NATIONAL TRANSPORTATION SAFETY BOARD

RAILROAD ACCIDENT REPORT

PENN CENTRAL COMPANY
COLLISION OF TRAINS
N-48 AND N-49 AT
DARIEN, CONNECTICUT
AUGUST 20, 1969

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C. 20591

REPORT NUMBER: NTSB-RAR-70-3

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FOREWORD

The field investigation was conducted by the National Transportation Safety Board in cooperation with the Federal Railroad Administration (FRA). This investigation included a public hearing which was held by the Safety Board in New Haven, Connecticut, on October 7, 8, 9, and 10, 1969. This report of facts and circumstances and determination of cause by the Safety Board is based on the facts developed in the field investigation and public hearing.

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I. SYNOPSIS

About 8:20 p.m. on August 20, 1969, Penn Central commuter trains N-48 and N-49 collided head-on just north of the Hoyt Street crossing on the New Canaan Branch near Darien, Connecticut. Train N-48, going from Stamford to New Canaan, had a three-man crew and about 60 to 80 passengers. The first car in train N-48 had been closed to revenue passengers before it left Stamford. Train N-49, a deadhead equipment train from New Canaan to Stamford, had a three-man crew and was carrying a car inspector and an electrician who had performed service at New Canaan and were returning to Stamford, still on duty.

A passenger, who was riding without authorization in the head car of N-48, and the engineer were killed. The conductor, flagman, and about 40 passengers were injured. The conductor and flagman on train N-49 were killed and the engineer was seriously injured. The head cars of both trains were almost completely destroyed; other cars were less severly damaged.

The two trains involved in the accident consisted of self-propelled electrically-operated commuter-type passenger cars. The engineer's operating compartment of these cars was located on the front platform. Train N-48 consisted of three cars and train N-49 consisted of nine cars. An overhead wire catenary system provides power for the operation of the trains.

No automatic block-signal system is used on the branch. Trains are operated by timetable, train orders, and a manual block system. A siding of sufficient length to accommodate three commuter cars is located at Dale, about 4 miles east of Stamford, within the town of Darien. An intermediate block-limit station was provided at Dale which, when opened, divided the branch into two blocks.

Train N-48 departed from Stamford at 8:11 p.m., and was authorized by train order to operate on the main track to Dale where it was required to enter the siding so that train N-49 could pass. This is called a "meet." Train N-49 departed from New Canaan at 8:11 p.m., and was authorized by train order to operate on the main track to Dale block-limit station where it was required to stop and obtain permission to

occupy the next block after N-48 entered the siding.

Train N-48 made stops at Glenbrook and Springdale to discharge passengers. Springdale is located 0.7 miles west of Dale siding. After departing from Springdale, the train did not stop and enter Dale siding as required by the train order but accelerated to a speed approaching 30 miles per hour and continued to move eastward on the main track. Shortly after it passed the siding, and while moving around a 1° 30' curve to the right, train N-48 collided head-on with N-49.

PROBABLE CAUSE

The Safety Board determines that the collision was caused by the operation of train N-48 beyond its meeting point, in violation of properly issued train orders. It could not be determined why the engineer of train N-48 failed to stop and enter the siding at Dale as required by train order. Among the several possibilities, the Board considers it most probable that the engineer misinterpreted the "high ball" signal given by the conductor at Stamford. He assumed that he had right-of-way over train N-49 and failed to read the order which was given him by the Stamford operator. If the conductor of N-48 had fully complied with the operating rules in obtaining a copy of the train order, in instructing the flagman in his duties concerning the meet with train N-49, and had monitored the operation of the train approaching the siding at Dale, the collision might have been prevented, despite the engineer's action.

Contributing to the cause of the serious injuries and fatalities of the employees and the one passenger were: the design and location of the engineer's control compartment, the inability of the leading cars to withstand the force of the impact, and the location of the victims at the time of the collision in the forward area of the cars. Factors contributing to a great extent to the passengers' injuries were: the lack of restraining devices to hold the passengers in their seats, and the failure and movement of the seat backs.

II. FACTS

A. Location of Accident

The accident occurred August 20, 1969, in Darien, Connecticut, on the New Canaan Branch. This Branch is part of the New Haven Division of the New Haven Region of the Penn Central Company.

The New Canaan Branch is a single-track line extending 7.9 miles northward geographically from Stamford to New Canaan, Connecticut. At Stamford, the branch connects with the main line of the New Haven Region extending between New York, New York, and Boston, Massachusetts. Railroad timetable direction, however, is eastward from Stamford to New Canaan and westward in reverse, and these directions will be used in the report. The accident occurred at a point 4.33 miles east of Stamford and 0.74 miles east of Springdale station, within the town of Darien. 1/

Dale siding, 587 feet in length, is parallel to the main track on the south. The east switch of the siding is located 1,050 feet west of the point of accident. The switches of the siding are hand operated and are equipped with targets and reflectors. The west switch of the siding is located 2,262 feet east of the station at Springdale. The main track and Dale siding are provided with an overhead wire catenary system to provide electric power for the propulsion of trains.

Stamford Interlocking Tower is located at the west end of the New Canaan Branch on the New Haven Region 33.1 miles east of Grand Central Station in New York City. Signals and switches governing eastbound train movements to the New Canaan Branch are controlled from this tower.

The circuit breakers and the disconnects for the New Canaan Branch electric power system are also operated from the tower. The Stamford passenger station is located 1,839 feet west of the interlocking tower, along the main line of the New Haven Region.

B. Method of Operation

Trains are operated on the New Canaan Branch by timetable, train orders, and a manual block system. A manual block is a length of track of defined limits which is governed by block signals or by block-limit signals or both, controlled manually by an operator upon information received by telephone or other means of communication. There is no automatic signal system in use.

A manual-block signal at Stamford, displaying two aspects, governs the movements of eastbound trains to the Branch. This signal is located

1/ Appendix #3 - Sketch of accident area.
Appendix #4 - Detailed description of the accident area.

at the entrance of the New Canaan Branch, 1,255 feet east of Stamford Tower. A green aspect displayed for a passenger train indicates that the block is clear and it conveys permission for the train to enter the block. A red aspect displayed indicates that a train is not permitted to enter the block.

At New Canaan, a block-limit signal constantly displaying an aspect of one red and one yellow light is mounted on a pole along the main track about 1,540 feet west of the station. The red and yellow lights are displayed horizontally with the yellow next to the track. A sign with the word "Cane" is mounted below the lights. This signal identified the eastern limits of the block.

At Dale siding, there is a similar block-limit signal with "Dale" mounted below the lights. (See Figure 1, page 5.) This signal is located along the north side of the track, 299 feet east of the west switch of the siding. Dale block-limit station was opened by time-table instructions from 6:55 a.m. to 8:25 a.m. and from 6:10 p.m. to 7:25 p.m., daily except Saturday, Sunday, and holidays for regular meets between opposing trains. Dale block-limit station was opened as needed at other times by train order. Since the accident, rules regarding the time of the open block-limit station have been changed. When Dale block-limit station was opened, the New Canaan Branch was divided into two manual blocks, and a train was not permitted to pass the block-limit station without obtaining permission from the operator to occupy the block.

Under the rules governing manual-block operation, a train can enter one block on verbal permission of the operator. When it is desired to give permission to enter the second block, the operator must issue a clearance card (Form K). 2/ The blocks of the New Canaan Branch are under the control of the operators at Stamford and New Canaan. When Dale block-limit station is opened, it is under the control of the operator at New Canaan. Permission to occupy a block, movements to and from the block, and all other pertinent information must be recorded by the operators on a prescribed form.

An interlocking signal governing movements on the track leading to the New Canaan Branch, which is also used as a train order signal, is located 658 feet east of Stamford Tower. When this signal indicates "stop" in conjunction with the displaying of a train order signal on the tower (a yellow flag by day and yellow light by night), it indicates that there are orders for the train.

A dwarf signal governing eastward movements on No. 5 track, which is the track used at the Stamford station by the New Canaan trains, is located 704 feet west of Stamford Tower.

2/ Appendix #1-Excerpts from Penn Central Company's Rules for Conducting Transportation rules 316, 317, 334, and blank forms.

Figure No. 1

Dale block - limit station

The rules do not permit an opposing or following train to enter a manual block occupied by a passenger train nor do they permit a passenger train to enter an occupied block. 3/ To allow opposing passenger trains to meet at Dale siding it is necessary to divide the branch into two blocks by opening Dale block-limit station.

In addition to the manual-block signal and the block-limit signal, several other signals are used on the New Canaan Branch. 4/

A train order is a written instruction issued by the train dispatcher over the signature of the Superintendent for movements not provided for by timetable or otherwise. They are transmitted in a prescribed manner by the dispatcher to an operator or crewmember who prepares the order. The orders are addressed to those employees who are to execute them. If more than one train is involved identical train orders must be delivered to the employees of each train. Train orders are in effect until fulfilled, superseded, or annulled. The rules require that train orders must be issued for all meets between passenger trains on single track. 5/

The operating rules require that a train on a single track approaching meeting point must sound a prescribed whistle signal -- two long blasts and one short blast -- at least 1 mile before it reaches the meeting or waiting point. If the engineman fails to sound the prescribed whistle signal, a member of the crew must communicate with him at once and if necessary, the crew member must stop the train. 6/ The whistle signal for approaching the meeting point differs from that for approaching highway grade crossings. The signal for the highway grade crossing is two long blasts, one short blast, and one long blast which is to be held until the locomotive reaches the crossing. 7/ The rules also specify that the conductor and engineman are responsible for the safety of the train and for the observance of the rules. 8/

Passenger trains are authorized to operate at a maximum speed of 40 miles per hour between Stamford and Springdale Cemetery, 30 miles per hour between Springdale Cemetery and Talmadge Hill, and 40 miles per hour between Talmadge Hill and Cane block-limit station.

3/ Appendix 1 Excerpts from Penn Central Company's Rules for Conducting Transportation rules 305 to 342, inclusive.
4/ Appendix 3&4-A sketch and detailed description of the accident area
5/ Appendix 1 - supra, rules 201 to 226, inclusive.
6/ Appendix 1 - supra, rule S-90 .
7/ Appendix 1 - supra, rule 14
8/ Appendix 1 - supra, rule 106

C. Description of Accident

1. Crews of Trains N-48 and N-49

The conductor and brakeman of train N-48 began their tour of duty at 2 p.m., on August 20, 1969, at Stamford. Their assignment was on a train to Grand Central Station, New York City, and then on train No. 334 to New Canaan, arriving there at 6:43 p.m. They were then assigned to train N-47, scheduled to depart from New Canaan at 7:29 p.m. The engineer of train N-48 began his tour of duty on August 20, at 6:29 p.m., and, after he arrived at New Canaan on train N-44, he was assigned to N-47. The crew of N-47 was also assigned to be the crew of N-48 between Stamford and New Canaan.

The engineer of N-49 was first assigned on August 20th, to train No. 334 from New York City to New Canaan. His next assignment after his arrival at New Canaan was on train N-49. The conductor and brakeman of N-49 went on duty at Stamford at 1:15 p.m., and after several round trips between Stamford and New Canaan arrived at New Canaan on train N-44. Their next assignment was on train N-49.

The rest and hours of service of the employees on trains N-48 and N-49, and of those in the Stamford and New Canaan control stations, met the requirements of the Hours of Service Law for their tours of duty on August 20, 1969.

2. Trains

Commuter service was provided on the New Canaan Branch by the shuttling of trains, consisting of one or more self-propelled cars, between Stamford and New Canaan. An exception to this arrangement, however, was that two trains were operated from New Canaan to New York City in the morning and returned in the evening. In the evening, the two trains, Nos. 332 and 334, were scheduled to arrive at New Canaan at 6:15 p.m. and 6:43 p.m., respectively. After the passengers of these two trains had detrained at New Canaan, the cars were used in other trains. Three cars from the first train, No. 332, were used for train N-41 and then later for N-44, N-47, and N-48. The rest of the cars from the first train were used for train N-45. The cars from the second train No. 334 were scheduled to return dead-head to Stamford as train N-49.

An electrician and a car inspector were sent to New Canaan to perform the required inspections and brake tests on trains N-41 and N-45 which were assembled from train No. 332. On August 20, 1969, the tests were properly performed and no exceptions were taken to any of the equipment. The nine self-propelled cars from train No. 334, which were used to make train N-49, were also inspected and tested and no exceptions were taken.

On August 20, Penn Central Train No. 88, operating from Grand Central Station to New Haven, was delayed and arrived at Stamford at 7:26 p.m., 33 minutes late. The Stamford to New Canaan train N-44 was scheduled to connect with train No. 88 at Stamford, consequently N-44 was held for the arrival of No. 88. Train N-44 departed from Stamford at 7:30 p.m., arriving at New Canaan at 7:50 p.m., 31 minutes late. As the cars from train N-44 were used for train N-47, the late arrival of N-44 delayed the departure of N-47 from New Canaan.

After the train crew had received copies of the clearance form and permission from the operator to occupy the block, train N-47 departed from New Canaan at 7:53 p.m., 24 minutes late. It proceeded from New Canaan to Stamford without incident, arriving at Stamford at 8:06 p.m., 21 minutes late.

3. Issuance of Train Orders

Train N-49 was scheduled to depart from New Canaan at 7:48 p.m., and to arrive at Stamford at 8:04 p.m. The train, however, could not enter the block as long as N-47 was occupying it, since Dale block-limit station was closed, making only one block between New Canaan and Stamford. This meant that N-49 could not depart from New Canaan until after 8:06 p.m. The train dispatcher reasoned that to have held N-48 at Stamford for the arrival of N-49 or to have held N-49 at New Canaan for the arrival of N-48, would have further delayed one or the other. The dispatcher then decided to have trains N-48 and N-49 meet at Dale siding. To accomplish this, it was necessary for him to issue orders to each train and to open Dale block-limit station by train order. Because Dale siding is only long enough to accomodate a train of three commuter cars, it was decided to have N-48 enter the siding and to permit the longer train to pass on the main track. The train dispatcher then called the operators at New Canaan and Stamford by telephone and instructed them to copy the following train order No. 29 addressed to the:

"Conductor and Engineman of No N-49 MU eng 4404 at New Canaan.
"Conductor and Engineman of N-48 MU eng 4425 at Stamford."

Train order No. 29 read:

"No N-49 MU eng 4404 meet No N-48 MU eng 4426 at Dale
"No N-48 MU 4426 take siding.
"Dale open as block limit station for this meet."

After it was properly repeated back to the dispatcher by the operators, the train order was made complete at 8:02 p.m.

Train order No. 29 was the second order held by the operator at New Canaan for train N-49. Train Order No. 28, which had been made complete at 6:57 p.m., stated:

"No N-44 MU eng 4426 has right over No N-47 MU eng 4464 and N-49 MU eng 4404 Stamford to New Canaan."

Two copies of a clearance form A and of train orders No. 28 and No. 29 were delivered by the operator at New Canaan to the conductor of N-49 who, in turn, gave one copy of each to the engineer.

4. Action of Crew of N-47 on Arrival at Stamford

The cars and the crew of train N-47, after their arrival at Stamford, became train N-48, departing from Stamford for New Canaan. The conductor of N-47, who was also the conductor of N-48, said that as train N-47 was arriving at Stamford, he was discussing with the engineer the possibilities of the outbound train's (N-48) receiving orders for a meet with train N-49 at Dale siding. The conductor further said that he would call the operator and, if there were such orders, he would give the engineer a hand signal (a vertical waving of his hand over his head, often referred to as a "high ball"). After N-47 arrived at Stamford station, the conductor called the operator and was informed that N-48 was to receive orders for a meet with N-49 at Dale. He said that after he completed his call, he signalled to the engineer, who acknowledged his signal. The flagman was assisting passengers to detrain from N-47 and, after he completed this task, he went to the baggage room where the conductor was talking to the operator by telephone. The flagman heard the latter part of the conversation between the conductor and the operator. He heard only that they were to receive orders at Stamford Tower, but he did not know what the orders would contain.

The conductor had instructed the flagman on their arrival at Stamford to close the first car of N-48 to the passengers, as there were not sufficient passengers for three cars. The flagman went to the first car and instructed the passengers who had entered it to go into the other cars, as this car would be closed. He then pulled the shades, closed the doors, and departed. The flagman thoroughly checked the first car before the train departed and there were no passengers in the car at that time. The doors of the car were not locked.

After the arrival of N-47 in Stamford, the same three cars were used for train N-48. This necessitated the engineer's changing to the operating compartment at the east end of the train. A brake test was not made on the train after the engineer made the changeover. After the passengers had boarded the train, the conductor, from his position at the rear of the train, using the communicating whistle, signalled to the engineer to proceed. After the wayside signal, displayed a proceed aspect, the train departed from Stamford at 8:11 p.m. The train crew immediately started to collect the tickets from the passengers, the conductor starting at the

rear of the train and working forward and the flagman starting at the front of the second car and working toward the rear.

5. Movement of Trains to Point of Collision

a. Train N-48

After train order No. 29 was made complete, the operator at Stamford Tower talked by telephone to the conductor of N-48. The operator told the conductor that train N-48 was to receive orders at the tower, instructing it to meet train N-49 at Dale. Due to the fact that he had talked to the conductor, the operator did not display the train order signal on the tower but caused the interlocking signal (which is used as a train order signal) and the manual block signal to display stop indications. A leverman, assigned to work with the operator in Stamford Tower stated that he overheard the conversation between the operator and the conductor. The leverman then caused the signal governing movement from the station to display a proceed indication for train N-48. As N-48 moved toward the tower, the operator took the engineer's and the conductor's copies of the clearance form A and train order No. 29, left the tower, and proceeded toward the track and the point where N-48 would stop. Before he left the tower, the operator had instructed the leverman to watch him at the train and, immediately after the orders were delivered to the crewmembers, to change the interlocking and manual block signals to display proceed indications. When the train stopped near the tower, the side door leading to the engineer's control compartment had been opened by the engineer. As the conductor was not in evidence, the operator handed both copies of the order to the engineer. The operator said that the engineer asked, "What's up this time?" and he replied that N-48 was meeting N-49. The operator saw the engineer look at the orders but did not know whether he read them. After the accident occurred, both copies of the train order and of the clearance cards were found in the engineer's rear trouser pocket.

The leverman, seeing the operator hand the orders to the engineer, changed the signals to indicate proceed. The train then departed for New Canaan.

The conductor and the flagman continued to collect the passengers' tickets and at no time did either employee go forward to the engineer's compartment to obtain a copy of the orders. At Glenbrook, the first stop, both employees were on the station platform to assist passengers from the train. A proceed hand signal was given to the engineer by the conductor and, after the engineer acknowledged the signal, the train proceeded. The conductor and flagman completed the collection of the tickets before the next stop, Springdale. At Springdale, the conductor and flagman were on the station platform assisting passengers from the train. These platforms were on the opposite side of the train from the engineer so the crewmembers could not see him. When all the passengers had detrained, the conductor entered the third car, and the flagman the second.

At Springdale, after the conductor on N-48 signalled the engineer to proceed by use of the communicating signal, the train immediately started to move. The conductor said that shortly thereafter, he started to get his flashlight and keys from his case when he saw the red flashing lights of a grade-crossing signal. He said he realized the train was not stopping at the siding and that he had started for the conductor's emergency brake valve as the collision occurred. He was not able to estimate the speed of the train after it departed from Springdale.

The flagman of N-48, leaving Springdale, entered the second car to answer a question of a passenger. He said that he heard a whistle sounding two longs and a short blast, and assumed that it was being sounded for a highway grade crossing. He was talking to the passengers when he heard the sound of the application of brakes on the train, and the collision occurred immediately thereafter.

Several of the passengers testified at the public hearing that when the train departed from Springdale, it accelerated to moderate speed. The speed was such that they realized the train would not stop at Springdale Cemetery nor would it enter the siding to meet another train. The passengers stated that the speed of the train passing the siding was approaching the normal speed for other trains which did not stop at the siding.

Most of the passengers who testified at the hearing stated that they did not hear any whistles being sounded between Springdale and the point of the accident. One witness did state, however, that just prior to the collision, he heard a whistle for what he thought was a grade crossing. The passenger witnesses stated that either they felt no retardation from the braking system or they felt the brakes apply immediately prior to the collision. In any event, there was no appreciable reduction of speed from the brake application.

b. Train N-49

After the crew of N-49 had received copies of clearance Form A and train orders Nos. 28 and 29 from the operator at New Canaan, train N-49 departed from New Canaan at 8:11 p.m. It was operated as a "dead-head" train, meaning that it did not carry revenue passengers, nor make any station stops en route. The car inspector and the electrician, who had been sent to New Canaan to inspect and test the trains being assembled there, were returning to Stamford in the ninth car. When the train approached Talmadge Hill, the engineer applied the brakes to slow the train at a highway grade crossing. He took no exceptions to the braking capabilities of the train at that time. The conductor came out on the front platform of the train to ride with the engineer. The door on the vestibule, which is used to close off the engineer's operating compartment, was open.

The engineer did not know the position of the flagman in the train. After he passed Woodway station, the engineer sounded two long and one short blasts on the whistle to indicate that he was approaching the meeting point.

The first indication the engineer had of anything unusual was a glare of light on the rail and he made an application of the brakes. Almost immediately thereafter, he saw the headlight of an approaching train a short distance away. At once he made an emergency application of the brakes, and he and the conductor started to run back into the first car as the collision occurred. The engineer estimated the speed of the train to be about 30 miles per hour when he made the emergency application of the brakes.

6. Collision of Trains

Estimates obtained from several sources indicated that both trains were moving at a speed of about 30 miles per hour shortly before the collision occurred at a point 1,050 feet east of Dale siding. The leading car of N-49 became detached from its front truck; its underframe struck and rode over the underframe of the leading car of N-48, so that the underframe and superstructure passed through the superstructure of N-48 for about one-half the length of the car. The leading car of N-49 came to a stop with the front end towards the south side of the track and about 30 feet beyond the front end of the leading car of N-48. The leading car of N-48 was derailed and moved towards the north side of the track against one of the catenary poles.

When the collision occurred, apparently something other than the pantograph of the car came in contact with the overhead catenary system, causing the circuit breakers at Stamford Tower to trip. This power outage occurred at 8:19 p.m. The breakers were reset and did not trip again. This indicated that whatever had caused the outage had cleared itself.

7. Post-Crash Activities

A resident of Darien, who lived directly across from the site of the accident, heard the crash of the trains and immediately went to a telephone and called the Darien police and the Darien fire department rescue squads. He then proceeded to the scene of the accident and assisted in removing the passengers from the train and in locating the injured engineer of train N-49.

The conductor of N-48 was injured to the extent that he was unable to render assistance to the injured passengers. The flagman was slightly injured but was able to aid the passengers. Very shortly after the collision occurred, police appeared on the scene and the flagman requested them to contact Stamford Tower and have the current removed from the catenary system.

The fire department rescue squads arrived at the scene of the accident within minutes of its occurrence. They promptly administered first aid to the injured passengers and employees and transported them to the various hospitals in the Stamford area. Fire and police department personnel removed the fatalities from the trains.

8. Casualties and Damages

Because the leading car of N-49 passed through the superstructure of the leading car of train N-48, almost one-half of the first car of train N-48 was destroyed. The underframe of the first car of N-48 was broken off at the body bolster or at a point about 13 feet from the end of the car. The engineer's compartment, on the front platform on the end of the car was completely destroyed and this entire section of the car was forced approximately 20 feet to the rear. (See Figure 2, page 14.) The underframe of the second car of N-48 buckled and was moderately damaged. The third car was slightly damaged.

The forward portion of the leading car of N-49, including the engineer's compartment, was destroyed. The destroyed area extended back into the car about one-quarter of its length which included several rows of seats (See Figure 3, page 15.)

Of the remaining eight cars on train N-49, five had moderate underframe damage and three were slightly damaged.

Little damage was done to the track structure.

The engineer of train N-48, and a passenger, who was riding somewhere in the forward portion of the first car when the accident occurred, were killed. The conductor was seriously injured and was admitted to the hospital. The flagman and about 43 passengers were injured; none, however, was admitted to the hospital.

On train N-49, both the engineer, who was in the control compartment, and the conductor, who was on the front platform, saw that the collision was inevitable. Both employees entered the car and ran towards the rear but the collision occurred when they were still in the forward portion of the car, and they were trapped in the wreckage. The conductor was killed and the engineer was seriously injured. Several hours were required to free the injured engineer from the wreckage. The flagman of N-49 was occupying a seat near the front of the leading car which was within the damaged area. He also was killed.

9. Construction of the Cars

The cars provided train N-48 and N-49 were of the self-propelled, multiple-unit controlled, passenger cars designed for commuter service.

Figure No. 2

Damage to leading car of N-48

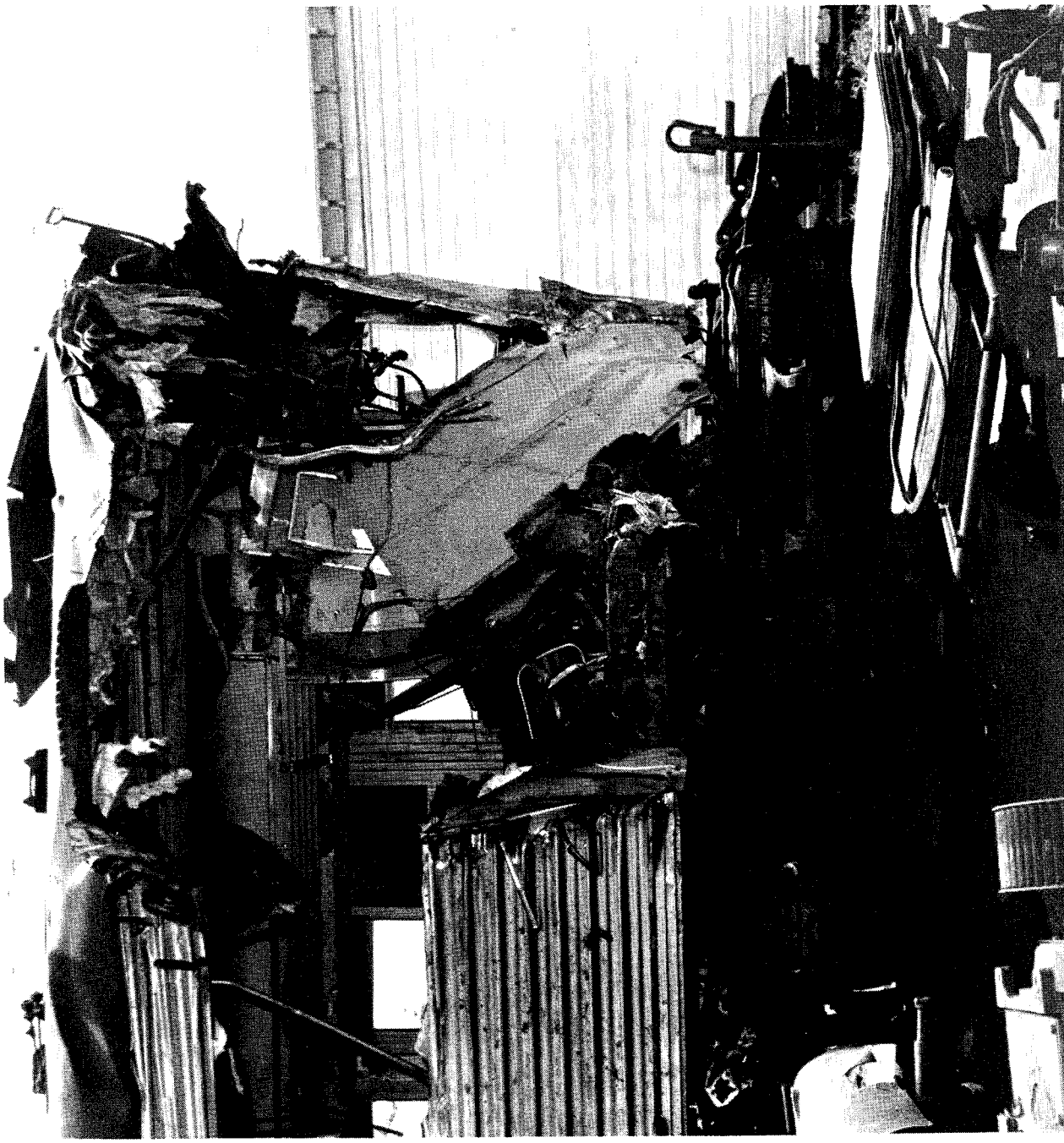


Figure No. 3

Damage to leading car of N-49

They are 86 feet 9 inches in length over the buffers, 14 feet 8 inches high over the pantograph in down position, and 10 feet 5-3/4 inches over the extreme width. The cars are of all-steel construction, with a low alloy, high-tensile strength steel framing and with stainless steel exterior sheathing extending from the side sill to the top of the side plate. They were built in 1954 by the Pullman Steel Car Manufacturing Company. The average weight of the car without passengers and water is 156,900 pounds. The cars are provided with vestibules at each end. End doors are provided to permit entrance to the body of the car from the vestibule and are arranged to open inward. A saloon is located at one end of the car. The trucks are of the four wheel, inside-swing hanger type, having all coil spring suspension and roller bearings. A pantograph is provided on the saloon end to collect electricity from the overhead catenary system for the propulsion and operation of the car. Each truck is provided with two 100-horsepower d.c. motors, transom mounted and connected to each driving axle by a flexible coupling and high-speed gearing. The 11,000-volt, 25-cycle, single-phase a.c. current from the catenary system is converted to 600 volts d.c. current for use in the traction motors by Ingitron rectifier equipment. The cars are provided with 14-inch, 250-watt, prefocussed, built-in headlights.

The engineer's operating compartments are located in the vestibule, one on each end on the right side when one is standing in the car and facing the end. By the positioning of a door, a portion of the vestibule can be converted into the operating compartment. By changing the position of the door, the vestibule can be used for the loading and unloading of passengers. The necessary controls are mounted on the end of the car at this location. A folding seat is provided for use of the engineer. A window of sufficient size for visibility of the engineer, when he is either seated or standing, is installed in the end of the car. (See Figure 4, page 17.)

The cars are so constructed that when they are coupled together with the electrical control jumpers in place and all air hoses properly coupled, each car is controlled from one control compartment. The power controller is so arranged that when it is in service, if the handle is moved toward the right, forward motion is obtained; toward the left, reverse movement occurs. The handle is spring-loaded so that when pressure is released, it returns to a vertical position. When the handle is placed in vertical position, and the controller is in service, power is removed and the brakes on the train are applied. If for some reason the engineer should remove his hand or pressure from the controller handle, the train would be stopped. This is referred to as the "dead man control."

In addition to the engineer's control for operating the airbrakes, there is an emergency brake valve located in each vestibule on the opposite side from the control compartment. Another valve for applying the brakes in emergency, known as the conductor's valve, is located inside the car on the wall of the saloon. The airbrakes system uses air to power the brakes and electricity or air for control. In the event of an electrical failure, the brakes can be controlled by air.

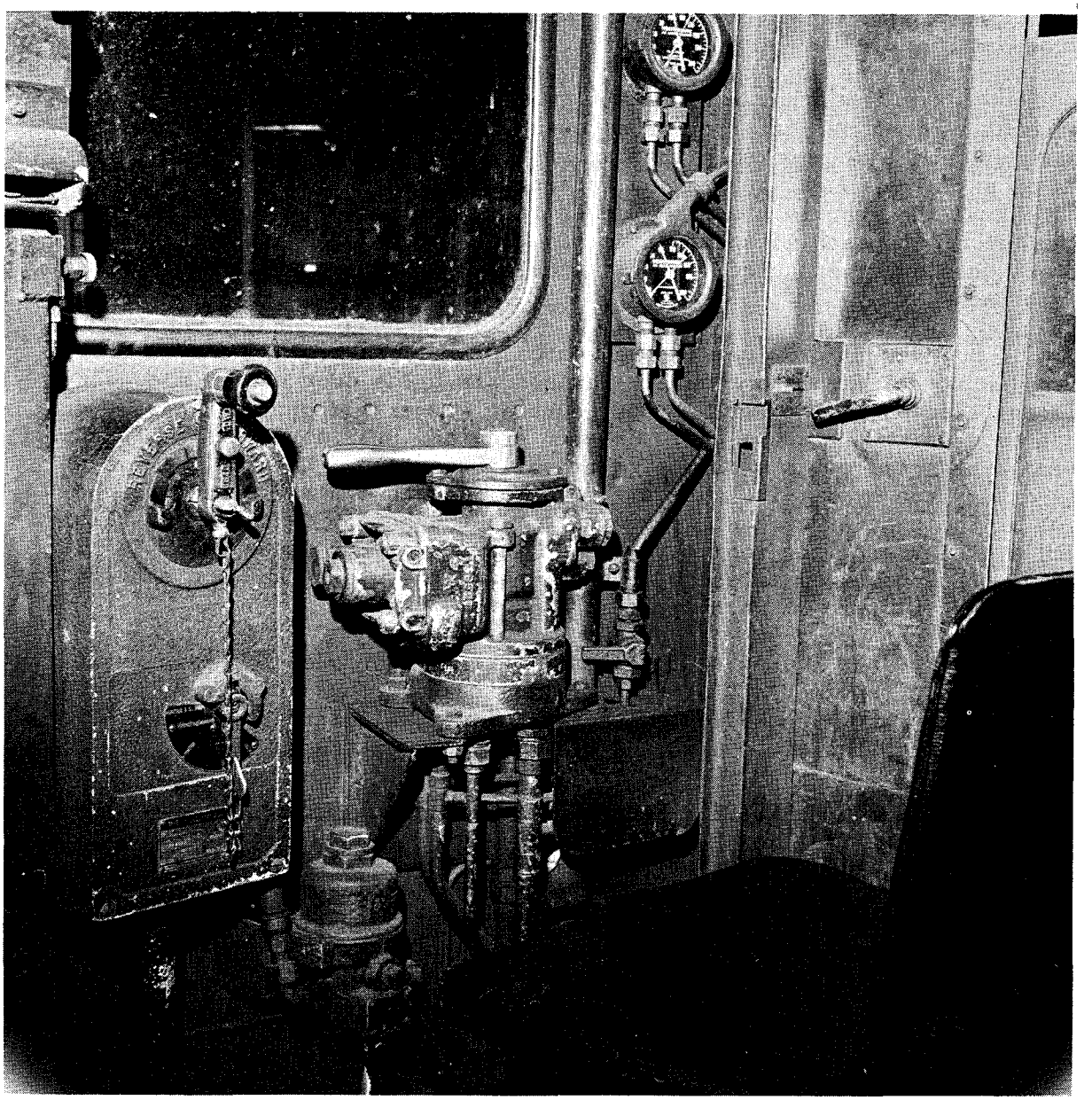


Figure No. 4

Interior view of engineer's operating compartment

The seats are of the walk-over type of two sizes, one for two passengers and the other for three passengers. The walk-over seat is one in which its direction is changed by pushing the seat back only from one side to the other without moving the seat. Along one side of the car there are 22 three-passenger seats and three two-passenger seats. Along the other side are 24 two-passenger seats. This provides a total seating capacity for 120 passengers. The seats and backs are spring-assembled, covered with foam rubber, and upholstered. The frame is of stainless steel tubing and is secured to the floor of the car. The height of the seat is about 18 inches from the floor and the height of the top of the back is about 41 inches from the floor. A stainless steel molding is attached to the center of the sides and top of the seat backs.

A doorway is provided in the center of the end of the car so that passage from one car to the next is possible. The door can be closed across the end if the car happens to be at either end of the train or it can be used to isolate a car. On each side of this doorway is a structural member referred to as a diaphragm or collision post. Each of the posts is a 5-½-inch by 8-½-inch H-beam, reinforced with a plate welded to the web of the post. The post is connected at the bottom to the underframe and at the top to the roof structure. The purpose of these beams is to prevent one car from telescoping or mounting the underframe and penetrating the superstructure of another.

A representative of the builder testified that when the cars were constructed, they met all of the existing requirements for strength, and they were built in accordance with the Railway Mail Service specifications which includes the 800,000 pounds minimum requirements for static end load.

10. Tests and Evaluation of Equipment after the Accident

The cars involved in the accident were not equipped with devices to deposit sand on the rails to provide better traction. There was no indicator to determine where the brakes were applied and whether the brake application was heavy or light except when the wheels of the car started to skid. When this occurred, light skid marks appeared on the contact surface of the rail. Following the accident, an examination was made of the heads of the rails near the point of collision to determine if any evidence of emergency braking could be found. Some evidence was found to indicate that train N-49 had developed braking just before the collision. There was also evidence of skid marks made by N-48, but it could not be determined whether it occurred before or as a result of the collision.

Tests were made of the complete airbrake equipment of each car in trains N-48 and N-49 except the badly damaged leading cars. The various component parts of the brake equipment on the leading cars which were not damaged were tested separately. These tests indicated that the brakes functioned as intended. From these tests made after the collision and from the report of the brake tests made when the trains were assembled,

it can be assumed that the airbrakes and their electrical control equipment were functioning properly on each train.

On August 24, 1969, special train braking and visibility tests were conducted in the vicinity of the point of the accident. The train used consisted of nine of the same type cars involved in the collision. Visibility tests were conducted by dividing the train into two parts and backing each part to the point where the other part would first become visible to the engineer, as they would in approaching each other. The distance of each train from the point of collision and from the other train was then measured.

A similar test was conducted at a time when the atmospheric light corresponded to the light at the time of the accident. Braking and stopping tests were conducted with a nine-car train and with a three-car train. 9/

Some of the more significant results of the tests were:

Eastbound and westbound trains first came in view of each other when the eastbound train was at a point 315 feet west of the point of impact and the westbound train was at a point 239 feet east of the point of impact, making a total distance between the trains of 554 feet.

At 8:16 p.m., when the atmospheric light was at a corresponding brightness to 8:19 p.m., on August 20, visibility tests were made in the same manner except the headlights on each train were brightly lighted. The net gain of sight distance due to the lighted headlight at dusk was only 21 feet.

A nine-car train moving at 30 miles per hour, making an electrical emergency application of the brakes, required 844 feet to stop.

A three-car train moving at a speed of 30 miles per hour, making an electric emergency application of the brakes, required 591 feet to stop.

A three-car train moving at a speed of 20 miles per hour, making an electric emergency application of the brakes, required 353 feet to stop.

A three-car train, moving at a speed of 30 miles per hour, having the brakes applied by the conductor's valve at a point near the middle of Dale siding, required 564 feet to stop. The train would have stopped clear of the west side of Hoyt Street Crossing.

9/ Appendix No. 2 - Record of tests made on the New Canaan Branch between Springdale Station and Woodway Station incident to the collision between Trains N-48 and N-49 on August 20, 1969.

III. ANALYSIS

A. Dynamics of the Collision

Trees and vegetation had grown along the track of the New Canaan Branch in some areas to the extent that on curves the range of vision of the engineer was greatly reduced. The westbound train approaching the point of the accident passed through such an area. Tests made after this accident indicated that the trains came into view of each other when they were only 553 feet apart. Statements of the witnesses and other information, developed during the investigation, indicated that each train was moving at a speed of about 30 miles per hour when it first became visible to the other, thus making the closing speed between the two trains of 60 miles per hour. At this speed, 6.3 seconds would be required for the trains to traverse the distance and collide. Considering the reaction time of the engineers and the time required for the brakes to become effective, the 6.3 seconds would have elapsed before effective deceleration occurred. According to tests made on August 24, 1969, even if both engineers had applied the brakes of the trains in emergency when they first sighted each other, the trains could not have been stopped short of the point of collision. It is also questionable whether the speed of either train would have been materially reduced.

The impact caused the body of the leading car of N-49 to break away from the forward truck and to rise upwards. The car body mounted the underframe of the leading car of N-48 and passed partly through the superstructure. The force of the collision caused the leading car of each train to move laterally, the first car of N-49 to the south, and the first car of N-48 to the north. When the cars came to rest, they were side-by-side with the front end of the leading car of N-49 about 30 feet east of the front of the leading car of N-48. The momentum exchange of the impact moved the lighter, three-car train (N-48) backwards from the point of impact about 21 feet, while the heavier train came to a stop after a movement of 21 feet plus the distance of the collaspsed superstructure of the first car of N-48, a total distance of about 40 feet. Much of the force of the impact was absorbed by the collapsing structure of the two leading cars, and the full force of the impact was not transmitted to the other cars in the train. This reduced the extent and severity of injuries to the passengers riding in the second and third cars of N-48.

The engineer of N-48 was in the control compartment and a passenger was somewhere in the forward portion of the leading car prior to the accident. The forward half of the car was demolished by the collision. The body of engineer was found in the crushed control compartment, and the body of the passenger in the twisted metal of the damaged portion of the car.

The engineer of N-49 was in the control compartment of the leading car but had opened the door separating the compartment from the vestibule. When he saw the approaching train, it was an easy matter for him to leave the compartment, enter the car, and run toward the rear. If this door to the control compartment had been closed, it is doubtful if he could have left the compartment prior to the collision. The conductor of N-49, standing on the front platform when N-48 was sighted, turned and ran back into the car. The control compartment, vestibule, and forward portion of the carwere demolished. The engineer and the conductor were trapped in the twisted metal of the damaged car. The conductor was killed and the engineer seriously injured. About 4 hours were required to remove the engineer from the wreckage. The flagman of N-49 was seated in the portion of the leading car collapsed by the collision. He was killed and his body found in the twisted metal.

Sufficient force from the impact was transmitted through the remaining cars of N-48 to propel most of the passengers from their seats. Some were thrown into the seat backs ahead, some were thrown over the seat backs, while others were thrown into the aisle and even into the front bulkhead and end doors. Most of the injuries to the passengers were in the form of lacerations and contusions, primarily to the facial area and the upper parts of their bodies.

The low-type seat backs provided a small barrier to the propelled passengers. A number of seat backs broke or bent from the force of the passengers' being thrown against them. None of the seat frames, however, was torn loose from the floor. There were no restraining devices, such as seat belts, to hold the passengers in place.

The conductor of N-48, who was standing in the aisle towards the rear of the third car when the collision occurred, was thrown toward the front of the car onto the floor. The flagman, who was standing in the aisle of the second car, was also thrown to the floor of that car.

If passengers had been riding in the leading cars of either train, the number of fatalities would have been much higher. If much of the force of the impact had not been absorbed by the collapsing cars, the number of fatalities to passengers would also have been higher and their injuries much more severe.

B. Human Factors Involved in the Cause of the Collision

1. Engineer of Train N-48

The engineer of N-48 had received orders for N-48 to enter the siding at Dale and meet N-49. The orders were prepared and delivered to the engineer in accordance with the requirements of the Penn Central Company. The engineer, however, did not stop his train at Dale siding but continued eastward, passed the siding, and it collided with train N-49. Why the engineer did not stop the train and enter the siding, as

ordered, has not been determined by the investigation, but several possibilities do exist.

Possibility: The engineer might have suffered a disabling physical or mental impairment after his train departed from Springdale.

The pathologist who performed the autopsy on the body of the engineer reported that the injuries were too extensive to allow a determination whether any such condition was present. If the engineer had died or suffered an incapacitating illness, however, it would have been necessary for his body to have blocked the controller handle, to prevent it from returning to the vertical position.

If this handle had returned to the vertical position, the "dead man" control would have been actuated and the train would have been stopped. While being possible, it is unlikely that the control handle was blocked. The whistle sounds heard by several witnesses, including the flagman, could have been made by train N-49. The brake application reported by a few witnesses could have resulted from the collision or from a last minute effort by the engineer to stop the train.

The engineer last had a physical examination, as required by the carrier, on December 20, 1968. At this time, he was 43 years of age, height 5 feet 10 inches, and weight 140 pounds. His blood pressure was reported to be 124/74 and pulse 68 and regular. The doctor took no exceptions to his physical condition, as all tests resulted in normal reactions. It was the doctor's opinion that the engineer's physical condition was such that he was well qualified for regular work. Tests made of the engineer's vision, color sense, and hearing were last made on November 21, 1966. At this time, his vision without glasses was reported to be 20/20 in each eye, color sense satisfactory, and hearing good. He was approved for duty.

The investigation disclosed that the engineer apparently had sufficient rest before he reported for duty at 6:29 p.m., on August 20, which was about 2 hours before the accident occurred. He had worked his regular assignment during each of the 6 days prior to August 20 and, with the exception of August 18 when he worked 3 hours overtime for a total of 11 hours, he had not been on duty over 8 hours for any of the days of this period. He and his family were involved in a business venture, but investigation of this employment indicated that it did not interfere with the engineer's position on the railroad nor was it physically or mentally exhausting.

Possibility: The engineer could have overlooked or misinterpreted the orders or assumed he knew what they were.

During the 90-day period preceding the accident, there had been only three occasions on which train orders were issued for train N-48 to meet train N-49. So even though orders of this kind had been issued before, they were not a commonplace procedure. On August 15, the Friday prior to the accident, train order was issued for trains N-48 and N-49 to meet at Dale. The same engineer and conductor were assigned to train N-48 as on the date of the accident. Information obtained from the 30-day period prior to the accident indicated that daily, except Saturday and Sunday, four meet orders and three right-over train orders were issued for the same trains each day. None of these orders involved train N-48. On several occasions during this same 30-day period, orders were issued for the protection of grade crossing because of inoperative warning devices. The fact that the issuance of train orders to train N-48 was uncommon tends to argue that the engineer would have read them to be sure of their contents.

The engineer of N-48 was also the engineer of train N-44, the preceding eastbound train, which was one of the regular trains that received a right-over train order giving it right over train N-47 and sometimes N-49. The engineer could have confused N-48 with N-44 on the day of the accident, believed he was operating N-44, and assumed that the order received was the regular order giving him rights over N-49.

There could have been a misunderstanding by the engineer as to the meaning of the hand signals when given by the conductor at Stamford. The proceed hand signal, described by the conductor as a "high ball," has a general meaning of "go ahead" in addition to the temporary arranged meaning of "you will receive an order." The engineer might have forgotten the temporary agreement and, out of long practice, assumed he was to have right-of-way over the other train. If this were his understanding, then the engineer might have assumed he already knew the contents of the order and failed to actually read the order.

Possibility: The engineer could have read the order but forgotten the contents of the order.

This does not seem likely as he had so recently received it, and the order described a situation which would have been perilous.

Possibility: The engineer could have disobeyed the order deliberately.

Extensive testimony was presented during the hearing as to the engineer's ability, character, and attitude toward his job. Information was also developed concerning the engineer's activities, other than those with the railroad, and about his physical condition. Nothing was disclosed to indicate that there was any reason for the engineer deliberately to disobey the orders, since he would know the ultimate results of such action. He did not have a record for breaking rules, and he had a good reputation as an engineer. His service record contained no entries for discipline.

Possibility: The engineer might have been distracted or incapacitated by another person.

There was another person in the first car at the time of the accident although it had been closed by the flagman. This was the fatally injured passenger. His body was found in the damaged portion of the car, indicating that he was in the passenger area at the time of the collision. The Safety Board made every effort to produce evidence to support or deny the possibility that the passenger interferred with the operation of the train, and to determine why this passenger was in the first car but none was found.

2. The Conductor of Train N-48

The conductor of N-48 had considerable experience and knowledge in the operation of trains. He had been in passenger train service for about 26 years, of which 17 were as a conductor. He had attended a number of instruction classes conducted on the application of the operating rules and stated that he was thoroughly qualified to carry out his duties.

On the date of the accident, he had talked with the operator at Stamford Tower and knew that train N-48 was to stop for train orders establishing a meet with N-49. This information he claims to have given to the engineer by the prearranged "high ball" signal. He knew that a clearance card accompanied the orders, without which the train was not authorized to proceed. He did not know whether there would be any additional orders for the train. The conductor did not attempt to obtain a copy of the clearance card and train orders when the train stopped at Stamford or at any time thereafter. Though he stated during the hearing that the safety of the train comes first, his testimony created the impression that he was too busy collecting tickets from the passengers to get copies of the orders. He stated that he had told the flagman of the meet with N-49 at Dale. This was denied by the flagman. If the conductor had told the flagman of the meet, it is evident that they did not have a clear understanding as to what duties each would perform. Nor did the conductor, as the supervisor in charge of the train, see that the flagman was in a position to carry out his duties for the meet at Dale. It is evident that the conductor himself was not in a position to

monitor the operation of the train, particularly when he had such an important function in carrying out the orders for the meet. One of the tests conducted on August 24 indicated that, with a train moving at a speed of 30 miles per hour and the brakes applied by operating the conductor's valve, when the train was partly past the siding, the train would have stopped clear of the west side of Hoyt Street. With N-49 being operated in a manner described by the engineer, N-49 would have been stopped clear of the east side of Hoyt Street and the accident would have been prevented.

Rule S-90 of the Penn Central Operating Rules requires the engineer to sound a certain whistle signal at least a mile prior to the meeting point and, if he fails to do so, a member of the crew must communicate with him and, if necessary, stop the train. This rule is a safeguard prescribed to prevent a train from passing its meeting point by a failure of the engineer. The conductor of N-48 stated that he did not hear such a whistle, nor had he made any arrangements with the engineer in lieu of such a signal. Yet he made no attempt to communicate with the engineer or to stop the train until he saw the flashing lights of the road-crossing warning device at Hoyt Street.

3. The Flagman of Train N-48

The flagman had been employed by the railroad for a period of about 14 months when the accident occurred. He had received instructions in the application of the operating rules and he stated that he had sufficient knowledge to perform his duties as a flagman and ticket collector. The conductor's claim that the flagman had knowledge of the meet between N-48 and N-49 was vehemently denied by the flagman. He did acknowledge that he knew N-48 was to receive orders of some sort at Stamford Tower. He stated during the hearing that he was familiar with the flagman's duties required during the meeting of trains at Dale. The flagman stated that if he had been informed of the contents of the order, he would have been in the front vestibule in position to get off of the train when it stopped to line the switch to the siding. If the train passed the switch, he would have called this to the engineer's attention and, if necessary, would have stopped the train. He said that when N-48 was in the vicinity of Springdale Cemetery, he heard two long blasts and one short blast being sounded on the whistle but thought it was being sounded for the road crossing. It is doubtful if this was the engineer of N-48 blowing the whistle, for at that time the train was at Camp Avenue crossing and very close to the siding. It might have been the engineer of N-49 sounding the whistle for the meeting point.

Two passenger witnesses claimed that after the accident occurred, they were able to detect the odor of alcohol on the flagman's breath. One of these passengers requested the police to have the flagman tested

for alcohol but this was not done. The hospital record did not disclose any evidence of the flagman's using alcohol. Other passenger witnesses stated that they did not detect the odor of alcohol on the flagman's breath. No evidence could be found to indicate that the influence of alcohol prevented the flagman from carrying out his duties.

4. Crewmembers of Train N-49

Nothing was disclosed during the investigation to indicate that train N-49 was operated in a manner other than in compliance with the operating rules of the Penn Central Company. Train N-49 had authority to occupy the main track from New Canaan to Dale block-limit station and was authorized to travel at a speed of 30 miles per hour in the vicinity of the accident. This was being done. There were no other actions that could have been taken by the crewmembers of N-49, under the rules, to prevent the collision.

5. Fatally Injured Passenger in Train N-48

A passenger testified at the hearing that he observed a man, dressed in clothing similar to that worn by the fatally injured passenger, enter the first car shortly after the train departed from Stamford. He said that he did not know exactly when this occurred and that he did not observe the man return. The doors between the first and second cars were closed and the shades were drawn, but the doors were not locked.

Although the commutation ticket held by the passenger was for passage on the Danbury commuter route, it is believed that he had ridden on the New Canaan line on previous occasions, since his home could be reached from either destination. The flagman had started at the front of the second car to collect the tickets and was working facing toward the rear. Because of this, it must be assumed that the passenger went forward to the first car sometime after his ticket was checked by the flagman or during the station stop at Glenbrook. Otherwise he would have been seen by the flagman. From the position in which his body was found, it must be assumed that he was seated toward the front of the passenger's section of the car. From this position in the car, it would have been most difficult for the passenger to have easily conversed with the engineer. No definite reason has been found for this passenger's going into the first car.

Background information concerning the passenger developed during the investigation disclosed that he was not of a violent nature, and had no relationship with the engineer. There is no evidence that he distracted or physically interferred with the operation of the train.

C. Analysis of the Interpretation and Application of the Carriers' Operating Rules Applicable to the Accident

The New Haven Region of the Penn Central Company was formerly the New York, New Haven, and Hartford Railroad. The approval of the merger of the Pennsylvania with the New York Central Railroads to form the Penn Central Company contained the conditional requirement that subsequent to the merger, the New Haven Railroad was to be included in the Penn Central Company. The New Haven Railroad was included in the Penn Central Company on January 1, 1969.

Most of the employees were retained in the same positions that they held under the New Haven Railroad. The operating rules, timetables, instructions, etc., of the New Haven Railroad were continued in force until an orderly changeover to the Penn Central rules could be accomplished. On April 27, 1969, the Rules for Conducting Transportation of the Penn Central Company superseded the New Haven Railroad Operating Rules.

Under the New Haven Railroad's Operating Rules, the New Canaan Branch was operated as a single block of a manual-block system. Opposing passenger trains were permitted to occupy the block and to meet at Dale siding by timetable. Train orders were not required for all meets. These rules were changed when the Penn Central Operating Rules were adopted.

On the New Canaan Branch some of the more significant changes resulting from the adoption of the Penn Central Operating Rules were:

(1) Establishing the intermediate block-limit station at Dale;

(2) Prohibiting opposing passenger trains from occupying the same block; and

(3) Requiring train orders for all meets between passenger trains.

These changes provided more definitive control than the earlier rules. All of the employees involved in the accident appeared to have had a thorough understanding of the requirements of these rules and of the other changes involved in this transition. There was no misunderstanding as to their application.

The Penn Central Company had conducted instruction classes for all of the employees involved in the changes of operating rules. The employees, when questioned, stated that they understood the application of the rules and they were capable of performing their duties. There was no evidence that the rule changes resulted in a less safe operation on the New Canaan Branch.

1. Train Orders and Clearance Forms

The train orders and clearance forms issued to the employees on trains N-48 and N-49 were properly worded and transmitted from the train dispatcher to the operators in accordance with the Penn Central requirements. The rules specify the manner in which the train orders shall be written and transmitted. The rules prescribe that the train orders must be addressed to those employees who are to execute them, naming the place at which each is to receive his copy. The train orders in this case were addressed to the conductor and the engineer of N-48 and N-49.

The rules require that a clearance form, when used, must be properly filled out, showing the total number of train orders and the number of each order addressed to employees on the train. The rules require that the clearance form, together with all train orders, be delivered to each person addressed. The conductor and engineer, when practicable, must show the orders to the other members of the crew.

Rule 210 10/ requires that when the operator receives a "complete" from the train dispatcher for train orders that have been transmitted, he will write the word "complete," the time, and his last name in full in the space provided, and must then effect delivery of the order to the persons addressed. The operator at Stamford delivered both copies of the orders to the engineer of train N-48 under the impression that this fulfilled that part of Rule 210 stated above. Penn Central officials concurred in this interpretation. The fact remains, however, that neither the Penn Central rules, nor their interpretation of them, assigned the responsibility for the conductor's receipt of train orders to anyone.

Rule 221 (a) 10/ requires the train to be stopped if delivery of the train order is not effected on the engine, but it is silent regarding failure to deliver the order to the conductor. In this case, the train stopped at Stamford Tower to permit the operator to deliver the train orders to the engineer. Penn Central officials testified that delivery of both copies of the orders to the engineer met the requirements of Rule 210. At New Canaan, both copies of the clearance form and train orders were given to the conductor who, in turn, gave the engineer his copies. However, the engineer may not start the train from New Canaan without first receiving a clearance form. Under the rules at New Canaan, the engineer could have received his copy and the conductor not received his copy.

The operator at Stamford properly performed his duties in the movement of train N-48 except he did not display the train order signal, which is a yellow flag by day and a yellow light by night on the tower. This is in addition to the interlocking signal which was being used as a train order signal. The operator stated that they normally did display such a signal but, in this case, it was not displayed because

10/ Appendix #1 - Excerpts from Penn Central Company's Rules for Conducting Transportation -- Rules 201 to 226, inclusive.

he had informed the conductor by phone that train N-48 would receive train orders. The officials of the carrier condoned this procedure.

2. Manual Block System

The manual-block system rules used to govern the operation of trains on the New Canaan Branch are referred to as permissive rules. Under these rules, following trains, other than passenger trains, are permitted to enter a block. If passenger trains are involved, then neither opposing nor following trains are permitted. Under the absolute manual-block rules, no opposing or following trains are permitted within the block. In the case of absolute manual-block rules, the rules requiring protection for the rear of the train are not applicable. In the case of the permissive rules, there is nothing in them or in the timetable special instructions that states that protection for the rear of the train should not be provided. The rules are so worded that following and opposing trains are forbidden to enter the same block with a passenger train, but there is still nothing to eliminate flagging from the employees duties. The carrier did not specify by rule or instructions that it was not necessary for the flagman to protect the rear of passenger trains when stopped in this area.

The operator must maintain a station record of train movements for each block and block-limit station, in which he must record information concerning all movements within the block. The investigation disclosed discrepancies in the manner of maintaining such block records. The proper forms were not being used. The operators were not providing all of the necessary information on the forms. There were no data to indicate when Dale block-limit station was open. The turnover between operators had not been properly recorded. The officials of the carrier agreed that the forms were not properly prepared.

Dale block-limit station was opened daily, except Saturday, Sunday, and holidays, from 6:55 a.m. to 8:25 a.m., and from 6:10 p.m. to 7:25 p.m., by timetable. At other times, it was opened and closed by train order. There was nothing physical to indicate whether they station was opened or closed. The employees had to rely on the information provided in the timetable or in train orders to know the status of the station.

3. A Train Approaching a Meeting Point

The rules require that the engineer of a train operating on single track, approaching a meeting point, must sound a prescribed whistle signal at a point at least 1 mile before reaching the meeting point. If the engineer fails to sound the whistle, the members of the crew

must communicate with the engineer and, if necessary, stop the train. The employees and the officials of the carrier stated that the rule was in effect. They agreed that there was a change in the application of the rule, but the change was not made part of the rules or other instructions. It was merely an understanding between the employees and the carrier. This change permitted eastbound trains not to sound the signal until after leaving Springdale. This of course was a much shorter distance than that required by the rule. The engineer of N-49 had sounded the whistle as required by the rule.

4. The Engineer and the Conductor are Responsible for the Safety of the Train

The operating rules state that the conductor and the engineer are responsible for the safety of the train, the observance of the rules, and, under conditions not provided for by the rules, must take every precaution for the train's protection. The conductor of train N-48 stated that he understood the intent of this rule and realized that the safety of the train was one of his foremost duties. He also stated that he knew that nothing should interfere with the discharge of this duty. The officials of the carrier agreed with the interpretation of this rule by the employee.

IV. CONCLUSIONS

1. Train order No. 29, for the meet, was properly issued by the train dispatchers to the operators at Stamford and New Canaan.

2. Train order No. 29 was properly received and prepared by the operators.

3. Even though orders had been issued for the meeting of trains N-48 and N-49 at Dale several times prior to the accident, it was not a usual arrangement.

4. Train order No. 29 and clearance form A were delivered to the designated members of the crew of train N-49 at New Canaan.

5. Train order No. 29 and clearance form A were delivered to the engineer but were not delivered to the conductor of train N-48 at Stamford as required by rule.

6. The carrier's rules do not specify the employee responsibility for the delivery of train orders and clearance cards to the employees addressed.

7. The train order signal was not displayed at Stamford Tower in compliance with Rule 221 (a).

8. Permission was granted for trains N-48 and N-49 to enter the manual blocks upon leaving Stamford and New Canaan.

9. Proper manual-block records, as required by the carrier, were not maintained.

10. There was no indication that either train exceeded the maximum allowable speed.

11. The engineer of N-48, failing to obey train order No. 29 directing train N-48 to enter the siding and meet train N-49 at Dale, operated the train, past Dale siding, eastward on the main track.

12. The conductor of train N-48 did not comply with the operating rules of carrier in that:

(a) he did not obtain copies of the train order and clearance form A, as required in Rules 204 and 211,

(b) he did not properly instruct the flagman as to the requirements of the meet as required in Rules 204 and 400N.1, and

(c) he did not comply with Rule S-90 requiring him to communicate with the engineer and, if necessary, stop

the train if he did not hear the required meeting whistle being sounded.

13. Train N-49 was operated in accordance with the rules between New Canaan and the point of collision.

14. The fatally injured passenger was occupying a car closed to passengers without the knowledge of the train crew, but his position in the first car at the time of the collision could not be determined.

15. The surviving employees involved in the collision stated that they had received sufficient training in the changeover of rules from those of the New Haven to those of the Penn Central to enable them to perform their duties properly. No evidence could be found to indicate that the change in operating rules contributed to the cause of the accident.

16. The cars were constructed to meet all requirements existing at the time of their construction.

17. The cars were not designed to withstand impacts of this magnitude.

18. The engineer's operating compartment is located on the side of the front vestibule of the first car, with little protection being afforded him in case of collision.

19. The leading cars afford little protection for those persons riding near the front end and, in the event of collision, serious injuries and fatalities result.

20. No form of automatic control was installed on the New Canaan Branch to prevent trains from running past their meeting points.

21. No form of automatic block-signal system was installed, and the railroad relied only on employees' carrying out orders for the safe operation of trains.

22. Most of the injuries sustained by the passengers, in other than the first car of train N-48, were caused by the passengers' being thrown from their seats due to the impact of the collision. No form of restraining device was in use or installed.

23. The lack of consistent display of the train order signal by the operator at Stamford, when it is required by rule to be displayed, was not a causal factor in this accident, but it could result in confusion between employees and constitutes a hazard.

V. GENERAL CONCLUSIONS

The investigation of this accident has disclosed a number of instances in which the employees involved did not fully comply with the operating rules. Instances in which ad hoc interpretations of the rules by officials of the carrier or employees condoned this practice of poor compliance were also disclosed.

One of the outstanding examples of the employee's failure to comply fully with the rules and of the management's interpretation condoning the action was in the failure to deliver the train order to the conductor. Another example was the Stamford operator's failure to display the train order signal as required by rule when he had talked with the conductor by telephone. A third example was the application and interpretation of the rule requiring the engineer to sound a prescribed whistle before reaching the meeting point. A fourth example was the temporary agreement between the conductor and the engineer that a hand signal, having a meaning of long practice, was to have a new interpretation.

It is reasonable to assume then that if compliance which was scrutinized after this accident was weak and in some cases the failure of full compliance was condoned by the carrier's interpretations, then there probably are other rules that are treated in much the same manner. The practices of condoning less than full compliance with the rules and of permitting employees to make informal arrangements that can supersede rules or long standing practices can result in disaster.

It is imperative that the management write the operating rules in such a manner that they can be understood by the employees and that they be applied to situations without interpretations which relax or destroy the governing effect of the rule.

Even though several of the employees stated that they had received instructions to carry out their duties properly, it was evident from testimony that there were applications of rules with which they were not completely familiar. For this reason, it is imperative that the employees be thoroughly instructed in the rules, in their interpretations, and in their applications to various situations, and that employees be examined concerning their knowledge of the rules.

The investigation by the Safety Board of the collision between two New York Central Railroad freight trains which occurred in New York City, on May 22, 1967, developed that a contributing cause for the accident was the failure of the New York Central Railroad Company to establish explicit boundaries of authority, explicit operating rules, and procedures to insure that its personnel are instructed in and comply

with such rules. In the report of that accident the Board recommended that due to a wide variety of inadequacies in the rules, operating practices, and personnel training revealed by the investigation on one of the largest railroads in the country, the industry make a reappraisal, a self-assessment, and take the necessary corrective action. In addition to this, the Board recommended that the New York Central Railroad revise and amend its operating rules and require compliance with them by its operating personnel. 11/

Many of the same problems resulting from improper use or application of the rules and practices by the employees, which were disclosed during the investigation of the New York Central accident, were also disclosed in the instant case.

The design of the operating compartment on these commuter-type cars affords little protection to the engineer in cases of collisions. Some thought should be given to either relocating the compartment or providing the engineer with better protection. Cars being constructed at this time still incorporate the same basic design.

Little protection is also afforded the passengers riding in the forward ends of the cars, although the cars involved in this accident were designed to the specifications established for standard passenger car equipment and similar design practices. Had the front car of N-48 been filled with passengers instead of being closed, perhaps half of the occupants would have been in the zone that was invaded by N-49. A far higher fatality toll would have ensued.

The collision impact speeds were not unusual, about 30 miles per hour for each train. Federal standards now provide some protection to the occupants of passenger automobiles against some crashes at speeds of this order, and protection against even higher impact speeds is being sought in experimental vehicles. 12/ The railroad industry, when it adopted all-steel construction for passenger cars more than 50 years ago took one of the most pioneering steps in occupant protection that has been taken in the transportation field. However, this accident, as well as investigations of other accidents, points out the fact that newer railroad cars are similar in design to the older ones, and indicates that the more recent knowledge in occupant crash protection is not being applied as yet. The Board noted other sources of injury in the report of the accident at Glenn Dale, Maryland.

11/ The National Transportation Safety Board's report adopted December 29, 1967, of the investigation of collision of two New York Central Railroad freight trains which occurred in New York City on May 22, 1967.

12/ Standards for seat belts, padded visors, and collapsible steering columns contained in the Motor Vehicle Safety Standards as formulated under Public Laws 89-563 and 89-564.

VI. PROBABLE CAUSE

The Safety Board determines that the collision was caused by the operation of train N-48 beyond its meeting point, in violation of properly issued train orders. It could not be determined why the engineer of train N-48 failed to stop and enter the siding at Dale as required by train order. Among the several possibilities, the Board considers it most probable that the engineer misinterpreted the "high ball" signal given by the conductor at Stamford. He assumed that he had right-of-way over train N-49, and failed to read the order which was given him by the Stamford operator. If the conductor of N-48 had fully complied with the operating rules in obtaining a copy of the train order, in instructing the flagman in his duties concerning the meet with train N-49, and had monitored the operation of the train approaching the siding at Dale, the collision might have been prevented, despite the engineer's action.

Contributing to the cause of the serious injuries and fatalities of the employees and the one passenger were: the design and location of the engineer's control compartment, the inability of the leading cars to withstand the force of the impact, and the location of the victims at the time of the collision in the forward area of the cars. Factors contributing to a great extent to the passengers' injuries were: the lack of restraining devices to hold the passengers in their seats, and the failure and movement of the seat backs.

VII. RECOMMENDATIONS

1. The Safety Board recommends that the Penn Central Company review its operating rules and its interpretation of such rules, as they applied to this accident, to assure that operations of this type are adequately protected. It is further recommended that the Penn Central Company take the necessary action to insure that its employees comply with the company's operating rules.

2. The Safety Board recommends that the Federal Railroad Administration, if it receives additional statutory authority under legislation now in-progress, study the feasibility of requiring a form of automatic train control at points where passenger trains are required to meet other trains.

3. The Safety Board recommends that The Association of American Railroads and the American Short Line Railroad Association advise their member railroads of the dangers arising from the practice of employees' placing other than accepted interpretations on rules and long-standing practices, and of the need for rules prohibiting such practices.

4. The Safety Board reiterates the recommendation made in its report covering the derailment of Penn Central train second 115 at Glenn Dale, Maryland, on June 28, 1969, " . . . the Federal Railroad Administration initiate studies to determine the relationship between rail passenger car design and passenger injury and, where practical, take action for correction in the design of future high-speed and rapid transit passengers cars." These studies should include some form of occupant restraining device.

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JOHN H. REED
Chairman

/s/ OSCAR M. LAUREL
Member

/s/ FRANCIS H. McADAMS
Member

/s/ LOUIS M. THAYER
Member

/s/ ISABEL A. BURGESS
Member

October 14, 1970

APPENDIX I

Excerpts from Penn Central Company's
Rules for Conducting Transportation

GENERAL RULES

A. Employes whose duties are prescribed by these rules must provide themselves with a copy

Employes whose duties are in any way affected by the timetable must have a copy of the current timetable with them while on duty

In special instructions, general orders, bulletin orders, general notices and all other instructions for conducting transportation, references to rules by letter or number only, shall be restricted to rules contained in the Rules for Conducting Transportation

B Employes must be conversant with and obey the rules and special instructions Where rules are subdivided they apply equally to all and must be observed wherever they relate in any way to the proper discharge of the duties of employes If in doubt as to their meaning they must apply to proper authority for an explanation

C. Employes must pass the required examinations

Employes whose duties require them to be familiar with the Rules for Conducting Transportation and timetable, must pass a satisfactory examination within six months after entering service. Employes must be re-examined annually, or as required by law or by proper authority

When reporting for examination they must present their copy of the Rules for Conducting Transportation, timetable, and other instructions for inspection as required

D. Persons employed in any service on trains are subject to the rules and special instructions

E. Employes must devote themselves exclusively to the Company's service while on duty, render every assistance in their power in carrying out the rules and special instructions and promptly report to the proper official any violation thereof

To enter or remain in the service, employes must be of good moral character and must conduct themselves at all times, whether on or off Company property in such manner as not to bring discredit upon the Company

Gambling, making bets, fighting or participating in any illegal, immoral or unauthorized activity while on duty or on Company property is prohibited.

Books, magazines, or papers other than Company instructions must not be read while performing service

Sleeping or assuming an attitude of sleep while on duty is prohibited The use or possession of televisions and radios other than those furnished for railroad operations is prohibited while performing service.

The solicitation by employes of gratuities from patrons is prohibited

Any act of hostility or willful disregard of the Company's interest will not be condoned

F. Accidents, failure in the supply of water, fuel or electric power, defects in track, bridges, signals, catenary, third rail and transmission lines, or any unusual conditions which may affect the movement of trains must be reported by quickest available means of communication to the proper authority and protection provided when necessary

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

H. The use of tobacco by employes on duty while engaged in serving patrons in or about passenger stations or occupied passenger cars, is prohibited Smoking in engines, except in cabs is prohibited

J. Employes must keep the premises in a neat and orderly condition

J-1. Employes on duty must wear the prescribed badge and uniform and be neat in appearance

K. To avoid annoyance to the public, employes and others authorized to transact business at stations and on or about trains, must be courteous, orderly and quiet.

L. In case of danger to or loss of the Company's property, from any cause, employes must unite to protect it

Abuse, misuse, defacing of or deliberate damage to or destruction of Company property, tools or equipment is prohibited

The unauthorized possession of, removal or disposal of, any material from railroad property or property served by the railroad is prohibited

Property of the railroad, as well as freight and articles found in or on cars, or on company premises, must be cared for and properly reported

M. Employes must provide themselves with a copy of the Safety Rules prescribed for their department and be governed by the rules contained therein

DEFINITIONS

Block

Block—A length of track of defined limits, the use of which by trains and engines is governed by block signals, block-limit signals, cab signals or cab signals and block signals

Absolute Block—A block in which a train or engine is not permitted to enter while it is occupied by another train or engine except as prescribed by the rules

Block Signal Systems

Automatic Block Signal System (ABS)—A block signal system wherein the use of each block is governed by an automatic block signal, cab signal, or both

Manual Block Signal System (MBS)—A block signal system wherein the use of each block is governed by block signals controlled manually or by block-limit signals or both upon information by telephone or other means of communication

Assigned Territories

Region—That portion of the railroad assigned to the supervision of the General Superintendent

Division—That portion of the railroad assigned to the supervision of the Superintendent

Branch—That portion of a division designated by timetable

Interlocking

Interlocking—An arrangement of signals and signal appliances so interconnected that their movements must succeed each other in proper sequence and for which interlocking rules are in effect It may be operated manually or automatically

Interlocking Limits—The tracks between the extreme opposing home signals of an interlocking

Signals

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

NOTE—The definition of a "Fixed Signal" covers such signals as switch target, train order, block, approach block limit, block limit, interlocking, speed signs, stop signs, yard limit signs, or other means for indicating a condition affecting the movement of a train or engine

Aspect—The appearance of a fixed signal conveying an indication as viewed from the direction of an approaching train; the appearance of a cab signal conveying an indication as viewed by an observer in the cab

Indication—The information conveyed by the aspect of a signal

Block Signal—A fixed signal, or hand signal in the absence of a fixed signal, at the entrance of a block to govern trains and engines in entering and using that block

Block Limit Signal—A fixed signal indicating the limit of a block the use of which by trains or engines is prescribed by manual block signal system rules

Home Signal—A fixed signal at the entrance to a route or block to govern trains or engines entering and using that route or block

Interlocking Signals—The fixed signals of an interlocking

Dwarf Signal—A low home signal

Stations

Station—A place designated in the timetable by name

Block Station—A place provided for the blocking of trains by block signals or other means

Block-Limit Station—A place at which a block-limit signal is displayed

Interlocking Station—A place from which an interlocking is operated

Timetable

Timetable—The authority for the movement of regular trains subject to the rules It contains classified schedules with special instructions relating to the movement of trains and engines

Schedule—That part of a timetable which prescribes class, direction, number, and movement for a regular train

14. ENGINE WHISTLE OR HORN SIGNALS

NOTE—The signals prescribed are illustrated by "o" for short sounds; "—" for long sounds. The sound of the whistle or horn should be distinct, with intensity and duration proportionate to the distance signal is to be conveyed.

	SOUND	INDICATION
(l)	——o—	(1) Approaching public crossings at grade, to be prolonged or repeated until crossing is reached unless otherwise provided
(n)	——o	Approaching meeting or waiting points See Rule S-90

SUPERIORITY OF TRAINS

S-71. A train is superior to another train by right, class or direction

Right is conferred by train order; class and direction by timetable

Right is superior to class or direction

Direction is superior as between trains of the same class.

S-90. Engine whistle or horn signal 14(n) must be sounded at least one mile before reaching a meeting or waiting point If engineman fails to sound whistle signal, a member of crew must communicate with him at once and if necessary stop the train.

NOTE—Will not apply where Rule 261 is in effect.

99. When a train stops under circumstances in which it may be overtaken by another train, a member of the crew must go back immediately with flagging equipment a sufficient distance to insure full protection, placing two torpedoes, and when necessary, in addition, displaying lighted fusees

When recalled and safety to the train will permit, he may return

When conditions require, he will leave the torpedoes and a lighted fusee.

The front of the train must be protected in the same way when necessary

When a train is moving under circumstances in which it may be overtaken by another train, a member of the crew must take such action as may be necessary to insure full protection By night, or by day when the view is obscured, lighted fusees must be dropped off at proper intervals

When day signals cannot be plainly seen, owing to weather or other conditions, night signals must also be used

Conductors and enginemen are responsible for the protection of their trains

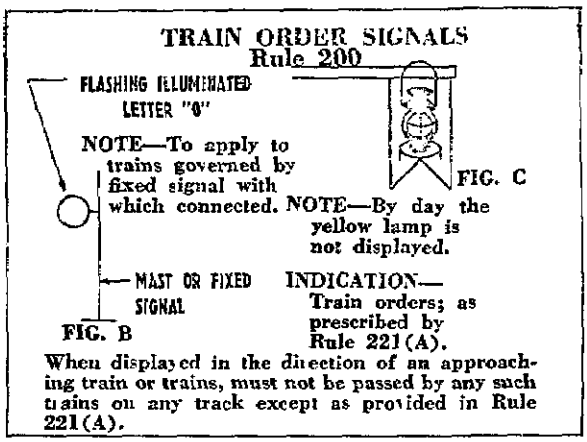
When a pusher engine is assisting a train, coupled behind the cabin car, and the member of the crew that protects the rear end of the train is riding in the cabin car, the requirements as to the use of fusees should be met by dropping them off between the cabin car and pusher engine on the track the train is using, and not between that track and an adjacent track

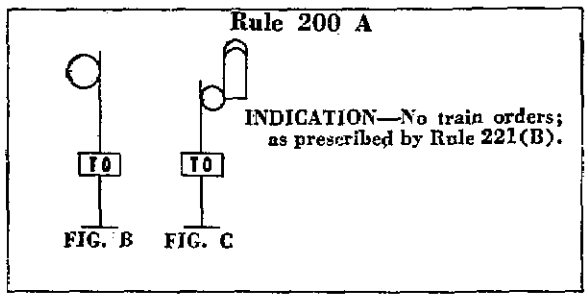
NOTE—When trains are operating under automatic block signal system rules or traffic control system rules, the requirements of Rule 99 do not apply for following movements on the same track.

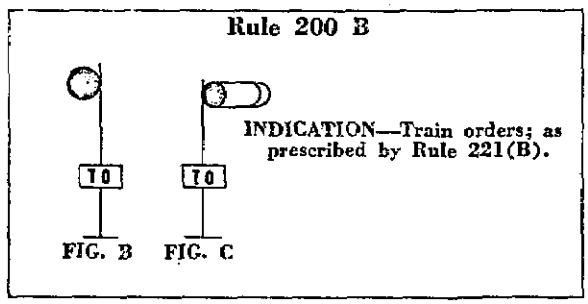
NOTE—When trains are operating under manual block signal system rules, the requirements of Rule 99 will not apply for following movements on the same track where Rule 316 is in effect, except when required by train order or timetable special instructions

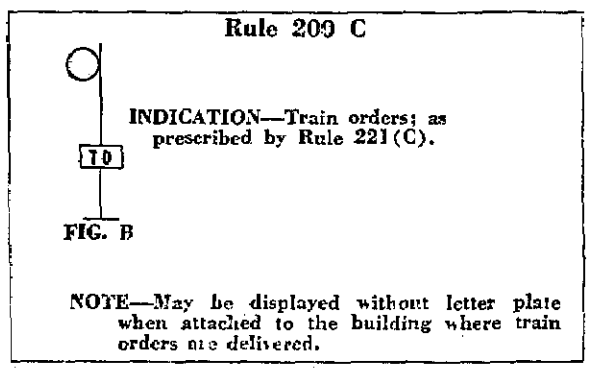
106. The conductor, enginemen, and pilot are responsible for the safety of the train and the observance of the rules, and under conditions not provided for by the rules, must take every precaution for protection

This does not relieve other employes of their responsibility under the rules









MOVEMENT BY TRAIN ORDERS

201. For movements not provided for by timetable, unless otherwise provided, train orders will be issued by authority and over the signature of the Superintendent and contain only information or instructions essential to such movements

They must be brief and clear; in the prescribed forms when applicable; and without erasure, alteration or insertion of a word or words on or between lines

Figure in train orders must not be surrounded by brackets, circles or other characters

Except where Rule 261 is in effect, train orders will be issued to cover the meeting of passenger trains at scheduled meeting points

Where switch numbers are used, only switches of sidings will be numbered, No 1 being the most eastward or northward switch, with the numbers increasing toward the west or south

When switch numbers are used in train orders, the word "Switch ." will precede the name of the station.

Mile post numbers used in train orders must conform to mile post location on right-of-way of portion of railroad involved

202. Each train order must be given in the same words to all employes or trains addressed

203. Train orders must be numbered consecutively each day, beginning at midnight

204. Train orders must be addressed to those who are to execute them naming the place at which each is to receive his copy. Those for a train must be addressed to the conductor and engineman and also to anyone who acts as its pilot A copy must be prepared for each employe addressed and for the engineman of each helper engine

Orders addressed to operators restricting the movement of trains must be respected by conductors and enginemen the same as if addressed to them

Conductors and enginemen must show train orders, when practicable, to other members of crew, who will, when practicable, remind conductor and engineman of the requirements of train orders

The engineman of each engine taken on at a point where no train orders are delivered to the train, must be advised by the conductor or engineman of that train of all train orders, previously received, affecting the train in the territory covered by the additional engine

NOTE—When so indicated by special instructions, a copy of the train order for the engineman of each helping engine pushing the train need not be supplied

205. Each train order must be written in full in a book provided for the purpose in the office of Train Dispatcher; and with it recorded the information required by the rules and the train order book These records must be made at once and never from memory or memoranda

Additions to train orders must not be made after they have been repeated

206 In train orders regular trains will be designated by schedule and engine number as "No 10 Eng 798," and sections as "Second 10 Eng 799" Extra trains will be designated by engine number and direction, as "Extra 798 'east' or 'west'," for electric and diesel engines; "M U extra 798 'east' or 'west'," for multiple unit engines; "R C extra 798 'east' or 'west'," for rail motor car; and "T C extra 7981 'east' or 'west'," for Track Car For the movement of an engine of another company, the initials will precede the engine number

In transmitting train orders; even hours as "10 00 A M" must not be stated; time must be stated in figures and duplicated in words; names of stations and numerals in the body of the order must first be plainly pronounced and then spelled, letter by letter, thus; Aurora, A-u-r-o-r-a, and 1-0-5, o-n-e n-a-u-g-h-t f-i-v-e

The letters duplicating names of stations and numerals must not be written in the order book nor upon train orders, except time, which must be duplicated in words In transmitting train orders, the Train Dispatcher must write the order as he transmits it and underscore each word and figure at the time it is repeated by each operator

When engine numbers are used in the address of train orders they must be specified as follows:

C & E Eng	for electric and diesel engines
C & E M U Eng	for multiple unit engines
C & E R C Eng	for rail motor car

Train orders issued to track cars must be addressed to Driver T C

On portions of the railroad, so specified in the timetable, regular trains will be designated by schedule as "No 10" and sections as "Second 10," adding engine numbers when necessary for identification

206a When trains have two or more engines coupled, and a designation is made by engine numbers, the number of the leading engine only will be used

When an engine consists of more than one unit the number of the leading unit or the numbers of both the leading and rear units may be used to identify the train

207. To transmit a train order, the signal "19" followed by the direction must be given to each office addressed, the number of copies being stated if more or less than three — thus, "19, east, copy 2."

208. 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 superior train

The several addresses must be in the order of superiority of trains, each office taking its proper address, and when practicable must include the operator at the meeting or waiting point.

A train order restricting the movement of a train must not be issued for it at the point where such movement is restricted (except where it is required to receive Clearance Form A) if it can be avoided When so sent, the fact must be stated in the order, the train must be stopped before delivery is made, and special precautions must be taken to insure safety

209. Operators receiving train orders must write or typewrite the required number of carbon copies during transmission They must retain a copy of each train order The word "complete," the time, and the signature of the operator must be in his handwriting

209a. If the requisite number of copies of a train order cannot be made at one writing, operator 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 operator who re-copies the order must be

shown, but the date of issue, time completed and name of original receiving operator must not be changed Operator must retain a copy of each additional writing showing thereon the time and day it was repeated to the Train Dispatcher

Train Dispatcher must check the repetition as prescribed by Rule 206, and if correct respond "OK," making notation in train order book showing station, time and date

210. When a train order has been transmitted, operators must, unless otherwise directed, repeat it at once from their copy in the succession in which the offices have been addressed Each operator receiving the order should observe whether the others repeat correctly When the order has been repeated correctly by an operator, the response "complete" and the time, with the initials of the Superintendent, will be given by the Train Dispatcher The operator receiving this response will then write in the space provided the word "complete," the time and his last name in full and must then effect delivery of the order to the persons addressed

When a train order restricting the superiority of a train is issued for it at the point where such superiority is restricted, the train must be stopped before delivery of the order.

211. Where Clearance Form A is used, it must be filled out by the operator before clearing a train, showing thereon, without erasure or alteration, the total number of train orders and the number of each train order, if any, addressed to a train He will then repeat from Clearance Form A to the Train Dispatcher the information shown thereon The Train Dispatcher will make the required record in the train order book, and if operator has correctly repeated the number of all train orders addressed to a train will respond "OK," and the time, which the operator will endorse on the Clearance Form A

Clearance Form A must be delivered together with all train orders to each person addressed Conductor and engineman must, and other members of the crew when practicable will, see that the information shown on Clearance Form A corresponds with the train orders received

Operators must forward office copy of each Clearance Form A to the Division Operator or Chief Train Dispatcher at specified intervals

213. "Complete" must not be given to a train order for delivery to an inferior train until the order has been repeated by the operator who receives the order for the superior train

214. When a train order has been repeated and before "complete" has been given, the order must be treated as a holding order for the train addressed but must not be otherwise acted on until "complete" has been given

If the means of communication fail before an office has repeated an order, the order at that office is of no effect and must be treated as if it had not been sent

216 For train orders delivered by the Train Dispatcher the requirements as to the record and delivery are the same as at other offices

217. To effect delivery of a train order at a point other than a train order office, it must be addressed to "C & E ——— at ——— care of ———," and forwarded and delivered by the person in whose care it is addressed

217a. To effect delivery of a train order by telephone, or radio to a train, the Train Dispatcher or operator must transmit to the conductor, engineman or other employe addressed, the complete train order including his own last name, except that he will not give the "time complete" until the employe receiving the order has repeated it to the operator correctly The employe so receiving the order must sign it as "Received by ———," and then deliver a copy to each person addressed

The operator must show on his office copy of the train order the name of the person to whom delivered by these means and the time

Train orders received by these means, after being fulfilled, must be retained and turned in at the end of trip or day to be forwarded to the Division Operator or Chief Train Dispatcher

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

219. An operator must not accept complete for a

train order when such train has passed beyond his jurisdiction

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

Orders held by or issued for or any part of an order relating to a regular train become void when such train loses both right and schedule as prescribed by Rules 4 and 82, or its schedule or section is annulled

When a conductor or engineman, or both, is relieved, all train orders and instructions held must be delivered to the relieving conductor or engineman Such orders or instructions must be compared by the conductor and engineman before proceeding

221 Rules 221(B), and 221(C) will not be in effect except by special instruction

When a slow order to be delivered to a train covers a portion of track close to the train order office, the operator must stop the train before delivering the order

221(A). Unless otherwise provided in the timetable or by train order, a fixed signal must be used at each train order office which shall indicate "Stop" when there is an operator on duty, except when changed to "Proceed" to allow a train to pass after receiving train orders or for which there are no orders A train must not pass the signal while "Stop" is indicated

When an order is to be delivered to a train at a train-order office, the fixed signal must be displayed at "Stop" for the track and in the direction of the approaching train and a train-order signal must be displayed in the place provided for the purpose

The operator must not clear these signals for an approaching train unless he knows that the train is not the one to which orders are addressed

This combination of signals must be acknowledged by the engineman by two short sounds of the engine whistle or horn

In delivering orders without stopping a train, the operator, after the signal has been acknowledged, must leave the train-order signal displayed until the orders have been delivered, place the fixed signal at its proper position and effect delivery of the orders together with a Clearance Form A showing orders delivered The engineman's copies of the orders and the Clearance Form A will be handed on the engine and the conductor's copies on the train

When the train-order signal is displayed, the speed of the train must be reduced sufficiently to enable the operator to deliver the order If delivery is not effected on the engine the train must be stopped

When train orders are issued that restrict the superiority of train addressed at the point where they are to be delivered to the train, the fixed signal at that point must remain at "Stop" until the orders are delivered

Before a train order is issued to hold trains the fixed signal at the point at which the trains are to be held must be displayed at "Stop" for the track and in the direction of the approaching train and the operating lever blocked by the approved blocking device

221(B) Unless otherwise provided, a fixed signal must be used at each train-order office, which shall indicate "Stop" when there is an operator on duty, except when changed to "Proceed" to allow a train to pass after receiving train orders or for which there are no orders The signal must be returned to "Stop" as soon as the train has passed

A train must not pass a train-order signal while "Stop" is indicated without receiving Clearance Form A, except:

(1) When making a station stop, the head end of a passenger train may pass signal (except an interlocking signal used as block signal) not more than 300 feet if track is seen or known to be clear and the engine will not foul switch to be used by opposing trains

(2) Signal (except an interlocking signal used as block signal) may be passed to enter a siding to meet an opposing train when switch is located in advance of signal, after engineman has had proper understanding with the operator, and, in addition, a hand signal is received from trainman of train holding main track

(3) Where no form of Block Signal System is in effect to do station work or to enter a siding after proper understanding is had with the operator

When a train has passed the signal, as in (1) and (2) while "Stop" is indicated, it must not thereafter accept a "Proceed" indication of such signal.

At train order stations where but one train order signal is provided for a direction, it will govern trains moving only with the current of traffic Trains moving against the current of traffic must receive Clearance Form A at each open train order station

The "Proceed" indication of train order signal applies only to trains on main tracks

If the fixed signal should fail to work properly, Clearance Form A must be used If a signal is not displayed at a night office, trains which have not been notified must stop and ascertain the cause and report the facts to the Train Dispatcher from the next available point of communication

221(C). Unless otherwise provided, an operator before receiving train orders for delivery to a train will, in addition to displaying the "Stop" indication of the fixed signal, display at or near the station from which the signal is controlled and in the direction of the approaching train, a yellow flag or light by day and a yellow light by night and then reply "train-order signal displayed."

Enginemen must acknowledge the train order signal by two short sounds of the engine whistle or horn After the signal has been acknowledged, if the orders restrict the movement of the train at that station, the signal must remain at "Stop" until the orders have been delivered; if the orders do not restrict the movement of the train at that station, the operator will then display the signal to give the proper "Proceed" indication and the train may proceed to the station, but not beyond without receiving train orders and/or Clearance Form A

222 Operators must promptly record and report to the Train Dispatcher the time of arrival and time of departure and the engine number of all trains, including direction of extra trains, and such other information as required.

They must observe trains and report at once to the Train Dispatcher if the proper signals are not displayed.

223. The following signals and abbreviations may be used:

Initials for signature of the Superintendent

The usual abbreviations for the names of the months and authorized abbreviations for stations.

225. Upon arrival of train at a meeting or passing point at an unattended station, if the other train is not in sight the conductor or engineman must communicate with the Train Dispatcher or operator and ascertain if there are any orders

226. A train order office must not be closed until permission is obtained from Train Dispatcher Signals, where used, must then be arranged to indicate "No train orders."

FORMS OF TRAIN ORDERS

NOTE—Forms with a prefix "S" are for single track; those with a prefix "D" are for two or more tracks The words and figures in italics in the forms are examples, indicating the manner in which the orders are to be filled out.

The train in the superior time-table direction will be the first named train in the meet order.

S-A

FIXING MEETING POINTS FOR OPPOSING TRAINS

(1) *No 1 Eng 981* meet *No 2 Eng 982* at *B*
No 3 Eng 986 meet *Second 4 Eng 984* at *B*
No 5 Eng 983 meet *extra 984 east* at *B*
Psgr extra 652 north meet *extra 231 south* at *B*

(2) *No 2 Eng 982 and Second 4 Eng 984* meet *No 1 Eng 981 and No 3 Eng 986* at *C and extra 95 west* at *D*

(3) *No 2 Eng 982* take siding and meet *No 1 Eng 981* at *B*
Extra 652 north take siding and meet *extra 231 south* at *B*

Trains receiving these orders will run with respect to each other to the designated points and there meet in the manner prescribed by the rules.

S-C

GIVING RIGHT OVER AN OPPOSING TRAIN

(1) *No 1 Eng 981* has right over *No 2 Eng 982 G* to *X*.

If the second named train reaches the point last named before the other arrives, it may proceed, keeping clear of the schedule of opposing train as required by the rules.

(2) *Extra 37 east* has right over *No 3 Eng 981 F* to *A*.
The regular train must not go beyond the point last named until the extra train has arrived, unless authorized by train order to do so.

Examples (1) and (2) give right to the train first named over the other train between the points named. If the trains meet at either of the designated points, the first named train must take the siding, unless the order otherwise prescribes.

(3) *Extra 72 south* has right over *Extra 91 north*
A to *Z* and wait
at *N* until *2 10 two ten p m.*
at *P* until *3 25 three twenty five p m* for *Extra 91 north.*

The first named extra train must not pass the designated waiting points before the time given, unless the second named extra train has arrived. The second named extra train must clear the time specified at the designated points or any intermediate station not less than five minutes.

Example (3) must not be used unless the first named extra is given right over the opposing extra the entire limits either of the extras is authorized to run.

Rule 230

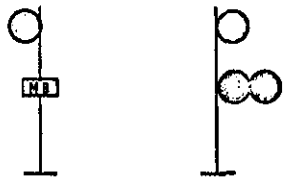


FIG. B FIG. B-1

INDICATION—Proceed; for passenger trains, manual block clear; for trains other than passenger trains, manual block clear outside yard limits.

NAME: Clear-block.

Rule 292

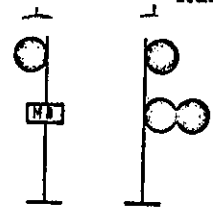


FIG. B-5 FIG. B-6

INDICATION—Stop

NAME: Stop Signal

Rule 293

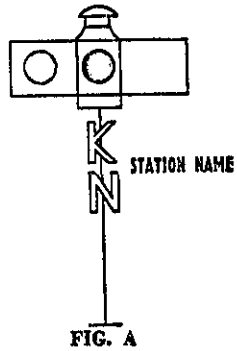


FIG. A

INDICATION—Limit of the block.

NAME: Block-limit.

NOTE—Yellow light to be placed next to track governed.

Rule 293(A)

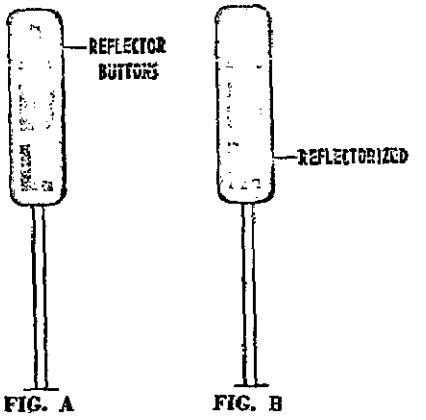


FIG. A FIG. B

INDICATION—Proceed prepared to stop at next Block-limit signal. Train exceeding Medium speed must at once reduce to that speed.

NAME: Approach block-limit.

NOTE—Will not apply to trains authorized to pass the Block-limit station as though Clear-block signal were displayed.

Rule 295

FIG. B

INDICATION—Switch closed, proceed.

NAME: Clear distant switch signal.

Rule 295(A)

FIG. B

INDICATION—Switch open. Approach all switches connected with the signal prepared to stop short of the switches.

NAME: Caution distant switch signal.

MANUAL BLOCK SIGNAL SYSTEM

NOTE—Rules 305 to 342 inclusive will not be effective except by special instructions.

305. Block signals govern the use of the blocks, and except where Rule 251 or 261 is in effect, do not supersede the superiority of trains, nor dispense with the use and the observance of other signals whenever and wherever they may be required

At a block-limit station trains will be governed in their use of the block by instructions of the operator in charge of the block-limit station as indicated in the timetable

305a. Block signals will be used as train order signals where separate train order signals are not provided

Interlocking signals which serve also as manual block signals will display manual block indications on top arm or light

306. When a block station is open at an irregular hour, trains must be notified by train order or bulletin order Operator must use hand signals in addition to block signals to give required indications until all trains have passed which have not been notified by train order or bulletin order that the block station is open

D-308. When a train is operated against the current of traffic, manual block signal system rules must be observed; Rule 316 or 317 to apply as specified in the timetable Block stations named in the timetable indicate limits of manual block, except when a train is authorized by train order to run against the current of traffic to an interlocking or a block station-remote controlled, the portion of the main track between that interlocking or block station and the first block station in the rear will constitute a block for that train

309. Except as provided in Rules 801 to 829(h), equipment of a type which may not operate signals or shunt track circuits must not be operated in Manual Block Signal System territory, without authority of the Superintendent and permission of the operator who must also be advised when the movement has entered a block. After such equipment has entered a block, the block signal must be restored to its most restrictive indication, approved blocking device applied and must not be changed until the equipment has cleared

the block or following movement has been notified by train order to look out for such equipment.

311. Signals must be kept in the position displaying the most restrictive indication, except when displayed for an immediate movement

312. Appliances must be operated carefully and only by those charged with that duty If any irregularity affecting their operation is detected the signals must be displayed to give their most restrictive indication until repairs are made Defects must be promptly reported to the Train Dispatcher.

316. (For absolute block for following and opposing movements on the same track)

Before admitting a passenger train to a block, the operator in charge of the block station or block-limit station at the entrance of the block must know that the block is clear and that no other train or engine has been given permission or a signal to enter the block

Before admitting a train or engine, other than a passenger train, to a block, the operator in charge of the block station or block-limit station at the entrance of the block must know that the block is clear of passenger trains and clear of all other trains and engines outside yard limits, and that no other train or engine has been given permission or a signal to enter the block outside yard limits.

Signals governing opposing movements, where provided, must display Stop-signal. The operator will then display Clear-block signal for the train or engine to be admitted to the block The operator in charge of a block-limit station may give a train or engine at that block-limit station verbal permission to enter one block. The operator, when authorized by the Train Dispatcher, will issue Clearance Card (Form K) to a train to pass one or more block-limit stations as though Clear-block signal were displayed.

A train or engine must not be admitted to a block unless it is clear except as provided in Rules 327, 333 or by train order.

317. (For absolute block for opposing movements and permissive block for following movements on the same track.)

Before admitting a passenger train to a block under Clear-block signal, the operator in charge of the block station or block-limit station at the entrance of the block must know that the block is clear and that no other train or engine has been given permission or a signal to enter the block Signals governing opposing movements, where provided, must display Stop-signal The operator in charge of a block-limit station may give a passenger train at that block-limit station verbal permission to enter one block The operator, when authorized by the Train Dispatcher, will issue Clearance Card (Form K) to a passenger train to pass one or more block-limit stations as though Clear-block signal were displayed

Before admitting a train other than a passenger train to a block under Clear-block signal, the operator in charge of the block station or block-limit station at the entrance of the block must know that the block is clear of passenger trains and clear of all other trains outside yard limits and that no other train has been given permission or a signal to enter the block outside yard limits Signals governing opposing movements outside of yard limits, where provided, must display Stop-signal The operator in charge of a block-limit station may give a train or engine at that block-limit station verbal permission to enter one block The operator, when authorized by the Train Dispatcher, will issue Clearance Card (Form K) to a train to pass one or more block-limit stations as though Clear-block signal were displayed.

When the block is clear of passenger trains, and clear of opposing trains outside yard limits, the operator in charge of the block station may permit a train other than a passenger train to follow a train other than a passenger train into the block by displaying a Permissive-block signal for the train to be admitted to the block Signals governing opposing movements outside yard limits, where provided, must display Stop-signal and Stop-signals to passenger trains must be displayed The operator in charge of a block-limit station may give a train or engine at that block-limit station verbal permission to enter one block The operator, when authorized by the Train Dispatcher, will issue Clearance Card (Form K) to a train not governed by Clear-block signal to pass one or more block-limit stations as though Permissive-block signal were displayed.

Except as provided in Rules 327, 333 or by train order, a train must not be admitted to a block which is occupied by a passenger train or an opposing

train and a passenger train must not be admitted to a block which is occupied by any train.

319. When a train enters a block, the control of which is divided between two block stations, the operator must give the train, engine number and time to the next block station in advance. On two or more tracks they must also specify the track.

When a train clears a block, the operator receiving the information must give the record of the train to the block station in the rear.

A Station Record of Train Movements must be maintained for each block and block-limit station on which information as to all movements within blocks under their jurisdiction must be recorded by the operator. Any change in condition of block by radio or telephone after train has entered block must also be promptly recorded.

319a. At remote control signals indicated in the timetable, operator may accept office indication that train has passed signal.

At such locations trains must not pass remote control signals without entire train or do switching without first notifying the operator in control of intended moves, and must report as soon as such moves have been completed.

321. Operators must, as far as practicable, observe each passing train and note whether it is complete and in order, and the marker properly displayed.

322. Should a train pass a block station with any indications of conditions endangering the train or a train on another track, the operator must immediately attempt to contact that train and other trains involved, notify the operator at the next block station in advance and each must display Stop-signals to all trains that may be affected They must not permit any train to proceed until it is known that its track is not obstructed.

325. When there is an obstruction between block stations, notice must be given to the nearest operator or Train Dispatcher.

An operator or Train Dispatcher informed of any obstruction in a block must immediately attempt to contact any train involved, notify the operator at the other end of the block and each must display Stop-signals to all trains that may be affected and must not permit any train to proceed until it is known that its track is not obstructed.

326. When a train clears the main track the operator must know that it is clear of the block before reporting the block clear or displaying a Clear-block signal for that block.

When a train clears the main track, the conductor, engineman or member of their crew when authorized by the conductor or engineman, must report clear unless the switch involved is controlled by the operator.

Clearance Card (Form K) is annulled when train clears the main track and is reported clear of the block.

Inferior trains in clearing superior trains as required by the rules must clear the block for regular passenger trains.

Unless otherwise provided, at block stations where the siding is located in advance of the block signal, the inferior train must clear the time of opposing superior trains at the next open block station in advance.

326a. A train, other than a passenger train, may be admitted to a block occupied by a work extra which has been authorized by train order to work on main track while protecting itself. A copy of the order will be addressed and delivered to such train at the entrance of the block.

327. To permit a train or engine to enter a block or foul the main track or to cross from one main track to another, the operator must first obtain control of the block to be used.

A train must not enter a block nor foul the main track or cross from one main track to another without proper block signal or permission of the operator.

Where Rule 261 applies and such switch or crossover is not equipped with electric lock, a train order must be issued authorizing the movement if the normal speed is over 20 MPH.

Before permitting a passenger train to cross from one main track to another the operator must know that all blocks to be used are clear of approaching trains and that block protection for the crossover movement has been provided.

Unless so directed by the Train Dispatcher, the operator must not give permission to a train or engine to enter a block at a hand-operated switch or crossover or foul the main track on which another train is moving or has been authorized to move, in the direction of such switch or crossover from the next block station or interlocking.

When permission has been given by the operator to a train or engine to enter a block at a hand-operated switch or crossover, the operator in charge of the block stations or interlockings between which the block is located must know that the movement is being protected before permitting another train to move between such block stations or interlockings and the switch or crossover where such movement is being made.

A train having passed beyond the limits of a block must not back into that block without permission of the Train Dispatcher or operator.

Information concerning the block received by the conductor or engineman must personally be given to members of the crew, when practicable.

All crossover movements must be entered on the block records.

The operator may permit a train to enter a block behind a train a sufficient distance to clear main track switch in order to proceed in the opposite direction.

328. Unless otherwise directed, when two or more trains have been coupled and so move past any block station, they must be separated only at a block station and the operator notified.

When coupled trains are separated, the operator must regard each portion as an independent train.

329. When necessary to stop a train for which other than a Stop-signal has been displayed and accepted, the operator must give hand signals in addition to displaying the Stop-signal.

331. Trains or engines must not pass a block signal indicating "Stop" (Rule 292). When it is necessary to authorize a train or engine to pass a stop signal, verbal permission or hand signal may be given by the Train Dispatcher, or operator when authorized by the Train Dispatcher, to pass such signal after giving proper block indication.

Permission or hand signals must not be given until the train or engine has come to a stop at the signal and a member of the crew is fully informed of the situation.

When hand signals are necessary, they must be given from such a place and in such a manner that there can be no misunderstanding on the part of the employe receiving them as to the signals given or as to the train or engine for which they are intended.

332. Operating levers must be blocked with approved blocking devices and not be used when a track, switch or signal is undergoing repairs, nor when a track is obstructed.

333. When an operator is unable to communicate with the next block station in advance, he must stop all trains approaching in that direction. Should no cause for detaining a train be known, it may then be permitted to proceed by train order.

334. Hand signals must not be used and trains must not accept such signals when the proper indication can be displayed by the block signals except as prescribed by Rules 306 or 329. Block signals for a track apply only to trains moving with the current of traffic on that track. Hand signals will be used for trains moving against the current of traffic except where fixed signals are provided for blocking trains against the current of traffic.

A train approaching a block station on a track for which there is no fixed block signal must stop and ascertain from the operator the condition of the block ahead unless a signal to proceed is given by the operator with a green or yellow flag by day or a green or yellow light by night.

Unless authorized to proceed by Clearance Card (Form K), or as provided by Rule 716, trains must stop at block-limit stations and the conductor or engineman must communicate with the operator in charge as to the condition of the next block. After clearing a block at a block-limit station the conductor, engineman or member of their crew when authorized by the conductor or engineman, must report clear unless otherwise directed.

NOTE—Green flag or light indicates Clear-block (Rule 280). Yellow flag or light indicates Permissive-block (Rule 289). Absence of signal indicates Stop-signal (Rule 292).

339. If a Stop-signal is disregarded the operator must immediately attempt to contact that train and other trains involved, notify the next open station in advance and the Train Dispatcher

340. To open a block station, the operator must first notify the Train Dispatcher and then obtain from the operator in charge of the next block or block-limit stations in each direction the record of trains that are in the extended block or blocks over which the operator is taking charge and enter them on his block record.

When trains which were in the extended block or blocks when the block station was opened and which had passed his block station before it was opened, clear the block in advance, the operator must so advise the operator in charge of the block or block-limit station in the rear.

Unless otherwise directed, trains must not be admitted to a block in the direction of a closed block station after the time specified for it to be opened until it is known that such block station is open

340a. Trains in an extended block at the time specified for an intermediate closed block station to be opened, must identify their train to the operator before accepting a signal to proceed at that station

A train authorized by Clearance Card (Form K) to pass a block-limit station at which a block station is opened before its arrival must stop and be identified before accepting a signal to proceed at the open block station, as the Clearance Card (Form K) is thereby annulled.

341. A block station must not be closed except as provided for by timetable, general order, bulletin order or train order.

342. A block station must not be closed until the block in each direction is clear of trains moving under a block signal indication that would not be proper for the extended block.

To close a block station, the operator must notify the operator in charge of the block or block-limit station in each direction that his block station is being closed and give the record of trains and track cars in the extended block The block signals must then be secured in clear position, all lights in signals extinguished, reflector lights obscured and block wires arranged to work through the closed block station

BLANK FORMS

FORM 19 **PENN CENTRAL** FORM 19

TRAIN ORDER No._____

19

To

At

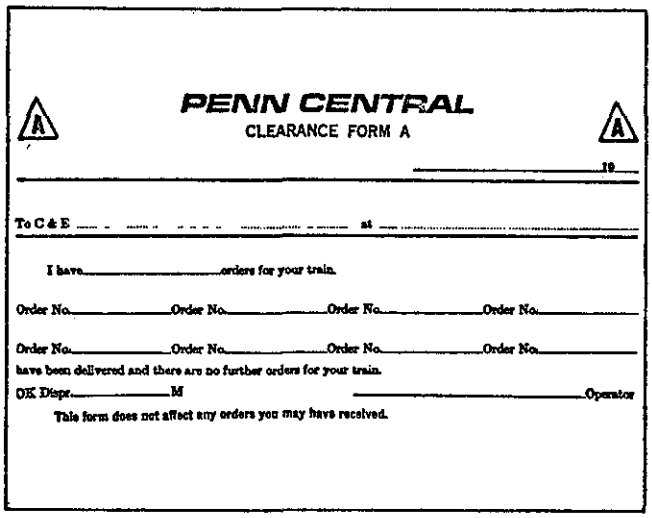
Mode Time M. Operator

SPECIFICATIONS FOR TRAIN ORDER FORM AND BOOKS FOR OPERATORS FOR 19 ORDERS

Form as shown. Blank space for order 4¾ inches with ruled lines, three to an inch. One inch for heading, order number and date, 1¼ inches for address and location, and ⅝ inch for signature The mode of filling the blank is indicated by small type

Form 6¾ x 7¼ inches Books 6¾ x 7¼ inches, 200 leaves, gummed binding at top, manila cover on face and stiff back

Paper opaque, yellow, sized and of such thickness as to admit of making nine good manifold copies at one writing; to be used with carbon paper 6¾ x 7¼ inches and a stiff tin, same size, corners rounded



PENN CENTRAL

CLEARANCE FORM A

_____ 19___

To C & E ____ at ____

I have_____orders for your train.

Order No._____ Order No._____ Order No._____ Order No._____

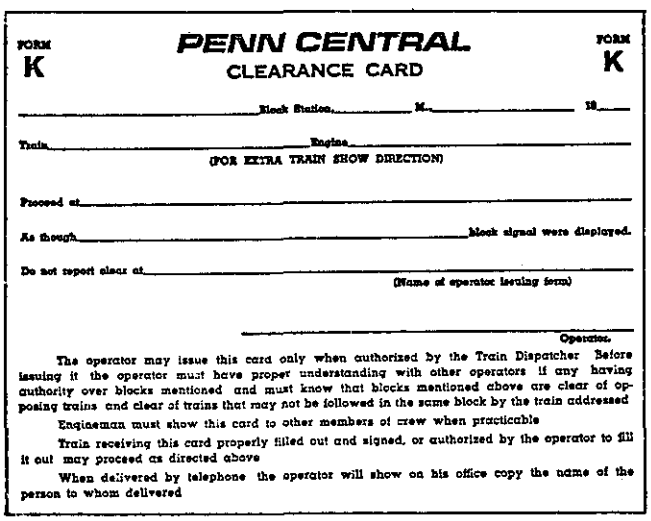
Order No._____ Order No._____ Order No._____ Order No._____

have been delivered and there are no further orders for your train.

OK Dispr._____ M _____ Operator

This form does not affect any orders you may have received.

Printed on white tissue 5¼ x 4¼



FORM K

PENN CENTRAL

CLEARANCE CARD

FORM K

_____ Block Station_____ M._____ 19___

Train_____ Engine_____

(FOR EXTRA TRAIN SHOW DIRECTION)

Proceed at_____

As though_____ block signal were displayed.

Do not report clear at_____

(Name of operator issuing form)

_____

Operator.

The operator may issue this card only when authorized by the Train Dispatcher Before issuing it the operator must have proper understanding with other operators if any having authority over blocks mentioned and must know that blocks mentioned above are clear of opposing trains and clear of trains that may not be followed in the same block by the train addressed

Engineman must show this card to other members of crew when practicable

Train receiving this card properly filled out and signed, or authorized by the operator to fill it out may proceed as directed above

When delivered by telephone the operator will show on his office copy the name of the person to whom delivered

Printed on green paper 5¼ x 4¼

Conductors

400N-1. Report to and receive their instructions from the Superintendent or other designated officer. They must obey the instructions of train master, station masters, station agents, yard masters, and operators within their jurisdiction, and from officers of other departments on matters pertaining to those departments.

Conductors have general charge of the train to which assigned and all persons employed thereon are subject to their instructions. They are responsible for the prompt movement, safety and care of their respective trains and the passengers and commodities carried, for the vigilance and conduct of the men employed thereon and for the prompt reporting to the Superintendent of conditions that interfere with the prompt and safe movement of trains.

They must know that members of crew providing protection as required by Rule 99 are familiar with their duties and that their trains are properly equipped and inspected; also that Air Brake Rules have been complied with and that the prescribed signals are displayed.

Passenger conductors must familiarize themselves with the location of the conductor's valve, (emergency brake valve), hand brakes and communicating signal appliances.

They must, when examining tickets, inform passengers destined to stations on other divisions or connecting lines at what station they will change cars and of the probable location and leaving time of the train to which they will change.

When through error of any employe a passenger is carried beyond the station to which the transportation reads, the passenger should be returned free to destination by the first available passenger train upon the written request of the conductor of train from which carried past the proper destination.

When a passenger refuses to produce proper transportation, apparently having a valid reason for the refusal, the conductor must ascertain the name and address of the passenger and report the facts to the Auditor of Passenger Accounts.

In case the refusal to pay fare is evidently an attempt to evade fare, the conductor must wire ahead for an officer of the law, and, in the presence of the officer, make demand for the fare. If the passenger still refuses to pay he must be turned over to the officer for evading fare. No person shall be removed from a train between stations for any cause. When necessary for any reason to eject a passenger from the train, it must be at an open passenger station where the train stops. In so doing they must ascertain name and address of such person and names and addresses of a number of passengers who witness the occurrence, and make prompt report to proper official.

Any passenger acting in a disorderly manner, or who annoys other passengers, may be removed from the train in the same manner. Conductors must exercise reasonable discretion in the performance of this duty.

Conductors of freight trains must not permit any person, except staff officers, their assistants, and trainmen in discharge of their duty, to enter cars, handle freight, or ride upon the train, without proper authority.

Trainmen and Brakemen

400N-2. Report to and receive their instructions from the Superintendent or other designated officer. They must obey the instructions of their conductor and of officers of other departments on matters pertaining to those departments.

They are responsible for the display of train signals, the proper protection of trains, the handling of switches, the coupling and uncoupling of cars and engines, the manipulation of brakes and for assisting the conductor or engineman in all things requisite for the prompt and safe movement of their train.

The proper place for the forward brakeman on a freight train while train is in motion is the leading end of the engine when a seat is provided.

They must familiarize themselves with the location of the emergency brake valve, and communicating signal appliances.

When assigned as ticket collectors, they must assist the conductor in the collection of transportation. When assigned as baggagemen they must receive, take care of and correctly deliver baggage, mail, express, etc. and make out proper reports on prescribed forms.

ENGINEMEN

400N-3. Report to and receive instructions from the Superintendent or other designated officer. They will be governed by current mechanical, electrical and air brake instructions pertaining to the safety, inspection, preparation, and operation of trains and engines. They must comply with the orders of the Road Foreman of Engines, Trainmaster or other designated officer within their jurisdiction.

They must obey the instructions of Station Masters, Station Agents, Yard Masters, and Operators within their jurisdiction; and the conductor in charge of their train as to general management of their train, unless by so doing they endanger its safety or commit a violation of the rules.

They must be qualified on type of engine to which assigned including any devices or auxiliaries attached thereto. At a point where no mechanical forces are on duty and except on through trains, they will check the prescribed form in the cab to be sure that the unit or units of the engine consist have been inspected within the previous 24 hour period for road service or within one calendar day in yard service.

If the engine unit or units are not within date they will make an inspection. After making inspection, they will then record date, time and location on the prescribed form in the cab and prepare and sign regular work report.

At points where mechanical forces are employed and on duty, they will accept the inspection of the mechanical forces, except air brake test, as to the condition of the engine.

They will at the end of the trip make written report on the prescribed forms.

They will be responsible for the observance of all signals controlling movements accordingly and the regularity of speed between stations, exercise discretion, care, and vigilance in moving the engine with or without cars to prevent injury to persons, damage to property, and lading, avoiding collisions and derailments. While acting as pilot they will operate the engine unless otherwise instructed and when in charge of the engine to which no qualified conductor is assigned or is disabled they must perform the duties of and conform to the rules relating to conductors. They will require the assistance of crew members in any duties relative to the prompt and safe movement of their trains, engine and cars, promptly reporting irregularities or failures.

They must not allow any member of the crew to operate the engine except under their personal supervision. They will be responsible for the proper operation of the engine and must not leave it while on duty except in case of necessity in which case the engine must be secured.

They must, if anything withdraws attention from constant lookout ahead, or weather conditions make observation of signals or warnings in any way doubtful, at once so regulate speed as to make train progress entirely safe.

When a train has more than one engine the rules apply alike to the engineman of each engine, but the use of the engine bell, whistle and air brake except in emergency must be limited to the leading engine.

The engineman is responsible for the vigilance and conduct of other employes on the engine. He will see that they are familiar with their duties and instruct them if necessary.

TRAIN DISPATCHERS

400N-10. Report to and receive their instructions from the Superintendent or from such officer as he may designate. They must be familiar with the physical characteristics of the portion of the territory in their charge and with all general orders, bulletin orders, general notices and other instructions in effect on their territory before assuming charge of their duties. They will control and issue orders governing the movement of trains in accordance with the rules. They are responsible for transmitting and recording train orders as prescribed by the rules; for issuing such other instructions as may be required for the safe and efficient movement of trains; for maintaining the prescribed record of train movements and important incidents affecting the movement of traffic; for having available when being relieved an ink written transfer in their train order book of all outstanding and unfulfilled train orders along with the number of the last general order, bulletin order and general notice and other information relative to existing conditions the relieving Train Dispatcher should know and for being assured that they are understood. Such transfer must be in accordance with instructions and initialed by the relieving Train Dispatcher.

They must also be conversant with the requirements of the current issue of special instructions governing operation of signals and interlockings insofar as their duties are concerned.

They must keep informed of weather and other unusual conditions that may affect the movement of trains and see that crews and others concerned are promptly notified.

OPERATORS

400N-11. Report to and receive their instructions from the Division Operator or Chief Train Dispatcher

They must obey the instructions of the Train Dispatcher and Train Director and advise them immediately of any occurrence which may affect proper operation or safety of train movements They must comply with instructions of the Wire Chief and officers of other departments on matters pertaining to those departments.

They are responsible for the delivery of train orders and messages to the persons addressed, arranging the use of blocks, tracks, interlocking switches and signals and prompt movement of trains in accordance with the rules, train orders and special instructions.

They will observe passing trains in compliance with Rule 77, and also report the improper display of marker

They must maintain the prescribed station record of train and track car movements and make a written transfer thereon with all necessary information The relieving operator must read this information aloud to operator being relieved to insure complete understanding and sign this record in his presence

The display of unauthorized publications, the use of unauthorized appliances, as well as placing non-essential items on instrument cases or interlocking; is prohibited

They must not absent themselves from duty until relieved and must notify the Train Dispatcher promptly should their relief fail to report at the prescribed time.

They must report the weather as required, and in case of sudden change, high water, storm or fog, promptly advise the Train Dispatcher

When required, they will operate hand-operated switches, crossing gates, movable bridges, and other devices as may be designated

When necessary to temporarily nullify protection afforded by blocking devices, to permit a movement over a route not restricted, the devices must be immediately restored to restricted position

They must comply with the requirements of the current issue of Special Instructions Governing Operation of Signals and Interlockings.

They must pass necessary examination and be qualified at a block or interlocking station before accepting an assignment for duty

In electrified territory they will operate power control boards and such other devices as directed by the power director

Train directors, their assistants and levermen, in the duties assigned them, are also governed by these instructions

APPENDIX 2

RECORD OF TESTS MADE ON THE NEW CANAAN BRANCH BETWEEN SPRINGDALE STATION AND WOODWAY STATION INCIDENT TO THE COLLISION BETWEEN TRAINS N-48 AND N-49 ON AUGUST 20, 1969.

The tests commenced at 5:52 p.m., August 24, 1969, the first series of tests being made with nine stainless multiple-unit cars of the same type which were involved in the accident on August 20.

TEST #1 - Nine cars with straight air applied in rock cut at approximately 30 miles per hour. Speed was materially reduced approaching impact point about 20 to 22 miles per hour, and train stopped easily with several graduations of the brake before reaching clearance point of Hoyt Street crossing.

TEST #2 - Nine cars starting 6:01 p.m. Brake applied fully with straight air service in sight of a brake point (relay case on north side of track). Train stopped in 18 seconds (timed by stop watch) one catenary pole short of Hoyt Street crossing with gradual release of the brake just prior to stopping.

TEST #3 - Nine cars commencing at 6:06 p.m. This test was made by making electric emergency from the sight of impact point, took 22 seconds to stop, and we were one-half of the distance between Catenary Pole 96 and 97, or about 75 feet further than from the straight air service stop. Total stopping distance--approximately 840 feet. The electric emergency on a.c.-d.c. MU equipment is a safety control feature achieved by releasing the control handle, which is spring-loaded, self-centering, creating an emergency application of the brakes. This control is commonly referred to as the "dead man" feature.

TEST #4 - Commencing with nine cars at 6:09 p.m., with a pneumatic emergency from sight distance of the point of impact 20 seconds from application of brakes to stopping, stopping approximately 225 feet shorter than the previous stop, or about 70 feet west of Cemetery Crossing. Total stopping distance - approximately 615 feet.

At this time the cars were brought to a marker indicating point of impact and the train was separated into a three-car train on the west or Stamford end and a six-car train on the New Canaan end. At 6:25 p.m., the two train units moved slowly away from impact point until we reached a location at which each from the motorman's position was no longer visible from the other train. A measured distance between front end of the two trains as they were standing indicated 553 feet 7 inches from the front of the multiple unit to the front of the multiple unit. The distance westward toward Stamford from the point of visibility to the point of impact was 314 feet 5 inches. The distance eastward from the point of visibility to point of impact was 239 feet 2 inches.

TEST #5 - The first test commenced at 6:54 p.m., moving eastward at a speed of about 20 miles per hour with electric emergency at the marker indicating visibility, the time was 10 seconds to stop and the east end of the train stopped 39 feet past the point of impact.

TEST #6 - Started at 7:15 p.m. with three cars at 30 miles per hour eastward, applied the brakes in pneumatic emergency at a point of visibility marker. It took 16 seconds to come to a stop and the east end of the train was then 285 feet past the point of impact.

TEST #7 - Commenced 7:25 p.m., three cars, at 30 miles per hour eastward, the brakes applied in electric emergency at a point of visibility marker taking 15 seconds to come to a stop. The east end was 276 feet 5 inches past point of impact.

TEST #8 - Commenced with three cars at 7:38 p.m., moving eastward at about 30 miles per hour, using the conductor's valve on the third car, the west car of the three-car train, the air was applied in emergency east of the west switch toward the middle of Dale siding. It took 17 seconds to come to a stop. We were 290 feet 1 inch from the westward point of the visibility marker which was the point of visibility for train N-48. The east end of the northerly car was approximately at the clearance point of the east side of Hoyt Street crossing.

At this time, we moved east to Woodway Station and coupled the three cars to the six cars standing at that point and tested airbrakes and again made a nine-car train.

TEST #9 - At 7:53 p.m., moving westward at about 30 miles per hour to the point of visibility marker, the brakes were applied in electric emergency, taking 23 seconds to come to a stop. We were 90 feet 5 inches from the clearance point of Hoyt Street road crossing and 290 feet 10 inches from the west visibility marker, total stopping distance of 844 feet 5 inches. The speed was not materially reduced passing point of impact marker.

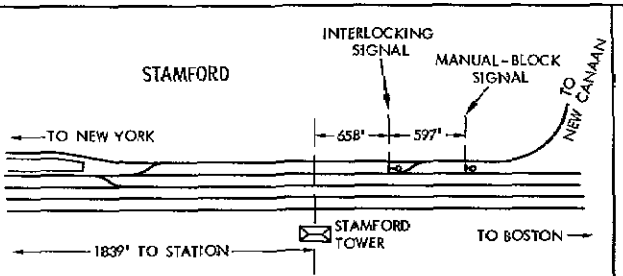
TEST #10 - Commenced 8:02 p.m., nine cars, moving westward at about 30 miles per hour, pneumatic emergency made at the point of sight marker, stopping time 23 seconds until we came to rest. We were 317 feet west of the west sight marker, a total stopping distance of 870 feet 7 inches. Speed was not materially reduced passing the point of impact marker.

We again then brought the train to the point of impact where the cars were then separated and starting at 8:16 p.m., with headlight lighted bright, the cars were again slowly moved eastward and westward away from one another to determine the line of visibility sight distance. The westward three-car train was 9 feet 10 inches of the west sight marker farther than had been in brighter daylight. The eastward train was 32 feet 1 inch west of the west marker, or 32 feet 1 inch closer to point of impact. The net gain of sight distance in the deepening dark being just a little more than 21 feet.

Those present at the tests were:

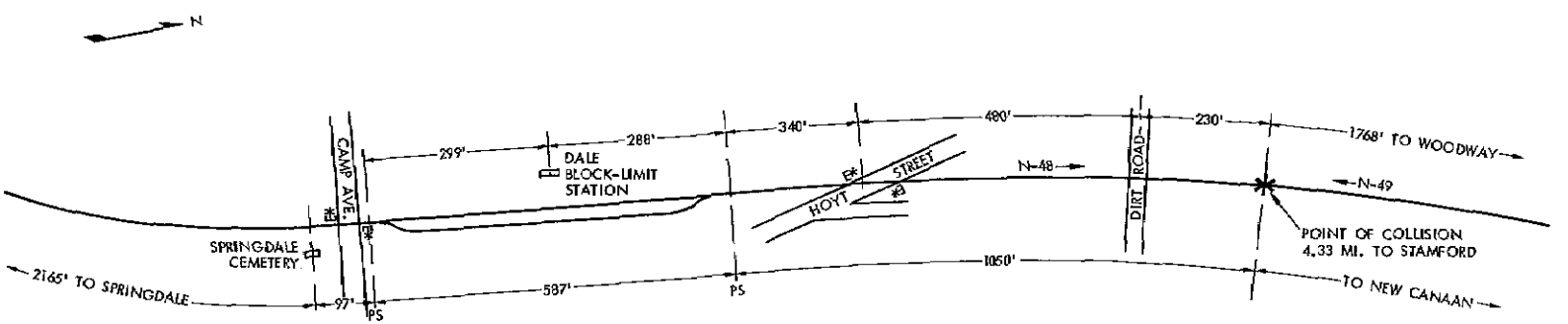
J. Sheridan	Department of Transportation
E. Hassel	Department of Transportation
E. Neusse	Chief Engineer, Connecticut Public Utilities Commission
M. Kelsey	Penn Central
B. Tripoli	Penn Central
Vincent Mason	Lieutenant, Darien Police
W.E. Copeland	Regional Road Foreman of Engines
W.J Mahon	Master Mechanic
D.A. Fink	Transportation Superintendent
J.F. Spreng	Division Superintendent

8.26.69



NEW CANAAN
.3 MI
CANE
1.9 MI
TALMADGE HILL
.8 MI
WOODWAY
1768'
POINT OF ACCIDENT
1338'
DALE
.1 MI
SPRINGDALE CEMETERY
.3 MI
SPRINGDALE
.7 MI
GLENBROOK
2.9 MI
STAMFORD

PENN CENTRAL COMPANY
DARIEN, CONNECTICUT
AUGUST 20, 1969



APPENDIX #4

Description of the accident area

Main Track

The single-track main line of the New Canaan Branch extends eastward, by timetable direction, from Stamford to New Canaan, Connecticut, 7.9 miles. Approaching the point of accident from the west, there is a 4° curve to the left 845 feet, a tangent 1,094 feet, a curve to the right 790 feet to the point of accident and for 1,374 feet beyond. From the east, there is a tangent of about 1,382 feet and the curve on which the accident occurred. The grade is 1.14 percent ascending eastward approaching the point of the accident and for a considerable distance beyond. The width of the railroad's right-of-way varies considerably: at the point of accident, it is about 100 feet wide and, 25 feet westward, it is reduced to about 66 feet. West of that point, it again widens to more than 100 feet. East of point of accident, the right-of-way varies in much the same manner.

Dale Siding

The only siding on the New Canaan Branch provided for the passing or meeting of trains is located at Dale and is 587 feet in length. The switches at each end are hand operated by high-type switch stands and are not protected by any type of electric locking. The switch stands are provided with targets and reflectors to indicate the position of the switch to trains approaching on the main track. With the switch lined for movement on the main track, a green circle with a white band and a green reflector are displayed to an approaching train. See Figure 4-2. With the switch lined for movement to the siding, a red arrow pointing perpendicular to the track and a red reflector are displayed. See figure 4-3. A derailing device is installed on the siding about 175 feet east of the west switch for the protection of the main track. This device is connected to the switch-operating mechanism so that when the switch is lined for movement on the main track, the device is in derailing position, and when the switch is lined for movement to the siding, the device is clear of the track. The same lever operates both the switch and the derailing device.

Many trees and other vegetation were growing along the main track approaching the accident area from the east. A westbound train from New Canaan approaching the accident site passes through areas containing dense foliage on both sides of the track. The engineer's range of vision on curves is greatly reduced by this condition. West of the accident point the vegetation is not as dense.

Electricity, for the propulsion of trains, is provided by a catenary system over the track. The wires of this system are carried

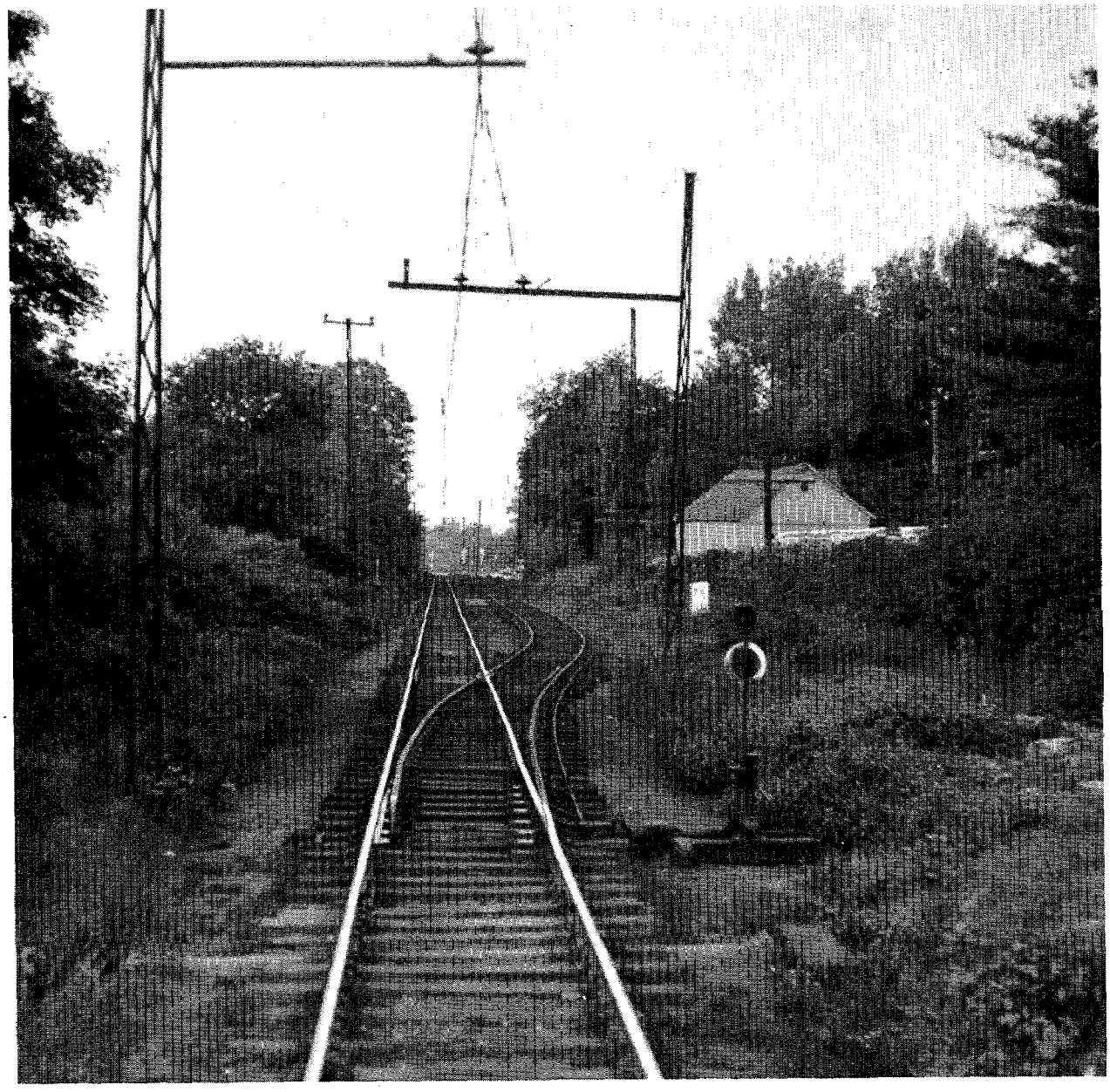


Figure No. 4-2

West switch of Dale siding
Lined for the Main track

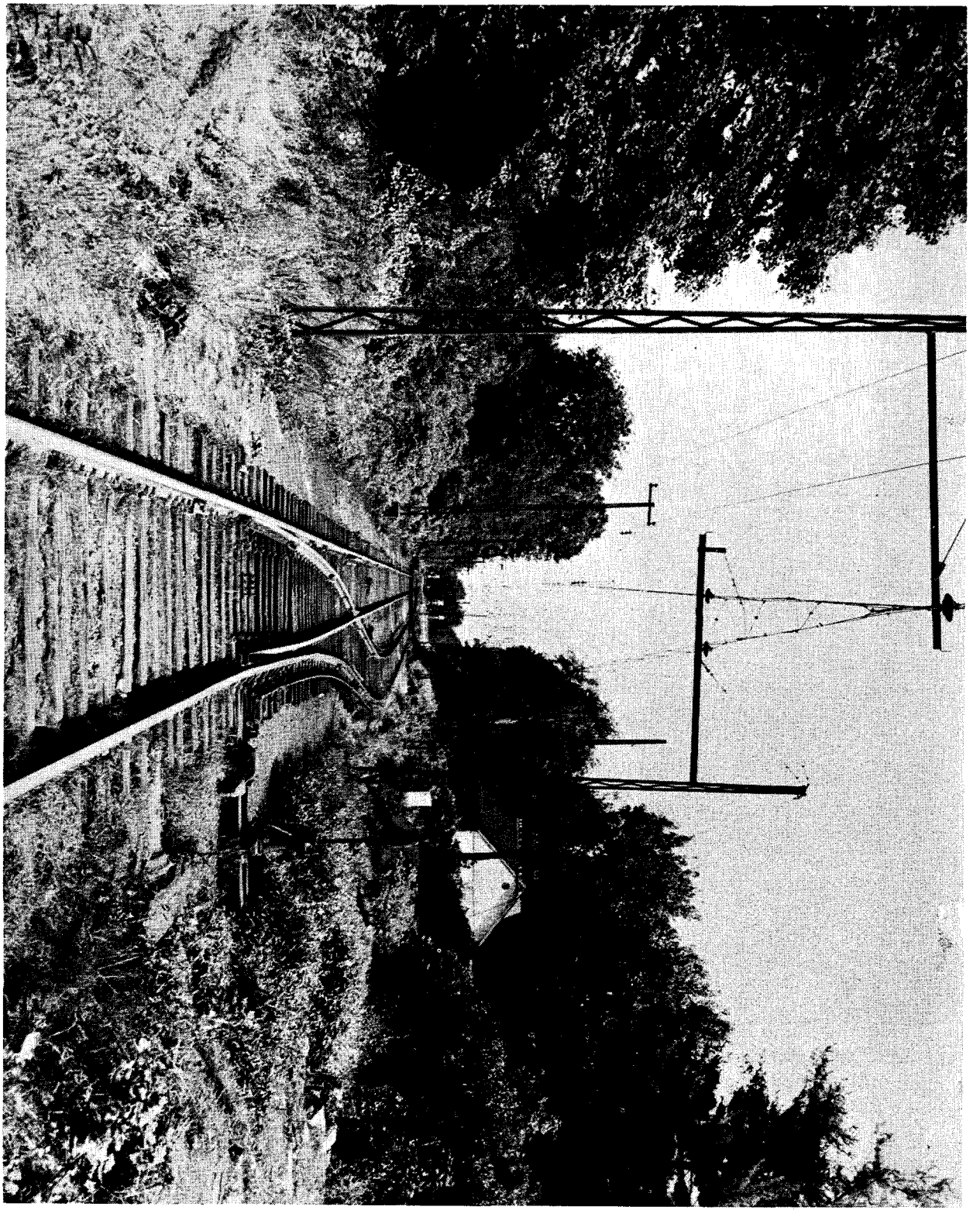


Figure No. 4-3, West switch of Dale siding lined for the siding

by single poles with cross arms of built-up construction, generally spaced between 100 to 125 feet apart, along either side of the track and are located about 10 feet from the nearest rail. The electricity provided is of 11,000 volts, 25-cycle, single-phase, alternating current, and is produced at a powerplant located at Cos Cob near New York City. Circuit breakers and disconnects are located in a control tower at Stamford. The self-propelled cars are provided with pantographs, which when raised, contact the catenary wires to collect the electrical current for the operation of the cars.

At New Canaan there are three tracks. The north track was used as the station track along which was located the passenger platforms and the station; the middle track was used to park commuter trains; and the south track was used for freight service. The north and middle tracks are provided with the catenary system. The operator is located in the station building.

In addition to those stations already mentioned, there are several other stations located along the branch including Springdale Cemetary, which is located just west of Camp Avenue. The station sign is located about 97 feet west of the west switch of Dale siding and is only 2,165 feet east of Springdale Station. Glenbrook is located 2.9 miles east of Stamford. Woodway and Talmadge Hill are located between the accident area and New Canaan, 4.9 and 5.7 miles, respectively, east of Stamford.

Rail-Highway Grade Crossing

The center of Camp Avenue, which crosses the main track at an angle of about 90°, is located about 50 feet west of the west switch of Dale siding. The road and crossing is surfaced with bituminous material. Automatic, red-flashing light protection devices are located in the northwest and southwest corners of the intersection.

Hoyt Street crosses the main track from south to north at an angle of about 20°. The center of this crossing is located about 340 feet east of the east siding switch of Dale siding. Another street, which approximately parallels the main line on the south, intersects with the east side of Hoyt Street. This junction is located just south of the railroad crossing. These roads and crossings are surfaced with bituminous material. Apparently due to the angle of the intersection and the additional road intersecting Hoyt Street close to the crossing, four automatic red-flashing light protection devices are provided, one on each corner. Due to the angle of the crossing and the installation of the devices, the red-flashing lights can be more easily seen by persons on the train than those signals protecting roadways crossing the track at right angles. (See Figure 4-6.)

Figure No. 4-6

Hoyt Street Crossing as seen by the engineer of an eastbound train after passing Dale siding.

A private, dirt road crosses the main track at grade at an angle of about 90°. The center of this road is located about 480 feet east of Hoyt Street grade crossing and about 230 feet west of the point of the accident. This crossing is not protected with any type of automatic warning device.

Signals

In addition to the signals already described in the report, there are several additional signals used for the operation of trains. Approaching Dale block-limit signal, there are advance block-limit signals (ABL). These consisted of a yellow board on which the reflectorized black letters "ABL" are mounted. The eastward ABL signal is located 318 feet west of Springdale station, and the westward ABL signal is located 1343 feet east of the point of accident. A two-aspect distant switch signal for westbound trains is located 151 feet west of the westward advance block-limit signal. When the east switch of Dale siding and of a spur track located west of Dale siding are lined for movement on the main track, a green aspect is displayed and when either switch is lined for movement to the siding or spur track, a yellow aspect is displayed. A whistle post for westbound trains is located about 626 feet east of the point of accident.

GPO 901-634