

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

Ford Motor Co  
2018 Ford EcoSport FWD

TEST NUMBER: 18-11

Final Report  
10 May 2018



Prepared by:

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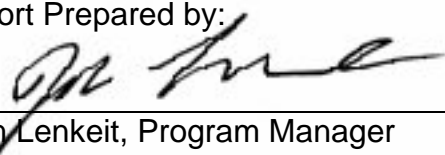
Prepared for:

National Highway Traffic Safety Administration  
Office of Crash Avoidance Standards  
1200 New Jersey Avenue S.E.  
Washington, DC 20590

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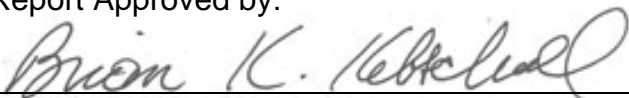
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16. Abstract  An NCAP Dynamic Rollover Maneuver (Fishhook) Test was conducted on a 2018 Ford EcoSport FWD at Dynamic Research, Inc. on March 7, 2018. The vehicle did not experience two-wheel lift. The vehicle's steering angle at 0.3 g lateral acceleration at 50 mph was 27.9 degrees.			
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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 2018 Ford EcoSport FWD 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](http://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, "New Car Assessment Program (NCAP) Non-Destructive Vehicle Testing and Data Gathering."

## 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 reduce the possibility of tire debanding during Fishhook testing, an appropriately sized inner tube was installed in each tire. 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

<b>General Data</b>					
Model year, make, model	2018 Ford EcoSport FWD				
VIN	MAJ3P1TE5JC17xxxx				
Body style	Crossover				
Number of doors	4				
Trim level	SE				
Seating positions	Front:	2 <sup>nd</sup> row	3 <sup>rd</sup> row	4 <sup>th</sup> row	5 <sup>th</sup> row
	2	3			
Electronic stability control	Yes				
4-Wheel ABS (Yes/No)	Yes				
Power steering (Yes/No)	Yes				
Major optional equipment	Convenience Package				
Odometer at start of testing	39 miles				
<b>Drivetrain</b>					
Engine cylinder arrangement	Inline 3				
Engine displacement	1 L				
Transmission type	Automatic				
Drive arrangement	FWD				
<b>Chassis</b>					
Track width	F: 59.8 in (1518.9 mm) , R: 59.7 in (1516.4 mm)				
Wheelbase	99.2 in (2519.7 mm)				
Curb weight	3093 lb (1403 kg)				
<b>Certification Data from Vehicle's Label</b>					
Vehicle manufactured by	Ford Motor Co				
Date of manufacture	11/17				
GVWR	3990 lb (1810 kg)				
GAWR Front	2105 lb (955 kg)				
GAWR Rear	1907 lb (865 kg)				

Table 2. Tire Information

Tire Manufacturer	Bridgestone
Tire Model	Ecopia EP 422 Plus
Tire Size	Front: 205/60R16 Rear: 205/60R16
Load rating	Front: 92 Rear: 92
Speed rating	Front: H Rear: H
Treadwear grade	Front: 600 Rear: 600
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: 35 psi, (240 kPa) Rear: 35 psi, (240 kPa)
First 8 digits of DOT code	Front: 1V20 JNL Rear: 1V20 JNL

Table 3. Vehicle Loading

Water dummy and other loading	Water weight was taken from water dummies to get vehicle to meet GVWR.3 water dummies in second row
Water dummy weight	175 lb (79.4 kg)
Fuel level	Full
<b>Weight as Tested</b>	
Left front	1153 lb (523 kg)
Right front	1028 lb (466.3 kg)
Left rear	934 lb (423.7 kg)
Right rear	871 lb (395.1 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  $\pm 0.045$  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 4). The MicroAutoBox II specifications are:

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

A list of the sensors is given in Table 4.

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. 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

- A five point safety harness was installed.
- Airbags were removed or otherwise disabled

Photographs of the vehicle tested are given in Appendix A.

Table 4. 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: 6/8/2017 Due: 6/8/2018
Vehicle Total, Wheel, and Axle Load	Platform Scales (Minter)	7000 lb 31.1 kN 31.1 kN	0.5 lb 2.2 N  2.2 N	±0.1% of applied load	Proform 67644	VS800W16- 00455	By: DRI Date: 6/1/2017 Due: 6/1/2018
	Platform Scales (Torrance)	1200 lb/platform 5338 N/platform	1 lb 4.4 N	0.5% of applied load	Intercomp SWI	1110M206352	By: DRI Date: 12/12/2017 Due: 12/12/2018
Handwheel Angle	Steering Angle Encoder (Automated Steering Controller)	±800 deg	0.25 deg	±0.25 deg	DRI Automatic Vehicle Controller using D-Space Micro- Autobox II	NA	Verified by DRI at installation <sup>1</sup>
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 km/h	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	015386	By: Oxford Technical Solutions Date: 6/21/2017 Due: 6/21/2019

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.

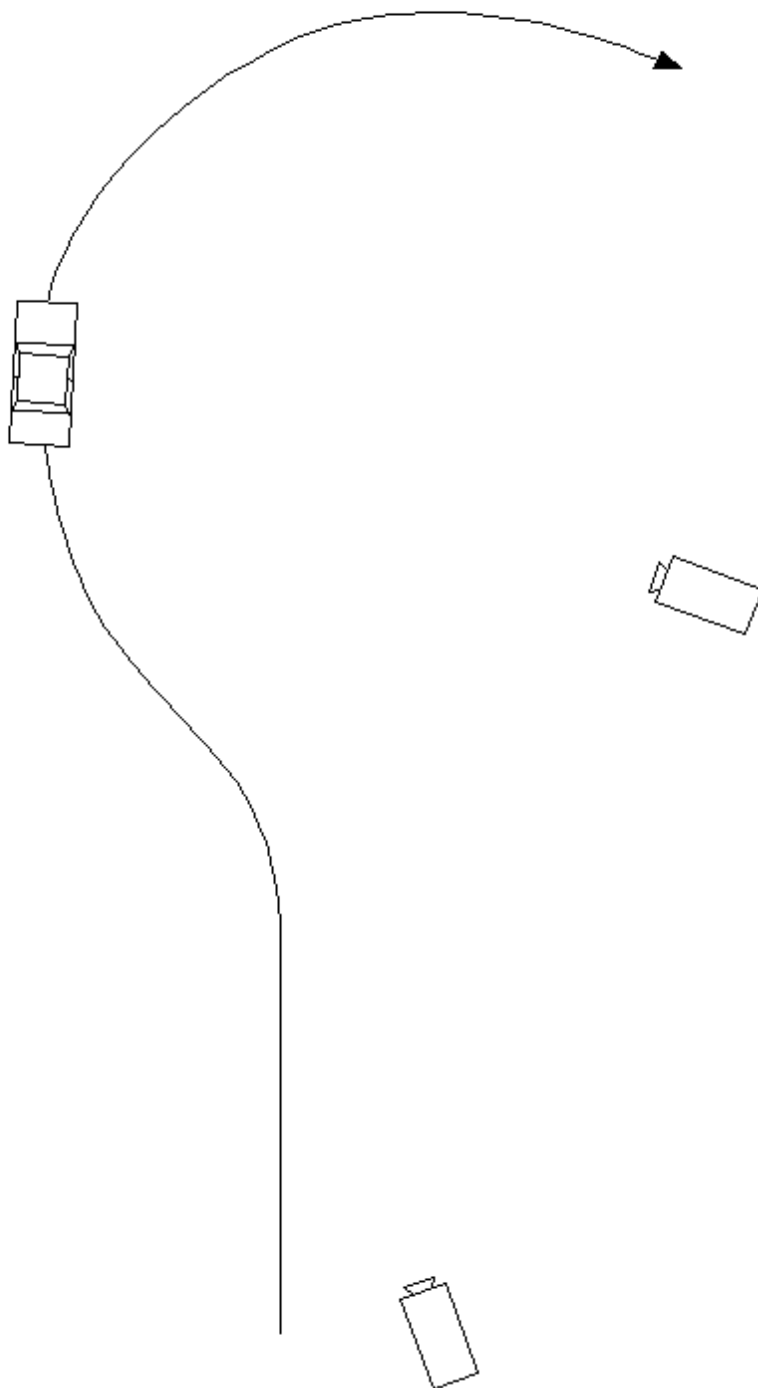


Figure 1. Nominal Position of Video Cameras for Fishhook Tests

### 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 3/7/2018. 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 ( $\pm 0.5$ ) psi at a test speed of 40 ( $\pm 0.5$ ) 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 5.

Table 5. Surface Friction

Date of surface friction measurements	3/7/2018
Average normalized lateral force	0.808

### 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 6.

Table 6. Handwheel Angles

0.3 g handwheel angle (from SIS tests at 50 mph)	27.9 °
5.5 scalar handwheel angle for Fishhook Test	153°
6.5 scalar handwheel angle for Fishhook Test	181 °



### 3. Weather Conditions

The weather conditions, recorded at the end of testing, are shown in Table 7.

Table 7. Weather Conditions

Ambient temperature	73.4 °F ( 23 °C)
Wind Speed	3 mph (1.3 m/s)
Wind Direction	W-NW

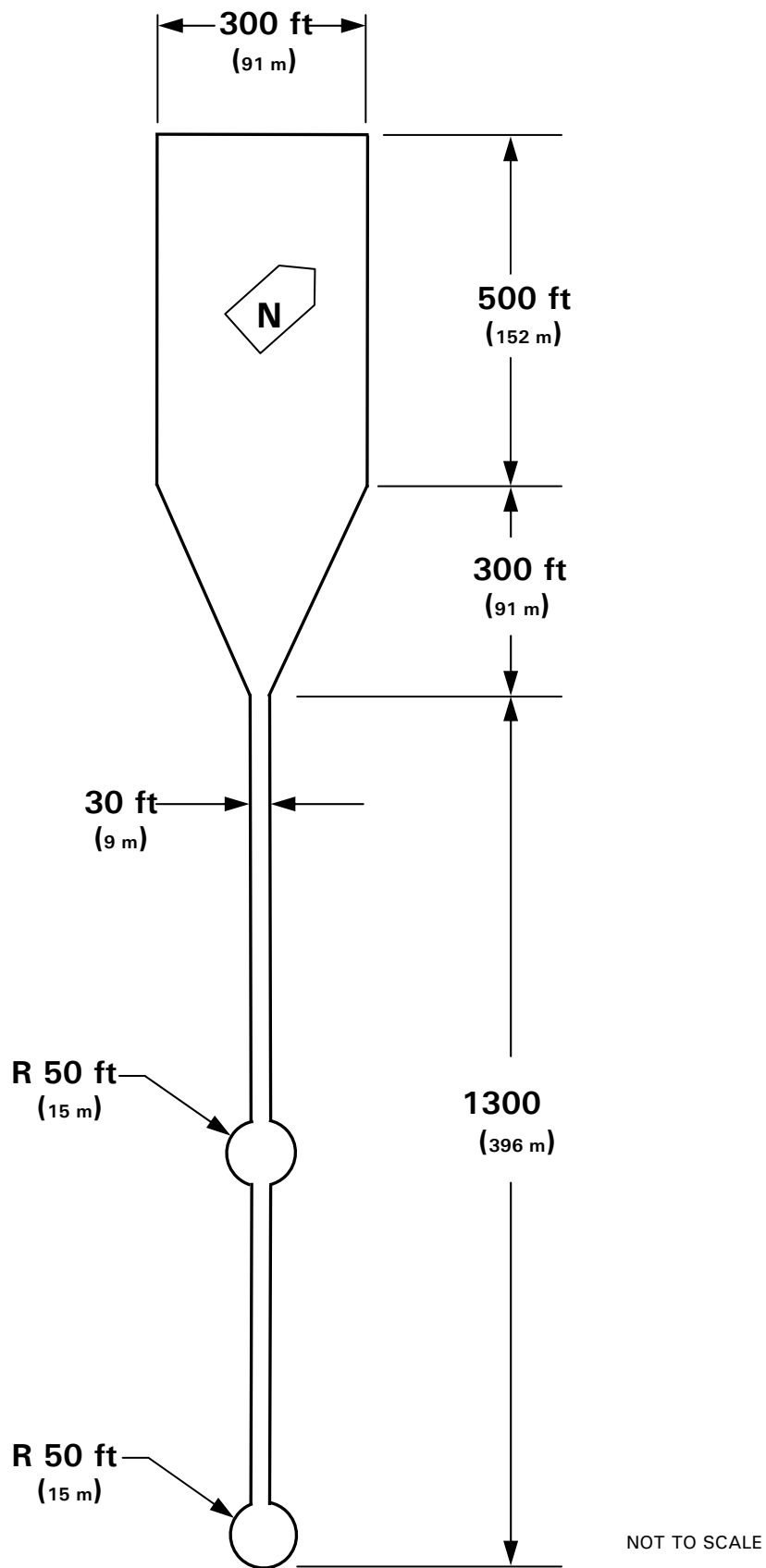


Figure 2. DRI-Minter Vehicle Dynamics Area

## 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. For the 2018 Ford EcoSport FWD, there was no two-wheel lift at any test condition.

APPENDIX A

Photographs

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**VEHICLE DESCRIPTION**  
**ECOSPORT**  
2016 ECOSPORT SE FWD  
5-PASSENGER  
1.0L ECOBOOST ENGINE  
6-SPD AUTO TRANS W/SLCTSHFT

**EXTERIOR**  
WHITE PLATINUM MET TRI-COAT  
**INTERIOR**  
EBONY BLACK CLOTH SEATS

**STANDARD EQUIPMENT INCLUDED AT NO EXTRA CHARGE**

<p><b>EXTERIOR</b></p> <ul style="list-style-type: none"> <li>• ACOUSTIC-LAMINATE WINDSHLD</li> <li>• ACTIVE GRILLE SHUTTERS</li> <li>• EASY FUEL CAPLESS FILLER</li> <li>• FOG LAMPS</li> <li>• HEADLAMPS - AUTO HALOGEN</li> <li>• LED SIGNATURE LIGHTING</li> <li>• MIRRORS - POWER GLASS/</li> <li>• MANUAL-FOLD/TURN SIGNALS</li> <li>• MOONROOF - POWER</li> <li>• PRIVACY GLASS - REAR DOORS</li> <li>• REAR INT WIPER/WASH/DPRST</li> <li>• ROOF RACK SIDE RAILS</li> <li>• SWING GATE REAR DOOR</li> <li>• TOW HOOKS</li> <li>• TRAILER TOW PREP WIRING</li> </ul>	<p><b>INTERIOR</b></p> <ul style="list-style-type: none"> <li>• 1-TOUCH UP/DOWN DRIVER WIN</li> <li>• 2ND ROW 60/40 FLIP-UP/</li> <li>• SPLIT FOLD-FLAT SEATS</li> <li>• ELECTRONIC AUTO TEMP CTRL</li> <li>• FLOORMATS - 1ST AND 2ND ROW</li> <li>• ILLUMINATED ENTRY SYSTEM</li> <li>• LTHR WRAP WHEEL/SHFT KNOB</li> <li>• MANUAL PASS SEAT - 4-WAY</li> <li>• POWER DRIVER SEAT - 6-WAY</li> <li>• POWERPOINTS - 12V</li> <li>• SLDNG-VISORS/ILLUM MIRROR</li> <li>• SMART CHARGING USB PORT(2)</li> <li>• STEERING-TILT/TELESCOPE</li> <li>• CRUISE &amp; AUDIO CONTROLS</li> <li>• UNIQUE CLTH/HTD FRT SEATS</li> </ul>	<p><b>FUNCTIONAL</b></p> <ul style="list-style-type: none"> <li>• AM/FM WITH MP3</li> <li>• AUTO START STOP TECH</li> <li>• BRAKES, 4-WHEEL DISC/ABS</li> <li>• HILL START ASSIST</li> <li>• INTELLIGENT ACCESS W/PUSH</li> <li>• BUTTON START</li> <li>• MYKEY®</li> <li>• POWER STEERING W/EPS</li> <li>• REAR VIEW CAMERA</li> <li>• REVERSE SENSING SYSTEM</li> <li>• SIRIUSXM® - SVC N/A AKAH1</li> <li>• SYNC® 3</li> </ul>
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**INCLUDED ON THIS VEHICLE (MSRP)**

2010 MODEL YEAR	595.00
WHITE PLATINUM MET TRI-COAT EQUIPMENT GROUP 200A	
16" SHADOW SLVR-PNTD ALM WHLS	
P205/60R16 A/S BSW TIRES	NO CHARGE
50 STATE EMISSIONS	1,795.00
SE CONVENIENCE PACKAGE	
NAVIGATION W/8" TOUCHSCREEN	
FRONT LICENSE PLATE BRACKET	NO CHARGE

**OPTIONAL EQUIPMENT/OTHER (MSRP)**

PRICE INFORMATION	(MSRP)
BASE PRICE	\$22,905.00
TOTAL OPTIONS/OTHER	2,390.00
TOTAL VEHICLE & OPTIONS/OTHER DESTINATION & DELIVERY	25,295.00
TOTAL BEFORE DISCOUNTS SE CONVENIENCE PKG DISC	- 500.00
TOTAL SAVINGS	- 500.00

SOLD TO	RAMP ONE	DEALER NO.	<b>TOTAL MSRP \$25,790.00</b>
	CD7T		
SHIP TO (IF OTHER THAN SOLD TO)	RAMP TWO	FINAL ASSEMBLY PLANT	This label is affixed pursuant to the Federal Automobile Information Disclosure Act. Gasoline, License, and Title Fees, State and Local taxes are not included. Dealer installed options or accessories are not included unless listed above.
		CHENNAI	
SHIP THROUGH	METHOD OF TRAIHERP	ITEM #: 71-2600 O/T 2	
	CONVOY		

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combined city/hwy  
27 city  
29 highway  
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**You save \$250** in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel cost \$1,300**

**Fuel Economy & Greenhouse Gas Rating** (tailpipe only) Smog Rating (tailpipe only)

1 6 10 1 3 10  
Best Best

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**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.

<b>Frontal Crash</b>	Driver Passenger	Not Rated
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.		
<b>Side Crash</b>	Front seat Rear seat	Not Rated
Based on the risk of injury in a side impact.		
<b>Rollover</b>		Not Rated
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](http://www.safercar.gov) or 1-888-327-4236

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Figure A1. Window Sticker





Figure A2. Front View, Test Vehicle as Delivered



Figure A3. Rear View, Test Vehicle as Delivered



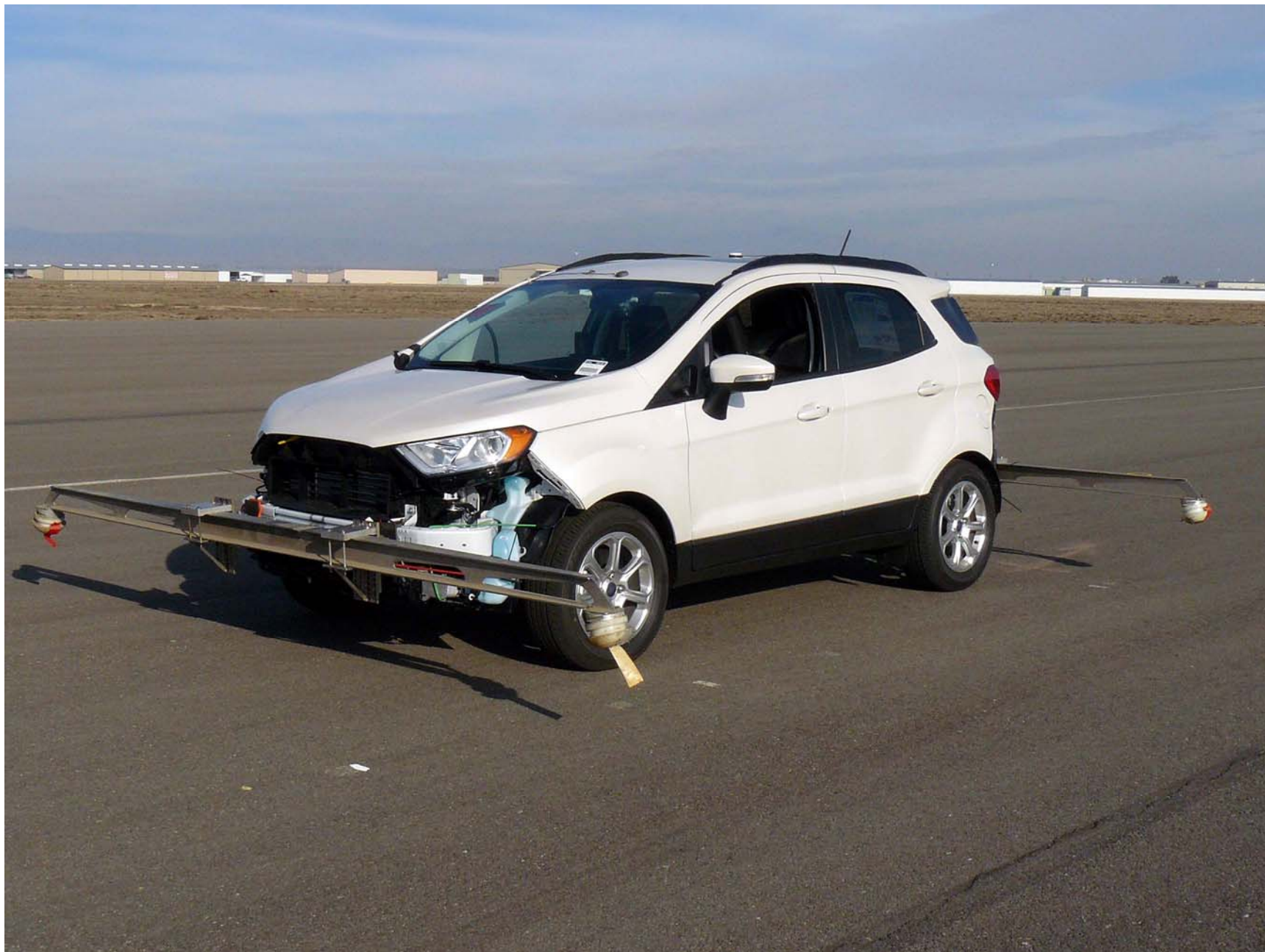


Figure A4. Front View, Test Vehicle in Test Condition



Figure A5. Rear View, Test Vehicle in Test Condition





Figure A6. Instrumentation in Test Vehicle



Figure A7. Steering Controller and Computer





Figure A8. Ballast Condition

APPENDIX B

Test Run Log

Vehicle: **2018 Ford EcoSport FWD**Driver: **John Partridge**Date: **3/7/2018**

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
1	Tire Warm-Up	35	40	Right	NA	Resulted in ay = 0.32g
2			60		NA	Resulted in ay = 0.51g
3					NA	
4					NA	
5					NA	
6					NA	2x SWA last cycle
7	Static	0	0		NA	
8	Steady State	50	0		NA	
9	Slowly Increasing Steer	50	30	Left	NA	Resulted in ay = 0.37g
10			50	Left	NA	Resulted in ay = 0.58g
11				Left	NA	
12				Left	NA	
13				Right	NA	
14				Right	NA	
15				Right	NA	
16	6.5 Scalar Fishhook	35	181	Left	No	
17		40			No	
18		45			No	
19		47.5			No	
20		50			No	
21	5.5 Scalar Fishhook	45	153	Left	No	
22		47.5			No	
23		50			No	

Vehicle: **2018 Ford EcoSport FWD**Driver: **John Partridge**Date: **3/7/2018**

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
24	6.5 Scalar Fishhook	35	181	Right	No	
25		40			No	
26		45			No	
27		47.5			No	
28		50			No	
29	5.5 Scalar Fishhook	45	153	Right	No	
30		47.5			No	
31		50			No	



APPENDIX C

Slowly Increasing Steer Test Worksheet

## NCAP, 2018 Ford EcoSport FWD , Multi-Passenger Load, Test Date: 3/7/2018

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
7	Left	50.8	0.0	100.0	1116	-29.9	-0.299	-194.1	-0.2696	-164.3	-0.2282	0.9975	475	675
8	Left	49.4	0.0	100.0	1138	-32.1	-0.313	-208.4	-0.2894	-176.3	-0.2449	0.9955	505	705
9	Left	50.7	-0.1	100.1	1116	-29.7	-0.301	-192.8	-0.2678	-163.2	-0.2266	0.9962	505	705
10	Right	50.1	0.9	98.2	1148	30.8	0.301	200.1	0.2779	169.3	0.2352	0.9977	480	680
11	Right	50.2	-0.1	100.1	1155	32.8	0.302	213.2	0.2961	180.4	0.2505	0.9970	512	712
12	Right	50.4	0.6	98.8	1136	30.1	0.297	195.9	0.2721	165.8	0.2303	0.9966	491	691

Mean: 30.9 0.302 201 0.279 170 0.236

## Steering Controller Input Values

## Scalar 6.5 values:

Initial HW angle: 201 deg  
Initial time: 0.279 s  
Reversal HW angle: -201 deg  
Reversal time: 0.558 s

## Scalar 5.5 values:

Initial HW angle: 170 deg  
Initial time: 0.236 s  
Reversal HW angle: -170 deg  
Reversal time: 0.472 s

## APPENDIX D

### Time History Plots

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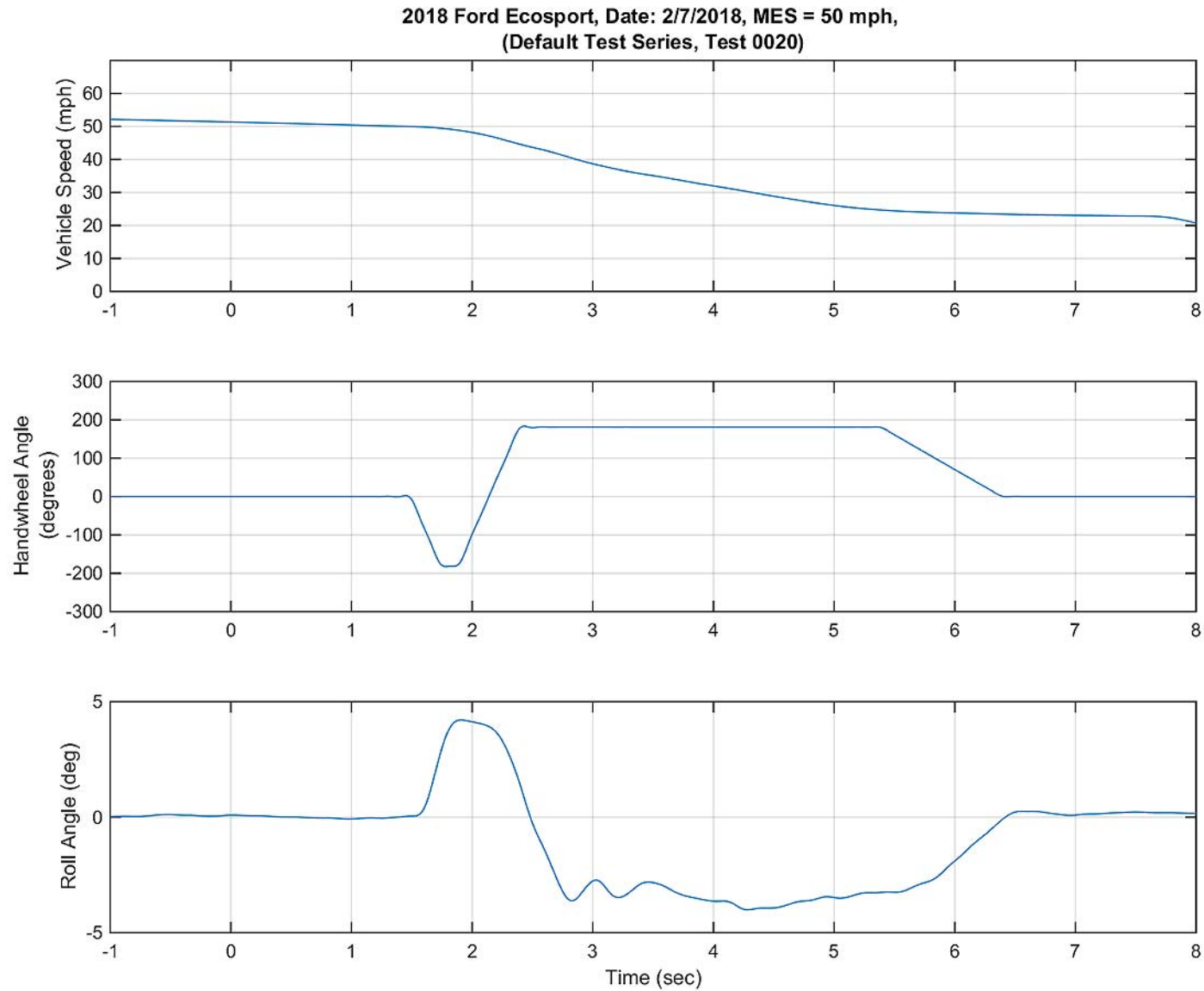


Figure D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph

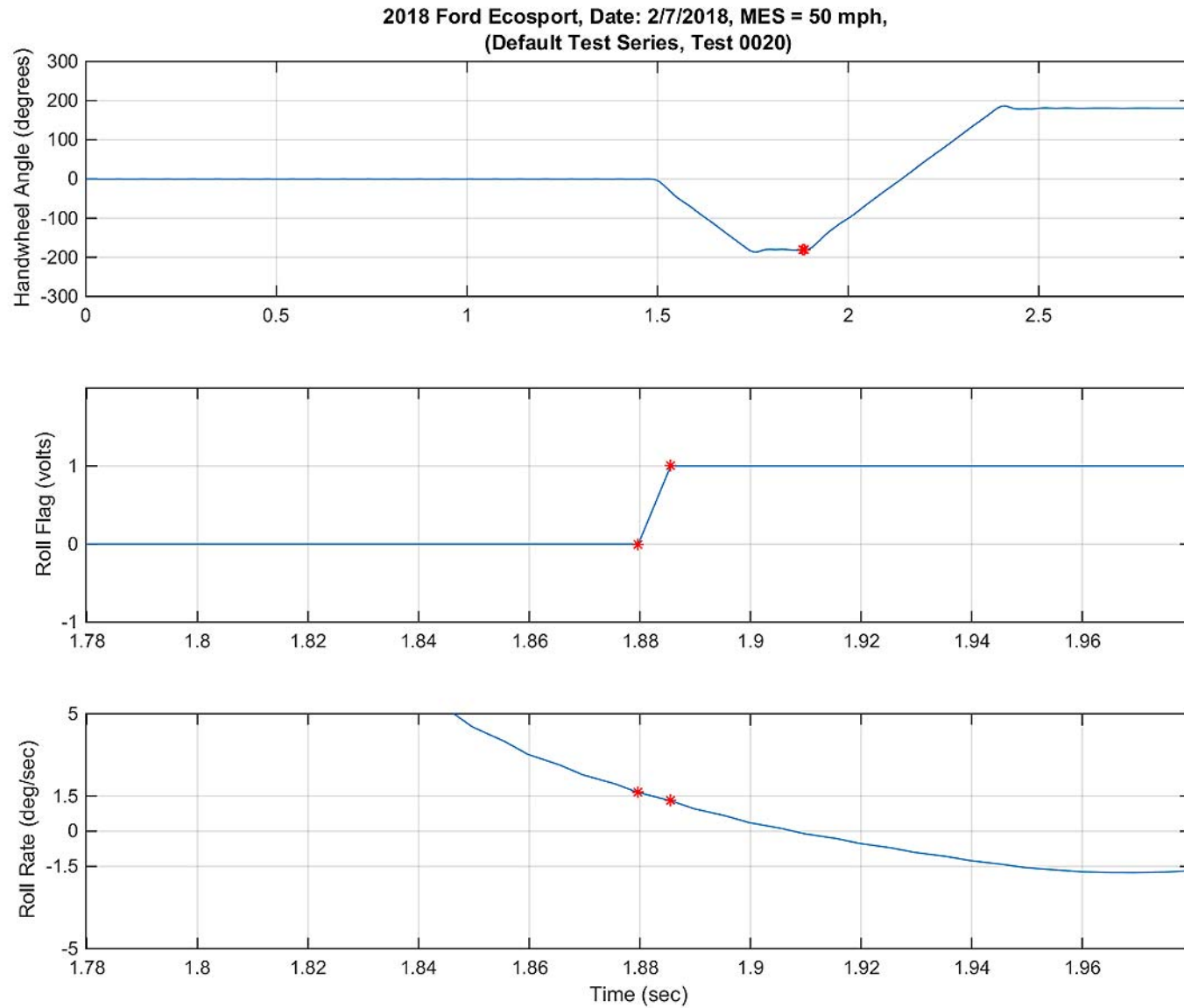


Figure D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph

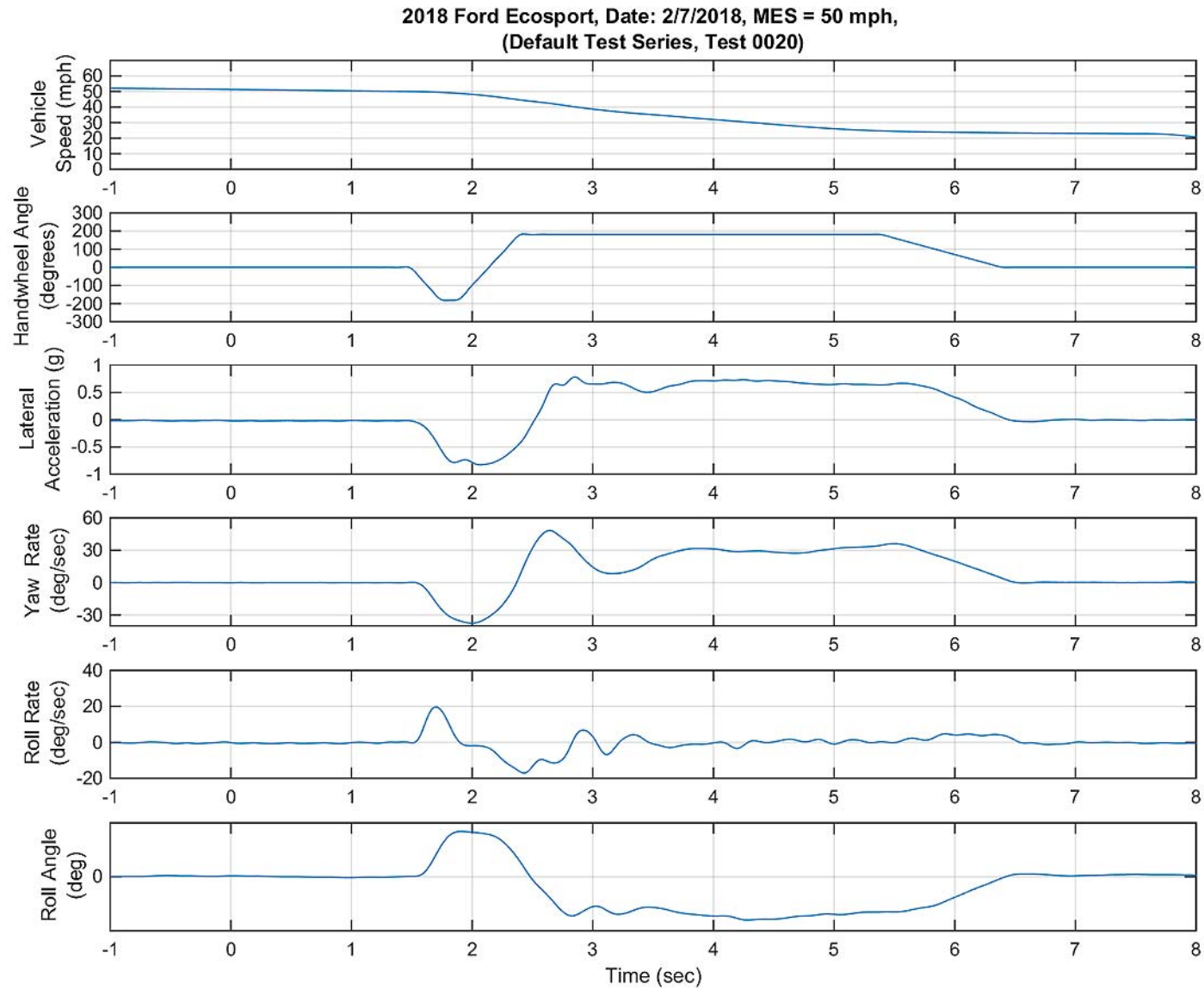


Figure D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots For Default Test Series, L-R, 50 mph

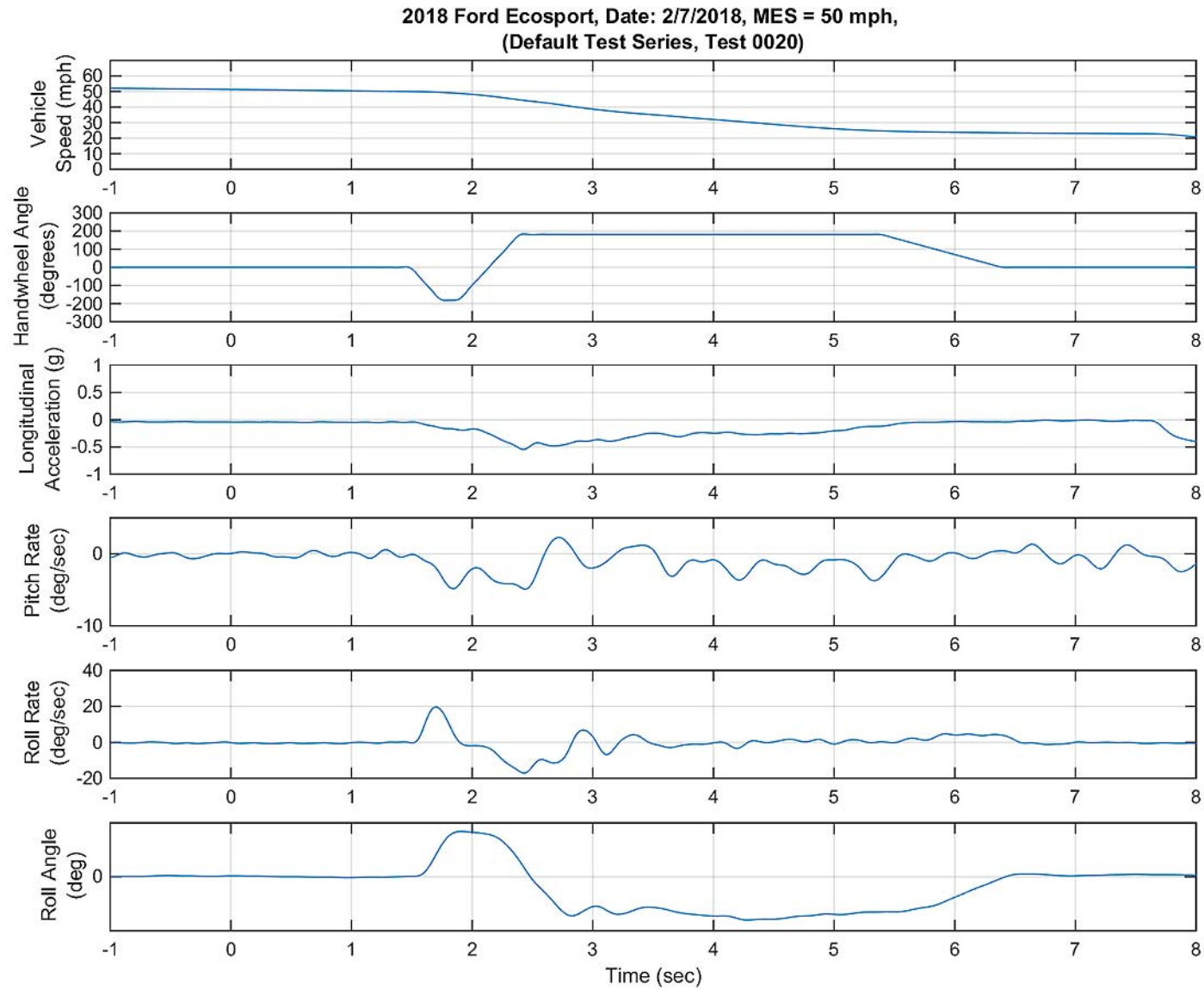


Figure D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph



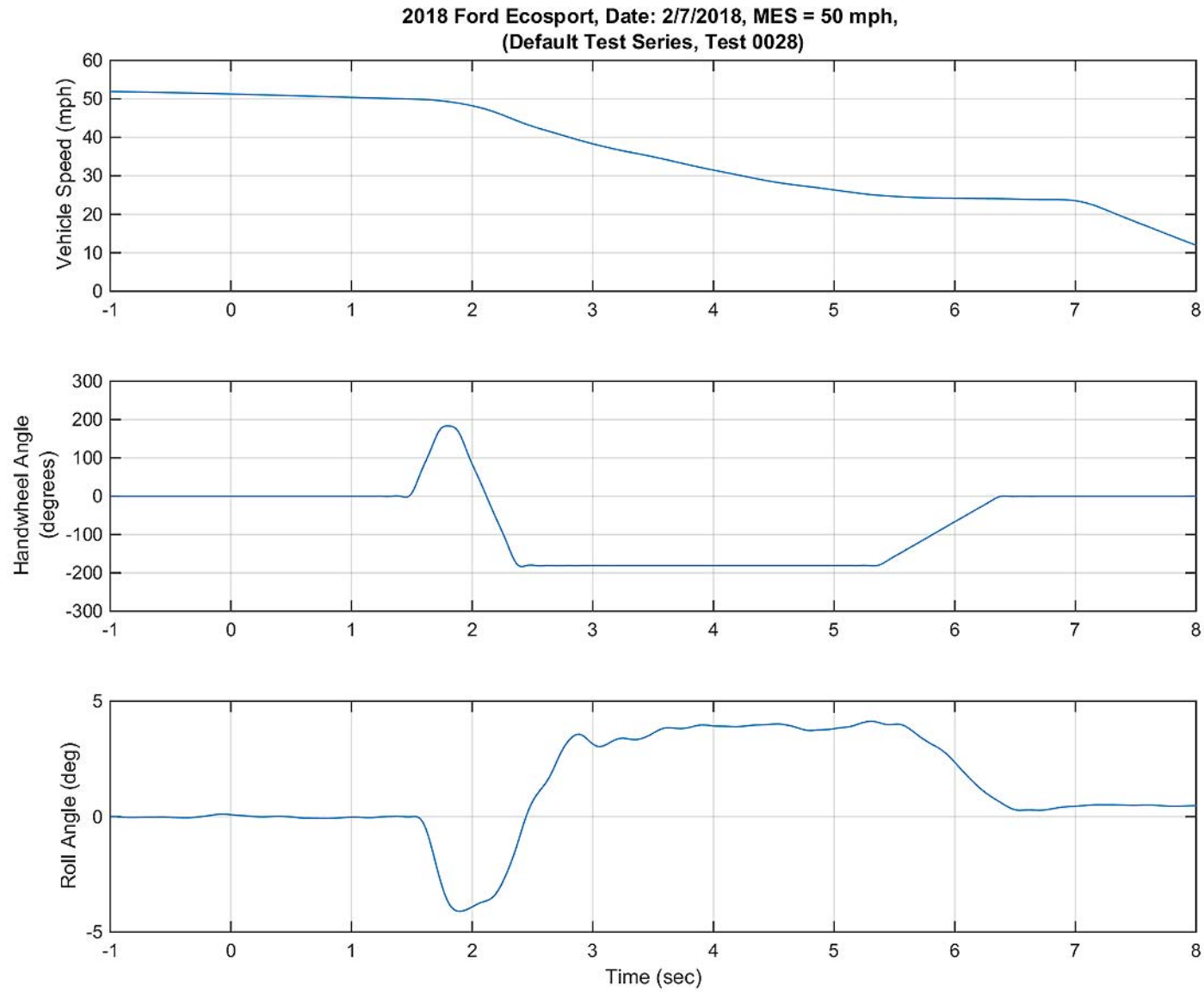


Figure D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph

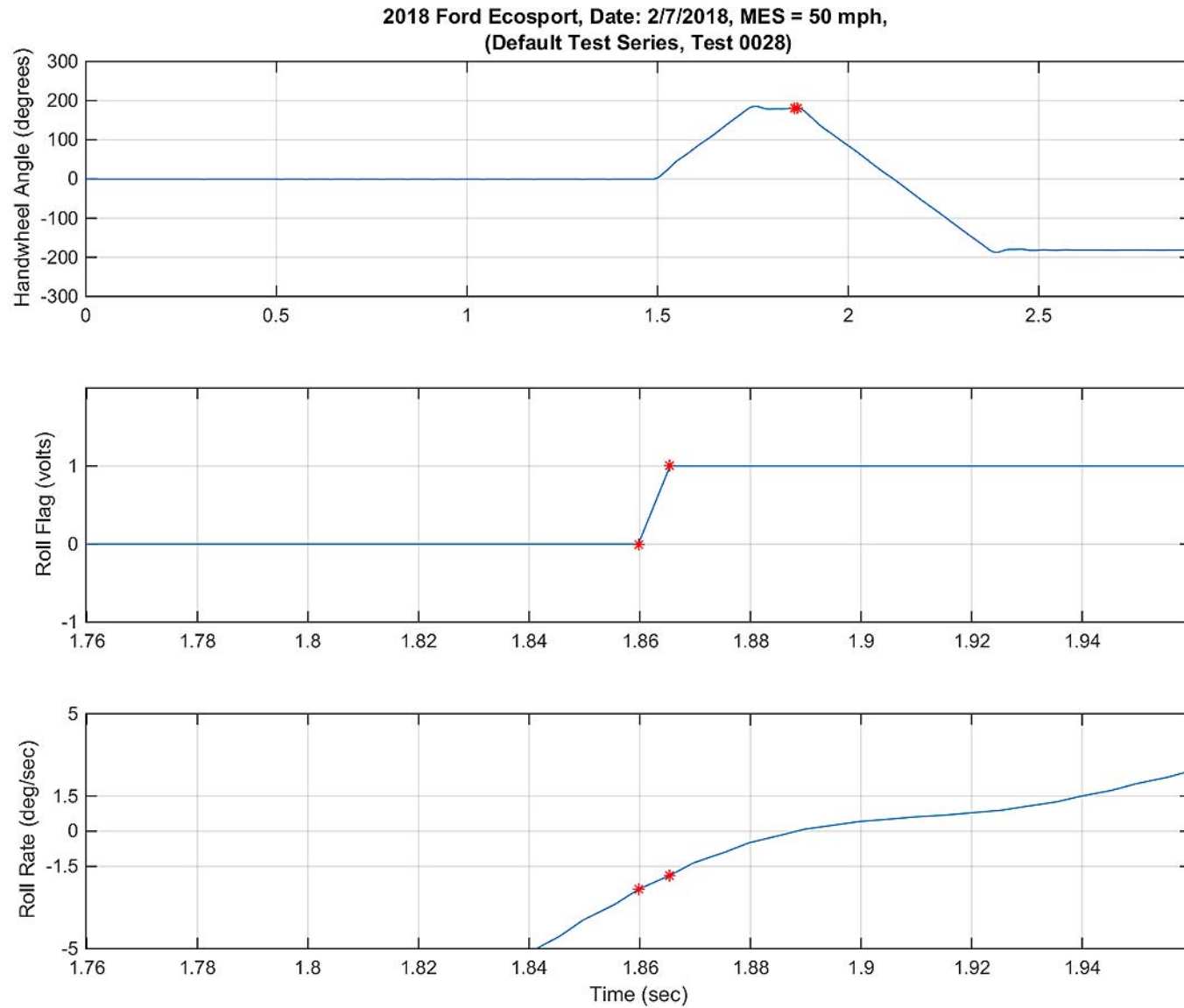


Figure D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph

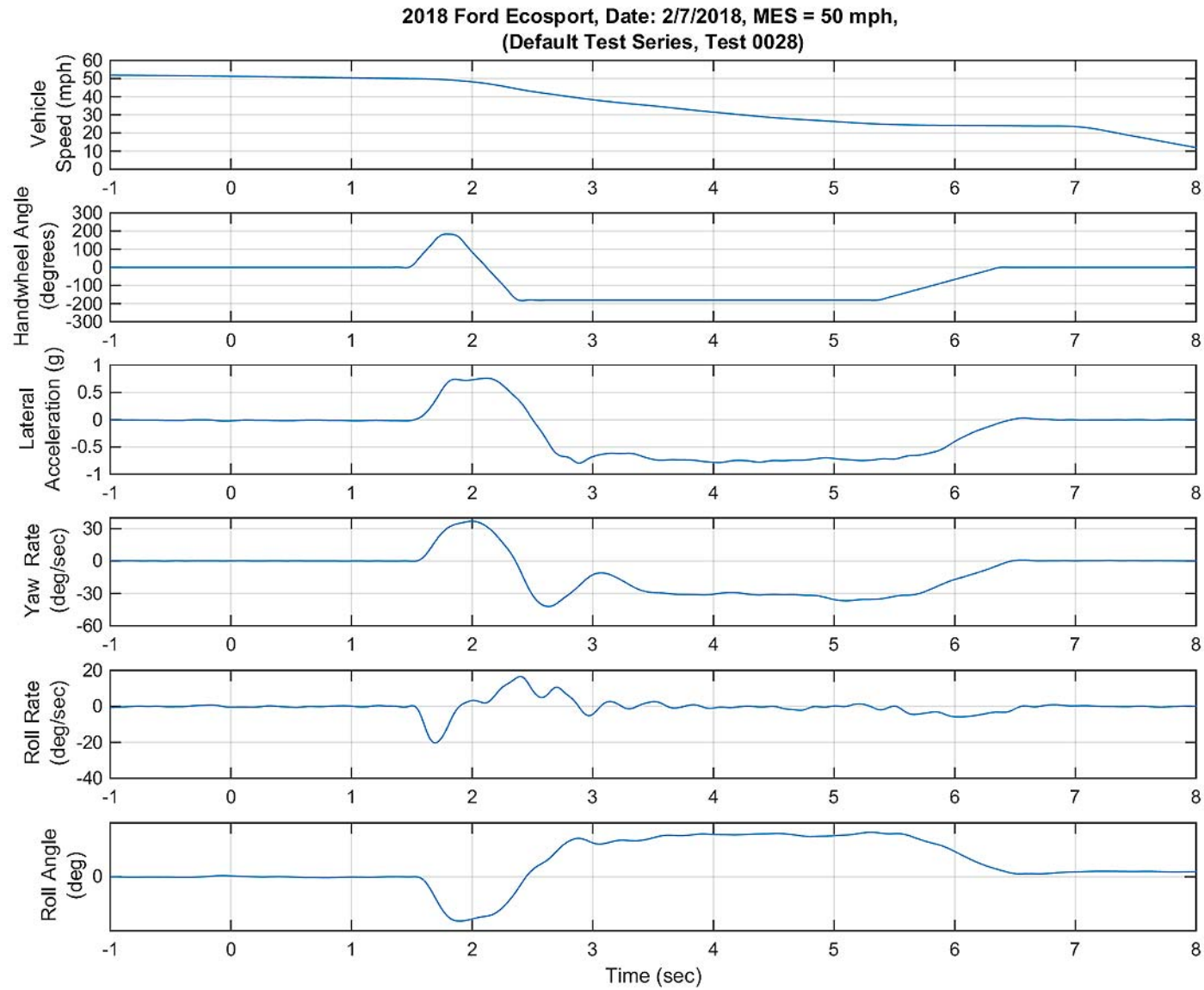


Figure D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph

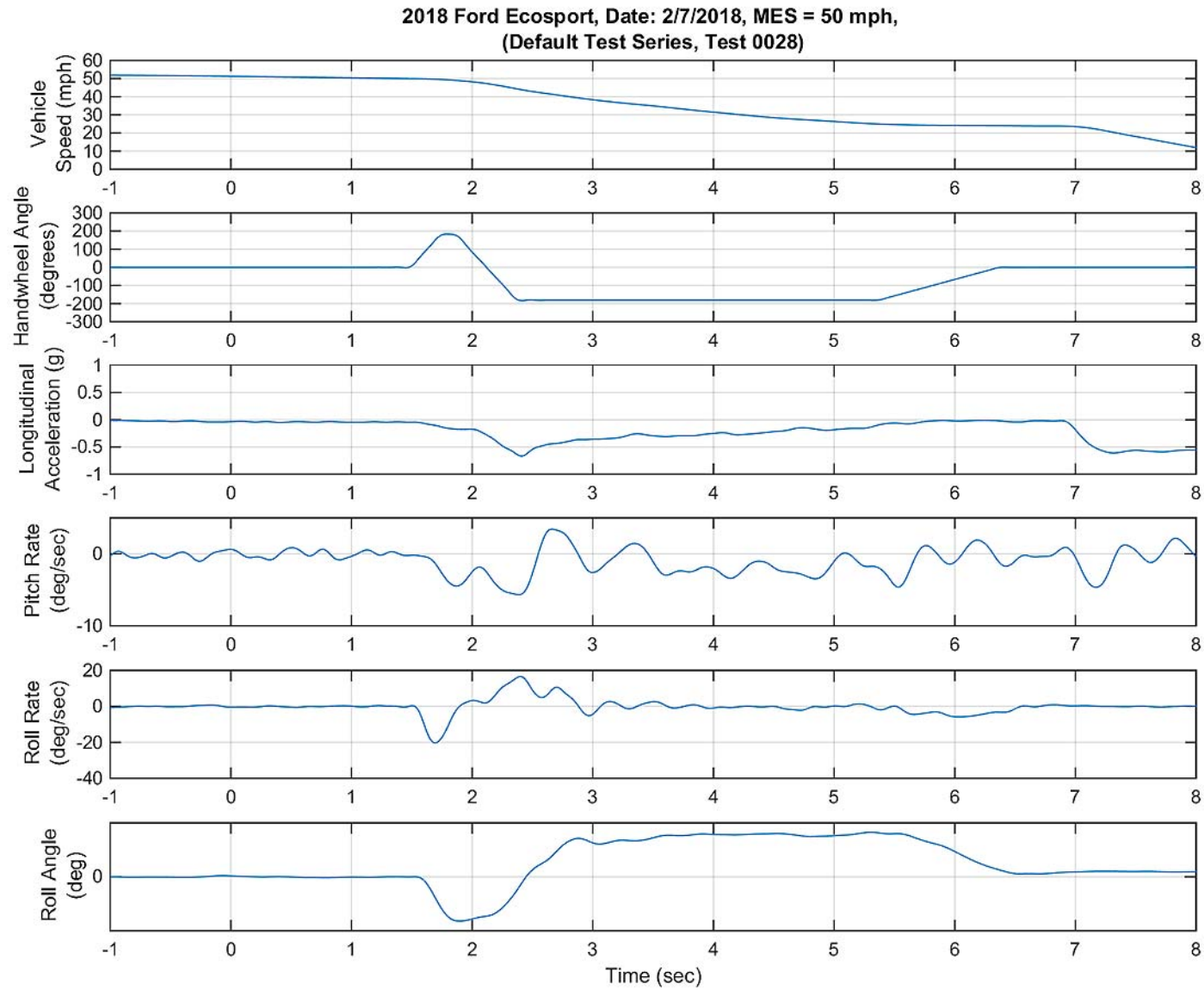


Figure D8. Pitch Rate and Longitudinal Acceleration Time History Plots or Default Test Series, R-L, 50 mph

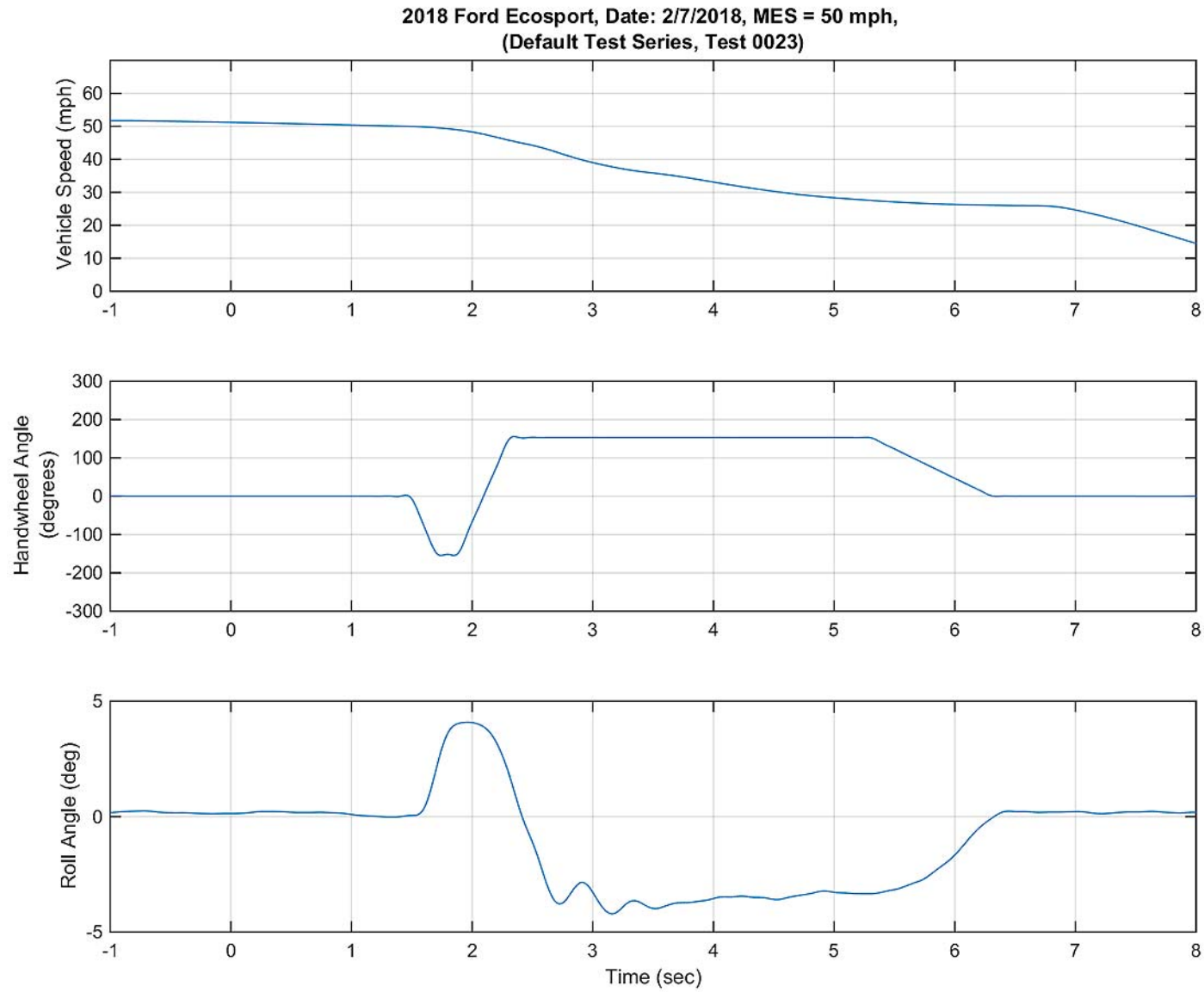


Figure D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

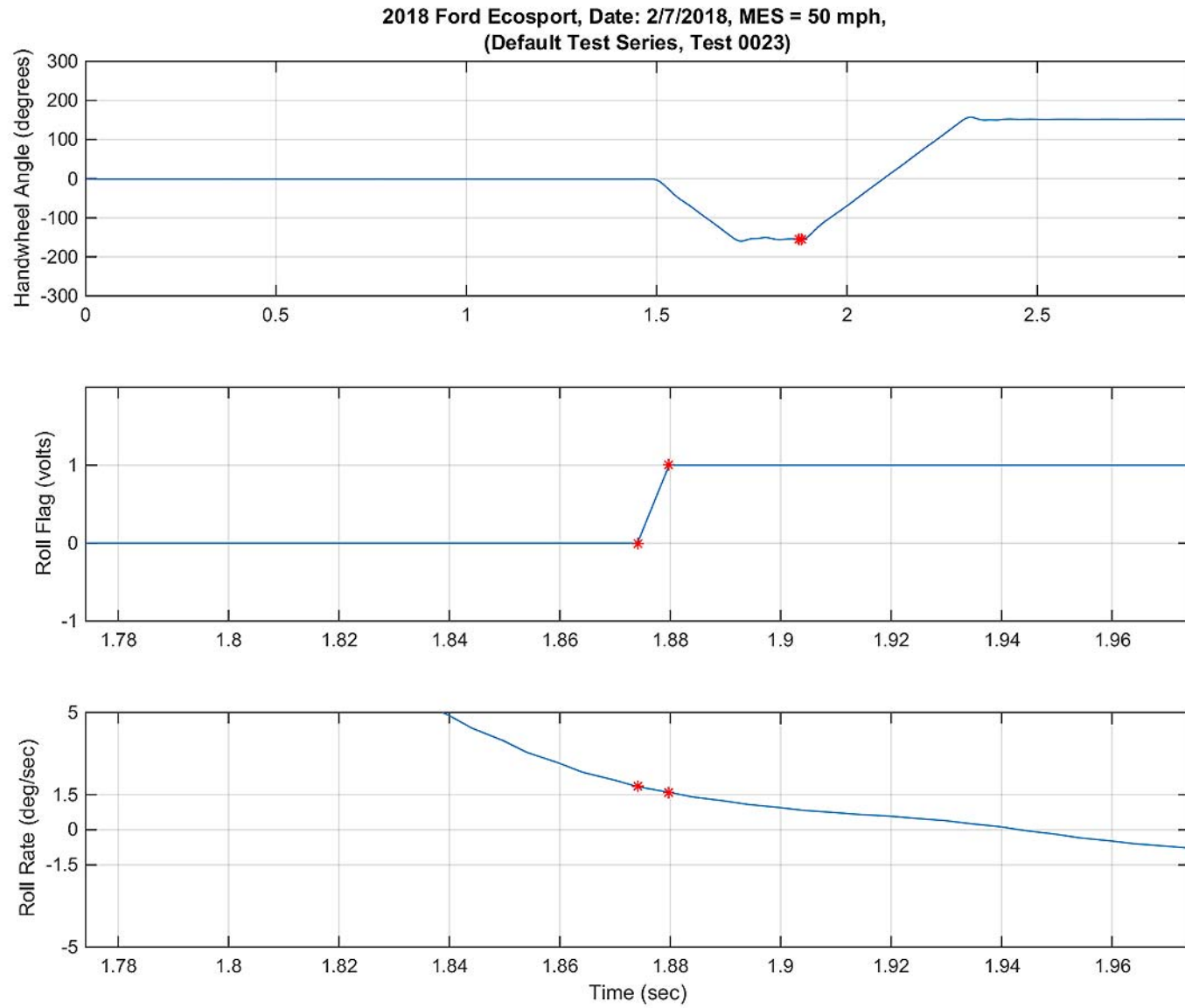


Figure D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

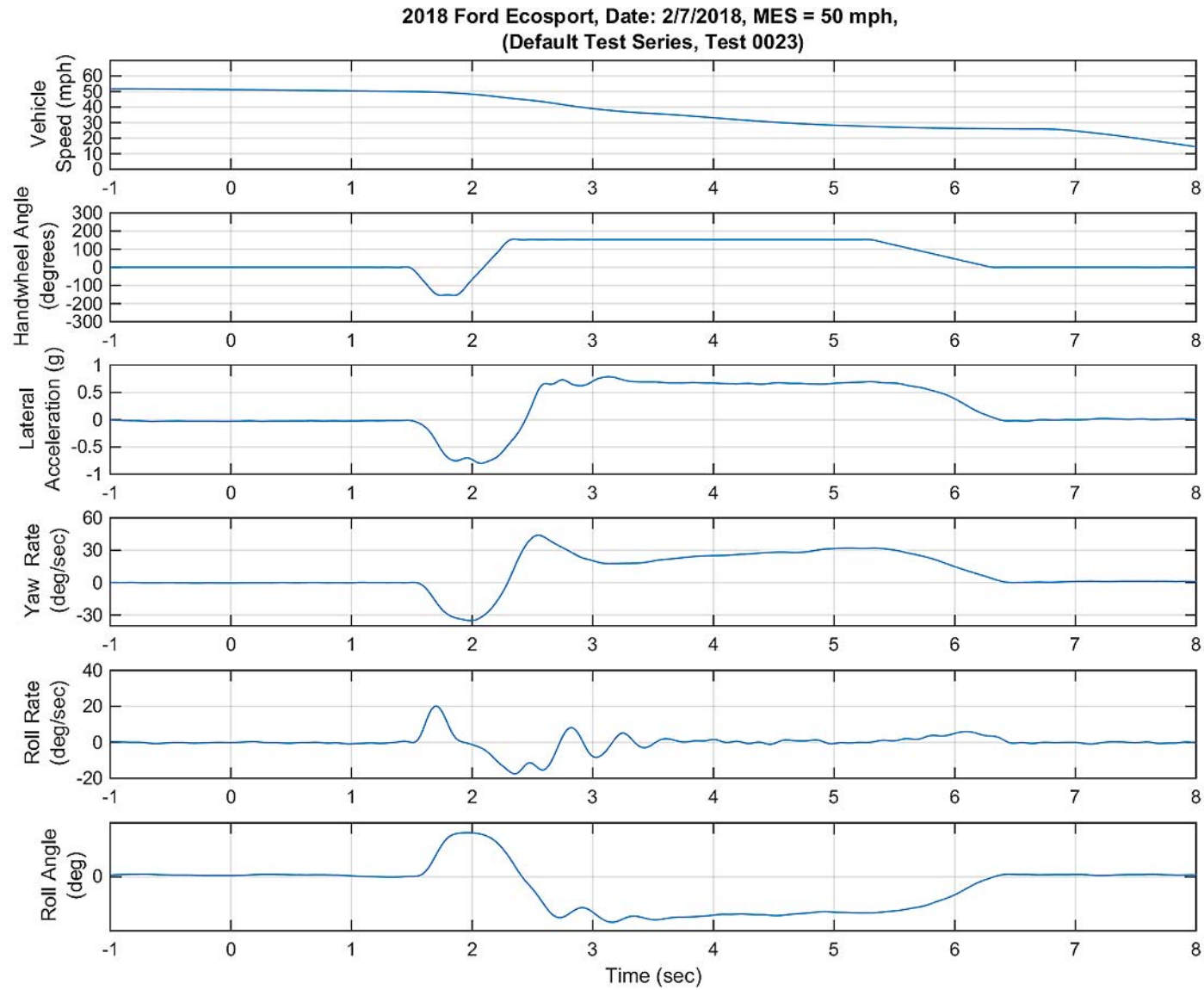


Figure D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

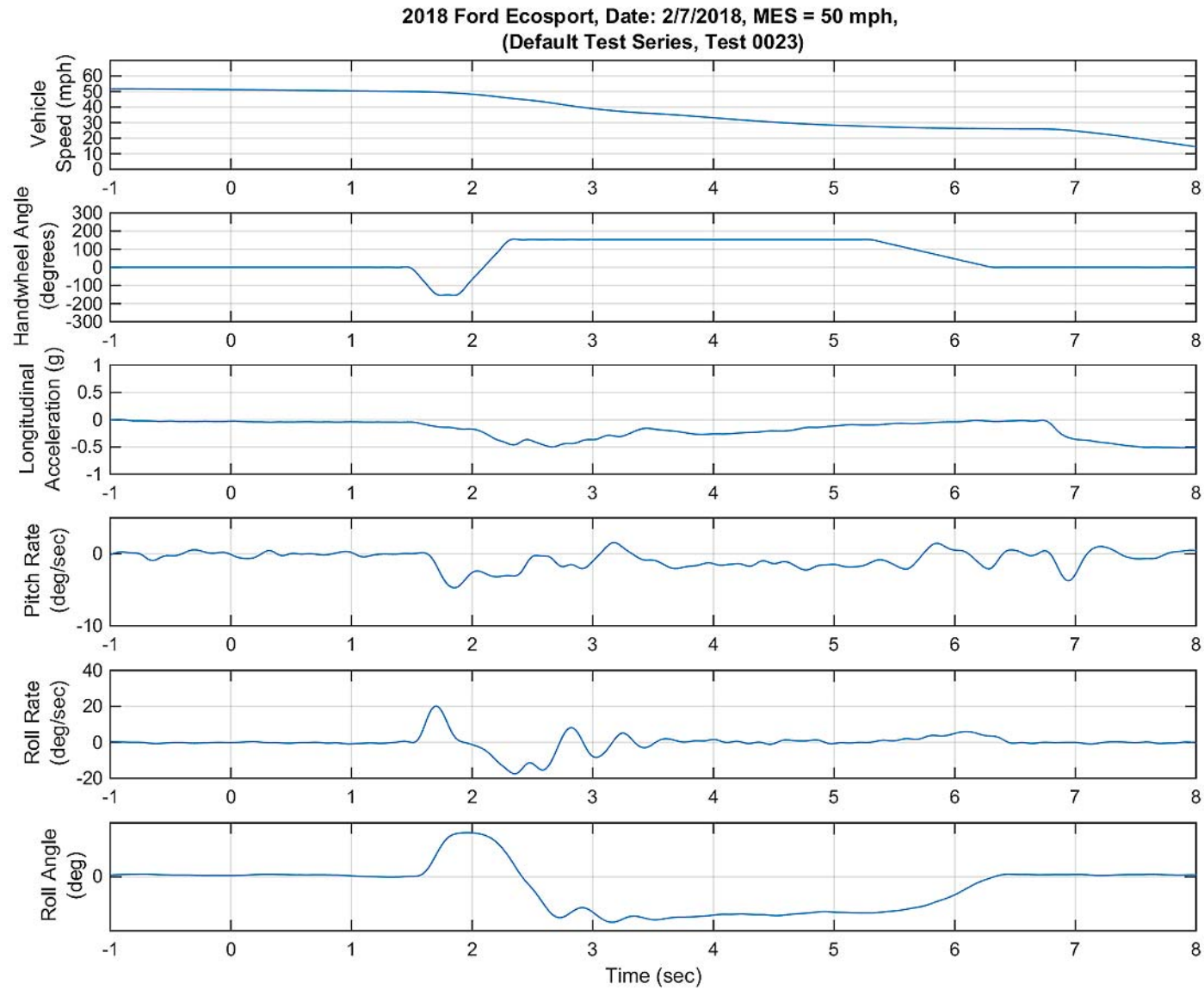


Figure D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph



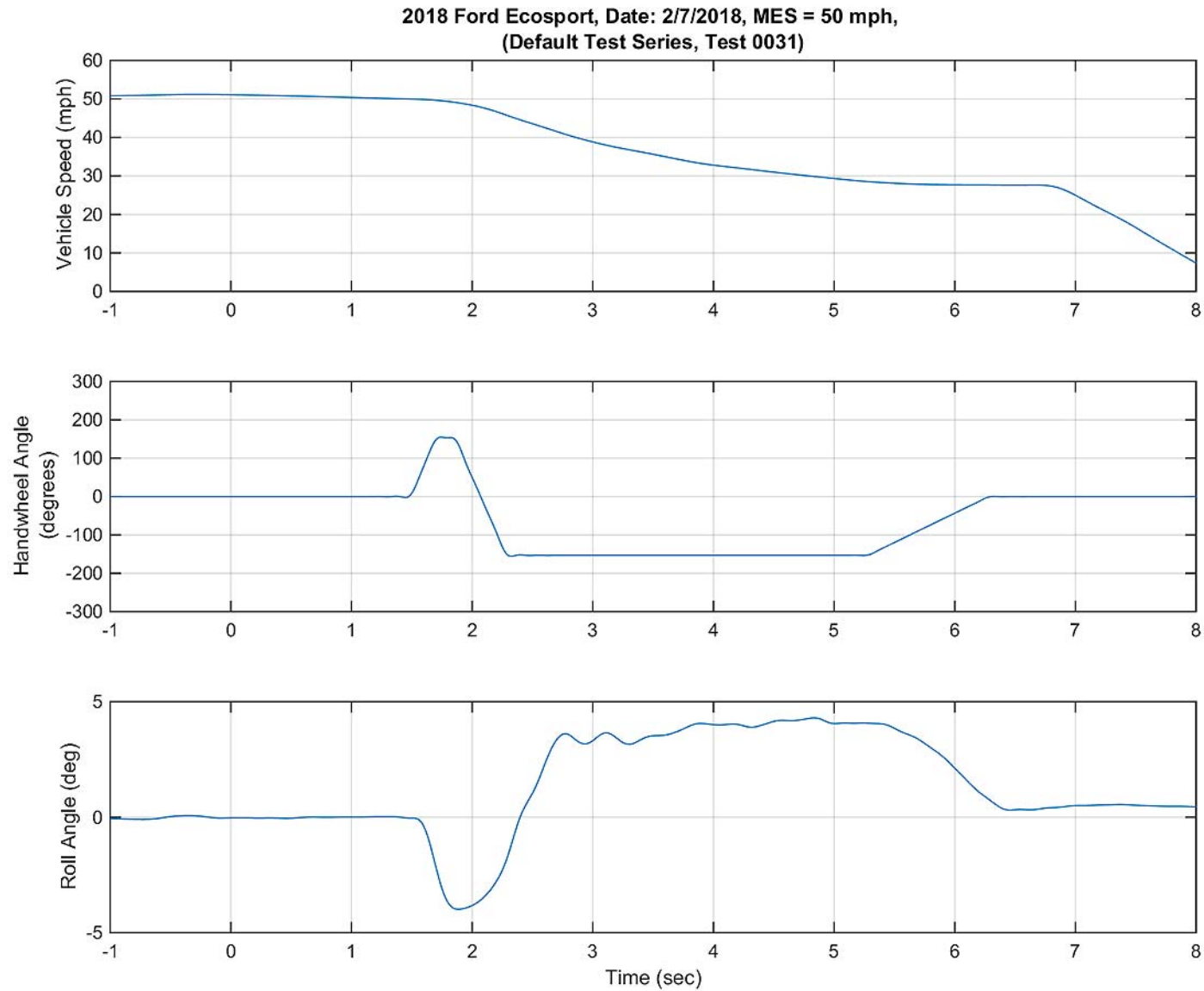


Figure D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

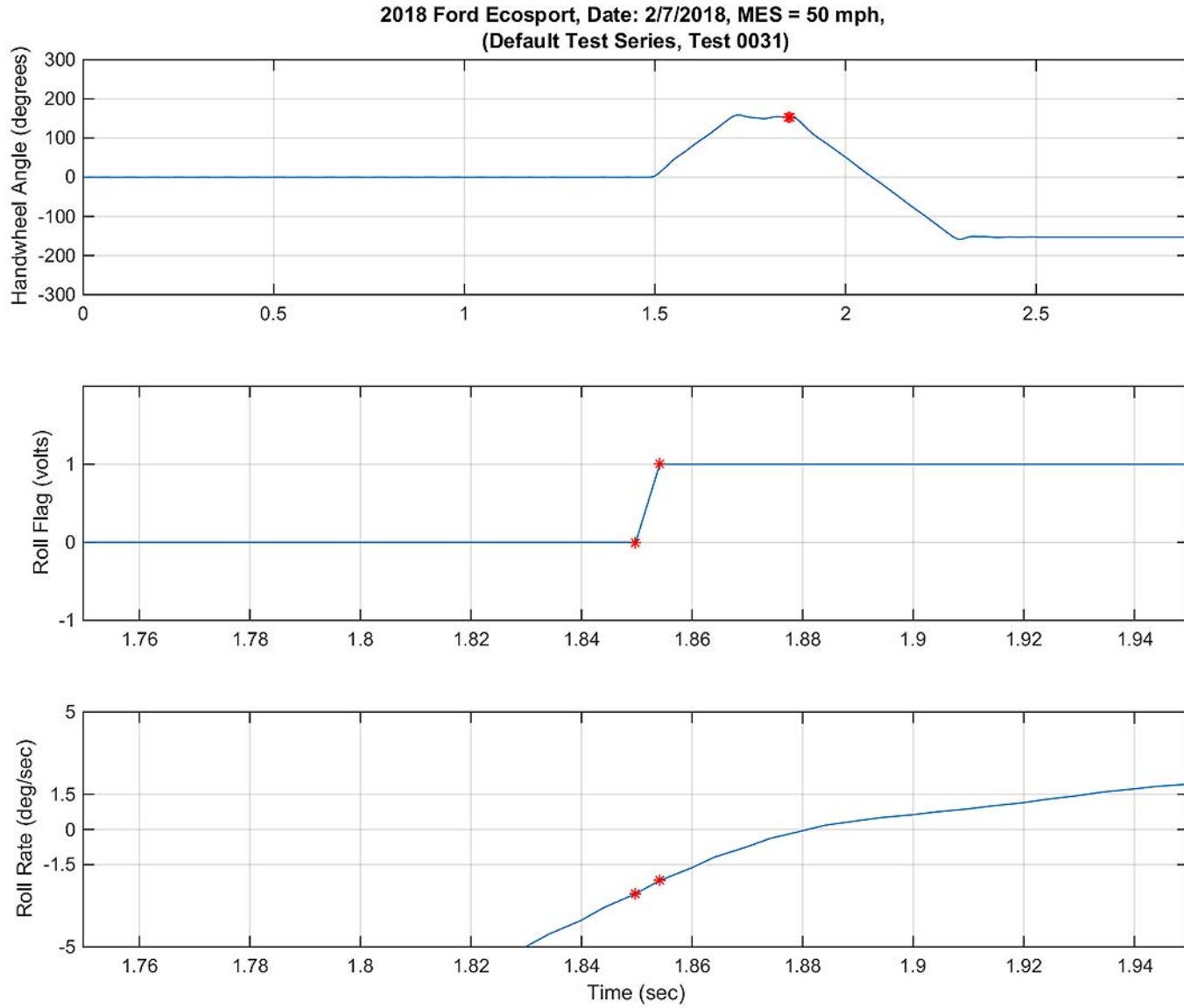


Figure D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

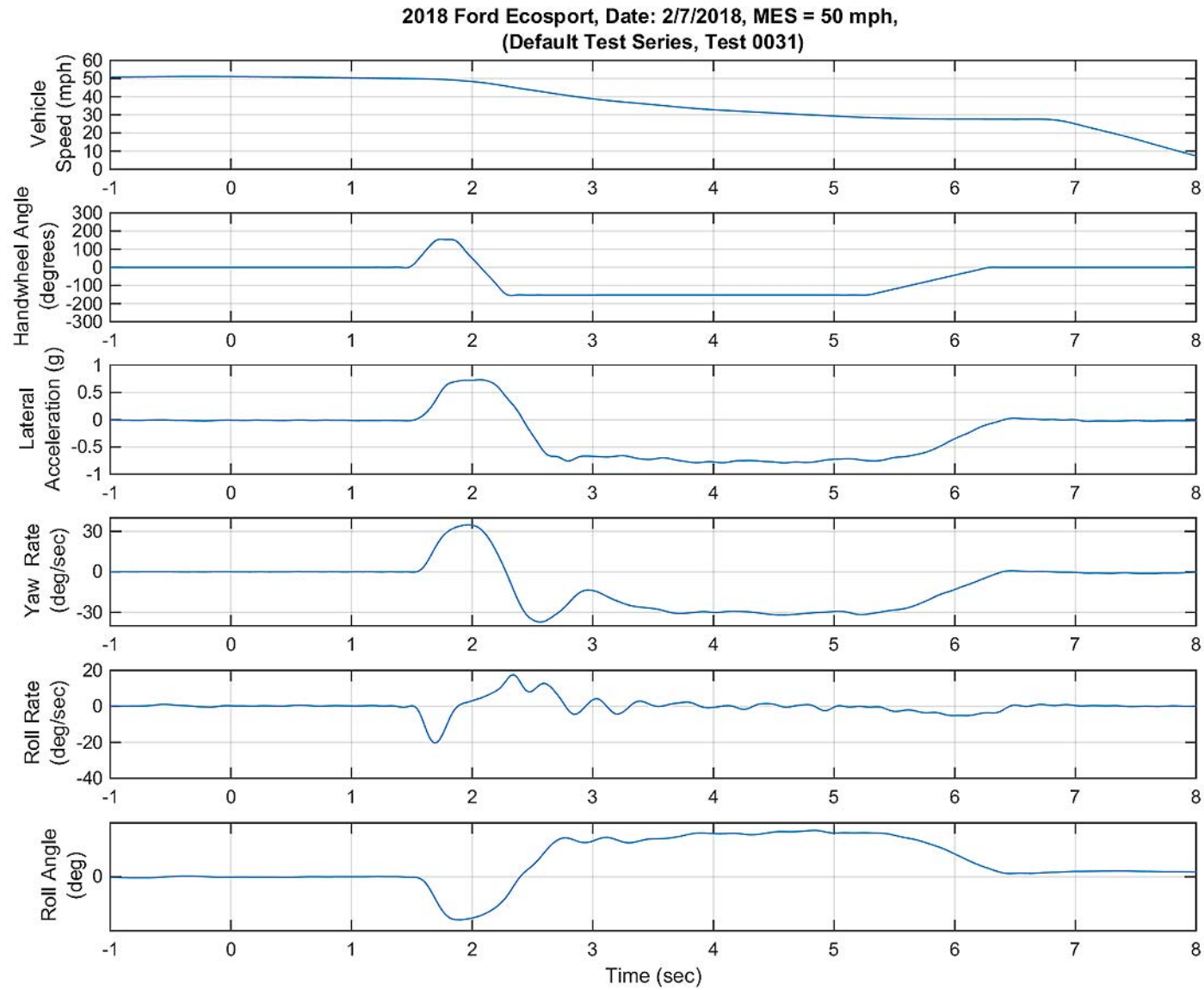


Figure D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

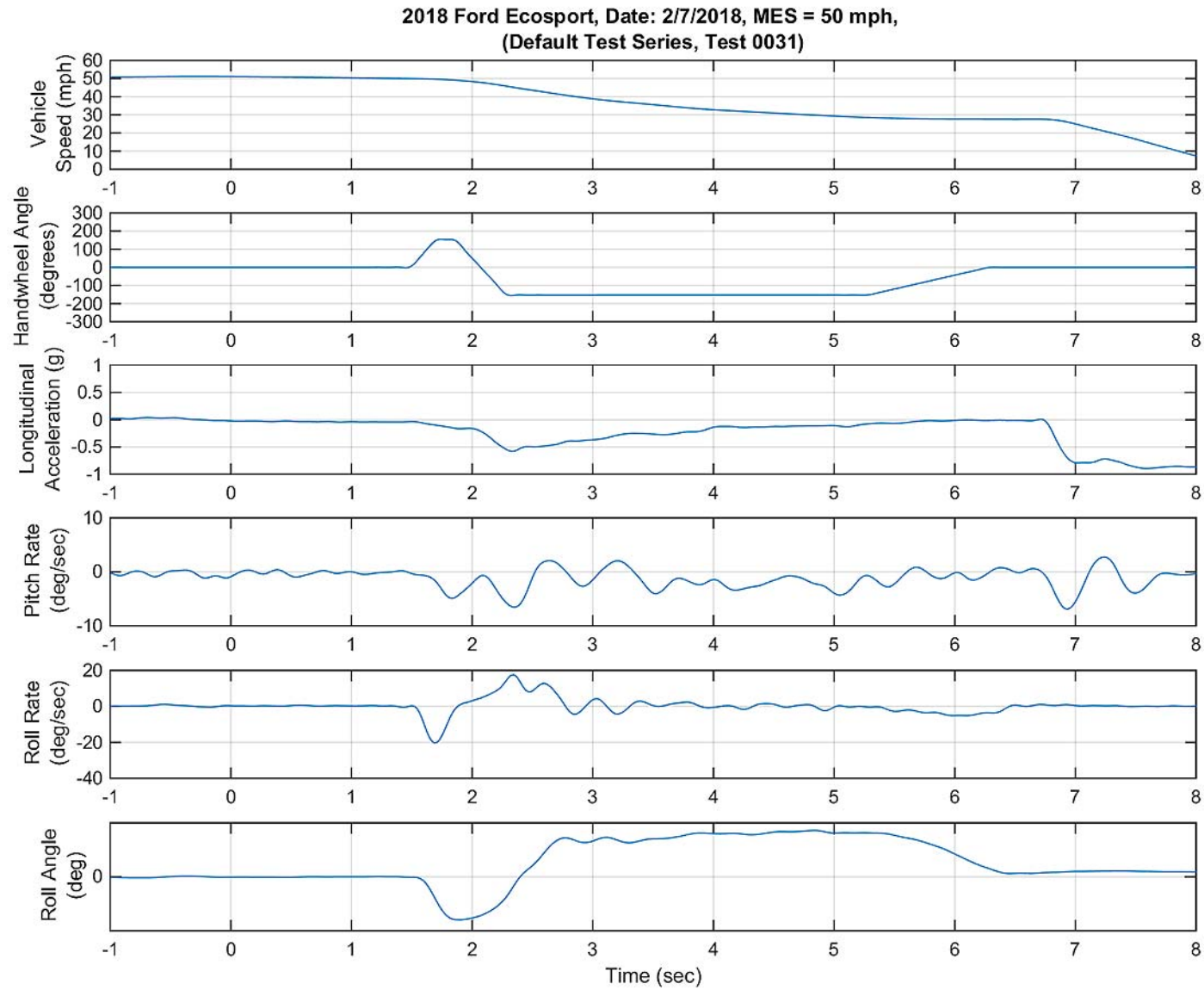


Figure D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph