



**TECHNICAL RECONSTRUCTION GROUP CHAIRMAN'S
FACTUAL REPORT**

Cranbury, NJ

HWY14MH012

(23 pages)

**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF HIGHWAY SAFETY
WASHINGTON, D.C.**

**TECHNICAL RECONSTRUCTION GROUP CHAIRMAN'S
FACTUAL REPORT**

A. CRASH INFORMATION

Location: New Jersey Turnpike (I-95) northbound near Milepost 71.4
Cranbury, Middlesex County, New Jersey

Vehicle #1: 2011 Peterbilt truck-tractor in combination with a 2003 Great Dane
semitrailer

Operator #1: Walmart Transportation LLC

Vehicle #2: 2012 Mercedes-Benz Sprinter limo van

Operator #2: Atlantic Transportation Services, LLC

Vehicle #3: 2011 Buick Enclave

Vehicle #4: 2011 Ford F150

Vehicle #5: 2005 Nissan Altima

Vehicle #6: 2006 Freightliner tractor in combination with a 2001 Utility semitrailer

Operator #6: 4 Way Transport LLC

Date: June 7, 2014

Time: Approximately 01:00 a.m. EDT

NTSB #: **HWY14MH012**

B. TECHNICAL RECONSTRUCTION GROUP

Robert Squire - Accident Investigator, Group Chairman
NTSB Office of Highway Safety
490 L'Enfant Plaza East, S.W., Washington, DC 20594

C. CRASH SUMMARY

For a summary of the crash, refer to the *Crash Summary Report* in the docket for this investigation.

D. DETAILS OF THE TECHNICAL RECONSTRUCTION GROUP INVESTIGATION

The Technical Reconstruction Group participated in the documentation of the involved motor vehicles, reviewed scene documentation data (roadway evidence documentation and photographs) provided by the New Jersey State Police (NJSP) and highway construction data provided by the NTSB Highway Factors Group. Primary forensic documentation conducted by the group included photographs and three-dimensional scanning of all, including an exemplar, but two of the involved vehicles. This report provides descriptions of significant observations and information regarding the documentation process. Factual reports prepared by other investigative groups should be consulted for additional details.

All photographs were taken in digital format using an SLR camera. Laser scanning was accomplished using the FARO Focus 3D scanner.¹ Linking of the individual scans from multiple positions produces a single three-dimensional point cloud that can be used with other software applications, including CAD (computer aided drawing), to acquire dimensional information or create other visual images as needed.

1. Vehicle Documentation – Three-Dimensional Scans

Four of the six motor vehicles involved in the collision and one exemplar vehicle were three-dimensionally scanned during June 11 through June 13, 2014. Most of the vehicles were examined and scanned while being stored under NJSP supervision at George's Garage and Towing located on US 130 in Cranbury. The Peterbilt-Great Dane combination was scanned at the NJSP facility on Prospect Plains Road in Cranbury. An exemplar Mercedes-Benz limo van was scanned at the Rehoboth Beach, DE, facility for Atlantic Transportation Services. While the Nissan Altima and Freightliner combination were not scanned, they were photographed and examined by NTSB investigators. The NTSB Vehicle Factors Group factual report should be consulted for specific vehicle data.

1.1. Mercedes-Benz Sprinter 2500 van

The Mercedes-Benz Sprinter (Mercedes-Benz) was identified as a model year 2012, 2500 series high roof extended² model that had been outfitted for limousine service. The vehicle was scanned from 12 positions that captured all vertical exterior surfaces.

¹ The FARO Focus3D is a high-speed Terrestrial Laser Scanner for 3D measurement and image documentation. The scanner produces dense point cloud scans that can be combined or linked with multiple positions to create a cohesive three-dimensional point cloud rendering an exact measureable copy of the target.

² Model features include a 170-inch wheelbase, 107.5-inch overall height, and extended rear overhang.

Figures 1 and 2 depict screen captures of the colorized three-dimensional linked scans of the vehicle.



Figure 1: Screen capture of colorized, linked 3D scans of Mercedes-Benz Sprinter from the driver's side.



Figure 2: Screen capture of colorized, linked 3D scans of Mercedes-Benz Sprinter from the passenger's side.

The vehicle exhibited three distinct areas of impact damage that included the rear, left (driver's) side, and right front. The most severe collision damage was observed at the rear of the vehicle where there was substantial forward displacement of the structure, particularly about the left side. The damage extended vertically from the floor pan to the roof line with the greatest forward displacement occurring at the bumper level. In addition to the forward displacement of the structure, the aft end of the vehicle body exhibited a lateral shift toward the left.

Contact damage to the left side was observed in an area between the aft edge of the driver's door (B-pillar) and the rear axle. A distinct area of contact was located about 13 feet rearward of the vehicle front at a vertical height of about 1.8 feet (21–22 inches) above the ground. This area of contact continued rearward to the rear wheel well. Additional evidence of contact damage was observed to extend above this area to a height of about 5.6 feet and to encompass a side window. Paint damage superimposed additional damage on the left front fender and along the roof line.

A third area of impact damage was observed to the right (passenger's) front fender. Evidence of contact extended vertically from bumper height to about 3.6 to 4.8 feet (43–57 inches) above the ground. The area of damage was consistent with the contour of the hood. The damage trailed rearward to the vehicle A-pillar.

Postcollision, the right front wheel exhibited a significant clockwise rotation with tire scuff marks located inside the aft portion of the inner wheel well. The presence of gouges and scraping was observed to the undercarriage forward of the right front wheel.

Figures 3 through 5 depict images of the Mercedes-Benz 3D scan data rendered in a CAD application with figure 3 depicting the structural displacement of the vehicle body as measured in 6-inch increments upward from the level of the vehicle axle line. Figures 4 and 5 provide an overlay of certain dimensional information.

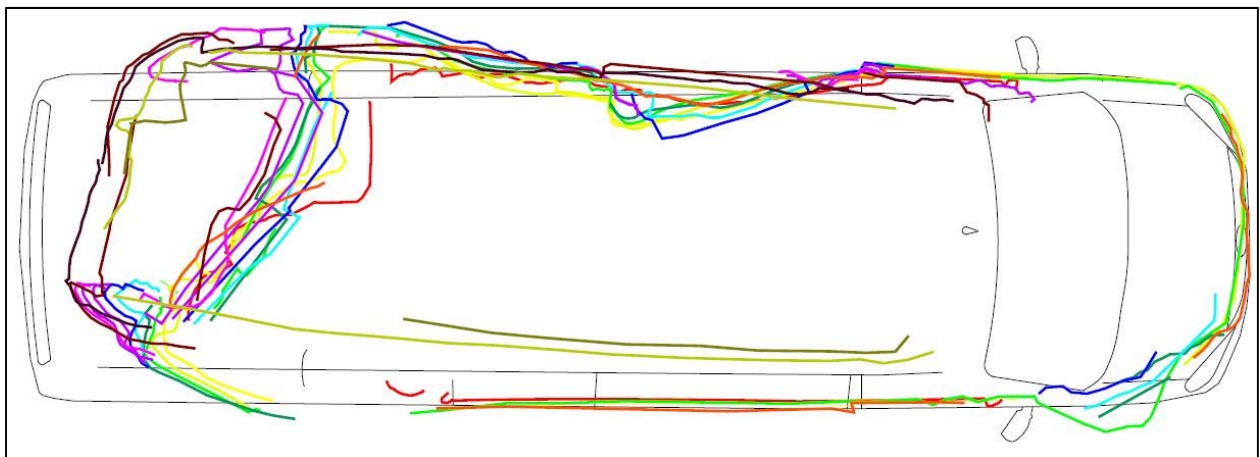


Figure 3: Vehicle body structure displacement depicted in 6-inch vertical increments upward from the axle line.

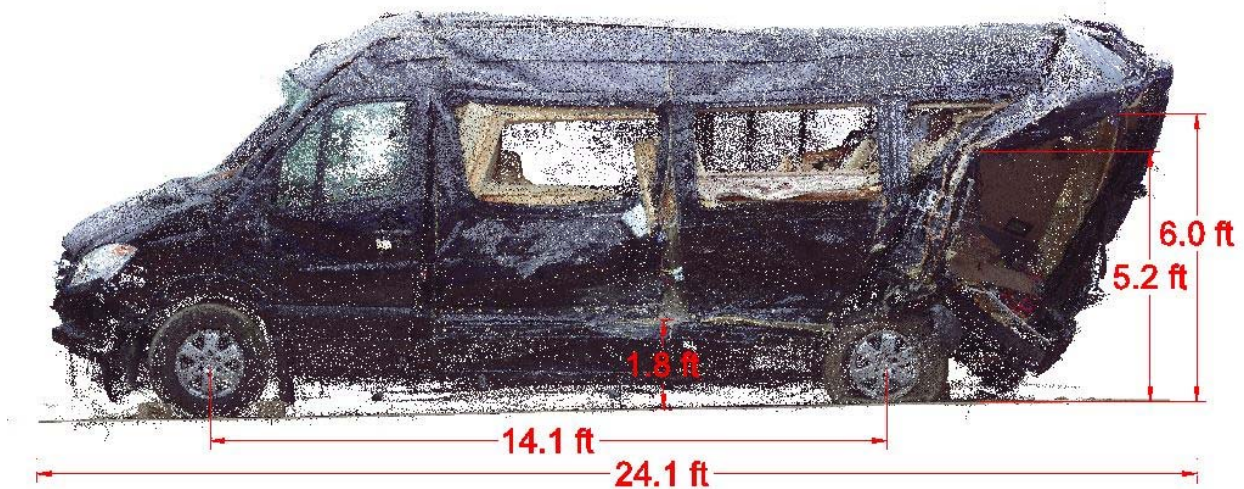


Figure 4: Dimensional information at various points along driver's side of Mercedes-Benz Sprinter.

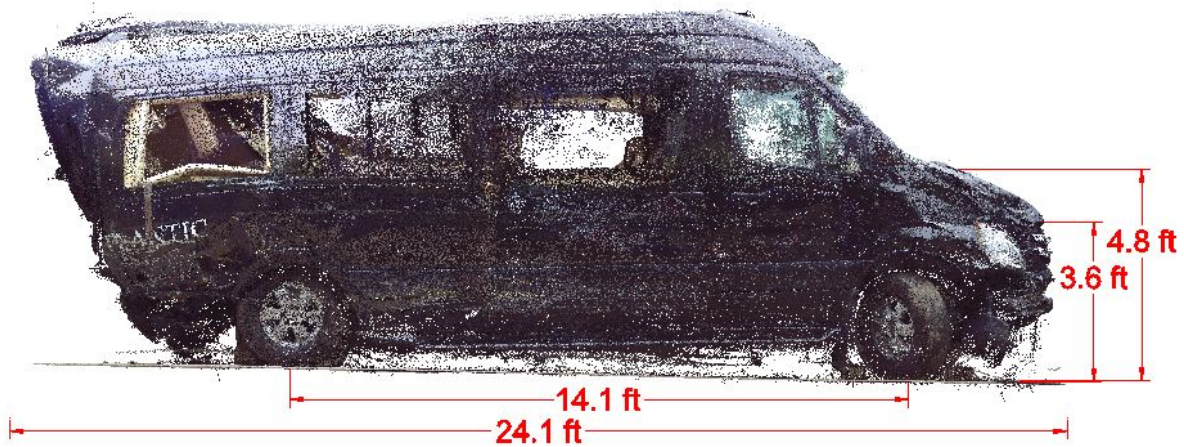


Figure 5: Dimensional information at various points along passenger's side of Mercedes-Benz Sprinter.

1.2. Peterbilt/Great Dane combination

The vehicle that collided with the rear of the Mercedes-Benz was identified as a 2011 Peterbilt model 386 truck-tractor in combination with a 2003 Great Dane 7311TP-S van body semitrailer. The Peterbilt combination was scanned from 12 positions that captured all vertical exterior surfaces.

Figure 6 depicts a screen capture of the colorized three-dimensional linked scans of the postcollision condition of the combination vehicle.



Figure 6: Screen capture of colorized, linked 3D scans of Peterbilt-Great Dane combination along driver's side.

The truck-tractor unit exhibited two distinct areas of impact damage that included the front end and left (driver's) front wheel assembly. With regard to the front end damage, the fiberglass (composite) hood and front bumper cover were displaced from the vehicle. Some leading end structural components, including the front bumper, lower radiator support, and radiator, were displaced rearward at a position approximately centered along the lateral width of the vehicle.

The left front (steer axle) wheel assembly exhibited an excessive leftward (counter-clockwise) orientation in addition to a rearward displacement of about 10–11 inches (0.9 feet).

Figures 7 and 8 depict images of the Peterbilt combination scan data rendered in a CAD application to acquire certain dimensional measurements.

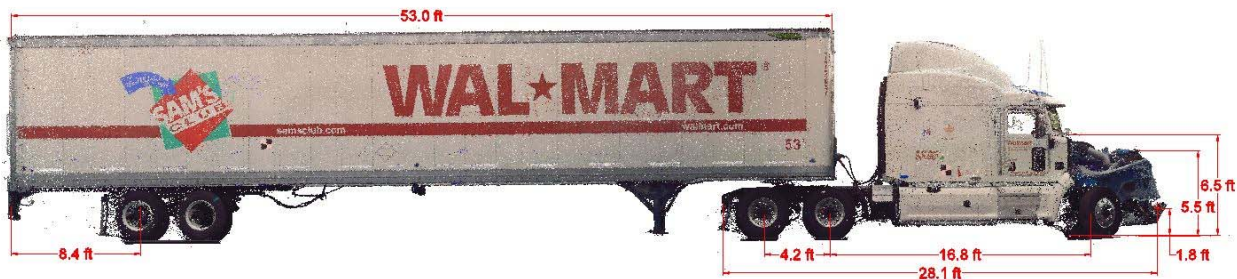


Figure 7: Dimensional information from 3D rendering of the Peterbilt–Great Dane combination vehicle. Dimensions are measured in feet. (Note-colors of the logos applied to the vehicle as shown are inaccurate as a function of how the point cloud colors were interpreted by the CAD software.)

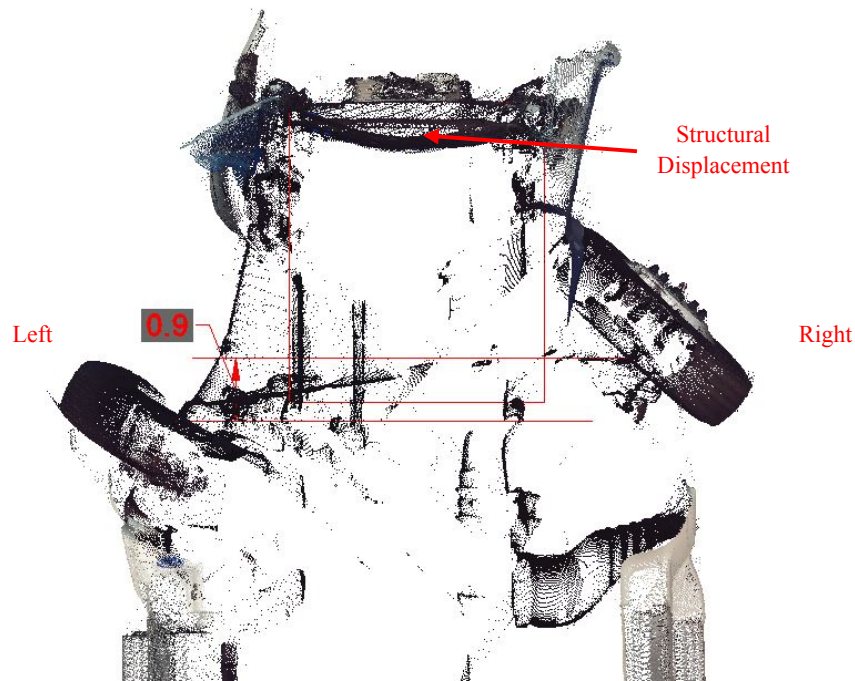


Figure 8: Depiction of steer axle displacement on driver side of vehicle as portrayed from the 3D scan. Dimensions are measured in feet.

1.3. Buick Enclave

A third vehicle involved in the collision sequence was identified as a 2011 Buick Enclave CXL, four-door sport utility vehicle. The vehicle was scanned from nine positions that captured all vertical surfaces and the roof. Figures 9 and 10 depict screen captures of the colorized three-dimensional linked scans of the vehicle.

The Buick exhibited two distinct areas of impact damage that encompassed the rear and right front fender. Damage at the rear was more substantial toward the passenger side and extended vertically from the bumper to the roof line over an approximate range of 1.8 to 5.6 feet. The trailing end of the right rear quarter panel exhibited induced damage as the right rear corner of the vehicle was displaced forward. Evidence of contact damage extended laterally to the left of center along the bumper face and mid-level along the rear hatch.

Damage to the right front quarter panel was directed longitudinally rearward from the bumper. The headlamp assembly was displaced from the vehicle while the fender was disfigured and crumpled rearward toward the A-pillar.

Dynamics of the collision indicate that the Buick was struck in the rear by the Mercedes-Benz as that vehicle rotated. The front of the Buick then collided with the rear of the Ford.



Figure 9: Screen capture of colorized, linked 3D scans depicting the right front area of damage on the Buick Enclave.



Figure 10: Screen capture of colorized, linked 3D scans depicting the right rear area of damage on the Buick Enclave.

1.4. Ford F-150 pickup

A fourth vehicle involved in the collision sequence was identified as a 2011 Ford F-150 XLT pickup truck. The vehicle was scanned from seven positions that captured all its vertical surfaces. Figure 11 depicts a screen capture of the colorized three-dimensional linked scans of the vehicle.



Figure 11: Screen capture of colorized, linked 3D scans depicting the left rear area of damage on the Ford F-150.

The Ford exhibited impact damage to the left rear bumper end and quarter panel. Contact damage at the rear extended upward to a vertical height of about 3 feet (35–36 inches) and inboard from the left side of the vehicle about 1.7 feet (20–21 inches).

1.5. Exemplar Mercedes-Benz Sprinter limousine

An exemplar 2012 Mercedes-Benz Sprinter also owned by Atlantic Transportation Services was scanned for use in comparing dimensional data with the Mercedes-Benz involved in the accident. The vehicle was scanned at the motor carrier facility in Rehoboth Beach, DE, from eight positions that captured all vertical surfaces of the vehicle. Figure 12 depicts a screen capture of the colorized three-dimensional linked scans of the vehicle.



Figure 12: Screen capture of colorized, linked 3D scans depicting the left side of an exemplar Mercedes-Benz Sprinter outfitted for limousine service.

While the interior of the exemplar Mercedes-Benz was configured differently from the one involved in the collision, the exterior dimensions were identical.

2. Additional Vehicle Documentation – Not Scanned

The collision involved two additional vehicles that were not digitally scanned. Those vehicles included a 2005 Nissan Altima and a 2006 Freightliner in combination with a 2001 Utility semitrailer.

2.1. Nissan Altima

The Nissan was photographed while in storage on June 11, 2014 and is depicted in figure-13. The vehicle was identified as a model year 2005 four-door sedan. Impact damage was observed at the outboard edge of the rear bumper on the left (driver's) side of the vehicle. The tail lamp assembly and fiberglass bumper cover that extended from the wheel well to the bumper corner were displaced from the vehicle. Damage was also observed extending forward along the

quarter panel from the tail lamp assembly opening at about the height of the fuel fill port. The outer fuel fill door was missing and some additional minor damage was observed along the trailing edge of the wheel well lip.



Figure 13: Photograph of Nissan depicting impact damage to the driver's side rear.

Dynamics of the collision sequence indicate that the Nissan was struck by the Peterbilt combination after that vehicle separated from the Mercedes-Benz and continued toward impact with a guardrail adjacent to the left highway shoulder.

2.2. Freightliner/Utility Combination

A second combination vehicle involved in the collision sequence was identified as a 2006 Freightliner Century Class CST 120 truck-tractor towing a 2001 Utility VS2RA van body refrigerated trailer. The combination unit was photographed and examined on June 11, 2014. While the vehicle exhibited several areas of damage, the area at the rear of the tractor cab on the left (driver's) side was significant to this collision. Contact evidence and impact damage were located on the left side of the combination beginning around the trailing end of the side fuel tank and continuing rearward to the trailer. Evidence of contact was also observed to the left side tractor drive axle tires and rim flanges. Vertical height of the contact damage ranged from about 2.4 feet (29 inches) at the trailing edge of the fuel tank to about 4.5 feet (50–54 inches) at the rear of the cab. Material transfer and scrapes extended rearward from the leading edge of the trailer rearward for a distance of about 3.3 feet (40 inches). Damage to the trailer extended vertically from the lower edge of the sidewall (~3.8 feet) to about 4.5 feet above the ground.

Figures 14 through 16 are photographs depicting the Freightliner combination.



Figure 14: Photograph of Freightliner-Utility combination depicting passenger side of vehicle.



Figure 15: Photograph of driver's side impact damage to Freightliner-Utility combination.



Figure 16: Photograph of Freightliner-Utility combination depicting impact damage on driver's side of vehicle.

3. Scene Documentation

The New Jersey Turnpike (I-95) is a north-south limited-access highway. The collision events occurred in the northbound travel lanes between milepost markers 71.4 and 71.5. Through this area, the northbound roadway exhibited a heading of about 20° east of north. The initial impact occurred between the Mercedes-Benz limousine and Peterbilt-Great Dane combination at a location just south of the overpass leading to the Molly Pitcher service area and NJSP facility located on the west side of the highway. Documentation of collision scene roadway evidence was undertaken by NJSP investigators who provided photographs and electronic mapping documentation (total station) data³ to NTSB investigators.

³ While the type of system used was not identified, the data was conveyed in tabular format that identified specific points of evidence and reported their location as x,y,z coordinates. Electronic total station devices typically use distance and angular measurements or triangulation to locate the point being documented.

3.1. Roadway Evidence

Roadway evidence of the collision events consisted of tire friction marks, road surface scrapes (metal scars), and fluid debris. As compared with scene photographs, relevant roadway evidence had been documented by the NJSP total station data. Scaled diagrams depicting the roadway evidence are appended to this report. Review of the available data revealed the following:

- The area of impact between the Mercedes-Benz and Peterbilt combination was identified by the presence of tire friction marks and road surface gouging located in the center travel lane approximately 239 feet north of mile point 71.4 or approximately 149 feet south of the end of the parapet below the overpass leading to the service area. The tire friction marks exhibited an overlap of linear tire marks and heavy scuff marks. The linear parallel marks (including those characteristic of dual tires) were oriented northwestward and continued into the left lane while the heavy scuff marks exhibited a northward heading within the center lane. Some road surface gouging and scraping were also present with the tire friction marks.
- Tire friction marks along the path of travel for the Peterbilt combination were oriented about 6° relative to the travel lane. Damage to both the Mercedes-Benz and Peterbilt tractor indicated a relative angle of approximately 16° between the two vehicles at impact.
- Extending northward and northwestward from the area of impact, the onset of additional tire friction marks, road surface scrapes and fluid debris was identified. The surface scrapes began about 10 feet south of the evidence at the area of impact and continued about 71 feet northward, terminating about 10 feet south of the position of rest (relative to the approximate center of gravity) for the Mercedes-Benz. Similarly, the heavy (tire) scuff marks extended northward within the center lane and likewise terminated about 10–12 feet before the final rest position of the Mercedes-Benz.
- A trail of fluid debris began just north of the area of impact and continued northwestward into the left lane. The fluid trail terminated beneath the Peterbilt tractor at its position of rest on the left shoulder.
- At final rest, the Mercedes-Benz was overturned onto the driver's side, facing eastward (oriented about 90° to travel lane) approximately 90 feet⁴ north of the area of impact. The vehicle completely occupied the center lane with some overhang by the front into the right lane and slight overhang at the rear into the left lane.
- The Peterbilt combination came to rest approximately 177 feet north of the area of impact (as measured from the front of the tractor) atop the left shoulder. The tractor was located beneath the overpass against the concrete parapet. The vertical face of the

⁴ Vehicle center of mass traveled approximately 78 feet.

concrete barrier exhibited black material transfer and scrape marks adjacent to the vehicle's position of rest.

- Contact damage to the guardrail that paralleled the left northbound shoulder was located approximately 109 feet northwest of the area of impact. The more significant damage, which included displacement of the vertical supports, extended northward approximately 21 feet, terminating about 20 feet south of the concrete parapet and 49.5 feet south of the front of the Peterbilt tractor at its position of rest. The relative angle between the guardrail impact and the area of impact was about 9°.
- Beginning approximately 95 feet south of the area of impact, intermittent linear tire friction marks were documented. The marks exhibited a heading parallel with the travel lane and alternated between the left and right sides of the travel lane. The three marks documented ranged in length from 12 to 23 feet and appeared in photographs as single linear marks. In the northward direction, the mark nearest the area of impact terminates about 48 feet after the onset of the marks.
- The final rest position of the Buick Enclave was located approximately 103 feet north of the area of impact (as measured to the approximate center of mass). The vehicle primarily occupied the center travel lane with the driver's side of the vehicle partially in the left lane. At final rest, the vehicle was approximately 10–11 feet north of the Mercedes-Benz.
- The final rest positions⁵ of the Nissan Altima and Ford F-150 were located on the left shoulder, north of the overpass near the 71.5 mile point marker. The Altima stopped just south of the mile point marker while the Ford was stopped just north of the marker. The vehicles were drivable following the collision.
- The position of rest for the Freightliner combination was identified as just south of the 71.6 mile point marker, also on the left shoulder. The location was identified by police photographs.

⁵ Positions of final rest were identified through police photographs and markings applied to the road surface.

4. Mercedes-Benz Telemetric Data

While certain electronic data was retrieved from specific vehicles involved in the collision,⁶ the carrier operating the Mercedes-Benz limousine also provided NTSB investigators telemetric data that originated from a GPS-based fleet management system onboard that vehicle. Although certain details of the system and its operation were not conveyed, references on the data print-out indicated that the data originated from an Audiovox Car Connection fleet management system.

The system primarily served to report the vehicle's location and certain operating parameters via cellular connection to a central account that could be accessed by the customer through an Internet portal. The data presented to NTSB investigators conveyed the following parameters –

- Vehicle geographic position (latitude and longitude)
- Date and time the position was recorded
- Vehicle heading (relative to north) when the position was recorded
- System status⁷
- Vehicle speed

Generally, the system reported the vehicle location and select parameters at approximately 5-minute intervals while the vehicle was running (ignition “on”) and once every hour while the vehicle ignition was “off” (when power was available to the system). Review of the data indicated that while the vehicle ignition was “on,” the system did report a position approximately every 5 minutes. Data was also reported when the ignition status changed (defined as “cause”) between “on” and “off.” When the ignition was “off,” data was found to have been transmitted about once an hour.

⁶ See Vehicle Recorders Factual report prepared by the NTSB Office of Research and Engineering.

⁷ The printed report refers to this parameter as “cause.”

Table 1 presents some of the data retrieved from the Audiovox system report as provided by the carrier. The comment heading was added to provide additional information. A complete copy of the data page is included as an attachment in the docket for this investigation.

Table 1: Select racking data acquired from the Mercedes-Benz Audiovox system.

Date	Time ⁸	Latitude	Longitude	Heading	Status/Cause	Speed ⁹ mph	Comment
6/6/2014	9:02 pm	38.73953	-75.139	-	Ignition/GPS “on”	0	Vehicle start at carrier facility
6/6/2014	10:24 pm	39.18693	-75.536	-	Ignition/GPS “on”	0	Parking lot Dover Downs, DE
6/6/2014	10:54 pm	39.19943	-75.5564	313°	Ignition/GPS “on”	35.4	~ 5 minutes and 1.4 miles NW of Dover Downs
6/7/2014	12:14 am	39.85955	-75.0716	179°	Ignition/GPS “on”	33.4	Ramp from NJ Route 168 to I-95 North (entering turnpike)
6/7/2014	12:48 am	40.23872	-74.5319	54°	Ignition/GPS “on”	68.8	Estimated 11–12 miles south of collision
6/7/2014	12:53 am	40.31423	-74.48.92	20°	Ignition/GPS “on”	44.3	Estimated 0.26 miles south of collision
6/7/2014	12:55 am	40.3177	-74.4875	30°	Ignition/GPS “off”	4.0	Status change – Estimated area of impact

⁸ Data was reported in a 24-hour format.

⁹ Speed is a computed average based on time and distance between sequential geographic positions.

Figure 17 depicts the relative location of certain geographic positions for the Mercedes-Benz (after entering the turnpike) as reported by the Audiovox system. The data were overlaid atop a Google Earth image of the route.

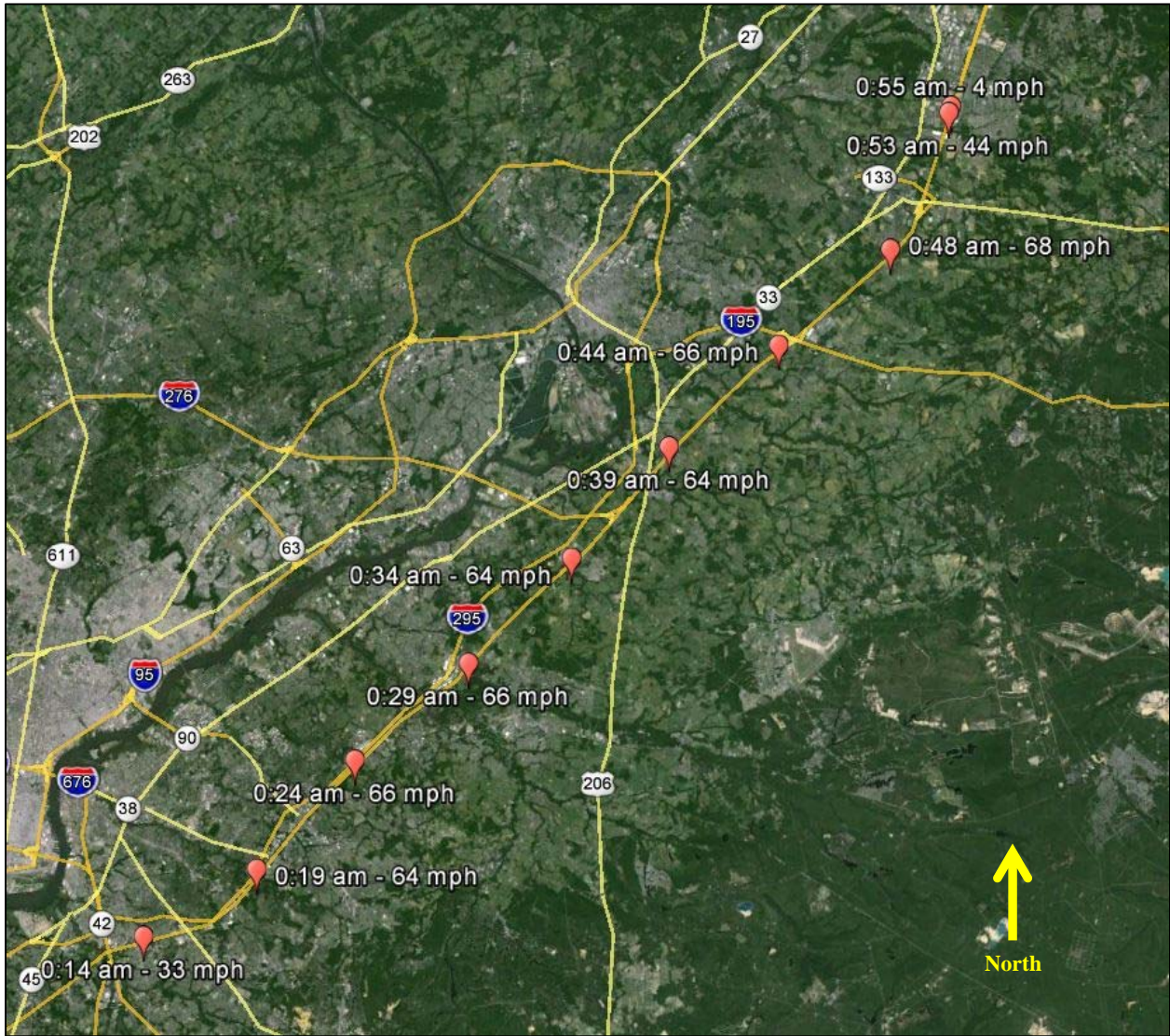


Figure 147: Geographic positions as reported by the Mercedes-Benz limo van system while traveling on the turnpike.

Figure 18 depicts the last two geographic positions of the Mercedes-Benz as reported by the vehicle's GSP system nearest to the area of the collision. The positions are overlaid on a September 2013 Google Earth image.



Figure 158: Final two GPS transmitted geographic positions as reported by the Mercedes-Benz limo van system about the area of the collision.

E. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

Technical Reconstruction Group Attachment 1 – One page print out of Audiovox vehicle management and tracking data

END OF REPORT

Robert Squire
Highway Accident Investigator

Appendix A – Site Diagrams

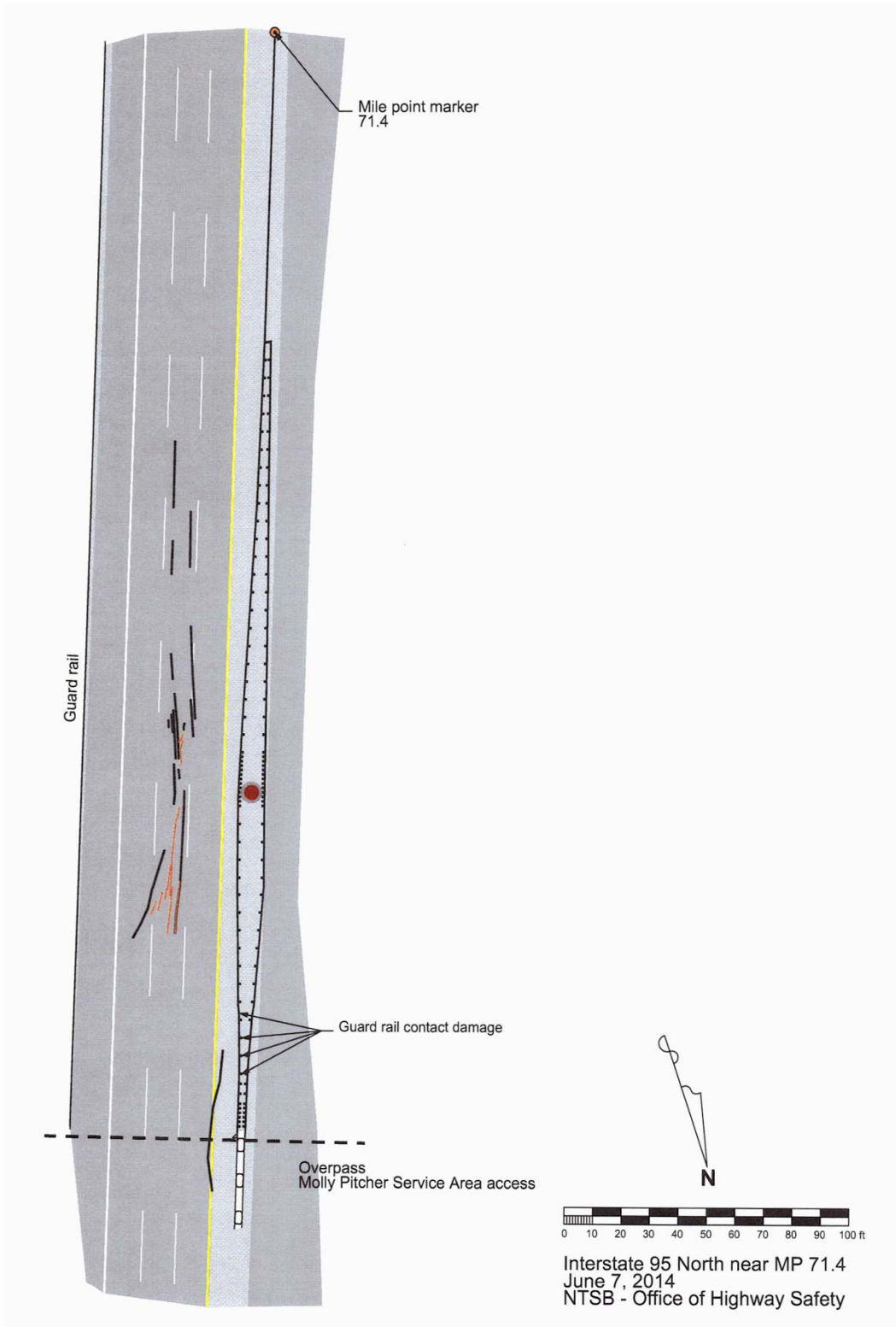


Diagram 1: Site diagram depicting documented roadway evidence.

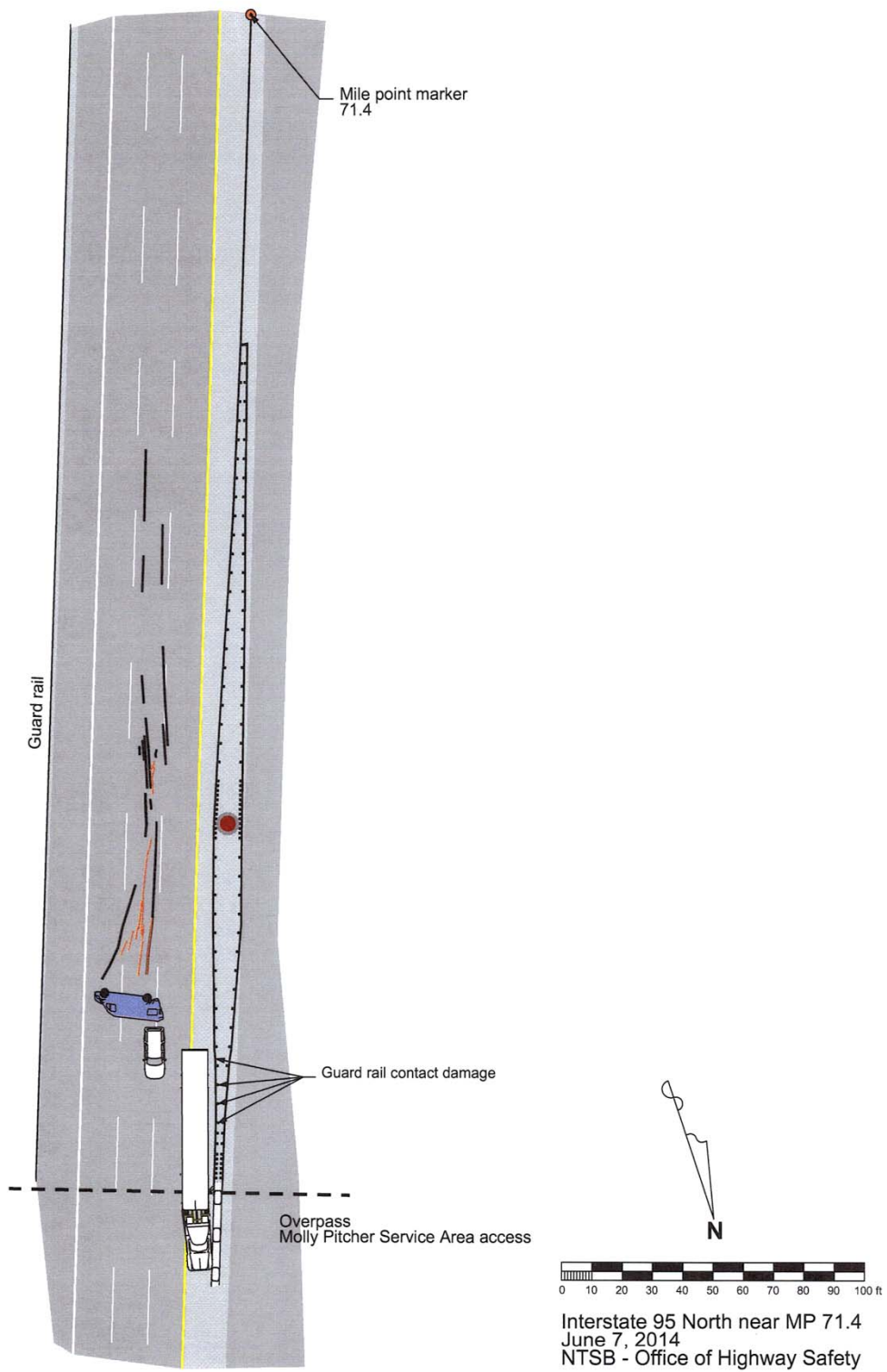


Diagram 2: Site diagram depicting documented positions of rest for the Mercedes, Buick, and Peterbilt combination.