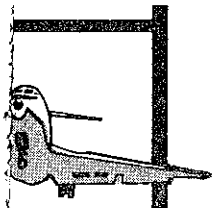

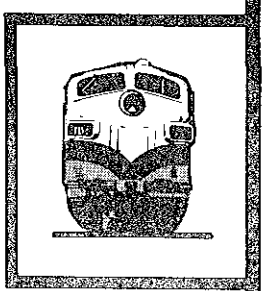

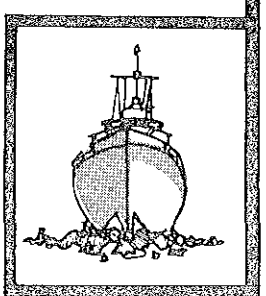

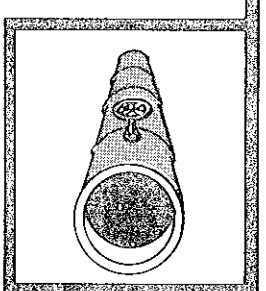

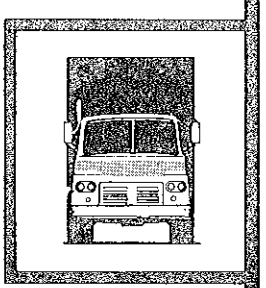

NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

HEAD-END COLLISION OF NINE BURLINGTON NORTHERN LOCOMOTIVE UNITS WITH A STANDING FREIGHT TRAIN ANGORA, NEBRASKA

FEBRUARY 16, 1980

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UNITED STATES GOVERNMENT

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16 Abstract

On February 16, 1980, Burlington Northern (BN) freight train Extra 2048 East (No. 178) stalled on an ascending grade about 4.7 miles west of Angora, Nebraska. The crew was instructed to uncouple the three-unit locomotive from the train and move it east to Angora to meet the six-unit locomotive of Extra 7814 West at Angora. The nine locomotive units were coupled together and moved westward on the descending grade toward the standing train. While moving at a speed of about 46 mph, the locomotive units collided with the standing portion of train No. 178. The head brakeman of train No. 178 and the engineer of Extra 7814 West were killed, and three crewmembers of Extra 7814 were injured. Damage was estimated at $1,297,000.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 178 to control the speed of the nine locomotive units on the return downgrade trip to the standing train. Contributing to the accident were the improper coupling of the nine locomotive units; the lack of sufficient supervision and instructions; the failure of the conductors of the two trains and the engineer of BN Extra 7814 West to perform their duties properly; and the failure of the train dispatcher to issue adequate orders and instructions.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: August 12, 1980

HEAD-END COLLISION OF NINE BURLINGTON NORTHERN LOCOMOTIVE UNITS WITH A STANDING FREIGHT TRAIN ANGORA, NEBRASKA FEBRUARY 16, 1980

SYNOPSIS

On February 16, 1980, Burlington Northern (BN) freight train Extra 2048 East (No. 178) stalled on an ascending grade about 4.7 miles west of Angora, Nebraska. The crew was instructed to uncouple the three-unit locomotive from the train and move it east to Angora to meet the six-unit locomotive of Extra 7814 West at Angora. The nine locomotive units were coupled together and moved westward on the descending grade toward the standing train. While moving at a speed of about 46 mph, the locomotive units collided with the standing portion of train No. 178. The head brakeman of train No. 178 and the engineer of Extra 7814 West were killed, and three crewmembers of Extra 7814 were injured. Damage was estimated at $1,297,000.

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INVESTIGATION

The Accident

About 12:50 a.m., 1/ on February 16, 1980, eastbound Burlington Northern (BN) freight train Extra 2048 East (No. 178), consisting of 2 locomotive units, 65 cars, and a caboose, departed Northport, Nebraska, en route to Alliance, Nebraska. A light, blowing snow was falling as the train began a 12-mile, 1.0 percent ascending grade to Angora, Nebraska. The train traveled about 1 mile east of Northport - still within the Northport yard limits - and stalled on the hill.

1/ All times herein are mountain standard time.

The conductor notified the operator at Northport that the train had stalled and was unable to proceed eastward, and the Northport operator notified the train dispatcher at Alliance, Nebraska. The train dispatcher relayed instructions through the operator to the conductor to have train No. 178 return to Northport and to add an additional locomotive unit, which was on the Union Pacific Railroad transfer track.

After receiving the instructions from the operator, the crewmembers backed the train to Northport. After arriving at Northport, the two locomotive units were uncoupled from the train and backed against the additional unit, and the air brakes were connected between the three units. However, because a multiple unit control jumper cable 2/ was not available, the third locomotive unit could not be electrically connected for multiple unit control. Thus, the third locomotive unit could not be operated in unison with the other two units by the engineer from his operating position.

The engineer sent the fireman, a qualified engineer, to the operating position on the added locomotive unit to control the throttle of the single rear unit. The engineer gave instructions to the fireman using the radios in the locomotive units. After the locomotive units were coupled to the train, the engineer, in the lead locomotive unit, and the fireman, in the third unit, started the eastbound trip.

Train No. 178 traveled approximately 9.5 miles east of Northport when it again stalled. The conductor notified the train dispatcher that the train had stalled again on the hill. The train dispatcher instructed the crewmembers to uncouple the locomotive from the train. At the same time, he issued Train Order No. 310 to the conductor and engineer of Extra 2048 East (No. 178) and to the conductor and engineer of Extra 7814 West at Alliance:

"Extra 7814 West take siding meet Extra 2048 East at Angora."

The engineer stated that after the three units of train No. 178 were uncoupled he pulled forward about 1/2 mile and stopped to allow the head brakeman to set torpedoes 3/ before proceeding east to Angora. The three locomotive units of train No. 178 arrived at Angora, passed the westward siding, and continued eastward on the main track to the east switch of the eastward siding where they stopped and waited on the main track for Extra 7814 West.

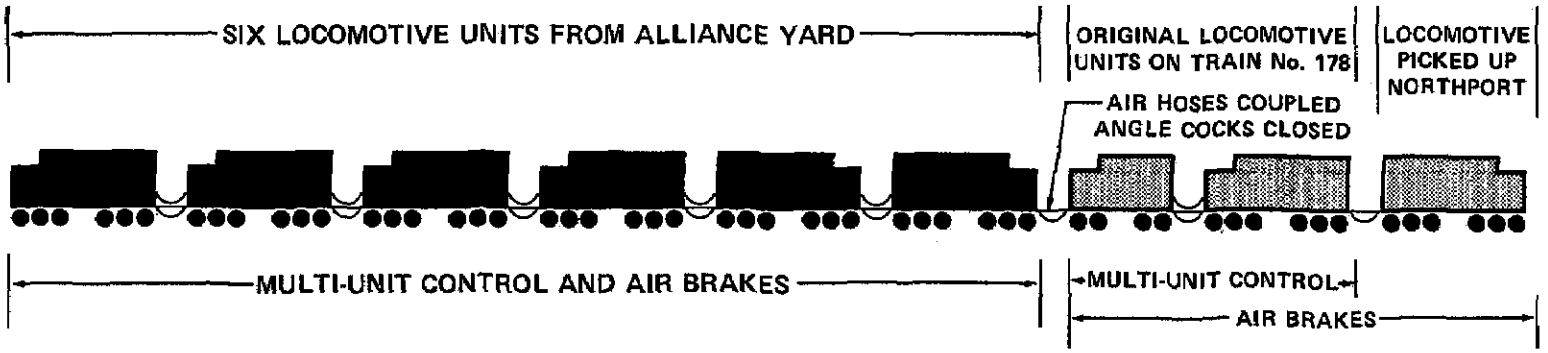
Extra 7814 West consisted of six locomotive units with five crewmembers. Following the engineer's instructions to operate the locomotive units, the fireman and head brakeman boarded the west end (lead) unit, with the fireman at the control stand and the brakeman on the left side of the unit. The engineer and

2/ A flexible cable containing conductors used to connect the electrical control circuits between locomotive units.
3/ Small explosive charges used for signaling which, when fastened to a rail and overridden by a train, explode loudly.

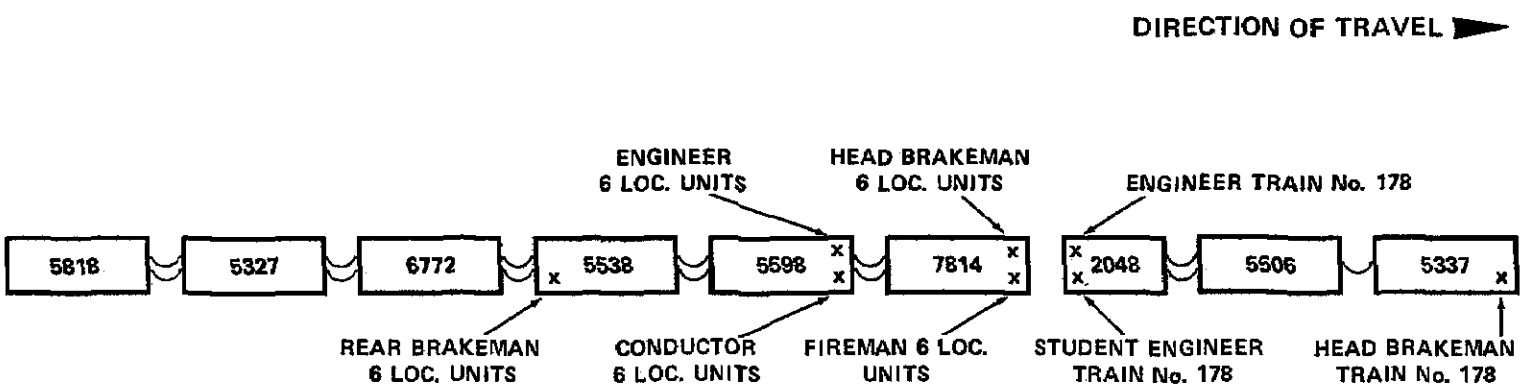
conductor boarded the second unit, with the engineer in the fireman's seat and the conductor in the engineer's seat, and another brakeman was seated in the third unit. The fireman operated the locomotive to the west end of the Alliance yard to await the arrival of train No. 178 so that they could proceed west to Northport. While the locomotive was standing at the west end of the yard, the dispatcher issued Train Order No. 310 by radio. The order was copied by the conductor, but he did not give a copy of the order to the engineer nor to the fireman. The fireman, who had not previously worked with the engineer or the conductor, walked back to the second unit, saw the conductor copying the order, and overheard the contents of the order as the dispatcher issued it. The fireman returned to the controls in the lead unit and operated the locomotive toward Angora.

Extra 7814 West arrived 20 minutes after the locomotive units of train No. 178 had stopped on the main track at Angora. When the headlight of Extra 7814 West came into view, the engineer of train No. 178 told Extra 7814 West, over the radio, to come down and couple to his three units. As the locomotive of Extra 7814 West came close, the head brakeman of train No. 178 signaled him by lantern and the six locomotive units were coupled to the three standing units. The passing or meeting as directed by the train order was not completed, but the six locomotive units of Extra 7814 West were coupled to the east end of the three locomotive units of train No. 178. Neither the air brakes nor the multiple unit control were connected between the two sets of locomotive units. The engineer of train No. 178 instructed the fireman of Extra 7814 West to continue to operate the six units and to apply dynamic braking according to his radio instructions. The engineer and the fireman of train No. 178 were in the cab on the east end of the third unit, and the fireman of Extra 7814 West was in the cab on the west end of the fourth unit of the nine units. The conductor and the engineer of Extra 7814 West remained in the fifth unit throughout the operation. The head brakeman of train No. 178 was instructed to ride the cab on the west end of the lead unit, to maintain a lookout as the locomotives moved westward and to advise the engineer when they approached the standing train, or of any problems by radio. The engineer of train No. 178 proceeded to move the nine units toward the standing portion of train No. 178 from his position in the control compartment of the third unit. (See figure 1.)

The distance from Angora to the standing portion of train No. 178 was 4.7 miles. Because of the manner in which the nine locomotive units were coupled, the engineer on the third locomotive unit had control of the air brakes, power, and dynamic braking on the two original units of train No. 178, but he had control of only the air brakes on the lead locomotive unit, which had been added. He had no control over the six units of Extra 7814 West. The engineer stated that the visibility was poor and that he could not see beyond the lead locomotive unit because of the blowing snow. As the locomotive units descended the grade, the engineer attempted to control the speed of the nine locomotive units by using the dynamic brakes on the two original locomotive units. According to the speed tape, the speed of the locomotive units increased steadily to 25 mph, dropped to about 18 mph, increased during the next mile to 32 mph, and dropped slightly, followed by a steady increase to 46 mph. The engineer received no communication from the lead locomotive unit until he radioed to slow down because they were only "10 car lengths" from the standing train. The engineer immediately applied the air brakes



METHOD LOCOMOTIVE UNITS WERE COUPLED



LOCATION OF CREWMEMBERS PRIOR TO ACCIDENT

INDICATES AIR BRAKES CONNECTED

INDICATES BOTH AIR BRAKE AND MULTI-UNIT CONTROL CONNECTED

ANGORA, NEBRASKA
FEBRUARY 16, 1980

FIGURE 1

on the three units and radioed the fireman operating the six locomotive units of Extra 7814 to apply all available dynamic braking. However, before the fireman could apply dynamic braking, the locomotive unit collided with the standing portion of train No. 178. The head brakeman of train No. 178, in the lead unit, and the engineer of Extra 7814 West, in the fifth locomotive unit, were killed, and three other crewmembers were injured. (See figure 2.)

Injuries to Persons

	Train No. 178 Crewmembers	Extra 7814 West Crewmembers	Total
Fatal	1	1	2
Nonfatal	0	2	2
Minor/None	4	2	6
Total	5	5	10

Damage

After the impact with the standing train, the locomotive units traveled westward 562 feet. The three leading locomotive units derailed. The lead unit was destroyed, the next four units were heavily damaged, and the following four units were slightly damaged. Eleven cars were heavily damaged and one was slightly damaged. Damage was estimated as follows:

Locomotives	$1,026,500
Cars	252,000
Track	8,000
Wreckage and cleanup	10,500
	$1,297,000

Crewmember Information

The crew of train No. 178 consisted of an engineer, a conductor, a fireman, and two brakemen. All were qualified under BN operating rules without restrictions. They had been off duty 10 hours 20 minutes before reporting for duty at 6:15 p.m., on February 15, 1980, at Guernsey, Wyoming. The train departed Guernsey at 8:15 p.m. They had been on duty 9 hours 15 minutes when the accident occurred.

The crew of Extra 7814 West consisted of an engineer, a conductor, a fireman, and two brakemen. All were qualified under BN operating rules without restrictions. They had reported for duty at 1:30 a.m., on February 16, 1980, at Alliance. The engineer had been off duty 8 hours and the head brakeman had been off duty 17 hours 29 minutes before reporting for duty on February 16, 1980. The other crewmembers had been off duty over 24 hours. They had been on duty 2 hours when the accident occurred.

Of the two crews, four crewmembers were promoted to engineers, three of whom had been trained by the BN. The training consisted of 30 days on-the-job training (OJT) at Alliance and 3 weeks of training at the engineer's school in St.

Paul, Minnesota. The OJT consisted of the student engineers making road trips to familarize themselves with the railroad, locomotives, and trains. The training at the engineer's school consisted of 1 week of instructions on air brakes and train handling, 1 week of instructions on the mechanical and electrical systems of locomotives, and 1 week of instructions on the operating rules. After completing the course, the student engineers made approximately 60 additional student trips. The students were required to take a qualifying trip with a road foreman of engines, attend a review class, and take an examination on the operating rules. After successfully completing the training and testing, they were promoted to engineers. The fireman of Extra 7814 West had only operated a train 14 miles for his qualifying trip for promotion to engineer. The fireman, a qualified engineer, on train No. 178, had previous railroad experience as an engineer and was not required to complete the BN training course for engineers.

The other six train crewmembers had attended a 5-day training course for brakemen, which consisted of classroom, as well as on the ground training, and covered safety rules, operating rules, and familiarization with equipment. Instruction on the operating rules was accomplished by using eight pamphlets which covered 23 of the total 309 rules. Following the 5-day course, the students were required to take several student trips: one crewman had made two trips, and the other three crewmembers had made three trips each. In addition to taking the brakeman 5-day course, the two conductors had worked as brakemen, taken instructions on operating rules, and passed a qualifying examination.

The years of service on the BN of the crewmembers was as follows:

	Years of Service	As Engineer	As Conductor
Conductor No. 178	1 yr 7 mo		1 yr
Engineer No. 178	2 yrs 6 mo	1 yr 2 mo	
Fireman No. 178	3 mo	3 mo	
Head Brakeman No. 178	10 mo		
Rear Brakeman No. 178	10 mo		
Conductor Extra 7814	1 yr 2 mo		5 mo
Engineer Extra 7814	11 mo	6 mo	
Fireman Extra 7814	3 yr 0 mo	3 mo	
Head Brakeman Extra 7814	4 mo		
Rear Brakeman Extra 7814	10 mo		

The train dispatcher had worked on this division 1 year 4 months, before the accident. He had qualified for the position through 9 days of OJT, and he was qualified under BN operating rules without restriction. The OJT was the only experience he had as a train dispatcher on a nonsignaled main track.

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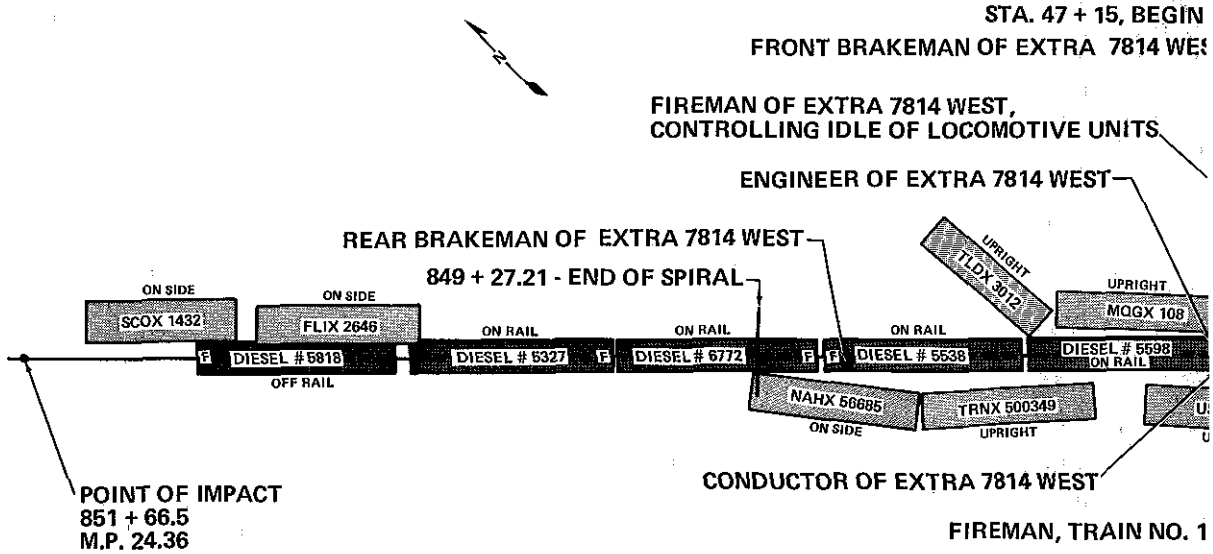

COLLISION OF 9 LOCOMOTI

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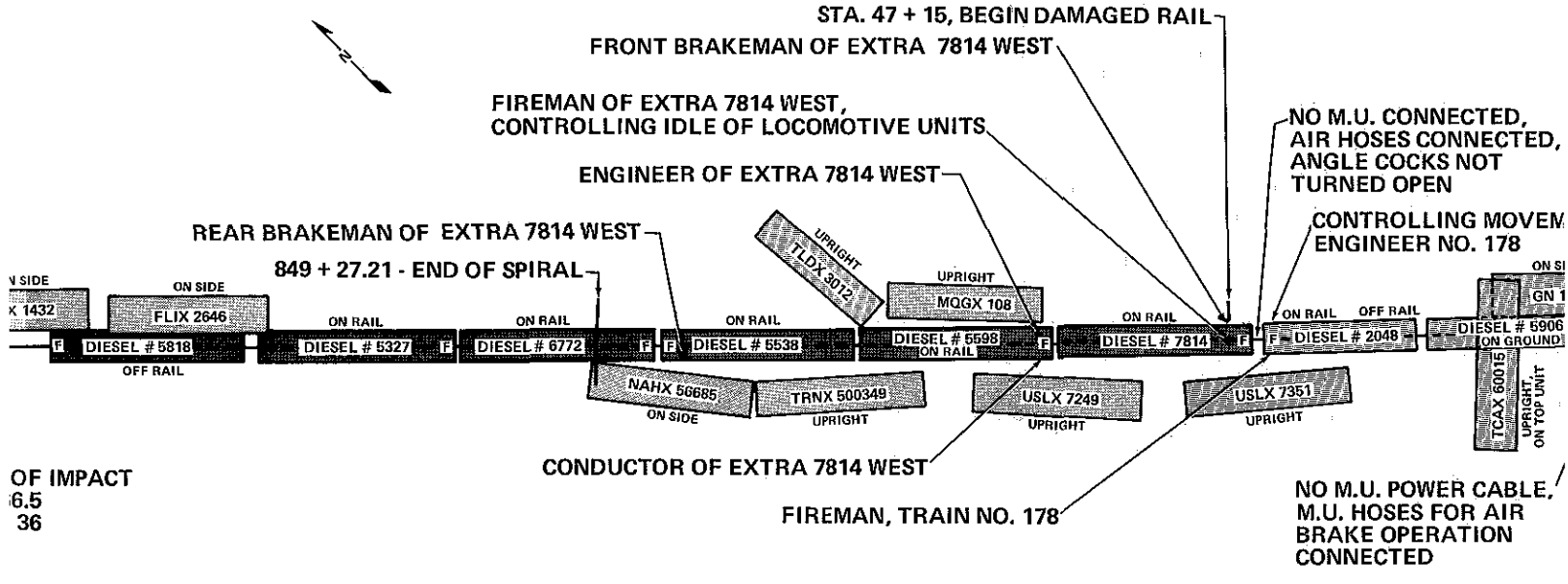

Figure 2

COLLISION OF 9 LOCOMOTIVE UNITS WITH STANDING TRAIN OF NO.

ANGORA, NEBRASKA

FBRUARY 16, 1980

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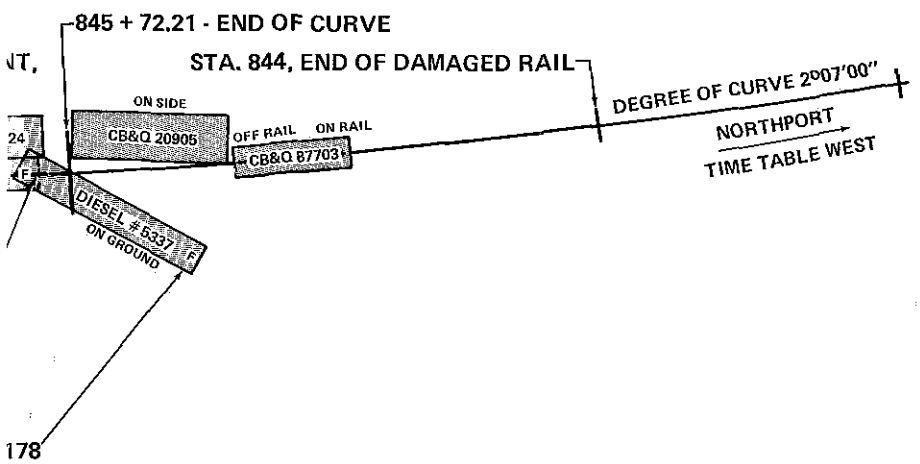


Train Information

When train No. 178 originally departed Northport, it consisted of two locomotive units - one General Motors, Electro Motive Division (EMD) Model GP-20 and one General Electric (GE) Model U-30C - 65 cars, and a caboose. The locomotive was rated to haul 5,066 tons through the area. When train No. 178 departed Northport the second time, the locomotive consisted of an additional GE Model U-30C. With the additional locomotive unit, the tonnage rating was increased to 8,000 tons. At the time of the accident, the trailing tonnage of the train was 3,510 tons. The locomotive units of train No. 178 had the following minimum continuous speed and short time ratings:

Class of Locomotive	Minimum Continuous Speed (mph)
GP-20	14.0
U-30C	8.4

GP-20 Short Time Rating	
Continuous	900 amps
1 hr	925 amps
1/2 hr	970 amps
1/4 hr	1065 amps
4 min	1480 amps
2 min	1760 amps

U-30C Short Time Rating	
Continuous	1195 amps
50 min	1220 amps
12 min	1290 amps
6 min	1380 amps

See appendix C.

Extra 7814 West consisted of two EMD Model SD40-2 units, two GE Model U-30C units, and two GE Model C30-7 units.

Each of the nine locomotive units were equipped with dual sealed-beam headlights, speed indicators, wheel slip protection devices, dynamic braking, and multiple unit control. Several of the units were provided with speed recorder tapes. Coupled together, the nine locomotive units weighed approximately 3,500,000 lbs, or 1,750 tons.

Medical and Pathological Information

A post-mortem toxicological examination of the engineer of Extra 7814 West revealed he had a blood-alcohol level of .074 ethyl alcohol. No post mortem examinations were made on the head brakeman.

Method of Operation

Trains are operated on the single main track for 27 miles between Northport and Letan, Nebraska, 6.8 miles south of Alliance, by timetable, train order, and special instructions. There is no automatic block signal system. A train operator is on duty at Northport, and the train dispatcher is on duty at Alliance. The maximum authorized train speed is 49 mph.

BN Special Instructions No. 11, Rule 421, states that, "E. Except as provided by Rule 414 before a train order is acted upon, both the conductor and engineer must have a written copy of the train order and make certain that the train order is read and understood by other members of the crew." and "G. Information contained in a train order may not be acted upon by persons other than those to whom the train order is addressed."

BN operating rule No. 105 requires that, "Sidings of an assigned direction must not be used in a reverse direction unless authorized by the train dispatcher or in an emergency under flag protection."

BN operating rule No. 102 (B) provides that, "When an engine leaves its train or part of its train behind on the main track, a sufficient number of hand brakes must be set to keep the train from moving. At night or when visibility is obscured, torpedoes must be placed a sufficient distance in advance of the detached portion to warn the returning movement. The returning movement must be made at reduced speed."

Reduced speed is defined by BN rules as, "proceed prepared to stop short of train, engine, or obstruction."

BN operating rule No. S-89 (A) provides that, "At train order meeting points, the train holding the main track must stop clear of the switch used by the train taking siding unless the train to be met is clear of the main track and switch is properly lined."

BN operating rule No. 800 provides that, "The general direction and government of a train is in charge of the conductor and all persons employed on the train are subject to his instructions."

BN operating rule No. 802 provides that, "Conductors and engineers must know that their subordinates are familiar with and perform their duties and comply with rules and special instructions. They must ascertain the extent of their subordinates' experience, instructing them when necessary, in the proper and safe performance of their work."

BN operating rule No. 804 (C) provides that, "Members of the crew must know by the speed of the train, grade, or air gauge that train is being handled safely and under control, and, when necessary, take immediate action to get the train under safe control."

BN air brake and train handling rule No. 436E provides that, "Unless otherwise provided, brake pipe hose must be coupled and air cut in on all helper locomotives. . ."

BN rules describe a train as, "an engine or more than one engine coupled, with or without cars, displaying a marker or markers."

BN Special Instructions No. 11, Rule No. 2, places a limit on the number of locomotive units by providing that, "The number of diesel units coupled together in train operation, either working, idle, or dead in tow, must not exceed seven."

BN has a provision for a work order, as outlined in the train dispatcher's manual with accompanying instructions, which reads, "When necessary to send power to assist a disabled train, issue a work order addressed to the engine that is to assist, to the disabled train as well as to other trains that would operate in the area to read as follows:

> Engine _____ works Extra _____ until _____
> between _____ and _____ not protecting
> against Extra trains. Extra (the disabled train)
> protect against work Extra _____.

In addition, the manual requires that a message of instruction be given the work train and the disabled train to read as follows:

> Extra _____ at (location of disabled train)
> unable to handle their train into _____.
> Work Extra _____ will assist Extra _____,
> disabled train, from _____ location of disabled
> train to _____.

See appendix D for BN special instructions and operating rules.

Meteorological Information

The nearest reporting National Weather Service (NWS) station is at Scottsbluff, Nebraska, 25 miles west of the accident site. The NWS reported the weather at 3:53 a.m., m.s.t., as temperature 10° F, overcast, dark with light snow. Wind was blowing from the northwest at 7.9 mph and visibility was 3 miles.

Survival Aspects

An embankment is located on each side of the track at the accident site. As the standing cars were struck, they were raised upward, overriding the lead locomotive units, and because of the enbankment, some were retained on top of the locomotive units and some fell down and were held alongside the units. The overriding cars crushed and tore away much of the superstructure of the lead unit, including the operator's cab. (See figure 3.) The head brakeman of train No. 178, who was in the operating cab of this unit, was killed when the cab was destroyed. The engineer of Extra 7814 West was seated in the fireman's seat of the fifth locomotive unit and was killed when the cab section was torn away. The fireman, was riding in the fourth locomotive unit and was injured when he was thrown into the operating console; and the front brakeman, who was in the same unit, was injured when he was thrown about the cab. The rear brakeman, who was riding in the sixth locomotive unit, was slightly injured by the force of the impact. The engineer, fireman, conductor, and rear brakeman of train No. 178 were not injured.

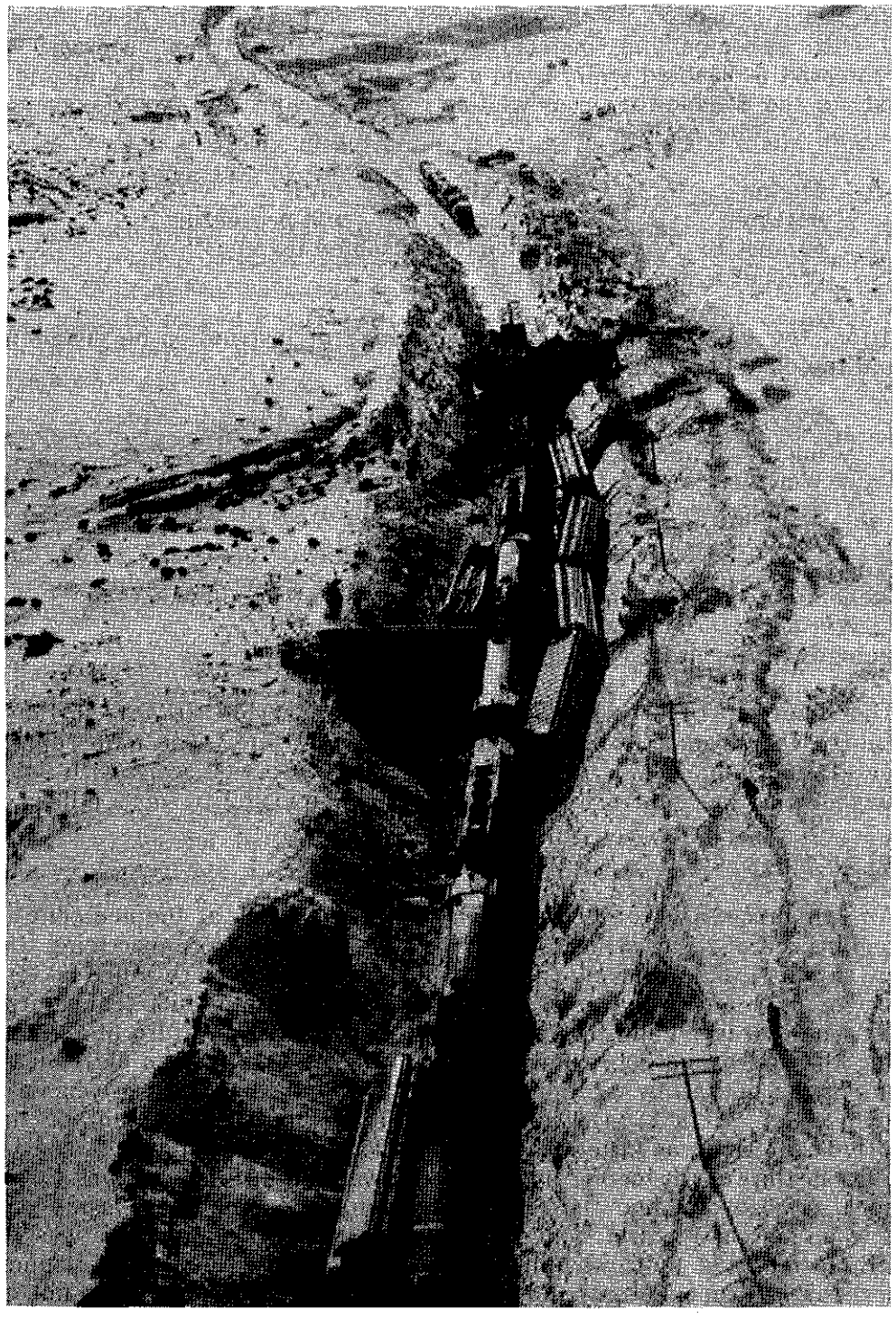


Figure 3.--Derailment of trains
No. 178 and Extra 7814 West.

Tests and Research

Air brake tests were conducted on all of the locomotive units, except the lead locomotive unit which was destroyed in the collision. The tests indicated that all of the locomotive units' air brakes functioned as intended. Electrical tests conducted on the locomotive units indicated that the dynamic brake was operable on all of the locomotive units and would have been available if the units had been properly coupled.

The controlling locomotive unit of train No. 178 was equipped with a Barco mechanical type of speed recorder and indicator. The speed recorder and indicator was tested and found to be accurate within 1 mph for speeds 20 mph or above and was accurate for distance. The speed recorder tape indicated that only one stop was made, 990 ft forward of the standing portion of the train, after the locomotive was cut away to go to Angora.

Examination of the three locomotive units of train No. 178 disclosed that they were out of sand. No mechanical condition was found that would have caused the locomotive units to function at diminished power.

Stop pins distance tests were conducted using a train dynamics analyzer. The tests were conducted using a speed of 46 mph with the following results:

- When operated from the third locomotive unit, without the multiple unit jumper cable connected on the lead unit or the trailing six units, full independent brake application required 3,268 ft to stop the nine locomotive units.

- With the locomotive units arranged as in test No. 1, but making an emergency automatic brake application, it required 2,530 ft to stop the nine locomotive units.

- With the air brakes operable on all nine units, an emergency brake application required 1,702 ft to stop the nine locomotive units.

- Using dynamic braking on eight locomotive units and maximum independent locomotive braking, it would take 1,266 ft to stop the nine locomotive units.

ANALYSIS

Operation of the Nine Locomotive Units

After the nine locomotive units were coupled at Angora, the engineer of train No. 178 decided to control the locomotive units from the operating compartment of the third unit from the west end, which had been the lead unit of train No. 178. From this position, he had control of only the power on the second and third units and control of the brakes on the three west units. He had no physical control of

the six units of Extra 7814 West which had to be controlled by the fireman on instructions by radio from the engineer in the third unit. The only power needed was that required to start the nine units moving on the 1.0 percent descending grade from Angora to the standing train. Snow was falling, and the engineer of train No. 178 stated that he could not see beyond the first unit. A review of the speed tape indicated that the added weight of the six uncontrolled locomotive units quickly caused the speed of the locomotive to increase and because of the restricted visibility, the engineer was probably not able to relate the distance traveled with the increased speed. Even though the engineer had an operable speedometer, he had covered much of the distance to the standing train when he realized that the locomotive units were moving at a high rate of speed. The collision with the standing train occurred almost immediately following the engineer's request to the fireman of Extra 7814 West to apply dynamic braking and before the braking became effective.

The momentum of the six uncontrolled heavy locomotive units moving down the descending grade would have overcome much of the retarding effort of the braking force on the three lead units. This would have allowed the speed to increase more rapidly than the engineer anticipated and the locomotive to approach too near to the standing train before he realized the situation and started action to slow the locomotive. If the brakes of all nine units had been coupled as required by BN air brake and train handling rule No. 436E and had been under the control of the engineer of the third unit, the speed would not necessarily have been excessive. If necessary, the engineer could have quickly and effectively applied the brakes on all of the locomotive units to reduce the speed or to stop.

It appeared that the engineer of train No. 178 was confused on the application of the special instructions prohibiting the use of more than seven units in a locomotive. He stated that at the time of the accident, he understood the instructions only applied to the units which were in multiple unit control and under the control of one engineer, and that operating locomotives, even if the number of units exceeded seven coupled, but under the control of more than one engineer, the rule did not apply. It also appeared that he had little experience or training in what could occur if he attempted to move a number of locomotive units on a descending grade without using the brakes on all of the units.

When the locomotive of train No. 178 was first uncoupled from the stalled train and moved eastward, torpedoes were placed on the track to warn the crew when they returned that the end of the standing train was close. The front brakeman had been instructed to ride the leading control compartment as a lookout and to advise the engineer by radio when they were approaching the standing train or of any other problems which might develop. He was not instructed to control the brakes and, in fact, did not have the levers to do so except to make an emergency application. This, of course, would only have been effective on the first three units. The head brakeman's and the engineer's visibility apparently were restricted by the snow. The only comment made by the brakeman over the radio was when the locomotive was about 500 ft from the standing train and he called, "10 car lengths."

It could not be determined if the brakeman of train No. 178 heard the explosion of the torpedo placed on the track as a warning because he was killed in the accident. The torpedo would have exploded when the first wheels of the lead locomotive unit struck it. Because the engineer was riding in the third locomotive unit and because of the noise from the diesel engines, it is doubtful that he would have heard the explosion of the torpedoes. He stated he did not. However, even if the engineer had heard the exploding torpedoes, at a speed of 46 mph and with only about 990 ft remaining to the standing portion of the train, he would not have been able to stop before the collision.

Although the engineer said the torpedoes had been placed about a half mile east of the standing portion of the train, the speed recorder tape indicated that the locomotive had stopped only once, at about 990 feet east of the standing portion, during the eastbound trip to Angora. That stop would have provided the only opportunity for the brakeman to have placed the torpedoes.

If the engineer had been able to operate the nine units from the cab of the leading unit, he would have been in a much better position to control the movement. But, since the lead unit was not connected for multiple unit control with the other two units, he believed that full control of two units was the preferred arrangement. In any event, from the beginning he should have required the fireman of the six units to apply sufficient dynamic braking to prevent an increase in speed. If all nine units had been properly coupled for multiple unit control and operated from the leading cab for the direction of travel sufficient braking would have been available to the engineer to control the speed and stop the locomotive.

Train Stalling

Operation of other than identical units in a single locomotive consist under common control usually creates no particular problem except at upper and lower speed extremes. Every such consist will have its "weak unit," and tonnages and speeds for the consist must be tailored to protect that unit. At the lower speed range, the "weak unit" is the one whose adhesion and thermal limit is reached at the highest minimum speed. Therefore, the minimum speed in the consist becomes that of the "weak unit." Since the GP-20 unit, the lead locomotive unit of Train No. 178 and the controlling unit of the locomotive, had the higher minimum continuous speed rating and a more restrictive short time rating than the U-30C units, the engineer was compelled to operate the locomotive so as to protect the GP-20 unit. With the minimum continuous speed restriction of 14 mph on the locomotive and the need to start the train at Northport on a 1.0 percent ascending grade, the engineer was unable to maintain a speed of 14 mph. It is likely that the engineer was operating the locomotive at its full load condition and was reaching the critical high amperage value, and was requiring him to cut back on power to prevent overheating or damaging the traction motors. This was probably the reason the train stalled on the grade.

Many times it becomes necessary en route to either substitute units or to add them to a locomotive for additional power. If they are added to the locomotive, multiple unit control cables should be provided so that the units can be properly coupled and controlled by the engineer to provide the needed power.

Train Order and Train Dispatcher Handling

After the train dispatcher had been informed of the second stalling of train No. 178, he apparently decided that different action would be necessary to move the train into the yard. The locomotive could have moved the front half of the train into the siding at Angora and then returned for the rear portion and moved that section into Angora. This is referred to as "doubling the hill." It is a safe and an acceptable practice, but it consumes considerable time to execute. The train dispatcher elected to use the six locomotive units of Extra 7814 West to assist or to move the train into Angora.

The train orders which were issued by the train dispatcher following the second stalling established a meeting between the two trains. However, there were no instructions issued for the actions to be taken by either locomotive crew after the meeting had been accomplished. When a train order is issued for the meeting of two trains at a siding, the entire opposing train must clear the siding switch before the other train is authorized to enter and occupy the track. The rules define a train as a locomotive with or without cars displaying markers. In this case, the markers of No. 178 were displayed on the caboose and train No. 178 could not be considered clear of the track until the caboose passed the switch. If it is assumed that the train dispatcher meant for the locomotives to pass each other at Angora siding, the meet order as issued would not have permitted the six unit locomotive to have proceeded westward on the main track and be coupled to the standing train as only the locomotive of train No. 178 would have been met. If it is assumed that the locomotive units were to be coupled together to assist the train, the train order, as issued, would not have permitted it. If it is assumed that the locomotive of train No. 178 was to be coupled to Extra 7814 West and be the lead unit so that the locomotive could be moved to the train, the train order would not have provided for that arrangement. The train order as issued by the train dispatcher, was not proper to accomplish any of the possible movement. However, a work order to send the locomotive to assist a disabled train would have accomplished his intent. Moreover, the train dispatcher did not inform either crew of his intentions. With the exception of the conductors, there was no other supervisor available to supervise the operation. The train dispatcher stated that he knew of the BN's prohibition for coupling more than seven locomotive units and that he was aware of the number of units on each locomotive. Therefore, any arrangement for coupling the two locomotives would have violated these instructions.

A train dispatcher must be precise and accurate when giving instructions to traincrews for train handling. He is the authority crewmembers rely on for their instructions and most of the time he is the only one available to the crewmembers for instruction and for advise in carrying out those instructions. The train dispatcher's instructions were improper and did not contain sufficient information about his intention for handling the locomotive units at Angora.

Crewmember Experience

Because the crewmembers on each locomotive had little railroad experience, it is not difficult to understand how they became confused by the ambiguous train

order and interpreted it to mean that the locomotive units would be coupled to assist train No. 178 into the yard. Consequently, when the engineer of train No. 178 saw Extra 7814 West, he radioed to the fireman of Extra 7814 West to proceed and couple to the locomotive units of train No. 178. The engineer of train No. 178 stated that he understood the instructions concerning the prohibition of coupling more than seven units, to refer only to those coupled in multiple unit control, and as long as the air brakes and power controls were not coupled, the instructions did not apply. He further stated that this was the reason he insisted that the six-unit locomotive of Extra 7814 West remain in control of the fireman.

Supervision of Train Handling

The only supervisors available were the conductors of each train. The BN's operating rules places the conductor in charge of the train. However, in the absence of the conductor, the engineer is responsible for the operation of the locomotive and for compliance with the rules.

The conductor of train No. 178 elected to stay on the caboose when the locomotive was uncoupled from the train and moved to Angora. Since he had a copy of train Order No. 310, he should have known that it could not be complied with, and he should have questioned it. It was his opinion that because he stayed with the train, the engineer was in charge of fulfilling the intent of the train orders and his responsibility ceased.

The conductor and engineer of Extra 7814 West were in the second unit behind the controlling unit. They made no attempt to determine if the train order was proper or how the fireman would comply with it. In fact, they completely relied on the fireman for the operation of the locomotive. This assignment was the first time they had worked with the fireman so they had little knowledge of his capabilities. The conductor had received copies of train Order No. 310, issued to Extra 7814 West, and if he was qualified for the position, he should have realized the problem in complying with it.

The engineer of Extra 7814 West told the fireman to operate the locomotive when they reported for the assignment. The engineer's previous assignment had been on February 15, 1980, from 11:00 a.m., to 5:30 p.m. Eight hours later, he reported for this assignment at 1:30 a.m., on February 16. After the accident, the postmortem toxocological examination indicated a .074 percent ethyl alcohol level. Alcohol is "burned up" by the body at a rate of 0.015 percent per hour. Based on the alcohol content at death, the engineer's blood-alcohol level could have been 0.1 percent when he reported for duty. Since the engineer was relieved at 5:30 p.m. and reported for duty 8 hours later, his blood-alcohol level would suggest that he probably used little of the time to sleep. The lack of rest and the significant blood-alcohol level may have been the reason the engineer did not take any active part in the assignment.

It appears that the BN has a good training program for engineers, and while not nearly as complete, has a fair program for other train service employees. All of the train crewmembers involved in this accident, except the fireman of train

No. 178, had been trained in the BN programs. However, when the circumstances of the accident are reviewed, it is evident that either the theory taught at the school did not provide the necessary knowledge, or the instruction was not adequate to give the employees the capability to make the proper decisions when exposed to problems, such as the following which lead to this accident:

- o Issuance of an improper train order
- o Failure of the crewmembers to question improper orders
- o Failure of the crewmembers to question the lack of instructions for handling locomotives
- o Confusion about the proper number of locomotive units which were permitted in a train operation
- o Failure of the crewmembers to anticipate problems which could occur if air brakes were not all operable
- o Failure of the crewmembers to use proper braking systems to control train speed rather than emergency air brakes
- o Failure of the conductors to exercise their supervisory responsibilities

The BN has hired a large number of train service employees during the past several years because of an increase in business. This increase has generated a need for a program which will qualify new employees to function properly under adverse conditions. Moreover, sufficient supervision must also be provided to assist crews in making proper decisions.

The BN rules provide that, "The general direction and government of a train is in charge of the conductor and all persons employed on the train are subject to his instructions." Neither conductor took any part in the handling of the locomotive units at Angora or on the return trip to the standing train. When the order was given for the locomotive of train No. 178 to proceed to Angora and to meet the locomotive of Extra 7814 West, the conductor of train No. 178 did not question the content of the order nor did he question or give instructions to the engineer about how the order would be accomplished or how the locomotives were to be coupled. The conductor of Extra 7814 West neither questioned any actions nor gave any instructions to the crewmembers from the time he went on duty until the accident occurred. When BN rules were violated, he took no corrective action. Train crewmembers, especially the less experienced ones, need the proper direction and instruction of the conductor so that they can fulfill the requirements for train handling.

CONCLUSIONS

Findings

1. The coupling of the six locomotive units to the three locomotive units, without coupling the air brakes or power between the units, created a serious train handling problem.

2. Braking capability of the three lead locomotive units was insufficient to controll the speed of the combined locomotive units on the descending grade toward the standing train.

3. If the air brakes and power had been connected on all nine locomotive units, the engineer would have had sufficient braking power to prevent the excessive speed of the locomotive and, thus, to stop before the collision occurred.

4. Train order No. 310 did not authorize all of the necessary moves to accomplish the desired assistance in pulling the train to Angora.

5. The train crewmembers did not question the content of the train order which they were unable to complete as it was given.

6. The conductor and engineer of Extra 7814 West gave no direction to the crewmembers at Angora about coupling the locomotive units.

7. The train crewmembers took no action to comply with the BN Special Instruction which prohibited the coupling of more than seven locomotive units. They also failed to take actions necessary to stop or slow the locomotive units when the speed became excessive for the existing conditions.

8. The training of the crewmembers did not prepare them adquately to assist train No. 178 to Angora.

9. More supervisory participation by BN officials should be provided to assist the new and inexperienced crewmembers in the proper performance of the tasks necessary in train handling.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 178 to control the speed of the nine locomotive units on the return downgrade trip to the standing train. Contributing to the accident were the improper coupling of the nine locomotive units; the lack of sufficient supervision and instructions; the failure of the conductors of the two trains and the engineer of BN Extra 7814 West to perform their duties properly; and the failure of the train dispatcher to issue adequate orders and instructions.

RECOMMENDATIONS

As a result of this investigation, the National Transportation Safety Board recommends:

--to the Burlington Northern, Inc.:

> Provide the equipment necessary to make proper couplings between all units of a locomotive, so that the engineer will have complete control of all locomotive units. (Class II, Priority Action) (R-80-34)
>
> Insure that Rule 800, which assigns the responsibility for train operation to conductors, is adhered to strictly and conductors are adequately trained to make the necessary decisions for the safe handling of train. (Class II, Priority Action) (R-80-35)"

In addition, the Safety Board reiterates safety recommendation R-74-9 which was made to the Federal Railroad Administration on June 25, 1973, as a result of its investigation of a train collision at Indio, California:

> "The Federal Railroad Administration include in their proposed Standards for Rules Governing the Operation of Trains regulations that will in effect prohibit the use of narcotics and intoxicants by employees for a specific period prior to their reporting for duty and while they are on duty."

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, and FRANCIS H. McADAMS, Member, did not participate.

August 12, 1980

APPENDIX A

INVESTIGATION

Investigation

The National Transportation Safety Board was notified of the accident about 10:30 a.m., on February 16, 1980. The Safety Board immediately dispatched an investigator from its Kansas City field office to the scene. An investigator from Washington, D.C., also went to the scene and to Alliance, Nebraska, during the course of the investigation.

Depositions

A 3-day deposition proceeding was held on May 13, 14, and 16, 1980, at St. Paul, Minnesota, Gering, Nebraska, and Denver, Colorado, respectfully. Parties represented at the hearing were the Burlington Northern, Inc., Federal Railroad Administration, Brotherhood of Locomotive Engineers, and United Transportation Union. Statements were taken from 13 witnesses.

APPENDIX B

CREW INFORMATION

Train No. 178

Conductor Richard P. Foland

Conductor Foland, 38, was employed as a brakeman by the BN on July 9, 1978, and was promoted to conductor on July 20, 1979. Foland passed the BN operating rules examination on July 20, 1979, and a company physical examination on July 1, 1978. He had attended the 5-day brakeman course.

Engineer Thomas J. Roach

Engineer Roach, 36, was employed as a brakeman by the BN on September 16, 1977, and he became a fireman on March 23, 1978. He entered the engineers training program and was promoted to engineer on December 21, 1978. Roach passed the BN operating rules examination on December 21, 1978, and a company physical examination on September 13, 1977. He attended the 5-day brakeman course and the 3-week engineer training program at St. Paul. Roach had previously worked for the Chicago Northwestern Railroad as a fireman for 5 years, during which time he attended the engineers school, but he did not work as an engineer during his employment with them.

Fireman John F. Crane

Fireman Crane, 30, was employed by the BN as an engineer on November 8, 1979. He passed the BN operating rules examination on January 17, 1980, and a company physical examination on November 8, 1979. Crane had previously worked for the White Pass and Yukon Railroad as a fireman and on the Denver and Rio Grande Western Railroad as an engineer.

Head Brakeman Darwyn L. Swartwood

Brakeman Swartwood, 26 was employed as a brakeman by the BN on May 20, 1979. He passed the BN operating rules examination on September 4, 1979, and a company physical examination on May 11, 1979. He had attended the 5-day brakeman course.

Rear Brakeman Robert C. Pepples

Brakeman Pepples, 23, was employed as a brakeman by the BN on May 19, 1979. He passed a company physical examination on May 18, 1979. He took an examination on BN operating rules on September 6, 1979, however, he was censured for dishonesty after an investigation disclosed he copied answers during the rules examination. He had attended the 5-day brakeman course.

Train Extra 7814 West

Conductor Richard L. Heglin

Conductor Heglin, 24, was employed as a brakeman by the BN on April 19, 1978. On December 13, 1978, he transferred to the position of fireman. On February 12, 1979, he took and failed the BN operating rules examination. On April 29, 1979, he entered the engineer training program, and on July 1, 1979, he resigned from the program and returned to the position of brakeman. He again took and failed the BN operating rules examination on July 25, 1979. On September 6, 1979, he took and passed the BN operating rules examination and was promoted to conductor. He took a company physical examination on April 12, 1978, and passed it with the restriction that he must wear glasses while on duty.

Engineer John A. Todish

Engineer Todish, 31, was employed as a brakeman by the BN on June 2, 1979. He transferred to the engineer training program on June 23, 1979, and on August 14, 1979, he was promoted to engineer. Todish passed the BN operating rules examination on August 14, 1979, and a company physical examination on May 15, 1979. He had attended the 5-day brakeman course, as well as the 3-week engineer training program. Todish had previously worked for the Elgin, Joliet and Eastern Railroad for 7 years as an engineer.

Fireman David E. Skorupa

Fireman Skorupa, 37, was employed as an enginehouse laborer by the BN on February 11, 1977. He transferred to the position of brakeman on February 1, 1978. On December 11, 1978, he transferred to the engineer training program, and on November 6, 1979, he was promoted to engineer. He passed the BN operating rules examination on November 6, 1979, and a company physical examination on February 1, 1978. He had attended the engineer school.

Head Brakeman Marty E. Knudson

Brakeman Knudson, 23, was employed as a brakeman by the BN on November 4, 1979. He passed the BN operating rules examination on January 31, 1980, and a company physical examination on October 19, 1979. He had attended the 5-day brakeman course.

Rear Brakeman John S. Porter

Brakeman Porter, 28, was employed as a brakeman by the BN on June 10, 1979. He passed the BN operating rules examination on October 15, 1979, and a company physical examination on May 29, 1979. He had attended the 5-day brakeman course.

APPENDIX C

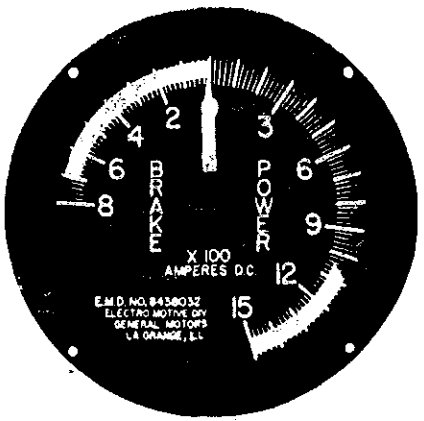
LOCOMOTIVE MINIMUM CONTINUOUS SPEED AND SHORT TIME RATINGS

512 Load Current Indicating Meter

Locomotive pulling force is indicated by the load current indicating meter which is graduated to read amperes of electrical current, with 1000 to 1500 being the maximum reading on the scale, depending on the model of locomotive An area on the meter face or plate on control stand indicates when current levels are too high for continuous operation

The meter is connected so as to indicate the current flowing through the No 2 traction motor with each motor carrying the amount shown on the meter

On later model locomotives, a zero-center type meter is used The meter needle swings to the right of zero to indicate load current during power operation, and it swings to the left of zero to indicate dynamic braking current, with 800 amperes being the maximum reading on the braking portion of the meter



Since the dynamic brake regulator controls maximum braking current, the meter should seldom, if ever, indicate more than 700 amperes, which is the rating of the dynamic braking resistor grids.

Since the amperage through the motor, (for a given step of field shunt or transition) is proportional to the torque or force developed at the motor shaft, the meter can also be used as a "Pull Meter" to indicate the tractive effort of a locomotive In general, the greatest need for increased "torque or force" is in starting heavy trains, running on ascending grades, or accelerating the train It is during these operations that amperage will rise, indicating that more "torque or force" is being produced and increased train forces.

Excessively high amperage within a traction motor, for too long a duration, will damage or even destroy the traction motor For this reason it is important for the engineer to monitor this meter

513 Minimum Continuous Speed

The minimum continuous speed of a locomotive is the minimum speed at which a locomotive can operate continuously under full load conditions without damaging the traction motors by the application of high current (amperage) This speed is based on the maximum amperage the traction motor can accept without overheating

The minimum continuous speed will vary between locomotives depending upon gear ratio, number of powered axles, type of performance control or power reduction

If the load meter is monitored and the train operated in such a manner as to prevent the application of destructively high amperage, the minimum continuous speed will not reach a critical value

Minimum continuous speeds of locomotives are as follows:

Class	Loco No	Min Cont Speed mph
BURLINGTON NORTHERN		
NW 5	986 995	10 0
GP 5	1350-1365	15 0
F 7	600 761	11 0
GP 7	1504 1643	11 0
SD 7	6000 6659	6 0
P 7	9700 9749	15 0
	9750 9760	11 0
	9761 9794	15 0
E 8	9967 9976	30 0
F 9	766 853	12 0
GP 9	1700 1980	12 0
SD 9	6100 6206	8 0
GP 10	1400 1499	12 0
GP 18	1990 1998	12 0
GP 20	2000 2071	14 0
GP 30	2200 2254	12 0
GP 35	2500 2545	12 0
GP 38	2072 2109	10 7
SD 24	6240 6255	10 0
	(62:15 G R)	11 5
	(60:17 G R)	13 0
GP 40	3000 3039	13 0
SD 40	6300 6324	9 0
	6325 6385	8 5
	6394 6399	13 0
	6700 6734	8 5
	6800 6836	8 5
	6900 6928	8 5
SD 40-2	8800-8804	8 5
	8900 8904	8 5
SD 45	6400 6429	8 5
	6430 6456	13 2
	6457 6471	9 0
	6472 6542	13 2
	6543 6567	9 0
	6592-6599	13 2
F 45	6600 6613	9 0
	6614 6625	13 2
	6626 6645	9 0
U 23C	5200-5208	7 5
U 25B	5400-5423	15 6
	5424-5429	13 7
U 25C	5600 5617	8 2
	5618 5620	9 2
U-25C	5621 5629	8 2

Class	Loco No	Min Cont Speed mph
BURLINGTON NORTHERN		
U-25C	5630	9 2
	5631-5641	8 2
U 28B	5450 5459	13 5
	5460-5465	17 5
U 28C	5650-5665	9 6
	5666 5677	8 4
U 30B	5470 5484	13 0
U 30C	5300-5394	8 4
	5800-5839	8 4
	5900-5944	8 4
U-33C	5600-5714	12 7
	5715 5724	8 4
	5725 5734	12 7
	5735-5763	9 2
	5764-5764	11 0
A 415	4010 4011	11 0
ARS 3	4050 4085	10 0
APS 11	4180 4197	10 0
A 424	4240 4246	13 0
A 425	4250 4265	13 0
A 636	4360 4369	14 8
C&S:		
SD 7	810- 819	6 0
SD 9	820 842	8 0
SD 40	875 887	13 0
S	9950 959,	8 5
	980	8 5
	900-925	8 5
	990	8 5
SD 45	868 874	9 0
U 30C	890- 893	11 4
FW&D:		
GP 7	700 703	11 0
SD 7	850 859	6 0
AMTRAK:		
P 7	A 100 Ser	15 0
E-8	9900 Ser	30 0
	A 300 Ser	30 0
E 9	A 400 Ser	33 0
SDP 40	A 500 Ser	16 4
	A-600 Ser	36 4
WSMTD:		
E 9	9901 9904	33 0
	9910-9925	33 0

514 Short Time Ratings

A short time rating plate near the load meter gives the time limitations at various current levels The times are non cumulative and it should be understood that the short time ratings are not to be interpreted as being consecutive ratings The locomotive must not under any circumstances be operated at the 1/4 hour rating for 1/4, then the 1/2 hour rating for 1/2 hour, then the 1 hour rating for 1 hour If the load indicating meter pointer exceeds the short time ratings, as indicated on the plate or load meter, then the tonnage must be reduced

Short time ratings are related to minimum continuous speed in that the locomotive will be operating within the maximum safe amperage limitations down to the specified speed

For example a GP-35 locomotive consist may be operated continuously at 12 MPH with 1000 amperes indicated on the load indicating meter If the speed drops to 8 MPH with the load indicating meter in the "red" at 1125 amperes, the short time rating will govern and, by referring to the plate or load meter on the control stand, it can be seen that the locomotive must only be operated at 1/4 hour at this amperage

The short time ratings of locomotives are as follows:

GP-7	
Continuous	825 Amps
1 Hour	900 Amps
1/2 Hour	925 Amps
1/4 Hour	950 Amps

GP 9 20	
Continuous	900 Amps
1 Hour	925 Amps
1/2 Hour	970 Amps
1/4 Hour	1065 Amps

GP - 35	
Continuous	1000 Amps
1 Hour	1025 Amps
1/2 Hour	1050 Amps
1/4 Hour	1125 Amps

GP - 40 SD - 40 45	
Continuous	1050 Amps
1 Hour	1075 Amps
1/2 Hour	1100 Amps
1/4 Hour	1150 Amps

SD - 7 - 9 24	
Continuous	900 Amps
1 Hour	950 Amps
1/2 Hour	985 Amps
1/4 Hour	1035 Amps

GP-30	
Continuous	980 Amps
1 Hour	1000 Amps
1/2 Hour	1025 Amps
1/4 Hour	1075 Amps

U - 23C 25B 25C	
Continuous	1140 Amps
50 Minutes	1150 Amps
12 Minutes	1220 Amps
6 Minutes	1300 Amps
4 Minutes	1400 Amps
2 Minutes	1680 Amps

U - 28B 28C - 30B - 30C - 33C	
Continuous	1195 Amps
50 Minutes	1220 Amps
12 Minutes	1290 Amps
6 Minutes	1380 Amps
4 Minutes	1480 Amps
2 Minutes	1760 Amps

515 A A locomotive or locomotive consist must not be operated below the minimum continuous speed of any locomotive working in a head end or helper consist beyond the allowed time limit

B When operating below the minimum continuous speed of any locomotive working in the head end or helper consist, the short time rating will govern

C When operating a mixed consist, and all locomotives do not have the same minimum continuous speed rating, the consist should not be operated with high amperage readings for extended time periods at speeds which are slower than the highest minimum continuous speed rating of any locomotive in the consist

D Where required, train must be reduced or doubled to comply with these instructions

E Dispatchers will regulate train tonnage to avoid doubling or reducing unless such doubling or reducing is positively planned in advance

APPENDIX D

EXCERPTS FROM BN RULES AND SPECIAL INSTRUCTIONS

BURLINGTON NORTHERN INC.

DENVER REGION

NEBRASKA, COLORADO AND ALLIANCE DIVISIONS

Special Instructions No. 11

IN EFFECT AT 12:01 A.M.
Central Standard Time
AND
MOUNTAIN STANDARD TIME

Sunday, October 28, 1979

Asst. Vice President Transportation	Asst. Vice President Operations
H. E. PIERCE	W. J. CONDOTTA
Superintendent Nebraska Division	**Superintendent Alliance Division**
T. R. HACKNEY	W. E. GREENWOOD

Superintendent
Colorado Division
D. H. BURNS

2 Restrictions on Diesel Units—

The number of diesel units coupled together in train operation, either working, idle, or dead in tow, must not exceed seven When the operating diesel units on head end of train exceed 18 powered axles, Individual Subdivision Special Instructions or bulletin must be referred to in determining if any restrictions are in effect governing trailing tonnage Maximum tonnages expressed in Individual Subdivision Special Instructions for head end power are extreme limits under ideal conditions and superintendents will establish lower limits as required.

421 When train orders are transmitted by radio they must be transmitted in accordance with applicable operating rules, and the following:

A The train dispatcher or operator shall call the addressees of the train order and state his intention to transmit the train order

B Before the train order is transmitted the employee to receive and copy the train order shall state his name, identification or call sign, location, and that he is prepared to receive a train order Train orders may not be received and copied by an employee operating the controls on an engine of a moving train Train orders may not be transmitted to the crew of a moving train when, in the judgment of either the conductor, the engineer, or the train dispatcher, the train order cannot be received and copied without impairing the safe operation of their train

C Train orders shall be copied in writing by the receiving employee in the format prescribed in the operating rules

D After the train order has been received and copied, it shall be immediately repeated in its entirety After verifying the accuracy of the repeated train order, train dispatcher shall then state "complete", the time, and the initials of the employee designated by the railroad Employees copying train orders must then acknowledge by repeating "complete" and the time

E Except as provided by Rule 414 before a train order is acted upon, both the conductor and engineer must have a written copy of the train order and make certain that the train order is read and understood by other members of the crew

F Except as provided by Rule 414 a train order transmitted by radio which has not been made complete may not be acted upon and must be treated as though not sent Rule 209 will not apply "Complete" must not be given to a radio transmitted train order for other trains until response "complete" has been acknowledged by the train being restricted

G Information contained in a train order may not be acted upon by persons other than those to whom the train order is addressed

Reduced Speed. -- Proceed prepared to stop short of train, engine or obstruction.

S-89 (A). At train order meeting points, the train holding the main track must stop clear of the switch used by the train taking siding unless the train to be met is clear of the main track and switch is properly lined.

102 (B). When an engine leaves its train or part of its train behind on the main track, a sufficient number of hand brakes must be set to keep the train from moving. At night or when visibility is obscured, torpedoes must be placed a sufficient distance in advance of the detached portion to warn the returning movement. The returning movement must be made at reduced speed.

105. Trains and engines using a siding or any track other than a main track must move at reduced speed and be prepared to stop short of a switch not properly lined.

Sidings of an assigned direction must not be used in a reverse direction unless authorized by the train dispatcher or in an emergency under flag protection.

Air Brake and Train Handling Rules

E. Unless otherwise provided, brake pipe hose must be coupled and air cut in on all helper locomotives and locomotives must not be cut off while train is in motion.

800. The general direction and government of a train is in charge of the conductor and all persons employed on the train are subject to his instructions.

802. Conductors and engineers must know that their subordinates are familiar with and perform their duties and comply with rules and special instructions. They must ascertain the extent of their subordinates' experience, instructing them when necessary, in the proper and safe performance of their work.

804 (C). Members of the crew must know by the speed of train, grade, or air gauge that train is being handled safely and under control, and, when necessary, take immediate action to get train under safe control.