National Transportation Safety Board

Office of Highway Safety

Washington, DC 20594

HWY23MH006

TECHNICAL RECONSTRUCTION

Group Chair's Factual Report

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A. CRASH

Location: Delray Beach, Florida
Date: February 8, 2023
Time: 8:06 PM (EST)

B. TECHNICAL RECONSTRUCTION GROUP

Group Chair	Eric Gregson NTSB, Technical Reconstructionist Washington D.C.
Group Member	Sergeant Matt Saraceni Delray Beach Police Department Delray Beach, Florida
Group Member	Officer Jesus Tabares Delray Beach Police Department Delray Beach, Florida

C. SUMMARY

For a summary of the crash, refer to the *Crash Information and Crash Summary Report* which can be found in the NTSB docket for this investigation.

D. FACTUAL INFORMATION

1.0 Introduction

On Wednesday, February 8th, 2023, the NTSB initiated an investigation of a highway-railroad grade crossing (grade crossing) collision which occurred on Lindell Boulevard in Delray Beach, Florida.[1] A 2015 Nissan Rogue had made a right turn onto westbound Lindell Boulevard from southbound Old Dixie Highway. The Nissan entered the grade crossing and stopped with the front wheels on the eastern rail of main track #1.

[1] The grade crossing is owned and operated by the Florida East Coast Railway and is identified by DOT grade crossing inventory #272498Y, at FEC mile post 319.36.

The intersection was controlled by two pole mounted signal heads for each direction of travel. The grade crossing was equipped with an active grade crossing warning system. The warning system consisted of flashing LED lights, two audible warning bells, two automated fiberglass gate arms, and a pedestrian warning system which also consisted of flashing LED lights and gate arms. As the Nissan was stopped, a Florida East Coast Railway (FECR) freight train traveling northbound on main track #2 traveled through the grade crossing. As the FECR freight train cleared the grade crossing a southbound Brightline commuter train, consisting of two locomotives and four passenger cars, traveling the opposite direction on the adjacent track entered the grade crossing, and struck the right front of the Nissan. The impact propelled the Nissan into a counterclockwise rotation redirecting it southeast across eastbound Lindell Boulevard.

NTSB investigators examined and documented the collision site and other roadway and environmental features using terrestrial and aerial photographs, and three-dimensional scanning. All photographs were taken in digital format. Recon3D application was used to provide a three-dimensional scanning to document the Nissan. A small Unmanned Aircraft System (sUAS) was used to document the crash grade crossing. The aerial photographs were processed through Pix4DMapper software to create a three-dimensional point cloud project for analysis.[2] Additional processing allowed the data to be exported for the use in various computer aided diagramming software to acquire additional dimensional data and created two-dimensional images of the highway environment. Delray Beach Police Department (DRBPD) investigators provided scene images to NTSB investigators.

This report provides details of observations and information regarding the evidentiary documentation process. Factual reports prepared by other investigative groups should be consulted for additional details.

2.0 Scene Information and Documentation

The collision occurred at FECR grade crossing inventory #272498Y located at mile post 319.36. The grade crossing intersected with Lindell Boulevard at a right

[2] Pix4DMapper is a photogrammetry software package designed to use overlapping photographic images to generate 3D point clouds. Additional outputs from the generated point clouds include 3D models and 2D orthomosaic maps.

angle. The FEC main tracks paralleled Old Dixie Highway. **Figure 1** is a map showing the area in Delray Beach where the crash occurred. (Figure 1)

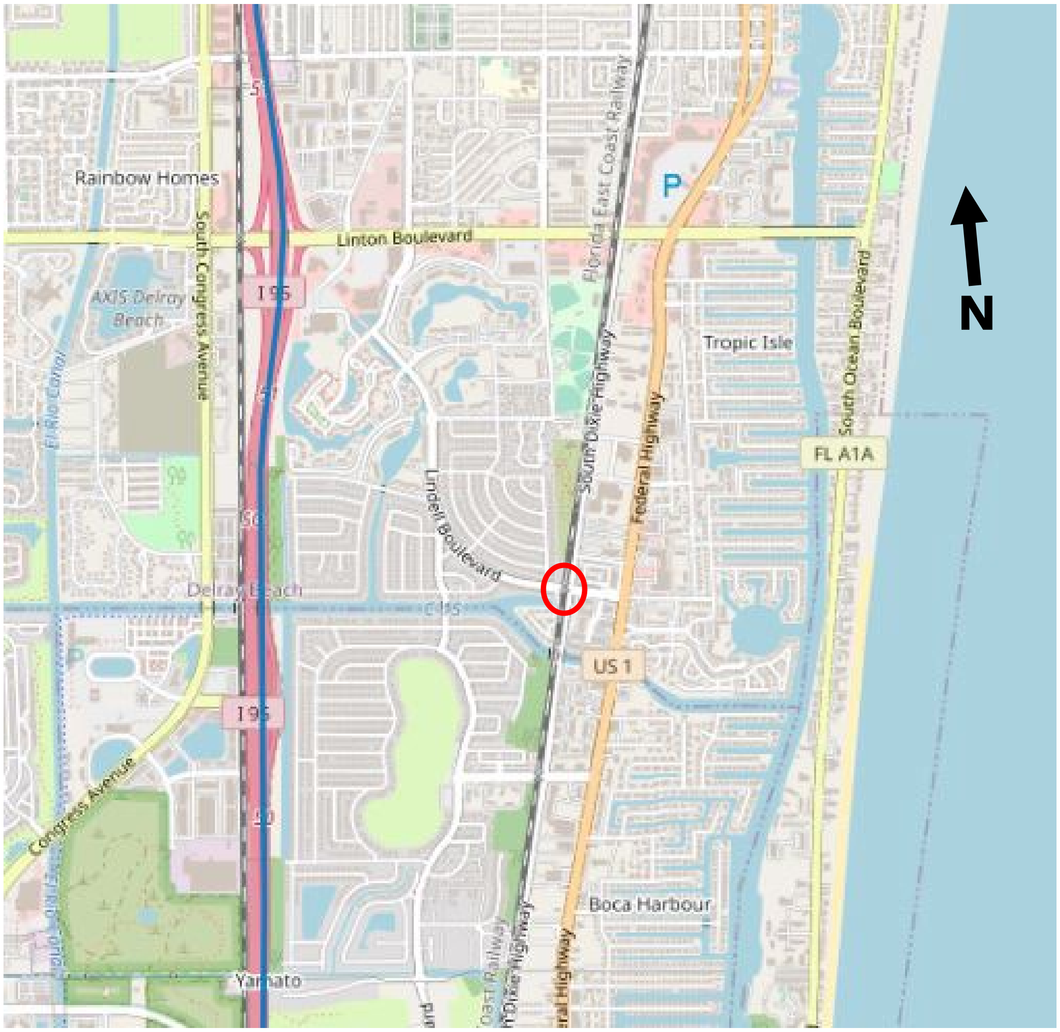

Figure 1. Map of Delray Beach focused on the intersection where the crash occurred which is withing the red circle. Map is for informational purposes only. (Source: Florida Department of Transportation)

Northbound Old Dixie Highway, south of Lindell Boulevard, consisted of two lanes, one northbound and one southbound. The northbound lane transitioned from one lane to two lanes approximately 127 feet south of the intersection. Pavement markings delineated the right turn only lane. Old Dixie Highway, north of the intersection, consisted of two lanes, one southbound and one northbound.

Lindell Boulevard traveled east and west. East of the intersection was four lanes, two lanes in each direction. At the intersection, the left lane was designated left turn only and the right lane was marked for straight and right turn. A crosswalk was present for pedestrians crossing Lindell Boulevard east of Old Dixie Highway.

Lindell Boulevard west of the intersection had three lanes, one lane for westbound traffic and two for eastbound traffic. East of the grade crossing was a 24-inch white stop line. The stop line identified the area for vehicles to stop while the grade crossing was active. The eastbound lane was separated into two lanes as indicated by pavement markings approximately 125 feet west of the intersection. The left lane was designated for left turns and continuing east. The right lane was designated for right turns and continuing east. Medians were located between the east and westbound lanes on both the east and west side of the grade crossing.

Sidewalks were contiguous with Lindell Boulevard west of Old Dixie Highway on the north and south sides. The sidewalks measured approximately 18 feet in length and 6 feet in width. As previously discussed, the grade crossing warning system included a pedestrian warning system. When the grade crossing warning activated, the pedestrian gate arms lowered simultaneously to prevent pedestrian traffic from crossing the tracks.[3] **Figure 2** is the orthomosaic image of the grade crossing as it was on February 10th, 2023.

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[3] Refer to the Railroad Signal and Highway Factors Factual in the Docket for further information.

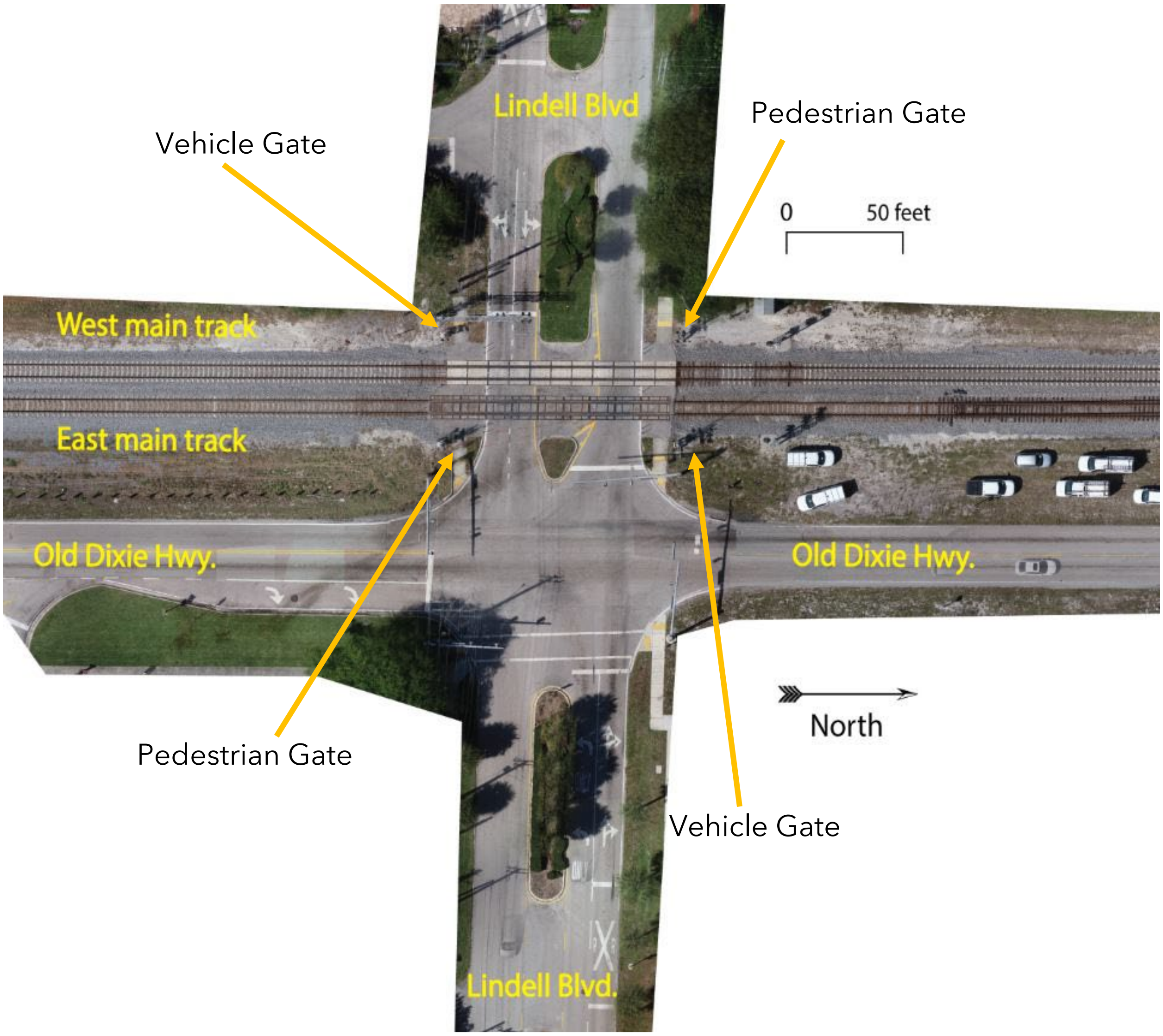

Figure 2. Orthomosaic of the grade crash grade crossing with the roadways and main tracks labeled.

2.1 Roadway Evidence Documentation

Tire friction marks, roadway surface scraping, and orange marking paint, were observed by NTSB investigators on the road surface. The evidence of impact originated on the east rail of the east main track and was approximately 20 feet west of the stop line and about 13 feet south of the westbound Lindell Boulevard white edge line. A tire friction mark initiated at the area of impact angling southeastward from the eastern rail at an angle of approximately 25° and measured about 12 feet in length. A second tire friction mark began in the same area as the first. The second mark paralleled the first one and measured about 2.6 feet in length. Both tire marks extended towards the median located east of the grade crossing. Evidence of scrape/gouge marks were observed on the west side curb of the median. As measured from the initial tire friction mark, a third tire mark began approximately 18 feet south and continued southeastward at an approximate 12° angle relative to the track. The fourth mark began about 27.5 feet south of the initial tire mark and extended southeastward for approximately 22 feet. The third and fourth marks paralleled each other and slightly diverged towards the end. The marks terminated at the edge of the roadway/curb along the south side of eastbound Lindell Boulevard. Again, scrape marks were observed along the height of the curb in line with the tire marks. Additional scrape marks were identified across the width of the sidewalk located at the southwest corner of the intersection. The scrape marks were in line with the described third tire mark and terminated at the final rest of the vehicle. The road surface evidence was consistent with impact and post-impact vehicle movement. No pre-collision roadway evidence was observed. **Figures 3 and 4** are photographic images taken by police investigators showing the roadway collision evidence that traveled southeastward from the area of impact.

The post-collision position of rest for the Nissan and train was determined through police photographs. **Figure 5** is a two-dimensional diagram of the intersection showing the final rest position of the Nissan.

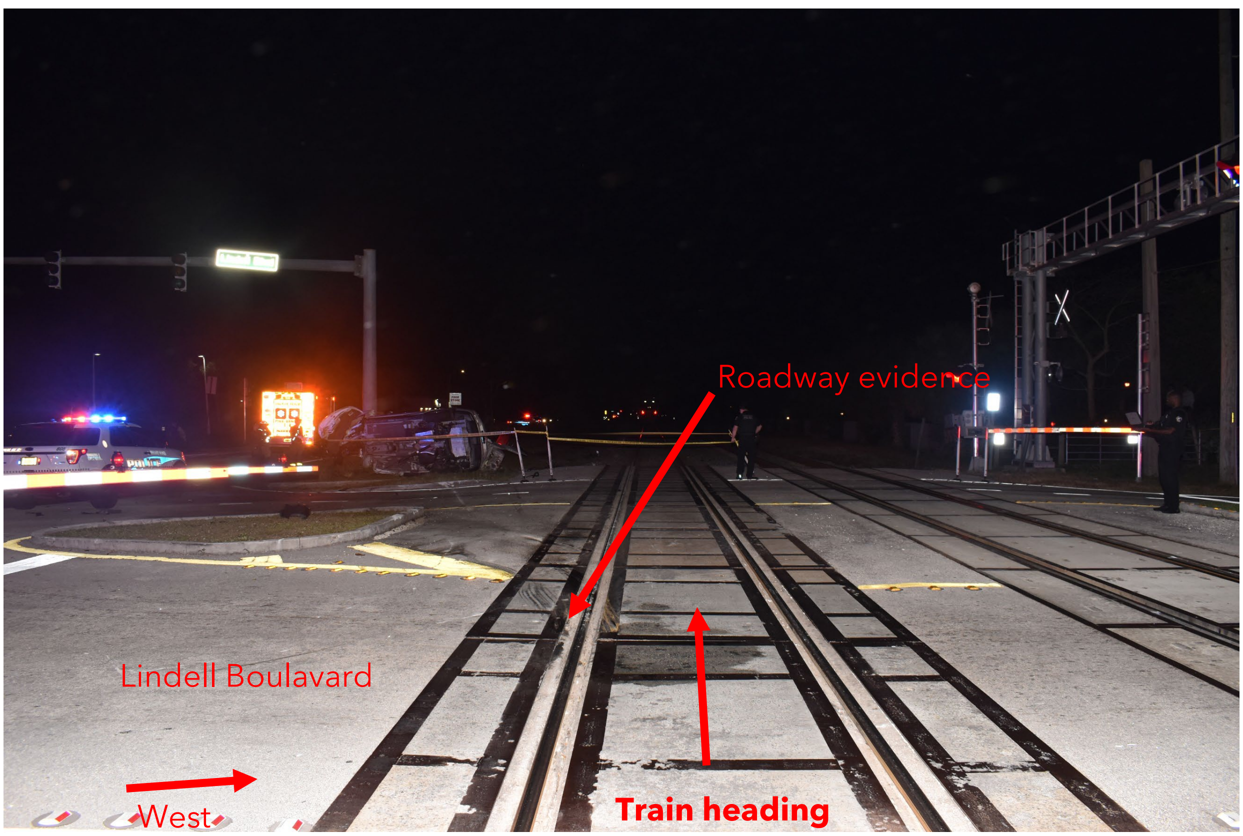

Figure 3. Modified photographic image taken by DBPD investigators showing the roadway evidence. The photograph was taken north of area of impact facing southeastward. The final rest to the Nissan is depicted in the distance.

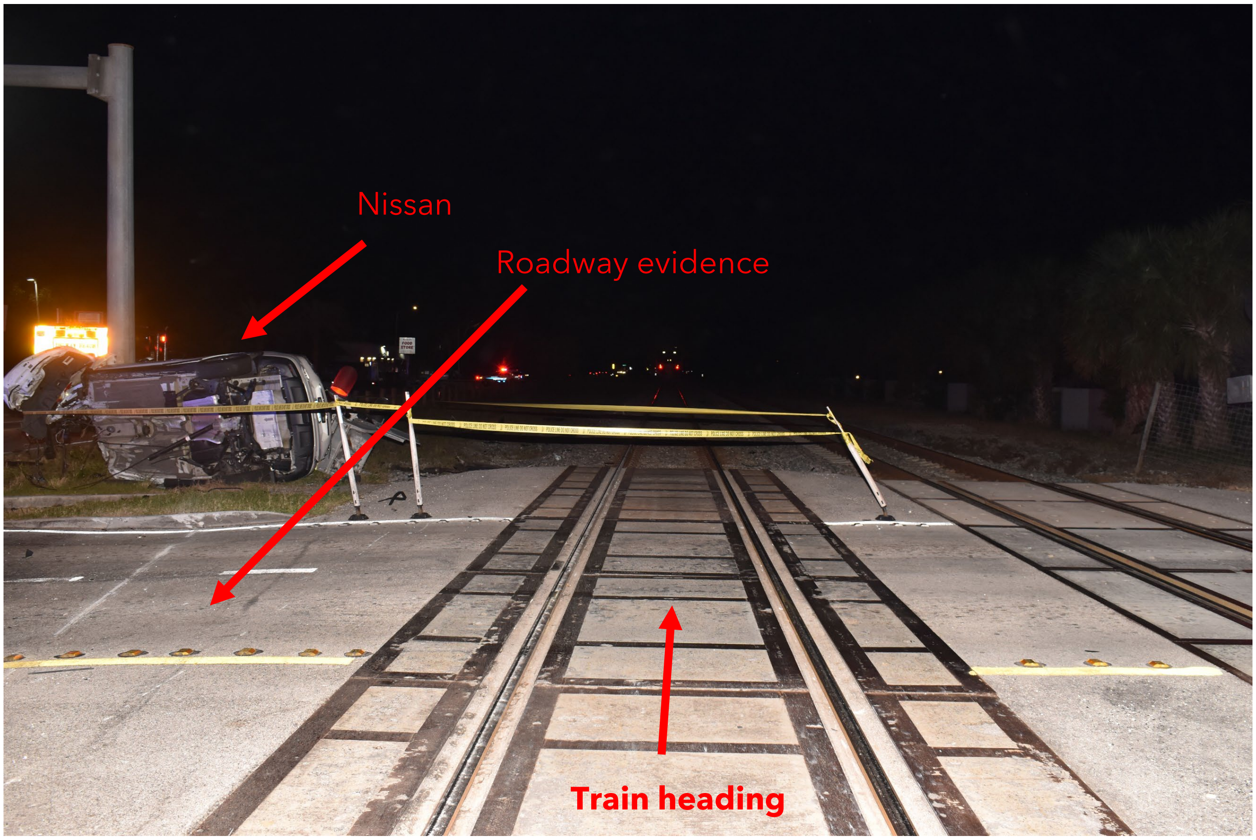

Figure 4. Modified photographic image taken by DBPD investigators showing the roadway evidence. The view is looking south with the evidence visible continuing southeastward.

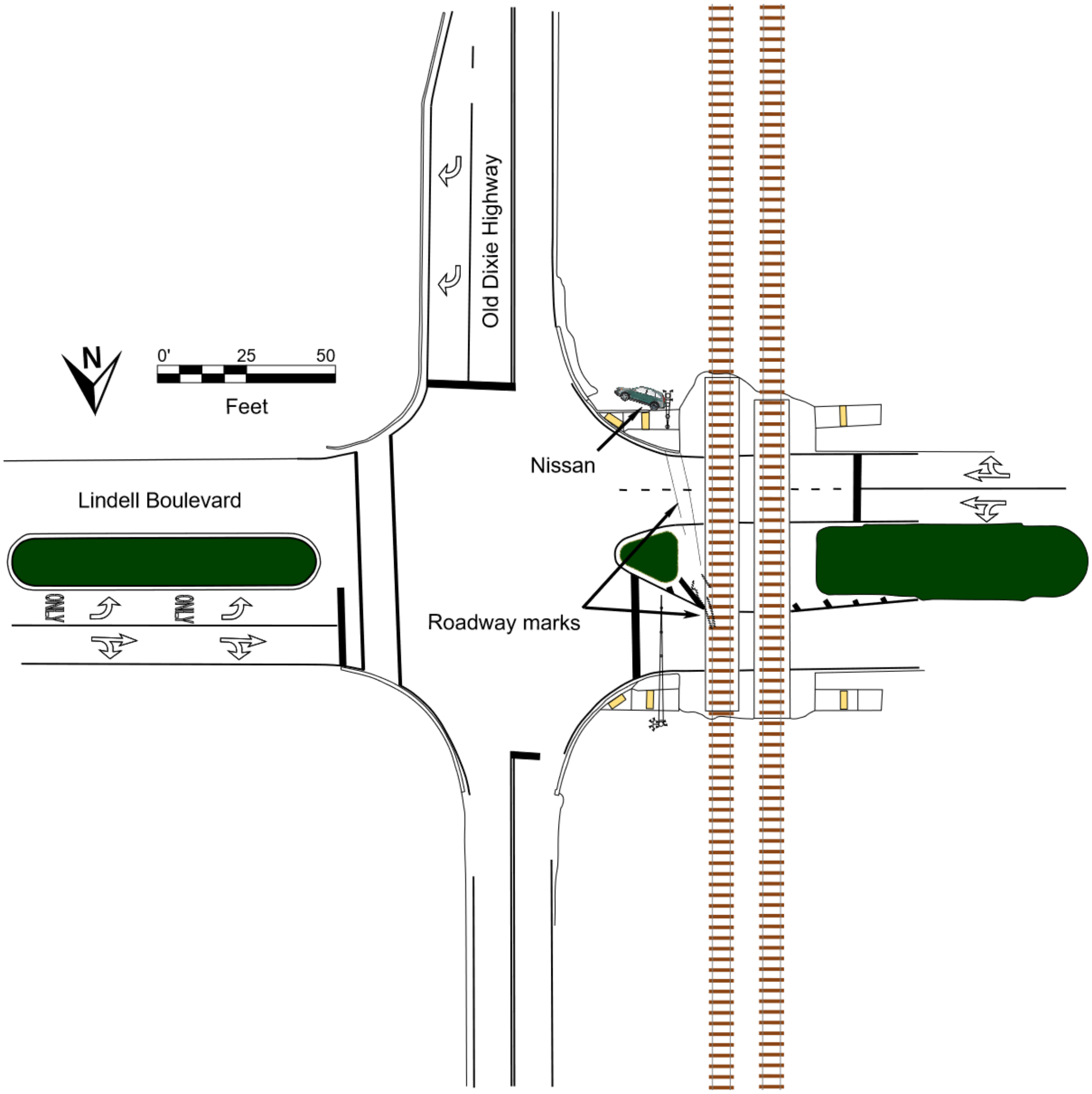

Figure 5. Two-dimensional diagram depicting final rest position of the Nissan following the collision event. Also displayed are the post-crash roadway marks.

3.0 Vehicle Damage

The collision involved a 2015 Nissan Rogue and a Brightline commuter train, consisting of two locomotives and 4 passenger cars. The Nissan was impounded by police investigators following the crash. Brightline moved the train to a Brightline maintenance facility. Both the Nissan and locomotive were made available to NTSB investigators.

3.1 2015 Nissan Rogue

The Nissan was identified by police investigators through forward facing video from the Brightline train, as stationary within the grade crossing at the time of the collision. The vehicle exhibited evidence of contact damage to the right-front and rear of the vehicle. The most substantial impact was on the front-right. The right fender, engine, axle assembly, and front grille were torn from the vehicle up to the firewall. Evidence of secondary contact was observed along the right-side. Exhibited within the damage to the right-rear door and right quarter-panel were areas of yellow-colored material transfer. The rear of the vehicle exhibited a passenger-side to driver side displacement. **Figure 6** depicts the observed material transfer on the door and quarter panel.

Figure 6. Image of the right side of the Nissan. Red arrows are pointing to the areas of yellow-colored material transfer.

Emergency responders removed the roof and rear hatch. The occupant supplemental restraint airbags had not been deployed.

At its position of final rest, the Nissan was on its right-side facing southeastward, positioned about 70 feet southeast of the area of impact and just over 15 feet off the roadway. **Figures 7** and **8** depict images of the three-dimensional point cloud from the scanning of the Nissan. **Table 1** provides a sampling of dimensional data for the Nissan.[4]

Table 1. Dimensional data for a 2015 Nissan Rogue.

	Inches	Feet	
Overall length	182	15.17	
Wheelbase	107	8.92	
Overall width	72	6.00	
Maximum height	66	5.50	
Curb weight			3,429 lbs.

Figure 7. Screen capture image showing 3D point cloud of Nissan as viewed from the right-side of the vehicle. The impact damage to the front is visible.

[4] Reference – 4N6XPRT Systems Expert AutoStats v6.2.1. See Factual Attachment – 2015 Nissan Rogue Vehicle Specs.

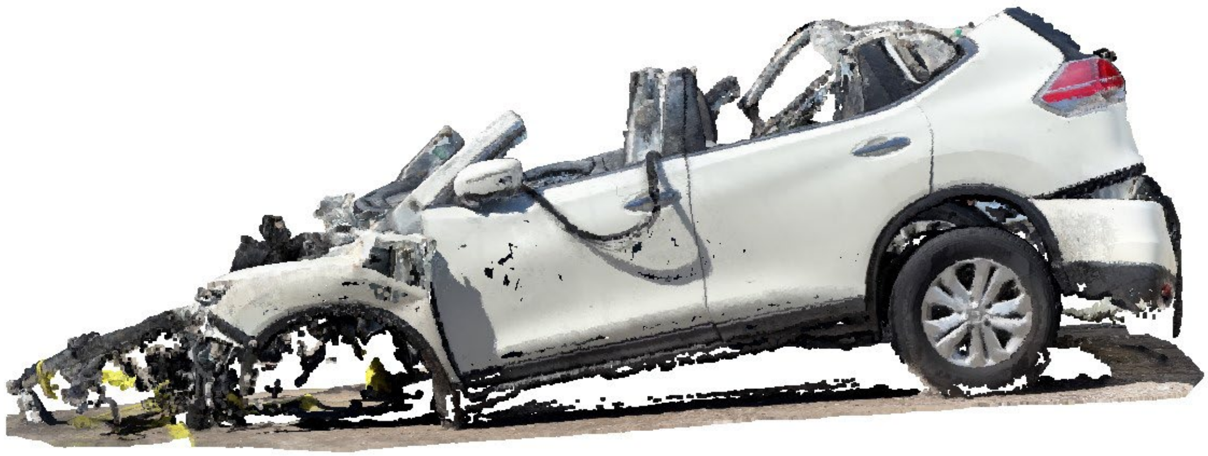

Figure 8. Screen capture image showing the 3D point cloud of the Nissan as viewed from the left-side of the vehicle.

3.2 Brightline Locomotive

The locomotive that collided with the Nissan was identified as a Siemens Diesel-Electric SCB-40, unit number 108. Production of the locomotive began in 2016. **Table 2** provides certain dimensional data for the locomotive.[5]

Table 2. General dimensional specifications for lead locomotive.

Siemens Diesel-Electric SCB-40	
Weight	264,556 lbs.
Total length	71.5 ft
Width	10 ft
Wheel Diameter	44 in
Wheelbase	9.8 ft
Height	12.5 ft

Figure 9 is a photograph of the locomotive and consist at final rest showing the overall damage. Scene photographs taken by DBPD show that the contact damage was to the front nose cone and lower left-front of the locomotive. The left-side of the nose cone exhibited displacement rearward, and the front-left corner exhibited displacement inward from left to right. There were several tears noted in the sheet metal along with scrapes and scars. A second area of damage was noted aft

Figure 9. Image depicting damage to the front and left side of the locomotive. View of the photograph is looking northwest. (Source: DBPD revised)

[5] "Charger Diesel-Electric Locomotive: All Aboard Florida". Siemens Mobility. 2014.

of the left side door. The DBPD photograph depicted an area within the yellow paint that had been scraped and scuffed.

Figure 10. Image of the left side of locomotive looking southwest. Area of second impact circled in red. Inset in lower left corner enlarged image of area circled in red. (Source: DBPD revised)

Figure 10 depicts the left-side of the locomotive looking southwest. The inset photograph is an enlarged image of the area circled in red, secondary impact.

Following the crash, the locomotive was moved to a Brightline facility in West Palm Beach, FL. When NTSB investigators inspected the locomotive on February 11th, 2023, repairs to the train were underway. The extent of the repairs was documented via terrestrial photography. The nose cone had been removed and was located with the locomotive. Evidence of repair was observed along the left-side of the locomotive. The damaged sheet metal along the lower portion, below the doorstep and forward of the left-side door, had been removed and a new piece of sheet metal had been attached. The lower doorstep was also removed. Paint repairs were visible to the yellow area aft of the left side door. **Figure 11** is an image showing the repairs that were made prior to the inspection by NTSB employees. The main areas are circled in green.

Figure 11. Image showing the left front and left side of crash locomotive. Areas circled in green are areas of repair prior to the inspection.

4.0 Passenger Vehicle's Electronic Crash Data

Light duty vehicles (GVWR of 3,855 kg/8,500 pounds or less) manufactured on or after September 1, 2012, if equipped with an event data recorder must comply with rules enacted under 49 Code of Federal Regulations Part 563. As defined by Part 563, an event data recorder (EDR) means a device or function in a vehicle that records the vehicle's dynamic time-series data during the time period just prior to a crash event (e.g., vehicle speed vs. time) or during a crash event (e.g., delta-V vs. time). The regulation further describes the data elements, sample rate, range, accuracy, and resolution. The EDR is generally contained within the supplement restraint system (SRS) module – typically referred to as airbag control module (ACM). The ACM processes information from peripheral and internal sensors. When an acceleration or deceleration threshold is met, the EDR is triggered to record the associated event.

The ACM is powered by the vehicle's power system thusly; power to the ACM is necessary for the ACM to receive data from the vehicle sensors and deploy the vehicles supplement restraint systems. The ACM contains an energy reserve capacitor, in the event of a catastrophic power loss, or loss of battery power the power stored in the capacitor deploys the required supplemental restraints. After deployment of the SRS any residual power remaining in the capacitor is utilized to write the EDR data to the EEPROM.[6] In the event a vehicle is powered off (i.e. driver has turned the ignition to off) and a crash occurs, no data has been communicated over the vehicle Controller Area Network (CAN bus). As a result, there is no power to the ACM and thusly no power in the energy reserve capacitor resulting in the ACM not detecting the crash event and subsequently no SRS deployments.

4.1 2015 Nissan Rogue

Investigators from DBPD were able to access and image the Nissan's ACM using a direct-to-module download method. The data from the EDR utilizing the Bosch Crash Data Retrieval tool and software version 23.0. As the data was imaged from the EDR it was simultaneously interpreted by the CDR software and an output file was generated in a user readable format. DBPD investigators provided the NTSB with a copy of the 6-page EDR report.[7] **Figure 12** is a screenshot of the CDR File Information.

CDR File Information

User Entered VIN	5N1AT2MV7FC785441
User	C. Reed
Case Number	23001924
EDR Data Imaging Date	02/10/2023
Crash Date	02/08/2023
Filename	23-001924 ROGUE.CDRX
Saved on	Friday, February 10 2023 at 10:40:06
Imaged with CDR version	Crash Data Retrieval Tool 23.0
Imaged with Software Licensed to (Company Name)	Delray Beach Police Department
Reported with CDR version	Crash Data Retrieval Tool 23.0
Reported with Software Licensed to (Company Name)	Delray Beach Police Department
EDR Device Type	Airbag Control Module
Event(s) recovered	None

Figure 12. Image from the CDR report provided by the DBPD investigators showing the CDR File Information.

4.2 Brightline and FECR Locomotive

NTSB investigators obtained an event recorder file and an outward facing video from the Brightline locomotive as well as the FEC locomotive. The outward facing video obtained from the northbound FEC freight train showed the Nissan stopped within the grade crossing with the front wheels atop the eastern most rail of the east main track. Looking north of the grade crossing the front lights of the

[6] Electrically Erasable Programmable Read Only Memory.
[7] See Technical Reconstruction Attachment – 2015 Nissan Rogue EDR Report

Brightline locomotive are visible. **Figure 13** is an image captured from the FECR locomotive outward facing video.

49 Code of Federal Regulation 229.135 mandates that a train operated faster than 30 mph shall have an event recorder in the lead locomotive. It further states that the event recorder may be located elsewhere provided it monitors and records the required data.[8] The Brightline train event recorder captured several operating parameters such as, but not limited to, distance, time, speed, throttle, brake pipe pressure, and brake cylinder pressure. The information obtained was forwarded to the NTSB Office of Research and Engineering Video and Recorders Division for processing.[9]

Figure 13. Image from the outward facing camera of the northbound FEC freight train locomotive. The Nissan can be seen stopped on the east side rail and north of the grade crossing the light of the Brightline locomotive are visible. (Source: FECR)

[8] 49 Code of Federal Regulation 229.135.

[9] Refer to the Office of Research and Engineering Recorders Report in the Docket for further information.

E. LIST OF ATTACHMENTS

Technical Reconstruction Attachment – 2015 Nissan Rogue EDR Report
Technical Reconstruction Attachment – Nissan Rogue Vehicle Specifications

Submitted by:

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