NEW CAR ASSESSMENT PROGRAM
LANE DEPARTURE WARNING CONFIRMATION TEST
NCAP-DRI-LDW-21-06

2021 Honda Passport 2WD EX-L

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28 January 2021

Final Report

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

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
New Car Assessment Program
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.

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16. Abstract These tests were conducted on the subject 2021 Honda Passport 2WD EX-L in accordance with the specifications of the New Car Assessment Program's (NCAP) most current Test Procedure in docket NHTSA-2006-26555-0135 to confirm the performance of a Lane Departure Warning system. The vehicle passed the requirements of the test for all three lane marking types and for both directions.		
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Section I

INTRODUCTION

The purpose of the testing reported herein was to confirm the performance of a Lane Departure Warning (LDW) system installed on a 2021 Honda Passport 2WD EX-L. The LDW system for this vehicle provides both a visual and haptic alert. The visual alert is displayed in the center of the instrument panel. The haptic alert is provided by the steering wheel in the form of a low amplitude oscillation. The vehicle passed the requirements of the test for all three lane marking types and for both directions.

The test procedure is described in detail in the National Highway Traffic Safety Administration (NHTSA) document "LANE DEPARTURE WARNING SYSTEM CONFIRMATION TEST" dated February of 2013 (Docket No. NHTSA-2006-26555-0135). Its purpose is to confirm the performance of LDW systems installed on light vehicles with gross vehicle weight ratings (GVWR) of up to 10,000 lbs. Current LDW technology relies on sensors to recognize a lane delimiting edge line. As such, the test procedures described in the document rely on painted lines, taped lines, or Botts Dots being present on the test course to emulate those found on public roadways. Although it is impossible to predict what technologies could be used by future LDW systems (e.g., magnetic markers, RADAR reflective striping, ultra violet paint, infrared, etc.), it is believed that minor modifications to these procedures, when deemed appropriate, could be used to accommodate the evaluation of alternative or more advanced LDW systems.

Section II

DATA SHEETS

LANE DEPARTURE WARNING

DATA SHEET 1: TEST RESULTS SUMMARY

(Page 1 of 1)

2021 Honda Passport 2WD EX-L

VIN: *5FNYF7H53MB00xxxx*

Test Date: *1/20/2021*

Lane Departure Warning setting: *Road Departure Mitigation: Warning Only*

Test 1 – Continuous White Line	Left: *Pass*	Right: *Pass*
Test 2 – Dashed Yellow Line	Left: *Pass*	Right: *Pass*
Test 3 – Botts Dots	Left: *Pass*	Right: *Pass*

Overall: *Pass*

Notes:

LANE DEPARTURE WARNING

DATA SHEET 2: VEHICLE DATA

(Page 1 of 1)

2021 Honda Passport 2WD EX-L

TEST VEHICLE INFORMATION

VIN: *5FNYF7H53MB00xxxx*

Body Style: *SUV* Color: *Obsidian Blue P.*

Date Received: *1/11/2021* Odometer Reading: *13 mi*

DATA FROM VEHICLE'S CERTIFICATON LABEL

Vehicle manufactured by: *Honda MFG. of Alabama, LLC*

Date of manufacture: *11/'20*

Vehicle Type: *MPV*

DATA FROM TIRE PLACARD

Tires size as stated on Tire Placard: Front: *245/50R20 102H*

Rear: *245/50R20 102H*

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

Rear: *240 kPa (35 psi)*

TIRES

Tire manufacturer and model: *Continental Cross Contact LX Sport*

Front tire size: *245/50R20 102H*

Rear tire size: *245/50R20 102H*

Front tire DOT prefix: *A376 D3K9*

Rear tire DOT prefix: *A376 D3K9*

LANE DEPARTURE WARNING

DATA SHEET 3: TEST CONDITIONS

(Page 1 of 2)

2021 Honda Passport 2WD EX-L

GENERAL INFORMATION

Test date: *1/20/2021*

AMBIENT CONDITIONS

Air temperature: *5.6 C (42 F)*

Wind speed: *2.1 m/s (4.6 mph)*

X Wind speed ≤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.

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)*

LANE DEPARTURE WARNING

DATA SHEET 3: TEST CONDITIONS

(Page 2 of 2)

2021 Honda Passport 2WD EX-L

WEIGHT

Weight of vehicle as tested including driver and instrumentation

Left Front:	*608.7 kg (1342 lb)*	Right Front:	*557.0 kg (1228 lb)*
Left Rear:	*398.3 kg (878 lb)*	Right Rear:	*404.2 kg (891 lb)*
		Total:	*1968.2 kg (4339 lb)*

LANE DEPARTURE WARNING

DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION

(Page 1 of 3)

2021 Honda Passport 2WD EX-L

Name of the LDW option, option package, etc.:

Road Departure Mitigation (RDM) comes standard on all trims as a part of "Honda Sensing"

Type and location of sensor(s) used:

Mono Camera located middle upper windscreen

Lane Departure Warning Setting used in test:

Road Departure Mitigation: Warning Only

How is the Lane Departure Warning presented to the driver?

(Check all that apply)

- **X** Warning light
- ____ Buzzer or audible alarm
- **X** Vibration
- ____ Other ____

Describe the method by which the driver is alerted. For example, if the warning is a light, where is it located, its color, size, words or symbol, does it flash on and off, etc. If it is a sound, describe if it is a constant beep or a repeated beep. If it is a vibration, describe where it is felt (e.g., pedals, steering wheel), the dominant frequency, (and possibly magnitude), the type of warning (light, audible, vibration, or combination), etc.

The driver is alerted with a visual and haptic alert. The visual alert is a warning image displayed in the center of the instrument panel. The image consists of a steering wheel with lane lines on either side and the words "Lane Departure" above. The lane line in the warning image corresponding to the side the vehicle approached is illuminated yellow.
See Appendix A, Figure A12.

The haptic alert is provided by the steering wheel and consists of a low amplitude oscillation.

Is the vehicle equipped with a switch whose purpose is to render LDW inoperable?

X Yes

_____ No

If yes, please provide a full description including the switch location and method of operation, any associated instrument panel indicator, etc.

On the dash to the left of the steering wheel is a button which turns the system on or off. The button has a symbol of a car crossing over dashed lane lines. See Appendix A, Figure A11.

Is the vehicle equipped with a control whose purpose is to adjust the range setting or otherwise influence the operation of LDW?

X Yes

_____ No

If yes, please provide a full description.

The LDW is a subcomponent of the Road Departure Mitigation system. Those settings can be changed using the touch screen display. The menu hierarchy is:

Settings

Vehicle

Driver Assist System Setup

Road Departure Mitigation Setting

Select: Normal, Wide, or Warning (for LDW)

See Appendix A, Figures A9 and A10.

LANE DEPARTURE WARNING

DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION

(Page 3 of 3)

2021 Honda Passport 2WD EX-L

Are there other driving modes or conditions that render LDW inoperable or reduce its effectiveness? **X** Yes / ____ No

If yes, please provide a full description.

- *Driving in bad weather (rain, fog, snow, etc.).*
- *Sudden changes between light and dark, such as an entrance or exit of a tunnel.*
- *There is little contrast between lane lines and the roadway surface.*
- *Driving into low sunlight (e.g., at dawn or dusk).*
- *Strong light is reflected onto the roadway.*
- *Driving in the shadows of trees, buildings, etc.*
- *Shadows of adjacent objects are parallel to lane markings.*
- *Roadway objects or structures are misinterpreted as lane markers.*
- *Reflections on the interior of the windshield.*
- *Driving at night or in a dark condition such as a tunnel.*

System limitations are described in the Owner's Manual, pages 471 and 472, shown in Appendix B, pages B-9 and B-10.

Notes:

Section III

TEST PROCEDURES

A. Test Procedure Overview

Each LDW test involved one of three lane marking types: solid white lines, dashed yellow lines, or Botts Dots. Lane departures were done both to the left and to the right, and each test condition was repeated five times, as shown in Table 1.

Table 1. LDW Test Matrix

Lane Geometry	Line Type	Departure Direction	Number of Trials
Straight	Solid	L	5
		R	5
	Dashed	L	5
		R	5
	Botts Dots	L	5
		R	5

Prior to the start of a test series involving a given lane marking type and departure direction combination, the accuracy of the distance to lane marking measurement was verified. This was accomplished by driving the vehicle to the approximate location at which the lane departure would occur and placing the tire at the lane marking edge of interest (i.e., distance to lane marking = 0). The real-time display of distance to the lane marking was then observed to verify that the measured distance was within the tolerance (5 cm). If the measured distance was found to be greater than the tolerance, the instrumentation setup was checked and corrected, if necessary. If the measured distance was found to be within the tolerance, the instrumentation setup was considered appropriate and the test series was begun.

To begin the maneuver, the vehicle was accelerated from rest to a test speed of 72.4 km/h (45 mph), while being driven in a straight line parallel to the lane marking of interest, with the centerline of the vehicle approximately 1.83 m (6.0 ft) from the lane edge (i.e., such that the vehicle would pass through the center of the start gate). The test speed was achieved at least 60 m (200 ft) before the start gate was reached. Striking any start gate cones was not permitted, and any run in which a cone was struck was considered to be invalid. Also, during the initialization and test phases, the test driver avoided using turn signals and avoided applying any sudden acceleration, sudden steering, or sudden braking, and any use of the turn signals, sudden acceleration, sudden steering, or sudden braking invalidated the test trial.

Data collection began with the vehicle at least 60 m (200 ft) from the start gate, which was configured using a pair of non-reflective, low-contrast color traffic cones. A second set of cones, placed 6 m (20 ft) longitudinally before the start gate, was used to guide the driver into the start gate. The lateral width between the cone pairs was 20 cm (8 in) greater than the width of the vehicle, and the centerline of each pair was laterally offset from the lane marking by 1.8 m (6 ft).

Once the driver passed the gate, the driver manually input sufficient steering to achieve a lane departure with a target lateral velocity of 0.5 m/s with respect to the lane line. As shown in Figure 1, two additional non-reflective cones were used to guide the driver in making this steering maneuver. Throughout the maneuver, the driver modulated the throttle or used cruise control, as appropriate, such that vehicle speed remained at constant speed. The test was considered complete when the vehicle crossed at least 1 m (3.3 ft) over the lane edge boundary.

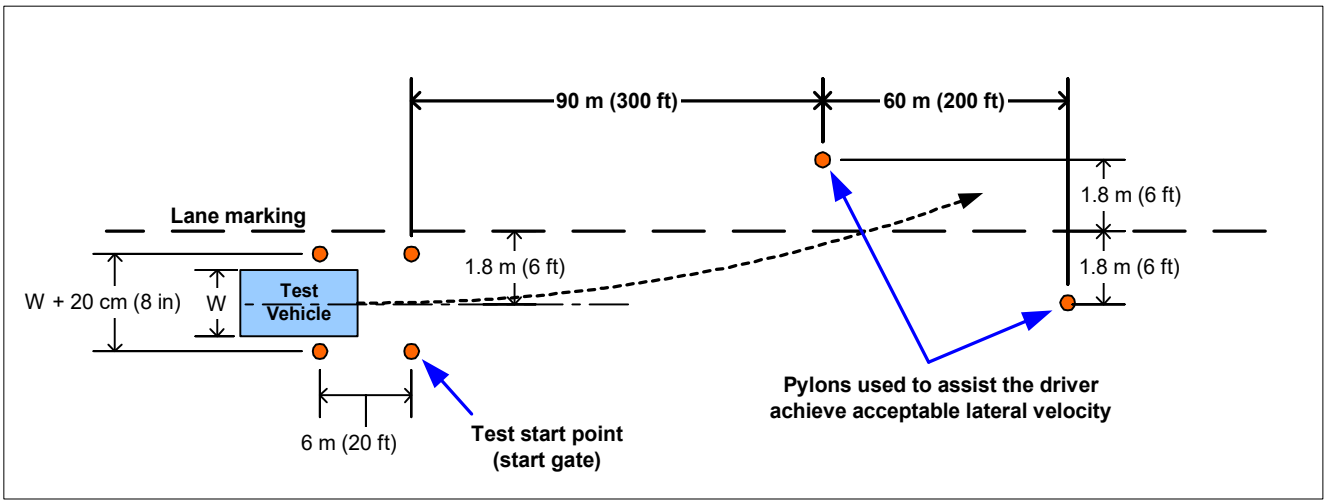


Figure 1. Position of Cones Used to Assist Driver

Data collected included vehicle speed, position, and yaw rate. In addition to cone strikes, vehicle speed and yaw rate data were used to identify invalid runs as described in Section C below. Data from trials where speed or yaw rate were outside of the performance specification were not considered valid.

B. Lane Delineation Markings

The New Car Assessment Program's Test Procedure for the confirmation of a Lane Departure Warning system contains a requirement that all lane markings meet United States Department of Transportation (USDOT) specifications as described in the Manual on Uniform Traffic Control Devices (MUTCD) and be considered in "very good condition".

1. Lane Marker Width

The width of the edge line marker was 10 to 15 cm (4 to 6 in). This is considered to be a normal width for longitudinal pavement markings under Section 3A.05 of the MUTCD.

2. Line Marking Color and Reflectivity

Lane marker color and reflectivity met all applicable standards. These standards include those from the International Commission of Illumination (CIE) for color and the American Society for Testing and Materials (ASTM) on lane marker reflectance.

3. Line Styles

The tests described in this document required the use of three lane line configurations: continuous solid white, discontinuous dashed yellow, and discontinuous with raised pavement markers.

- Continuous White Line

  A continuous white line is defined as a white line that runs for the entire length of the test course.

- Dashed Yellow Line

  As stated in the MUTCD, and as shown in Figure 2, a discontinuous dashed yellow line is defined as by a series of 3 m (10 ft) broken (dashed) yellow line segments, spaced 9.1 m (30 ft) apart.

- Raised Pavement Marker Line (Botts Dots)

  California Standard Plans indicates raised pavement markers are commonly used in lieu of painted strips for marking roads in California. Other states, mainly in the southern part of the United States, rely on them as well. These markers may be white or yellow, depending on the specific application, following the same basic colors of their analogous white and yellow painted lines. Following the California 2006 Standard Plans, three types of raised pavement markings are used to form roadway lines. It is believed that these types of roadway markings are the hardest for an LDW sensor system to process. Type A and Type AY are non-reflective circular domes that are approximately 10 cm (4 in) in diameter and approximately 1.8 cm (0.7 in) high. Type C and D are square markings that are retro reflective in two directions measuring approximately 10 x 10 x 5 cm (4 x 4 x 0.5 in), and Type G and H that are the same as C and D only retro reflective in a single direction.

For the tests described in this document, raised pavement markers were set up following California Standard Plan A20A, Detail 4, as shown in Figure 3. Note that in this figure, the squares are Type D yellow reflectors and the circles are yellow Type AY discs.

Figure 2. MUTCD Discontinuous Dashed Line Specifications

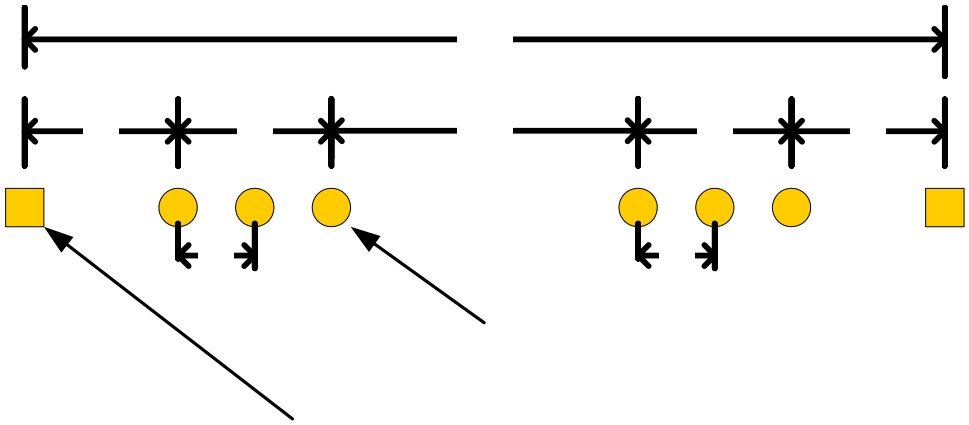


Figure 3. California Standard Plan A20A, Detail 4

C. Test Validity

1. Speed

All LDW tests were conducted at 72.4 km/h (45 mph). Test speed was monitored and a test was considered valid if the test speed remained within ± 2 km/h (± 1.2 mph) of the 72.4 km/h (45 mph) target speed. It was required that the speed must remain within this window from the start of the test until any part of the vehicle crossed a lane line by 1 m (3.3 ft) or more.

2. Lateral Velocity

All tests were conducted with a lateral velocity of 0.1 to 0.6 m/s (0.3 to 2.0 ft/s), measured with respect to the lane line at the time of the alert. To assist the test driver in being able to efficiently establish the target lateral velocity, cones were positioned in the manner shown in Figure 1.

3. Yaw Rate

It was required that the magnitude of the vehicle's yaw rate could not exceed 1.0 deg/sec at any time during lane departure maneuver, from the time the vehicle passes through the start gate to the instant the vehicle has crossed a lane line by 1 m (3.3 ft).

D. Pass/Fail Criteria

The measured test data were used to determine the pass/fail outcome for each trial. The outcome was based on whether the LDW produced an appropriate alert during the maneuver. In the context of this test procedure, a lane departure is said to occur when any part of the two-dimensional polygon used to represent the test vehicle breaches the inboard lane line edge (i.e., the edge of the line close to the vehicle before the departure occurs). In the case of tests performed in this procedure, the front corner of the polygon, defined as the intersection of the center of the front wheels (longitudinally) with the outboard edge of the front tire (laterally), crossed the line edge first. So, for example, if the vehicle departed its lane to the left, the left front corner of the polygon would first breach the lane line edge.

For an individual trial to be considered a "pass":

- Test speed, lateral velocity, and yaw rate validity conditions must be satisfied.
- The LDW alert must not occur when the lateral position of the vehicle is greater than 0.75 m (2.5 ft) from the lane line edge (i.e., prior to the lane departure).
- The LDW alert must occur before the lane departure exceeds 0.3 m (1.0 ft).

For an overall, "Pass" the LDW system must satisfy the pass criteria for 3 of 5 individual trials for each combination of departure direction and lane line type (60%), and pass 20 of the 30 trials overall (66%).

E. Instrumentation

Table 2 lists the sensors, signal conditioning, and data acquisition equipment used for these tests.

Table 2. Test Instrumentation and Equipment

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Tire Pressure Gauge	Vehicle Tire Pressure	0-100 psi 0-690 kPa	0.5 psi 3.45 kPa	Ashcroft, D1005PS	17042707002	By: DRI Date: 8/18/2020 Due: 8/18/2021
Platform Scales	Vehicle Total, Wheel, and Axle Load	8000 lb 35.6 kN	±1.0% of applied load	Intercomp, SWII	0410MN20001	By: DRI Date: 4/20/2020 Due: 4/20/2021
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	Latitude: ±90 deg Longitude: ±180 deg Altitude: 0-18 km Velocity: 0-1000 knots Accel: ±100 m/s^2 Angular Rate: ±100 deg/s Angular Disp: ±180 deg	Position: ±2 cm Velocity: 0.05 km/h Accel: ≤ 0.01% of full range Angular Rate: ≤ 0.01% of full range Roll/Pitch Angle: ±0.03 deg Heading Angle: ±0.1 deg	Oxford Technical Solutions (OXTS), Inertial+	2258	By: Oxford Technical Solutions[1] Date: 5/3/2019 Due: 5/3/2021
Real-Time Calculation of Position and Velocity Relative to Lane Markings	Distance and velocity to lane markings	Lateral Lane Dist: ±30 m Lateral Lane Velocity: ±20 m/sec	Lateral Distance to Lane Marking: ±2 cm Lateral Velocity to Lane Marking: ±0.02m/sec	Oxford Technical Solutions (OXTS), RT-Range	97	N/A

[1] Oxford Technical Solutions recommends calibration every two years.

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
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
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
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).	D-Space Micro-Autobox II 1401/1513	
		Base Board	549068
		I/O Board	588523

For systems that implement audible or haptic alerts, part of the pre-test instrumentation verification process is to determine the tonal frequency of the audible warning or the vibration frequency of the tactile warning through use of the PSD (Power Spectral Density) function in Matlab. This is accomplished in order to identify the center frequency around which a band-pass filter is applied to subsequent audible or tactile warning data so that the beginning of such warnings can be programmatically determined. The band-pass filter used for these warning signal types is a phaseless, forward-reverse pass, elliptical (Cauer) digital filter, with filter parameters as listed in Table 3.

Table 3. Audible and Tactile Warning Filter Parameters

Warning Type	Filter Order	Peak-to-Peak Ripple	Minimum Stop Band Attenuation	Passband Frequency Range
Audible	5^{th}	3 dB	60 dB	Identified Center Frequency ± 5%
Tactile	5^{th}	3 dB	60 dB	Identified Center Frequency ± 20%

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)

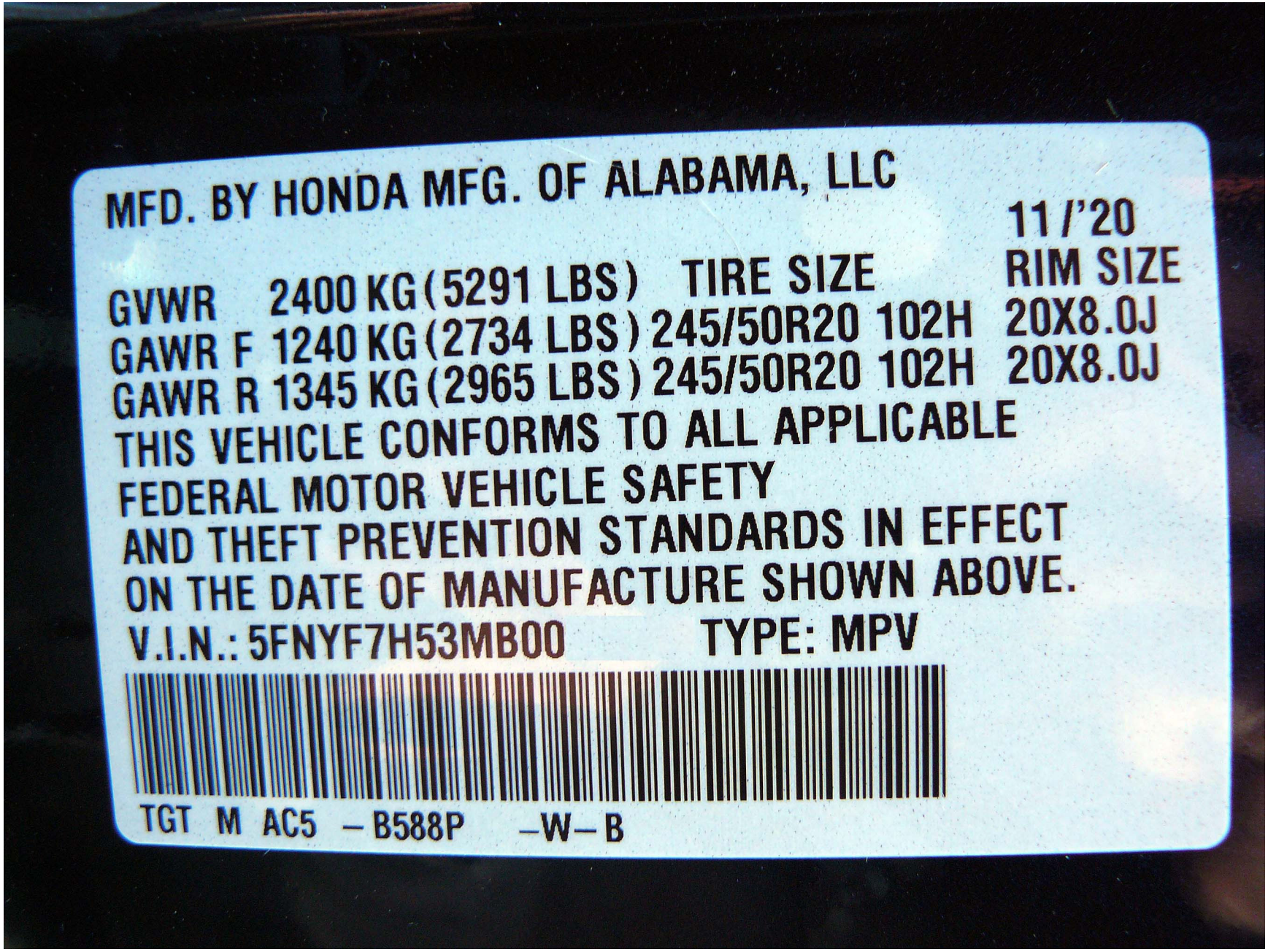


Figure A4. Vehicle Certification Label

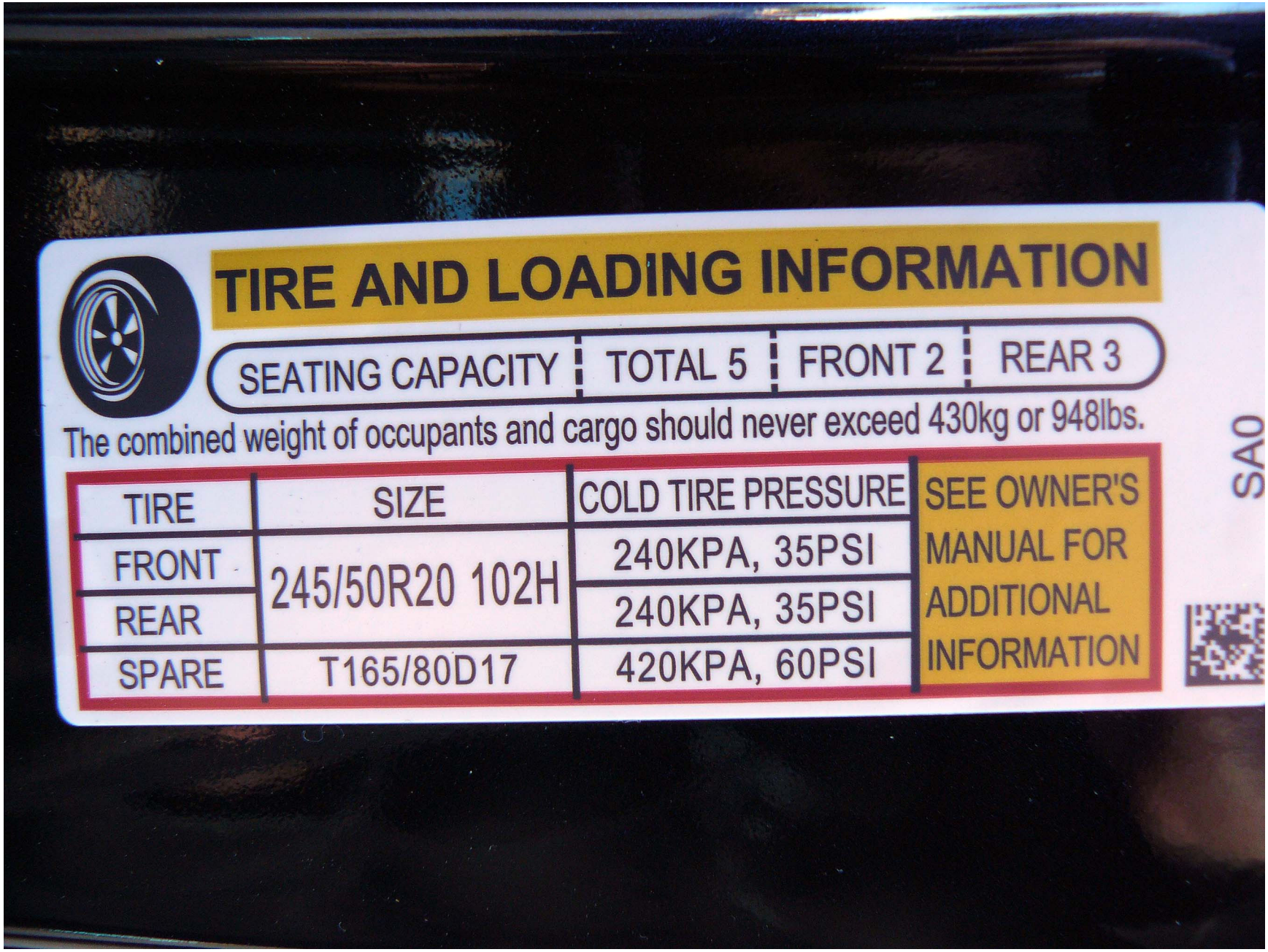
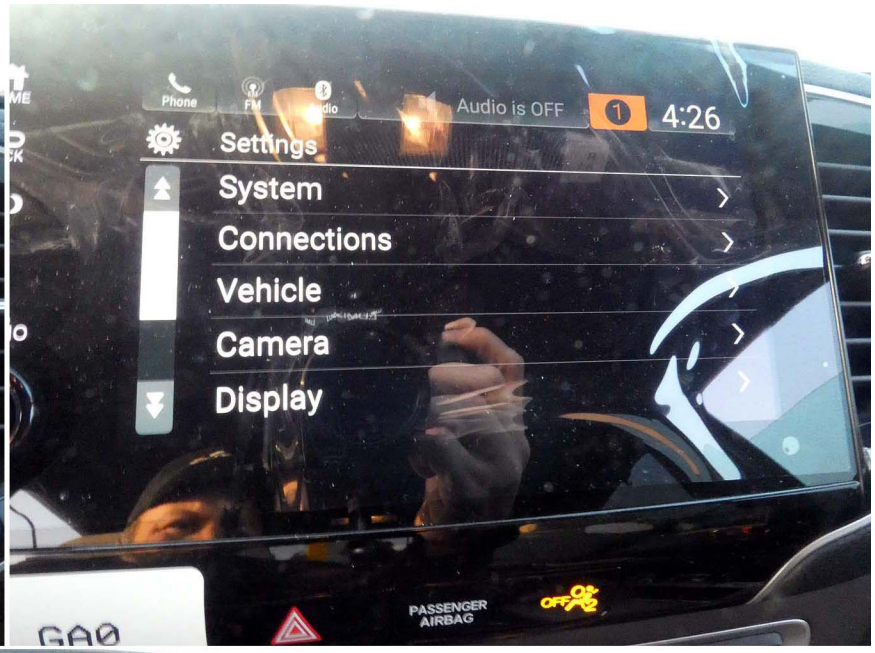


Figure A5. Tire Placard

Figure A6. DGPS, Inertial Measurement Unit, and MicroAutoBox Installed in Subject Vehicle

Figure A7. Sensors for Detecting Haptic and Visual Alerts

Figure A8. Computer Installed in Subject Vehicle



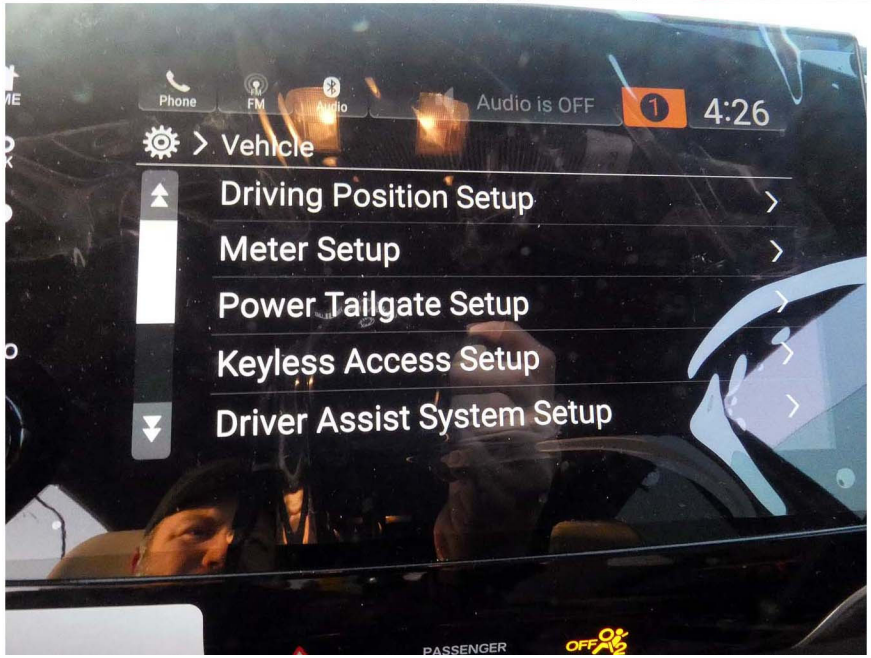


Figure A9. LDW Menus (1 of 2)

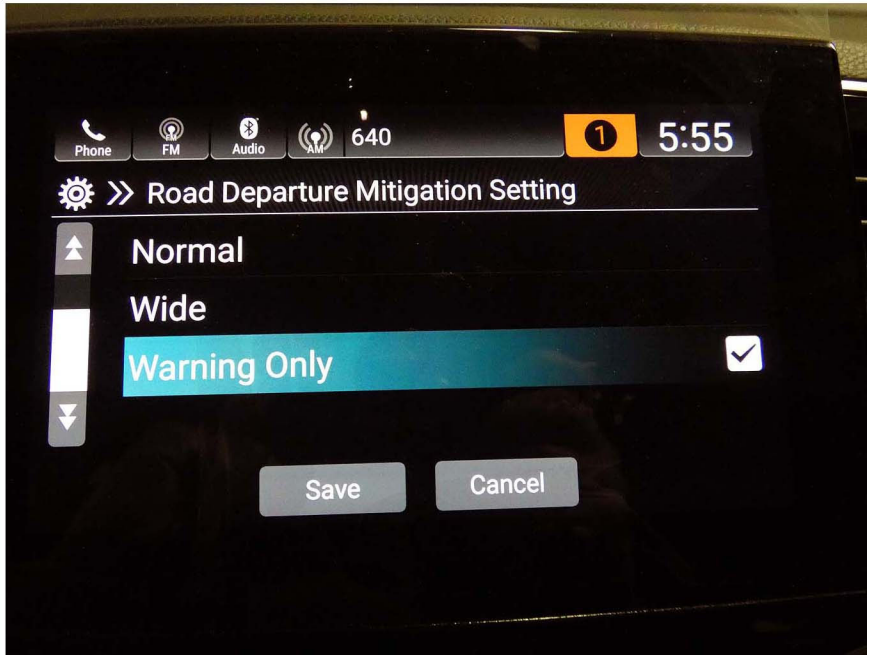


Figure A10. LDW Menus (2 of 2)

Figure A11. LDW On/Off Switch

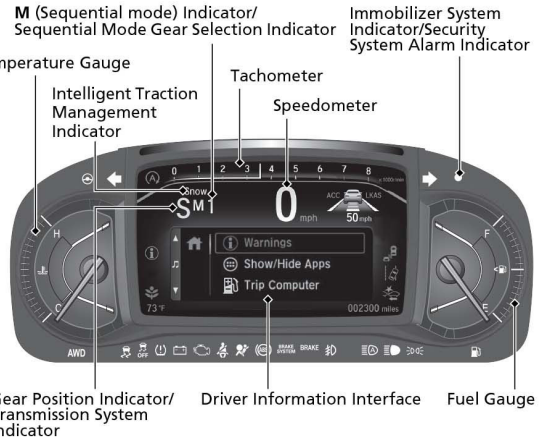
Figure A12. Visual Alert

APPENDIX B

Excerpts from Owner’s Manual

Instrument Panel P. 77

Gauges P. 106/Driver Information Interface P. 107/System Indicators P. 78



System Indicators

- Malfunction Indicator Lamp
- Charging System Indicator
- Electric Power Steering (EPS) System Indicator
- Low Fuel Indicator
- Vehicle Stability Assist™ (VSA®) System Indicator
- VSA® **OFF** Indicator
- Parking Brake and Brake System Indicator (Amber) (U.S. / Canada)
- Anti-lock Brake System (**ABS**) Indicator
- Blind spot information System Indicator*
- ACC — Adaptive Cruise Control (**ACC**) Indicator (Green/ Amber)

System Indicators

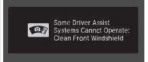
- LKAS — Lane Keeping Assist System (**LKAS**) Indicator (Green/ Amber)

Lights Indicators

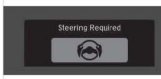
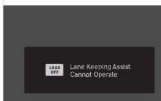
- Lights On Indicator
- High Beam Indicator
- Fog Light Indicator
- Auto High-Beam Indicator

System Indicators

- Turn Signal and Hazard Warning Indicators
- Low Tire Pressure/ TPMS Indicator
- BRAKE (U.S. / Canada) — Parking Brake and Brake System Indicator (Red)
- Seat Belt Reminder Indicator
- Supplemental Restraint System Indicator
- Econ Mode Indicator
- Auto Idle Stop System Indicator (Amber)/ Auto Idle Stop Indicator (Green)
- System Message Indicator
- Road Departure Mitigation (RDM) Indicator
- Collision Mitigation Braking System™ (CMBS™) Indicator
- AWD — All-wheel drive system (AWD) Indicator*

Indicator	Name	On/Blinking	Explanation	Message
	Road Departure Mitigation (RDM) Indicator	• Comes on for a few seconds when you change the power mode to ON, then goes off. • Comes on if there is a problem with the RDM system.	• **Stays on constantly** - Have your vehicle checked by a dealer.	
		• Comes on when the RDM system shuts itself off.	• **Stays on** - The temperature inside the camera is too high. Use the climate control system to cool down the camera. The system activates when the temperature inside the camera cools down. ➡ **Front Sensor Camera** P. 473	
			• **Stays on** - The area around the camera is blocked by dirt, mud, etc. Stop your vehicle in a safe place, and wipe it off with a soft cloth. • Have your vehicle checked by a dealer if the indicator and message come back on after you cleaned the area around the camera. ➡ **Front Sensor Camera** P. 473	

Continued

Message	Condition	Explanation
	**Lane Keeping Assist System (LKAS)** • Appears when the vehicle is driving out of a detected lane. The steering wheel vibrates rapidly. **Road Departure Mitigation (RDM) System** • Appears when the vehicle is driving out of a detected lane. **When you selected Warning Only** - The steering wheel vibrates rapidly when the vehicle is drifting out of a detected lane. **When you selected Normal or Wide** - The steering wheel vibrates rapidly when the vehicle is drifting out of a detected line. The system also steers the vehicle to help you remain within your driving lane.	• Keep the vehicle within the lane you are driving. ➡ **Lane Keeping Assist System (LKAS)** P. 459 • Keep the vehicle within the lane you are driving. ➡ **Road Departure Mitigation (RDM) System** P. 468 • You can change the setting for the road departure mitigation system. **Normal**, **Wide**, and **Warning Only** can be selected. ➡ **Customized Features** P. 324
	• Blinks when you fail to steer the vehicle. The beeper sounds simultaneously.	• Operate the steering wheel to resume the LKAS.
	• Appears when the LKAS is in operation, or the LKAS button is pressed, but there is a problem with a system related to the LKAS. The LKAS cancels automatically. The beeper sounds simultaneously if selected by customization.	• If any other system indicators come on, such as the VSA®, ABS and brake system, take appropriate action. ➡ **Indicators** P. 78

Continued

Setup Group	Customizable Features		Description	Selectable Settings
Vehicle	Keyless Access Setup	Remote Start System On/Off	Turns the remote engine start feature on and off.	ON*1/OFF
		Walk Away Auto Lock	Changes the settings for the automatic locking the doors when you walk away from the vehicle while carrying the remote.	Enable/Disable*1
	Driver Assist System Setup	Forward Collision Warning Distance	Changes at which distance CMBS™ alerts.	Long/Normal*1/Short
		ACC Forward Vehicle Detect Beep	Causes the system to beep when the system detects a vehicle, or when the vehicle goes out of the ACC range.	ON/OFF*1
		Road Departure Mitigation Setting	Changes the setting for the road departure mitigation system.	Normal*1/Wide/Warning Only
		Lane Keeping Assist Suspend Beep	Causes the system to beep when the LKAS is suspended.	ON/OFF*1
		Blind Spot Information*	Changes the setting for the blind spot information.	Audible and Visual Alert*1/Visual Alert/OFF

*1:Default Setting

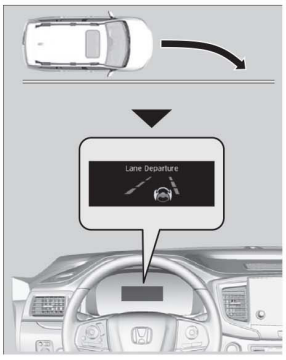
* Not available on all models

Continued

Road Departure Mitigation (RDM) System

Alerts and helps to assist you when the system detects a possibility of your vehicle unintentionally crossing over detected lane markings and/or leaving the roadway altogether.

How the System Works



The front camera behind the rearview mirror monitors left and right lane markings (in white or yellow). If your vehicle is getting too close to detected lane markings without a turn signal activated, the system, in addition to a visual alert, applies steering torque and alerts you with rapid vibrations on the steering wheel, to help you remain within the detected lane.

Customized Features P. 324

As a visual alert, the **Lane Departure** message appears on the driver information interface.

If the system determines that its steering input is insufficient to keep your vehicle on the roadway, it may apply braking.

▶ Braking is applied only when the lane markings are solid continuous lines.

The system cancels assisting operations when you turn the steering wheel to avoid crossing over detected lane markings.

If the system operates several times without detecting driver response, the system beeps to alert you.

Road Departure Mitigation (RDM) System

Important Safety Reminder

Like all assistance systems, the RDM system has limitations.

Over-reliance on the RDM system may result in a collision. It is always your responsibility to keep the vehicle within your driving lane.

The RDM system only alerts you when lane drift is detected without a turn signal in use. The RDM system may not detect all lane markings or lane or roadway departures; accuracy will vary based on weather, speed and lane marker condition. It is always your responsibility to safely operate the vehicle and avoid collisions.

You can read about handling information for the camera equipped with this system.

Front Sensor Camera P. 473

The RDM system may not work properly or may work improperly under the certain conditions:

RDM Conditions and Limitations P. 471

There are times when you may not notice RDM functions due to your operation of the vehicle, or road surface conditions.

How the System Activates

The system becomes ready to start searching for lane markings when all the following conditions are met:

- The vehicle is traveling between about 45 and 90 mph (72 and 145 km/h).
- The vehicle is on a straight or slightly curved road.
- The turn signals are off.
- The brake pedal is not depressed.
- The wipers are not in continuous operation.
- The vehicle is not accelerating or braking, and the steering wheel is not being turned.
- The system makes a determination that the driver is not actively accelerating, braking or steering.

How the System Activates

The RDM system may automatically shut off and the indicator comes and stays on.

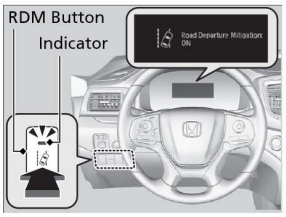
Indicators P. 78

RDM system function can be impacted when the vehicle is:

- Not driven within a traffic lane.
- Driven on the inside edge of a curve, or outside of a lane.
- Driven in a narrow lane.

Continued

RDM On and Off



Press the RDM button to turn the system on and off.

▶ The indicator in the button comes on and the message appears on the driver information interface when the system is on.

RDM On and Off

When you have selected **Warning Only** from the customized options using the audio/information screen, the system does not operate the steering wheel and braking.

Customized Features P. 324

RDM Conditions and Limitations

The system may not properly detect lane markings and the position of your vehicle under certain conditions. Some examples of these conditions are listed below.

Environmental conditions

- Driving in bad weather (rain, fog, snow, etc.).
- Sudden changes between light and dark, such as an entrance or exit of a tunnel.
- There is little contrast between lane lines and the roadway surface.
- Driving into low sunlight (e.g., at dawn or dusk).
- Strong light is reflected onto the roadway.
- Driving in the shadows of trees, buildings, etc.
- Shadows of adjacent objects are parallel to lane markings.
- Roadway objects or structures are misinterpreted as lane markers.
- Reflections on the interior of the windshield.
- Driving at night or in a dark condition such as a tunnel.

Continued

■ **Roadway conditions**

- Driving on a snowy or wet roadway (obscured lane marking, vehicle tracks, reflected lights, road spray, high contrast).
- Driving on a road with temporary lane markings.
- Faint, multiple, or varied lane markings are visible on the roadway due to road repairs or old lane markings.
- The roadway has merging, split, or crossing lines (e.g., such as at an intersection or crosswalk).
- The lane markings are extremely narrow, wide, or changing.
- The vehicle in front of you is driving near the lane lines.
- The road is hilly or the vehicle is approaching the crest of a hill.
- Driving on rough or unpaved roads, or over bumpy surfaces.
- When objects on the road (curb, guard rail, pylons, etc.) are recognized as white lines (or yellow lines).
- Driving on roads with double lines.

■ **Vehicle conditions**

- Headlight lenses are dirty or the headlights are not properly adjusted.
- The outside of the windshield is streaked or blocked by dirt, mud, leaves, wet snow, etc.
- The inside of the windshield is fogged.
- The camera temperature gets too high.
- An abnormal tire or wheel condition (wrong sized, varied size or construction, improperly inflated, compact spare tire, etc.).
- The vehicle is tilted due to a heavy load or suspension modifications.
- When tire chains are installed.
- The vehicle is towing a trailer.

APPENDIX C

Run Log

Subject Vehicle: **2021 Honda Passport 2WD EX-L** Test Date: **1/20/2021**

Driver: **S. Rhim** **Note: For Distance at Warning, positive values indicate inside the lane**

Notes: Due to difficulties with reliably registering haptic alerts, only the visual alerts were analyzed.

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Visual Alert (ft)	Distance at Haptic Alert (ft)	Pass/Fail	Notes
1	**Botts**	**Left**	Y	0.09		Pass	Haptic warning cannot be captured properly
2			Y	0.10		Pass	
3			Y	0.17		Pass	
4			Y	0.19		Pass	
5			Y	0.16		Pass	
6			Y	0.24		Pass	
7			Y	0.15		Pass	
8	**Botts**	**Right**	N				Wrong map file
9			Y	0.35		Pass	
10			Y	0.38		Pass	
11			Y	0.42		Pass	
12			Y	0.37		Pass	
13			Y	0.33		Pass	
14			Y	0.12		Pass	
15			Y	0.41		Pass	

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Visual Alert (ft)	Distance at Haptic Alert (ft)	Pass/Fail	Notes
16			N				Wrong map file
17			N				Wrong map file
18			N				Wrong map file
19			Y	0.59		Pass	
20	**Solid**	**Right**	Y	0.58		Pass	
21			Y	0.51		Pass	
22			Y	0.37		Pass	
23			Y	0.25		Pass	
24			Y	0.35		Pass	
25			Y	0.49		Pass	
26			Y	0.38		Pass	
27			Y	0.42		Pass	
28			Y	0.57		Pass	
29	**Solid**	**Left**	Y	0.56		Pass	
30			Y	0.59		Pass	
31			Y	0.47		Pass	
32			Y	0.49		Pass	
33			Y	0.71		Pass	
34			Y	0.66		Pass	
35	**Dashed**	**Left**	Y	0.75		Pass	
36			Y	0.76		Pass	
37			Y	0.69		Pass	
38			Y	0.79		Pass	

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Visual Alert (ft)	Distance at Haptic Alert (ft)	Pass/Fail	Notes
39	**Dashed**	**Left**	Y	0.82		Pass	
40	**Dashed**	**Right**	N				SV speed
41			N				SV speed
42			Y	0.60		Pass	
43			Y	0.70		Pass	
44			Y	0.68		Pass	
45			Y	0.61		Pass	
46			Y	0.74		Pass	
47			Y	0.74		Pass	
48			Y	0.63		Pass	

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 the Subject Vehicle, as well as pass/fail envelopes and thresholds. The following is a description of data types shown in the time history plots, as well as a description of the color code for data envelopes.

Time History Plot Description

Time history figures include the following sub-plots:

- Warning – Indicates timing of warning issued by LDW system. Depending on the type of LDW alert or instrumentation used to measure the alert, this can be any of the following:
    - Filtered and rectified sound signal
    - Filtered and rectified acceleration (e.g., steering wheel vibration)
    - Light sensor signal
    - Discrete on/off value
- Speed (mph) – Speed of the Subject Vehicle
- Yaw Rate (deg/sec) – Yaw rate of the Subject Vehicle
- Distance to Lane Edge (ft) – Lateral distance (in lane coordinates) from the outer front tire bulge to the inside edge of the lane marking of interest for a given test (a positive value indicates the vehicle is completely within the lane while a negative value indicates that the outer front tire bulge has crossed over the inner lane marking edge). The distance to the lane edge at the moment the LDW alert is issued, is displayed to the right of subplot.
- Lateral Lane Velocity (ft/sec) – Lateral velocity (in lane coordinates) of the outer front tire bulge
- Bird's Eye View – Indicates the position of the Subject Vehicle with respect to the lane marking of interest for a given test. Green rectangles represent the Subject Vehicle's position at approximately 2 second intervals, while the yellow rectangle indicates the position of the Subject Vehicle at the time of LDW warning issuance.

Envelopes and Thresholds

Each of the time history plot figures can contain either green or yellow envelopes and/or black threshold lines. These envelopes and thresholds are used to programmatically and visually determine the validity of a given test run. Envelope and threshold exceedances are indicated with either red shading or red asterisks, and red text is placed to the right side of the plot indicating the type of exceedance.

Green envelopes indicate that the time-varying data should not exceed the envelope boundaries at any time within the envelope. Exceedances of a green envelope are indicated by red shading in the area between the measured time-varying data and the envelope boundaries.

Yellow envelopes indicate that the time-varying data should not exceed the envelope only at the right end. Exceedances at the right extent of a yellow envelope are indicated by red asterisks. Data within the boundaries at the right extent of a yellow envelope are indicated by green circles.

For the warning plot, a dashed black threshold line indicates the threshold used to determine the onset of the LDW alert. The alert is considered on the first time the alert signal crosses this threshold line.

Color Codes

Color codes have been adopted to easily identify the types of data, envelopes, and thresholds used in the plots.

Color codes can be broken into three categories:

1. Validation envelopes and thresholds
2. Instantaneous samplings
3. Text

1. Validation envelope and threshold color codes:
   - Green envelope = time varying data must be within the envelope at all times in order to be valid
   - Yellow envelope = time varying data must be within limits at right end
   - Black threshold (Solid) = time varying data must not exceed this threshold in order to be valid
   - Black threshold (Dashed) = for reference only – this can include warning level thresholds which are used to determine the timing of the alert

2. Instantaneous sampling 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

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

Other Notations

- NG – Indicates that the value for that variable was outside of bounds and therefore “No Good”.
- No Wng – No warning was detected.

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 (including passing, failing and invalid runs) are shown in Figure D1 through Figure D3. Actual time history data plots for the vehicle under consideration are provided subsequently.

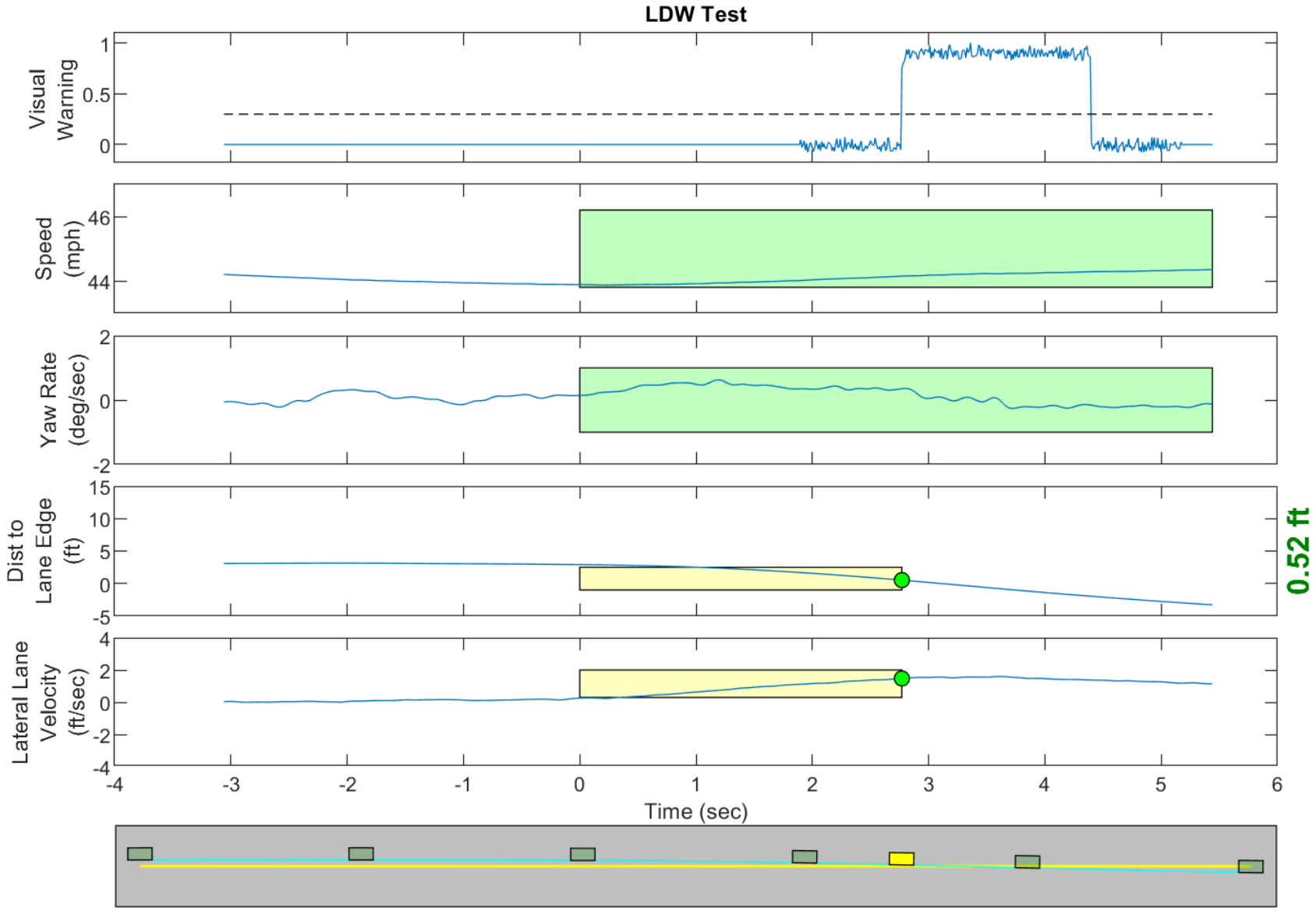


Figure D1. Example Time History for Lane Departure Warning Test, Passing

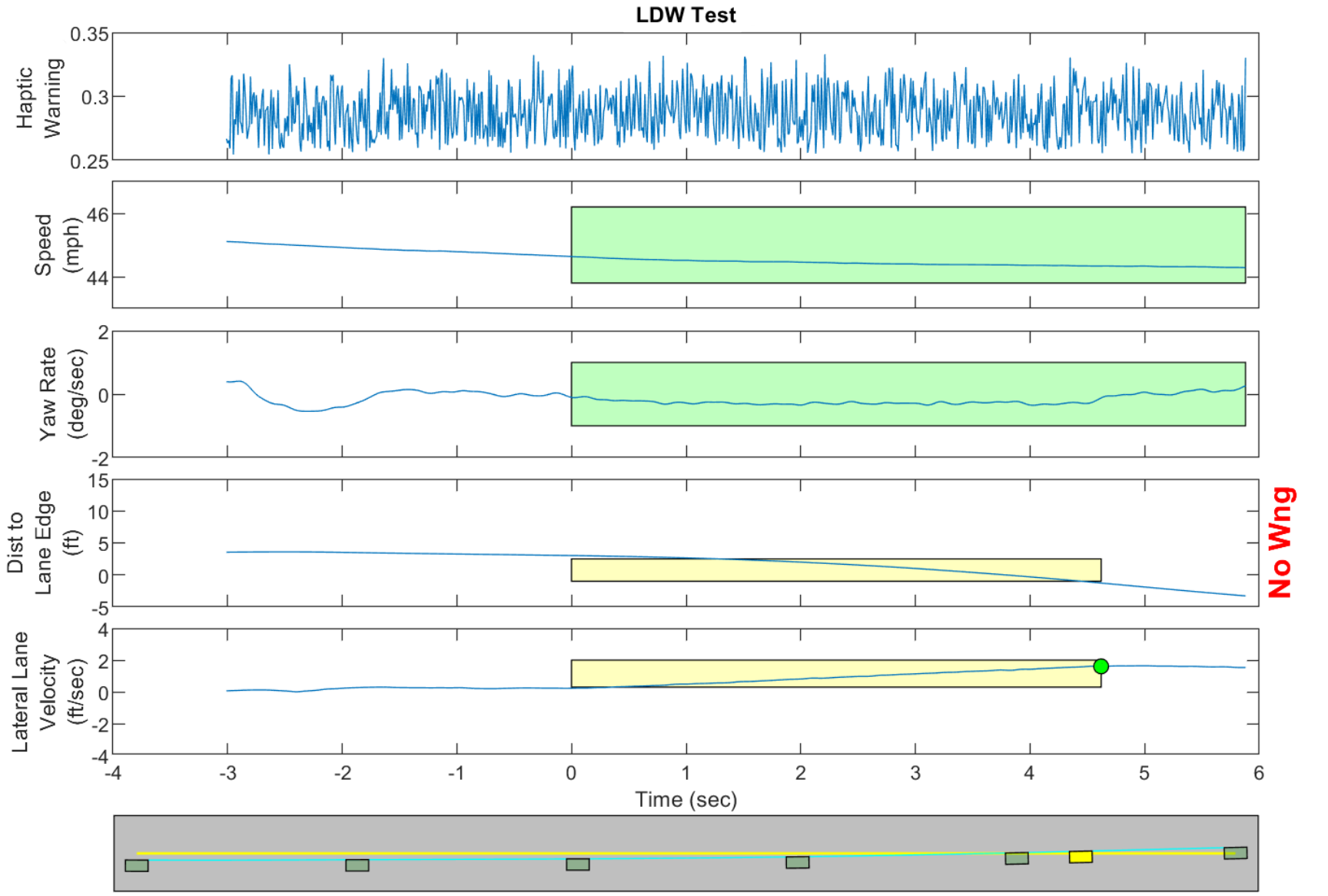


Figure D2. Example Time History for Lane Departure Warning Test, Failing, No Warning Issued

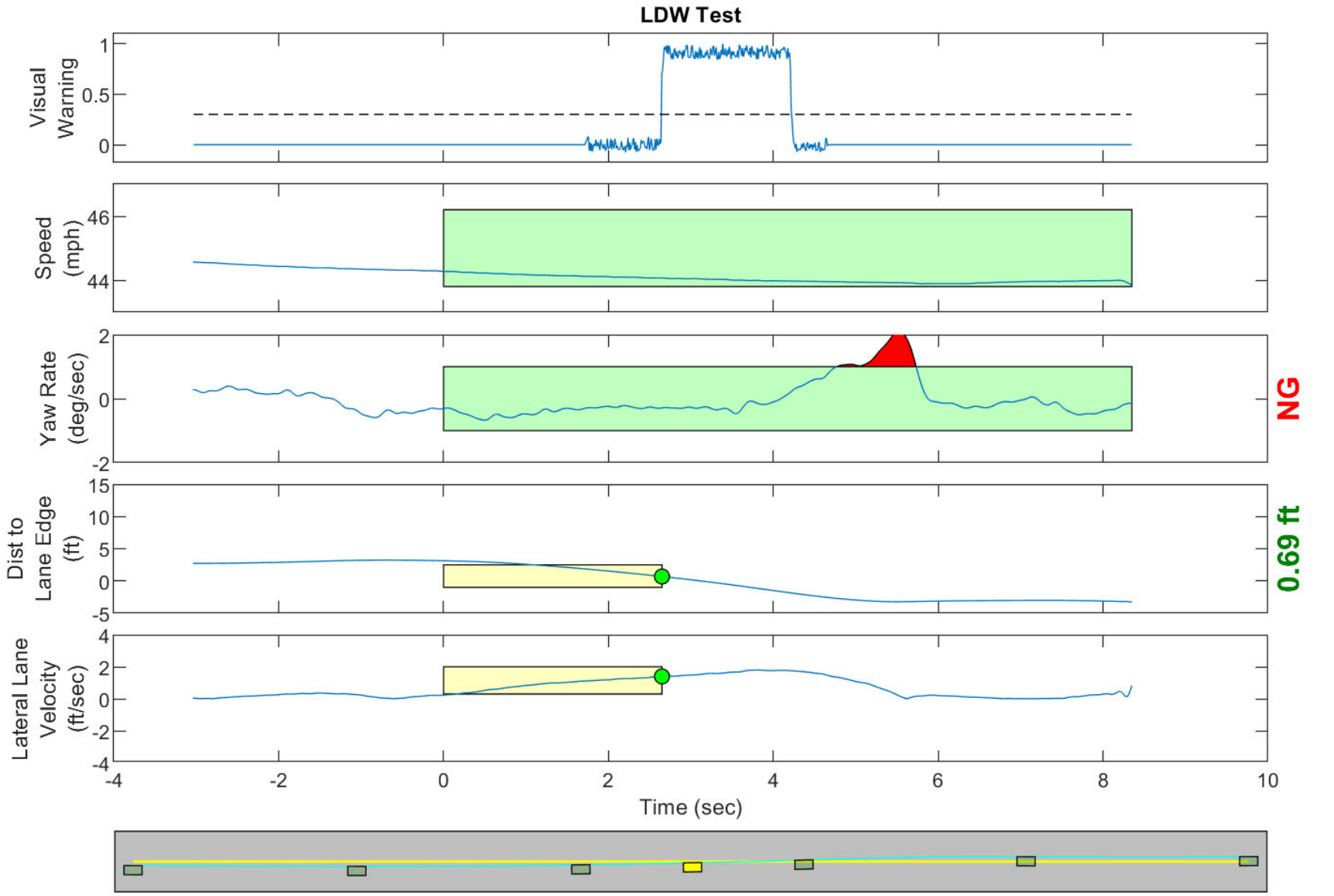


Figure D3. Example Time History for Lane Departure Warning Test, Invalid Run Due to Subject Vehicle Yaw Rate

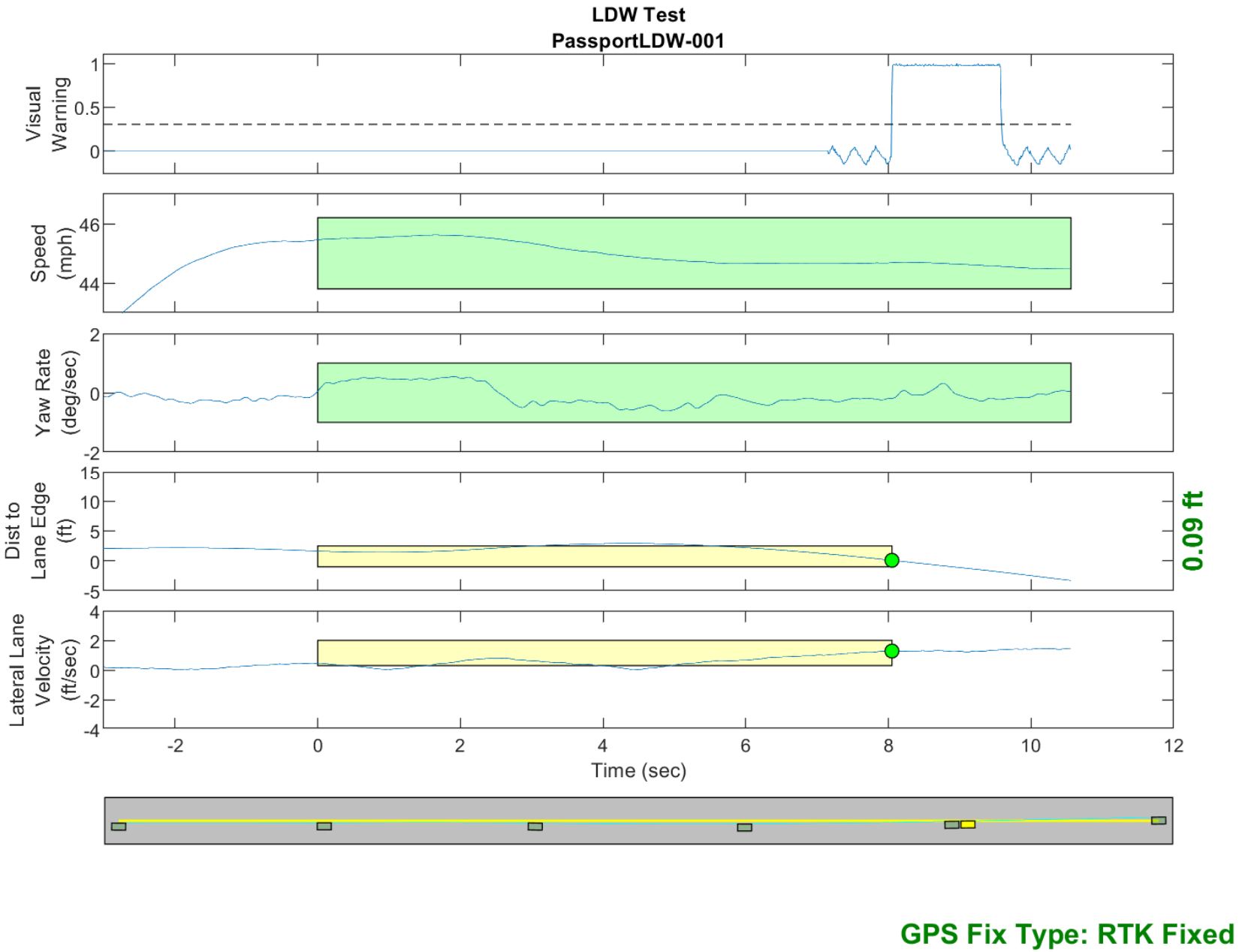


Figure D4. Time History for Run 01, Botts Dots, Left Departure, Visual Warning

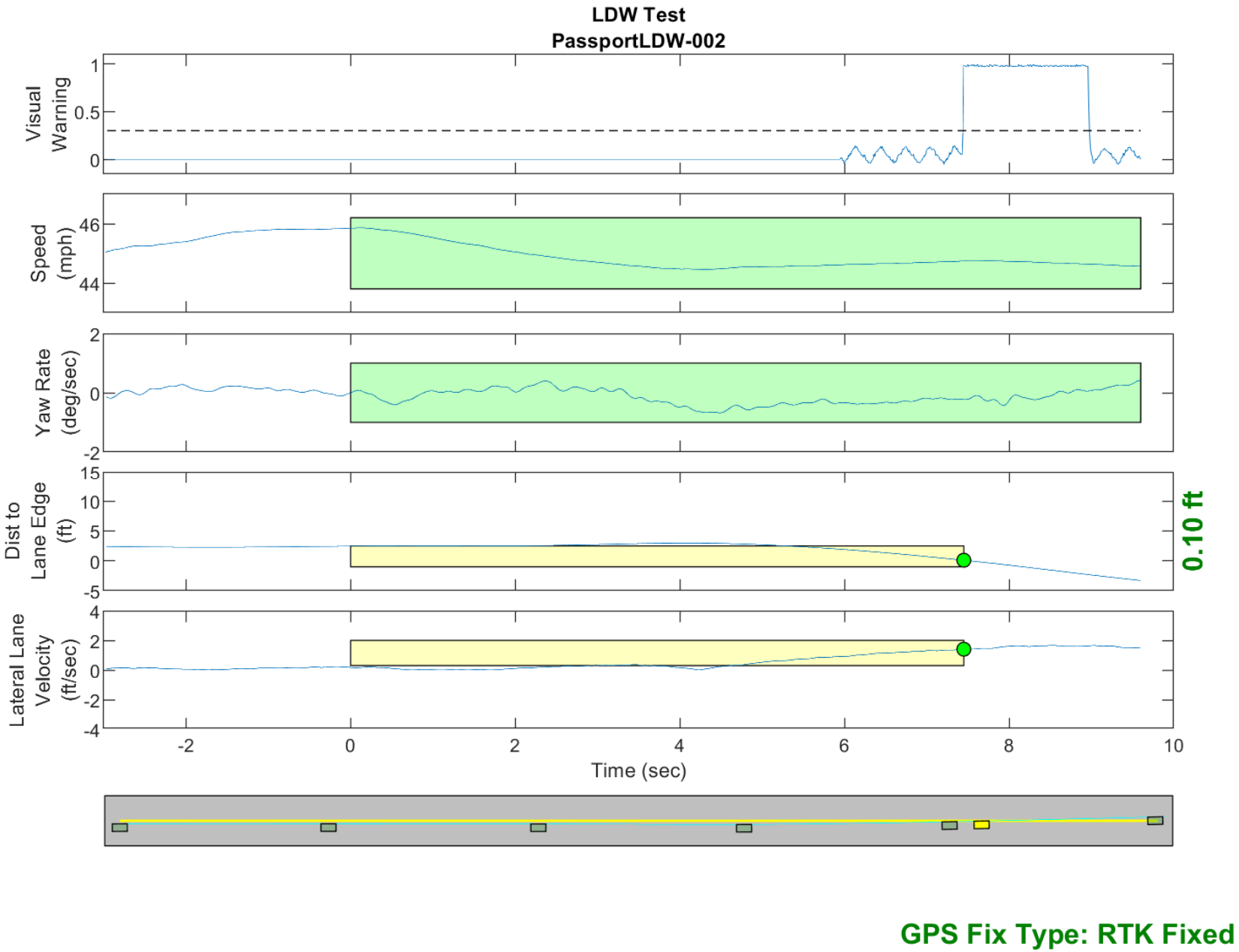


Figure D5. Time History for Run 02, Botts Dots, Left Departure, Visual Warning

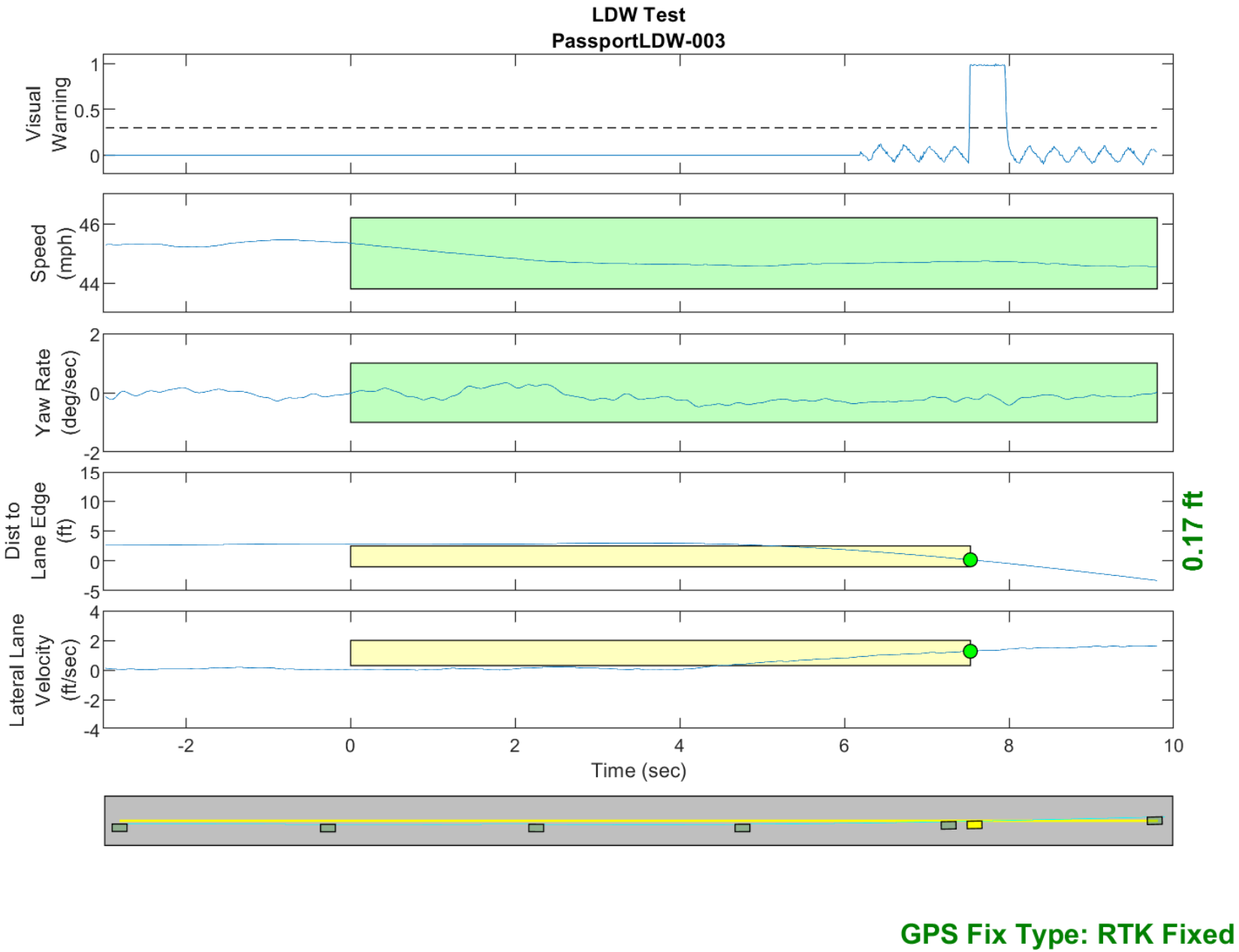


Figure D6. Time History for Run 03, Botts Dots, Left Departure, Visual Warning

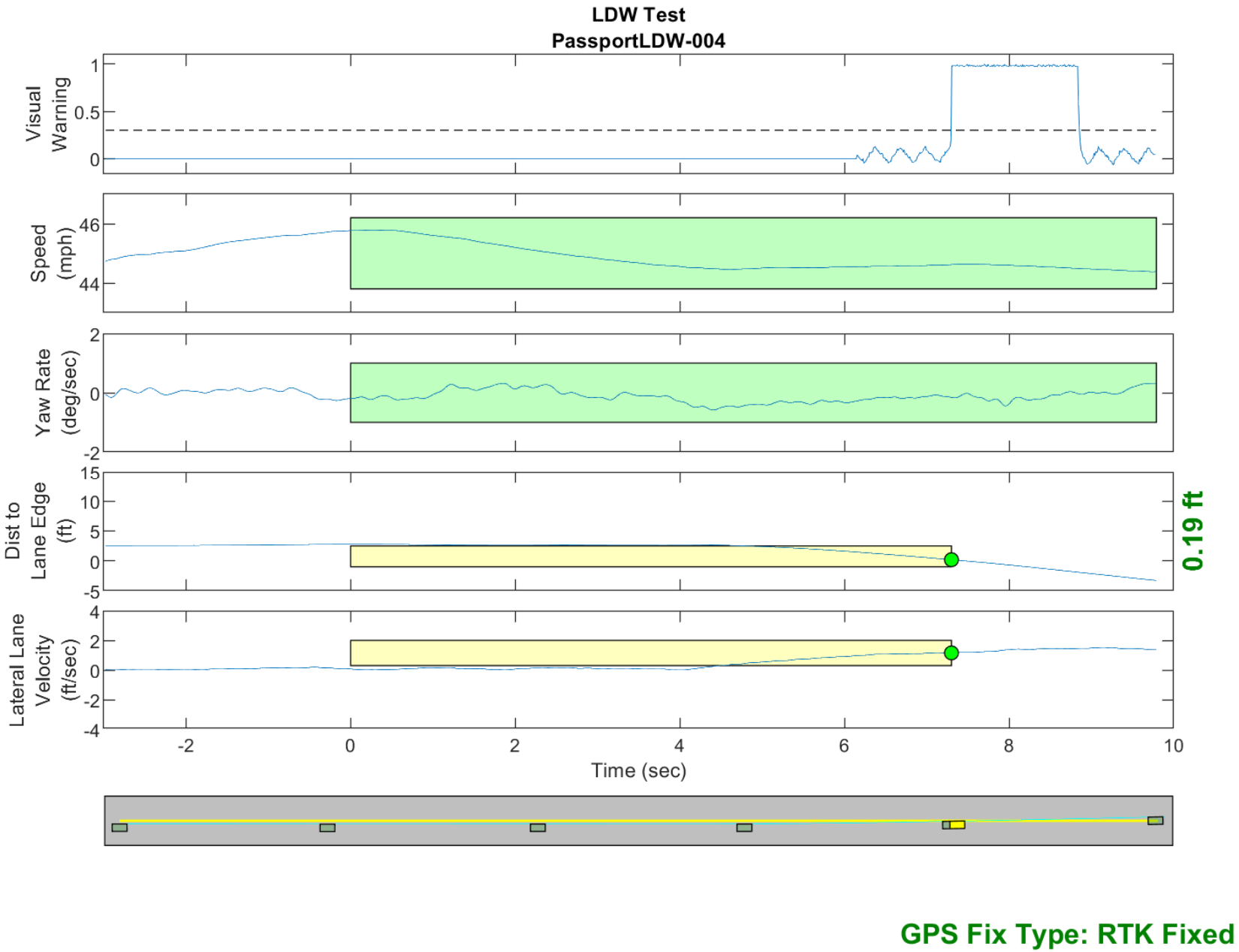


Figure D7. Time History for Run 04, Botts Dots, Left Departure, Visual Warning

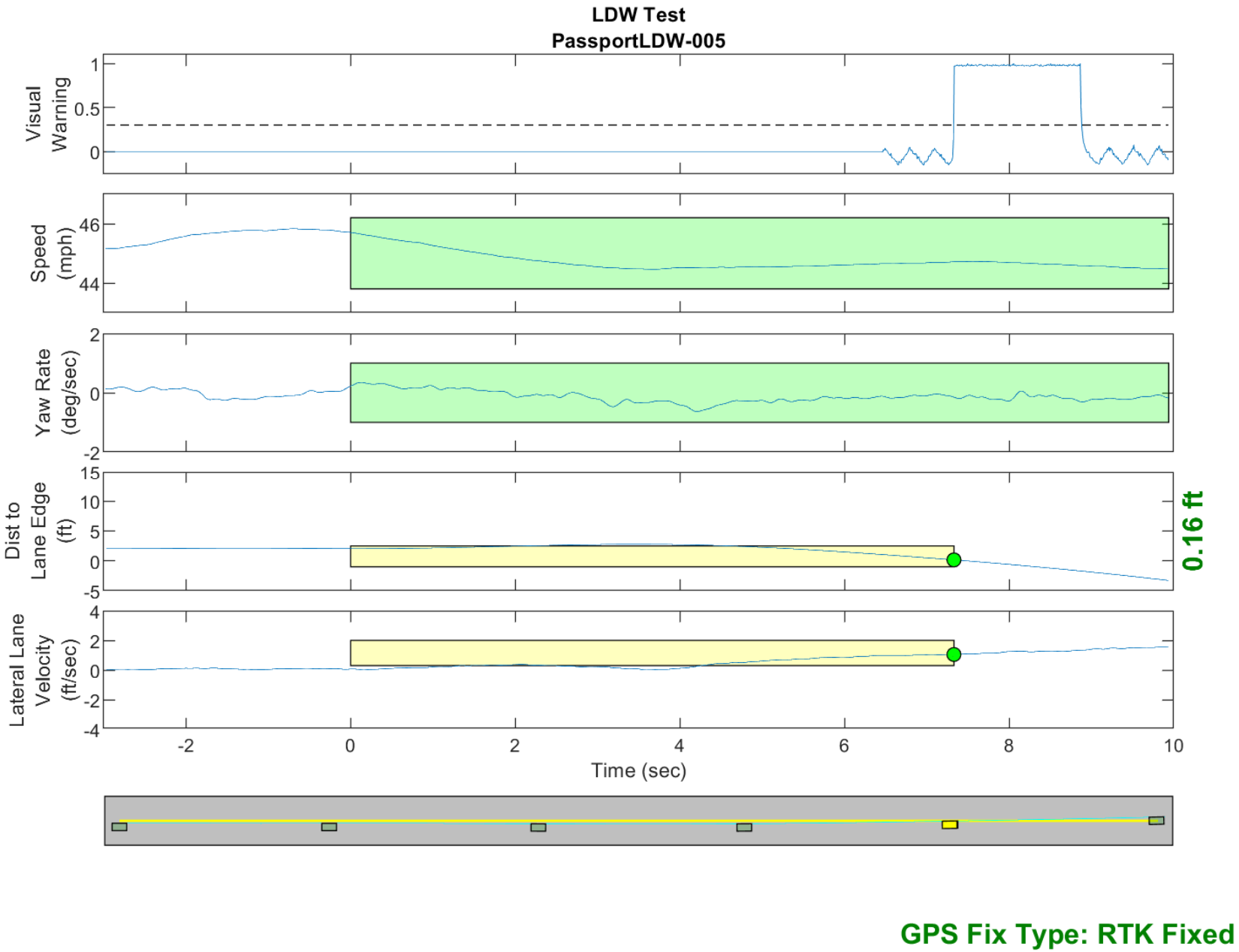


Figure D8. Time History for Run 05, Botts Dots, Left Departure, Visual Warning

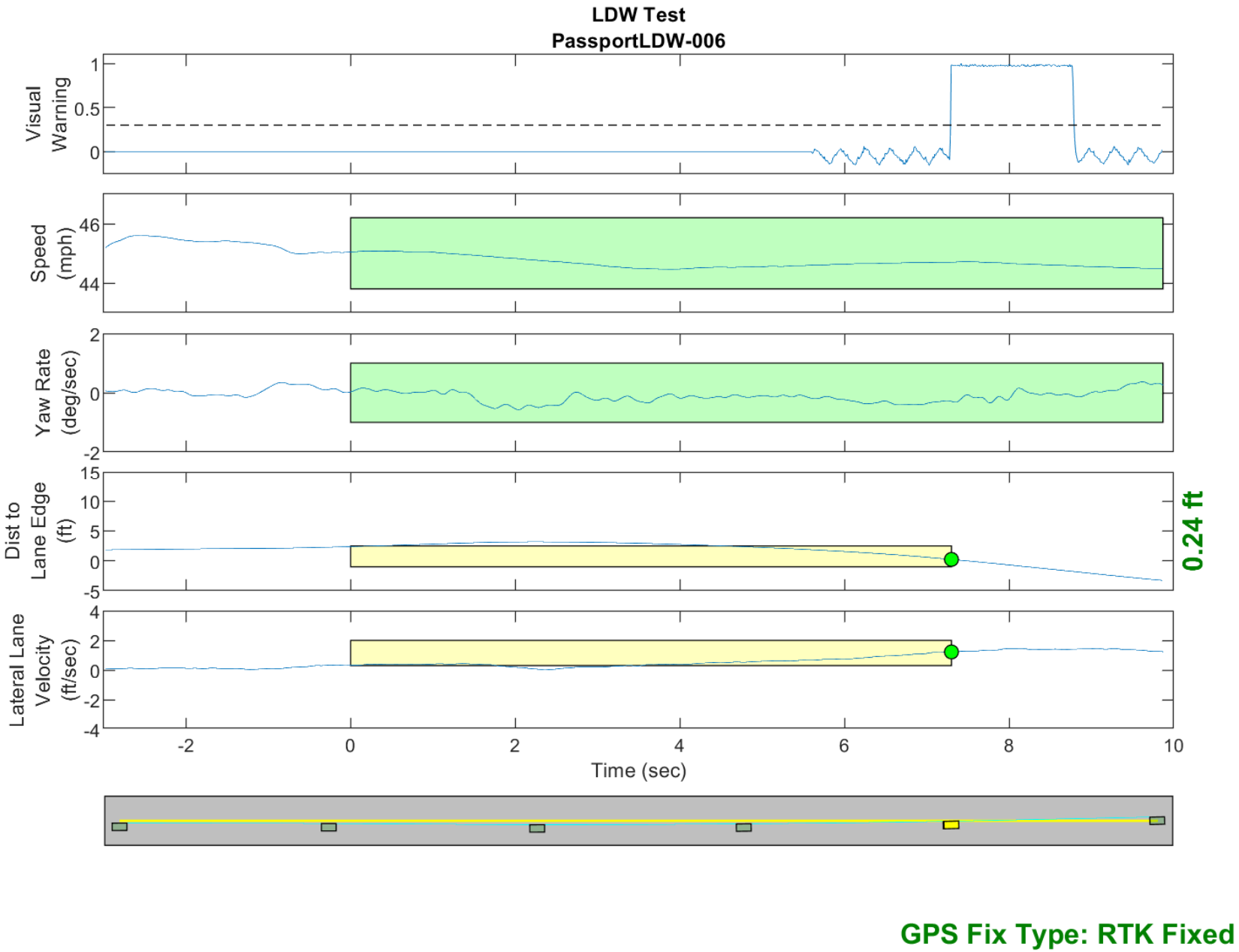


Figure D9. Time History for Run 06, Botts Dots, Left Departure, Visual Warning

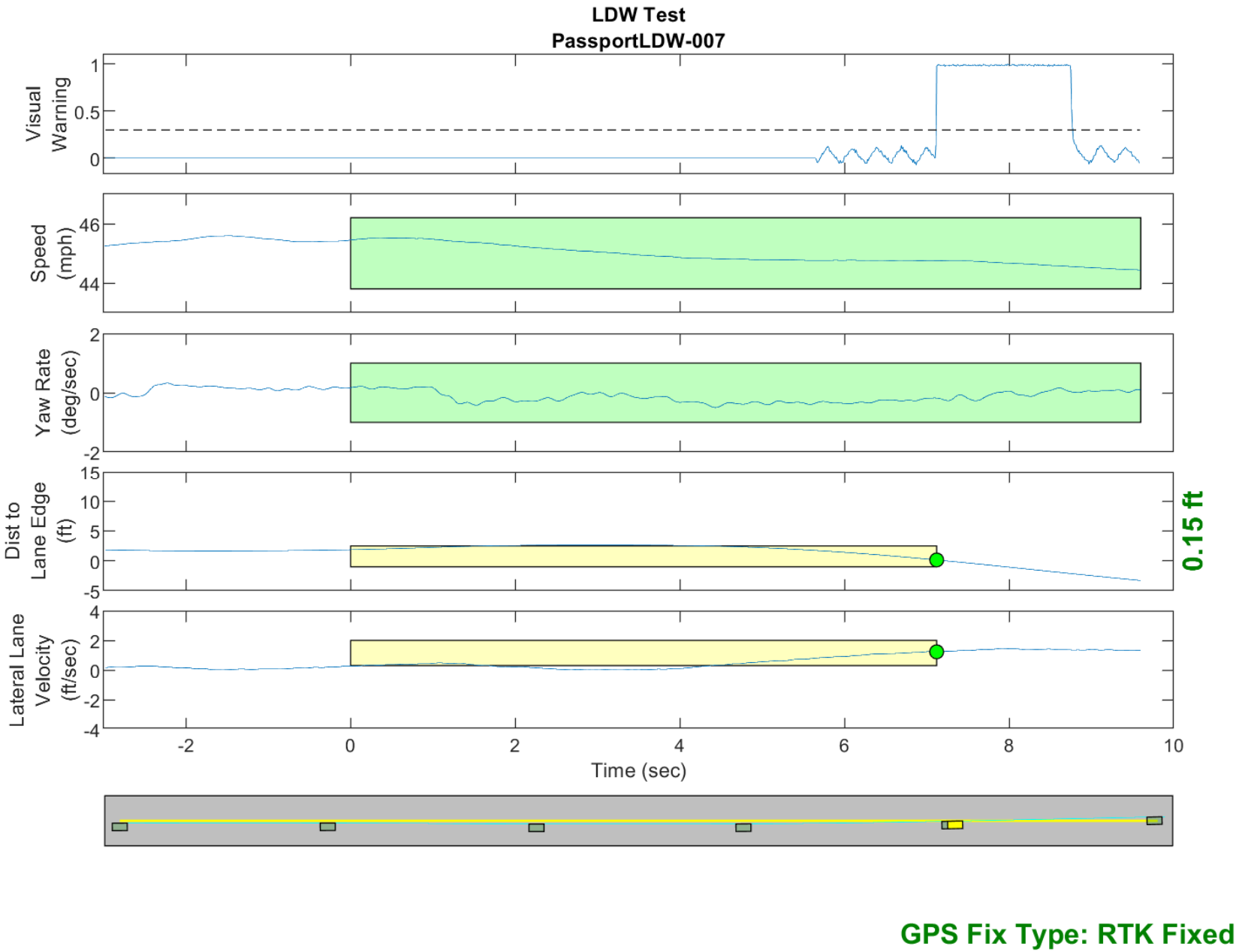


Figure D10. Time History for Run 07, Botts Dots, Left Departure, Visual Warning

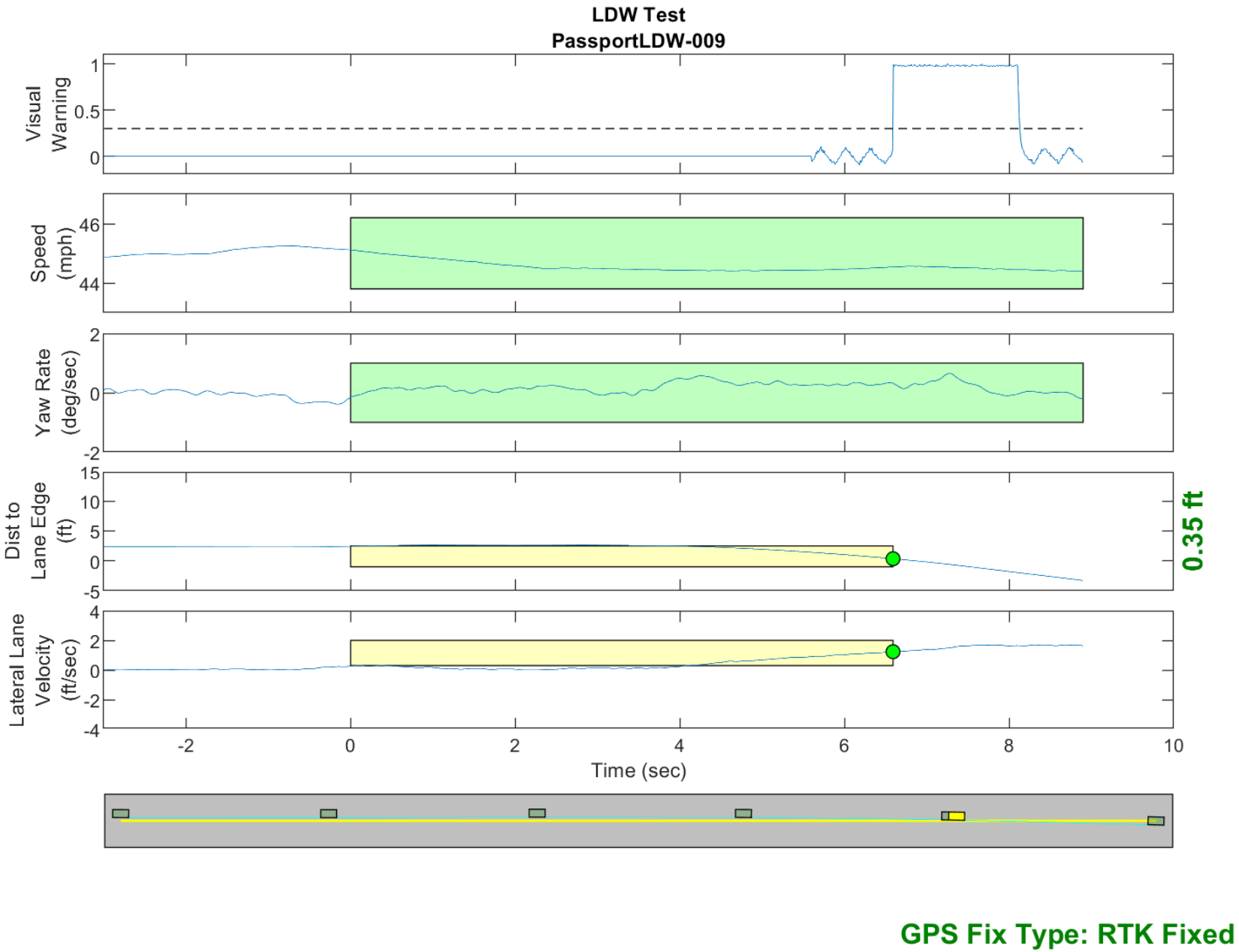


Figure D11. Time History for Run 09, Botts Dots, Right Departure, Visual Warning

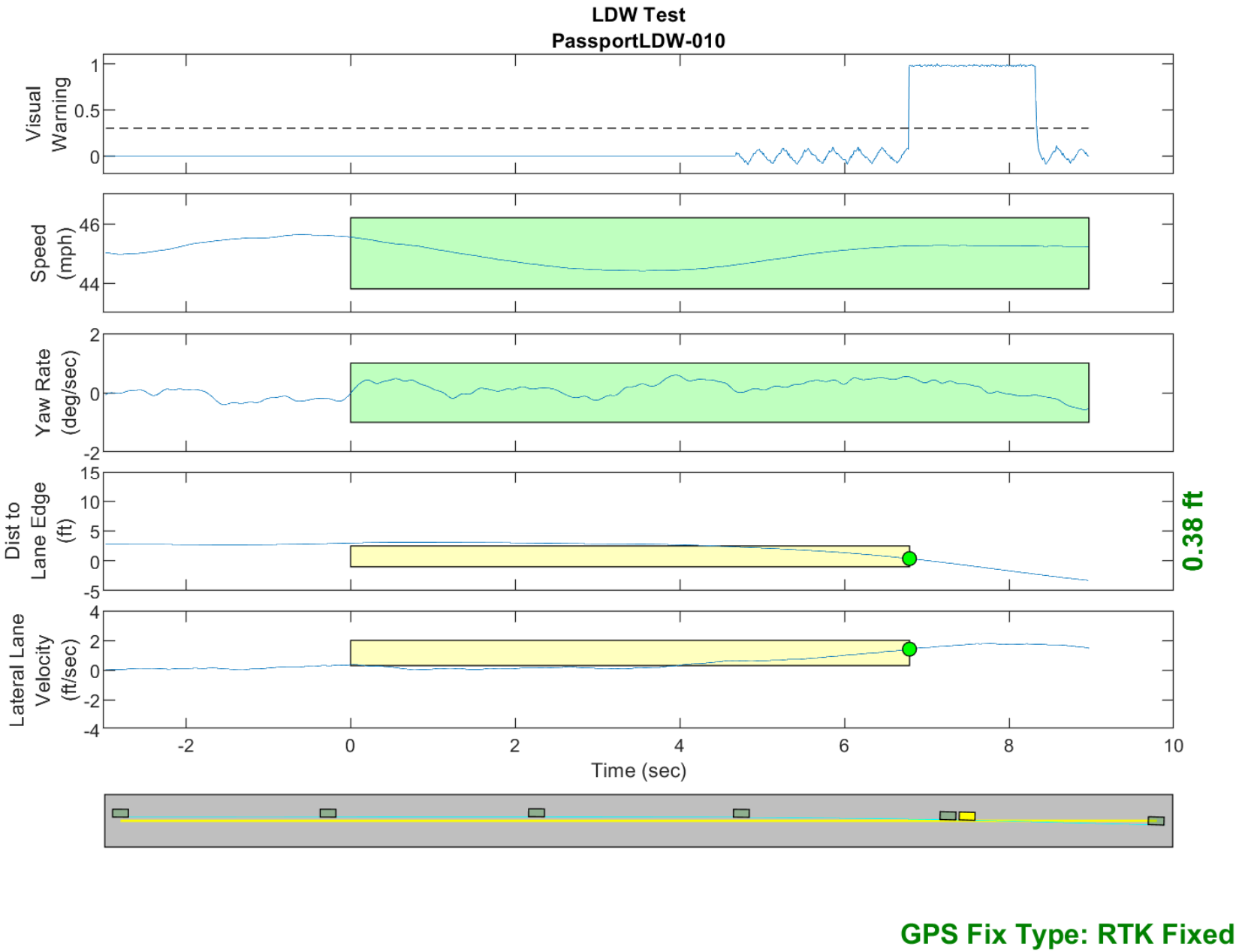


Figure D12. Time History for Run 10, Botts Dots, Right Departure, Visual Warning

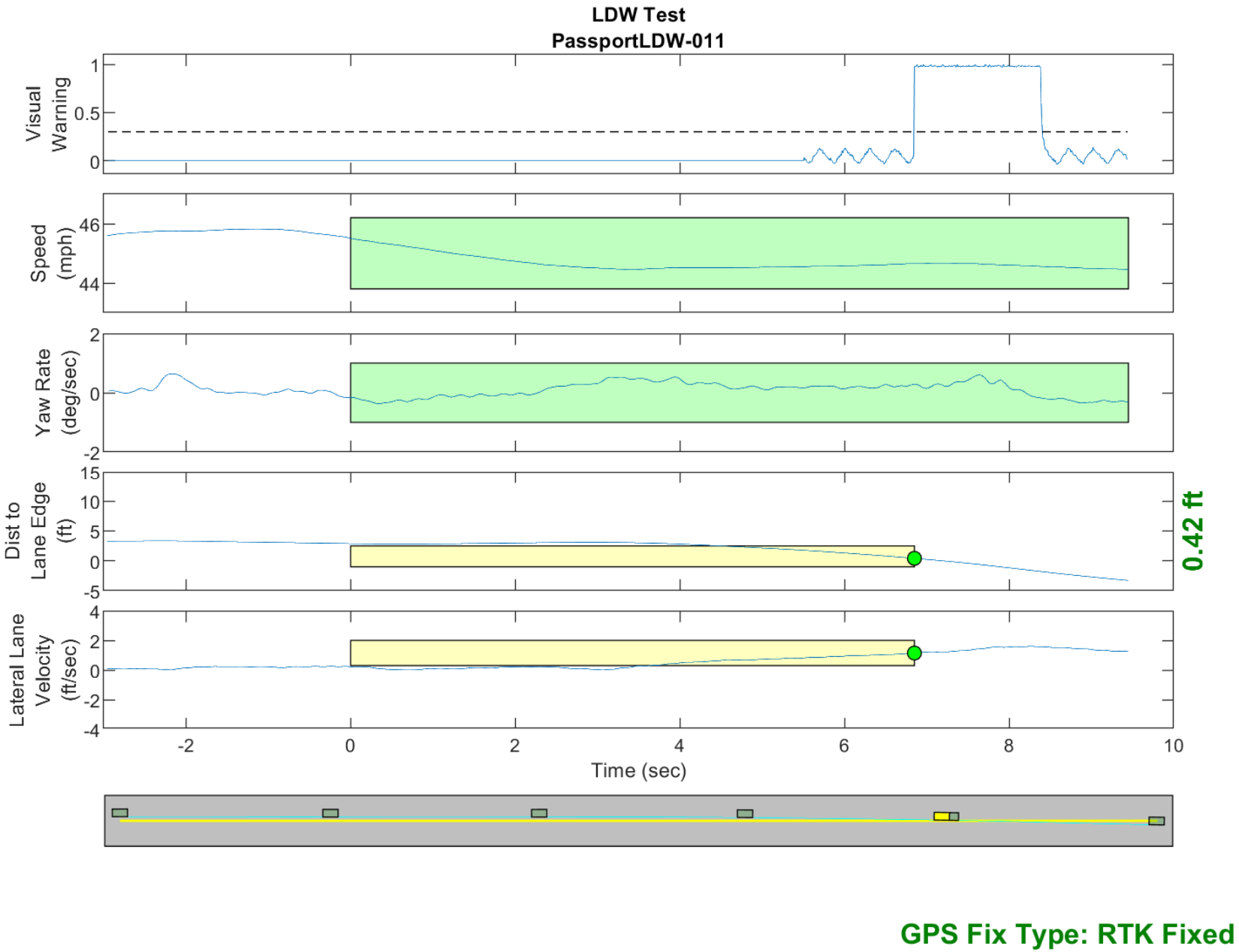


Figure D13. Time History for Run 11, Botts Dots, Right Departure, Visual Warning

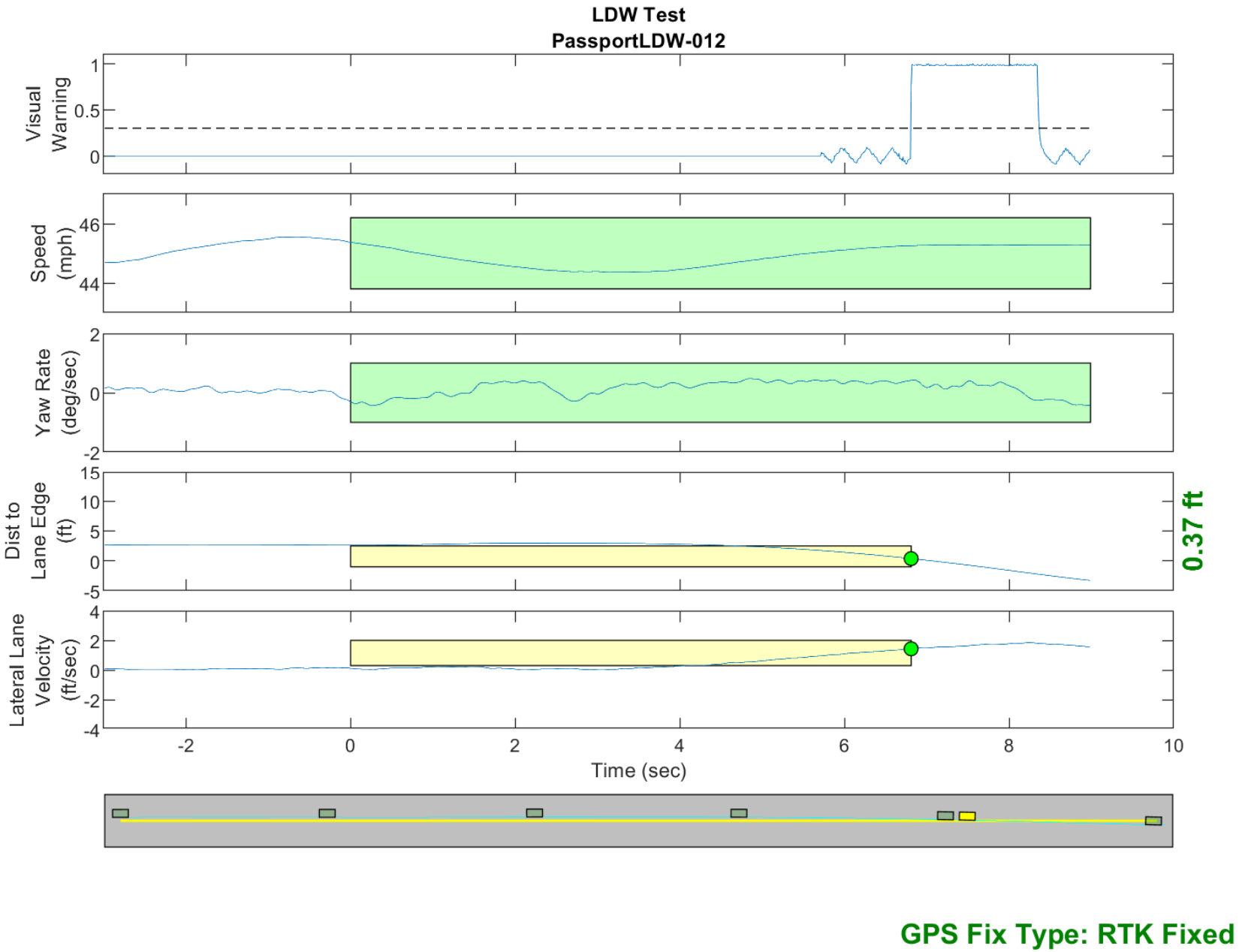


Figure D14. Time History for Run 12, Botts Dots, Right Departure, Visual Warning

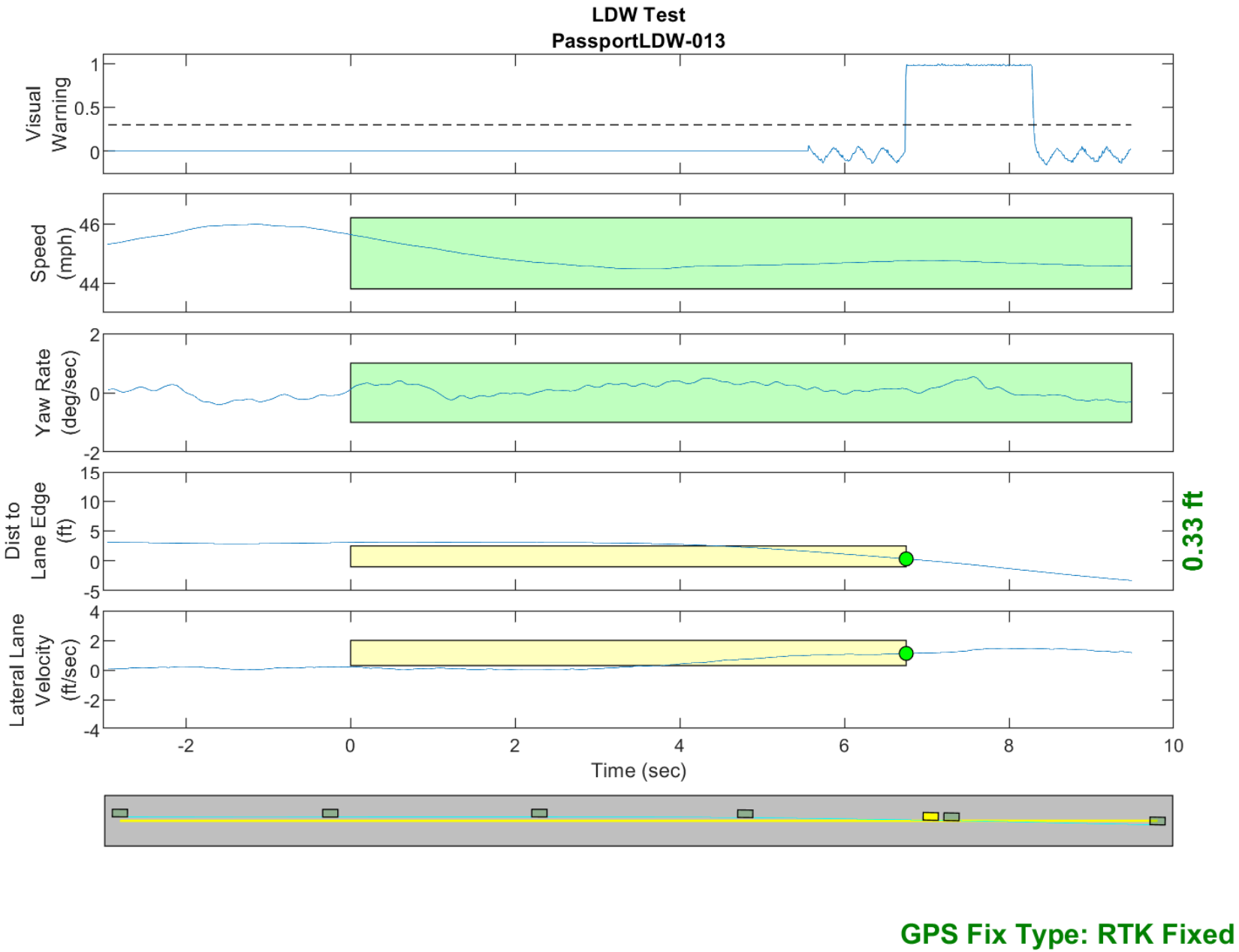


Figure D15. Time History for Run 13, Botts Dots, Right Departure, Visual Warning

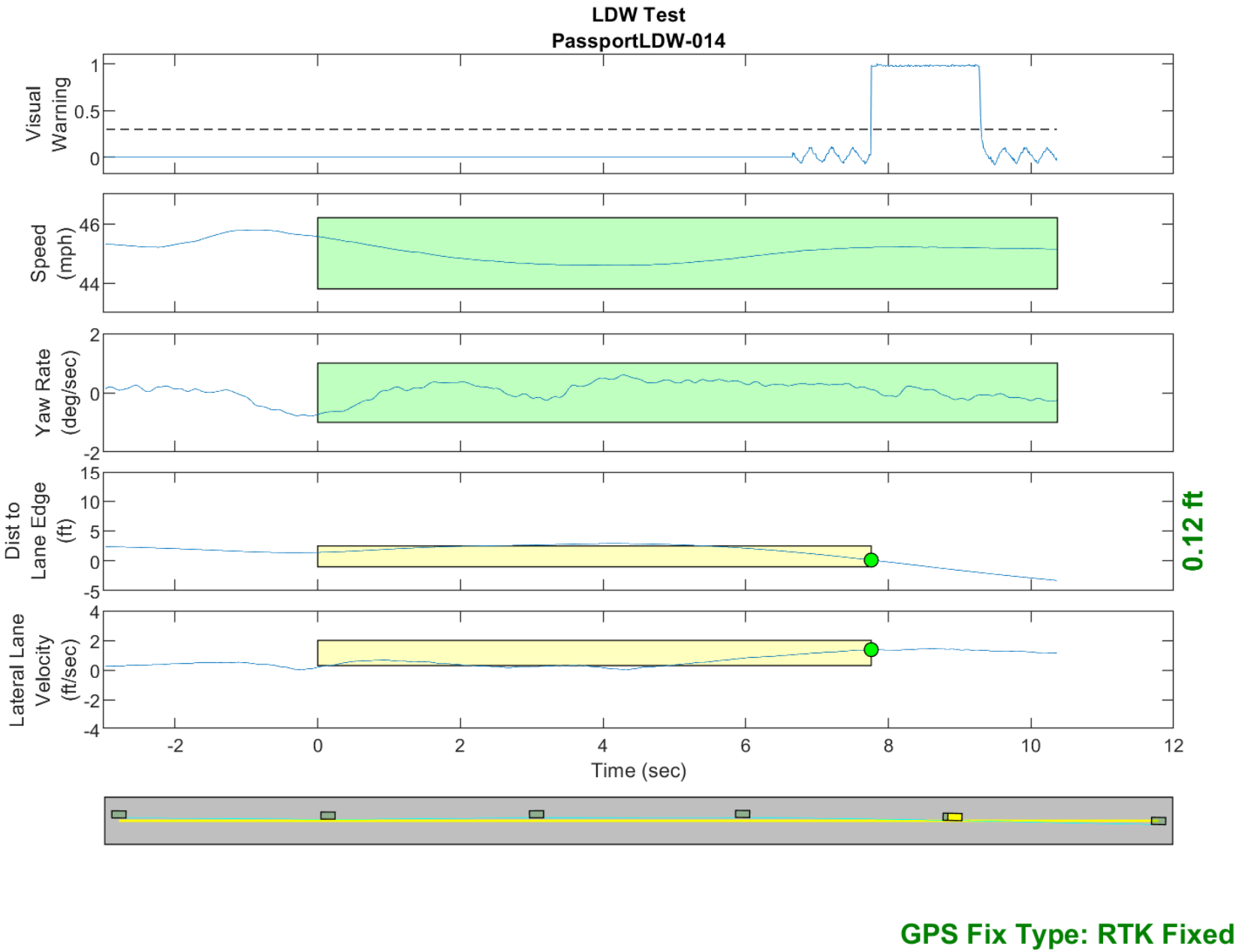


Figure D16. Time History for Run 14, Botts Dots, Right Departure, Visual Warning

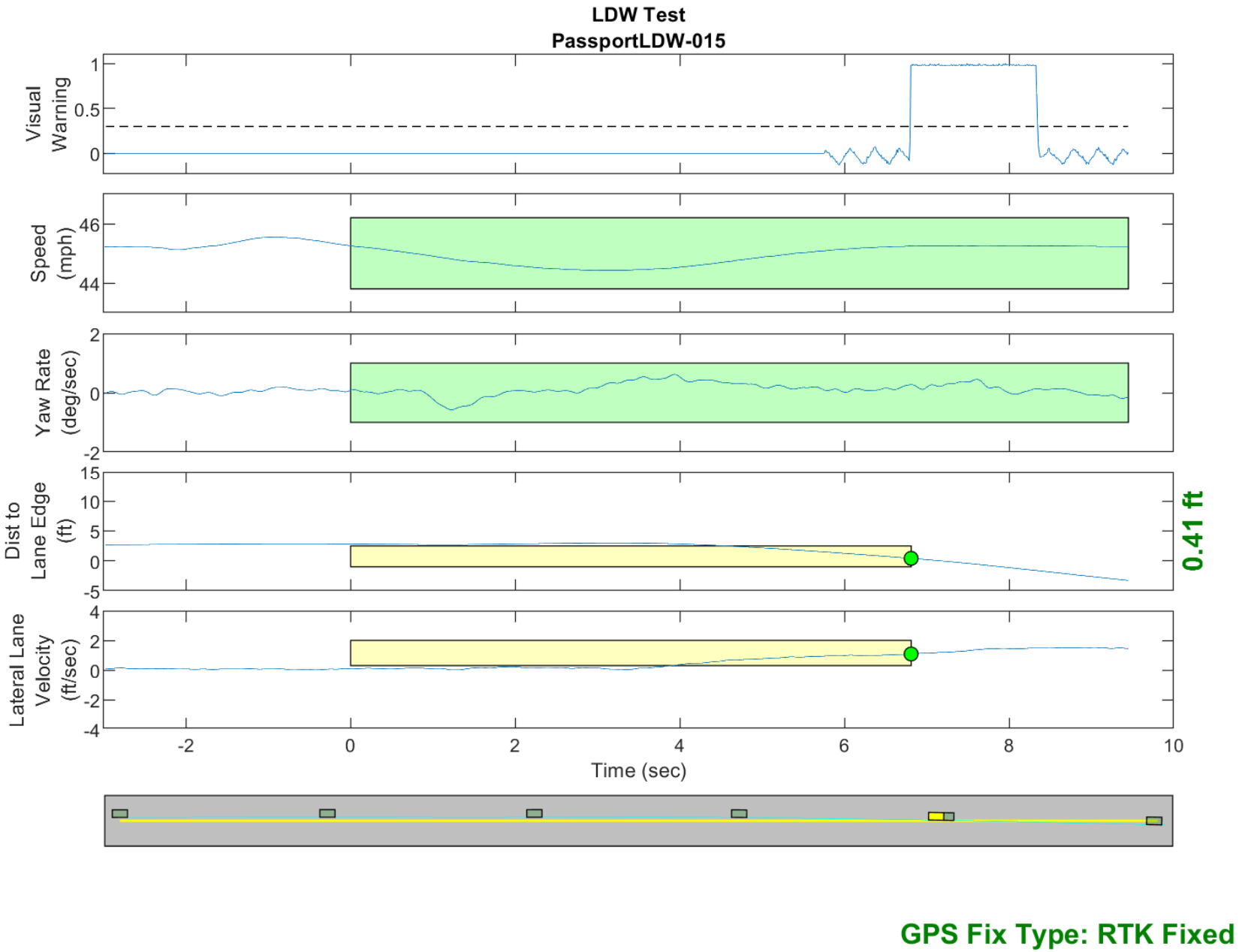


Figure D17. Time History for Run 15, Botts Dots, Right Departure, Visual Warning

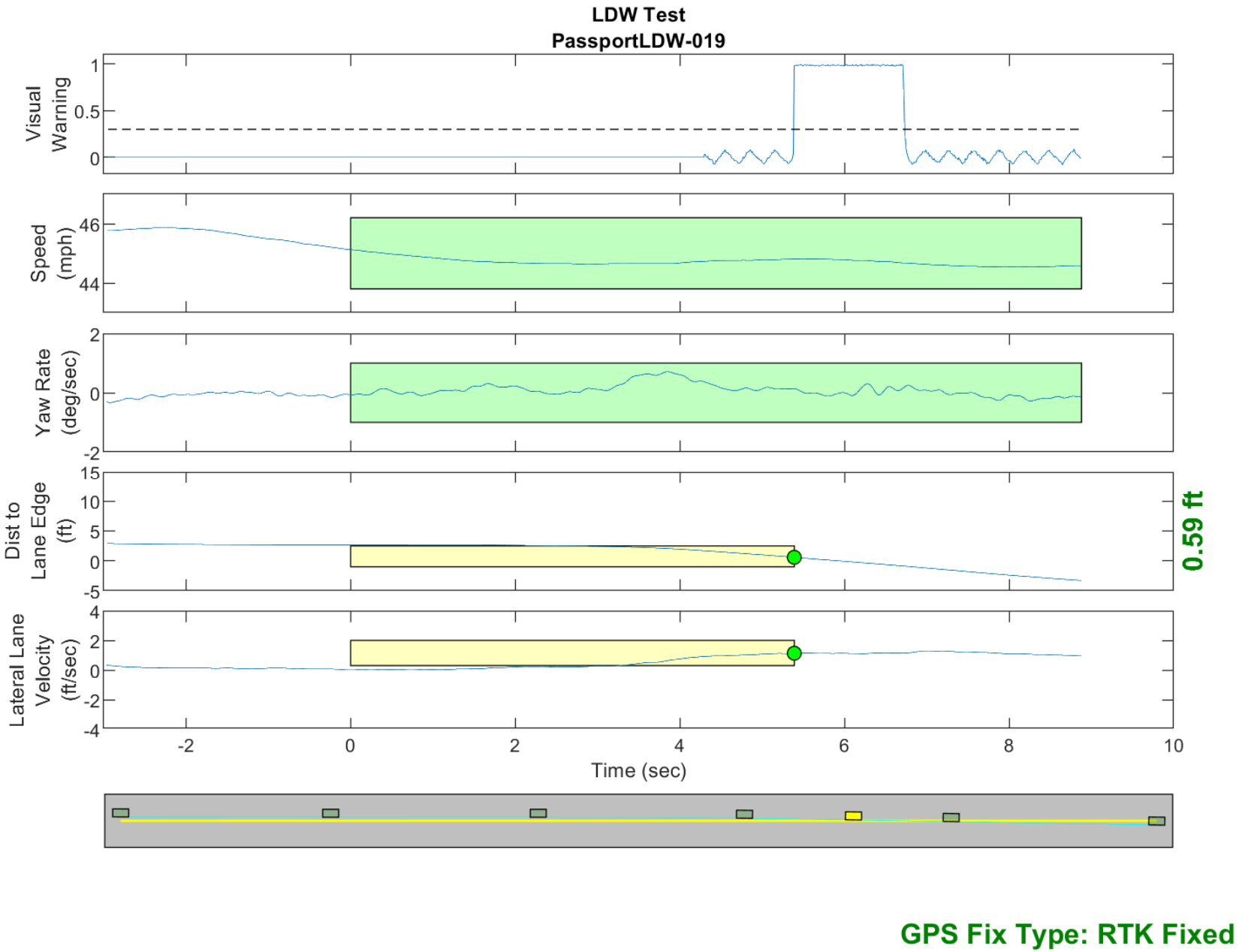


Figure D18. Time History for Run 19, Solid Line, Right Departure, Visual Warning

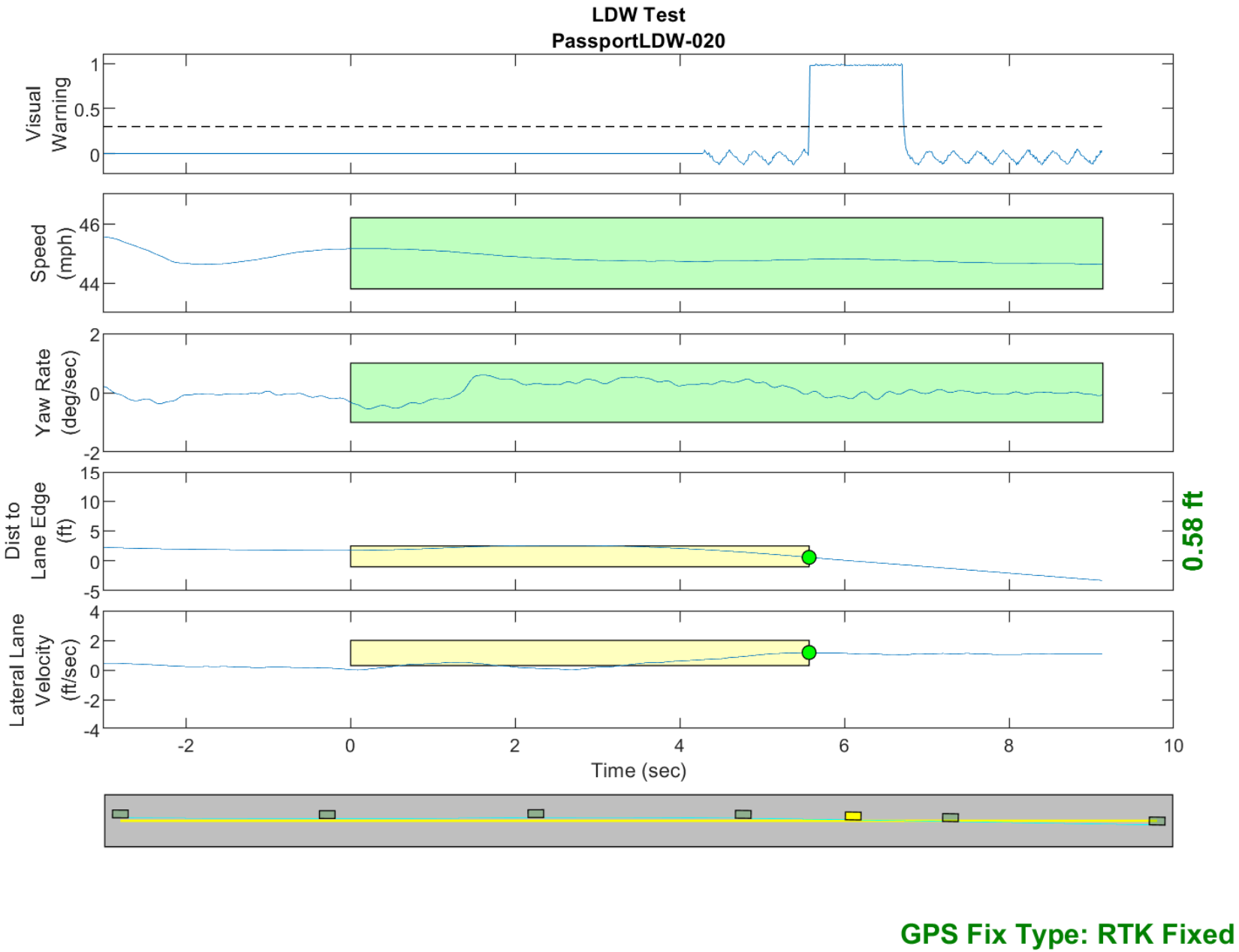


Figure D19. Time History for Run 20, Solid Line, Right Departure, Visual Warning

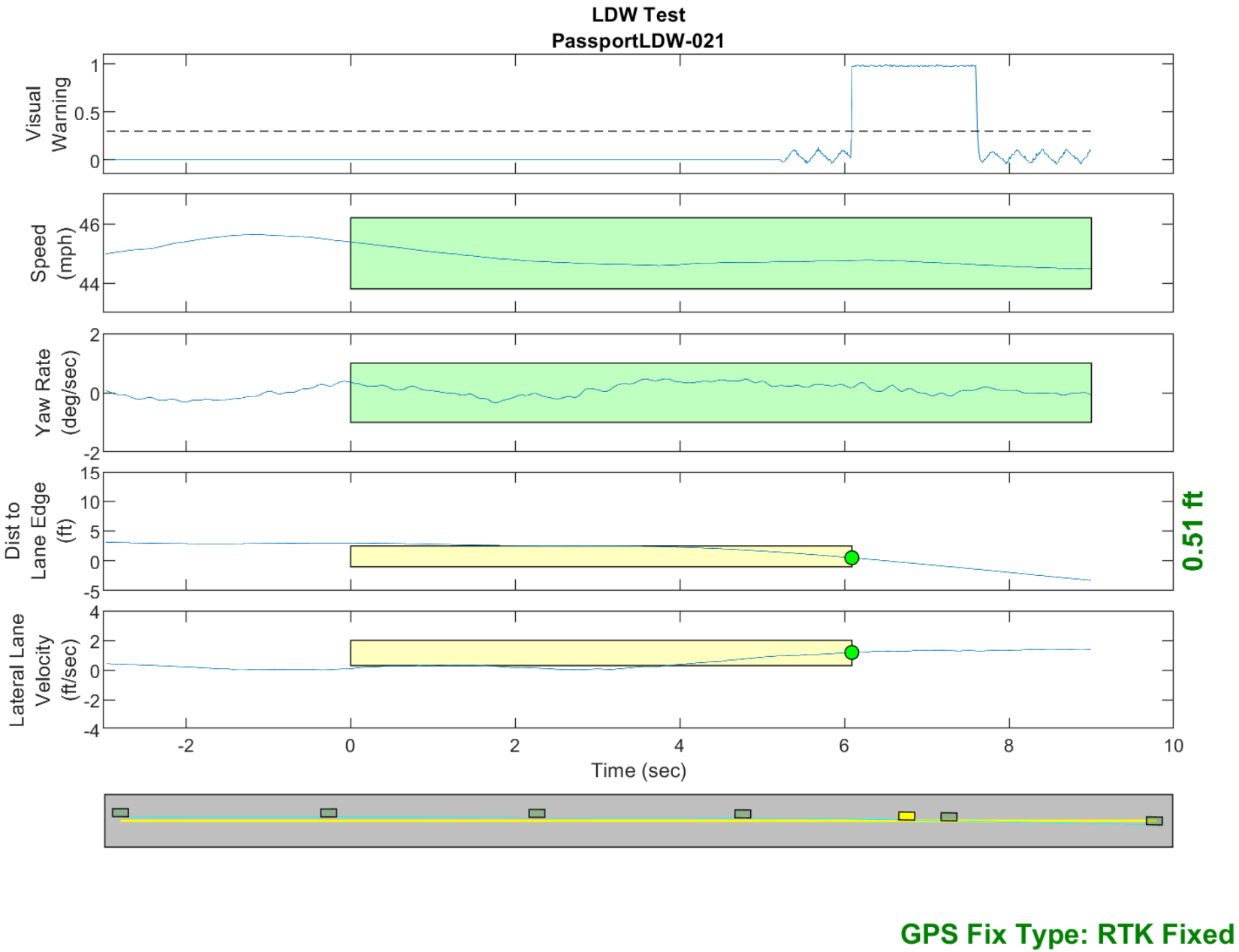


Figure D20. Time History for Run 21, Solid Line, Right Departure, Visual Warning

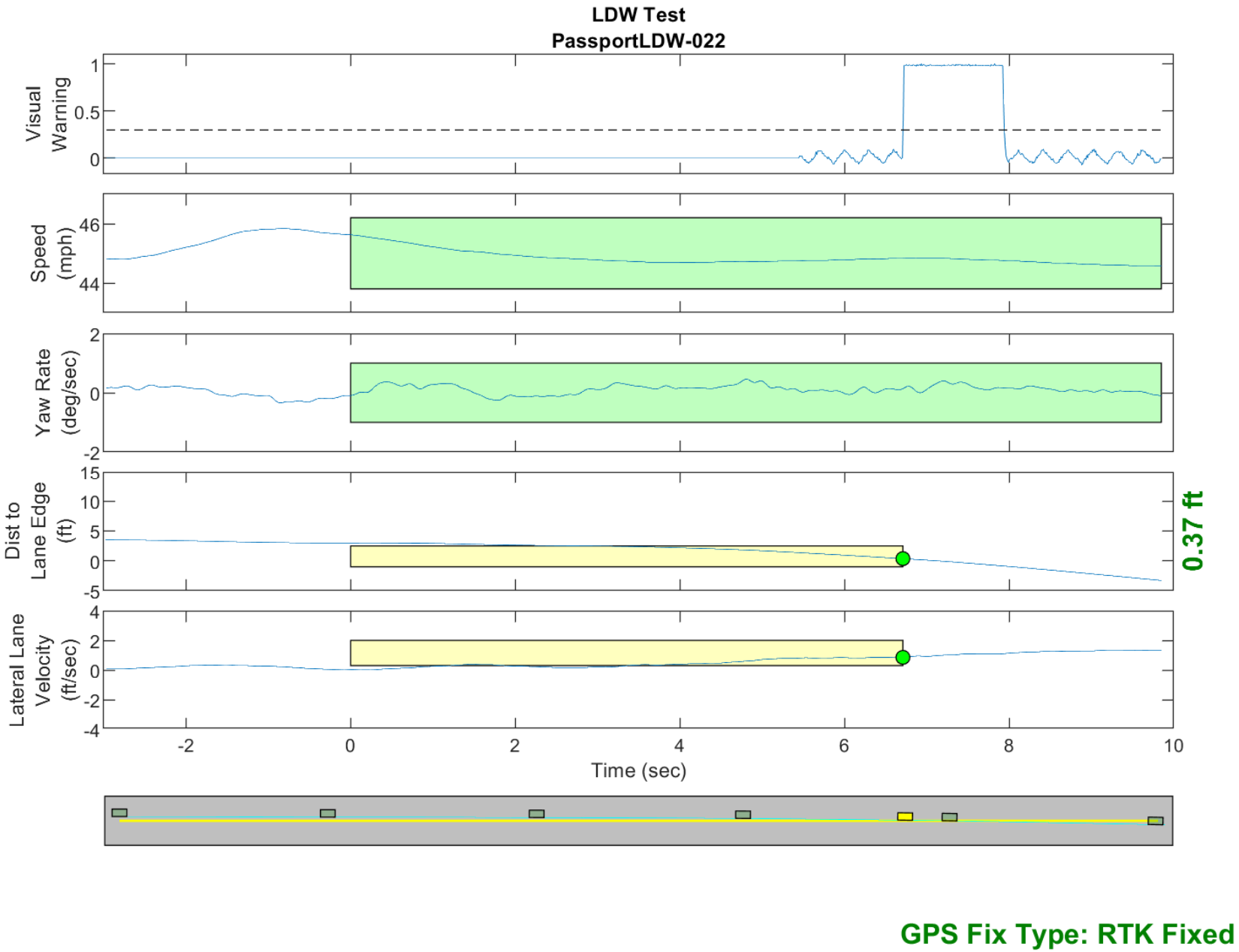


Figure D21. Time History for Run 22, Solid Line, Right Departure, Visual Warning

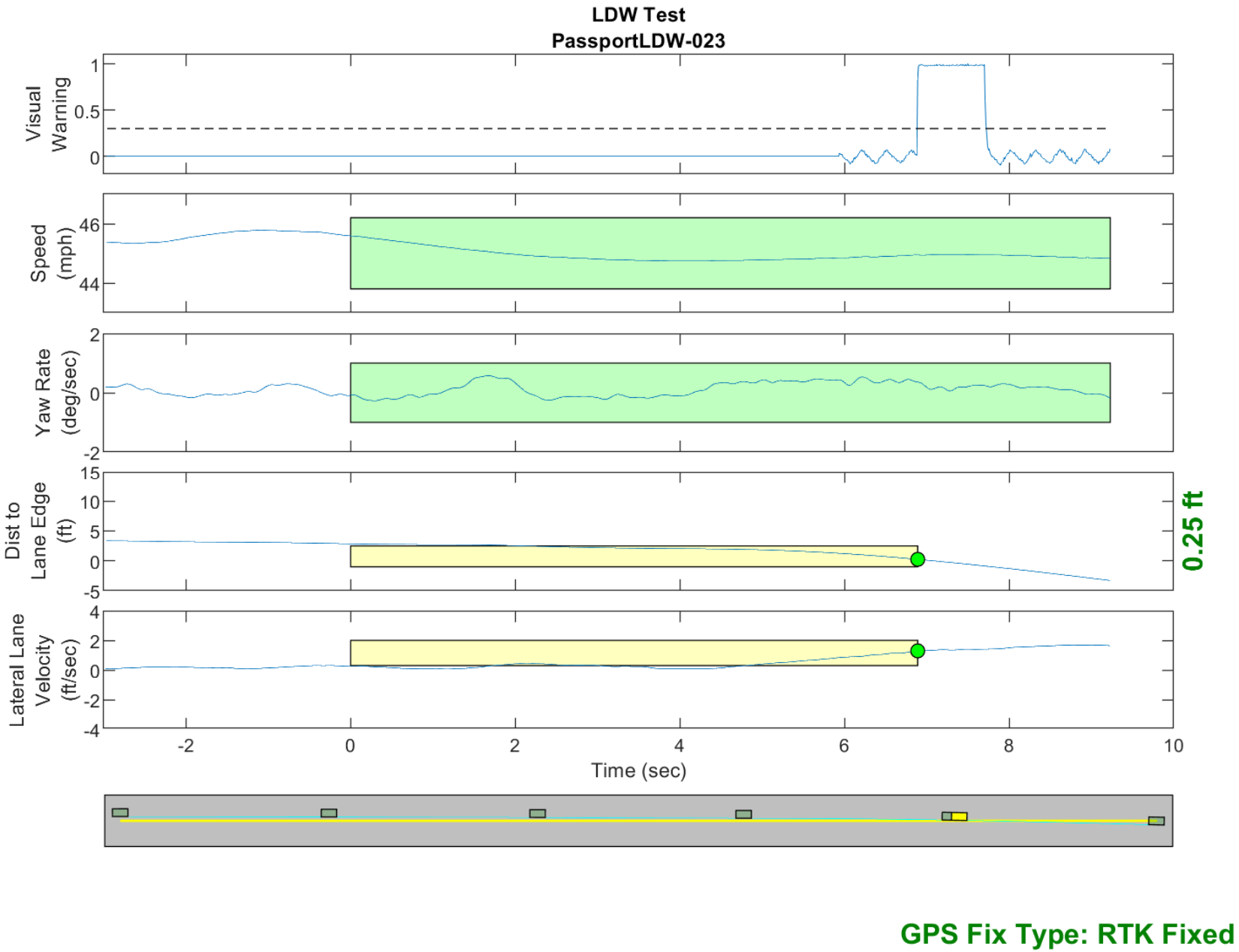


Figure D22. Time History for Run 23, Solid Line, Right Departure, Visual Warning

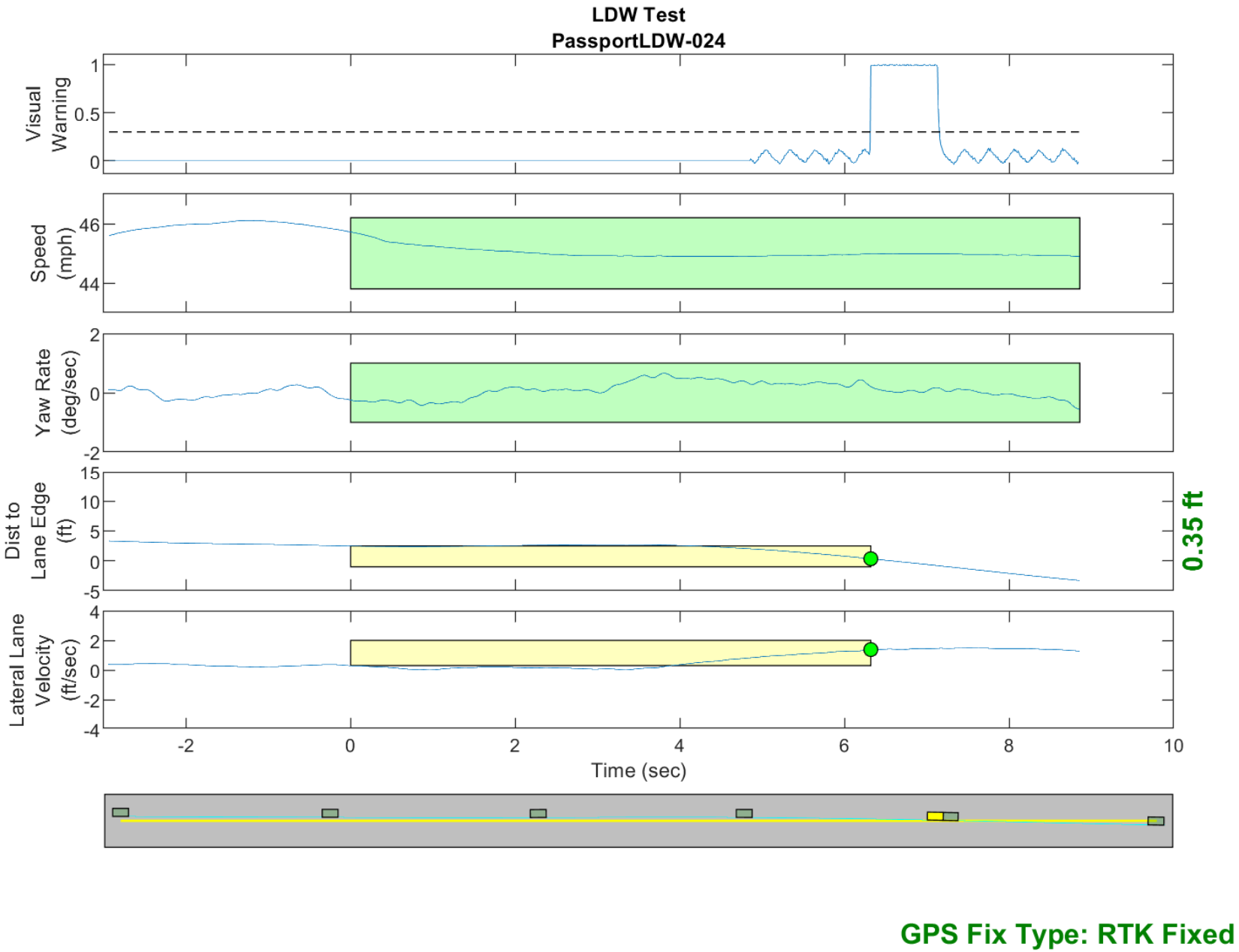


Figure D23. Time History for Run 24, Solid Line, Right Departure, Visual Warning

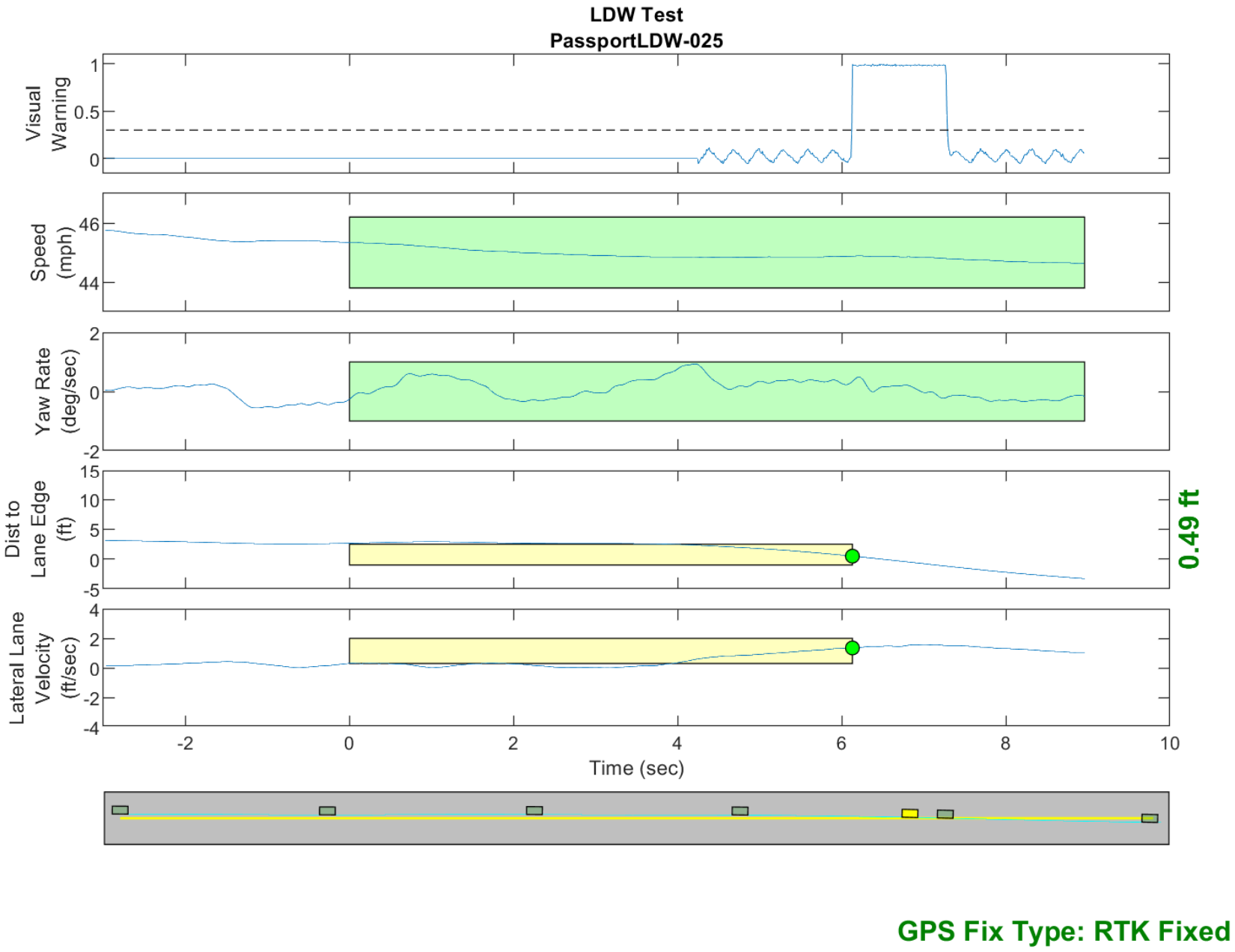


Figure D24. Time History for Run 25, Solid Line, Right Departure, Visual Warning

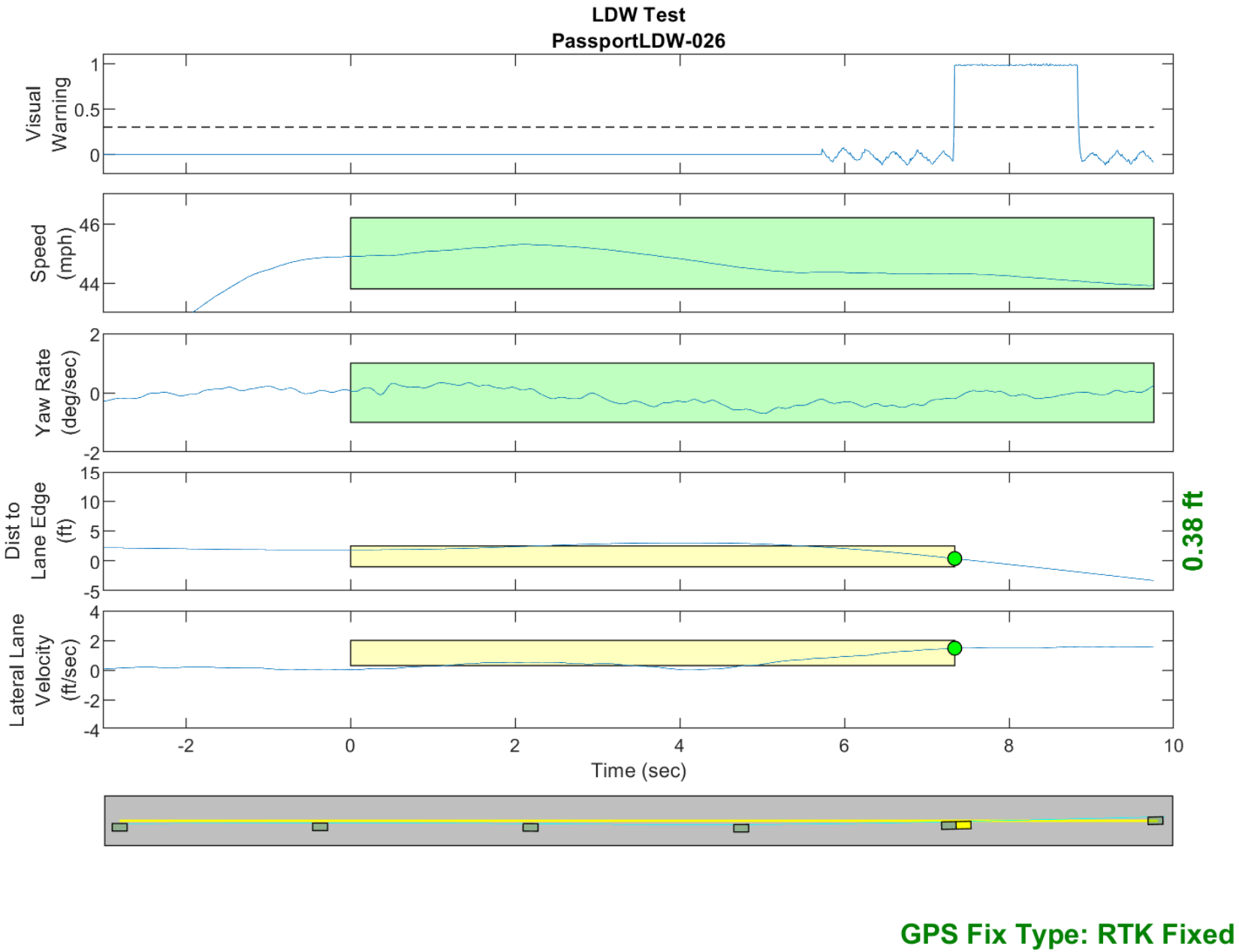


Figure D25. Time History for Run 26, Solid Line, Left Departure, Visual Warning

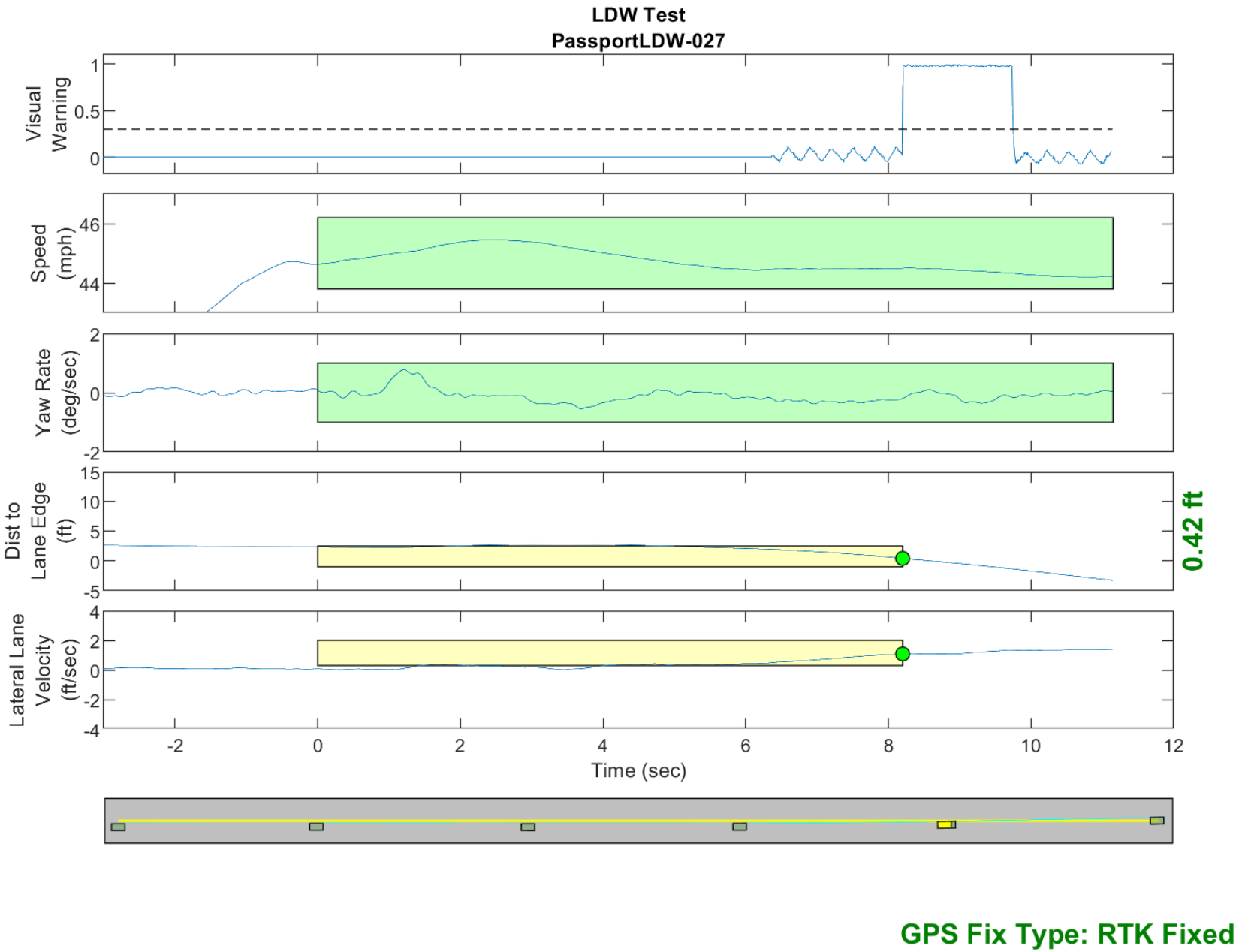


Figure D26. Time History for Run 27, Solid Line, Left Departure, Visual Warning

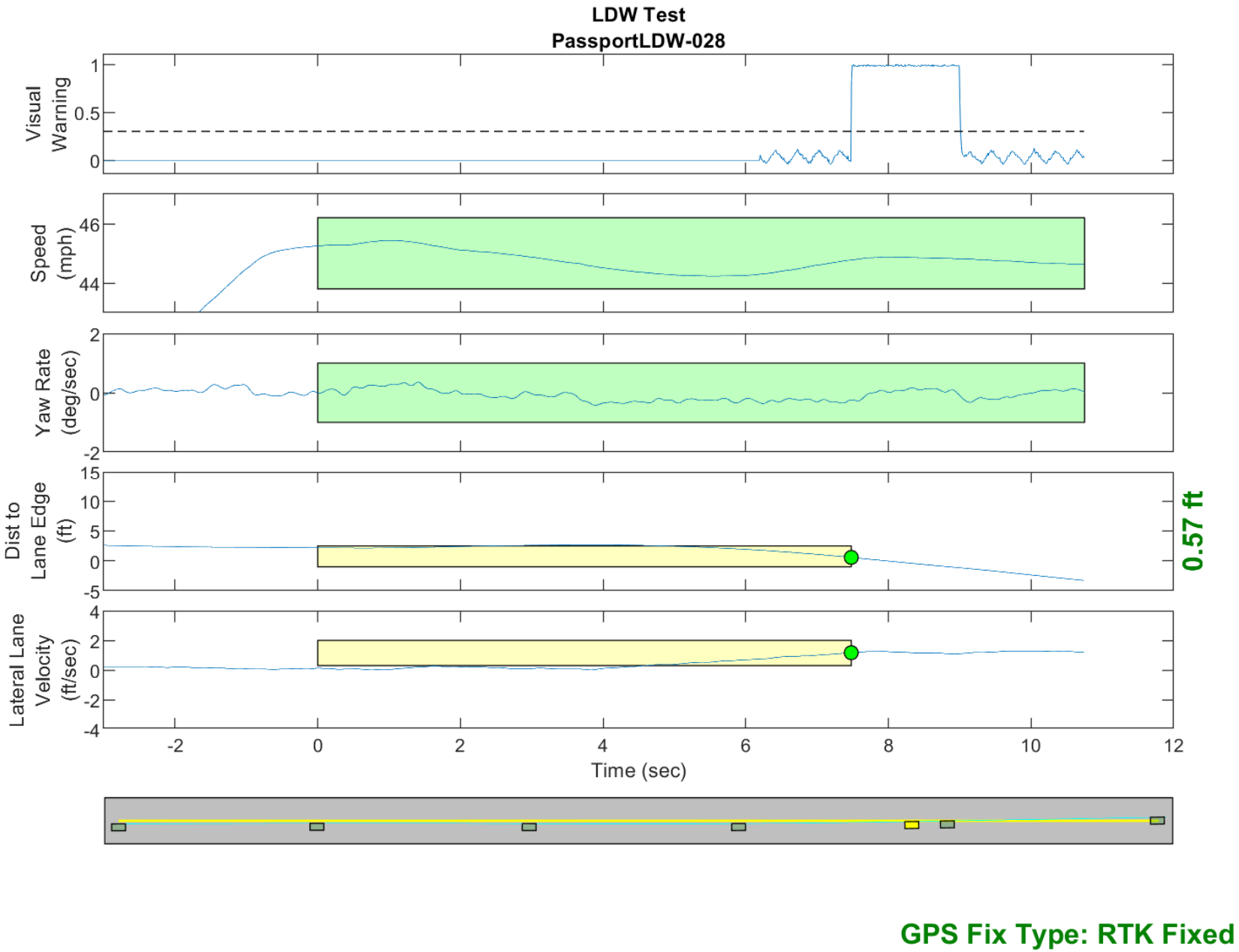


Figure D27. Time History for Run 28, Solid Line, Left Departure, Visual Warning

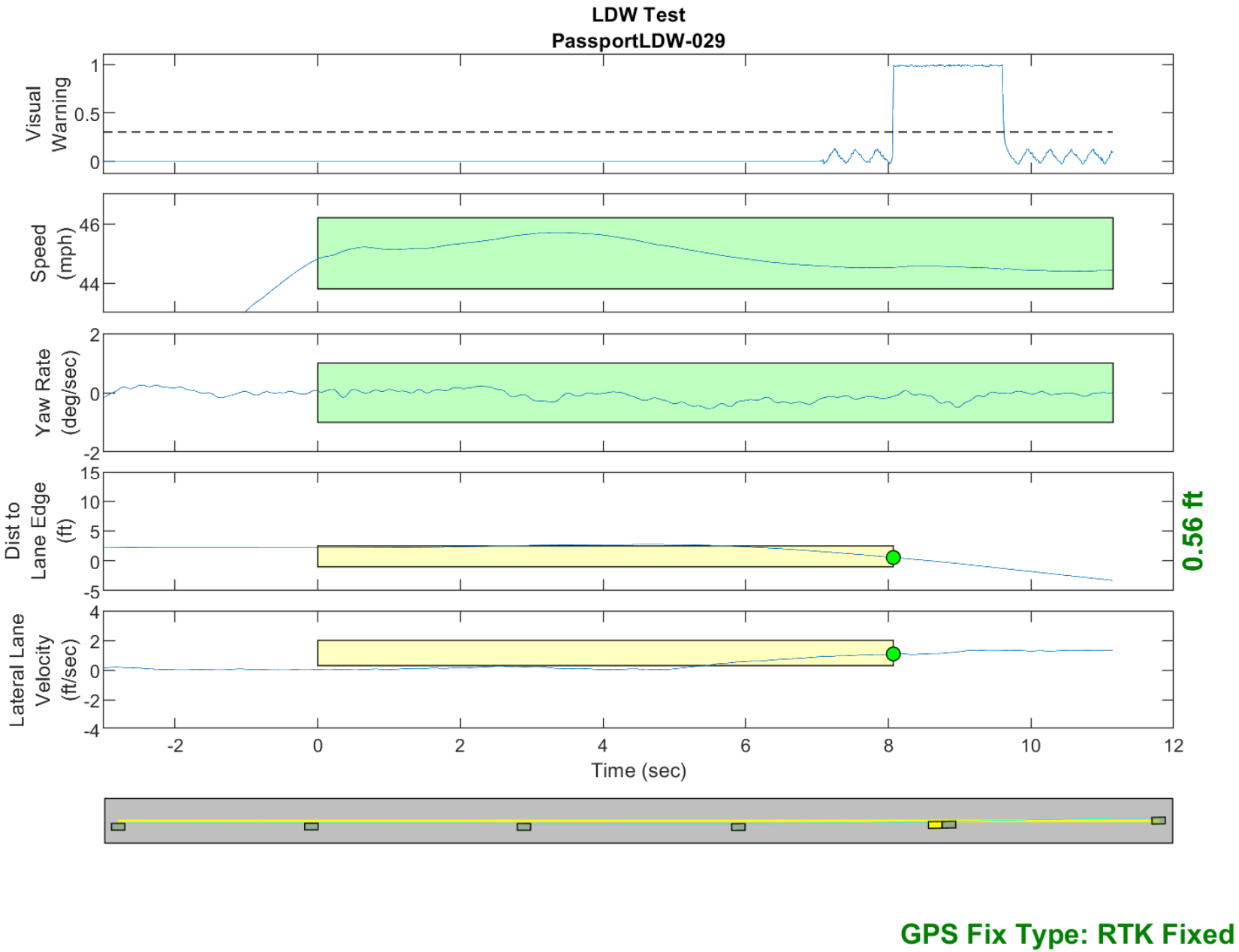


Figure D28. Time History for Run 29, Solid Line, Left Departure, Visual Warning

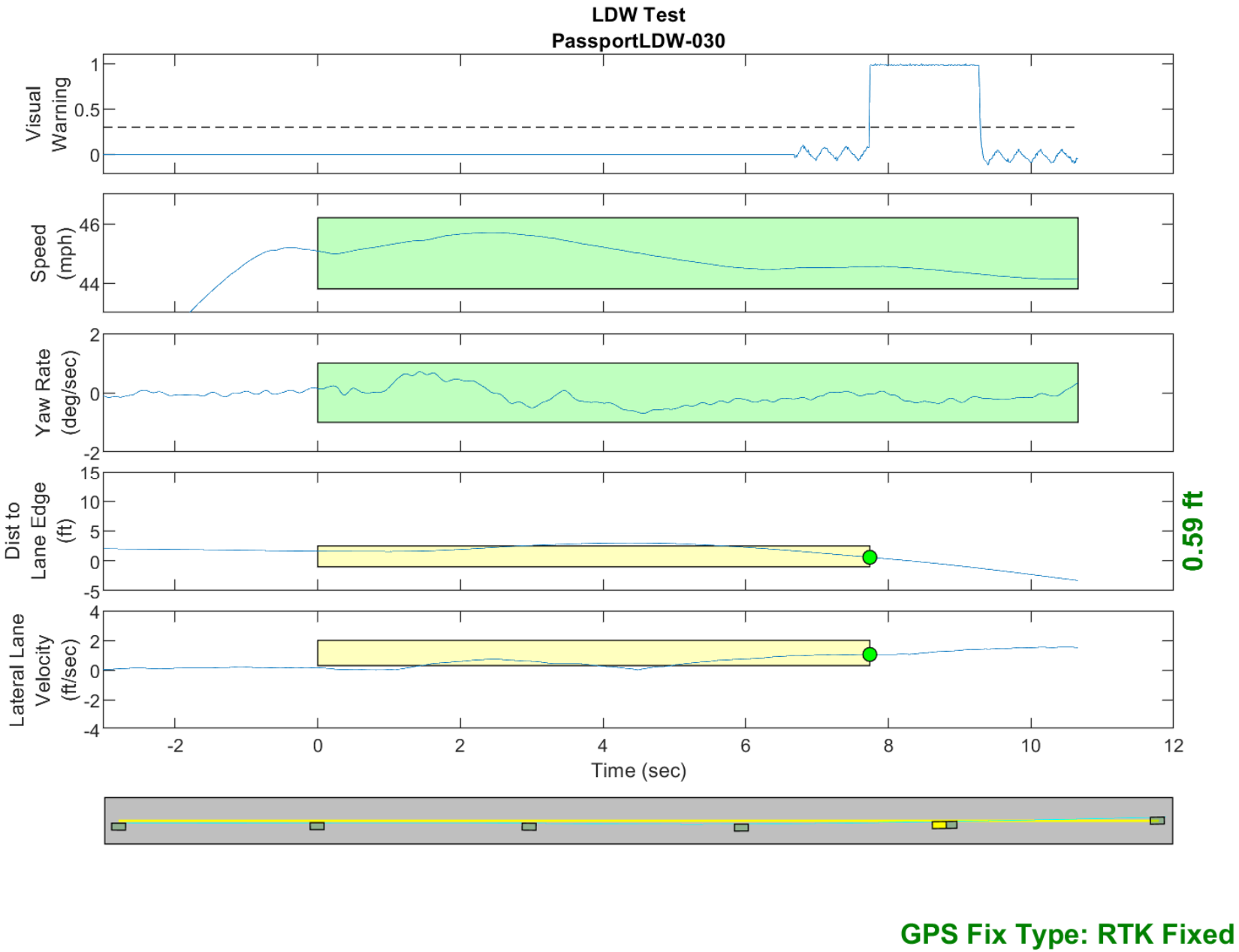


Figure D29. Time History for Run 30, Solid Line, Left Departure, Visual Warning

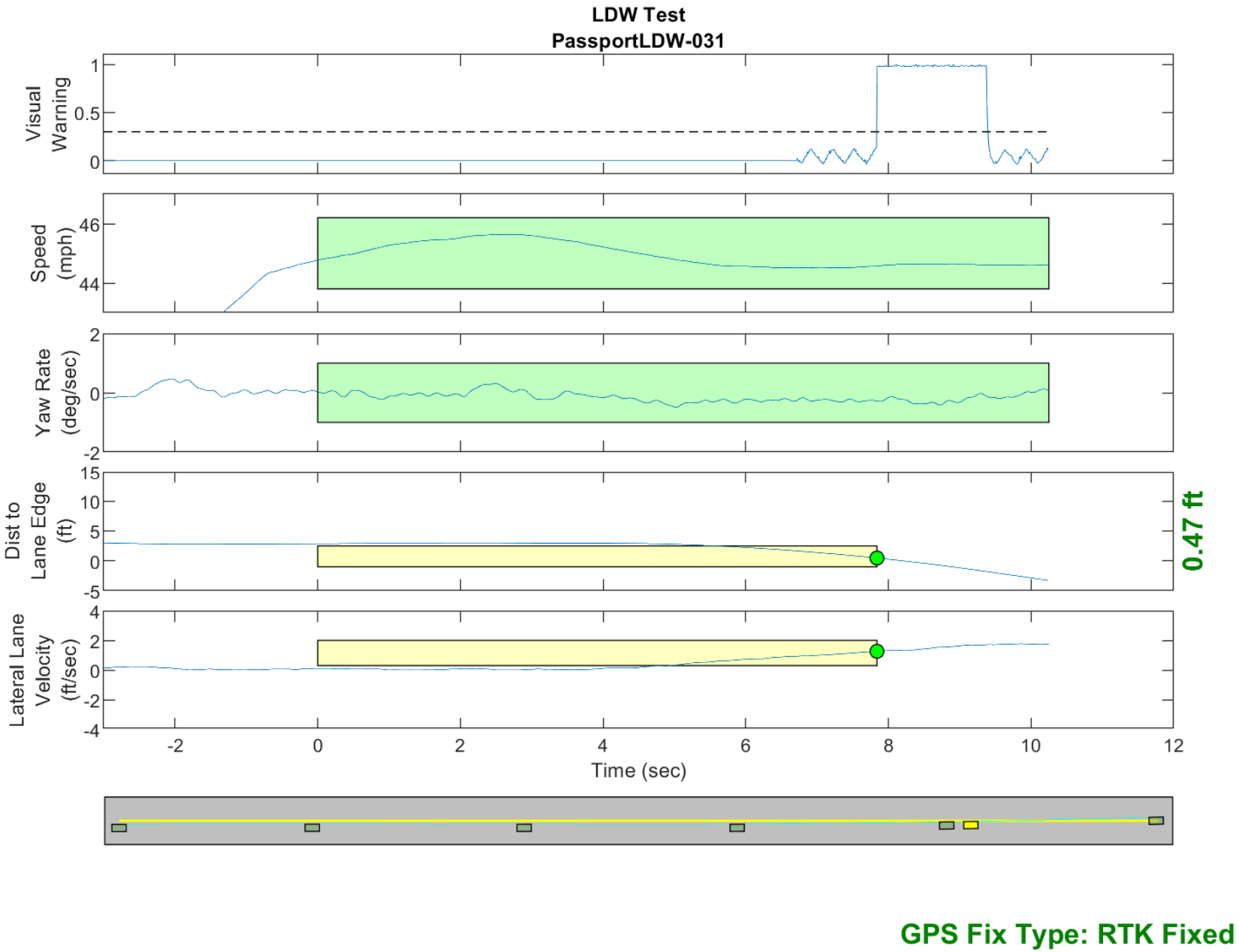


Figure D30. Time History for Run 31, Solid Line, Left Departure, Visual Warning

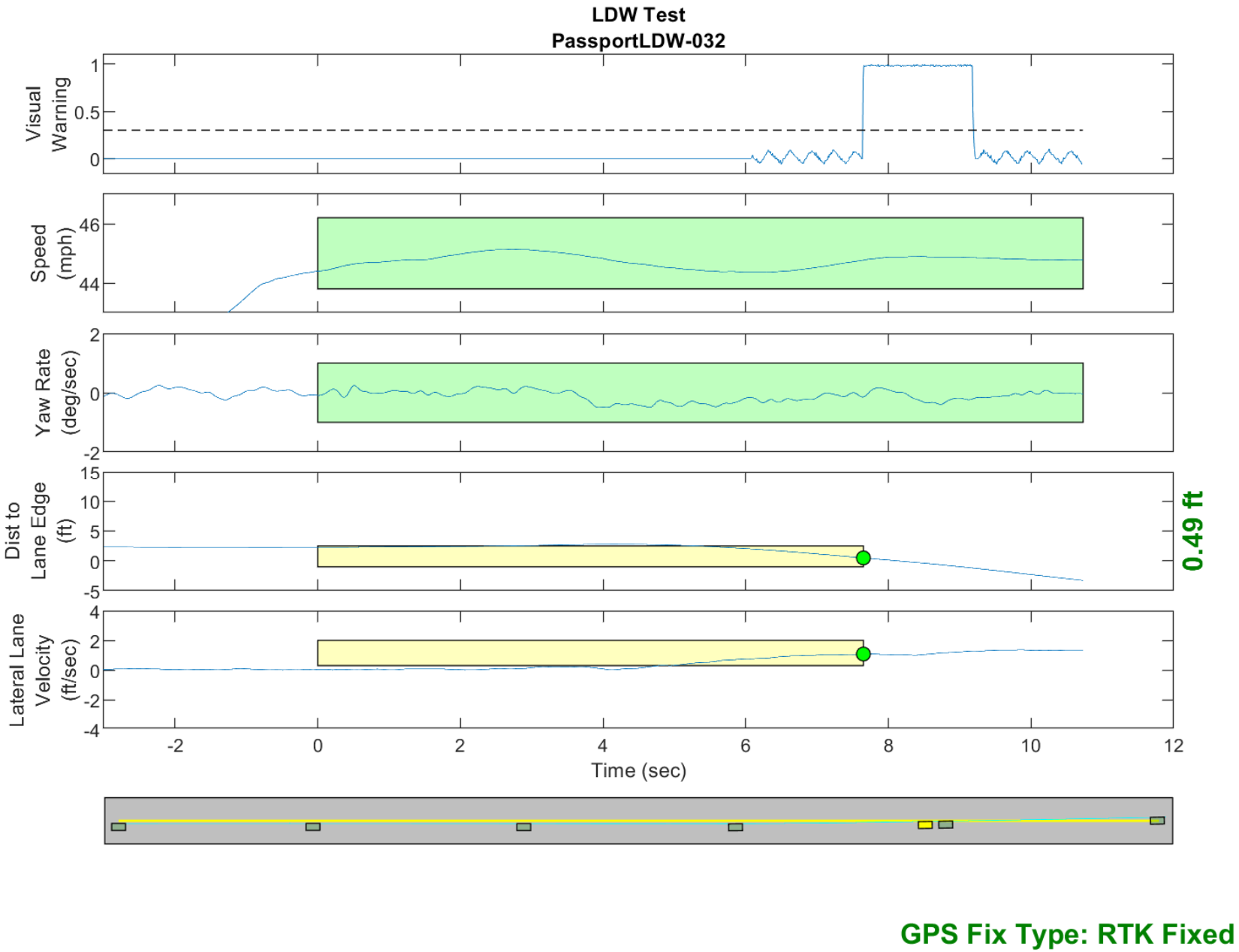


Figure D31. Time History for Run 32, Solid Line, Left Departure, Visual Warning

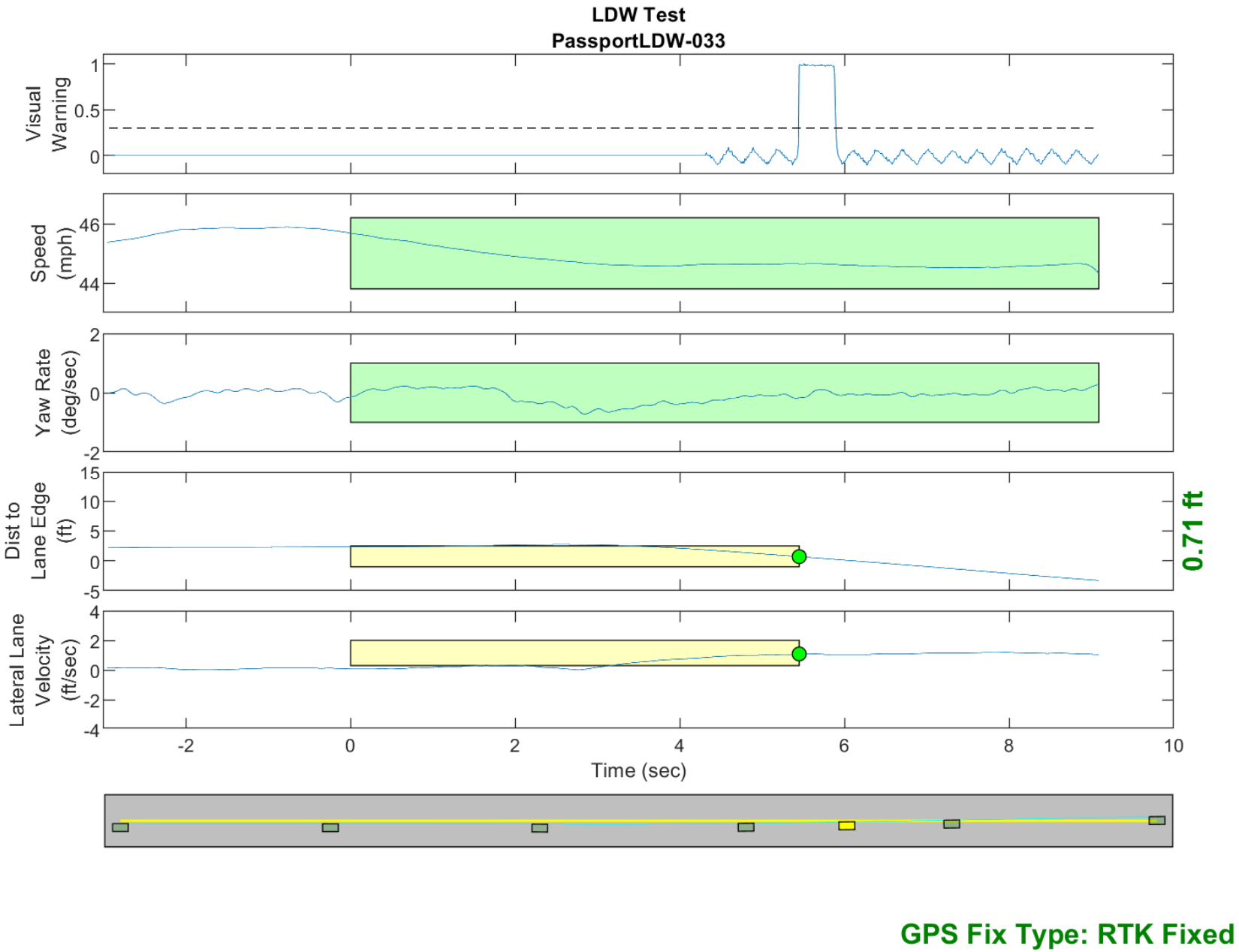


Figure D32. Time History for Run 33, Dashed Line, Left Departure, Visual Warning

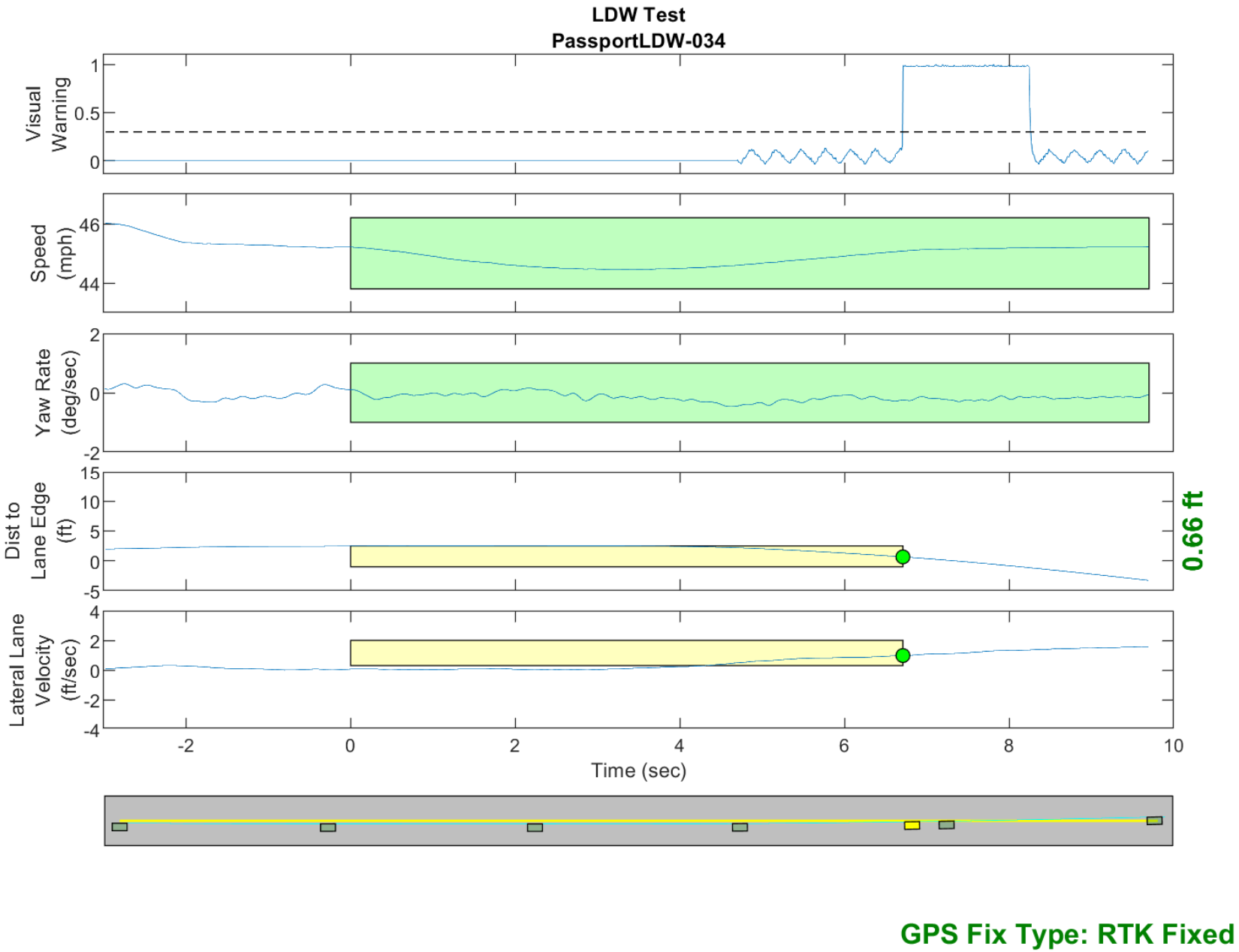


Figure D33. Time History for Run 34, Dashed Line, Left Departure, Visual Warning

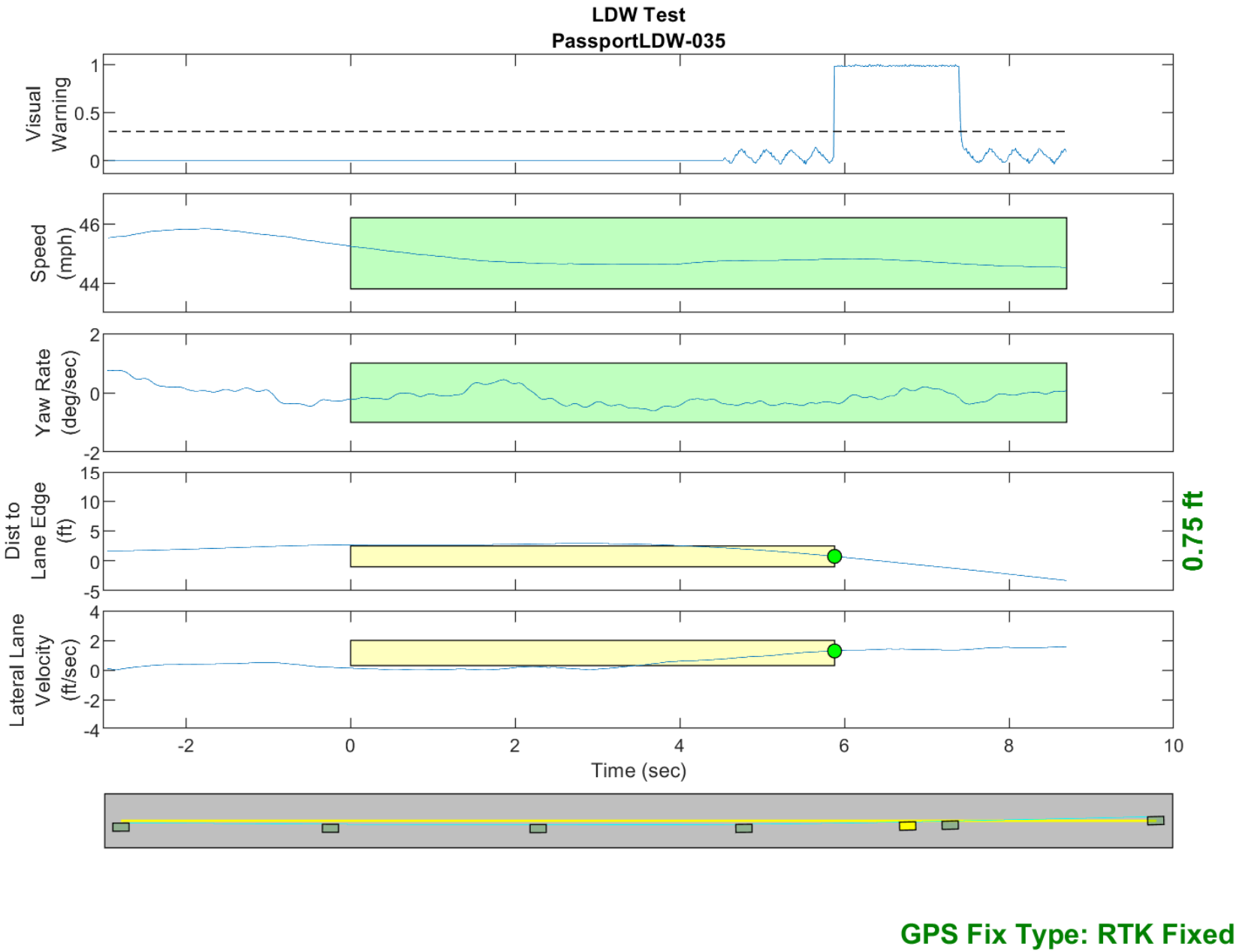


Figure D34. Time History for Run 35, Dashed Line, Left Departure, Visual Warning

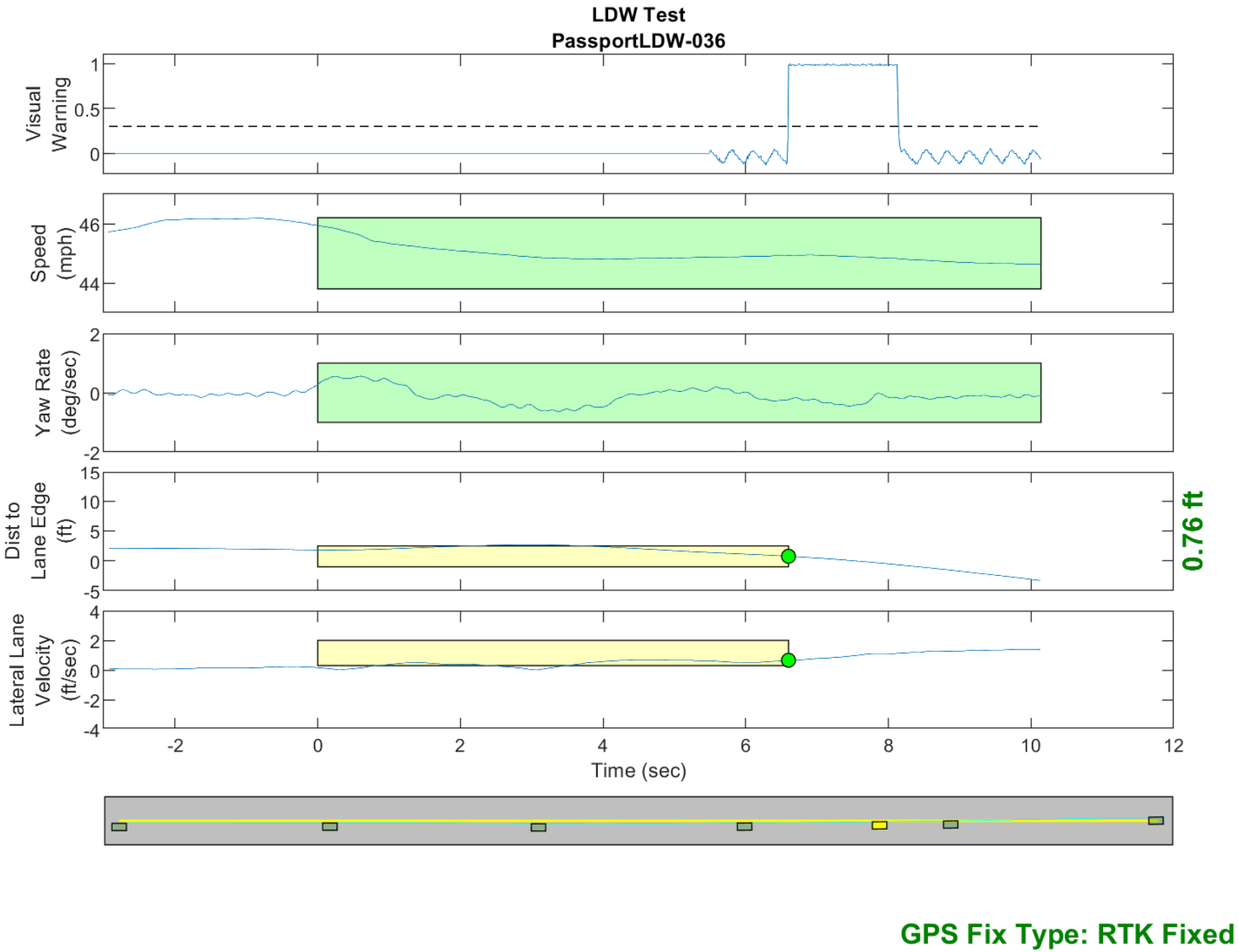


Figure D35. Time History for Run 36, Dashed Line, Left Departure, Visual Warning

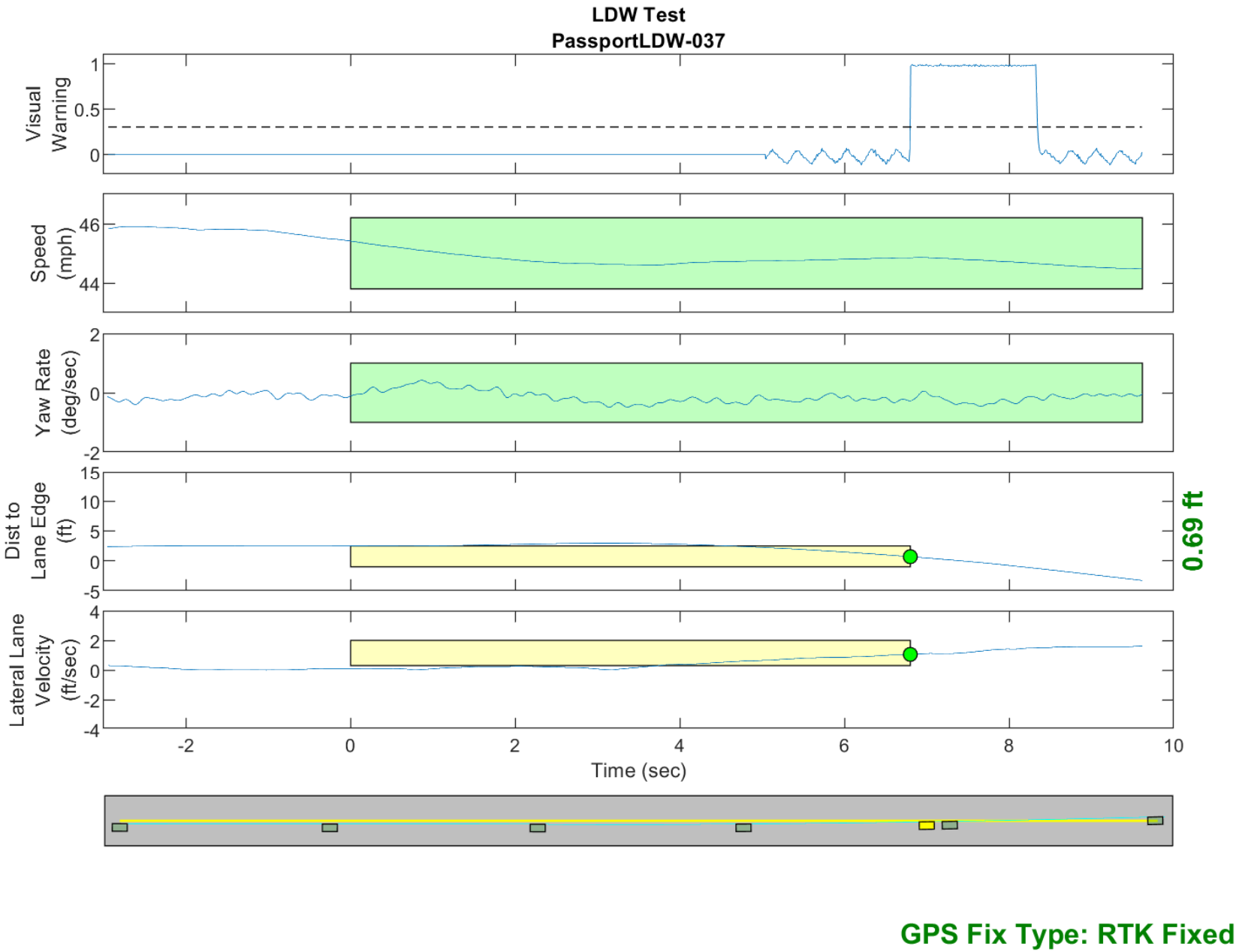


Figure D36. Time History for Run 37, Dashed Line, Left Departure, Visual Warning

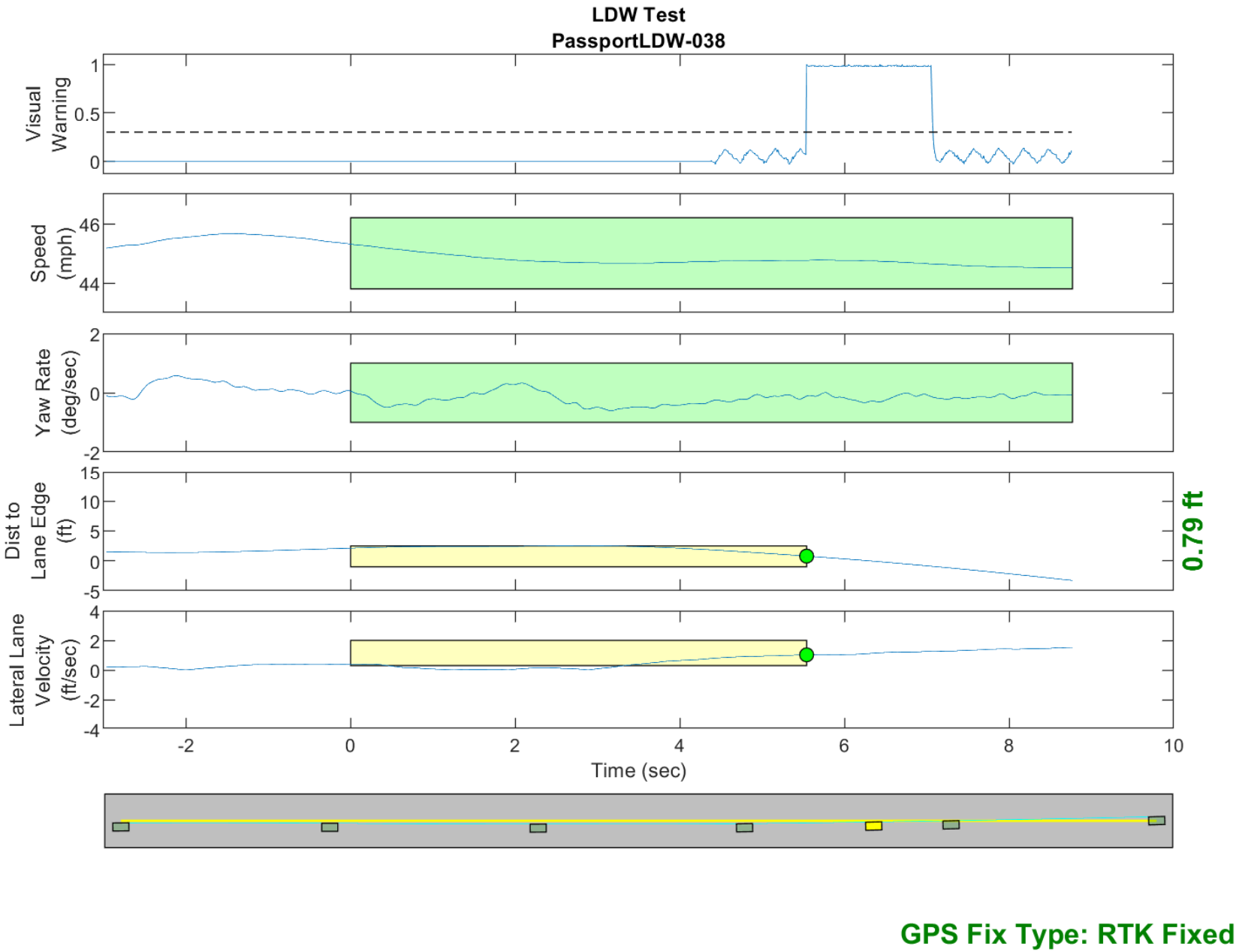


Figure D37. Time History for Run 38, Dashed Line, Left Departure, Visual Warning

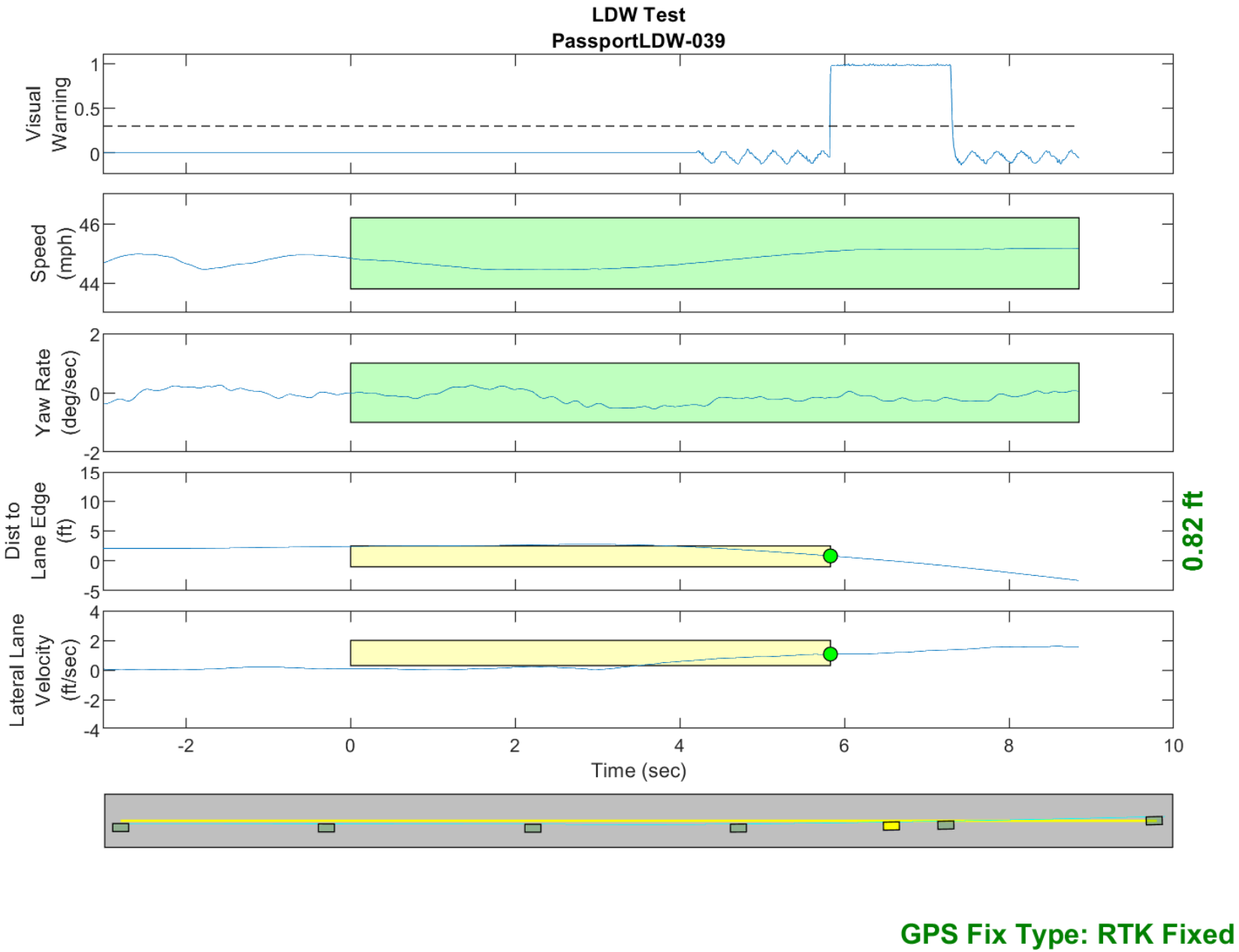


Figure D38. Time History for Run 39, Dashed Line, Left Departure, Visual Warning

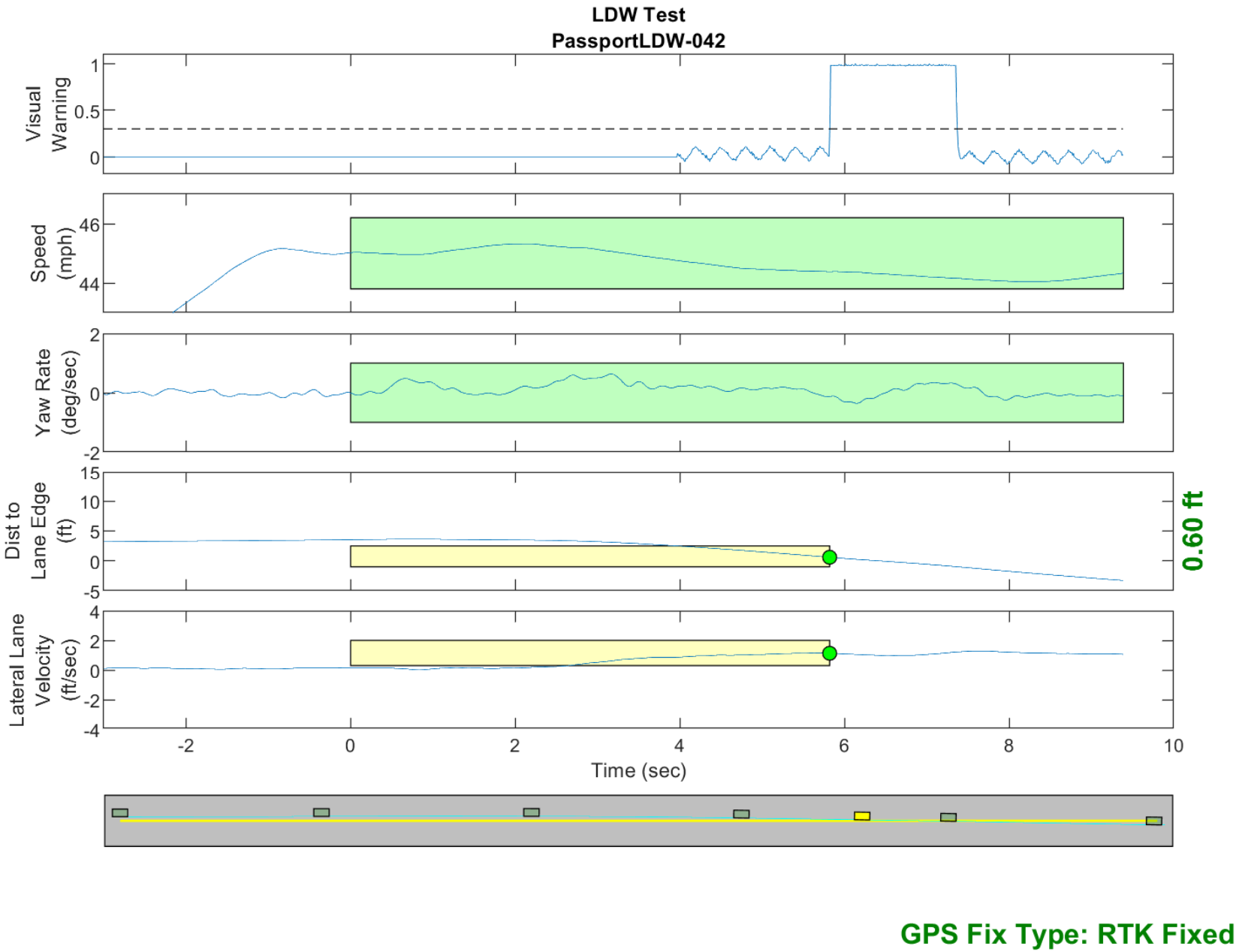


Figure D39. Time History for Run 42, Dashed Line, Right Departure, Visual Warning

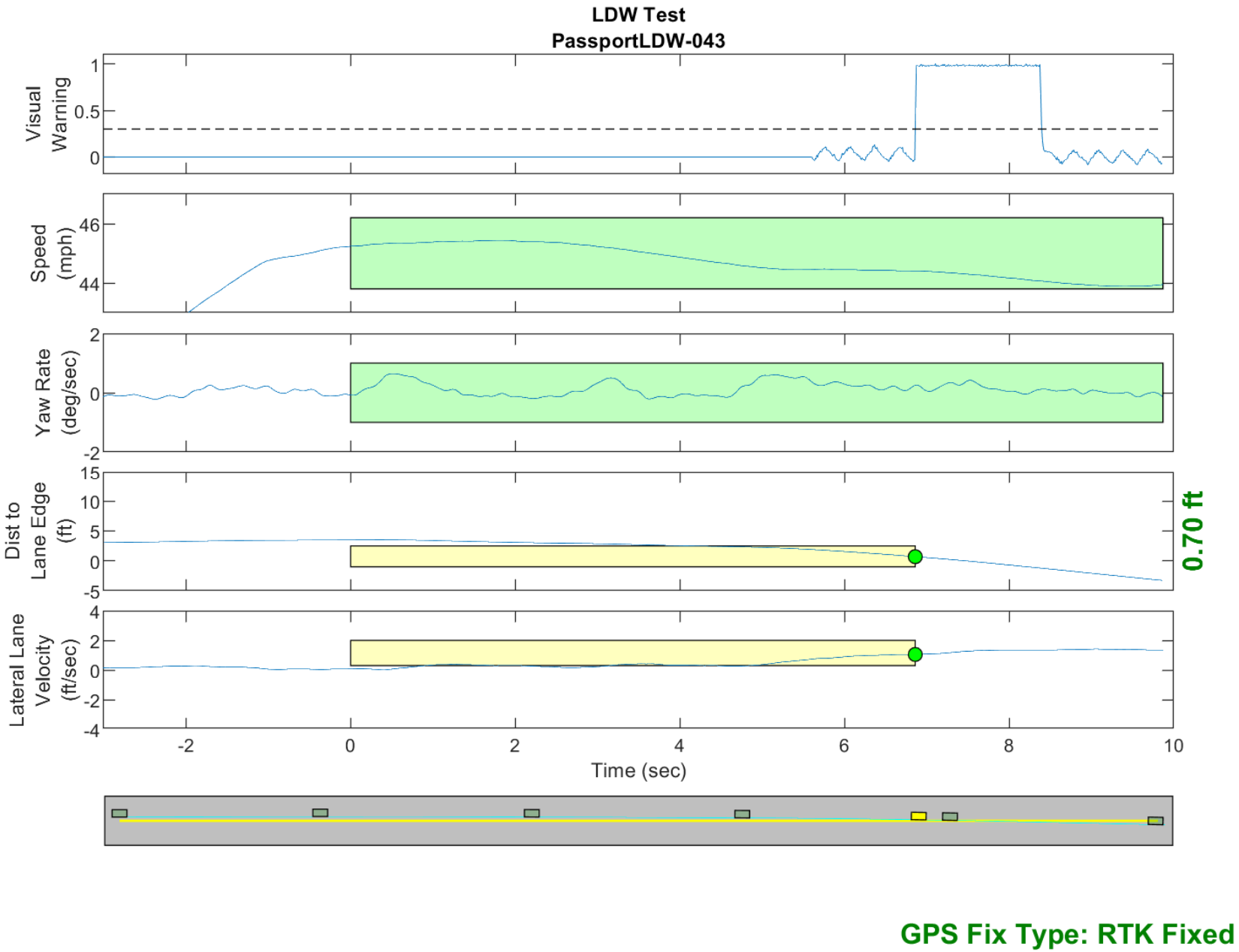


Figure D40. Time History for Run 43, Dashed Line, Right Departure, Visual Warning

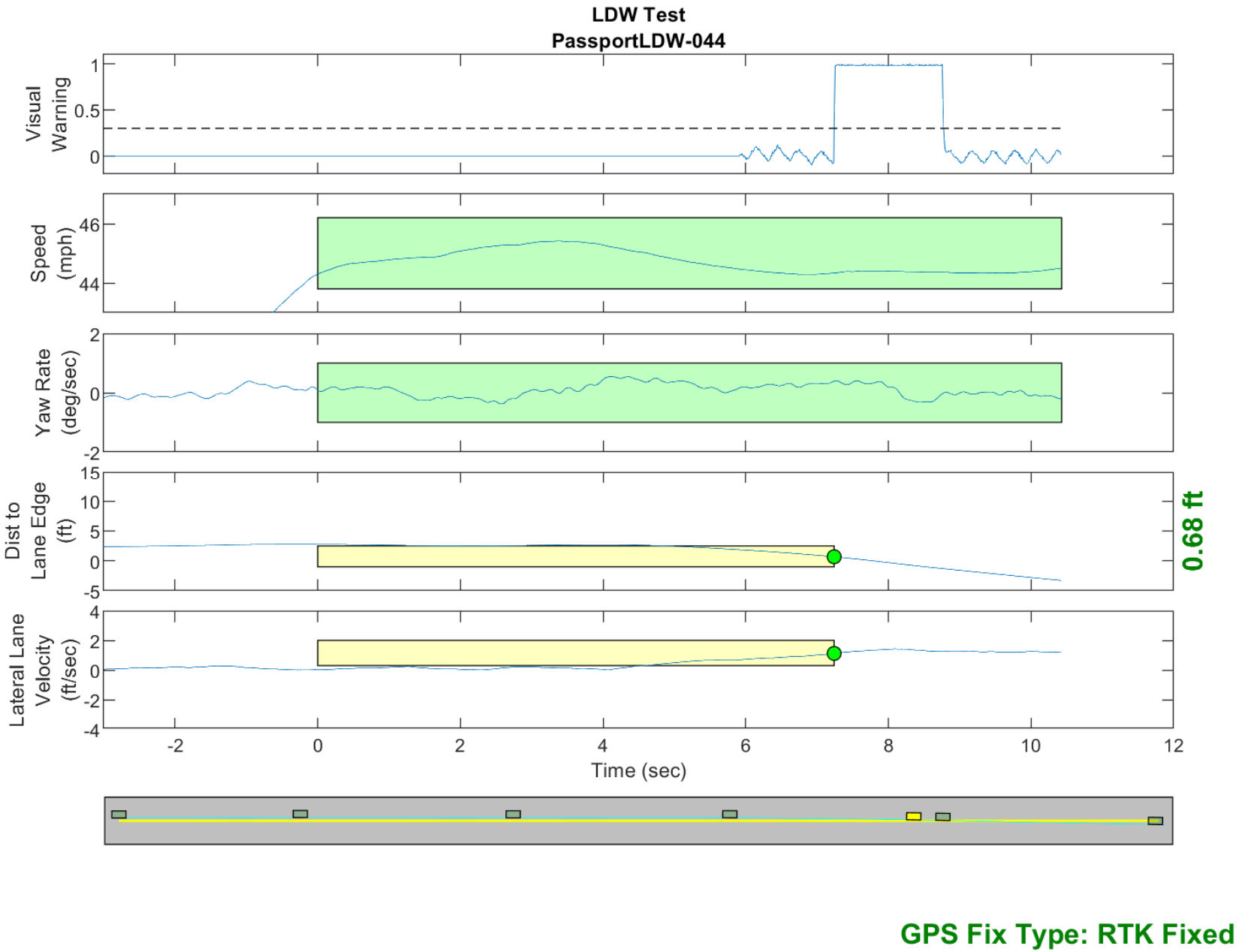


Figure D41. Time History for Run 44, Dashed Line, Right Departure, Visual Warning

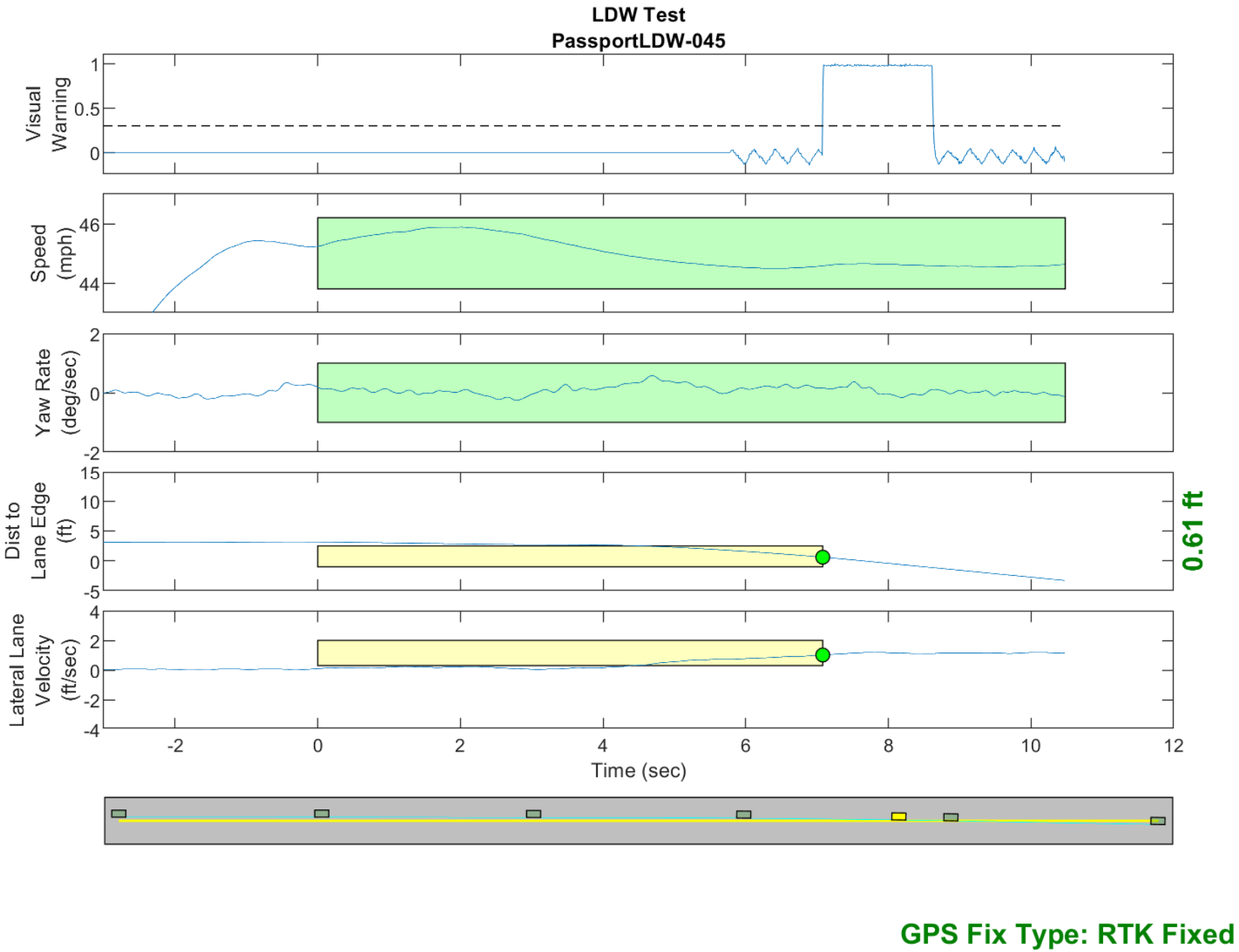


Figure D42. Time History for Run 45, Dashed Line, Right Departure, Visual Warning

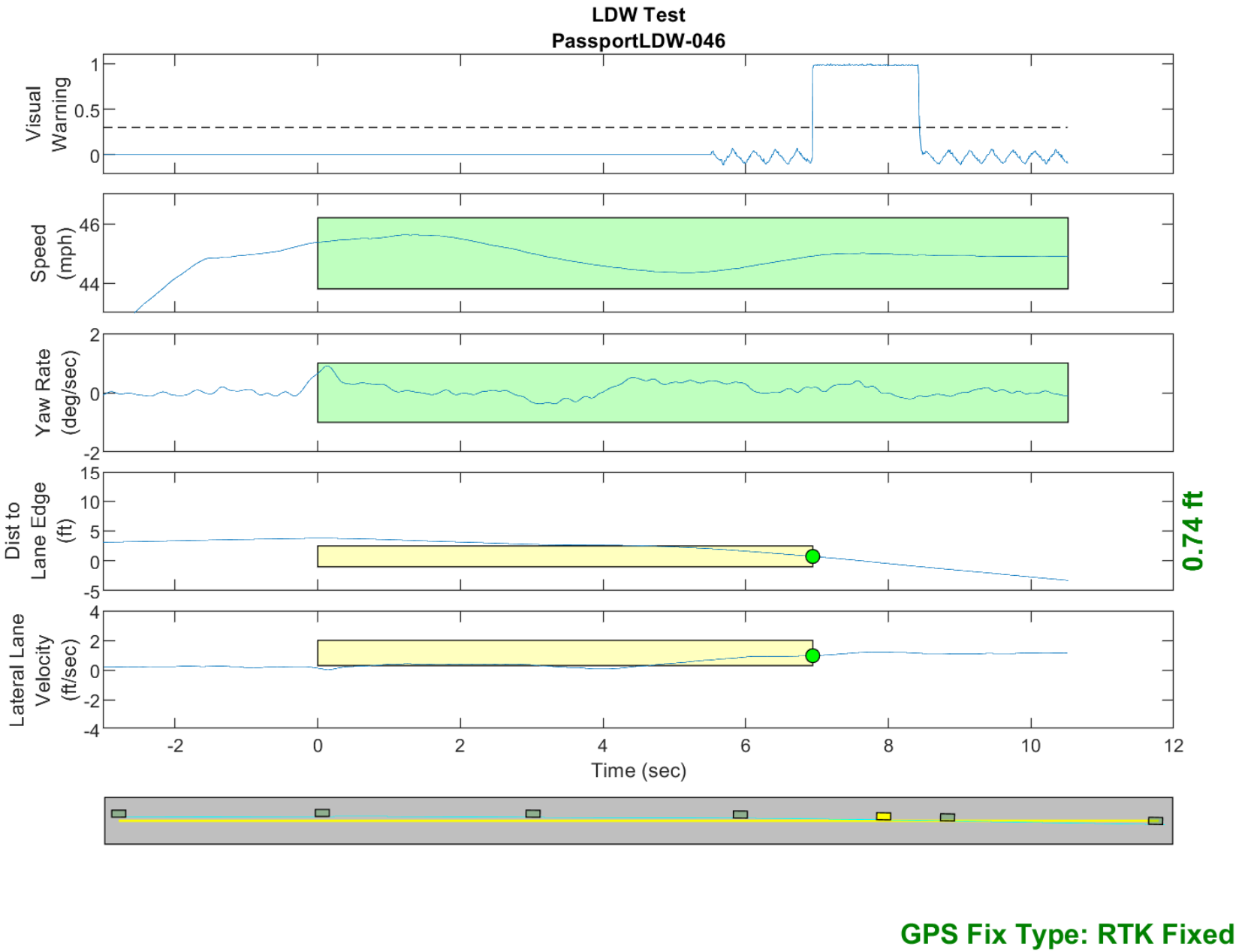


Figure D43. Time History for Run 46, Dashed Line, Right Departure, Visual Warning

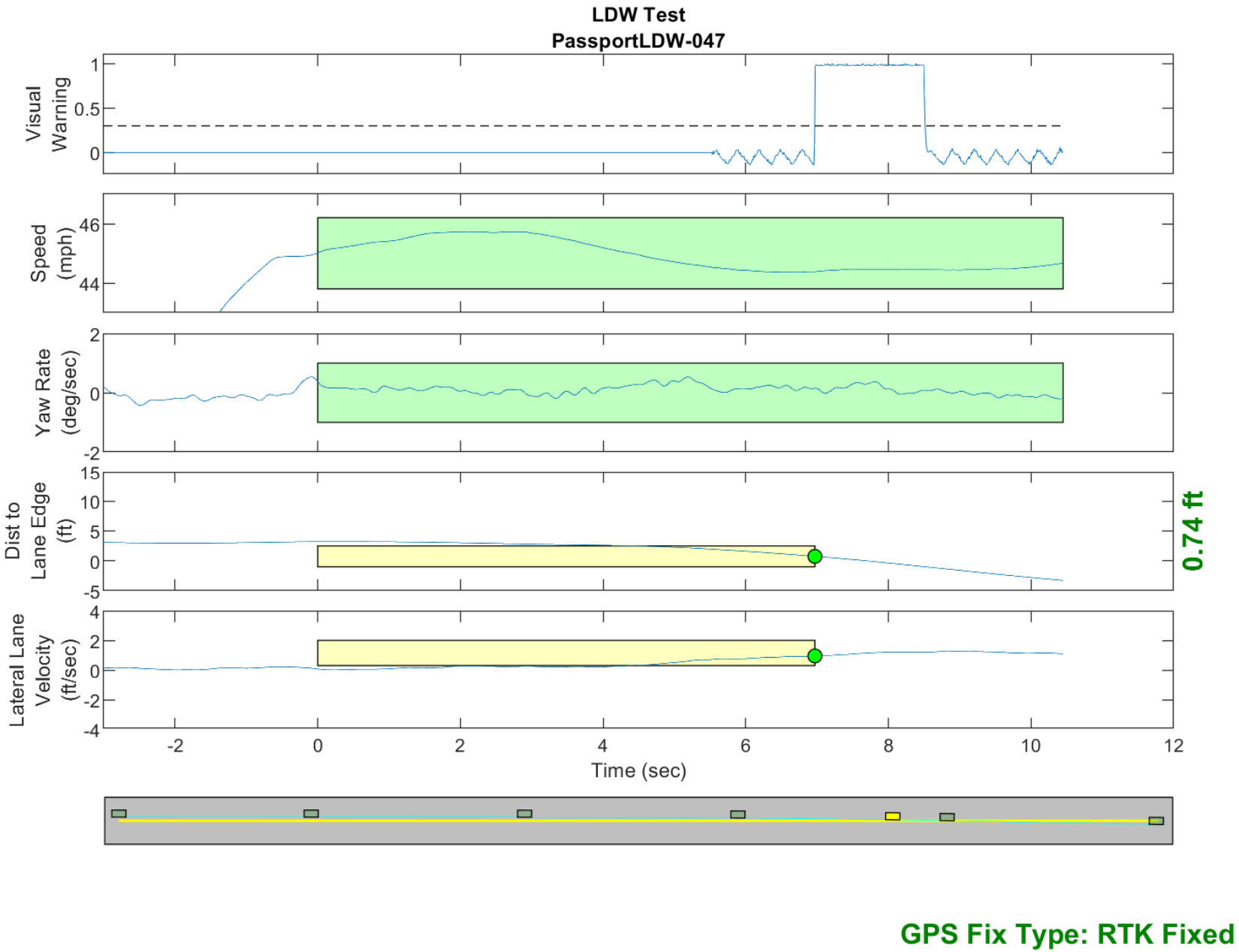


Figure D44. Time History for Run 47, Dashed Line, Right Departure, Visual Warning

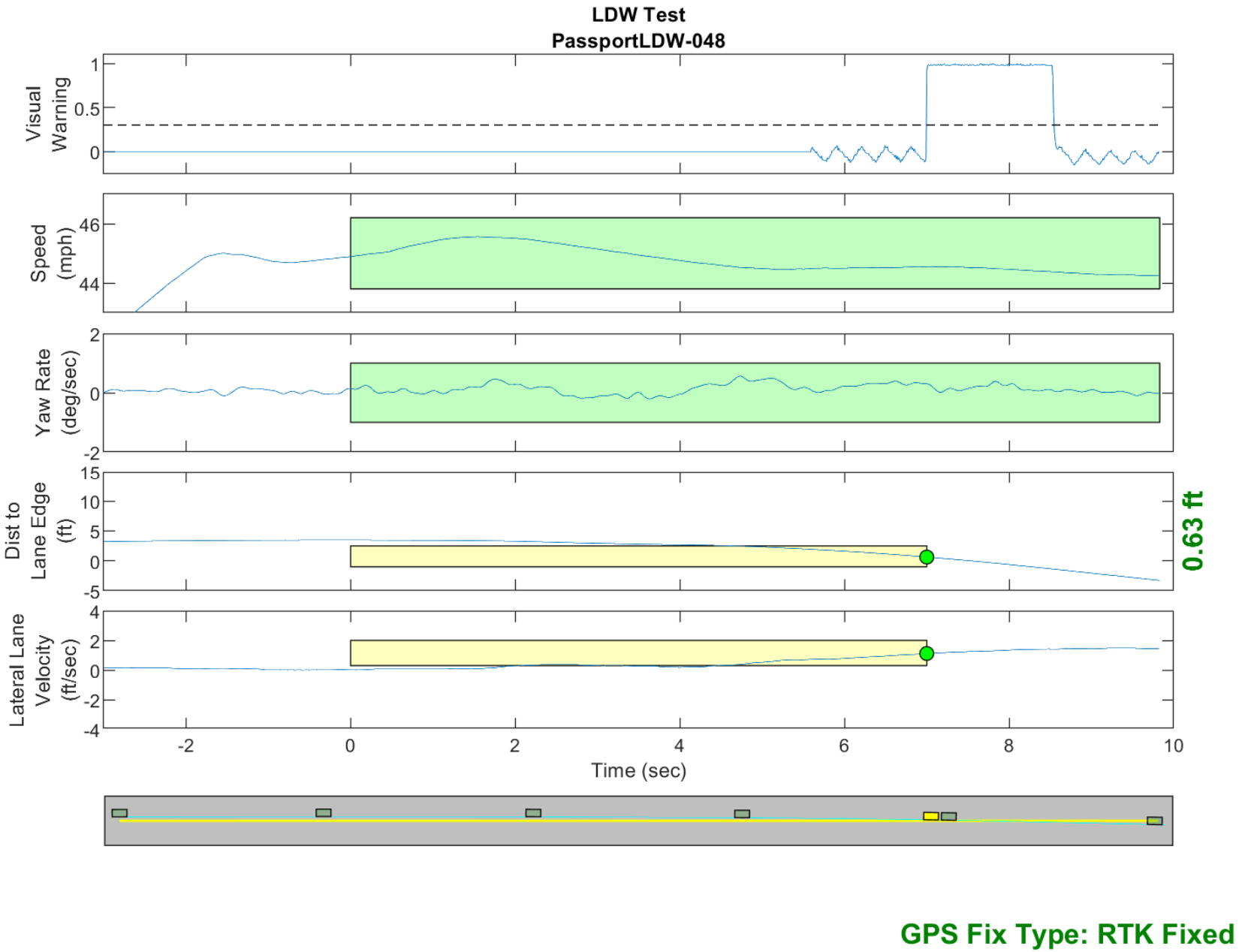


Figure D45. Time History for Run 48, Dashed Line, Right Departure, Visual Warning