Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch

Accident Investigation Report
HQ-2014-11

Union Pacific Railroad Company (UP)
Galva, KS
September 25, 2014

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.

U.S. Department of Transportation
Federal Railroad Administration

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File #HQ-2014-11

TRAIN SUMMARY

1. Name of Railroad Operating Train #1	1a. Alphabetic Code	1b. Railroad Accident/Incident No.
Union Pacific Railroad Company	UP	0914KC012
2. Name of Railroad Operating Train #2	**2a. Alphabetic Code**	**2b. Railroad Accident/Incident No.**
Union Pacific Railroad Company	UP	0914KC012

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	0914KC012
2. U.S. DOT Grade Crossing Identification Number	**3. Date of Accident/Incident**	**4. Time of Accident/Incident**
	9/25/2014	12:00 AM

5. Type of Accident/Incident
Side Collision

6. Cars Carrying HAZMAT	7. HAZMAT Cars Damaged/Derailed	8. Cars Releasing HAZMAT	9. People Evacuated	10. Subdivision
4	0	0	0	Herrington

11. Nearest City/Town	12. Milepost *(to nearest tenth)*	13. State Abbr.	14. County
Galva	207.6	KS	MCPHERSON

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

19. Track Name/Number	20. FRA Track Class	21. Annual Track Density *(gross tons in millions)*	22. Time Table Direction
Main ESW Galva	Freight Trains-80, Passenger Trains-90	40.6	East

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OPERATING TRAIN #1

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	ILXG4X22

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross exluding 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
41 MPH	R	6197		0

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Signal Indication

Supplemental/Adjunct Codes:

Q, N, L

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.)*	UP8572	1			0	0
(2) Causing *(if mechanical, cause reported)*				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	1	(1) Total in Equipment Consist	112	0	0	0	0
(2) Total Derailed	2	0	0	0	0	(2) Total Derailed	11	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
2027062	1211915

14. Primary Cause Code

H221 - Automatic block or interlocking signal displaying a stop indication - failure to comply.*

15. Contributing Cause Code

H299 - Other signal causes (Provide detailed description in narrative)

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: 6 Mins: 42	Hrs: 6 Mins: 42

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	0	0	0		N/A

28. Latitude	29. Longitude
38.384459000	-97.481307000

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FRA FACTUAL RAILROAD ACCIDENT REPORT

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OPERATING TRAIN #2

1. Type of Equipment Consist:	2. Was Equipment Attended?	3. Train Number/Symbol
Freight Train	Yes	KG4GSX23

4. Speed (recorded speed, if available) R - Recorded E - Estimated	Code	5. Trailing Tons (gross exluding 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
8 MPH	R	7898		0

6. Type of Territory

Signalization:

Signaled

Method of Operation/Authority for Movement:

Signal Indication

Supplemental/Adjunct Codes:

Q, N/A

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.)*	DTTX680480	113	yes		0	0
(2) Causing *(if mechanical, cause reported)*				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	1	(1) Total in Equipment Consist	121	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	7	0	0	0	0

12. Equipment Damage This Consist	13. Track, Signal, Way & Structure Damage
427550	0

14. Primary Cause Code

H220 - Fixed signal (other than automatic block or interlocking signal), failure to comply.

15. Contributing Cause Code

H299 - Other signal causes (Provide detailed description in narrative)

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: 2 Mins: 47	Hrs: 2 Mins: 47

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	0	0	0		N/A

28. Latitude	29. Longitude
38.384459000	-97.481307000

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CROSSING INFORMATION

Highway User Involved		Rail Equipment Involved
1. Type N/A		5. Equipment
2. Vehicle Speed *(est. mph at impact)*	3. Direction *(geographical)*	6. Position of Car Unit in Train
4. Position of Involved Highway User		7. Circumstance
8a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? N/A		8b. Was there a hazardous materials release by N/A

8c. State here the name and quantity of the hazardous material released, if any.
none

9. Type of Crossing Warning	10. Signaled Crossing Warning	11. Roadway Conditions
1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other *(spec. in narr.)* 3. Standard FLS 6. Audible 9. Watchman 12. None N/A		N/A

12. Location of Warning	13. Crossing Warning Interconnected with Highway Signals	14. Crossing Illuminated by Street Lights or Special Lights
N/A	N/A	N/A

15. Highway User's Age	16. Highway User's Gender	17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train	18. Highway User

19. Driver Passed Standing Highway Vehicle	20. View of Track Obscured by *(primary obstruction)*

Casualties to:	Killed	Injured	21. Driver was	22. Was Driver in the Vehicle?
23. Highway-Rail Crossing Users			24. Highway Vehicle Property Damage *(est. dollar damage)*	25. Total Number of Vehicle Occupants *(including driver)*

26. Locomotive Auxiliary Lights?	27. Locomotive Auxiliary Lights Operational?
N/A	N/A
28. Locomotive Headlight Illuminated?	29. Locomotive Audible Warning Sounded?
N/A	N/A

10. Signaled Crossing Warning

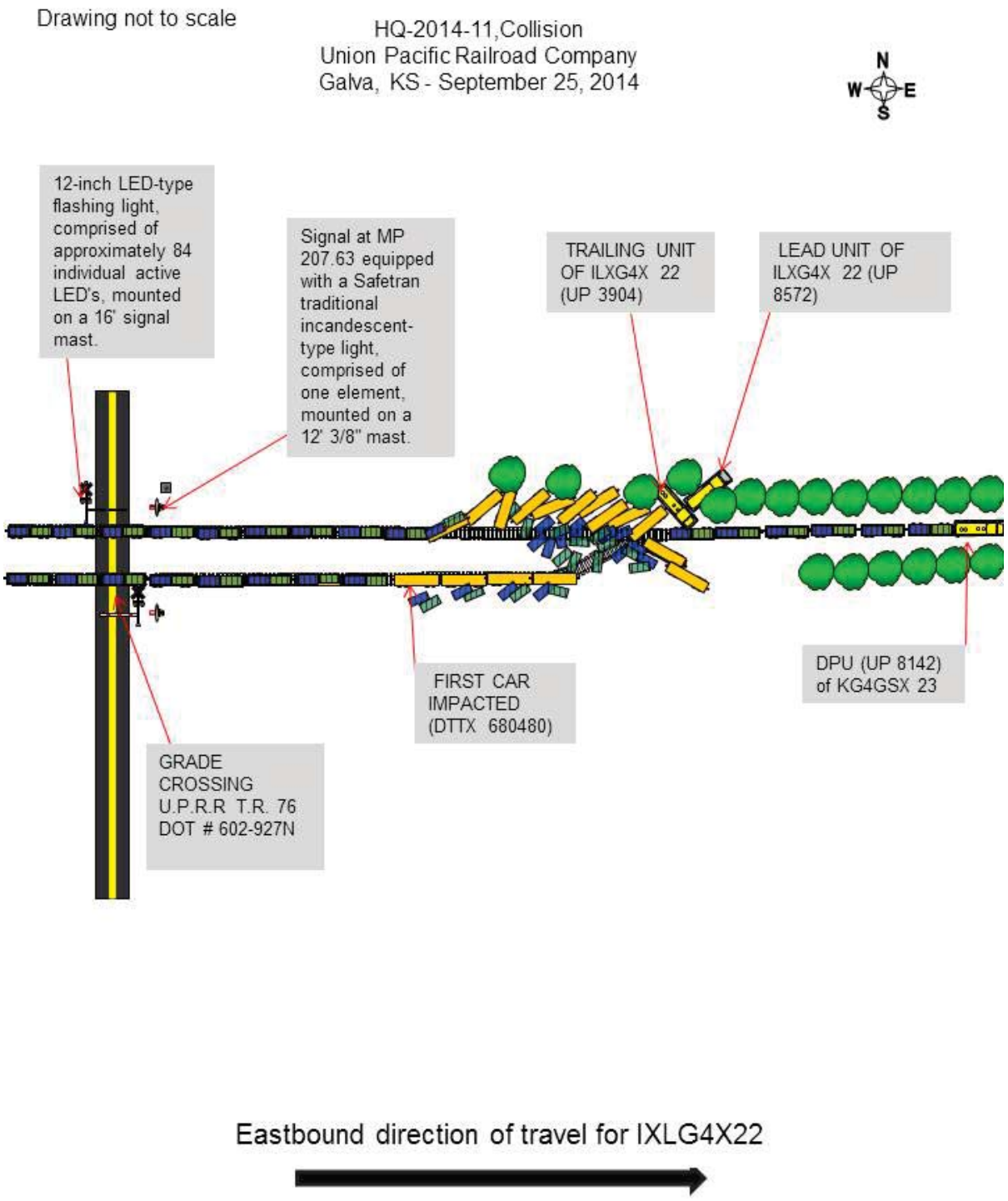
1 - Provided minimum 20-second warning
2 - Alleged warning time greater than 60 seconds
3 - Alleged warning time less than 20 seconds
4 - Alleged no warning
5 - Confirmed warning time greater than 60 seconds
6 - Confirmed warning time less than 20 seconds
7 - Confirmed no warning
N/A - N/A

Explanation Code

A - Insulated rail vehicle
B - Storm/lightning damage
C - Vandalism
D - No power/batteries dead
E - Devices down for repair
F - Devices out of service
G - Warning time greater than 60 seconds attributed to accident-involved train stopping short of the crossing, but within track circuit limits, while warning devices remain continuously active with no other in-motion train present
H - Warning time greater than 60 seconds attributed to track circuit failure (e.g., insulated rail joint or rail bonding failure, track or ballast fouled)
J - Warning time greater than 60 seconds attributed to other train/equipment within track circuit limits
K - Warning time less than 20 seconds attributed to signals timing out before train's arrival at the crossing/ island circuit
L - Warning time less than 20 seconds attributed to train operating counter to track circuit design direction
M - Warning time less than 20 seconds attributed to train speed in excess of track circuit's design speed
N - Warning time less than 20 seconds attributed to signal system's failure to detect train approach
O - Warning time less than 20 seconds attributed to violation of special train operating instructions
P - No warning attributed to signal systems failure to detect the train
R - Other cause(s). Explain in Narrative Description

SKETCHES

HQ-2014-11 Sketch



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SYNOPSIS

On September 25, 2014, at 5:42 a.m., CDT, eastbound Union Pacific Railroad (UP) Freight Train ILXG4X-22 (Train 1) was traveling at a recorded speed of 41 miles mph, with 112 loads and 0 empties, 6,197 tons, and 6,812 feet, when it struck the side of westbound UP Freight Train KG4GSX-23 (Train 2). The collision occurred at Milepost 207.67 on the Kansas City Service Unit, Herington Subdivision near Galva, Kansas. Freight Train KG4GSX-23 was entering a siding, but the rear of the train had not cleared the main track at the time of the collision. The two head-end locomotives, UP 8572 and UP 3904, and 11 multi-platform intermodal cars derailed from Freight Train ILXG4X-22. Seven multi-platform intermodal cars derailed from Freight Train KG4GSX-23. The crew of Freight Train ILXG4X-22 was not seriously injured in the accident, nor was there a fire. UP estimated approximately 200 gallons of diesel fuel leaked from the fuel tank of one of the derailed locomotives. Damages were reported as follows: $2,027,062 to Freight Train ILXG4X-22; $427,550 to Freight Train KG4GSX-23; and $1,211,915 to track, signal, and structure. Federal Railroad Administration (FRA) reportable damages totaled $3,666,527.

The crew members on Freight Train ILXG4X-22 received on-site medical attention for minor abrasions. Post-accident toxicological testing was conducted on all crew members of both trains.

The accident occurred at night. The weather was clear, with a temperature of 70 degrees F.

FRA's investigation determined the probable cause of this accident was the failure of the crew of Freight Train ILXG4X 22 to comply with a signal displaying a Stop indication at the east-end of Galva; Cause Code H220 - Fixed signal other than automatic block or interlocking signal, failure to comply. The height of the signal masts, the elevation, and the differential in the amount of visible light displayed by the two types of signals were found to be contributing factors; Cause Code H299 - Other signal causes.

NARRATIVE

Circumstances Prior to the Accident

UP Freight Train ILXG4X 22 (Freight Train ILXG4X 22)

The crew of Freight Train ILXG4X 22 consisted of an engineer and conductor. They were called for duty at their away-from-home terminal, in Pratt, Kansas, at 11:00 p.m. Prior to being called to work, the Engineer and Conductor both had 17 hours and 32 minutes off duty. Both crew members received more than the statutory off-duty rest period prior to reporting for duty. The crew reviewed their paperwork upon going on duty. The crew's assignment was to take Freight Train ILXG4X 22 from Pratt to Herington, Kansas. The train consisted of three locomotives; Lead Locomotive UP 8572 and Locomotive UP 3904 on the head-end, and distributed power unit (DPU) UP 7726 on the rear of the train; 112 loaded cars and zero empties; with a weight of 6,197 gross tons. The train length was 6,592 feet (6,812 feet including locomotives). The rear end-of-train device was listed as DPU, Locomotive UP 7726.

The train had been pretested as indicated on the air test slip UP Form Number 25021, retrieved from the cab of the lead locomotive. The Class I brake test, initial terminal inspection, and extended haul train inspection were performed at 4:40 p.m., September 23, at Santa Teresa, New Mexico.

Freight Train ILXG4X 22 departed Pratt at 11:50 p.m.

Freight Train ILXG4X 22 met two trains at Preston Siding, one train at Janet Siding, two trains at Whiteside Siding, and one train at Inman Siding.

UP's Herington dispatcher (Dispatcher 72) located in the Harriman Dispatch Center in Omaha, Nebraska, coordinated a meet with Freight Train ILXG4X 22 and Freight Train KG4GSX 23 at Galva, Kansas (MP 207.6). Freight Train KG4GSX 23 was to take the siding and Freight Train ILXG4X 22 was to hold the main track.

Freight Train ILXG4X 22 was approaching Control Point (CP) CP TC210. The Engineer was operating the train in accordance with the instructions conveyed by the previous Advance Approach signal that the Engineer had received at Milepost (MP) 212.0. The signal required the Engineer to proceed prepared to stop at the second signal. Freight trains exceeding 40 mph must immediately reduce the train speed to 40 mph. Freight Train ILXG4X 22 passed CP TC210 on an Approach signal at 35 mph. The Approach signal required the Engineer to proceed prepared to stop before any part of train or engine passes the next signal. Freight trains exceeding 30 mph must immediately reduce to 30 mph.

The Engineer decreased the throttle speed preparing to apply dynamic brakes to stop the train at CP TC208. The Engineer of Freight Train ILXG4X 22 observed the head-end of Freight Train KG4GSX 23 moving westward on the adjacent siding track at Galva.

The only radio communication the crew remembered was concerning a track warrant that was not connected to their train. Their trip was uneventful until the collision.

The Engineer of Freight Train ILXG4X 22 was seated at the controls on the south side of the cab of the leading locomotive and the Conductor was seated on the north side of the cab of the leading locomotive.

The railroad timetable and geographic direction is east. Timetable directions are used throughout this report.

Freight Train KG4GSX 23 (Freight Train KG4GSX 23)

The crew of Freight Train KG4GSX 23 consisted of an Engineer and Conductor. They were called for duty in their home terminal at Herington, at 2:55 a.m. Prior to being called to work, the Engineer had 16 hours and 5 minutes and the Conductor had 33 hours and 22 minutes off duty. Both crew members received more than the statutory off-duty period prior to reporting for duty. The crew's assignment was to take Freight Train KG4GSX 23 from Herington to Pratt. Their train consisted of four locomotives: Lead Locomotive UP 8120, Locomotive UP 8065, and Locomotive UP 7422 on the head-end, and DPU Locomotive UP 8142 on the rear of the train; 121 loaded cars and zero empty cars; and 7,898 gross tons. The train length was 7,320 feet (7,616 feet including locomotives). The crew reviewed their paperwork upon going on duty. A review of the TTX Company (TTX) air brake slip retrieved from the cab of the lead locomotive indicates the Class I brake test and initial terminal inspection were performed at 10:20 a.m., September 24, in Chicago, Illinois.

Freight Train KG4GSX 23 departed Herington at 4:55 a.m.

The crew of Freight Train KG4GSX 23 passed an Advanced Approach signal at CP TC203.9 which required the Engineer to proceed prepared to stop at the second signal. Freight trains exceeding 40 mph must immediately reduce to 40 mph. The next signal received was an Approach Diverging signal at CP TC208. The Approach Diverging required the Engineer to proceed prepared to advance on diverging route at the next signal at prescribed speed through the turnout. The Engineer prepared to enter the siding (Galva) at the next signal at the prescribed speed.

The crew of Freight Train KG4GSX 23 heard Freight Train ILXG4X 22 call out the eastbound Approach signal for Galva siding on the radio. Freight Train KG4GSX 23 had a track warrant with an "after the arrival of the UP 8572" (Freight Train ILXG4X 22) at Galva. Track warrant control (TWC) territory begins at MP 209.6. The Conductor on Freight Train ILXG4X 22 contacted the Conductor on Freight Train KG4GSX 23 to let the crew know that Freight Train ILXG4X 22 would hold the main track at Galva. The Engineer of Freight Train KG4GSX 23 was seated at the controls of the locomotive on the north side of the cab of the leading Locomotive. The Conductor was seated on the south side of the cab of the leading Locomotive. Their trip was uneventful until the collision.

UP's Herington Subdivision of the Kansas Service Unit runs in a timetable east-west direction between the Herington Yard limits (MP 171.4) and CP Pratt (CP TC298). This Subdivision extends from Herington to Pratt. Through this subdivision, UP operates on single main track territory, signaled in both directions with multiple sidings. Milepost numbers increase in the westerly direction. On UP's Herington Subdivision from MP 173.1 to MP 209.6, the method of operation is centralized traffic control. The method of operation between MP 209.6 (CP TC210) and MP 247.8 (CP TC248) is TWC/automatic block system. The maximum authorized speed from MP 171.4 to MP 297.9 is 70 mph. The crews are governed by the General Code of Operating Rules (GCOR), sixth edition, effective April 7, 2010, with updates added July 2, 2013. At the time of the accident, the current timetable was UP Salina Division Timetable Number 5, effective December 16, 2013. The General Order in effect was the Herington Subdivision General Order Number 7, effective December 16, 2013.

The railroad timetable and geographic direction is west. Timetable directions are used throughout this report.

The Accident

Striking Train, UP Train ILXG4X 22 (Freight Train ILXG4X 22)

After receiving an Approach signal at CP TC210, which instructs the Engineer to proceed prepared to stop before any part of the train or engine passed the next signal, and freight trains exceeding 30 mph must immediately reduce to 30 mph, the event recorder data shows the Engineer of Freight Train ILXG4X 22 reduced the throttle position to three for the signal indication at CP 210. According to interviews, while proceeding to MP 207.6, the crew of Freight Train ILXG4X 22 stated that they received a Clear (Proceed), at CP TC208. The signal at CP TC208, at the east-end of Galva, was actually displaying a Red (Stop), because Freight Train KG4GSX 23 was still pulling into the siding at a recorded speed of 8 mph. Event recorder data shows that the Engineer on Freight Train ILXG4X 22 began to throttle up when the crew perceived the signal at CP TC208 to be showing Clear (Proceed).

As the crew realized that the rear of Freight Train KG4GSX 23 was still entering the siding, the Engineer of Freight Train ILXG4X 22 initiated an emergency air brake application which was recorded in the event recorder data. The Engineer braced himself against the back wall of the cab for impact. The Conductor braced himself under the desk and held on to the electrical lines. At 5:42 a.m., approximately 850 feet after the Engineer initiated the emergency air brake application, Freight Train ILXG4X 22 impacted Line Number 110 in Freight Train KG4GSX 23 (Car Number DTTX 680480) at a recorded speed of 41 mph. Car Number DTTX 680480 traveled approximately 125 feet before coming to rest. The two head-end locomotives, UP 8572 and UP 3904, and 11 multi-platform intermodal cars derailed from Freight Train ILXG4X 22. Seven multi-platform intermodal cars derailed from Freight Train KG4GSX 23.

According to crew interviews, Freight Train KG4GSX 23 experienced an emergency train brake application. The alarm on the DPU initiated. The Engineer immediately contacted Freight Train ILXG4X 22 via radio to see what had happened. The crew was notified via radio by the Conductor of the striking train that a collision had occurred. There were no injuries to the crews on either train as a result of the collision.

The crew of Freight Train ILXG4X 22 exited the locomotive through the Engineer's window. An emergency call to the dispatcher was made via radio advising of the collision. Approximately 15 minutes after the crew exited the locomotive, emergency responders arrived followed by company officials. Emergency responders provided minor on-site medical attention to the crews. The crew of Freight Train KG4GSX 23 remained on the lead locomotive of Freight Train KG4GSX 23. The crew members of Freight Train ILXG4X 22 and Freight Train KG4GSX 23 were later transported by a railroad representative to the clinic for Post-Accident toxicological testing.

Analysis and Conclusions

Analysis - FRA Post-Accident Toxicological Testing: Post-Accident Forensic Toxicology Reports indicate all crew members of Freight Train ILXG4X 22 and Freight Train KG4GSX 23 had negative test results.

Conclusion: Intoxication was not a factor.

Analysis - Fatigue: FRA obtained fatigue-related information, including a 10-day work history, for four employees involved in this accident, including the Engineer and Conductor for both trains. FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis, which is equivalent to a blood alcohol content of 0.05. At or above this baseline, we do not consider fatigue as probable for any employee. Software sleep settings vary according to information obtained from each employee. If an employee does not provide sleep information, FRA uses the default software settings.

Conclusion: FRA concluded that fatigue was probable for one or more crew members of the trains involved in this incident, and the employee(s) may have been working at a diminished level of safety (effectiveness) due to mental and/or physical attributes associated with fatigue. Fatigue was probable for both the crew members of Train ILXG4X22 and the Engineer of Train KG4GSX2. And while fatigue is not probable for the Conductor of Train KG4GSX2, his overall effectiveness was borderline with a rating just barely above the cut-off level. The Office of Railroad Safety's Human Performance Program Manager concurs with these findings and believes fatigue could be a contributing factor in this accident.

Analysis - Locomotive Engineer Operating Performance: The lead locomotive of Freight Train ILXG4X 22 was equipped with a speed indicator and event recorder. The event recorder data was reviewed by FRA and the National Transportation Safety Board (NTSB). The Engineer's training records and work history were reviewed by FRA.

Conclusion: FRA reviewed the Engineer's training records and his work history which indicated that he was qualified on the territory. The event recorder data retrieved from the lead locomotive of Freight Train ILXG4X 22 was reviewed by FRA. The data indicated that the Engineer reduced his train speed to 35 mph and placed the throttle in position 3 after passing the Approach signal located at CP TC210. He then began to increase the train speed by moving the throttle to position 8 when he perceived the signal aspect at CP TC208 to be Clear (Proceed). A review of the CAD records indicates the signal aspect in the field was actually Red (Stop). The event recorder data shows that the Engineer then initiated an emergency train air brake application 850 feet from the point of impact when the Engineer realized that he was about to strike Freight Train KG4GSX 23.

After passing a block signal requiring the Engineer to be prepared to stop at the next signal, the Engineer failed to stop his train before passing the block signal requiring the train to stop. The Engineer was not in compliance with GCOR 9.5 Where Stop Must Be Made - When movement is being made beyond a block signal requiring a train to stop at the next signal, the stop must be made before any part of the train passes the block signal requiring the train to stop. The Engineer was not in compliance with all applicable railroad operating and train handling requirements.

Analysis - Operations Testing: The FTX Testing results for 2014 for the crew on Freight Train ILXG4X 22 were provided to FRA. According to the operational testing records, the Engineer had been observed by UP management while operating a locomotive on UP's Herington Subdivision on July 31, 2014, with no failures noted on his performance.

Conclusion: UP had properly monitored this employee in the field.

Analysis - Interviews: The crew members on Freight Train ILXG4X 22 and Freight Train KG4GSX 23 were interviewed after the accident by FRA and the NTSB Accident Team.

Conclusion: The crew of Freight Train ILXG4X 22 believed that they had observed a Clear (Proceed) at CP TC208. The Engineer on Freight Train ILXG4X 22 stated that he had only made 3 trips on the territory and heavily relied on his timetable throughout the trips. The Engineer also stated that he had not been on the territory since the activation of the new control point at CP TC207. The Conductor had less than 1 month of work experience. Based on the interviews, it was found that the crew of Freight Train ILXG4X 22 was alert and attentive at the time of the accident.

Analysis - Mechanical: Prior to FRA inspection, UP performed a brake test on the non-derailed portion of Freight Train ILXG4X 22. UP provided a list of conditions discovered during the inspection. Subsequently, FRA inspected the south side of the train. UP requested movement of the train to accommodate moving a tamper into the accident site. FRA completed inspection of the train north side at the Whiteside siding in Hutchinson, Kansas (Report Number FRA F6180.96 JCB-174). Exceptions were noted as follows:

• Leading locomotive – improperly prepared Class I brake test record
• Sixth head car – coupler knuckle pin missing
• Twelfth head car – excessive piston travel
• Twenty-second head car – inoperative air brakes
• Twenty-seventh head car – wheel flange thin*
• Thirty-first head car – excessive piston travel; side bearing damaged*

*Verification of the wheel flange thickness could not be made with a field inspection which required going underneath the car. Thus, no formal exception was taken. The condition was documented as a railroad comment. The damaged side bearing was also not cited formally, but noted as a railroad comment. Both cars were evaluated in Chicago, Illinois.

Prior to FRA inspection, UP performed a brake test on the non-derailed portion of Freight Train KG4GSX 23. UP provided a list of conditions discovered during the inspection. FRA inspected the train at Galva (Report Number FRA F6180.96 TCC-154). Exceptions were noted as follows:

• Leading locomotive – improperly prepared Class I brake test record
• 5th head car – insufficient piston travel
• 8th head car – inoperative air brakes
• 11th head car – insufficient piston travel
• 29th head car – service portion valve blowing excessively*
• *The air brake was operative. However, UP replaced an air brake service portion on the 29th car. No formal exception was taken. The condition was documented as a railroad comment.

The UP Form Number 25021 retrieved from the cab of the lead locomotive of Freight Train ILXG4X 22, indicated the Class I air brake test initial terminal inspection was performed at 4:40 p.m., September 23, on 112 cars of Freight Train ILXG4X 22. The record indicated that this was an extended haul train inspection at Santa Teresa, New Mexico. The identity of the person(s) performing the test was not indicated. Federal regulations require, at a minimum, the first initial and last name of the person(s) performing the Class 1 air brake test. The record indicated only the first and last initial written in illegible cursive handwriting. There was a ½ psi leak in the air brake system at the time of the inspection.

Conclusion: None of the defective conditions in either Freight Train ILXG4X 22 or Freight Train KG4GSX 23 were causative regarding this accident. The overall condition of the air brakes on both trains was good and the ability of the trains to slow or stop was not impacted by the brake equipment.

The railroad was in compliance with UP and FRA standards. The locomotive air brake system on Freight Train ILXG4X 22 worked properly and was not a factor in the collision.

Analysis - Signal testing: On September 25, the field investigation and testing of the railroad signal system between CP TC210, Galva and CP TC207, Canton was performed. The main signal bungalow at CP TC208 was struck by debris and was destroyed during the train collision. The printed circuit board (316B Recorder Card) containing the wayside signal data was recovered from the wreckage by the signal group but data was unrecoverable from the printed circuit board. The post-accident examination found the signal equipment and apparatuses locked and secured with no indications of tampering or vandalism.

Conclusion: There were no defects noted during the accident investigation of the signal system or the associated signal apparatuses. Inspection and test records were reviewed and found to be in accordance with FRA requirements.

Analysis - Signal System Re-enactment: On September 22, a new control point was installed at CP TC207 (MP 206.52), approximately 5,860 feet away from CP TC208 (MP 207.63). When traveling in an eastwardly direction, the grade slopes slightly uphill from MP 207.63 at an elevation of 1,567 feet, to MP 206.52 at an elevation of 1,586 feet. The 19-foot difference in elevation allowed the crew of Freight Train ILXG4X 22 to view the signal at CP TC207 (MP 206.52) directly above the signal at CP TC208 (MP 207.63).

The signal at MP 206.52 was equipped with an 8-inch Safetran Monochromatic (colored) LED-type light, comprised of approximately 84 individual active light emitting diodes, is mounted on a 20-foot 3/8-inch mast. The signal at MP 207.63 was equipped with a Safetran traditional incandescent-type bulb, comprised of a single element, mounted on a 12-foot 3/8-inch mast. The crossing signals at the crossing at MP 207.71 (DOT 602-927N) were equipped with a Western Cullin Hays 12-inch LED-type flashing red light mounted on a 16-foot signal mast. The signal at MP 207.63 was located 50.8 feet from the gate mast of an active warning device.

On September 27, starting at 8:55 p.m. and concluding about 10:10 p.m., a re-enactment was conducted with similar environmental conditions as those present at the time of the accident. The purpose of the reenactment was to determine the distance at which the aspect of the signals associated with the accident could be identified. Representatives from FRA, UP, the Brotherhood of Locomotive Engineers and Trainmen (BLET) Sheet Metal, Air, Rail and Transportation (SMART), and the NTSB were present.

Conclusion: During the reenactment, it was determined that due to the height of the signal masts, the elevation, and the differential of light emitted by the two types of signals, created the illusion that the signal aspect at CP TC 208 was Clear. The lenses of the active warning device, while directed away from the rail for highway traffic, contributed to this effect when activated by creating red light pollution in the vicinity of the Red (Stop) signal that was displayed at CP TC208. The light emitted by the LED-type signal at CP TC207 (MP 206.52) surpassed the amount of visible light emitted by the single element, incandescent-type signal at CP TC208 (MP 207.63). This created the perception of a Clear (Proceed) at CP TC208 when, in fact, it was displaying a Red (Stop). The crew of Freight Train ILXG4X 22 witnessed the much brighter Clear (Proceed) displayed at MP 206.52 as the rear end of the westbound Freight Train KG4GSX 23 cleared that circuit, and believed they (Freight Train ILXG4X 22 crew) were witnessing the signal at CP TC208 (MP 207.63) go from Red (Stop) to Clear (Proceed). The Engineer consequently ceased slowing and began to speed the train up. The crew did not realize the mistake until it was too late to avoid a collision.

UP implemented two effective countermeasures. On October 7, they performed a cutover of a new control point at CP TC208 with the same equipment and system as before the accident. However to enhance signal visibility for train movements through the subject location, UP installed new standard 20-foot 3/8-inch signal masts with LED-type (colored) lights to replace the old standard 12-foot 3/8-inch existing signal masts with incandescent-type (colored) lights. On October 8, they put the control point back in service. According to UP signal personnel, the Harriman Dispatching Center has placed a protective tag on CP TC207 and CP TC210 to prevent the Computer Aided Dispatching (CAD) system from “quick displaying” signals for stack moves through the subject CP location.

Applicable Rules and Regulations

General Code of Operating Rules

9.5: Where Stop Must Be Made

When movement is being made beyond a block signal requiring a train to be prepared to stop at the next signal, the stop must be made before any part of a train passes the block signal requiring the train to stop. If a train overruns any block signal that requires it to stop, the crew must:

- Warn other trains at once by radio.
- Stop the train immediately.
- Report it to the train dispatcher.

9.8: Next Governing Signal

A train may comply with the next signal’s indication when its aspect can be clearly seen and the signal governs the track where movement is occurring or will be made. This does not apply when a rule or previous signal indication requires movement at restricted speed.

Probable Cause and Contributing Factors

FRA’s investigation determined the probable cause of this accident was the failure of the crew of Freight Train ILXG4X 22 to comply with a signal displaying a Stop indication at the east-end of Galva; Cause Code H220 - Fixed signal other than automatic block or interlocking signal, failure to comply. The height of the signal masts, the elevation, and the differential in the amount of visible light displayed by the two types of signals were found to be contributing factors; Cause Code H299 - Other signal causes.