

**NCAP-KAR-DR-21-03
NEW CAR ASSESSMENT PROGRAM (NCAP)
DYNAMIC ROLLOVER RESISTANCE TEST**

MERCEDES-BENZ U.S. INTL., INC

2021 MERCEDES-BENZ GLE350 RWD 5-DOOR SUV

**PREPARED BY:
APPLUS IDIADA KARCO ENGINEERING, LLC.
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ADELANTO, CA 92301**



FEBRUARY 19, 2021

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
NEW CAR ASSESSMENT PROGRAM
MAIL CODE: NRM-110
1200 NEW JERSEY AVE, SE
WASHINGTON, D.C. 20590**

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TECHNICAL REPORT DOCUMENTATION PAGE

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12. Sponsoring Agency Name and Address U. S. Department of Transportation National Highway Traffic Safety Administration New Car Assessment Program 1200 New Jersey Ave., SE Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report, February 12 - 19, 2021	
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15. Supplementary Notes			
16. Abstract An NCAP Dynamic Rollover Maneuver (Fishhook) Test was conducted on a 2021 Mercedes-Benz GLE350 RWD 5-Door SUV by Applus+ IDIADA KARCO Engineering, LLC. on February 12, 2021. The vehicle did not experience two-wheel lift. The vehicle's steering angle at 0.3 g lateral acceleration at 50 mph was 31.3 degrees.			
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SECTION I INTRODUCTION

The National Highway Traffic Safety Administration (NHTSA) has engaged Applus+ IDIADA KARCO Engineering, LLC 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 2021 Mercedes-Benz GLE350 RWD 5-Door SUV 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 Dynamic Rollover Test 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 693JJ920D000011.

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	2021 Mercedes-Benz GLE350				
VIN	4JGFB4JB9MA40xxxx				
Body style	SUV				
Number of doors	5				
Trim level	-				
Seating positions	Front:	2 nd row	3 rd row	4 th row	5 th row
	2	3			
Electronic stability control	Yes				
4-Wheel ABS (Yes/No)	Yes				
Power steering (Yes/No)	Yes				
Major optional equipment	-				
Odometer at start of testing	16 miles				
Drivetrain					
Engine cylinder arrangement	Inline 4				
Engine displacement	2.0 L				
Transmission type	Automatic				
Drive arrangement	RWD				
Chassis					
Track width	F: 69.9 in (1775 mm), R: 70.3 in (1785 mm)				
Wheelbase	117.8 in (2992 mm)				
Curb weight	4626 lb (2098.5 kg)				
Certification Data from Vehicle's Label					
Vehicle manufactured by	Mercedes-Benz U.S. Intl., Inc				
Date of manufacture	1/21				
GVWR	6063 lb (2750 kg)				
GAWR Front	2866 lb (1300 kg)				
GAWR Rear	3417 lb (1550 kg)				

Table 2. Tire Information

Tire Manufacturer	Pirelli
Tire Model	Scorpion Zero
Tire Size	Front: 255/50R19 Rear: 255/50R19
Load rating	Front: 107 Rear: 107
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: 39 psi, (270 kPa) Rear: 44 psi, (300 kPa)
DOT code (8 first digits)	Front: UN64 W115 Rear: UN64 W115

Table 3. Vehicle Loading

Water dummy and other loading	Multi-Passenger Configuration 3 water dummies in second row
Water dummy weight	525.1 lb (238.2 kg)
Fuel level	Full
Weight as Tested	
Left front	1443 lb (654.5 kg)
Right front	1433 lb (650.0 kg)
Left rear	1470 lb (667.0 kg)
Right rear	1377 lb (624.5 kg)
Total weight	5723 lb (2596.0 kg)

D. STEERING CONTROLLER

Precise steering control is accomplished using a steering machine designed and constructed by ABD. It can provide up to 45 ft-lb torque and at rates over 1000 deg/sec. The integrated angle encoder has an unlimited range with a resolution of 0.25 degrees and an accuracy of ± 0.25 degrees. The steering motor is controlled by RC8 software from ABD, which also acts as the data acquisition system.

E. REAL-TIME CONTROLLER AND DATA ACQUISITION

Data acquisition is achieved using a MOSES Meas X, which also serves as the real-time system for the steering controller. Data from the OXTS, 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 MOSES MeasX. The Oxford IMUs are calibrated per the manufacturer's recommended schedule (Table 5).

Two video cameras were used to record the Fishhook runs. They were positioned nominally as shown in Figure 1. The recorded video was reviewed after the Fishhook runs to check for any two-wheel lift. If any two-wheel lift was observed, four 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 Applus+ IDIADA KARCO Engineering, LLC used for this specific test program.

Table 4. Weight of In-Cab Test Equipment

Equipment	Location	Equipment Weight (lb)	
		NHTSA*	IDIADA
Data Acquisition System	Front passenger seat	58	35
GPS Inertial unit	At the chassis in a flat and rigid surface		7
Steering Machine	Handwheel	31	51
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 footwell.	39	39
	Total	128	132

* 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. Sensor Specifications

Type	Measured Variable	Sensor	Range	Resolution	Accuracy	Specifics	Serial Number	Calibration	Unit
<i>Multi-Axis Inertial Sensing System</i>	Longitudinal speed	GPS inertial unit	-	0.01 %/s 0.01 m/s ²	±0.1	OXTS (RT)	1611	By: IDIADA Date: 6/16/2020 Due: 6/16/2022	km/h
<i>Distance Measuring System</i>	Lateral speed		-		±0.1				km/h
	Longitudinal acc.		±100		±0.1				m/s ²
<i>Radar Speed Sensor</i>	Lateral acc.		±100		±0.05				°
	Roll angle		±100		±0.05				°
<i>Data Flag (Roll Rate Flag)</i>	Pitch angle		±100		±0.1				°/s
	Yaw angle		±100		±0.1				°/s
	Roll rate		±100		±0.1				°/s
	Pitch rate		±100		±0.1				°/s
<i>Angle Encoder¹</i>	Steering angle		Steering wheel robot		>1000				0.25 deg
<i>Data Flag (Handwheel Command Flag)</i>	Steering torque	60		Nm					
<i>Infrared Distance Measuring System</i>	Tire wheel lift	Height sensors	300-700	0.01 mm	±0.8	OPTImess	OMS 4140-3098 OMS 4140-4506 OMS 4140-4508 OMS 4140-4509	By: IDIADA Date: 7/7/2020 Due: 7/7/2021	mm
<i>Load Cell</i>	Brake Pedal Force	Load Cell	±600	-	±0.5	Novatech	48305	By: IDIADA Date: 3/27/2020 Due: 3/27/2021	N
<i>Acquisition system</i>	-	Acquisition system	200	-	-	IDIADA Moses MEAS X	180749	By: IDIADA Date: 05/21/2020 Due: 05/21/2022	-

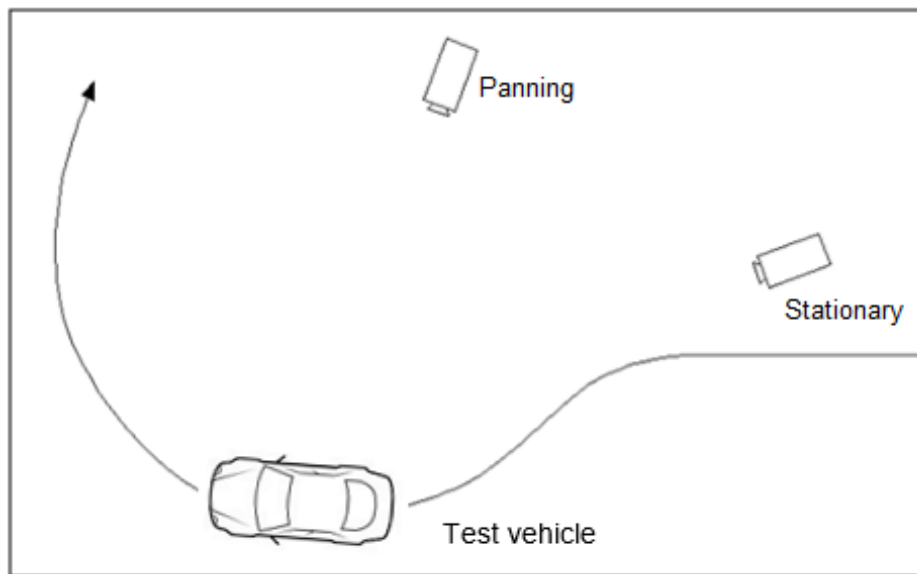


Figure 1. Nominal Position of Video Cameras for Fishhook Tests

SECTION III TEST PROCEDURES

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 3 seconds, and then returned to zero angle in 2 seconds.

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.

A. TEST CONDITIONS

1. Test Surface

The tests were conducted on the Vehicle Dynamics Area (VDA) at HONDA Proving Center facility, located in Cantil, California, on 2/12/2021. The VDA has a smooth, flat (slope less than 0.5% throughout) asphaltic concrete surface. Its dimensions are as shown in Figure 2. 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 surface friction measurement results are shown in Table 6.

Table 6. Lateral Surface Friction

Date of surface friction measurements	2/12/2021
Average lateral friction coefficient	0.94
Peak braking coefficient	0.92

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

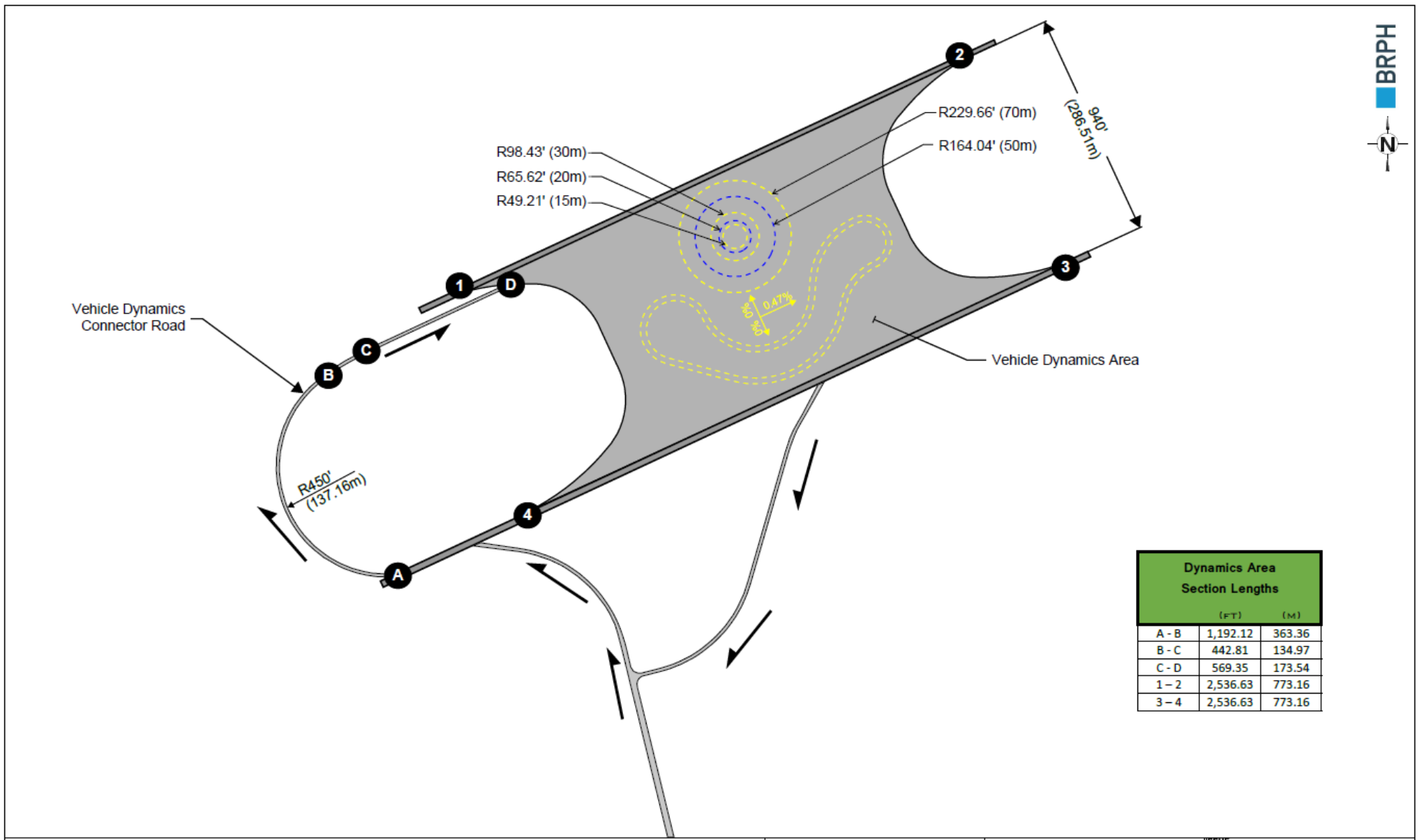
0.3 g handwheel angle (from SIS tests at 50 mph)	31.3°
5.5 scalar handwheel angle for Fishhook Test	172.2°
6.5 scalar handwheel angle for Fishhook Test	203.5°

3. Weather Conditions

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

Table 8. Weather Conditions

Ambient temperature	59.7 °F (15.4 °C)
Wind Speed	19.2 mph (8.6 m/s)
Wind Direction	WNW



Dynamics Area Section Lengths		
	(FT)	(M)
A - B	1,192.12	363.36
B - C	442.81	134.97
C - D	569.35	173.54
1 - 2	2,536.63	773.16
3 - 4	2,536.63	773.16

VEHICLE DYNAMICS



HONDA PROVING CENTER
CANTIL, CALIFORNIA

ISSUE	JUNE 1, 2018
REVISION	JULY 12, 2019
	HPC-05

Figure 2. Vehicle Dynamics Area at Honda Proving Center

SECTION IV
RESULTS

There is Appendix A with the photographic documentation. The test run log is given in Appendix B. A summary of the Slowly Increasing Steer Test 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 2021 Mercedes-Benz GLE350 RWD 5-Door SUV, there was no two-wheel lift at any test condition.

**APPENDIX A
PHOTOGRAPHS**

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2021 GLE350 SUV

PO#: 0171762855

VIN: 4JGFB4JB9MA4

Standard Features	Suggested Retail Price	\$54,750
PERFORMANCE/HANDLING	PAINT, UPHOLSTERY, TRIM	
2.0L Inline-4 Turbo Engine	040 Black	N/C
255 Horsespower	111 Black MB-Tex	N/C
273 lb-ft of Torque	R15 design® Natural Grain Black Wood Trim	\$50.00
9G-TRONIC 9-Speed Automatic Transmission		
ECO Start/Stop	OPTIONAL EQUIPMENT AND VALUE ADDED PACKAGES	
DYNAMIC SELECT	826 19" Twin 5-Spoke Wheels	N/C
	U14 Augmented Video for Navigation	350.00
COMFORT/CONVENIENCE	S1U Black Headliner	N/C
Dual-Zone Automatic Climate Control	046 Illuminated Running Boards	650.00
KEYLESS-GO®	D07 Wheel Locking Bolts	150.00
Bluetooth® Connectivity	DP1 Premium Package: 115V AC household-type Power Outlet, Surround View System, Burmester Surround Sound System	1,375.00
12.3" Widescreen Digital Instrument Cluster	Destination and Delivery	1,050.00
12.3" Widescreen Display	Total Retail Price	\$59,175.00
MB Navigation		
with Map Updates for First Three Years		
Touchpad		
Apple CarPlay™		
Android Auto		
Voice Control		
Mercedes me connect services w/ trial period (subscription required thereafter)		
Power-Folding Side Mirrors		
LED Side Mirror Lane Projectors		
Power Tilt/Sliding Sunroof		
NFC Wireless Charging		
04-Color Interior Ambient Lighting		
SiriusXM Radio w. 6 mos. service		
SAFETY/SECURITY		
New Vehicle 4 Year/50,000 Mile Warranty		
24 Hour Roadside Assistance Program		
Advanced Air Bag Protection System		
ATTENTION ASSIST®		
Active Brake Assist		
Active Parking Assist		
Blind Spot Assist		
LATCH/ISOFIX Child Restraint System		
Rearview Camera		
LED Headlamps		
LED Taillamps		
Mercedes-Benz Emergency Call Service		
PRE-SAFE® Predictive Occupant-Protection System		
PRE-SAFE® Sound		
Advanced Alarm System		

Special Messages:

* Bluetooth is a registered trademark of Bluetooth SIG, Inc. ** Prepaid Maintenance Plan available for this vehicle; see dealer for details. † This vehicle is equipped with bumpers that can withstand an impact of 2.5 miles per hour with no damage to the vehicle's body and safety systems, although the bumper and related components may sustain damage. The bumper system on this vehicle conforms to the current federal bumper standard of 2.5 miles per hour.

EPA DOT

Fuel Economy and Environment

Gasoline Vehicle

Fuel Economy

22 MPG
combined city/hwy

19 city

26 highway

4.5 gallons per 100 miles

Standard SUVs range from 13 to 101 MPG. The best vehicle rates 141 MPG.

You spend \$3,500
more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost

\$2,200

Fuel Economy & Greenhouse Gas Rating (tailpipe only)

1 4 10 Best

Smog Rating (tailpipe only)

1 5 10 Best

This vehicle emits 403 grams CO₂ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions. Learn more at fuel economy.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 \$3.29 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fuel economy.gov

Calculate personalized estimates and compare vehicles

Smartphone QR Code

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. Should ONLY be compared to other vehicles of similar size and weight.		
Side Crash	Front seat Rear seat	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

PARTS CONTENT INFORMATION

For vehicles in this carline:
U.S./Canadian Parts Content: **69%**

Major Sources of Foreign Parts Content:
GERMANY: 12%

NOTE: Parts content does not include final assembly, distribution or other non-parts costs.

For this vehicle:
Final Assembly Point: **VANCE, ALABAMA USA**
Country of Origin: **USA**
Engine: **USA**
Transmission: **GERMANY**

Ship To:
MERCEDES-BENZ FINANCIAL SERVICES, INC.
ONE ALPACENTER DRIVE
BUENA VISTA, CA 95021

Point of Entry: MBUSA Alabama
Transport:

Figure A1. Monroney Label



Figure A2. Right Front View, Test Vehicle As-Delivered



Figure A3. Left Rear View, Test Vehicle As-Delivered



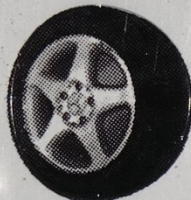
Figure A4. Left Front View, Test Vehicle in Test Condition



Figure A5. Right Rear View, Test Vehicle in Test Condition




Figure A6. Vehicle's Certification Label



TIRE AND LOADING INFORMATION RENSEIGNEMENTS SUR LES PNEUS ET LE CHARGEMENT

SEATING CAPACITY NOMBRE DE PLACES	TOTAL	5	FRONT AVANT	2	REAR ARRIÈRE	3
--------------------------------------	-------	---	----------------	---	-----------------	---

The combined weight of occupants and cargo should never exceed **432** kg or **952** lbs.
Le poids total des occupants et du chargement ne doit jamais dépasser **432** kg ou **952** lb.

TIRE PNEU	SIZE DIMENSIONS	COLD TIRE PRESSURE PRESSION DES PNEUS À FROID	SEE OWNER'S MANUAL FOR ADDITIONAL INFORMATION 
FRONT AVANT	255/50 R19 EXTRA LOAD	270 KPA, 39 PSI	
REAR ARRIÈRE	255/50 R19 EXTRA LOAD	300 KPA, 44 PSI	
SPARE DE SECOURS	T155/80 R19 114M	410 KPA, 60 PSI	

A 167 584 83 17

Figure A7. Vehicle's Tire Information Placard



Figure A8. Instrumentation in Test Vehicle



Figure A9. Steering Controller and Computer



Figure A10. Ballast Condition

**APPENDIX B
TEST RUN LOG**

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
1	Tire Warm-Up	35	30.0	Left	N/A	Resulted in ay = 0.24g
2	"	"	70.1	"	"	Resulted in ay = 0.39g
3	"	"	"	"	"	
4	"	"	"	"	"	
5	2x SWA last cycle	"	140.2	"	"	2x SWA last cycle
6	Static	0	0	N/A	N/A	
7	Steady State	50	0	N/A	N/A	
8	Slowly Increasing Steer	50	30.0	Left	N/A	
9	"	"	44.9	Left	"	HW angle at 0.3 g = -33.3
10	"	"	"	Left	"	HW angle at 0.3 g = -32.7
11	"	"	"	Left	"	HW angle at 0.3 g = -33.7
12	"	"	"	Right	"	HW angle at 0.3 g = 29.3
13	"	"	"	Right	"	HW angle at 0.3 g = 29.7
14	"	"	"	Right	"	HW angle at 0.3 g = 28.7
						Average = 31.3
15	Fishhook 6.5 Scalar	35	203.5	Left	No	
16	"	40	"	"	"	
17	"	45	"	"	"	
18	"	47.5	"	"	"	
19	"	50	"	"	"	
20	Fishhook 6.5 Scalar	35	203.5	Right	No	
21	"	40	"	"	"	
22	"	45	"	"	"	

Run Number	Test Type	Speed (mph)	Handwheel Angle (deg)	Dir. of First Steer	2 Wheel Lift	Notes
23	"	47.5	"	"	"	
24	"	50	"	"	"	
25	Fishhook 5.5 Scalar	45	172.2	Left	No	
26	"	47.5	"	"	"	
27	"	50	"	"	"	
28	Fishhook 5.5 Scalar	45	172.2	Right	No	
29	"	47.5	"	"	"	
30	"	50	"	"	"	

APPENDIX C
SLOWLY INCREASING STEER TEST WORKSHEET

2021 Mercedes-Benz GLE350 RWD 5-Door SUV, Multi-Passenger Configuration,
 Test Date: 2/12/2021



Slowly Increasing Steer



Vehicle: 2021 Mercedes-Benz GLE350
 Test Date: 2/12/2021
 Analysis Date: 2/12/2021
 Analysed by: EL
 Executed by: OG
 Weight Condition: Test condition

Test Track: Dynamic Platform
 Test Speed: 50 mph

Run	Dir of Steer	Start speed [mph]	End speed [mph]	Speed red [%]	Index of ay	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
sis_001	L	49.7	0.3	99.4	1111	-33.3	-0.300	-216.7	-0.3010	-183.4	-0.2547	0.9952	415	615
sis_002	L	50.0	0.4	99.2	1095	-32.7	-0.300	-212.3	-0.2949	-179.7	-0.2495	0.9928	397	597
sis_003	L	49.8	0.3	99.5	1108	-33.7	-0.300	-219.1	-0.3043	-185.4	-0.2575	0.9948	396	596
sis_004	R	49.4	0.2	99.6	1034	29.3	0.300	190.6	0.2648	161.3	0.2240	0.9834	348	548
sis_005	R	49.6	0.4	99.3	1045	29.7	0.300	193.3	0.2685	163.6	0.2272	0.9925	360	560
sis_006	R	50.2	0.1	99.8	1044	28.7	0.300	186.7	0.2594	158.0	0.2195	0.9928	365	565

Mean: 31.3

Steering Controller Input values

Scalar 6.5 values:

Initial HW angle: 203.5 deg

Reversal HW angle: -203.5 deg

Scalar 5.5 values:

Initial HW angle: 172.2 deg

Reversal HW angle: -172.2 deg

APPENDIX D
TIME HISTORY PLOTS

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FILENAME: FH005

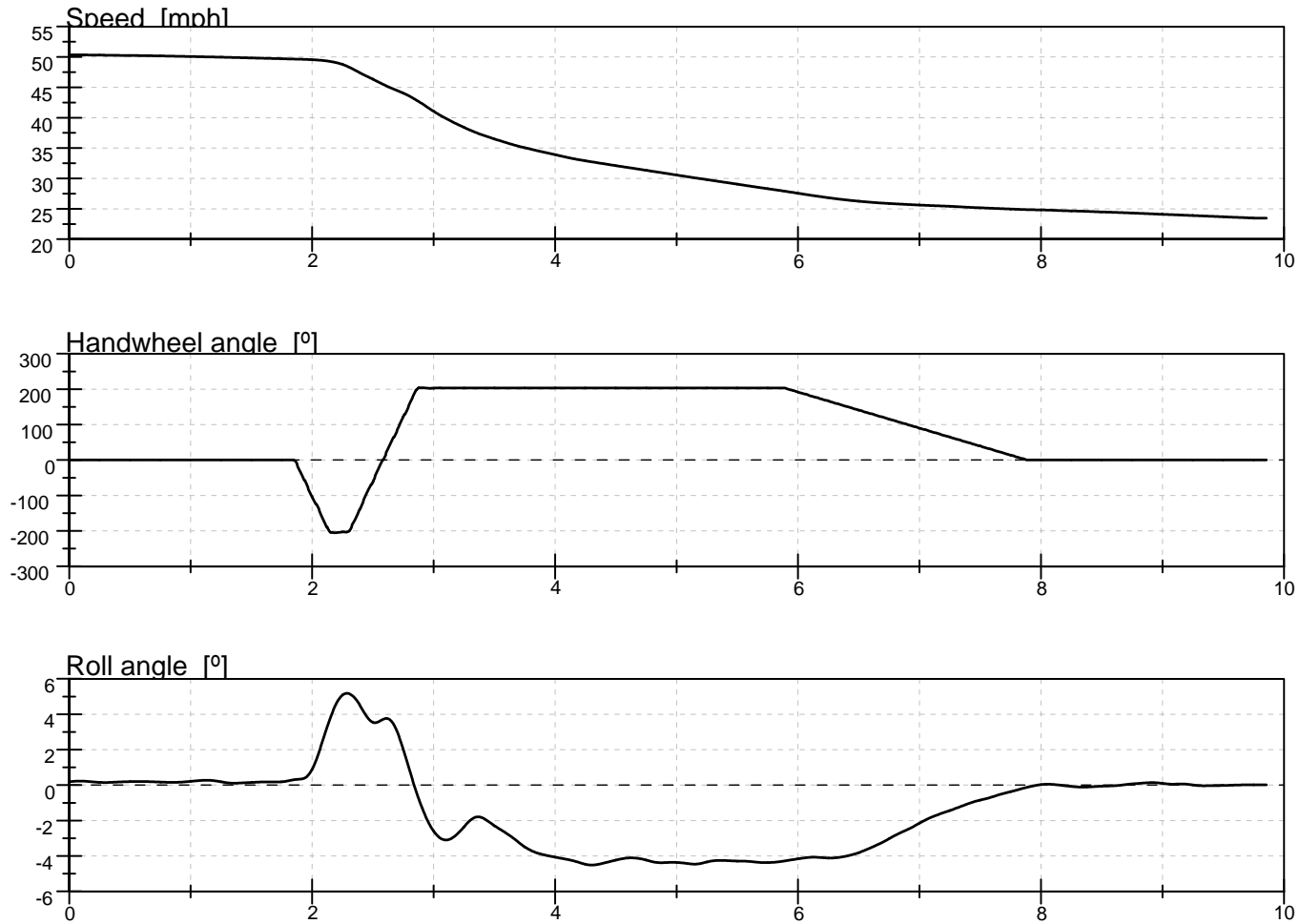


Figure D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph

FILENAME: FH005

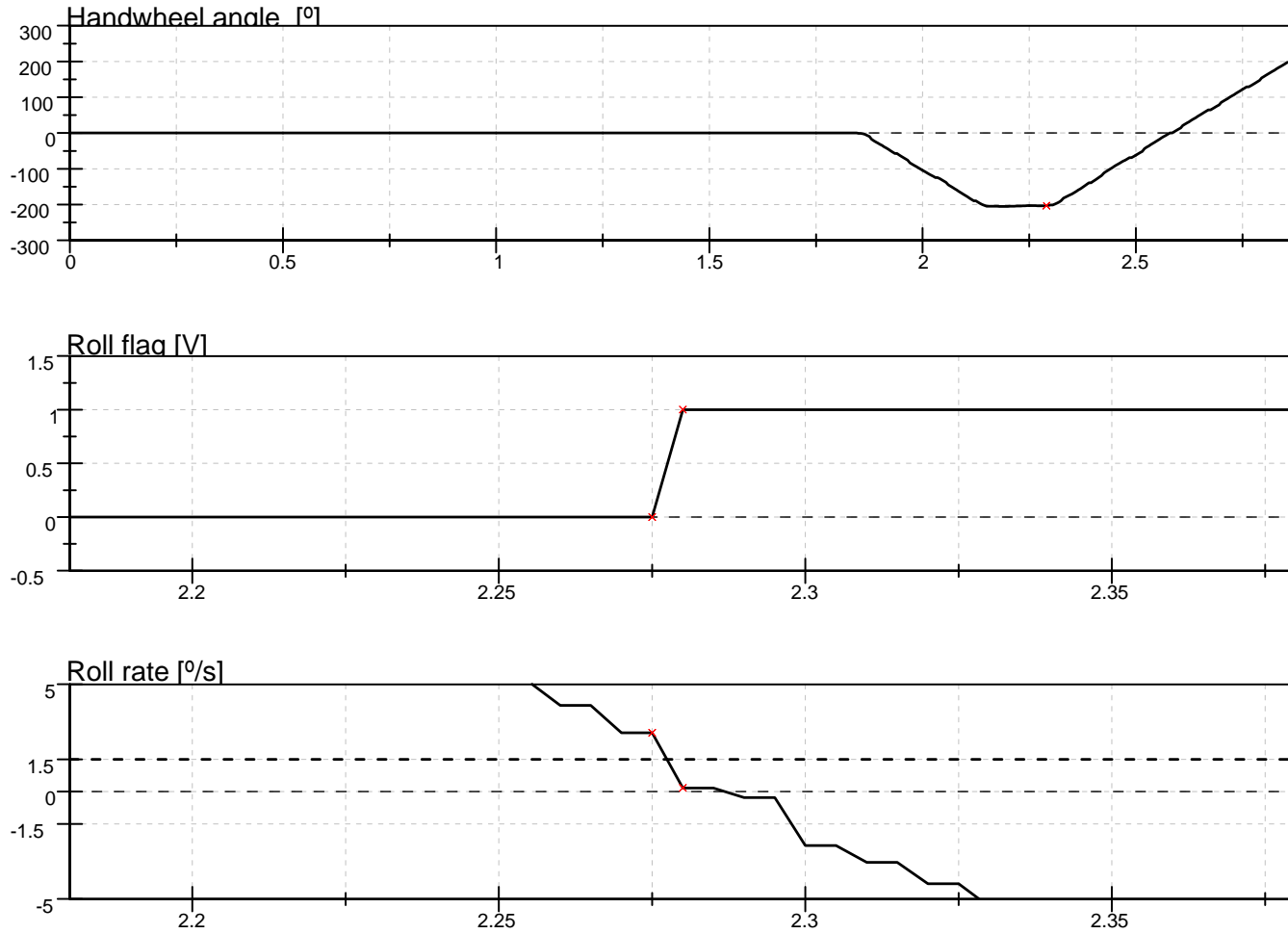


Figure D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph

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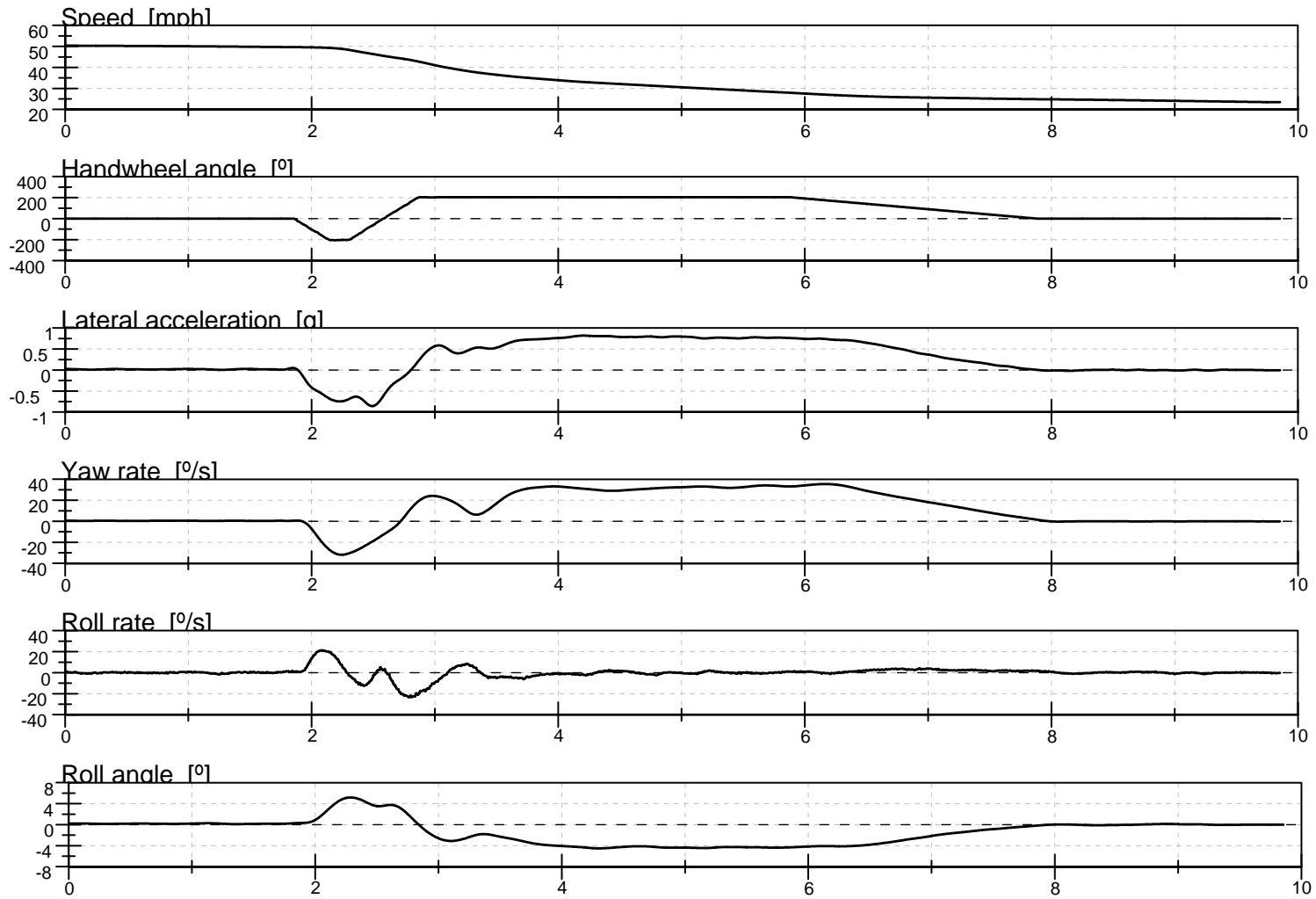


Figure D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots For Default Test Series, L-R, 50 mph

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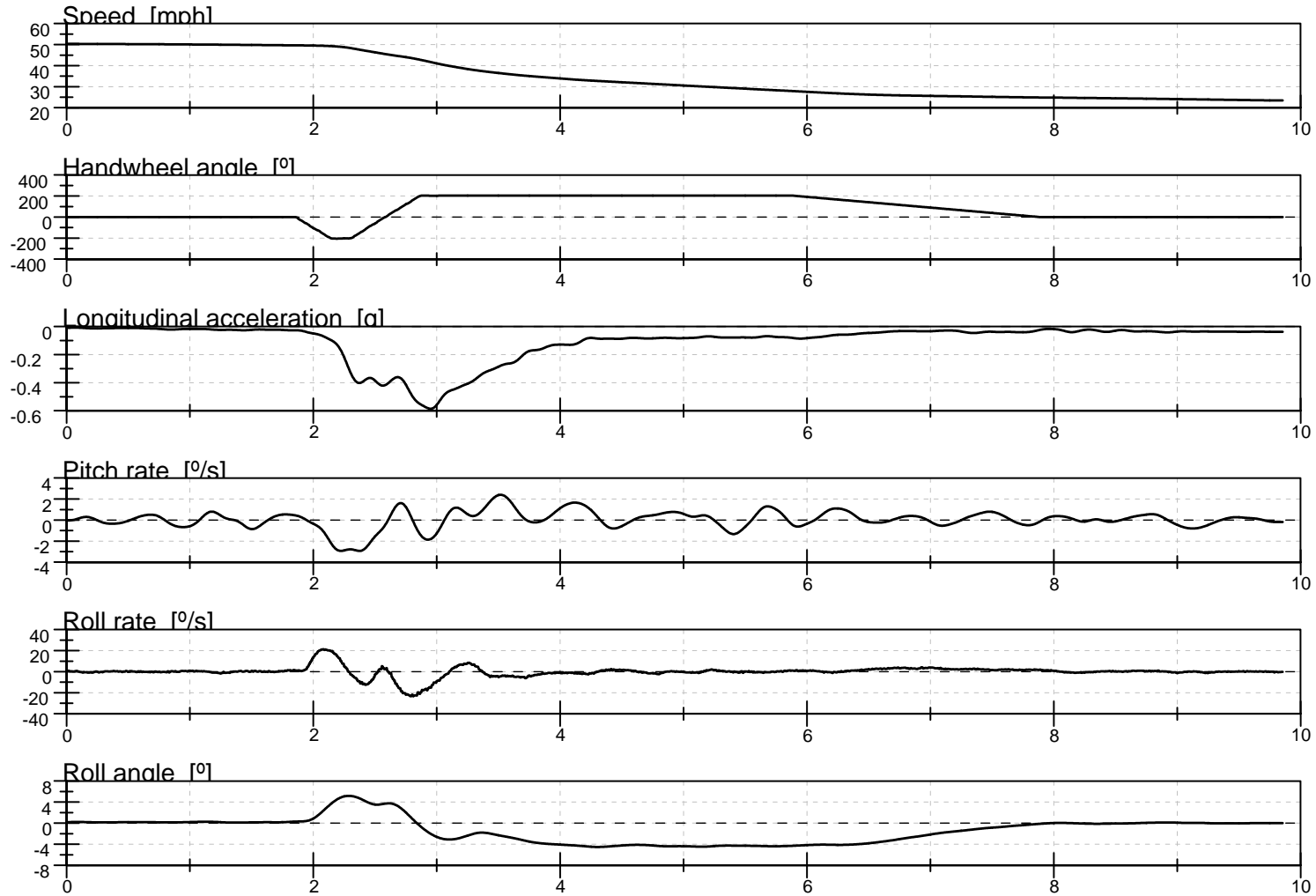


Figure D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph

FILENAME: FH010

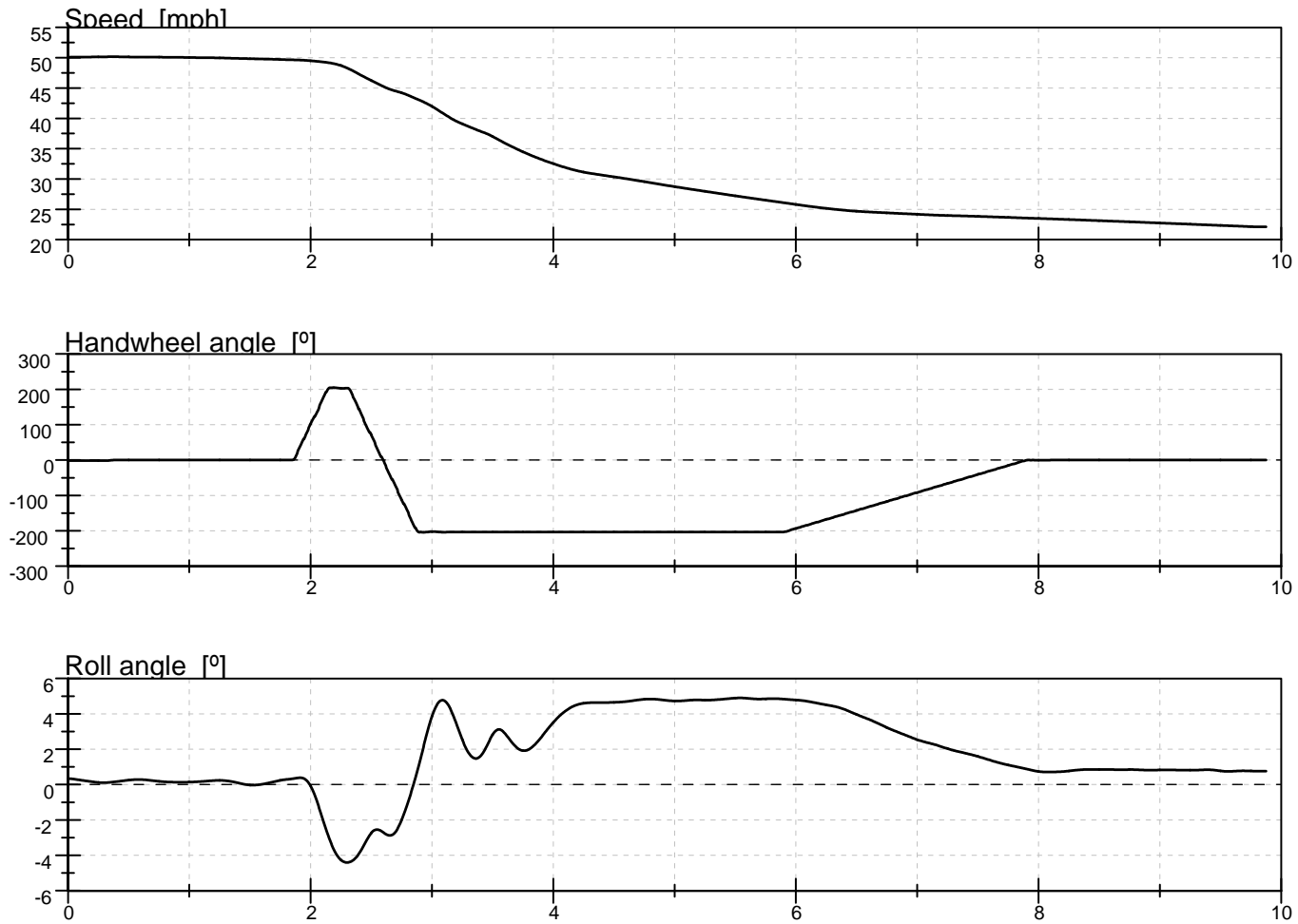


Figure D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

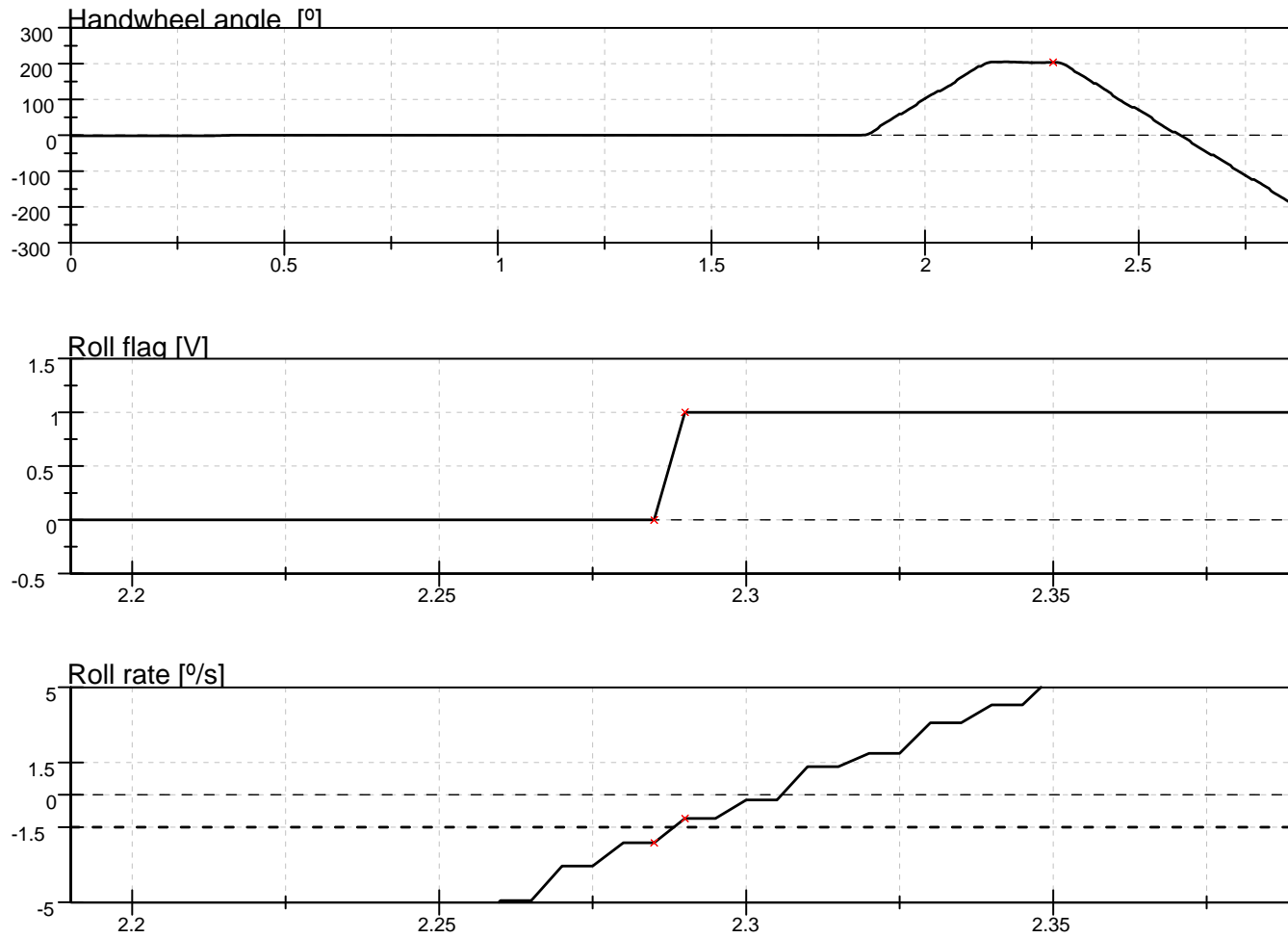


Figure D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

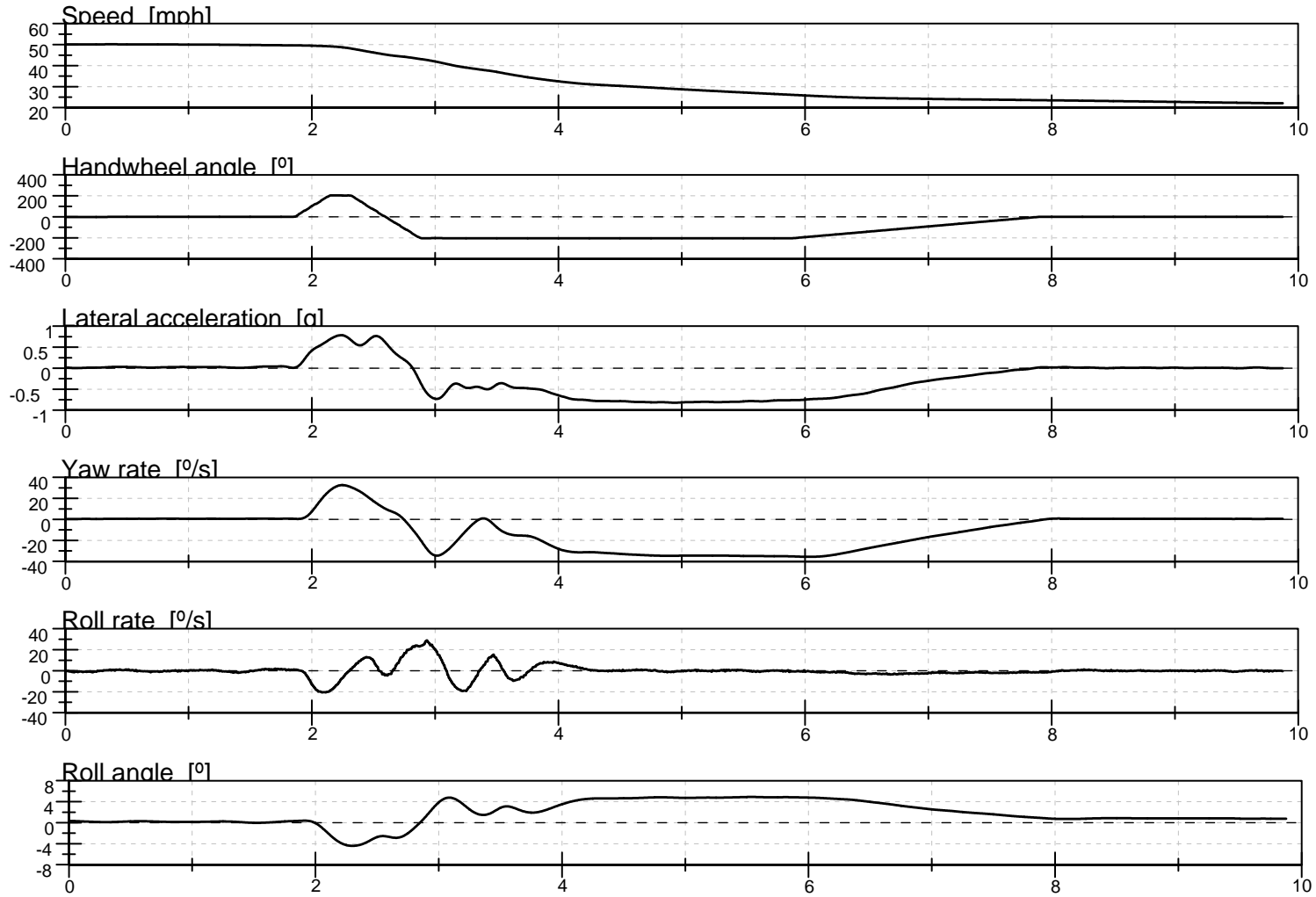


Figure D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

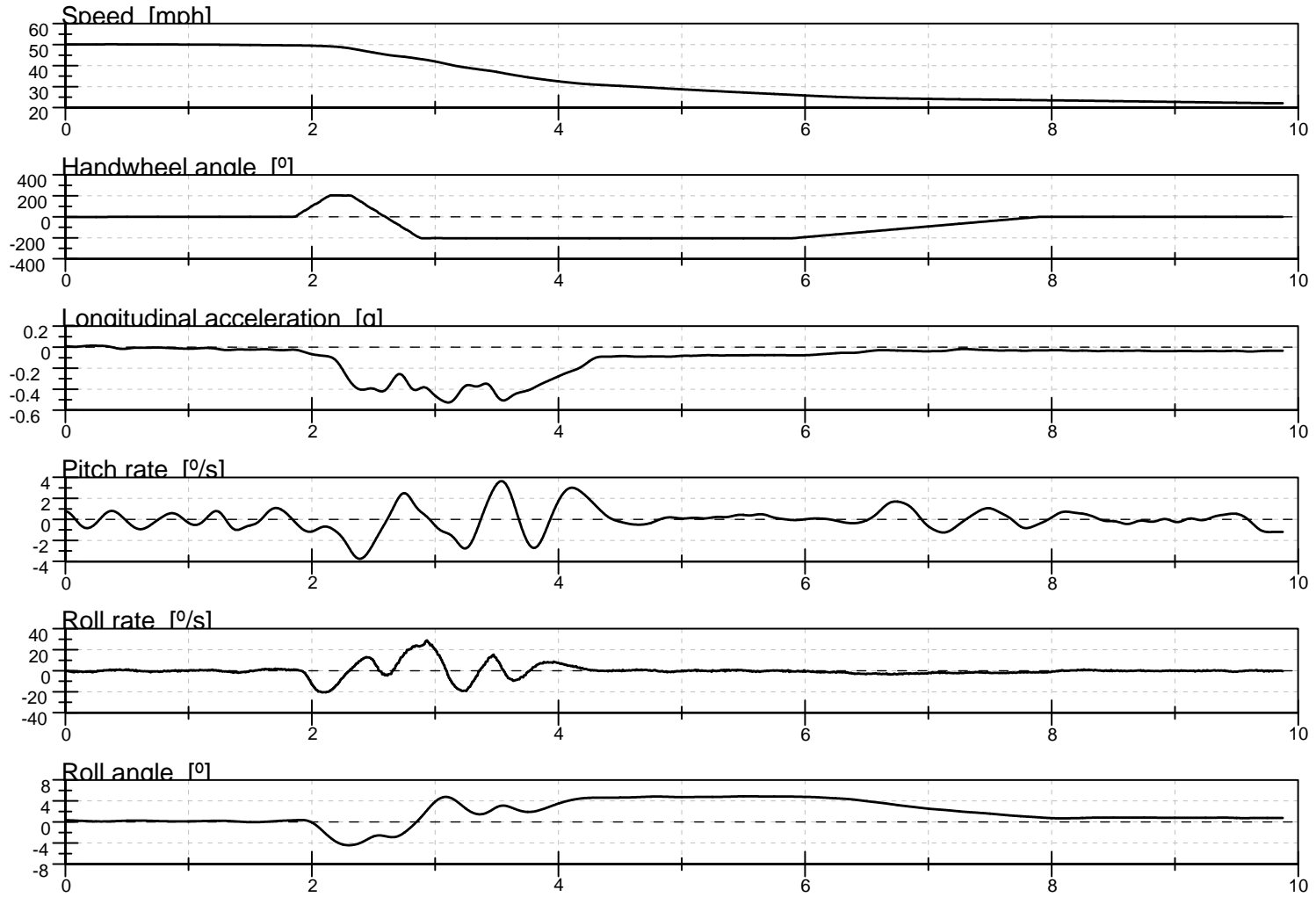


Figure D8. Pitch Rate and Longitudinal Acceleration Time History Plots or Default Test Series, R-L, 50 mph

FILENAME: FH013

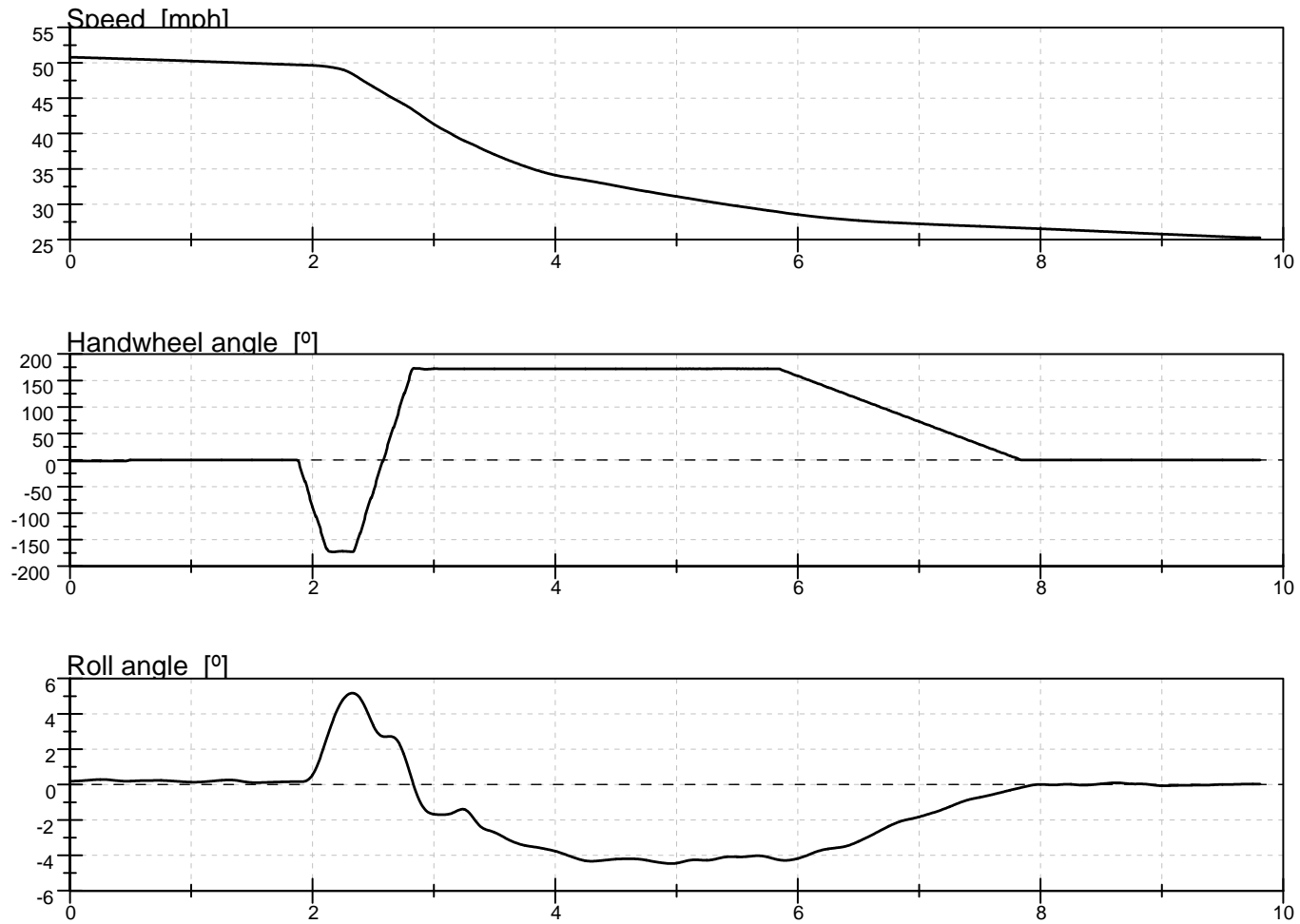


Figure D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH013

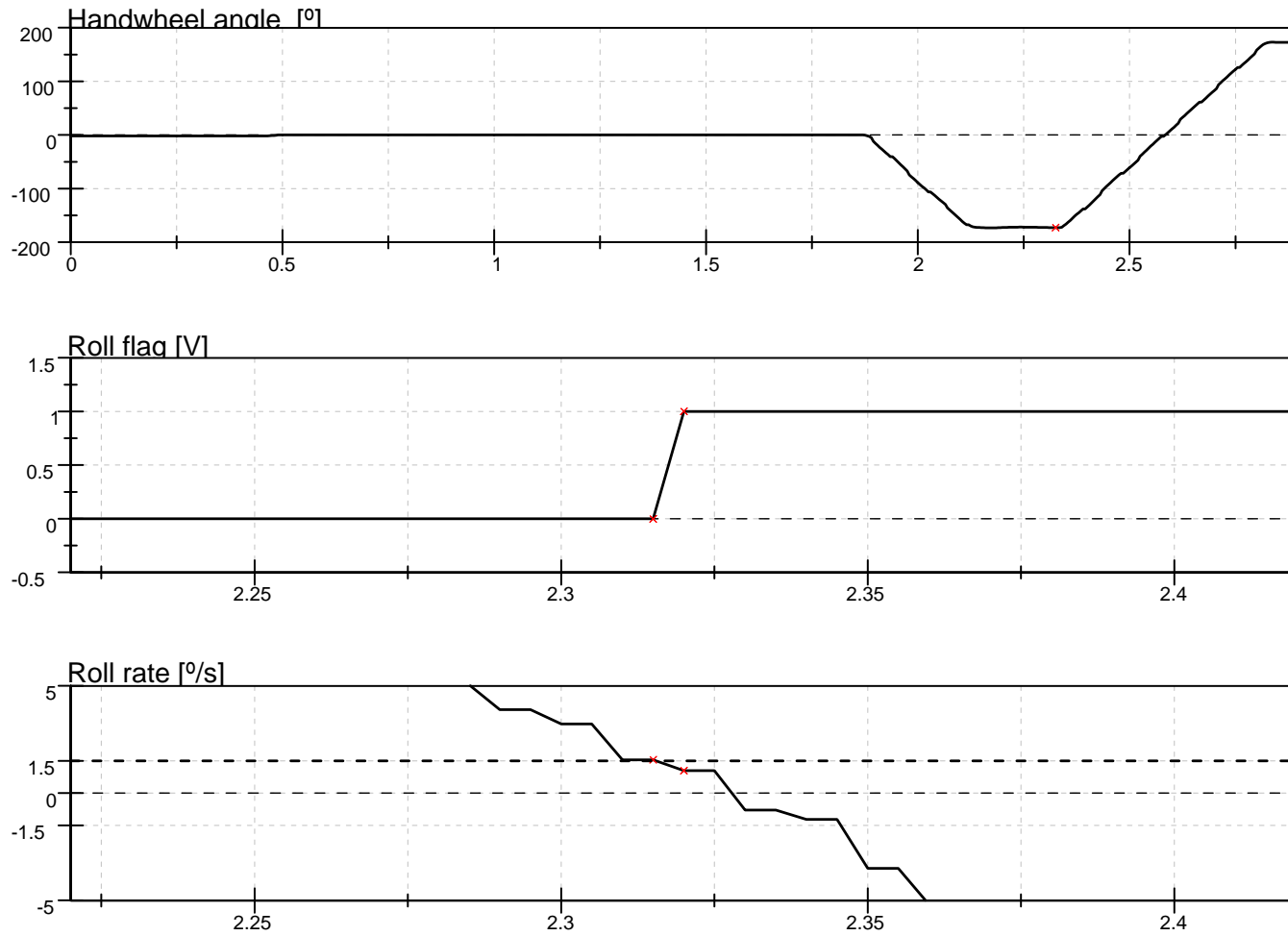


Figure D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH013

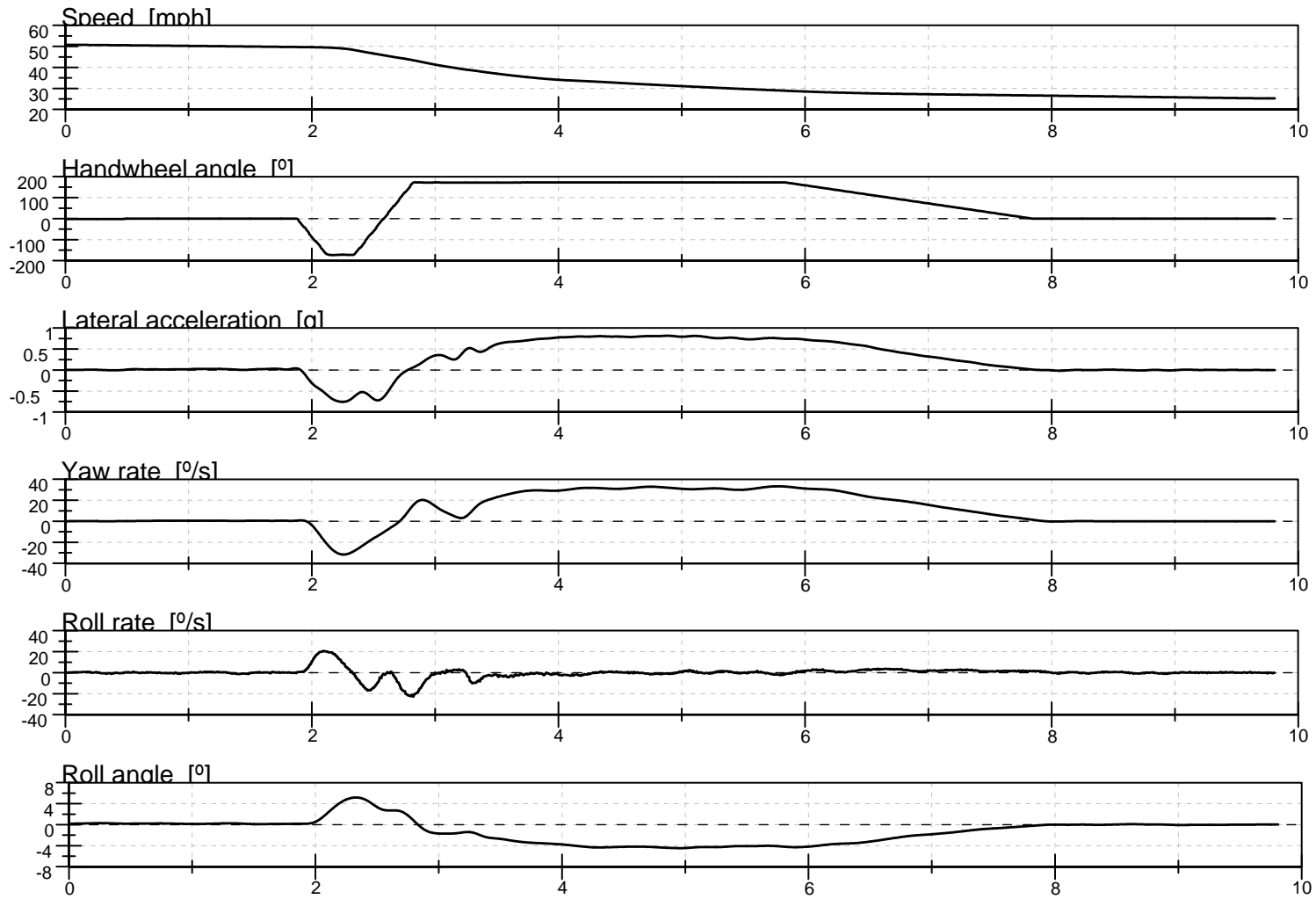


Figure D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

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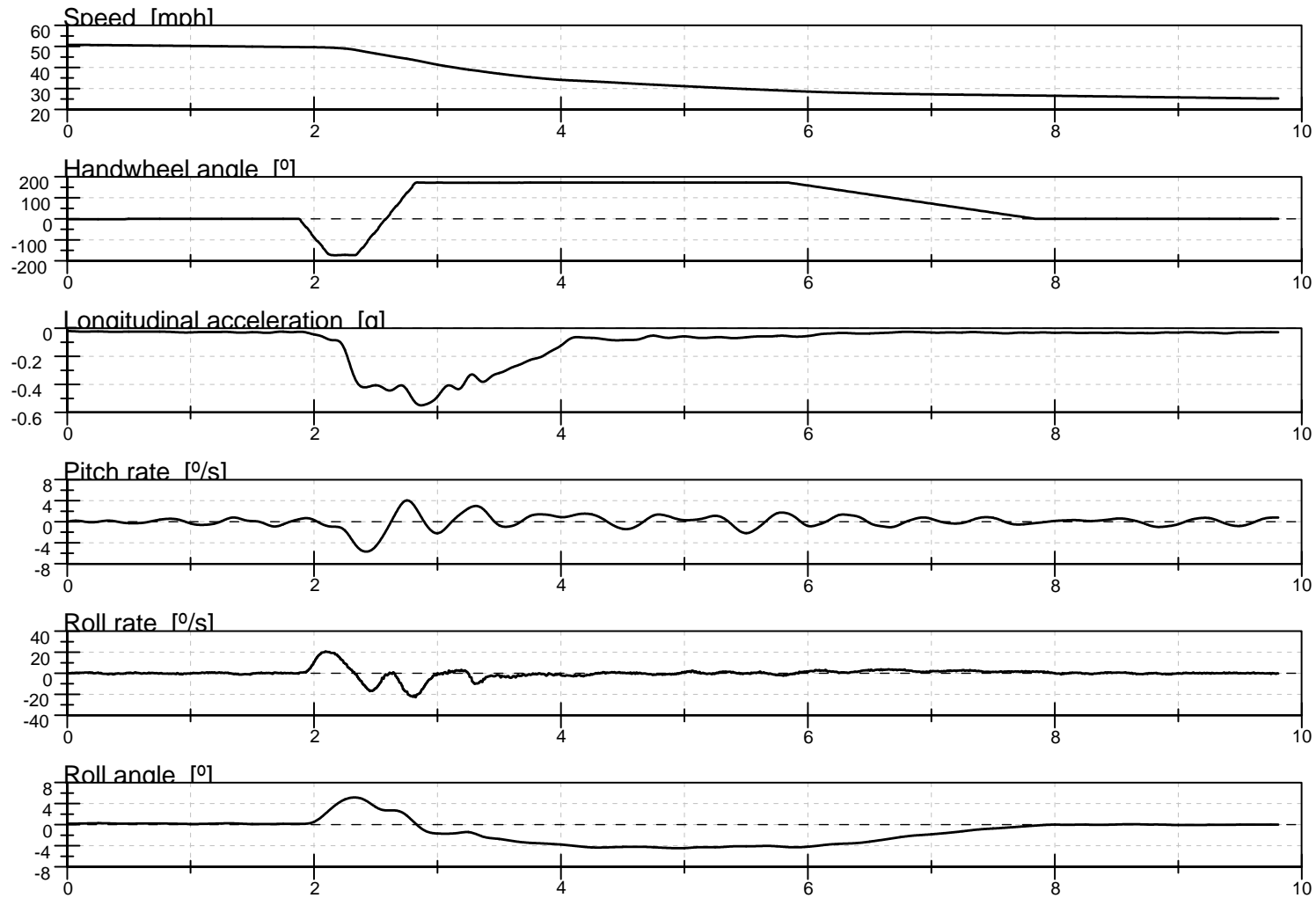


Figure D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

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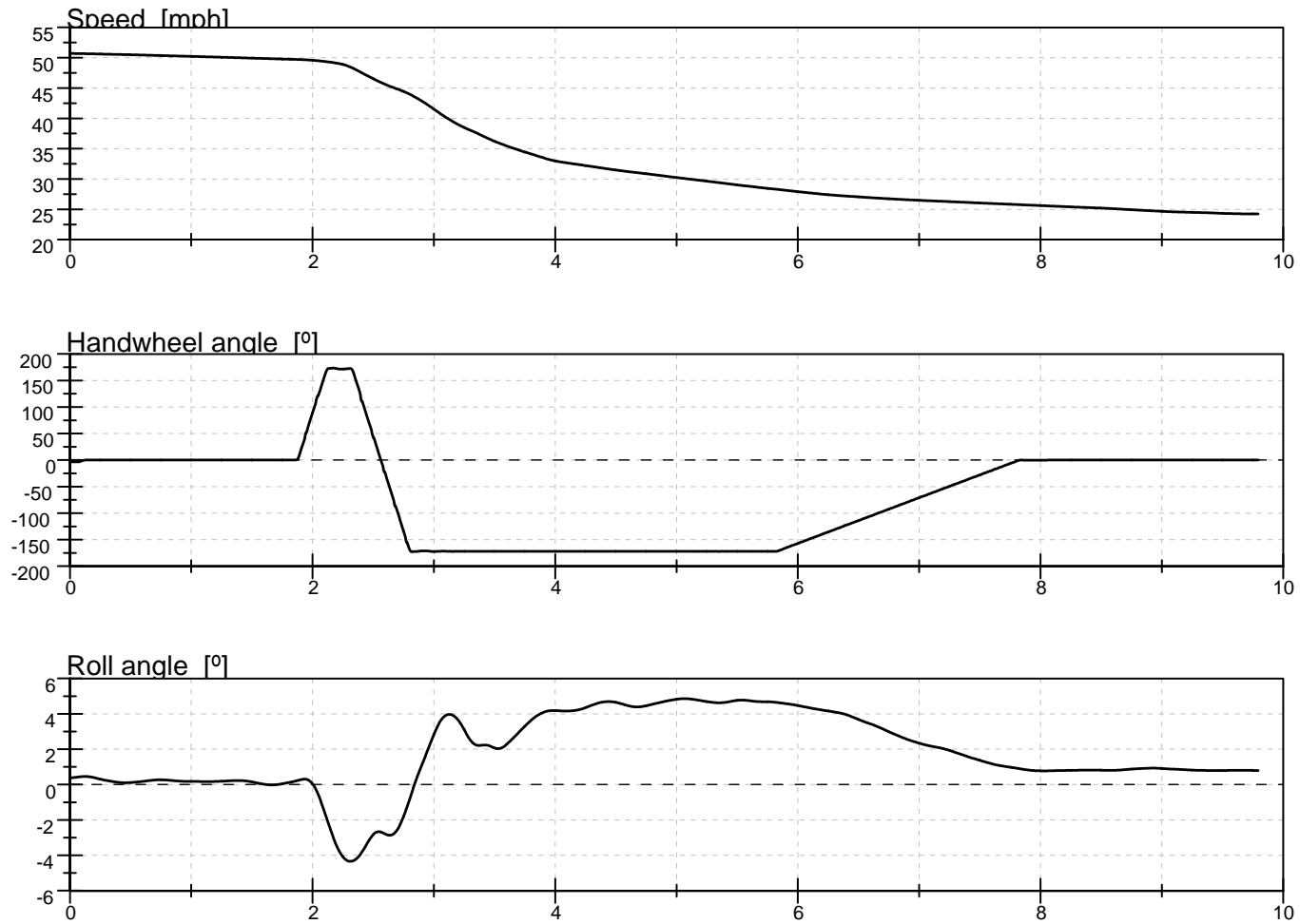


Figure D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

FILENAME: FH016

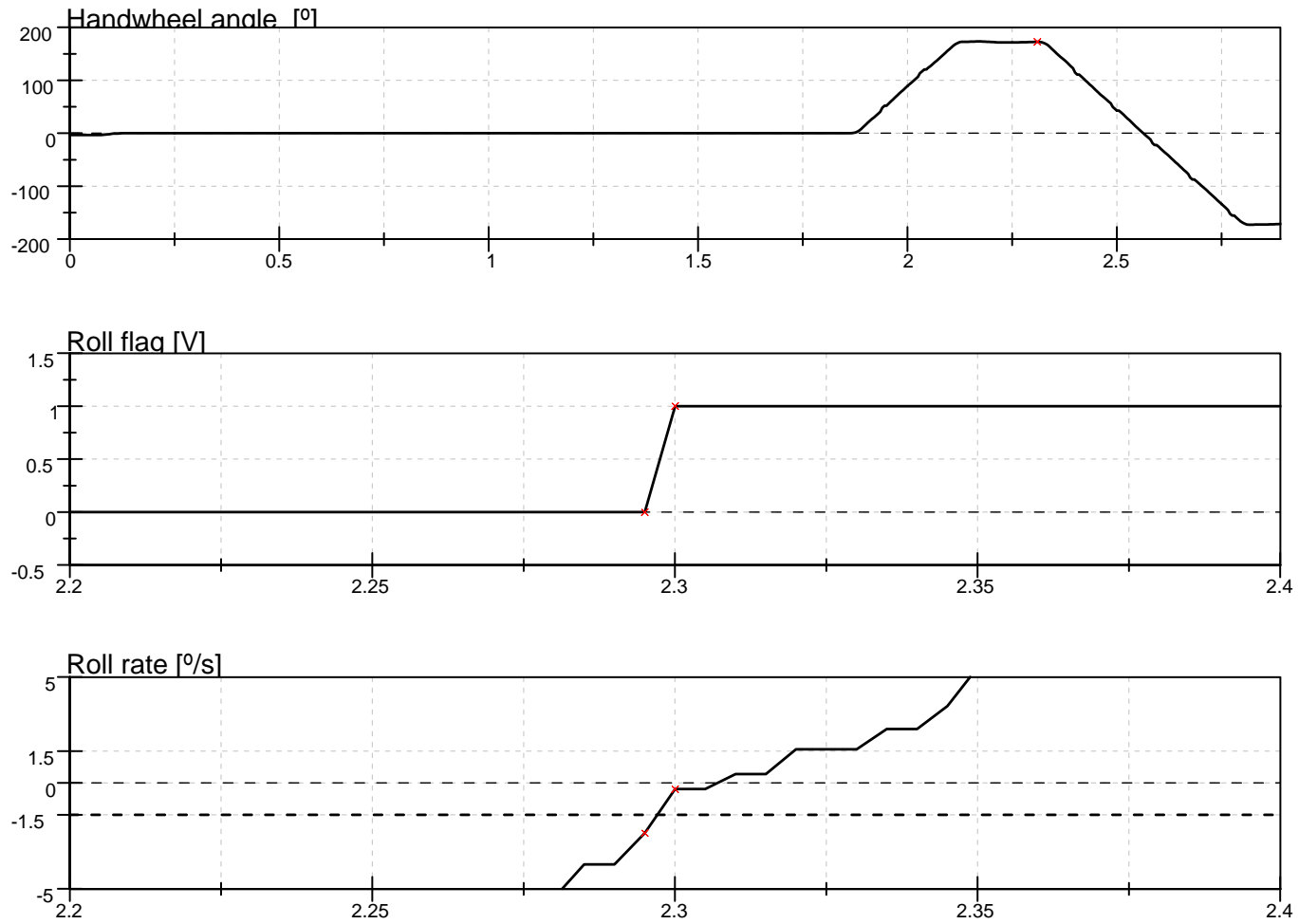


Figure D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

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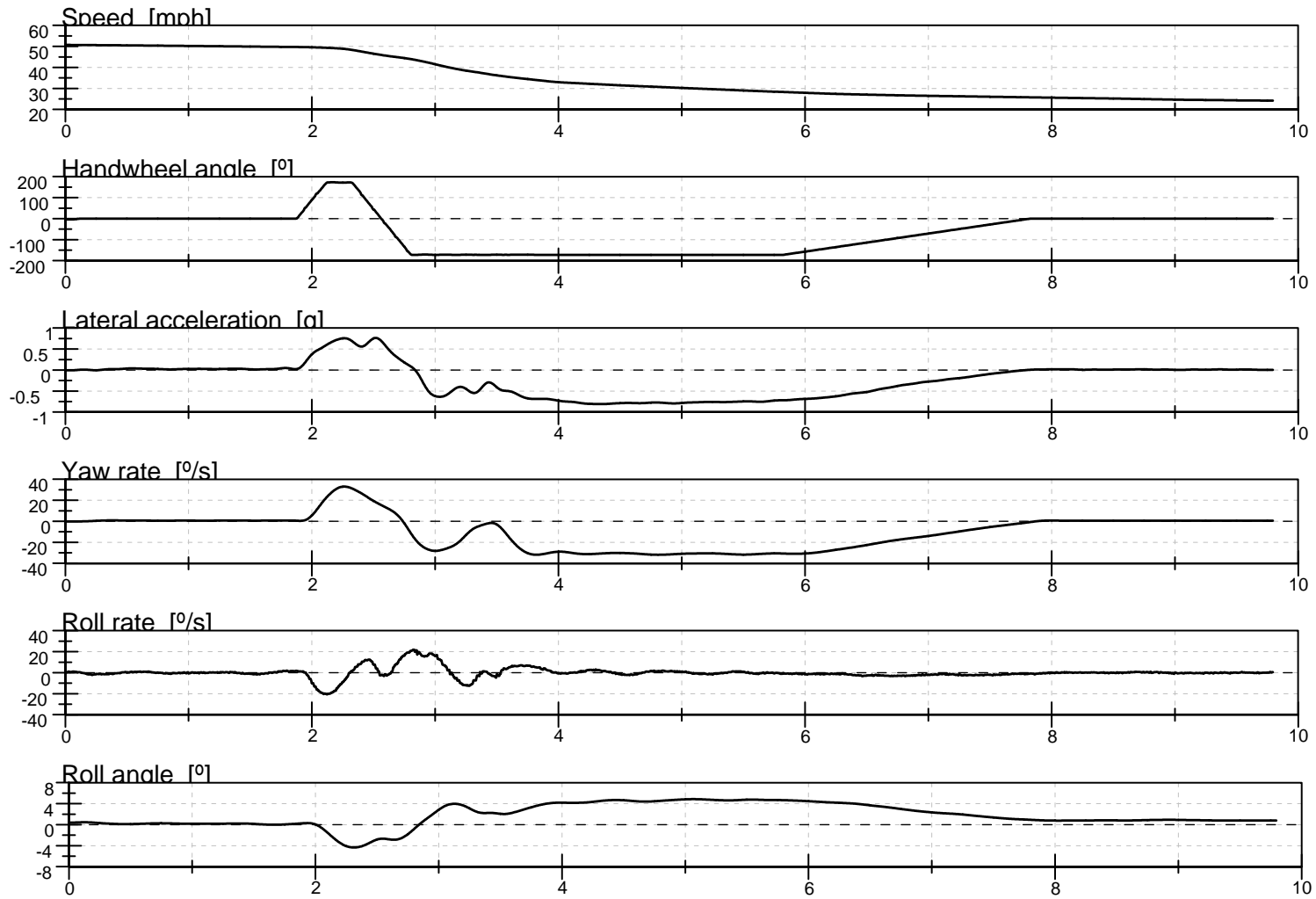


Figure D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

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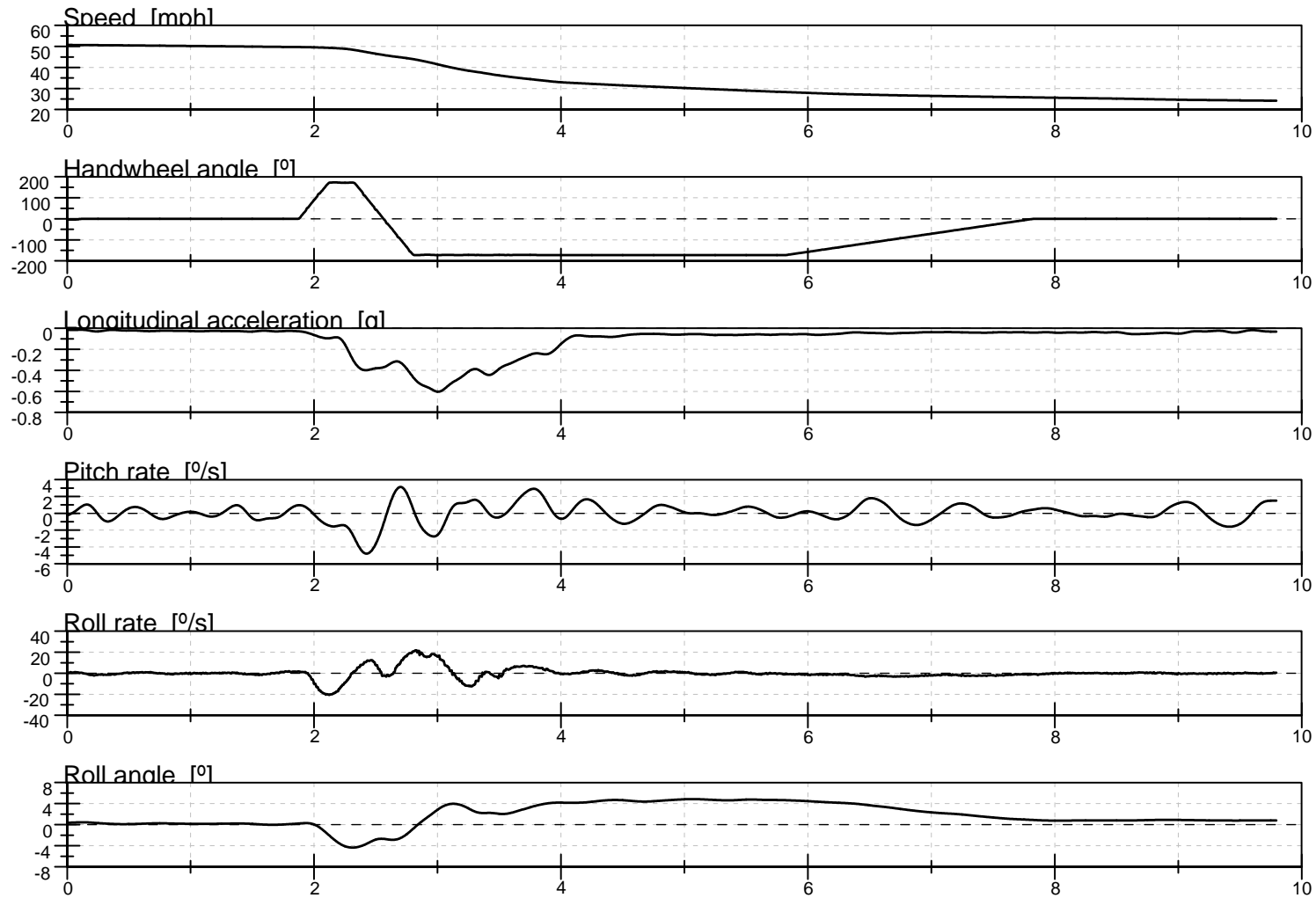


Figure D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

