OCAS-DRI-LDW-19-04
NEW CAR ASSESSMENT PROGRAM
LANE DEPARTURE WARNING CONFIRMATION TEST

2019 Nissan Rogue

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Final Report

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16. Abstract These tests were conducted on the subject 2019 Nissan Rogue in accordance with the specifications of the Office of Crash Avoidance Standards 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 2019 Nissan Rogue. The LDW system for this vehicle provides both visual and audible alerts. 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 SUMMARY

(Page 1 of 1)

2019 Nissan Rogue

VIN: *5N1AT2MT6KC7xxxx*

Test Date: *5/8/2019*

Lane Departure Warning setting: *Nominal*

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*

LANE DEPARTURE WARNING

DATA SHEET 2: GENERAL TEST AND VEHICLE PARAMETER DATA

(Page 1 of 2)

2019 Nissan Rogue

TEST VEHICLE INFORMATION

VIN: *5N1AT2MT6KC7xxxx*

Body Style: *SUV* Color: *Pearl White Tricoat*

Date Received: *4/19/2019* Odometer Reading: *30 mi*

Engine: *2.5 L Inline 4*

Transmission: *CVT*

Final Drive: *FWD*

Is the vehicle equipped with:

ABS	X	Yes		No
Adaptive Cruise Control	X	Yes		No
Collision Mitigating Brake System	X	Yes		No

DATA FROM VEHICLE'S CERTIFICATON LABEL

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

Date of manufacture: *02/19*

DATA FROM TIRE PLACARD:

Tires size as stated on Tire Placard: Front: *225/55R19*

Rear: *225/55R19*

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

Rear: *230 kPa (33 psi)*

LANE DEPARTURE WARNING

DATA SHEET 2: GENERAL TEST AND VEHICLE PARAMETER DATA

(Page 2 of 2)

2019 Nissan Rogue

TIRES

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

Front tire size: *225/55R19*

Rear tire size: *225/55R19*

VEHICLE ACCEPTANCE

Verify the following before accepting the vehicle:

X All options listed on the "window sticker" are present on the test vehicle.

X Tires and wheel rims are the same as listed.

X There are no dents or other interior or exterior flaws.

X The vehicle has been properly prepared and is in running condition.

X Verify that spare tire, jack, lug wrench, and tool kit (if applicable) is located in the vehicle cargo area.

LANE DEPARTURE WARNING

DATA SHEET 3: TEST CONDITIONS

(Page 1 of 2)

2019 Nissan Rogue

GENERAL INFORMATION

Test date: *5/8/2019*

AMBIENT CONDITIONS

Air temperature: *18.3 C (65 F)*

Wind speed: *0.0 m/s (0.0 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: *230 kPa (33 psi)*

LANE DEPARTURE WARNING

DATA SHEET 3: TEST CONDITIONS

(Page 2 of 2)

2019 Nissan Rogue

WEIGHT

Weight of vehicle as tested including driver and instrumentation

Left Front:	*499.0 kg (1100 lb)*	Right Front	*492.6 kg (1086 lb)*
Left Rear	*394.2 kg (869 lb)*	Right Rear	*361.1 kg (796 lb)*
		Total:	*1746.9 kg (3851 lb)*

LANE DEPARTURE WARNING

DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION

2019 Nissan Rogue

How is the Lane Departure Warning presented to the driver? (Check all that apply)

- **X** Warning light
- **X** Buzzer or audible 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, audible, vibration, or combination), etc.

In the center of the instrument panel there is a display of a car with an outline of lane lines on either side. When lane departure occurs, the lane lines flash solid yellow in conjunction with a high pitched audible beep that has a frequency of approximately 900 Hz. There is also a small lane departure tell-tale above and to the right of the main display showing a car between two dashed lanes that flashes amber when lane departure occurs.

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.

Buttons on the steering wheel are used to interact with the vehicle setup menus:
- *Settings*
  - *Driving Asistance– OK*
    - *Driving Aids - OK*
      - *Lane - OK*
        - *Warning (LDW) - OK to select or deselect "Warning (LDW)"*

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.

LANE DEPARTURE WARNING

DATA SHEET 4: LANE DEPARTURE WARNING SYSTEM OPERATION

2019 Nissan Rogue

(Page 2 of 3)

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.

The system will not operate at speeds below approximately 37 mph (60 km/h) or if it cannot detect lane markers.
·Excessive noise will interfere with the warning chime sound, and the chime may not be heard.
·Do not use the LDW system under the following conditions as it may not function properly:

- *During bad weather (rain, fog, snow, etc.).*
- *When driving on slippery roads, such as on ice or snow.*
- *When driving on winding or uneven roads.*
- *When there is a lane closure due to road repairs.*
- *When driving in a makeshift or temporary lane.*
- *When driving on roads where the lane width is too narrow.*
- *When driving without normal tire conditions (for example, tire wear, low tire pressure, installation of spare tire, tire chains, nonstandard wheels).*
- *When the vehicle is equipped with non-original brake parts or suspension parts.*
- *When you are towing a trailer or other vehicle.*

The system may not function properly under the following conditions:

- *On roads where there are multiple parallel lane markers; lane markers that are faded or not painted clearly; yellow painted lane markers; non-standard lane markers; or lane markers covered with water, dirt, snow, etc.*
- *On roads where the discontinued lane markers are still detectable.*
- *On roads where there are sharp curves.*
- *On roads where there are sharply contrasting objects, such as shadows, snow, water, wheel ruts, seams or lines remaining after road repairs. (The LDW system could detect these items as lane markers.)*
- *On roads where the traveling lane merges or separates.*
- *When the vehicle's traveling direction does not align with the lane marker.*
- *When traveling close to the vehicle in front of you, which obstructs the lane camera unit detection range.*

(continued next page)

- *When rain, snow, dirt or an object adheres to the windshield in front of the lane camera unit.*
- *When the headlights are not bright due to dirt on the lens or if the aiming is not adjusted properly.*
- *When strong light enters the lane camera unit.(For example, the light directly shines on the front of the vehicle at sunrise or sunset.)*
- *When a sudden change in brightness occurs. (For example, when the vehicle enters or exits a tunnel or under a bridge.)*
- *If the vehicle is parked in direct sunlight under high temperature conditions (over approximately 104°F [40°C]) and then started, the LDW system may be deactivated automatically and the following message will appear in the vehicle information display: "Unavailable: High Cabin Temp."*

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.

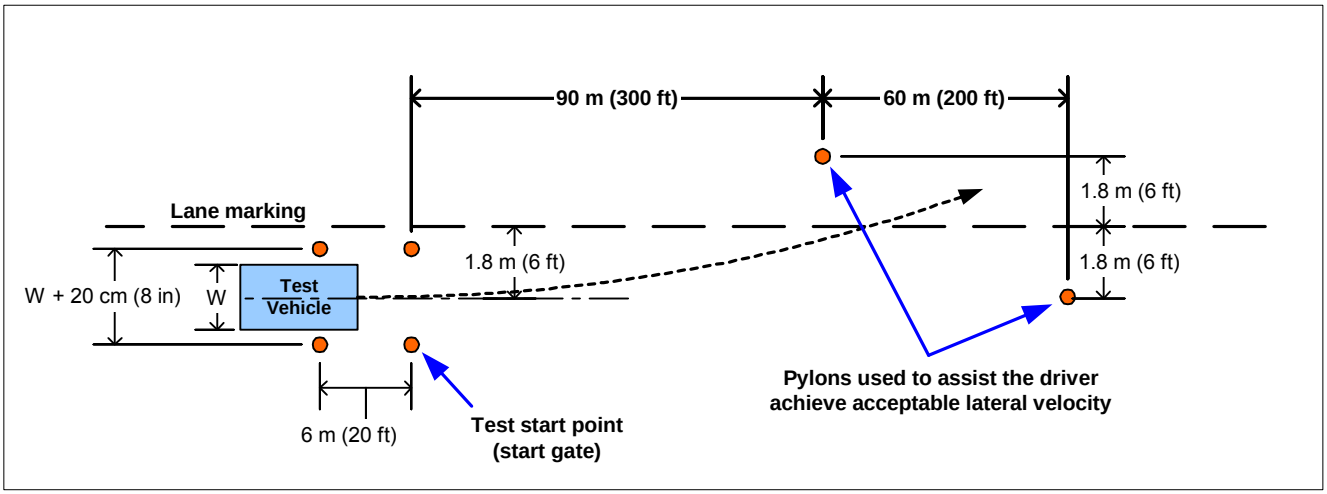

Figure 1. Position of Cones Used to Assist Driver

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 Office of Crash Avoidance Standards' 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.

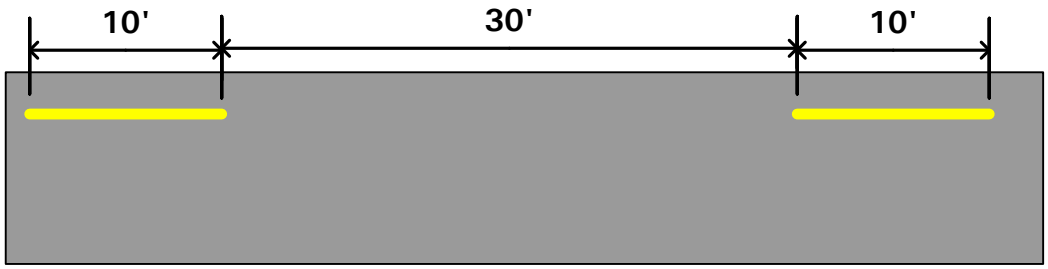

Figure 2. MUTCD Discontinuous Dashed Line Specifications

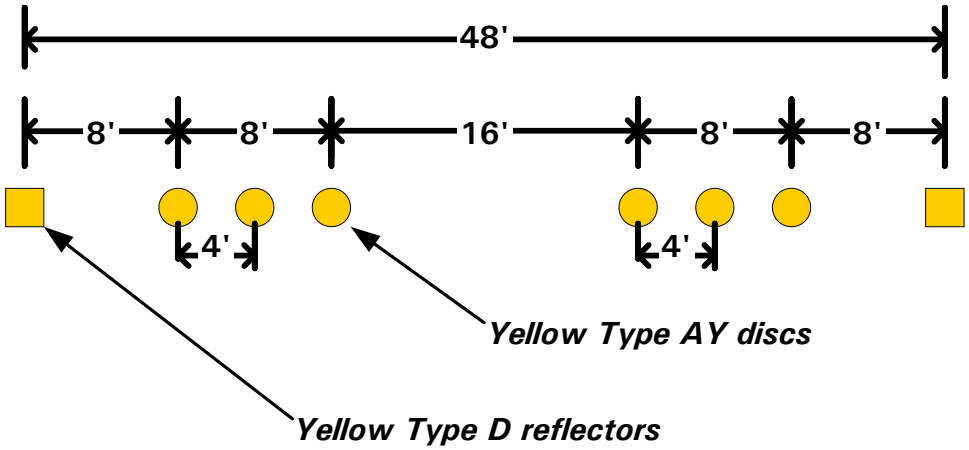

Figure 3. California Standard Plan A20A, Detail 4

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 percent), and pass 20 of the 30 trials overall (66 percent).

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: 6/21/2018 Due: 6/21/2019
Platform Scales	Vehicle Total, Wheel, and Axle Load	8000 lb 35.6 kN	±1.0% of applied load	Intercomp, SWII	1110M206352	By: DRI Date: 1/3/2019 Due: 1/3/2020
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	NA
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+	2182	By: Oxford Technical Solutions1 Date: 10/16/2017 Due: 10/16/2019
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	NA

[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	NA	NA
Light Sensor	Light intensity (to measure time at alert)	Spectral Bandwidth: 440-800 nm	Rise time < 10 msec	DRI designed and developed Light Sensor	NA	NA
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: 1/2/2019 Due: 1/2/2020

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 bandpass 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	Pass-Band 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

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Figure A1. Front View of Subject Vehicle

Figure A2. Rear View of Subject Vehicle

Year: 2019
Make: Nissan
Model: Rogue FWD SL
VIN: 5N1AT2MT6KC78

Engine: 4 Cylinder Engine
Transmission: CVT Transmission
Exterior: Pearl White Tricoat
Interior: Charcoal

CITY MPG 26 — HIGHWAY MPG 33

Fuel Economy Information

Actual mileage will vary with options, driving conditions, driving habits and vehicle's condition

MECHANICAL

· 6.386 Axle Ratio
· GVWR: 4,590 lbs
· Front-Wheel Drive
· Battery w/Run Down Protection
· 110 Amp Alternator
· 900lbs. Maximum Payload
· Gas-Pressurized Shock Absorbers
· Front And Rear Anti-Roll Bars
· Electric Power-Assist Speed-Sensing Steering
· 14.5 Gal. Fuel Tank
· Single Stainless Steel Exhaust
· Strut Front Suspension w/Coil Springs
· Multi-Link Rear Suspension w/Coil Springs
· 4-Wheel Disc Brakes w/4-Wheel ABS, Front And Rear Vented Discs, Brake Assist, Hill Hold Control and Electric Parking Brake

EXTERIOR

· Wheels: 19" Aluminum Alloy
· Tires: 225/55R19
· Wheels w/Silver Accents
· Steel Spare Wheel
· Compact Spare Tire Mounted Inside Under Cargo
· Clearcoat Paint
· Body-Colored Front Bumper w/Chrome Rub Strip/Fascia Accent
· Body-Colored Rear Bumper w/Black Rub Strip/Fascia Accent and Chrome Bumper Insert
· Chrome Side Windows Trim and Black Rear Window Trim
· Chrome Door Handles
· Chrome Bodyside Insert, Black Bodyside Cladding and Black Wheel Well Trim
· Body-Colored Power w/Tilt Down Heated Side Mirrors w/Manual Folding and Turn Signal Indicator
· Fixed Rear Window w/Fixed Interval Wiper, Heated Wiper Park and Defroster
· Variable Intermittent Wipers
· Deep Tinted Glass
· Galvanized Steel/Aluminum/Composite Panels
· Lip Spoiler
· Black Grille w/Chrome Surround
· Roof Rack Rails Only
· Fully Automatic Aero-Composite Halogen Daytime Running Auto High-Beam Headlamps w/Delay-Off
· LED Brakelights
· Perimeter/Approach Lights
· Front Fog Lamps

ENTERTAINMENT

· Integrated Roof Antenna
· 2 LCD Monitors In The Front
· Bluetooth Wireless Phone Connectivity

INTERIOR

· Heated Front Bucket Seats -inc: 8-way power driver seat w/2-way lumbar support and memory, 4-way power front passenger seat and front seatback storage
· 6-Way Driver Seat
· 40-20-40 Folding Bench Front Facing Manual Reclining Fold Forward Seatback Rear Seat w/Manual Fore/Aft
· Manual Tilt/Telescoping Steering Column
· NissanConnect Selective Service Internet Access
· Heated Leather/Metal-Look Steering Wheel
· Front Cupholder
· Rear Cupholder
· Valet Function
· HomeLink Garage Door Transmitter
· Cruise Control w/Steering Wheel Controls
· Distance Pacing w/Traffic Stop-Go
· HVAC -inc: Underseat Ducts and Console Ducts
· Dual Zone Front Automatic Air Conditioning
· Glove Box
· Driver Foot Rest
· Interior Trim -inc: Metal-Look Door Panel Insert and Chrome/Metal-Look Interior Accents
· Full Cloth Headliner
· Leather/Metal-Look Gear Shift Knob
· Vinyl Door Trim Insert
· Driver And Passenger Visor Vanity Mirrors w/Driver And Passenger Illumination, Driver And Passenger Auxiliary Mirror
· Day-Night Auto-Dimming Rearview Mirror
· Full Floor Console w/Covered Storage, Mini Overhead Console w/Storage and 3 12V DC Power Outlets
· Front Map Lights
· Fade-To-Off Interior Lighting
· Full Carpet Floor Covering
· Carpet Floor Trim
· Cargo Area Concealed Storage
· Trunk/Hatch Auto-Latch
· Cargo Space Lights
· NissanConnect Services Tracker System
· Driver / Passenger And Rear Door Bins
· Delayed Accessory Power
· Systems Monitor
· Outside Temp Gauge
· Analog Display
· Manual Anti-Whiplash Adjustable Front Head Restraints and Manual Adjustable Rear Head Restraints
· Front Center Armrest w/Storage and Rear Center Armrest
· Perimeter Alarm
· 3 12V DC Power Outlets
· Air Filtration

SAFETY

· Side Impact Beams
· Dual Stage Driver And Passenger Seat-Mounted Side Airbags
· Blind Spot Warning Blind Spot Sensor
· Forward Collision Mitigation
· Tire Specific Low Tire Pressure Warning
· Dual Stage Driver And Passenger Front Airbags
· Curtain 1st And 2nd Row Airbags
· Rear Child Safety Locks
· Outboard Front Lap And Shoulder Safety Belts - inc: Rear Center 3 Point, Height Adjusters and Pretensioners
· Back-Up Camera
· Around View Monitor Front Camera
· Left Side Camera
· Right Side Camera

New

MSRP	**$31,490.00**
INSTALLED OPTIONS	
Pearl White Tricoat	$0
Charcoal, Leather Appointed Seat Trim	$0
Premium Package	$1,820
• LED Headlights • Power Panoramic Moonroof	
50 State Emissions	$0
Chrome Rear Bumper Protector	$165
Black Splash Guards (Set Of 4)	$170
Floor Mats & 2 PC Cargo Area Protector	$280
• 2-pc front and 2-pc 2nd row floor mats • First Aid Kit	
Retractable Cargo Cover	$195
Navigation Manual	$0
Original Shipping Charge	$1,045
RETAIL PRICE (ORIGINALLY NEW)	$35,165.00

Get more information on your smartphone:

Figure A3. Window Sticker (Monroney Label)

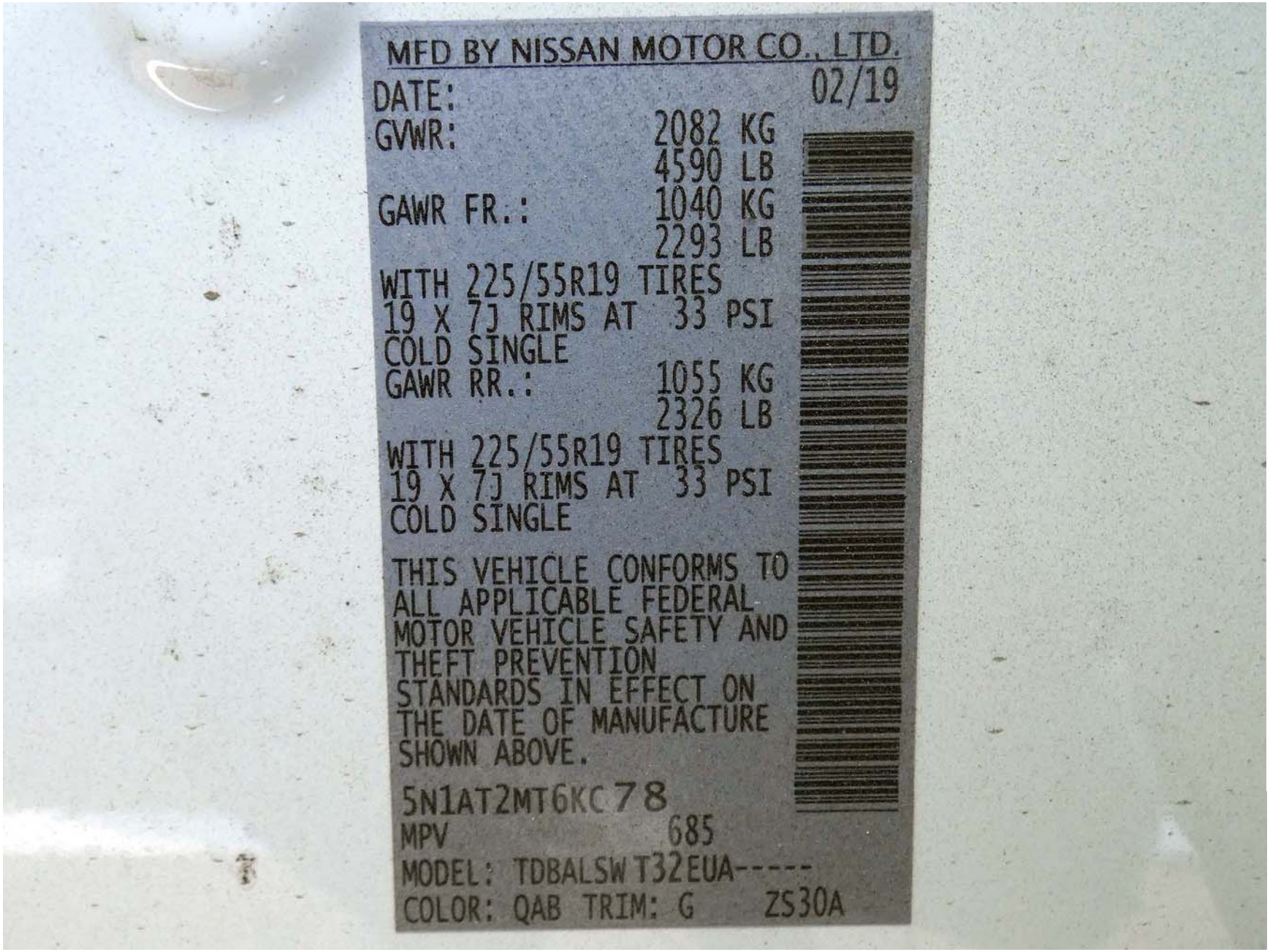


Figure A4. Vehicle Certification Label

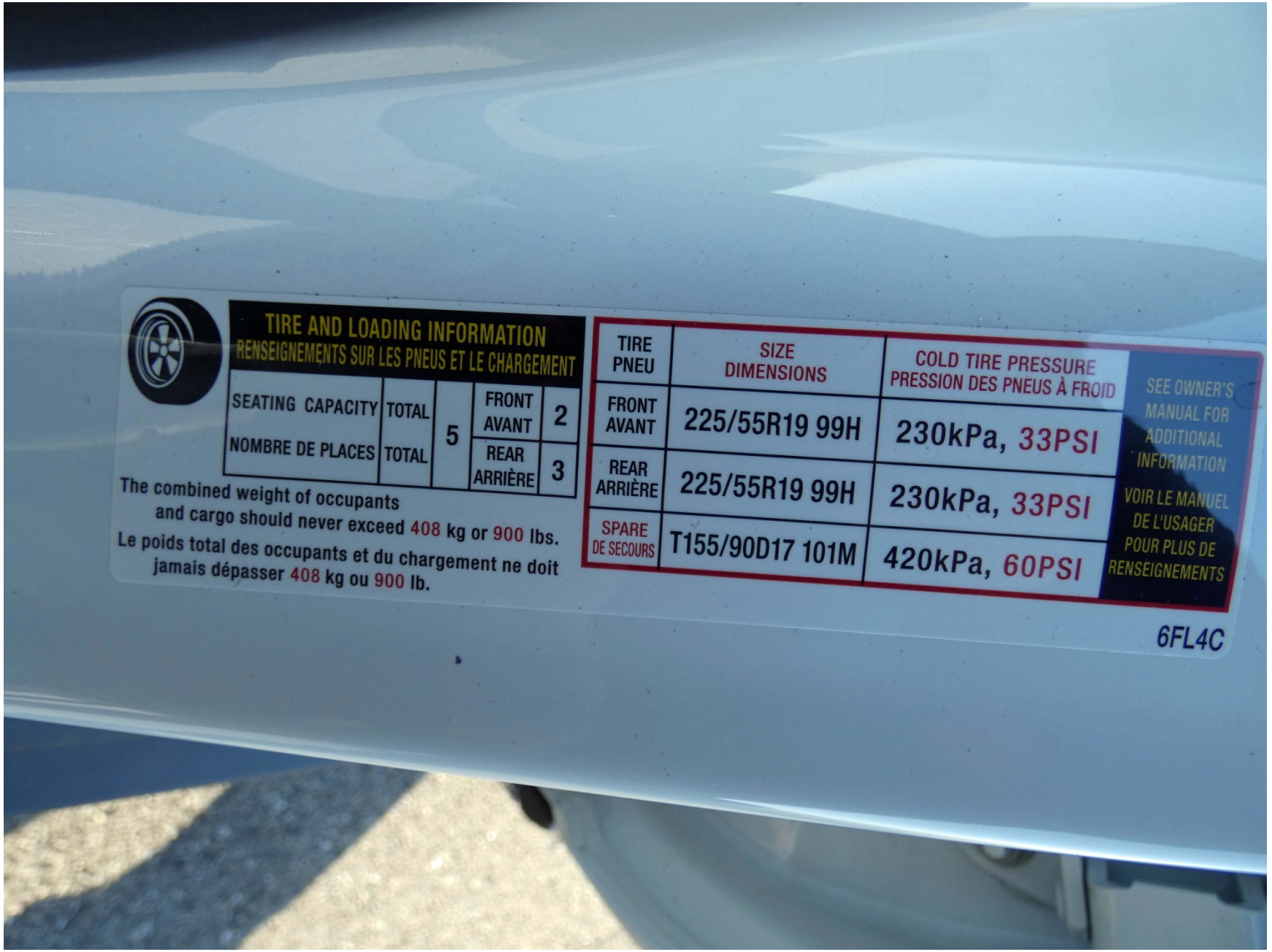


Figure A5. Tire Placard

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

Figure A7. Computer Installed in Test Vehicle

Figure A8. Sensor for Detecting Auditory Alerts

Figure A9. Sensor for Detecting Visual Alerts

Figure A10. LDW Instrument Panel Visual Alerts

Figure A11. LDW Settings Menu Options

Figure A12. Steering Wheel Mounted Controls for Interacting with LDW Settings

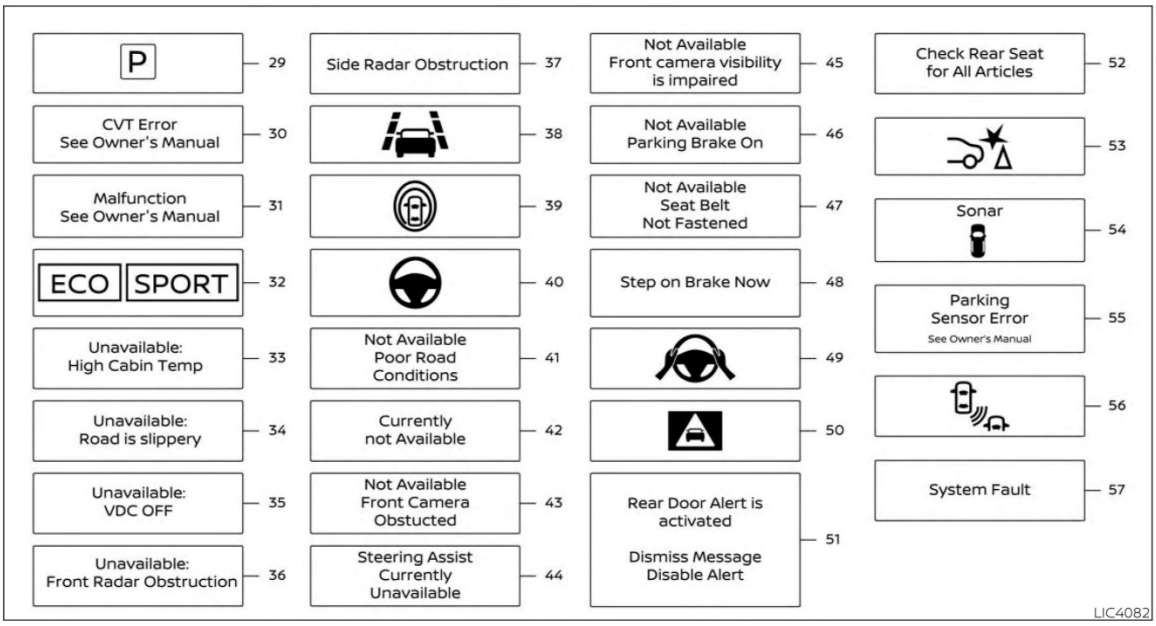
APPENDIX B

Excerpts from Owner's Manual

Driver Assistance

The driver assistance menu allows the user to change the settings for driving, parking, and braking aids.

Menu item			Result
Driving Aids (if so equipped)			Displays available driving aids.
	Steering Assist (if so equipped)		Allows user to turn the steering assist on or off.
	Emergency Brake		Displays available emergency braking options.
		Front	Allows user to turn the front emergency braking system on or off. For additional information, refer to "Automatic Emergency Braking (AEB)" and "Automatic Emergency Braking (AEB) with Pedestrian Detection" in the "Starting and driving" section of your owner's manual.
		Rear (if so equipped)	Allows user to turn the rear emergency braking system on or off. For additional information, refer to "Rear Emergency Braking (RAB)" in the "Starting and driving" section of your owner's manual.
	Lane		Displays available lane options.
		Warning (LDW) (if so equipped)	Allows user to turn the Lane Departure Warning (LDW) and Intelligent Lane Intervention (I-LI) systems on or off. For additional information, refer to "Lane Departure Warning (LDW)" and "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.
		Prevention (LDP) (if so equipped)	Allows user to turn the Intelligent Lane Intervention (I-LI) system on or off. For additional information, refer to "Intelligent Lane Intervention (I-LI) in the "Starting and driving" section of this manual.
	Blind Spot		Displays available blind spot options.
		Warning (BSW)	Allows user to turn Blind Spot Warning (BSW) on or off. For additional information, refer to "Blind Spot Warning (BSW)" in the "Starting and driving" section of your owner's manual.
Parking Aids			Displays available parking aids.
	Moving Object (if so equipped)		Allows user to turn the Moving Object Detection (MOD) feature on or off. For additional information, refer to "Intelligent Around View Monitor" in the "Monitor, climate, audio, phone and voice recognition systems" section of your owner's manual.
	Cross Traffic		Allows user to turn the Rear Cross Traffic Alert (RCTA) feature on or off.
	Front Sensor (if so equipped)		Allows user to turn the front sensor on or off.
	Rear Sensor (if so equipped)		Allows user to turn the rear sensor on or off.


P
29
CVT Error
See Owner's Manual
30
Malfunction
See Owner's Manual
31
ECO SPORT
32
Unavailable:
High Cabin Temp
33
Unavailable:
Road is slippery
34
Unavailable:
VDC OFF
35
Unavailable:
Front Radar Obstruction
36
Side Radar Obstruction
37
38
39
40
Not Available
Poor Road
Conditions
41
Currently
not Available
42
Not Available
Front Camera
Obstucted
43
Steering Assist
Currently
Unavailable
44
Not Available
Front camera visibility
is impaired
45
Not Available
Parking Brake On
46
Not Available
Seat Belt
Not Fastened
47
Step on Brake Now
48
49
50
Rear Door Alert is
activated
Dismiss Message
Disable Alert
51
Check Rear Seat
for All Articles
52
53
Sonar
54
Parking
Sensor Error
See Owner's Manual
55
56
System Fault
57
LIC4082

VEHICLE INFORMATION DISPLAY WARNINGS AND INDICATORS

1. Engine start operation
2. No Key Detected (if so equipped)
3. Shift to Park
4. Key Battery Low (if so equipped)
5. Engine start operation for Intelligent Key system (if I-Key battery level is low) (if so equipped)
6. Key ID incorrect (if so equipped)
7. Release Parking Brake
8. Low Fuel
9. Low Washer Fluid (if so equipped)
10. Door/liftgate Open
11. Key System Error: See Owner's Manual (if so equipped)
12. Loose Fuel Cap
13. Tire Pressure Low — Add Air
14. Flat Tire — Visit dealer (if so equipped)
15. Low Oil Pressure Stop Vehicle
16. AWD Error: See Owner's Manual (if so equipped)
17. AWD High Temp. Stop vehicle (if so equipped)
18. Tire Size Incorrect: See Owner's Manual (if so equipped)
19. Battery Voltage Low Charge Battery
20. Shipping Mode On Push Storage Fuse
21. Power will turn off to save the battery
22. Power turned off to save the battery
23. Reminder: Turn OFF Headlights
24. Headlight System Error: See Owner's Manual (if so equipped)
25. Timer Alert — Time for a driver break?
26. Chassis Control System Error: See Owner's Manual (if so equipped)
27. Cruise control indicator (if so equipped)
28. Intelligent Cruise Control (ICC) indicators (if so equipped)
29. Transmission Shift Position indicator
30. CVT Error: See Owner's Manual
31. Malfunction: See Owner's Manual (if so equipped)
32. Drive mode indicators
33. Unavailable: High Cabin Temp (if so equipped)
34. Unavailable: Road is slippery (if so equipped)
35. Unavailable: VDC OFF (if so equipped)
36. Unavailable: Front Radar Obstruction (if so equipped)
37. Side Radar Obstruction (if so equipped)
38. Lane Departure Warning (LDW) indicator (if so equipped)
39. Intelligent Lane Intervention (I-LI) indicator (if so equipped)
40. Steering Assist indicator (if so equipped)
41. Not Available Poor Road Conditions (if so equipped)
42. Currently not available (if so equipped)
43. Not Available Front Camera Obstructed (if so equipped)
44. Steering Assist Currently unavailable (if so equipped)
45. Not Available Front camera visibility impaired (if so equipped)

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

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

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

Transmission Shift Position Indicator

This indicator shows the transmission shift position.

CVT Error: See Owner's Manual

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

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

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

- Automatic Emergency Braking (AEB)
- Automatic Emergency Braking (AEB) with Pedestrian Detection
- Rear Automatic Braking (RAB)
- Lane Departure Warning (LDW)
- Blind Spot Warning (BSW)
- Intelligent Cruise Control (ICC)

If one or more of these warning appears, have the system checked. It is recommended that you visit a NISSAN dealer for this service.

Drive mode indicators

These indicators illuminate in the vehicle information display when either the ECO or SPORT modes are selected.

For additional information, refer to "SPORT mode switch" or "ECO mode switch" in the "Starting and driving" or the section of this manual.

Unavailable: High Cabin Temp. (if so equipped)

This message appears when the camera detects an interior temperature of more than approximately 104°F (40°C). For additional information, refer to "Lane Departure Warning (LDW)" and "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Unavailable: Road is slippery (if so equipped)

This message appears when the Intelligent Lane Intervention (I-LI) system becomes unavailable because the road is slippery. For additional information, refer to " Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Unavailable: VDC OFF (if so equipped)

This message appears when the Intelligent Lane Intervention (I-LI) system becomes unavailable because the VDC is turned off. For additional information, refer to " Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Unavailable: Front Radar Obstruction (if so equipped)

This message appears when the Intelligent Cruise Control (ICC), Automatic Emergency Braking (AEB), Automatic Emergency Braking (AEB) with Pedestrian Detection, and/or ProPILOT Assist system(s) become unavailable because the front radar is obstructed. For additional information, refer to "Intelligent Cruise Control (ICC)", "Automatic Emergency Braking (AEB)", "Automatic

Emergency Braking (AEB) with Pedestrian Detection" and/or "ProPILOT Assist" in the "Starting and driving" section of this manual.

Side Radar Obstruction (if so equipped)

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

Lane Departure Warning (LDW) indicator (if so equipped)

This indicator shows when the LDW and Intelligent Lane Intervention (I-LI) systems are engaged.

For additional information, refer to "Lane Departure Warning (LDW) system" and "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Intelligent Lane Intervention (I-LI) indicator (if so equipped)

This indicator shows when the I-LI system is engaged.

For additional information, refer to "Dynamic driver assistance switch" in this section and "Intelligent Lane Intervention (I-LI)" in the "Starting and driving" section of this manual.

Steering Assist indicator (if so equipped)

This indicator appears when the Steering Assist system is engaged.

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

Not Available Poor Road Conditions (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (with ProPILOT Assist) system or the ICC system is engaged.

Under the following conditions, the ICC (with ProPILOT Assist) or the ICC system is automatically canceled:

- When the VDC operates
- When a wheel slips

The above system cannot be used in some situations (VDC operates and wheel slip.)

Currently not available (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (with ProPILOT Assist) system or the ICC system is engaged.

Under the following conditions, the ICC (with ProPILOT Assist) or the ICC system is automatically canceled:

- When the VDC operates
- When a wheel slips
- When the VDC system is turned off

The above system cannot be used in some situations (VDC operates, wheel slip and VDC system is off.)

Not Available Front Camera Obstructed (if so equipped)

This message may appear when the Intelligent Cruise Control (ICC) (with ProPILOT Assist) system is engaged.

Under the following conditions, the ICC (with ProPILOT Assist) system is automatically canceled:

- The camera area of the windshield is fogged up or covered with dirt, water, drops, ice, snow, etc.

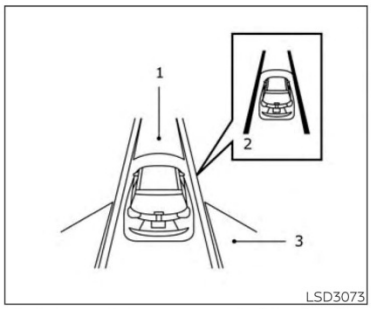
⚠ CAUTION

- **To avoid possible damage to your vehicle, when stopping the vehicle on an uphill grade, do not hold the vehicle by depressing the accelerator pedal. The foot brake should be used for this purpose.**
- **Except in an emergency, do not shift to the N (Neutral) position while driving. Coasting with the transmission in the N (Neutral) position may cause serious damage to the transmission.**

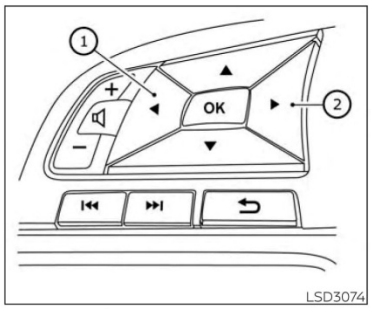
The CVT in your vehicle is electronically controlled to produce maximum power and smooth operation.

The recommended operating procedures for this transmission are shown on the following pages. Follow these procedures for maximum vehicle performance and driving enjoyment.

Engine power may be automatically reduced to protect the CVT if the engine speed increases quickly when driving on slippery roads or while being tested on some dynamometers.



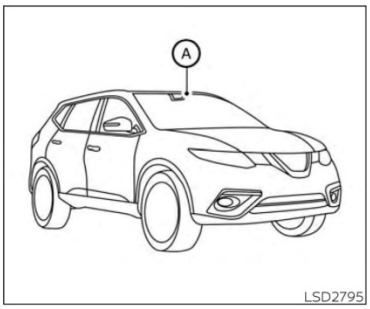
1. Automatic Emergency Braking (AEB)
2. Lane Departure Warning (LDW) when shaded and Intelligent Lane Intervention (I-LI) when solid
3. Blind Spot Warning (BSW)



Starting the vehicle

1. After starting the engine, fully depress the foot brake pedal before moving the shift lever out of the P (Park) position.
   This Continuously Variable Transmission is designed so that the foot brake pedal must be depressed before shifting from P (Park) to any driving position while the ignition switch is in the ON position.
   The shift lever cannot be moved out of the P (Park) position and into any of the other positions if the ignition switch is placed in the LOCK or OFF position.

LANE DEPARTURE WARNING (LDW) (if so equipped)



LSD2795

⚠ WARNING

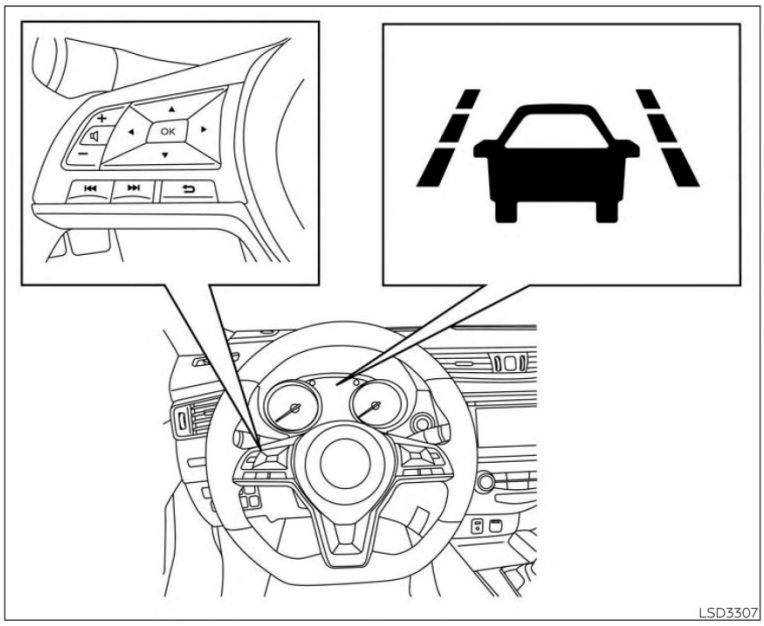
Failure to follow the warnings and instructions for proper use of the LDW system could result in serious injury or death.

- **This system is only a warning device to inform the driver of a potential unintended lane departure. It will not steer the vehicle or prevent loss of control. It is the driver's responsibility to stay alert, drive safely, keep the vehicle in the traveling lane, and be in control of the vehicle at all times.**

The LDW system will operate when the vehicle is driven at speeds of approximately 37 mph (60 km/h) and above, and only when the lane markings are clearly visible on the road.

The LDW system monitors the lane markers on the traveling lane using the camera unit Ⓐ located above the inside mirror.

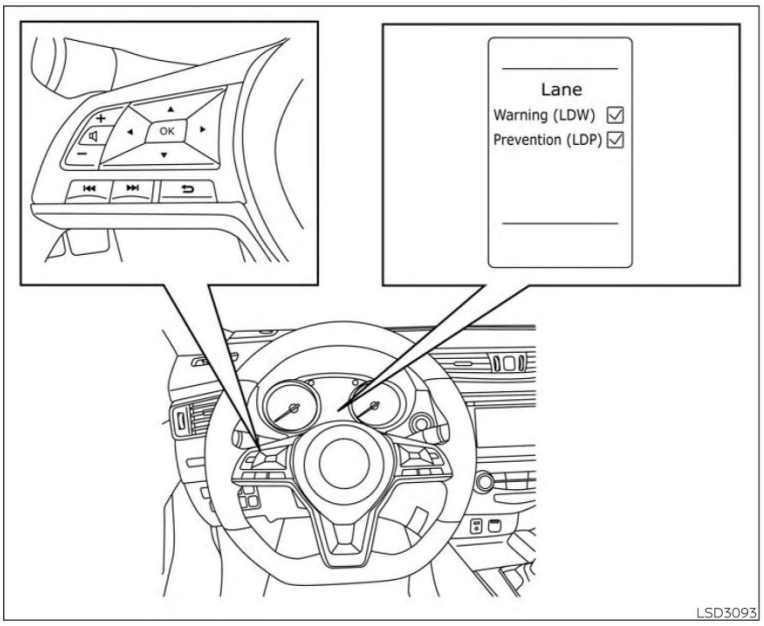
The LDW system warns the driver with an indicator and chime that the vehicle is beginning to leave the driving lane. For additional information, refer to "LDW system operation" in this section.



LDW SYSTEM OPERATION

The LDW system provides a lane departure warning function when the vehicle is driven at speeds of approximately 37 mph (60 km/h) and above and the lane markings are clear. When the vehicle approaches either the left or the right side of the traveling lane, a warning chime will sound and the LDW indicator on the instrument panel will blink to alert the driver.

The warning function will stop when the vehicle returns inside of the lane markers.



HOW TO ENABLE/DISABLE THE LDW SYSTEM

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

1. Press the ◀▶ button until "Settings" displays in the vehicle information display. Use the ▲▼ button to select "Driver Assistance." Then press the OK button.
2. Select "Driving Aids" and press the OK button.
3. To set the LDW system to on or off, use the ▲▼ buttons to navigate in the menu and use the OK button to select or change an item:
   - Select "Lane" and press the OK button.
     - To turn on the warning system, use the OK button to check the box for "Warning (LDW)."

LDW SYSTEM LIMITATIONS

⚠ WARNING

Listed below are the system limitations for the LDW system. Failure to follow the warnings and instructions for proper use of the LDW system could result in serious injury or death.

- **The system will not operate at speeds below approximately 37 mph (60 km/h) or if it cannot detect lane markers.**
- **Excessive noise will interfere with the warning chime sound, and the chime may not be heard.**
- **Do not use the LDW system under the following conditions as it may not function properly:**
  - **During bad weather (rain, fog, snow, etc.).**
  - **When driving on slippery roads, such as on ice or snow.**
  - **When driving on winding or uneven roads.**
  - **When there is a lane closure due to road repairs.**
  - **When driving in a makeshift or temporary lane.**
  - **When driving on roads where the lane width is too narrow.**
  - **When driving without normal tire conditions (for example, tire wear, low tire pressure, installation of spare tire, tire chains, nonstandard wheels).**
  - **When the vehicle is equipped with non-original brake parts or suspension parts.**
  - **When you are towing a trailer or other vehicle.**
- **The system may not function properly under the following conditions:**
  - **On roads where there are multiple parallel lane markers; lane markers that are faded or not painted clearly; yellow painted lane markers; non-standard lane markers; or lane markers covered with water, dirt, snow, etc.**
  - **On roads where the discontinued lane markers are still detectable.**
  - **On roads where there are sharp curves.**
  - **On roads where there are sharply contrasting objects, such as shadows, snow, water, wheel ruts, seams or lines remaining after road repairs. (The LDW system could detect these items as lane markers.)**
  - **On roads where the traveling lane merges or separates.**
  - **When the vehicle's traveling direction does not align with the lane marker.**
  - **When traveling close to the vehicle in front of you, which obstructs the lane camera unit detection range.**
  - **When rain, snow, dirt or an object adheres to the windshield in front of the lane camera unit.**
  - **When the headlights are not bright due to dirt on the lens or if the aiming is not adjusted properly.**
  - **When strong light enters the lane camera unit. (For example, the light directly shines on the front of the vehicle at sunrise or sunset.)**
  - **When a sudden change in brightness occurs. (For example, when the vehicle enters or exits a tunnel or under a bridge.)**

SYSTEM TEMPORARILY UNAVAILABLE

If the vehicle is parked in direct sunlight under high temperature conditions (over approximately 104°F [40°C]) and then started, the LDW system may be deactivated automatically and the following message will appear in the vehicle information display: "Unavailable: High Cabin Temp."

When the interior temperature is reduced, the LDW system will resume operating automatically.

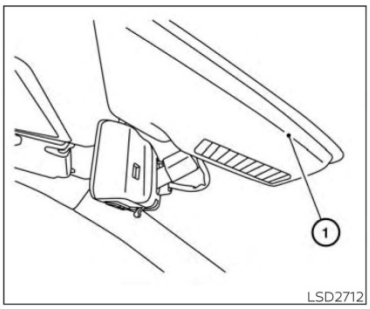
The LDW system is not designed to warn under the following conditions:

- When you operate the lane change signal and change traveling lanes in the direction of the signal. (The LDW system will become operable again approximately 2 seconds after the lane change signal is turned off.)
- When the vehicle speed lowers to less than approximately 37 mph (60 km/h).

After the above conditions have finished and the necessary operating conditions are satisfied, the LDW functions will resume.

SYSTEM MALFUNCTION

If the LDW system malfunctions, it will cancel automatically and "Malfunction: See Owner's Manual" will appear in the vehicle information display. If "Malfunction: See Owner's Manual" appears in the vehicle information display, pull off the road to a safe location and stop the vehicle. Place the shift lever in the P (Park) position and the ignition switch in the OFF position and restart the engine/motor. If "Malfunction: See Owner's Manual" continues to appear in the vehicle information display, have the system checked. It is recommended that you visit a NISSAN dealer for this service.



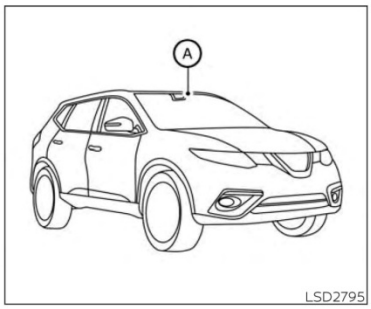
SYSTEM MAINTENANCE

The lane camera unit ① for the LDW system is located above the inside mirror. To keep the proper operation of the LDW system and prevent a system malfunction, be sure to observe the following:

- Always keep the windshield clean.
- Do not attach a sticker (including transparent material) or install an accessory near the camera unit.

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

INTELLIGENT LANE INTERVENTION (I-LI) (if so equipped)



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⚠ WARNING

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

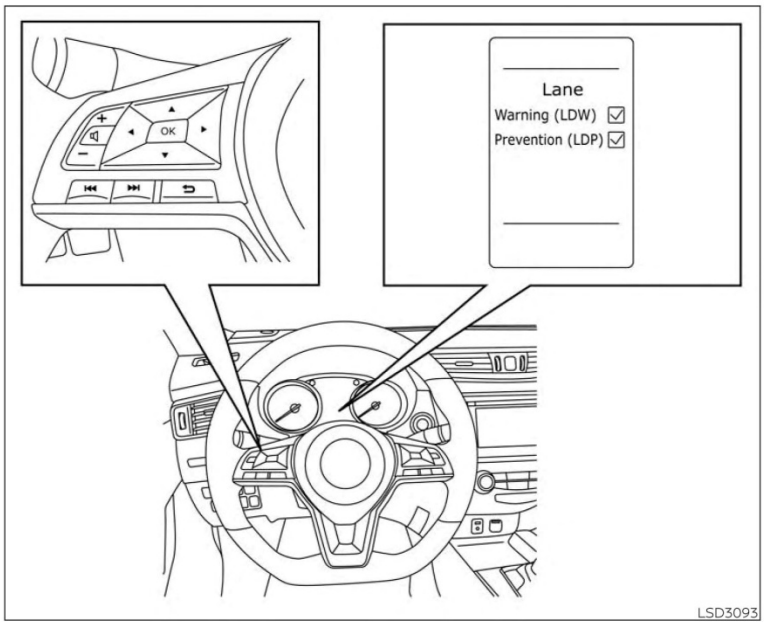
- **The I-LI system will not steer the vehicle or prevent loss of control. It is the driver's responsibility to stay alert, drive safely, keep the vehicle in the traveling lane, and be in control of the vehicle at all times.**
- **The I-LI system is primarily intended for use on well-developed freeways or highways. It may not detect the lane markers in certain road, weather, or driving conditions.**

The I-LI system must be turned on with the dynamic driver assistance switch (for vehicles without ProPILOT Assist) or the ProPILOT Assist switch (for vehicles with ProPILOT Assist) on the steering wheel, every time the ignition is placed in the ON position.

The I-LI system will operate when the vehicle is driven at speeds of approximately 37 mph (60 km/h) and above, and only when the lane markings are clearly visible on the road.

The I-LI system warns the driver when the vehicle has left the center of the traveling lane with an indicator and chime. The system helps assist the driver to return the vehicle to the center of the traveling lane by applying the brakes to the left or right wheels individually (for a short period of time).

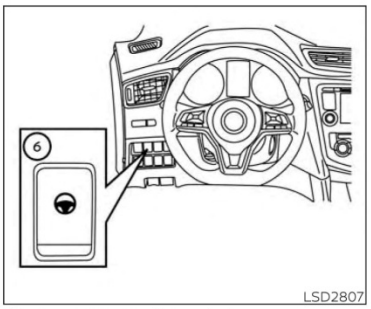
The I-LI system monitors the lane markers on the traveling lane using the camera unit Ⓐ located above the inside mirror.



HOW TO ENABLE/DISABLE THE I-LI SYSTEM

Perform the following steps to enable or disable the I-LI system.

1. Press the ◀▶ button until "Settings" displays in the vehicle information display. Use the ▲▼ button to select "Driver Assistance." Then press the OK button.
2. Select "Driving Aids" and press the OK button.
3. To set the I-LI system to on or off, use the ▲▼ buttons to navigate in the menu and use the OK button to select or change an item:
   - Select "Lane" and press the OK button.
   - To turn on the I-LI system, use the OK button to check the box for "Prevention (LDP)."
4. Push the ProPILOT Assist switch (for vehicles with ProPILOT Assist) or the dynamic driver assistance switch (for vehicles without ProPILOT Assist) to turn the system on or off.



④ **ProPILOT Assist switch:**

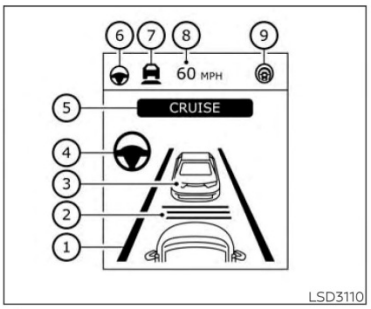
Turns the ProPILOT Assist system on or off

⑤ **SET- switch:**

Sets desired cruise speed or reduces speed incrementally

⑥ **Steering Assist switch:**

Turns the Steering Assist function on or off



The ProPILOT Assist system display and indicators

① **Lane marker indicator**

Indicates whether the system detects lane markers

- No lane markers displayed: Steering Assist is turned off
- Lane marker indicator (gray): No lane markers detected
- Lane marker indicator (green): Lane markers detected
- Lane marker indicator (yellow): Lane departure is detected

② **Set distance indicator**

Displays the selected distance

③ **Vehicle ahead detection indicator**

Indicates whether the system detects a vehicle in front of you

④ **Steering Assist indicator**

Indicates the status of the Steering Assist function by the color of the indicator

- Steering Assist indicator (gray): Steering Assist standby
- Steering Assist indicator (green): Steering Assist active
- Steering Assist indicator (orange): Steering Assist malfunction

⑤ **ProPILOT Assist activation**

Displays once the ProPILOT Assist system is activated

② **Steering Assist indicator**

Indicates the status of the Steering Assist by the color of the indicator

- Steering Assist indicator (gray): Steering Assist standby
- Steering Assist indicator (green): Steering Assist active

③ **Lane marker indicator**

Indicates whether the system detects the lane marker

- Lane marker indicator (gray): Lane markers not detected
- Lane marker indicator (green): Lane markers detected
- Lane marker indicator (yellow): Lane departure is detected

When the Steering Assist is in operation, the Steering Assist status indicator ①, the Steering Assist indicator ②, and the lane marker indicator ③ on the vehicle information display turn green. A chime sounds when the Steering Assist initially activates.

When the Steering Assist deactivates, the Steering Assist status indicator ①, the Steering Assist indicator ②, and the lane marker indicator ③ on the vehicle information display turn gray and a chime sounds twice.

Intelligent Lane Intervention (I-LI)

When a curve or strong cross wind exceeds the capabilities of the Steering Assist and your vehicle approaches either the left or the right side of the traveling lane, a warning chime sounds and the I-LI indicator light (orange) on the instrument panel flashes to alert the driver. Then, the I-LI system automatically applies the brakes for a short period of time to help assist the driver to return the vehicle to the center of the traveling lane. This action is in addition to any Steering Assist actions.

APPENDIX C

Run Log

Subject Vehicle: **2019 Nissan Rogue** Test Date: **5/8/2019**

Driver: **N. Watanabe**

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

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Auditory Alert (ft)	Distance at Visual Alert (ft)	Pass/Fail	Notes
1	**Botts**	**Left**	N				Lat velocity
2			Y	-0.60	-0.89	Pass	
3			Y	-0.75	-1.06	Pass	
4			Y	-0.81	-1.10	Pass	
5			Y	-0.78	-1.08	Pass	
6			Y	-0.64	-0.90	Pass	
7			Y	-0.54	-0.82	Pass	
8			Y	-0.63	-0.90	Pass	
9	**Botts**	**Right**	Y	0.32	0.09	Pass	
10			Y	0.24	0.07	Pass	
11			Y	0.18	-0.03	Pass	
12			Y	0.22	-0.01	Pass	
13			Y	0.12	-0.16	Pass	
14			Y	0.30	0.04	Pass	
15			Y	0.21	-0.11	Pass	
16	**Solid**	**Right**	Y	0.45	0.24	Pass	
17			N				Did not cross over far enough
18			Y	0.45	0.19	Pass	
19			Y	0.59	0.22	Pass	

Subject Vehicle: **2019 Nissan Rogue** Test Date: **5/8/2019**

Driver: **N. Watanabe**

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

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Auditory Alert (ft)	Distance at Visual Alert (ft)	Pass/Fail	Notes
20			Y	0.44	0.16	Pass	
21			Y	0.51	0.23	Pass	
22			Y	0.42	0.19	Pass	
23			Y	0.54	0.38	Pass	
24	**Solid**	**Left**	Y	-0.40	-0.81	Pass	
25			Y	-0.26	-0.50	Pass	
26			Y	-0.22	-0.48	Pass	
27			Y	-0.22	-0.42	Pass	
28			Y	-0.35	-0.56	Pass	
29			Y	-0.26	-0.42	Pass	
30			Y	-0.24	-0.55	Pass	
31	**Dashed**	**Left**	Y	-0.54	-0.83	Pass	
32			Y	-0.51	-0.86	Pass	
33			Y	-0.44	-0.67	Pass	
34			Y	-0.66	-0.91	Pass	
35			Y	-0.52	-0.71	Pass	
36			Y	-0.75	-1.12	Pass	
37			Y	-0.64	-0.93	Pass	
38	**Dashed**	**Right**	Y	-0.11	-0.43	Pass	
39			Y	0.05	-0.23	Pass	

Subject Vehicle: **2019 Nissan Rogue** Test Date: **5/8/2019**

Driver: **N. Watanabe**

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

Run	Lane Marking Type	Departure Direction	Valid Run?	Distance at Auditory Alert (ft)	Distance at Visual Alert (ft)	Pass/Fail	Notes
40			Y	-0.06	-0.39	Pass	
41			Y	-0.05	-0.37	Pass	
42			Y	-0.03	-0.31	Pass	
43			Y	-0.12	-0.42	Pass	
44			Y	-0.20	-0.54	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. **Note:** The Bird's Eye View representation is not synchronized to the time history plots above it. It is a spatial, not temporal, representation.

Note that 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.

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

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.

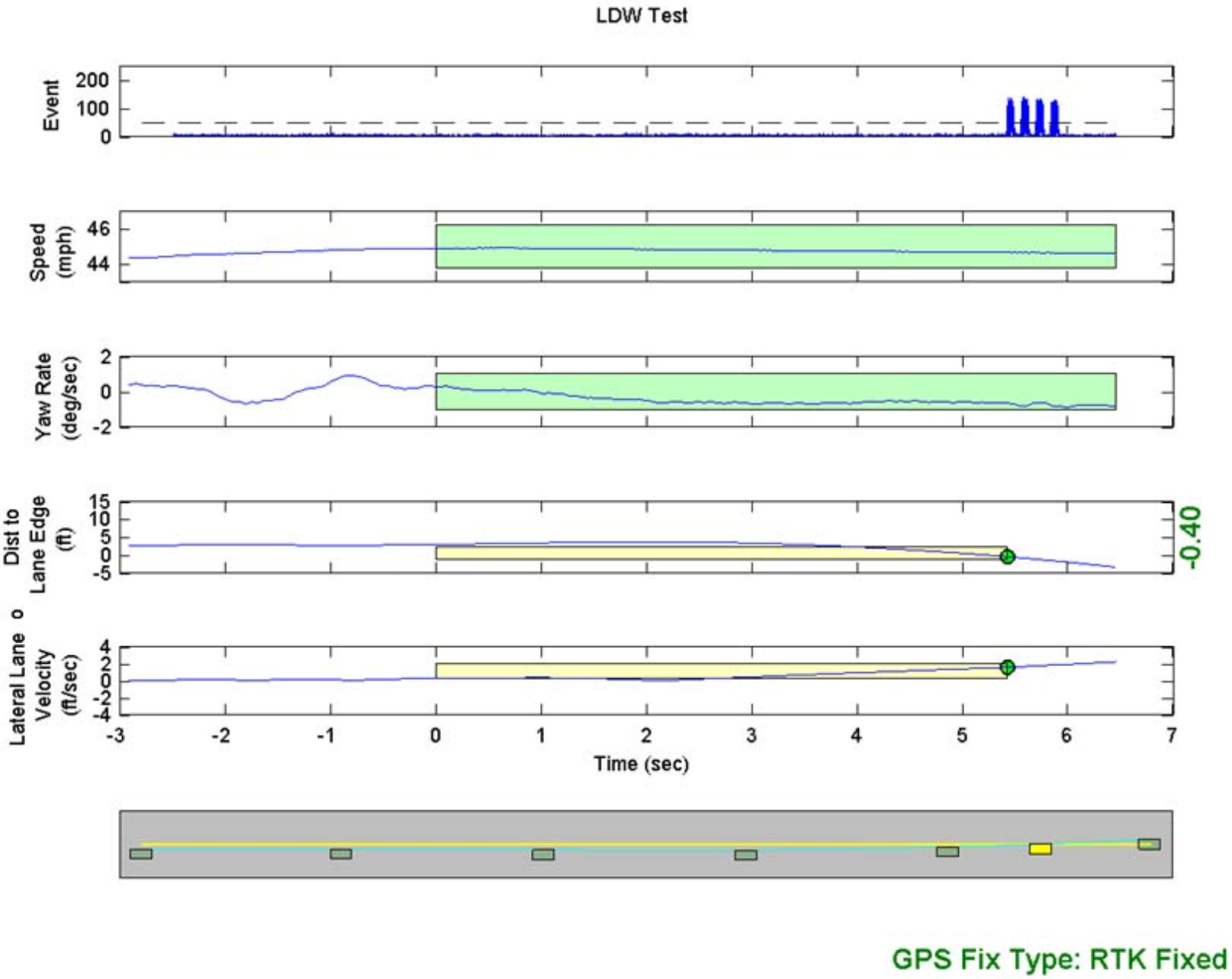

Figure D1. Example Time History for Lane Departure Warning Test, Passing

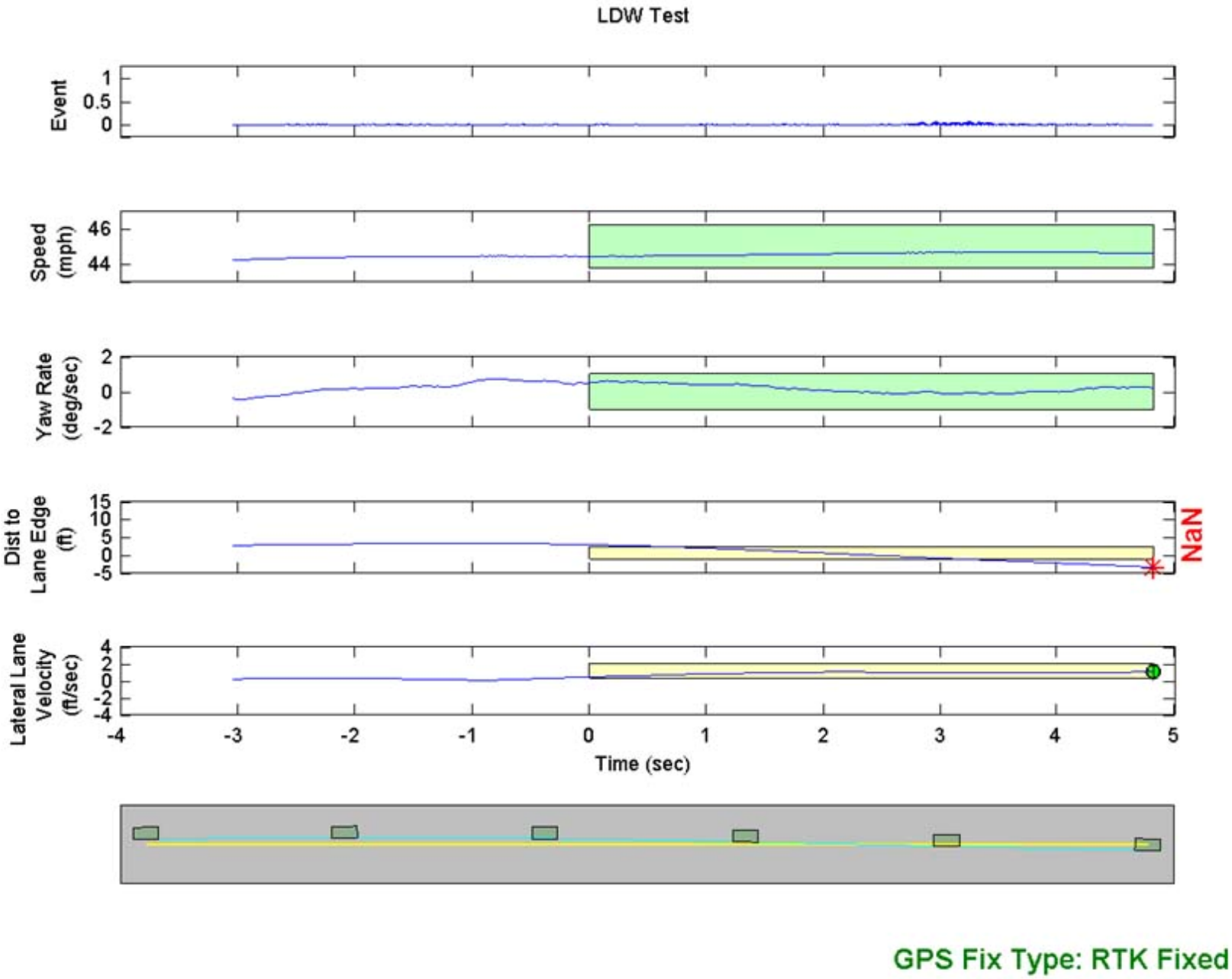

Figure D2. Example Time History for Lane Departure Warning Test, Failing, No Warning Issued

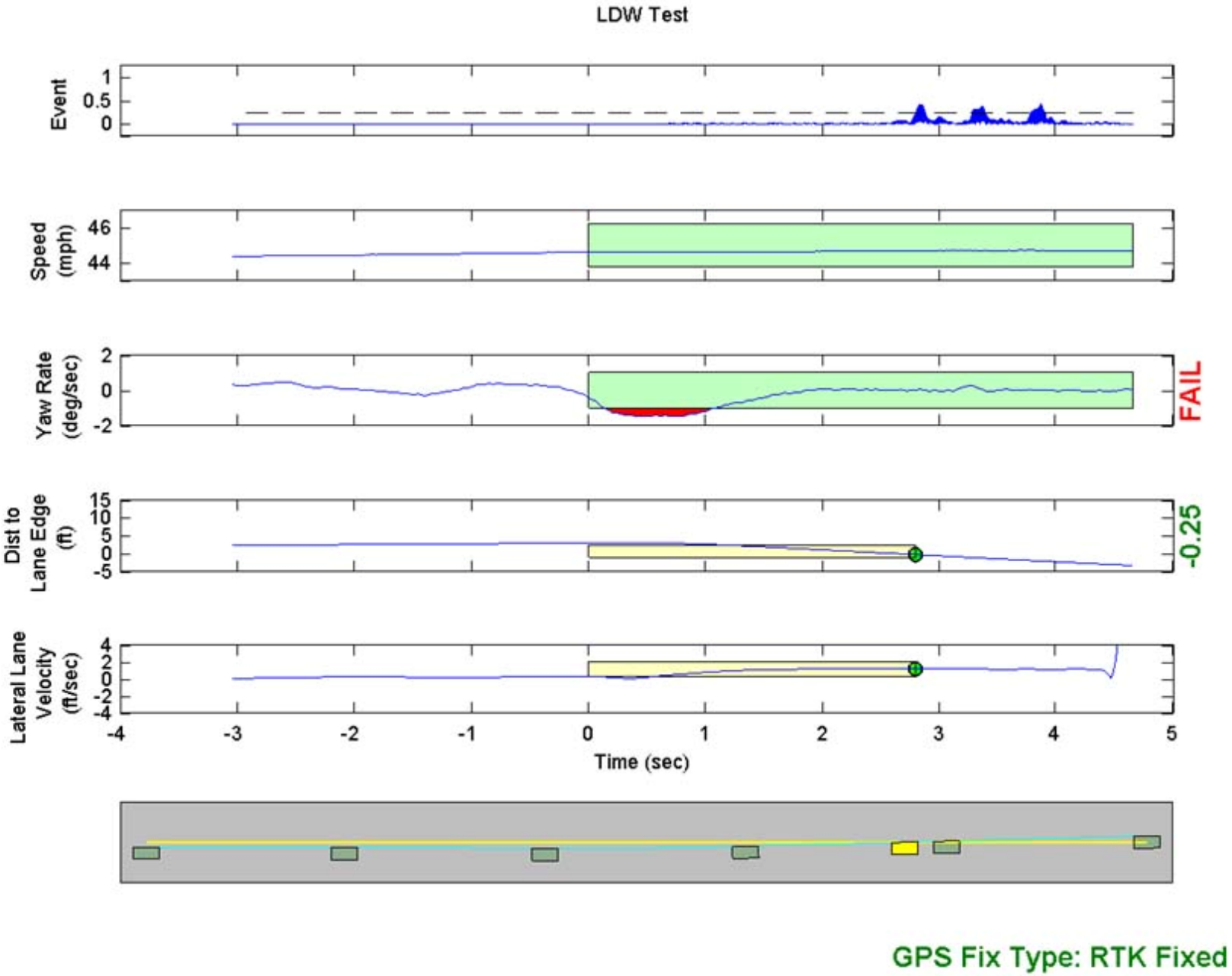

Figure D3. Example Time History for Lane Departure Warning Test, Invalid Run Due to Subject Vehicle Yaw Rate

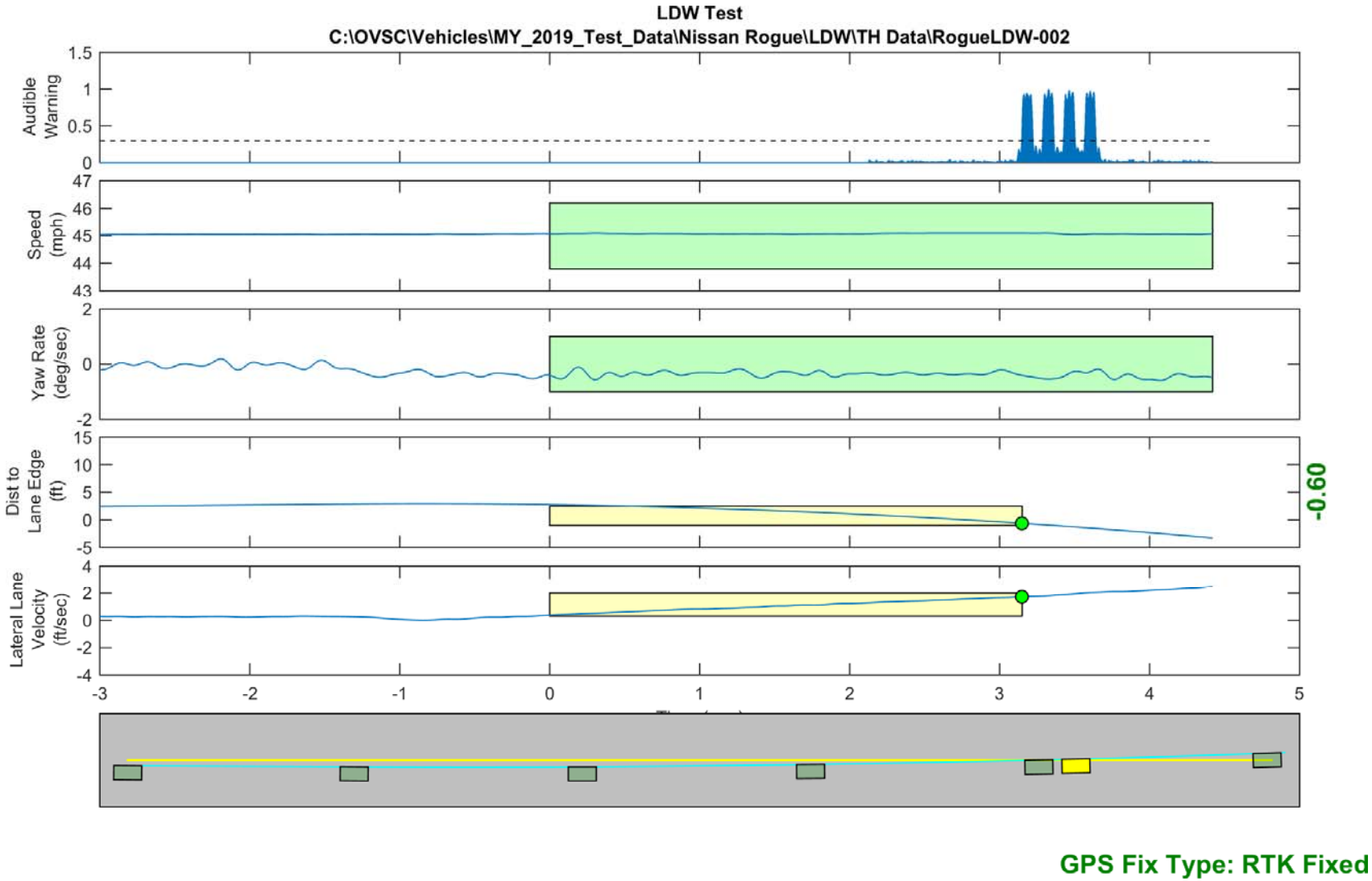

Figure D4. Time History for Run 2, Botts Dots, Left Departure, Audible Warning

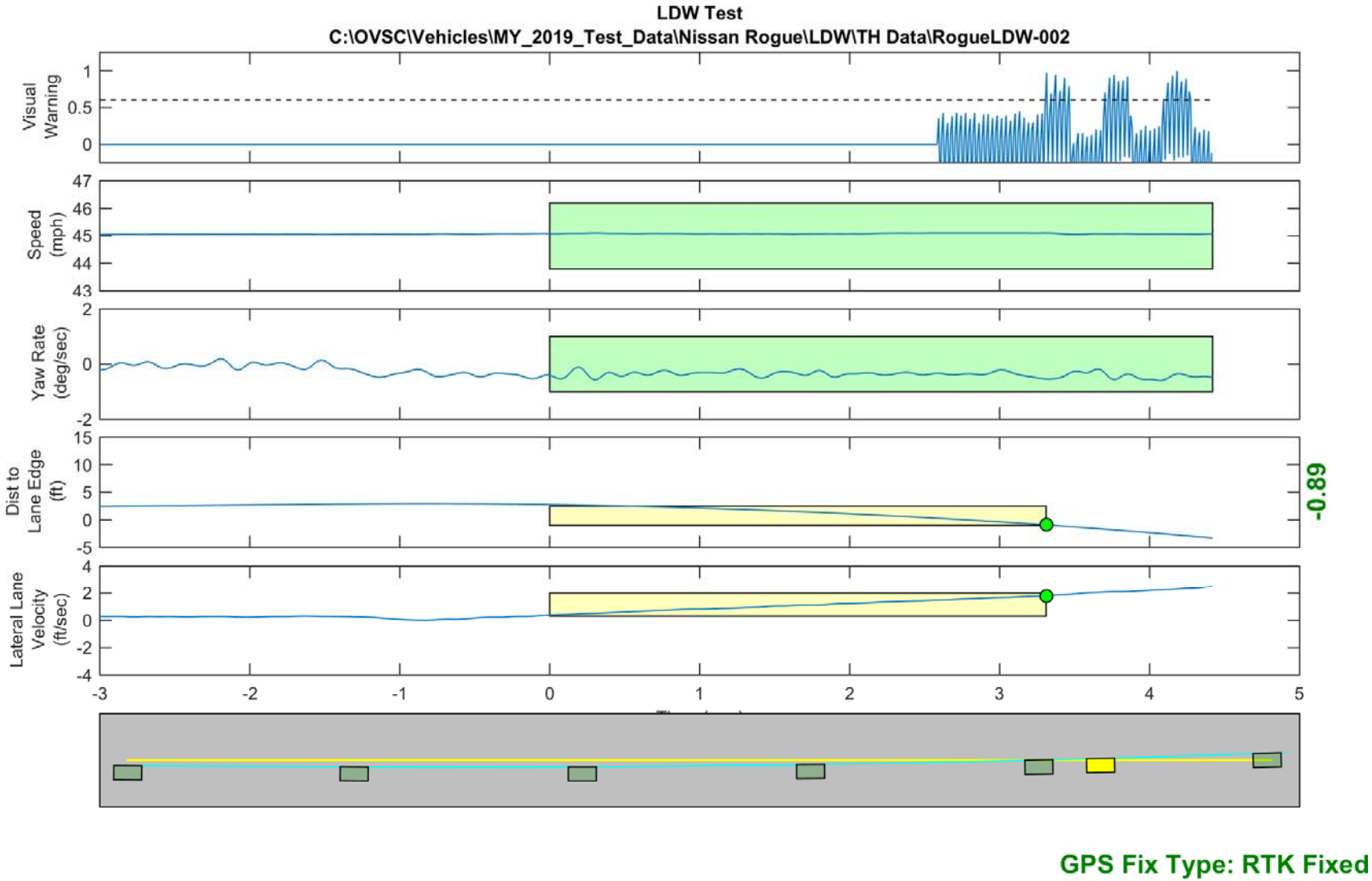

Figure D5. Time History for Run 2, Botts Dots, Left Departure, Visual Warning

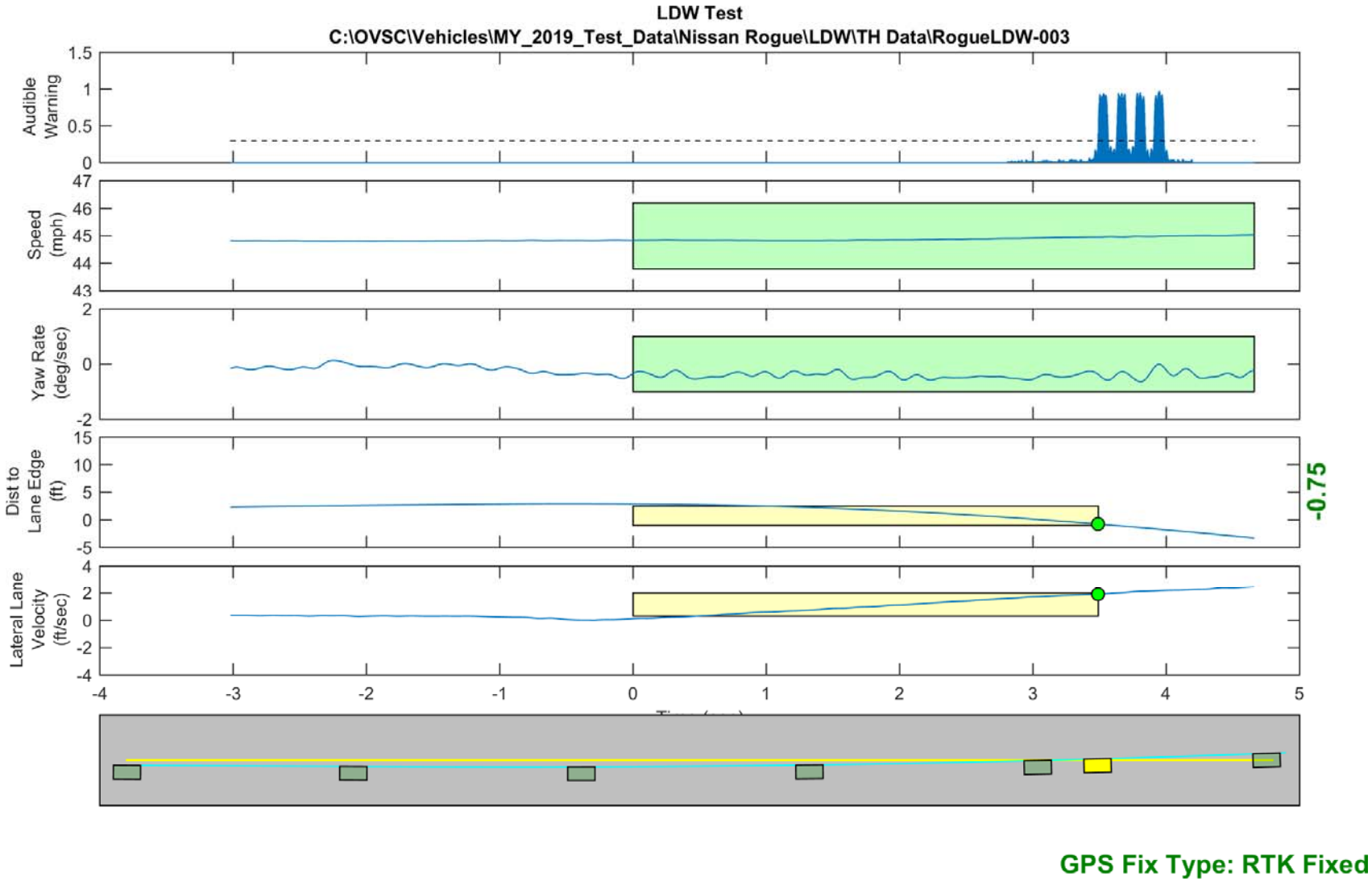

Figure D6. Time History for Run 3, Botts Dots, Left Departure, Audible Warning

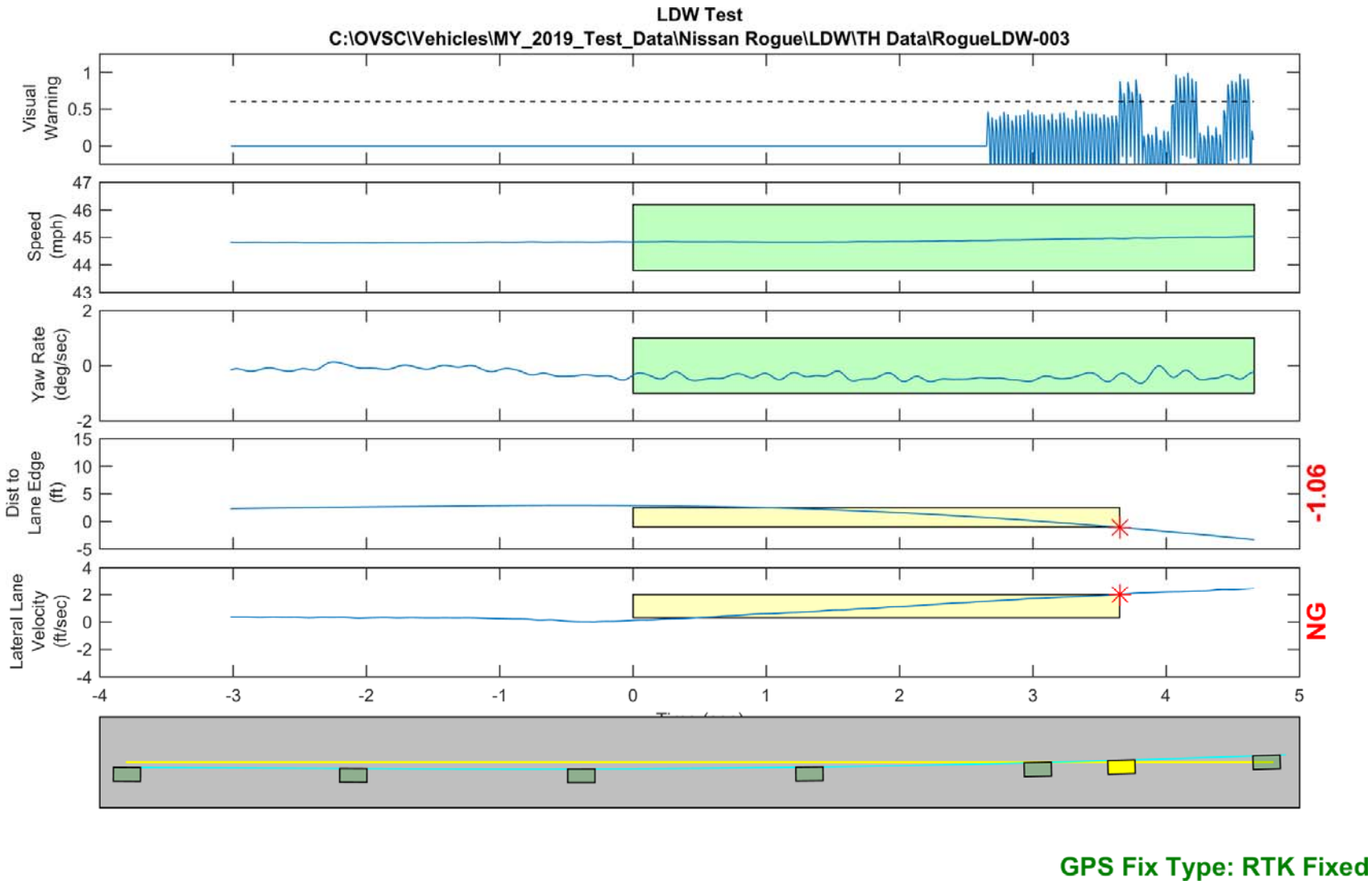

Figure D7. Time History for Run 3, Botts Dots, Left Departure, Visual Warning

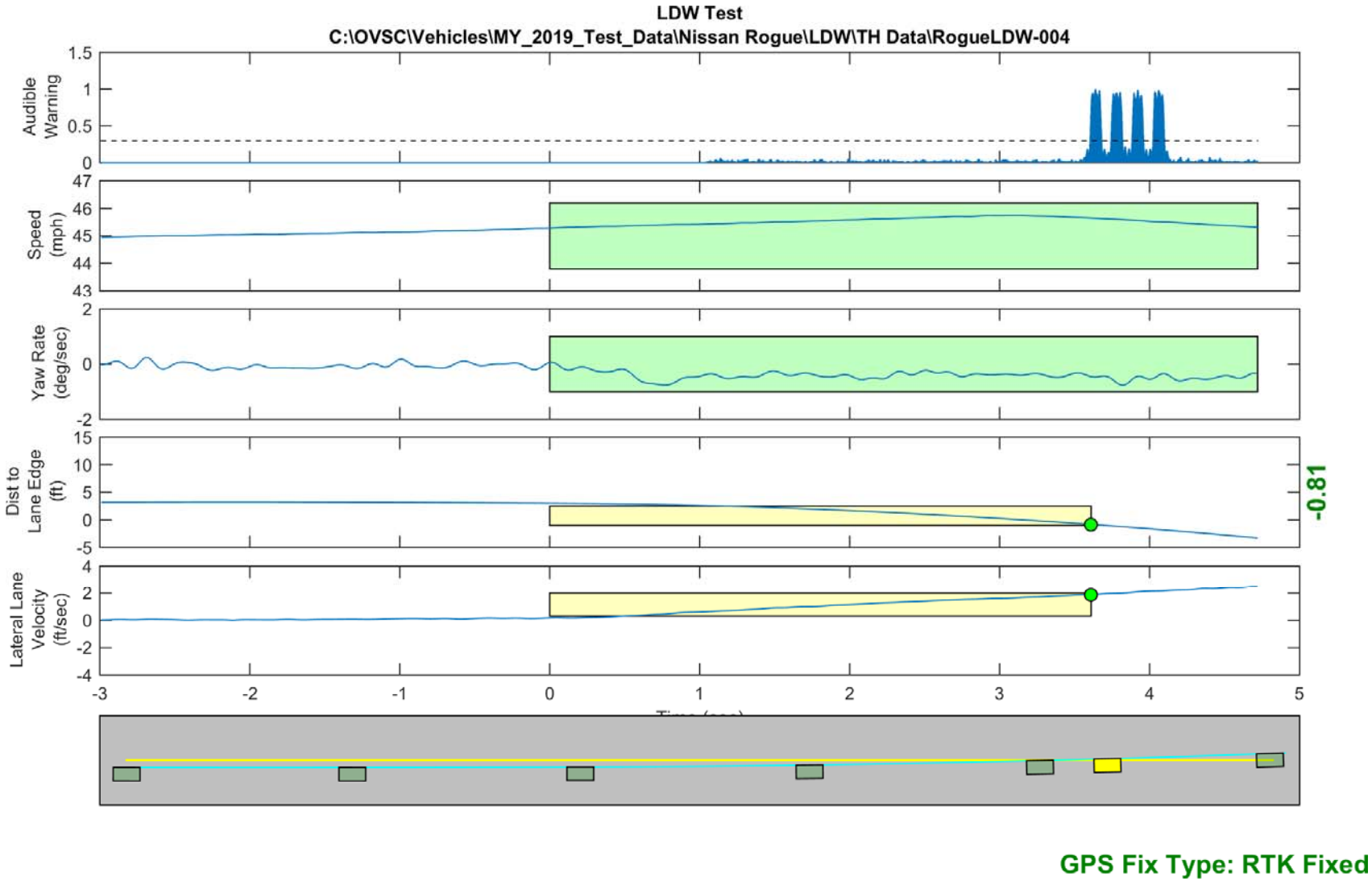

Figure D8. Time History for Run 4, Botts Dots, Left Departure, Audible Warning

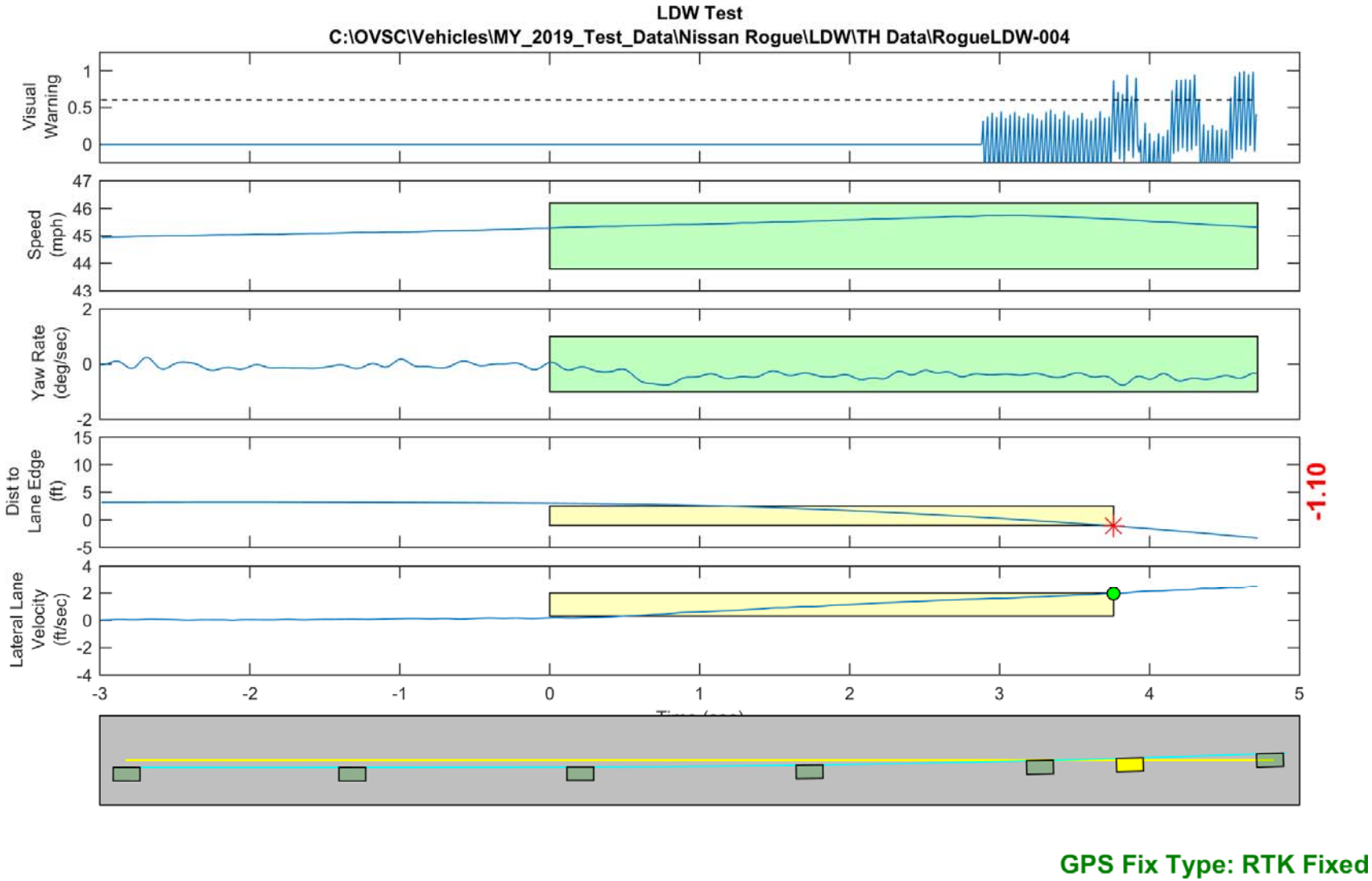

Figure D9. Time History for Run 4, Botts Dots, Left Departure, Visual Warning

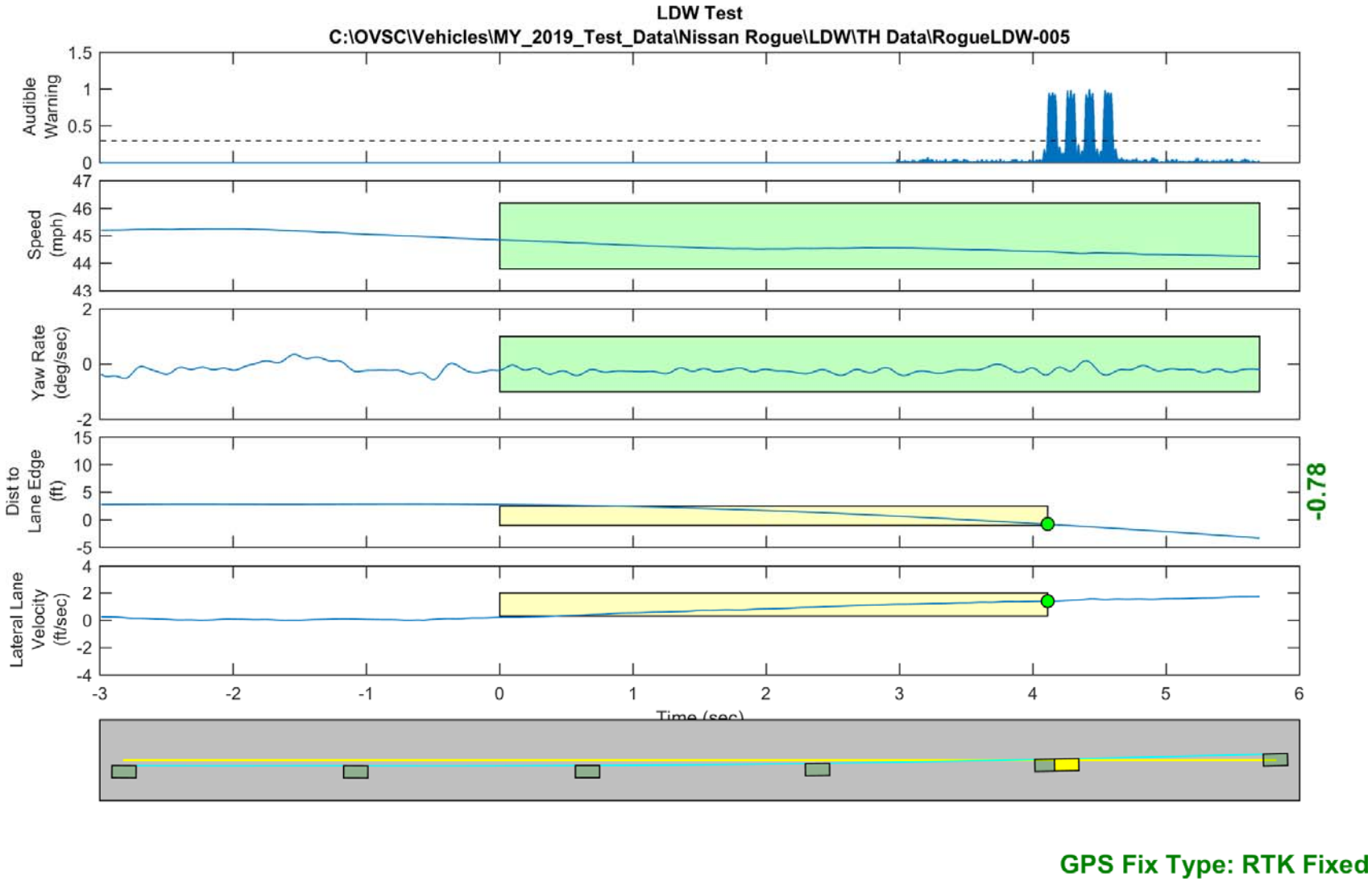

Figure D10. Time History for Run 5, Botts Dots, Left Departure, Audible Warning

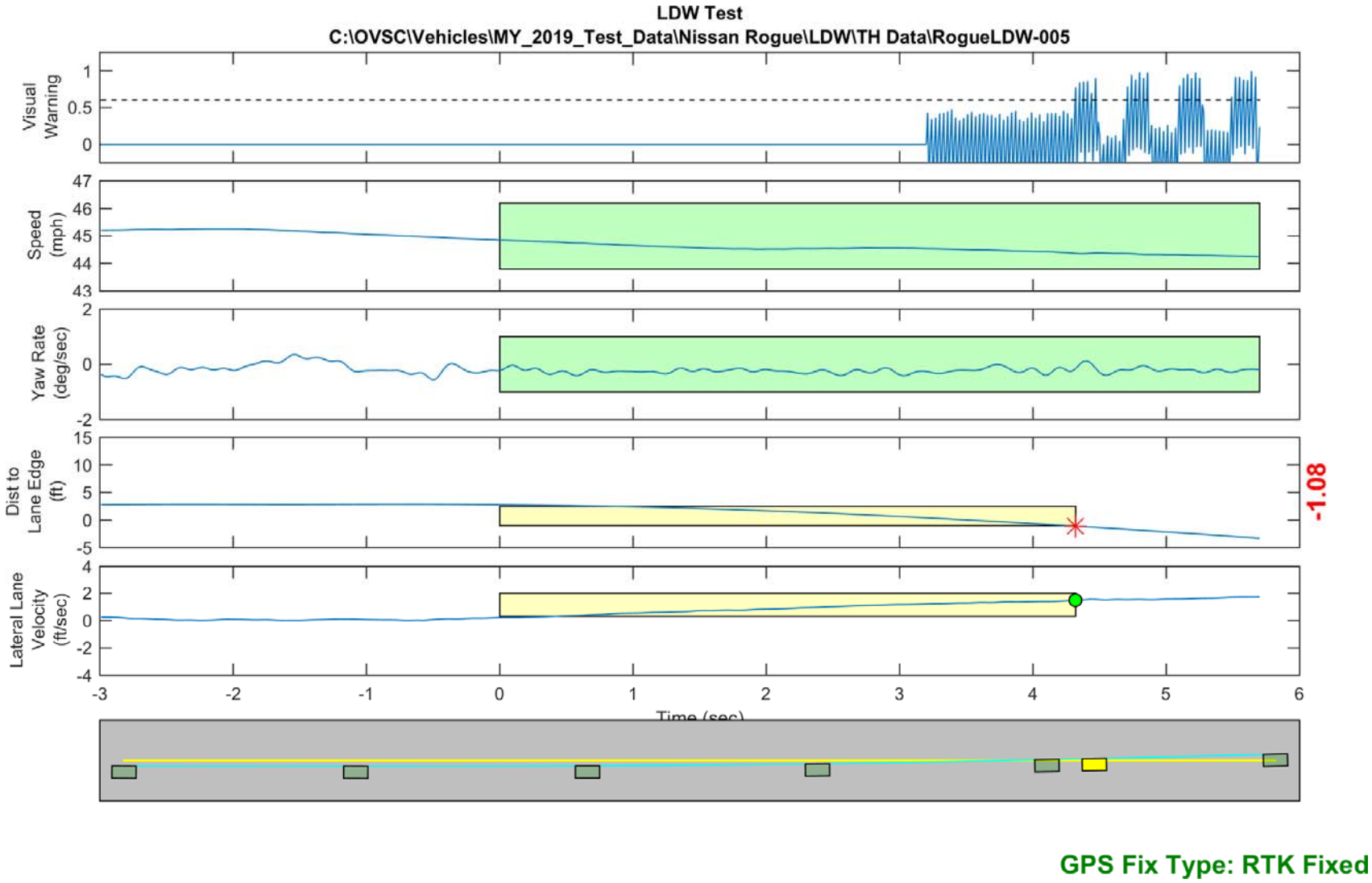

Figure D11. Time History for Run 5, Botts Dots, Left Departure, Visual Warning

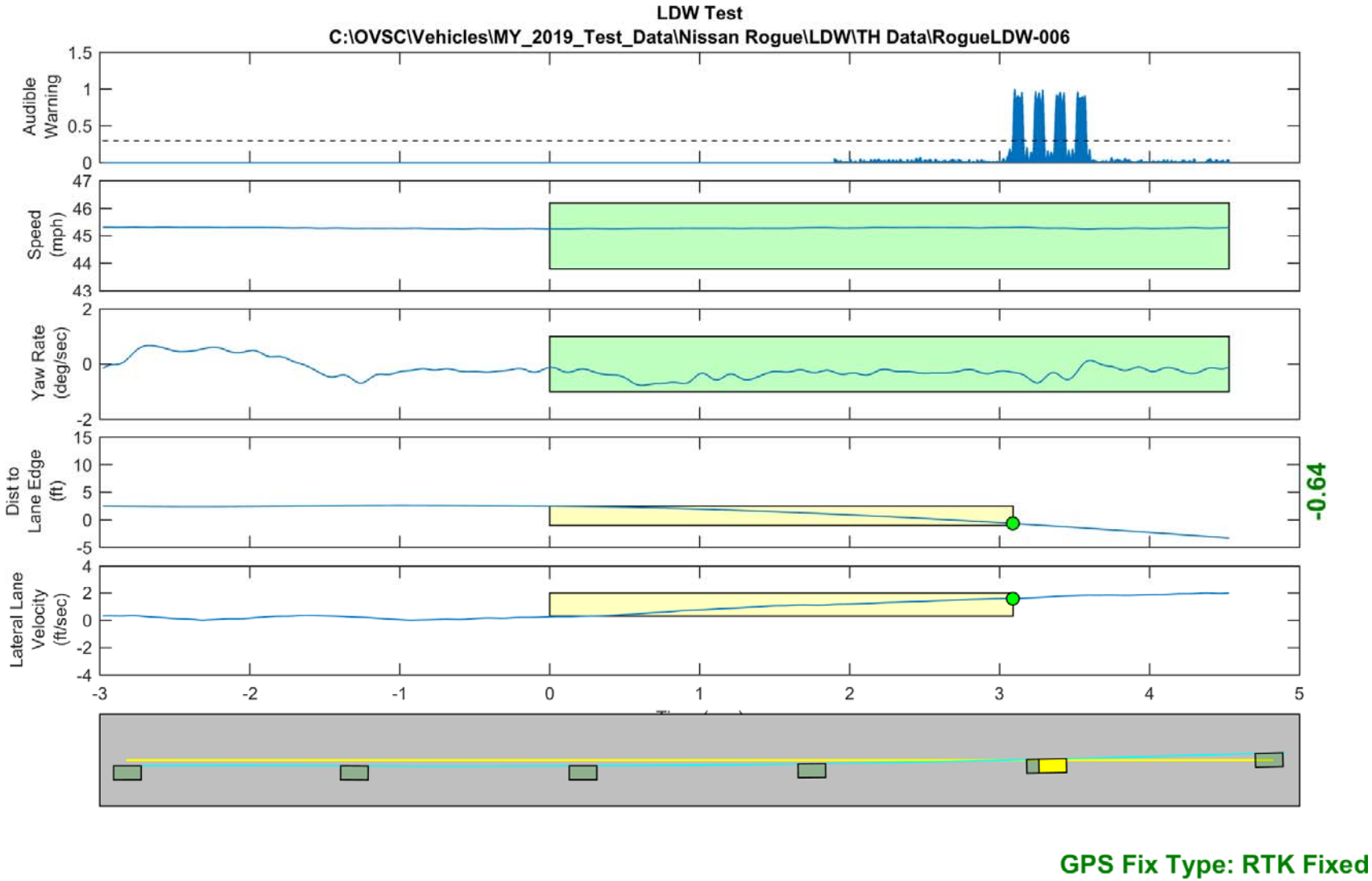

Figure D12. Time History for Run 6, Botts Dots, Left Departure, Audible Warning

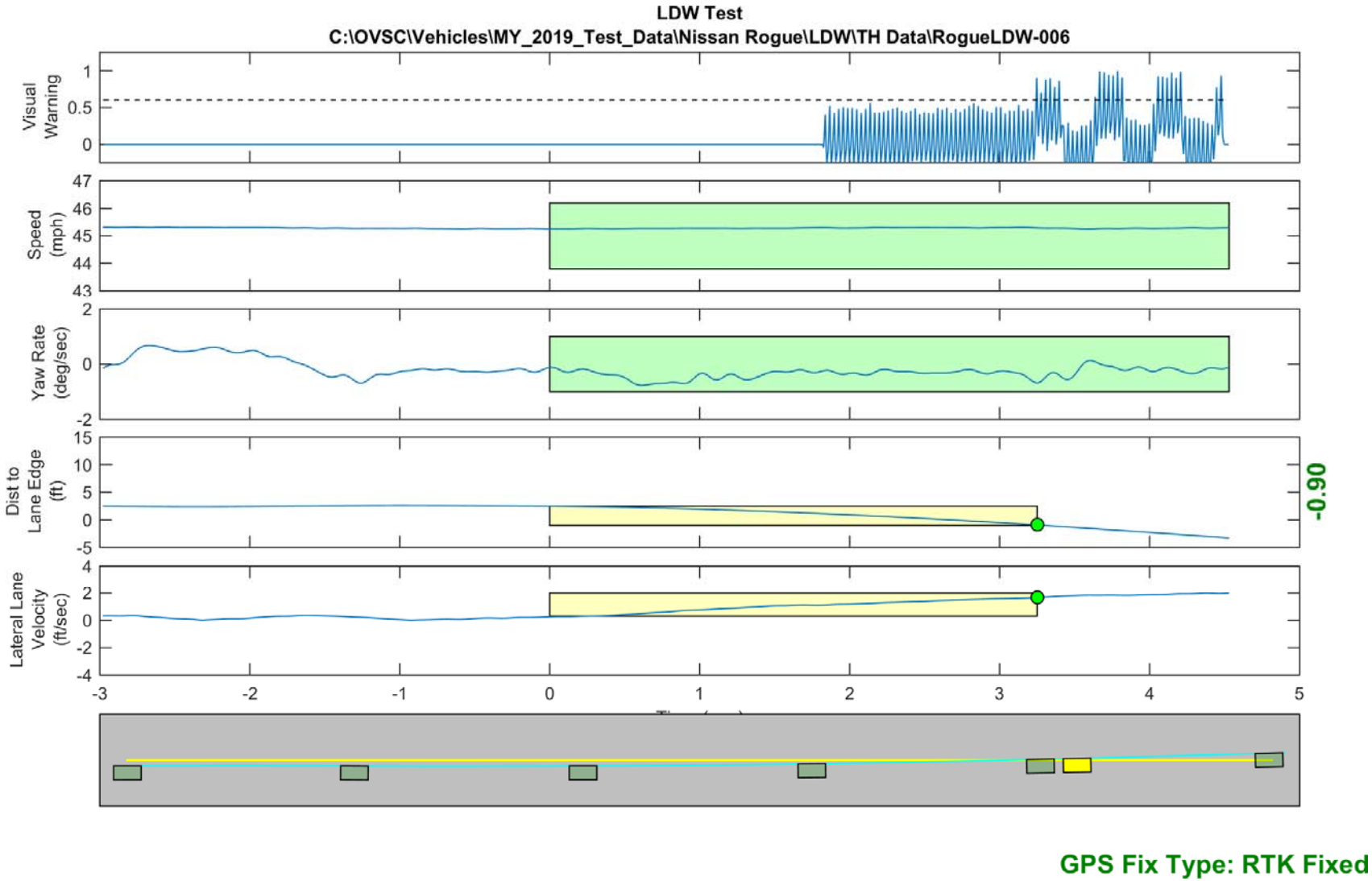

Figure D13. Time History for Run 6, Botts Dots, Left Departure, Visual Warning

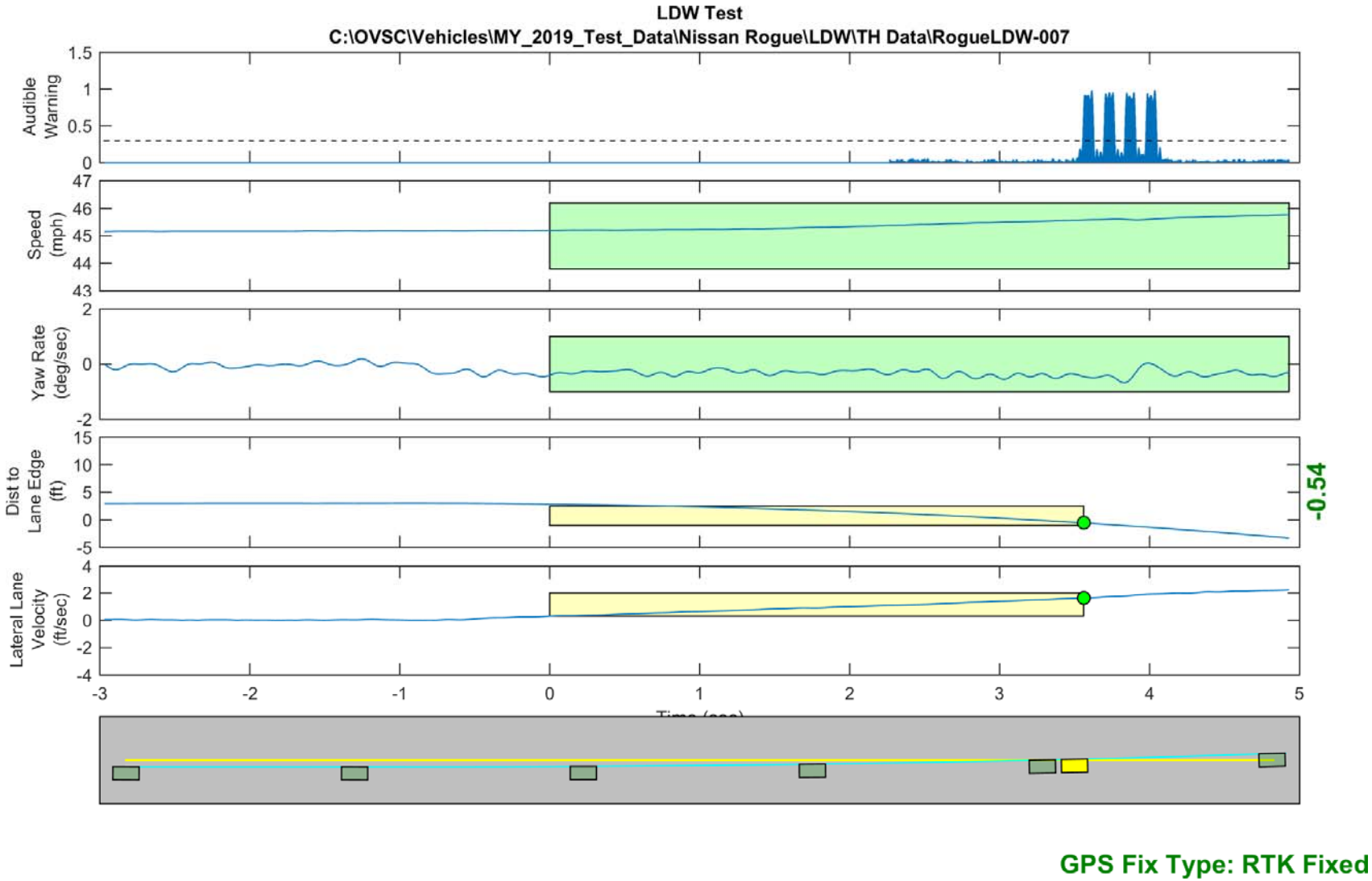

Figure D14. Time History for Run 7, Botts Dots, Left Departure, Audible Warning

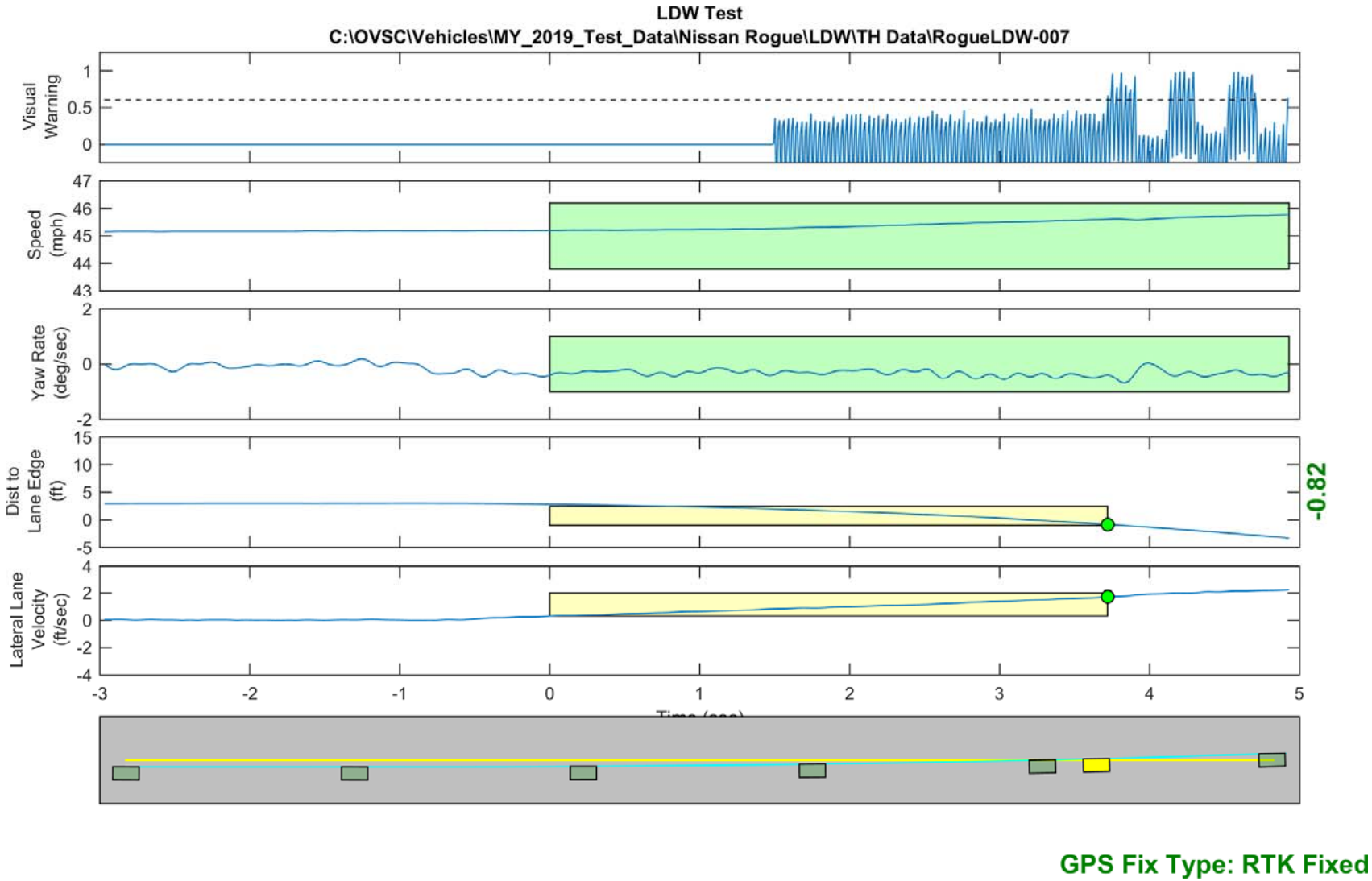

Figure D15. Time History for Run 7, Botts Dots, Left Departure, Visual Warning

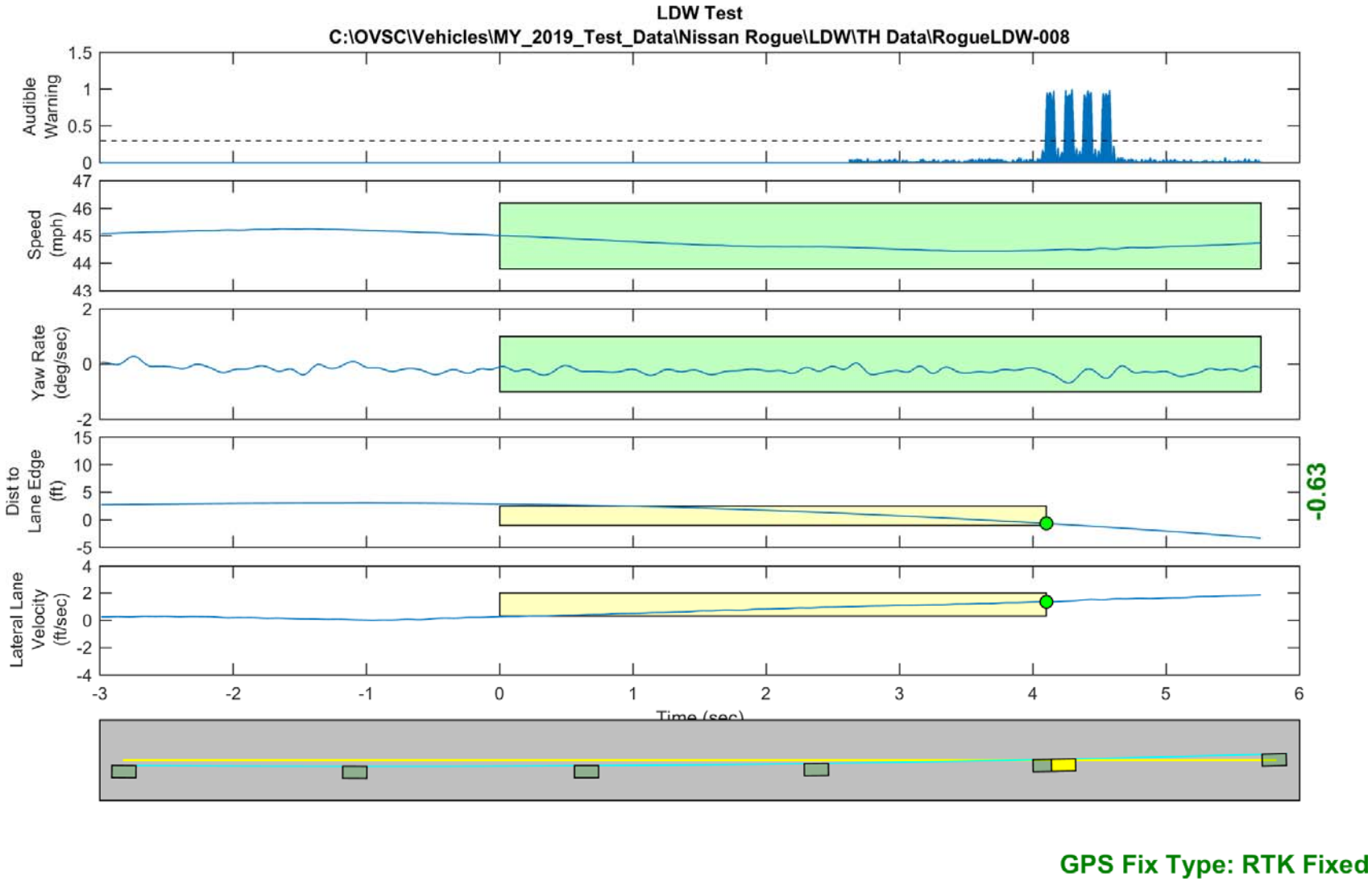

Figure D16. Time History for Run 8, Botts Dots, Left Departure, Audible Warning

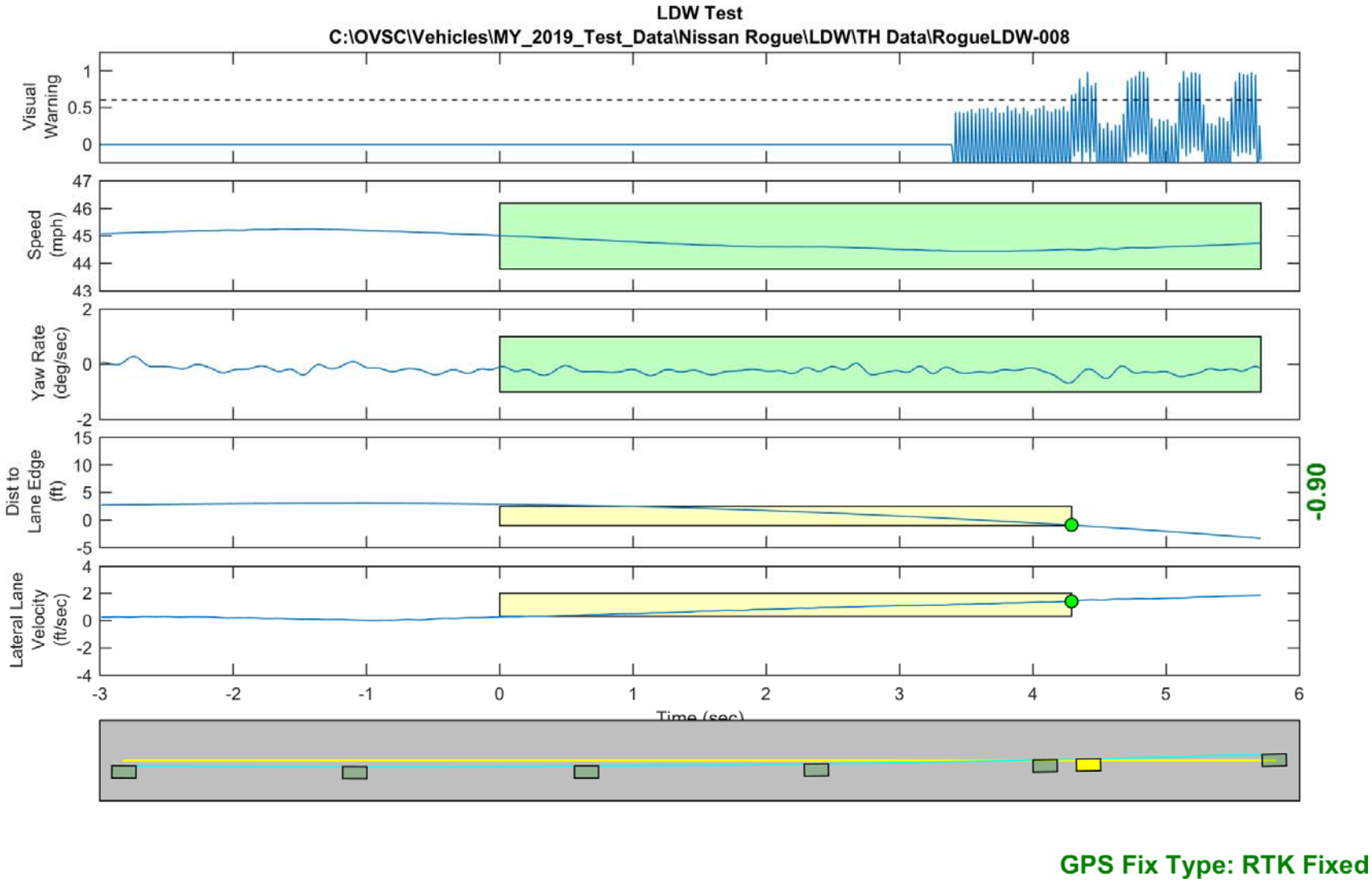

Figure D17. Time History for Run 8, Botts Dots, Left Departure, Visual Warning

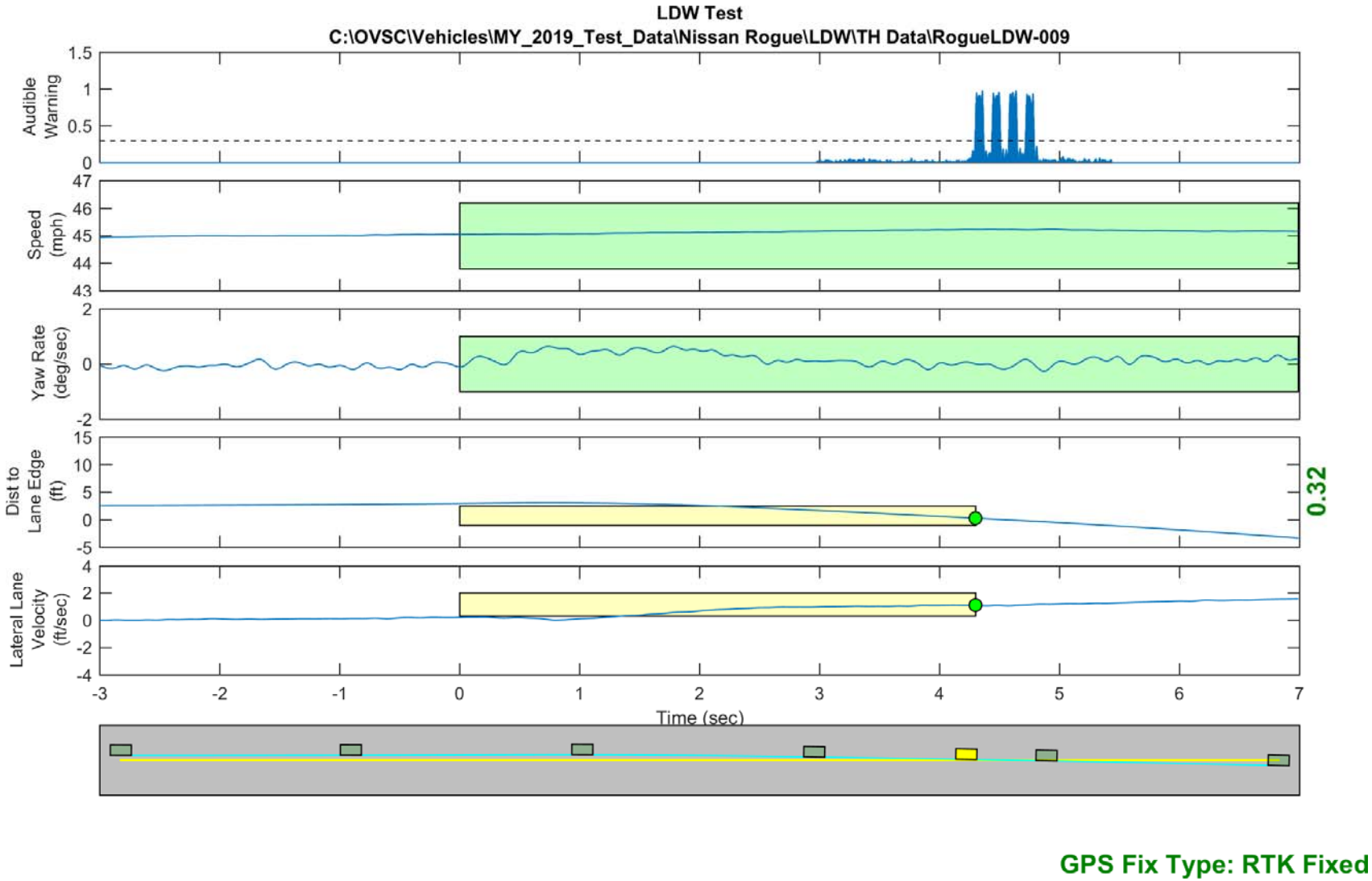

Figure D18. Time History for Run 9, Botts Dots, Right Departure, Audible Warning

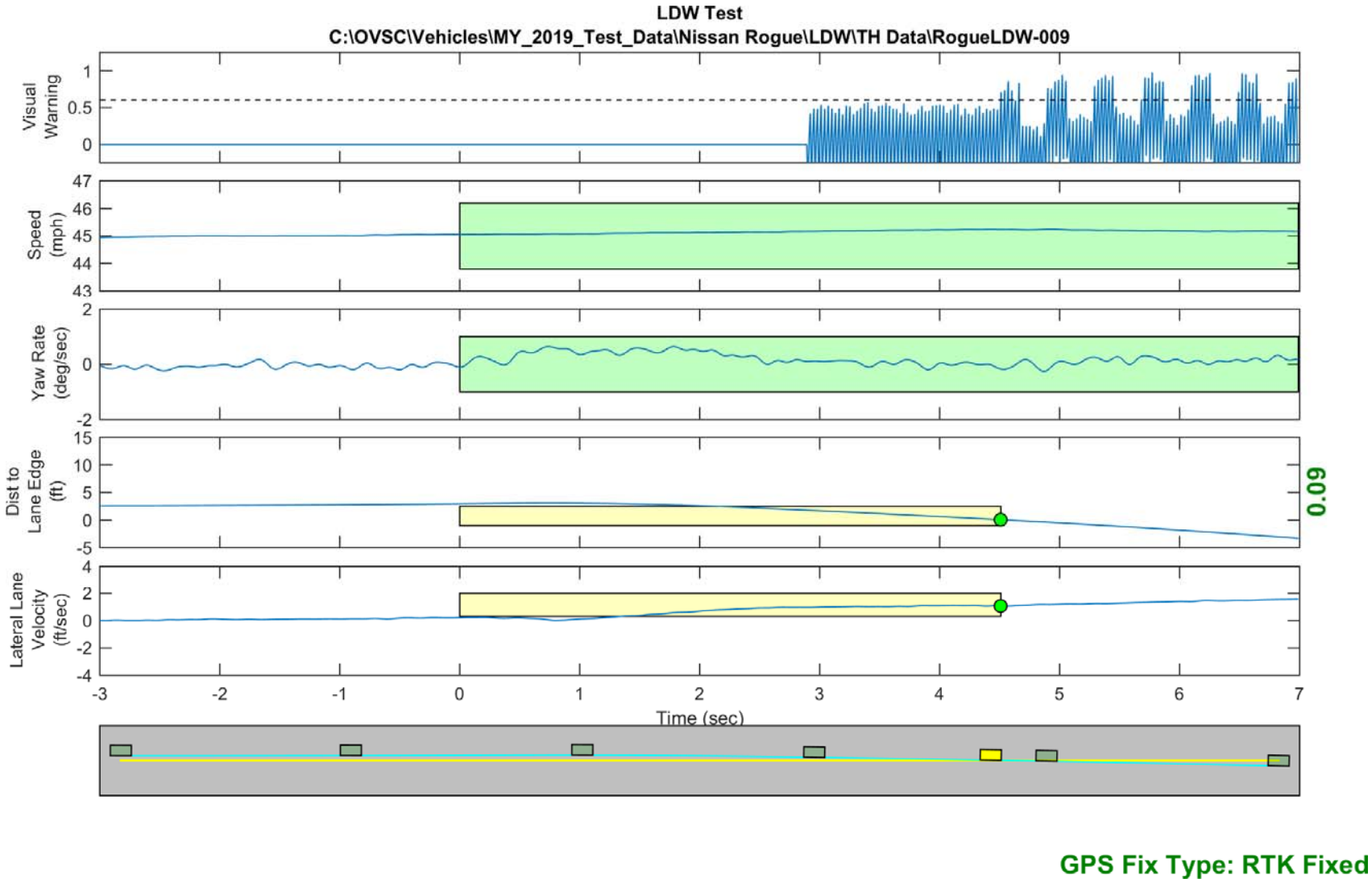

Figure D19. Time History for Run 9, Botts Dots, Right Departure, Visual Warning

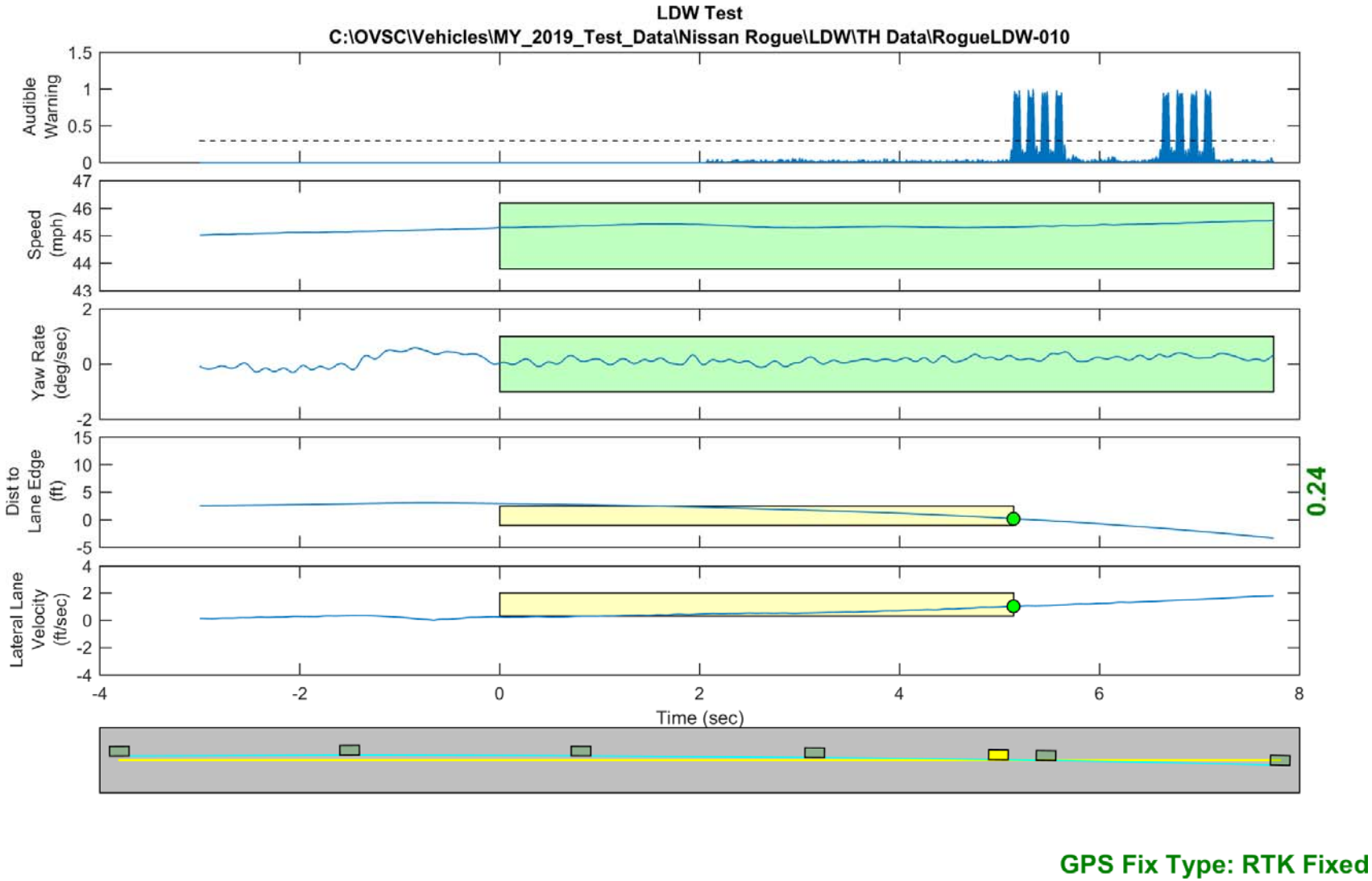

Figure D20. Time History for Run 10, Botts Dots, Right Departure, Audible Warning

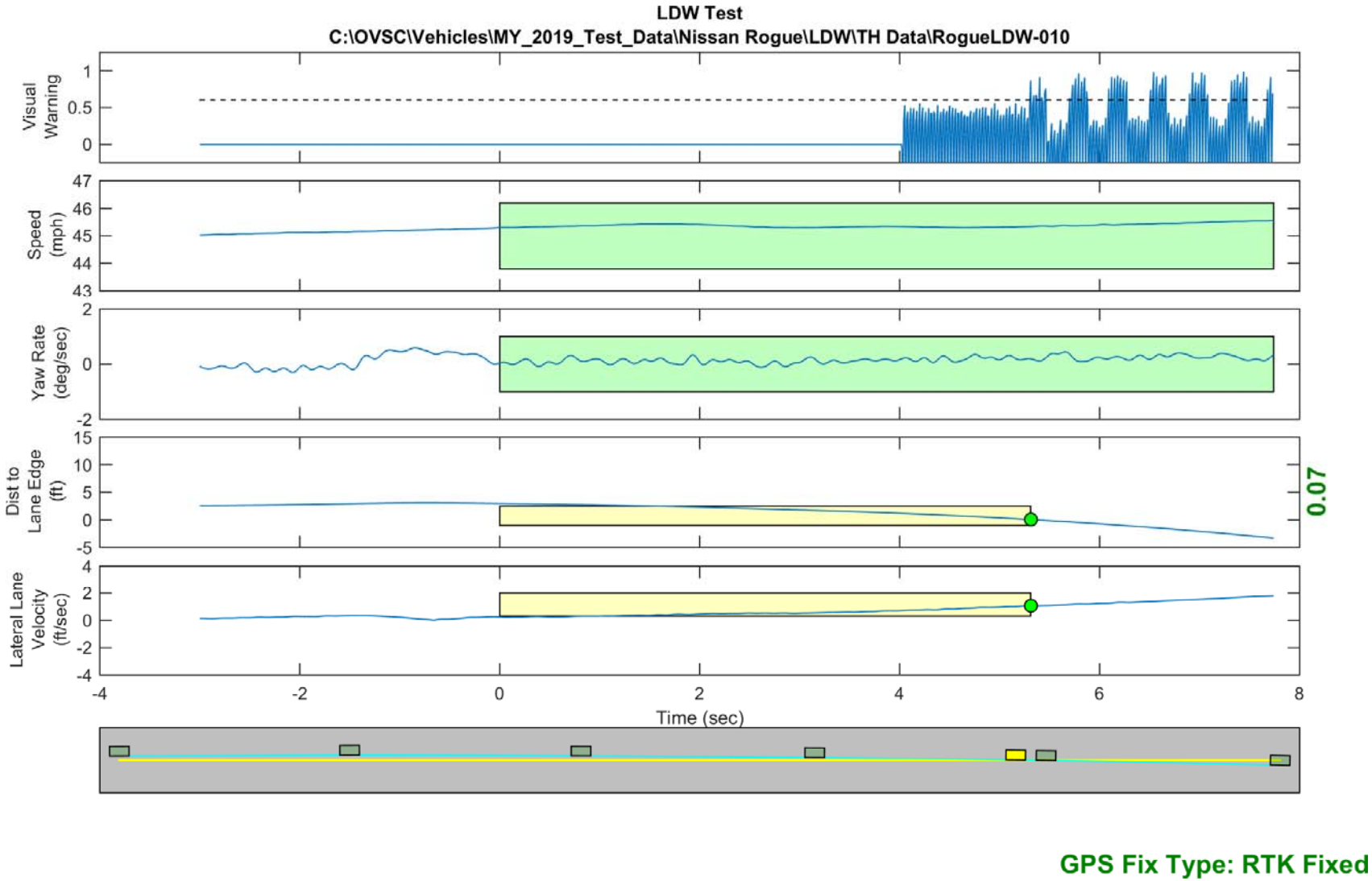

Figure D21. Time History for Run 10, Botts Dots, Right Departure, Visual Warning

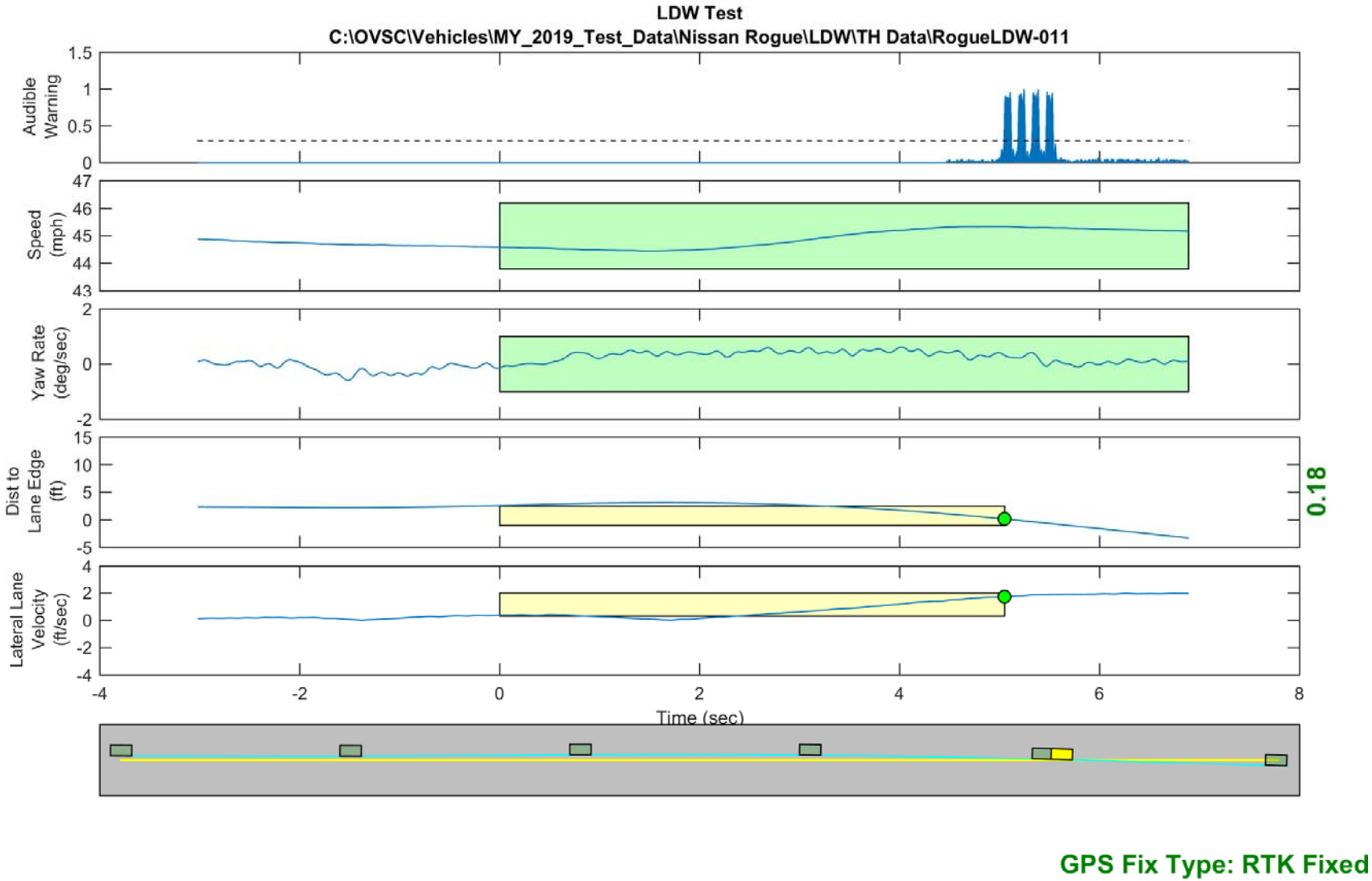

Figure D22. Time History for Run 11, Botts Dots, Right Departure, Audible Warning

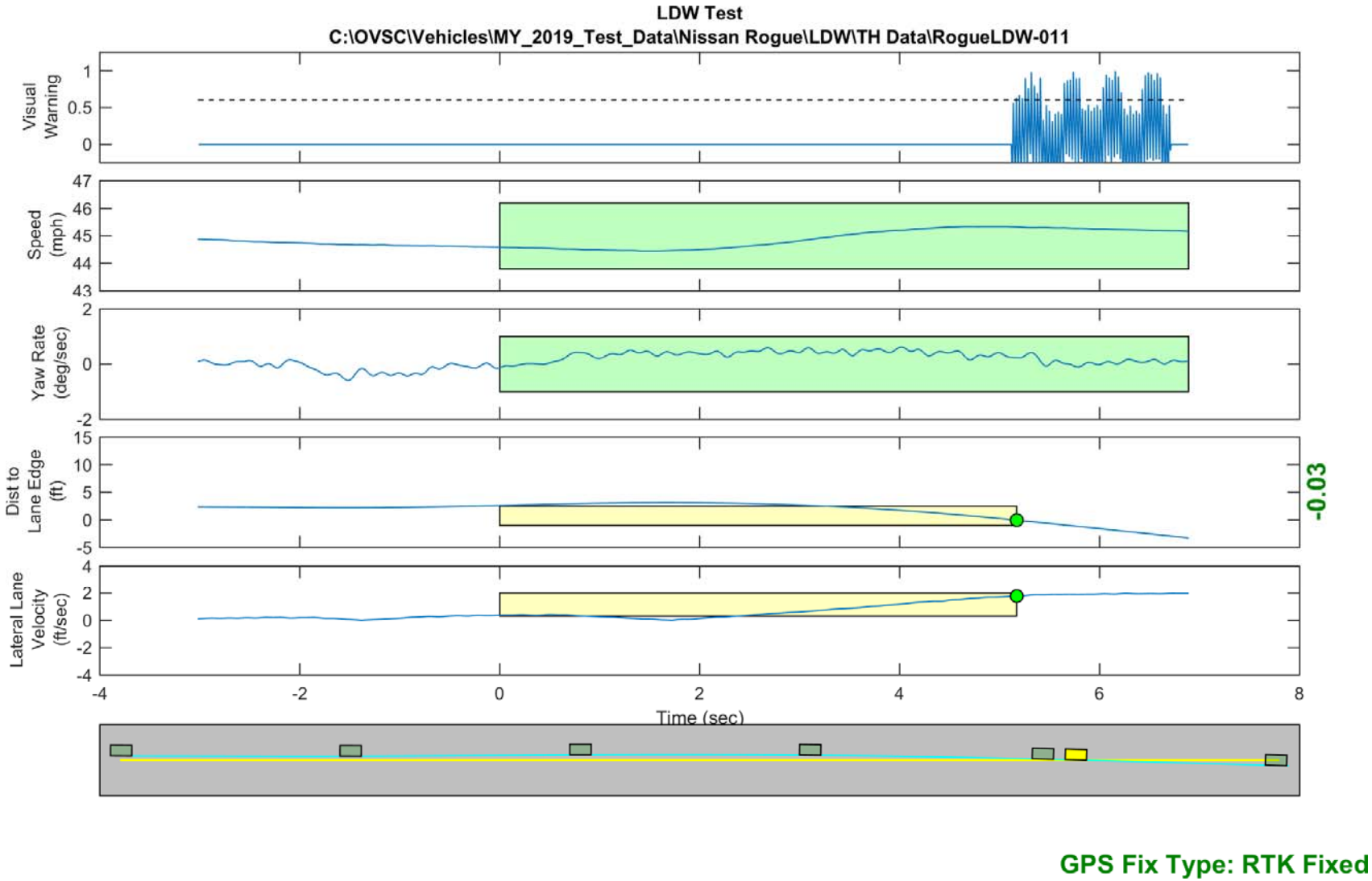

Figure D23. Time History for Run 11, Botts Dots, Right Departure, Visual Warning

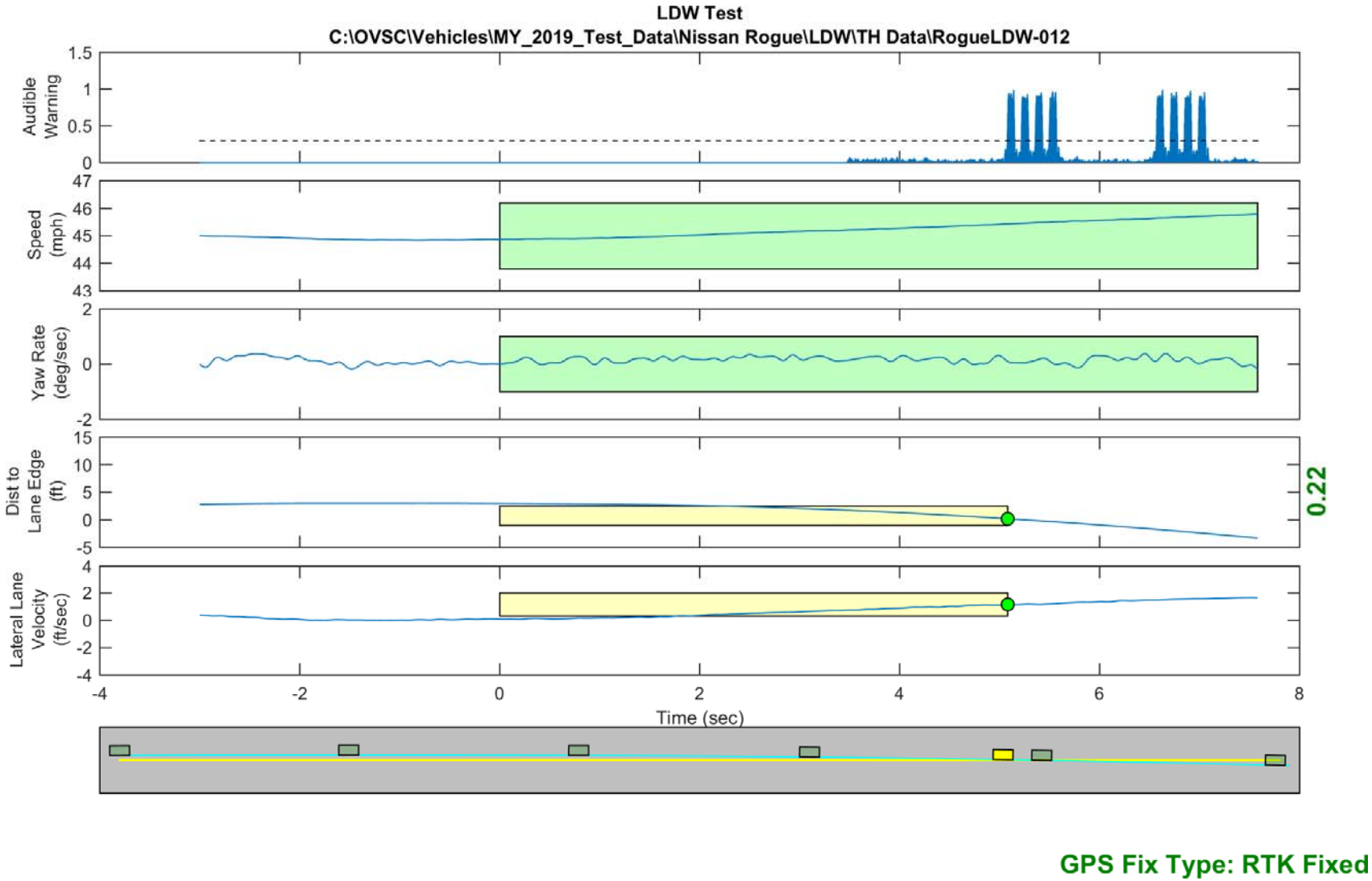

Figure D24. Time History for Run 12, Botts Dots, Right Departure, Audible Warning

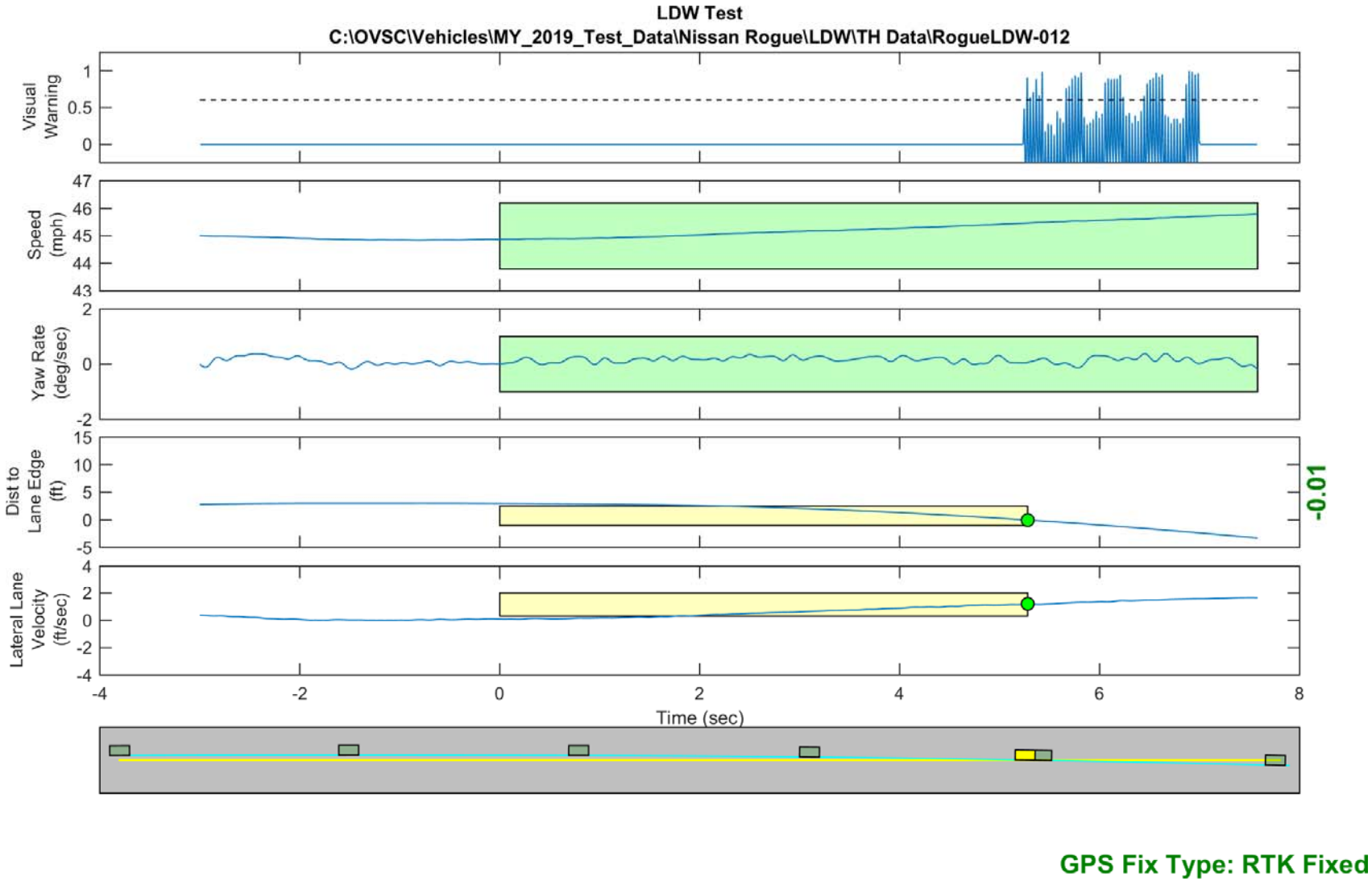

Figure D25. Time History for Run 12, Botts Dots, Right Departure, Visual Warning

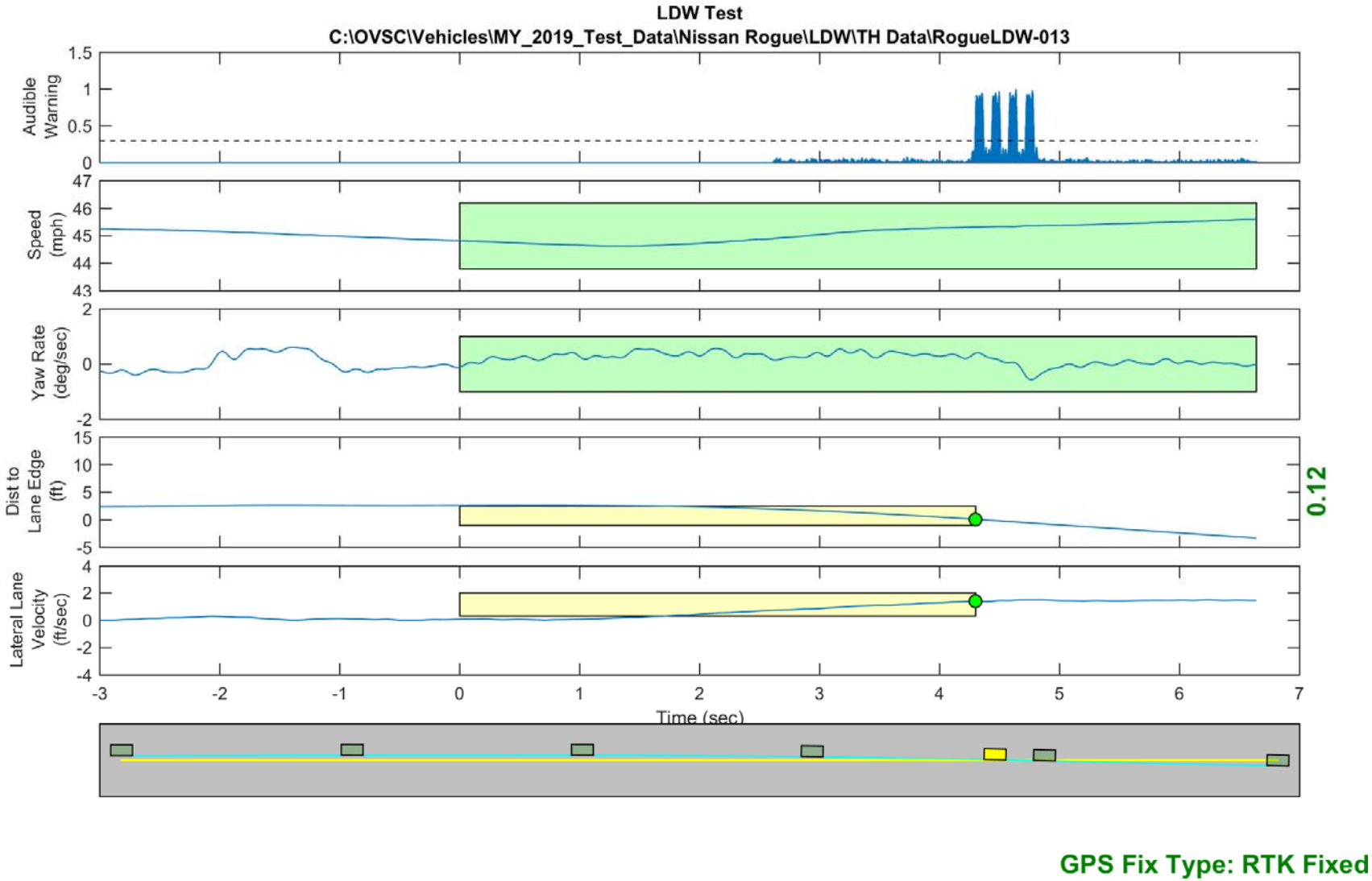

Figure D26. Time History for Run 13, Botts Dots, Right Departure, Audible Warning

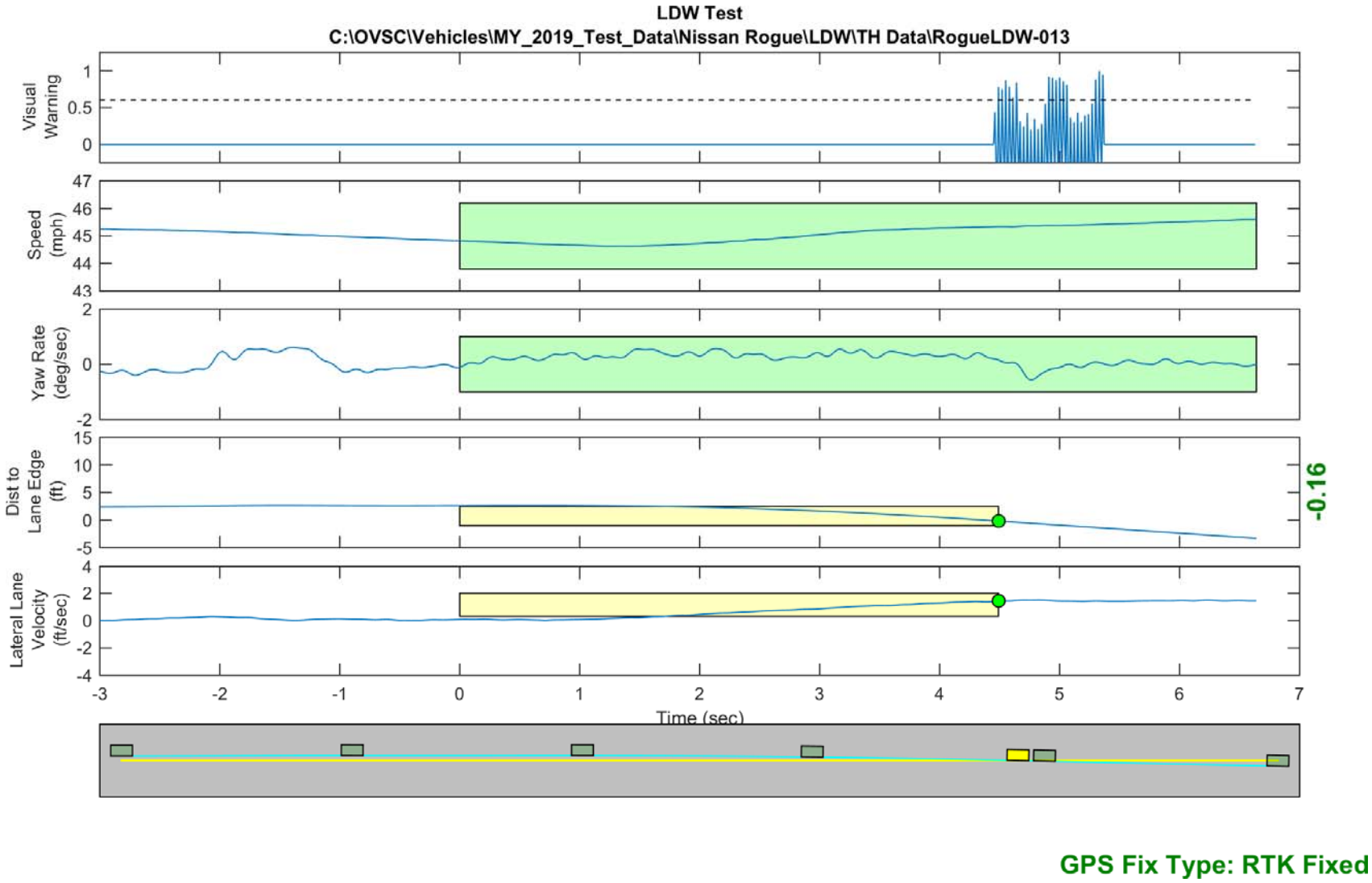

Figure D27. Time History for Run 13, Botts Dots, Right Departure, Visual Warning

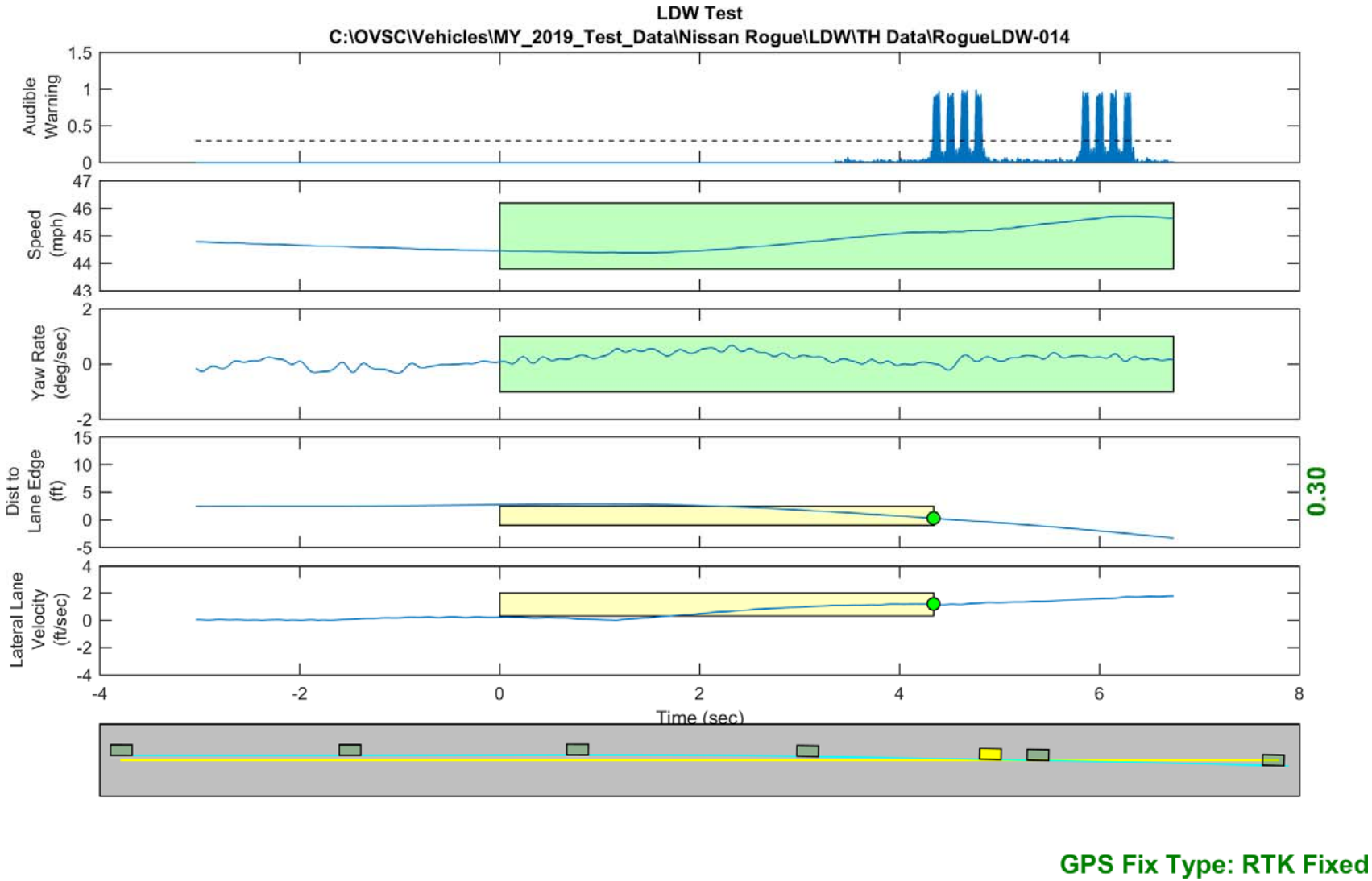

Figure D28. Time History for Run 14, Botts Dots, Right Departure, Audible Warning

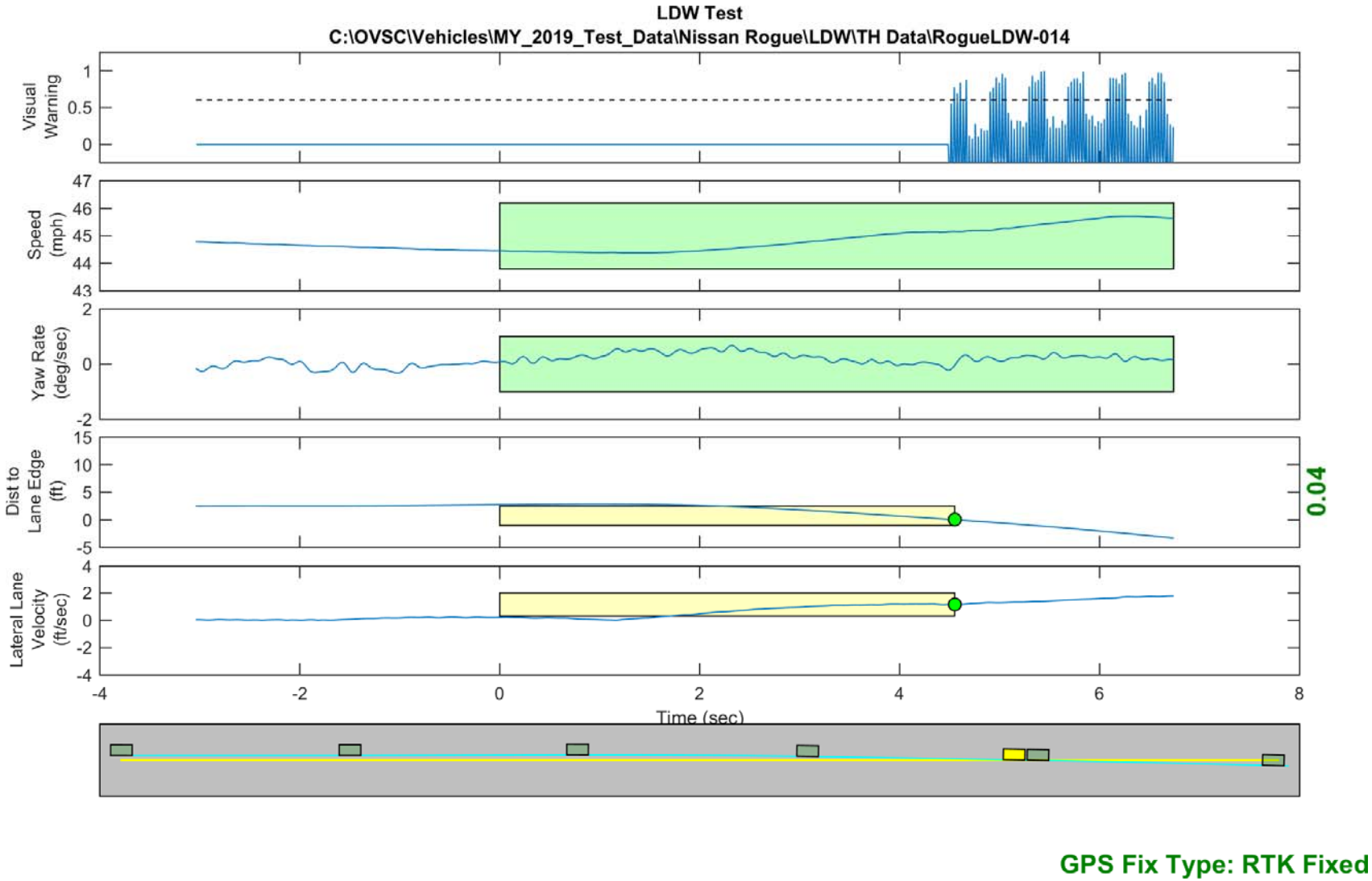

Figure D29. Time History for Run 14, Botts Dots, Right Departure, Visual Warning

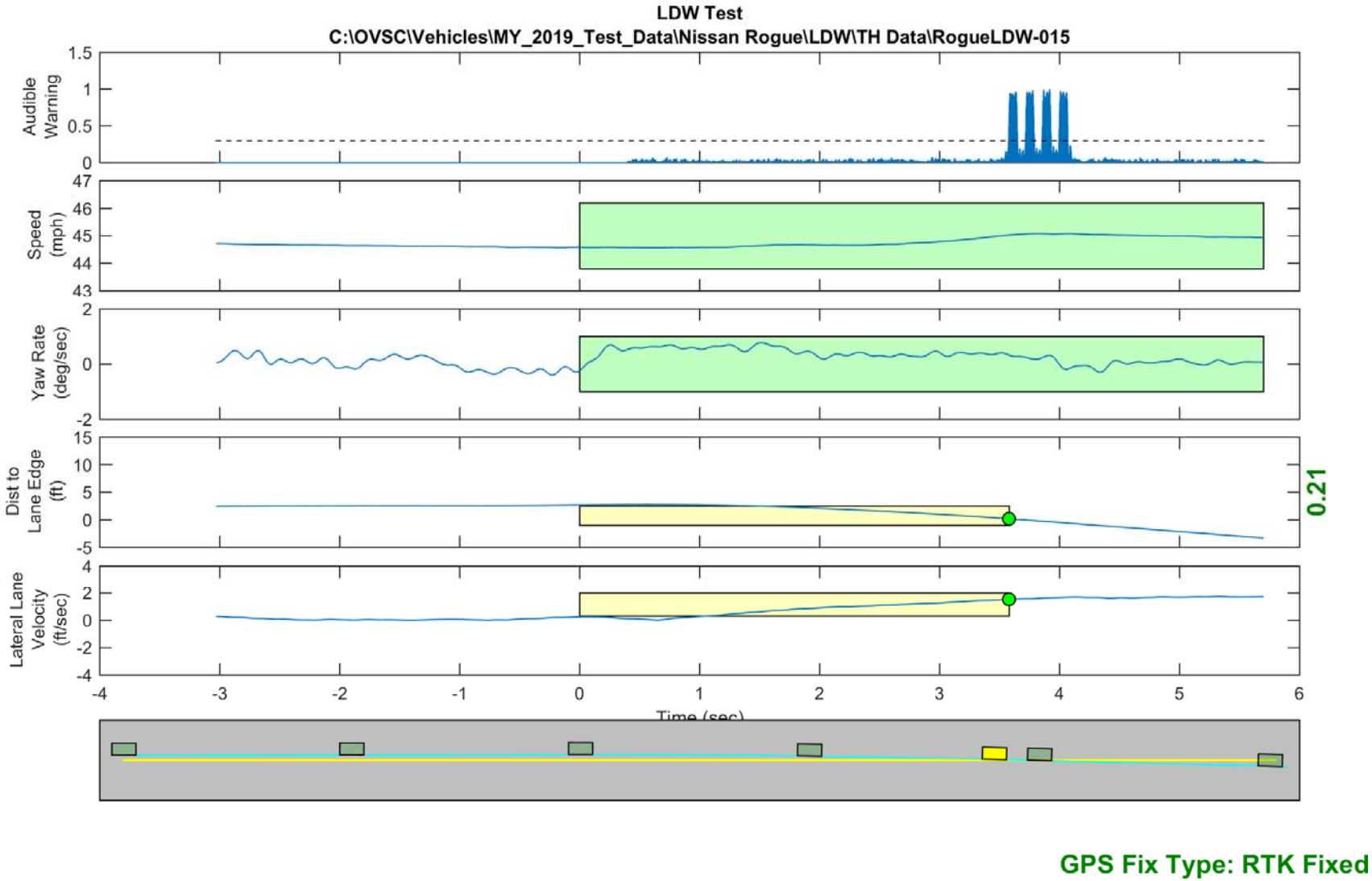

Figure D30. Time History for Run 15, Botts Dots, Right Departure, Audible Warning

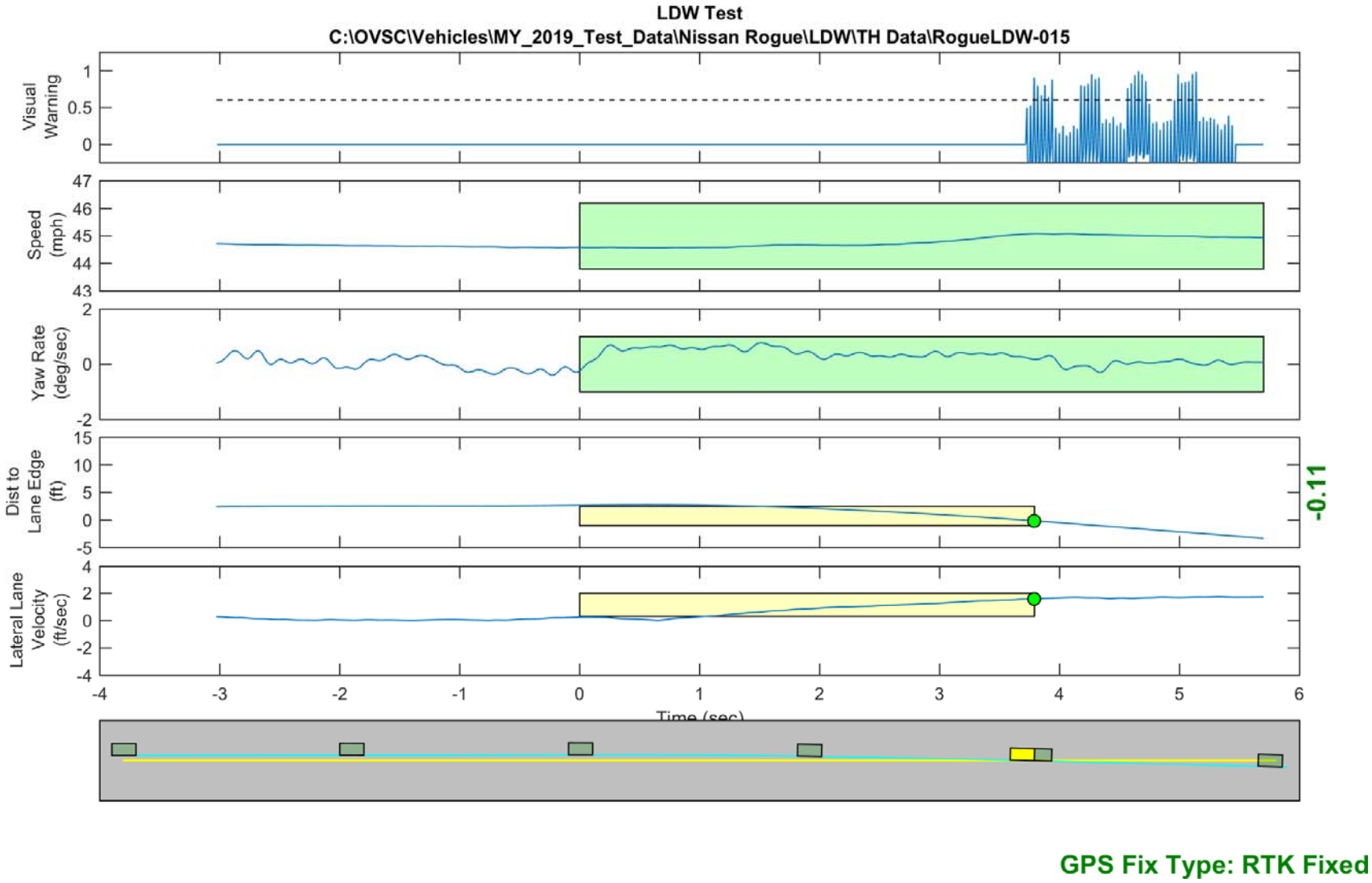

Figure D31. Time History for Run 15, Botts Dots, Right Departure, Visual Warning

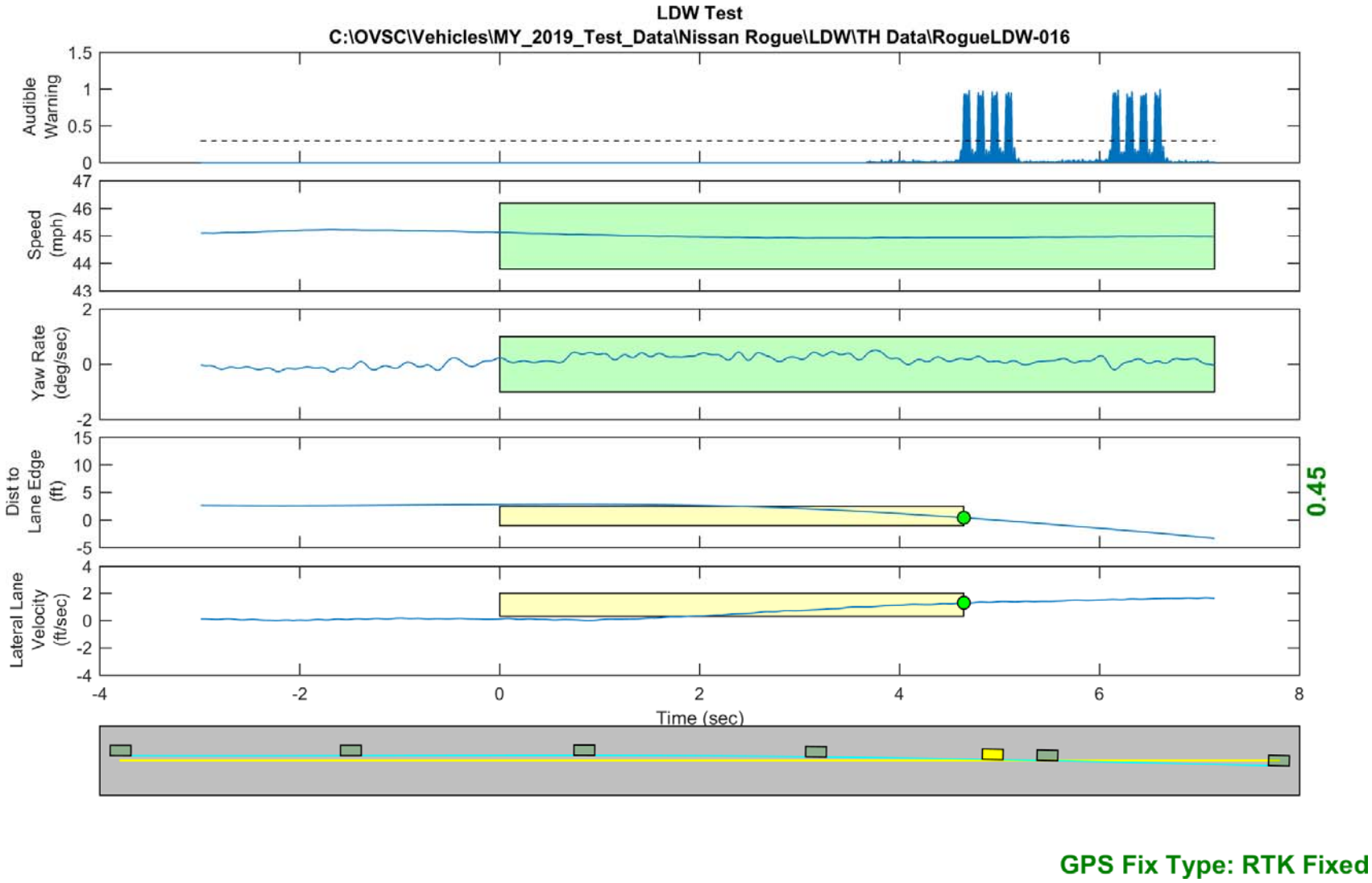

Figure D32. Time History for Run 16, Solid Line, Right Departure, Audible Warning

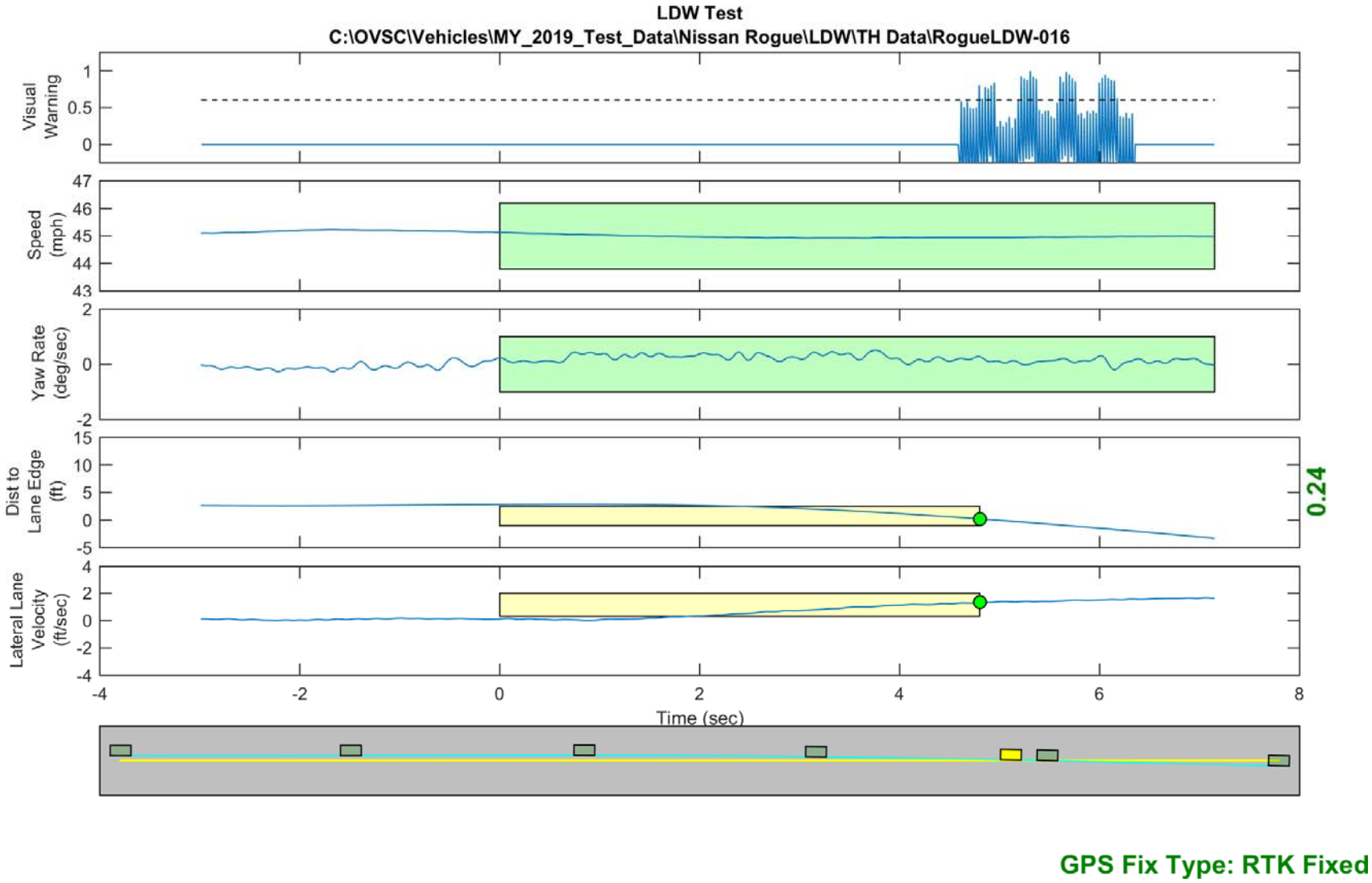

Figure D33. Time History for Run 16, Solid Line, Right Departure, Visual Warning

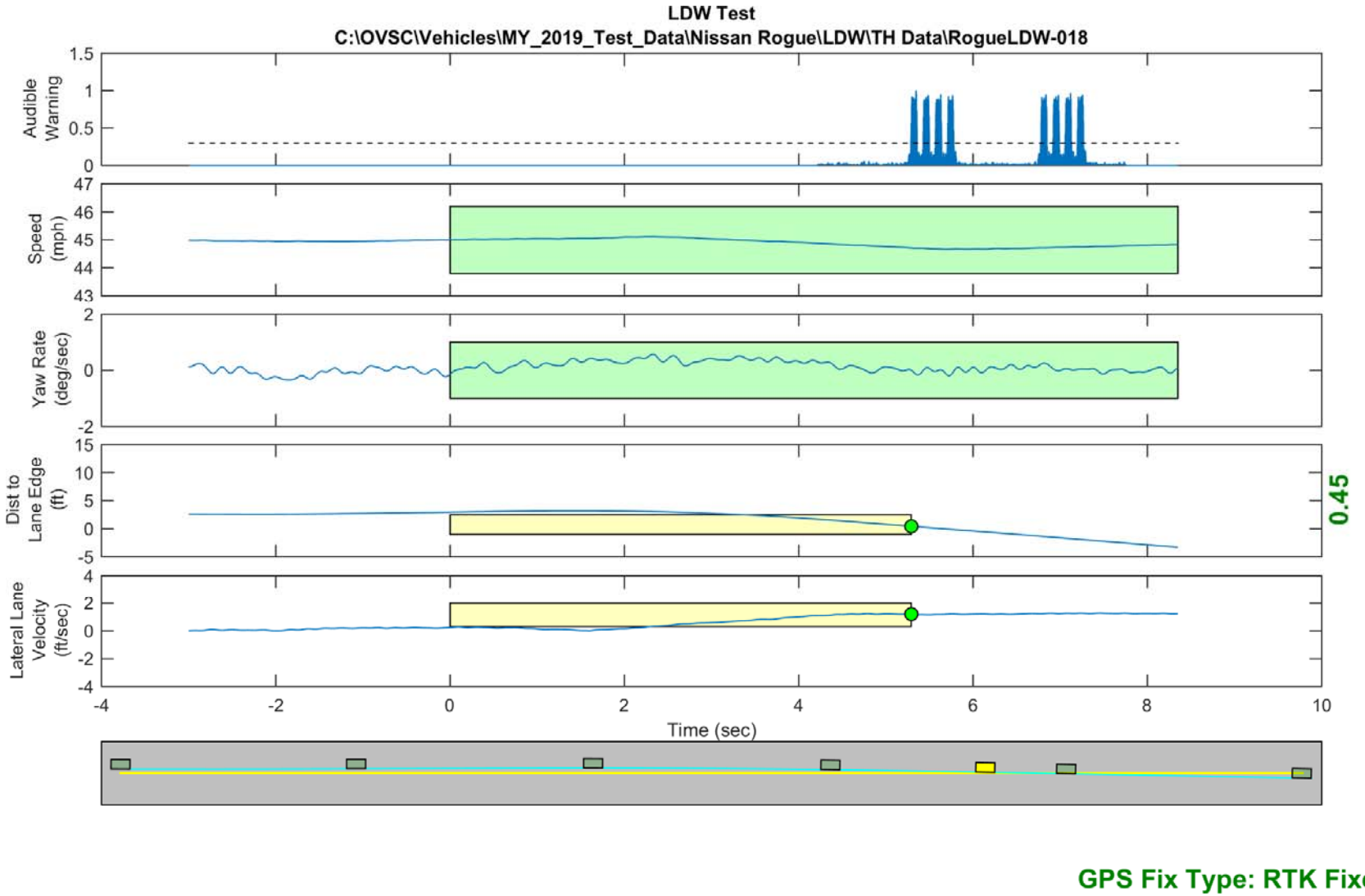

Figure D34. Time History for Run 18, Solid Line, Right Departure, Audible Warning

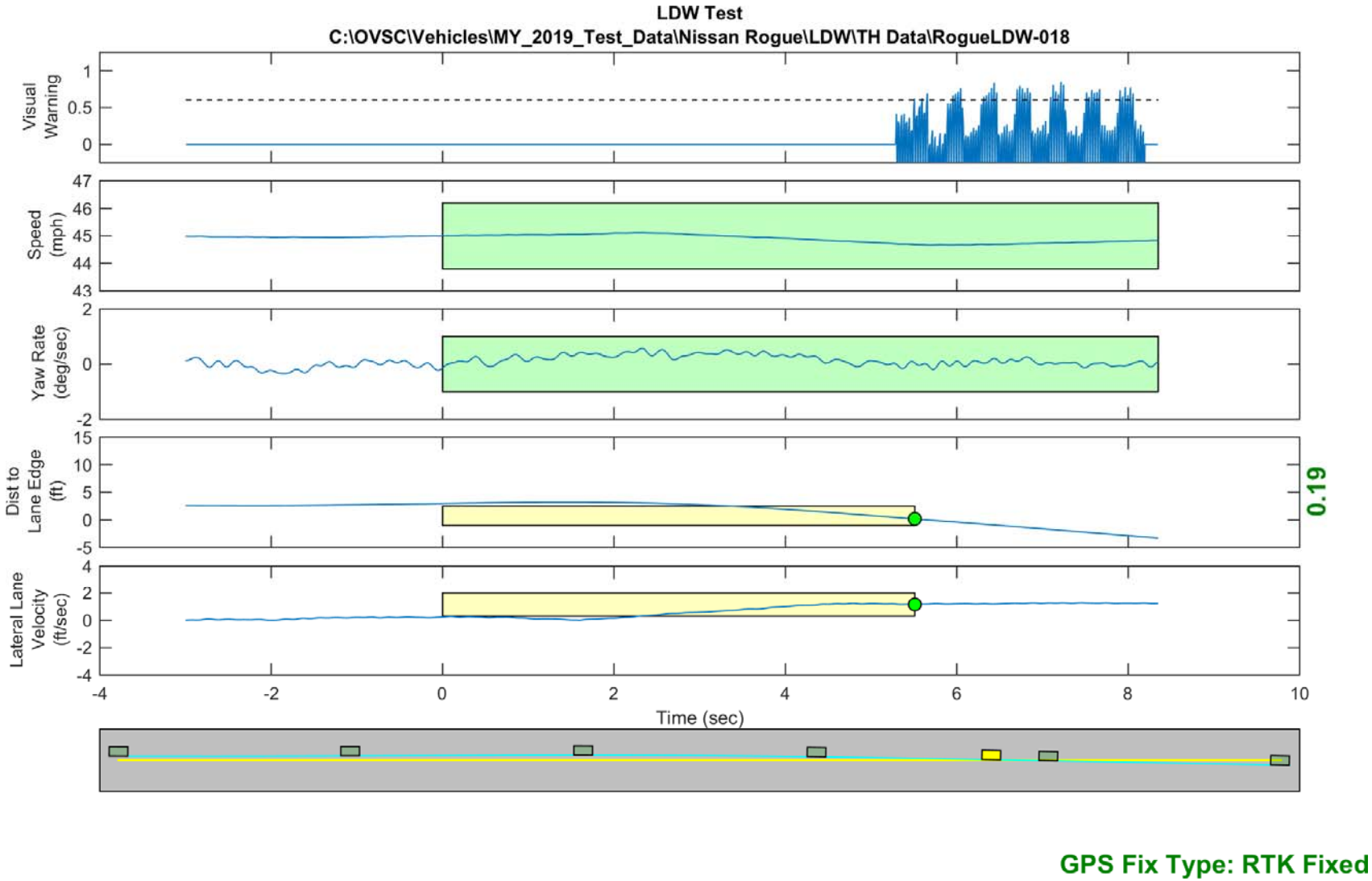

Figure D35. Time History for Run 18, Solid Line, Right Departure, Visual Warning

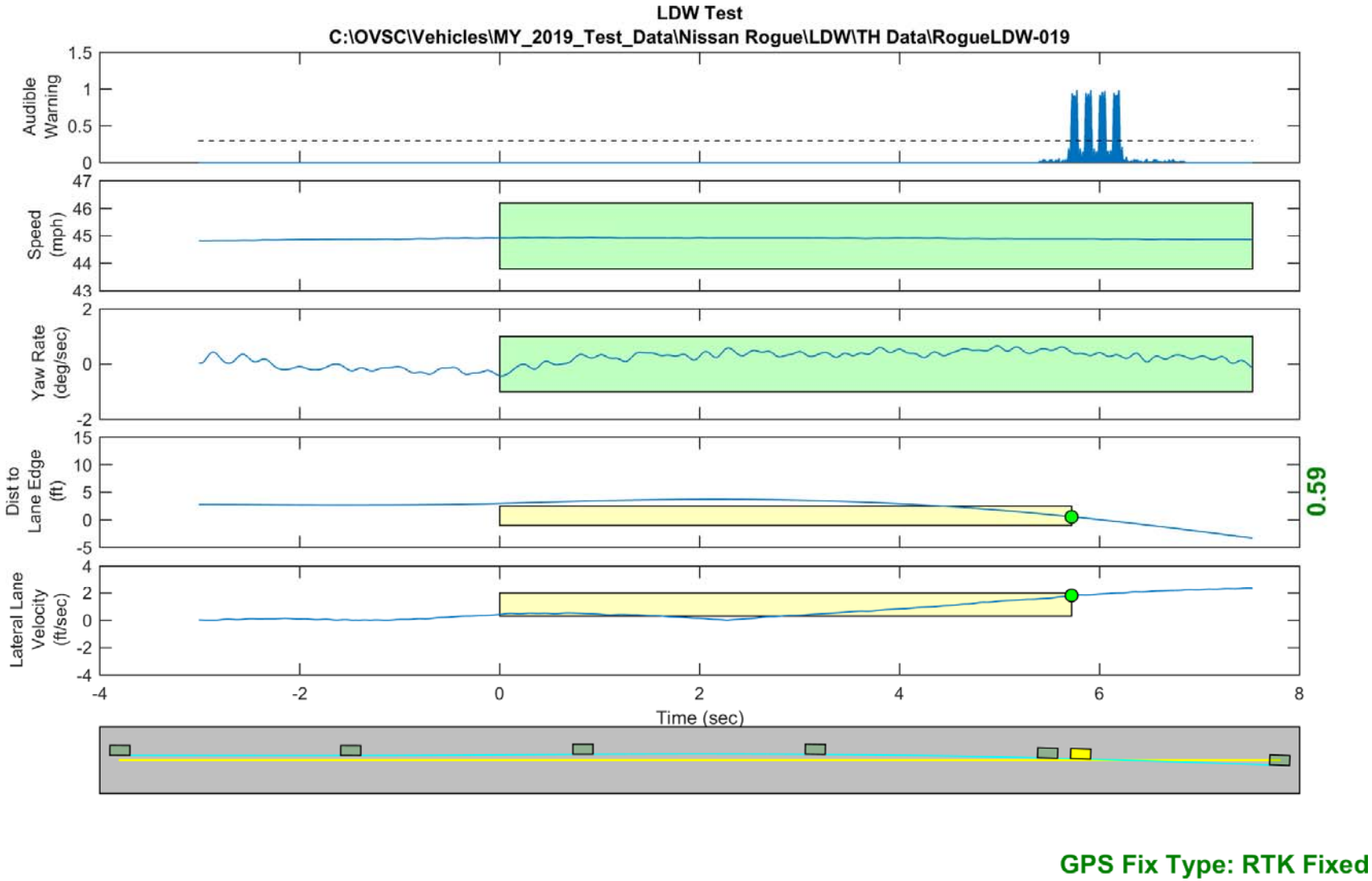

Figure D36. Time History for Run 19, Solid Line, Right Departure, Audible Warning

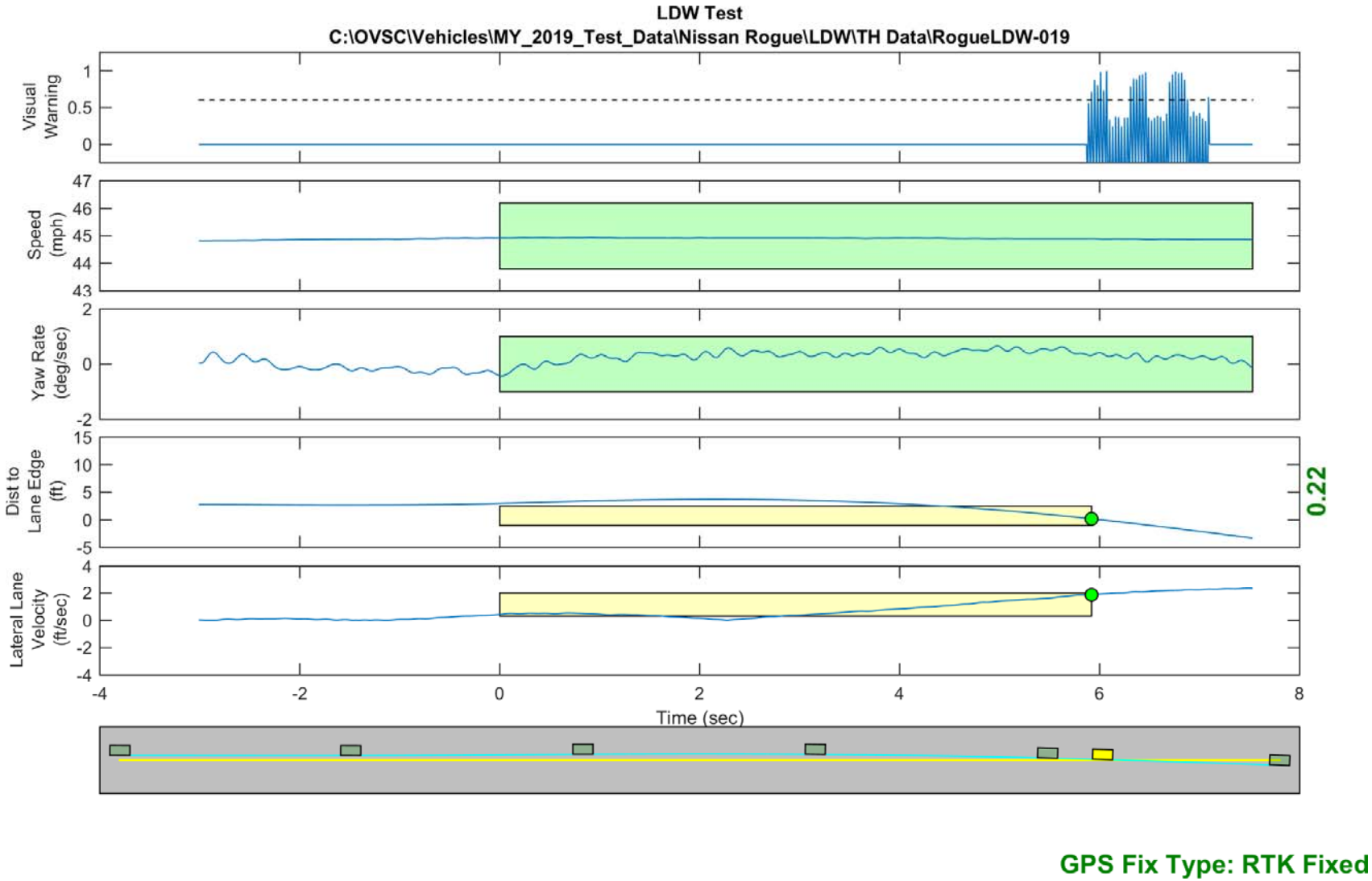

Figure D37. Time History for Run 19, Solid Line, Right Departure, Visual Warning

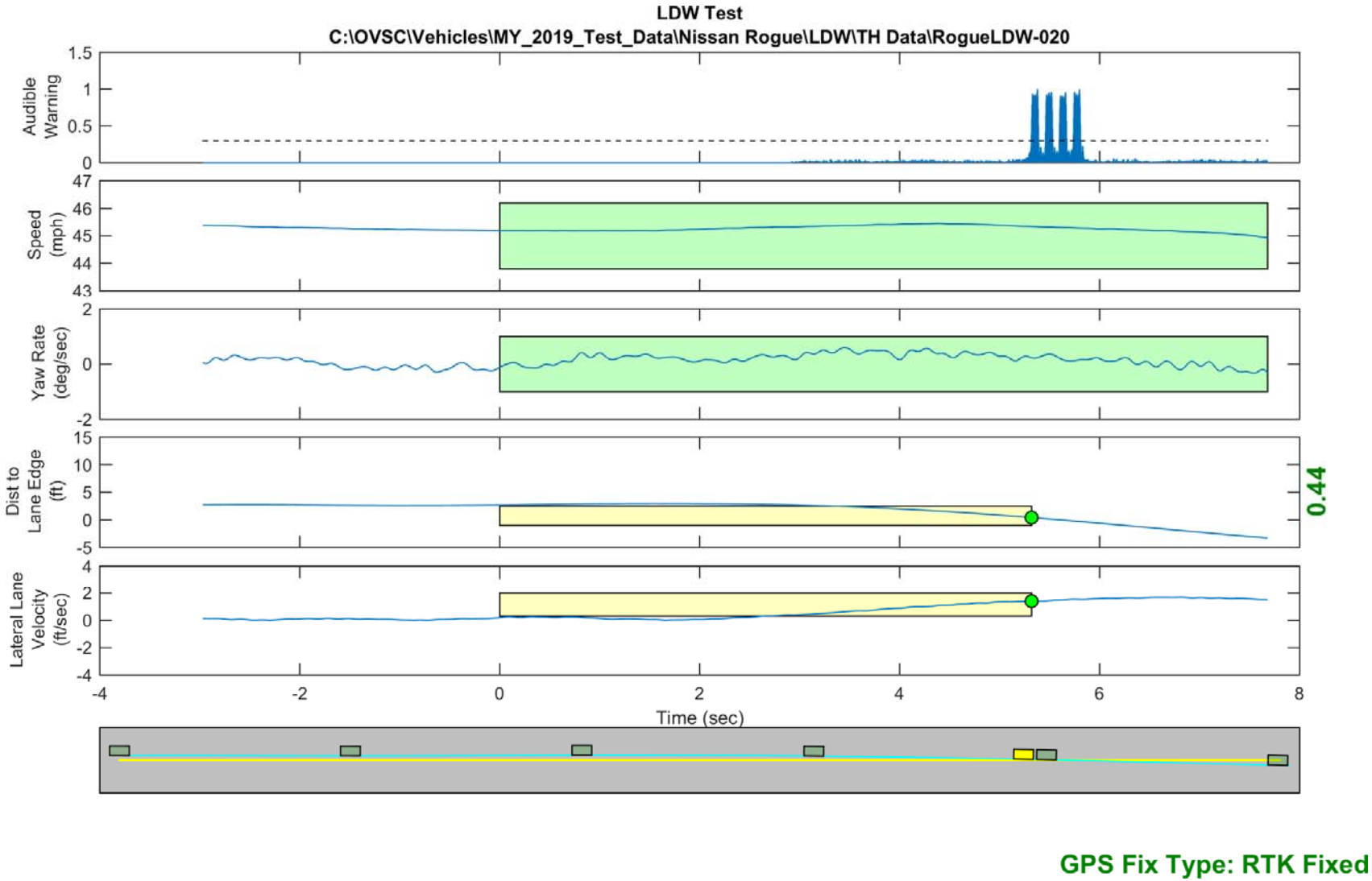

Figure D38. Time History for Run 20, Solid Line, Right Departure, Audible Warning

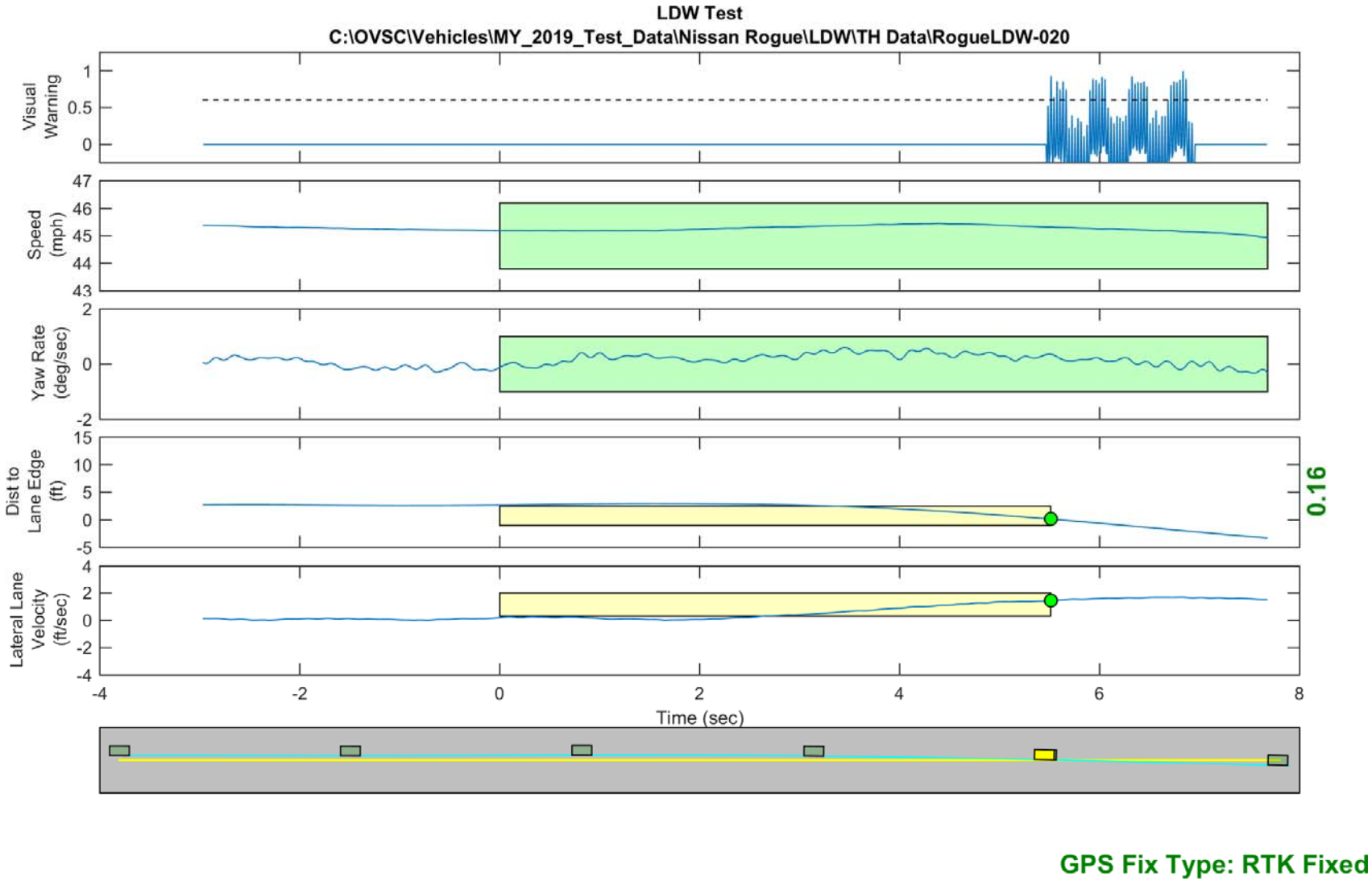

Figure D39. Time History for Run 20, Solid Line, Right Departure, Visual Warning

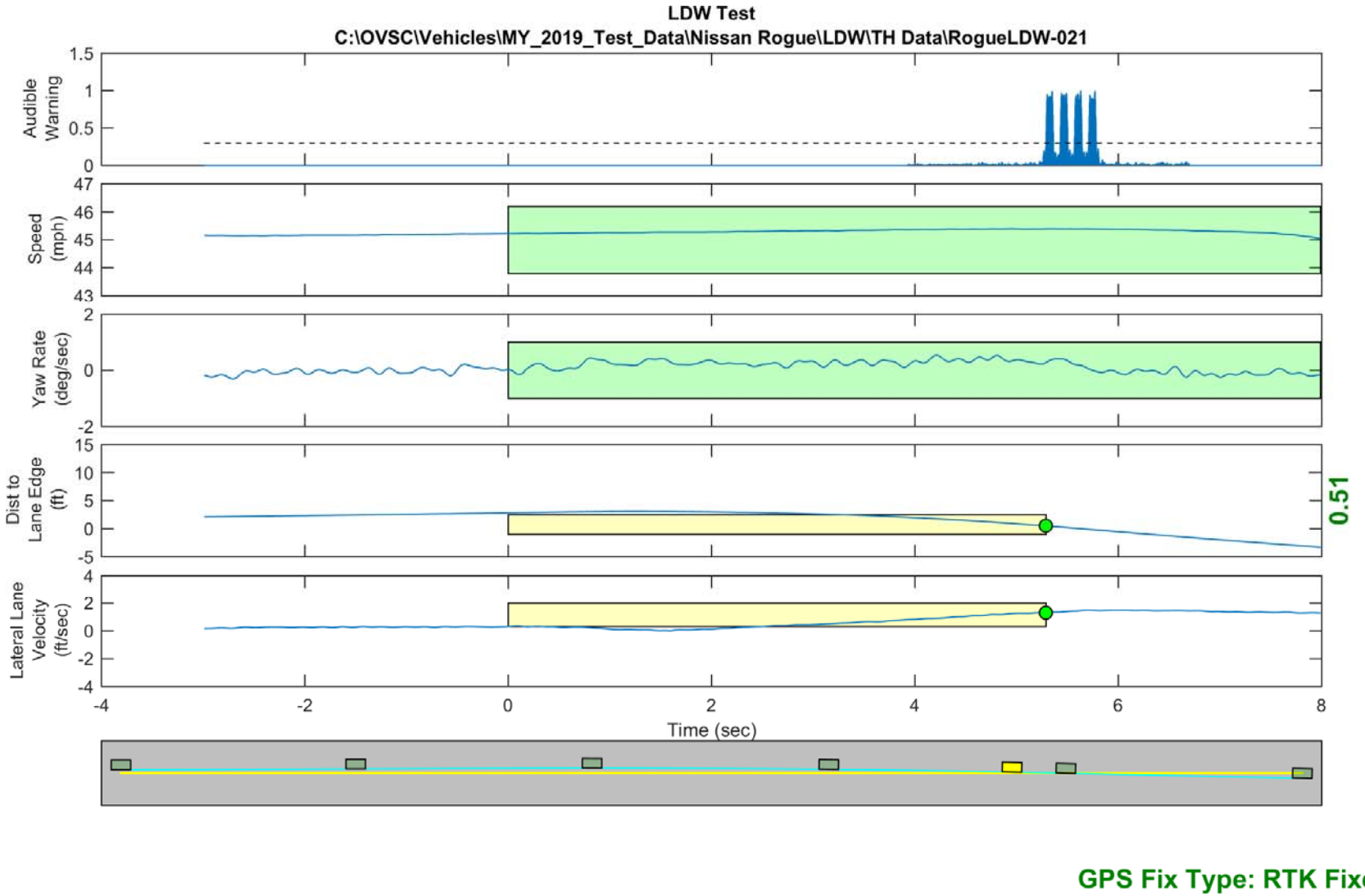

Figure D40. Time History for Run 21, Solid Line, Right Departure, Audible Warning

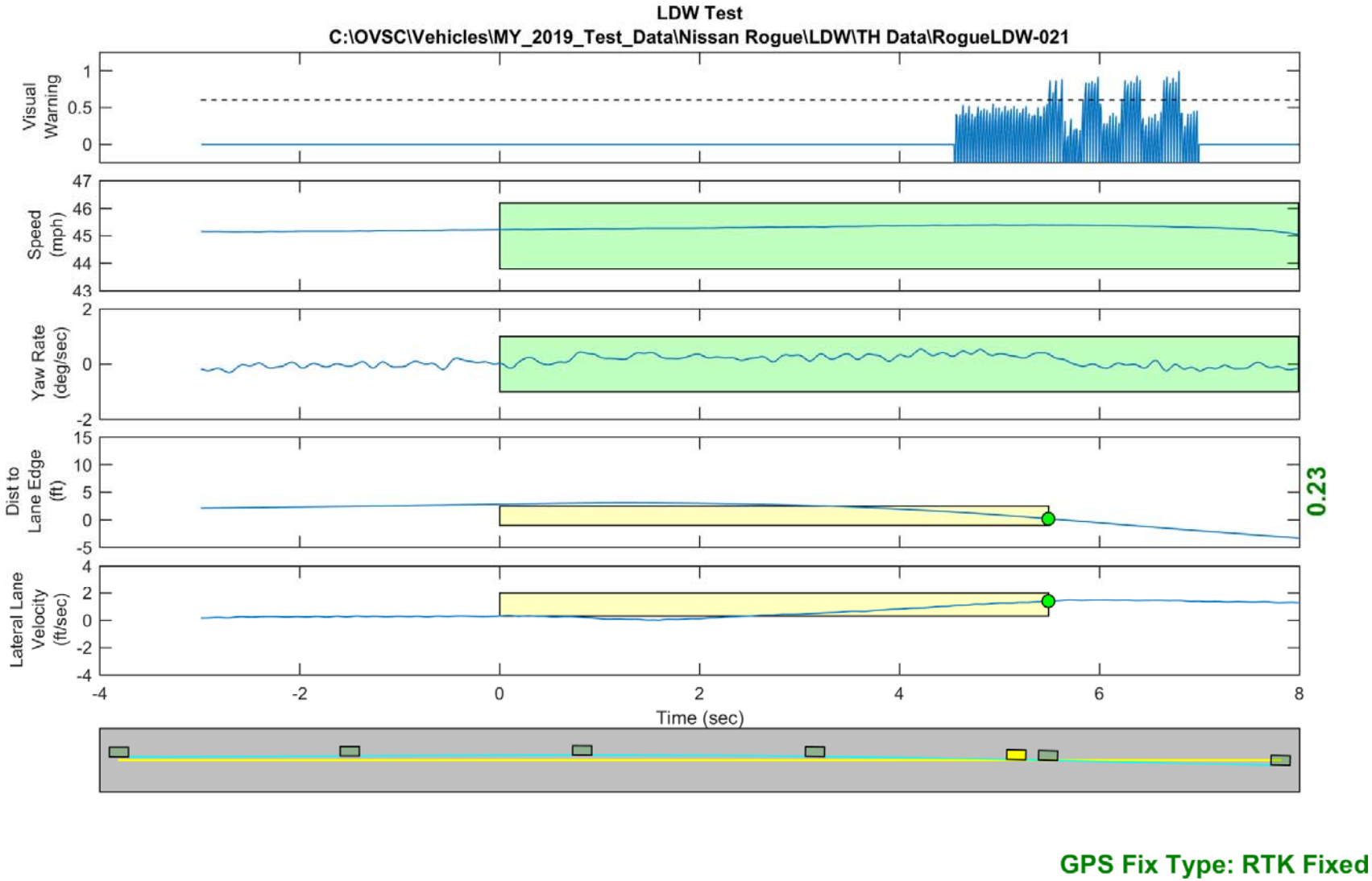

Figure D41. Time History for Run 21, Solid Line, Right Departure, Visual Warning

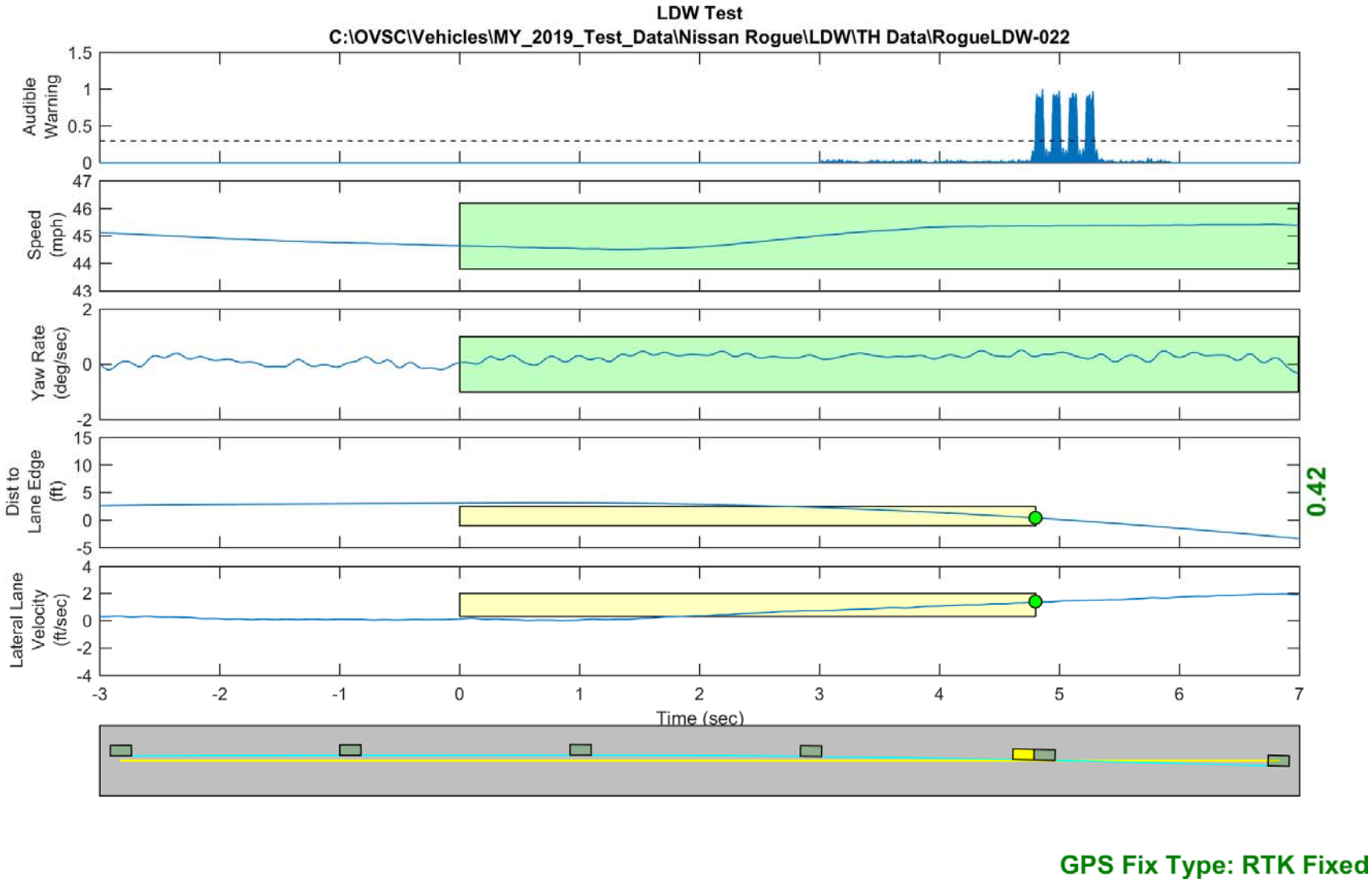

Figure D42. Time History for Run 22, Solid Line, Right Departure, Audible Warning

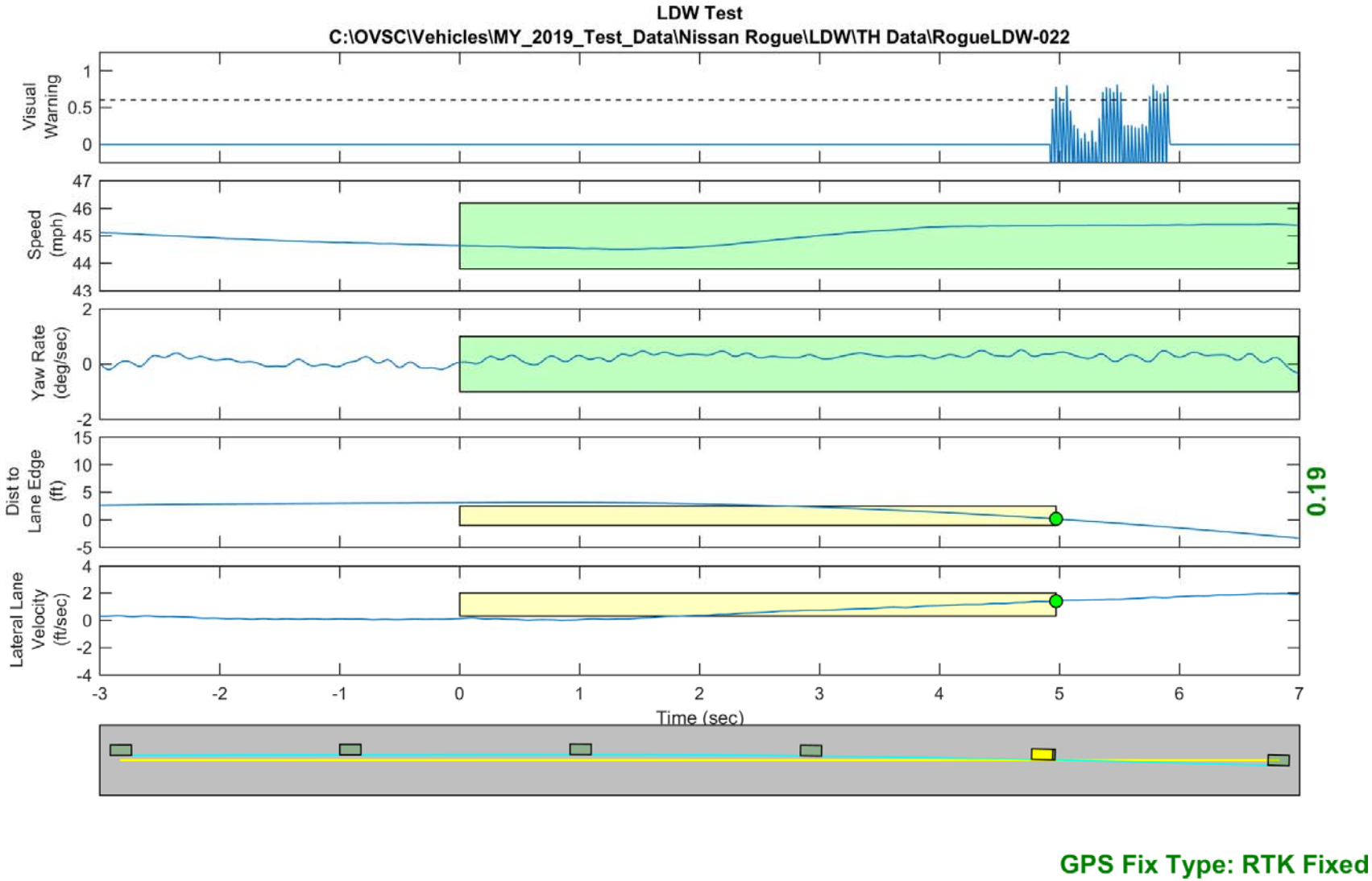

Figure D43. Time History for Run 22, Solid Line, Right Departure, Visual Warning

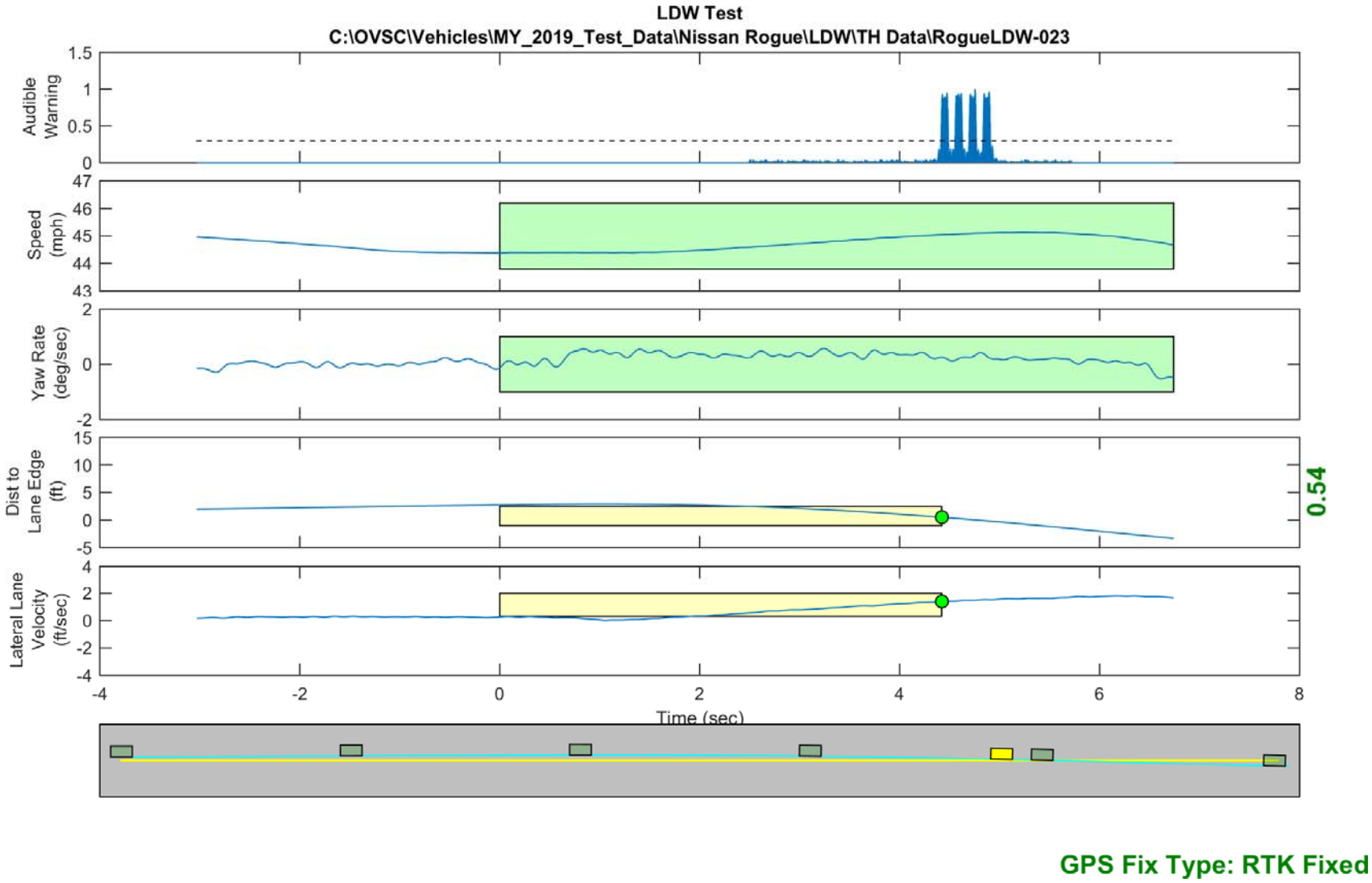

Figure D44. Time History for Run 23, Solid Line, Right Departure, Audible Warning

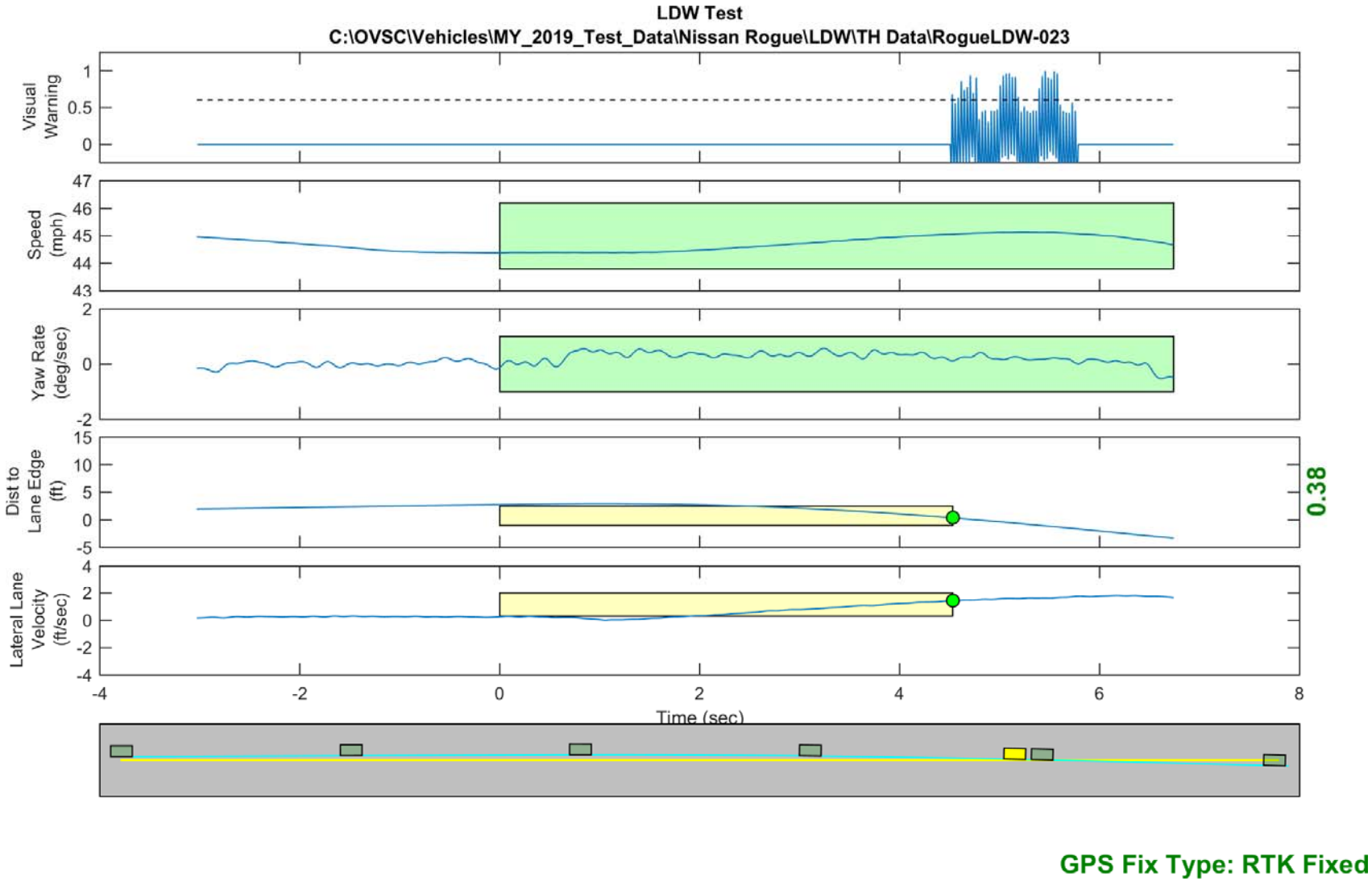

Figure D45. Time History for Run 23, Solid Line, Right Departure, Visual Warning

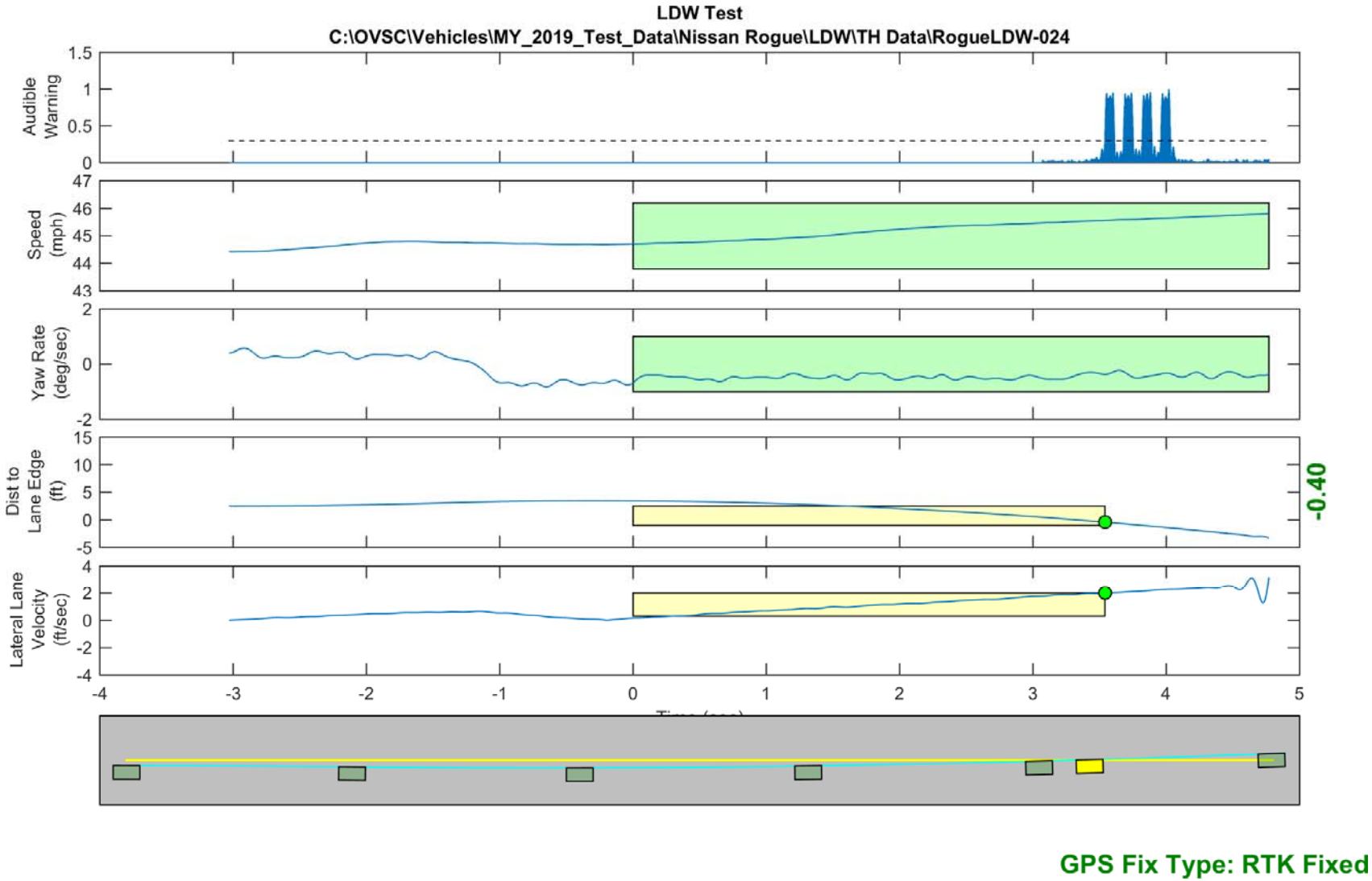

Figure D46. Time History for Run 24, Solid Line, Left Departure, Audible Warning

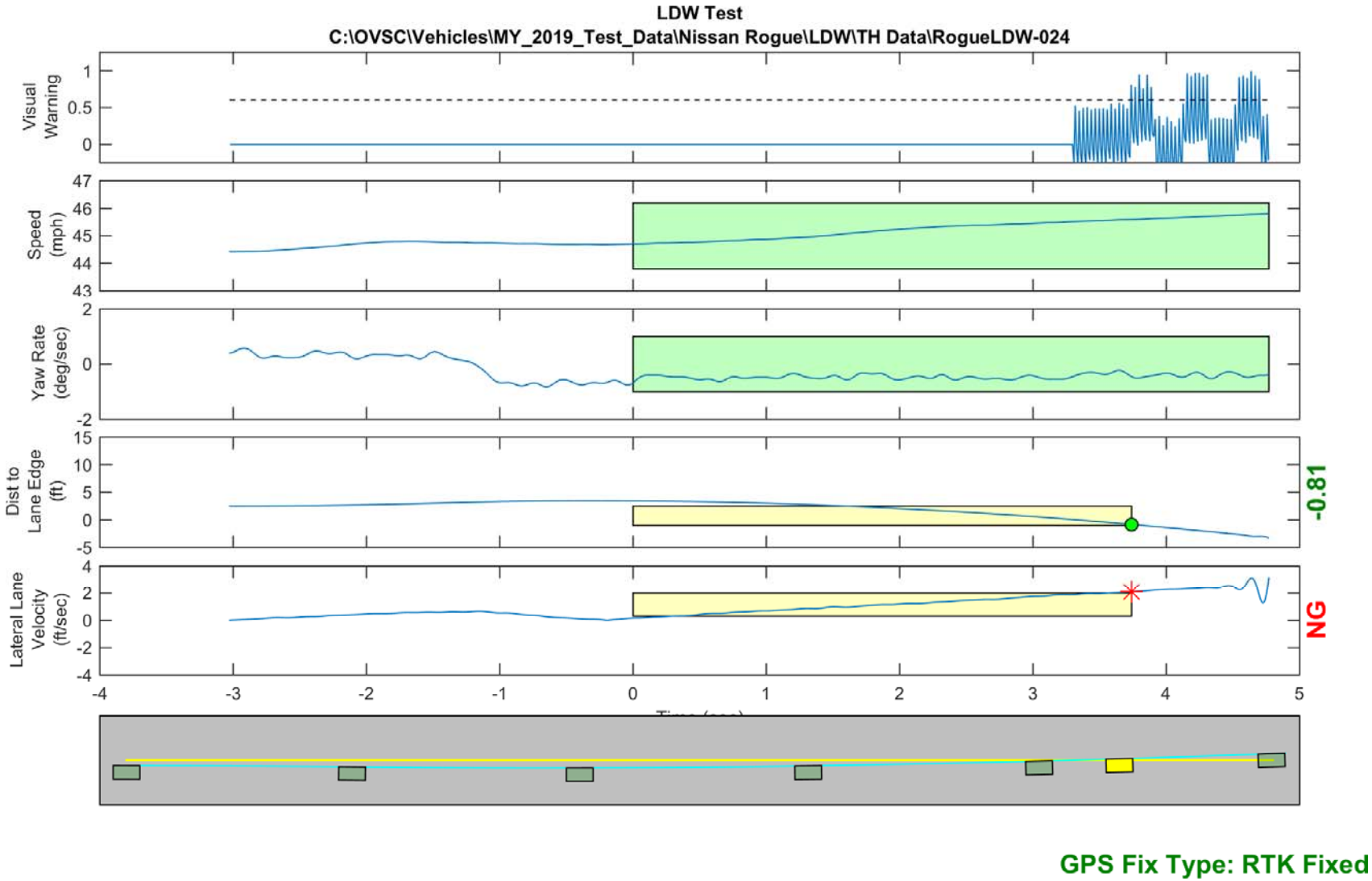

Figure D47. Time History for Run 24, Solid Line, Left Departure, Visual Warning

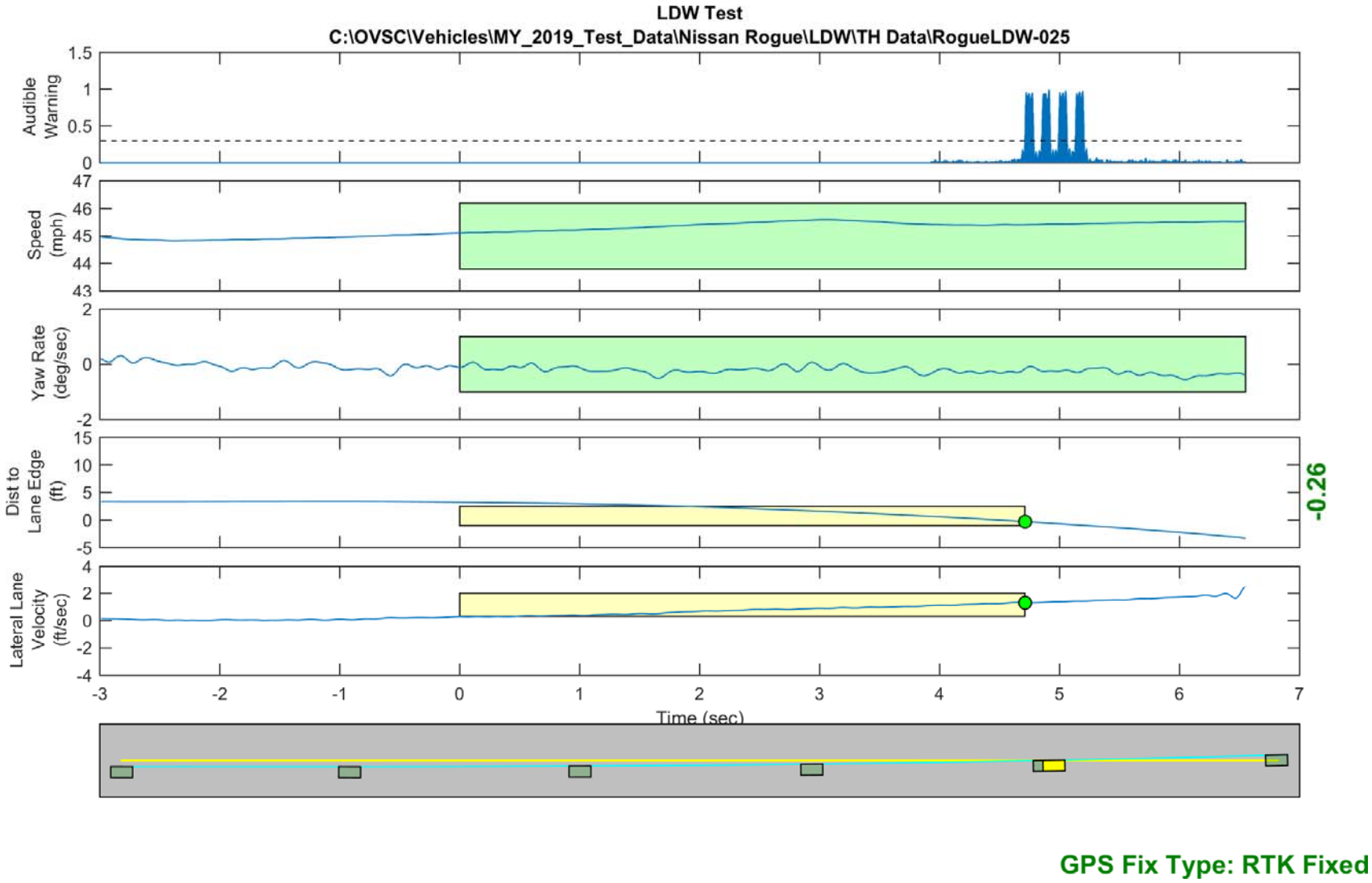

Figure D48. Time History for Run 25, Solid Line, Left Departure, Audible Warning

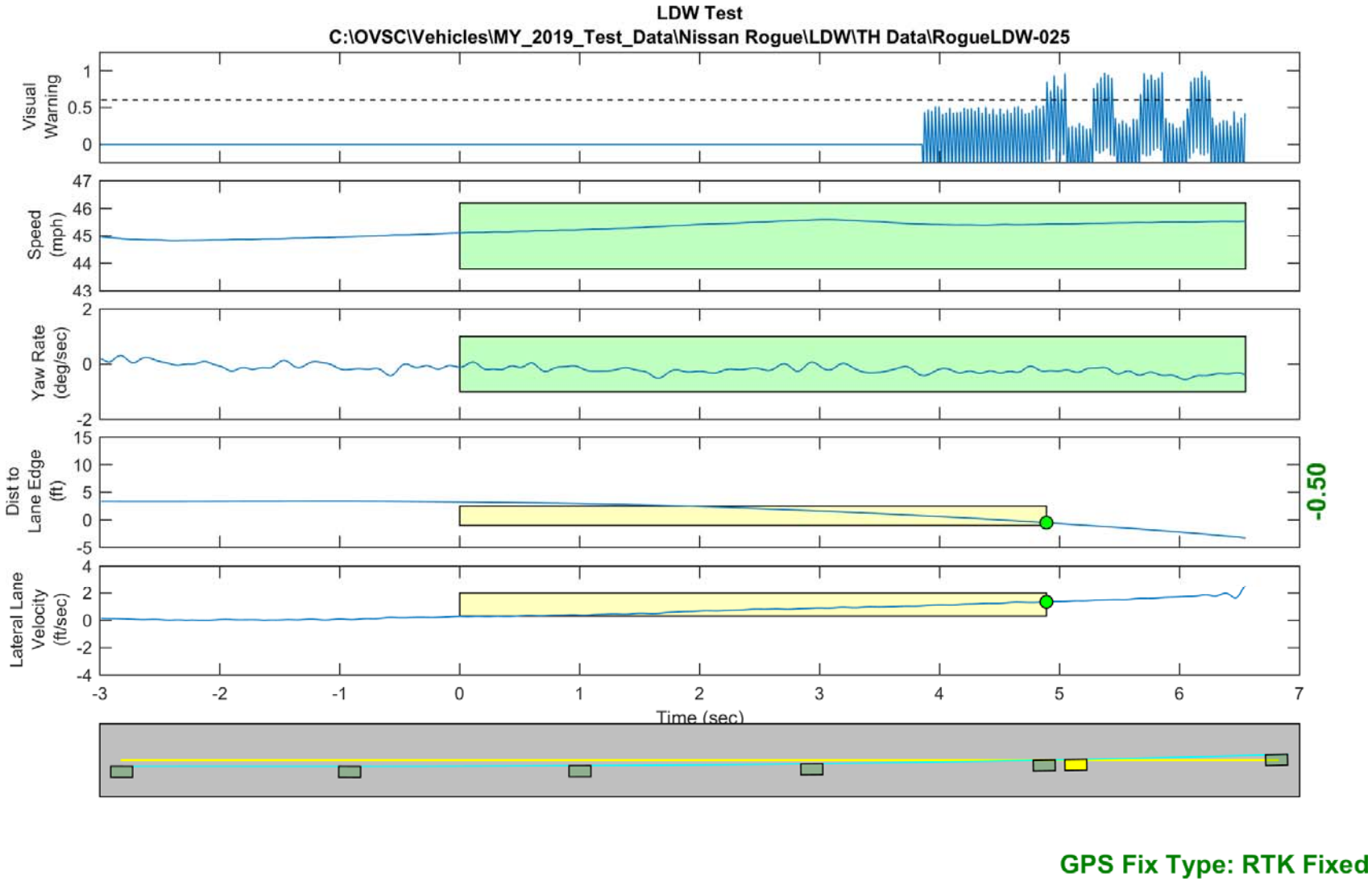

Figure D49. Time History for Run 25, Solid Line, Left Departure, Visual Warning

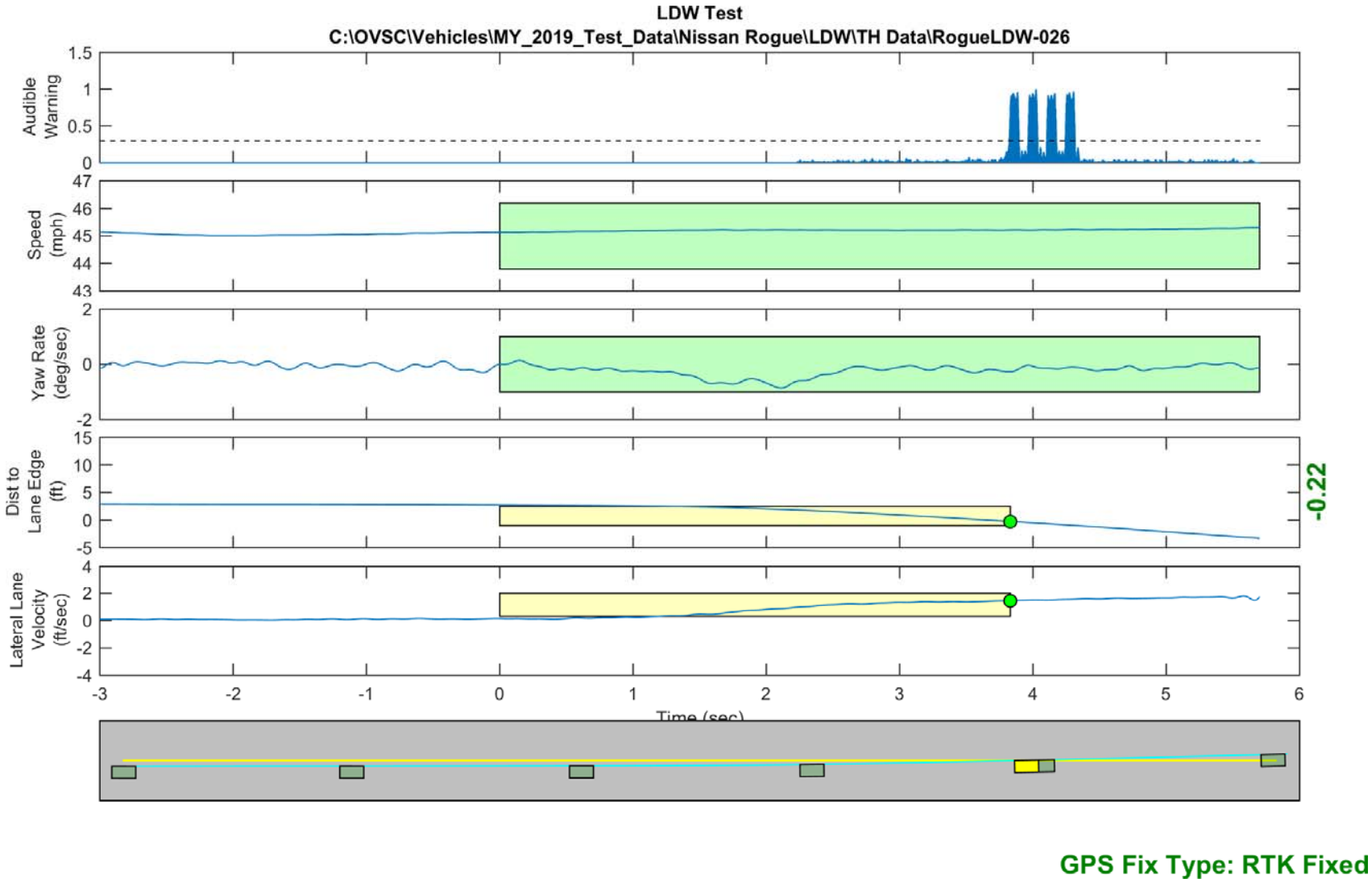

Figure D50. Time History for Run 26, Solid Line, Left Departure, Audible Warning

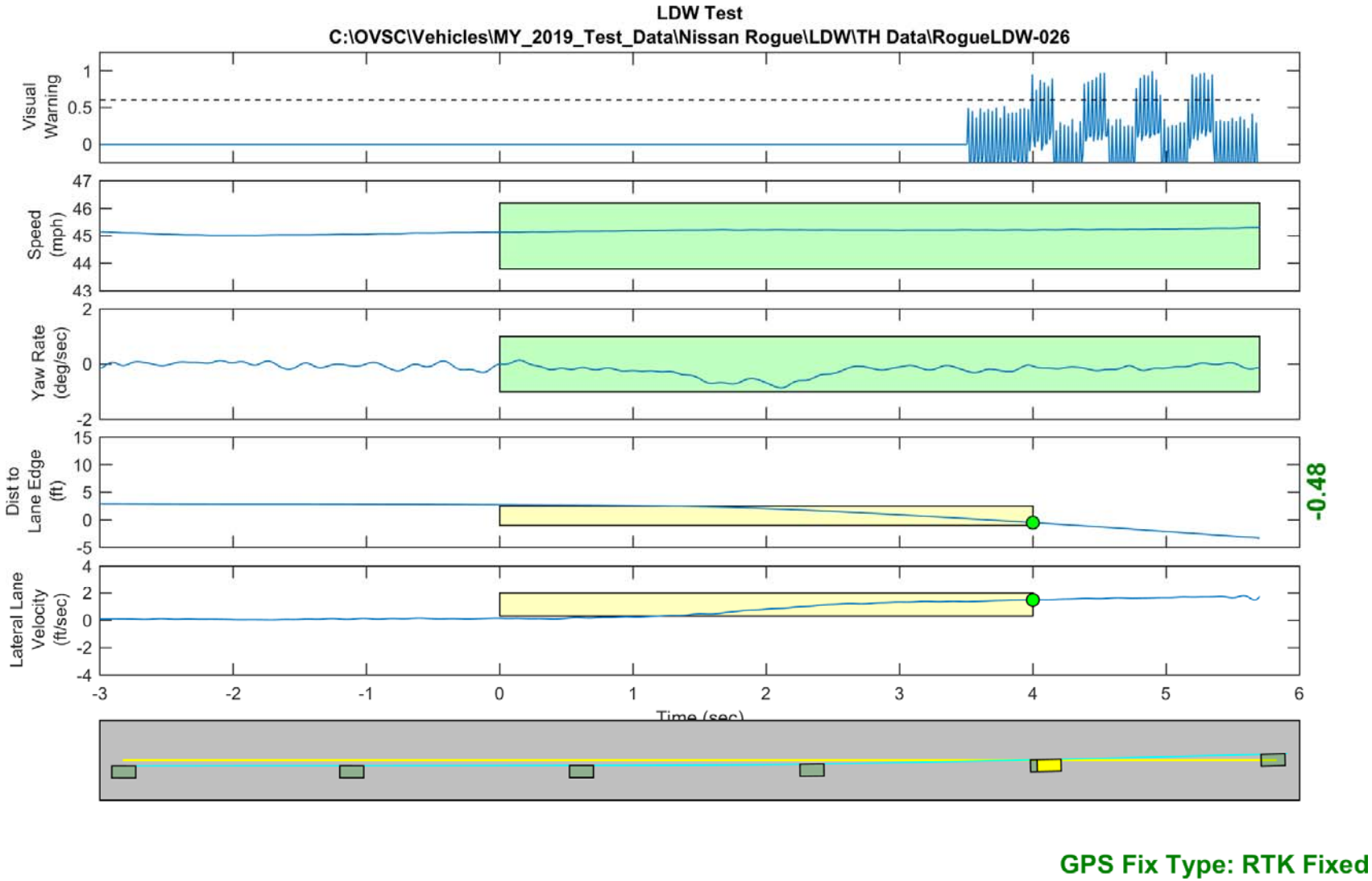

Figure D51. Time History for Run 26, Solid Line, Left Departure, Visual Warning

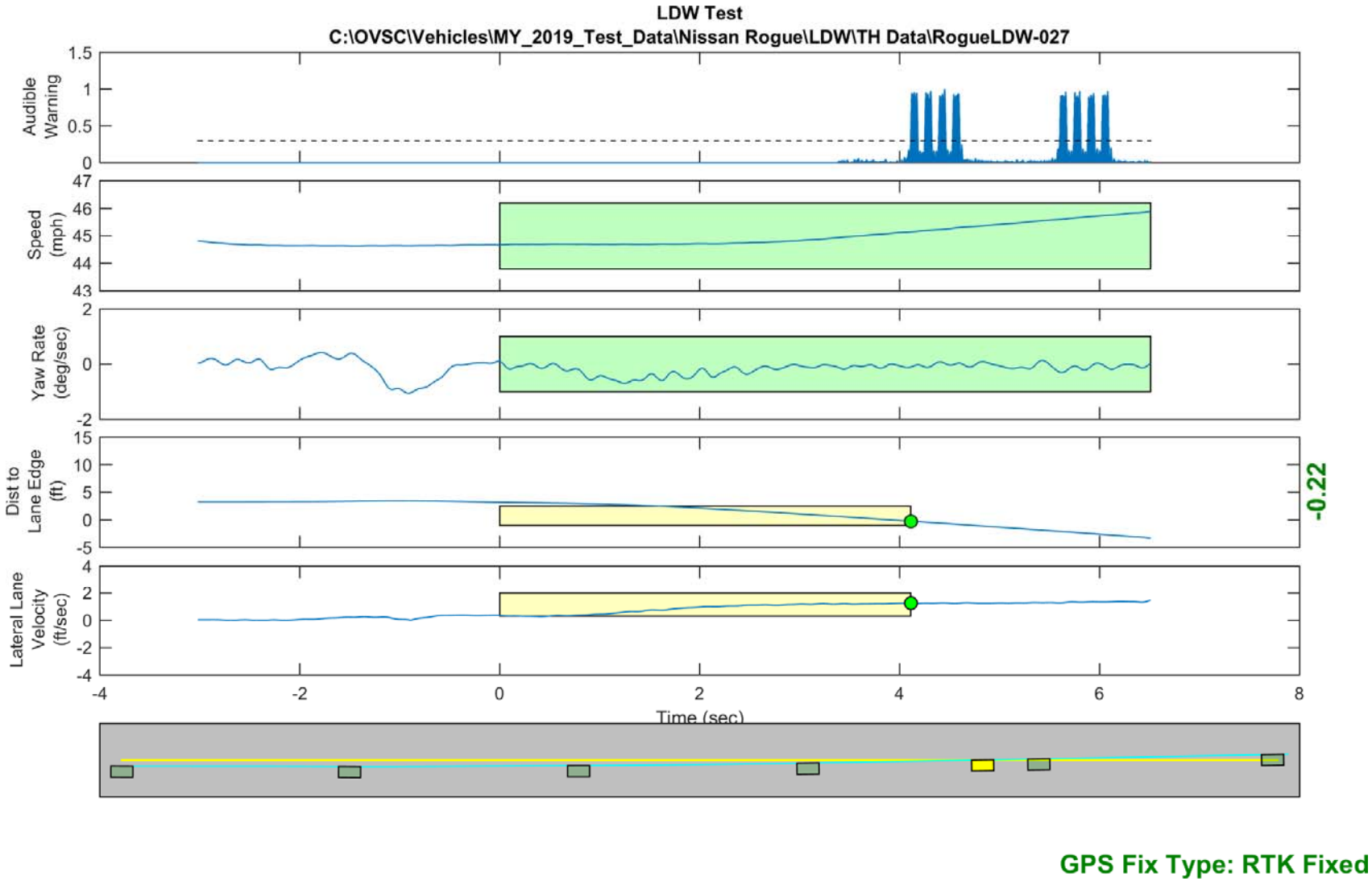

Figure D52. Time History for Run 27, Solid Line, Left Departure, Audible Warning

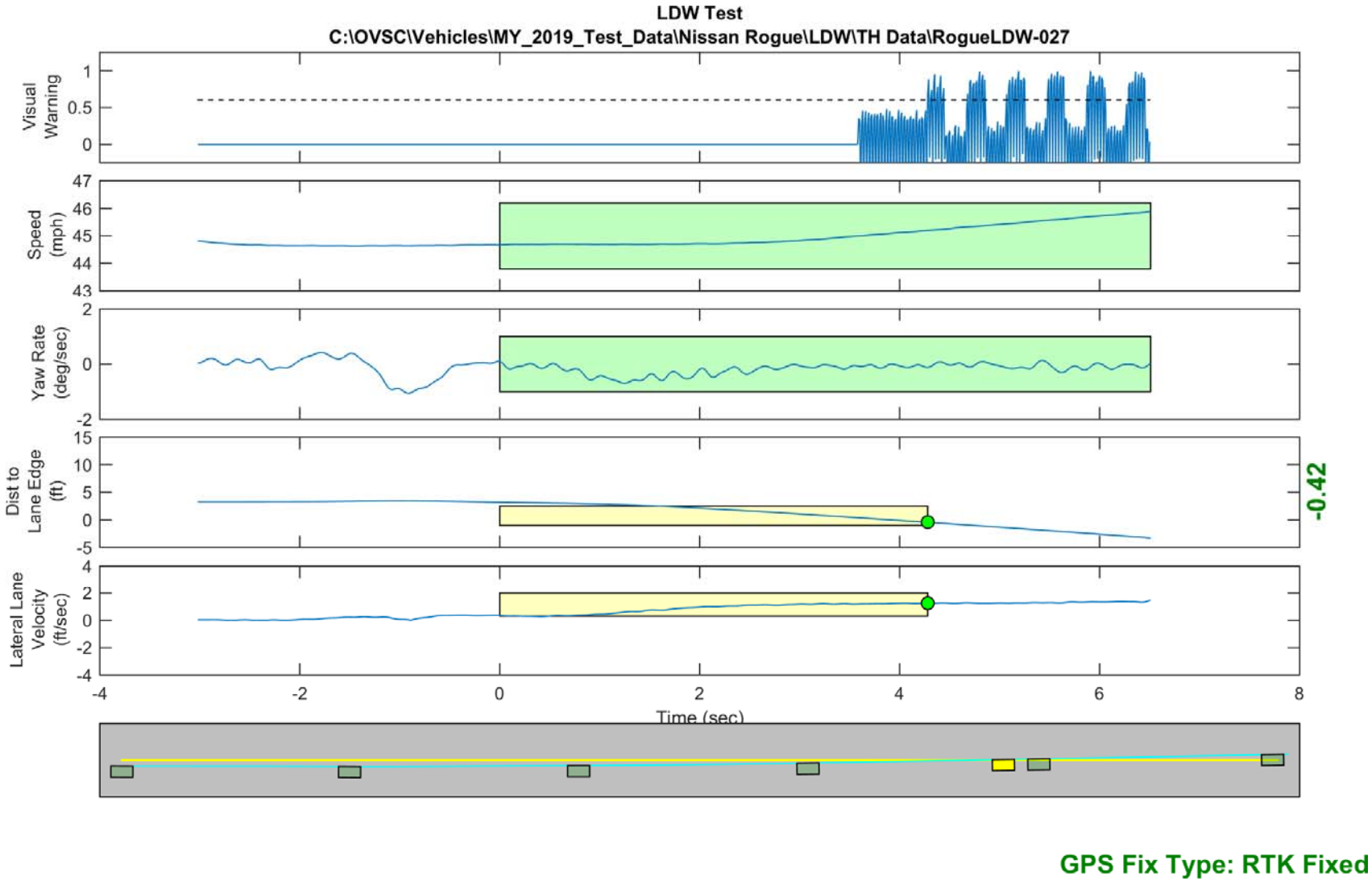

Figure D53. Time History for Run 27, Solid Line, Left Departure, Visual Warning

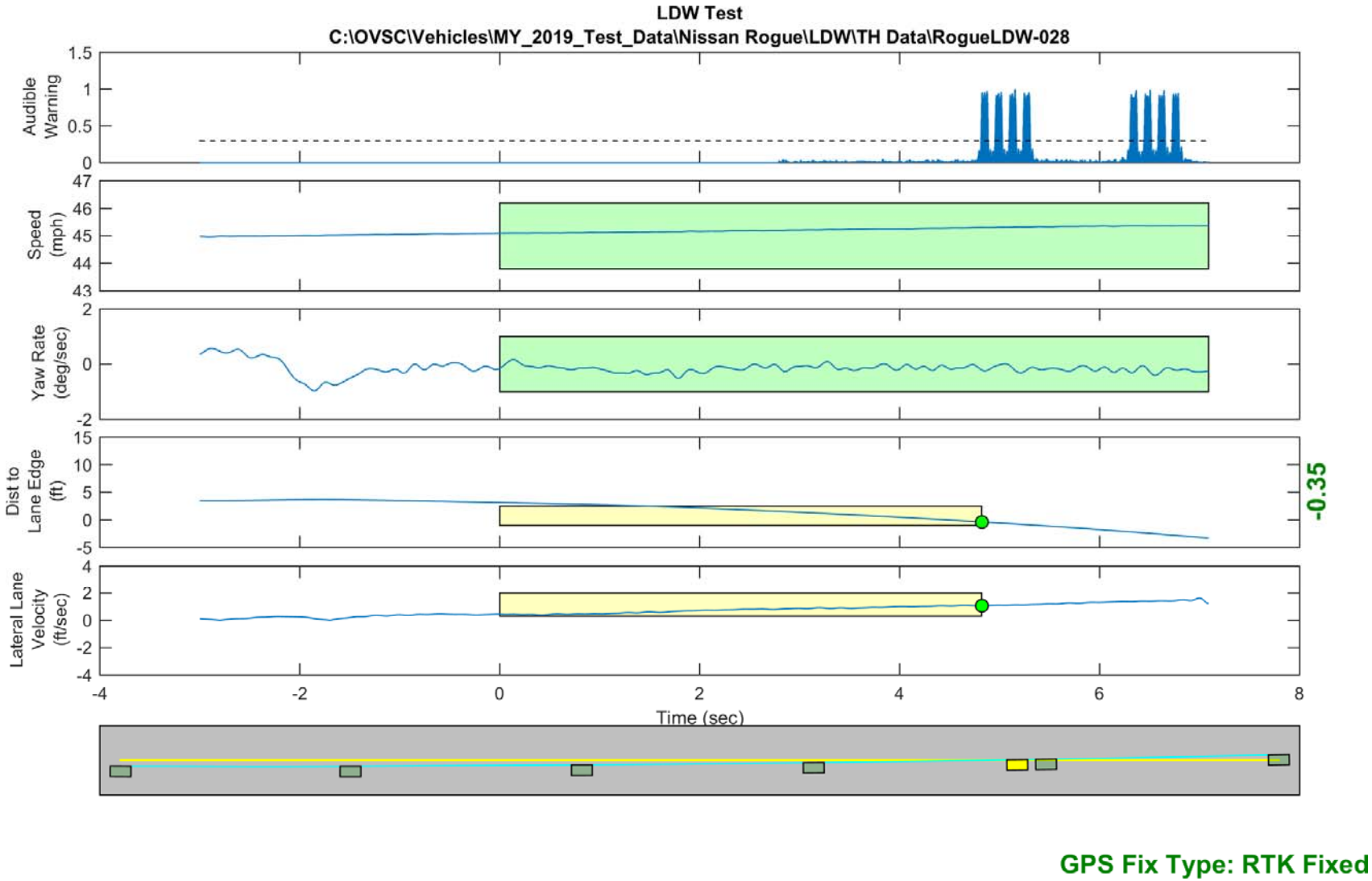

Figure D54. Time History for Run 28, Solid Line, Left Departure, Audible Warning

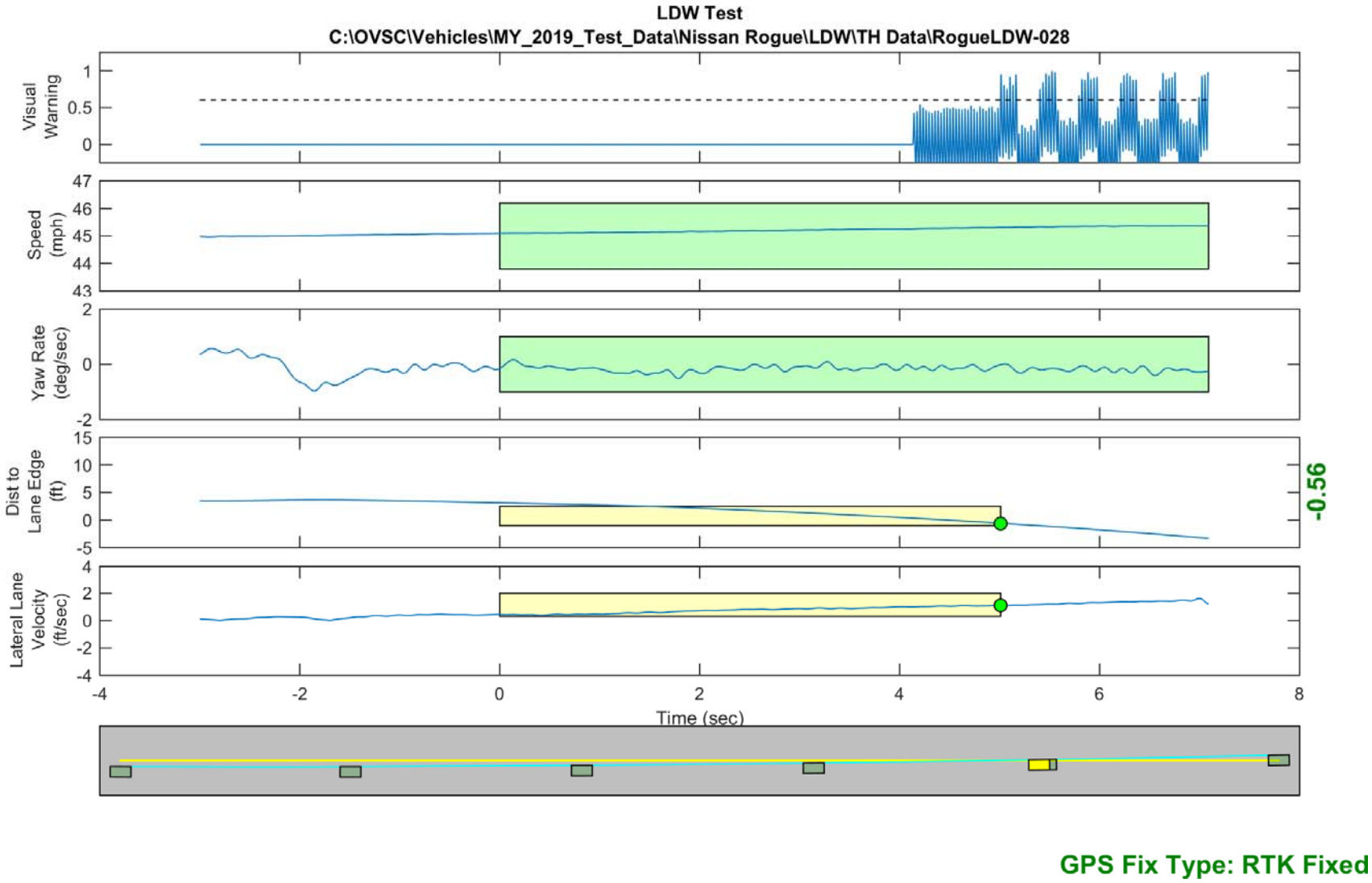

Figure D55. Time History for Run 28, Solid Line, Left Departure, Visual Warning

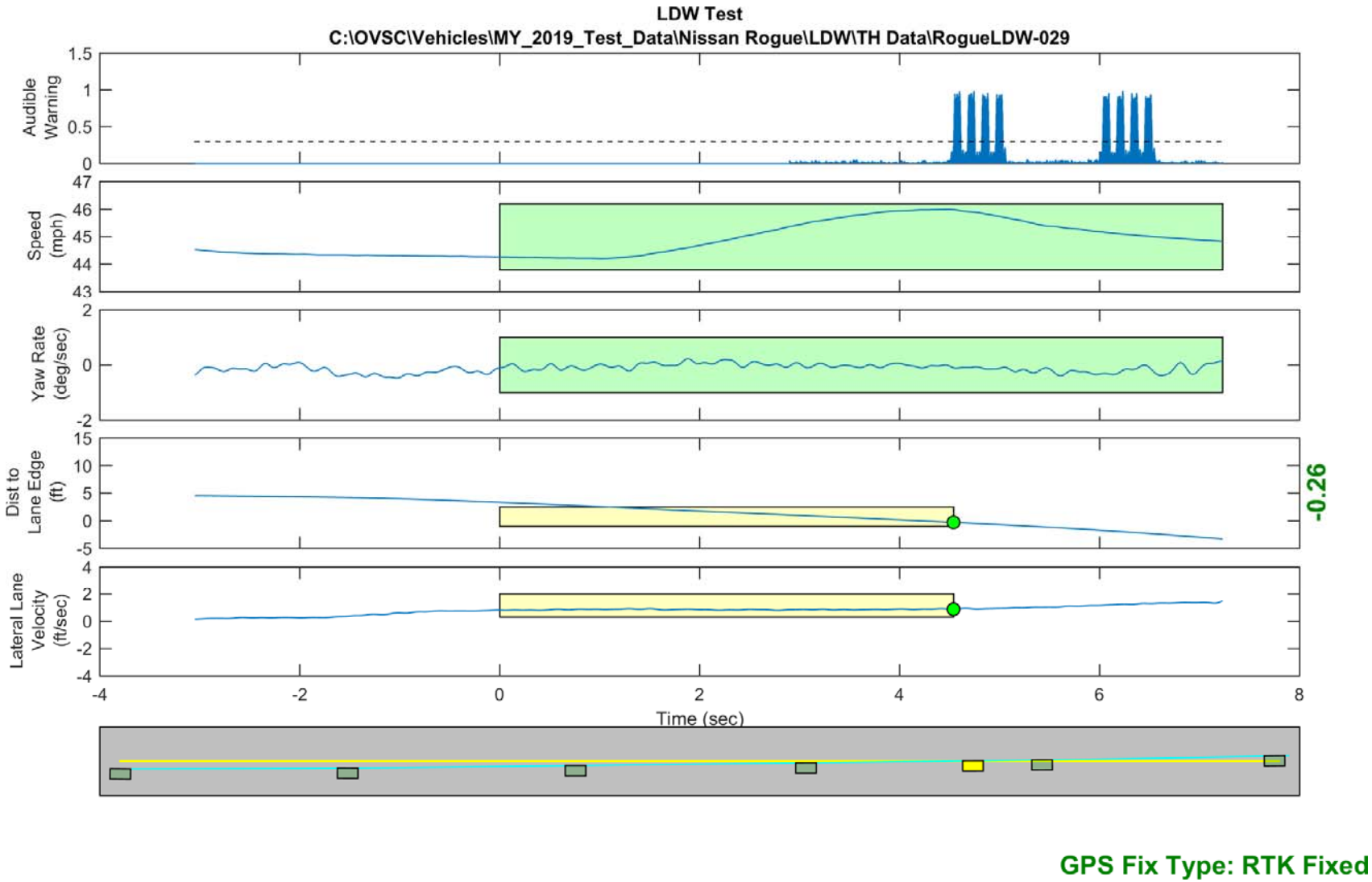

Figure D56. Time History for Run 29, Solid Line, Left Departure, Audible Warning

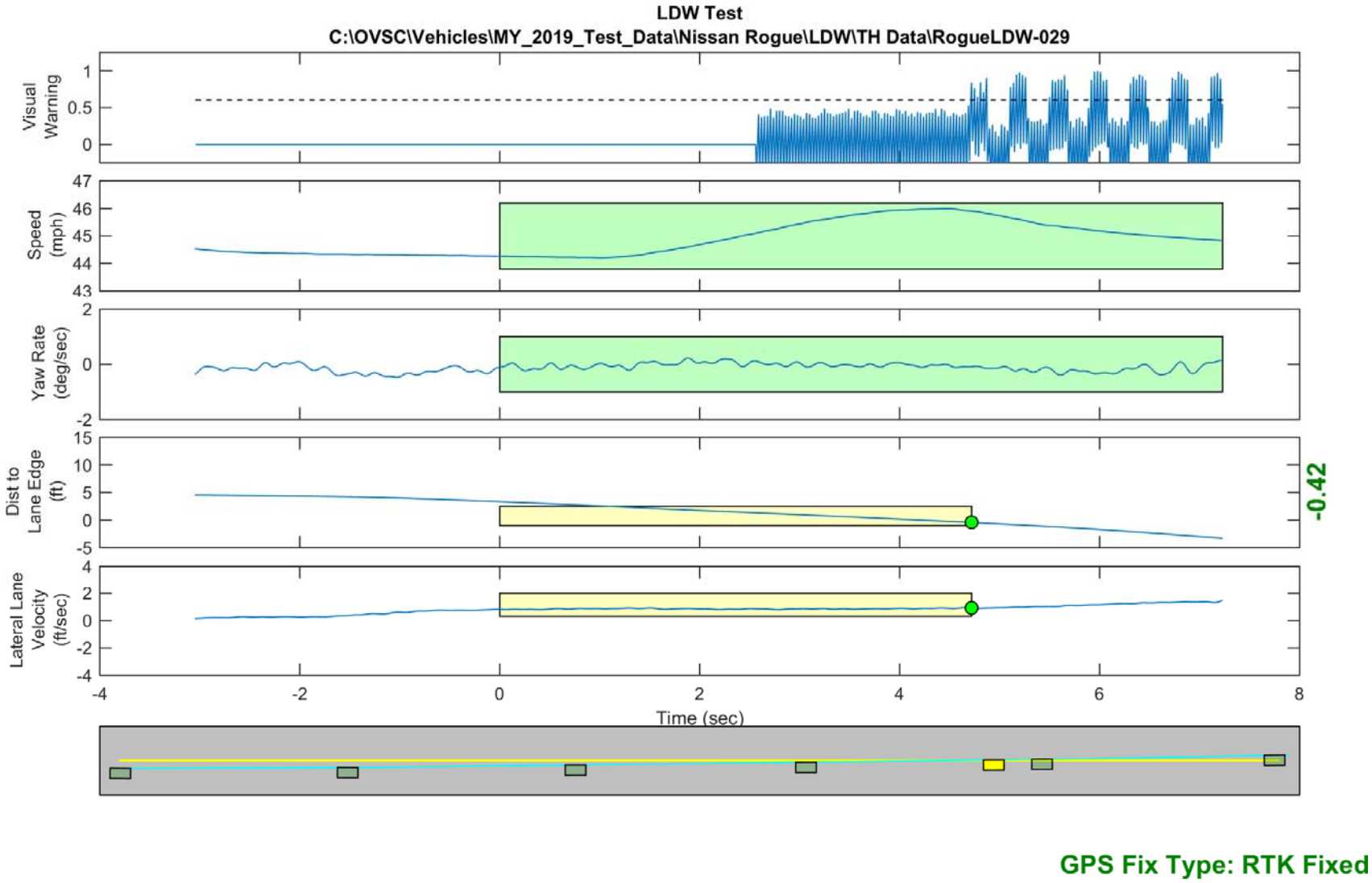

Figure D57. Time History for Run 29, Solid Line, Left Departure, Visual Warning

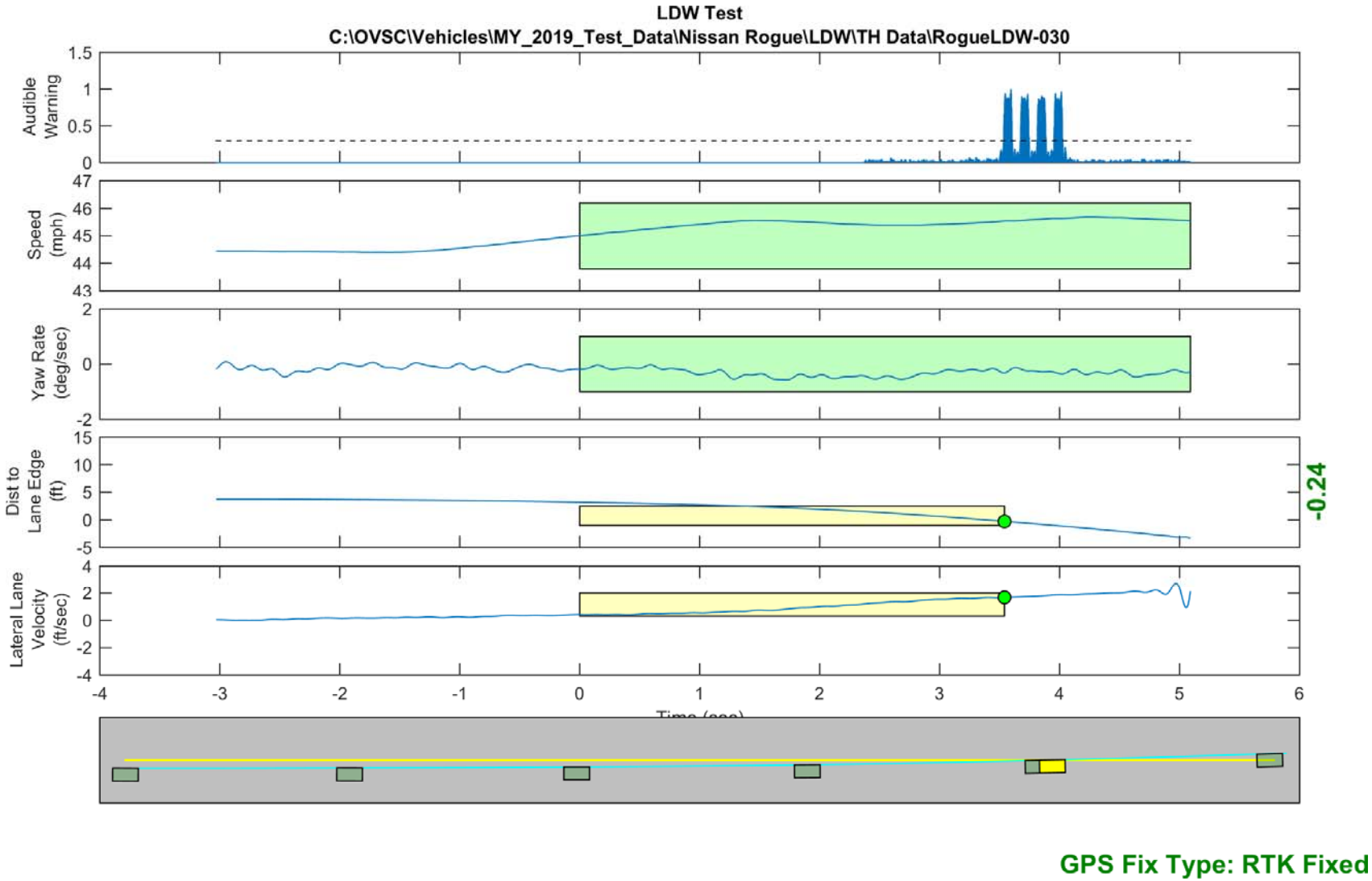

Figure D58. Time History for Run 30, Solid Line, Left Departure, Audible Warning

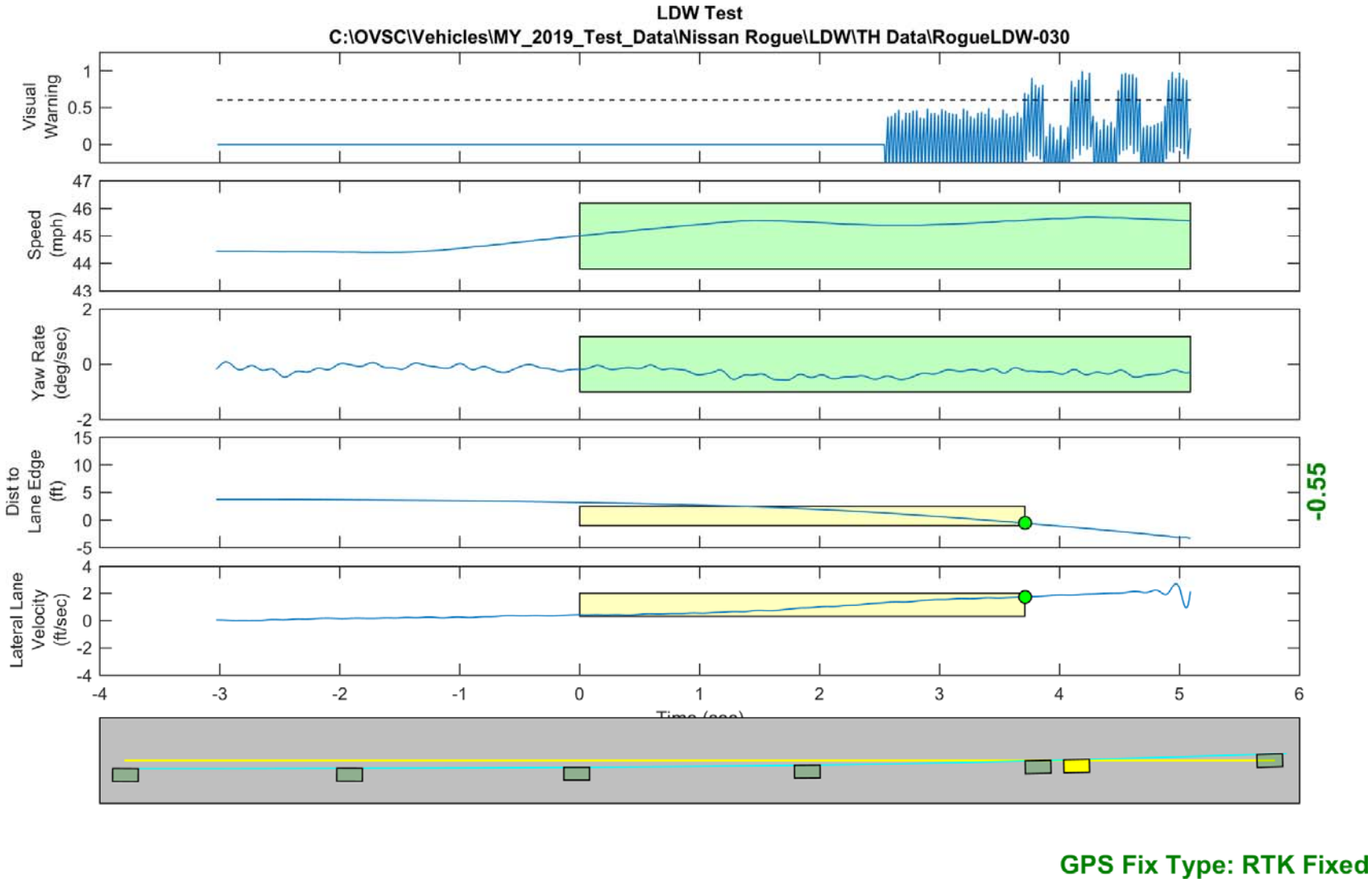

Figure D59. Time History for Run 30, Solid Line, Left Departure, Visual Warning

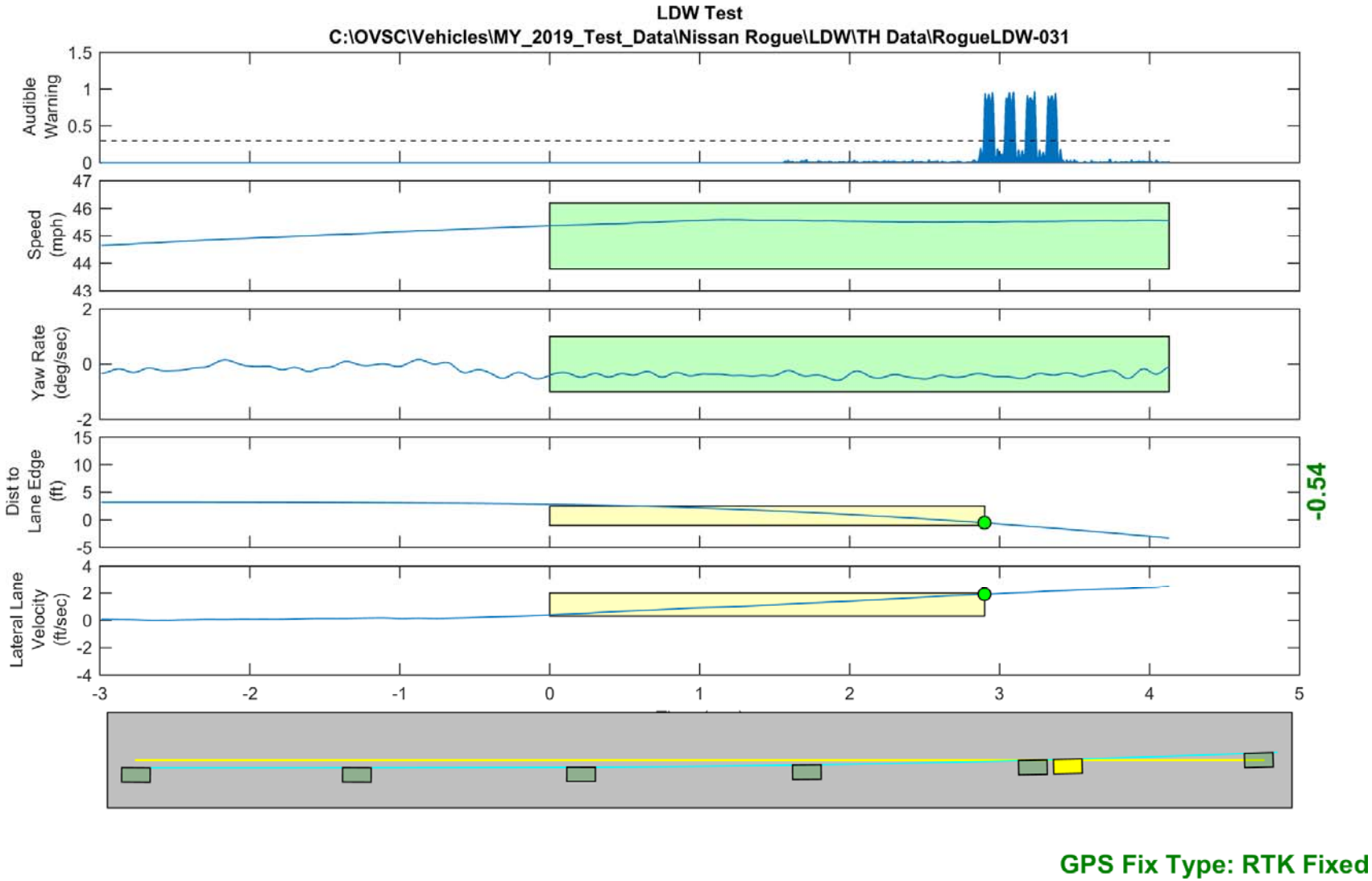

Figure D60. Time History for Run 31, Dashed Line, Left Departure, Audible Warning

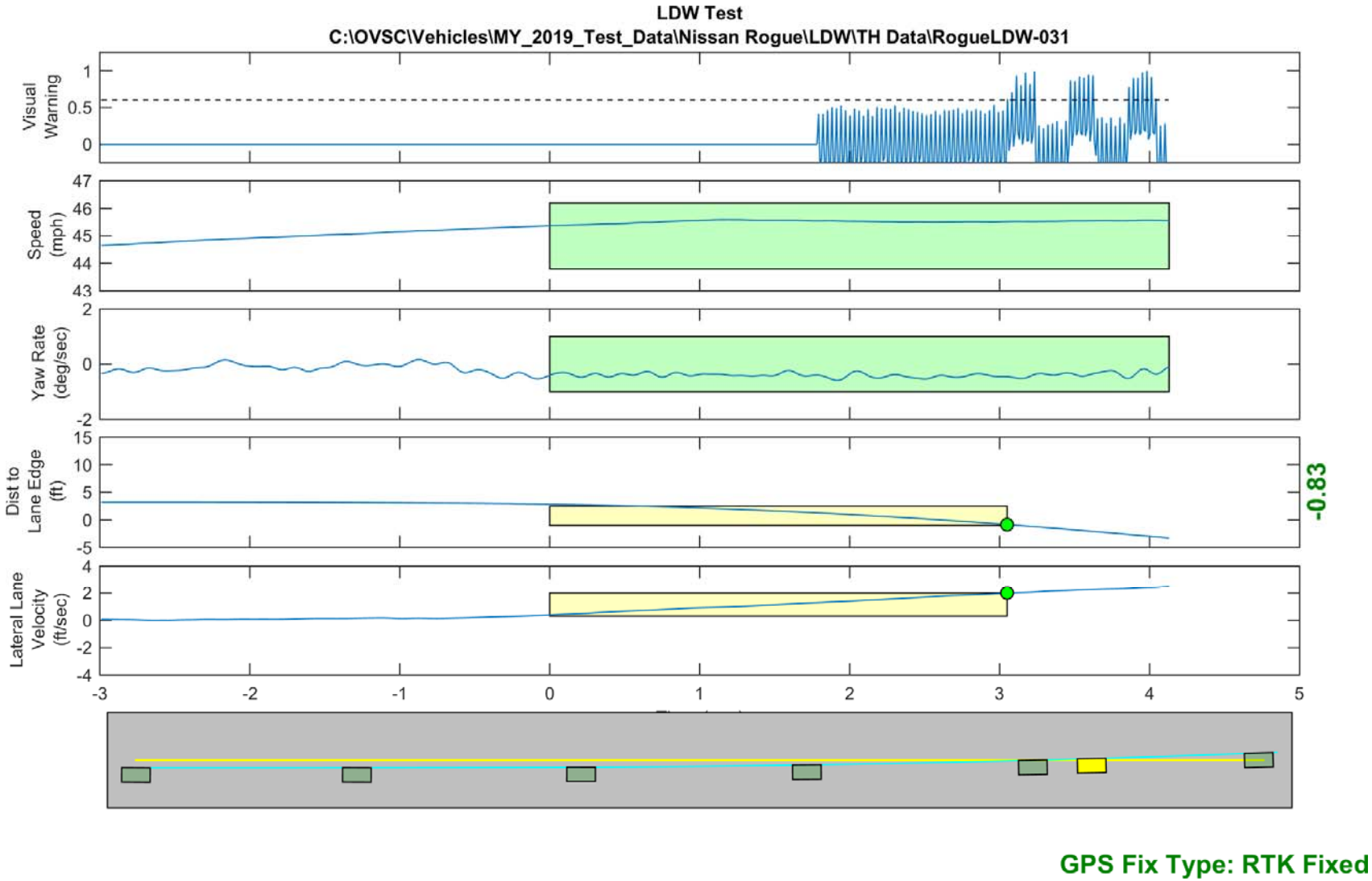

Figure D61. Time History for Run 31, Dashed Line, Left Departure, Visual Warning

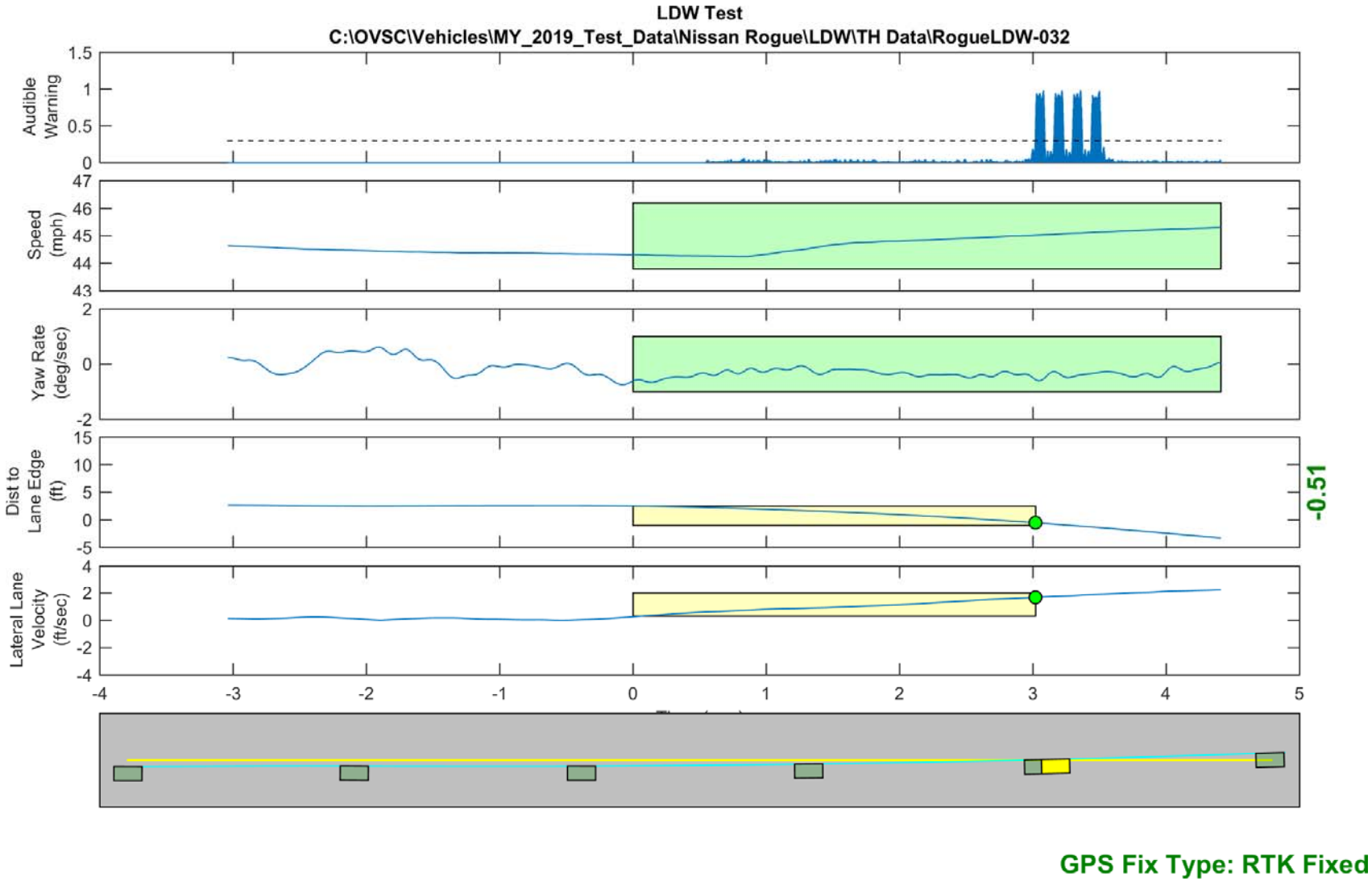

Figure D62. Time History for Run 32, Dashed Line, Left Departure, Audible Warning

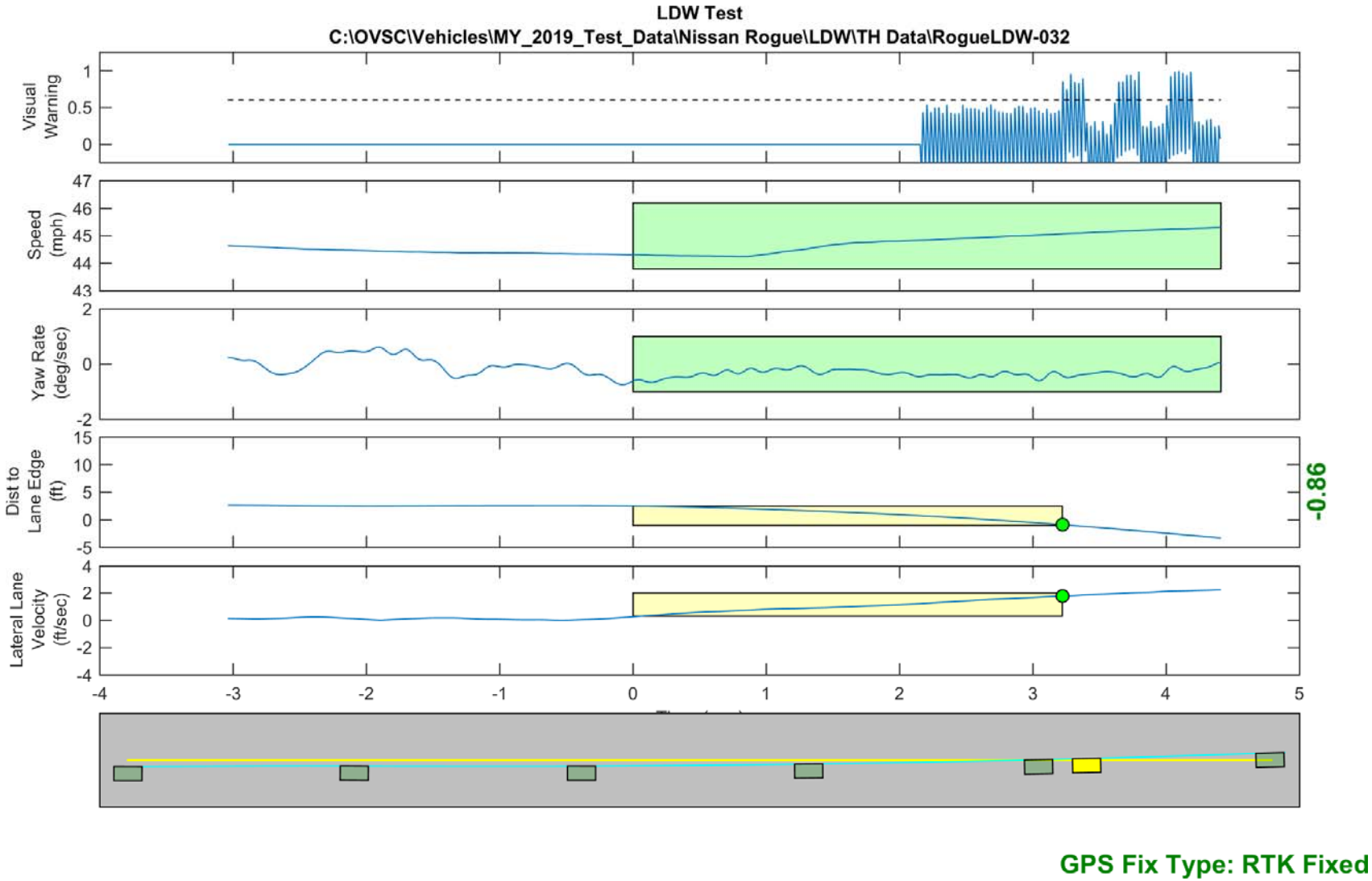

Figure D63. Time History for Run 32, Dashed Line, Left Departure, Visual Warning

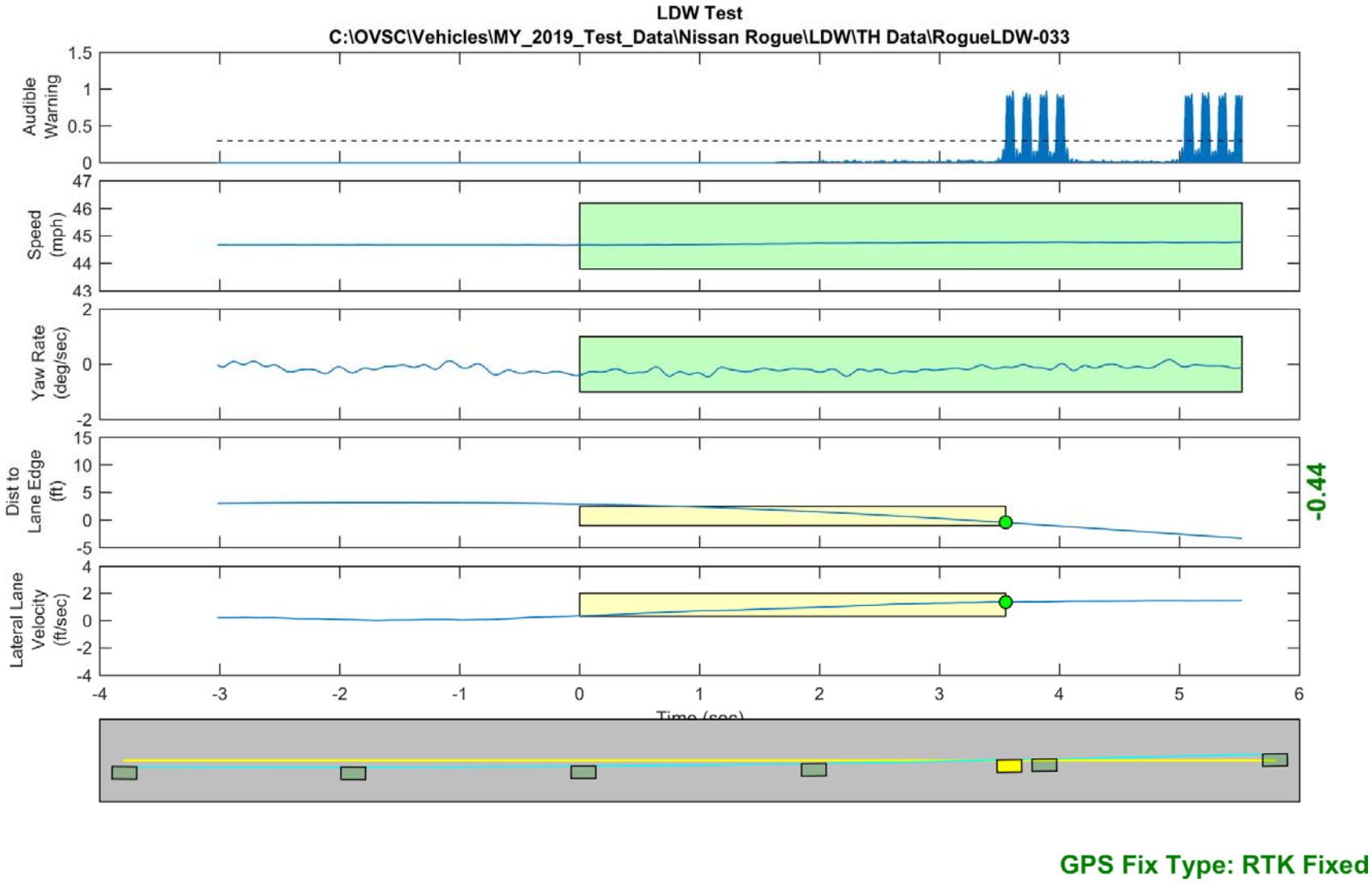

Figure D64. Time History for Run 33, Dashed Line, Left Departure, Audible Warning

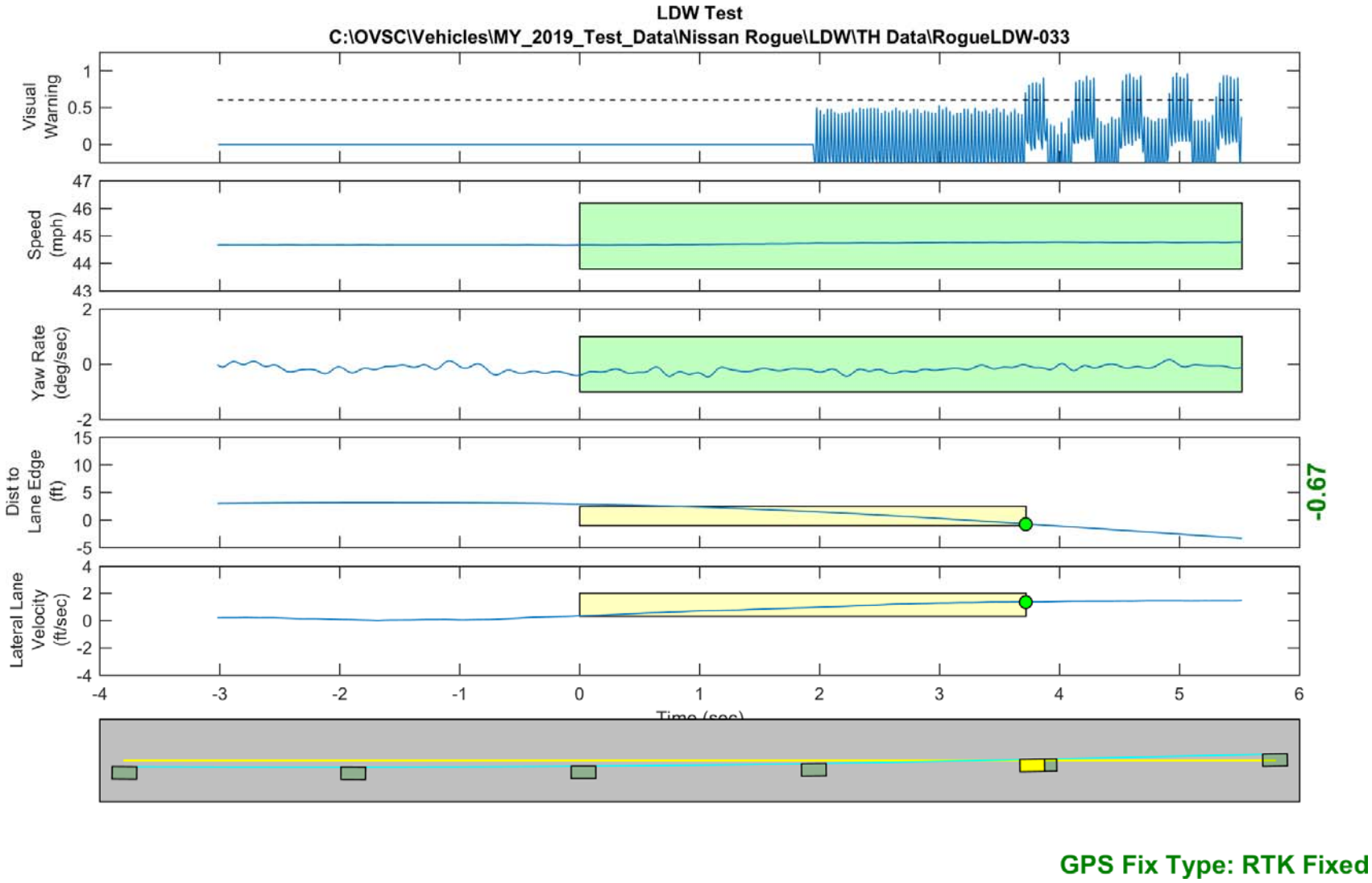

Figure D65. Time History for Run 33, Dashed Line, Left Departure, Visual Warning

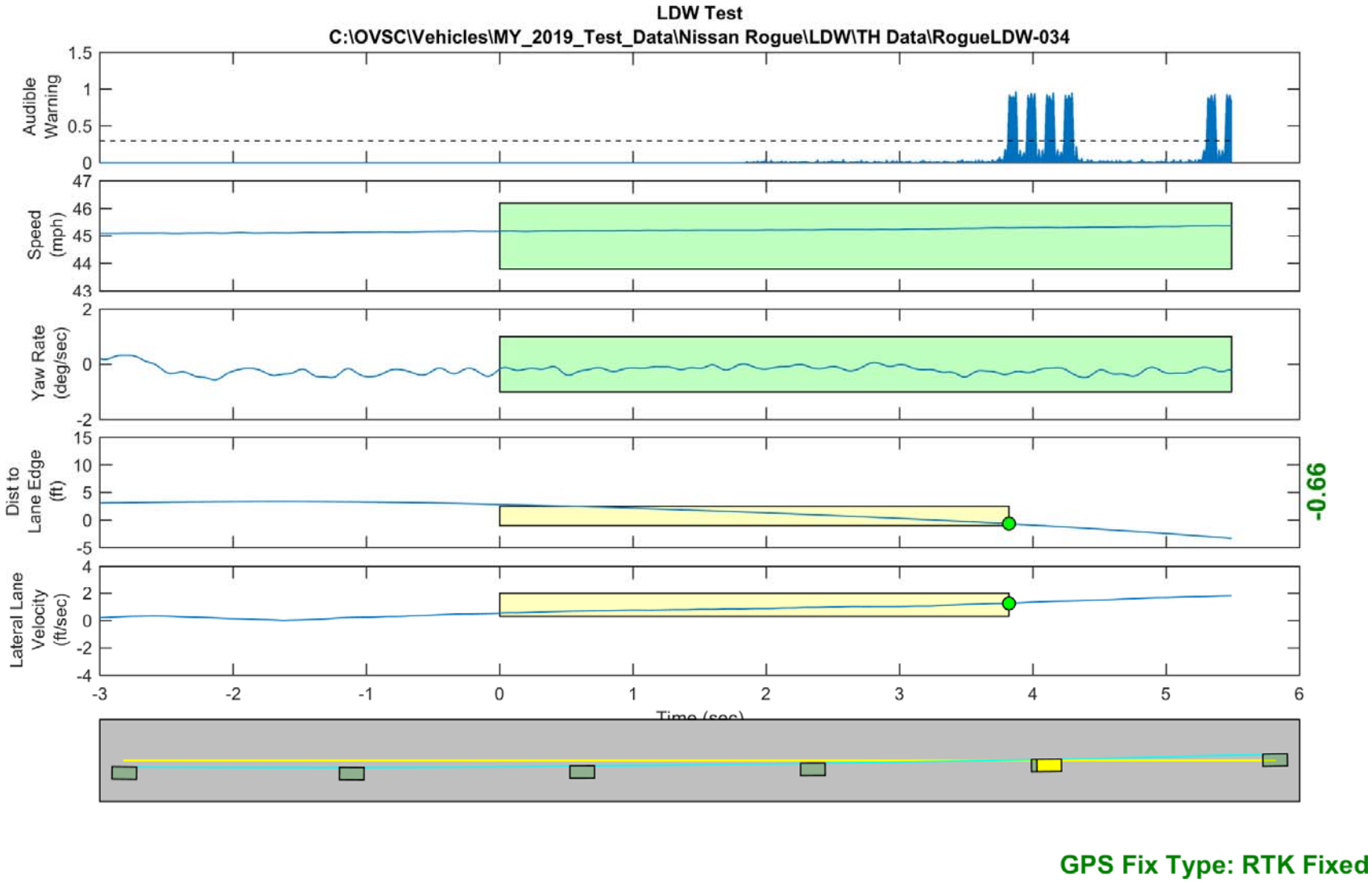

Figure D66. Time History for Run 34, Dashed Line, Left Departure, Audible Warning

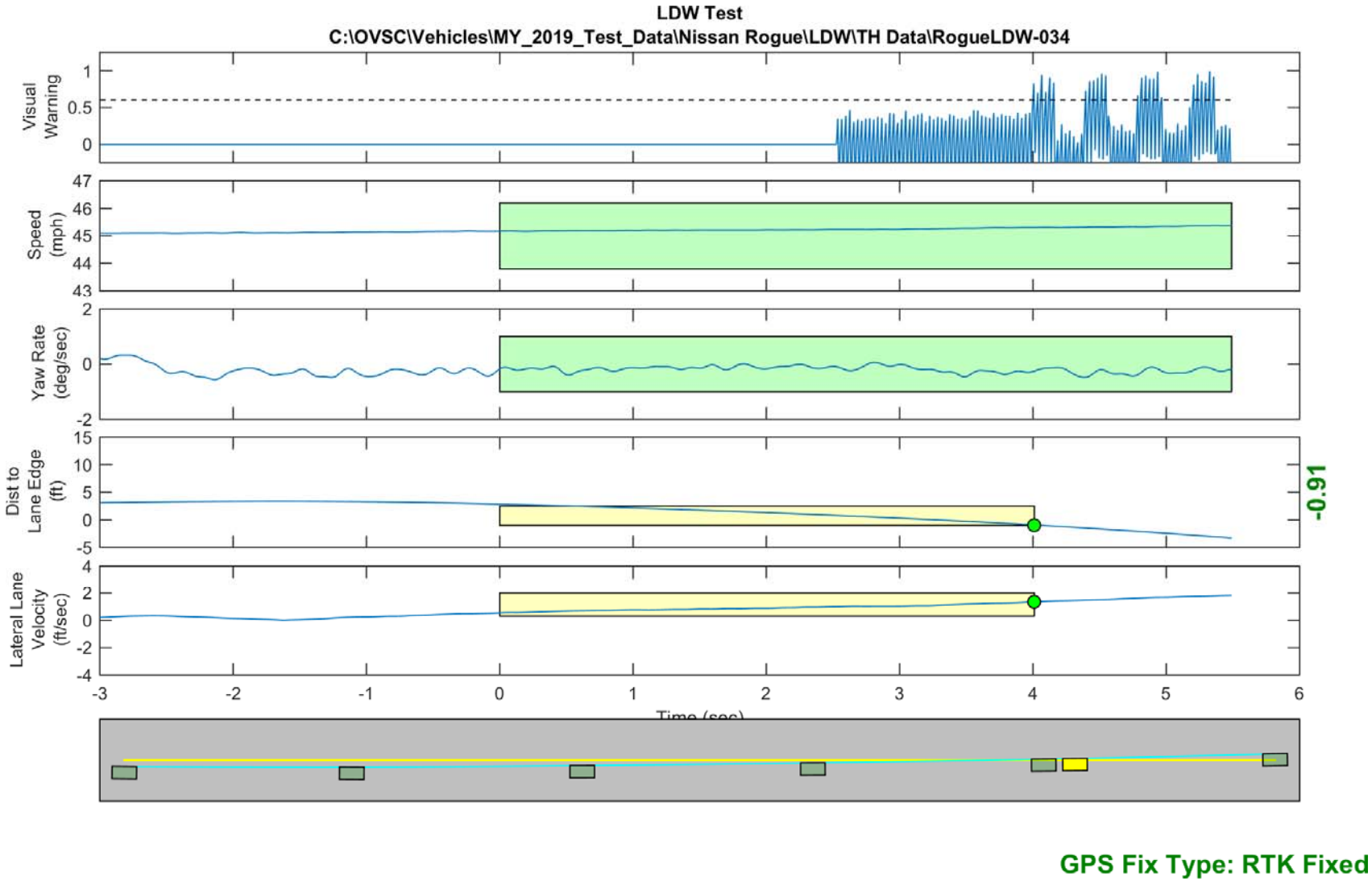

Figure D67. Time History for Run 34, Dashed Line, Left Departure, Visual Warning

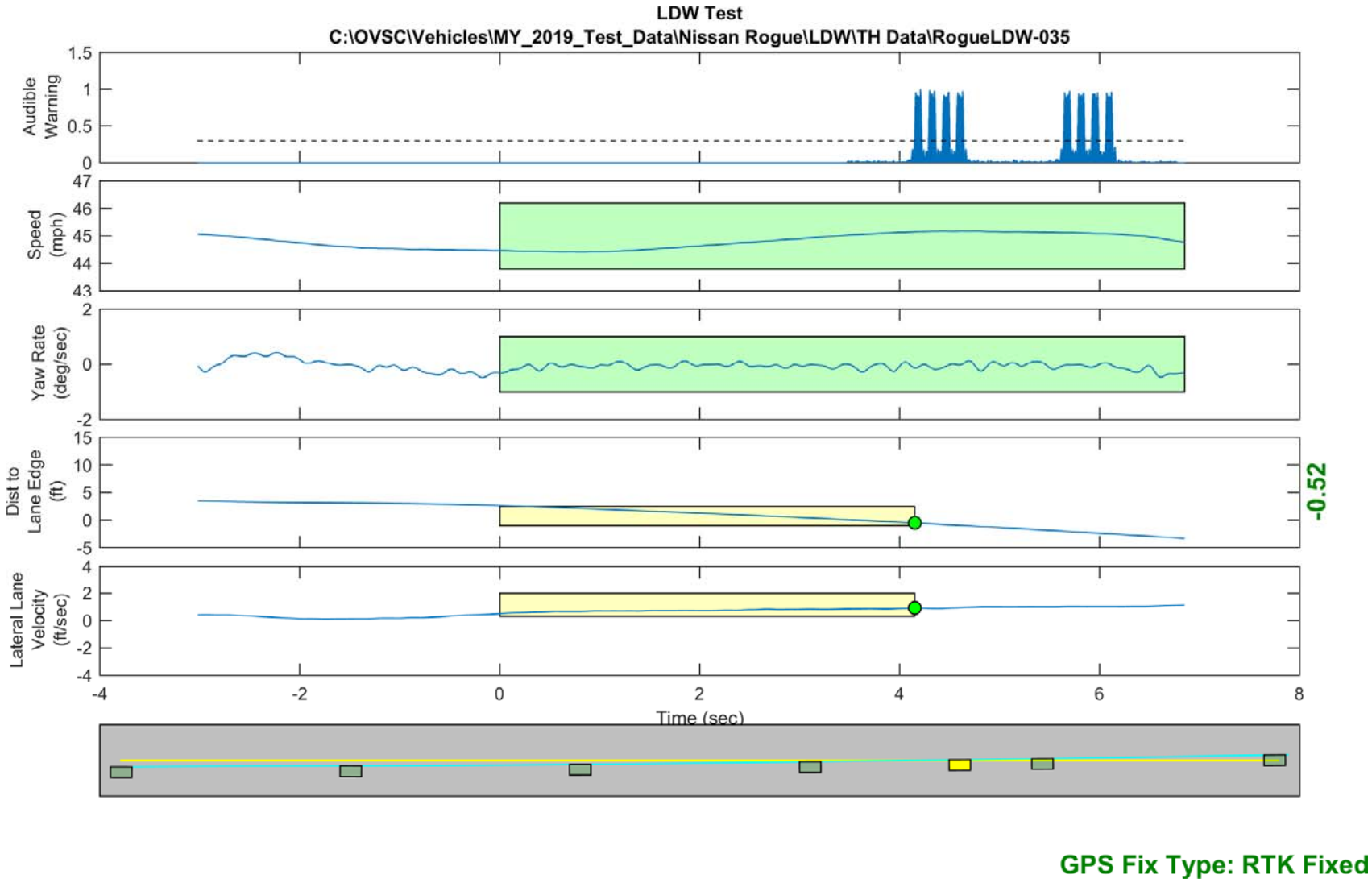

Figure D68. Time History for Run 35, Dashed Line, Left Departure, Audible Warning

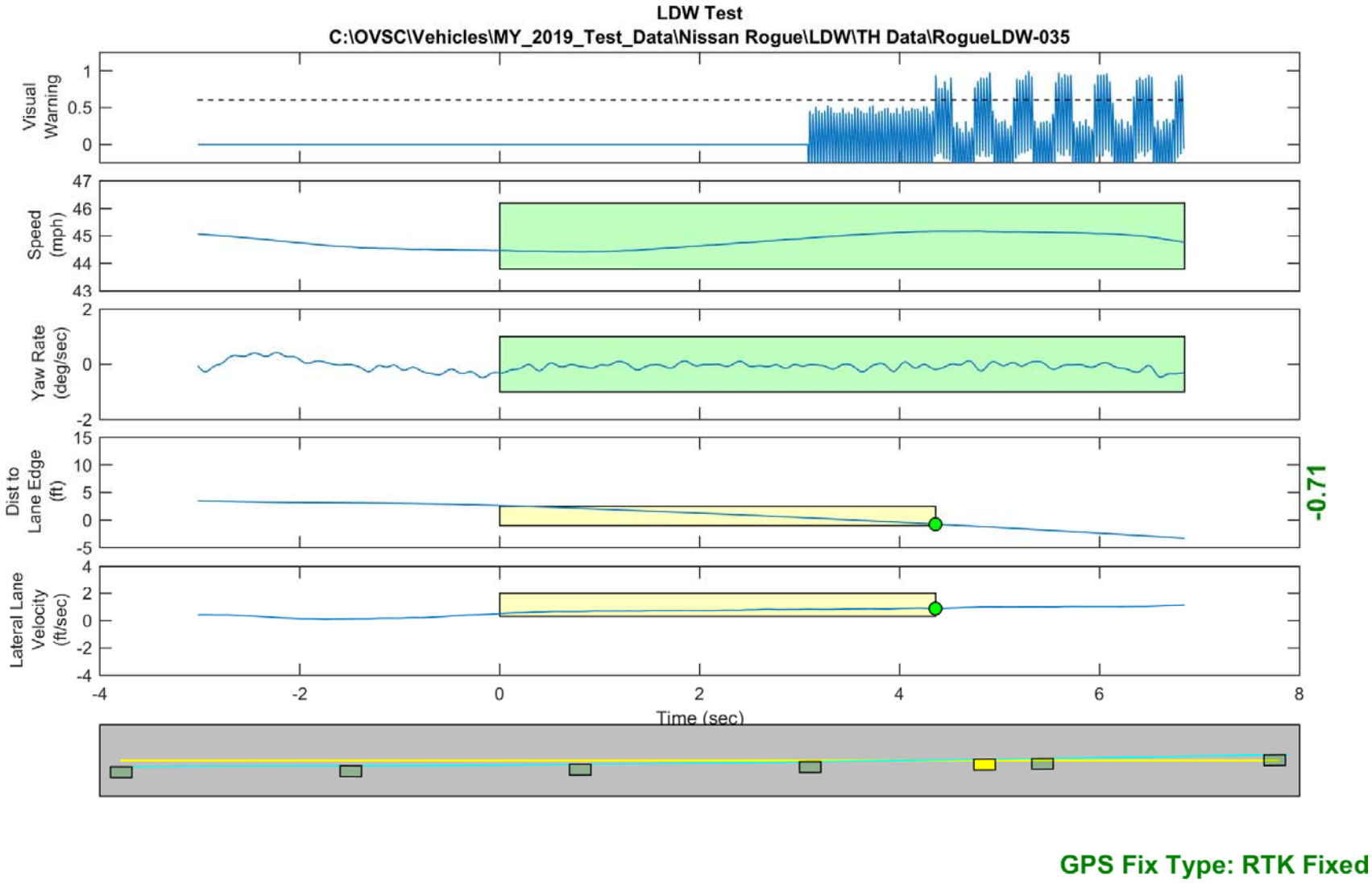

Figure D69. Time History for Run 35, Dashed Line, Left Departure, Visual Warning

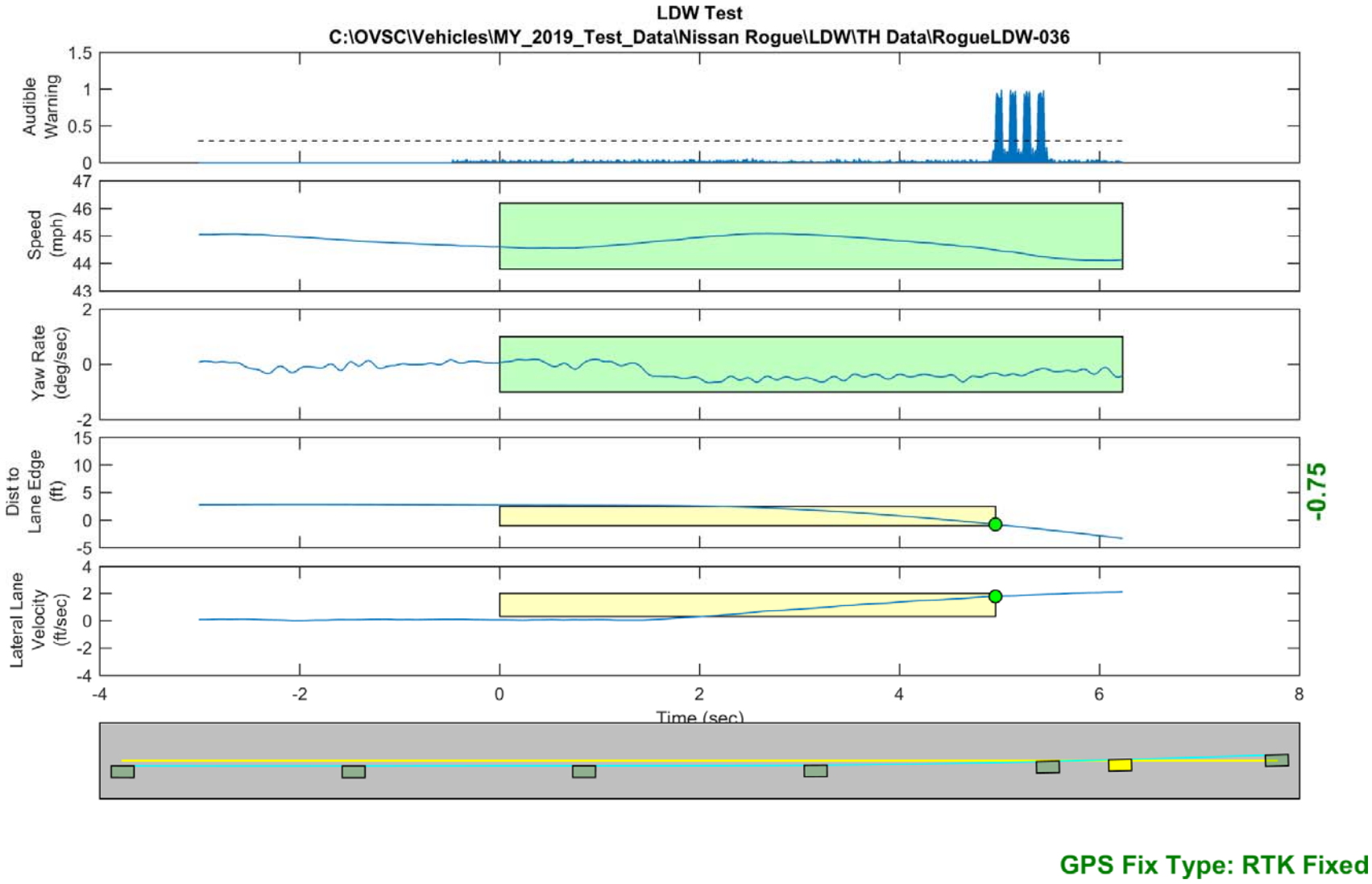

Figure D70. Time History for Run 36, Dashed Line, Left Departure, Audible Warning

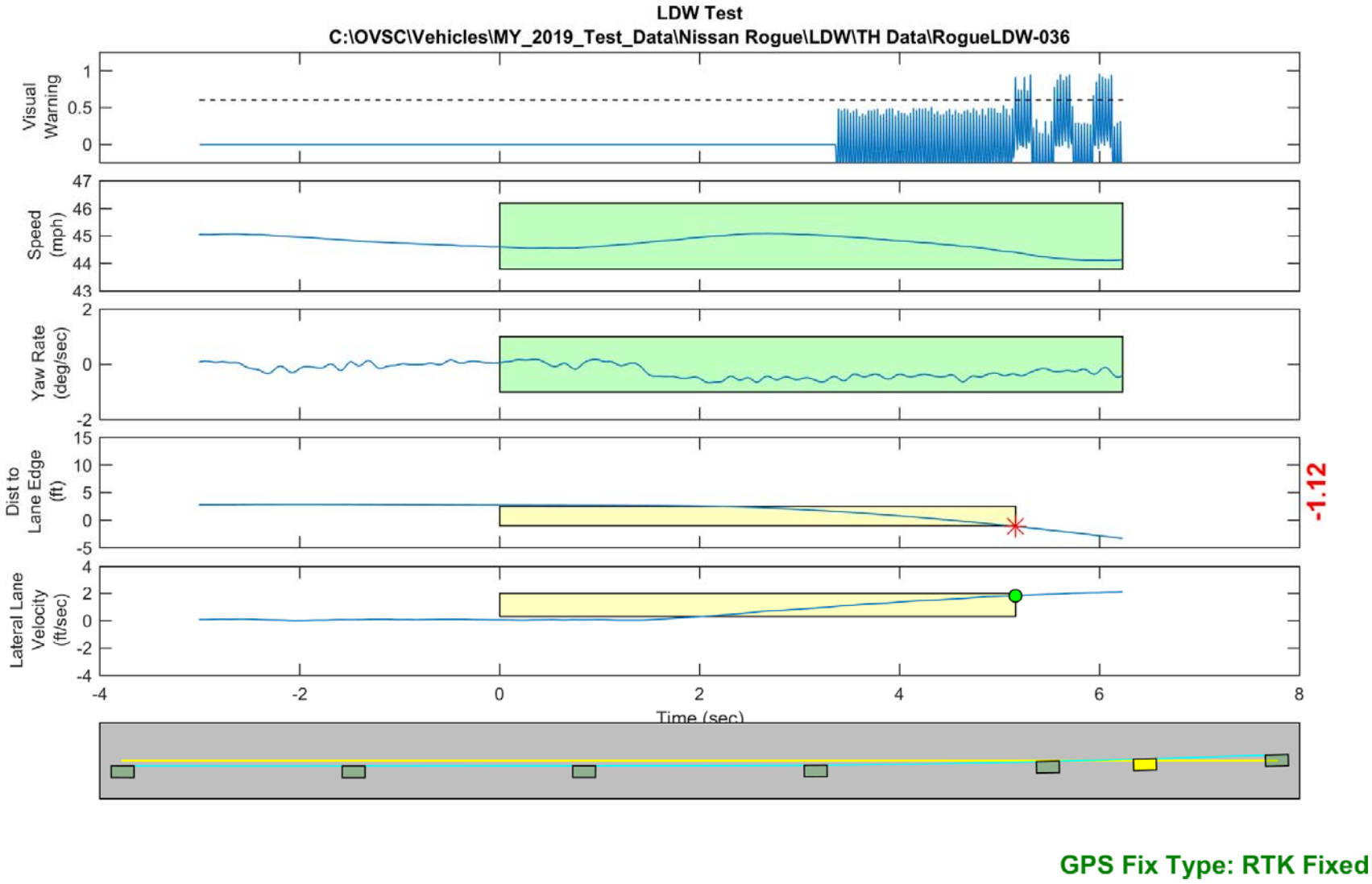

Figure D71. Time History for Run 36, Dashed Line, Left Departure, Visual Warning

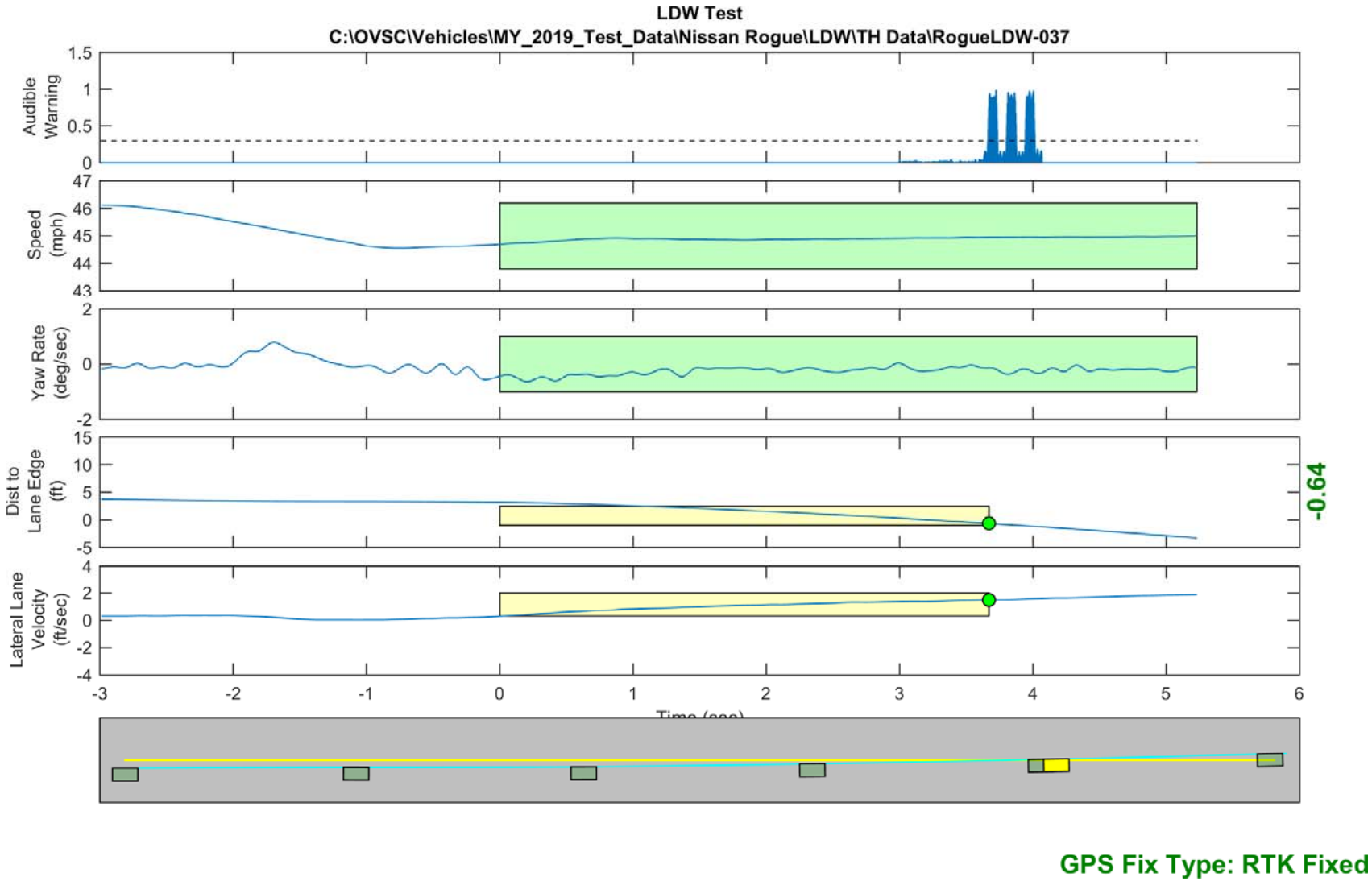

Figure D72. Time History for Run 37, Dashed Line, Left Departure, Audible Warning

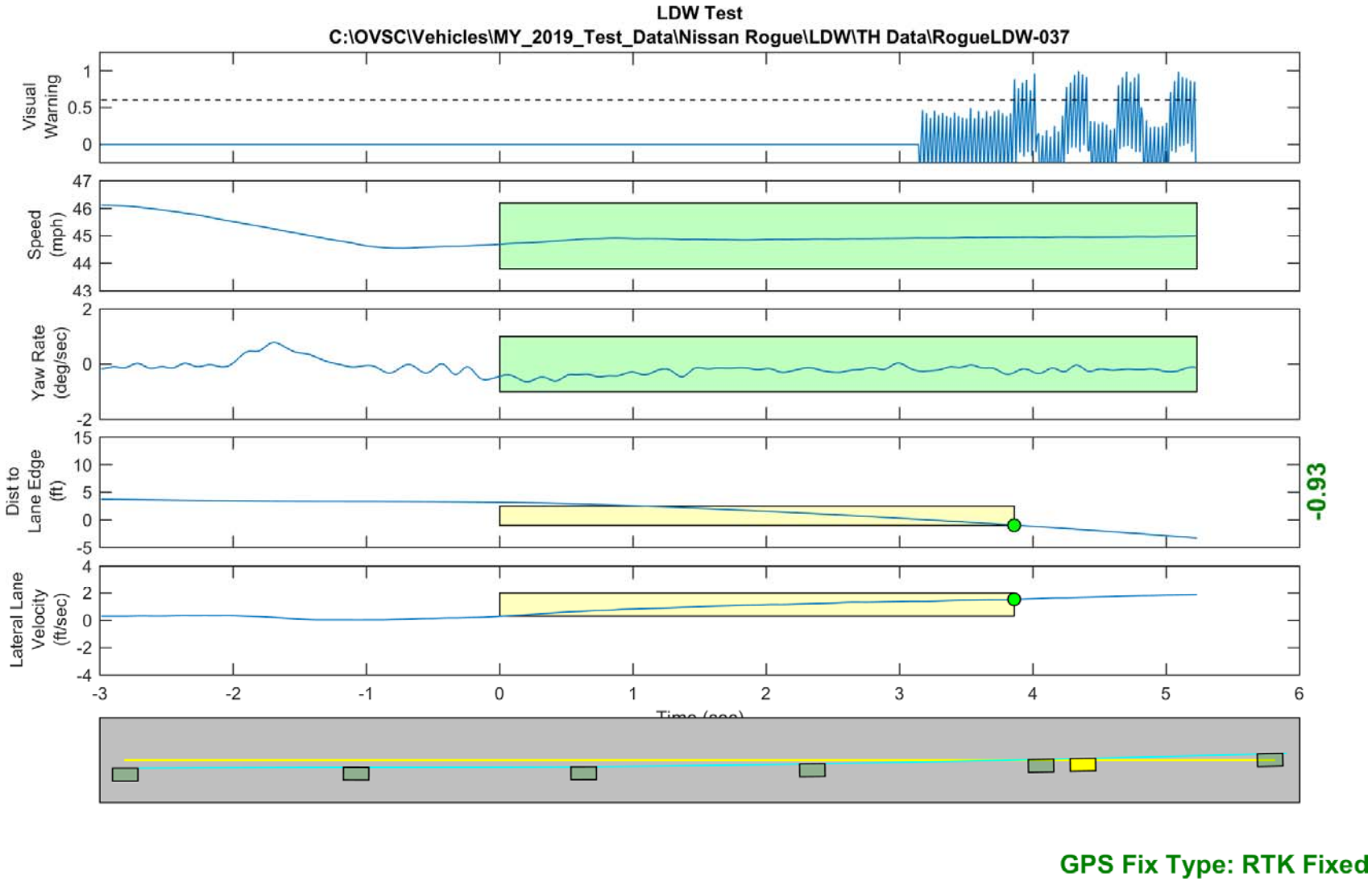

Figure D73. Time History for Run 37, Dashed Line, Left Departure, Visual Warning

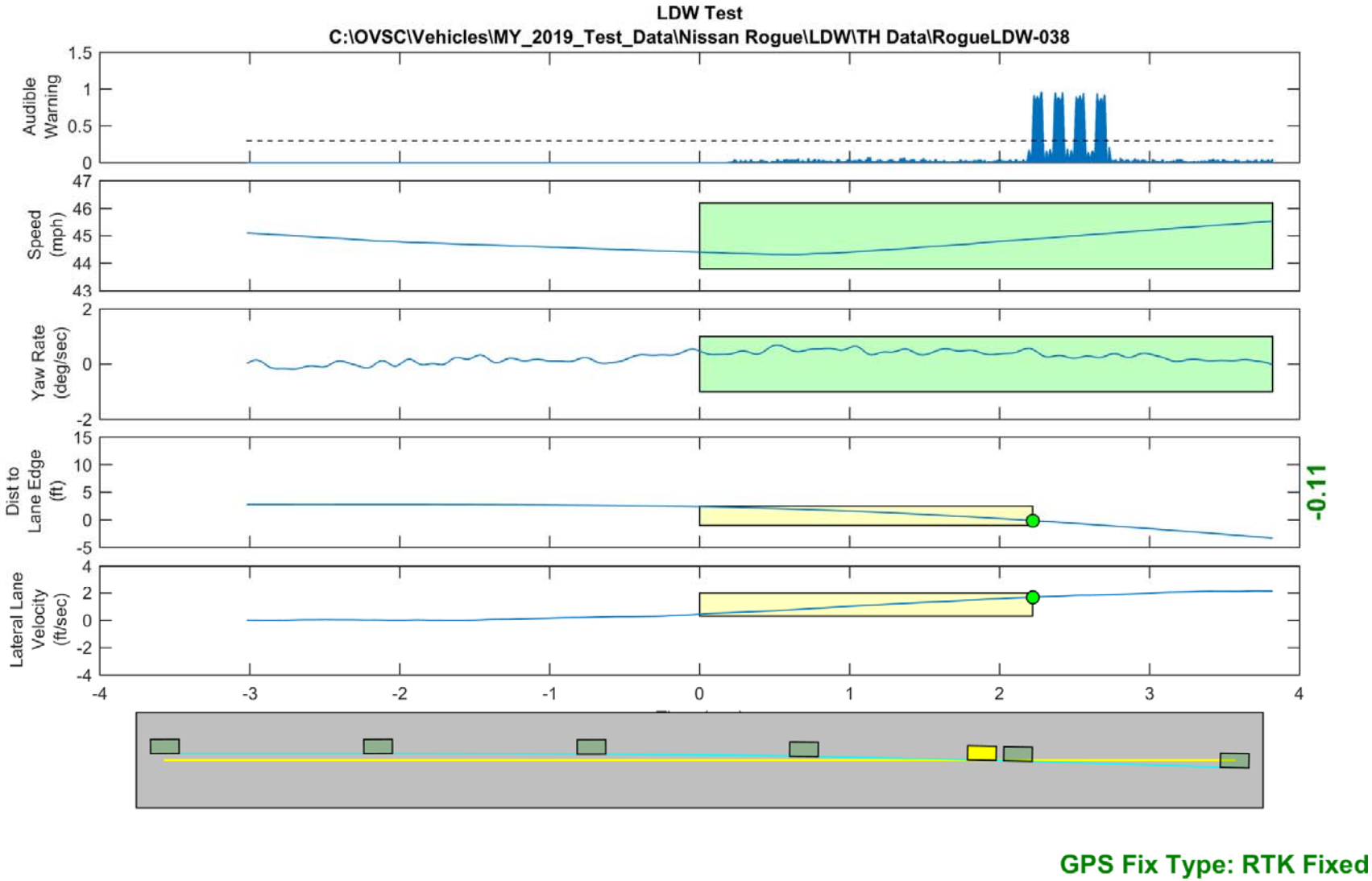

Figure D74. Time History for Run 38, Dashed Line, Right Departure, Audible Warning

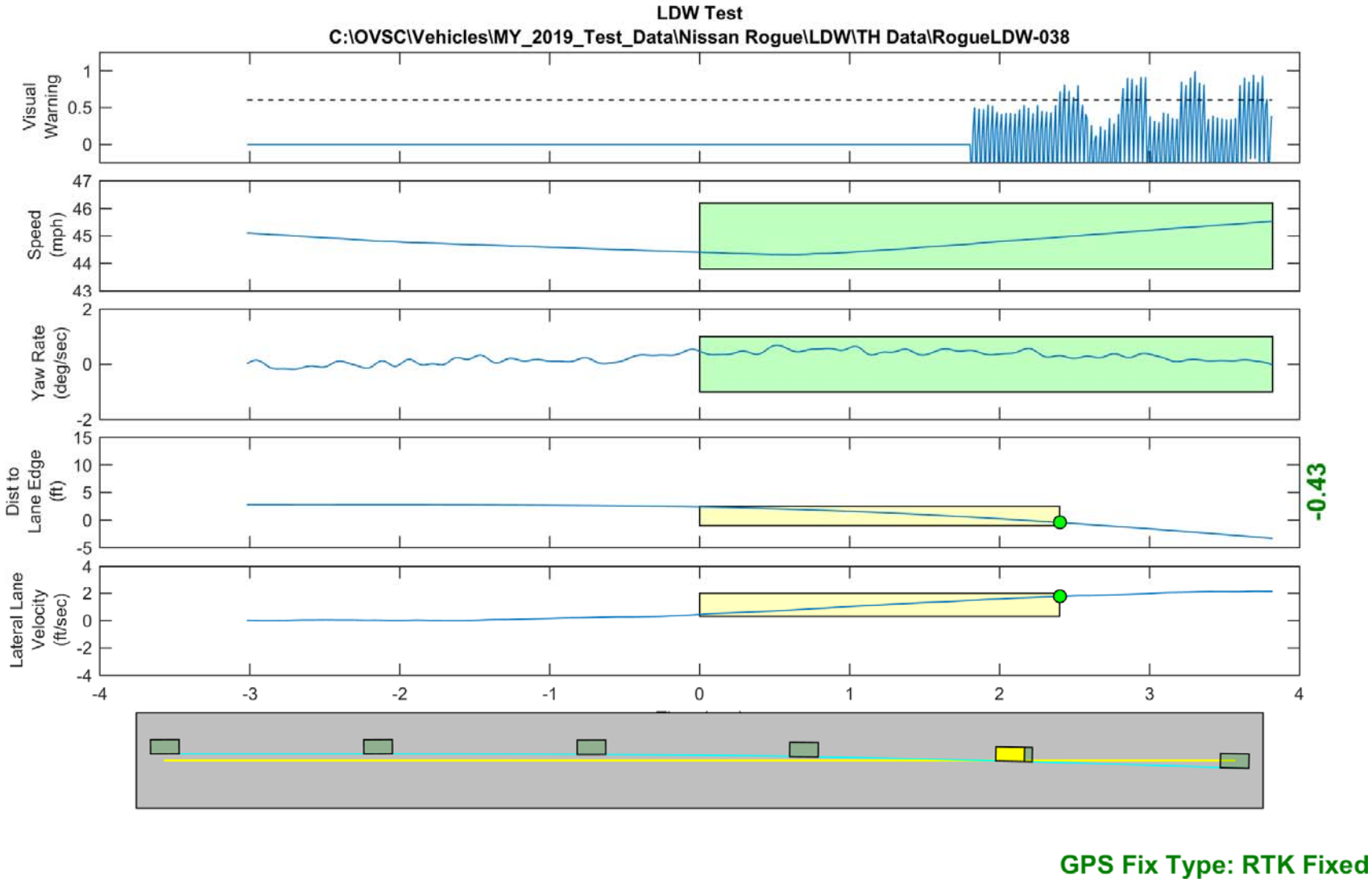

Figure D75. Time History for Run 38, Dashed Line, Right Departure, Visual Warning

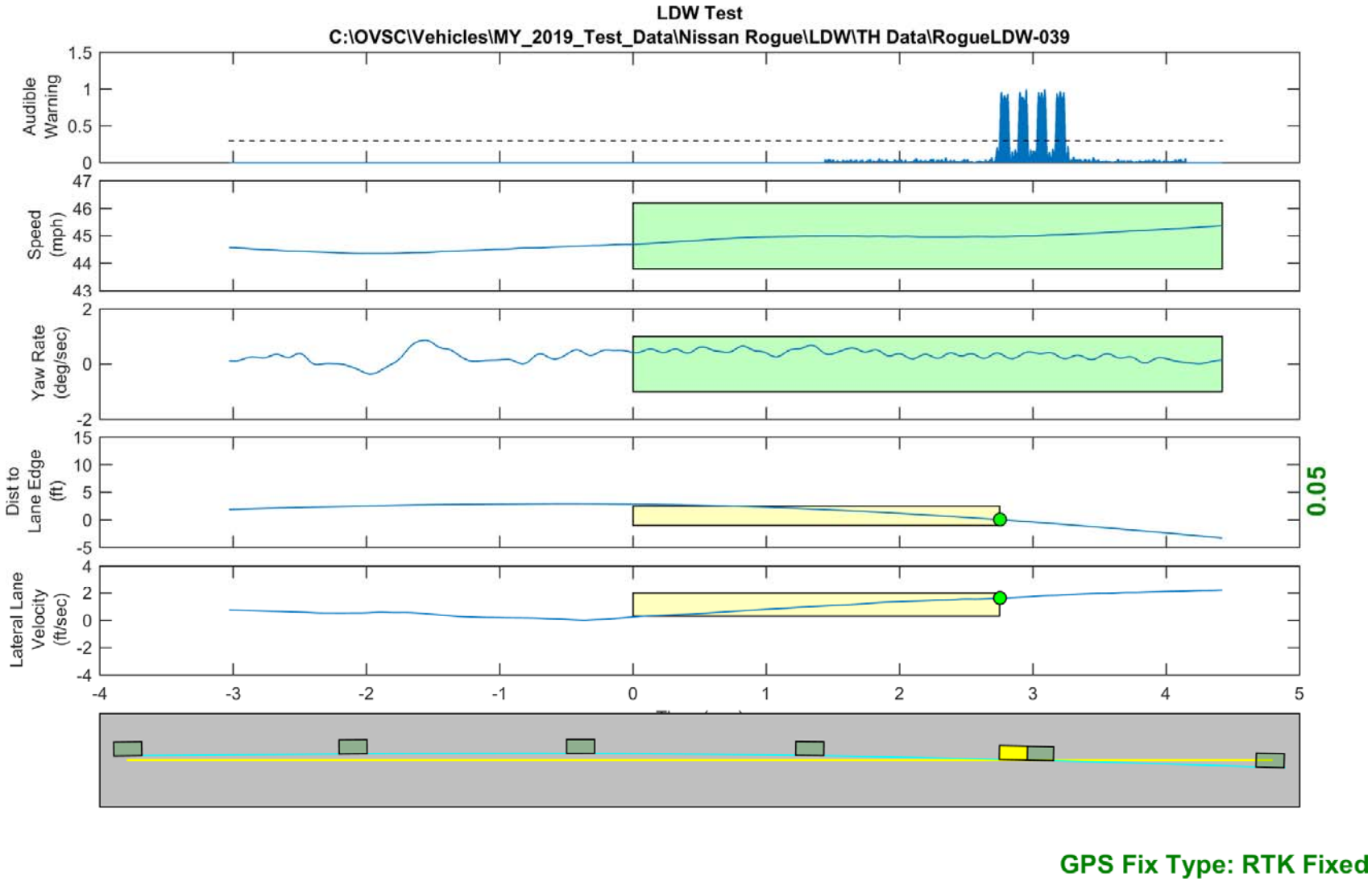

Figure D76. Time History for Run 39, Dashed Line, Right Departure, Audible Warning

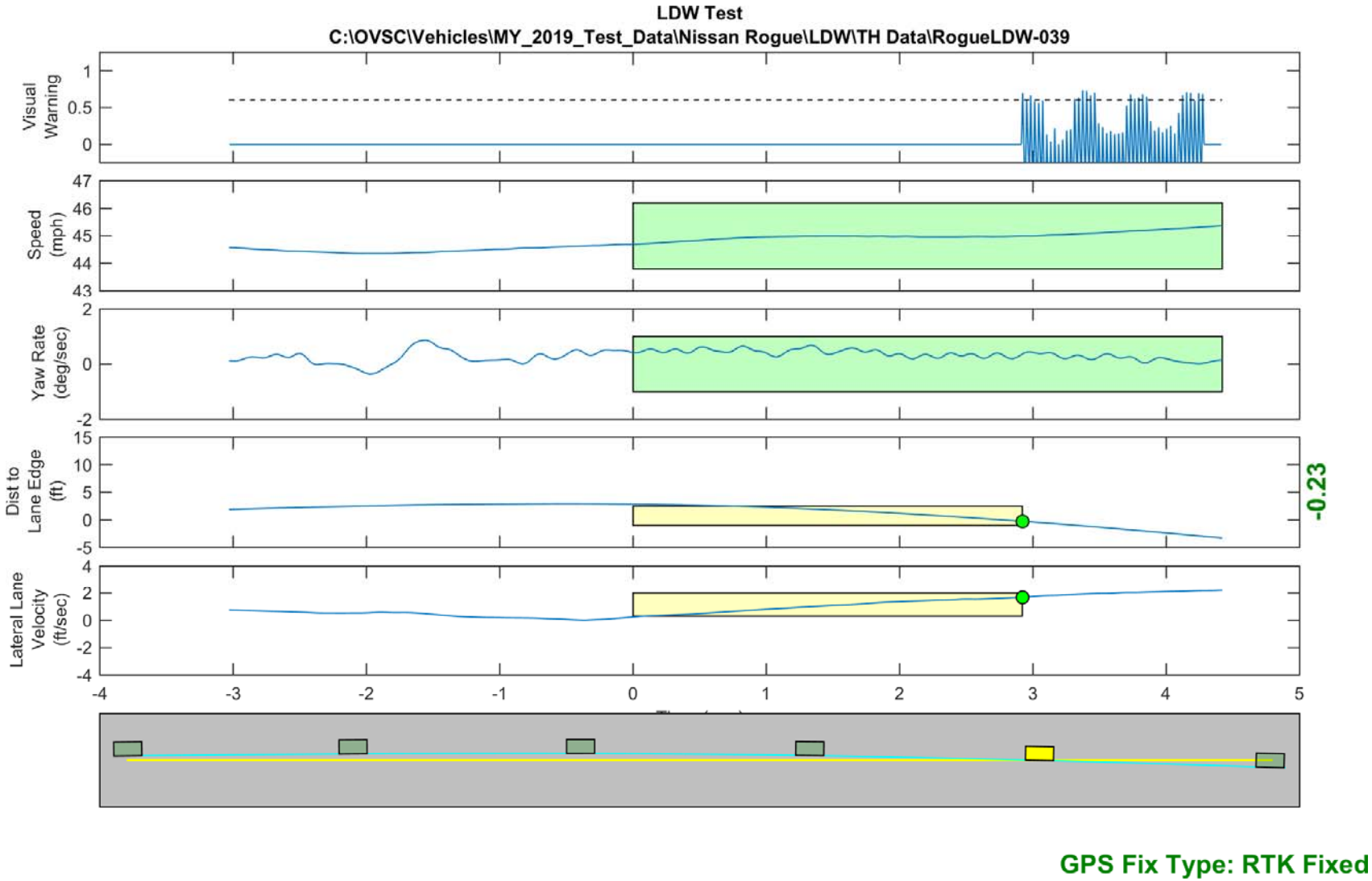

Figure D77. Time History for Run 39, Dashed Line, Right Departure, Visual Warning

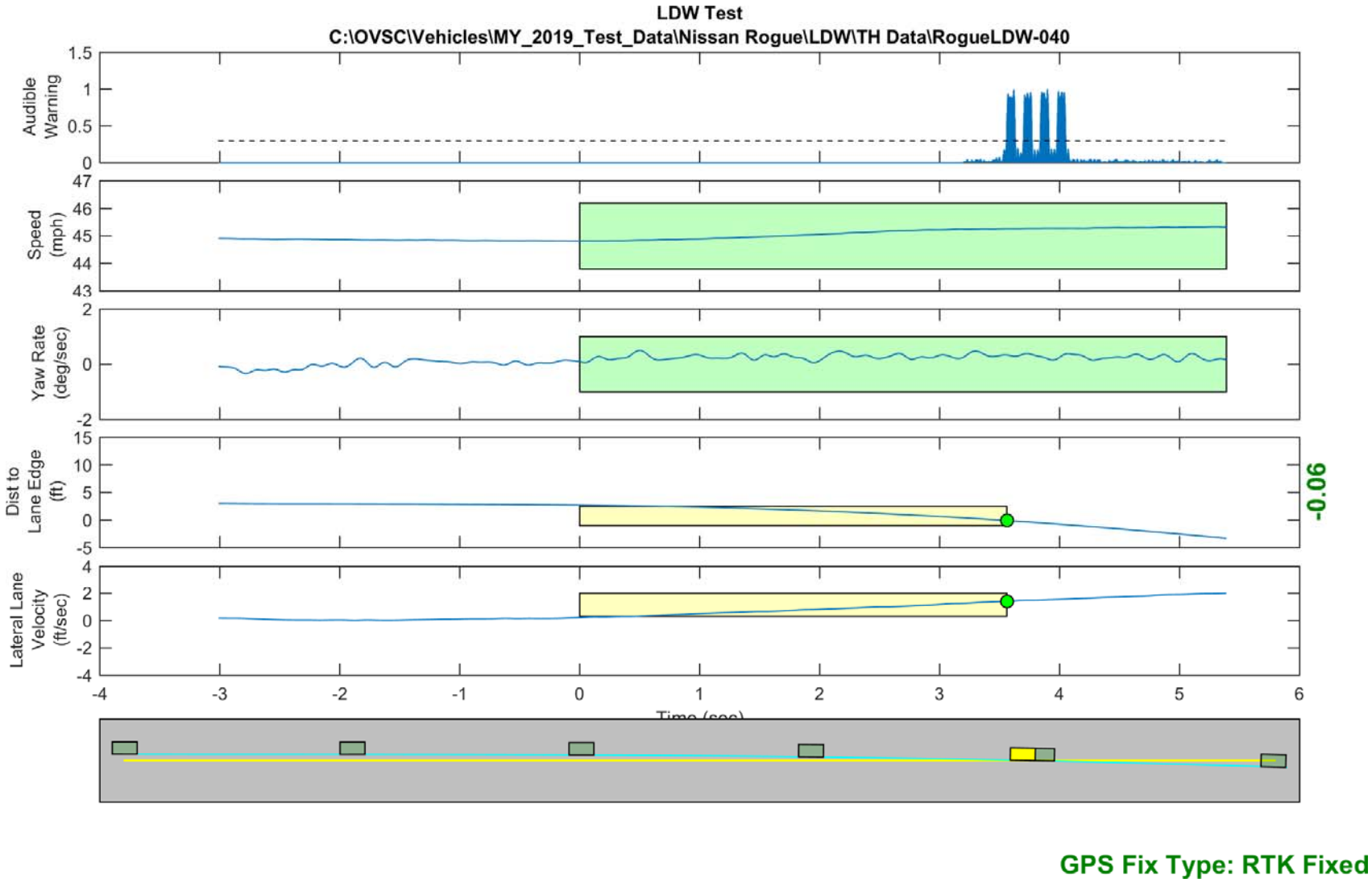

Figure D78. Time History for Run 40, Dashed Line, Right Departure, Audible Warning

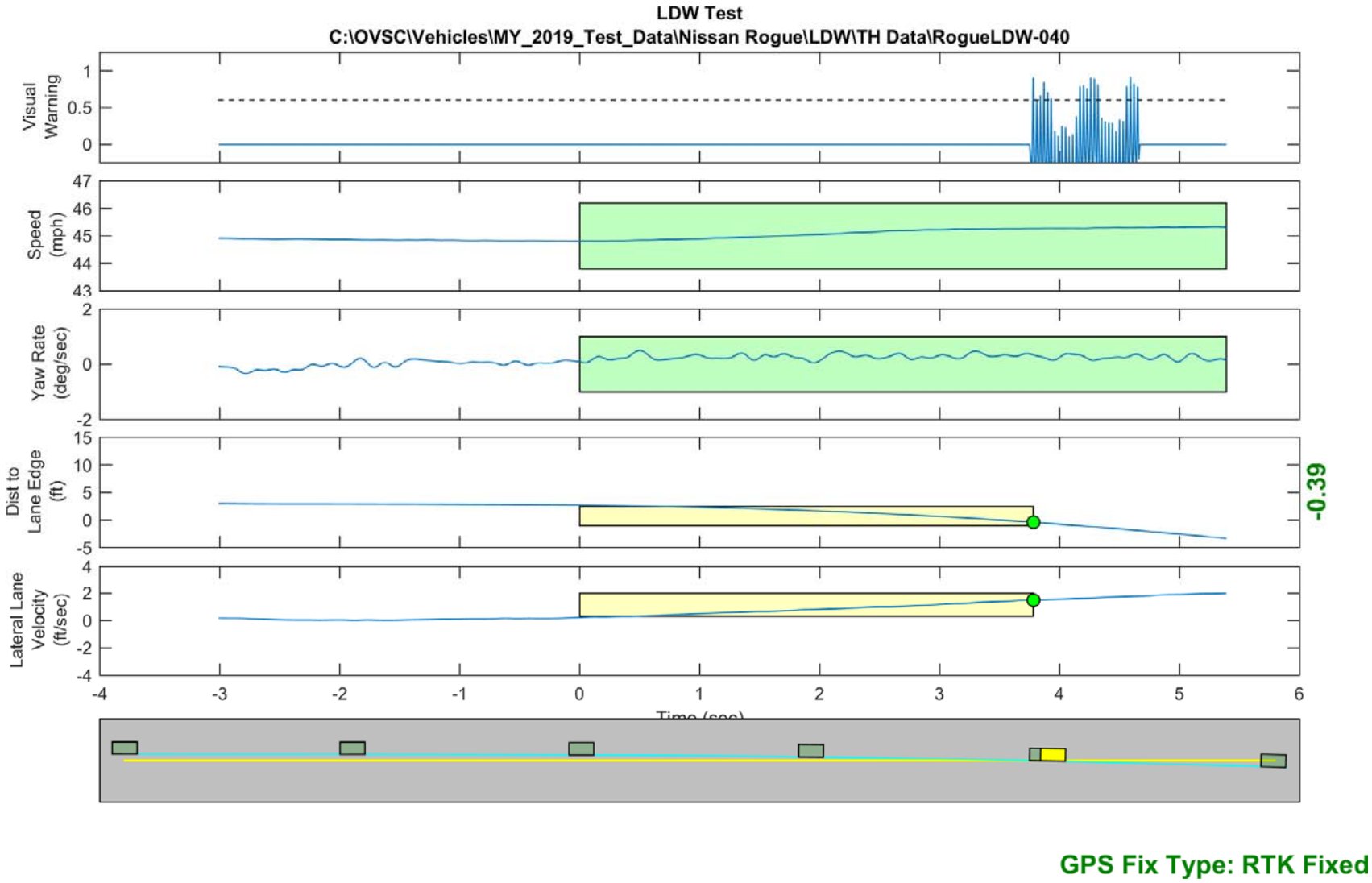

Figure D79. Time History for Run 40, Dashed Line, Right Departure, Visual Warning

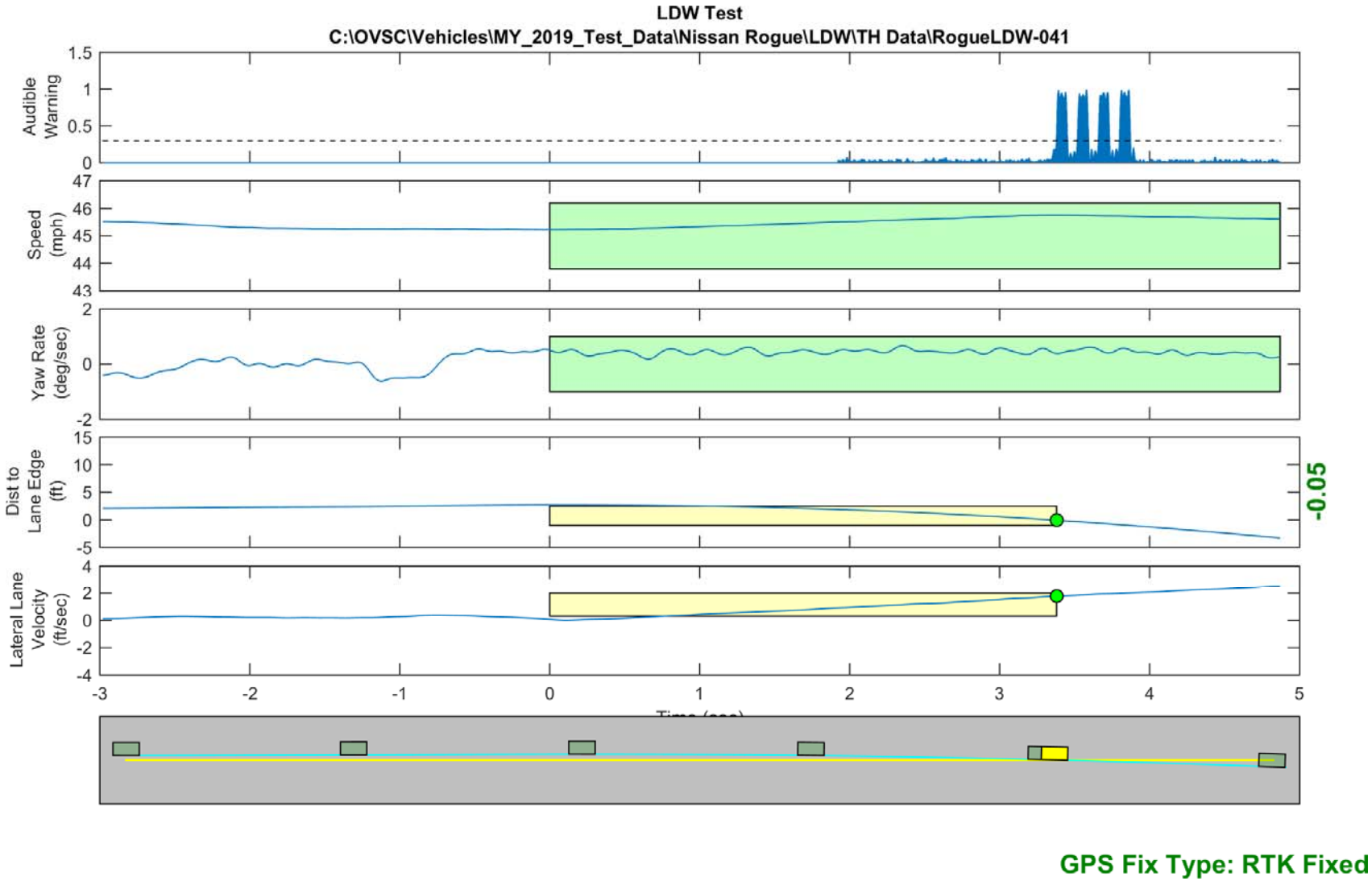

Figure D80. Time History for Run 41, Dashed Line, Right Departure, Audible Warning

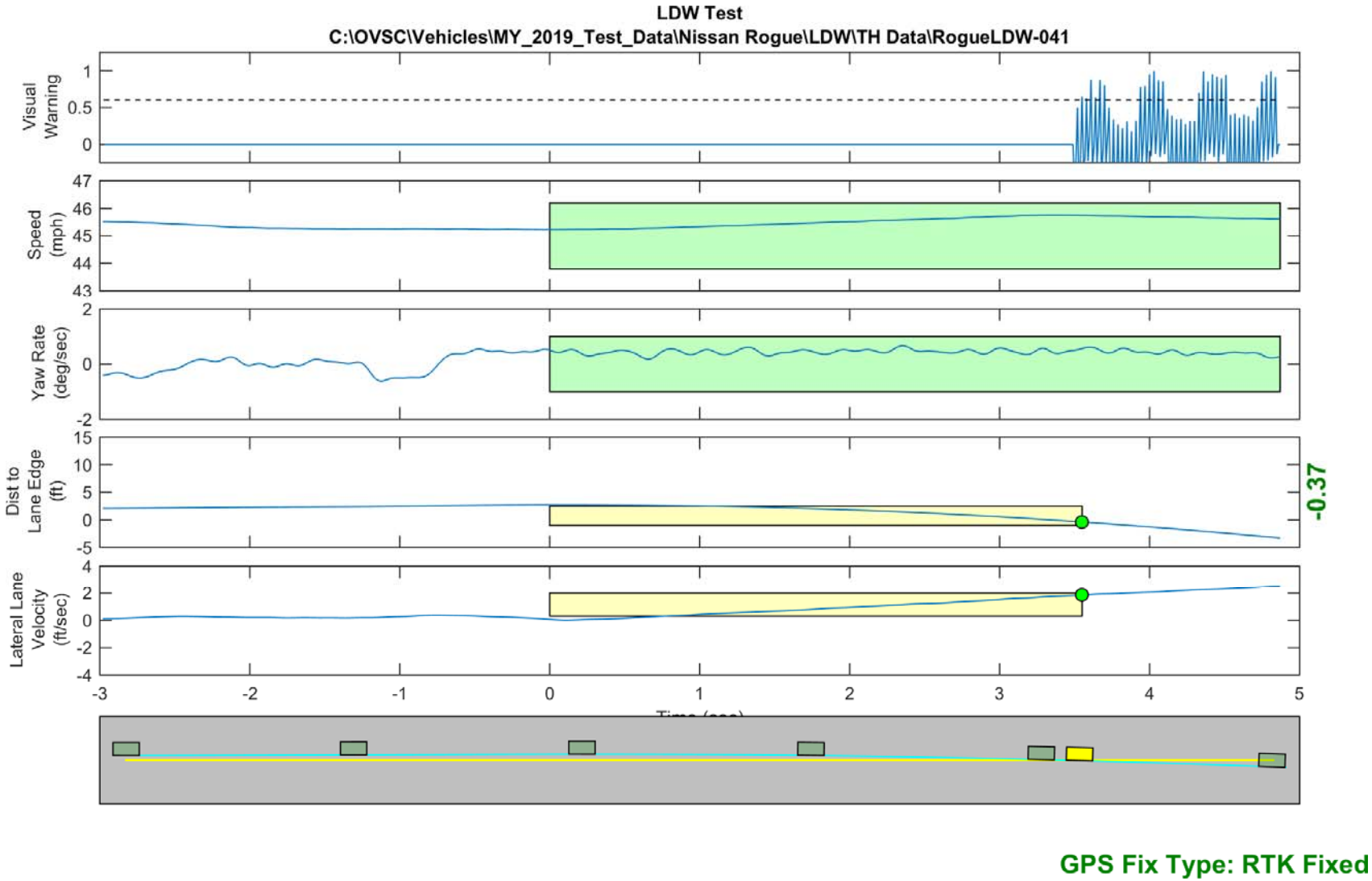

Figure D81. Time History for Run 41, Dashed Line, Right Departure, Visual Warning

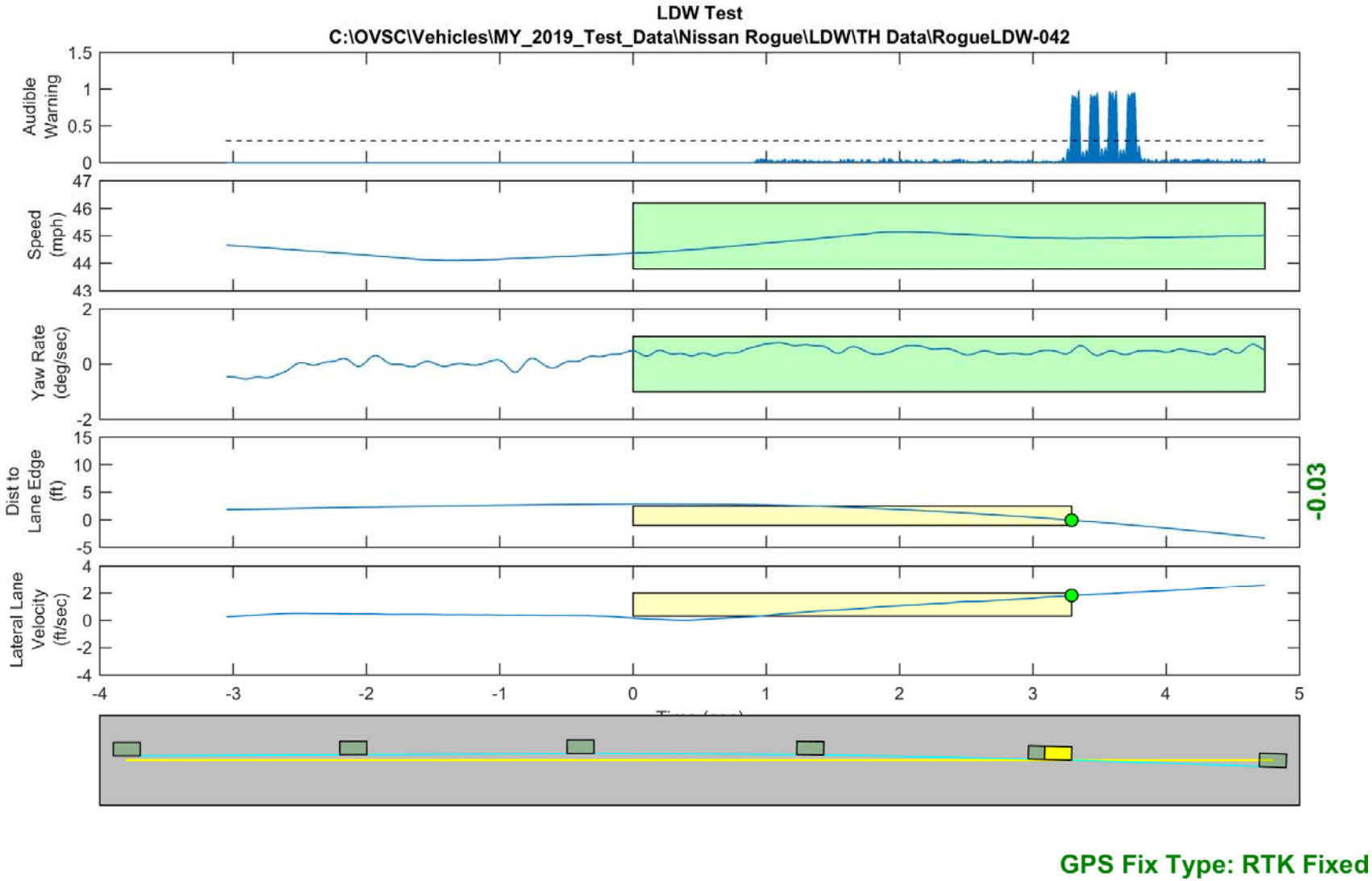

Figure D82. Time History for Run 42, Dashed Line, Right Departure, Audible Warning

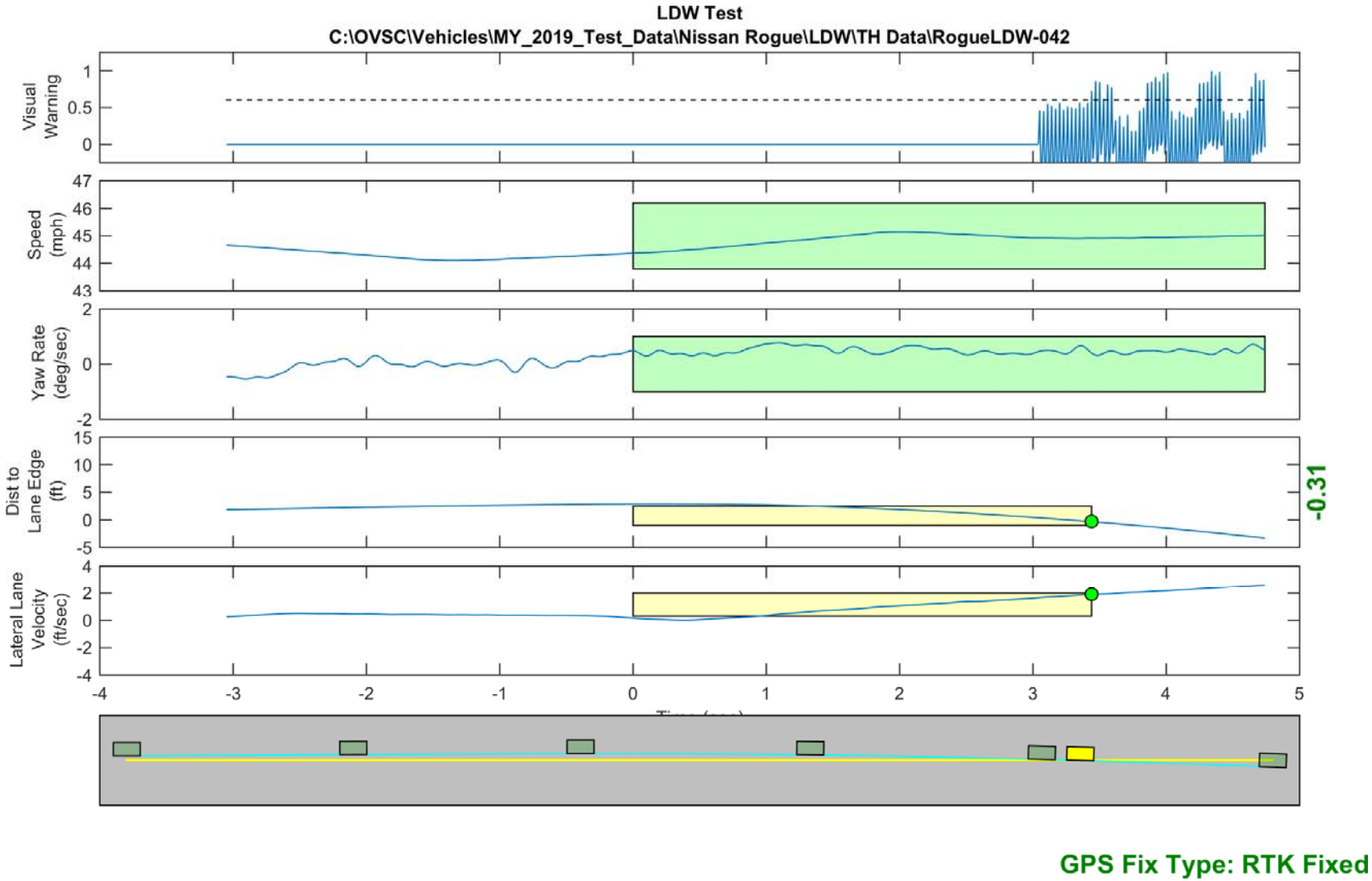

Figure D83. Time History for Run 42, Dashed Line, Right Departure, Visual Warning

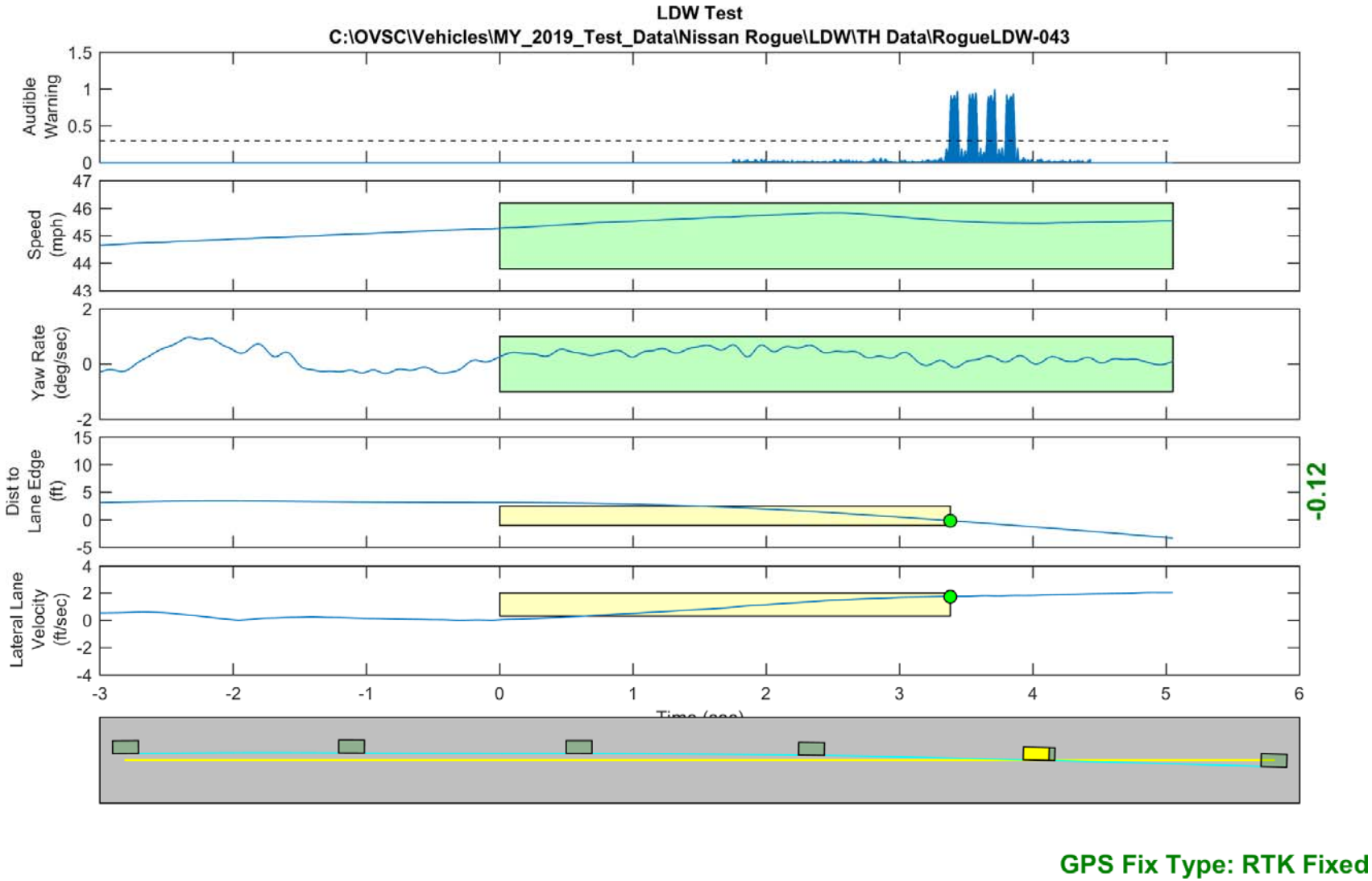

Figure D84. Time History for Run 43, Dashed Line, Right Departure, Audible Warning

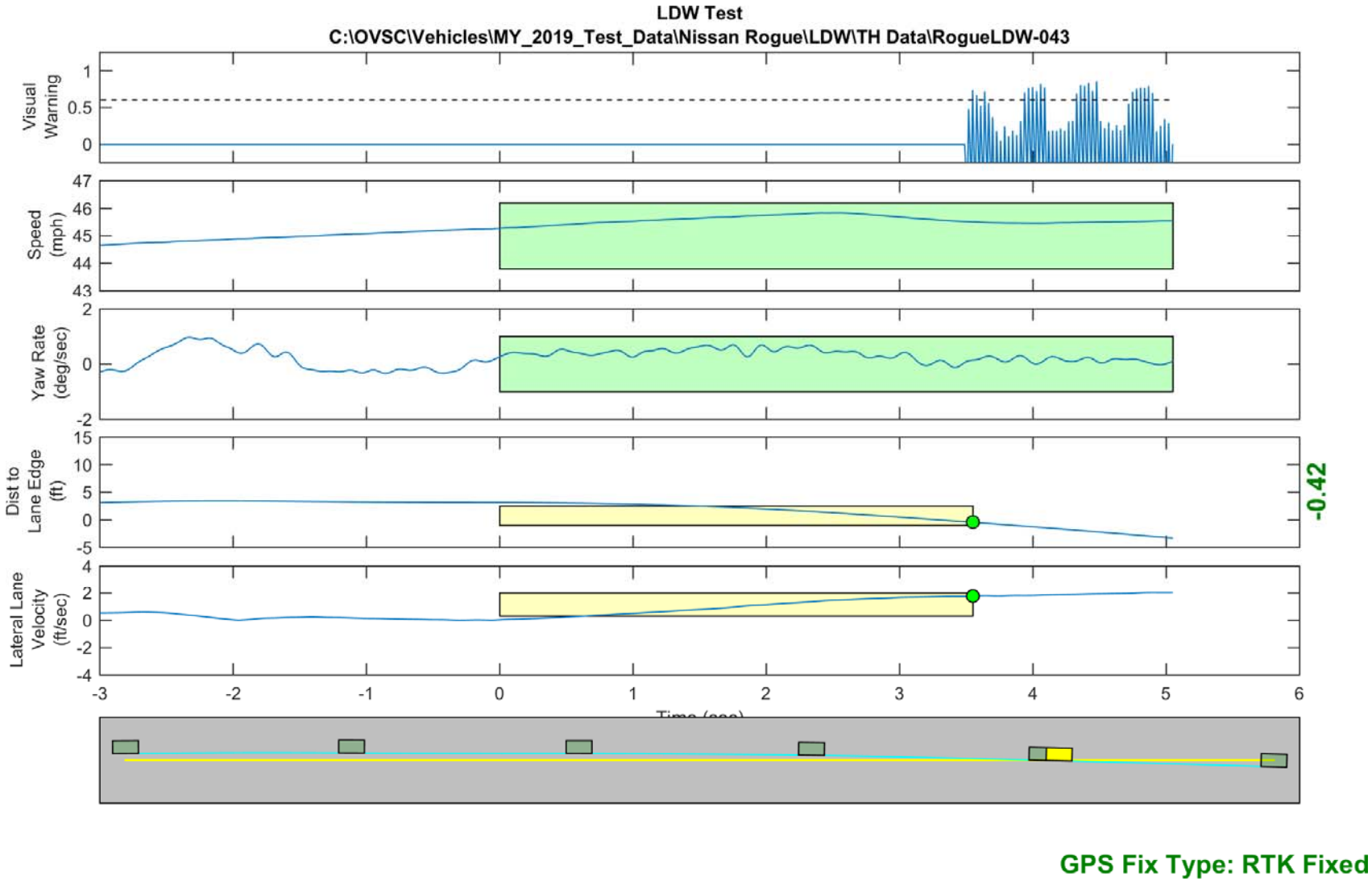

Figure D85. Time History for Run 43, Dashed Line, Right Departure, Visual Warning

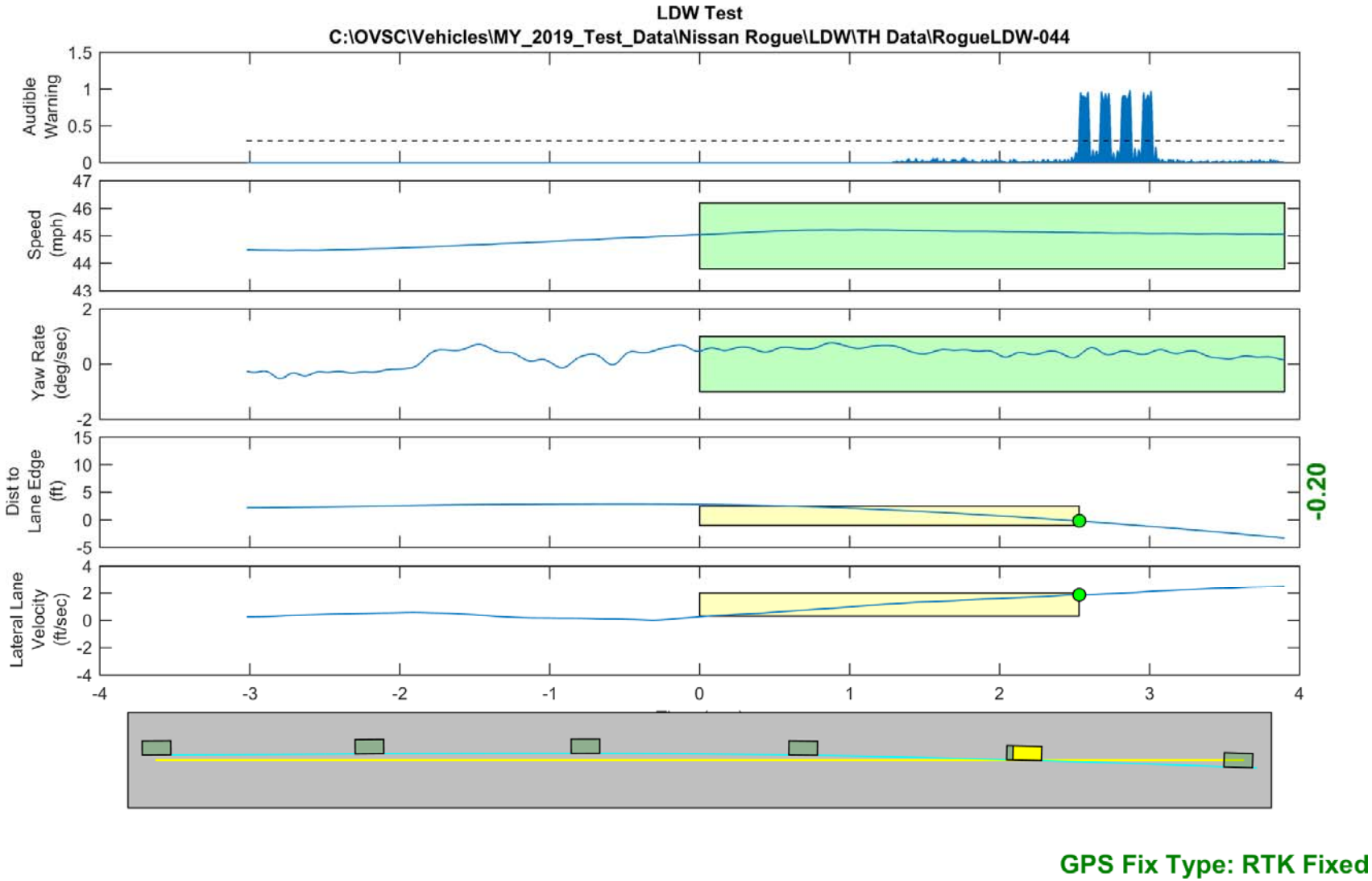

Figure D86. Time History for Run 44, Dashed Line, Right Departure, Audible Warning

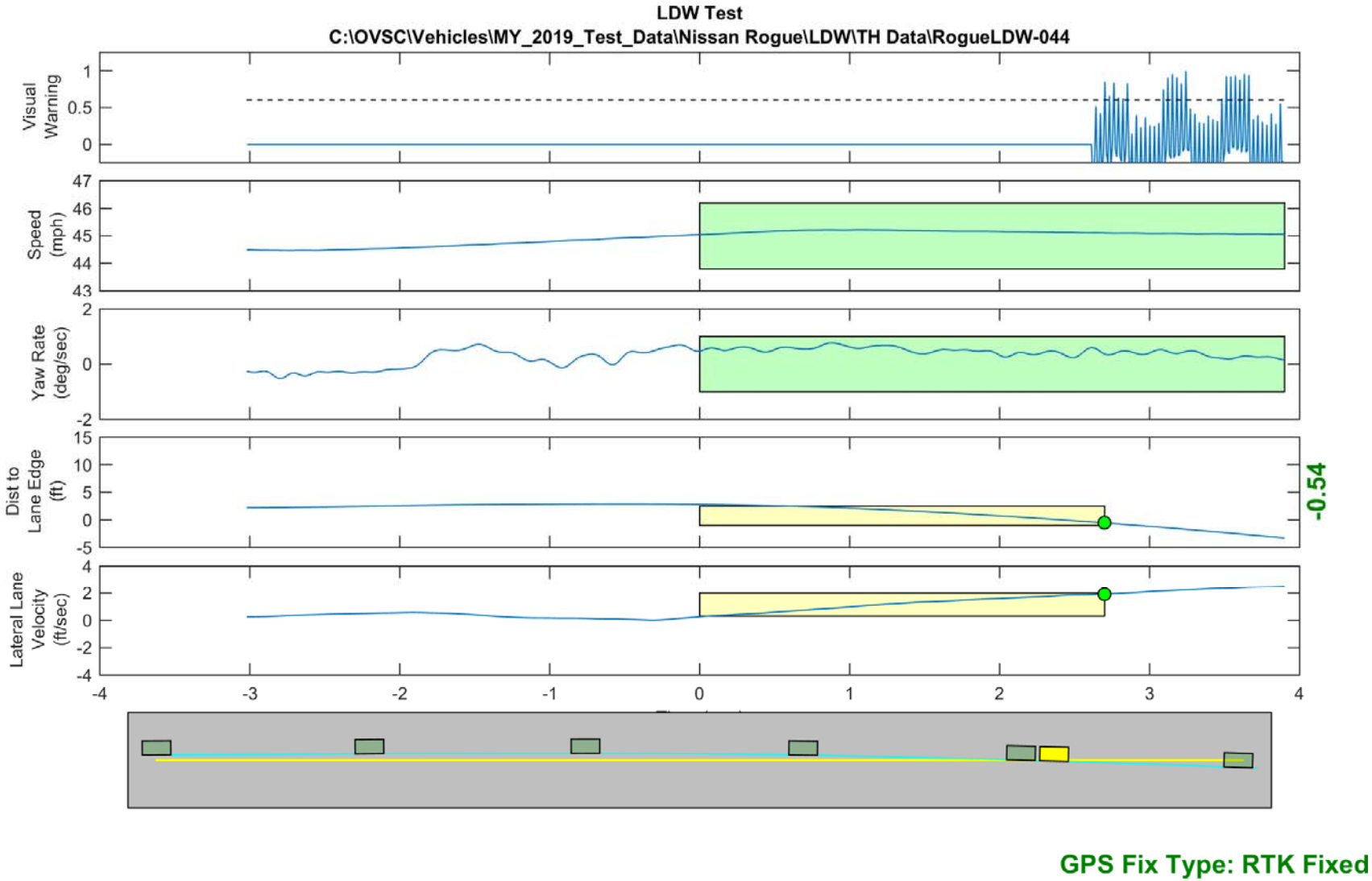

Figure D87. Time History for Run 44, Dashed Line, Right Departure, Visual Warning