

**NEW CAR ASSESSMENT PROGRAM (NCAP)
DYNAMIC ROLLOVER RESISTANCE TEST**

FCA US LLC

2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary

TEST NUMBER: NCAP-DRI-RR-20-03

Final Report
9 April 2020



Prepared by:

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Prepared for:

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New Car Assessment Program
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Date: 9 April 2020

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		15. Supplemental Notes	
16. Abstract An NCAP Dynamic Rollover Maneuver (Fishhook) Test was conducted on a 2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary at Dynamic Research, Inc. on March 12, 2020. The vehicle did not experience two-wheel lift. The vehicle's steering angle at 0.3 g lateral acceleration at 50 mph was 28.8 degrees.			
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TABLE OF CONTENTS

	Page
I. INTRODUCTION.....	1
II. VEHICLE PREPARATION	2
A. Test Vehicle	2
B. Tires	2
C. Vehicle Loading.....	2
D. Steering Controller	5
E. Real-Time Controller and Data Acquisition	5
F. Equipment Weight.....	6
G. Sensors	6
H. Other Vehicle Preparation	6
III. TEST PROCEDURES.....	9
A. Test Procedure Overview.....	9
B. Test Conditions	10
IV. RESULTS.....	13
APPENDIX A Photographs	A-1
APPENDIX B Test Run Log.....	B-1
APPENDIX C Slowly Increasing Steer Test Worksheet.....	C-1
APPENDIX D Time History Plots	D-1

LIST OF FIGURES

	Page
1. Nominal Position of Video Cameras for Fishhook Tests	8
2. DRI-Minter Vehicle Dynamics Area	12

LIST OF TABLES

	Page
1. Test Vehicle Data	3
2. Tire Information	4
3. Vehicle Loading	4
4. Weight of In-Cab Test equipment.....	6
5. Sensor Specifications	7
6. Surface Friction	10
7. Handwheel Angles	10
8. Weather Conditions.....	11

Section I
INTRODUCTION

Beginning with the 2006 fiscal year, the National Highway Traffic Safety Administration (NHTSA) has engaged Dynamic Research, Inc. (DRI) of Torrance, CA to conduct dynamic rollover testing and gather data from that testing as part of NHTSA's New Car Assessment Program (NCAP).

The purpose of the testing reported herein was to determine if a typical 2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary would experience tip-up, defined as simultaneous two-wheel lift of two inches or more at an entry speed of 50 mph or less in the Fishhook Procedure developed by NHTSA. This procedure may be found at www.regulations.gov, docket item NHTSA-2006-26555-0136.

The testing reported herein was accomplished under contract DTNH22-14-D-00332. The task order is entitled, "NCAP Dynamic Rollover Testing."

Section II
VEHICLE PREPARATION

A. Test Vehicle

The test vehicle was new or in as-new condition, meaning the vehicle had been driven no more than 500 miles prior to the start of dynamic rollover testing. It was acquired through a commercial rental/leasing company. Details of the test vehicle are given in Table 1.

B. Tires

All tires used were new, and of the same make, model, size, and DOT specification of those installed on the vehicle when purchased new. Tire inflation pressures were in accordance with the recommendations indicated on each vehicle's identification placard. To further reduce the possibility of tire debanding, the tires were mounted to the rims without the use of tire mounting lubricant. Tire specifications are listed in Table 2.

C. Vehicle Loading

The multi-passenger load, described in the Fishhook Procedure, was used for all tests. The load and positioning of the load in the vehicle are listed in Table 3.

In addition to water dummies, the loading included instrumentation, a steering machine, and outriggers. Test vehicle bumper assemblies were removed for outrigger installation. The reduction in vehicle weight due to the removal of the bumpers was offset by the additional weight of the outriggers and their mounting system. The outrigger system typically outweighs the bumper assemblies.

Table 1. Test Vehicle Data

General Data					
Model year, make, model	2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary				
VIN	2C4RC1N7XLR13xxxx				
Vehicle type/Body style	MPV/minivan				
Number of doors	4				
Trim level	Limited				
Seating positions	Front:	2 nd row	3 rd row	4 th row	5 th row
	2	2	3		
Electronic stability control	Yes				
4-Wheel ABS (Yes/No)	Yes				
Power steering (Yes/No)	Yes				
Major optional equipment	Customer Preferred Package 2EU S Appearance Package Advanced SafetyTec Group				
Odometer at start of testing	98 miles				
Drivetrain					
Engine cylinder arrangement	V-6				
Engine displacement	3.6 L				
Transmission type	Si-EVT				
Drive arrangement	2WD (FWD)				
Chassis					
Track width	F: 68.5 in (1739.9 mm), R: 68.75 in (1746.2 mm)				
Wheelbase	132 in (3352.8 mm)				
Curb weight	5051 lb (2291.1 kg)				
Certification Data from Vehicle's Label					
Vehicle manufactured by	FCA US LLC				
Date of manufacture	11-19				
GVWR	6300 lb (2858 kg)				
GAWR Front	3200 lb (1452 kg)				
GAWR Rear	3200 lb (1452 kg)				

Table 2. Tire Information

Tire Manufacturer	Nexen
Tire Model	Npriz RH7a
Tire Size	Front: 235/60R18 Rear: 235/60R18
Load rating	Front:103 Rear:103
Speed rating	Front: H Rear: H
Treadwear grade	Front: 680 Rear: 680
Traction grade	Front: A Rear: A
Temperature grade	Front: A Rear: A
Location of "Recommended Tire Pressure" label	Driver's door jamb
Recommended cold tire pressure	Front: 36 psi, (250 kPa) Rear: 36 psi, (250 kPa)
First 8 digits of DOT code	Front: UAKV EAKL Rear: UAKV EAKL

Table 3. Vehicle Loading

Water dummy and other loading	3 water dummies - 2 in second row, 1 in center of third row
Water dummy weight	575 lb (260.8 kg)
Fuel level	Full
Weight as Tested	
Left front	1613 lb (731.6 kg)
Right front	1563 lb (709 kg)
Left rear	1512 lb (685.8 kg)
Right rear	1373 lb (622.8 kg)

D. Steering Controller

Precise controlled steering is accomplished using a steering machine designed and constructed by DRI. DRI has used its Automated Vehicle Controller (AVC) steering machine for many vehicle tests including FMVSS 126 tests. It can provide up to 65 ft-lb torque and rates over 1300 deg/sec. The integrated angle encoder has an unlimited range with a resolution of 0.045 degrees and an accuracy of ± 0.045 degrees. The steering motor is controlled by a MicroAutoBox II from dSPACE, which also acts as the data acquisition system.

E. Real-Time Controller and Data Acquisition

Data acquisition is achieved using a MicroAutoBox II from dSPACE, which also serves as the real-time system for the steering controller. Data from the Oxford IMU, including Longitudinal, Lateral, and Vertical Acceleration, Roll, Yaw, and Pitch Rate, Forward and Lateral Velocity, Roll and Pitch Angle, are sent over Ethernet to the Micro AutoBox. The Oxford IMUs are calibrated per the manufacturer's recommended schedule (Table 5). The MicroAutoBox II specifications are:

Model: dSPACE Micro-Autobox II 1401/1513
Base Board SN 549068
I/O Board SN 588523

Two video cameras were used to record the Fishhook runs. They were positioned nominally as shown in Figure 1. The recorded videotapes were reviewed after the Fishhook runs to check for any two-wheel lift. If any two-wheel lift was observed, eight infrared distance- measuring sensors for measurement of wheel lift (two sensors at each wheel) were then mounted for use in subsequent confirmation Fishhook tests.

F. Equipment Weight

Table 4 lists the equipment and associated weights outlined in the NHTSA Laboratory Test Procedure for Dynamic Rollover and the equipment at DRI used for this specific test program. The equipment used at DRI for this test program differs slightly from the equipment that was previously used by NHTSA for rollover testing. Because DRI's equipment is lighter than NHTSA's equipment, DRI uses ballast to maintain a consistent weight and weight distribution in the vehicle.

Table 4. Weight of In-Cab Test Equipment

Equipment	Location	Equipment Weight (lb)	
		NHTSA*	DRI
Data Acquisition System	Front passenger seat	58	
Steering Machine	Handwheel	31	31
Steering Machine Electronics Box	Passenger row foot well behind the front passenger seat. If vehicle does not have a rear passenger row foot well, the Electronics Box should be placed in the front passenger seat foot well.	39	
MABX, and laptop	Front passenger seat		21
Motor control and power supply	Front passenger footwell		26
Ballast	Front passenger footwell		50
Total		128	128

* Table A.1 from US DOT NHTSA - Laboratory Test Procedure for Dynamic Rollover - The Fishhook Maneuver Test Procedure - New Car Assessment Program (NCAP) - March 2013

G. Sensors

A list of the sensors is given in Table 5.

H. Other Vehicle Preparation

In addition to installation and preparation discussed above, the test vehicle was prepared as follows:

- Front and rear bumpers were removed
- Outrigger mounts were installed in the bumper locations and titanium outriggers were fastened to these mounts
- Airbags were removed or otherwise disabled
- Photographs of the vehicle tested are given in Appendix A.

Table 5. Sensors

Measured Variable	Sensor	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration
Vehicle Tire Pressure	Tire Pressure Gauge	0-100 psi 0-690 kPa	0.01 psi 6.89 kPa	< 1% error between 20 and 100 psi	Omega DPG8001	17042707002	By: DRI Date: 7/3/2019 Due: 7/3/2020
Vehicle Total, Wheel, and Axle Load	Platform Scales (Minter)	1200 lb/platform 5338 N/platform	1 lb 4.4 N	0.5% of applied load	Intercomp SWI	1110M206352	By: DRI Date: 1/6/2020 Due: 1/6/2021
	Platform Scales (Torrance)	1200 lb/platform 5338 N/platform	1 lb 4.4 N	0.5% of applied load	Intercomp SW500	0828MA19001	By: DRI Date: 9/12/2019 Due: 9/12/2020
Handwheel Angle	Steering Angle Encoder (Automated Steering Controller)	±800 deg	0.045 deg	±0.045 deg	DRI Automatic Vehicle Controller using dSPACE Micro-Autobox II	NA	Verified by DRI at installation ¹
Longitudinal, Lateral, and Vertical Acceleration Roll, Yaw, and Pitch Rate, Forward and Lateral Velocity, Roll and Pitch Angle	Multi-Axis Inertial Sensing System	Accels ± 5 g, Angular Rate ±300 deg/s, Angle >45 deg, Velocity >200	Accels .001 g, Angular Rate 0.01 deg/s, Angle 0.05 deg, Velocity 0.1 km/h	Accels .001g, Angular Rate 0.01 deg/s, Angle 0.05 deg, Velocity 0.1 km/h	Oxford xNav 550	015477	By: Oxford Technical Solutions Date: 9/12/2018 Due: 9/12/2020

1. The steering encoder is checked prior to beginning tests to verify that there are no faults. The steering controller is installed in the vehicle and the steering wheel is turned through two complete revolutions while recording data. The data are then reviewed for any dropouts or other nonlinearities that would indicate dust intrusion or faulty sectors.

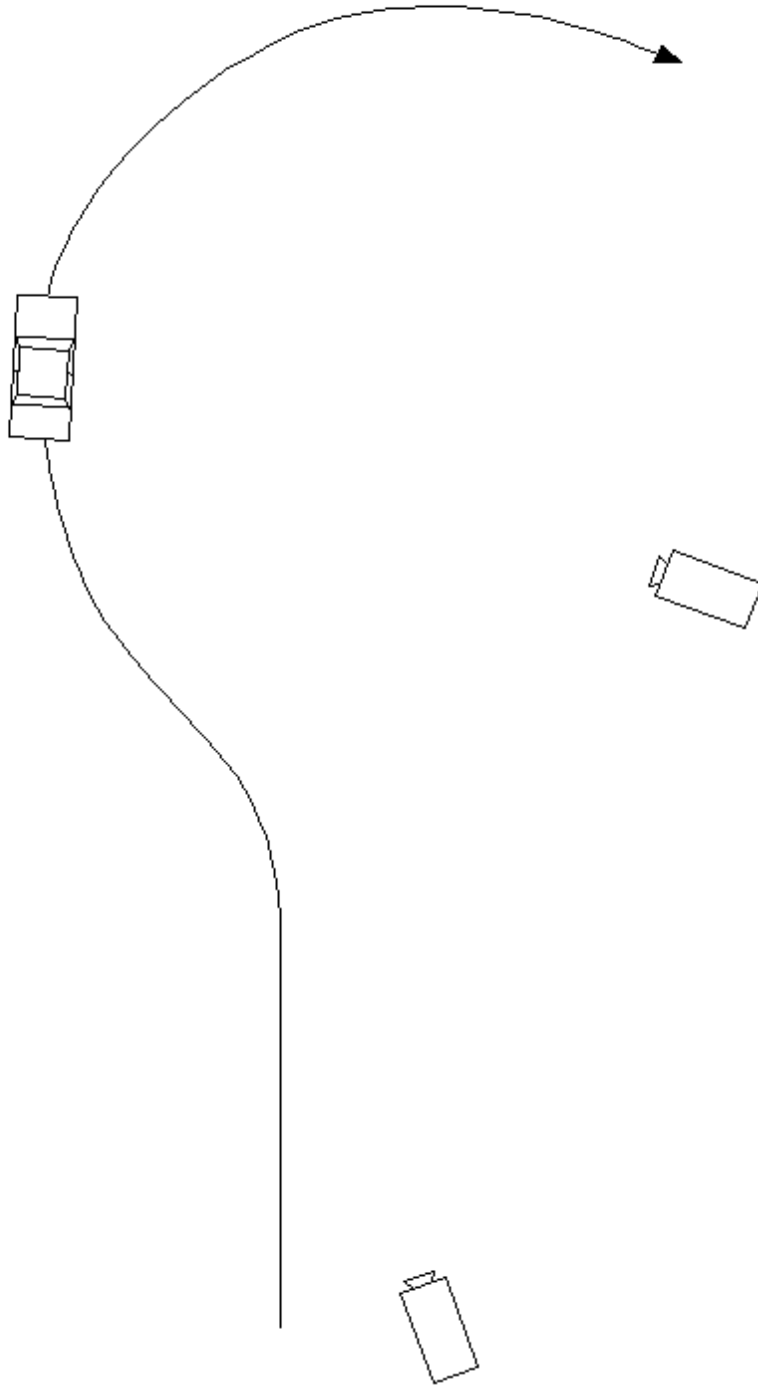


Figure 1. Nominal Position of Video Cameras for Fishhook Tests

Section III

TEST PROCEDURES

This section includes a general overview of the test procedures and details of the particular test.

A. Test Procedure Overview

This test was conducted in accordance with NHTSA's NCAP Rollover Resistance Test Procedure (Fishhook) as described in the Federal Register (68 FR 59250). Detailed descriptions of the test procedure, pass/fail criteria, and data acquisition specifications may be found at docket NHTSA-2001-9663.

There are two major components of the test procedure, the Slowly Increasing Steer (SIS) pre-test and the Fishhook test.

The Slowly Increasing Steer (SIS) maneuver was used to characterize the steady state lateral dynamics of each vehicle, and is based on the "Constant Speed, Variable Steer" test defined in SAE J266. The maneuver is used to determine the handwheel angle that produces a lateral acceleration of 0.3 g at 50 mph. This handwheel angle is then used to determine the magnitude of steering to be used for the NHTSA Fishhook maneuver.

SIS tests were performed at a constant speed of 50 mph. Handwheel angle was input at a rate of 13.5 deg/sec, from 0 to an angle that provided at least 0.55 g. Three tests were conducted in each direction, and the data for the six runs were averaged to obtain the handwheel angle that produced 0.3 g at 50 mph.

The Fishhook test is a programmed steering maneuver that is implemented via the steering controller. The vehicle was initially steered in one direction and then the steering was reversed. The timing, magnitude, and rate of the steering were prescribed by the Fishhook Procedure.

To begin the maneuver, the vehicle was driven in a straight line at a speed slightly greater than the desired entrance speed. The driver then released the throttle. When the vehicle was at the target speed, the steering controller automatically initiated the steering maneuver. Following completion of the steering reversal, the handwheel position was maintained for three seconds and then returned to zero angle in 1 second.

The tests were conducted in both left-right and right-left directions. The "Default" test series used a handwheel angle equal to 6.5 times the handwheel angle that produced 0.3 g at 50 mph in the SIS tests, and initial vehicle speeds beginning at 35 mph and concluding up to 50 mph (if no two-wheel lift occurs). Supplemental tests were also done, as specified in the Fishhook Procedure.

B. Test Conditions

1. TEST SURFACE

The tests were conducted on the Vehicle Dynamics Area at DRI's Minter Field facility, located near Bakersfield, California, on 3/12/2020. The VDA has a smooth, flat (slope less than 0.5% throughout) asphaltic concrete surface. Its dimensions are as shown in Figure 2. It was built in the spring of 2005.

VDA surface friction measurements were accomplished using the DRI Mobile Tire Tester. Three runs were done, one at each of three previously determined locations. Each run provided for a minimum of 3 seconds of tire friction at constant normal load, slip angle, and speed in a free rolling condition. The test was accomplished using an ASTM E1136 tire with an inflation pressure of 35 (± 0.5) psi at a test speed of 40 (± 0.5) mph. The net slip angle of the test tire for each test run was 7.5 deg. The test tire was no older than 6 months from the date of manufacture. The surface friction measurement results are shown in Table 6.

Table 6. Surface Friction

Date of surface friction measurements	3/13/2020
Average normalized lateral force	0.815

2. FISHHOOK HANDWHEEL ANGLES

The 0.3 g handwheel angle obtained from the SIS tests and the handwheel angles used in the Fishhook tests are shown in Table 7.

Table 7. Handwheel Angles

0.3 g handwheel angle (from SIS tests at 50 mph)	28.8°
5.5 scalar handwheel angle for Fishhook Test	158°
6.5 scalar handwheel angle for Fishhook Test	187°

3. WEATHER CONDITIONS

The weather conditions, recorded at the end of testing, are shown in Table 8.

Table 8. Weather Conditions

Ambient temperature	60.8° F (16° C)
Wind Speed	3.5 mph (1.3 m/s)
Wind Direction	270

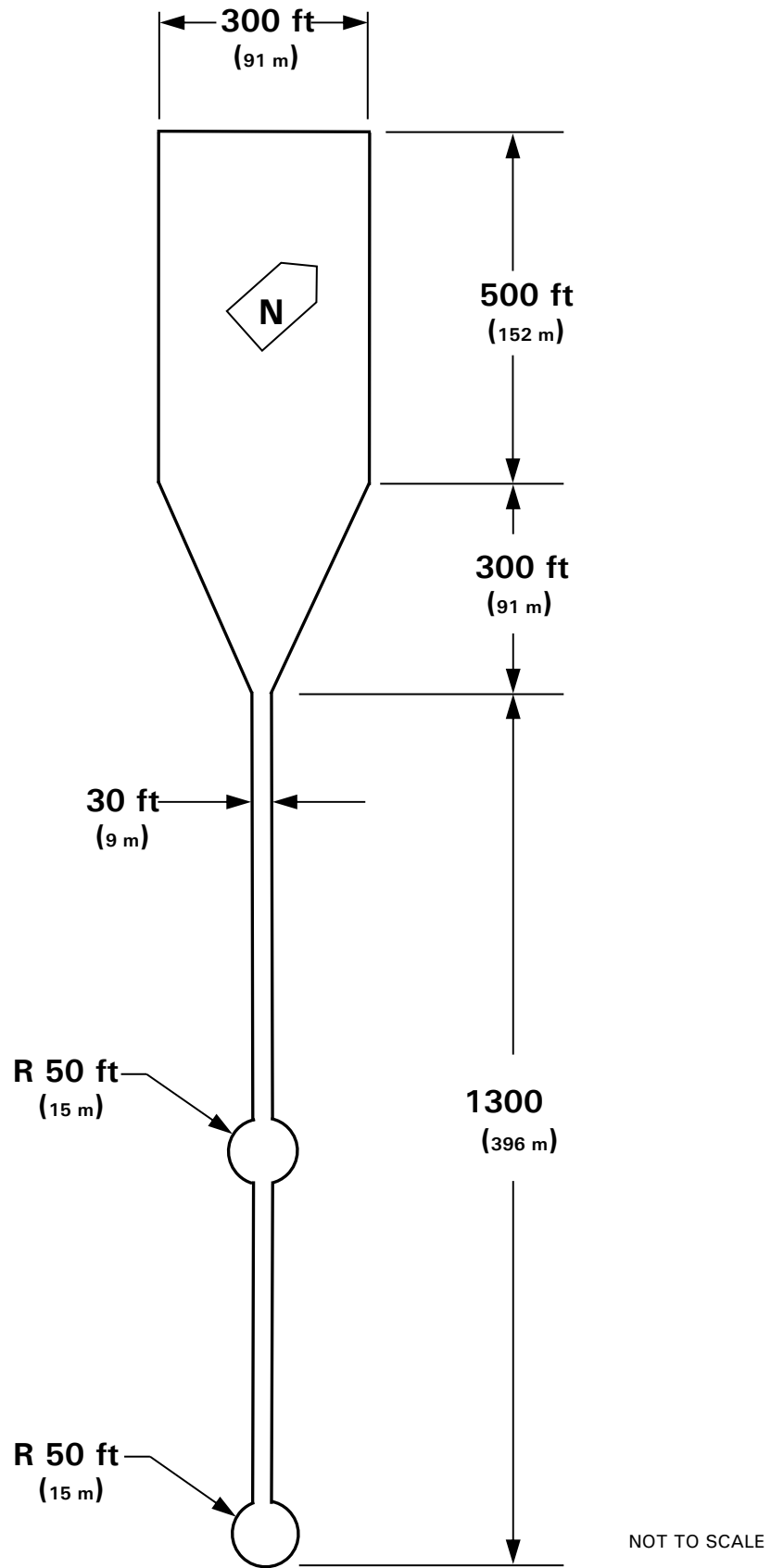


Figure 2. DRI-Minter Vehicle Dynamics Area

Section IV

RESULTS

The test run log is given in Appendix B. The Slowly Increasing Steer Test Worksheet is given in Appendix C. Appendix D contains time history plots for the 50 mph runs and any runs which resulted in two-wheel lift. There was no two-wheel lift at any test condition for the 2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary.

APPENDIX A

Photographs

LIST OF FIGURES

	Page
A1. Window Sticker.....	A-3
A2. Front View, Test Vehicle as Delivered	A-4
A3. Rear View, Test Vehicle as Delivered	A-5
A4. Front View, Test Vehicle in Test Condition	A-6
A5. Rear View, Test Vehicle in Test Condition	A-7
A6. Certification Label.....	A-8
A7. Tire Placard	A-9
A8. Instrumentation in Test Vehicle	A-10
A9. Steering Controller and Computer	A-11
A10. Ballast Condition.....	A-12

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NONO

PACIFICA HYBRID LIMITED
35TH ANNIVERSARY

For more information visit: www.chrysler.com
or call 1-800-CHRYSLER

FCA US LLC

THIS VEHICLE IS MANUFACTURED TO MEET SPECIFIC UNITED STATES REQUIREMENTS. THIS VEHICLE IS NOT MANUFACTURED FOR SALE OR REGISTRATION OUTSIDE OF THE UNITED STATES.

MANUFACTURER'S SUGGESTED RETAIL PRICE OF THIS MODEL INCLUDING DEALER PREPARATION

Base Price: **\$45,845**

CHRYSLER PACIFICA HYBRID LIMITED
Exterior Color: Bright White Clear-Coat Exterior Paint
Interior Color: Black / Black / Black Interior Colors
Interior: Premium Leather-Trim Bucket Seats
Engine: 3.6L V6 Hybrid Engine
Transmission: 8-Speed S/EVT Transmission

STANDARD EQUIPMENT (UNLESS REPLACED BY OPTIONAL EQUIPMENT)

FUNCTIONAL/SAFETY FEATURES

- 6.8kW Battery Charger with Cord
- ABS 4-Wheel Disc Regen Brakes
- Advanced Multistage Front Air Bags
- Driver Inflatable Knee-Bolster Air Bag
- Passenger Inflatable Knee-Bolster Air Bag
- Supplemental Side-Curtain All-Row Air Bags
- Supplemental Front Seat-Side Air Bags
- LATCH Ready Child Seat Anchor System
- Blind-Spot and Rear Cross-Path Detection
- ParkSense® Rear Park Assist with Stop
- Remote-Start System
- Rear View Automatic Dimming Mirror
- Electronic Stability Control
- Sentry Key® Theft Deterrent System
- Ready-Alert Braking
- Tire Service Kit

INTERIOR FEATURES

- Uconnect® 4 NAV with 8.4-Inch Display
- SiriusXM® with 1-Year Radio Sub Call 800-643-2112
- SiriusXM® Traffic Plus
- SiriusXM Guardian™ Connected Services w/1-Yr Trial
- Google Android Auto™
- Apple CarPlay®
- 4G LTE Wi-Fi Hot Spot
- 7-Inch Full Color TFT Display
- Integrated Voice Command with Bluetooth®
- 13-Alpine® Speakers
- Active Noise-Control System
- Heated Steering Wheel
- Heated Front Seats
- Ventilated Front Seats
- Driver Seat Memory
- Driver Seat Auto Advance™ in Return
- Front Passenger Seat Auto Advance™ in Return
- 8-Way Power Driver Seat
- Easy Slide 2nd-Row Bucket Seats
- 3rd-Row Stow™ in Go® 60 / 40 Bench
- Power Front and Rear Windows with 1-Touch Up & Down
- 2nd and 3rd-Row Window Shades

OPTIONAL EQUIPMENT (May Replace Standard Equipment)

- Customer Preferred package 2EU **\$995**
- 18-Inch x 7.5-Inch Aluminum Polished Wheels
- 235/60R18 BSW All-Season Tires

- 35th Anniversary Liftgate Badge
- 35th Anniversary Floor Mats with Logo
- Cranberry Wine Accents
- Black Seats
- 20-Speaker Harman Kardon® Sound Group **NO CHARGE**
- 760-Watt Amplifier **\$795**
- S Appearance Package
- Gloss Black Upper/Lower Grille Surround
- 18-Inch x 7.5-Inch Black Noise Painted Wheels
- Black Noise Badging
- Black Stow™ in Place® Roof Rack **\$995**
- Advanced SafetyTec Group
- 360 Surround-View Camera System
- Full Speed Forward Collision Warn Plus
- Adaptive Cruise Control with Stop & Go
- Lane Departure Warning Plus
- Parallel and Perpendicular Park Assist with Stop
- ParkSense® Front and Rear Park Assist with Stop
- Rain-Sensitive Windshield Wipers
- Advanced Brake-Assist
- Automatic High Beam Headlamp Control
- Uconnect® Theater with Streaming
- Blu-Ray/DVD Player/Video USB Port
- Scatback Video Screens
- Media Hubs - HDMI/USB/Headphone Ports
- Video USB Port
- 115-Volt Auxiliary Power Outlet
- Video Remote Controls
- Wireless Headphones
- KeySense™ **NO CHARGE**

DESTINATION CHARGE **\$1,495**

TOTAL PRICE: * \$50,125

WARRANTY COVERAGE

- 5-year or 60,000-mile Powertrain Limited Warranty.
 - 10-year or 100,000-mile Hybrid System Limited Warranty.
 - 10-year or 100,000-mile High Voltage Battery Warranty.
 - 3-year or 36,000-mile Basic Limited Warranty.
- Ask Dealer for a copy of the limited warranties or see your owner's manual for details. Warranty details may differ in Zero Emission States. See Dealer for details.

5 YEAR / 60,000 MILE
POWERTRAIN WARRANTY

Assembly Point/Port of Entry: WINDSOR, ONTARIO, CANADA

vin: 2C4-RC1N7XLR-13

LEAD: 4751

1127



THIS LABEL IS ADDED TO THIS VEHICLE TO COMPLY WITH FEDERAL LAW. THE LABEL CANNOT BE REMOVED OR ALTERED PRIOR TO DELIVERY TO THE ULTIMATE PURCHASER.
* STATE AND/OR LOCAL TAXES IF ANY, LICENSE AND TITLE FEES AND DEALER SUPPLIED AND INSTALLED OPTIONS AND ACCESSORIES ARE NOT INCLUDED IN THIS PRICE. DISCOUNT, IF ANY, IS BASED ON PRICE OF OPTION IF PURCHASED SEPARATELY.

EPA DOT Fuel Economy and Environment

Plug-In Hybrid Vehicle
Electricity-Gasoline

Fuel Economy. Midrange range from 20 to 48 MPG. The best vehicle rates 136 MPG.

Electricity + Gasoline
Charge Time: 2.0 hours (240V)
82 MPGe
0.0 41
combined city/highway

Gasoline Only
30 MPG
3.3
gallons per 100 miles
combined city/highway

Driving Range
Electricity + Gasoline
Gasoline only
All electric range: 0 - 32 miles
32 miles

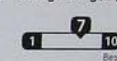
You Save
\$2,250
in fuel costs
over 5 years
compared to the
average new vehicle.

Annual fuel cost
\$1,050

Fuel Economy & Greenhouse Gas Rating (tailpipe only)



Smog Rating (tailpipe only)



This vehicle emits 119 grams CO2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also creates emissions. Learn more at fuelconomy.gov

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and cost \$7,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.70 per gallon and \$0.13 per kWh. This is a dual fueled automobile. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

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GOVERNMENT 5-STAR SAFETY RATINGS

This vehicle has not been rated by the government for overall vehicle score, frontal crash, side crash or rollover risk.

Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 54%
MAJOR SOURCES OF FOREIGN PARTS

CONTENT:
MEXICO: 22%
NOTE: PARTS CONTENT DOES NOT INCLUDE FINAL ASSEMBLY, DISTRIBUTION, OR OTHER NON-PARTS COSTS.

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT:
WINDSOR, ONTARIO, CANADA
COUNTRY OF ORIGIN:
ENGINE: MEXICO
TRANSMISSION: UNITED STATES



VEHICLE PROTECTION
A PRODUCT OF FCA US LLC

Ask for Mopar Vehicle Protection for your vehicle. We Built It. We Back It.

Figure A1. Window Sticker



Figure A2. Front View, Test Vehicle as Delivered



Figure A3. Rear View, Test Vehicle as Delivered

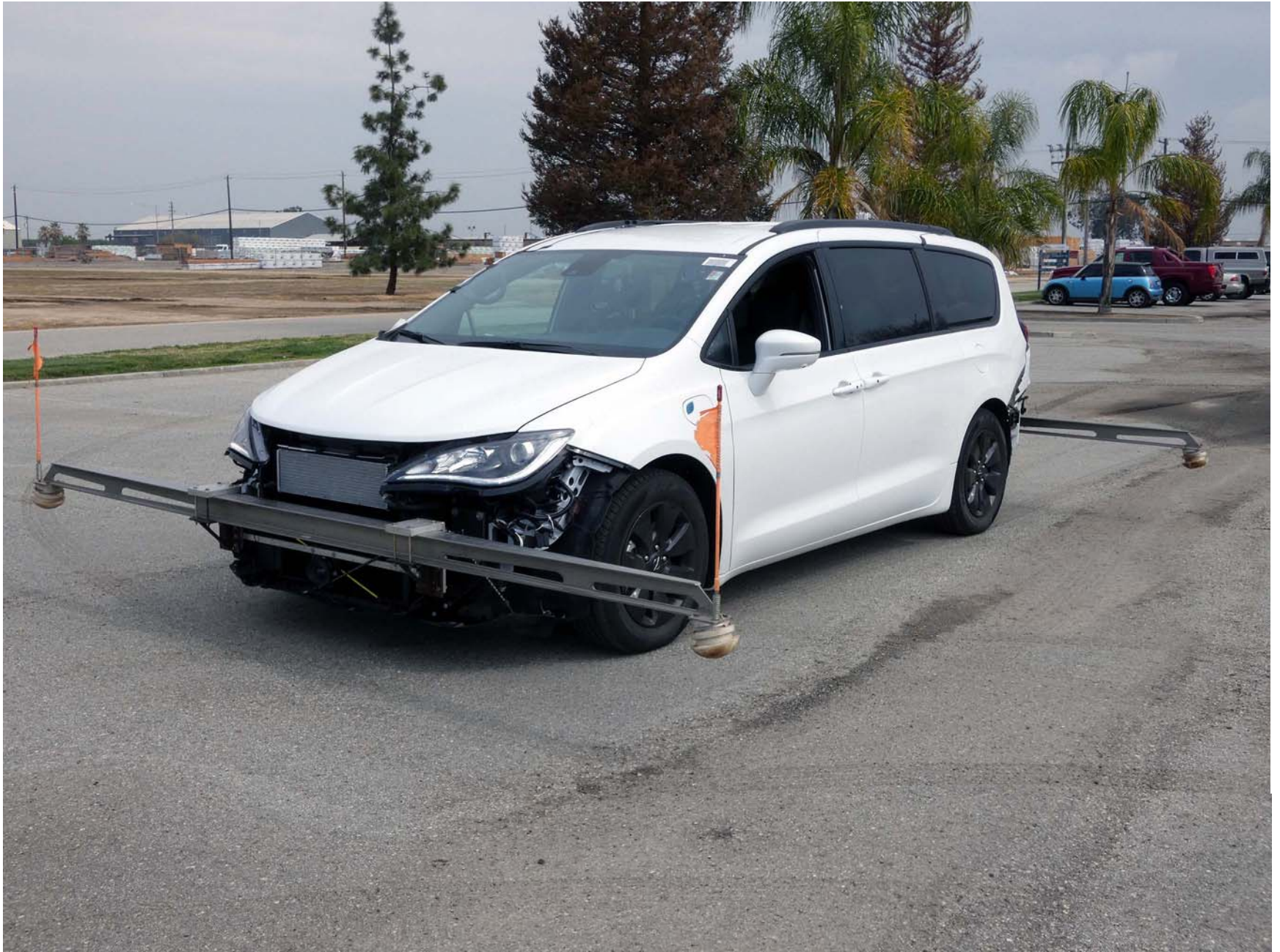
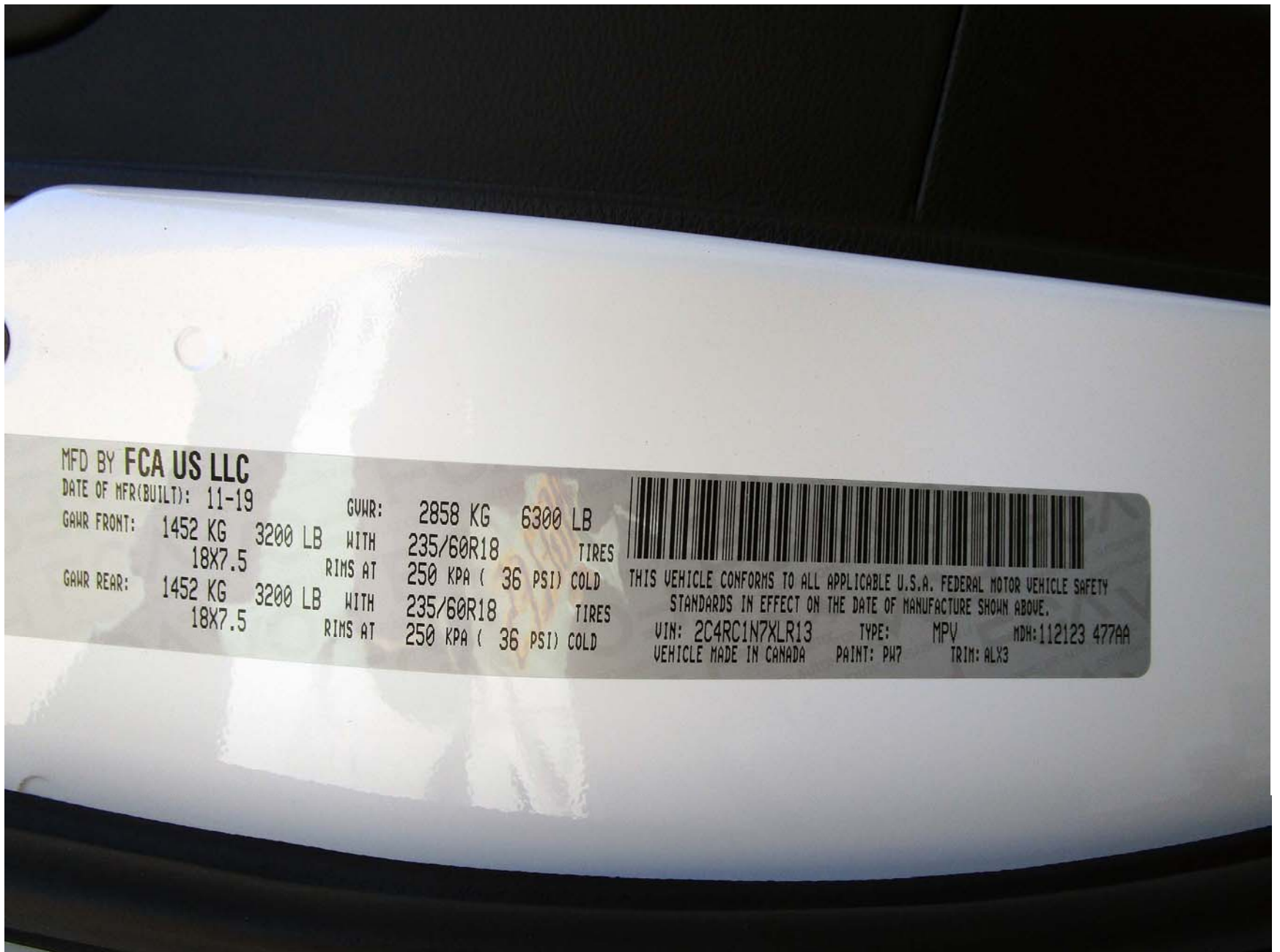


Figure A4. Front View, Test Vehicle in Test Condition



Figure A5. Rear View, Test Vehicle in Test Condition



MFD BY **FCA US LLC**

DATE OF MFR(BUILT): 11-19

GAWR FRONT: 1452 KG 3200 LB WITH
18X7.5 RIMS AT

GAWR REAR: 1452 KG 3200 LB WITH
18X7.5 RIMS AT

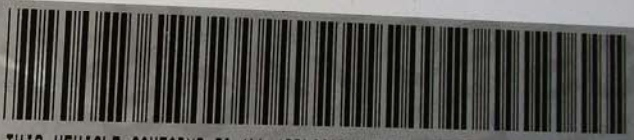
GWR: 2858 KG 6300 LB

235/60R18 TIRES

250 KPA (36 PSI) COLD

235/60R18 TIRES

250 KPA (36 PSI) COLD



THIS VEHICLE CONFORMS TO ALL APPLICABLE U.S.A. FEDERAL MOTOR VEHICLE SAFETY
STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: 2C4RC1N7XLR13
VEHICLE MADE IN CANADA

TYPE: MPV
PAINT: PH7

TRIM: ALX3
MDH: 112123 477AA

Figure A6. Certification Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY – TOTAL **7** FRONT **2** REAR **5**

THE COMBINED WEIGHT OF OCCUPANTS AND CARGO SHOULD NEVER EXCEED
498 KG OR 1100 LB

TIRE	FRONT	REAR	SPARE
ORIGINAL TIRE SIZE	235/60R18	235/60R18	NONE
COLD TIRE INFLATION PRESSURE	250 kPa / 36 PSI	250 kPa / 36 PSI	NONE

SEE OWNERS MANUAL FOR ADDITIONAL INFORMATION



LR13

Figure A7. Tire Placard



Figure A8. Instrumentation in Test Vehicle



Figure A9. Steering Controller and Computer



Figure A10. Ballast Condition

APPENDIX B

Test Run Log

Vehicle: **2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary**

Driver: **Jonathon Robel** Test Date: **3/12/2020**

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
1	Tire Warm-Up	35	50	Left	NA	
2	"	"	70	"	"	
3	"	"	"	"	"	
4	"	"	"	"	"	
5	2x SWA last cycle				"	
6	Static	0	0		"	
7	Steady State	50	0		"	
8	Slowly Increasing Steer	50	40	Left	NA	
9	"	"	"	Left	"	
10	"	"	"	Left	"	
11	"	"	"	Right	"	
12	"	"	"	Right	"	
13	"	"	"	Right	"	
14	Fishhook 6.5 Scalar	35	187	Left	No	
15	"	40	"	"	"	
16	"	45	"	"	"	
17	"	47.5	"	"	"	

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
18	"	50	"	"	"	
19	Fishhook 5.5 Scalar	45	158	Left	No	
20	"	47.5	"	"	"	
21	"	50	"	"	"	
22	Fishhook 6.5 Scalar	35	187	Right	No	
23	"	40	"	"	"	
24	"	45	"	"	"	
25	"	47.5	"	"	"	
26	"	50	"	"	"	
27	Fishhook 5.5 Scalar	45	158	Right	No	
28	"	47.5	"	"	"	
29	"	50	"	"	"	

APPENDIX C

Slowly Increasing Steer Test Worksheet

NCAP, 2020 Chrysler Pacifica Hybrid Pacifica Hybrid Limited 35th Anniversary, Multi-Passenger Load,

Test Date: 3/12/2020

SIS_out_v2

Run	Dir of Steer	Start Speed (mph)	End Speed (mph)	Speed Red. (%)	Index of ay @ 0.3g	HW Angle (deg) at 0.3g	ay (g) @ 0.3g index	6.5x HW Angle (deg)	Ramp Time (sec) at 6.5x	5.5x HW Angle (deg)	Ramp Time (sec) at 5.5x	R2	Zero Begin Index	Zero End Index
8	Left	49.8	-0.1	100.1	1237	-29.0	-0.301	-188.6	-0.2619	-159.6	-0.2216	0.9971	601	800
9	Left	50.3	-0.1	100.2	1218	-28.2	-0.301	-183.2	-0.2544	-155.0	-0.2153	0.9967	600	800
10	Left	50.1	0.0	100.1	1229	-28.6	-0.304	-185.8	-0.2580	-157.2	-0.2183	0.9963	600	800
11	Right	50.7	-0.1	100.2	1235	29.0	0.302	188.6	0.2620	159.6	0.2217	0.9967	600	800
12	Right	50.5	-0.1	100.2	1233	28.9	0.301	187.6	0.2605	158.7	0.2205	0.9990	601	800
13	Right	50.3	1.5	97.1	1233	28.9	0.303	187.8	0.2608	158.9	0.2207	0.9988	601	800

Mean: 28.8 0.302 187 0.26 158 0.22

Steering Controller Input Values

Scalar 6.5 values:

Initial HW angle: 187 deg
 Initial time: 0.26 s
 Reversal HW angle: -187 deg
 Reversal time: 0.519 s

Scalar 5.5 values:

Initial HW angle: 158 deg
 Initial time: 0.22 s
 Reversal HW angle: -158 deg
 Reversal time: 0.439 s

APPENDIX D

Time History Plots

LIST OF FIGURES

	Page
D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph	D-3
D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph.....	D-4
D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, L-R, 50 mph	D-5
D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph	D-6
D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph	D-7
D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph	D-8
D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph	D-9
D8. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, R-L, 50 mph	D-10
D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph.....	D-11
D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph.....	D-12
D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph.....	D-13
D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph.....	D-14
D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph.....	D-15
D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph.....	D-16
D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph.....	D-17
D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph.....	D-18

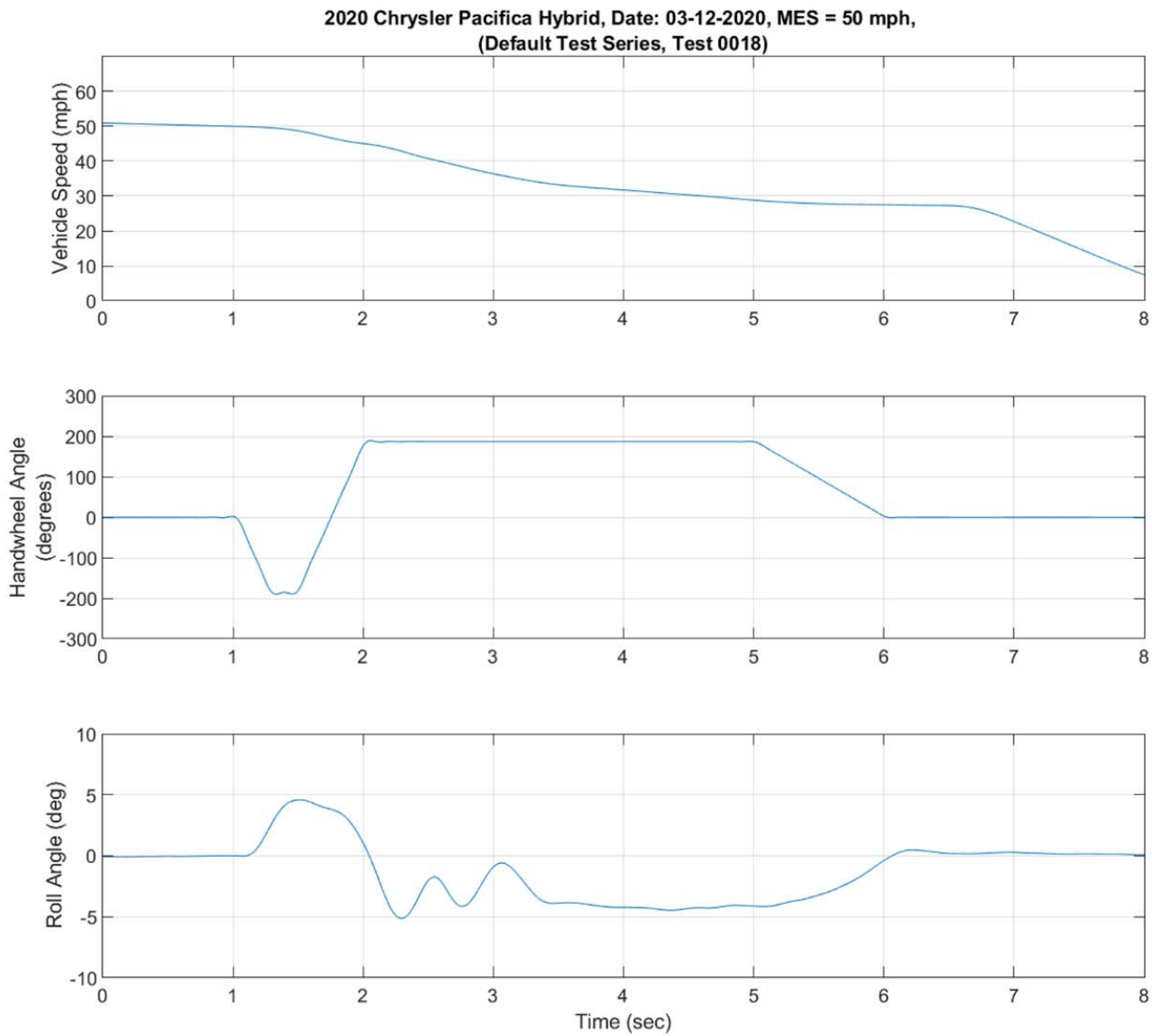


Figure D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph

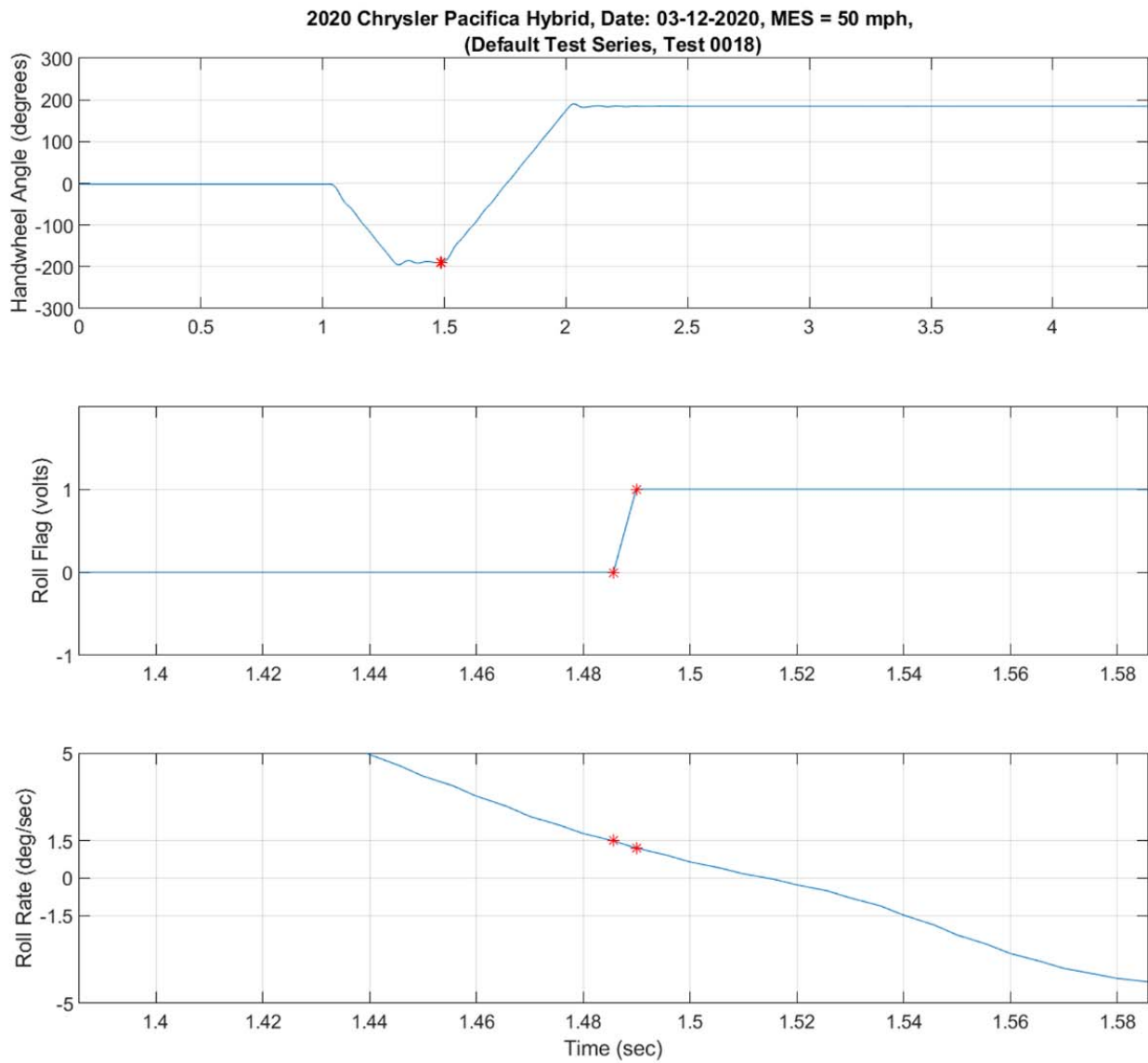


Figure D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph

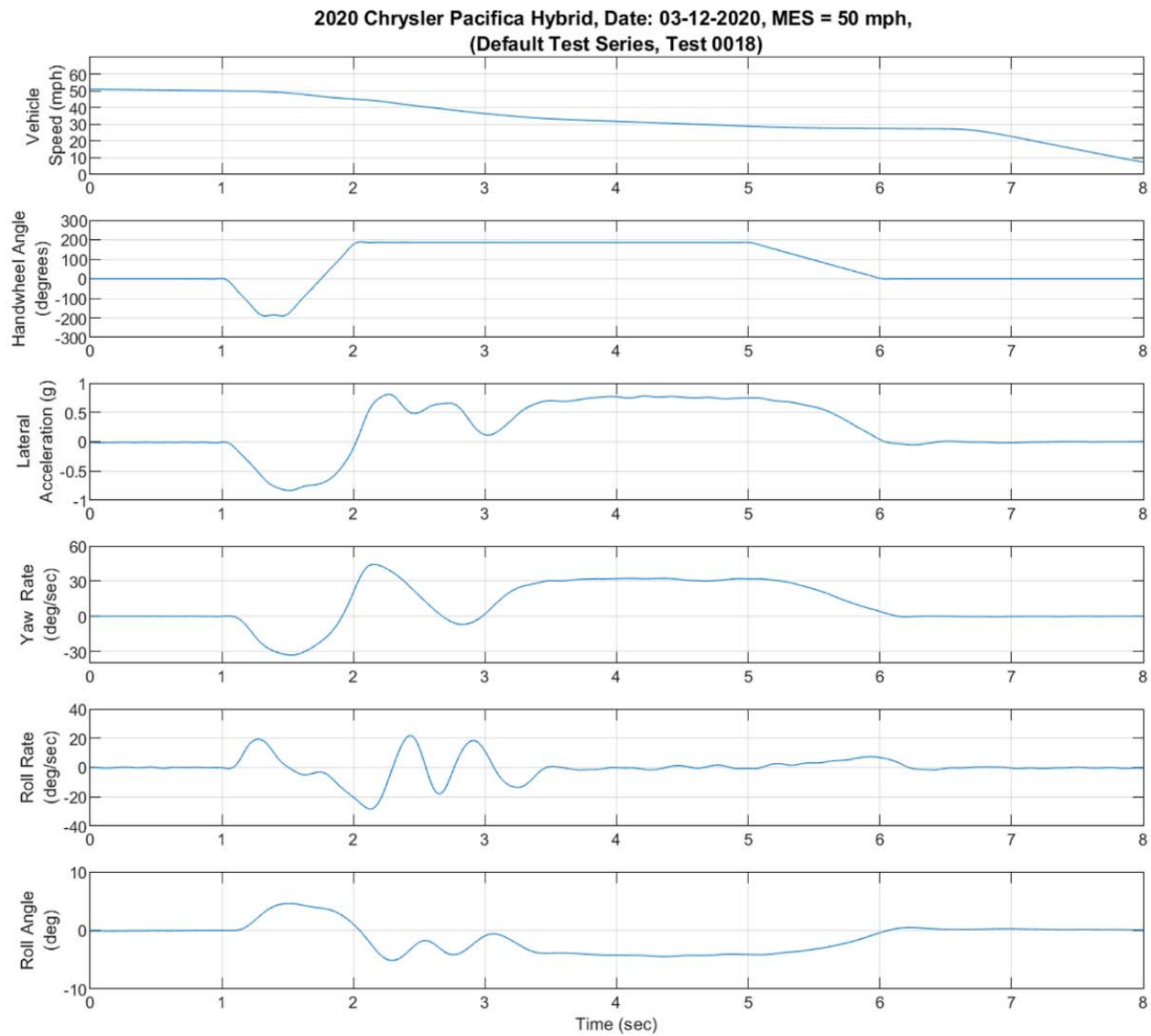


Figure D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots For Default Test Series, L-R, 50 mph

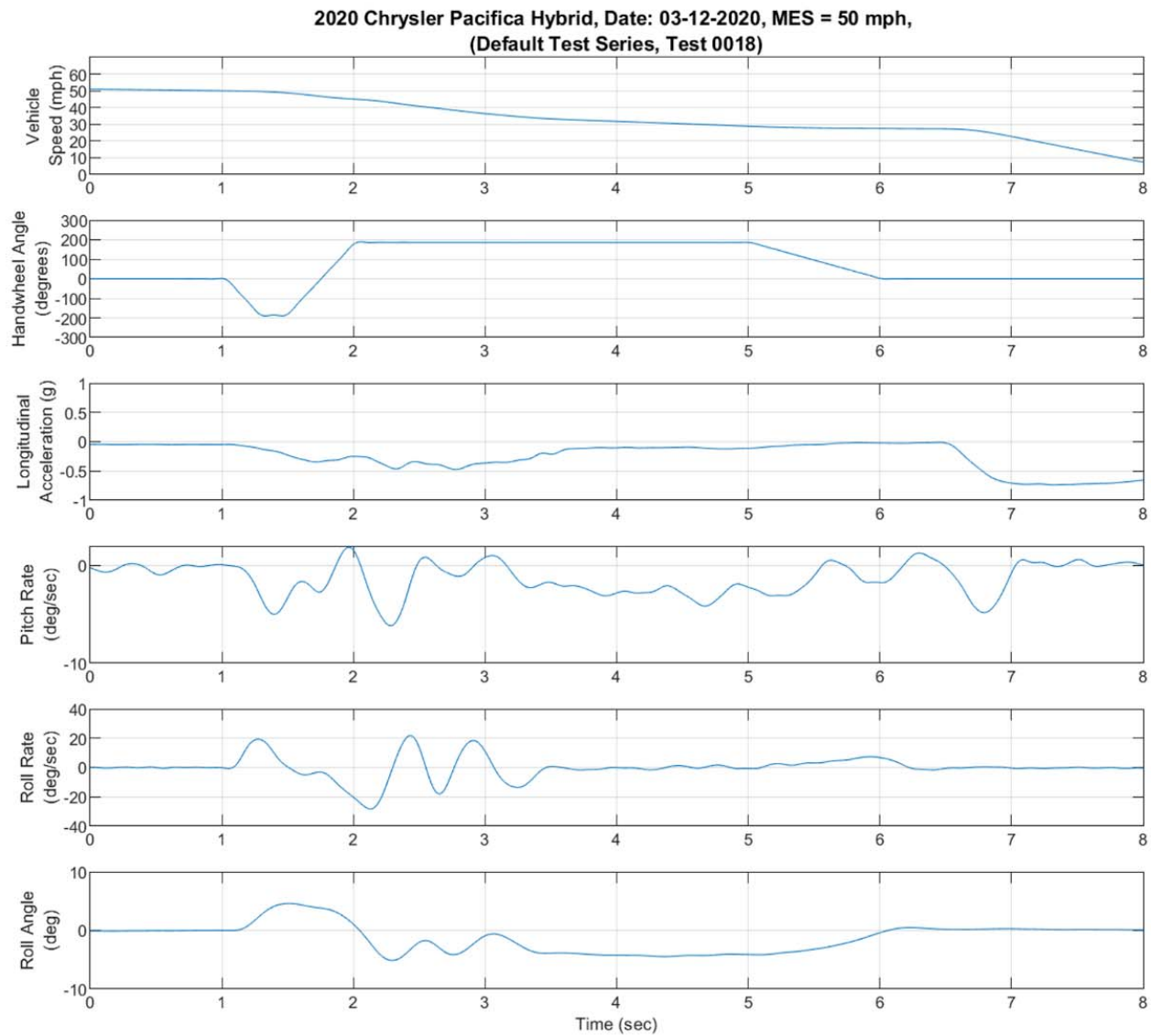


Figure D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph

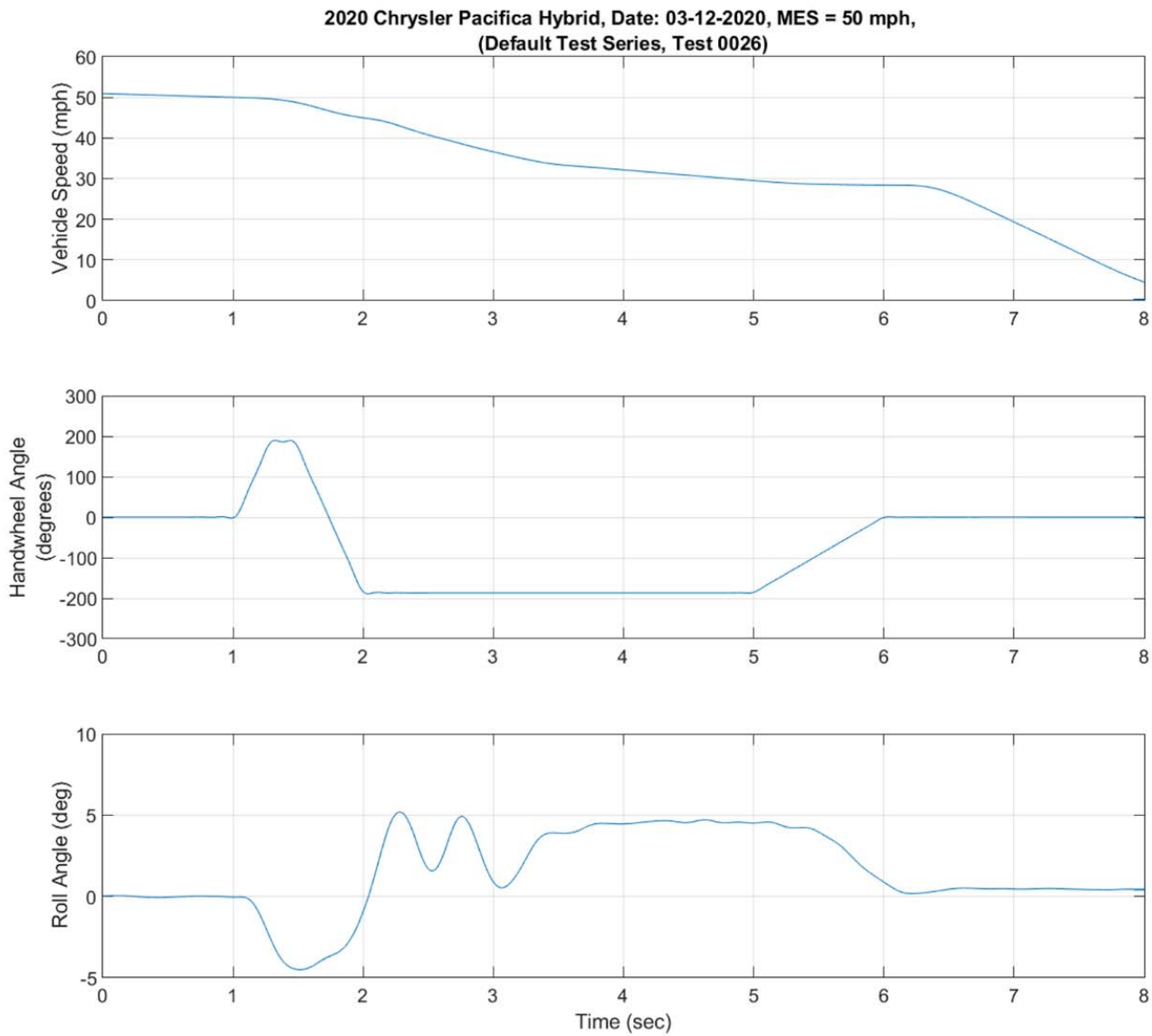


Figure D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph

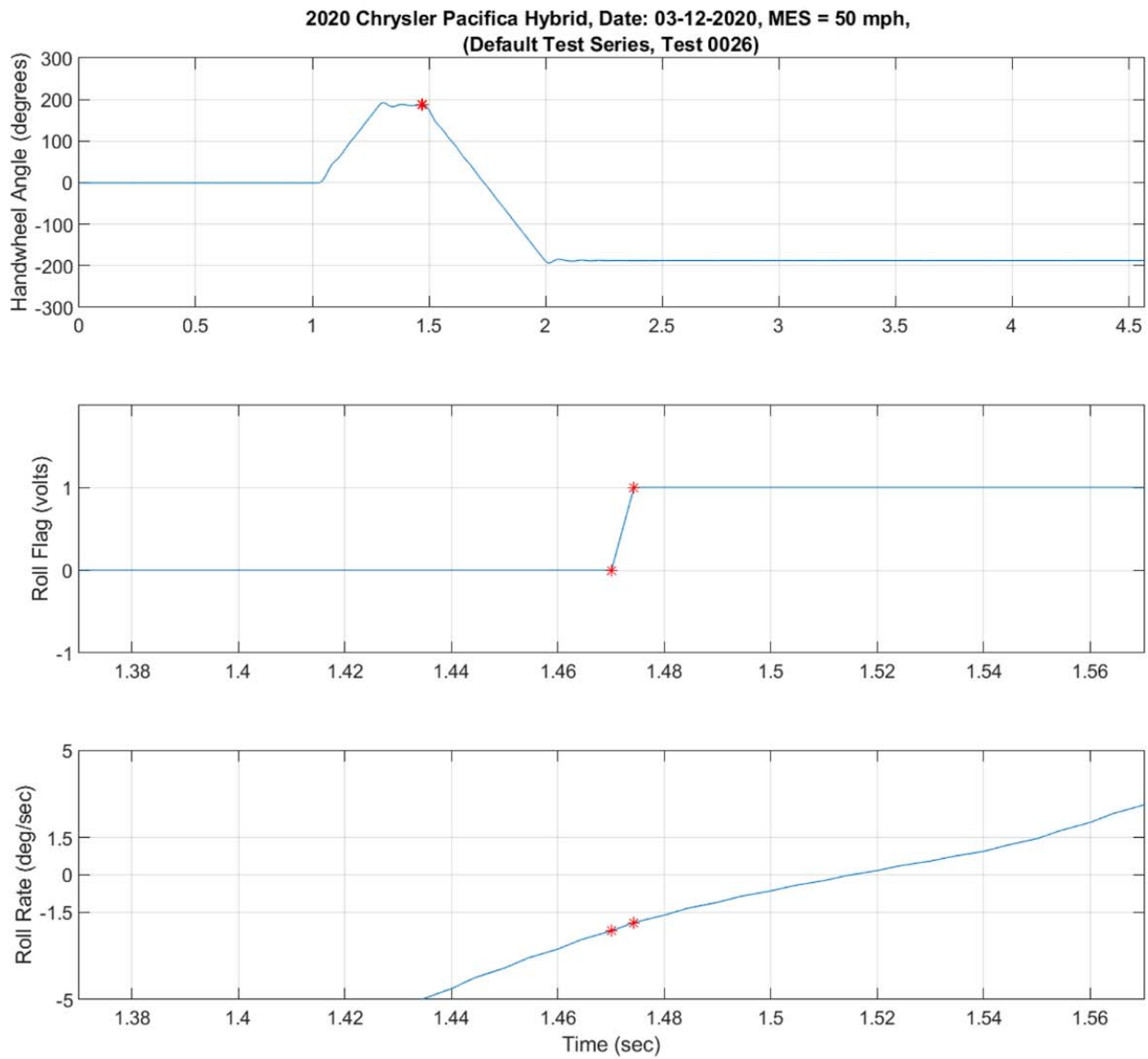


Figure D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph

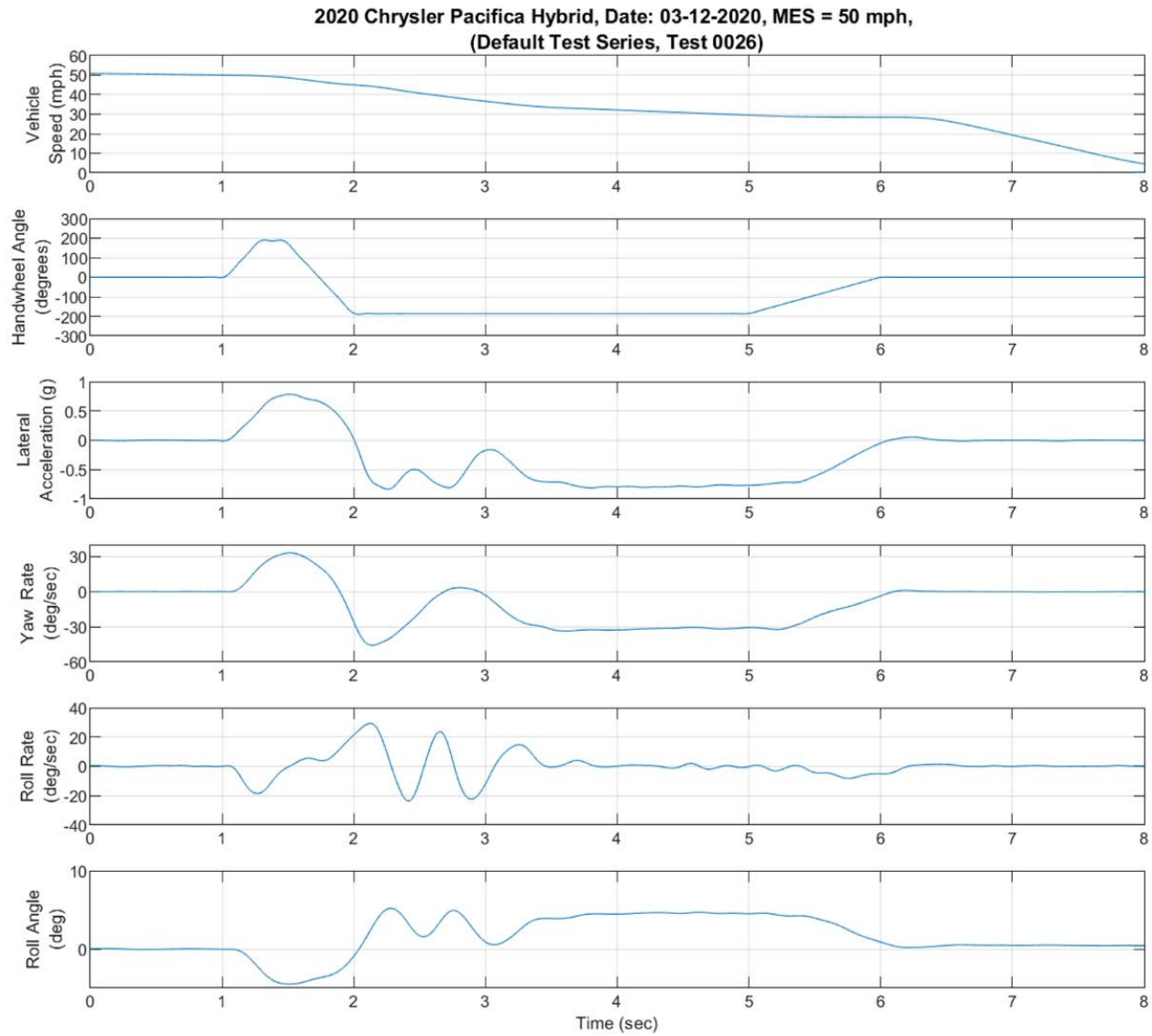


Figure D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph

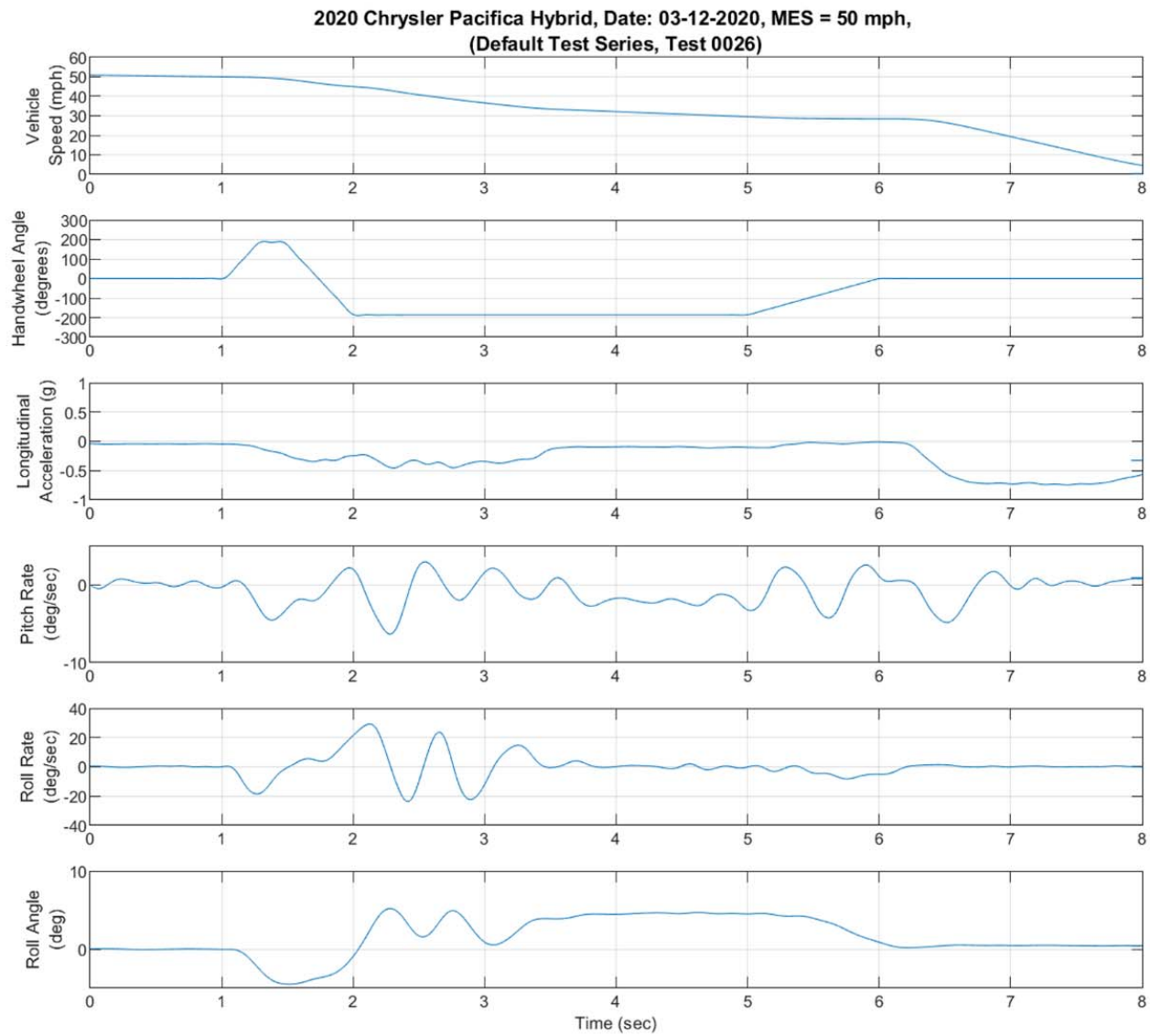


Figure D8. Pitch Rate and Longitudinal Acceleration Time History Plots or Default Test Series, R-L, 50 mph

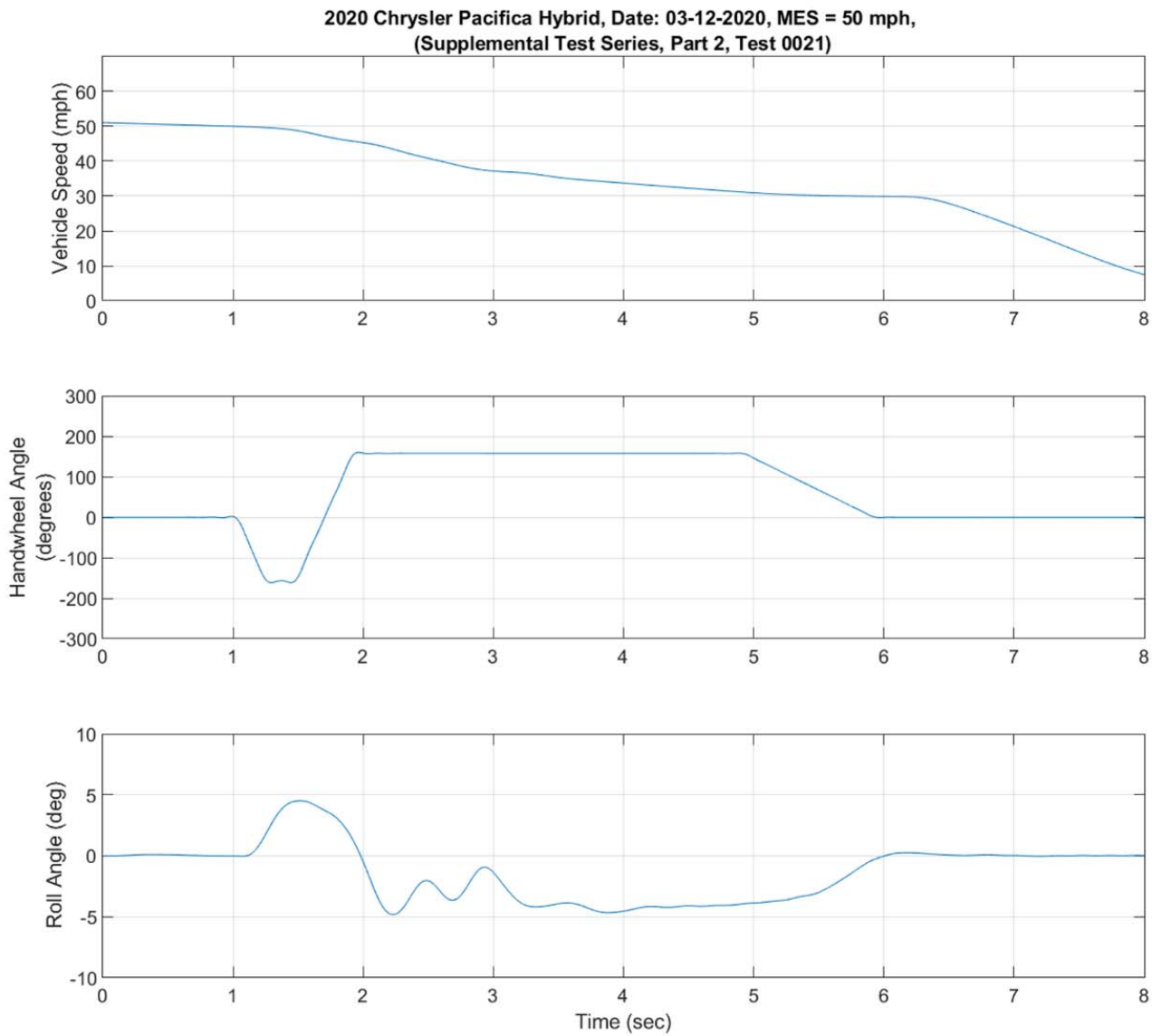


Figure D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

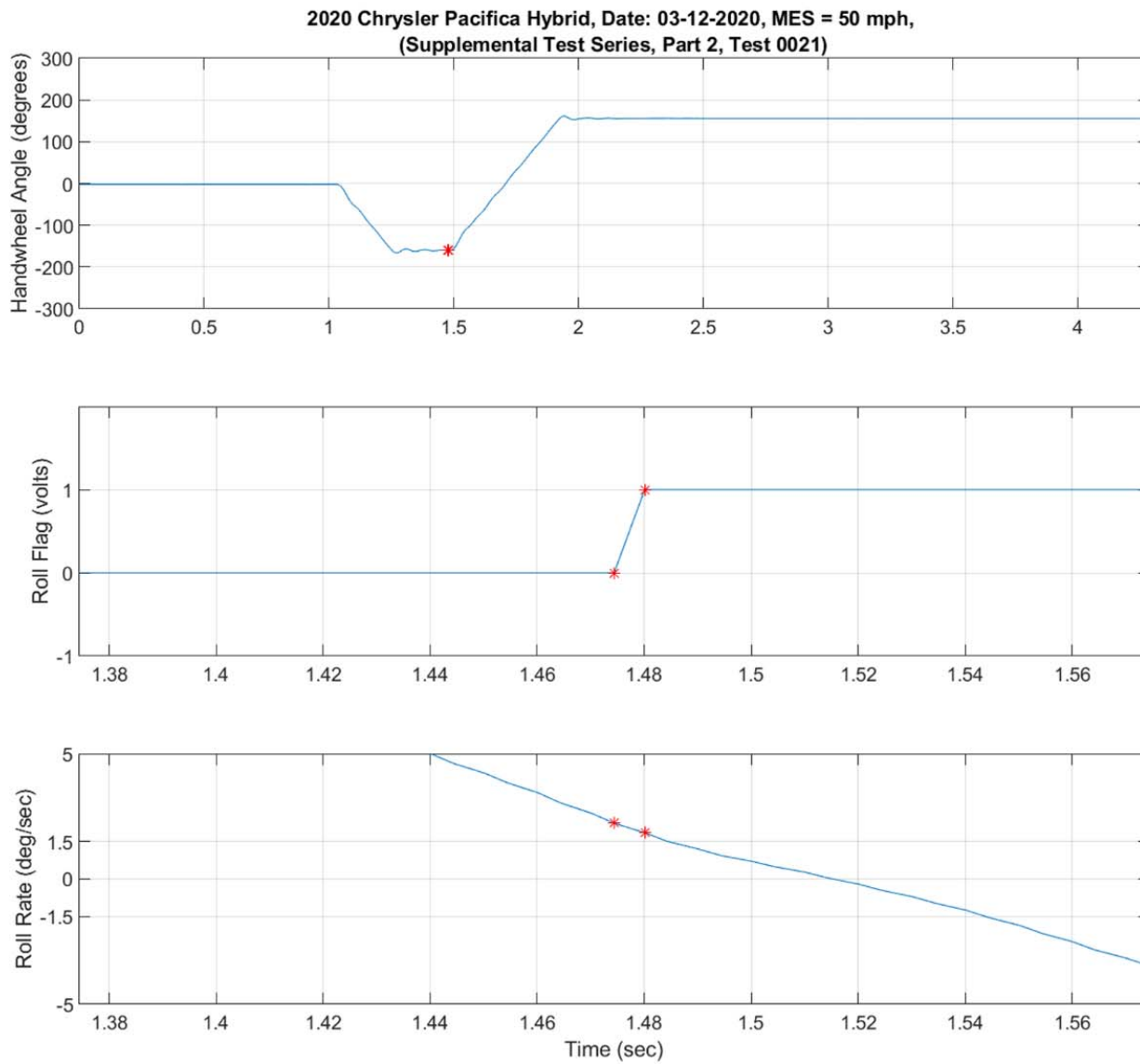


Figure D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

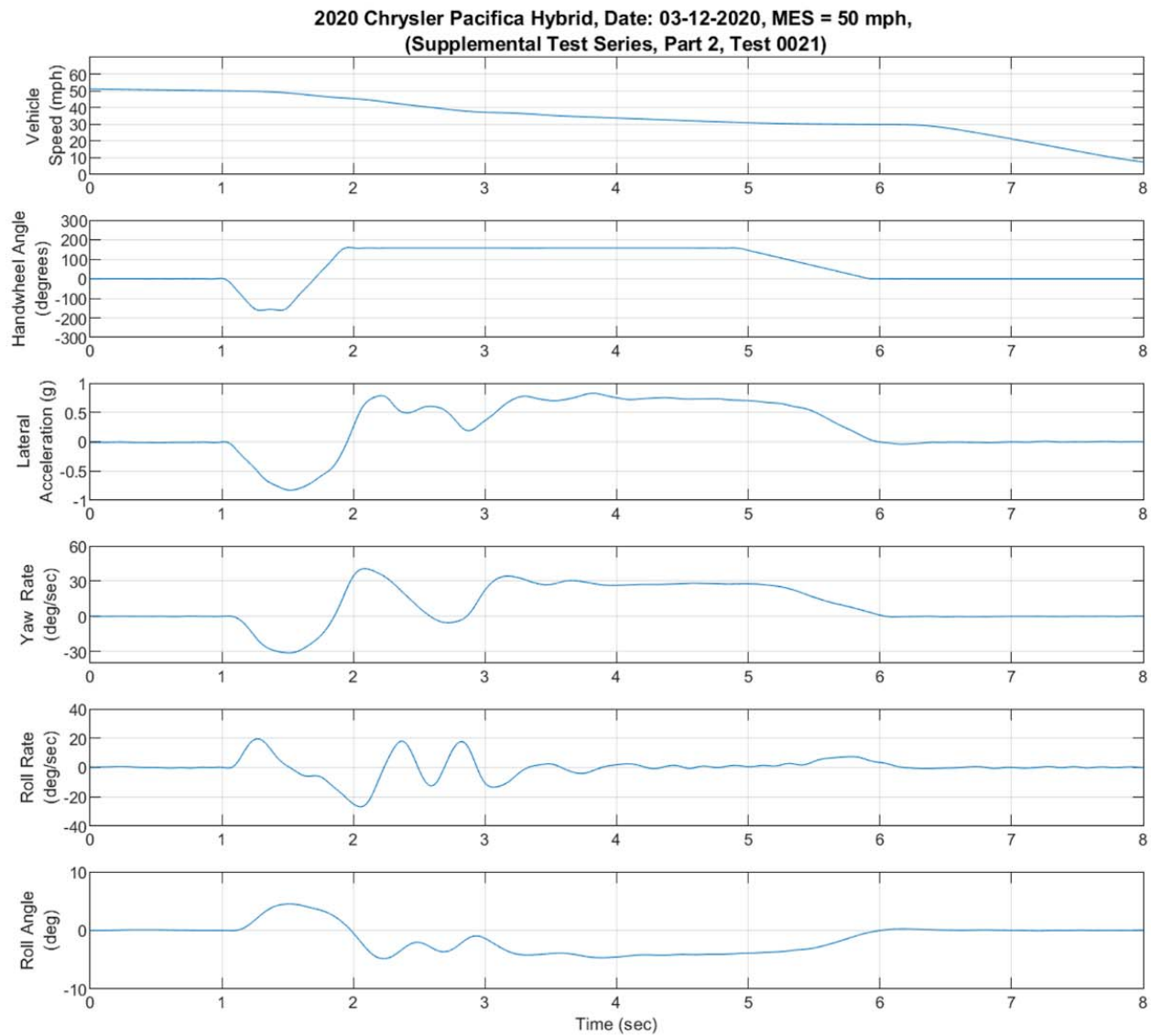


Figure D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

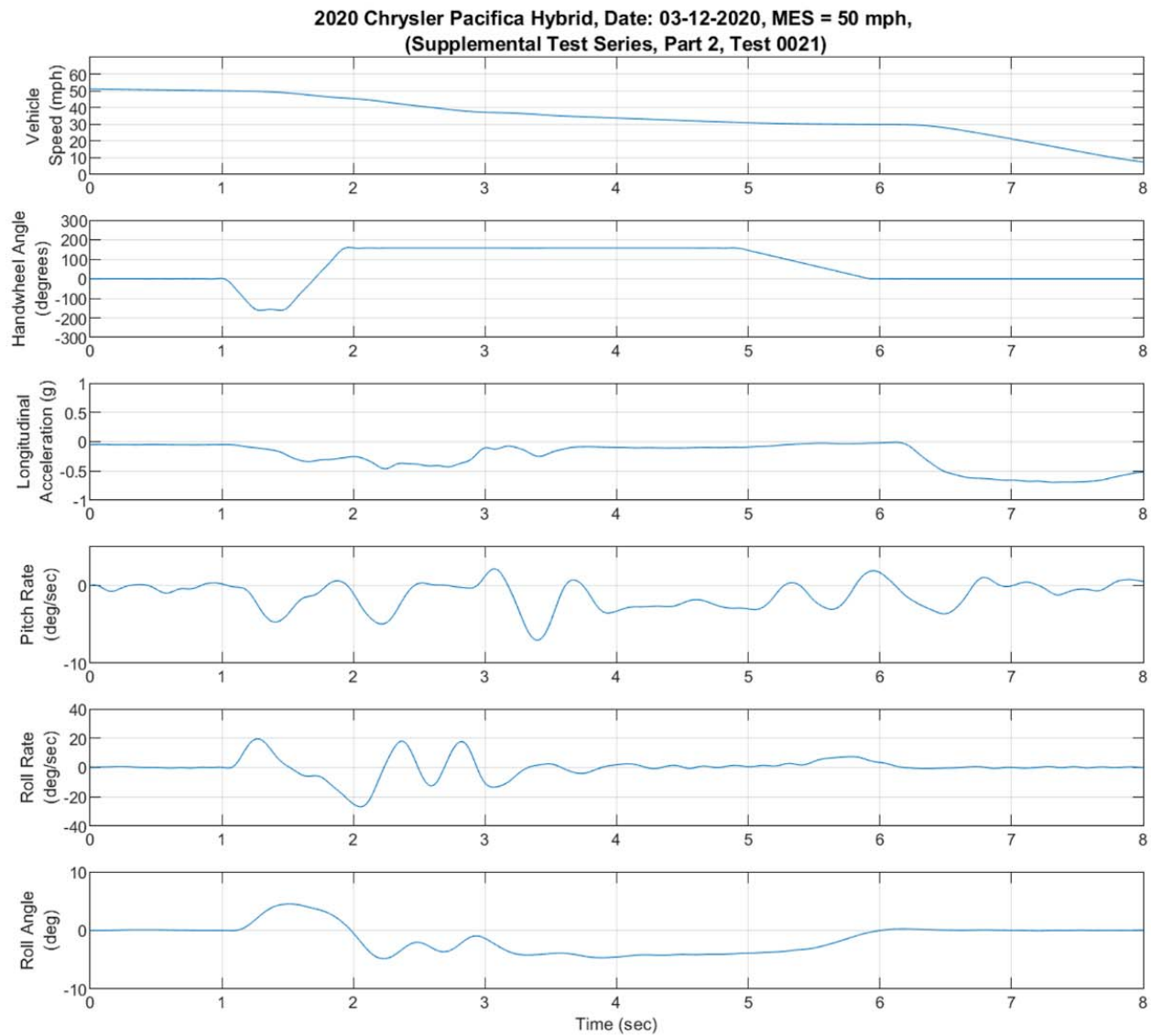


Figure D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

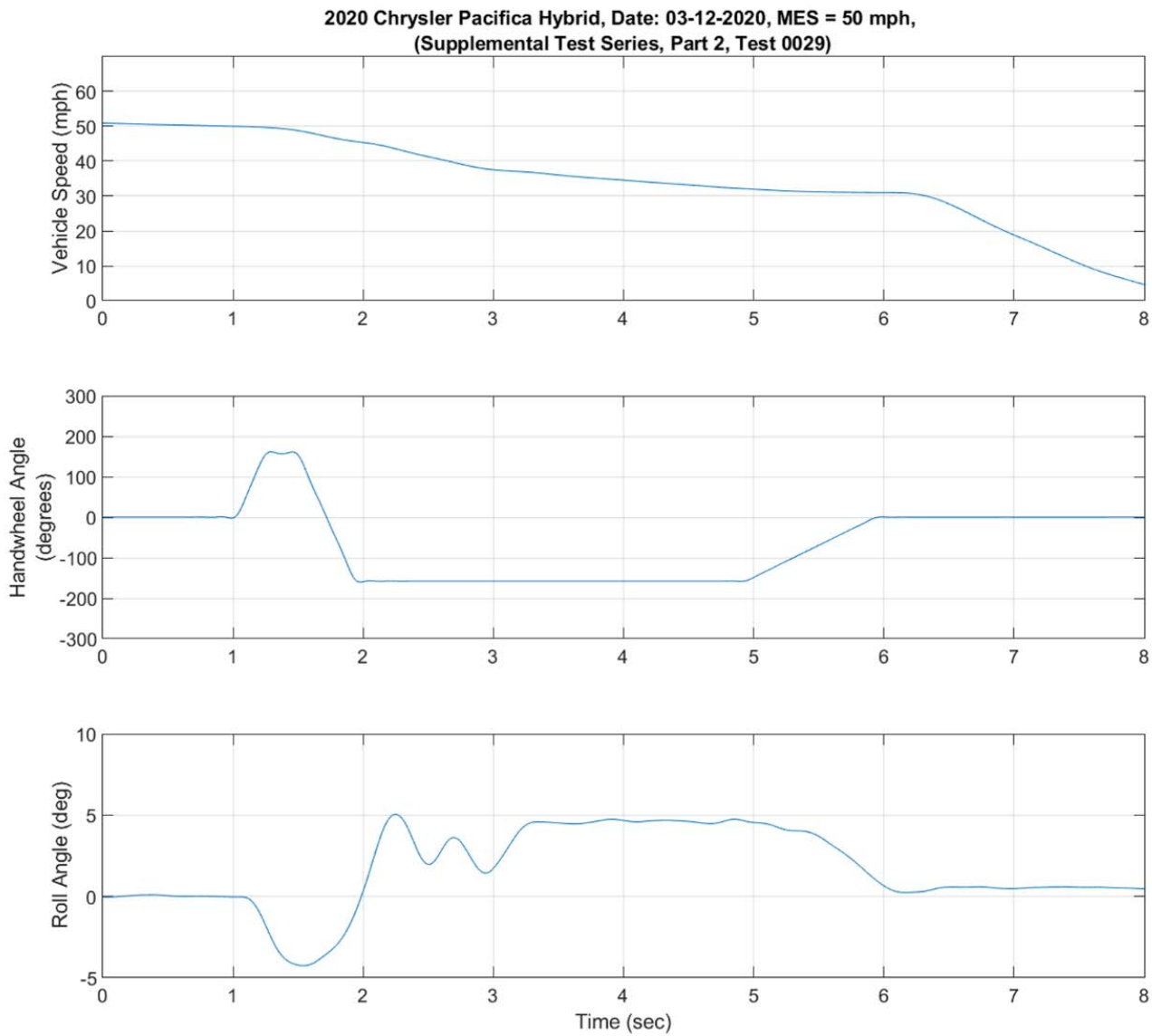


Figure D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

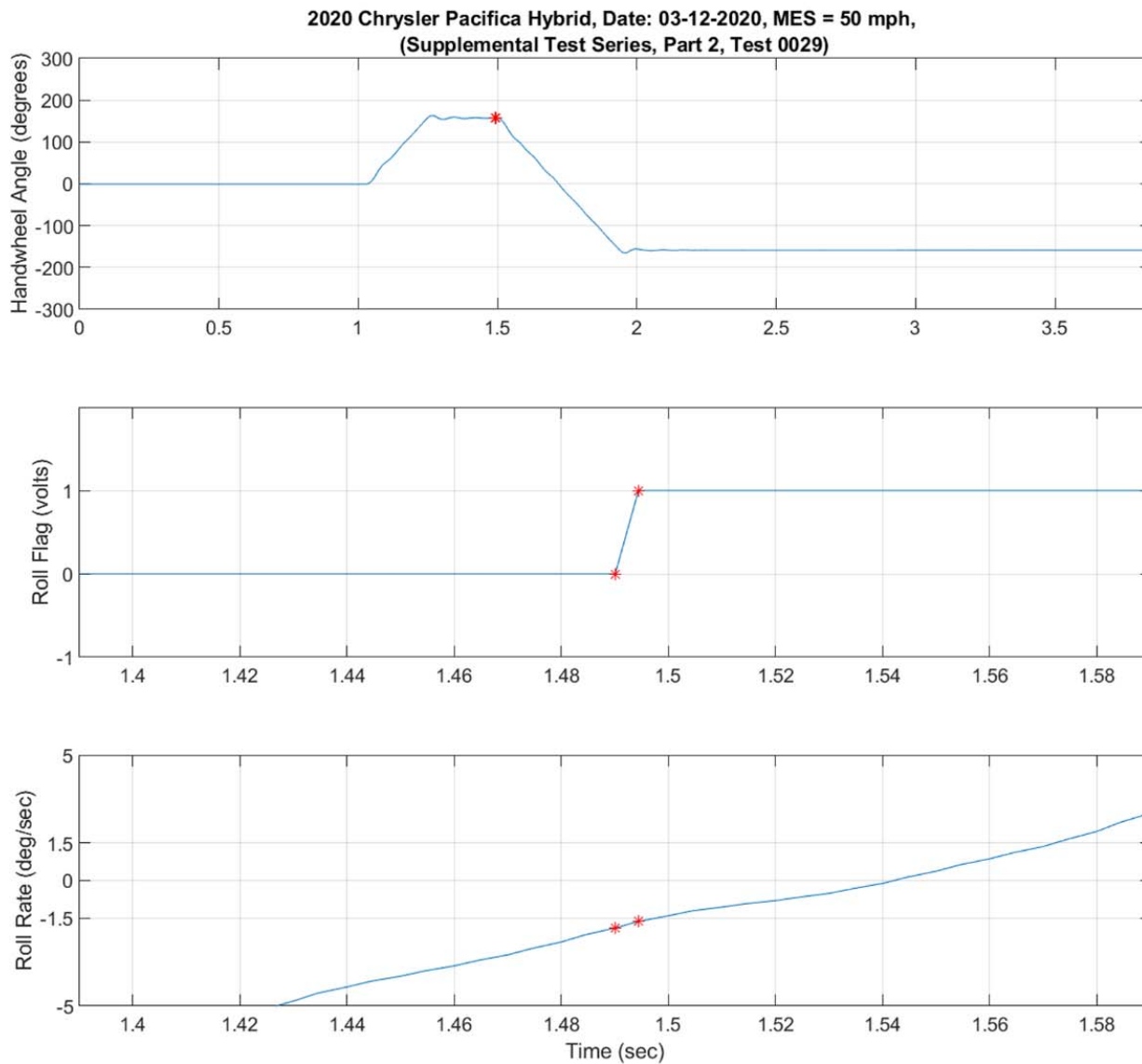


Figure D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

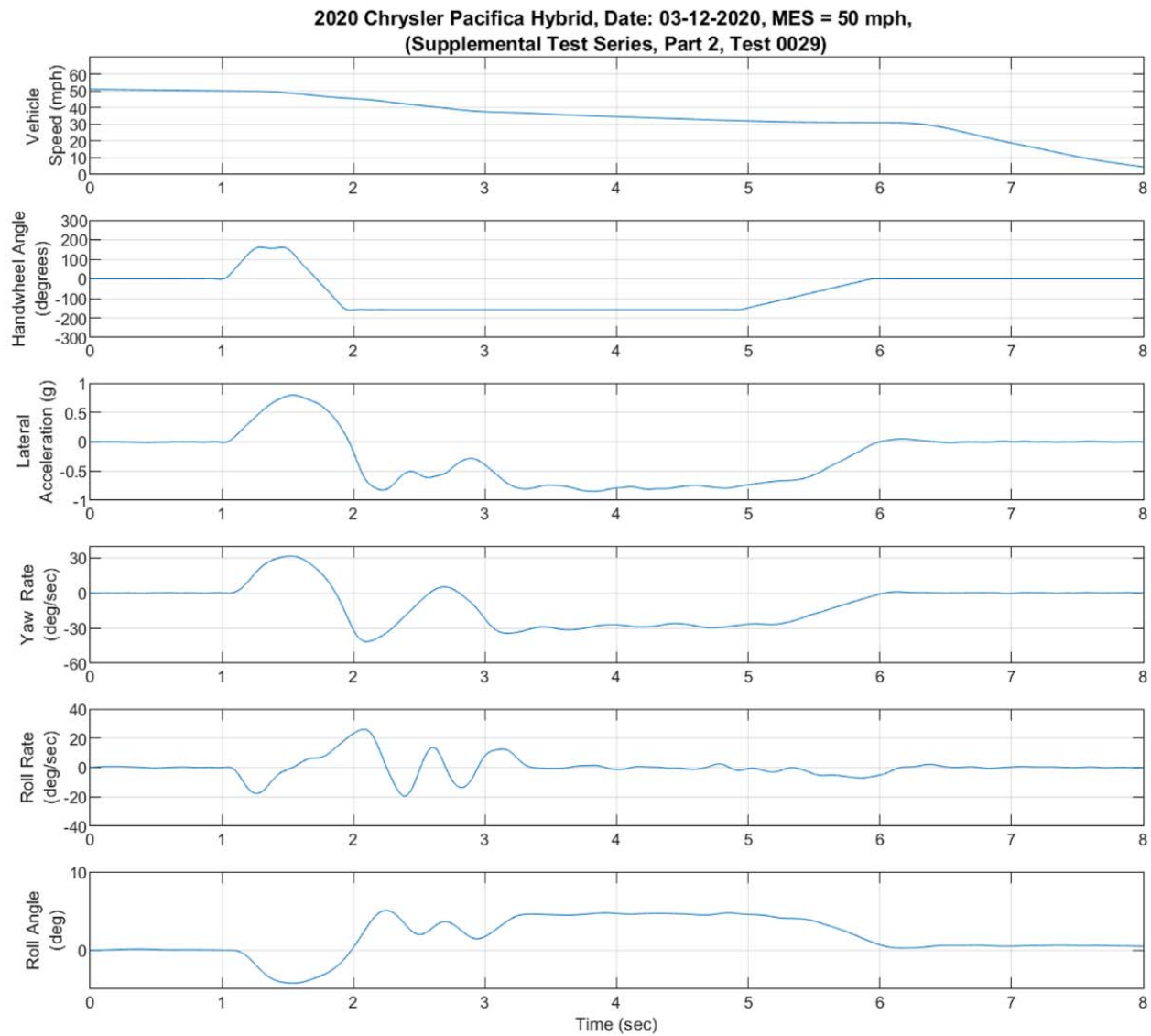


Figure D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

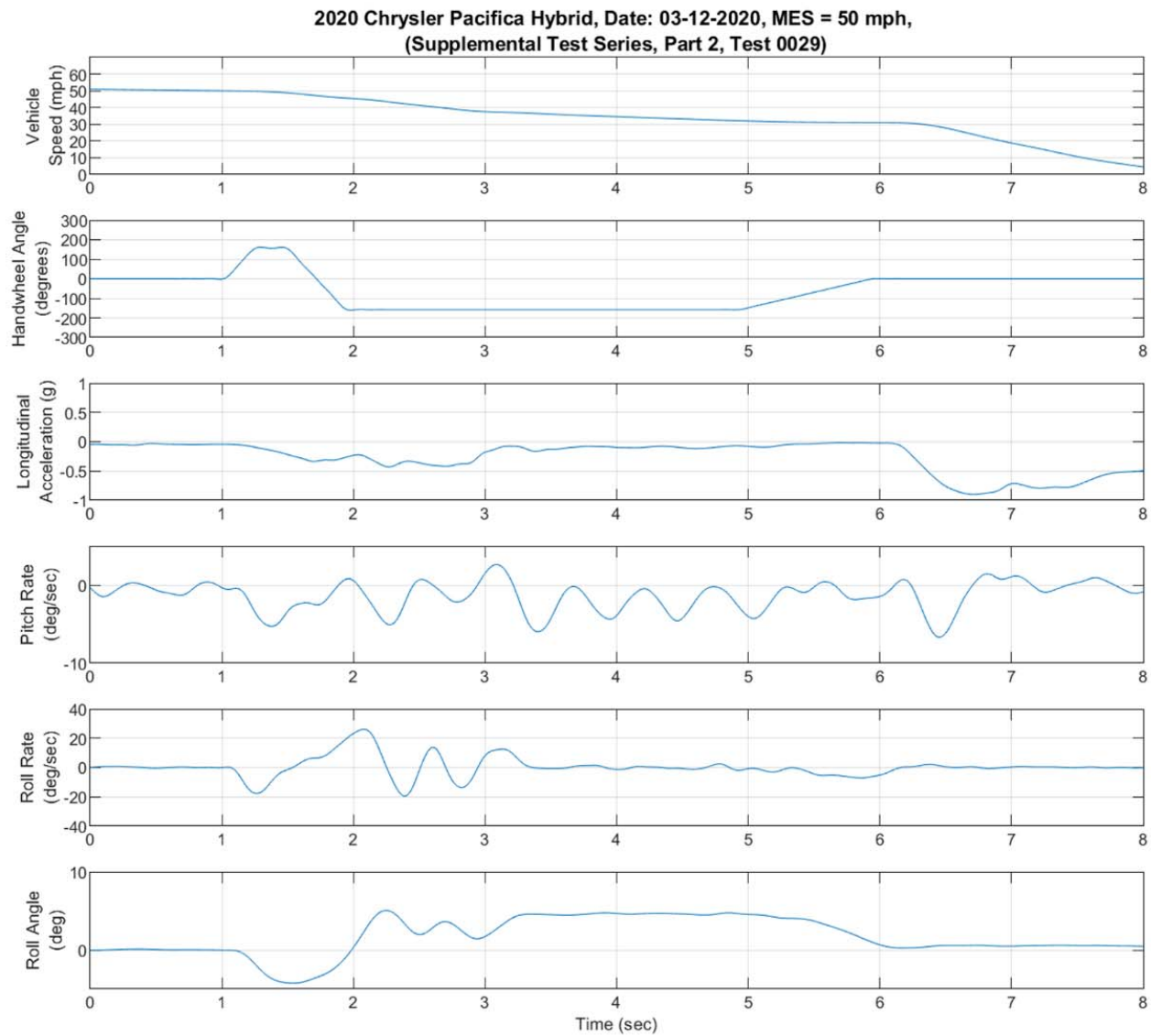


Figure D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph