

NATIONAL TRANSPORTATION SAFETY BOARD

**Office of Railroad, Pipeline and Hazardous Materials Investigations
Washington, DC**

TRACK & ENGINEERING FACTUAL REPORT

RRD18MR003

**CSX Railroad, Amtrak Passenger Train/Freight Train Collision with Derailment
and Crew Fatalities**

**Cayce, SC
February 4, 2018**

Accident

NTSB Accident Number:	RRD18MR003
Date of Accident:	February 4, 2018
Time of Accident:	2:27 a.m.
Railroad Owner:	CSX Transportation
Passenger Train and No:	Amtrak-P 091
Freight Train and No:	CSX-F 777 03
Location of Accident:	Cayce, SC

Accident Summary

For a summary of this accident, refer to the *Accident Summary* report within this docket, RRD18MR003.

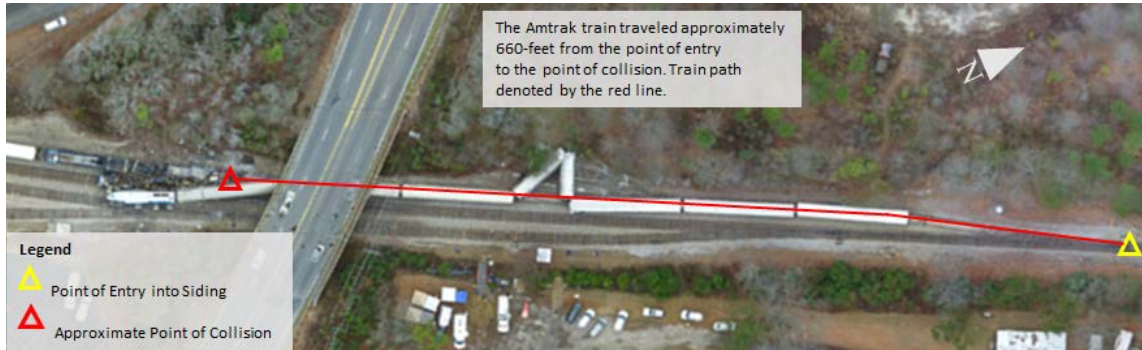


Figure 1. Aerial drone image of accident location. The Amtrak train was traveling in a railroad timetable-south direction; from the bottom-right toward the top-left corner of the photo. The CSX train and point of collision was on the west side of the highway overpass. (Photo: South Carolina Department of Public Safety)



Figure 2. Photo facing north showing the damaged lead locomotives of each train (Photo: NTSB)

Track Description

The CSX Transportation (CSX)-Columbia subdivision consists of 137.5 miles of single main track between milepost S-359.7 and milepost S-497.2. According to CSX documentation, the 2017 total tonnage figure for the subject track between milepost S-366.6 and milepost S-376.4 was about 4.5 million gross tons. On average there are 22 trains that operate daily over the Columbia subdivision.

CSX inspects and maintains the main track near the accident location to Federal Railroad Administration (FRA) Track Safety Standards (TSS) for Class 3 track, which allows for a maximum operating speed of 40 mph for freight trains and 60 mph for passenger trains. The track where the collision occurred, the Silica Storage Track is inspected and maintained to FRA Class 1 standards, which allows for maximum operating speeds of 10 MPH for freight train. In accordance with CSX operating rules, the speed in the Silica Storage Track is restricted to 10 MPH for freight and passenger trains are not routinely operated on the storage track. Amtrak operates 2 passenger rail trains (one northbound and one southbound) over this subdivision 7 days a week.

Generally, the main track leading up to the accident location was constructed with crossties that measured 9-inches by 7-inches by 8-feet 6-inch long, spaced 19.5 inches on center (nominal). On the main track, the rail sections were 115 lb. continuous welded rails were fastened to the crossties using standard double shoulder tie plates, fastened with rail and anchor spikes on the field side of the rails and one rail spike on the gage sides of each rail. Some crossties had additional spikes consistent with routine track maintenance.¹ The rails were anchored on every other tie, except for locations noted by this working group. These fasteners and anchors are used to maintain

¹ Rail section/weight is the rails weight in pounds per yard of rail.

gage and alinement of the track as well as restrain longitudinal movement of the continuous welded rail (CWR).² The track was supported by granite rock ballast.

Traveling on main track, the southbound Amtrak train traversed a grade ranging from 0% to 1.01%, beginning at milepost S-366.0 to the point of collision (POC) at milepost S-367.1. The main track curvature leading up to the POC from milepost S-366.0 was mostly tangent track with five curves ranging from 2.15-degree to .27-degree curves.

North End Silica Storage Track Switch

To provide entry into the north end of the Silica Storage Track, there was a No. 10, right-hand turnout. The switch points of the turnout were controlled by a hand-operated switch machine with an electric lock. The design standard of the turnout denoted an average degree of curve through the curved closure rail of less than 7.5-degrees. Measurements taken by the investigative team revealed a less than 1-inch deviation from uniform alinement in the turnout. Investigators inspected the switch and turnout components and noted two conditions that did not meet Federal Railroad Administration (FRA) minimum track safety standards. The defective conditions noted were: guard check less than allowable (54-5/16") for class 3 track, and the tread portion of frog worn in excess of allowable (1/2"). Both standards are relevant to rail wheels and flanges traversing through the frog portion of the turnout. Investigators also noted that the inside rail spikes of the curved-closure rail had been raised from the switch-ties between the left-hand, rigid heelblock and the frog. These spikes were between one-quarter and three-eighths of an inch raised.

²Continuous welded rail (CWR) means rail that has been welded together into lengths exceeding 400 feet.



Figure 3. Photo facing south, showing the North End Silica Storage Track switch. The switch is lined as found by investigators. (Photo: NTSB)

Silica Storage Track

The Silica Storage Track extends from milepost S-366.9 (north switch) to milepost S-367.9 (south switch) and is about 5,000 feet long. The track in the storage track is constructed with standard wooden crossties and 110 lb. rails. The rails were seated on single shoulder plates, fastened to the crossties with two rail-spikes on the gage side of the rail and one gage-spike on the field side of the rail. Upon entry into the Silica Storage Track, the Amtrak train entered a left-hand curve with an estimated (pre-accident) curve degree of 4.5. (Investigators took track measurements; however due to the track misalignment caused by the derailment the degree of

curve could not be verified).³ As the Amtrak train entered this curve, the track structure was displaced to the right or in a west direction about 20-inches.⁴ The rail was displaced as it canted outward. Investigators took track geometry measurements at this location; the track gage was measured by documenting the location of the rail plates. Investigators found no evidence of noncompliance with FRA and CSX standards that existed prior to the accident.



Figure 4. Photo showing the track misalignment/displacement, and unseated rail near the derail at the north end of Silica Storage Track.

³ The CSX Maintenance of Way Field Manual denotes that this return curve was to be installed as a 4.5-degree curve.

⁴ The west direction noted is in relation to CSX Timetable Direction, not geographical direction.



Figure 5. Photo showing distance the track structure in the Silica Storage Track return curve had been displaced because of the accident. The track structure shifted west about 20 inches; the void in the ballast from the edge of the crosstie was measured.

Silica Storage Track Derails

To prevent unintended movement of equipment from the Silica Storage Track onto the main track, slide on type derails were installed at both ends of the storage track. These derails were designed to derail equipment in only one direction; to prevent train and equipment movements from the storage track to the main track. At the north end of the storage track, the position of the derail handle indicated that the derail was in the derailing position, the handle was locked in the derailing position. Investigator examined the derailing portion of the derail at the north end of the storage track and found no marks from rail wheel strikes on the north facing end (non-derailing

end) of the derail shoe. Investigators noted wheel departure marks across the rail head of the east rail near the derail.



Figure 6. Photo of derail operating handle applied and locked in the derailing position-as found.

Documentation of Point of Collision

The investigation team determined that the point of collision (POC) was near mile S-367.1 in the Silica Storage Track. The train traveled about 660 feet south into the storage track before striking the stationary CSX train.

Damages Estimates

CSX reported \$5,000 damages to the track structure. In total about of 450 track feet of the

track structure was disturbed as the Amtrak train traveled south in the storage track. Additional damage to the track structure of the Silica Storage Track and main line occurred near the POC.



Figure 7. Photo showing the non-derailing end of the derail shoe with no indication of contact from railroad equipment.

Post-Accident Inspection/Testing of Track

On February 5, 2018, members of the track and engineering technical working group conducted a walking inspection from milepost S-366.6 to milepost S-367.05. FRA inspectors noted 9 deviations from FRA TSS. The defective conditions identified are as follows:

- (5) separate concentrated loads where there was an object between the base of the rail and the bearing surface of the tie plate
- (1) CWR rail anchoring procedure requirements not met for approximately 150 ties
- (1) vertical split head rail defect 6” in length on the Silica Storage Track; FRA class 1 track
- (1) guard check less than allowable for class 3 track of 54-5/16” on the North Silica Storage Track Switch
- (1) tread portion of frog worn in excess of allowable (1/2”) on the North Silica Storage Track Switch
- (1) loose adjustable rail brace on the north Auto Ramp Storage Switch

Investigators made the following general observations of the track structure:

- Track alinement was uniform
- Crosstie conditions meet requirements
- No track surface conditions were noted
- One location was observed where the ballast had receded to expose the ends of six crossties
- Drainage conditions were acceptable

Track Inspection Records

FRA regulations found in 49 CFR 213 require that a rail carrier's track inspection records be prepared and signed on the day of the inspection for frequency of compliance with the FRA Track Safety Standards (TSS). FRA track inspection records are required to reflect actual field conditions and deviations from the FRA/TSS. CSX has elected to operate at FRA Class 3 speeds on the main in the accident area requiring CSX personnel to inspect the main track at least twice per calendar week. The Silica Storage Track where the accident occurred is operated by CSX as FRA Class 1 track requiring CSX

personnel to inspect the track at least once per month.

On February 8, 2018, an FRA Track Safety Inspector conducted an inspection of CSX track inspection records from January 4, 2018 through the day of the accident. This inspection revealed that track inspection frequencies were being met. Prior to the accident, the main track in the accident area was inspected by CSX on February 2, 2018 and the Silica Storage Track was last inspected on January 23, 2018. The FRA inspector took no exception to the CSX track inspections records.

Geometry Tests

Prior to the accident, CSX conducted a survey of the Columbia subdivision using a geometry vehicle on January 10, 2018. No defective geometry conditions were identified in the accident area during this test.

Internal Rail Tests Data

The most recent ultrasonic rail test of the CSX Columbia subdivision was conducted in October 2017. There were no defective rails identified in the accident area during this test.

Regulatory Track Inspection History

Prior to the accident, the last inspection by FRA Track Safety Inspector through the derailment area was conducted on July 6th, 2017. Three deviations from FRA TSS were identified. The nearest to the accident area was a combustible vegetation around track carrying structures defect at MP S-364.8.

FRA Automated Track Inspection Program (ATIP)

FRA conducted an ATIP geometry survey on December 7, 2016. This survey included the main track through the accident area. There were no geometry defects identified in the accident area during this test.

[End of Report]