Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2018-1250

Amtrak P09103 Collision
Cayce, South Carolina
February 4, 2018

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.

SYNOPSIS

On February 4, 2018, at 2:27 a.m., EST, CSX Transportation (CSX) freight train F77703 (Train 1) was struck head-on by southbound National Railroad Passenger Corporation (Amtrak) passenger train P09103 (Train 2) in the Silica side track at Milepost (MP) S 367.1. The accident occurred on the CSX Columbia Subdivision in Dixiana, South Carolina. Dixiana is an unincorporated community south of Cayce, South Carolina, in Lexington County.

A signal suspension was in effect in the accident area for signal system upgrades.

The locomotive and six cars in Train 2 were derailed. The Engineer and Conductor of Train 2 were fatally injured. The Assistant Conductor, 6 on-board Passenger Service Attendants, and 122 passengers were injured on Train 2. The Conductor on Train 1 was also injured. Estimated damages to track and equipment involved in the accident was $17,336,899.

An active signal system would have likely prevented Train 2 from entering the block where the switch was misaligned.

The weather conditions at the time of this collision were cloudy, dark, and 39 °F.

The Federal Railroad Administration (FRA) investigation determined the probable cause of the accident was the failure of the crew of Train 1 to properly line the switch at MP S 366.9 prior to releasing their track authority, H702 – Switch improperly lined.

Additionally, FRA determined several contributing factors in this accident to be:

- The crew of Train 1 failed to properly release authority limits, H404 – Train order, track warrants, track bulletin, or timetable authority, failure to comply.
- The signal suspension between MP S 362.5 and MP S 385.1, M599 – Other miscellaneous cause.

U.S. Department of Transportation Federal Railroad Administration	**FRA FACTUAL RAILROAD ACCIDENT REPORT**	FRA File #HQ-2018-1250

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
CSX Transportation	CSX	000174491
2. Name of Railroad Operating Train #2	**2a. Alphabetic Code**	**2b. Railroad Accident/Incident No.**
Amtrak (National Railroad Passenger Corporation)	ATK	151818

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
CSX Transportation	CSX	151818
2. U.S. DOT Grade Crossing Identification Number	**3. Date of Accident/Incident**	**4. Time of Accident/Incident**
	2/4/2018	2:27 AM

5. Type of Accident/Incident
Head On Collision

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated	10. Subdivision
0	0	0	0	CSX Columbia Subdivision

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Cayce	S367.1	SC	LEXINGTON

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
39 ˚F	Dark	Cloudy	Yard

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Silica Storage Track	Freight Trains-10, Passenger Trains-15		South

23. PTC Preventable
Yes

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2018-1250

OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	F77703

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross excluding power units)	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter	Code
0.0 MPH	R	1797		0

6. Type of Territory

Signalization:
Not Signaled

Method of Operation/Authority for Movement:
N/A

Supplemental/Adjunct Codes:

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box	Alcohol	Drugs
(1) First Involved *(derailed, struck, etc.)*	CSXT 130	1	no		0	0
(2) Causing *(if mechanical, cause reported)*	N/A	0	no	9. Was this consist transporting passengers?		No

10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote	11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	2	0	0	0	0	(1) Total in Equipment Consist	0	0	34	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	0	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
337000	5014

14. Primary Cause Code
H702 - Switch improperly lined

15. Contributing Cause Code
H404 - Train order, track warrant, track bulletin, or timetable authority, failure to comply

Number of Crew Members				Length of Time on Duty	
16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen	20. Engineer/Operator	21. Conductor
1	0	1	0	Hrs: 11 Mins: 30	Hrs: 11 Mins: 30

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others	25. EOT Device?	26. Was EOT Device Properly Armed?
				Yes	Yes
Fatal	0	0	0	27. Caboose Occupied by Crew?	
Nonfatal	1	0	0		N/A

28. Latitude	29. Longitude
33.908908000	-81.067241000

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2018-1250

OPERATING TRAIN #2

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Passenger Train-Pulling	Yes	P09103

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross excluding power units)	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter	Code
50.0 MPH	R			0

6. Type of Territory

Signalization:
Not Signaled

Method of Operation/Authority for Movement:

Supplemental/Adjunct Codes:

7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box	Alcohol	Drugs
(1) First Involved *(derailed, struck, etc.)*	ATK 47	1	no		0	0
(2) Causing *(if mechanical, cause reported)*	N/A	0	no	9. Was this consist transporting passengers?		Yes

10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End e. Remote	11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight	Loaded b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Train	1	0	0	0	0	(1) Total in Equipment Consist	0	7	0	0	0
(2) Total Derailed	1	0	0	0	0	(2) Total Derailed	0	6	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
16994885	0

14. Primary Cause Code
H702 - Switch improperly lined

15. Contributing Cause Code
H404 - Train order, track warrant, track bulletin, or timetable authority, failure to comply

Number of Crew Members

16. Engineers/Operators	17. Firemen	18. Conductors	19. Brakemen
1	0	2	0

Length of Time on Duty

20. Engineer/Operator	21. Conductor
Hrs: 3 Mins: 44	Hrs: 3 Mins: 44

Casualties to:	22. Railroad Employees	23. Train Passengers	24. Others
Fatal	2	0	0
Nonfatal	7	117	0

25. EOT Device?	26. Was EOT Device Properly Armed?
No	N/A

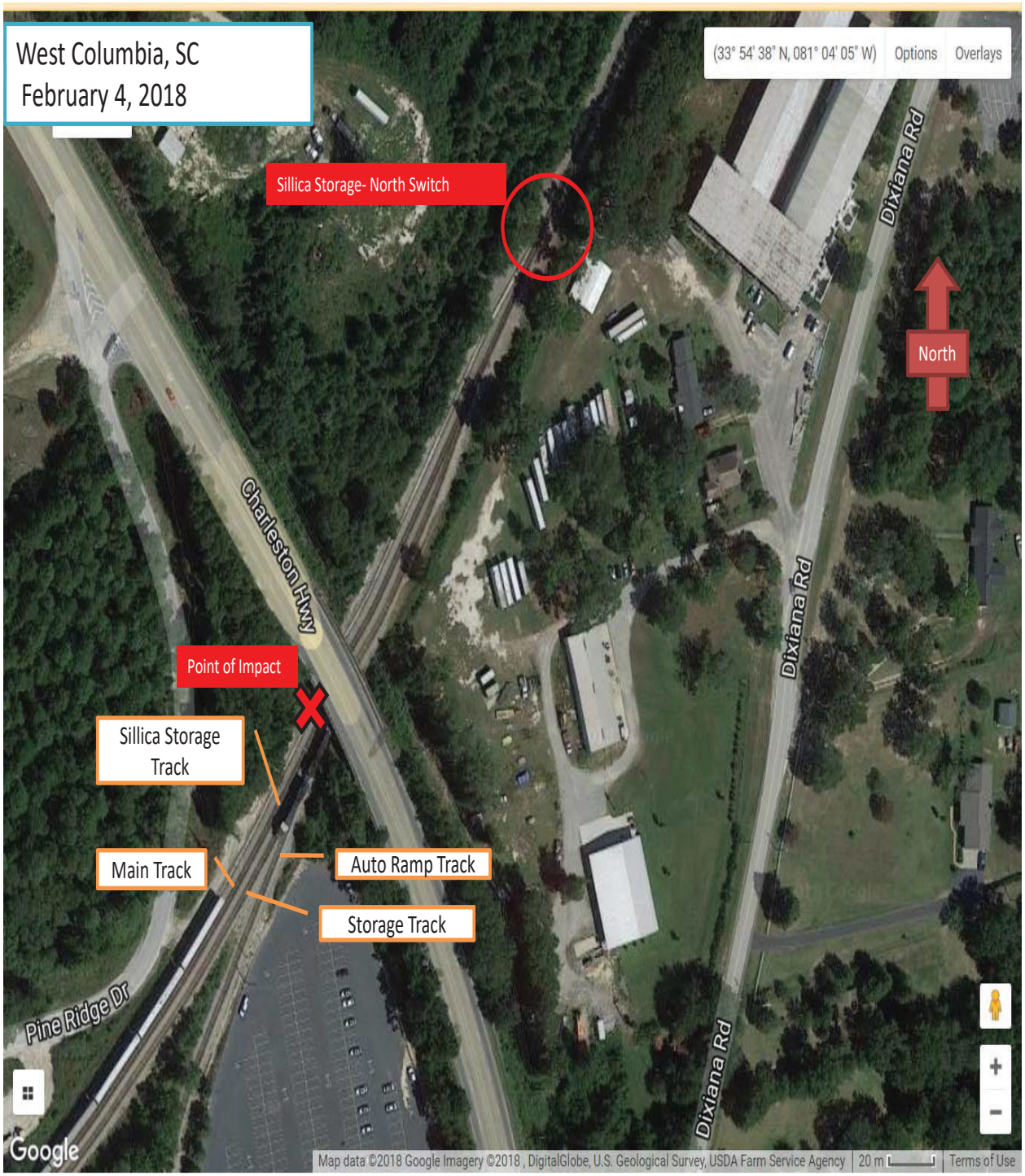
27. Caboose Occupied by Crew? N/A

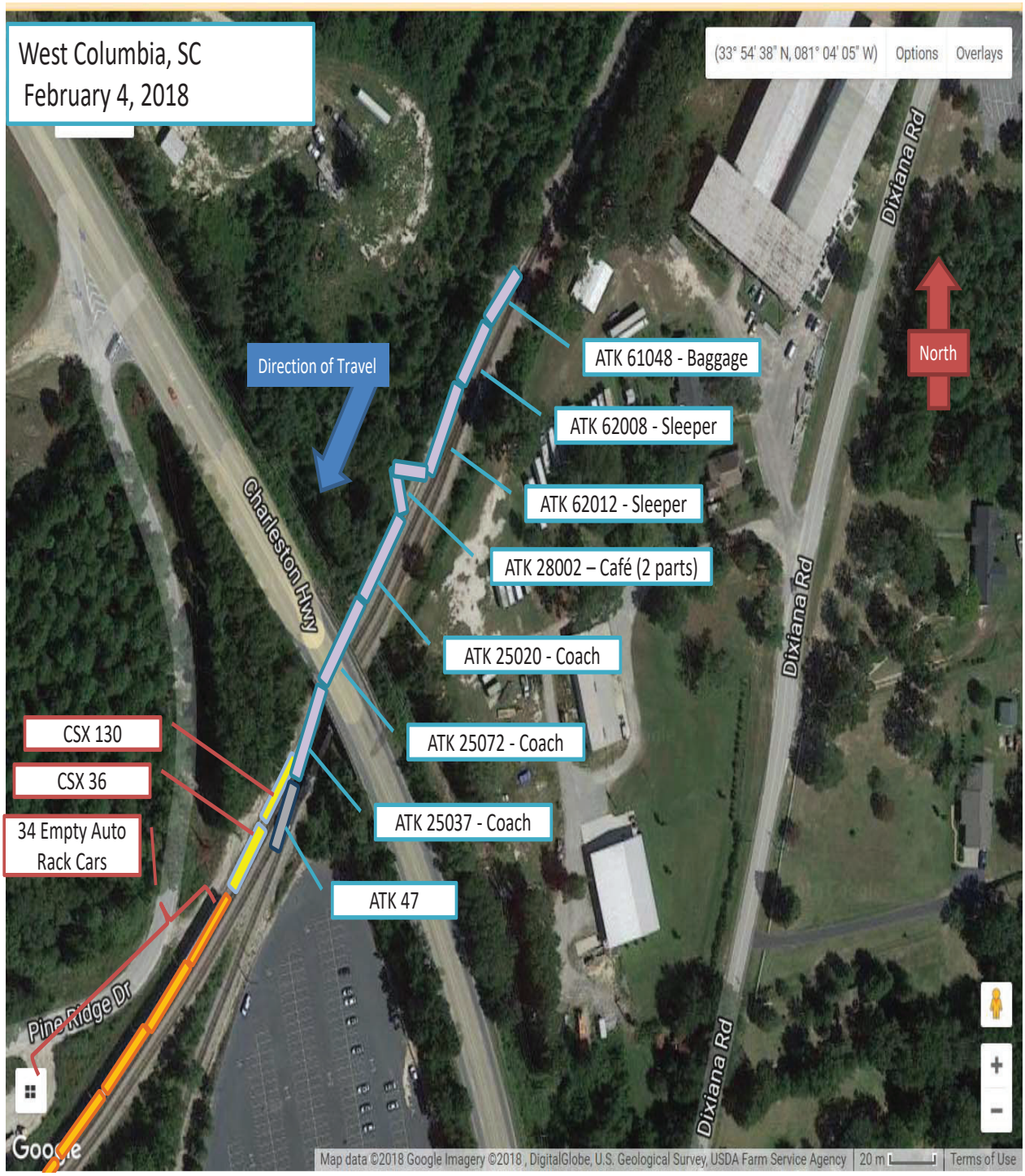
28. Latitude	29. Longitude
33.911285000	-81.065321000

SKETCHES

Sketch - Sketch

HQ-2018-1250




West Columbia, SC
February 4, 2018
(33° 54' 38" N, 081° 04' 05" W)
Options
Overlays
Dixiana Rd
North
Direction of Travel
ATK 61048 - Baggage
ATK 62008 - Sleeper
ATK 62012 - Sleeper
ATK 28002 – Café (2 parts)
ATK 25020 - Coach
ATK 25072 - Coach
ATK 25037 - Coach
ATK 47
CSX 130
CSX 36
34 Empty Auto Rack Cars
Charleston Hwy
Pine Ridge Dr
Dixiana Rd
Dixiana Rd
Google
Map data ©2018 Google Imagery ©2018 , DigitalGlobe, U.S. Geological Survey, USDA Farm Service Agency
20 m
Terms of Use

NARRATIVE

Circumstances Prior to the Accident

CSX Train F77703

CSX Transportation (CSX) Freight Train F77703 (Train 1) was a local switcher based out of CSX Cayce Yard, Cayce, South Carolina. Train 1 consisted of 2 locomotives (CSXT 130 and CSXT 36) and 38 loaded auto racks, was 3,718 feet long, and had 2,891 trailing tons when it departed Cayce Yard. Train 1 was scheduled to depart Cayce Yard with the loaded auto racks, and switch the TDSI Dixiana Automotive Distribution Center (auto ramp) in Dixiana, South Carolina. Train 1's work included spotting all 38 loads, and pulling 34 empty auto racks.

The crew of Train 1 consisted of an engineer and conductor. Both employees were placed on duty at 3:00 p.m., EST, at Cayce Yard, their home terminal, after receiving more than the required statutory off-duty period.

Amtrak Train P09103

National Railroad Passenger Corporation (Amtrak) Passenger Train P09103 (Train 2) operates daily service between New York, New York, and Miami, Florida. Train 2 consisted of one electric locomotive (ATK 665) and seven cars, which included three coach cars, a dining car, two sleeper cars, and a baggage car. Train 2 received a class 1 brake test by qualified mechanical personnel at 12:10 a.m., EST, on February 3, 2018, at Amtrak's Sunnyside Yard, New York City. Upon arriving at Union Station, Washington, D.C., ATK 665 was removed, and diesel locomotive ATK 47 was added for the remainder of the trip to Miami.

Car Number	Equipment Type	Passengers
ATK 47	Locomotive	Occupied
ATK 25037	Amfleet II Coach	Unoccupied
ATK 25072	Amfleet II Coach	Occupied
ATK 25020	Amfleet II Coach	Occupied
ATK 28002	Amfleet II Café	Occupied
ATK 62012	Viewliner Sleeper	Occupied
ATK 62008	Viewliner Sleeper	Occupied
ATK 61048	Viewliner II Baggage	Unoccupied

The crew of Train 2 consisted of an engineer, conductor, and assistant conductor, and was placed on duty at 10:43 p.m., EST, in Hamlet, North Carolina. Additionally, there were six onboard service attendants assigned to Train 2 that were already on board when the train arrived in Hamlet.

The accident occurred on CSX's Columbia Subdivision in Dixiana, South Carolina. Dixiana is an unincorporated community south of Cayce, South Carolina. Timetable direction on the Columbia Subdivision is south, and will be used throughout the report. Through the accident area, there is a single main line with a storage track (Silica storage track) on the west side of the main line, and an industrial lead (east storage track) to the auto ramp on the east side. The north end of Silica storage track is located at Milepost (MP) S 366.9, and is equipped with a hand throw, electric lock switch into a right-hand, #10 turnout. The Columbia Subdivision is signaled territory that is controlled by a dispatcher in Jacksonville, Florida, using a Centralized Traffic Control (CTC) system. However, the signal system in the accident area at the time of the accident was suspended for an upgrade to the signal system. The temporary signal suspension required trains to operate from MP S 362.5 to MP S 385.1 under Track Warrant Control (TWC), where trains would receive an EC-1 authority, via radio, granting them authority for movement through the signal suspension limits. The maximum authorized speed throughout the accident area was 59 mph for passenger trains, and 40 mph for freight trains. There is an ascending grade beginning about MP S 366.0 to S 367.1 of up to 1.01-percent. Leading up to the accident location, there is an estimated 4.5-degree, left-hand curve before the track becomes tangent through the accident area.

Due to the signal suspension, Train 1 was unable to depart Cayce Yard when the crew came on duty. The crew was instructed by the Cayce Yardmaster to relieve another CSX freight train (F79403) that was stopped on the main line with the crew about to exceed the hours of service limits for their shift. After yarding the train at Cayce, the Train 1 crew took a meal break before contacting the dispatcher to receive their EC-1. At 8:32 p.m., EST, the CSX Dispatcher issued EC-1 No. 93537 to Train 1 with limits of MP S 365.8 and S 369.7, and Train 1 departed the yard. Upon arriving at MP S 367.9 at about 9:00 p.m., EST, the crew of Train 1 began their switch work utilizing the switches to Silica storage track at MP S 366.9 and MP S 367.9, and the switch to the east storage track at MP S 367.0. At about 1:38 a.m., EST, on February 4, 2018, Train 1 had completed their assigned work and pulled out of the north end of the east storage track onto the main line. Train 1 then shoved into the north end of Silica storage track, and stopped in the clear of the derail on the north end. The Conductor of train 1 then applied the derail on the north end of the Silica storage track, walked across the main line and restored the switch on the north end of the east storage track, restored the derail on the north end of east storage track, and returned to Train 1. The crew of Train 1 then shoved further back into Silica storage track and coupled to the empty auto racks they had pulled earlier in the evening. Train 1 now consisted of 2 locomotives and 34 empty auto racks, and was 3,196 feet long, with 1,797 trailing tons. The Engineer was in the process of applying the hand brakes on the two locomotives, while the Conductor released EC-1 No. 93537 to the dispatcher at 1:51 a.m., EST.

The operating crew of Train 2 took over control of the train in Hamlet, and departed at 11:42 p.m., EST. After arriving at the passenger station in Columbia, South Carolina, at MP S 361.0, the Conductor moved from the passenger cars to the locomotive to assist the Engineer while they operated through the limits of the signal suspension. At 2:01 a.m., EST, the CSX Dispatcher issued EC-1 No. 93758 to Train 2 with limits from MP S 362.5 to S 385.1. Train 2 departed the passenger station in Columbia, and stopped at

MP S 362.5 to call the CSX Dispatcher and waited on permission to pass the stop signal and enter the limits of the signal suspension. At 2:21 a.m., EST, the CSX Dispatcher responded to Train 2 informing them that their EC-1 authority authorized them into the signal suspension, and Train 2 began to move south again.

Leading up to the accident, the Engineer for Train 1 was on the ground walking in the direction of the switch at MP S 366.9 while the Conductor remained on locomotive CSXT 130.

The Engineer of Train 2 was seated on the right (west) side of locomotive ATK 47, with the Conductor on the left (east) side of the locomotive. The Assistant Conductor was seated in the dining car.

The Accident

As Train 2 was rounding the 4.5-degree left-hand curve, it entered Silica storage track due to a misaligned switch, traveling 57 mph. The crew of Train 1 saw Train 2 enter Silica storage track. The Engineer began to run west, away from the tracks, and the Conductor ran south, out of the rear door of CSXT 130, and onto the walkway. The Engineer of Train 2 placed the train in emergency, as Train 2 traveled about 659 feet into Silica storage track and collided head-on into Train 1 at 2:27 a.m., EST, at MP S 367.1, still traveling 50 mph.

At the point of impact (POI), the front truck of ATK 47 was detached from the locomotive, and the fuel tank ruptured, as the locomotive overrode CSXT 130. The nose and cab of ATK 47 folded completely under its deck, fatally injuring the Engineer and Conductor of Train 2, and causing them to fall from the locomotive between the two trains. ATK 47 rolled to the left (east) and off CSXT 130, coming to rest on its side approximately 150 feet south of the POI. Both ATK 47 and CSXT 130 experienced a total loss of survival space. The Conductor of Train 1 was knocked off the right (east) side of the walkway of CSXT 130 onto the ground.

The first coach car (ATK 25037) in Train 2 began to follow ATK 47 atop of CSXT 130 before coming to rest on the east side of CSXT 130. The car was unoccupied, and sustained buckling in the roof, and a partial loss of occupant volume in the front third of the car. The second coach car (ATK 25072) was occupied, and derailed the lead trucks coming to rest upright, and inline. The third coach car (ATK 25020) was occupied, and did not derail. The café car (ATK 28002) was occupied by the Assistant Conductor and one passenger and derailed, buckling over 90-degrees in the middle into a “V” shape. The two sleeper cars (ATK 62012 and ATK 62008) and the baggage car (ATK 61048) all derailed and came to rest upright, and inline.

Train 1 was shoved back 15 feet from the impact. The collision posts of CSXT 130 were sheared off as ATK 47 overrode the locomotive, but none of the cars or locomotives from Train 1 were derailed. Immediately after the collision, the Conductor of Train 1 was between CSXT 130 and ATK 47, covered in diesel fuel, with no visible injuries.

After checking on the passenger from the café car, the Assistant Conductor made an emergency broadcast over the radio, and established communication with the CSX Dispatcher.

The Engineer of Train 1 returned to the POI, and located the Conductor from Train 1. The Engineer's cell phone was still on the locomotive when the accident occurred, so he borrowed the Conductor's cell phone and called the CSX Yardmaster at Cayce.

First responders to the accident began to arrive at 2:35 a.m., EST, and included:
• Lexington County Emergency Medical Services (EMS);
• Town of Lexington Police Department;
• Lexington County Sheriff's Department;
• Richland County Sheriff's Department;
• Cayce Department of Public Safety;
• Springdale Police Department;
• South Carolina Highway Patrol;
• Cayce Fire Department;
• Lexington County Fire Service;
• West Columbia Fire Department; and,
• Columbia Fire Department.

Also on scene were the National Transportation Safety Board (NTSB), Federal Bureau of Investigation (FBI), Volpe National Transportation Systems Center (Volpe), U.S. Department of Homeland Security, South Carolina Governor Henry McMaster, South Carolina Secretary of Transportation Christy Hall, U.S. Department of Transportation Senior Advisor for Infrastructure James Ray, and South Carolina Department of Health and Environmental Control.

On Train 2, the Engineer and Conductor were fatally injured, and the Assistant Conductor, 6 Passenger Service Attendants, and 122 passengers reported injuries. Emergency response reports reflect 61 individuals were transported to 5 area hospitals:
• Lexington Hospital;
• Park Ridge Hospital;
• Baptist Hospital;
• Palmetto-Richland Hospital; and,
• Veterans Affairs Hospital.

The Engineer and Conductor of Train 1 were transported to the hospital by CSX officers for toxicological testing and later released. Pine Ridge Middle School was set up as a shelter for all passengers who were not transported to the hospital.

Estimated damages to track and equipment in the accident were $17,336,899. There were no hazardous materials in either train; however, a contractor was hired to mitigate the diesel fuel that was released from the locomotives.

Post-Accident Investigation

FRA investigated this accident, with participation from NTSB, Volpe, Amtrak, and CSX. The investigation included collecting physical evidence, performing tests and inspections, conducting interviews, and reviewing records of the personnel and equipment involved in the accident.

Analysis and Conclusions

Analysis – Toxicological Testing: This accident met the criteria for Title 49 Code of Federal Regulations (CFR) part 219, subpart C, *Post Accident Toxicological Testing*. FRA Post Accident Forensic Toxicology Result Reports indicate all crew members from Train 1 and Train 2 were negative for drugs and alcohol.

Conclusion: FRA determined alcohol and drugs did not contribute to the cause or severity of the accident.

Analysis – Train Operations: A review of CSX and Amtrak Engineers', Conductors', Assistant Conductor's, and Dispatcher's training and certification records was conducted; no exceptions were noted. The review included the employees' work history, discipline history, operational tests, efficiency tests, and physical characteristics tests.

The crew of Train 1 had worked together in the past, but not on a regular basis. The Engineer indicated it had been about a year and a half since he last worked the Silica storage track, while the Conductor worked this job multiple times in January 2018. Both had been called from the extra board to work Train 1.

The crew of Train 1 received a safety briefing from the Trainmaster at the start of their shift. They needed an EC-1 track authority to operate the train through the signal suspension area, with additional permission to operate three switches at MP S 366.9, MP S 367.0, and MP S 367.9. It was required that the crew report to the Dispatcher the time that each switch was reversed, and the final time the switch was restored to its normal position (lined for main line movement), before releasing their EC-1 track authority. This information is also required to be recorded on the Switch Position Awareness Form (SPAF), and signed by both employees prior to releasing their EC-1 track authority. Prior to reporting the times to the Dispatcher, the Engineer and Conductor were required to have a briefing regarding the position of the switches and the times they were restored. Both crew members had received training on this process, and on using EC-1 track authority when operating on non-signaled territory.

The Conductor of Train 1, working without a watch, asked the Engineer to keep track of time for him during their shift. In a post-accident interview, the Conductor of Train 1 stated the switch times on the SPAF "was a mess" because he forgot to remind the Engineer to record the time each switch was restored.

The Train 1 Conductor applied the handbrake on CSXT 130 while the Engineer walked back and secured CSXT 36. While the Engineer was securing CSXT 36, the Conductor contacted the Dispatcher and

released EC-1 No. 93537.

The Dispatcher recalled the Train 1 Conductor called him and gave him the times when the three switches were restored to normal position. He repeated the times back to Train 1 and asked the Conductor if the switches were restored to normal position, and if the SPAF was completed and initialed. Based on a voice recording between the Conductor and Dispatcher, the switch times that were reported to the Dispatcher were:

- MP S 366.9 was reversed at 8:12 p.m., EST, and restored at 8:15 p.m., EST.
- MP S 367.0 was reversed at 8:32 p.m., EST, and restored at 10:10 p.m., EST.
- MP S 367.9 was reversed at 8:48 p.m., EST, and restored at 8:49 p.m., EST.

FRA's investigation revealed the times reported to reverse and restore the two north end switches (MP S 366.9 and MP S 367.0) were not actual times. EC-1 93537 was issued to Train 1 at 8:32 p.m., EST, which was after the times reported by Train 1 that the switch at the north end of Silica storage track. FRA determined the actual times the crew of Train 1 operated the switches were not recorded as required by CSX Operating Rules, resulting in inaccurate times being reported to the dispatcher.

In a post-accident interview, the Engineer of Train 1 reported that he questioned the Conductor multiple times about lining the switch at the north end of Silica storage track back for the main line, and the Conductor insisted he had lined the switch. A review of CSXT 130 forward facing video confirmed the Conductor did not restore the main track switch at the north end of Silica storage track.

The Train 1 Conductor failed to properly align the switch at MP S 366.9 for the main line prior to releasing his track authority, as required by Title 49 CFR § 218.105(d)(1).

Conclusion: FRA determined the failure of the Train 1 crew to restore the switch at the north end of Silica storage track was the probable cause of the accident.

Analysis – Mechanical Inspection: A complete inspection of the cars and locomotives from the accident site was conducted by an investigation team comprised of mechanical personnel from FRA, NTSB, CSX, and Amtrak. All required locomotive inspections, tests, and records were compliant with Federal regulations. Both trains received the required pre-departure inspections and air brake tests. The investigation team physically inspected all equipment associated with Train 1 on Silica storage track. A single exception was noted for a broken uncoupling lever on one of the empty auto racks. No other exceptions to the locomotives or freight cars were noted. The investigation team physically inspected all equipment associated with Train 2 on Silica storage track. Several exceptions were noted to the interior signage and markings of the passenger cars. No other exceptions to the equipment associated with Train 2 were noted.

FRA concluded the exceptions identified on Train 1 and Train 2 were not casual factors in the accident.

Conclusion: FRA determined the mechanical condition of the equipment involved did not contribute to the

cause or severity of the accident.

Analysis – Track and Track Structure: A complete inspection of the track and track structure from MP S 366.6 to MP S 367.5 was conducted by an investigation team comprised of maintenance of way (MOW) personnel from FRA, NTSB, CSX, and Amtrak. This inspection included the single main track, east storage track, and Silica storage track. Track geometry measurements taken at the scene complied with the FRA Track Safety Standards for the intended class. Special attention was given during the inspection of the switch and sliding derail at the north end of Silica storage track. All damage found at the switch is consistent with track that is subjected to high lateral forces exerted when a train has traveled through the switch at a speed higher than the track is designed to withstand.

The investigation team found nine defective conditions. None of these defects would have contributed to or caused this accident. The investigation team determined the track alignment was uniform with compliant crosstie conditions. There were no unacceptable track surface conditions. Track drainage conditions were acceptable. The main track was maintained to Class 3 track standards.

As part of the investigation, a complete review of CSX's track inspection records, geometry test records, internal rail test records, regulatory track inspection history, and FRA automated track inspection program reports were made by the investigation team. No exceptions were noted.

Conclusion: FRA determined the track and track structure did not contribute to the cause or severity of the accident.

Analysis – Signal System: The signal and train control system was inspected by an investigation team comprised of signal and train control personal from FRA, NTSB, CSX, and Amtrak. The signal system on CSX's Columbia Subdivision from MP S 359.7 to MP S 497.2 consisted of Traffic Controlled Signals (TCS) that governed movement in both directions on the main line and siding tracks. The Train Dispatcher for the Columbia Subdivision was in Jacksonville, Florida. The normal method of operation was by signal indication of the TCS. Signals were color light type, controlled by direct current (DC) coded and non-coded track circuits. Dispatcher-controlled power-operated switches utilized in this area were Union Switch & Signal (US&S) M-23 and M-22 dual-control switch machines. The switch at the north end of Silica storage track involved in this accident was a US&S T-21 hand throw type switch equipped with an SL-25 electric switch lock.

At the time of the accident, the signal system was suspended for the installation of Positive Train Control (PTC) components. The dispatcher was using Track Warrant Control (TWC) as an alternate method of train operation. During the signal suspension, controls and indications were disabled from the Dispatcher, and all power-operated switches were in hand throw mode.
A post-accident inspection of the switch located at MP S 366.9 was completed. There was no damage to the T-21 switch or the equipped SL-25 electric lock. The switch was found locked in the reverse position with a switch-lock.

The post-accident inspection found all signal equipment secured with no indications of tampering or vandalism. The signal system was suspended at the time of the accident. If the signal system had been in service, trains would have been authorized by CTC signals, and the system would have recognized the misaligned switch on the north end of Silica storage track, and stopped Train 2 until the switch was restored.

Conclusion: FRA determined the signal system did not contribute to the cause or severity of the accident, but the suspension of the signal system did contribute to the cause of the accident.

Analysis – Event Recorder and Forward-Facing Rail View Camera: FRA analyzed event recorder data provided by CSX and Amtrak. CSX event recorder data indicated both CSX locomotives were shut down and stationary for more than 25 minutes prior to the collision. CSXT 36, Train 1's trailing locomotive, indicated the impact occurred at 2:27:27 a.m., EST.

ATK 47's event recorder data prior to the collision indicated train handling was consistent and expected for the train movements made. About 300 feet, or approximately four seconds, prior to impact, the data shows the Engineer initiated an emergency application of the air brakes, changed throttle position from T-8 to Idle, and sounded the horn with the bell on. The speed decreased from 57 mph to 50 mph prior to impact. No additional data was retrievable beyond this point.

CSXT 130's, Train 1's lead locomotive, forward-facing video captured a northward view of Train 1 departing the auto ramp onto the single main track. The video shows Train 1 then making a reverse move into the north end of Silica storage track. As CSXT 130 moved southward past the north end of Silica storage track switch, it was evident the switch remained aligned for Silica storage track. The Train 1 Conductor was visible stepping down from the front west side of CSXT 130 near the derail at the north end of Silica siding. The Train 1 Conductor was then seen manually operating the Silica storage track derail to the derailing position, and locking the handle. The Train 1 Conductor then walked east towards the north end East storage track switch, lined it for normal movement (on the main track), and locked the handle. The Train 1 Conductor then walked south and lined the derail on the north end East storage track to the derailing position, and locked the handle. The Train 1 Conductor was last seen in the video walking south to the rear of the locomotive consist to make the coupling. The locomotive consist was coupled to the empty auto racks, and at 1:54 a.m., EST, the headlight was turned off.

At 2:25:55 a.m., EST, CSXT 130 was stationary when the headlight was illuminated to bright and then extinguished. Based on post-accident interviews, FRA concluded the crew of Train 1 did this to verify the position of the switch at the north end of Silica storage track. At about 2:26 a.m., EST, a light consistent with that of a flash light was observed shining on the CSXT 130 windshield, and then on the ground on the east side of CSXT 130. The video showed the Engineer walking, with his flashlight, on the west side of Silica storage track towards the switch when Train 2's headlight was visible as it approached Silica storage track at 2:26:54 a.m., EST.

The CSXT 36 forward-facing video captured a southward view of the locomotive movement out of the auto ramp onto the single main track. The view then shows the reverse move from the main track, through the switch, and onto the north end of Silica storage track before coming to a stop. At 1:47 a.m., EST, the video showed the movement continued southward and CSXT 36 coupled to the first empty auto rack on Silica storage track. At 2:27:27 a.m., EST, the video shows the locomotive lurched, and moved about 15 feet south.

The ATK 47 forward-facing video captured the southward movement until about 2:26:30 a.m., EST. At that time, the ATK 47 was .9 miles from the accident site. The video between 2:26:30 a.m., EST, and the POI was not recovered due to the damage to ATK 47.

The investigation team requested Amtrak provide a copy of an example video of what the Train 2 Engineer and Conductor may have seen just prior to the MP S 366.9 switch. Amtrak provided a previously recorded video from March 2018 of Amtrak Train P09103, operating at the same time, same speed, and in similar weather conditions. The video showed the approach to the MP S 366.9 switch. The team concluded that a person could not recognize the position of the switch until a locomotive was already on top of the switch. This would not allow time for the engineer to take corrective action, even under ideal circumstances.

Conclusion: FRA determined train handling did not contribute to the cause or severity of the accident.

Analysis – Fatigue Analysis: FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis. At or above this baseline, FRA does not consider fatigue as probable for any employee. Software sleep settings vary based on information obtained from each employee. If an employee does not provide sleep information, FRA uses the default software settings.

FRA obtained fatigue-related information, including a 10-day work history, for the operating crews of both Train 1 and Train 2. The analysis identified that fatigue was not probable for the crew of Train 1, but was possible for the crew of Train 2 due to the irregular work-rest cycles.

FRA determined that, while fatigue was possible for the crew of Train 2, the existence of any possible fatigue did not contribute to the accident.

Conclusion: FRA concluded fatigue did not contribute to the cause or severity of the accident.

Analysis – Positive Train Control: Positive Train Control (PTC) is a processor-based/communication-based train control system designed to prevent certain train accidents. With limited exceptions and exclusions as described within Title 49 CFR part 236, subpart I, *Positive Train Control Systems*, PTC is required to be installed and implemented on Class I railroad main lines handling poisonous- or toxic-by-inhalation (PIH/TIH) materials and any railroad main lines with regularly scheduled passenger intercity and commuter operations.

PTC technology is capable of automatically controlling train speeds and movements should a train operator fail to take appropriate action for the conditions at hand. PTC uses communication-based/processor-based train control technology that provides a system capable of reliably and functionally preventing:

• Train-to-train collisions;
• Overspeed derailments;
• Incursions into established work zone limits; and,
• Movement of a train through a main line switch in the improper position.

In 2015, Congress passed the Positive Train Control Enforcement and Implementation Act of 2015 (PTCEI Act), which extended the deadline for full PTC system implementation from December 31, 2015, to December 31, 2018. In addition, under the PTCEI Act, Congress permitted a railroad to request FRA's approval of an "alternative schedule" with a deadline extending beyond December 31, 2018, but no later than December 31, 2020, for full PTC system implementation. FRA has approved an alternative schedule for CSX, for full PTC implementation by December 31, 2020.

The Columbia Subdivision was not equipped with an active PTC system. The signal suspension between MP S 362.5 and MP S 385 was to install PTC equipment. An active PTC system would likely have prevented the accident.

Conclusion: FRA determined PTC did not contribute to the cause or severity of the accident.

Overall Conclusions:

The investigation concluded the MP S 366.9 switch was not restored to normal position by the crew of Train 1. The forward-facing rail view camera of CSXT 130 confirmed the switch was not restored by the Conductor after the locomotive consist entered Silica storage track.

The times the crew of Train 1 operated the switches at MP S 366.9, S 367.0, and S 367.9 were not recorded or provided to the Dispatcher properly. The transcripts of the radio communications show the crew provided incorrect times, some before Train 1 received its authority.

The signal system for the CSX Columbia Subdivision was under a planned signal suspension to install PTC components. This signal suspension required trains to operate under TWC instead of CTC. An active signal system would have likely prevented Train 2 from entering the block where the switch was misaligned.

Probable Cause and Contributing Factors:

The FRA investigation determined the probable cause of the accident was the failure of the crew of Train 1 to properly line the switch at MP S 366.9 prior to releasing their track authority, H702 – Switch improperly lined.

Additionally, FRA determined several contributing factors in this accident to be:

- The crew of Train 1 failed to properly release authority limits, H404 – Train order, track warrants, track bulletin, or timetable authority, failure to comply.
- The signal suspension between MP S 362.5 and MP S 385.1, M599 – Other miscellaneous cause.