# NEW CAR ASSESSMENT PROGRAM
# LANE DEPARTURE WARNING CONFIRMATION TEST
# NCAP-DRI-LDW-22-10

## 2022 Subaru Forester Premium/NFF


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


**Draft 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.



Prepared By: Stephen Rhim and Jonathon Robel

Senior Engineer Test Engineer

Date: 1/21/2022

| | | | |
|---|---|---|---|
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| 16. Abstract<br><br>These tests were conducted on the subject 2022 Subaru Forester Premium/NFF in accordance with the specifications of the New Car Assessment Program's (NCAP's) 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 2022 Subaru Forester Premium/NFF. The LDW system for this vehicle provides both a visual and audible alert 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)**

**2022 Subaru Forester Premium/NFF**

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VIN: *JF2SKADC7NH41xxxx*

Test start date: *1/12/2022*

Test end date: *1/13/2022*

Lane Departure Warning setting: *No range settings available*

| | | |
|---|---|---|
| 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)**

**2022 Subaru Forester Premium/NFF**

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## TEST VEHICLE INFORMATION

VIN: *JF2SKADC7NH41xxxx*

Body Style: *SUV* Color: *Autumn Green Metallic*

Date Received: *1/3/2022* Odometer Reading: *5 mi*

## DATA FROM VEHICLE'S CERTIFICATON LABEL

Vehicle manufactured by: *Subaru Corporation*

Date of manufacture: *11/21*

Vehicle Type: *MPV/VTUM*

## DATA FROM TIRE PLACARD

Tires size as stated on Tire Placard: Front: *225/60R17*

Rear: *225/60R17*

Recommended cold tire pressure: Front: *230 kPa (33 psi)*

Rear: *220 kPa (32 psi)*

## TIRES

Tire manufacturer and model: *Bridgestone Ecopia H/L 422 Plus*

Front tire size: *225/60R17 99H*

Rear tire size: *225/60R17 99H*

Front tire DOT prefix: *EL FC DMM*

Rear tire DOT prefix: *EL FC DMM*

**LANE DEPARTURE WARNING**

**DATA SHEET 3: TEST CONDITIONS**

**(Page 1 of 2)**

**2022 Subaru Forester Premium/NFF**

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## GENERAL INFORMATION

Test start date: *1/12/2022*

Test end date: *1/13/2022*

## AMBIENT CONDITIONS

Air temperature: *12.2 C (54 F)*

Wind speed: *1.0 m/s (2.3 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: *230 kPa (33 psi)*

Rear: *220 kPa (32 psi)*

**LANE DEPARTURE WARNING**

**DATA SHEET 3: TEST CONDITIONS**

**(Page 2 of 2)**

**2022 Subaru Forester Premium/NFF**

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## WEIGHT

Weight of vehicle as tested including driver and instrumentation

| | | | |
|---|---|---|---|
| Left Front: | *526.2 kg (1160 lb)* | Right Front: | *479.0 kg (1056 lb)* |
| Left Rear: | *376.9 kg (831 lb)* | Right Rear: | *371.9 kg (820 lb)* |
| | | Total: | *1754.0 kg (3867 lb)* |

**LANE DEPARTURE WARNING**

**DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION**

**(Page 1 of 2)**

**2022 Subaru Forester Premium/NFF**

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

*EyeSight Driver-Assist System*

Type and location of sensor(s) used:

*Stereo camera located at the top center of the windshield*

Lane Departure Warning Setting used in test:

*N/A*

How is the Lane Departure Warning presented to the driver?

(Check all that apply)

| | |
|---|---|
| **X** | Warning light |
| **X** | Buzzer or auditory alarm |
| | 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, auditory, vibration, or combination), etc.

*The EyeSight system alerts the driver with a visual and auditory alert. The visual alert is displayed in the center of the instrument panel and consists of an image of a vehicle with lane lines, and the words "Lane Departure" above. The lane line corresponding to the side in which the vehicle activated the lane departure warning illuminates yellow. The auditory alert consists of three consecutive beeps with a primary frequency of 2215 Hz.*

## LANE DEPARTURE WARNING

## DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION

**(Page 2 of 2)**

**2022 Subaru Forester Premium/NFF**

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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.

*A button to deactivate the Lane Departure Warning system is located on the front center ceiling control panel. Press and hold the button for approximately 2 seconds and the system will emit a single audible beep and illuminate a Lane Departure Warning Off indicator light when it is deactivated. The on/off status of Lane Departure Warning is restored when you restart the engine. Refer to the Subaru EyeSight Manual pages 130-131 shown in Appendix B pages B-6 to B-7.*

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

_____ Yes

__**X**__ No

If yes, please provide a full description.

*There are no range settings available for the EyeSight system.*

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.

*Refer to the Subaru EyeSight Manual pages 126-129 shown in Appendix B pages B-2 to B-5.*

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.

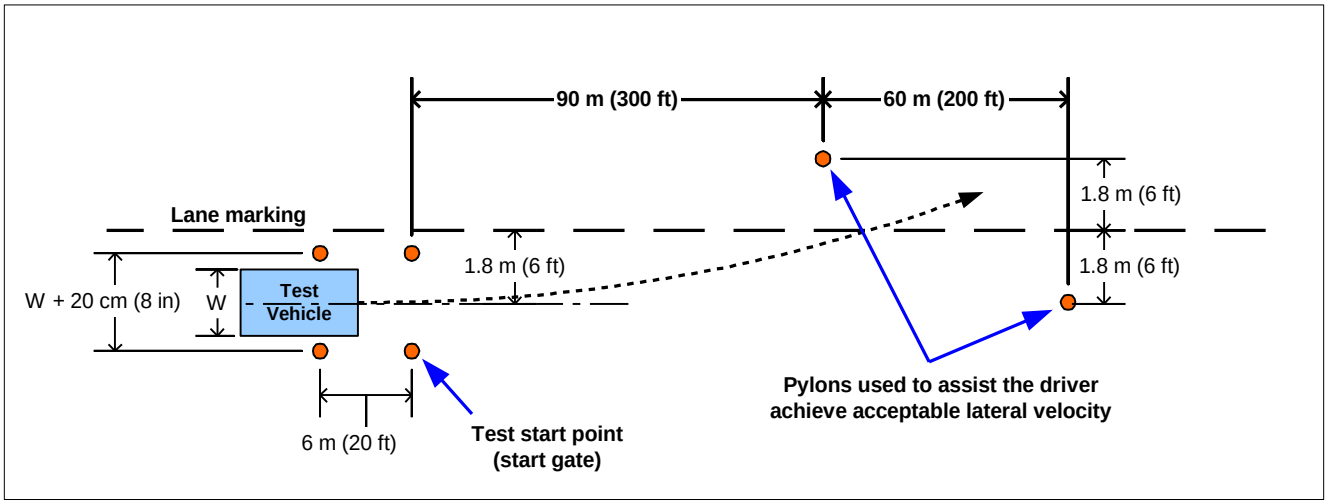


Figure 1. Position of Cones Used to Assist Driver

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.

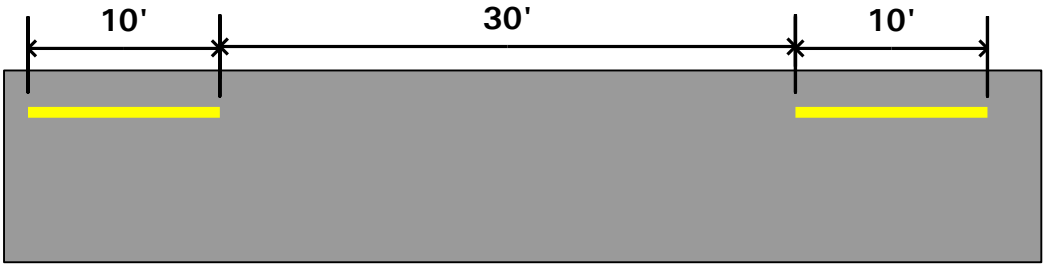


Figure 2. MUTCD Discontinuous Dashed Line Specifications

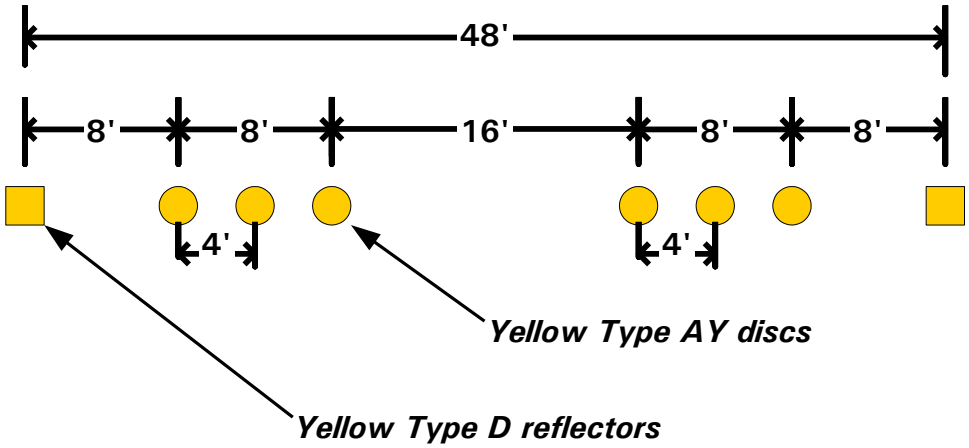


Figure 3. California Standard Plan A20A, Detail 4

## 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<br>0-690 kPa | < 1% error between 20 and 100 psi | Omega DPG8001 | 17042707002 | By: DRI<br>Date: 10/5/2021<br>Due: 10/5/2022 |
| Platform Scales | Vehicle Total, Wheel, and Axle Load | 2200 lb/platform | 0.1% of reading | Intercomp SW wireless | 0410MN20001 | By: DRI<br>Date: 2/10/2021<br>Due: 2/10/2022 |
| Differential Global Positioning System | Position, Velocity | Latitude: ±90 deg<br>Longitude: ±180 deg<br>Altitude: 0-18 km<br>Velocity: 0-1000 knots | Horizontal Position: ±1 cm<br>Vertical Position: ±2 cm<br>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<br>Accels: Lateral, Longitudinal and Vertical<br>Velocities: Roll, Pitch, Yaw<br>Rates: Roll, Pitch, Yaw<br>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 + | 2176 | By: Oxford Technical Solutions[1]<br>Date: 6/26/2020<br>Due: 6/26/2022 |
| Real-Time Calculation of Position and Velocity Relative to Lane Markings | Distance and velocity to lane markings | Lateral Lane Dist: ±30 m<br>Lateral Lane Velocity: ±20 m/sec | Lateral Distance to Lane Marking: ±2 cm<br>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<br>0-2.4 m | ±.0020 in.<br>±.051 mm<br>(Single point articulation accuracy) | Faro Arm, Fusion | UO8-05-08-06636 | By: DRI<br>Date: 1/6/2022<br>Due: 1/6/2023 |

| 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 auditory or haptic alerts, part of the pre-test instrumentation verification process is to determine the tonal frequency of the auditory 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 auditory 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. Auditory and Tactile Warning Filter Parameters**

| Warning Type | Filter Order | Peak-to-Peak Ripple | Minimum Stop Band Attenuation | Passband Frequency Range |
|---|---|---|---|---|
| Auditory | $5^{th}$ | 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


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Figure A1.  Front View of Subject Vehicle

Figure A2.  Rear View of Subject Vehicle

# FORESTER®

VIN JF2SKADC7NH41
Model/Code 2022 SUBARU FORESTER PREMIUM/NFF
Port/Assembly HUENEME
Deliver by/Carrier TRUCK / 456

SUBARU

## GOVERNMENT 5-STAR SAFETY RATINGS

**Overall Vehicle Score** ★★★★★
Based on the combined ratings of frontal, side and rollover.
Should ONLY be compared to other vehicles of similar size and weight.

**Frontal Crash** Driver ★★★★★ Passenger ★★★★★
Based on the risk of injury in a frontal impact.
Should ONLY be compared to other vehicles of similar size and weight.

**Side Crash** Front seat ★★★★★ Rear seat ★★★★★
Based on the risk of injury in a side impact.

**Rollover** ★★★★
Based on the risk of rollover in a single-vehicle crash.

Star ratings range from 1 to 5 stars ( ★★★★★ ) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

CR Consumer Reports RECOMMENDED

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- We use Subaru-trained technicians - those who know your vehicle best
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## EPA DOT Fuel Economy and Environment

Gasoline Vehicle

**Fuel Economy**
**29** MPG
Small SUVs range from 16 to 125 MPG.
The best vehicle rates 142 MPGe.
26 city
33 highway
combined city/hwy
**3.4** gallons per 100 miles

You **save** **$500** in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel cost**
**$1,200**

**Fuel Economy & Greenhouse Gas Rating** (tailpipe only) 6 (1 – 10, Best)
**Smog Rating** (tailpipe only) 7 (1 – 10, Best)
This vehicle emits 310 grams $CO_2$ per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also creates emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs $6,500 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $2.35 per gallon. MPGe is miles per gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

**fueleconomy.gov**
Calculate personalized estimates and compare vehicles

Smartphone QR Code ™

## PARTS CONTENT INFORMATION

FOR VEHICLES IN THIS CARLINE:
U.S./CANADIAN PARTS CONTENT: 5%
MAJOR SOURCES OF FOREIGN PARTS CONTENT: JAPAN: 80%

FOR THIS VEHICLE:
FINAL ASSEMBLY POINT: OTA, GUNMA, JAPAN
COUNTRY OF ORIGIN:
ENGINE:JAPAN
TRANSMISSION:JAPAN

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

## STANDARD EQUIPMENT

**SAFETY**
Symmetrical All-Wheel Drive (AWD)
EyeSight Driver-Assist System
Vehicle Dynamics Control (VDC)
Driver's Side Knee Airbag
Side-Curtain Airbags w/ Rollover Sensor
Subaru Advanced Frontal Airbag System
Front Seat Side (Pelvis/Torso) Airbags
LATCH System for Child Safety Seats, Rear Seat Reminder
Whiplash Protection Front Seats
Anti-Theft Alarm & Immobilizer System
4-Wheel Anti-Lock (ABS) Disc Brakes w/ Brake Assist
Brake Override System and Safety Pedal System
Electronic Brake-Force Distribution
Rear Vision Camera, Daytime Running Lights (DRL)

**PERFORMANCE AND EXTERIOR**
2.5L Horizontally-Opposed DOHC Engine w/ Auto Start-Stop
Lineartronic CVT w/ X-MODE
SI-Drive
17" Aluminum Alloy Wheels
Privacy Glass and Panoramic Power Moonroof
LED Steering Responsive Headlights (SRH)
Automatic On/Off Headlights with High Beam Assist (HBA)
Fog Lights & Folding Exterior Mirrors
Variable Intermittent Windshield Wipers
Rear Spoiler and Roof Rails with Tie Down Points

**COMFORT, CONVENIENCE & INTERIOR**
STARLINK 6.5 Multimedia System w/CD, HD Radio & Dual USB Ports
SiriusXM Radio and SiriusXM Travel Link - 4 Months Free
Multi-Function Display
SUBARU STARLINK Safety Plus+ - 3 Years Free
+Not Available to Massachusetts Residents or Businesses
Bluetooth Hands-Free Phone Connectivity
Tilt/Telescopic Steering Wheel w/Bluetooth & Audio Switches
Leather-Wrapped Steering Wheel
Automatic Climate Control with Air Filtration System
Advanced Adaptive Cruise Control
All-Weather Package w/Heated Front Seats
10-Way Power Driver's Seat w/ Power Lumbar Support
60/40 Split Fold-Down Rear Seatback w/ Reclining Function
Electronic Parking Brake w/ Auto Vehicle Hold (AVH)
Power Windows w/ Driver's and Front Passenger's Auto Up/Down
12V Outlet In Dash, Console & Cargo Area
Keyless Access with Push-Button Start
Retractable Cargo Area Cover

**LIMITED WARRANTY/ROADSIDE ASSISTANCE**
3 Years / 36,000 Miles Basic
5 Years / 60,000 Miles Powertrain
5 Yrs/Unlimited Mileage Rust Perforation
3 Yrs / 36,000 24/7 Roadside Assistance
See Owner Info Kit&Warranty For Details

## OPTIONAL EQUIPMENT AND OTHER ITEMS

| | |
|---|---|
| Manufacturer's Suggested Retail Price | $28,195.00 |
| Exterior Color: Autumn Green Metallic | |
| Full Tank of Gas | INCLD |

**Standard Option: 11**

| | |
|---|---|
| **Destination and Delivery** | **$1,125.00** |
| **Total Suggested Retail Price** | **$29,320.00** |

Privacy Notice www.subaru.com/company/privacy.html



THIS LABEL HAS BEEN APPLIED PURSUANT TO FEDERAL LAW. DO NOT REMOVE OR ALTER PRIOR TO THE DELIVERY TO THE ULTIMATE PURCHASER.

Figure A3. Window Sticker (Monroney Label)


Figure A4. Vehicle Certification Label

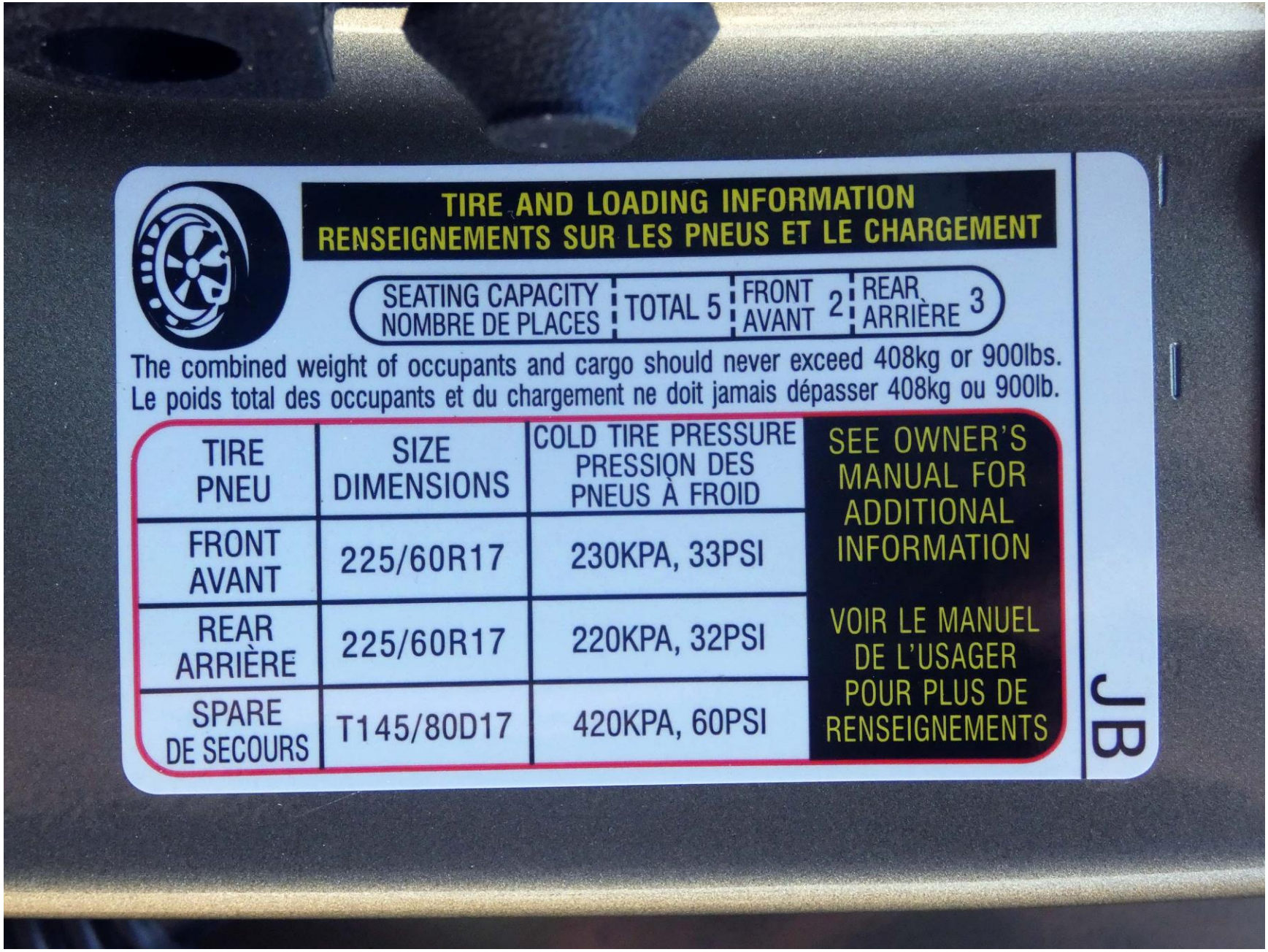



Figure A5. Tire Placard

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

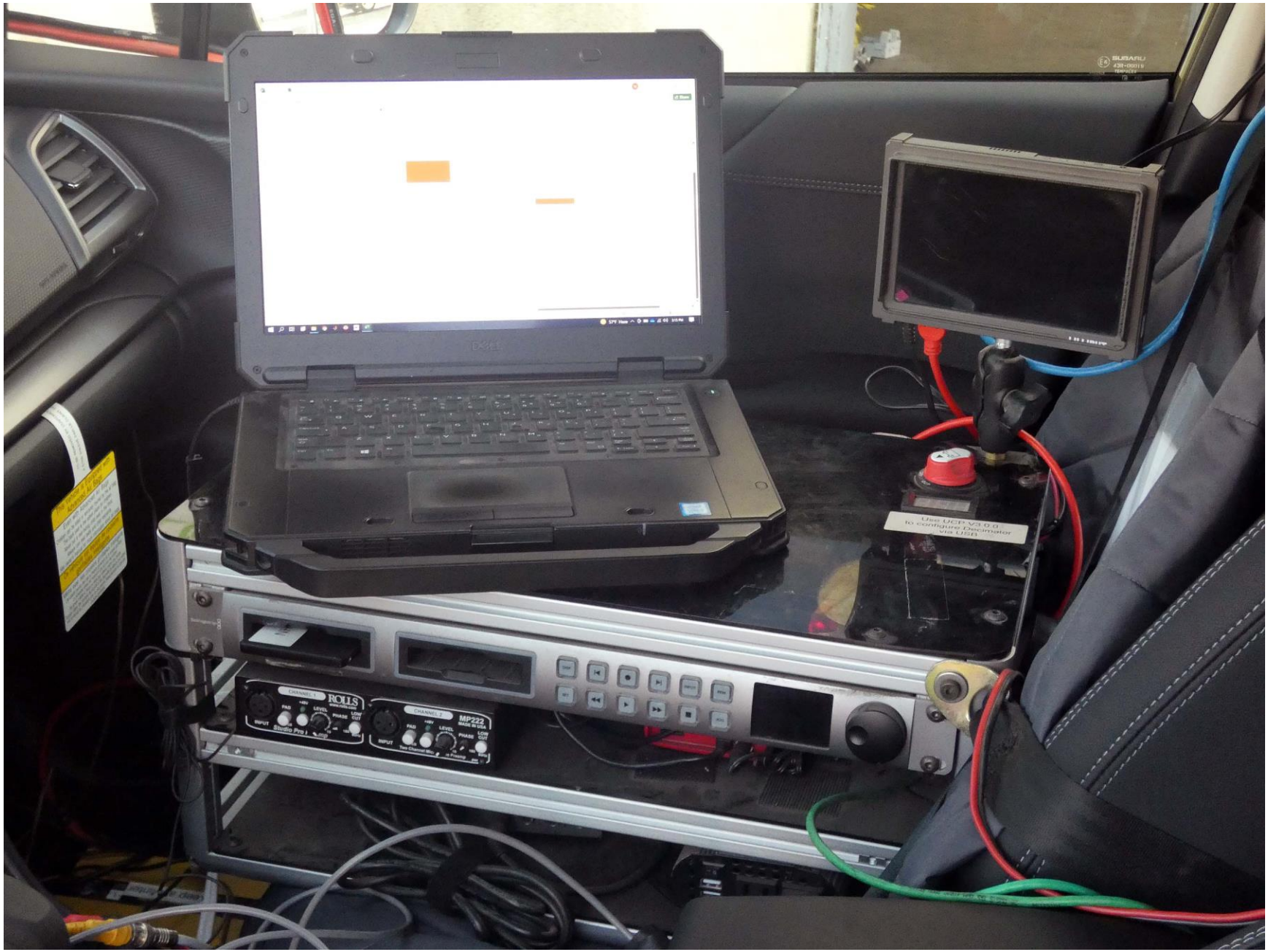



Figure A7. Computer Installed in Subject Vehicle


Figure A8. Sensors for Detecting Visual and Auditory Alerts

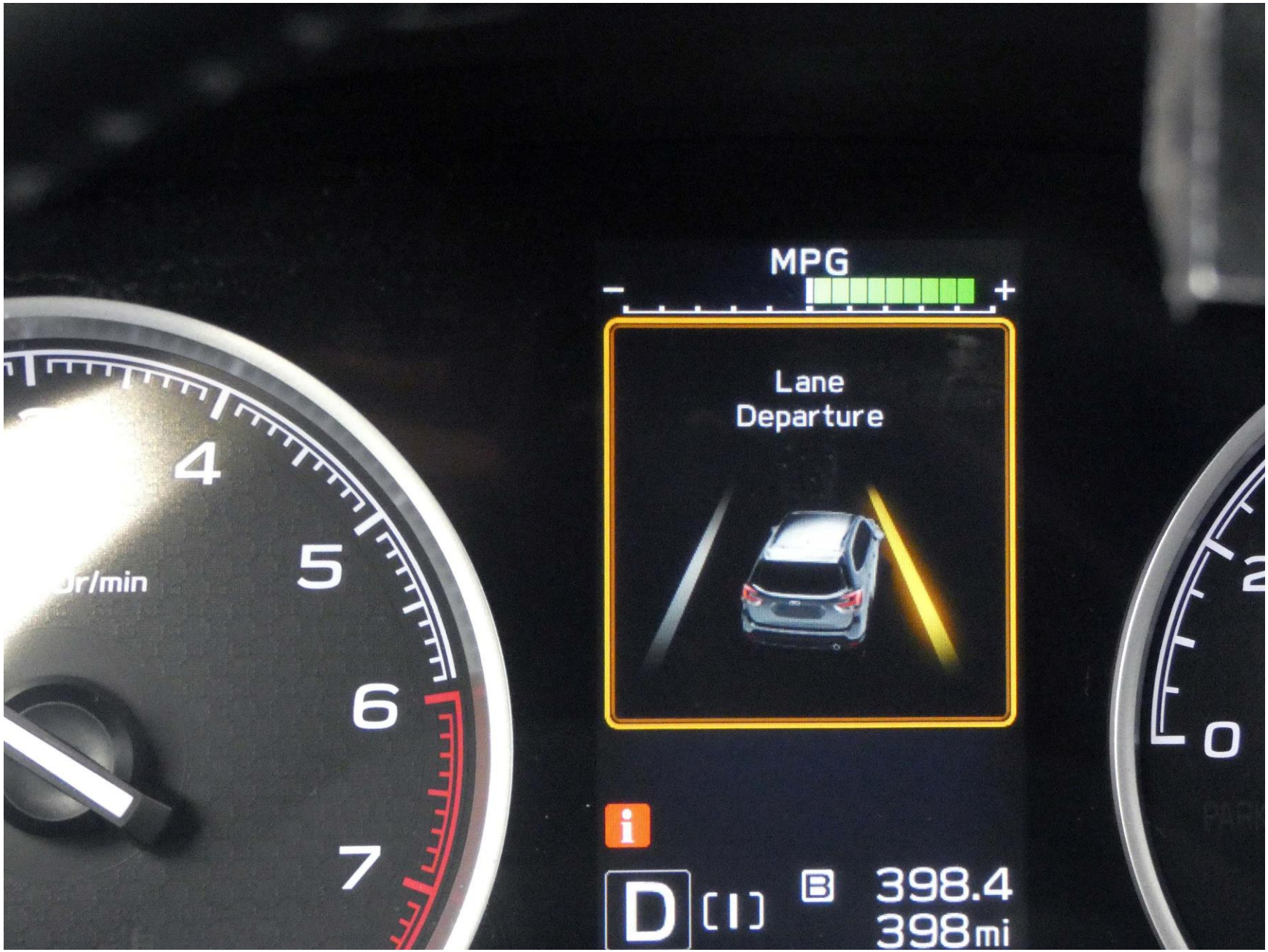



Figure A9. LDW Visual Alert

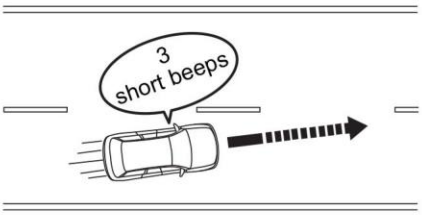

Figure A10. LDW On/Off Switch

# APPENDIX B

Excerpts from Owner’s Manual

# Lane Departure Warning

When vehicle speed is approximately 30 mph (50 km/h) or more, this function warns the driver if the system detects that the vehicle is likely to depart the traffic lane.
When Lane Departure Warning activates, an alert sounds 3 short beeps and an interruption screen will be displayed.




S03878

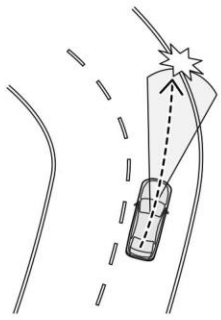

S03037

*: The illustration depicts a vehicle about to cross the left line.

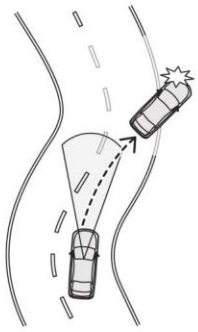
**WARNING**

- Lane Departure Warning will not operate in all conditions. It also will not automatically return the vehicle to the original lane. If the driver relies only on Lane Departure Warning to keep the vehicle in the lane, lane departure may occur, resulting in an accident.
  Lane Departure Warning activates when it detects lane markings. However, it is not a function which can detect the edge of a road (shoulders or side ditches, etc.) and warn the driver.
- The stereo camera may have difficulty detecting the lane markings under the following conditions and the system may not operate properly.
  - At night or in a tunnel without the headlights on
  - In bad weather (for example, rain, snow or thick fog)
  - The road surface is wet and shining by reflected sunlight.
  - There are other traffic markings on the lane you are driving in (arrows, words, etc.).
  - The distance between your vehicle and the vehicle in front is short, making it difficult to detect lane markings.
  - A vehicle intruded from an adjacent lane or the vehicle in front changed lanes.

- The shape of a curve in the road suddenly changes.
- Shadows of guardrails or similar objects are overlapped on the lane markings.
- Strong light is coming from the front (sunlight or headlight beams of oncoming traffic, etc.).
- The width of a lane is either too narrow or too wide.
- The width of a lane has changed.


S03022

- The stereo camera may have difficulty detecting the lane due to the performance of the camera.
  - There are no lane markings or they are very worn.
  - The lane markings are painted in yellow.
  - The lane markings are similar in color to the road surface.
  - The lane markings are drawn in double.
  - The width of lane markings is narrow.
  - Lines that are not lane markings are painted on roads.
  - The lane markings are touching the walls and poles.
- The shape of lane markings suddenly changes (entrance/exit of a curve, crank and winding road, etc.).
- There is a curb or a side wall on the road shoulder.
- The brightness changes such as at a tunnel entrance or exit or when you drive under an overpass.
- Fluid has not been fully wiped off the windshield during or after washer use.


S02855

Continued on next page ⇒

⇒ Continued from previous page

- The vehicle is tilted at an extreme angle due to loaded cargo or other factors.
- Snow, puddles or snow melting agents remain on the road surface.
- Visibility is poor due to sand, smoke or water vapor blowing in the wind, or the front vision is obscured due to water splashes, snow, dirt or dust stir up generated by the vehicle in front or oncoming traffic.
- The windshield has become fogged, scratched or smeared, or snow, dirt, dust or frost has adhered to it, or it is otherwise affected. These will reduce the stereo camera's field of view. Also, light is reflecting off the dirt, etc.
- Rain or dirt has not been fully wiped off of the windshield. There is a risk of that the stereo camera may not detect the lanes or the oncoming vehicle.
- The stereo camera's field of view is obstructed (for example by a canoe on the roof of the vehicle).

**⚠ CAUTION**

In the following situations, Lane Departure Warning may not activate:

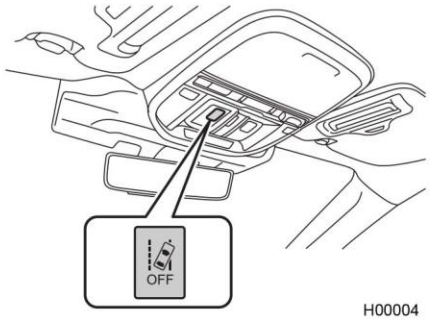
- Vehicle speed is approximately 30 mph (50 km/h) or less.
- The steering wheel is turned significantly to either side.
- The road grade abruptly changes (uphill or downhill).
- On a sharp curve
- The brake pedal is depressed or immediately after it is depressed.
- The turn signal is operating.
- For approximately 3 seconds after the turn signal lever has returned to its original position
- The vehicle has not returned to the inside of the lane after Lane Departure Warning has activated.

**NOTE**

- The following situations may cause incorrect lane detection and a faulty Lane Departure Warning to occur.
  - There are tire tracks on a wet road or snow-covered road.
  - There are boundaries between snow and asphalt, or marks from road repair, etc.
  - There are the shadows of guardrails.
  - Lane markings are drawn in double.
  - There are some lane markings left from roadwork or markings from the previous road.
  - Lane Departure Warning determines when to activate the warning from various factors, such as how fast the vehicle is approaching the lane markings. Therefore, the position at which the warning is activated may vary.
- When the Lane Departure Warning OFF indicator light is illuminated, Lane Departure Warning is inactive.
  ⇒ Page 131

## Turning off Lane Departure Warning

Press and hold the Lane Departure Warning OFF switch for approximately 2 seconds or longer to turn off Lane Departure Warning. When 1 short beep sound emits, this function is turned off and the Lane Departure Warning OFF indicator light on the instrument panel will illuminate.
To turn the function back on, press and hold the Lane Departure Warning OFF switch again for approximately 2 seconds or longer. When the function is turned on, the Lane Departure Warning OFF indicator light turns off.



H00004

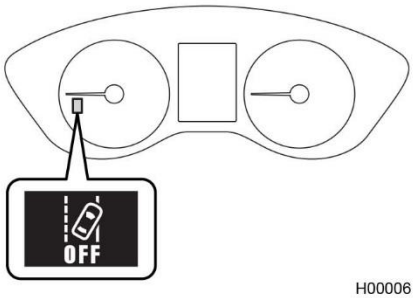
**NOTE**

- When Lane Departure Warning is turned off, Lane Sway Warning is also turned off.
- The on/off status of Lane Departure Warning is restored when you restart the engine.

## ■ Lane Departure Warning OFF indicator light

This indicator light illuminates when the ignition switch is turned to the ON position, and then approximately 10 seconds after the engine starts, it turns off or remains illuminated depending on the current status (ON or OFF). It turns on when Lane Departure Warning and Lane Sway Warning are turned off.
It also illuminates under the following conditions.

- The EyeSight system has a malfunction.
  ⇒ Page 155
- The EyeSight system has stopped temporarily.
  ⇒ Page 157




H00006

# APPENDIX C

## Run Log

Subject Vehicle: **2022 Subaru Forester Premium/NFF**

Test start date: **1/12/2022**

Test end date: **1/13/2022**

Driver: **J. Robel**

**Note: For Distance at Warning, positive values indicate inside the lane**

| Run | Lane Marking Type | Departure Direction | Valid Run? | Distance at Audible Alert (ft) | Distance at Visual Alert (ft) | Pass/Fail | Notes |
|---|---|---|---|---|---|---|---|
| 1 | **Solid** | **Left** | N | | | | SV Speed |
| 2 | | | Y | -0.03 | -0.23 | Pass | |
| 3 | | | Y | -0.08 | -0.27 | Pass | |
| 4 | | | Y | -0.14 | -0.28 | Pass | |
| 5 | | | Y | 0.02 | -0.16 | Pass | |
| 6 | | | Y | -0.01 | -0.18 | Pass | |
| 7 | | | Y | -0.05 | -0.25 | Pass | |
| 8 | | | Y | 0.02 | -0.19 | Pass | |
| | | | | | | | |
| 9 | **Solid** | **Right** | Y | 0.17 | 0.03 | Pass | |
| 10 | | | Y | 0.18 | -0.04 | Pass | |
| 11 | | | Y | 0.12 | -0.11 | Pass | |
| 12 | | | Y | 0.18 | 0.01 | Pass | |
| 13 | | | Y | 0.27 | 0.01 | Pass | |
| 14 | | | Y | 0.07 | -0.18 | Pass | |
| 15 | | | Y | 0.14 | -0.10 | Pass | |

| Run | Lane Marking Type | Departure Direction | Valid Run? | Distance at Audible Alert (ft) | Distance at Visual Alert (ft) | Pass/Fail | Notes |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| 16 | **Dashed** | **Left** | Y | 0.02 | -0.09 | Pass | |
| 17 | | | Y | 0.11 | -0.10 | Pass | |
| 18 | | | Y | 0.10 | -0.08 | Pass | |
| 19 | | | N | | | | Bad GPS |
| 20 | | | Y | 0.06 | -0.08 | Pass | |
| 21 | | | Y | 0.07 | -0.09 | Pass | |
| 22 | | | Y | 0.07 | -0.12 | Pass | |
| 23 | | | Y | 0.09 | -0.02 | Pass | |
| | | | | | | | |
| 24 | **Dashed** | **Right** | Y | -0.49 | -0.77 | Pass | |
| 25 | | | Y | -0.29 | -0.50 | Pass | |
| 26 | | | Y | 0.24 | 0.07 | Pass | |
| 27 | | | Y | 0.09 | -0.09 | Pass | |
| 28 | | | Y | -0.24 | -0.38 | Pass | |
| 29 | | | Y | 0.12 | -0.11 | Pass | |
| 30 | | | Y | -0.37 | -0.54 | Pass | |
| | | | | | | | |
| 31 | **Botts Dots** | **Left** | N | | | | Sun Angle |
| 32 | | | N | | | | Cone Hit |
| 33 | | | N | | | | Sun Angle |
| 34 | | | N | | | | Sun Angle |

| Run | Lane Marking Type | Departure Direction | Valid Run? | Distance at Audible Alert (ft) | Distance at Visual Alert (ft) | Pass/Fail | Notes |
|---|---|---|---|---|---|---|---|
| 35 | | | N | | | | Sun Angle |
| 36 | | | N | | | | Sun Angle |
| 37 | | | N | | | | Sun Angle |
| 38 | | | N | | | | Sun Angle |
| 39 | | | Y | 0.12 | -0.10 | Pass | |
| 40 | | | Y | 0.03 | -0.20 | Pass | |
| 41 | | | Y | -0.03 | -0.23 | Pass | |
| 42 | | | Y | 0.07 | -0.15 | Pass | |
| 43 | | | Y | 0.05 | -0.18 | Pass | |
| 44 | | | Y | 0.09 | -0.04 | Pass | |
| 45 | | | Y | 0.08 | -0.07 | Pass | |
| | | | | | | | |
| 46 | **Botts Dots** | **Right** | Y | 0.32 | 0.15 | Pass | |
| 47 | | | Y | 0.28 | 0.10 | Pass | |
| 48 | | | Y | 0.35 | 0.06 | Pass | |
| 49 | | | Y | 0.24 | 0.03 | Pass | |
| 50 | | | Y | 0.25 | 0.03 | Pass | |
| 51 | | | Y | 0.16 | 0.01 | Pass | |
| 52 | | | Y | 0.24 | -0.10 | Pass | |

# APPENDIX D

## Time History Plots

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## 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.

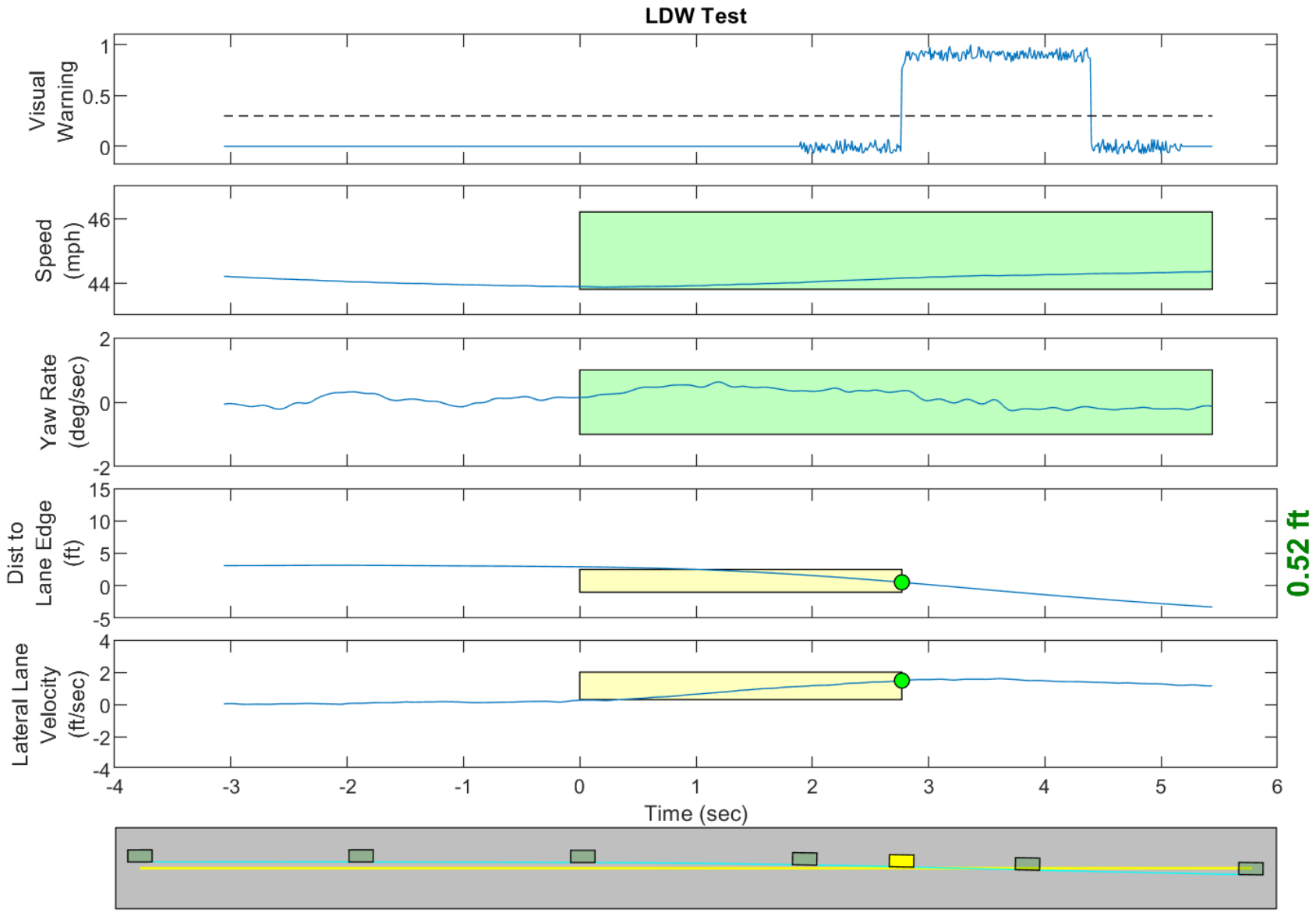


Figure D1. Example Time History for Lane Departure Warning Test, Passing

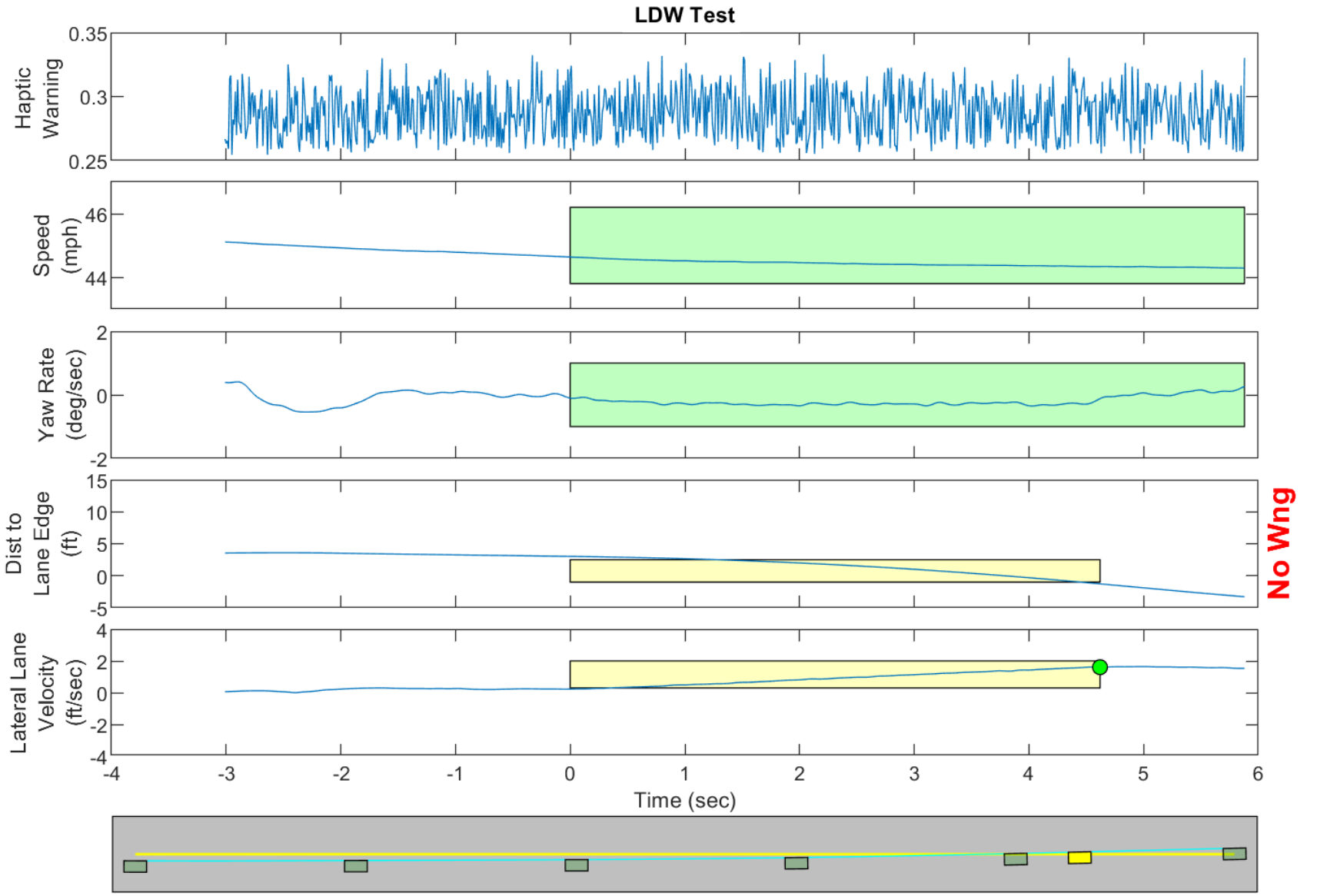


Figure D2. Example Time History for Lane Departure Warning Test, Failing, No Warning Issued

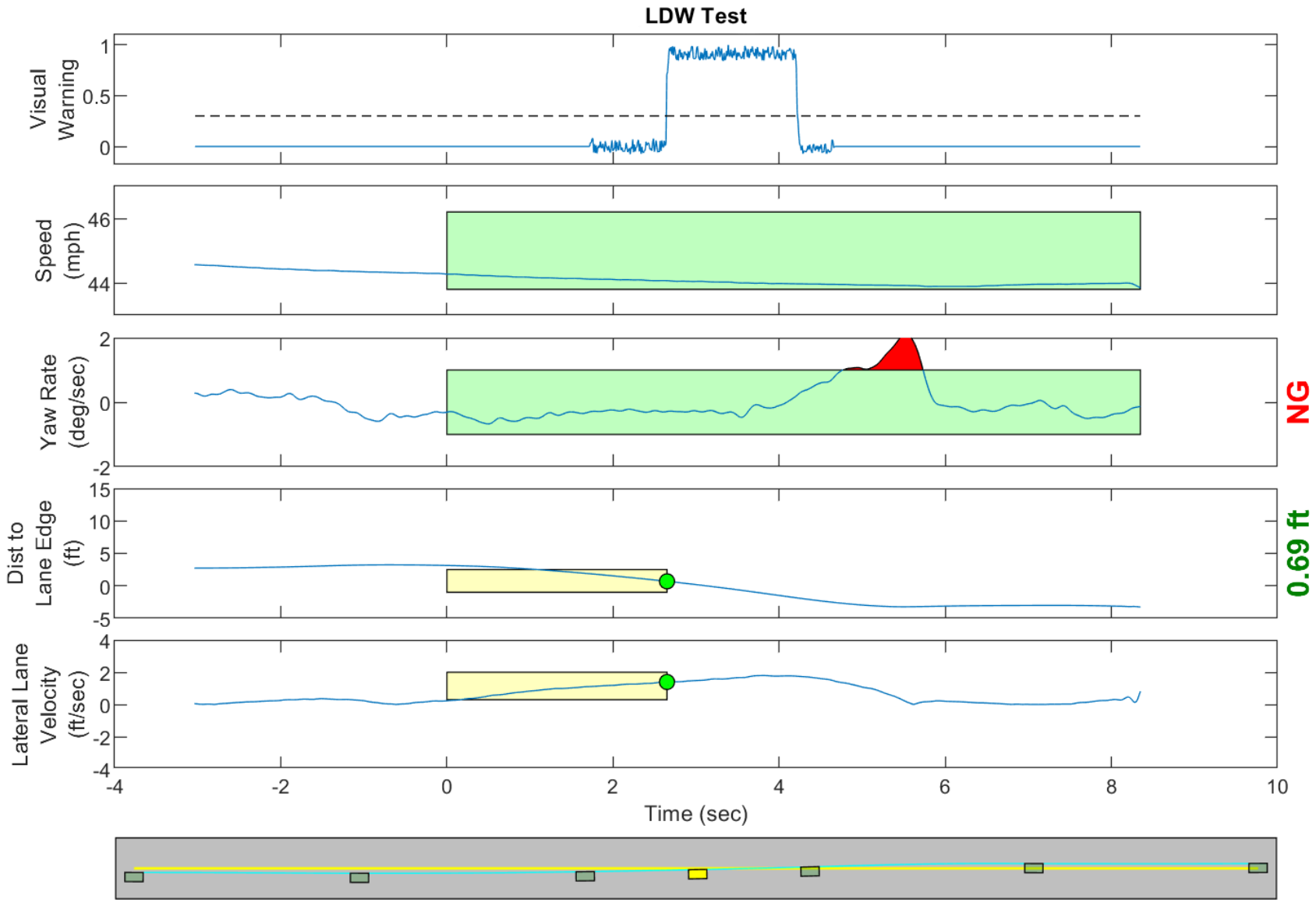


Figure D3. Example Time History for Lane Departure Warning Test, Invalid Run Due to Subject Vehicle Yaw Rate

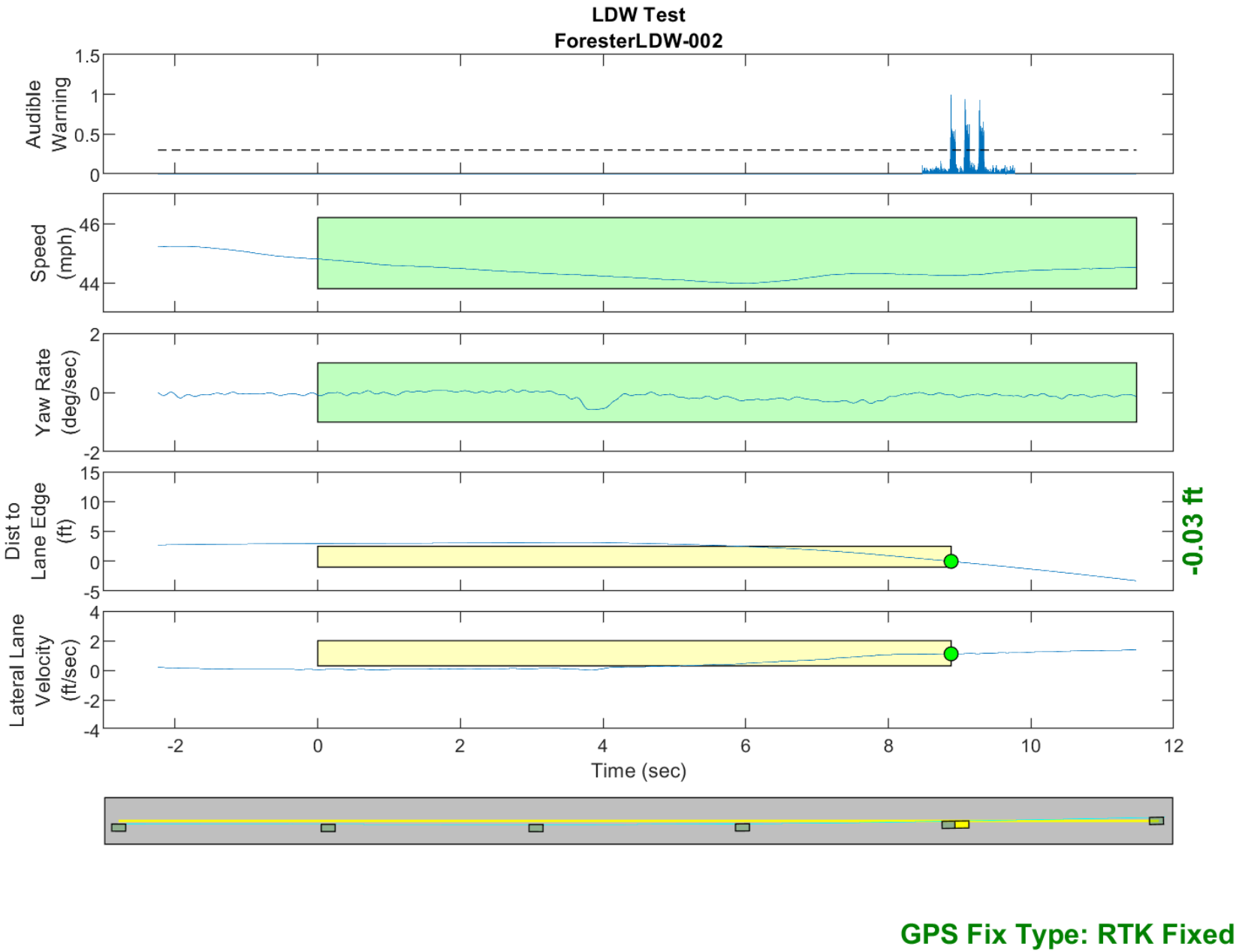


Figure D4. Time History for Run 02, Solid Line, Left Departure, Auditory Warning

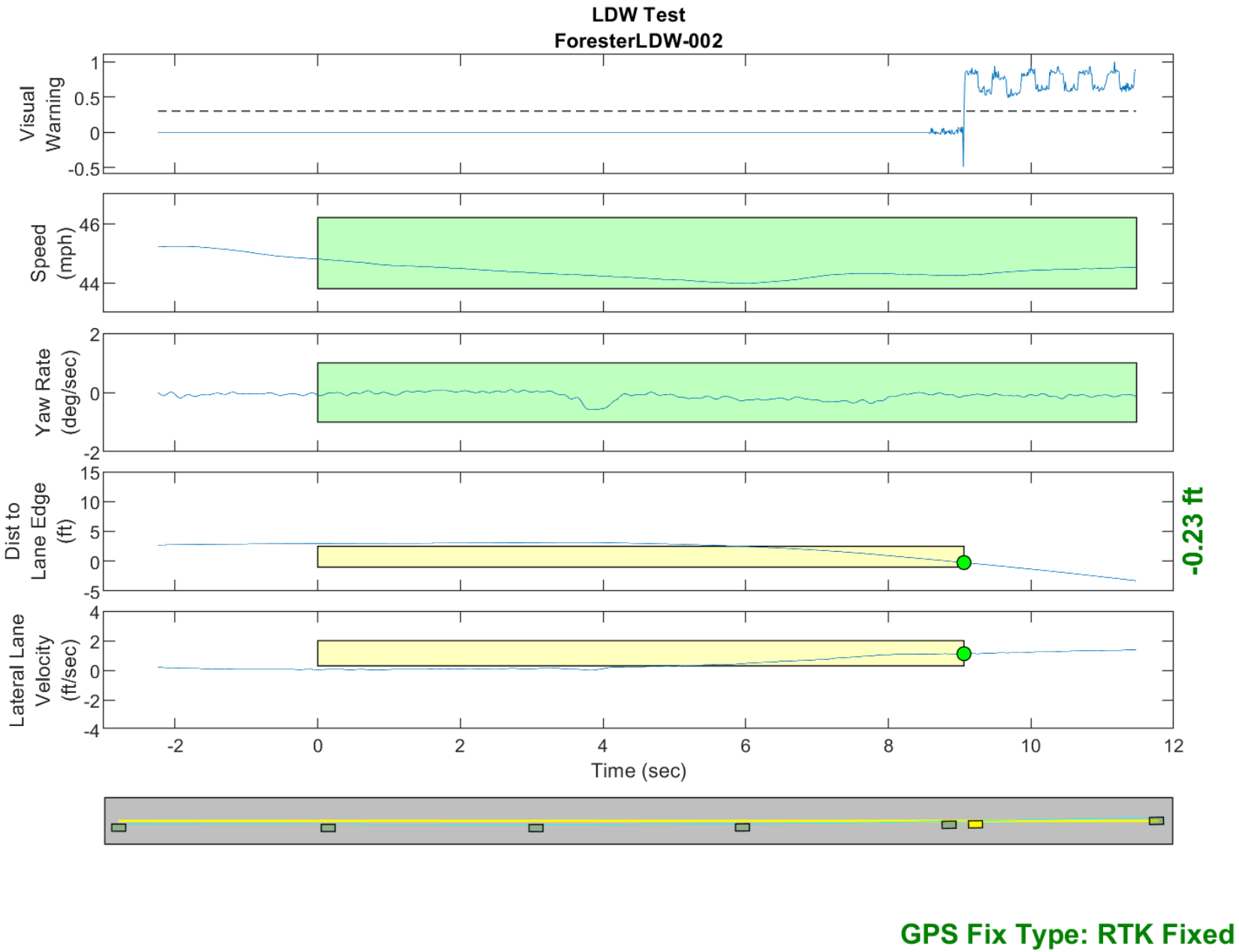


Figure D5. Time History for Run 02, Solid Line, Left Departure, Visual Warning

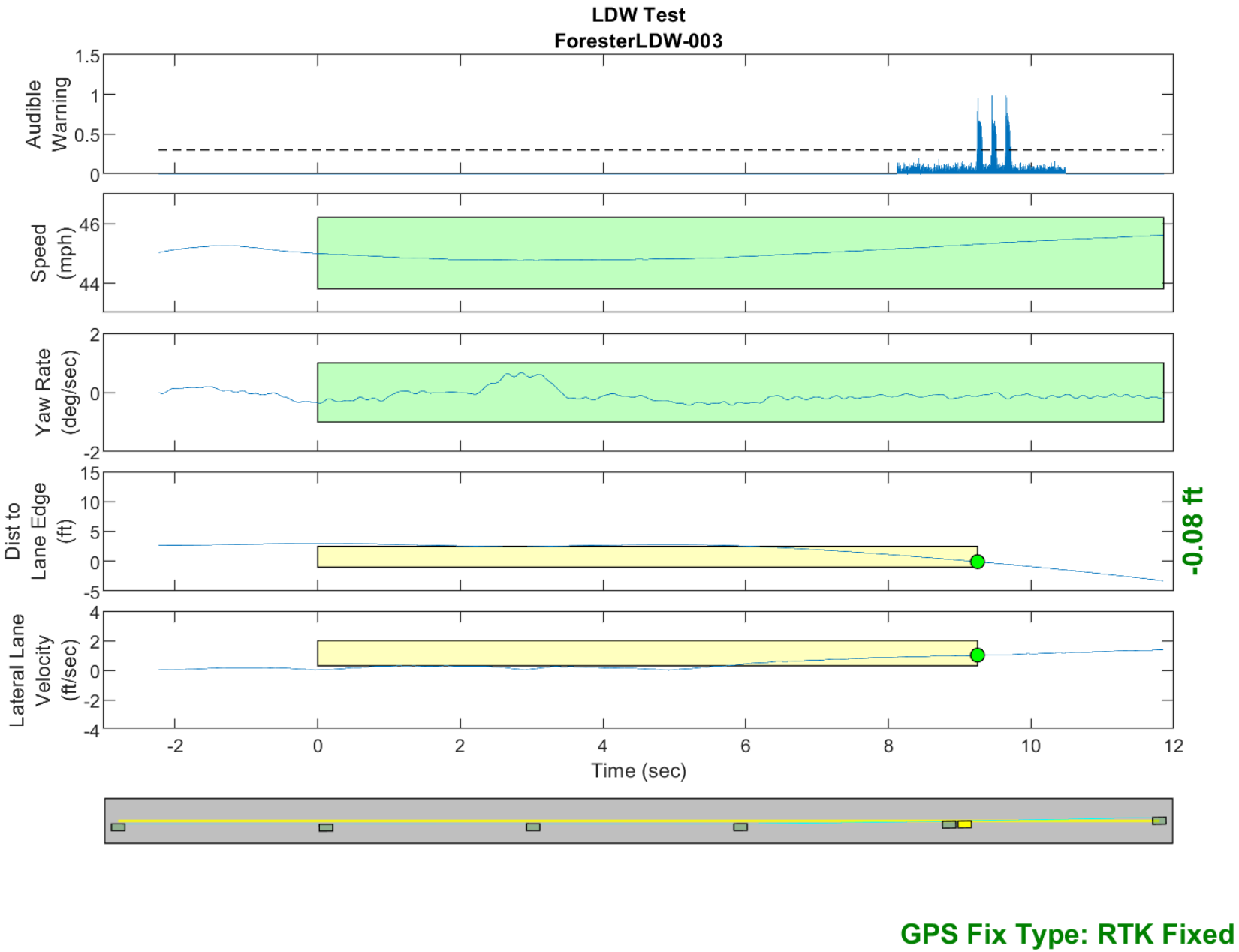


Figure D6. Time History for Run 03, Solid Line, Left Departure, Auditory Warning

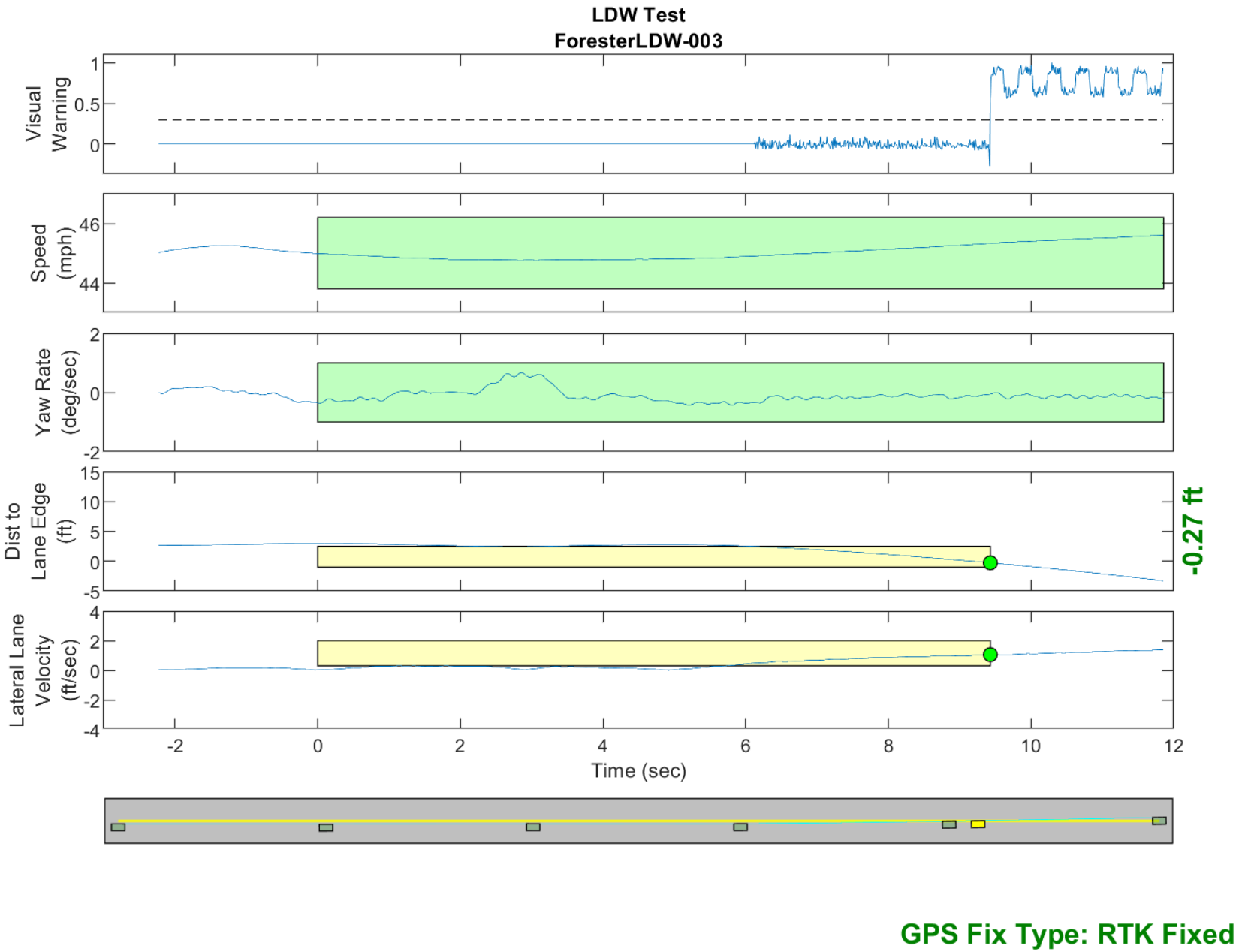


Figure D7. Time History for Run 03, Solid Line, Left Departure, Visual Warning

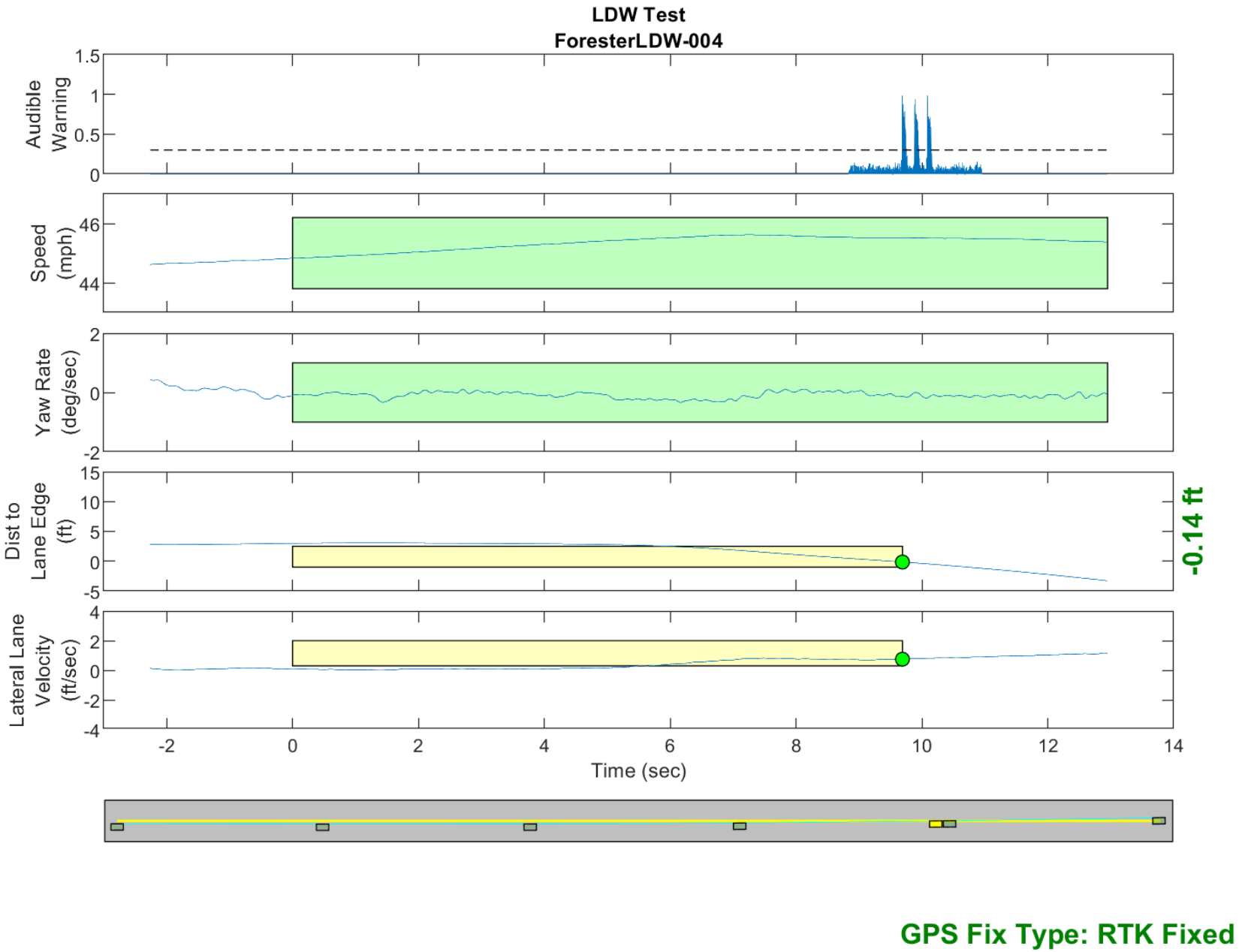


Figure D8. Time History for Run 04, Solid Line, Left Departure, Auditory Warning

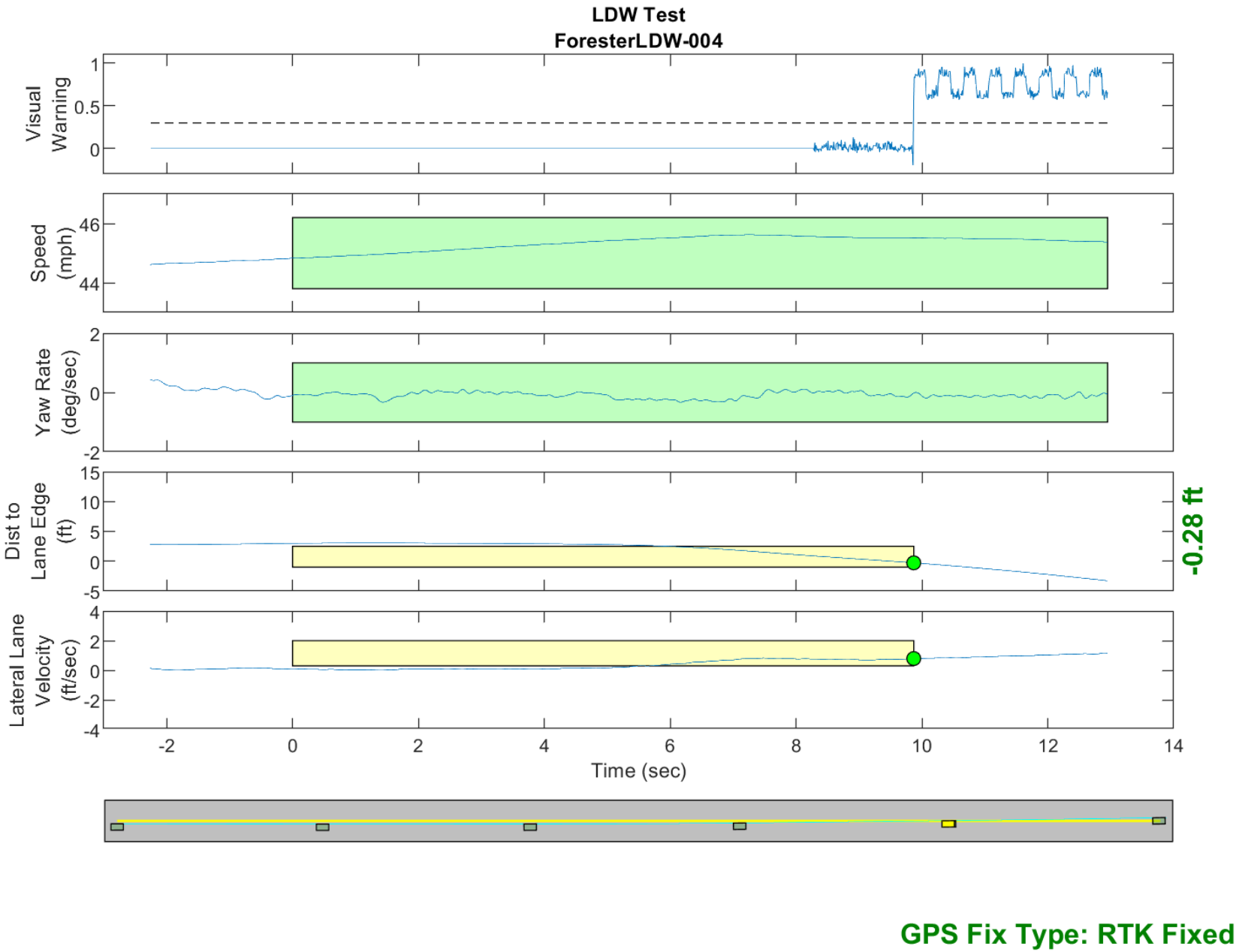


Figure D9. Time History for Run 04, Solid Line, Left Departure, Visual Warning

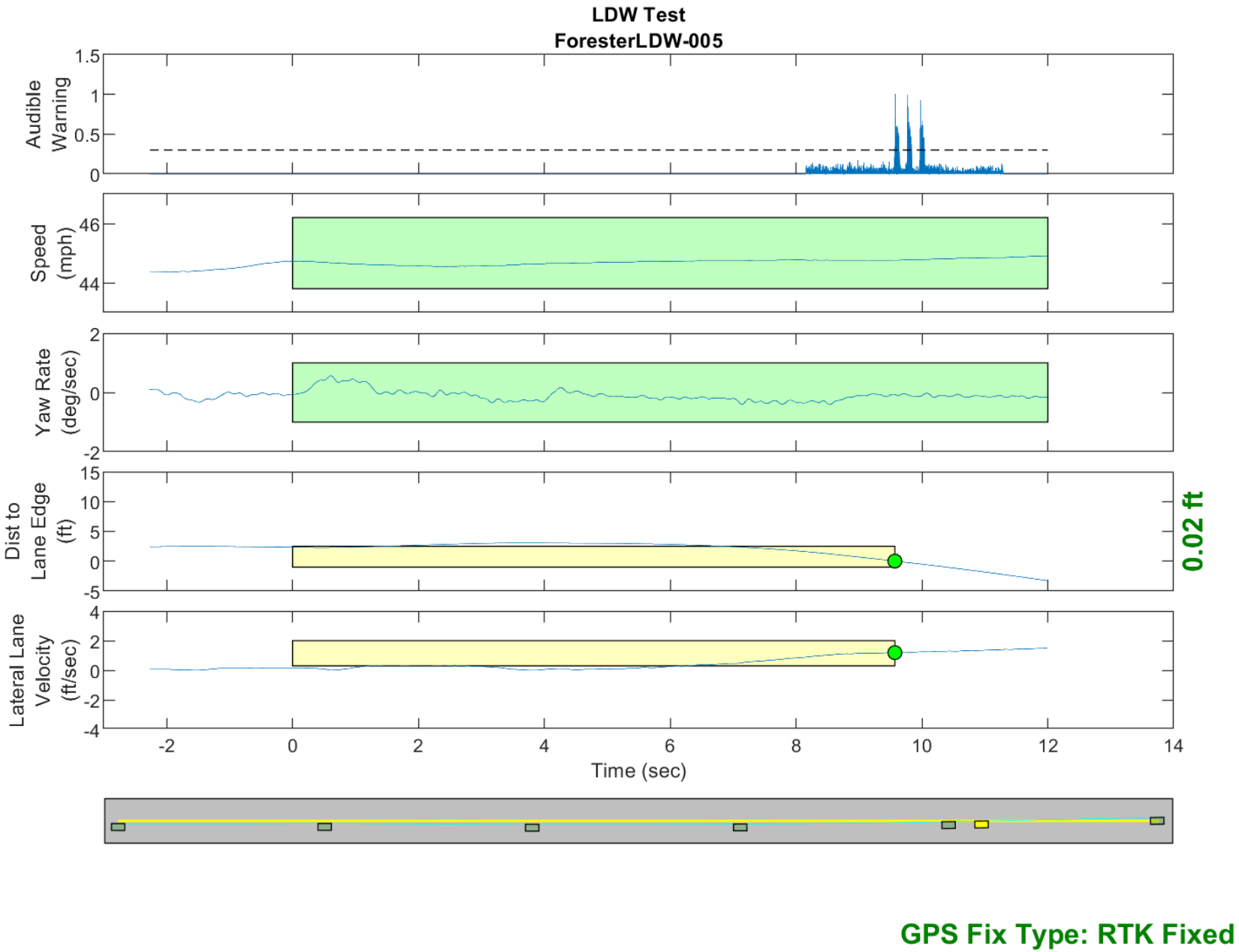


Figure D10. Time History for Run 05, Solid Line, Left Departure, Auditory Warning

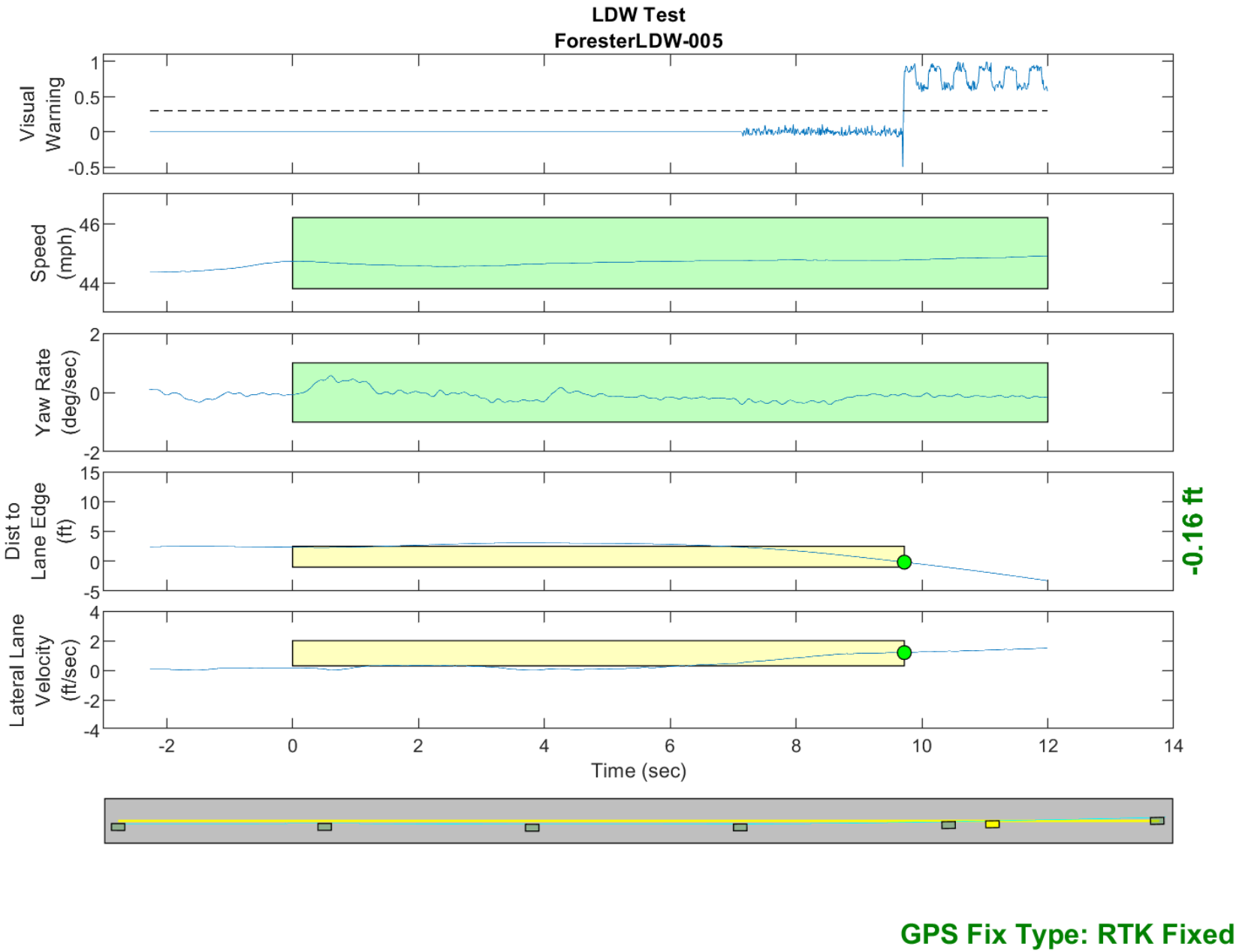


Figure D11. Time History for Run 05, Solid Line, Left Departure, Visual Warning

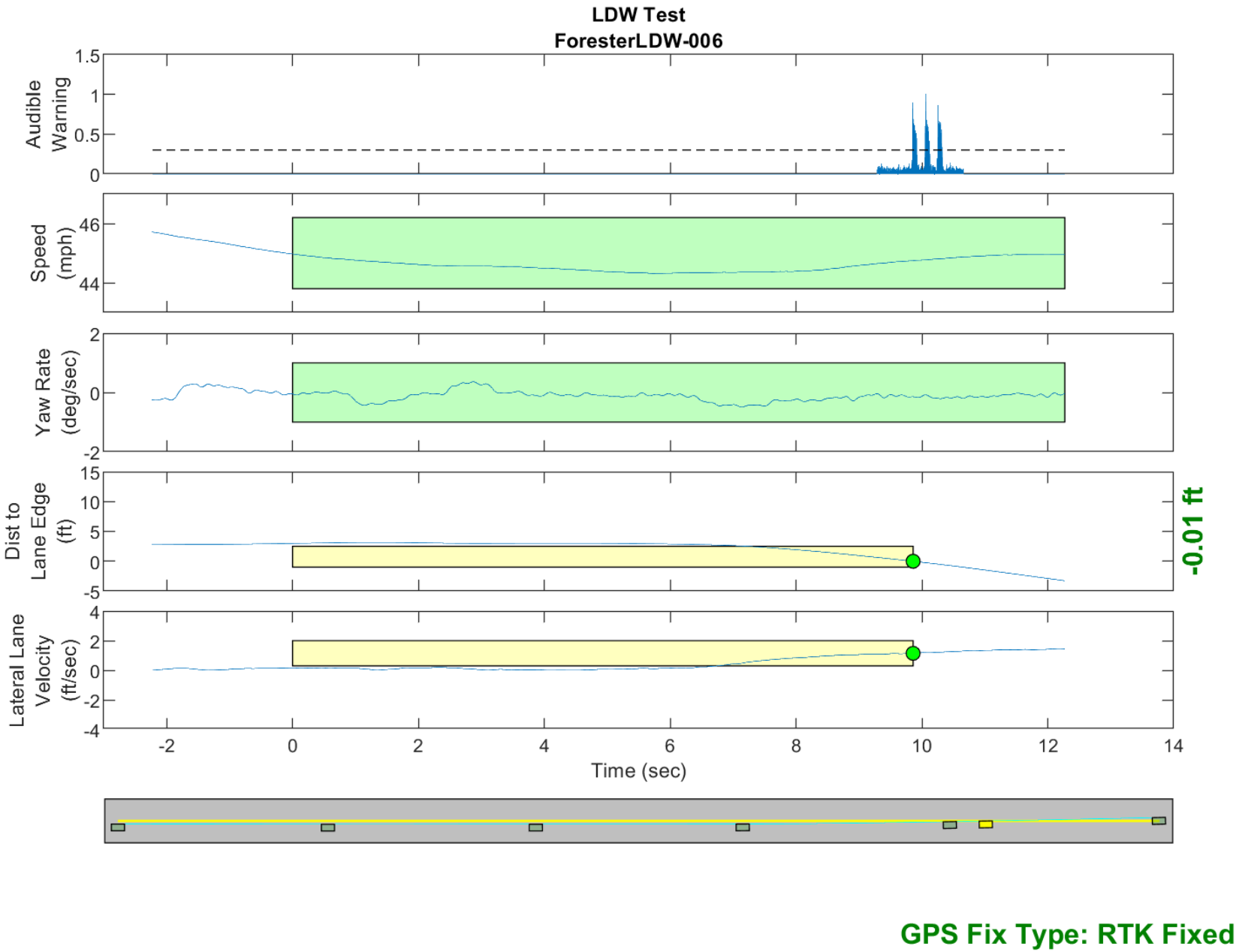


Figure D12. Time History for Run 06, Solid Line, Left Departure, Auditory Warning

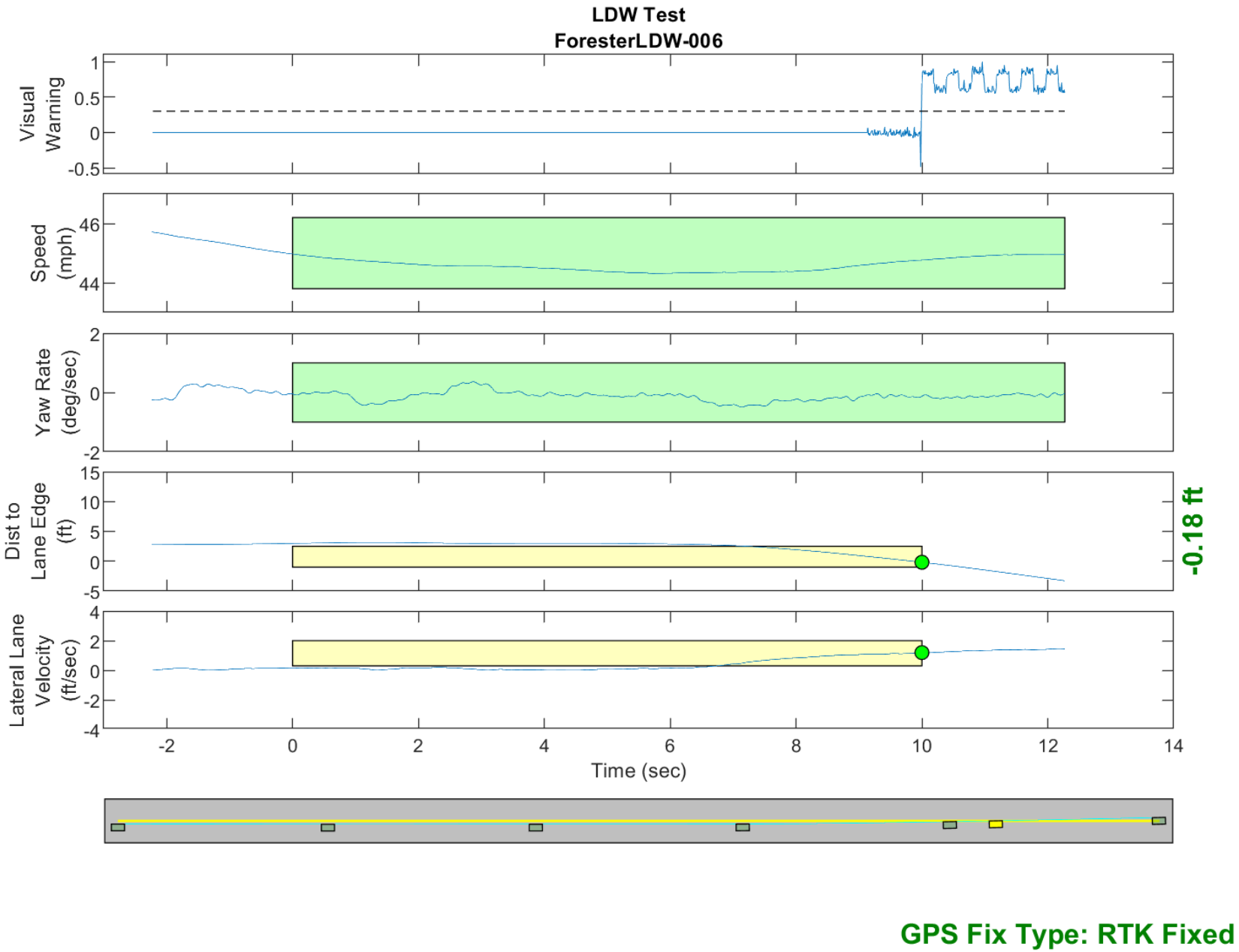


Figure D13. Time History for Run 06, Solid Line, Left Departure, Visual Warning

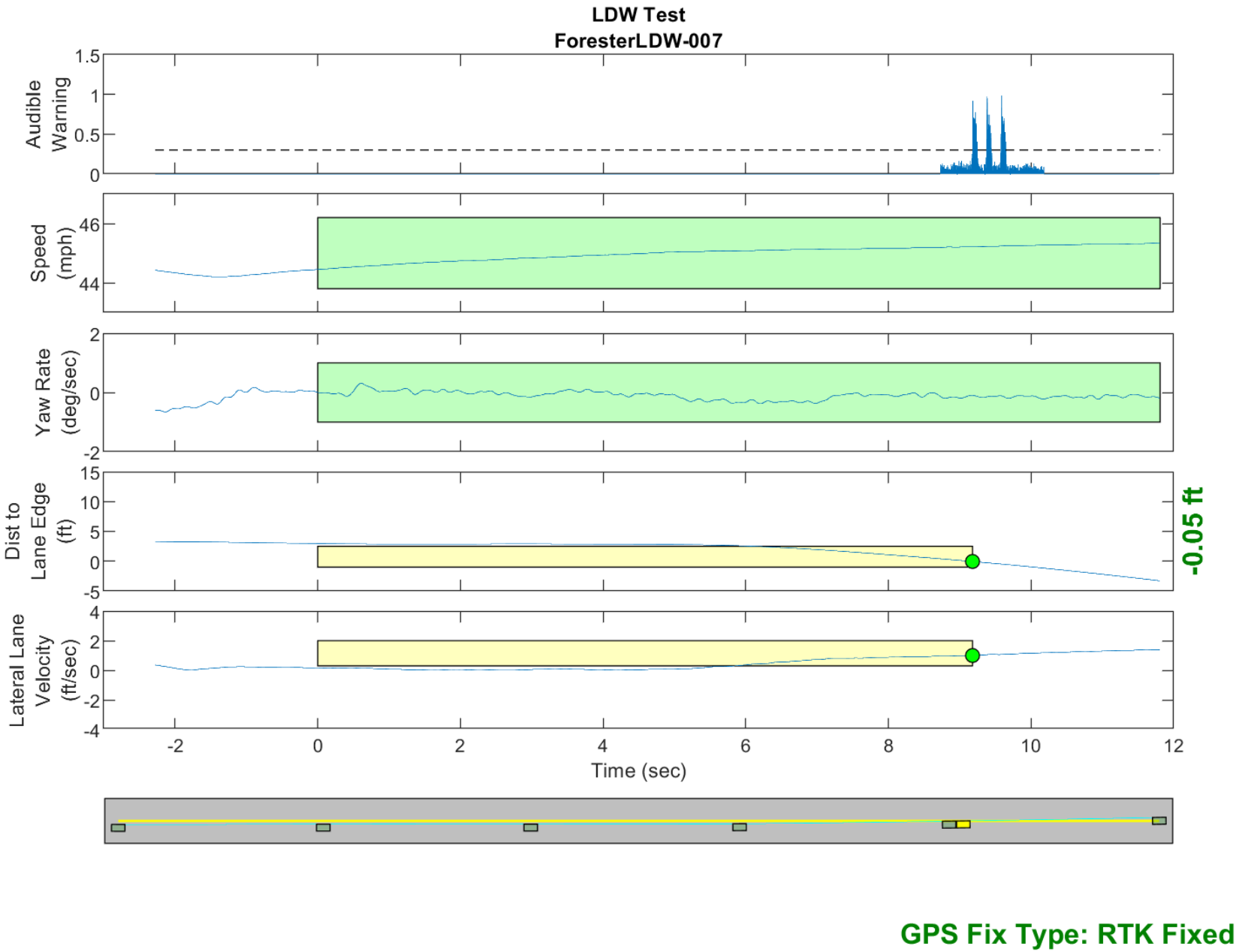


Figure D14. Time History for Run 07, Solid Line, Left Departure, Auditory Warning

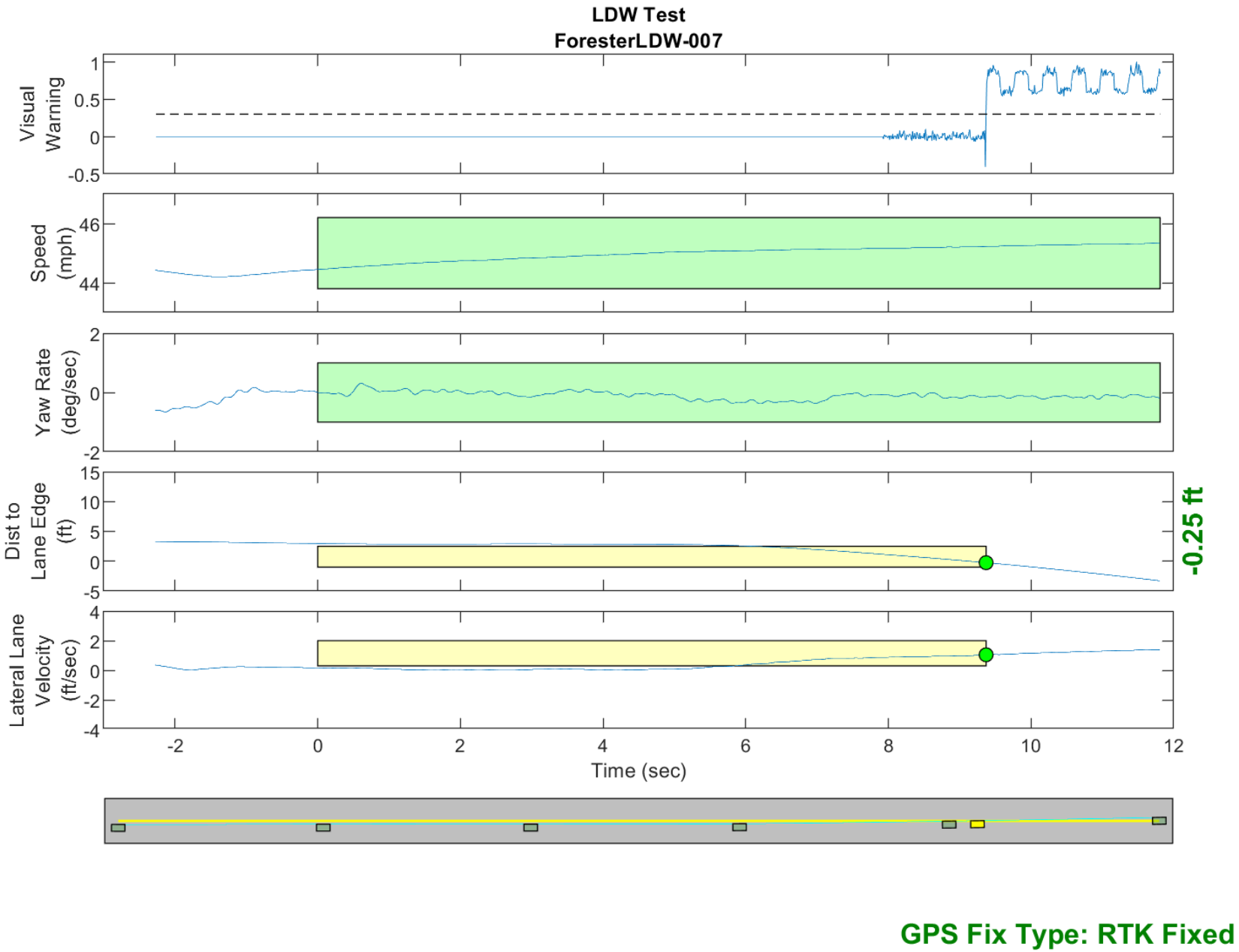


Figure D15. Time History for Run 07, Solid Line, Left Departure, Visual Warning

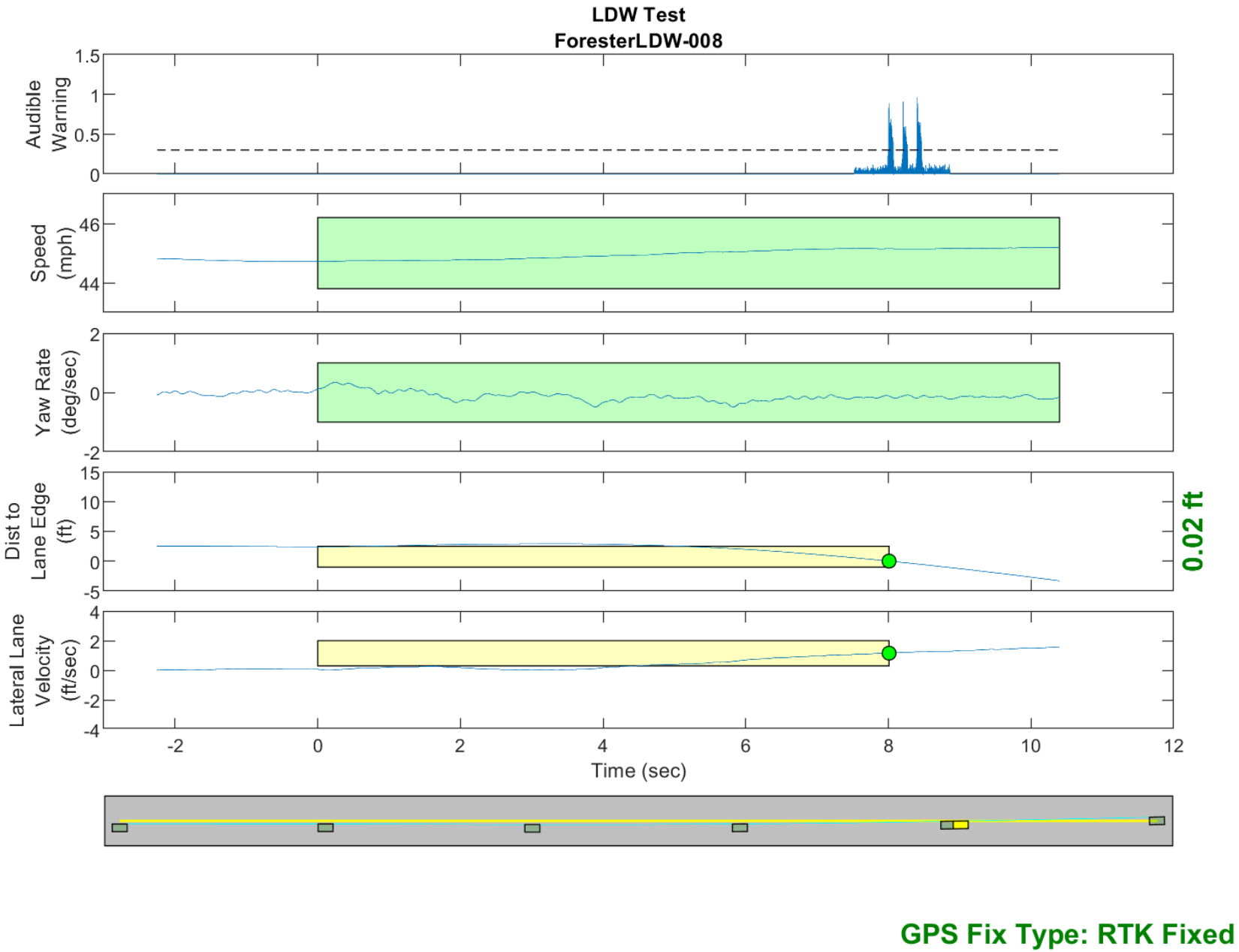


Figure D16. Time History for Run 08, Solid Line, Left Departure, Auditory Warning

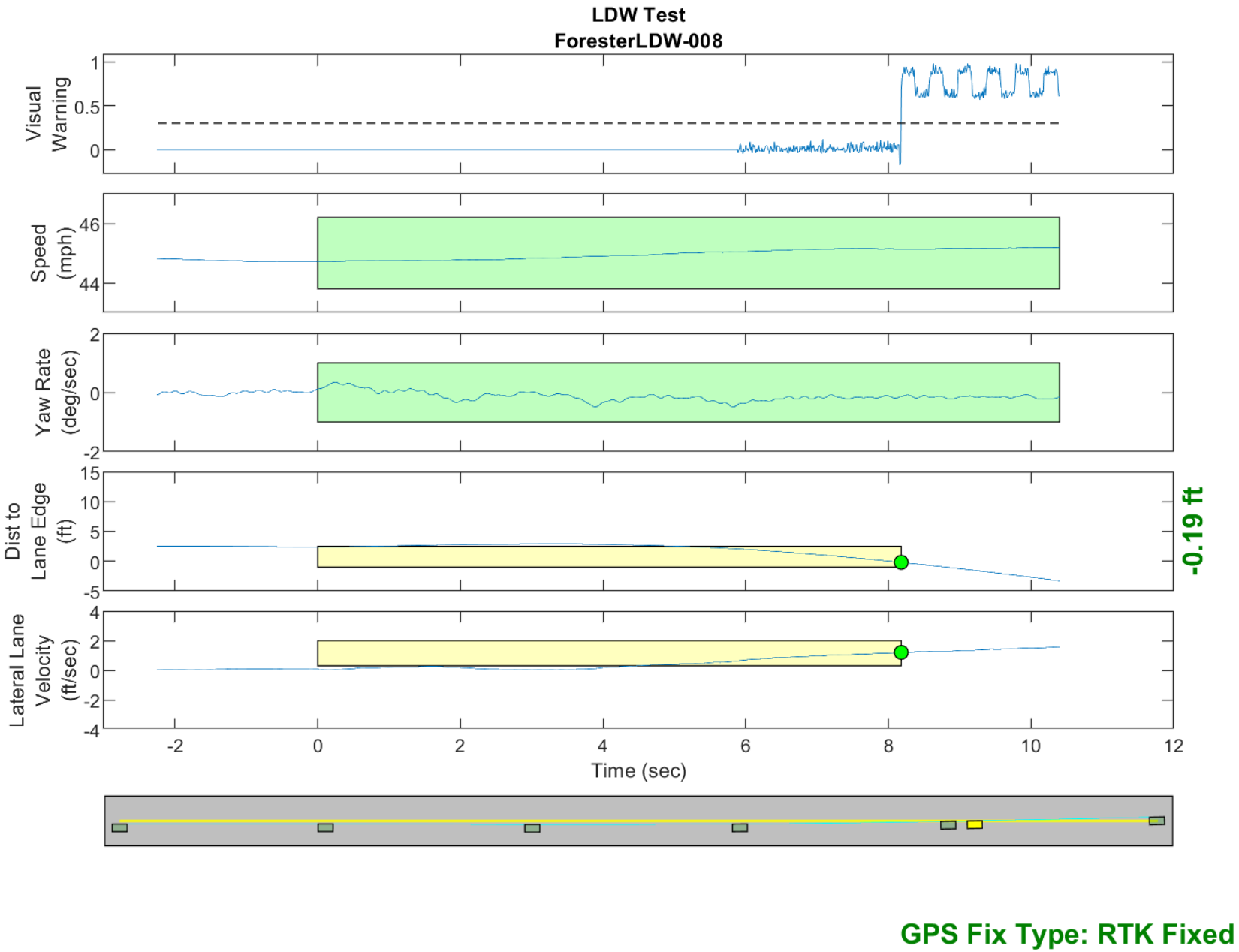


Figure D17. Time History for Run 08, Solid Line, Left Departure, Visual Warning

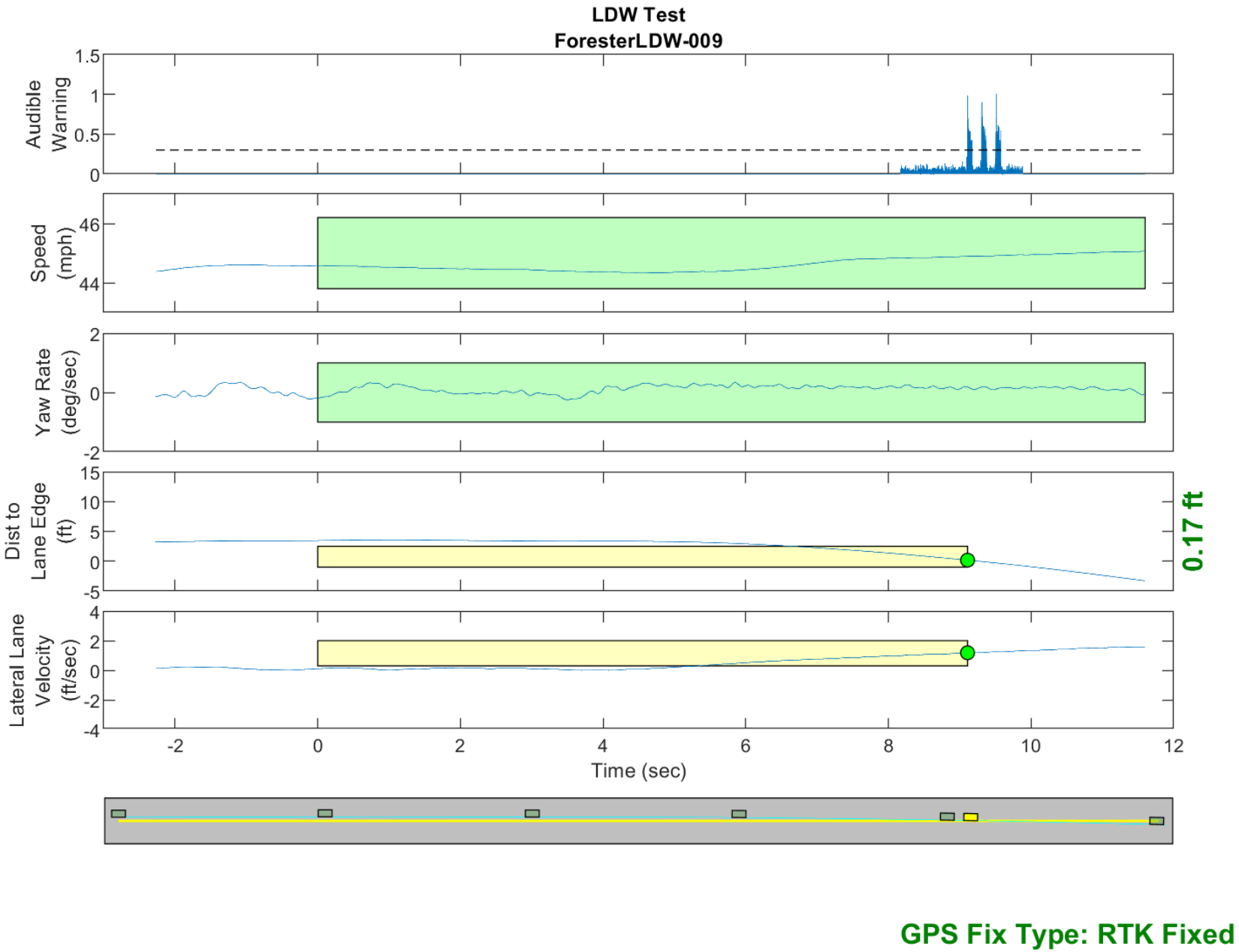


Figure D18. Time History for Run 09, Solid Line, Right Departure, Auditory Warning

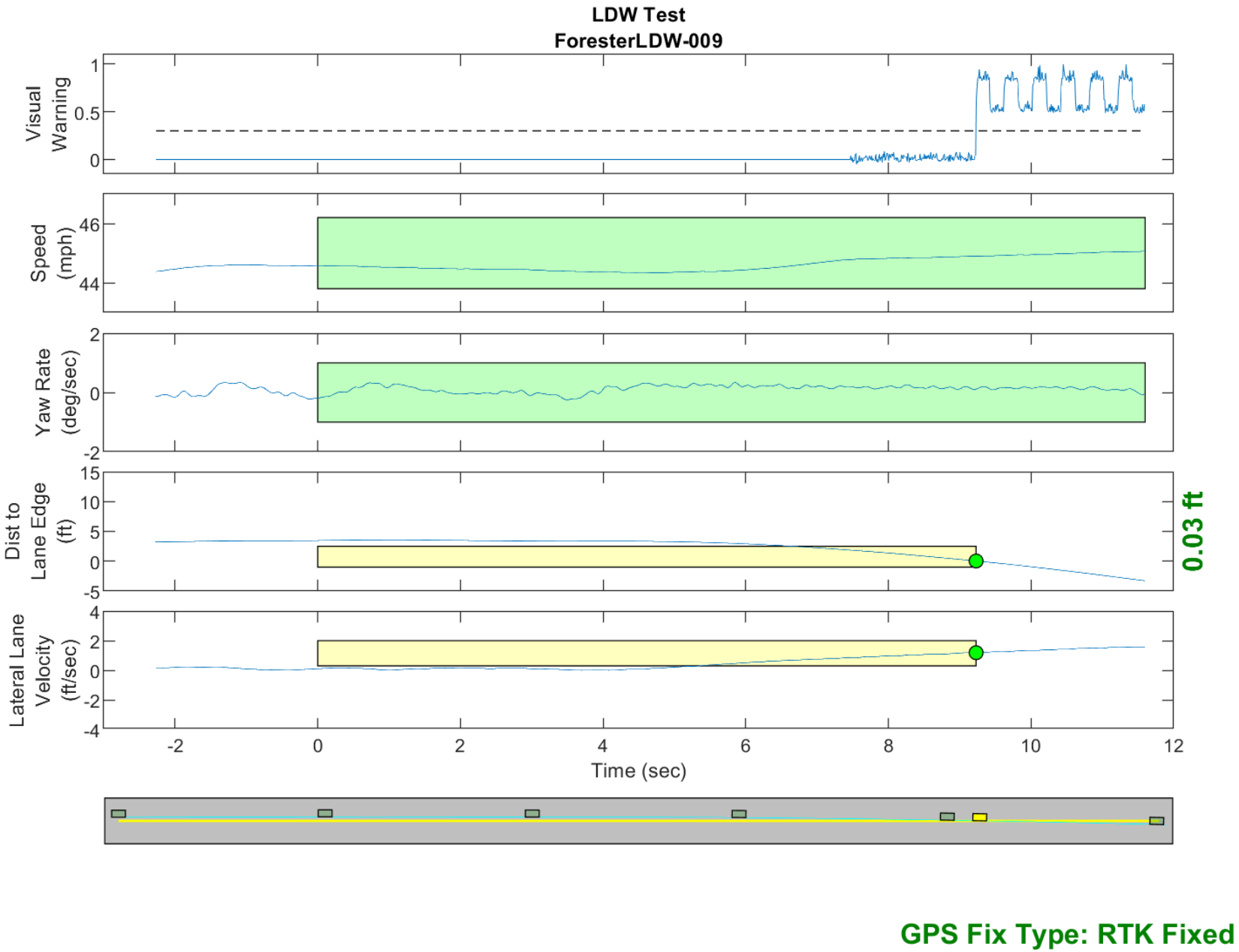


Figure D19. Time History for Run 09, Solid Line, Right Departure, Visual Warning

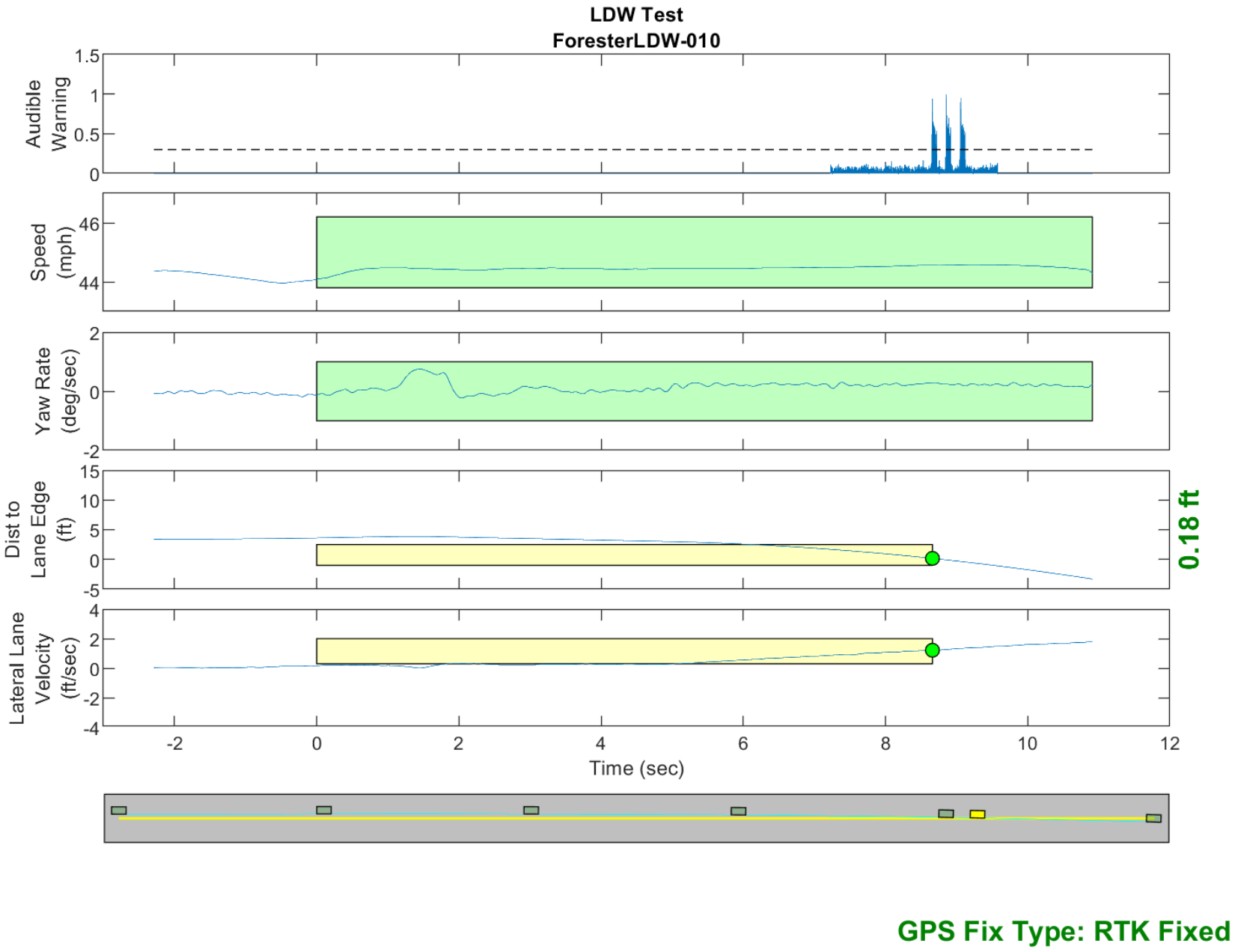


Figure D20. Time History for Run 10, Solid Line, Right Departure, Auditory Warning

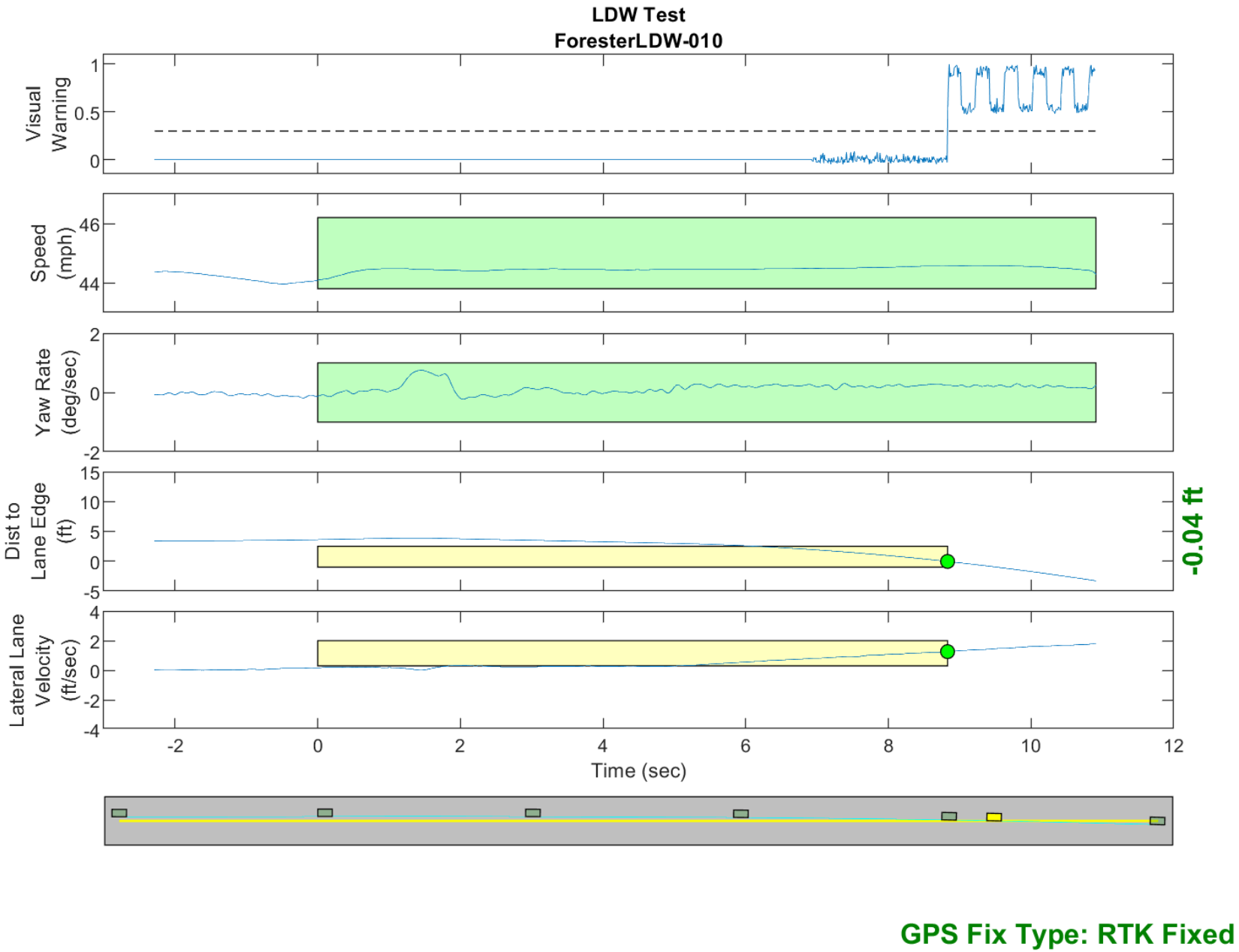


Figure D21. Time History for Run 10, Solid Line, Right Departure, Visual Warning

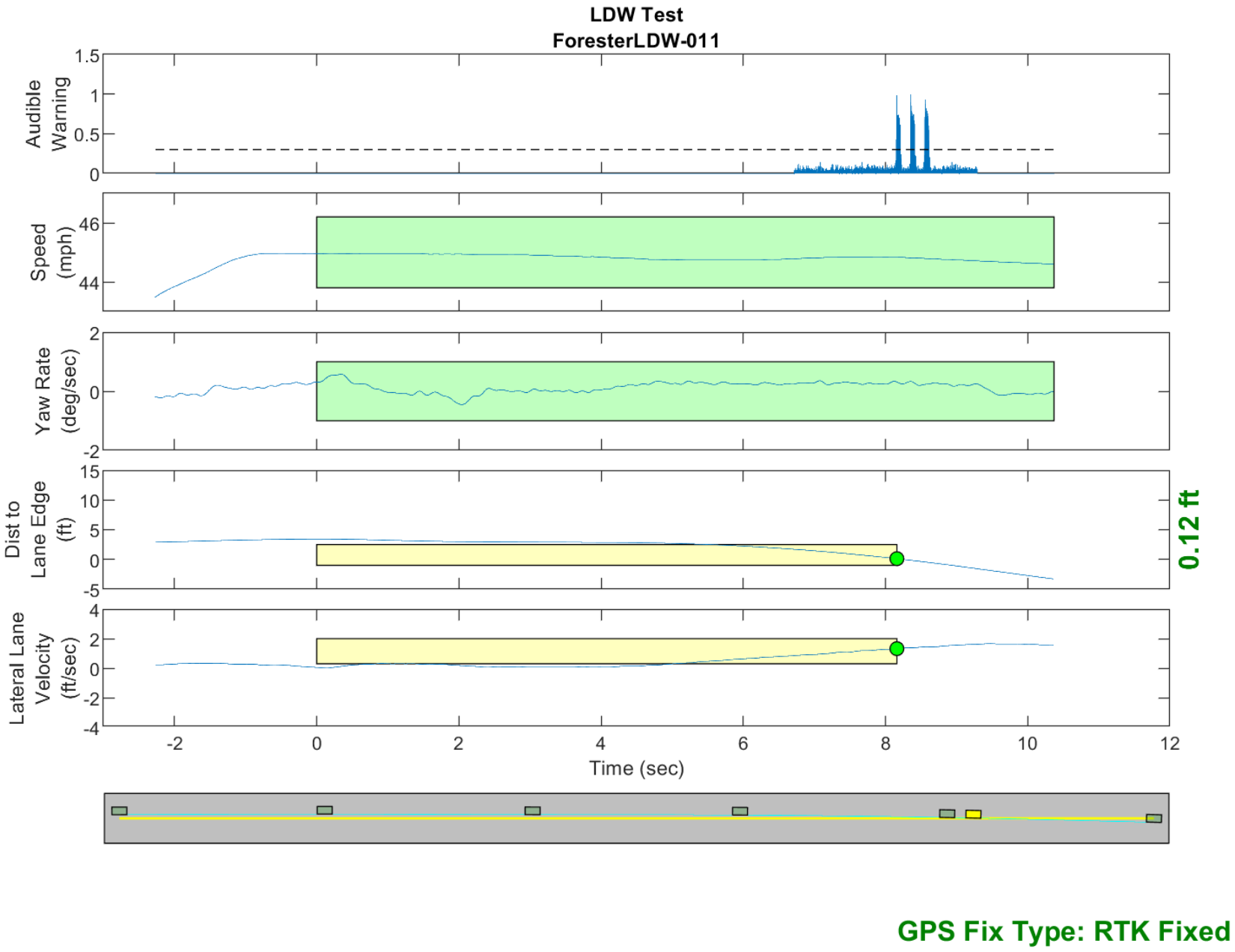


Figure D22. Time History for Run 11, Solid Line, Right Departure, Auditory Warning

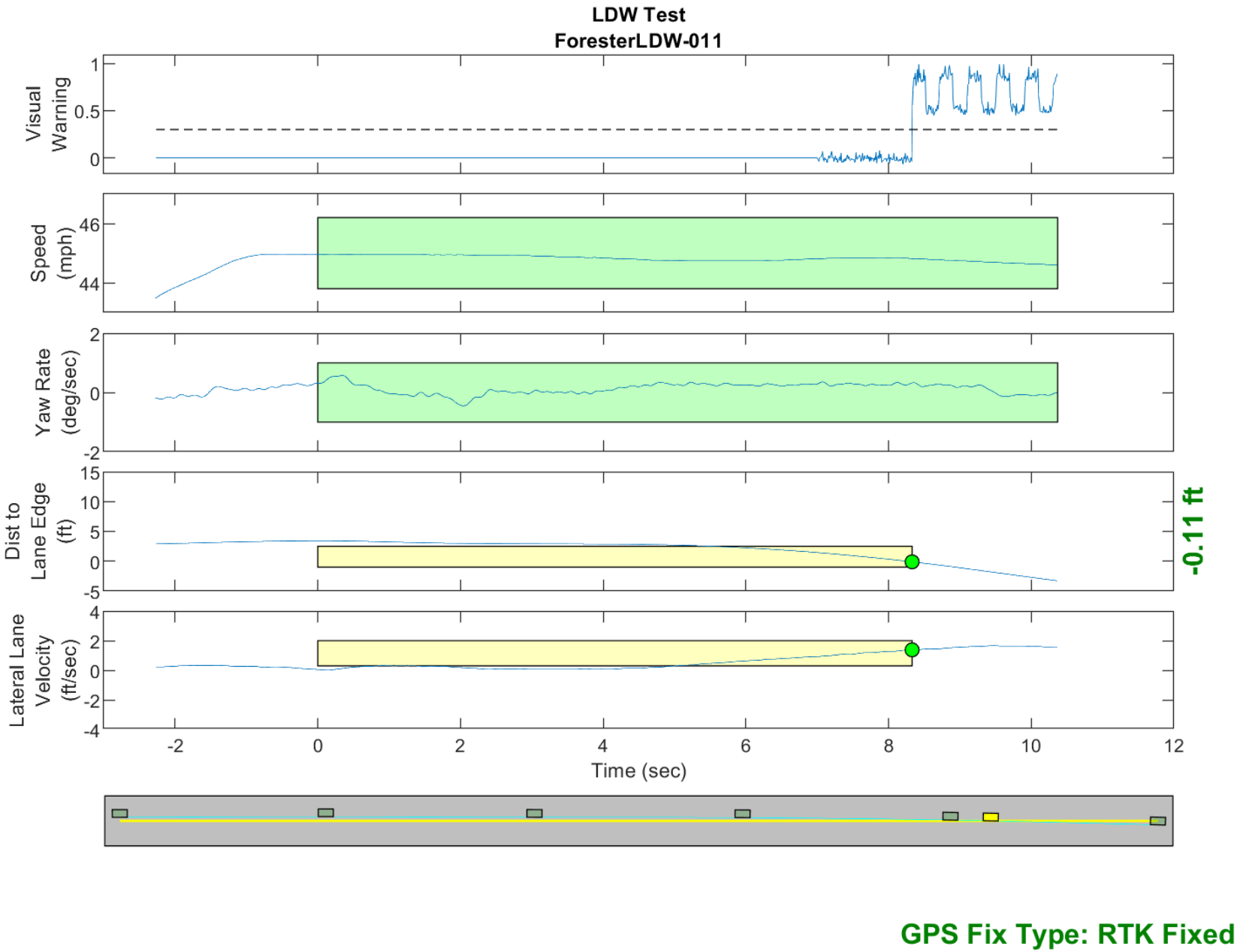


Figure D23. Time History for Run 11, Solid Line, Right Departure, Visual Warning

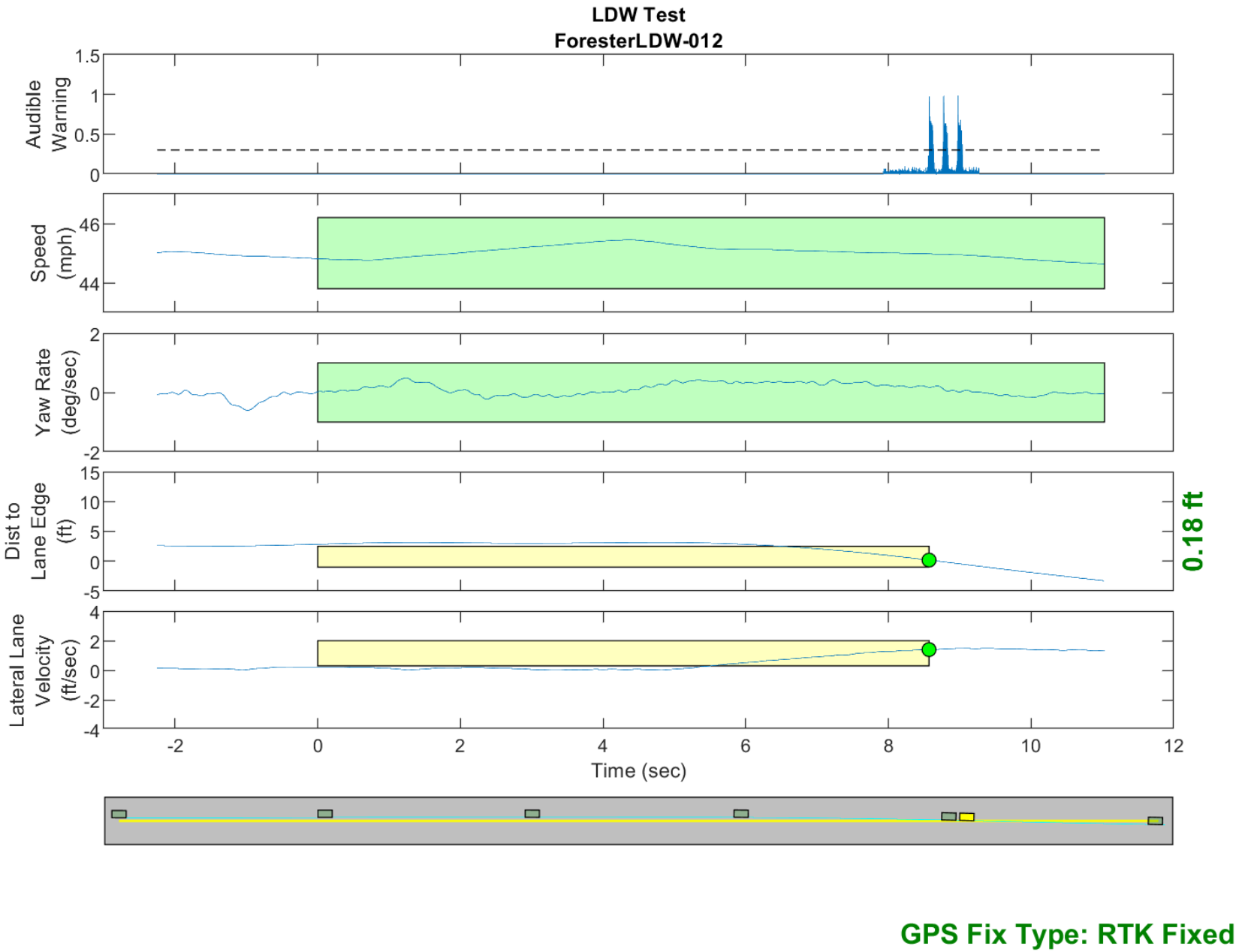


Figure D24. Time History for Run 12, Solid Line, Right Departure, Auditory Warning

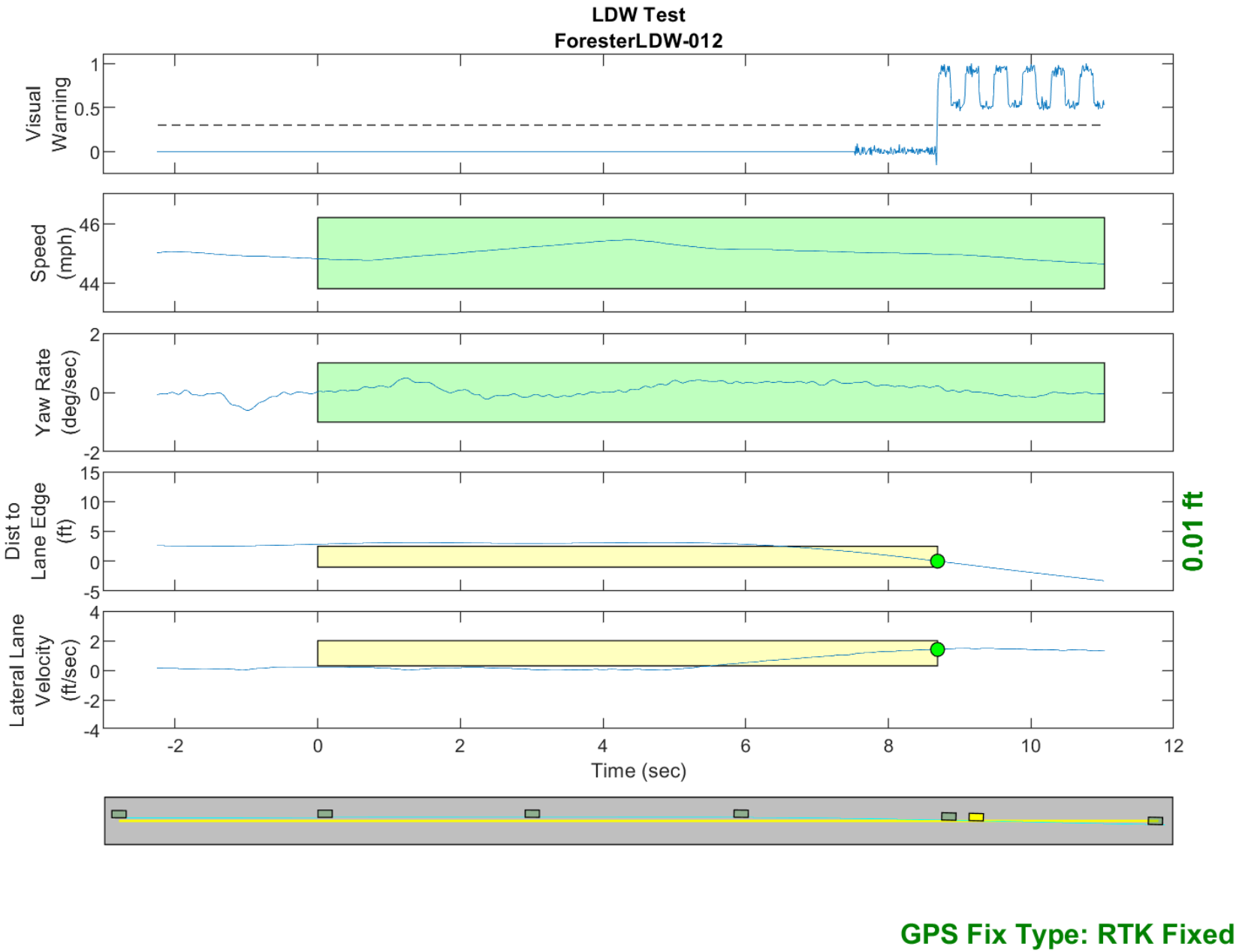


Figure D25. Time History for Run 12, Solid Line, Right Departure, Visual Warning

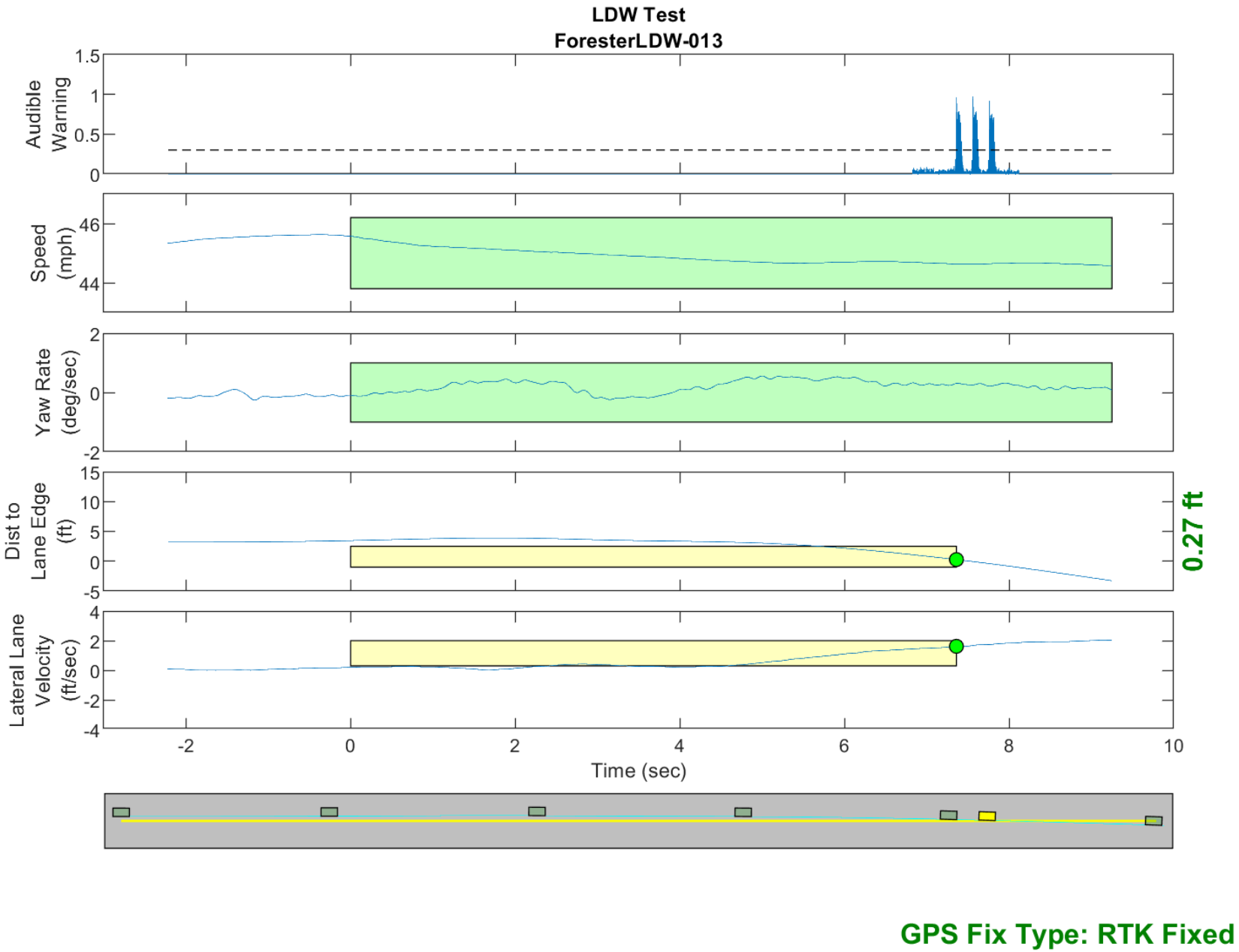


Figure D26. Time History for Run 13, Solid Line, Right Departure, Auditory Warning

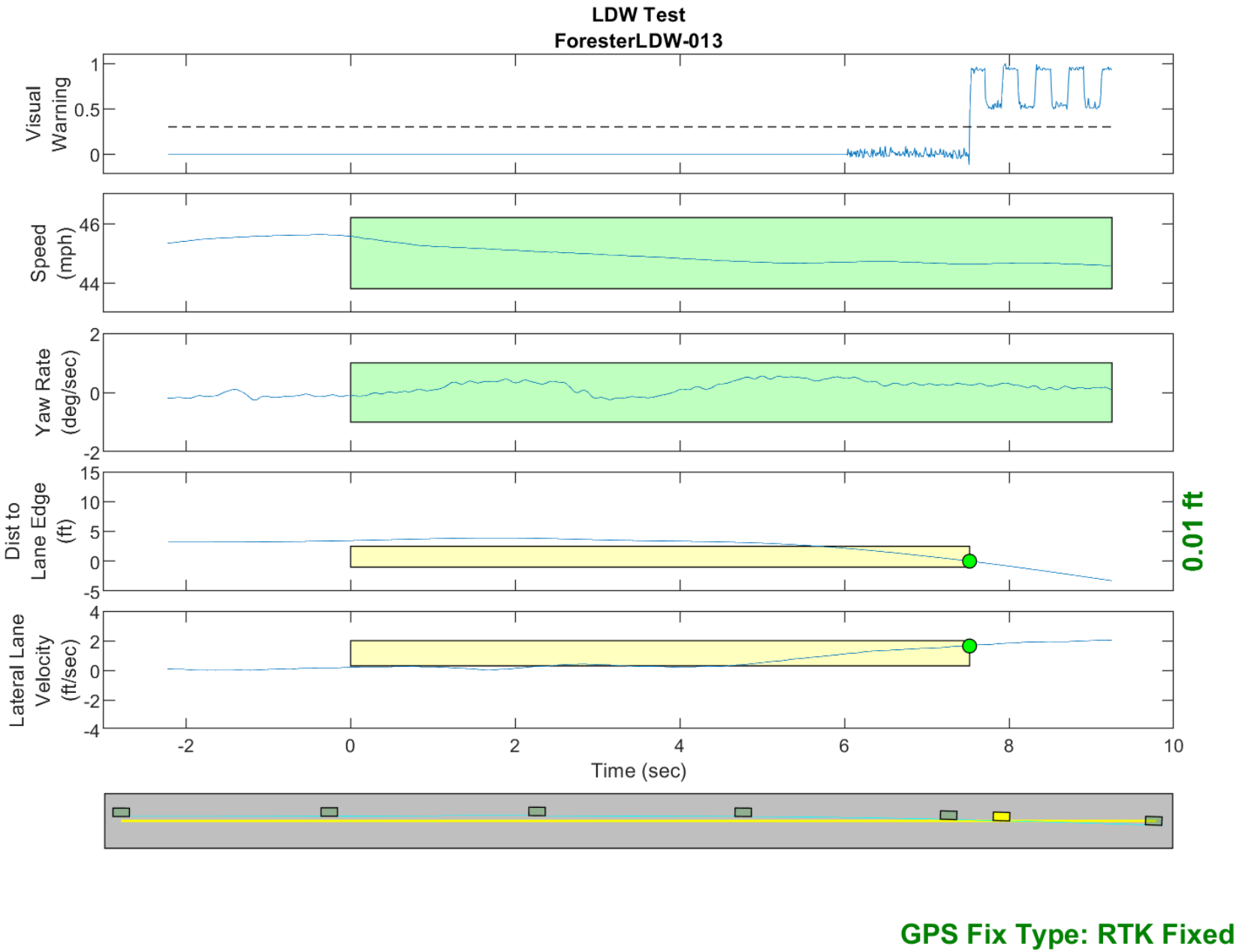


Figure D27. Time History for Run 13, Solid Line, Right Departure, Visual Warning

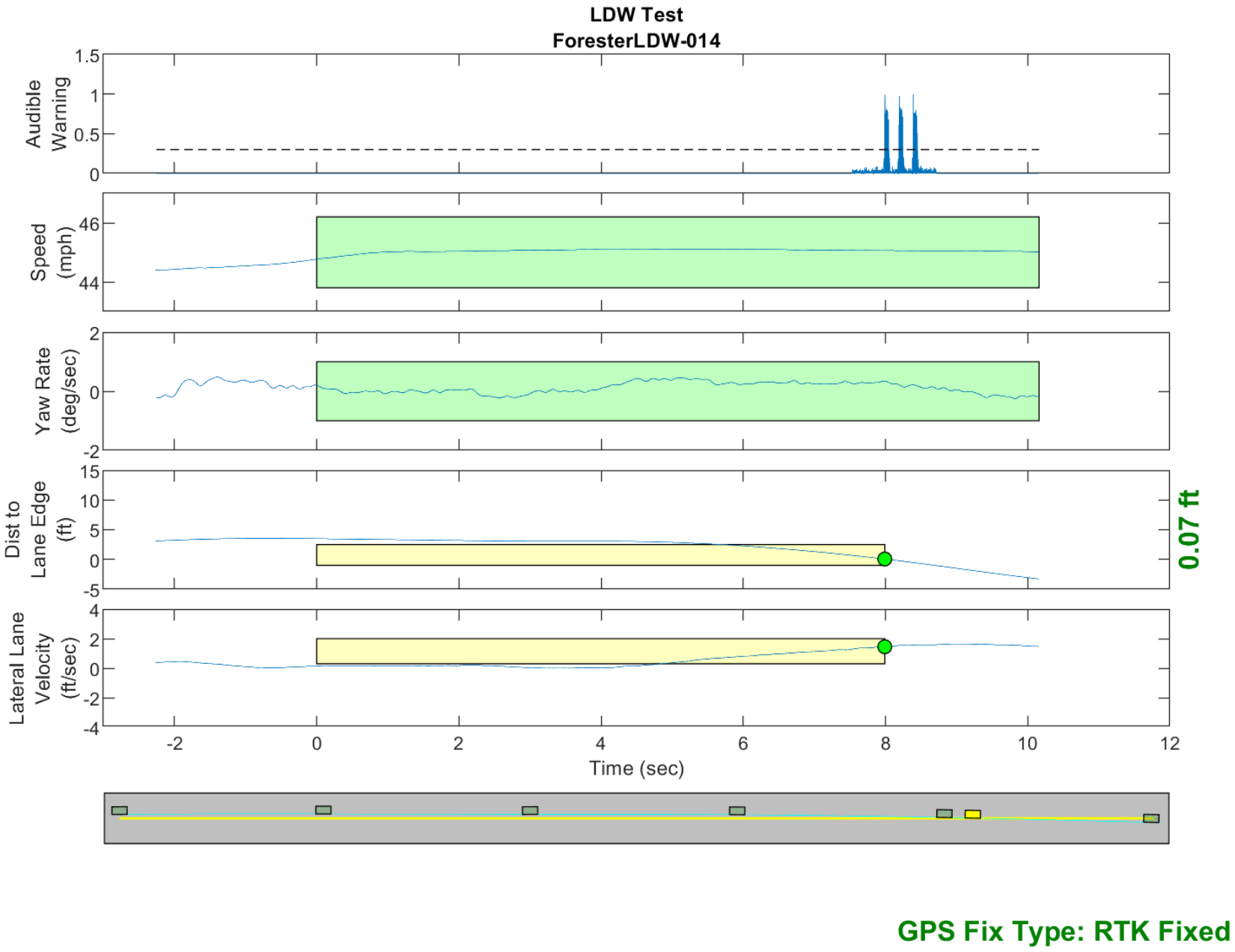


Figure D28. Time History for Run 14, Solid Line, Right Departure, Auditory Warning

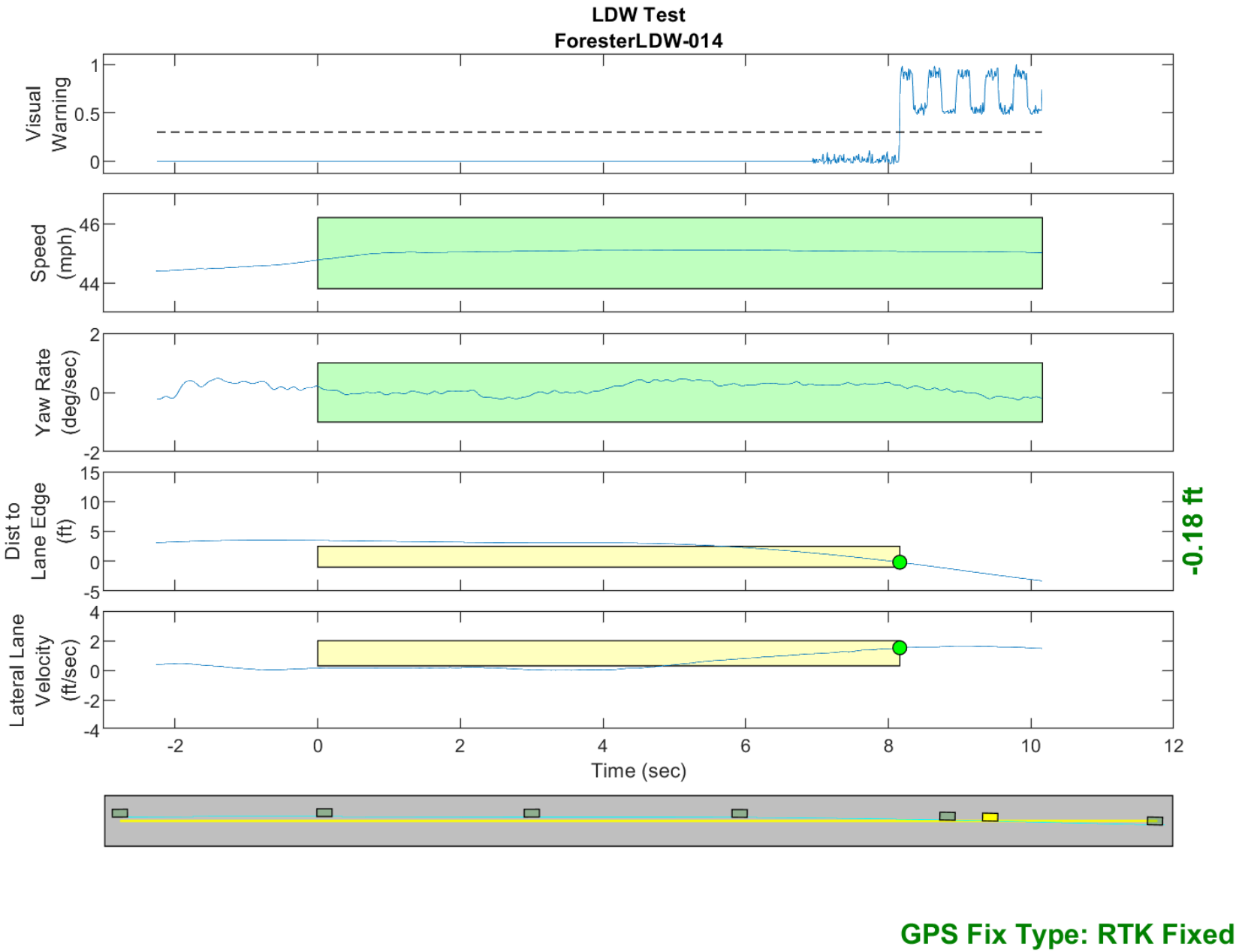


Figure D29. Time History for Run 14, Solid Line, Right Departure, Visual Warning

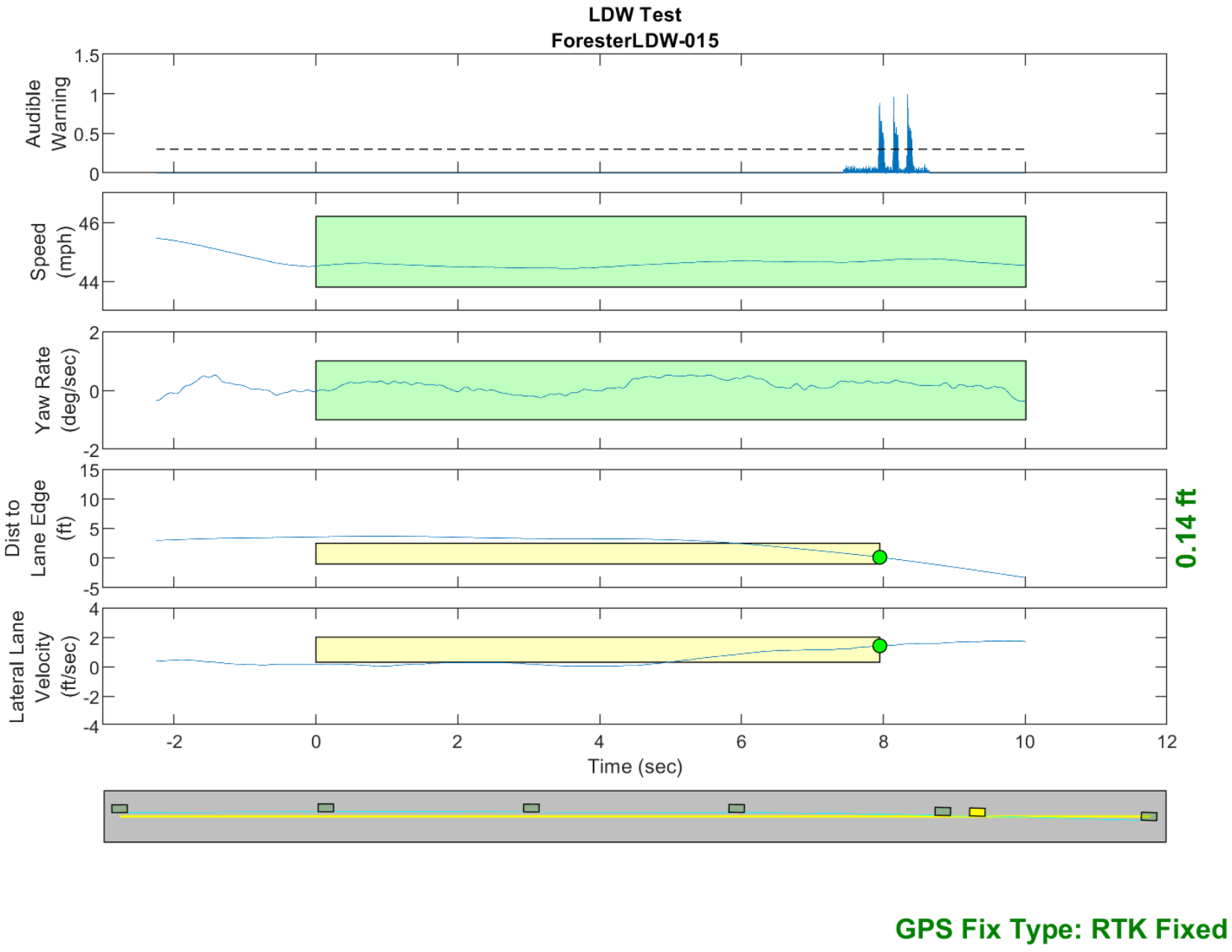


Figure D30. Time History for Run 15, Solid Line, Right Departure, Auditory Warning

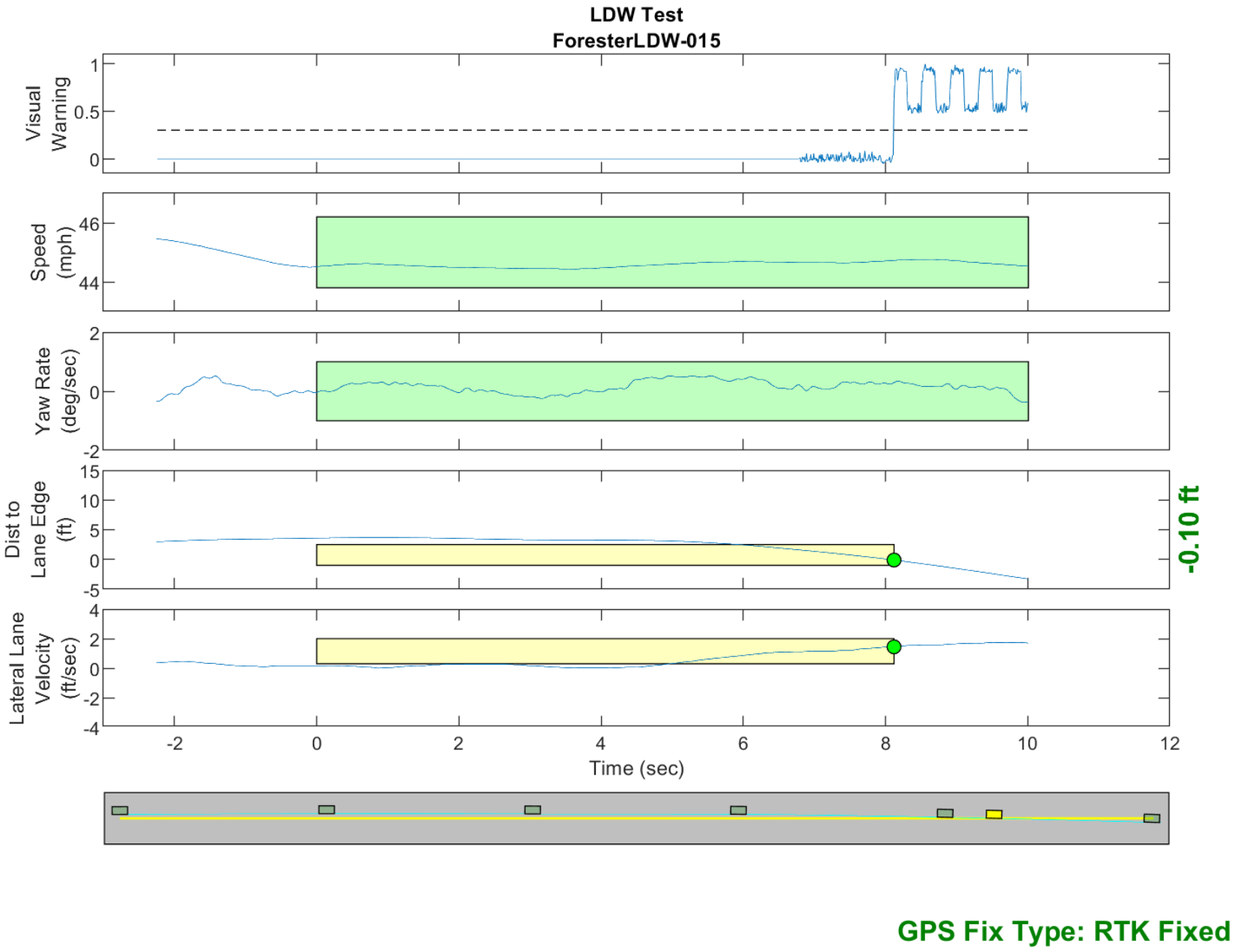


Figure D31. Time History for Run 15, Solid Line, Right Departure, Visual Warning

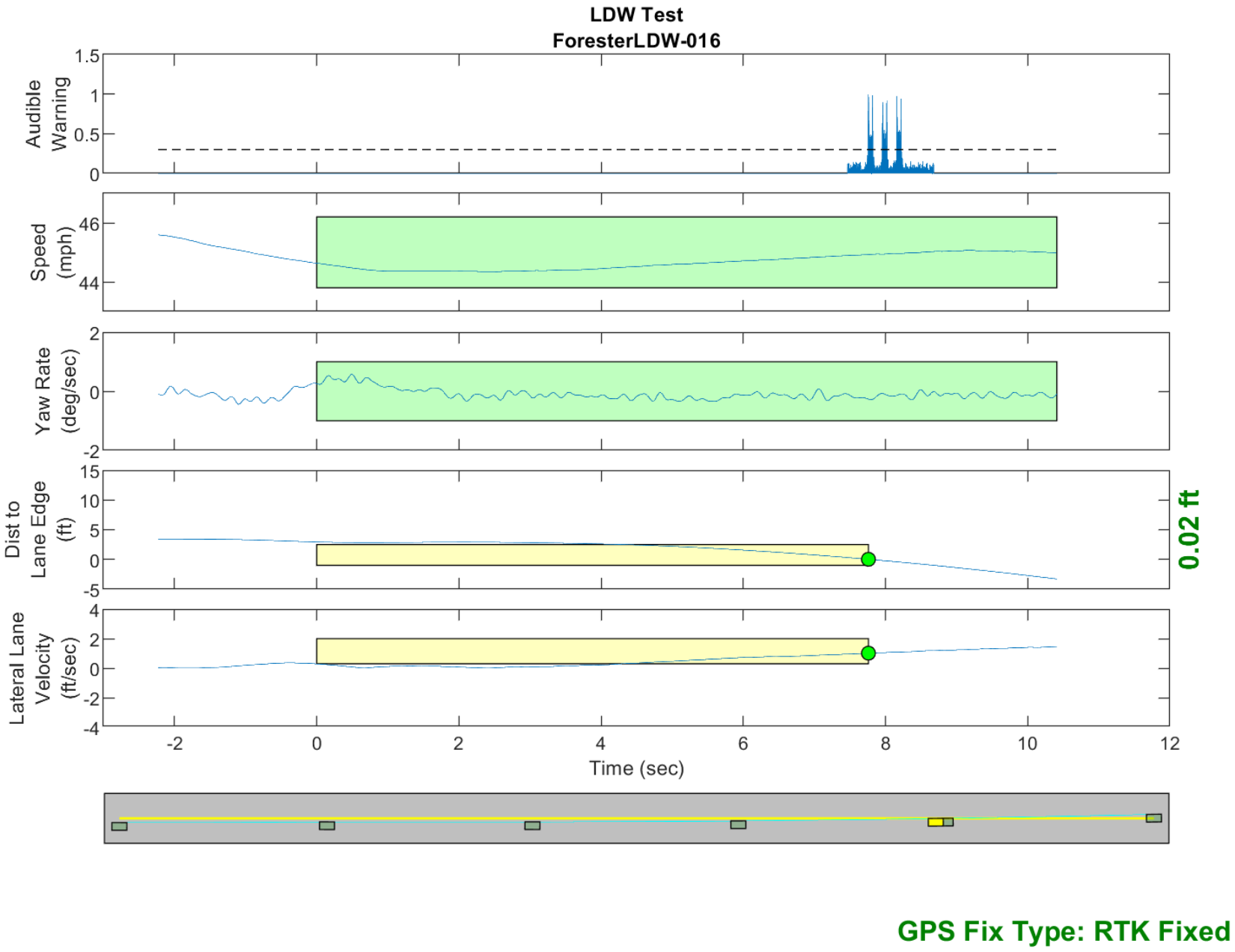


Figure D32. Time History for Run 16, Dashed Line, Left Departure, Auditory Warning

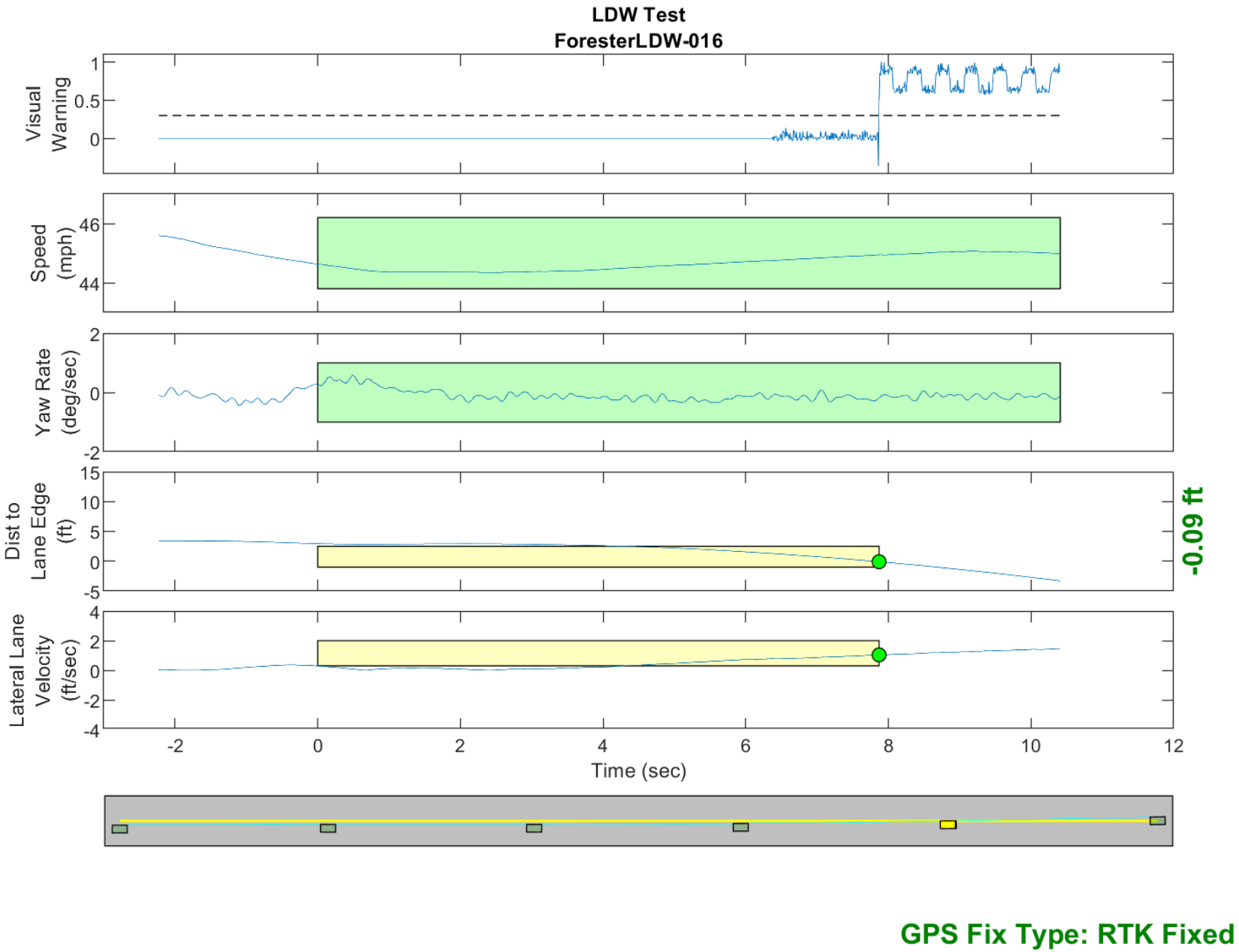


Figure D33. Time History for Run 16, Dashed Line, Left Departure, Visual Warning

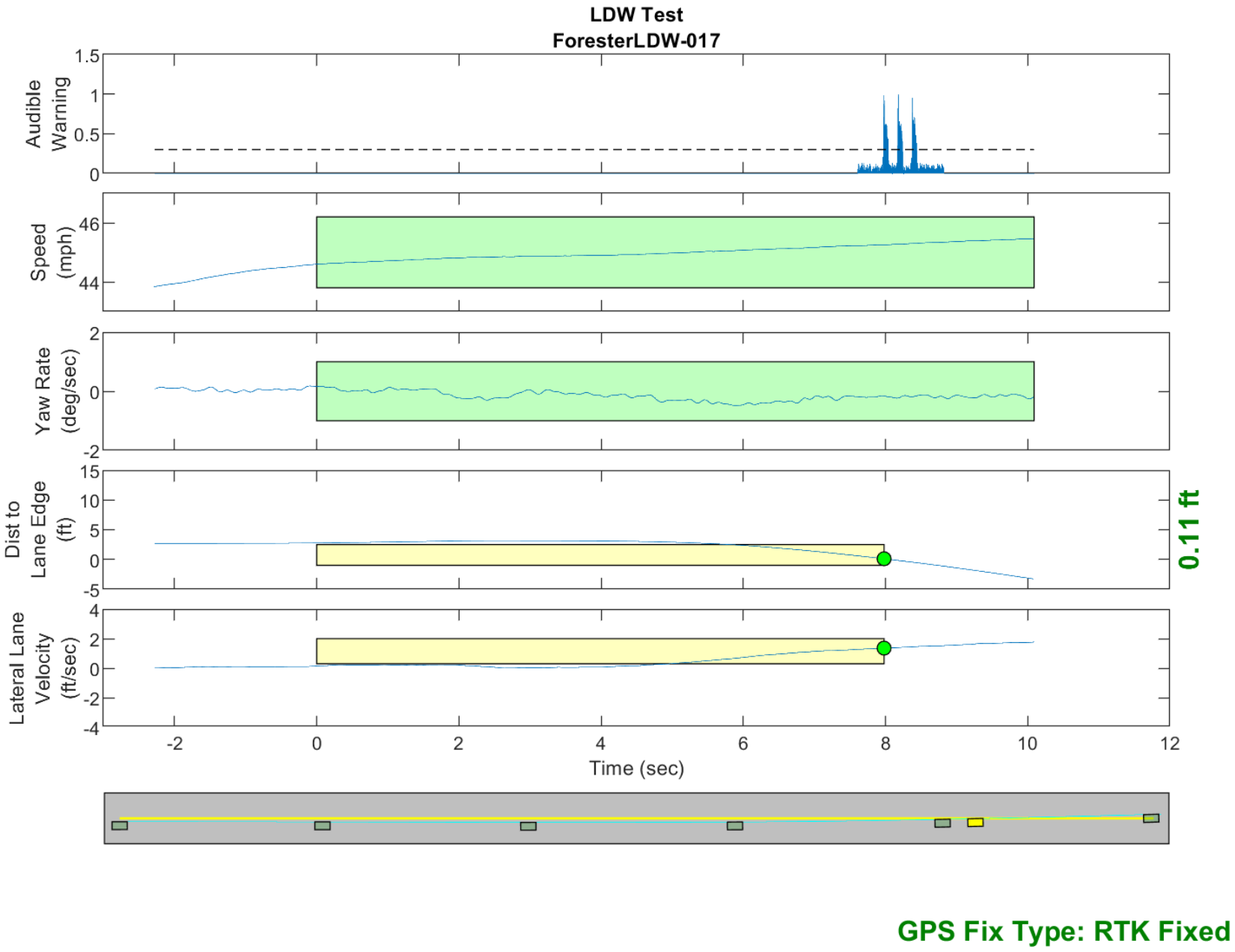


Figure D34. Time History for Run 17, Dashed Line, Left Departure, Auditory Warning

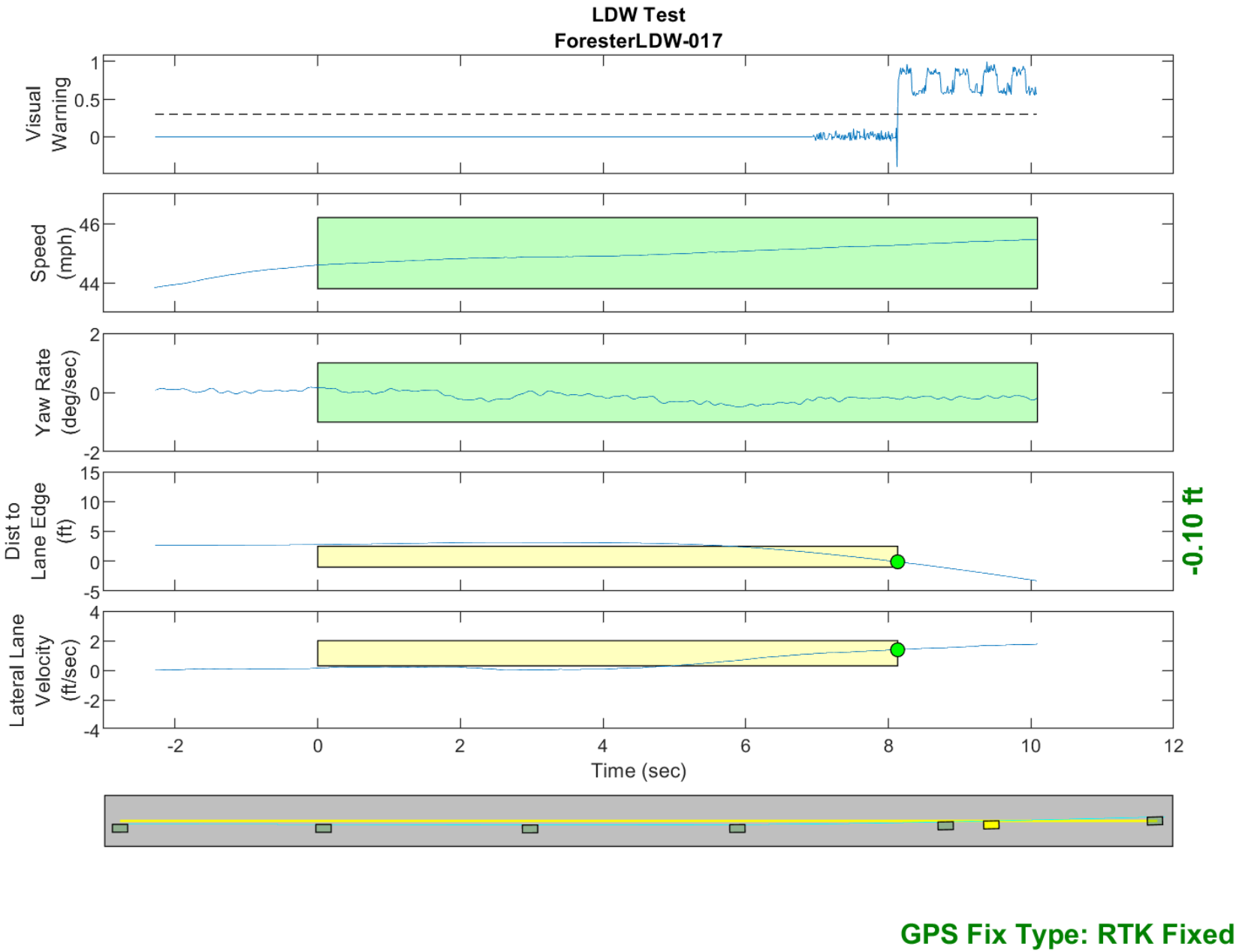


Figure D35. Time History for Run 17, Dashed Line, Left Departure, Visual Warning

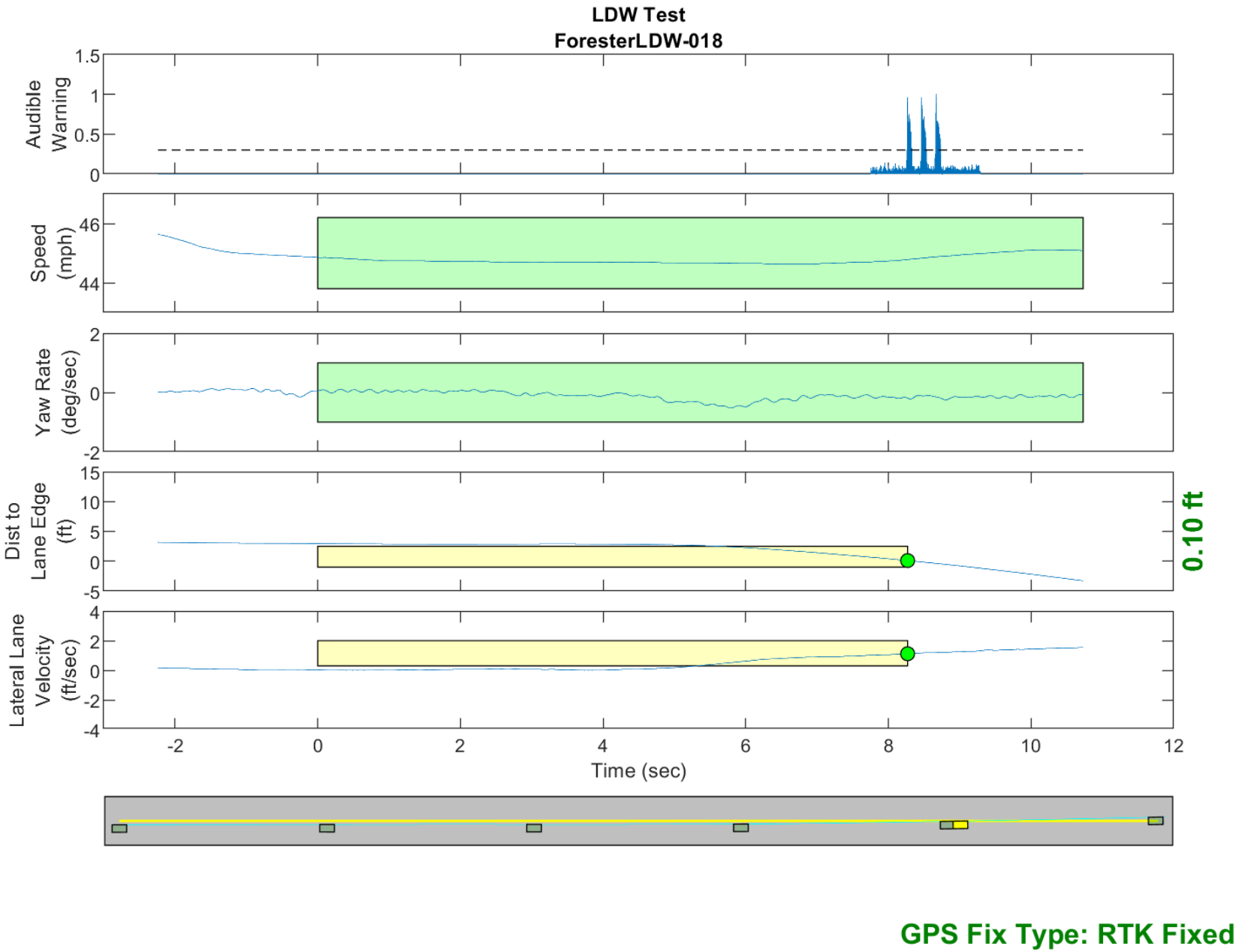


Figure D36. Time History for Run 18, Dashed Line, Left Departure, Auditory Warning

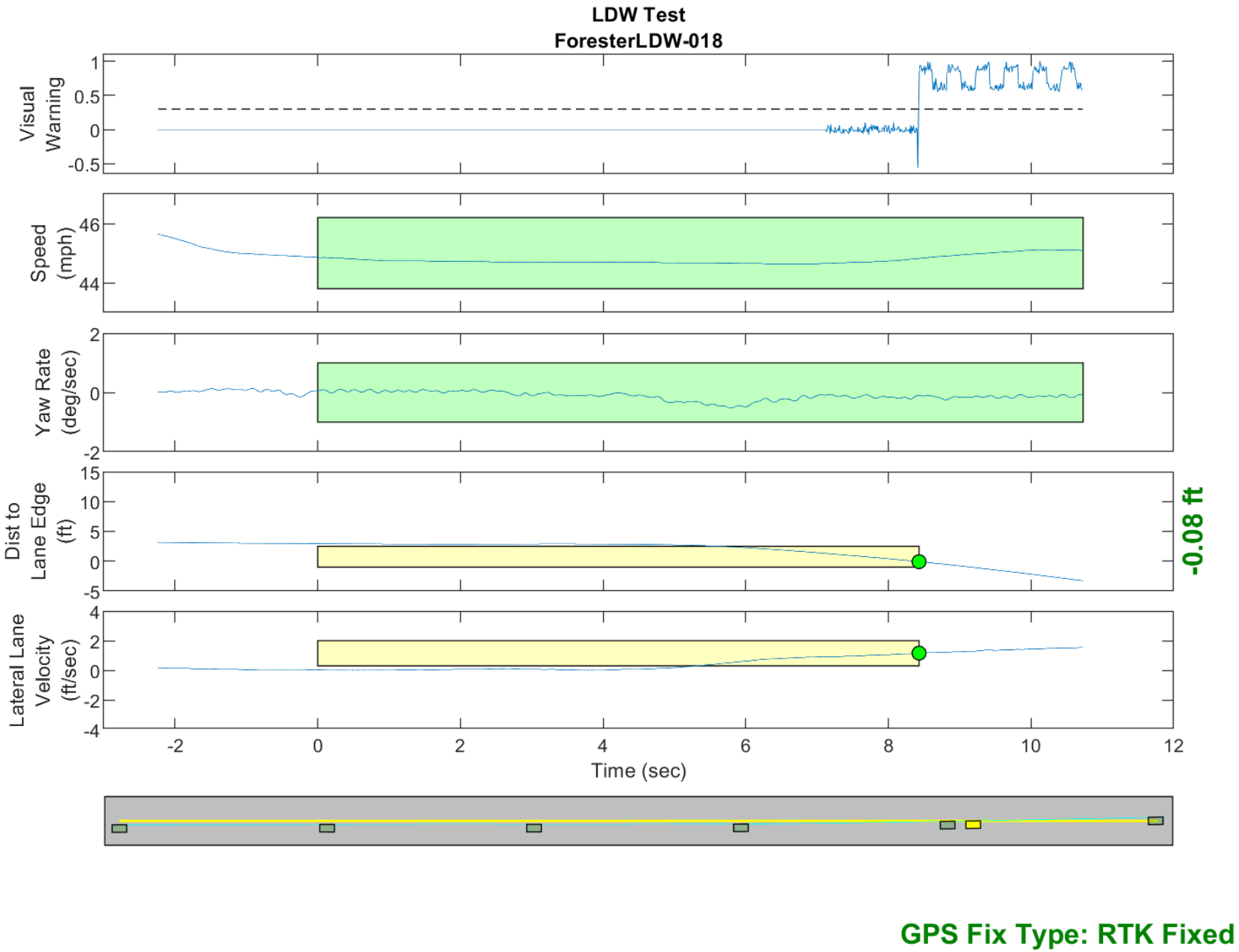


Figure D37. Time History for Run 18, Dashed Line, Left Departure, Visual Warning

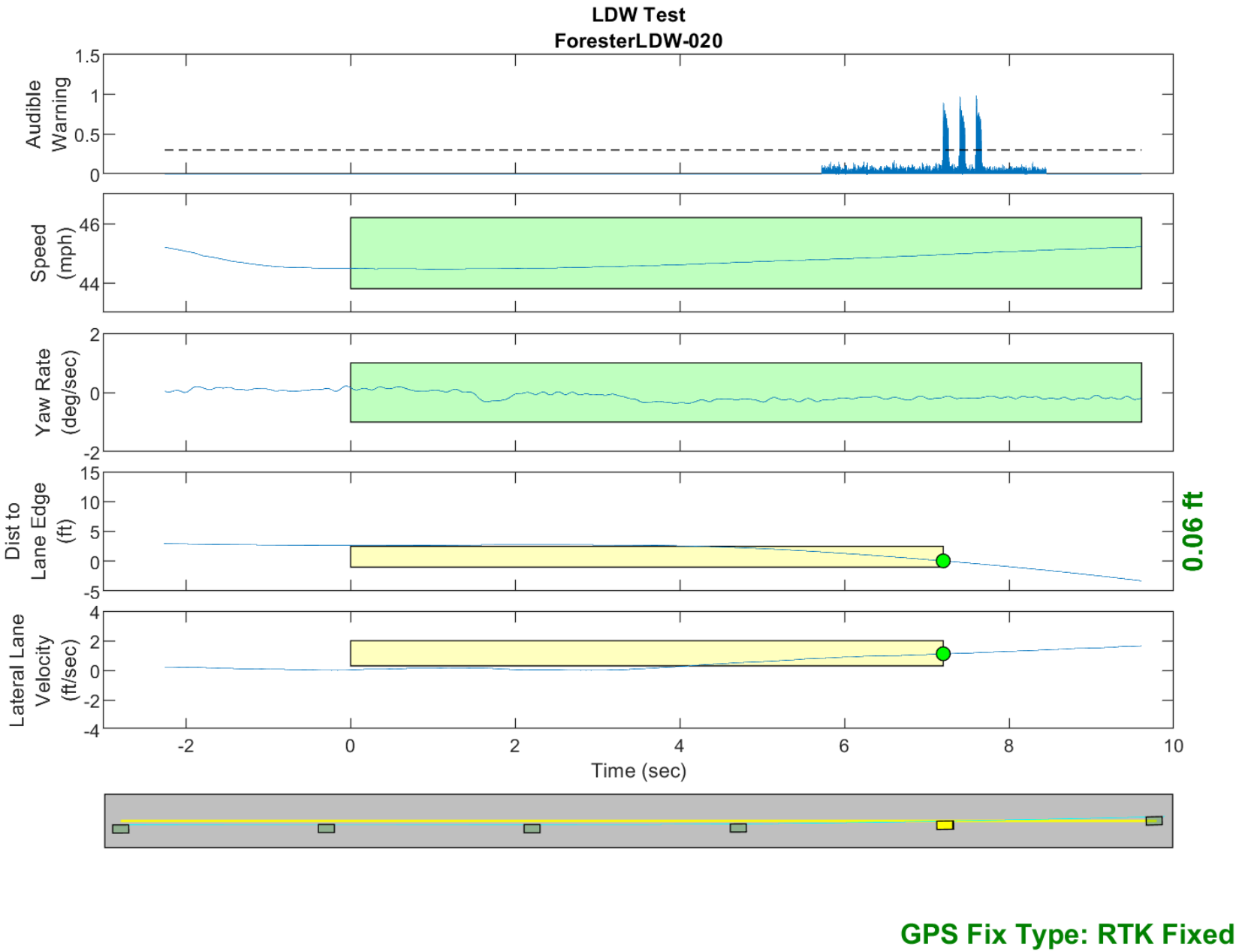


Figure D38. Time History for Run 20, Dashed Line, Left Departure, Auditory Warning

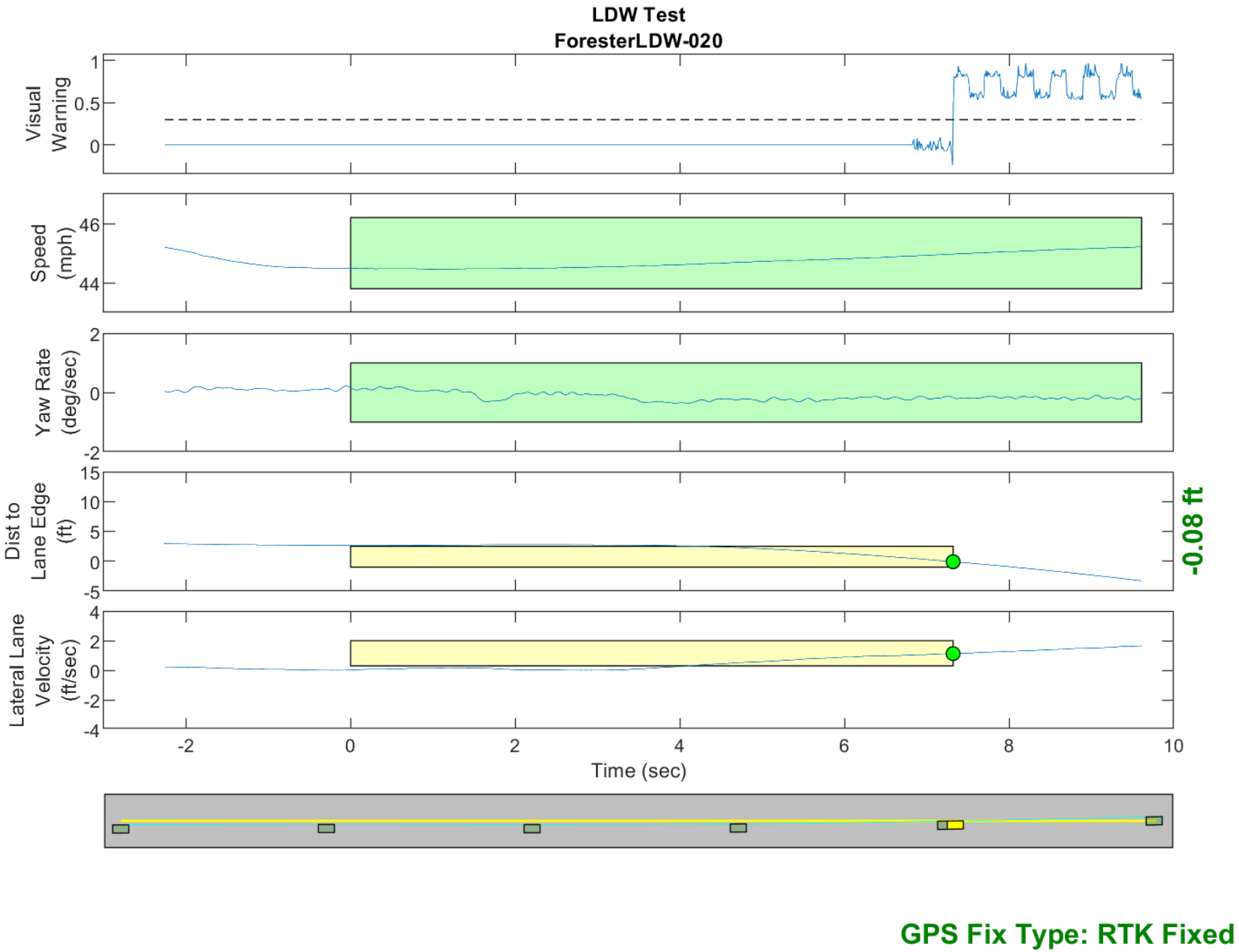


Figure D39. Time History for Run 20, Dashed Line, Left Departure, Visual Warning

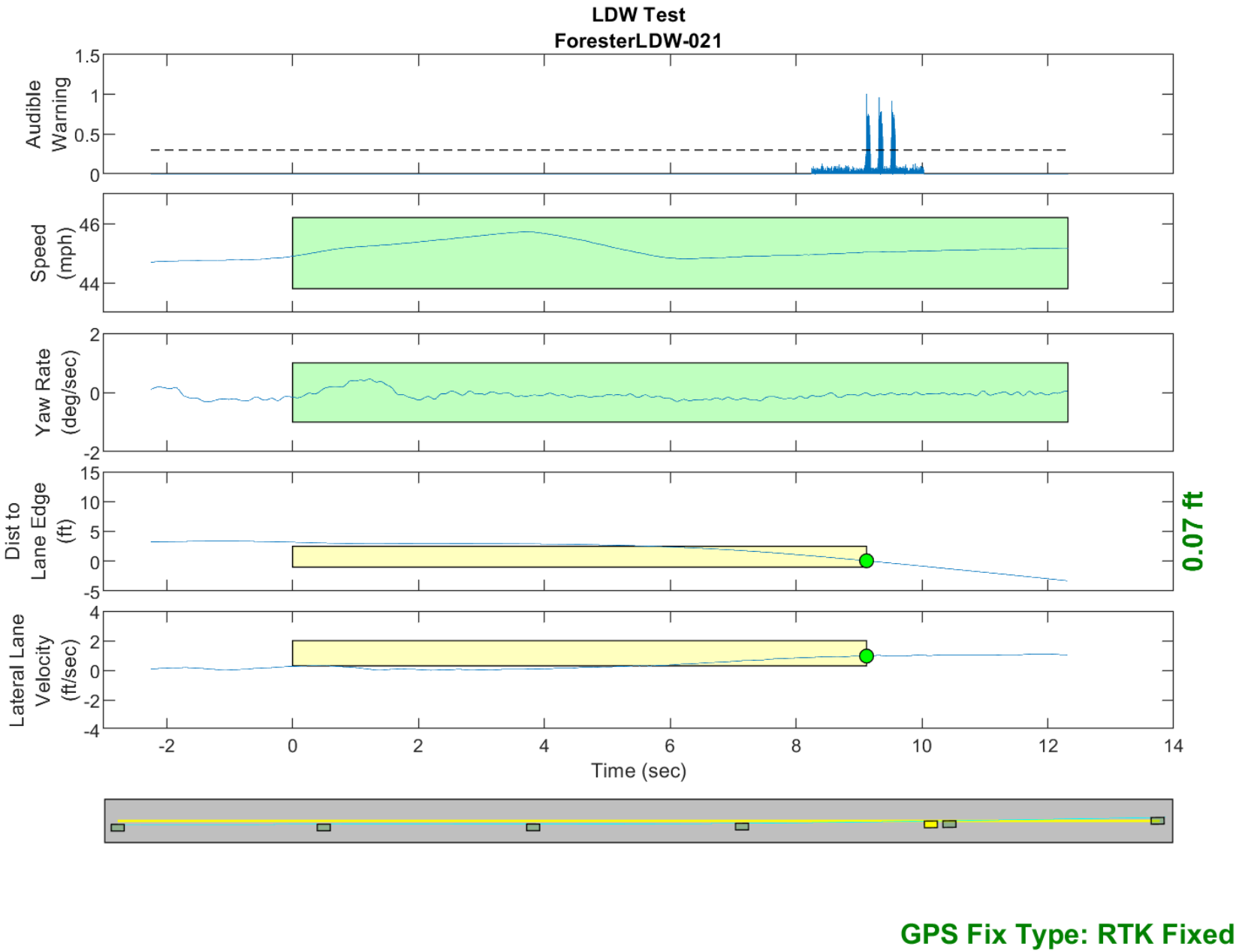


Figure D40. Time History for Run 21, Dashed Line, Left Departure, Auditory Warning

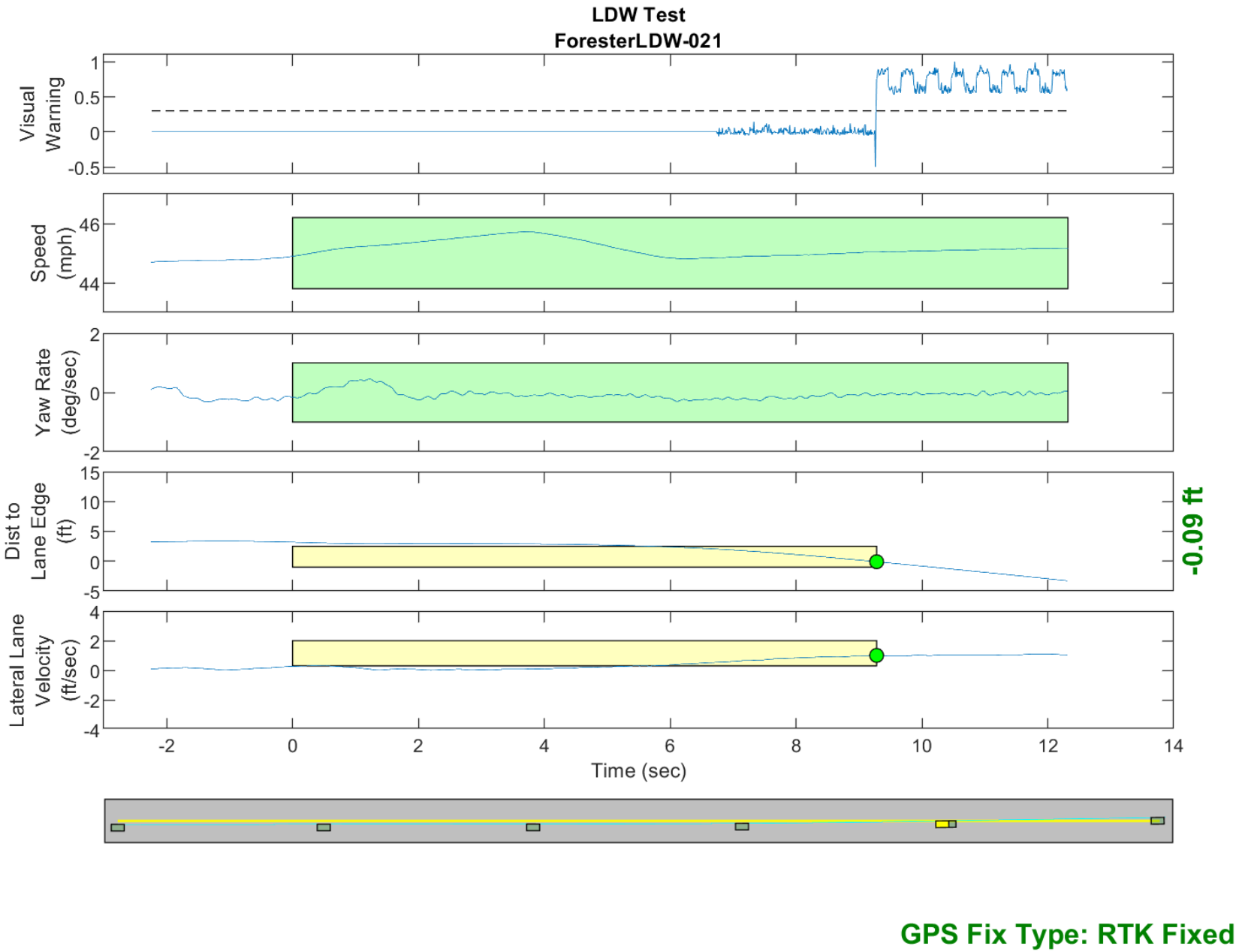


Figure D41. Time History for Run 21, Dashed Line, Left Departure, Visual Warning

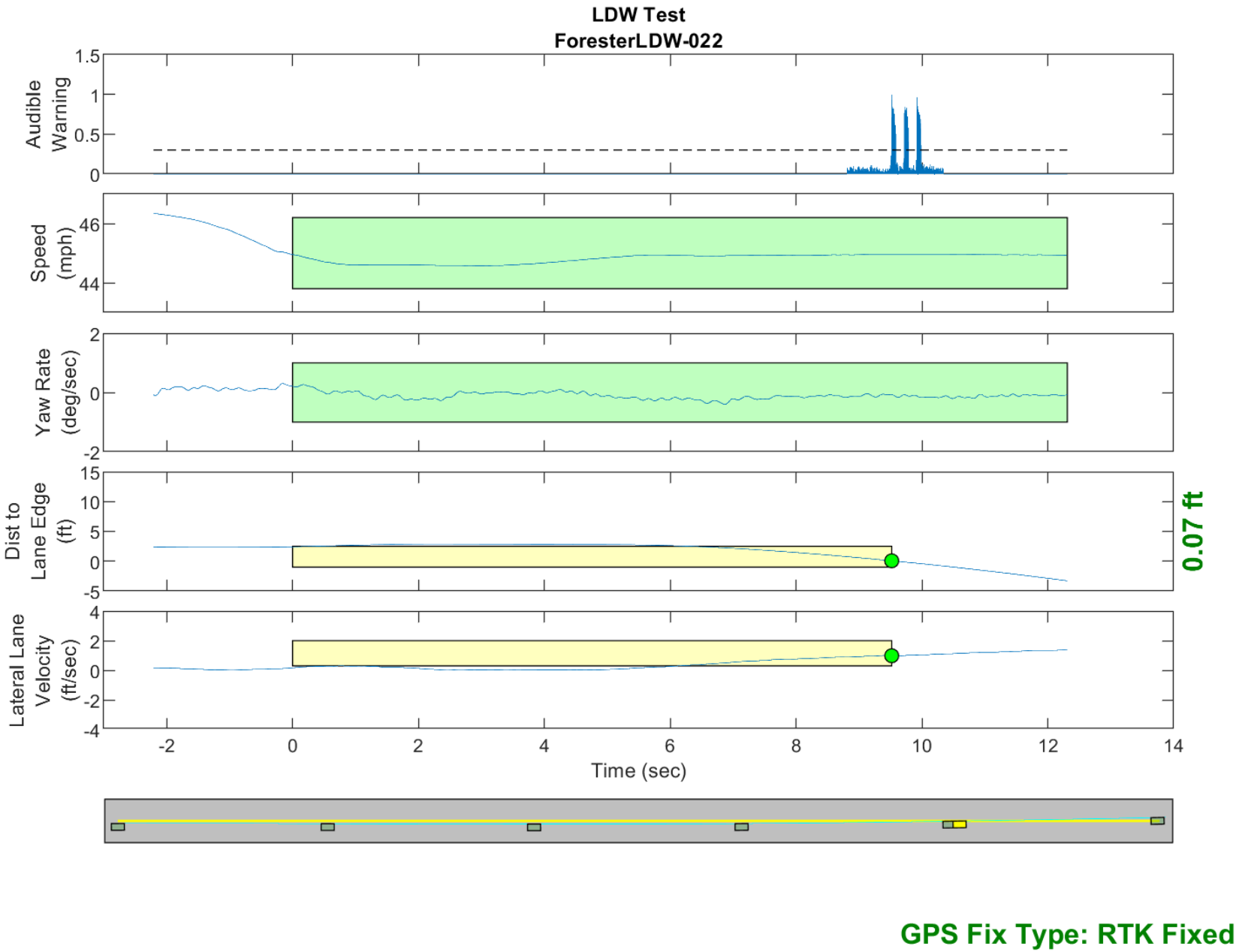


Figure D42. Time History for Run 22, Dashed Line, Left Departure, Auditory Warning

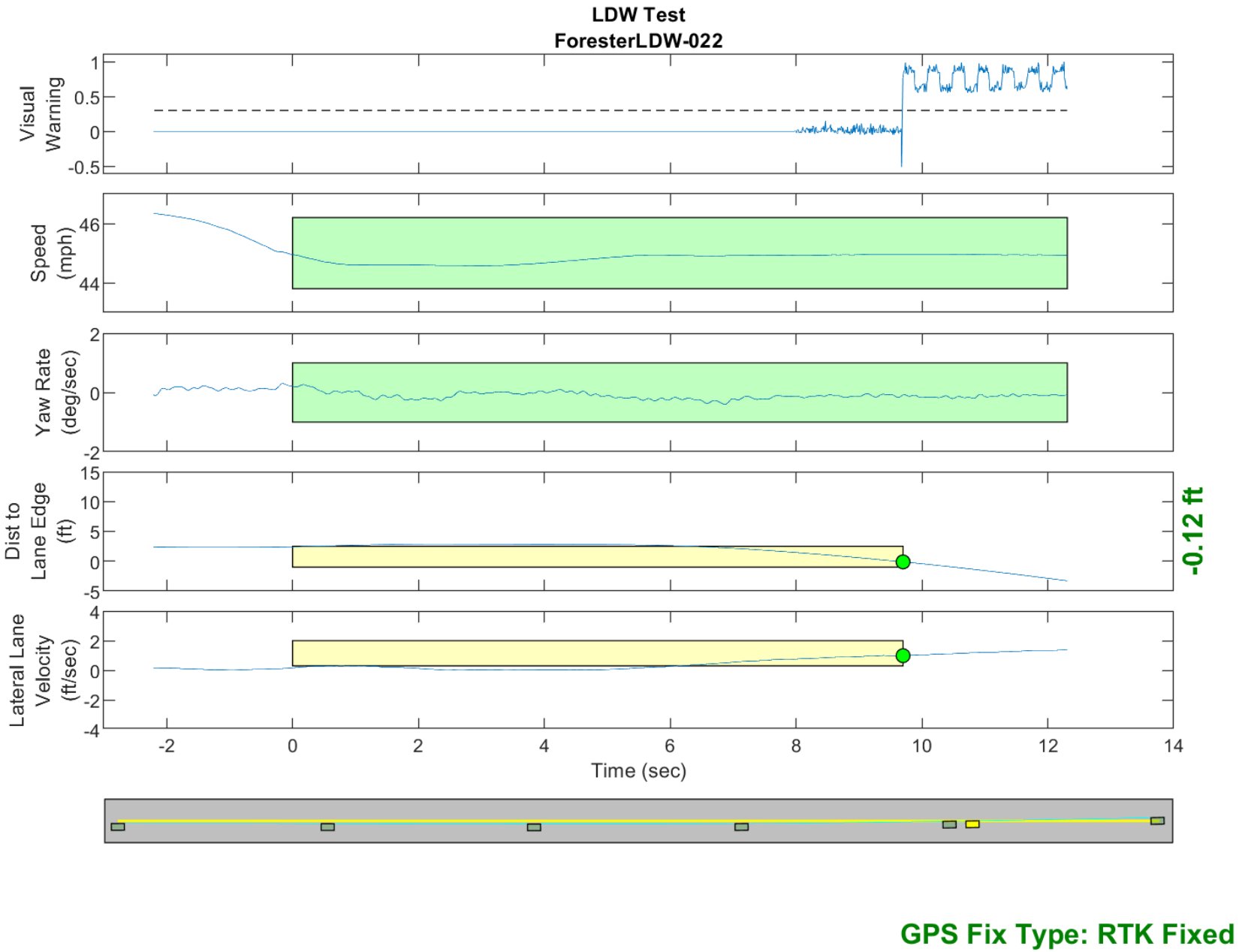


Figure D43. Time History for Run 22, Dashed Line, Left Departure, Visual Warning

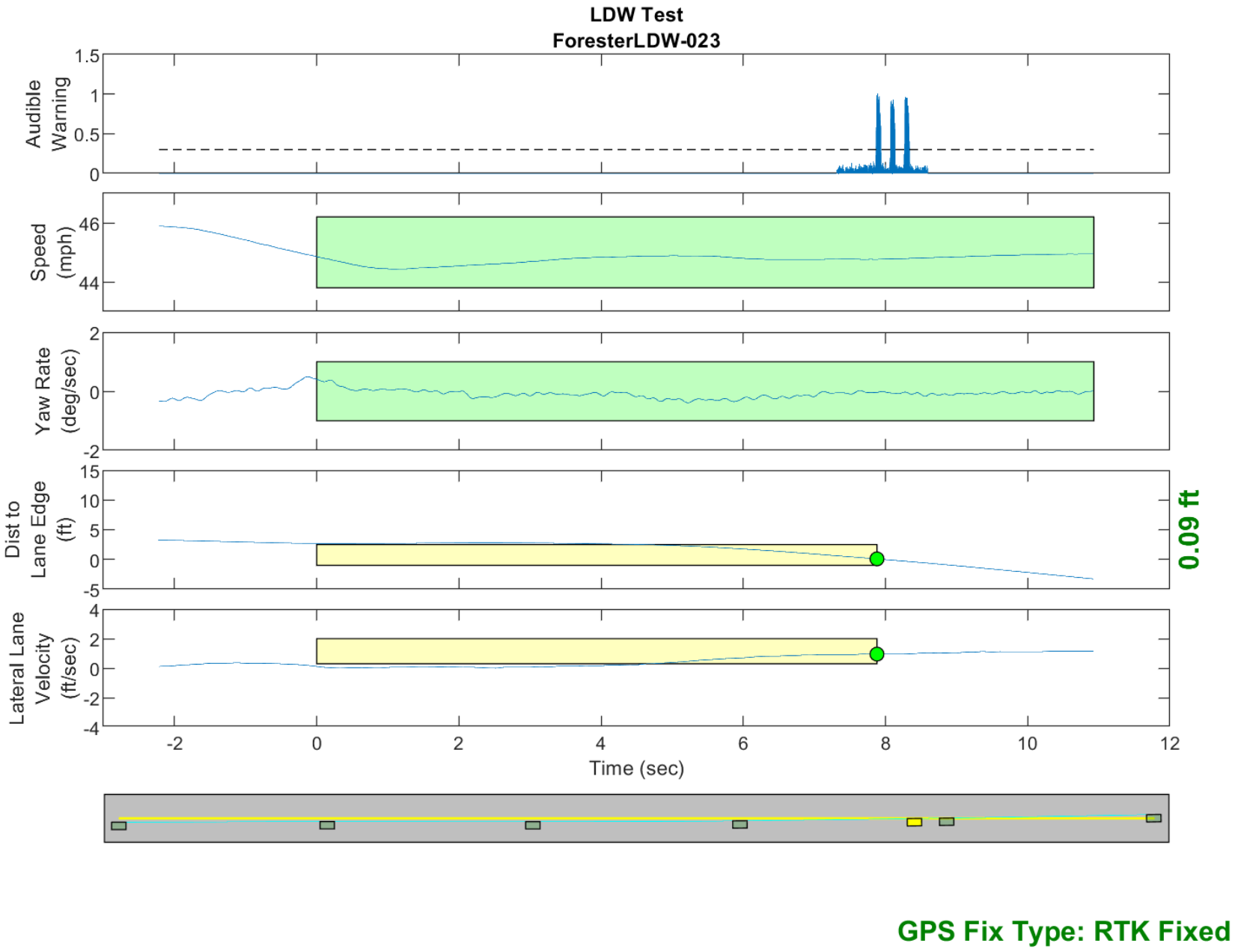


Figure D44. Time History for Run 23, Dashed Line, Left Departure, Auditory Warning

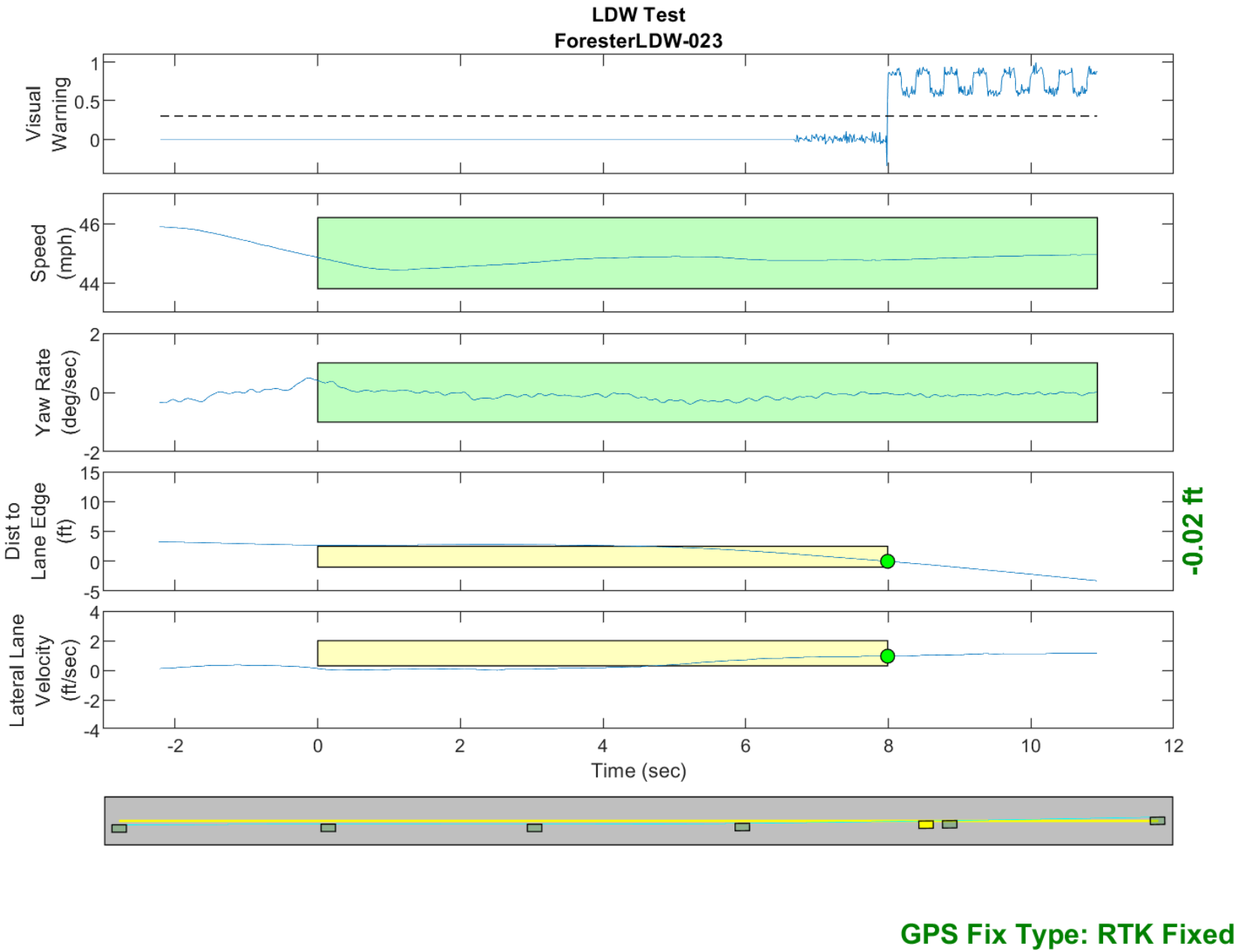


Figure D45. Time History for Run 23, Dashed Line, Left Departure, Visual Warning

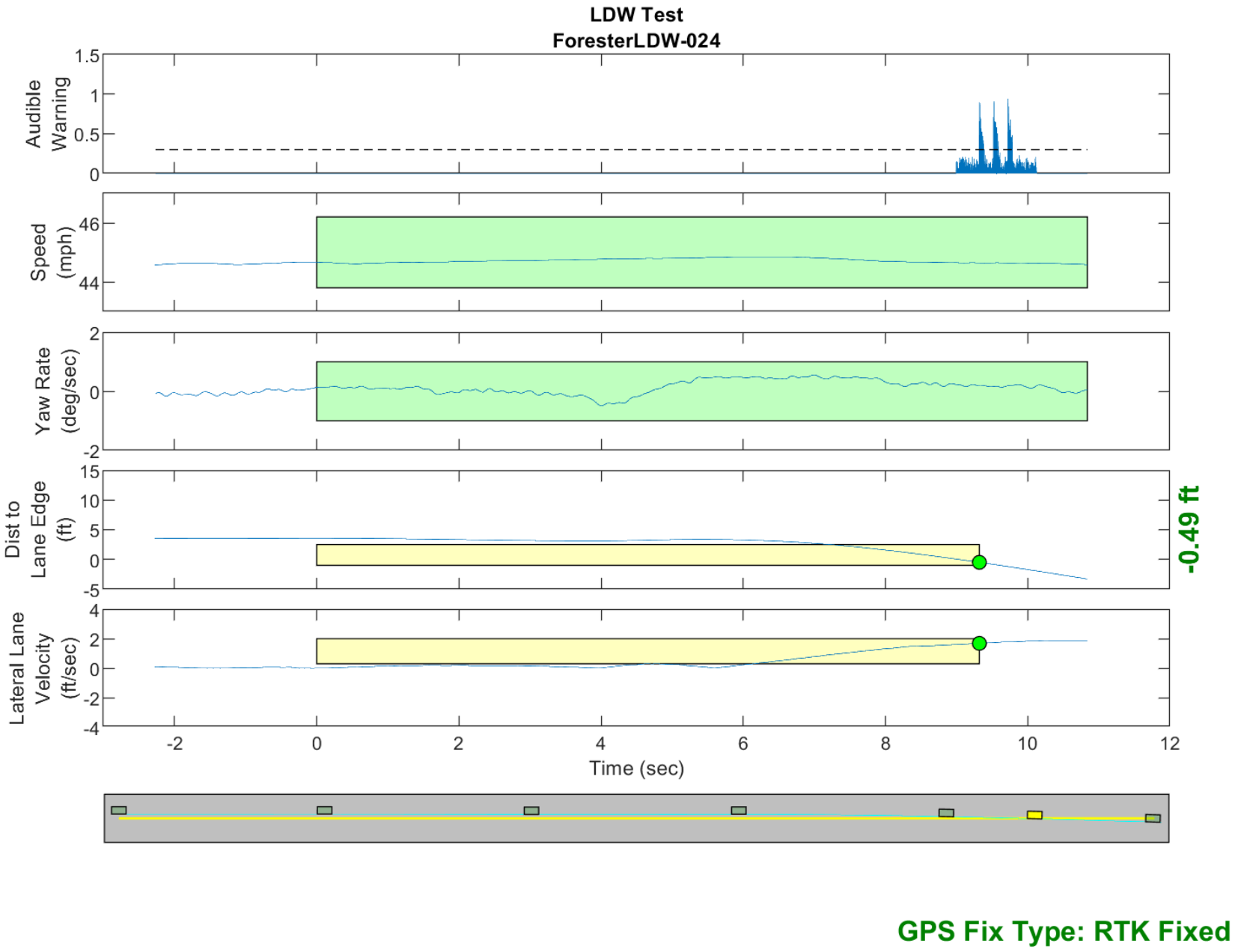


Figure D46. Time History for Run 24, Dashed Line, Right Departure, Auditory Warning

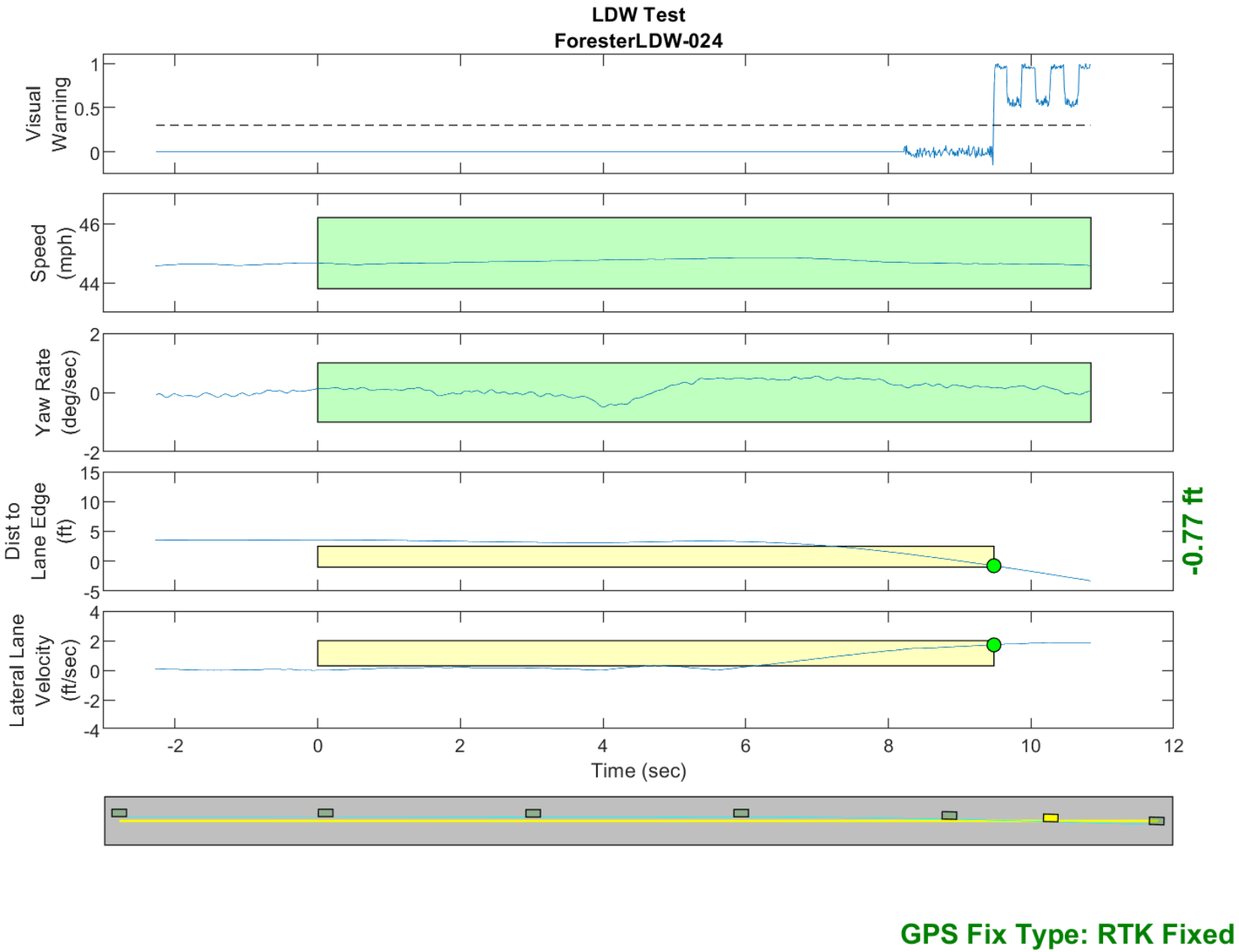


Figure D47. Time History for Run 24, Dashed Line, Right Departure, Visual Warning

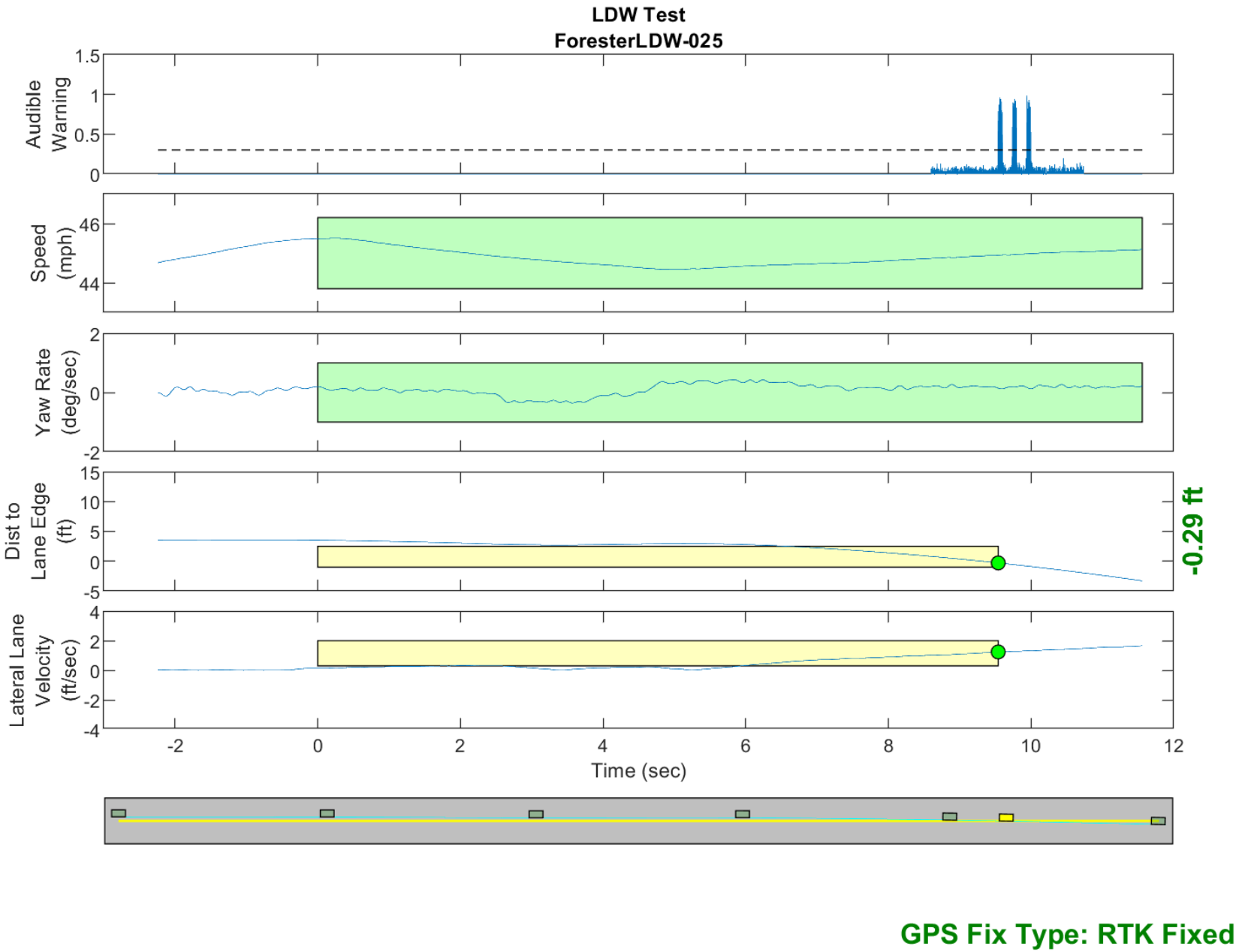


Figure D48. Time History for Run 25, Dashed Line, Right Departure, Auditory Warning

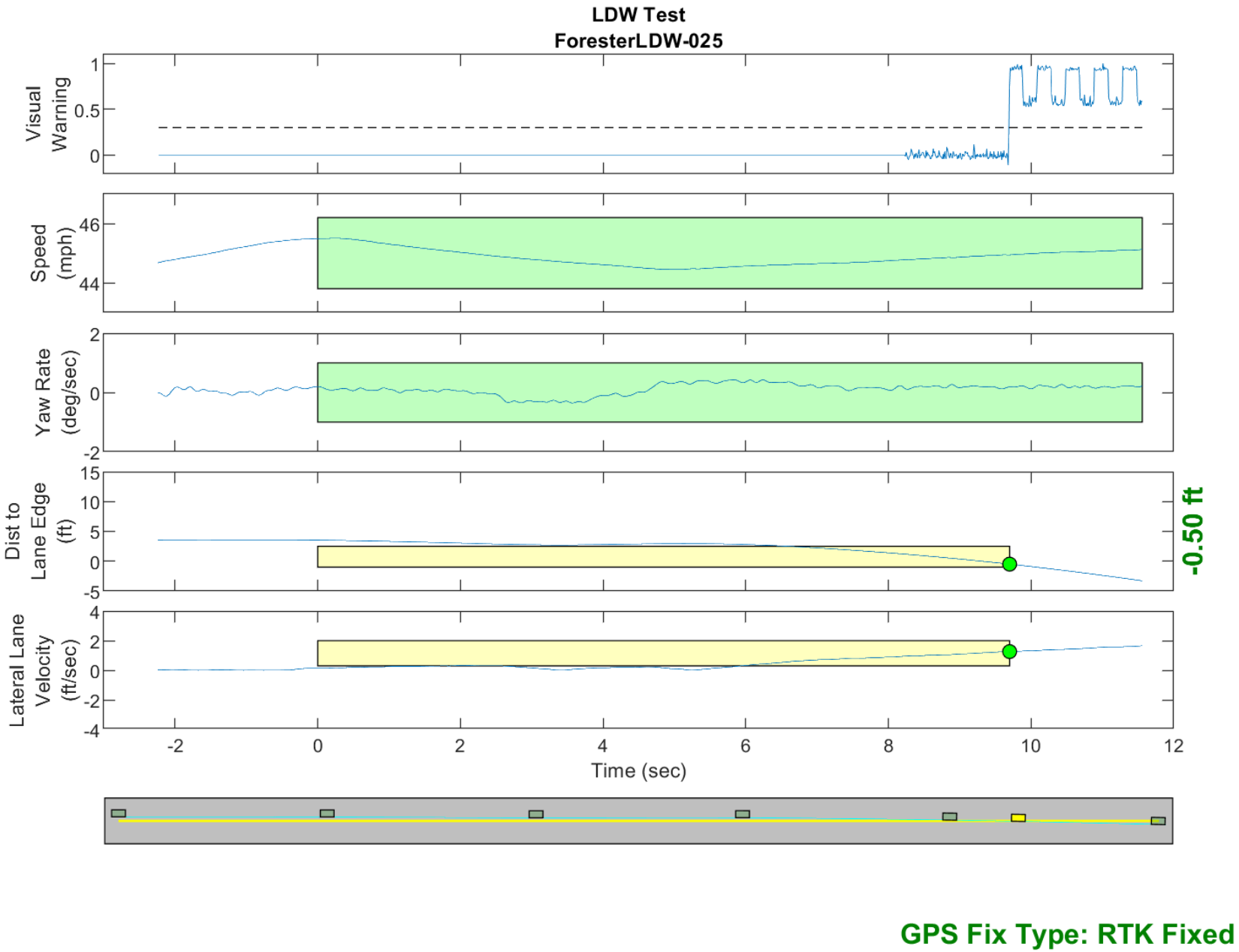


Figure D49. Time History for Run 25, Dashed Line, Right Departure, Visual Warning

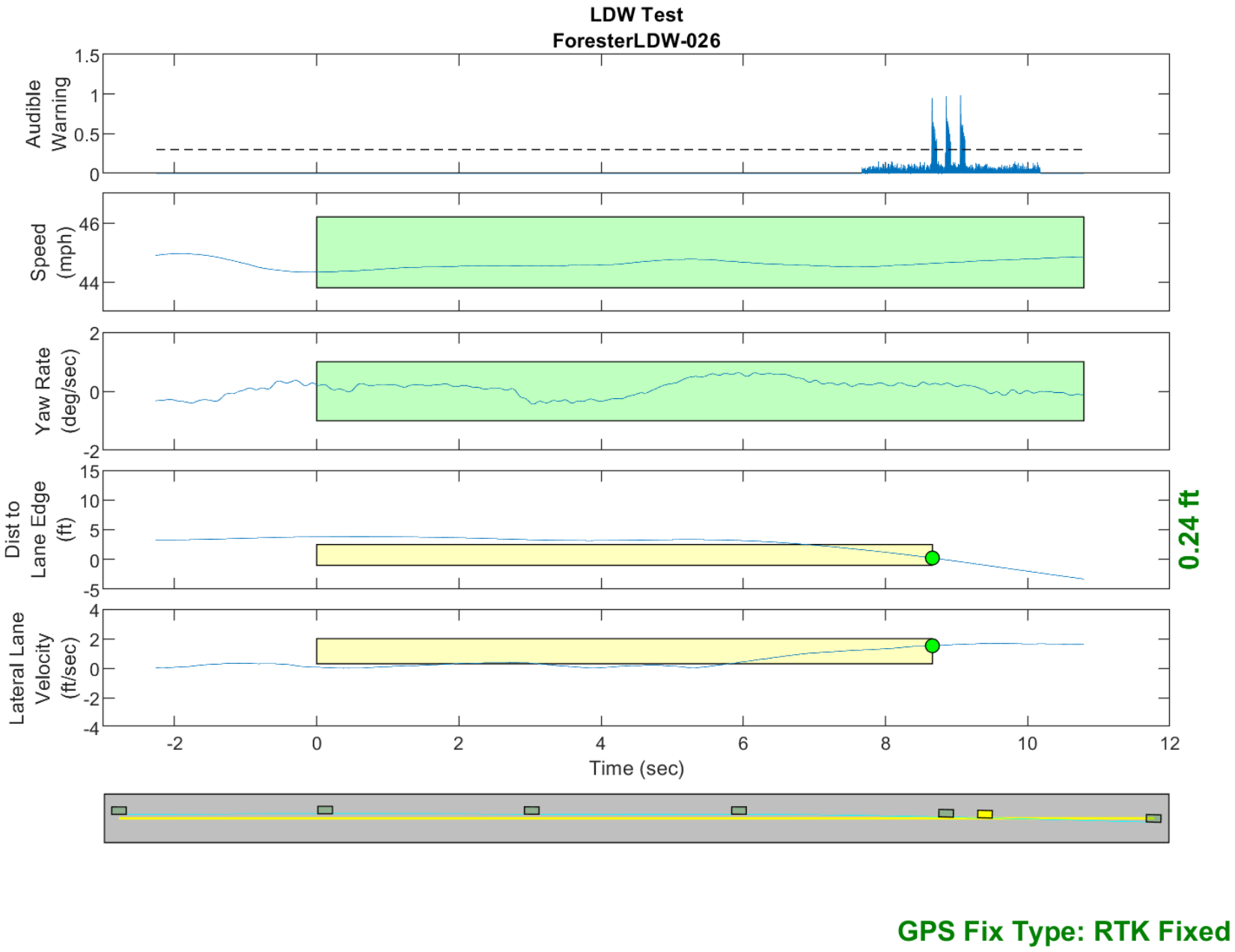


Figure D50. Time History for Run 26, Dashed Line, Right Departure, Auditory Warning

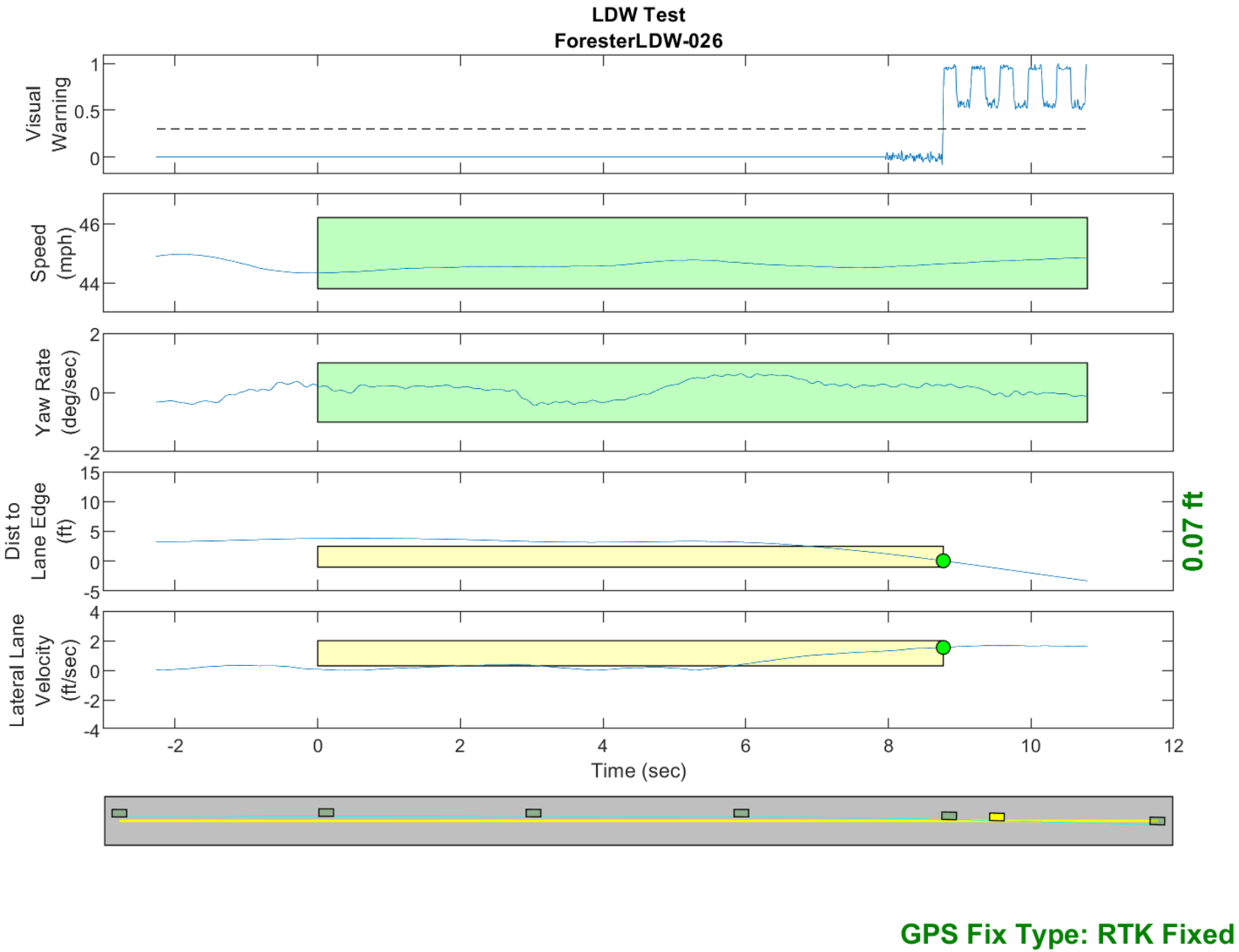


Figure D51. Time History for Run 26, Dashed Line, Right Departure, Visual Warning

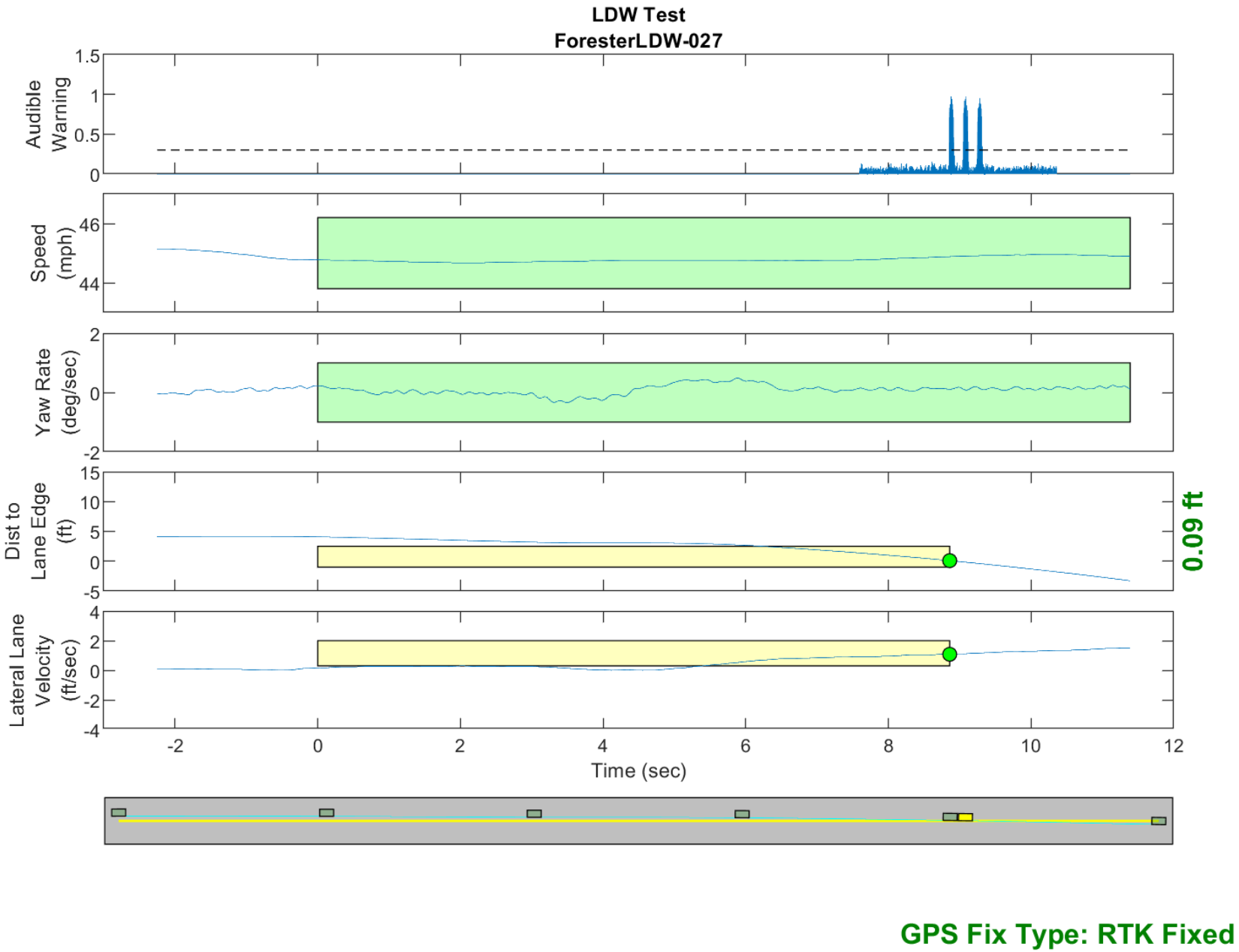


Figure D52. Time History for Run 27, Dashed Line, Right Departure, Auditory Warning

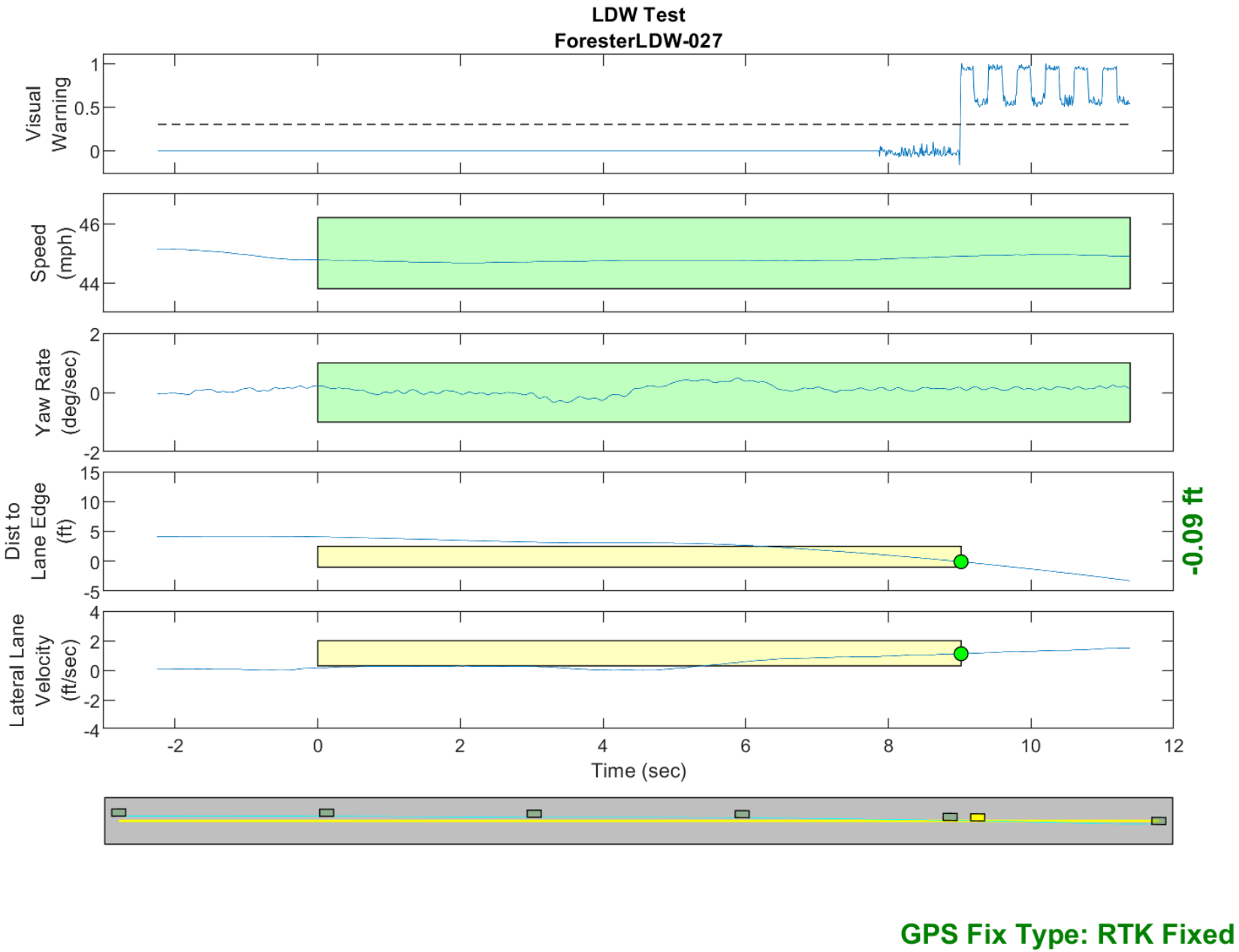


Figure D53. Time History for Run 27, Dashed Line, Right Departure, Visual Warning

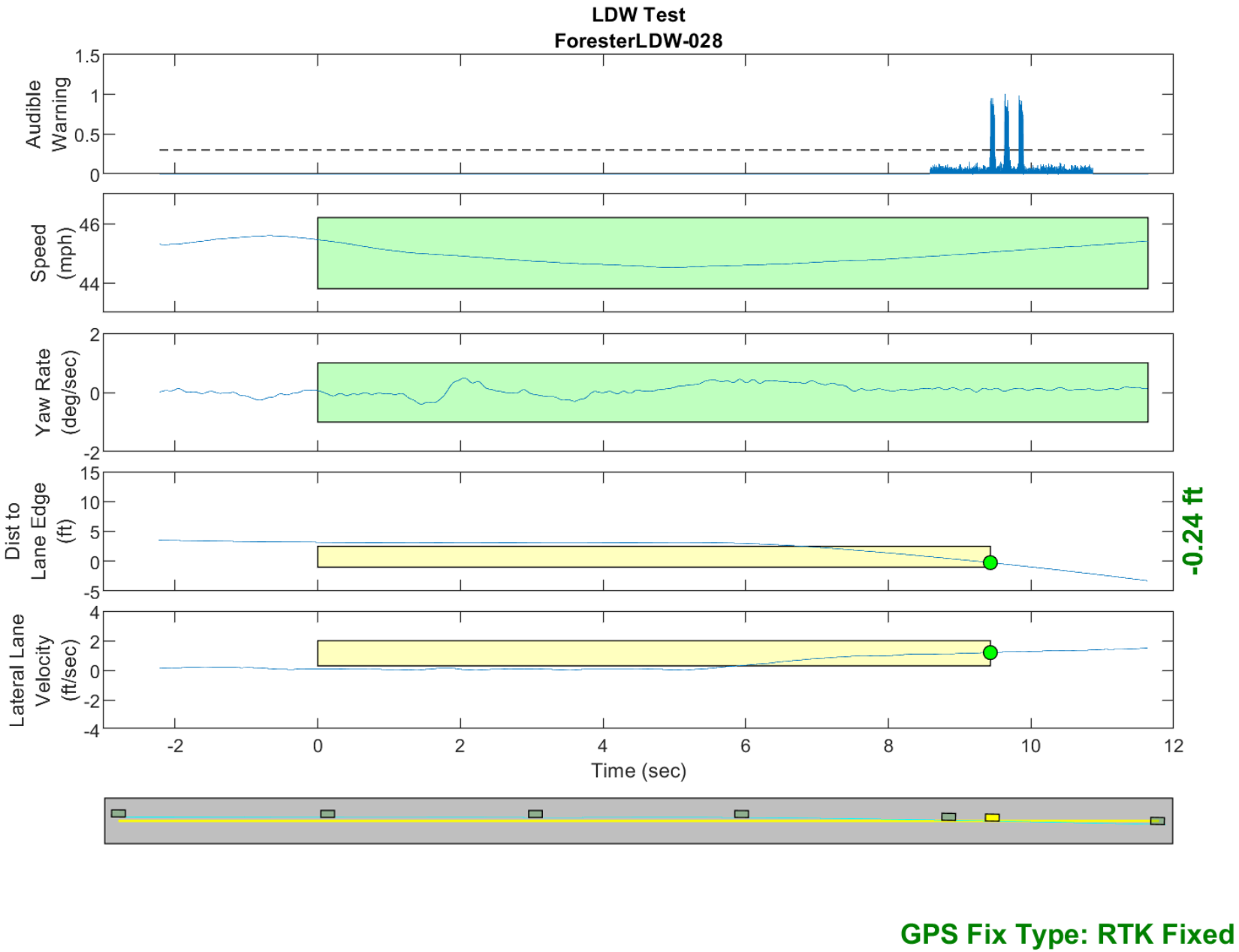


Figure D54. Time History for Run 28, Dashed Line, Right Departure, Auditory Warning

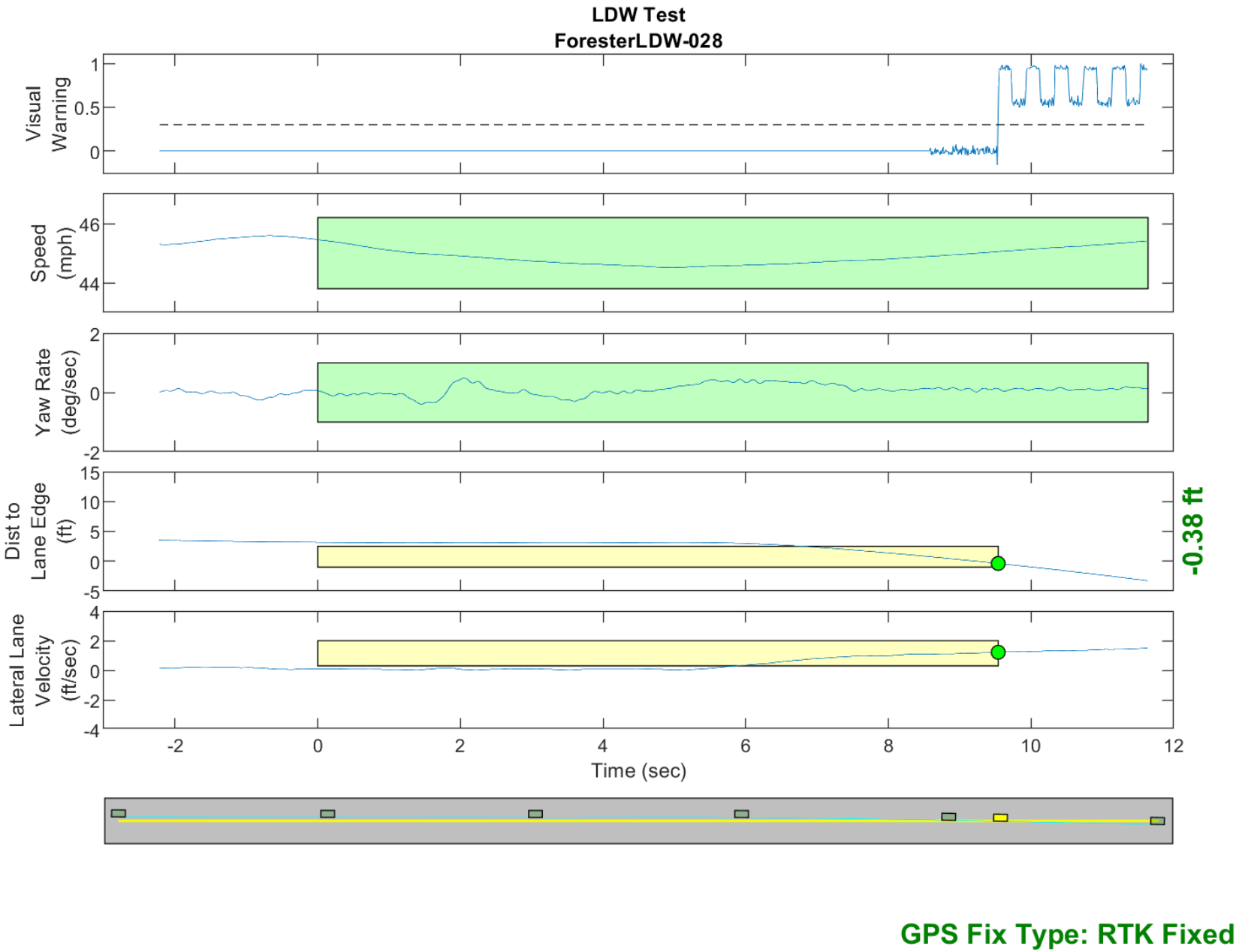


Figure D55. Time History for Run 28, Dashed Line, Right Departure, Visual Warning

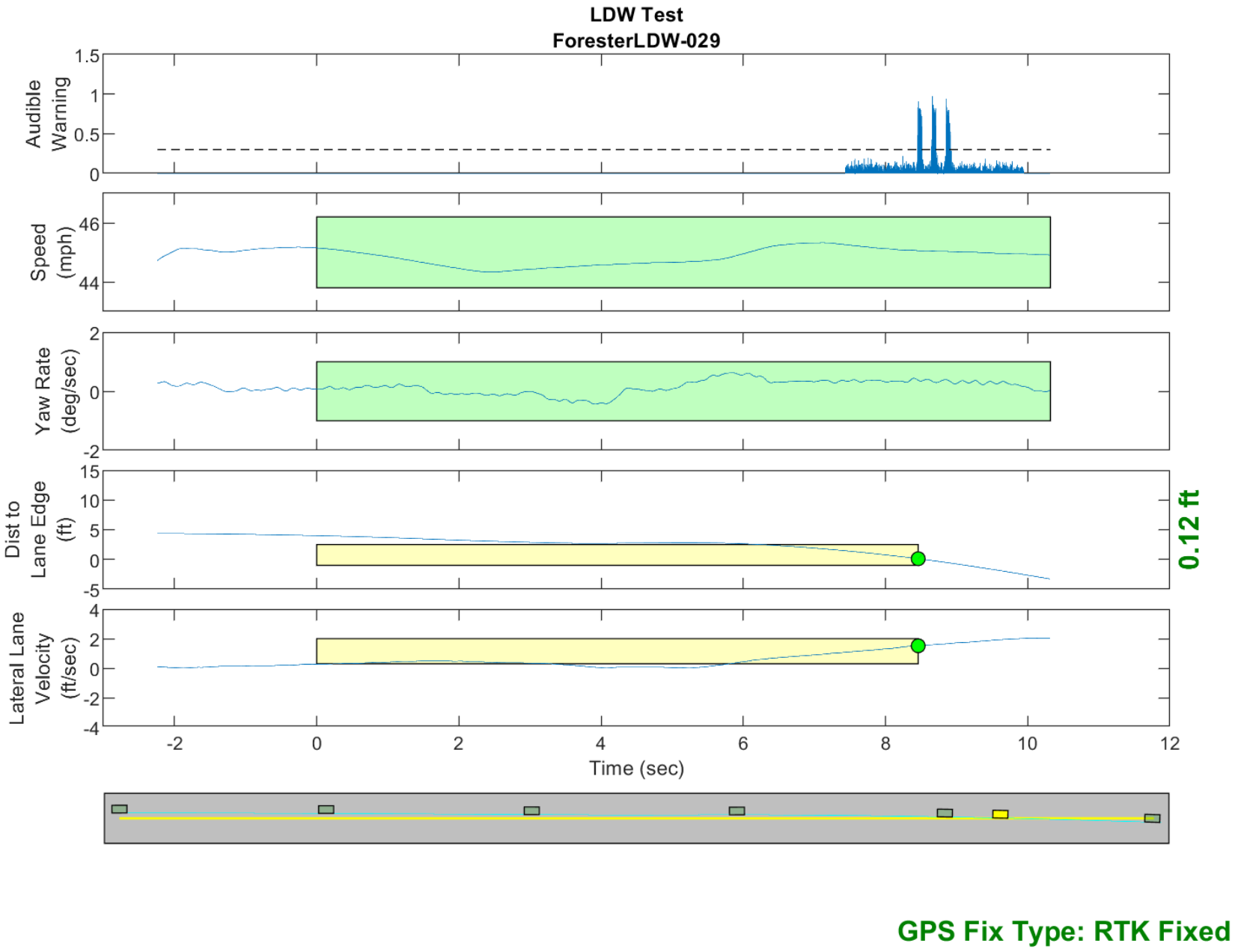


Figure D56. Time History for Run 29, Dashed Line, Right Departure, Auditory Warning

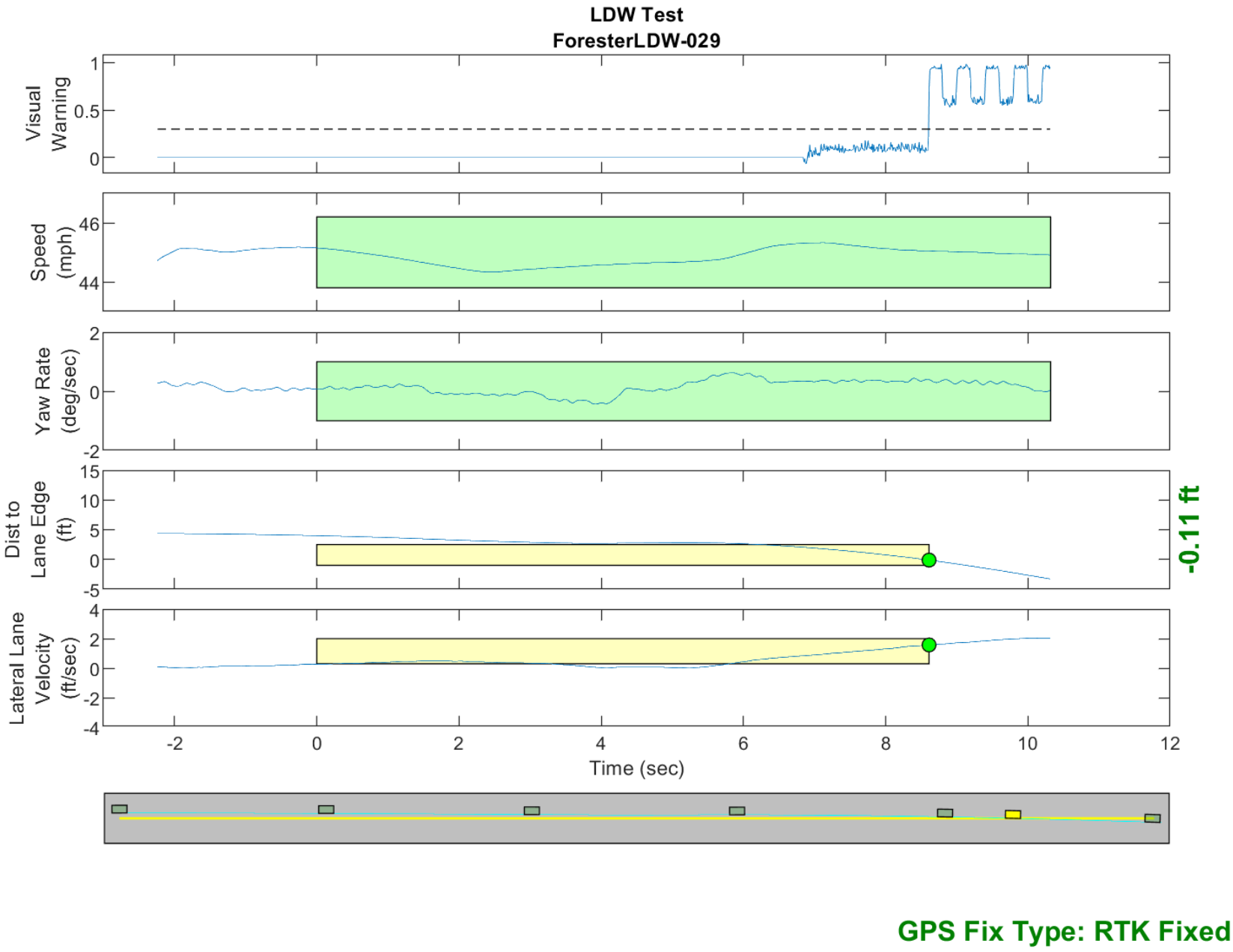


Figure D57. Time History for Run 29, Dashed Line, Right Departure, Visual Warning

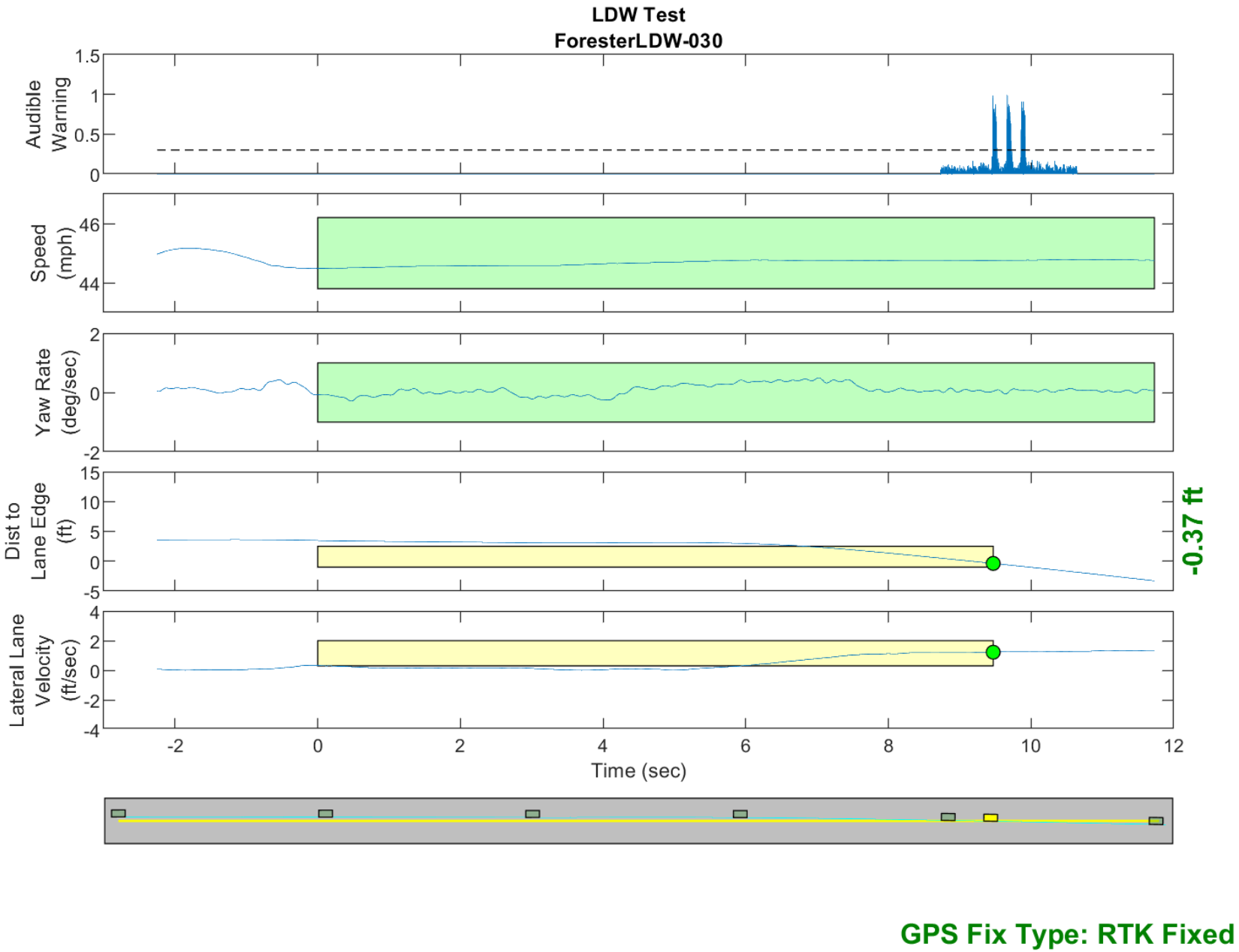


Figure D58. Time History for Run 30, Dashed Line, Right Departure, Auditory Warning

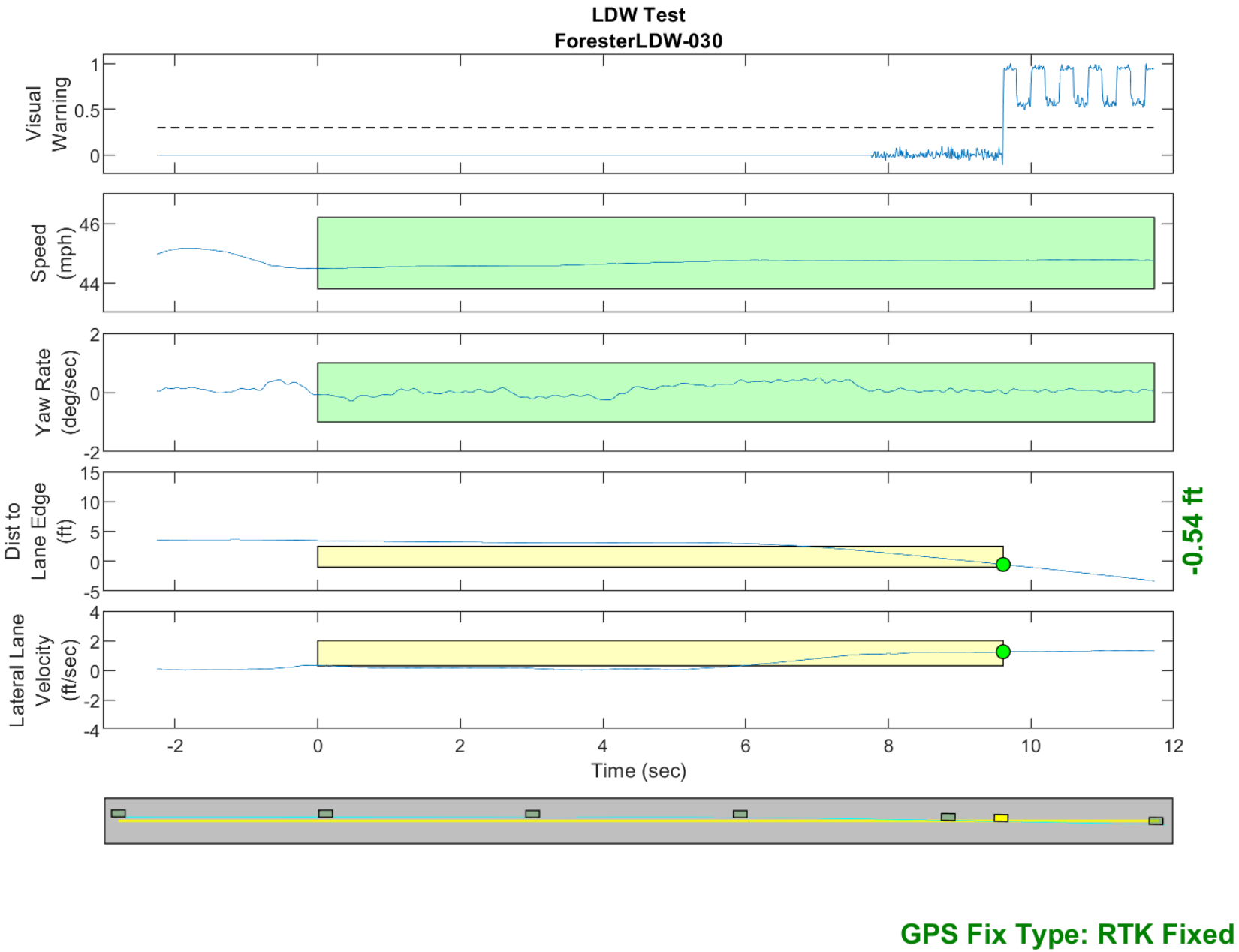


Figure D59. Time History for Run 30, Dashed Line, Right Departure, Visual Warning

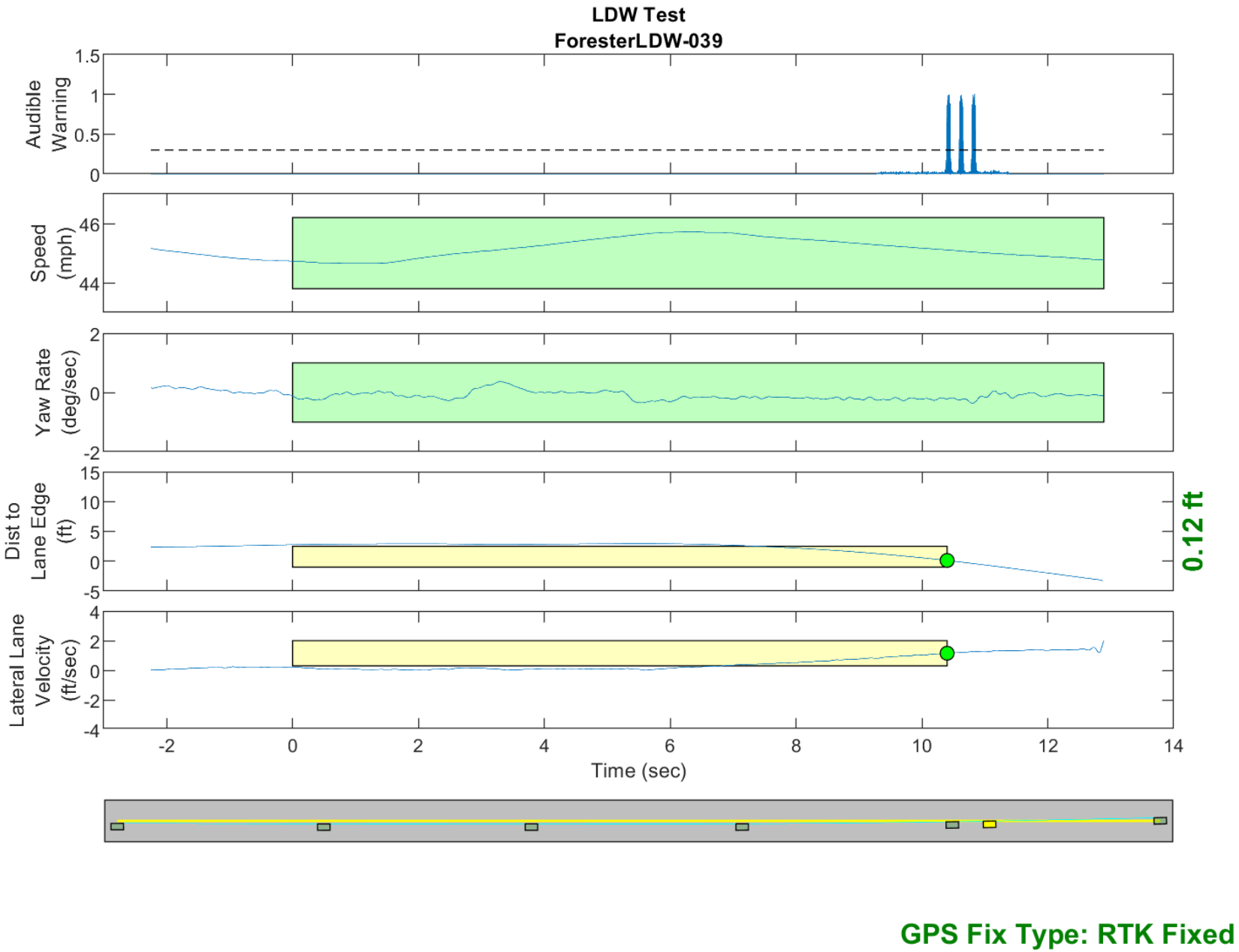


Figure D60. Time History for Run 39, Botts Dots, Left Departure, Auditory Warning

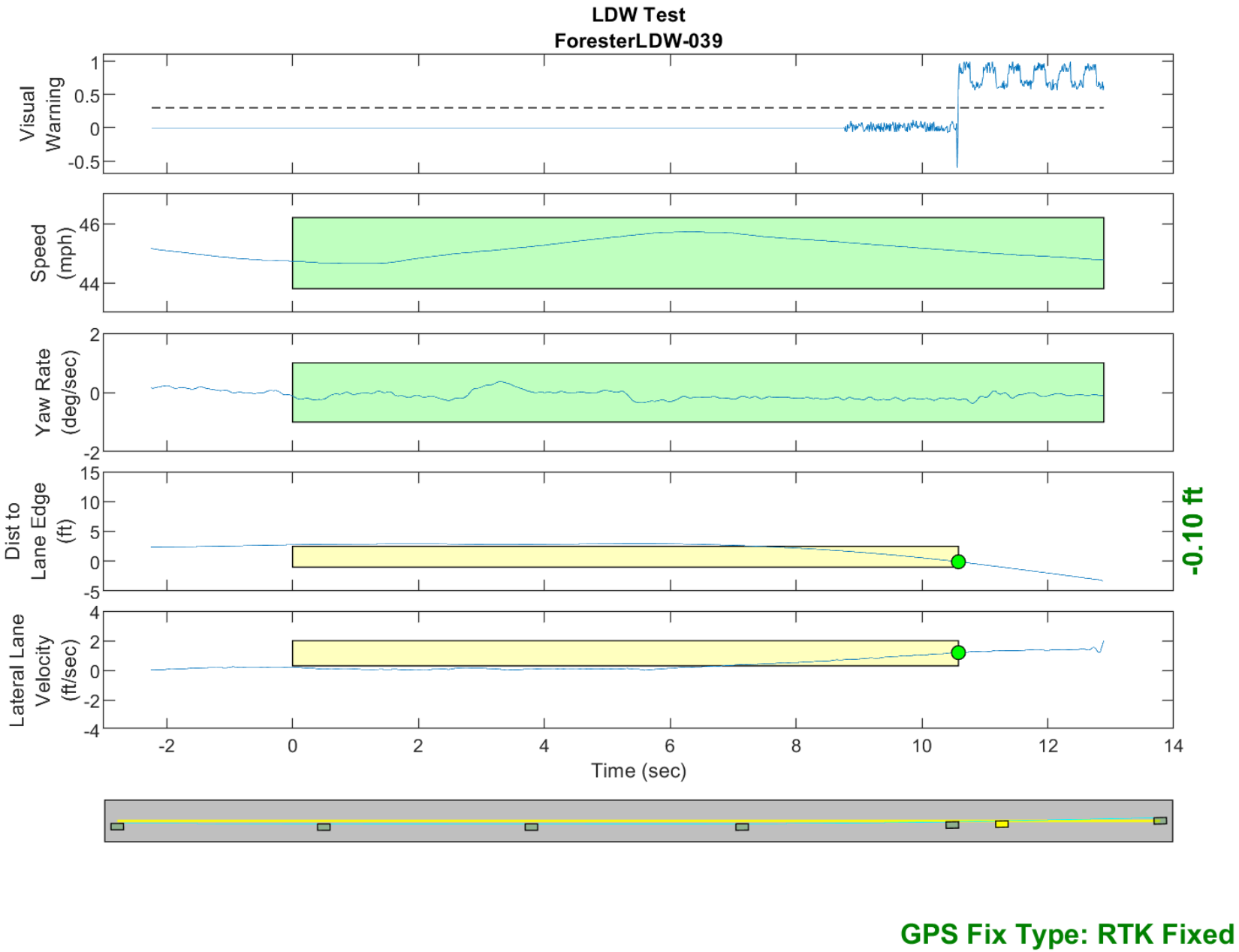


Figure D61. Time History for Run 39, Botts Dots, Left Departure, Visual Warning

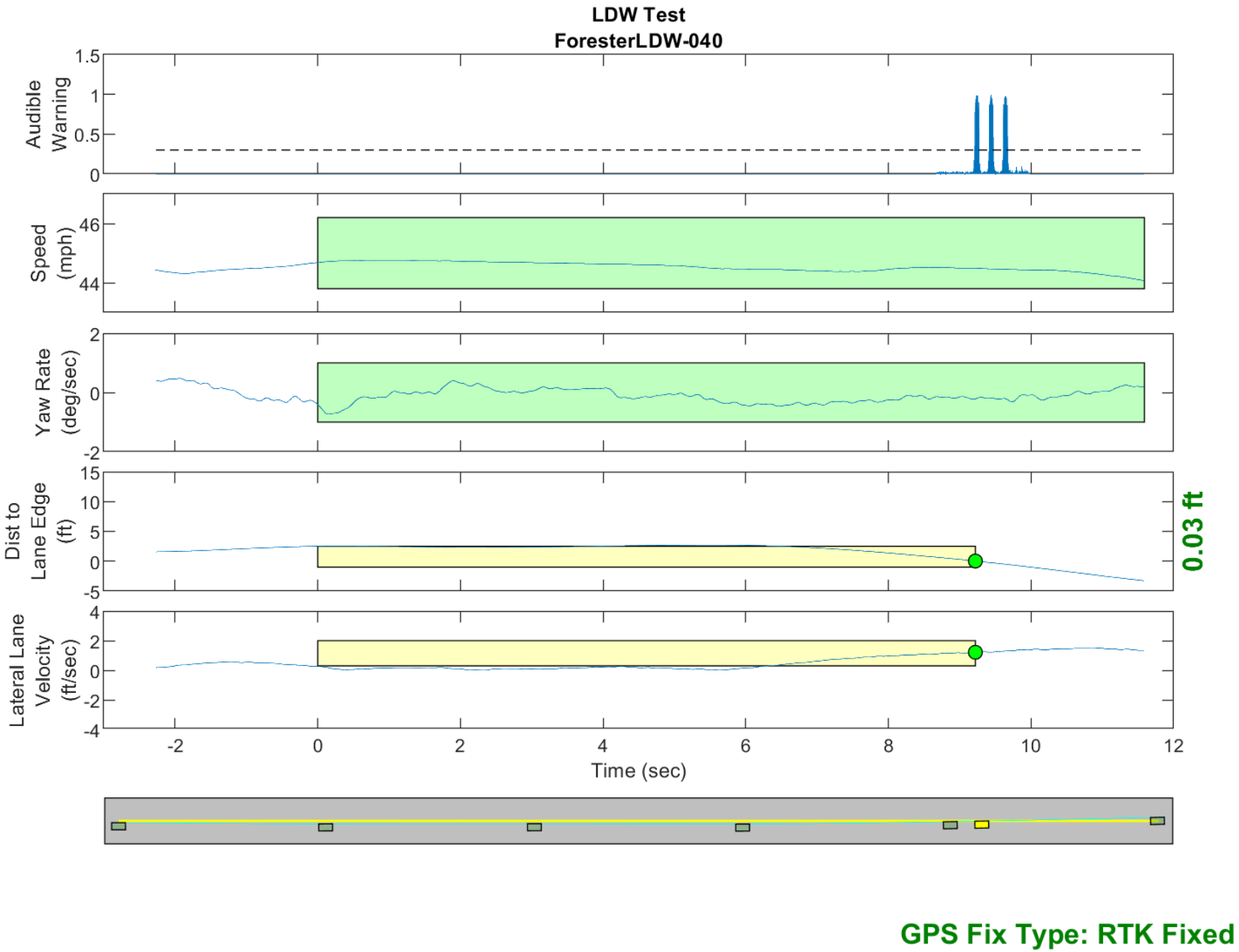


Figure D62. Time History for Run 40, Botts Dots, Left Departure, Auditory Warning

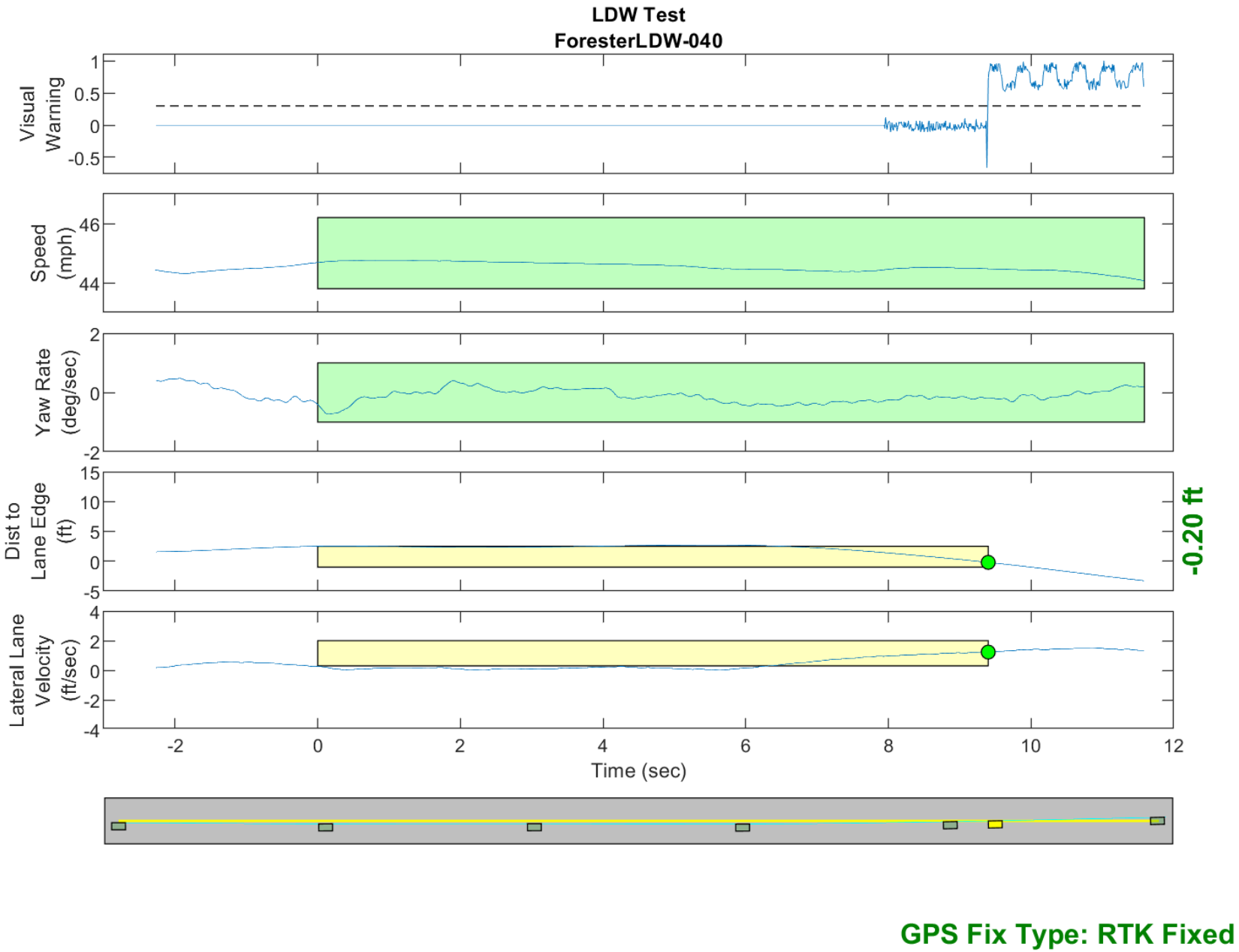


Figure D63. Time History for Run 40, Botts Dots, Left Departure, Visual Warning

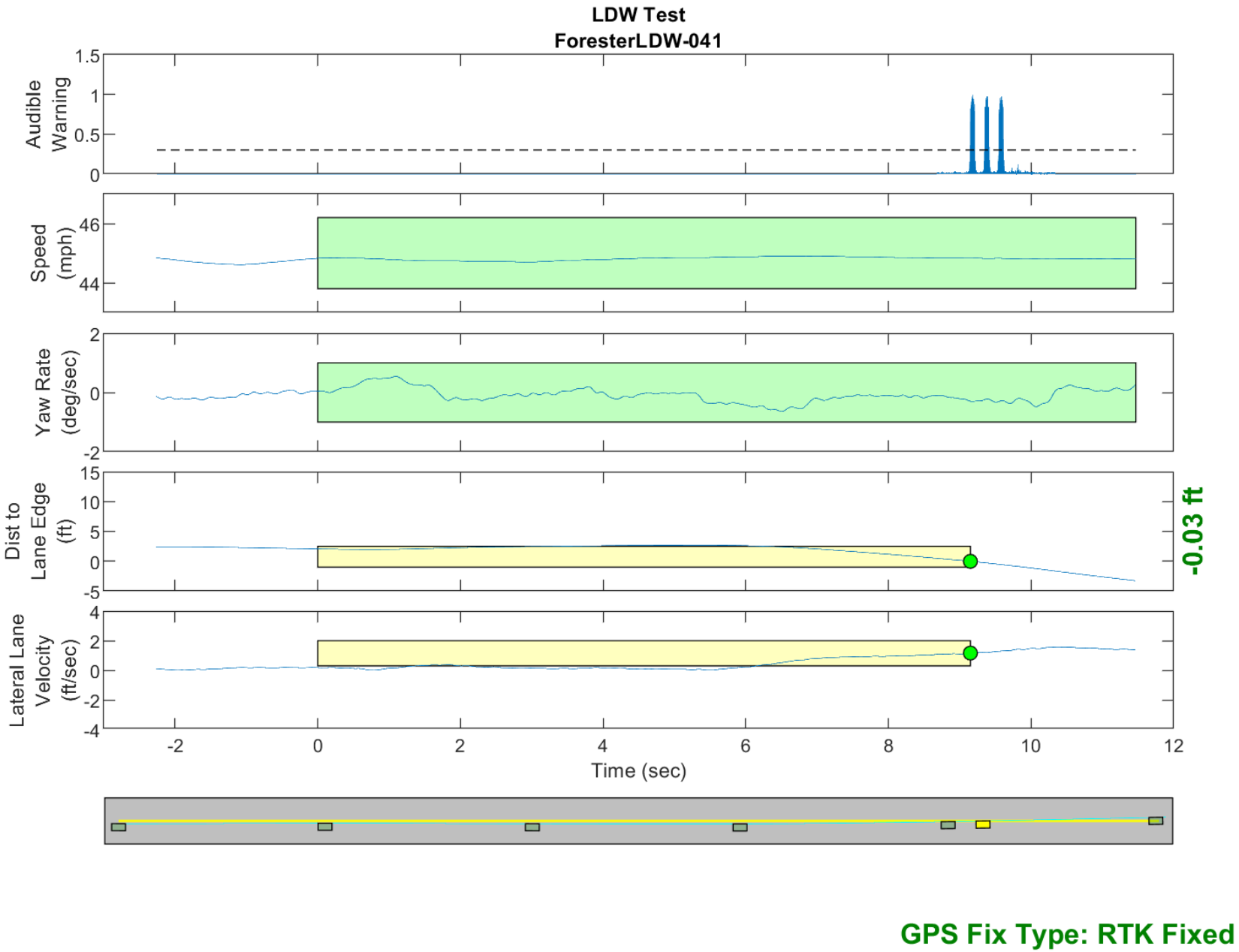


Figure D64. Time History for Run 41, Botts Dots, Left Departure, Auditory Warning

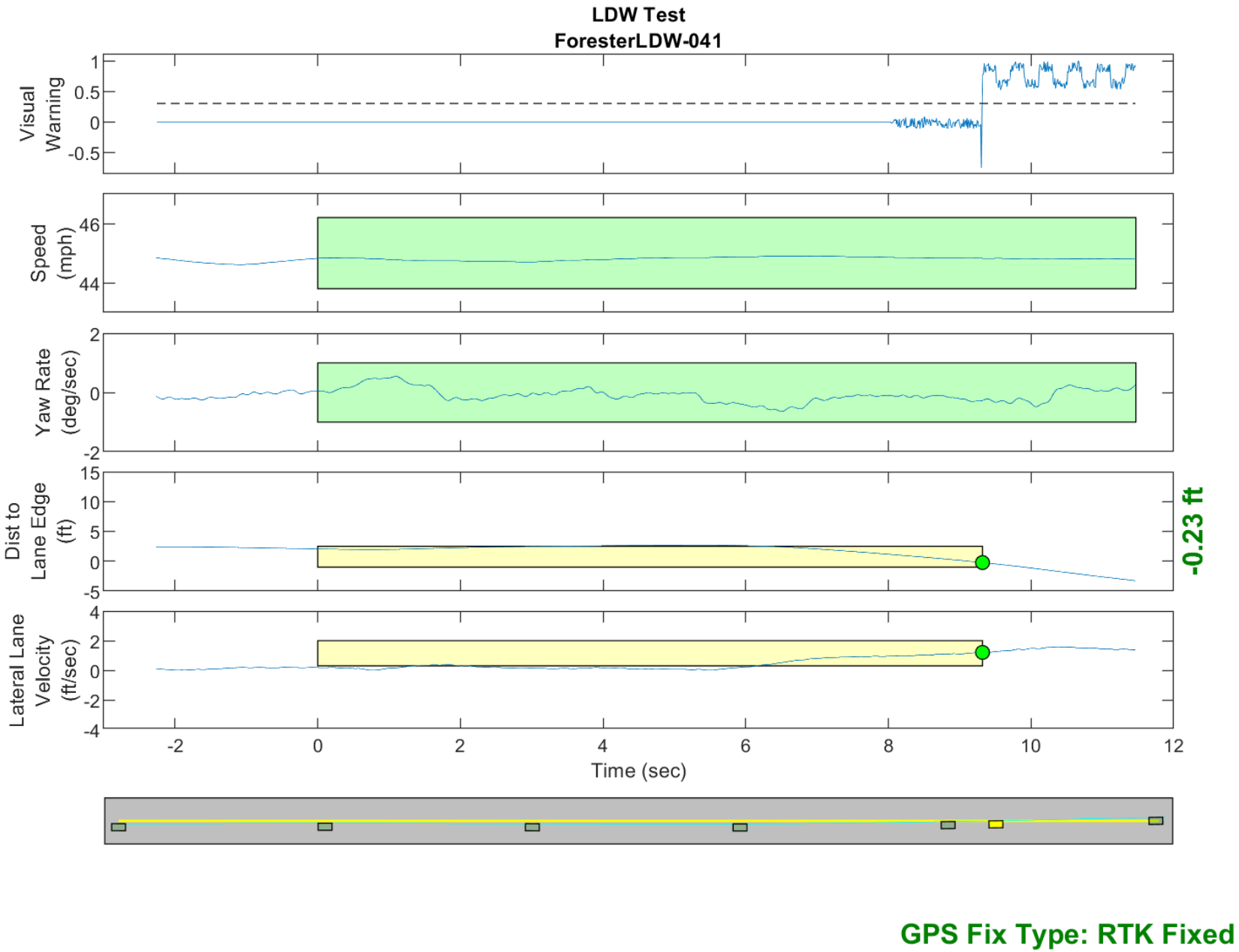


Figure D65. Time History for Run 41, Botts Dots, Left Departure, Visual Warning

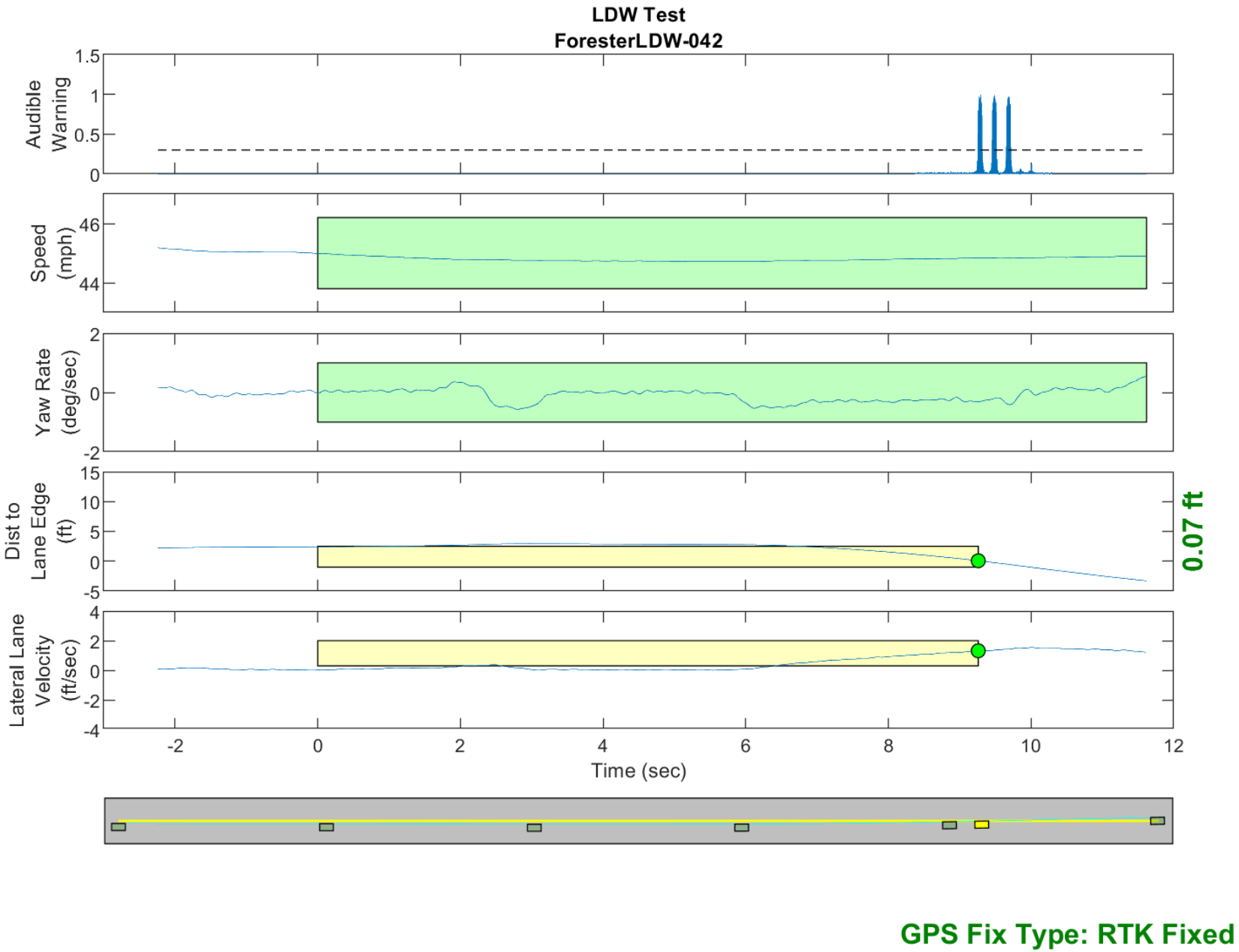


Figure D66. Time History for Run 42, Botts Dots, Left Departure, Auditory Warning

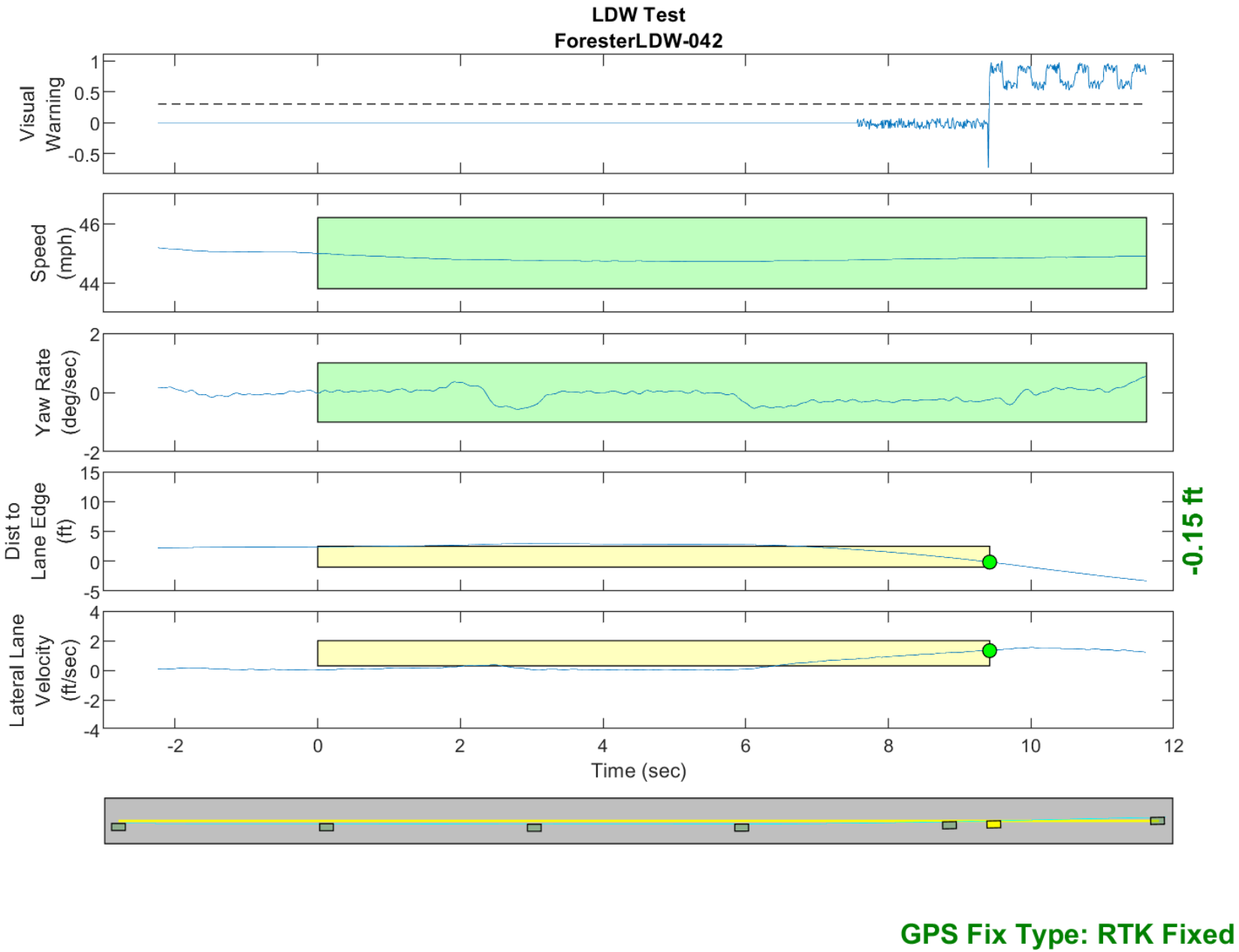


Figure D67. Time History for Run 42, Botts Dots, Left Departure, Visual Warning

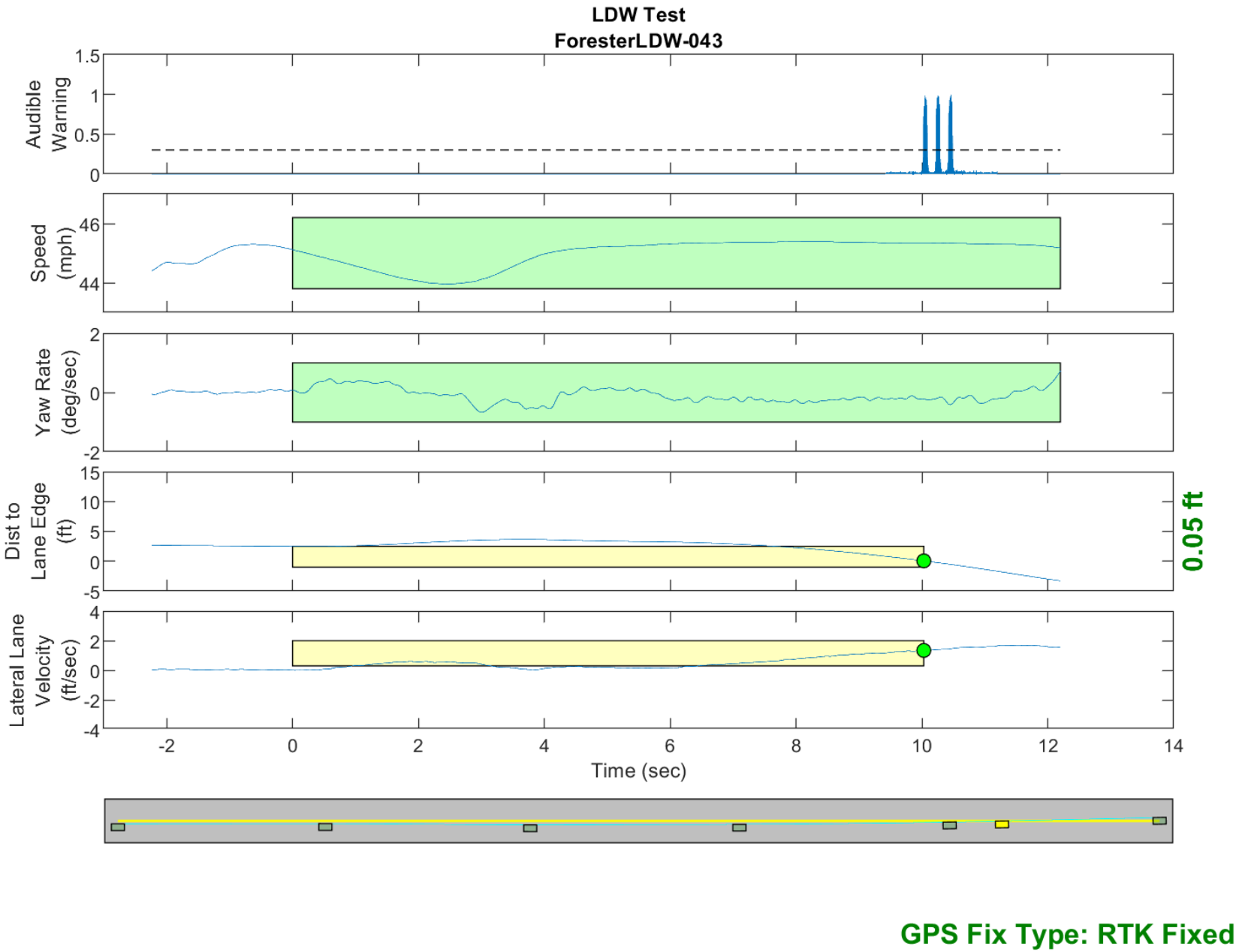


Figure D68. Time History for Run 43, Botts Dots, Left Departure, Auditory Warning

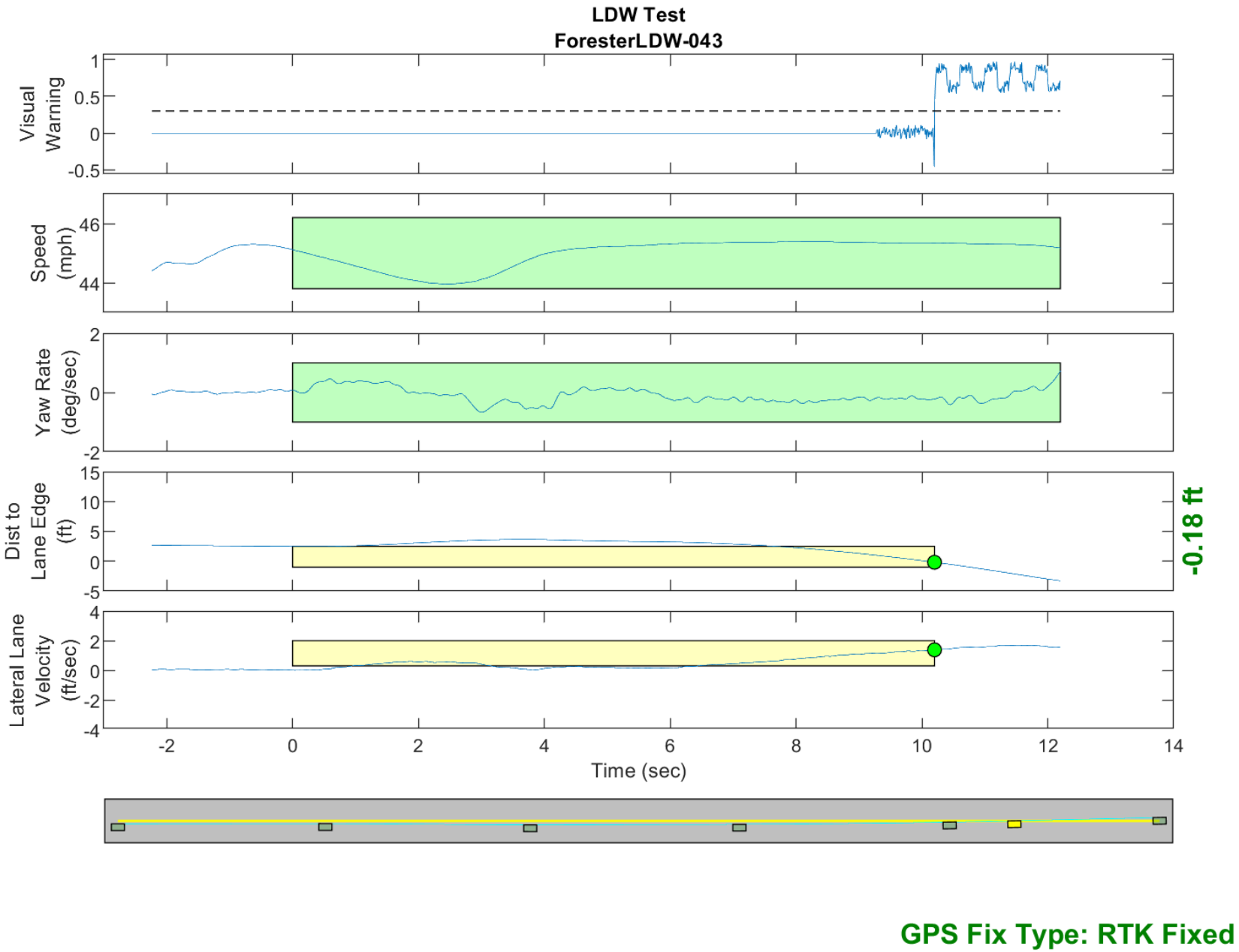


Figure D69. Time History for Run 43, Botts Dots, Left Departure, Visual Warning

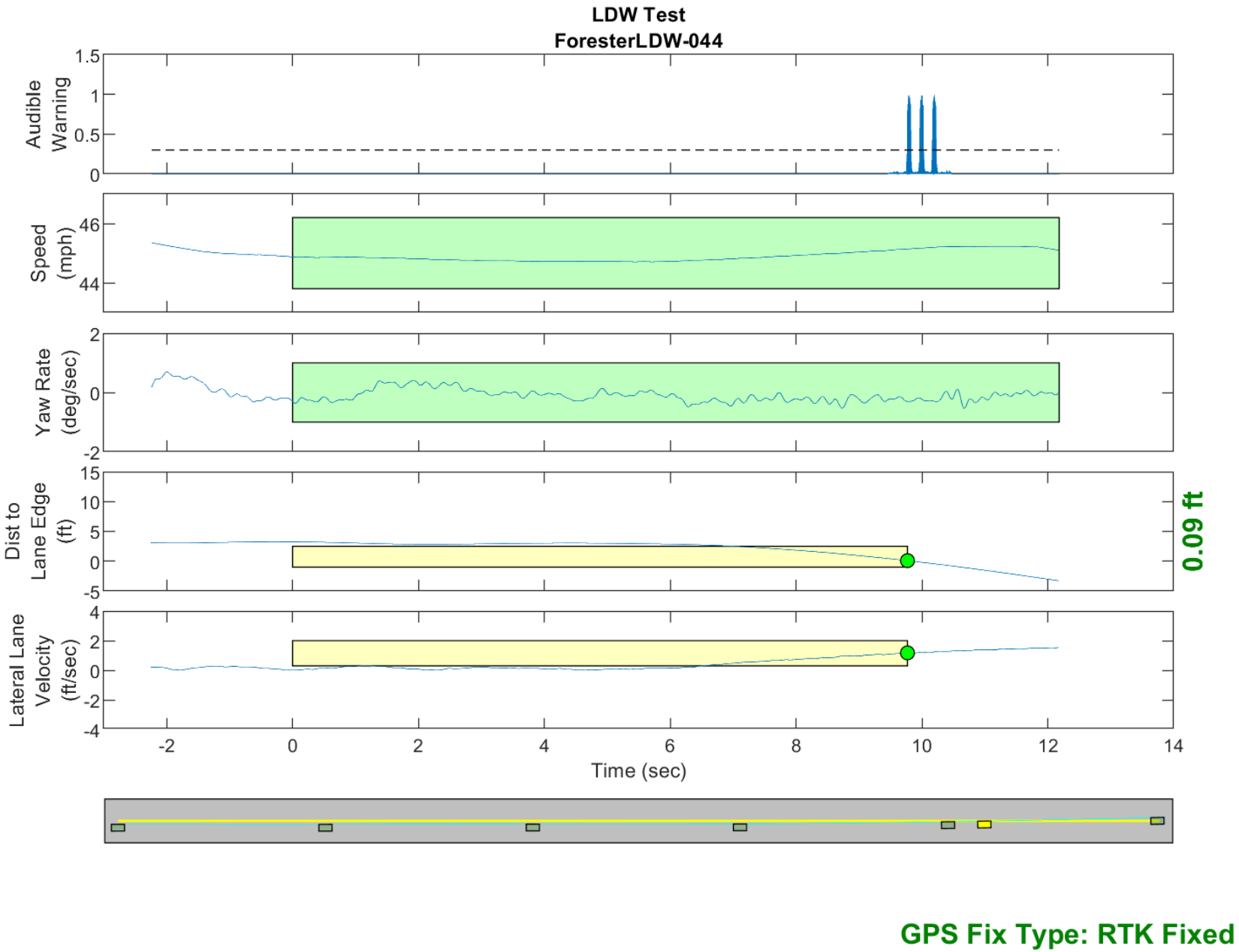


Figure D70. Time History for Run 44, Botts Dots, Left Departure, Auditory Warning

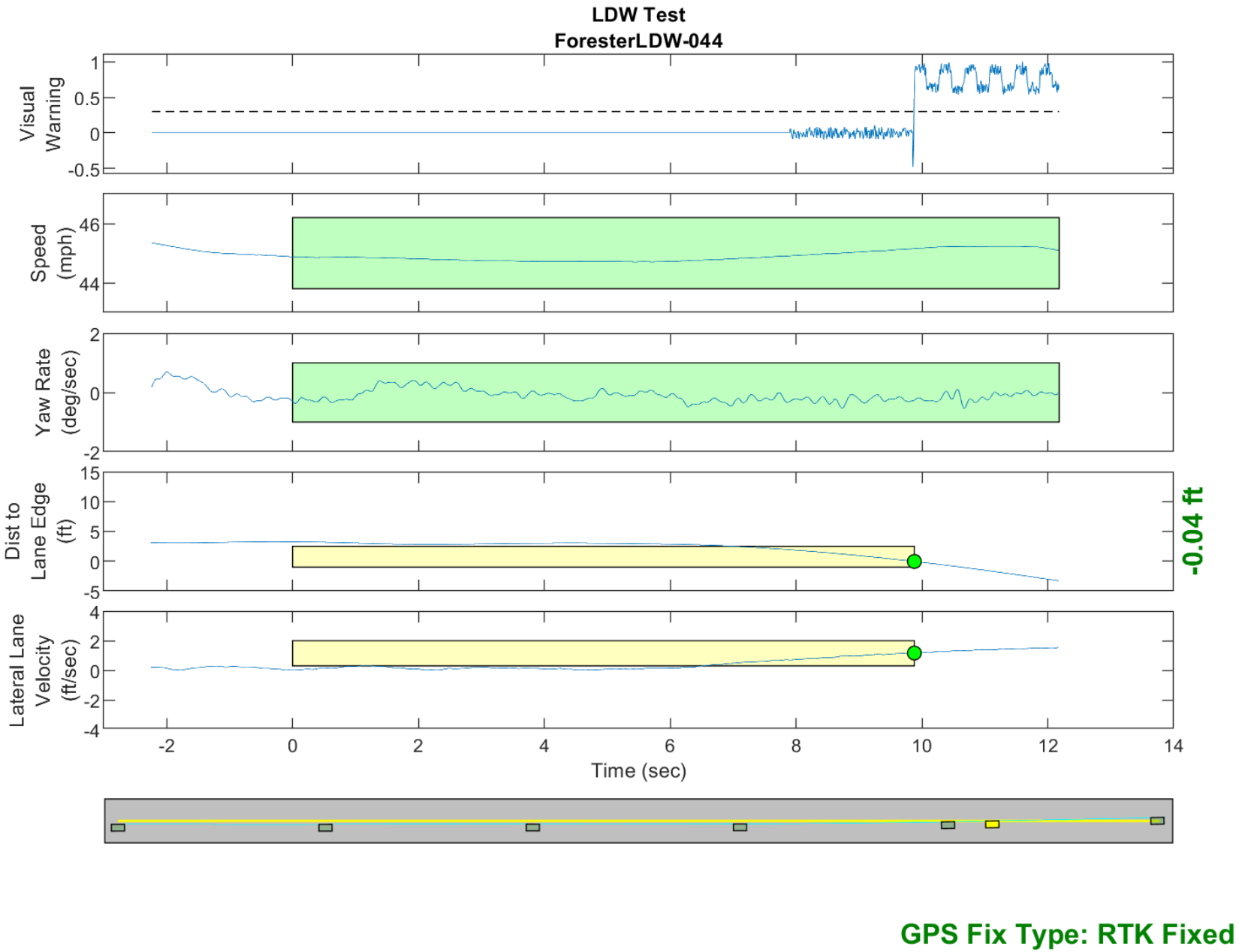


Figure D71. Time History for Run 44, Botts Dots, Left Departure, Visual Warning

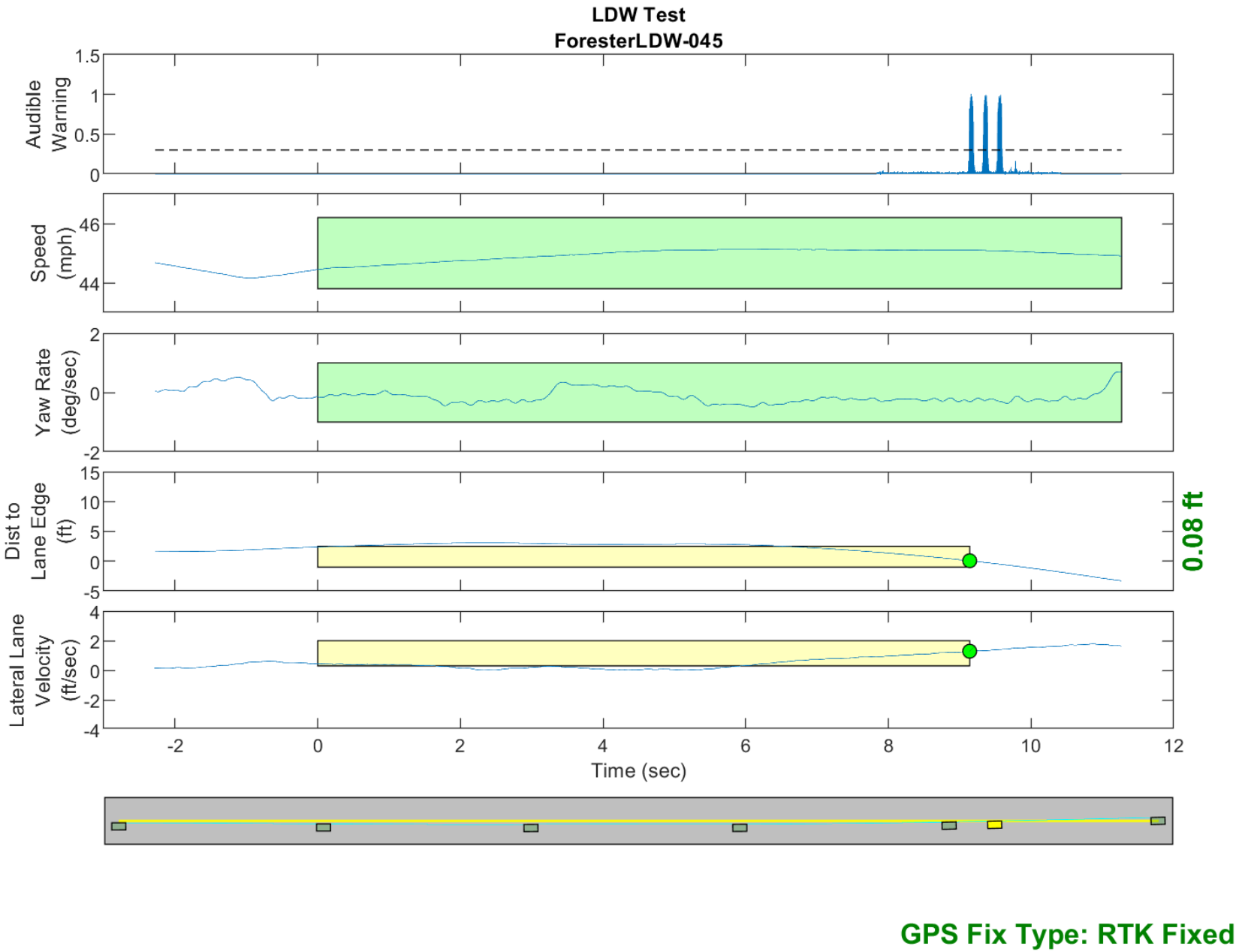


Figure D72. Time History for Run 45, Botts Dots, Left Departure, Auditory Warning

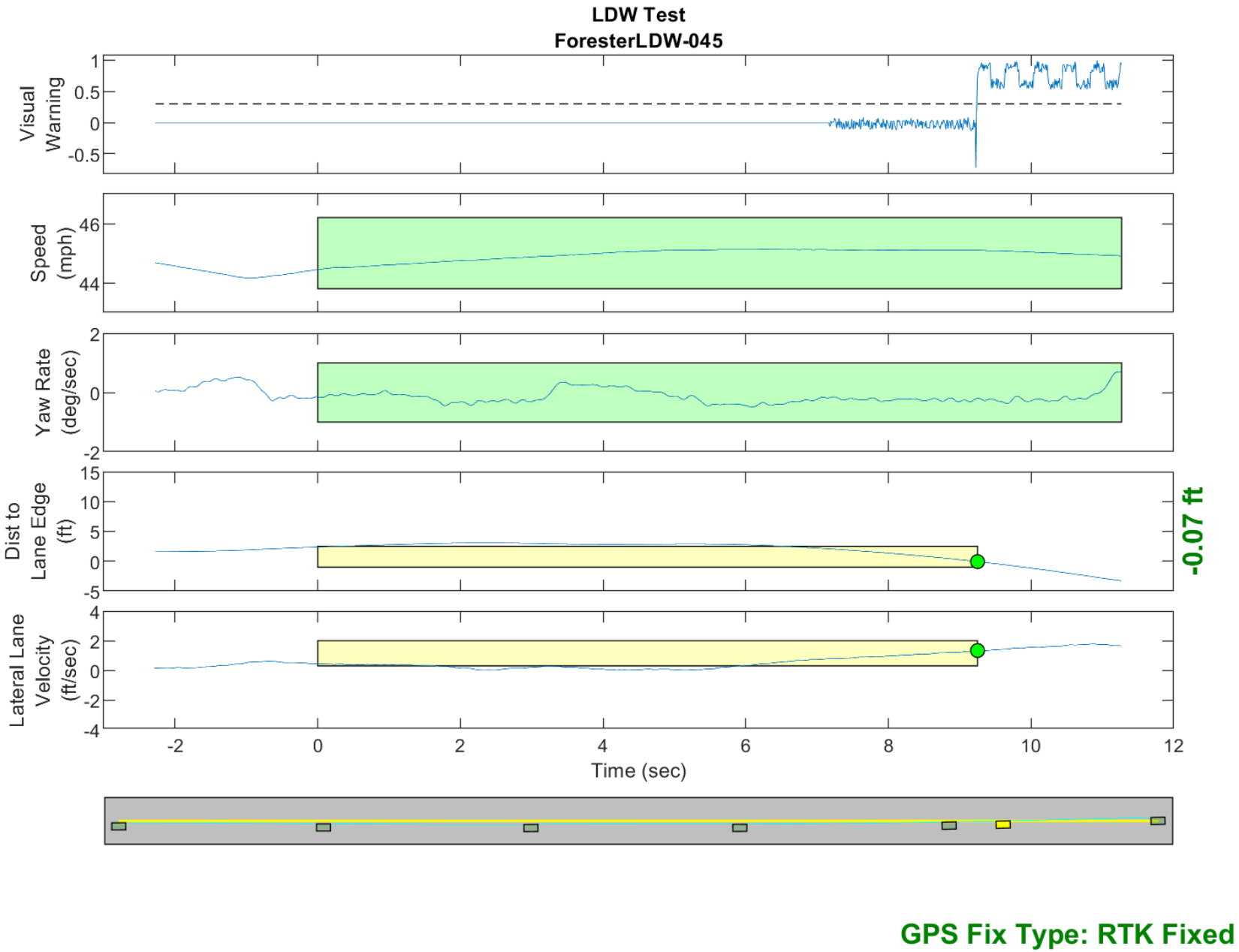


Figure D73. Time History for Run 45, Botts Dots, Left Departure, Visual Warning

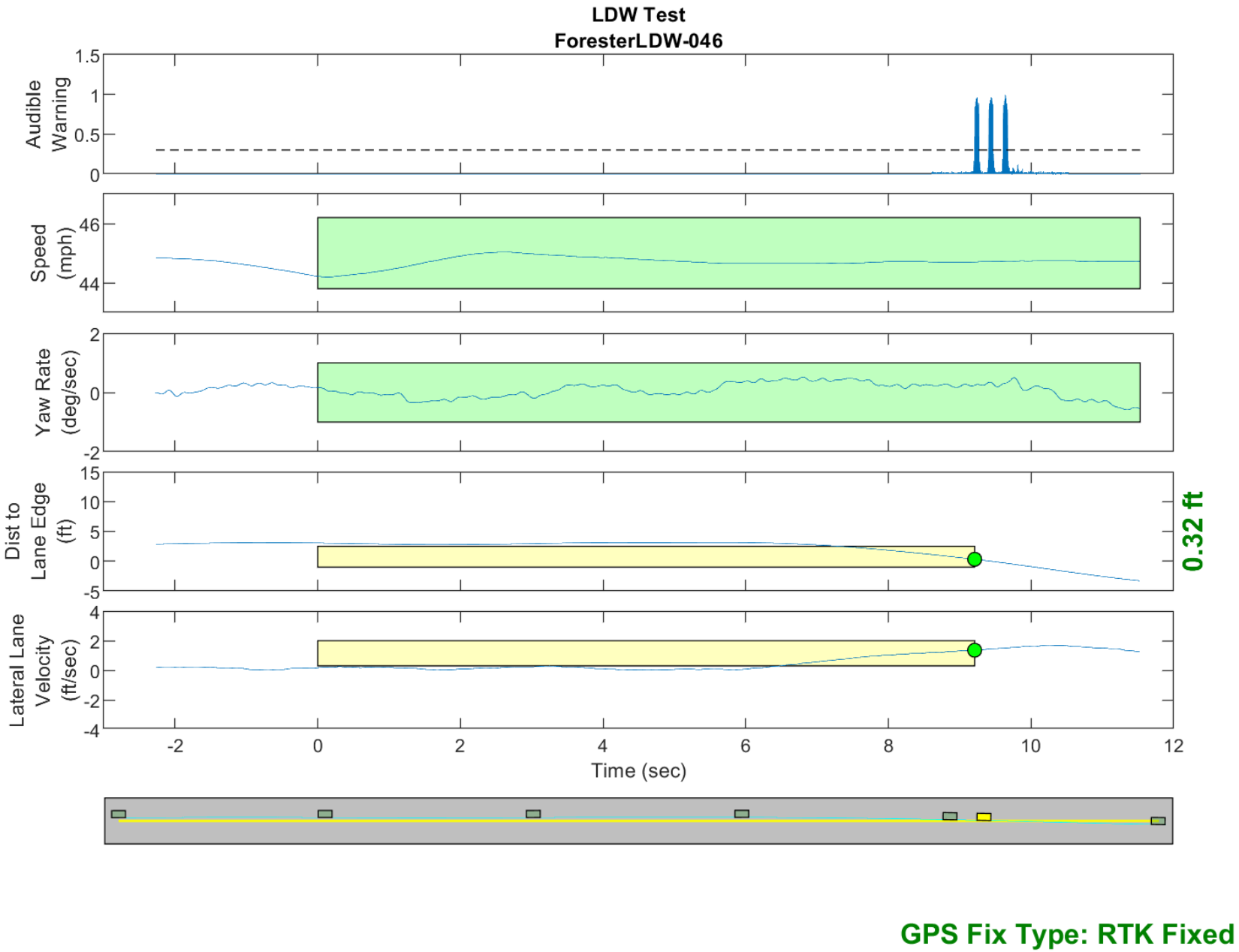


Figure D74. Time History for Run 46, Botts Dots, Right Departure, Auditory Warning

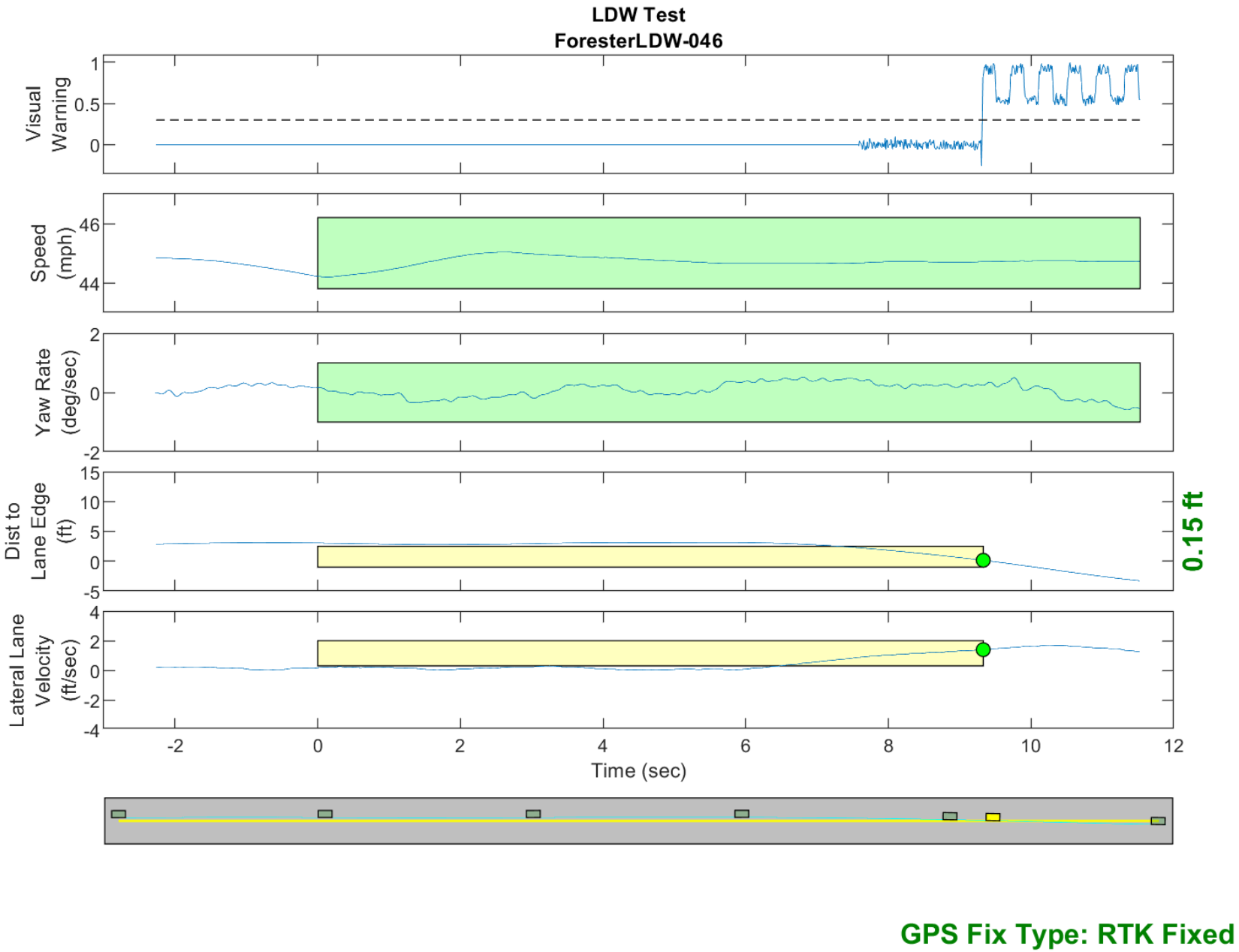


Figure D75. Time History for Run 46, Botts Dots, Right Departure, Visual Warning

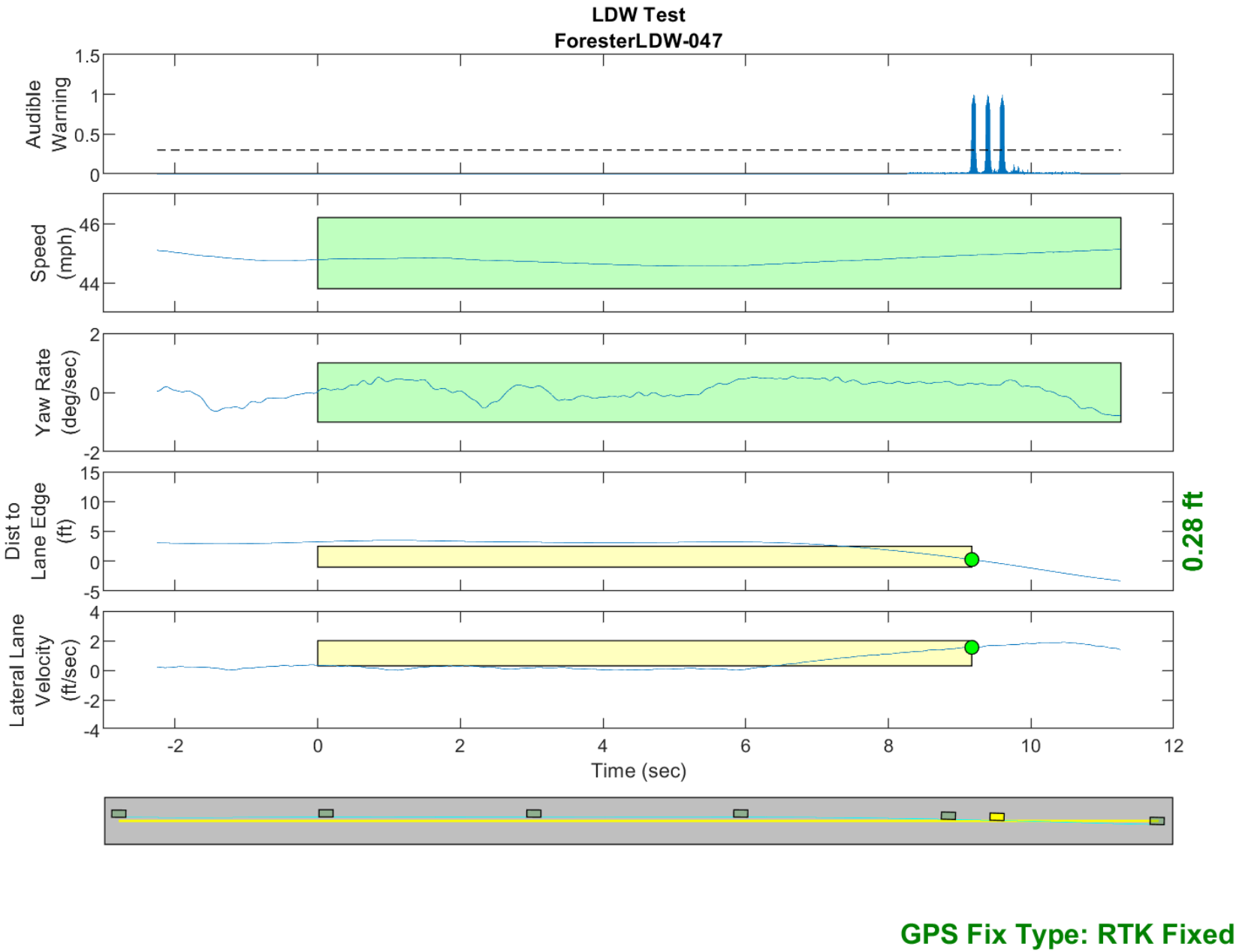


Figure D76. Time History for Run 47, Botts Dots, Right Departure, Auditory Warning

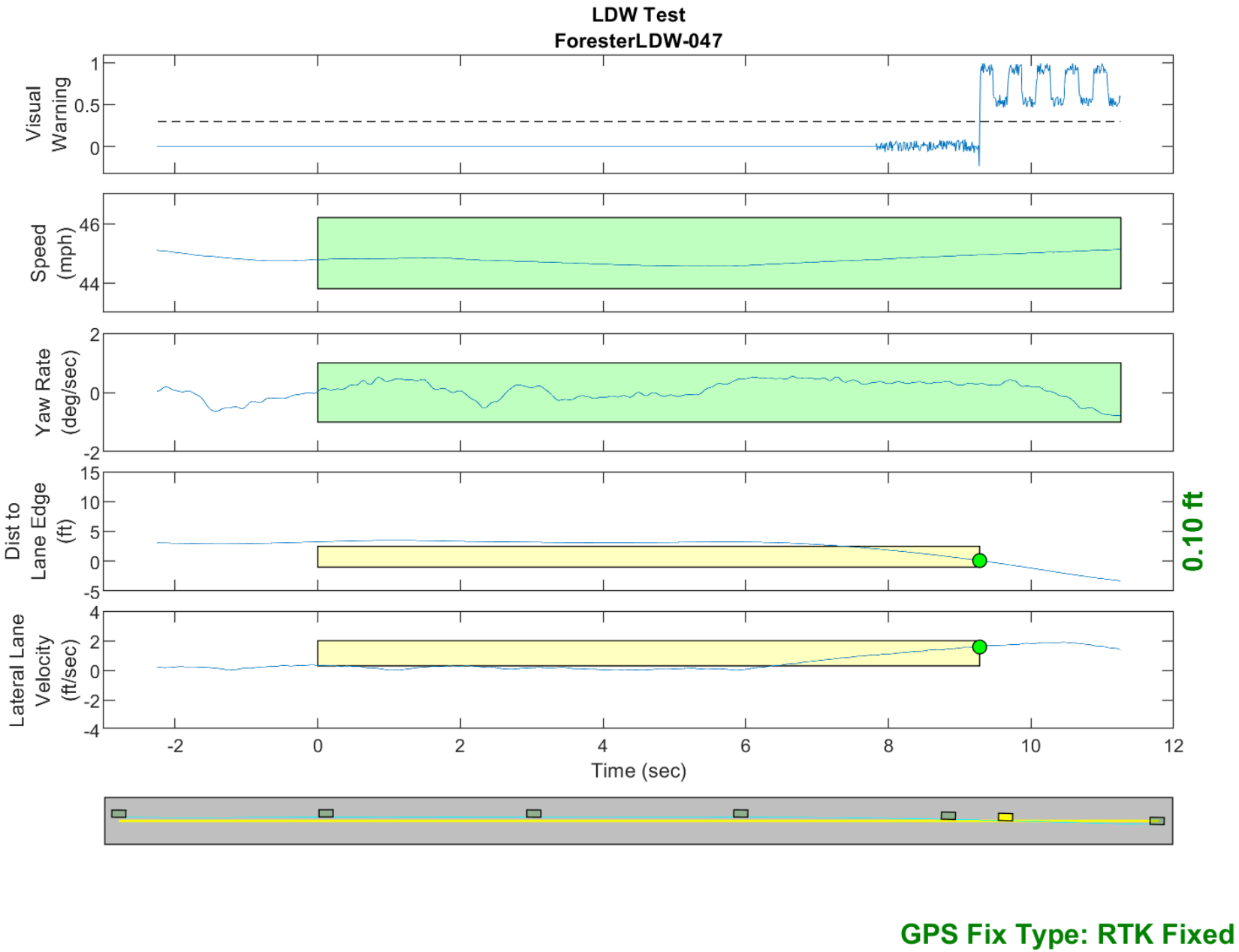


Figure D77. Time History for Run 47, Botts Dots, Right Departure, Visual Warning

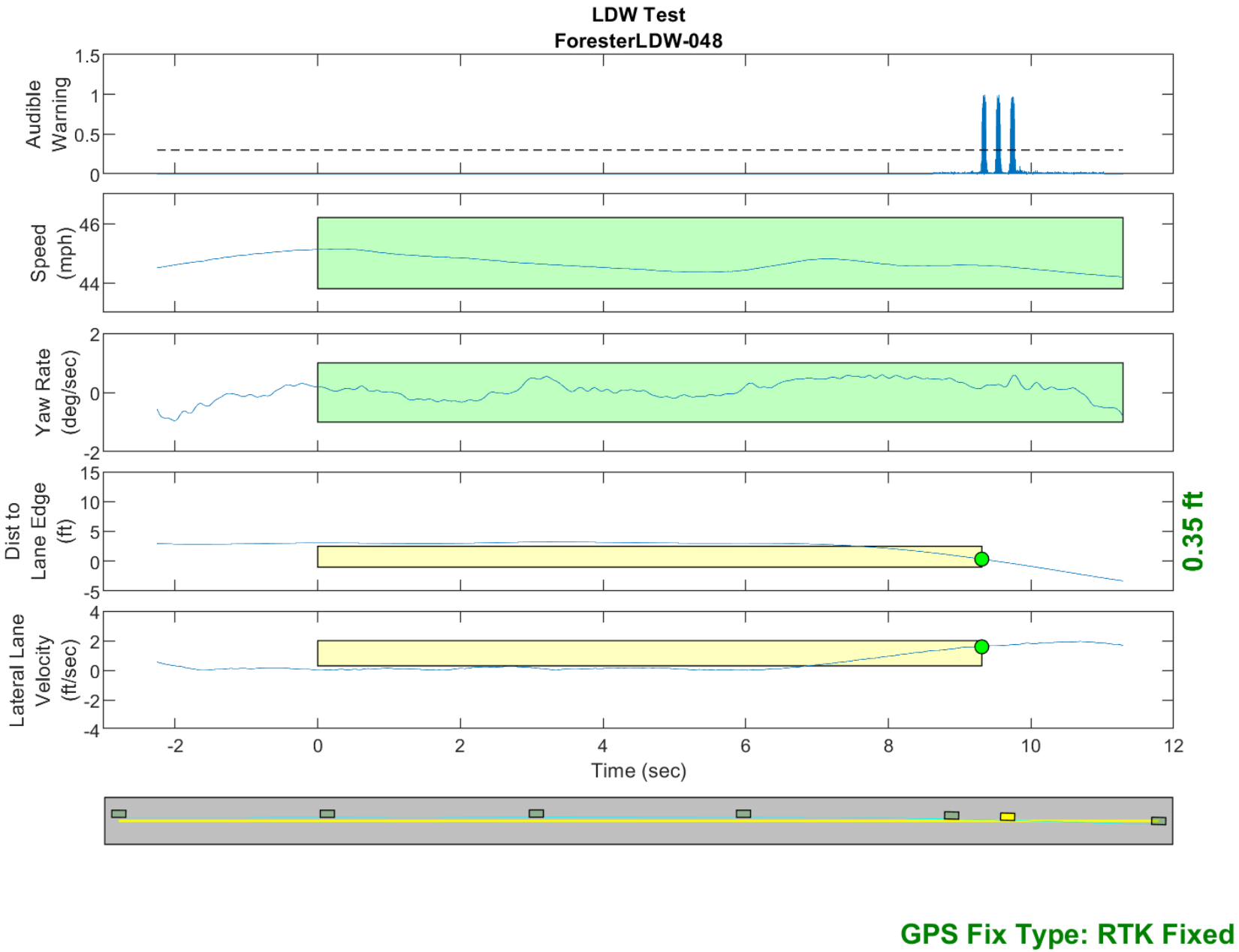


Figure D78. Time History for Run 48, Botts Dots, Right Departure, Auditory Warning

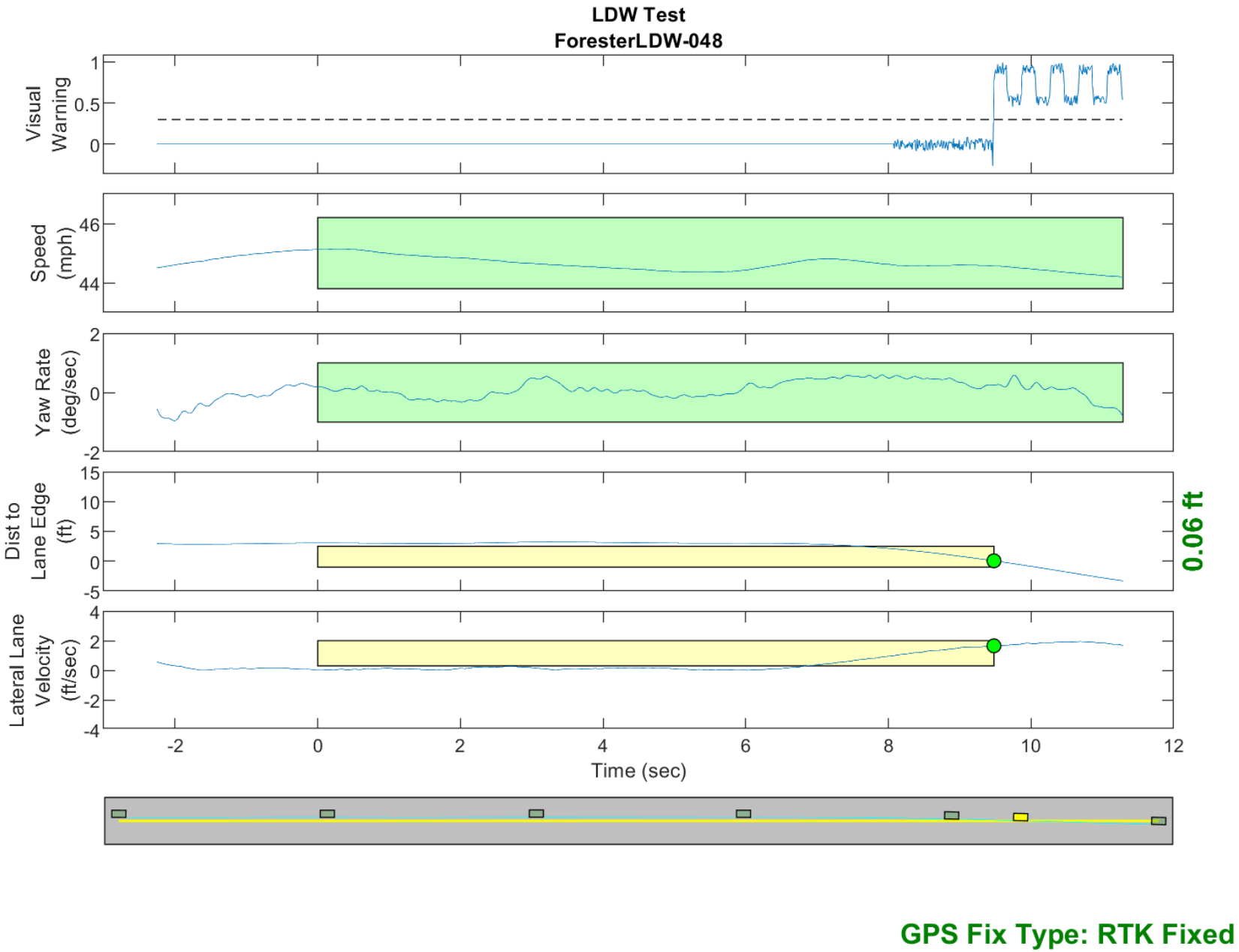


Figure D79. Time History for Run 48, Botts Dots, Right Departure, Visual Warning

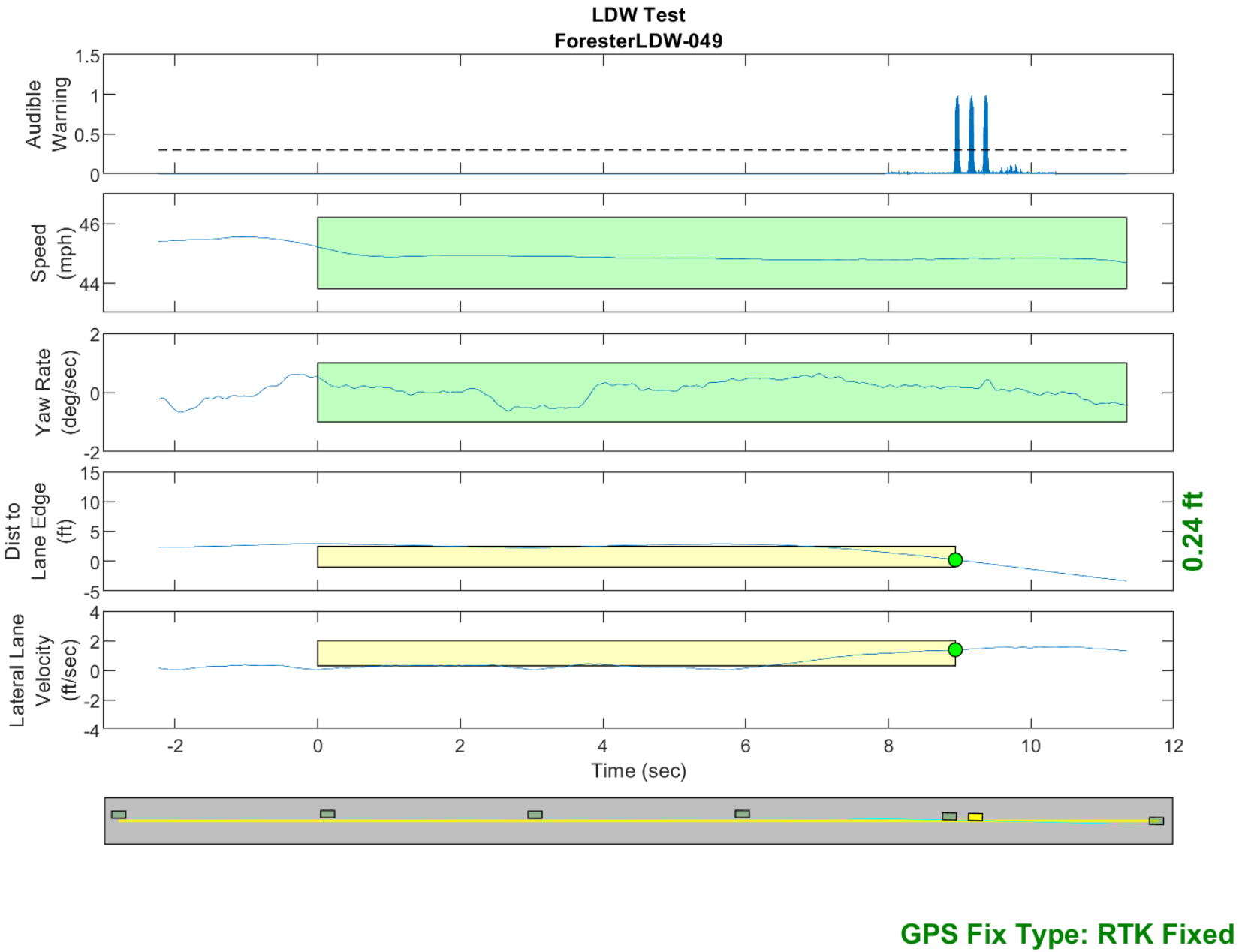


Figure D80. Time History for Run 49, Botts Dots, Right Departure, Auditory Warning

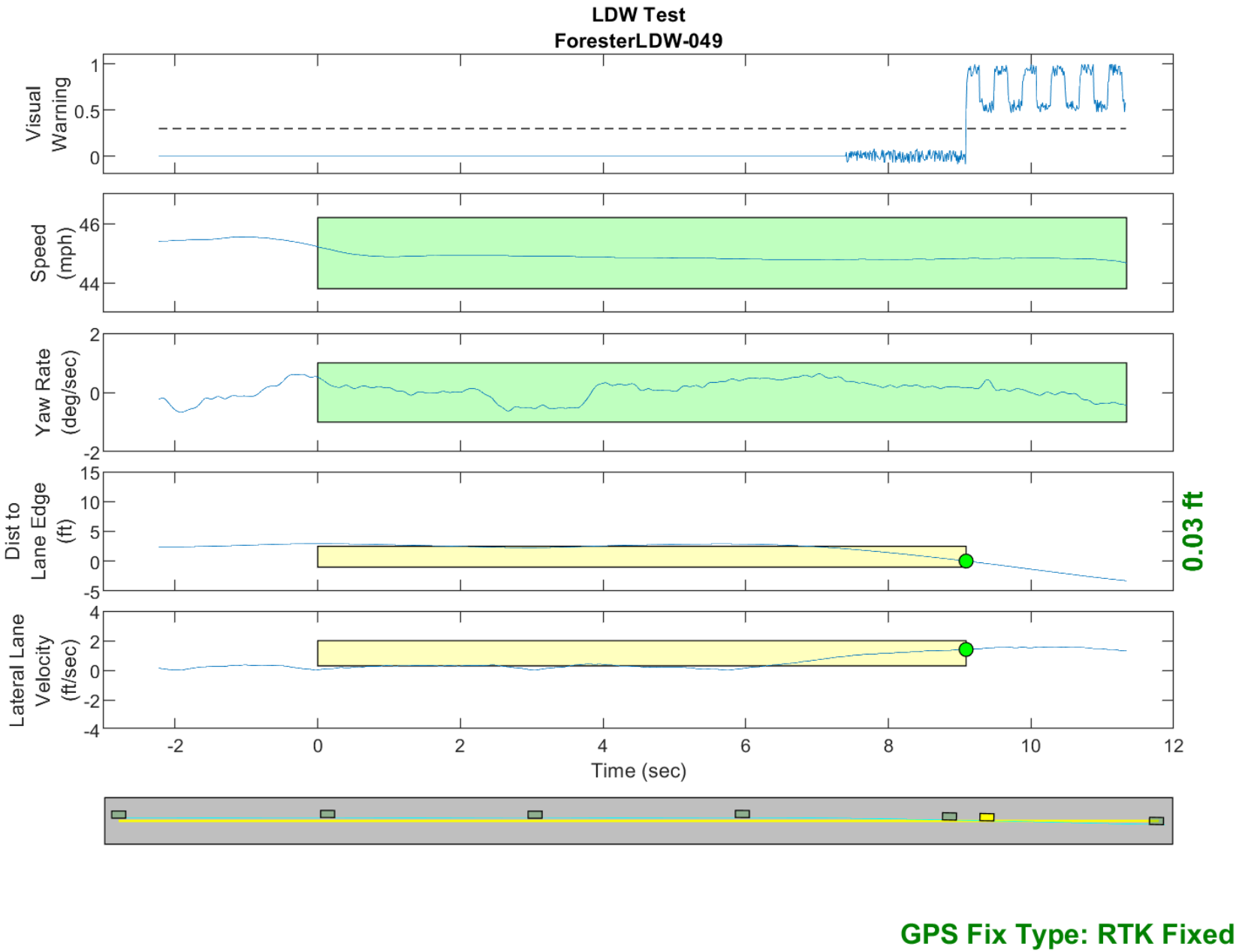


Figure D81. Time History for Run 49, Botts Dots, Right Departure, Visual Warning

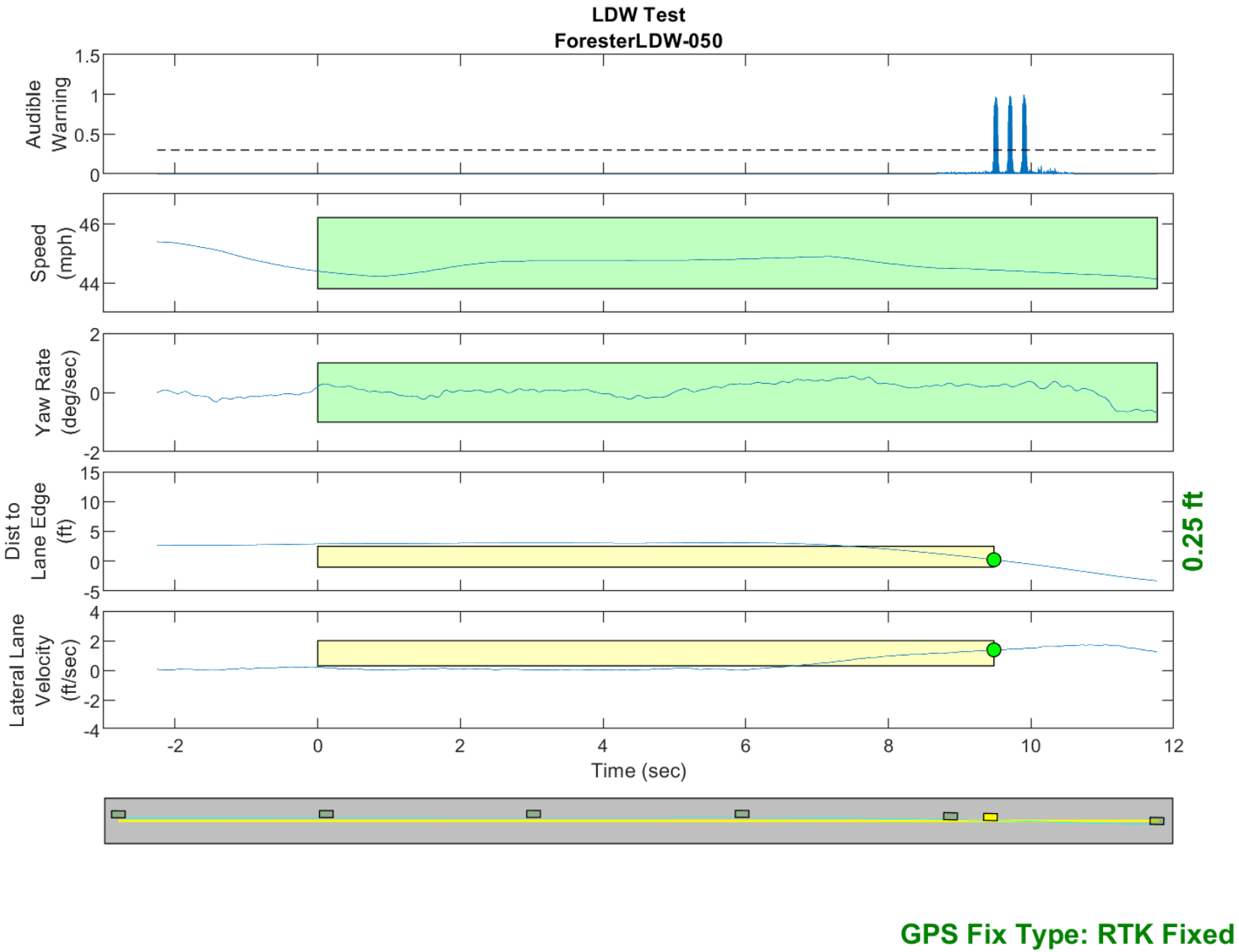


Figure D82. Time History for Run 50, Botts Dots, Right Departure, Auditory Warning

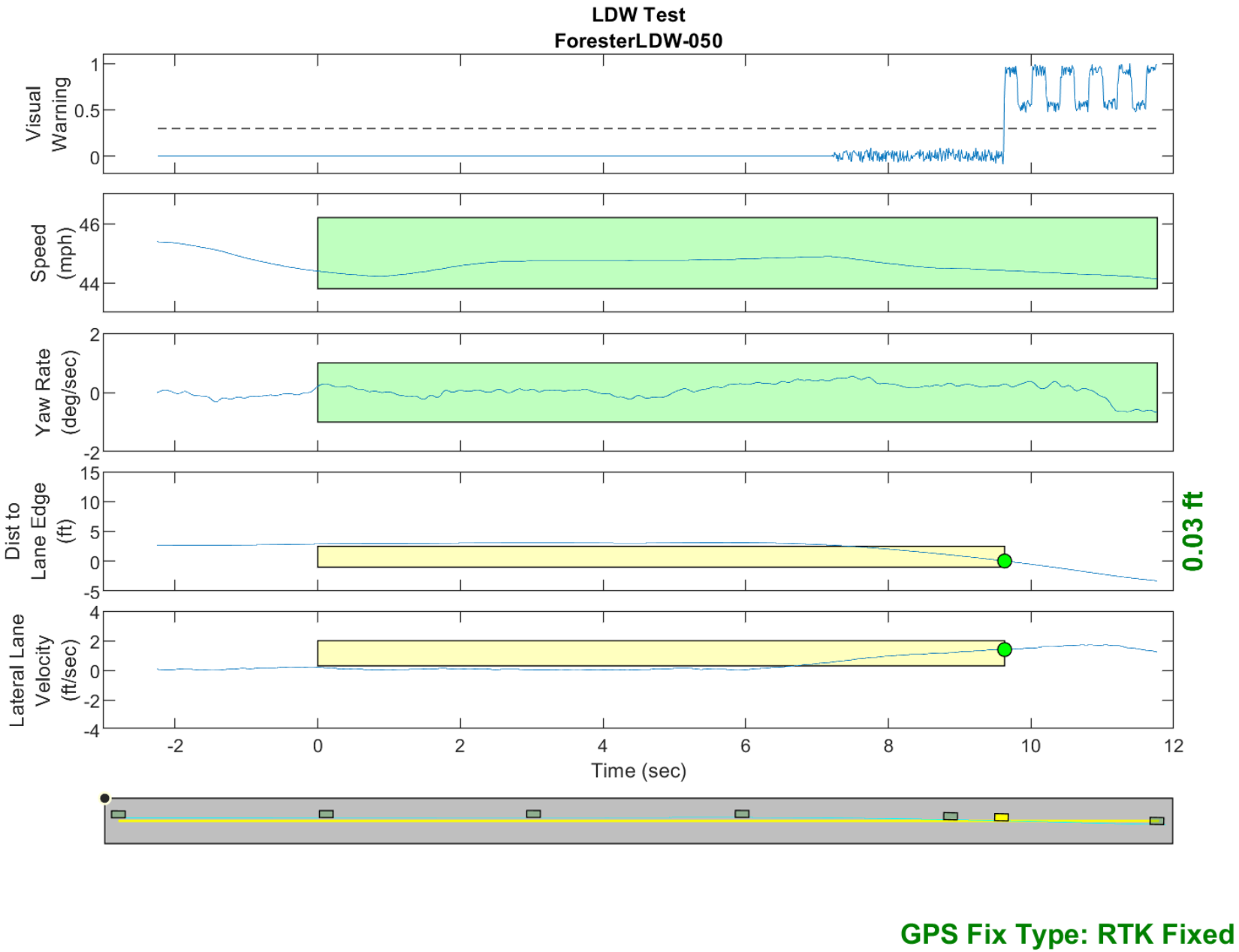


Figure D83. Time History for Run 50, Botts Dots, Right Departure, Visual Warning

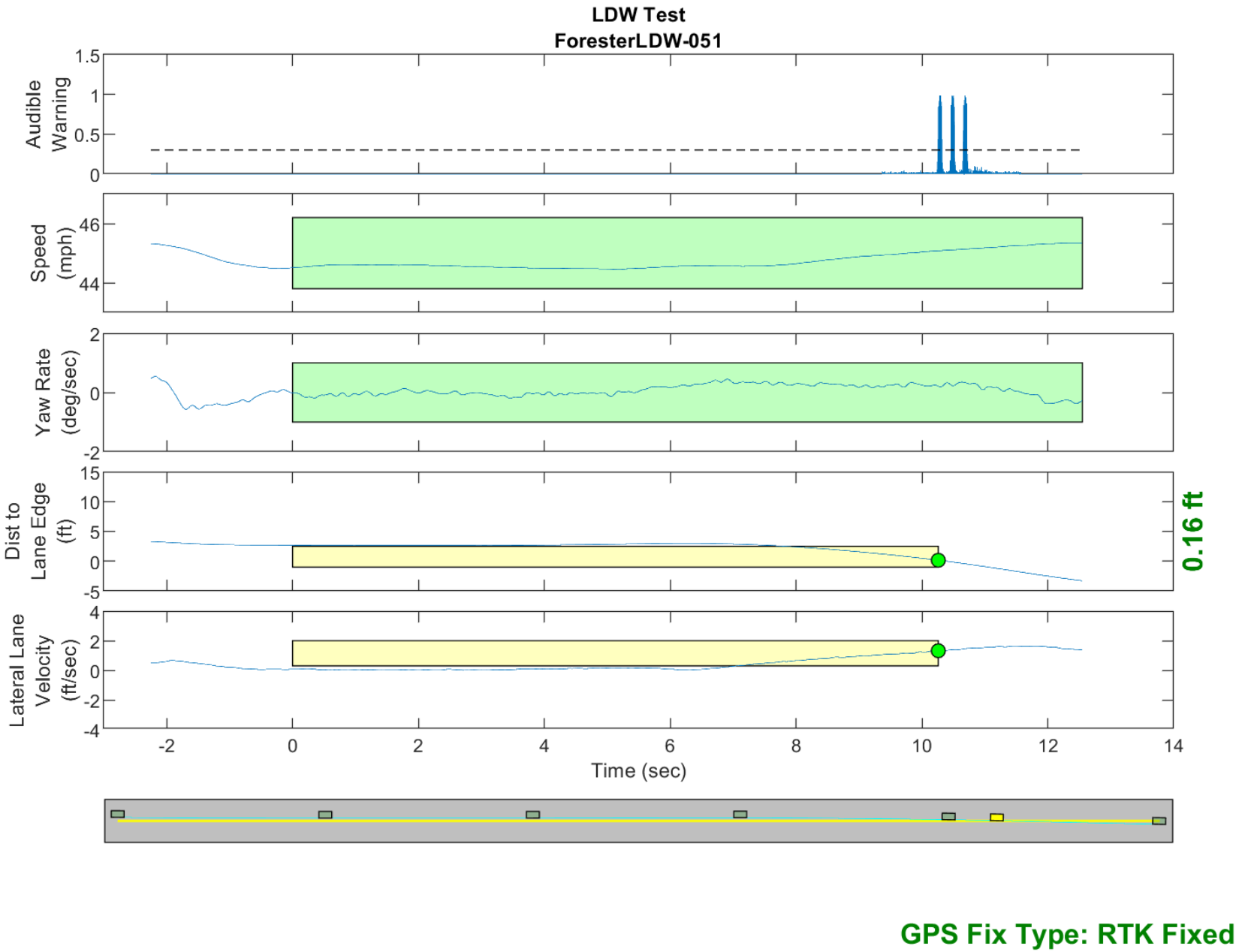


Figure D84. Time History for Run 51, Botts Dots, Right Departure, Auditory Warning

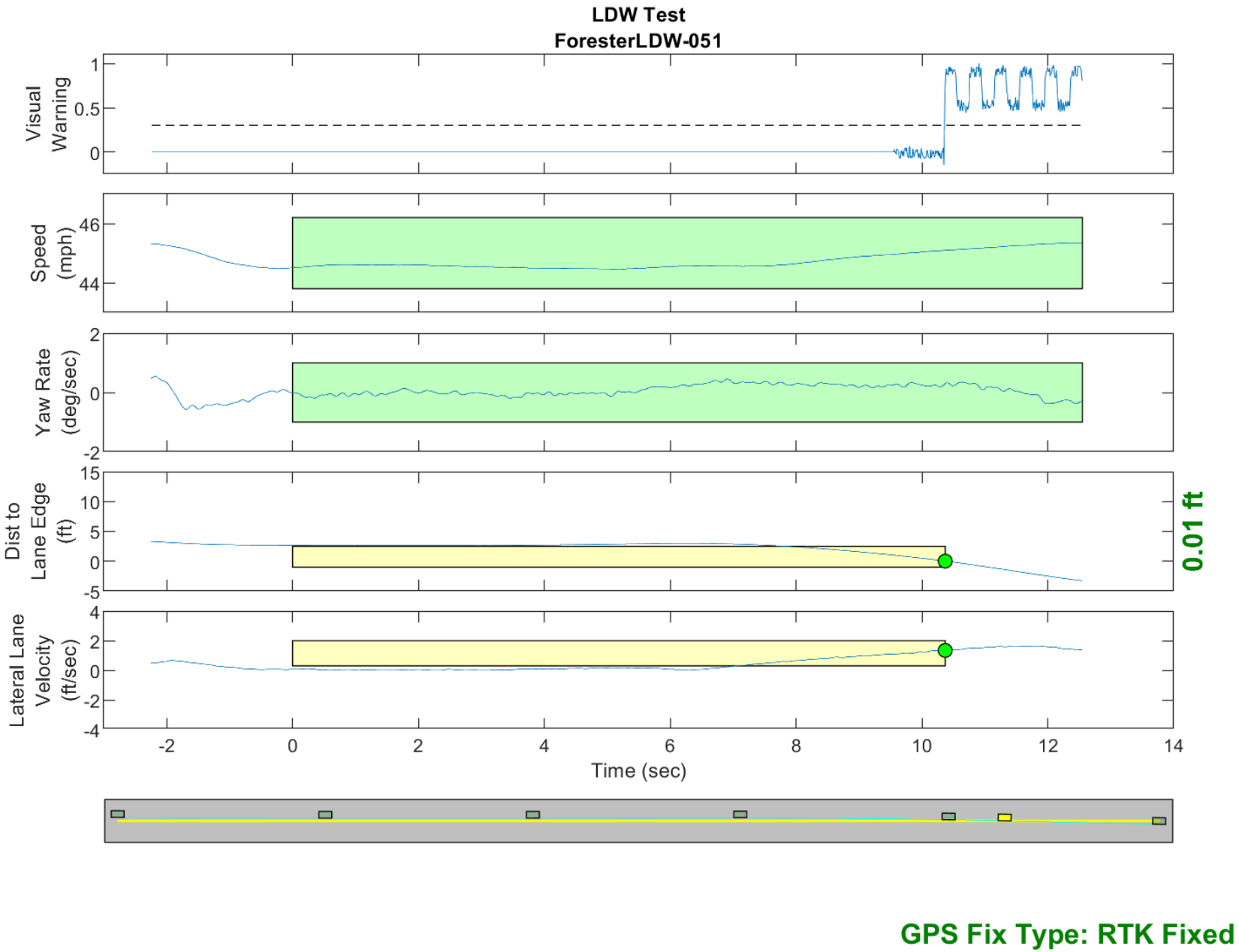


Figure D85. Time History for Run 51, Botts Dots, Right Departure, Visual Warning

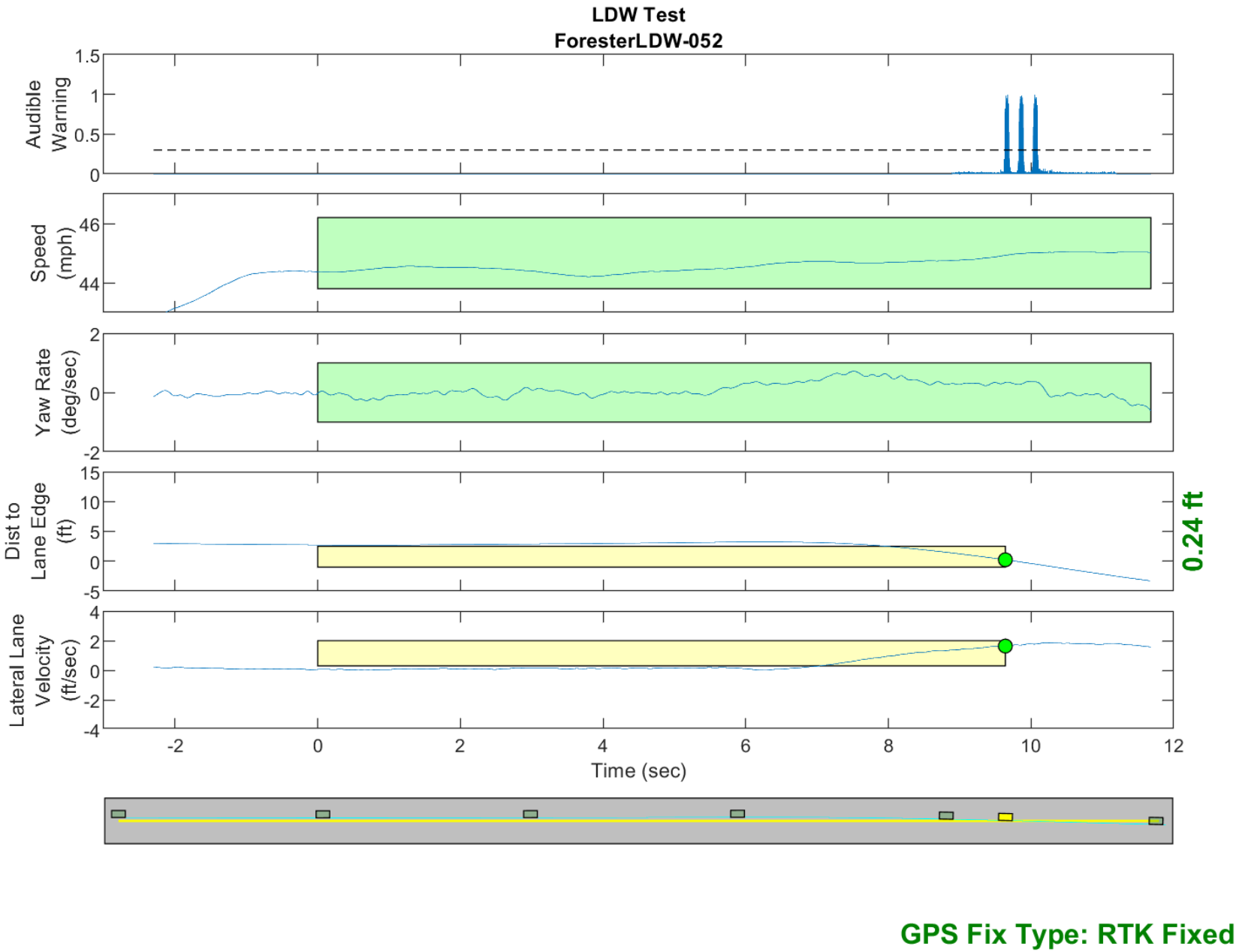


Figure D86. Time History for Run 52, Botts Dots, Right Departure, Auditory Warning

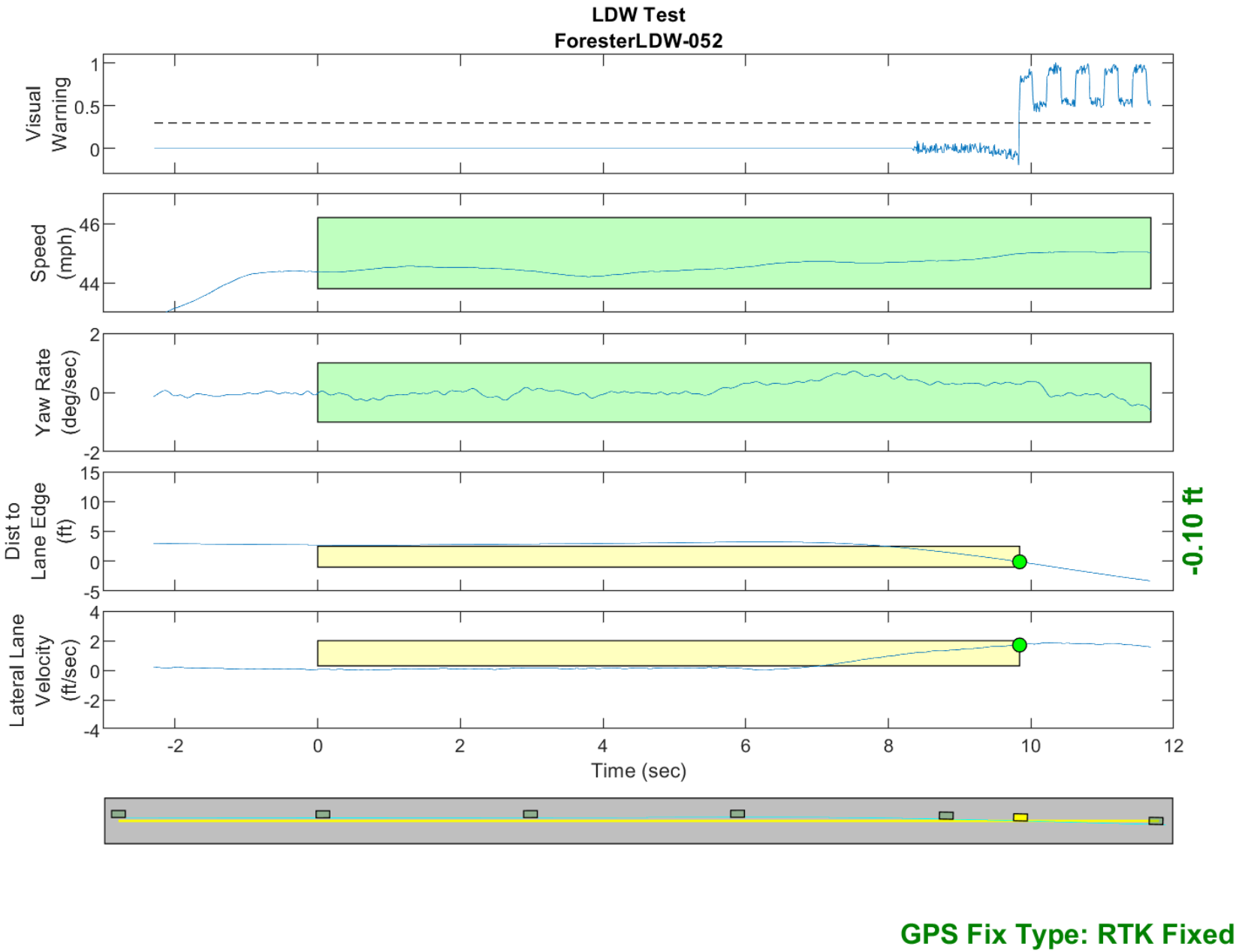


Figure D87. Time History for Run 52, Botts Dots, Right Departure, Visual Warning