Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2018-1298

Union Pacific Railroad Company (UP) Derailment
Alton, Iowa
September 23, 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 September 23, 2018, at 3:49 a.m., CST, southbound Union Pacific Railroad Company (UP) mixed freight train MVPNP-22 (Train 1), operating on Track Warrant Control (TWC) territory, derailed on the Little Floyd River Bridge. The incident occurred on the northeast edge of Alton, Iowa, city limits at Milepost (MP) 227.4, on the UP's Twin Cities Service Unit, Worthington Subdivision.

A total of 38 cars had derailed, and the Little Floyd River Bridge collapsed. Estimated damages from the derailment were $2,459,119 to equipment, and $3,857,944 to track, signal, and structures. There were no reported fatalities or injuries caused by the derailment, and no hazardous materials were on the train.

At the time of the derailment, it was dark and clear with a temperature of 60 °F.

The Federal Railroad Administration (FRA) determined the probable cause of the derailment was M103 – Extreme environmental conditions – Flood.

Additionally, FRA identified T002 – washout/rail damage to track; and M599 – other miscellaneous causes, contributed to the derailment.

U.S. Department of Transportation Federal Railroad Administration	**FRA FACTUAL RAILROAD ACCIDENT REPORT**	FRA File # HQ-2018-1298

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Union Pacific Railroad Company	UP	0918TC020

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Union Pacific Railroad Company	UP	0918TC020

2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident	4. Time of Accident/Incident
	9/23/2018	3:49 AM

5. Type of Accident/Incident
Derailment

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated
0	0	0	0

10. Subdivision
UNION PACIFIC RAILROAD COMPANY - WORTHINGTON

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Alton	227.47	IA	SIOUX

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
60 °F	Dark	Clear	Main

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Single Main Track	Freight Trains-60, Passenger Trains-80	10.7	South

23. PTC Preventable	24. Primary Cause Code	25. Contributing Cause Code(s)
No	[M103] Extreme environmental condit	M599, T002

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2018-1298

OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	MVPNP-22

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
40.0 MPH	R	13375		0

6. Type of Territory

Signalization:
Not Signaled

Method of Operation/Authority for Movement:
Direct Train Control

Supplemental/Adjunct Codes:
P

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.)*	WWUX 16428	15	yes		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	3	0	0	0	0	(1) Total in Equipment Consist	95	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	38	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
2459119	3857944

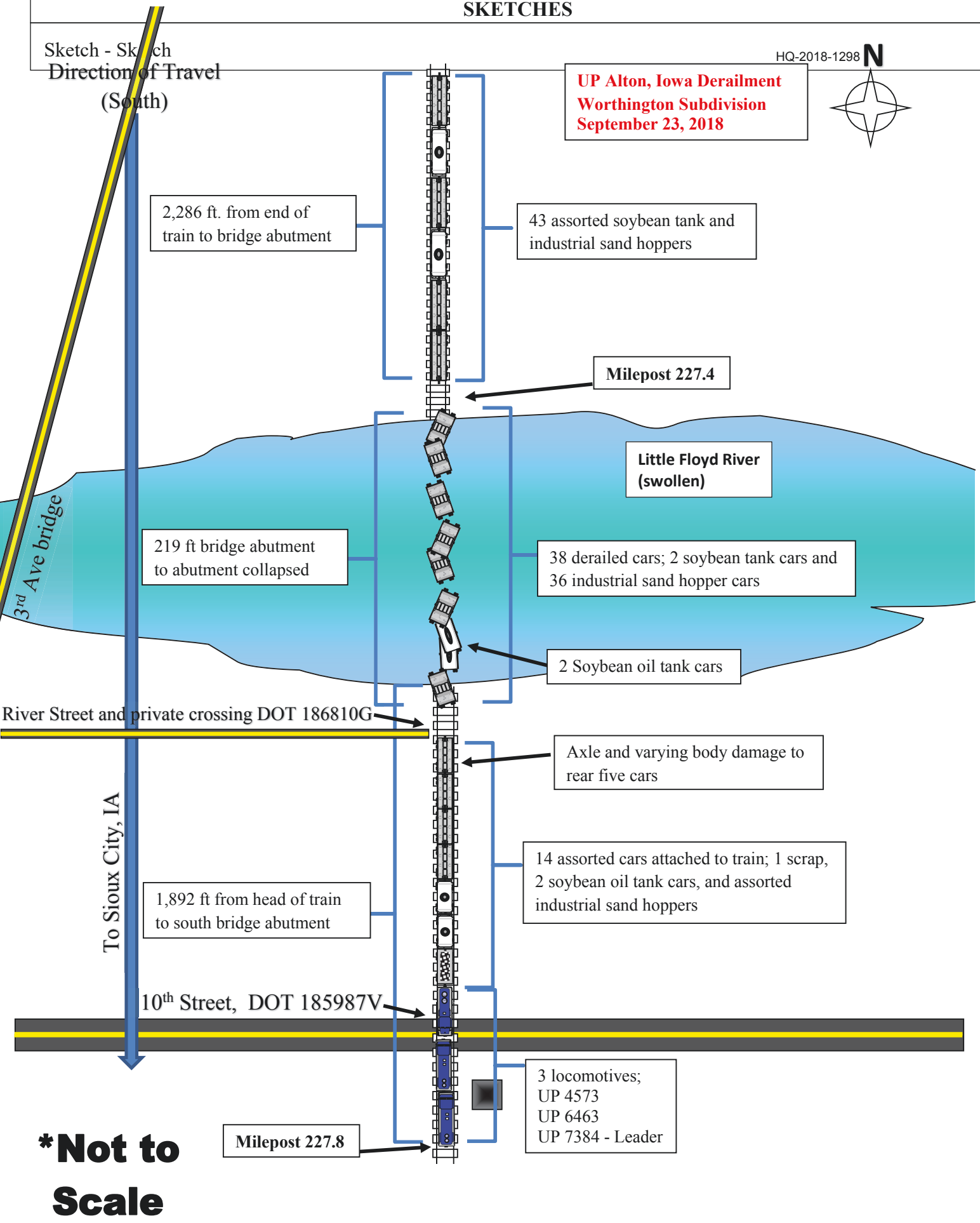
Number of Crew Members				Length of Time on Duty	
14. Engineers/Operators	15. Firemen	16. Conductors	17. Brakemen	18. Engineer/Operator	19. Conductor
1	0	1	1	Hrs: 7 Mins: 44	Hrs: 7 Mins: 44

Casualties to:	20. Railroad Employees	21. Train Passengers	22. Others	23. EOT Device?	24. Was EOT Device Properly Armed?
				Yes	Yes
Fatal	0	0	0	25. Caboose Occupied by Crew?	N/A
Nonfatal	0	0	0		

26. Latitude	27. Longitude
42.990697000	-96.005410000

SKETCHES

Sketch - Sketch



NARRATIVE

CIRCUMSTANCES PRIOR TO THE ACCIDENT

Union Pacific Railroad Company (UP) southbound freight train MVPNP-22 (Train 1) was a mixed manifest train consisting of 3 head-end locomotives and 95 loaded cars containing sand, soybean oil, soybean meal, and scrap metal. Train 1 was 4,581 feet long, and had 13,375 trailing tons. Train 1 received all required tests and inspections performed by qualified mechanical personnel in Mankato, Minnesota, on September 22, 2018.

The crew assigned to Train 1 consisted of an engineer, a conductor, and a conductor-in-training (CIT). The crew went on duty at 8:05 p.m., on September 22, 2018, in St. James, Minnesota. This was the home terminal for the crew, and all crew members had received more than the required statutory off-duty rest prior to reporting for duty. Their assignment was to cab from St. James to Mankato and take Train 1 from Mankato back to St. James.

Train 1 was operating on the UP Twin Cities Service Unit, Worthington Subdivision, which is single main track with a maximum authorized speed of 49 mph, as designated in the UP's Twin Cities Service Unit Timetable No. 5 (effective November 14, 2016). Approximately one-half mile prior to the point of derailment (POD), the track comes out of a 1-degree, left-hand curve on a 0.4-percent descending grade. The track then remains tangent with a 0.0-percent grade to the POD. The derailment occurred on tangent track on a 219-foot, pre-stressed concrete and girder bridge which spans the Little Floyd River. The timetable direction for the Worthington Subdivision is south, and the geographic direction is south. Timetable direction will be used throughout this report.

Train 1 departed Mankato for St. James at 10:53 p.m. Prior to arriving at St. James, the UP Dispatcher informed the crew they would take the train on to Sioux City, Iowa. The train arrived in St. James at 12:57 a.m. on September 23, 2018, and after receiving additional track warrants, departed St. James, at 1:30 a.m. Train 1 conducted no pick-ups or set-outs during the trip and no issues were reported by the crew.
As the train approached the location of the derailment, the Engineer was seated at the controls on the west side of the lead locomotive; the Conductor was seated on the east side of the lead locomotive; and the CIT was seated in the middle or jump seat on the lead locomotive.

At the time of the derailment, it was dark and clear with a temperature of 60 °F.

THE ACCIDENT

Train 1 was traveling south at a recorded speed of 45 mph approaching the POD, and had begun to reduce its speed in anticipation of a 10-mph speed restriction 3 miles ahead at MP 230.0. At approximately 3:49 a.m., near Milepost (MP) 227.77, Train 1 experienced an Undesired Emergency

Brake Application (UDEBA) of the train's air brake system.
The Engineer made four attempts to recover the train air while simultaneously attempting to contact the UP's Train Dispatcher in Omaha, Nebraska, by radio. As the Engineer notified the Dispatcher that they had experienced the UDEBA, the Conductor and CIT inspected the train. As the Conductor and CIT walked the train, they found the train separated beyond the 14th car, but could not see the rest of the train due to the dark conditions. The Conductor and CIT continued to walk north toward the Little Floyd River Bridge, and found several rail cars derailed and piled together on the southern end of the bridge, and the rail bridge at MP 227.47 had collapsed. The Conductor contacted the Engineer by radio and relayed what he was observing, and the Engineer relayed the information to the UP Dispatcher by radio.

The Sioux City Senior Manager of Train Operations arrived at about 7:45 a.m., and transported the crew to the LeMars Hospital for a drug and alcohol test, and then to the Sioux City Yard office to tie-up.

A total of 38 cars had derailed, and the Little Floyd River Bridge had collapsed. Estimated damages from the derailment were $2,459,119 to equipment, and $3,857,944 to track, signal, and structures. There were no reported fatalities or injuries caused by the derailment, and no hazardous materials were in the train.

POST-ACCIDENT INVESTIGATION

The Federal Railroad Administration (FRA) responded to investigate the derailment in coordination with UP. FRA traveled to the derailment site to take measurements, perform inspections, and collect physical evidence. FRA requested, and UP provided, records that were relevant to the track, employees, and equipment involved in the derailment for review.

The following analysis and conclusions represent the findings of the FRA investigation.

ANALYSIS AND CONCLUSIONS

Analysis - Toxicology Testing: This incident met the criteria for Title 49 Code of Federal Regulations (CFR) Part 219, Subpart C – Post-accident Toxicological Testing. Post-accident toxicological testing was performed on the crew of Train 1 with negative results for all tests.

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

Analysis - Fatigue: A fatigue analysis was made regarding the performance level of the UP crew after their assigned train experienced a derailment. 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.

FRA obtained a 10-day work history for the Engineer and Conductor involved in this incident. Default software sleep settings were used for each employee; information from the fatigue-related questionnaire

was available.

Fatigue Avoidance Scheduling Tool (FAST) analysis indicated all three crew members of Train 1 were experiencing fatigue, and all were likely operating in a degraded state. FRA concluded that while fatigue was likely for the crew, there was no correlation between the presence of fatigue in the crew and the incident, as the actions of the crew did not contribute to the incident.

Conclusion: FRA determined fatigue did not contribute to the cause or severity of the incident.

Analysis - Human Performance: The lead locomotive was equipped with a speed indicator and event recorder as required. The recorder data was downloaded and analyzed by the UP and FRA. The Locomotive Engineer was found to have complied with all applicable UP Operating Rules and train-handling requirements.

FRA reviewed the relevant certification and qualification documentation provided by UP. FRA concluded the crew of Train 1 was properly certified and qualified for the kind of service they were performing. No exceptions were taken to the training or performance of the crew of Train 1 that would have contributed to the incident.

The lead locomotive of the train was equipped with a forward-facing camera. The UP provided frame-by-frame still photos of the forward-facing camera as the lead locomotive crossed the Little Floyd River Bridge. The still photos were reviewed by the FRA. The still frame photographs clearly show a void in the shoulder ballast behind the backwall on the north side of the bridge.

Conclusion: Locomotive Engineer operating performance did not contribute to the cause or severity of the derailment.

Analysis - Mechanical Condition: A walking inspection on the south portion of the train (head end) that made it over the POD revealed impact marks on the last 6 cars to pass the POD (cars 9 through 14). FRA investigators observed signs of physical contact between the lead axle of the lead truck only, on each car, and the car body frame. Additionally, the FRA investigators observed that the signs and severity of impact between the axle and car frame increased on each car as they approached the 14th car. The last car past the POD showed significant impact between the front truck axle and the car body frame, resulting in significant structural damage to the car body. The witness marks observed indicated the leading end of the affected cars impacted the rail and abutment as the bridge was collapsing beneath Train 1.
A walking inspection of the rear or north end of the train was conducted. This section did not cross over the bridge, and FRA Inspectors did not observe any witness marks on the rail cars.

Conclusion: The FRA investigation concluded that the mechanical condition of the equipment did not contribute to the cause or severity of the derailment.

Analysis - Track Structure: The track in the area the derailment occurred is constructed of control cooled (CC), 133-lb. rail, rail section American Railway Engineering Association (RE), manufactured in February 1976, by Colorado Fuel & Iron, USA (CF&I) and was continuous welded rail (CWR). The rail is set on 7-inch by 8.5-inch by 9-foot wood crossties that are box anchored every other crosstie and had no visible longitudinal movement in either direction. It is fastened with cut-spikes and seated in 8-inch by 14-inch double shoulder tie plates.

The overall condition of the ballast and geometry in the area just north of the track disturbed by the derailment was compliant with all standards for FRA Class 4 Track. The overall crosstie conditions surpassed the minimum regulatory standards for sufficient number of crossties required in 39 feet and were distributed effectively, with the rail joints in the area also being well supported.

The required track inspection frequency in the area in which the derailment occurred, MP 227.47, on the Worthington Subdivision is twice weekly with at least one calendar day interval between inspections. The last FRA-recorded track inspection by the UP Track Inspector was conducted the morning of September 20, 2018. An analysis of the UP's track inspection records revealed the UP met the required frequency of inspection for the six months prior to the derailment, from March 29, 2018, to the day of the derailment, September 23, 2018.

The UP's Worthington Subdivision is FRA Class 4 Track, which is considered a hazardous material route, and has a rail service failure rate of 0.0056 percent in the area the derailment occurred. This requires that once every calendar year a search for internal rail defects must be conducted. The UP's rail test record revealed that ultrasonic rail tests were conducted three times in the year prior to this derailment -- December 20, 2017; May 1, 2018; and August 2, 2018. A 10-percent defective weld was found by the ultrasonic rail test vehicle on August 2, 2018, at MP 227.43. A plug rail was installed: a CC, 133-lb., RE, manufactured in February 1984, by CF&I, and was stenciled UT TESTED June 22, 2015. Markings on the rail indicated that proper CWR procedures were used when installing this plug rail.

The UP conducted geometry car inspections on the Worthington Subdivision, in the derailment area, three times in the year prior to the derailment. The inspections were conducted on September 27, 2017; March 14, 2018; and May 31, 2018. A tight gage location was identified on March 14, 2018, at MP 227.479. This location was repaired, as evident by it not being found on the next geometry car inspection conducted on May 31, 2018.

The Little Floyd River Bridge, located at MP 227.47 (Center of Mass), was 219-feet long. It consisted of, from north to south, a three-span, Pre-stressed Concrete Box (PCB) (85 feet); a one-span, Deck Plate Girder Open Deck (DPGOD) (60 feet); and a three-span PCB (74 feet).
Records provided by UP revealed that the last annual inspection was conducted on March 3, 2018; the last underwater inspection was conducted on September 8, 2018; and the last intermediate inspection was conducted on September 19, 2018.

A high-water visual bridge inspection was conducted on September 22, 2018. This inspection was conducted by observing the bridge from the private crossing at MP 227.54, DOT No. 186 810G, south of the bridge, approximately 360 feet from the north end of the bridge, and from west of the bridge at County Road B62, Third Avenue within the city limits of Alton, Iowa, approximately 680 feet from the bridge. These observations were conducted from inside the vehicle the inspectors were driving.

The high-water visual inspection was conducted from a good distance away and from inside a vehicle. This type of observation would have only been effective if there had been some type of very visible alignment or surface irregularity at the bridge or its approaches and may have been insufficient to determine conclusively if the washout had previously occurred.

The FRA investigation determined the track was maintained by UP in compliance with Federal Regulations; however, the extreme flooding resulted in a washout of the roadbed.

Conclusion: FRA determined washout damage to the track contributed to the cause of the derailment. (Cause code T002)

Analysis - Special Inspection: Northwest Iowa had seen very heavy rainfall amounts from September 18-21, 2018. The National Weather Service (NWS), Sioux Falls, South Dakota, reported up to 7.5 inches of rain in some areas around Alton over those four days.
On September 20, 2018, at 4:41 a.m., the UP issued a flood warning, Correlation ID 180920up8227a0, to the Worthington Subdivision, reporting: “Excessive runoff will continue across this region. Additional rain and storms with rainfall rates near 1 inch per hour will continue to produce an additional 1 to 2 inches of rainfall across saturated soil. Watch for flash flooding and possible washouts.” The Location Summary gave the limits of Worthington Subdivision MP 204 to MP 241. This message was to expire at 9:30 a.m. At 8:55 a.m., it was extended to 12 p.m.

The Manager of Track Maintenance (MTM) reported that he received a call from the Corridor Manager very early on the morning of September 20, 2018, concerning flash flooding. The MTM sent out his Track Inspector, who inspected the area and called back to report no issues. The NWS, Advanced Hydrologic Prediction Service (AHPS), estimated the Floyd River at Alton would have only been at minor flood stage during the morning hours of September 20, 2018. The Floyd River crested at a record high of 21.96 feet, 3.96 feet above major flood stage, on September 20, 2018, at 8:45 p.m. NWS records indicate from the time of the record crest and the time of the derailment on September 23, 2018, at 3:49 a.m., the river dropped to 14.33 feet. This equates to a 7.63 foot drop of the river in just over 55 hours. During the flooding, the river came up on both sides of the track, saturating the subgrade of the roadbed. The subgrade saturation, along with the rapid descent of the river caused the area behind the backwall of the bridge to become unstable and be displaced as the river receded, as observed from the photos UP provided from the forward-facing camera on the lead locomotive. FRA concluded the track structure degraded very rapidly as Train 1 was traversing the washed-out area resulting in the derailment, pile-up, and bridge collapse.

For approximately one-quarter mile north and prior to the bridge at MP 227.47, the track is constructed on a fill. The fill ranges from approximately 10 to 20 feet in height.

In accordance with Title 49 Code of Federal Regulations (CFR) Section 213.239, special inspections are required to be conducted when qualifying events occur. The record flooding that occurred the evening of September 20, 2018, would qualify as a qualifying event and should have been monitored more closely by the UP.

The FRA investigation concluded the absence of a special inspection during flooding conditions, as required, allowed for the washout condition to go undetected.

Conclusion: FRA determined the extreme rain and flooding was the probable cause of the derailment. (Cause code M103) Additionally, the failure of UP to perform a special inspection as required contributed to the cause of the derailment. (Cause code M599)

OVERALL CONCLUSIONS

The FRA investigation concluded heavy rains, and storm water runoff resulted in flooding conditions. Such conditions require a special inspection to be performed to identify such conditions; however, UP failed to conduct this required inspection. The rapid rise, and subsequent runoff of flood waters over the track in the accident area, resulted in damage to the roadbed and a washout beneath the track at the point of derailment.

This derailment was not positive train control (PTC) preventable.

PROBABLE CAUSE AND CONTRIBUTING FACTORS

FRA determined the probable cause of the derailment was M103 – Extreme environmental conditions – Flood.

Additionally, FRA identified T002 – washout/rail damage to track; and M599 – other miscellaneous causes, contributed to the derailment.s