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RAILROAD ACCIDENT REPORT

Head-On Collision of Two
Burlington Northern Freight Trains
near Maquon, Illinois
May 24, 1972

NATIONAL TRANSPORTATION SAFETY BOARD



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Washington, D.C. 20591

Report Number: NTSB-RAR-73-4

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TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. NTSB-RAR-73-4	2 Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Railroad Accident Report - Head-On Collision of Two Burlington Northern Freight Trains near Maquon, Illinois, May 24, 1972.		5. Report Date April 11, 1973	
		6. Performing Organization Code	
7 Author(s)		8. Performing Organization Report No.	
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Surface Transportation Safety Washington, D. C. 20591		10. Work Unit No. 1064	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D. C. 20591		13. Type of Report and Period Covered Railroad Accident Report May 24, 1972	
		14. Sponsoring Agency Code	
15. Supplementary Notes This report contains Railroad Safety Recommendations Number R-73-19 through R-73-21			
16. Abstract At 6:37 p m , on May 24, 1972, two Burlington Northern freight trains, Extra 1577 West and Extra 2043 East, collided head-on near Maquon, Illinois. Four of the locomotive units of the trains were destroyed and the fifth was heavily damaged. The engineer and the head brakeman on each train were killed. The National Transportation Safety Board determines that the probable cause of this accident was the failure of the responsible employees to deliver to the crew of Extra 1577 West at Yates City, Illinois, a restricting train order which established a meet between Extra 1577 West and Extra 2043 East at Yates City. Two factors contributed to this failure First, Extra 1577 West did not stop at the Yates City station to obtain a copy of the train order, in disregard of the stop aspect displayed by the west- bound train-order signal at the station The reason the engineer failed to stop his train could not be determined. The Board, however, considers that because of the effect of alcohol and a misleading phantom clear aspect of the westbound train- order signal, the engineer may have failed to interpret the signal correctly Second, the employees involved with the transmission and handling of the restricting train order did not comply with the requirements of the operating rules to take special precautions for the safety of Extra 1577 West			
17. Key Words Railroad accident, head-on collision, freight trains, single track, train orders, passed train-order signal.		18. Distribution Statement Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151	
19. Security Classification (of this report) UNCLASSIFIED	20. Security Classification (of this page) UNCLASSIFIED	21. No. of Pages 26	22. Price

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Consolidated Code of Operating Rules

FOREWORD

The accident described in this report has been designated as a major accident by the National Transportation Safety Board under the criteria established in the Safety Board's regulations

This report is based on facts obtained from an investigation conducted by the Safety Board, in cooperation with the Federal Railroad Administration. The conclusions, the determination of probable cause, and the recommendations are those of the Safety Board

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

Adopted: April 11, 1973

HEAD-ON COLLISION OF TWO BURLINGTON
NORTHERN FREIGHT TRAINS NEAR MAQUON, ILL.,
MAY 24, 1972

I. SYNOPSIS

At 6:37 p m., on May 24, 1972, two Burlington Northern freight trains, Extra 1577 West and Extra 2043 East, collided head-on near Maquon, Ill. Four of the locomotive units of the trains were destroyed and the fifth was heavily damaged. Four employees, the engineer and the head brakeman on each train, were killed.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the responsible employees to deliver to the crew of Extra 1577 West at Yates City, Ill., a restricting train order which established a meet between Extra 1577 West and Extra 2043 East at Yates City. Two factors contributed to this failure.

First, Extra 1577 West did not stop at the Yates City station to obtain a copy of the train order, in disregard of the stop aspect displayed by the westbound train-order signal of the station. The reason the engineer failed to stop his train could not be determined. The Board, however, considers that because of the effects of alcohol and a misleading phantom clear aspect of the westbound train-order signal, the engineer may have failed to interpret the signal correctly.

Second, the employees involved with the transmission and handling of the restricting train order did not comply with the requirements of the operating rules to take special precautions for the safety of Extra 1577 West, the train which was being restricted by the order.

II. FACTS

The Accident

At 6:37 p m., on May 24, 1972, two Burlington Northern freight trains, Extra 1577 West and Extra 2043 East, collided head-on at a point 2.5 miles east of Maquon, Ill., on the 23d subdivision of Burlington Northern's Hannibal Division. The 23d subdivision, which extended 51.5 miles between Galesburg and Peoria, Ill., consisted of a single-track line which had been provided with four sidings for the passing of trains.

At the time of the accident, the only open station on the 23d subdivision was the station at Yates City, located about 23 miles east of Galesburg. Just west of the station, a 4,595-foot-long siding paralleled the main track on the south. (See Figure 1.) On the afternoon of the accident, a train order was issued at Galesburg for Extra 2043 East and at Yates City for Extra 1577 West to establish a meet between the two trains at the Yates City siding. This order, however, was not delivered to the crew of Extra 1577 West.

Impact occurred 15.1 miles east of Galesburg, 321 feet west of the east end of a 1°58' curve to the north. (See Figure 1.) The track east and west of this curve was straight for a considerable distance. Trees restricted visibility on the curve to about 450 feet on either side of the impact point. A one-percent downgrade began about

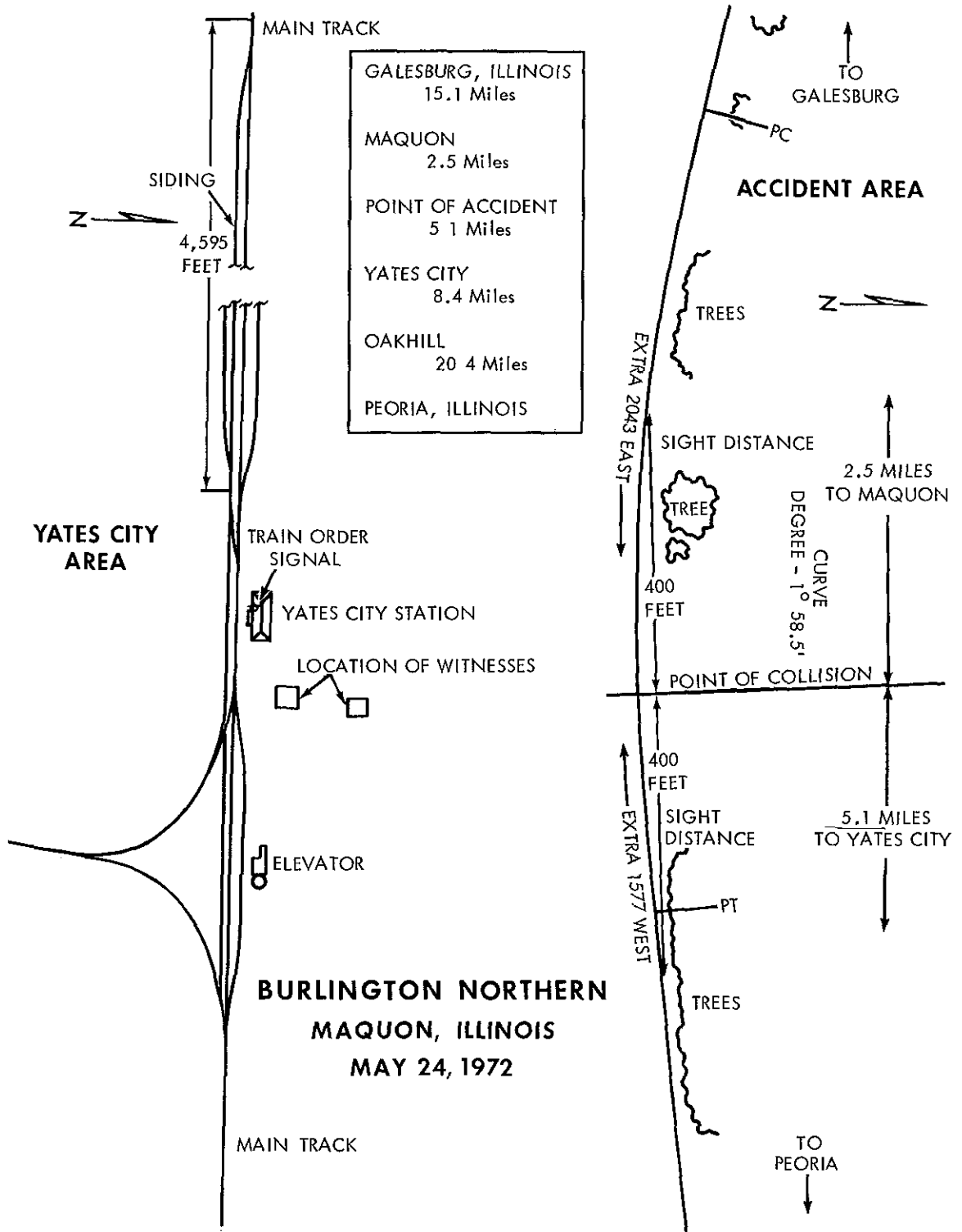


Figure 1 Map of the accident area

one mile east of the point of impact, increased to 1.8 percent at the impact point, and then leveled off

When each of the trains was about one mile from impact, Extra 1577 West was traveling at 47 m.p.h., and Extra 2043 East at 39 m.p.h. The maximum authorized speed for freight trains on the 23d subdivision was 40 m.p.h. When the trains collided, Extra 1577 West was traveling at 39.5 m.p.h., and Extra 2043 East was traveling at 41 m.p.h. The maximum authorized speed on the curve on which the accident happened was 30 m.p.h.

When the two trains were about 800 feet apart, the locomotive of each train became visible to the crewmembers in the locomotive of the other train. Just before impact, an emergency application of the brakes was made on Extra 1577 West. The conductor of that train, who was riding in the cupola of the caboose, said that his first knowledge of a problem was this emergency brake application, which was immediately followed by a severe impact.

After Extra 1577 West stopped, the conductor instructed the flagman, who was also riding in the caboose, to protect the rear of the train. The flagman proceeded eastward along the track and provided the necessary protection.

The conductor of Extra 1577 West proceeded westward along the train. As he approached the point of impact, he saw the locomotive units of both trains on fire and met the conductor and flagman of Extra 2043 East. Together they searched for the crewmembers on the locomotives, but were driven back by the intense fire.

The conductor of Extra 2043 East, who had been riding in the caboose with the flagman, said that he first became aware of the collision when he felt three severe impacts, followed by an emergency brake application. As the train came to a stop, the conductor saw smoke rising from the head end of the train. After trying in vain to contact the engineer and the head brakeman by radio, he called the Galesburg Terminal and requested that the operator send fire apparatus and ambulances and stop all trains in both directions.

Having been assured that all trains would be stopped, the conductor and the flagman proceeded to the point of impact, where they met the conductor of Extra 1577 West. The two crewmembers of Extra 2043 East grabbed fire extinguishers from their train's locomotive and tried to put out some of the fire. The fire, however, was too intense and covered too large an area. Furthermore, several fire extinguishers did not function properly.

Fire apparatus and ambulances arrived at the scene at about 7:05 p.m. The fire was extinguished, and the bodies of the fatally injured crewmembers (the engineer and the head brakeman on each train) were recovered.

Method of Operation

Trains were operated on the 23d subdivision by means of timetable and train orders. Automatic block signals were not used. All trains were operated as extras.

Train orders The train dispatchers who controlled the 23d subdivision were located in the Burlington Northern main office at Hannibal, Mo., 116 miles west of Galesburg. The train dispatchers communicated with station operators by telephone. All train orders were issued by the dispatcher for delivery to those employees addressed in the order. Train orders remained in effect until fulfilled, superseded, or annulled.

Use of radio in train operation A radio system was provided for this portion of the railroad to assist in train movements. Crewmembers on a train could communicate by radio with crewmembers on the same train or on other trains as well as with the operators at Peoria, Galesburg, and Yates City. The dispatcher had radio communication with the trains by means of a connection made by the station operators upon request.

Train-order signal at Yates City The train-order signal at the Yates City station was mounted on a mast which extended about 20 feet above the roof of the building. Two semaphores were provided, one for eastbound trains and the other for westbound trains. Each

semaphoric displayed two aspects. When the semaphore arm was horizontal, it indicated stop; when the arm was 30° below horizontal, it indicated proceed. A red light on the semaphore lighted when the arm was in the stop position, and a green light when in the proceed position. The two semaphores were manually operated by means of levers located in a room adjacent to the station operator's office. Because the train order signal was above the roof, the station operator could not see the aspects displayed by the signal for either direction. (See Figure 2.)

When the signal indicated stop, a train approaching from the applicable direction was to receive a properly executed clearance before it was permitted to pass the signal.¹ If the operator was on the station platform and handed the orders and the clearance form to the engineer, the train could continue. If the operator, however, was not on the platform, the train had to be stopped.

Applicable operating rules. Rule 215 of the Burlington Northern's Consolidated Code of Operating Rules requires that:

"Except at initial stations, a train order must not be issued for a train at the point where its movement is restricted for an operating movement if it can be avoided. When so sent, except at initial stations, the fact must be stated in the order thus '(train) gets this order at (station)'. The train being restricted must be brought to a stop before the train dispatcher OK's the clearance and special precautions must be taken to insure safety."

(Additional rules in the Consolidated Code which pertain to the movement of the trains involved in this accident can be found in Appendix A.)

The Burlington Northern supplements the Consolidated Code with a manual for train dispatchers. Rule 78 of the manual concerns the

restricting train orders described in Rule 215 of the Consolidated Code:

"Except at initial stations, train orders must not be issued for a train at the point where its movement is restricted by such order if it can be avoided, especially when weather conditions impair visibility, or the location of the train order signal in relation to the switch to be used by the train being advanced would cause a hazardous condition. If the conditions make it necessary to issue the order in such a manner, the operator must be instructed to place torpedoes not less than one-half mile in advance of train order signal to provide warning for the train being restricted, and take any additional precautions that may be necessary."

"When restricting the superiority of a train at a meeting or waiting point, the train advanced should not be given authority to the main track at that point, unless the restricted train is already in on the siding and it is definitely known that the engine will not move out of the siding until the other train arrives."

Extra 1577 West

Extra 1577 West departed from Peoria for Galesburg at 12:50 p.m. on the day of the accident. The train consisted of a three-unit locomotive, 10 loaded cars, 26 empty cars, and a caboose. The crew on Extra 1577 West had begun work that day at 3:35 a.m. in Galesburg.

Before Extra 1577 West departed, a brake test was made by the crew. No exceptions were taken. The conductor and the engineer then received copies of a clearance card and six train orders. The first three train orders imposed speed restrictions on the train at points not involved in the accident. The fourth order concerned bridgework being performed between Peoria and Edwards, a town about 12 miles west of Peoria. The fifth order established a meet between Extra 1577 West and the Extra 5625 East at the Oakhill siding, about 20 miles west of Peoria. Extra 1577 West was to enter the

¹Clearances were issued in accordance with Rules 219, 220, 221 and 222D of the Consolidated Code of Operating Rules.

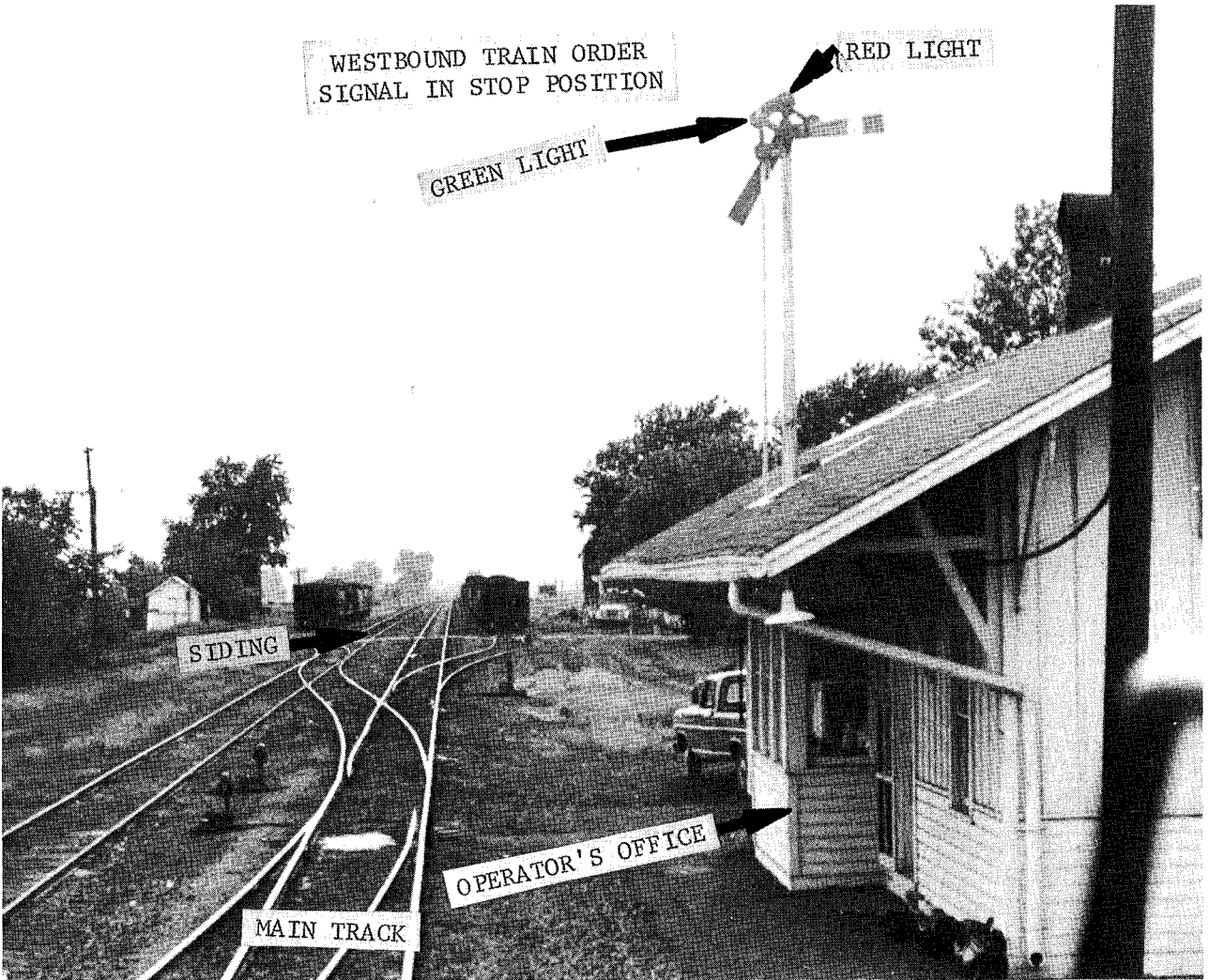


Figure 2. Train-order signal and station at Yates City.

siding. The final order was the authorization for Extra 1577 West to operate between Peoria and Galesburg after the arrival of Extra 5720 East in Peoria.

After departure, Extra 1577 West proceeded about 9 miles to the point at which the bridgework was being done, where the train was delayed until 4:10 p.m. At that time, Extra 1577 West continued on to Oakhill and stopped on the Oakhill siding at 5:10 p.m. to meet Extra 5625 East. The train crew decided that in order to comply with the Hours of Service Law (which required that they be off duty at 5:30), they could proceed no farther with the train.

Issuance of Train Order 263 The train dispatcher on duty in Hannibal from 8 a.m. to 4 p.m. had known that Extra 1577 West was being delayed by bridgework and that its crew would have to be relieved. He was also aware that a train order would have to be issued to establish a meet between Extra 1577 West and Extra 2043 East. The dispatcher decided that this meet should take place at Yates City and issued the following order (No. 263) to the conductor and the engineer of Extra 2043 East at Galesburg and to the conductor and the engineer of Extra 1577 West at Yates City:

“Extra 2043 East take siding meet Extra 1577 West at Yates City. Extra 1577 West gets this order at Yates City.”

This train order, which was a restricting order of the type referred to in Rule 215, was made complete to the station operators at Galesburg and Yates City at 3:21 p.m. The rules required that Extra 1577 West be stopped before the order and clearance were delivered. The train was then to proceed to the west siding switch and wait for Extra 2043 East to enter the siding and clear the main track.

When the train dispatcher telephoned the station operator at Yates City and instructed him to copy the train order, the operator went to the adjacent room and positioned the westbound train-order signal at stop. He returned to his desk and answered the train dispatcher with

“SD West.”² After he received this information, the dispatcher dictated train order 263, which the Yates City operator repeated back to the dispatcher. No special precautions were issued to the operator.

Activities of Yates City operator The operator who took the train order worked from 8 a.m. to 4 p.m. Since the station's second-trick operator worked from 9 p.m. to 5 a.m., an arrangement had been made that if an operator was needed, the first-trick operator would respond between 4 and 6 p.m. and the second-trick operator between 6 and 9 p.m.

The Hours of Service Law forbids an operator who handles train movements at a station where two or more shifts are employed from working more than 9 hours in any 24-hour period. For this reason, the train dispatcher relieved the Yates City operator from duty at 3:30 p.m., in case the operator had to be called after 4 p.m. to deliver train order 263.

The operator stated that prior to leaving the station, he checked the westbound train-order signal to assure himself that it was in the stop position. A carpenter-foreman who arrived at the station prior to the operator's departure verified that the signal was in the stop position at that time. A signal maintainer who drove into the station parking lot (See Figure 3) as the operator was leaving stated that the signal was in the stop position and that the red light was lit. All three employees left the station by 4 p.m.

The operator stated that before he left the station, he noted on the Station Record that the westbound train-order signal was in the clear position, but immediately corrected his error by writing the word stop over the word clear with a felt-tip pen. He also forgot to note on the Record that train order 263 had not been delivered.

Communication with Extra 1577 West The first-trick operator returned to the Yates City

²“SD West,” used in conjunction with transmittal of a train order, indicates that the westbound signal has been placed in the stop position.



Figure 3. Location of witnesses in relation to the Yates City station.

station at 5 p.m., because he was concerned about the movement of Extra 1577 West. He contacted the train dispatcher, who informed him that the train was probably in the Oakhill area and would change crews at that point. The operator then called Extra 1577 West by radio and was informed by a crewmember that the train would remain at the Oakhill siding until a relief crew arrived. When told of this, the train dispatcher made arrangements to transport a crew by taxi from Galesburg to Oakhill.

At no time during his conversation with the crew of Extra 1577 West did the operator mention train order 263. Once again to conserve the operator's time, the train dispatcher relieved the operator at 5:10 p.m. The operator made sure that the westbound train-order signal was in the stop position and so notified the dispatcher. The two men agreed that Extra 1577 West probably would not arrive at Yates City until after 6 p.m. and the second-trick operator would be called in that case. The operator noted on the Station Record that train order 263 was on hand for Extra 1577 West and that the westbound

train-order signal was in the stop position, and then departed.

A man whose house is just east of the Yates City station stated that he saw the westbound train-order signal in the stop position at 5:20 p.m. Two other independent witnesses, a man and his wife who lived north of the track and east of the station, stated that they saw the signal in the stop position at about 7 p.m. (See Figure 3.)

Crew change at Oakhill. The relief crew left Galesburg for Oakhill at about 5:15 p.m. The conductor of the crew stated that the other crewmembers appeared to be normal and that no one complained of any condition that might have impaired the crew's ability to operate the train from Oakhill to Galesburg. The conversation between the crewmembers during the ride to Oakhill contained no reference to anything that would have implied that the physical condition of any of the men was abnormal.

When the taxi arrived at Oakhill, the relieving conductor and engineer were given the orders which had been issued to Extra 1577 West and

were told that the meet with Extra 5625 East at Oakhill had been completed

After they were informed by the inbound engineer that "the railroad is yours," the relieving engineer and front brakeman climbed into the control compartment of the locomotive while the conductor and flagman proceeded to the caboose. None of the relieving crewmembers contacted the train dispatcher to inform him that they had relieved the inbound crew and were ready to proceed westward.

Movement through Yates City The conductor and flagman of Extra 1577 West stated that after it entered the main track, the train was operated in a normal manner at a normal rate of speed to Yates City. As the train approached Yates City, the conductor instructed the flagman to go out on the rear platform of the caboose and observe the train-order signal. When the caboose was in the vicinity of the grain elevator located just east of the Yates City station (see Figure 1), the flagman looked around the end of the caboose toward the signal and reported to the conductor that the signal was "all green," i.e., in the proceed position. The conductor instructed the flagman to check the siding for Extra 2043 East. The flagman saw no train on the siding.

As Extra 1577 West moved past the Yates City station, the conductor joined the flagman on the rear platform. Both crewmembers stated that as they passed the train-order signal, it was their impression that the signal was in the proceed position for both directions of travel. Shortly after passing the station, both men reentered the caboose, where they stayed until the accident. The conductor stated that he realized before he left Galesburg that Extra 2043 East would be operating, but when he neither received a train order nor saw the train on the siding at Yates City, he assumed other arrangements had been made. For example, Extra 2043 East could have been held in Galesburg until the arrival of Extra 1577 West

Extra 2043 East

On the afternoon of May 24, Extra 2043 East was assembled in Galesburg for operation from Galesburg to Peoria. The train consisted of a two-unit locomotive, 37 loaded cars, 29 empty cars, and a caboose. After the required tests were performed, the train was ready to depart.

Prior to the train's departure, the operator at Galesburg delivered to the engineer and the conductor of Extra 2043 East a copy of train order 263, along with copies of a clearance card and eight other train orders. These other eight train orders included five orders that restricted the speed of the train at points not involved in the accident. The sixth train order concerned the bridgework 9 miles west of Peoria. The seventh order established a meet between Extra 2043 East and Extra 5720 West at Yates City, and the eighth established the authority for Extra 2043 East to run between Galesburg and Peoria after the arrival in Galesburg of Extra 6050 West.

After Extra 6050 West arrived, Extra 2043 East departed Galesburg at 6 p.m. The conductor said that the only conversation he heard on the radio prior to departure was the conversation, previously described, between the Yates City operator and the crew of Extra 1577 West at Oakhill. According to the conductor, Extra 2043 East was operated in a normal manner at a normal rate of speed between Galesburg and the accident site.

Accident Losses

The locomotive units of Extra 1577 West came to rest south of the main track; the two lead units were destroyed and the third unit was heavily damaged. The locomotive units of Extra 2043 East stopped on the track structure. The locomotive cab and other parts of the superstructure were torn from the first unit and were thrown to a point south of the main track alongside the first unit of the other train. Of the nine derailed cars of Extra 1577 West, five were heavily damaged and two were destroyed.

Fifteen cars of Extra 2043 East were derailed, of which six were destroyed and the remainder were heavily damaged. After the collision, diesel fuel oil which spilled over the wreckage from the punctured fuel tanks of the locomotive caught fire.

The engineer and the head brakeman on both trains died as a result of the accident.

The engineer and the head brakeman of Extra 1577 West were found in the control compartment of the lead unit of that train. The engineer of Extra 2043 East was found along the north side of the first locomotive unit and the brakeman was found between the first and second unit of Extra 1577 West.

Postaccident Inspection of Yates City Station

When the train dispatcher was informed of the accident, he immediately called the first-trick operator at Yates City and requested him to proceed to the scene of the accident. After the operator directed the emergency vehicles to the accident, he returned to the station at Yates City to determine why Extra 1577 West had not complied with train order 263. On his arrival at the station, he found the conductor's and engineer's copies of the train order on the hook at his desk as he had left them at 5 p.m. He checked the westbound train-order signal and found that it was still in the stop position. He stayed at the station until he was relieved by a supervisor.

A thorough examination revealed that the station had not been broken into and that the door had been locked.

The second-trick operator at Yates City was called for duty and, on his arrival at the station at 8:35 p.m., he found the train-order signal in the stop position for westbound trains and in the proceed position for eastbound trains.

Postaccident Tests of Fatally Injured Crewmembers

After the bodies of the fatally injured crewmembers were taken to Galesburg, blood

samples were taken from three of the bodies for analysis. It was not possible to obtain a sufficient quantity of blood from the body of the front brakeman of Extra 1577 West for tests.

The blood samples were sent to two laboratories. A laboratory in Peoria reported that the blood sample removed from the engineer of Extra 1577 West had a blood-alcohol level of 95 mg%, which is equivalent to 0.095 percent. A laboratory in Chicago reported that the blood sample taken from this employee contained 0.078 percent Ethanol. The laboratory in Peoria found traces of alcohol in the blood samples taken from the other two employees, whereas the laboratory in Chicago found none. It is not abnormal for blood alcohol to test 0.005 when no alcohol has been consumed.

The laboratory in Chicago reported that the analysis of the blood sample taken from the engineer of Extra 1577 West showed the hemoglobin to be 27.5 percent saturated with carbon monoxide. An analysis of the blood taken from the front brakemen of Extra 2043 East showed the hemoglobin to be 53.5 percent saturated with carbon monoxide.

Postaccident Check of Operating Practices

Speed tapes. A check of 33 speed tapes removed from various trains which operated over this portion of the railroad during the 30 days immediately prior to the day of the accident disclosed 13 tapes which showed train speeds in excess of 43 m.p.h. One tape showed a speed of 62 m.p.h. Of the tapes inspected, eight indicated excessive speed on the 30-m.p.h. curve on which the accident occurred. There was no indication that the tapes had been examined by Burlington Northern supervisors, and no indication that action had been taken to correct the overspeed conditions found.

Train orders for meets at Yates City. During the 90 days immediately prior to the day of the accident, 83 train orders were issued to establish meets at Yates City. Twelve of these orders were issued at Yates City for trains to meet other trains at that point. In other words, these

were restricting train orders of the same type as train order 263. Other than placing the train-order signal in stop position, no special precautions were taken by the Yates City operators.

Locomotive inspection reports A check of the locomotive inspection reports for the lead locomotive units involved in this accident for 30 days prior to the day of the accident disclosed no indication of excessive smoke or fumes in the control compartments. The reports indicated that the locomotives were in good operating condition. The lead locomotive units involved in the accident were provided with the floor-pedal air-actuated type of safety device (dead-man control).

Postaccident Inspection of the Train-order Signal

After the accident, the westbound train-order signal at Yates City was observed at about the same time of day and under similar weather conditions as were present when Extra 1577 West passed through Yates City on the day of the accident. With the semaphore set in the stop position, the red roundel was in the vertical position directly in front of the lighted lamp. The green roundel was to the left of the mast at an angle about 45° from the vertical. There was nothing to shield this roundel, and the rays of the sun from the west shone through the green lens. This made the green light more prominent than the red light. The red light could not be seen until the observer was close to the signal. When the eastbound signal was in proceed position, the green roundel of that signal was in the vertical position, but facing the opposite direction, and the red roundel of the eastbound signal was blanked. If the westbound signal was in stop position and the eastbound signal in proceed position with the sun shining brightly west of the signal, the engineer of a westbound train approaching the signal would see a green light until the train arrived at a point close to the signal.

It was also found that when the signal first came into view, a utility pole partially blocked

out the arm of the westbound signal when the signal was in stop position (See Figure 4).

III. ANALYSIS

Issuance of Train Order 263

Because it is often necessary to operate opposing trains on a single track, safeguards must be provided for safe operation. On lines where automatic signals are provided, the signals, in most instances, are relied on to provide the necessary protection. On lines where automatic signals are not provided, it is necessary to provide a system incorporating train orders, timetables, and notices. Both systems depend entirely on employees' carrying out the full intent of the instructions received.

In this accident, before the train dispatcher could issue authority for Extra 2043 East to operate between Galesburg and Peoria over the signal track, it was necessary for him to establish meeting points with several westbound trains, including Extra 1577 West. This was accomplished by issuing train orders to each of the trains involved.

Shortly after 3 p. m., the dispatcher decided to have Extra 1577 West pass Extra 2043 East at Yates City and issued the necessary train orders. Because Extra 1577 West left Peoria at 12:50 p. m., a restricting train order had to be delivered to the train at Yates City. Although Burlington Northern's rules required that special precautions be taken when a restricting order was issued, these precautions were not defined, nor was the responsibility for taking such precautions assigned to an employee. If management believed that extra protection was necessary, the responsibility for providing such protection should have been assigned and the precautions defined.

The train dispatcher apparently had no misgivings about issuing a restricting train order, since this had been done a number of times in the past with few problems. The dispatcher relied on the train-order signal at Yates City to

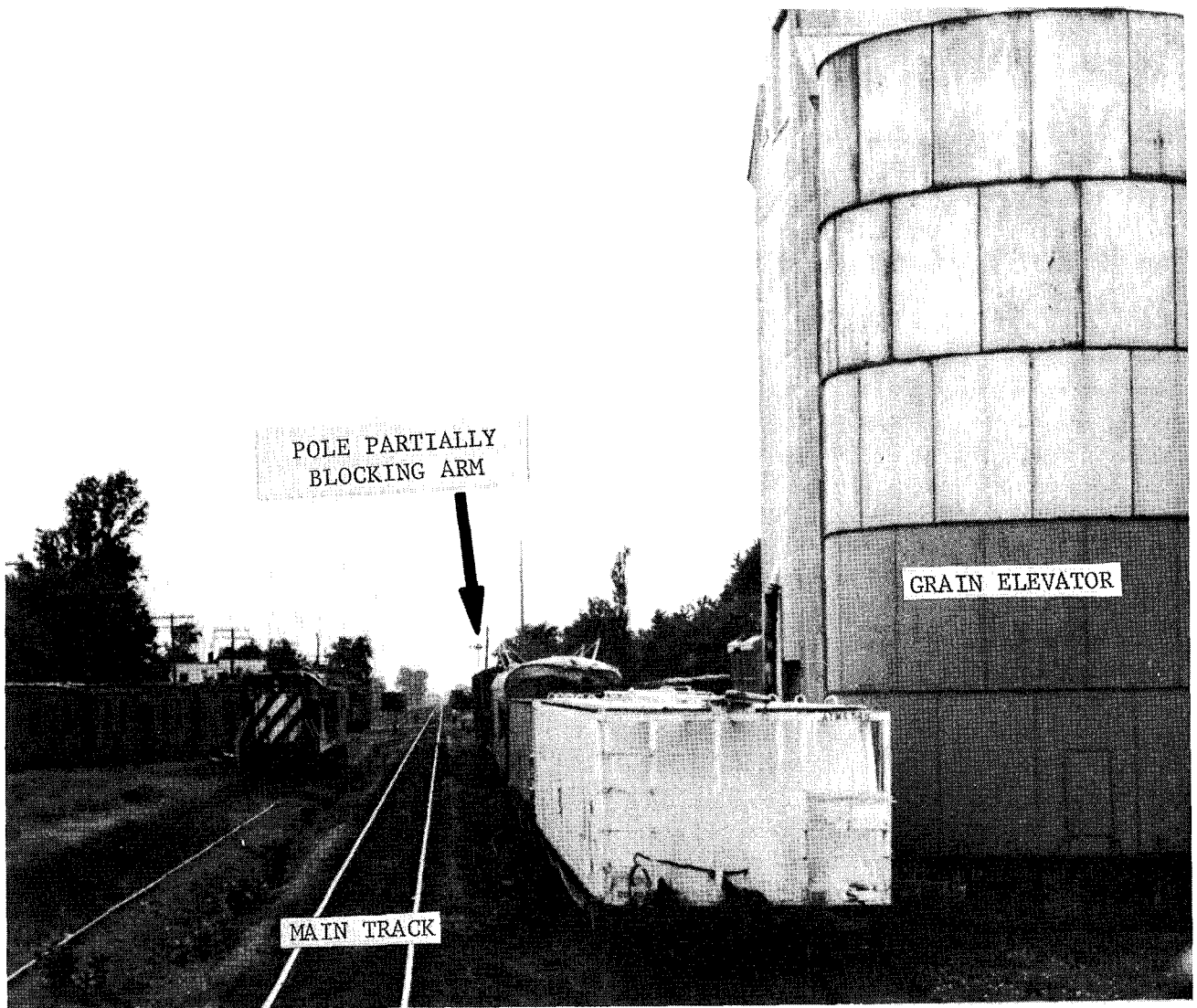


Figure 4. Westbound train-order signal (picture taken from vicinity of grain elevator east of the station).

stop Extra 1577 West at the station to obtain the train order and clearance. No other precautions were taken, and, according to the train dispatcher, none were necessary, because none had been taken during similar operations in the past.

Rule 78 of the train dispatcher's manual required that special precautions be taken, especially if bad weather or physical conditions impaired visibility or created a hazardous condition. The implementation of this rule depended

entirely on the ability of the dispatcher to determine if visibility was impaired or a hazardous condition had been created. Furthermore, Rule 78 applied only to train dispatchers and not to station operators. A train dispatcher located 116 miles from a station cannot determine if weather or physical conditions present a hazard at that station.

There was nothing about the location of the tracks and station at Yates City and the weather conditions on the day of the accident which by

themselves would have required additional precautions prescribed by Rule 78.

Operation of the Yates City Station

The train dispatcher transmitted train order 263 to the operator at Yates City in the manner prescribed by the operating rules. Because he was aware of the instruction that operators should work no more than 9 hours in any 24-hour period, the train dispatcher relieved the operator at 3:30 p.m. so that the operator would be available to deliver the train order.

The operator stated that it was at this time that he corrected the erroneous notation he made on the Station Record. Nothing was disclosed in the Safety Board's investigation to indicate that this is not so. However, even if the operator had not corrected the Station Record prior to the accident, the improper notation would not have been a determining factor in the cause of the accident.

After returning to the station at 5 p.m., the operator contacted Extra 1577 West about the crew change. If the operator had not been relieved at 5:10 p.m., he could have contacted Extra 1577 West later to determine the train's time of departure from the Oakhill siding. The operator could then have easily computed the time of the train's arrival at Yates City. With this information, the train dispatcher could have arranged for either station operator to be on duty at Yates City to deliver the train order.

Position of Train-order Signal

Because of the testimony of the signal maintainer and the two witnesses who saw the westbound signal in the stop position at 5:20 and 7 p.m., it may be assumed that the westbound signal was in stop position as described by the operator.

The flagman of Extra 1577 West, however, claimed that when he looked at the train-order signal (when the caboose was in the vicinity of the grain elevator), the signal was "all green."

The shining of the sun through the green lens of the signal and the partial blocking of the arm by the utility pole might have caused the flagman to mistake the aspect displayed. Furthermore, when the flagman looked at the signal, the locomotive had passed the station and no attempt had been made by the engineer to reduce the speed of the train, which could have strengthened the flagman's conviction that the signal was in proceed position.

The reason the crewmembers on the locomotive did not see or respond to the train-order signal is an entirely different question. The eastbound approach to the signal is straight for a considerable distance, and there is nothing that would have obstructed the crew's view of the signal for any appreciable distance. The signal should have been visible to the crewmembers on the locomotive from a point more than a mile east of the station. If the engineer's physical reactions, however, were impaired by alcohol, his view of the phantom aspect produced by the shining of the sun through the green lens could have convinced him that the signal was displaying a proceed aspect.

Condition of the Engineer and Front Brakeman

Because, as part of the relieving crew, the engineer and front brakeman on Extra 1577 West had been operating the train for only about 30 minutes at the time of the accident, they should not have been so fatigued from working that they would have fallen asleep. Although the conductor and flagman stated that they did not smell alcohol on the engineer or front brakeman while riding in the taxi from Galesburg to Oakhill, the blood sample taken from the engineer must be taken into account.

Both of the laboratories to which the blood sample was sent found that the blood contained a considerable amount of alcohol. Both reports indicated that the engineer could have been approaching a state of intoxication. One laboratory reported that the level of alcohol in the engineer's blood was 0.95 percent, the other

laboratory reported 0.78 percent; many States consider a person intoxicated when the amount of alcohol in his blood reaches 100 percent. These States contend that, in such a condition, a

person is unable to operate a motor vehicle safely. The National Safety Council describes the effect of the amount of alcohol found in the engineer's blood as follows:

<u>Ethyl-Alcohol Level in Blood (percent)</u>	<u>Stage of Alcoholic Influence</u>	<u>Clinical Signs/Symptoms</u>
0.09 - 0.25	Excitement	Emotional instability; decreased inhibitions, loss of critical judgement; impairment of memory and comprehension; decreased sensory response; increased reaction time, some muscular incoordination.
0.18 - 0.30	Confusion	Disorientation, mental confusion; dizziness exaggerated emotional states; disturbance of sensation (diplopia, etc) and of perception of color, form, motion, and dimensions; decreased pain sense; impaired balance; muscular incoordination; staggering gait, slurred speech

If the engineer's stage of alcoholic influence were as described in this table, that could account for his misinterpretation of the aspect displayed by the train-order signal

The amount of carbon monoxide found in the body of the engineer probably resulted from the fire after the collision and not from exposure to fumes in the locomotive control compartment before the collision. The relieved crewmembers did not report an excessive amount of fumes in the control compartment nor did they suffer any effects as a result of being in the compartment for more than 5 hours³

A review of the engineer's work record disclosed no evidence of an alcohol problem. His last physical examination, taken on January 31,

³The front brakeman of Extra 2043 East also showed a high content of carbon monoxide in his blood, again probably the result of the fire following the collision. It is not logical to assume that just two employees out of four, one from each train, would be affected by carbon monoxide prior to the collision

1972, indicated that he met the prescribed standards of the Burlington Northern and that his vision was 20/10 without glasses.

The front brakeman either did not observe or misinterpreted the signal as the train approached Yates City. The reason for this failure can only be theorized:

- He was in some part of the locomotive other than the control compartment as Extra 1577 West approached Yates City
- His physical reactions, like those of the engineer, may have been impaired by alcohol. As previously stated, it was not possible to obtain a blood sample from the front brakeman
- He could have been asleep, or some other physical condition could have developed which prevented him from seeing the signal. His last physical examination, taken in June 1971, indicated that he met the prescribed standards and that his vision and hearing were normal

Adequacy of Operating Rules

The interpretation and application of operating rule 215, which established the requirements for a restricting train order, are directly involved with this accident. The rule first requires that, except at initial stations, this type of order should not be used if it can be avoided. In this case, the meeting point between the trains could have been established at a siding located between Yates City and Galesburg. The radio at Yates City station could have been used either to inform the crew of Extra 1577 West of the impending order or to transmit the order to the crew while the train was still at Oakhill. The order also could have been delivered to the crew at Oakhill by the operator. Any one of these methods would have eliminated the need for using a restricting train order.

Rule 215 also required that special precautions must be taken in the event of the issuance of a restricting train order. Neither the management nor the employees involved were able to describe what precautions should have been taken in this case; with one exception, all agreed that the operator should have been kept on duty. However, no such instructions had been issued prior to the accident. The positioning of the train-order signal at stop could not be construed as a special precaution, since this is required when any train order is issued at Yates City. Since Rule 215 does not specify who is to take the special precautions, it must be assumed that all employees involved with the issuance of such an order, which would include management, would be required to take such precautions.

No specific instructions had been issued by the management to train dispatchers to take certain precautions before issuing a restricting train order. Some precautions which could be taken *before* issuing a train order are:

- Notify or obtain permission from the Chief Train Dispatcher before such an order could be issued
- Arrange for an operator to be on duty until the order was delivered

- Review with the operator the special precautions that are required of him.

Management should prescribe the specific special precautions which an operator is required to take when this type of order is issued. It should not be left to the discretion of the employee to decide the action to be taken or when. Some special precautions that could be required of the operator are:

- Place torpedoes on the track ahead of the train-order signal to warn the engineer.
- Flag the train with fuses as it approaches the station.
- Notify the crew by radio of the impending order.
- Display a special type of signal to indicate the restrictive-type order.

Use of Radio

Although this portion of the railroad was equipped for communication by radio, the system was not used to its best advantage. The dispatcher had the means to contact traincrews by radio through the wayside stations, but little use was made of this arrangement. The engineer and the conductor of Extra 2043 East were provided with radios and each had copies of train order 263, but no attempt was made to contact the crewmembers on Extra 1577 West to determine the location of the train.

Operation of Trains in Excess of Speed Limit

It was apparent from the check of the 33 speed recorder tapes that many trains had been operated on the 23d subdivision in excess of the speed limit. The tapes apparently had not been previously calculated or examined and, consequently, it is doubtful that the overspeed occurrences had been brought to the attention of the crews involved. Due to the number of trains that had exceeded the speed limit, it is not surprising that the conductors of each of the trains involved in this accident took no exception to the overspeed operation of their trains.

Effect of Train Speed

Each train, according to the speed recorder tapes, was moving at a speed of almost 40 m.p.h. when the collision occurred. There was no indication that the brakes of either train had been applied for a sufficient time in advance of the collision point to have reduced materially the speed of the trains. Since the amount of energy produced at impact varies with the square of the speed of the vehicle, at least 77 percent more energy was produced by the collision of the trains traveling at 40 m.p.h. than would have been produced if the trains had been traveling at the 30 m.p.h. speed limit. It is not known whether the crewmembers on the locomotives would have survived a collision of the trains at 30 m.p.h., but the amount of energy to be dissipated from the collision would have been considerably less.

IV CONCLUSIONS

- 1 Train order 263, which established the meet for Extra 1577 West and Extra 2043 East at Yates City, was worded and transmitted to the operators at Yates City and Galesburg as required by the rules, and was a restricting order for Extra 1577 West, in accordance with Rule 215.
- 2 It was possible to avoid the use of a restricting train order to establish the meet between the trains. There was a pattern of noncompliance with this aspect of Rule 215 for some time preceding the accident.
- 3 Rule 215 was ambiguous in that the rule did not make clear what special precautions were to be taken in the event of a restricting train order or which employee was to take them.
- 4 No special precautions were taken to protect Extra 1577 West other than those precautions required for any type of train order.
- 5 The westbound train-order signal at Yates City was in the stop position when Extra 1577 West passed the station, but there was no operator on duty at the station.
- 6 Extra 1577 West did not stop at Yates City as required by the indication of the train-order signal and did not receive train order 263.
- 7 The design of the westbound signal at Yates City was such that at certain hours of the day the sun could shine through the green roundel of the signal and could produce a phantom clear aspect when the signal was viewed from certain positions. Furthermore, the semaphore arm was partially obscured at several locations.
- 8 The phantom clear aspect and the partially obscured semaphore arm were seen by the flagman of Extra 1577 West when he checked the signal as the train approached Yates City.
9. The same phantom clear aspect was seen by the engineer and front brakeman as Extra 1577 West approached Yates City. However, they had a clearer view as the train approached the station.
- 10 The level of alcohol in the blood of the engineer on Extra 1577 West was sufficient to impair his mental and physical actions.
11. The effect of the alcohol and the misleading phantom clear aspect of the westbound train-order signal at Yates City could have caused the engineer of Extra 1577 West to misinterpret the indication of the signal.
12. Both Extra 1577 West and Extra 2043 East were exceeding the speed limit as they approached the point of the collision.
- 13 Trains had been permitted to operate routinely at speeds in excess of the speed limit.
- 14 Visibility between the trains was reduced to about 800 feet by the curve of the track.
- 15 The fire which developed after the collision resulted from the ignition of diesel oil spilled from the ruptured tanks of the locomotive units.
- 16 The relatively high carbon-monoxide content found in the blood of the engineer of Extra 1577 West and front brakeman of

Extra 2043 East resulted from the fire which followed the collision.

- 17 Radio communication by means of which the train order could have been transmitted to the crew of Extra 1577 West was available
- 18 The relief crew on Extra 1577 West was permitted to take over the operation of a train at an intermediate point and to proceed without notifying the train dispatcher.

V. PROBABLE CAUSE

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the responsible employees to deliver to the crew of Extra 1577 West at Yates City, Ill, a restricting train order which established a meet between Extra 1577 West and Extra 2043 East at Yates City. Two factors contributed to this failure.

First, Extra 1577 West did not stop at the Yates City station to obtain a copy of the train order, in disregard of the stop aspect displayed by the westbound train-order signal of the station. The reason the engineer failed to stop his train could not be determined. The Board, however, considers that because of the effects of alcohol and a misleading phantom clear aspect of the westbound train-order signal, the engineer may have failed to interpret the signal correctly.

Second, the employees involved with the transmission and handling of the restricting train order did not comply with the requirements of the operating rules to take special precautions for the safety of Extra 1577 West, the train which was being restricted by the order.

VI. RECOMMENDATIONS

The National Transportation Safety Board recommends that:

- 1 The Burlington Northern change the design of their train-order signals so that there is no possibility that a phantom aspect will be displayed.⁴ (Recommendation No R-73-19)
- 2 The Burlington Northern review its operating rules and its interpretation of these rules to assure that train movements are adequately protected. The management and employees of Burlington Northern should take any action necessary to insure that the operating rules are complied with. (Recommendation No R-73-20)
- 3 The Burlington Northern adopt a system of safety analysis of their operating rules and practices to disclose conditions of inadequate protection of train operations. (Recommendation No R-73-21)

The Safety Board reiterates and emphasizes a recommendation made in the Board's report on the collision of two Penn Central freight trains at Herndon, Pa., on March 12, 1972. The Board recommended that:

"The Federal Railroad Administration, in the promulgation of regulations covering the use of radio, require that where radio is part of an operating system, it be maintained in effective condition unless all personnel involved are notified by appropriate railroad procedure such as a train order or general order."

⁴The train-order signal at Yates City has already been corrected.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JOHN H REED
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M THAYER
Member

/s/ ISABEL A. BURGESS
Member

/s/ WILLIAM R. HALEY
Member

April 11, 1973

APPENDIX A

EXCERPTS FROM BURLINGTON NORTHERN'S CONSOLIDATED CODE OF OPERATING RULES

GENERAL RULES

G. The use of alcoholic beverages or narcotics by employes subject to duty is prohibited. Being under the influence of alcoholic beverages or narcotics while on duty or on Company property is prohibited. The use or possession of alcoholic beverages or narcotics while on duty or on Company property is prohibited.

DEFINITIONS

EXTRA TRAIN—A train not authorized by a timetable schedule. It may be designated as:

Extra—For any extra train except work extra,

Work Extra—For an extra train authorized by Form H train order.

REDUCED SPEED—Proceed prepared to stop short of train, engine or obstruction.

RESTRICTED SPEED—Proceed prepared to stop short of train, engine, obstruction, or switch not properly lined, looking out for broken rail or anything that may require the speed of a train or engine to be reduced, but not exceeding 20 MPH.

SIDING—A track auxiliary to the main track for meeting or passing trains. The timetable will indicate stations at which sidings are located.

OPERATING RULES

Note—Rules without a prefix are for single, double, and three or more tracks; rules with a prefix "S" are for single track; rules with a prefix "D" are for double or three or more tracks.

FUSEES

11. A train or engine finding a fusee burning red on or near its track must stop, and may then proceed at reduced speed for one mile. If

the fusee is beyond the nearest rail of an adjacent track the train or engine need not stop, but must proceed at reduced speed for one mile.

Fusees must not be placed where they may set fire to anything, nor on public crossings.

ENGINE NUMBER INDICATORS

24. On trains, the engine number must be illuminated on engines equipped with indicators. When an engine consists of more than one unit, the number of one unit only will be illuminated when in service and will be the identifying number; the numbers of other units must not be illuminated. When practicable, the number of the leading unit must be used.

91. In Non-ABS territory, trains in the same direction must keep not less than ten minutes apart, except in closing up at stations.

The crew of the following train will be responsible for keeping trains not less than ten minutes apart when passed by another train or before following a train which has been overtaken.

RULES FOR MOVEMENT BY TRAIN ORDERS

200. For movements requiring their use, train orders will be issued by the authority and over the signature of the Superintendent and contain only information or instructions essential to such movements.

Train orders must be brief and clear in their meaning and in the prescribed forms when applicable.

201. Train orders once in effect continue so until fulfilled, superseded or annulled. Any part of an order specifying a particular movement may be superseded or annulled.

Except as provided in Rule 201 (A), train orders held by, issued for, or any part of a train order relating to a regular train, become

APPENDIX A

void when such train loses its authority to proceed as prescribed by Rules 4 and 82, or its schedule is annulled

Except as provided in Rule 201 (A), train orders held by an extra train become void when such extra train arrives at the station to which it was authorized to run, or the authority for movement is annulled

201 (A) Train orders annulling a schedule or a section and slow and cautionary orders issued to a conductor or engineer continue in effect to them on a continuous trip or tour of duty

202. Train orders must show number, date of issue and name of station where copied. Each train order must be given in the same words to all employes or trains addressed without erasure, alteration or interlineation. Additions to train orders must not be made after they have been repeated

203 Train orders must be addressed to those who are to execute them. Those for a train must be addressed to the conductor and engineer, and also to anyone acting as its pilot. Those for a yard engine will be addressed to the yardmaster or to the conductor and engineer

Train orders addressed to operators restricting the movement of trains must be respected by conductors and engineers the same as if addressed to them

204 In train orders and clearances, regular trains will be designated by numbers as "No 10" and sections as "Second 10", adding engine numbers in train orders if practicable. Extra trains, except work extras, will be designated by engine numbers and the direction as "Extra 798 east". Work extras will be designated by engine numbers, as "Work Extra 798"

For the movement of an engine of another company, the initials or the designated name will precede the engine number

When two or more engines are coupled, the number of the leading engine only will be used in train orders. When helper engines or other engines are placed on the head end of a train over a portion of a subdivision, the road engine number will be used

205 To transmit a train order, the train dispatcher must instruct each office addressed the position and direction in which the train order signal is to be displayed and the number of copies to be made, thus "Stop West copy 5",

or "19 East copy 3". At stations where there is a train order signal, an operator receiving these instructions must immediately display the train order signal as directed for the direction specified, and reply "SD" or "19D", adding the direction. Until the order has been delivered or annulled, the train order signal must not be restored to "Proceed"

When transmitting a train order for a train originating at a station and the train addressed is otherwise required to receive a clearance at that station, the train dispatcher may instruct the operator not to display the train order signal at "Stop" or "19"

At stations where there is no train order signal or when the operator is instructed by the train dispatcher not to display the train order signal at "Stop" or "19", the operator will reply "ND"

206. A train order to be sent to two or more offices must be transmitted simultaneously to as many of them as practicable. When not sent simultaneously to all, the order must be sent first to the train being restricted

207. Operators receiving train orders must write or typewrite them in manifold on the prescribed form during transmission. A copy of each train order must be retained in the office

208 When a train order has been transmitted, operators must, unless otherwise directed, repeat it at once in the succession in which the several offices have been addressed. Each operator receiving the order must observe whether the others repeat correctly

When an order has been repeated correctly, the response "Complete" and the time, will be given by the train dispatcher. The operator receiving this response will then write or typewrite in the space provided, the time and his last name in full

In transmitting a train order of a previous date, the operator must be advised of the date of issue and when such order is made complete, the train dispatcher and operator must record the date completed following the "Complete" time

208 (A) "Complete" must not be given to a train order for other trains until the order has been repeated or the "X" response sent by the employe receiving the order for the train being restricted

208 (B) When so directed by the train dispatcher, a train order, having been transmitted, may be acknowledged before repeating, by the operator responding: "**(office name), (number of train order) to (train number), X, (operator's initials)**" The operator must then write or typewrite on the order his initials and the time

209. When a train order has been repeated, including the signature of the Superintendent, or "X" response sent, and before "Complete" has been given, the train addressed must be held until the order is made complete

If communication fails before a train order has been repeated, or the "X" response sent, the order at that office is of no effect and must be destroyed

210 When an error is made in transmitting a train order and before it has been repeated, all copies of that order must be immediately destroyed, the order marked "void" in the train order book, and if reissued, given another number. If a train order in which an error has been made has been repeated, that order must be annulled

211 When the necessary number of copies of a train order cannot be made at one writing, operators must make additional copies from one previously repeated, and must then repeat to the train dispatcher from the new copies each time additional copies are made. Initials of the operator who recopies the order must be shown, but the date of issue, time completed, and name of original receiving operator must not be changed. Operators must retain a copy of each additional writing, showing thereon the time and date it was repeated to the train dispatcher

The train dispatcher must place notation in the train order book of each repetition

212 Even hours as "7 00 a m" must not be used in stating time in train orders

In transmitting and repeating train orders by telegraph, time will be stated in figures only

In transmitting and repeating train orders by voice, time and all other numerals must be pronounced first, followed by pronouncing each figure, except where the number is but one figure, it must be pronounced first, then spelled. The names of stations, sections and direction must be pronounced then spelled

In train order books and on train orders, time and other numerals will be written in

figures only, letters duplicating names of stations, sections and direction will not be written

213 A legible copy of each train order must be furnished for each employe addressed unless the order is annulled by a train order addressed to the operator

When a train is named in a train order by its schedule number alone, all sections of that schedule are included, and copies of the order must be delivered to each section

When a train has more than one engine in service, or when an engine is added between terminals, a copy of all train orders and clearances affecting their movement must be furnished to each engineer

214 Train orders must be read promptly upon receipt by those to whom they are addressed. Conductors must, when practicable, obtain from engineers an understanding of all train orders before they are acted upon. Conductors must, when practicable, show train orders to trainmen. Engineers must show train orders to members of the crew on the engine

When a conductor or engineer, or both, is relieved before completion of a trip, all train orders, clearances and instructions held by them must be delivered to the relieving conductor or engineer. Such train orders, clearances and instructions must be compared by the relieving conductor and engineer before proceeding

215 Except at initial stations, a train order must not be issued for a train at the point where its movement is restricted for an opposing movement if it can be avoided. When so sent, except at initial stations, the fact must be stated in the order, thus: "**(train) gets this order at (station)**". The train being restricted must be brought to a stop before the train dispatcher OK's the clearance and special precautions must be taken to insure safety

When time in a wait order at that station expires before arrival of the restricted train, train dispatcher may OK clearance and train order may be delivered without stopping train

A train advanced to a station where the opposing train receives the order must approach that station expecting to find the train receiving the order on the main track, and, where conditions require, the train advanced must protect against the opposing train as prescribed by Rule 99

216. Under the following circumstances an operator must not be permitted to repeat a

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train order or give the "X" response to a train order restricting the movement of a train until he has obtained the signature of the conductor and engineer to the order

When the engine of the train being restricted has passed the train order signal displaying a proceed indication,

When the train being restricted has received a clearance at that station,

When a work extra is to be restricted after having received its work order

217 A train order to be delivered to a train at a point not a train order office, or at which the office is closed, must be addressed to "C&E _____ (at) (between) _____ care of _____", and forwarded and delivered with clearance by the person in whose care it is addressed, and who is responsible for its delivery

When delivery is to be made by conductor or engineer of another train, the numbers of such orders must be shown in the usual manner on clearance of the train making the delivery and both conductor and engineer supplied with copies. If necessary, train must be stopped to effect delivery

When orders are sent in the manner herein provided, to a train which is thereby restricted for another train, the operator will be directed to make an extra copy of the order which he will deliver to the person who is to make delivery of the order. On this copy, the person delivering the order must secure the signatures of the conductor and engineer addressed. This copy he must deliver to the first operator accessible, who must at once transmit the signatures of the conductor and engineer to the train dispatcher, and preserve the copy "Complete" must not be given to the order for a train being advanced until the train dispatcher has received the signatures of the conductor and engineer of the train being restricted

218. To relay a train order, the train dispatcher must transmit it to the employe at the relaying office, who must then transmit it to destination. The employe receiving it at destination must, after obtaining signatures of conductor and engineer when required, repeat it to the relaying office, where each word and figure must be underscored as it is repeated. It must then be repeated to the train dispatcher and if correct, "Complete" will be given by the train dispatcher and relayed to destination

219. Clearance must be filled out by the operator before clearing a train, showing there-

on, without erasure or alteration, the date, station, address, total number of train orders, (if none show "No") and the number of each train order, if any, and transmit to the train dispatcher from the clearance. The train dispatcher must make the required record, check the train order numbers, and if correct will repeat the information from his record, giving OK, the time and Superintendent's initials, which the operator will endorse on the clearance

Operators must make the required number of copies of clearance at one writing, show his last name and retain a copy

220 A train must receive a clearance before leaving a station where train orders are delivered to it

Conductors and engineers must, and when practicable other members of the crew will, see that their train is correctly designated and that the information shown on clearance corresponds with the train orders received

220 (A) Clearance must not be issued without authority from the train dispatcher except when communication has failed. When communications have failed, if all train orders have been completed, clearance may be issued bearing notation "wire failure" and the time, instead of the OK and Superintendent's initials. Such clearance will be acted upon as though OK had been given in the usual way

A numbered clearance authorizing a section as provided in Rule 85 or an extra train as provided in Rule 97(A), must not be issued by an operator when communications have failed

When communication is restored, the train dispatcher must be notified the time each train was cleared and the numbers of the train orders delivered, which the train dispatcher will record

220 (B) When a train has received a clearance at a station and it becomes necessary to issue a train order to such train at that station restricting its movement, in addition to obtaining the signatures of the conductor and engineer to the train order as required by Rule 216, all previous clearances received by that train at that station must be taken up and destroyed and the train dispatcher so advised. A new clearance must be issued

When a train has received a clearance at a station and it is desired to issue a train order to such train which does not restrict its move-

ment, additional clearance may be issued without taking up previous clearance

When more than one clearance is issued to a train at a station, the last clearance must show the numbers of all train orders the train receives at that station

221. Where provided, fixed signals of the types as indicated in Rule 222 will be used at each train order office. Unless otherwise provided, when there are no train orders, signal must indicate "Proceed".

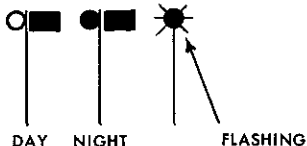
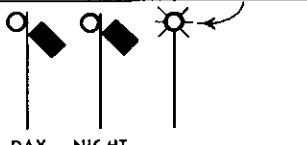

When train order signal displays "Stop" or "19 order" indication trains must not leave that station without a clearance

Except as provided in Rule 222(D), where a two indication color light type or Swift type, or two position semaphore type train order signal is used, signal will indicate "Stop" when trains are to be stopped for train orders, except when a yellow flag by day or a yellow light by night is displayed below the "Stop" indication it will indicate "19 order" and the name and indication will be the same as shown in Rule 222(B)

Operators must have the proper appliances for hand signaling and will use these hand signals should the fixed signals fail to operate properly, or when other conditions require

BURLINGTON LINES

Special Signal Aspects Which Are Not A Part of Automatic Block CTC and Interlocking Systems

RULE NO	TRAIN ORDER SIGNAL ASPECTS
222 (A)	
222 (B)	
222 (C)	<p>LUNAR</p> 

BURLINGTON LINES

Special Signal Aspects Which Are Not A Part of Automatic Block CTC and Interlocking Systems

INDICATION	
NON AUTOMATIC BLOCK SIGNAL TERRITORY	AUTOMATIC BLOCK SIGNAL TERRITORY
Train orders for a train or block occupied by a preceding train	Train orders for a train
No train orders and block clear	No train orders.
When illuminated train order signal displays stop	When illuminated train order signal displays stop.

APPENDIX A

223. Train order signal indications are given by the positions of the arms, by lights of the prescribed color, or by both Flashing lights of the prescribed color may be used Where authorized by the Superintendent, lights will not be displayed

Where the semaphore is used, the governing arm is displayed to the right of the signal mast as viewed from an approaching train, and on double or three or more tracks, governs trains moving against the current of traffic the same as if moving with the current of traffic

703 Employes must familiarize themselves with the Federal Hours of Service Law Each employe governed by this law must notify the proper authority of the time the law requires him to be off duty early enough so that he may be relieved, if necessary, before exceeding the hours of service permitted by the law

ENGINE SERVICE

920. The engineer is responsible for the safe and efficient operation of the engine in his charge and all persons employed thereon must obey his instructions

921. At locations where engines are serviced, engine must not be moved or any of its machinery operated, until all servicing equipment has been disconnected, attendants are clear of engine and it is known that movement can be made without injury to anyone

922 Any defective condition of the engine must be promptly reported to the proper authority, and a record made on the prescribed form of the repairs required