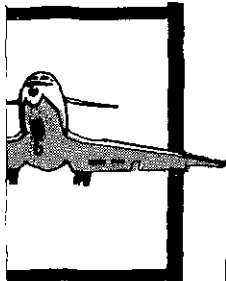


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NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

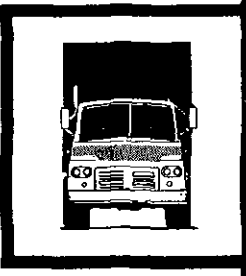
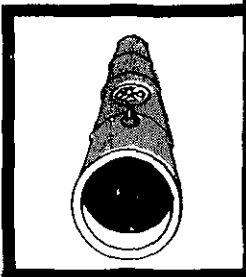
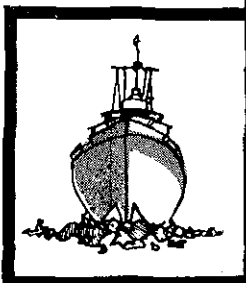
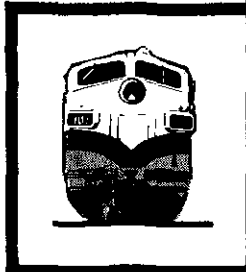
NATIONAL RAILROAD PASSENGER CORPORATION (AMTRAK)
HEAD-END COLLISION OF TRAIN NO. 111
AND PLASSER TRACK MACHINE EQUIPMENT
EDISON, NEW JERSEY
APRIL 20, 1979

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<p>About 12:03 p.m., e.s.t., on April 20, 1979, National Railroad Passenger Corporation (Amtrak) passenger train No. 111 collided head-on with an Amtrak Plasser track machine at Edison, New Jersey. The track machine was destroyed, and the locomotive was heavily damaged. The lead truck of the passenger car behind the locomotive derailed. Seventy-one persons were treated for minor injuries, and one passenger and one onboard attendant were admitted to the hospital. Total property damage was about \$353,600.</p> <p>The National Transportation Safety Board determines that the probable cause of the accident was the failure of (1) the train dispatcher to issue proper orders and to secure the route for the movement of the track machine and (2) a block operator to secure the traffic direction and route for the movement of the track machine. Contributing to the accident was the failure of several block operators to comply with operating instructions by permitting the track machine to proceed without securing proper authority. Also contributing to the accident was the operation of a passenger train with an inoperative radio.</p>					
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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: September 13, 1979

NATIONAL RAILROAD PASSENGER CORPORATION
HEAD-END COLLISION OF TRAIN NO. 111
AND PLASSER TRACK MACHINE EQUIPMENT
EDISON, NEW JERSEY
APRIL 20, 1979

SYNOPSIS

About 12:03 p.m., e.s.t., on April 20, 1979, National Railroad Passenger Corporation (Amtrak) passenger train No. 111 collided head on with an Amtrak Plasser track machine at Edison, New Jersey. The track machine was destroyed, and the locomotive was heavily damaged. The lead truck of the passenger car behind the locomotive derailed. Seventy-one persons were treated for minor injuries, and one passenger and one onboard attendant were admitted to the hospital. Total property damage was about \$353,600.

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INVESTIGATION

The Accident

On April 20, 1979, a National Railroad Passenger Corporation's (Amtrak) track relaying crew was scheduled to replace track in the vicinity of Rahway, New Jersey. A Plasser track machine assigned to this crew had become defective. Arrangements were made to move a replacement Plasser track machine from the yard at Midway, New Jersey, to Union, a distance of 21.5 miles, under its own power, via the main track. To accomplish this movement, the track machine had to enter the main track at Midway, pass the interlocking towers at County and Lincoln, and depart from the main track at Union.


A track machine driver and an assistant foreman of a track crew, acting as the pilot, were assigned to operate the track machine to Union. A pilot was required for the trip since the driver was not qualified on the operating rules or on the main track territory over which they would operate; the pilot was not qualified to operate the machine. They made the necessary arrangements and were ready to enter the main track at Midway at 10:43 a.m.

The pilot telephoned the Midway block operator and requested permission for the track machine to enter the main track to move eastward to Union. The track machine was not designed to operate the automatic signal system, and Amtrak rules required special authority for movement on the main track. Therefore, the operator relayed the pilot's request to the train dispatcher in New York for the necessary authority. The train dispatcher issued a Form M, Track Card Permit, and a Form C, Clearance Permit, to the Midway block operator authorizing the movement of the track machine eastward on track No. 3 from Midway to Union between 10:43 a.m. and 12:15 p.m. (See figure 1.) Copies of the Form M were not given to the operators at the intervening blocks at County and Lincoln nor at Union, the track machine's destination.

The Midway block operator gave the pilot copies of the Forms M and C and then displayed a proceed signal. At 11:01 a.m., the track machine entered track No. 3 and proceeded eastward.

The Midway block operator called the County block operator, the next eastward tower, located 8.7 miles east of Midway, and informed him of the movement of the track machine on track No. 3 so that the traffic direction could be established. This was the first information the County block operator had of the move. The track machine was stopped at the County interlocking by a stop signal, and a Form C was issued by the operator to the pilot for the track machine to pass the signal and to continue eastward on track No. 3 at 11:50 a.m. After passing County, the track machine proceeded eastward at a speed of 15 to 20 mph.

Before the track machine passed, the County block operator informed the block operator at Lincoln, located 6.5 miles east of County, of the intended eastward movement of the track machine. The Lincoln operator then established traffic direction for the eastward movement on track No. 3 at about 11:45 a.m. However, the Lincoln block operator did not apply protecting devices on the traffic, signal, or switch levers for the movement of the track machine between County and Lincoln.



**NORTHEAST CORRIDOR
TRACK CAR PERMIT**

FORM
M

(1) Time blocking devices applied _____ AM
PM

Issuing Dispatcher's Office _____	Time Effective _____	Date _____
To TC-Driver or Foreman _____	At _____	Location _____

(2) TC No _____ and _____ additional pieces of equipment
Authorized to use _____ Track until _____ AM
PM

(3) From _____ to _____
or _____

(4) Between _____ and _____
Information including speed restrictions
Track cars and engines or trains ahead:

(5) Time delivered _____ AM
PM by _____
Name of Dispatcher or Operator

(1) This permit may be issued only after the Dispatcher or Operator has applied blocking devices for the territory involved and in accordance with NEC 405 "Special Instructions Governing Operation of Signals and Interlockings"

(2) When the TC driver is in charge of more than one piece of equipment, only one TC number will be used for identification
Example: TC No 1971 and 10 additional pieces, etc


(3) Use when running in one direction from one point to another

(4) Use for movement between two points or for maintenance work obstructing a track

(5) In compliance with Rule 705, when delivered by telephone or radio, information on permit must be repeated back by the employe receiving the permit, before entering "Time delivered"

Additional MW equipment or MW work extras may be admitted to the work area with permission of the TC driver or Foreman to whom the permit is addressed and then only after delivering a copy of the permit to such MW equipment or MW work extras

NEC-264



**AMTRAK—NORTHEAST CORRIDOR REGION
CLEARANCE PERMIT**

FORM
C

Station, _____ M, _____ 19____

Train _____ Direction _____
(For extra train show direction)

Engine _____ on _____ track

Signal cannot be cleared:

1 (FOR BLOCK SIGNAL)—Proceed into the block as though _____ signal were displayed

2 (FOR INTERLOCKING SIGNAL)—Proceed from _____ track to _____ track, as though restricting signal were displayed

3 (FOR STOP-SIGNAL, REFERRED TO IN RULE 509)
Proceed at _____, at though Stop-and-proceed signal were displayed

Operator _____

The Train Dispatcher or the Operator, when authorized by the Train Dispatcher, will issue this permit to a train to pass a Stop signal due to signal failure, or when signal cannot be displayed for an engine returning to its train

Train addressed receiving this permit may proceed as directed by the numbered paragraphs that are properly filled out

Operator when issuing this permit will be governed as follows:

Fill out paragraph 1 when signal is a manual block system signal

Fill out paragraphs 1 and 2 when signal is an interlocking signal and also a manual block signal for movement through the interlocking and into the block

Fill out paragraph 2 when signal is an interlocking signal

Fill out paragraph 3 when signal is a Stop-signal as referred to in Rule 509

Paragraph 1 will be used only when block is clear

Paragraph 3 will be used only when track is clear of opposing trains to the next block station or interlocking and clear of trains in the same direction to the next block signal

Note—Conductor, engineman or driver of track car required to fill out permit at remote interlockings and at interlockings where it is impractical for operator or train dispatcher to examine route, must know that the route is clear and that the switches are properly lined, operators must have signals governing routes that conflict with the one indicated on the permit display their most restrictive indication

Figure 1. Form M and Form C.

Amtrak train No. 111, a Metroliner, departed New York, New York, at 11:30 a.m. The train consisted of an electrically propelled locomotive unit, five passenger cars, and one power car which was being substituted for the standard Metroliner car. An air brake test and inspection disclosed no defective conditions. The engineer had tested the radio in the yard and had found it inoperative. He reported its condition to other yard employees and assumed that they had reported the inoperative radio to the train dispatcher. No other report was made on the inoperative radio. The train stopped at Newark, New Jersey, and was scheduled to stop next at Trenton, en route to Washington, D.C. The brakes had functioned properly, and the engineer experienced no difficulty in slowing or stopping the train. The train proceeded westward on track No. 3 with all wayside signals displaying "clear" aspects which were repeated by the cab signals. The engineer was operating the train from the right side and the fireman was seated on the left side. The remainder of the crewmembers were located in the passenger cars.

The Lincoln block operator was informed by the Union block operator, 6.4 miles to the east, that train No. 111 was approaching Lincoln Tower on track No. 3. At about 11:56 a.m., the Lincoln block operator lined the traffic direction and displayed the signal for train No. 111 to continue westward on track No. 3 at an unrestricted speed. Immediately after train No. 111 passed Lincoln, the operator realized his error and attempted to radio train No. 111 to stop; however, the radio equipment on the locomotive was not operative.

As train No. 111 was passing Edison Station, 2.9 miles west of Lincoln Tower about 12:02 p.m., at a speed of 80 mph, the engineer observed the track machine approaching on track No. 3 at a distance of about 1,600 feet. The engineer immediately applied the brakes in emergency, but before he could reduce the train's speed, the train and track machine collided. The engine crewmembers elected to stay with the locomotive until it came to rest. The track machine driver and pilot jumped from the track machine before the collision.

The track machine was embedded 12 feet into the front of the locomotive. (See figure 2.) As a result of the collision, fuel from the track machine sprayed over the train and then ignited. The flash fire covered the locomotive and the first car. The equipment was moved westward about 2,652 feet after the impact before stopping. The track machine and the lead truck of the first car derailed.

The tracks of the four-track system in the vicinity of the accident, were numbered 1 to 4 from south to north. Tracks No. 2 and No. 3 were maintained for operation of Metroliner trains at speeds of 110 mph. Approaching Edison station, the train moved westward on straight track to a 0°30' right-hand curve 1,584 feet in length past the Edison station platforms and then onto straight track for 1,384 feet to the collision point. The grade for westbound trains is about 0.10 percent ascending. (See figure 3.)

Injuries to Persons

<u>Injuries</u>	<u>Passengers</u>	<u>Crewmembers</u>
Fatal	0	0
Nonfatal	65	8
None	95	1

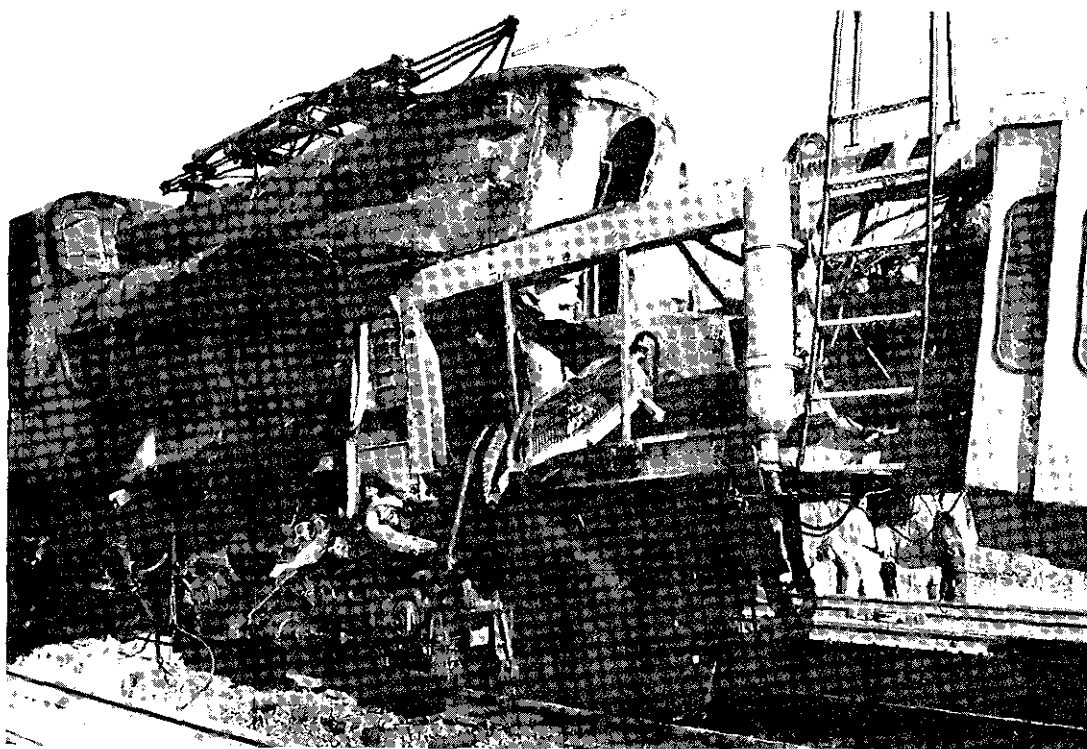


Figure 2. Track machine and locomotive after impact.

Damage

The Plasser track machine was destroyed. The locomotive unit of train No. 111 was heavily damaged, and the first car was damaged slightly by fire. Passengers' seats throughout the train were moved out of position by the impact. The total property damage included:

Plasser track machine	\$250,000
Train equipment	103,000
Track	600
Total	\$353,600

Crewmember Information

The train dispatcher had 11 years of experience, 5 of which were as a train dispatcher, and was last examined on the operating rules during April 1979. The Midway, County, Lincoln, and Union block operators had 5 to 31 years of experience. Each operator, except Union, had been examined on the operating rules during 1979. The Union operator was examined during 1978.

The engineer had 42 years of experience and was last examined on the operating rules during December 1978. The fireman had 5 years of experience and was last examined on the operating rules during September 1978.

On the day of the accident, the trackman's assignment as pilot was in addition to his regular position. The pilot of the track machine had held positions that required little use of the operating rules, and he had not been involved with any application of the rules during the previous 2 months before the accident. He stated that he knew a Form M was required before he could operate track machinery on the main track, but that he had no knowledge of its requirements for transmittal by the train dispatcher. He had functioned as a pilot several times before this assignment. (See appendix B.)

The driver of the Plasser track machine was a machine operator in the Maintenance of Way (M of W) department.

Train Information

The Plasser track machine (Tamper) weighted 46 1/2 tons and was 48 feet long and 10 feet 3 inches wide. The frame was of rigid steel construction. It was equipped with disc brakes on both sets of rear driving trucks. A GMC diesel engine supplied the power, and it was supplied with a 6-speed traveling gearbox. The operating compartment was fully enclosed, and the operator had a seat from which all controls were accessible. A radio was not provided the crew. The tamper was supplied with two tamping heads. All operations were hydraulically controlled. (See figure 4.) It had a maximum speed of 30 mph. The tamper was used to compact ballast under ties to maintain proper track profile.

The electrically powered locomotive of train No. 111 was a type GG-1, built by the Pennsylvania Railroad at Altoona in 1942. It had an articulated frame with a four-wheel engine truck and six driving wheels on each end. It was 79 feet 6 inches long and weighed 230 tons. The cab contained two operating compartments, and each compartment was located about 20 feet from each end. Electric power for traction was collected from an overhead catenary system by pantographs. The locomotive was provided with safety control, speedometer, cab signal, and train control.

The passenger coaches of train No. 111 were manufactured by the Budd Company; each had a capacity of 84 passengers seated 4 abreast in 21 rows. Emergency window exits were provided at four locations, two on each side.

Method of Operation

Trains were operated in either direction on track No. 3 by automatic block signals and by signals at interlockings controlled by the operators. When a direction of traffic was established between two adjacent towers, the controlled signals for the opposite direction were locked in "stop" position so that opposing movements could not be made.

BEAM BRIDGE
B-81
29.7

Plasser Track
Equipment No N-11302

Plasser Track Equipment No N-11302
Embedded 12' in GG-1

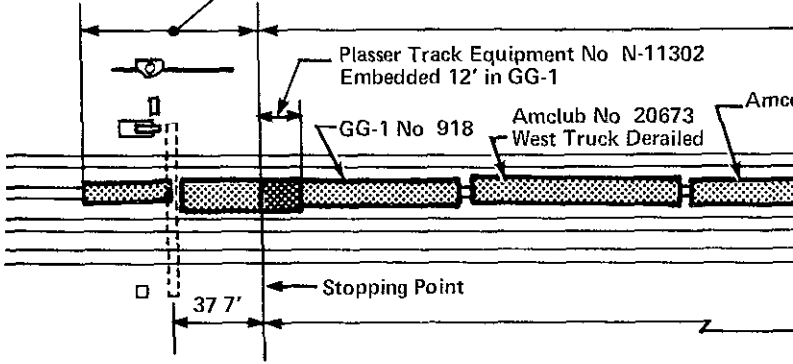
GG-1 No 918

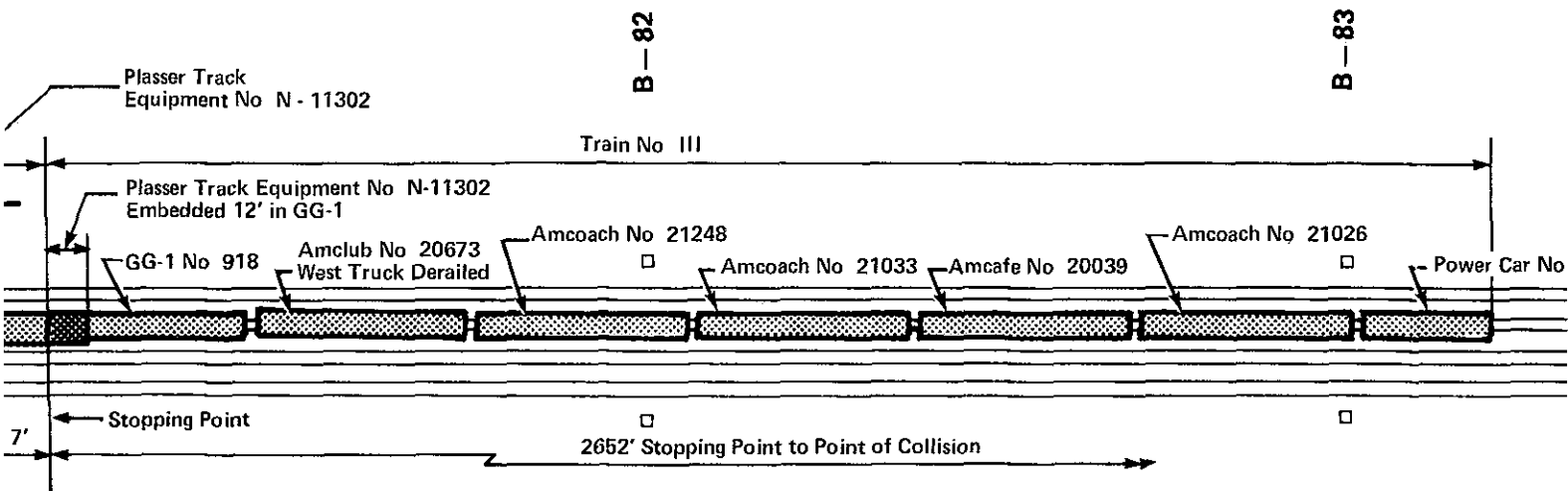
Amclub No 20673
West Truck Derailed

Amclub

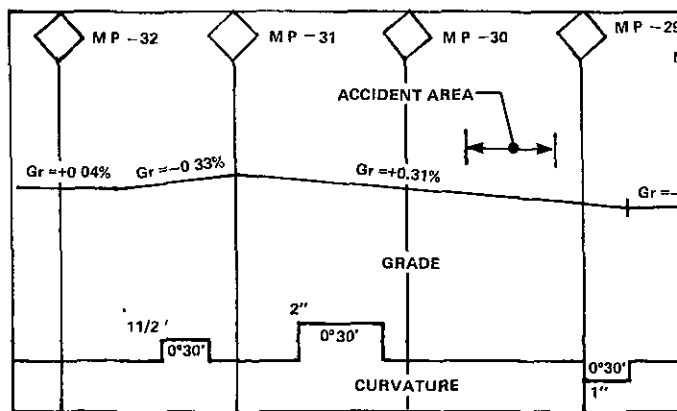
Stopping Point

37.7'





PLAN
Scale: 1" = 40'

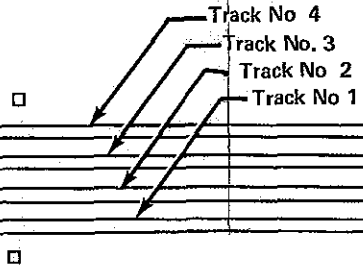
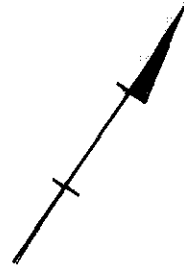


TRACK PROFILE
N.T.S.

FIGURE 3
ACCIDENT SITE
EDISON, N.J.
TRAIN NO. III & PLASSER TRACK EQUIPI

B-84

B-85



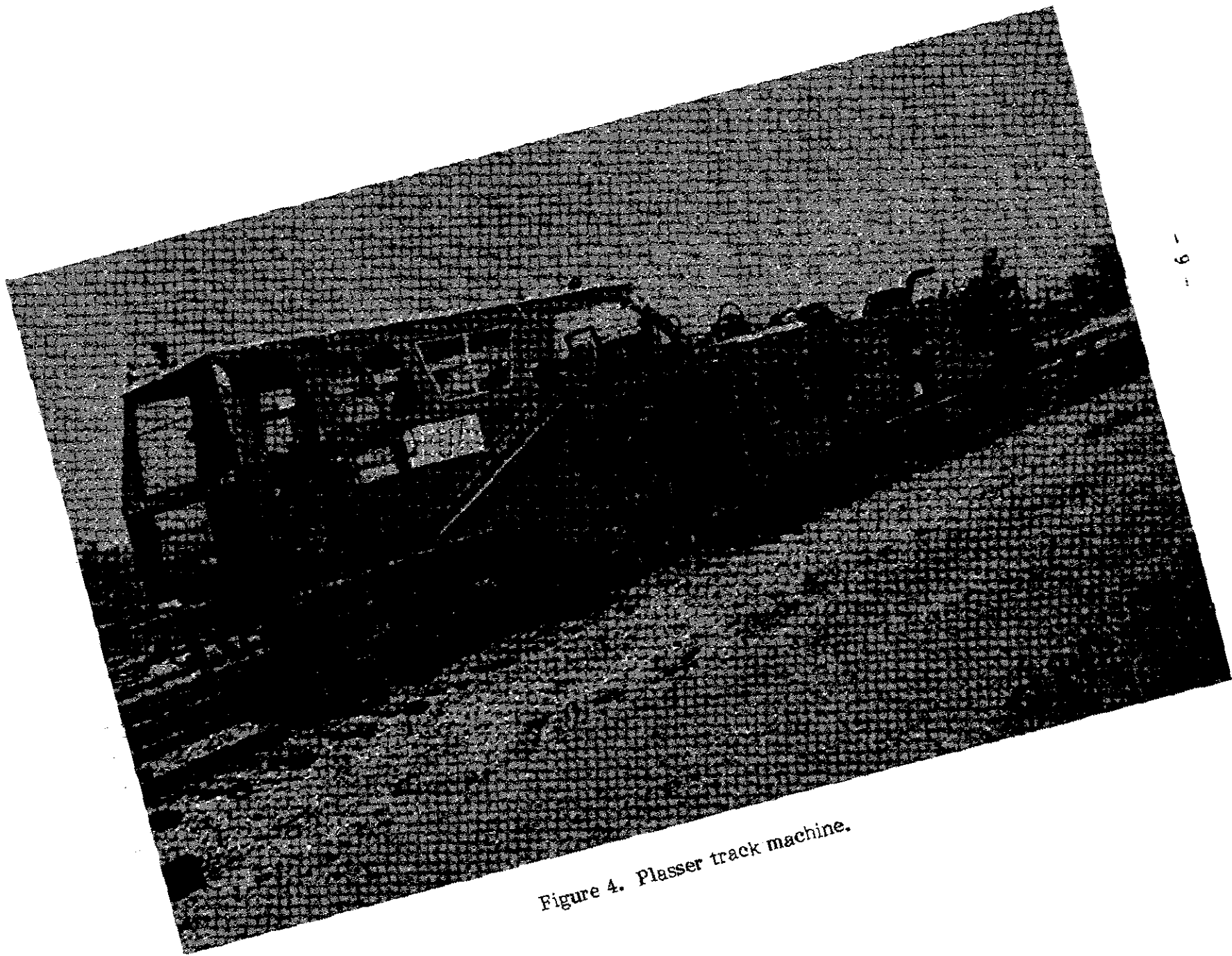


Figure 4. Plasser track machine.

Since the wheels of the M of W track equipment were insulated so that the equipment would not operate the automatic signal system, special instructions were required for their movements on main tracks. Amtrak's Rules for the Conducting of Transportation required the following for the movement of track motor cars:

"805. On tracks governed by Block Signal System Rules, track cars will operate with authority of Track Car Permit Form M in lieu of train order.

"810. Movement against the current of traffic, or on tracks of no assigned direction, or where Rule 261 is in effect, will be authorized after Stop indication is displayed at each end of the block and approved blocking devices applied for the track to be occupied."

Other applicable rules for the operation of track motor cars are contained in appendix C.

Before the train dispatcher could issue authority for movement of the track machine, operating rules required that he first make certain that the route was secured and that no other trains or equipment would operate on the same section of track as that used by the track machine. He should have required all tower operators involved in the movement of the machine to align the route, display stop signals at each end of the route, display proceed signals at intermediate points, and then place protective devices over the controlling levers so that they could not be inadvertently changed. The operators should have informed the train dispatcher when they had completed these procedures so that he could have recorded the time. Then the dispatcher could issue the Form M authorizing the movement of the track machine to each tower operator involved and to the pilot or driver of the track machine. (See figure 1.) Each tower operator should have had a copy of the Form M before he could permit the track machine to occupy the main track in his territory.

The operating rules required that a clearance permit, Form C, be issued by the train dispatcher, through the tower operator at the initial point, to the track machine pilot permitting the machine to move past the stop signal and enter the designated route. In addition to the requirements of the operating rules, a notice, dated November 15, 1977, was issued to train dispatchers, train directors, and operators by Amtrak's Supervisor of Operator Rules to require the issuance of train orders instead of clearance permits for the passing of a stop signal to enter main tracks which were signaled for the operation of trains in each direction in accordance with Operating Rule 261. (See appendix D.) These instructions were not provided to train crewmembers or M of W employees involved with the operation of track motor cars.

Signal System

The Lincoln block operator controlled the traffic direction on track No. 3 between Lincoln and County by manipulation of a lever. Traffic direction at other

points required the operators at each end of the signal block to position a lever for proper selection. When the lever was positioned for eastward traffic, the eastward signals functioned automatically and the westward signals at the entrance of the route displayed three horizontal yellow lights which indicated stop. If the two signal blocks ahead were unoccupied in the automatic signal territory, the signal displayed three vertical yellow lights which indicated proceed.

The maximum authorized speed for passenger trains on track No. 3 was 80 mph for conventional equipment and 110 mph for Metroliner equipment. The maximum authorized speed for the Plasser track machine was 25 mph.

Survival Aspects

As the train and track machine collided, the track machine raised upward from the track and penetrated 12 feet into the superstructure of the locomotive, but did not enter the operating compartment. The engineer and fireman were injured slightly from exposure to smoke and fire following the collision.

None of the passengers in the train were injured by the smoke or fire since it did not penetrate the cars. Most of the passenger injuries resulted from being thrown around the interiors of the cars as a result of the emergency application of the brakes or the actual collision.

It was found that the seats in the passenger cars were not securely locked and the collision forces were sufficient to cause the seats to rotate, resulting in most of the leg injuries. A similar seat condition occurred in the Seabrook, Maryland, accident on June 9, 1978. ^{1/} The investigation of that accident disclosed that the failure of the seats to remain in the locked position was due to improper maintenance practices. During the investigation of the Seabrook accident, it appeared that Amtrak had started to correct their poor maintenance practices, but this investigation disclosed that the conditions still exist.

Tests and Research

Tests made of the braking system of train No. 111 following the accident disclosed no defective conditions which would have prevented the brakes from functioning as intended. Tests made of the signal system following the accident disclosed that the system functioned as intended.

Visibility tests made under similar weather conditions as those at the time of the accident indicated that an engineer of an approaching train provided with a GG-1 type of electric locomotive moving westward on track No. 3 could first see a track machine approaching the point of the collision at a distance of 2,900 feet but could not determine if it was on the same track until it was 1,600 feet east of the collision point.

^{1/} "Railroad Accident Report--Rear End Collision of Conrail Commuter Train No. 400 and Amtrak Passenger Train No. 60, Seabrook, Maryland, June 9, 1978, NTSB-RAR-79-3.

ANALYSIS

If complied with, Amtrak's operating rules were adequate to provide the necessary degree of safety for the movement of insulated track machines on main tracks protected by automatic signals systems. The rules provided for and required redundancy in at least three levels before the track machine could enter the main track. After receiving the request for moving the track machine, the train dispatcher should have required all tower operators to align the route, place the signals at each end of the route in stop positions, place the intermediate block station signals in the proceed position, apply protective covers to the levers and, report the time completed. That information should have been recorded by the dispatcher so that a Form M could be issued for the movement of the track machine. Coordination with all persons involved with controlling the movement of the vehicle would have provided for its exclusive use of a section of track.

The train dispatcher should have transmitted copies of the Form M to each block operator and to the crew of the track vehicle. Without copies of the order, the crew of the vehicle should not have proceeded and the tower operator should not have permitted the vehicle into his controlled area.

The signal at the entrance to the main track should have been placed in the stop position and proper authority should have been issued for the track machine to pass the signal. This placed an obligation on the vehicle's crew to ascertain that proper instructions had been issued.

The arrangement for advancing the Plasser track machine from Midway to Union over track No. 3 followed the request of the machine's trackman pilot which was relayed to the dispatcher by the Midway block operator. The dispatcher's decision to authorize this relatively long movement involving four block operators by a machine that did not activate the block signal circuitry was made despite the fact that track No. 3 was used by Metroliners traveling as fast as 110 mph. Since opposing Metroliners were scheduled to reach the section to be used by the track machine during the authorized time period, the dispatcher's action created the possibility that a Metroliner could be operated at full speed on "clear" signal aspects into a block occupied by the track machine. The Safety Board concludes that such a lengthy movement of the relatively slow, insulated track machine should not have been made over a track normally used by the fastest passenger trains without special precautions. In addition, it should have been arranged, supervised, and monitored by upper level supervisors, including the chief train dispatcher and the chief track maintenance supervisor on the territory involved rather than relying on a routine operation.

After deciding to move the track machine on track No. 3, the dispatcher failed to follow the prescribed procedure for protecting its movement. A notice issued by the supervisor of operating rules required the dispatcher to assure and record the times that all switches were aligned and all signals properly displayed with the levers involved at each block station properly secured with protective covers before he issued the Form M authorizing the track machine movement. Nevertheless, the dispatcher transmitted the Form M only to the operator at Midway. The block operators at County and Lincoln were not aware of the

movement until the track machine had cleared the block station adjacent to them. The signals at the ends of the route were never caused to display a "stop" aspect as required. Indeed, the Union block operator was never informed of the track machine movement, and he was not instructed to protect it. The dispatcher failed to issue the train order required to authorize the track machine to pass what should have been a "stop" aspect on track No. 3 at Midway.

The dispatcher was experienced and he testified that he understood the prescribed procedure for multiblock movement of track machines. Although the Form M issued to the track machine constituted an absolute block over track No. 3 all the way to Union, the dispatcher chose not to protect the route at any of the four block stations, and he continued to operate trains in and out of the block at Union and the intermediate block stations. Based on the evidence, the Safety Board concludes that the dispatcher violated a prescribed practice in an effort to hold delays to trains to a minimum while the track machine moved over the territory.

The County block operator was first informed of the movement by the Midway block operator after he had allowed the track machine to proceed. Similarly, the Lincoln block operator first learned of the movement from the County block operator at about 11:40 a.m., nearly an hour after the dispatcher had issued the Form M to Midway.

The Midway, County, and Lincoln block operators were all experienced and all understood the proper method of moving an insulated track machine over the main track involving three or more blocks. The Midway block operator should have displayed a "stop" aspect for track No. 3 and he should have questioned why a train order had not been issued to permit the track machine to pass the signal. Once the County and Lincoln block operators were aware of the track machine movement, they should have questioned the fact that they had not been instructed to protect the movement and had not received the Form M. The operators' failures to question the dispatcher's movement of the track machine indicate that this method of bypassing certain written instructions to expedite train movement was a common practice.

The pilot of the track machine could not be expected to question the dispatcher's failure to issue a train order permitting his machine to pass the signal at Midway because the special notice requiring this form had never been issued to pilots and operators of M of W track machines on the division involved. The pilot rightfully understood that the Form M issued at Midway gave him absolute right on track No. 3 from Midway to Union and that his movement would be protected by "stop" aspects on the signals at each end of the route as required by Rule 810, before the block could be entered. Although he should have questioned the signal at Midway, which did not display a "stop" aspect, his regular position as trackman required little use of the operating rules for the movements of trains. Therefore, he probably depended heavily on the tower operators and on the train dispatcher to properly perform their job in the movement of the track machine.

The assignment of a pilot with little experience to move the machine, instead of an experienced employee who regularly applied the operating rules, causes the Safety Board to question the judgment of the railroad's management.

In the past, track equipment, such as motor cars, track surfacing and lining equipment, high rail automotive vehicles and other lightweight vehicles would not always shunt the track circuit to operate the signal systems. To offset the possibility of accidents from this undependable type of operation, the industry decided to insulate the wheels of such lightweight equipment and move it over main tracks by special instructions. However, since this was done, track machinery has become larger and heavier; the track machine involved in this accident weighed almost as much as a small locomotive unit. But regardless of size, the industry still maintains their past decision and the wheels of on-track M of W vehicles are insulated because they cannot be depended upon to consistently shunt the signal circuits.

Some modern rapid transit systems do not use insulated track vehicles and to insure that the vehicles will shunt the track circuits to operate the signals often equip them with additional shunting devices. This provides the added protection of the signal system.

Had the track machine shunted the signal circuitry like any piece of conventional train equipment, the machine would have been automatically protected by the block signal system, and it would not have been necessary to rely completely on the judgment and abilities of a dispatcher and several block operators, all of whom were subject to frequent distractions. The Safety Board believes that the movement of insulated track vehicles on any main line protected by an automatic signal system is a questionable practice and should be afforded the greatest protection consistent with the prevailing mode of operation.

The Lincoln block operator learned that the track machine was being advanced to him on track No. 3 about 15 minutes before he was informed that train No. 111 had left Union and was also approaching Lincoln on track No. 3. Since the machine was insulated and could not activate the signal circuitry, the Lincoln operator had to reverse the established direction of traffic independently on track No. 3 and display proceed signals. By doing this, the operator routed the train on a collision course with the track machine. The operator did not realize what he had done until it was too late to display a "stop" signal aspect for train No. 111. He immediately attempted to contact the train by radio to prevent the accident, but this action was thwarted by the fact that the radio on train No. 111 was inoperative. The investigation revealed that the radio on the locomotive of train No. 111 was inoperative from the time the train left New York. Although the rules require that such a radio failure be reported to the dispatcher as soon as practicable, the rules do not prohibit the operation of a passenger train without an operative radio or even require additional precautions to be taken, such as informing tower operators en route that the train has no radio. Since no attempt was made by the crew to report the defective radio during the stop at Newark, the Safety Board concludes that the crew did not consider this as a deterrent to the operation of the train. In Safety Recommendation 78-6, the Safety Board recommended to the Federal Railroad Administration (FRA) "to require railroads to install radios where appropriate on trains and to maintain them in operating condition, unless all personnel involved are notified to the contrary by appropriate railroad procedures." In response to the Safety Board's recommendation, the FRA stated that radios should not be used to replace other safeguards, such as those provided by signal systems, and advised the Safety Board that they would take no

further action in this regard. Therefore, Recommendation 78-6 was closed with unacceptable action. At no time has the Safety Board believed that radios should be used to circumvent any rules or other safeguards provided for the safe operation of trains, but it does believe that operable radios can certainly improve the safe operation of trains.

This accident once again points out the need for operable radios to be provided on all trains where the control system incorporates their use or to notify all persons concerned that the radios are inoperable so that the dependency will not be made on their being in service. Had train No. 111 consisted of regular Metroliner equipment traveling at the authorized 110 mph speed, the accident could have been a major catastrophe involving many fatalities and serious injuries.

This accident could have been prevented if any of five employees -- the train dispatcher, the three tower operators, and the track machine pilot -- had complied with the operating rules. In addition, if the M of W department's top divisional supervision had been required to oversee the movement of the track machine on the heavily traveled Northeast corridor, better protection may have been provided.

CONCLUSIONS

Findings

1. The pilot for the track machine had been qualified on Amtrak Operating Rules, but he had little experience in rules application.
2. There were adequate rules and instruction to provide for the safe movement of a track machine if they were complied with; however, Amtrak's management provided little supervision to insure compliance of the rules.
3. The train dispatcher failed to have the route properly secured and recorded before transmitting the Form M.
4. The train dispatcher failed to transmit the order properly authorizing the movement of the track machine when he failed to provide all tower operators with the order.
5. The train dispatcher permitted other high-speed passenger trains to operate in the section of track No. 3 restricted by Form M for the operation of the track machine.
6. The County operator failed to comply with applicable instructions when he permitted the track machine to proceed without first having the authority to do so.
7. The Lincoln operator failed to comply with applicable instructions when he accepted a request from County for the movement of the track machine without first having the proper authority.

8. The Lincoln operator failed to apply a protective device to the traffic directional lever for operation of the nonshunting track machine between County and Lincoln.
9. The operation of a nonshunting track machine eliminated the protection afforded by an automatic block signal system.
10. The rules do not require an operable radio on each passenger train; the rules require only that inoperable radios be reported to the train dispatcher.
11. If the radio on train No. 111 had been operable, the accident may have been prevented.
12. If Metroliner train No. 111 had consisted of regular Metroliner equipment, the number of passengers and employees injured would have been greater, and many passengers and employees could have been killed.
13. If the track machine had been provided with a radio, the Lincoln operator could have warned the driver or pilot of the approaching train.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of (1) the train dispatcher to issue proper orders and to secure the route for the movement of the track machine and (2) a block operator to secure the traffic direction and route for the movement of the track machine. Contributing to the accident was the failure of several block operators to comply with operating instructions by permitting the track machine to proceed without securing proper authority. Also contributing to the accident was the operation of a passenger train with an inoperative radio.

RECOMMENDATIONS

As a result of this accident investigation, the National Transportation Safety Board made the following recommendations:

-- to the National Railroad Passenger Corporation (Amtrak):

"Conduct an audit of its train operations to determine the extent of noncompliance with its operating rules and instructions, and provide the Board with a report of its findings. (Class II, Priority Action) (R-79-68)

"Provide adequate supervision to arrange and monitor the movement of insulated track machines which eliminate the protection of the automatic block signal system on the Northeast Corridor. (Class II, Priority Action) (R-79-69)

"Establish procedures to require that pilots employed in the movement of track machines are fully experienced with all rules and instructions relating to such movements. (Class II, Priority Action) (R-79-70)

"Require that all trains operating on a main track be equipped with an operable radio. (Class II, Priority Action) (R-79-71)

"Require that the seats of all Amfleet equipment are maintained in proper condition to insure that the seats are locked securely in place. (Class II, Priority Action) (R-79-72)"

-- to the Federal Railroad Administration:

"Establish regulations that would require all trains operating on a main track to be equipped with an operable radio. (Class II, Priority Action) (R-79-73)"

-- to the Association of American Railroads:

"Promote the use by all railroads of operable radios for the operation of trains as an additional safety requirement. (Class II, Priority Action) (R-79-74)"

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ PATRICIA A. GOLDMAN
Member

/s/ G.H. PATRICK BURSLEY
Member

FRANCIS H. McADAMS, Member, did not participate.

APPENDIX A

Investigation and Hearing

Investigation

The National Transportation Safety Board was notified of the accident about 1:07 p.m., on April 20, 1979. The Safety Board immediately dispatched an investigator from the New York Field Office and an investigative team from Washington, D.C., to the scene. Investigative groups were established for operations and equipment.

Hearing

Depositions were taken on June 8, 1979, at 9:00 a.m., in Trenton, New Jersey. Represented at the depositions were the National Railroad Passenger Corporation (Amtrak), the Federal Railroad Administration, the Brotherhood of Locomotive Engineers, the Brotherhood of Maintenance of Way Employees, the American Train Dispatchers, and the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees. Statements were taken from 10 witnesses.

APPENDIX B

Personnel Information

Frank W. Moersdorf, Engineer Train No. 111

Engineer Moersdorf, 60, was employed by the Pennsylvania Railroad, predecessor to Conrail, in April 1937. On March 6, 1941, he was transferred to the position of locomotive fireman. After 11 years, he was promoted to engineer. He qualified as an engineer through on-the-job training. He received air brake instructions on June 1, 1975, and on December 11, 1978, he was examined on the operating rules. His last physical examination was on May 3, 1978, by a carrier-appointed physician.

James J. Walsh, Fireman Train No. 111

Fireman Walsh, 41, was employed by Conrail on March 18, 1974. He entered the Conrail Engineer's Training School and completed the course on March 18, 1976. In the summer of 1978, he served as a locomotive engineer for 3 months. He had had instructions on the air brake on March 18, 1976, and he was examined on the operating rules on September 14, 1978. His last physical examination was on June 13, 1977, by a carrier-appointed physician.

E.F. Barnes, Conductor Train No. 111

Conductor Barnes, 38, was employed by Conrail on January 17, 1972. He was promoted to conductor on October 1, 1974 through on-the-job training. He had air brake instructions on October 21, 1977, and was examined on the operating rules on December 14, 1978. His last physical examination was on June 24, 1976, by a carrier-appointed physician.

R.E. Zimmock, Brakeman Train No. 111

Brakeman Zimmock, 49, was employed by the Pennsylvania Railroad, predecessor to Conrail, on March 16, 1951. On March 1, 1953, he was promoted to conductor. He had air brake instructions on April 14, 1977, and was examined on the operating rules on December 12, 1978. His last physical examination was on September 27, 1977, by a carrier-appointed physician.

J.F. Strong, Brakeman Train No. 111

Brakeman Strong, 62, was employed by the Pennsylvania Railroad, predecessor to Conrail. He was promoted to conductor on February 1, 1945, through on-the-job training. He was instructed on the air brake on November 15, 1977, and was examined on the operating rules on November 10, 1978. His last physical examination was in December 1977, by a carrier-appointed physician.

Patrick H. Frank, Train Dispatcher

Train Dispatcher Frank, 37, was employed by Penn Central, predecessor to Conrail. He served in several capacities, and through on-the-job training, became a train dispatcher in 1974. Later he became an employee of Amtrak in the same capacity. He was examined on the operating rules on October 17, 1978. His last physical examination was in March 1977, by a carrier-appointed physician.

Leo Erick, Block Operator, Midway

Block operator Erick was employed by the Pennsylvania Railroad, predecessor to Amtrak in August 1979, as a block operator. He was qualified on most of the block stations on the New York Division. Midway block station was his regular assignment. He was examined on the operating rules in April 1979.

Charles Harrahill, Block Operator, Union

Block operator Harrahill, was employed by the Pennsylvania Railroad, predecessor to Amtrak in 1948 as a block operator. Union block station was his regular assignment. He was examined on the operating rules during 1978.

Patrick T. Razler, Block Operator, County

Block operator Razler was employed on February 24, 1974, by Penn Central, predecessor to Amtrak as a block operator, and he was qualified at several other locations. He was examined on the operating rules in April 1979.

Richard T. Williams, Block Operator, Lincoln

Block operator Williams was employed by Penn Central, predecessor to Amtrak, on September 18, 1973, and he has qualified to serve at several other locations. He was examined on the operating rules in March 1979.

Frank E. Boatwright, Track Machine Driver

Track machine driver Boatwright, 27, was employed by Conrail in August 1975 as a machine operator in the M of W department. Although he had been trained for his position in the M of W department, he had no training in the application of the operating rules.

Peter Notaro, Track Machine Pilot

Track machine pilot Notaro, 20, was employed as a trackman on July 15, 1976. He attended the carrier's school conducted for new employees in the M of W department for 6 weeks. He was also instructed on the application of the operating rules as they applied to M of W equipment. He was examined on the operating rules in February 1979.

APPENDIX C

Excerpts from Amtrak Rules for Conducting Transportation

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.

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.

PILOT—An employe assigned to a train when the engineman, conductor or driver of track car is not qualified on the physical characteristics or rules of the railroad, or portion of the railroad, over which the movement is to be made.

ROUTE—The course or way which is, or is to be, traveled.

CONFLICTING ROUTES—Two or more routes, opposing, converging or intersecting, over which movements cannot be made simultaneously without possibility of collision.

FIXED SIGNAL—A signal of fixed location 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.

CAB SIGNAL—A signal located in the engine control compartment or cab indicating a condition affecting the movement of a train and used in conjunction with interlocking signals and in conjunction with or in lieu of block signals.

APPROACH SIGNAL—A fixed signal used in connection with one or more signals to govern the approach thereto.

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.

BLOCK STATION—A place provided for the blocking of trains by block signals or other means.

INTERLOCKING STATION—A place from which an interlocking is operated.

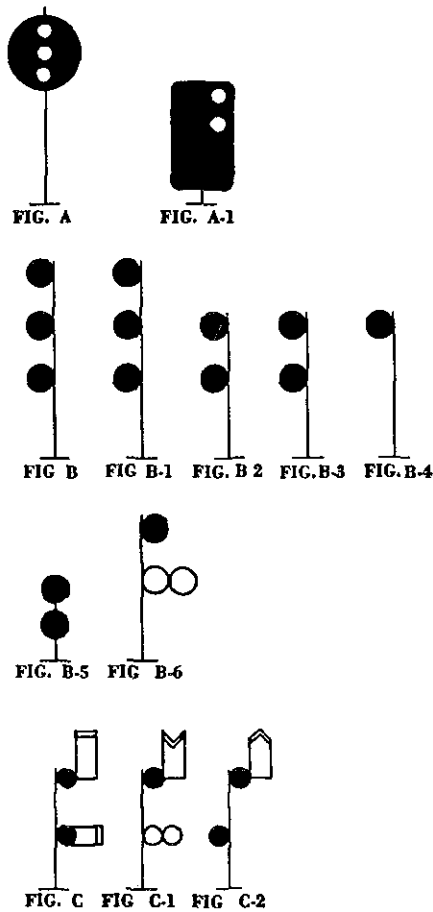
MAIN TRACK—A designated track upon which trains are operated by timetable, train order, or both, or the use of which is governed by block signals.

TRACK CAR—A self propelled car with or without trailers which may be manually moved to or from the track. The term "Track Car" shall include other self propelled units, such as: Burro Cranes, Highway Rail Cars, Detector Cars, Weed Burners, Tie Tampers, and other similar equipment. This type equipment may not operate signals or shunt track circuits.

251. On portions of the railroad, and on designated tracks so specified in the timetable, trains will run with reference to other trains in the same direction by block signals whose indications will supersede the superiority of trains.

261. On portions of the railroad, and on designated tracks so specified in the timetable, trains will be governed by block signals whose indications will supersede the superiority of trains for both opposing and following movements on the same track.

Rule 281



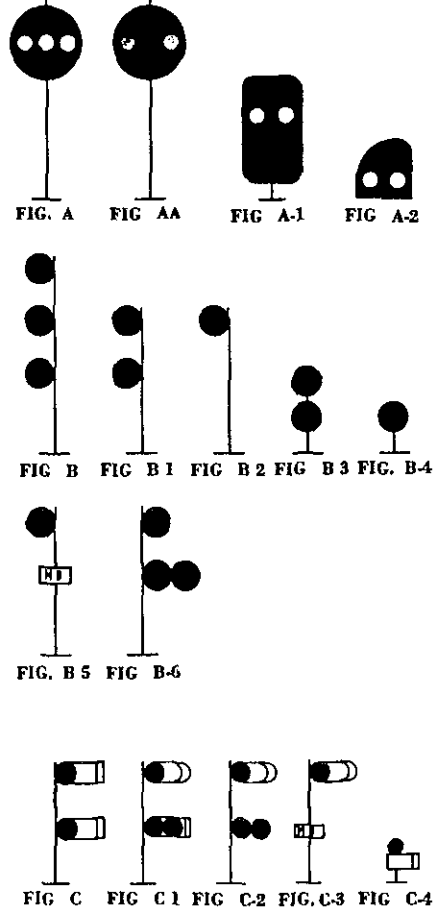
IN CAB SIGNAL TERRITORY
CAB SIGNAL WILL DISPLAY



INDICATION—Proceed

NAME: Clear

Rule 292



IN CAB SIGNAL TERRITORY
CAB SIGNAL WILL DISPLAY



AND FIXED SIGNAL INDICATION WILL GOVERN

INDICATION—Stop

NAME: Stop Signal

NOTE—Rules 501 to 514 inclusive will not be effective except by special instructions.

501. Block signals, cab signals or both govern the use of the blocks and except where Rule 251 or Rule 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

Interlocking home signals governing the use of routes leading to a block will in addition govern the use of the block in direction for which traffic has been established for a train to the next block signal

NOTE—Cab signals will not be used without block signals except as provided by special instructions

605. Interlocking signals govern the use of the routes of an interlocking, and as to movements within interlocking limits, their indications supersede the superiority of trains, but do not dispense with the use or the observance of other signals whenever and wherever they may be required

Rules 99 and 152 do not apply within interlocking limits

617. Operating levers must immediately be blocked with approved blocking devices whenever the operation of the lever is restricted

627. An operator or Train Dispatcher informed of any obstruction in a block must immediately attempt to contact any trains involved, notify the next station in advance and each must display Stop-signal 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

706. All employes except those specifically authorized to do so, are prohibited from making any technical adjustments to a railroad radio set. When a radio set is not operating properly the fact must be reported to the Train Dispatcher or Yardmaster as soon as practicable

714. Employes shall make a talking test of radio channels provided when taking charge of such equipment. Such test shall be made between fixed stations, fixed stations and trains or other portable equipment and end to end test of trains. If radio does not operate properly Train Dispatcher or Yardmaster must be notified promptly

Equipped engines, cabooses or other equipment in service, equipped fixed points, when attended, must have radio on at all times with volume set high enough to hear all calls

801. Track cars will be in charge of driver, governed by rules and special instructions applying to track cars and by the same rules and special instructions as apply to trains other than passenger trains, except as provided in Rules 801 to 829 inclusive

805 On tracks governed by Block Signal System Rules, track cars will operate with authority of Track Car Permit Form M in lieu of train orders

806 Operators when authorized by the Train Dispatcher will issue Track Car Permit Form M which must be filled out in its entirety, including information regarding other track cars, trains or engines in the block. If none in the block he will show "none" on the Form M

A track car having received Track Car Permit Form M to run from one point to another must not move in the reverse direction

A track car having received Track Car Permit Form M to occupy a track between designated points may move in the reverse direction

810. Movements against the current of traffic, or on tracks of no assigned direction, or where Rule 281 is in effect, will be authorized after Stop indication is displayed at each end of the block and approved blocking devices applied for the track to be occupied

828 Maximum Speeds, Unless otherwise specified

Highway-Rail-Car		
Passenger Type	— forward	45 MPH
	— backward	10 MPH
Truck Type	— forward	20 MPH
	— backward	5 MPH

Aerial towers, truck mounted hoisting equipment or other such equipment with rigid highway rail mounting

	— forward	10 MPH
	— backward	5 MPH
Not otherwise specified		
	— forward	20 MPH
	— backward	10 MPH

Track Car		25 MPH
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829g. Signal will not be displayed for the movement to the portion of track taken out of service. Hand signals or verbal permission will be used by Train Dispatcher or operator authorizing the movement to pass signal in Stop position as though Restricting signal were displayed

Track Car Drivers

400N-5 They must obey the instructions of Train Dispatcher, Yard Masters and Operators, within their jurisdiction, and of others with proper authority

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 D
NATIONAL RAILROAD PASSENGER CORPORATION
AMTRAK
NORTHEAST CORRIDOR REGION
NEW YORK DIVISION

November 15, 1977

SUPERVISOR OPERATING RULES
N O T I C E 77 - 14

ASST. CHIEF DISPATCHERS
TRAIN DISPATCHERS
TRAIN DIRECTORS
BLOCK OPERATORS
LEVERMEN

In further reference to Instruction of Supervisor Operating Rules Notice 77-13:

Rule 829 (g) - NEC 400 will not apply to passing of MofW Equipment.

A. MOVEMENT OF MW EQUIPMENT BETWEEN BLOCK AND/OR INTERLOCKING STATION.

At originating station, before form is issued, signals must be in Stop Position and Blocking Devices must be applied to signals and switches to protect the route. After BLOCKING DEVICES are applied, FORM M will be issued. FORM C will be issued to pass Stop Signal where Rules 251-253-254 apply. Train Orders will be issued where Rules 261-262-263-264 apply.

B. MOVEMENT FOR EXTENDED DISTANCES BETWEEN 3 OR MORE BLOCK AND/OR INTERLOCKING STATIONS:

At originating Station, before FORM M IS ISSUED, signals must be in STOP POSITION and BLOCKING DEVICES must be applied to SIGNALS AND SWITCHES to protect the route. At Intermediate Block and Interlocking Stations, the route must be set and signal pulled to proceed indication with BLOCKING DEVICES applied in that position.

When entire route is set and locked up, FORM M will be issued to all Block Stations and FORM C will be issued to pass Stop Signal where Rules 251-253-254 apply.

Train Orders will be issued where rules 261-262-263-264 apply.

In the application of Rule 637, Operator of MW Equipment finding a HOME SIGNAL more favorable than STOP will take that signal as Block Operator's authority to enter INTERLOCKING. Operator of MW Equipment must report to clear to Block Operator when the movement has been made through the interlocking and is Clear.

November 15, 1977
Notice 77-14

Page 2 of 2

BLOCK and/or INTERLOCKING STATIONS to the rear of the movement may remove their BLOCKING DEVICES after the movement has reported clear of the Interlocking of the Adjacent Block and/or Interlocking Station.

ISSUING FORM "W" TRAIN ORDER WHEN TRACK IS OBSTRUCTED OR MAINTENANCE.

A B C

Track Out of Service by Form "W" Train Order between any Two Points (A to B or B to C) will not include the interlocking at either Location

Track Out of Service by Form "W" Train Order between Extended Points (A to C) will also include the Interlocking at B - At Intermediate Interlockings, BLOCKING DEVICES must be applied to the Track Named in the TRAIN ORDER. Signals will be in Stop Position and considered nonexistent.

When a portion of track is Out of Service by FORM "W" TRAIN ORDER Signals must be in Stop Position and BLOCKING DEVICES applied to signal and switches to protect the route at both ends, before Train Order is made Complete

Train Dispatcher must be careful before giving Extended Authority of Extended Block in FORM "W" TRAIN ORDER.

/s/ A E. HOAGLAND

A. E HOAGLAND
SUPERVISOR OPERATING RULES

AEH:cg