BLIND SPOT DETECTION SYSTEM RESEARCH TEST
NCAP-DRI-BSD-20-05

2020 Infiniti QX60 LUXE

DYNAMIC RESEARCH, INC.
355 Van Ness Avenue, STE 200
Torrance, California 90501

19 November 2020

Final Report

Prepared Under Contract No. DTNH22-14-D-00333

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
West Building, 4th Floor (NRM-110)
Washington, DC 20590

Prepared for the Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-14-D-00333.

Prepared By: J. Lenkeit — Program Manager
K. Nagao — Test Engineer

Date: 19 November 2020

1. Report No. NCAP-DRI-BSD-20-05	2. Government Accession No.	3. Recipient's Catalog No.	
4.Title and Subtitle Final Report of Blind Spot Detection System Testing of a 2020 Infiniti QX60 LUXE.		5. Report Date 19 November 2020	
		6. Performing Organization Code DRI	
7. Author(s) J. Lenkeit, Program Manager K. Nagao, Test Engineer		8. Performing Organization Report No. DRI-TM-20-110	
9. Performing Organization Name and Address Dynamic Research, Inc. 355 Van Ness Ave, STE 200 Torrance, CA 90501		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-14-D-00333	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 1200 New Jersey Avenue, SE, West Building, 4th Floor (NRM-110) Washington, DC 20590		13. Type of Report and Period Covered Final Test Report July - November 2020	
		14. Sponsoring Agency Code NRM-110	
15. Supplementary Notes			
16. Abstract These tests were conducted on the subject 2020 Infiniti QX60 LUXE in accordance with the specifications of the National Highway Safety Administration's most current Test Procedure in docket NHTSA-2019-0102-0010, BLIND SPOT DETECTION SYSTEM CONFIRMATION TEST, to confirm the performance of a Blind Spot Detection system. The preliminary BSD requirements were met for 25 out of 72 valid test runs.			
17. Key Words Blind Spot Detection, BSD, New Car Assessment Program, NCAP		18. Distribution Statement Copies of this report are available from the following: NHTSA Technical Reference Division National Highway Traffic Safety Administration 1200 New Jersey Avenue, SE Washington, DC 20590	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 147	22. Price

TABLE OF CONTENTS

Section I

INTRODUCTION

This test evaluates Blind Spot Detection (BSD) systems on light vehicles with gross vehicle weight ratings (GVWR) of under 10,000 pounds as specified in the National Highway Traffic Safety Administration's (NHTSA's) "Blind Spot Detection System Confirmation Test", dated June 2019. BSD technology uses sensors to detect the presence of other vehicles in the equipped vehicle's left and right blind zone. The procedures described herein emulate two straight-road, real-world scenarios in which the Subject Vehicle's (SV's) blind zone is breached by a single Principal Other Vehicle (POV). Although it is impossible to predict what technologies could be used by future BSD systems, it is believed that minor modifications to these procedures, when deemed appropriate, could be used to accommodate the evaluation of alternative or more advanced BSD systems.

The BSD system tests described in this document and prescribed by NHTSA involve two different test scenarios: 1) straight lane converge and diverge maneuvers and 2) a straight lane pass-by. In the first scenario, the POV is driven at the same speed as the SV, at a constant headway. After a brief period of steady-state driving, the POV enters, then exits the SV blind zone from the side of the vehicle. In the second scenario, the POV is driven by the SV in an adjacent lane at a speed greater than the SV. During this pass-by, the POV enters, then exits the SV's blind zone. In both scenarios, BSD performance is assessed by comparing the proximity of the POV to the SV at the time of the BSD alert to the SV blind zone. The test scenarios are conducted at multiple speeds, and on both sides of the vehicle, to the left and right, as indicated in the specific test methodologies.

Section II

DATA SHEETS

BLIND SPOT DETECTION

DATA SHEET 1: TEST RESULTS SUMMARY

(Page 1 of 1)

2020 Infiniti QX60 LUXE

VIN: *5N1DL0MN9LC50xxxx*

Test Date: *8/10/2020*

System Setting: *Default - On*

	Number of valid test runs for which acceptability criteria[1] were:		
	Met	**Not met**	**Valid trials**
Test 1 - Straight Lane Converge and Diverge			
45 mph - Left	*7*	*0*	*7*
45 mph - Right	*7*	*0*	*7*
Overall Test 1:	*14*	*0*	*14*
Test 2 - Straight Lane Pass-by			
POV 50 mph - Left	*4*	*3*	*7*
POV 50 mph - Right	*7*	*0*	*7*
POV 55 mph - Left	*0*	*7*	*7*
POV 55 mph - Right	*0*	*7*	*7*
POV 60 mph - Left	*0*	*8*	*8*
POV 60 mph - Right	*0*	*7*	*7*
POV 65 mph - Left	*0*	*7*	*7*
POV 65 mph - Right	*0*	*8*	*8*
Overall Test 2:	*11*	*47*	*58*
Overall:	***25***	***47***	***72***

[1] The acceptability criteria listed herein are used only as a guide to gauge system performance, and are identical to the Pass/Fail criteria given in NHTSA's most current Test Procedure in docket NHTSA-2019-0102-0010, BLIND SPOT DETECTION SYSTEM CONFIRMATION TEST.

BLIND SPOT DETECTION

DATA SHEET 2: VEHICLE DATA

(Page 1 of 1)

2020 Infiniti QX60 LUXE

TEST VEHICLE INFORMATION

VIN: *5N1DL0MN9LC50xxxx*

Body Style: *SUV* Color: *Black Obsidian*

Date Received: *7/16/2020* Odometer Reading: *29 mi*

DATA FROM VEHICLE'S CERTIFICATON LABEL

Vehicle manufactured by: *Nissan Motor Co., LTD.*

Date of manufacture: *08/19*

Vehicle Type: *MPV*

DATA FROM TIRE PLACARD

Tires size as stated on Tire Placard: Front: *235/55R20*

Rear: *235/55R20*

Recommended cold tire pressure: Front: *240 kPa (35 psi)*

Rear: *240 kPa (35 psi)*

TIRES

Tire manufacturer and model: *Bridgestone Dueller H/P Sport AS*

Front tire size: *235/55R20 102H*

Rear tire size: *235/55R20 102H*

Front tire DOT prefix: *7X8A HPE*

Rear tire DOT prefix: *7X8A HPE*

BLIND SPOT DETECTION

DATA SHEET 3: TEST CONDITIONS

(Page 1 of 2)

2020 Infiniti QX60 LUXE

GENERAL INFORMATION

Test date: *8/10/2020*

AMBIENT CONDITIONS

Air temperature: *36.1 C (97 F)*

Wind speed: *3.1 m/s (6.9 mph)*

X Windspeed ≤ 10 m/s (22 mph)

X Tests were not performed during periods of inclement weather. This includes, but is not limited to, rain, snow, hail, fog, smoke, or ash.

X Tests were conducted during daylight hours with good atmospheric visibility (defined as an absence of fog and the ability to see clearly for more than 5000 meters). The tests were not conducted with the vehicle oriented into the sun during very low sun angle conditions, where the sun is oriented 15 degrees or less from horizontal, and camera “washout” or system inoperability results.

All tests were also conducted such that there were no overhead signs, bridges, or other significant structures over, or near, the testing site. Except for the POV, each trial shall be conducted with no vehicles, obstructions, or stationary objects within one lane width of either side the SV path.

VEHICLE PREPARATION

Verify the following:

All non-consumable fluids at 100% capacity: **X**

Fuel tank is full: **X**

Tire pressures are set to manufacturer's recommended cold tire pressure: **X**

Front: *240 kPa (35 psi)*

Rear: *240 kPa (35 psi)*

BLIND SPOT DETECTION

DATA SHEET 3: TEST CONDITIONS

(Page 2 of 2)

2020 Infiniti QX60 LUXE

WEIGHT

Weight of vehicle as tested including driver and instrumentation

Left Front:	*631.9 kg (1393 lb)*	Right Front:	*568.8 kg (1254 lb)*
Left Rear:	*481.3 kg (1061 lb)*	Right Rear:	*481.3 kg (1061 lb)*
		Total:	*2163.3 kg (4769 lb)*

BLIND SPOT DETECTION

DATA SHEET 4: BLIND SPOT DETECTION SYSTEM OPERATION

(Page 1 of 4)

2020 Infiniti QX60 LUXE

General Information

Name of the BSD option, option package, etc., as shown on the Monroney label:

Blind Spot Warning (BSW) is standard equipment.

Type and location of sensors the system uses:

Side radar sensors located in each side of the rear bumper. See Owner's Manual page 5-38 shown in Appendix B, page B-7.

System setting used for test (if applicable):

Default - On

Method(s) by which the driver is alerted

X Visual:

	Type	Location	Description
X	Symbol	*Instrument cluster*	*Blind Spot symbol*
	Word		
	Graphic		

X Audible – Description:

Repeated high pitch, low pitch

Haptic:

	Steering Wheel		Seatbelt
	Pedals		Steering Torque
	Seat		Brake Jerk

Description of alert:

The system chimes (twice) and the side BSW indicator light flashes. The side BSW indicator light continues to flash until the detected vehicle leaves the detection zone. See the Owner's Manual page 5-40 shown in Appendix B page B-9.

System Function

What is the speed range over which the system operates?

Minimum: *32 km/h (20 mph)*

Maximum: *N/A*

If the system requires an initialization sequence/procedure, please provide a description of the process required to initialize the system.

No initialization is needed.

If the system requires the driver to operate their turn signal indicator during lane change in order to activate, please provide a description.

If the radar sensors detect a vehicle in the detection zone, the side BSW indicator light in the instrument cluster illuminates. If the turn signal is then activated, the system chimes (twice) and the side BSW indicator light flashes. The side BSW indicator light continues to flash until the detected vehicle leaves the detection zone.

If a vehicle comes into the detection zone after the driver activates the turn signal, then only the side BSW indicator light flashes and no chime sounds.

BLIND SPOT DETECTION

DATA SHEET 4: BLIND SPOT DETECTION SYSTEM OPERATION

(Page 3 of 4)

2020 Infiniti QX60 LUXE

If the vehicle is equipped with a method to activate/deactivate the system(s) please provide a description of how this is accomplished. If the system is deactivated by this method, does it reactivate upon each ignition cycle?

Perform the following steps to enable or disable the BSW system.

1. Press the "pages" button on the upper left steering wheel control until "Settings" displays in the vehicle information display. Use the Up/Down buttons to select "Driver Assistance." Then press the ENTER button.

2. Select "Driving Aids" and press the ENTER button.

3. Select "Blind Spot" and press the ENTER button.

4. Select "Blind Spot" and use the ENTER button to turn the system on or off.

The system will retain current settings when the engine is restarted.

See Appendix A, Figures A11 and A12.

If the vehicle is equipped with a method to adjust the range setting/sensitivity or otherwise influence the operation of BSD, please provide a description.

There is no setting for sensitivity for BSD (BSW).

If the system deactivates due to damage to the sensors, how is this indicated to the driver?

When a radar problem is detected, the system will be deactivated automatically. The "Unavailable: Side Radar Obstruction" warning message will appear and the BSW indicator (white) will blink A in the vehicle information display.

If the BSW system malfunctions, it will turn off automatically. The system malfunction warning message with the BSW indicator (orange) will appear in the vehicle information display.

See page 5-46 of the Owner's manual, shown in Appendix B, page B-15.

BLIND SPOT DETECTION

DATA SHEET 4: BLIND SPOT DETECTION SYSTEM OPERATION

(Page 4 of 4)

2020 Infiniti QX60 LUXE

If the system deactivates due to repeated BSD activations:

- How is this indicated to the driver?
- Can deactivation be avoided (e.g., by cycling the ignition after each BSD activation)?
- How can the system be reactivated?

If the BSW system malfunctions, it will turn off automatically. The system malfunction warning message with the BSW indicator (orange) will appear in the vehicle information display.

If the system deactivates or its effectiveness is reduced due to periods of inactivity:

- How is this indicated to the driver?
- Can deactivation be avoided?
- How can the system be reactivated?

If the BSW system malfunctions, it will turn off automatically. The system malfunction warning message with the BSW indicator (orange) will appear in the vehicle information display.

If there are other driving modes or conditions (such as weather) that render the system inoperable or reduce its effectiveness please provide a description.

System limitations are described in the Owner's Manual, page 5-42, shown in Appendix B, page B-11.

Notes:

Section III

TEST PROCEDURES

A. Test Procedure Overview

Two test scenarios were used, as follows:

Test 1. Straight Lane Converge and Diverge
Test 2. Straight Lane Pass-by

An overview of each of the test procedures follows.

For the purposes of this document, headway is defined as the longitudinal distance from the front-most point of the POV to the rear-most point of the SV, regardless of the relative lateral (lane) positions of the SV and POV. When the front-most part of the POV is ahead of the rear-most point on the SV, the headway is negative.

1. TEST 1 – STRAIGHT LANE CONVERGE AND DIVERGE

The Straight Lane Converge and Diverge Test evaluates the ability of the Blind Spot Detection (BSD) system to detect and respond to a vehicle that enters and exits the blind zone from a lane outside of the blind zone area. This test scenario is depicted in Figure 1. In this scenario, the test begins with the POV two lanes away from the SV. After both vehicles have reached their designated speeds and headway overlap, the POV begins a single lane change maneuver so that it is travelling in the lane next to the SV and holds this relative position for at least 2.5 seconds. The POV then begins a lane change maneuver back to its original lane, moving outside of the SV's blind zone.

This test was performed with the POV on both the left- and right-hand sides of the SV. The SV and POV turn signals were not active during any of the tests.

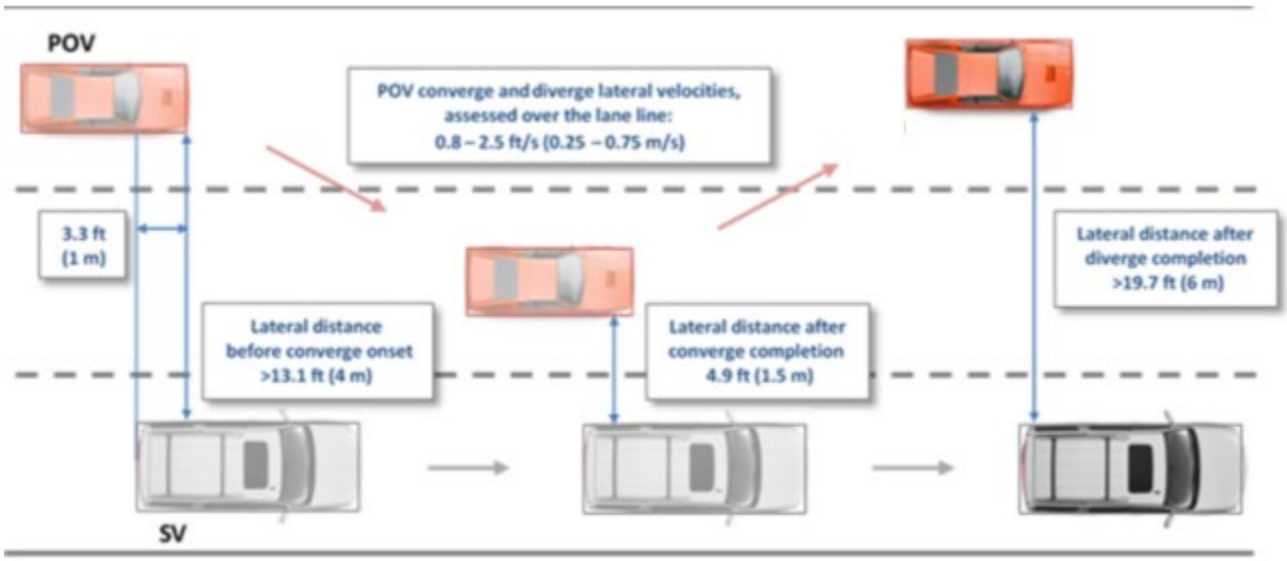


Figure 1. Straight Lane Converge and Diverge Test
(POV converge and diverge from the left is shown)

a. Procedure

The SV began in the center of a travel lane, with its longitudinal axis oriented parallel to the roadway edge. The POV began two lanes away from the SV, with its longitudinal axis oriented parallel to the roadway edge. Both vehicles then accelerated to a nominal speed of 45 mph (72.4 km/h). The nominal speed and specified headway overlap between the front bumper of the POV and the rear bumper of SV was maintained, within tolerance, throughout the test. As shown in Figure 1, the specified headway for this test was -3.3 ft (-1.0 m) resulting in a longitudinal overlap. The specified speed for both the SV and POV was 45 mph (72.4 km/h).

Once the specified speed and headway were stabilized and maintained for at least 2.5 seconds, the POV performed a “converge” lane change into the lane adjacent to the SV using a lateral velocity between 0.8 ft/s and 2.5 ft/s (0.25 to 0.75 m/s).

Once the lane change was completed, the POV continued in a straight line for at least 2.5 seconds, and then performed a “diverge” lane change back into its original lane using a lateral velocity between 0.8 ft/s and 2.5 ft/s (0.25 to 0.75 m/s).

The test concluded once the POV was back in its original lane and had been driving straight for at least 1.0 second.

The validity period for this test started 2.5 seconds prior to initiating the first POV lane change and ended 1.0 second after completion of the final POV lane change. For an individual test trial to be valid, the following requirements must have been met throughout the validity period:

- The SV and POV speeds could not deviate from the specified speed by more than 1.0 mph (1.6 km/h) during the entire test trial interval.
- The SV yaw rate could not exceed ±1 deg/s for the entire test interval.
- The POV yaw rate could not exceed ±1 deg/s when not performing a lane change maneuver.
- The POV lateral velocity during a lane change maneuver must have been 0.8 to 2.5 ft/s (0.25 to 0.75 m/s), assessed at the instant the vehicle first crossed the lane line separating the initial and adjacent travel lanes.
- The headway overlap from the front of the POV to the rear of the SV bumper must have been within 3.3 ± 1.6 ft (1.0 ± 0.5 m) for the entire test interval.
- The lateral offset between the widest point of the SV (not including side mirrors) and the widest point of the POV (not including side mirrors) must have been
    - greater than 13.1 ft (4 m) before the POV begins the converge lane change,
    - within 4.9 ± 1.6 ft (1.5 ± 0.5 m) when the POV is in the lane adjacent to the SV, and
    - greater than 19.7 ft (6 m) after the POV completes the diverge lane change.

After the test validity period ended, the SV driver manually applied force to the brake pedal, bringing the vehicle to a stop, and placed the transmission in park. The POV was also braked to a stop, and the test trial was complete.

b. Number of Test Trials

Seven valid trials per POV approach direction were performed for the Straight Lane Converge and Diverge Test scenario, for a total of 14 tests overall. If the test conductor performed more than 7 trials per approach direction within this scenario, the first 7 trials satisfying all test tolerances per approach direction were used to assess the SV performance.

c. Evaluation Criteria

The performance requirement for this series of tests is that the BSD system must be presented by a time no later than 300 ms after any part of the POV enters the SV blind zone defined by the intersections of lines A, C, D, and E for left side tests and of lines A, C, F, and G for right side tests (as shown in Figure 3), and shall remain on while any part of the POV resides within the SV blind zone. During the diverge portion of the test scenario, the BSD alert may remain active when the lateral distance between the SV and the POV is greater than 9.8 ft (3 m) but less than or equal to 19.7 ft (6 m). The BSD shall not be active once the lateral distance between the SV and the POV is greater than 19.7 ft (6 m).

2. TEST 2 – STRAIGHT LANE PASS-BY

This test evaluates the ability of the BSD system to detect and respond to a vehicle which approaches and then passes by the SV in an adjacent lane. This test scenario, depicted in Figure 2, was performed with the POV on both the left- and right-hand side of the SV, with four different POV speed configurations on each side: 50 mph, 55 mph, 60 mph, and 65 mph.

The SV and POV turn signals were not active during any of the tests.

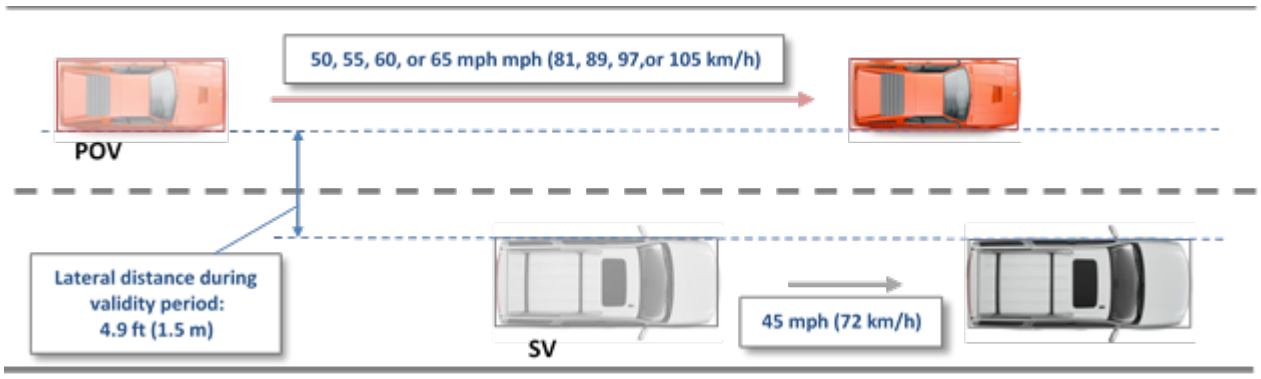


Figure 2. Straight Lane Pass-by Test
(Left-side POV Pass-by is shown)

a. Procedure

The SV is started in the center of a travel lane, with its longitudinal axis oriented parallel to the roadway edge. The POV is started in an adjacent lane on either the left or right side of the SV, with its longitudinal axis oriented parallel to the roadway edge, and behind the SV blind zone area.

The SV is then accelerated to a nominal speed of 45 mph (72.4 km/h) and the POV is accelerated to a nominal speed of either 50 mph (80.5 km/h), 55 mph (88.5 km/h), 60 mph (96.6 km/h), or 65 mph (104.6 km/h) depending on the test configuration. Both vehicles continue straight in their respective lanes.

The Straight Lane Pass-by Test parameters are defined in Table 1. The test validity period begins 4.0 seconds before the front-most part of the POV passes beyond a plane defined by the rear-most part of the SV perpendicular to the SV centerline. The test validity period ends 2.0 seconds after the rear-most point of the POV passes beyond a plane defined by the front-most point of the SV perpendicular to the SV centerline.

Table 1. Straight Lane Pass-by Test Scenarios

Parameter	Test Scenario			
	Straight Lane 45/50	Straight Lane 45/55	Straight Lane 45/60	Straight Lane 45/65
SV Speed	45 ± 1 mph (72.4 ± 1.6 km/h)	45 ± 1 mph (72.4 ± 1.6 km/h)	45 ± 1 mph (72.4 ± 1.6 km/h)	45 ± 1 mph (72.4 ± 1.6 km/h)
POV Speed	50 ± 1 mph (80.5 ± 1.6 km/h)	55 ± 1 mph (88.5 ± 1.6 km/h)	60 ± 1 mph (96.6 ± 1.6 km/h)	65 ± 1 mph (104.6 ± 1.6 km/h)
Differential Speed	5 ± 1 mph (8.0 ± 1.6 km/h)	10 ± 1 mph (16.1± 1.6 km/h)	15 ± 1 mph (24.1 ± 1.6 km/h)	20 ± 1 mph (32.2 ± 1.6 km/h)
Starting Headway Distance (nominally a 4 second gap) at validity period onset	29.3 ft (8.9 m)	58.7 ft (17.9 m)	88.0 ft (26.8 m)	117.3 ft (35.8 m)

For an individual test trial to be valid, the following requirements must have been met throughout the validity period:

- The SV speed could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) during the entire test interval.
- The POV speed could not deviate from the nominal speed by more than 1.0 mph (1.6 km/h) during the entire test interval.
- The SV yaw rate could not exceed ±1 deg/s for the entire test interval.
- The POV yaw rate could not exceed ±1 deg/s for the entire test interval.
- The lateral offset between the widest point of the SV (not including side mirrors) and the widest point of the POV (not including side mirrors) must have been within 4.9 ± 1.6 ft (1.5 ± 0.5 m) for the entire test interval.

After the test validity period ended, the SV driver manually applied force to the brake pedal, bringing the vehicle to a stop, and placed the transmission in park. The POV was also braked to a stop, and the test trial was complete.

b. Number of Test Trials

Seven valid trials for each POV pass-by side and speed were performed for the Straight Lane Pass-by Test scenario, for a total of 56 test trials overall. If the test conductor performed more than 7 trials per approach direction within this scenario, the first 7 trials satisfying all test tolerances per test condition were used to assess the SV performance.

c. Evaluation Criteria

The performance requirement for this series of tests is that the BSD alert must be presented by a time no later than 300 ms after the front-most part of the POV enters the blind zone defined by the intersections of lines A, C, D, and E for left side tests and of lines A, C, F, and G for right side tests, and shall remain on while the front-most point of the POV lies behind line A. The BSD alert shall not be active once the longitudinal distance between the front-most part of the SV and the rear-most part of the POV exceeds the BSD termination distances specified in Table 2.

Table 2. Straight Lane Pass-by BSD Evaluation Criteria

SV Speed	POV Speed	BSD Onset Headway[1] (SV ahead of POV)	BSD Termination Distance[2] (POV ahead of SV)
45 ± 1 mph (72.4 ± 1.6 km/h)	50 ± 1 mph (80.5 ± 1.6 km/h)	Within 300 ms after $\overline{BC}$ = 18.3 ft (5.6 m)	>7.3 ft (2.2 m)
	55 ± 1 mph (88.5 ± 1.6 km/h)	Within 300 ms after $\overline{BC}$ = 36.7 ft (11.2 m)	>14.7 ft (4.5 m)
	60 ± 1 mph (96.6 ± 1.6 km/h)	Within 300 ms after $\overline{BC}$ = 55.0 ft (16.8 m)	>22.0 ft (6.7 m)
	65 ± 1 mph (104.6 ± 1.6 km/h)	Within 300 ms after $\overline{BC}$ = 73.3 ft (22.4 m)	>29.3 ft (8.9 m)

[1] The BSD onset headway is the longitudinal distance when the rear-most part of the SV is ahead of the front-most part of the POV. The BSD onset headway criteria nominally corresponds to 2.5 seconds before the front-most part of the POV passes by the rear-most part of the SV.

[2] The BSD termination distance is the longitudinal distance when the rear-most part of the POV is ahead of the front-most part of the SV. The BSD termination distance criteria nominally corresponds to 1 second after the rear-most part of the POV passes by the front-most part of the SV.

B. Pre-Test Initialization and Calibration

A zero calibration was performed to align the lateral and longitudinal zero for the vehicles immediately before and after testing. The “zero position” was determined by positioning the SV and POV such that the centerline of the front-most location of the POV was aligned with the centerline of the rear-most location of the SV. Longitudinally, the front-most point of the front bumper of the POV was placed at the rear-most point of the rear bumper of the SV.

Static calibrations were then performed by placing the SV and POV transmissions in park, where applicable. Data were then collected for approximately 10 seconds using data from at least six GPS satellites. If the pre-test and post-test zero-positions reported by the data acquisition system differed by more than ±2 in (±5 cm) then the tests performed between the pre-test and post-test static calibrations were repeated.

C. Vehicle’s Blind Zone

The SV blind zones, for the purpose of this test, are defined by two rectangular regions adjacent to the sides of the SV, as shown in Figure 3.

The width of each rectangle is 8.2 ft (2.5 m) and is represented by lines parallel to the longitudinal centerline of the vehicle. The width of the rectangle begins 1.6 ft (0.5 m) from the outermost edge of the SV’s body, excluding the side view mirrors.

The length of the rectangle starts at the rear-most portion of the SV’s side view mirrors, perpendicular to the longitudinal centerline of the vehicle, and continues to a distance dependent on the differential speed between the SV and POV or SOV. To calculate the distance for the length of the rectangle that extends beyond the rear bumper of the SV, the following equation is used and corresponds to the length from point B to point C in Figure 3.

$$\overline{BC} = 2.5\Delta v\ (ft/s\ to\ ft)$$

where,

> Δv is the differential speed between the POV and the SV. A positive Δv indicates that the POV is travelling faster than the SV.

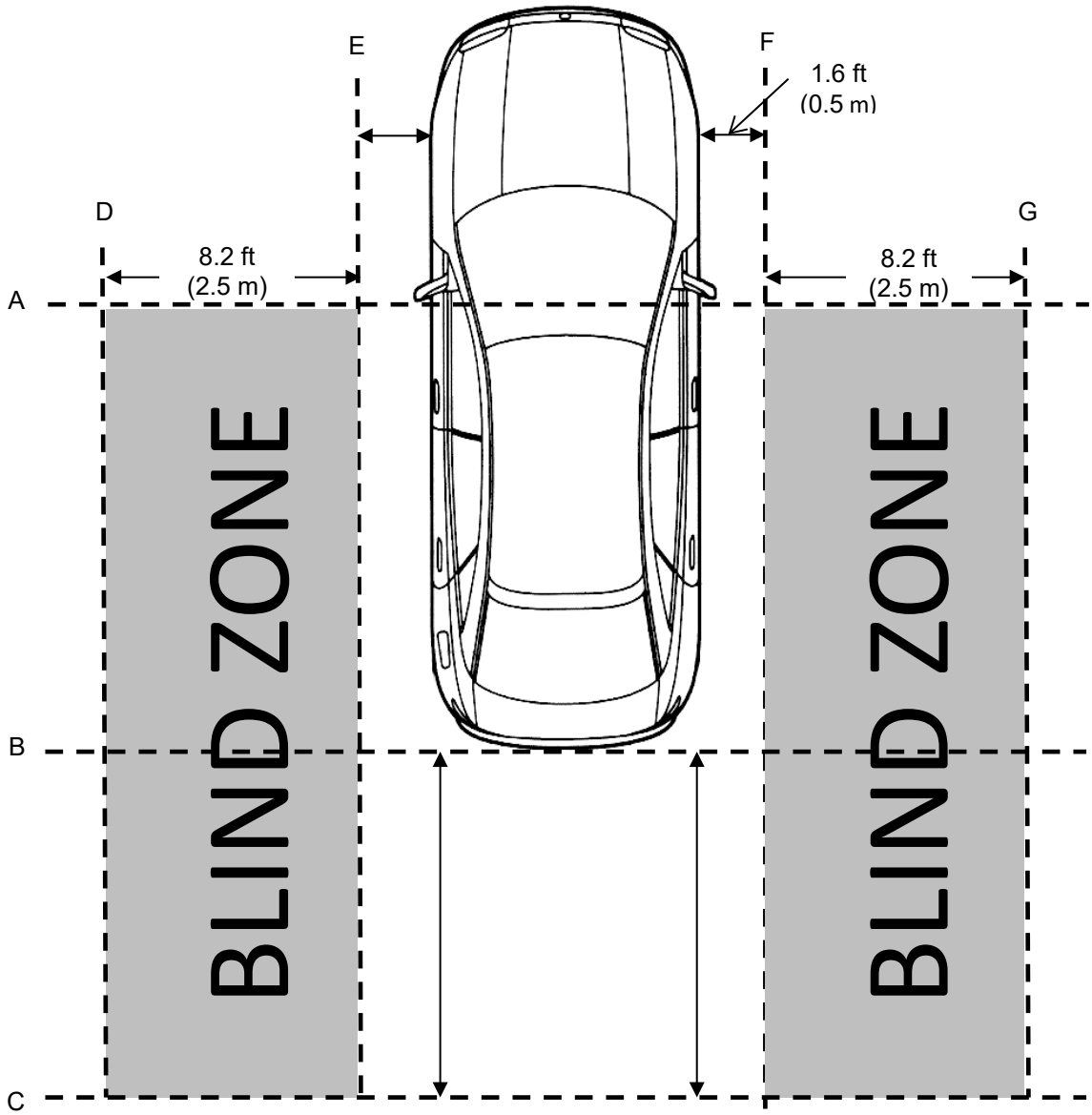


Figure 3. Vehicle Blind Zone Areas

Table 3 details the difference in length from point B to point C of the blind zone for the different speeds used in the tests.

Table 3. B to C Blind Zone Distance

SV-to-POV Differential Speed	B to C Distance (Nominal TTC = 2.5s)
5 ± 1 mph (8.0 ± 1.6 km/h)	18.3 ft (5.6 m)
10 ± 1 mph (16.1 ± 1.6 km/h)	36.7 ft (11.2 m)
15 ± 1 mph (24.1 ± 1.6 km/h)	55.0 ft (16.8 m)
20 ± 1 mph (32.2 ± 1.6 km/h)	73.3 ft (22.4 m)

For the Straight Lane Converge and Diverge Test scenario where there is no speed differential between the SV and POV, the B to C distance is given as 9.8 ft (3 m).

D. Principal Other Vehicle

The vehicle used as the Principal Other Vehicle (POV) was a 2006 Acura RL. This vehicle met the test requirements that the POV be a high-production mid-sized passenger car from 175 to 197 in (445 to 500 cm) long, and 70 to 76 in (178 to 193 cm) wide, measured at the widest part of the vehicle, exclusive of signal lamps, marker lamps, outside rearview mirrors, flexible fender extensions, and mud flaps, determined with doors and windows closed and the wheels in the straight-ahead position. Vehicle loading consisted of the driver plus equipment and instrumentation.

E. Throttle Controller

The POV was equipped with a programmable throttle controller which was used during the Straight Lane Converge and Diverge Test scenarios to modulate both speed and headway overlap between the SV and the POV. The throttle controller system consisted of the following components:

- Electronically controlled servo motor, mounted on an aluminum rail system and installed in the vehicle
- Real time computer (Arduino)

- Laptop computer, used to program and enable the throttle controller

F. Instrumentation

Table 4 lists the sensors, signal conditioning, and data acquisition equipment used for these tests.

Table 4. Test Instrumentation and Equipment

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Differential Global Positioning System	Position, Velocity	Latitude: ±90 deg Longitude: ±180 deg Altitude: 0-18 km Velocity: 0-1000 knots	Horizontal Position: ±1 cm Vertical Position: ±2 cm Velocity: 0.05 km/h	Trimble GPS Receiver, 5700 (base station and in-vehicle)	00440100989	N/A
Multi-Axis Inertial Sensing System	Position; Longitudinal, Lateral, and Vertical Accels; Lateral, Longitudinal and Vertical Velocities; Roll, Pitch, Yaw Rates; Roll, Pitch, Yaw Angles	Accels ± 10g, Angular Rate ±100 deg/s, Angle >45 deg, Velocity >200 km/h	Accels .01g, Angular Rate 0.05 deg/s, Angle 0.05 deg, Velocity 0.1 km/h	Oxford Inertial +	2258	By: Oxford Technical Solutions Date: 5/3/2019 Due: 5/3/2021
				Oxford Inertial +	2258	Date: 9/16/2019 Due: 9/16/2021
Real-Time Calculation of Position and Velocity Relative to Lane Markings (LDW) and POV (FCW)	Distance and Velocity to lane markings (LDW) and POV (FCW)	Lateral Lane Dist: ±30 m Lateral Lane Velocity: ±20 m/sec Longitudinal Range to POV: ±200 m Longitudinal Range Rate: ±50 m/sec	Lateral Distance to Lane Marking: ±2 cm Lateral Velocity to Lane Marking: ±0.02m/sec Longitudinal Range: ±3 cm Longitudinal Range Rate: ±0.02 m/sec	Oxford Technical Solutions (OXTS), RT-Range	97	N/A
Microphone	Sound (to measure time at alert)	Frequency Response: 80 Hz – 20 kHz	Signal-to-noise: 64 dB, 1 kHz at 1 Pa	Audio-Technica AT899	N/A	N/A

Table 4. Test Instrumentation and Equipment (continued)

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Light Sensor	Light intensity (to measure time at alert)	Spectral Bandwidth: 440-800 nm	Rise time < 10 msec	DRI designed and developed Light Sensor	N/A	N/A
Accelerometer	Acceleration (to measure time at alert)	±5g	≤ 3% of full range	Silicon Designs, 2210-005	N/A	N/A
Tire Pressure Gauge	Vehicle Tire Pressure	0-100 psi	< 1% error between 20 and 100 psi	Omega DPG8001	18111410000	By: DRI Date: 5/4/2020 Due: 5/4/2021
Platform Scales	Vehicle Total, Wheel, and Axle Load	2200 lb/platform	0.1% of reading	Intercomp SW wireless	0410MN20001	By: DRI Date: 4/20/2020 Due: 4/20/2021
Coordinate Measurement Machine	Inertial Sensing System Coordinates	0-8 ft 0-2.4 m	±.0020 in. ±.051 mm (Single point articulation accuracy)	Faro Arm, Fusion	UO8-05-08-06636	By: DRI Date: 1/6/2020 Due: 1/6/2021

Type	Description	Mfr, Model	Serial Number
Data Acquisition System	Data acquisition is achieved using a dSPACE MicroAutoBox II. 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 MicroAutoBox. The Oxford IMUs are calibrated per the manufacturer's recommended schedule (listed above).	dSPACE Micro-Autobox II 1401/1513	
		Base Board	549068
		I/O Board	588523
Throttle Controller	Arduino based, servo actuated controller for managing POV speed	DRI developed	N/A

APPENDIX A

Photographs

LIST OF FIGURES

Figure A1. Front View of Subject Vehicle

Figure A2. Rear View of Subject Vehicle

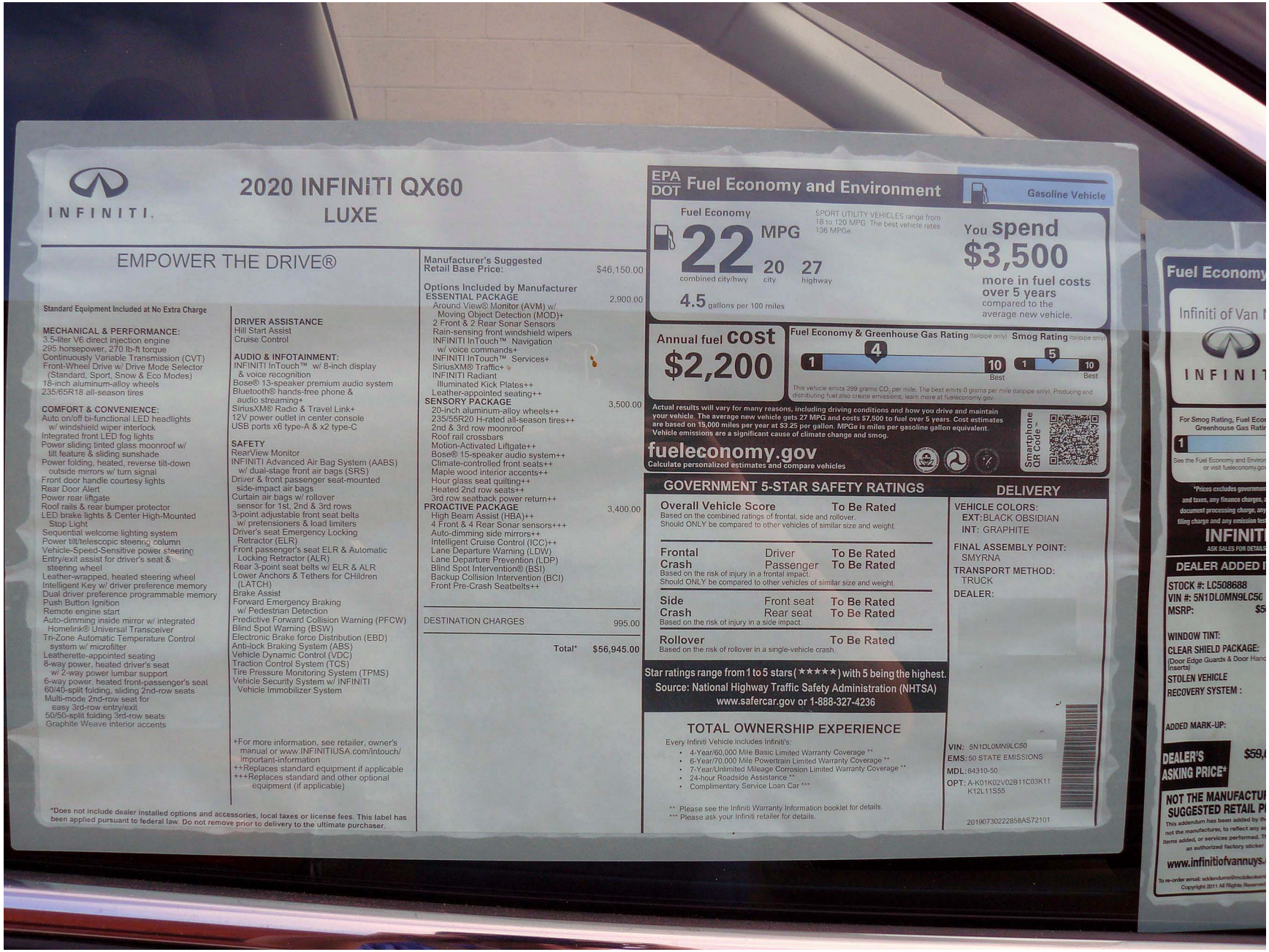


Figure A3. Window Sticker (Monroney Label)

Figure A4. Vehicle Certification Label

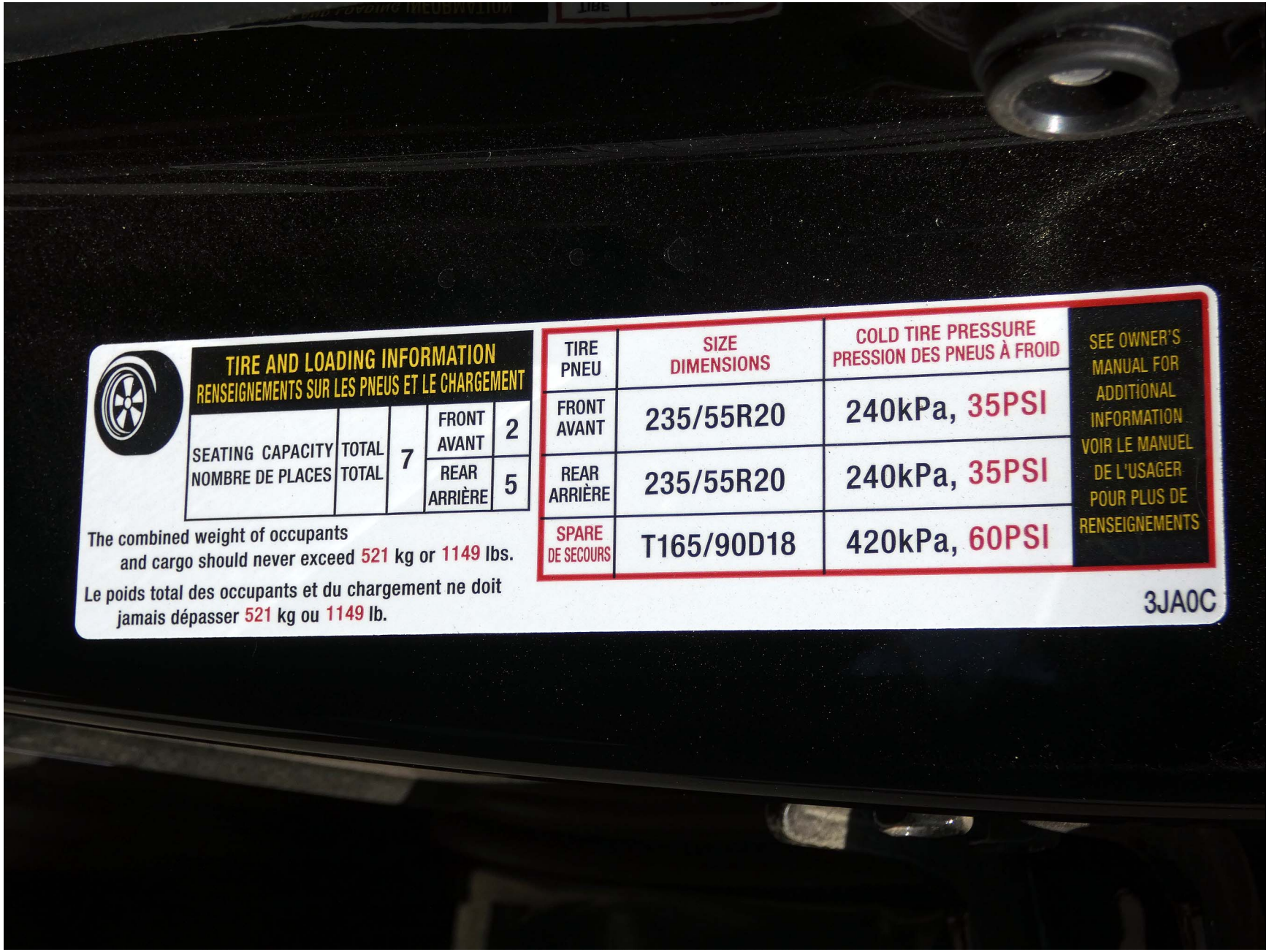


Figure A5. Tire Placard

Figure A6. Front View of Principal Other Vehicle

Figure A7. Rear View of Principal Other Vehicle

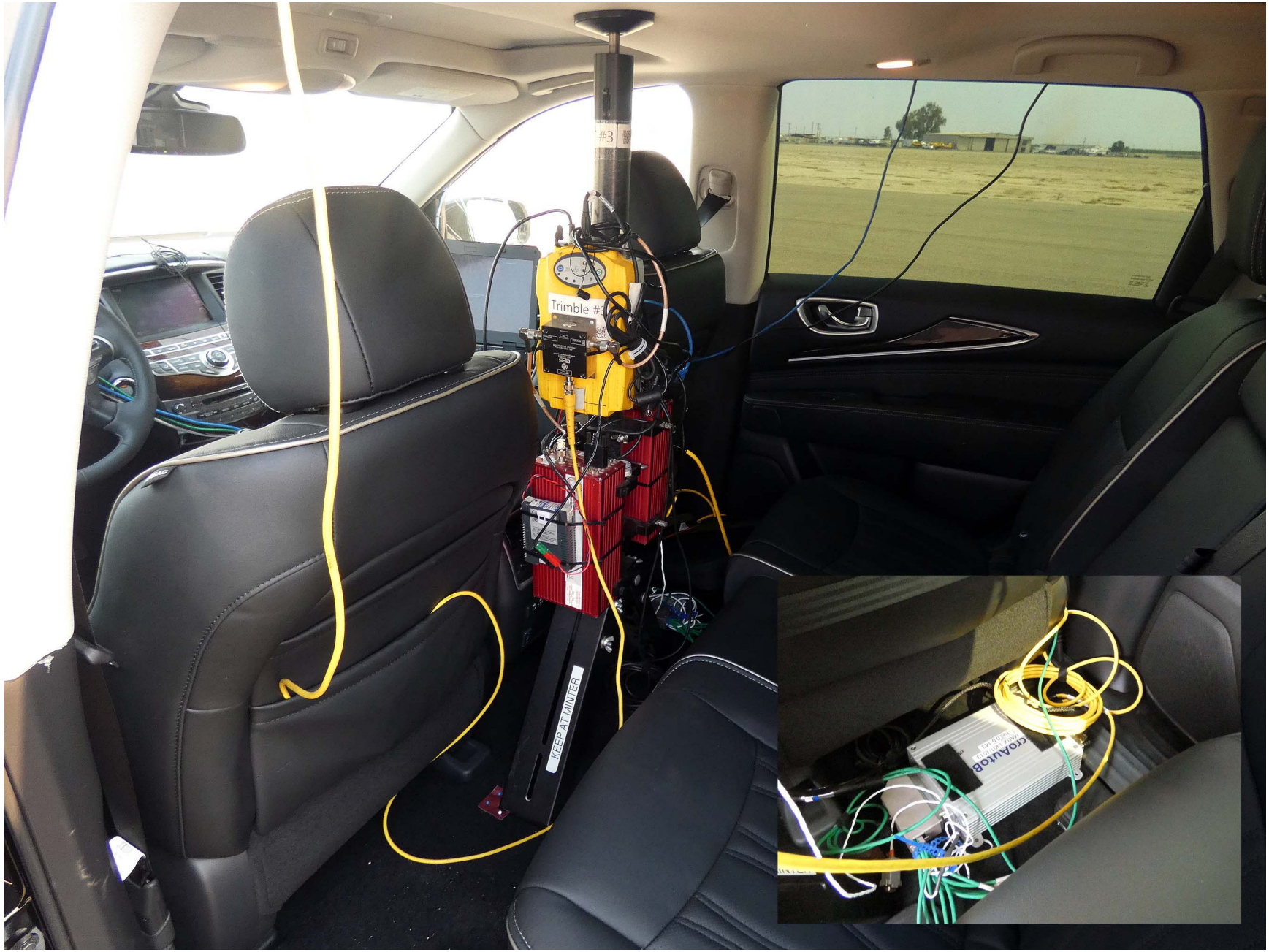


Figure A8. DGPS, Inertial Measurement Unit, and MicroAutoBox Installed in Subject Vehicle

Figure A9. Sensor for Detecting Visual Alerts

Figure A10. Computer Installed in Subject Vehicle

Figure A11. System Setup Menus

Figure A12. Controls for Interacting with System Menus

Figure A13. Visual Alert

APPENDIX B

Excerpts from Owner's Manual

Driver Assistance (if so equipped)

The driver assistance menu allows the user to change the various driving aids.

Menu item			Result
Driving Aids			Displays available driving aids.
	Forward (if so equipped)		Displays available forward driving aids.
		Assistance (DCA)	Allows user to turn the Distance Control Assist (DCA) system on or off. For additional information, refer to "Distance Control Assist (DCA)" in the "Starting and driving" section of this manual.
	Lane (if so equipped)		Displays available lane driving aids.
		Lane	Allows user to turn the Lane Departure Warning (LDW) system on or off. For additional information, refer to "Lane Departure Warning (LDW)" in the "Starting and driving" section of this manual.
		Assistance (LDP) (if so equipped)	Allows user to turn the Lane Departure Prevention (LDP) system on or off. For additional information, refer to "Lane Departure Prevention (LDP)" in the "Starting and driving" section of this manual.
	Blind Spot		Displays available blind spot driving aids and settings.
		Blind Spot	Allows user to turn the Blind Spot Warning (BSW) and Rear Cross Traffic Alert (RCTA) systems on or off. For additional information, refer to "Blind Spot Warning (BSW)" and "Rear Cross Traffic Alert (RCTA)" in the "Starting and driving" section of this manual.
		Assistance (BSI)	Allows user to turn the Blind Spot Intervention® (BSI) system on or off. For additional information, refer to "Blind Spot Intervention® (BSI)" in the "Starting and driving" section of this manual.
		Brightness (if so equipped)	Allows user to choose between standard (STD), dark or bright settings for the blind spot display.
Back-Up Collision Interv. (if so equipped)			Displays available Backup Collision Intervention (BCI) options.
	Ignition On Status		Allows user to turn the Backup Collision Intervention (BCI) system on or off. For additional information, refer to "Backup Collision Intervention (BCI)" in the "Starting and driving" section of this manual.
Emergency Braking			Displays available emergency braking options.
	System		Allows user to turn the emergency braking system on or off. For additional information, refer to "Forward Emergency Braking (FEB) with Pedestrian Detection system" and "Predictive Forward Collision Warning (PFCW)" in the "Starting and driving" section of this manual.

ture. The driving mode may change to 2-Wheel Drive (2WD). If this warning is displayed, stop the vehicle with the engine idling, as soon as it is safe to do so. Then if the warning turns off, you can continue driving.

Tire Size Incorrect: See Owner's Manual (if so equipped)

This warning may appear if there is a large difference between the diameters of the front and rear wheels. Pull off the road in a safe area, with the engine idling. Check that all the tire sizes are the same, that the tire pressure is correct and that the tires are not excessively worn.

Door Open

This warning illuminates when a door has been opened.

Liftgate Open

This warning illuminates when the liftgate has been opened.

Timer Alert — Have a break?

This indicator appears when the set time is reached. The time can be set up to six hours. For additional information, refer to "Settings" in this section.

Low Outside Temperature

This warning appears if the outside temperature is below 37°F (3°C). The temperature can be changed to display in Celsius or Fahrenheit. For additional information, refer to "Settings" in this section.

Power will turn off to save the battery

This message appears in the vehicle information display after a period of time if the ignition switch is in the ACC or the ON position and if the vehicle is in P (Park). For additional information, refer to "Push-button ignition switch positions" in the "Starting and driving" section of this manual.

Reminder: Turn OFF headlights

This warning appears when the headlights are left in the ON position when exiting the vehicle. Place the headlight switch in the OFF or AUTO position. For additional information, refer to "Headlight and turn signal switch" in this section.

Parking Sensor Error: See Owner's Manual

This warning illuminates when there is an error with the system. For additional information, refer to "Front and rear sonar system" in the "Starting and driving" section of this manual.

Predictive Forward Collision Warning (PFCW) indicator

This indicator shows when the PFCW system is engaged.

For additional information, refer to "Warning systems switch" in this section and "Predictive Forward Collision Warning (PFCW)" in the "Starting and driving" section of this manual.

Lane Departure Warning (LDW)/Lane Departure Prevention (LDP) indicator (if so equipped)

This indicator shows when the LDW/LDP system is engaged.

For additional information, refer to "Warning systems switch" in this section and "Lane Departure Warning (LDW)" and "Lane Departure Prevention (LDP)" in the "Starting and driving" section of this manual.

Blind Spot Warning (BSW) and Rear Cross Traffic Alert (RCTA) (if so equipped) indicator

This indicator shows when the following systems (if so equipped) are engaged:

- Blind Spot Intervention® (BSI)
- Blind Spot Warning (BSW)
- Rear Cross Traffic Alert (RCTA)

For additional information, refer to "Blind Spot Intervention® (BSI)" , "Blind Spot Warning (BSW)" and "Rear Cross Traffic Alert (RCTA)" in the "Starting and driving" section of this manual.

Malfunction: See Owner's Manual (if so equipped)

This warning appears when one or more of the following systems (if so equipped) is not functioning properly:

- Backup Collision Intervention (BCI)
- Blind Spot Intervention® (BSI)
- Blind Spot Warning (BSW)
- Distance Control Assist (DCA)
- Forward Emergency Braking (FEB) with Pedestrian Detection
- Intelligent Cruise Control (ICC)
- Lane Departure Prevention (LDP)
- Lane Departure Warning (LDW)
- Predictive Forward Collision Warning (PFCW)
- Rear Cross Traffic Alert (RCTA)

If one or more of these warning appears, have the system checked. It is recommended that you visit an INFINITI retailer for this service.

Intelligent Cruise Control (ICC) indicators (if so equipped)

These indicators show the Intelligent Cruise Control (ICC) system status. For additional information, refer to "Intelligent Cruise Control (ICC)" in the "Starting and driving" section of this manual.

Cruise control indicators (if so equipped)

These indicators show the cruise control system status.

For additional information, refer to "Cruise control" in the "Starting and driving" section of this manual.

INFINITI Drive Mode Selector indicators

These indicators show the current drive mode of the vehicle.

For additional information, refer to "INFINITI Drive Mode Selector" in the "Starting and driving" section of this manual.

Unavailable: Road is slippery (if so equipped)

This message appears when the Distance Control Assist (DCA), Lane Departure Prevention (LDP), or Blind Spot Intervention® (BSI) systems become unavailable because the road is slippery. For additional information, refer to "Distance Control Assist (DCA)," "Lane Departure Prevention (LDP)," or "Blind Spot Intervention® (BSI)" in the "Starting and driving" section of this manual.

Unavailable: Snow Mode Active (if so equipped)

This message appears when the Distance Control Assist (DCA), Lane Departure Prevention (LDP), or Blind Spot Intervention® (BSI) systems become unavailable because the Snow Mode is selected. For additional information, refer to "Distance Control Assist (DCA)," "Lane Departure Prevention (LDP)," or "Blind Spot Intervention® (BSI)" in the "Starting and driving" section of this manual.

Unavailable: VDC OFF (if so equipped)

This message appears when the Distance Control Assist (DCA), Lane Departure Prevention (LDP), or Blind Spot Intervention® (BSI) systems become unavailable because the Vehicle Dynamic Control (VDC) is turned

off. For additional information, refer to "Distance Control Assist (DCA)", "Lane Departure Prevention (LDP)", or "Blind Spot Intervention® (BSI)" in the "Starting and driving" section of this manual.

Unavailable: High Cabin Temp. (if so equipped)

This message appears when the camera detects an interior temperature of more than 40°C (104°F). For additional information, refer to "Distance Control Assist (DCA)," "Lane Departure Warning (LDW)," "Lane Departure Prevention (LDP)" or "Blind Spot Intervention® (BSI)" in the "Starting and driving" section of this manual.

Unavailable: Side Radar Obstruction (if so equipped)

This message appears when the Blind Spot Warning (BSW), Rear Cross Traffic Alert (RCTA), Blind Spot Intervention® (BSI), or Backup Collision Intervention (BCI) systems become unavailable because a radar blockage is detected. For additional information, refer to "Blind Spot Warning (BSW)," "Rear Cross Traffic Alert (RCTA)," "Blind Spot Intervention® (BSI)," or "Backup Collision Intervention (BCI)" in the "Starting and driving" section of this manual.

Unavailable: High Accelerator Temp. (if so equipped)

This message appears when the Backup Collision Intervention (BCI) system becomes unavailable because of an interior temperature greater than approximately 104°F (40°C). For additional information, refer to "Backup Collision Intervention (BCI)" in the "Starting and driving" section of this manual.

Unavailable: Front Radar Obstruction (if so equipped)

This message appears when the Intelligent Cruise Control (ICC), Distance Control Assist (DCA), Forward Emergency Braking (FEB) with Pedestrian Detection system, or Predictive Forward Collision Warning (PFCW) systems become unavailable because the front radar is obstructed. For additional information, refer to "Intelligent Cruise Control (ICC)," "Distance Control Assist (DCA)," "Forward Emergency Braking (FEB) with Pedestrian Detection system," or "Predictive Forward Collision Warning (PFCW)" in the "Starting and driving" section of this manual.

BCI OFF (if so equipped)

This message appears when the Backup Collision Intervention (BCI) system is turned off using the BCI switch. For additional information, refer to "Backup Collision Intervention (BCI)" in the "Starting and driving" section of this manual.

Shipping Mode On Push Storage Fuse

This warning may appear if the extended storage switch is not pushed in. When this warning appears, push in the extended storage switch to turn off the warning. For additional information, refer to "Extended storage switch" in this section.

CVT Error: See Owner's Manual

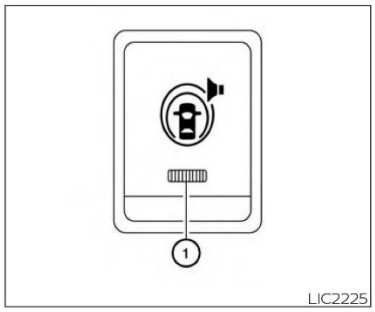
This warning illuminates when there is a problem with the CVT system. If this warning comes on, have the system checked. It is recommended that you visit an INFINITI retailer for this service.

Rear Door Alert is activated

When the system is enabled, this message appears when the Rear Door Alert system is active and can remind the driver to check the back seat.

- Using the steering wheel switch, a driver can select "Dismiss Message" to clear the display for a period of time. If no selection is made, this message automatically turns off after a period of time.

WARNING SYSTEMS SWITCH (if so equipped)



⚠WARNING

When this switch is activated the following Warning Systems (if so equipped) are turned off and will not work.

- **Blind Spot Warning (BSW)**
- **Lane Departure Warning (LDW)**
- **Rear Cross Traffic Alert (RCTA)**

The warning systems switch is used to turn on and off the warning systems (Lane Departure Warning (LDW), Blind Spot Warning (BSW), and Rear Cross Traffic Alert (RCTA)) that are activated (if so equipped) using the settings menu on the vehicle information display.

When the warning systems switch is turned off, the indicator ① on the switch is off. The indicator will also be off if the warning system is deactivated using the settings menu.

The LDW system warns the driver with a warning light and chime that the vehicle is beginning to leave the driving lane. For additional information, refer to "Lane Departure Warning (LDW)" in the "Starting and driving" section of this manual.

The BSW system will turn on the side indicator light, located next to the outside mirrors, if the radar detects a vehicle in the detection zone. If the turn signal is activated in the direction of the detected vehicle, a chime sounds twice and the side indicator light will flash. For additional information, refer to "Blind Spot Warning (BSW)" in the "Starting and driving" section of this manual.

The RCTA system can help alert the driver of an approaching vehicle when the driver is backing out of a parking space. If the system detects an approaching vehicle from either side, the system chimes (once) and the side BSW/RCTA indicator light flashes on the side the vehicle is approaching from. For additional information, refer to "Rear Cross Traffic Alert (RCTA)" in the "Starting and driving" section of this manual.

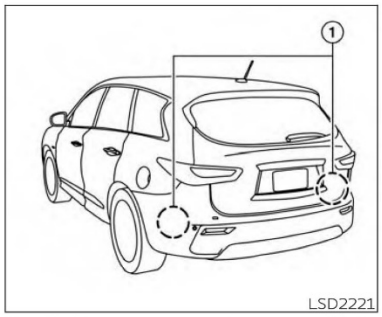
- Do not place reflective materials, such as white paper or a mirror, on the instrument panel. The reflection of sunlight may adversely affect the camera unit's capability of detecting the lane markers.
- Do not strike or damage the areas around the camera unit. Do not touch the camera lens or remove the screw located on the camera unit. If the camera unit is damaged due to an accident, it is recommended that you visit an INFINITI retailer.

⚠WARNING

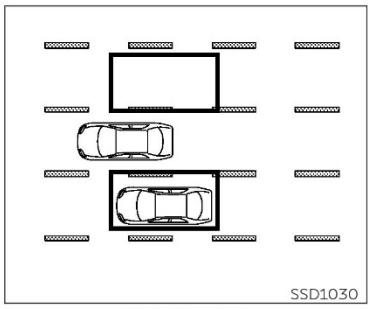
Failure to follow the warnings and instructions for proper use of the BSW system could result in serious injury or death.

- **The BSW system is not a replacement for proper driving procedures and is not designed to prevent contact with vehicles or objects. When changing lanes, always use the side and rear mirrors and turn and look in the direction your vehicle will move to ensure it is safe to change lanes. Never rely solely on the BSW system.**

The BSW system helps alert the driver of other vehicles in adjacent lanes when changing lanes.

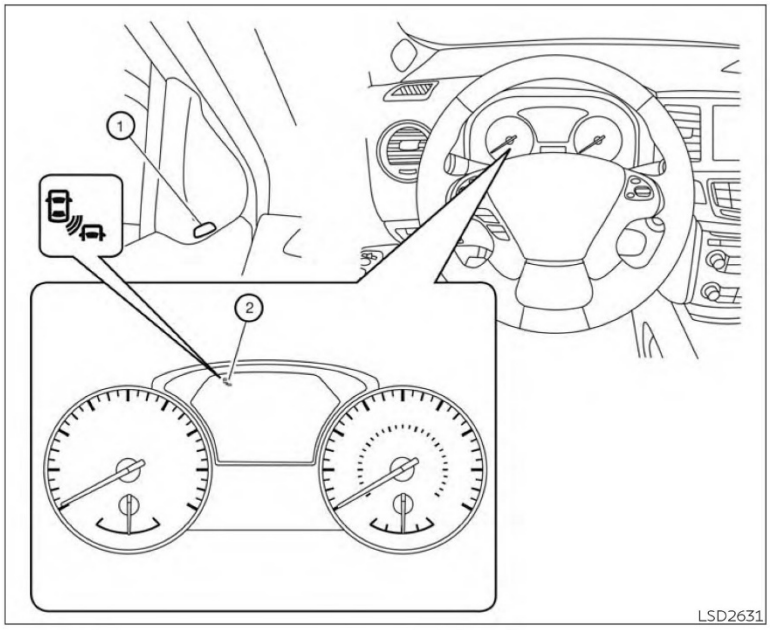


The BSW system uses radar sensors ① installed near the rear bumper to detect other vehicles in an adjacent lane.



Detection zone

The radar sensors can detect vehicles on either side of your vehicle within the detection zone shown as illustrated. This detection zone starts from the outside mirror of your vehicle and extends approximately 10 ft (3.0 m) behind the rear bumper, and approximately 10 ft (3.0 m) sideways.



① Side BSW/RCTA indicator light

② BSW/RCTA indicator

BSW SYSTEM OPERATION

The BSW system operates above approximately 20 mph (32 km/h).

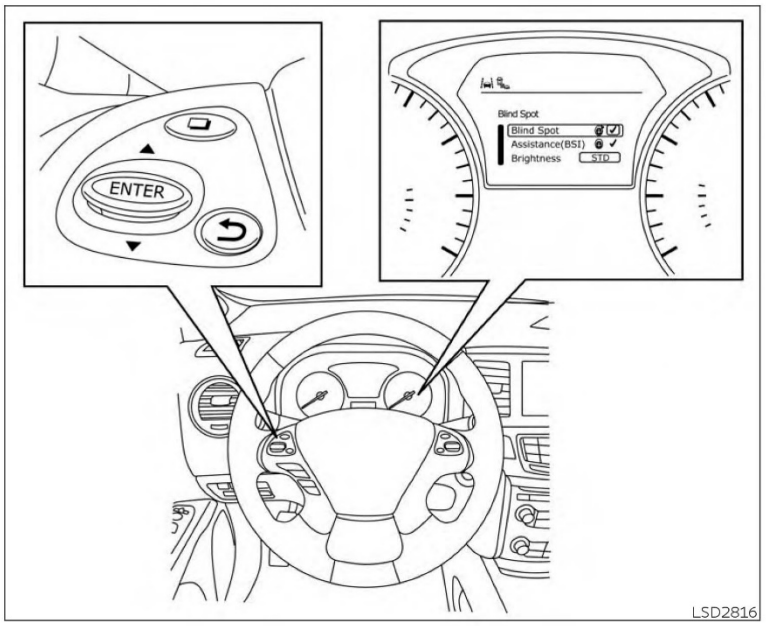
If the radar sensors detect a vehicle in the detection zone, the side BSW/RCTA indicator light ① illuminates. If the turn signal is then activated, the system chimes (twice) and the side BSW/RCTA indicator light flashes. The side BSW/RCTA indicator light continues to flash until the detected vehicle leaves the detection zone.

The side BSW/RCTA indicator light illuminates for a few seconds when the ignition switch is placed in the ON position.

The brightness of the side BSW/RCTA indicator light is adjusted automatically depending on the brightness of the ambient light.

If a vehicle comes into the detection zone after the driver activates the turn signal, then only the side BSW/RCTA indicator light flashes and no chime sounds. For additional information, refer to "BSW driving situations" in this section.

The BSW system automatically turns on every time the engine is started, as long as it is activated using the settings menu on the vehicle information display.



HOW TO ENABLE/DISABLE THE BSW SYSTEM

When the BSW system is enabled in the vehicle information display, the system can be turned off temporarily by pushing the warning systems switch. For additional information, refer to "Warning systems switch" in the "Instruments and controls" section of this manual.

Perform the following steps to enable or disable the BSW system.

1. Press the ❑ button until "Settings" displays in the vehicle information display. Use the ▲▼ button to select "Driver Assistance." Then press the ENTER button.
2. Select "Driving Aids" and press the ENTER button.
3. Select "Blind Spot" and press the ENTER button.
4. Select "Blind Spot" and use the ENTER button to turn the system on or off.

NOTE:

- **When enabling/disabling the system, the system will retain current settings even if the engine is restarted.**

- **The RCTA system (if so equipped) is integrated into the BSW system. There is not a separate selection in the vehicle information display for the RCTA system. When the BSW is disabled, the RCTA system is also disabled.**
- **When the BSW system is turned on, the BSW/RCTA indicator (white) in the vehicle information display illuminates.**

BSW SYSTEM LIMITATIONS

⚠ WARNING

Listed below are the system limitations for the BSW system. Failure to operate the vehicle in accordance with these system limitations could result in serious injury or death.

- **The BSW system cannot detect all vehicles under all conditions.**
- **The radar sensors may not be able to detect and activate BSW when certain objects are present such as:**
  - **Pedestrian, bicycles, animals.**
  - **Vehicles such as motorcycles, low height vehicles, or high ground clearance vehicles.**
  - **Oncoming vehicles.**
  - **Vehicles remaining in the detection zone when you accelerate from a stop.**
  - **A vehicle merging into an adjacent lane at a speed approximately the same as your vehicle.**
  - **A vehicle approaching rapidly from behind.**
  - **A vehicle which your vehicle overtakes rapidly.**
  - **A vehicle that passes through the detection zone quickly.**
  - **When overtaking several vehicles in a row, the vehicles after the first vehicle may not be detected if they are traveling close together.**
- **The radar sensors' detection zone is designed based on a standard lane width. When driving in a wider lane, the radar sensors may not detect vehicles in an adjacent lane. When driving in a narrow lane, the radar sensors may detect vehicles driving two lanes away.**
- **The radar sensors are designed to ignore most stationary objects; however, objects such as guardrails, walls, foliage and parked vehicles may occasionally be detected. This is a normal operation condition.**
- **The following conditions may reduce the ability of the radar to detect other vehicles:**
  - **Severe weather**
  - **Road spray**
  - **Ice/frost/snow/dirt build-up on the vehicle**
- **Do not attach stickers (including transparent material), install accessories or apply additional paint near the radar sensors. These conditions may reduce the ability of the radar to detect other vehicles.**
- **Excessive noise (for example, audio system volume, open vehicle window) will interfere with the chime sound, and it may not be heard.**

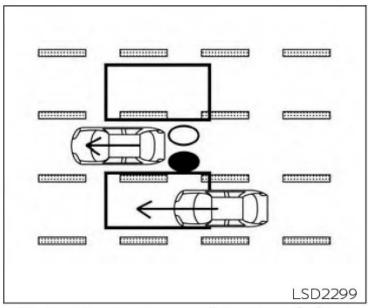


Illustration 1 – Approaching from behind

BSW DRIVING SITUATIONS

Indicator on

Indicator off

Indicator flashing

Another vehicle approaching from behind

Illustration 1: The side BSW/RCTA indicator light illuminates if a vehicle enters the detection zone from behind in an adjacent lane.

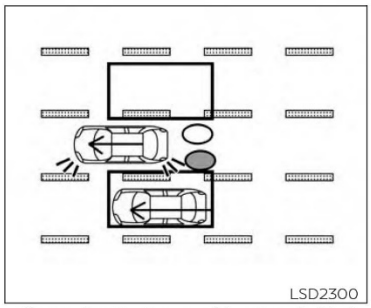


Illustration 2 – Approaching from behind

Illustration 2: If the driver activates the turn signal when another vehicle is in the detection zone, then the system chimes (twice) and the side indicator light flashes.

NOTE:

- **The radar sensors may not detect vehicles which are approaching rapidly from behind.**
- **If the driver activates the turn signal before a vehicle enters the detection zone, the side indicator light will flash but no chime will sound when the other vehicle is detected.**

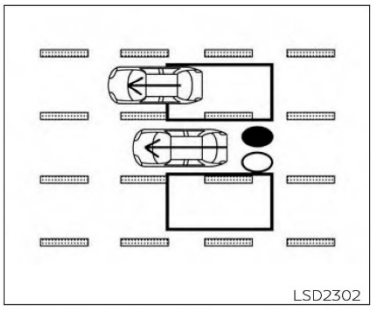


Illustration 3 – Overtaking another vehicle

Overtaking another vehicle

Illustration 3: The side indicator light illuminates if you overtake a vehicle and that vehicle stays in the detection zone for approximately 2 seconds.

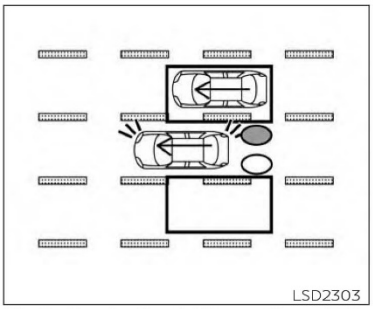


Illustration 4 – Overtaking another vehicle

Illustration 4: If the driver activates the turn signal while another vehicle is in the detection zone, then the system chimes (twice) and the side indicator light flashes.

NOTE:

- **When overtaking several vehicles in a row, the vehicles after the first vehicle may not be detected if they are traveling close together.**
- **The radar sensors may not detect slower moving vehicles if they are passed quickly.**
- **If the driver activates the turn signal before a vehicle enters the detection zone, the side indicator light will flash but no chime will sound when the other vehicle is detected.**

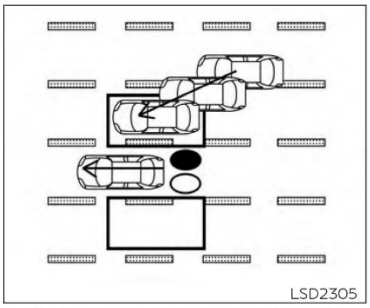


Illustration 5 – Entering from the side

Entering from the side

Illustration 5: The side indicator light illuminates if a vehicle enters the detection zone from either side.

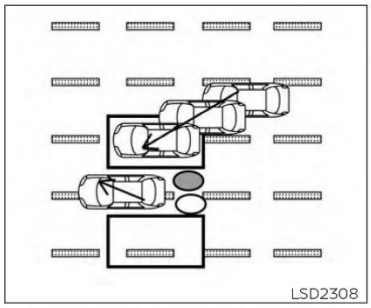
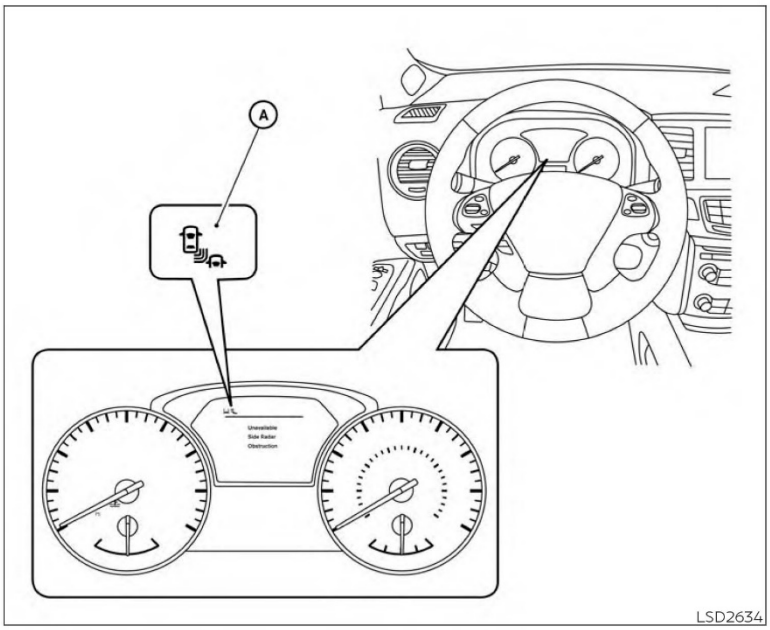


Illustration 6 – Entering from the side

Illustration 6: If the driver activates the turn signal while another vehicle is in the detection zone, then the system chimes (twice) and the side indicator light flashes.

NOTE:

- **If the driver activates the turn signal before a vehicle enters the detection zone, the side indicator light will flash but no chime will sound when the other vehicle is detected.**
- **The radar sensors may not detect a vehicle which is traveling at about the same speed as your vehicle when it enters the detection zone.**



SYSTEM TEMPORARILY UNAVAILABLE

When radar blockage is detected, the system will be deactivated automatically. The "Unavailable: Side Radar Obstruction" warning message will appear and the BSW/RCTA indicator (white) will blink Ⓐ in the vehicle information display.

The system is not available until the conditions no longer exist.

The radar sensors may be blocked by temporary ambient conditions such as splashing water, mist or fog. The blocked condition may also be caused by objects such as ice, frost or dirt obstructing the radar sensors.

NOTE:

If the BSW system stops working, the RCTA system (if so equipped) will also stop working.

Action to take:

When the above conditions no longer exist, the system will resume automatically.

Malfunction

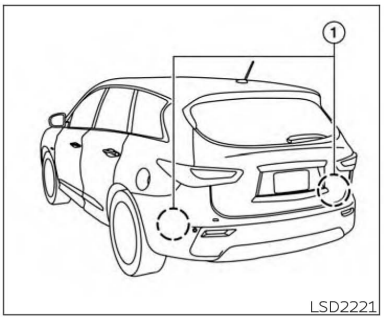
If the BSW system malfunctions, it will turn off automatically. The system malfunction warning message with the BSW/RCTA indicator (orange) will appear in the vehicle information display.

NOTE:

If the BSW system stops working, the RCTA system (if so equipped) will also stop working.

Action to take:

Stop the vehicle in a safe location, place the vehicle in the P (Park) position, turn the engine off and restart the engine. If the message continues to appear, have the system checked. It is recommended that you visit an INFINITI retailer for this service.



SYSTEM MAINTENANCE

The two radar sensors ① for the BSW and RCTA systems are located near the rear bumper. Always keep the area near the radar sensors clean.

The radar sensors may be blocked by temporary ambient conditions such as splashing water, mist or fog.

The blocked condition may also be caused by objects such as ice, frost or dirt obstructing the radar sensors.

Check for and remove objects obstructing the area around the radar sensors.

Do not attach stickers (including transparent material), install accessories or apply additional paint near the radar sensors.

Do not strike or damage the area around the radar sensors. It is recommended that you visit an INFINITI retailer if the area around the radar sensors is damaged due to a collision.

Radio frequency statement

For USA

FCC ID: OAYSRR3B

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

FCC Warning

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

APPENDIX C

Run Log

Subject Vehicle: **2020 Infiniti QX60 LUXE** Date: **8/10/2020**

Test Engineer: **K. Nagao**

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
1	**Static Run**							Static	
80	**Converge/ Diverge**	**Left**	N						POV speed, lateral velocity
81			Y	1.0	3.5	Yes	Yes	Yes	
82			Y	1.7	3.3	Yes	Yes	Yes	
83			Y	0.7	3.8	Yes	Yes	Yes	
84			Y	1.3	3.0	Yes	Yes	Yes	
85			Y	0.8	2.6	Yes	Yes	Yes	
86			N						Lateral velocity
87			N						Headway, POV speed, lateral velocity
88			N						POV speed, yaw
89			N						Headway, POV speed, lateral velocity
90			N						Lateral distance
91			N						Lateral velocity
92			Y	1.0	3.8	Yes	Yes	Yes	
93			Y	1.0	3.6	Yes	Yes	Yes	
38	**Converge/ Diverge**	**Right**	N						Ran out of track
39			N						POV speed, yaw, lateral velocity

[1] The acceptability criteria listed herein are used only as a guide to gauge system performance, and are identical to the Pass/Fail criteria given in NHTSA's most current Test Procedure in docket NHTSA-2019-0102-0010, BLIND SPOT DETECTION SYSTEM CONFIRMATION TEST.

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
40	Converge/ Diverge	Right	N						Lateral velocity
41			N						POV speed, yaw, lateral distance, lateral velocity
42			N						POV speed, yaw, lateral distance, lateral velocity
43			N						Yaw, lateral velocity
44			N						Yaw
45			N						Lateral velocity
46			Static						
47			N						Ran out of track
48			N						POV speed, yaw, lateral velocity
49			N						Ran out of track
50			N						Convergence not found
51			N						Convergence not found
52			N						Convergence not found
53			N						Convergence not found
54			N						Yaw, lateral distance, lateral velocity
55			N						POV speed, yaw
56			N						Yaw, lateral velocity
57			N						Yaw
58			N						Yaw, lateral distance
59			N						Convergence not found
60			N						Yaw, lateral velocity
61			N						Yaw, lateral velocity
62			N						Yaw, lateral distance, lateral velocity
63			N						Yaw, lateral velocity
64			N						Lateral velocity

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
65	Converge/ Diverge	Right	N						Yaw
66			Y	1.7	4.4	Yes	Yes	Yes	Video cut short
67			Y	2.0	4.1	Yes	Yes	Yes	
68			Y	1.1	4.0	Yes	Yes	Yes	
69			N						Lateral velocity
70			N						Convergence not found
71			Y	1.9	4.0	Yes	Yes	Yes	
72			N						Ran out of track
73			N						Yaw, lateral distance
74			N						Lateral distance
75			N						SV speed
76			N						POV speed
77			Y	0.9	4.2	Yes	Yes	Yes	
78			Y	1.1	3.8	Yes	Yes	Yes	
79			Y	1.0	4.8	Yes	Yes	Yes	
94	Straight Lane 45/50	Left	N						Lateral distance
95			Y	0.5	14.8	Yes	Yes	Yes	
96			Y	-1.3	14.5	No	Yes	No	
97			Y	-0.5	14.8	No	Yes	No	
98			N						POV speed
99			Y	-1.0	14.4	No	Yes	No	
100			Y	1.5	14.7	Yes	Yes	Yes	
101			N						POV speed
102			Static						
103			Y	0.1	14.9	Yes	Yes	Yes	
104			N						Vehicle never enters blind spot
105			Y	1.3	15.0	Yes	Yes	Yes	

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
2	**Straight Lane 45/50**	**Right**	Y	0.2	14.8	Yes	Yes	Yes	
3			N						Lateral distance
4			N						SV speed
5			Y	0.6	14.8	Yes	Yes	Yes	
6			Y	2.2	15.7	Yes	Yes	Yes	
7			Y	1.7	15.3	Yes	Yes	Yes	
8			Y	0.9	15.2	Yes	Yes	Yes	
9			Y	2.5	15.0	Yes	Yes	Yes	
10			Y	0.4	14.9	Yes	Yes	Yes	
106	**Straight Lane 45/55**	**Left**	N						Lateral distance
107			Y	-15.1	22.2	No	Yes	No	
108			Y	-13.7	22.8	No	Yes	No	
109			Y	-14.5	21.8	No	Yes	No	
110			Y	-15.8	21.0	No	Yes	No	
111			Y	-13.1	21.9	No	Yes	No	
112			Y	-13.4	23.7	No	Yes	No	
113			Y	-14.3	21.6	No	Yes	No	
11	**Straight Lane 45/55**	**Right**	Y	-14.9	22.1	No	Yes	No	
12			Y	-16.6	22.0	No	Yes	No	
13			Y	-15.3	22.7	No	Yes	No	
14			Y	-13.9	22.1	No	Yes	No	
15			N						SV speed
16			Y	-15.4	21.8	No	Yes	No	
17			N						SV speed
18			Y	-14.8	23.0	No	Yes	No	
19			Y	-14.1	22.6	No	Yes	No	

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
114	**Straight Lane 45/60**	**Left**	Y	-29.5	31.7	No	Yes	No	
115			Y	-31.1	38.5	No	Yes	No	
116			Y	-30.7	31.4	No	Yes	No	
117			Y	-31.5	32.0	No	Yes	No	
118			Y	-29.5	39.6	No	Yes	No	
119			Y	-31.7	30.7	No	Yes	No	
120			Y	-31.9	32.1	No	Yes	No	
121			Y	-30.2	40.8	No	Yes	No	
20	**Straight Lane 45/60**	**Right**	Y	-32.7	38.1	No	Yes	No	
21			N						POV speed
22			Y	-30.3	31.9	No	Yes	No	
23			Y	-31.0	30.2	No	Yes	No	
24			Y	-31.1	31.9	No	Yes	No	
25			N						Lateral distance
26			Y	-27.6	37.7	No	Yes	No	
27			Y	-30.8	32.4	No	Yes	No	
28			Y	-29.5	37.7	No	Yes	No	
122	**Straight Lane 45/65**	**Left**	Y	-49.3	37.2	No	Yes	No	
123			Y	-50.0	37.4	No	Yes	No	
124			Y	-46.7	49.8	No	Yes	No	
125			Y	-48.3	48.2	No	Yes	No	
126			Y	-48.2	48.5	No	Yes	No	Warning turned on and off twice (first warning captured)
127			Y	-48.9	49.0	No	Yes	No	
128			Y	-47.8	48.2	No	Yes	No	

Run	Test Type	BSD Side (L/R)	Valid Run?	BSD On (ft)	BSD Off (ft)	Acceptability Criteria met[1]			Notes
						BSD On	BSD Off	Overall	
29	**Straight Lane 45/65**	**Right**	Y	-46.0	39.3	No	Yes	No	
30			N						Lateral distance
31			Y	-49.2	47.9	No	Yes	No	
32			Y	-48.6	49.6	No	Yes	No	
33			Y	-47.7	48.6	No	Yes	No	
34			Y	-49.0	37.0	No	Yes	No	
35			Y	-48.8	38.5	No	Yes	No	
36			Y	-48.5	48.6	No	Yes	No	
37			Y	-47.4	39.4	No	Yes	No	

APPENDIX D

Time History Plots

LIST OF FIGURES

Description of Time History Plots

A set of time history plots is provided for each valid run in the test series. Each set of plots comprises time varying data from both the Subject Vehicle (SV) and Principal Other Vehicle (POV) with overlaid pass/fail and validity envelopes and thresholds.

Several of the plots include green envelopes (boxes) that are provided to verify test validity. For plots with green envelopes, the test is valid if the time-varying data is completely within the envelope boundaries.

Plots shown herein are grouped by test type and are presented sequentially within a given test type. Each time history plot consists of data relevant to the test type under consideration, and therefore the data channels plotted vary according to test type. The test types (shown in the plot titles) include:

- Straight Lane Converge/Diverge
- Straight Lane Pass-by (SV at 45 mph, POV at 50 mph)
- Straight Lane Pass-by (SV at 45 mph, POV at 55 mph)
- Straight Lane Pass-by (SV at 45 mph, POV at 60 mph)
- Straight Lane Pass-by (SV at 45 mph, POV at 65 mph)

Sub-plots

Time history figures include the following sub-plots:

- BSD Warning – displays the Blind Spot Detection alert (which can be audible, visual, or haptic). Depending on the type of BSD alert or instrumentation used to measure the alert, this can be any of the following:

    - Filtered, rectified, and normalized sound signal. The vertical scale is 0 to 1.
    - Filtered, rectified, and normalized acceleration (i.e., haptic alert, such as steering wheel vibration). The vertical scale is 0 to 1.
    - Normalized light sensor signal. The vertical scale is 0 to 1.

    The magenta envelopes indicate pass/fail criteria. For a test to meet the BSD-on criterion, the trace must be greater than a threshold of 0.5 and completely within the first envelope. The envelope begins 300 ms after the POV enters the SV Blind Zone and ends when the POV is no longer in the SV Blind Zone for

Converge/Diverge tests and when the front-most part of the POV is in front of line A[1] for Straight Lane Pass-by test.

For a test to meet the BSD-off criterion, the trace must be less than a threshold of 0.5 and completely within the second envelope. The envelope begins when the lateral distance between the POV and SV is greater than 6 m (19.7 ft) for Converge/Diverge Tests and when the longitudinal distance between the rear-most part of the POV and the front-most part of the SV exceeds the BSD termination headway specified in Table 4 of the test procedure. The envelope ends at the end of the test.

The bold black vertical lines indicate BSD-on and BSD-off. The value shown for BSD-on represents the distance[2] between the POV and 300 ms into SV's Blind Zone. A negative value means the BSD warning activated after 300 ms of the POV entering the SV's blind zone and the warning was late. The value shown for BSD-off for Converge/Diverge tests represents the lateral distance between the POV and SV relative to the 6 m (19.7 ft) BSD-off requirement. The value shown for BSD-off for Pass-by tests represents the longitudinal distance between the POV and SV relative to the BSD termination headway for a given test speed. A negative value means the BSD warning deactivated after the lateral distance between the POV and SV was greater than 6 m (19.7 ft) for Converge/Diverge tests or the longitudinal distance between the POV and SB was greater than the BSD termination headway for Pass-by tests and the warning was late.

- Headway (ft) – for Converge/Diverge tests, this is the longitudinal distance from the front of the POV to the rear of the SV. A negative value for headway indicates that the front of the POV is forward relative to the rear of the SV. For Straight Lane Pass-by tests, two headway traces are shown. The distance from the front of the POV to the rear of the SV is shown in *black* and the distance from the front of the SV to the rear of the POV is shown in *green*. Additionally, there are colored markers with values to indicate critical events.
    - Yellow Marker – BSD warning activates
    - Black Marker – POV enters the SV Blind Zone
    - Cyan Marker – 300 ms after the POV enters the SV Blind Zone
    - Red Marker – POV exits the SV Blind Zone
    - Green Marker – BSD warning deactivates
    - Blue Marker – BSD termination headway

[1] Line A is defined as the line that connects the rearmost part of the SV side mirror housings and runs perpendicular to the SV's longitudinal centerline
[2] Lateral distance for Converge and Diverge Scenarios and longitudinal distance for Pass-by Scenarios

- SV Speed (mph) – speed of the SV.
- POV Speed (mph) – speed of the POV.
- Yaw Rate (deg/sec) – yaw rate of the SV and POV. Overlapping validity envelopes are shown for the Converge/Diverge tests. The darker green indicates the validity envelope for the POV.
- Lateral Distance (ft) – lateral distance from the widest point (not including side mirrors) on the side of the SV to the widest point (not including side mirrors) on the side of the POV.
- Lateral Velocity (ft/s) – lateral velocity of the POV for Converge/Diverge tests only. Bold vertical black lines are provided to indicate the allowable lateral velocity range. A green dot indicates a valid value.

Color Codes

Color codes have been adopted to easily identify which data correspond to which vehicle, as well as to indicate the types of envelopes and thresholds used in the plots.

Color codes can be broken into four categories:

1. Time-varying data
2. Pass/Fail envelopes, validation envelopes and thresholds
3. Individual data points
4. Text

1. Time-varying data color codes:
   - Blue = Subject Vehicle data
   - Magenta = Principal Other Vehicle data
   - Brown = Relative data between SV and POV (i.e., TTC, lateral distance and headway distance)

2. Pass/Fail envelopes, validation envelopes and threshold color codes:
   - Magenta envelope = time varying data must be within the envelope at all times for a passing run
   - Green envelope = time varying data must be within the envelope at all times in order to be valid

- Black threshold (Solid) = time varying data must cross this threshold in the time period shown in order to be valid

3. Individual data point color codes:
   - Green circle = passing or valid value at a given moment in time
   - Red asterisk = failing or invalid value at a given moment in time

4. Text color codes:
   - Green = passing or valid value
   - Red = failing or invalid value

Other Notations

- No Wng – No warning was detected.
- On Late – Indicates that the BSD warning activated after the allowable criteria.
- Off Early – Indicates that the BSD warning deactivated before the allowable criteria.
- Off Late – Indicates that the BSD warning deactivated after the allowable criteria.
- POV – Indicates that the value for the Principal Other Vehicle was out of bounds.
- SV – Indicates that the value for the Subject Vehicle was out of bounds.

The minimum (worst) GPS fix type is displayed in the lower right corner of each page. The only valid fix type is RTK fixed (displayed in green). If the fix type during any portion of the test was anything other than RTK fixed, then “RTK Fixed OR LESS!!” is displayed in red.

Examples of time history plots for the Straight Lane Converge/Diverge and Straight Lane Pass-by are shown in Figures D1 through D4. These show examples of passing and failing runs for both test types. Time history data plots for the tests of the vehicle under consideration herein are provided beginning with Figure D5.

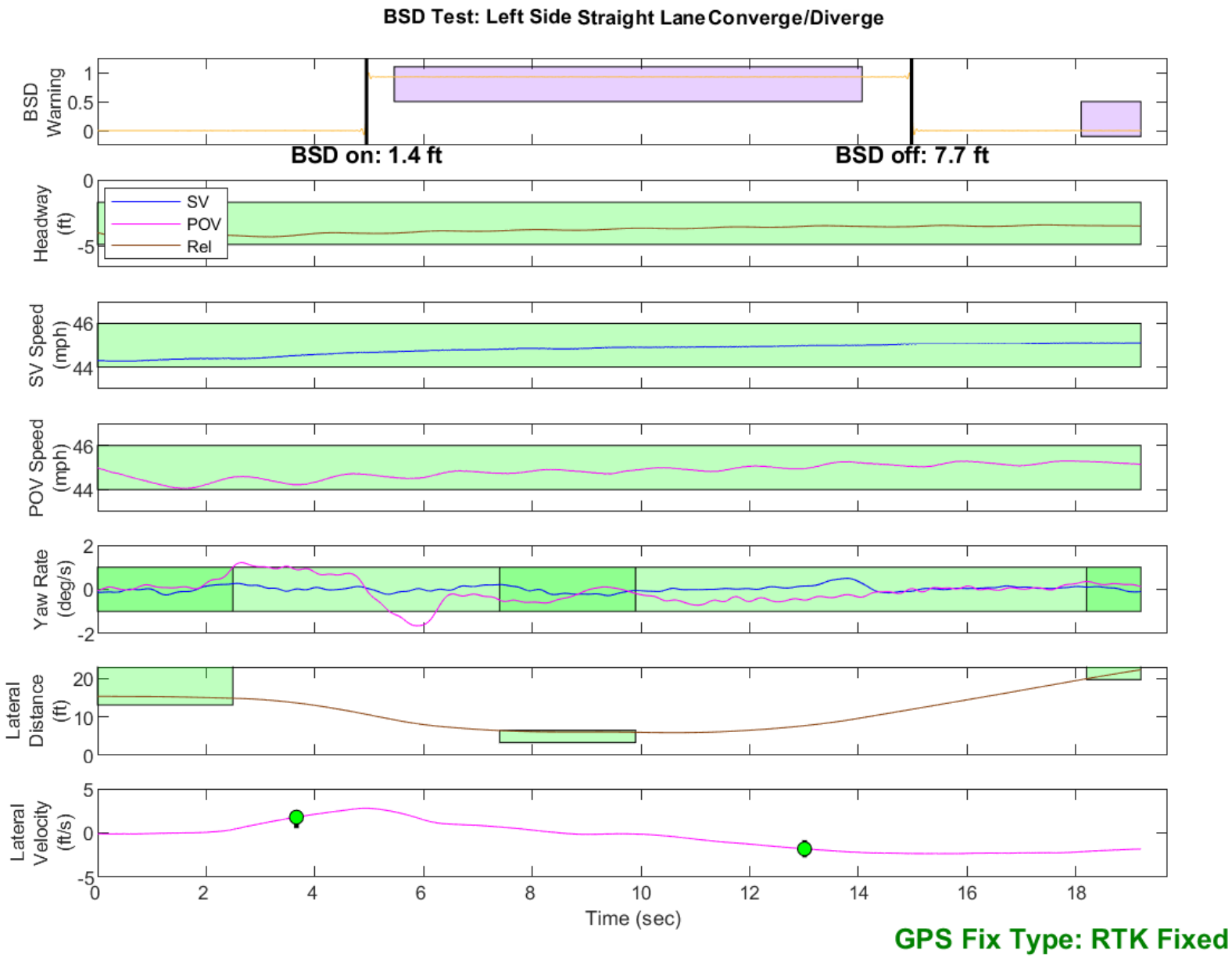


Figure D1. Example Time History for Straight Lane Converge/Diverge Test, Passing

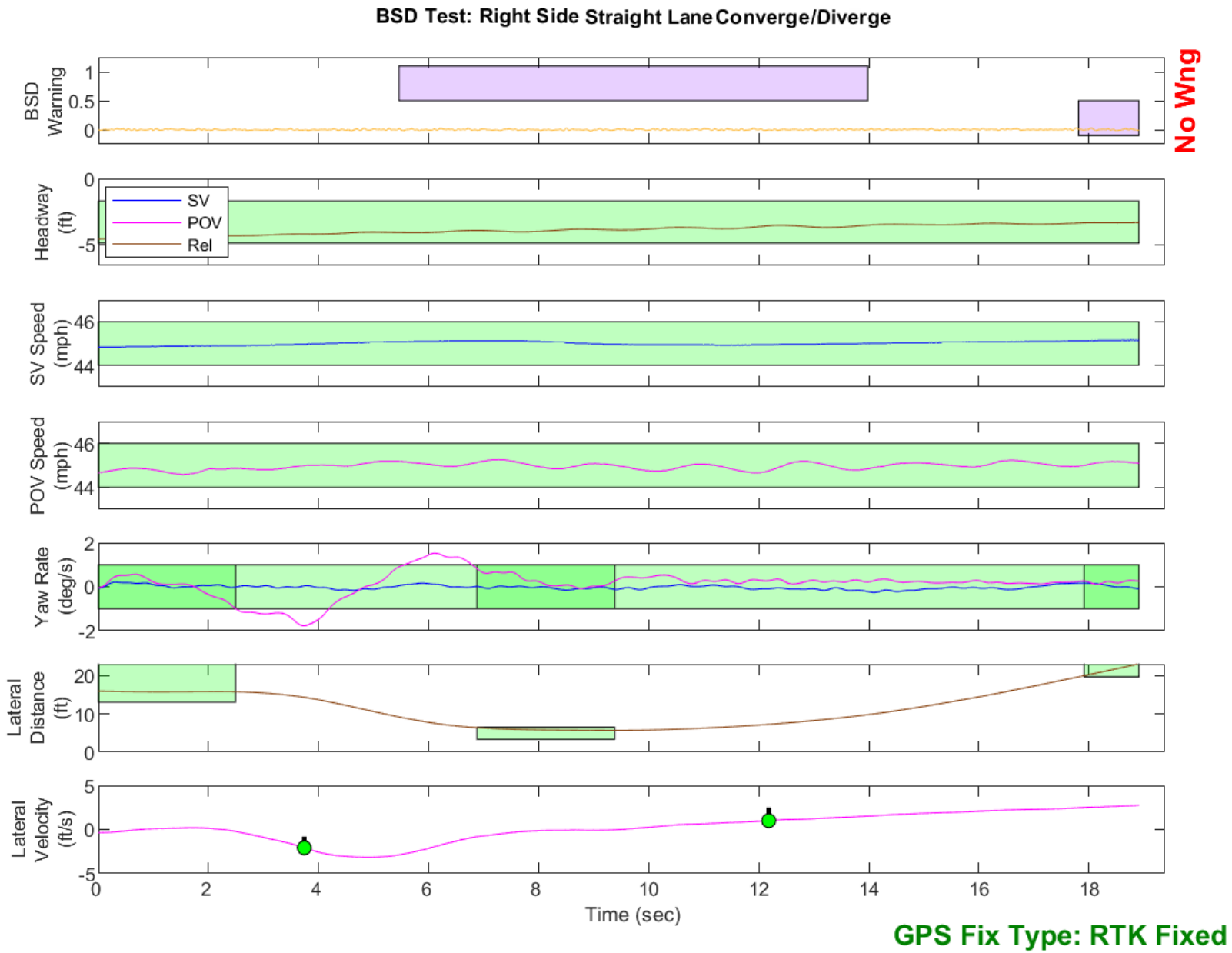


Figure D2. Example Time History for Straight Lane Converge/Diverge Test, Failing

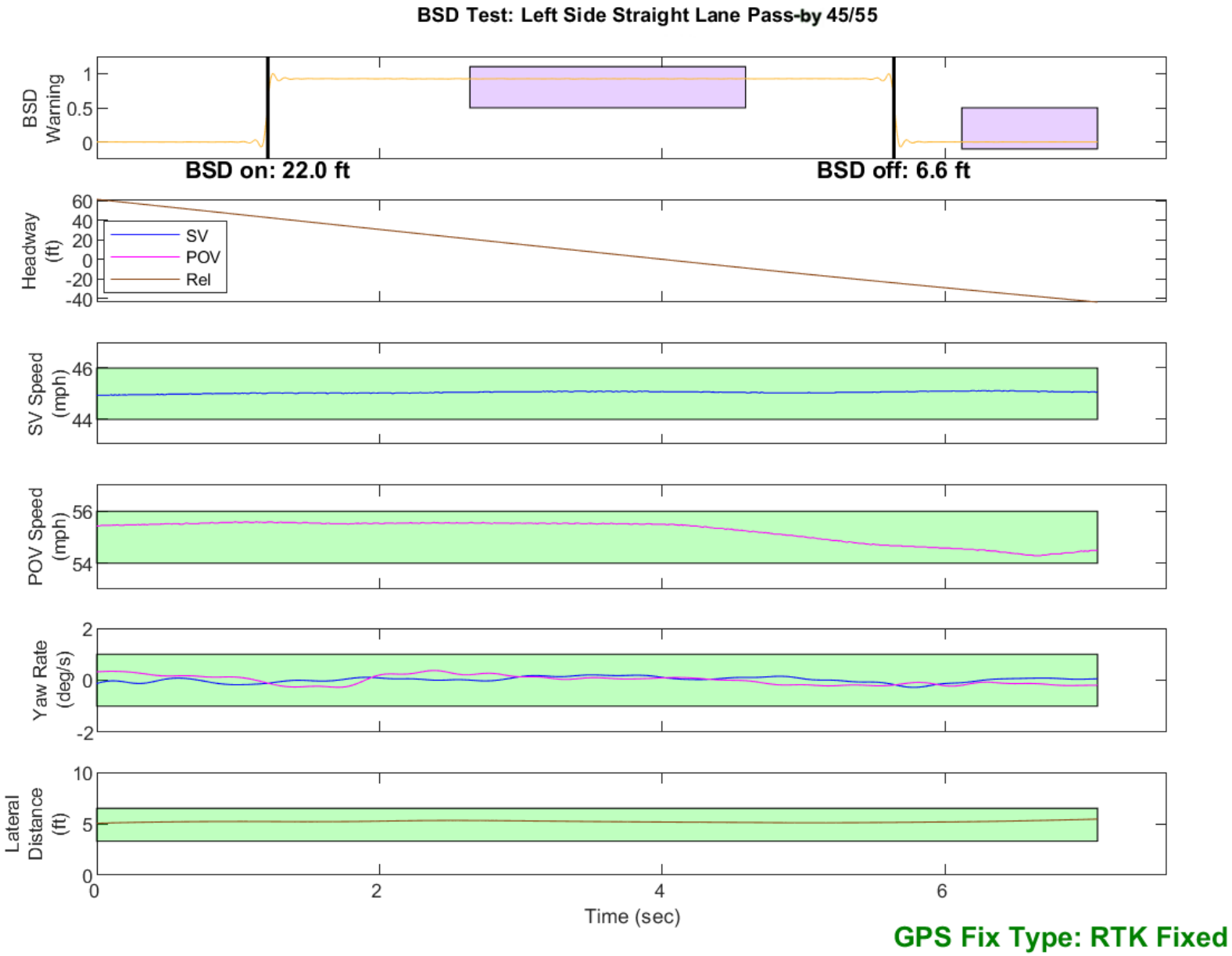


Figure D3. Example Time History for Straight Lane Pass-By Passing

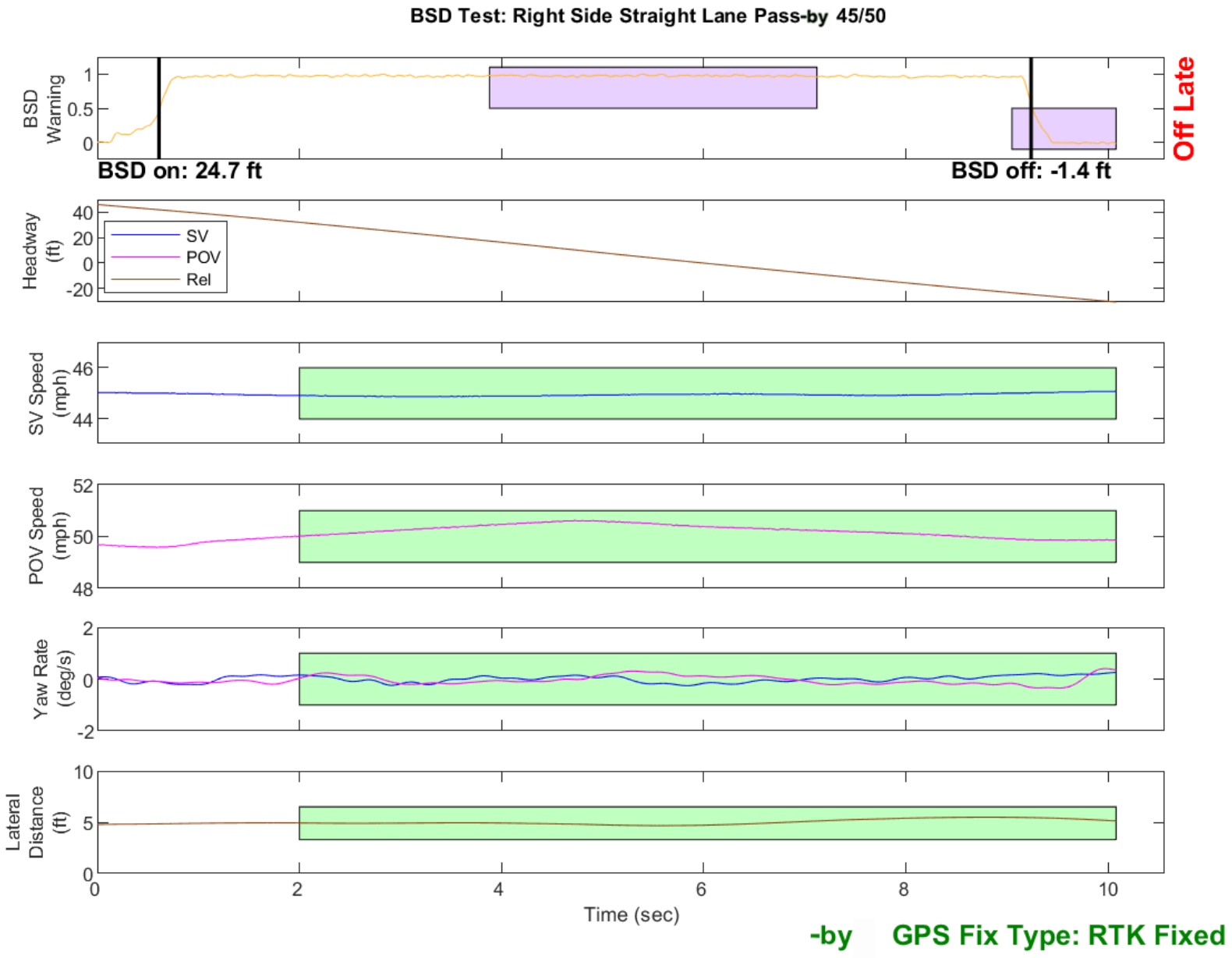


Figure D4. Example Time History for Straight Lane Pass-by Test, Failing

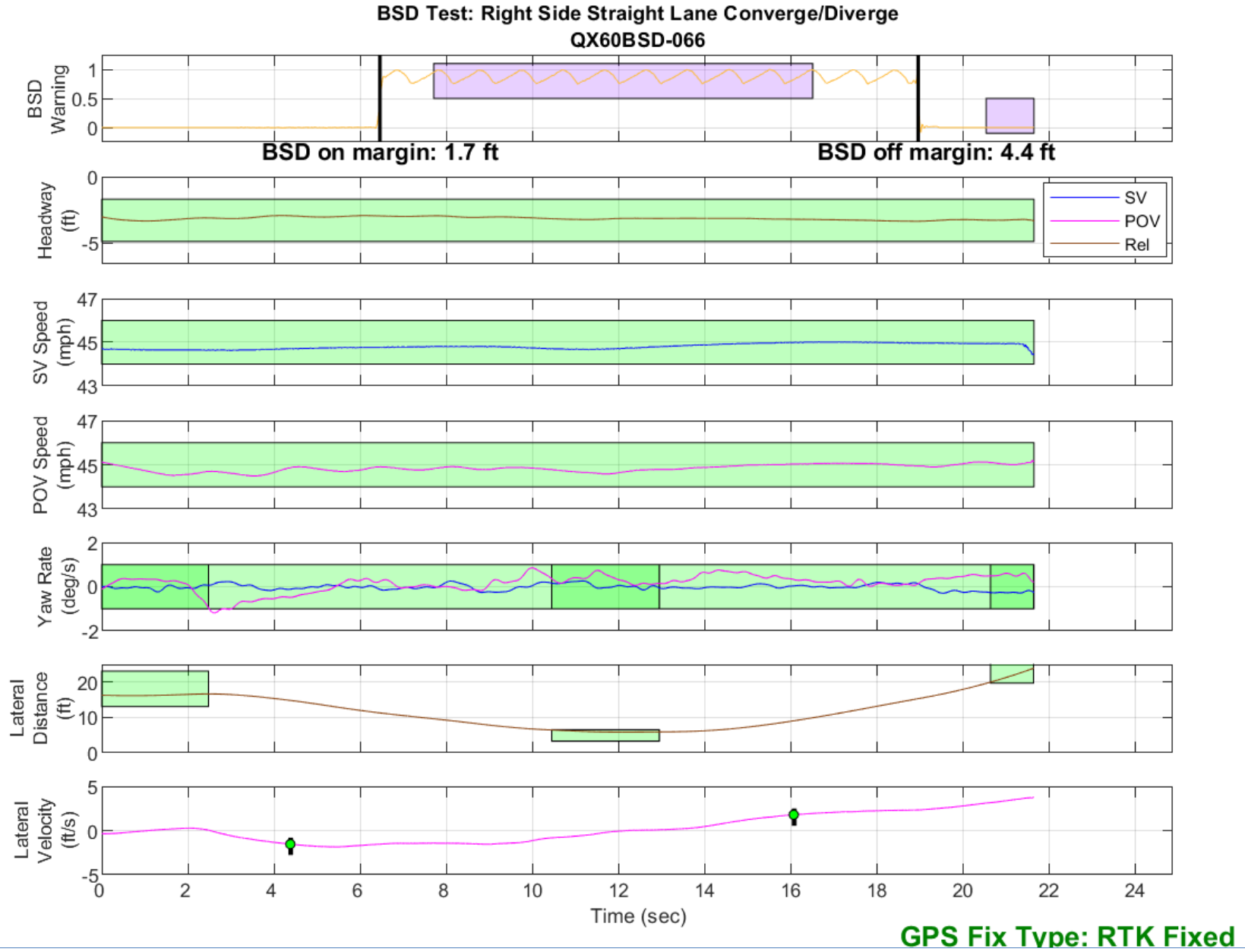


Figure D5. BSD Run 66, Straight Lane Converge/Diverge

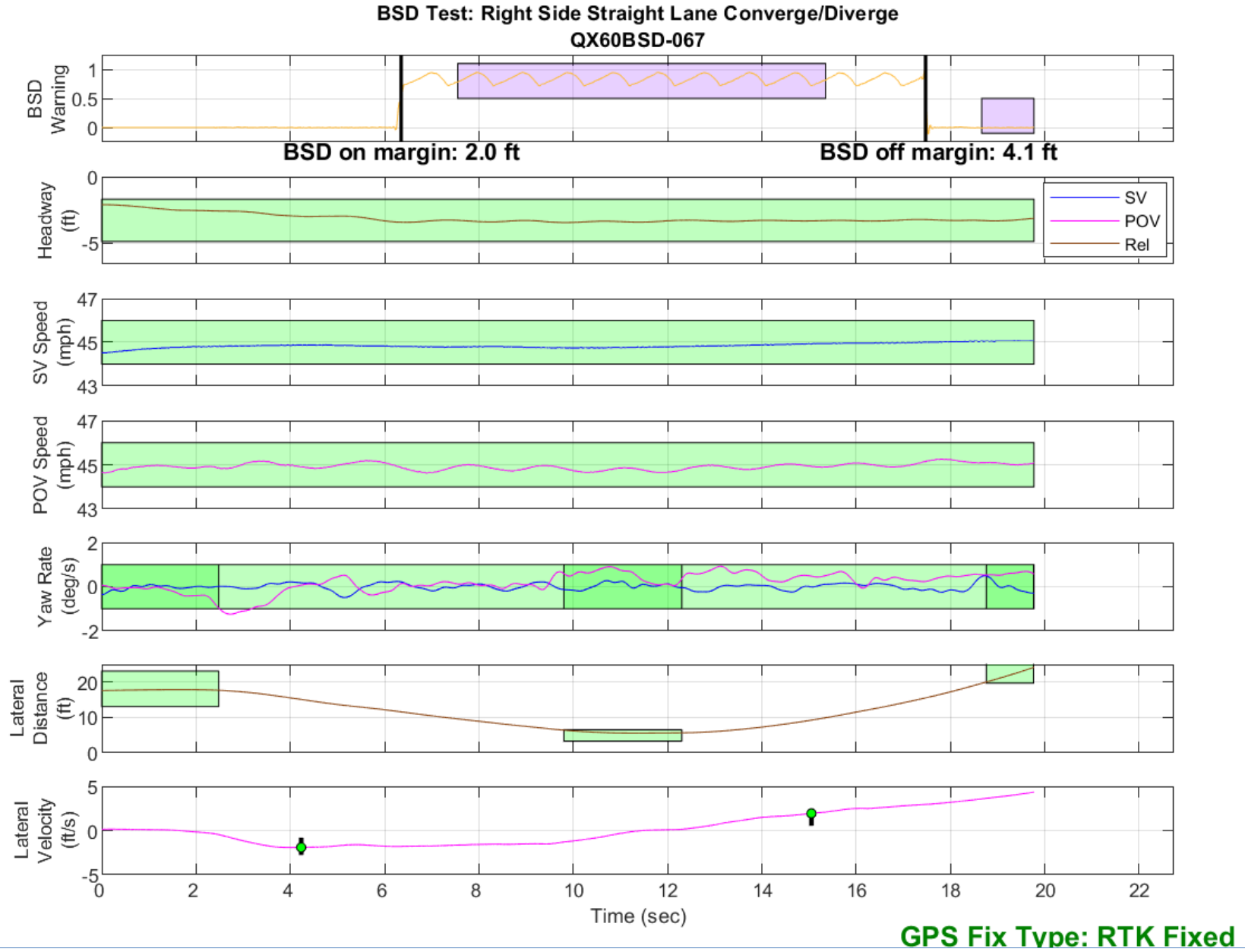


Figure D6. BSD Run 67, Straight Lane Converge/Diverge

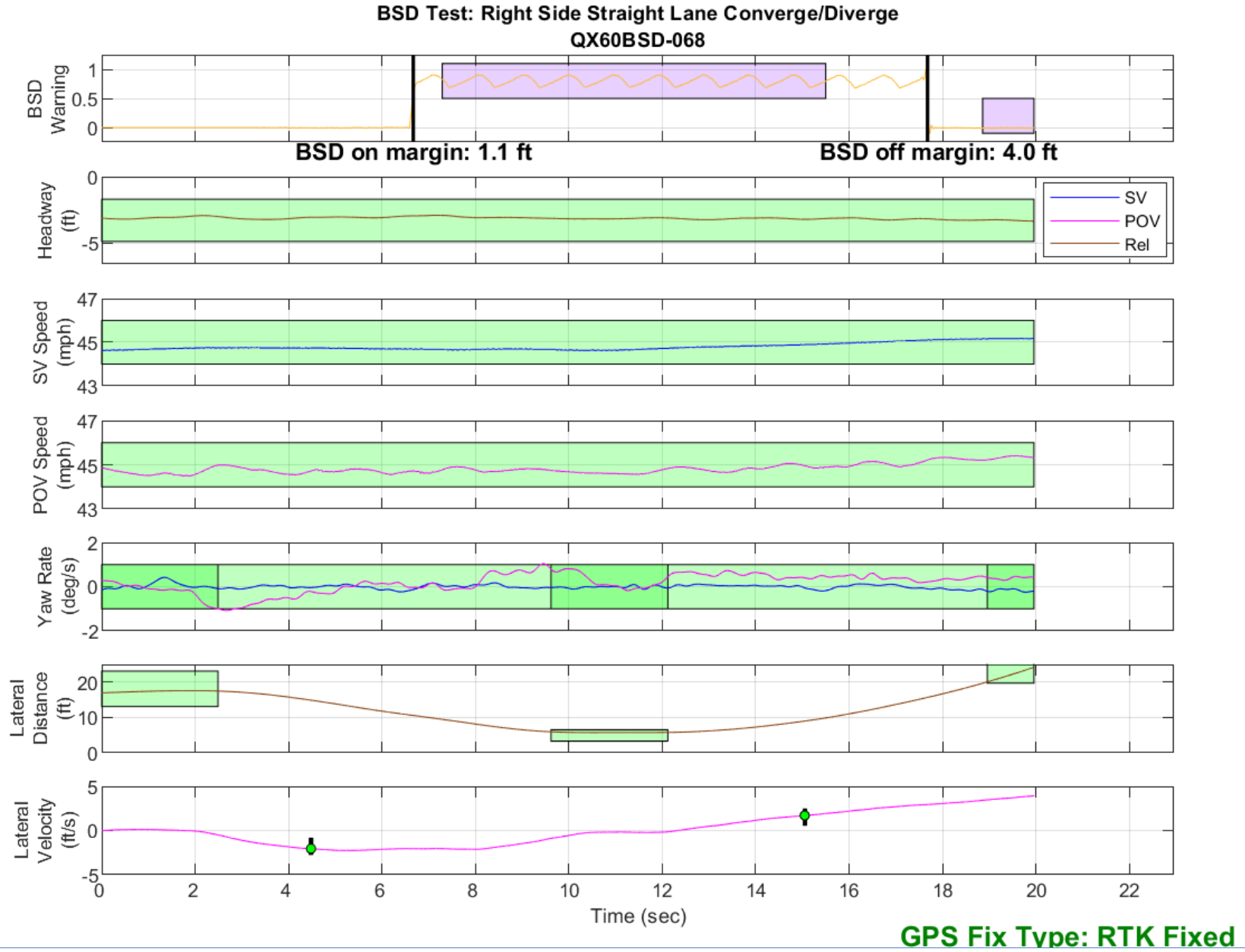


Figure D7. BSD Run 68, Straight Lane Converge/Diverge

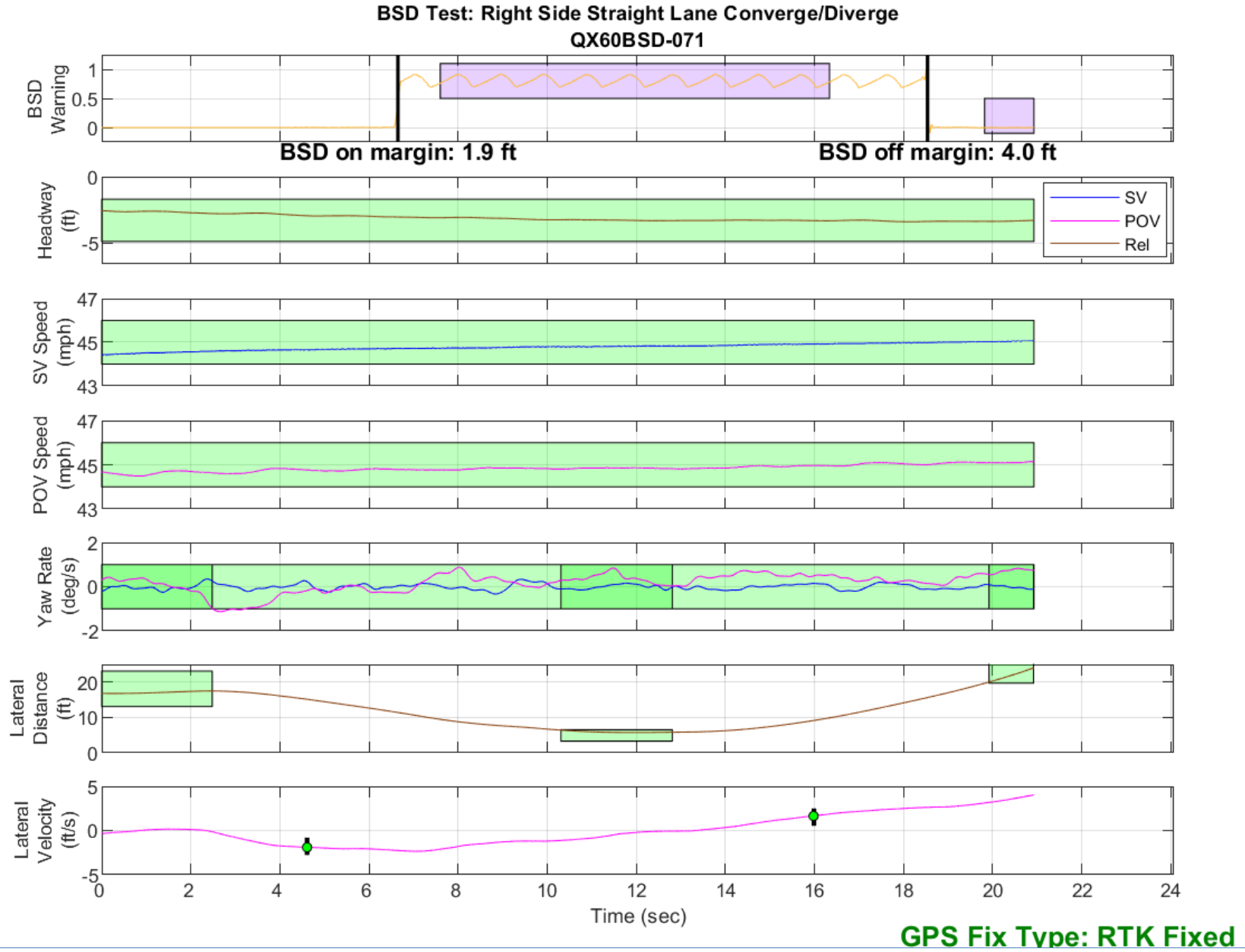


Figure D8. BSD Run 71, Straight Lane Converge/Diverge

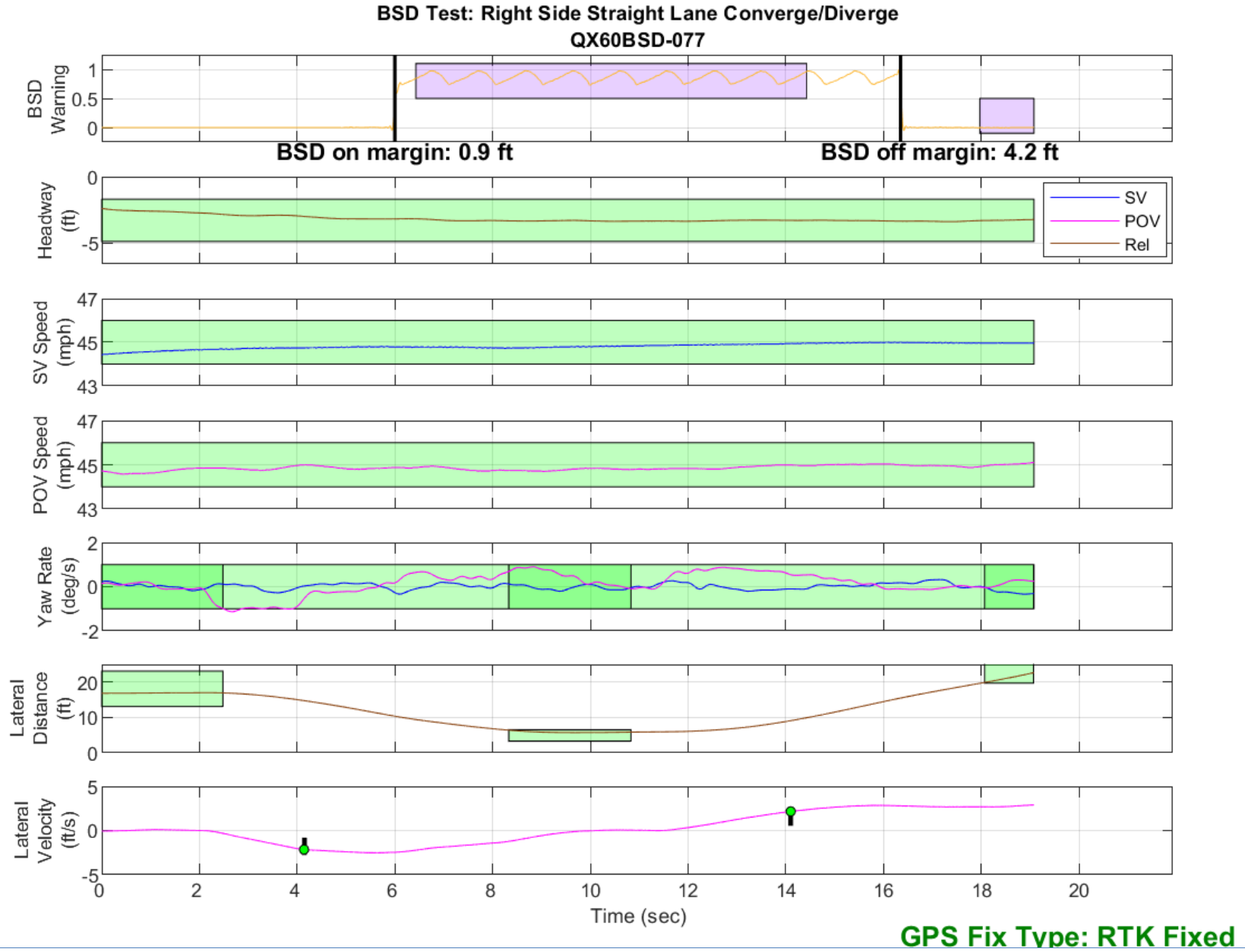


Figure D9. BSD Run 77, Straight Lane Converge/Diverge

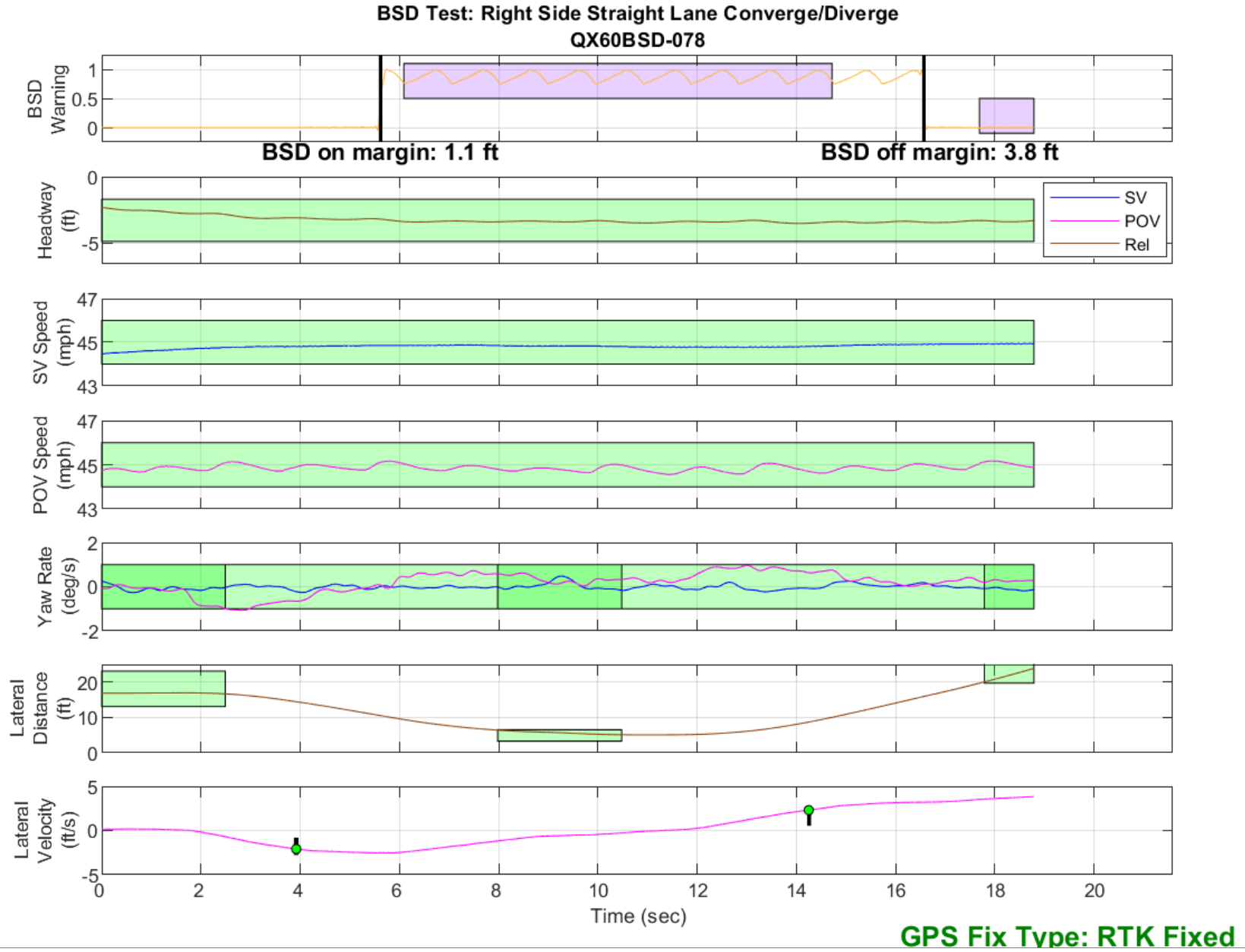


Figure D10. BSD Run 78, Straight Lane Converge/Diverge

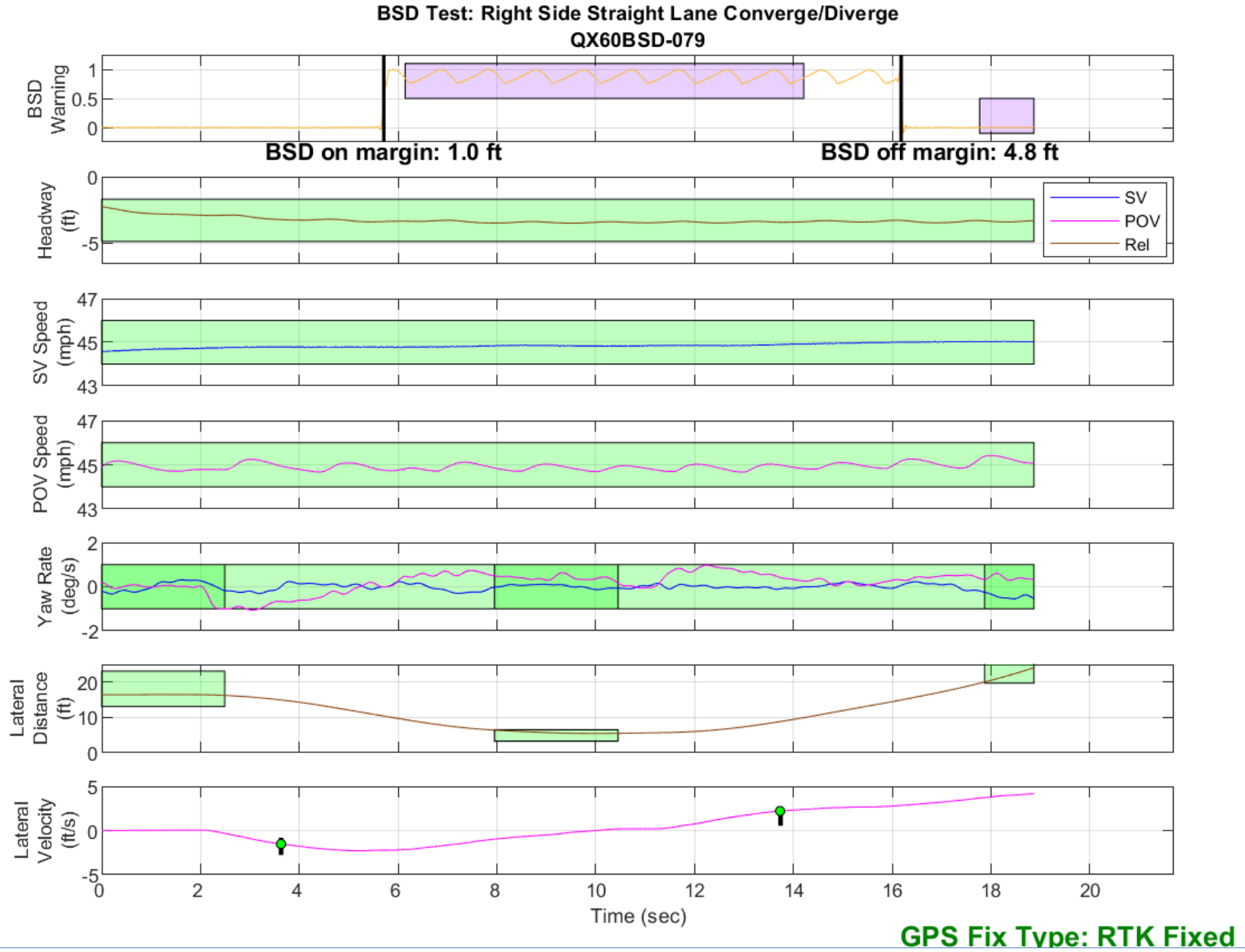


Figure D11. BSD Run 79, Straight Lane Converge/Diverge

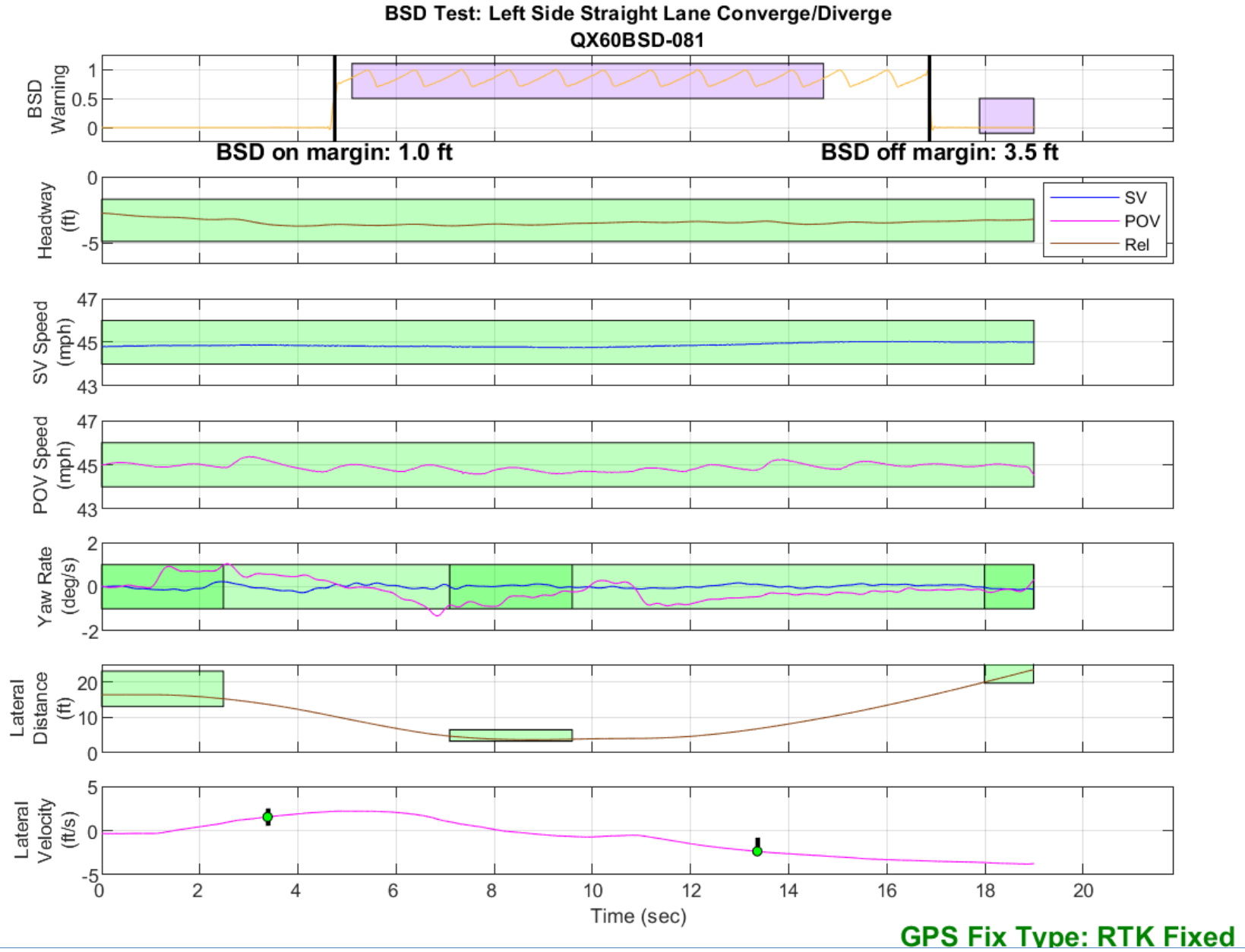


Figure D12. BSD Run 81, Straight Lane Converge/Diverge

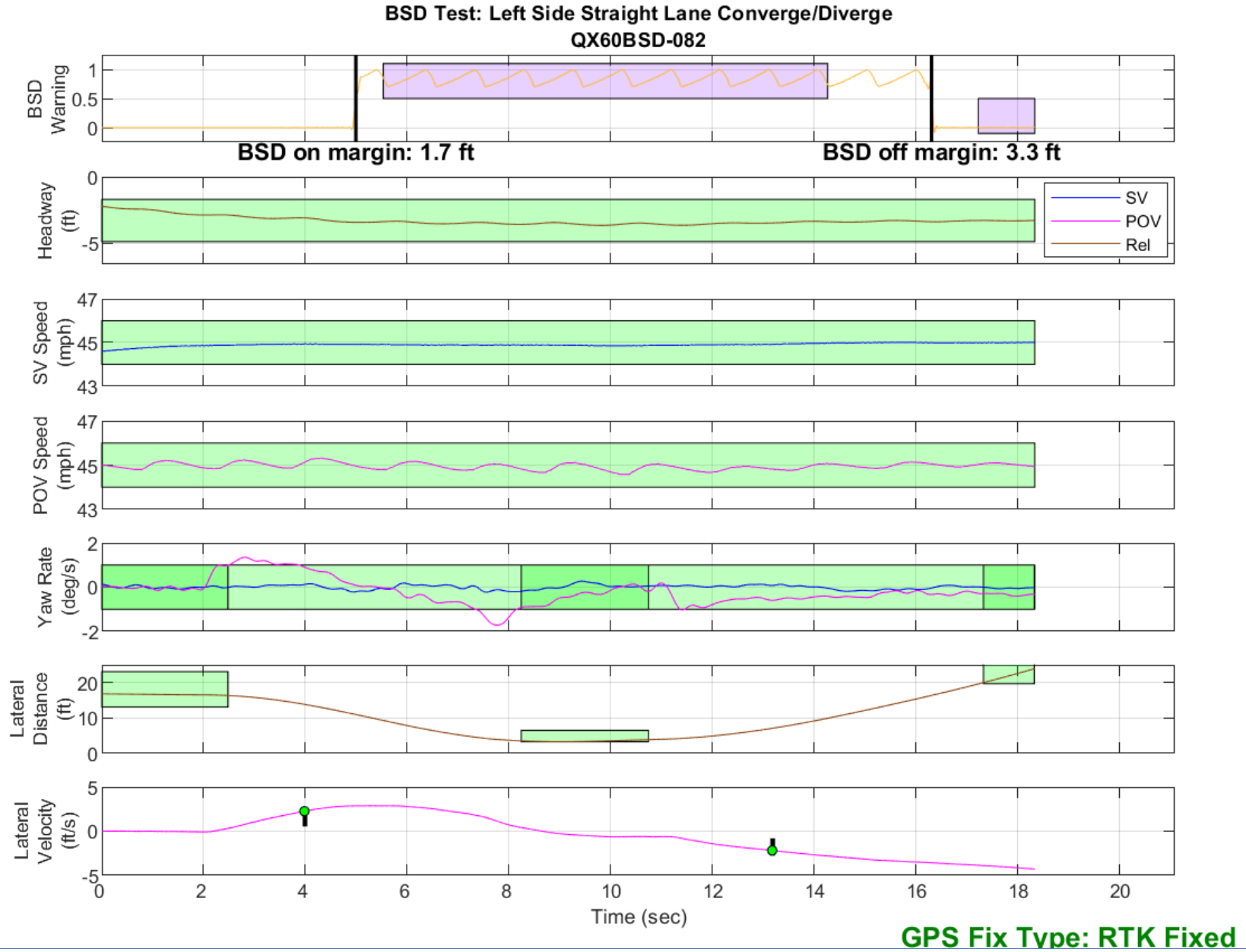


Figure D13. BSD Run 82, Straight Lane Converge/Diverge

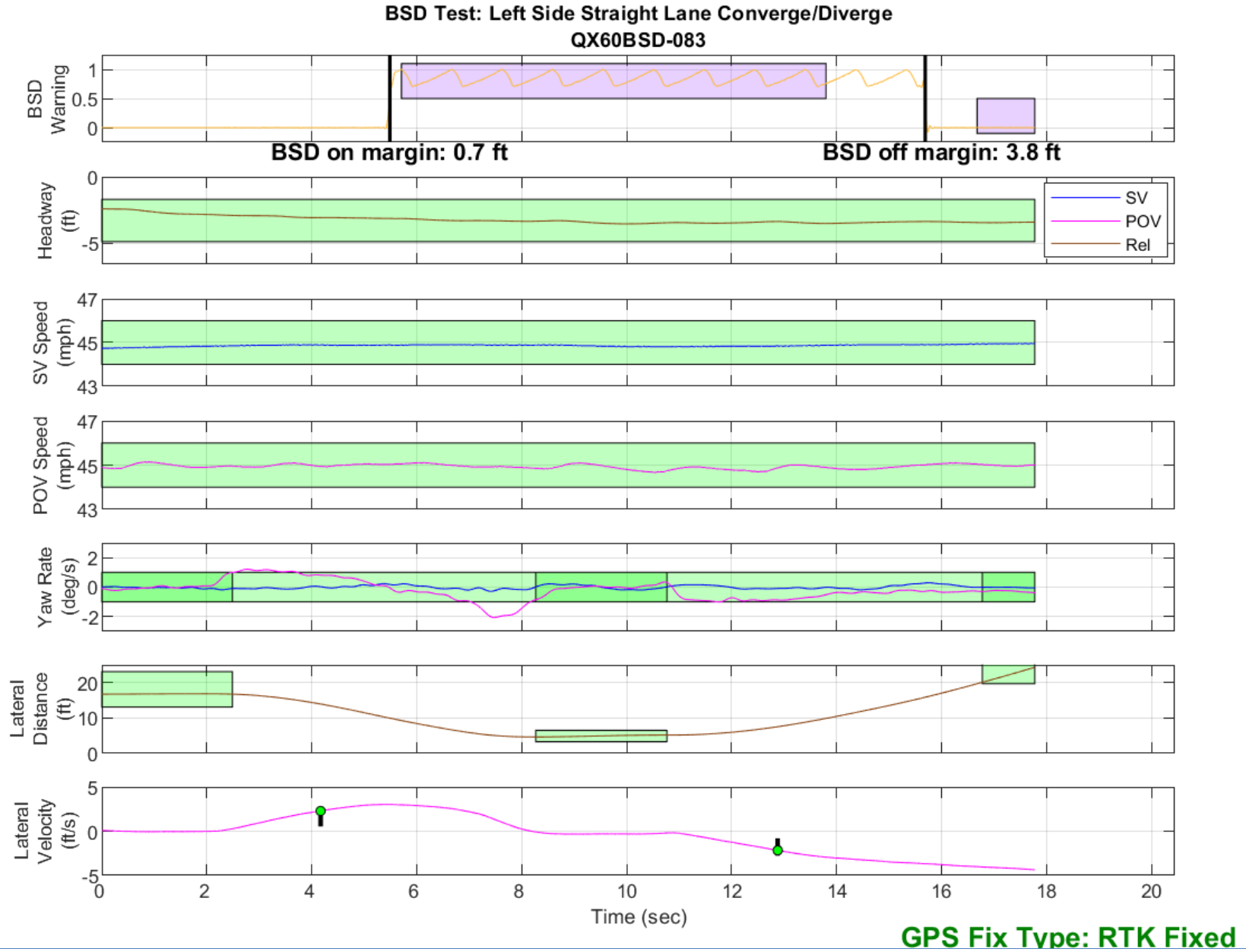


Figure D14. BSD Run 83, Straight Lane Converge/Diverge

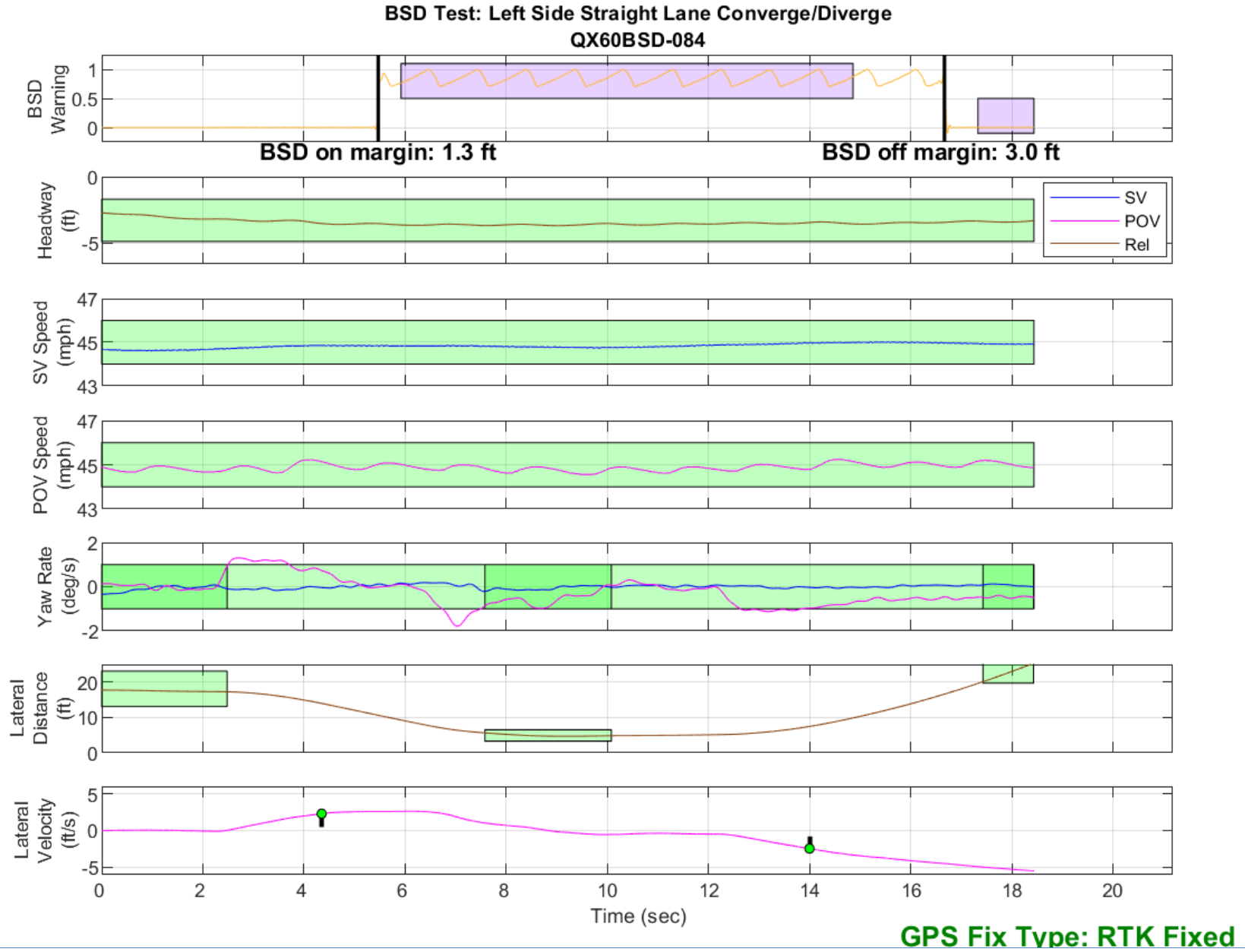


Figure D15. BSD Run 84, Straight Lane Converge/Diverge

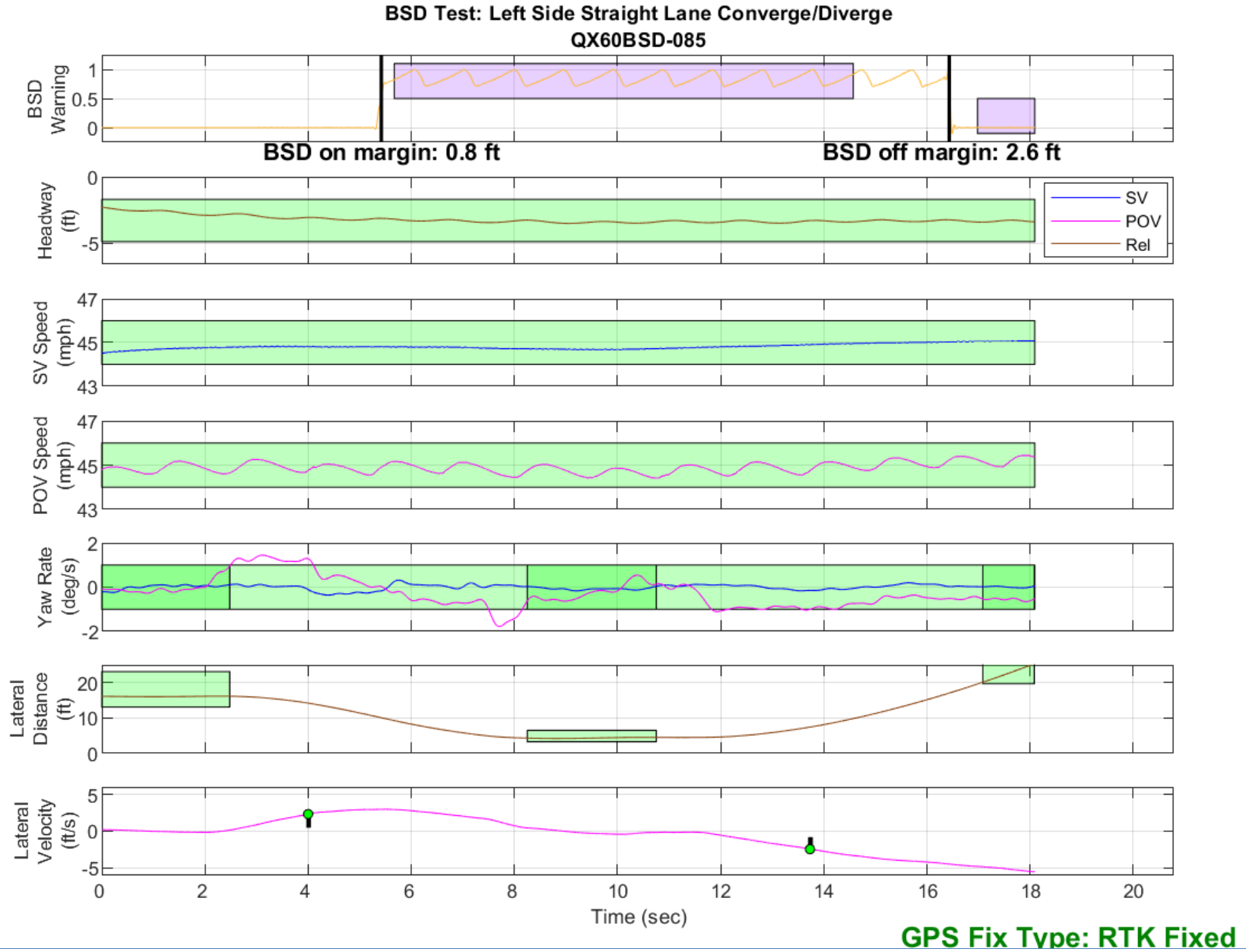


Figure D16. BSD Run 85, Straight Lane Converge/Diverge

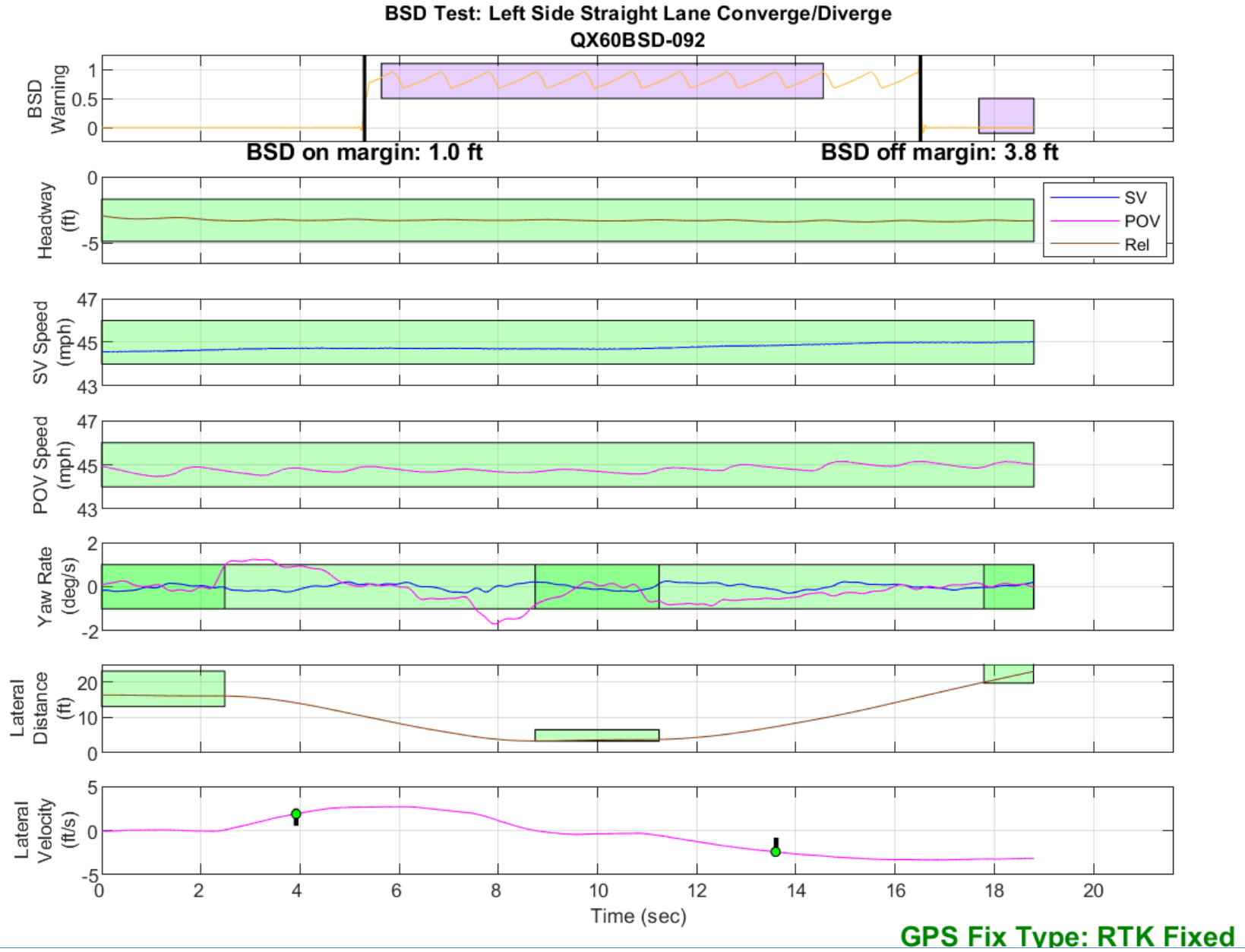


Figure D17. BSD Run 92, Straight Lane Converge/Diverge

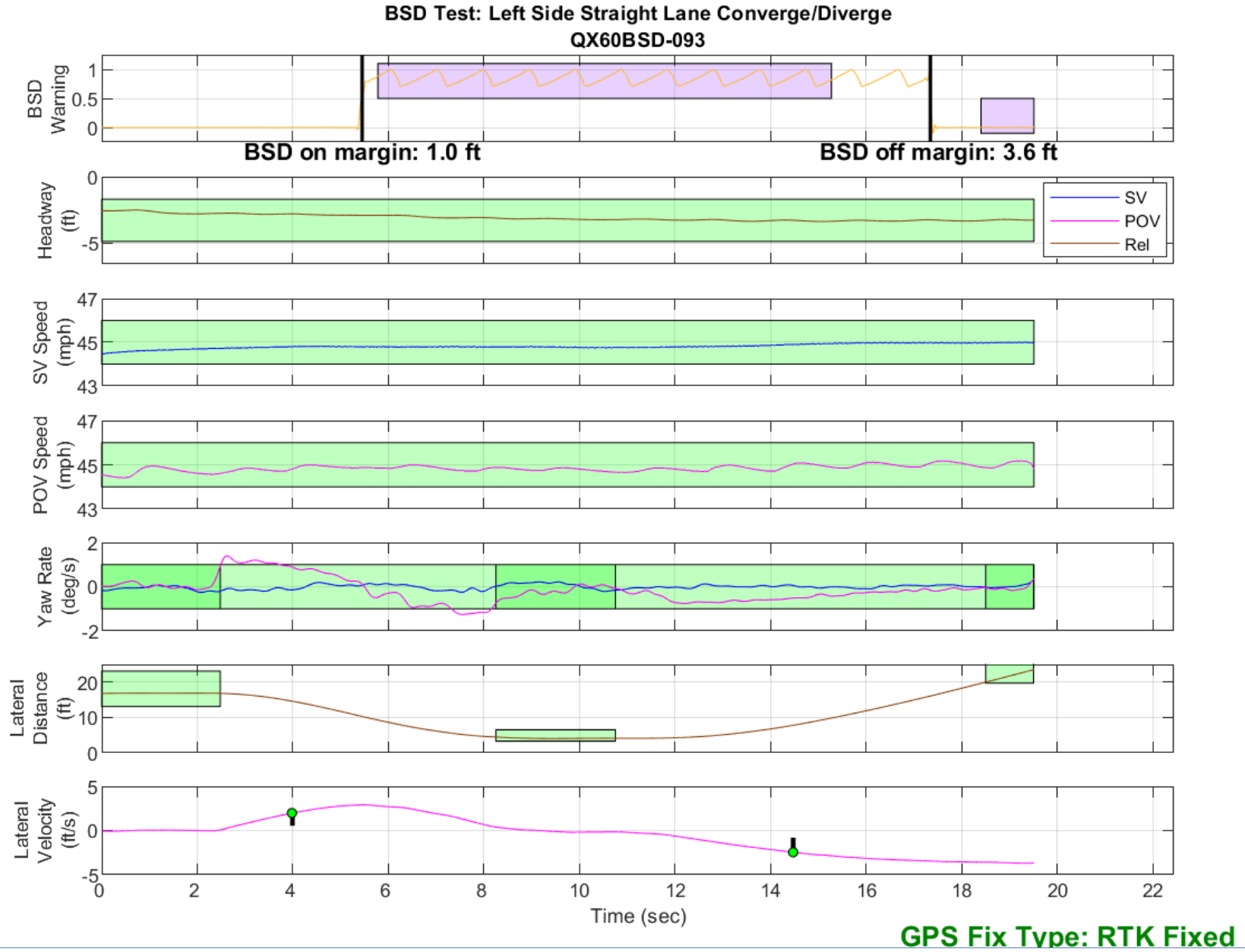


Figure D18. BSD Run 93, Straight Lane Converge/Diverge

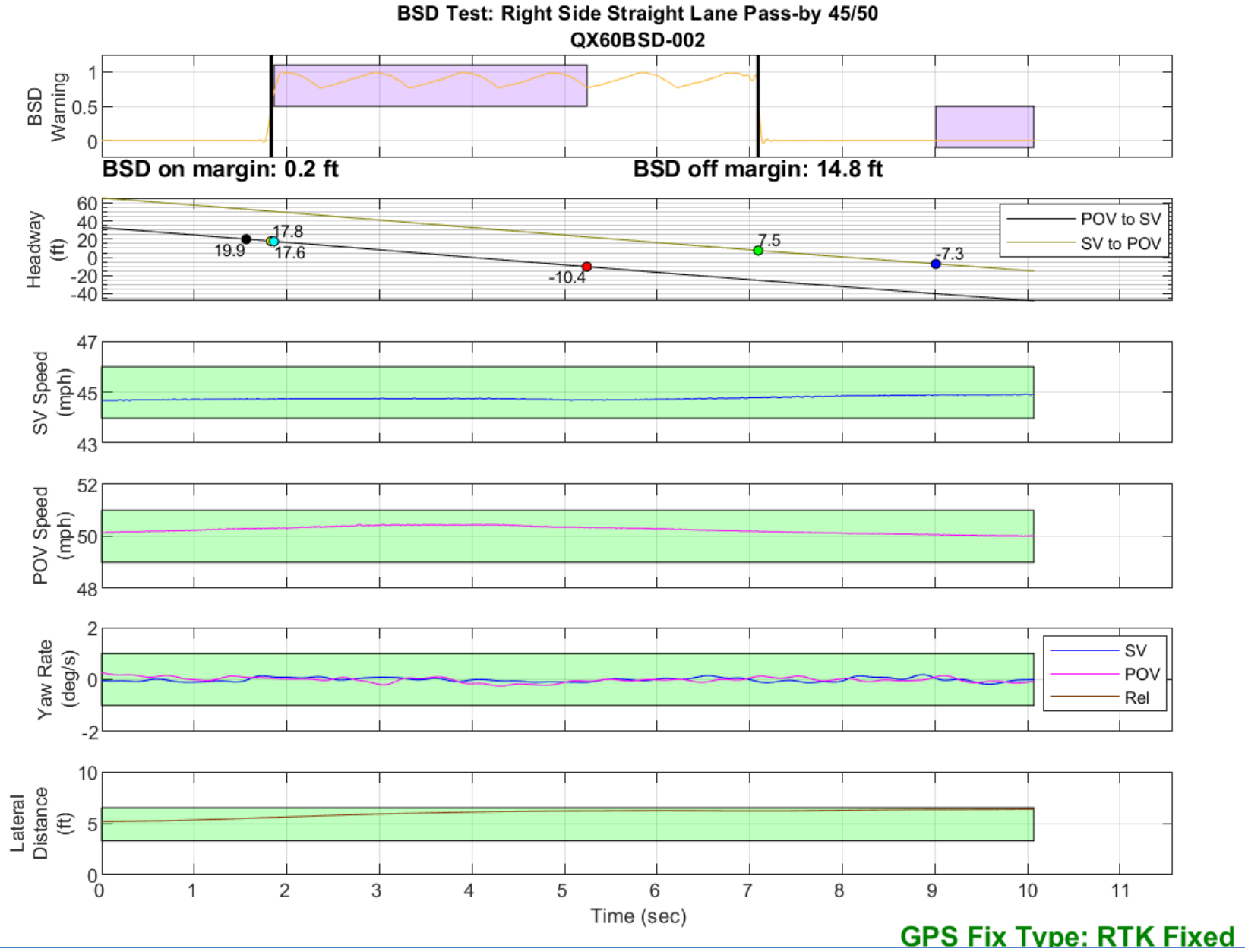


Figure D19. BSD Run 2, Straight Lane Pass-by, SV 45 mph, POV 50 mph

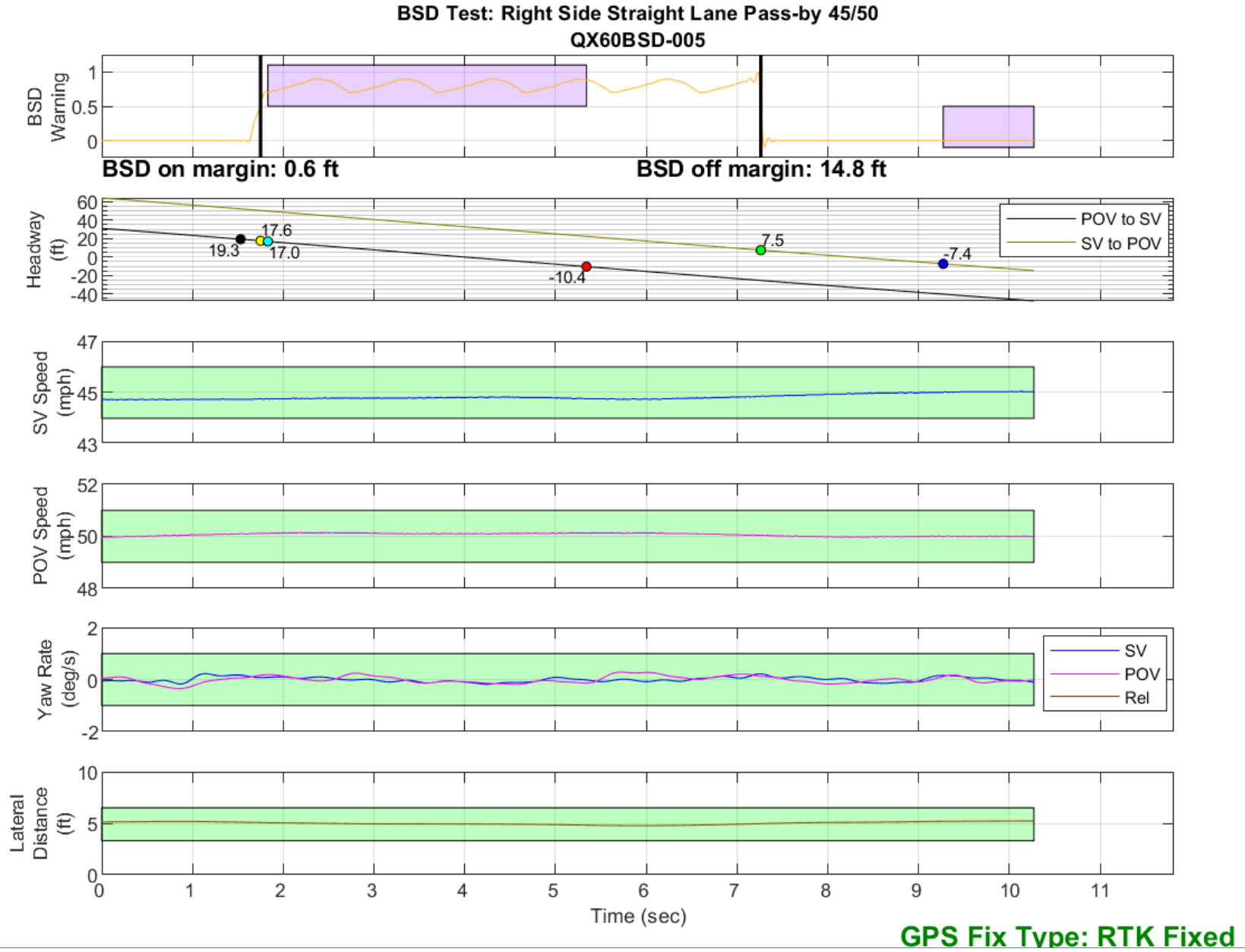


Figure D20. BSD Run 5, Straight Lane Pass-by, SV 45 mph, POV 50 mph

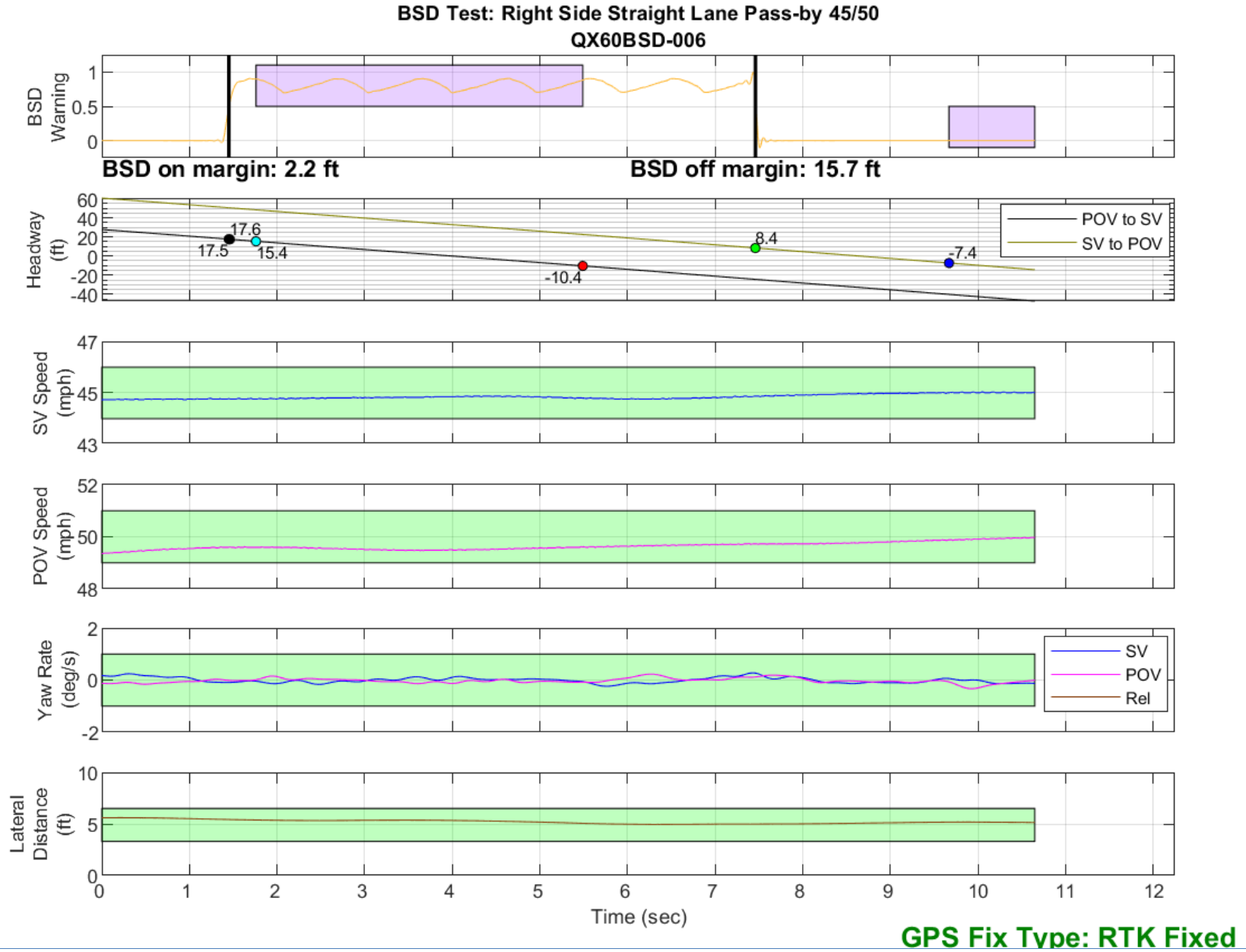


Figure D21. BSD Run 6, Straight Lane Pass-by, SV 45 mph, POV 50 mph

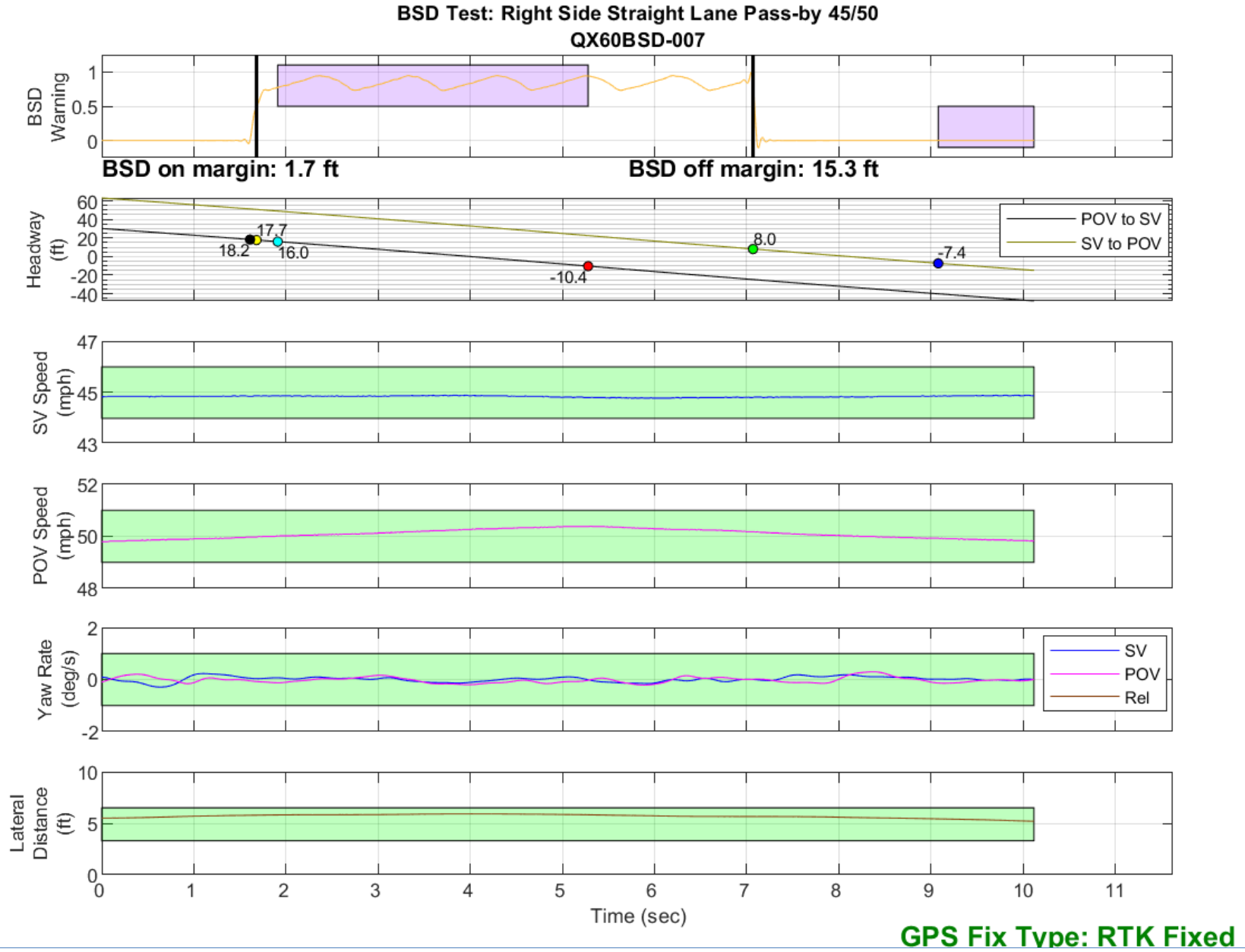


Figure D22. BSD Run 7, Straight Lane Pass-by, SV 45 mph, POV 50 mph

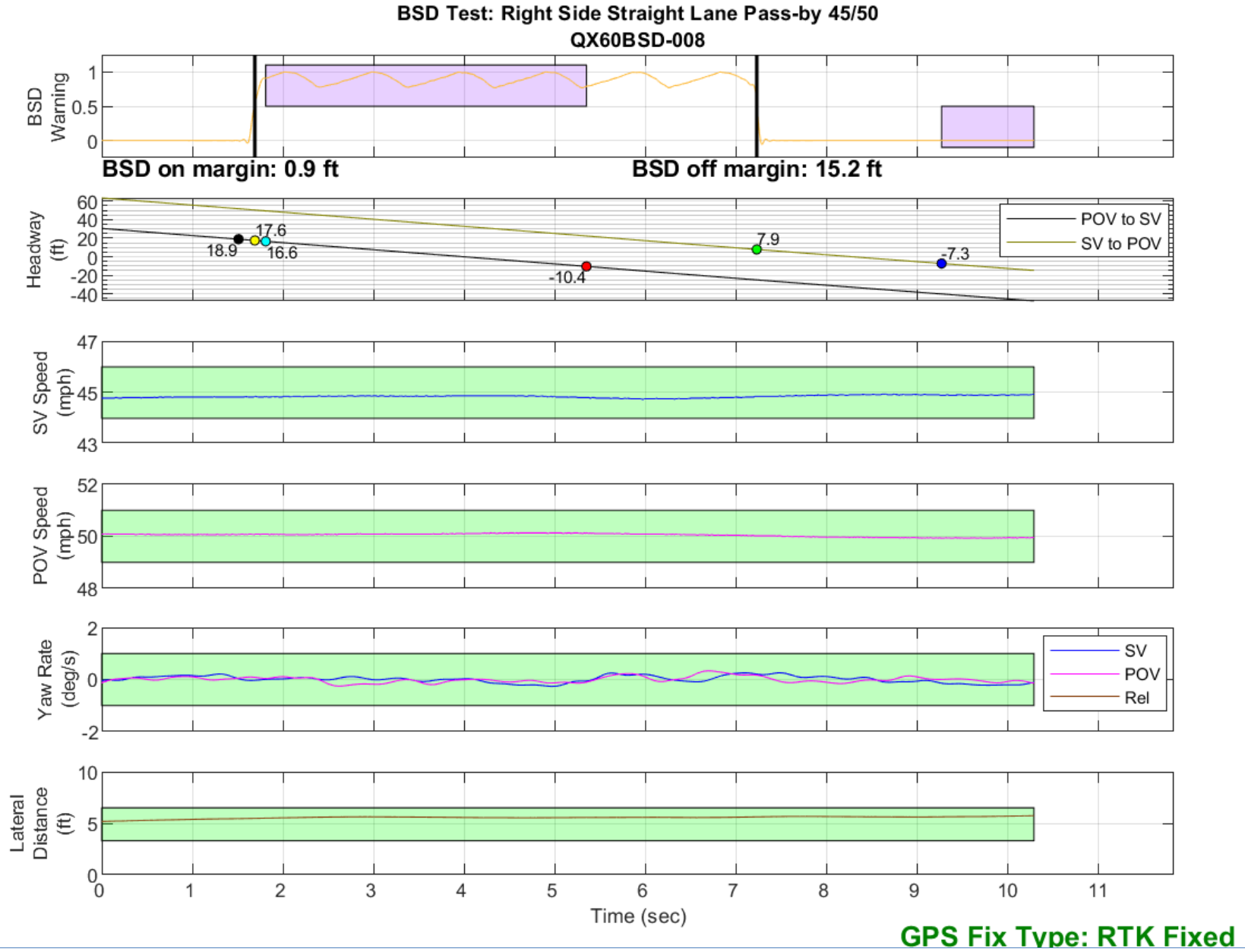


Figure D23. BSD Run 8, Straight Lane Pass-by, SV 45 mph, POV 50 mph

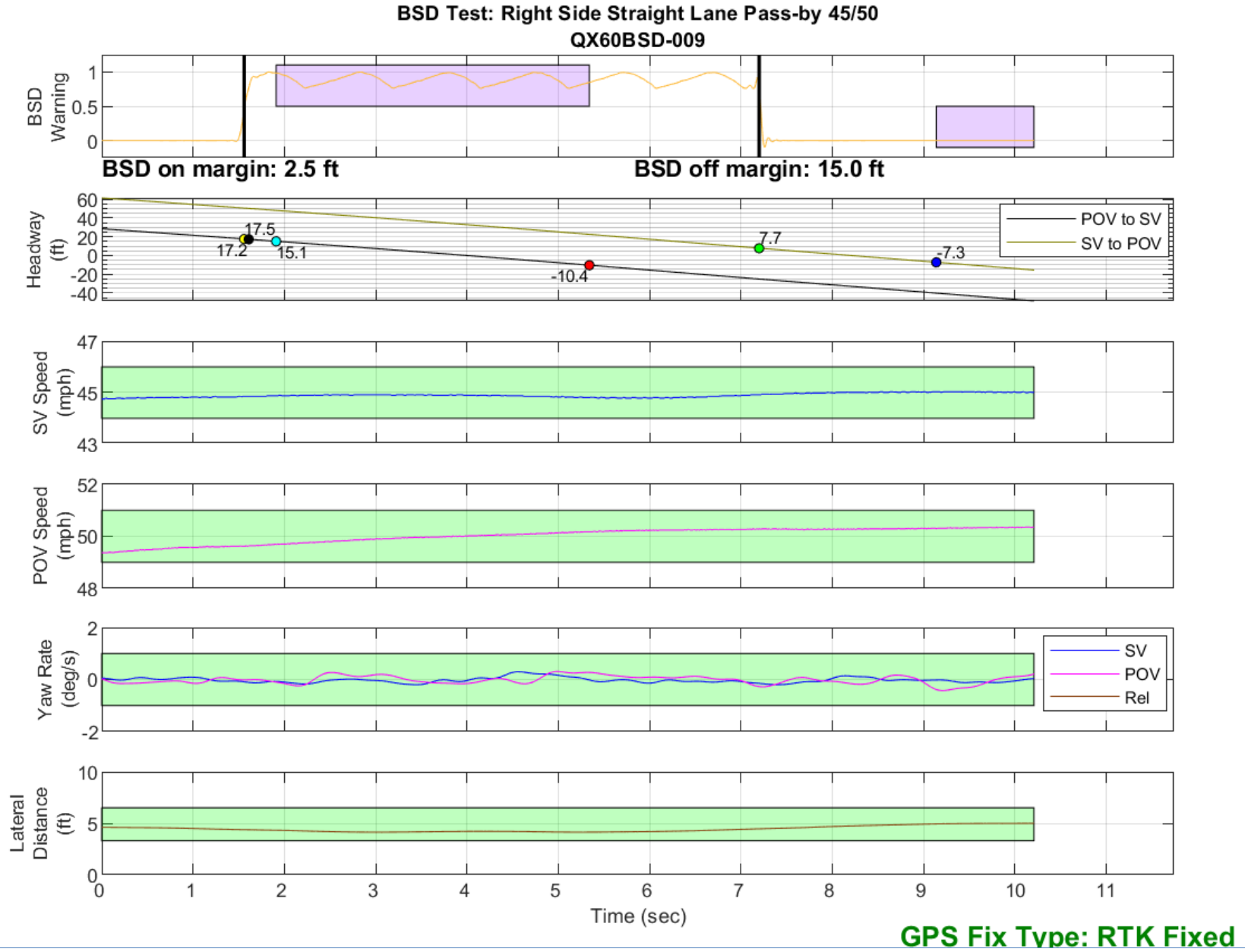


Figure D24. BSD Run 9, Straight Lane Pass-by, SV 45 mph, POV 50 mph

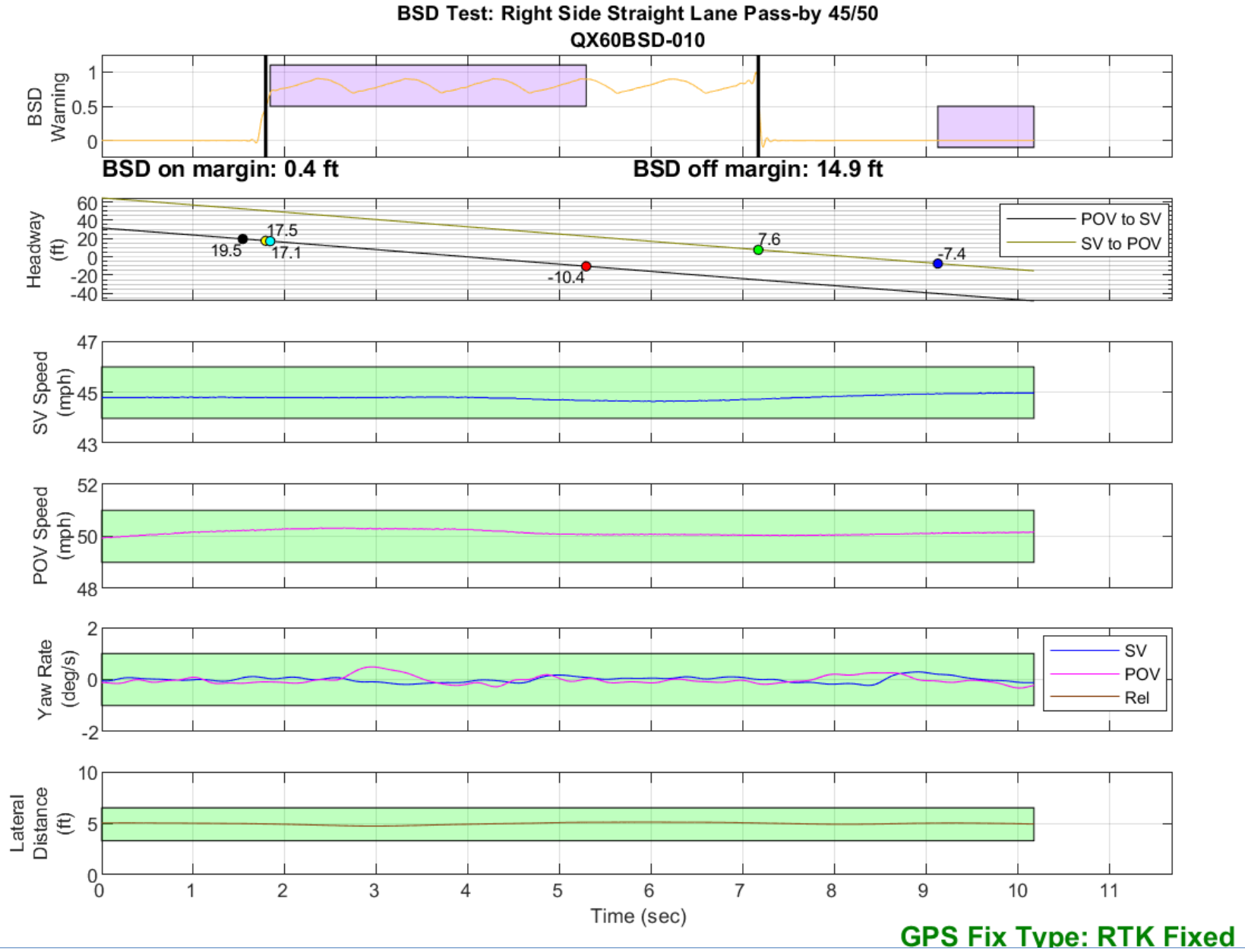


Figure D25. BSD Run 10, Straight Lane Pass-by, SV 45 mph, POV 50 mph

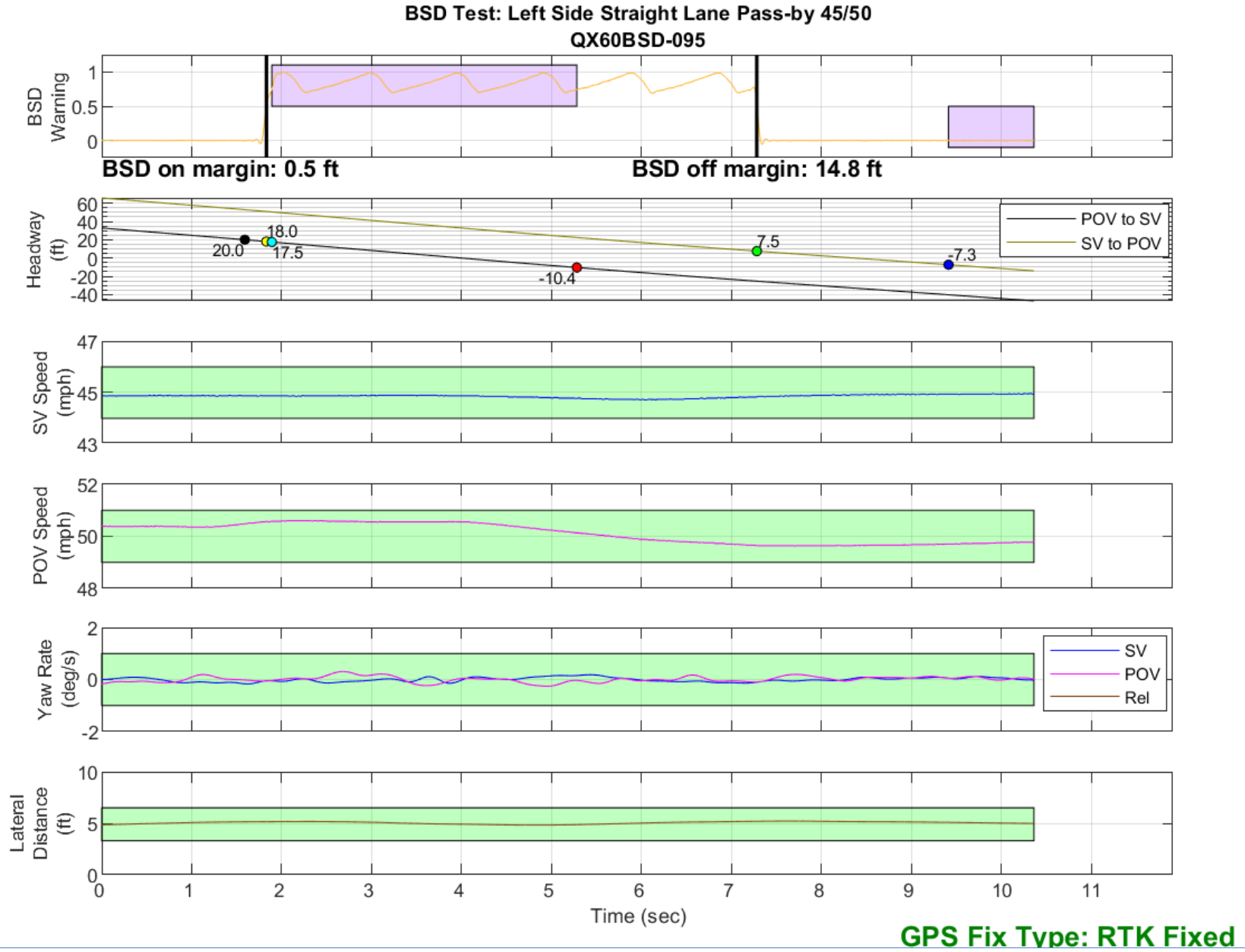


Figure D26. BSD Run 95, Straight Lane Pass-by, SV 45 mph, POV 50 mph

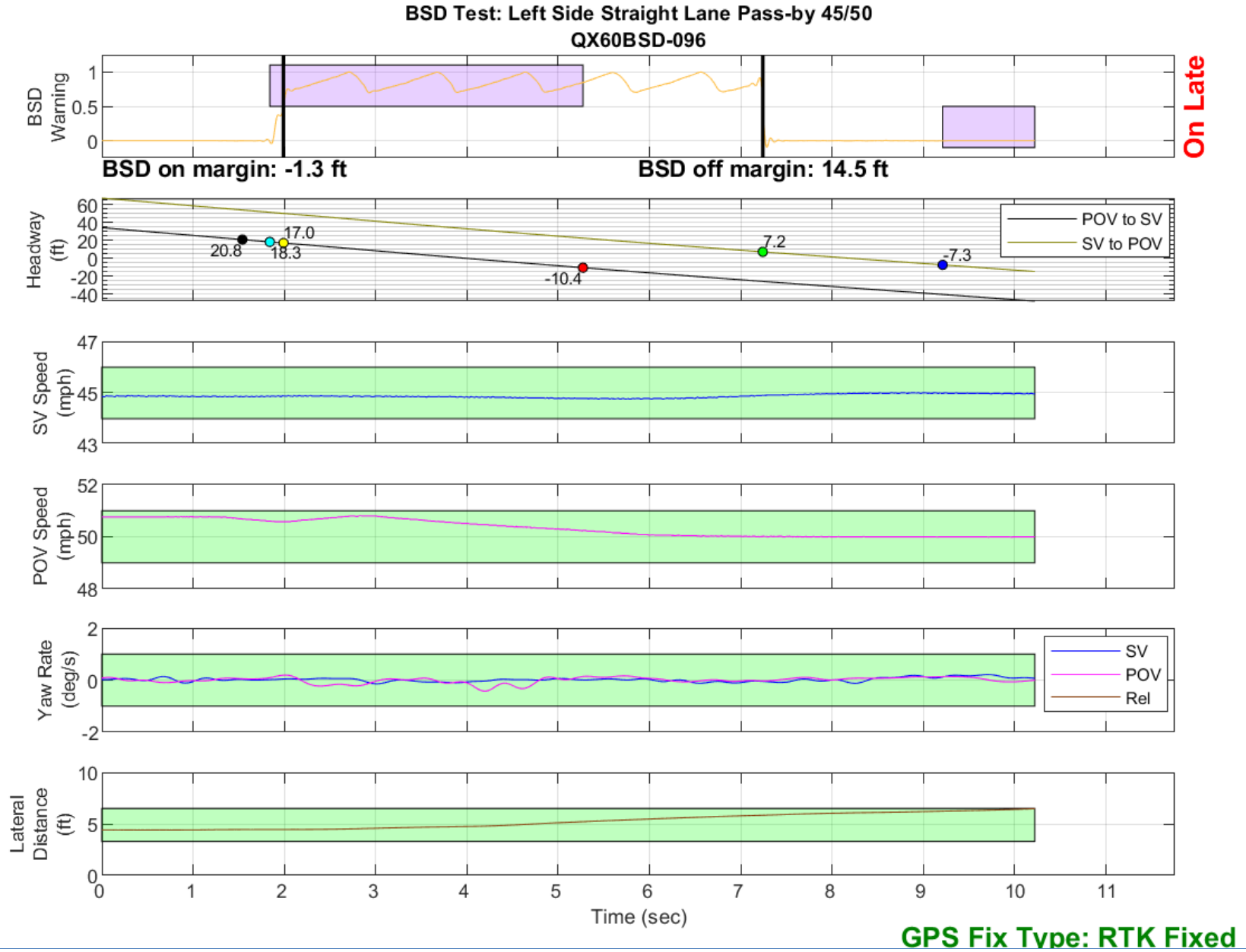


Figure D27. BSD Run 96, Straight Lane Pass-by, SV 45 mph, POV 50 mph

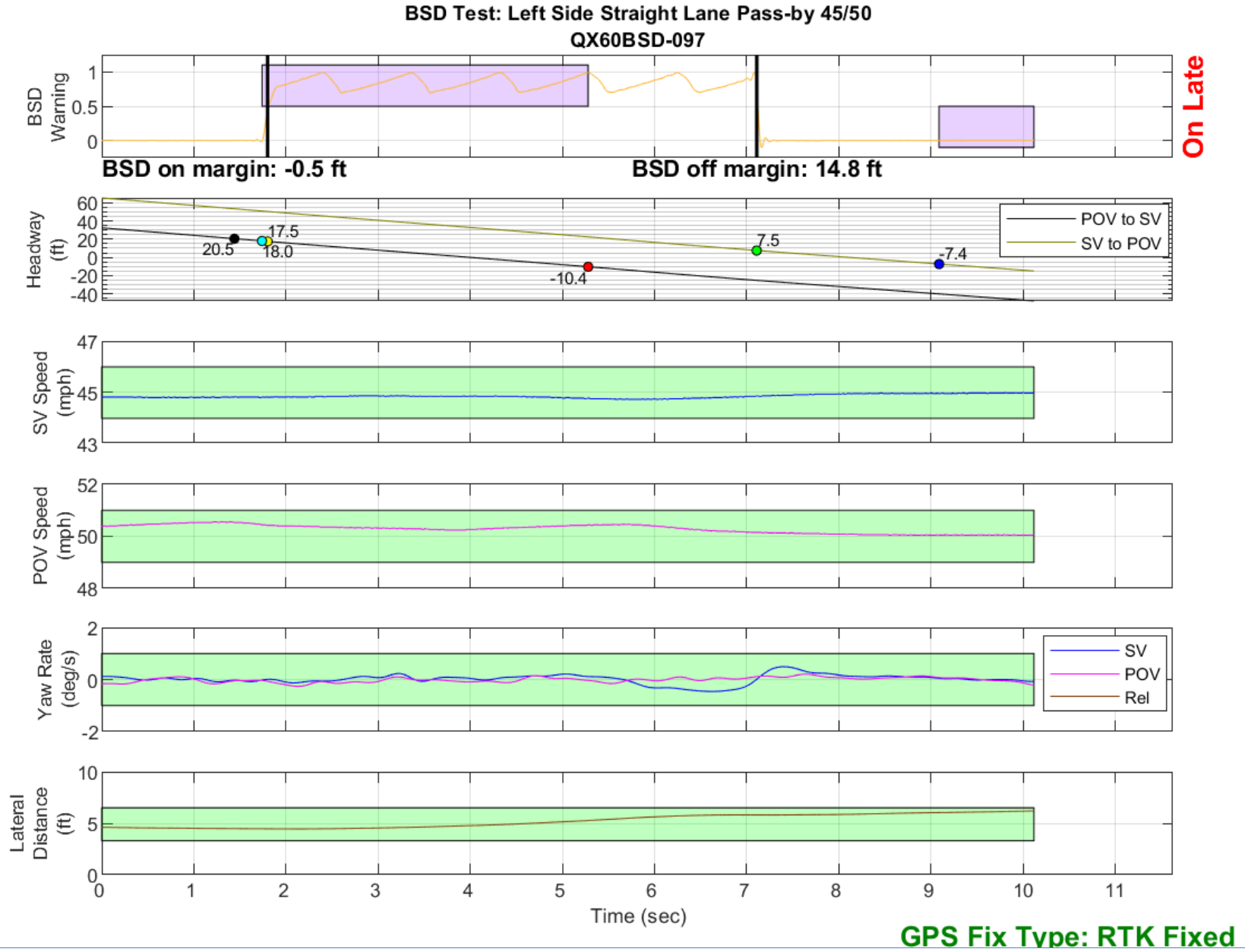


Figure D28. BSD Run 97, Straight Lane Pass-by, SV 45 mph, POV 50 mph

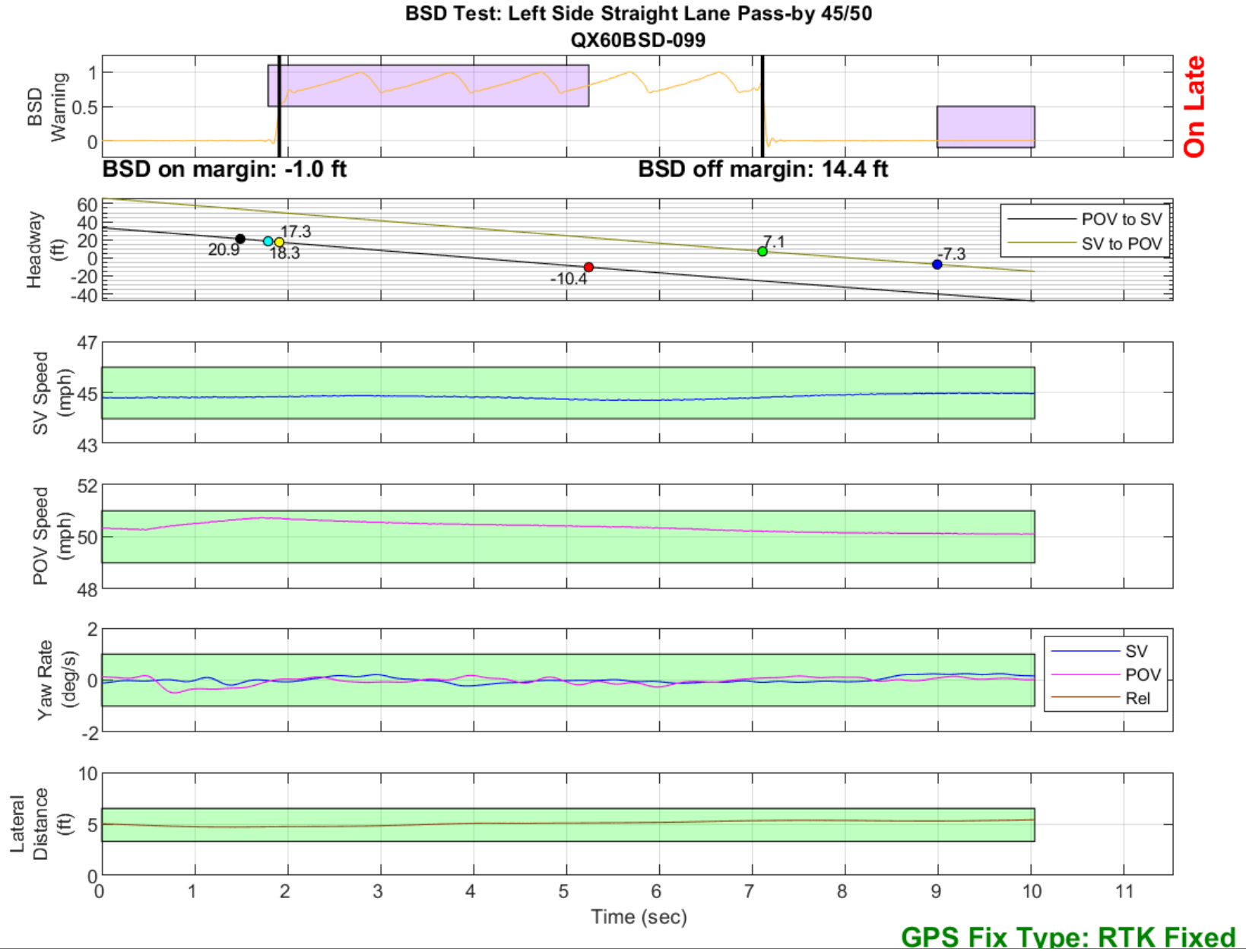


Figure D29. BSD Run 99, Straight Lane Pass-by, SV 45 mph, POV 50 mph

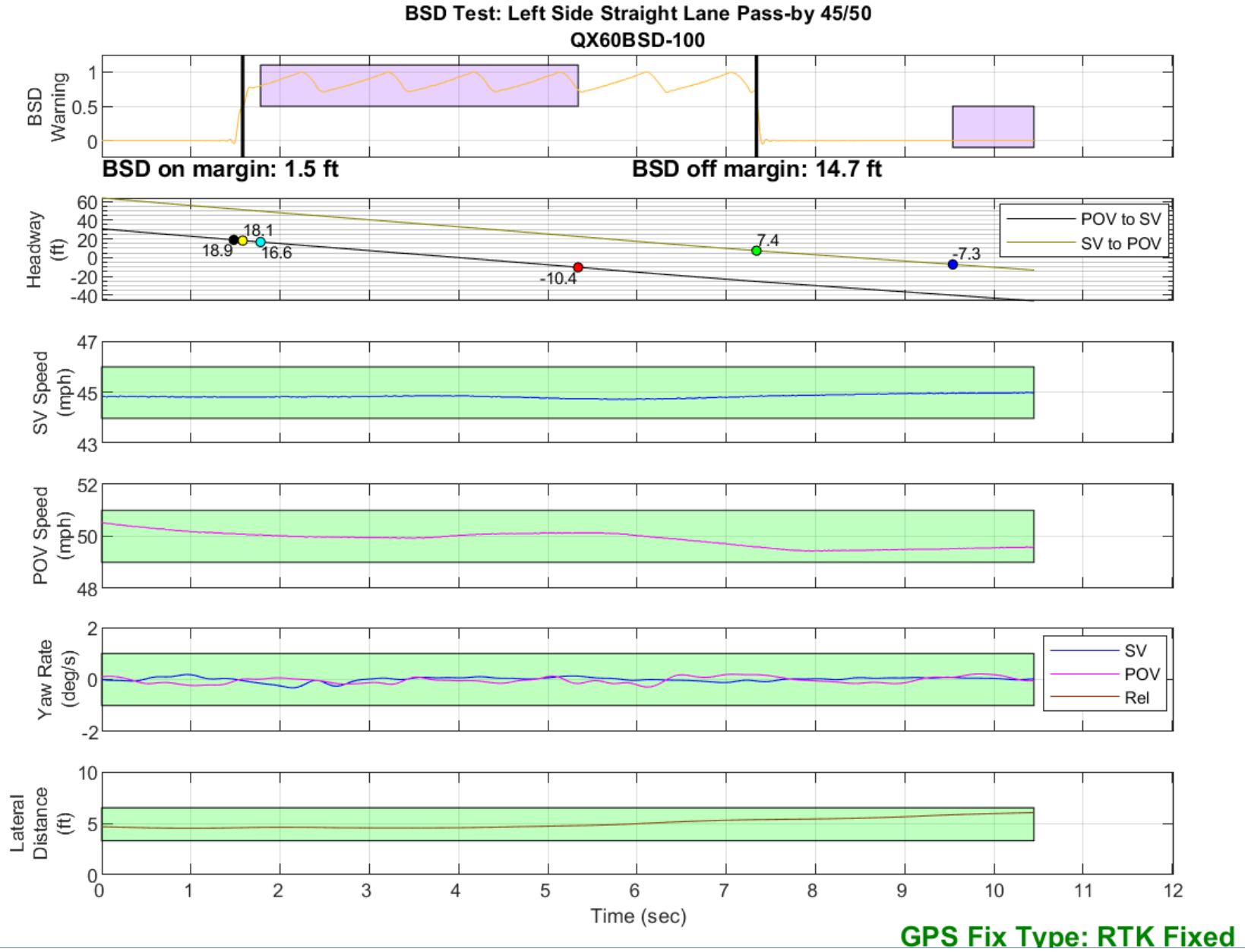


Figure D30. BSD Run 100, Straight Lane Pass-by, SV 45 mph, POV 50 mph

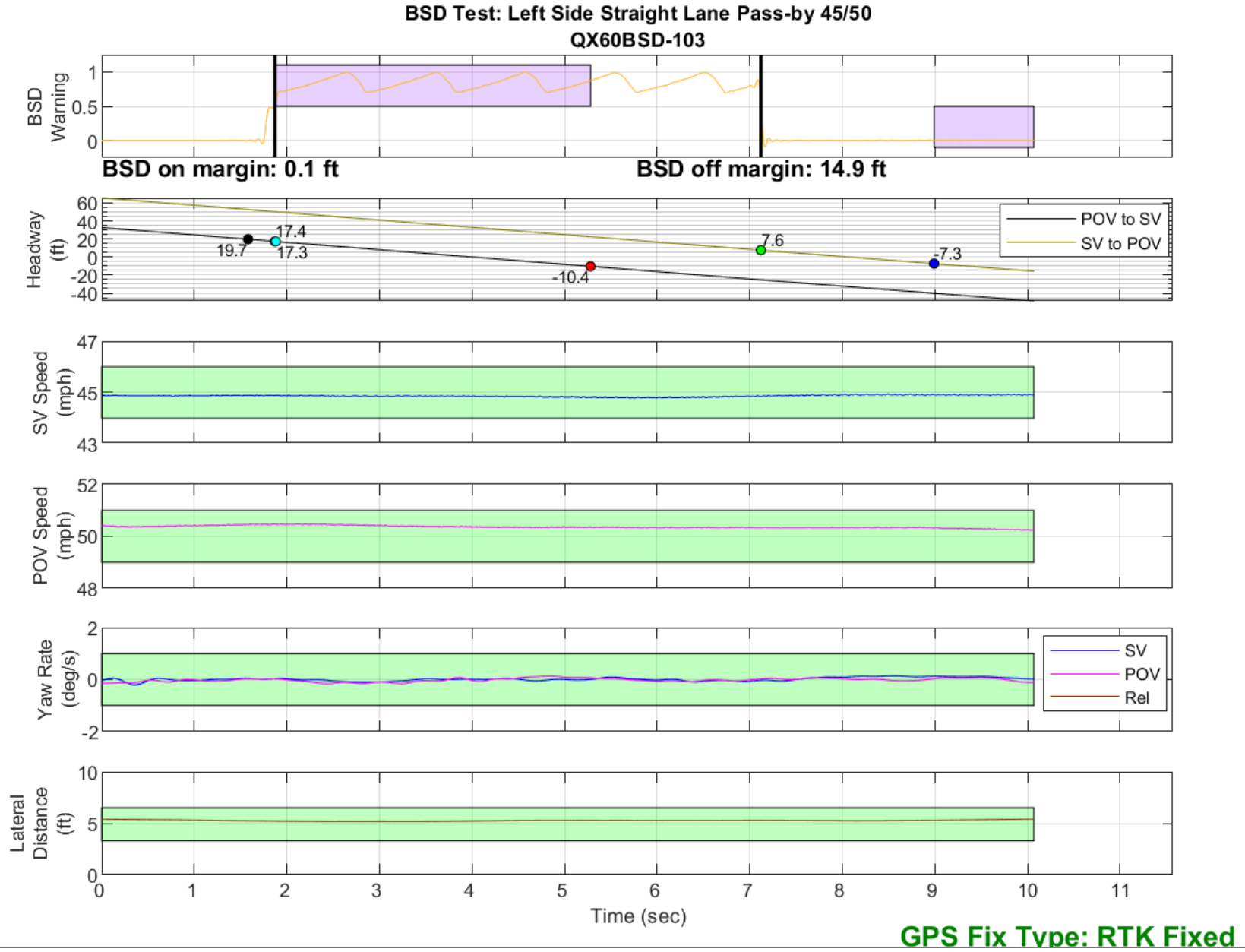


Figure D31. BSD Run 103, Straight Lane Pass-by, SV 45 mph, POV 50 mph

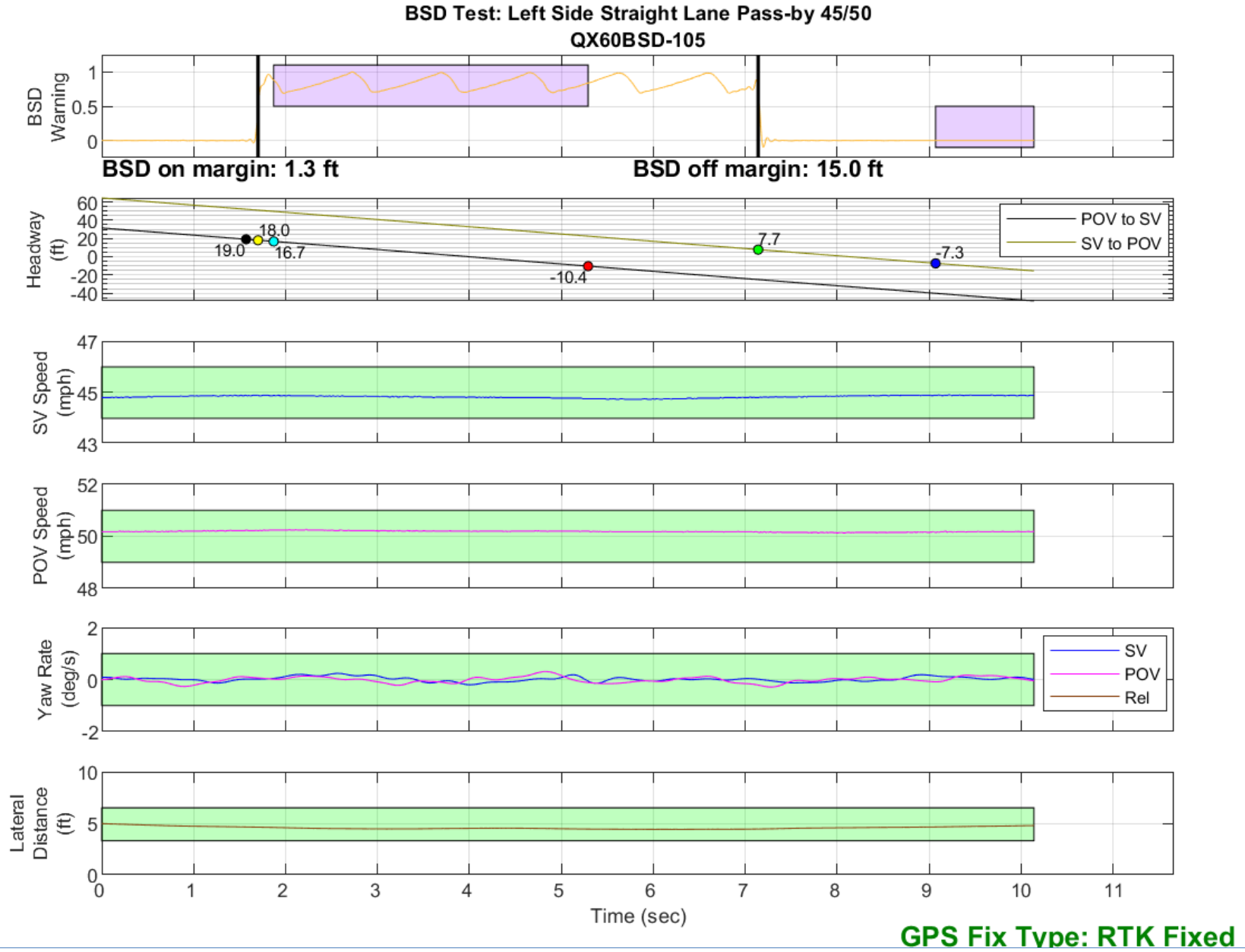


Figure D32. BSD Run 105, Straight Lane Pass-by, SV 45 mph, POV 50 mph

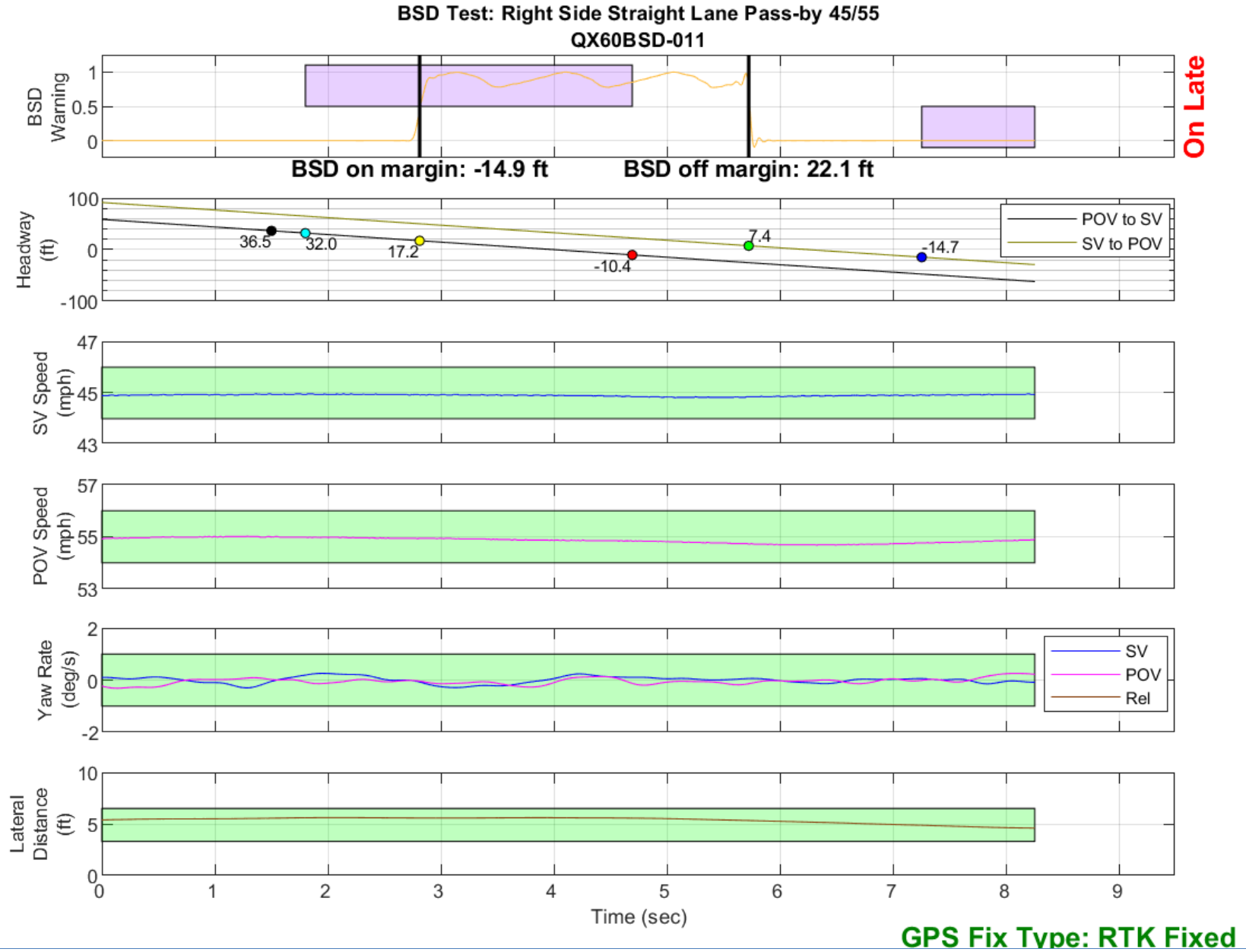


Figure D33. BSD Run 11, Straight Lane Pass-by, SV 45 mph, POV 55 mph

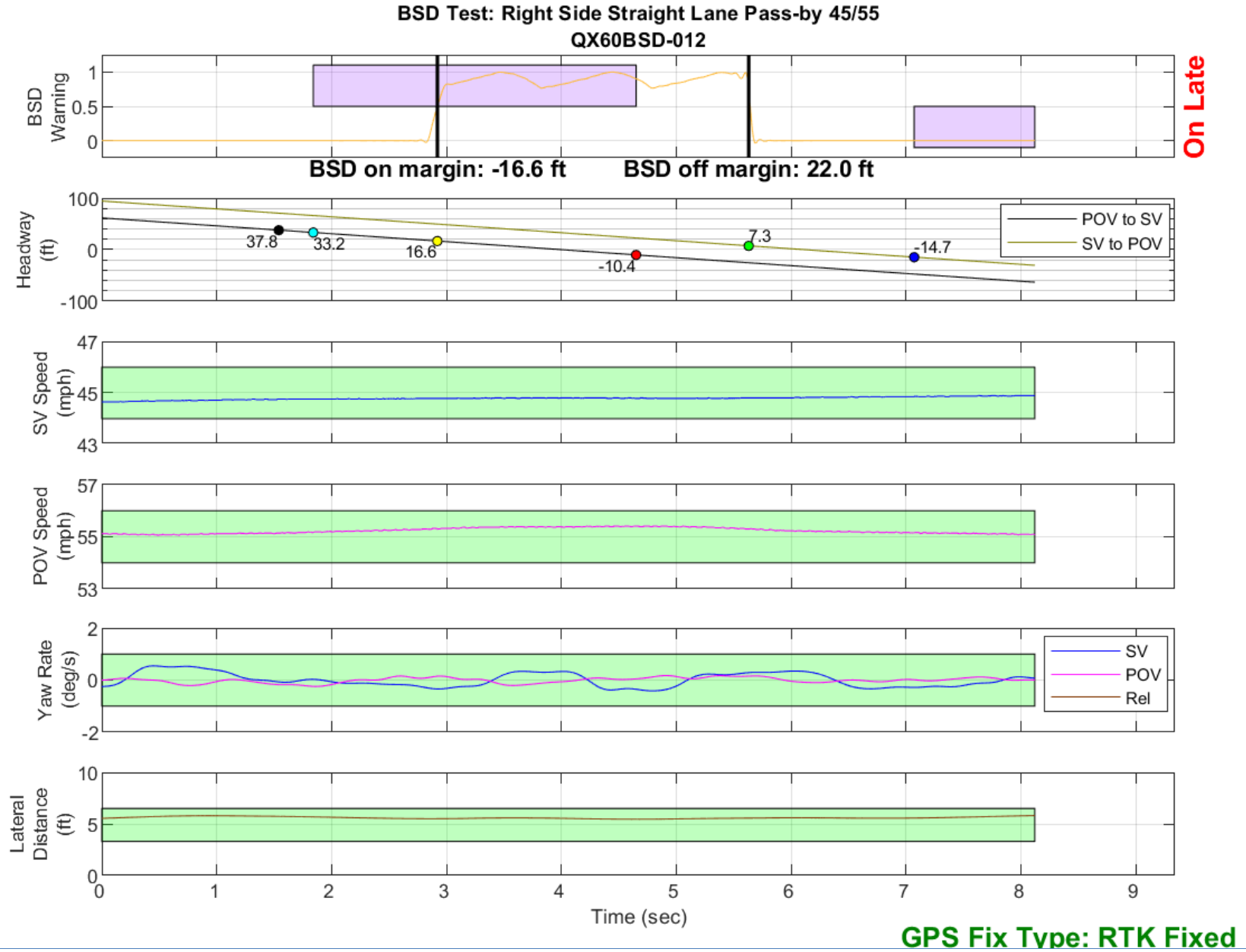


Figure D34. BSD Run 12, Straight Lane Pass-by, SV 45 mph, POV 55 mph

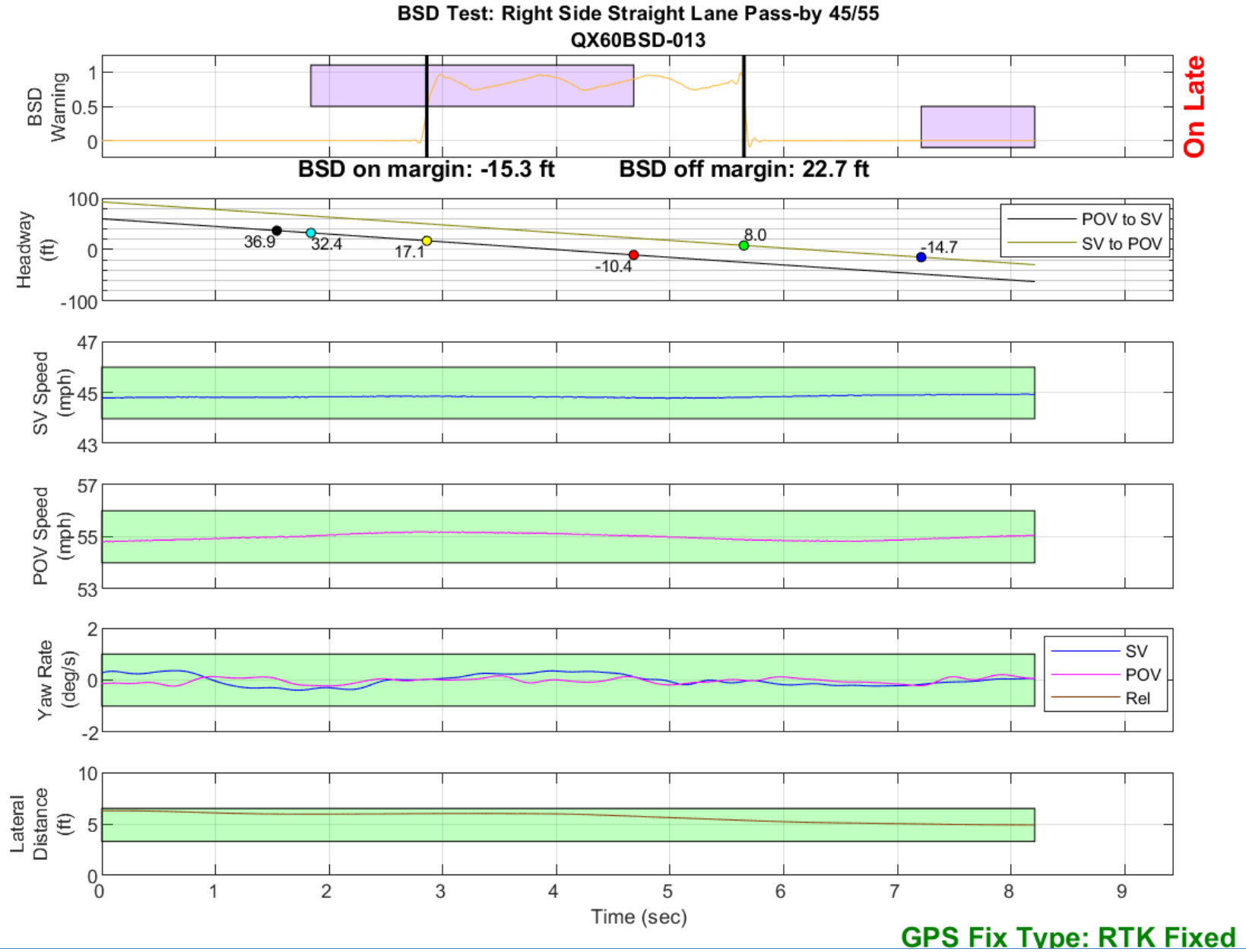


Figure D35. BSD Run 13, Straight Lane Pass-by, SV 45 mph, POV 55 mph

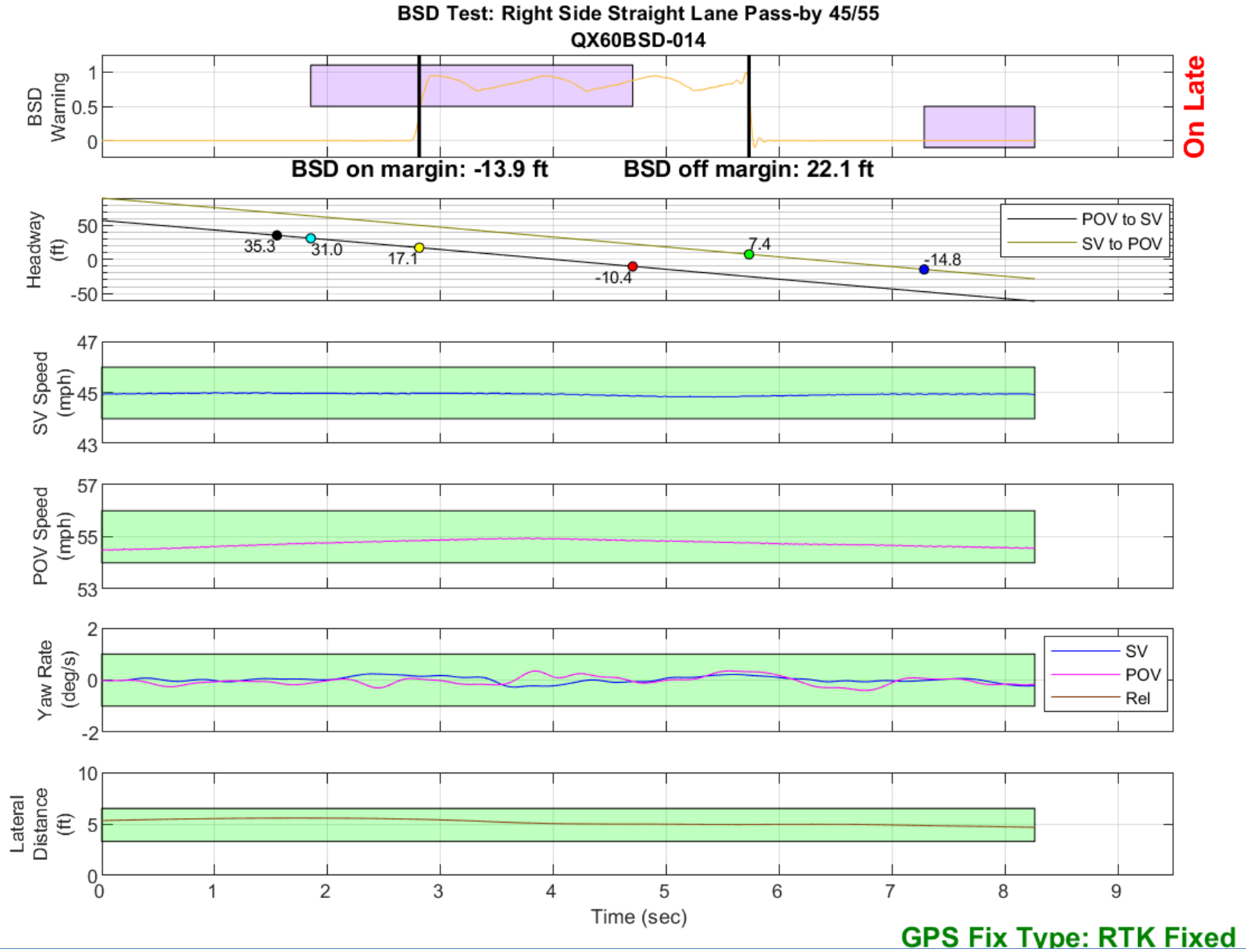


Figure D36. BSD Run 14, Straight Lane Pass-by, SV 45 mph, POV 55 mph

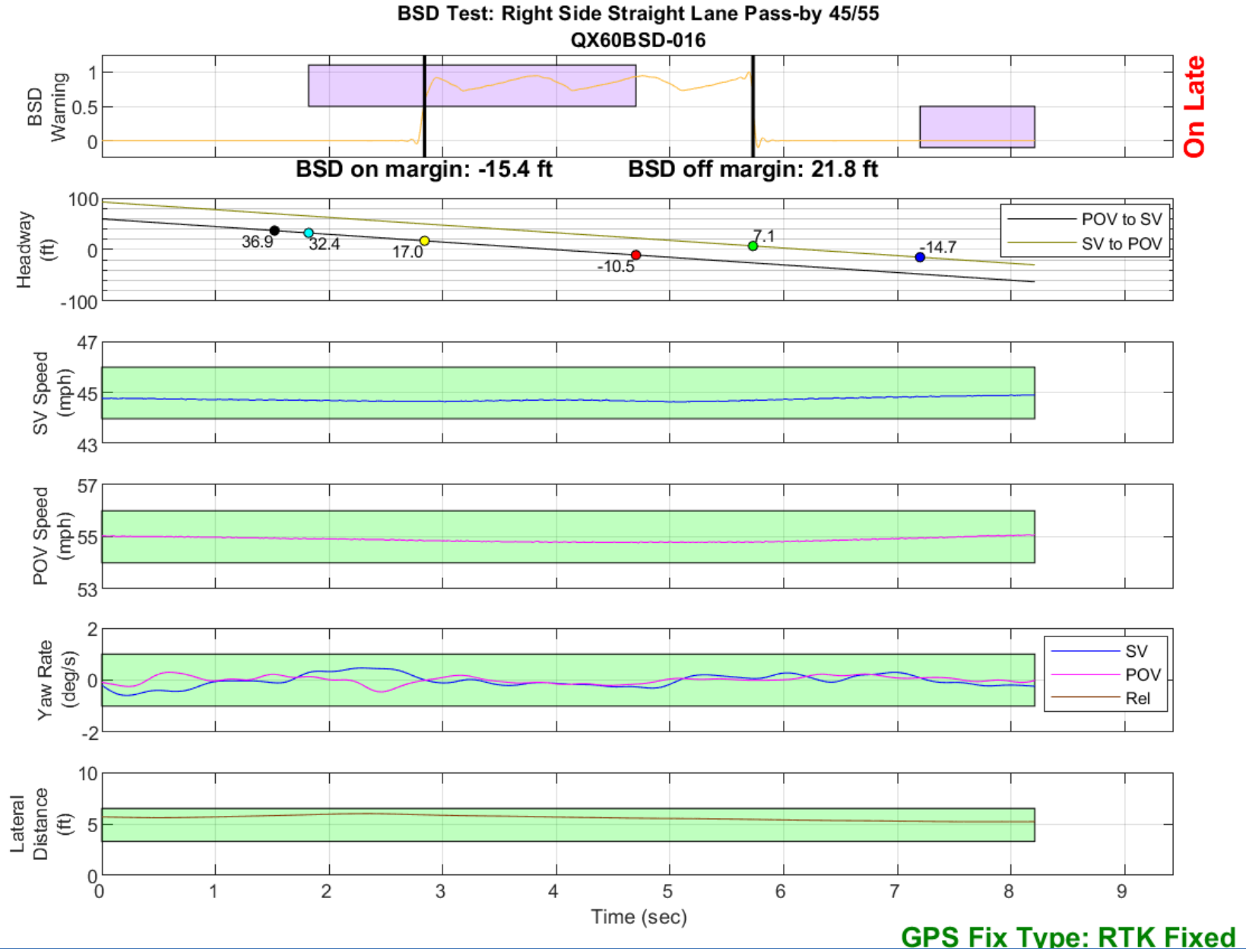


Figure D37. BSD Run 16, Straight Lane Pass-by, SV 45 mph, POV 55 mph

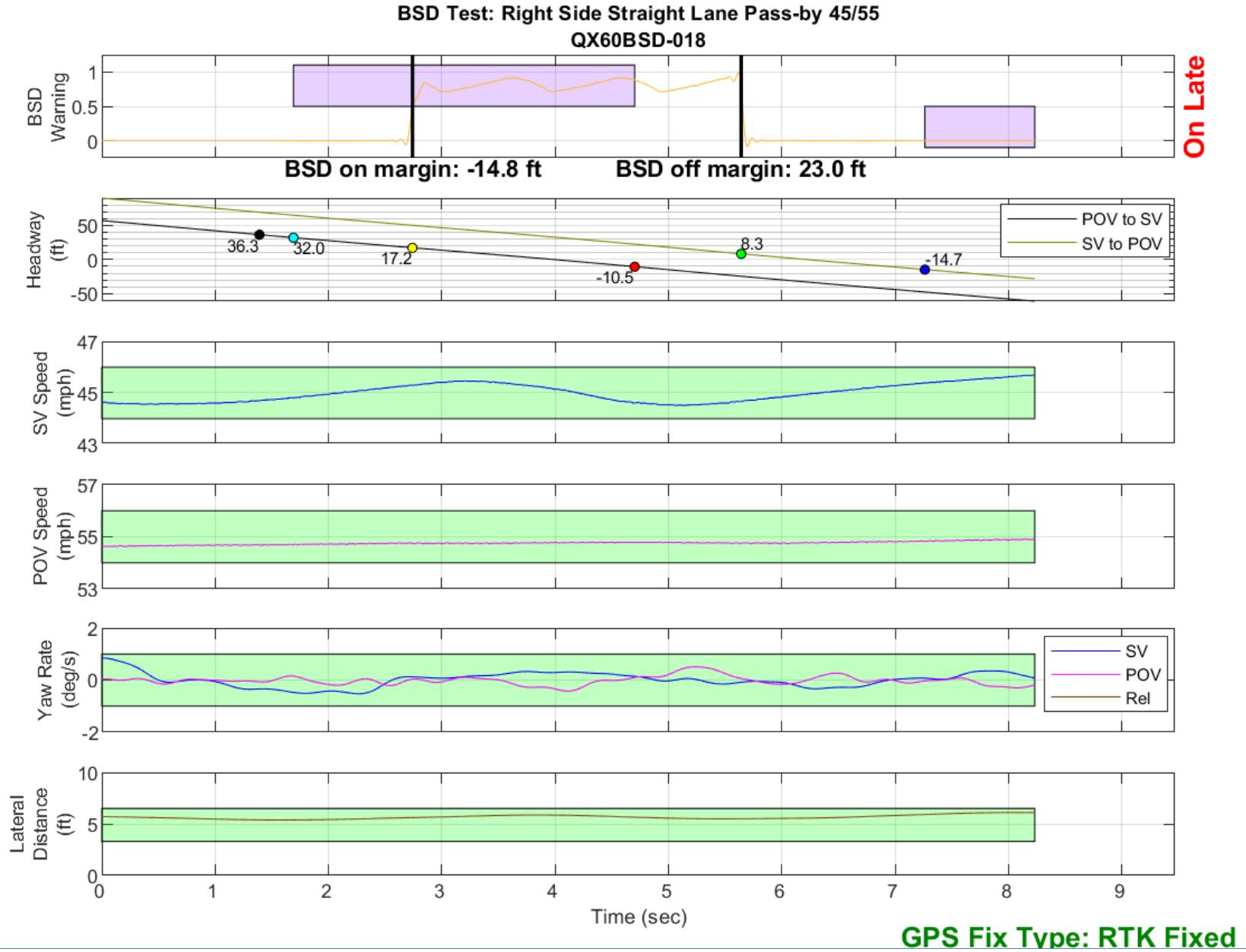


Figure D38. BSD Run 18, Straight Lane Pass-by, SV 45 mph, POV 55 mph

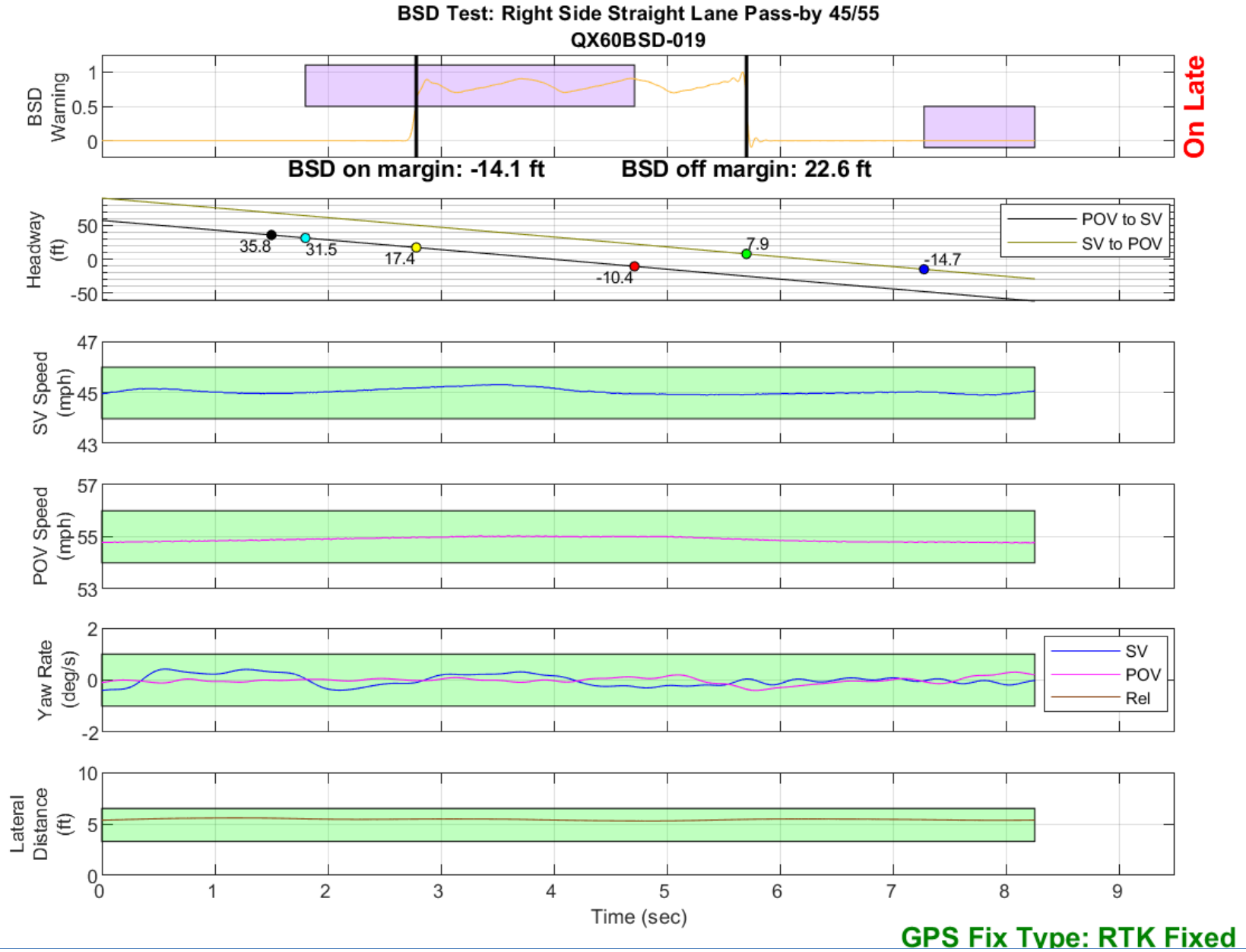


Figure D39. BSD Run 19, Straight Lane Pass-by, SV 45 mph, POV 55 mph

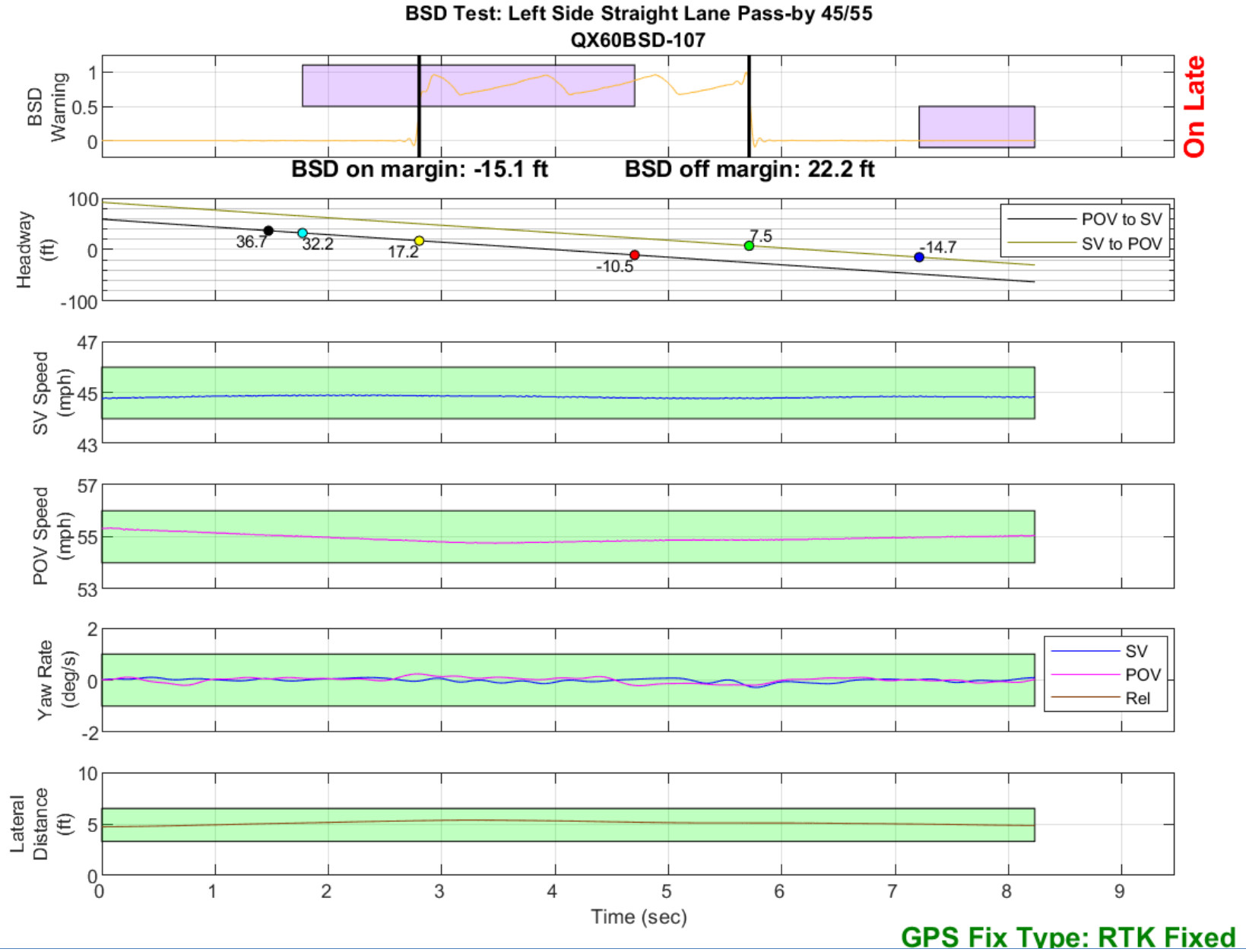


Figure D40. BSD Run 107, Straight Lane Pass-by, SV 45 mph, POV 55 mph

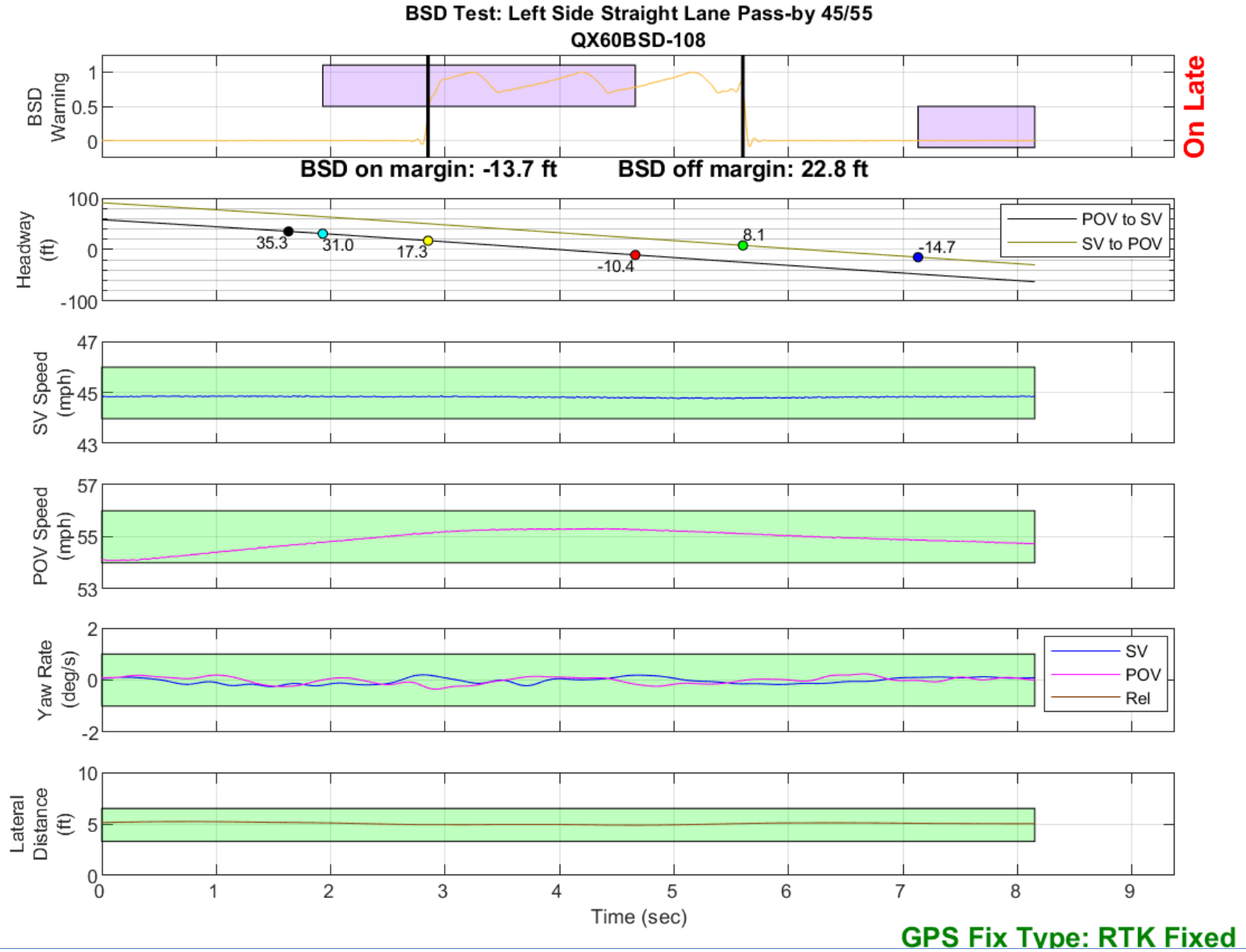


Figure D41. BSD Run 108, Straight Lane Pass-by, SV 45 mph, POV 55 mph

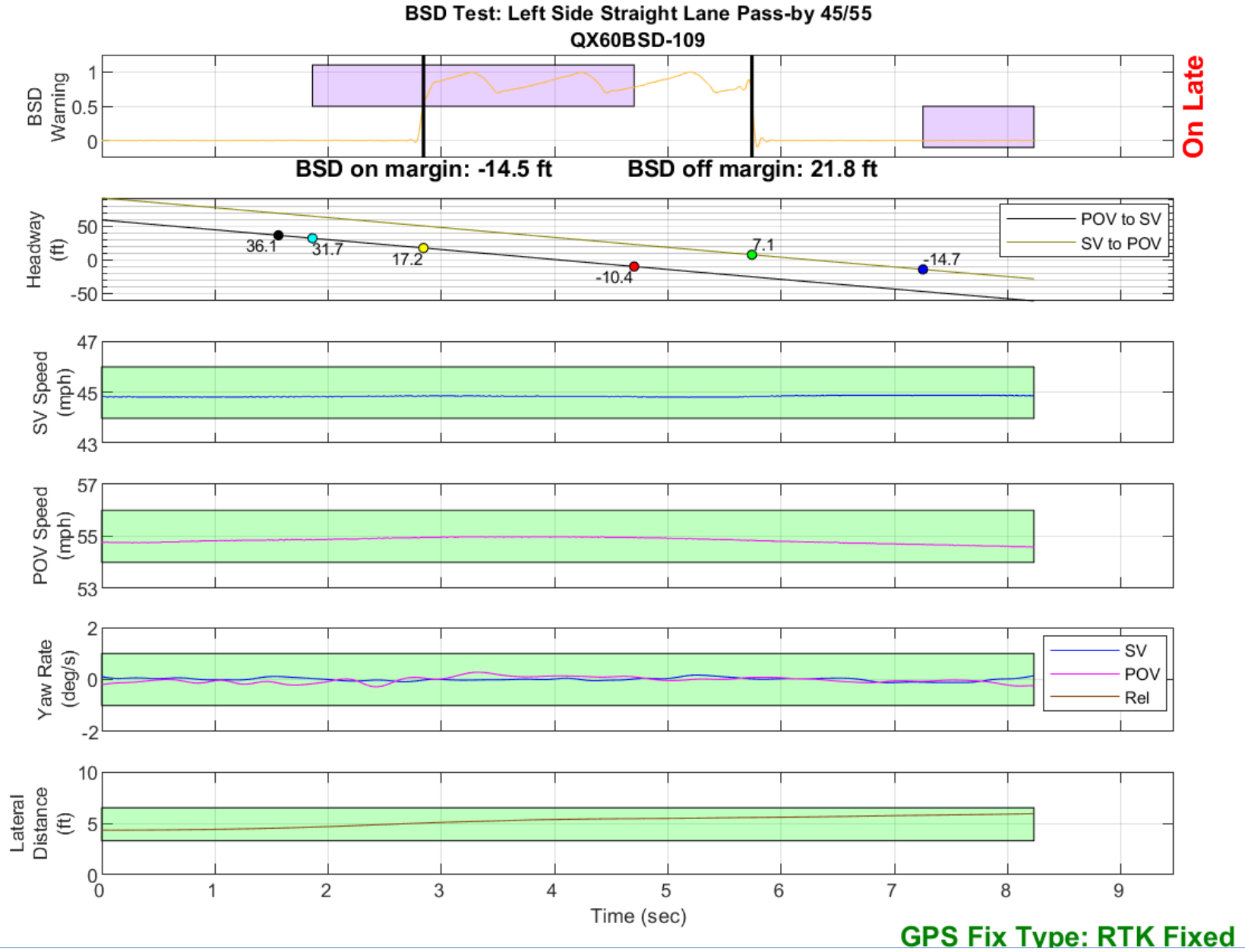


Figure D42. BSD Run 109, Straight Lane Pass-by, SV 45 mph, POV 55 mph

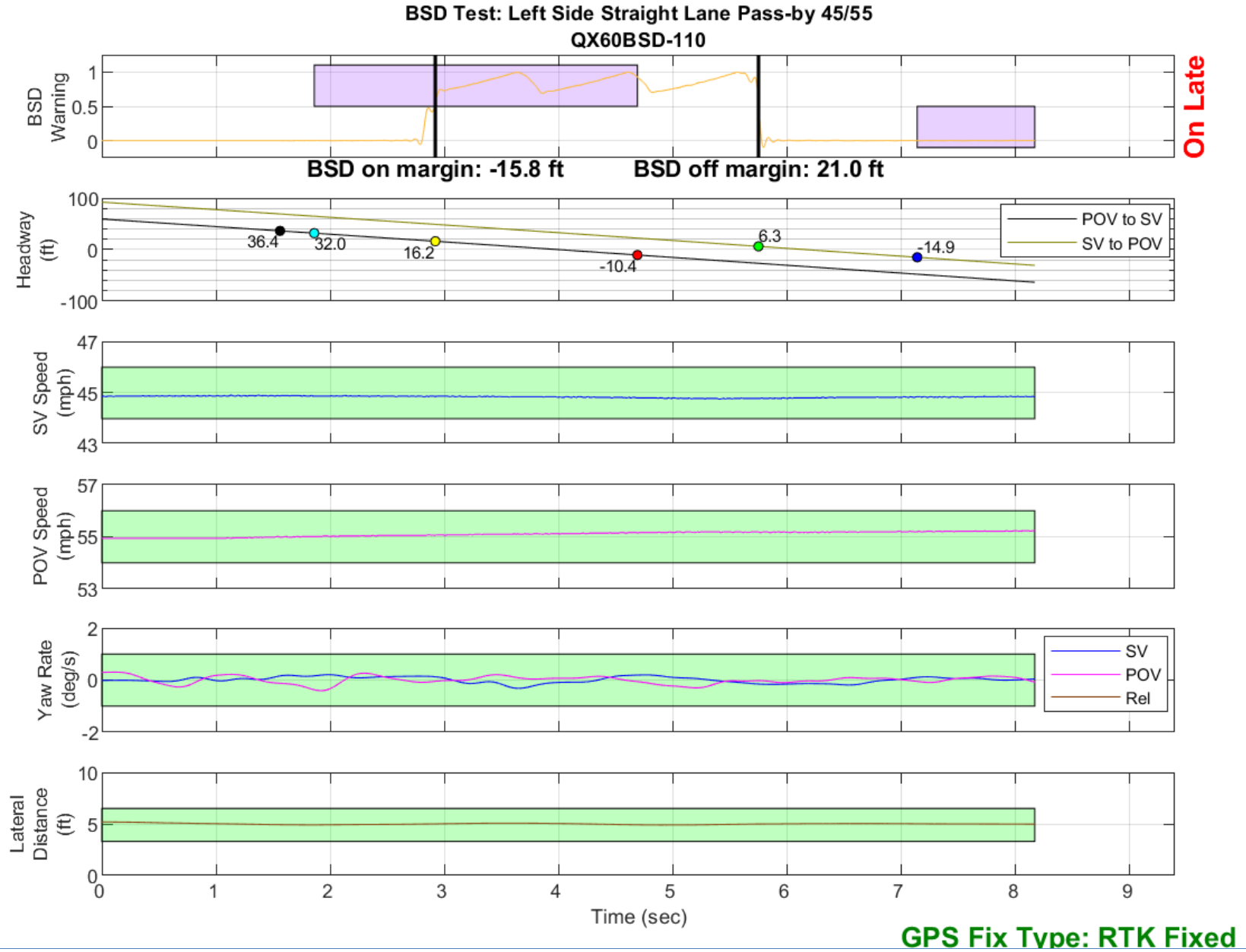


Figure D43. BSD Run 110, Straight Lane Pass-by, SV 45 mph, POV 55 mph

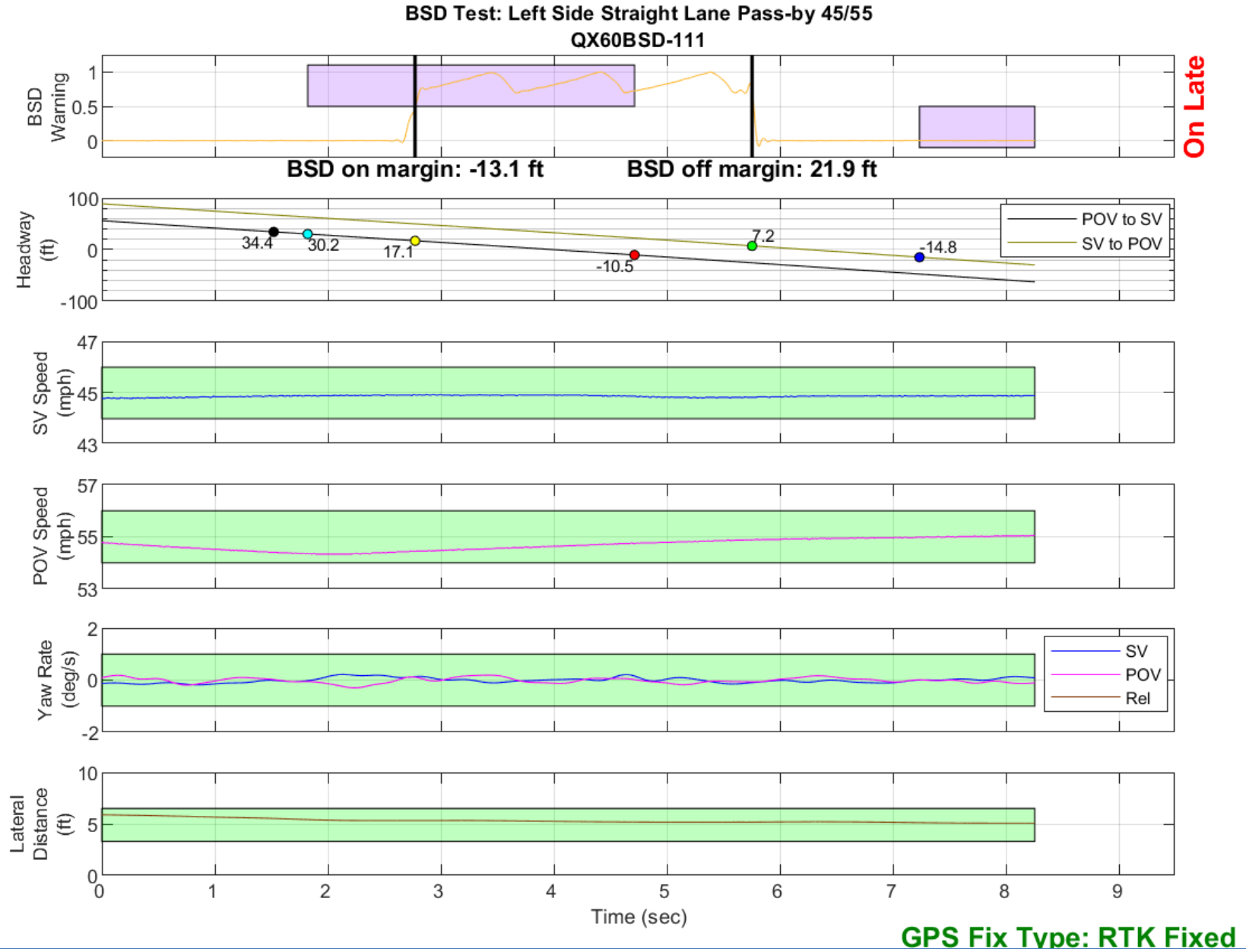


Figure D44. BSD Run 111, Straight Lane Pass-by, SV 45 mph, POV 55 mph

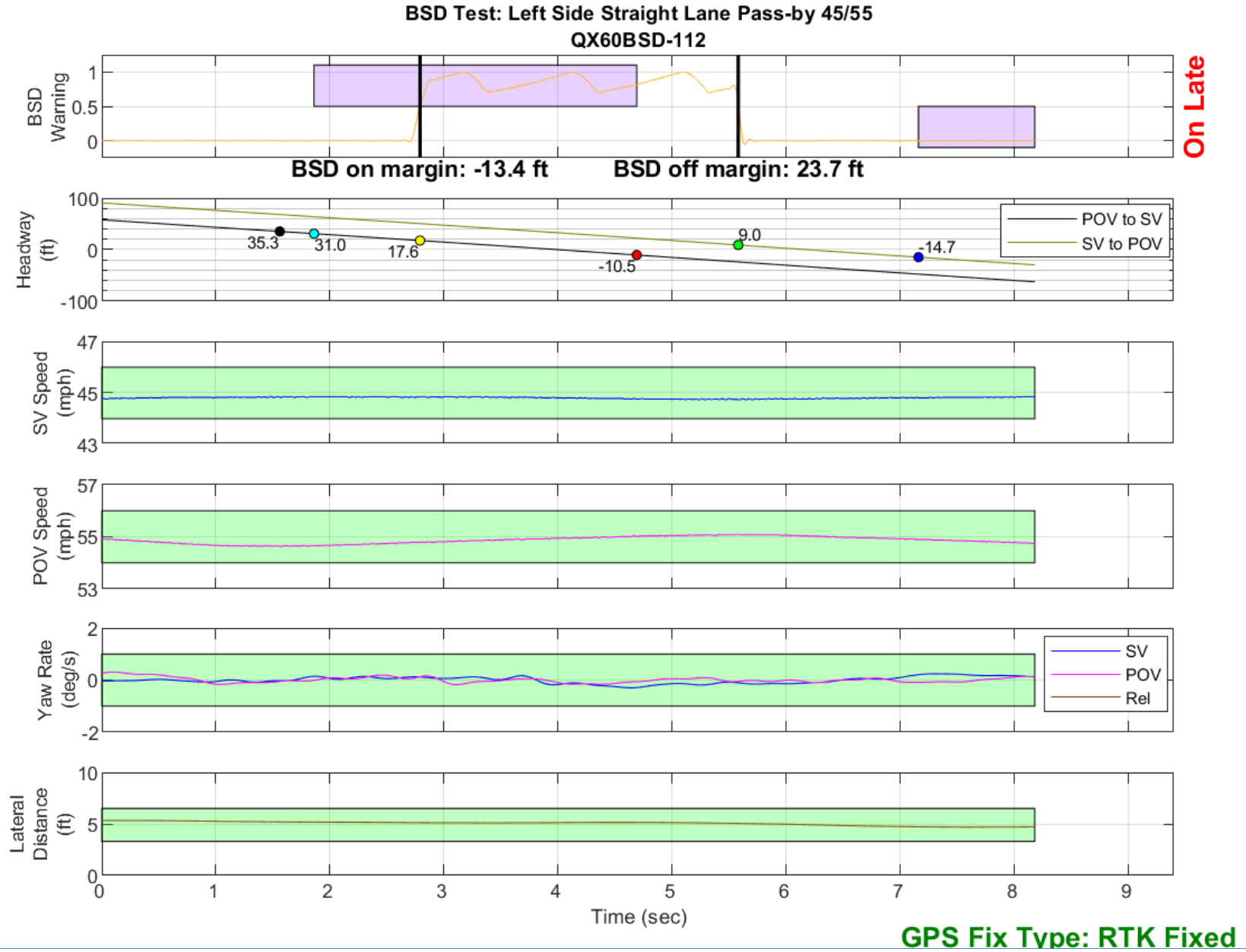


Figure D45. BSD Run 112, Straight Lane Pass-by, SV 45 mph, POV 55 mph

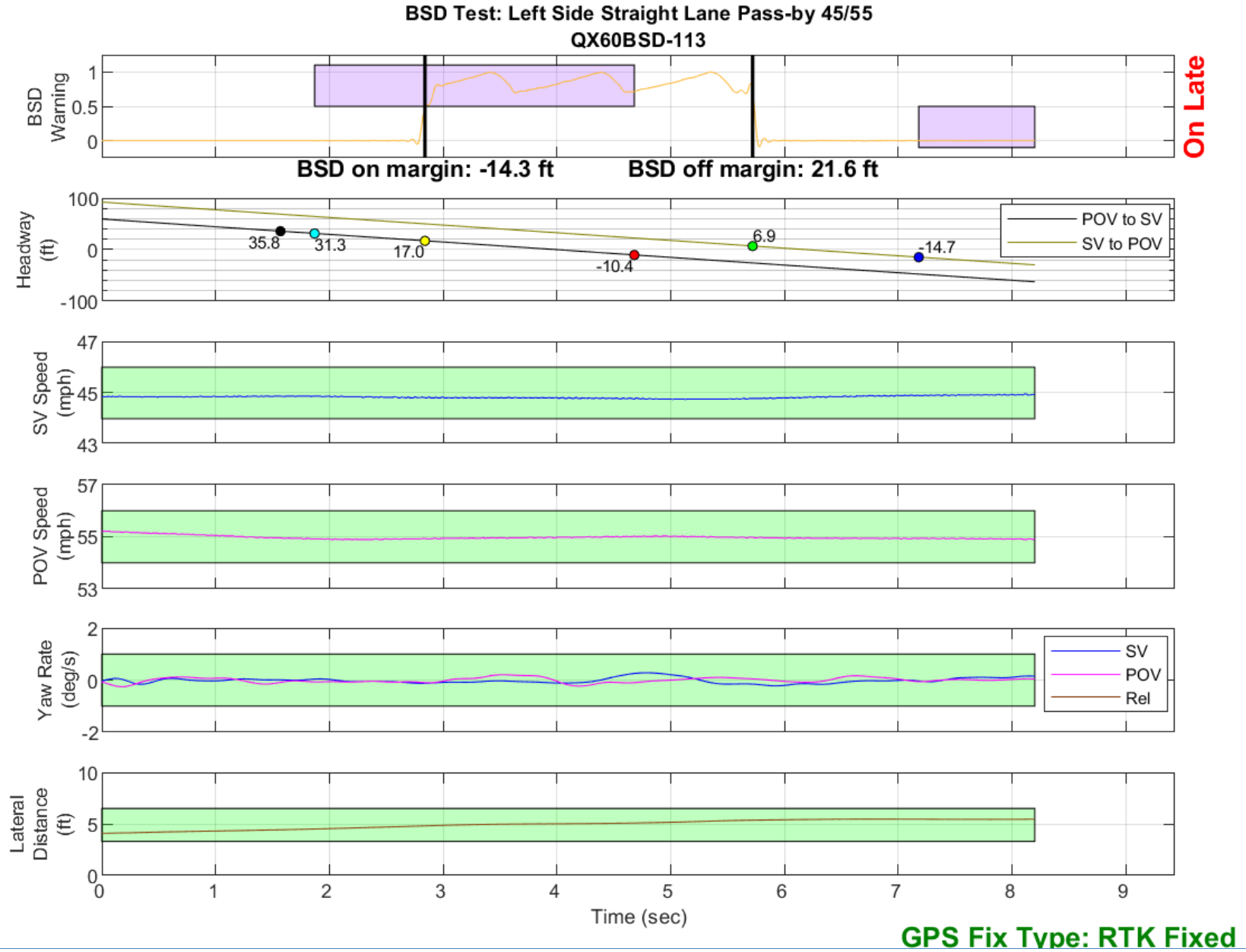


Figure D46. BSD Run 113, Straight Lane Pass-by, SV 45 mph, POV 55 mph

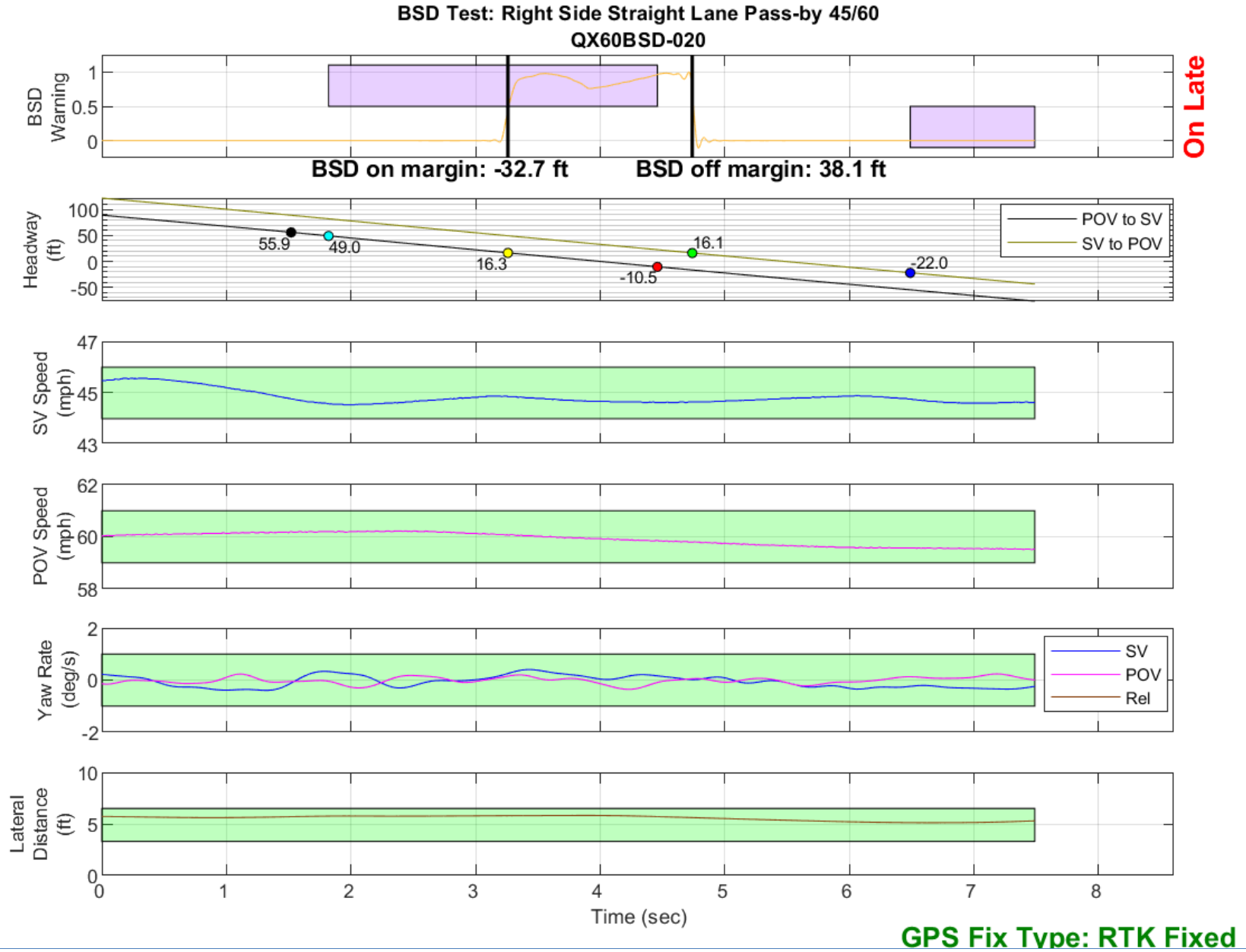


Figure D47. BSD Run 20, Straight Lane Pass-by, SV 45 mph, POV 60 mph

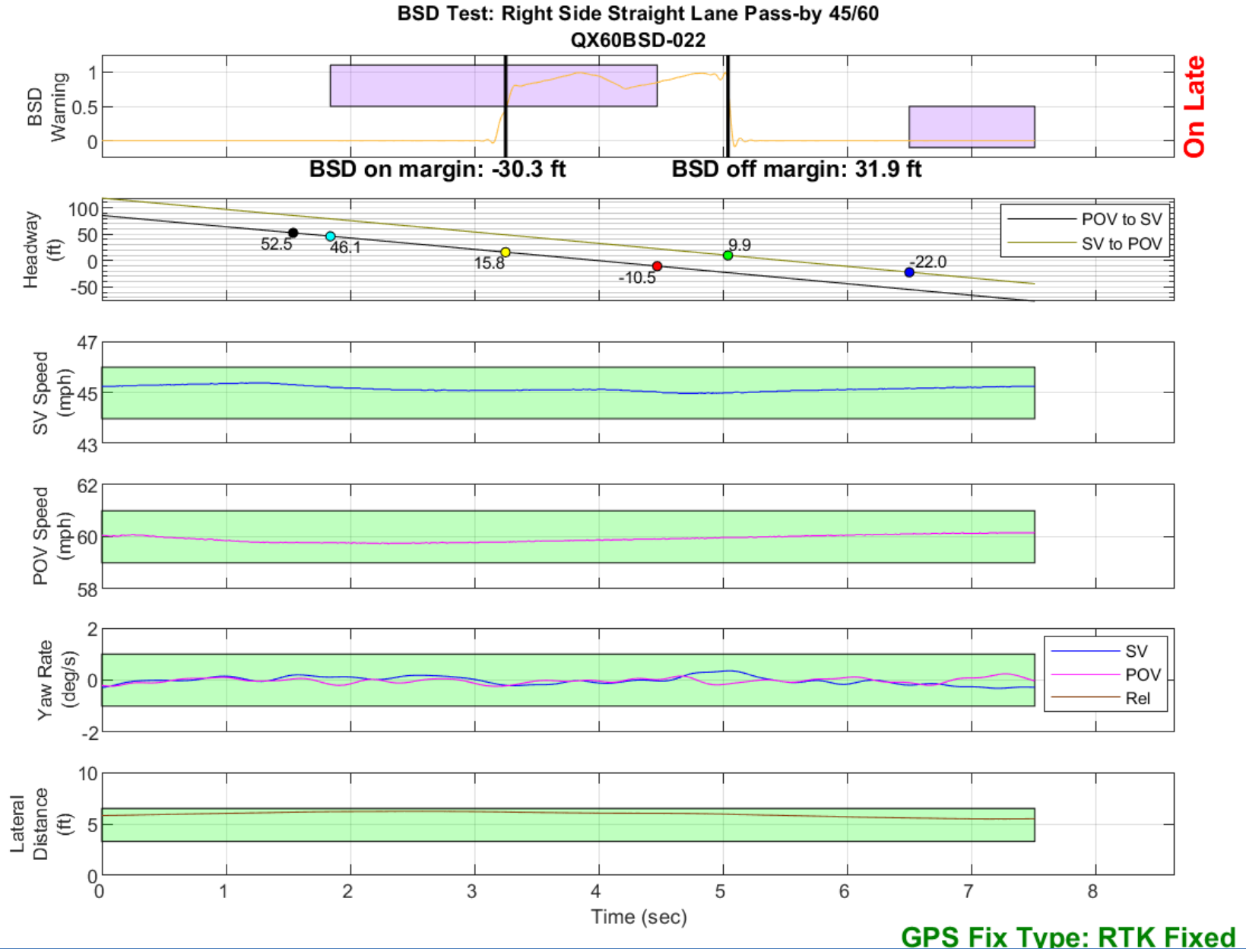


Figure D48. BSD Run 22, Straight Lane Pass-by, SV 45 mph, POV 60 mph

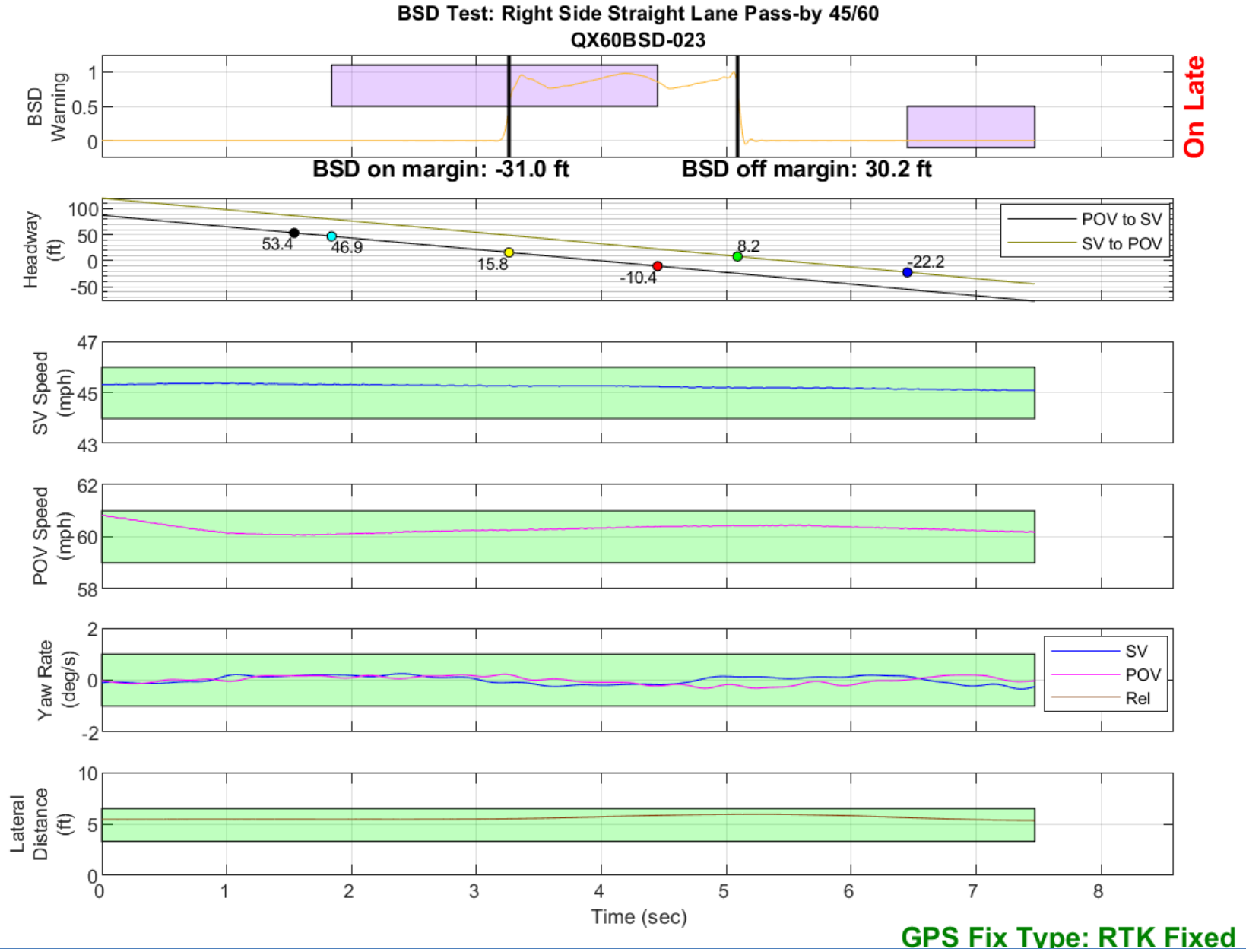


Figure D49. BSD Run 23, Straight Lane Pass-by, SV 45 mph, POV 60 mph

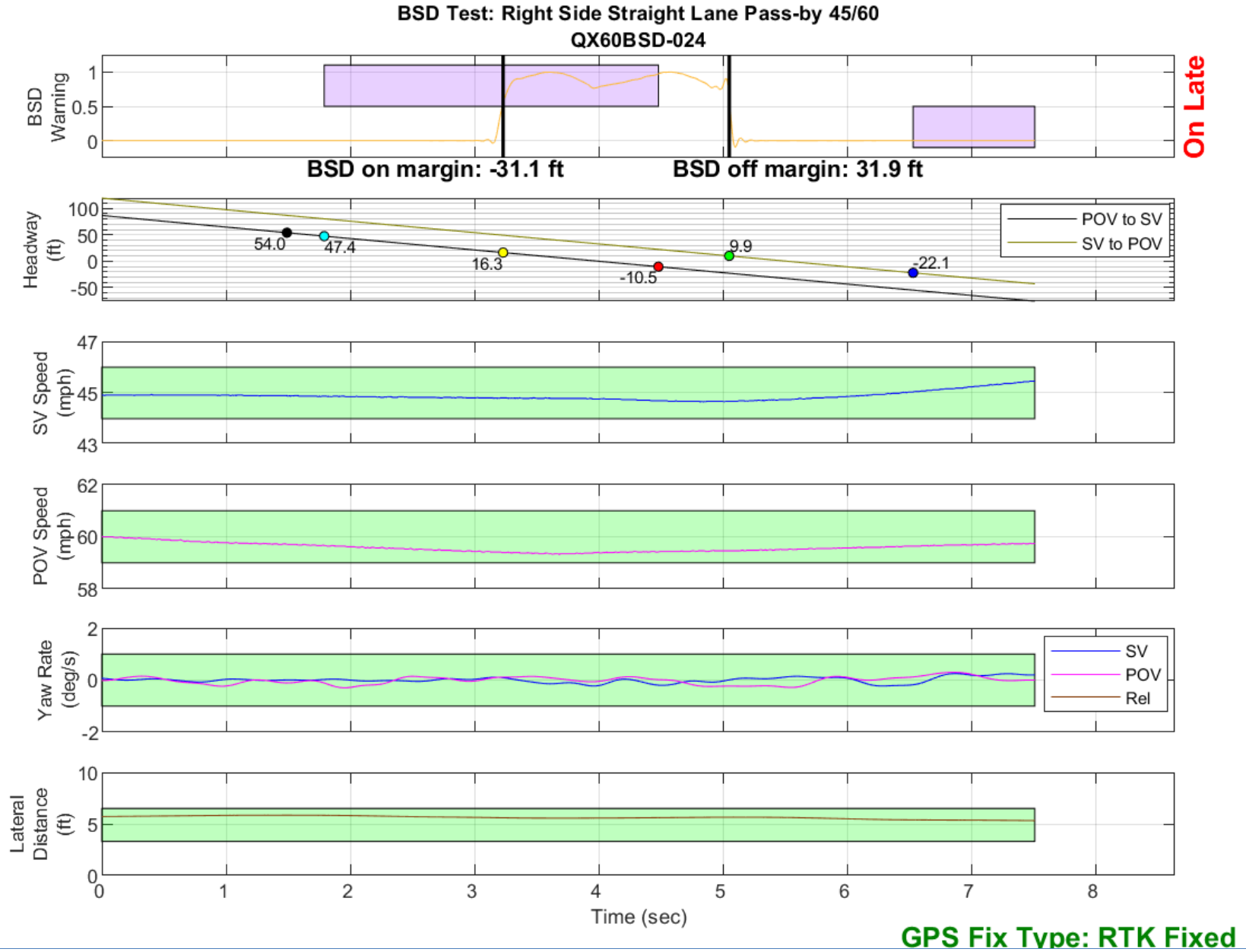


Figure D50. BSD Run 24, Straight Lane Pass-by, SV 45 mph, POV 60 mph

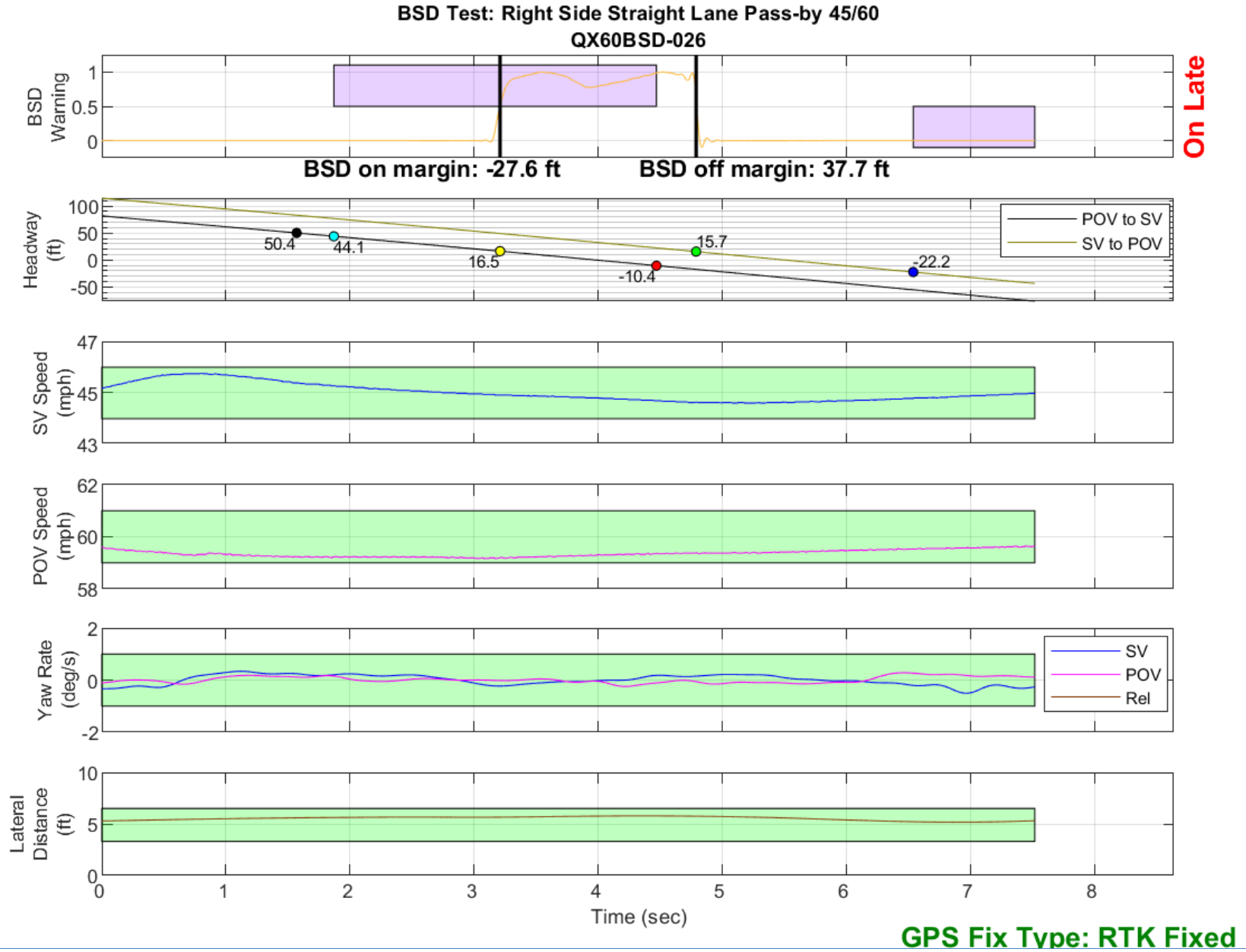


Figure D51. BSD Run 26, Straight Lane Pass-by, SV 45 mph, POV 60 mph

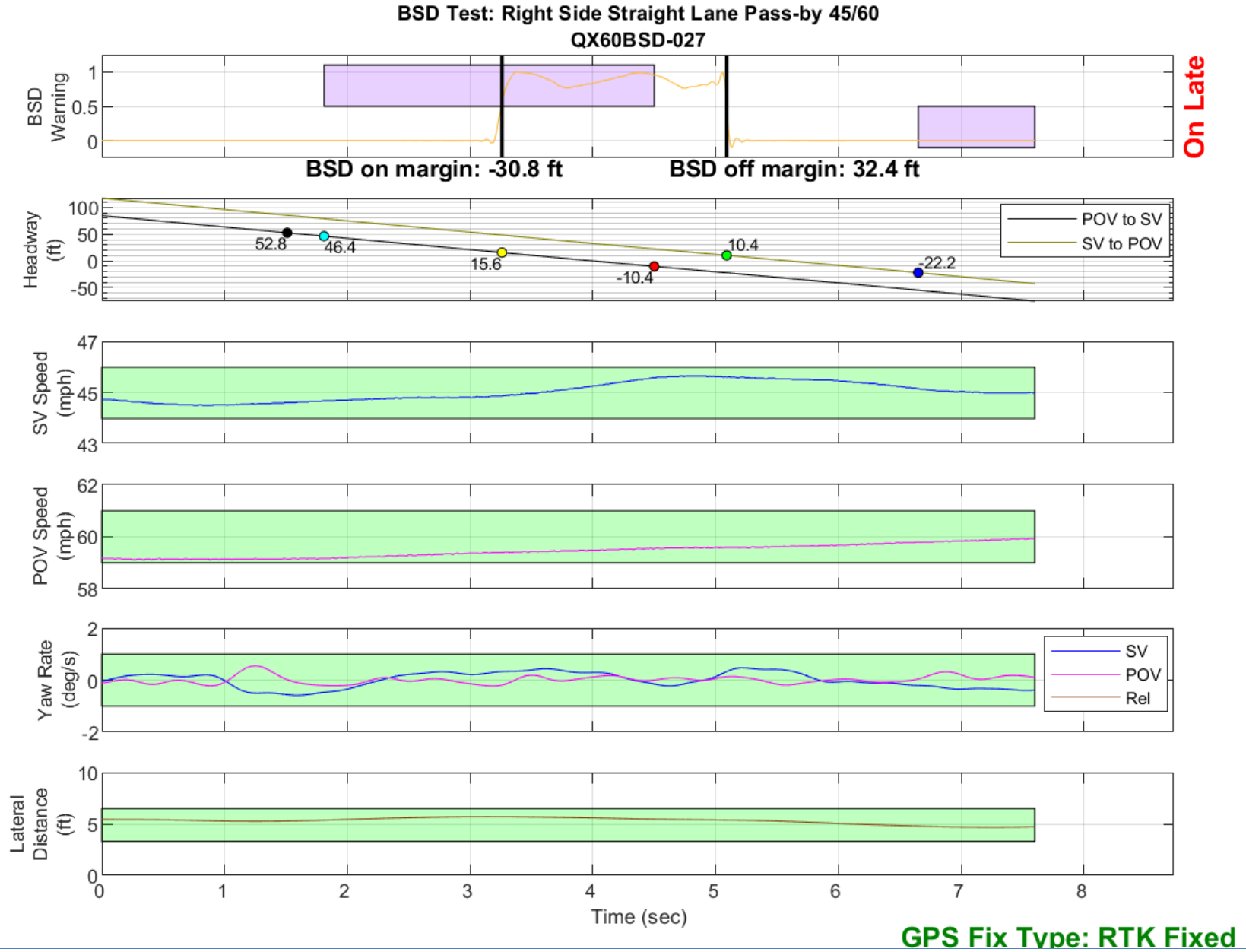


Figure D52. BSD Run 27, Straight Lane Pass-by, SV 45 mph, POV 60 mph

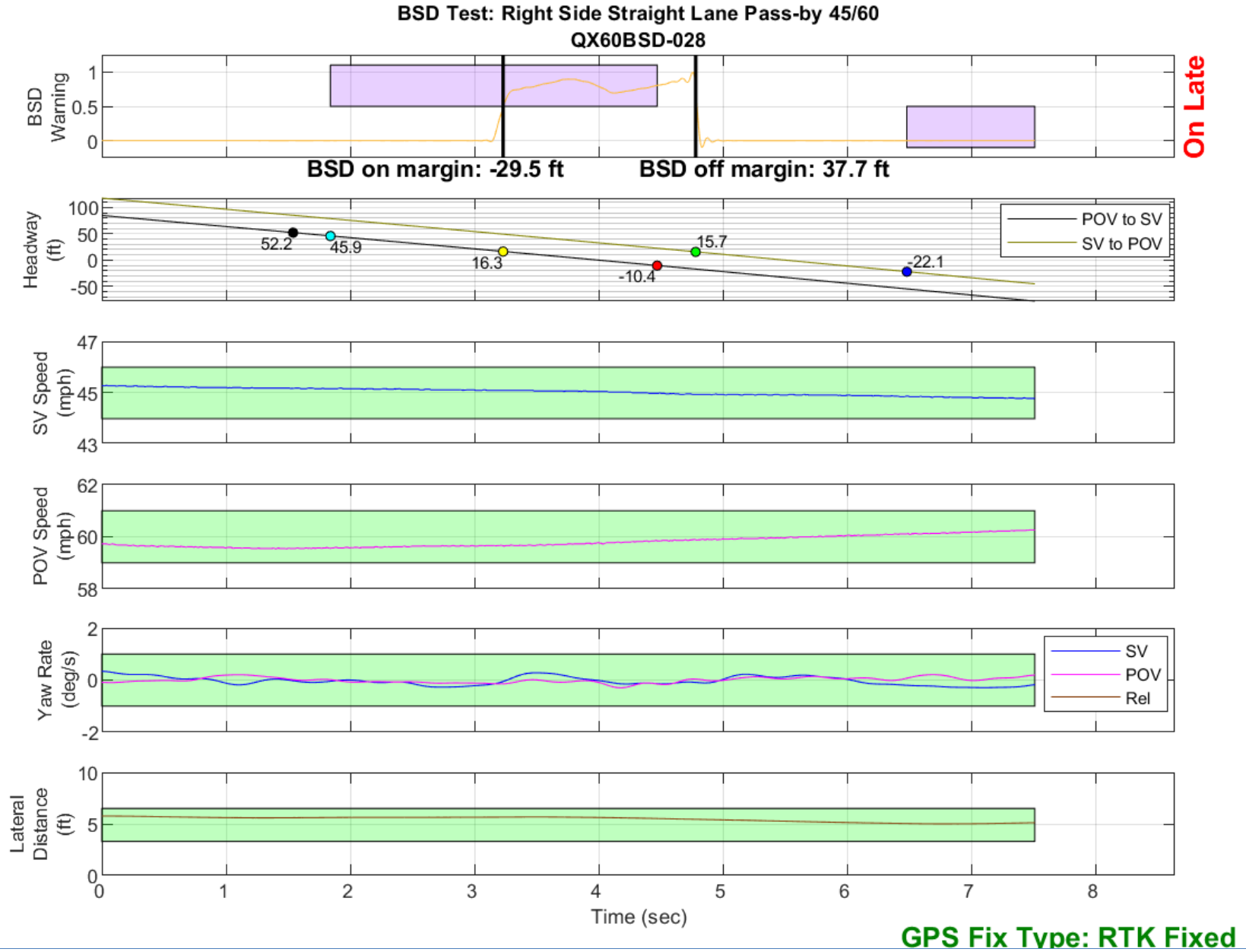


Figure D53. BSD Run 28, Straight Lane Pass-by, SV 45 mph, POV 60 mph

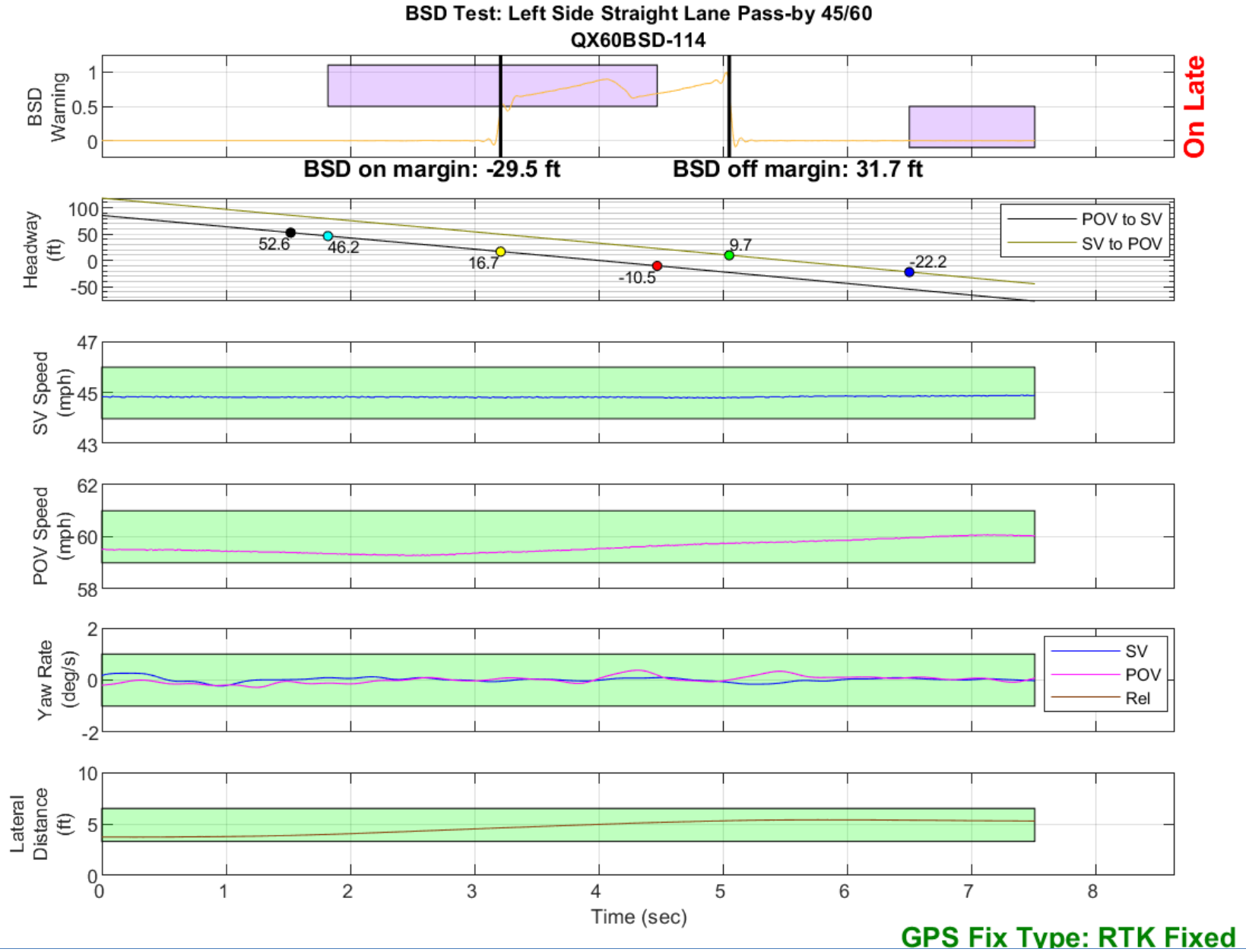


Figure D54. BSD Run 114, Straight Lane Pass-by, SV 45 mph, POV 60 mph

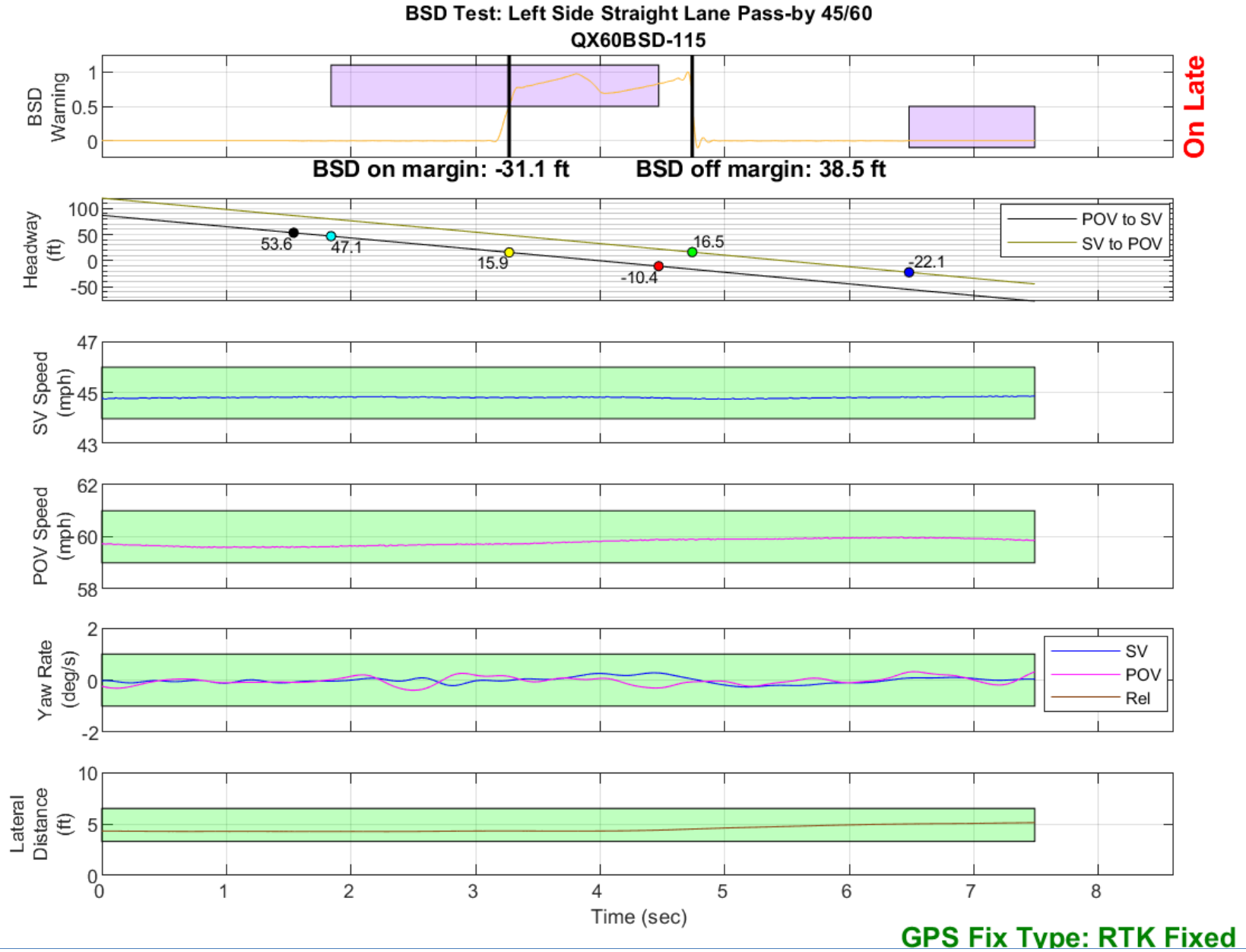


Figure D55. BSD Run 115, Straight Lane Pass-by, SV 45 mph, POV 60 mph

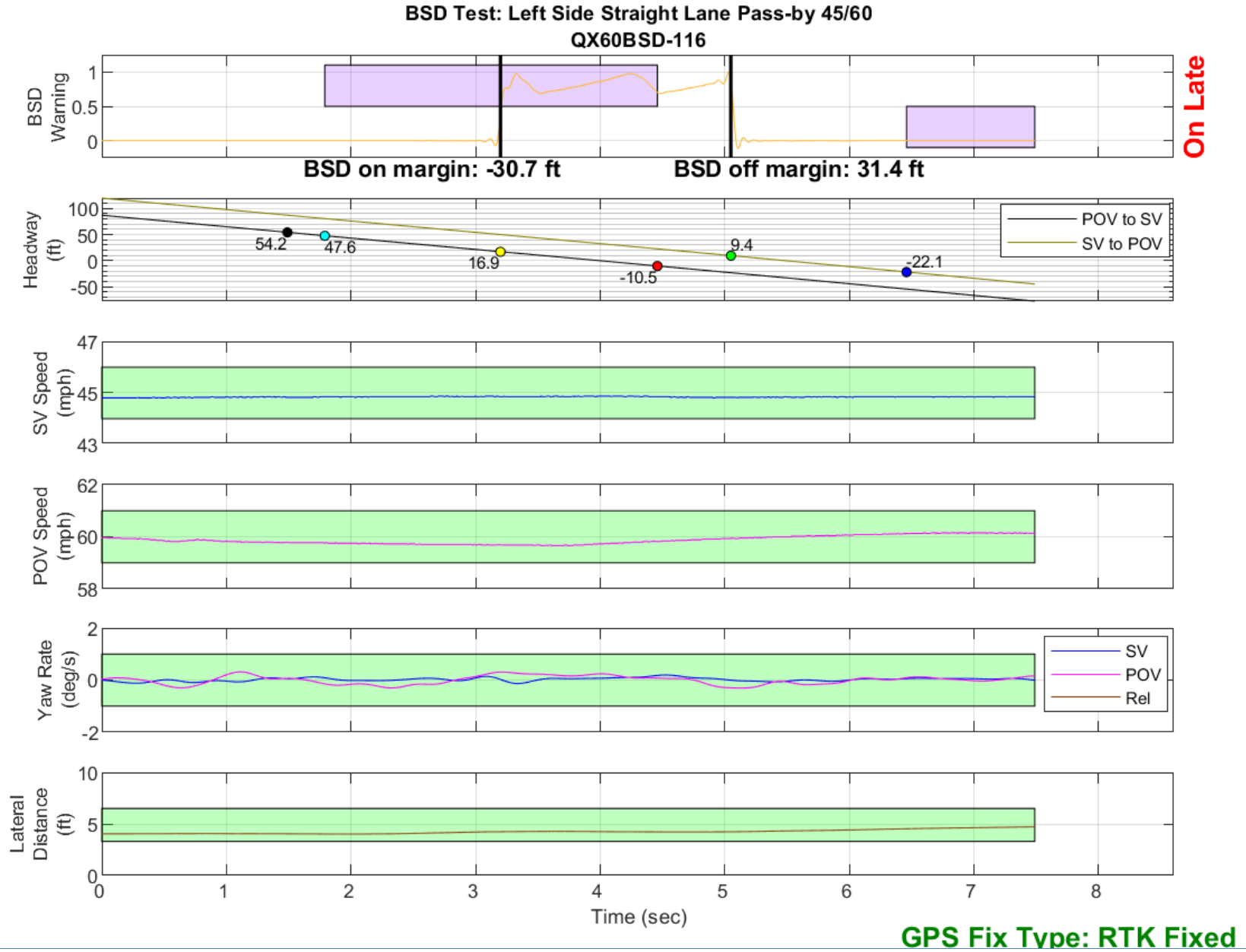


Figure D56. BSD Run 116, Straight Lane Pass-by, SV 45 mph, POV 60 mph

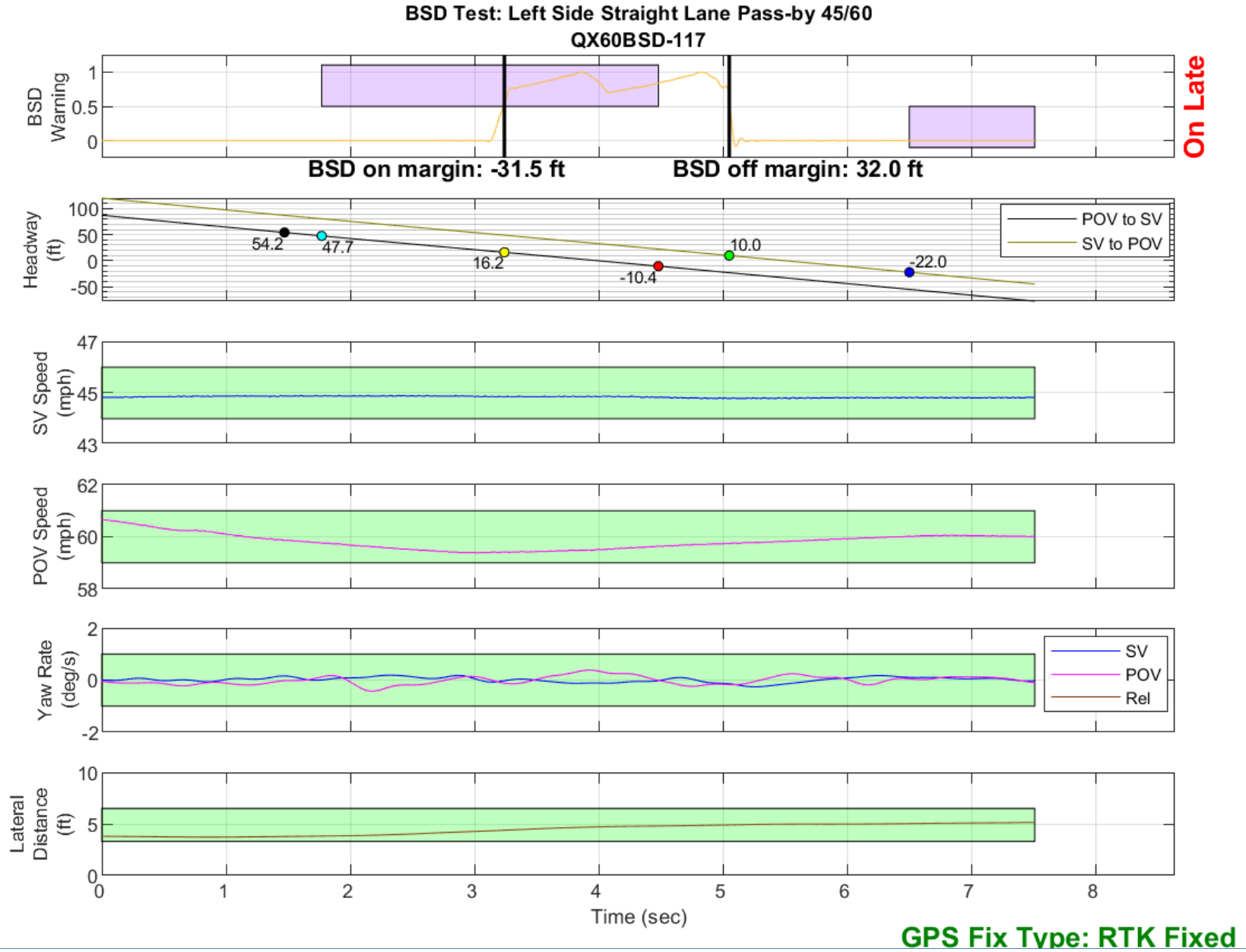


Figure D57. BSD Run 117, Straight Lane Pass-by, SV 45 mph, POV 60 mph

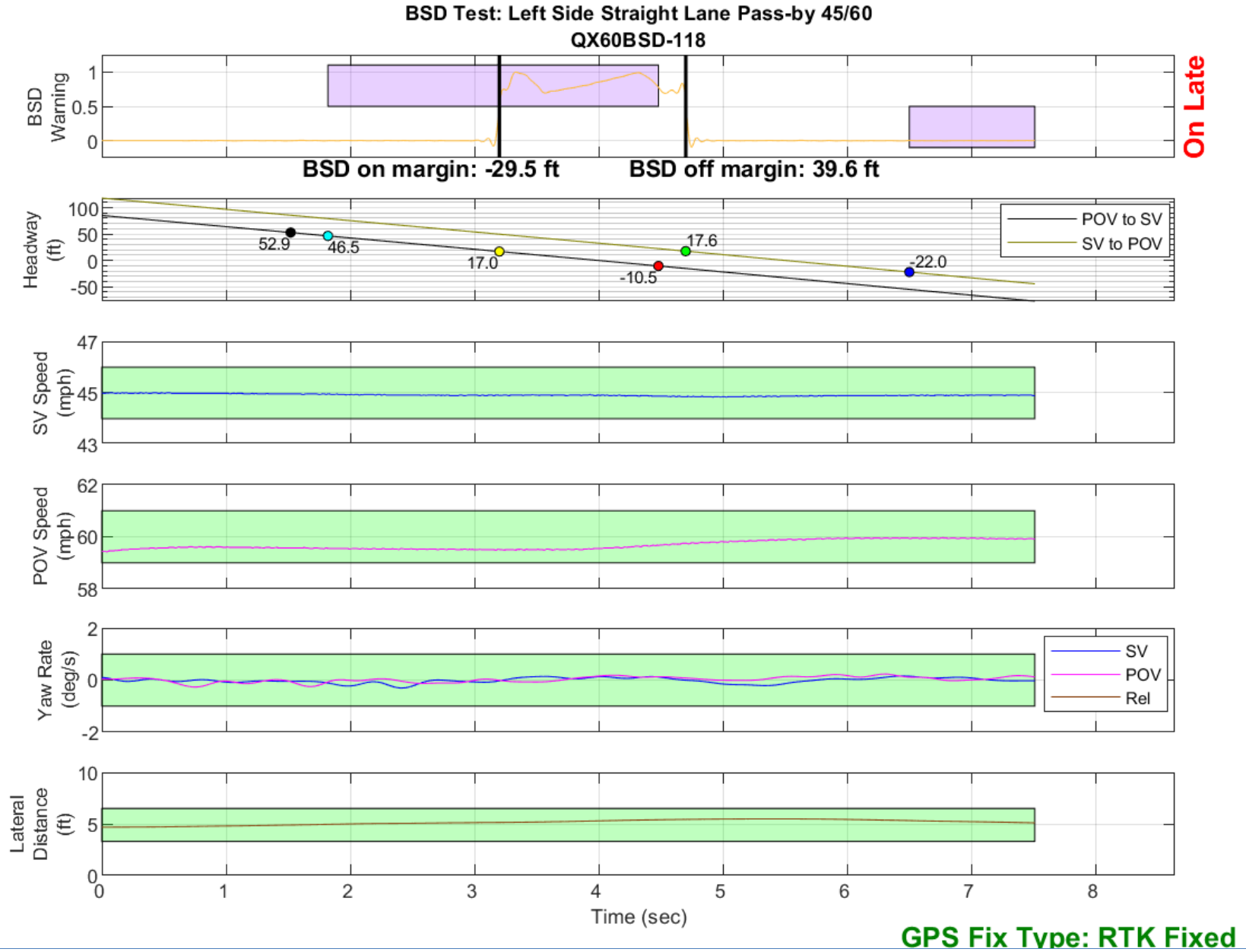


Figure D58. BSD Run 118, Straight Lane Pass-by, SV 45 mph, POV 60 mph

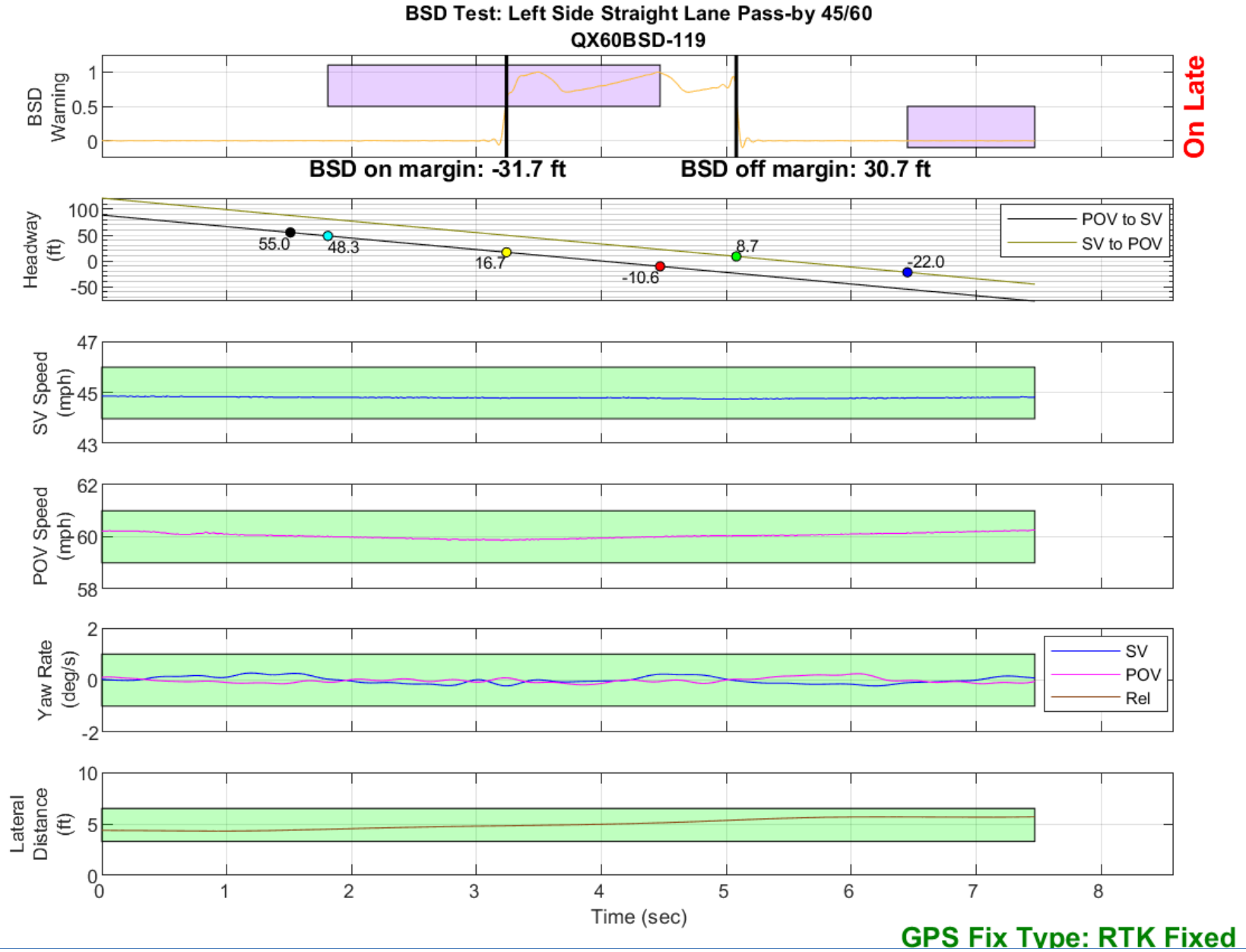


Figure D59. BSD Run 119, Straight Lane Pass-by, SV 45 mph, POV 60 mph

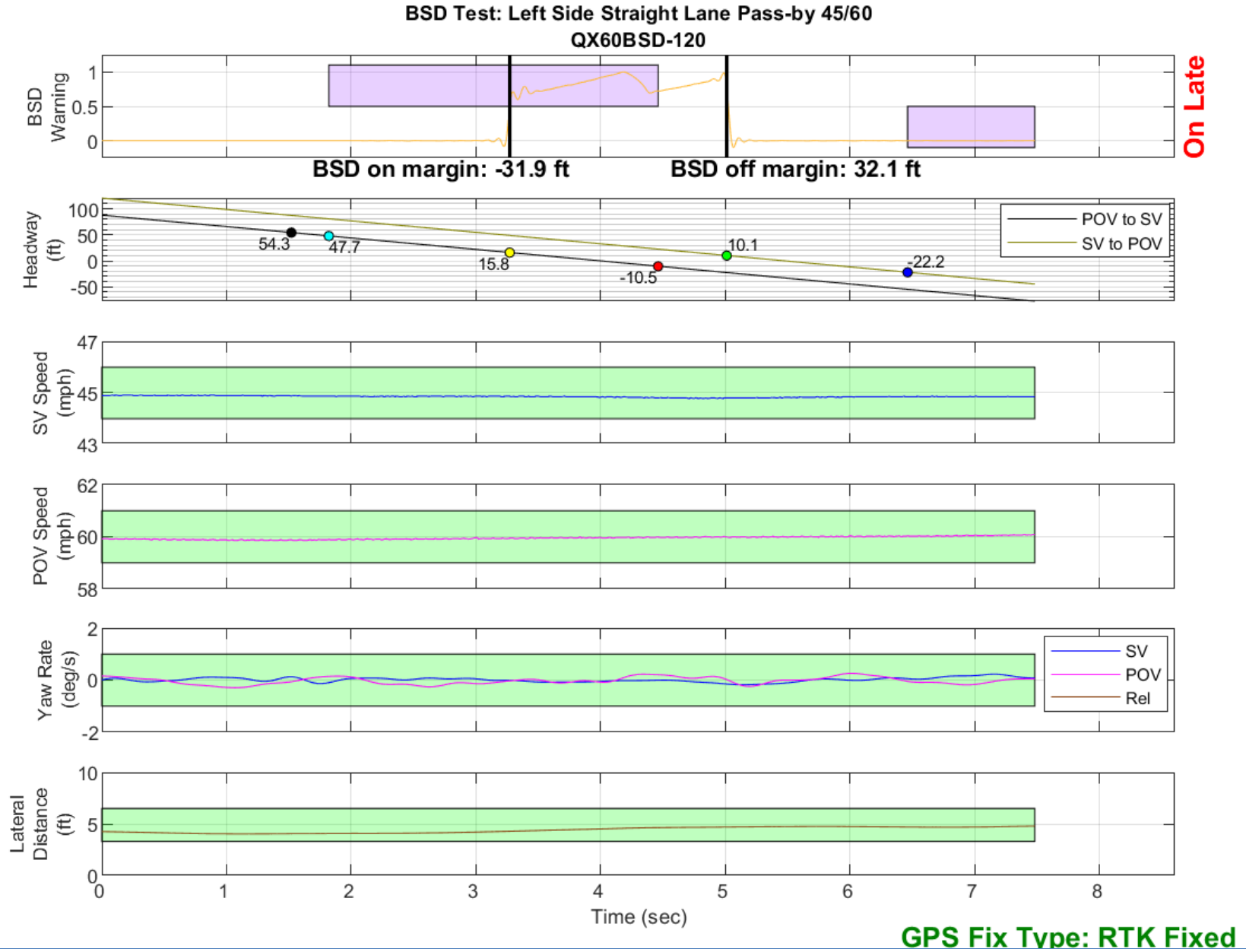


Figure D60. BSD Run 120, Straight Lane Pass-by, SV 45 mph, POV 60 mph

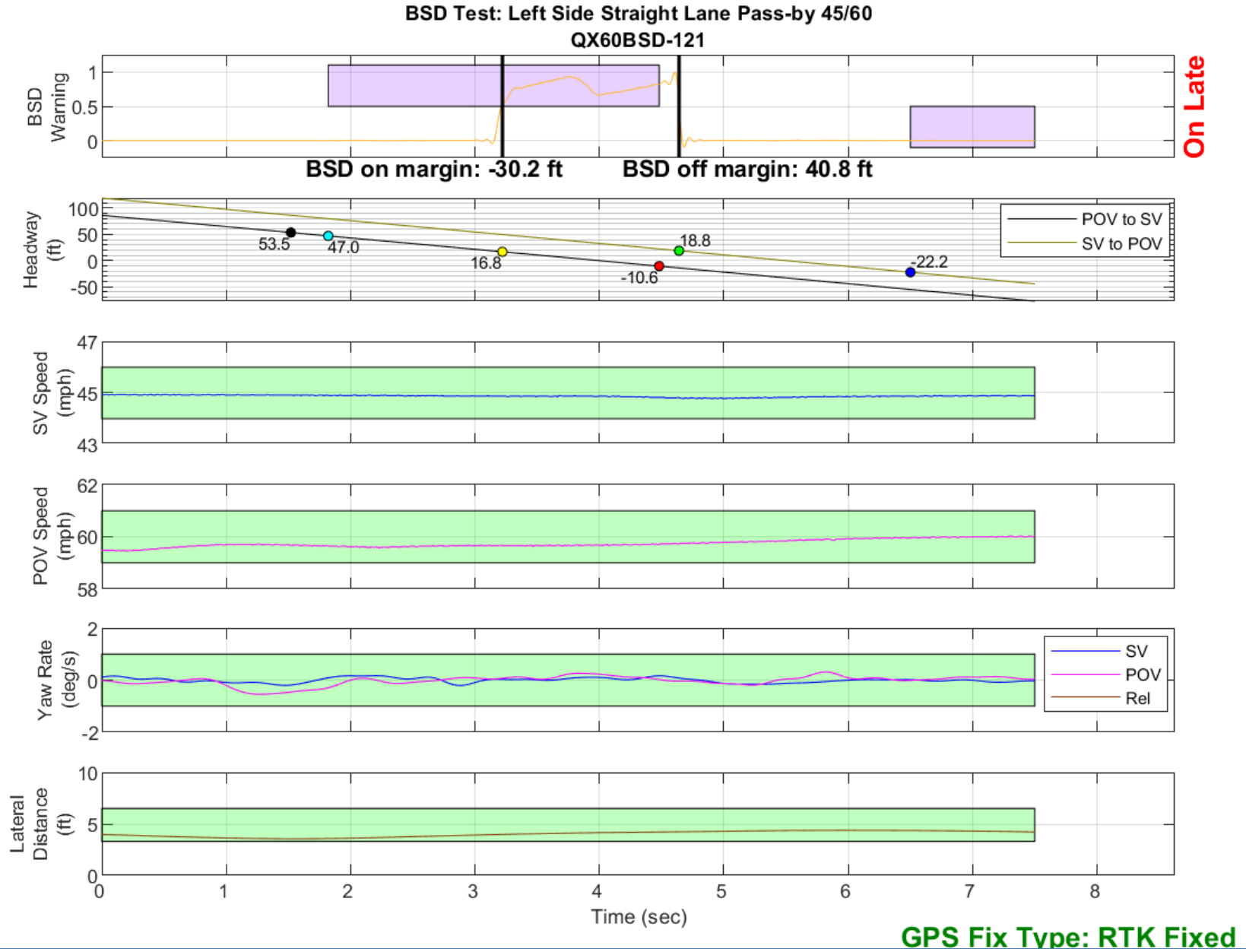


Figure D61. BSD Run 121, Straight Lane Pass-by, SV 45 mph, POV 60 mph

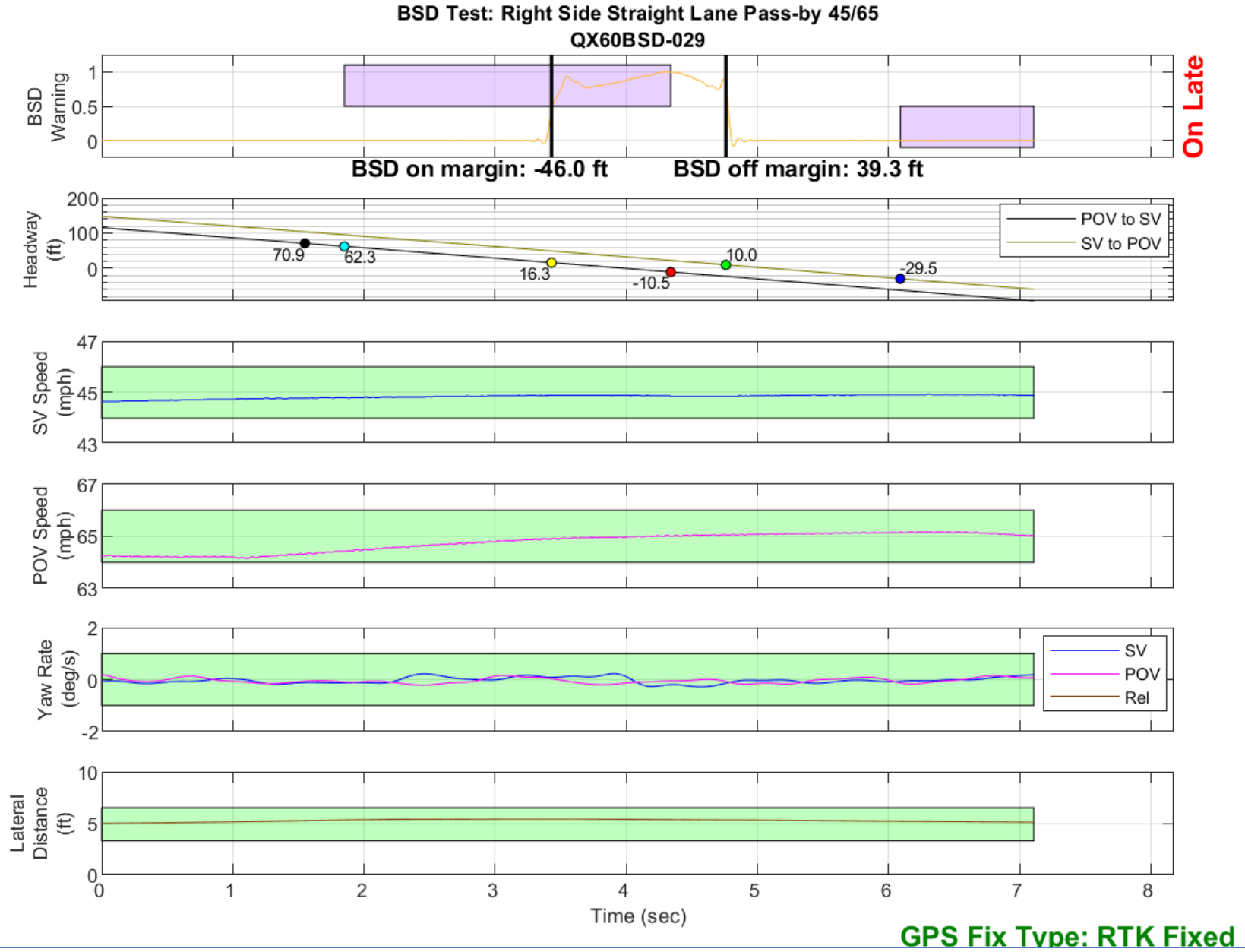


Figure D62. BSD Run 29, Straight Lane Pass-by, SV 45 mph, POV 65 mph

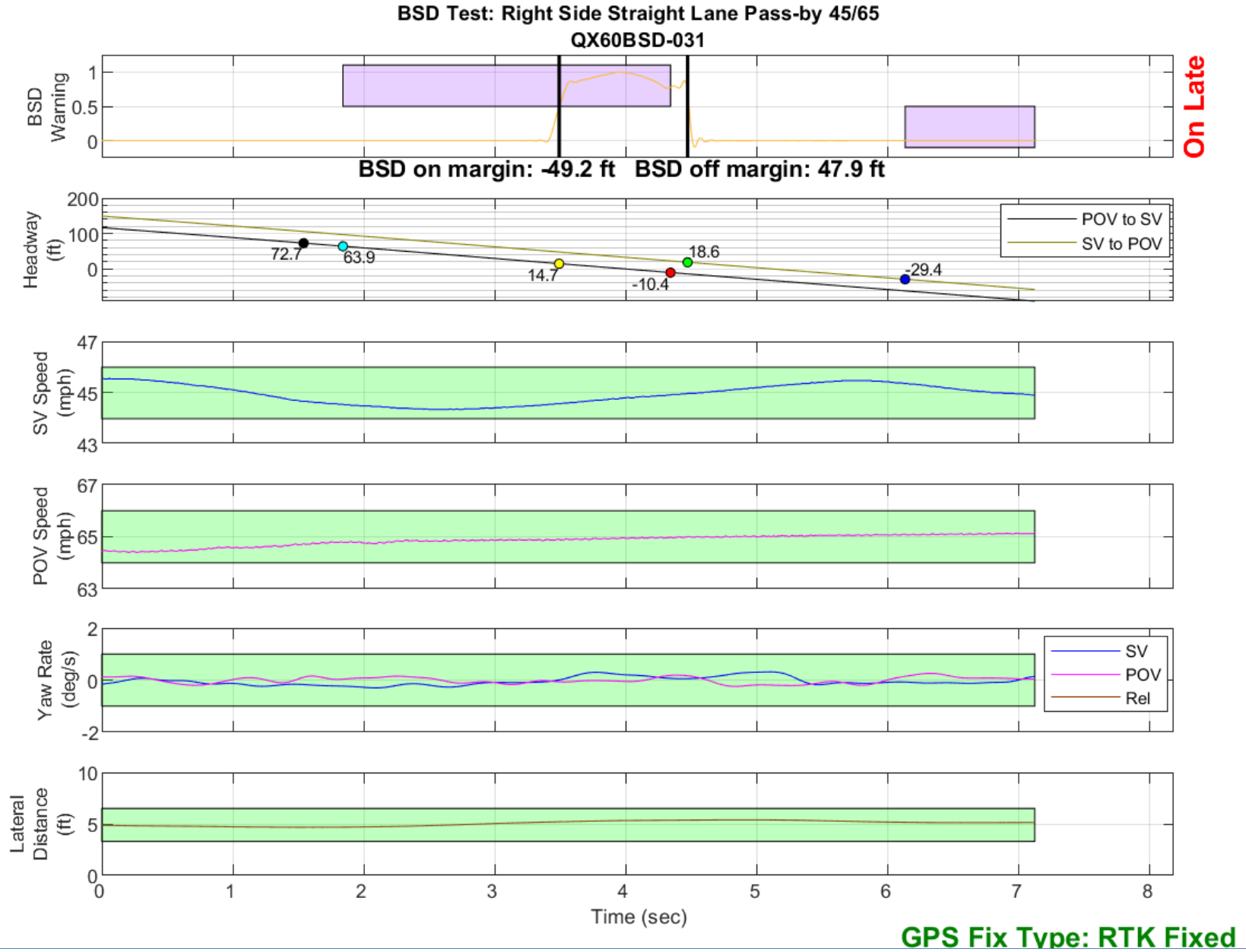


Figure D63. BSD Run 31, Straight Lane Pass-by, SV 45 mph, POV 65 mph

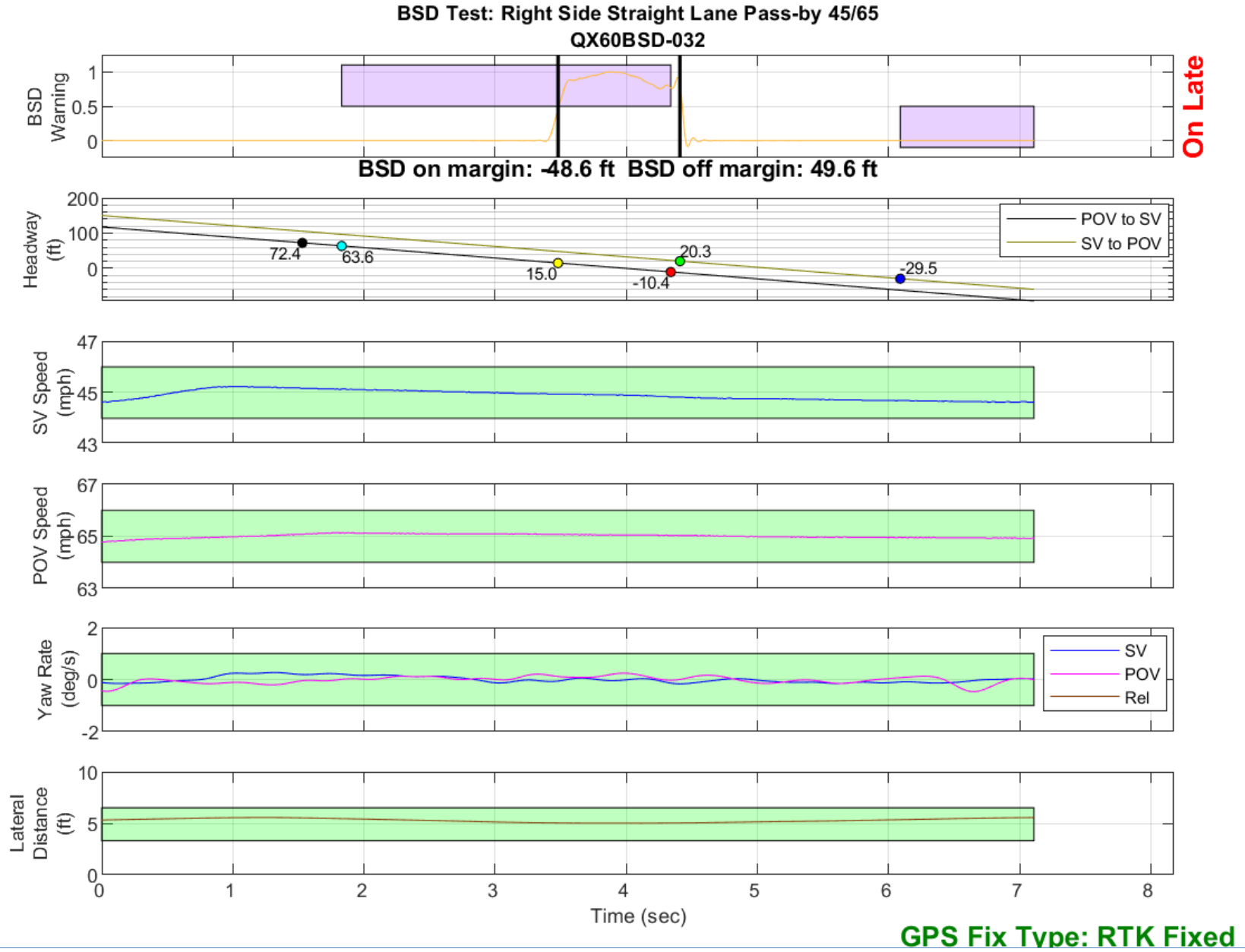


Figure D64. BSD Run 32, Straight Lane Pass-by, SV 45 mph, POV 65 mph

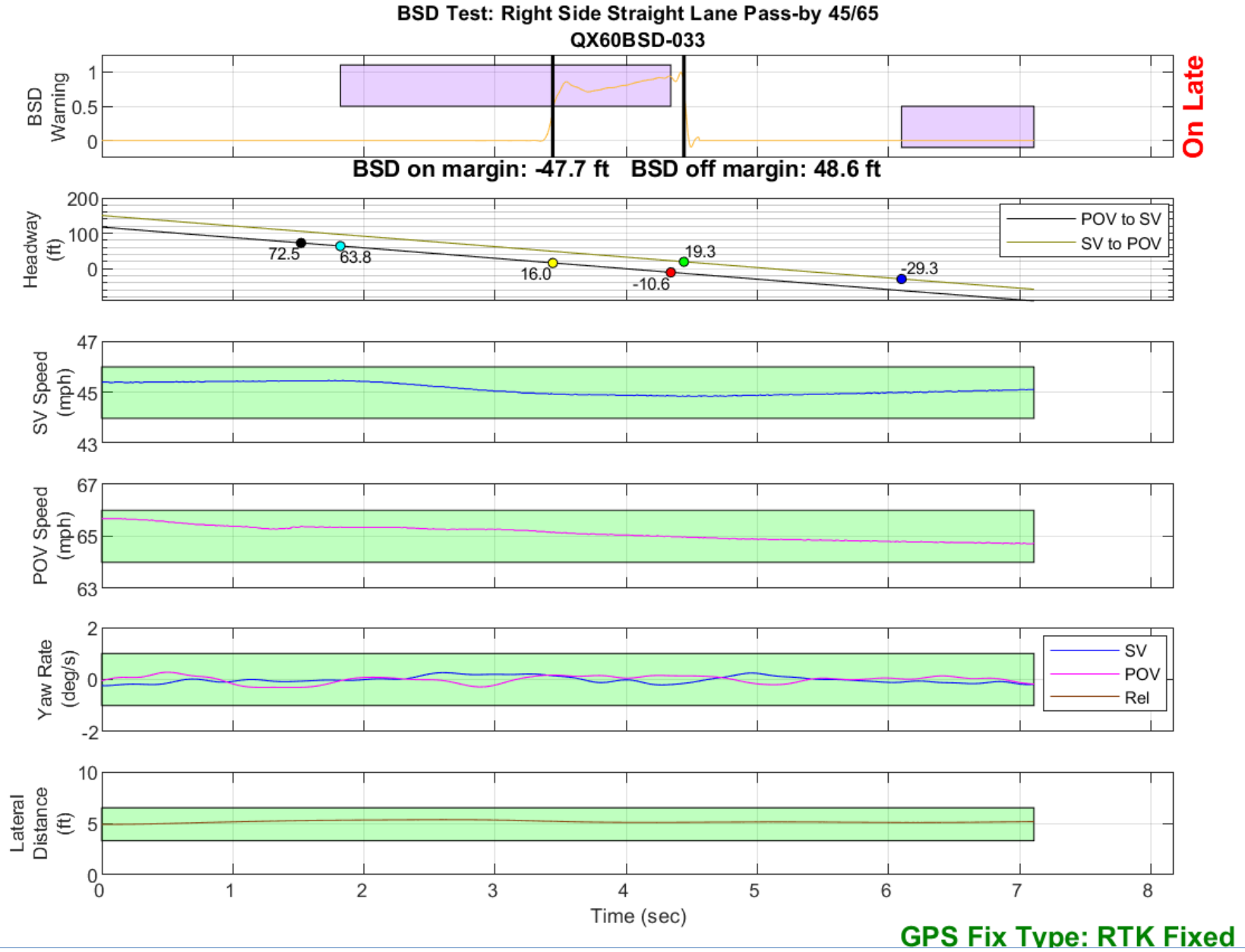


Figure D65. BSD Run 33, Straight Lane Pass-by, SV 45 mph, POV 65 mph

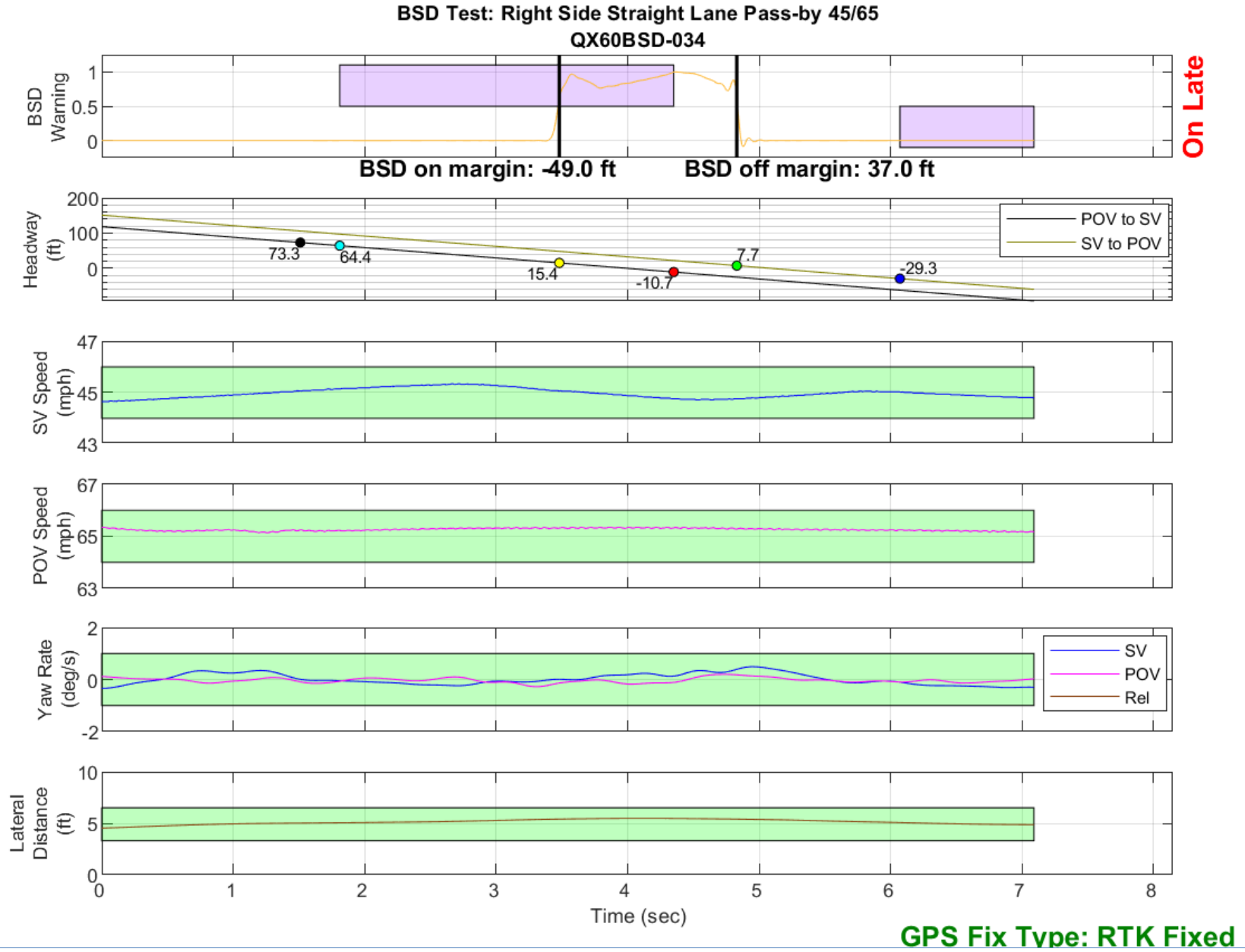


Figure D66. BSD Run 34, Straight Lane Pass-by, SV 45 mph, POV 65 mph

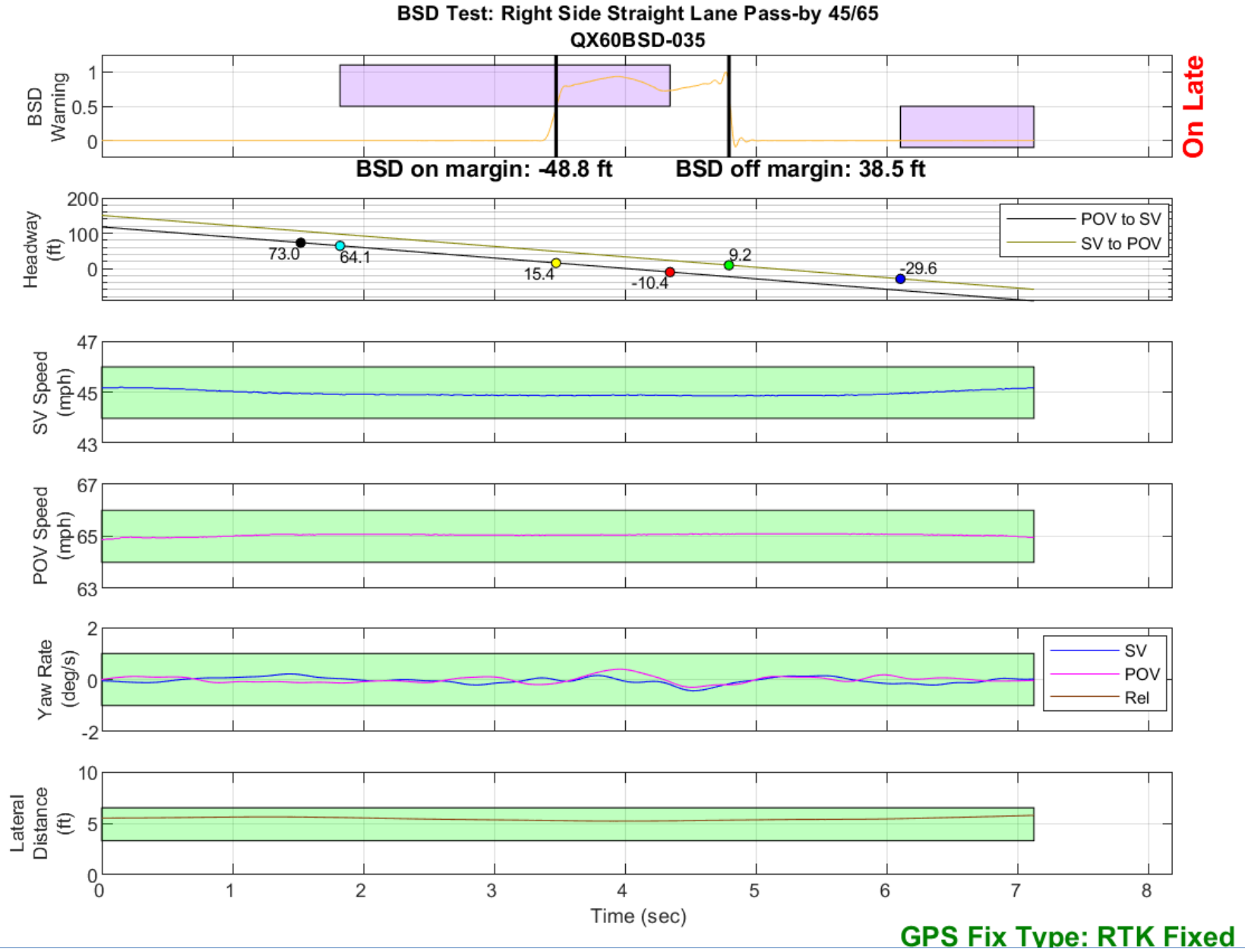


Figure D67. BSD Run 35, Straight Lane Pass-by, SV 45 mph, POV 65 mph

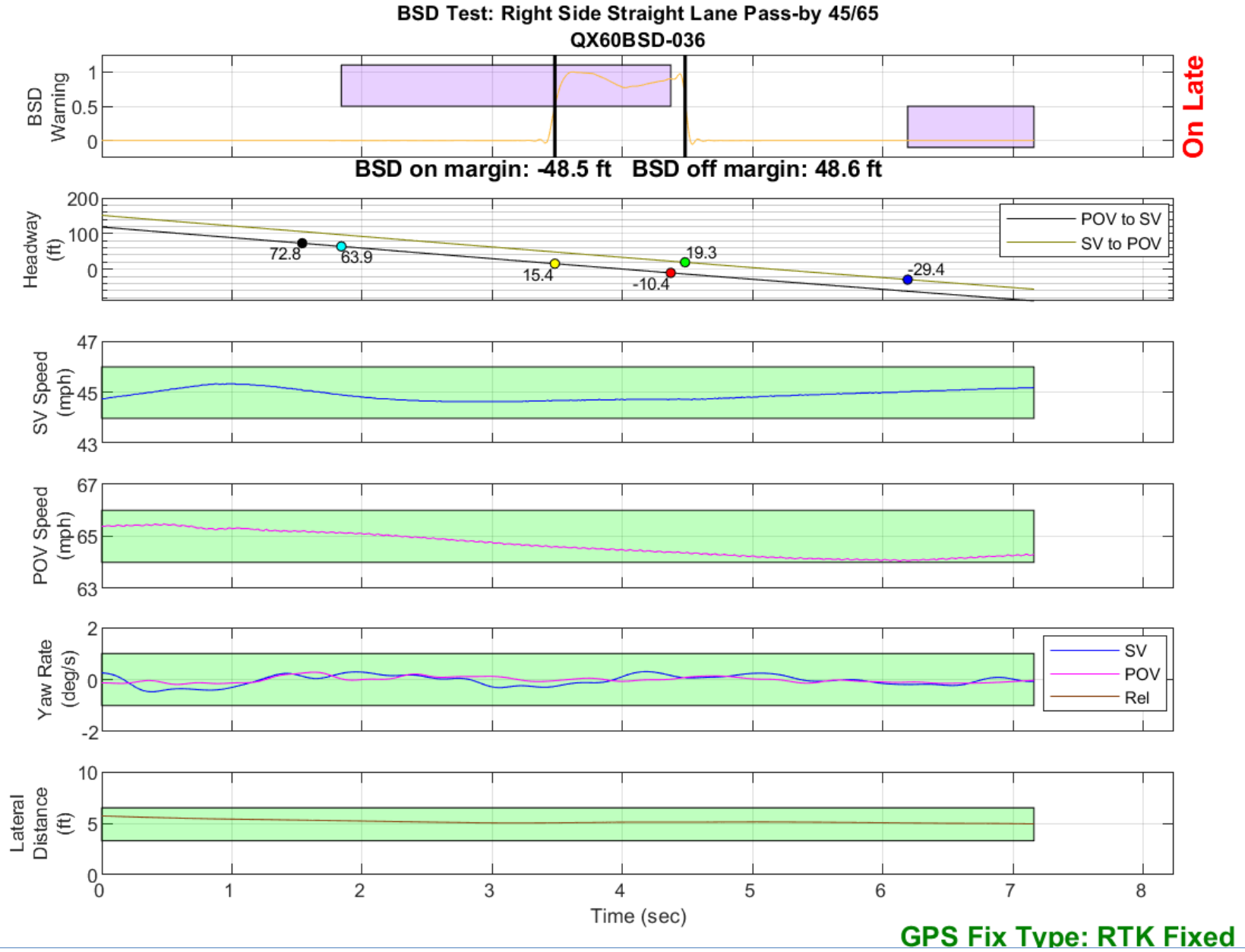


Figure D68. BSD Run 36, Straight Lane Pass-by, SV 45 mph, POV 65 mph

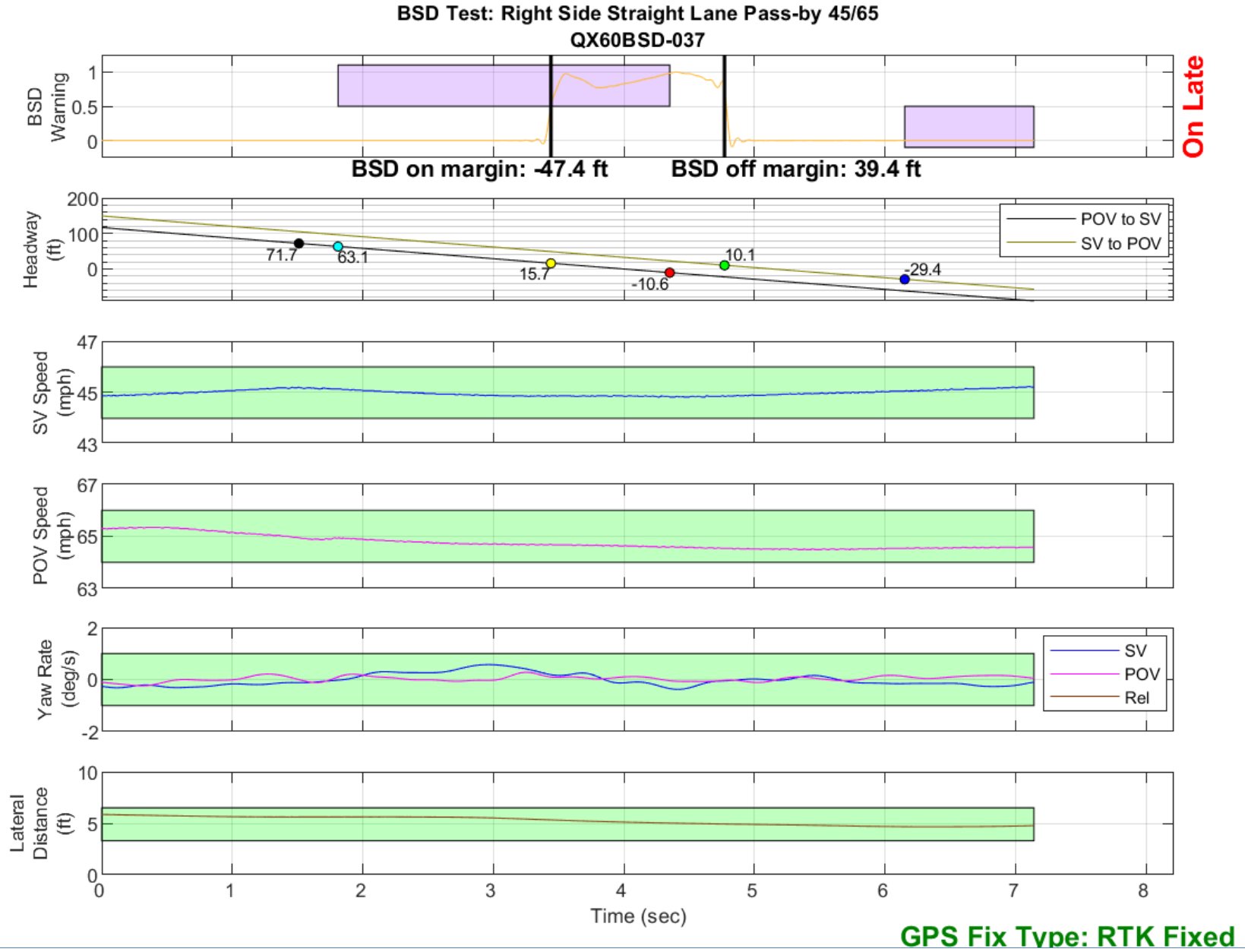


Figure D69. BSD Run 37, Straight Lane Pass-by, SV 45 mph, POV 65 mph

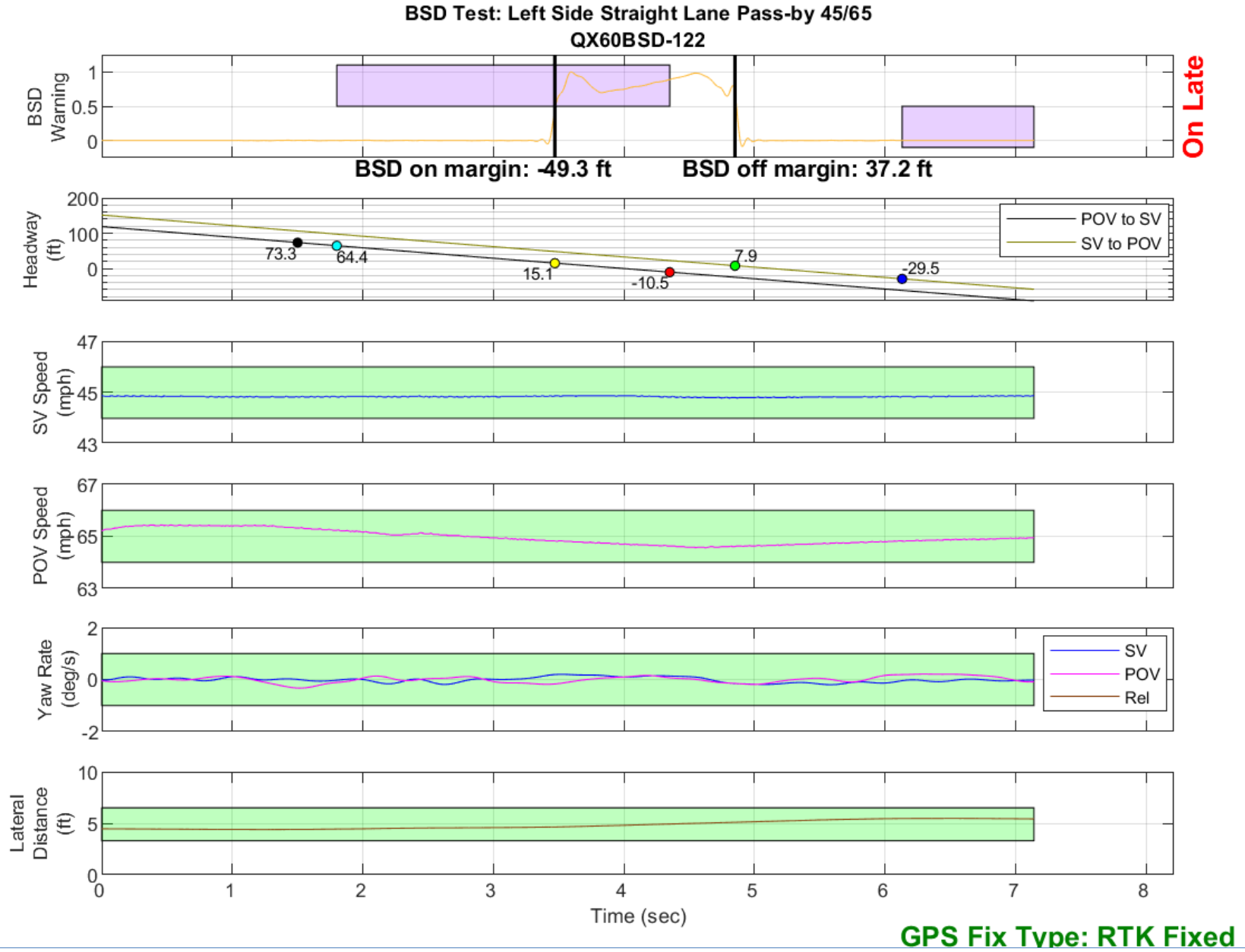


Figure D70. BSD Run 122, Straight Lane Pass-by, SV 45 mph, POV 65 mph

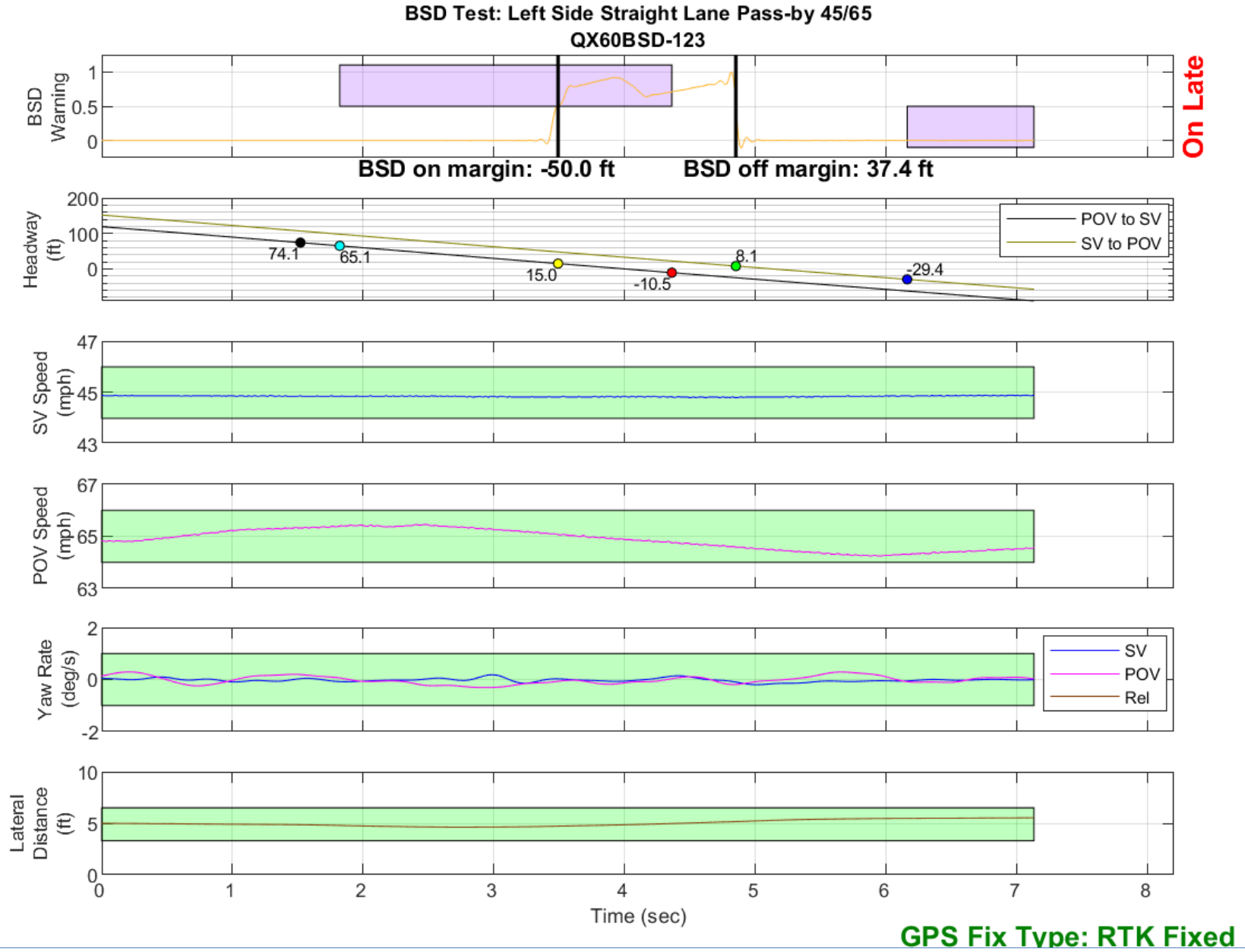


Figure D71. BSD Run 123, Straight Lane Pass-by, SV 45 mph, POV 65 mph

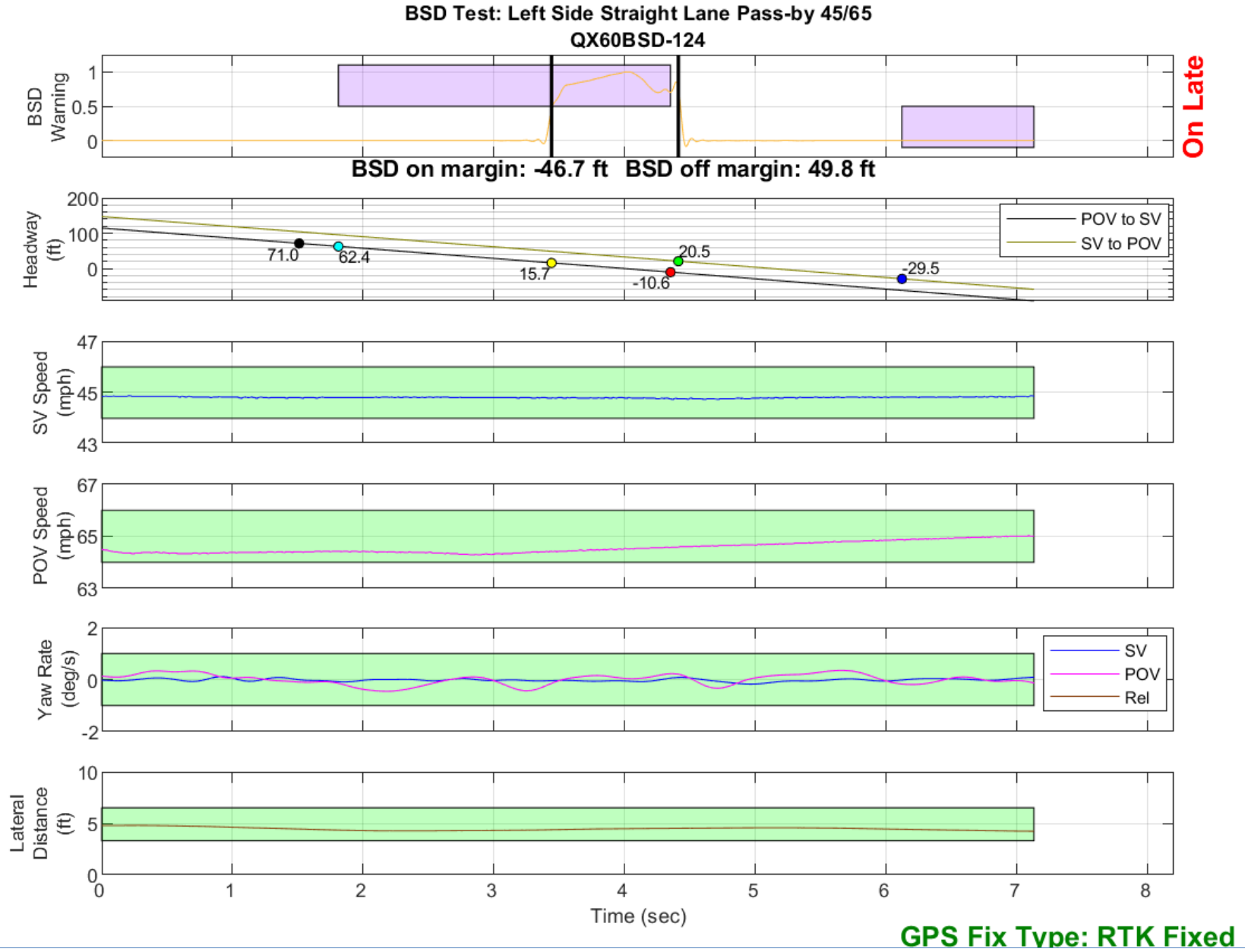


Figure D72. BSD Run 124, Straight Lane Pass-by, SV 45 mph, POV 65 mph

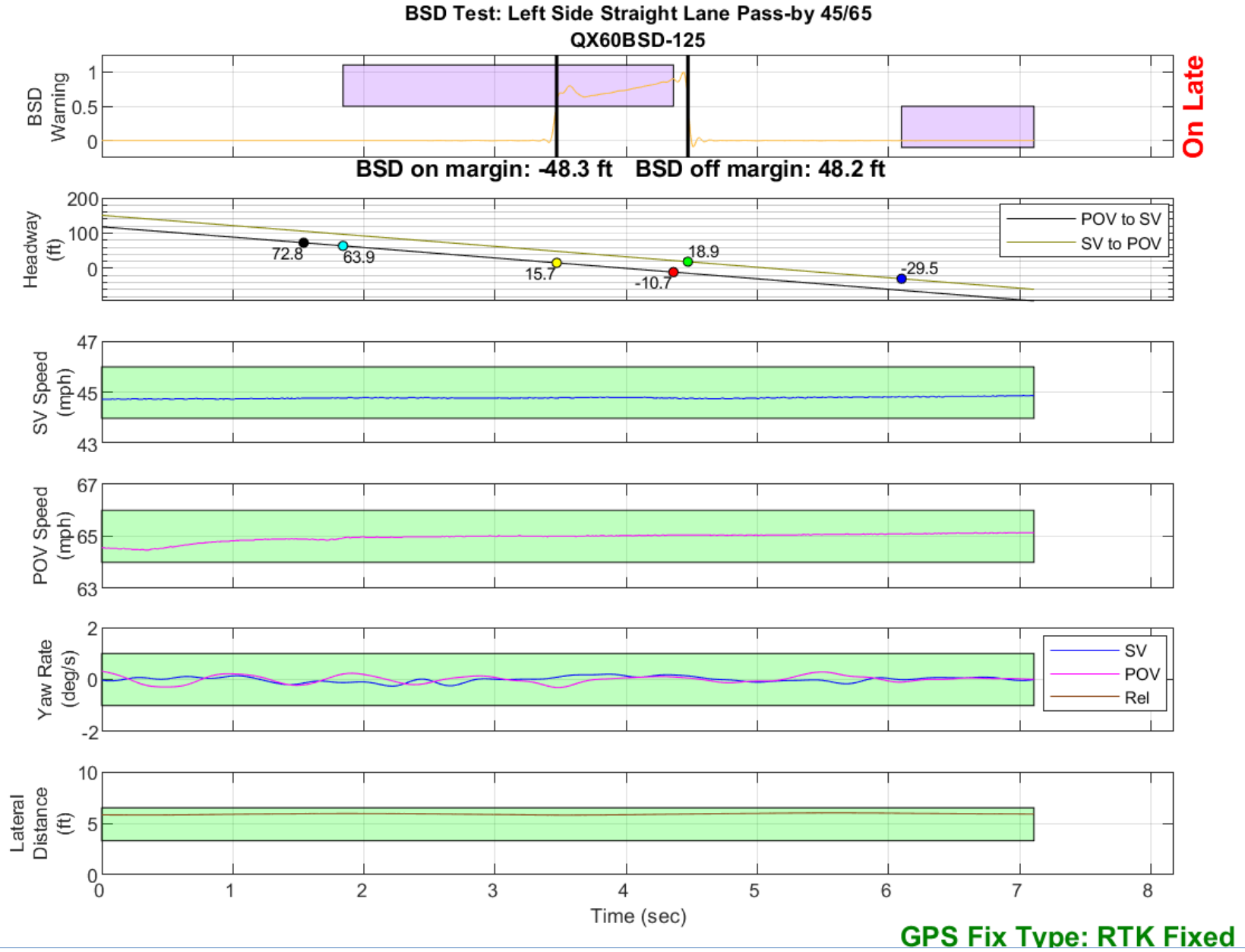


Figure D73. BSD Run 125, Straight Lane Pass-by, SV 45 mph, POV 65 mph

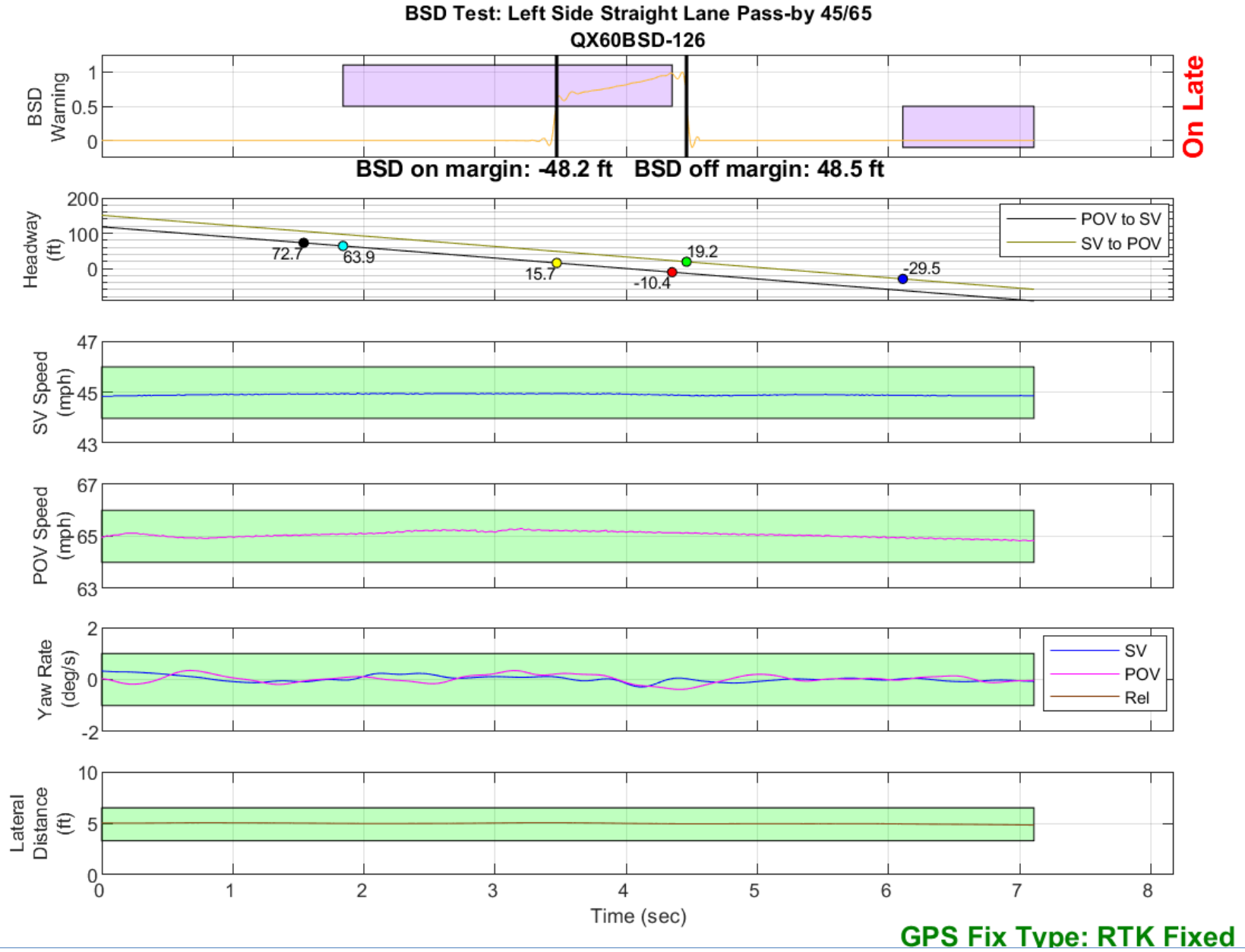


Figure D74. BSD Run 126, Straight Lane Pass-by, SV 45 mph, POV 65 mph

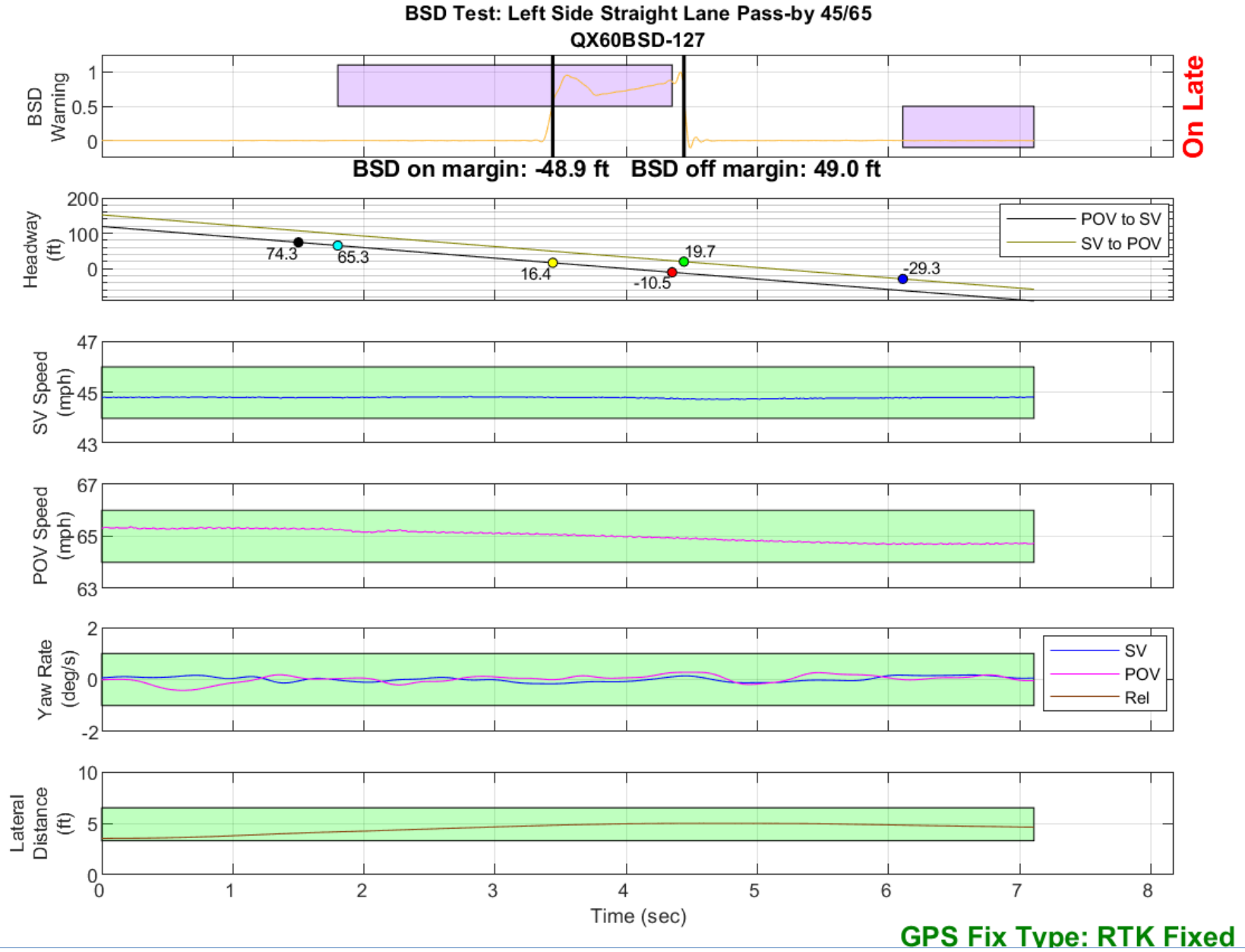


Figure D75. BSD Run 127, Straight Lane Pass-by, SV 45 mph, POV 65 mph

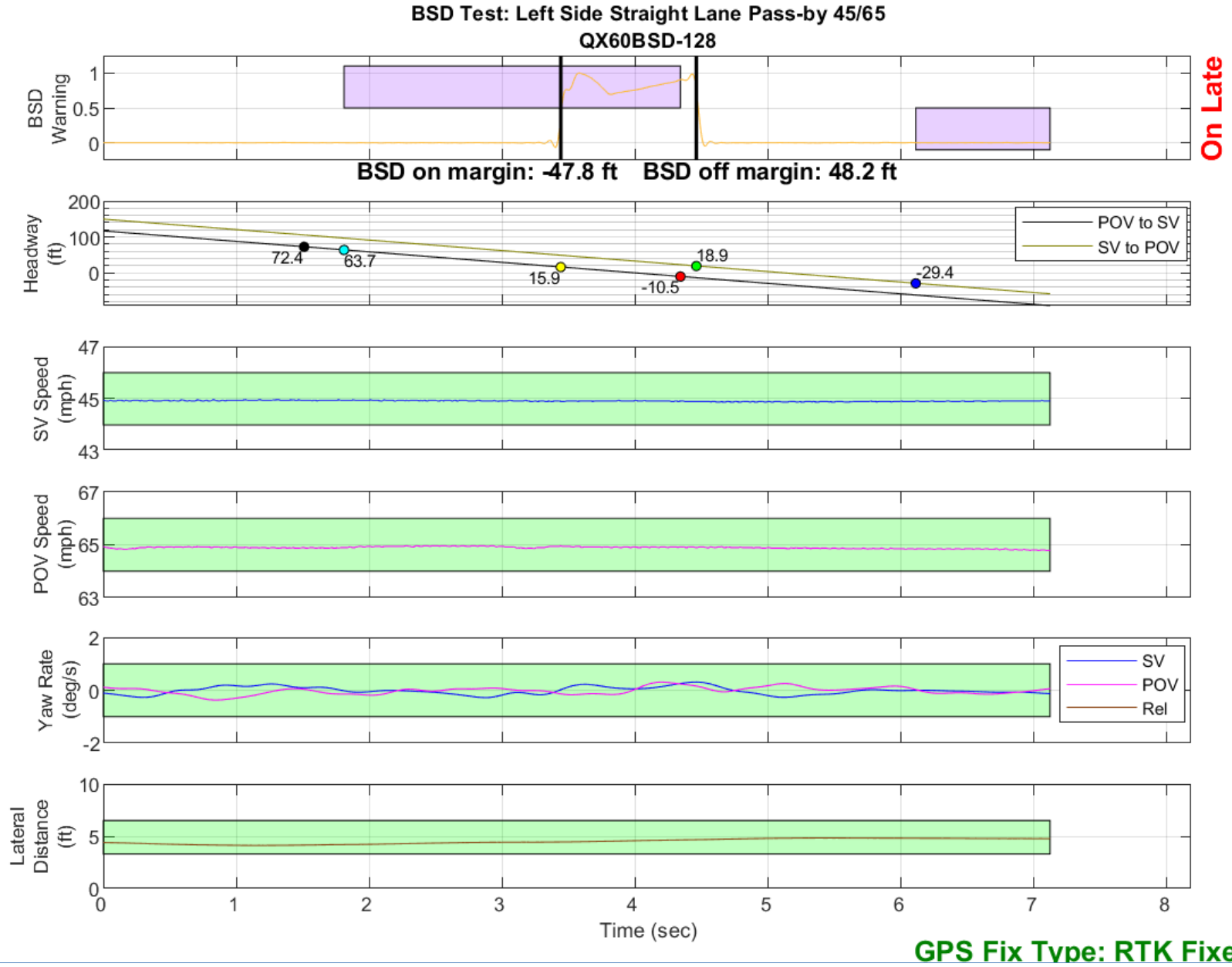


Figure D76. BSD Run 128, Straight Lane Pass-by, SV 45 mph, POV 65 mph