



**NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF RAILROAD, PIPELINE AND HAZARDOUS
MATERIALS INVESTIGATIONS WASHINGTON, D.C. 20594**

RAILROAD SIGNAL AND TRAIN CONTROL SIGNAL FACTUAL

DCA17FR004

Roadway Worker Employee Fatalities

Edgemont, SD

January 17, 2017

SIGNAL GROUP FACTUAL

Prepared by: Timothy J. DePaepe, Signal Group Chairman

1. ACCIDENT

LOCATION: Edgemont, SD
TRAIN: Westbound E-DOLEBM0-01E
OPERATOR: BNSF Railway
DATE: January 17, 2017
TIME: 10:09 a.m. Mountain Standard Time
NTSB #: DCA17FR004

2. SIGNAL & TRAIN CONTROL GROUP

Tim DePaepe
Railroad Accident Investigator
NTSB, Office of Railroad, Pipeline & Hazardous Materials Investigations

Aaron Wagner Signal Manager - Denver,
BNSF

Lyle Rasnic – FRA Signal
Signal & Train Control Inspector
Federal Railroad Administration

3. ACCIDENT SUMMARY

For a summary of the accident, refer to the *Accident Summary* report, within this docket.

The parties to the investigation include Federal Railroad Administration (FRA), BNSF Railway Company (BNSF), Brotherhood of Locomotive Engineers and Trainmen (BLET), Sheet Metal Aviation, and Railroad Transportation Union – Transportation Division, (SMART), and Brotherhood of Maintenance of Way Employees BMWED.

4. DETAILS OF THE INVESTIGATION

4.1 Description of Railroad Signal System

Train movements are governed by a signal system controlled by BNSF dispatchers located in Fort Worth, Texas with signal indications of a traffic control system (CTC). Train dispatchers also issue instructions and miscellaneous communications via radio. The Butte Subdivision extends from Emerson Street MP 365.9 to Edgemont MP 476.1 (110.9 miles). The Blackhills Subdivision extends from Edgemont MP 476.1 to West Gillette MP 599.95 (123.8 miles).

Control point (CP) at 475.30 (East Edgemont) is a HLC (Non-Vital Logic Controller, relay base). CP 478 is a VHLC (Vital Logic Controller). Intermediate signals at 477 are automatic signals equipped with Electrocode 5.

There are four aspect signals in the accident area. The color light signals are lit with incandescent light bulbs. Intermediate signals are approach lit and control point signals are lit upon request/alignment from the dispatch center. Power switches are US&S model M23's. Track circuits are coded track and the electric locks have phase shift overlays (PSO's).

4.2 Data Logs

Investigators retrieved data logs from the CP East Edgemont and intermediate signal 477. Information from those data logs were reviewed and the following slides detail the chain of events surrounding the fatal strike of two BNSF Maintenance of Way (MOW) employees by a westbound train E-DOLEBM0-01E at approximately MP 477, operating on Main 1 of the Blackhills Subdivision near Edgemont, South Dakota. Times reflect Central time zone, incident occurred in the Mountain time zone. See Figures 1 through 7.

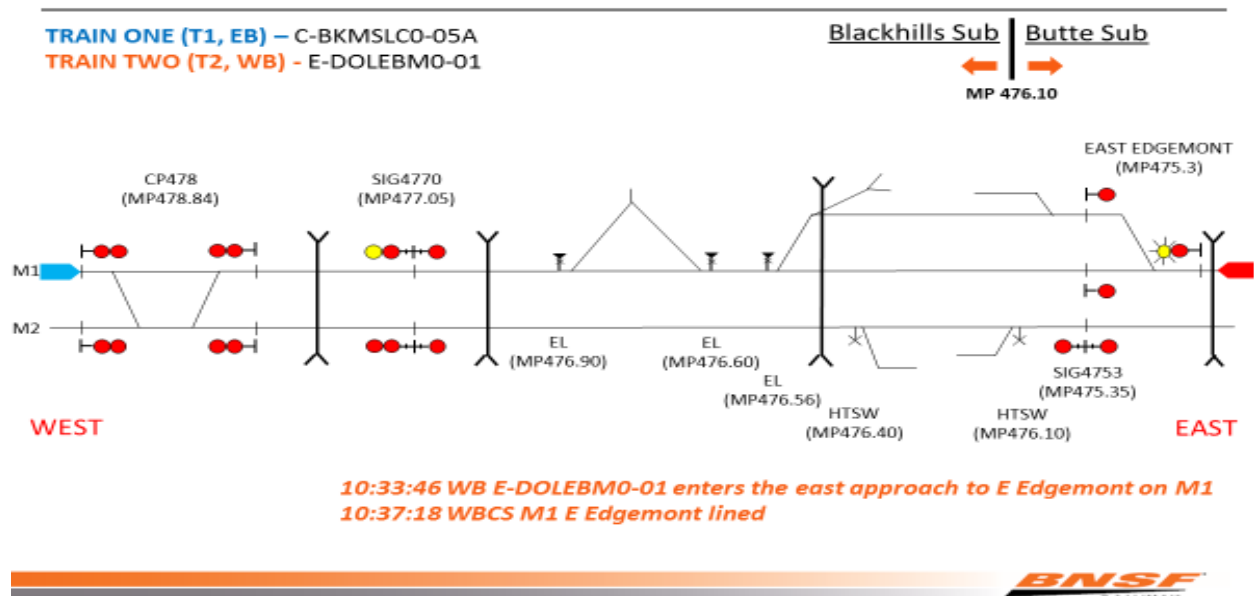


Figure 1. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).

508 Text: *This graphic shows the westbound accident train, E-DOLEBM0-01E, on main track 1 approaching a flashing yellow signal at CP East Edgemont. It also shows the eastbound train, C-BKMSLC0-1 on main track 1 approaching a red signal at CP478.*

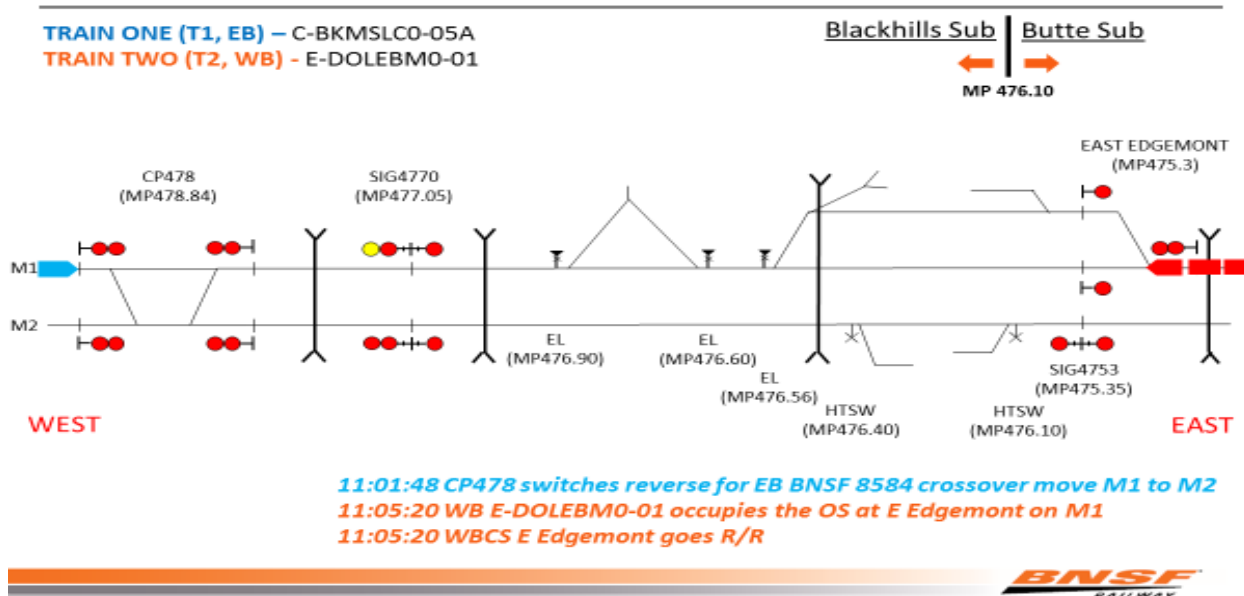


Figure 2. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows the westbound accident train, E-DOLEBM0-01E, on main track 1 entering and occupying the OS track circuit at CP East Edgemont. It also shows the eastbound train, C-BKMSLC0-1, on main track 1 approaching a red signal at CP478.

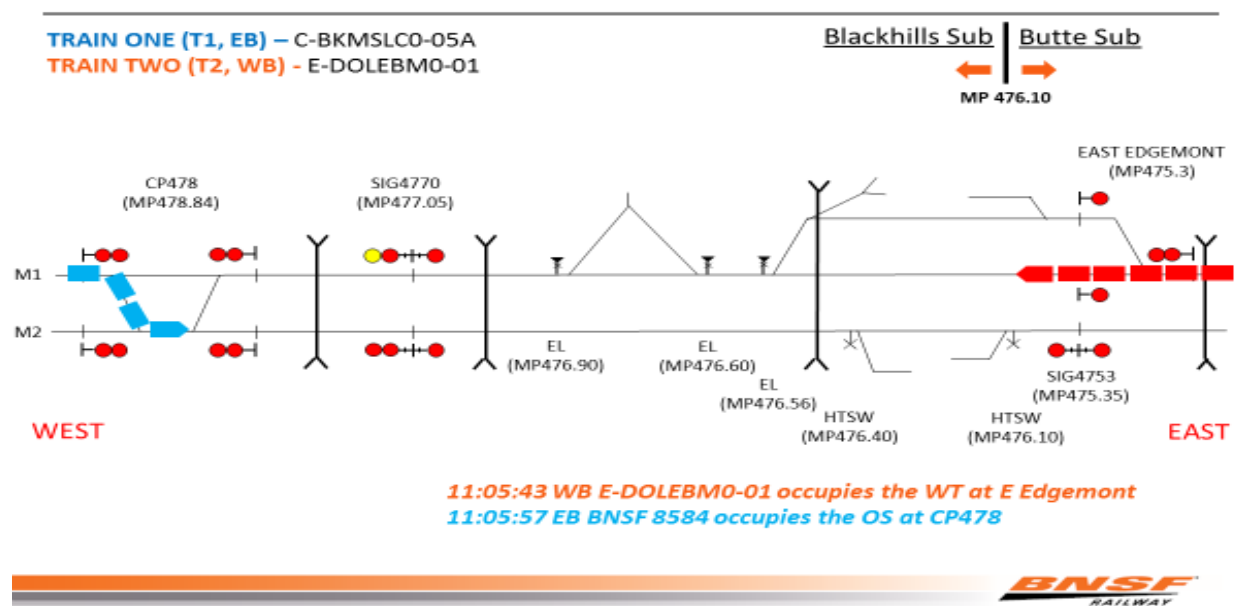


Figure 3. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows the westbound accident train, E-DOLEBM0-01E, on main track 1 occupying the WT track circuit at CP East Edgemont. It also shows the eastbound train, C-BKMSLC0-1, crossing over from main track 1 to main track 2 at CP478.

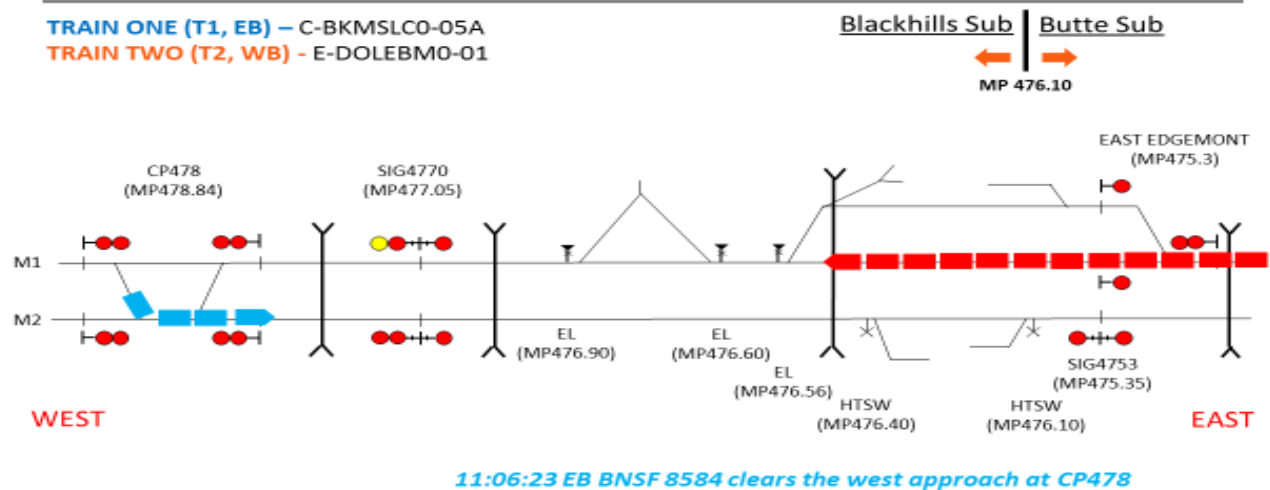


Figure 4. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows the westbound accident train, E-DOLEBM0-01E, on main track 1 occupying the WT track circuit at CP East Edgemont continuing the westbound movement. It also shows the eastbound train, C-BKMSLC0-1, crossing over from main track 1 to main track 2 at CP478 and in the clear of main track 1.

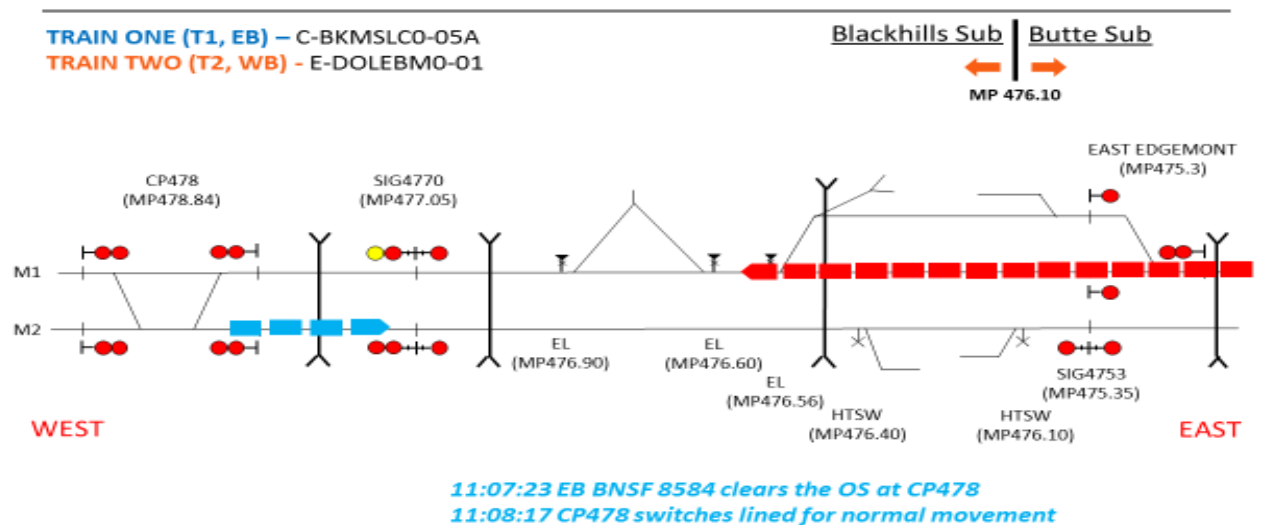


Figure 5. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows the westbound accident train, E-DOLEBM0-01E, on main track 1 occupying the WT track circuit at CP East Edgemont continuing the westbound movement. It also shows the eastbound train, C-BKMSLC0-1, completely on main track 2 continuing the eastbound movement.

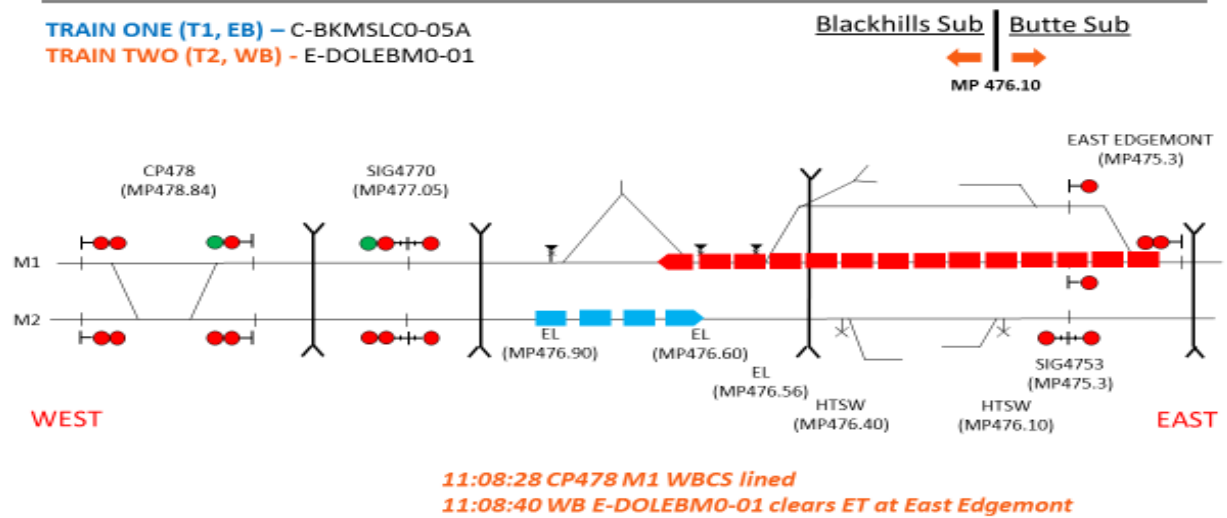


Figure 6. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows the that the last car of the westbound accident train, E-DOLEBM0-01E, on main track 1 clears the eastbound approach track circuit at CP East Edgemont while continuing the westbound movement. It also shows the eastbound train, C-BKMSLC0-1, on main track 2 continuing the eastbound movement.

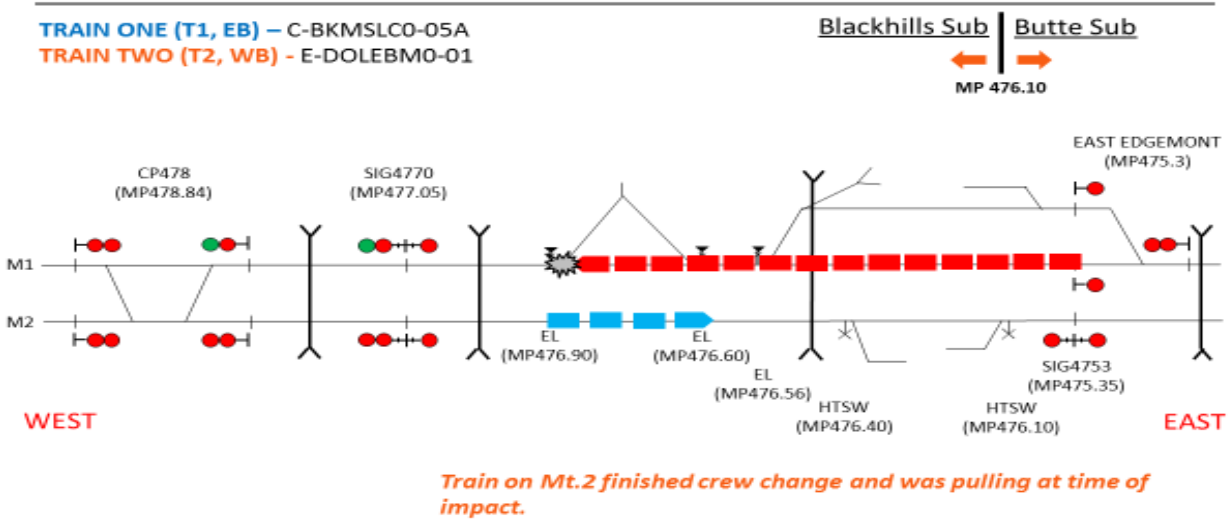


Figure 7. Signal Aspect and Train Movement. (Graphic courtesy of BNSF Railway).
508 Text: This graphic shows where the westbound accident train, E-DOLEBM0-01E, on main track 1 struck the roadway workers at MP 476.90. The rear of the eastbound train, C-BKMSLC0-1, on main track 2 passes the accident location at the same time while continuing the eastbound movement.

4.3 Signal Maintenance Records

Investigators collected BNSF signal maintenance reports for the accident area. Investigators reviewed the maintenance records and all signal tests and inspections were conducted in accordance with BNSF protocols and FRA regulatory requirements. Investigators collected and reviewed the trouble tickets for the Blacks Hills Subdivision with no exceptions taken.

4.4 Post Accident Inspection/Testing Of Signal System

On January 19, 2017, representatives from the FRA, BNSF and the NTSB began inspecting and testing the signal system. The post-accident inspection found all signal units and the signal cases at CP East Edgemont and intermediate signal 477 locked with no indications of tampering or vandalism to any of the signal equipment.

At CP East Edgemont BNSF employees took ground readings on all busses with no exceptions taken. The OS and OSA track circuits within the interlocking were .06 ohm shunted and verified for proper operation. BNSF employees recorded signal lamp voltages at the westbound signal 1WA, at CP East Edgemont. One resistor regulates/adjusts the voltage for all three bulbs (the red bulb, the yellow bulb and the green bulb). Adjusting the resistor changes the bulb voltage for all three signals. The bulb voltage at 1WA signal was 9.745 volts.

Investigators simulated the westbound train movement on main one through East Edgemont Interlocking and continued the train movement through Intermediate Signal 477.

At intermediate signal 477 and the West Leg switch at the Deadwood Wye. Intermediate signal 477 track circuits 1ET and 1WT, which are east and west of the intermediate signal 477, were .06 ohm shunted and verified for proper operation.

Investigators simulated track inputs on the 1W track at intermediate signal 477 using a Track Input Simulator (TIS) and input vital codes, 2, 3, 4, and 7 to display all aspects westbound. Checked all bulb voltages on main one track top and bottom aspects, verified at 9.0 volts on each.

Investigators simulated westbound train movement on main track one through intermediate signal 477 with both green and yellow aspects lit and verified westbound stick circuit set and westbound signals turned red with west track shunted. The group tested for grounds in the area and verified all circuits were ground free.

At the Electric Switch Lock and Hand Throw West Leg Deadwood Wye investigators verified that when the Normal Switch Repeater relay (NWLPR) dropped, it stopped the vital codes to East Edgemont and CP 478.8. Turnout track (1T) relay and unlock section (OT) relay, were .06 ohm shunted and verified for proper operation. The electric lock drum contacts and switch circuit controller were opened with ¼" obstruction and dropped the normal switch repeater. Investigators walked the switch layout and inspected for proper fouling and bonding. Verification of all signal components revealed properly fastening, connection and securement. The group tested for grounds in the area and verified all circuits were ground free.

4.5 Signal Damages

There was no damage to any signal equipment. The BNSF engineering personnel concluded that the total signal and switch damages was zero.

Requested Signal Documents

1. CP East Edgemont and intermediate signal 477 signal test records (six months prior to the accident)
2. Signal installation plans
3. Straight line plan showing signals approaching the accident area
4. Signal Aspect Chart
5. Signal plans for the system in the area involved
6. Operating rules relating to each signal involved
7. Original event recording data/downloads at CP East Edgemont and intermediate signal 477.
8. CP East Edgemont and intermediate signal 477 trouble ticket records (six months prior to the accident)
9. Current Timetable
10. Book of Operating Rules
11. Pertinent Train Orders, Bulletin Orders, General Orders, Clearance Cards, Instructions or Messages.

Party to the Investigation - Acknowledgment Signatures

The undersigned designated *Party to the Investigation* representatives attest that the information contained in this report is a factually accurate representation of the information collected during the investigation, to the extent of their best knowledge and contribution in this investigation.

Timothy J. DePaepe, NTSB /s/ Date 3-24-17

Lyle Rasnic, Federal Railroad Administration /s/ Date 3-24-17

Aaron Wagner, BNSF /s/ Date 3-24-17

END OF REPORT