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RAILROAD ACCIDENT REPORT

BURLINGTON NORTHERN INC.
Derailment of Extra 5701 East
at
Sheridan, Wyoming
March 28, 1971



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Washington, D. C. 20591
REPORT NUMBER: NTSB-RAR-72-4

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Sheridan, Wyoming

March 28, 1971

Adopted: April 26, 1972

U.S.
NATIONAL TRANSPORTATION SAFETY BOARD,
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| 16. Abstract Burlington Northern Extra 5701 East, approaching Sheridan Yard, Sheridan, Wyoming, on the morning of March 28, 1971, called the Yard Office for a track on which to deliver the train. The main track was assigned, but as the approach was continued, cars were sighted standing on the main track. The cars were sighted too late. The train did not stop, and there was a collision. The engineer and fireman were killed, two brakemen were injured, and three diesel units and eleven cars were derailed. Recommendations are directed at correcting those discrepancies revealed during the course of the investigation. This includes still another case where prima facie evidence is given to enable the Federal Railroad Administration to go forward with dispatch to correct the safety hazards in locomotive cabs. | | | | | |
| 17. Key Words Extra, Spring Switch, semaphore signal, dynamic braking, mainline, train orders, yard office, Footboard Yardmaster, reduced speed, rules, non-automatic block (non ABS) turnover book, time tables, special instructions, division, sub-division, clearance point, safety control foot valve, emergency brake lever, yard limits. | | | | 18. Distribution Statement Released to Public. Unlimited Distribution. | |
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FOREWORD

This report of facts and circumstances and determination of probable cause by the National Transportation Safety Board is based on facts developed in the field investigation by the Bureau of Railroad Safety of the Federal Railroad Administration. In developing its recommendations, the Safety Board has considered the suggestions the Federal Railroad Administration made in forwarding the investigatory data; however, the recommendations made are those of the Safety Board.

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NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D.C. 20591
RAILROAD ACCIDENT REPORT

Adopted: April 26, 1972

BURLINGTON NORTHERN INCORPORATED
DERAILMENT OF EXTRA 5701 EAST
AT
SHERIDAN, WYOMING
MARCH 28, 1971

I. SYNOPSIS

Burlington Northern freight train, Extra 5701 East, with 69 cars and three locomotive units approached Sheridan Yard, Wyoming, about 1:20 a.m., March 28, 1971. A yard clerk used a radio to advise the crew to remain on the main track, stop the train, and deliver the locomotive to the roundhouse. Unknown to the yard clerk and the crew of Extra 5701 East, a draft of cars was standing on the main track short of the spot where the train was to stop. Visibility was decreased by blowing snow and when the standing cars unexpectedly came into view, the train could not stop before it struck them. The fireman who was operating the locomotive, and the engineer, were killed. The locomotive, the first three cars, and cars 22 through 26 of Extra 5701 East, and the first three standing cars were derailed.

PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the operation of Extra 5701 East at such a speed that it could not be stopped before it collided with cars standing on the main track.

Factors contributing to the occurrence of the accident were:

1. Ineffective, and unenforced operating rules.
2. Ineffective and misleading signals.
3. Assigned responsibilities beyond the abilities of inadequately trained and instructed employees in the Sheridan yard.
4. Inadequate organization and procedures in the Sheridan Yard operation.

II. FACTS

A. Location of Accident

The accident occurred on the main track, within yard limits, of the Burlington Northern (BN) near the west end of the Sheridan Yard, Sheridan, Wyoming. Sheridan is the junction point of the 16th and 17th subdivisions of the Yellowstone Division. The 16th subdivision extends west from Sheridan, Wyoming to Huntley, Montana, a distance of 130.8 miles, and the 17th subdivision extends east from Sheridan, Wyoming, to Edgemont, South Dakota, a distance of 222.5 miles.

The point of collision was on the main track 348 feet east of a spring switch to the yard lead track. Other distances pertinent to the point of collision are shown in the sketch of figure No. 1.

In the vicinity of the collision, the main track is straight for 6,076 feet from the west

BURLINGTON NORTHERN
FREIGHT YARD - WEST END, SHERIDAN
WYOMING

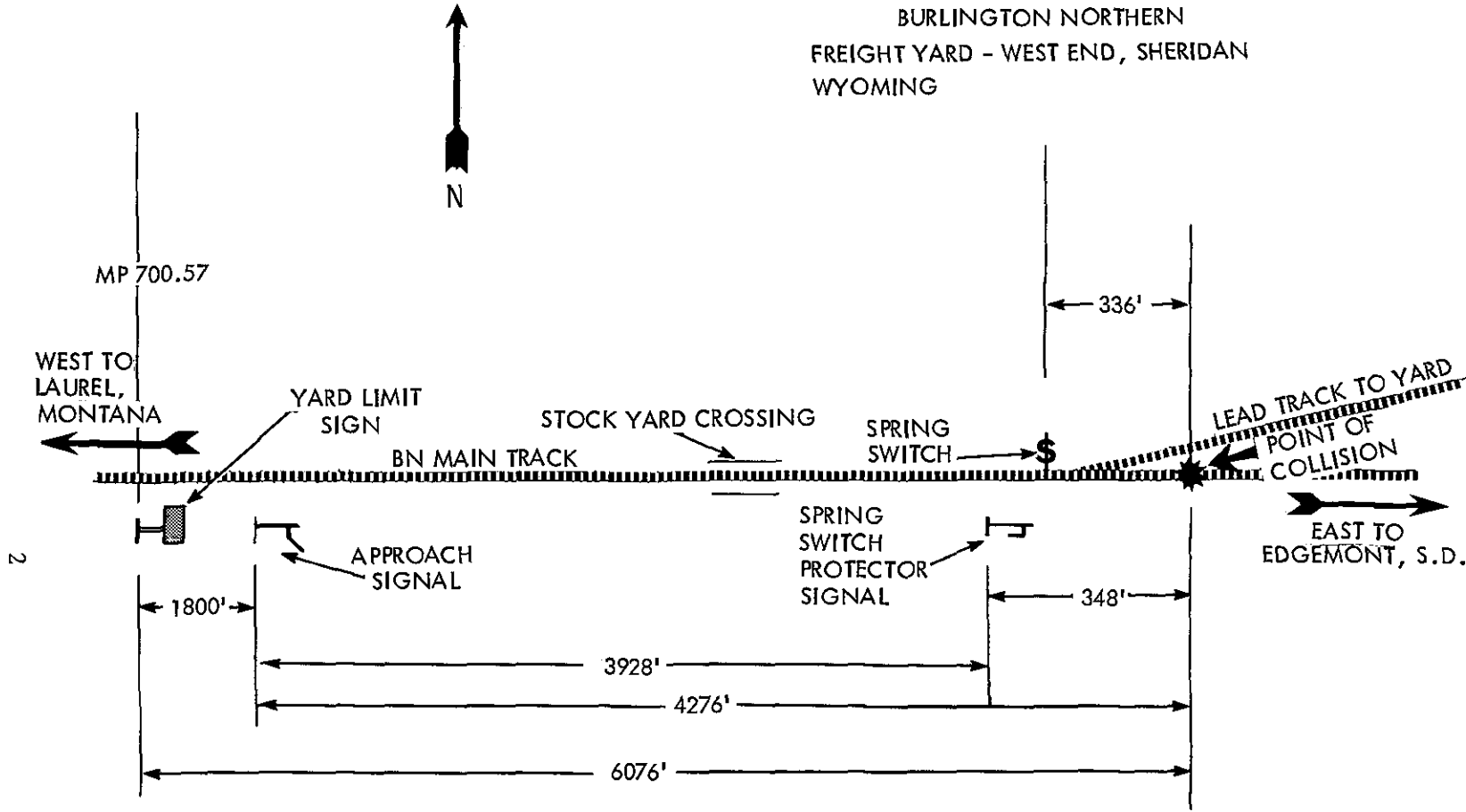


FIGURE NO. 1
RELATIVE DISTANCES FROM REFERENCE POINTS TO
POINT OF COLLISION - NOT TO SCALE

yard limit sign, located approximately at MP 700.57, to the point of collision. The track has an 0.08 percent grade descending eastward, beginning at a point 1,000 feet west of the switch to the yard lead track, and an 0.02 percent ascending grade from the west to that point.

There is a three-track grade crossing known as the Stock Yard Crossing, approximately 700 feet west of the lead track switch. Figure No. 2 is a picture of the immediate area where the collision occurred.

The approach signal, located 3,928 feet west of the switch to the yard lead track, is an upper quadrant semaphore type signal which permanently indicates approach. It does not work in conjunction with the spring switch protective signal, nor does it indicate whether the track is clear or occupied between the approach signal and the spring switch protective signal.

The west yard limit sign is on the south side of the track 1,800 feet west of the approach signal.

Access from the main track to the lead track of the 13-track yard at Sheridan is through a spring switch, the position of which is indicated by a switch protective signal. The normal position of the spring switch is aligned for the main track. The switch protective signal is a lower quadrant, semaphore type signal which indicates the position of the spring switch or shows whether the main track is occupied within a distance of 175 feet east of the spring switch. It is capable of displaying two aspects, green or the corresponding position of the semaphore arm, and red, or the corresponding position of the semaphore arm.

A green aspect indicates that the spring switch is aligned for the main track, that the switch points are fitting up properly to the stock rail for a movement down the main track, and that there is no track occupancy within 175 feet east of the spring switch. A red signal indicates either that the spring switch is reversed, (that is, aligned for the yard lead track), or that the switch points are not closed to the stock rail

properly for safe movement onto the lead track or down the main track.

B Method of Operation

At the point of the collision, the railroad runs north and south geographically, but east and west by timetable direction. Timetable directions are used in this report.

Trains operate in the vicinity of the accident by timetable and train orders in nonautomatic block signal territory over a single track. Special Instructions for the 16th subdivision, instruction No. 6 reads, "At Sheridan-17th Subdivision instructions govern." (Appendix No. 1.)

The telegraph office at Sheridan Yard is manned by a relay operator twenty-four hours per day. The train dispatcher is located at Glendive, Montana.

The main track at Sheridan is used within yard limits to make up trains, and, as needed, to facilitate yard operations.

Train movements between Sheridan and Huntley for the 30-day period February 26, 1971, to March 27, 1971, inclusive, were:

| <u>Westward</u> | <u>Eastward</u> | <u>Mine Runs (Local round trips)</u> |
|-----------------|-----------------|--|
| 80 | 75 | 29 |

C. Events Leading to the Accident

Extra 5451 West left Gillette, Wyoming, at 2:35 p.m., March 27, 1971, with 56 loaded and 13 empty cars (3,050 tons). It arrived at Sheridan at 3:35 p.m., March 27, 1971, and was stopped on the main track.

An outbound crew was ordered for 3:20 p.m. to continue the movement of this train west. The locomotive to be used consisted of units 5451 and 5421. At approximately 4 p.m., Extra 5451 west was cancelled. The locomotive

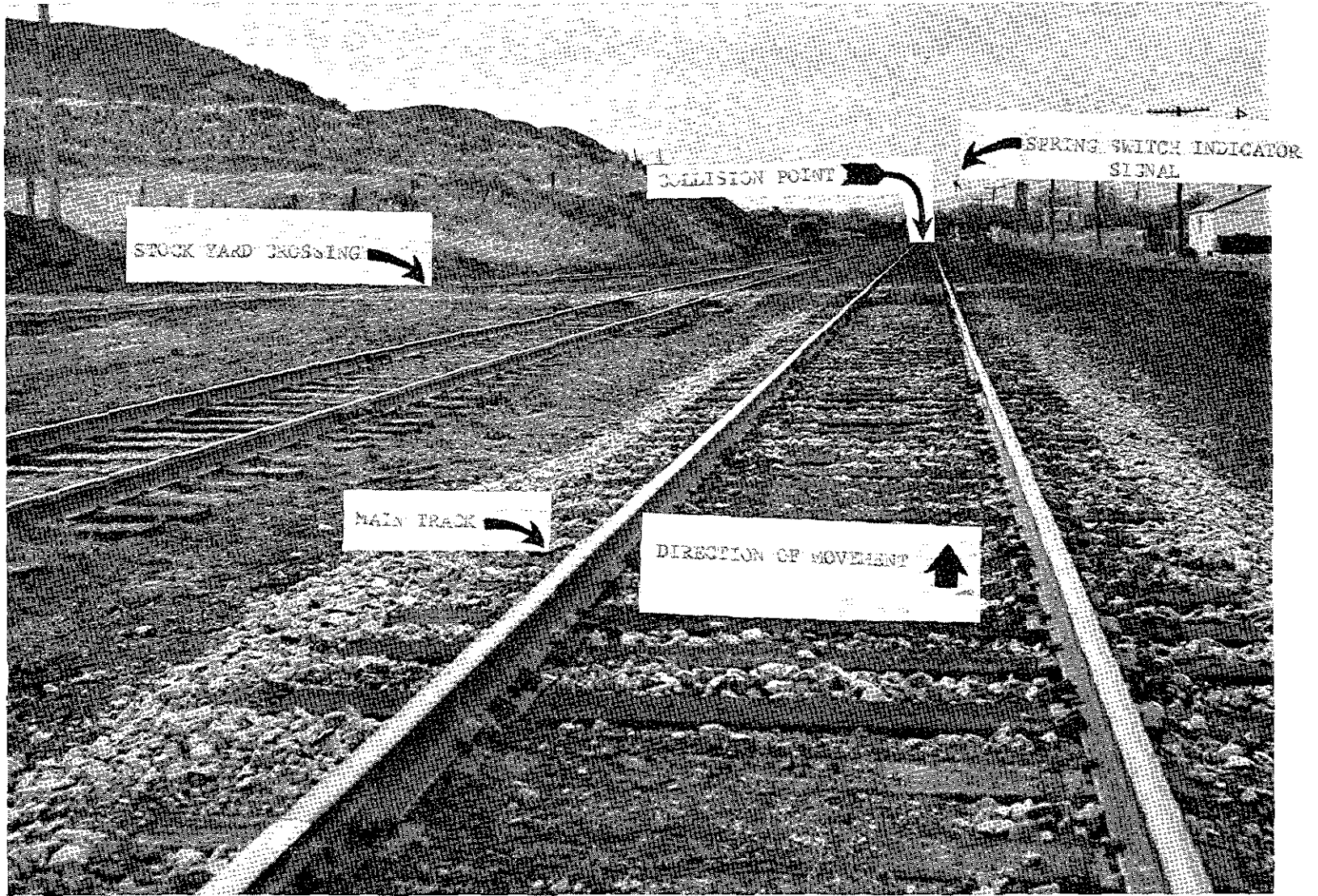


Figure 2.—General Area where derailment occurred.

had been attached to the train and the brake system of the train had been charged with air. The crew set the air brakes on the train and, in addition, set the hand brakes on the first six cars. They then returned the locomotive to the yard and the units were split, one unit going to assist train 76 which had experienced locomotive difficulty and the other for train 79. The evidence does not indicate whether the dispatcher was told that the cars were left on the main track.

The locomotive of the 5701 East consisted of units 5701, 6457, and 6482. The 5701 was a General Electric Model U33C equipped with 26L airbrakes. The 6457 and 6482 were Electro Motive Division Model SD 45.

The 5701 was equipped with a tape speed recorder, but at the time of the accident, it was not working because of a broken galvanometer, an integral part of the recording mechanism.

Extra 5701 East left Laurel, Montana, at 9:15 p.m., March 27, 1971, with 65 loaded and 4 empty cars (4,639 tons) and arrived at Sheridan Yard about 1:20 a.m., March 28, 1971. The crew consisted of a conductor, a rear brakeman, a head brakeman, an engineer, and a fireman.

Extra 5701 East made an uneventful run from Laurel to Sheridan, stopping at Huntley to check the train register, and at Parkman to meet train No. 75. No difficulties were reported in handling the train enroute. The fireman, a qualified engineer, operated the locomotive from Huntley to Sheridan. The engineer and the head brakeman were in the cab of the locomotive.

The footboard yardmaster reported for duty at 3:45 p.m., March 27, 1971, at Sheridan yard. He performed usual and normal duties during the 8-hour tour. At approximately 8 p.m., the footboard yardmaster ate his lunch and at this time partially filled out the yard track situation turnover book.

At 11:45 p.m., just before he went off duty, he completed the required entries in the turnover book to indicate the yard track condition.

He left the book in its customary place on the desk of the yardmaster, and departed without discussing the entries in the book with the third-trick yard clerk. Included in the last entries made in the turnover book by the footboard yardmaster was the entry "ML Extra West in."

The third-trick yard-freight clerk reported for duty at 11 p.m., March 27, 1971. He talked to no one but the second-trick clerk whom he was relieving. Their attention centered around transmitting card information on an IBM-1050 system which had been installed March 23, 1971. They were experiencing some difficulty with the new system.

At approximately 11:45 p.m., the yard-freight clerk checked with the relay operator to confirm a lineup of train movements he had been given. The lineup read as follows:

A local to arrive (Sheridan) at 11 p.m.
Second 188 (Extra 5701 East) to arrive (Sheridan) at 3 a.m. (This was later changed to 2 a.m.)
No. 79 to arrive (Sheridan) at 6 a.m.
An Extra West, Ex 5656 to depart (Sheridan) about 2 a.m.
Second 188 given as final to arrive (Sheridan) at 1:15 a.m.

Following the receipt of the lineup the yard clerk checked the turnover book. According to the book, tracks Nos. 1, 2, 3, and 4 were clear. He also noted at the top of the page a notation "ML Extra West in," but this entry was not on a line and it was above the listings for the other tracks. His check of the book was made shortly after 11:45 p.m. Except for the period 11:45 p.m. until about 1:15 a.m., the time the clerk left the yard office to pick up the crew of Extra 5701 East, he worked at routine duties processing train information for further handling.

The yard-freight clerk did not physically check the yard to determine the accuracy of the turnover book nor had this been the practice.

D. Description of the Accident

1. Extra 5701 East Prior to Accident

Extra 5701 East left Laurel, Montana at 9:15 p.m. March 27, 1971. En route to Sheridan, the crew stopped at Huntley, Montana, to examine the train register in accordance with train order No. 497, and at Parkman, Montana, to meet train No. 75.

As Extra 5701 East approached Sheridan Yard at a speed of approximately 30 m.p.h. and at a distance of about 3 miles, the head brakeman called the yard office by radio to determine what track the train should enter. In response to his call, the yard-freight clerk assigned the main track. In addition, in response to a query from the brakeman, the engine crew was instructed to take the locomotive to the roundhouse. The testimony of a United Transportation Union local chairman at the BN investigation indicated, that he and train crewmembers of another train had been told by a supervisor at another time, that when a crew was told to yard a train in a track and were told it was clear, then the crew could assume that the track was in fact clear.

Extra 5701 East passed the yard limit sign without the crew's acknowledging it to each other as required by Rule 34 of the Consolidated Code of Operating Rules. Similarly, they passed the approach signal indicating approach without calling the signal to each other as required by rules.

As the train continued into the yard, the speed was reduced effectively by dynamic braking, and as they approached the spring switch protective signal, the head brakeman noted it was green. At that time he was putting on his coat and the engineer was putting away some coffee cups. Suddenly the head brakeman saw cars standing on the main track ahead at an estimated distance of 10-car lengths. Visibility was reduced noticeably because of a blowing snow. He yelled that there were cars on the main track, then left the engine cab through the left

door and jumped to the ground. He did not pull the emergency brake lever located on the control panel of the 5701. (See Figure No. 3) When the brakeman sighted the cars on the main track the speed of the train had been reduced to an estimated 10-15 miles per hour.

Before he left the cab, the brakeman heard the engineer tell the fireman to "big hole" the train, meaning to apply emergency braking. This was the last the brakeman remembers of the engineer or of his actions. As he left the cab, he saw the engineer standing in the center of the locomotive cab, and was under the impression that the engineer was following him.

The head brakeman jumped from the left side of the locomotive and landed on his side. He slid several feet into an irrigation ditch, where he lay for a few minutes, apparently stunned.

When the head brakeman called the yard office at Sheridan for yarding instructions, the conversation was overheard on the caboose by the conductor and rear brakeman. At the conclusion of the conversation between the locomotive and the yard office, the conductor called the locomotive and told the head brakeman to show on their time cards arriving at 1:15 a.m. and "tying up" at 1:20 a.m.

The conductor noted the train was slowing down at this time. He was seated at his desk when he felt a severe jolt and the train brakes apply in emergency.

Since he was seated with his back to the east wall (to the front of the train) when the collision occurred, he suffered no ill effects from the abrupt stop. The rear brakeman was descending from the cupola when the collision occurred. He suffered some bruises but sustained no serious injuries.

2. Collision

The point of collision was 348 feet east of the spring switch protective signal. Locomotive units 5701, 6457, and 6482 were derailed. The 5701 derailed to the south, leaning at a 45°



7

Figure 3.—Locomotive cab interior showing the emergency brake valve.

angle, and stopped 49 feet from the main track and 148 feet east of the point of impact. (See Figure No. 4) The 6457 and 6482 stopped in an upright position in line with the main track.

The head three cars and the 22nd through 26th cars were derailed and stopped in various positions on or near the track.

In addition to the derailed diesel units and cars of Extra 5701 East, the first three cars on the west end of the standing train were derailed.

3 Post Collision Activities

Immediately following the collision, the head brakeman returned to the locomotive units and attempted to mount the steps to gain entrance to the cab in order to use the radio to call for help. He found he could not do this because of an injury. He then crawled under the freight cars and went to a company telephone booth adjacent to the track to get help. The communication lines were torn down by the scattered wreckage and again his efforts to obtain help were thwarted. He then decided to try to reach a nearby restaurant to use a telephone to call for help. At that time, the conductor and rear brakeman arrived at the head of the train.

After the brakes were applied in an emergency application, the conductor tried unsuccessfully to contact the locomotive by radio. Therefore, he and the rear brakeman started walking to the head of the train.

At the stock yard crossing they found 5 cars derailed and they surmised this was the cause of the emergency brake application. They continued on eastward and as they neared the east end of the train, they could hear the head brakeman moving about. Apparently, the head brakeman saw the lights of the conductor and rear brakeman as they approached and went toward them. When they met, he told the conductor and rear brakeman of the wreck and the need for help. The conductor immediately started for the aforementioned restaurant to call

for help. At the restaurant, the conductor called the ambulance and the relay operator. He told the relay operator to call a doctor, and all railroad officials concerned. By the time he left the restaurant, the police and an ambulance were arriving at the scene. He also met the outbound crew and sent them to the locomotive.

The assistant superintendent was the first BN official to arrive at the scene after the collision. He had been notified by telephone at about 1:25 a.m., March 28, 1971, and arrived on the scene at approximately 1:40 a.m. The ambulances were there when he arrived. One of the first persons he met was a roundhouse machinist who told him they had not located the engineer. The assistant superintendent went to diesel unit 5701 where he saw the fatally injured fireman. He described his position as "on the deck of the engine sitting upright on the right hand side of the cab with his back facing east." He qualified this by saying that the fireman's back was toward the window in front of the engineer's seat.

As the assistant superintendent left unit 5701, the machinist found the body of the engineer 12 to 14 feet west of the locomotive cab. At this time, the doctor arrived and was directed to the fatally injured engine crewmembers.

The road foreman of engines arrived shortly after the arrival of the assistant superintendent. He found out from the conductor who the engine crew was and then went to the derailed engines. Upon his arrival he made a cursory survey of the wreckage and debris, but waited until the bodies of the two crewmen had been removed before he began his inspection of the locomotive.

During his examination of the locomotive, he observed the position of the operating controls. The positions of the throttle lever and the selector lever indicated that the locomotive was operating in full forward dynamic braking. The position of the automatic brake valve lever



Figure 4.—Derailed unit 5701 showing location, position, and general condition after impact.

indicated a full service application had been set. He also noted that a journal box packing hook was placed on the safety control foot valve so as to hold it in an inoperative position when foot pressure from the valve was relieved. Its use in this manner defeated the purpose of the control valve. Figures 5 and 6, respectively, show the operating controls and the foot valve control

Shortly after talking to Extra 5701 East, the yard-freight clerk left the yard office at approximately 1:15 a. m. to pick up the inbound crew off of Extra 5701 East. When he arrived at the scene of the collision, he saw and was aware of it for the first time. Upon arrival he talked to the rear brakeman, who told him the events as he knew them. The clerk then left the scene to telephone those in authority of the circumstances. After making the phone calls he obtained a portable radio and returned to the scene of the accident to help.

E. Casualties and Damages

The engineer and fireman were killed in the collision. At a coroner's inquest held in Sheridan, Wyoming, March 31, 1971, the examining medical doctor testified that the engineer had among other bodily injuries, "an obvious depressed skull fracture involving the left frontal and parietal areas of the * * * skull * * *." It was his opinion that death was due to the head injury. He further testified that the fireman had, among others, an injury to his neck of the nature usually caused by a fracture dislocation of the cervical spine. He said in his opinion, the fireman died of, "a fracture dislocation of the cervical spine, plus probable head injuries."

The injuries of the head brakeman were identified as bruises, lacerations, and a broken little finger. The rear brakeman incurred bruises on his body as a result of being knocked down in the caboose when the brakes went into emergency.

Equipment damage is shown below.

| <u>Diesel Units</u> | <u>Damage</u> | <u>Cost</u> |
|---------------------|---------------|-------------|
| BN 5701 | Demolished | \$175,000 |
| BN 6482 | Heavy Damage | 12,000 |
| BN 6457 | Heavy Damage | 10,000 |
| Freight car damage | Total | \$70,000 |
| Track damage | | \$20,000 |
| | Total | \$197,000 |

The cab of diesel unit 5701 was not crushed nor badly deformed. When the locomotive hit the first car on the main track, the car started to climb up over the hood of the locomotive, but the corner of the car apparently dug into the locomotive nose and was restrained. The force of impact caused the locomotive to move to the right while the car travelled to the left without overriding the locomotive cab. It appears that with the exception of the left front corner of the cab, most of the damage resulted from loose objects within the cab. The three seats in the cab were thrown from the floor support columns. The front windows were badly cracked, but intact. The left front cab door was distorted considerably by the impact and hung as a twisted mass to the left side. The corner post around the side window was bent considerably but remained substantially in place. The seats which were fastened to the floor supports with pins became detached and were tossed around the cab. (See Figures 5 and 6.)

The window in front of the engineer's position appears to have been struck from within by a heavy object. Figure No. 5 shows the throttle handle and the selector handle bent downward. The radio speaker head and support bracket were broken.

Figure No. 6 shows a large adjustable wrench lying on the floor beneath the engineers seat.

F. Applicable Operating Rules

1. Train and Engine Crews

The Burlington Northern uses a consolidated code of operating rules which is used by a

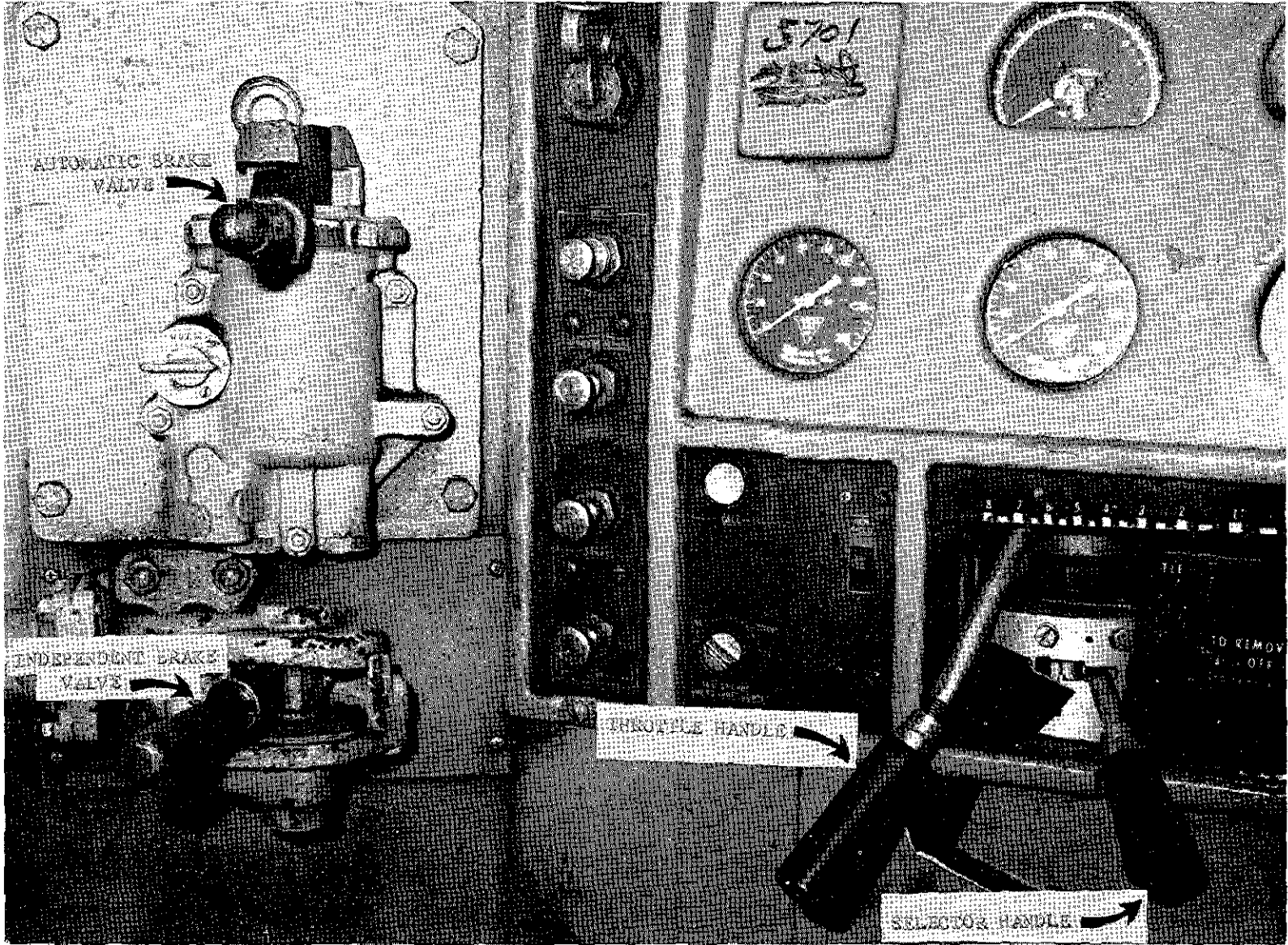


Figure 5.—Locomotive cab interior showing the brake levers and the operating controls.

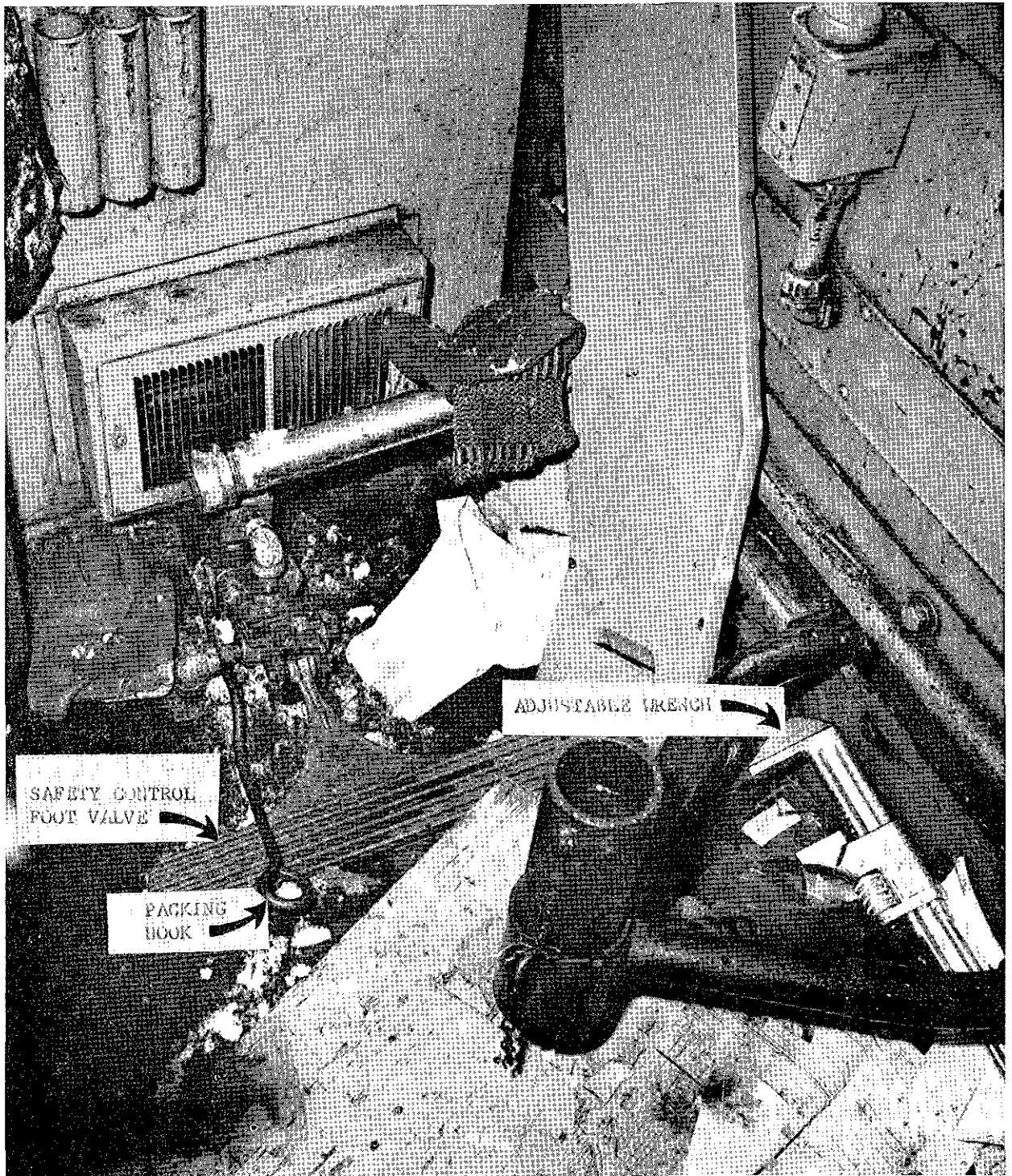


Figure 6 —Interior of Locomotive Cab—Engineer's Side

number of other railroads. The following rules of the BN, in effect June 1, 1967, are considered applicable to this accident:

“Definitions

- a. Fixed Signal—A signal of fixed location indicating a condition affecting the movement of a train or engine.

Note—The definition of a “fixed signal” covers such signals as switch * * * Such signs as * * * Yard Limit Signs, * * * and other means for displaying indications that govern the movement of a train or engine

- b. Reduced Speed—Proceed prepared to stop short of trains, engine or obstruction

34. All members of the crew in cab of engine must, * * * communicate to each other by its name the indication of each signal affecting the movement of their train * * * as soon as it becomes visible * * *

93 * * * Within yard limits the main track may be used, clearing first class trains when due to leave the last station where time is shown * * * Second and third class trains, extra trains and engines must move within yard limits at reduced speed unless the main track is known to be clear.¹

108 In case of doubt or uncertainty, the safe course must be taken.

804. Members of trains and engine crews * * * keep in mind the requirements of rules, timetables, train orders, special instructions, bulletins or general orders and messages affecting the movement of their train, and must call attention to or take

necessary action in event of any oversight or mistake.

804A Other members of the crew in cab of engine must give instant notice to the engineer of any signals or indication of danger or obstruction, * * *

804B. When conditions or signals require that the train be stopped or speed of train be reduced and the engineer or conductor fails to take proper action to do so or should the engineer become incapacitated, other members of the crew must take immediate action to stop train, using emergency brake valve if necessary.”

2. Yard Service Personnel

The clerical forces at the Sheridan yard office are not examined on the book of operating rules, but they are subject to certain rules. The rules to which they are subject and which are applicable in this instance are set forth below

803 Where no yardmaster is employed, such employees will be governed by instructions of agents in doing work at stations.

803A The yardmaster is responsible for and shall have direct supervision over the work of yard crews, clerks and all other employees working in the yard. He must see that they carry out their work in a safe, efficient and economical manner, in accordance with the rules, regulations and instructions of the company. He is charged with the prompt and regular movement of cars, also giving special attention to the proper make-up of trains and to their prompt movement into and out of the yard.

Rule C. Any violation of rules or special instructions must be reported promptly to the proper authority

¹See Appendix III

Special Instructions Covering The Turnover Book:

“This book we have in the yard office will be used to mark clear and occupied tracks in Sheridan yard and notations must be made by the Yardmaster or Footboard Yardmaster on completion of his tour of duty and initialed showing the time. When Yardmaster and Footboard Yardmaster are not on duty it will be the responsibility of the Yard Clerk to know what tracks are clear and what tracks are occupied, making proper notations in the book and they also should initial the book and show the time.

Yardmaster and Footboard Yardmaster use separate pages.”

G. Yard Office

1. Turnover Book

The turnover book is a document of record in which the yardmaster and footboard yardmaster record the status of the tracks in Sheridan yard. The turnover book was established, and instructions for maintaining it were issued, by the assistant superintendent. It covered the 13 yard tracks, the scale track, and sometimes if applicable, the mainline. The turnover book was designed to reflect the condition of the yard at the end of a tour of duty of either the yardmaster or footboard yardmaster. However, it could reflect the condition of the yard several hours hence, because in application, certain tracks were designated for trains enroute to Sheridan, and consistent with instructions, they were yarded on the tracks indicated in the book. Appendix 2 is a copy of the turnover book record for March 27, 1971.

Entries for the mainline were infrequent. The status of the mainline was not shown daily. Further, it required only the initials of the supervisor entering data in the book. Abbreviations and phrases used were not standard or generally known except by those thoroughly familiar with the yard operation.

2. Footboard Yardmaster

The footboard yardmaster is shown on the switchmen's seniority roster as having service commencing March 19, 1970. He had worked as a switchman since September 1970 and was promoted to footboard yardmaster November 1, 1970. His experience as footboard yardmaster covers a period of five months prior to the accident. There is no record of his training background, but because of his short employment, his experience was limited

The footboard yardmaster works the shift 3:45 p.m. to 11:45 p.m. daily except Saturday and Sunday. He is responsible for the operations of the yard crew, assigning tracks for various uses, and the yarding of trains and other general duties normally a part of the job. One of his responsibilities is the recording of the yard track situation in the turnover book, based on his first hand knowledge. The turnover book is used by the 11 p.m. to 7 a.m. yard-freight clerk for his guidance, in the absence of the footboard yardmaster, in assigning tracks to inbound trains or for yard movements. Additionally, the turnover book is used by an early-morning crew to assist in determining the yard situation and the planning of immediate work. The footboard yardmaster also has the responsibility, as the immediate supervisor of the yard-freight clerk, to make an orderly, understandable transfer of the turnover book and to describe the general yard situation to the clerk at 11:45 p.m.

3. Yard-Freight Clerk

The yard-freight clerk was hired by the Norfolk and Western Railroad Company as a yard clerk at the Hazelwood Yard, St. Louis, Missouri, in December 1966. He resigned his position there in September 1967 and went to work for the Chicago Burlington and Quincy Railroad on October 14, 1967, at Denver, Colorado. His first duties there were those of an extra clerk. He then took an assignment as a general yard clerk assigned to the extra board

and later as the Perpetual Car Identification (PCI) clerk. He continued in this position until August 1970 at which time he became chief clerk at the 38th Street Yard Office in Denver. When the job opening occurred in Sheridan, Wyoming, he was the successful applicant and was assigned the yard-freight clerk's job at that point. He began work at Sheridan January 22, 1971.

His instructive training period at Denver was for one week, after which, he began working his assignment as a fully responsible incumbent. Work consisted of billing cars, operating machines, and general office work. On his shift he also managed the switchmen's and yard clerks' extra boards, and operated a keypunch machine.

His training in Sheridan consisted of an 8 hour tour of duty with the second-trick (3 p.m. to 11 p.m.) clerk. He then began working the job on his own. The only similarity between his previous positions and the job at Sheridan was the billing of cars, some paper work and handling of IBM coded data cards. He received no instruction in the use of the radio; however, he was told to use it.

The yard-freight clerk is responsible for a number of assignments during his 11 p.m. to 7 a.m. tour of duty. The duties of the job according to a Position Bulletin are as follows: "Check and list trains, make arrival and departure reports, call and haul crews, must be competent typist and operate key punch machine." According to the agent at Sheridan and the assistant superintendent, the clerk is required to do many things incidental to those duties described on the Position Bulletin. No evidence indicates that he was required or expected to verify the accuracy of the information left in the turnover book for his use.

H. Weather

The weather as reported by the weather station at Sheridan for Sunday March 28, 1971, at 1 a.m. was:

"Snowing, wind 310°, 5 knots or about 6 m p h."

The weather bureau further provided information that it, "started snowing at 10:30 p.m., March 27 and ended at 3:47 a.m., March 28, 1971. Cloud cover, 800 feet and scattered."

The crew of Extra 5701 East indicated heavy wet snow was falling with a brisk wind blowing and a temperature of about 34°F

III. ANALYSIS

A. How the Instructions Governing Entrance to Sheridan Yard Affected the Accident.

The special instructions for the 17th Sub-division cover in detail (Appendix 1, Item 7) the procedure for a westbound train to get into Sheridan Yard, but there are no instructions outlining the procedure for eastbound trains. It cannot be stated with certainty that similar procedures for eastbound trains would have prevented this accident; however, they may have lessened the severity of the collision. The speed of the train at impact undoubtedly would have been less, possibly avoiding the fatalities.

B. How the Operating Rules Were Involved

Rule 93, the Consolidated Code of Operating Rules, states in part, "Within yard limits the main track may be used, clearing first class trains when due to leave the last station where time is shown." "May be used" has no qualification; therefore, there is no specific usage set forth for the main track. There were no first class trains to be considered; therefore, insofar as the yard forces at Sheridan were concerned, the main track within yard limits was another yard track. Rule 93 further states, "Second and third class trains, extra trains and engines must move within yard limits at reduced speed unless the main track is known to be clear." Extra 5701 East was not told the main track was clear, but

that the train should be delivered to the yard on the main track. The crew of Extra 5701 East was still obligated to operate their train at reduced speed in compliance with Rule 93; however, in the absence of other indications to the contrary, such as singlas, message, etc., they could accept this with assurance that the main track was clear. Statements by employees at the BN hearing lead one to believe that supervisors have told train and engine crewmembers that when a yardmaster or his designee assigns a track for use as being clear, then the crew may assume that the track in fact has no other cars or locomotives on it. This system cannot be effective unless a constant check on track occupancy is maintained by those assigning the use of the tracks. In this case, it is obvious that the clerk did not know the actual condition of the track assigned for use.

According to Rule 93, Extra 5701 should have been moving at such a speed that it could be stopped before striking those cars on the main track. Since the train's speed has been reduced considerably after it entered yard limits, it appears that the crew knew they were subject to yard limit restrictions. It also appears that the assumption that the main track was clear influenced the engineer's decision as to how fast to run

The vagueness of Rule 93 and the absence of specific instructions governing the use of the main track within yard limits leaves it open to interpretation. From the records available, there is no indication that the train dispatcher in Glendive had been alerted to the prolonged blockage of the main track at Sheidan. If he knew of the cars on the main track, he should have issued a train order or a message to Extra 5701 East to be on lookout for cars or that the main track was blocked by cars. The cars had been on the main track for 9 hours 40 minutes, ample time for written notice to be given to scheduled or extra trains.

Rule No. 34 in part directs that all members of the crew in the cab of the engine must, and other members of the train crew will, when

practicable, communicate to each other by its name the indication of each signal affecting the movement of their train or engine as soon as it becomes visible or audible.

By definition in the BN operating rules, the yard limit sign, the advance signal, and the semaphore signal at the spring switch are fixed signals; however, there was no acknowledgement in the locomotive cab of these signals. Although these signals may not have been used in a standard way, they were fixed signals, and allowing employees to disregard them in the application of Rule 34, can only lead to a degradation of their effects. Further, this laxity in applying Rule 34 may lead to the failure to acknowledge the standard fixed signals which are so important to safe train operations. Signals which require no positive response are unimpressive and may contribute very little to the safety of train operations.

C. The Signals Governing the Approach Provided Inadequate Operating Information

The signals governing the approach to the yard are arranged so that they convey information that may be misleading to the crew of a train approaching the yard. The advance signal constantly displays the yellow (approach) aspect indicating, according to BN rule, that the train should approach the next signal prepared to stop. Contrary to this, Extra 5701 East found the next signal, the switch indicator semaphore signal, displaying a green (clear) aspect. The engineer would find the switch indicator displaying a red aspect if cars were standing within 175 feet east of the spring switch, or if the switch points were not properly fitting the stock rail, or if the switch were aligned for a diverging movement from the main track. When the engineer of the train first sees this red aspect, he does not know which of the conditions pertain. The responsibility for determining the conditions and setting the appropriate speed rests entirely with the engineer. The BN rules do not specify whether the red aspect on the switch

indicator signal indicates stop, stop-and-proceed, or proceed at restricted speed. Clearly, if an engineer is to maintain a speed with a freight train that will assure that he can stop his train short of an obstruction or an improperly lined switch, it must be a virtual snail's pace.

The advance signal is redundant and contributes nothing to safety. The yard limit sign precedes the advance signal; therefore, the train should have been at reduced speed when it passed the advance signal. Since the advance signal does not give advance information about the position of the spring switch or the occupancy of the main track, it is superfluous.

D. The Inconsistency in Recording Information in the Turnover Book

The absence of established and enforced procedures for filling out the turnover book could lead to the omission of pertinent information. This also allows the recording of information in varying, non-standard language and formats which can be interpreted in a variety of ways. In this case the entry relating to the occupancy of the main track was not made regularly. On the date of the accident the entry "ML extra west in" (see Appendix 2) was not made in an orderly manner and could have been mistaken for a temporary note or could have been overlooked.

The notation "Extra west in" did not always mean that train had already arrived on that track, but sometimes it meant that it should be yarded on that track when it arrived. Therefore, identically worded notations meant different things to different people on different tours of duty. Under this system the notation became useless unless clarified by the person making the notation.

E. The Training and Experience of the Employees

The footboard yardmaster and the yard-freight clerk, with a questionable background in

training and experience, were required to make judgments. Neither employee had worked long enough to develop the appreciation for potential hazards gained by more experienced employees, and that lack of experience had not been compensated for by training. If the footboard yardmaster had been more experienced, he would have recognized the inadequacies of the inexperienced clerk, and could have been more positive and specific in the transfer of information. A simple caution to the clerk concerning the unusual storage of cars on the main track would have been effective.

Similarly the small amount of training and experience of the yard clerk affected his judgment. A more experienced clerk or one who had been trained in the hazards of train operations may have questioned the entry concerning the cars on the main track. Also, if the clerk knew the cars were on the main track, a simple word of warning to the engineer of Extra 5701 East would have prevented the collision.

The duties of the position, in practice, were over and above those called for in the job description and for the classification of the job. The duties were many and varied, including those of hauling crews which took him away from the immediate vicinity of the yard office. The yard clerk had a right to expect the turnover book to be accurate as reflecting the judgement and knowledge of his supervisor. He was not required to check the yard personally to verify the conditions set forth in the book. His instructions directed that he check the book.

The yard clerk came on duty at 11 p.m. and was confronted immediately with distraction and confusion. Shortly after he reported for duty he was left alone because the 3 p.m. to 11 p.m. clerk and the footboard yardmaster left. He had been given a train lineup which led him to believe the mainline was clear. His lineup indicated that the extra west was expected in about 11 p.m.; therefore, it was overdue which no doubt confirmed his belief that the main track was clear. The second-trick clerk had told his

relief that the motive power off the local west would be used on a westbound train. He did not specify the location of this train and no mention was made of the mainline, its condition, etc. The clerks' lineup also stated that there would be an extra west local run about 2 a.m. Therefore, there are factors in the lineup, the turnover book with its past usage and notation, and the information given the third-trick clerk by the second-trick clerk, that could support the understanding indicated by the third-trick yard-freight clerk.

One might ask why the yard clerk assigned Extra 5701 East to the mainline if he understood that the mainline was to be used for a westbound extra which had not arrived. Normally the extra east would not have been in the yard long, but the fact remains that the westbound extra was already long overdue. The experience and training of the clerk did not qualify him to make this type of operating decision. Further, this responsibility was beyond the scope of the yard clerk's assigned duties. The number and kinds of duties actually required of the clerk may have been too much of an occupational load for his experience and training.

F. The Train Braking Technique

The question arises as to the propriety of the braking technique in use immediately before the collision. When a service application is made with the locomotive in full dynamic braking as the 5701 was, airbrakes on the locomotive do not operate. When the speed of the train decreases, the effectiveness of the dynamic brake decreases until it is ineffective at slightly less than 10 miles per hour.

It could not be determined why the fireman made a full service brake application instead of an emergency brake application when he saw the cars ahead. Probably in his haste to get out, he did not move the brake valve handle far enough

to initiate an emergency brake application. The effect was a full service application of the train brakes with only a slight dynamic brake on the locomotive. If the "dead-man" pedal had not been held down by the packing hook, there would have been a full service brake application on the locomotives when the fireman left his position.

If an emergency brake application had been initiated, the locomotive and all cars would have received an emergency application of their brakes. The emergency application would have been propagated rearward more rapidly than the service application and the slightly quicker retardation may have lessened the effect of the collision. Because of the short distance for stopping after the cars were sighted, the train could not have been stopped short of the collision.

The effect of the brakeman's actions must be considered. If the brakeman had operated the emergency brake lever which was readily accessible to him on the back of the control stand, when he first saw the cars, an emergency brake application would have been initiated immediately. It has been noted in many investigations that trainmen are reluctant to override the control of the engineer (or fireman) except in cases where the engineer is incapacitated.

G. Crashworthiness of the Locomotive Cab

The interior of the locomotive cab was in complete disarray. Indications were that objects from within the cab caused some of the damage. The locomotive controls indicate a heavy object hit them and bent them downward out of alignment. (See Figure 5.) This may have been the body of the fireman as he pitched forward upon impact because of lack of restraint. The badly cracked window in front of the control position is also indicative of having received a blow from within. Since the window was not penetrated, which would eliminate a heavy hard object, there is the possibility that this blow was

struck by the fireman. This is further supported by the fact that his body was found directly under this front window.

It is doubtful that the radio speaker head and support bracket would have been broken by the force of the impact because there is very little mass involved. This again points to the possibility of a flying object hitting them.

Figure No. 6 shows a heavy adjustable wrench lying on the floor, unsecured. A storage facility should be provided and used for stowing tools, or they should be securely fastened to a suitable restraint. Any object with an appreciable mass left unsecured within the cab of a locomotive is potentially dangerous.

The injury to which the death of the fireman was attributed was a broken neck, possibly incurred when he was thrown against the windshield. He sustained other injuries caused by his own unrestrained movement or by being hit by flying objects. It is highly probable that the fireman would have survived the impact and wreck if there had been a seat belt and/or padding around the control position.

IV. CONCLUSIONS

1. The lack of specific instructions covering the approach and entrance to Sheridan Yard from the west leaves the election of procedures to the individual responsible for the approach.

2. Rule 93 was violated when Extra 5701 East was unable to stop short of a collision.²

3. Rule 34 was violated when the locomotive passed the yard limit sign, the advance signal, and the switch indicator signal without the acknowledgment by the crew in the cab.

4. Rule 93 is indefinite as to the use of the main tracks in yard limits.

5. The inoperable approach signal is of no significant value in governing the approach of a

train into Sheridan yard. The yard limit sign serves the same purpose and the signal per se is redundant. If it were connected to operate in conjunction with the spring switch protective signal, it would attain a state of reality and become significant.

6. Employees believed that the assignment of a track for use indicated that there were no other cars or locomotives on that track.

7. The inconsistent manner in which the turnover book was used made it inadequate as an effective system of transferring operating information from one shift to another.

8. The training and experience of the footboard yardmaster and the yard-freight clerk did not qualify them adequately for the responsibility assigned them.

9. Blocking the safety control foot valve pedal with the journal box packing hook nullified its basic purpose as a safety feature.

10. The use of emergency braking when the cars were sighted would have been preferable to full service braking; however, it would not have stopped the train short of a collision.

11. The absence of crash injury protection in the locomotive contributed to the severity of injury received by the fireman.

V. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the operation of Extra 5701 East at such a speed that it could not be stopped before it collided with cars standing on the main track.

Factors contributing to the occurrence of the accident were:

1. Ineffective, and unenforced operating rules.
2. Ineffective and misleading signals.
3. Assigned responsibilities beyond the abilities of inadequately trained and instructed employees in the Sheridan yard.

²See Conclusion 11(b), NTSB Railroad Accident Report, New York Central Railroad Company, Train 1/NY-4, Extra 2020 East and Train ND 5, Extra 5305 West, Head-on Collision, New York, New York, May 22, 1967.

4. Inadequate organization and procedures in the Sheridan Yard operation.

VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

1. The Burlington Northern revise the turn-over book system at Sheridan Yard, and anywhere else that it is used, so that the transfer of information is clear, concise, and accomplished in a consistent manner. The system should assign responsibility for accurate preparation of the information as well as acknowledgement of receipt and understanding.
2. The Burlington Northern analyze the operation at Sheridan Yard as it relates to the fixed signals and the operating rules, reconcile the rules and procedures, and require compliance with rules by the operating personnel.

3. The Burlington Northern re appraise its personnel training and qualification practices and the assignment of duties to employees, and take corrective action where warranted.

The Safety Board reiterates the recommendation made in its report of the freight train derailment and passenger train collision with a hazardous material car on the Penn Central at Sound View, Connecticut, on October 8, 1970:

“The Federal Railroad Administration continue to a conclusion its recently initiated efforts in the matter of the improvement of the design of locomotive operator compartments to resist crash damage, and in conjunction with the Association of American Railroads undertake a review of modern design crashworthiness concepts in an effort to identify areas of applicability in the railroad industry.”

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ LOUIS M THAYER
Member

/s/ ISABEL A. BURGESS
Member

Francis H McAdams, was absent, not voting.

April 26, 1972

YELLOWSTONE DIVISION SIXTEENTH SUBDIVISION

- 1 **Speed Restrictions—**
 Zone—Between Maximum Speeds Permitted
- | | |
|---|---------|
| Sheridan and M P. 723..... | 45 MPH |
| M P 723 and M P. 757..... | 49 MPH |
| M P 757 and Anita—trains containing cars exceeding 273,000 lbs..... | 30 MPH |
| M P 757 and Anita..... | 45 MPH |
| Anita and Huntley..... | 49 MPH. |
| Curves between M.P. 705 0 and M P 706.2 | 30 MPH |
| Hardin: Engine or leading car over Center Street west of passenger depot | 15 MPH |
| Hardin North Line — Maximum Speed | 10 MPH |
| An octagonal yellow sign with horizontal black stripe displayed on the right of the track will indicate the beginning of slow track | |
- 2 **Bridge and Engine Restrictions—**
 SD-24, SD-45, U25C, U28C and U33C engines:
- | | |
|--|---------------|
| Between Sheridan and M.P. 723. .. | 40 MPH. |
| Between MP 757 and Anita | 30 MPH. |
| KiewitPower house lead, beyond R R Xing | |
| Big HornTail track beyond middle chute of stockyards | |
| Hardin North LineMain track beyond Bridge 2 09 | |
| 250 ton wrecking derrick and CBQ derrick 204620: | |
| Between Sheridan and Huntley | 25 MPH |
| Hardin North Line | Not permitted |
| Other derricks | 10 MPH. |
- Except:**
 Maximum gross wt of cars handled on Hardin North Line Spur beyond M P 1 60 and on Fort McKenzie Spur must not exceed 220,000 lbs
 Engine consist of passenger units must not exceed six (6) units in passenger or freight service
 Engine consist of freight units must not exceed eight (8) units in freight or passenger service.
3. **Heavy Cars—**
 Cars heavier than the following not permitted without authority of Superintendent:
- | | |
|--|-------------|
| 40 ft or less in length | 220,000 lbs |
| Over 40 ft long | 263,000 lbs |
| EXCEPT on Subdivisions 1, 2, 3, 16 and 17, cars over 52 5 ft. long | 315,000 lbs |
- 4 **Train Register Exceptions—**
 At Huntley, Trains will register when instructed to do so.
- 5 **Clearance Provisions and Exceptions Rule 83(B)—**
 In addition to Clearance received at Sheridan for movement on Sixteenth Subdivision additional Clearance for movement on the Third Subdivision must be secured
 Hardin North Line between M P 783 5 (Hardin) and M P 2 6 within yard limits
 Billings: Trains must secure Sixteenth Subdivision clearance
- 6 **At Sheridan—17th Subdivision instructions govern.**

YELLOWSTONE DIVISION SEVENTEENTH SUBDIVISION

- 1 **Speed Restrictions—**
 Zone—Between Maximum Speeds Permitted
 Freight
 Edgemont and Sheridan 49 MPH
 Curves between
 M.P 520 7 and M P 521 0 30 MPH
 M P 609 9 and M P 613 9 45 MPH
 M P 675 2 and M P 676 2 45 MPH
 Between Sheridan and Edgemont—
 Trains handling coal in 100 ton cars 40 MPH
 Through all Turnouts 10 MPH
- 2 **Bridge and Engine Restrictions—**
 250 ton wrecking derricks and derrick CBQ 204620:
 Between Edgemont and Sheridan 25 MPH
 Engine consist of passenger units must not exceed six (6) units
 in passenger or freight service
 Engine consist of freight units must not exceed eight (8) units
 in freight or passenger service
 SD-24, SD-45, U25C, U28C and U33C engines, not permitted
 on the following tracks:

| Location | Local Name of Track |
|-----------------------------|--|
| Sheridan | L-3 track beyond switch to No 109 track M tracks beyond Grinell Street City 4 track City 2 track City 3 track Sugar factory spur |
| Fort McKenzie Spur. | Bridge 0 48 to end of track |
- 3 **Heavy Cars—**
 Cars heavier than the following not permitted without authority
 of Superintendent:
 40 ft or less in length 220,000 lbs
 Over 40 ft long 263,000 lbs
 EXCEPT on Subdivisions 1, 2, 3, 16 and 17, cars
 over 52 5 ft. long 315,000 lbs
- 4 **Clearance Provisions and Exceptions Rule 83(B)—**
 Gillette—Operator on duty 8:00 A.M. to 4:00 P M and 6 P M -
 2 A M. daily.
 Unless otherwise provided, conductor or engineer or both, arriv-
 ing at Gillette on all trains must deliver all clearance forms, train
 orders and messages to relieving conductor or engineer, or both
 When operator on duty, trains must receive clearance in addi-
 tion to receiving all clearance forms, train orders and messages
 held by conductor and engineer relieved
- 5 **At Edgemont Alliance Division Instructions Govern—**
- 6 **At Edgemont—**
 No. 12 track Edgemont yard will be used as a runaround track.
 All switches leading off this track must be lined back for run-
 around track after being used, except will not apply to eastward
 or westward freight trains leaving yard.
- 7 **At Sheridan—**Normal position east switch is for old main track
 Freight trains approaching Sheridan from east must stop at Mill
 track switch and if no advance notice of track to be used and ab-
 sence of a signal from yardman will proceed to yard office where
 brakeman will receive necessary instructions Light engines ap-
 proaching from east must stop east of First Street and then
 proceed without signal, heading in on independent lead opposite
 unloading platform.

| | | | |
|----|-----------------------|-------|--|
| | 3-27-71 | | |
| | Scale C | | |
| | ML Ex West in | | |
| 1 | C | | |
| 2 | C | | |
| 3 | C | | |
| 4 | C | | |
| 5 | X chip - Ex W (E End) | | |
| 6 | No B | | |
| 7 | Hops | | |
| 8 | Hops + No B - X Beet | | |
| 9 | Hops out 79 | | |
| 10 | C | | |
| 11 | X Hops | | |
| 12 | C | | |
| 13 | Usual | | |
| | | MJM | |
| | | 11:45 | |

| | |
|---------------|-------------------------|
| | 3 - 27-- 71 |
| Scale | C |
| ML Ex West in | |
| 1 | C |
| 2 | C |
| 3 | C |
| 4 | C |
| 5 | X Chip - Ex W (E End) |
| 6 | No B |
| 7 | Hops |
| 8 | Hops & No B & X Beet |
| 9 | Hops out 79 |
| 10 | C |
| 11 | X Hops |
| 12 | C |
| 13 | Usual |
| Initials | MJM |
| | 11:45P |

Copy of a page from the Yard
Turnover Book, 11:45PM March
27, 1971.

APPENDIX NO. 3

Copy of Statement Made by R. E. Foid, Local Chairman, UTU, at BN Hearing Regarding Extra 5701 East

"On July 7, 1970, an investigation was held at Sheridan to determine the facts involving a derailment that occurred while a crew was doubling a train over at the west end of Sheridan Yard. At about 3:05 a.m. on June 30, 1970, the crewmembers involved were instructed by radio to bring their train down track No. 3 and double to No. 8 track. In the process of doubling over, a train that was already on No. 8 track was hit by the cars being doubled over, resulting in derailment of two cars and damage to three other cars. After the investigation, this employee representative along with the principles involved in this investigation questioned local supervisory officers as to what course of action was to be taken to comply with Operating Rules in determining the tracks we were instructed to use and informed were clear. It was suggested that it might be necessary to have a member of the crew walk the entire length of the tracks involved or cut the engine off and run through the tracks with headlights burning to determine if the tracks were clear. This employee representative and the crew members under investigation were informed by local supervisory officers that this action would not be necessary and in the future we were informed by radio or other means that tracks could be used where clear and we could be assured the tracks would be clear. Shortly after this notice was posted in regard to the turnover book now being used by yard crews and clerks."