



***Federal Railroad Administration
Office of Railroad Safety
Accident Analysis Branch***

***Accident Investigation Report
HQ-2015-1061
Technical Report***

***CSX Transportation
Maryville, TN
July 1, 2015***

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

Synopsis

On July 1, 2015, at 11:45 p.m., EDT, a southbound CSX Transportation (CSX) freight train, Number S541-01, originating in Cincinnati, Ohio, and consisting of 2 locomotives, 45 loaded, and 12 empty freight cars, derailed. The accident train was operating southbound near Maryville, Tennessee, at 34 mph, on a clear signal indication on single main track near Milepost (MP) 287.0 when the Engineer observed what he described as sparks or fire in the train. The crew notified the Dispatcher by radio, and brought their train to a stop at MP 291.2 to conduct an inspection. The Conductor walked back to approximately the tenth car from the front of the accident train, and observed a fire towards the middle of the train. Because the accident train contained hazardous material, the Conductor notified the Dispatcher about the fire, and returned to the lead locomotive.

The 2 lead locomotives, first 36 cars, and last 20 cars of Train S541-01 remained on the track. Car 37, UTLX 901717, was derailed, leaking, and on fire. The car contained 24,710 gallons of acrylonitrile, stabilized, a Class 3 (flammable liquid), Packing Group 1 material. Combustion of acrylonitrile produces hydrogen cyanide gas and oxides of nitrogen. The consist also included Liquefied Petroleum Gas (a flammable gas), Propane gas cars and elevated temperature materials.

Approximately 5,000 people were evacuated for 36 hours from the affected area, which extended for up to two miles from the derailment site. The evacuation zone included The Highlands Housing subdivision and DENSO manufacturing plant, which employs over 3,000 workers and operates on a 24-hour, 3-shift schedule. One hundred and ninety-seven people, including 8 police officers, were seen at a local hospital and 46 were admitted for observation with symptoms associated with exposure to acrylonitrile and its combustion products (toxic oxides of nitrogen and hydrogen cyanide gas). The eight police officers, who were affected and sent to the hospital, went door-to-door within the adjacent housing area to notify residents of the evacuation.

The weather at the time of the accident was dark with a temperature of 70 °F. CSX reported damages of \$125,000 to equipment and \$152,000 to track and structures, for a total of \$277,000.

A burned-off journal from Car UTLX 901717 was recovered near the initial point of derailment (POD). The Federal Railroad Administration's investigation determined that the probable cause of the accident was a journal (roller bearing) failure from overheating, cause code E53C.

TRAIN SUMMARY

1. Name of Railroad Operating Train #1 CSX Transportation	1a. Alphabetic Code CSX	1b. Railroad Accident/Incident No. 000148646
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GENERAL INFORMATION

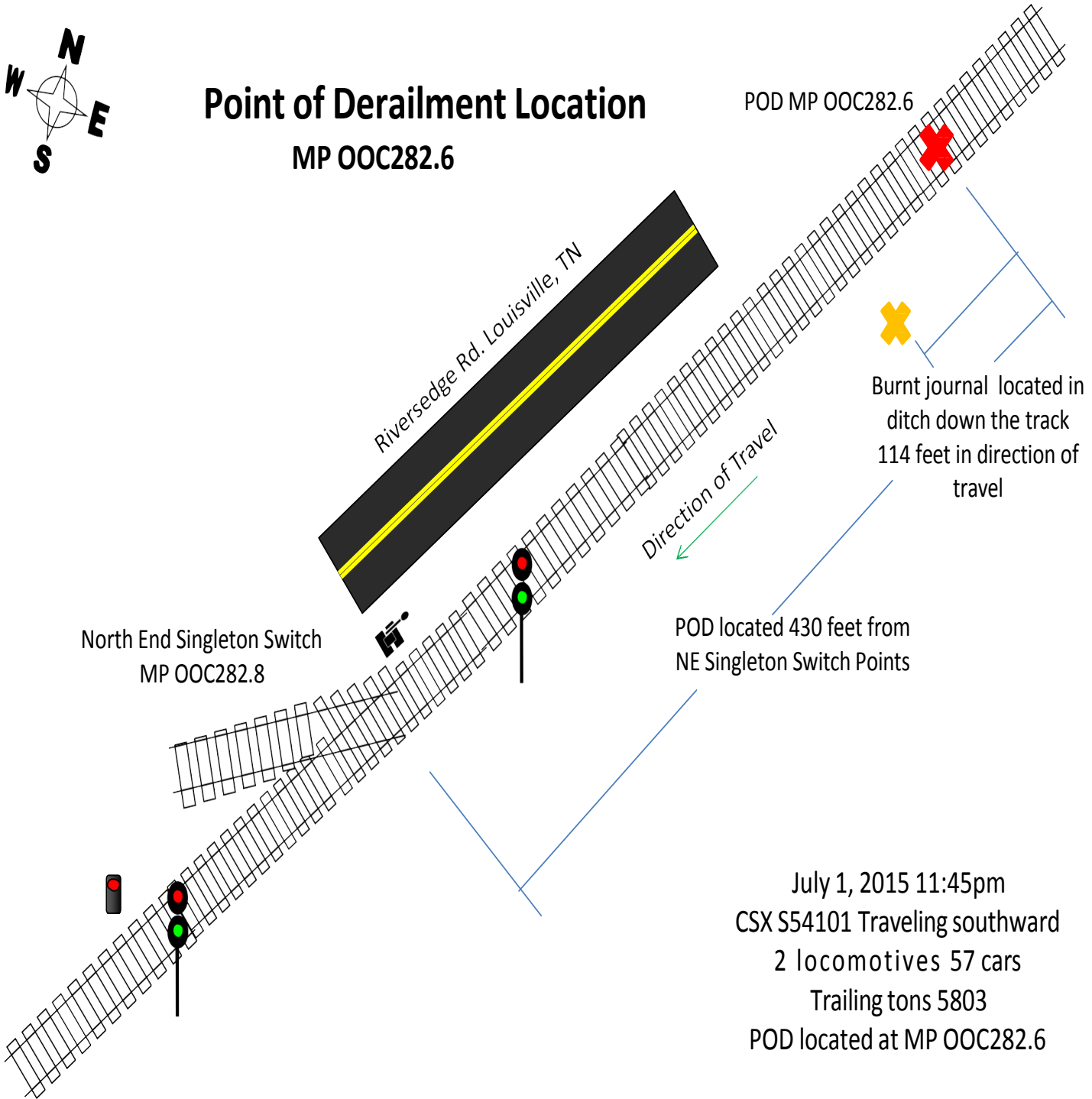
1. Name of Railroad or Other Entity Responsible for Track Maintenance CSX Transportation		1a. Alphabetic Code CSX	1b. Railroad Accident/Incident No. 000148646	
2. U.S. DOT Grade Crossing Identification Number		3. Date of Accident/Incident 7/1/2015	4. Time of Accident/Incident 11:45 PM	
5. Type of Accident/Incident Derailment				
6. Cars Carrying HAZMAT 27	7. HAZMAT Cars Damaged/Derailed 1	8. Cars Releasing HAZMAT 1	9. People Evacuated 5000	10. Subdivision KD
11. Nearest City/Town Maryville		12. Milepost (to nearest tenth) OOC282.6	13. State Abbr. TN	14. County BLOUNT
15. Temperature (F) 70 °F	16. Visibility Dark	17. Weather Cloudy	18. Type of Track Main	
19. Track Name/Number Main		20. FRA Track Class Freight Trains-60, Passenger Trains-80		21. Annual Track Density (gross tons in millions) 22.6
				22. Time Table Direction South

OPERATING TRAIN #1

1. Type of Equipment Consist: Freight Train					2. Was Equipment Attended? Yes			3. Train Number/Symbol S54101			
4. Speed (recorded speed, if available) R - Recorded 34 MPH E - Estimated		Code R	5. Trailing Tons (gross excluding power units) 5803		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	
6. Type of Territory Signalization: <u>Signaled</u> Method of Operation/Authority for Movement: <u>Signal Indication</u> Supplemental/Adjunct Codes: <u>Q</u>											
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.)		UTLX 901717		39		yes				0	0
(2) Causing (if mechanical, cause reported)		UTLX 901717		39		yes		9. Was this consist transporting passengers?			No
10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train		Rear End		11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded		Empty		e. Caboose
		b. Manual	c. Remote	d. Manual	e. Remote		a. Freight	b. Pass.	c. Freight	d. Pass.	
		(1) Total in Train	2	0	0		0	0	(1) Total in Equipment Consist	45	
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	1	0	0	0	0
12. Equipment Damage This Consist 125000				13. Track, Signal, Way & Structure Damage 152000							
14. Primary Cause Code E53C - Journal (roller bearing) failure from overheating											
15. Contributing Cause Code E53C - Journal (roller bearing) failure from overheating											
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: 9 Mins: 15		Hrs: 9 Mins: 15	
Casualties to:		22. Railroad Employees		23. Train Passengers		24. Others		25. EOT Device?		26. Was EOT Device Properly Armed?	
Fatal		0		0		0		Yes		Yes	
Nonfatal		0		0		0		27. Caboose Occupied by Crew?			N/A
28. Latitude 35.764606000				29. Longitude -84.022912000							

SKETCHES

HQ-2015-1061 Maryville Sketch Revision



Point of Derailment Location
MP OOC282.6

POD MP OOC282.6

Riversedge Rd. Louisville, TN

Burnt journal located in ditch down the track 114 feet in direction of travel

North End Singleton Switch
MP OOC282.8

Direction of Travel

POD located 430 feet from NE Singleton Switch Points

July 1, 2015 11:45pm
CSX S54101 Traveling southward
2 locomotives 57 cars
Trailing tons 5803
POD located at MP OOC282.6

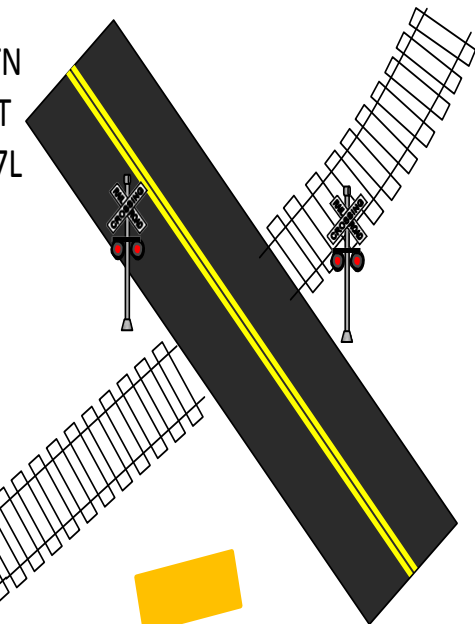


Mt. Tabor Rd. Maryville, TN
MP OOC 290.62 DOT
Crossing ID # 347607L

Location Where Train Stopped

MP OOC291.2

Direction of Travel



Entire truck frame assembly from leading truck of derailed car located southeast quadrant off road crossing.

MP OOC291.0



UTLX 901717 Loaded tank car
39th car in train

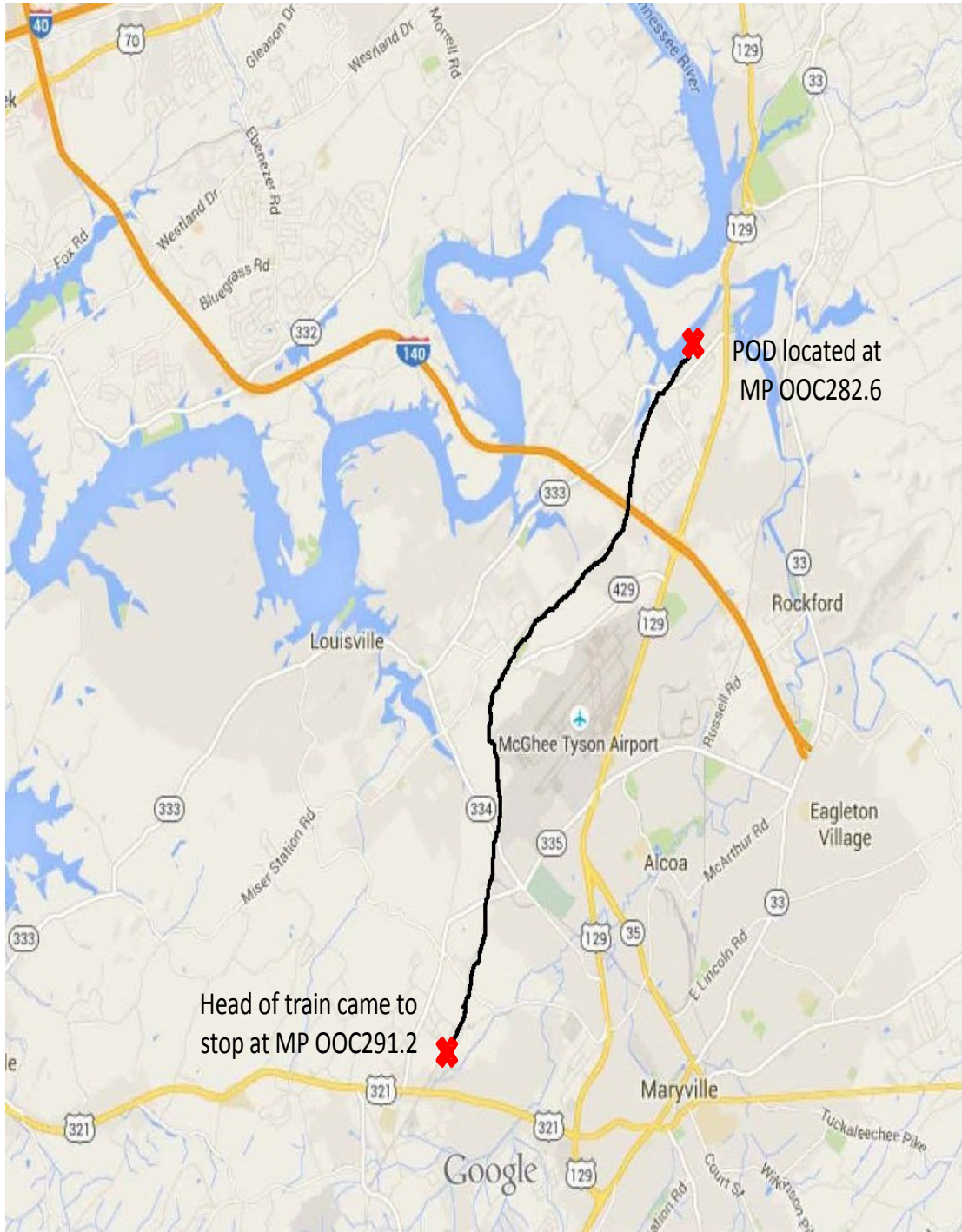
Derailed leading truck set 'A' end of car

CSXT 8723

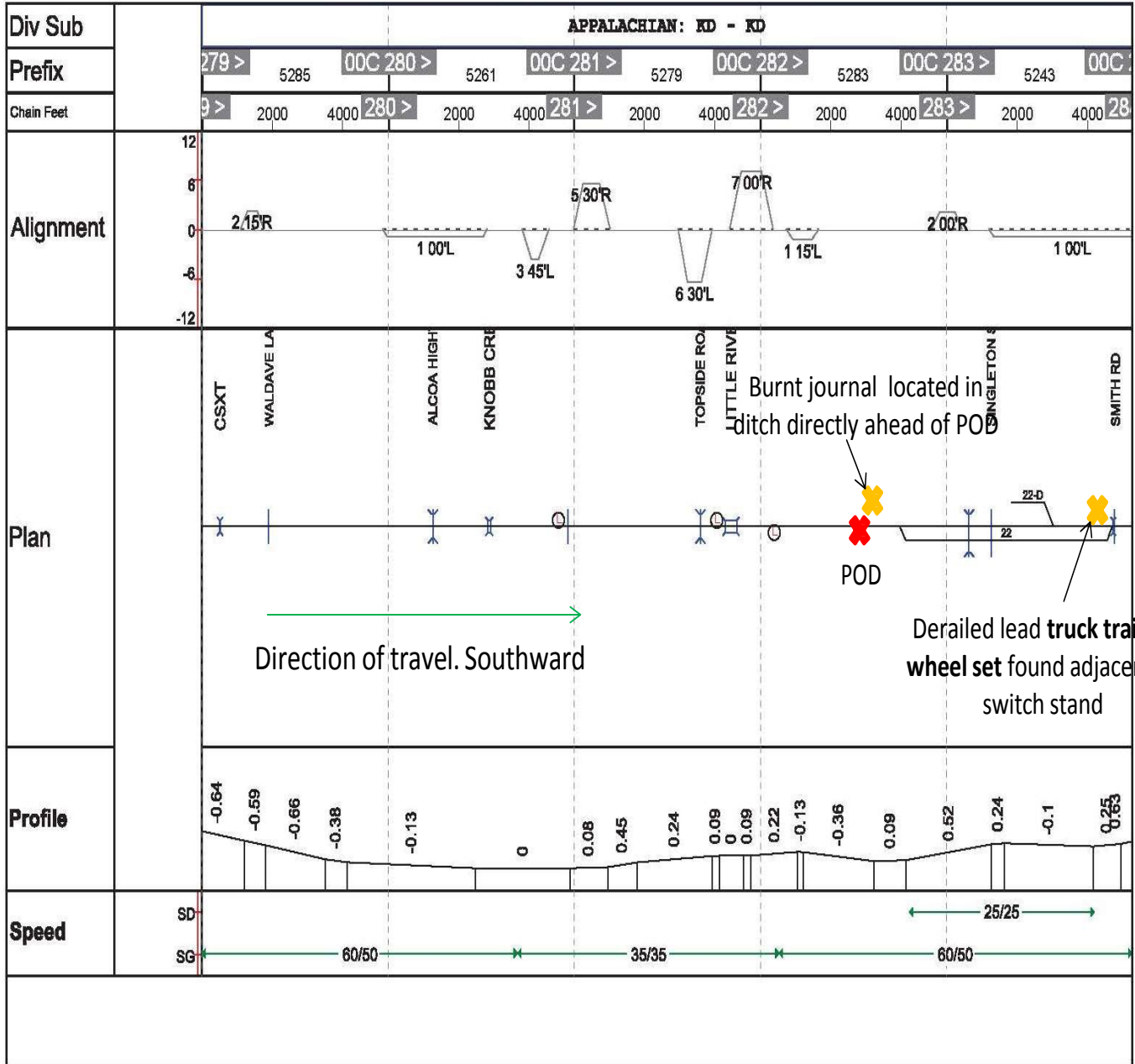
CSXT 5361

Lewall Rd Overpass MP OOC291.2

July 1, 2015 11:45pm
CSX S54101 Traveling southward
2 locomotives 57 cars
Trailing tons 5803
Head end came to stop at MP OOC291.2



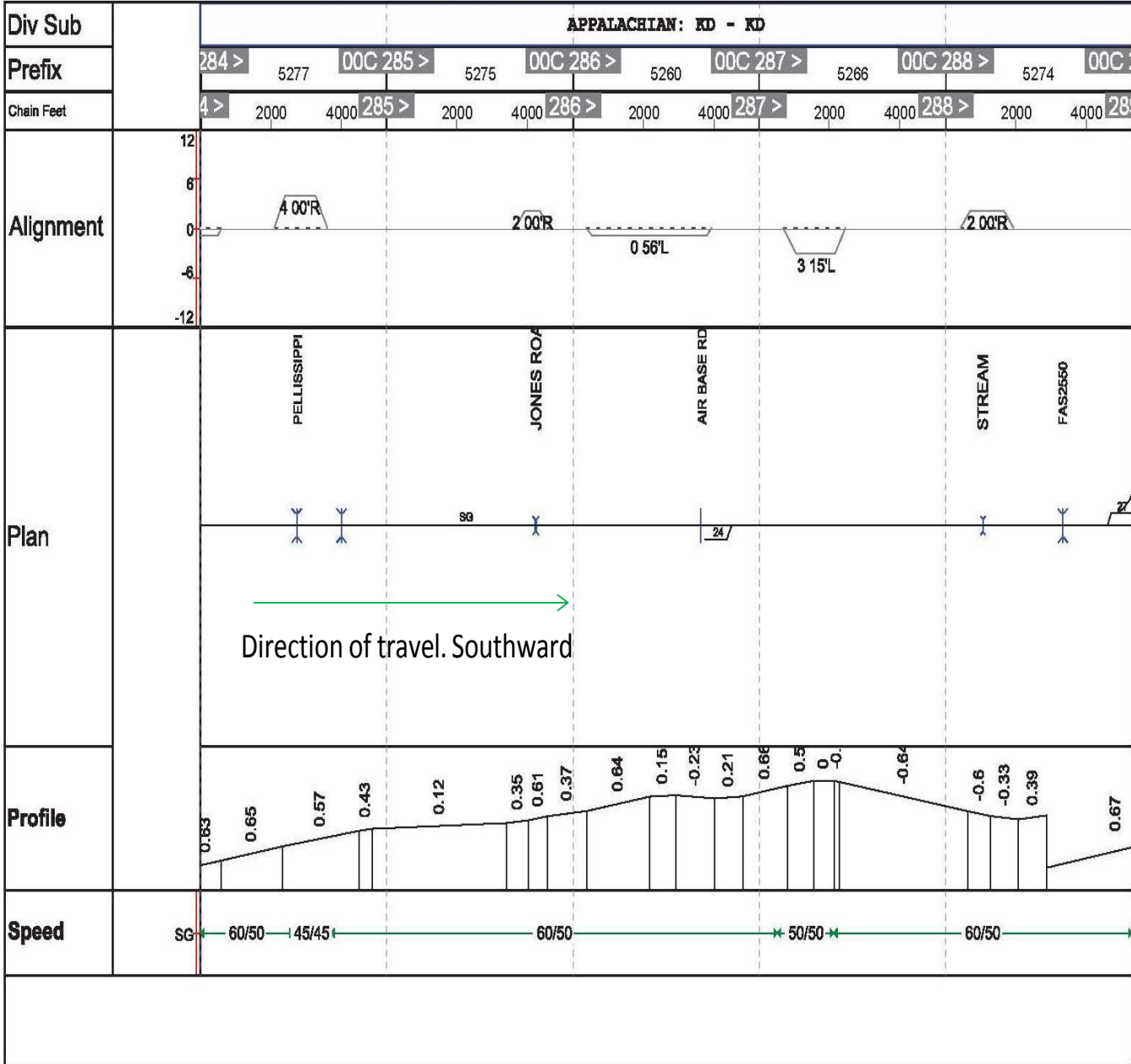
CSX Track Charts -- For Use With Outside Parties



CSX Track Charts -- For Use With Outside Parties

LINE: 00C line

South



SCALE: 1 INCH = 3189 FEET

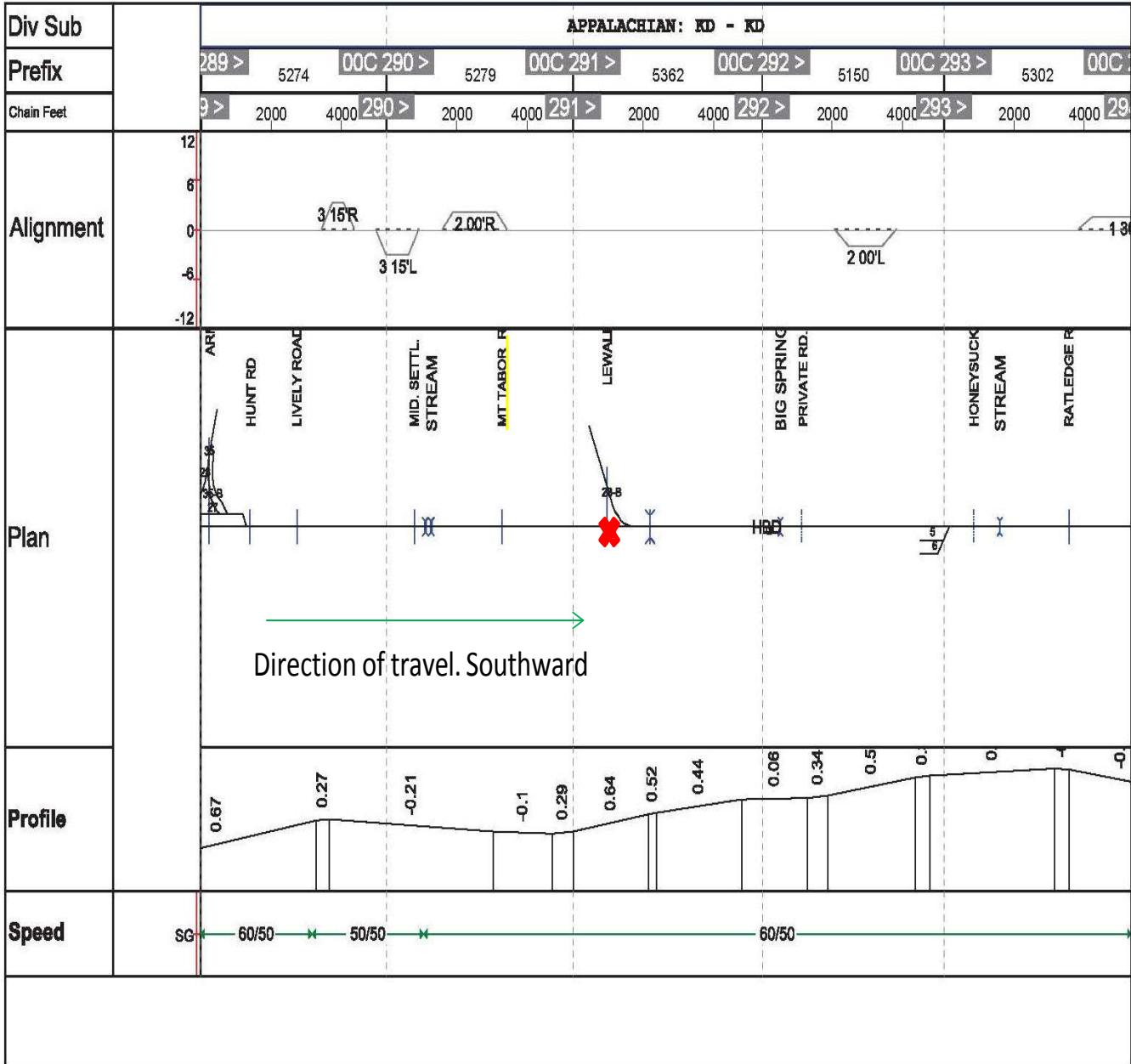
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PAGE: 8

LINE: 00C line

CSX Track Charts -- For Use With Outside Parties

South



SCALE: 1 INCH = 3191 FEET

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PAGE: 9

NARRATIVE

Circumstances Prior to the Accident

On July 1, 2015, CSX Transportation (CSX) Train S541-01 received a crew change in Corbin, Kentucky. The train crew, consisting of a locomotive engineer and conductor, went on duty at their away-from-home terminal at 2:30 p.m., EDT. The train crew received the statutory off-duty rest period prior to reporting for duty. Etowah, Tennessee, is the crew's home terminal. The crew previously operated Train S542-29 from Etowah to Corbin, on June 30, 2015, going off duty at 8:55 p.m.

The train originated in Cincinnati, Ohio, and consisted of 2 locomotives, 45 loaded, and 12 empty freight cars. No changes were made to the train consist when it arrived in Corbin. All required inspections (and documentation) were performed before the train departed Corbin. The train departed Corbin and continued south through Knoxville, Tennessee. The Engineer indicated that their trip had been uneventful to that point. The train passed a Hot Box defect detector (HBD - CSX HBD 7889 with a PRMICRO Processor and ACS Scanner) at Milepost (MP) 265.4. No defective conditions were identified and the detector provided the crew an accurate axle count.

The Accident

On July 1, 2015, at 11:45 p.m., southbound Train S541-01 was operating on a clear signal indication on single main track near MP OOC282.6 with the Engineer seated at the controls in the cab of the lead locomotive. He was operating the train in throttle position eight, traveling at a recorded speed of 34 mph with no air or dynamic brake applied. The maximum authorized speed for this segment of track is 50 mph. The Conductor was seated in his position in the cab of the lead locomotive. The Engineer advised the Conductor that he thought he saw sparks back in the train, around MP OOC287.0, near Maryville, Tennessee. Both crew members concentrated their attention toward the rear of the train and observed what they thought were sparks or fire. The crew notified the Dispatcher and brought their train to a stop at MP OOC291.2 to conduct an inspection. The Conductor dismounted the train and began walking back performing his inspection. He proceeded back approximately 10 cars and observed a fire toward the middle of the train. Knowing the train contained hazardous material in the train consist, he ceased his inspection, notified the Dispatcher, and returned to the lead locomotives.

Post-Accident Investigation

The Federal Railroad Administration (FRA) mobilized an investigation team consisting of Region 3 personnel from Track, Motive Power and Equipment, and Hazardous Materials disciplines. The team arrived on site on July 2, 2015, at 4:45 a.m. Also, on-site were personnel from the Maryville City Fire Department (Blount County, the Foster and Wheeler environmental company, the United States Environmental Protection Agency, the Tennessee Environmental Services, and CSX's Track, Transportation, Hazmat, and Mechanical departments. FRA's investigation lasted for 2 days, concluding on July 3, 2015.

The track investigation found visible physical evidence that the lead truck of Car 37, UTLX 901717, carrying acrylonitrile, initially derailed at MP 282.6, but unaware of the derailment, the train continued until the Engineer and Conductor noticed the sparks or fire near MP 287.0 and brought the train to a safe stop

at MP 291.2.

FRA's investigators found a burned-off roller journal bearing 114 feet in the direction of travel (south) from the point of derailment (POD), near MP 282.6, on the east side of the tracks.

The two lead locomotives, first 36 cars and last 20 cars of S541-01 remained on the track and did not derail. A burned off journal was found near MP OOC282.6 on the east side of the tracks 114 feet in the direction of travel from the POD. The burnt journal was from the lead truck trailing wheel, A-end, of UTLX 901717. Parts of the UTLX 901717 lead truck were found scattered all through the derailment site, and almost 9 miles back. The lead truck traveled nearly 9 miles before it became disconnected from the car body near Mt. Tabor road crossing in Maryville, at MP OOC290.62. When the trailing axle of the leading truck disconnected from UTLX 901717, it permitted the truck's side frames to drop and the leading axle wheels came in contact with first the tank jacket and insulation then the tank shell. When the wheel flanges wore through the tank shell, the contents of the tank car began leaking out and was ignited by the friction and sparks of the wheels against the tank shell. The wheel flanges restricted the flow of commodity from the tank, and reduced the magnitude of the fire. The B-end trailing truck set of UTLX 901717 did not derail. UTLX 901717 was carrying acrylonitrile, stabilized, which is a Class 3 flammable liquid.

Approximately 24,710 gallons of acrylonitrile leaked into the ground at the location where the derailed car came to rest at MP OOC291.0 in Maryville. Approximately 5,000 people were evacuated from the affected area defined by a nearly 2-mile radius for approximately 36 hours. The evacuation zone included The Highlands Housing subdivision and DENSO manufacturing plant, which employs over 3,000 workers and operates on a 24-hour, 3-shift schedule. One hundred and ninety-seven people, including 8 police-first responders, were seen at a local hospital and 46 were admitted for observation with symptoms associated with exposure to acrylonitrile and its combustion products (toxic oxides of nitrogen). The eight police-first responders, who were affected and sent to the hospital, went door-to-door within the adjacent housing area to notify residents of the evacuation.

A motorist waiting at Mt. Tabor Road grade crossing saw the sparks/fire in the train and called 911. Emergency responders were notified of the fire by the Dispatcher, and the Maryville City Fire Department (Blount County) was first on-scene. The Foster and Wheeler environmental company, the United States Environmental Protection Agency, and Tennessee Environmental Services also responded to the accident scene to determine the impact to the environment. Personnel from CSX's Track, Transportation, Hazmat, and Mechanical departments responded to the accident site as well.

Analysis and Conclusion

Analysis—Federal Post-Accident Toxicology Testing: Both crew members of CSX S541-01 were tested for alcohol and drug usage in accordance with FRA's post-accident testing requirements.

Conclusion: All tests were negative. Crew impairment was not a causal or contributing factor.

Analysis—Operating Crew: The Engineer and Conductor of Train S541-01 were interviewed for proper train handling and procedures. FRA interviewed the crew to determine compliance with CSX's Operating Rules, FRA regulations, or any additional actions that may have impacted the train's operation. Crew actions and train handling that occurred before, during and immediately after the accident were discussed. Crew work histories, rest cycles, experience, and training were also reviewed.

Conclusion: FRA took no exception to the practices and procedures of the train crew.

Analysis—Fatigue: FRA obtained fatigue-related information from CSX, including the 10-day work history, for the Engineer and Conductor of Train S541-01, which was involved in the derailment in Maryville. FRA considers an overall effectiveness rate of 77 percent as a baseline for fatigue analysis, which is equivalent to blood alcohol content (BAC) of 0.05. At or above this baseline, FRA does not consider fatigue as probable for the machine operator.

1. Engineer of Train S541-01

Sleep setting Excellent

Overall effectiveness 86.06 %

Lapse Index 0.1

Reaction time 116.19

Chronic Sleep Debt 5.81

Hours of continuous wakefulness 16.75

Time of Day 23:45

BAC Equivalent <0.05

Conclusion: Fatigue was not probable for this employee.

2. Conductor of Train S541-01

Sleep setting Excellent

Overall effectiveness 80.36 %

Lapse Index 0.3

Reaction time 124.45

Chronic Sleep Debt 7.81

Hours of continuous wakefulness 16.75

Time of Day 23:45

BAC Equivalent <0.05

Conclusion: Fatigue was not probable for this employee.

Conclusion: Fatigue was not a contributing factor in this derailment.

Analysis—Train Operations: The locomotives were equipped with event recorders and speed indicators. The event recorder data was downloaded by CSX's Road Foreman of Engines at the accident site and reviewed both by FRA and CSX. There was no exception taken to train handling.

Conclusion: The Locomotive Engineer was in compliance with all applicable railroad operating and train handling requirements.

Analysis–Mechanical: An FRA Motive Power and Equipment Inspector performed an inspection of available non-derailed cars and locomotives of CSX Train S541-01, after they had been placed in a secure location. He took no exceptions to the inspected equipment. A failed (burned-off) roller bearing was located near the POD. It was found to be the roller bearing at the L-3 position from Tank Car UTLX 901717. The L-3 axle was the inside wheel on the leading truck of UTLX 901717 in the direction of movement. The L3 roller bearing was a 6 ½-by-12 Brenco Certificate #5A. The wheel type/design was a J36 36-inch 2 wear heat treated curve plate.

Examination of mechanical records show the required pre-departure mechanical inspection for Train S541-01 was conducted at CSX's facility at Cincinnati by CSX mechanical forces. It was completed on June 28, 2015, at 6:40 a.m. No defective mechanical conditions were noted. The Class 1 train air brake test was also conducted in Cincinnati by CSX's mechanical personnel. This test was complete on July 1, 2015, at 1:00 a.m. No bad ordered cars were noted during this test. The last Single Car Test performed on the subject car was October 10, 2013, which is in compliance with Title 49 Code of Federal Regulations Part 232.

UTLX 901717 was a DOT 105J300W pressure car and was built in September 1994. Pressure cars are used to transport hazardous materials under pressure or hazardous materials which the DOT or the shipper feel require the additional protection of a stronger car. DOT 105 tanks cars have thermal protection, full head protection and a 225-psi safety valve. The tank jacket material is low grade carbon steel. UTLX 901717 was equipped with type SBE60DE double shelf couplers on the A- and B-ends.

Previous repairs made to UTLX 901717 on CSX's property show no repairs or issues related to the roller bearings or axles on the subject car.

Conclusion: The journal failure (roller bearing) due to overheating at the L-3 location on UTLX 901717 was causal in this accident.

Track - Analysis: The track at POD MP 00C282.6 is tangent and consists of 136-pound continuous welded rail on concrete ties in good condition, spaced on average 24 inches with a clean, full ballast section.

The last equipment defect detector S541-01 traversed over before the accident was the Amherst/Meadowbrook Detector ID Number 7889 located at MP OOC265.4. A report was pulled from the detector and no exceptions were taken by CSX or FRA to the entire train as it passed over at approximately 10:45 p.m.

On June 30, 2015, and June 28, 2015, a CSX-qualified track inspector conducted a regular track inspection and did not take exception to the condition of the track within a mile of the POD. A review of

CSX track inspection records for the period of April 1, 2015, to July 1, 2015, found three defective conditions within 1-mile of the derailment location. On May 24, 2015, a CSX track inspector identified loose frog bolts at MP OOC282.8, on May 27, 2015, a CSX track inspector identified loose connecting rod bolts at MP OOC282.8 and on June 6, 2015, a CSX track inspector identified loose rail braces at MP OOC282.8. These defects that were identified and recorded occurred at a location beyond the POD.

Sperry Rail Services' Ultra-Sonic Rail tests for the last two consecutive tests dated February 2015, and May 2015, recorded one defect within 1-mile of the POD. On May 14, 2015, Sperry Car S948 identified a 10-percent TDD rail defect at MP OOC282.77 and slow ordered the track to 10 mph. The defect was then removed from the track by CSX on May 14, 2015.

CSX provided track disturbance reports from October 2014 to June 25, 2015. These reports showed four occurrences where the track was disturbed within 1-mile of the POD in this time frame. On May 13, 2015, CSX surfaced the track from MP OOC281.8-OOC282.1 and from MP OOC282.6-OOC282.7. On June 8, 2015, CSX surfaced the track at MP OOC282.0 and on June 22, 2015, CSX installed ties at MP OOC282.2.

An inspection of the track at the derailment site, including the disturbed track during the first days of the investigation, found no defective conditions near the POD. Digital photographs were taken of the track at the POD.

Conclusion: FRA took no exception to the track conditions at the point of derailment. After reviewing the track notes and measurements along with all of CSX's provided documentation, track conditions were not a causal or contributing factor.

Probable Cause

The probable cause of the train's derailment was the sudden overheating and failure of a roller journal bearing on the lead truck of Car 37, UTLX 901717.