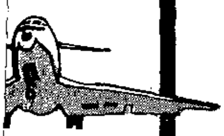
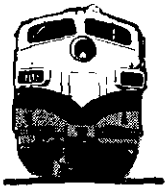


NATIONAL TRANSPORTATION SAFETY BOARD



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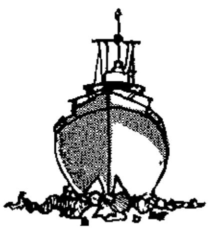
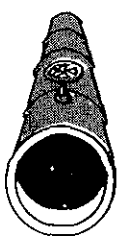


RAILROAD ACCIDENT REPORT

REAR-END COLLISION OF SEPTA-CONRAIL TRAINS NOS. 406 AND 472 ON CONRAIL TRACK NORTH WALES, PENNSYLVANIA JULY 17, 1980



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16. Abstract

About 7:56 a.m., on July 17, 1980, Southeastern Pennsylvania Transportation Authority (SEPTA)-Consolidated Rail Corporation (Conrail) commuter train No. 472 struck the rear of SEPTA-Conrail commuter train No. 406 while it was standing on the No. 2 track east of the station at North Wales, Pennsylvania. The rear car of train No. 406 overrode and destroyed the empty lead car of train No. 472. Of the estimated 321 persons on the 2 trains, 64 passengers and 3 crewmembers received injuries. Damage to the equipment was estimated at $1,475,000.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 472, who was operating the train from the second car, to observe the roadway ahead and to keep the brakeman in the lead car in his view so he could receive the brakeman's hand signals to properly control the train, and Conrail's failure to take malfunctioning equipment out of service when repairs could not be effected. Contributing to the cause of the accident were the placement of a brakeman who was not familiar with the physical characteristics of the roadway, inclement weather, Conrail's inadequate training program for traincrews, and the inability of the brakeman to distinguish whether train No. 406 was approaching on the opposite track or moving/standing on the track occupied by train No. 472 because of confusion created by the illuminated rear headlight on train No. 406.

17. Key Words Commuter train; timelock derail; traffic control machine; headlight; circuit breakers; control voltage; motor alternator sets; pantograph

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

RAILROAD ACCIDENT REPORT

Adopted: December 23, 1980

REAR-END COLLISION OF SOUTHEASTERN PENNSYLVANIA TRANSPORTATION AUTHORITY AND CONSOLIDATED RAIL CORPORATION TRAINS NOS. 406 AND 472 ON CONRAIL TRACK NORTH WALES, PENNSYLVANIA JULY 17, 1980

SYNOPSIS

About 7:56 a.m., on July 17, 1980, Southeastern Pennsylvania Transportation Authority (SEPTA)-Consolidated Rail Corporation (Conrail) commuter train No. 472 struck the rear of SEPTA-Conrail commuter train No. 406 while it was standing on the No. 2 track east of the station at North Wales, Pennsylvania. The rear car of train No. 406 overrode and destroyed the empty lead car of train No. 472. Of the estimated 321 persons on the 2 trains, 64 passengers and 3 crewmembers received injuries. Damage to the equipment was estimated at $1,475,000.

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INVESTIGATION

The Accident

Southeastern Pennsylvania Transportation Authority (SEPTA)-Consolidated Rail Corporation (Conrail) commuter train No. 406 departed Lansdale, Pennsylvania, on main track No. 2 at 7:40 a.m. on July 17, 1980, after an inspection and brake test disclosed no defects. The train was composed of three multiple-unit, electrically propelled cars. As train No. 406 moved out of the station at Lansdale, the engineer observed a wheel slip which she attributed to wet rail. After stopping at Pennbrook, Pennsylvania, 0.9 mile east of Lansdale, the train again had trouble accelerating from the station. The engineer believed the trouble was due to an electrical problem and reported this to the dispatcher.

Train No. 406 next stopped at North Wales, Pennsylvania, 2 miles east of Lansdale. When the train attempted to leave North Wales, it lost most of its power and it was difficult to obtain a speed of 5 mph. The engineer requested permission from the conductor to stop about 650 feet east of the North Wales Station to inspect the train to determine the cause of the power loss. The conductor approved the request, and the engineer stopped train No. 406 between Walnut Avenue and Third Street so that the street grade crossings in North Wales would not be blocked. The rear of the train was standing about 305 feet east of the Walnut Street crossing and about 228 feet east of automatic block signal No. 328 which displayed a "stop and proceed" aspect and the North Wales train order signal which displayed a "green" aspect. (See figure 1.) The crew then disembarked to inspect the electrical equipment mounted under the cars. The station agent-operator saw train No. 406 stop east of the station and attempted to notify the dispatcher, but when he received no response, he abandoned the effort. While train No. 406 was stopped, it was struck in the rear by SEPTA-Conrail commuter train No. 472 about 7:56 a.m.

Train No. 472 was en route from Doylestown, Pennsylvania, to Reading Terminal, Philadelphia, Pennsylvania, at the time of the accident. The train consisted of, from front to rear, electrically propelled cars Nos. 9020, 123, 124, 114, and 113. When the three crewmembers assigned to operate train No. 472 arrived at Doylestown Yard to prepare the train for service earlier in the day, they could not enter cars Nos. 9020, 114, or 113, because they could not operate the doors. They also found that the pantograph was lowered on car No. 113. The crew manually raised the pantograph and manually started the motor alternator on cars Nos. 9020 and 113 to provide electricity for the cars' auxiliary systems. Car No. 9020 was started by resetting the transformer pump fault breaker and operating the manual start button. After a brake test, which disclosed no defects, the train was operated from the west end of car No. 113 into the Doylestown station to load passengers for its scheduled run. While the train was in the station the engineer moved to the operating compartment of car No. 9020 which would be the lead car of the train leaving Doylestown. While the train was standing in the station, cars Nos. 9020, 114, and 113 shut down.

After the cars were started again and after another brake test which disclosed no faults, train No. 472 departed Doylestown at 7:03 a.m. The electrical

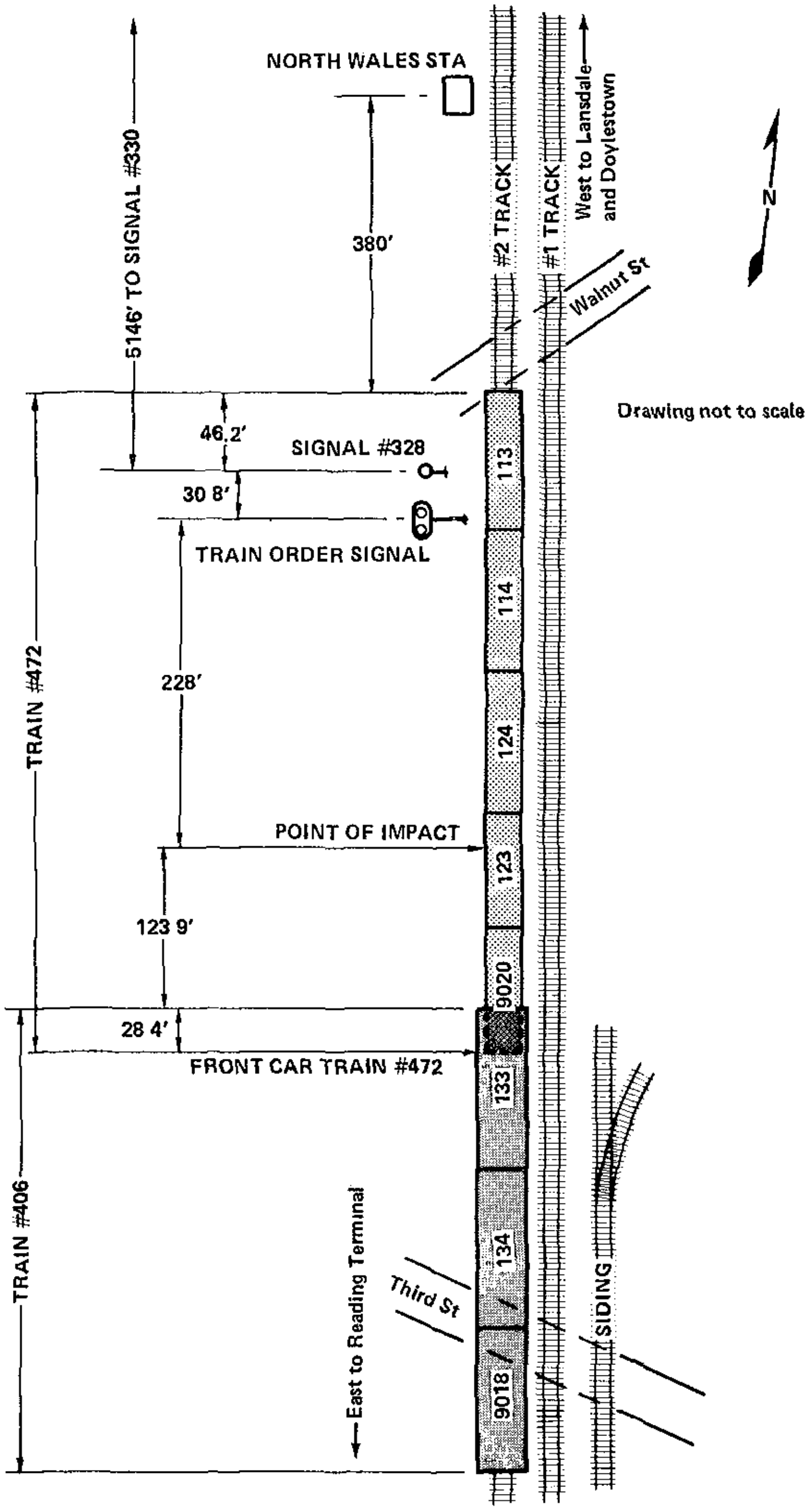


Figure 1.--Plan view of accident site. (The tracks are considered to extend east and west for timetable direction.)

problems with cars Nos. 9020, 114, and 113 persisted en route. In addition to the cars shutting down, the automatic brakes were being applied in undesired emergency applications. Between Doylestown and Lansdale, in an effort to keep the train operable, train No. 472 was stopped and the crew electrically isolated cars Nos. 9020, 114, and 113 from cars Nos. 123 and 124 by opening the contactor plates of the automatic coupler, through which the electrical circuits are transferred from one car to another, between cars Nos. 9020 and 123 and between cars Nos. 124 and 114. During this activity the crew informed the Conrail mechanical department, the WIND tower operators, and the train dispatcher at Wayne Junction, Pennsylvania, of their problems and asked for advice. The dispatcher and tower operators were dealing with problems that remained from damage and electrical outages caused by a severe electrical storm on July 16, 1980, in addition to their normal workload for rush-hour traffic. Therefore, they did not respond promptly to each request for advice from train No. 472.

Since car No. 9020 was electrically isolated from cars Nos. 123 and 124, the engineer could no longer operate the train from the operating position in that car. The dispatcher authorized the engineer to operate the train from car No. 123, the second car, and the dispatcher later instructed the crew to set off car No. 9020 in a yard track at Lansdale.

To assist in the operation of the train, the conductor assigned the brakeman to ride in the operating compartment of car No. 9020 en route to Lansdale. The brakeman was instructed to sound the whistle for road crossings and to advise the engineer in car No. 123 of any restricting wayside signals or unusual conditions of the roadway ahead which would affect the operation of the train. Because car No. 9020 was electrically isolated from the train, there was no operable radio in the car and no operable intercom or buzzer systems between cars Nos. 9020 and 123. Therefore, it was agreed that the brakeman would pass hand signals outside of the train to the engineer in the second car. As a backup system the conductor agreed to stand in the center aisle of car No. 123 near the engineer where he could see the brakeman signal through the car of any conditions requiring action by the engineer. The engineer was aware of the arrangement.

When the train arrived at the Lansdale siding where car No. 9020 was to be set off, the crew was unable to unlock an 8-minute timelocked derail so the facing point switch could be aligned for the siding. No instructions were posted at the derail to explain the procedure for operating the timelock circuit. After about 7 to 10 minutes, the crew advised the dispatcher that the timelock would not operate and they could not set off car No. 9020. They requested permission to move the car to Reading Terminal and to operate from Lansdale to Reading Terminal without making station stops. The dispatcher gave his approval, and at 7:52 a.m., train No. 472 left Lansdale on track No. 2 in a medium to heavy rain. The maximum authorized speed for operating a train under such circumstances was 30 mph. As the train passed the crossing gate operator at Lansdale, the operator called to the brakeman that the headlight on car No. 9020 was not illuminated. The brakeman later said that the headlight switch was on "dim" at the time.

As train No. 472 approached wayside signal No. 330, 4,720 feet west of the North Wales station, the signal displayed an "approach" aspect. The brakeman looked back outside the car for the engineer to confirm the signal indication, but he did not see the engineer. Since the brakeman considered the train's speed to be in accordance with the rules, even though the speedometer in car No. 9020 was not operable, he made no further attempt to pass a signal. The engineer later said he could not lean out of the window to receive or to observe signals because it was raining and the water running from car No. 9020 hit him in the face.

Between Pennbrook and North Wales, the engineer and conductor discussed the desirability of stopping at the North Wales Station to pick up some passengers to reduce the load for a following train, even though train No. 472 had been given permission to bypass intermediate stations; the conductor decided the train should not stop.

After the train passed wayside signal No. 330, the brakeman saw the whistle board west of North Wales which required the engineer of an approaching train to sound the whistle for the Beaver Street crossing in North Wales. About the same time, he saw the lighted headlight of a train ahead. He said he did not see red marker lights displayed to the rear. He later stated that at the time he could not distinguish on which track the train was or if it was moving toward or away from him. He also said he saw a green light ahead but he did not remember seeing a distinguishable signal aspect. After he saw the headlight, he turned to the rear and attempted to pass a signal through the car to the conductor to warn the engineer to reduce speed, because of his uncertainty about the location of the train ahead, but the signal apparently was not received.

The train continued eastward moving about 38 mph as it passed the North Wales station. The agent-operator and several passengers were standing on the station platform as the train passed the station. The agent-operator pointed in the direction of train No. 406 but he did not give a hand stop signal. The engineer and the crewmembers either did not see his pointing signal or failed to understand it. By the time train No. 472 was near the station, the brakeman realized that there was a train ahead on track No. 2, and he activated the single-car auxiliary brake in an attempt to stop the train, but it had no effect on the train's speed. The brakeman then moved from the operating compartment into the car's interior and grabbed for the conductor's emergency brake valve located just inside the aisle door, but it was not actuated. He ran toward the rear of the car to tell the engineer to stop the train. The conductor, who had seen his attempt to activate the emergency brakes, told the engineer to make an emergency brake application. There was no apparent reduction in the 38-mph speed of train No. 472 before it struck the rear of train No. 406. The engineer later said that he did not believe he was moving too fast.

Injuries to Persons

Injuries	Conrail employees	Passengers	Total
Fatal	0	0	0
Serious	1	3	4
Minor	2	61	63
Total	3	64	67

Damage

The collision moved train No. 406 about 124 feet eastward from its standing position. The "B" end of rear car No. 133, which train No. 472 struck, was derailed and the end underframe assembly was extensively damaged. The welded box-beam between the coupler pocket and the car body bolster sustained compression bending and buckling about 25 inches from the centerline of the car bolster. The auxiliary equipment on the underside of car No. 133 was damaged when the car overrode car No. 9020 of train No. 472. The first and second cars of train No. 406 were not derailed and the only damage to these cars was a failed seatbase in the first car.

Car No. 9020 of train No. 472 was derailed on the "A" end and was severely damaged by the overriding and penetration of the rear car of train No. 406. (See figure 2.) The roof structure of car No. 9020 containing the pantograph was completely destroyed. The collision posts were bent rearward from the vertical, but the base welds remained intact. The forward floor section, attached to the end frame assembly, separated from the frame when the center-welded box section of the end frame assembly failed about 25 inches forward of the body bolster centerline. About 30 feet of the forward portion of the car was completely destroyed. The couplers between the standing and striking cars coupled upon impact, but were subsequently destroyed during the override. The "B" end of car No. 9020 had only minor structural and interior damage.

The other cars in train No. 472 were derailed but the damage to the cars' structural members and interiors was minor. The wheel treads of all cars exhibited light slidemarks.

Crewmember Information

The engineer and train crewmembers of train No. 406 reported for duty at Lansdale at 7:10 a.m. and 7:20 a.m., respectively, on July 17, 1980. Each crewmember had been off duty more than 8 hours and each had rested well before reporting for duty. (See appendix B.) The crewmembers of train No. 472 reported for duty at Doylestown at 6:09 a.m. The crewmembers reported that they had rested well during their off-duty period.

The brakeman of train No. 472 was not familiar with the physical characteristics of the roadway over which the train was operating. The conductor and engineer said later that although they knew that a knowledge of the roadway was a requirement for the brakeman's assigned task, they did not ask the brakeman if he was qualified.

After initial training, Conrail considers traincrew personnel eligible to serve as operating crewmembers on a roadway as long as they make at least one trip over that roadway in 1 year.

Track Information

The double track through the area of the accident was well maintained. It was not a causal factor in the accident. The track through North Wales is straight for more than 1 mile west of the point of the accident. Beginning at signal

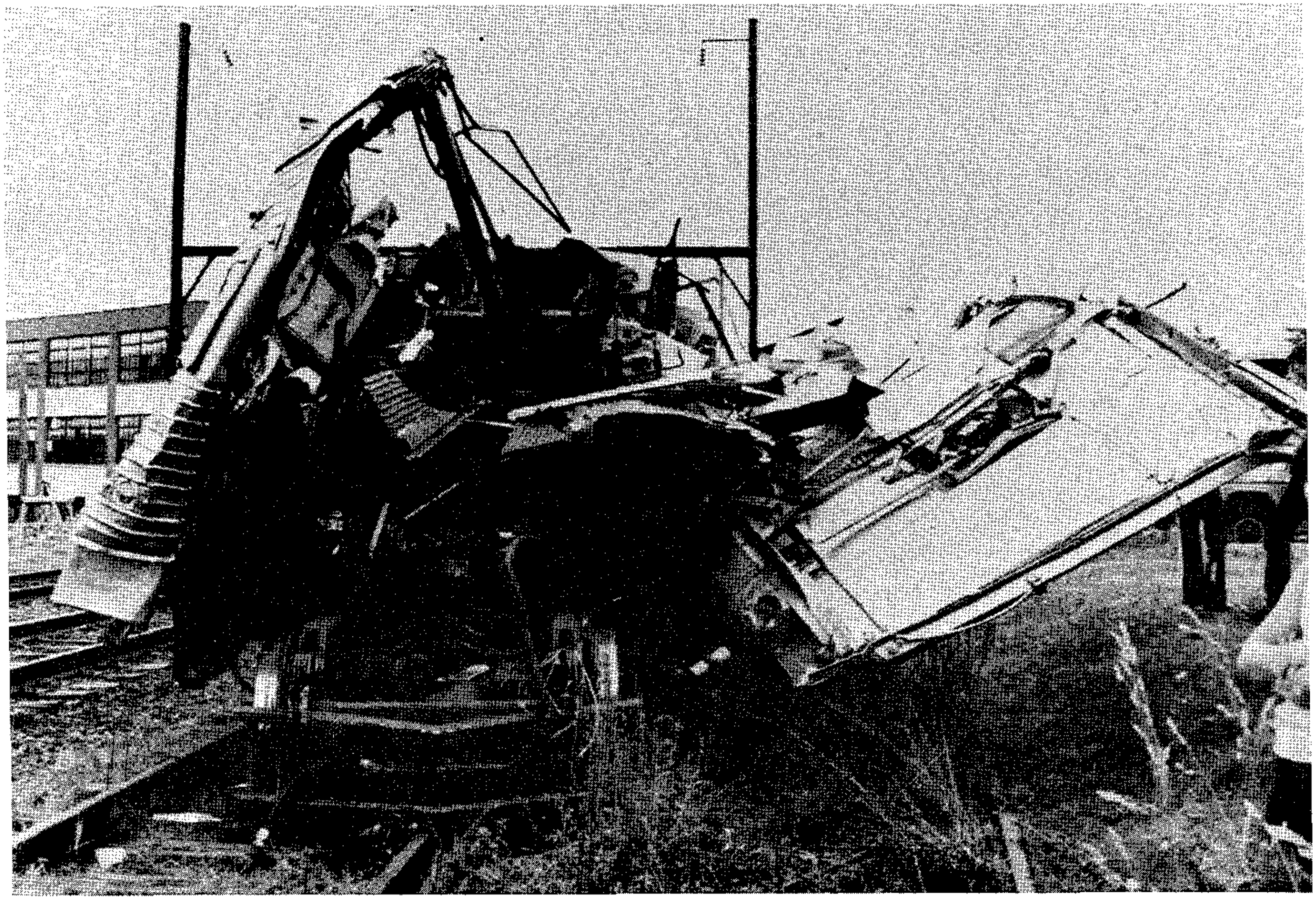


Figure 2.--Car No. 9020 of train No. 472.

No. 330, the track descends eastward on a 1-percent grade to a point 3,043 feet west of the station where the grade changes to a 0.7-percent ascending grade which continues through the point of the accident.

The facing point switch at Lansdale, leading to the track where car No. 9020 was to be left, was protected by a timelock circuit. By design, an 8-minute timing cycle is activated by removing a switch lock from a hasp which then drops to an open position. When the timing cycle has elapsed, a visual "unlocked" indication is displayed through a glass window in the derail operating mechanism housing. The derail can then be removed from the rail manually by use of the operating lever. Simultaneously, when the derail is operated, a lock rod is withdrawn from the locking mechanism of the switch and the switch can be operated. If the hasp is momentarily restored before the timing cycle has been completed, the timing stops. If the timing is restarted by dropping the hasp, the entire 8-minute cycle begins again. The traincrew said they were not certain about the length of the time cycle for operating the timelock circuit, and the operating instructions were not posted at the switch as stated in the operating rules.

The timing circuit also has a shunt feature which bypasses the timing cycle. If the lead wheels of a train are moved past an insulated track joint located about 25 feet before the switch points, the derail/switch can be operated immediately. The traincrew said later that they did not know about the shunt feature.

Train Information

Train No. 406 consisted of cars Nos. 9018, 134, and 133. Train No. 472 consisted of cars Nos. 9020, 123, 124, 114, and 113. Cars Nos. 134 and 133, 123 and 124, and 114 and 113 were semipermanently connected, respectively, and they were identified as multiple-unit A and B cars. They were dependent on each other for two-way operation, and they could only be operated as a coupled pair, or coupled with other coupled pairs or single cars. The A and B cars each had an operating compartment on the ends opposite from the semipermanent coupling by which the "F" end or front of the car was identified. The B car contained the air compressor, the communication equipment, and the pantograph. The single cars (Nos. 9018 and 9020) contained all necessary equipment for independent two-way operation with an operating cab on each end.

The cars were manufactured by the General Electric Company. They were 85 feet long, and a two-car unit weighed 235,200 pounds while a single car weighed 121,600 pounds. Each of the cars could seat 129 passengers.

SEPTA-Conrail commuter trains are equipped with white headlights at both the front and the rear. The rear of the trains are also equipped with small red marker lights, but they are not visible from a distance during daylight. The Federal Railroad Administration (FRA) permits Conrail to use the rear white headlight illuminated on low beam to mark the rear of selfpropelled commuter trains rather than the red or amber lights required by 49 CFR 221.15(c)3 for other trains.

The multiple-unit car of the type used in both trains has a vestibule at each end of the car. Seats are arranged so that one-half face the front of the car and one-half face the rear of the car. The seats are covered with vinyl and the seatbacks are well padded across the tops. A metal binder strip runs across the top of the seatback and terminates as a handle at the aisle end.

All multiple-unit cars are powered by an 11,000 V a.c., 25-hz catenary line. Propulsion power is applied by a master controller with the following positions: switch, P1, P2, and P3. The switch position provides minimum acceleration while positions P1, P2, and P3 provide a graduated acceleration through transition of the traction motors. A high-voltage bus jumper cable connects an A car to a B car to transfer power to the A unit because the single pantograph is located on the B car. The control functions for all multiple-unit cars in a train are transmitted via trainlines from the lead operating compartment. The trainlines are connected between combinations of single- and coupled-unit cars at the coupler ends by a special electrical contactor which is part of the N-2 automatic coupler. (See figure 3.) It is coupled by jumper cables between each car of the semipermanently coupled units. Different cable pairs are used for transmitting controller command functions and the 38 V d.c. control battery.

Electrical isolation between single cars or between single cars and coupled units is accomplished by retracting and locking open the electrical contactor boxes of the automatic coupler between the cars. This does not affect the airbrake system, but it eliminates the dynamic brake on the isolated cars and all other controls. Electrical isolation does not affect the operation of the horn; the horn on car No. 9020 was operable.

The automatic airbrake system is controlled by a brake valve handle which meters the main reservoir air to the cylinders from a control valve on each car, and by blending dynamic brakes with the airbrakes. The dynamic brake is locked out if an emergency brake application is made. In the service position, a maximum braking rate of 2.25 miles per hour per second (mphps) is obtained within the speed range from 100 mph to 0 mph, and in the emergency position the maximum braking rate is 2.75 mphps within the speed range from 100 mph to 0 mph. An actual stopping distance within 10 percent more or 10 percent less of the theoretical calculated distance is considered an acceptable response. The single-car auxiliary brake will operate the brakes on a single car only, and it will not apply the trainbrakes when the car is used in multiple operation.

Each car is provided with a public address system, a buzzer communication system, and a two-way radio system. The radio system permits communication from train to train and from train to wayside stations. When a car is electrically isolated, the intercom and buzzer systems are inoperative between cars, but the radio will continue to be operable if power is available.

The control functions of the multiple-unit cars are dependent on a 38 V d.c. control voltage. In addition to providing a means of operation, the voltage provides energy to the active FA-4 magnet valve in the airbrake system. When the control voltage decreases to about 24 V d.c., the FA-4 valve is deenergized and vents the brakepipe pressure to the atmosphere, which causes the train's airbrakes to be set in an emergency application.

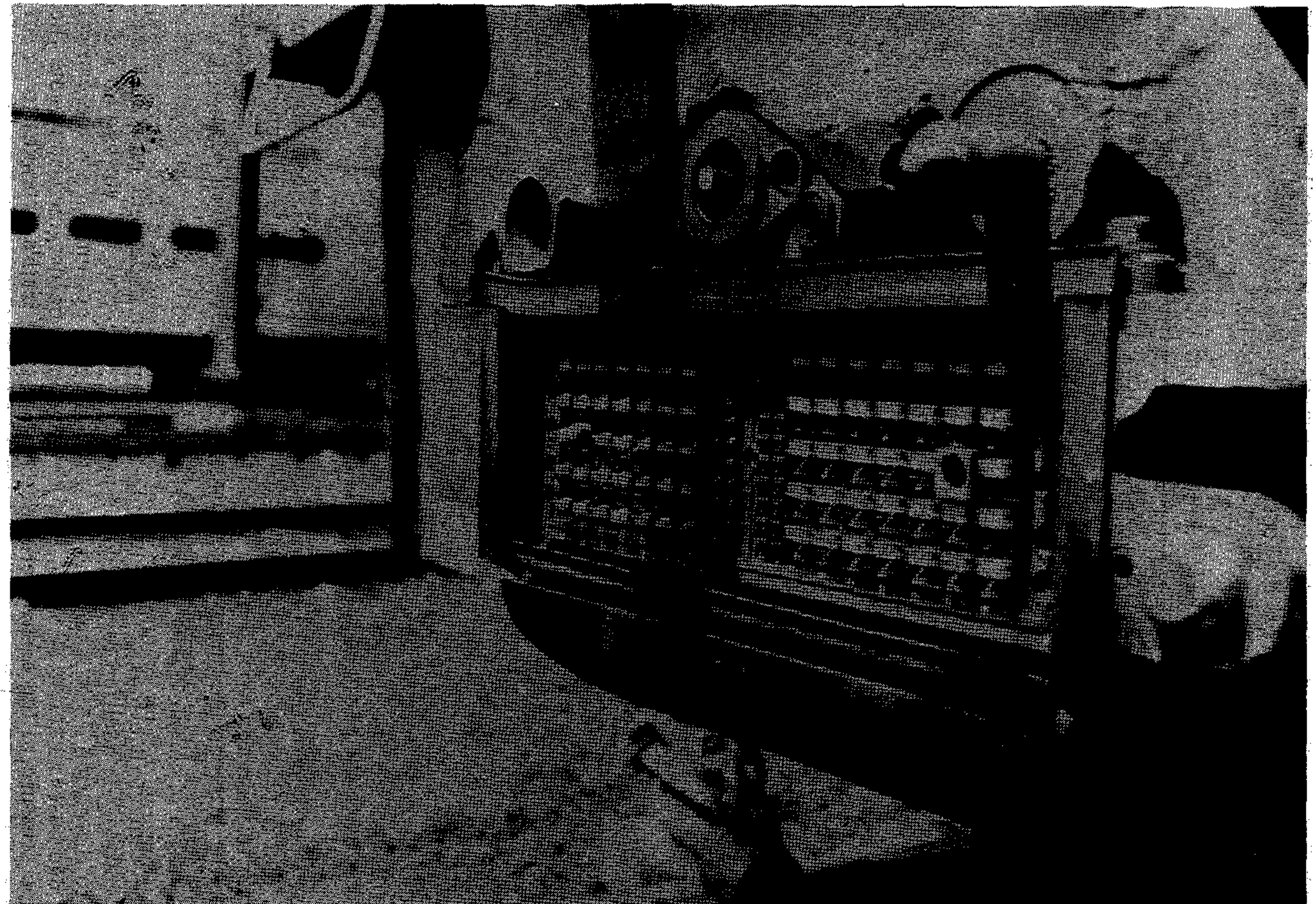


Figure 3.--A special electrical contactor which is part of the N-2 automatic coupler used on the type cars involved in this accident.

The control voltage for a car is supplied either by the rectified output of a motor alternator or a 38 V d.c. battery. The motor alternator keeps the battery charged. When the motor alternator is operating with an output from between 28 V d.c. to 38 V d.c., it supplies the required control voltage. If the motor alternator is not operating, the battery will supply 38 V d.c. control voltage until the battery is depleted. Normally, each single car or coupled unit is selfcontained and will operate independently. However, the output from the motor alternator or the battery can be transferred to another car by a trainline conductor to supply the required 38 V d.c. control voltage when that car has an inoperative motor alternator or depleted batteries.

In order for the 38 V d.c. control voltage to be transferred between cars, there are specific circuit breakers that have to be properly positioned. If the trainline circuit breakers on either an active car--one that is capable of independent operation as opposed to one that is not--or an inactive car were electrically open, there could be no transfer of control voltage. Similarly, if the battery circuit breaker on the active car was open, the control voltage could not be transferred to an inactive car, and it would only be available to operate the emergency lights and the marker lights on the active car.

Neither a single car nor a coupled unit can be operated without the 38 V d.c. control voltage. When the 38 V d.c. control voltage is transferred from an active to an inactive car, that car will operate with full propulsion power, and the train can be controlled from that car, but it will not have air conditioning or main lighting in such instances.

Normally, the door control circuits are left active during a layover at an outlying terminal so that cars can be entered by use of a key. If the control voltage is absent, the doors cannot be operated. The control voltage must also be present for the pantograph to be raised with the electrical control and for the motor alternator to begin to operate when the pantograph contacts the catenary. An inherent feature of the motor alternator is that when the motor loses its power voltage, a load-sharing relay drops the high-power load requirements, such as air conditioning, from the line and provides a quick "in-shot" or "buck boost" voltage which allows the motor alternator to bridge the power loss for several seconds.

On July 16, 1980, car No. 9020 was dispatched from Reading Terminal as the rear car in train No. 489, with the motor alternator, lights, and air conditioning inoperative. The discrepancy was reported to a supervisor by the conductor of the outbound train, but the car was allowed to depart without any corrective action. In addition to this problem, a severe electrical storm moved through the Philadelphia area during the evening and train No. 489 was delayed en route to Doylestown, arriving there at 11:50 p.m. Several times during the trip, catenary power was lost and the train was stopped. During these times the power for the lights on the train was supplied by the batteries.

According to Conrail instructions, traincrews are to lower the pantographs on equipment when it is stored overnight at outlying terminals in warm months. During the layover period at night, cleaning personnel prepare the cars for service the following day and lights are used in the cars. The cleaning personnel may raise or lower a car's pantograph to provide additional lighting and cooling. Under certain fault conditions, a pantograph may be lowered automatically, but this is evidenced by an actuated pantograph lower relay (PLR). The PLR's were not actuated on the cars at Doylestown.

During the layover period at Doylestown, no repairs were made and no further inspection was made of car No. 9020 except that which was made by the crew of train No. 472. Conrail does not have any mechanical maintenance personnel permanently assigned at Lansdale or Doylestown. When such services are required, personnel are dispatched, usually, from Wayne Junction.

Method of Operation

SEPTA has the responsibility of providing and improving commuter transportation in the city of Philadelphia and the four counties surrounding Philadelphia. SEPTA has contracted Conrail to provide commuter services over certain routes using portions of the Conrail system. The Bethlehem Branch of Conrail is one of these routes. Contractually, SEPTA furnishes the equipment, establishes the schedules and fare structures, and provides the funding for the commuter operation. Conrail provides the crews to operate the trains over Conrail facilities and maintains SEPTA equipment. SEPTA can monitor the maintenance program and offer corrective suggestions, and it can monitor the services provided by Conrail. SEPTA officials stated that under the present agreement there is a lack of clear-cut lines of authority and responsibility for the management of SEPTA commuter services.

The Bethlehem Branch of Conrail begins at Berks Street in Philadelphia, and includes the 7-mile Ninth Street Branch to Tabor, Pennsylvania, from Tabor to Jenkintown, Pennsylvania, and from Jenkintown to Lansdale. At Lansdale the line branches and one line, the Stoney Creek Branch, extends about 32 miles to Bethlehem, Pennsylvania, and the other branch extends 10 miles to Doylestown.

Trains operate in an assigned direction over the two main tracks between Tabor and Lansdale by an automatic block signal system. The wayside signals are the color light type arranged in a triangular pattern. Signal No. 330, the approach signal to North Wales, is located 5,146 feet west of signal No. 328 which is 426 feet east of the North Wales Station. A two-indication train order signal is located 457 feet east of the North Wales Station and about 31 feet east of signal No. 328. The train order signal appears from a distance to be mounted on the same mast as signal No. 328. The two main tracks extend east and west by timetable direction through North Wales and are numbered from south to north as Nos. 1 and 2. Trains were operated in both directions on the single track of the Doylestown Branch by a traffic controlled system (TCS). The TCS control machine for the Doylestown Branch at Wayne Junction is operated by an operator under the supervision of a train dispatcher.

The reporting of trains past specified reporting points to establish a permanent record is accomplished in two ways. The agent-operator at North Wales reports to the dispatcher at Wayne Junction the arriving and departing times of trains that stop at North Wales. When trains pass remote control points they are annunciated on the control machine, and the operator at the WIND tower records the time on the tower block sheet. Then, either immediately or later, the operator will pass this information verbally to the dispatcher across the room where they are collocated, or the dispatcher will walk over and read the time off of the block sheet and record it on the dispatcher's train sheet.

Railroad operating rules require that the headlight of the lead locomotive unit be illuminated when trains are operated on a main track. Federal regulations permit the use of an illuminated rear headlight on low beam to serve as a marker light on locomotives.

Meterological Information

The weather between 7 a.m. and 8 a.m. at North Wales on July 17, 1980, was cloudy with intermittent light rain. The temperature was in the lower to mid eighties.

Medical and Pathological Information

Seventy-two persons were treated at local hospitals for minor injuries consisting of multiple contusions and abrasions, neck and back sprains, and minor lacerations. The serious injuries were wrist and nasal fractures and severe back and neck sprains.

Survival Aspects

The facial injuries to the passengers were caused by their being thrown forward and striking their heads against the seatback in front of them or, in some instances, striking the window facing or rim. The sudden impact caused whiplash injuries to passengers.

An emergency triage center was established adjacent to the railroad in a lumber yard warehouse building. Some of the injured were treated there and dispatched to a hospital while others were dispatched directly to a hospital after being evacuated from the trains. The hospitals treating the injured were the North Penn Hospital at Lansdale and the Suburban Hospital in North Wales.

The passengers were evacuated from the train without difficulty. However, a hazard recognized by the crews alerted the emergency personnel to take extra precautions when removing the passengers from the cars. If a train is derailed but remains in contact with the overhead catenary system, the normal return to ground through the rails for the catenary current can be broken. If a person bridges the gap between the car and the ground during this time, the person could become the return path for the electrical current to ground.

The emergency forces from several boroughs and townships in Montgomery County, Pennsylvania, responded to the emergency, and the police chief at North Wales provided most of the rescue coordination. The handling and removal of the injured was greatly facilitated by an effective county-sponsored emergency response plan operated in conjunction with the local hospitals and emergency forces.

Tests and Research

On July 20, 1980, tests were conducted at North Wales to determine sight distances of signals and trains, and the stopping and acceleration capabilities of the trains. The same equipment used in train No. 472 on July 17, 1980, was used for the test train except that car No. 9018 from train No. 406 was substituted for car No. 9020. At no time during the test runs did car No. 9018 exhibit a power loss such as that experienced by the engineer of train No. 406 on July 17, 1980, nor did cars Nos. 113 and 114 shut down. No repairs had been made to any of the equipment, but the batteries had been recharged.

At the beginning of the tests, car No. 9018 was cut off and positioned at the point of impact at North Wales and left standing on track No. 2 to represent the rear of train No. 406. During the test it was determined that car No. 9018, with the rear headlight illuminated, could be seen from 5,197 feet by the engineer of the test train. The red aspect of signal No. 328, which was protecting the rear of train No. 406 on July 17, 1980, could first be seen by the engineer of the test train from 4,140 feet when he leaned his head out the side window and from 3,234 feet from the center door window.

Several stopping tests were conducted from speeds ranging from 35 mph to 55 mph. (See appendix C.) During the tests, the weather was clear and the sun was shining brightly. No compensation was made during the tests for the difference between a wet and a dry rail or for the passenger load since train No. 472 had been lightly loaded.

In all instances the test train stopped within acceptable braking design tolerances. In test No. 5 the actions described by the brakeman of train No. 472 just before the impact were simulated: A test train crewmember operated the single-car brake valve, then he grabbed for, but did not activate, the conductor's emergency brake, and then ran towards the engineer. The crewmember started this action as the front of the test train was about at the North Wales station; the test train engineer did not know in advance of the test plan. Even so, the test train was stopped in 274 feet from a speed of 35 mph, 192 feet short of the impact point.

The Structures and Mechanical Branch of the Transportation Systems Center, Cambridge, Massachusetts, was engaged to perform a mathematical analysis of the impact speed. From parameters relating to speed, weight, friction, and car deformation, the impact speed was determined to be 39 mph. (See appendix D.)

A witness testified that while driving her automobile on a road parallel to the tracks she clocked the speed of train No. 472 for a short distance about 1,000 feet west of North Wales Station. She reported that the train's speed was about 38 mph. A calibration of her car's speedometer indicated that at 40 mph the speedometer was 1 mph slow. (See appendix E.)

The signal system through North Wales and the timelock device at Lansdale were checked after the accident and no defects were found.

ANALYSIS

The Accident

The brakeman of train No. 472 was not qualified on the characteristics of the roadway at the accident site. Because of the nature of the work performed by the conductor and traincrew on commuter trains, which essentially is ticket collecting, it is not easy for them to remain knowledgeable about the characteristics of the roadway. They seldom are in a position to view the roadway ahead and keep abreast of physical changes, or to refresh themselves on the locations of signals and curves. Traincrew personnel are not required to requalify on any portion of the system as long as they make one trip a year over the territory on which they are qualified. Conrail has a responsibility to insure that operating personnel maintain a high state of qualification for the duties they are required to perform. Training or retraining could be more positively controlled if a mandatory, well-organized program were in effect.

The crew of train No. 472 did not take full advantage of the options available to them for relaying signals to guide the movement of the train. Since the horn was functional on the lead unit, it could have been used as a signaling medium. It was not necessary for the brakeman to occupy the engineer's exact position in the operating compartment of the lead car, since he did not have to keep the deadman control pedal operated and he could have reached the horn control from a position near the aisle. He could have positioned himself in the center aisle where he could see or have been seen by the conductor or engineer in the second car.

The engineer did not fulfill his responsibility for the safe operation of the train when he did not insure that he either could see or be in a position to receive signals from the brakeman in the lead car at all times. When it began to rain at Lansdale and the engineer found it difficult to lean out the side window to observe signals, he could have required the conductor to be directly at his side and could have instructed the brakeman to remain in the conductor's sight. The engineer should have verified the aspects displayed by signals Nos. 330 and 328 and the train order signal at North Wales. He should not have allowed his attention to be diverted from his immediate responsibility of operating the train safely. The discussion between the engineer and conductor about stopping at the North Wales Station was an unwarranted distraction for the engineer because permission had already been received from the train dispatcher to operate the train without making any scheduled station stops en route to Reading Terminal. His attention should have been directed toward the aspects displayed by signal No. 328 and the train order signal. Although the engineer did not believe he was moving too fast, he was operating the train in excess of the 30-mph authorized speed for his operating circumstances.

The brakeman in the front compartment waited too long to begin his attempt to stop the train. Possibly he was confused initially by the headlight ahead or his unfamiliarity with the characteristics of the roadway. When he failed to see his engineer as the train first entered North Wales, and when the engineer failed to respond to his signals, the brakeman should have made an immediate effort to directly communicate with the engineer. Even with the failure of the crew to prearrange a horn signal, a series of blasts on the horn by the brakeman probably would have gotten the engineer's or conductor's attention.

The illuminated rear headlight of train No. 406 presented a visual problem for the brakeman. Even after the brakeman could distinguish on which track the train was, it was still difficult to perceive motion. This same problem was observed by personnel on the test train, because when the rear headlight of the standing car of the test train was first sighted, it was impossible to determine on which track the car was and if the car was standing or in motion. The Safety Board believes that the brakeman's lack of familiarity with the characteristics of the roadway and his uncertainty over the situation presented by the headlight ahead may have contributed to his failure to see signal No. 328 and to recognize its aspect. His failure to do so reduced the time available to him to relay a signal to the engineer and thus allow the engineer to stop the train. The Safety Board concludes that the use of a white light on the rear of certain trains, rather than a red or amber light which is required to be displayed on the rear of most trains, creates confusion and unsafe conditions.

Under the prevailing circumstances the agent-operator at North Wales should have given the regulation stop signal to train No. 472 instead of merely pointing ahead. A pointing signal could lend itself to various interpretations and it is not a recognized hand signal authorized by the Conrail operating rules. Also, he could have been more persistent in his attempt to reach the train dispatcher to report that train No. 406 was standing at North Wales. As an alternative, he could have contacted the operator at the WIND tower, who could have reached the trains by radio. If the train dispatcher had been alerted to this situation, he may have been prompted to warn train No. 472 and the accident would not have occurred.

Mechanical Aspects

The series of problems experienced by train No. 406, the difficulties with train No. 472 which actually began with car No. 9020 the evening before, and a series of breakdowns and power losses over the system that demanded extra attention from the train dispatcher and the tower operators were all factors in the accident. The loss of power experienced by train No. 406 could not be resolved. The train was struck by train No. 472 before the crew could finish their inspection and checks and resume operation to see if the problem had been corrected. The lead car of train No. 406 was used on July 20, 1980, for the test train without any repairs having been made, and it operated without any problems. Rain or snow sometimes will be blown into the electrical equipment and cause it to "short out" and fail. There is a possibility that rainwater from the storm the previous evening could have been blown into some of the electrical motors or controls and caused a partial ground which in turn could have caused a loss of power.

The problems of train No. 472 probably were caused by weak batteries. This condition indicates that Conrail does not have an adequate maintenance program. It also suggests that the lack of qualified electrical or mechanical inspectors at outlying terminals and the lack of crew training in the proper positioning of breakers for train operation under adverse conditions were contributing factors in the accident. When the traincrew attempted to enter the three inactive cars in the yard at Doylestown, the doors would not operate. This was indicative of the absence of the 38 V d.c. control voltage. The pantograph had to be manually raised on car No. 113 which again points to the lack of control voltage. The fact that the motor alternator on each inactive car had to be started manually and the absence of an illuminated headlight on car No. 9020 also indicate the lack of control voltage. The 38 V d.c. trainline breakers apparently were open on one or more cars because of the manner in which cars Nos. 9020, 114, and 113 operated. Thus, the trainline would have bypassed cars Nos. 123 and 124, and cars Nos. 9020, 114, and 113 would have been connected to each other via the trainline. The 38 V d.c. control voltage would have been common to those three cars, but cars Nos. 123 and 124 would have operated independently. This is supported by the fact that cars Nos. 9020, 114, and 113 shut off at the same time.

When the motor alternators on cars Nos. 9020 and 113 were manually started, they should have continued to operate because the motor alternators were supplying the 38 V d.c. control voltage. If the power supply to the motor of the motor alternators were interrupted, the motor alternators would be expected to shut off if the batteries were depleted because the 38 V d.c. control voltage would be missing. Power to the motor of the motor alternator could have been interrupted if the pantograph bounced momentarily from the catenary on either cars Nos. 9020 or 113. It also could have occurred if the catenary voltage were interrupted or dropped momentarily below 7,300 V. Either occurrence could have caused the motor alternators to become inoperative if the control voltage were absent. Even so, if the batteries on either cars Nos. 9020 or 113 had been charged sufficiently to provide the minimum control voltage, the cars should have continued to be operable without the motor alternator. Also, even if the batteries on the units were depleted, and the trainline and battery circuit breakers were closed to provide electrical continuity, the cars would still have been operable. From the manner in which the cars responded to service during the time that the motor alternators were not operating properly, it appears that either the trainline or battery circuit breakers were not properly positioned.

The fact that car No. 9020 departed Reading Terminal the previous evening with no lights, air conditioning, or traction power suggests that the batteries were depleted on the car at that time. The extra load that was imposed on the batteries of all the cars caused by the delays resulting from the evening storm probably contributed to their depleted condition. The engineer of train No. 472 knew that he could operate the train from car No. 9020 with the car shut down, and he attempted to do so, but the brakes applied in emergency before the train had gone about 200 yards. It is probable that the engineer was able to operate from car No. 9020 for a short distance after the motor alternator shut down because of the "buck boost" features and loadsharing on the motor alternator that extend the rundown time and output of control voltage. This would have kept the FA-4 magnet valve energized for several seconds until low voltage allowed the valve to open, vent the brakepipe, and apply the brakes in emergency. Since the batteries were depleted, they would not have supplied voltage to keep the FA-4 valve energized. Because of the damage to car No. 9020, the exact condition of the batteries and the control circuits or the positions of the breakers could not be determined.

With the batteries depleted on car No. 9020, the improper positioning of the trainline or the battery breakers on car No. 9020 or the adjoining cars would have prevented the engineer from operating the train from car No. 9020. When the crew called for advice, qualified personnel at Wayne Junction might have helped the crew to discover some improperly positioned switches or breakers which, when located correctly, would have allowed the engineer to operate the train from the lead car.

High resistance between mating contacts in the contactor boxes could have prevented the control voltage from passing through the trainline from cars Nos. 123 and 124 to cars Nos. 114 and 9020. However, it is very unlikely that a simultaneous failure would occur between two different cars on the same numbered contacts. Conrail supervisory personnel knew that car No. 9020 would be the lead car on its return trip to Reading Terminal unless it was switched to another position or to another train. Yet, no qualified electrician or car inspector was dispatched to Doylestown to check the car after the reported problem on the previous day. None of the supervisors to whom the trouble was reported took any action to have the car checked.

The communities served by the SEPTA-Conrail commuter service place a high priority on that service. To protect and insure that service, Conrail should have competent personnel to check the equipment laying over at outlying terminals before it begins a return trip to Reading Terminal each day. If SEPTA had required a preventive maintenance procedure, such a program might have prevented the accident.

The traincrew on train No. 472 and other commuter trains seldom operate a timelock circuit such as the one on the derail/switch at Lansdale. Conrail did not have operating instructions posted as stated in the operating rules, and the crew was not certain of the proper procedure. They had not received proper instructions for operating the timelock derail. They did not know that the timing cycle could be bypassed if the track was occupied within 25 feet in approach to the switch. Instructions of this nature could be covered in requalifying classes or be properly posted at the point of application. Unless persons frequently perform a specific task or operation covered by instructions, especially if it is of a technical nature, they often forget or become uncertain of the procedure. If the operating instructions had been properly posted, the derail circuit might have been operated in a timely manner, and car No. 9020 could have been left behind.

Operations

The two traincrews attempted to keep the train dispatcher abreast of developments by the train radios but did not communicate directly with each other. The crews of each train apparently were too involved in their own problems to adequately monitor the radio channel. Train radio has the potential for preventing or reducing the severity of many accidents. Railroad management should encourage its application in this manner by training operating personnel to use it conservatively, but when necessary, to alert other trains of potentially unsafe situations.

Operating Agreement

The contractual agreement between SEPTA and Conrail appears to give Conrail great latitude in handling the commuter program. In order for SEPTA to oversee all phases of the operation, it may need more qualified railroad personnel to work with Conrail. As an alternate approach, the contract could be rewritten to be more specific in those things that SEPTA expects of Conrail. At the same time, the contract could be rewritten to give SEPTA more enforcement authority to insure that Conrail performs according to SEPTA's needs. Some corrective measures are needed to improve the maintenance of the equipment and to insure that the crews operating commuter trains are well qualified. The qualifications of the crewmembers of commuter trains do not appear to be adequate with regard to the proper positioning of train circuit breakers, and a mandatory retraining program appears to be needed to insure that traincrew personnel remain qualified on the equipment, operating rules, and the physical characteristics of the roadway.

Survival Aspects

The postaccident activities of the crews of both trains were commendable. The police department of North Wales and the rescue forces in the surrounding area responded promptly, and the evacuation and treatment of the injured persons were handled promptly and orderly. The local plan for emergency preparedness played an important part in the manner in which two local hospitals were alerted and thus prepared to receive and treat the injured persons.

The deformation of equipment was less than might be expected, which is probably due to the unusual overriding action of the rear car of train No. 406. The overriding was initiated by the failure of the underframe assembly on car No. 9020 at the minimum cross section area. Failure would be expected at this point since it was the minimum cross sectional area of the beam. When the end underframe assembly separated, it permitted car No. 133 to override and penetrate car No. 9020 because of the nature of the failure. The mass and momentum of the striking train then forced the rear car of train No. 406 up and over the lead car of train No. 472, which accounts for the destruction of car No. 9020. The dissipation of kinetic energy through this action undoubtedly reduced the severity and the number of injuries received by the passengers.

CONCLUSIONS

Findings

1. Train No. 406 had difficulty in accelerating and maintaining speed because of an undetermined electrical problem.

2. Train No. 472 left Doylestown with malfunctioning equipment.

3. The crew of train No. 472 was not certain about the operation of the time-lock derail at the Lansdale siding.

4. The crew of train No. 472 did not arrange an adequate method for the brakeman to relay signals to the engineer nor did they use all of the options available to them.

5. The engineer of train No. 472 did not see signal No. 330, signal No. 328, the train order signal, or the rear end of train No. 406 in time to avert the collision.

6. The brakeman failed to take positive action soon enough to enable the train to be stopped before the collision.

7. An improved maintenance program could reduce the likelihood of operating problems such as those experienced by the traincrews.

8. Conrail does not have a retraining program that would maintain better qualified operating personnel.

9. Cars at layover points are not normally inspected by maintenance personnel before departure on a scheduled run.

10. No precautionary measures were taken by supervisors to provide a high degree of safety for train No. 472 while it was being operated from the second car.

11. The agent-operator at the North Wales Station did not give a positive stop signal to train No. 472 as it passed the station and approached train No. 406.

12. The brakeman was not qualified on the physical characteristics of the Bethlehem and Doylestown Branches, and was not qualified to observe the roadway signals and conditions and relay signals to the engineer that affected the movement of the train.

13. Depleted batteries and improperly positioned circuit breakers were responsible for the shutdown of cars Nos. 9020, 114, and 113 on train No. 472.

14. If a qualified electrician or car inspector had inspected the equipment of trains Nos. 406 and 472, the operating problems may have been avoided.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the engineer of train No. 472, who was operating the train from the second car, to observe the roadway ahead and to keep the brakeman in the lead car in his view so he could receive the brakeman's hand signals to properly control the train, and Conrail's failure to take malfunctioning equipment out of service when repairs could not be effected. Contributing to the cause of the accident were the placement of a brakeman who was not familiar with the physical characteristics of the roadway, inclement weather, Conrail's inadequate training program for traincrews, and the inability of the brakeman to distinguish whether train No. 406 was approaching on the opposite track or moving/standing on the track occupied by train No. 472 because of confusion created by the illuminated rear headlight on train No. 406.

RECOMMENDATIONS

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

— to the Consolidated Rail Corporation:

> Develop and implement a program for training and periodically requalifying operating personnel and train dispatchers on the physical characteristics of the system over which they operate. (Class II, Priority Action) (R-80-51)
>
> Develop and implement a program for training and periodically requalifying operating personnel on the mechanical and electrical characteristics of commuter cars to include some elementary troubleshooting and corrective measures. (Class II, Priority Action) (R-80-52)
>
> Provide for the inspection by competent maintenance personnel of equipment laying over at outlying terminals before it is released on a scheduled run. (Class II, Priority Action) (R-80-53)

-- to the Federal Railroad Administration:

> Amend 49 CFR 221.15(c)3 to prohibit the use of the white rear headlight as a marking device on any train. (Class II, Priority Action) (R-80-54)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JAMES B. KING
Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

/s/ G. H. PATRICK BURSLEY
Member

ELWOOD T. DRIVER, Vice Chairman, did not participate.

December 23, 1980

APPENDIXES

APPENDIX A

INVESTIGATION

1. Investigation

The Safety Board was notified of this accident the morning of July 17, 1980. The Safety Board immediately dispatched investigators from its New York Field Office and from its Washington, D.C., headquarters to the scene. Participants in the investigation included the Federal Railroad Administration, the Consolidated Rail Corporation, the Southeastern Pennsylvania Transportation Authority, the Pennsylvania Public Utility Commission, the United Transportation Union, the Brotherhood of Locomotive Engineers and the General Electric Company.

2. Public Hearing

A public hearing was held in Philadelphia on September 10-12, 1980.

APPENDIX B

CREWMEMBER INFORMATION

TRAIN NO. 406

Tory Ann Dunn, Engineer

Tory Ann Dunn, 24, was employed by Conrail on September 12, 1977, as a traffic control operator. She transferred into engine service as a fireman in November 1978 and entered the engineer training program on August 20, 1979. She was promoted to engineer on December 21, 1979. She passed her last medical examination on September 12, 1977, passed her last book of rules examination on April 9, 1980, and attended her last airbrake class on November 8, 1978. She was qualified on the Bethlehem Branch of Conrail on March 10, 1980.

Louis Paul Scholler, Conductor

Louis Paul Scholler, 60, was employed by the Reading Railroad Company on January 9, 1946, as a flagman. He was promoted to passenger conductor on February 12, 1952, and to freight conductor in 1968. He passed his last medical examination on November 14, 1978, passed his last book of rules examination on August 21, 1979, and attended an airbrake class on May 30, 1980. He was qualified on the Bethlehem Branch of Conrail on January 4, 1964.

TRAIN NO. 472

Gerald Henry Suloff, Engineer

Gerald Henry Suloff, 31, was hired by the Reading Railroad Company on December 19, 1973, as a locomotive fireman. He was promoted to engineer on December 10, 1974. He passed his last medical examination on June 7, 1978, passed his last book of rules examination on March 13, 1980, and attended his last airbrake class on November 9, 1979. He was qualified on the Bethlehem Branch of Conrail to Lansdale on September 4, 1974, and to Doylestown, on September 9, 1974.

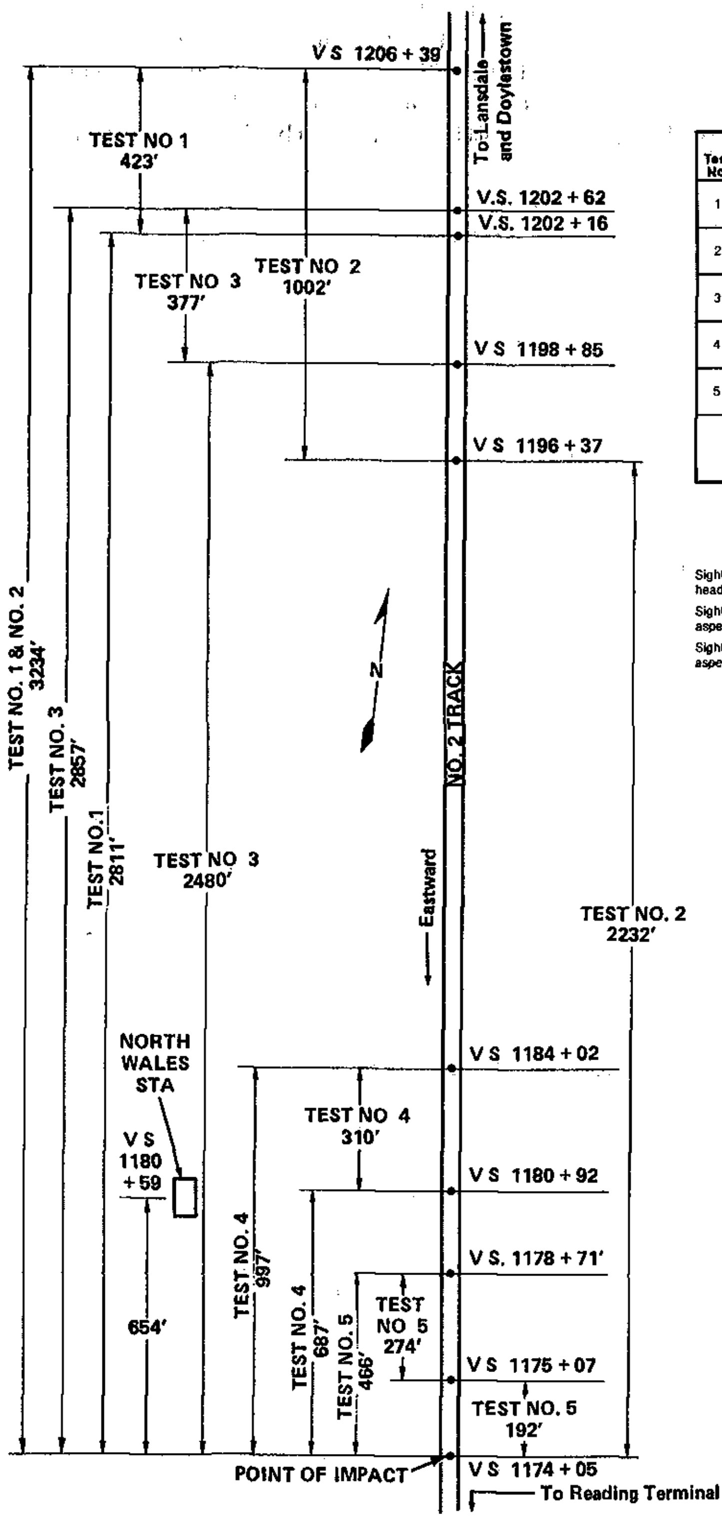
Anthony Ned De Maio, Conductor

Anthony Ned De Maio, 32, was hired by the Reading Railroad Company on September 24, 1973, as a brakeman. He was promoted to conductor on December 17, 1976. He passed his last medical examination on August 2, 1977, passed his last book of rules examination on January 30, 1980, and attended his last airbrake class on May 30, 1980. He was qualified on the Bethlehem Branch to Lansdale and on the Doylestown Branch on October 29, 1976.

Dennis Joseph Kubach, Brakeman

Dennis Joseph Kubach, 26, was hired by the Reading Railroad Company on February 13, 1974, as a trainman. He was promoted to conductor in March 1976. He passed his last medical examination on February 27, 1978, passed his last book of rules examination on January 9, 1980, and attended his last airbrake class on March 7, 1977. He was qualified on the timetable and operating rules only for passenger service on the Bethlehem Branch on March 17, 1977. He was not qualified on the physical characteristics of either the Bethlehem or Doylestown Branches.

APPENDIX C
STOPPING TESTS DATA



Test No.	Speed (MPH)	Stopping Distance (ft.)	Stopping Time (sec.)	Remarks
1	40	423	13 09	Emergency stop No wheel slide
2	55	1002	A) 20 50 B) 17 99	Emergency 2-car propulsion
3	30	377	A) 13 60 B) 11 15	Repeat of Test No 2
4	38	310	A) 11 80 B) 11 70	Simulated run Emergency stop (Beaver St)
5	35	274	A) 20 20 B) 10 57	Simulated emergency A) Single car complete stop B) Engineman's application

NOTE: All points referenced to Point of Impact
V S = Valuation Station

Sight distance from test train to point engineer could see headlight of standing car – 5 197 feet

Sight distance from test train to point engineer could see the red aspect of signal no 328 leaning out side window – 4 140 feet

Sight distance from test train to point engineer could see the red aspect of signal no 328 from car s center window – 3 234 feet

APPENDIX D
SPEED CALCULATIONS

THE MATHEMATICAL COMPUTATION OF IMPACT SPEED

The Kinetic energy of Train No. 472 before impact is:

$$E_o = \frac{W_1}{2\ g} \quad V_o^{\ 2}$$

$$= \frac{1}{2} \ \frac{662,620}{32.2 \times 12} \quad V_o^{\ 2}$$

$$= 857.4 \quad V_o^{\ 2} \qquad V_o = \quad \text{inch/sec}$$

The energy dissipated in moving Trains No. 472 and No. 406 can be calculated as:

$$E_1 = M\ (W_1 + W_2)\ d$$

$$= 0.12\ (\ 1,063,040\ ) \quad 123.9 \times 12$$

$$= 189.67 \times 10^6 \text{ in.-lbs.}$$

The energy dissipated in crushing of car 9020 may be estimated as (Ref.2):

$$E_2 = \text{Area under Force - Penetration Curve}$$

$$= 54 \times (\ 200,000 \times 20\ )$$

$$= 54\ (\ 4 \times 10^6\ )$$

$$= 216 \times 10^6 \text{ in-\#}$$

where penetration distance = $B_1\ S_1$ = 14.2 ft.

The energy dissipated in underframe crush of car 133 may be estimated as:

$$E_3 = F \times S_2$$

$$= 800{,}000 \times 5''$$

$$= 4 \times 10^6 \text{ in - \#}$$

Neglecting the energy dissipated due to center pin failure, collision post crack, and others, the impact speed can be calculated by equating the Kinetic energy to the total energy dissipated, i.e.,

$$E_o = E_1 + E_2 + E_3$$

$$857.4 \quad V_o^{\,2} = 409.7 \times 10^6$$

$$V_o = 691 \text{ in/sec}$$

$$= 39 \text{ mph}$$

TABLE 1

SYMBOL	EXPLANATION	NUMERICAL VALUE
W_1	Total weight of Trains No. 472 including 46,500 lbs. for 300 passengers	662,620 lbs.
W_2	Total weight of Trains No. 406 including 27,900 lbs. for 180 passengers	400,420 lbs.
M	Coefficient of adhesion (Reference 1)	.12
F	AAR Compression Spec.	800 K lbs.
d	Distance travelled by both trains after impact	123.9 ft.
S_1	Total crush distance of Train 472	28.4 ft.
S_2	Total crush length of Train 406's underframe	5 inches
E_0	Kinetic energy of Train 472 before the impact	
g	Gravitational acceleration	32.2 ft/sec^2
B_1	Modification factor for car 9020 crush distance	0.5

APPENDIX E
SPEEDOMETER CALIBRATION

D
S
R

DAVIDHEISER'S SPEEDOMETER REPAIR, INC.

APPENDIX D

First in Mobile Dynamometer Testing
BOX 181 - W RIDGE ROAD
Telford, Pa. 18969

Phone
215-257-5676
215-723-9544

Radiator Speedometer Specialists

PENNA. SPEEDOMETER TESTING STATION NO 19

This is to certify that Davidheiser's Speedometer Repair, Inc. has been designated as official speedometer testing station No. 19, by the Bureau of Traffic Safety.

On 8/27/80 (date) speed tested a 1971 Dodge CP (year, make, model)

LL23C1R238058 (serial no.) 3U4-993 (registration) 81512 (mileage)

LAURA CATHERINE MOORE (owner's name) 7 WALTERS RD (address)

SUMNEYTOWN, PA 18084

(X) tested for accuracy and found to be as follows:
( ) adjusted for accuracy and found to be as follows:

True Speed	Vehicle Speed	Error Slow	Error Fast
10	8	2	
20	19	1	
30	29	1	
40	39	1	
50	48	2	
60	57	3	

Test Equipment
Make Clayton
Model PSN
Ser. No. C-4904-R

C Eugene Donnelly
certified inspector

Remarks This is a true copy
H A Jewell Jr.
Investigator-in-Charge
NTSB

Relative Penna. Official Inspection Station
Bulletin 336, dated 12/15/78