TECHNICAL RECONSTRUCTION GROUP CHAIRMAN'S FACTUAL REPORT

Biloxi, MS

HWY17MH010

(9 pages)

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

TECHNICAL RECONSTRUCTION GROUP CHAIRMAN'S FACTUAL REPORT

A. CRASH INFORMATION

Location: Rail crossing, Main Street, Biloxi, Harrison County, Mississippi

Vehicle #1: 2016 Van Hool CX45 Motorcoach

Operator #1: Echo Transportation - Dallas, Texas

Vehicle #2: CSX Freight Train, consisting of 3 locomotives, 27 loaded cars, and 25 empty cars

Operator #2: CXS Transportation

Date: March 7, 2017

Time: Approximately 02:12 p.m. Central Standard Time (CST)

NTSB #: **HWY17MH010**

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 provided investigative support through the documentation of the collision scene, the involved motorcoach and an exemplar motorcoach. Additional factual data was also acquired through the review of documentation provided by other NTSB investigative groups.

Primary documentation involved photography and 3D laser scanning techniques. Photographs were taken in digital format, while scanning was accomplished using the FARO Focus^{3D} x330 laser scanner.[1] Multiple scans of a subject were processed into three-dimensional point clouds for further analysis. Three scan projects that included the crash site, the involved motorcoach and an exemplar motorcoach were completed. Video documentation of the immediate approach to, and through the area of the crash was also conducted following the route of the motorcoach.

Factual reports prepared by other NTSB investigative groups should be consulted for additional information.

1. Collision Overview, Site Location and Documentation

The crash involved a 2016 Van Hool CX45 motorcoach traveling northbound on Main Street in Biloxi, MS that became grounded atop a high vertical profile (humped) at-grade railway crossing. As passengers were exiting from the motorcoach it was struck by an east-bound freight train operated by CXS Transportation.

As a follow-up to the initial on-scene instigation, the NTSB Technical Reconstruction Group examined the collision site on May 1, 2017. The site and other relevant features were documented through photographs, video and geographic coordinate (GPS) acquisition. The crossing and adjacent area were three-dimensionally scanned from 12 positions, which effectively covered an area of approximately 95,800 square feet. The scanned area included the crossing and extended eastward approximately 336 feet along the railway. The scan area also encompassed the Esters Boulevard roadways, which paralleled the railway to the north and south. The area of final rest for the motorcoach following the collision was identified about 205 feet east of the northbound lane at the crossing and along the south side of the tracks. Displaced railway ballast and soil adjacent the tracks indicated where the motorcoach had stopped. While no roadway evidence of the collision was identifiable, both travel lanes exhibited parallel longitudinal surface scrapes and gouges oriented within the lanes. The northbound lane exhibited gouging on both sides and atop the crossing. Surface gouges in the southbound lane were less substantial, particularly on the south side of the crossing.

The Main Street crossing consisted of a north- and southbound lane of travel that intersected the railway at a right angle. The roadway exhibited a north-south heading of 358/178

[1] The FARO Focus^{3D} is a high-speed terrestrial laser scanner used for 3D documentation. The scanner creates point cloud scans that are combined or linked from multiple positions to create a cohesive three-dimensional point cloud rendering of the subject target. The laser will only capture features within the direct line of sight to the scanner. Areas obstructed to the laser or where surfaces fail to provide a reflection will exhibit the background color. The point cloud data can be imported into a CAD application for additional analysis.

degrees in the north- and southbound directions respectively. The crossing had active warning infrastructure that included automatic gates and warning lights. The DOT crossing identification number was listed as DOT 340185W.

Figure 1 depicts a colorized image of the linked 3D scans covering the highway-railroad crossing and track area extending eastward approximately 336 feet.

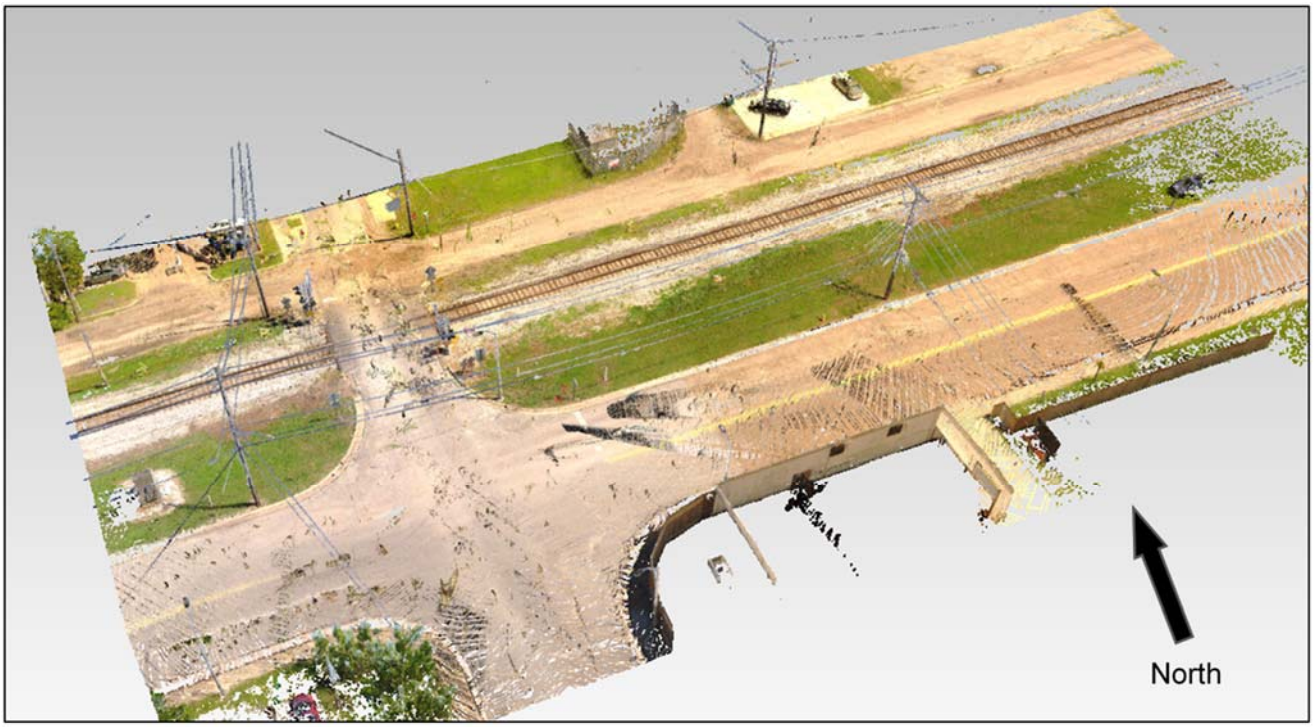

Figure 1: Colorized image of linked 3D scans depicting the Main Street highway-railway grade crossing and track area eastward of the crossing.

To examine the roadway grade profile at the crossing in the direction of travel taken by the motorcoach, the 3D scan was sliced to depict the northbound travel lane. As depicted in **Figure 2**, the grade of the approach on the north and south sides of the railway were substantially different as measured horizontally from the respective northern and southern rails. The south-side approach exhibited a grade of between two and three degrees as measured at five-foot intervals over a distance of about 42 feet. The corresponding vertical rise was approximately 1.68 feet. For reference, the northern curb line of Esters Boulevard (south side of railway) was approximately 51.4 feet south of the southern rail.[2] The roadway grade appeared to become essentially level about 45 feet south of the rail.

The north-side approach exhibited a variable grade that ranged between three and 12 degrees as measured at 1.5-foot intervals over a distance of approximately 24 feet. The corresponding vertical rise was approximately 3.21 feet. The southern curb line of Esters

[2] The curb line was established by extending a parallel line between the raised concrete curbing along Esters Avenue (to the south) on the opposing sides of Main Street.

Boulevard (north side of railway) was approximately 23.5 feet north of the northern rail.[3] The northbound lane of Main Street through the intersection with Esters Avenue exhibited a slight descending grade north of the curb line and appeared to become essentially level about 33 feet north of the northern rail.

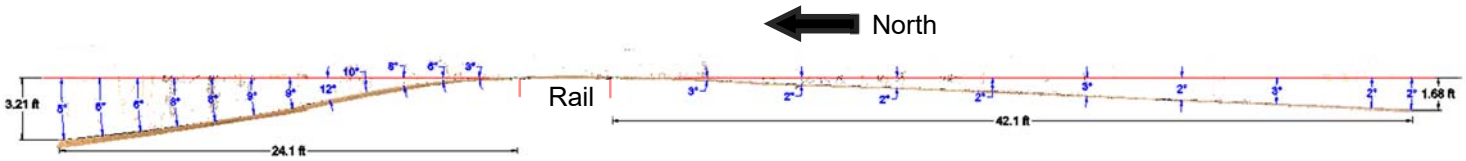

Figure 2: Image depicting the crossing approach profile along the northbound lane of Main Street based on the 3D scan. Slope angles were measured vertically from horizontal extension lines from the rails at 1.5- and 5-foot intervals to the north and south respectively.

Additional, and more detailed, information regarding the highway is available in the NTSB Highway Factors Group factual report.

2. Vehicle Identification and Documentation

2.1. Train and Locomotive

The train consist reportedly included 52 rail cars preceded by three locomotives. The lead locomotive that collided with the motorcoach was identified as a General Electric[4] Freight Diesel-Electric AC4400CW locomotive, unit number 230. The locomotive was manufactured in 1996.

While the locomotive was unavailable for examination by this group, certain general dimensional data is conveyed in **Table 1**.[5]

Table 1: General dimensional specifications for lead locomotive.

GE Diesel-Electric AC4400CW	
Weight	420,000 lbs.
Total Length	73.16 ft
Wheel Diameter	42 in
Truck Wheel Base	13.16 ft
Height to Top Engine Hood	15.5 ft
Height to Top Cab Hood	15.33 ft
Cab Width	10.25 ft
Hood Width	9.91 ft
Center Bolster	53 ft
Center of Lead Truck to Center of Trailing Truck	66.16 ft

[3] The curb line was established by extending a parallel line between the raised concrete curbing along Esters Avenue (to the north) on the opposing sides of Main Street.
[4] General Electric Transportation Systems
[5] https://www.thedieselshop.us/DataAC4400.HTML

2.2. Motorcoach

The motorcoach was identified as a 2016 Van Hool model CX45 configured for 56 passengers. The vehicle was examined on May 2, 2017, while stored at a secured police facility. The exterior and interior were documented with the 3D scanner from 12 positions. **Figure 3** depicts a colorized rendering of the scans as viewed from the left side of the vehicle.

Figure 3: Colorized image of linked 3D scans depicting the involved motorcoach.

The motorcoach sustained an impact at the left (driver's) side that resulted in substantial intrusion damage. Evidence of direct contact was observed over a longitudinal distance of approximately 9.8 feet beginning about 17.5 feet rearward of the front of the motor coach. Evidence of direct contact was identified through structural damage to the motor coach and material transfer. Measurements taken of the area of direct contact correspond well with the frontal surface of the locomotive.

Corresponding with the left side intrusion, the right side of the motor coach exhibited an outward displacement. Overall, the vehicle body exhibited evidence of misalignment beginning approximately 12 feet aftward of the front and continuing almost to the vehicle rear. Maximum lateral displacement was observed approximately 22.8 feet aftward of the vehicle front where the left sidewall intruded approximately 2.27 feet.[6] The maximum corresponding outward displacement on the right side was observed about three feet further forward where the outward displacement measured approximately 1.48 feet. **Figure 4** depicts the lateral displacement of the vehicle sidewall as measured at 1.5-foot intervals from an undamaged sidewall plane. The location of the impact damage indicates that the front of the motor coach was approximately 20.4 feet past (north of) the northern rail when the vehicle was struck by the locomotive.

[6] As measured from a base line established along an undamaged sidewall plane.

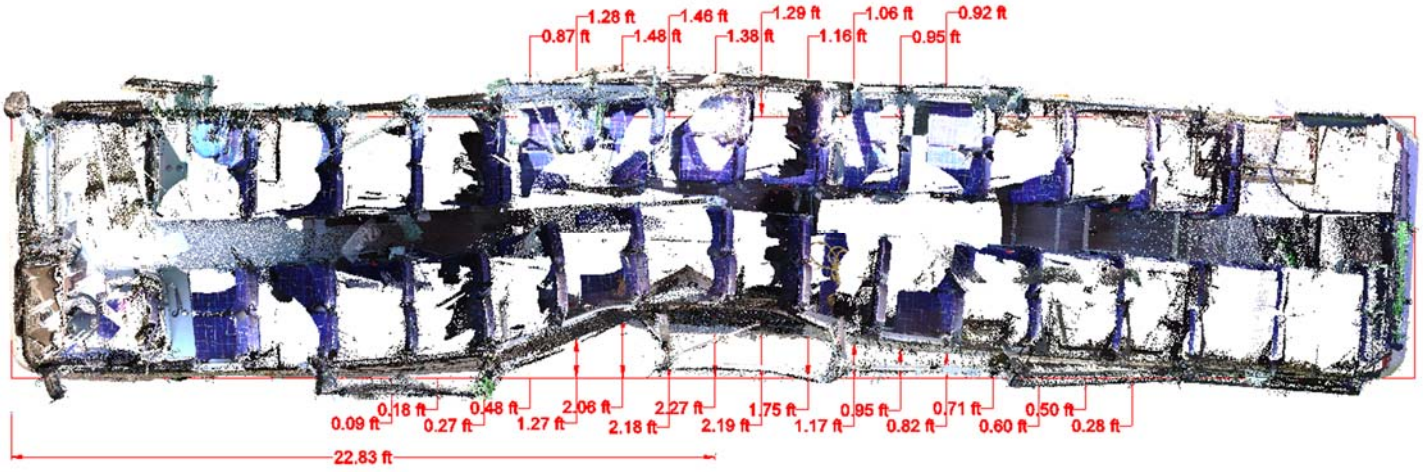

Figure 4: Image depicting an overhead view of the motorcoach interior based a slice of the 3D scan. The image illustrates the exterior and interior lateral displacement of the vehicle sidewalls and seating. Measurements of lateral displacement were made at 1.5-foot intervals.

The lateral displacement of the left sidewall also created a corresponding reduction in the width of the aisleway between the left- and right-side seat rows. At the front of the motor coach the aisleway appeared unaffected and had a nominal width of approximately 1.45 feet between the outboard armrests and about 1.6 feet between the seat backs. At the area of maximum sidewall displacement, the aisleway width decreased to a minimum of about 0.68 feet (8.2”) at the seat bottom and 0.88 feet (10.6”) at the seat back.

Figure 5 depicts certain longitudinal dimensions that were acquired from the 3D scan. The post-collision measurements depict some rearward displacement of the steer axle as compared with an exemplar motor coach, as depicted in **Figure 6**.

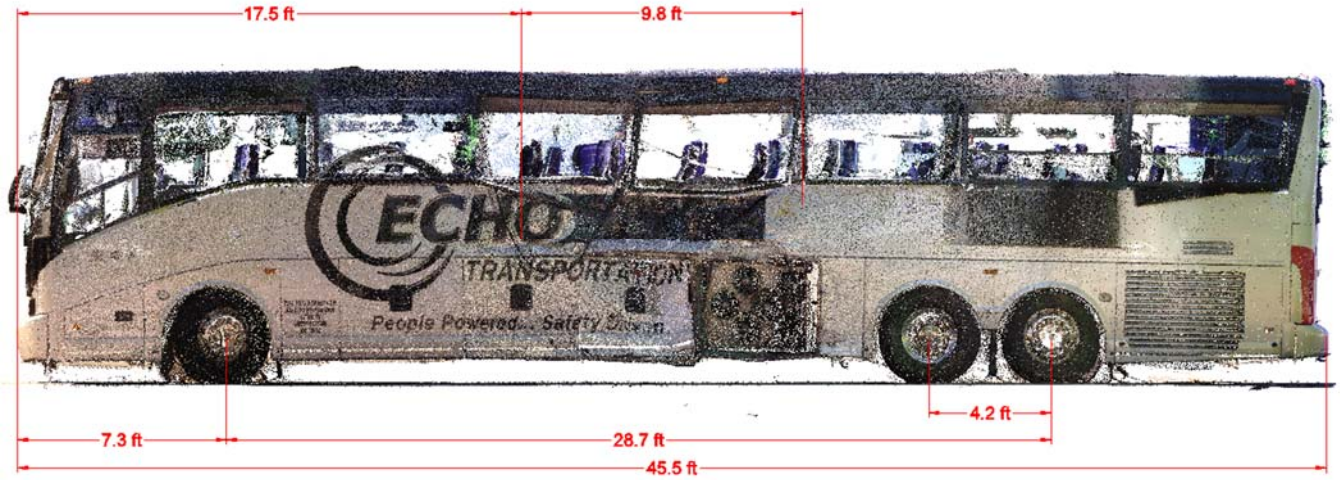

Figure 5: Image depicts certain dimensional measurements acquired from the 3D scan of the involved motorcoach.

An exemplar Van Hool CX45 motorcoach was three-dimensionally scanned on May 1, 2017 from 9 positions. Certain longitudinal dimensions that were acquired from the 3D scan are depicted in Figure 6. From the scan data, the exemplar motorcoach exhibited a nominal static ground clearance 11.9 to 12.6 inches, as measured between the axles.[7]

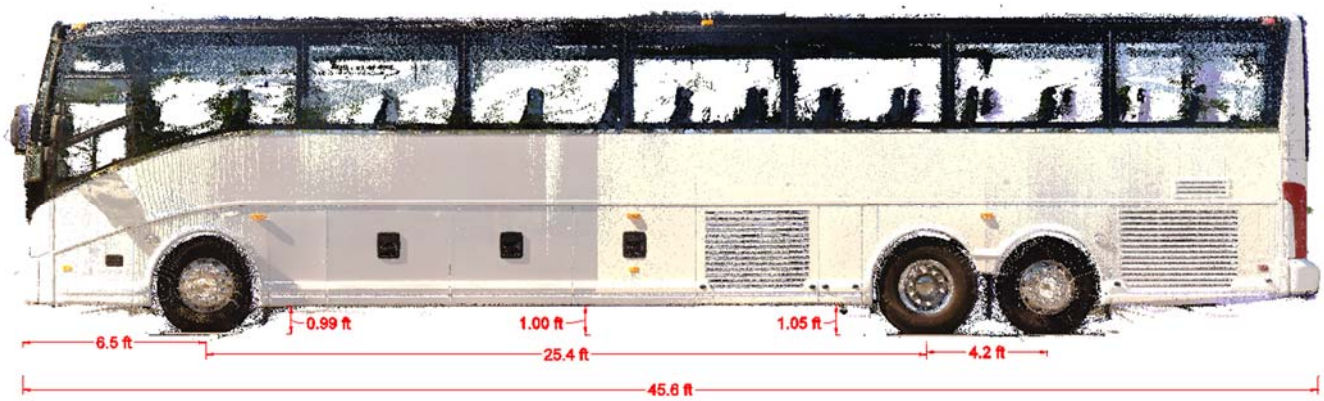

Figure 6: Image depicts certain dimensional measurements acquired from the 3D scan of the exemplar motorcoach.

E. REPORT APPENDICES

None

F. REFERENCES

1. NTSB Vehicle Factors Group factual report
2. NTSB Highway Factors Group factual report

[7] See NTSB Vehicle Factors Group factual report for additional information regarding axle clearance and pneumatic suspension system.

G. DOCKET MATERIAL

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

LIST OF ATTACHMENTS

None

LIST OF PHOTOGRAPHS

None

END OF REPORT

Robert Squire
Highway Accident Investigator