

# National Transportation Safety Board

Office of Highway Safety

Washington, DC 20594



HWY23FH010

## **TECHNICAL RECONSTRUCTION**

Group Chair's FACTUAL REPORT

## TABLE OF CONTENTS

A. Crash.....	4
B. Technical Reconstruction Group.....	4
C. Summary.....	4
D. Factual Information.....	4
1.0 Introduction.....	4
2.0 Location .....	4
3.0 Vehicles.....	5
3.1 2017 Acura TLX .....	5
3.2 2017 Volkswagen Jetta.....	7
4.0 Electronic Data .....	8
4.1 2017 Acura ACM Data .....	9
4.2 2017 Volkswagen ACM Data.....	12
5.0 Roadway Evidence Documentation .....	13
5.1 Pedestrians (Construction Zone Workers) .....	15
6.0 Video Evidence.....	15
6.1 MDOT Traffic Camera .....	16
6.2 Dash Camera Video #1 (Escort) .....	17
6.3 Dash Camera Video #2 (Nexar).....	18
E. Attachments.....	19

## LIST OF FIGURES

Figure 1. Map showing the location of the collision. Inset is a satellite image showing the location of the crash.....	5
Figure 2. Images showing the damage to the Acura TLX. The image on the right shows the damage to the front left and left side. The image on the left shows the damage to the front right and right side. ....	6
Figure 3. Images of the Volkswagen Jetta. Image on the left shows the damage to the front right and the image on the right shows the damage to the left side. ....	7
Figure 4. Acura Deployment Command Data associated with Event Record 1. ....	10
Figure 5. Acura EDR data showing the pre-crash parameters reported at 1/2 - second intervals. ....	10
Figure 6. Acura EDR data showing the pre-crash parameters reported at 1/2 - second intervals. The highlighted data is the data related to the 1.5 second between events. ....	11

Figure 7. Image of northbound I-695 leading up to an including the area of the collision. Overlaid on the image are the data associated with the Acura. (Source: Google Earth edited by NTSB) ..... 12

Figure 8. Image of the Deployment Command Data associated with event record 1 from the Volkswagen..... 13

Figure 9. Image of the 5 seconds of pre-crash data associated with event 1 from the Volkswagen..... 13

Figure 10. Images taken by MSP investigators depicting the roadway evidence. Image on the left shows the initial tire friction mark. The image on the right shows the four curvilinear friction marks. (Source: MSP modified by NTSB) ..... 15

Figure 11. Overhead image of I-695. The location of the MDOT traffic camera, the approximate location of the crash is identified. Also identified is the approximate field of view of the camera. (Source: Google Earth modified by NTSB)..... 16

Figure 12. Image capture from MDOT camera depicting the Acura and Volkswagen just prior to contact. (modified by NTSB)..... 17

Figure 13. Image captured from the dash camera depicting the impact between the Acura and the Volkswagen. (modified by NTSB) ..... 19

**LIST OF TABLES**

Table 1. General information for 2017 Acura TLX. .... 5

Table 2. General information for 2017 Volkswagen Jetta..... 7

Table 3. Shows certain data associated with track\_26 which was imaged from the Acura infotainment system..... 11

Table 4. Timeline of events observed in MDOT traffic camera..... 17

Table 5. Timeline of events observed in the Escort dash camera video. .... 18

Table 6. Timeline of events observed in the Nexar dash camera video..... 18

## **A. CRASH**

Location: Woodlawn, Baltimore County, Maryland  
Date: March 22, 2023  
Time: 12:36 p.m. EDT

## **B. TECHNICAL RECONSTRUCTION GROUP**

Group Chair Eric Gregson  
National Transportation Safety Board  
Washington, DC

Group Member Corporal James Lantz  
Maryland State Police

## **C. 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. FACTUAL INFORMATION**

### **1.0 Introduction**

The Technical Reconstruction Group for this investigation was convened after NTSB Office of Highway Safety Investigators initiated an investigation of this crash to assist in the collection of data, analysis of the collision events, and causation factors. Data received from the Maryland State Police (MSP) included terrestrial and aerial photographs, total station data, and pre-crash electronic data from each vehicle involved.<sup>1</sup> Further data was collected by NTSB investigators regarding the highway, and work zone design and setup.<sup>2</sup>

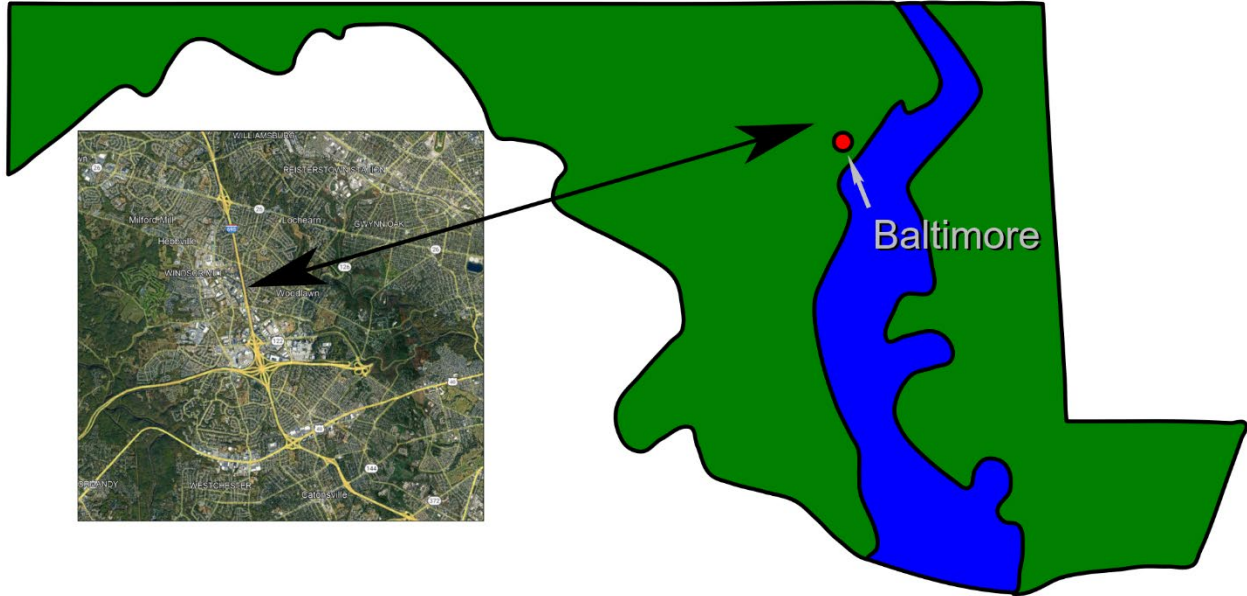
### **2.0 Location**

Figure 1 is a map that depicts the crash was in the central area of Maryland northwest of the City of Baltimore. The crash occurred on Interstate 695 in Woodlawn, Baltimore County, Maryland. The GPS coordinates were 39.3261 latitude, -76.7446 longitude.

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<sup>1</sup> The total station is a combination of and Electronic Distance Measuring Instrument (EDMI) and a theodolite which measures vertical and horizontal angles.

<sup>2</sup> Refer to Highway Factors Chairman's Report for further information.



**Figure 1. Map showing the location of the collision. Inset is a satellite image showing the location of the crash.**

**3.0 Vehicles and Drivers**

**3.1 2017 Acura TLX**

**3.1.1 Acura Driver Licensing**

The driver of the 2017 Acura TLX was a 55-year-old female that lived in Randallstown, MD. At the time of the crash the Acura driver held a Maryland Class C license with restrictions. The driving record showed no traffic violations.

**3.1.2 Crash History**

Based on information from an insurance industry database, the Acura driver had no records of any crashes within the previous 5 years.

**3.1.3 General Information**

**Table 1. General information for 2017 Acura TLX.**

VIN	19UUB1F56HA003335
Make	Acura
Model	TLX
Model Year	2017
Curb weight	3,492 lbs.
Length	190.3 inches
Track width	63 inches
Wheelbase	109.3 inches



**Figure 2. Images showing the damage to the Acura TLX. The image on the right shows the damage to the front left and left side. The image on the left shows the damage to the front right and right side.**

### **3.1.4 Damage Description**

The vehicle had been removed from the scene and towed to the MSP Barrack located in Golden Ring, MD, for storage and inspection. The vehicle was inspected at this location on April 4<sup>th</sup>, 2023.

The Acura sustained contact at areas around the entire vehicle. Beginning at the front of the vehicle, the front bumper cover and grille were torn off the vehicle. The radiator had been pushed rearward into the engine along with the lower radiator support bar. The upper radiator support bar had been bent down and inward. The hood was detached from the latch and buckled in a couple areas. The front of the left fender was bent downward raising the rear of the fender upwards. The left front tire separated from the bead and lost all its air. The driver's door was buckled inward around the driver's side view mirror and was slightly open. The area around the rear of the driver side passenger door, the right rear quarter panel, and the gas cap had been buckled inward causing the rear of the door to push outward. Lateral scrapes and scratches were observed throughout the damage. The left rear tire had also separated from the bead and had several cuts along the sidewall.

The right rear of the Acura had been displaced downward along with the right rear quarter-panel. The rear bumper cover had been torn off the vehicle and the right rear taillight assembly was broken and missing. Longitudinal and lateral scrapes were observed along the trunk lid and upper area of the quarter-panel. The "C" Pillar was pushed inward, and the right rear passenger door was partially open with the outer panel separated from the door. The right front passenger door was also partially open, and the "A" pillar had separated about midway up from the front of the vehicle. The



"A" pillar and door window frame were pushed downward and displaced rearward towards the "B" pillar. The right fender had buckled outward and was offset from where it met the front passenger door.

The roof had been torn from the vehicle and all the glass was shattered. The driver's front, side airbag, knee bolster, and side curtain airbags were deployed along with the passenger side curtain airbags. The seatbelt was observed in a latched condition, with the seatbelt tongue connected to the buckle. The seatbelt retractor was locked leaving the seatbelt extended. The webbing had been cut and was pulled out of the ring at the seatbelt tongue and was lying across the driver's seat and center console.

### 3.2 2017 Volkswagen Jetta

#### 3.2.1 Volkswagen Driver Licensing

The driver of the 2017 Volkswagen Jetta was a 20-year-old male that lived in Baltimore, MD. At the time of the crash the Volkswagen driver held a Maryland Class C license with a Corrective Lenses Restriction and an Under 21 Alcohol Restriction. The driving record showed no traffic violations.

#### 3.2.2 Crash History

Based on information from an insurance industry database, the Volkswagen driver had no records of any crashes within the previous 5 years.

#### 3.2.3 General Information

**Table 2. General information for 2017 Volkswagen Jetta.**

VIN	3VW2B7AJ9HM368928
Make	Volkswagen
Model	Jetta
Model Year	2017
Curb weight	3,025 lbs.
Length	183.3 inches



**Figure 3. Images of the Volkswagen Jetta. Image on the left shows the damage to the front right and the image on the right shows the damage to the left side.**

Track width	60.4 inches
Wheelbase	104.4 inches

### 3.2.4 Damage Description

The vehicle had been removed from the scene and towed to the MSP Barrack located in Golden Ring, MD, for storage and inspection. The vehicle was inspected at this location on April 4<sup>th</sup>, 2023.

The Volkswagen sustained contact damage along the driver's and passenger's side. Black colored tire transfer marks were observed on the lower area of the front passenger side door. The marks began approximately in the middle of the door. There were three circumferential marks, the marks were dark at the bottom and became lighter as they traveled up the door. The marks continued onto the right fender and the two forward marks left black colored tire transfer marks. The right fender was slightly buckled, and the right front tire sidewall was scuffed encompassing the circumference of the tire.

The right side of the front bumper cover was pulled away from the vehicle and there were black colored tire transfer marks that continued around to the front of the bumper for the length of the headlight. The left front headlight lens was broken.

There was a black colored mark along the bottom left side of the front bumper cover. The marks continued aft of the left front tire along the bottom of the driver's door and onto the left rear passenger door. The left front rim was severely damaged and bent in two locations. The tire had separated from the bead and scuff marks were observed around the circumference of the tire sidewall. The left rear tire also had scuff marks observed on the sidewall.

## 4.0 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) means 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 supplemental 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 subsequently "locking" the data so to not be overwritten. Events not reaching a threshold for being "locked" can still be recorded however, the data can be overwritten by subsequent events of greater magnitude.



Investigators from MSP were able to access and image the Acura's and Volkswagen'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 23.0.2. 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. MSP investigators provided the NTSB with a copy of both EDR reports.<sup>3,4</sup>

Most modern passenger vehicles are now equipped with an infotainment system within the vehicle. The infotainment system is an integrated system that is located within the dashboard and is a combination of GPS, Bluetooth, satellite radio, and Wi-Fi. It is in the system that stores user data that is transferred during a syncing process. The data can include vehicle event data, brake application, gear changes, doors open/closed, etc., navigation data, including saved or recent locations, and track points. User data is also stored in the system including call logs, SMS messages etc.<sup>5</sup> MSP investigators were able to image the data from the Acura's infotainment system utilizing iVe Software.<sup>6</sup> The route GPS data which included location and speed, was provided to NTSB investigators.

#### **4.1 2017 Acura ACM Data**

Reviewing the data showed that there were two events associated with the collision and the reported time between the events was 1.5 seconds.<sup>7</sup> Deployment Command Data from Event Record 1, shown in Figure 4, reported deployment of the driver's seatbelt pretensioner, frontal airbag, knee airbag, side airbag, and side curtain airbag. Further pre-crash data indicated that the driver safety belt status was "on".

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<sup>3</sup> See Factual Attachment - 2017 Acura TLX CDR Report

<sup>4</sup> See Factual Attachment - 2017 Volkswagen Jetta CDR Report

<sup>5</sup> Whelan, C. J., Sammons, J., McManus, B., & Fenger, T. W. (2018). Retrieval of Infotainment System Artifacts from Vehicles Using iVe. *Journal of Applied Digital Evidence*, 1(1). Retrieved from <http://mds.marshall.edu/jade/vol1/iss1/2>

<sup>6</sup> iVe Software - Software used by investigators to acquire and analyze information that has been stored within the vehicles infotainment system.

<sup>7</sup> Two events can be recorded if the time zero values for each event occur within 5.0 seconds of each other.

### Deployment Command Data (Event Record 1)

Pretensioner Deployment, Time to Fire, Driver (msec)	42
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to Deploy First Stage, Driver (msec)	53
Frontal Air Bag Deployment, Time to Deploy First Stage, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (msec)	83
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	0
Knee Air Bag Deployment, Time to Deploy, Driver (msec)	42
Side Air Bag Deployment, Time to Deploy, Driver (msec)	57
Side Air Bag Deployment, Time to Deploy, Right Front Passenger (msec)	0
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Driver Side (msec)	57
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Right Side (msec)	0
Frontal Air Bag Deployment, nth Stage Disposal, Driver (Yes/No)	No
Frontal Air Bag Deployment, nth Stage Disposal, Right Front Passenger (Yes/No)	No

**Figure 4. Acura Deployment Command Data associated with Event Record 1.**

The pre-crash data reported certain vehicle parameters for up to five seconds before time zero (T0) at ½ - second intervals for both events. While the data is reported at discrete ½ - second intervals, it can be received by or processed by the EDR asynchronously.

1.5 seconds after the threshold was met for event 1 to be recorded a second threshold was met initiating the recording of event 2.<sup>8</sup> The time between the two events resulted in an overlap in data between the two events. Figure 5 and Figure 6 below show the data parameters recorded during event 1 and event 2. The highlighted data in event record 2 is the data related to the 1.5 second timing between the two events.

### Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	121 [195]	24	Off	Off	On Non-Engaged	5	5,300
-4.5	120 [193]	25	Off	Off	On Non-Engaged	5	5,100
-4.0	121 [194]	57	Off	Off	On Non-Engaged	0	5,200
-3.5	119 [192]	0	Off	Off	On Non-Engaged	0	5,100
-3.0	119 [191]	0	On	Off	On Non-Engaged	0	5,000
-2.5	117 [189]	0	Off	Off	On Non-Engaged	5	5,000
-2.0	116 [187]	0	Off	Off	On Non-Engaged	0	4,900
-1.5	115 [185]	13	Off	Off	On Non-Engaged	-10	4,900
-1.0	116 [186]	60	Off	Off	On Non-Engaged	-5	4,900
-0.5	115 [185]	71	Off	Off	On Non-Engaged	-25	4,900
0.0	108 [174]	100	Off	On	On Engaged	-45	4,600

**Figure 5. Acura EDR data showing the pre-crash parameters reported at 1/2 - second intervals.**

<sup>8</sup> An event is recorded if front air bag(s), side air bag(s), or side curtain air bag(s) are deployed. An event will also be recorded when a change in either the longitudinal or lateral velocity equal or exceeds 8 km/h (5 mph) over 150ms.

**Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2)**

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	119 [192]	0	Off	Off	On Non-Engaged	0	5,100
-4.5	119 [191]	0	On	Off	On Non-Engaged	0	5,000
-4.0	117 [189]	0	Off	Off	On Non-Engaged	5	5,000
-3.5	116 [187]	0	Off	Off	On Non-Engaged	0	4,900
-3.0	115 [185]	13	Off	Off	On Non-Engaged	-10	4,900
-2.5	116 [186]	60	Off	Off	On Non-Engaged	-5	4,900
-2.0	115 [185]	71	Off	Off	On Non-Engaged	-25	4,900
-1.5	108 [174]	100	Off	On	On Engaged	-45	4,600
-1.0	80 [128]	100	Off	On	On Non-Engaged	-45	4,500
-0.5	105 [169]	100	Off	On	On Non-Engaged	-55	5,800
0.0	101 [163]	100	Off	Off	On Non-Engaged	-70	5,900

**Figure 6. Acura EDR data showing the pre-crash parameters reported at 1/2 - second intervals. The highlighted data is the data related to the 1.5 second between events.**

**4.1.1 Acura TLX Infotainment System Data**

Several files were provided to NTSB investigators by MSP. The files were of several "tracks" that were obtained from the vehicle's infotainment system. In reviewing the data received it was determined that the file associated with the crash was the file labeled Track\_26. The data was reported at a rate of 1hz (1 sample every second) and included a date and time stamp (dd/mm/yyyy hh:mm:ss), latitude, and longitude. Table 3 shows the data associated with the 11 seconds prior to the crash.<sup>9</sup>

**Table 3. Shows certain data associated with track\_26 which was imaged from the Acura infotainment system.**

Date	Time	Latitude	Longitude
3/22/2023	12:35:51	39.31999	-76.7445
3/22/2023	12:35:52	39.32056	-76.7445
3/22/2023	12:35:53	39.32114	-76.7445
3/22/2023	12:35:55	39.32173	-76.7445
3/22/2023	12:35:56	39.32231	-76.7445
3/22/2023	12:35:57	39.32288	-76.7445
3/22/2023	12:35:58	39.32346	-76.7445
3/22/2023	12:35:59	39.32402	-76.7445
3/22/2023	12:36:01	39.32456	-76.7445
3/22/2023	12:36:02	39.32507	-76.7446
3/22/2023	12:36:03	39.32551	-76.7449

<sup>9</sup> Review of the data showed inconsistency in the speed data when compared to other available data. However, the position and time data are reasonably accurate.



Figure 7 is an image obtained from Google Earth of the area of Interstate 695 leading up to and including the area of the crash. The image is overlaid with the data from Table 3.



**Figure 7. Image of northbound I-695 leading up to an including the area of the collision. Overlaid on the image is the positioning data associated with the Acura. (Source: Google Earth edited by NTSB)**

### 4.2 2017 Volkswagen ACM Data

Review of the data determined that there was one event associated with the crash and that the recording of the file was complete. According to the Deployment Command Data associated with the event, there were no deployment of the vehicle's

SRS indicating that the event did not meet the acceleration or deceleration thresholds. Figure 8 shows the Deployment Command Data for event 1.

**Deployment Command Data (Record 1, Most Recent)**

Pretensioner, Time to 1st Stage Deployment, Driver (msec)	Not Deployed
Belt-Load Limiter, Time to Deployment, Driver (msec)	Not Deployed
Frontal Airbag, Time to 1st Stage Deployment, Driver (msec)	Not Deployed
Side Airbag, Time to Deployment 1st Stage, Driver (msec)	Not Deployed
Side Curtain/Tube Airbag, Time to Deployment, Driver Side (msec)	Not Deployed
Pretensioner, Time to 1st Stage Deployment, Front Passenger (msec)	Not Deployed
Belt-Load Limiter, Time to Deployment, Front Passenger (msec)	Not Deployed
Frontal Airbag, Time to 1st Stage Deployment, Front Passenger (msec)	Not Deployed
Frontal Airbag, Time to 2nd Stage Deployment, Front Passenger (msec)	Not Deployed
Frontal Airbag, 2nd Stage Disposal, Front Passenger	Not Deployed
Side Airbag, Time to Deployment 1st Stage, Front Passenger (msec)	Not Deployed
Side Curtain/Tube Airbag, Time to Deployment, Passenger Side (msec)	Not Deployed

**Figure 8. Image of the Deployment Command Data associated with event record 1 from the Volkswagen.**

The pre-crash data reported certain vehicle parameters for up to five seconds before time zero (T0) at ½ - second intervals. While the data is reported at discrete ½ - second intervals, it can be received by or processed by the EDR asynchronously. At 5 seconds before the collision the Volkswagen had been traveling at approximately 122 mph. The speed increased to 124 mph and then decreased to 111 mph at (T0). The service brake was applied about 0.5 seconds before (T0). Figure 9 is an image of the pre-crash data as reported. Regarding occupant seat belt status, the record indicated “belted” for the driver.

**Pre-Crash Data -5 to 0 sec (Record 1, Most Recent)**

Time (sec)	Engine RPM (Combustion Engine) (RPM)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation
-5.0	4.608	122 [196]	100	Off
-4.5	4.608	122 [197]	100	Off
-4.0	4.608	123 [198]	100	Off
-3.5	4.608	123 [198]	100	Off
-3.0	4.608	123 [198]	100	Off
-2.5	4.608	123 [198]	100	Off
-2.0	4.608	124 [199]	100	Off
-1.5	4.608	124 [199]	100	Off
-1.0	4.608	123 [198]	0	Off
-0.5	4.544	122 [196]	0	On
0.0	4.416	111 [178]	54	On

**Figure 9. Image of the 5 seconds of pre-crash data associated with event 1 from the Volkswagen.**

**5.0 Roadway Evidence Documentation**

NTSB investigators did not conduct an on-scene inspection, although a video documentation of the scene was conducted by NTSB investigators on March 26<sup>th</sup>, 2023.

The Maryland State Police Crash Team provided NTSB investigators with both terrestrial and aerial photographs in digital format. The aerial photographs were acquired with a small Unmanned Aerial System (sUAS). MSP also provided evidentiary data points that were collected at the scene utilizing a total station.<sup>10</sup>

Tire friction marks, road surface scrapes, and marking paint applied by MSP investigators were observed in the photographs provided. Scrape and scratch marks were also observed along the concrete jersey wall that bordered the left lane as well as the median barrier. The roadway evidence appeared to originate within the left lane. As previously described, there was a concrete barrier that bordered the left lane along the yellow edge line. The concrete barrier was in place for an active construction zone along the left shoulder. There was an opening within the barrier that measured about 149-feet. There were two friction marks which began approximately 158-feet south of the beginning of the opening. The first tire friction mark that was observed within the left lane, associated with the Acura, measured about 8.5-feet in length and was offset into the left lane from the concrete barrier about 10-feet. The second tire friction mark was identified approximately 55-feet north of the first tire mark, in the left lane, measured approximately 38-feet in length and was offset from the concrete barrier about 8-feet. Adjacent to the first friction mark, in the region of the Volkswagen striking the concrete barrier, was a tire friction mark coupled with scrape and scratch marks. The tire friction mark evidence continued northwest. Approximately 58-feet north of the second friction mark began a series of four curvilinear friction marks beginning in the left lane, approximately 5.0-feet from the yellow edge line, and traveling onto the left shoulder, through the opening in the barrier. The four curvilinear friction marks arced to the left, extending for about 122-feet, terminating on the left shoulder. Adjacent the end of the curvilinear friction marks along the concrete median barrier about 126-feet north of the beginning of the opening, were scrape and scratch marks that extended north for approximately 37-feet.

The friction mark evidence on the roadway surface and median barrier was consistent with the post impact travel of the Acura while the evidence along the concrete barrier wall was consistent with the Volkswagen post impact. Figure 10 is two photographic images taken by MSP investigators depicting the roadway evidence that extended northwestward from the apparent area of impact.

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<sup>10</sup> The total station is a combination of an Electronic Distance Measuring Instrument (EDMI) and a theodolite which measures vertical and horizontal angles.





**Figure 10. Images taken by MSP investigators depicting the roadway evidence. Image on the left shows the initial tire friction mark. The image on the right shows the four curvilinear friction marks. (Source: MSP modified by NTSB)**

The post-crash positions of rest for the two vehicles involved in the crash were identified through photographs and the orthomosaic image that was created from the three-dimensional point cloud received from MSP investigators. The Acura was located about 367 feet north of the south end of the opening in the barrier. The Volkswagen was located approximately 536 feet north of the of the beginning of the opening, in the left lane.

### **5.1 Pedestrians (Construction Zone Workers)**

There were six workers within the construction zone at the time of the crash that were reported by MSP investigators to have been struck by the Acura. Scene photographs depict three of the workers on the ground in the drainage area between the left shoulder edge and the median barrier around the final rest of the Acura. The remaining three workers were located on the ground across the median barrier along southbound I-695, northwest of the final rest of the Acura. Two were located approximately 412-feet and 454-feet, from the south end of the opening in the concrete barrier in the left shoulder. The third was approximately 474-feet from the south end of the opening in lane #3. The pedestrian's positions of rest were consistent with the post-crash travel for the Acura.

### **6.0 Video Evidence**

As a part of the investigation MSP investigators received three video recordings that captured events leading up to the crash. The first video was obtained from a third party that had recorded the live feed video from a Maryland Department of Transportation (MDOT) camera that was positioned along I-695 facing northbound. The remaining two were from dash cameras from motorists traveling northbound on I-695. The videos were provided to NTSB investigators by MSP investigators, and pertinent information is provided in the following sections.

## 6.1 MDOT Traffic Camera

The camera was pole mounted and positioned adjacent the right edge of the paved road and was approximately 434 feet south of the area of the crash. Figure 11 is an overhead image from Google Earth modified by NTSB. The image depicts the location of the MDOT camera, the crash, and the approximate field of view from the camera. The field of view was approximated from the video.



**Figure 11. Overhead image of I-695. The location of the MDOT traffic camera, the approximate location of the crash is identified. Also identified is the approximate field of view of the camera. (Source: Google Earth modified by NTSB)**

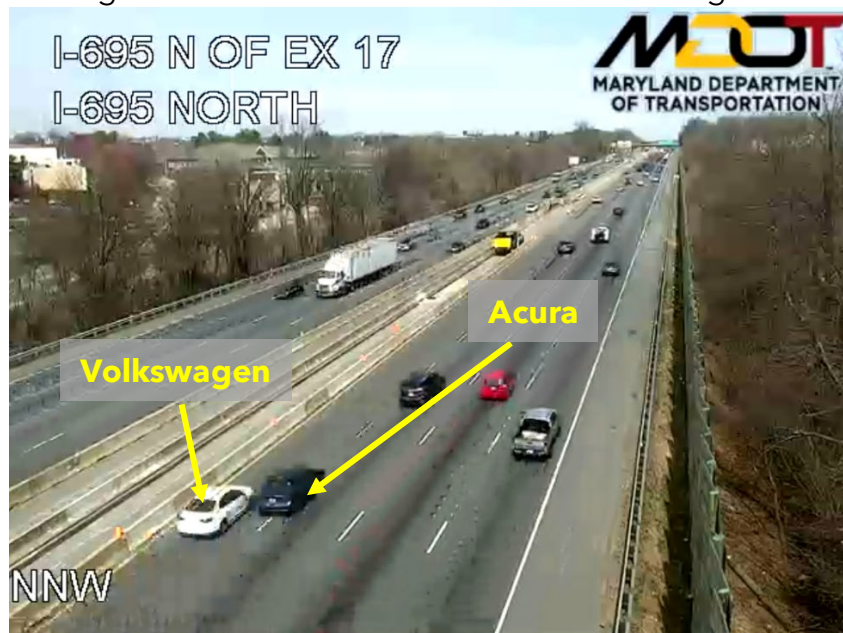
There was no date or time stamp associated with the video. In the upper left corner was the location of the camera, I-695 North of Exit 17, below that was the direction of the highway the camera was observing, I-695 North. In the lower left was the direction the camera was facing; NNW and the upper right was labeled MDOT Maryland Department of Transportation. The provided video was 1 hour 03 minutes and 42 seconds long. Table 4 summarizes certain events depicted in the MDOT traffic camera. The time stamps are from the video run time and not associated with a time of day.



**Table 4. Timeline of events observed in MDOT traffic camera.**

Time - related to video timeline (mm:ss)	Event
00:00	Video starts and traffic is relatively light.
44:43	Both vehicles appear in the video. Volkswagen is in the left lane (lane 1) and the Acura is in lane 2 entering lane 1. The left rear of the Acura is adjacent the right front wheel of the Volkswagen.
	Acura has almost fully entered lane 1 and the left rear is contacting the right front of the Volkswagen.
44:44	The Acura is now fully in lane 1 with the Volkswagen. The Volkswagen has moved to the left and is contacting the concrete barrier.
	The left side of the Volkswagen has climbed the concrete barrier, and the Acura has begun to rotate counterclockwise.
44:46	The Acura is completely in the work zone and the Volkswagen is continuing northbound.

Figure 12 below is an image captured from the MDOT traffic camera. The image depicts the Volkswagen in lane one and the Acura encroaching on the Volkswagen.



**Figure 12. Image capture from MDOT camera depicting the Acura and Volkswagen just prior to contact. (modified by NTSB)**

## 6.2 Dash Camera Video #1 (Escort)

The dash camera was identified as an Escort as labeled in the lower right corner of the video. There was a date and time stamp 2023/03/22 (YYYY/MM/DD, hh:mm:ss), also in the lower right corner. The camera was mounted on the windshield along the centerline of the vehicle. The vehicle travels in the left lane (lane 1) for the duration of the video. Table 5 summarizes certain events depicted in the Escort dash camera.

**Table 5. Timeline of events observed in the Escort dash camera video.**

Displayed Time	Event
12:32:30	Video begins
12:32:32	Volkswagen can be seen passing dash camera in lane 2.
12:32:33	Volkswagen transitions from lane 2 to lane 1.
12:32:36	Volkswagen transitions from lane 1 back into lane 2.
12:32:55	Volkswagen transitions from lane 2 into lane 3 and accelerates away from dash camera.
12:33:11	Volkswagen transitions from lane 3 back into lane 2 and again accelerates
12:33:19	Volkswagen leaves the field of view of the dash camera.
12:34:04	Acura appears in the video transitioning from lane 2 across lane 3 and into lane 4, accelerating away from the dash camera.
12:34:14	Acura transitions from lane 4 across lane 3 into lane 2.
12:34:24	Acura transitions from lane 2 into lane 1 and accelerates out of the field of view.
12:36:30	Dust cloud can be seen encompassing the northbound I-695 lanes.

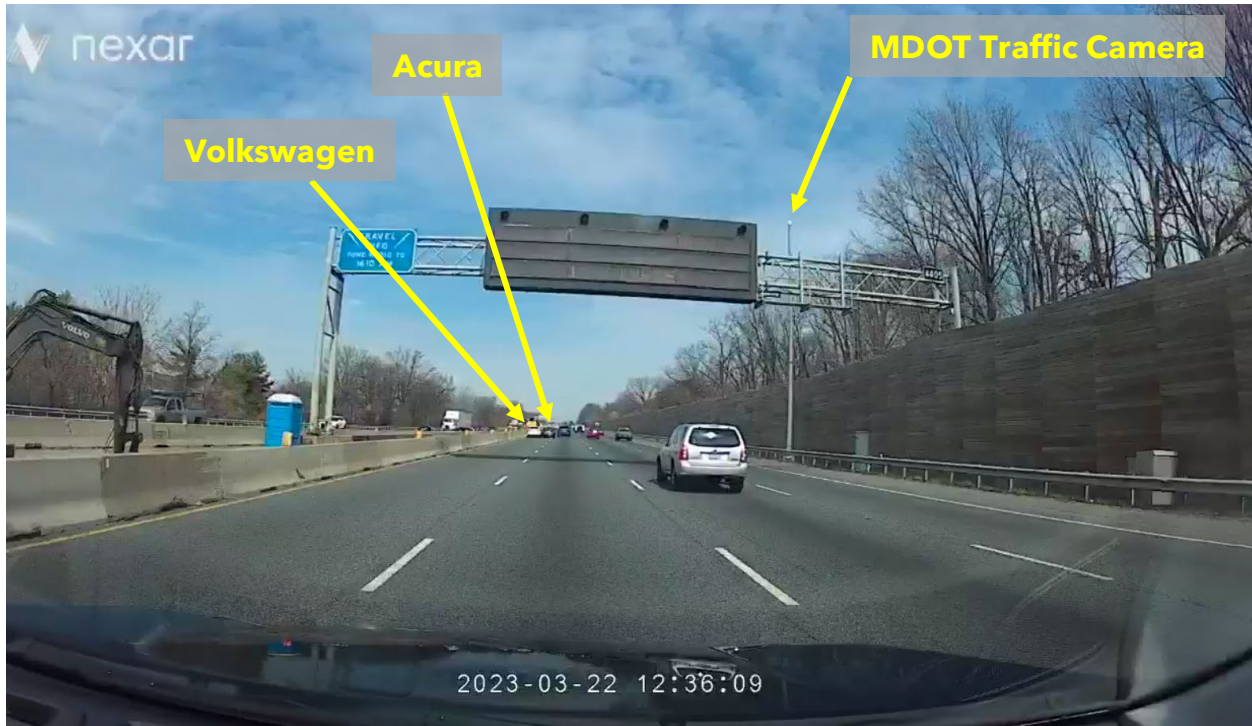
### 6.3 Dash Camera Video #2 (Nexar)

The dash camera was identified as a Nexar as it was labeled in the upper left corner of the video. There was a date and time stamp in the lower center of the video, 2023-03-22 12:35:02 (YYYY-MM-DD, hh:mm:ss). The camera was mounted to the windshield along the centerline of the vehicle. Table 6 summarizes certain events depicted in the Nexar dash camera.

**Table 6. Timeline of events observed in the Nexar dash camera video.**

Displayed Time	Event
12:35:02	Video Begins
12:36:04	The Acura passes the camera in lane 4.
12:36:05	Volkswagen passes the camera in lane 1. There is no traffic in front of Volkswagen Traffic is visible ahead of Acura in lanes 2, 3, and 4.
12:36:07	Acura transitions from lane 4 across lanes 3, and 2 into lane 1.
12:36:09	Acura completely within lane 1 contacted the Volkswagen.

Figure 13 below is an image captured from the dash camera video. In lane 1 (left lane) the Volkswagen and the Acura can be seen. The Acura had transitioned from lane 4 (right lane) to lane 1. Impact between the two vehicles can be seen. Also visible is the MDOT traffic camera discussed above in Section 6.1.



**Figure 13. Image captured from the dash camera depicting the impact between the Acura and the Volkswagen. (modified by NTSB)**

## **E. ATTACHMENTS**

The following attachments are included in the docket for this investigation:

- CDR report for Acura TLX
- Acura TLS Specifications
- CDR report for Volkswagen Jetta
- Volkswagen Jetta Specifications

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