3D LASER SCANNING FACTUAL REPORT

Train & Truck Crash
On Railroad Right-Of-Way

Oxnard, California

HWY15MH006
(14 Pages)

NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF RESEARCH AND ENGINEERING
WASHINGTON, D.C. 20594

3D LASER SCANNING FACTUAL REPORT

A. CRASH INFORMATION

Type:	Train & Utility Truck Crash on Railroad Right-of-way (not at a Grade Crossing)
Date and Time:	February 24, 2015 at 5:44 a.m. PST
Location:	Oxnard, Ventura County, California
Vehicle #1:	2005 Ford F450 Pick-up towing a 2000 Tandem Axle Utility Trailer
Vehicle #2:	Metrolink Commuter Train #102
Vehicle #3:	1998 Toyota Camry
Fatalities:	1
Injuries:	33
Uninjured:	22
NTSB #:	HWY15MH006

B. CRASH SUMMARY

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

C. SUMMARY

A three-dimensional (3D) laser scanner was used to record the 3D data of crash- related objects including the grade crossing, three rail cars, the 2005 Ford F450, the trailer, a sister 2011 Ford F450, and the CPCO 406 south end Oxnard main line rail signal. The scanner cannot capture objects that are out of its line of sight. As a result, special targets were used to link together multiple scans from various vantage points.

In this crash, the rail cars, the grade crossing, the F450, the trailer, the sister F450, and the signal were examined and scanned using both a FARO Focus 3D X120[1] and a FARO Focus 3D X330[2] laser scanner. The scanners were used in unison to increase efficiency. Both the interior and exterior of the first three rail cars were scanned. The exterior of the 2005 Ford F450 and the trailer were scanned along with parts that were separate from the truck and trailer, such as the engine. The grade crossing was scanned along with the track in the direction of the initial impact and in the direction of the final rest of the trailer. In addition, the exterior of the sister F450 was scanned. The signal was scanned for potential future modeling efforts.

The scanning activity was conducted post-recovery and may not represent the condition of the vehicles immediately after the crash. A total of 140 individual scans were performed during this investigation. All of the scan data can be measured to show vehicle dimensions, extent of damage, and positions in the scene.[3]

1. Cab Car – 645 (Rotem)

The exterior of the Rotem cab car – 645, which was the lead car, was documented with a total of 17 exterior scans and 16 interior scans. Images from the point cloud created by the scanner documenting the cab car exterior are shown in Figure 1 and Figure 2. The interior of the car from the developed point cloud data is shown in Figure 3 and Figure 4.

Figure 1: An image from the 3D laser scanner point cloud showing left side of the cab car - 645.

[1] The FARO Focus X120 laser scanner has an advertised scan range of 100 meters.
[2] The FARO Focus X330 laser scanner has an advertised scan range of 330 meters.
[3] FARO quotes a systematic measurement error (one sigma) of ±2 mm (±0.079 in) at ranges of 10 m (33 ft) and 25 m (82 ft). FARO quotes a random error (one sigma) of less than ±2.2 mm (±0.087 in) in a best-fit plane at ranges of 10 m (33 ft) and 25 m (82 ft), with a target reflectivity of either 10 % or 90 %.
Additional uncertainty in dimensional data may result from the manual choice of points to represent a specific object from the entire 3D point cloud.

Figure 2: An image from the 3D laser scanner point cloud showing the right side of the cab car - 645.

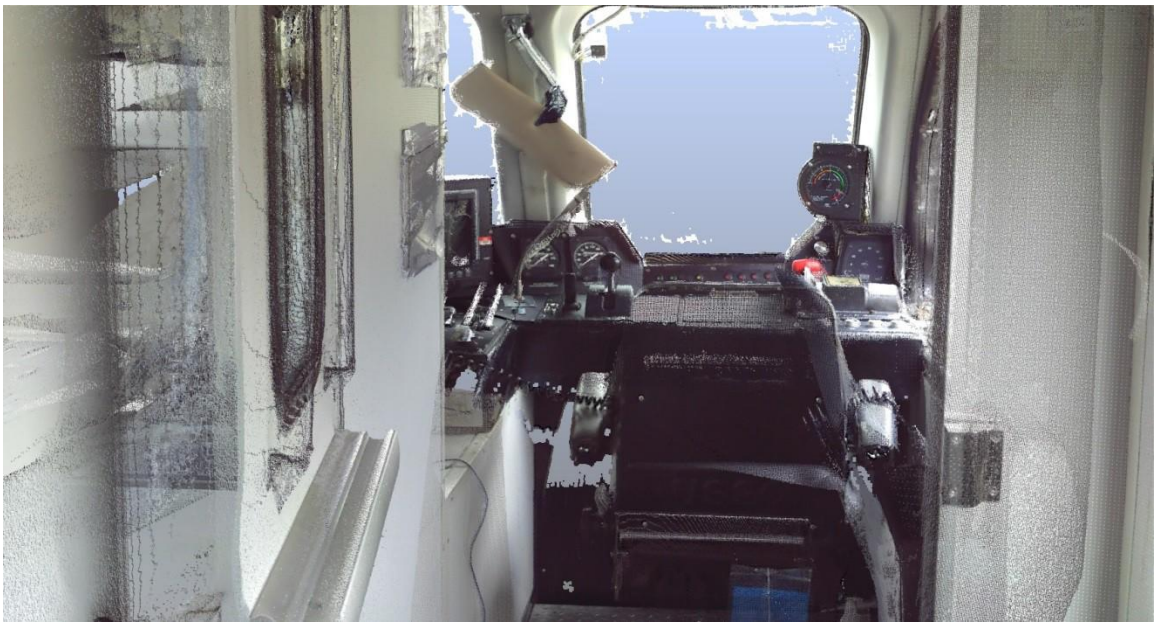
Figure 3: An image from the 3D laser scanner point cloud showing the engineer's cab in car - 645.

Figure 4: An image from the 3D laser scanner point cloud showing the upper level of cab car - 645.

2. Rail Car – 206 (Bombardier)

The exterior of the Bombardier rail car 206, which was second in the train, was documented with a total of 13 exterior scans and 12 interior scans. Images from the point cloud created by the scanner documenting the rail car 206 exterior are shown in Figure 5 and Figure 6. The interior of the car from the developed point cloud data is shown in Figure 7.

Figure 5: An image from the 3D laser scanner point cloud showing left side and the A end of the 2nd rail car - 206.

Figure 6: An image from the 3D laser scanner point cloud showing the right side and A end of the 2nd rail car - 206.

Figure 7: An image from the 3D laser scanner point cloud showing the interior of the 2nd rail car – 206 (upper level).

3. Rail Car – 211 (Rotem)

The exterior of the Rotem rail car 211, which was third in the train, was documented with a total of 16 exterior scans, including one scan from an elevated position to document roof damage and 12 interior scans. Images from the point cloud created by the scanner documenting the rail car 211 exterior are shown in Figure 8, Figure 9, and Figure 10. The interior of the car from the developed point cloud data is shown in Figure 11.

Figure 8: An image from the 3D laser scanner point cloud showing left side, with the A end on the left side of the image, of the 3rd rail car - 211.

Figure 9: An image from the 3D laser scanner point cloud showing the roof damage from the left side of the 3rd rail car - 211. (The A end is on the left side of the image.)

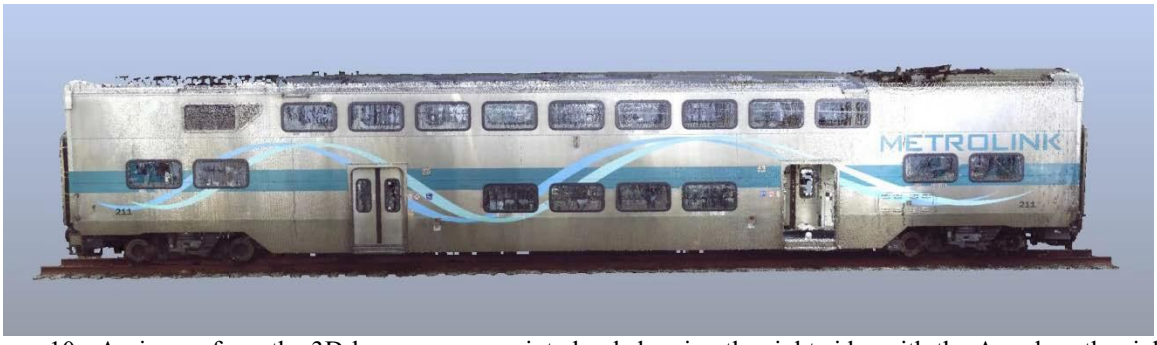

Figure 10: An image from the 3D laser scanner point cloud showing the right side, with the A end on the right side of the image, of the 3rd rail car - 211.

Figure 11: An image from the 3D laser scanner point cloud showing the interior of the 3rd rail car – 211 (upper level).

4. Grade Crossing

The grade crossing was documented with a total of 25 scans. Four of the 25 scans were performed to document the track near the impact point up to the crossing. Another ten scans were performed to document the grade crossing, itself. The additional 11 scans were performed to document the track in the direction the train traveled to final rest. A view from the scanner of the approach to the crossing and looking toward the direction of the train approach is shown in Figure 12. Images from the scanner showing the track in the direction of impact and the direction of the train's final rest are shown in Figure 13 and Figure 14.

Figure 12: An image from the 3D laser scanner showing the grade crossing, looking generally to the west. To the right is the direction the truck likely came from. In the center is the track looking toward the point of impact.

Figure 13: An image from the scanner showing the track near the point of impact. The view is looking east toward the grade crossing. The area highlighted in the red circle shows the location of the damaged railroad ties near the point of impact.

Figure 14: An image from the scanner looking to the east, showing the track in the direction of the train's final rest on the east side of the grade crossing.

5. 2005 Ford F450 and Trailer

The exterior of the 2005 Ford F450, the trailer and the associated parts were documented with a total of 18 scans. Exterior images of the Ford and the trailer from the point cloud created by the scanner are shown in Figure 15, Figure 16, and Figure 17.

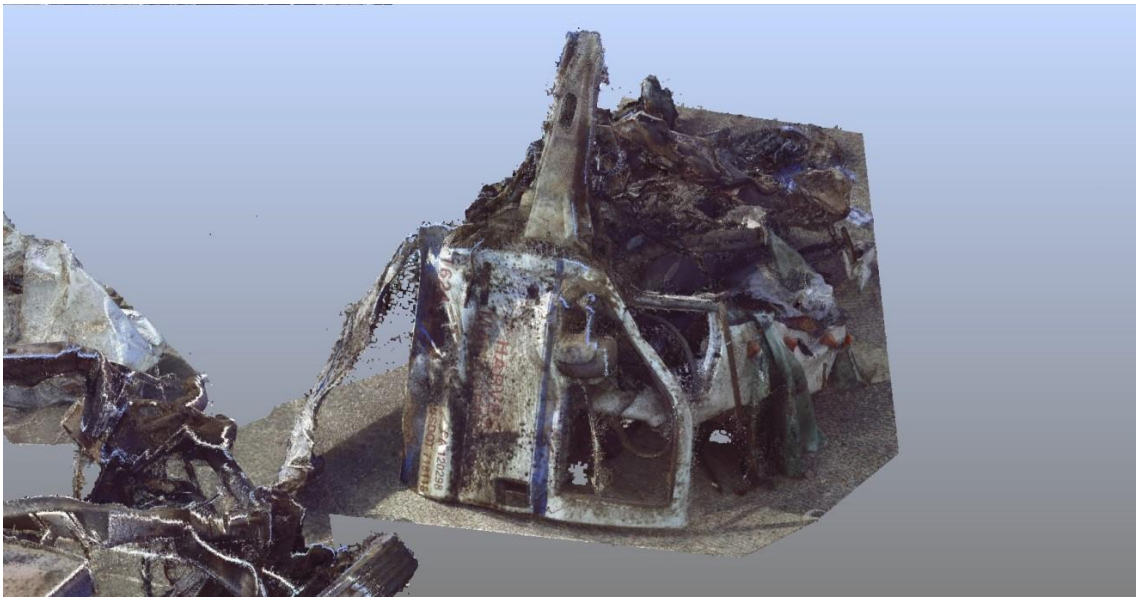

Figure 15: An image from the 3D laser scanner point cloud showing the driver side of the Ford F450. (The Ford is oriented such that the front of the truck is pointed upward in the scan.)

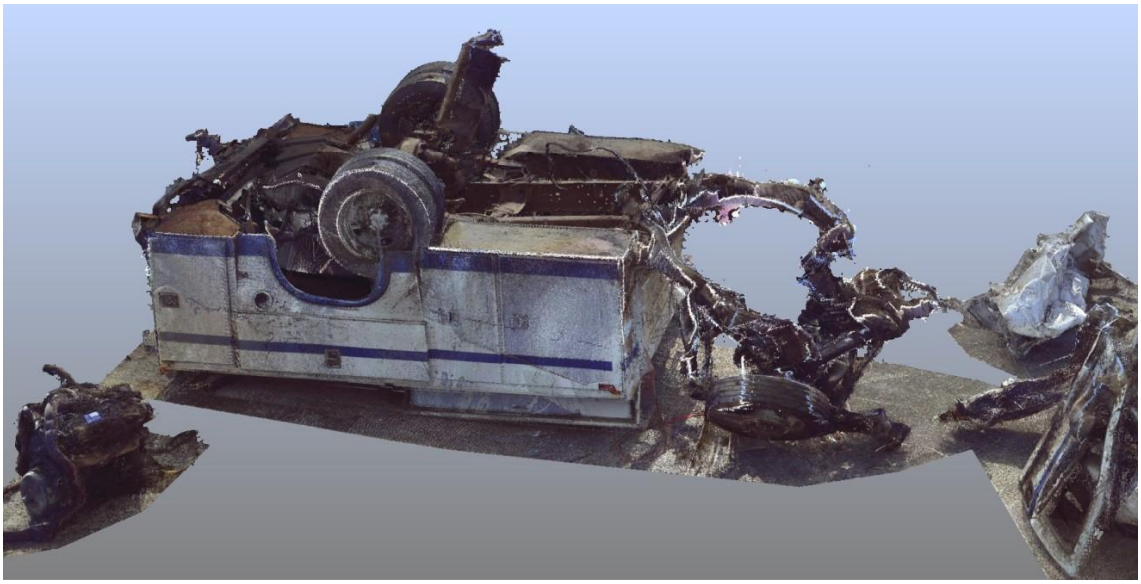

Figure 16: An image from the 3D laser scanner point cloud showing left side of the box portion of the Ford F450.

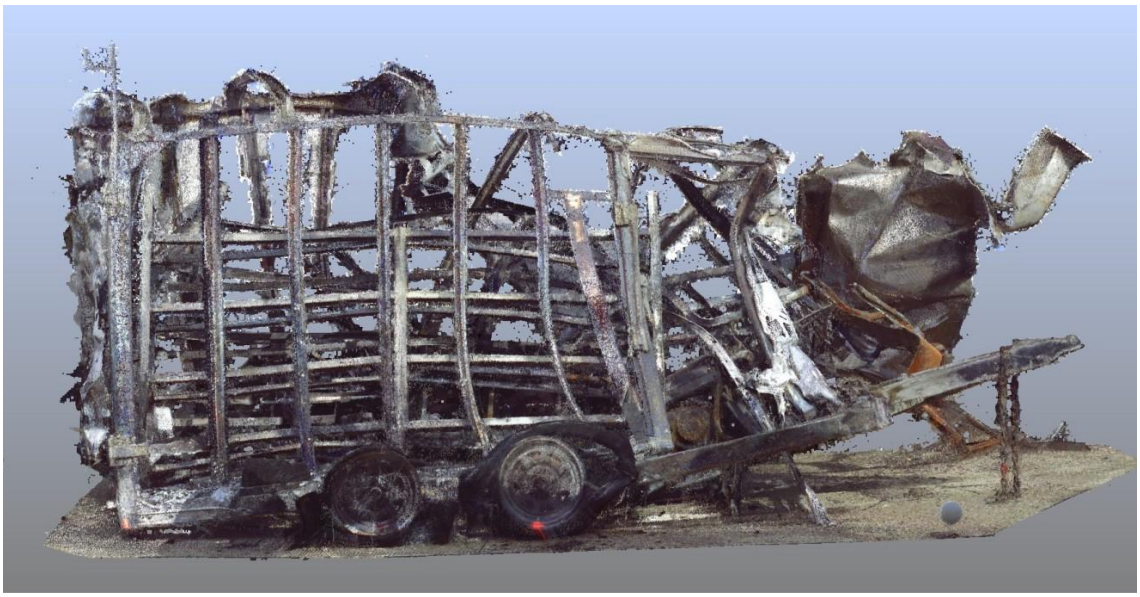

Figure 17: An image from the 3D laser scanner point cloud showing the right side of the trailer.

6. Sister 2011 Ford F450

A sister 2011 Ford F450 truck (Unit T626) was documented with a total of 8 scans. The sister truck is slightly different than the 2005 Ford F450 truck. The 2011 Ford F450 truck is 7.5 inches longer and 6 inches taller (in the box area). Point cloud images of the 2011 Ford F450 exterior created by the scanner are shown in Figure 18 and Figure 19.

Figure 18: An image from the 3D laser scanner point cloud showing the right side of the 2011 Ford F450.

Figure 19: An image from the 3D laser scanner point cloud showing the left side of 2011 Ford F450.

7. CPCO 406 South End Oxnard Main Line Signal

The CPCO 406 south end Oxnard main line signal was documented with a total of 3 scans. Point cloud images of the signal created by the scanner are shown in Figure 18 and Figure 19.

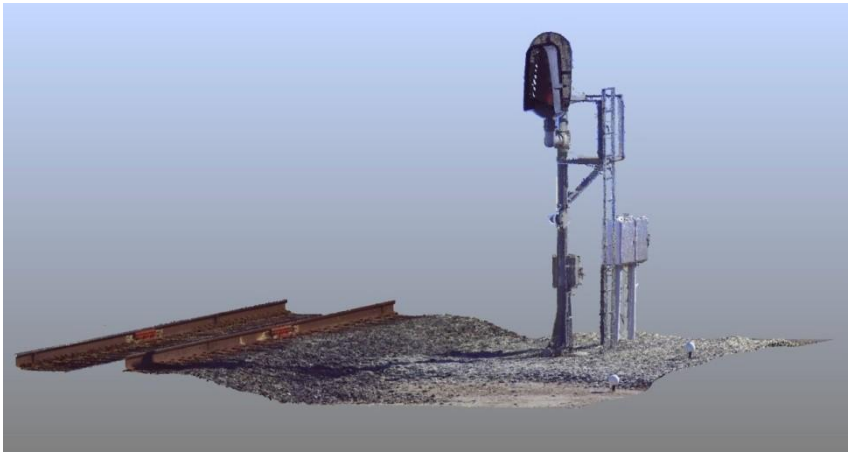
Figure 20: An image from the 3D laser scanner point cloud showing the signal facing the oncoming trains.

Figure 21: An image from the 3D laser scanner point cloud showing the back side of the signal.

END OF REPORT

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