National Transportation Safety Board
Office of Highway Safety
Washington, DC 20594

HWY24FH002

FACTUAL REPORT OF INVESTIGATION

Group Chair's Factual Report

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Location: Melbourne, Brevard County, Florida
Date: January 12, 2024
Time: 12:51 p.m. EST

B. FACTUAL REPORT OF INVESTIGATION GROUP

Group Chair	Eric Gregson Highway Investigator NTSB - OHS
Group Member	Kenneth Bragg Investigator-In-Charge NTSB - OHS
Group Member	Gregory Scott Rail Accident Investigator NTSB - RPH
Group Member	Michael Bachmeier Rail Accident Investigator NTSB - RPH
Group Member	Bill Young Chief Engineer Signals and Communications Florida East Coast Railway
Group Member	Michael LeFevre Vice President, Operations Brightline

C. CRASH SUMMARY

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

D. DETAILS OF THE INVESTIGATION

This report presents an investigation into a highway-grade crossing crash that occurred on January 12, 2024, on WH Jackson Street in Melbourne, Florida. It also includes information concerning a prior crash that occurred at the same location two days earlier on January 10, 2024.[1] Both crashes involved similar actions in which a highway vehicle drove around lowered gate arms at the crossing. The report begins with an overview of prefatory data, including the crash location, crash history at the grade crossing, rail traffic volume, and the construction history of the double tracks. A detailed examination of signal-related factors follows, covering the signal system's design and operation, the highway-rail grade crossing warning system, data logs, inspections and testing of the warning system, damage to the railroad traffic control signal system, and relevant grade crossing regulations and industry standards. The report also addresses highway-related factors, such as the geometry and lane designations of the grade crossing, posted speed limits, the grade crossing protection system at WH Jackson Street, and average daily traffic. Subsequently, it provides a description of evidence documented at the scene, including information from the two involved vehicles and the two locomotives. Finally, the report concludes with an assessment of the drivers' backgrounds, license histories, performance, witness statements, and environmental conditions.

1.0 Crash Location

Figure 1 is a crash map that illustrates the crash location was located at GPS coordinates latitude 28.071469 and -80.601783 longitude.

[1] The January 12, 2024 crash is assigned NTSB investigation number HWY24FH002. Information detailing the events of the January 10, 2024 crash, which occurred at the same location is provided as supplemental information and is not assigned an individual investigation number.

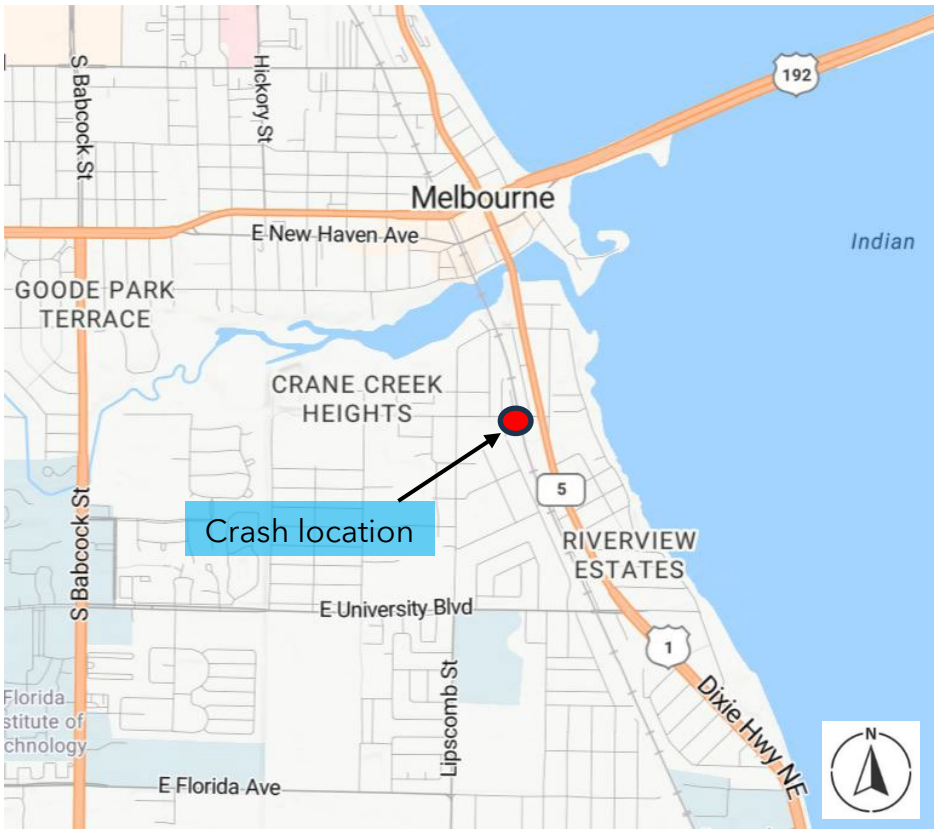

Figure 1. Crash map (Source: Bing maps revised).

2.0 Grade Crossing Crash History

Table 1 summarizes the crash history at the grade crossing from 1975 through present-day.

Table 1. Crash history at the grade crossing.

Date	Fatalities	Injured	Track #	Narrative
4/1/2006	1	0	Main	Pedestrian crawled under stopped train that began to move while pedestrian was still under train
3/8/2005	1	0	Main	Bicyclist pedaled around lowered gats in attempt to beat train. Train was unable to stop in time
2/8/1981	0	0	Main	None

3.0 Rail Volumes

Prior to Brightline service, the approximate rail volume at WH Jackson Street crossing was 14 FECR trains per day; 7 northbound and 7 southbound. The approximate rail volume after Brightline service was added at the WH Jackson Street crossing is 32 Brightline passenger trains per day and 14 FEC freight trains per day.

4.0 Construction History of Double Tracks

The double track through the WH Jackson Street grade crossing was placed into service on June 4, 2023. The Florida East Coast Railway (FECR) was originally double track and was reduced to single track with passing siding sometime in the late 1970's and early 1980's. The double track was added back to the railway to accommodate the Brightline service. [2]

E. RAILROAD SIGNAL FACTORS

1.0 Florida East Coast Railway

The Florida East Coast Railway (FECR) extends from mile post (MP) 0.0 Jacksonville Drawbridge to MP 369.2 Hialeah Yard in a timetable north-south direction. The subdivision consists of two main tracks. [3] The maximum authorized timetable speed for the subdivision is 60 miles per hour (mph) for freight trains and 110 mph for passenger trains. The maximum speed at the accident location is 60 mph for freight trains and 79 mph for passenger trains.

1.1 Description of Signal System

The FECR controls train movements from Jacksonville to Miami with a Centralized Traffic Control (CTC) system, which includes the crash. Train movements are coordinated by the North Desk train dispatcher located at Dispatch Center in Jacksonville, FL. Train movements on the FECR line are governed by operating rules, special instruction, timetable instructions, and the signal indications of the traffic control system. The FECR centralized traffic control system was not affected, nor did it sustain any damage from the collisions.

The signal system uses direct current (DC) Track Circuits interfaced with an Electro Code coded circuit on the rail for train occupancy detection. Wayside signals are colored light signals with upper and lower signal heads capable of displaying green, yellow, and red to direct train movements in either direction. Locomotives are also equipped with a 40hz cab signal that communicates track status and condition to the crew of the locomotive.

2.0 Highway-Rail Grade Crossing Warning System

The FECR double main track runs through the City of Melbourne, FL. At MP 194.4, the FECR two main tracks and two-lane WH Jackson Street crossed at grade. The grade crossing inventory number was DOT # 272142R. The highway-rail grade crossing was equipped with an active grade crossing warning system. The grade

[2] Construction began on the double track in 2020, and service started in 2023.
[3] Florida East Coast Railway Timetable No. 9, effective August 23, 2023.

crossing warning system consisted of flashing LED light units, two warning bells and two gate arms mounted on two signal masts and arranged to provide warning for all directions of highway traffic. The gate arms extended across incoming lanes of the WH Jackson Street grade crossing to the centerline for each direction of traffic. The grade crossing warning system also included a pedestrian warning system which consisted of flashing LED light units to provide warning for all directions of pedestrian traffic. The gate arms extended across all incoming sidewalks along WH Jackson Street. The grade crossing warning system operated on commercial electric power and was equipped with a standby battery backup system.

Train detection and warning system activation was configured through an Alstom Grade Crossing Predictor (GCP), model XP-4, microprocessor unit. The crossing was equipped with a primary and standby GCP unit. Each GCP unit was configured in a semi bi-directional mode. The GCP unit was a constant warning device and could calculate the speed of an approaching train. The GCP unit provided a relatively uniform warning time, but the time could fluctuate slightly due to changing ballast and track conditions or variances in the speed of an approaching train.[4] The warning devices were configured to provide above the minimum warning time of 20 seconds, which was required by the Federal Railroad Administration (FRA) and recommended by the Manual on Uniform Traffic Control Devices (MUTCD) for all train speeds up to 79 mph.

2.1 Highway-Rail Grade Crossing Warning System Data Logs

The GCP unit at the WH Jackson Street crossing was equipped with a data logger. The data event recorder provided the capability to record information associated with the previous train movements through that location. The data log contained the date and time of train movements, the detected train speed, the average train speed, and island speed. The log could also retain any error alarms detected by the microprocessor.

During the January 10, 2024 crash, the WH Jackson Street crossing protection devices were activated at 14:59:43p.m. by the northbound Brightline train. Based on the warning device logs, the northbound Brightline train was traveling on the west track and activated for 32 seconds before the train occupied the island circuit. [5]

During the January 12, 2024 crash, the WH Jackson Street crossing protection devices were activated at 12:50:16 p.m. by the southbound Brightline train. Based on the warning device logs, the southbound Brightline train was traveling on the east track and activated for 32 seconds before the train occupied the island circuit.[6] The warning time is discussed under the *Railroad and Traffic Signal Time* section.

[4] If the ballast becomes saturated with water or mud it can cause less resistance between the rails and cause the reported time to fluctuate slightly.
[5] Recorder time was in advance by one hour of actual time. Explained on page 8.
[6] The island circuit is the grade crossing area where the pavement is located.

The data log for the WH Jackson Street crossing contained multiple data log entries. A post-accident review of the data found all warning times to be in accordance with the minimum requirements. There were no error alarms detected in this incident.

Figure 2. Video screen shots of accident vehicles driving around horizontal crossing gates (edited Ring video screen shots).

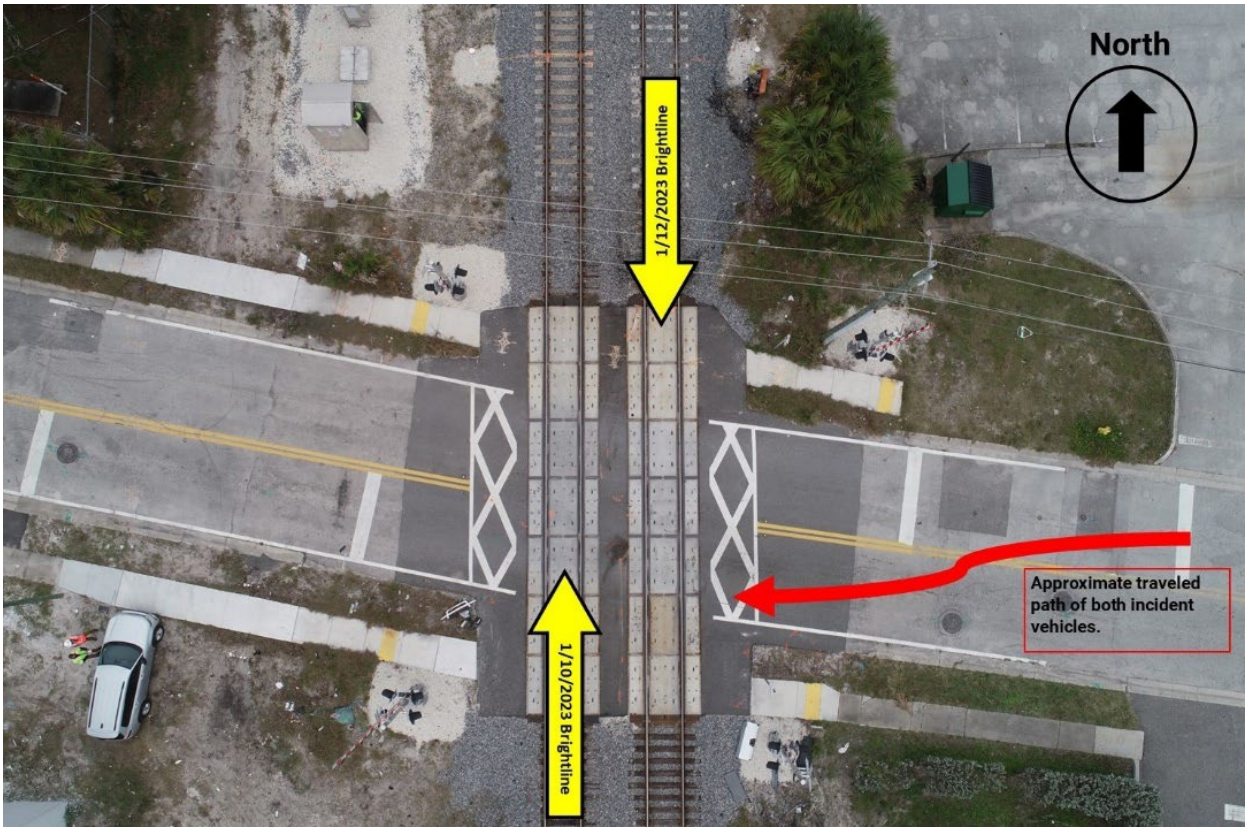

Figure 3. Traveled path of both accident vehicles (edited drone photo).

2.2 Inspection & Testing of Grade Crossing Warning System

Following the January 10, 2024 crash, FECR secured the crossing signal bungalow. On January 11, 2024, representatives from the FECR and the FRA performed a post-accident inspection of the highway-rail grade crossing warning system at WH Jackson Street and found no discrepancies. Following the January 12, 2024 crash, FECR secured the crossing signal bungalow and performed a post-accident inspection of the highway-rail grade crossing warning system at WH Jackson Street and found no discrepancies. The post-accident testing performed after both incidents were found to be within compliance of FRA rules and regulations. Their investigation also found the signal bungalow and all flashing light units were locked and secured with no evidence of vandalism or tampering.

2.2.1 Track Circuits

Track components and connections were inspected, and the approach track circuits were verified.[7] Approach track circuits extended from the WH Jackson Street crossing in both track directions. The northbound and southbound approach track circuit are set to a semi bi-directional configuration that also includes external Dax units.[8] With this configuration the approach lengths were 4,387 feet for train speeds up to 79 mph, in accordance with the signal circuit plans for that location.

2.2.2 GCP Microprocessor Unit

The signal circuit plans for the WH Jackson Street grade crossing indicated the GCP unit was configured to provide above the minimum 20 seconds of activation warning time.[9]

The post-accident inspection found the WH Jackson Street grade crossing warning system to be operating on the normal segment of the GCP unit that is equipped with a normal and standby unit. If an issue were to be detected with the normal portion of the GCP it would automatically switch to the standby unit as a backup attempt to recover from the problem issue.

The clock time of the GCP unit was verified with the FECR Dispatch Center clock. The GCP unit clock was ahead of the Dispatch Center time by 1 hour for the first accident that happened on January 10, 2024. The FEC corrected the clock discrepancy after the first accident and the clock time was correct for the second accident on January 12, 2024. The program configuration of the GCP microprocessor was recorded and verified against the programming parameters on file by FRA inspectors

[7] A track circuit is also known as a shunt circuit.
[8] Dax is a Downstream Adjacent Crossing. Crossing predictors communicate with each other, to instruct downstream adjacent crossings to activate their warning devices.
[9] Title 49, Code of Federal Regulations, Part 234.225, Activation of Warning Systems.

during the investigation. No discrepancies were identified in the programming parameters of the GCP unit.

2.2.3 Gate Arms

Post-accident testing measured the start of the descent time for the gate arms to be about 3 seconds after the flashing light units were activated. The gate arms assumed a horizontal position approximately 9 seconds after the flashing light units were activated.

2.2.4 Flashing Light Units

Post-accident insulation resistance tests were completed for the lighting cables from the signal bungalow to the signal masts. Testing determined the flashing light units were operating at 60 flashes per minute. Lamp voltage measurements were taken with the warning devices operating on primary commercial power and on the standby battery backup system. The average lighting circuit voltages measured 12.6 volts DC on standby power.

2.3 Railroad Traffic Control Signal System Damages

The FECR highway-rail grade crossing warning system was not damaged in either crash.

3.0 Grade Crossing Regulations and Industry Standards

FRA regulations specified a minimum warning time in Title 49, Code of Federal Regulations, Part 234.225, Activation of Warning Systems, which stated:

A highway-rail grade crossing warning system shall be maintained to activate in accordance with the design of the warning system, but in no event shall it provide less than 20 seconds warning time before the grade crossing is occupied by rail traffic.

The 2023 edition of the MUTCD recommended national uniformity in traffic control devices. To provide for uniformity, the MUTCD was the adopted national standard for traffic control devices. The MUTCD provided guidance through its recommended standards regarding flashing light units, gates, and traffic control signals.

The American Railway Engineering and Maintenance-of-Way Association (AREMA), Communication and Signal Manual of Recommended Practices recommends the addition of buffer times and equipment response times to the warning time to accommodate assurance of providing the minimum required warning time.

4.0 Maximum Authorized Speeds along the Brightline System

Figure 4 illustrates the general segments of the maximum authorized speeds along the Brightline System. The general segments included the following:

- From Miami to West Palm Beach the maximum authorized speed was 79 mph.
- From West Palm Beach to Cocoa, Brightline has a maximum authorized speed of 110mph.
- From Cocoa to Orlando, Brightline has a maximum authorized speed of 125 mph.
- Extension from Orlando to Tampa, Brightline plans are estimated to be 125 mph.

F. HIGHWAY FACTORS

1.0 Speed Limit on WH Jackson Street

There were no speed regulatory signs posted along WH Jackson Street. In the City of Melbourne, the speed limit on all streets within the city, except where otherwise designated by official traffic control devices, is 30 mph.[10]

2.0 Speed Statistics

The most recent speed study on WH Jackson Street prior to the crash occurred between May 23, 2017, and June 8, 2017. The speed study was conducted at the intersection of Grant Street and WH Jackson Street and included all classes of vehicles. Figure 4 is a chart showing the number of vehicles within each speed range during the speed study. The maximum and minimum reported speeds were 49 and 5.1 mph respectively.[11]

[10] Melbourne, Florida – Code of Ordinances, Chapter 56, Section 56-2.
[11] See Factual Report Attachment – WH Jackson St Speed Statistics.

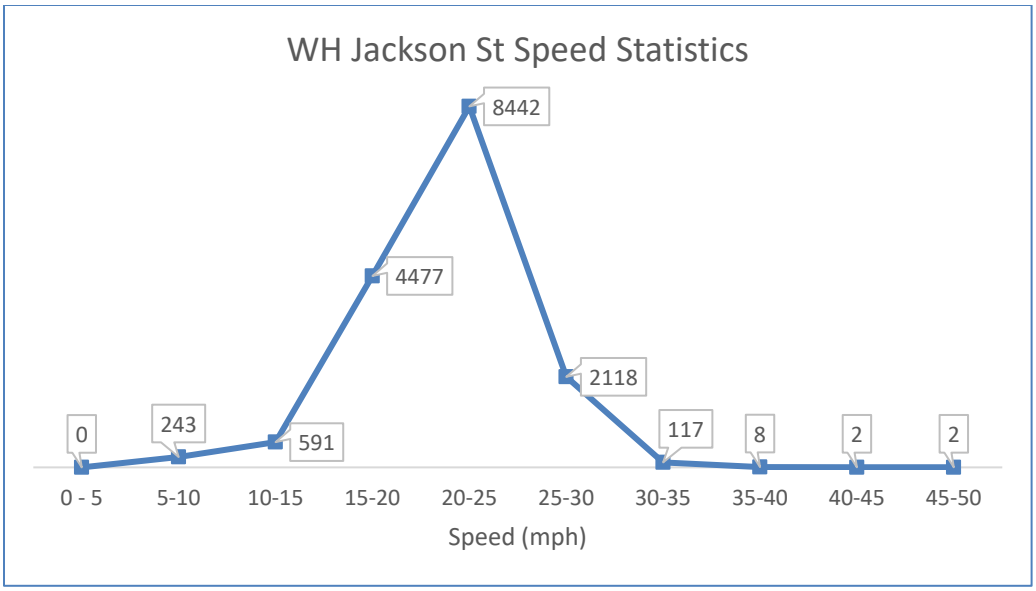

Figure 4. Chart depicting the number of vehicles in each speed range.

3.0 Daily Traffic Volumes

In conjunction with the speed study, the daily traffic volumes were reported.[12] The traffic study began on May 23rd, 2017, and concluded on June 8th, 2017. The daily number of vehicles was reported in 15-minute increments. The average number of vehicles at 2:00 pm on Wednesdays was approximately 17. The average number of vehicles at 12:51 pm on Fridays was approximately 18.

4.0 Typical Section

WH Jackson Street was an undivided roadway consisting of two travel lanes, one in each direction, each measuring approximately 12-feet wide. The roadway intersected with the highway-rail crossing at an approximate 98-degree angle. The travel lanes were separated by two 6-inch-wide solid yellow lane lines. The highway-rail grade crossing was located approximately 265-feet west of the intersection between WH Jackson Street and Harbor City Boulevard. Because the highway-rail grade crossing is more than 200-feet from the signaled intersection, there was no requirement for pre-emption and priority control of the traffic signal as recommended by the Manual on Uniform Traffic Control Devices (MUTCD).[13]

[12] See Factual Report Attachment – WH Jackson St. Vehicle Count

[13] Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways, Federal Highway Administration, 2009 Edition, Part 8 Traffic Control for Railroad and Light Rail Transit Grade Crossings, page 776.

5.0 WH Jackson Street Signage and Pavement Markings

Along both the east and westbound approaches approximately 97-feet prior to the highway-rail grade crossing were W10-1 Grade Crossing Advanced Warning signs. There were four, R8-8, Do Not Stop on Tracks signs were posted on the right-hand side of each travel lane on both the near and far sides of the highway-rail grade crossing.

Grade crossing pavement-marking symbols were located on the roadway in the eastbound and westbound travel lanes. Each pavement marking was located approximately 97 feet from the nearest rail. There were two 24-inch-wide white stop lines for each approach (east, west) located approximately 25-feet and 32-feet respectively, from the nearest rail. Additionally, two 4-inch-wide white lines extended across the roadway on each side of the highway-rail grade crossing identifying the dynamic envelope.[14] The markings were located approximately 10-feet from the nearest rail and contained transverse markings. Figure 5 is an overhead image of the WH Jackson grade crossing depicting the signage and pavement markings.

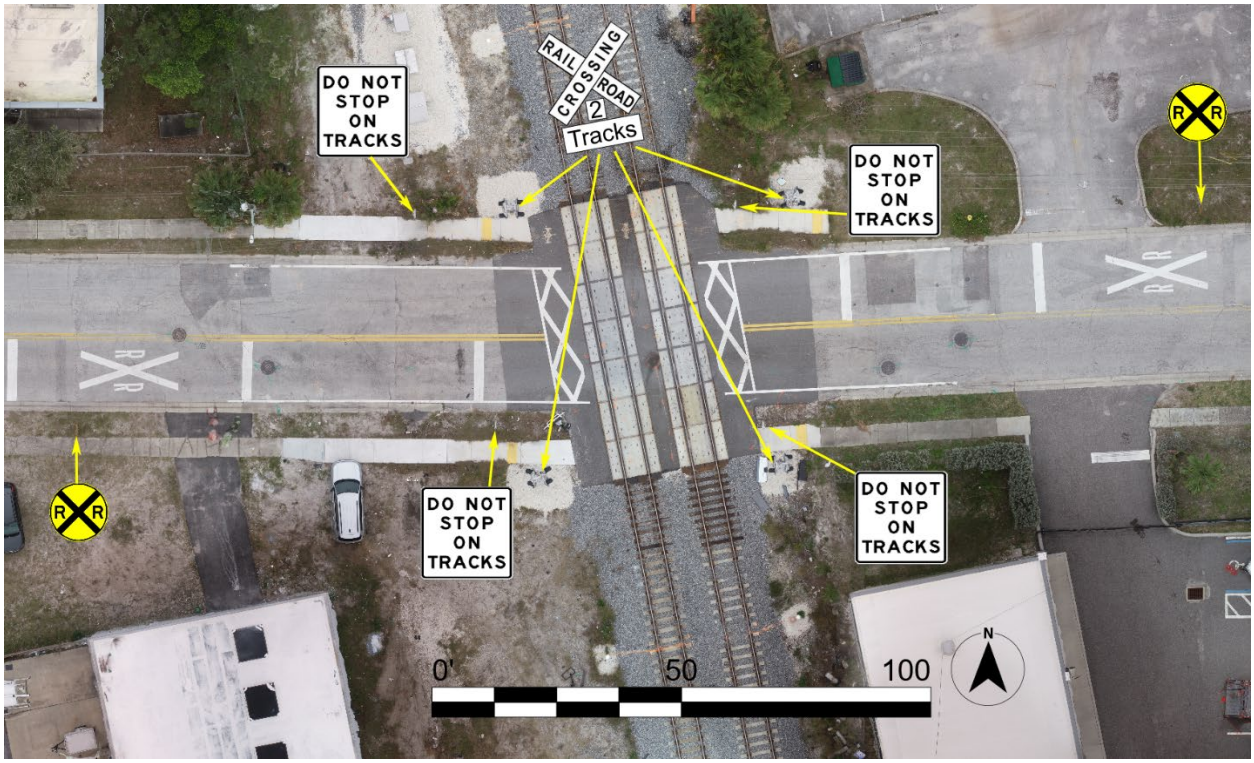

Figure 5. WH Jackson highway-rail grade crossing related signage.

[14] The dynamic envelope is a clearance envelope which considers not only the size and shape of the rail vehicles, but also the overhang and sway of the vehicles moving along the tracks. Highway-Rail Crossing Handbook, 3rd Edition, FHWA 2019.

5.1 2-quadrant gate system at the WH Jackson Street grade crossing

The WH Jackson grade crossing has a 2-quadrant gate system with flashing lights, facing each approach and exit of the grade crossing, with bells, and gate arms with opposing pedestrian gates.

5.2 Raised Delineators Section

On January 19, 2024, following the two crashes, Brightline received a right-of-way use permit from the City of Melbourne to install centerline delineators along WH Jackson Street east and west of the grade crossing. [15] Figure 6. Screen capture of the generated orthomosaic with depicting the added raised delineators. the location of the delineators.

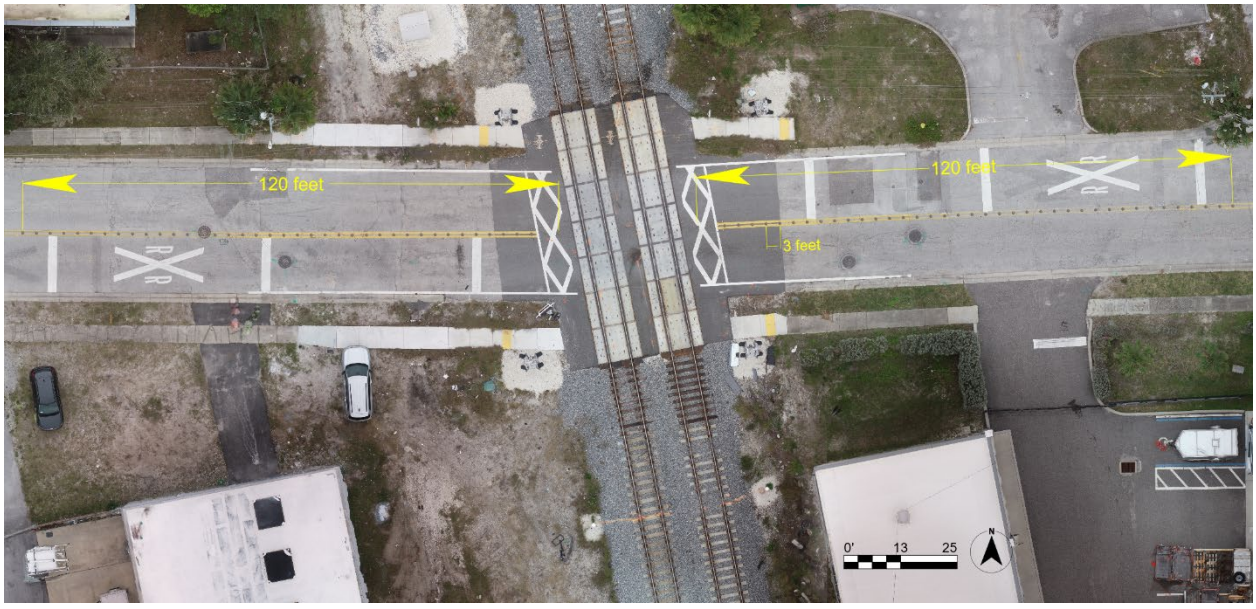

Figure 6. Screen capture of the generated orthomosaic with depicting the added raised delineators.

G. UAS DOCUMENTATION

The Unmanned Aerial System (UAS) was deployed during the on-scene investigation to document the roadway, grade crossing, and evidence through a series of aerial images. The following sections will discuss the documentation process and resultant processing of the data.

[15] See Attachment – City of Melbourne Right-of-Way Use Permit

1.0 Equipment

Mapping and imagery flights were conducted on January 14th, 2024, using the NTSB DJI Phantom 4 Professional Advanced drone. The drone is equipped with a dual GPS/GLONASS receiver which provides georeferenced information on all still photographs. The drone is equipped with an FC6310 camera using the Sony Exmor 1" CMOS sensor, with a focal length of 8.8mm. Still photo resolution is 20 megapixels in JPG or RAW format.

1.1 Procedures

The crash site was located at a highway-rail grade crossing along WH Jackson Street west of Harbor City Boulevard. The crash site was in Class D airspace approximately 2.9 miles south southeast of KMLB Melbourne Orlando International Airport. There was no significant terrain, environmental, or obstruction hazards. The flight was conducted under 14 CFR 107 with a commercial Low-Altitude Authorization and Notification Capability (LAANC) referenced number ALT84PXD9FW0, restricting the flight altitude to 200-feet above ground level (AGL).

A visual observer was used to monitor for air and vehicle traffic. The highway-rail grade crossing was active and WH Jackson Street was open for traffic.

The UAS was flown at an altitude of approximately 80-feet AGL within the authorization. A total of 2 flights were conducted for a total flight time of 19 minutes and 10 seconds.

1.2 Processing

The UAS captured 438 high resolution, georeferenced photographs of the crash scene suitable for processing in the Pix4D photogrammetry software.[16] An additional 19 perspective photographs were taken capturing a 360-degree view of the crash scene and were not included in the photogrammetry processing. Figure 7 is an image of the generated point cloud showing the highway-rail grade crossing. The view is looking westbound along WH Jackson Street.

[16] Pix4DMapper is a photogrammetry software package designed to use overlapping photographic images to generate 3D point clouds. Additional outputs can be generated through additional processing, including 3D models and a 2D orthomosaic image.

Figure 7. Image of the generated point cloud depicting WH Jackson Street and the highway-rail grade crossing.

H. TECHNICAL RECONSTRUCTION

1.0 Post Collision Site Documentation and Roadway Evidence

The crash sites were confined to the grade crossing and railway. Both collision events were documented by local police investigators. Investigators from the Melbourne Police Department (MPD) marked several areas of roadway evidence with orange marking paint and documented the physical evidence with terrestrial photography. NTSB investigators inspected and documented the grade crossing on January 14th, 2024. In addition to sUAS documentation the area was documented via terrestrial photography.

1.1 January 10, 2024, Collision Event

The area of impact (AOI) was established at a location where tire friction marks, surface scrapes/scratches, and vehicle fluid spray were identified within the westbound lane. Pre-collision, the vehicle was traveling westbound on WH Jackson St., and the train was traveling northbound on the west track. The tire friction mark (A) originated approximately 1.50 feet east of the eastern rail of the west track. The post-collision roadway marks (B) continued northeast in a clockwise rotation for approximately 57 feet terminating at the final rest of the Honda. The Honda came to rest (C) approximately 11 feet east of the eastern rail of the east track and had overturned onto

the driver's side. Figure 8 is an image of the orthomosaic rendered from the three-dimensional point cloud depicting the post-collision physical evidence.

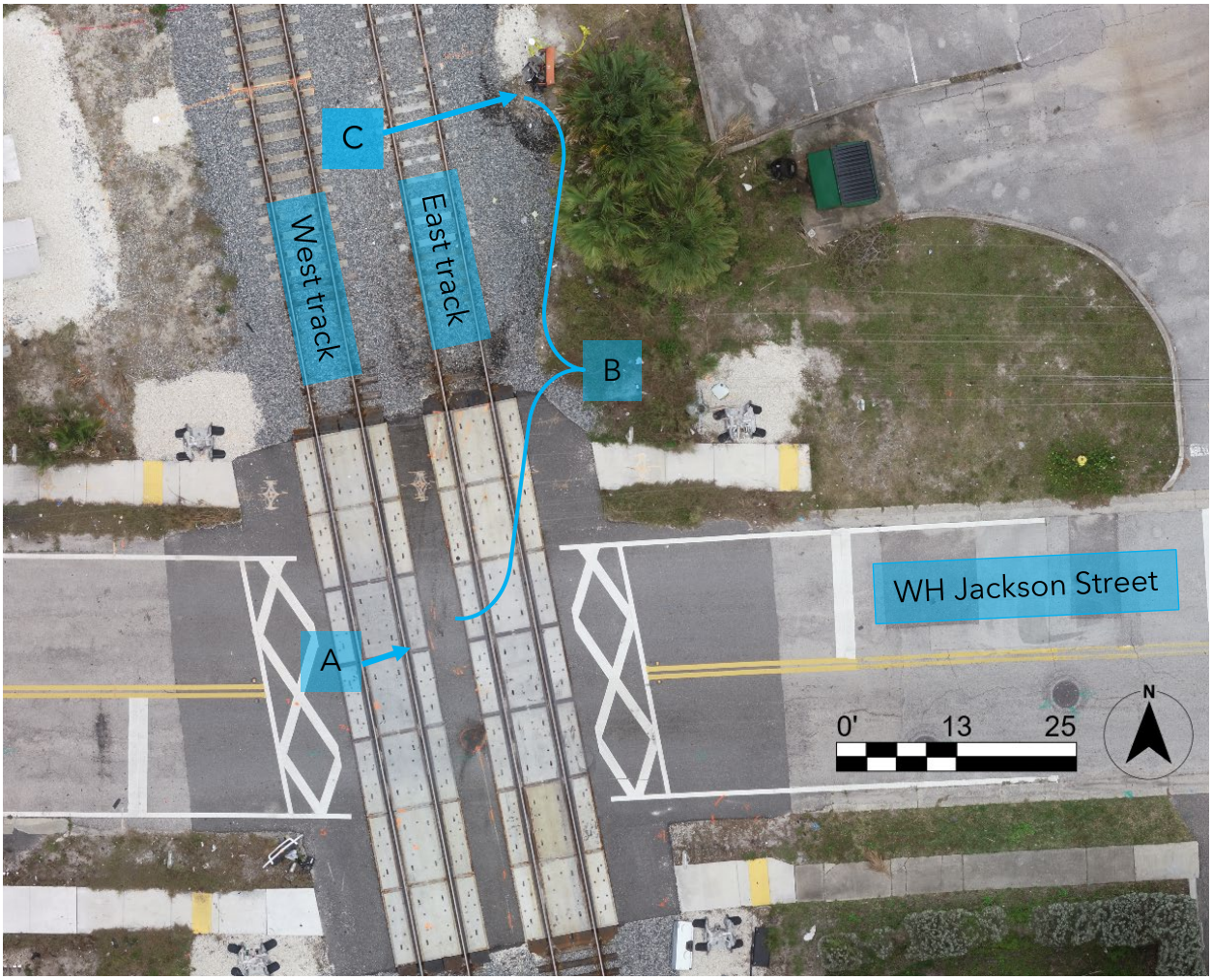

Figure 8. Image of the orthomosaic three-dimensional point cloud depicting 1/10/2024 physical evidence.

1.2 January 12, 2024, Collision Event

The AOI was established within the eastbound lane on the east track. Approximately 3.50 feet west of the western rail of the east track was an area of fluid (AA). Pre-collision, the vehicle was traveling westbound on WH Jackson St. and the train was traveling southbound on the east track. Scrape marks (BB) were identified beginning at the edge of the fluid, continuing south for approximately 20 feet where they terminated at the end of the asphalt. In line with the fluid, on the eastern rail of the east track, were tire friction marks. The tire friction marks traveled parallel to the scrape marks terminating at the end of the asphalt. The tire friction marks were consistent with the rear of the Chevrolet.

Post-impact, the Chevrolet remained in contact with the lead locomotive coming to rest approximately 1600 feet south of the AOI. Numerous vehicle parts and components were identified and marked with orange spray paint by MPD investigators around the grade crossing and along the post impact travel of the Chevrolet. Figure 9 below shows the described physical evidence for the 1/12/2024 collision.

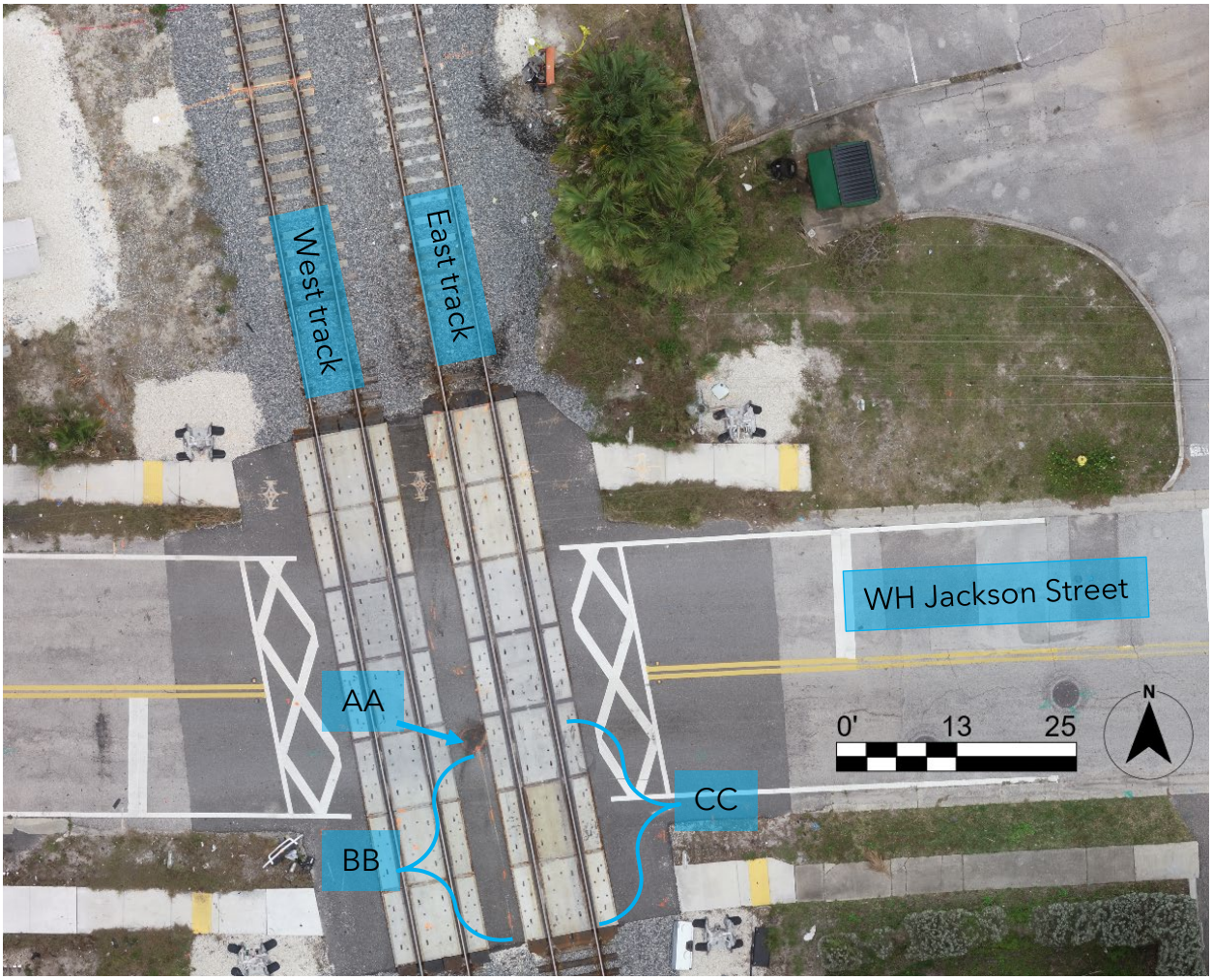

Figure 9. Image of the orthomosaic rendered from the three-dimensional point cloud depicting 1/12/2024 physical evidence.

2.0 Vehicle Documentation

There were 4 total vehicles involved in the two collisions. The January 10, 2024, crash involved lead locomotive 107 and a 2008 Honda Element. The January 12, 2024 crash, involved lead locomotive 102 and a 2004 Chevrolet Avalanche. Both locomotives were photographed and scanned at the Brightline Maintenance Facility, located in Orlando, FL. Repairs to locomotive 107 had already begun. After being towed to the local storage facilities, both vehicles were scanned.

2.1 Locomotive 107

Inspection of locomotive 107 occurred on January 13, 2024. Brightline had begun repairs but stopped work upon notification that NTSB investigators wanted to conduct the inspection. The crash damage was concentrated along the right side beginning approximately 34-inches aft of the steps. Scratch and scuff marks began approximately 12-feet aft of the steps and continued rearward for about 22-feet. Figure 10 is a photograph of the right side of locomotive 107 looking forward showing the initial impact damage.

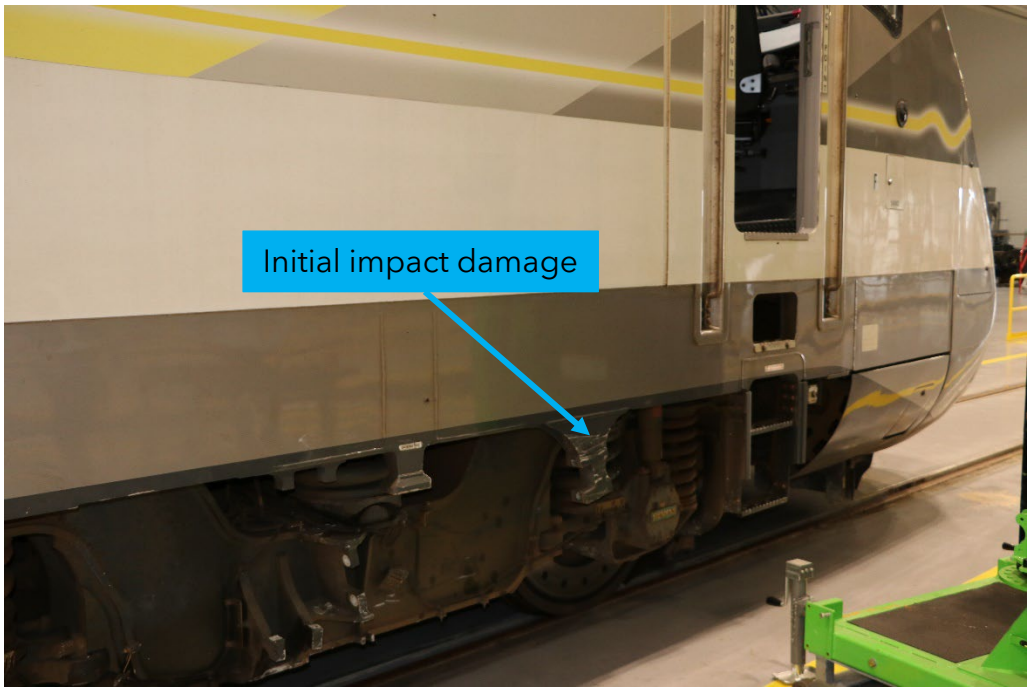

Figure 10. Photograph showing the damage to the right side of locomotive 107.

2.2 2008 Honda Element

The Honda was inspected and photographed at a storage facility on January 16, 2024. The front of the vehicle; bumper cover, grille, headlights, and radiator had been torn from the vehicle along with the hood. The windshield was shattered, and the top edge of the roofline was displaced downward. Contact damage continued along the entire left side of the vehicle. There was no contact damage observed on the right side of the Honda. The right side "A" and "B" pillars had been cut during occupant extrication by first responders. Figure 11 is a photograph from the left front corner of the Honda showing the damage to the front, left side, and roof.

2.2.1 Honda Electronic Data

The 2008 Honda Element was not equipped with an Event Data Recorder (EDR). No crash data was obtained from the vehicle.

Figure 11. Photograph showing the damage to the Honda.

2.3 Locomotive 102

Locomotive 102 was inspected on January 13, 2024. Collision damage was concentrated to the front nose cone, and area above the nose cone. Contact damage was observed along the right and left side of the locomotive as well as damage beneath the front of the locomotive. Figure 12 is a photograph of the front and right side of locomotive.

Figure 12. Photograph depicting the damage to the front of locomotive 102.

2.4 2004 Chevrolet Avalanche

The Chevrolet had been impacted on the passenger side by the locomotive. The body had been torn from the frame. The driver's seat was displaced outward and was positioned outside the body of the vehicle. The front passenger seat was displaced inward and was atop the driver's seat. The front end of the vehicle, up to the firewall, was torn from the frame and separated from the rest of the vehicle. Figure 13 is an overhead image from the rendered three-dimensional point cloud of the damage sustained to the Chevrolet.

Figure 13. Overhead image of the rendered three-dimensional point cloud depicting the damage to the Chevrolet.

2.4.1 Chevrolet Electronic 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) is a device or function in a vehicle that records the vehicle's dynamic time-series data during the 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 airbag control module (ACM). The ACM

processes information from peripheral and internal sensors. When an acceleration threshold is met, the EDR is triggered to record the associated event.

The Chevrolet was equipped with a sensing diagnostic module (SDM), also referred to as an airbag control module (ACM). NTSB investigators with the assistance of the local Fire Department located the ACM beneath the driver's seat which had broken from the three mounting bolts.

NTSB investigators were able to access and image the Chevrolet's ACM using a direct-to-module download method. The data from the EDR was imaged utilizing the Bosch Crash Data Retrieval tool and software version 23.4. 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.[17]

Review of the data determined that there was one event associated with the collision and that the recording of the file was complete. The EDR recorded the system status at deployment that included seatbelt status, ignition cycles, maximum recorded longitudinal change in velocity (Δv), and airbag deployment. Table 2 lists certain data as reported in the System Status at Deployment.

Table 2. Table showing certain data as listed in the System Status at Deployment.

Driver's Belt Switch Status	Buckled
Passenger's Belt Switch Status	Buckled
Ignition Cycles at Deployment	27603
Ignition Cycles at Investigation	27604
Maximum Recorded Velocity Change	-34.44 mph
Driver 1st Stage Airbag Deployment	20 msec
Driver 2nd Stage Airbag Deployment	32.5 msec
Passenger 1st Stage Airbag Deployment	20 msec
Passenger 2nd Stage Airbag Deployment	32.5 msec
Event Recording Complete	Yes

The pre-crash data reported certain vehicle parameters for up to five seconds before algorithm enable.[18] While the data is reported at discrete 1-second intervals, it can be received by or processed by the EDR asynchronously. At 5 seconds before the collision the Chevrolet had been traveling at approximately 18 mph. The vehicle speed then decreases to approximately 17 mph at 4 seconds and 14 mph at 3 seconds and 2 seconds. At 1 second the vehicle speed was reported to be approximately 17 mph. The percent of throttle was reported at 0 percent until 2 seconds when it increased to 93 percent. At 1 second it was reported to be 100 percent. Table 3 below shows the

[17] See Attachment – 2004 Chevrolet Crash Data Retrieval Report

[18] A programmed threshold for a specific ACM at which the ACM begins the deployment decision making algorithm.

pre-crash data as recorded by the EDR. Table 4 shows the pre-crash data related to the brake switch circuit state.[19]

Table 3. Table showing the reported 5 seconds of pre-crash data.

Seconds Before AE	Vehicle Speed (mph)	Engine Speed (RPM)	Percent Throttle (%)
-5	18	768	0
-4	17	704	0
-3	14	704	0
-2	14	1472	93
-1	17	2368	100

Table 4. Shows the status of the brake switch circuit.

Seconds Before AE	Brake Switch Circuit State
-8	Off
-7	Off
-6	Off
-5	On
-4	On
-3	Off
-2	Off
-1	Off

I. RAIL OPERATIONS

This section focuses on the Brightline and Florida East Coast Railroad operations.

1.0 Track Description

The location of both accidents was double mainline, governed by signal indication (ATC). Positive Train Control is active, and the track is owned and maintained by Florida East Coast Railroad. The accident on January 10, 2024, occurred on the West Main track while traveling northbound. The accident on January 12, 2024, occurred on the East Main track while traveling southbound. Both accidents occurred at Mile Post 194.77.

2.0 Outward Facing Camera Review

The investigation team met with Brightline supervision and reviewed the outward facing camera footage on both train incidents. Both videos showed the lights and gates were in the fully lowered position prior to the trains entering the crossings.

[19] The brake switch circuit status indicates the open/close state of the brake switch circuit.

The video of the incident that occurred on January 10, 2024, showed the driver of the vehicle going into the left lane, around a car that was already stopped at the crossing, around the lowered crossing gate, and striking the side of BLF locomotive 107.

The video of the incident that occurred on January 12, 2024, showed the driver of the vehicle going into the left lane, around the lowered crossing gate, and fouling the tracks in front of BLF locomotive 102.

3.0 Locomotive Event Recorder Review

The operations working group got together at approximately 3:30 p.m. local time on January 14, 2024, to review the event recorder data from the accidents on January 10, 2024, and January 12, 2024. The team looked at the locomotive downloads and put together the timelines shown below.

As shown in Figure 14 below, the throttle position for train BLF 107 from the January 10, 2024, accident was in idle, and it was determined that train handling was not a factor. The engineer was blowing his horn prior to placing the trains brakes into emergency.

The team noted that the engineer placed BLF 107 into emergency at 2:00:30 p.m. local time after the engineer felt something hit his train and then saw the accident in the rear-view mirror. When the train went into emergency, it was traveling at 68 MPH.

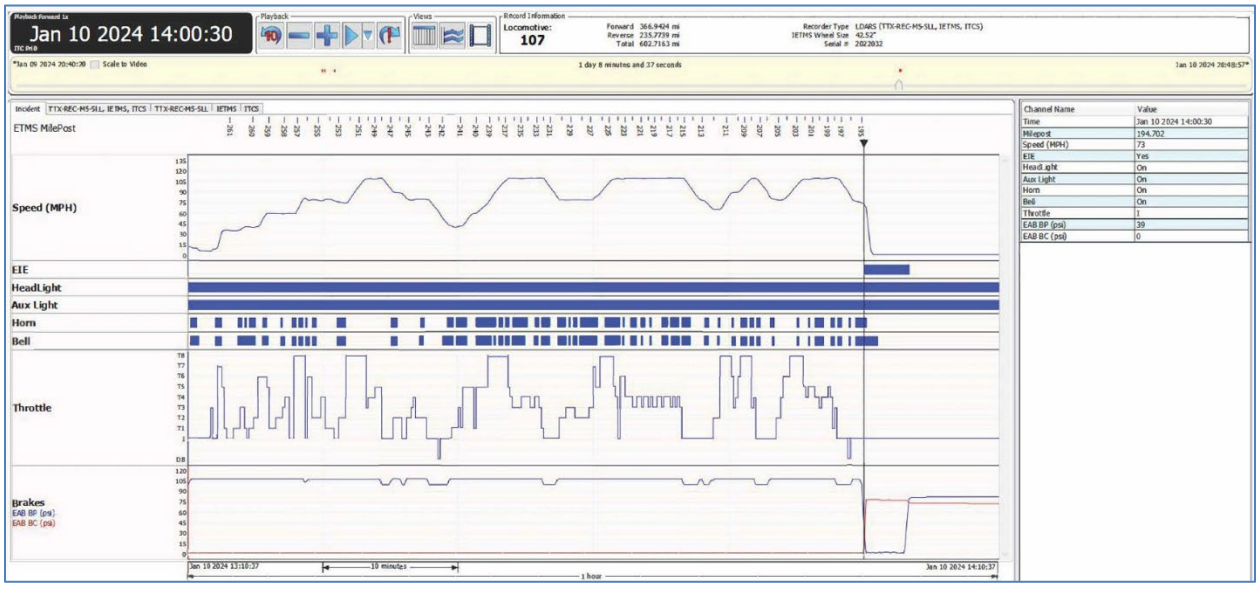

Figure 14. Locomotive BLF 107 ERU download.

As shown in Figure 15 below, the throttle position for BLF 102 from the January 12, 2024, accident was in T2, and it was determined that train handling was not a factor. The engineer was blowing his horn prior to placing the train into emergency and continued to blow the horn for an additional 8 seconds after the train brakes emergency application.

The team noted that the engineer placed the BLF 102 into emergency at 12:50:51 p.m. local time upon impact with the highway vehicle. When the train was placed in emergency, it was traveling at 78 MPH.

Figure 15. Locomotive BLF 102 ERU download.

4.0 Train Crew Interviews

The operations group held virtual interviews on Monday, January 29, 2024, with the two crew members off the BLF 107 from the accident on January 10, 2024, and the two crew members off the BLF 102 from the January 12, 2024, grade crossing accident.[20]

4.1 Engineer BLF 107

- On duty at 5:35 a.m. local time in Orlando, Florida on January 10, 2024.
- Took train from Orlando to Miami without incident.
- On his northbound trip back to Orlando, he was on the west main track, had just finished sounding the horn approaching the accident crossing,

[20] See Attachment – Train Crew Interview Transcripts

when he heard a noise and then saw what he believed to be a vehicle and car parts flying in the rear-view facing camera.

4.2 Engineer BLF 102

- On-duty at 7:00 a.m. local time in Miami, Florida on January 12, 2024.
- Took train from Miami to Orlando without incident.
- On his southbound trip back to Miami, he was on the east main track, Engineer was sounding his bell and horn approaching the accident crossing when a vehicle went around the gates where the vehicle was struck by the train.

5.0 Mechanical Inspection

The investigation team met at the Brightline Running Repair Facility in Orlando, FL on Saturday morning, January 13, 2024, to inspect the lead locomotives, BLF 102 and BLF 107. The crash damage for both locomotives can be seen in Figure 16 below.

The inspection found no exceptions to the locomotive air brake system, head lights, locomotive horn, and the auxiliary lights functioned as designed.

The locomotives were released back to Brightline at 11:00 a.m. local time.

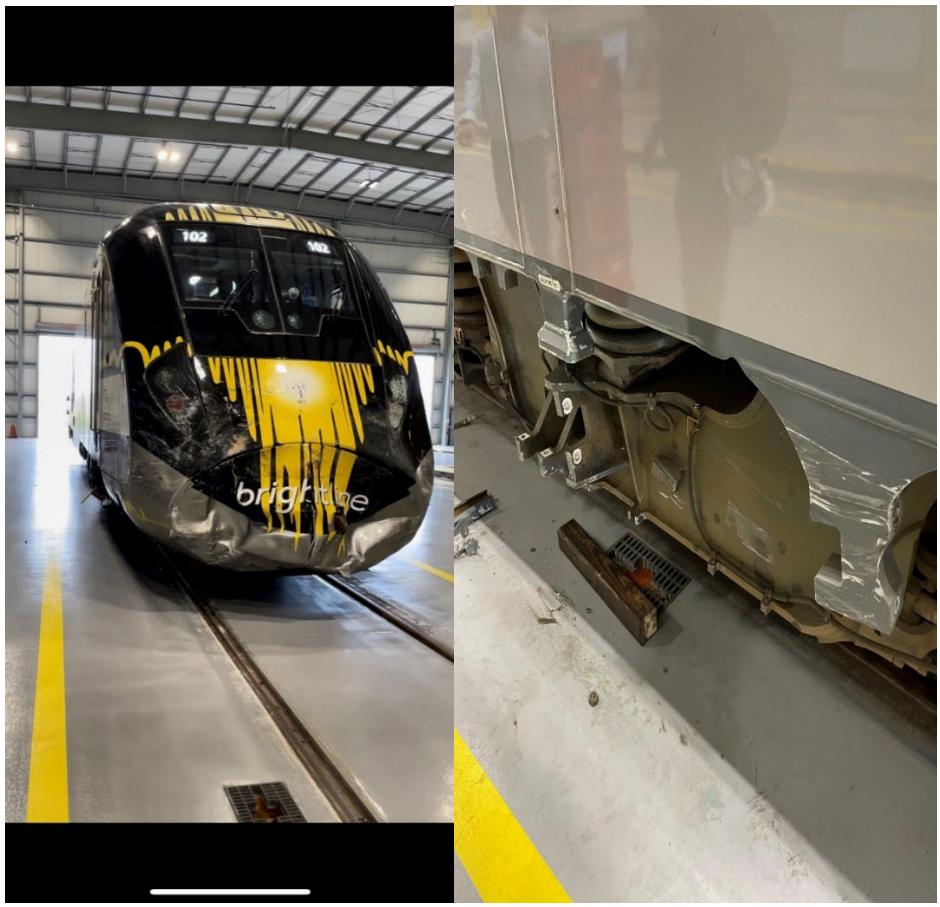

Figure 16. Locomotive BLF 102. Left photograph depicts the front-end damage. Right photograph depicts the right-side damage on Locomotive BLF 107.

6.0 Train Ride

NTSB (Operations & Signal) rode Brightline on Sunday, January 14, 2024. The NTSB investigator's rode from Orlando, FL to West Palm Beach, FL and then back to Orlando, FL.

The NTSB investigators worked with two different train crews and both crews were very professional and were very alert and attentive during the trip.

During the ride of Run 725 south from Orlando to West Palm Beach, a trespasser fouled the adjacent track, walking north, causing the locomotive engineer to place the train into emergency and bring the train to a stop until the trespasser cleared the tracks in Melbourne, FL. Shortly after restarting the trip, the train crew encountered a bicyclist crossing in front of the train while the crossing gates were lowered, nearly striking the bicyclist. This close call was also in the town of Melbourne, FL. It was observed that all crossing gates and warning lights at road crossings were working as intended along the route. While talking with the engineer he stated that he had been involved in seven incidents while working for Brightline involving striking trespassers or vehicle strikes.

NTSB investigators rode Run 723 north from West Palm Beach to Orlando. During this ride staff encountered no crashes or near crashes along the route. It was observed that all crossing gates and warning lights at road crossings were working as intended.

J. HUMAN PERFORMANCE

The focus of the Human Performance investigation is the driver of the 2004 Chevrolet Avalanche sport utility vehicle (SUV). More specifically, this section will describe the operational and environmental factors which may have influenced the driver's performance in this crash. Similar information will be discussed for the driver of a 2008 Honda Element SUV which was involved in a crash on January 10, 2024 (two days prior) at the same grade crossing.

1.0 2008 Honda Driver

The 2008 Honda Element was operated by a 62-year-old male that resided in Melbourne, Florida; about 3 miles from the crash site. Information regarding the Honda driver's pre-crash medical condition, sleep/rest history, and cellphone use are not discussed in this report.

1.1 Driver License History

At the time of the crash, the Honda driver had a valid Florida Class E driver's license.[21] The driver's most recent license was issued in August 2023 with an expiration date on his birthday in 2032. According to his Florida driving history, his license had been previously suspended for unspecified violations and failure to pay a traffic fine penalty.[22] He had no history of driving under the influence violations however, he had several moving and non-moving violations on his driving record. See Table 5 below for a summary of traffic violations. There was no record of any previous crashes on the Honda driver's license record.

Table 5. Honda Driver's Traffic Violation Summary.

Violation	Date	Jurisdiction
Improper stop/stand/park vehicle	10/29/23	Brevard, FL
Operating vehicle with no proof of insurance	9/25/2023	Brevard, FL
Driving while license canceled/suspended	10/7/2022	Brevard, FL

[21] A Florida Class E driver's license permits the holder to operate any non-commercial motor vehicle with a Gross Vehicle Weight Rating (GVWR) less than 26,001 pounds including passenger cars, 15 passenger vans (including the driver), trucks or recreational vehicles and two- or three-wheel motor vehicles 50 cc or less, such as mopeds or small scooters.
[22] See Factual Report Attachment – Honda Driver's License History

Expired tag – more than six months	7/1/2022	Brevard, FL
Failure to use due care	11/9/2018	Brevard, FL
Driving while license canceled/suspended	1/22/2010	Brevard, FL
Driving while license canceled/suspended	9/30/2004	Indian River, FL
Driving while license canceled/suspended	9/26/2004	Indian River, FL
Driving while license canceled/suspended	07/24/1994	Orange, FL

1.2 Post Crash Toxicology

Steward Reference Laboratory performed postmortem toxicological testing of the Honda driver's blood at the request of the Office of the Medical Examiner, Eighteenth District – Brevard County, Florida.[23] The Honda driver's iliac blood screened positive for N,N-dimethylpentylone, pentylone, caffeine, caffeine metabolite, and nicotine metabolite. No secondary confirmation testing was performed for caffeine, caffeine metabolite, or nicotine metabolite. Testing performed by AXIS Forensic Technology at the request of Steward Reference Laboratory confirmed the presence of N,N-dimethylpentylone at 83 ng/mL and pentylone at 23 ng/mL in the Honda driver's iliac blood. Urine drug screening performed by Steward Reference Laboratory was positive for cannabinoids. Urine screening for 3,4-methylenedioxymethamphetamine (MDMA) and 3,4-methylenedioxyamphetamine (MDA) was indeterminate due to the presence of interfering substances. Blood screening for cannabinoids was performed by LabCorp Laboratories at the request of Steward Reference Laboratory; this screening result was reported as suggesting the need for further testing.

At the request of the National Transportation Safety Board, the Federal Aviation Administration Forensic Sciences Laboratory performed postmortem toxicological testing of specimens from the Honda driver. N,N-dimethylpentylone was detected at 223 ng/mL in femoral blood and 33 ng/mL in liver tissue. Pentylone was detected at 22 ng/mL in femoral blood and 31 ng/g in liver tissue. Delta-9-THC was detected at 7.9 ng/mL in femoral blood and 4.7 ng/g in liver tissue. 11-hydroxy-THC was detected at 2.9 ng/mL in femoral blood and 4.7 ng/g in liver tissue. Carboxy-delta-9-THC was detected at 30.3 ng/mL in femoral blood and 306.7 ng/g in liver tissue. Tadalafil was detected in femoral blood and liver tissue.

1.2.1 Concise Statement of Results

Postmortem toxicology testing of the Honda driver's blood and urine detected N,N-dimethylpentylone and its metabolite pentylone, as well as delta-9-THC and its metabolites 11-hydroxy-THC and carboxy-delta-9-THC. Tadalafil was also detected. Caffeine, caffeine metabolite, and nicotine metabolite were detected by unconfirmed screening.

[23] See Factual Report Attachment – Honda Driver's Toxicology Report

1.2.2 Description of Detected Substances

N,N-dimethylpentylone is a psychoactive stimulant drug belonging to a class of drugs called synthetic cathinones, commonly known as "bath salts." N,N-dimethylpentylone emerged in the United States in late 2021 after the synthetic cathinone that was then most prevalent was recommended for international control. Synthetic cathinones are designed to have similar effects to other stimulants such as methamphetamine, cocaine, or MDMA. Although the term "ecstasy" is commonly associated with MDMA, drugs sold as ecstasy frequently contain synthetic cathinones alone or in combination with other stimulants. Users of synthetic cathinones may snort, smoke, inject, or ingest the drugs seeking effects of euphoria or alertness. Impairing effects of synthetic cathinones may include confusion, agitation, aggressiveness, and psychosis. Pentylone is a metabolite of N,N-dimethylpentylone and is also a synthetic cathinone drug.

Delta-9-THC is the primary psychoactive chemical in cannabis, including marijuana and hashish. Delta-9-THC may be smoked, vaped, or ingested recreationally by users seeking mind-altering effects. It may also be used medicinally to treat symptoms including illness-associated nausea and appetite loss. Psychoactive effects of delta-9-THC vary depending on the user, dose, and route of administration, and may impair motor coordination, reaction time, decision making, problem solving, and vigilance. 11-hydroxy-THC and carboxy-delta-9-THC are metabolites of delta-9-THC.

Tadalafil is a prescription medication commonly used to treat erectile dysfunction, as a sexual enhancement aid, or to treat symptoms of an enlarged prostate. Caffeine is a stimulant that is commonly ingested, including in coffee, tea, soft drinks, and chocolate, and is also an ingredient in certain anti-drowsiness medications and headache medications, as well as some illicit stimulant drugs. Nicotine is a chemical that is found in tobacco products, electronic cigarette liquid, and certain smoking cessation aids. Tadalafil, caffeine, and nicotine are not generally considered impairing.

1.3 Honda Driver's Performance

The Honda driver's driving performance as he approached the grade crossing was determined from video footage recorded by a surveillance video from a nearby business and an interview with a surviving passenger that was in the vehicle when the crash occurred.

The grade crossing is shown in the periphery of the video image. Although it is not the primary focus of the video, the grade crossing can be clearly seen. The video segment is about 54 seconds long. At the beginning of the video, the grade crossing gate was fully lowered, and a passenger car is stopped at the gate, traveling west on W. H. Jackson Street. At elapsed time frame 0:00:06, the Honda enters the video frame,

traveling west on W.H. Jackson Street toward the grade crossing. As the Honda reached the grade crossing, it entered the eastbound lane and traveled around the stopped passenger car. At frame 0:00:09 the Brightline train entered the frame, traveling northbound on the east main track (nearest the stopped passenger car). At frame 0:00:11 the Brightline train had fully occupied the grade crossing; the Honda entered the grade crossing and struck the second car of the train.

1.4 Witness Interview

Following the crash, the rear seat adult passenger was interviewed at a local hospital as she recovered from her injuries.[24] According to the passenger, just prior to the crash, she was walking her son home from his bus stop. She saw the Honda driver pass by, he stopped, and he offered her a ride home. She and her son got in the car at the corner of W.H. Jackson Street and South Harbor City Boulevard, about 260 feet from the grade crossing. She stated that she was familiar with the Honda driver and had ridden with him previously. She did not know him as a drug user and did not know him to be an unsafe driver. As the Honda approached the grade crossing, the witness observed that the train was coming and yelled for the driver to stop. The driver looked at the front seat passenger, then at her, and continued driving. The witness did not remember anything after the crash occurred.

1.5 Environmental Conditions

1.5.1 Weather

Weather observations near the time of the crash were obtained from National Weather Station Melbourne Orlando International Airport (KMLB), about 3 miles from the crash site. The weather observations for January 10, 2024, are listed below in Table 6.

Table 6. KMLB January 10, 2024, weather observations.

Observation	1:53 PM	2:53 PM
Temperature	64° F	65° F
Dew Point	44° F	45° F
Humidity	48%	48%
Wind Direction	W	WNW
Wind Speed	13 mph	10 mph
Wind Gust	0 mph	0 mph
Pressure	29.93 in	29.91 in
Precipitation	0.0 in	0.0 in
Condition	Fair	Fair

[24] Factual Report Attachment – Honda Passenger Interview Transcript

1.5.2 Astronomical Factors

Astronomical conditions on the day of the crash were obtained from the United States Naval Observatory Astronomical Applications Department. According to reported observations, Civil Twilight began at 5:41 a.m., sunrise was at 6:04 a.m. and sunset was at 7:23 p.m. The crash occurred at about 12:51 p.m., during daylight hours.

2.0 2004 Chevrolet Driver

The 2004 Chevrolet Avalanche was operated by a 67-year-old female that resided in Palm Bay, Florida; about 4 miles from the crash site. (1-12-24 crash) Information regarding the Chevrolet driver's pre-crash medical condition, sleep/rest history, and cellphone use are not discussed in this report.

2.1 Driver License History

At the time of the crash, the Chevrolet driver had a valid Florida Class E driver's license.[25] The driver's most recent license was issued in February 2018 with an expiration date on her birthday in 2026. According to her Florida driving history, she had no history of license suspensions or driving under the influence violations.[26] Her license history had a single traffic law violation: Unlawful Speed – 40 mph in a 30-mph speed limit zone. There was no record of any previous crashes on the Chevrolet driver's license record.

2.2 Post Crash Toxicology

Steward Reference Laboratory performed postmortem toxicological testing of the Chevrolet driver's blood at the request of the Office of the Medical Examiner, Eighteenth District – Brevard County, Florida. The Chevrolet driver's pericardial blood tested positive for cocaine at 331 ng/mL, as well as the cocaine metabolites benzoylecgonine and ecgonine methyl ester, at 4070 ng/mL and 1000 ng/mL, respectively. The pericardial blood also screened positive for caffeine and caffeine metabolite, without secondary confirmation testing.

At the request of the National Transportation Safety Board, the Federal Aviation Administration Forensic Sciences Laboratory performed postmortem toxicological testing of specimens from the Chevrolet driver.[27] Cocaine was detected at 372 ng/mL

[25] A Florida Class E driver's license permits the holder to operate any non-commercial motor vehicle with a Gross Vehicle Weight Rating (GVWR) less than 26,001 pounds including passenger cars, 15 passenger vans (including the driver), trucks or recreational vehicles and two- or three-wheel motor vehicles 50 cc or less, such as mopeds or small scooters.
[26] See Factual Report Attachment – Chevrolet Driver's License History
[27] See Factual Report Attachment – Chevrolet Driver's Toxicology Report

in cavity blood and 2130 ng/g in brain tissue. Benzoylecgonine was detected at 5425 ng/mL in cavity blood and 3622 ng/g in brain tissue. Ecgonine methyl ester, anhydroecgonine methyl ester, dextromethorphan, and pramoxine were also detected in cavity blood and brain tissue.

2.2.1 Concise Statement of Results

Postmortem toxicology testing of the Chevrolet driver detected cocaine, as well as the cocaine metabolites benzoylecgonine and ecgonine methyl ester, and the cocaine thermal degradation product anhydroecgonine methyl ester. Dextromethorphan and pramoxine were also detected. Caffeine and caffeine metabolite were detected by unconfirmed screening.

2.2.2 Description of Detected Substances

Cocaine is a stimulant drug that is commonly used illicitly by recreational users who may smoke it, snort it, inject it, ingest it, or apply it to gums / mucous membranes. Cocaine users may seek euphoric effects, appetite suppressant effects, and feelings of increased alertness, strength, and decisiveness. Impairing effects that occur early after recreational cocaine use may include dizziness, restlessness, poor impulse control, and increased risk taking. Attention, perception, coordination, decision making, and task execution may be impaired by effects of cocaine and cocaine withdrawal. Benzoylecgonine and ecgonine methyl ester are metabolites of cocaine. Anhydroecgonine methyl ester is a thermal degradation product of cocaine that may be inhaled when cocaine is smoked.

Dextromethorphan is a cough suppressant medication that is available over the counter in a variety of cold and allergy products. Dextromethorphan is not typically impairing at levels associated with medicinal use. If abused at higher doses, it can have impairing psychoactive effects including confusion and altered perception and judgment.

Pramoxine is a topical anesthetic medication available over the counter in a variety of products for temporary relief of skin pain and itching. Caffeine is described above. Pramoxine and caffeine are not generally considered impairing.

2.3 Chevrolet Driver's Performance

The Chevrolet driver's driving performance as she approached the grade crossing was determined from video footage recorded by a surveillance video from a nearby business. Although the grade crossing is not the primary focus of the video, it can be clearly seen in the periphery of the video image. The video segment is 1 minute,

4 seconds long. At the beginning of the video, there is no traffic on W.H. Jackson Street and the grade crossing gates are fully up. At elapsed time frame 0:00:01 gates begin to lower and are fully lowered at frame 0:00:04. At frame 0:00:19, the Chevrolet enters the frame, traveling west on W.H. Jackson Street toward the grade crossing. As the Chevrolet reached the grade crossing, it traveled into the eastbound lane, drove around the lowered stop arm, and entered the grade crossing. The train collided with the passenger side of the Chevrolet at frame 0:00:23.

2.4 Environmental Factors

2.4.1 Weather

Weather observations near the time of each crash were obtained from National Weather Station Melbourne Orlando International Airport (KMLB), about 3 miles from the crash site. The weather observations for January 12, 2024, are listed below in Table 7.

Table 7. KMLB January 12, 2024, weather observations.

Observation	12:11 PM	12:53 PM
Temperature	75° F	77° F
Dew Point	73° F	73° F
Humidity	94%	88%
Wind Direction	SSE	S
Wind Speed	8 mph	12 mph
Wind Gust	0 mph	20 mph
Pressure	29.88 in	29.26 in
Precipitation	0.0 in	0.0 in
Condition	Cloudy	Cloudy

2.4.2 Astronomical Factors

Astronomical conditions on the day of the crash were obtained from the United States naval Observatory Astronomical Applications Department. According to reported observations, Civil Twilight began at 5:42 a.m., sunrise was at 6:04 a.m. and sunset was at 7:28 p.m. The crash occurred at about 12:51 p.m., during daylight hours.

K. DOCKET MATERIAL

LIST OF ATTACHMENTS:

Factual Report Attachment – WH Jackson St. Speed Statistics
Factual Report Attachment – WH Jackon St. Vehicle Count
Factual Report Attachment – City of Melbourne Right-of-Way Use Permit
Factual Report Attachment – 2004 Chevrolet Crash Data Retrieval Report
Factual Report Attachment – Train Crew Interview Transcripts
Factual Report Attachment - Honda Driver's License History
Factual Report Attachment - Honda Driver's Toxicology Report
Factual Report Attachment – Honda Passenger Interview Transcript
Factual Report Attachment – Chevrolet Driver's License History
Factual Report Attachment - Chevrolet Driver's Toxicology Report

Submitted by:

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