37 - 57 ms	38.7 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:32:09 669

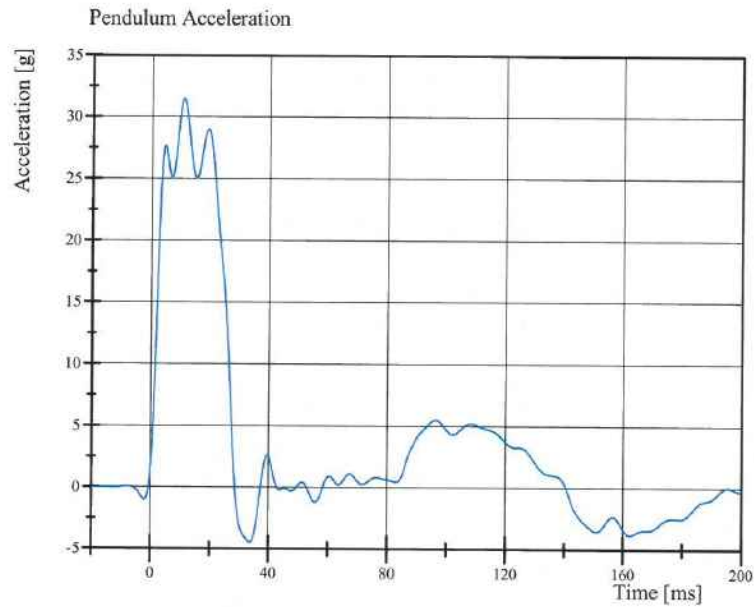


Transportation Research Center Inc.

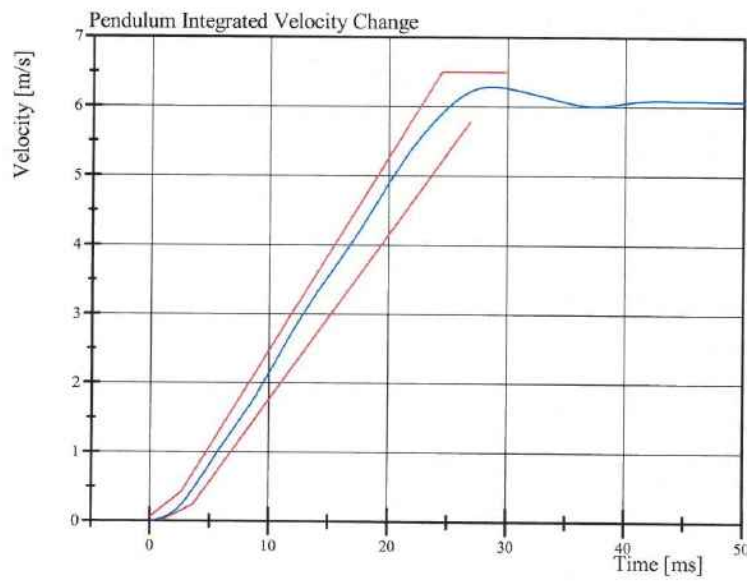
Left Lateral Lumbar

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016



Filter Class: CFC_60
Max: 31.4 g at 10.9 ms
Min: -4.5 g at 33.8 ms



Filter Class: CFC_60
Max: 6.3 m/s at 28.6 ms
Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:32:24 669

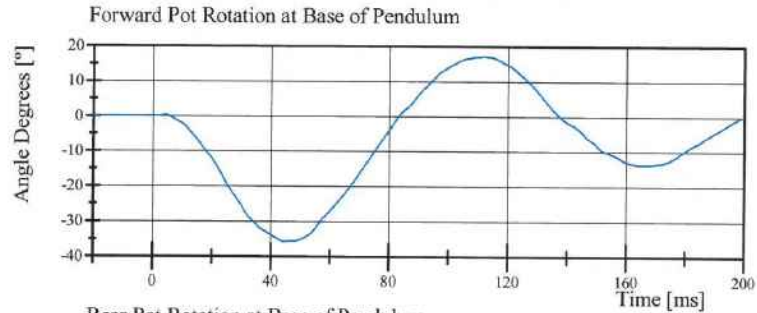


Transportation Research Center Inc.

Left Lateral Lumbar

ES-2re Serial No. F030 Certification No. 43-1

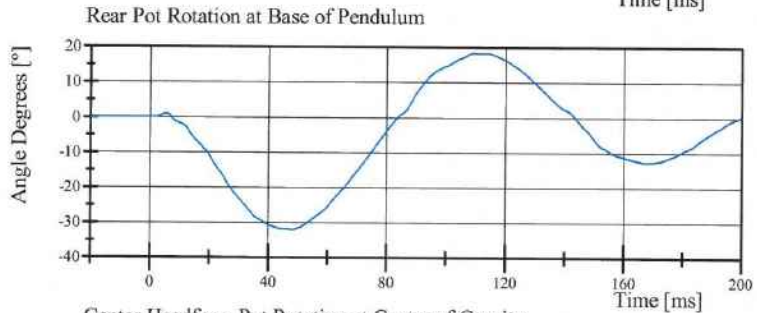
Test Date: 11/17/2016



Filter Class: CFC_180

Max: 17.0 ° at 111.9 ms

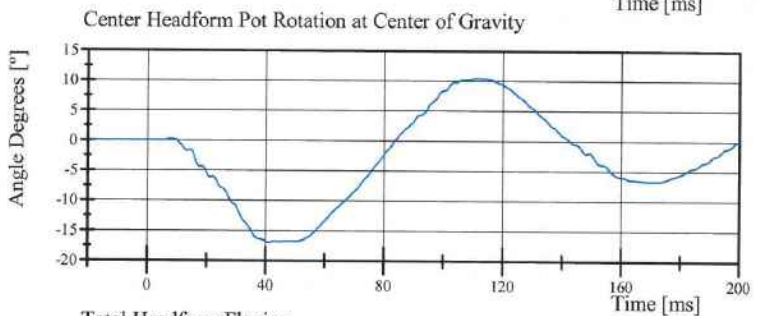
Min: -35.8 ° at 44.6 ms



Filter Class: CFC_180

Max: 18.3 ° at 109.4 ms

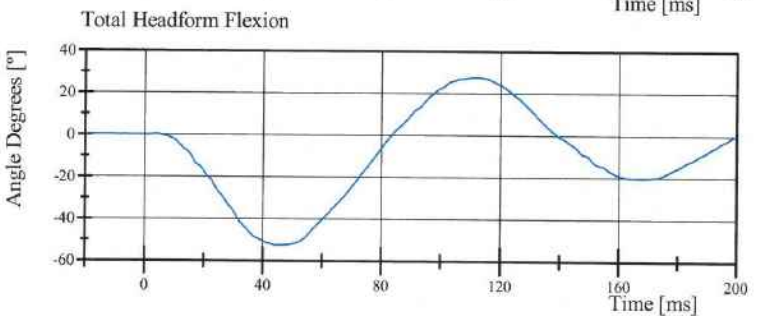
Min: -32.1 ° at 48.2 ms



Filter Class: CFC_180

Max: 10.5 ° at 111.4 ms

Min: -17.0 ° at 41.1 ms



Filter Class: CFC_180

Max: 27.5 ° at 111.6 ms

Min: -52.7 ° at 44.7 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 13:32:25 669



Transportation Research Center Inc.

Left Lateral Pelvis

ES-2re Serial No. F030 Certification No. 43-1

Test Date: 11/17/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Test Probe Velocity	4.2 - 4.4 m/s	4.32 m/s	Yes
Test Probe Force			
Peak	4,700 - 5,400 N	5,166.1 N	Yes
Time of Peak	11.8 - 16.1 ms	13.44 ms	Yes
Pubic Symphysis Force			
Peak	(-1,230) - (-1,590) N	-1,262.0 N	Yes
Time of Peak	12.2 - 17.0 ms	13.12 ms	Yes

Test meets specifications.

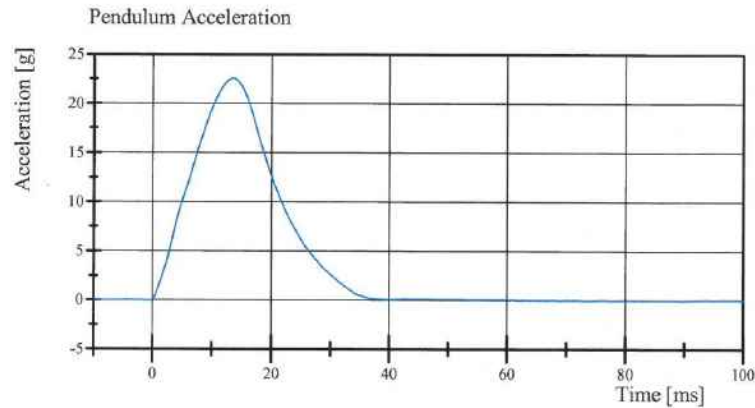
Comments:

Transportation Research Center Inc.

Left Lateral Pelvis

ES-2re Serial No. F030 Certification No. 43-1

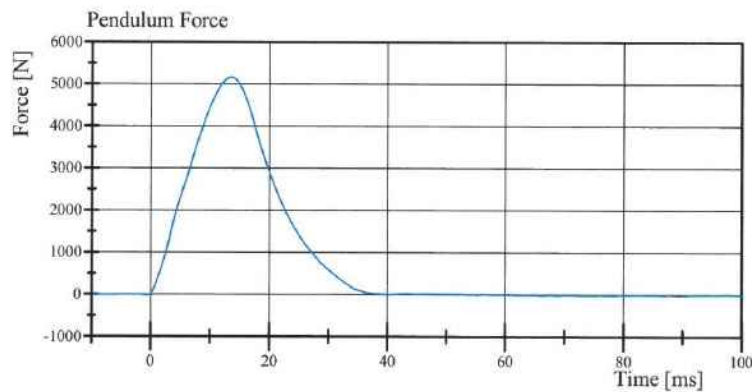
Test Date: 11/17/2016



Filter Class: CFC_180

Max: 22.5 g at 13.4 ms

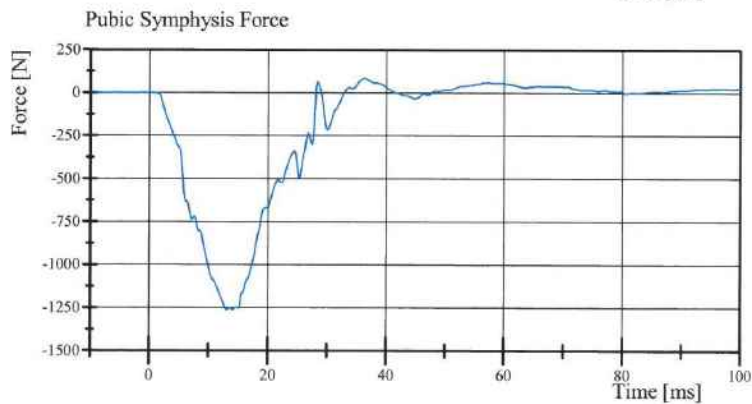
Min: -0.1 g at 89.4 ms



Filter Class: CFC_180

Max: 5,166.1 N at 13.4 ms

Min: -15.3 N at 89.4 ms



Filter Class: CFC_600

Max: 85.1 N at 36.2 ms

Min: -1,262.0 N at 13.1 ms

Specification Source: CFR49 Part 572 Subpart U
with Polarity in accordance with J211

11.17.2016 15:41:44 557



Pre-Test Calibration Sheets
Passenger S/N 305

Transportation Research Center Inc.
SIDIIs Dummy - Level D
External Dimensions
Serial No. 305 Calibration No.49

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Sitting Height	772.0 - 788.0	777	Yes
B	Shoulder Pivot Height	437.0 - 453.0	447	Yes
C	H-Point Height	79.0 - 89.0	88	Yes
D	H-Point from Seat Back	141.0 - 151.0	143	Yes
E	Shoulder Pivot from Backline	97.0 - 107.0	100	Yes
F	Thigh Clearance	119.0 - 135.0	125	Yes
G	Head Breadth	140.0 - 148.0	145	Yes
H	Head Back from Backline	40.0 - 46.0	45	Yes
I	Head Depth	178.0 - 188.0	183	Yes
J	Head Circumference	541.0 - 551.0	543	Yes
K	Buttock to Knee Length	514.0 - 540.0	535	Yes
L	Popliteal Height	343.0 - 369.0	345	Yes
M	Knee Pivot to Floor Height	393.0 - 409.0	395	Yes
N	Buttock Popliteal Length	416.0 - 442.0	434	Yes
O	Chest Depth without Jacket	195.0 - 211.0	202	Yes
P	Foot Length (right)	216.0 - 232.0	222	Yes
P	Foot Length (left)	216.0 - 232.0	222	Yes
Q	Hip Breadth	313.0 - 323.0	320	Yes
R	Arm Length	249.0 - 259.0	253	Yes
S	Knee Joint to seat Back	478.0 - 493.0	480	Yes
V	Shoulder Width (only one arm installed)	341.0 - 357.0	349	Yes
W	Foot Width (right)	78.0 - 94.0	85	Yes
W	Foot Width (left)	78.0 - 94.0	85	Yes
Y	Chest Circumference with Jacket	851.0 - 881.0	873	Yes
Z	Waist Circumference	761.0 - 791.0	780	Yes

Transportation Research Center Inc.

Left Lateral Head Drop

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Peak Head Resultant Acceleration	115 - 137 g	118.6 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	2.5 g	Yes
Is Head Resultant Acceleration Curve Unimodal within 15% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:35:52 232

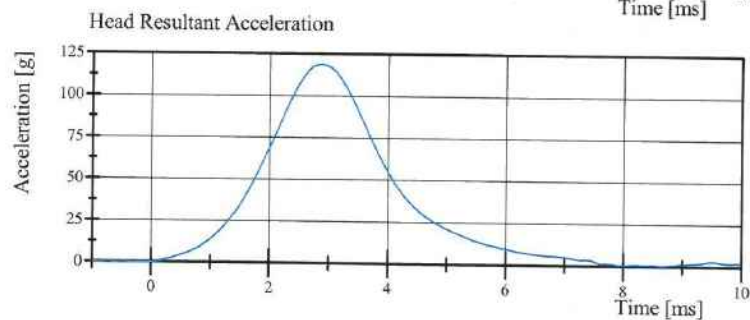
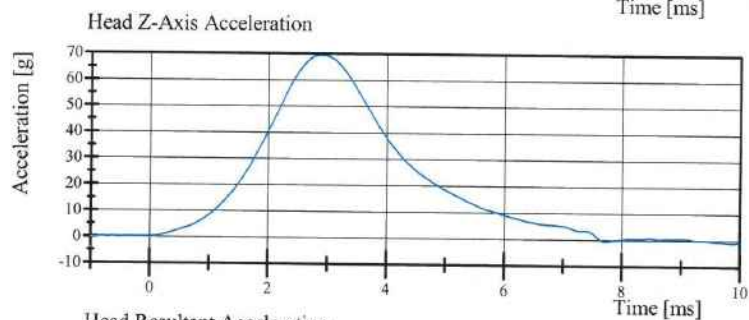
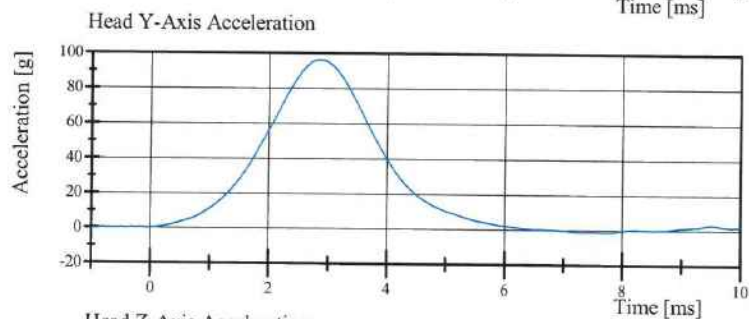
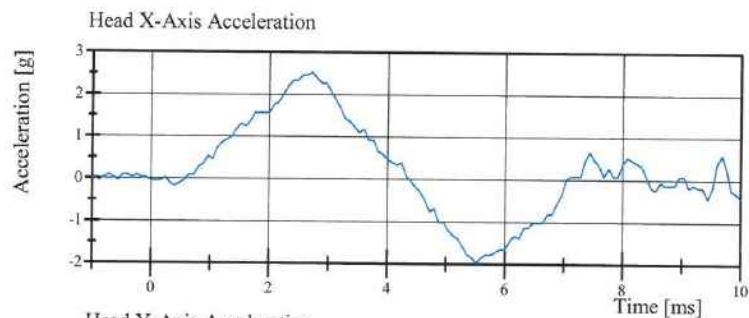


Transportation Research Center Inc.

Left Lateral Head Drop

SID II's Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:36:00 232



Transportation Research Center Inc.

Left Lateral Neck

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Velocity	(-5.51) - (-5.63) m/s	-5.610 m/s	Yes
Pendulum Integrated Velocity Change at 10 ms	2.20 - 2.80 m/s	2.629 m/s	Yes
Change at 15 ms	3.30 - 4.10 m/s	4.014 m/s	Yes
Change at 20 ms	4.40 - 5.40 m/s	5.395 m/s	Yes
Change at 25 ms	5.40 - 6.10 m/s	5.788 m/s	Yes
Change at 25 to 100 ms	5.50 - 6.20 m/s	5.790 m/s	Yes
Maximum Headform Flexion occurring between 50ms and 70ms.			
Peak	(-71) - (-81) deg	-77.3 deg	Yes
Time of Peak	50 - 70 ms	60.1 ms	Yes
Total Neck Occipital Condyles Moment	36 - 44 N·m	43.3 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	102 - 126 ms	115.8 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:15:49 739

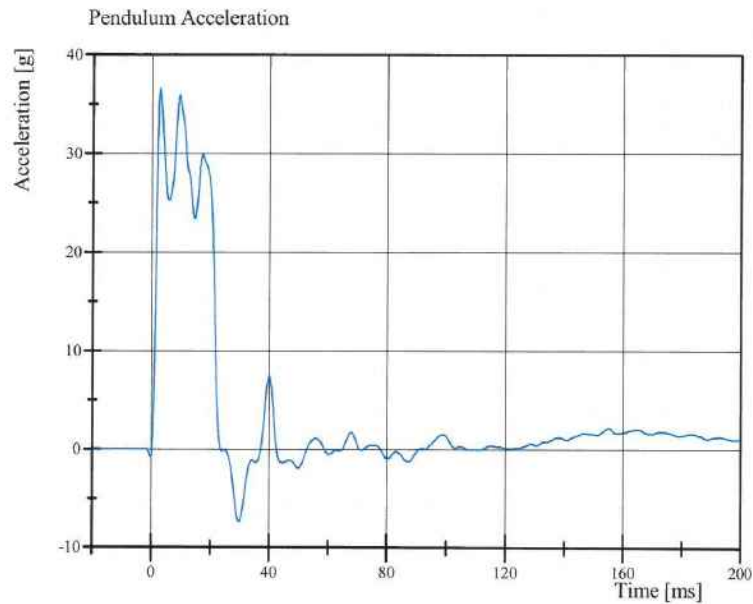


Transportation Research Center Inc.

Left Lateral Neck

SID IIs Serial No. 305 Certification No. 49-1

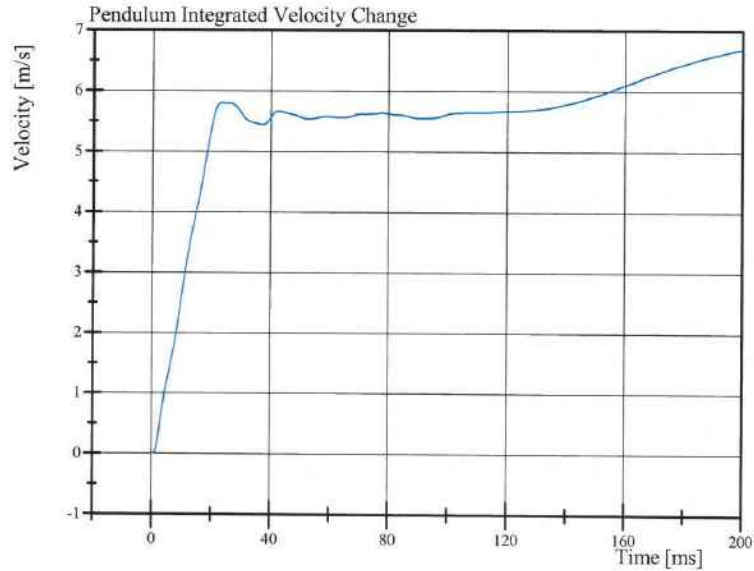
Test Date: 11/11/2016



Filter Class: CFC_180

Max: 36.5 g at 2.7 ms

Min: -7.4 g at 29.9 ms



Filter Class: CFC_180

Max: 6.7 m/s at 200.0 ms

Min: -0.0 m/s at 0.2 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:15:59 739

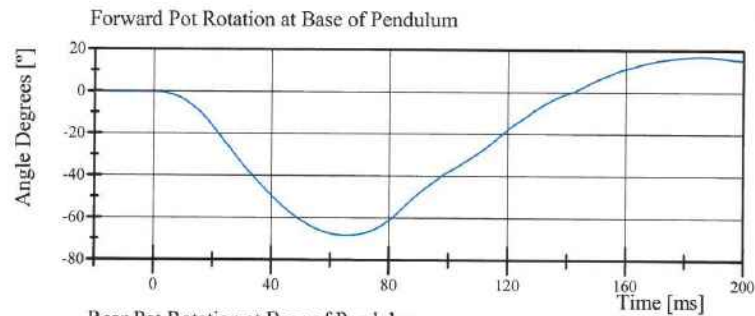


Transportation Research Center Inc.

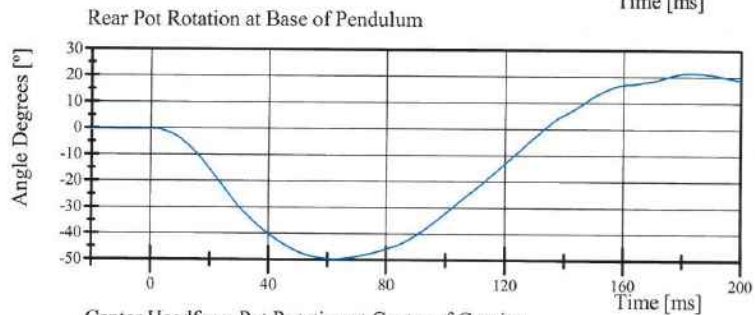
Left Lateral Neck

SID IIs Serial No. 305 Certification No. 49-1

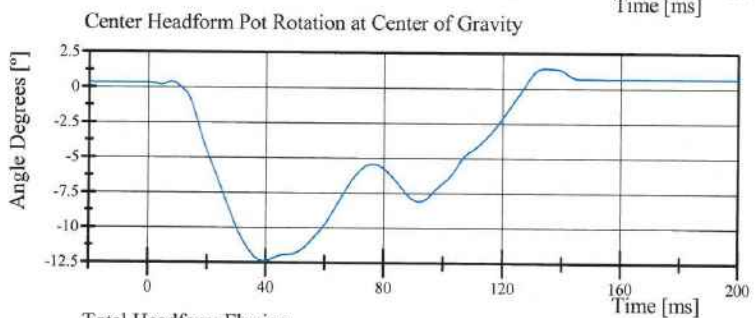
Test Date: 11/11/2016



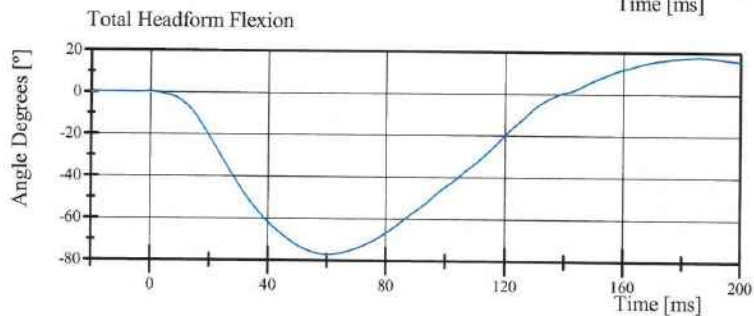
Filter Class: CFC_60
Max: 17.1 ° at 186.0 ms
Min: -68.4 ° at 65.6 ms



Filter Class: CFC_60
Max: 21.4 ° at 183.3 ms
Min: -49.7 ° at 62.0 ms



Filter Class: CFC_60
Max: 1.4 ° at 134.2 ms
Min: -12.4 ° at 39.3 ms



Filter Class: CFC_60
Max: 17.8 ° at 186.0 ms
Min: -77.3 ° at 60.1 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:16:00 739

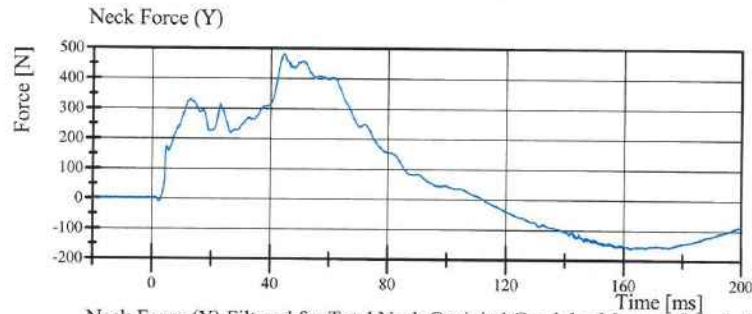


Transportation Research Center Inc.

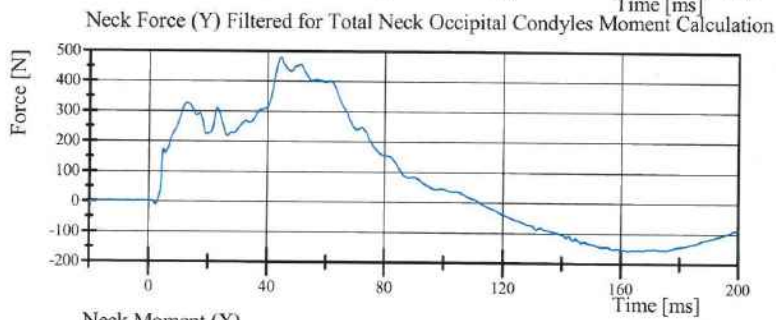
Left Lateral Neck

SID IIs Serial No. 305 Certification No. 49-1

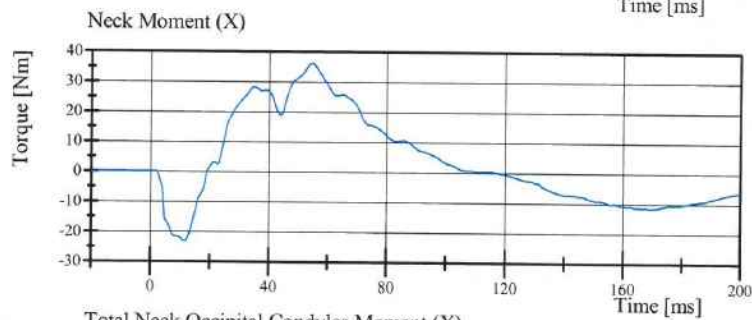
Test Date: 11/11/2016



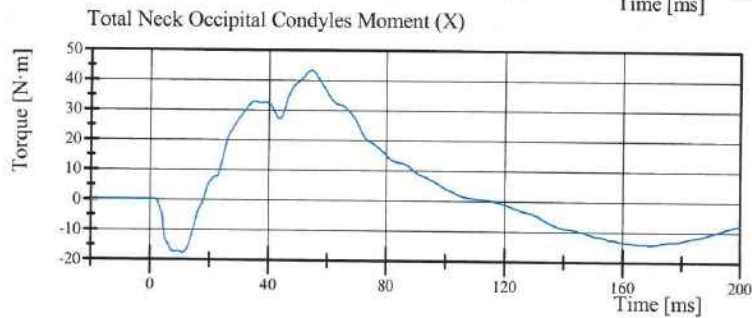
Filter Class: CFC_1000
Max: 479.8 N at 44.5 ms
Min: -160.2 N at 162.3 ms



Filter Class: CFC_600
Max: 479.1 N at 44.5 ms
Min: -158.9 N at 162.2 ms



Filter Class: CFC_600
Max: 36.1 Nm at 54.7 ms
Min: -23.2 Nm at 11.4 ms



Filter Class: Without_(Consta
Max: 43.3 N·m at 54.6 ms
Min: -17.9 N·m at 11.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:16:01 739



Transportation Research Center Inc.

Left Lateral Shoulder

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.3 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.27 m/s	Yes
Impactor Acceleration	(-13) - (-18) g	-16.1 g	Yes
Shoulder Displacement	28 - 37 mm	30.6 mm	Yes
Upper Spine Lateral Acceleration	17 - 22 g	21.1 g	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:04:15 875

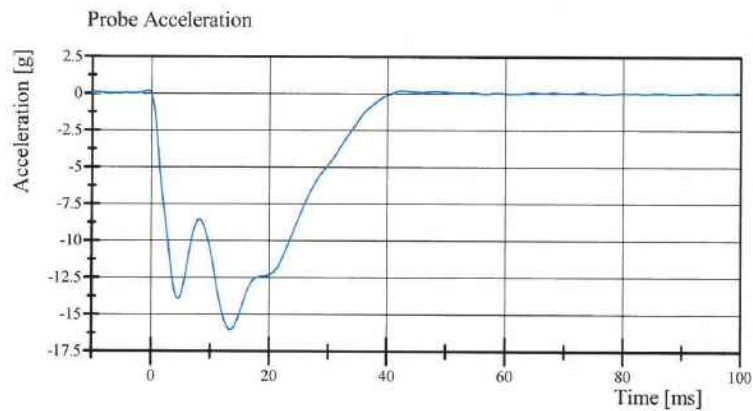


Transportation Research Center Inc.

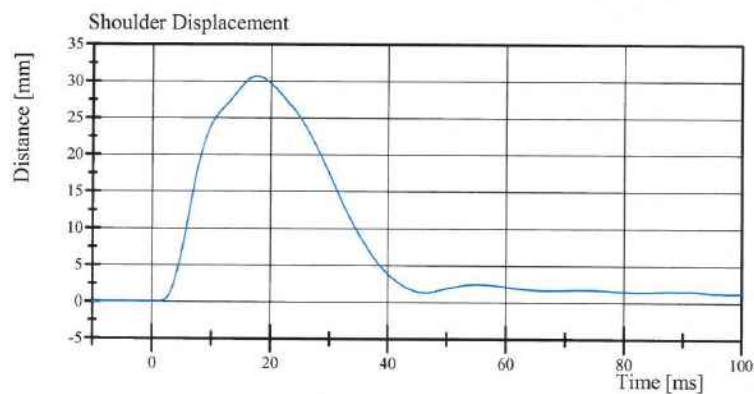
Left Lateral Shoulder

SID IIs Serial No. 305 Certification No. 49-1

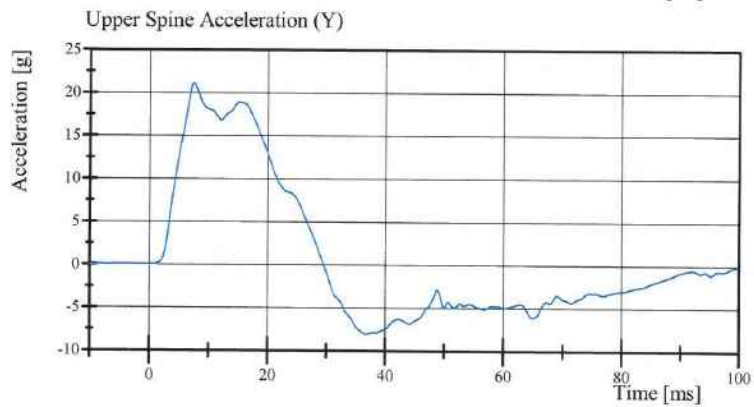
Test Date: 11/11/2016



Filter Class: CFC_180
Max: 0.2 g at 42.4 ms
Min: -16.1 g at 13.4 ms



Filter Class: CFC_600
Max: 30.6 mm at 17.7 ms
Min: -0.0 mm at -6.9 ms



Filter Class: CFC_180
Max: 21.1 g at 7.4 ms
Min: -8.1 g at 36.8 ms



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:04:24 875

Transportation Research Center Inc.

Left Lateral Thorax with Arm

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	6.60 - 6.80 m/s	6.793 m/s	Yes
Impactor Acceleration	(-30) - (-36) g	-33.2 g	Yes
Shoulder Displacement	31 - 40 mm	34.0 mm	Yes
Upper Thorax Rib Displacement	25 - 32 mm	26.6 mm	Yes
Center Thorax Rib Displacement	30 - 36 mm	32.0 mm	Yes
Lower Thorax Rib Displacement	32 - 38 mm	34.8 mm	Yes
Upper Spine Lateral Acceleration	34 - 43 g	38.3 g	Yes
Lower Spine Lateral Acceleration	29 - 37 g	32.8 g	Yes

Test meets specifications.

Comments:

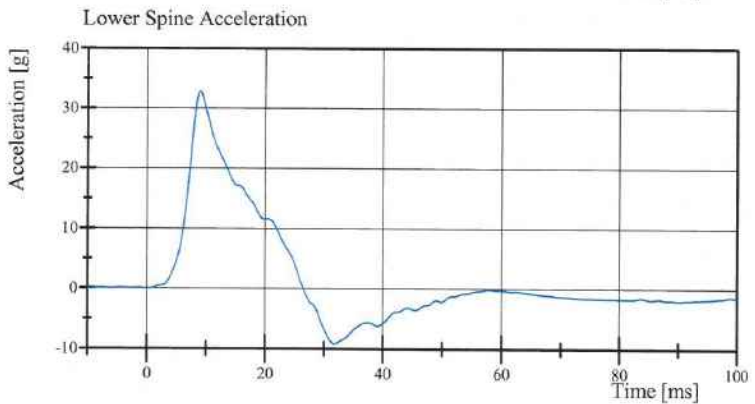
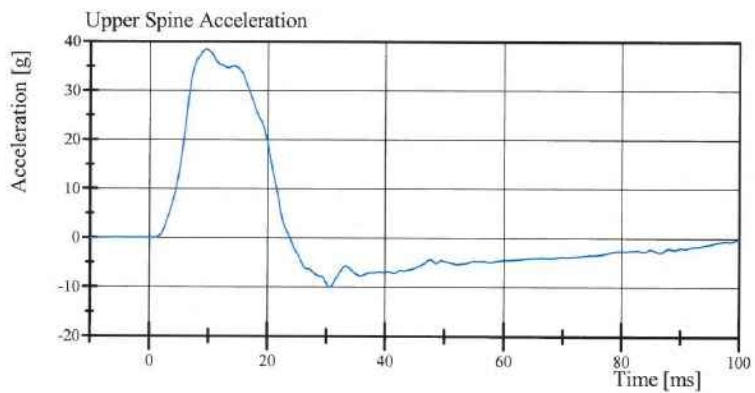
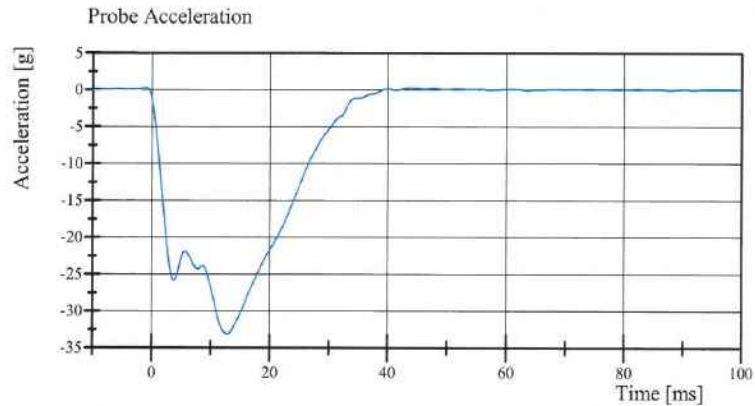
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:10:29 640



Transportation Research Center Inc.

Left Lateral Thorax with Arm
SID IIs Serial No. 305 Certification No. 49-1
Test Date: 11/11/2016

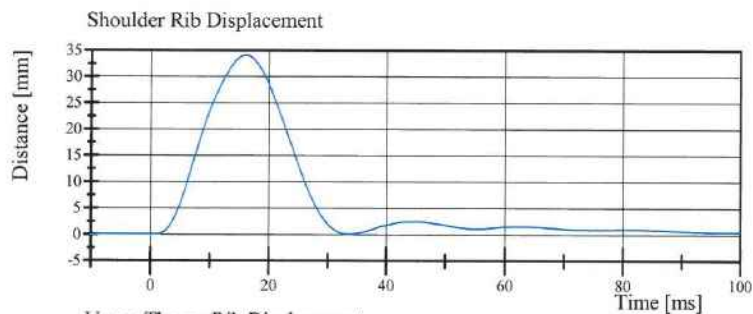


Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

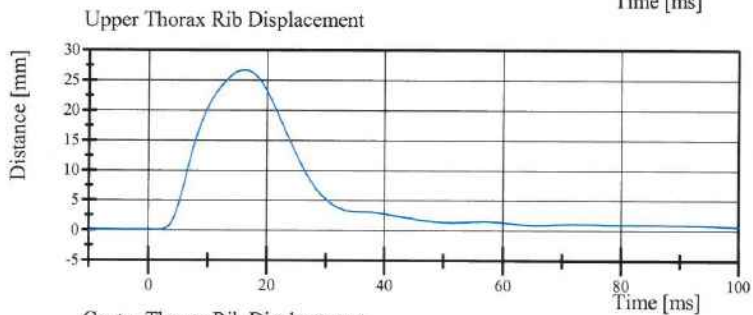
11.11.2016 12:10:40 640

Transportation Research Center Inc.

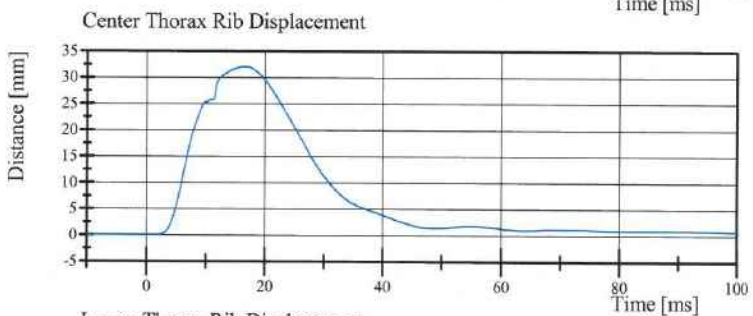
Left Lateral Thorax with Arm
SID IIs Serial No. 305 Certification No. 49-1
Test Date: 11/11/2016



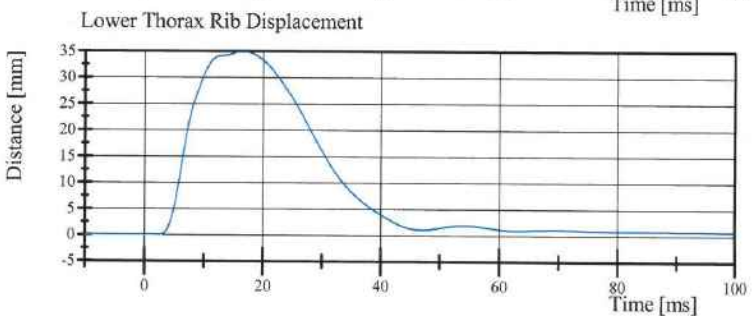
Filter Class: CFC_600
Max: 34.0 mm at 16.0 ms
Min: -0.0 mm at 1.1 ms



Filter Class: CFC_600
Max: 26.6 mm at 16.2 ms
Min: -0.0 mm at -0.9 ms



Filter Class: CFC_600
Max: 32.0 mm at 16.6 ms
Min: -0.0 mm at -10.0 ms



Filter Class: CFC_600
Max: 34.8 mm at 16.1 ms
Min: -0.0 mm at -10.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:10:40 640



Transportation Research Center Inc.

Left Lateral Thorax without Arm

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	4.20 - 4.40 m/s	4.384 m/s	Yes
Impactor Acceleration	(-14) - (-18) g	-16.0 g	Yes
Upper Thorax Rib Displacement	32 - 40 mm	35.6 mm	Yes
Center Thorax Rib Displacement	39 - 45 mm	40.3 mm	Yes
Lower Thorax Rib Displacement	35 - 43 mm	37.0 mm	Yes
Upper Spine Lateral Acceleration	13 - 17 g	15.3 g	Yes
Lower Spine Lateral Acceleration	7 - 11 g	9.7 g	Yes

Test meets specifications.

Comments:

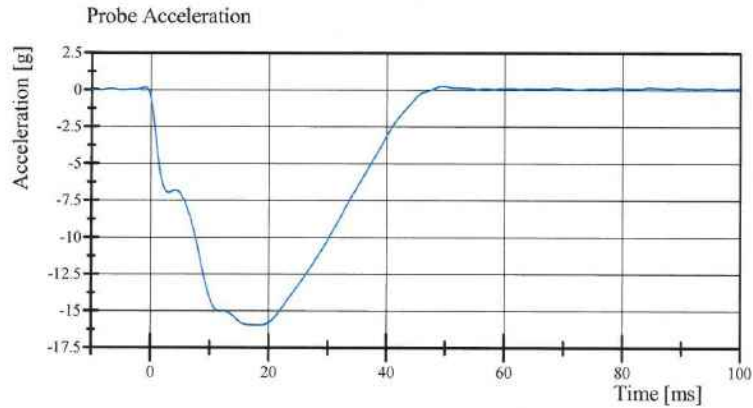
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:25:49 868

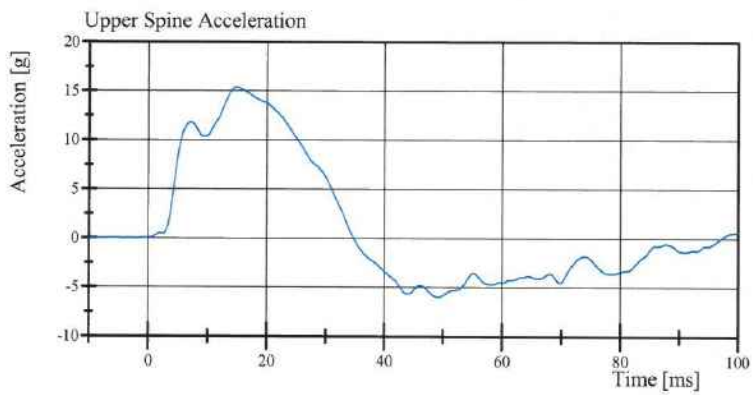


Transportation Research Center Inc.

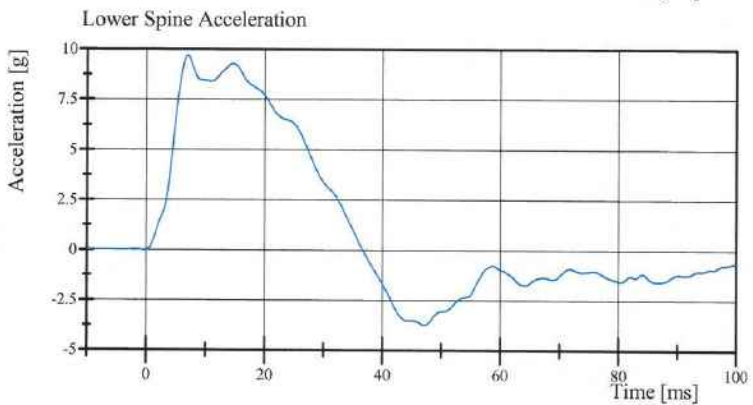
Left Lateral Thorax without Arm
SID IIs Serial No. 305 Certification No. 49-1
Test Date: 11/11/2016



Filter Class: CFC_180
Max: 0.2 g at 49.5 ms
Min: -16.0 g at 18.3 ms



Filter Class: CFC_180
Max: 15.3 g at 14.8 ms
Min: -6.0 g at 49.2 ms



Filter Class: CFC_180
Max: 9.7 g at 7.0 ms
Min: -3.8 g at 47.2 ms

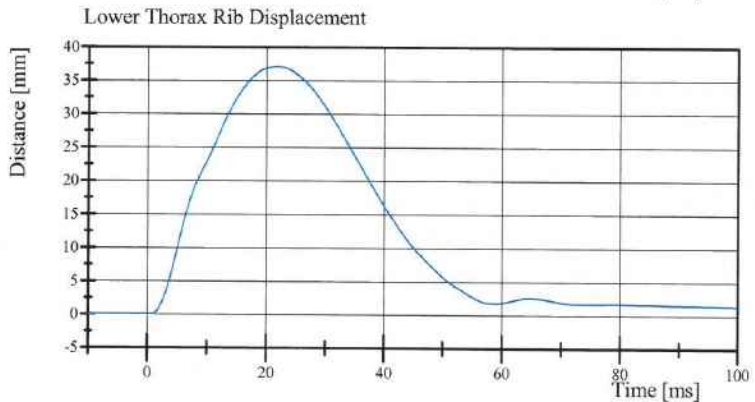
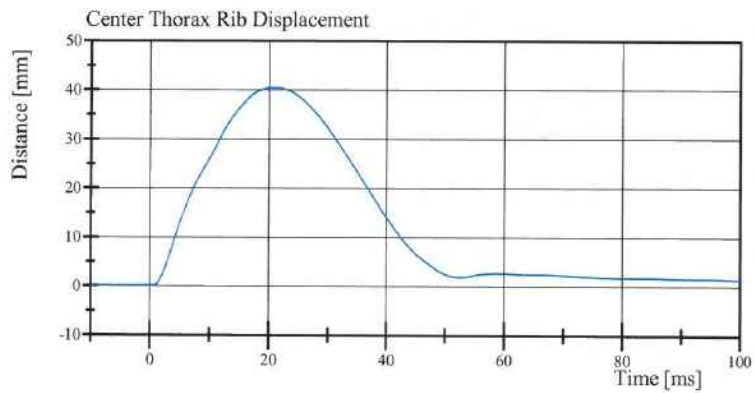
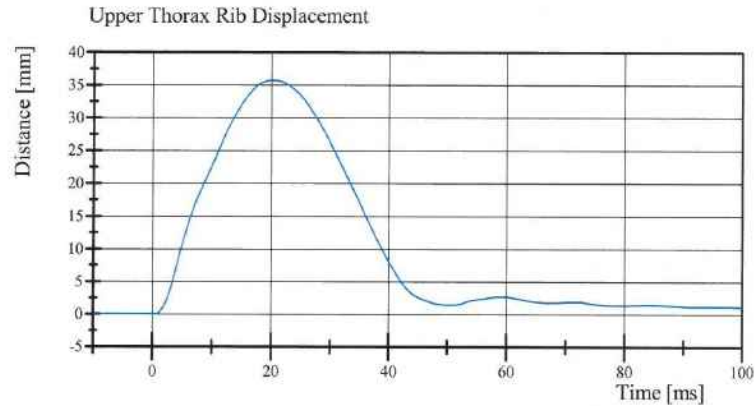


Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:26:00 868

Transportation Research Center Inc.

Left Lateral Thorax without Arm
SID II_s Serial No. 305 Certification No. 49-1
Test Date: 11/11/2016



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:26:00 868

Transportation Research Center Inc.

Left Lateral Abdomen

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.24 m/s	Yes
Impactor Acceleration	(-12) - (-16) g	-13.5 g	Yes
Upper Abdominal Rib Displacement	36 - 47 mm	44.5 mm	Yes
Lower Abdominal Rib Displacement	33 - 44 mm	39.5 mm	Yes
Lower Spine Lateral Acceleration	9 - 14.0 g	10.34 g	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:15:27 720

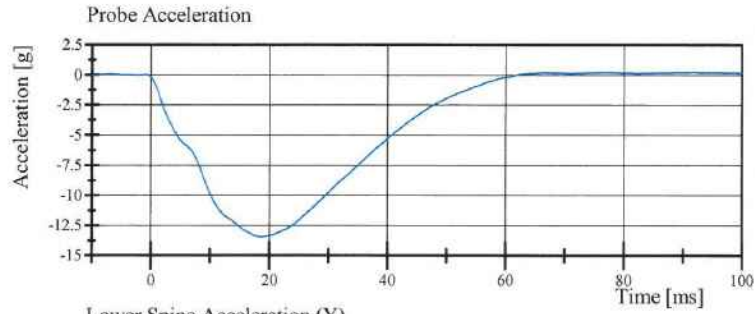


Transportation Research Center Inc.

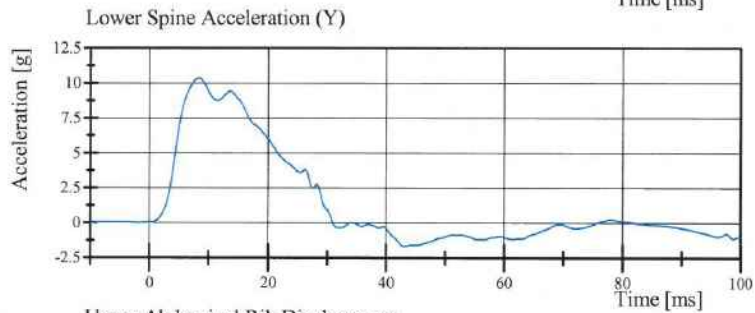
Left Lateral Abdomen

SID IIs Serial No. 305 Certification No. 49-1

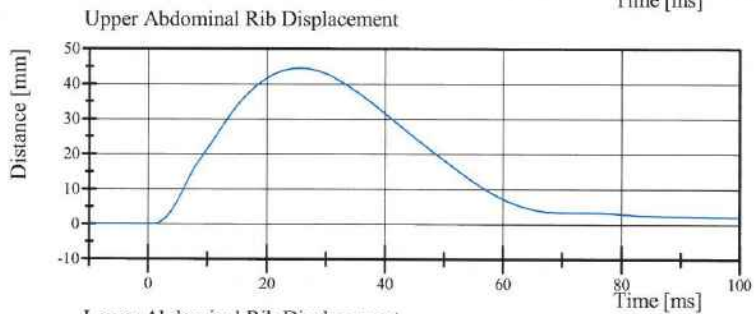
Test Date: 11/11/2016



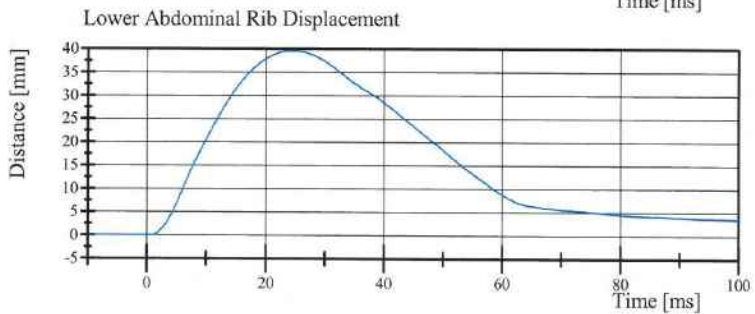
Filter Class: CFC_180
Max: 0.3 g at 91.6 ms
Min: -13.5 g at 18.6 ms



Filter Class: CFC_180
Max: 10.3 g at 8.3 ms
Min: -1.7 g at 43.0 ms



Filter Class: CFC_600
Max: 44.5 mm at 25.5 ms
Min: -0.0 mm at -5.4 ms



Filter Class: CFC_600
Max: 39.5 mm at 24.4 ms
Min: -0.0 mm at 0.8 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 11:15:42 720



Transportation Research Center Inc.

Left Lateral Pelvis

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.8 °C	Yes
Relative Humidity	10 - 70 %	37 %	Yes
Pendulum Velocity	6.6 - 6.8 m/s	6.61 m/s	Yes
Impactor Acceleration	(-38.0) - (-47.0) g	-46.72 g	Yes
Peak Pelvis Lateral Acceleration after 6ms	34 - 42 g	39.2 g	Yes
Acetabulum Force	3,600 - 4,300 N	4,163.3 N	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:51:45 473

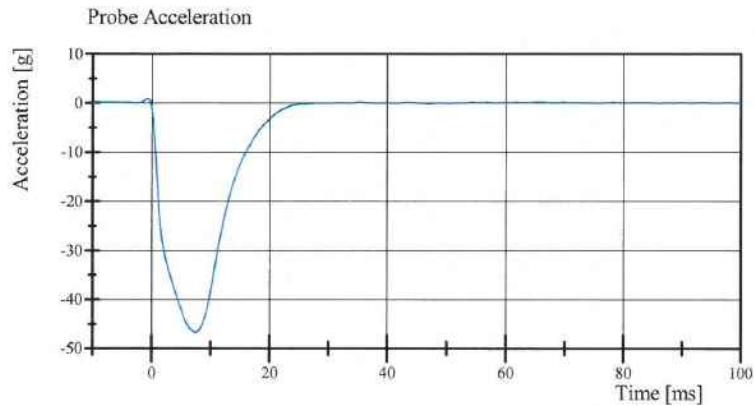


Transportation Research Center Inc.

Left Lateral Pelvis

SID IIs Serial No. 305 Certification No. 49-1

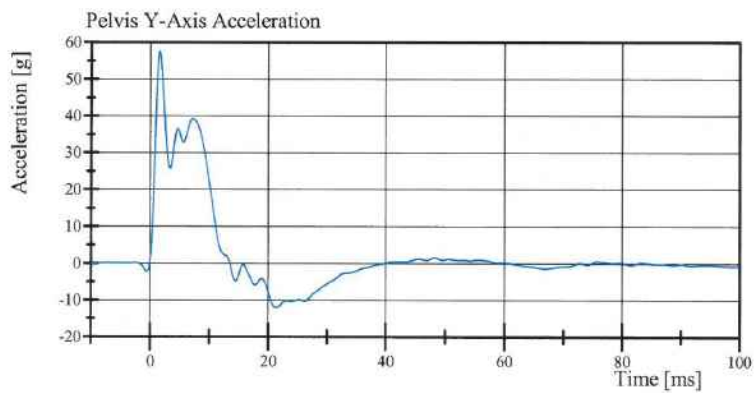
Test Date: 11/11/2016



Filter Class: CFC_180

Max: 0.8 g at -0.7 ms

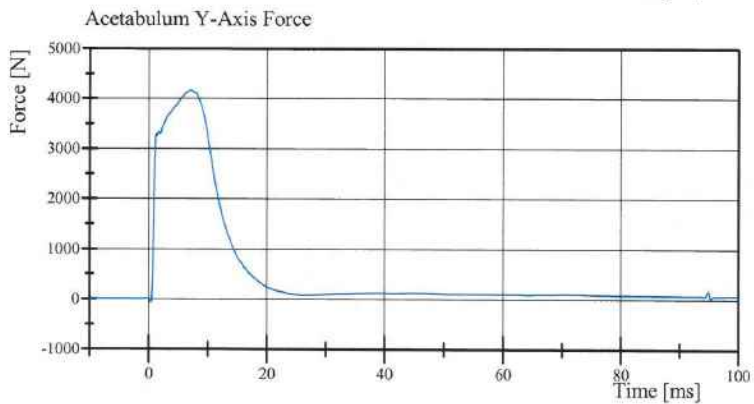
Min: -46.7 g at 7.4 ms



Filter Class: CFC_180

Max: 57.5 g at 1.6 ms

Min: -12.1 g at 21.4 ms



Filter Class: CFC_600

Max: 4,163.3 N at 7.1 ms

Min: -70.8 N at 0.3 ms



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 12:52:10 473

Transportation Research Center Inc.

Left Lateral Iliac

SID IIs Serial No. 305 Certification No. 49-1

Test Date: 11/11/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Velocity	4.2 - 4.4 m/s	4.36 m/s	Yes
Impactor Acceleration	(-36) - (-45) g	-41.9 g	Yes
Peak Pelvis Lateral Acceleration	28 - 39 g	31.2 g	Yes
Iliac Force	4,100 - 5,100 N	4,651.2 N	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 10:52:49 678

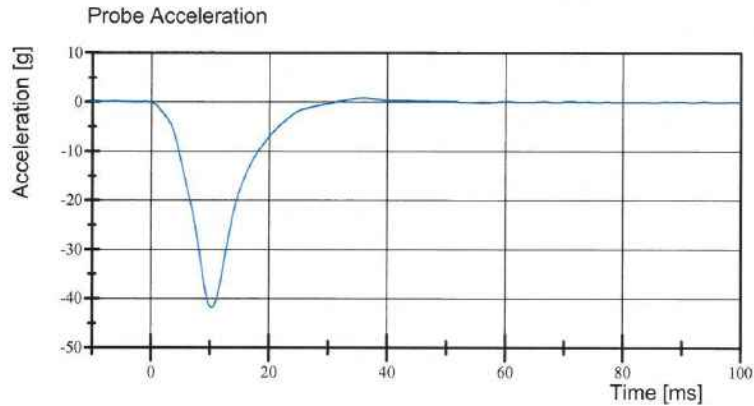


Transportation Research Center Inc.

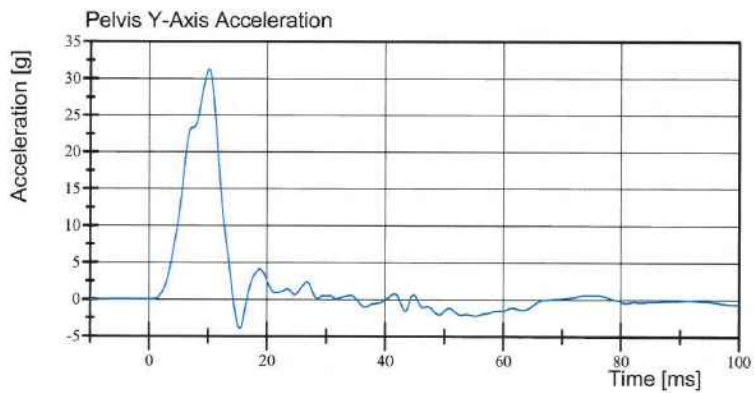
Left Lateral Iliac

SID IIs Serial No. 305 Certification No. 49-1

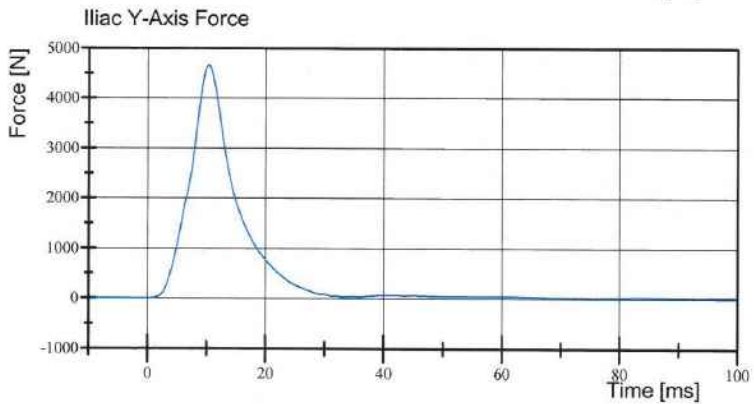
Test Date: 11/11/2016



Filter Class: CFC_180
Max: 0.8 g at 35.9 ms
Min: -41.9 g at 10.3 ms



Filter Class: CFC_180
Max: 31.2 g at 10.1 ms
Min: -4.0 g at 15.4 ms



Filter Class: CFC_600
Max: 4,651.2 N at 10.3 ms
Min: -0.6 N at -3.0 ms



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.11.2016 10:52:59 678

Post-Test Calibration Sheets
Passenger S/N 305

Transportation Research Center Inc.
SIDI's Dummy - Level D
External Dimensions
Serial No. 305 Calibration No.50

Symbol	Description	Specification	Results	Pass
		mm	mm	
A	Sitting Height	772.0 - 788.0	777	Yes
B	Shoulder Pivot Height	437.0 - 453.0	447	Yes
C	H-Point Height	79.0 - 89.0	88	Yes
D	H-Point from Seat Back	141.0 - 151.0	143	Yes
E	Shoulder Pivot from Backline	97.0 - 107.0	100	Yes
F	Thigh Clearance	119.0 - 135.0	125	Yes
G	Head Breadth	140.0 - 148.0	145	Yes
H	Head Back from Backline	40.0 - 46.0	45	Yes
I	Head Depth	178.0 - 188.0	183	Yes
J	Head Circumference	541.0 - 551.0	543	Yes
K	Buttock to Knee Length	514.0 - 540.0	535	Yes
L	Popliteal Height	343.0 - 369.0	345	Yes
M	Knee Pivot to Floor Height	393.0 - 409.0	395	Yes
N	Buttock Popliteal Length	416.0 - 442.0	434	Yes
O	Chest Depth without Jacket	195.0 - 211.0	202	Yes
P	Foot Length (right)	216.0 - 232.0	222	Yes
P	Foot Length (left)	216.0 - 232.0	222	Yes
Q	Hip Breadth	313.0 - 323.0	320	Yes
R	Arm Length	249.0 - 259.0	253	Yes
S	Knee Joint to seat Back	478.0 - 493.0	480	Yes
V	Shoulder Width (only one arm installed)	341.0 - 357.0	349	Yes
W	Foot Width (right)	78.0 - 94.0	85	Yes
W	Foot Width (left)	78.0 - 94.0	85	Yes
Y	Chest Circumference with Jacket	851.0 - 881.0	873	Yes
Z	Waist Circumference	761.0 - 791.0	780	Yes

Transportation Research Center Inc.

Left Lateral Head Drop

SID IIs Serial No. 305 Certification No. 50-2

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	40 %	Yes
Peak Head Resultant Acceleration	115 - 137 g	119.8 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-2.4 g	Yes
Is Head Resultant Acceleration Curve Unimodal within 15% of Peak?	Yes	Yes	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 13:11:54 232

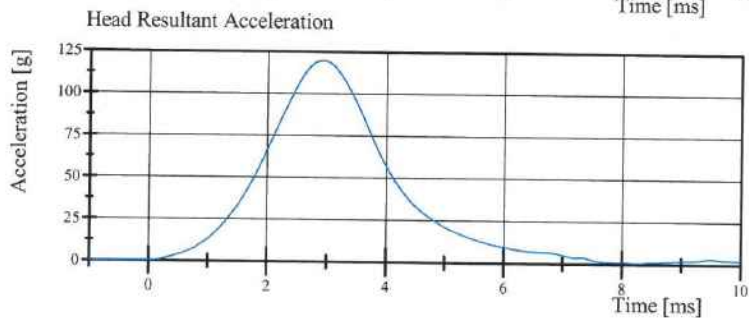
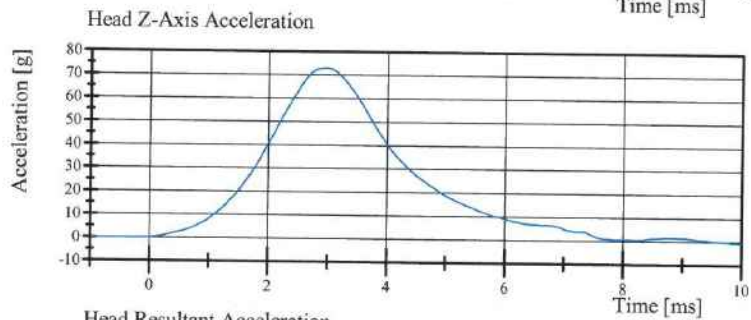
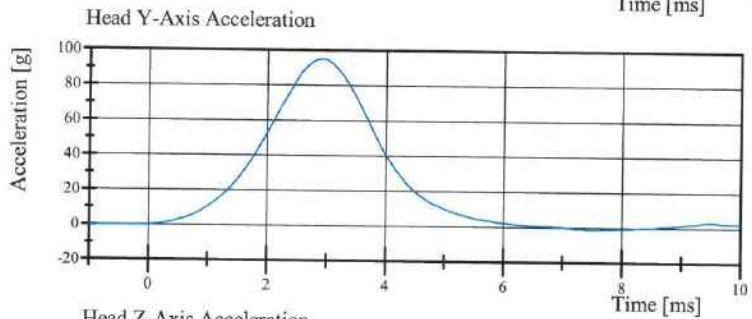
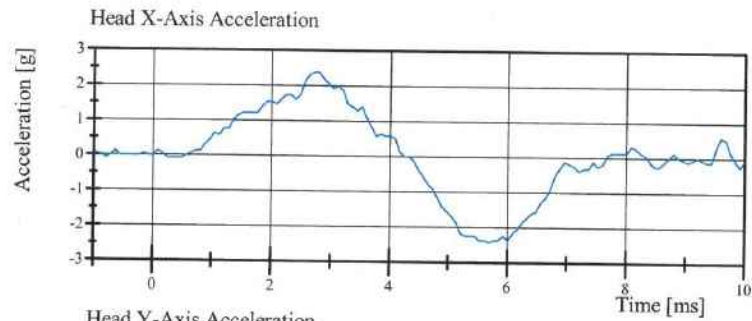


Transportation Research Center Inc.

Left Lateral Head Drop

SID IIs Serial No. 305 Certification No. 50-2

Test Date: 11/18/2016



Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 13:12:00 232



Transportation Research Center Inc.

Left Lateral Neck

SID IIs Serial No. 305 Certification No. 50-1

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Velocity	(-5.51) - (-5.63) m/s	-5.608 m/s	Yes
Pendulum Integrated Velocity			
Change at 10 ms	2.20 - 2.80 m/s	2.665 m/s	Yes
Change at 15 ms	3.30 - 4.10 m/s	3.967 m/s	Yes
Change at 20 ms	4.40 - 5.40 m/s	5.318 m/s	Yes
Change at 25 ms	5.40 - 6.10 m/s	5.783 m/s	Yes
Change at 25 to 100 ms	5.50 - 6.20 m/s	5.784 m/s	Yes
Maximum Headform Flexion occurring between 50ms and 70ms.			
Peak	(-71) - (-81) deg	-76.8 deg	Yes
Time of Peak	50 - 70 ms	64.0 ms	Yes
Total Neck Occipital Condyles Moment	36 - 44 N·m	41.8 N·m	Yes
Total Neck Occipital Condyles Moment			
Decay Time to 0 N·m	102 - 126 ms	122.6 ms	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:47:31 742

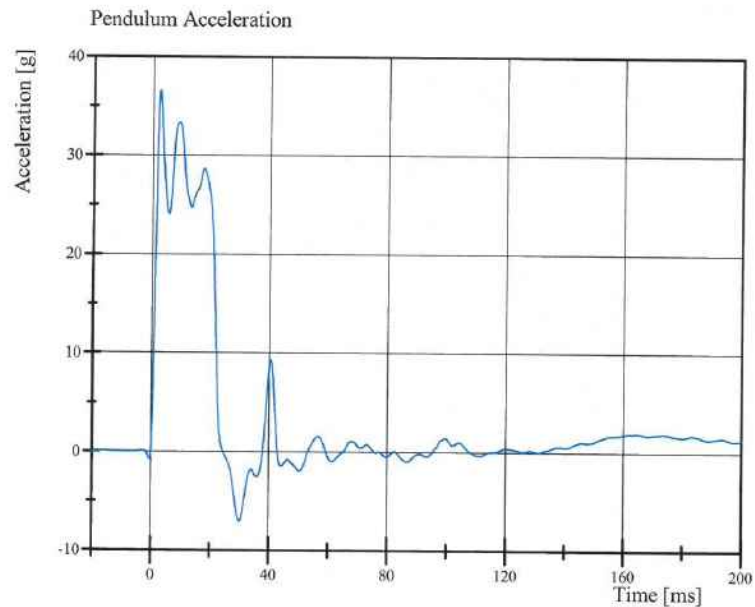


Transportation Research Center Inc.

Left Lateral Neck

SID IIs Serial No. 305 Certification No. 50-1

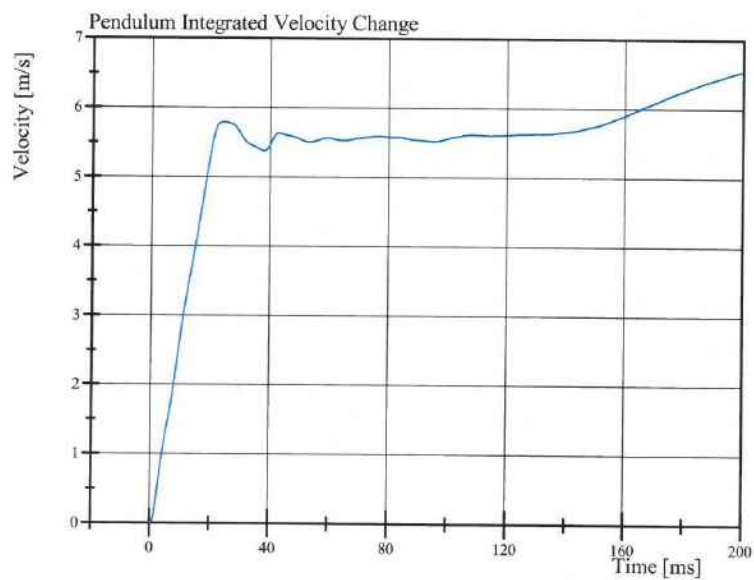
Test Date: 11/18/2016



Filter Class: CFC_180

Max: 36.5 g at 2.5 ms

Min: -7.1 g at 30.2 ms



Filter Class: CFC_180

Max: 6.5 m/s at 200.0 ms

Min: 0.0 m/s at 0.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:47:42 742

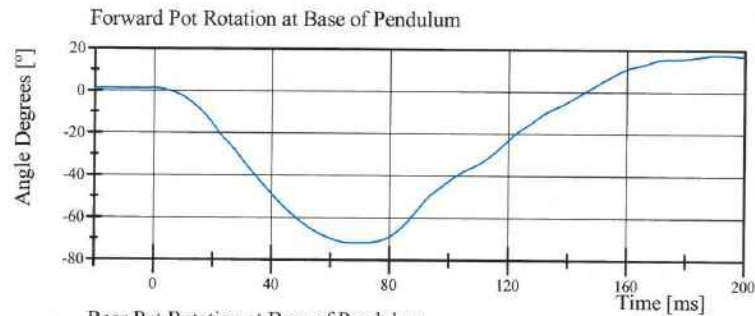


Transportation Research Center Inc.

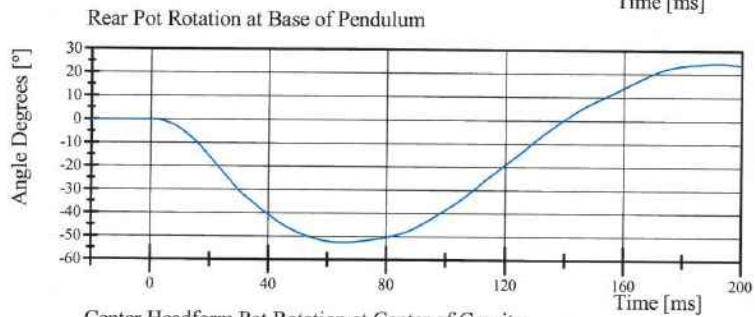
Left Lateral Neck

SID IIs Serial No. 305 Certification No. 50-1

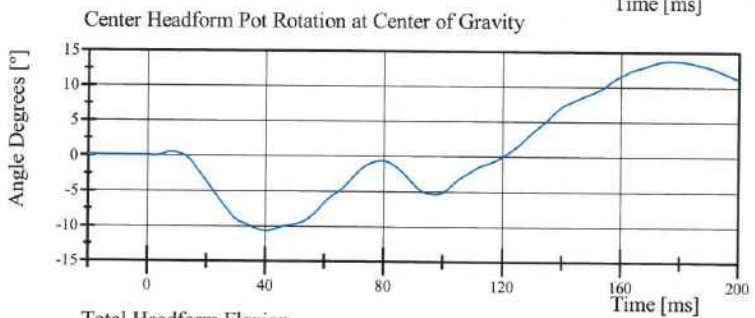
Test Date: 11/18/2016



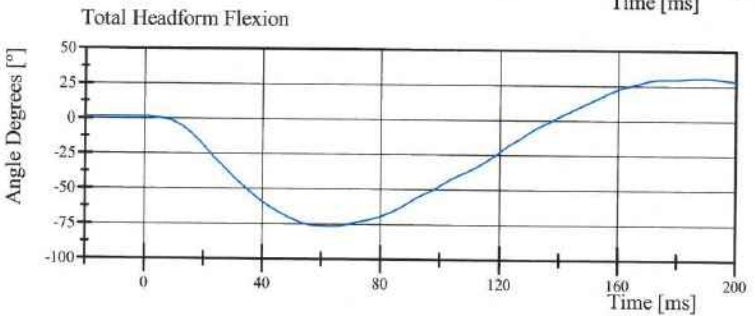
Filter Class: CFC_60
Max: 17.7 ° at 191.4 ms
Min: -71.9 ° at 67.6 ms



Filter Class: CFC_60
Max: 24.6 ° at 192.2 ms
Min: -52.7 ° at 64.7 ms



Filter Class: CFC_60
Max: 13.8 ° at 177.0 ms
Min: -10.7 ° at 40.3 ms



Filter Class: CFC_60
Max: 30.5 ° at 189.4 ms
Min: -76.8 ° at 64.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:47:43 742

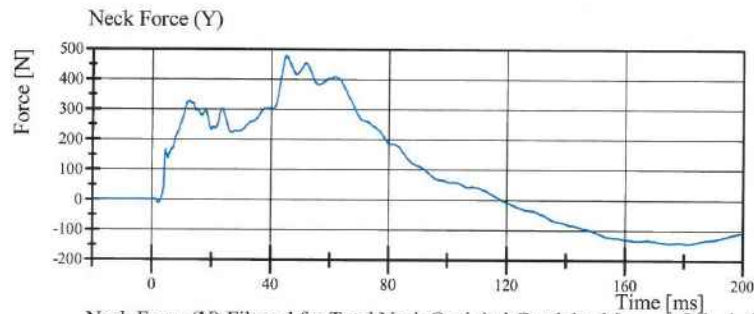


Transportation Research Center Inc.

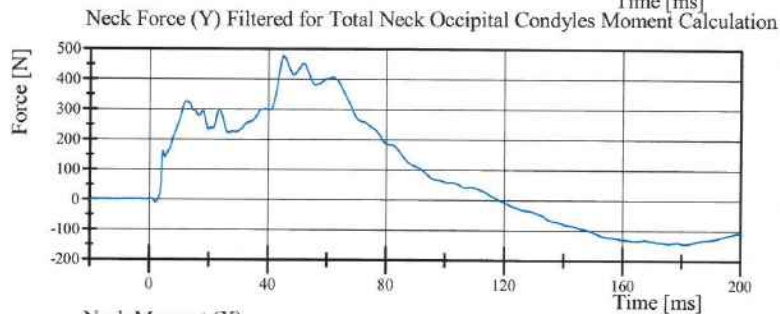
Left Lateral Neck

SID IIs Serial No. 305 Certification No. 50-1

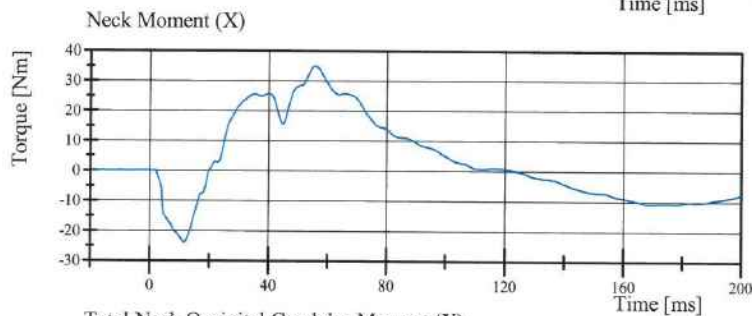
Test Date: 11/18/2016



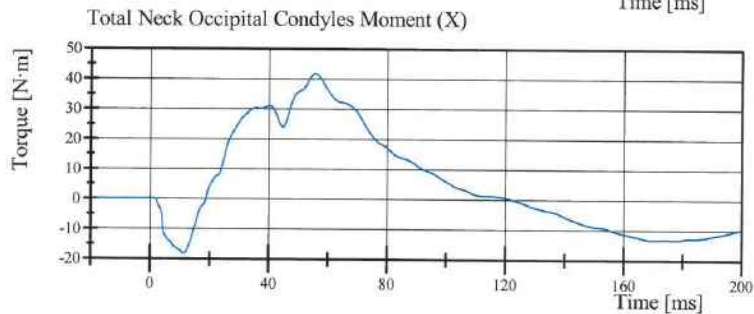
Filter Class: CFC_1000
Max: 478.2 N at 44.9 ms
Min: -143.8 N at 181.3 ms



Filter Class: CFC_600
Max: 477.8 N at 45.0 ms
Min: -143.7 N at 181.4 ms



Filter Class: CFC_600
Max: 35.0 Nm at 55.7 ms
Min: -23.9 Nm at 11.6 ms



Filter Class: Without_(Consta
Max: 41.8 N·m at 55.6 ms
Min: -18.3 N·m at 11.4 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:47:45 742



Transportation Research Center Inc.

Left Lateral Shoulder

SID IIs Serial No. 305 Certification No. 50-1

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.27 m/s	Yes
Impactor Acceleration	(-13) - (-18) g	-15.8 g	Yes
Shoulder Displacement	28 - 37 mm	30.6 mm	Yes
Upper Spine Lateral Acceleration	17 - 22 g	21.0 g	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:45:43 868

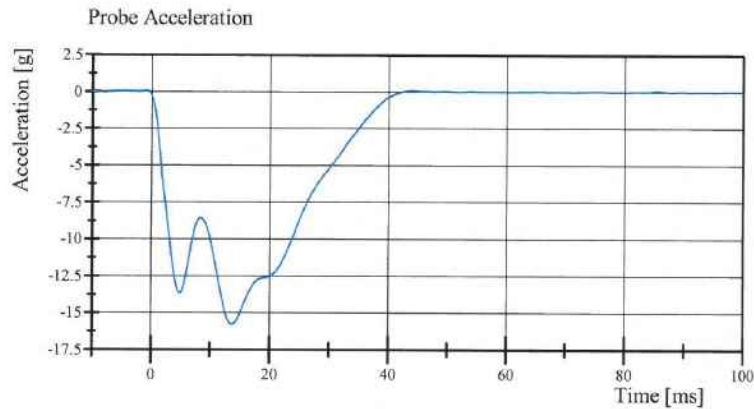


Transportation Research Center Inc.

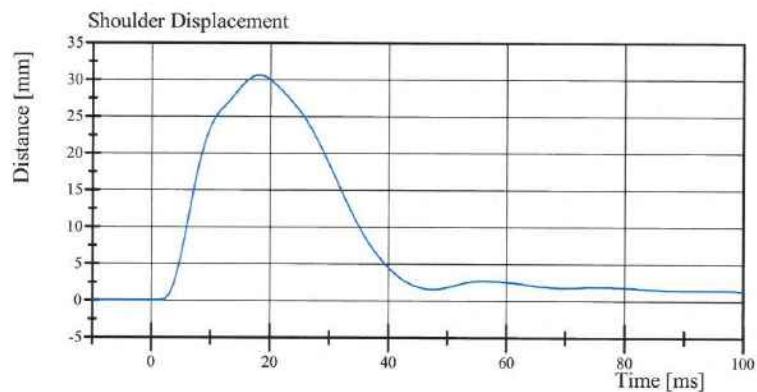
Left Lateral Shoulder

SID IIs Serial No. 305 Certification No. 50-1

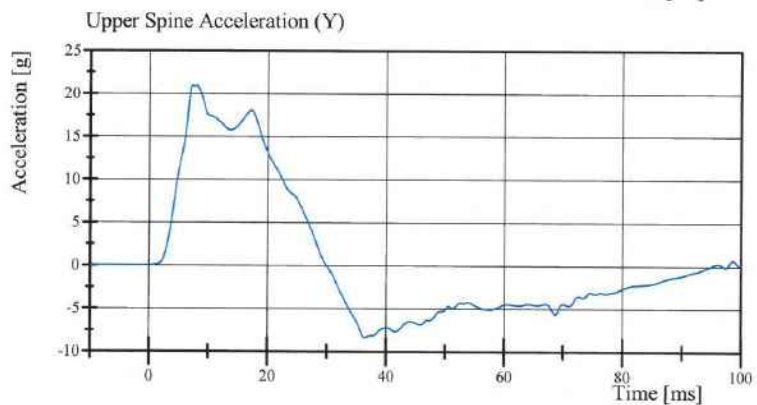
Test Date: 11/18/2016



Filter Class: CFC_180
Max: 0.1 g at 85.3 ms
Min: -15.8 g at 13.7 ms



Filter Class: CFC_600
Max: 30.6 mm at 18.2 ms
Min: -0.0 mm at 0.3 ms



Filter Class: CFC_180
Max: 21.0 g at 7.4 ms
Min: -8.4 g at 36.5 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:45:52 868



Transportation Research Center Inc.

Left Lateral Thorax with Arm
SID IIs Serial No. 305 Certification No. 50-2
Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.6 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Impactor Velocity	6.60 - 6.80 m/s	6.778 m/s	Yes
Impactor Acceleration	(-30) - (-36) g	-31.9 g	Yes
Shoulder Displacement	31 - 40 mm	33.2 mm	Yes
Upper Thorax Rib Displacement	25 - 32 mm	26.5 mm	Yes
Center Thorax Rib Displacement	30 - 36 mm	31.7 mm	Yes
Lower Thorax Rib Displacement	32 - 38 mm	34.5 mm	Yes
Upper Spine Lateral Acceleration	34 - 43 g	37.6 g	Yes
Lower Spine Lateral Acceleration	29 - 37 g	30.3 g	Yes

Test meets specifications.

Comments:

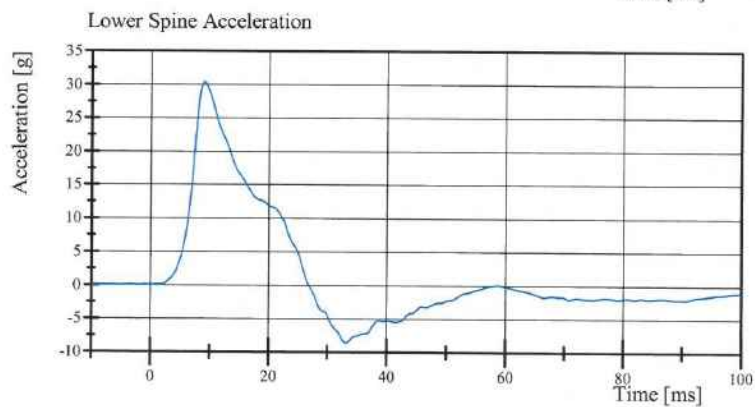
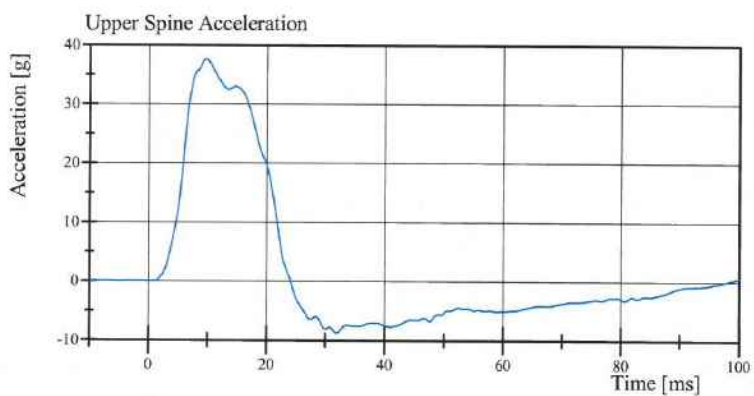
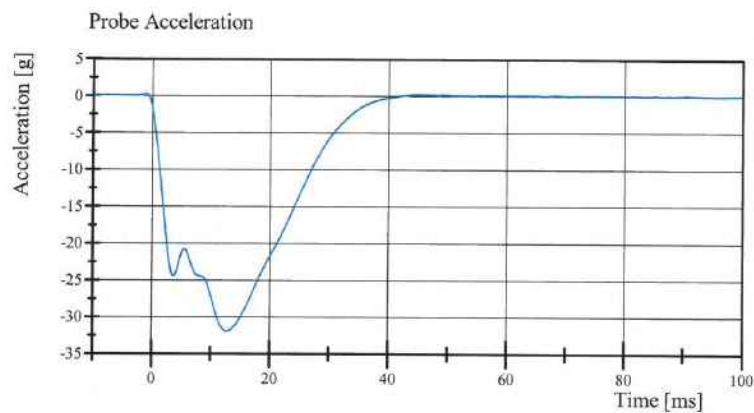
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:35:56 628



Transportation Research Center Inc.

Left Lateral Thorax with Arm
SID IIs Serial No. 305 Certification No. 50-2
Test Date: 11/18/2016



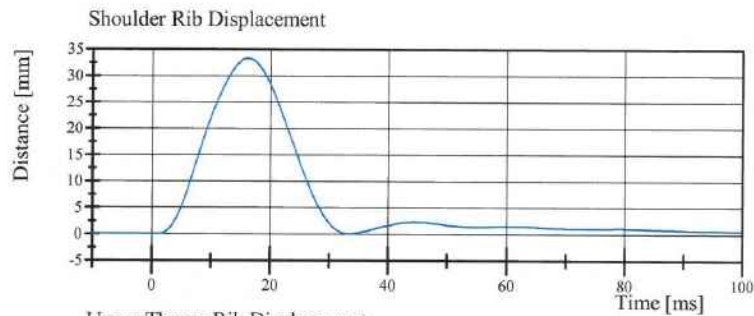
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:36:08 628

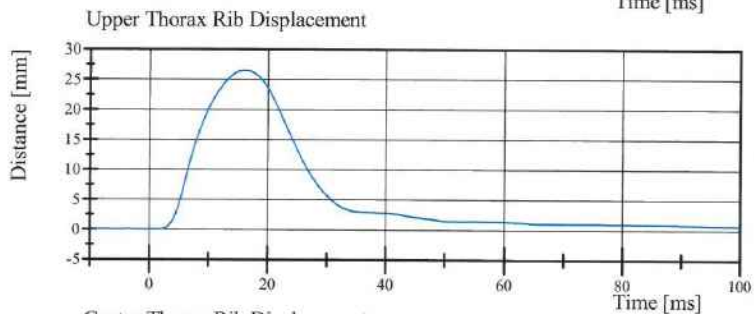


Transportation Research Center Inc.

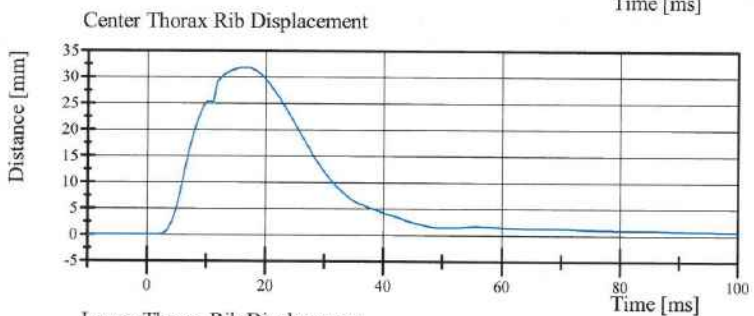
Left Lateral Thorax with Arm
SID IIs Serial No. 305 Certification No. 50-2
Test Date: 11/18/2016



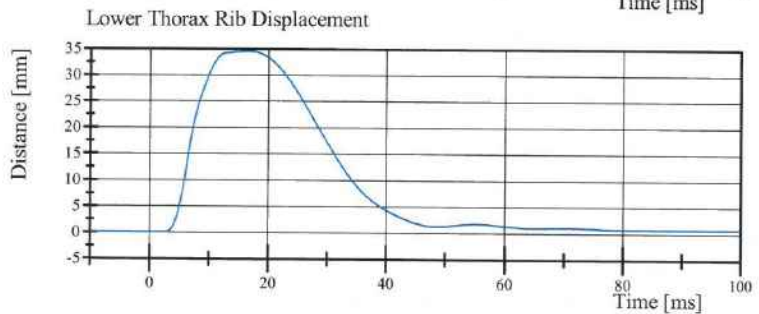
Filter Class: CFC_600
Max: 33.2 mm at 16.2 ms
Min: -0.0 mm at -1.0 ms



Filter Class: CFC_600
Max: 26.5 mm at 16.2 ms
Min: -0.0 mm at -2.0 ms



Filter Class: CFC_600
Max: 31.7 mm at 16.6 ms
Min: -0.0 mm at -6.2 ms



Filter Class: CFC_600
Max: 34.5 mm at 16.0 ms
Min: -0.0 mm at -1.3 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 10:36:09 628



Transportation Research Center Inc.

Left Lateral Thorax without Arm
SID IIs Serial No. 305 Certification No. 50-1
Test Date: 11/18/2016

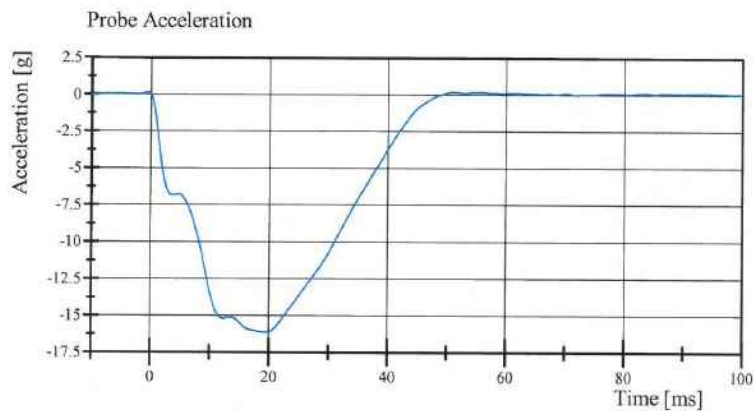
Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.1 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Impactor Velocity	4.20 - 4.40 m/s	4.355 m/s	Yes
Impactor Acceleration	(-14) - (-18) g	-16.2 g	Yes
Upper Thorax Rib Displacement	32 - 40 mm	35.3 mm	Yes
Center Thorax Rib Displacement	39 - 45 mm	40.8 mm	Yes
Lower Thorax Rib Displacement	35 - 43 mm	38.0 mm	Yes
Upper Spine Lateral Acceleration	13 - 17 g	14.5 g	Yes
Lower Spine Lateral Acceleration	7 - 11 g	9.5 g	Yes

Test meets specifications.

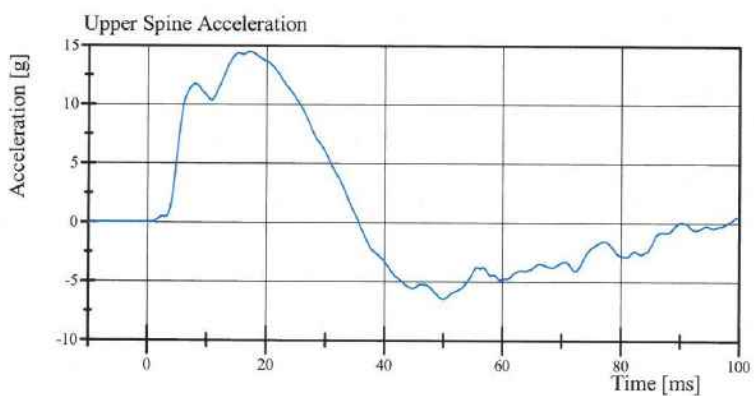
Comments:

Transportation Research Center Inc.

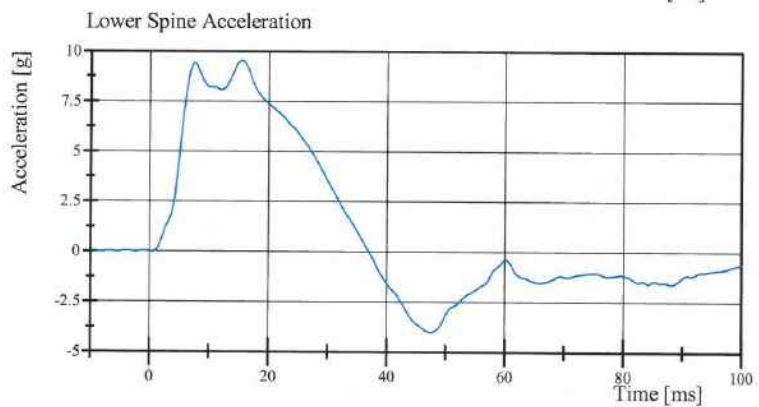
Left Lateral Thorax without Arm
SID IIs Serial No. 305 Certification No. 50-1
Test Date: 11/18/2016



Filter Class: CFC_180
Max: 0.2 g at 55.8 ms
Min: -16.2 g at 19.4 ms



Filter Class: CFC_180
Max: 14.5 g at 17.2 ms
Min: -6.5 g at 50.0 ms



Filter Class: CFC_180
Max: 9.5 g at 15.5 ms
Min: -4.0 g at 47.4 ms

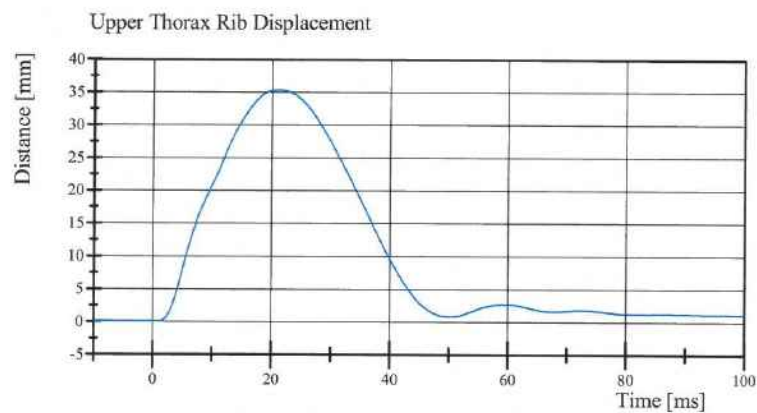
Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

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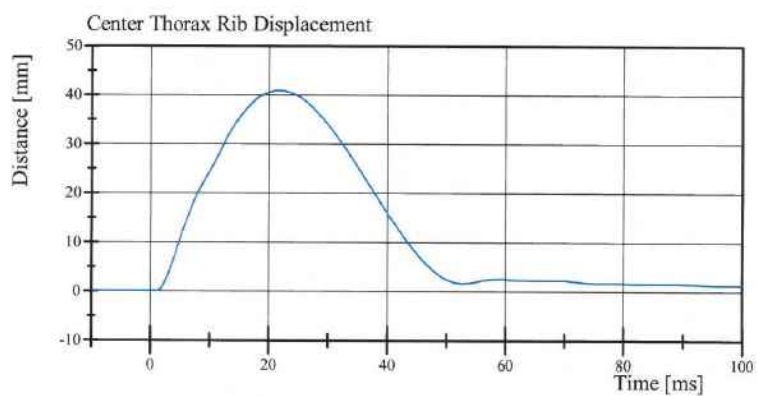


Transportation Research Center Inc.

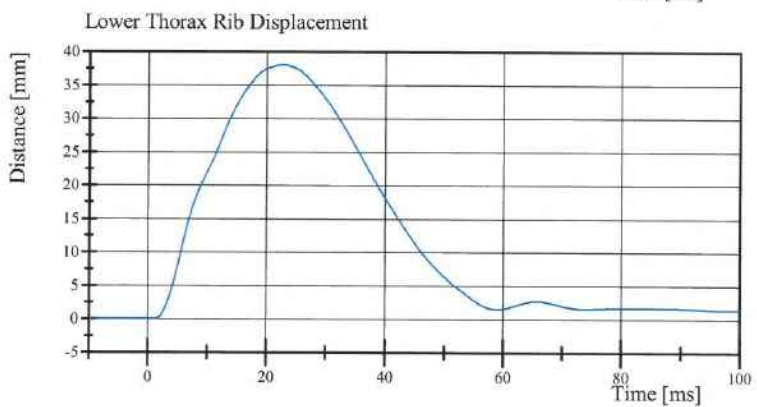
Left Lateral Thorax without Arm
SID IIs Serial No. 305 Certification No. 50-1
Test Date: 11/18/2016



Filter Class: CFC_600
Max: 35.3 mm at 21.3 ms
Min: -0.0 mm at 1.2 ms



Filter Class: CFC_600
Max: 40.8 mm at 21.7 ms
Min: -0.0 mm at 0.9 ms



Filter Class: CFC_600
Max: 38.0 mm at 22.9 ms
Min: -0.0 mm at -9.7 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 09:20:21 840



Transportation Research Center Inc.

Left Lateral Abdomen

SID IIs Serial No. 305 Certification No. 50-1

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.7 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Impactor Velocity	4.2 - 4.4 m/s	4.27 m/s	Yes
Impactor Acceleration	(-12) - (-16) g	-13.6 g	Yes
Upper Abdominal Rib Displacement	36 - 47 mm	43.7 mm	Yes
Lower Abdominal Rib Displacement	33 - 44 mm	39.7 mm	Yes
Lower Spine Lateral Acceleration	9 - 14.0 g	10.34 g	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:54:59.700

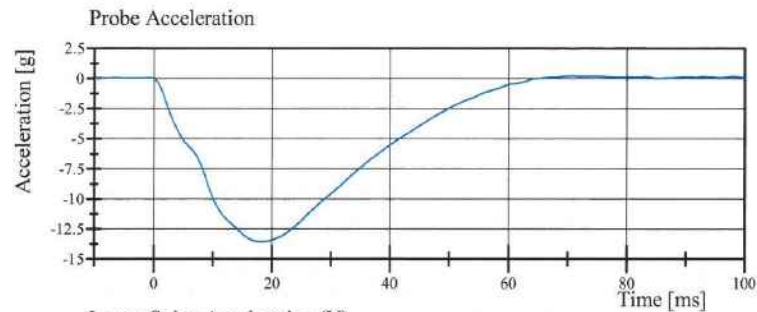


Transportation Research Center Inc.

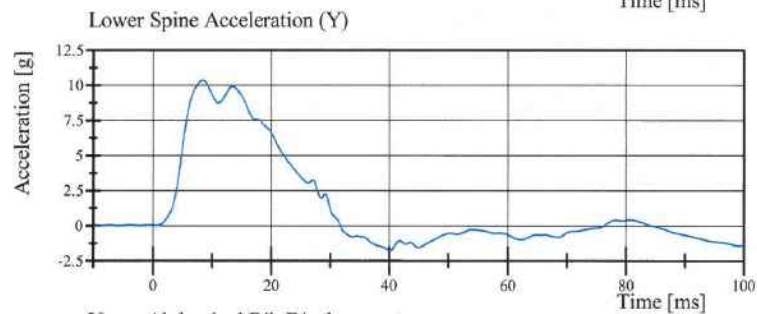
Left Lateral Abdomen

SID II: Serial No. 305 Certification No. 50-1

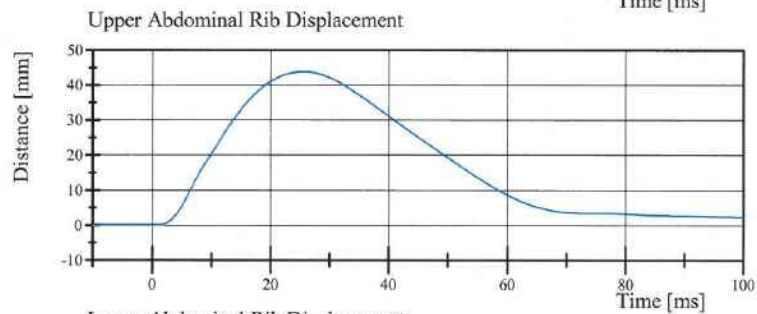
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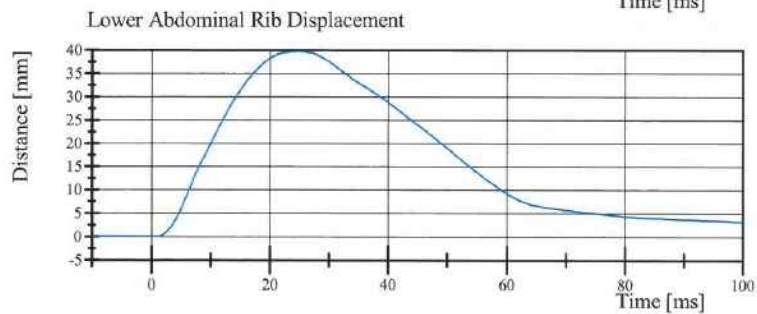
Filter Class: CFC_180
Max: 0.2 g at 70.7 ms
Min: -13.6 g at 18.3 ms



Filter Class: CFC_180
Max: 10.3 g at 8.5 ms
Min: -1.8 g at 40.2 ms



Filter Class: CFC_600
Max: 43.7 mm at 25.5 ms
Min: -0.0 mm at -9.8 ms



Filter Class: CFC_600
Max: 39.7 mm at 25.0 ms
Min: -0.0 mm at -5.5 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:55:09 700



Transportation Research Center Inc.

Left Lateral Pelvis

SID IIs Serial No. 305 Certification No. 50-1

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.9 °C	Yes
Relative Humidity	10 - 70 %	38 %	Yes
Pendulum Velocity	6.6 - 6.8 m/s	6.62 m/s	Yes
Impactor Acceleration	(-38.0) - (-47.0) g	-44.15 g	Yes
Peak Pelvis Lateral Acceleration after 6ms	34 - 42 g	40.0 g	Yes
Acetabulum Force	3,600 - 4,300 N	3,862.0 N	Yes

Test meets specifications.

Comments: Pelvis Pulg#11026

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:28:07.447

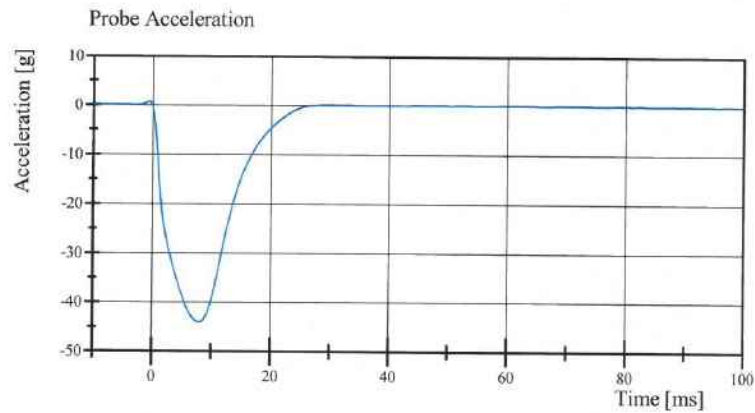


Transportation Research Center Inc.

Left Lateral Pelvis

SID IIs Serial No. 305 Certification No. 50-1

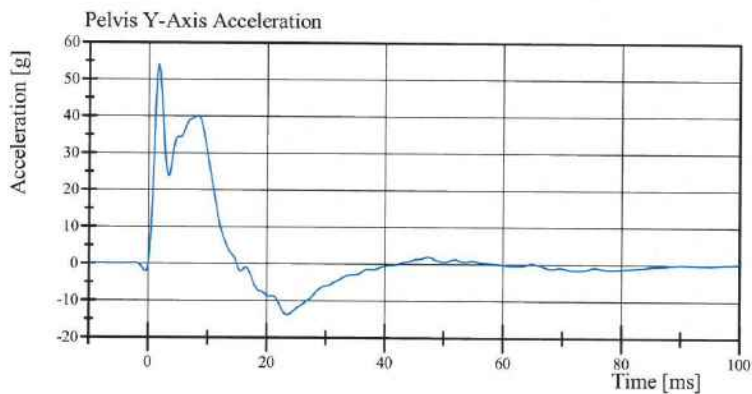
Test Date: 11/18/2016



Filter Class: CFC_180

Max: 0.6 g at -0.6 ms

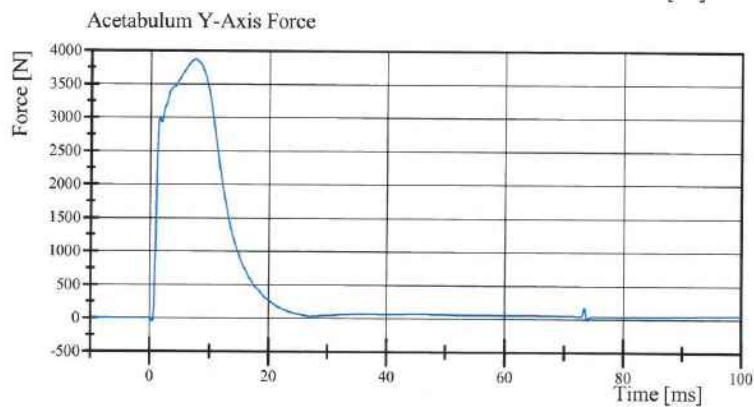
Min: -44.1 g at 8.0 ms



Filter Class: CFC_180

Max: 54.0 g at 1.7 ms

Min: -13.8 g at 23.5 ms



Filter Class: CFC_600

Max: 3,862.0 N at 7.6 ms

Min: -51.4 N at 0.5 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 08:29:42 447



Transportation Research Center Inc.

Left Lateral Iliac

SID IIs Serial No. 305 Certification No. 50-1

Test Date: 11/18/2016

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	21.4 °C	Yes
Relative Humidity	10 - 70 %	39 %	Yes
Pendulum Velocity	4.2 - 4.4 m/s	4.35 m/s	Yes
Impactor Acceleration	(-36) - (-45) g	-42.1 g	Yes
Peak Pelvis Lateral Acceleration	28 - 39 g	28.5 g	Yes
Iliac Force	4,100 - 5,100 N	4,678.6 N	Yes

Test meets specifications.

Comments:

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 11:03:12 666

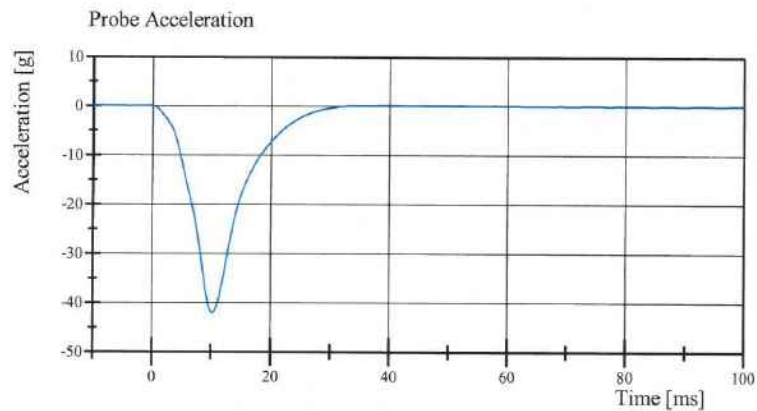


Transportation Research Center Inc.

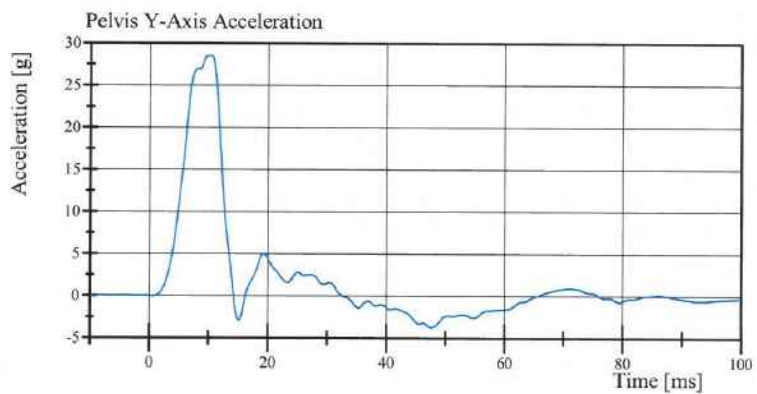
Left Lateral Iliac

SID IIs Serial No. 305 Certification No. 50-1

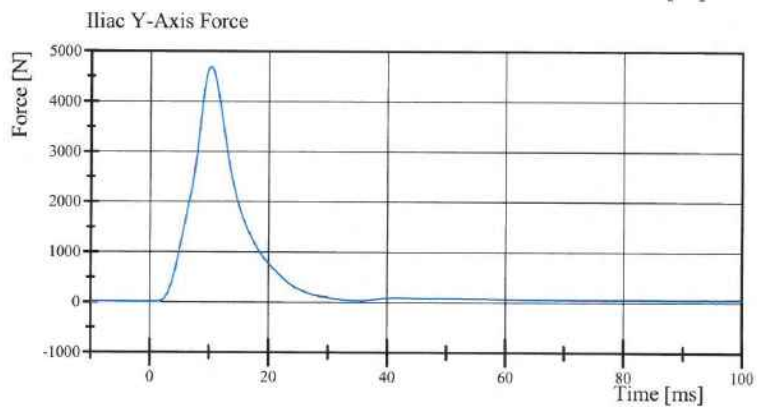
Test Date: 11/18/2016



Filter Class: CFC_180
Max: 0.1 g at 39.7 ms
Min: -42.1 g at 10.2 ms



Filter Class: CFC_180
Max: 28.5 g at 10.5 ms
Min: -3.7 g at 47.6 ms



Filter Class: CFC_600
Max: 4,678.6 N at 10.3 ms
Min: -0.9 N at -10.0 ms

Specification Source: CFR49 Part 572 Subpart V
with Polarity in accordance with J211

11.18.2016 11:03:22 666



APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

TABLE 1 – Dummy Instrumentation (ES-2re)

			ES-2re S/N F030		
			Serial Number	Manufacturer	Calibration Date
Head Accelerometers	X		P87680	Endevco	21-Sep-16
	Y		P66873	Endevco	10-Nov-16
	Z		P91950	Endevco	6-Oct-16
Redundant Head Accelerometers	X		P94566	Endevco	10-Nov-16
	Y		P94429	Endevco	1-Sep-16
	Z		P94483	Endevco	1-Sep-16
Thoracic Rib Displacement Potentiometers	Upper	Y	111	Honeywell	29-Sep-16
	Middle	Y	174	FTSS	29-Sep-16
	Lower	Y	173	FTSS	29-Sep-16
Abdomen Load Cells	Front	Y	1441	Denton	18-Mar-16
	Middle	Y	1436	Denton	18-Mar-16
	Rear	Y	1437	Denton	18-Mar-16
Lower Spine Accelerometers (T12)	X		P89126	Endevco	21-Sep-16
	Y		P87139	Endevco	21-Sep-16
	Z		P64884	Endevco	21-Sep-16
Acetabulum Load Cell		Y	N/A	N/A	N/A
Pubic Symphysis Load Cell		Y	457-FY	Denton	18-Mar-16

TABLE 2 – Dummy Instrumentation (SID-IIs)

				SID-IIs S/N 305		
				Serial Number	Manufacturer	Calibration Date
Head Accelerometers			X	P90267	Endevco	29-Sep-16
			Y	P93774	Endevco	01-Sep-16
			Z	P91566	Endevco	21-Sep-16
Redundant Head Accelerometers			X	P91615	Endevco	21-Sep-16
			Y	P93762	Endevco	01-Sep-16
			Z	P93761	Endevco	01-Sep-16
Displacement Potentiometers	Shoulder		N/A	N/A	N/A	N/A
	Thoracic Rib	Upper	Y	007	Servo	29-Sep-16
		Middle	Y	1161	Servo	29-Sep-16
		Lower	Y	037	Servo	29-Sep-16
	Abdominal Rib	Upper	Y	1295	Servo	29-Sep-16
		Lower	Y	1136	Servo	29-Sep-16
Lower Spine Accelerometers (T12)			X	P94545	Endevco	15-Sep-16
			Y	P94647	Endevco	21-Sep-16
			Z	P94530	Endevco	1-Sep-16
Acetabulum Load Cell			Y	103-FY	FTSS	13-Jun-16
Iliac Wing Load Cell			Y	287-FY	Denton	22-Mar-16
Pelvis Plug (struck side)				81023	Humanetics	03-Dec-14
Pelvis Plug (non-struck side)				36473	FTSS	23-Sep-10

TABLE 3 – Vehicle Instrumentation

Vehicle Instrumentation			Serial Number	Manufacturer	Calibration Date
1	Vehicle Center of Gravity	X	P94489	Endevco	31-Oct-16
	Vehicle Center of Gravity	Y	P94426	Endevco	26-Jul-16
	Vehicle Center of Gravity	Z	P94550	Endevco	26-Jul-16
2	Right Sill at Front Seat	X	P94424	Endevco	31-Oct-16
	Right Sill at Front Seat	Y	P94541	Endevco	26-Jul-16
	Right Sill at Front Seat	Z	P91184	Endevco	10-Nov-16
3	Right Sill at Rear Seat	X	P94524	Endevco	10-Nov-16
	Right Sill at Rear Seat	Y	P94570	Endevco	10-Nov-16
	Right Sill at Rear Seat	Z	P94488	Endevco	10-Nov-16
4	Left Sill at Front Door	Y	P50430	Endevco	12-Oct-16
5	Left Sill at Rear Door	Y	P93452	Endevco	10-Nov-16
6	Left A-Post Lower	Y	P94562	Endevco	2-Nov-16
7	Left A-Post Middle	Y	P94559	Endevco	2-Nov-16
8	Left B-Post Lower	Y	P63151	Endevco	25-Jul-16
9	B-Post Middle	Y	P88468	Endevco	25-Jul-16
10	Front Seat Track	Y	P94504	Endevco	27-Oct-16
11	Rear Seat Track or Structure	Y	P91492	Endevco	27-Oct-16
12	Right Rear Occupant Compartment	Y	P94521	Endevco	27-Oct-16
13	Engine Block	X	P66749	Endevco	28-Sep-16
	Engine Block	Y	P94512	Endevco	2-Nov-16
14	Rear Floorpan Above Axle	X	P88004	Endevco	15-Aug-16
	Rear Floorpan Above Axle	Y	P91482	Endevco	28-Sep-16
	Rear Floorpan Above Axle	Z	P93550	Endevco	25-Jul-16

TABLE 4 – MDB Instrumentation

MDB Instrumentation		Serial Number	Manufacturer	Calibration Date
MDB Center of Gravity	X	P94552	Endevco	26-Jul-16
MDB Center of Gravity	Y	P94553	Endevco	26-Jul-16
MDB Center of Gravity	Z	P94546	Endevco	26-Jul-16
Left Frame Rail at Rear Axle Centerline	X	P93518	Endevco	25-Jul-16
Left Frame Rail at Rear Axle Centerline	Y	P93537	Endevco	25-Jul-16

How to Research Stiffness Data

Stiffness Calculations - Contractor Report

Contractor Report

NHTSA Test

10125

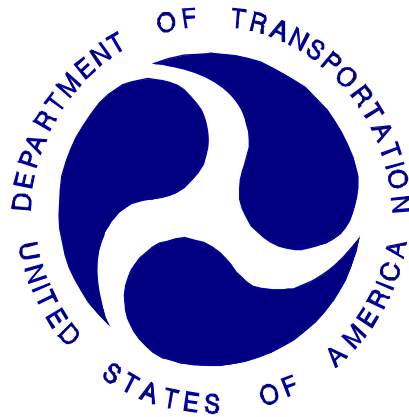
REPORT NUMBER: 301R-CAL-17-004

**SAFETY COMPLIANCE TESTING FOR FMVSS 301R
FUEL SYSTEM INTEGRITY – REAR IMPACT**

**Toyota Motor Manufacturing, Canada, Inc.
2017 Toyota Corolla**

NHTSA NUMBER: C20175102

**PREPARED BY:
CALSPAN CORPORATION
TRANSPORTATION TEST OPERATIONS
P.O. BOX 400
BUFFALO, NEW YORK 14225**



June 5, 2017

FINAL REPORT

**PREPARED FOR:
U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration Enforcement
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Avenue, SE
Washington, DC 20590**

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-16-D-00032.

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Prepared By: Alexander Rudniski
Alexander Rudniski, Engineer Technician

Approved By: Edward J. Dutton
Edward J. Dutton, Test Engineer Director
Transportation Test Operations

Approval Date: June 5, 2017

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance
Date: _____

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 301R-CAL-17-004	2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS 301R Compliance Rear Impact Testing of a 2017 Toyota Corolla NHTSA No.: C20175102		5. Report Date June 5, 2017		
		6. Performing Organization Code CAL		
7. Author(s) Alexander Rudniski, Engineer Technician Edward Dutton, Senior Test Engineer		8. Performing Organization Report No. CAL-DOT-2017-004		
9. Performing Organization Name and Address Calspan Corporation Transportation Test Operations P.O. Box 400 Buffalo, New York 14225		10. Work Unit No.		
		11. Contract or Grant No. DTNH22-16-D-00032		
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance- Enforcement Mail Code: NVS-220 1200 New Jersey Avenue, SE Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report June 2, 2017 - June 5, 2017		
		14. Sponsoring Agency Code NVS-220		
15. Supplementary Notes				
16. Abstract <p>A compliance test was conducted on a 2017 Toyota Corolla four door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301R-02 for the determination of FMVSS 301R compliance. Test failures identified were as follows:</p> <p>None - The test vehicle appeared to comply with all requirements of FMVSS 301R "Fuel System Integrity – Rear Impact."</p>				
17. Key Words Compliance Testing Safety Engineering FMVSS 301R		18. Distribution Statement <u>Copies of this report are available from:</u> National Highway Traffic Safety Administration Technical Reference Division (TIS) (NPO-230) 1200 New Jersey Avenue, SE Washington, D.C. 20590 Telephone No. (202) 366-4946		
19. Security Classification of Report UNCLASSIFIED	20. Security Classification of Page UNCLASSIFIED		21. No. of Pages 39	22. Price

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SECTION 1

PURPOSE AND TEST PROCEDURE

This rear impact test is part of the FMVSS 301R Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-16-D-00032. The purpose of this test was to determine if the subject vehicle, a 2017 Toyota Corolla four door sedan, meets the performance requirements of FMVSS No. 301R "Fuel System Integrity – Rear Impact." The test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-301R-02, dated January 17, 2007).

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

A 1,510 kg 2017 Toyota Corolla four door sedan was impacted from the rear by a 1357.0 kg moving barrier at a velocity of 79.24 kph (49.23 mph). The test was performed by Calspan Corporation on June 2, 2017

The test vehicle was equipped with a 50.3 liter fuel tank which was filled to 93 percent capacity with stoddard fluid prior to impact. Additional ballast (37 kg) was secured in the vehicle's rear passenger foot well. Two ballast Part 572E 50th percentile male Anthropomorphic Test Devices (ATD) were placed in the front occupant seating positions.

The crash event was recorded by three high-speed cameras and one real-time camera. High-speed camera locations and other pertinent camera information can be found on page 3-7 of this report. Pre- and post-test photographs of the vehicle can be found in Appendix A.

There was no fuel system fluid spillage following the impact and including all portions of the static rollover test. The maximum vehicle longitudinal crush was 740 millimeters of which the average was 588 millimeters. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity."

SECTION 3

SUMMARY OF TEST RESULTS

This section contains information reporting for the following Data Sheets:

Data Sheet No. 1 – Test Vehicle Specifications

Data Sheet No. 2 – Pre-Test Data

Data Sheet No. 3 – Moving Deformable Barrier (MDB) Data

Data Sheet No. 4 – High Speed Camera Locations and Data Summary

Data Sheet No. 5 – Post-Test Data

Data Sheet No. 6 – FMVSS No. 301 Static Rollover Test Data

DATA SHEET NO. 1
TEST VEHICLE SPECIFICATIONS

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	C20175102
Model Year	2017
Make	Toyota
Model	Corolla
Body Style	Four Door Sedan
Body Color	Red
Odometer Reading (km/mi)	12.9 km / 8 mi
Engine Displacement (L)	1.8
Type/No. Cylinders	I4
Engine Placement	Transverse
Transmission Type	Automatic
Transmission Speeds	CVT
Final Drive	Front Wheel Drive

Overdrive	Yes
Air Conditioning (AC)	Yes
All-Wheel Drive (AWD)	No
Anti-Lock Brakes (ABS)	Yes
Automatic Door Locks (ADL)	Yes
Power Brakes	Yes
Power Seats	No
Power Steering	Yes
Power Windows	Yes
Stability Control (Auto-Leveling)	No
Sunroof/T-Top	No
Tilt Steering Wheel	Yes
Traction Control System (TCS)	Yes

DEALER AND DELIVERY INFORMATION FROM CERTIFICATION LABEL

Manufactured By	Toyota Motor Manufacturing, Canada, Inc.
Date of Manufacture	09/16
VIN	2T1BURHE8HC754623

GVWR (kg)	1733
GAWR Front (kg)	939
GAWR Rear (kg)	839

TIRE PLACARD & SIDEWALL INFORMATION

Tire Placard Location: Driver's Door Sill

Spare Tire Type: T135/80R16

Measured Parameter	Front	Rear
Tire Manufacturer	Michelin	Michelin
Tire Name	Primacy MXV4	Primacy MXV4
Tire Type	All Weather	All Weather
Max. Tire Pressure (kPa)	350	350
Recommended Tire Size	P205/55R16	P205/55R16
Load Index/Speed Symbol	89H	89H
Recommended Cold Tire Pressure (kPa)	220	220
Tire Size on Vehicle	P205/55R16	P205/55R16
Treadwear/ Traction Grade/ Temperature Grade	320 / A / A	320 / A / A

VEHICLE CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Designated Seating Capacity (DSC)	2	3	-	5
Seat Type (Bench, Bucket, or Split Bench)	Bucket	Bench	-	
Capacity Weight (VCW) (kg)				390
DSC X 68.04 (kg)				340.2
Cargo Weight (RCLW) (kg)				49.8

**DATA SHEET NO. 2
PRE-TEST DATA**

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	408	260		469	301	
Right	kg	393	251		435	305	
Ratio	%	61	39		60	40	
Totals	kg	801	511	1312	904	606	1510

TARGET TEST WEIGHT CALCULATION (TTW)

Measured Parameter	Units	Value	
Total Unloaded Vehicle Weight (UVW)	kg	1312	(A)
Rated Cargo/Luggage Weight (RCLW)	kg	49.8	(B)
Weight of two P572E ATDS @ 74kg each	kg	155.4	(C)
Target Vehicle Test Weight (TVTWT)	kg	1517.2	(A+B+C)

*As tested Weight = (TVTWT -10kg) <=ATW < (TVTWT -5kg); TVTWT = Weight of Test Vehicle with 2 dummies and 49.8kg of Cargo Weight

GENERAL TEST VEHICLE DATA

Measured Parameter	Units	Value
Vehicle Wheelbase	mm	2701
Vehicle Length (at Centerline)	mm	4646
Vehicle Width	mm	1761
Weight of Ballast Secured in Cargo Area ¹	kg	37
Type of Ballast		Lead Shot
Method of Securing Ballast		Rear Foot Well
Components Removed for Weight Reduction		0
Vehicle Width at Widest Point	mm	1775
Vehicle Width at Widest Point Location		C-Pillar
Centerline offset for impact line	mm	355
Filler neck side (left/right)		Left

¹ Ballast weight does not include the weight of instrumentation, on-board cameras and data acquisition system

TEST VEHICLE ATTITUDE AND CG

	Units	Left		Right		CG (aft of front axle)
		Front	Rear	Front	Rear	
As Delivered (UVW)	mm	697	716	699	718	1052
As Tested (ATW)	mm	668	689	674	695	1084

DATA SHEET NO. 2 (Continued)
PRE-TEST DATA

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

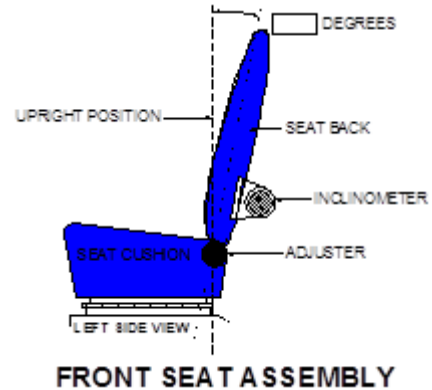
NHTSA No.: C20175102
Test Date: 6/2/2017

SEATING

Nominal Design Riding Position (for adjustable driver and passenger seat backs). *Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.*

Driver Seat Instructions: The driver seat back was positioned according to the Nominal Design Riding position listed in FORM 1.

Passenger Seat Instructions: The passenger seat back was positioned to the Nominal Design Riding position listed in FORM 1.



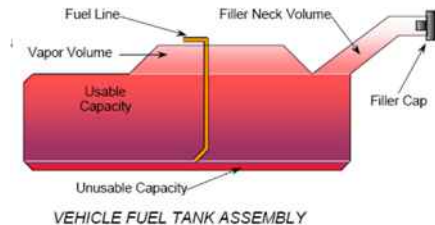
Measured Parameter	Deg.
Driver Seat Back Angle	3.1
Passenger Seat Back Angle	3.4

SEAT FORE/AFT POSITIONING

Driver Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.

Passenger Seat: Was positioned according to the Nominal Design Riding position listed in FORM1.

	Total Travel	Test Position
Driver Seat	240mm	120mm
Passenger Seat	240mm	120mm



FUEL TANK CAPACITY DATA

Measured Parameter	Reference	Liters
Fuel System Capacity (Standard Tank)	Owner's Manual	50.3
COTR Usable Capacity (Standard Tank)	Form No. 1	50.3
Test Volume Range	92-94% of Usable Capacity	46.27 – 47.28
Actual Test Volume (Solvent Used)	93% of Usable Capacity	46.78

FUEL SYSTEM DATA

Measured Parameter	Value
Test Fluid Type	Stoddard Solvent
Test Fluid Specific Gravity	0.764
Test Fluid Kinematic Viscosity (centistokes)	0.96
Test Fluid Color	Purple
Electric Fuel Pump?	Yes
Can Activate Electric Fuel Pump with Ignition Switch On but Engine Off?	Yes

Fuel Pump Comments : None

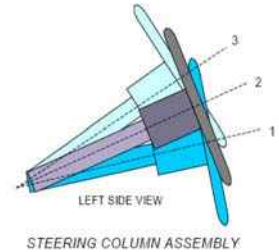
DATA SHEET NO. 2 (Continued)
PRE-TEST DATA

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the center of its geometric locus it describes when it moves through its full range of motion.



Operational Instructions: Tilt wheel was positioned to mid-range at 22.3 degrees. The For/aft travel
Was set to mid position at 20 mm.

SEAT BELT UPPER ANCHORAGE

Nominal design riding position

Operational Instructions: Anchorage were set to the most upright position.

COMMENTS: None

DATA SHEET NO. 3
MOVING DEFORMABLE BARRIER (MDB) DATA

Test Vehicle: 2017 Toyota Corolla four door sedan
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
 Test Date: 6/2/2017

MDB Face Manufacturer: Cellbond MDB Face Serial No. 118133

MDB SPECIFICATIONS

Measurement Description	Length (mm)
Overall Width of Framework Carriage	1250
Overall Length of MDB (incl. honeycomb impactor face)	4120
Wheelbase of Framework Carriage	2591
Tread of Framework Carriage (Front & Rear)	1880
CG Location of Front Axle	1136

MDB WEIGHTS

	Units	Front	Rear	Total
Left	kg	358.0	322.0	680.0
Right	kg	404.0	273.0	677.0
Ratio	%	56.2%	43.8%	100.0%
Totals	kg	762.0	595.0	1357.0

MDB TIRE SIZE & PRESSURES

	Units	Requirement	Left Front	Right Front	Left Rear	Right Rear
Tire Size		P205/75R15	P205/75R15	P205/75R15	P205/75R15	P205/75R15
Tire Pressure	kPa	200 ± 21	207	207	207	207

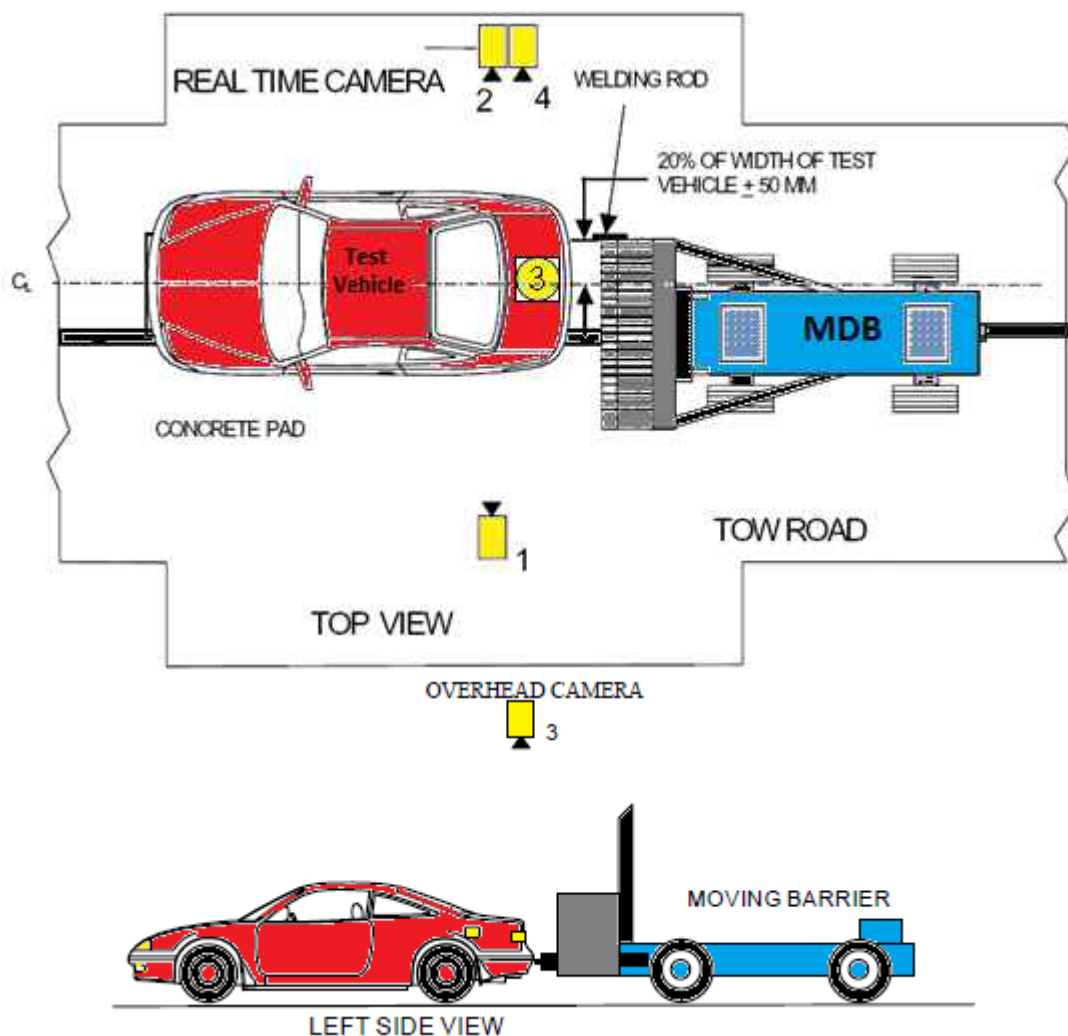
Brake Abort System? (Yes/No): Yes

Date of Last MDB Calibration: May 15, 2010

DATA SHEET NO. 4 **HIGH SPEED CAMERA LOCATIONS AND DATA SUMMARY**

Test Vehicle: 2017 Toyota Corolla four door sedan
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
 Test Date: 6/2/2017



No.	Camera View	Coordinates (mm)			Angle (Deg)	Lens (mm)	Film Speed (fps)
		X*	Y*	Z*			
1	Left Side View	1613	-10318	-1036	0.4	20	1000
2	Real-Time Camera						60
3	Overhead View	1102	0	5292	90	14	1000
4	Right Side View	1768	10195	-978	0.1	24	1000

* Reference (from point of impact); all measurements accurate to within ± 6 mm.

X = (Impact Point) + Forward

Y = (Impact Point) + To Right

Z = (Ground Level) + Down

**DATA SHEET NO. 5
POST-TEST DATA**

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

VIN: 2T1BURHE8HC754623

REQUIRED IMPACT VELOCITY RANGE: 78.5 to 80.1 km/h

ACTUAL IMPACT VELOCITY (WITHIN 1.5 M OF IMPACT PLANE)

Measurement Description	Units	Speed
Trap No. 1	km/h	79.24
Trap No. 2	km/h	79.14

WELDING ROD IMPACT POINT

Measurement Description	Tolerance	Units	Value
Vertical distance from target center (+ is above)	±40 mm	mm	-6
Horizontal distance from target center (+ is right)	±50 mm	mm	-6

STODDARD SOLVENT SPILLAGE MEASUREMENT:

A. From impact until vehicle motion ceases:
(Maximum allowable is 28 grams) 0 grams

B. For the 5-minute period after motion ceases:
(Maximum allowable is 28 grams) 0 grams

C. For the next 25 minutes:
(Maximum allowable is 28 grams/minute) 0 grams

D. Spillage Details: No Spillage Occurred

DATA SHEET NO. 5
POST-TEST DATA (Continued)

Test Vehicle: 2017 Toyota Corolla four door sedan
Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
Test Date: 6/2/2017

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Unlocked	Unlocked
Front Door Opening	Closed & Operational	Closed & Operational
Rear Door Opening	Jammed	Jammed
Seat Track Shift (mm)	0	25
Seat Back Failure	Reclined	Reclined
Glazing Damage	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	Rear Windshield Shattered

VEHICLE CRUSH MEASUREMENTS: LENGTH

Measurement	Left Side	Centerline	Right Side
Pre-Test	4543	4646	4546
Post-Test	3803	4013	4156
Crush	-740	-633	-390

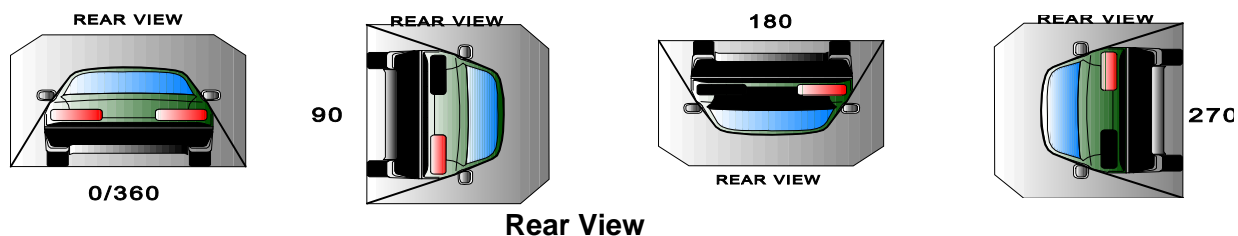
VEHICLE CRUSH MEASUREMENTS: WHEELBASE

Measurement	Left Side	Right Side
Pre-Test	2701	2701
Post-Test	2630	2695
Crush	-71	-6

DATA SHEET NO. 6
FMVSS NO. 301 STATIC ROLLOVER TEST DATA

Test Vehicle: 2017 Toyota Corolla four door sedan
 Test Program: FMVSS 301R Compliance Rear Impact Test

NHTSA No.: C20175102
 Test Date: 6/2/2017



ROLLOVER SOLVENT COLLECTION TIME TABLE

Test Phase	Rotation Time (spec. 1 -3 min)		Hold Time	Total Time		Next Whole Minute Interval
	Minutes	Seconds	Minutes	Minutes	Seconds	Minutes
0° to 90°	1	15	5	6	15	7
90° to 180°	1	5	5	6	5	7
180° to 270°	1	2	5	6	2	7
270° to 360°	1	6	5	6	6	7

FMVSS 301 REQUIREMENTS TABLE (Maximum allowable solvent spillage)

First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
142	28	28	28

ACTUAL TEST VEHICLE STODDARD SOLVENT SPILLAGE TABLE

Test Phase	First 5 Minutes (grams)	6th Minute (grams)	7th Minute (grams)	8th Minute (grams)
0° to 90°	0	0	0	
90° to 180°	0	0	0	
180° to 270°	0	0	0	
270° to 360°	0	0	0	

ROLLOVER STODDARD SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	None
90° to 180°	None
180° to 270°	None
270° to 360°	None

APPENDIX A
PHOTOGRAPHS

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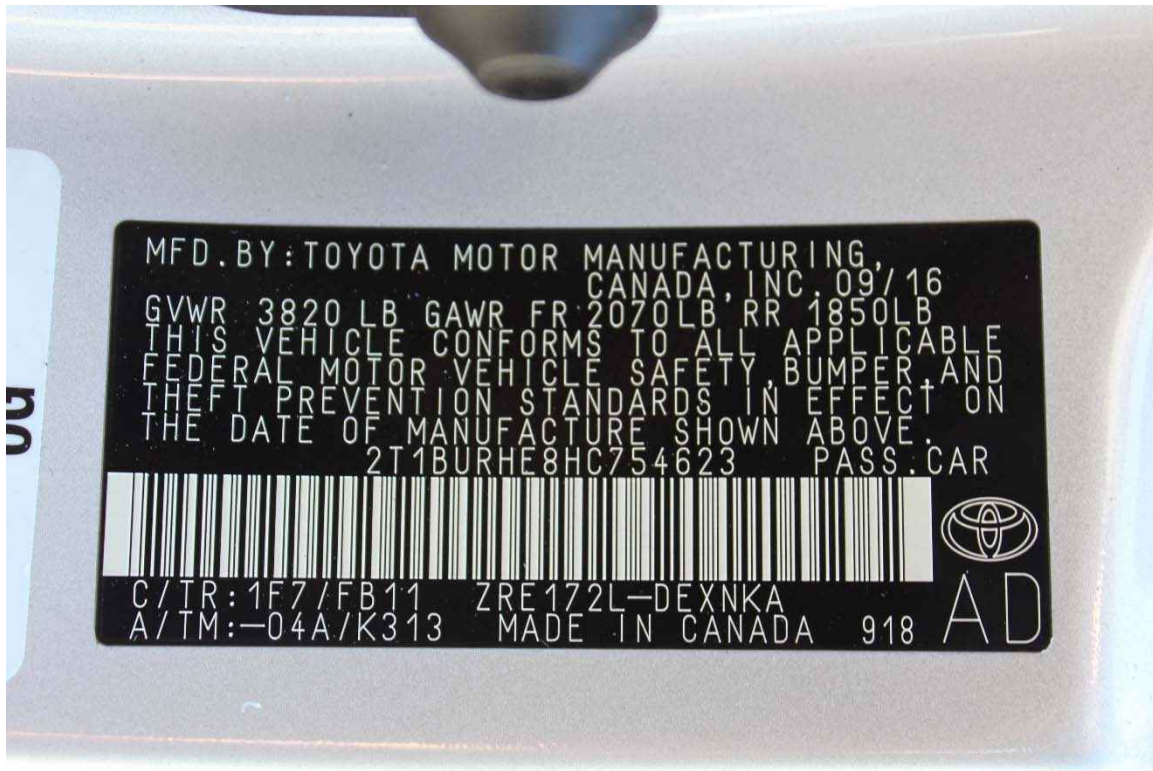


Figure A-1: Vehicle Certification Placard

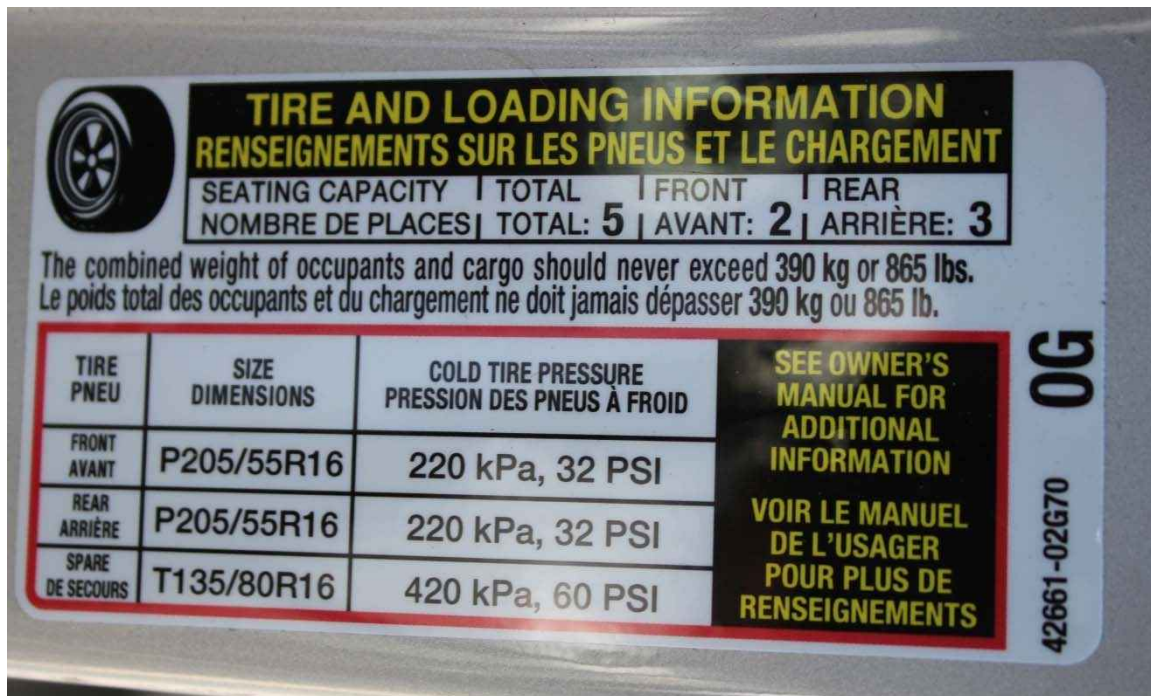


Figure A-2: Vehicle Tire Placard

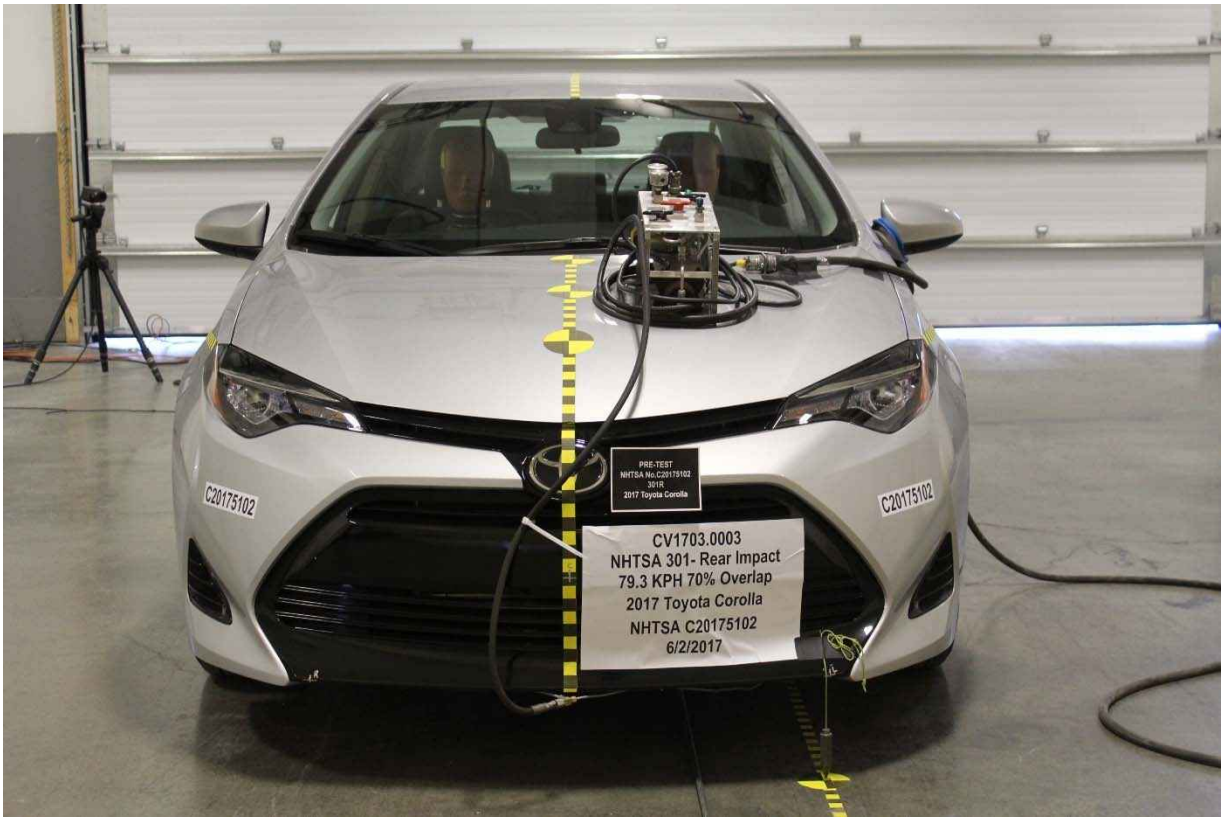


Figure A-3: Pre-Test Front View

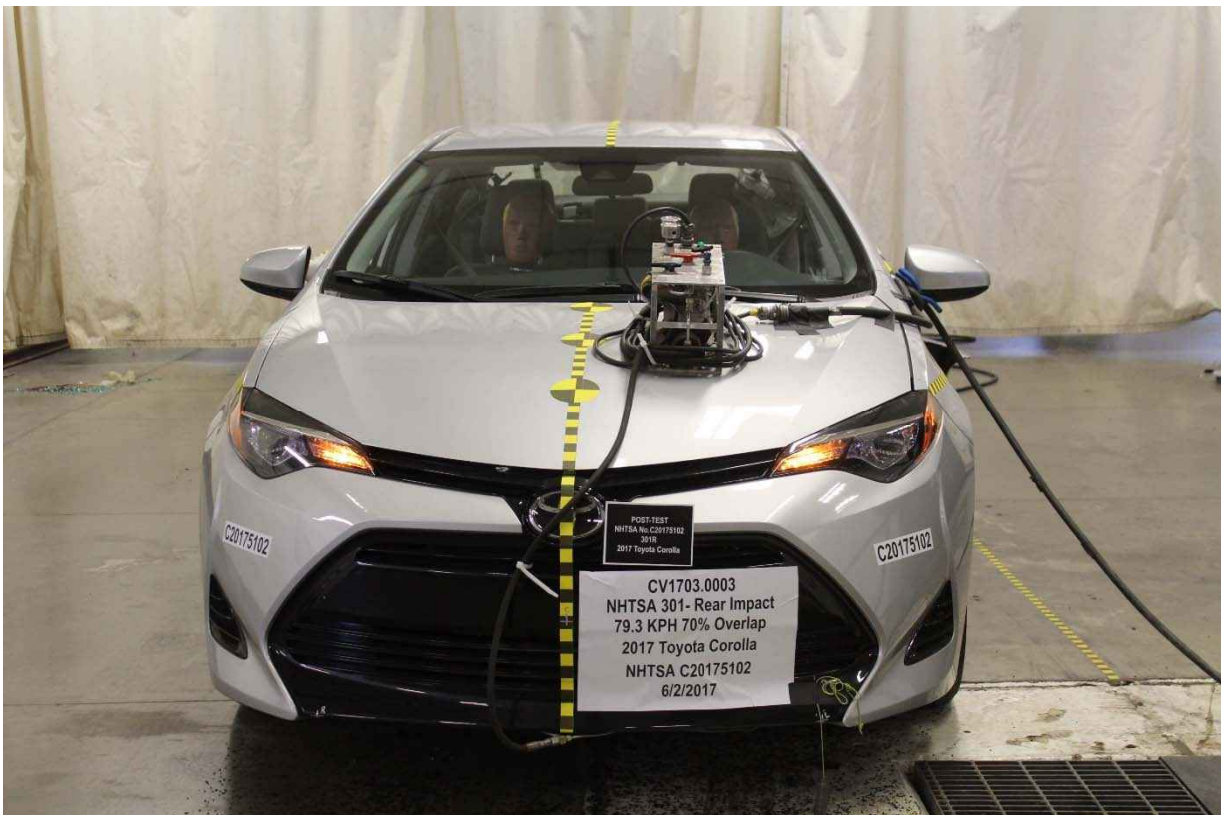


Figure A-4: Post-Test Front View



Figure A-5: Pre-Test Left Side View



Figure A-6: Post-Test Left Side View



Figure A-7: Pre-Test Right Side View



Figure A-8: Post-Test Right Side View



Figure A-9: Pre-Test Left Front 3/4 View



Figure A-10: Post-Test Left Front 3/4 View



Figure A-11: Pre-Test Right Front 3/4 View



Figure A-12: Post-Test Right Front 3/4 View



Figure A-13: Pre-Test Left Rear 3/4 View

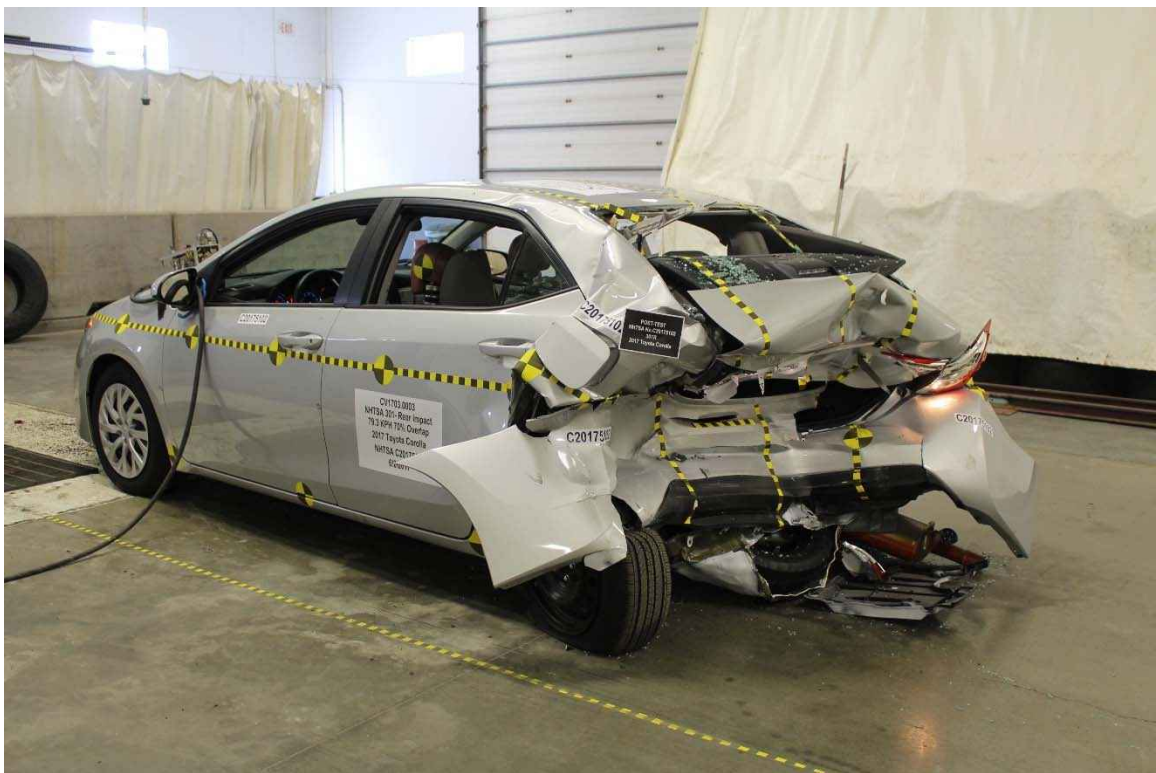


Figure A-14: Post-Test Left Rear 3/4 View



Figure A-15: Pre-Test Right Rear 3/4 View



Figure A-16: Post-Test Right Rear 3/4 View



Figure A-17: Pre-Test Rear View



Figure A-18: Post-Test Rear View



Figure A-19: Pre-Test MDB Front View



Figure A-20: Post-Test MDB Front View



Figure A-21: Pre-Test MDB Left Side View



Figure A-22: Post-Test MDB Left Side View



Figure A-23: Pre-Test MDB Right Side View



Figure A-24: Post-Test MDB Right Side View



Figure A-25: Pre-Test MDB Top View



Figure A-26: Post-Test MDB Top View

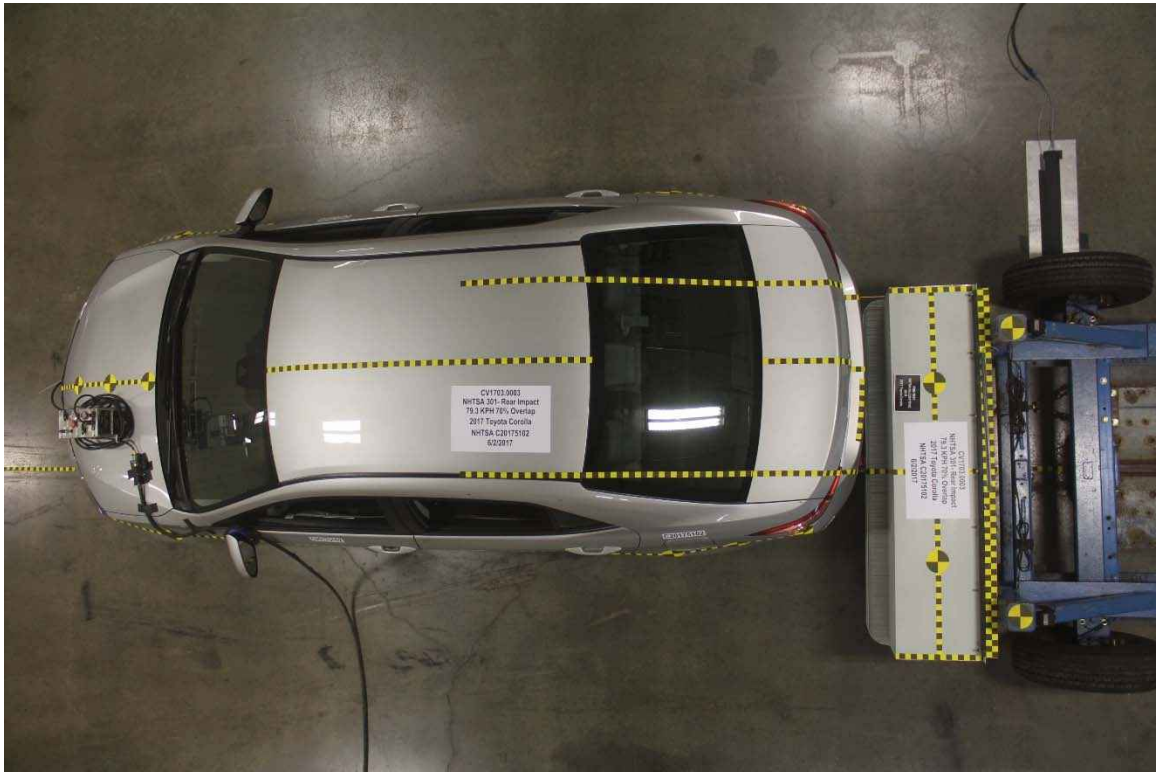


Figure A-27: Pre-Test Overhead Vehicle and MDB View



Figure A-28: Post-Test Impact Target View

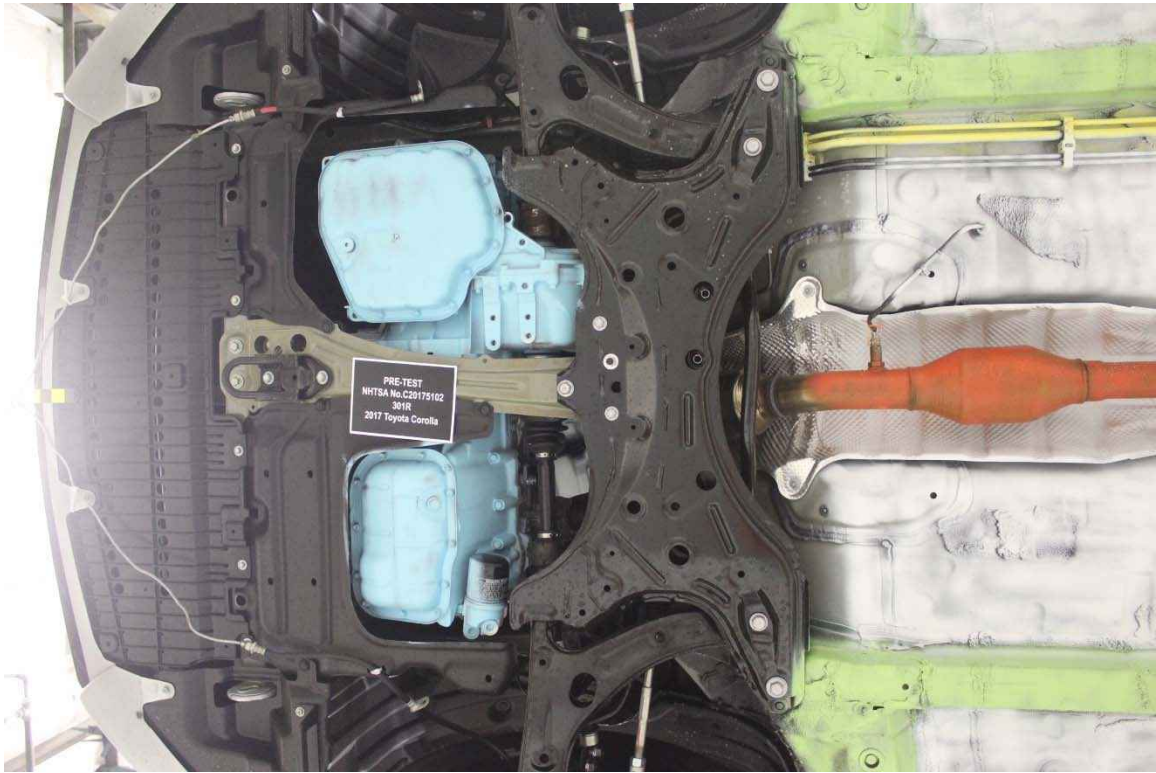


Figure A-29: Pre-Test Front Underbody View

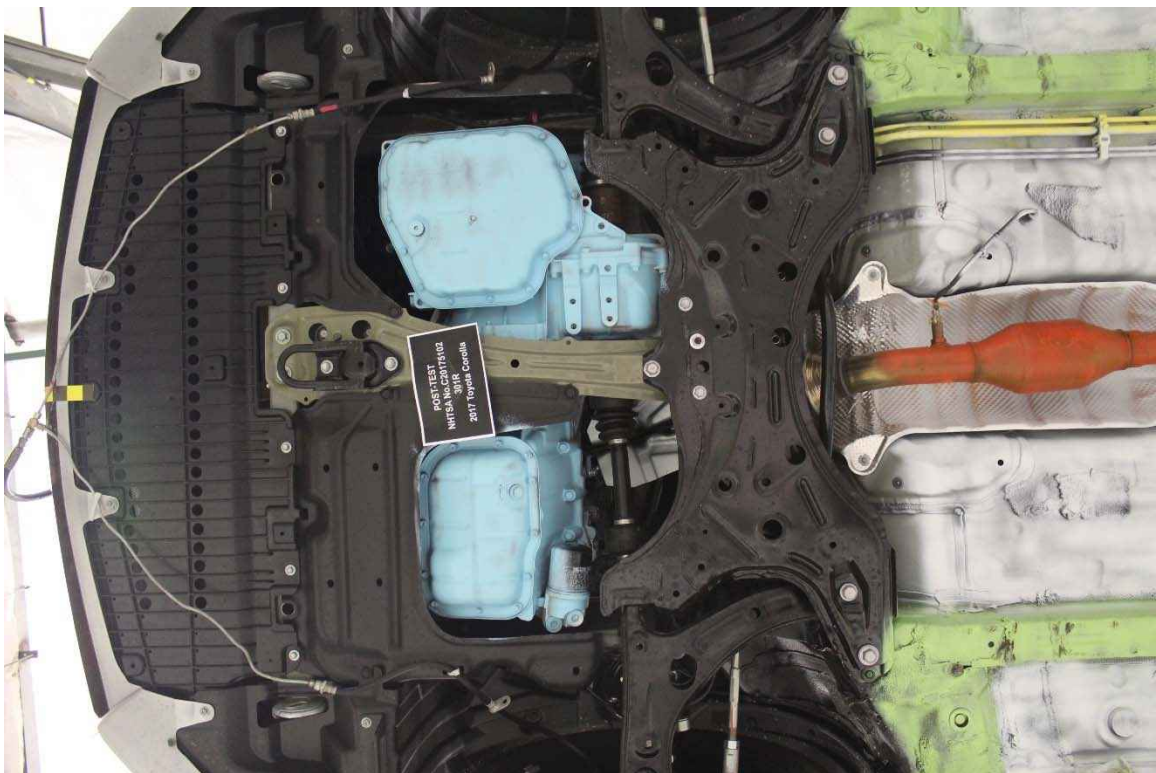


Figure A-30: Post-Test Front Underbody View

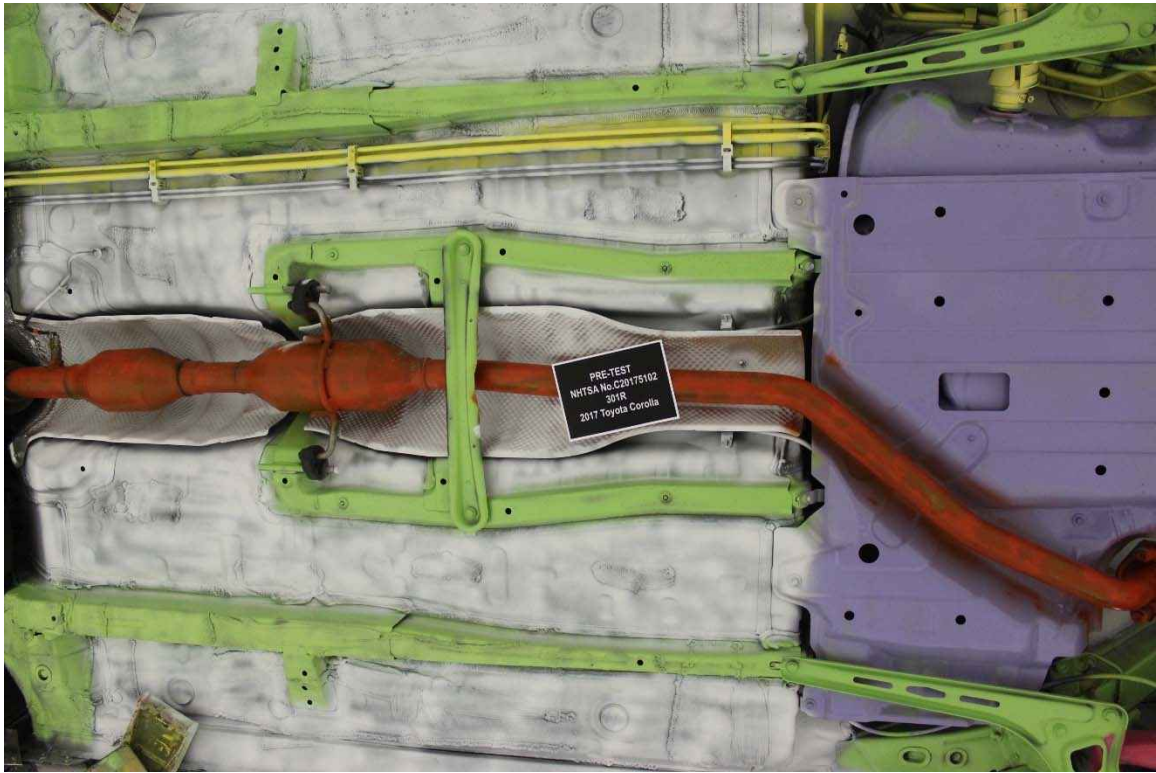


Figure A-31: Pre-Test Mid Underbody View

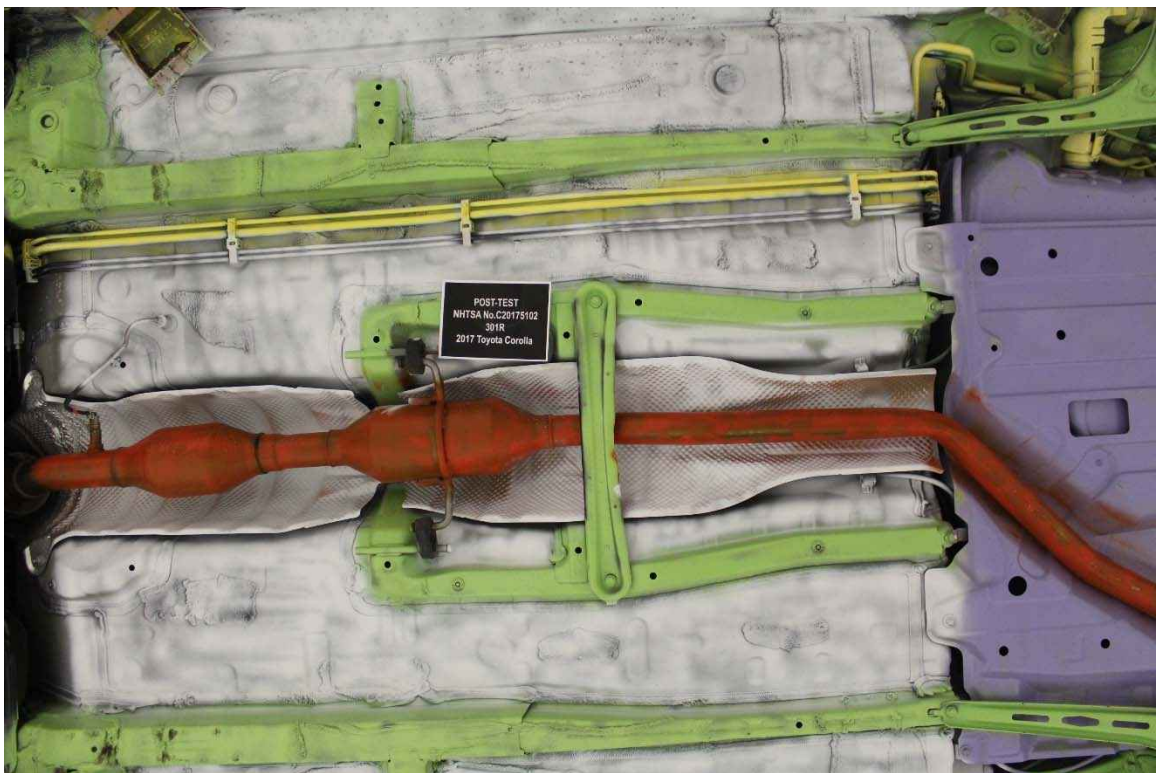


Figure A-32: Post-Test Mid Underbody View



Figure A-33: Pre-Test Rear Underbody View



Figure A-34: Post-Test Rear Underbody View



Figure A-35: Pre-Test Fuel Filler Cap View



Figure A-36: Post-Test Fuel Filler Cap View



Figure A-37: Impact View



Figure A-38: Speed Trap View*

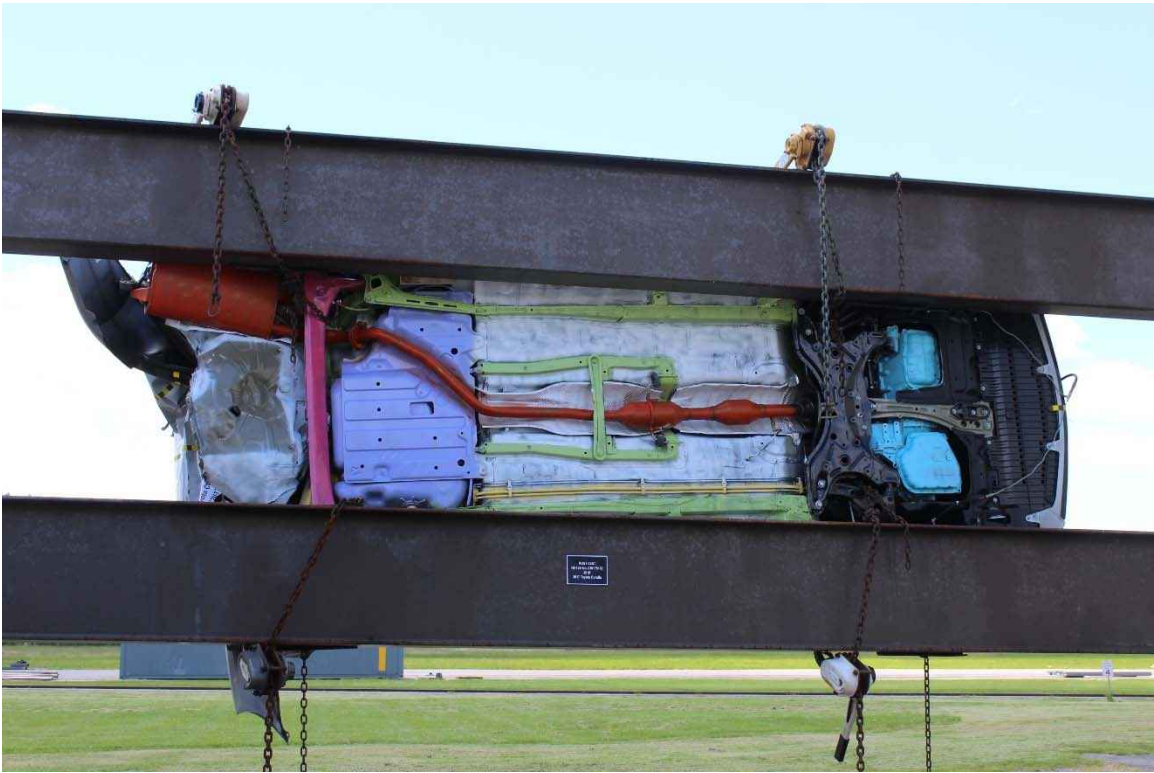


Figure A-39: Rollover 90° View



Figure A-40: Rollover 180° View



Figure A-41: Rollover 270° View



Figure A-42: Rollover 360° View