

Signal Factual Report

Nodaway, Iowa

DCA01MR003



**National Transportation
Safety Board**

Office of Rail, Pipeline &
Hazardous Materials Investigations
Washington, DC 20594

Railroad Accident
Factual Report of the Investigation

-- Railroad Signal Group --

*DERAILMENT of
NATIONAL RAILROAD PASSENGER CORPORATION TRAIN No. 5,
the CALIFORNIA ZEPHYR on the
BURLINGTON NORTHERN SANTA FE RAILWAY in
NODAWAY, IOWA
March 17, 2001*

NTSB File Ref.: DCA 01 MR 003

Prepared by:

Ruben Payan

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Electrical Engineer
NTSB Signal Group Chairperson

Date 6-1-01

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RAILROAD SIGNAL GROUP - FACTUAL REPORT

I. GENERAL

Location: Nodaway, Iowa
Date: March 17, 2001
Time: 11:40 p.m., Central Standard Time (CST)
Carriers: National Railroad Passenger Corporation (Amtrak)
Burlington Northern Santa Fe Railway (BNSF)
Train: Westbound Amtrak train No. 5, "The California Zephyr"
NTSB No.: DCA-01-MR-003

II. SIGNAL GROUP

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III. SYNOPSIS

At about 11:40 pm, March 17, 2001, westbound Amtrak Train No. 5 of the 17th, the California Zephyr, derailed at milepost (MP) 419.92 on the Burlington Northern Santa Fe Railway, Nebraska Division, Creston Subdivision, en route from Chicago, Illinois to Oakland, California. The two locomotive units and the first 11 of the 16 cars derailed. Of the 261 passengers and the 15 Amtrak employees, there was one passenger fatality and 3 other passengers seriously injured. There was no fire or hazardous materials release.

At the time of the derailment, the train was traveling 52 mph through a 1° curve. In the vicinity of the accident, the maximum authorized speed is 79 mph. The engineer stated he placed the train brakes in emergency when he felt the train hesitate or "tug".

At the point of derailment, a 14-½ foot length of 132-lb rail had been placed in the south rail of the track to replace a defective section that had been removed on February 13, 2001. The 14-½ foot rail or "plug" was held in place by joint bars secured by rails bolts and tie spikes. The plug was to be replaced by another 14-½ foot rail to be welded in place a day or two after the accident. After the derailment, the plug was found in 3 pieces. The center section of the plug showed signs at each end of a longitudinal sub-head defect with an "oyster shell" pattern.

IV. DETAILS OF THE INVESTIGATION

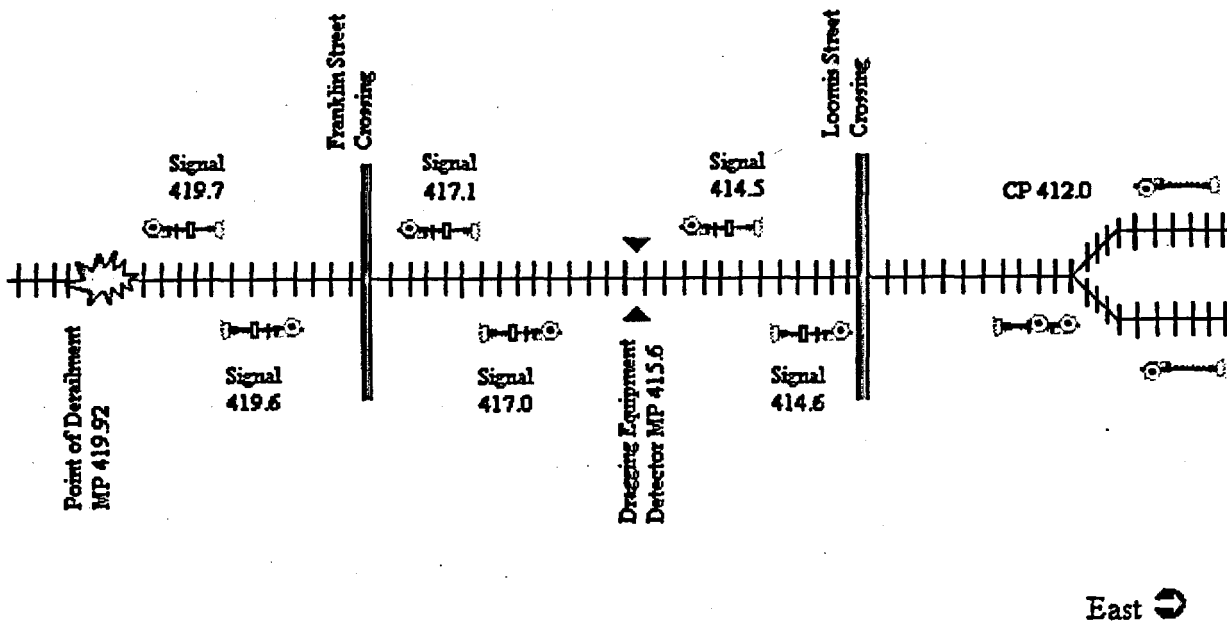
Description of Burlington Northern Santa Fe Railway Signal System:

The BNSF Railway, Creston Subdivision, runs in a geographic east-west direction between Creston, Iowa milepost (MP) 392.9 and the UP Junction (MP 59.6) near Lincoln, Nebraska. Train movements on the subdivision are governed by operating rules, timetable special instructions, and the signal indications of a traffic control signal (TCS) system¹. The signal system utilizes three aspect searchlight type signals controlled by Electro Code 4 Plus electronic coded track circuits.

The Creston Subdivision consists of two main track and single main track territory. The signal system is arranged for movement in either direction. In the vicinity of the accident area, the track structure is single main track. Dispatcher 45 located at the BNSF Control Center in Fort Worth, Texas operates the signal system.

¹ Defined by the Association of American Railroads (AAR) as "a block signal system under which train movements are authorized by block signals whose indications supersede the superiority of trains for both opposing and following movements on the same track"

Signal System Layout



NTSB Drawing
(not to scale)

Railroad Signal Event Recorders:

The Hot Box Detector at MP 398.9 logged Amtrak train No. 5 passing at 11:17:22 p.m.². The Dragging Equipment Detector at MP 415.6 logged the train passing at approximately 11:30 p.m.³. Neither detector recorded any defects associated with Amtrak train No. 5.

Additional postaccident data was obtained from the computer data log at the control center in Fort Worth, Texas. Table 1 summarizes the sequence of events recorded at the control center.

Table 1. Sequence of events recorded by the BNSF Control Center Data Logger

Train	Time ⁴	Timetable Station	Event
Eastbound BNSF coal train	10:42:38 p.m.	Nodaway	Track occupancy block 26 (OS) indicates occupied by train CNAMMEAO72
	10:42:56 p.m.	Nodaway	Track occupancy block 30 indicates occupied
	10:45:14 p.m.	Nodaway	Track occupancy block 26 indicates unoccupied
	10:51:49 p.m.	CP 4120	Track occupancy block 39 indicates occupied
	10:53:51 p.m.	Nodaway	Track occupancy block 30 indicates unoccupied

² Time is in accordance with the detector equipment clock.

³ Time and date on detector were set incorrectly, printout read as 3-2-00 at 4:01:38 p.m.

⁴ Time is as recorded by the computer at the control center

	10:59:57 p.m.	CP 4120	Track occupancy block 34 (OS) indicates occupied
	11:02:27 p.m.	CP 4120	Track occupancy block 39 indicates unoccupied
Westbound ATK train	11:30:37 p.m.	CP 4120	Track occupancy block 34 (OS) indicates occupied by train ATK 5
	11:30:38 p.m.	CP 4120	Signal 27 indicates stop indication
	11:30:52 p.m.	CP 4120	Track occupancy block 39 indicates occupied
	11:31:16 p.m.	CP 4120	Track occupancy block 34 indicates unoccupied
	11:35:43 p.m.	Nodaway	Track occupancy block 30 indicates occupied
	11:36:00 p.m.	CP 4120	Track occupancy block 39 indicates unoccupied
	11:42:41 p.m.	Nodaway	Derailment
	11:49:38 p.m.	Nodaway	Dispatcher requests signal 21 to stop
	11:49:43 p.m.	Nodaway	Signal 21 indicates at stop

The control point locations at CP 412.0 and CP 422.7 and the intermediate signal location at MP 417.1 were equipped with data loggers that were downloaded to acquire accident data. The data from the data logger at the intermediate signal location at MP 419.7 was also downloaded but did not contain events relevant to the time of the accident. The data logger at MP 419.7 was continuously recording, filling the memory buffer and overwriting older recorded events. The data logger at MP 419.7 could only provide data for approximately 15 minutes from the time of the download.

The data logs from the three, field locations recorded Amtrak train No. 5 operating on permissive signal indications. The data logs recorded all codes transmitted through the rails between signal locations and did not indicate any interruptions in the code transmissions.

Postaccident Inspection/Testing Of Signal System:

On March 18, 2001, a field inspection and investigation of the TCS system was initiated. Representatives from the Federal Railroad Administration (FRA), the BNSF Railroad, Amtrak and NTSB were present during testing. A visual inspection of the signal equipment found no evidence to indicate tampering or vandalism to the signal equipment. All signal units, power operated switches, and signal cases were found securely locked. A signal preview check did not identify obstructions that would hinder the preview to any of the signals in the vicinity of the accident.

Postaccident operational signal tests verified that the electronic track circuit units were transmitting the proper codes. The signal system transmitted codes in a logical progression when tested, and the displayed signal aspects were not in conflict with each other. All track circuit transmit/receive current levels were measured and found to be within BNSF maintenance standards.

BNSF signal maintenance, inspection, and test records were reviewed and found to be in accordance with federal requirements. Table 2 summarizes the signal records in the vicinity of the accident.

Table 2. Maintenance, Inspection and Test Dates

Test	Frequency	Location	Date
Locking	2 Year	CP 412.0	November 7, 2000
Grounds	Monthly	Signal 414.6	March 12, 2001
		Signal 414.5	March 12, 2001
		Signal 417.0	March 12, 2001
		Signal 417.1	March 12, 2001
		Signal 419.6	March 12, 2001
		Signal 419.7	March 12, 2001
Switch	Monthly	CP 412.0	March 13, 2001

The BNSF records indicate the equipment was in satisfactory operating condition and did not list any conditions that would prevent the TCS system from operating properly. The BNSF Signal Trouble Desk provided signal trouble tickets reported in the vicinity of the accident. Table 3 lists the signal trouble tickets.

Table 3. BNSF Signal Trouble Tickets

Date	Location	Description
10-21-00	West of MP 412	Track indication west of MP 412, indication cleared prior to maintainer's arrival
11-3-00	MP 422.7	Track indication between Nodaway and CP 412, broken rail found
11-20-00	MP 415.8	Track indication on 1 st section of CP 412.0 left by eastbound train, broken rail found
1-1-01	CP Nodaway	Track indication on main track left by westbound train, indication cleared prior to maintainer's arrival
2-7-01	CP 412.0	Track indication between CP 412.0 and crossover at MP 408, found rail shavings shunting track circuit
2-19-01	CP 412.0	Track indication between CP412.0 and crossover at MP 408, found rail sliver shunting track circuit