Federal Railroad Administration
Office of Railroad Safety

Accident Investigation Report
HQ-2020-1390

Union Pacific Railroad
Tempe, Arizona
July 29, 2020

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 Wednesday, July 29, 2020, Union Pacific Railroad (UP) freight train MTUPX-29 (Train 1) was operating northbound (timetable westbound) on the single main track in Tempe, Arizona, on UP's Phoenix Subdivision.

At 6:06:22 a.m., Train 1 derailed 12 cars at the south end of the Tempe Town Lake Bridge in Tempe. The train was operating on a single main track at 23 mph while crossing the bridge when the derailment occurred. Included in the 12 derailed cars were five hazardous materials tank cars, three of which were loaded with UN1915, Cyclohexanone, Class 3, PGIII. Two of the five hazardous material cars, that derailed fell into the dry riverbed, because a portion of the bridge collapsed. UP reported 2,201.45 gallons released from GATX 90208, a DOT-111A100W1 tank car.

Rio Salado Parkway was temporarily shut down because of equipment damage and for the containment, cleanup, and mitigation phase of the emergency response to the fire and due to the emergency response of the hazardous materials spill. A small area was evacuated near the accident and air traffic from Phoenix Sky Harbor International Airport was diverted away from the area of the derailment due to an accumulation of heavy black smoke.

The Federal Bureau of Investigation (FBI) was the lead entity for the first two days while it investigated the accident site for possible criminal activity. Its on-scene investigation was completed on July 30th without reported evidence of criminal activity prior to the derailment.

There were no injuries to UP employees or the public, however an emergency responder was treated at a local hospital for smoke inhalation. Damages were estimated at $559,073 for equipment and $8,711,005 for track, signal, wayside and structure.

The weather at the time of the accident was clear with a temperature of 90º F, with winds blowing from the north to northwest at 8 mph.

FRA determined the cause of the derailment to be a broken rail and concluded the probable cause of the accident was T299 – Other rail and joint bar defects.

U.S. Department of Transportation Federal Railroad Administration	**FRA FACTUAL RAILROAD ACCIDENT REPORT**	FRA File # HQ-UP-2020-0729-1390

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Union Pacific Railroad Company	UP	HQ-2020-1390

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	0720LA037

2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident	4. Time of Accident/Incident
	7/29/2020	6:06 AM

5. Type of Accident/Incident
Derailment

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated
13	5	1	0

10. Subdivision
UNION PACIFIC RAILROAD COMPANY - PHOENIX

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
TEMPE	913.9	AZ	MARICOPA

15. Temperature (F)	16. Visibility	17. Weather	18. Type of Track
90 °F	Dawn	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-25, Passenger Trains-30	3.8	West

23. PTC Preventable	24. Primary Cause Code	25. Contributing Cause Code(s)
No	[T299] Other rail and joint bar defects	

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-UP-2020-0729-1390

OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	N/A	MTUPX 29

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
22.0 MPH	E	11194		0

6. Type of Territory

Signalization:
Signaled

Method of Operation/Authority for Movement:
Signal Indication

Supplemental/Adjunct Codes:
P, D

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.)*	NATX 160112	49	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	89	0	8	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	12	0	0	0	0

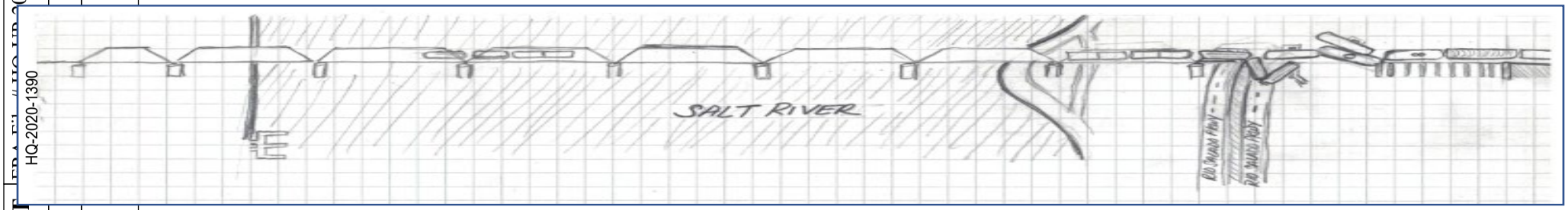
12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
559073	8711005

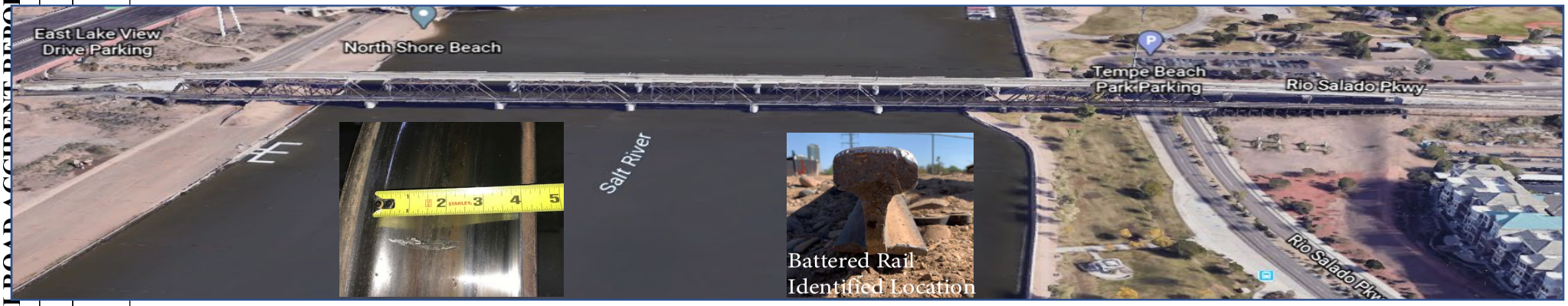
Number of Crew Members				Length of Time on Duty	
14. Engineers/Operators	15. Firemen	16. Conductors	17. Brakemen	18. Engineer/Operator	19. Conductor
1	0	1	1	Hrs: 9 Mins: 1	Hrs: 9 Mins: 1

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	1		

26. Latitude	27. Longitude
33.433706000	-111.943939000

Timetable West- Geographic North





Train Consist Legend

Head end portion of train (locomotive consist and cars lines 97 to 50) taken to Phoenix Yard.

Line 50- TILX 518747 (Lumber) west most car identified with witness marks.

- Line 49-NATX 160112 (sodium hydroxide) west most left on bridge. Witness Marks R3 & R4
- Line 48-GATX 6479 (Sulfuric Acid)
- Line 47-TTZX 861493 (Lumber)
- Line 46-TTZX 856969 (Lumber)
- Line 45-TTZX 862290 (Lumber)
- Line 44-TILX 540850 (SBMEAL)
- Line 43-GACX 55605 (SBMEAL)
- Line 42-TILX 540613 (SBMEAL)
- Line 41-GATX 90208 (CYCLOHEXANONE)
- Line 40-ACFX 72540 (CYCLOHEXANONE)
- Line 39-DBCX 201081 (RUBBER)
- Line 38-GATX 1384 (CYCLOHEXANONE)

Line 37-TTGX 715892 (Autovevor-Trucks)

Line 36-SOO 601398 (Lumber) East most car left on approach.

Rear portion of train lines 35 to 1 taken back to Mesa Yard.

- Bullet Point denotes derailed cars- Red Font denotes cars involved in collapse.

SKETCHES

Sketch - Sketch

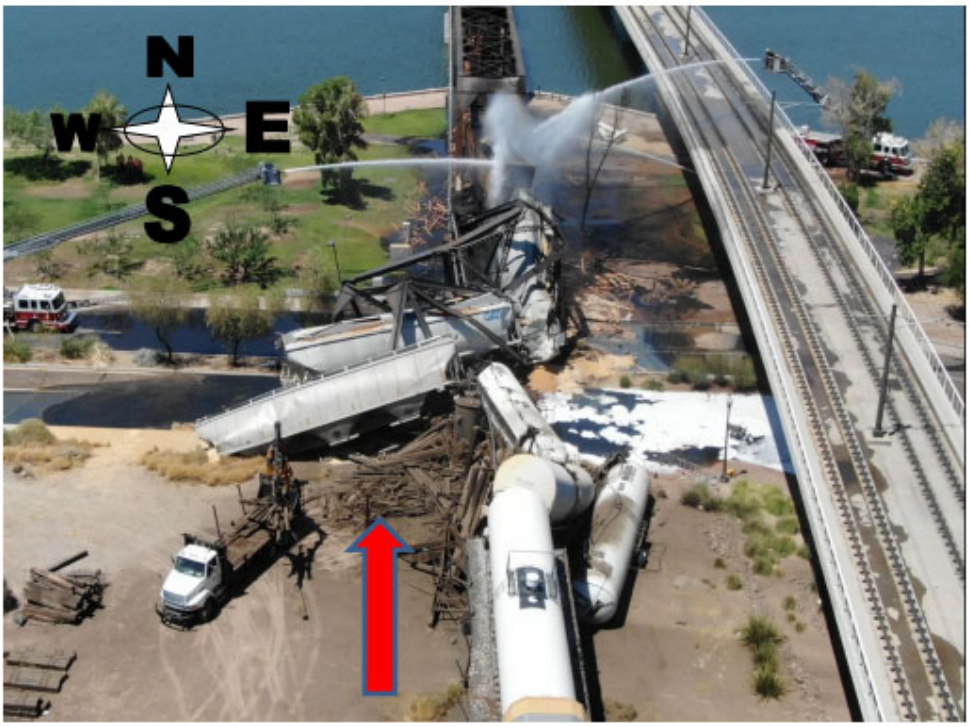
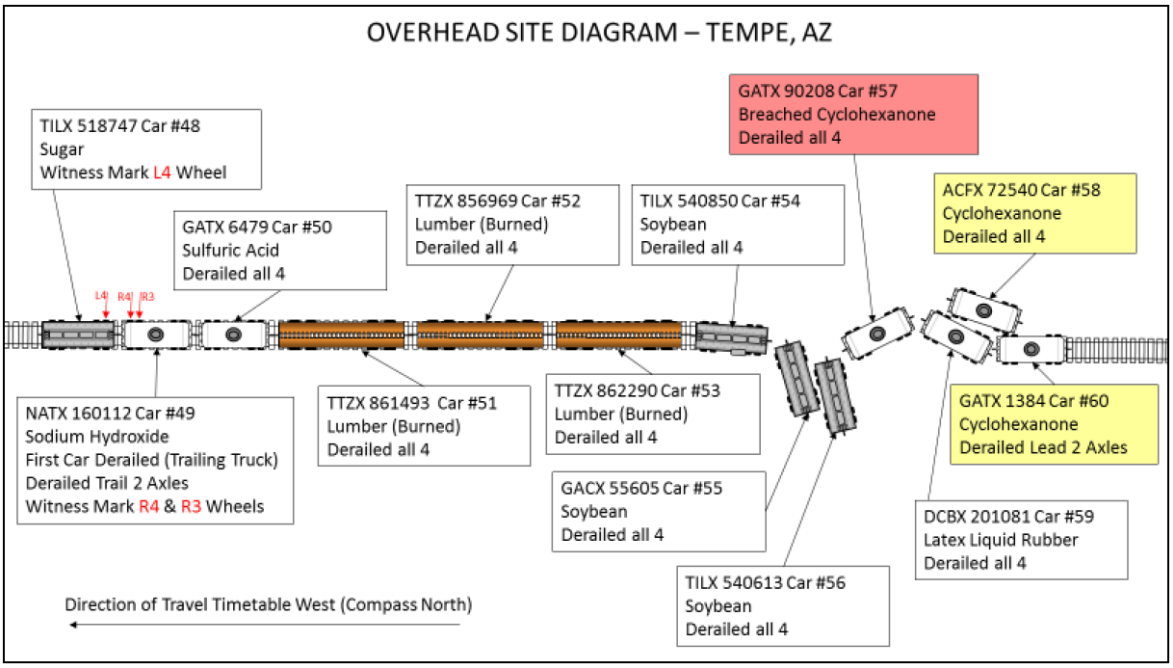


Figure 1. Aerial photo of the derailment site. Red arrow shows direction of train. Light rail operation to the east of UP's right-of-way. Note: Is the compass correctly positioned?



NARRATIVE

Circumstances Prior to the Accident
Union Pacific Railroad Company (UP) freight train MTUPX-29 (Train 1) was operating timetable westbound, geographic direction northbound on single main track in Track Warrant Control (TWC) Absolute Block System (ABS) territory in Tempe, Arizona, on UP's Phoenix Subdivision. The timetable speed of the track governed by the UP's Sunset Timetable is 25 mph.
The train consisted of 3 locomotives (UP 7390, UP 3056, and UP 7892), 97 cars (89 loads, 8 empties), 406 total axles, 11,194 gross tons, and a train length of 6,895 feet. The train crew, which consisted of an engineer, a conductor, and a brakeman, went on duty in Tucson, Arizona, at 9:05 p.m., MST, on Tuesday, July 28, 2020.

The Accident
At approximately 6:04:00 a.m., Train 1 approached the Tempe Town Lake Bridge at 23 mph. At 6:04:19 a.m., it entered the area of the Point of Derailment (POD) at Milepost (MP) 914.1. At 6:06:22 a.m., Train 1 experienced an undesired emergency brake application. The train came to a stop at 6:06:50 a.m.; 28 seconds after the undesired emergency brake application. The engineer was using throttle modulation to control the train's speed, per a review of the event recorder downloads. There were no applications of the train's automatic braking system made prior to the accident.
After the train stopped, the brakeman began walking south towards the bridge and noticed there was smoke in the distance. Subsequently, the train crew received a call via radio from the UP Dispatcher of a fire on their train and that the Tempe Fire Department was aware their train had derailed and that there was a fire near the south end of the Tempe Town Lake Bridge. The brakeman was instructed to return to the head end of the train and to wait for further instructions.
The UP Manager of Train Operations arrived on scene and assisted the brakeman in making a cut on the non-derailed portion of the train, which started at the 48th car from the head-end, line number 50, car TILX 518747. TILX 518747, a covered hopper, was the first car that showed any witness marks on the tread of the wheel. The witness mark was on the L4 east wheel. The head-end 48 cars were pulled to 48th Street to wait for initial relief and were eventually moved to the UP-Phoenix Railyard in Phoenix, Arizona.
The derailed portion of the train consisted of 12 cars. From the 49th car from the head-end; line number 49, tank car NATX 160112, derailed on the B-end (west end) and had witness marks on the east R3 and R4 wheels. All wheels on the 50th car from the head-end; line number 48, tank car GATX 6479, derailed, but there were no witness marks.

Post-Accident/Incident
On July 29, 2020, the Federal Railroad Administration (FRA) began an investigation into this derailment. FRA assigned multi-discipline inspectors to respond to the accident scene. Upon commencing its investigation, FRA investigators were briefed on the accident scene by the first responders. After the accident site was deemed safe, FRA inspected the accident site and equipment.
After their on-site inspection and investigation, FRA reviewed documents, event recorder downloads, videos of the derailment, and photographic evidence collected from the scene to determine the probable cause cited in this report. This report represents the findings of FRA's investigation based on the information provided.

Analysis and Conclusion
Analysis - Evaluation and Testing of Equipment: An MP&E inspector inspected all cars except for the cars in the collapsed portion of the bridge, consisting of line numbers 47 through 39. The inspector examined wheels, truck assemblies, and coupler assemblies for defects. The inspector noted witness marks on the tread of the L4 east wheel of TILX 518747, the 48th car from the head-end, line number 50, and witness marks on the tread of the R3 and R4 east wheels of NATX 160112, 49th car from the head-end, line number 49.
Conclusion: FRA determined the mechanical condition of the equipment did not contribute to the cause or severity of the incident.
Analysis - Operating Practices: A review of the event recorder download from engines UP 7390, UP 3056, and UP 7892 showed that the engineer was using throttle modulation to control the train's speed. No applications were made to the automatic braking system in the minutes prior to the accident, by the engineer. Approximately 15 seconds prior to the undesired emergency brake application, the engineer increased the throttle. Before the engines fully loaded from the increase in power, the undesired

emergency brake application occurred. There were no excessive changes to the throttle position or braking system. It was later determined that the probable cause of the undesired emergency brake application was the loss of continuity of the train line air brake system caused by the derailment.
Conclusion: FRA determined that train handling was not a factor in this derailment and the terrain did not contribute to the severity of the incident. Furthermore, no human factor issues attributed to the train crew performance.
Analysis - Toxicology: A toxicology test was performed by Quest Laboratory for the engineer, conductor, and brakemen in accordance with federal regulations.
Conclusion: FRA Post-Accident Forensic Toxicology Result Reports indicate the three employees tested each had negative test results.
Analysis - Track:
Track Description:
This portion of UP's Phoenix Subdivision is a single main track territory with sidings. UP's officials estimated that this portion of the Phoenix Subdivision Northline Segment operates an average of four (4) freight trains daily between Tucson and Phoenix, AZ. UP officials provided the annual track reports of their geometry car data over this area along with a tonnage figure of 3.81 million gross tons.
According to UP's track profile for the Phoenix Subdivision, for the northbound movement of the accident train, beginning at milepost 918.0, the train would have been on a segment of tangent (straight) track on a slight descending grade to milepost 915.8. It is at milepost 915.8 where the train entered a curve and where a 25-mph permanent speed restriction starts on this portion of the bridge.
According to UP's track chart, at milepost 915.8, the train entered a 4-degree curve about 2,800 feet long with a designed superelevation of 3/4 of an inch at the full body of the curve. The train exited the curve at about milepost 915.25. The train then traversed about a mile of straight track from milepost 915.25 to 914.2. At milepost 914.2, the train negotiated a right-hand 2-degree, 22-minute curve with 3/4 of an inch of superelevation. At about milepost 914.12, the train crossed over the south end bridge approach spans where the track is straight throughout the limits of the bridge structure between milepost 914.12 to 913.9.
On the Phoenix Subdivision between milepost 920.8 and 915.8, UP maintains a single main track 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 train operations (there is no passenger service on this line). However, UP also has in place in the area immediately preceding and including the accident, a permanent speed restriction beginning at milepost 915.8 to milepost 912.8, where the maximum authorized speed is 25 mph. The accident occurred within those speed restriction limits and where UP is required to maintain this section of track per FRA TSS for Class 2 track, which allows for a maximum speed of 25 mph for freight operations.
Crossties, Anchors, Ballast and CWR:
FRA verified that the last system production crosstie and surfacing operation for this area was in 2019. However, in June of 2020 a wide gage derailment occurred, and additional track work was performed to bring the track into compliance with TSS. The track structure preceding the bridge spans on this area of the Phoenix Subdivision is constructed with 136-pound continuous welded rail and is supported with wooden crossties spaced nominally at 19-1/2 inch apart (center of crosstie to center of adjacent crosstie). Both rails are sitting in 7-3/4 x 14-inch double shoulder tie plates fastened to the crossties through the tie plates with six-inch cut spikes. The spiking pattern for this area is one field side rail holding spike and one plate anchor spike with each of the rails spiked on the gage side of the rail with two rail holding spike and one plate anchor spike. The crossties and rails in tangent track prior to the curve approaching the Tempe Lake Bridge are box anchored on every other crosstie. Throughout the curve and the bridge approach, every crosstie is box anchored. The track is supported by ballast of local supply meeting AREMA No. 4A Specifications.
Investigators did not take any exception to the CWR rail restraint effectiveness in the area of the derailment. No rail movement was noted.
Point of Derailment:
Investigators made a preliminary identification of the point-of-derailment (POD) as a location on a section of the south bridge approach spans. At this location, there are four spans, spaced about 15 feet apart approximately 60 feet south of the concrete pillars about milepost 914.1 that is near the south end of the first superstructure span. To better estimate where the POD was a rail re-build exercise was conducted where investigators recovered pieces of rail for examination and reconstruction to determine how the rail would have laid on the bridge approach spans. The FRA track inspector and the UP investigation team reconstructed the broken pieces of the rail from the POD and took measurements of each rail. They

used photographs from before the derailment and the welder's reports to make sure the rails were put back together in the right order. Upon completion, it was determined there were still a few inches of the base and web of rail missing. A sketch of the broken rail pieces was then constructed and overlaid with the original rail configuration to help determine where any pieces of the rail that were not accounted for came from, and how much of the rail was missing.

Post-accident Inspection/Testing of Track

On July 30, 2020, track measurements were taken at 15 measured and marked stations on 15-foot 6-inch intervals beginning at about milepost 914.1. The measurements were taken with station zero at 64' 10" south of the edge of the remaining standing structure. This was due to the track being heaved upward when the train went over the edge of the wood trestle ballast deck bridge and relevant measurements were not able to be taken. All the track geometry measurement figures are unloaded measurements.

The track inspection field notes noted:

The maximum measurement allowed for gage in FRA Class 2 track, a maximum authorized speed of 25 mph (freight), 30 mph for passenger is 57-3/4 inch. Track notes determined that the widest gage prior to the disturbed track was 56-3/4 inch; or about an inch under the FRA maximum allowable limit.

The maximum allowed deviation for alignment measured with a 62' chord in FRA Class 2 track is 3 inches for both tangent and curved track. Track notes show that the greatest alignment deviation prior to disturbed track on the tangent section of track was 1/4 of an inch; or 2-3/4 inch under the FRA maximum allowable limit.

The maximum allowable deviation from zero crosslevel at any point on tangent or reverse crosslevel elevation on curves may not be more than 2 inches for Class 2 track. Investigators determined from the field notes measurement data that the maximum crosslevel deviation on the tangent portion of the track was 3/4 of an inch; or inch 1-1/4 inches under the FRA maximum allowable limit.

Note: Investigators observed that the 3/4 inch value measured was near the end of undisturbed track and that when re-railing efforts required the equipment to be pulled south, the activity caught or raised a portion of the track.

This is the last segment of track the accident train traveled over prior to the POD location, or derailment area. Investigator post-accident inspection from the south of the accident curve walking north to the beginning of the disturbed track found there were no visual exceptions.

Track Inspection:

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 Federal Railroad Administration Track Safety Standards (FRA/TSS). FRA track inspection records are required to reflect actual field conditions and deviations from the FRA TSS. The track in the derailment area was last inspected on July 28, 2020, by a UP qualified track inspector (T/I). The T/I noted no defects within the milepost range of the area including the derailment footprint.

Track inspection records for the Phoenix Subdivision were examined from April 14, 2020, through to July 28, 2020. The records show that the frequency of inspections were in compliance with federal regulations.

Geometry Tests

UP operated one of their geometry vehicles over the Phoenix Subdivision on July 13, 2020. There were no exceptions found in the derailment area and the defects noted by the geometry vehicles were properly remediated.

Internal Rail Tests Data:

On March 16, 2020, an ultrasonic rail test was conducted on UP's Phoenix Subdivision with UP's detector car No. 54. There were no exceptions found in the derailment area and the defects noted by the car were properly remediated.

Rail Re-build:

FRA, Arizona Corporation Commission (ACC), and Union Pacific investigators pieced together and examined all the rail found at the accident site. On July 30, 2020, investigators sent pictures to the NTSB and FRA's Rail Integrity Specialist of one rail end of the east rail that had a small amount of batter on it to be examined. A second rail rebuild was done with the rail pieces that were recovered from the steel structure portion of the bridge. Measurements were taken of each rail and a video conference call was conducted with the NTSB. It was concluded that there were no missing pieces or any evidence of a broken rail, and no visual defects on any of the rail ends from the steel structure portion of the bridge. The total length of the East rail was 65' 4" and the West rail is 60' 9-1/2".

Rail Integrity Analysis of Suspect Rail

For a rail to be the cause of a derailment it has to initiate the loss of the wheel/rail relationship. In this derailment, it is believed that a rail break occurred under the train with which the inclination would be that at least one or more wheels are going to traverse this broken rail until some event causes the rail end to become misaligned and the wheel path is lost. This action of wheels moving over the broken rail would leave markings on the rail head and break face of the rail ends that would be consistent with those events, and in line with the direction of travel.

The analyzed rail displayed wheel marks seen on the trailing rail are consistent with impacts not caused by wheels rolling off the rail directionally, and hence the indent pattern observed on the top of the rail head. This is also consistent with multiple hits that occurred to the edge of the rail lower down toward the face of the rail. Gouges in the rail seen on the rail head show signs that the flow of metal is in the opposite direction of wheel travel. This is not indicative of a fractured rail end that is the initial event that caused the derailment and is more likely to be a section of broken rail caused in the derailment event and therefore, the receiving rail end did not exhibit any flange or wheel marks on the rail head, gauge face, or the separation face.

Conclusion: Reviewing inspection and maintenance record documents there is no evidence of any track geometry or internal rail conditions. Photographic evidence was reviewed, and field conducted investigations did not indicate any rail misalignment of thermal CWR event contributed to this derailment. Broken rail information that was analyzed and presented by the Materials Laboratory Factual Report (20-063) shared by the NTSB along with other field rail reconstruction analyses conducted during this accident investigation, leads us to conclude there is no evidence that supports the claim that this rail broke due to an internal condition. The fracture face and chevrons present in the report listed above are consistent with extreme forces exhibited on the rail. The rail head is broken perpendicular to the rail while the base is fractured in a jagged diagonal direction all of which has the appearance of tearing not consistent with normal defect growth. In addition, there are no leaving and receiving wheel markings on either rail end and therefore, no conclusive evidence that this rail broke and caused this derailment.

Track and Rail Conclusion

Rail ends were metallurgically analyzed and no noted internal rail conditions were present on the fracture face. Chevrons present in the rail ends are consistent with extreme forces exhibited on the rail, likely from a broken rail but there is inadequate evidence to determine the exact nature and orientation of that rail failure.

The most compelling evidence presented toward a probable cause is three consecutive wheel strikes on the trailing axle of car 48 and on the leading two axles of car 49 with all three wheel strikes being on the east rail. This is the same direction that the railcar moved to strike the bridge span member before the bridge collapsed. Reconstruction efforts to find and locate fragments of the suspect rail were made and an ensuing rail analysis was conducted looking for conclusive proof that the reconstructed rail was the inception point of the derailment. An NTSB metallurgic laboratory analysis states that "*the rail near the derailment did not identify any signs of fatigue or flaws. The fracture pattern is consistent with overstress, suggesting that the rail broke due to forces applied immediately before the derailment*" (p.8), but offered no explanation as to what those forces were. FRA concurs with this finding and agrees that at some point wheel impact marks were made on the tread of passing wheels by an open (broken) rail.

Analysis - Bridge: The Tempe Town Lake Bridge at MP 913.91 had 26 spans, with a total length of 1,533 feet. Segment A consisted of 2 spans, 60 feet Pre-Stressed Concrete Box (PCB); Segment B had 1 span, 100 feet Through Truss Riveted Open Deck (TTROD); Segment C had 7 spans, 1050 Through Truss Pinned Open Deck (TTPOD); Segment D had 1 span, 100 feet TTROD; and Segment E had 15 spans, 223 feet Timber Stringers Trestle (TST).

UP's latest inspection report, dated July 9, 2020, was reviewed, and an FRA Structural Engineer and UP bridge inspectors jointly observed Segments A, B, C (spans 1-2), and E (spans 5-15). Segments D and E (spans 1-4) collapsed and were destroyed during the derailment. No significant structural deficiencies were indicated on the report for any of the collapsed spans and the conditions noted on the report for the remaining spans generally corresponded with the conditions observed at the site.

The inspection report did indicate the condition "no guardrail on bridge segment track" as a comment, not a defect, for the spans at the south end of the through truss (Segment D). A review of the condition of

the bridge prior to the derailment from the head-end video recorder confirmed that the “flare portion” of the inner guard rail was missing on the ballast deck spans south of the truss. The “flare portion” of would have joined with the inner guard rails at the south end of the truss and extended south a minimum of fifty (50) feet, terminating at a “point” in the center of the track, if installed in accordance with UP Engineering Standards.

UP Engineering Standards specify inner guard rails to be installed across through truss spans, such as Segment D, as well as several other types of critical structures. Notes on the standard plans give some relief on this requirement by stating that “inside guard rails are not required on bridges until bridge or bridge deck is replaced or running rail is relayed across the bridge.” The American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering only addresses this subject in Chapter 7, Timber Structures, where it states that “consideration should be given to the use of inner guard rails taking into account the bridge type, alignment, train speed, deck type, density and type of traffic, as well as the height and length of the bridge.” FRA has no regulations governing inner guard rails.

Conclusion: Based on the bridge inspection report reflecting the structural conditions of the bridge, the structural conditions of the railroad bridge did not cause the derailment. Installation of the inner guard rail on the spans south of the collapsed through truss in accordance with UP Engineering Standards may have reduced the severity of the accident.

Overall Conclusion

FRA determined the mechanical condition of the equipment, train handling (human factors), the terrain, track structure, and the track geometry did not contribute to the severity of the incident. FRA did determine that the rail and bridge structure did contribute to the severity of the incident.

Wheel witness marks identified as being on the east rail advance the possibility of a broken rail event but there is inconclusive evidence as to what caused the rail to fail. Therefore, based on the overall effort of FRA’s investigation it is likely that a broken rail caused this derailment.

Probable Cause

A broken rail was determined to be the cause of the derailment and FRA concluded the probable cause code of this derailment is T299 - Other rail and joint bar defects.

Installation of the inner guard rail in accordance with UP Engineering Standards on the spans south of the collapsed through truss may have reduced the severity of the accident.