



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

***Accident Investigation Report
HQ-2013-23***

***BNSF Railroad Co. (BNSF)
St. Francis, TX
September 25, 2013***

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.

TRAIN SUMMARY

1. Name of Railroad Operating Train #1 BNSF Railway Company	1a. Alphabetic Code BNSF	1b. Railroad Accident/Incident No. KS0913107
2. Name of Railroad Operating Train #2 BNSF Railway Company	2a. Alphabetic Code BNSF	2b. Railroad Accident/Incident No. KS0913107
3. Name of Railroad Operating Train #3 BNSF Railway Company	3a. Alphabetic Code BNSF	3b. Railroad Accident/Incident No. KS0913107

GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance BNSF Railway Company		1a. Alphabetic Code BNSF	1b. Railroad Accident/Incident No. KS0913107	
2. U.S. DOT Grade Crossing Identification Number		3. Date of Accident/Incident 9/25/2013	4. Time of Accident/Incident 4:15 AM	
5. Type of Accident/Incident Rear End Collision				
6. Cars Carrying HAZMAT 6	7. HAZMAT Cars Damaged/Derailed 0	8. Cars Releasing HAZMAT 0	9. People Evacuated 0	10. Subdivision Panhandle
11. Nearest City/Town St Francis		12. Milepost (to nearest tenth) 542	13. State Abbr. TX	14. County POTTER
15. Temperature (F) 59 °F	16. Visibility Dark	17. Weather Clear		18. Type of Track Main
19. Track Name/Number Main 2 Track		20. FRA Track Class Freight Trains-110, Passenger Trains-110	21. Annual Track Density (gross tons in millions) 74.5	22. Time Table Direction East

OPERATING TRAIN #1

1. Type of Equipment Consist: Freight Train				2. Was Equipment Attended? Yes		3. Train Number/Symbol BLACWSP123							
4. Speed (recorded speed, if available) R - Recorded E - Estimated		Code R	5. Trailing Tons (gross excluding power units) 1926		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, N/A</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.)		BNSF7891	1	no			0	0					
(2) Causing (if mechanical, cause reported)		BNSF 7891	1	no	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	0	0	67	0	0	
(2) Total Derailed		0	0	0	0	0	(2) Total Derailed	0	0	4	0	0	
12. Equipment Damage This Consist 501595			13. Track, Signal, Way & Structure Damage 0										
14. Primary Cause Code H222 - Automatic block or interlocking signal displaying other than a stop indication - failure to comply.*													
15. Contributing Cause Code H605 - Failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.													
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: 12			Hrs: 2 Mins: 12		
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		2		0		0		27. Caboose Occupied by Crew?			N/A		
28. Latitude 35.000000000				29. Longitude -102.000000000									

OPERATING TRAIN #2

1. Type of Equipment Consist: Freight Train				2. Was Equipment Attended? Yes		3. Train Number/Symbol SLHTLPC223					
4. Speed (recorded speed, if available) R - Recorded E - Estimated		Code R	5. Trailing Tons (gross excluding power units) 6447		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, N/A</u>											
7. Principal Car/Unit (1) First Involved (derailed, struck, etc.)		a. Initial and Number BNSF 6781	b. Position in Train 83		c. Loaded (yes/no) no		8. If railroad employee(s) tested for drug/ alcohol use, enter the number that were positive in the appropriate box.		Alcohol 0	Drugs 0	
(2) Causing (if mechanical, cause reported)		0	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 c. Remote		Rear End d. Manual e. Remote		11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded a. Freight b. Pass.		Empty c. Freight d. Pass.		e. Caboose
(1) Total in Train	1	0	0	0	2	(1) Total in Equipment Consist	80	0	0	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	0	0	0	0	0
12. Equipment Damage This Consist 118202			13. Track, Signal, Way & Structure Damage 0								
14. Primary Cause Code H222 - Automatic block or interlocking signal displaying other than a stop indication - failure to comply.*											
15. Contributing Cause Code H605 - Failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.											
Number of Crew Members						Length of Time on Duty					
16. Engineers/Operators 1		17. Firemen 0		18. Conductors 1		19. Brakemen 0		20. Engineer/Operator Hrs: 2 Mins: 57		21. Conductor Hrs: 2 Mins: 57	
Casualties to:		22. Railroad Employees		23. Train Passengers		24. Others		25. EOT Device? Yes		26. Was EOT Device Properly Armed? Yes	
Fatal		0		0		0					
Nonfatal		2		0		0		27. Caboose Occupied by Crew?		N/A	
28. Latitude 35.000000000				29. Longitude -102.000000000							

OPERATING TRAIN #3

1. Type of Equipment Consist: Freight Train				2. Was Equipment Attended? Yes		3. Train Number/Symbol ZWSPBD7-24								
4. Speed (recorded speed, if available) R - Recorded E - Estimated		Code R	5. Trailing Tons (gross excluding power units) 5457		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, N/A</u>														
7. Principal Car/Unit (1) First Involved (derailed, struck, etc.)		a. Initial and Number BNSF 6943	b. Position in Train 1	c. Loaded (yes/no) no	8. If railroad employee(s) tested for drug/ alcohol use, enter the number that were positive in the appropriate box.			Alcohol 0	Drugs 0					
(2) Causing (if mechanical, cause reported)		0	0	no	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			
			b. Manual	c. Remote	d. Manual	e. Remote			a. Freight	b. Pass.	c. Freight	d. Pass.	e. Caboose	
(1) Total in Train		4	0	0	0	0	(1) Total in Equipment Consist		71	0	0	0	0	
(2) Total Derailed		4	0	0	0	0	(2) Total Derailed		7	0	0	0	0	
12. Equipment Damage This Consist 1980619			13. Track, Signal, Way & Structure Damage 167257											
14. Primary Cause Code H222 - Automatic block or interlocking signal displaying other than a stop indication - failure to comply.*														
15. Contributing Cause Code H605 - Failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.														
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: 17			Hrs: 6 Mins: 17			
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		2		0		0		27. Caboose Occupied by Crew?			N/A			
28. Latitude 35.256143000				29. Longitude -101.640841000										

CROSSING INFORMATION

Highway User Involved		Rail Equipment Involved	
1. Type N/A		5. Equipment N/A	
2. Vehicle Speed (<i>est. mph at impact</i>) 0	3. Direction (<i>geographical</i>) N/A	6. Position of Car Unit in Train 0	
4. Position of Involved Highway User N/A		7. Circumstance N/A	
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.			
9. Type of Crossing Warning 1. Gates 4. Wig wags 7. Crossbucks 10. Flagged by crew 2. Cantilever FLS 5. Hwy. traffic signals 8. Stop signs 11. Other (<i>spec. in narr.</i>) 3. Standard FLS 6. Audible 9. Watchman 12. None N/A		10. Signaled Crossing Warning	
12. Location of Warning N/A		13. Crossing Warning Interconnected with Highway Signals N/A	
15. Highway User's Age		16. Highway User's Gender N/A	
17. Highway User Went Behind or in Front of Train and Struck or was Struck by Second Train N/A		18. Highway User N/A	
19. Driver Passed Standing Highway Vehicle N/A		20. View of Track Obscured by (<i>primary obstruction</i>) N/A	
Casualties to:		21. Driver was N/A	
Killed		22. Was Driver in the Vehicle? N/A	
Injured		23. Highway-Rail Crossing Users 0	
24. Highway Vehicle Property Damage (<i>est. dollar damage</i>) 0		25. Total Number of Vehicle Occupants (<i>including driver</i>) 0	
26. Locomotive Auxiliary Lights? N/A		27. Locomotive Auxiliary Lights Operational? N/A	
28. Locomotive Headlight Illuminated? N/A		29. Locomotive Audible Warning Sounded? N/A	

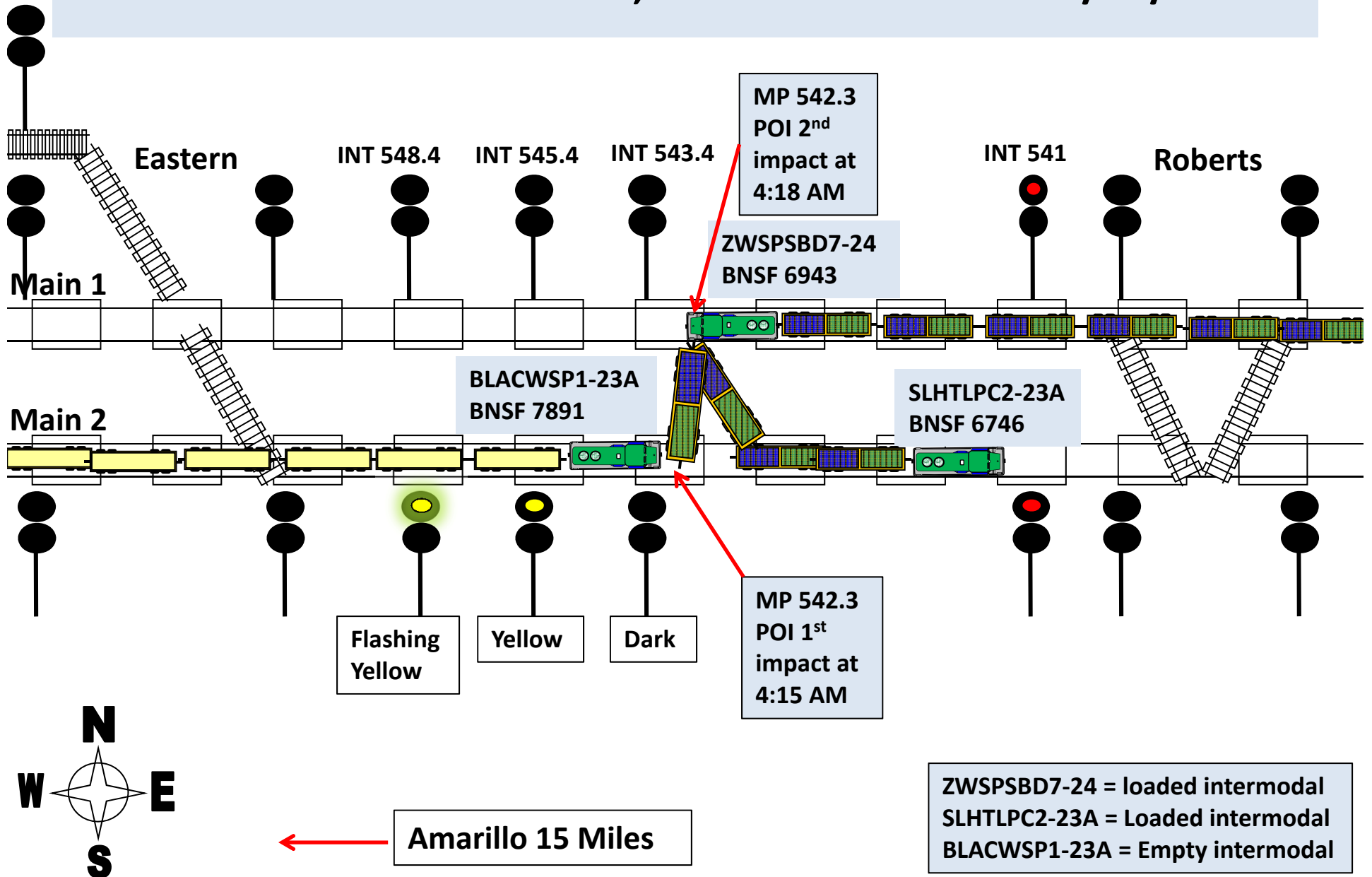
10. Signaled Crossing Warning

- 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

HQ-2013-23, BNSF Rear End Collision at MP 542 Panhandle Subdivision in St. Francis, Texas at 4:15 AM on 9/25/13



SYNOPSIS

On September 25, 2013, at 4:15 a.m. (CST), eastbound BNSF Railway (BNSF) freight train, BLACWSP1-23 (BLAC) struck the rear of BNSF standing freight train, SLHTLPC2-23 (SLHT). The accident occurred near St. Francis, TX, on BNSF's Kansas Division, Panhandle Subdivision on Main Track 2, at Milepost 542. As a result of the collision, the first four head cars of BLAC derailed. Westbound BNSF freight train, ZWSPSBD7-24 (ZWSP), traveling on Main Track 1 struck the derailed equipment of BLAC, resulting in the derailment of four locomotives and seven cars of ZWSP.

There were six reported injuries. Total damages were \$2,600,416 to equipment and \$167,257 to track, signal, way, and structures. At the time of the accident, it was dark, clear, and the temperature was 59 °F.

SLHT consisted of four and ZWSP consisted of two hazardous material cars. They were neither derailed nor damaged and there was no release.

The probable cause of the accident was BLAC's crew's failure to comply with an automatic block or interlocking signal displaying other than a stop indication.

A contributing factor was BLAC's crew's failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.

NARRATIVE

Circumstances Prior to the Accident

Method of Operations

Train movements are governed and authorized by signal indication. A Traffic Control System (TCS) is in effect in this territory with the train dispatcher stationed at Fort Worth, Texas. The train dispatcher sets routes at control points (CP). Intermediate automatic block signals are located at intervals between CPs.

Railroad operations in the accident area are conducted on two main tracks signaled for bidirectional movement. BNSF Railway's (BNSF) Kansas Division timetable dated April 2013 indicates the main tracks run east and west and BNSF designates the north track as Main Track 1 and the south track as Main Track 2. Maximum track speed in the accident area is 70 mph.

BNSF's Kansas Division, Panhandle Subdivision timetable notes the direction of train travel as Eastward and Westward. The railroad timetable direction for the striking train is east. The geographic direction was east. Timetable direction is used throughout this report. Standard Time is used throughout this report as well.

The Panhandle Subdivision consists of 136-pound, and 141-pound continuous welded rail. The rail is attached to standard wood, and concrete cross-ties with conventional fixation (double shoulder tie plates, cut spikes, McKay Clips, Pandrol Clips, and anchors). BNSF reports Main Track 1 had 81.1 million gross tons of traffic in the 12 months prior to the derailment. Main Track 2 had 75.5 million gross tons of traffic in the 12 months prior to the accident.

At the accident site, both Main Track 1 and Main Track 2 are on an ascending grade of .60 percent. Both main tracks were laid with 136-pound continuous welded rail. The rails rest in double shouldered tie plates and are affixed to the treated timber cross-ties with four cut spikes per tie plate.

BNSF maintains both main tracks in the area to the Federal Railroad Administration (FRA) Class 5 Standards (70 mph). This requires bi-weekly track inspection. According to BNSF records, the last track inspection performed prior to the accident was on September 24, 2013, by hi-rail vehicle. No defects were reported in the area.

Circumstances Prior to the Accident

Eastbound Striking Train Symbol BNSF Train BLACWSP1-23A (BLAC)

The crew of eastbound BNSF Train BLAC included a Locomotive Engineer and a Conductor. The crew first went on duty at 2:05 a.m. CST, September 25, 2013, at Amarillo, Texas. This is their Home Terminal. Both employees received more than the statutory off-duty period, 56 hours and 35 minutes for the Engineer and 60 hours and 25 minutes for the Conductor, prior to reporting for duty.

They were assigned to BNSF Train BLAC, consisting of two locomotives in the lead with 67 Bare Table Flat Cars. At the time of the collision, BNSF Train BLAC was 6,389 feet long, and weighed 1,926 tons. The train was scheduled to travel to Wellington, KS, with no scheduled stops en route.

BNSF Train BLAC received its Class 1 Initial Terminal Air Brake test, noted on BNSF's Train Profile, on September 24, 2013, at 11:34 a.m. in Belen, NM.

BNSF Train BLAC departed Amarillo at 3:49 a.m. The Engineer said that he had seen the crew from BNSF Train SLHT at the Amarillo crew room. He overheard the Engineer from BNSF Train SLHT talk with his Conductor. The Engineer from BNSF Train BLAC said that he knew his train would follow BNSF Train SLHT when departing Amarillo on Main Track 2.

The Engineer of BNSF Train BLAC stated that he recalled that most of the wayside signals were flashing yellow (advance approach), one at 8th Street, one at West Tower, and one at East Tower. He neither recalled the yellow signal at Milepost (MP) 546.0 nor the dark signal at MP 543.65. The Engineer stated that he was confused as to what happened because he believed that he had been operating on flashing yellow signals up to the collision.

As BNSF Train BLAC approached the accident area the Locomotive Engineer was seated in the locomotive engineer's seat at the controls on the south side of the locomotive. The Conductor was seated on the north side of the locomotive in the conductor's seat.

Eastbound Standing Train Symbol BNSF Train SLHTLPC2-23A (SLHT)

The crew of BNSF Train SLHT included a Locomotive Engineer and a Conductor. They first went on duty at 1:20 a.m. September 25, 2013, at Amarillo. This was their Away-From-Home Terminal. Both employees received more than the statutory off-duty period, approximately 16 hours and 40 minutes for the Conductor and 16 hours and 35 minutes for the Locomotive Engineer, prior to reporting for duty.

They were assigned to BNSF Train SLHT, consisting of one locomotive in the lead and two Distributed Power Units (DPU's) at the rear of the train. At the time of the collision, BNSF Train SLHT included 80 loaded Stack Container cars, weighing 6,434 tons, and was 7,134 feet long. The train was scheduled to travel to Wellington with no scheduled stops en route. BNSF Train SLHT received its Class 1 Initial Terminal Air Brake test, noted on BNSF's Train Profile, on September 22, 2013, at 11:30 pm in TICTF, CA.

Train SLHT departed Amarillo at 3:38 a.m. The Engineer and Conductor stated that they had slowed the train for a flashing yellow aspect (Advanced Approach), a yellow aspect (Approach), and finally stopped the train at the red aspect (Stop and Proceed) near MP 541.1 on Main Track 2.

While stop at the red signal the signal changed to a flashing yellow and then changed to a yellow signal. The Engineer said before the brakes entirely released on the train, the signal changed to a green aspect (proceed). He was just starting his train when he and the Conductor felt a surge forward and the train air brakes applied in emergency.

At the time of the collision, BNSF Train SLHT was standing on Main Track 2 facing east at approximately MP 542, near the vicinity of St Francis, Texas.

As BNSF Train SLHT waited at the accident area, the Locomotive Engineer was seated in the locomotive engineer's seat at the controls on the south side of the locomotive. The Conductor was seated on the north side of the locomotive in the conductor's seat.

Meanwhile a "Z" train (BNSF 6943 West) was passing them on Main Track 1 headed west.

Westbound BNSF Train ZWSPSBD7-24L (ZWSP)

The crew of BNSF Train ZWSP included a Locomotive Engineer and a Conductor. They first went on duty at 10:00 pm September 24, 2013, at Wellington. This was their Away-From-Home Terminal. Both employees received more than the statutory off-duty period, approximately 17 hours and 40 minutes for both employees.

They were assigned to BNSF Train ZWSP, consisting of four locomotives in the lead and 71 loaded Stack Container cars, weighing 5,457 tons and 6,840 feet long. BNSF Train ZWSP departed Wellington, at 12:09 a.m. and was scheduled to operate from Wellington to Amarillo with no scheduled stops en route. BNSF Train ZWSP received its Class 1 Initial Terminal Air Brake test, noted on BNSF's Train Profile, on September 24, 2013, at 4:50 a.m. in Wilspring, IL. At the time of the collision, BNSF Train ZWSP was traveling west bound on Main Track 1 at approximately 46 mph.

During interviews, the Engineer explained that while operating on Main Track 1 and passing an eastbound train on Main Track 2 near MP 542.0, he had heard the Conductor from BNSF Train BLAC announce on the radio "emergency, emergency, emergency." The Conductor on BNSF Train SLHT also advised him to stop his train. Just seconds later, the Engineer of BNSF Train ZWSP observed a railroad car, jackknifed, on Main Track 1.

As BNSF Train ZWSP approached the accident area the Locomotive Engineer was seated in the locomotive engineer's seat at the controls on the north side of the locomotive. The Conductor was seated on the south side of the locomotive in the conductor's seat. The Engineer applied emergency braking and both crew members braced for the impact.

The Accident

Eastbound Striking Train BNSF Train BLACWSP1-23 (BLAC)

Lead Locomotive BNSF 7891

Event recorder data from Locomotive BNSF 7891 from 4:05:00 a.m. to 4:20:00 a.m. shows the train traveling eastbound with all systems operating normally. At 4:15:14, the train is moving at approximately 32 mph just prior to an Engineer Initiated Emergency (EIE) Brake application at 4:15:15. The first indication of the train's collision with BNSF Train SLHT is indicated by a flat line speed value of 27 mph at 4:15:23 a.m. This event is marked in the plot as a solid vertical red line annotated as "Collision 1" at time 4:15:23 a.m. By 4:16:47 a.m., most of the event recorder parameter data streams have been lost and are in a flat line condition.

The Engineer sustained fractured eye sockets. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo. The Conductor sustained fractured toes. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo.

Both injuries were reported to FRA as required.

BNSF supervisors arrived at the accident site and assessed the damage. The following were damaged or derailed on BNSF Train BLAC:

BNSF 7891, Lead Locomotive, Damaged
BNSF 7587, Trail Locomotive, Damaged
TTAX 553683, First Head Car, Derailed
TTAX 79000, Second Head Car, Derailed
TTRX 370963, Third Head Car, Derailed
TTAX 753231, Fourth Head Car, Derailed

Eastbound Standing Train BNSF Train SLHTLPC2-23 (SLHT)

Lead Locomotive BNSF 6746

Event recorder data from Locomotive BNSF 6746 from 4:05:00 a.m. to 4:20:00 a.m. shows the train standing at rest just prior to the beginning of the accident sequence. At 4:14:59 a.m., data shows a simultaneous single horn blast and activation of the locomotive's bell. Seven seconds later at 4:15:06 a.m., the throttle position is moved from idle to command position T1 (Throttle 1). At 04:15:23 a.m., the time of the collision indicated by BNSF Train BLAC's lead locomotive data recorder, the speed of SLHT is shown at a value of 0 mph. One second later, at 4:15:24 a.m., the speed was recorded to increase to 1 mph.

The Engineer sustained neck sprain. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo. The Conductor sustained left arm sprain. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo.

Both injuries were reported to FRA as required.

BNSF supervisors arrived at the accident site and assessed the damage. The following were damaged or derailed on BNSF Train SLHT:

BNSF 6781, Rear Distributed Power Unit, Damaged
BNSF 4105, Second Rear Power Unit, Damaged
BRAN 4852, 27th Head Car, Damaged
DTTX 745983, 29th Head Car, Damaged

Westbound BNSF Train BNSF Train ZWSPBD7-24 (ZWSP)

Lead Locomotive BNSF 6943

Event recorder data from Locomotive BNSF 6943 between 4:05:00 a.m. to 4:20:00 a.m. shows the train's systems functioning normally as it accelerates westbound. At 4:11:17 a.m., the Engineer increases throttle to position T8 and the train accelerates to a peak speed of 55 mph by 4:15:44 a.m. By 4:16:36 a.m., throttle position is relaxed to idle as the train is traveling at 51 mph. One second later at 04:16:37, the locomotive enters emergency braking via an EIE. At the same time, Emergency Air Brake (EAB) Brake Handle position is also selected as "Emergency." At 4:16:43 a.m. at 47 mph, an indication of impact is shown in the recorder data as a sharp decline in train speed and the front headlight indication being shown as "Off." At 4:16:47 a.m. the data stream cuts off until approximately 4:19:58 a.m. when it returns for a few more seconds until 4:20:00 a.m.

The Engineer sustained neck sprain and body pains. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo. The Conductor sustained back and neck sprains. Medical attention was provided at the emergency room at the Northwest Hospital in Amarillo.

Both injuries were reported to FRA as required.

BNSF supervisors arrived at the accident site and assessed the damage. The following were damaged or derailed on BNSF Train ZWSP:

BNSF 6943, Lead Locomotive, Derailed
BNSF 4129, 2nd Trail Locomotive, Derailed
BNSF 7837, 3rd Trail Locomotive, Derailed
BNSF 7800, 4th Trail Locomotive, Derailed
GTW 676066, First Head Car, Derailed
DTTX 652668, Second Head Car, Derailed
DTTX 721406, Third Head Car, Derailed
SMW 210472, Fourth Head Car, Derailed
DTTX 652740, Fifth Head Car, Derailed
DTTX 765365, Sixth Head Car, Derailed
DTTX 620429, Seventh Head Car, Derailed

Analysis and Conclusions

Analysis – Post-Accident Toxicological Tests

This multiple train collision qualified as a Major Train Accident with more than one million dollars in damages. Members of all involved train crews were Post-Accident Toxicologically tested under Federal authority.

Conclusion:

Federal Railroad Administration Post-Accident Forensic Toxicology Result Reports indicate that the six employees tested had negative test results. Impairment was not a factor.

factor.

Analysis - Fatigue:

FRA uses an overall effectiveness rate of 77.5 percent as the baseline for fatigue analysis, which is equivalent to blood alcohol content (BAC) 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.

FRA obtained fatigue related information, including a 10-day work history, for six employees involved in this accident, including the locomotive engineers and the conductors assigned to all three trains.

Conclusions:

FRA concluded fatigue was not probable for the Locomotive Engineer assigned to train one. FRA concluded fatigue was probable for the Conductor of Train BLAC, Locomotive Engineer and Conductor for Train SLHT and the Locomotive Engineer and Conductor for Train ZWSP. Information for these six employees follows:

1. Locomotive Engineer assigned to train one, BLAC
Sleep setting – Good
Overall effectiveness = 80.36 percent
Lapse Index = 3
Reaction Time = 124 percent
Chronic Sleep Debt = 4.71
Hours of Continuous Wakefulness = 3.72
Time of Day 0417
BAC Equivalent = 0.05

Conclusion: Fatigue was not probable for this employee

2. Conductor assigned to train one, BLAC
Sleep setting – Good
Overall effectiveness = 71.00 percent
Lapse Index = 4.8
Reaction Time = 140 percent
Chronic Sleep Debt = 7.06
Hours of Continuous Wakefulness = 3.72
Time of Day 0417
BAC Equivalent - > 0.08

Conclusion: Fatigue was probable for this employee

3. Locomotive Engineer assigned to train two, SLHT
Sleep setting = Good
Overall effectiveness = 63.66 percent
Lapse Index = 6.9
Reaction Time = 158 percent
Chronic Sleep Debt = 9.16
Hours of Continuous Wakefulness = 4.47
Time of Day 0417
BAC Equivalent - >0.05

Conclusion: Fatigue was probable for this employee

4. Conductor assigned to train two, SLHT
Sleep setting - Excellent
Overall effectiveness = 67.91 percent
Lapse Index = 5.6
Reaction Time = 146 percent
Chronic Sleep Debt = 8.03
Hours of Continuous Wakefulness = 4.47
Time of Day 0417
BAC Equivalent - > 0.08

Conclusion: Fatigue was probable for this employee

5. Locomotive Engineer assigned to train three, ZWSP
Sleep setting - Excellent
Overall effectiveness = 63.49 percent
Lapse Index = 6.9
Reaction Time = 158 percent
Chronic Sleep Debt = 9.03
Hours of Continuous Wakefulness = 16.30
Time of Day 0750
BAC Equivalent - > 0.08

Conclusion: Fatigue was probable for this employee

6. Conductor assigned to train three, ZWSP
Sleep setting - Excellent
Overall effectiveness = 63.63 percent
Lapse Index = 6.6
Reaction Time = 155 percent
Chronic Sleep Debt = 9.08
Hours of Continuous Wakefulness = 16.30
Time of Day 0750
BAC Equivalent - > 0.08

Conclusion: Fatigue was probable for this employee

Analysis – Cell Phone Use

Conclusion:

There is no evidence that personal cell phones were used on a moving train or any other circumstances where prohibited by FRA regulations. Use of cell phones was not a factor to the accident.

Analysis – Wayside Signal System:

In the area of the accident, train movements are governed by operating rules, timetable instructions and the signal indications of a traffic control signal system. BNSF's Hereford dispatcher, located at the Network Operations Center in Fort Worth, controls train movements between CP Eastern and CP Roberts.

There are four intermediate wayside signals between CP Eastern and CP Roberts. The wayside signals utilize coded track circuits controlled by the GETS Electro Code 4 system. The intermediate signals consist of a three aspect color-light signal with 10 volt/25 watt incandescent lamps. Each bulb and aspect lens is housed separately within a single three position head capable of displaying a green, flashing yellow, yellow, and red aspect from top to bottom. The design of the Electro Code 4 signal system includes a light out down grade circuit. The Electro Code 4 microprocessor examines and interprets the status of each lamp filament. If a failure is detected the signal is downgraded and a more restrictive signal is displayed. In the case of a red bulb failure the dark aspect should be interpreted as the most restrictive aspect per GCOR rules 5.15 and 9.4.

On the morning of the accident, FRA's Signal and Train Control (S&TC) inspector arrived at the accident site at about 6:45 a.m. Upon arrival FRA's S&TC inspector observed that the three involved trains were still occupying both Main Track 1 and Main Track 2 tracks. FRA's S&TC inspector then traveled to the east and observed the wayside signals at MP 541.06 were displaying a red aspect on both main tracks for westbound movements towards the accident site. FRA's S&TC inspector then traveled west to the wayside signals located at MP 543.9 and observed a red aspect on the eastbound main one signal. He then observed that two BNSF locomotives were pulling the empty cars from BNSF BLACWSP1-23 back to the west to clear the accident site. While the BLACWSP1-23 was moving past the eastbound 5434 signal he observed that the east bound 5434 signal was dark. The eastbound 5434 signal was the last signal prior to the accident site. During the initial inspection, FRA's S&TC inspector found all signal equipment locked and secured with no indications of tampering or vandalism that affected the signal system. Once BNSF's signal department personnel arrived FRA's S&TC inspector observed the signal instrument cases and involved signal heads being sealed. Once all the cases were sealed FRA's S&TC inspector accompanied by BNSF's signal department personnel returned to the east bound 5434 signal to begin their investigation. Prior to the testing of individual signals a download of the GETS Electro Code 4 data log was made. Following the download of the data log an inspection of the involved signals began. During the inspection the lighting circuit wiring from the bungalow to the signal head for signal 5434 was verified and ground tests were performed. The lamp on signal 5434 for the red aspect was removed. The examination of the red signal lamp determined the lamp filament was open (or burned), preventing the bulb from lighting. Insulation resistance tests were conducted on the cables for both signals 5434 and 5454. The Electro Code EC4 codes that control signals 5434 and 5454 were verified and the signal conditions at the time of the accident were recreated. The burned lamp bulb was replaced and the light out feature of the signal system was tested. This test was performed by removing the bulb for each aspect (both the green and yellow) and observing the signal downgrade to the next least restrictive aspect. At the same time the 5454 signal, the east bound signal in advance to the 5434 was observed for proper aspects as the 5434 signal was downgraded. During this test, the red bulb was also removed from the 5434 signal and the 5454 signal displayed the appropriate yellow aspect. Battery cross tests, ground tests and battery voltages were checked at both locations. Track circuits and signal aspects were verified using track shunts. Signal lamp voltage and insulated rail joints were tested with no exceptions noted.

Following the field inspection and testing of the signal system, the Electro Code 4 data logs and the computer aided dispatch system logs from the Network Operations Center were reviewed. The logs revealed that the SLHTLPC2-23A was following an earlier east bound train and had passed the 5434 signal on a yellow aspect at about 3:54:46 a.m. At about 3:57:52 a.m. the SLHTLPC2-23 had passed the 5434 signal. The SLHTLPC2-23 then stopped prior to passing the next signal, the 5414 signal, displaying a red aspect. The BLACWSP1-23 was following the SLHTLPC2-23 and had cleared the CP at Eastern at 3:56:58 a.m. At about 4:00:49 a.m. the BLACWSP1-23 proceeded past a flashing yellow aspect at signal 5484. The logs then show the BLACWSP1-23 passed a yellow aspect at the 5454 signal at 4:05:35 a.m. As the BLACWSP1-23 approached the 5434 signal the logs show the Electro Code 4 system intending to display a red aspect. The Electro Code 4 data logs are not capable of recording a light out condition for a red aspect. There is no time stamp on the log to determine the time the BLACWSP1-23 passed the dark 5434 signal because the track circuits on both sides of the 5434 signal are occupied. Signal system remedy/trouble tickets logged by the Signal Operations Center were reviewed for the 6-month period preceding the date of the accident. The tickets did not contain any records of dark signals being reported at signal 5434.

Conclusion:

The data logs, tests, inspections and observations all indicated that the way side signal system was operating as intended and in compliance with the Federal regulations governing Signal and Train Control systems.

Analysis – Post-Accident Train Air Brake and Locomotive Inspections

BNSF conducted an air brake inspection of all remaining cars of Train's BLAC, SLHT, and ZWSP prior to the cars being removed from the collision site. Results indicated that all remaining car's brakes were operative in the full service brake position.

Conclusion:

Inspections were current and car's air brakes were operable. Equipment and braking systems were not a factor in the collision.

Analysis - Engineer and Conductor Certificate and Training:

Locomotive Engineer and Conductor certificates, hearing and vision testing, driver license checks, and other training were current and in compliance with 49 CFR part 240. The Engineer of BNSF Train BLAC current certificate was issued on June 01, 2012, with his latest monitored ride on September 04, 2013. The Conductor of BNSF Train BLAC current certificate was issued on October 21, 2012, with his latest annual training event on February 14, 2013.

Conclusion:

Engineer and Conductor training, monitoring rides, and certification were current and not a factor in the collision.

Analysis - Locomotive Engineer and Conductor Operating Performance:

At 4:15:14 the event recorder data indicates BNSF Train BLAC was operating at approximately 32 mph. The data demonstrates that neither the Locomotive Engineer nor the Conductor made any application of the air brakes previous to the emergency application. An EIE Brake application at 4:15:15 was the first indication of the train's collision with BNSF Train SLHT. This is indicated by a flat line speed value of 27 mph at 4:15:23 am.

Conclusion:

The Engineer and Conductor of Train BNSF BLAC failed to comply with signal indications and restricted speed.

Analysis - BNSF Testing Data for the Panhandle Subdivision June 1, 2013–August 31, 2013:

2292 total tests conducted with 28 failures or 1.2 percent failure rate:

There were 661 or 29 percent night (18:00 – 06:00) tests conducted with 7 failures or 10.6 percent failure rate. 94 of these night tests were conducted between MP 542.0–543.2, around the accident location, and none of them resulted in failures. Breakdown of failures:

- 2 – Test 203 (Dark Signal Test) conducted at MP 269.4
- 1 – 379 (PPE-MW Only)
- 2 – 381 (Hand Tools-MW Only)
- 4 – 602 (Trains/Engines/Cars left unattended)
- 4 – 610 (Horsepower Compliance)
- 1 – 617 (Operating Switches and Derails)

1 – 617 (Operating Switches and Derails)
4 – 624 (Locomotive Daily Inspection- TY&E and mechanical)
10 – 699 (All other failures)

Note: The 699 failures fell into these categories: (2) MAT of Way Safety Rule; (4) Air Brake and Train Handling; (3) T&E Safety Rules; and (1) GCOR Rule

Signal Tests: There were 273 signal tests or 12 percent conducted with only (2) failures for tests 203 (Dark signal). Test 201 (Movement prepared to stop) had 80 conducted with no failures. Test 203 (Dark Signal) had 70 tests conducted with 2 failures or 2.8 percent on one crew (KCKSCOL-13A at MP 269.4.) Test 204 (Block System Rules-Restricted Speed-Stop) no tests were conducted. Test 205 (Block Signals – Stop) had 94 tests conducted with no failures. Test 208 (Block Signals-Stop and Proceed) had 29 tests conducted with no failures.

There were total of 113 tests (day and night) conducted between MP 542.0 – 548.0, around the accident location, with no failures. Only 18 tests or 16 percent were signal tests (Test 201) and were conducted between June 6 – August 10 on six total trains.

Conclusion:

BNSF Operational Testing Failure rate is low at 1.2 percent. They only had 2 failures or .7 percent failure rate out of 273 signal tests conducted. BNSF should review these low numbers and increase the number of Dark Signal Test # 203.

Analysis – Sight Distance Test

The National Transportation Safety Board (NTSB)'s Sight Distance test was received by FRA on July 20, 2015. It details the Sight Distance Test conducted by the NTSB near the site, Amarillo, of the Burlington Northern Santa Fe (BNSF) Triple Train Collision on September 25, 2013. The test was conducted on and about the collision area from 2000-2330 hours using lite locomotives. Six data points that were agreed upon during development of the protocol were obtained. The following information was obtained:

Test Point	Description	Distance
A1	Distance loco headlight/loco could be deemed to be on same track	at least 7000 ft.

This test was conducted by having one locomotive, Locomotive X, with head light facing west, similar to the Distributed Power Unit (DPU) of the end of BNSF Train, SLHTLPC223A. Another locomotive, Locomotive Y, with members of BNSF, the NTSB, and FRA on board, traveled west to a point at least 7,000 feet distance from Locomotive X. At this point, the Striking train's crew traveling on Main Track 2 could have determined that the Standing Train's DPU was on Main Track 2.

A	Distance standing equipment (similar DP) disappeared from view, dim headlight	8500 ft.
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The same scenario as above: Locomotive Y traveled another 1,500 feet west. At this point, the crew in the striking locomotive cab, with a dim headlight, lost view of the DPU on the back of the standing train. This tells us that the crew of the striking could see and determine that the rear DPU on the standing train was visible from 8,499 feet prior to collision.

B1	Distance dark signal, headlight dim, disappeared from view	2206 ft.
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This test was conducted by having one locomotive, Locomotive Y with members of BNSF, the NTSB, and FRA on board, with head light on dim facing east, similar to BNSF Train BLACWSP223A's lead locomotive, start traveling west until the Dark Signal Mast at MP 543.65, disappeared from view. Locomotive Y, traveled west to a point at least 2,206 feet distance from the Dark Signal Mast. At this distance, the Dark signal Mast disappeared from view. At 2,205 feet, with headlight on dim, the striking train's crew could see the Dark Signal Mast. This gives the striking train crew approximately 60 seconds to stop, striking train traveling at 30 mph.

B2	Distance dark signal, headlight bright, disappeared from view	2949 ft.
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The same scenario as above: At 2,948 feet, with Locomotive Y's headlight on bright, the striking train's crew could see the Dark Signal Mast. If their headlight would have been on bright, it would have given the striking train crew approximately 70 seconds to stop, striking train traveling at 30 mph.

C	Signal Plate #5454 turned on from dark to red, dim headlight, distance when it comes into view	12,291 ft.
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The Dark Signal is located on the eastbound Main Track 2 at approximately MP 543.65. The testing parameters were Locomotive Y with members of BNSF, the NTSB, and FRA on board, Dark Signal at MP 543.3 displaying a red Signal, and Locomotive Y with headlight on dim. This point is after the testing point D. With this change and to continue with the notes, the striking train crew, with locomotive headlight on dim, would have been able to see this signal, if the signal had displayed red, at 12,291 feet.

D	Beginning at Signal Plate # 5454, headlight bright, distance traveled until couldn't be seen	10,455 ft.
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The Dark Signal is located on the eastbound Main Track 2 at MP 543.4. The testing parameters were Locomotive Y with members of BNSF, the NTSB, and FRA on board, and locomotive headlight was on bright. With this change and to continue with the notes, the striking train crew, traveling with the locomotive headlight on bright, should have been able to see this signal Mast, with a dark signal indication, at 10,454 feet.

Conclusion – The crew of BNSF BLAC, the striking train, with their locomotive headlight on dim, should have been able to see the Dark Signal at a distance over 2,200 feet. It is apparent to FRA that the crew of BNSF train BLAC failed to be alert, familiar and cognizant of their situation and location during their work assignment.

Overall Conclusions

BNSF Train crews were governed by the General Code of Operating Rules (GCOR). Rule modifications and specifics were provided in the timetable for the Kansas Division and specifically the Panhandle Subdivision. The General Code of Operating Rules, Sixth Edition Effective April 7, 2010, states the following: "1.47 Duties of Crew Members; C. All Crew Members' Responsibilities...2. Crew members in the engine control compartment must be alert for signals. As soon as signals become visible or audible, crew members must communicate clearly to each other the name of signals affecting their train. They must continue to observe signals and announce any change of aspect until the train passes the signal. If the signal is not complied with promptly, crew members must remind the engineer and/or conductor of the rule requirement. If crew members do not agree on the signal indication, regard the signal as the most restrictive indication observed.

When the Engineer and Conductor on Train BLACWSP223A (BNSF 7891 East), were operating out of Amarillo, they were required to be alert for upcoming signals and communicate the name of the wayside signals when the signals became visible. According to the interviews the two crewmembers had been calling the signals to each other; however, they did not observe the signal at MP 543.65 that was not lit.

In reference to an unlit signal, the General Code of Operating Rules, Sixth Edition 38 Effective April 7, 2010, states the following: "9.4 Improperly Displayed Signals or Absent Lights except as shown in block, cab, and interlocking signal aspects in the special instructions, if a light is absent, a white light is displayed where a colored or lunar light should be, or additional colored or lunar lights are displayed, regard a block or interlocking signal as displaying the most restrictive indication it can give; however, when the semaphore arm position is plainly seen, that aspect will govern.

Had the crew members of Train BLACWSP223A seen the signal at MP 543.65 and realized that it was not lit, the Engineer would have been required to stop the train and then proceed in the signal block beyond the signal at restricted speed. This would have applied the most restrictive indication that this signal could give. At restricted speed, the Engineer would have been required to maintain a speed that would have allowed him to stop his train in half the range of vision, short of a stopped train.

The crew of Train BLACWSP223A failed in their responsibilities to safely operate their train in accordance with the GCOR.

Probable Cause and Contributing Factors

The probable cause of the accident was BLACWSP1-23's crew's failure to comply with an automatic block signal displaying other than a stop indication.

A contributing factor was BLACWSP1-23's crew's failure to comply with restricted speed in connection with the restrictive indication of a block or interlocking signal.