

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

FORD MOTOR CO.
2020 Ford Explorer XLT RWD

TEST NUMBER: NCAP-DRI-RR-20-05

Final Report
6 May 2020



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		15. Supplemental Notes	
16. Abstract An NCAP Dynamic Rollover Maneuver (Fishhook) Test was conducted on a 2020 Ford Explorer XLT RWD at Dynamic Research, Inc. on February 13, 2020. The vehicle did not experience two-wheel lift. The vehicle's steering angle at 0.3 g lateral acceleration at 50 mph was 26.1 degrees.			
17. Key Words New Car Assessment Program Rollover Fishhook Test		18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division National Highway Traffic Safety Administration 1200 New Jersey Avenue, SE Washington, DC 20590	
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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 2020 Ford Explorer XLT RWD 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 Ford Explorer XLT RWD				
VIN	1FMSK7DH5LGA7xxxx				
Vehicle type/Body style	MPV/SUV				
Number of doors	4				
Trim level	XLT RWD				
Seating positions	Front:	2 nd row	3 rd row	4 th row	5 th row
	2	2	2	0	0
Electronic stability control	Yes				
4-Wheel ABS (Yes/No)	Yes				
Power steering (Yes/No)	Yes				
Major optional equipment	18" 5-SPOKE PAINTED ALUM WHLS, P255/65R18 A/S BSW TIRES, REMOTE START SYSTEM, 8-WAY POWER PASSENGER SEAT				
Odometer at start of testing	60 miles				
Drivetrain					
Engine cylinder arrangement	Inline 4				
Engine displacement	2.3 L				
Transmission type	Automatic				
Drive arrangement	2WD (RWD)				
Chassis					
Track width	F: 65.5 in (1663.7 mm), R: 66 in (1676.4 mm)				
Wheelbase	119 in (3022.6 mm)				
Curb weight	4292 lb (1946.8 kg)				
Certification Data from Vehicle's Label					
Vehicle manufactured by	FORD MOTOR CO.				
Date of manufacture	09/19				
GVWR	5770 lb (2617 kg)				
GAWR Front	2505 lb (1136 kg)				
GAWR Rear	3370 lb (1529 kg)				

Table 2. Tire Information

Tire Manufacturer	Hankook
Tire Model	KINERGY GT Kontrol Technology
Tire Size	Front: 255/65R18 Rear: 255/65R18
Load rating	Front:111 Rear:111
Speed rating	Front: H Rear: H
Treadwear grade	Front: 500 Rear: 500
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: 33 psi, (230 kPa) Rear: 33 psi, (230 kPa)
First 8 digits of DOT code	Front: 1T768 1B H0 Rear: 1T768 1B H0

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	175 lb (79.4 kg)
Fuel level	Full
Weight as Tested	
Left front	1300 lb (589.7 kg)
Right front	1169 lb (530.2 kg)
Left rear	1393 lb (631.9 kg)
Right rear	1438 lb (652.3 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 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	015360	By: Oxford Technical Solutions Date: 2/10/2020 Due: 2/10/2022

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.

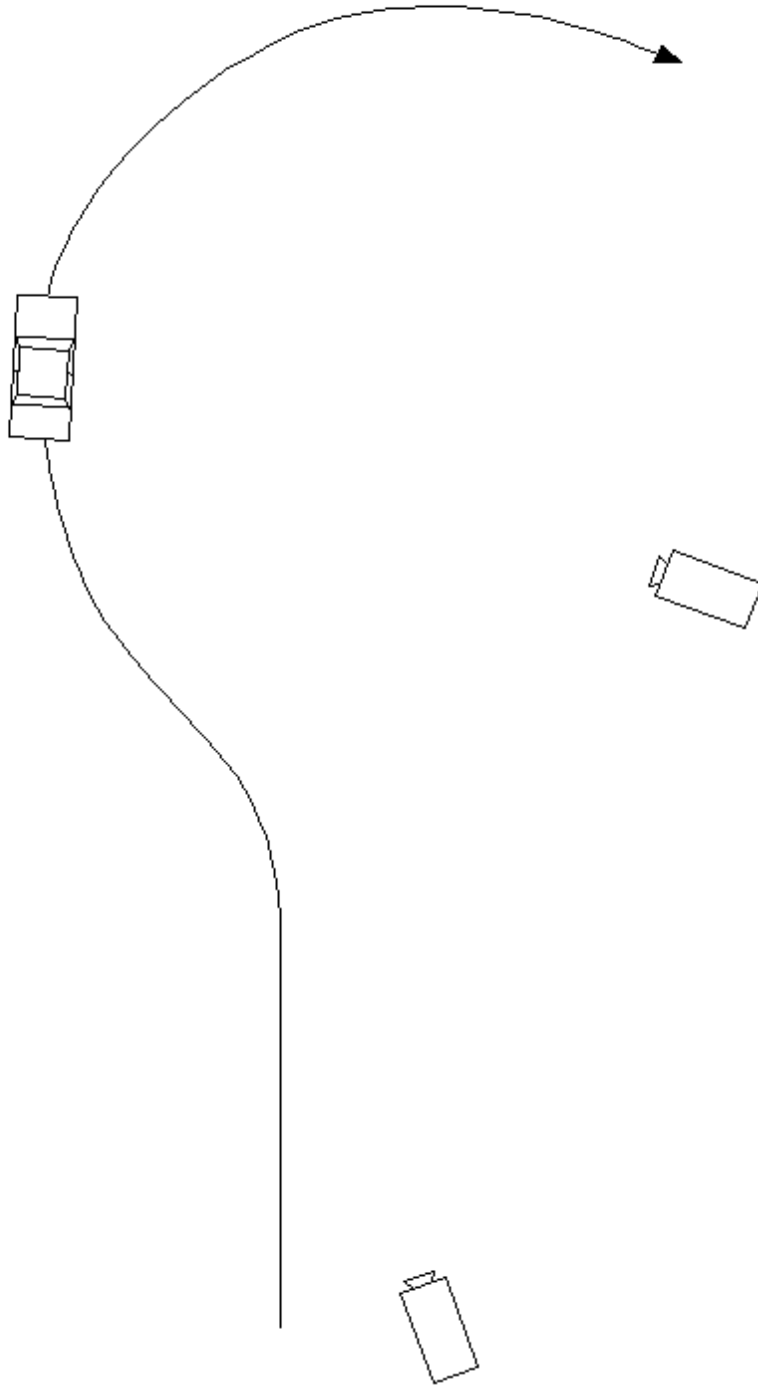


Figure 1. Nominal Position of Video Cameras for Fishhook Tests

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 2/13/2020. 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	2/14/2020
Average normalized lateral force	0.797

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)	26.1°
5.5 scalar handwheel angle for Fishhook Test	144°
6.5 scalar handwheel angle for Fishhook Test	170°

3. WEATHER CONDITIONS

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

Table 8. Weather Conditions

Ambient temperature	62.6° F (17° C)
Wind Speed	4.6 mph (1.8 m/s)
Wind Direction	240

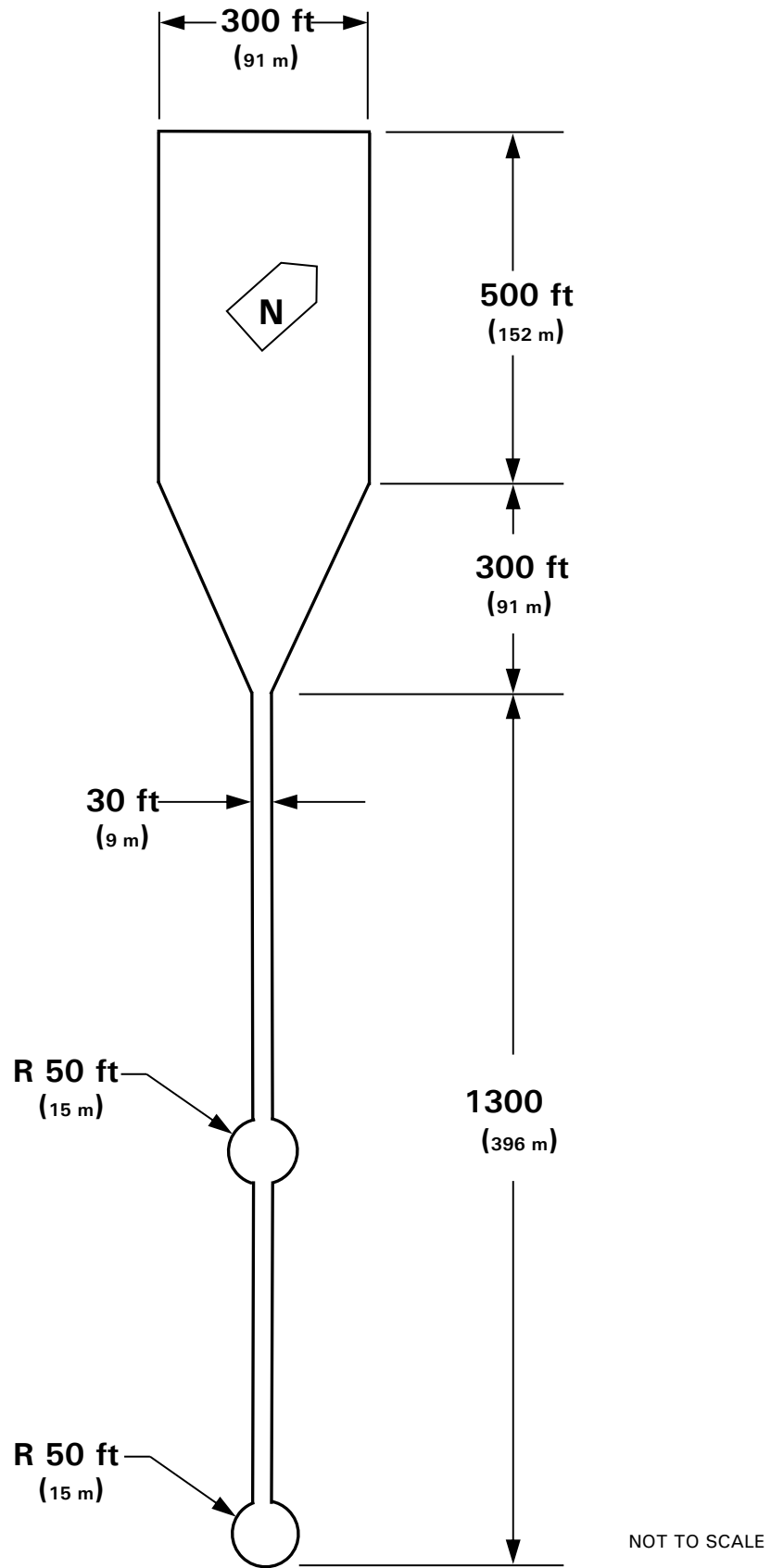


Figure 2. DRI-Minter Vehicle Dynamics Area

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 Ford Explorer XLT RWD.

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Photographs

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VEHICLE DESCRIPTION
EXPLORER
2020 EXPLORER XLT RWD
119" WHEELBASE
2.3L I4 ECOBOOST ENGINE
10-SPEED AUTO TRANSMISSION

LG A7

EXTERIOR OXFORD WHITE
INTERIOR EBONY ACTIVEX SEAT MTRL

STANDARD EQUIPMENT INCLUDED AT NO EXTRA CHARGE


<p>EXTERIOR</p> <ul style="list-style-type: none"> • DOOR HANDLES - BODY COLOR • EASY FUEL® CAPLESS FILLER • HEADLAMPS - AUTO LED • LED SIGNATURE LIGHTING • MIRRORS-MAN-FOLD DUAL PWR HEATED WITH APPROACH LAMPS • PRIVACY GLASS - REAR DOORS • REAR INT WIPER/WASH/FRST • REAR SPOILER, BODY COLOR • ROOF-RACK SIDE RAILS-BLACK • TAILLAMPS-LED • TRAILER SWAY CONTROL • VARIABLE INTERVAL WIPERS 	<p>INTERIOR</p> <ul style="list-style-type: none"> • 1 TOUCH UP/DOWN DR/PASS WIN • 3RD ROW - 50/50 FOLD FLAT • CARPETED FLOOR MATS • DUAL ILLUM VIS VANITY MIRR • IP CLUSTER 6.5" LCD SCREEN • LEATHER WRAPPED STR WHEEL • POWER DRIVER SEAT - 10 WAY • POWERPOINTS - 12V • ROTARY GEAR SHIFT DIAL • SMART CHARGING USB PORT(4) • STEERING-TILT/TELESCOPE, CRUISE & AUDIO CONTROLS • TRI-ZONE ELECTRIC TMP CTRL 	<p>FUNCTIONAL</p> <ul style="list-style-type: none"> • AM/FM/MP3, 6 SPEAKERS • BRAKES, 4-WHEEL DISC/ABS • FORD CO-PILOT360™ • FORDPASS™ CONNECT 4GWI-FI HOTSPOT TELEMATICS MODEM • HILL START ASSIST • INTELLIGENT ACCESS W/PUSH BUTTON START • REAR VIEW CAMERA • REVERSE SENSING SYSTEM • SECURITYCODE KEYLESS KEYPAD • SIDE-WIND STABILIZATION • SIRIUSXM® - SVC N/A AKAH • SYNC®3 8" SCR N/WAPLINK®
--	--	--

INCLUDED ON THIS VEHICLE (MSRP)

EQUIPMENT GROUP 202A	5,140.00
• REMOTE START SYSTEM	
• 8-WAY POWER PASSENGER SEAT	
OPTIONAL EQUIPMENT/OTHER	
• 18" 5-SPOKE PAINTED ALUM WHLS	
• P255/55R18 A/S BSW TIRES	
• 90 STATE EMISSIONS	
• FRONT LICENSE PLATE BRACKET	
NO CHARGE	NO CHARGE

PRICE INFORMATION (MSRP)

BASE PRICE	\$36,675.00
TOTAL OPTIONS/OTHER	5,140.00
<hr/>	
TOTAL VEHICLE & OPTIONS/OTHER	41,815.00
DESTINATION & DELIVERY	1,195.00
<hr/>	
TOTAL BEFORE DISCOUNTS	43,010.00
EQUIPMENT GROUP SAVINGS	- 1,000.00

SOLD TO:	RAMP ONE	PRML ASSEMBLY PLANT CHICAGO	TOTAL MSRP \$42,010.00
	CH27	METHOD OF TRANSP CONVOY	
SHIP TO IF OTHER THAN SOLD TO:	RAMP TWO	ITEM # 71-2653 OT 2	 <p>Whether you decide to lease or finance your vehicle, you'll find the choices that are right for you. See your dealer for details or visit www.ford.com/finance.</p>
SHIP THROUGH	<p>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.</p>		

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Fuel Economy and Environment Gasoline Vehicle

Fuel Economy

24 MPG combined city/hwy
21 MPG city
28 MPG highway

4.2 gallons per 100 miles

Standard SUVs range from 13 to 93 MPG. The best vehicle rates 136 MPG.

You spend \$1,000 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost \$1,700

Fuel Economy & Greenhouse Gas Rating (tailpipe only) **5** Smog Rating (tailpipe only) **5**

This vehicle emits 370 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create 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 costs \$7,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at \$2.30 per gallon. MPG is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuelconomy.gov Calculate personalized estimates and compare vehicles

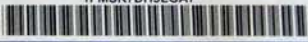
GOVERNMENT 5-STAR SAFETY RATINGS

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 Not Rated
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.		
Side Crash	Front seat Rear seat	Not Rated Not Rated
Based on the risk of injury in a side impact.		
Rollover		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 or 1-888-327-4236

1FMSK7DH5LGA7



WARNING: Operating, servicing and maintaining a passenger vehicle, pickup truck, van, or off-road vehicle can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your vehicle. For more information go to www.P65Warnings.ca.gov/passenger-vehicle.

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SCAN OR TEXT #FUSAT0514 TO #8888



 May 8 Data
 rates may
 apply.
 Text HELP
 for help.
www.ford.com/help/privacy-terms/

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 FORD MOTOR CO.

DATE: 09/19

GVWR: 2617 KG (5770 LB)

FRONT GAWR:
1136 KG (2505 LB)

WITH REAR GAWR:
1529 KG (3370 LB)

WITH

255/65R18 111H

TIRES 255/65R18 111H

TIRES

18x7.5J

RIMS 18x7.5J

RIMS

AT 230 kPa/ 33

PSI COLD

AT 230 kPa/ 33

PSI COLD

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY AND THEFT PREVENTION STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VIN: 1FMSK7DH5LGA7

F0094

TYPE: MPV

T0254



EXT PNT: YZ

RC: 71

DSO:

WB

INT TR

TP/PS

R

AXLE

TR

SPR

119

S6

S

3B

T

AAAA

1201909202570

UTC

▽ 5U5A-1520472-BA

Figure A6. Certification Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY TOTAL : 6 FRONT: 2 REAR: 4

The combined weight of occupants and cargo should never exceed : **646 kg or 1425 lbs.**

▽ 5USA-1532-AA (TLU)

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	255/65R18 111H	230 KPA, 33 PSI
REAR	255/65R18 111H	230 KPA, 33 PSI
SPARE	T165/70D18 116M	420 KPA, 60 PSI

**SEE OWNERS
MANUAL FOR
ADDITIONAL
INFORMATION**

1FM5K7DH5LGA7



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 Ford Explorer XLT RWD**

Driver: **Jonathan Robel**

Test Date: **2/13/2020**

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
1	Tire Warm-Up	35	50	Right	NA	
2	"	"	60	"	"	
3	"	"	"	"	"	
4	"	"	"	"	"	
5	2x SWA last cycle	"		"	"	
6	Static	0	0		NA	
7	Steady State	50	0		"	
8	Slowly Increasing Steer	50	50	Left	NA	
9	"	"	"	Left	"	
10	"	"	"	Left	"	
11	"	"	"	Left	"	
12	"	"	"	Right	"	
13	"	"	"	Right	"	
14	"	"	"	Right	"	
15	Fishhook 6.5 Scalar	35	170	Left	No	
16	"	40	"	"	"	
17	"	45	"	"	"	
18	"	47.5	"	"	"	

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
19	"	50	"	"	"	
20	Fishhook5.5 Scalar	45	144	Left	No	
21	"	47.5	"	"	"	
22	"	50	"	"	"	
23	Fishhook 6.5 Scalar	35	170	Right	No	
24	"	40	"	"	"	
25	"	45	"	"	"	
26	"	47.5	"	"	"	
27	"	50	"	"	"	
28	Fishhook 5.5 Scalar	45	144	Right	No	
29	"	47.5	"	"	"	
30	"	50	"	"	"	

APPENDIX C

Slowly Increasing Steer Test Worksheet

NCAP, 2020 Ford Explorer XLT RWD, Multi-Passenger Load, Test Date: 2/13/2020

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
9	Left	50.3	0.0	99.9	1186	-25.7	-0.301	-166.8	-0.2317	-141.1	-0.196	0.9969	600	800
10	Left	49.9	0.0	100.0	1193	-26.2	-0.305	-170.0	-0.2361	-143.9	-0.1998	0.9971	600	800
11	Left	50.0	0.1	99.8	1190	-26.0	-0.294	-168.9	-0.2345	-142.9	-0.1984	0.9965	600	800
12	Right	50.6	0.0	100.1	1193	26.1	0.3	169.6	0.2355	143.5	0.1993	0.9985	600	800
13	Right	50.2	-0.1	100.3	1195	26.2	0.305	170.3	0.2365	144.1	0.2002	0.998	600	800
14	Right	49.8	-0.1	100.2	1204	26.8	0.309	174.0	0.2416	147.2	0.2044	0.9967	600	800

Mean: 26.1 0.302 170.0 0.236 144.0 0.2

Steering Controller Input Values

Scalar 6.5 values:

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

Scalar 5.5 values:

Initial HW angle: 144 deg
 Initial time: 0.2 s
 Reversal HW angle: -144 deg
 Reversal time: 0.399 s

APPENDIX D

Time History Plots

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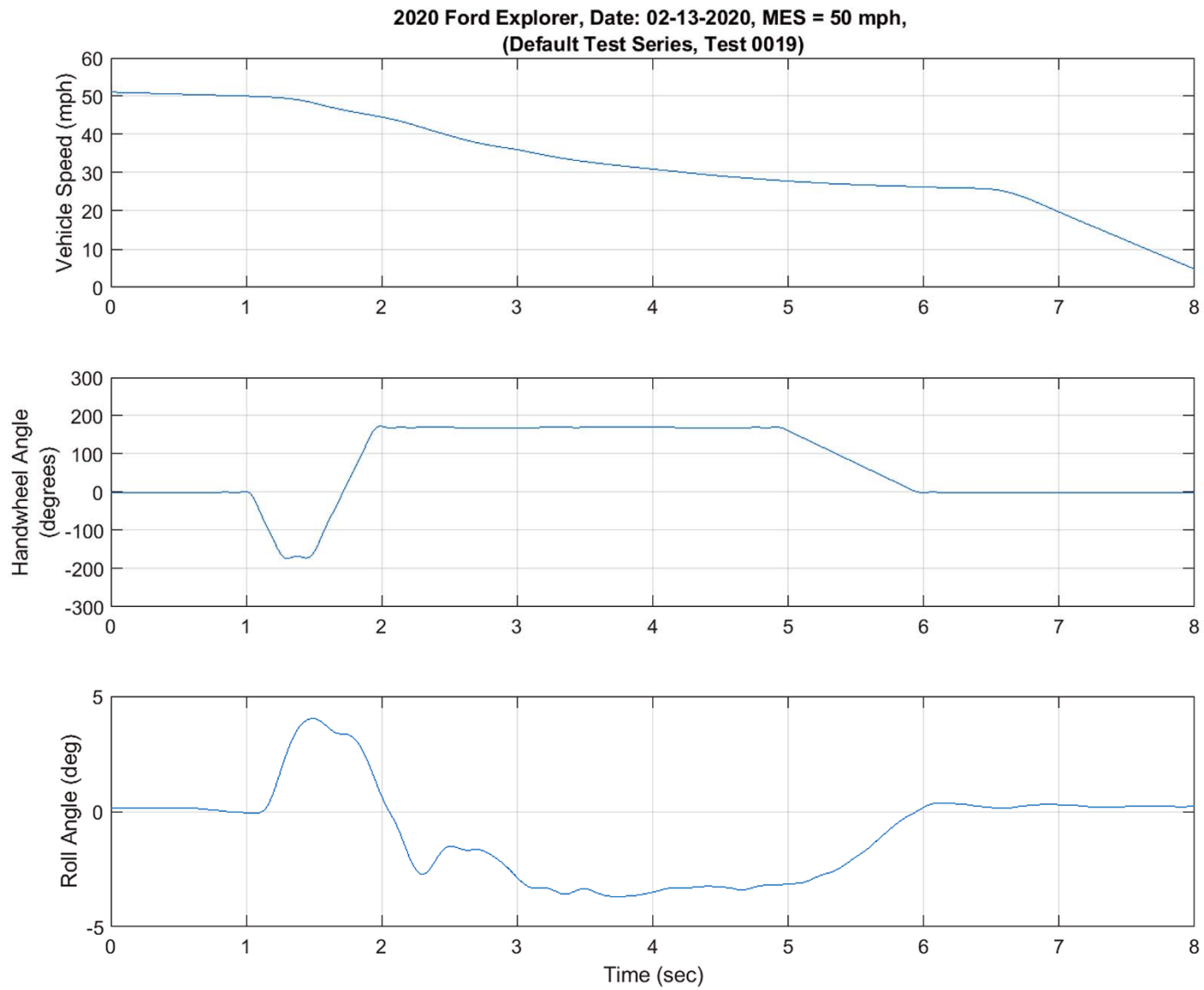


Figure D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph

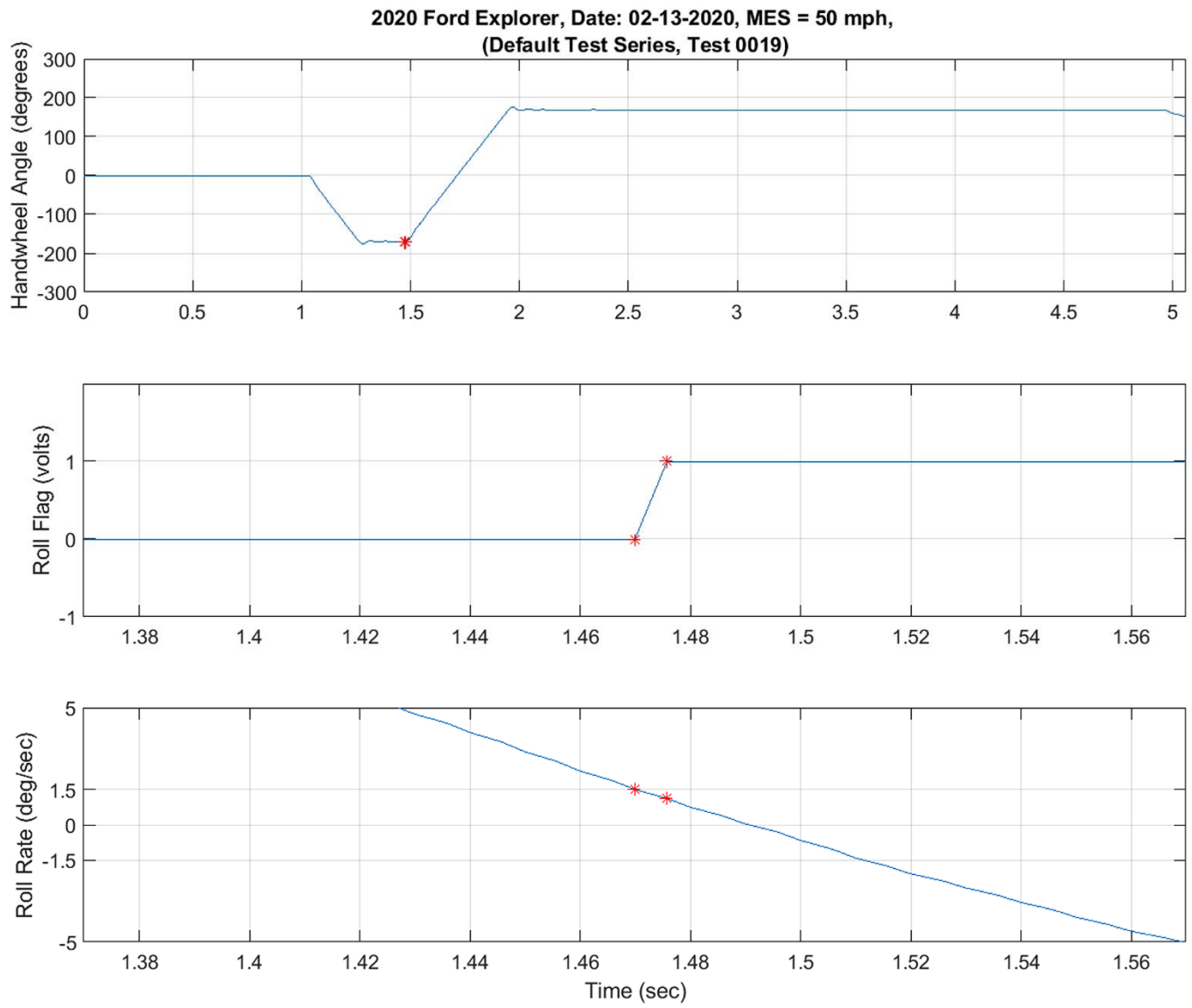


Figure D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph

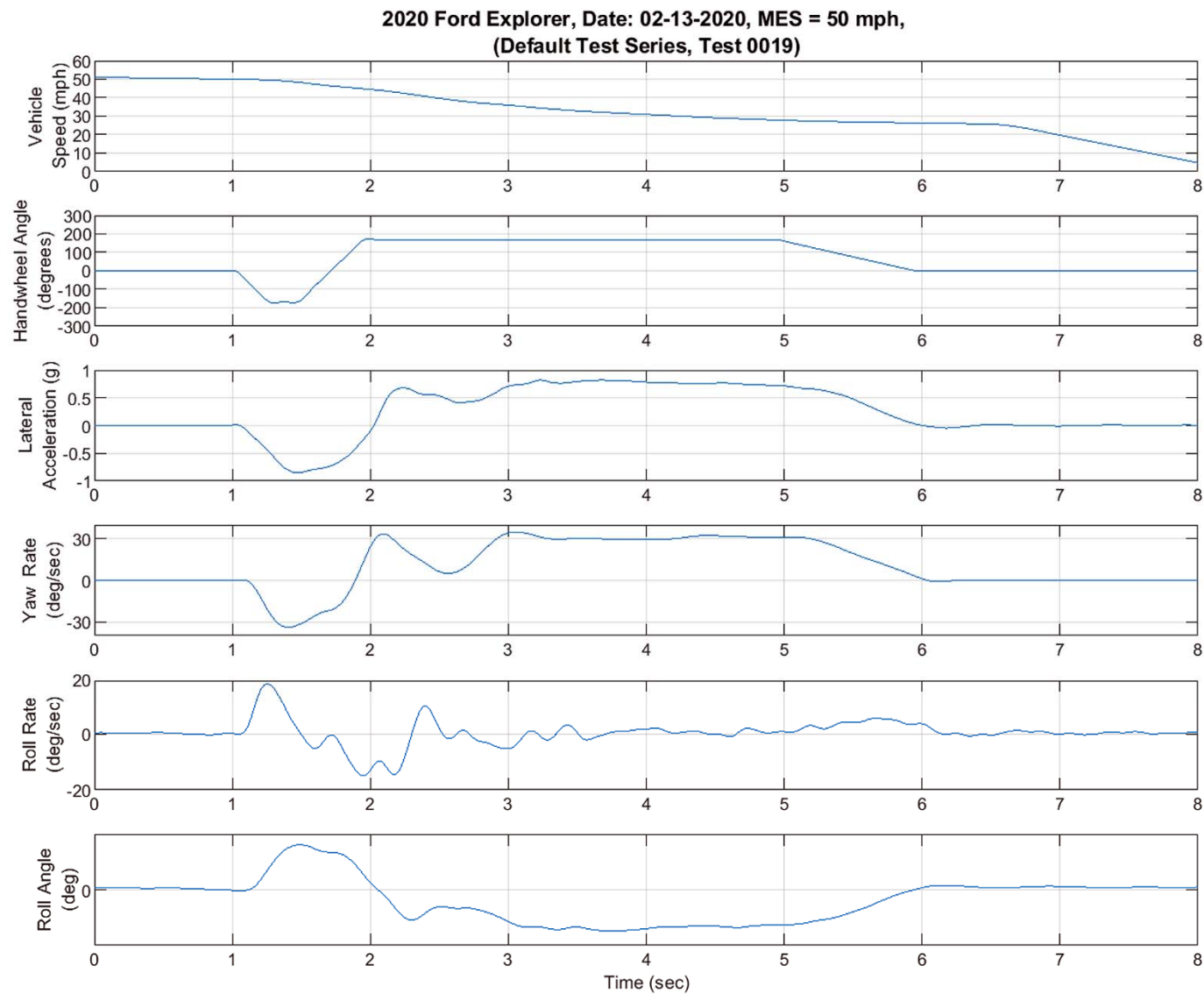


Figure D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots For Default Test Series, L-R, 50 mph

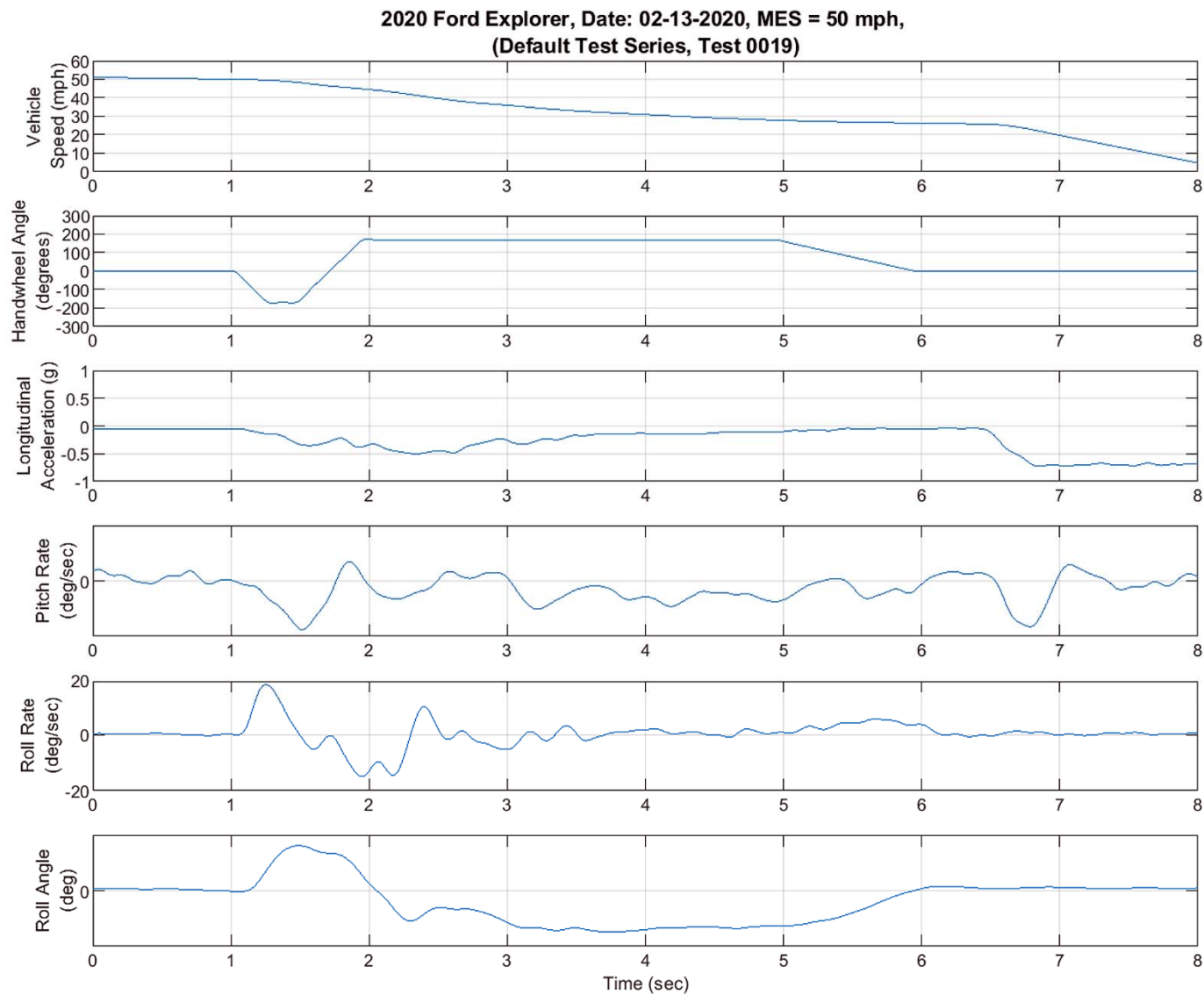


Figure D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph

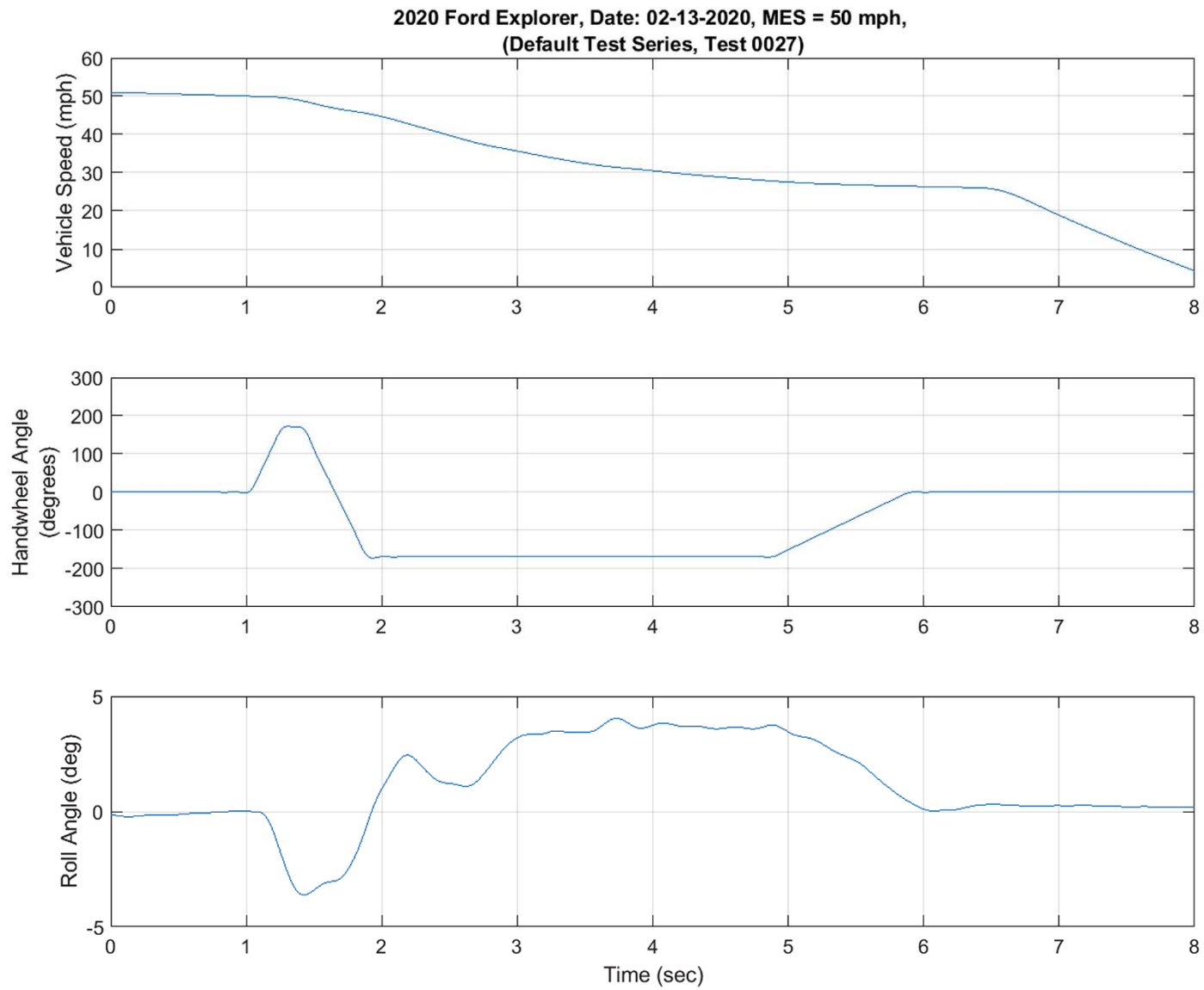


Figure D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph

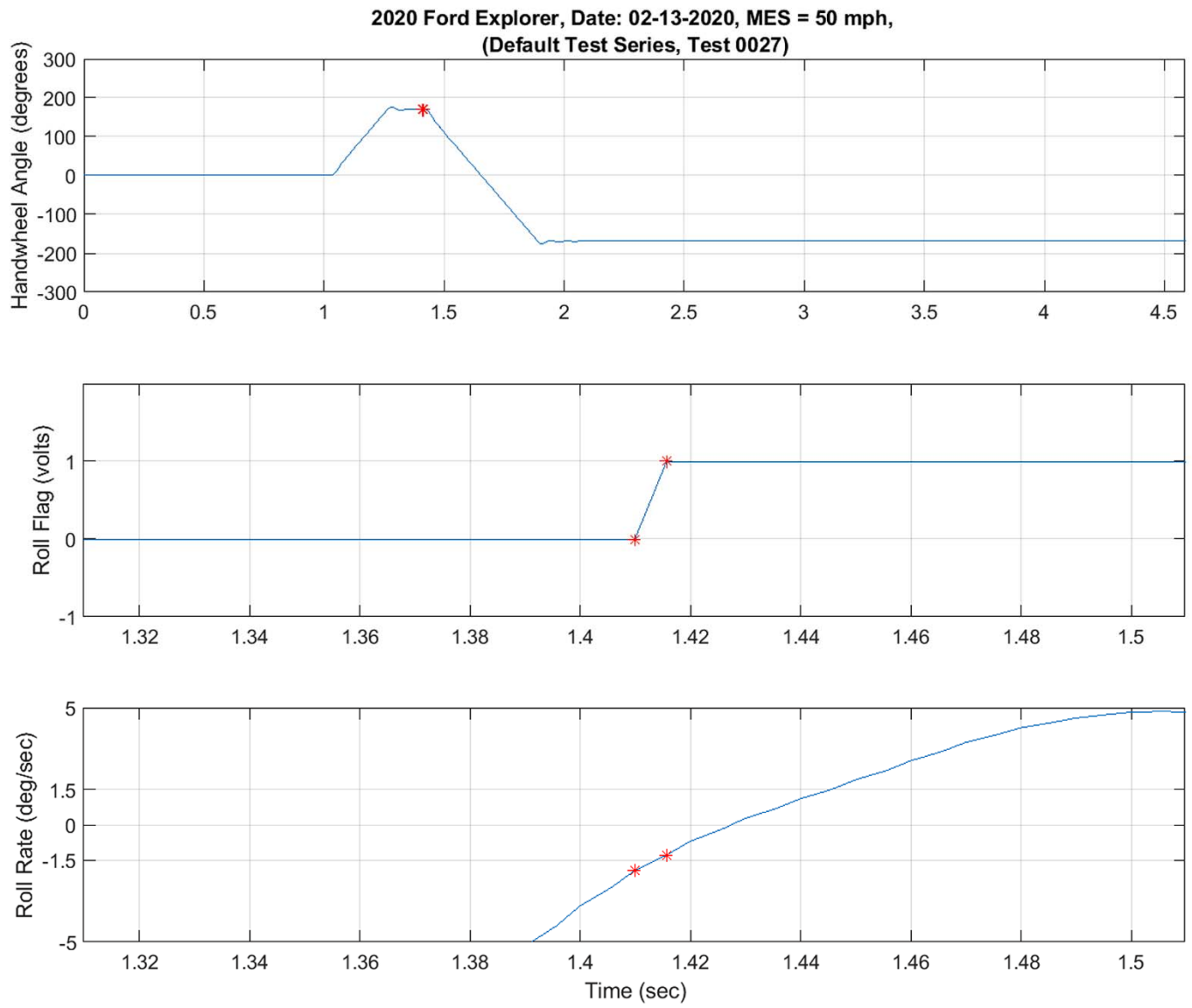


Figure D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph

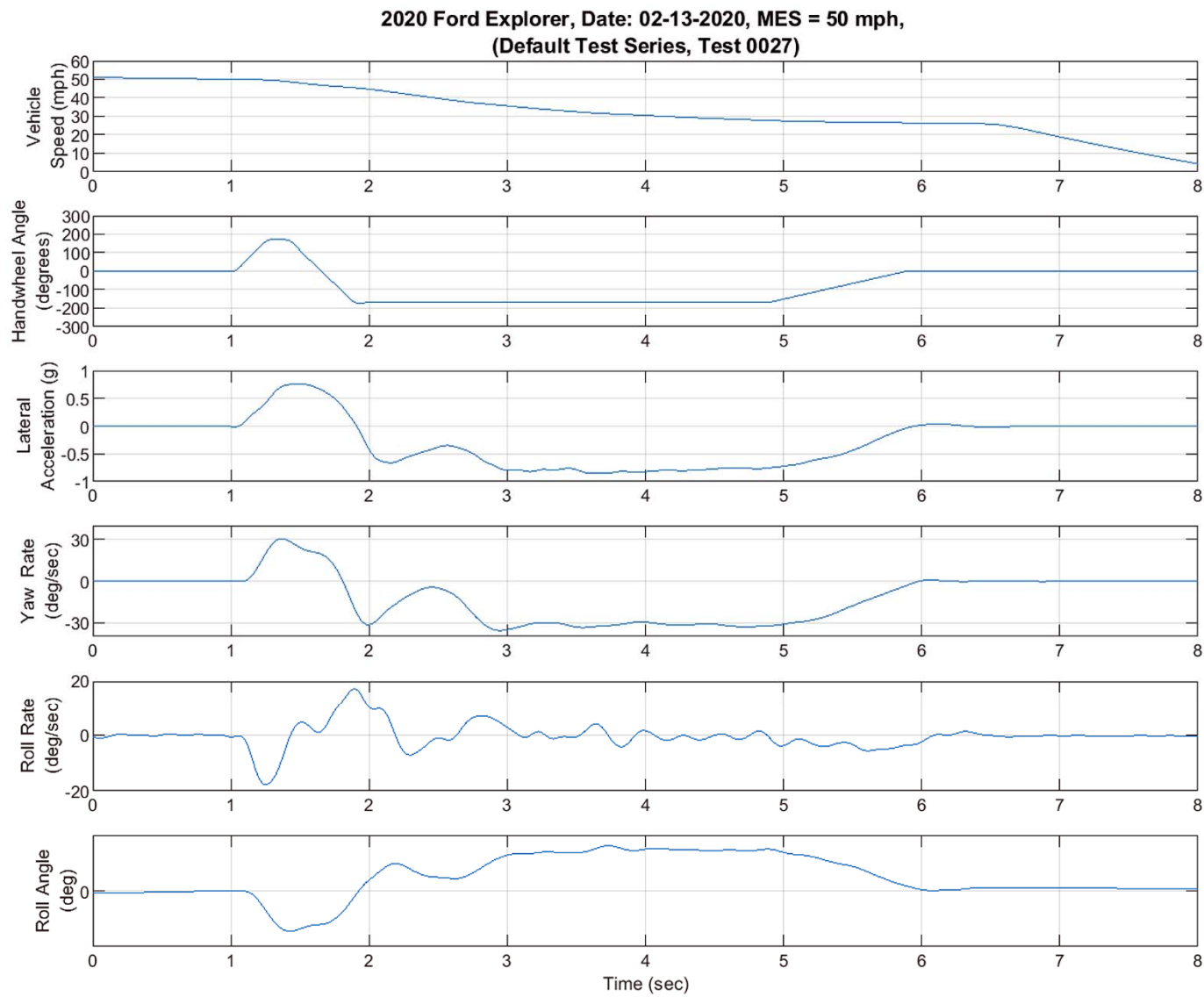


Figure D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph

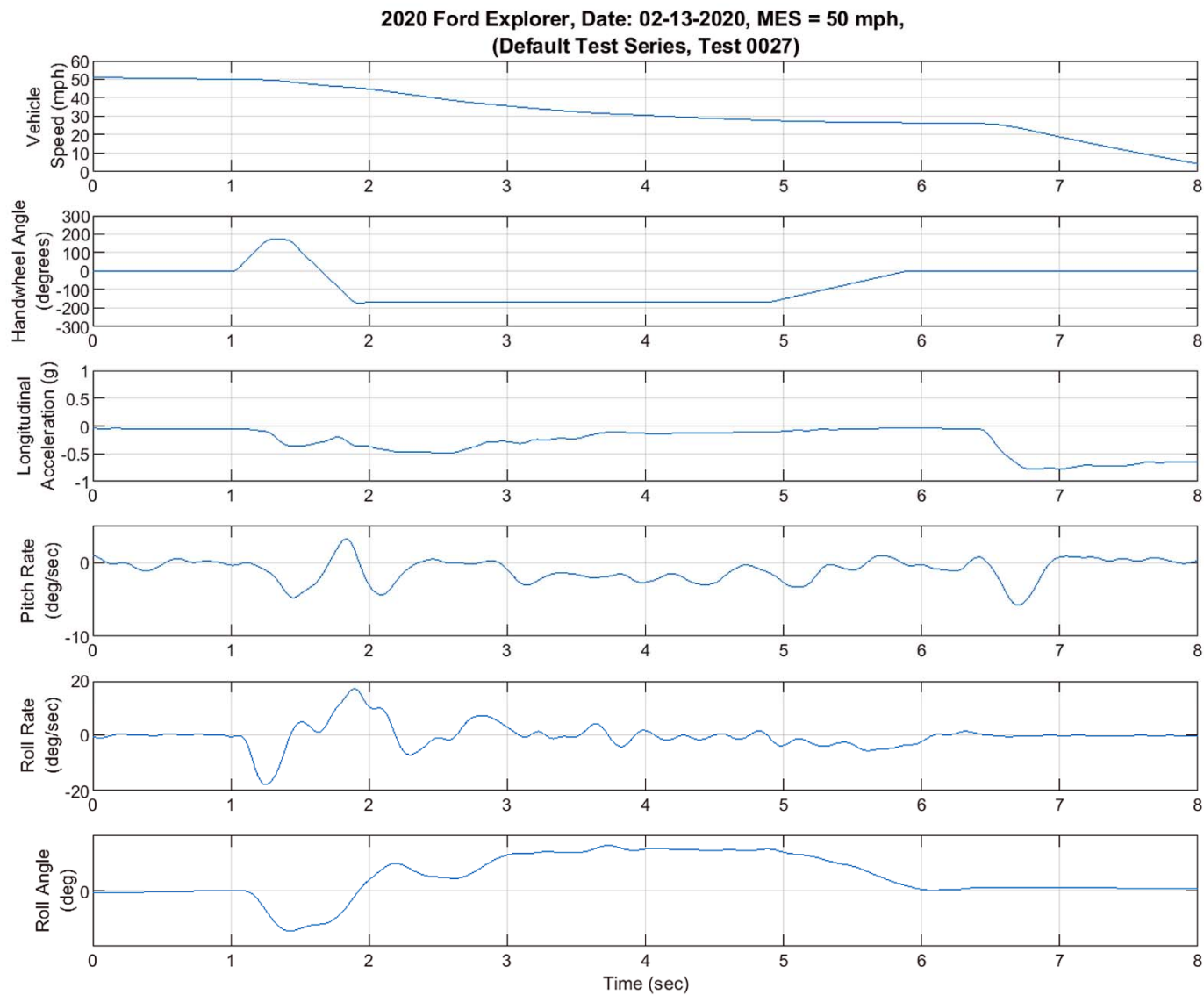


Figure D8. Pitch Rate and Longitudinal Acceleration Time History Plots or Default Test Series, R-L, 50 mph

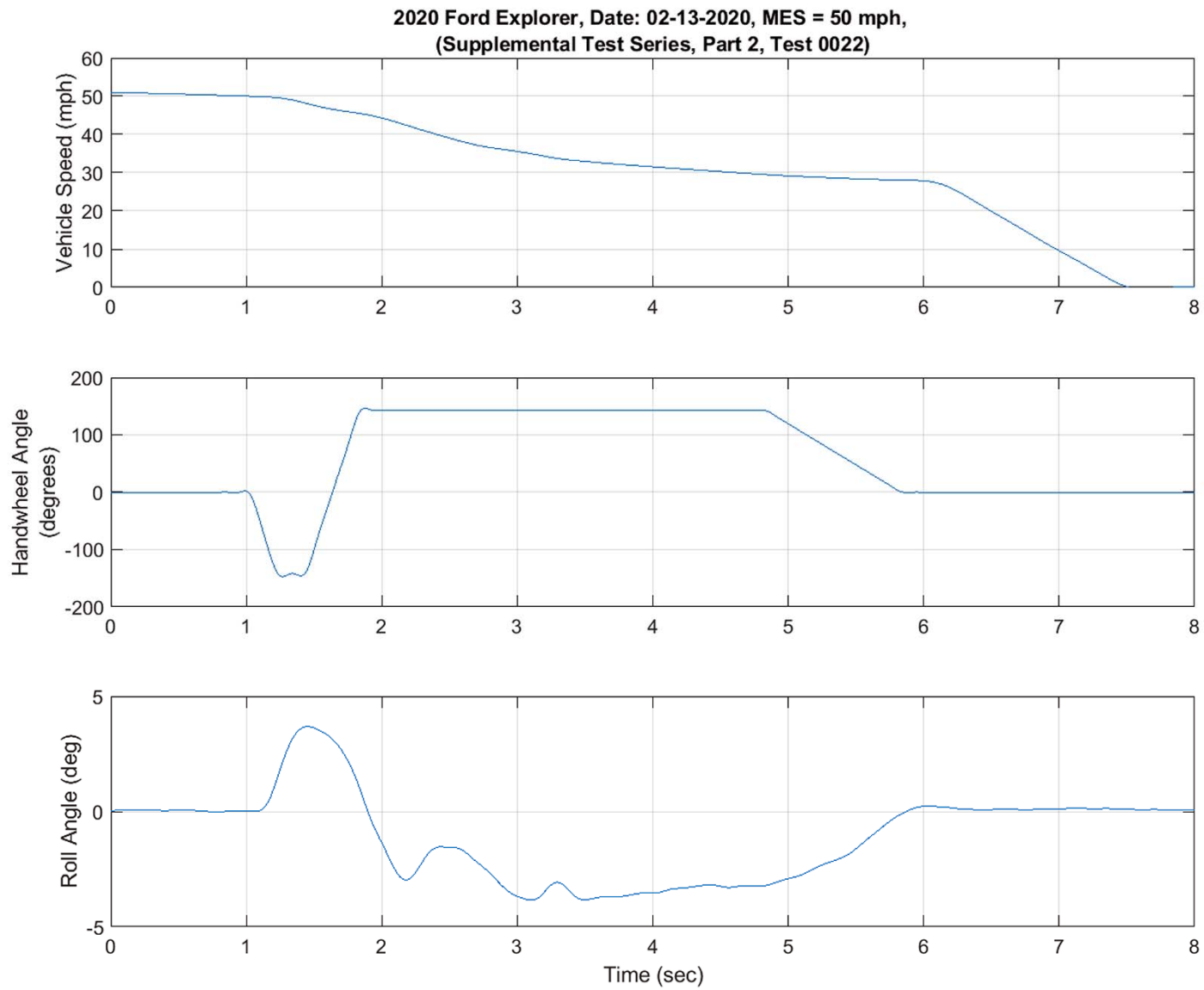


Figure D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

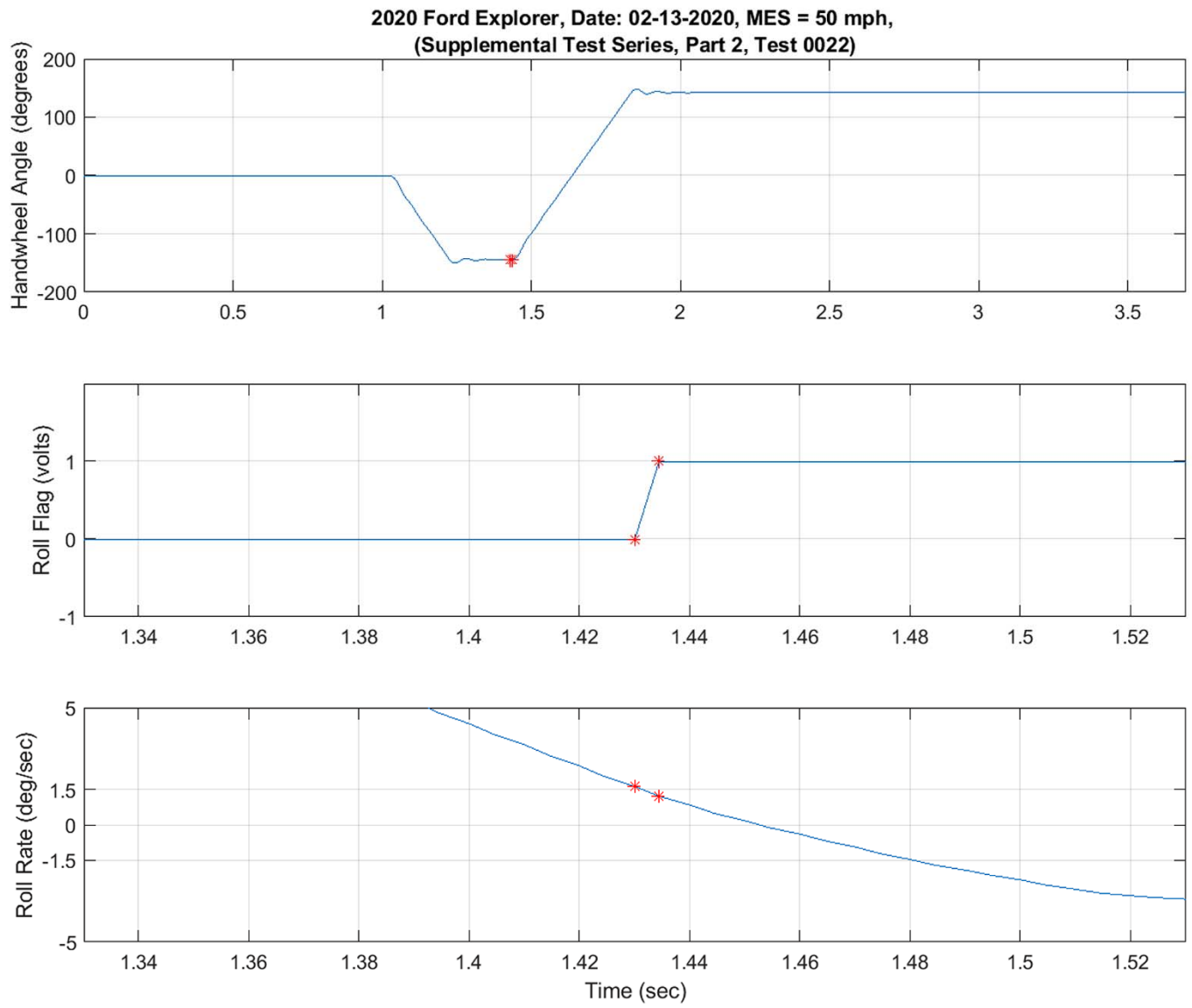


Figure D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

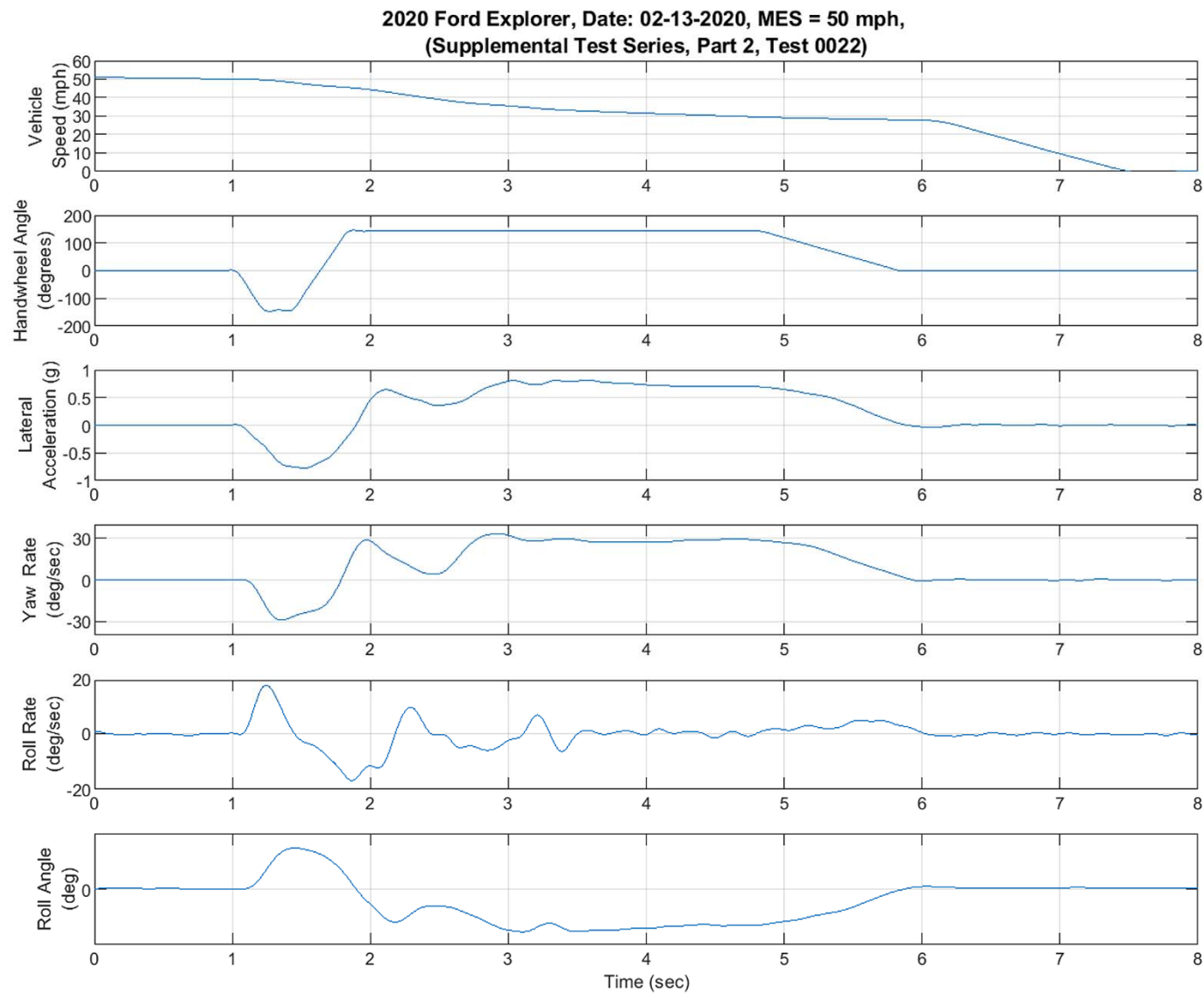


Figure D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

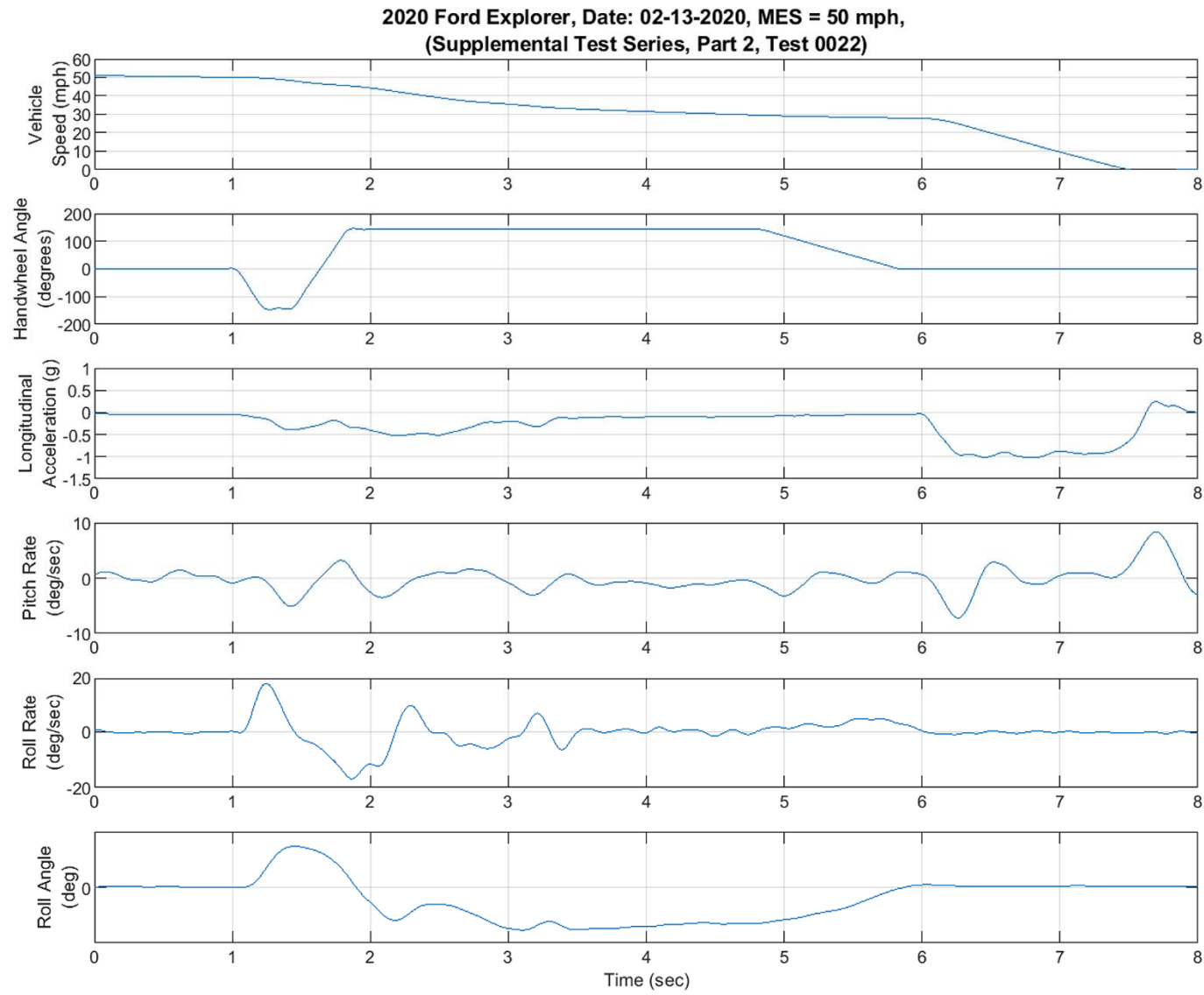


Figure D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

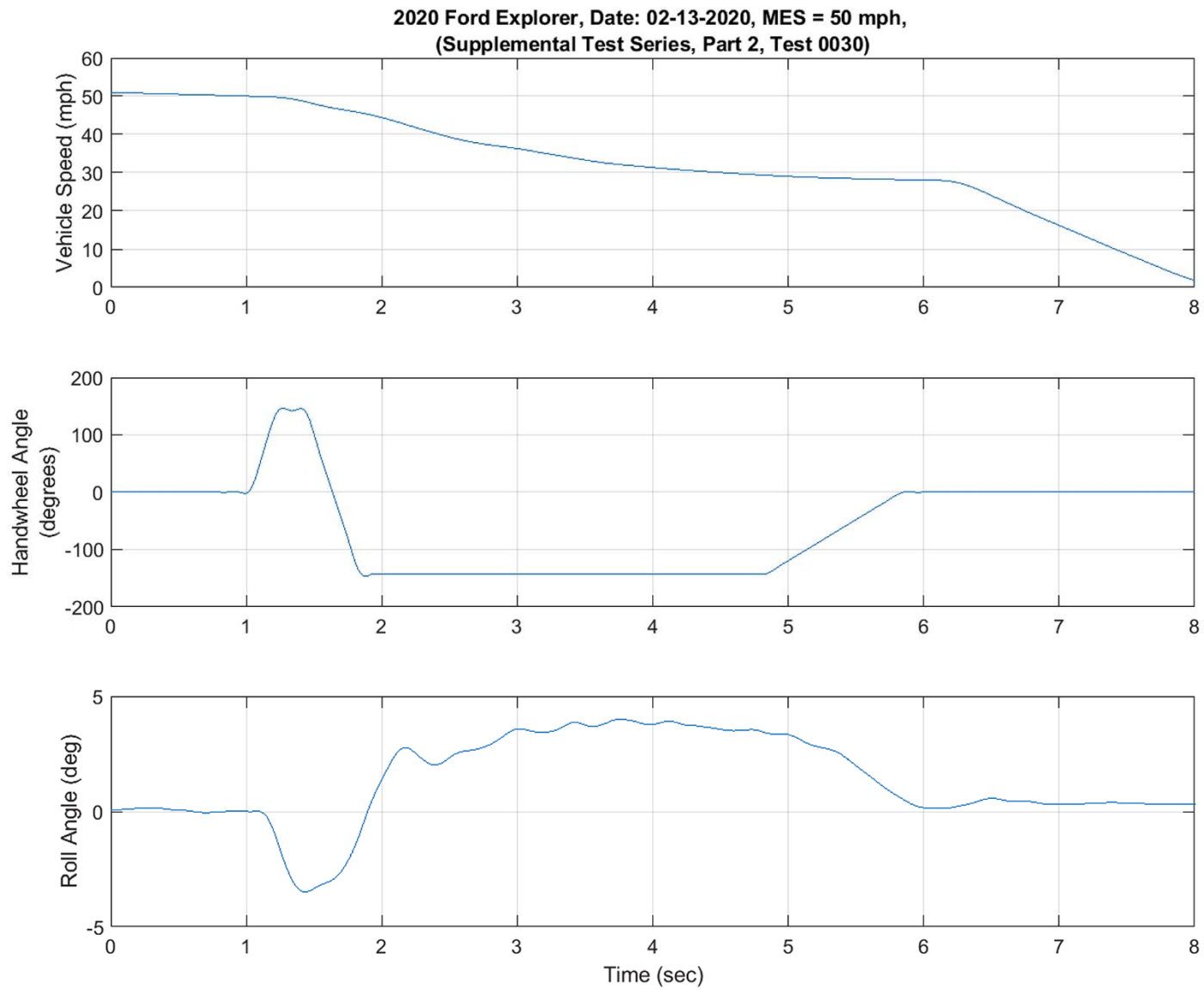


Figure D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

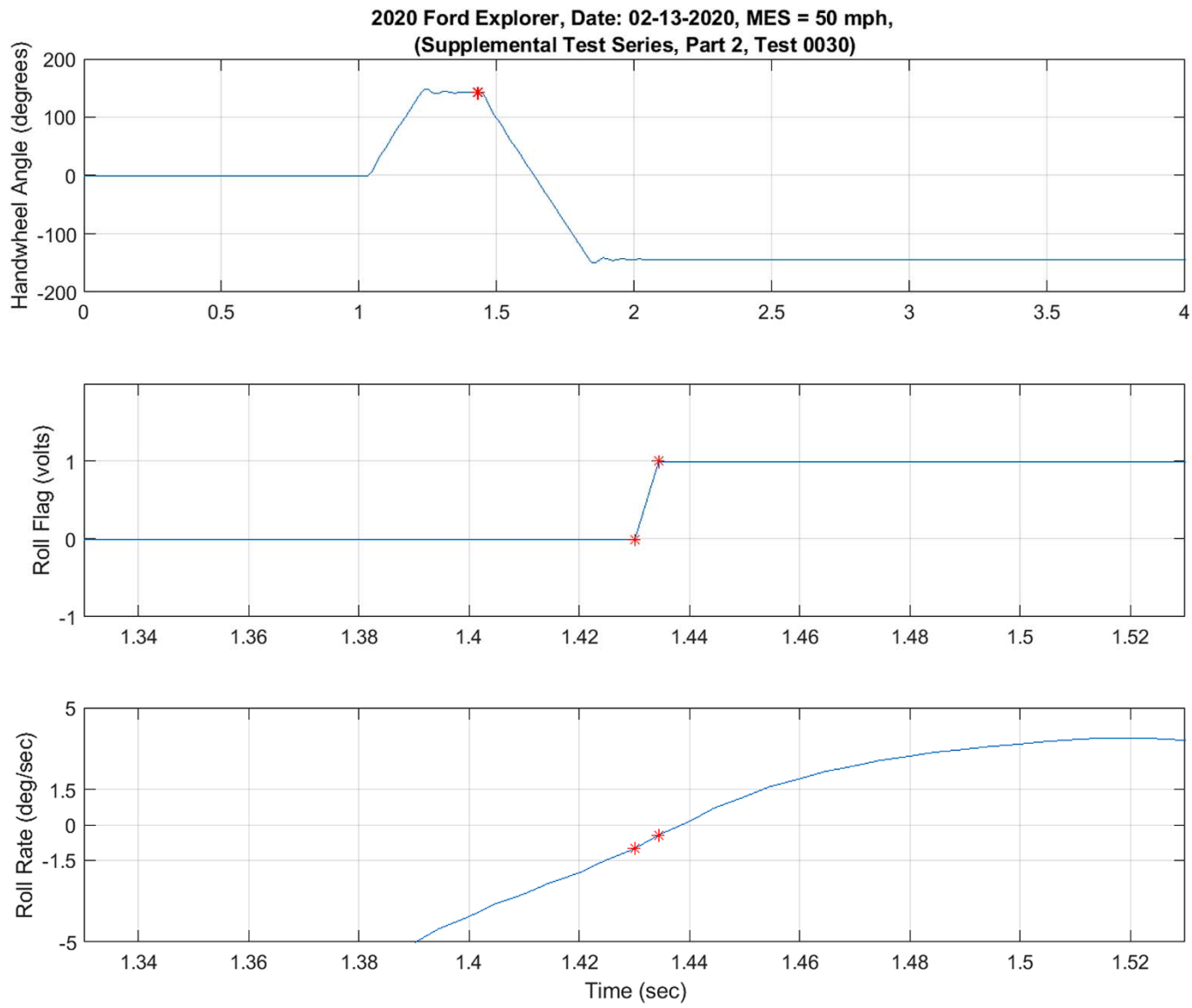


Figure D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

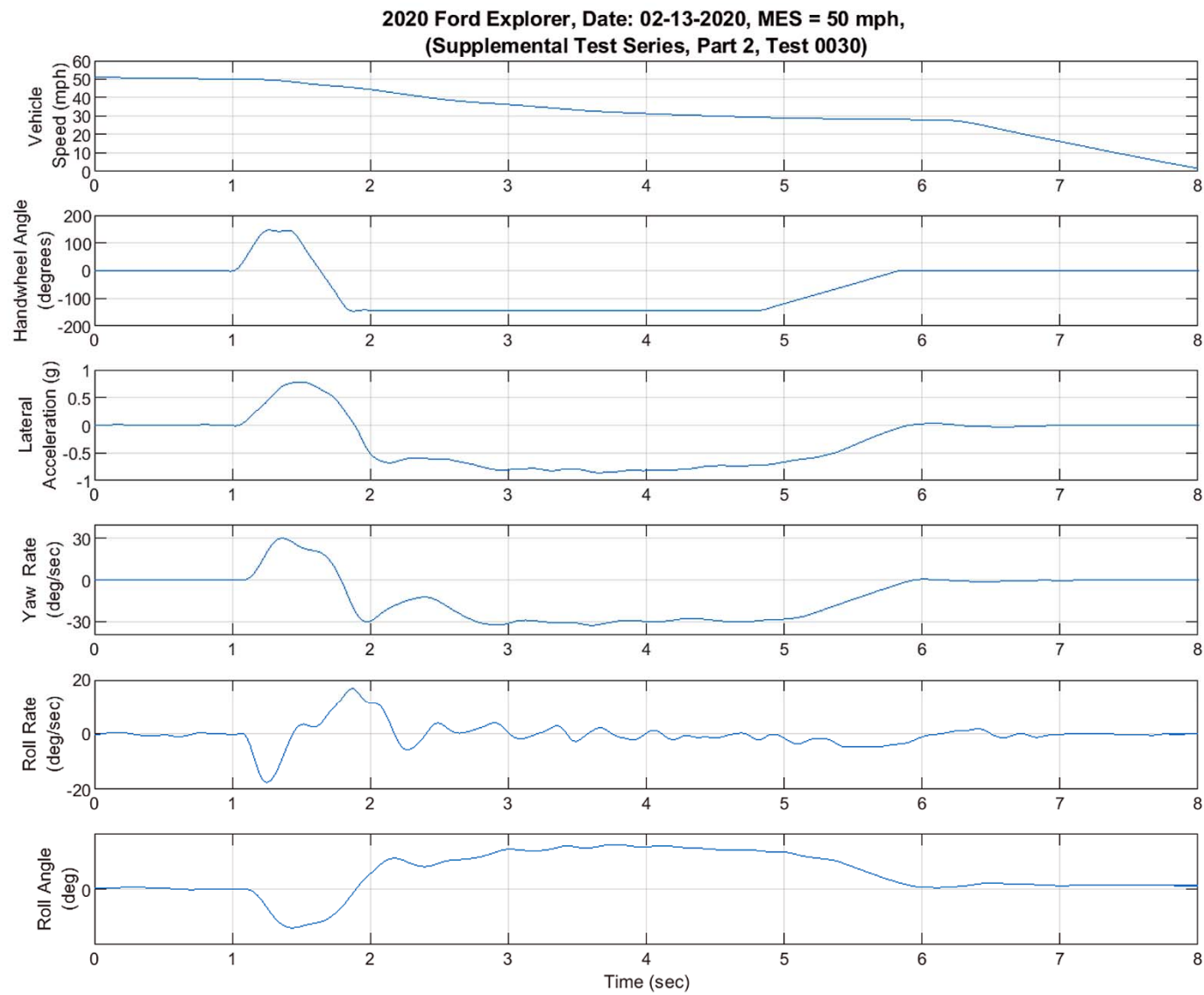


Figure D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

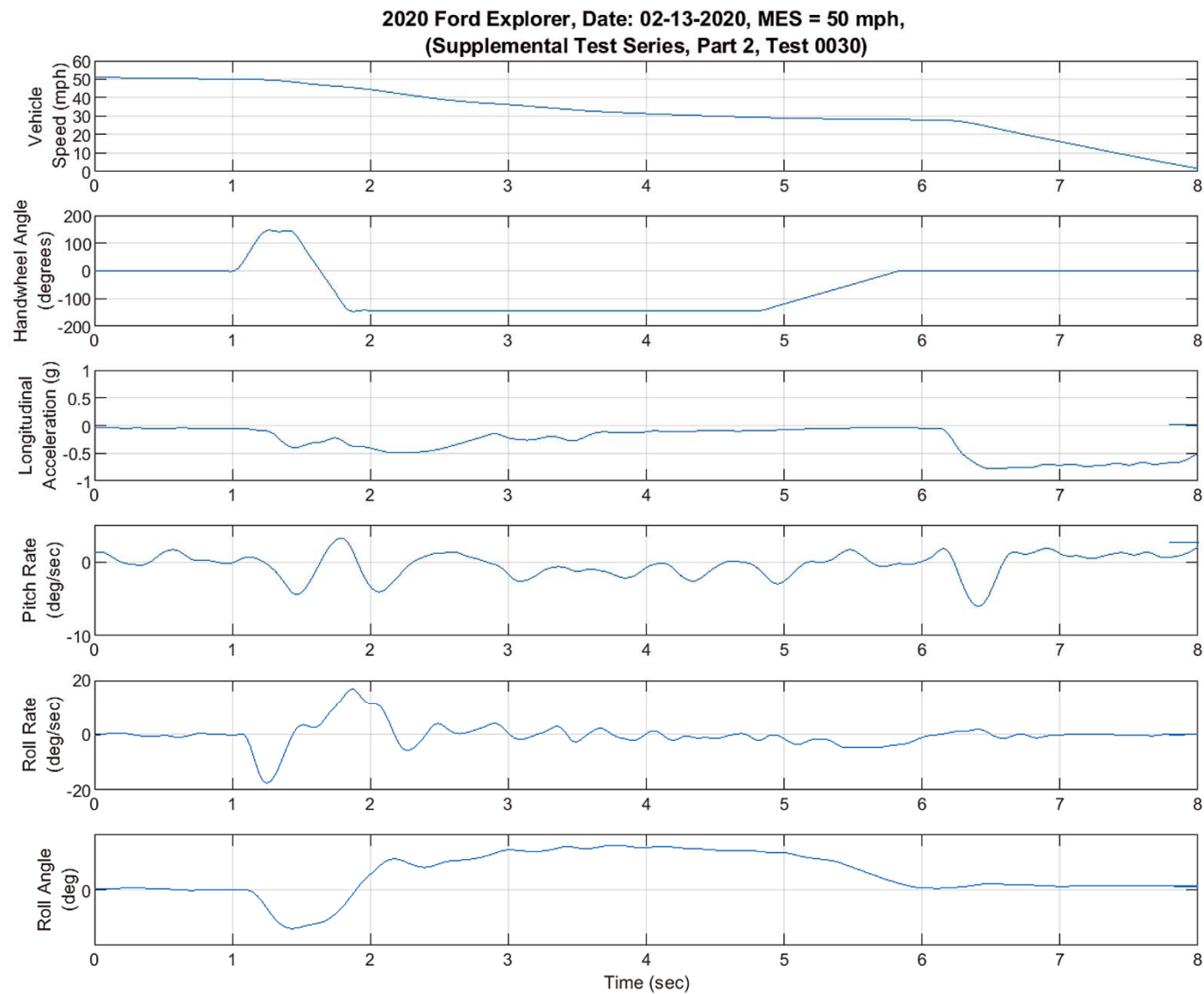


Figure D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph