National Transportation Safety Board

Office of Highway Safety

Washington, DC 20594

HWY23FH014

HIGHWAY, VEHICLE, AND TECHNICAL RECONSTRUCTION

Group Chair's Factual Report

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A. CRASH INFORMATION

Location: Philadelphia, Philadelphia County, Pennsylvania
Date: June 11, 2023
Time: 6:17 a.m. EDT

B. HIGHWAY, VEHICLE, AND TECHNICAL RECONSTRUCTION GROUP

Group Chair
Eric Gregson
National Transportation Safety Board
Washington, DC

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. DETAILS OF THE INVESTIGATION

This report is based on reports, photographs, documents, and data provided by the Pennsylvania State Police (PSP), and Pennsylvania Department of Transportation. Further support was provided through the examination and documentation of the collision scene, the involved combination vehicle, and an exemplar combination vehicle.

The report begins with a discussion that covers the crash location, recent construction history, annual average daily traffic, and crash data history for the Cottman Avenue off-ramp. The report will continue with roadway data that includes typical section, off-ramp speed limit, horizontal alignment, centerline and edge line markings, rumble strips, and signage. The report continues discussing the post-crash inspection and documentation of the vehicle involved. Finally, the report concludes with the documentation of the scene which involved terrestrial photography, sUAS aerial photography and three-dimensional scanning.[1] Photographs were taken in digital format, while scanning was accomplished using Recon3D scanning application.[2] The

[1] sUAS – small Unmanned Aircraft System
[2] Recon3D is a scanning application that utilizes the Lidar on the iPhone. The application uses the Everypoint engine and combines the lidar with video frames. The combination provides a photogrammetry plus lidar model.

aerial photographs were gathered using a DJI Phantom 4 Professional V2. A mapping and imagery flight was conducted of the crash scene. Video documentation of the collision location was conducted that included the roadway, highway signage and lighting.

1.0 Location

Figure 1 is a map that depicts the crash was in the northeast area of the City of Philadelphia. The crash occurred on the off-ramp from I-95 to Cottman Avenue, in Philadelphia, Philadelphia County, Pennsylvania. The GPS coordinates were 40.02391800 latitude, -75.03096000 longitude.

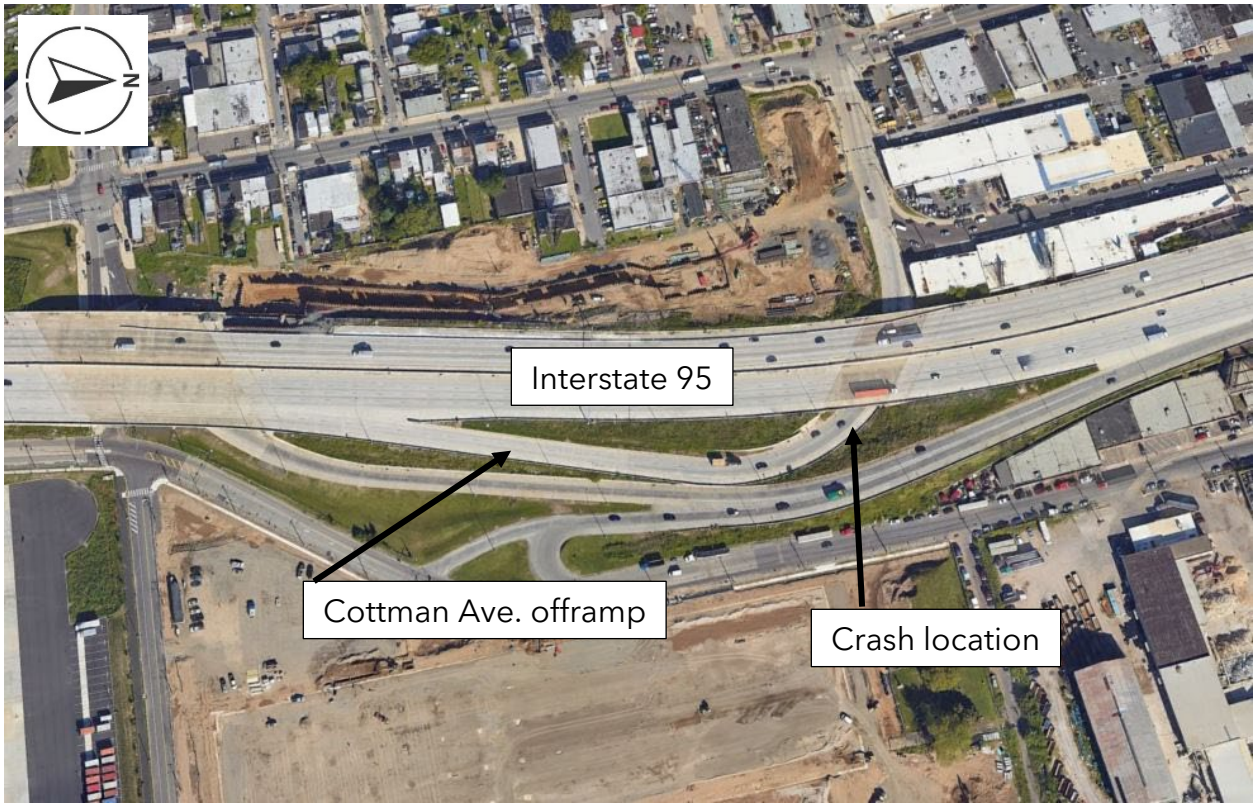

Figure 1. Map showing crash location. (Source: Google Maps edited by NTSB)

2.0 Highway Factors

2.1 Construction History of Cottman Avenue off-ramp and Overpass

The Cottman Avenue off-ramp and overpass went through a complete reconstruction which started in 2013. The off-ramp was completed on December 20, 2016. The

overpass was built in three phases. **Table 1** summarizes the phases and their completion dates.[3]

Table 1. Phases of overpass construction and their completion dates.

Phase	Location	Completion Date
Phase 1	Southbound	10/16/2014
Phase 2	Median	6/5/2015
Phase 3	Northbound	6/24/2016

2.2 Annual Average Daily Traffic Volumes

As reported by the Pennsylvania Department of Transportation (PennDOT) there have been four traffic volume reports since 2002. It should be noted that the truck volume and percentage was only reported for 2019 and was found to be 1,587 trucks with was 10.2%. The volume was gathered from the beginning of the off-ramp to the I-95 overpass. **Table 2** summarizes the average daily traffic volume.[4]

Table 2. Summary of the average daily traffic volumes for Cottman Avenue.

Year	Total
2002	16,822
2007	22,526
2012	22,239
2019	15,544

2.3 Speed Limit

The posted regulatory speed limit for Interstate 95 (I-95) leading up to the Cottman Avenue off-ramp was 55 miles per hour which began approximately 1 mile south of the off-ramp. The posted advisory speed limit for the Cottman Avenue off-ramp was 25 miles per hour.

2.4 Typical Section I-95

The design configuration of the northbound travel lanes and southbound travel lanes of I-95 are the same. This report will only detail the northbound travel lanes of I-95. The northbound lanes were constructed of concrete and consisted of four travel lanes. Each lane measured approximately 12-feet in width. There was a shoulder adjacent to both the left and right lane each measuring about 12-feet in width.[5] Approximately 0.40 miles south of the Cottman Avenue off-ramp the four northbound

[3] Highway Attachment – Cottman Avenue Construction Dates.
[4] TMS Site 15591 Traffic Report | PennDOT Traffic Information Repository.
[5] Highway Attachment – Cottman Avenue Ramp Roadway Sections.

lanes expanded to five lanes adding an additional right lane. At the entrance to the Cottman Avenue off-ramp the right lane split into two lanes onto Cottman Avenue.

2.5 Cottman Avenue off-ramp Highway Markings

The Cottman Avenue off-ramp consisted of two lanes separated by 6-inch-wide dashed white lane lines measuring approximately 10-feet in length and spaced about 30-feet apart. The right travel lane varied in measurements between 12 and 15-feet. The left lane measured approximately 12-feet. A 6-inch-wide solid white line separated the right travel lane from the right shoulder and a 6-inch-wide solid yellow line separated the left travel lane from the left shoulder. All highway markings were retroreflective.

2.6 Typical Section Cottman Avenue off-ramp

At the entrance to the off-ramp there was a right-hand horizontal curve that measured approximately 322-feet in length and had a radius of about 2,865-feet. The right-hand horizontal curve transitioned into a tangent that measured approximately 495-feet before transitioning to a left-hand horizontal curve that measured about 567-feet in length and had a radius of approximately 300-feet.[6] The right shoulder varied in width between 8 and14-feet with an approximate 4-foot-wide shoulder adjacent the left lane.

2.7 Crash Data History

Table 3 summarizes the contributing factor and crash summary on the Cottman Avenue off-ramp over the last five years.[7]

Table 3. Driver action and crash summary for the Cottman Avenue off-ramp.

Date	Time	Road Condition	Driver Action	Fatality (Yes or No)
2018 – 4 crashes				
04/24/2018	9:24 am	Dry	Too fast for conditions	No
07/12/2018	8:17 am	Dry	Affected by physical condition	No
11/16/2018	6:27 am	Wet	Too fast for conditions	No
12/08/2018	5:21 am	Dry	Improper entrance to highway	No
2019 – 1 crash				
06/22/2019	2:58 am	Dry	Affected by physical condition	No
2020 – 4 crashes				

[6] Highway Attachment – Cottman Avenue Curve Data.
[7] Highway Attachment – Cottman Avenue Ramp Crash Data.

04/27/2020	3:40 am	Wet	Distracted, too fast for condition, tailgating	No
07/12/2020	3:56 am	Dry	Driving wrong side of roadway	No
11/12/2020	7:46 pm	Wet	Driving wrong way on one-way	No
12/02/2020	6:36 pm	Dry	Careless passing or lane change	No
2021 – 4 crashes				
02/01/2021	9:17 am	Snow	Too fast for conditions	No
04/17/2021	11:22 pm	Dry	Improper exit from highway	No
06/20/2021	1:27 am	Dry	Physical condition, wrong way on one-way	No
09/02/2021	4:44 am	Dry	Careless passing or lane change	No
2022 – 3 crashes				
06/21/2022	9:15 am	Dry	Sudden slowing/stopping	No
10/02/2022	12:57 pm	Wet	Unknown	No
11/26/2022	10:15 pm	Dry	Wrong side of roadway, too fast for conditions	No

2.8 Rumble Strips

Grooved longitudinal rumble strips were present in both the right and left shoulders along the off-ramp. The dimensions of the rumble strips were 16-inches long and 5-inches wide.[8] The rumble strips were spaced approximately 7-inches apart measured from edge to edge. The depression of the rumble strip into the concrete was about 3/8-inch. The rumble strips along the right shoulder were offset from the edge of the right travel lane approximately 15-inches and the rumble strips along the left shoulder were offset from the edge of the left travel lane approximately 12-inches.

2.9 Highway Lighting

Along the Cottman Avenue off-ramp were three light poles that were offset from the roadway approximately 16-feet and were located behind the concrete barrier that aligned the right edge of the roadway. The light poles extended about 50-feet above the surface and contained 400-watt high pressure sodium luminaire attached at the end of the mast arm. The light poles were spaced approximately 280-feet apart.[9]

2.10 Cottman Avenue Grade and Cross-Slope

The northbound off-ramp had a negative (downhill) grade of approximately 2.3%. The left horizontal curve was constructed with an approximate positive (uphill) cross-slope of 6.0%, sloped upward from left to right, in the direction of travel. The right shoulder was constructed with an approximate negative (downhill) cross-slope of 2.0%, sloped downward from left to right, in the direction of travel. The cross-slope

[8] Highway Attachment – Cottman Avenue Rumble Strips.
[9] Highway Attachment – Cottman Avenue Ramp Sign and Lighting Plan.

break as measured at the edge of the paved traveled way and paved shoulder was determined by finding the algebraic difference in the grades between the travel lane and shoulder. As can be seen in **Figure 2** the cross-slope break along Cottman Avenue was 8%.

A Policy on Geometric Design of Highways and Streets, 7th Edition, 2018 (commonly known as the Green Book) stated:
"Within a superelevated roadway section, the maximum algebraic difference of cross slope break should not exceed 8 percent between the traveled way and usable shoulder. Edge line or shoulder rumble strips placed on or close to the edge line are desirable to reduce the potential for full traversal departures onto the shoulder."

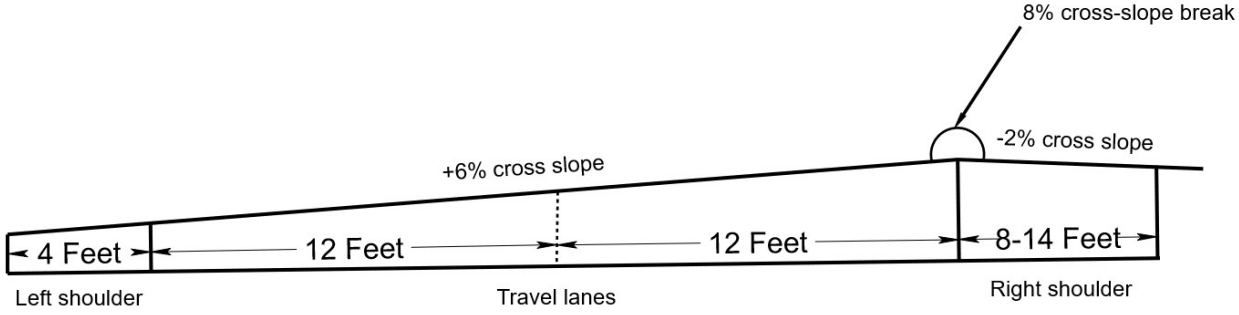

Figure 2. Graphic showing the cross slope of the travel lanes, the right shoulder, and the cross-slope break.

2.11 Concrete Barrier

The concrete barrier was rated as a Manual for Assessing Safety Hardware (MASH) Test Level 4 (TL-4) 42-inch-high barrier. A TL-4 barrier is considered for general use on high-speed freeways with an average mix of passenger vehicles and truck traffic. The crash test for TL-4 barriers is intended to provide resistance in most real- world crashes where typical impact scenarios do not exceed the practical worst-case scenarios of a 15-degree impact angle at 56-mph with a 22,000-pound single unit truck (SUT). In lesser impact speeds and angles which account for most barrier impacts the TL-4 has been found to provide adequate resistance even to heavier truck-tractor semitrailer combinations which are tested at the TL-5 level. In a TL-5 test an 79,300-pound truck-tractor van semi-trailer is used to impact the barrier at 50-mph and 15-degrees. In the Philadelphia crash the truck-tractor tanker semitrailer combination unit overturned sliding across the roadway striking the concrete median barrier at an approximate 9° angle, with the truck and tanker already on its side. There was no deformation observed to the barrier.

2.12 Cottman Avenue off-ramp Signage

Approximately 733-feet south of the collision area was an advisory exit speed sign advising motorists to travel 25 miles per hour. About 500-feet south of the area of the collision was a truck rollover warning sign accompanied by an advisory speed plaque indicating the recommended speed of 25 miles per hour. There were three chevron alignment signs placed along the outside of the horizontal curve providing emphasis of the change in the horizontal alignment. [10] The collision resulted in two of the three chevron signs being damaged. **Table 4** summarizes the signage prior to the crash on the Cottman Avenue off-ramp.

Table 4. Signage prior to the crash on the Cottman Avenue off-ramp

Signage	Distance from Crash
	733 Feet
	500 Feet
	In the area of the crash

The 2009 edition of the Manual on Uniform Traffic Control Devices (MUTCD) recommended national uniformity for all traffic control devices. To provide for uniformity, MUTCD was the adopted national standard for all traffic control devices. The MUTCD provided guidance through its recommended standards regarding advisory speed limit signage, truck rollover warning sign, advisory speed limit plaque,

[10] Highway Attachment – Cottman Avenue Sign and Lighting Plan.

and chevron alignment signs. Figure 3 below is a Google Earth image depicting the Cottman Avenue off-ramp signage locations.

Figure 3. Google Earth image depicting Interstate 95 and the Cottman Avenue off-ramp. The signage discussed above is identified. Revised by NTSB.

3.0 2017 International Truck-tractor

Figure 4. Photograph of 2017 International truck-tractor involved in the collision.

3.1 General Information[11]

Make:	International
Model:	Prostar+ 122
VIN:[12]	3HSDJAPR7HN473607
Model Year:	2017
Date of Manufacture:	May 2016
Mileage:	582,782[13]
GVWR:[14]	52,350 lbs.
Wheelbase:	175.2 inches

[11] Vehicle Attachment – International Prostar Build Sheet.
[12] Vehicle Identification Number.
[13] Vehicle Attachment - Vehicle Position History.
[14] Gross Vehicle Weight Rating (GVWR) is the total maximum weight that a vehicle is designed to carry when loaded, including the weight of the vehicle plus fuel, passengers, and cargo.

Engine:	Cummins ISX 15, 415 HP @ 1800 RPM
Transmission:	Eaton Advantage 10-speed automatic
Rear Axle Ratio:	2.64
Steering Gear:	Sheppard HD94
Brake Type:	Air-operated drum brakes with Antilock Braking System (ABS); Bendix 6-Chan ATC

3.2 Damage Description

The truck was removed from the scene on June 14, 2023, and transported to the Pennsylvania Department of Transportation located near the crash site. While at the facility initial photographs and examination was conducted. Damage specific to many of the vehicle components will be described in greater detail later in the appropriate sections of this report.

The truck sustained crash damage to the right and left side of the vehicle. The damage included severe fire damage to all areas affecting all major mechanical systems. Figure 4 above shows the truck looking from the front right.

The right side of the cab was displaced inwards to the left and rearwards. The right side "A" pillar and right side of the firewall were displaced rearward and downward. The combustible materials within the cab were completely consumed with only wire visible. The engine and right front frame rail were displaced leftward. The radiator, air conditioning condenser, accessory drive belts, engine cooling fan, and hood were all consumed by fire. The wiring harness casings were consumed by fire exposing bare wires. The exhaust particulate filter on the right side was damaged but still in place. Both the left and right-side saddle fuel tanks were consumed by fire and the straps were still in place. The lower fifth wheel plate was missing; the fifth wheel slider bracket was in place however damaged. Axle two drive had separated from the frame and was hanging down and the short drive line between axles two and three was separated. The right-side rear of the truck was displaced upward. The left-side frame of the truck, under the driver's door and in front of axle two was displaced inward. Figure 5 below shows the damage to the right side of the truck.

Figure 5. Photographs showing the damage to the left side of the tractor.

3.3 Steering System

Due to the extensive crash and fire damage, a functional check of the steering system was not able to be performed. A visual examination of the remaining steering components showed a bent upper portion of the steering arm that was still intact and connected to the steering shaft. The hydraulic fluid reservoir that contained the steering fluid was consumed by fire. The pitman arm and drag link were intact. The steering column was intact, and the outer steel hoop that made up the steering wheel was undamaged. Figure 6 is two photographs showing the components of the steering system as they were during the vehicle inspection.

Figure 6. Two photographs each depicting a section of the steering components as observed during the vehicle inspection.

3.4 Driver Control

Due to the extensive fire damage, there were no switches or gauges available to be inspected or documented. The clutch, brake pedal, and acceleration pedal were all consumed by the fire.

3.5 Suspension

The truck's steer axle (axle #1) suspension consisted of two leaf spring packs mounted to the solid steer axle, and shock absorbers. The U-bolts of both the left and right sides were intact. The right-side lower leaf spring was broken, and a portion was missing and had separated from the front spring hanger. The right shock absorber was crushed downward. On the left side all three leaf springs were visually intact however a more in-depth inspection could not be completed due to extensive damage.

The truck's drive axle (axle #2) suspension consisted of a single leaf spring mounted to the solid axle, a set of shock absorbers, and a set of airbags. On the right side the front leaf spring eye was broken from the hanger. The U-bolts were still connected to the leaf spring and axle was broken from the frame mount. The airbag was consumed by fire thus separating the rear of the leaf spring from the frame. On the left side, the front hanger was separated from the frame but still attached to the leaf spring eye. The U-bolts were still connected to the leaf spring and the axle was broken off the frame mount. The airbag was consumed by fire separating the rear of the leaf spring from the frame. Both axle 2 shock absorbers were bent, and the solid axle was separated from the frame.

The truck's axle #3 suspension consisted of the same components as axle #2. On the left side the forward leaf spring eye was bent inwards and broken from the hanger. The U-bolts were still connecting the leaf spring to the axle; however, the axle had broken from the frame mount. The airbag had been consumed by fire and the shock absorber was bent. On the right side the front leaf spring eye was still connected to the hanger and the hanger to the frame. The U-bolts were still connected to the leaf spring; however, the axle had broken from the frame mount. The airbag was consumed by fire.

3.6 Tires and Wheels

The tire and weight rating placards that should have been on the truck were all destroyed by the post-crash fire. The recommended tire size on the vehicle manufacturer build sheet were 295/75R22.5 with a load rating of "G" and to be mounted on 22.5x8.25-inch rims. All 10 tires on the truck were consumed by fire and unable to be inspected. According to maintenance records the steer axle (axle #1) tires were replaced on September 22, 2022, the recorded size was 295/75R22.5. Only the rims on the right-side axle #1 and axles #2 and #3 were available for inspection as the other seven were consumed by fire. The axle #1 rim was damaged because of the collision and post-crash fire. The outer rim on axles #2 and #3 were bent and melted due to the fire. The inner rims of axles #2 and #3 received thermal damage because of the fire.

3.7 Air and Brake Systems

Due to the significant crash and fire damage sustained by the truck, functional checks of the air and brake systems were not able to be performed. The truck was equipped with s-cam drum brakes on all the wheels. The type and sizes of the brake components are listed below in Table 5.

Table 5. Brake components for the involved truck-tractor.

Position	Brake Chamber Type	Manufacturer	Slack Adjuster Length	Manufacturer	Push Rod Stroke
Axle 1 L	24 long stroke	Bendix	NM	Haldex	Damaged
Axle 1 R	24 long stroke	Bendix	NM	Haldex	Damaged
Axle 2 L	30 clamp	Bendix	NM	Haldex	Damaged
Axle 2 R	30 clamp	Bendix	NM	Haldex	Damaged
Axle 3 L	30 clamp	Bendix	NM	Haldex	Damaged
Axle 3 R	30 clamp	Bendix	NM	Haldex	Damaged
Axle 4 L	30 clamp	Bendix	NM	Haldex	Damaged
Axle 4 R	30 clamp	Bendix	NM	Haldex	Damaged
Axle 5 L	30 clamp	Bendix	NM	Haldex	Damaged
Axle 5 R	30 clamp	Bendix	NM	Haldex	Damaged

The combustible materials including brake hoses, thermoplastic airlines, and brake chamber diaphragms, for the brake system were all consumed by fire. As mentioned previously the foot pedal, inside the cab, was also consumed by fire. Brake pad thickness was able to be measured and were found to be ½" in thickness.

3.8 Electrical

Due to the extent of the collision and post-crash fire damage, the truck's entire electrical system was compromised and could not be inspected for function.

3.9 Event Data Recorder

The Cummins engine was controlled by an Engine Control Module (ECM) that may have been capable of storing or recording certain engine and vehicle parameters and event data. The module was also capable of engine diagnostics associated with sensor faults which then can communicate to the driver in way of illuminated warnings on the dashboard. The ECM as well as other modules within the truck were all destroyed by the post-crash fire and were not able to be recovered for further examination.

4.0 2004 Heil Cargo Tank[15]

Make:	Heil
Model:	DOT 406
VIN:	5HTAB432747H67214
Model Year:	2004
Date of Manufacturer:	October 2003
Capacity:	9200 gallons
Compartments:	Four (4)
#1 Capacity:	2600 gallons
#2 Capacity:	2200 gallons
#3 Capacity:	1500 gallons
#4 Capacity:	2900 gallons

4.1 Damage Description

The tanker was consumed by fire leaving only pieces of aluminum. The rear axles were located at the crash site underneath the collapsed bridge however, NTSB investigators were not able to inspect the axles due to the location of them during the bridge cleanup process. The axles were moved after NTSB investigators left the crash site and brake pad measurements were obtained by PSP investigators. The brake shoe thickness measurements were recorded to be ½".

[15] For further information about the trailer contents and certifications see Motor Carrier Factual Report.

5.0 Maintenance History

Maintenance and inspection records for the 2017 International Pro-Star truck-tractor were obtained from TK Transport Inc. by the NTSB Motor Carrier Factors Group Chairman. The most current vehicle inspection was completed on April 19th, 2023, at which time all eight drive tires on the truck were replaced with new ones.

6.0 Recalls and Warranty Claims[16]

A search of the safety recall database maintained by the National Highway Traffic Safety Administration (NHTSA) indicated that there were no unrepaired recalls associated with the truck-tractor.[17]

7.0 Roadway Evidence Documentation

On-scene observations gleaned scrape marks located on the vertical portion of the concrete barrier. Also observed were black scorched areas on the concrete barrier, roadway, bridge structure, and the grass area along the opposite side of the concrete barrier. Recovery operations were underway during the evidence documentation and any roadway evidence had been covered up by debris or destroyed by heavy equipment being utilized to cleanup and remove the collapsed bridge. Figure 7 depicts the first area of scrape marks and the scorching along the concrete barrier.

Figure 7. Photograph depicting the impact marks and scorching on the concrete barrier.

[16] Vehicle Attachment – NHTSA Recalls
[17] Vehicle Attachment – International Warranty Claims.

The PSP Forensics Unit provided scene photographs. In reviewing the photographs NTSB investigators observed several areas of crash related physical evidence including tire friction marks, scrape and scratch marks within the right lane, right shoulder and along the concrete barrier.

Figure 8. Photograph looking north along the Cottman Avenue off-ramp. In the photograph evidentiary marks are visible along the roadway, and concrete barrier. (Photograph courtesy of PSP)

Figure 8 above is a photograph looking north along the Cottman Avenue off-ramp. The combination vehicle's direction of travel is noted on the photograph. The two parallel friction marks, noted on the image, were light at the beginning and became darker as the marks continued. The friction marks began approximately 170 feet south of the first strike on the concrete barrier, they were straight and transitioned to curvilinear as the combination negotiated the left horizontal curve. The marks were parallel to one another and measured approximately 6 feet 4 inches from the white edge line to the center of the marks which extended approximately 176 feet.

Figure 9. Photograph looking north along the Cottman Ave. off-ramp. The image shows the termination of the curvilinear friction marks. (Photo courtesy of PSP)

Figure 10. Photograph looking north along Cottman Avenue. In the photograph are the tire friction marks and noted is the area of the red lens and the beginning of the scorched concrete barrier. (Photo courtesy of PSP)

Figure 9 is a photograph depicting the area where the friction marks denoted in Figure 8 terminated. At the termination, the marks were dark, and the right outer

mark widened and traveled north towards the shoulder. In line and approximately 4.5 feet south, of the final friction mark were scrape marks on the roadway surface that continued to the concrete barrier. Associated scape marks on the concrete barrier were not visible due to the scorching from the post-crash fire. The scrape marks were at an approximate 9° angle relative to the direction of travel for a vehicle negotiating the left horizontal curve.

Figure 10 is a photograph depicting the tire friction marks created by the combination as it continued negotiating the leftward curve on Cottman Avenue. Also annotated are the two circular friction marks on the white edge line, east of the circular friction marks, about 5 feet east, on the right shoulder, was a semicircular scrape mark that continued north to the concrete barrier. Observed on the concrete barrier prior to the scorched area, were horizontal scrape marks along the face of the barrier. Observed on the right shoulder, within the rumble strips, between the circular friction marks and scrape marks were fragments of red plastic lens.

Figure 11 is an aerial image provided to NTSB investigators by PSP. The image shows the Cottman Avenue off-ramp prior to entering underneath the Interstate 95 bridge. Identified in the image are the friction marks and scrape marks associated with the crash.

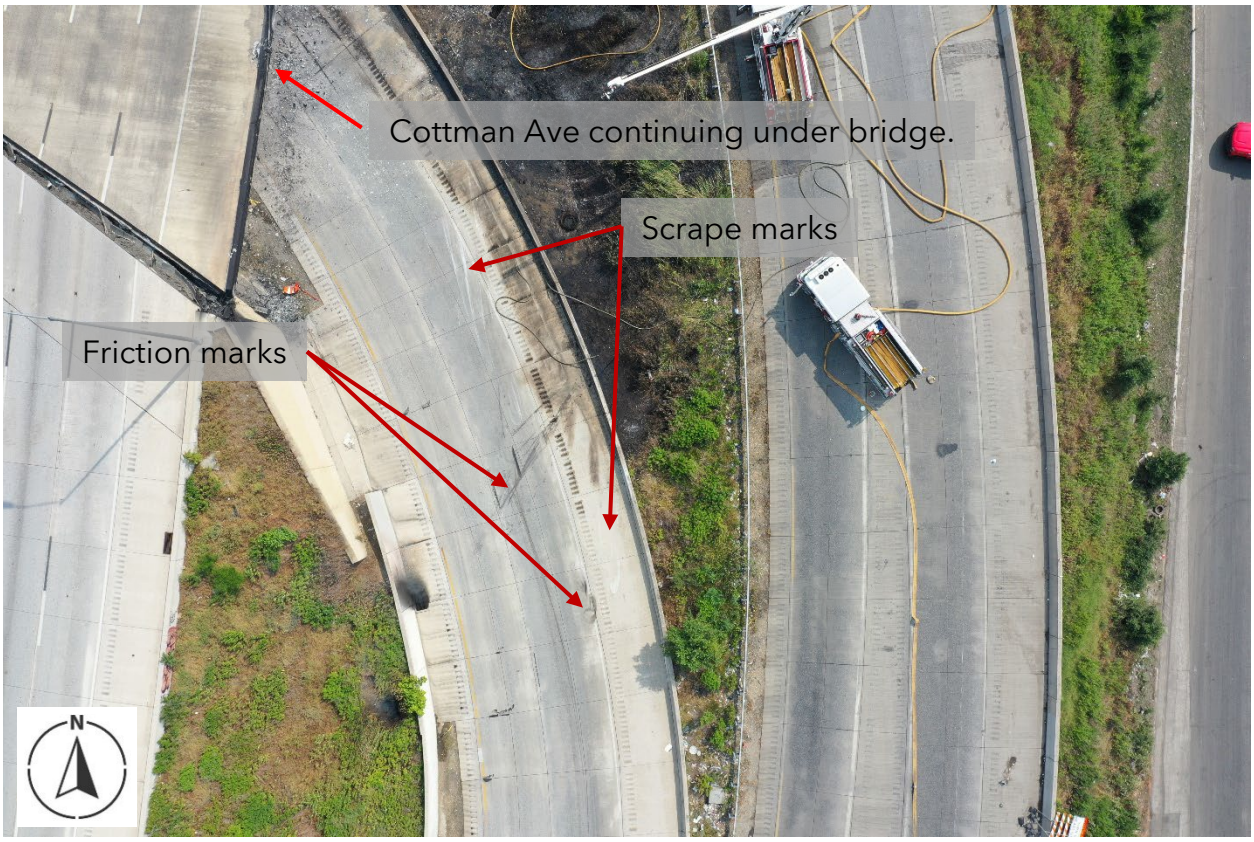

Figure 11. Overhead aerial photograph showing the friction marks and scrape marks on the roadway surface. (Photo courtesy of PSP)

Figure 12 below, is a screen capture of the three-dimensional point cloud generated from the aerial photos collected by PSP. The final rest of the overturned combination unit can be seen. It should be noted that the combination unit was located underneath the collapsed portion of Interstate 95, the trailer portion was found to be at rest with the top down.

Figure 12. Image of the point cloud generated from the aerial photographs. Final rest of the overturned combination unit is noted. (Photos courtesy of PSP)

7.1 Omnitracs Fleet Management Software

The truck-tractor was equipped with the Omnitracs Fleet Management Software. Penn Tank Lines provided NTSB investigators with the prior three days of telemetry data which included: position time, location, latitude and longitude, speed, direction, and odometer, reporting the data in one-minute intervals. The crash occurred at 6:17 a.m. Omnitracs stores the data and transfers it to the cloud on a timed interval. At the time of the collision the data for the 10 minutes leading up to the collision had not been transferred. Table 6 shows a sample of the data prior to the crash.[18]

Table 6. Sample of data received from the Omnitracs Fleet Management Software.

Date	Time (H:MM:SS)	Latitude	Longitude	Speed (mph)
6/11/2023	5:57:37	39.87175	-75.2982	64
6/11/2023	5:58:37	39.87597	-75.2787	65
6/11/2023	5:59:37	39.87606	-75.2582	65
6/11/2023	6:00:37	39.88574	-75.2431	63
6/11/2023	6:01:37	39.89277	-75.227	63
6/11/2023	6:02:37	39.88555	-75.2097	63
6/11/2023	6:03:37	39.89328	-75.1963	47
6/11/2023	6:04:37	39.89898	-75.1779	62

[18] Vehicle Attachment – Vehicle Position History.

6/11/2023	6:05:37	39.90023	-75.1577	64
6/11/2023	6:06:37	39.91226	-75.1485	63

7.2 Surveillance Video

A surveillance camera was located on a business building southeast of the crash site. The camera view showed the Cottman Avenue off-ramp. The video footage showed the combination vehicle traveling north on the off-ramp. As the combination negotiated the left horizontal curve the combination unit overturned onto its right-side after which an eruption of fire. The video was received from PSP and provided to investigators in the NTSB Office of Research and Engineering to conduct a video speed study.

E. LIST OF ATTACHMENTS

- Highway Attachment – Cottman Avenue Construction Dates
- Highway Attachment - Cottman Avenue Ramp Roadway Sections
- Highway Attachment – Cottman Avenue Curve Data
- Highway Attachment – Cottman Avenue Crash Data
- Highway Attachment - Cottman Avenue Rumble Strips
- Highway Attachment - Cottman Avenue Ramp Sign and Lighting Plan
- Vehicle Attachment – International Build Sheet
- Vehicle Attachment – Vehicle Position History
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- Vehicle Attachment – International Warranty Claims

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