

**NEW CAR ASSESSMENT PROGRAM  
DYNAMIC BRAKE SUPPORT SYSTEM CONFIRMATION TEST  
NCAP-DRI-DBS-22-04**

**2022 Ford Escape PHEV FWD**

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**1 June 2022**

**Final Report**

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

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16. Abstract These tests were conducted on the subject 2022 Ford Escape PHEV FWD in accordance with the specifications of the New Car Assessment Program's (NCAP's) most current Test Procedure in docket NHTSA-2015-0006-0026; DYNAMIC BRAKE SUPPORT PERFORMANCE EVALUATION CONFIRMATION TEST FOR THE NEW CAR ASSESSMENT PROGRAM, October 2015. The vehicle passed the requirements of the test for all four DBS test scenarios.			
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## TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
I. INTRODUCTION .....	1
II. DATA SHEETS .....	2
Data Sheet 1: Test Results Summary .....	3
Data Sheet 2: Vehicle Data .....	4
Data Sheet 3: Test Conditions .....	5
Data Sheet 4: Dynamic Brake System Operation .....	7
III. TEST PROCEDURES .....	10
A. Test Procedure Overview .....	10
B. General Information .....	15
C. Principal Other Vehicle .....	18
D. Foundation Brake System Characterization .....	19
E. Brake Control .....	200
F. Instrumentation .....	211
APPENDIX A Photographs .....	A-1
APPENDIX B Excerpts from Owner's Manual .....	B-1
APPENDIX C Run Log .....	C-1
APPENDIX D Brake Characterization .....	D-1
APPENDIX E Time Histories .....	E-1

## Section I

### INTRODUCTION

Dynamic Brake Support (DBS) systems are a subset of Automatic Emergency Braking (AEB) systems. DBS systems are designed to avoid or mitigate consequences of rear-end crashes by automatically applying supplemental braking on the subject vehicle (SV) when the system determines that the braking applied by the driver is insufficient to avoid a collision.

DBS systems intervene in driving situations where a rear-end collision is expected to be unavoidable unless additional braking is realized. Since DBS interventions are designed to occur late in the pre-crash timeline, and the driver has already initiated crash-avoidance braking, DBS systems are not required to alert the driver that a DBS intervention has occurred. In addition to sensors monitoring vehicle operating conditions, such as speed, brake application, etc., DBS systems employ RADAR, LIDAR, and/or vision-based sensors capable of detecting surrounding vehicles in traffic. Algorithms in the system's Central Processing Unit (CPU) use this information to continuously monitor the likelihood of a rear-end crash, and command additional braking as needed to avoid or mitigate such a crash.

The method prescribed by the National Highway Traffic Safety Administration (NHTSA) to evaluate DBS performance on the test track involves three longitudinal, rear-end type crash configurations and a false positive test. In the rear-end scenarios, a SV approaches a stopped, slower-moving, or decelerating principal other vehicle (POV) in the same lane of travel. For these tests, the POV is a strikeable object with the characteristics of a compact passenger car. The fourth scenario is used to evaluate the propensity of a DBS system to inappropriately activate in a non-critical driving scenario that does not present a safety risk to the SV occupant(s).

The purpose of the testing reported herein was to objectively quantify the performance of a Dynamic Brake Support system installed on a 2022 Ford Escape PHEV FWD. This test to assess Dynamic Brake Support systems is sponsored by the National Highway Traffic Safety Administration under Contract No. DTNH22-14-D-00333 with the New Car Assessment Program (NCAP).

Section II  
**DATA SHEETS**

**DYNAMIC BRAKE SUPPORT**  
**DATA SHEET 1: TEST RESULTS SUMMARY**

(Page 1 of 1)

**2022 Ford Escape PHEV FWD**

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VIN: 1FMCU0KZ8NUA2xxxx

Test start date: 5/24/2022

Test end date: 5/24/2022

Dynamic Brake Support System settings: High (FCW sensitivity only)

**Test 1 - Subject Vehicle Encounters Stopped Principal Other Vehicle**

SV 25 mph: Pass

**Test 2 - Subject Vehicle Encounters Slower Principal Other Vehicle**

SV 25 mph POV 10 mph: Pass

SV 45 mph POV 20 mph: Pass

**Test 3 - Subject Vehicle Encounters Decelerating Principal Other Vehicle**

SV 35 mph POV 35 mph: Pass

**Test 4 - Subject Vehicle Encounters Steel Trench Plate**

SV 25 mph: Pass

SV 45 mph: Pass

**Overall: Pass**

Notes:

**DYNAMIC BRAKE SUPPORT**  
**DATA SHEET 2: VEHICLE DATA**

(Page 1 of 1)

**2022 Ford Escape PHEV FWD**

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**TEST VEHICLE INFORMATION**

VIN: 1FMCU0KZ8NUA2xxxx

Body Style: SUV

Color: Agate Black Metallic

Date Received: 5/13/2022

Odometer Reading: 38 mi

**DATA FROM VEHICLE'S CERTIFICATON LABEL**

Vehicle manufactured by: Ford Motor Co.

Date of manufacture: 03/22

Vehicle Type: MPV

**DATA FROM TIRE PLACARD**

Tires size as stated on Tire Placard: Front: 225/60R18 100H

Rear: 225/60R18 100H

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

Rear: 230 kPa (33 psi)

**TIRES**

Tire manufacturer and model: Michelin Primacy A/S

Front tire specification: 225/60R18 100H

Rear tire specification: 225/60R18 100H

Front tire DOT prefix: DOT 03L14 027X

Rear tire DOT prefix: DOT 03L14 027X



**DYNAMIC BRAKE SUPPORT**  
**DATA SHEET 3: TEST CONDITIONS**

(Page 1 of 2)

**2022 Ford Escape PHEV FWD**

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**GENERAL INFORMATION**

Test start date: 5/24/2022

Test start date: 5/24/2022

**AMBIENT CONDITIONS**

Air temperature: 33.3 C (92 F)

Wind speed: 2.1 m/s (4.6 mph)

X Wind speed  $\leq$  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)

**DYNAMIC BRAKE SUPPORT**  
**DATA SHEET 3: TEST CONDITIONS**

(Page 2 of 2)

**2022 Ford Escape PHEV FWD**

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**WEIGHT**

Weight of vehicle as tested including driver and instrumentation

Left Front: 573.8 kg (1265 lb)

Right Front: 545.2 kg (1202 lb)

Left Rear: 422.3 kg (931 lb)

Right Rear: 414.6 kg (914 lb)

Total: 1955.9 kg (4312 lb)



**DYNAMIC BRAKE SUPPORT**

**DATA SHEET 4: DYNAMIC BRAKE SUPPORT SYSTEM OPERATION**

(Page 2 of 3)

**2022 Ford Escape PHEV FWD**

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Will the system deactivate due to repeated AEB activations, impacts or near-misses?  Yes  
 No

If yes, please provide a full description.

The system will deactivate due to three consecutive AEB activations within a short (approximately 1 minute) timeframe. This is indicated to the driver via a visual message that reads "Pre-Collision Assist Not Available" displayed in yellow text within the instrument panel cluster. If the system is deactivated due to consecutive activations within the short timeframe, it can be reactivated via an ignition cycle.

How is the Forward Collision Warning presented to the driver?  Warning light  
 Buzzer or auditory alarm  
(Check all that apply)  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 AEB system alerts the driver with a visual and auditory alert. The visual alert is displayed in the instrument panel and consists of a red flashing box with the words "Pre-Collision Assist" and an image of two vehicles. The auditory alert consists of repeated beeps with a primary frequency of 1800 Hz.

**DYNAMIC BRAKE SUPPORT**  
**DATA SHEET 4: DYNAMIC BRAKE SUPPORT SYSTEM OPERATION**

(Page 3 of 3)

**2022 Ford Escape PHEV FWD**

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Is there a way to deactivate the system?  Yes  
 No

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

The AEB system can be turned on/off using the touch screen display on the center dash. The procedure is as follows:

1. Select "Settings" -> "Driver Assistance Settings" -> "Pre-Collision Assist".

2. Select "Active Braking" to turn the AEB system on/off.

The system is automatically enabled each time the engine switch is turned on.

Is the vehicle equipped with a control whose purpose is to adjust the range setting or otherwise influence the operation of DBS?  Yes  
 No

If yes, please provide a full description.

The vehicle offers three FCW sensitivity settings (High, Normal, Low) using the touch screen display, however this does not affect the performance of the AEB system.

Are there other driving modes or conditions that render DBS inoperable or reduce its effectiveness?  Yes  
 No

If yes, please provide a full description.

For low-visibility conditions (e.g., fog, rain, snow, etc.), the sensing system's effectiveness will likely be degraded or potentially inoperable (particularly for the camera-only sensing variant). For low-friction conditions (e.g., icy or wet pavement), stopping distance may be adversely affected. Refer to the owner's manual pages 279 to 280 shown in Appendix B pages B-2 to B-3 for additional information.

Notes:

## Section III

### TEST PROCEDURES

#### A. Test Procedure Overview

Four test scenarios were used, as follows:

Test 1. Subject Vehicle (SV) Encounters Stopped Principal Other Vehicle (POV)

Test 2. Subject Vehicle Encounters Slower Principal Other Vehicle

Test 3. Subject Vehicle Encounters Decelerating Principal Other Vehicle

Test 4. Subject Vehicle Encounters Steel Trench Plate

An overview of each of the test procedures follows.

#### 1. TEST 1 – SUBJECT VEHICLE ENCOUNTERS STOPPED PRINCIPAL OTHER VEHICLE ON A STRAIGHT ROAD

This test evaluates the ability of the DBS system to detect and respond to a stopped lead vehicle in the immediate forward path of the SV, as depicted in Figure 1.

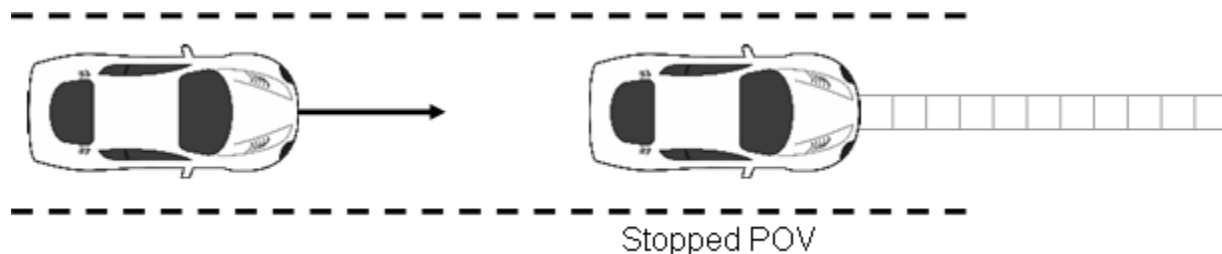


Figure 1. Depiction of Test 1

##### a. Procedure

The POV was parked in the center of a travel lane, with its longitudinal axis oriented parallel to the roadway edge and facing the same direction as the SV so that the SV approaches the rear of the POV.

The SV ignition was cycled prior to each test run. The SV was driven at a nominal speed of 25 mph (40.2 km/h) in the center of the lane of travel, toward the parked POV. The SV throttle pedal was released within 500 ms after  $t_{FCW}$ , i.e., within 500 ms of the FCW alert or SV brake application if no FCW alert was given. The SV brakes were applied at  $TTC = 1.1$  seconds (SV-to-POV distance of 40 ft (12 m)). The test concluded when either:

- The SV came into contact with the POV or

- The SV came to a stop before making contact with the POV.

In addition to the general test validity criteria described below, for an individual test trial to be valid, the following was required throughout the test:

- The lateral distance between the centerline of the SV to the center of the travel lane could not deviate more than  $\pm 1$  ft (0.3 m) during the validity period.
- The yaw rate of the SV could not deviate more than  $\pm 1$  deg/sec during the validity period.
- The SV speed could not deviate from the nominal speed by more than  $\pm 1.0$  mph ( $\pm 1.6$  km/h) during an interval defined by a Time to Collision (TTC) = 5.1 seconds to  $t_{FCW}$  or impact if no FCW alert was given.

**Table 1. Nominal Stopped POV DBS Test Choreography**

Test Speeds		SV Speed Held Constant		SV Throttle Fully Released By		SV Brake Application Onset (for each application magnitude)	
SV	POV	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway
25 mph (40.2 km/h)	0	5.1 $\rightarrow$ $t_{FCW}$	187 ft (57 m) $\rightarrow$ $t_{FCW}$	Within 500 ms of FCW1 onset	Varies	1.1	40 ft (12 m)

b. Criteria

The performance requirement for this series of tests is that there be no SV-to-POV impact for at least five of the seven valid test trials.

2. TEST 2 – SUBJECT VEHICLE ENCOUNTERS SLOWER PRINCIPAL OTHER VEHICLE

This test evaluates the ability of the DBS system to detect and respond to a slower-moving lead vehicle traveling at a constant speed in the immediate forward path of the SV, as depicted in Figure 2.





**Table 2. Nominal Slower-Moving POV DBS Test Choreography**

Test Speeds		SV Speed Held Constant		SV Throttle Fully Released By		SV Brake Application Onset (for each application magnitude)	
SV	POV	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway
25 mph (40 km/h)	10 mph (16 km/h)	5.0 → $t_{FCW}$	110 ft (34 m) → $t_{FCW}$	Within 500 ms of FCW1 onset	Varies	1.0	22 ft (7 m)
45 mph (72 km/h)	20 mph (32 km/h)	5.0 → $t_{FCW}$	183 ft (56 m) → $t_{FCW}$	Within 500 ms of FCW1 onset	Varies	1.0	37 ft (11 m)

b. Criteria

The performance requirement for this series of tests is that there be no SV-to-POV impact for at least five of the seven valid test trials.

3. TEST 3 – SUBJECT VEHICLE ENCOUNTERS DECELERATING PRINCIPAL OTHER VEHICLE

This test evaluates the ability of the DBS system to detect and respond to a lead vehicle slowing with a constant deceleration in the immediate forward path of the SV as depicted in Figure 3. Should the SV foundation brake system be unable to prevent an SV-to-POV impact for a given test condition, the DBS system should automatically provide supplementary braking capable of preventing an SV-to-POV collision.

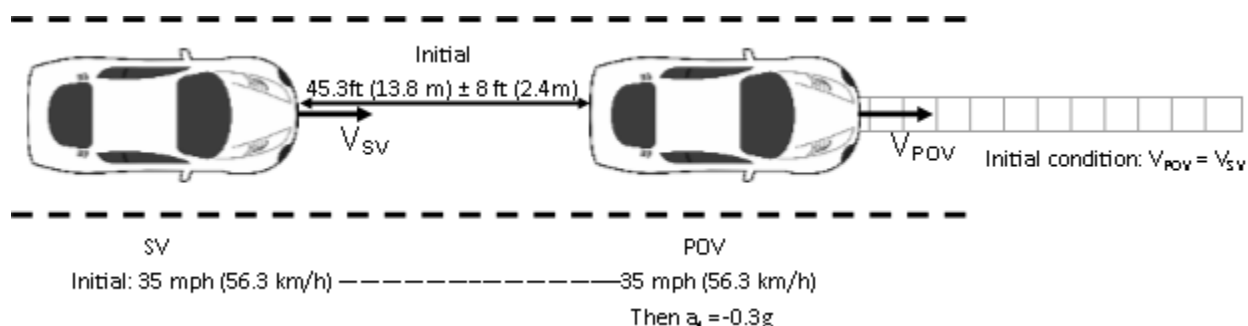


Figure 3. Depiction of Test 3

a. Procedure

The SV ignition was cycled prior to each test run. For this scenario both the POV and SV were driven at a constant 35.0 mph (56.3 km/h) in the center of the lane, with headway of 45.3 ft (13.8 m) ± 8 ft (2.4 m). Once these conditions were met, the POV tow vehicle

brakes were applied to achieve  $0.3 \pm 0.03$  g of deceleration within  $1.5 \pm 0.1$  sec. The SV throttle pedal was released within 500 ms of  $t_{FCW}$  or SV brake application if no FCW alert was given. The SV brakes were applied when TTC was 1.4 seconds (31.5 ft (9.6 m)).

The test concluded when either:

- The SV came into contact with the POV or
- 1 second after the velocity of the SV became less than or equal to that of the POV.

The SV driver then braked to a stop.

In addition to the general test validity criteria described below, for an individual test trial to be valid, the following was required throughout the test:

- The lateral distance between the centerline of the SV and POV to the center of the travel lane could not deviate more than  $\pm 1$  ft (0.3 m) during the validity period.
- The yaw rate of the SV and POV could not deviate more than  $\pm 1$  deg/sec during the validity period.
- The SV speed could not deviate more than  $\pm 1.0$  mph (1.6 km/h) during an interval defined by 3.0 seconds before the onset of POV braking to  $t_{FCW}$  or impact if no FCW alert was given.
- The POV speed could not deviate more than  $\pm 1.0$  mph (1.6 km/h) during an interval of 3.0 seconds before the onset of POV braking.
- The SV- POV headway distance could not deviate more than  $\pm 8$  ft (2.4 m) during an interval defined by the onset of the validity period to the onset of POV braking.
- The average POV deceleration could not deviate by more than  $\pm 0.03$  g from the nominal 0.3 g deceleration during the interval beginning at 1.5 seconds after the onset of POV braking and ending either 250 ms prior to the POV coming to a stop or the SV coming into contact with the POV.

**Table 3. Nominal Decelerating POV DBS Test Choreography**

Test Speeds		SV Speed Held Constant		SV Throttle Fully Released By		SV Brake Application Onset (for each application magnitude)	
SV	POV	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway	TTC (seconds)	SV-to-POV Headway
35 mph (56 km/h)	35 mph (56 km/h)	3.0 seconds prior to POV braking → $t_{FCW}$	45 ft (14 m) → $t_{FCW}$	Within 500 ms of FCW1 onset	Varies	1.4	32 ft (10 m)

## b. Criteria

The performance requirement for this series of tests is that no SV-to-POV contact occurs for at least five of the seven valid test trials.

## 4. TEST 4 – FALSE POSITIVE SUPPRESSION

The false positive suppression test series evaluates the ability of a DBS system to differentiate a steel trench plate (STP) from an object presenting a genuine safety risk to the SV. Although the STP is large and metallic, it is designed to be driven over without risk of injury to the driver or damage to the SV. Therefore, in this scenario, the automatic braking available from DBS is not necessary and should be suppressed. The test condition is nearly equivalent to that previously defined for Test 1, the stopped POV condition, but with an STP in the SV forward path in lieu of a POV.

### a. Procedure

This test was conducted at two speeds, 25 mph (40.2 km/h) and 45 mph (72.4 km/h). The SV was driven directly towards, and over, the STP, which was positioned in the center of a travel lane, with its longest sides parallel to the road edge. The SV was driven at constant speed in the center of the lane toward the STP. If the SV did not present an FCW alert during the approach to the STP by  $TTC = 2.1$  s, the SV driver initiated release of the throttle pedal at  $TTC = 2.1$  s and the throttle pedal was fully released within 500 ms of  $TTC = 2.1$  s. The SV brakes were applied at  $TTC$  of 1.1 seconds, assumed to be 40 ft (12.3 m) from the edge of the STP at 25 mph or 73 ft (22.1 m) at 45 mph. The test concluded when the front most part of the SV reached a vertical plane defined by the edge of the STP first encountered by the SV.

### b. Criteria

In order to pass the False Positive test series, the magnitude of the SV deceleration reduction attributable to DBS intervention must have been less than or equal to 1.5 times the average of the deceleration experienced by the baseline command from the braking actuator for at least five of seven valid test trials.

## **B. General Information**

### 1. $T_{FCW}$

The time at which the Forward Collision Warning (FCW) activation flag indicates that the system has issued an alert to the SV driver is designated as  $t_{FCW}$ . FCW alerts are typically haptic, visual, or auditory, and the onset of the alert is determined by post-processing the test data.

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 4.

**Table 4. Auditory and Tactile Warning Filter Parameters**

<b>Warning Type</b>	<b>Filter Order</b>	<b>Peak-to-Peak Ripple</b>	<b>Minimum Stop Band Attenuation</b>	<b>Passband Frequency Range</b>
Auditory	5 <sup>th</sup>	3 dB	60 dB	Identified Center Frequency $\pm$ 5%
Tactile	5 <sup>th</sup>	3 dB	60 dB	Identified Center Frequency $\pm$ 20%

## 2. GENERAL VALIDITY CRITERIA

In addition to any validity criteria described above for the individual test scenarios, for an individual trial to be valid, it must have met the following criteria throughout the test:

- The SV driver seatbelt was latched.
- If any load had been placed on the SV front passenger seat (e.g., for instrumentation), the vehicle’s front passenger seatbelt was latched.
- The SV was driven at the nominal speed in the center of the travel lane, toward the POV or STP.
- The driver used the least amount of steering input necessary to maintain SV position in the center of the travel lane during the validity period; use of abrupt steering inputs or corrections was avoided.
- The yaw rate of the SV did not exceed  $\pm 1.0$  deg/s from the onset of the validity period to the instant SV deceleration exceeded 0.25 g.
- The SV driver did not apply any force to the brake pedal during the applicable validity period. All braking shall be performed by the programmable brake controller.
- The lateral distance between the centerline of the SV and the centerline of the POV or STP did not deviate more than  $\pm 1$  ft (0.3 m) during the applicable validity period.

### 3. VALIDITY PERIOD

The valid test interval began:

- Test 1: When the SV-to-POV TTC = 5.1 seconds
- Test 2: When the SV-to-POV TTC = 5.0 seconds
- Test 3: 3 seconds before the onset of POV braking
- Test 4: 2 seconds prior to the SV throttle pedal being released

The valid test interval ended:

- Test 1: When either of the following occurred:
  - The SV came in contact with the POV (SV-to-POV contact was assessed by using GPS-based range data or by measurement of direct contact sensor output); or
  - The SV came to a stop before making contact with the POV.
- Test 2: When either of the following occurred:
  - The SV came into contact with the POV; or
  - 1 second after the velocity of the SV became less than or equal to that of the POV.
- Test 3: When either of the following occurred:
  - The SV came in contact with the POV; or
  - 1 second after minimum SV-to-POV range occurred.
- Test 4: When the SV stopped.

### 4. STATIC INSTRUMENTATION CALIBRATION

To assist in resolving uncertain test data, static calibration data was collected prior to, and immediately after each of the test series.

For Tests 1, 2, and 3, the SV, POV, and POV moving platform and tow vehicle were centered in the same travel lane with the same orientation (i.e., facing the same direction). For Test 4, the SV and STP were centered in the same travel lane.

For Tests 1, 2, and 3, the SV was positioned such that it just contacted a vertical plane defining the rearmost location of the POV. For Test 4, the front-most location of the SV was positioned such that it just reached a vertical plane defined by the leading edge of

the STP first encountered by the SV (i.e., just before it is driven onto the STP). This is the “zero position.”

If the zero position reported by the data acquisition system was found to differ by more than  $\pm 2$  in ( $\pm 5$  cm) from that measured during collection of the pre-test static calibration data file, the pre-test offset was adjusted to output zero, another pre-test static calibration data file was collected, and the test series was repeated.

## 5. NUMBER OF TRIALS

A target total of seven (7) valid trials were performed for each scenario. In cases where the test driver performed more than seven trials, the first seven trials satisfying all test tolerances were used to assess the SV performance.

## 6. TRANSMISSION

All trials were performed with SV automatic transmissions in “Drive” or with manual transmissions in the highest gear capable of sustaining the desired test speed. Manual transmission clutches remained engaged during all maneuvers. The brake lights of the POV were not illuminated.

### **C. Principal Other Vehicle**

DBS testing requires a POV that realistically represents typical vehicles, does not suffer damage or cause damage to a test vehicle in the event of collision, and can be accurately positioned and moved during the tests. The tests reported herein made use of the NHTSA developed Strikeable Surrogate Vehicle (SSV).

This SSV system was designed specifically for common rear-end crash scenarios which AEB systems address. The key components of the SSV system are:

- A POV shell which is a visually and dimensionally accurate representation of a passenger car.
- A slider and load frame assembly to which the shell is attached.
- A two-rail track on which the slider operates.
- A road-based lateral restraint track.
- A tow vehicle.

The key requirements of the POV element are to:

- Provide an accurate representation of a real vehicle to DBS sensors, including cameras and radar.
- Be resistant to damage and inflict little or no damage to the SV as a result of repeated SV-to-POV impacts.

The key requirements of the POV delivery system are to:

- Accurately control the nominal POV speed up to 35 mph (56 km/h).
- Accurately control the lateral position of the POV within the travel lane.
- Allow the POV to move away from the SV after an impact occurs.

Operationally, the POV shell is attached to the slider and load frame, which includes rollers that allow the entire assembly to move longitudinally along the guide rail. The guide rail is coupled to a tow vehicle and guided by the lateral restraint track secured to the test track surface. The rail includes a provision for restraining the shell and roller assembly in the rearward direction. In operation, the shell and roller assembly engages the rail assembly through detents to prevent relative motion during run-up to test speeds and minor deceleration of the tow vehicle. The combination of rearward stops and forward motion detents allows the test conditions, such as relative SV-to-POV headway distance and speed etc., to be achieved and adjusted as needed in the preliminary part of a test. If during the test, the SV strikes the rear of the POV shell, the detents are overcome and the entire shell/roller assembly moves forward in a two-stage manner along the rail and away from the SV. The forward end of the rail has a soft stop to restrain forward motion of the shell/roller assembly. After impacting the SSV, the SV driver uses the steering wheel to maintain SV position in the center of the travel lane, thereby straddling the two-rail track. The SV driver must manually apply the SV brakes after impact. The SSV system is shown in Figures A6 through A8 and a detailed description can be found in the NHTSA report: NHTSA'S STRIKEABLE SURROGATE VEHICLE PRELIMINARY DESIGN + OVERVIEW, May 2013.

#### **D. Foundation Brake System Characterization**

Data collected and analyzed from a series of pre-test braking runs were used to objectively quantify the response of the vehicle's foundation brake system without the contribution of DBS. The results of these analyses were used to determine the brake pedal input magnitudes needed for the main tests.

This characterization was accomplished by recording longitudinal acceleration and brake pedal force and travel data for a variety of braking runs. For three initial brake characterization runs, the vehicle was driven at 45 mph, and the brakes were applied at a rate of 1 inch/sec up to the brake input level needed for at least 0.7 g. Linear regressions were performed on the data from each run to determine the linear vehicle deceleration response as a function of both applied brake pedal force and brake pedal travel. The brake input force or displacement level needed to achieve a vehicle deceleration of 0.4 g was determined from the average of the three runs. Using the 0.4 g brake input force or displacement level found from the three initial runs, subsequent runs were performed at 25 mph, 35 mph, and 45 mph, with the brakes applied at a rate of 10 inch/sec to the determined 0.4 g brake input force or displacement level. For each of the three test speeds, if the average calculated deceleration level was found to be within  $0.4 \pm 0.025$  g, the resulting force or displacement was recorded and used. If the average calculated deceleration level exceeded this tolerance, the brake input force or displacement levels

were adjusted and retested until the desired magnitude was realized. Prior to each braking event, the brake pad temperatures were required to be in the range of 149° - 212°F.

## **E. Brake Control**

### **1. SUBJECT VEHICLE PROGRAMMABLE BRAKE CONTROLLER**

To achieve accurate, repeatable, and reproducible SV brake pedal inputs, a programmable brake controller was used for all brake applications. The controller has the capability to operate in one of two user-selectable, closed-loop, control modes:

- Constant pedal displacement. By maintaining constant actuator stroke, the position of the vehicle's brake pedal remains fixed for the duration of the input. To achieve this, the brake controller modulates application force.
- Hybrid control. Hybrid control uses position-based control to command the initial brake application rate and actuator position, then changes to force-based control to command a reduction of applied force to a predetermined force. This force is maintained until the end of the braking maneuver by allowing the brake controller to modulate actuator displacement.

### **2. SUBJECT VEHICLE BRAKE PARAMETERS**

- Each test run began with the brake pedal in its natural resting position, with no preload or position offset.
- The onset of the brake application was considered to occur when the brake actuator had applied 2.5 lbf (11 N) of force to the brake pedal.
- The magnitude of the brake application was that needed to produce 0.4 g deceleration, as determined in the foundation brake characterization.
- The SV brake application rate was between 9 to 11 in/s (229 to 279 mm/s), where the application rate is defined as the slope of a linear regression line applied to brake pedal position data over a range from 25% to 75% of the commanded input magnitude.

### **3. POV AUTOMATIC BRAKING SYSTEM**

The POV was equipped with an automatic braking system, which was used in Test Type 3. The braking system consisted of the following components:

- Electronically controlled linear actuator, mounted on the seat rail and attached to the brake pedal. The actuator can be programmed for control of stroke and rate.
- PC module programmed for control of the stroke and rate of the linear actuator.
- Switch to activate actuator.



## **F. Instrumentation**

Table 5 lists the sensors, signal conditioning, and data acquisition equipment used for these tests.

**Table 5. 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	< 1% error between 20 and 100 psi	Omega DPG8001	17042707002	By: DRI Date: 10/5/2021 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 Date: 2/11/2022 Due: 2/11/2023
Linear (string) encoder	Throttle pedal travel	50 in	0.05 in	TE Connectivity SE1-50	K3161858	By: DRI Date: 1/18/2022 Due: 1/18/2023
Load Cell	Force applied to brake pedal					By: DRI
		0-250 lb 1112 N	0.05% FS	Stellar Technology PNC700	1607338	Date: 3/30/2022 Due: 3/30/2023
		0-250 lb	0.05% FS	Stellar Technology PNC700	2002506	Date: 2/25/2022 Due: 2/25/2023
Differential Global Positioning System	Position, Velocity	Latitude: ±90 deg Longitude: ±180 deg Altitude: 0-18 km Velocity: 0-1000 knots	Horizontal Position: ±1 cm Vertical Position: ±2 cm Velocity: 0.05 km/h	Trimble GPS Receiver, 5700 (base station and in-vehicle)	00440100989	N/A

**Table 5. Test Instrumentation and Equipment (continued)**

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Multi-Axis Inertial Sensing System	Position; Longitudinal, Lateral, and Vertical Accels;	Accels $\pm 10g$ , Angular Rate $\pm 100$ 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 +		By: Oxford Technical Solutions
	Lateral, Longitudinal and Vertical Velocities;				2176	Date: 6/26/2020 Due: 6/26/2022
	Roll, Pitch, Yaw Rates; Roll, Pitch, Yaw Angles				2258	Date: 4/28/2021 Due: 4/28/2023
Real-Time Calculation of Position and Velocity Relative to Lane Markings (LDW) and POV (FCW)	Distance and Velocity to lane markings (LDW) and POV (FCW)	Lateral Lane Dist: $\pm 30$ m Lateral Lane Velocity: $\pm 20$ m/sec Longitudinal Range to POV: $\pm 200$ m Longitudinal Range Rate: $\pm 50$ m/sec	Lateral Distance to Lane Marking: $\pm 2$ cm Lateral Velocity to Lane Marking: $\pm 0.02$ m/sec Longitudinal Range: $\pm 3$ cm Longitudinal Range Rate: $\pm 0.02$ m/sec	Oxford Technical Solutions (OXTS), RT-Range	97	N/A
Microphone	Sound (to measure time at alert)	Frequency Response: 80 Hz – 20 kHz	Signal-to-noise: 64 dB, 1 kHz at 1 Pa	Audio-Technica AT899	N/A	N/A
Light Sensor	Light intensity (to measure time at alert)	Spectral Bandwidth: 440-800 nm	Rise time < 10 msec	DRI designed and developed Light Sensor	N/A	N/A
Accelerometer	Acceleration (to measure time at alert)	$\pm 5g$	$\leq 3\%$ of full range	Silicon Designs, 2210-005	N/A	N/A

Type	Output	Range	Accuracy, Other Primary Specs	Mfr, Model	Serial Number	Calibration Dates Last Due
Coordinate Measurement Machine	Inertial Sensing System Coordinates	0-8 ft 0-2.4 m	±.0020 in. ±.051 mm (Single point articulation accuracy)	Faro Arm, Fusion	UO8-05-08-06636	By: DRI Date: 1/6/2022 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).			dSPACE Micro-Autobox II 1401/1513		
				Base Board	549068	
				I/O Board	588523	

## APPENDIX A

### Photographs

## LIST OF FIGURES

	Page
Figure A1. Front View of Subject Vehicle.....	A-3
Figure A2. Rear View of Subject Vehicle .....	A-4
Figure A3. Window Sticker (Monroney Label).....	A-5
Figure A4. Vehicle Certification Label .....	A-6
Figure A5. Tire Placard .....	A-7
Figure A6. Rear View of Principal Other Vehicle (SSV) .....	A-8
Figure A7. Load Frame/Slider of SSV .....	A-9
Figure A8. Two-Rail Track and Road-Based Lateral Restraint Track.....	A-10
Figure A9. Steel Trench Plate .....	A-11
Figure A10. DGPS, Inertial Measurement Unit, and MicroAutoBox Installed in Subject Vehicle.....	A-12
Figure A11. Sensors for Detecting Auditory and Visual Alerts .....	A-13
Figure A12. Computer Installed in Subject Vehicle .....	A-14
Figure A13. Brake Actuator Installed in Subject Vehicle .....	A-15
Figure A14. Brake Actuator Installed in POV System .....	A-16
Figure A15. AEB System On/Off Menu .....	A-17
Figure A16. Visual Alert .....	A-18



Figure A1. Front View of Subject Vehicle



Figure A2. Rear View of Subject Vehicle



**VEHICLE DESCRIPTION**  
**ESCAPE FWD**  
 2022 ESCAPE SEL PHEV FWD  
 106.7" WHEELBASE  
 2.5L I-VCT ATK I-4 HYB ENG  
 ECVT TRANSMISSION

**Go Further**  
 ford.com

**EXTERIOR**  
 AGATE BLACK METALLIC  
 INTERIOR  
 EBONY ACTIVEV TRIM SEATS

**STANDARD EQUIPMENT INCLUDED AT NO EXTRA CHARGE**

**EXTERIOR**

- ACTIVE GRILLE SHUTTERS
- DUAL EXHAUST CHROME TIPS
- ELECTR FUEL DOOR RELEASE
- FOG LAMPS
- HEADLAMP COURTESY DELAY
- HEADLAMPS - AUTO HALOGEN
- HEADLAMPS - AUTO HIGH BEAM
- LED SIGNATURE LIGHTING
- MIRRORS-HTD/POWER GLASS, MANUAL FOLD
- PRIVACY GLASS - REAR DOORS
- REAR INT WIPER/WASH/DFRST
- REAR SPOILER
- TAILLAMPS-LED

**INTERIOR**

- 1 TOUCH UP/DOWN FRN/RR WIN
- DUAL ILLUM VIS VANITY MIRR
- DUAL ZONE AUTO CLIMATE CTL
- HTD DRVR
- FRNT PASS SEATS
- ILLUMINATED ENTRY SYSTEM
- MAP POCKETS-PASSENGER
- POWERPOINTS - 12V
- REAR SEAT CUPHOLDERS AND ARMREST
- ROTARY GEAR SHIFT DIAL
- SPLIT FOLD/SLIDE REAR SEAT
- STR WHL-HTD & PREMIUM WRPD
- USB A (1) AND C (1)

**FUNCTIONAL**

- BLIS W/CROSS-TRAFFIC ALERT
- FORD CO-PILOT360™
- FORDPASS™ CONNECT 4GWI-FI HOTSPOT TELEMATICS MODEM
- INTELLIGENT ACCESS W/PUSH BUTTON START
- LANE-KEEPING SYSTEM/ALERT
- PEDESTRIAN ALERT SOUNDER
- PRE-COLLISION ASSIST W/AEB
- REAR VIEW CAMERA
- REFRESH85
- REVERSE SENSING SYSTEM
- SECURICODE KEYLESS KEYPAD
- SIRIUSXM® - SVC N/A AK&HI
- SYNCS® 8" SCR N W/APLINK®

**SAFETY/SECURITY**

- ADVANCETRACT™ WITH RSC®
- AIRBAG - DRIVER KNEE
- AIRBAGS - DUAL STAGE FRONT
- AIRBAGS - FRONT SEAT MOUNTED SIDE IMPACT
- AIRBAGS - SAFETY CANOPY®
- LATCH CHLD SAFETY SYSTEM
- PERSONAL SAFETY SYSTEM™
- SOS POST-CRASH ALERT SYS™
- TIRE PRESSURE MONIT SYS

**WARRANTY**

- 3YR/36,000 BUMPER / BUMPER
- 5YR/60,000 ROADSIDE ASSIST
- 8YR/100,000 HYBRID UNIQUE COMPONENTS

**INCLUDED ON THIS VEHICLE EQUIPMENT GROUP #25A**

**OPTIONAL EQUIPMENT/OTHER**

.18" MACHINED EBONY ALUM WHL	
.225/60R18 100H A/S BSW TIRES	
PANORAMIC VISTA ROOF	1,595.00
FLR LINERS FR-RR W/O CRPT MTS	160.00
MINI SPARE WHEEL/TIRE	110.00
FORD CO-PILOT360 ASSIST+	995.00
ADP CRZ CTRL W/STOP N GO SEL TECHNOLOGY PACKAGE	1,250.00
.POWER LIFTGATE W/HANDS FREE	
S&O SOUND SYSTEM, 10-SPK MEMORY PACKAGE	
.WIRELESS CHARGING	
.10-WAY POWER DRIVER SEAT	
FRONT LICENSE PLATE BRACKET	NO CHARGE

**PRICE INFORMATION**

BASE PRICE	\$36,675.00
TOTAL OPTIONS/OTHER	4,110.00
TOTAL VEHICLE & OPTIONS/OTHER DESTINATION & DELIVERY	40,785.00
	1,245.00

**SHIP TO** 71A 040 **RAMP ONE** **FINAL ASSEMBLY PLANT** LOUISVILLE **TOTAL MSRP** \$42,030.00  
**SHIP TO (IF OTHER THAN SOLD TO)** **RAMP TWO** **METHOD OF TRNSP.** CONVOY  
**SHIP THROUGH** **ITEM #:** 71-1668 O/T 2 **FORD CREDIT** Whether you decide to lease or finance your vehicle, you'll find the choices that are right for you. See your dealer for details or visit [www.ford.com/finance](http://www.ford.com/finance).  
 This label is affixed pursuant to the Federal Automobile Information Disclosure Act. Gasoline, License, and Title Fees, State and Local taxes are not included. Dealer installed options or accessories are not included unless listed above.  
 NC172 N RB 2X 230 004362 03 17 22

**EPA DOT Fuel Economy and Environment**

Small SUVs range from 14 to 129 MPG. The best vehicle rates 142 MPG.

**Fuel Economy**

Electricity + Gasoline (Charge Time: 3.5 hours (240V))  
**105** MPG  
 0.0 gallons per 100 miles  
 32 kWh per 100 miles

Gasoline Only  
**40** MPG  
 2.5 gallons per 100 miles

**You save \$3,000** in fuel costs over 5 years compared to the average new vehicle.

**Annual fuel cost \$700**

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

10 Best 7 Best

This vehicle emits .77 grams CO per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel and electricity also create emissions; learn more at [fuelconomy.gov](http://fuelconomy.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 and \$1.19 per kWh. This is a dual fueled automobile. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.**

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

**GOVERNMENT 5-STAR SAFETY RATINGS**

**Overall Vehicle Score Not Rated**  
 Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.

<b>Frontal Crash</b>	<b>Driver Passenger</b>	<b>Not Rated</b>
<b>Side Crash</b>	<b>Front seat Rear seat</b>	<b>Not Rated</b>

**Rollover Not Rated**  
 Based on the risk of rollover in a single-vehicle crash.

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

**FordPass Connect™**

Download the FordPass™ app\* and you can:

**Access Vehicle Control Features**

- Remotely start, lock and unlock your vehicle.
- Locate your vehicle and check approximate fuel range.
- Receive vehicle health alerts.

**Activate 4G LTE Wi-Fi Hotspot**

- New vehicles include a 3-month or 3GB data (whichever comes first) Wi-Fi trial.
- Connect up to ten Wi-Fi-equipped devices.

\*Complete with select smartphone carriers. FordPass Connect™ wireless device use may require internet connectivity. Some restrictions may apply. Coverage not available in all areas. See your carrier for details. ©2022 Ford. All rights reserved. Safety features and equipment may vary by model and region. Always use proper driving techniques and wear your seat belt. Always use proper driving techniques and wear your seat belt. Always use proper driving techniques and wear your seat belt.

The FordPass Connect™ modem is active and sending vehicle data (e.g., diagnostics) to Ford. See in-vehicle Settings for connectivity options.

**FORD PROTECT™**

Insist on Ford Protect! The only extended service plan fully backed by Ford and honored at every Ford dealership in the U.S., Canada and Mexico. See your Ford dealer or visit [www.FordOwner.com](http://www.FordOwner.com).

SCAN OR TEXT: 1FNJA2S88E TO 48028

May 8 Data rates may apply. Text HELP for help.

[www.ford.com/help/privacy-160784/](http://www.ford.com/help/privacy-160784/)

**WARNING:** Operating, servicing and maintaining a passenger vehicle, pickup truck, van, or off-road vehicle can expose you to chemicals including engine exhaust, carbon monoxide, phthalates, and lead, which are known to the State of California to cause cancer and birth defects or other reproductive harm. To minimize exposure, avoid breathing exhaust, do not idle the engine except as necessary, service your vehicle in a well-ventilated area and wear gloves or wash your hands frequently when servicing your vehicle. For more information go to [www.P65Warnings.ca.gov/passenger-vehicle](http://www.P65Warnings.ca.gov/passenger-vehicle).

Figure A3. Window Sticker (Monroney Label)

MFD. BY FORD MOTOR CO.  
FRONT GAWR: 1175 KG ( 2590 LB)  
WITH 225/60R18 100H  
18x7.5J

DATE: 03/22

GVWR: 2232 KG ( 4920 LB)

TIRES  
RIMS

REAR GAWR: 1093 KG ( 2410 LB)  
WITH 225/60R18 100H  
18x7.5J

TIRES  
RIMS

AT 230 kPa/ 33 PSI COLD

AT 230 kPa/ 33 PSI COLD

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

VIN: 1FMCU0KZ8NUA2

TYPE: MPV



EXT PNT: UM

RC: 71 DSO:

WB	INT TR	TP/PS	R	AXLE	TR	SPR
----	--------	-------	---	------	----	-----

106	6H		2	91	5	CCCC
-----	----	--	---	----	---	------

1202203241109

ULC

▽ 5U5A-3520472-AA

F0045  
T0051

Figure A4. Vehicle Certification Label



## TIRE AND LOADING INFORMATION

SEATING CAPACITY    TOTAL : 5    FRONT: 2    REAR: 3

The combined weight of occupants and cargo should never exceed : **377 kg or 832 lbs.**

▽ 5U5A-1532-AA (TLU) FoMoCo

TIRE	SIZE	COLD TIRE PRESSURE
FRONT	225/60R18 100H	230 KPA, 33 PSI
REAR	225/60R18 100H	230 KPA, 33 PSI
SPARE	T155/70D17 110M	420 KPA, 60 PSI

**SEE OWNERS  
MANUAL FOR  
ADDITIONAL  
INFORMATION**

1FMCU0KZ8NUA2



Figure A5. Tire Placard



Figure A6. Rear View of Principal Other Vehicle (SSV)



Figure A7. Load Frame/Slider of SSV

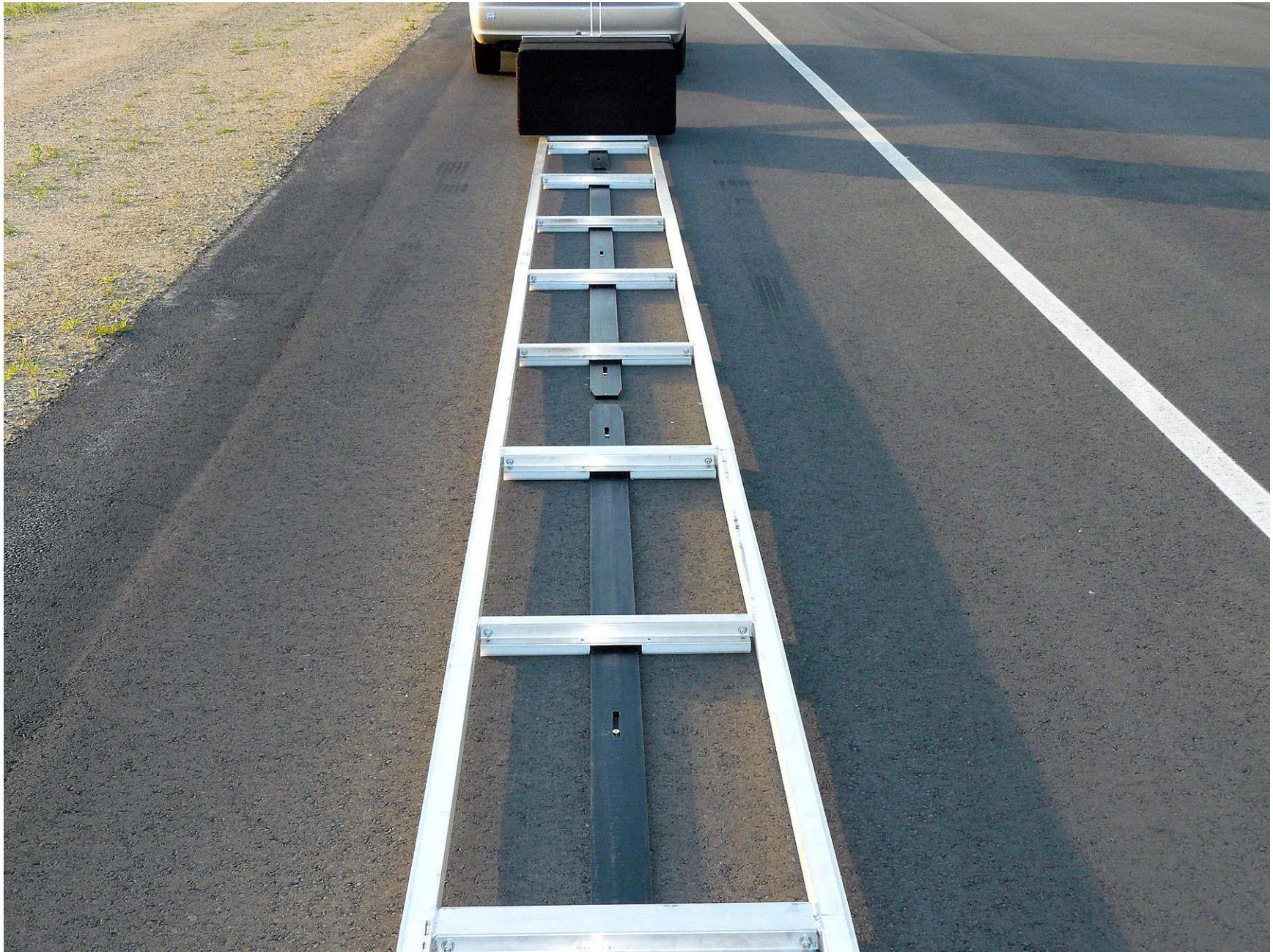


Figure A8. Two-Rail Track and Road-Based Lateral Restraint Track



Figure A9. Steel Trench Plate  
A-11



Figure A10. DGPS, Inertial Measurement Unit, and MicroAutoBox Installed in Subject Vehicle



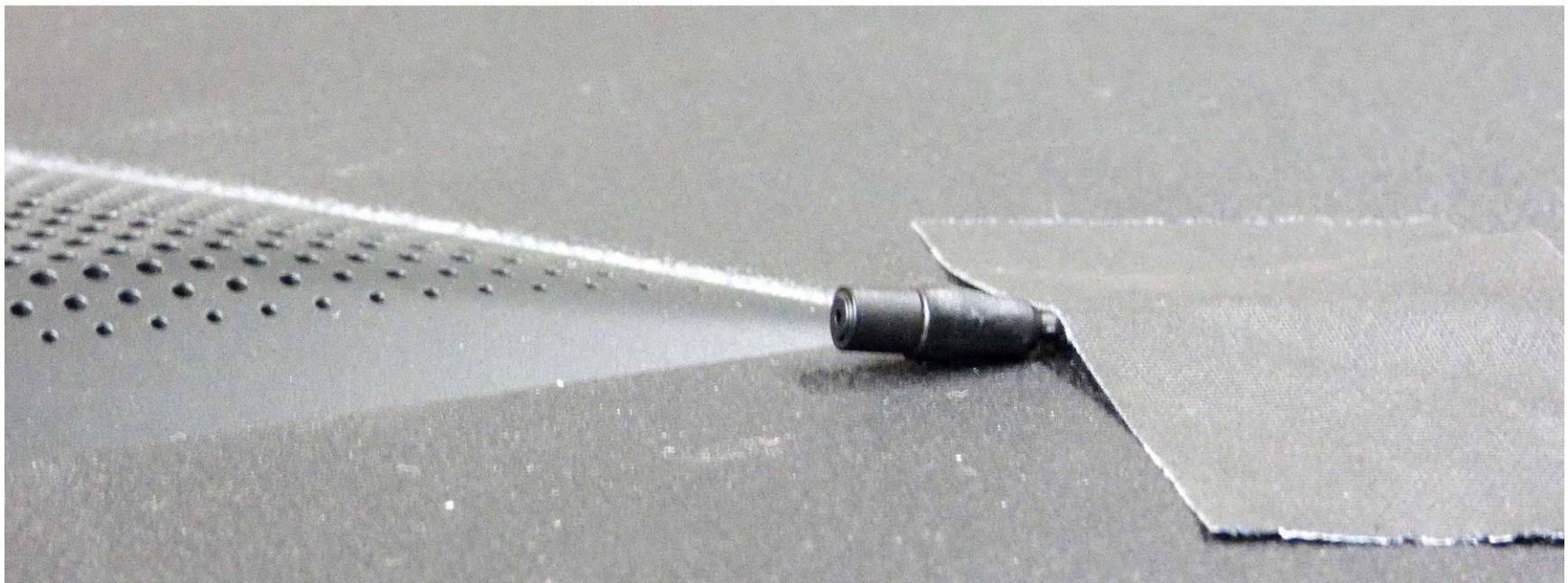


Figure A11. Sensors for Detecting Auditory and Visual Alerts



Figure A12. Computer Installed in Subject Vehicle



Figure A13. Brake Actuator Installed in Subject Vehicle



Figure A14. Brake Actuator Installed in POV System

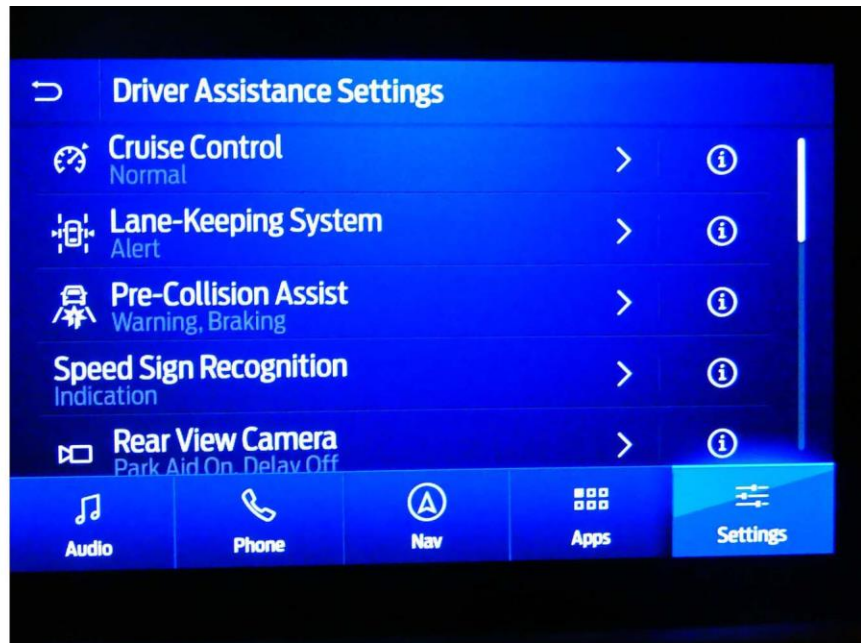


Figure A15. AEB System On/Off Menu

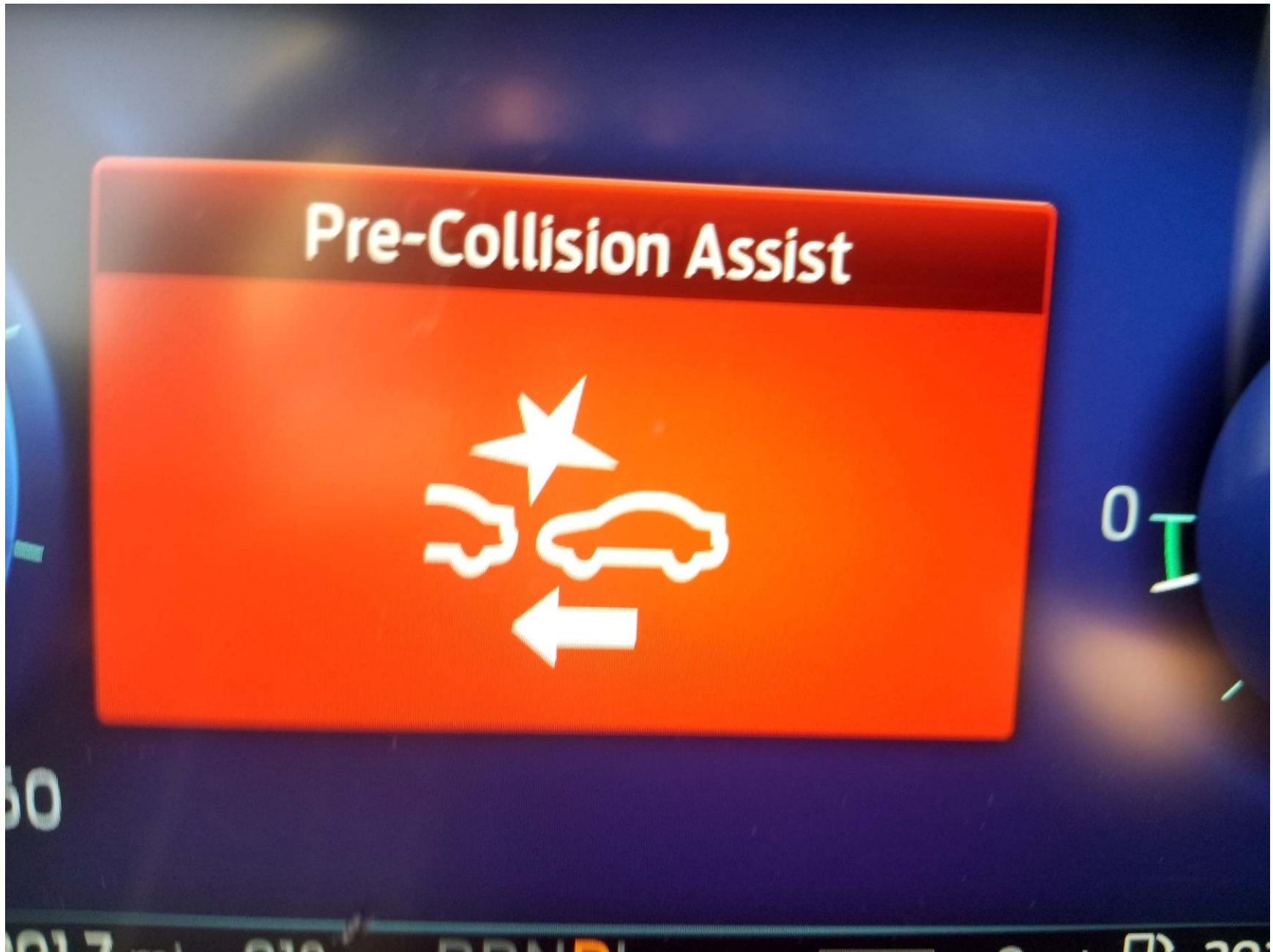


Figure A16. Visual Alert  
A-18

## APPENDIX B

Excerpts from Owner's Manual

# Pre-Collision Assist

## WHAT IS PRE-COLLISION ASSIST

Pre-collision assist detects and warns of approaching hazards in the roadway. If your vehicle is rapidly approaching another stationary vehicle, a vehicle traveling in the same direction as yours, or a pedestrian within your driving path, the system provides multiple levels of assistance to help avoid a collision.

## HOW DOES PRE-COLLISION ASSIST WORK

The system warns the driver of potential hazards by providing three levels of assistance.

If your vehicle is rapidly approaching potential hazards the system provides the following levels of functionality:

1. Alert.
2. Brake Support.
3. Automatic Emergency Braking.



**Alert:** When active, a flashing visual warning appears and an audible warning tone sounds.

**Brake Support:** The system is designed to help reduce the impact speed by preparing the brakes for rapid braking. The system does not automatically apply the brakes. If you press the brake pedal, the system could apply additional braking up to maximum braking force, even if you lightly press the brake pedal.

**Automatic Emergency Braking:** Automatic emergency braking may activate if the system determines that a collision is imminent.

**Note:** If you perceive pre-collision assist alerts as being too frequent or disturbing, then you can reduce the alert sensitivity, although the manufacturer recommends using the highest sensitivity setting where possible. Setting lower sensitivity would lead to fewer and later system warnings.

Each system has various levels of detection capabilities. See **Pre-Collision Assist Limitations** (page 280).

## PRE-COLLISION ASSIST PRECAUTIONS



**WARNING:** You are responsible for controlling your vehicle at all times. The system is designed to be an aid and does not relieve you of your responsibility to drive with due care and attention. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.



**WARNING:** The system does not detect vehicles that are driving in a different direction, cyclists or animals. Apply the brakes when necessary. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.




**WARNING:** The system does not operate during hard acceleration or steering. Failure to take care may lead to a crash or personal injury.





**WARNING:** The system may fail or operate with reduced function during cold and severe weather conditions. Snow, ice, rain, spray and fog can adversely affect the system. Keep the front camera and radar free of snow and ice. Failure to take care may result in the loss of control of your vehicle, serious personal injury or death.



## Pre-Collision Assist

 **WARNING:** Take additional care if your vehicle is heavily loaded or you are towing a trailer. These conditions could result in reduced performance of this system. Failure to follow this instruction could result in the loss of control of your vehicle, personal injury or death.

 **WARNING:** The system cannot help prevent all crashes. Do not rely on this system to replace driver judgment and the need to maintain a safe distance and speed.

 **WARNING:** In situations where the vehicle camera has limited detection capability, this may reduce system performance. These situations include but are not limited to direct or low sunlight, vehicles at night without tail lights, unconventional vehicle types, pedestrians with complex backgrounds, running pedestrians, partly obscured pedestrians, or pedestrians that the system cannot distinguish from a group. Failure to take care may result in the loss of control of your vehicle, serious personal injury or death.

### PRE-COLLISION ASSIST LIMITATIONS

Pre-collision assist depends on the detection ability of its camera and sensors. Any obstructions or damage to these areas can limit detection or prevent the system from functioning. See **Locating the Pre-Collision Assist Sensors** (page 281).

The system is active at speeds above 3 mph (5 km/h)

**Note:** The pre-collision assist system disables when you select four-wheel drive low or manually disable AdvanceTrac™.

**Note:** Brake support and automatic emergency braking are active at speeds up to 75 mph (120 km/h). If the vehicle has a radar sensor included with adaptive cruise control, then brake support and automatic emergency braking are active up to the maximum speed of the vehicle.

### Pedestrian Detection Limitations

Pedestrian detection is active at speeds up to 50 mph (80 km/h).

Pedestrian detection functions optimally when detected hazards are clearly identifiable. System performance may reduce in situations where pedestrians are running, partly obscured, have a complex background, or cannot be distinguished from a group.

### SWITCHING PRE-COLLISION ASSIST ON AND OFF

You cannot switch the system off.

### Adjusting the Pre-Collision Assist Settings

You can adjust the following settings by using the touchscreen controls in the pre-collision assist menu:

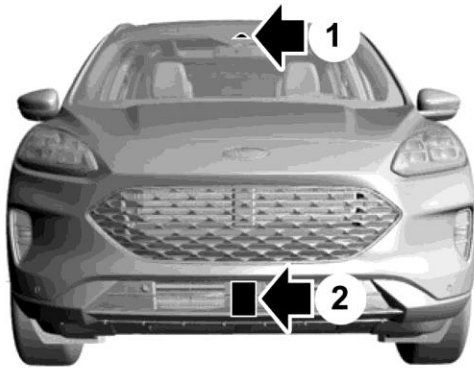
- Change alert and distance alert sensitivity to one of three possible settings.
- Switch distance indication and alert on or off.
- If required, switch automatic emergency braking on or off.
- If required, switch evasive steering assist on or off.

**Note:** Automatic emergency braking and evasive steering automatically turns on every time you switch the ignition on.

## Pre-Collision Assist

**Note:** If you switch automatic emergency braking off, evasive steering assist switches off.

### LOCATING THE PRE-COLLISION ASSIST SENSORS



1. Camera.
2. Radar sensor (if equipped).

If a message regarding a blocked sensor or camera appears in the information display, something is obstructing the radar signals or camera images. The radar sensor is behind the fascia cover in the center of the lower grille. With a blocked sensor or camera, the system may not function, or performance may reduce. See **Pre-Collision Assist – Information Messages** (page 285).

**Note:** Proper system operation requires a clear view of the road by the camera. Repair any windshield damage in the area of the camera's field of view.

**Note:** If something hits the front end of your vehicle or damage occurs and your vehicle has a radar sensor, the radar sensing zone could change. This could cause missed or false vehicle detections. Have your vehicle serviced to have the radar checked for proper coverage and operation.

**Note:** If your vehicle detects excessive heat at the camera or a potential misalignment condition, a message could display in the information display indicating temporary sensor unavailability. When operational conditions are correct, the message deactivates. For example, when the ambient temperature around the sensor decreases or the sensor recalibrates successfully.

### DISTANCE INDICATION

#### What Is Distance Indication

Distance indication displays the gap between your vehicle and the vehicle ahead of you.

**Note:** The graphic does not display if you switch on cruise control or adaptive cruise control.

## Pre-Collision Assist

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<b>Vehicle Speed</b>	<b>System Sensitivity</b>	<b>Distance Indicator Color</b>	<b>Distance Gap</b>	<b>Time Gap</b>
62 mph (100 km/h).	Normal.	Gray.	Greater than 82 ft (25 m).	Greater than 0.9 seconds.
		Yellow.	56–82 ft (17–25 m).	0.6-0.9 seconds.
		Red.	Less than 56 ft (17 m).	Less than 0.6 seconds.

# Pre-Collision Assist

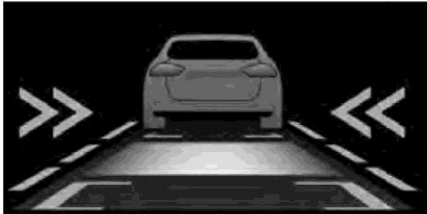
## Switching Distance Indication On and Off

To switch the system on or off, use the touchscreen:

1. Press **Settings** on the touchscreen.
2. Press **Driver Assistance**.
3. Press **Pre-Collision Assist**.
4. Press **Distance Indication**.

## Distance Indication Indicator

The indicator displays the time gap between your vehicle and vehicles traveling in the same direction ahead of you.



## DISTANCE ALERT

### What Is Distance Alert

The system alerts you with a warning lamp if the distance to the vehicle ahead is small.

**Note:** *The warning lamp does not illuminate if cruise control or adaptive cruise control is active.*

### Adjusting the Sensitivity of Distance Alert

To adjust the sensitivity of the system, use the touchscreen:

1. Press **Settings** on the touchscreen.
2. Press **Driver Assistance**.
3. Press **Pre-Collision Assist**.
4. Press **Alert Sensitivity**.
5. Press a setting.

## AUTOMATIC EMERGENCY BRAKING

### What Is Automatic Emergency Braking

Automatic emergency braking may activate if the system determines that a collision is imminent. The system may help reduce impact damage to avoid the crash completely.

Automatic emergency braking is only available up to certain speeds. See **Pre-Collision Assist Limitations** (page 280).

## Pre-Collision Assist

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### Switching Automatic Emergency Braking On and Off

To switch the system on or off, use the touchscreen:

1. Press **Settings** on the touchscreen.
2. Press **Driver Assistance**.
3. Press **Pre-Collision Assist**.
4. Press **Active Braking**.
5. Switch the feature on or off.

### EVASIVE STEERING ASSIST (If Equipped)

#### What Is Evasive Steering Assist

If your vehicle is rapidly approaching a road user, evasive steering assist helps you steer around the road user.

After you turn the steering wheel in an attempt to avoid a crash with the road user, the system applies additional steering torque to help you steer around the road user. After you pass the road user, the system applies steering torque when you turn the steering wheel to steer back into the lane. The system deactivates after you fully pass the road user.

**Note:** Road users are defined as obstacles encountered on the road that the system is able to detect. See **Pre-Collision Assist Precautions** (page 279).

### Evasive Steering Assist Limitations

Evasive steering assist only activates when all the following occur:

- Automatic emergency braking and evasive steering assist are on.
- The system detects a road user ahead and starts to apply the brakes.
- You significantly turn the steering wheel to steer around a road user.

**Note:** The system does not automatically steer around a road user. If you do not turn the steering wheel, the system does not activate.

**Note:** The system does not activate if the distance to the road user ahead is too small and the system cannot avoid a crash.

### Switching Evasive Steering Assist On and Off

To switch the system on or off, use the touchscreen:

1. Press **Settings** on the touchscreen.
2. Press **Driver Assistance**.
3. Press **Pre-Collision Assist**.
4. Press **Evasive Steering**.
5. Switch the feature on or off.

**Note:** If you switch automatic emergency braking off, evasive steering assist turns off.

**Note:** Automatic emergency braking and evasive steering assist turn on every time you switch the ignition on.

# Pre-Collision Assist

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## PRE-COLLISION ASSIST – TROUBLESHOOTING

### Pre-Collision Assist – Information Messages

<b>Message</b>	<b>Action</b>
Pre-Collision Assist Not Available Sensor Blocked	You have a blocked sensor due to bad weather, ice, mud or water in front of the radar sensor. You can typically clean the sensor to resolve.
Pre-Collision Assist Not Available	A fault with the system has occurred. Have your vehicle checked as soon as possible.

## Pre-Collision Assist

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### **Pre-Collision Assist – Frequently Asked Questions**

#### **Camera Troubleshooting**

##### **The windshield in front of the camera is dirty or obstructed.**

Clean the outside of the windshield in front of the camera.

##### **The windshield in front of the camera is clean, but the message remains in the instrument cluster display.**

Wait a short time. It could take several minutes for the camera to detect that there is no obstruction.

#### **Radar Troubleshooting (If Equipped)**

##### **The surface of the radar in the grille is dirty or obstructed.**

Clean the grille surface in front of the radar or remove the object causing the obstruction.

##### **The surface of the radar in the grille is clean, but the message remains in the instrument cluster display.**

Wait a short time. It could take several minutes for the radar to detect that there is no obstruction.

##### **Heavy rain, spray or fog is interfering with the radar signals.**

The pre-collision assist system is temporarily disabled. Pre-collision assist reactivates a short time after the weather conditions improve.

##### **Swirling water or snow or ice on the surface of the road could interfere with the radar signals.**

The pre-collision assist system is temporarily disabled. Pre-collision assist reactivates a short time after the weather conditions improve.

##### **Radar is out of alignment due to a front end impact.**

Have your vehicle serviced to have the radar checked for proper coverage and operation.

## APPENDIX C

### Run Log



Subject Vehicle: **2022 Ford Escape PHEV FWD**

Test start date: **5/24/2022**

Principal Other Vehicle: **SSV**

Test end date: **5/24/2022**

Run	Test Type	Valid Run?	FCW TTC (s)	Minimum Distance (ft)	Peak Deceleration (g)	Pass/Fail	Notes
	Brake characterization and determination						See Appendix D
43	Static Run						
44	<b>Stopped POV</b>	N					Early Braking
45		N					Invalid due to incorrect brake timing calculation method
46		N					Invalid due to incorrect brake timing calculation method
47		N					Invalid due to incorrect brake timing calculation method
48		N					Invalid due to incorrect brake timing calculation method
49		N					Invalid due to incorrect brake timing calculation method
50		N					Invalid due to incorrect brake timing calculation method
51		N					Invalid due to incorrect brake timing calculation method
52	Static Run						
70	<b>Stopped POV</b>	Y	1.98	1.51	0.73	Pass	
71		Y	1.99	1.73	0.59	Pass	
72		Y	1.97	1.77	0.58	Pass	

Run	Test Type	Valid Run?	FCW TTC (s)	Minimum Distance (ft)	Peak Deceleration (g)	Pass/Fail	Notes
73		Y	1.95	1.36	0.79	Pass	
74		Y	1.96	1.61	0.54	Pass	
75		Y	1.97	1.38	0.56	Pass	
76		Y	2.00	1.26	0.54	Pass	
77	Static run						
53	Static						
54	<b>Slower POV, 25 vs 10</b>	Y	1.84	6.86	0.79	Pass	
55		Y	1.84	5.68	0.68	Pass	
56		Y	1.84	5.34	0.67	Pass	
57		Y	1.87	7.02	0.78	Pass	
58		Y	1.72	7.07	0.81	Pass	
59		Y	1.81	6.09	0.78	Pass	
60		Y	1.86	3.06	0.49	Pass	
61	Static run						
62	<b>Slower POV, 45 vs 20</b>	Y	2.47	4.25	0.80	Pass	
63		Y	2.52	4.68	0.90	Pass	
64		Y	2.44	5.04	0.88	Pass	
65		Y	2.53	3.82	0.79	Pass	

Run	Test Type	Valid Run?	FCW TTC (s)	Minimum Distance (ft)	Peak Deceleration (g)	Pass/Fail	Notes
66		Y	2.48	4.25	0.88	Pass	
67		Y	2.51	4.30	0.86	Pass	
68		Y	2.53	4.35	0.92	Pass	
69	Static run						
78	<b>Decelerating POV</b>	N					POV Braking
79		Y	1.68	8.19	0.68	Pass	
80		Y	1.95	7.53	0.74	Pass	
81		Y	1.71	10.09	0.75	Pass	
82		Y	1.85	12.83	0.83	Pass	
83		Y	1.72	8.26	0.66	Pass	
84		Y	1.79	10.12	0.74	Pass	
85		Y	1.78	8.96	0.76	Pass	
90	Static run						
8	STP - Static run						
9	<b>Baseline, 25</b>	Y			0.47		
10		Y			0.47		
11		Y			0.47		
12		Y			0.47		

Run	Test Type	Valid Run?	FCW TTC (s)	Minimum Distance (ft)	Peak Deceleration (g)	Pass/Fail	Notes
13		Y			0.46		
14		Y			0.45		
15		Y			0.45		
16	STP - Static run						
17	<b>Baseline, 45</b>	Y			0.43		
18		Y			0.46		
19		Y			0.46		
20		Y			0.46		
21		Y			0.46		
22		Y			0.46		
23		N					Throttle Drop
24		Y				0.46	
25	STP - Static run						
26	<b>STP False Positive, 25</b>	Y			0.46	Pass	
27		Y			0.46	Pass	
28		Y			0.46	Pass	
29		Y			0.46	Pass	
30		Y				0.45	Pass

Run	Test Type	Valid Run?	FCW TTC (s)	Minimum Distance (ft)	Peak Deceleration (g)	Pass/Fail	Notes
31		Y			0.45	Pass	
32		Y			0.45	Pass	
33	STP - Static run						
34	<b>STP False Positive, 45</b>	N					Brake Temps
35		Y			0.43	Pass	
36		Y			0.44	Pass	
37		Y			0.44	Pass	
38		Y			0.44	Pass	
39		Y			0.44	Pass	
40		Y			0.44	Pass	
41		Y			0.43	Pass	
42	STP - Static run						

## APPENDIX D

### Brake Characterization

Subject Vehicle: **2022 Ford Escape PHEV FWD**

Test start date: **5/24/2022**

Test end date: **5/24/2022**

DBS Initial Brake Characterization				
Run Number	Stroke at 0.4 g (in)	Force at 0.4 g (lb)	Slope	Intercept
1	1.71	14.65	0.81	-0.19
2	1.73	14.71	0.84	-0.20
3	1.74	15.05	0.80	-0.14

DBS Brake Characterization Determination								
Run	DBS Mode	Speed	Valid Run	Average Decel. (g)	0.4 g Stroke Value (in)	0.4 g Force Value (lb)	Stroke/Force Calculator (in)	Notes
4	Displacement	35	Y	0.497	1.73		1.39	
5		35	Y	0.412	1.55		1.50	
6		25	Y	0.398	1.55		1.56	
7		45	Y	0.419	1.55		1.48	

Appendix E

TIME HISTORY PLOTS



## LIST OF FIGURES

	Page
Figure E1. Example Time History for Stopped POV, Passing .....	E-10
Figure E2. Example Time History for Slower POV 25 vs. 10, Passing .....	E-11
Figure E3. Example Time History for Slower POV 45 vs. 20, Passing .....	E-12
Figure E4. Example Time History for Decelerating POV 35, Passing .....	E-13
Figure E5. Example Time History for False Positive Baseline 25 .....	E-14
Figure E6. Example Time History for False Positive Baseline 45 .....	E-15
Figure E7. Example Time History for False Positive Steel Plate 25, Passing .....	E-16
Figure E8. Example Time History for False Positive Steel Plate 45, Passing .....	E-17
Figure E9. Example Time History for DBS Brake Characterization, Passing .....	E-18
Figure E10. Example Time History Displaying Invalid POV Acceleration Criteria .....	E-19
Figure E11. Example Time History Displaying Invalid Brake Force Criteria .....	E-20
Figure E12. Example Time History for a Failed Run .....	E-21
Figure E13. Time History for DBS Run 70, Test 1 - Stopped POV .....	E-22
Figure E14. Time History for DBS Run 71, Test 1 - Stopped POV .....	E-23
Figure E15. Time History for DBS Run 72, Test 1 - Stopped POV .....	E-24
Figure E16. Time History for DBS Run 73, Test 1 - Stopped POV .....	E-25
Figure E17. Time History for DBS Run 74, Test 1 - Stopped POV .....	E-26
Figure E18. Time History for DBS Run 75, Test 1 - Stopped POV .....	E-27
Figure E19. Time History for DBS Run 76, Test 1 - Stopped POV .....	E-28
Figure E20. Time History for DBS Run 54, Test 2 - Slower Moving POV 25/10 mph .....	E-29
Figure E21. Time History for DBS Run 55, Test 2 - Slower Moving POV 25/10 mph .....	E-30
Figure E22. Time History for DBS Run 56, Test 2 - Slower Moving POV 25/10 mph .....	E-31
Figure E23. Time History for DBS Run 57, Test 2 - Slower Moving POV 25/10 mph .....	E-32
Figure E24. Time History for DBS Run 58, Test 2 - Slower Moving POV 25/10 mph .....	E-33
Figure E25. Time History for DBS Run 59, Test 2 - Slower Moving POV 25/10 mph .....	E-34
Figure E26. Time History for DBS Run 60, Test 2 - Slower Moving POV 25/10 mph .....	E-35
Figure E27. Time History for DBS Run 62, Test 2 - Slower Moving POV 45/20 mph .....	E-36
Figure E28. Time History for DBS Run 63, Test 2 - Slower Moving POV 45/20 mph .....	E-37
Figure E29. Time History for DBS Run 64, Test 2 - Slower Moving POV 45/20 mph .....	E-38
Figure E30. Time History for DBS Run 65, Test 2 - Slower Moving POV 45/20 mph .....	E-39
Figure E31. Time History for DBS Run 66, Test 2 - Slower Moving POV 45/20 mph .....	E-40
Figure E32. Time History for DBS Run 67, Test 2 - Slower Moving POV 45/20 mph .....	E-41
Figure E33. Time History for DBS Run 68, Test 2 - Slower Moving POV 45/20 mph .....	E-42
Figure E34. Time History for DBS Run 79, Test 3 - Decelerating POV 35 mph .....	E-43
Figure E35. Time History for DBS Run 80, Test 3 - Decelerating POV 35 mph .....	E-44
Figure E36. Time History for DBS Run 81, Test 3 - Decelerating POV 35 mph .....	E-45
Figure E37. Time History for DBS Run 82, Test 3 - Decelerating POV 35 mph .....	E-46
Figure E38. Time History for DBS Run 83, Test 3 - Decelerating POV 35 mph .....	E-47
Figure E39. Time History for DBS Run 84, Test 3 - Decelerating POV 35 mph .....	E-48
Figure E40. Time History for DBS Run 85, Test 3 - Decelerating POV 35 mph .....	E-49
Figure E41. Time History for DBS Run 9, False Positive Baseline, SV 25 mph .....	E-50

Figure E42.	Time History for DBS Run 10, False Positive Baseline, SV 25 mph .....	E-51
Figure E43.	Time History for DBS Run 11, False Positive Baseline, SV 25 mph .....	E-52
Figure E44.	Time History for DBS Run 12, False Positive Baseline, SV 25 mph .....	E-53
Figure E45.	Time History for DBS Run 13, False Positive Baseline, SV 25 mph .....	E-54
Figure E46.	Time History for DBS Run 14, False Positive Baseline, SV 25 mph .....	E-55
Figure E47.	Time History for DBS Run 15, False Positive Baseline, SV 25 mph .....	E-56
Figure E48.	Time History for DBS Run 17, False Positive Baseline, SV 45 mph .....	E-57
Figure E49.	Time History for DBS Run 18, False Positive Baseline, SV 45 mph .....	E-58
Figure E50.	Time History for DBS Run 19, False Positive Baseline, SV 45 mph .....	E-59
Figure E51.	Time History for DBS Run 20, False Positive Baseline, SV 45 mph .....	E-60
Figure E52.	Time History for DBS Run 21, False Positive Baseline, SV 45 mph .....	E-61
Figure E53.	Time History for DBS Run 22, False Positive Baseline, SV 45 mph .....	E-62
Figure E54.	Time History for DBS Run 24, False Positive Baseline, SV 45 mph .....	E-63
Figure E55.	Time History for DBS Run 26, Test 4 - False Positive STP 25 mph .....	E-64
Figure E56.	Time History for DBS Run 27, Test 4 - False Positive STP 25 mph .....	E-65
Figure E57.	Time History for DBS Run 28, Test 4 - False Positive STP 25 mph .....	E-66
Figure E58.	Time History for DBS Run 29, Test 4 - False Positive STP 25 mph .....	E-67
Figure E59.	Time History for DBS Run 30, Test 4 - False Positive STP 25 mph .....	E-68
Figure E60.	Time History for DBS Run 31, Test 4 - False Positive STP 25 mph .....	E-69
Figure E61.	Time History for DBS Run 32, Test 4 - False Positive STP 25 mph .....	E-70
Figure E62.	Time History for DBS Run 35, Test 4 - False Positive STP 45 mph .....	E-71
Figure E63.	Time History for DBS Run 36, Test 4 - False Positive STP 45 mph .....	E-72
Figure E64.	Time History for DBS Run 37, Test 4 - False Positive STP 45 mph .....	E-73
Figure E65.	Time History for DBS Run 38, Test 4 - False Positive STP 45 mph .....	E-74
Figure E66.	Time History for DBS Run 39, Test 4 - False Positive STP 45 mph .....	E-75
Figure E67.	Time History for DBS Run 40, Test 4 - False Positive STP 45 mph .....	E-76
Figure E68.	Time History for DBS Run 41, Test 4 - False Positive STP 45 mph .....	E-77
Figure E69.	Time History for DBS Run 1, Brake Characterization Initial .....	E-78
Figure E70.	Time History for DBS Run 2, Brake Characterization Initial .....	E-79
Figure E71.	Time History for DBS Run 3, Brake Characterization Initial .....	E-80
Figure E72.	Time History for DBS Run 4, Brake Characterization Determination, Displacement Mode, 35 mph .....	E-81
Figure E73.	Time History for DBS Run 5, Brake Characterization Determination, Displacement Mode, 35 mph .....	E-82
Figure E74.	Time History for DBS Run 6, Brake Characterization Determination, Displacement Mode, 25 mph .....	E-83
Figure E75.	Time History for DBS Run 7, Brake Characterization Determination, Displacement Mode, 45 mph .....	E-84

## Description of Time History Plots

A set of time history plots is provided for each valid run in the test series. Each set of plots comprises time varying data from both the Subject Vehicle (SV) and the Principal Other Vehicle (POV), as well as pass/fail envelopes and thresholds. Plots shown herein are grouped by test type and are presented sequentially within a given test type. The following is a description of data types shown in the time history plots, as well as a description of the color code indicating to which vehicle the data pertain.

### Time History Plot Description

Each time history plot consists of data relevant to the test type under consideration, and therefore the data channels plotted vary according to test type. The test types (shown in the plot titles) include:

- Stopped POV (SV at 25 mph)
- Slower POV, 25/10 (SV at 25 mph, POV at 10 mph)
- Slower POV, 45/20 (SV at 45 mph, POV at 20 mph)
- Decelerating POV 35 mph (Both vehicles at 35 mph with 13.8 m gap, POV brakes at 0.3 g)
- False Positive Baseline 25 mph (Baseline run at 25 mph)
- False Positive Baseline 45 mph (Baseline run at 45 mph)
- False Positive STP 25 mph (Steel trench plate run over at 25 mph)
- False Positive STP 45 mph (Steel trench plate run over at 45 mph)
- DBS Brake Characterization Initial
- DBS Brake Characterization Determination

Time history figures include the following sub-plots:

- FCW Warning – Displays the Forward Collision Warning alert (which can be auditory, visual, or haptic). Depending on the type of FCW alert or instrumentation used to measure the alert, this can be any combination of the following:
  - Filtered, rectified, and normalized sound signal. The vertical scale is 0 to 1.
  - Filtered, rectified, and normalized acceleration (i.e., haptic alert, such as steering wheel vibration). The vertical scale is 0 to 1.
  - Normalized light sensor signal. The vertical scale is 0 to 1.

As only the auditory or haptic alert is perceptible by the driver during a test run, the earliest of either of these alerts is used to define the onset of the FCW alert. A vertical black bar on the plot indicates the TTC (sec) at the first moment of the warning issued by the FCW system. The FCW TTC is displayed to the right of the subplot in green.

- Headway (ft) – Longitudinal separation between the front-most point of the Subject Vehicle and the rearmost point of the Strikeable Surrogate Vehicle (SSV) towed by the Principal Other Vehicle. The minimum headway during the run is displayed to the right of the subplot.
- SV/POV Speed (mph) – Speed of the Subject Vehicle and the Principal Other Vehicle (if any). For DBS tests, in the case of an impact, the speed reduction experienced by the Subject Vehicle up until the moment of impact is displayed to the right of the subplot.
- Yaw Rate (deg/sec) – Yaw rate of the Subject Vehicle and Principal Other Vehicle (if any).
- Lateral Offset (ft) – Lateral offset within the lane of the Subject Vehicle to the center of the lane of travel. Note that for tests involving the Strikeable Surrogate Vehicle (SSV), the associated lateral restraint track is defined to be the center of the lane of travel. If testing is done with a different POV which does not have a lateral restraint track, lateral offset is defined to be the lateral offset between the SV and POV.
- Ax (g) – Longitudinal acceleration of the Subject Vehicle and Principal Other Vehicle (if any). The peak value of Ax for the SV is shown on the subplot.
- Pedal Position – Position of the accelerator pedal and brake pedal. The units for the brake pedal are inches and the units for the accelerator pedal are percent of full scale divided by 10.
- Brake Force (lb) – Force on the brake pedal as applied by the DBS controller. The TTC at the onset of the brake by the DBS controller is shown on the subplot. Additionally, the average force at the brake pedal while the DBS controller is active is displayed.

## Envelopes and Thresholds

Some of the time history plot figures contain either green or yellow envelopes and/or black or red 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. Such exceedances indicate either that the test was invalid or that the requirements of the test were not met (i.e., failure of the AEB system).

For plots with green envelopes, in order for the test to be valid, the time-varying data must 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.

With the exception of the brake force plots (see description below), for plots with yellow envelopes, in order for the test to be valid, the time-varying data must not exceed the envelope at the beginning (left edge of the boundary) and/or end (right edge), but may exceed the boundary during the time between the left and right edges. Exceedances at the left or right extent of a yellow envelope are indicated by red asterisks.

For the headway plot, a dashed black threshold line indicating a relative headway of zero is given. If no impact occurs, a green circle is displayed at the moment of minimum distance. If impact occurs, a red asterisk is displayed at the moment of impact.

For the Ax plot, if the scenario is an AEB brake to stop scenario, a vertical dashed black line is displayed for all plots indicating the moment of first POV braking. The yellow envelope in this case is relevant to the POV braking only. The left edge of the envelope is at 1.5 seconds after the first POV braking. A solid black threshold line extends horizontally 0.5 seconds to the left of the envelope. This threshold line represents the time during which the Ax of the Principal Other Vehicle must first achieve 0.27 g (the upper edge of the envelope, i.e.,  $0.30 \text{ g} \pm 0.03 \text{ g}$ ). A green circle or red asterisk is displayed at the moment the POV brake level achieves 0.27 g. A green circle indicates that the test was valid (the threshold was crossed during the appropriate interval) and a red asterisk indicates that the test was invalid (the threshold was crossed out of the appropriate interval).

For the pedal position plot:

- A thick black bar appears on the brake pedal position data over the DBS controller brake onset period to signify the time over which the brake application rate is determined. The calculated brake application rate is also displayed on the figure.

- If the tests are performed in Displacement mode, the plot additionally shows a short dashed black line above the brake onset period representing the 20% maximum allowable overshoot beyond the commanded pedal position.

For the brake force plots:

- There is a dashed black threshold line indicating a brake force of 2.5 lbs. For the time period where the DBS controller is active, the brake force at the pedal must not fall below this 2.5 lb threshold. Exceedances of this threshold are indicated by red shading in the area between the measured time-varying data and the dashed threshold line. A blue envelope represents the target average brake force necessary to be valid
- If the tests are performed in Displacement mode, there are no relevant brake force level thresholds or average brake force calculations.
- If the tests are performed in Hybrid mode, the brake force plot shows a short, solid black line at 2.5 lbs representing the required brake force onset and TTC of the brake actuator. A green dot is displayed if the actuator applied a force at the correct time. If not, a red asterisk is displayed.

In the instance of the “last second” braking applied by the brake robot, a thick vertical red line will appear on the plots at the moment the brake robot activates. Note that last second braking is only done when it has been determined by the onboard computer that test failure cannot be avoided. It is done simply to reduce the collision speed in order to minimize the likelihood of damage to the SSV and to the Subject Vehicle. Therefore, data validity checks are not performed after the red line, and certain values, such as minimum distance or peak deceleration, may not be accurate.

## Color Codes

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

Color codes can be broken into four categories:

1. Time-varying data
2. Validation envelopes and thresholds
3. Individual data points
4. Text

1. Time-varying data color codes:

- Blue = Subject Vehicle data
- Magenta = Principal Other Vehicle data
- Brown = Relative data between SV and POV (i.e., TTC, lateral offset and headway distance)

## 2. 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 left and/or right ends
- Blue envelope = visualized target range for the time varying data averaged over a period equal to the length of the envelope
- Black threshold (Solid) = time varying data must cross this threshold in the time period shown in order to be valid
- Black threshold (Dashed) = for reference only – this can include warning level thresholds, TTC thresholds, and acceleration thresholds.
- Red threshold (Solid) = for reference only – indicates the activation of last-minute braking by the brake robot. Data after the solid red line is not used to determine test validity.

## 3. Individual data point color codes:

- Green circle = passing or valid value at a given moment in time
- Red asterisk = failing or invalid value at a given moment in time

## 4. Text color codes:

- Green = passing or valid value
- Red = failing or invalid value

## Other Notations

- NG – Indicates that the value for that variable was outside of bounds and therefore “No Good”.
- No Wng – No warning was detected.
- POV – Indicates that the value for the Principal Other Vehicle was out of bounds.
- SV – Indicates that the value for the Subject Vehicle was out of bounds.
- SR – Shows the speed reduction value.
- Thr – Indicates that the requirements for the throttle were not met.
- Brk – Indicates that the requirements for the brake application rate were not met

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 valid or passing time history plots for each test type (including passing, failing, and invalid runs) are shown in Figure E1 through E12. Figures E1 through E8 show passing runs for each of the 8 test types. Figure E9 shows an example of a passing brake characterization run. Figures E10 and E11 show examples of invalid runs. Figure E12 shows an example of a valid test that failed the DBS requirements. Time history data plots for the tests of the vehicle under consideration herein are provided beginning with Figure E13.

### **Notes**

For valid runs, plots are shown for all warning types. In some cases, one of the plots may indicate that a run was invalid, but if the run was valid for either warning type it is considered valid. The companion plots are shown for the sake of completeness.



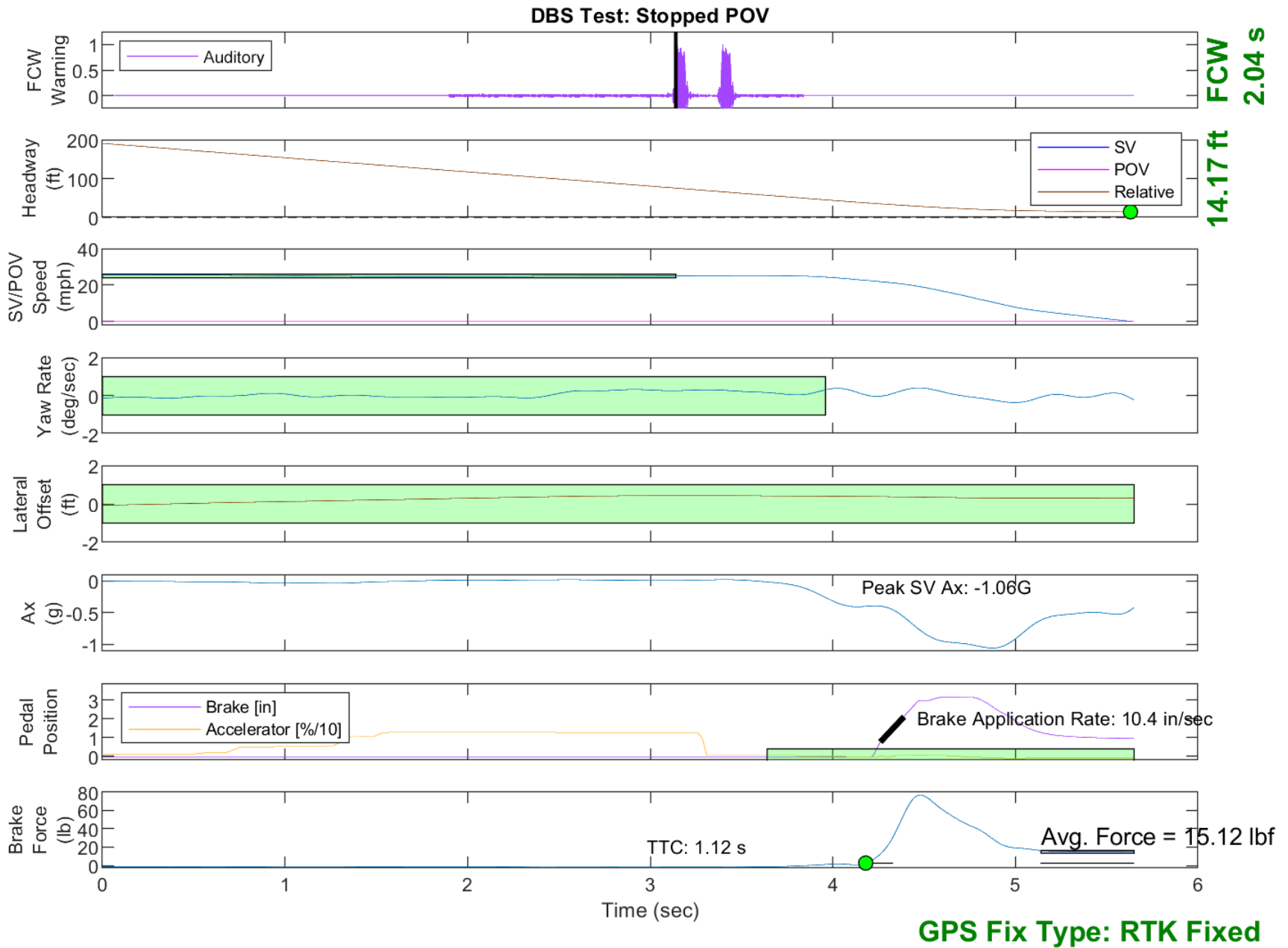


Figure E1. Example Time History for Stopped POV, Passing

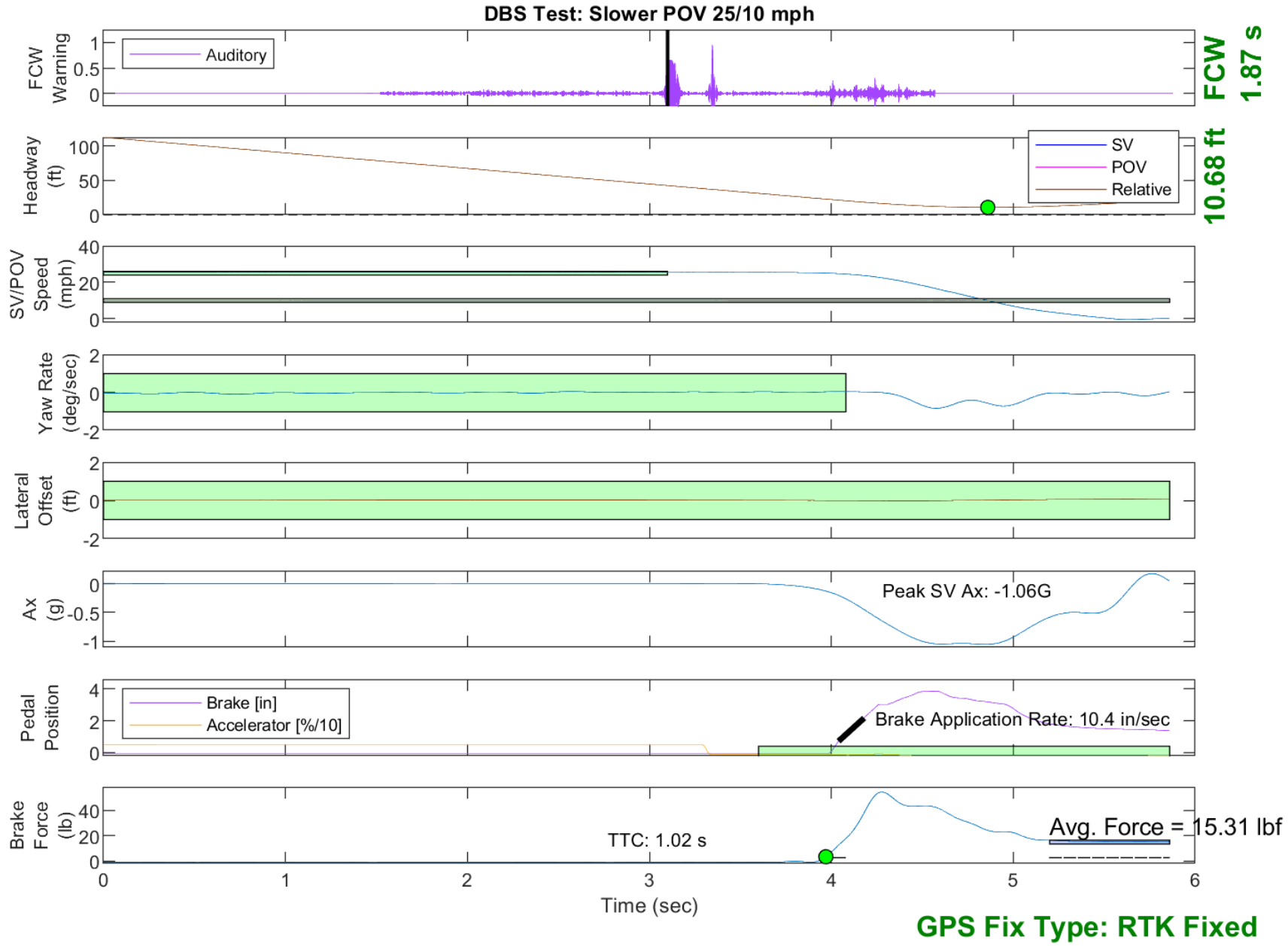


Figure E2. Example Time History for Slower POV 25 vs. 10, Passing

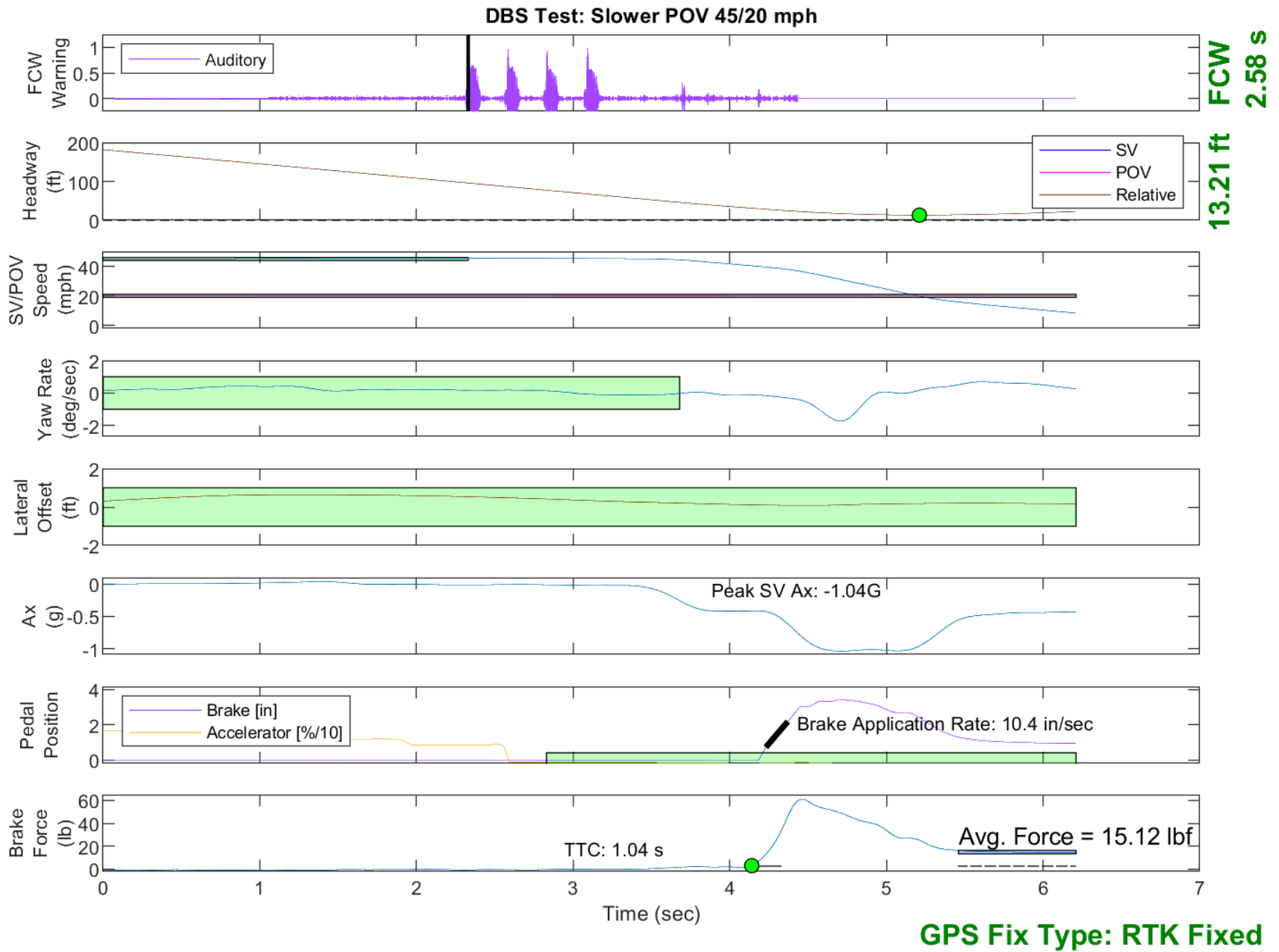


Figure E3. Example Time History for Slower POV 45 vs. 20, Passing

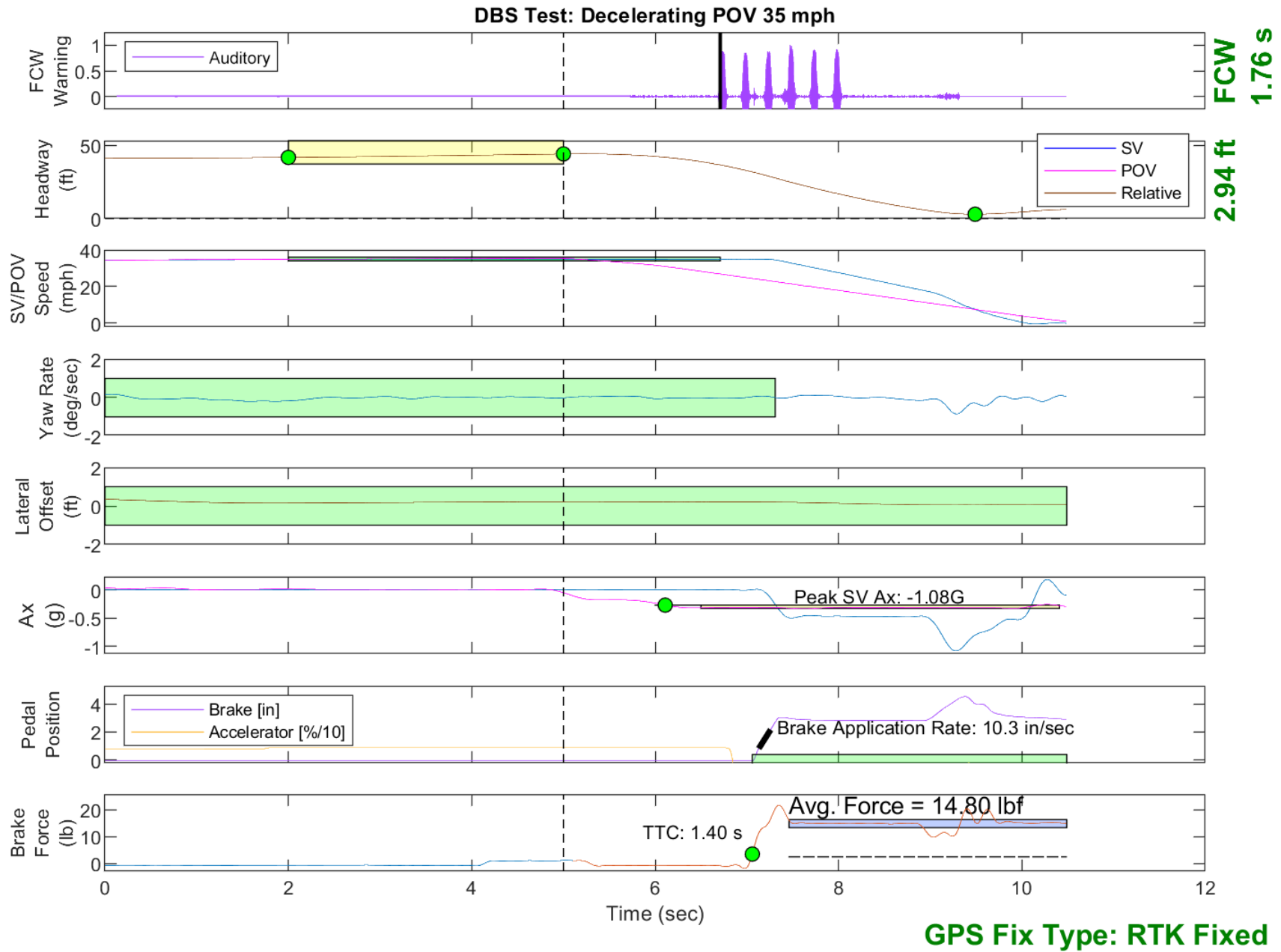
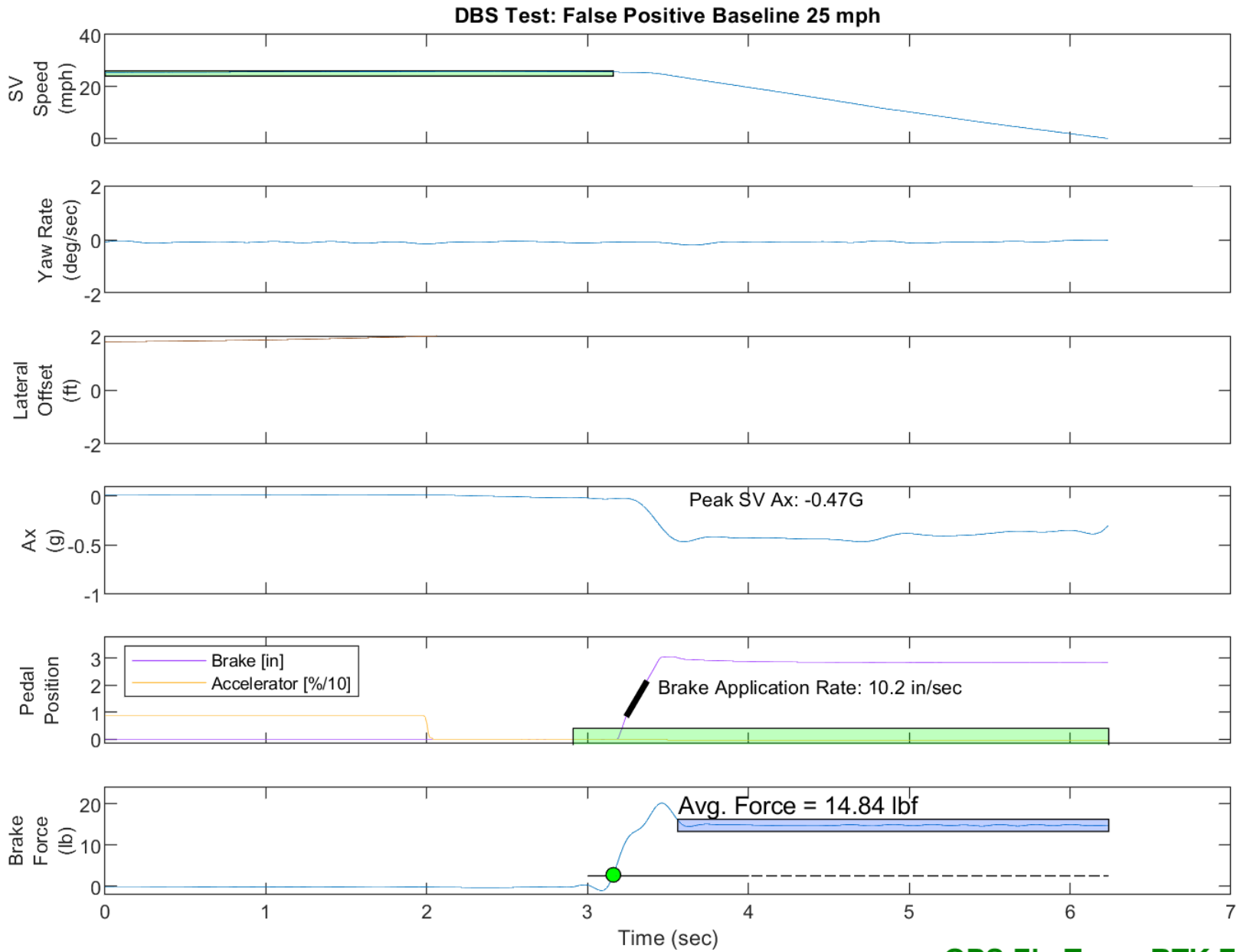
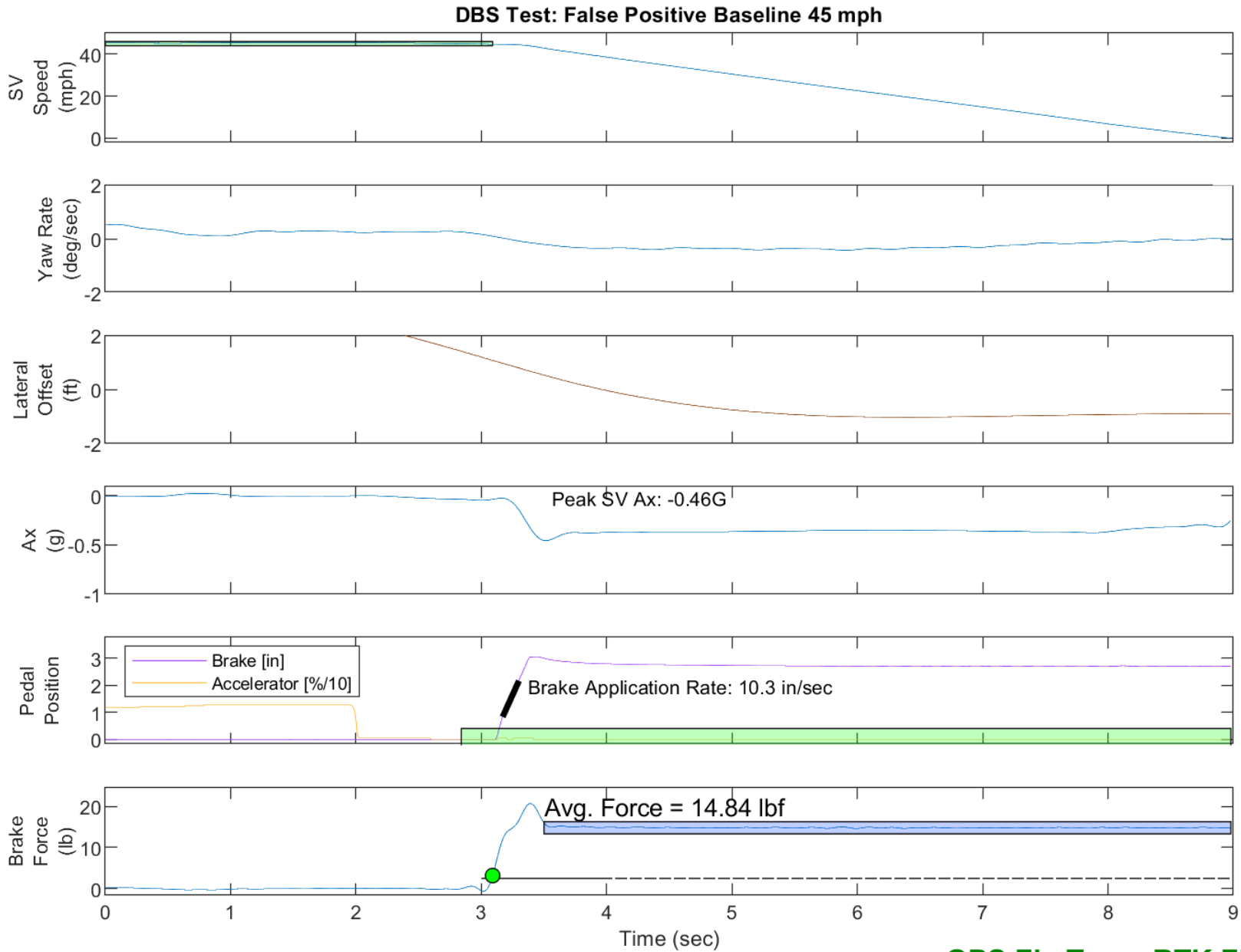


Figure E4. Example Time History for Decelerating POV 35, Passing



**GPS Fix Type: RTK Fixed**

Figure E5. Example Time History for False Positive Baseline 25



**GPS Fix Type: RTK Fixed**

Figure E6. Example Time History for False Positive Baseline 45

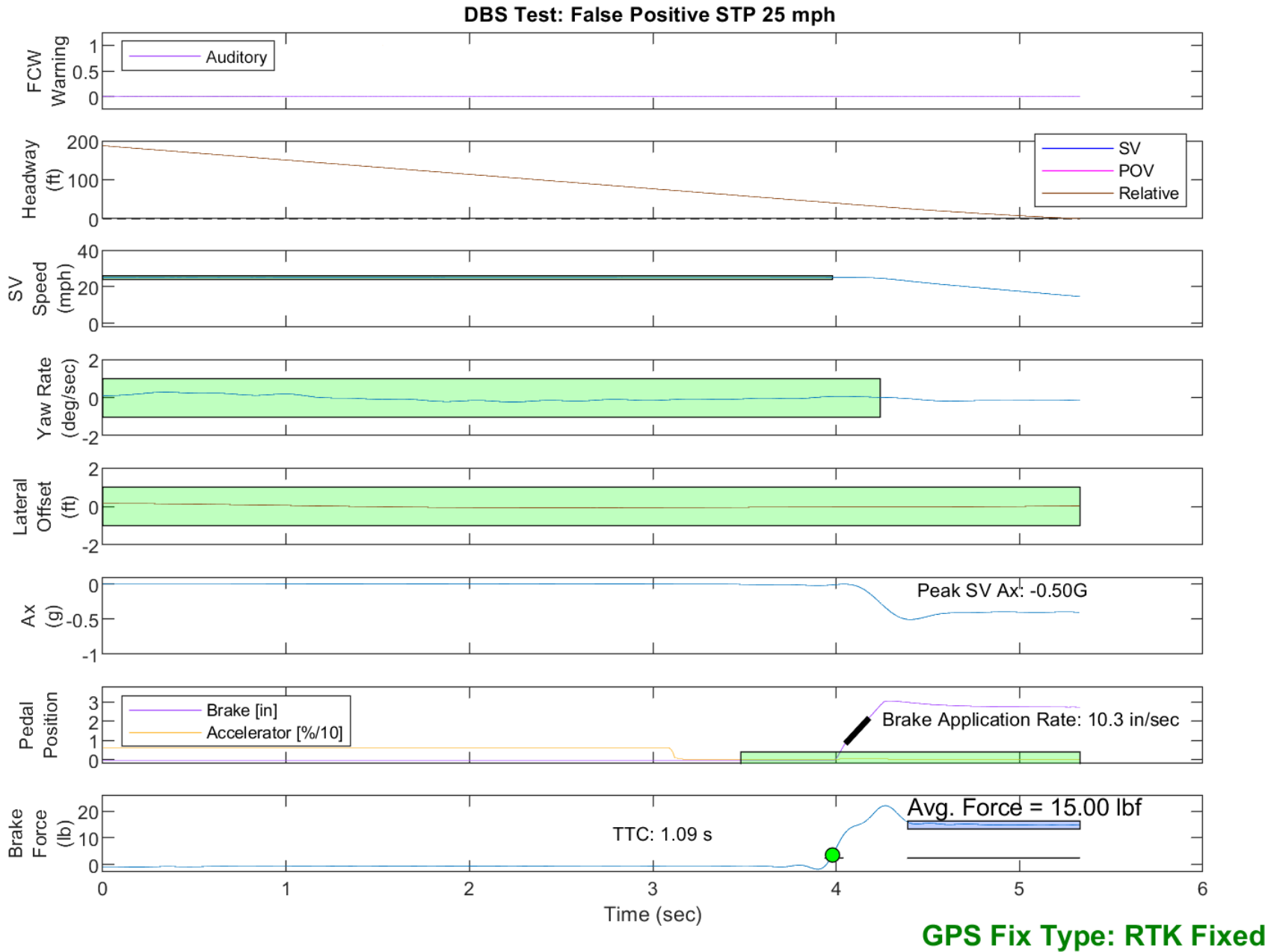


Figure E7. Example Time History for False Positive Steel Plate 25, Passing

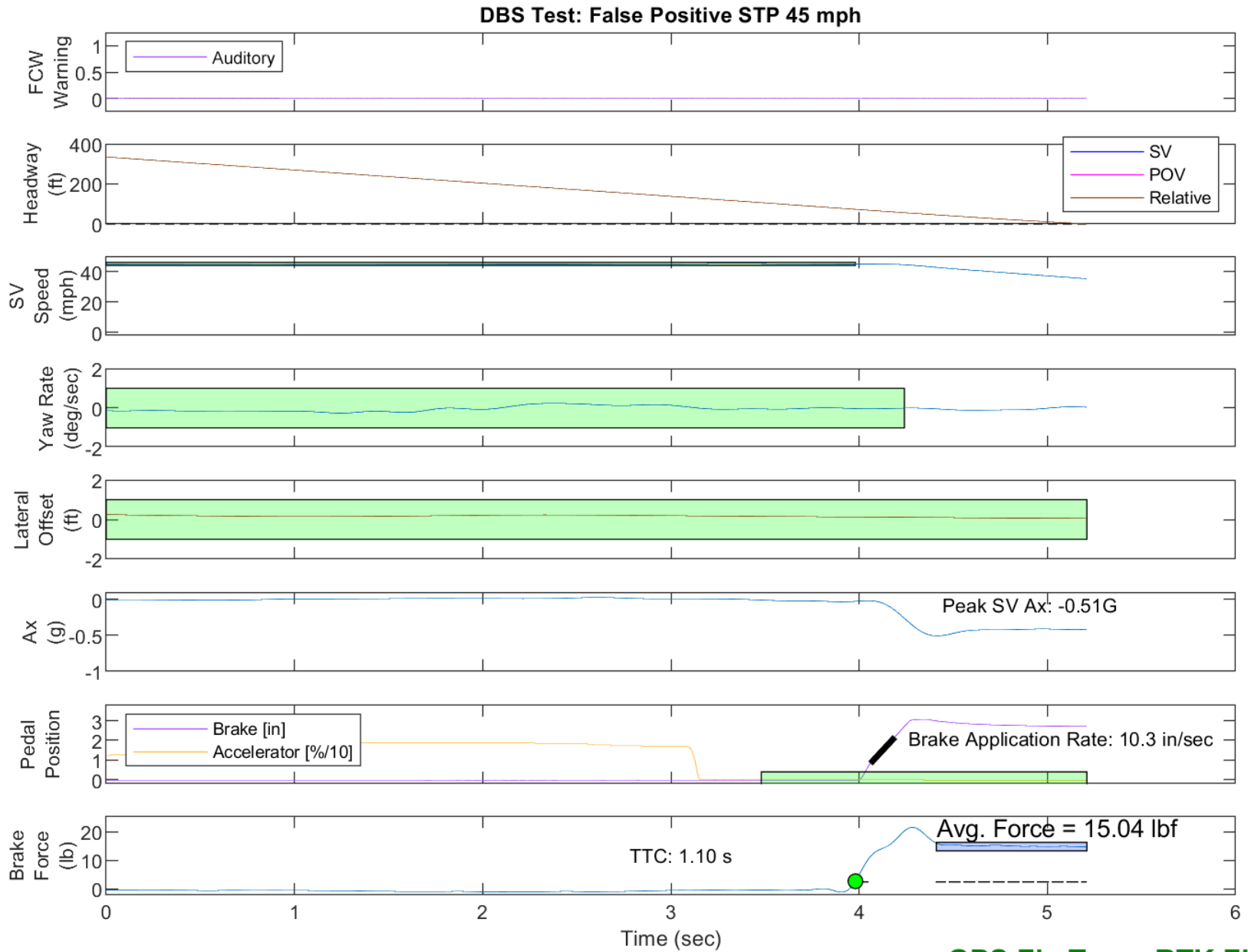
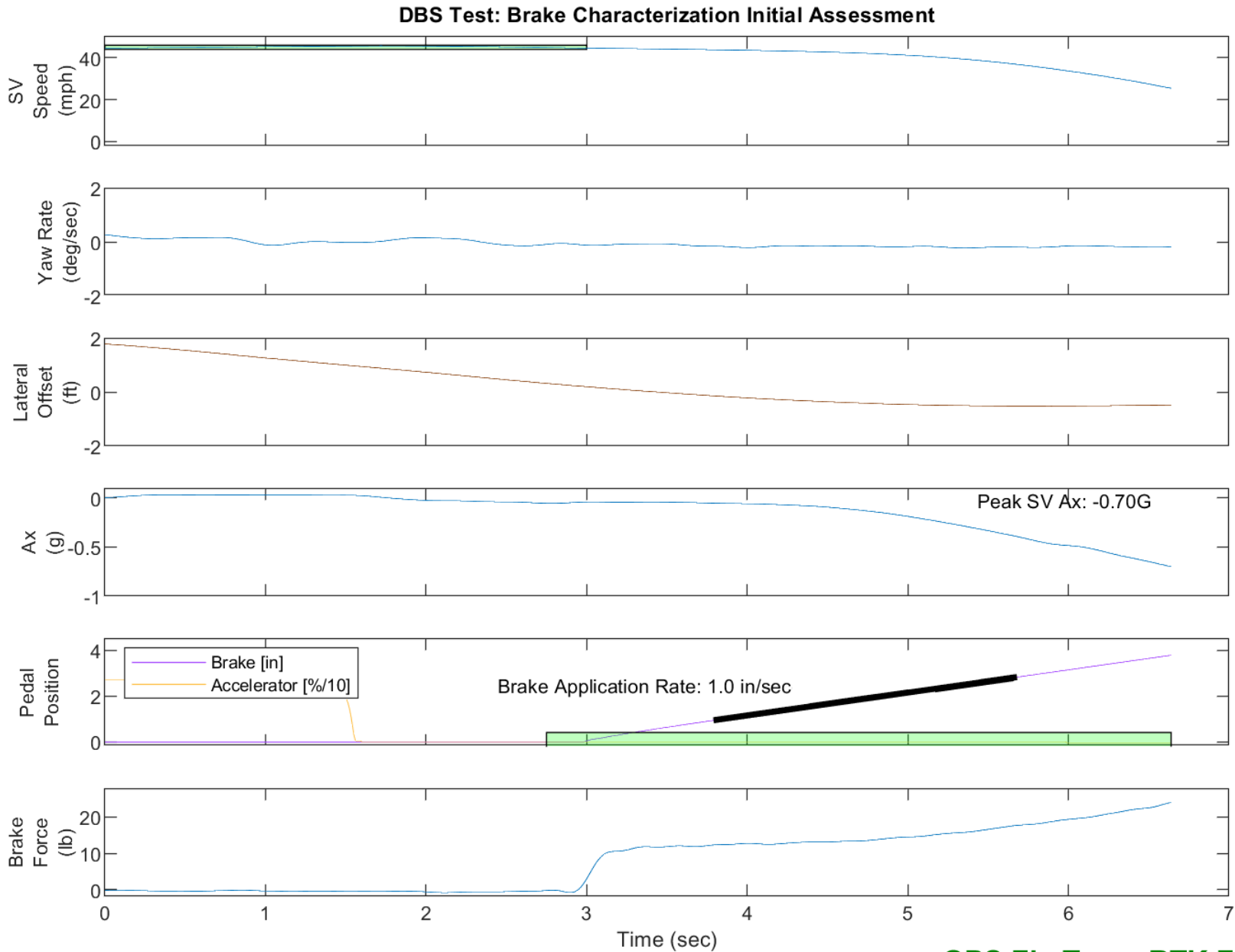


Figure E8. Example Time History for False Positive Steel Plate 45, Passing





**GPS Fix Type: RTK Fixed**

Figure E9. Example Time History for DBS Brake Characterization, Passing

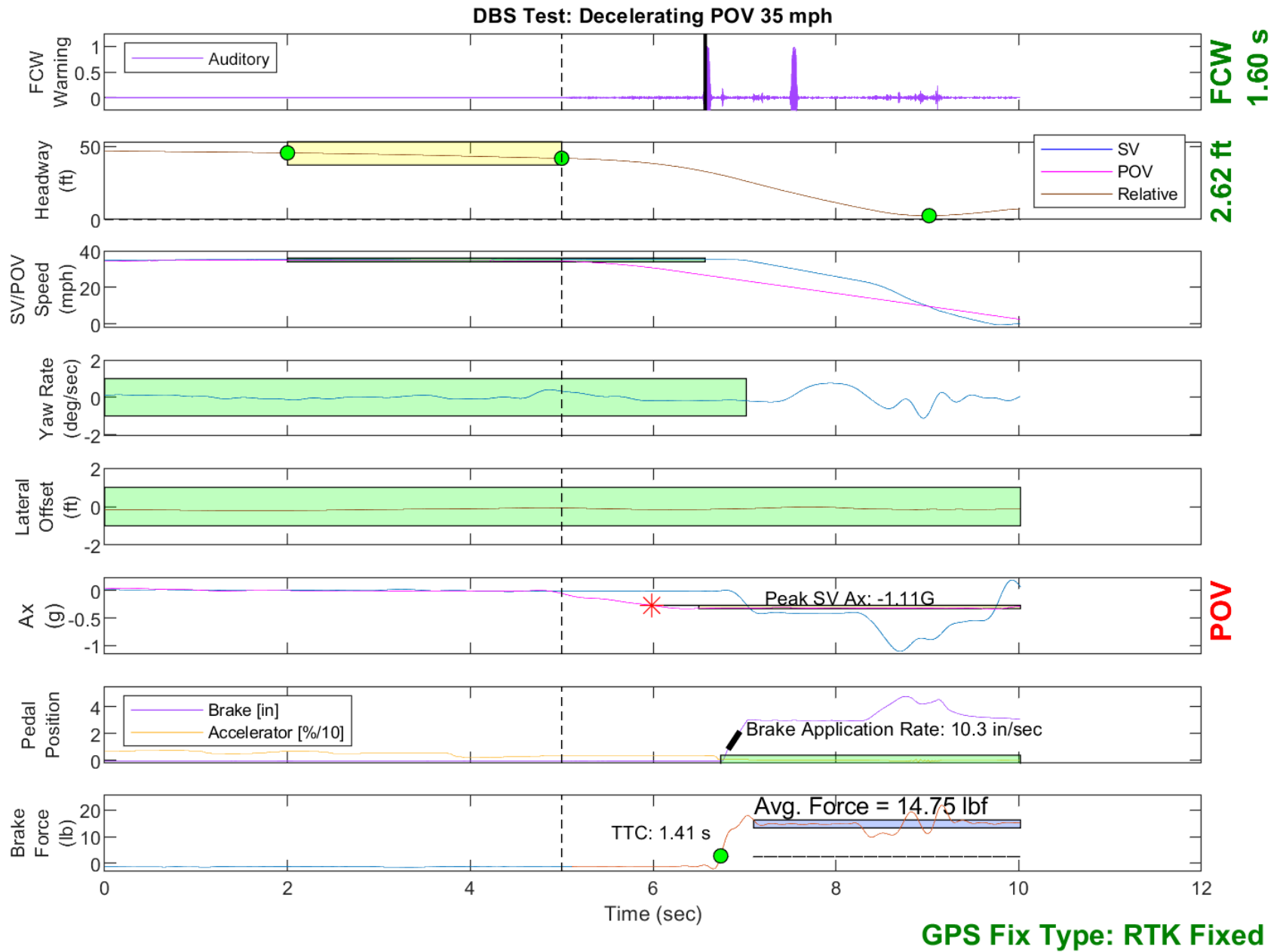
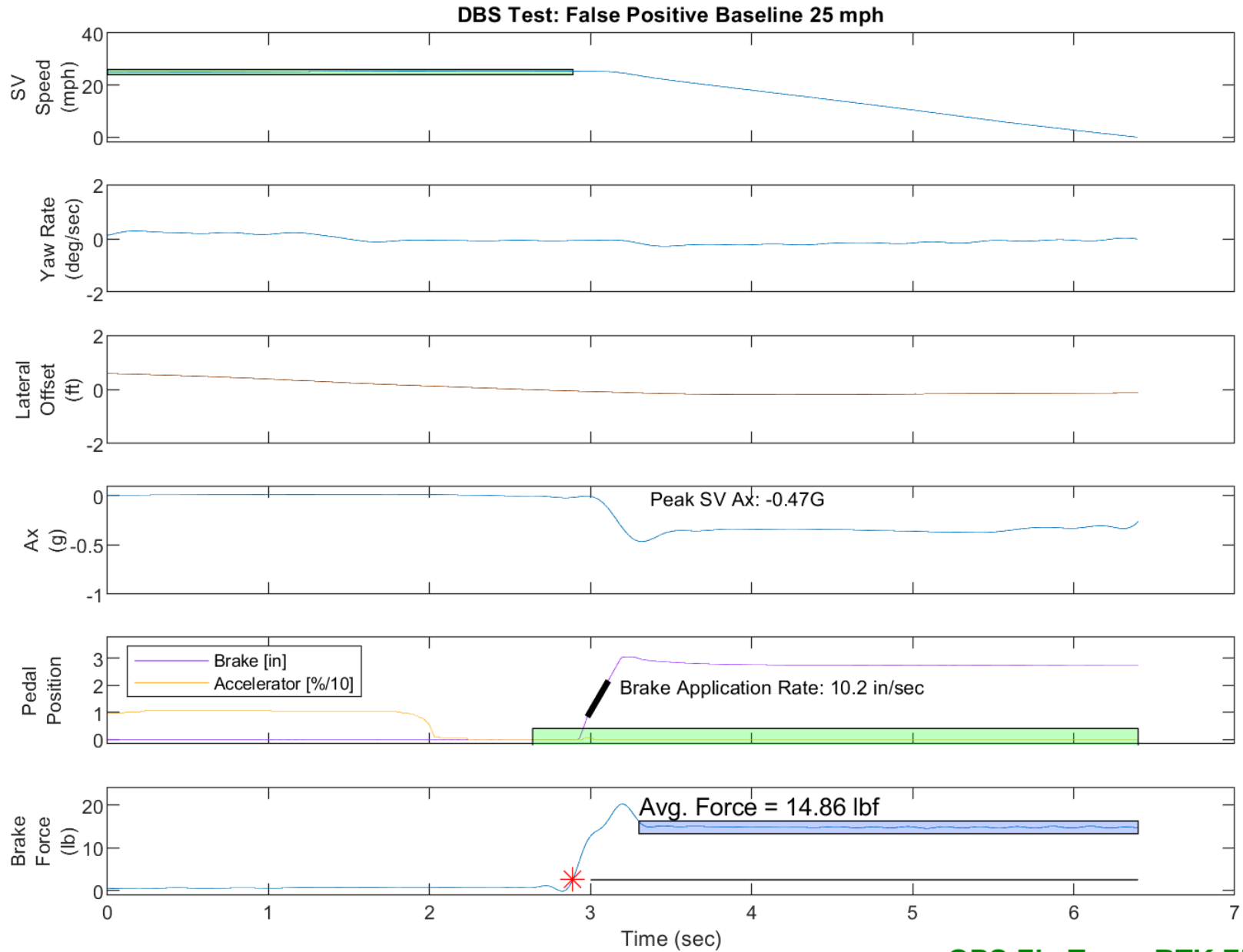


Figure E10. Example Time History Displaying Invalid POV Acceleration Criteria



**GPS Fix Type: RTK Fixed**

Figure E11. Example Time History Displaying Invalid Brake Force Criteria

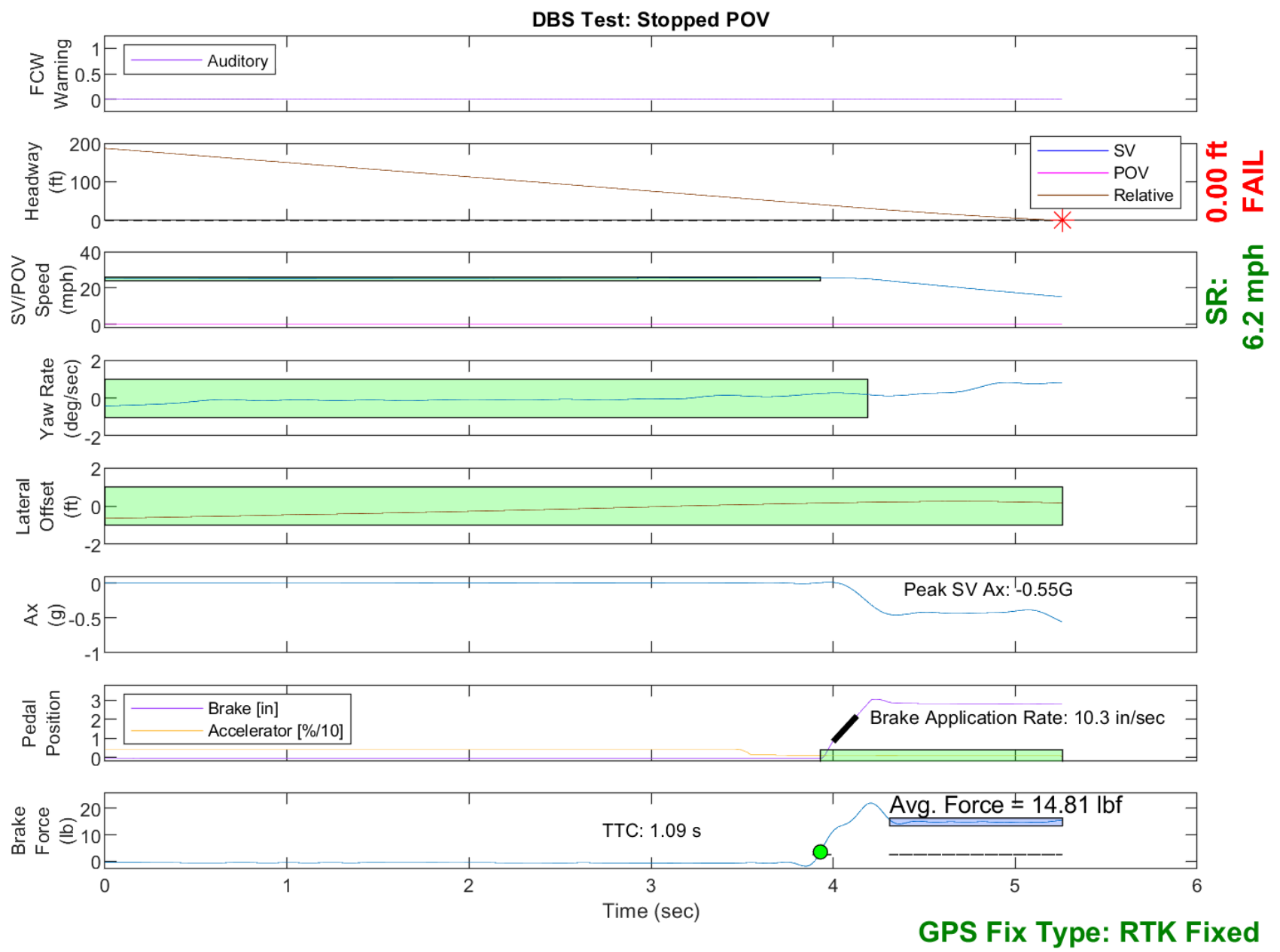


Figure E12. Example Time History for a Failed Run

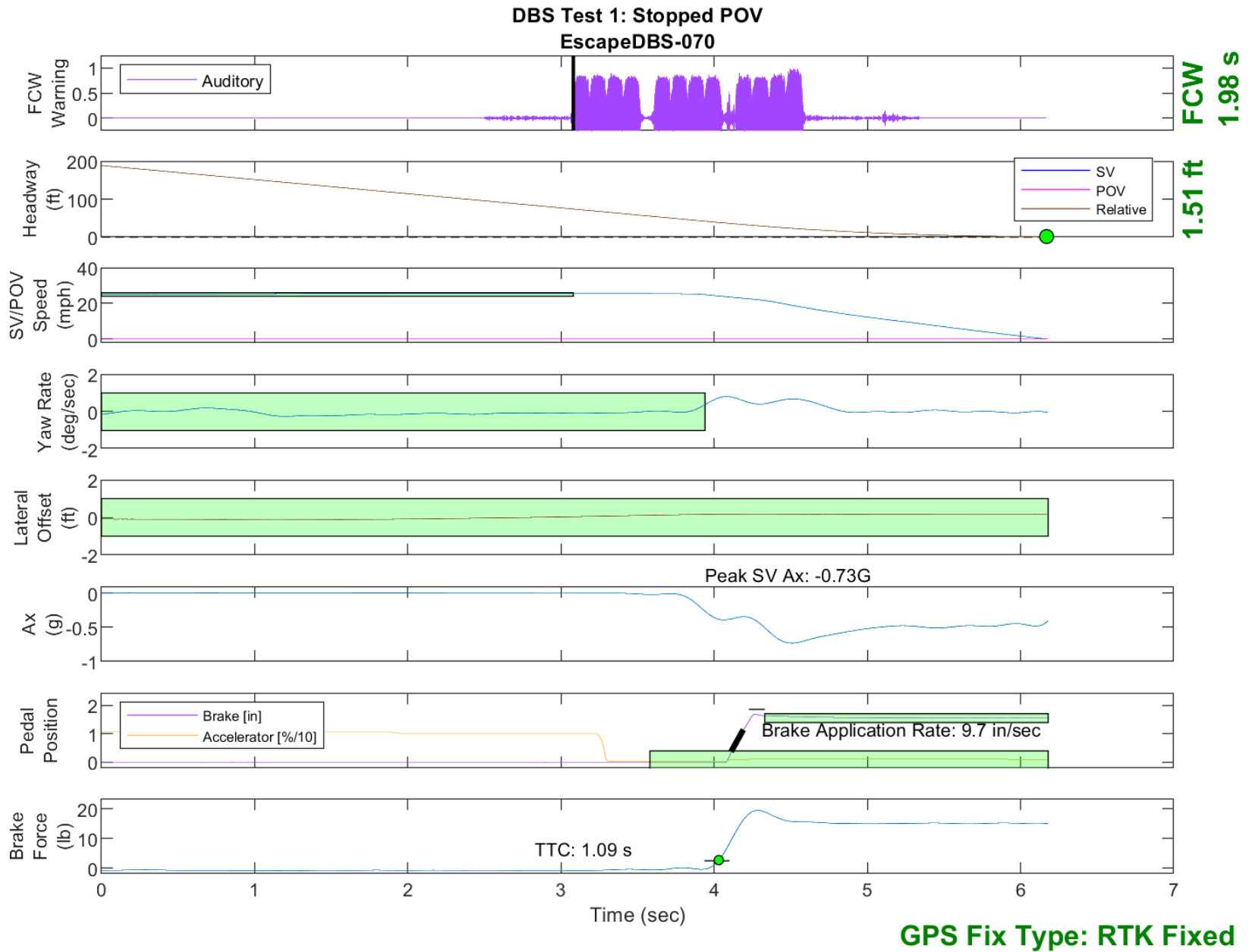


Figure E13. Time History for DBS Run 70, Test 1 - Stopped POV

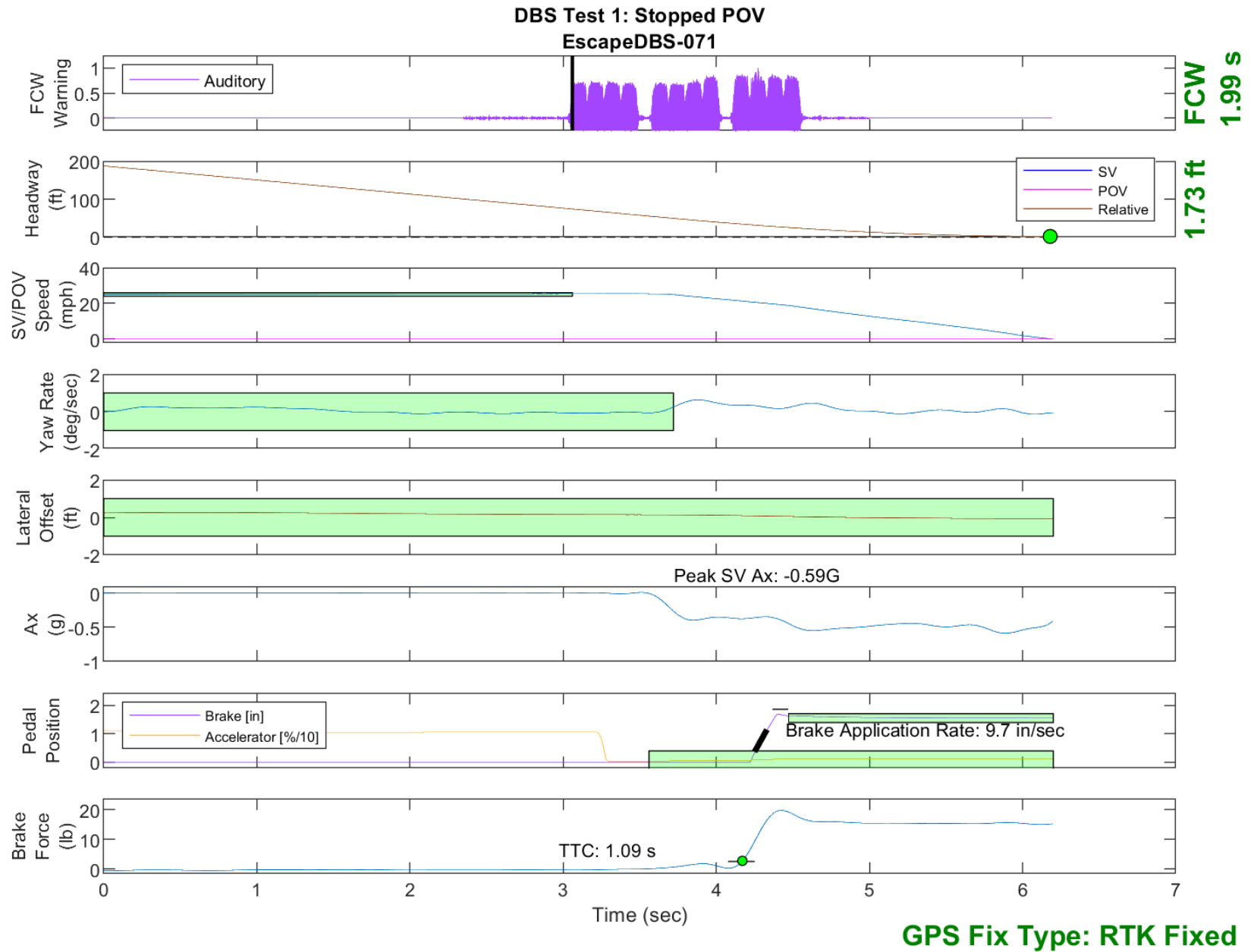


Figure E14. Time History for DBS Run 71, Test 1 - Stopped POV

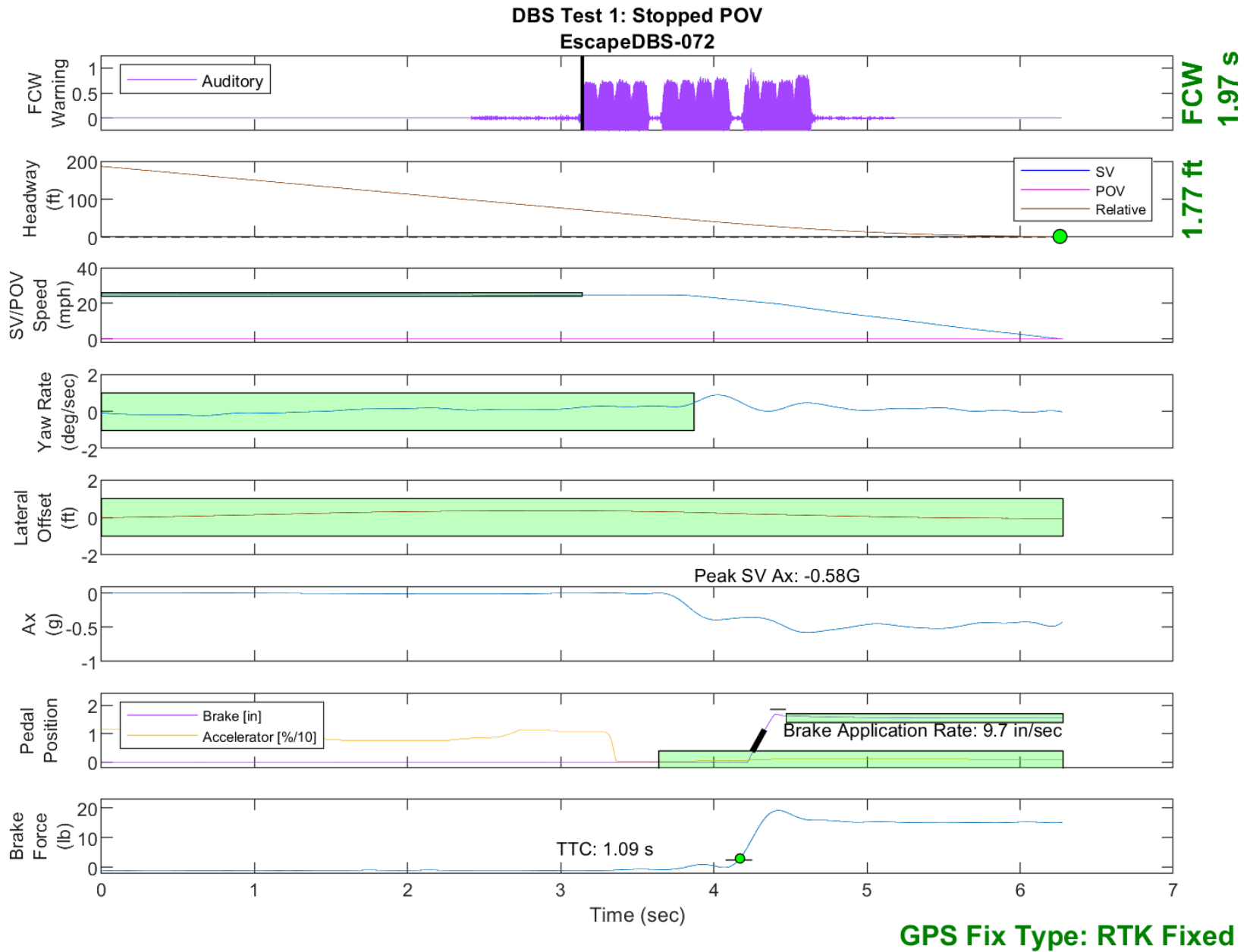


Figure E15. Time History for DBS Run 72, Test 1 - Stopped POV

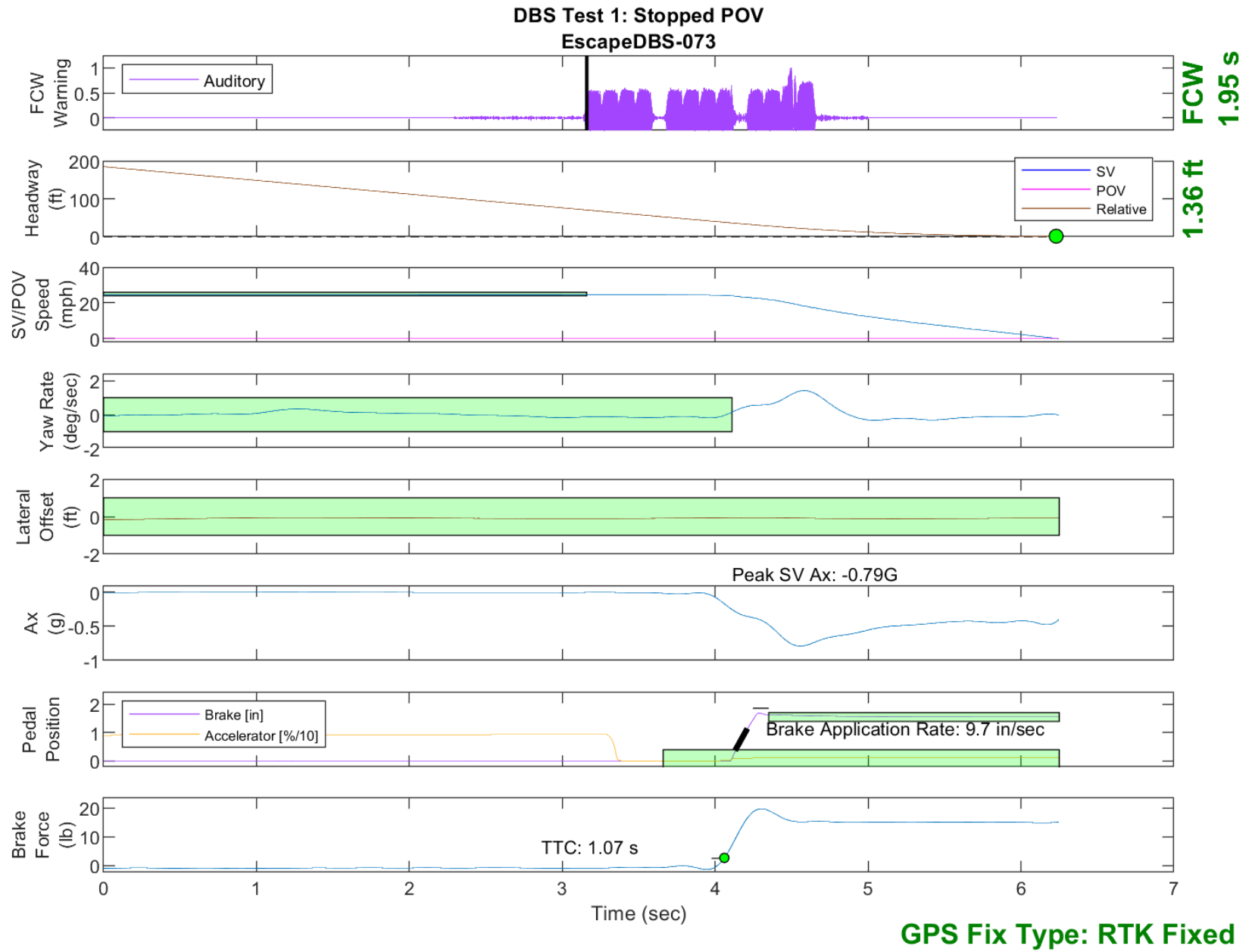


Figure E16. Time History for DBS Run 73, Test 1 - Stopped POV



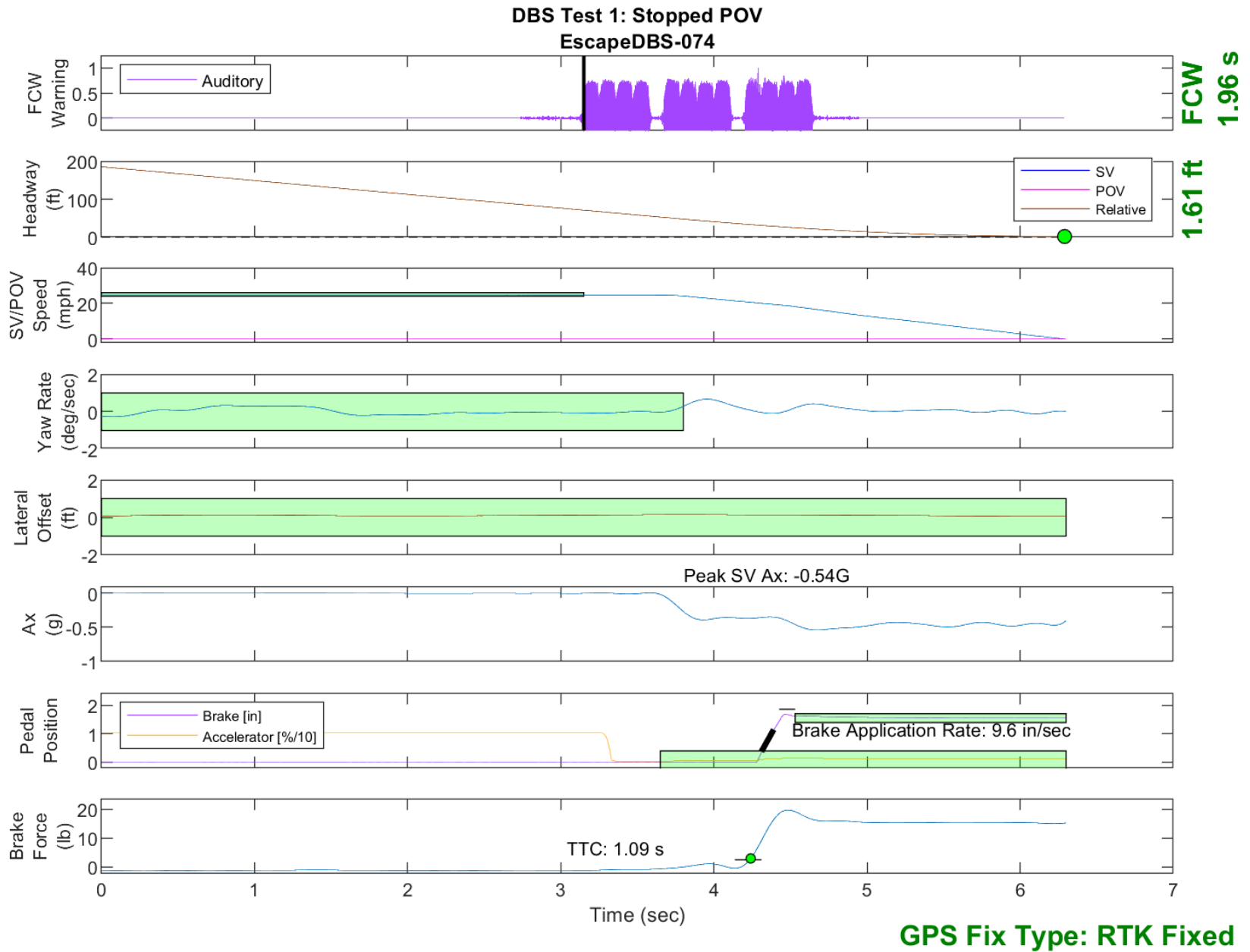


Figure E17. Time History for DBS Run 74, Test 1 - Stopped POV

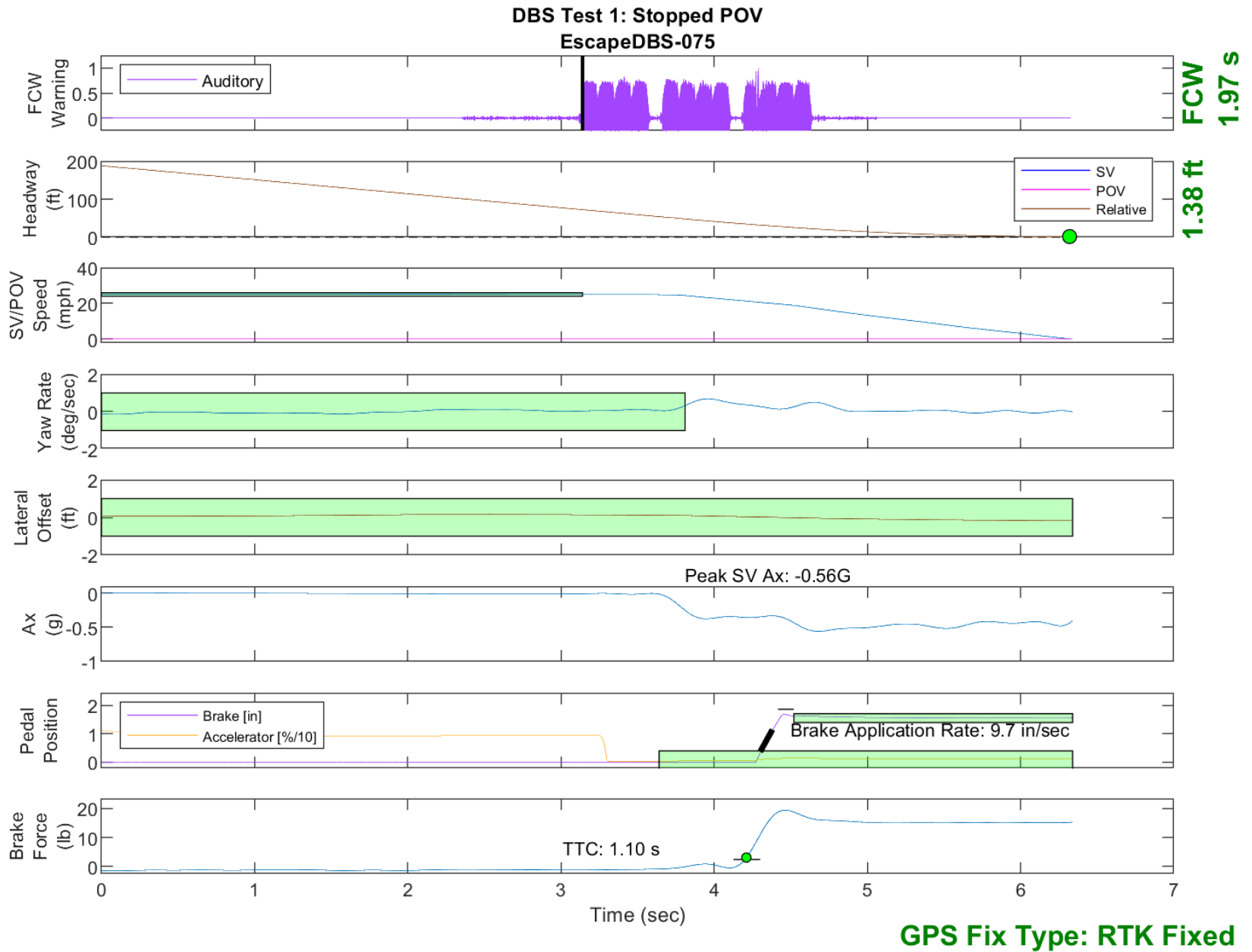


Figure E18. Time History for DBS Run 75, Test 1 - Stopped POV

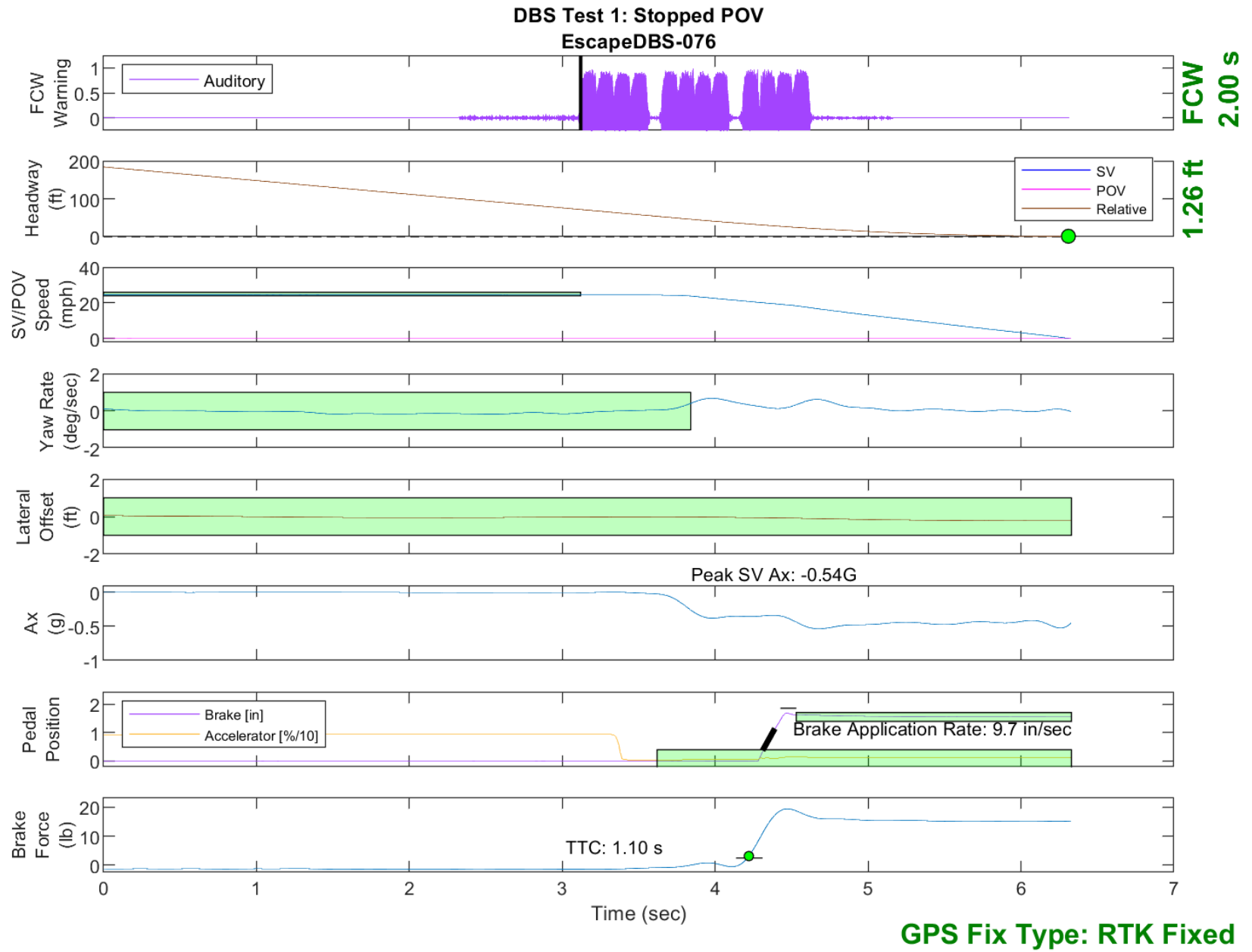


Figure E19. Time History for DBS Run 76, Test 1 - Stopped POV

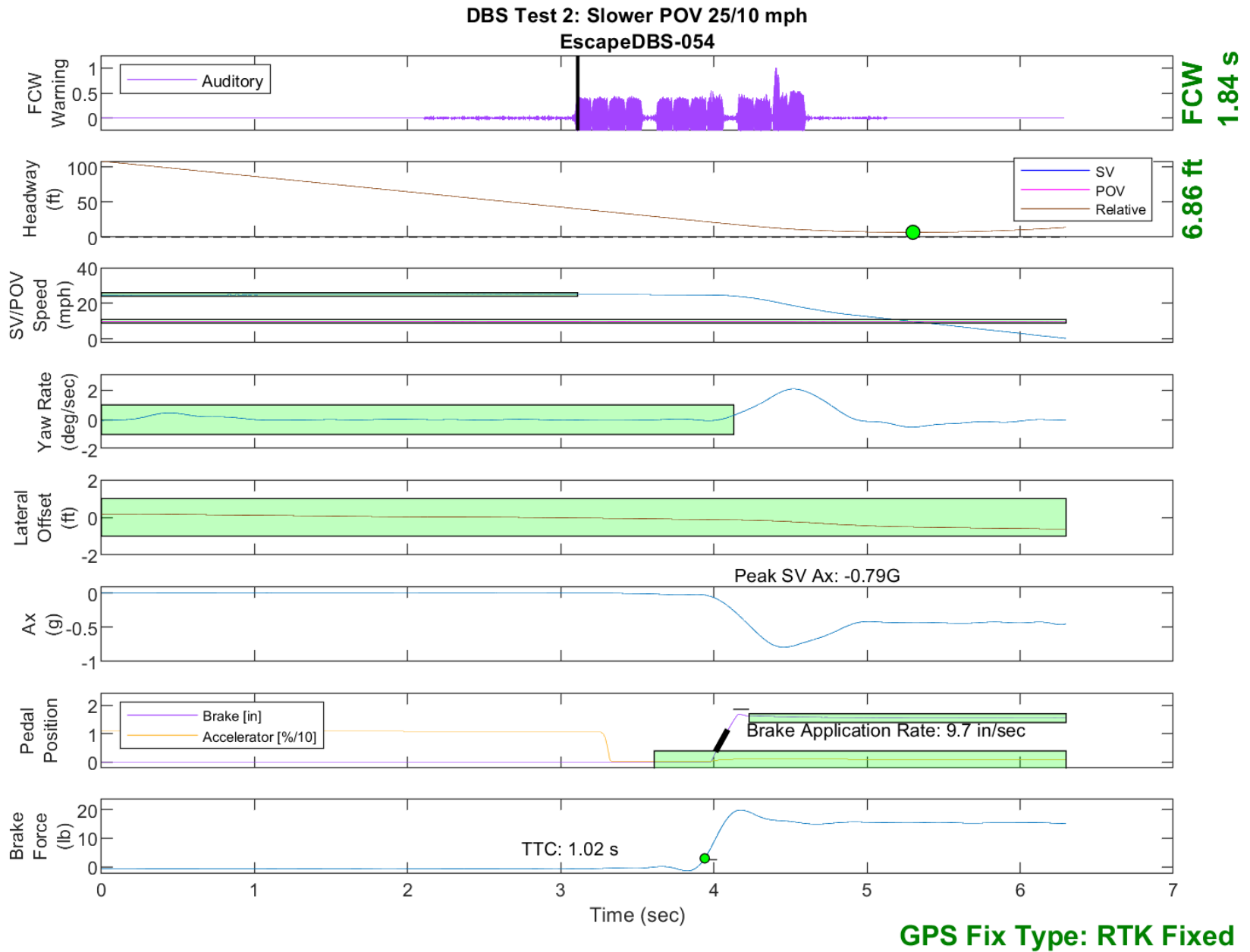


Figure E20. Time History for DBS Run 54, Test 2 - Slower Moving POV 25/10 mph

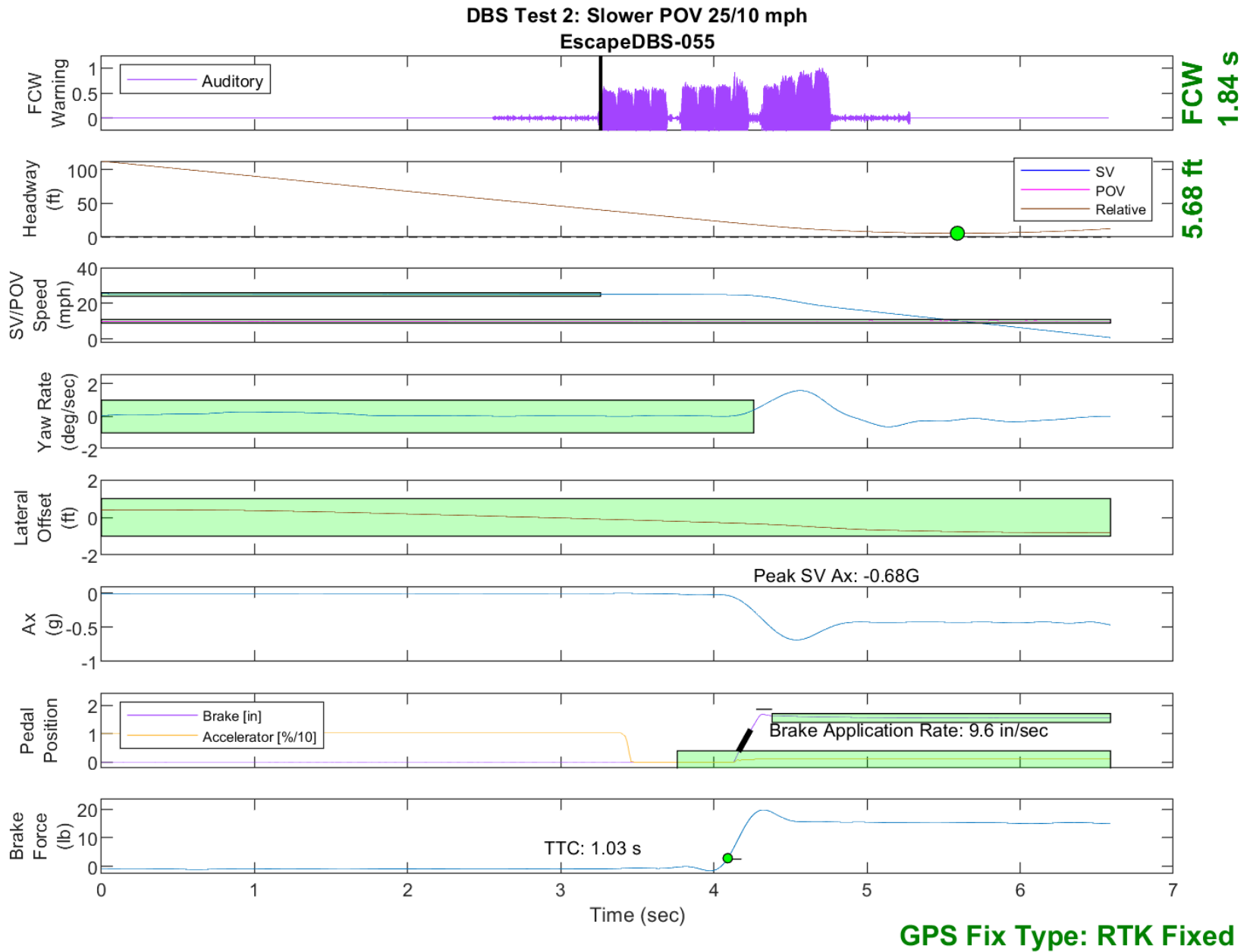


Figure E21. Time History for DBS Run 55, Test 2 - Slower Moving POV 25/10 mph

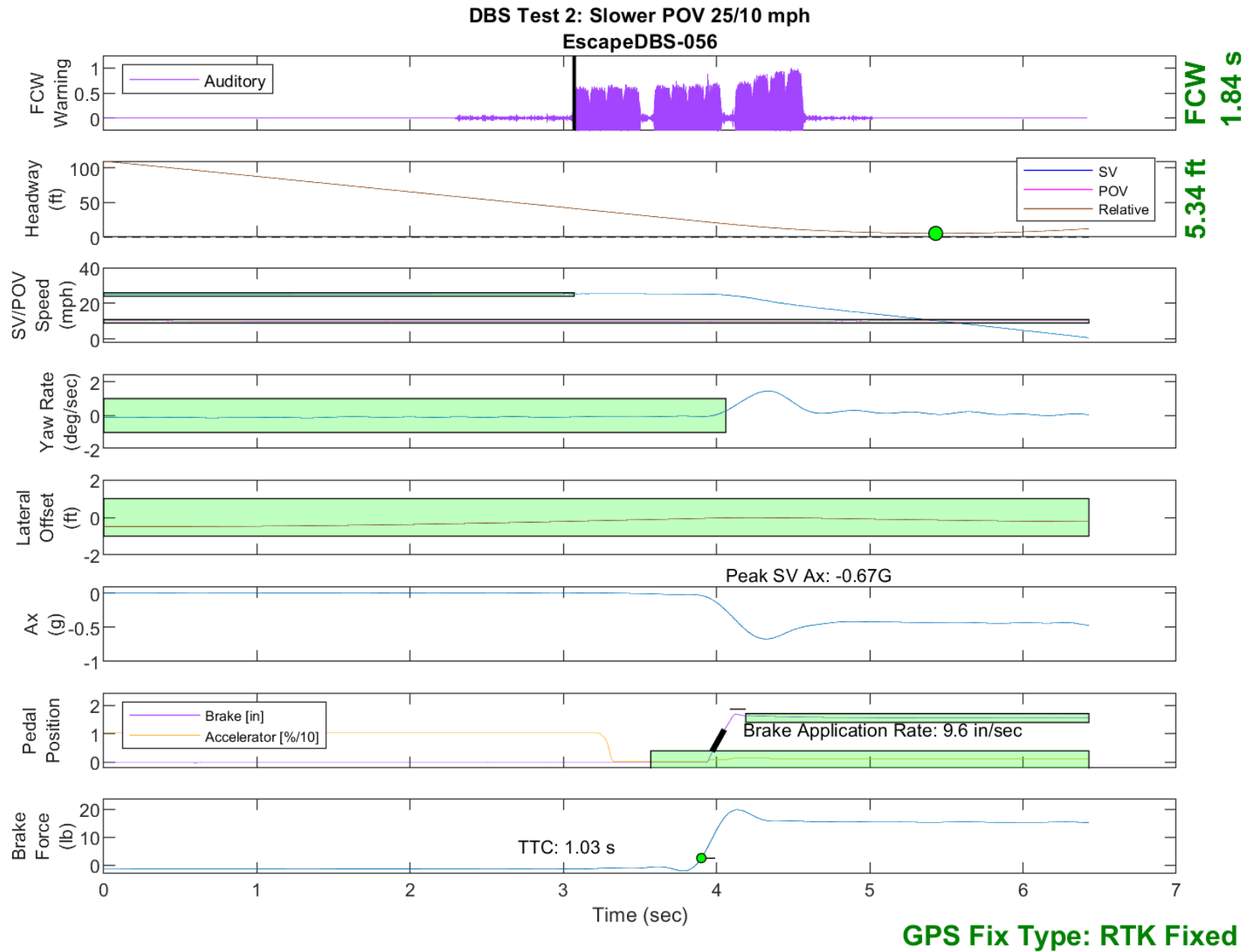


Figure E22. Time History for DBS Run 56, Test 2 - Slower Moving POV 25/10 mph

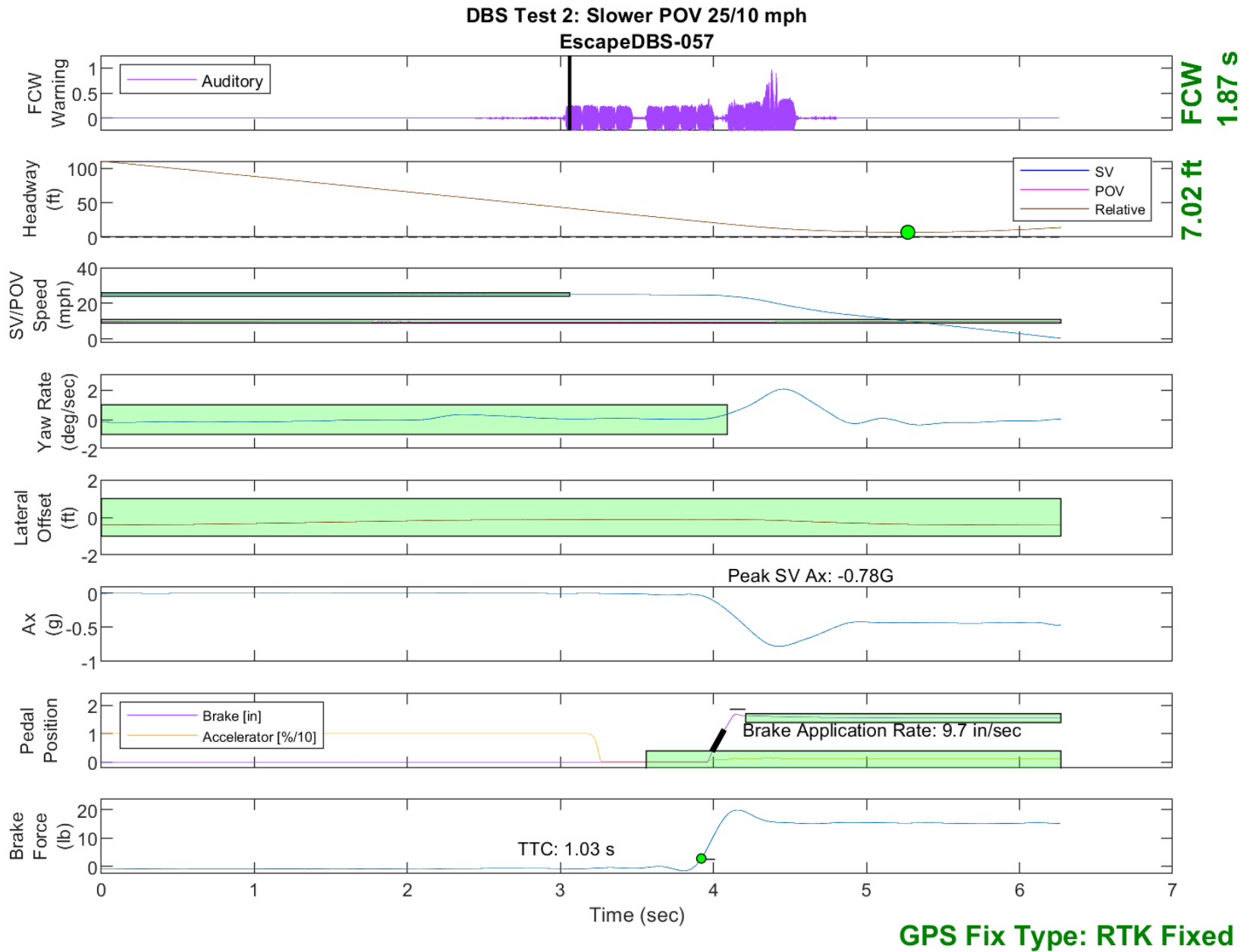


Figure E23. Time History for DBS Run 57, Test 2 - Slower Moving POV 25/10 mph

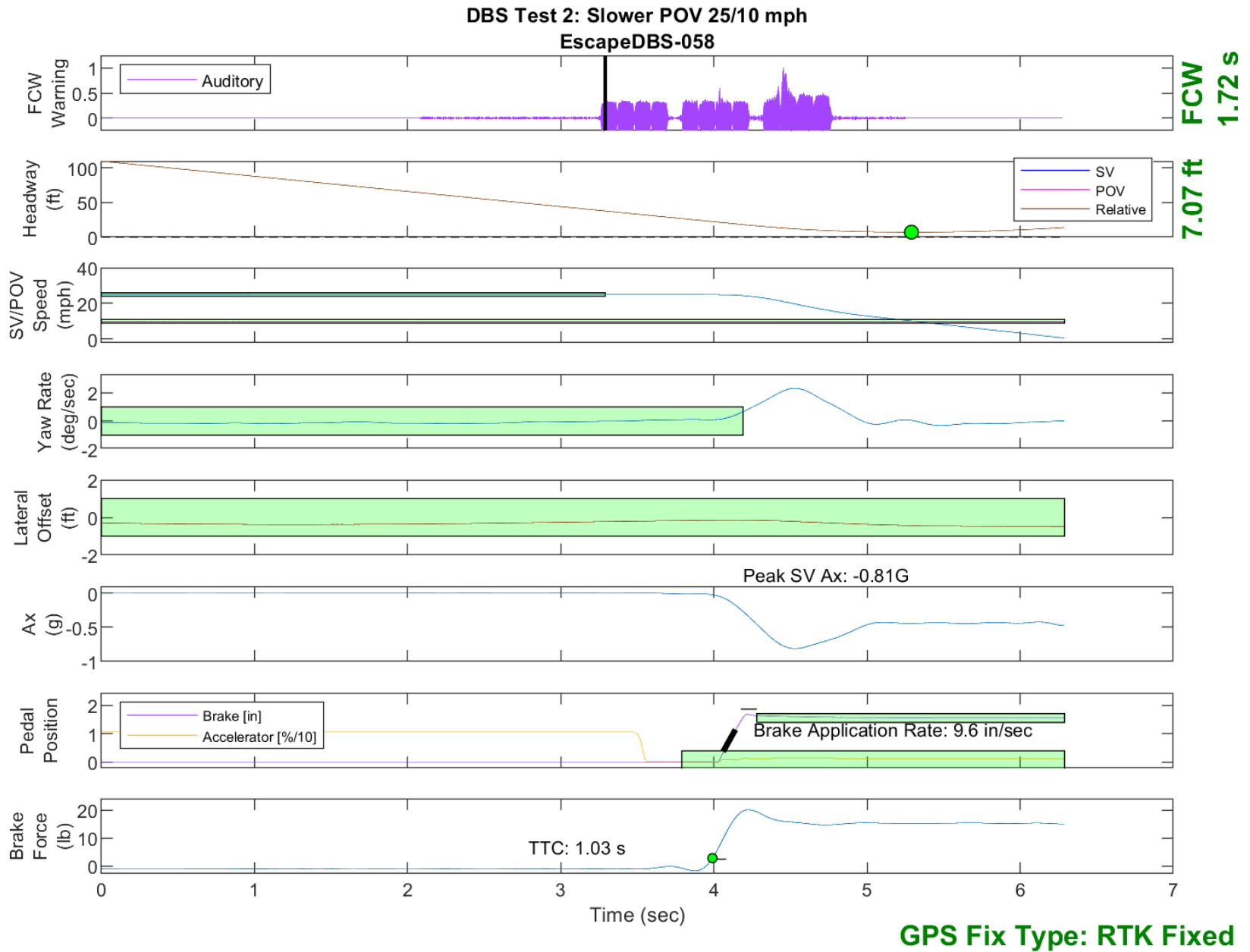


Figure E24. Time History for DBS Run 58, Test 2 - Slower Moving POV 25/10 mph



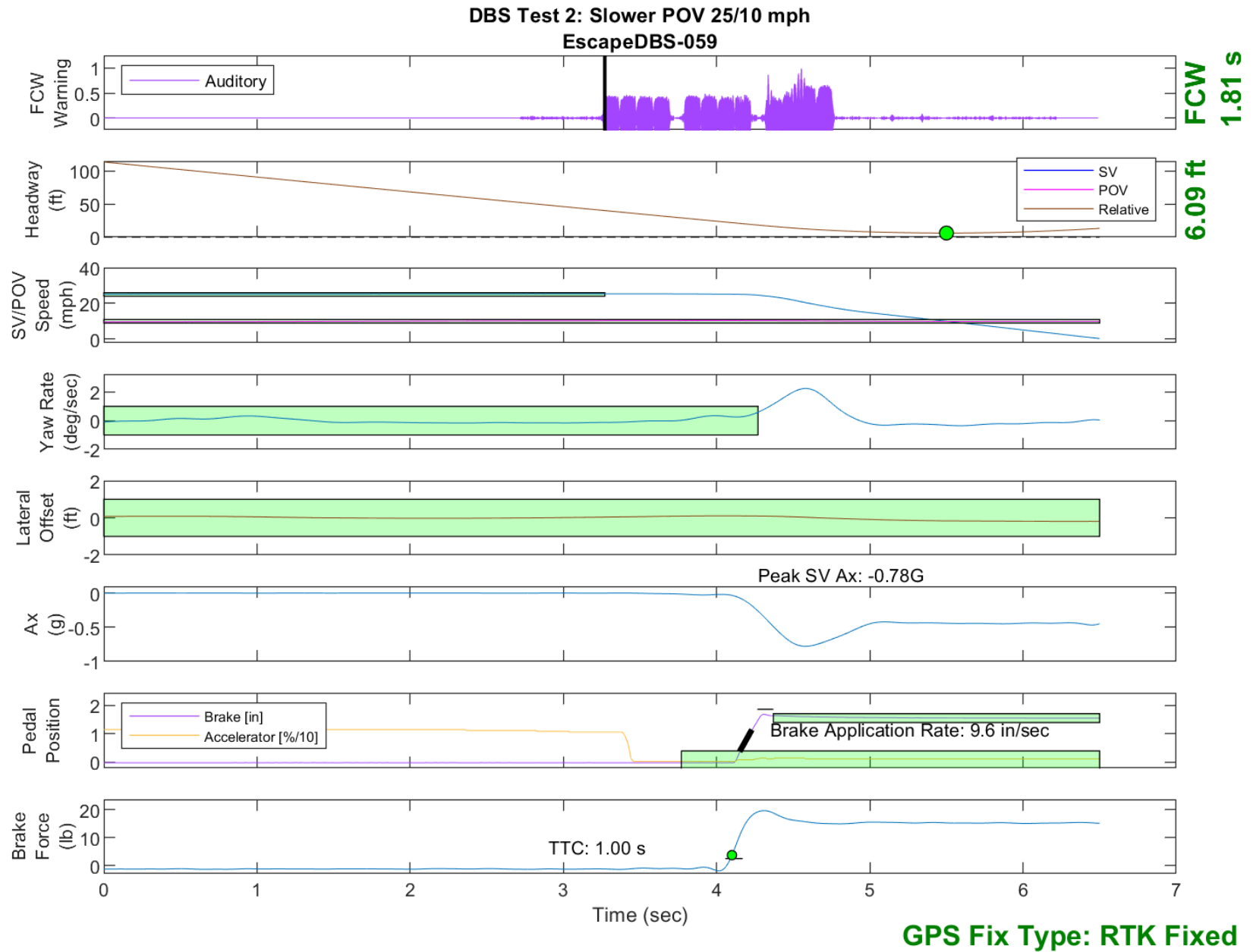


Figure E25. Time History for DBS Run 59, Test 2 - Slower Moving POV 25/10 mph

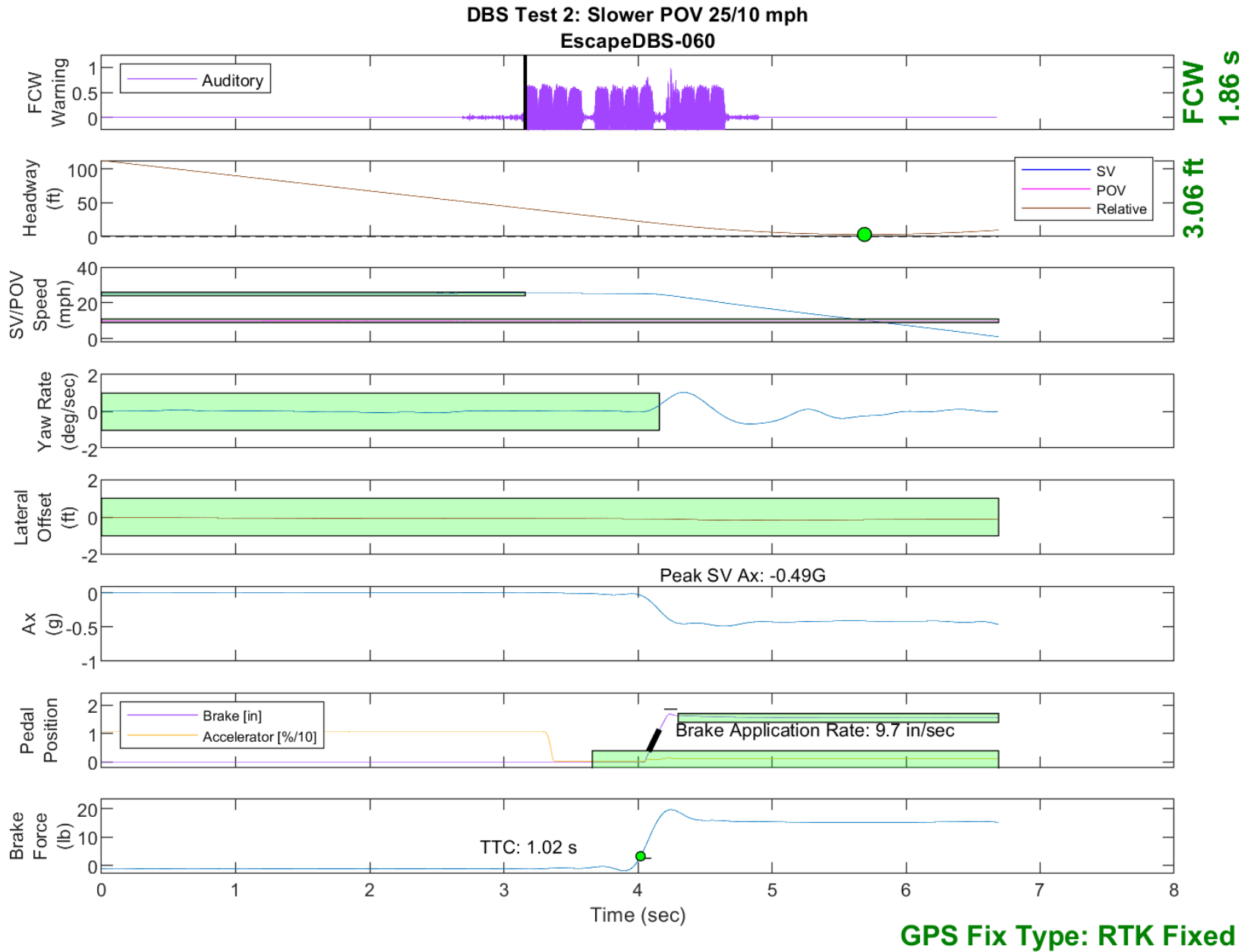


Figure E26. Time History for DBS Run 60, Test 2 - Slower Moving POV 25/10 mph

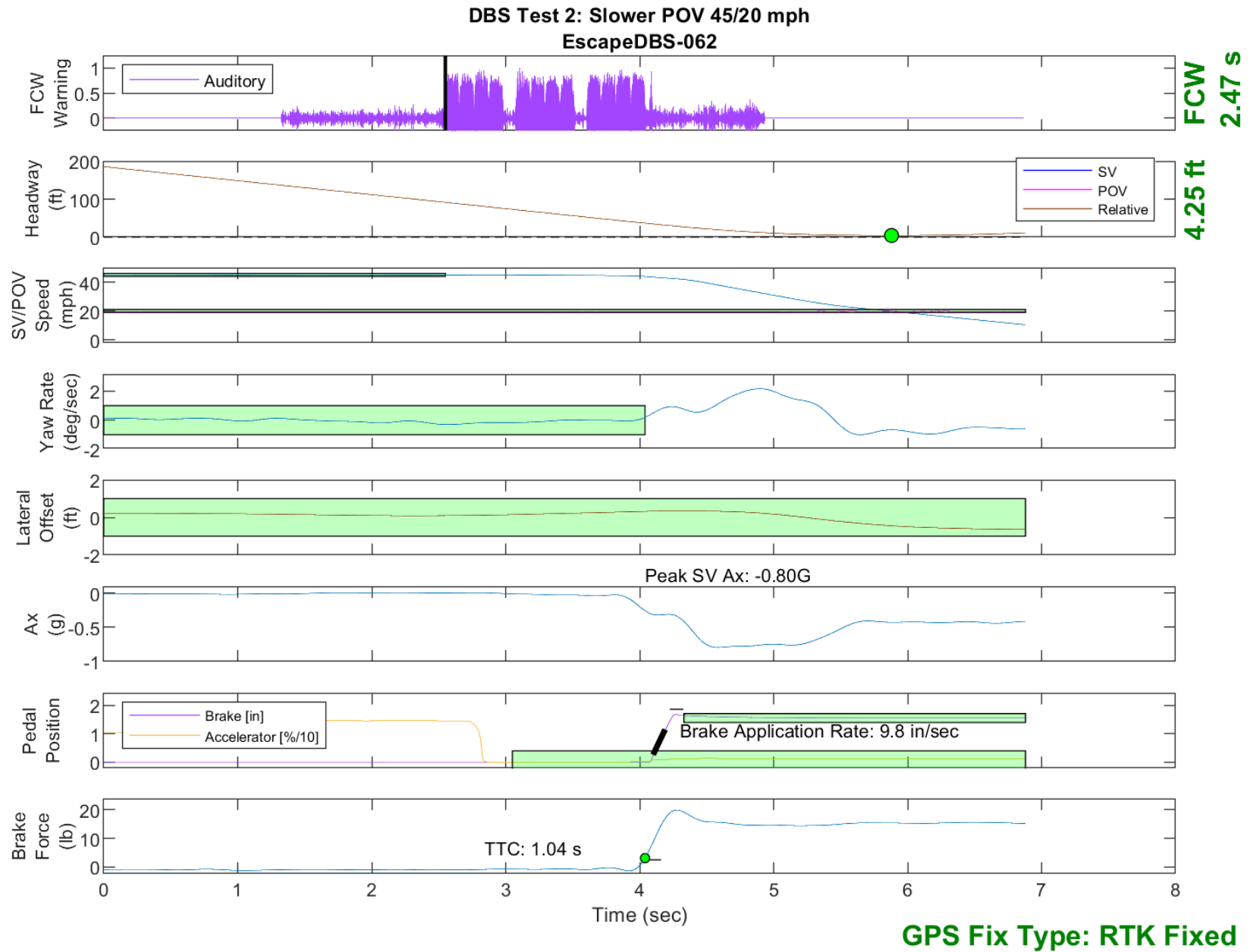


Figure E27. Time History for DBS Run 62, Test 2 - Slower Moving POV 45/20 mph

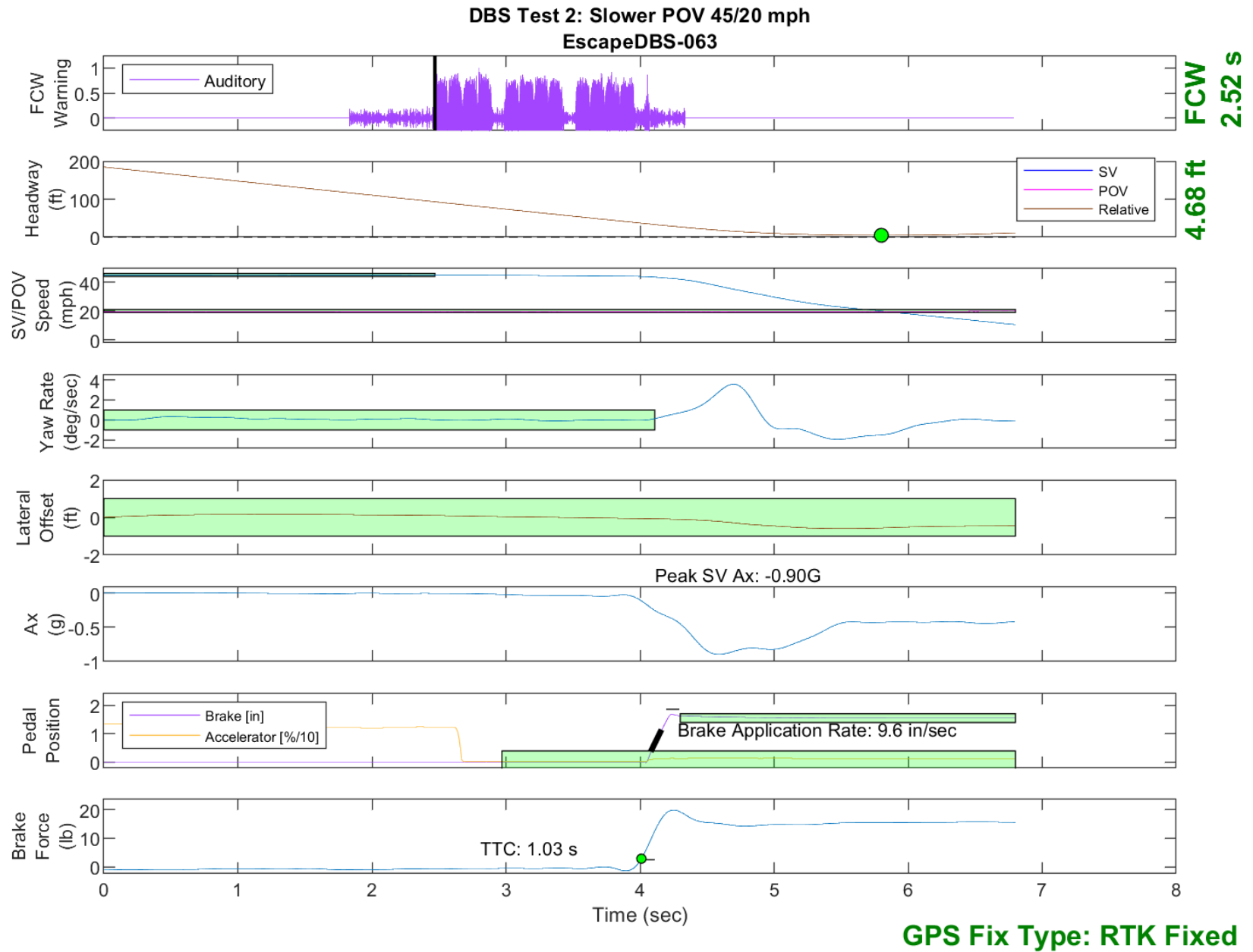


Figure E28. Time History for DBS Run 63, Test 2 - Slower Moving POV 45/20 mph

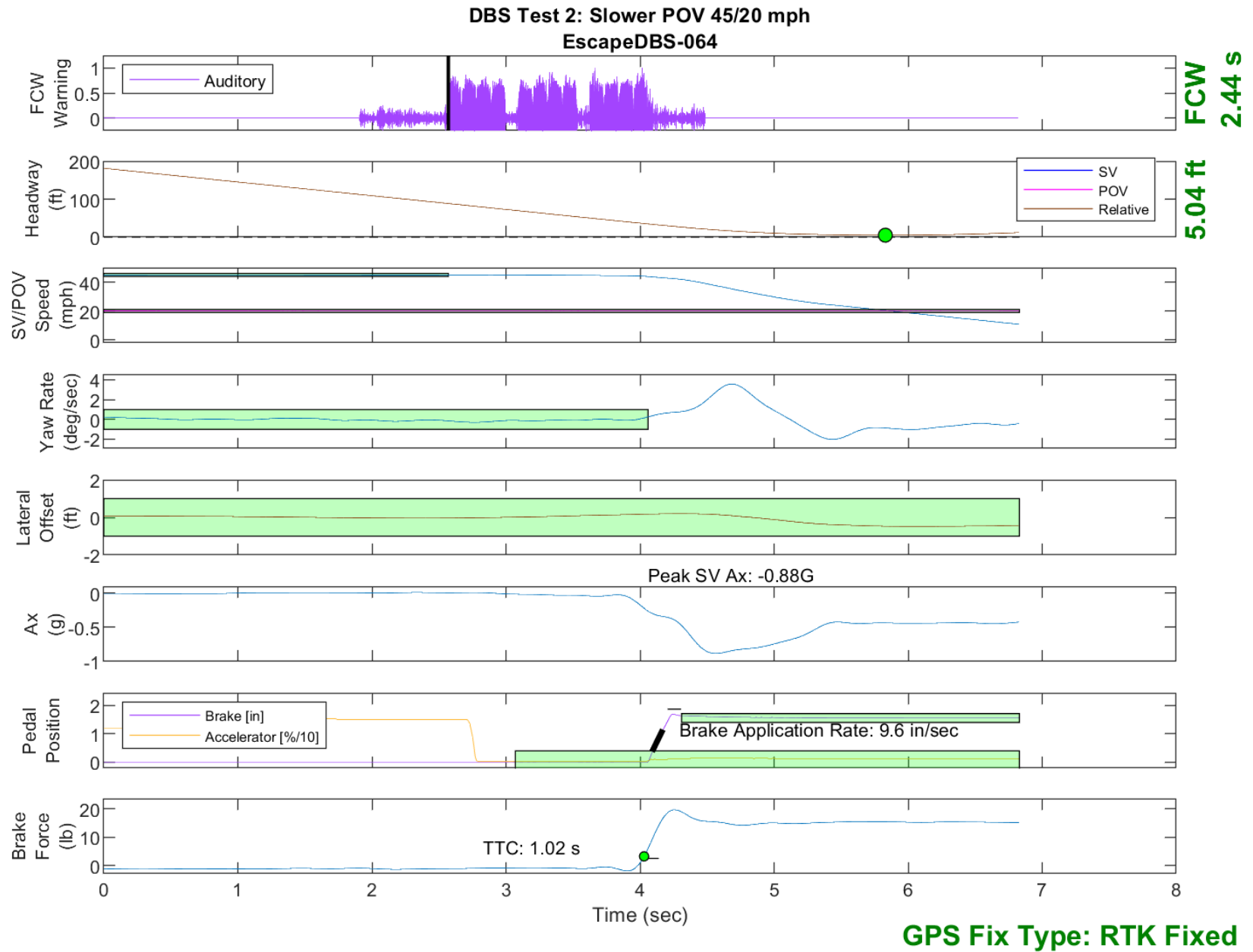


Figure E29. Time History for DBS Run 64, Test 2 - Slower Moving POV 45/20 mph

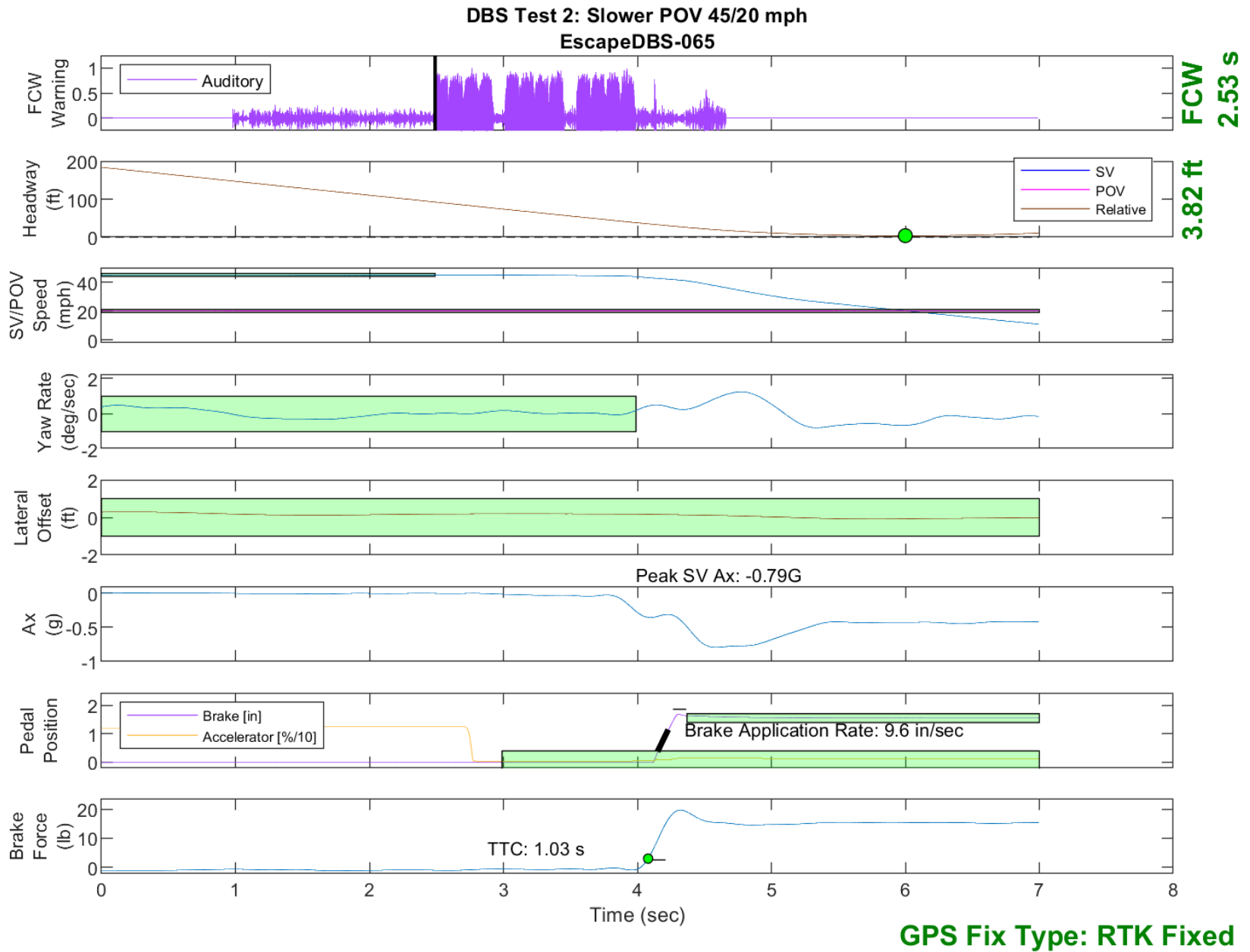


Figure E30. Time History for DBS Run 65, Test 2 - Slower Moving POV 45/20 mph

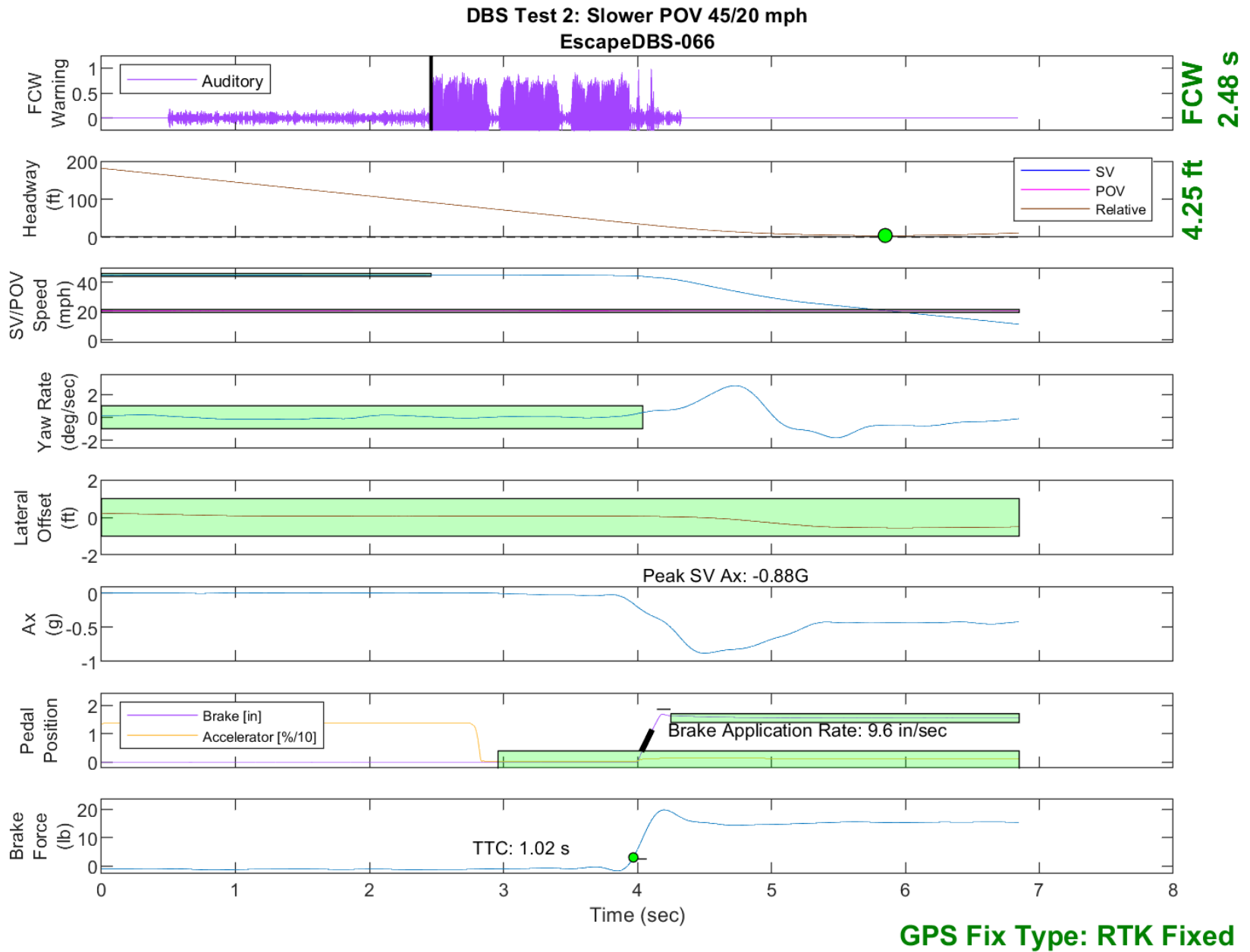


Figure E31. Time History for DBS Run 66, Test 2 - Slower Moving POV 45/20 mph

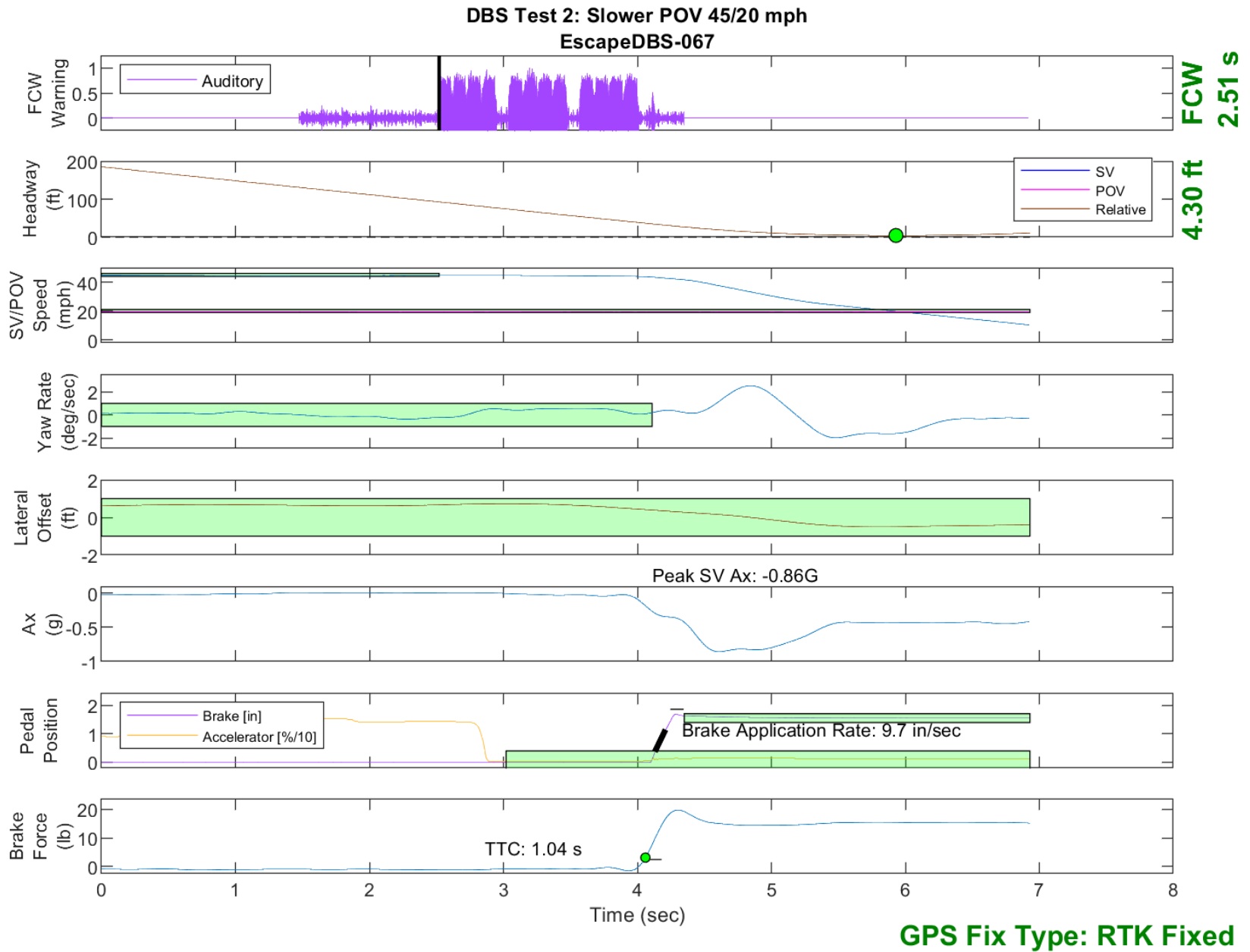


Figure E32. Time History for DBS Run 67, Test 2 - Slower Moving POV 45/20 mph



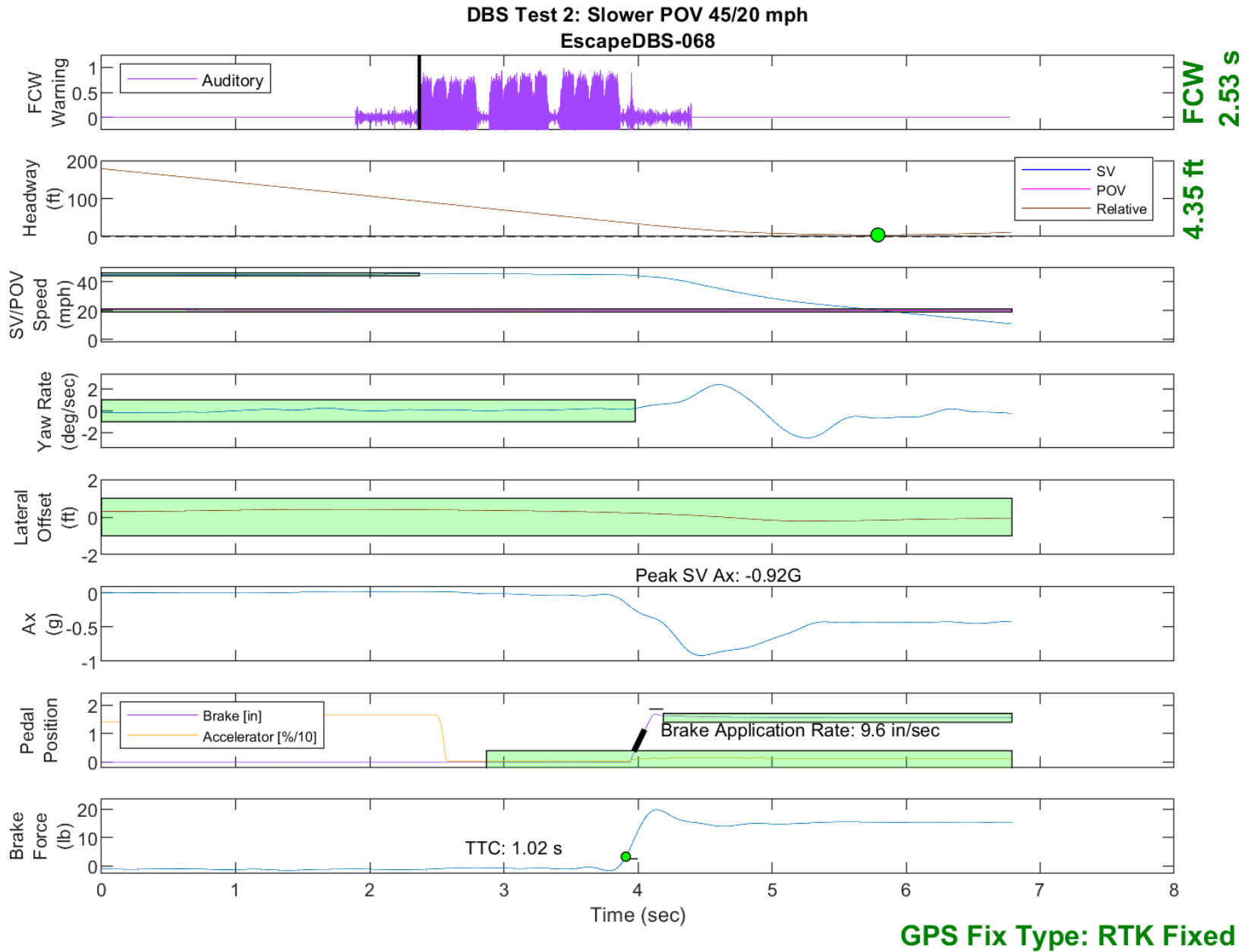


Figure E33. Time History for DBS Run 68, Test 2 - Slower Moving POV 45/20 mph

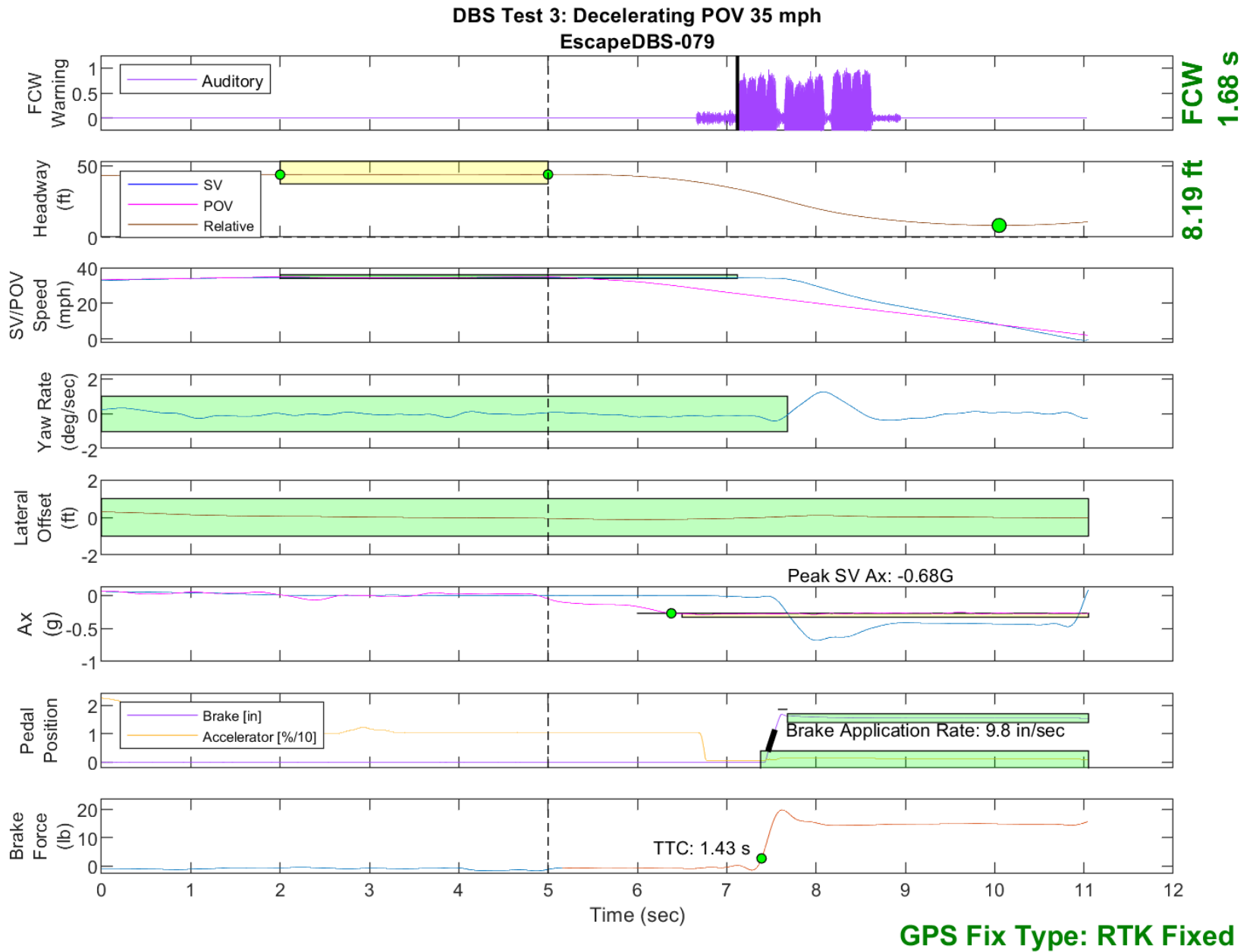


Figure E34. Time History for DBS Run 79, Test 3 - Decelerating POV 35 mph

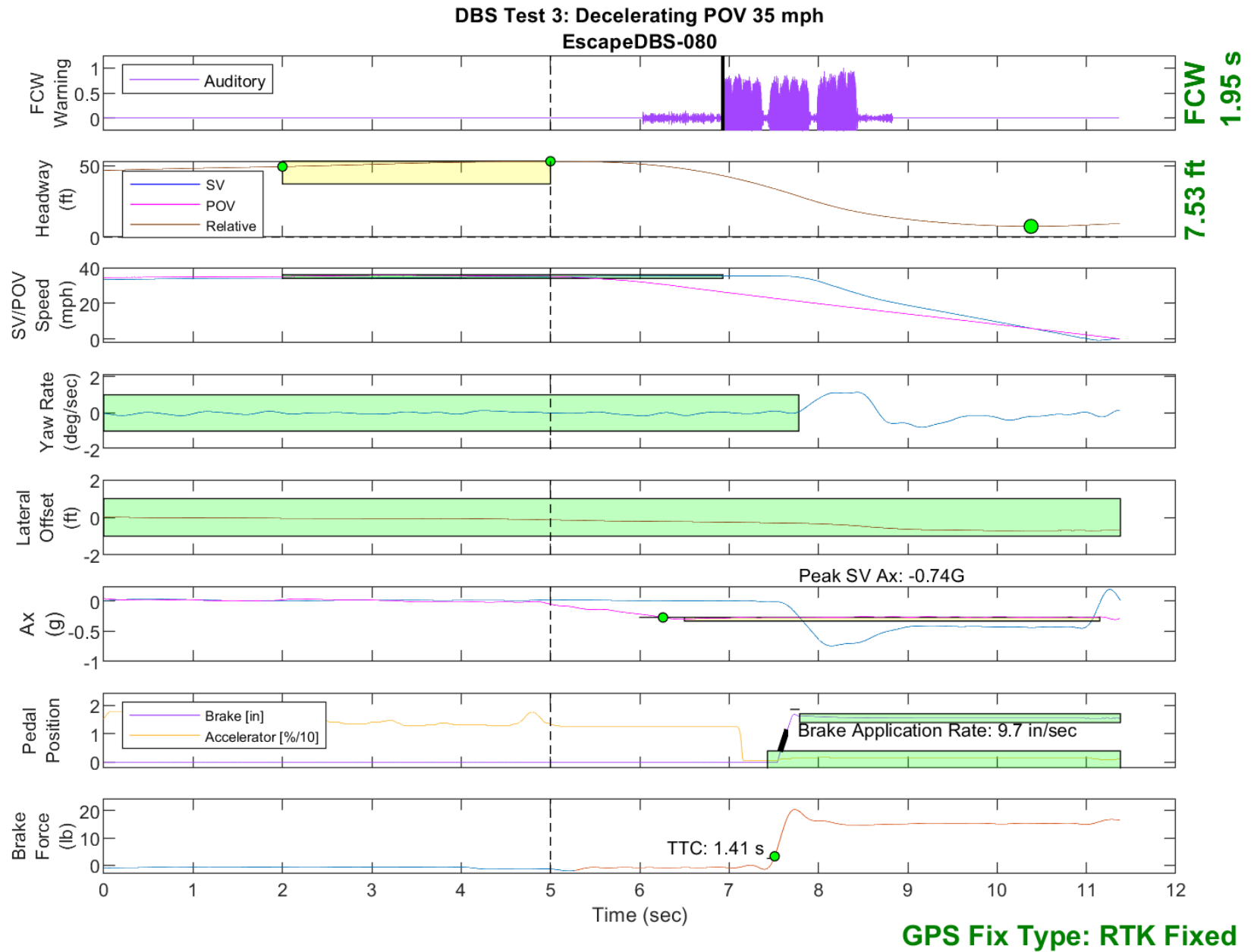


Figure E35. Time History for DBS Run 80, Test 3 - Decelerating POV 35 mph

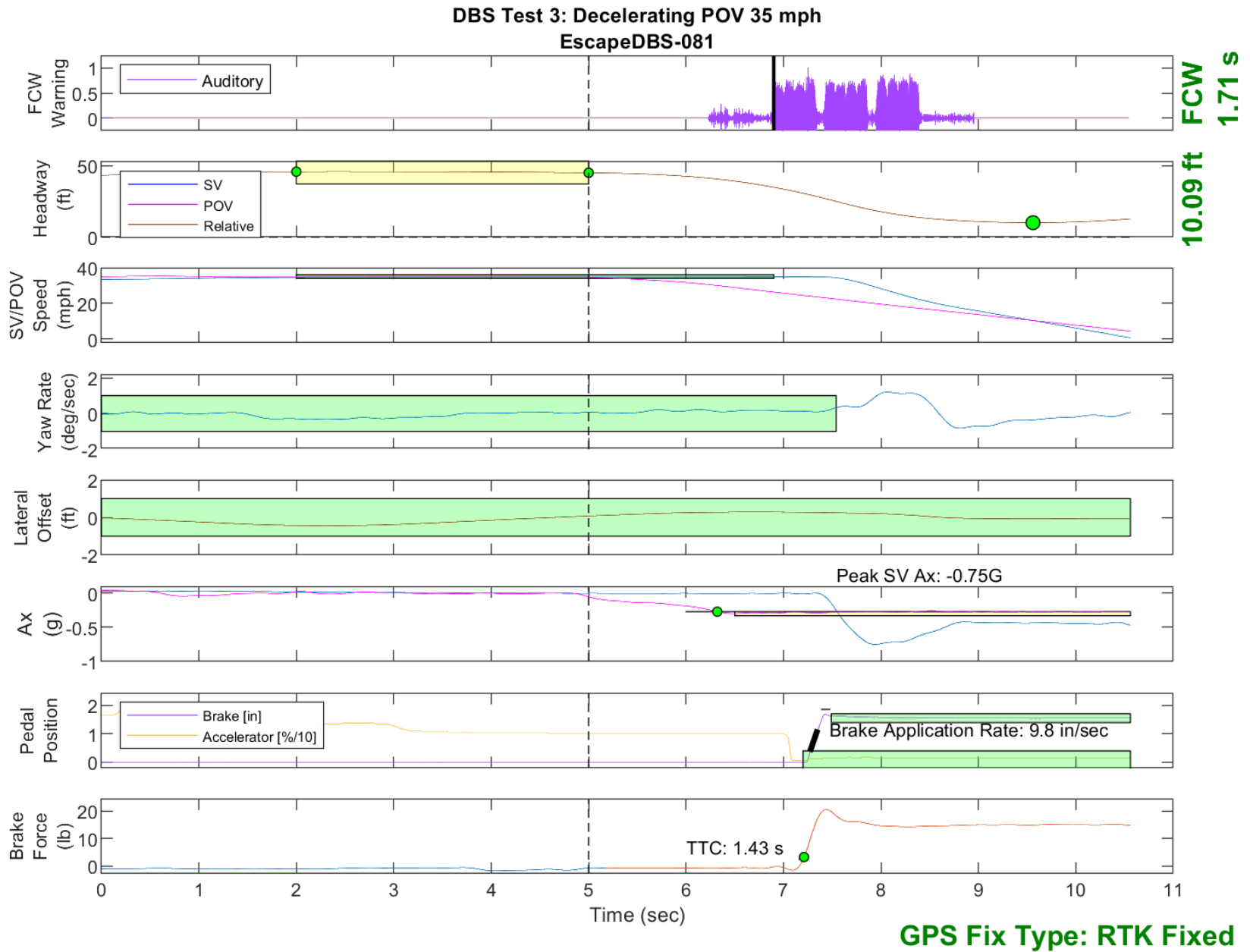


Figure E36. Time History for DBS Run 81, Test 3 - Decelerating POV 35 mph

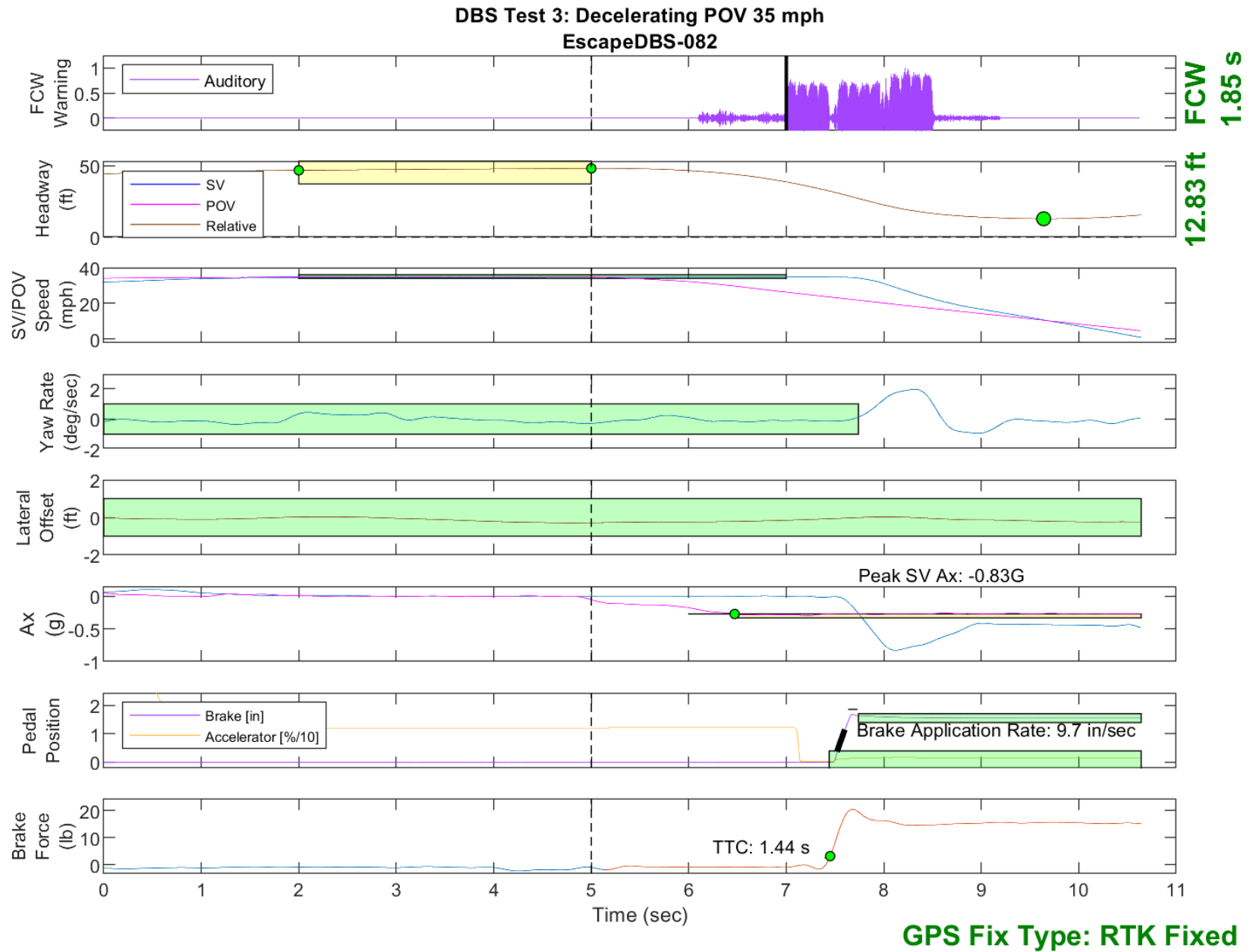


Figure E37. Time History for DBS Run 82, Test 3 - Decelerating POV 35 mph

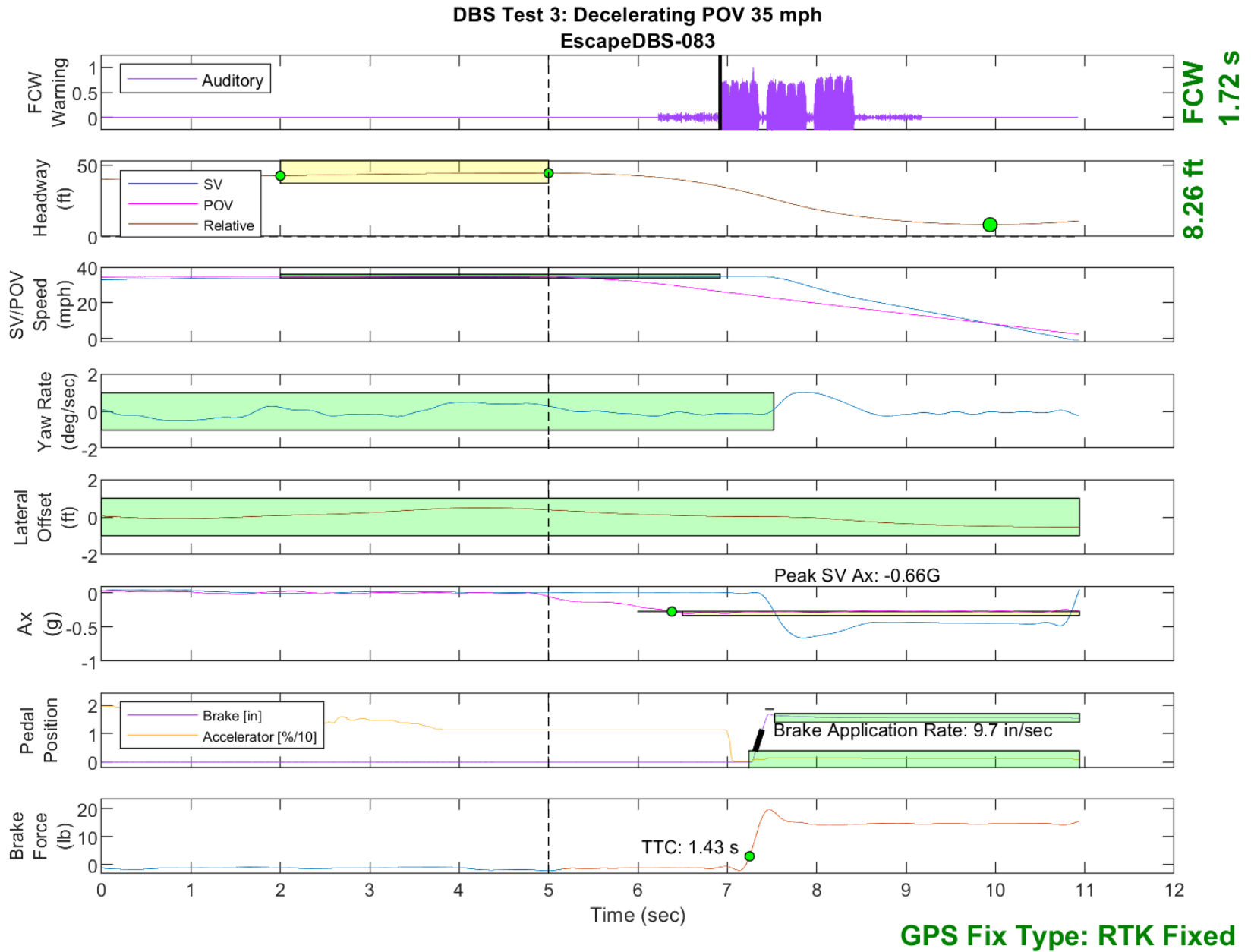


Figure E38. Time History for DBS Run 83, Test 3 - Decelerating POV 35 mph

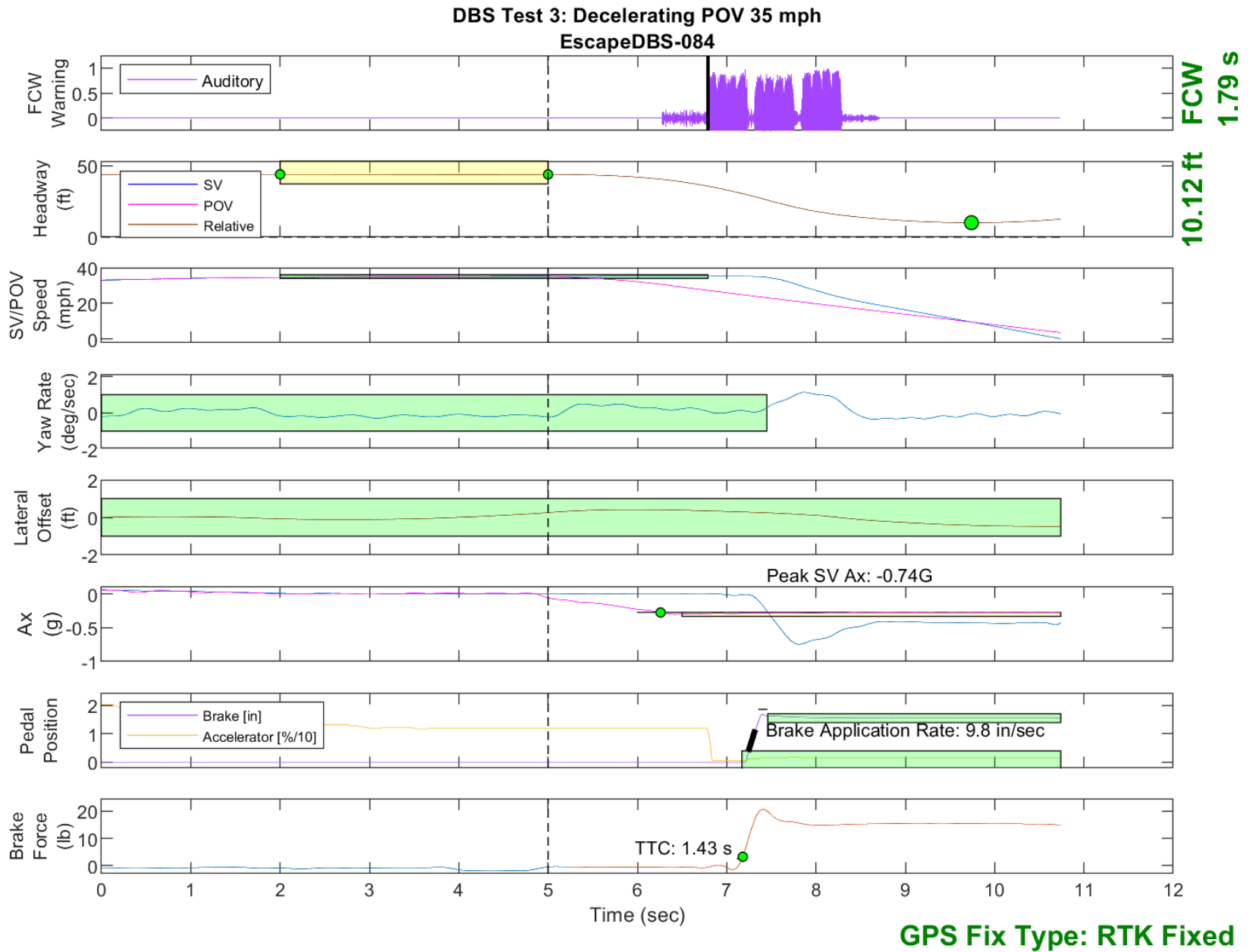


Figure E39. Time History for DBS Run 84, Test 3 - Decelerating POV 35 mph

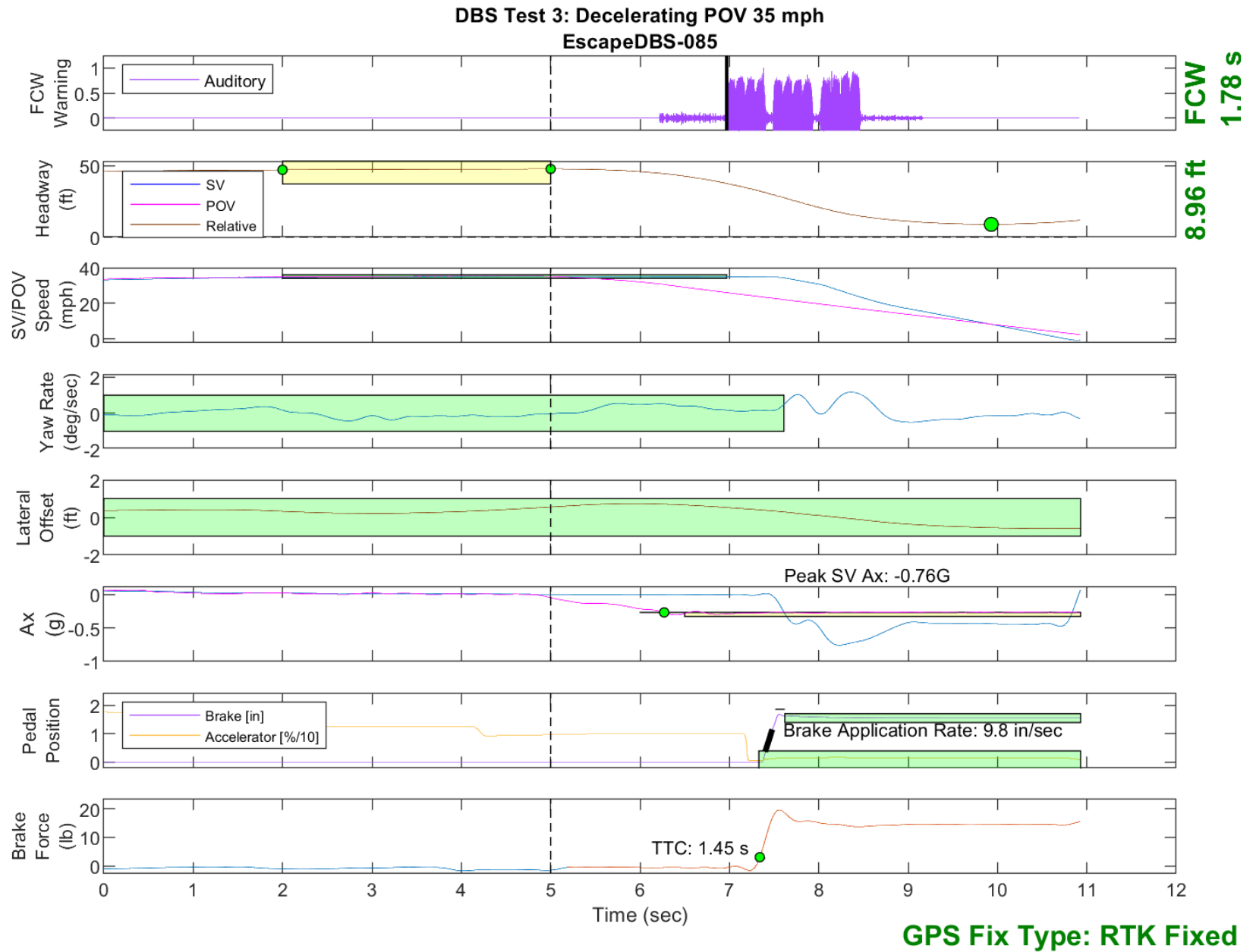


Figure E40. Time History for DBS Run 85, Test 3 - Decelerating POV 35 mph



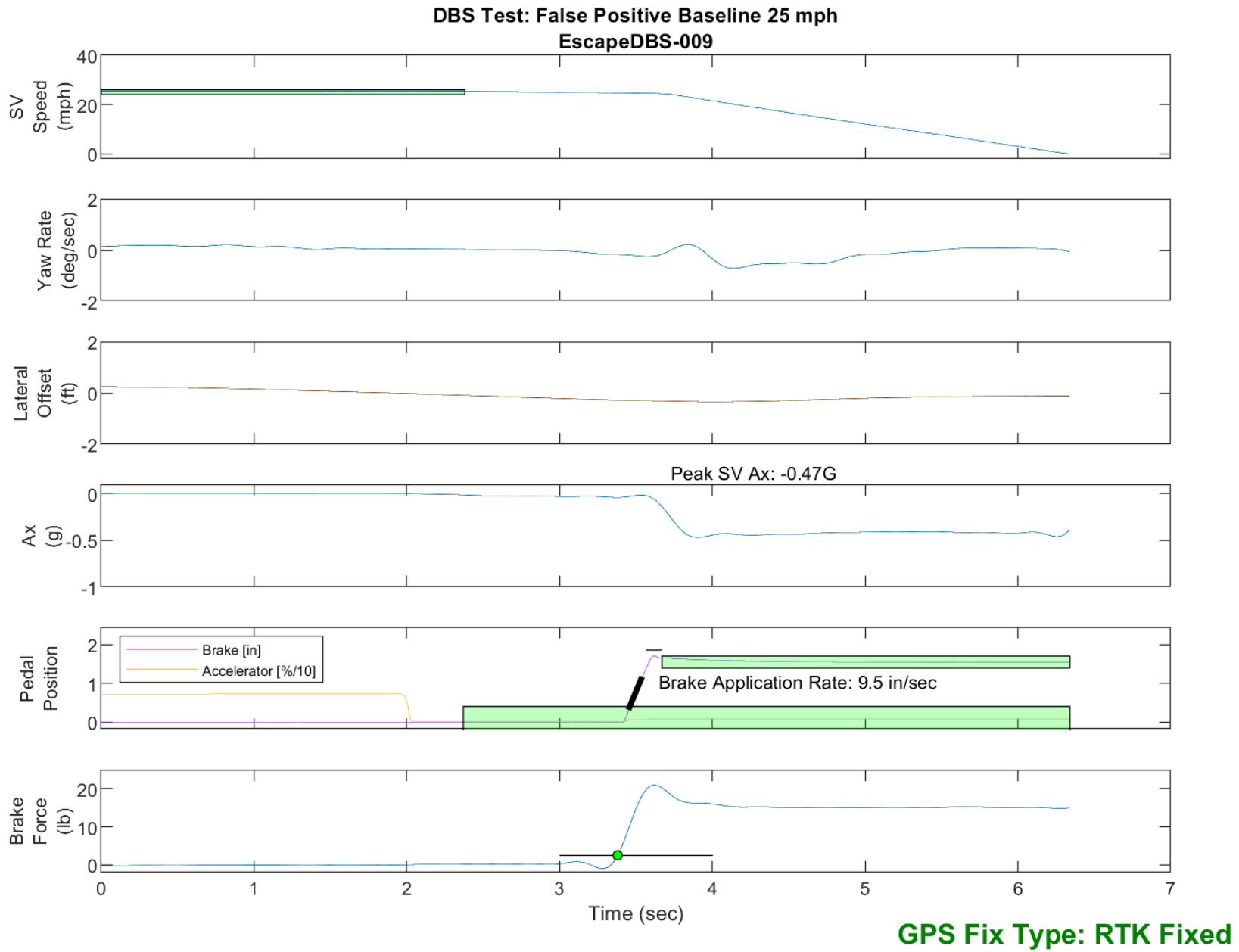


Figure E41. Time History for DBS Run 9, False Positive Baseline, SV 25 mph

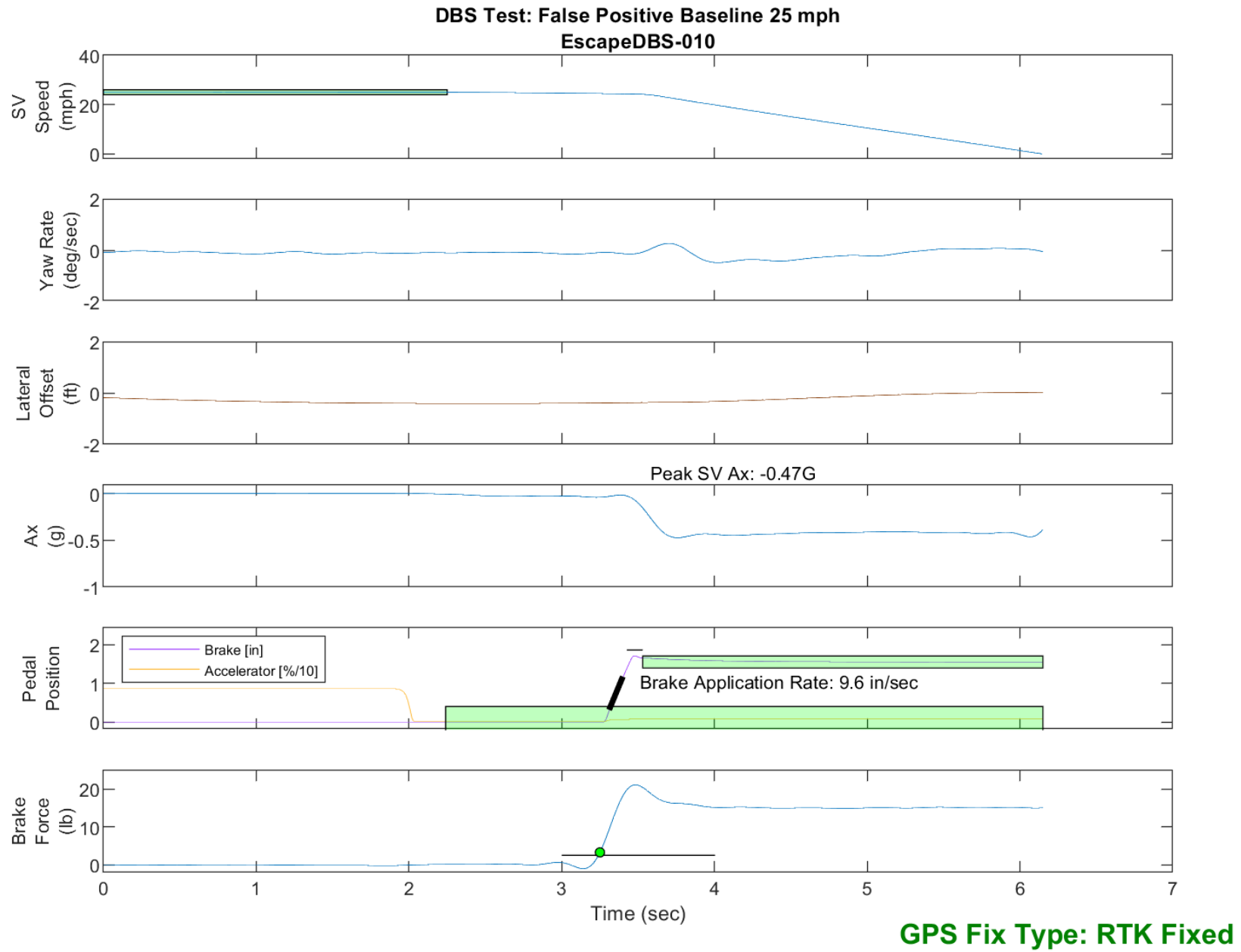


Figure E42. Time History for DBS Run 10, False Positive Baseline, SV 25 mph

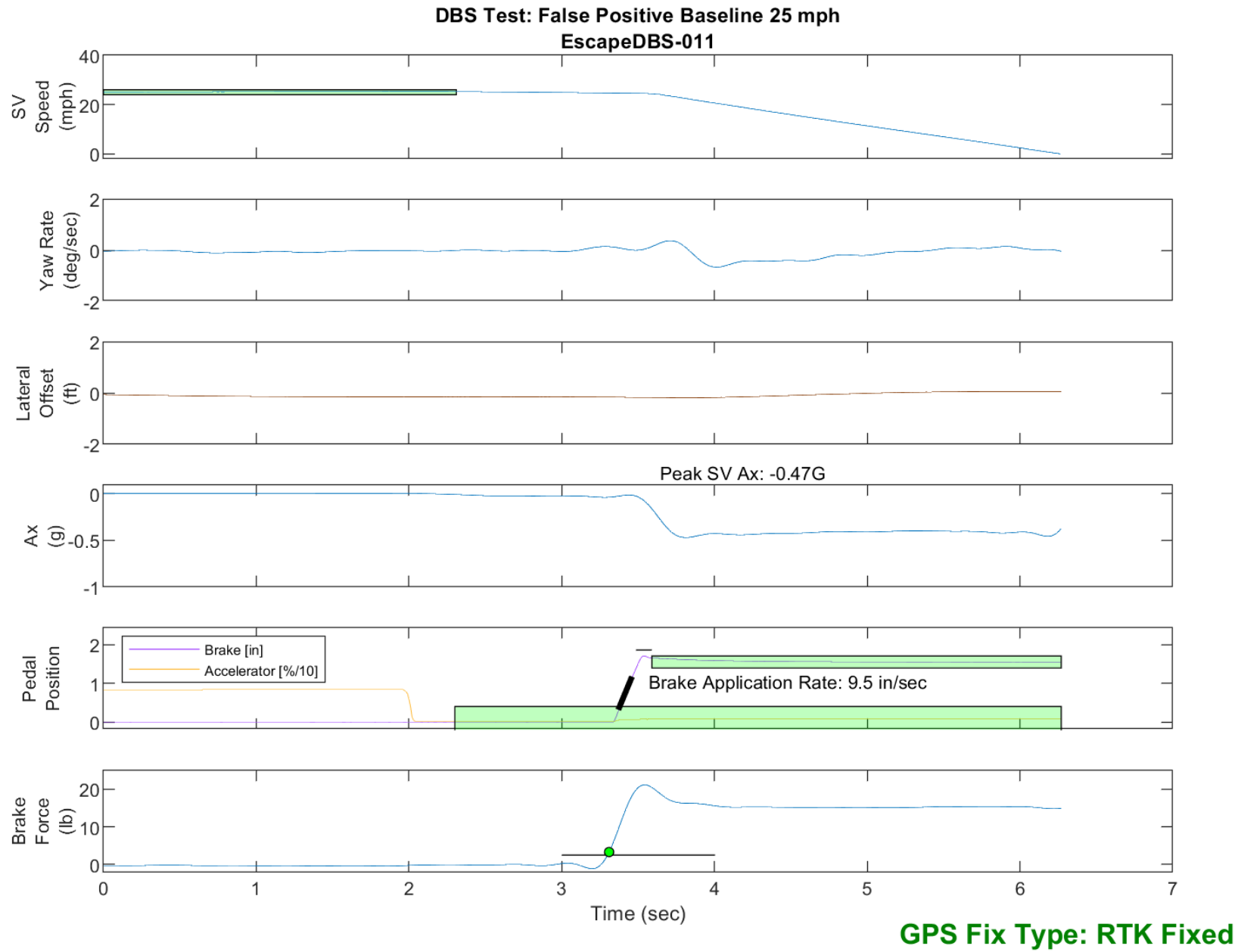


Figure E43. Time History for DBS Run 11, False Positive Baseline, SV 25 mph

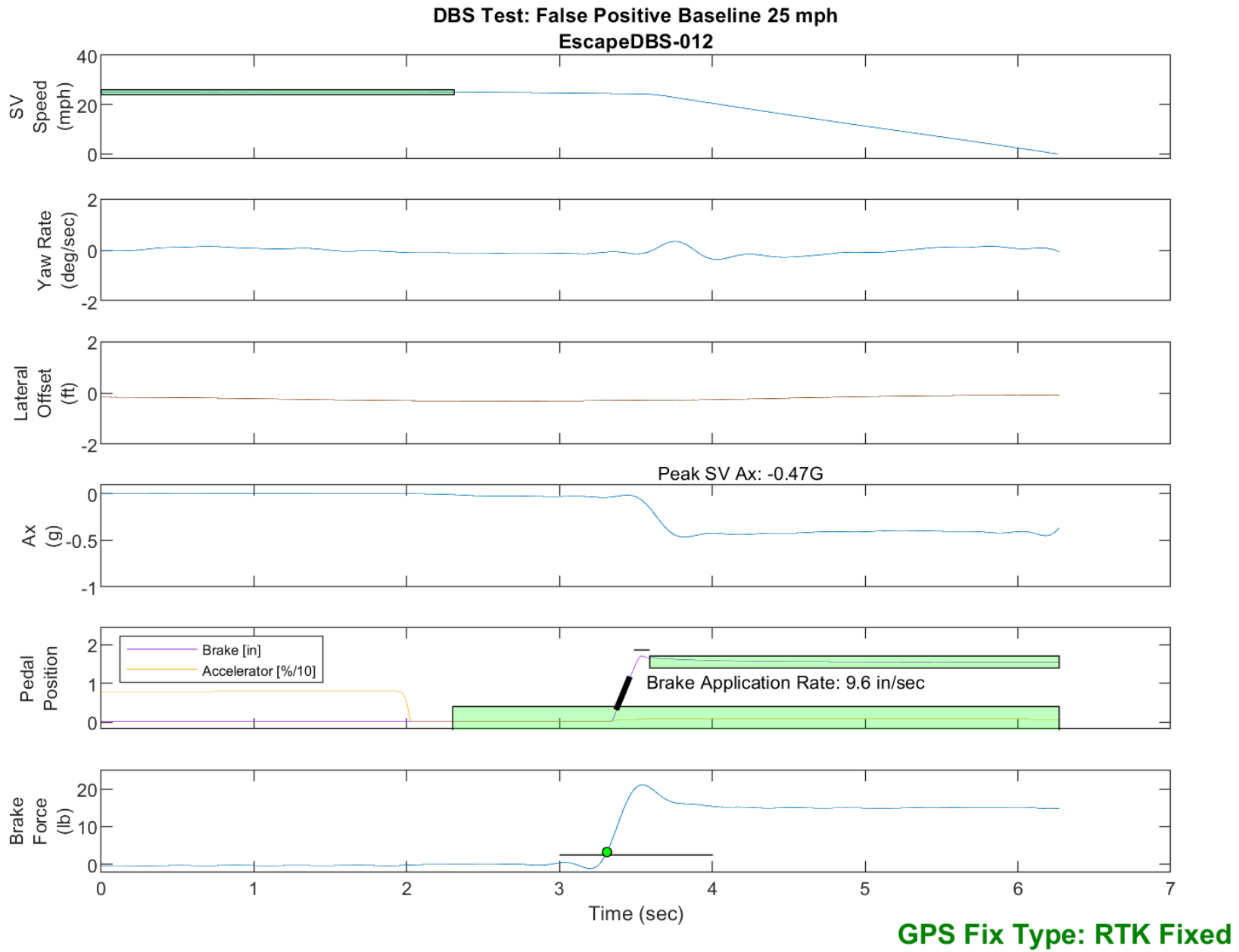


Figure E44. Time History for DBS Run 12, False Positive Baseline, SV 25 mph

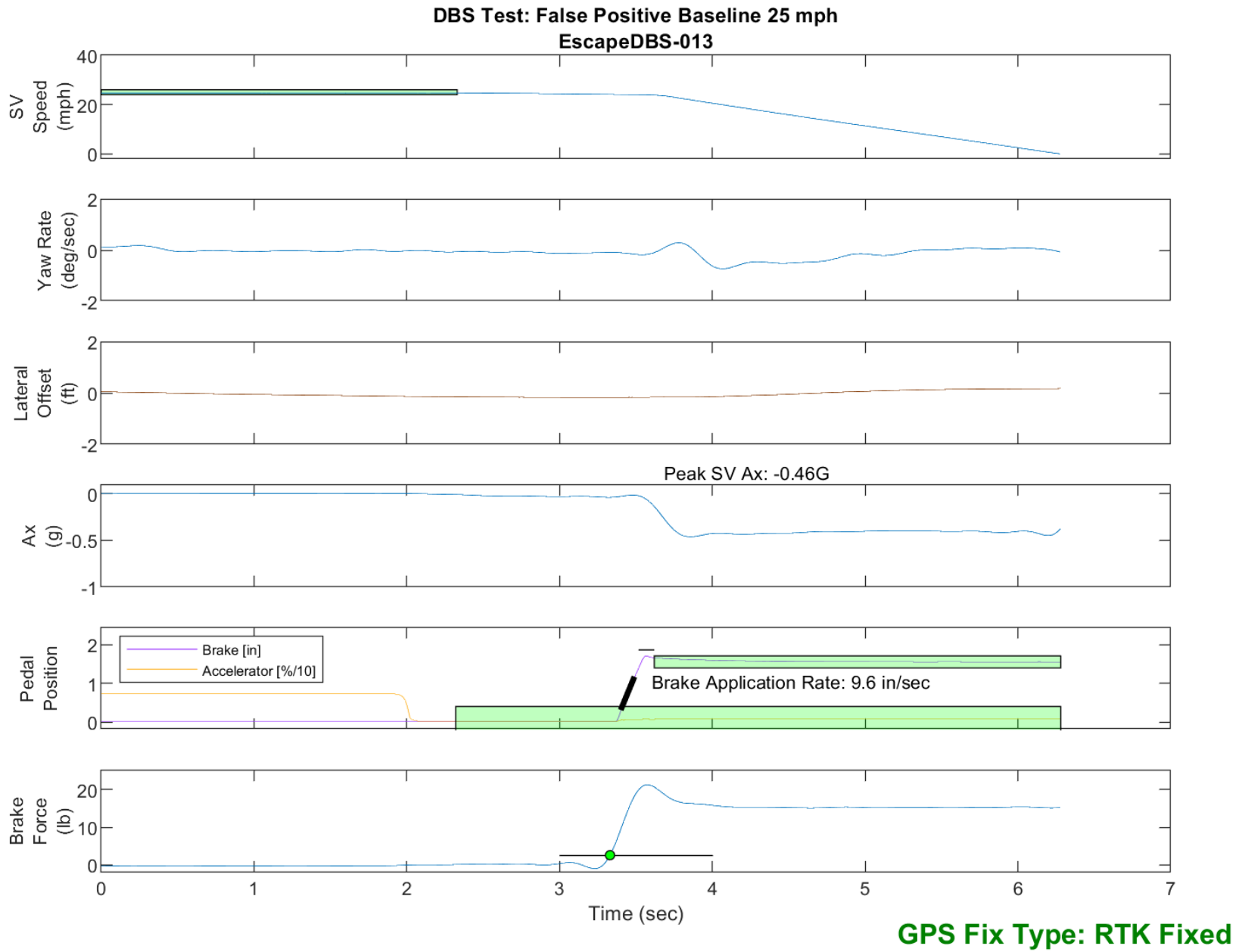


Figure E45. Time History for DBS Run 13, False Positive Baseline, SV 25 mph

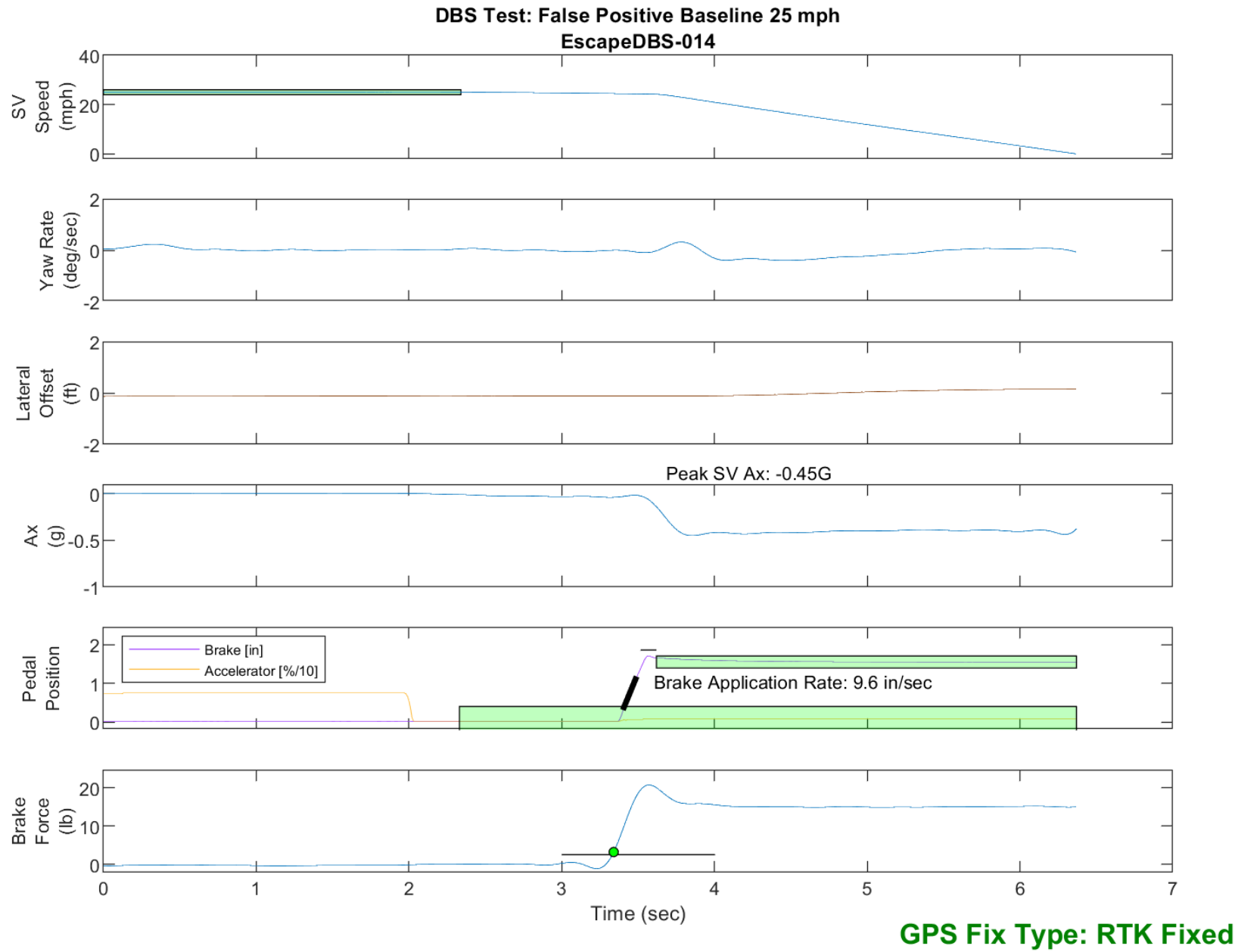


Figure E46. Time History for DBS Run 14, False Positive Baseline, SV 25 mph

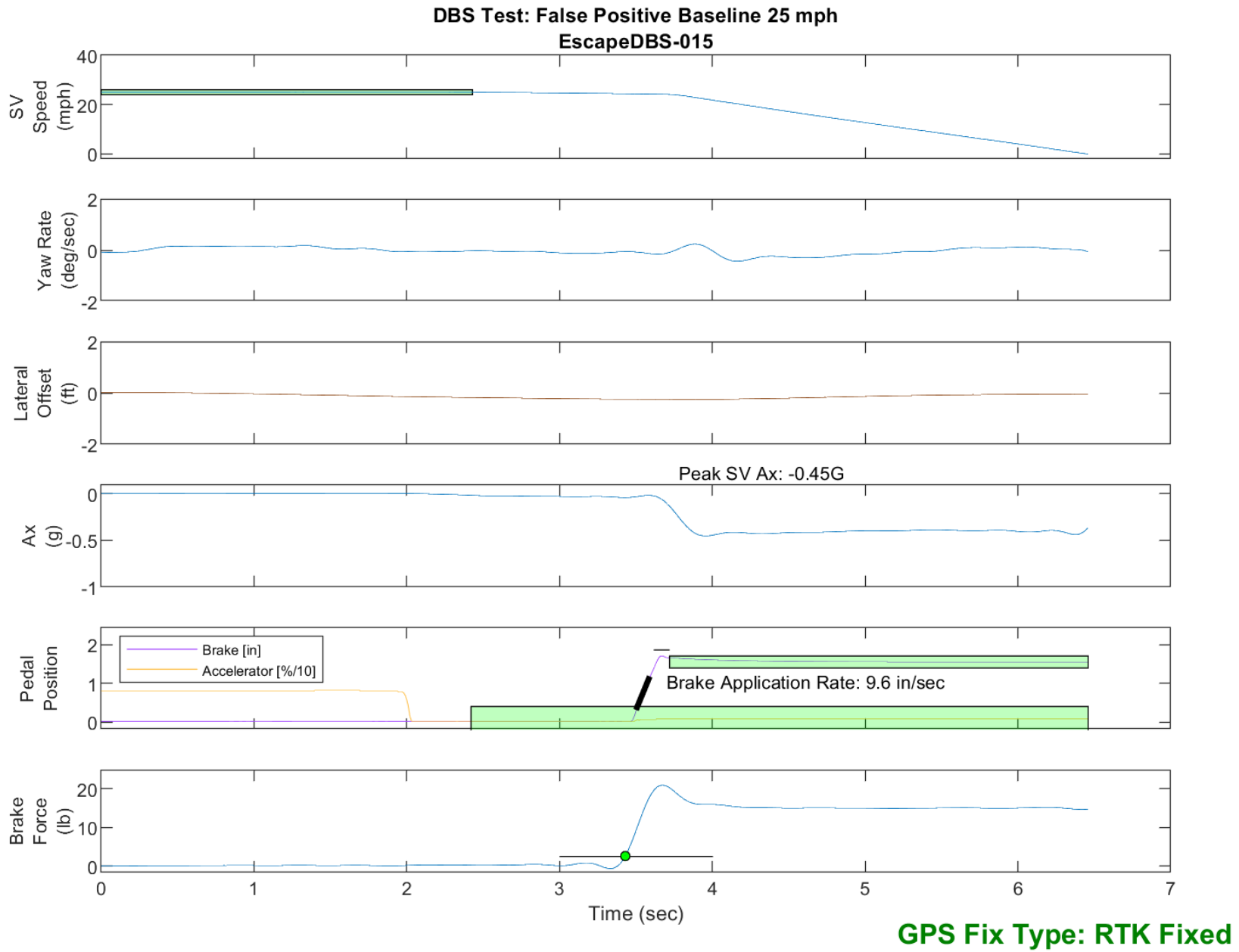


Figure E47. Time History for DBS Run 15, False Positive Baseline, SV 25 mph

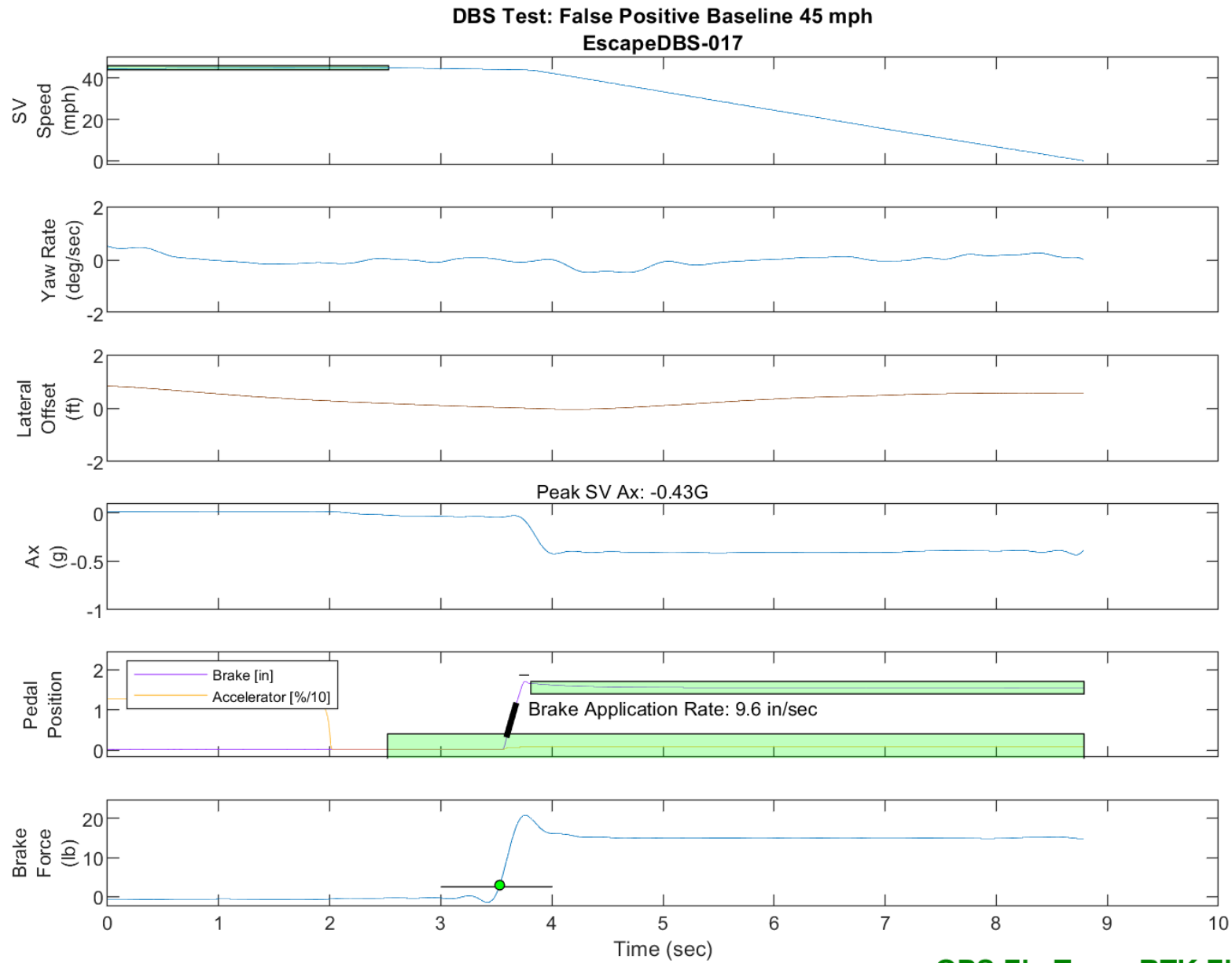


Figure E48. Time History for DBS Run 17, False Positive Baseline, SV 45 mph



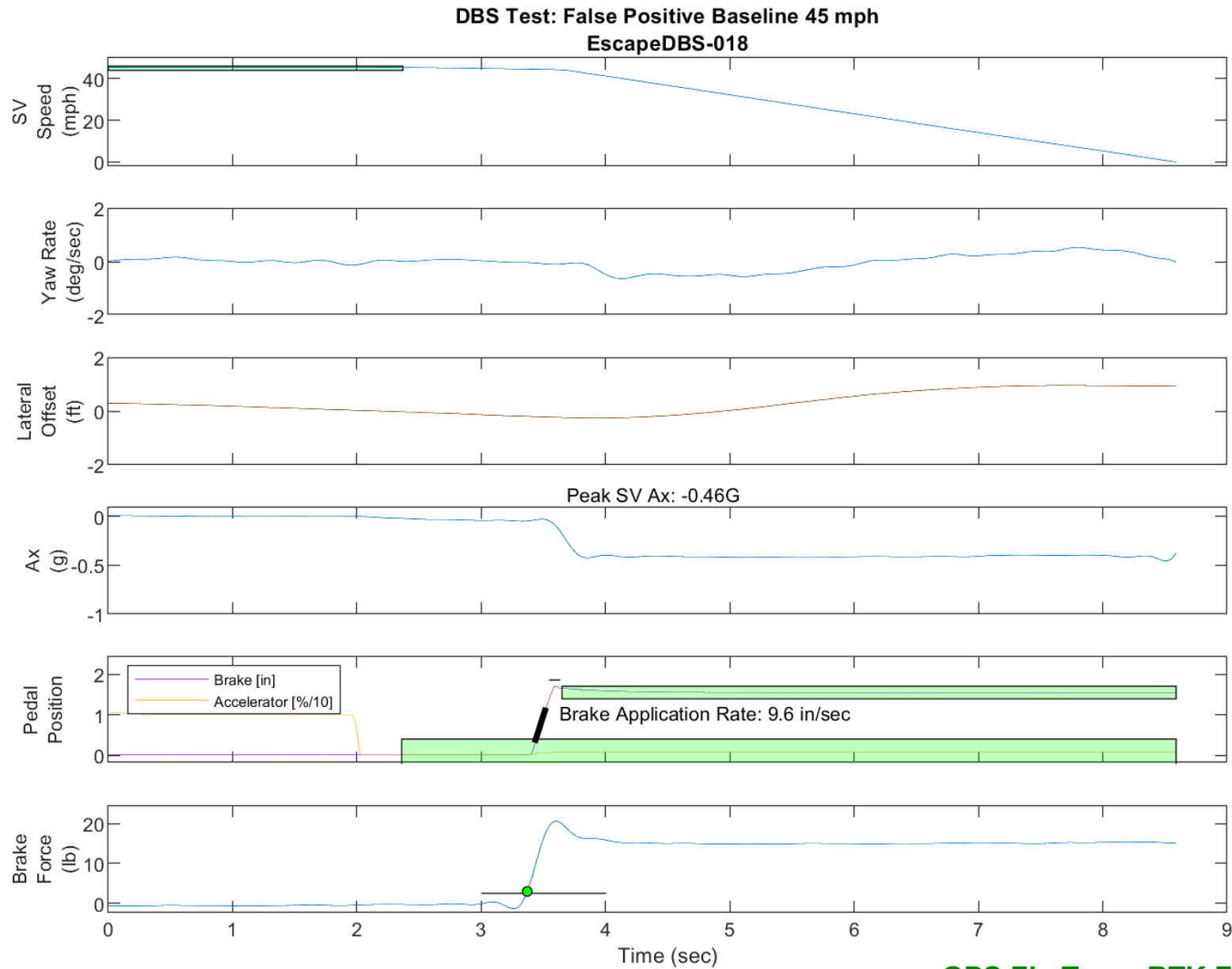
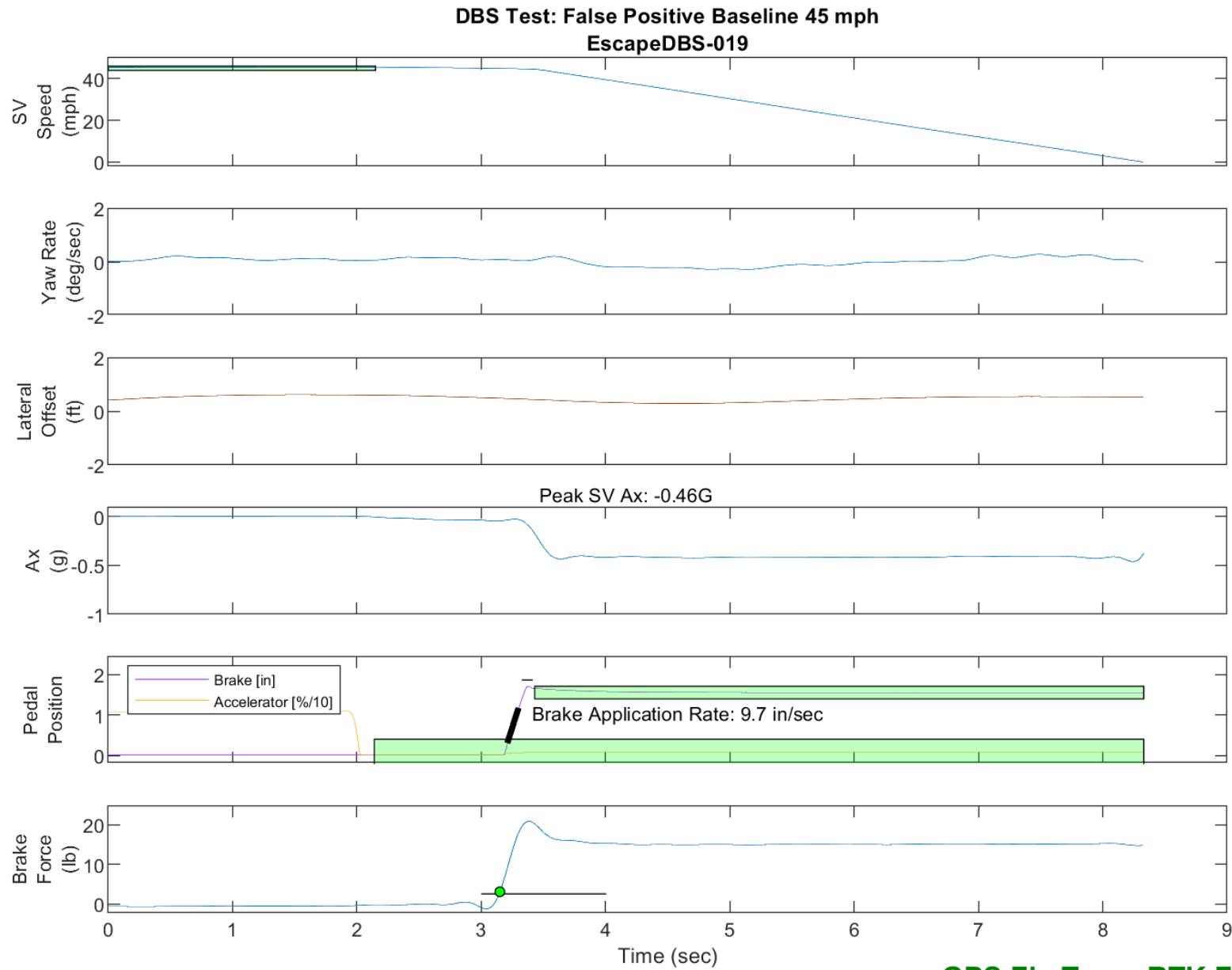


Figure E49. Time History for DBS Run 18, False Positive Baseline, SV 45 mph



**GPS Fix Type: RTK Fixed**

Figure E50. Time History for DBS Run 19, False Positive Baseline, SV 45 mph

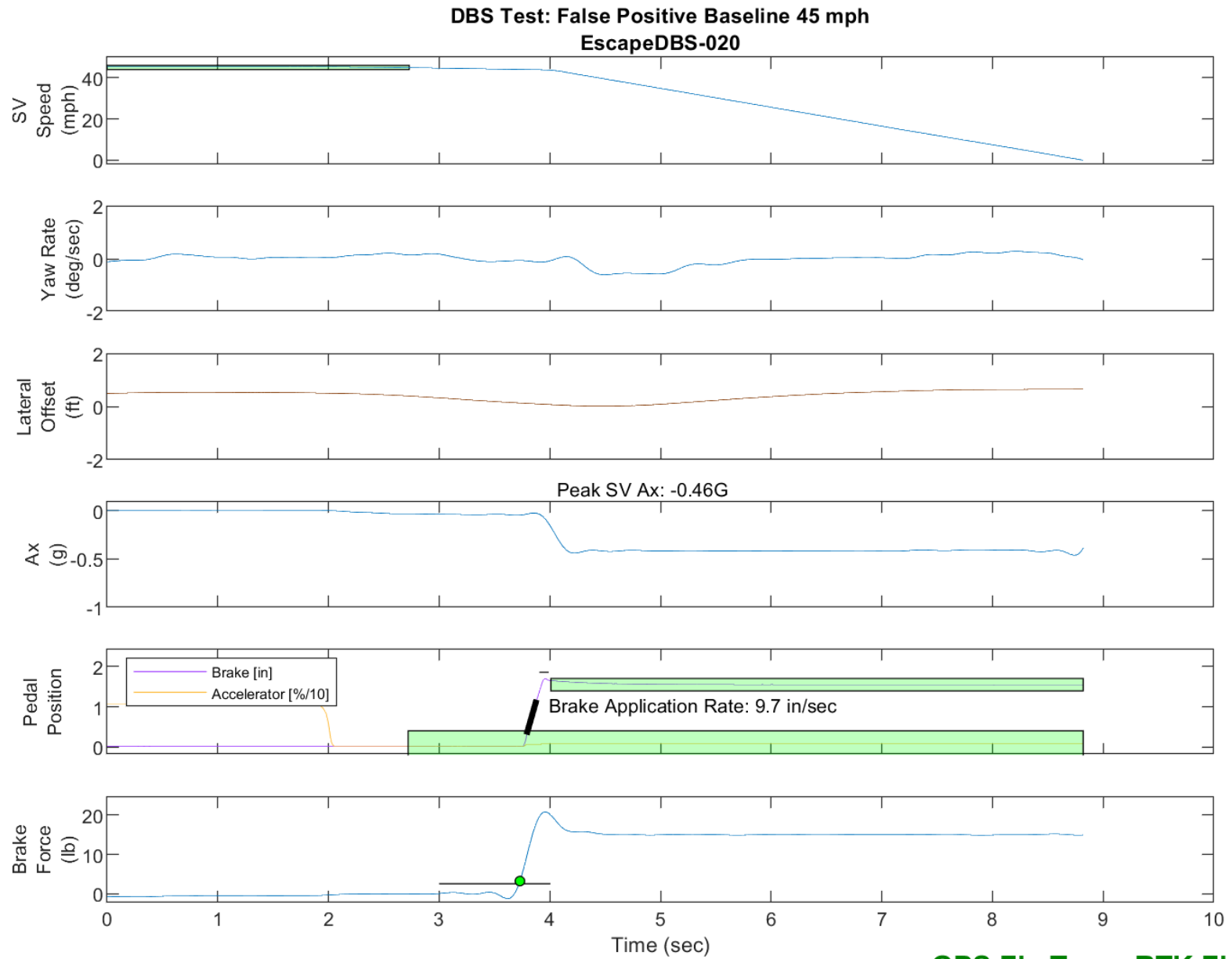


Figure E51. Time History for DBS Run 20, False Positive Baseline, SV 45 mph

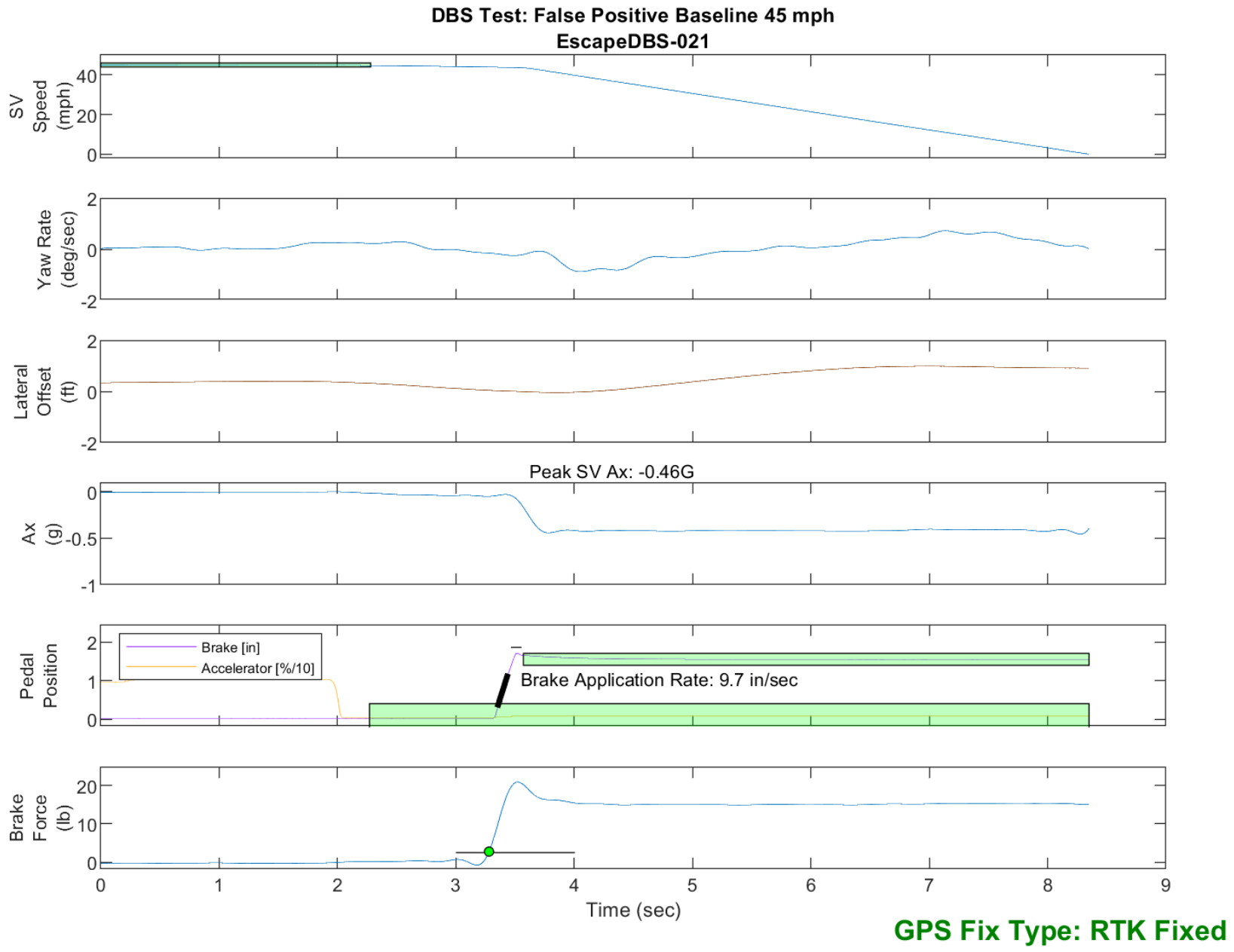
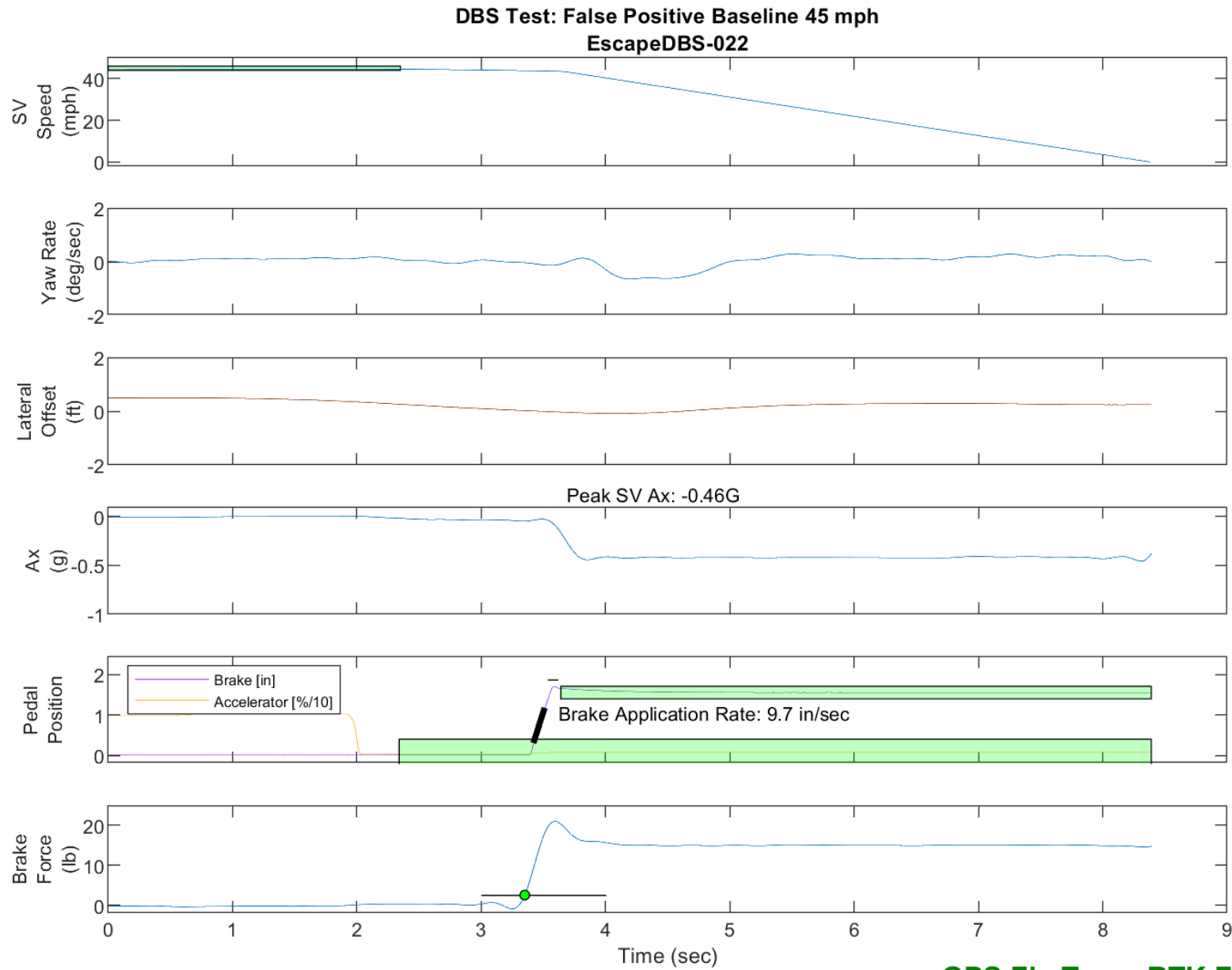
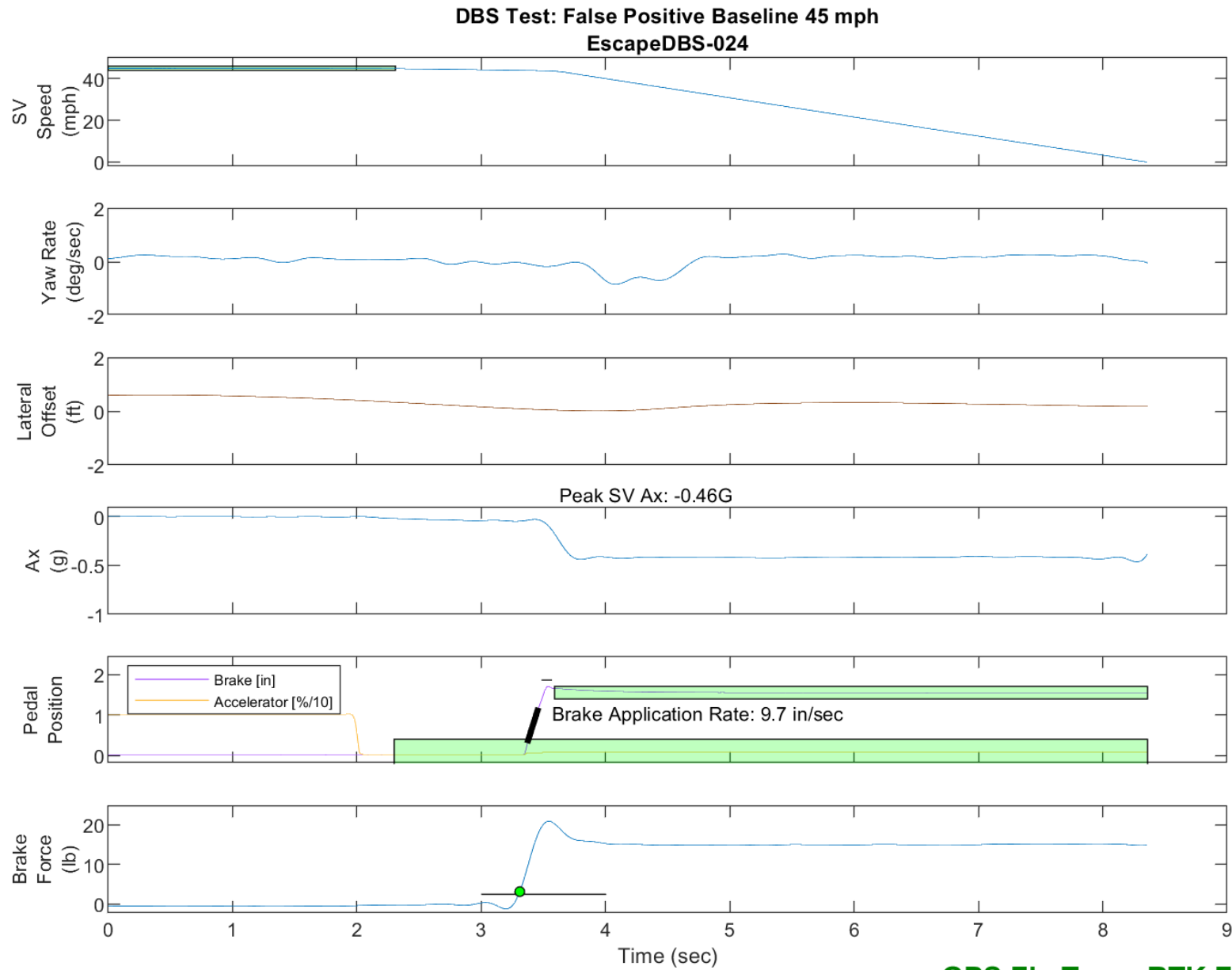


Figure E52. Time History for DBS Run 21, False Positive Baseline, SV 45 mph



**GPS Fix Type: RTK Fixed**

Figure E53. Time History for DBS Run 22, False Positive Baseline, SV 45 mph



**GPS Fix Type: RTK Fixed**

Figure E54. Time History for DBS Run 24, False Positive Baseline, SV 45 mph

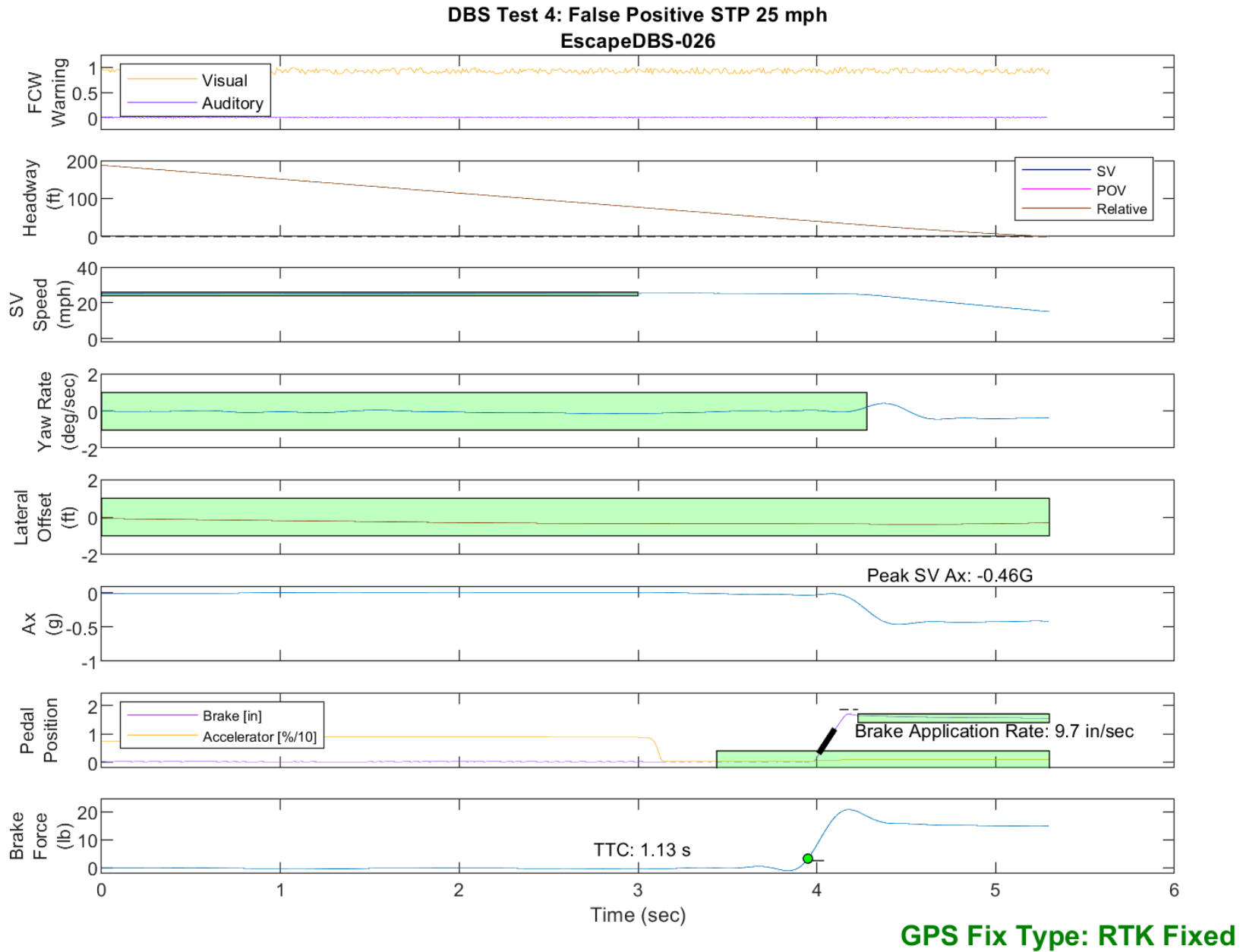


Figure E55. Time History for DBS Run 26, Test 4 - False Positive STP 25 mph

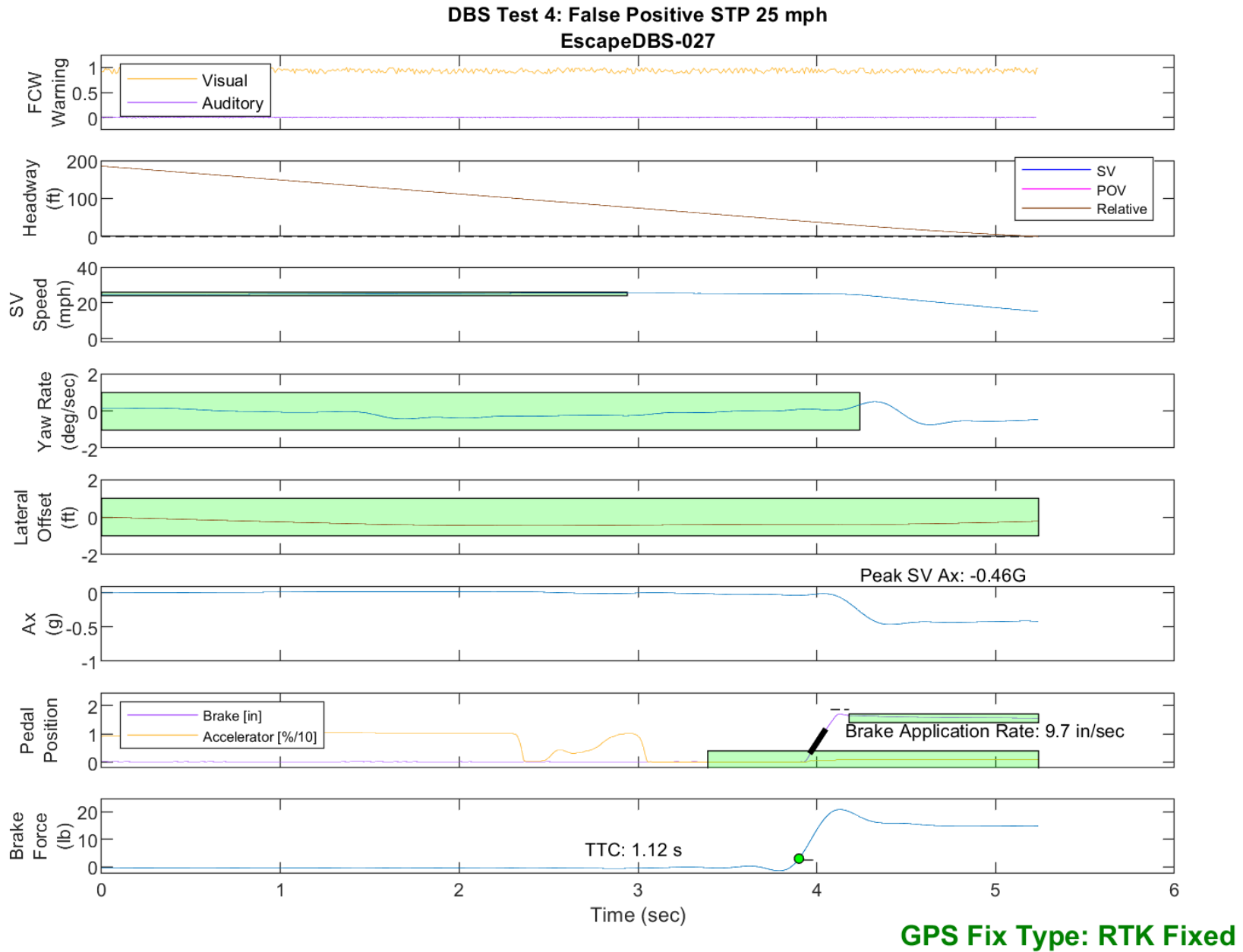


Figure E56. Time History for DBS Run 27, Test 4 - False Positive STP 25 mph



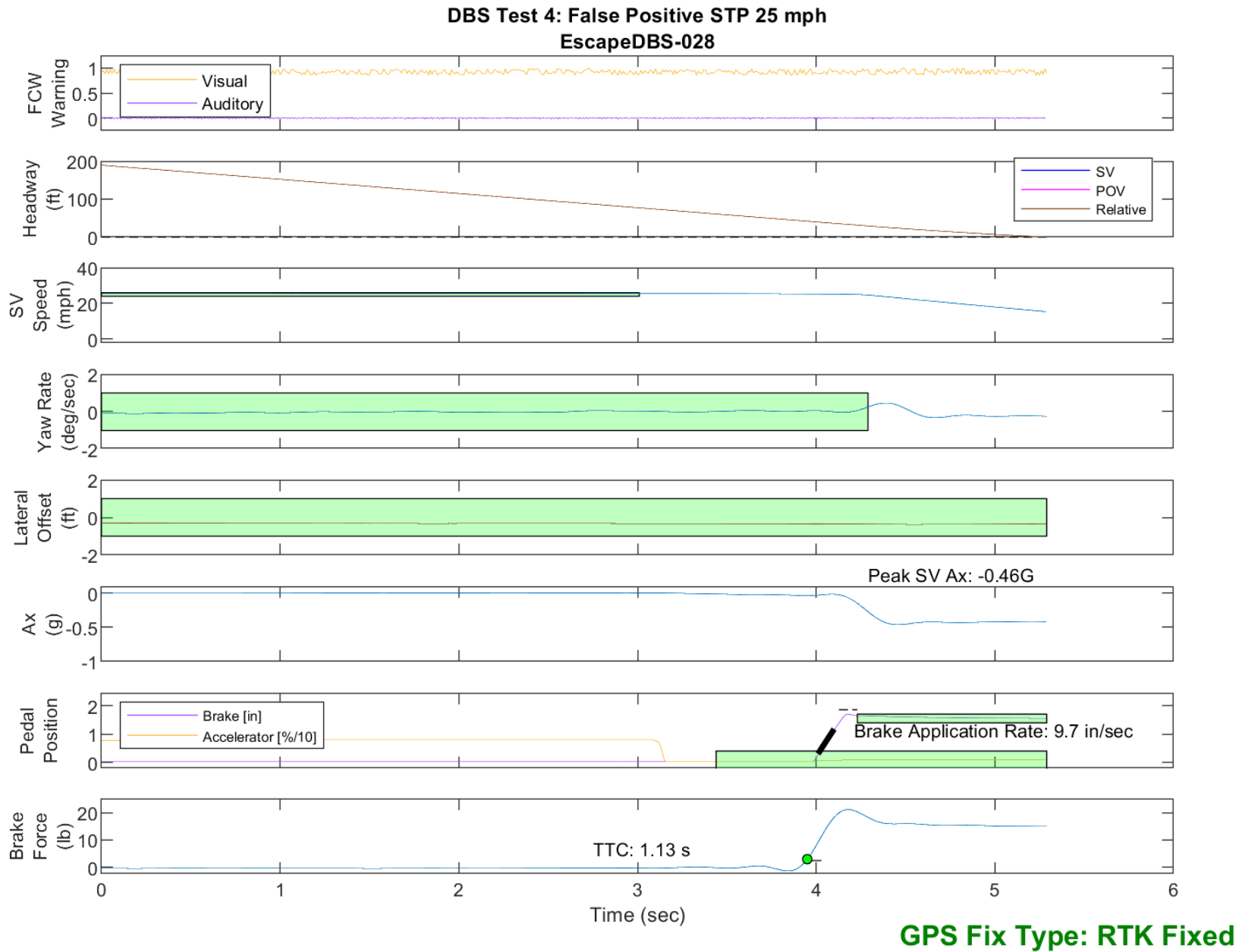


Figure E57. Time History for DBS Run 28, Test 4 - False Positive STP 25 mph

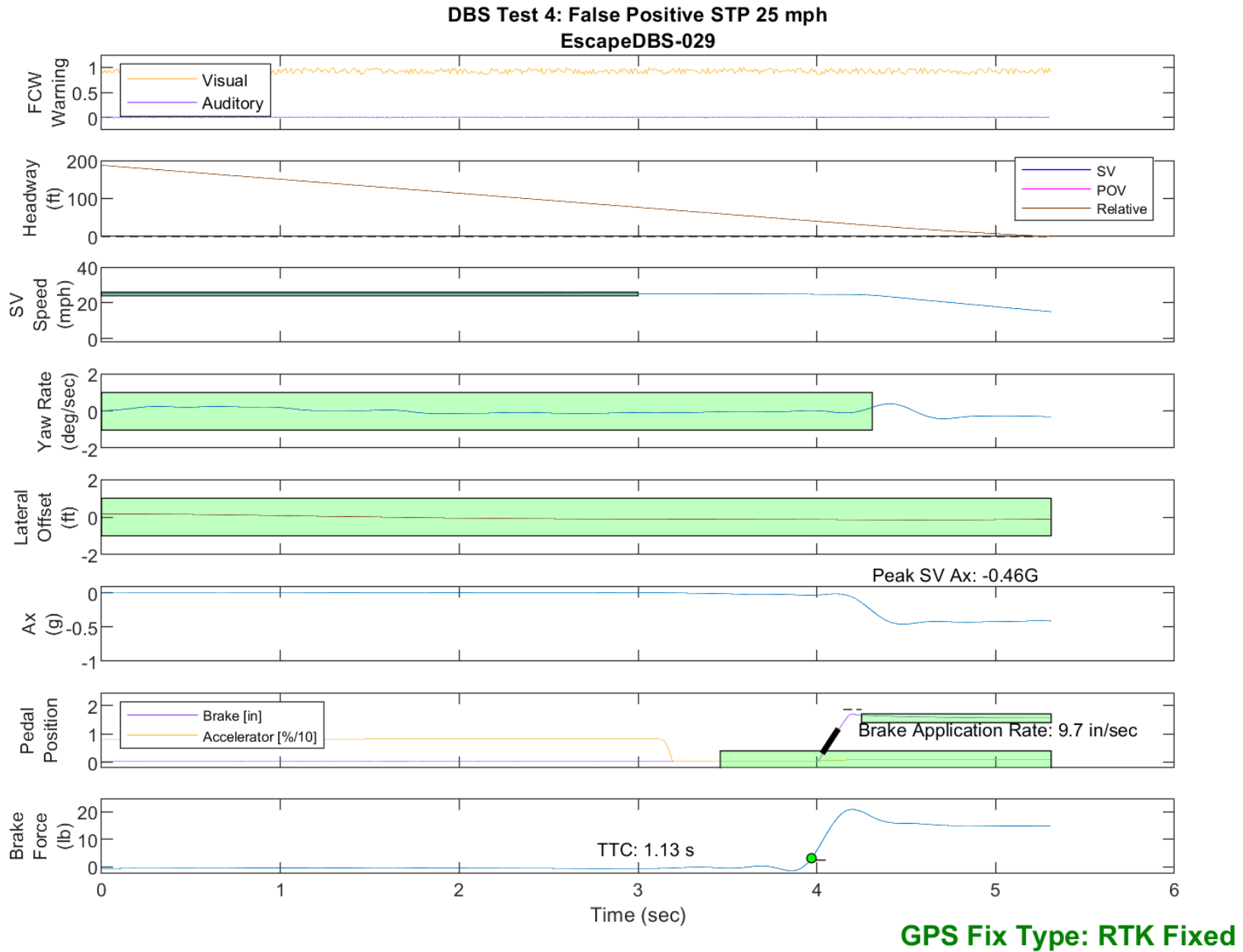


Figure E58. Time History for DBS Run 29, Test 4 - False Positive STP 25 mph

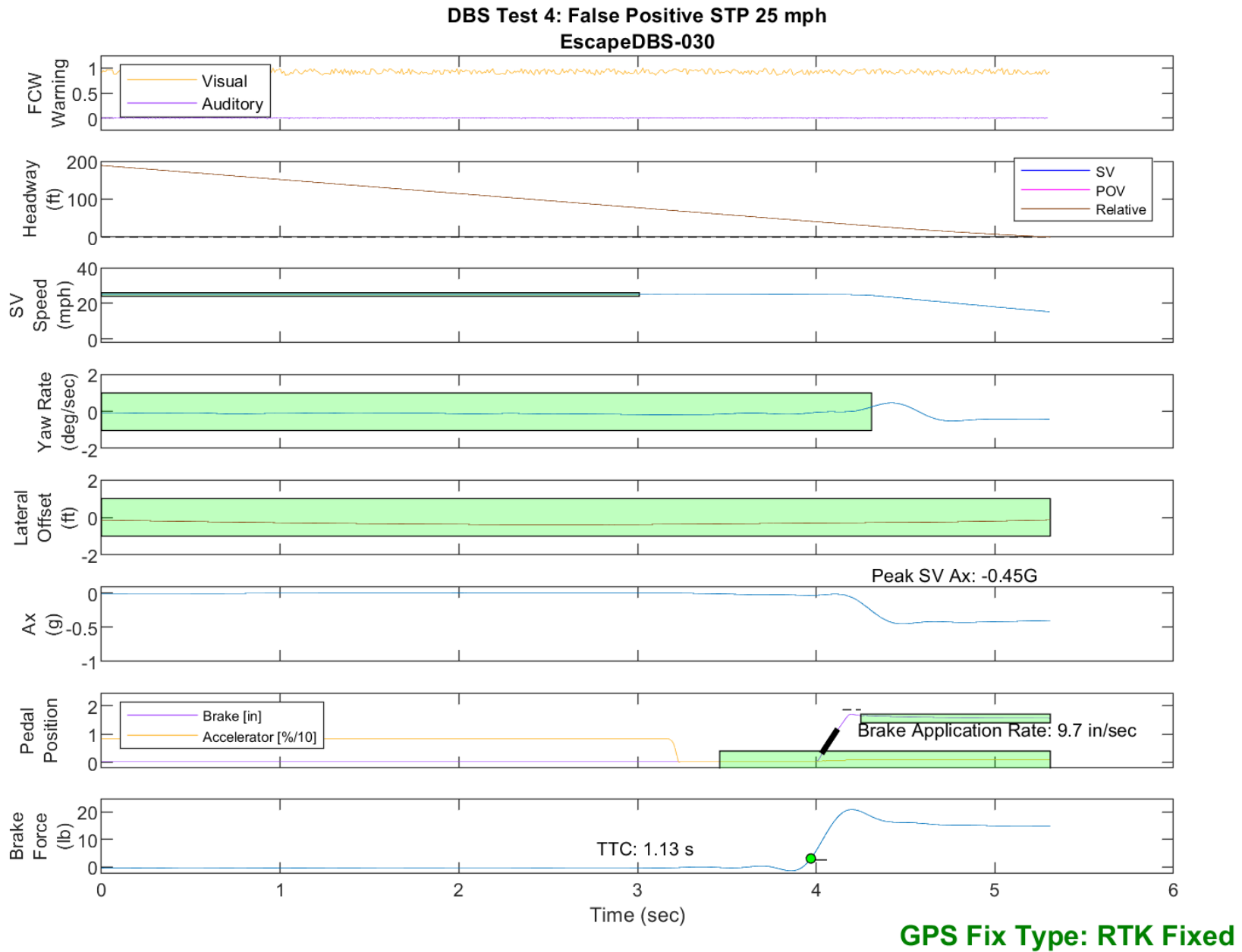


Figure E59. Time History for DBS Run 30, Test 4 - False Positive STP 25 mph

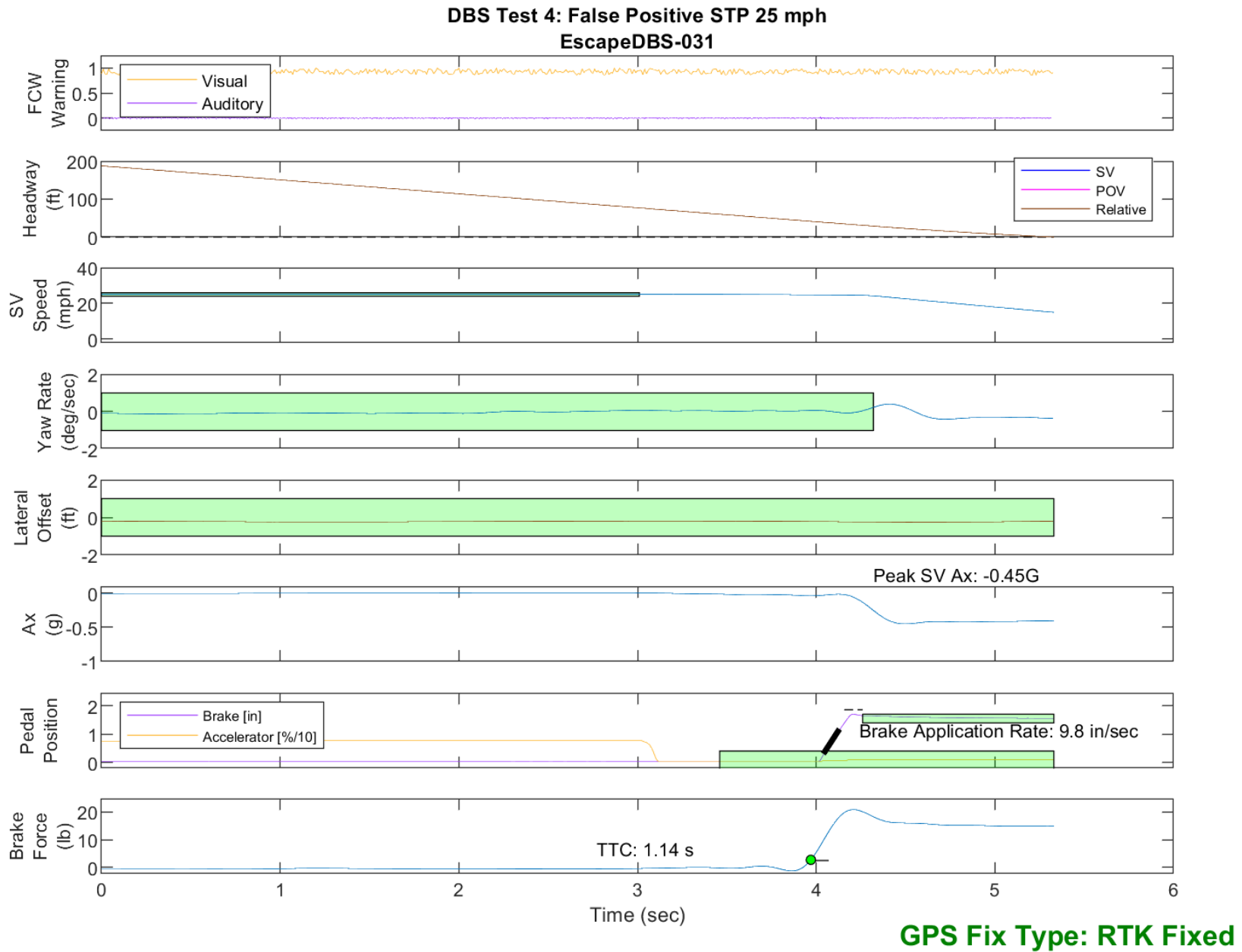


Figure E60. Time History for DBS Run 31, Test 4 - False Positive STP 25 mph

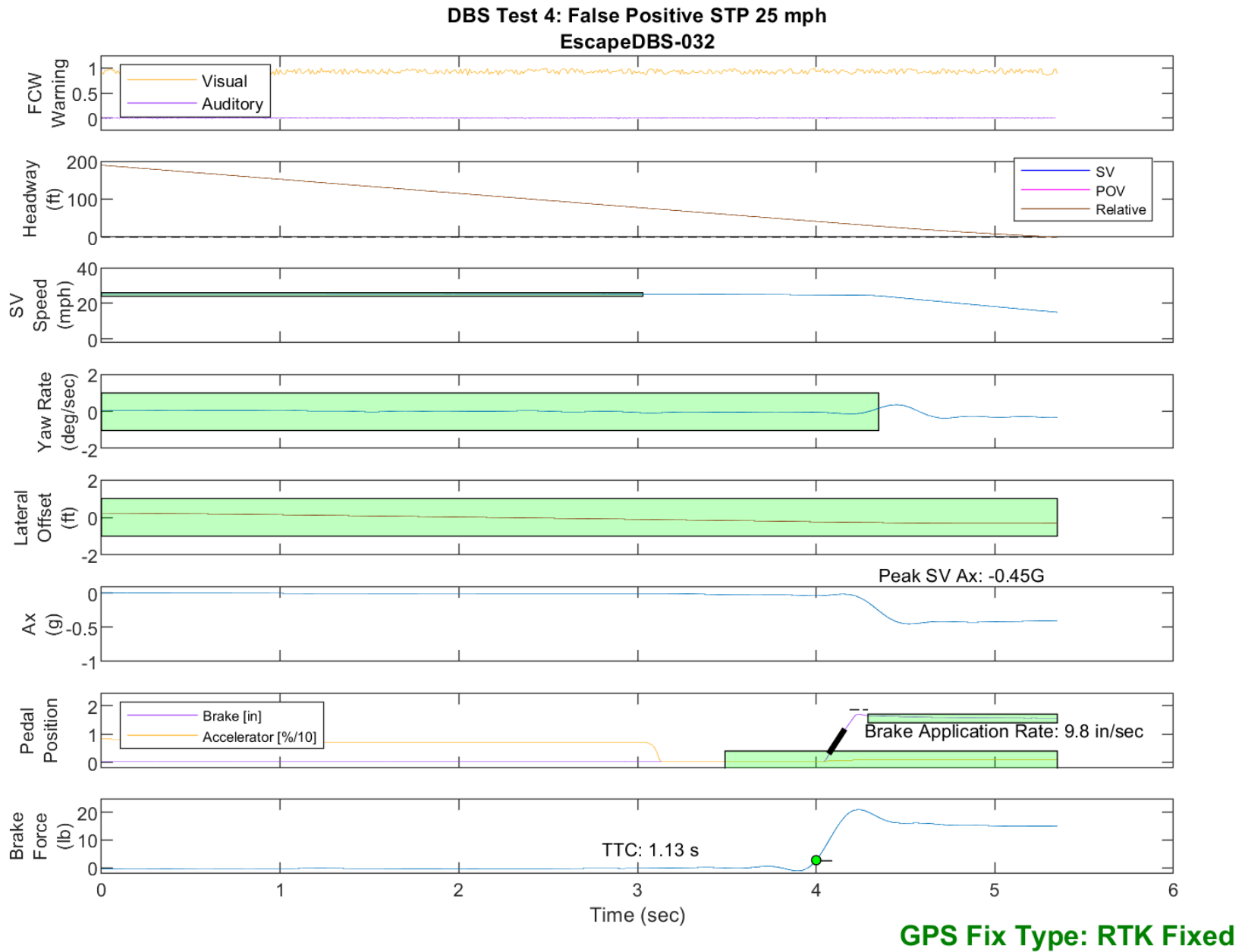


Figure E61. Time History for DBS Run 32, Test 4 - False Positive STP 25 mph

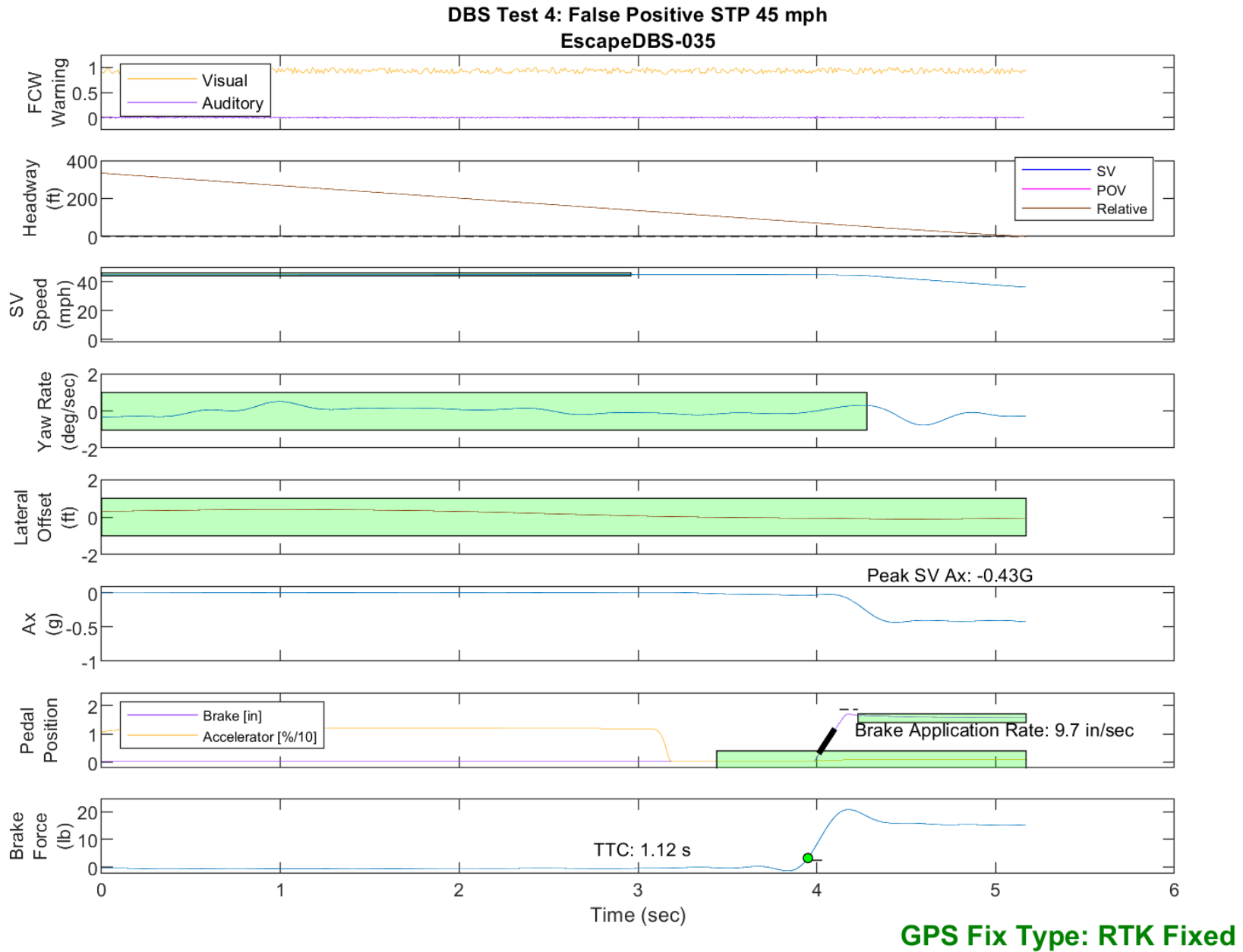


Figure E62. Time History for DBS Run 35, Test 4 - False Positive STP 45 mph

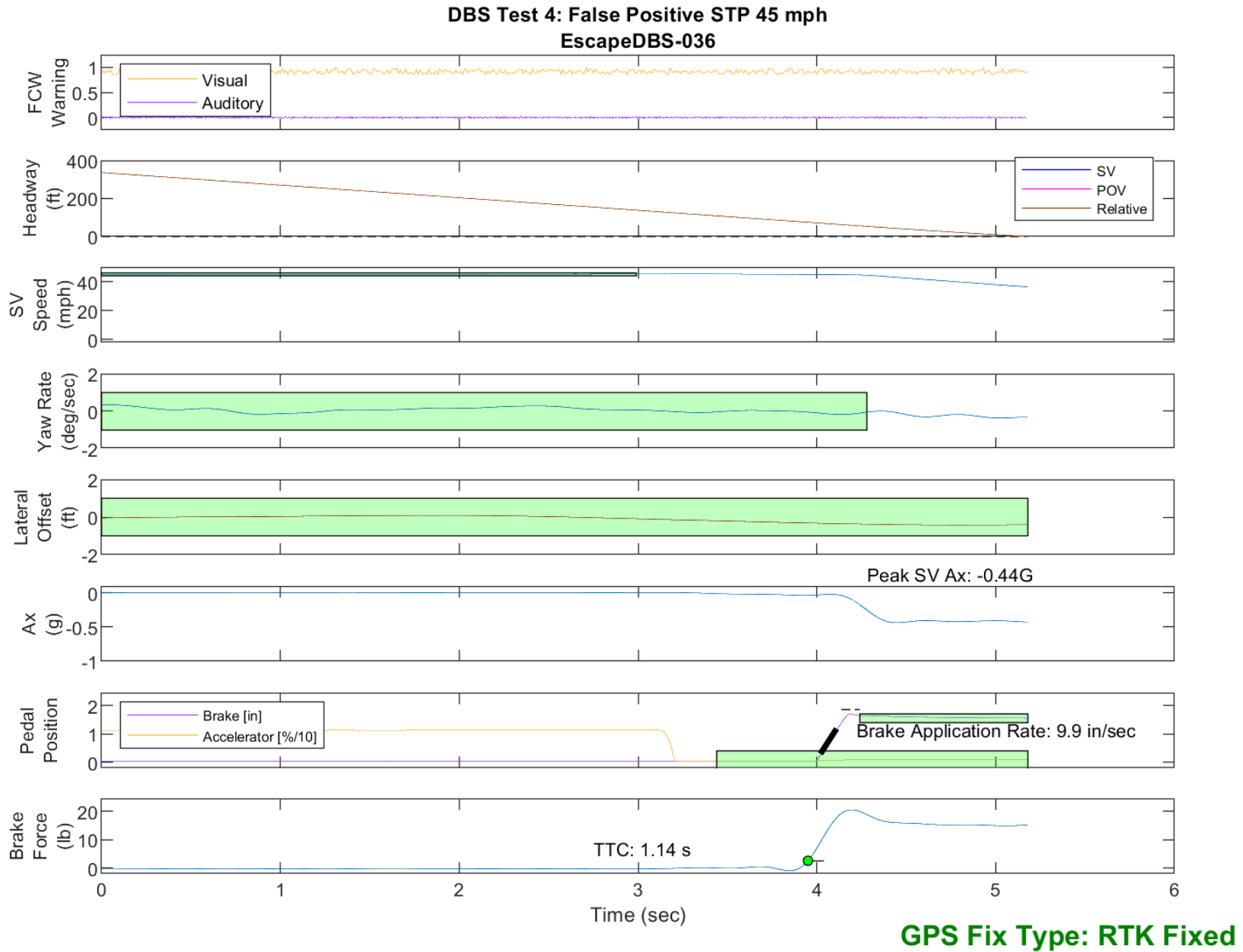


Figure E63. Time History for DBS Run 36, Test 4 - False Positive STP 45 mph

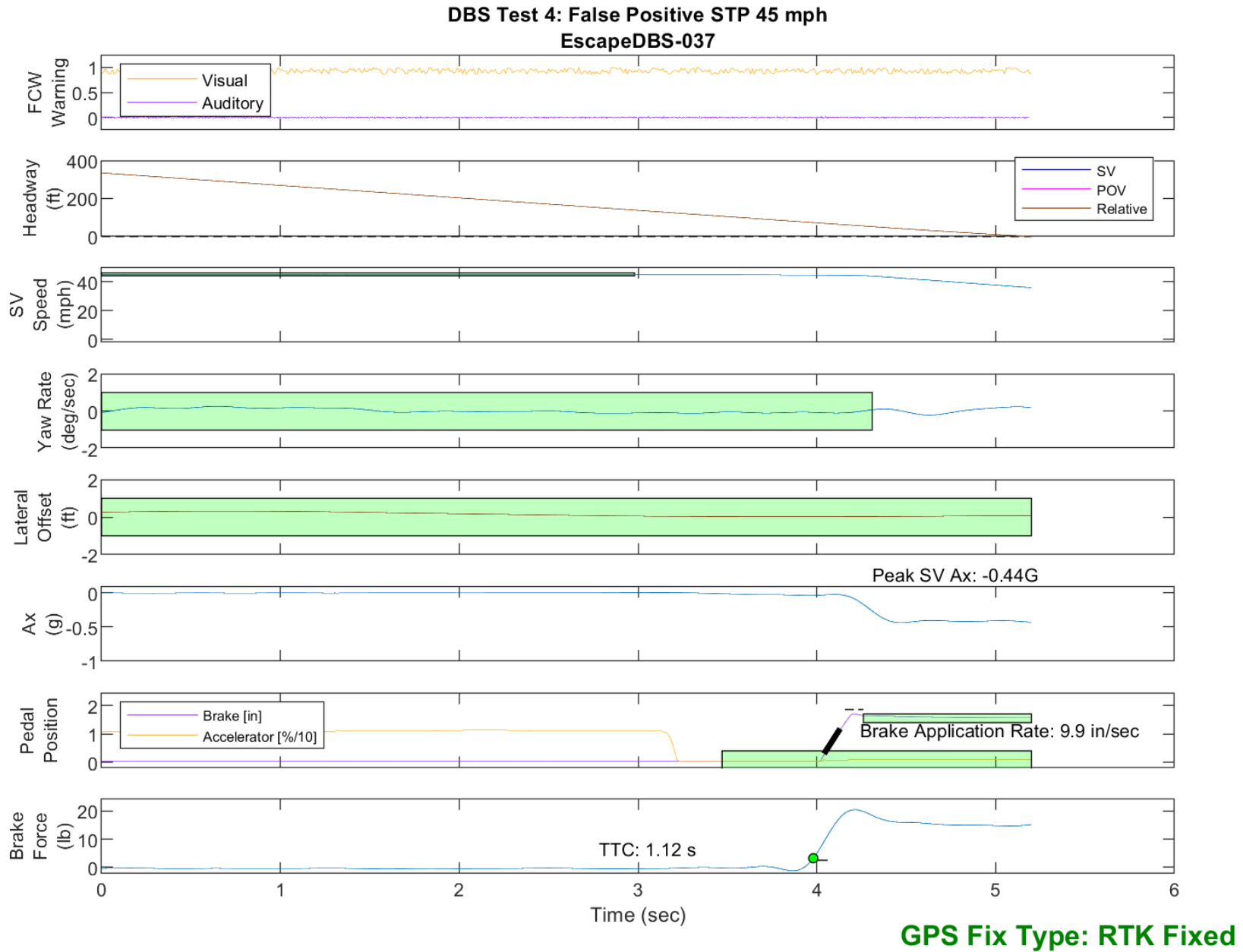


Figure E64. Time History for DBS Run 37, Test 4 - False Positive STP 45 mph



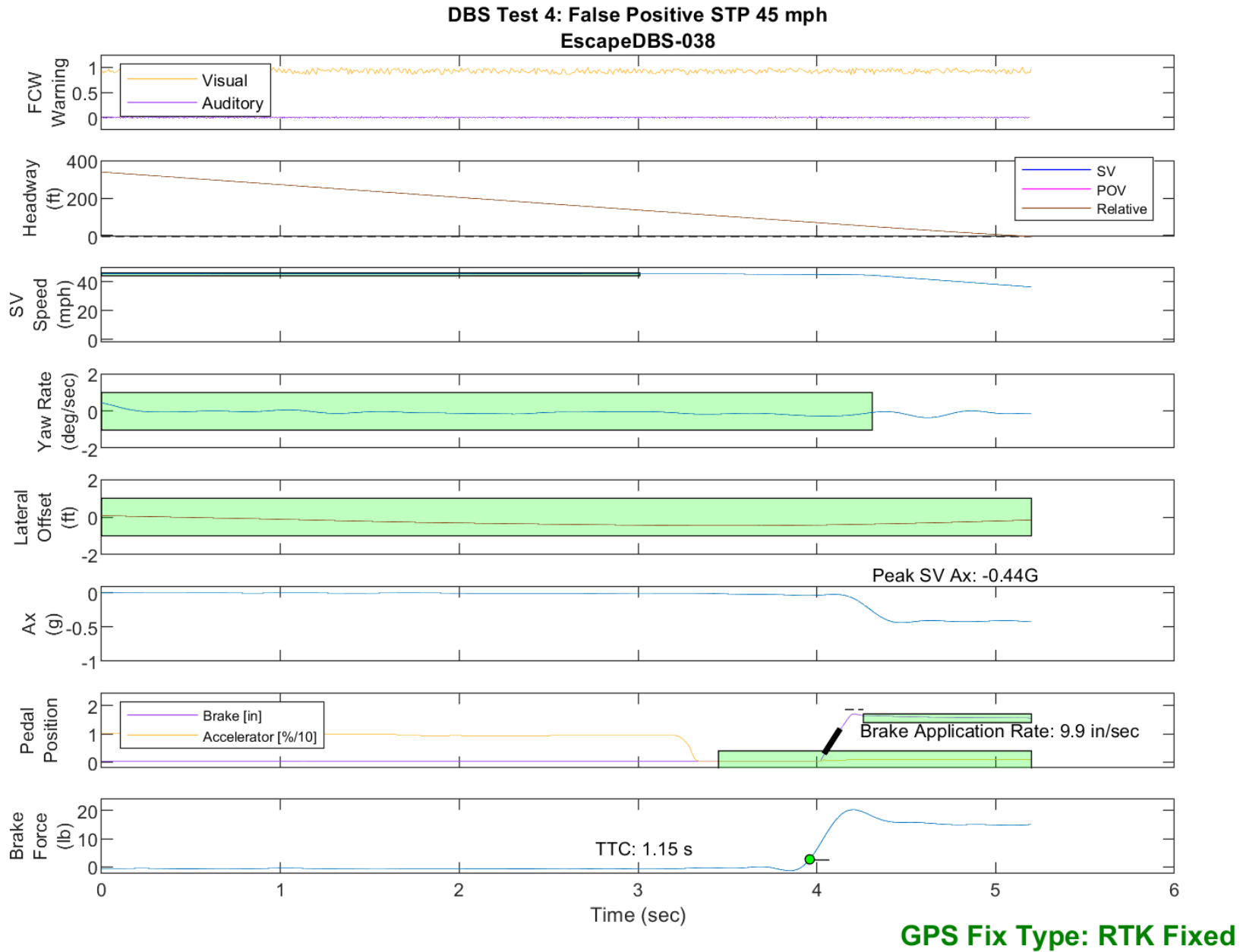


Figure E65. Time History for DBS Run 38, Test 4 - False Positive STP 45 mph

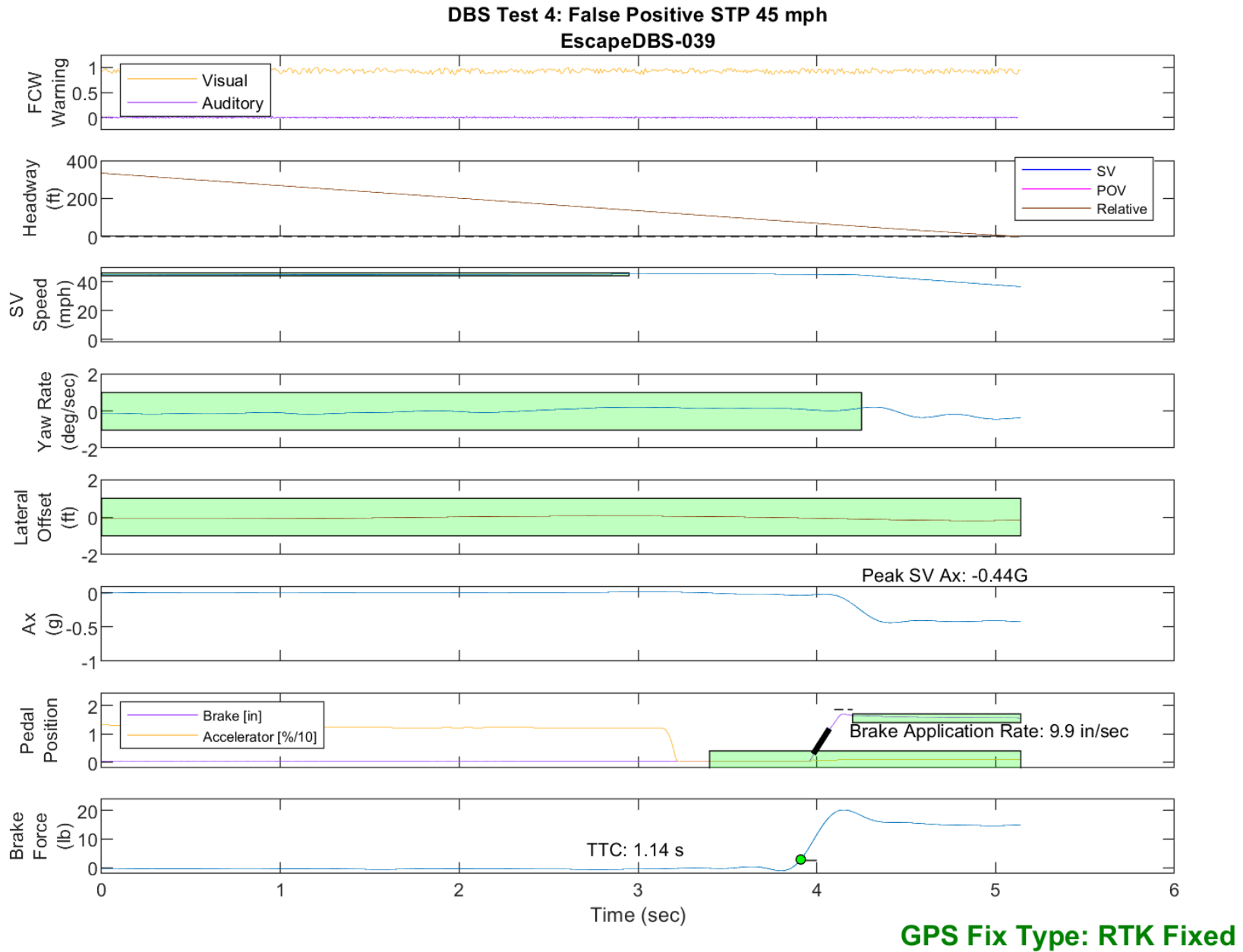


Figure E66. Time History for DBS Run 39, Test 4 - False Positive STP 45 mph

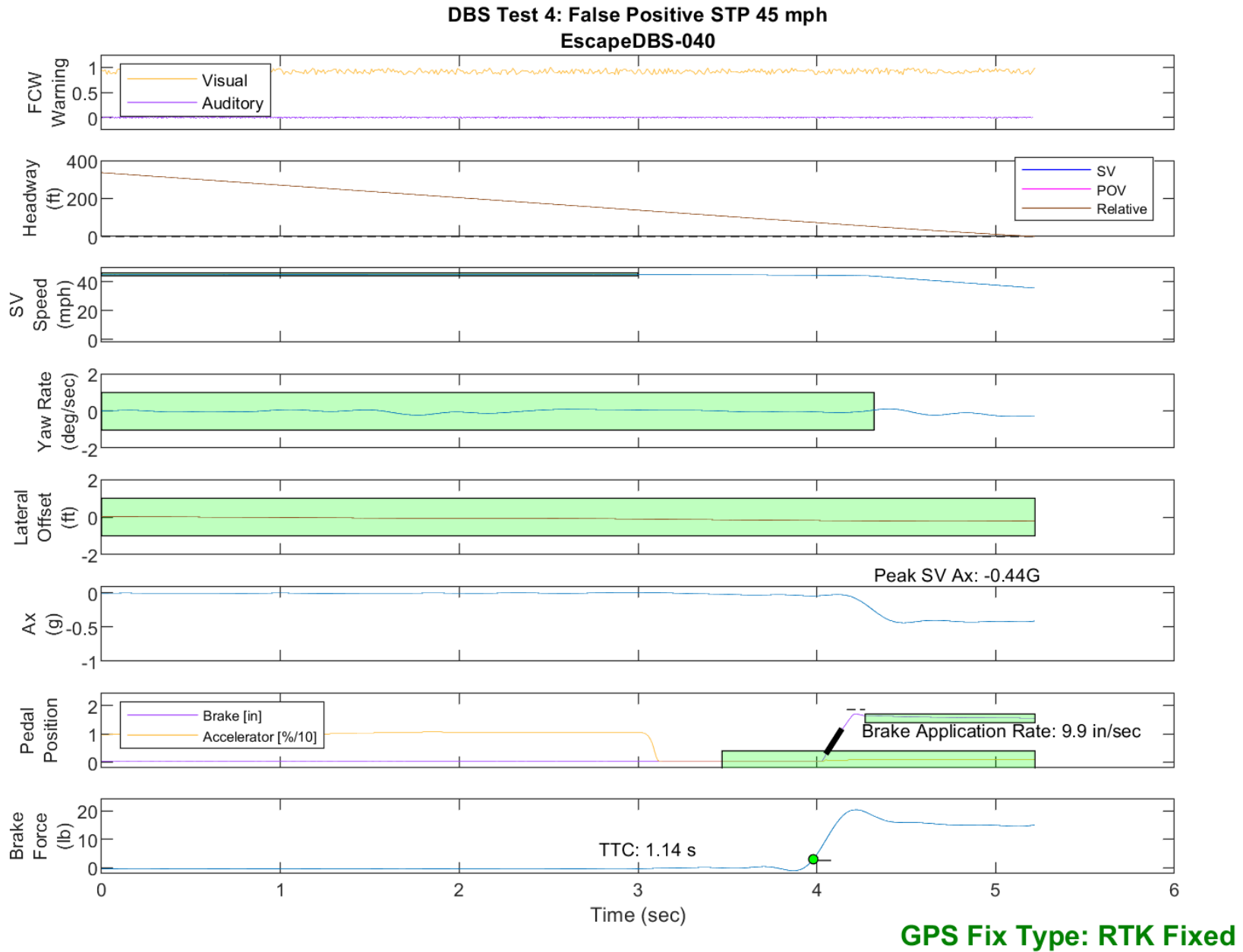


Figure E67. Time History for DBS Run 40, Test 4 - False Positive STP 45 mph

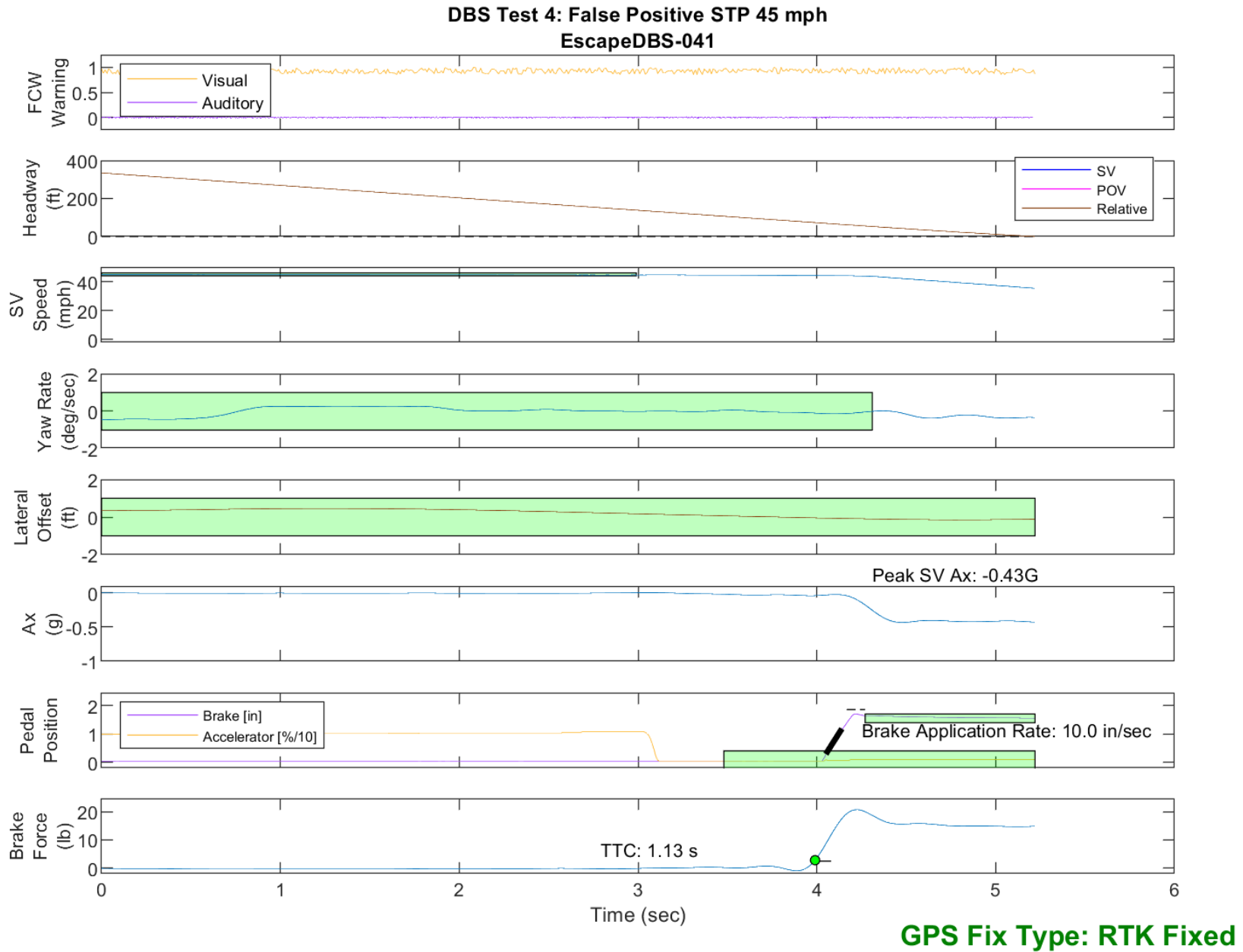


Figure E68. Time History for DBS Run 41, Test 4 - False Positive STP 45 mph

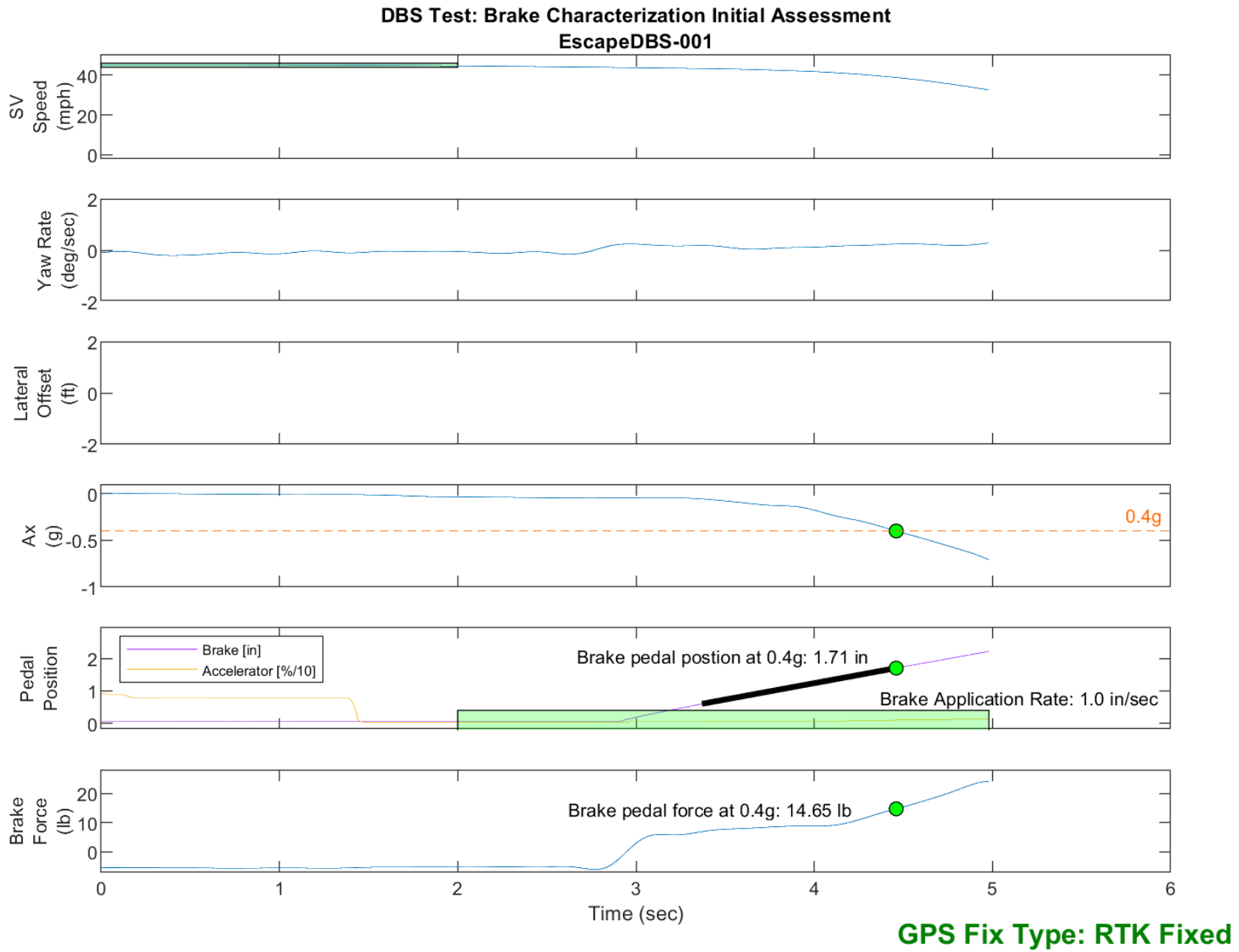


Figure E69. Time History for DBS Run 1, Brake Characterization Initial

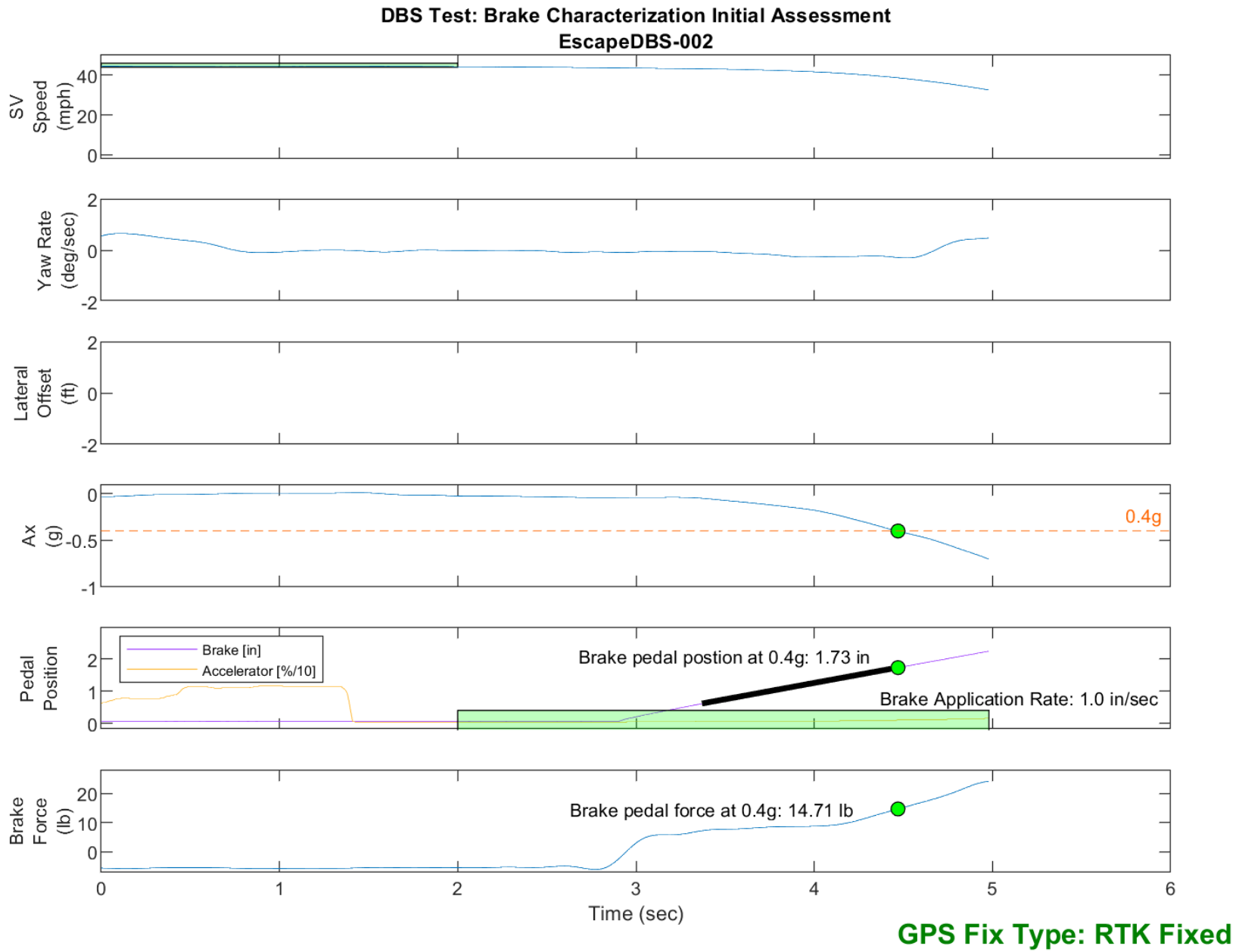


Figure E70. Time History for DBS Run 2, Brake Characterization Initial

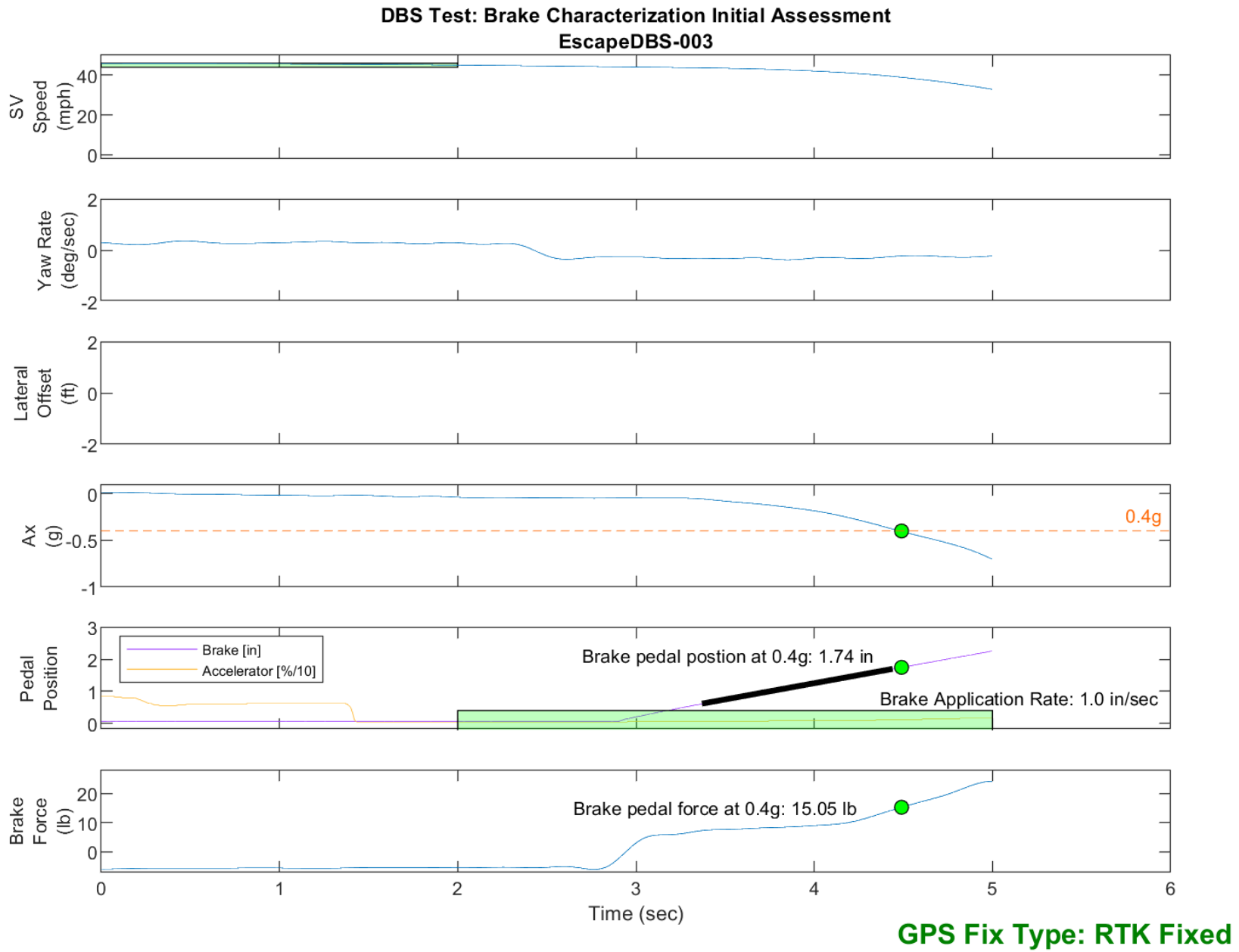


Figure E71. Time History for DBS Run 3, Brake Characterization Initial

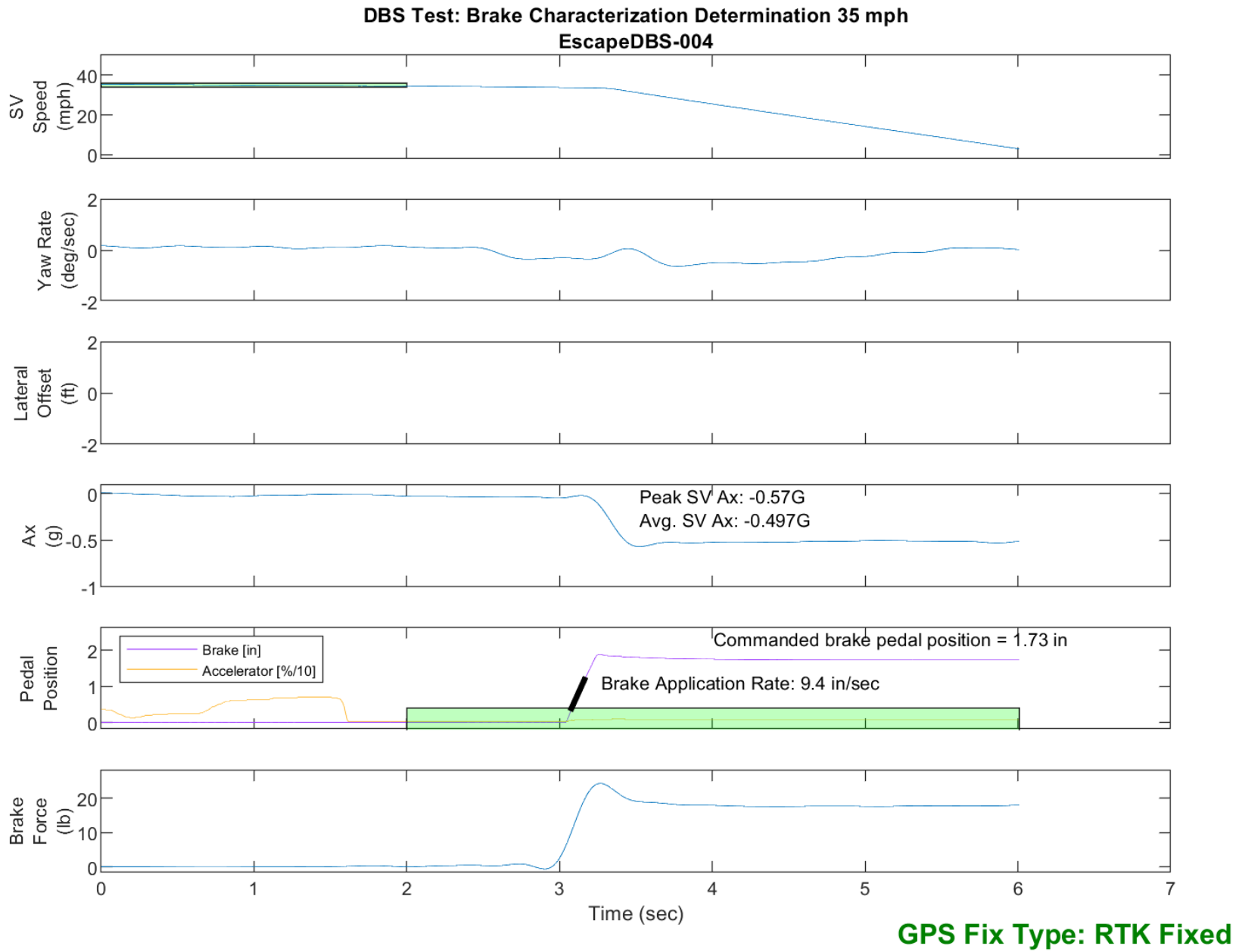


Figure E72. Time History for DBS Run 4, Brake Characterization Determination, Displacement Mode, 35 mph



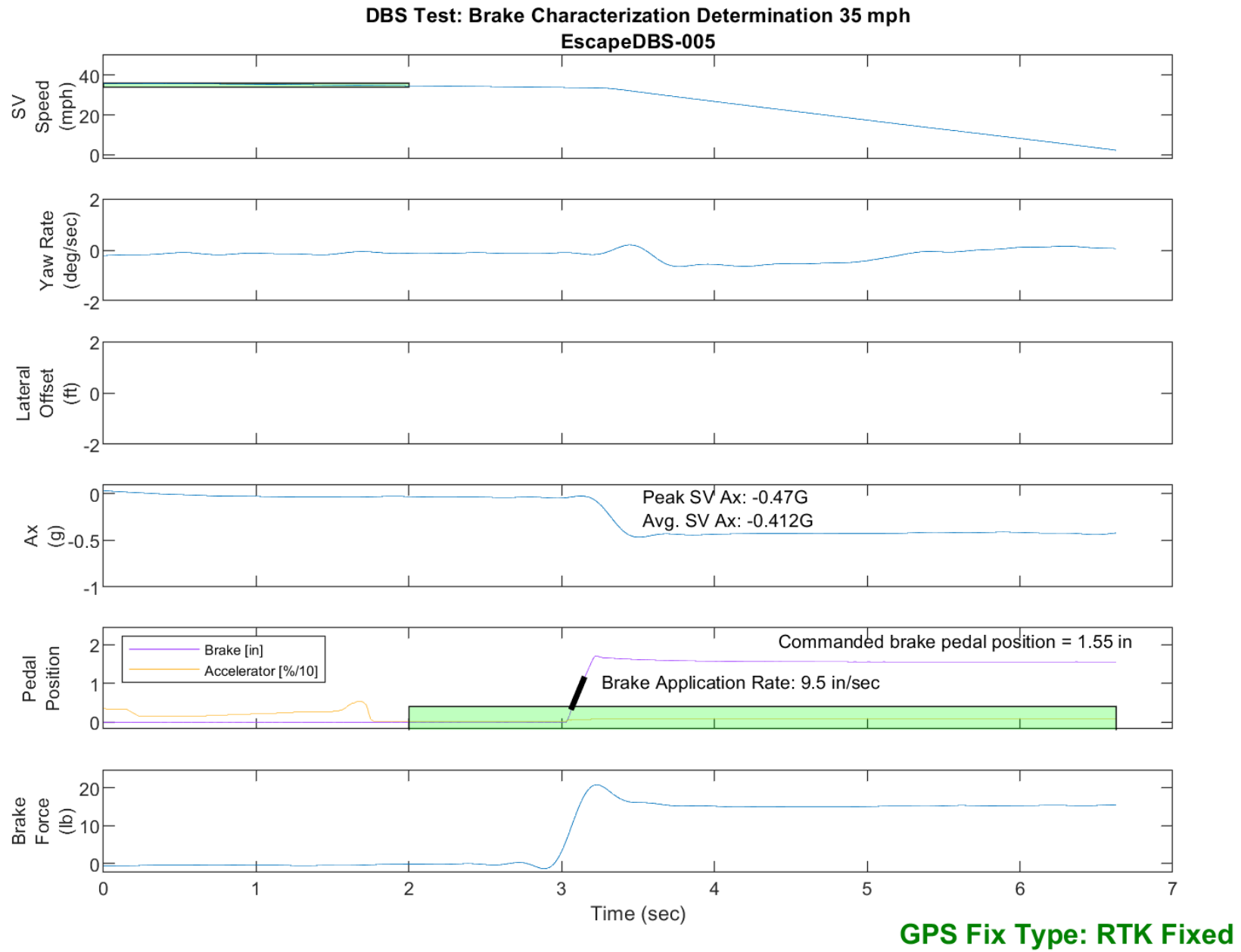
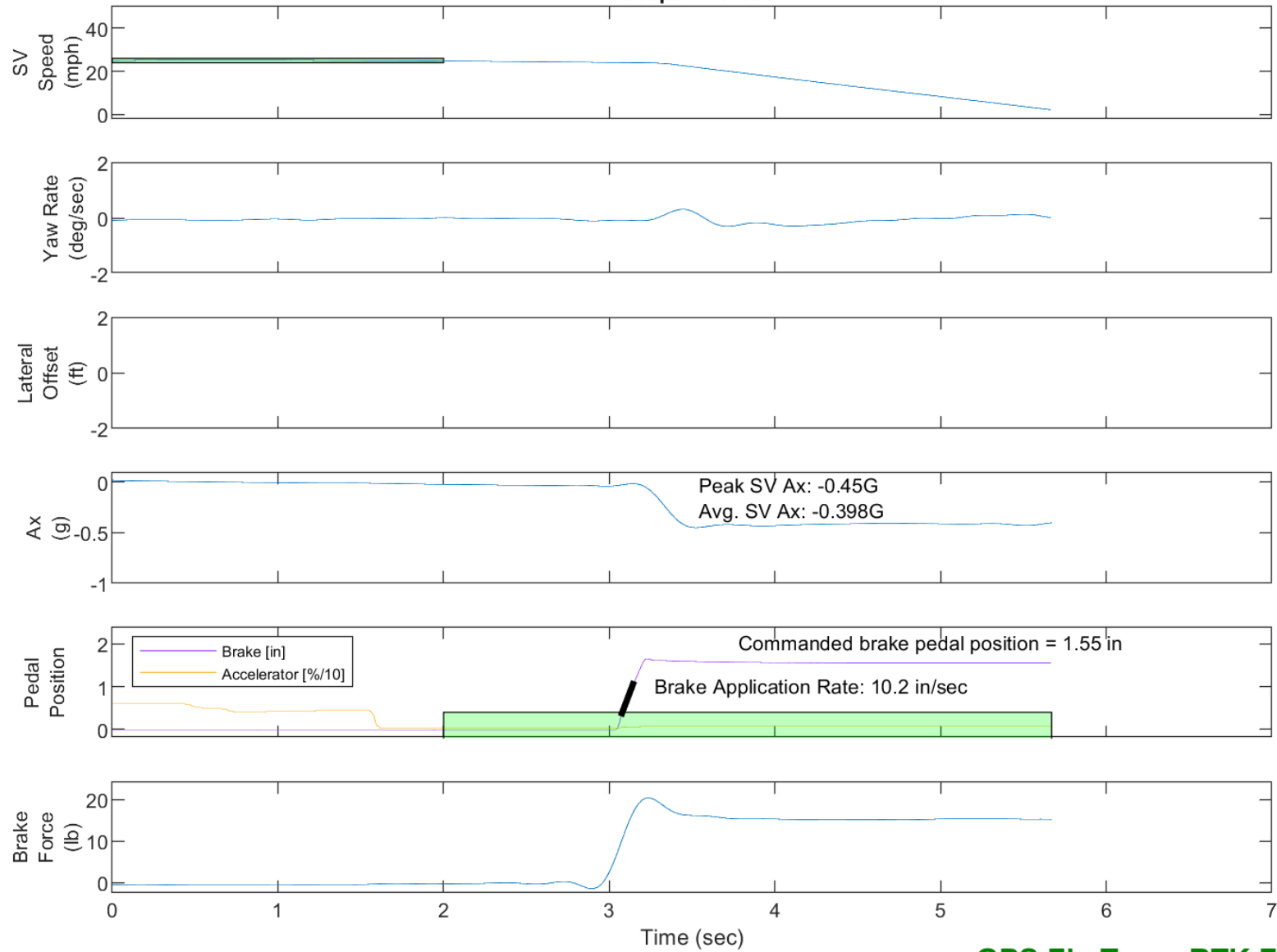


Figure E73. Time History for DBS Run 5, Brake Characterization Determination, Displacement Mode, 35 mph

### DBS Test: Brake Characterization Determination 25 mph EscapeDBS-006



**GPS Fix Type: RTK Fixed**

Figure E74. Time History for DBS Run 6, Brake Characterization Determination, Displacement Mode, 25 mph

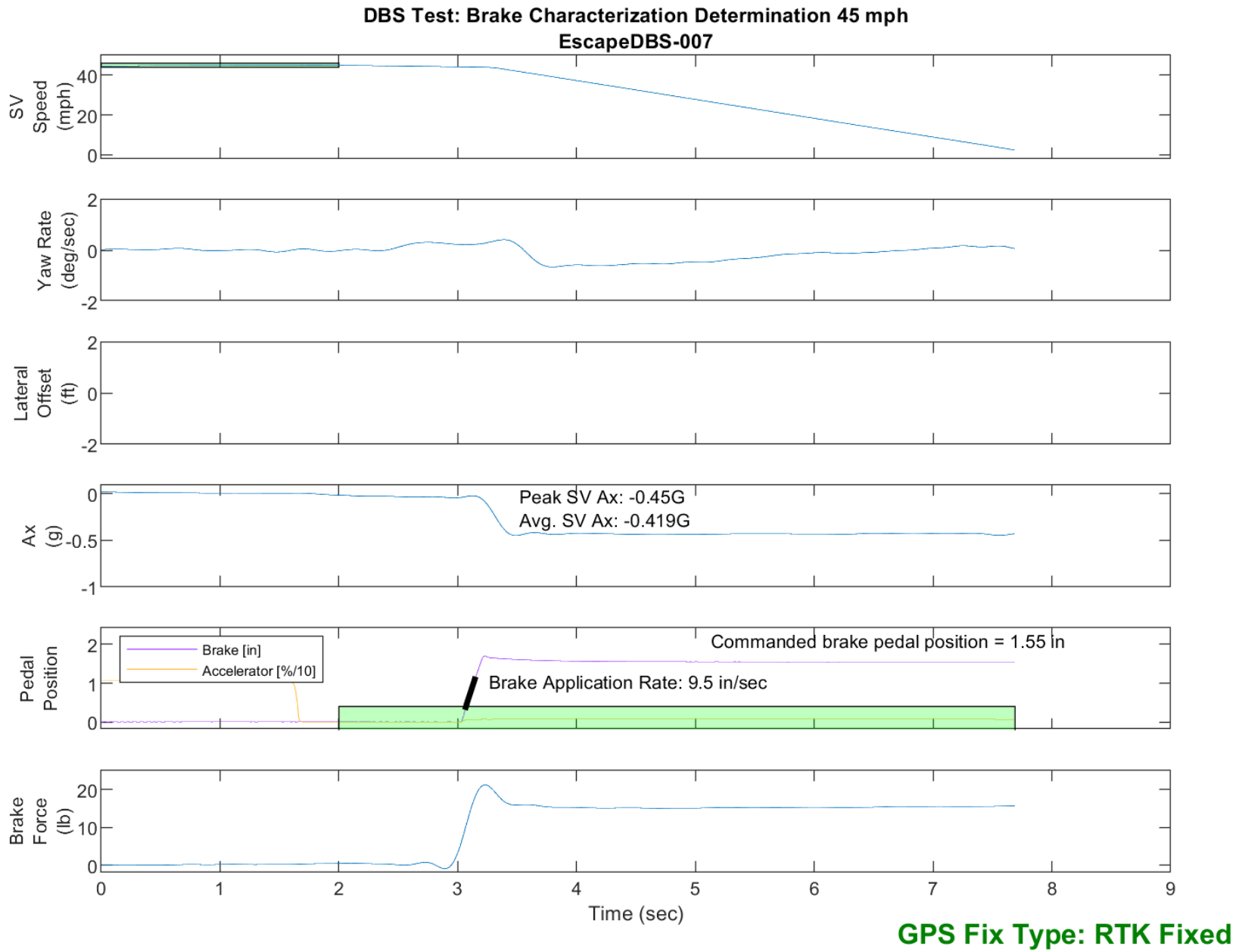


Figure E75. Time History for DBS Run 7, Brake Characterization Determination, Displacement Mode, 45 mph