

**NCAP-KAR-DR-21-05
NEW CAR ASSESSMENT PROGRAM (NCAP)
DYNAMIC ROLLOVER RESISTANCE TEST**

SAIC GENERAL MOTORS CORPORATION

2021 BUICK ENVISION FWD 5-DOOR SUV

PREPARED BY:

APPLUS IDIADA KARCO ENGINEERING, LLC.

9270 HOLLY ROAD

ADELANTO, CA 92301



MARCH 12, 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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16. Abstract An NCAP Dynamic Rollover Maneuver (Fishhook) Test was conducted on a 2021 Buick Envision FWD 5-Door SUV by Applus+ IDIADA KARCO Engineering, LLC. on March 5, 2021. The vehicle did not experience two-wheel lift. The vehicle's steering angle at 0.3 g lateral acceleration at 50 mph was 28.1 degrees.			
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TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	INTRODUCTION	1
II	VEHICLE PREPARATION	2
III	TEST PROCEDURES	9
IV	RESULTS	13
<u>Appendix</u>		<u>Page</u>
A	Photographs	A
B	Test Run Log	B
C	Slowly Increasing Steer Test Worksheet	C
D	Time History Plots	D

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Nominal Position of Video Cameras for Fishhook Tests	8
2	Vehicle Dynamics Area at Honda Proving Center	12

LIST OF TABLES

<u>Table</u>		<u>Page</u>
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	Lateral Surface Friction	10
7	Handwheel Angles	10
8	Weather Conditions	11

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 Buick Envision FWD 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 Buick Envision				
VIN	LRBFZRR49MD05xxxx				
Body style	SUV				
Number of doors	5				
Trim level	Avenir				
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	132 miles				
Drivetrain					
Engine cylinder arrangement	Inline 4				
Engine displacement	2.0 L				
Transmission type	Automatic				
Drive arrangement	FWD				
Chassis					
Track width	F: 67.5 in (1715 mm), R: 67.5 in (1715 mm)				
Wheelbase	109.6 in (2785 mm)				
Curb weight	3772 lb (1711.0 kg)				
Certification Data from Vehicle's Label					
Vehicle manufactured by	SAIC General Motors Corporation				
Date of manufacture	11/20				
GVWR	5070 lb (2300 kg)				
GAWR Front	2645 lb (1200 kg)				
GAWR Rear	2535 lb (1150 kg)				

Table 2. Tire Information

Tire Manufacturer	Continental
Tire Model	Pro Contact TX
Tire Size	Front: 245/45R20 Rear: 245/45R20
Load rating	Front: 99 Rear: 99
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: 35 psi, (240 kPa) Rear: 35 psi, (240 kPa)
DOT code (8 first digits)	Front: 1LF OFBBXY Rear: 1LF OFBBXY

Table 3. Vehicle Loading

Water dummy and other loading	Multi-Passenger Configuration 3 water dummies in second row
Water dummy weight	456.4 lb (207.0 kg)
Fuel level	Full
Weight as Tested	
Left front	1366 lb (619.5 kg)
Right front	1325 lb (601.0 kg)
Left rear	1066 lb (483.5 kg)
Right rear	1041 lb (472.5 kg)
Total weight	4798 lb (2176.5 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
	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	-

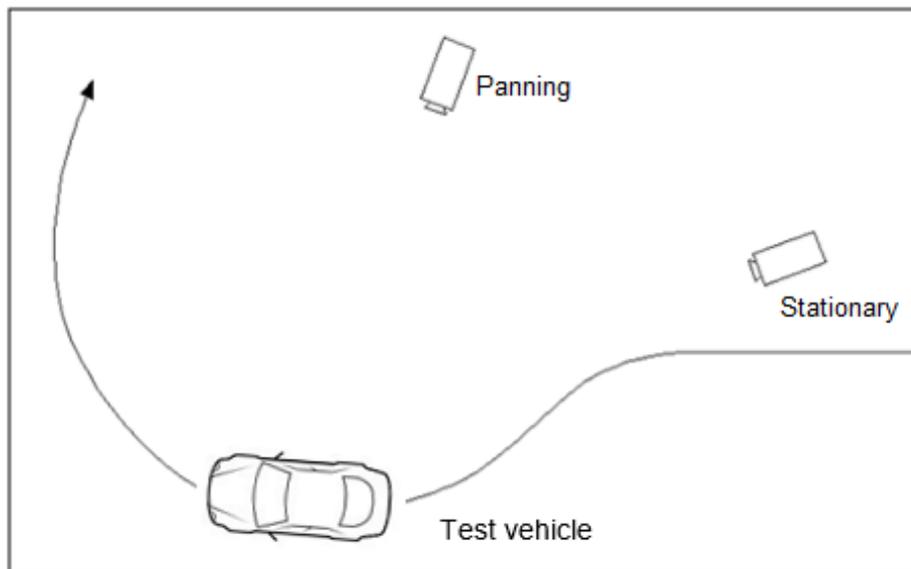


Figure 1. Nominal Position of Video Cameras for Fishhook Tests

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 3/5/2021. 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	3/5/2021
Average lateral friction coefficient	0.93
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)	28.1°
5.5 scalar handwheel angle for Fishhook Test	154.6°
6.5 scalar handwheel angle for Fishhook Test	182.7°

3. Weather Conditions

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

Table 8. Weather Conditions

Ambient temperature	70.5 °F (21.4 °C)
Wind Speed	8.9 mph (4.0 m/s)
Wind Direction	E

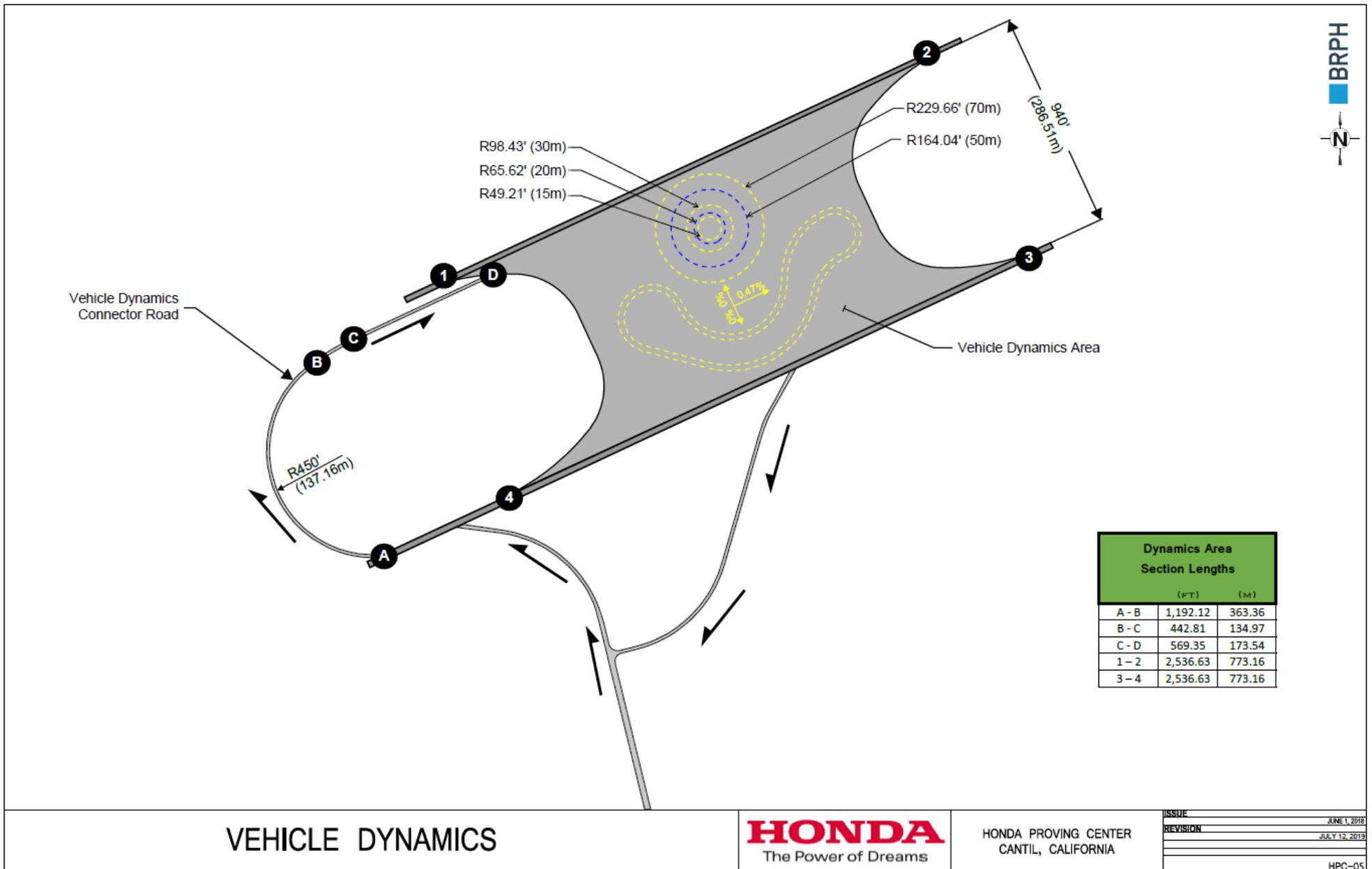


Figure 2. Vehicle Dynamics Area at Honda Proving Center

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 Buick Envision FWD 5-Door SUV, there was no two-wheel lift at any test condition.

**APPENDIX A
PHOTOGRAPHS**

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
Figure A1	Monroney Label	A-1
Figure A2	Right Front View, Test Vehicle As-Delivered	A-2
Figure A3	Left Rear View, Test Vehicle As-Delivered	A-3
Figure A4	Left Front View, Test Vehicle in Test Condition	A-4
Figure A5	Right Rear View, Test Vehicle in Test Condition	A-5
Figure A6	Vehicle's Tire Information Placard	A-6
Figure A7	Vehicle's Certification Label	A-7
Figure A8	Instrumentation in Test Vehicle	A-8
Figure A9	Steering Controller and Computer	A-9
Figure A10	Ballast Condition	A-10

◀ PULL THIS STRIP TO EXPOSE ADHESIVE



2021 ENVISION AVENIR FWD

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Fuel Economy

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You spend \$250 more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost \$1,550

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

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GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score To Be 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	To Be Rated To Be 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	To Be Rated To Be Rated
Based on the risk of injury in a side impact.		
Rollover		To Be 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

This label has been applied pursuant to Federal law - Do not remove prior to delivery to the ultimate purchaser. *Include Manufacturer's Recommended Pre-Delivery Service. Does not include dealer installed options and accessories not listed above, local taxes or license fees.

FOR VEHICLES IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 1%
MAJOR SOURCES OF FOREIGN PARTS CONTENT: CHINA 94%

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

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: YANTAI ETDZ.P.R., CHINA
COUNTRY OF ORIGIN: ENGINE: CHINA
TRANSMISSION: CHINA

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ORDER NO:00FXMB SALES CODE E
SALES MODEL CODE 4ZD26
DEALER NO 46501
FINAL ASSEMBLY: YANTAI ETDZ.P.R., CHINA
VIN LRBZRR49MD05 REISSUE

DEALER TO WHOM DELIVERED
MOTOR CITY BUICK GMC
PO BOX 40340
BAKERSFIELD, CA 93384-0340

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

GM MFD BY SAIC GENERAL MOTORS CORPORATION 11/20
 LIMITED FOR GENERAL MOTORS LLC

GVWR	GAWR FRT	GAWR RR
2300 KG	1200 KG	1150 KG
5070 LB	2645 LB	2535 LB

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

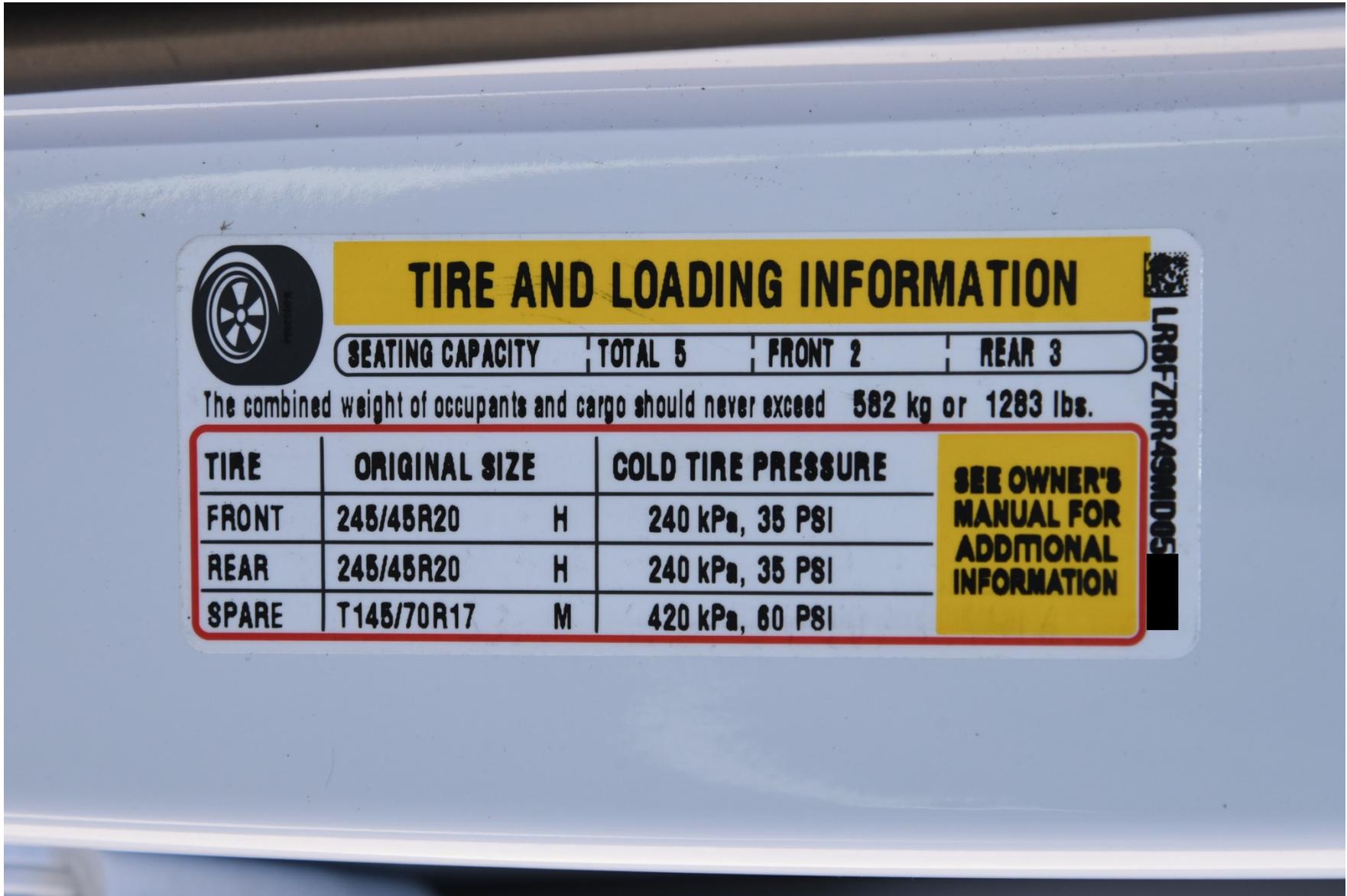
LRBFZRR49MD05 [REDACTED] TYPE: M.P.V.

MODEL: ZY26

ZBDQ	TIRE SIZE	SPEED RTG	RIM	COLD TIRE PRESSURE
FRT	245/45R20	H	20X8.5J	240KPA(35PSI)
RR	245/45R20	H	20X8.5J	240KPA(35PSI)
SPA	T145/70R17	M	17X4B	420KPA(60PSI)

SEE OWNER'S MANUAL  FOR MORE INFORMATION.

Figure A6. Vehicle's Certification Label



TIRE AND LOADING INFORMATION

SEATING CAPACITY | TOTAL 5 | FRONT 2 | REAR 3

The combined weight of occupants and cargo should never exceed 582 kg or 1283 lbs.

TIRE	ORIGINAL SIZE		COLD TIRE PRESSURE
FRONT	245/45R20	H	240 kPa, 35 PSI
REAR	245/45R20	H	240 kPa, 35 PSI
SPARE	T145/70R17	M	420 kPa, 60 PSI

SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION

LRBFZRR49ND05

Figure A7. Vehicle's Tire Information Placard

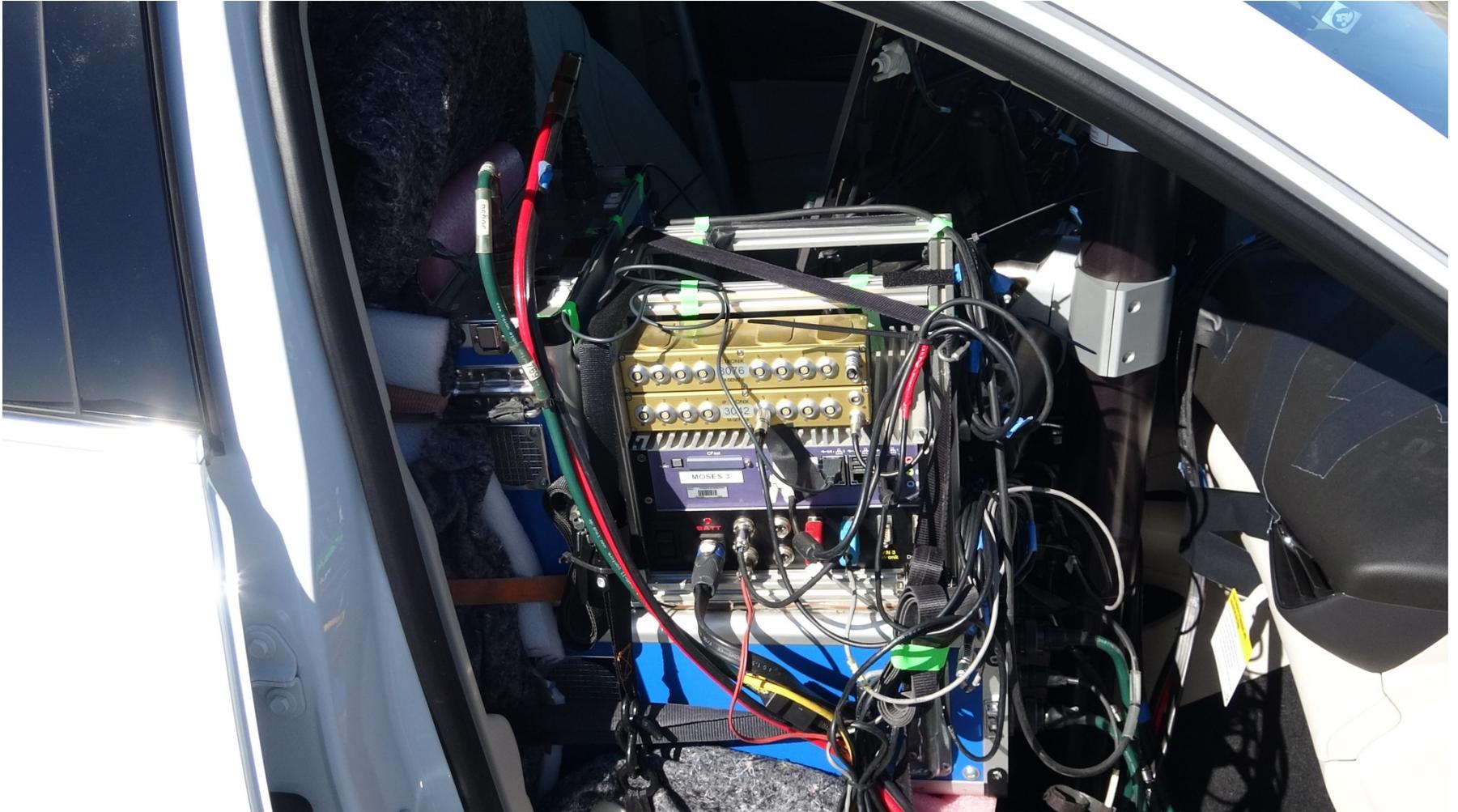


Figure A8. Instrumentation in Test Vehicle



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 = 0.21g
2	"	"	65.4	"	"	Resulted in ay = 0.39g
3	"	"	"	"	"	
4	"	"	"	"	"	
5	2x SWA last cycle	"	130.8	"	"	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	"	"	39.8	Left	"	HW angle at 0.3 g = -28.1
10	"	"	"	Left	"	HW angle at 0.3 g = -29.1
11	"	"	"	Left	"	HW angle at 0.3 g = -29.2
12	"	"	"	Right	"	HW angle at 0.3 g = 27.4
13	"	"	"	Right	"	HW angle at 0.3 g = 27.4
14	"	"	"	Right	"	HW angle at 0.3 g = 27.3
						Average = 28.1
15	Fishhook 6.5 Scalar	35	182.7	Left	No	
16	"	40	"	"	"	
17	"	45	"	"	"	
18	"	47.5	"	"	"	
19	"	50	"	"	"	
20	Fishhook 6.5 Scalar	35	182.7	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	154.6	Left	No	
26	"	47.5	"	"	"	
27	"	50	"	"	"	
28	Fishhook 5.5 Scalar	45	154.6	Right	No	
29	"	47.5	"	"	"	
30	"	50	"	"	"	

APPENDIX C
SLOWLY INCREASING STEER TEST WORKSHEET

2021 Buick Envision FWD 5-Door SUV, Multi-Passenger Configuration,
 Test Date: 3/5/2021



Slowly Increasing Steer



Vehicle: 2021 Buick Envision
 Test Date: 3/5/2021
 Analysis Date: 3/5/2021
 Analysed by: EL
 Executed by: OG
 Configuration: ESC on

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_008	L	49.9	0.6	98.8	1025	-28.1	-0.300	-182.9	-0.2540	-154.8	-0.2149	0.9965	356	556
sis_009	L	49.4	-0.5	101.1	1029	-29.1	-0.300	-189.4	-0.2630	-160.2	-0.2225	0.9960	378	578
sis_010	L	49.2	-0.4	100.9	1034	-29.2	-0.300	-189.6	-0.2633	-160.4	-0.2228	0.9952	379	579
sis_011	R	49.4	0.1	99.9	1011	27.4	0.300	177.9	0.2470	150.5	0.2090	0.9943	335	535
sis_012	R	50.3	0.4	99.2	1022	27.4	0.300	178.3	0.2477	150.9	0.2096	0.9938	351	551
sis_013	R	50.4	0.2	99.7	1015	27.3	0.300	177.3	0.2462	150.0	0.2083	0.9954	356	556

Mean: 28.1

Steering Controller Input values

Scalar 6.5 values:

Initial HW angle: 182.7 deg

Reversal HW angle: -182.7 deg

Scalar 5.5 values:

Initial HW angle: 154.6 deg

Reversal HW angle: -154.6 deg

APPENDIX D
TIME HISTORY PLOTS

LIST OF FIGURES

Figure		Page
Figure D1	Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph	D-1
Figure D2	Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph	D-2
Figure D3	Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, L-R, 50 mph	D-3
Figure D4	Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph	D-4
Figure D5	Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph	D-5
Figure D6	Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph	D-6
Figure D7	Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph	D-7
Figure D8	Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, R-L, 50 mph	D-8
Figure D9	Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph	D-9
Figure D10	Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph	D-10
Figure D11	Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph	D-11
Figure D12	Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph	D-12
Figure D13	Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph	D-13
Figure D14	Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph	D-14
Figure D15	Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph	D-15
Figure D16	Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph	D-16

FILENAME: FH005

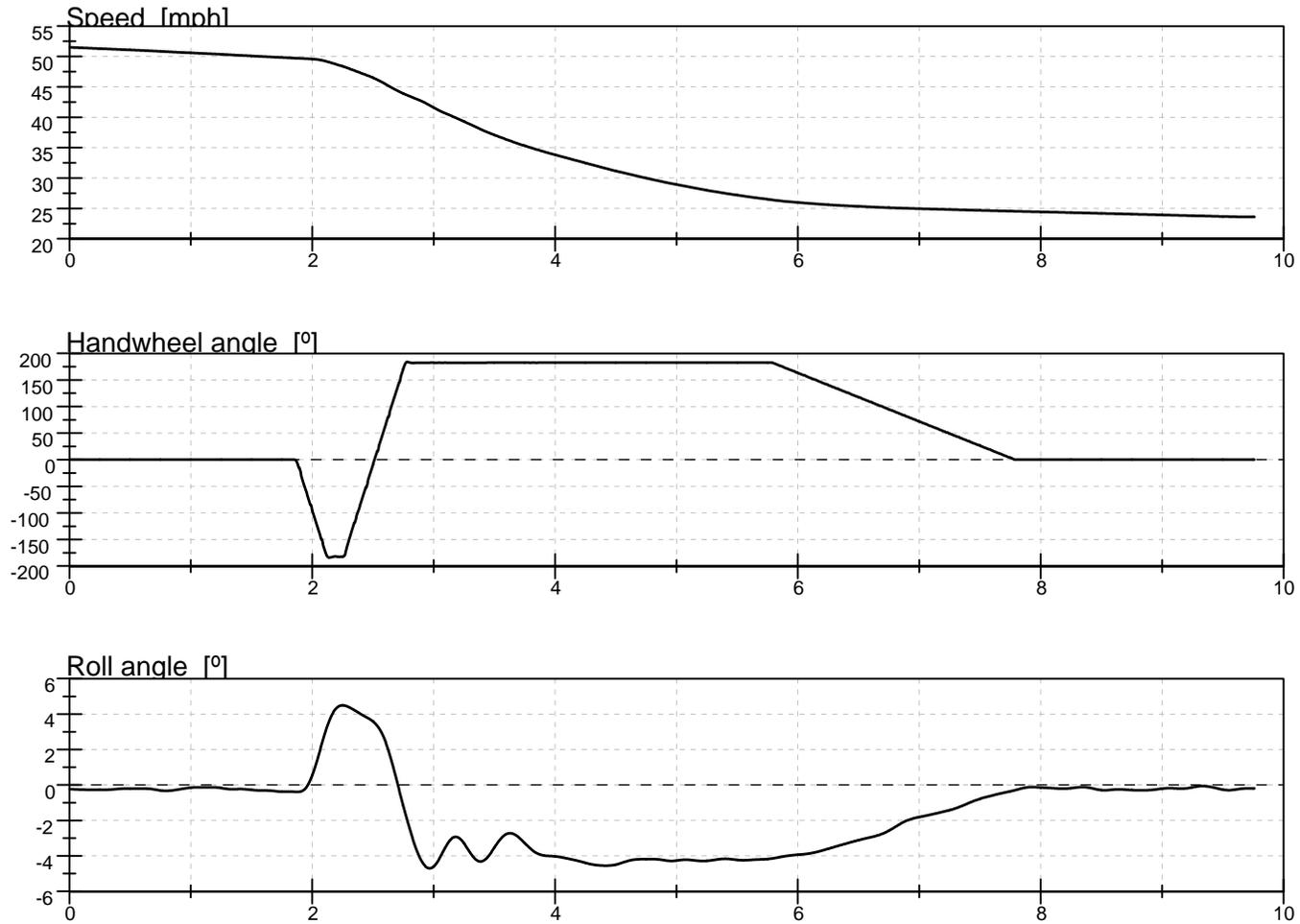


Figure D1. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, L-R, 50 mph

FILENAME: FH005

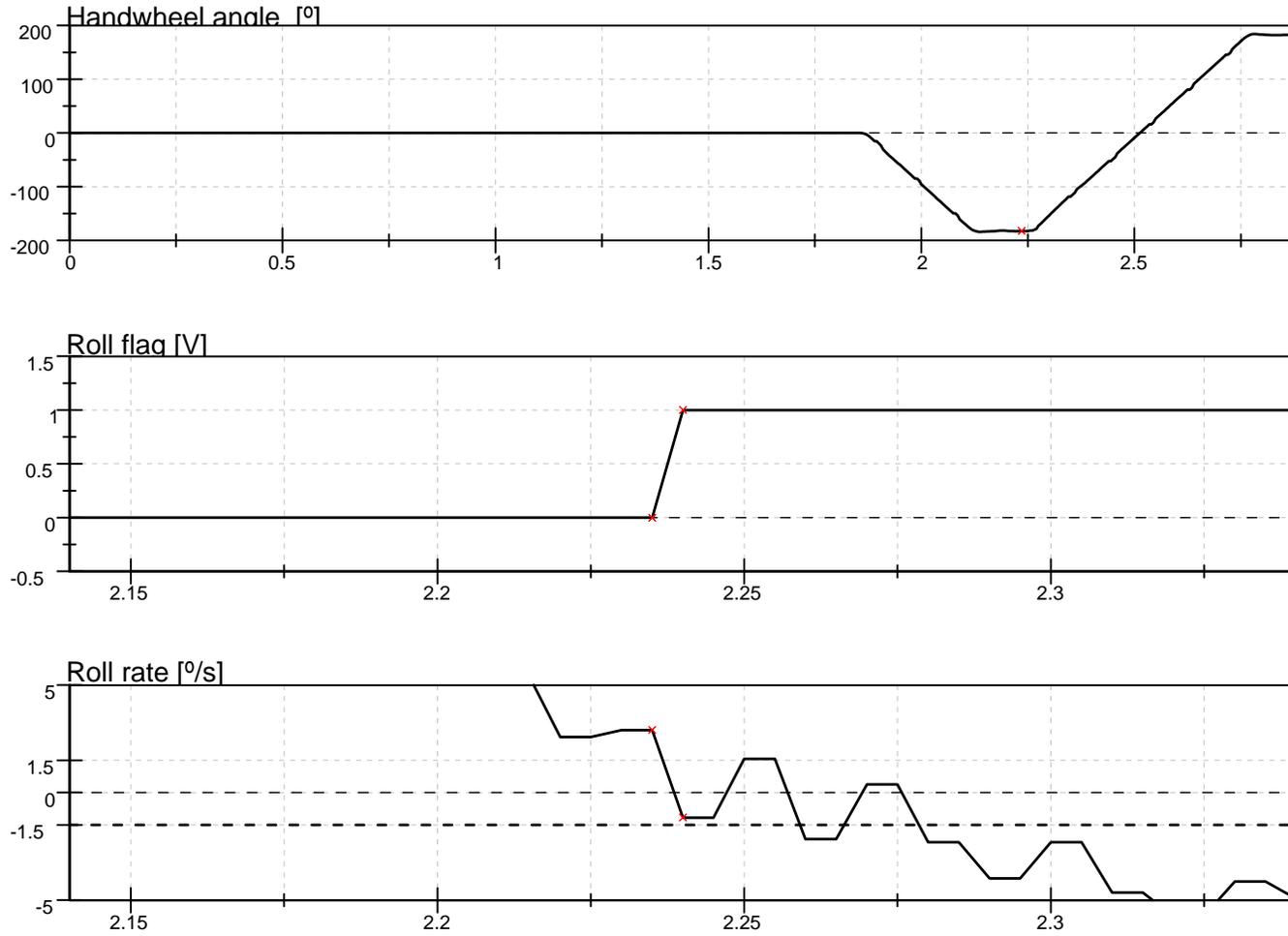


Figure D2. Steering Machine Operation Time History Plots for Default Test Series, L-R, 50 mph

FILENAME: FH005

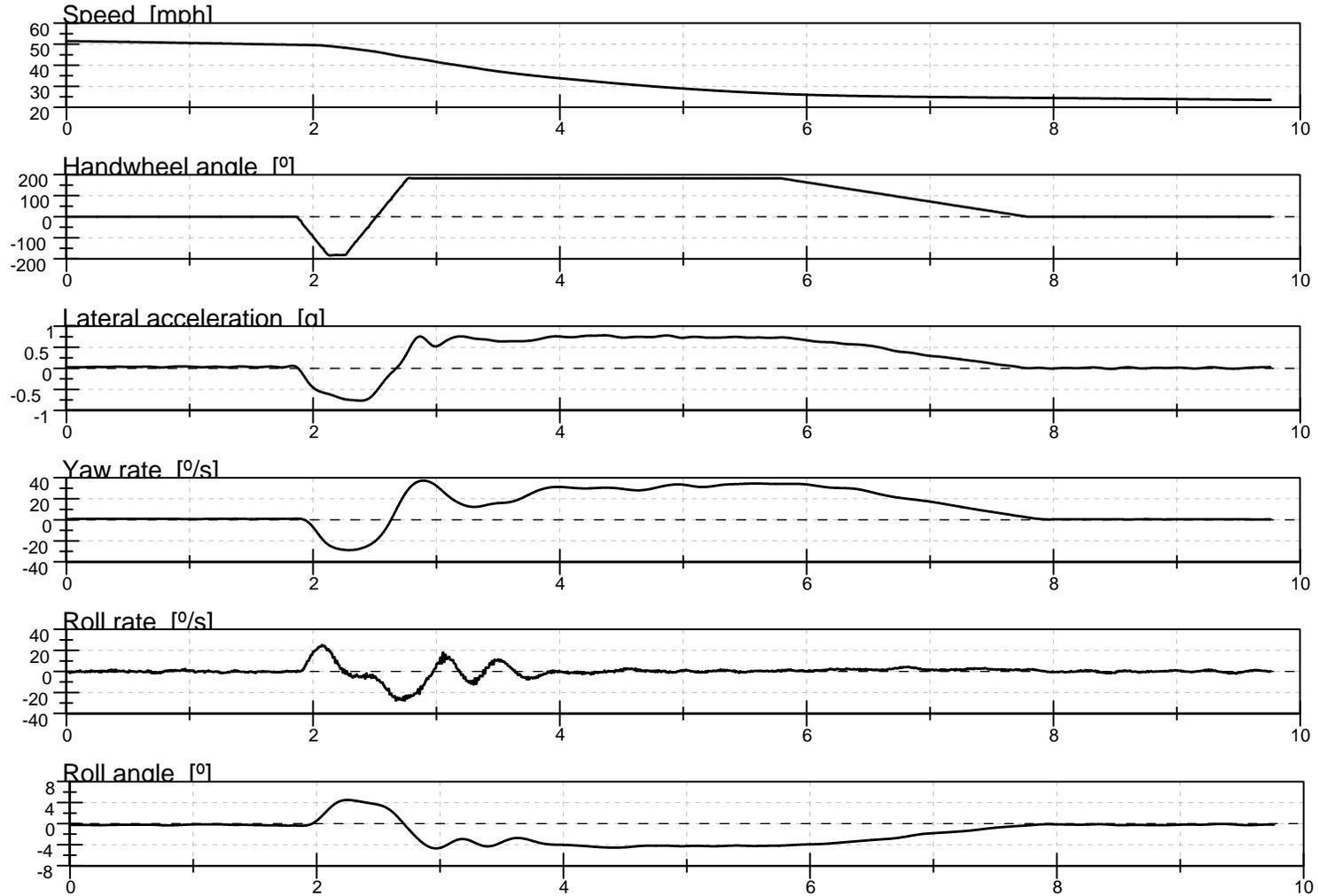


Figure D3. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots For Default Test Series, L-R, 50 mph

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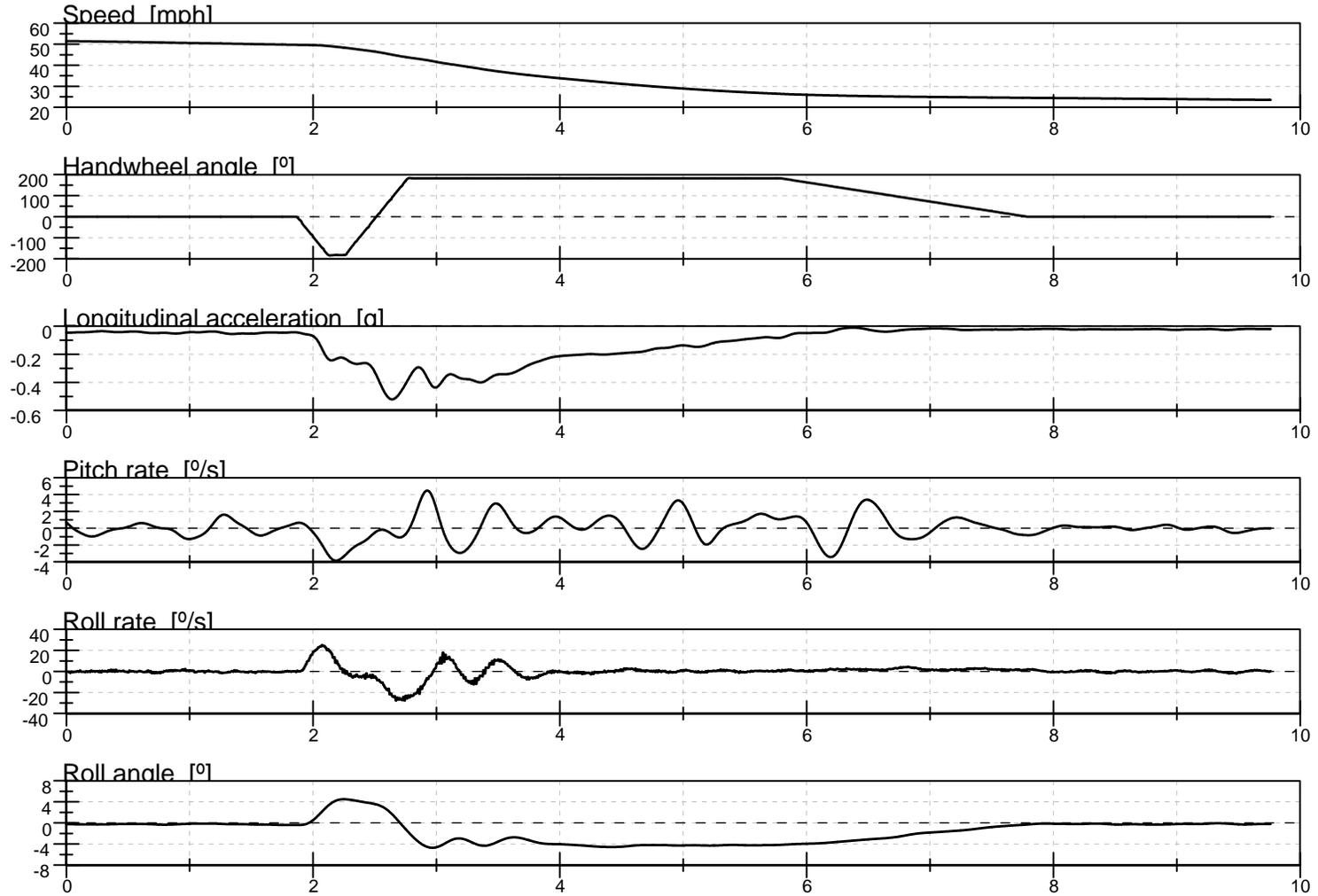


Figure D4. Pitch Rate and Longitudinal Acceleration Time History Plots for Default Test Series, L-R, 50 mph

FILENAME: FH010

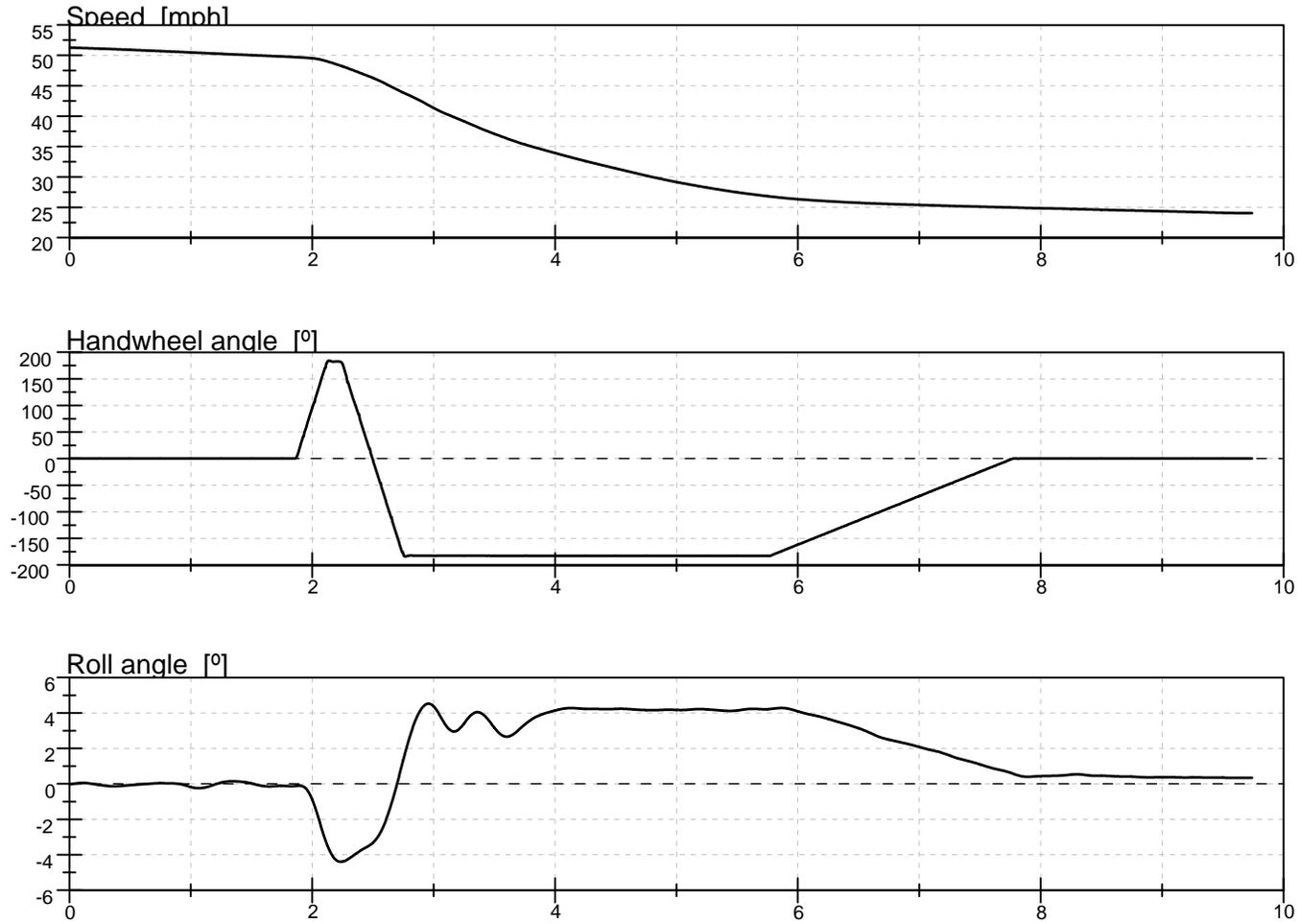


Figure D5. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

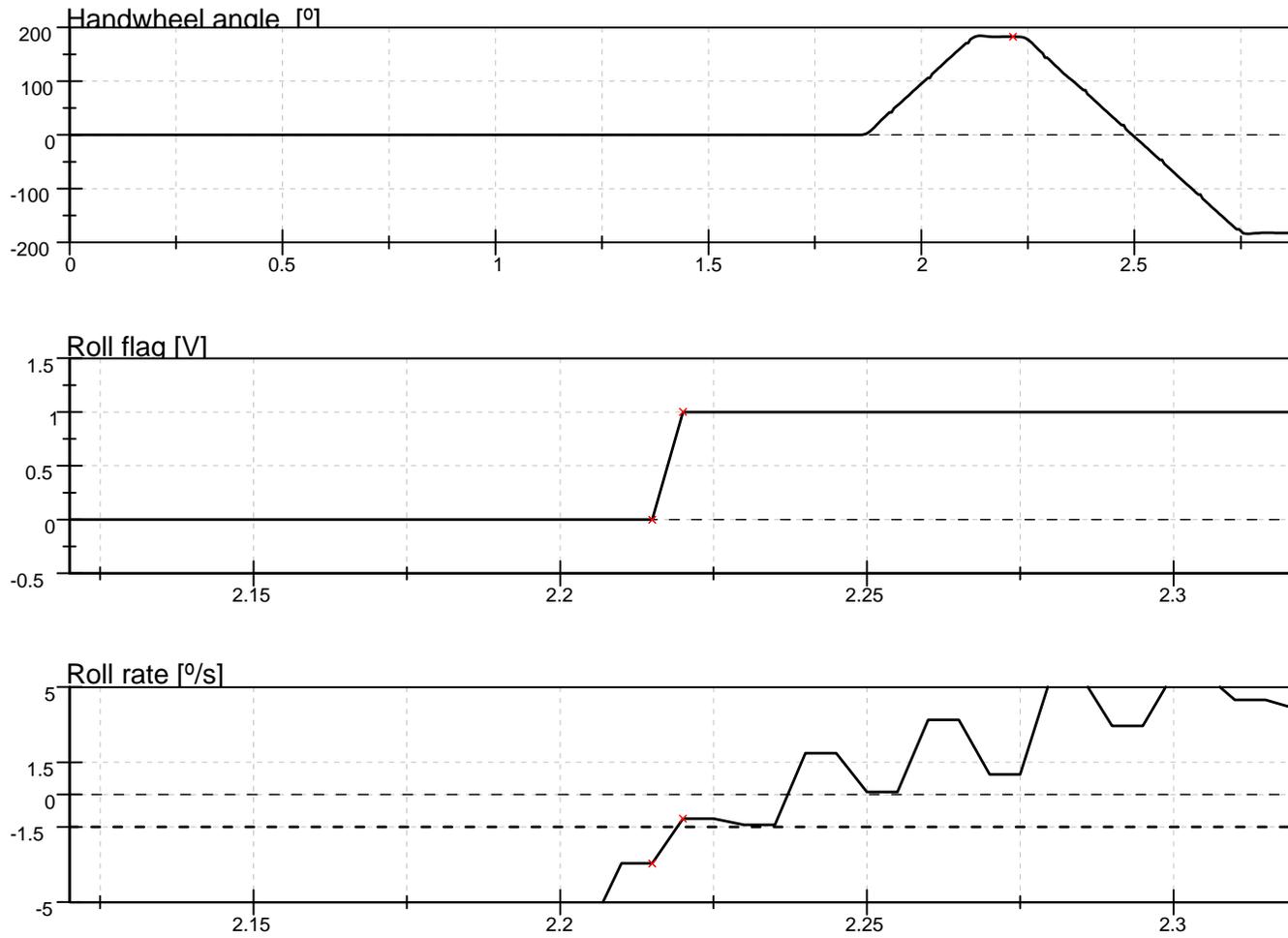


Figure D6. Steering Machine Operation Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

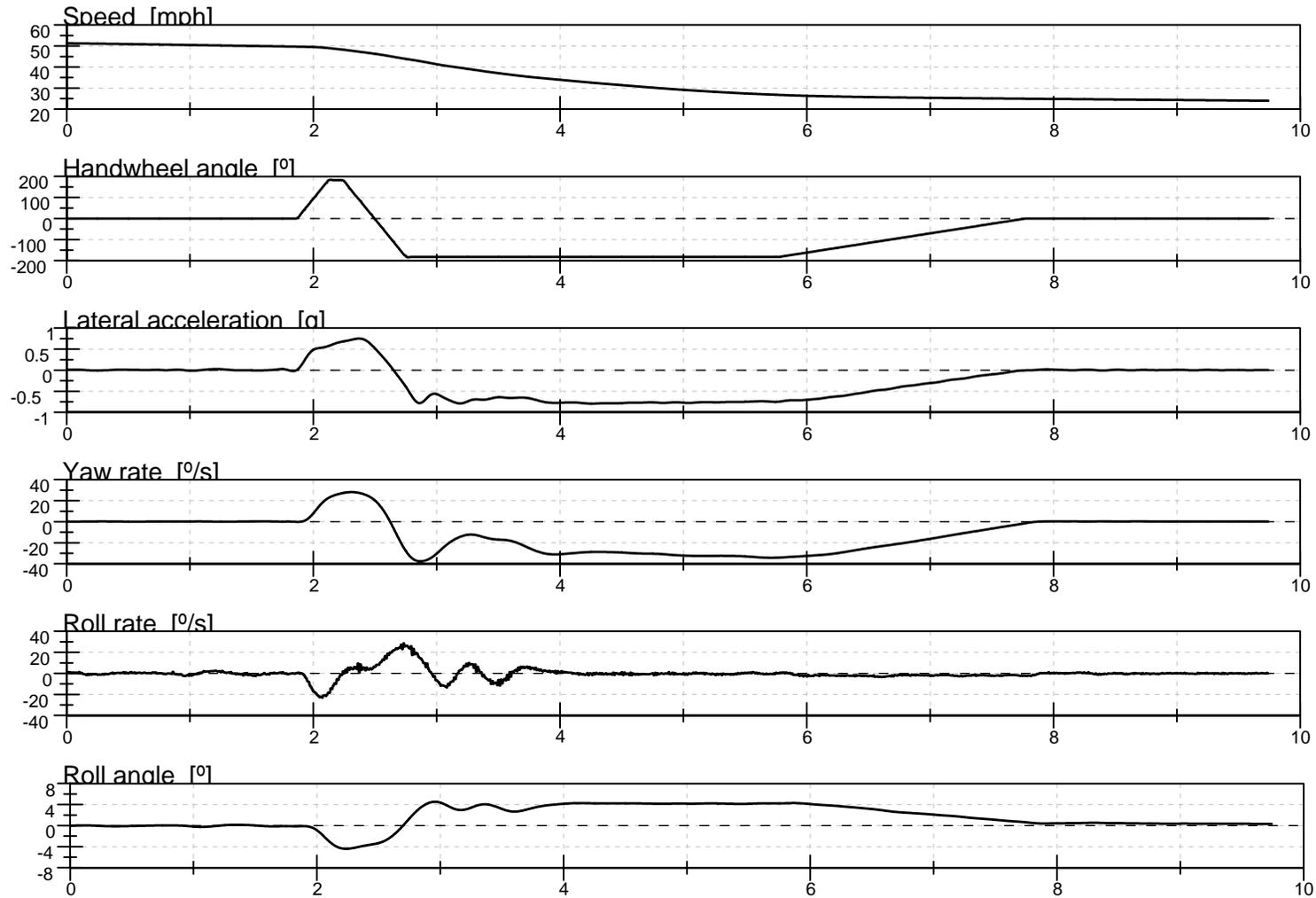


Figure D7. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Default Test Series, R-L, 50 mph

FILENAME: FH010

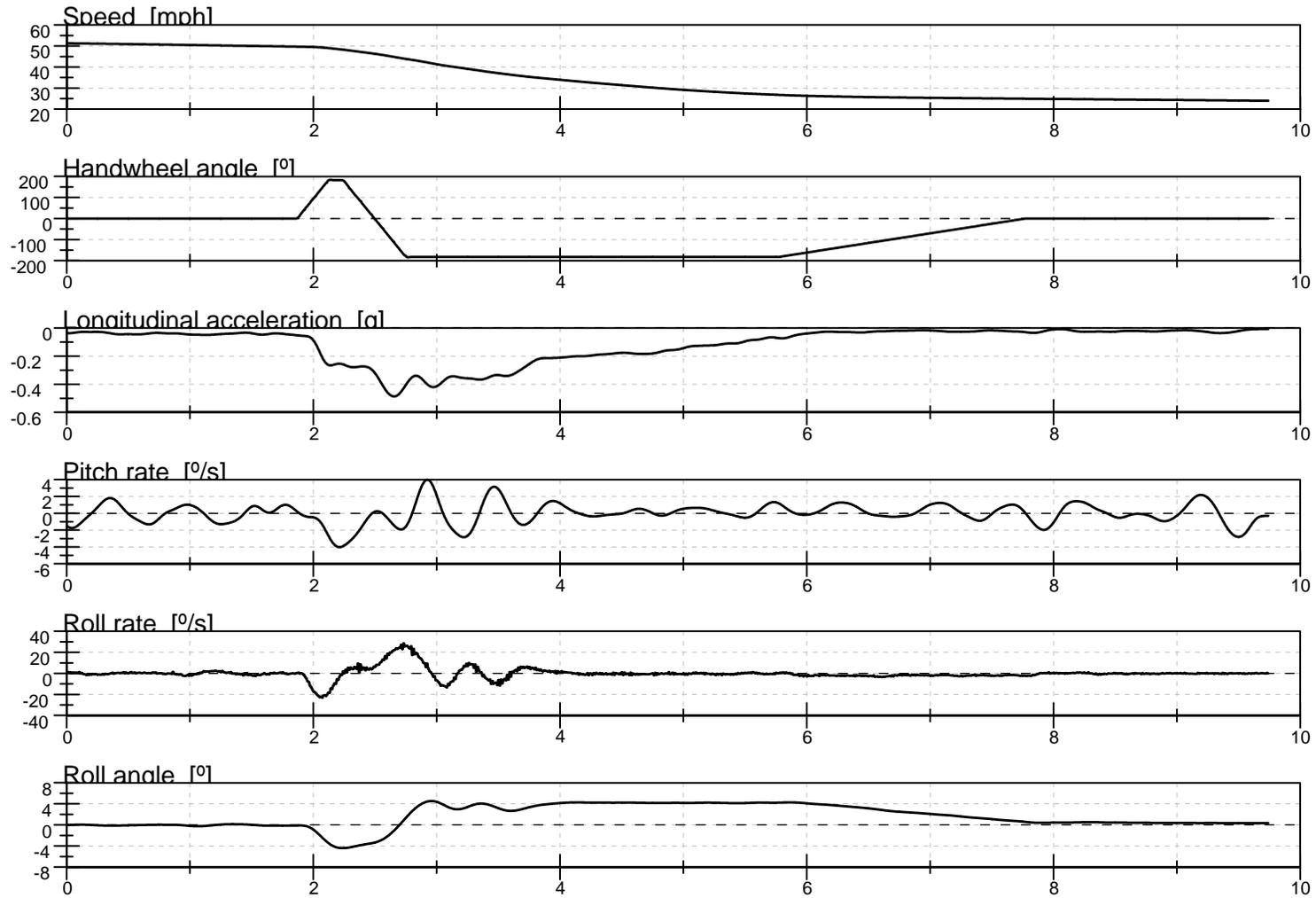


Figure D8. Pitch Rate and Longitudinal Acceleration Time History Plots of Default Test Series, R-L, 50 mph

FILENAME: FH013

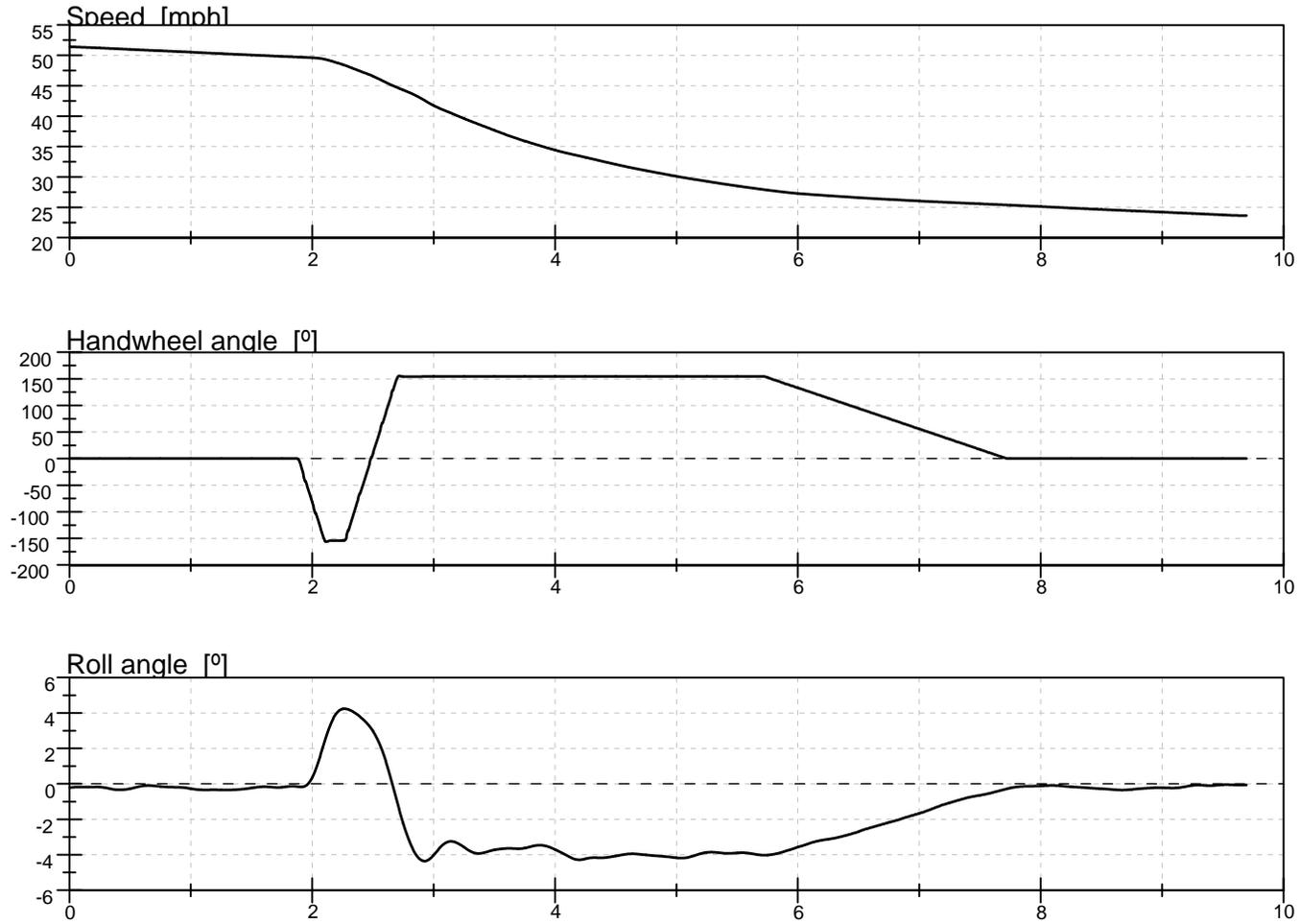


Figure D9. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH013

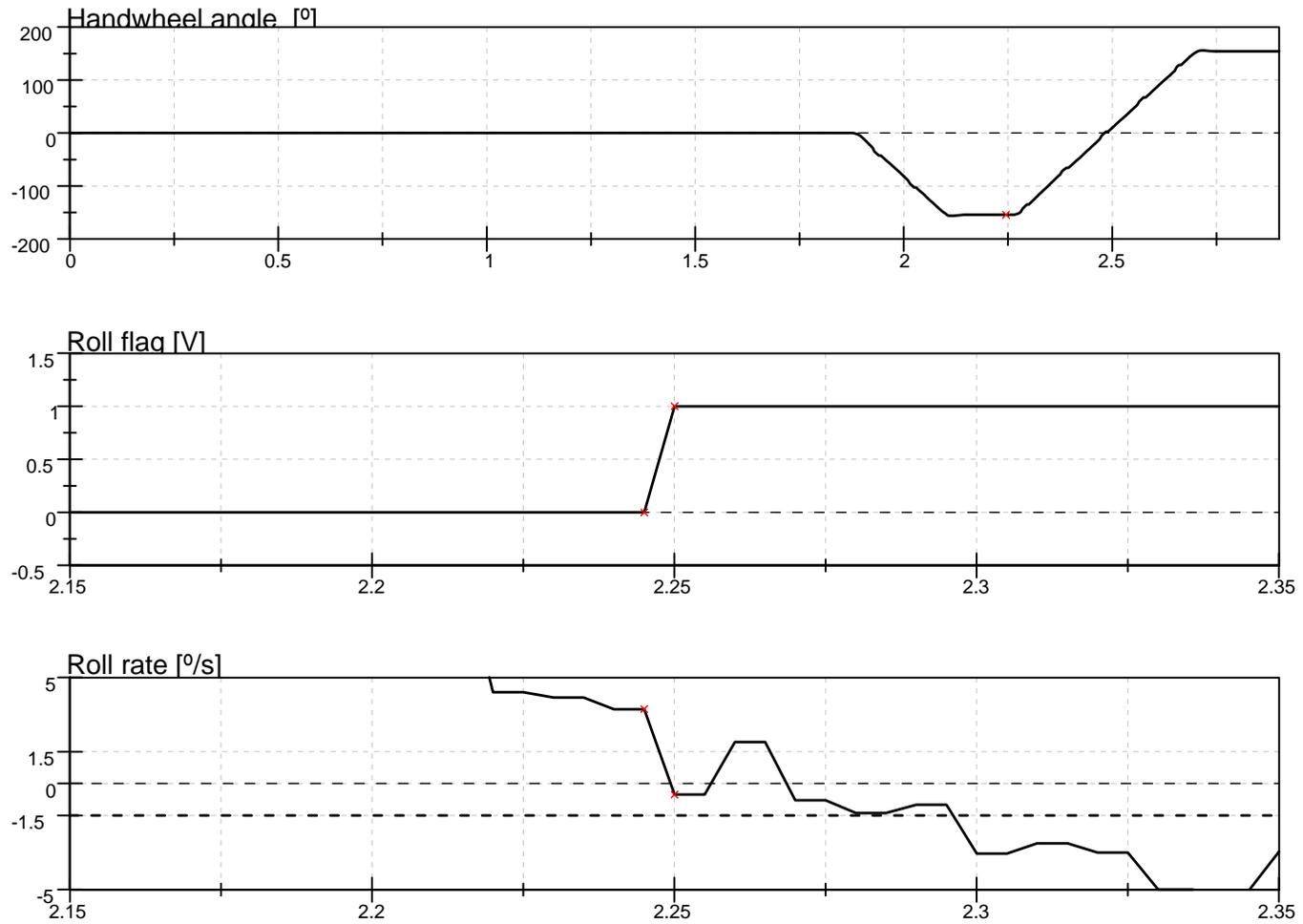


Figure D10. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH013

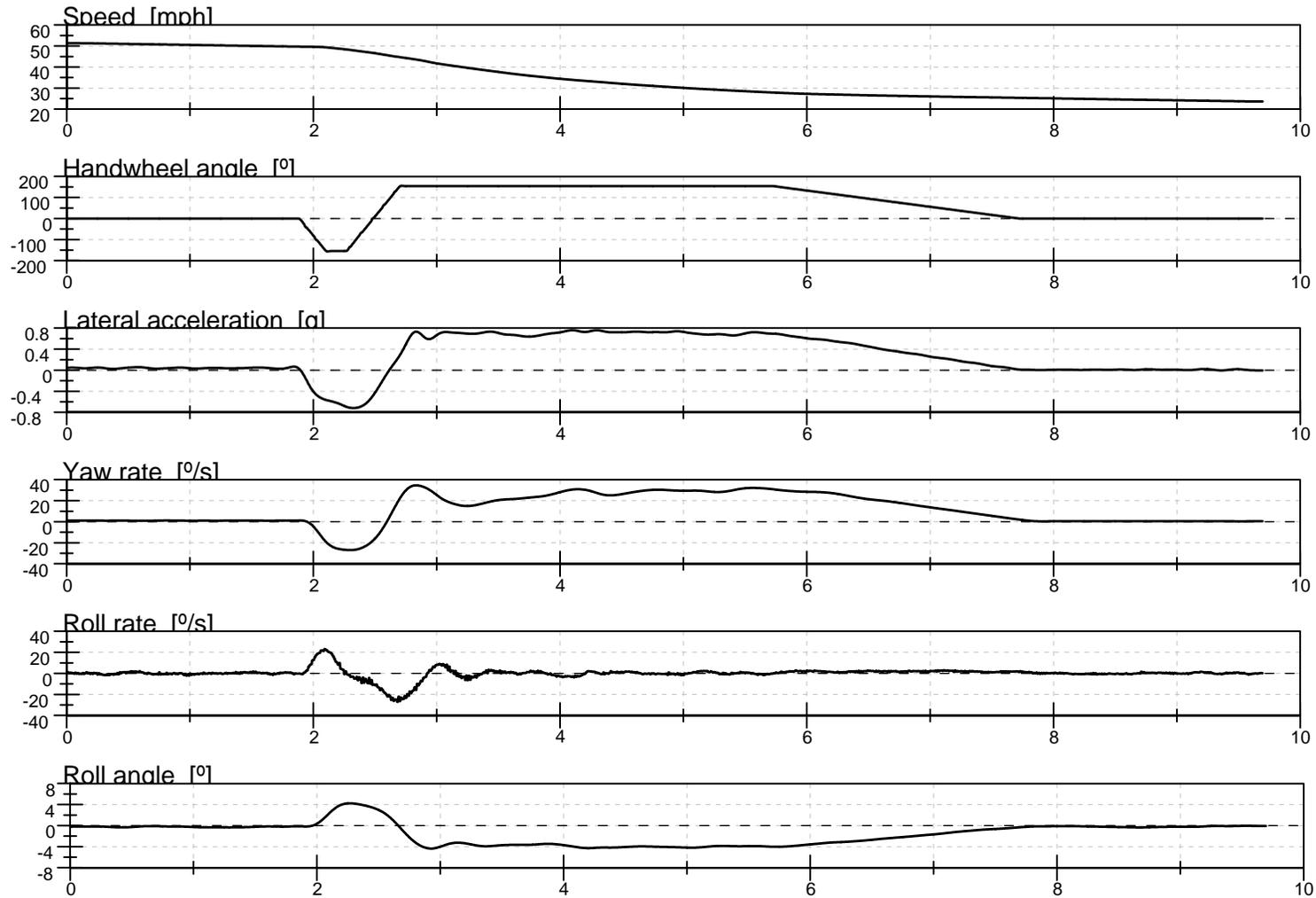


Figure D11. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH013

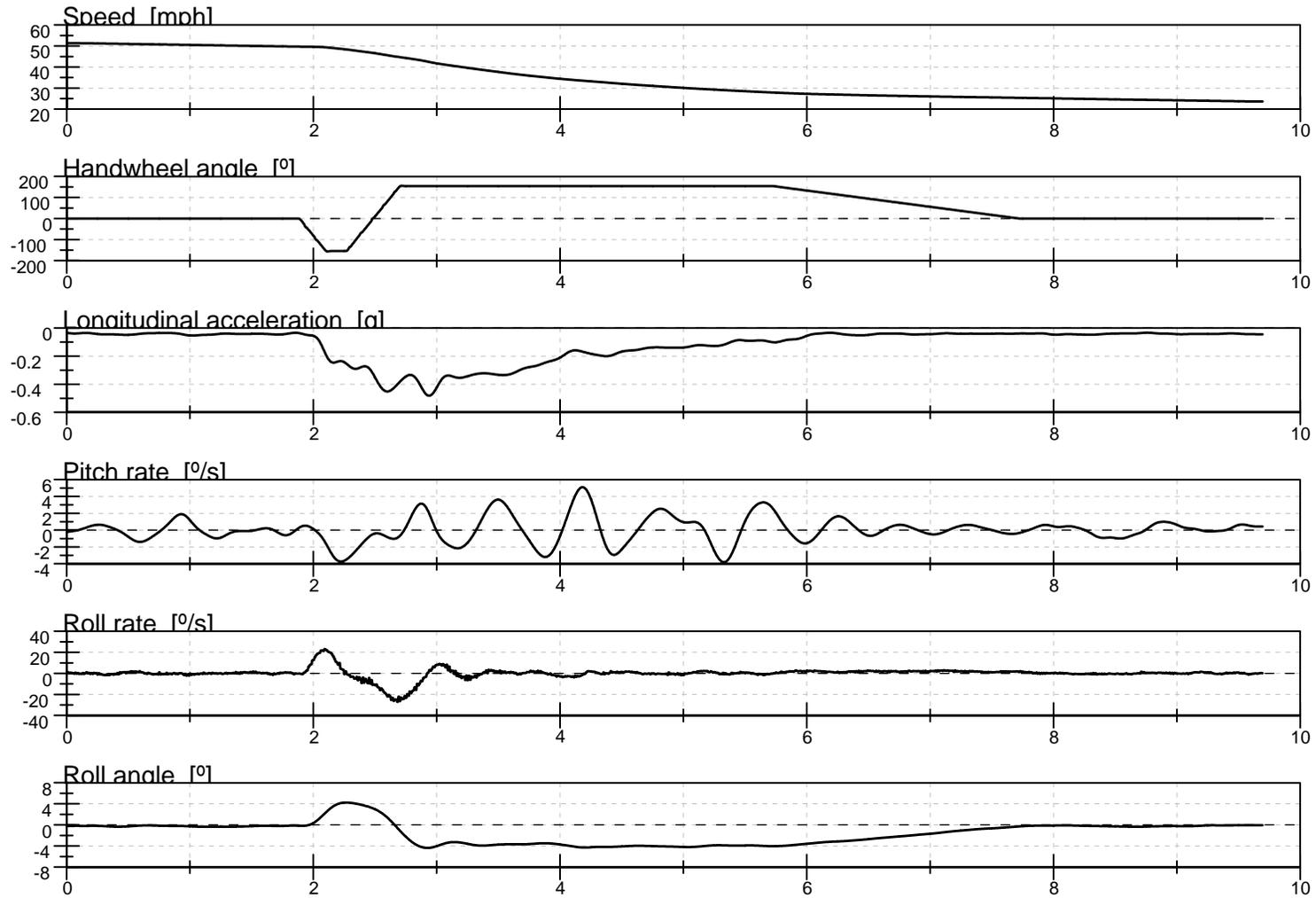


Figure D12. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, L-R, 50 mph

FILENAME: FH016

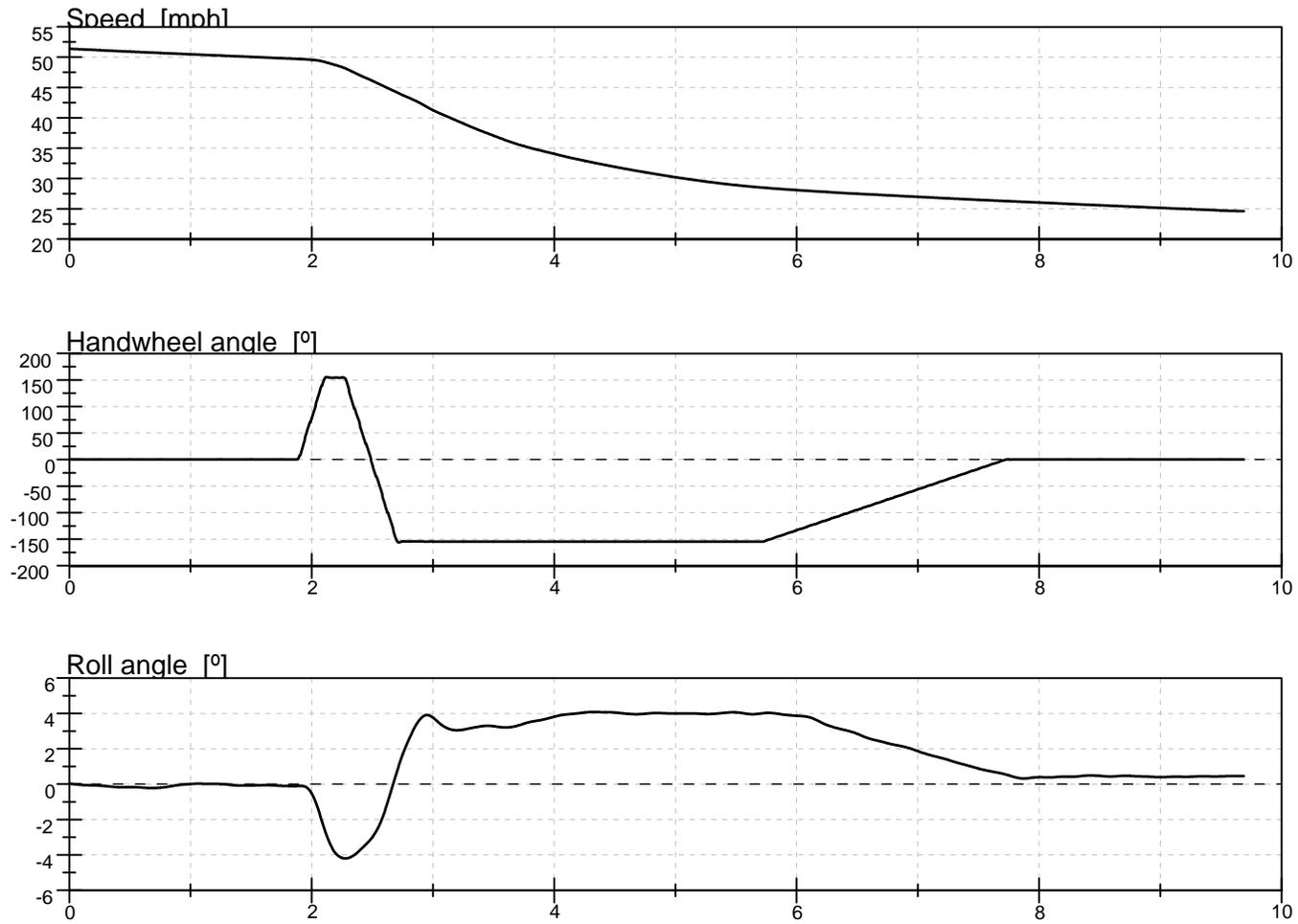


Figure D13. Vehicle Speed, Handwheel Angle, and Roll Angle Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

FILENAME: FH016

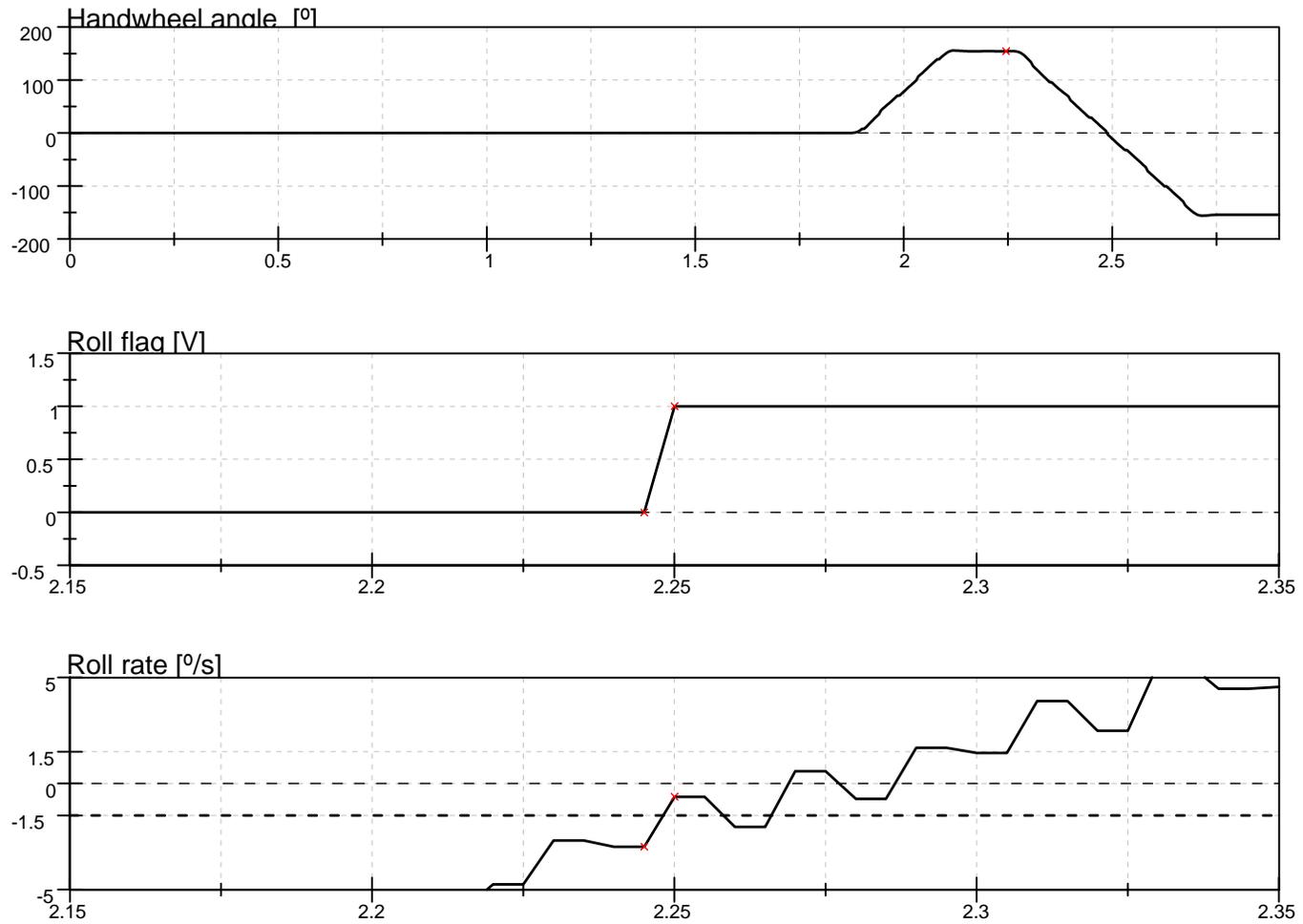


Figure D14. Steering Machine Operation Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

FILENAME: FH016

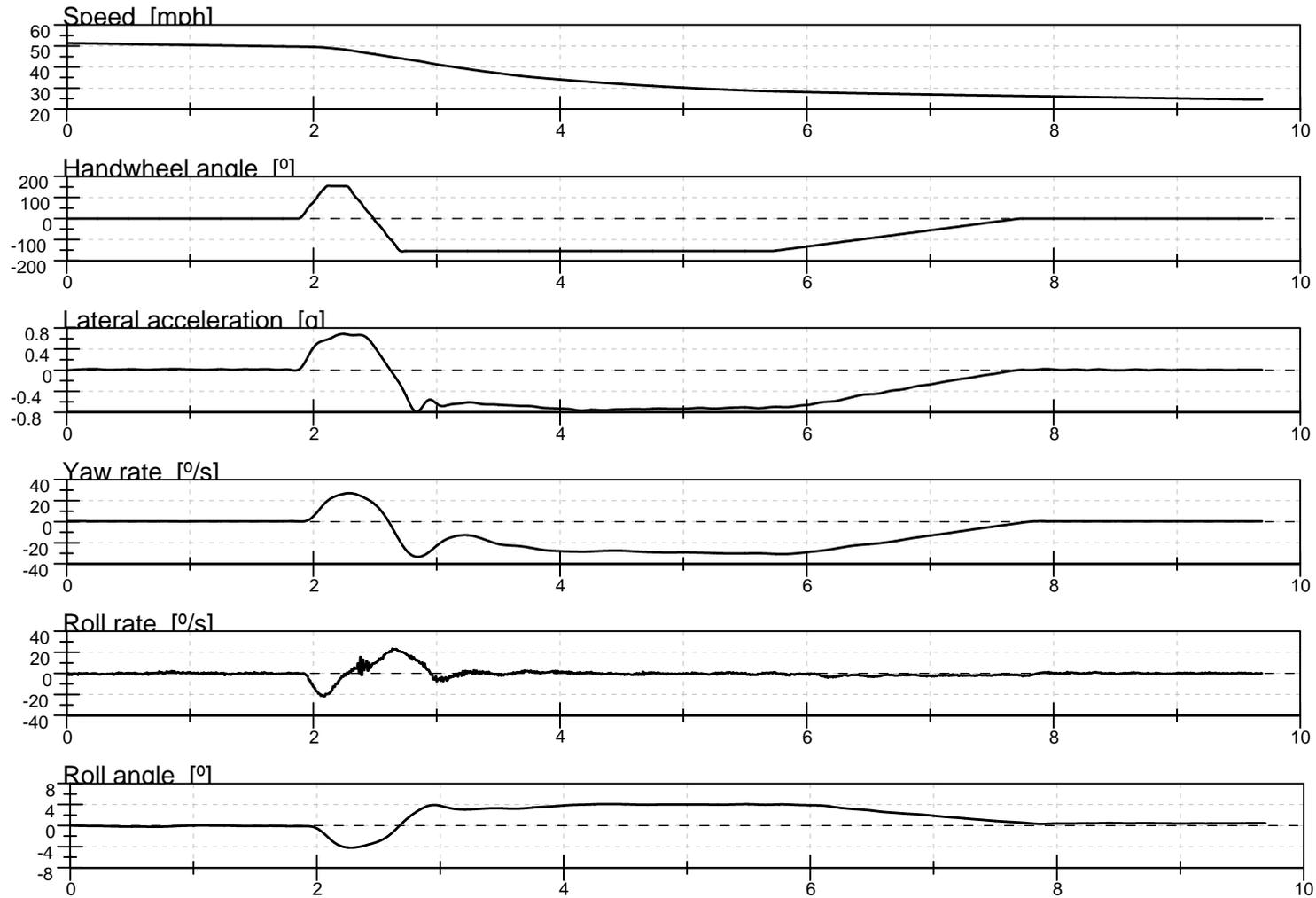


Figure D15. Yaw Rate, Roll Rate, and Lateral Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

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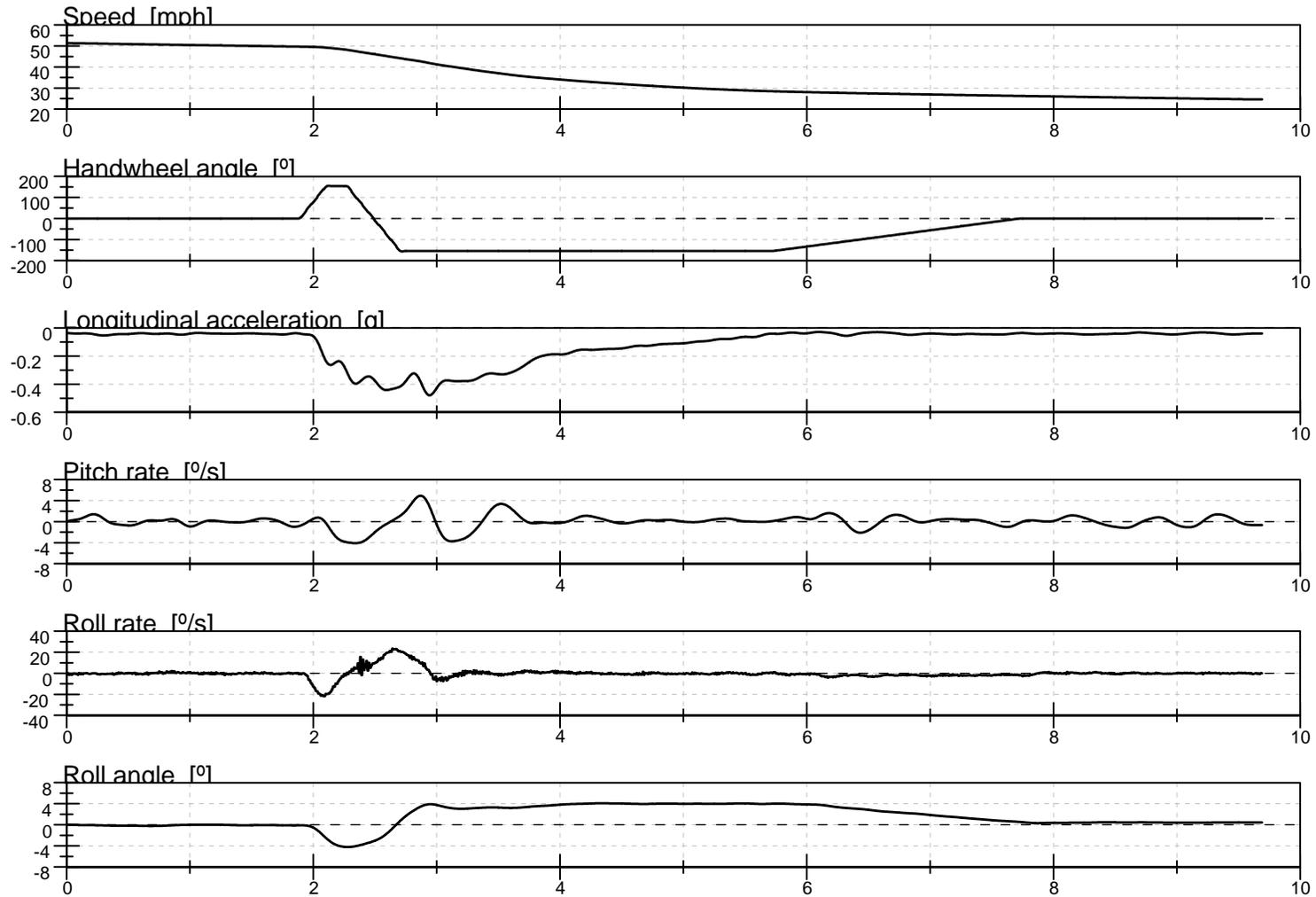


Figure D16. Pitch Rate and Longitudinal Acceleration Time History Plots for Supplemental 2 Test Series, R-L, 50 mph

