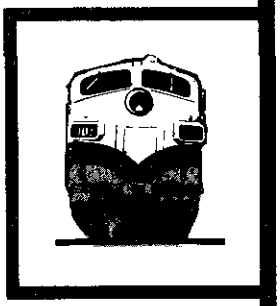
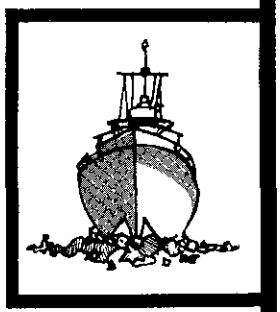
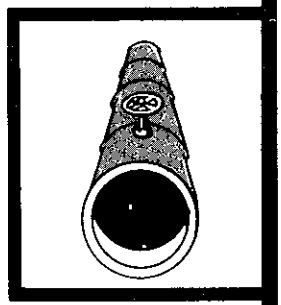
NATIONAL TRANSPORTATION SAFETY BOARD

WASHINGTON, D.C. 20594







RAILROAD ACCIDENT REPORT, no. 111

REAR END COLLISION OF TWO CHICAGO TRANSIT AUTHORITY TRAINS NEAR THE MONTROSE AVENUE STATION CHICAGO, ILLINOIS AUGUST 17, 1984

NTSB/RAR-85/11.

UNITED STATES GOVERNMENT

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The National Transportation Safety Board determines that the probable cause of this accident was the failure of the motorman of train No. 135 to apply the track brakes while the train was rolling downhill. Contributing to the accident was the failure of the Chicago Transit Authority to assure that the motorman was skilled in emergency procedures.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

RAILROAD ACCIDENT REPORT

Adopted: August 20, 1985

REAR END COLLISION OF TWO CHICAGO TRANSIT AUTHORITY TRAINS NEAR THE MONTROSE AVENUE STATION CHICAGO, ILLINOIS AUGUST 17, 1984

SYNOPSIS

About 5 p.m., on August 17, 1984, after southbound Chicago Transit Authority eight-car "A" train No. 135 left the Montrose Avenue Station and as it slowly ascended a 3.1-percent grade, the motorman saw "yellow dynamic" brake lights illuminated on the second and seventh cars. The train rolled to a stop, and the motorman secured the cab and went back to cut out the brakes on the second car. While the motorman was out of the cab, train No. 135 began to roll backward down the grade. The motorman ran back to the cab and attempted to stop the train; however, he did not stop it. Train No. 135, moving at about 20 mph, struck Chicago Transit Authority eight-car "B" train No. 143, which was standing just south of the Montrose Avenue Station. One passenger was killed, and 46 passengers and 3 crewmembers were injured.

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INVESTIGATION

The Accident

About 5 p.m., on August 17, 1984, southbound Chicago Transit Authority (CTA) eight-car "A" train No. 135 (hereafter referred to as train 135) was en route from River Road Station in Rosemont, Illinois, to Chicago, Illinois. As the train entered the Jefferson Park Station, the conductor in the third car heard a popping noise and smelled smoke. He signaled the motorman with the communication buzzer, and they met on the station platform where the conductor informed the motorman of his observations. The motorman suspected that the braking system might have caused a problem, so he told the conductor that they would continue to the next station, Montrose Avenue, and determine if the odor of smoke continued. At Montrose Avenue Station, the odor of smoke continued, and the motorman and the conductor met on the platform to discuss the trouble further. The motorman told the conductor that he would accelerate out of Montrose Avenue Station to more than 5 mph and apply the brakes and that the conductor was to check the outside of the train to determine if any "yellow dynamic" 1/ lights on the cars illuminated. The motorman instructed the conductor to cut out the brakes on any car on which the "yellow dynamic" brake light was illuminated.

1/ The "yellow dynamic" light on the outside of each car illuminates when the dynamic brakes malfunction; it also illuminates when standing to indicate that a parking brake is applied.

After the train left the station and as it slowly ascended a 3.1-percent grade, the motorman saw "yellow dynamic" lights on the second and seventh cars. The train rolled to a stop just before reaching the top of the grade. (See figure 1.) The motorman stated that he ". . . put the train in power to move on," but the train did not move. The motorman decided to go back to the second car and pull the seven-point switch. 2/ He said he put the master controller in the off position, took out the master controller key, closed and locked the door of the operator's cab, and started back to the second car. The friction brakes were applied. He did not apply the track brakes. He did not notify the CTA Control Center (controller) that he had stopped or that he was troubleshooting.

The motorman said that when he was about midway in the second car, he realized that the train was rolling backward. He immediately ran back to the head of the train, entered the cab, unlocked the master controller, put the key in the forward position, and put the master controller in the emergency brake position. The motorman said the train did not decelerate so he pulled the emergency cord, but the train did not slow down. He then pushed the track brake button, but it had no effect on the speed of the train. Since there was no microphone for the public address system at his position, the motorman could not warn the passengers of danger. When the motorman realized he could not stop the train, he used his portable radio to contact the controller to advise him of the situation; however, although the controller responded, the motorman was not sure that the controller understood his message. He did not use the portable radio to contact the conductor.

The conductor also did not radio the controller that the train was stopped or that he was troubleshooting. The conductor had seen the "yellow dynamic" light illuminated on the seventh car of the train. He said that he was walking back toward the seventh car when he realized that the train was rolling backward. The rearward movement did not alarm him at first, but he said that when he looked out a window to see if the "yellow dynamic" light was illuminated on the seventh car, he realized that the train was accelerating and he became alarmed. He did not recall hearing or feeling the track brake being applied and thought that the train continued to accelerate. The conductor attempted to communicate with the motorman by sounding the communication buzzer one time, a signal that indicates "stop the train." He thought he was in the seventh car at that time. When the train did not slow down, he became worried and started walking rapidly toward the head end. As he went through the cars, he yelled to the passengers to hold on. The conductor believes that he had reached the third car when train 135 struck a standing train. He thought the speed of impact was above 15 mph. Recollections of witnesses as to the whereabouts of the conductor at impact are conflicting. One passenger said she saw the conductor in the eighth car ". . . pushing a button, like he was trying to stop the train," but after the crash she did not see him again. Another passenger, who was in the third or fourth car, saw the conductor and motorman pass through the car several times, but he could not be sure whether it was before or after the collision.

The standing train, CTA eight-car "B" train No. 143 (train 143), which was not scheduled to stop at Montrose Avenue Station, had been following train 135. Although the motorman of train 143 had not seen train 135 before he arrived at the Montrose Avenue Station, he knew it was ahead of him. Train 143 had approached the station on a green

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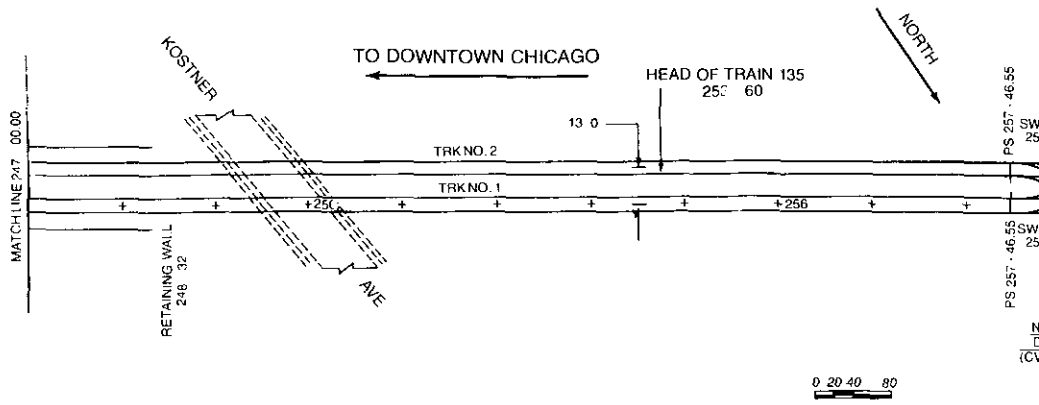
2/ A switch in each car that cuts out the brakes and power in that car when the switch is pulled.



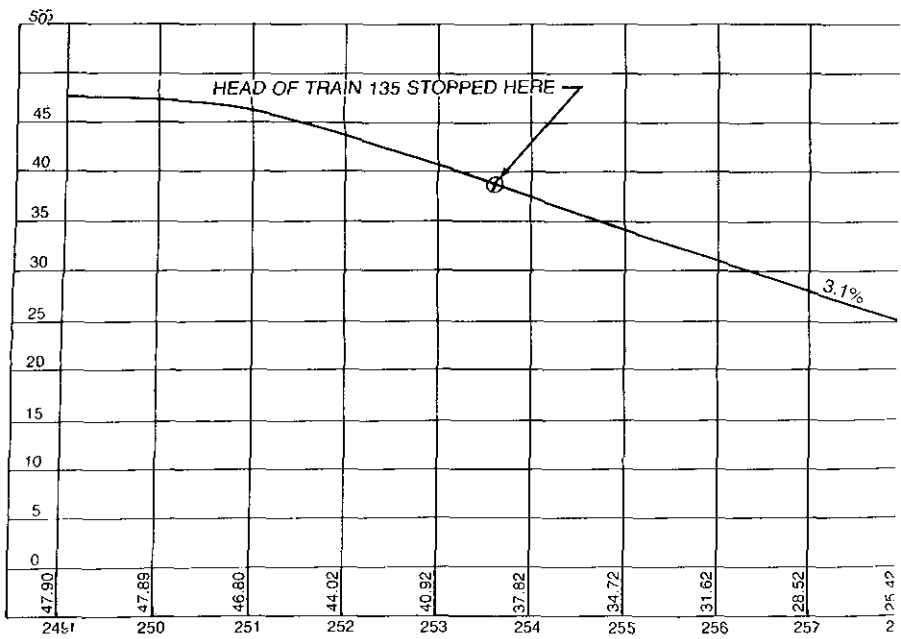
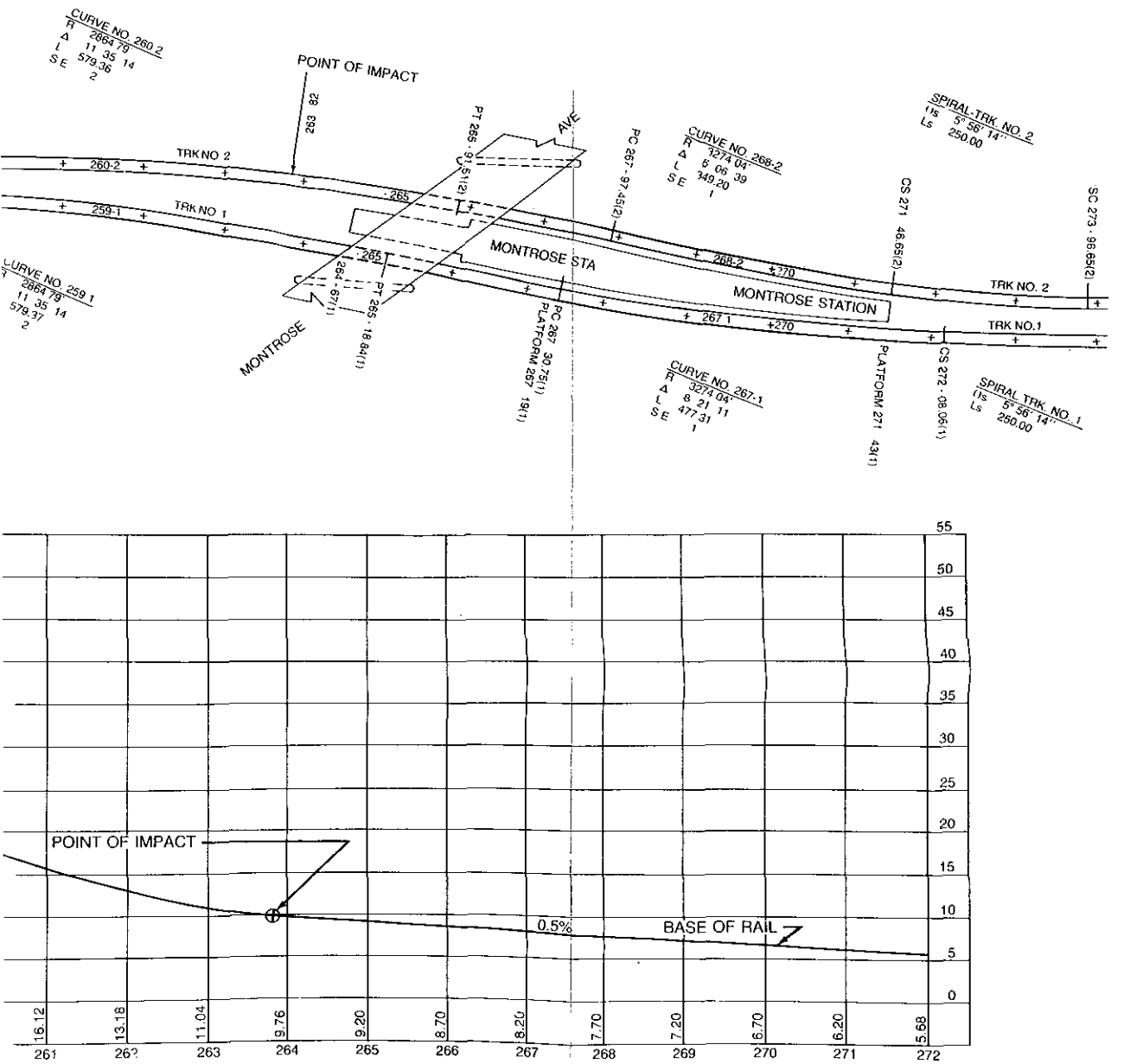


FIGURE 1 - - TRACI



ND PROFILE ACCIDENT SITE

(clear) cab signal which suddenly changed to a yellow aspect and then to a red aspect, indicating stop. The motorman said that when the signal changed to red, he had already applied the brakes because he was supposed to pass through the station at 35 mph. As train 143 came to a stop, the motorman saw train 135 on the hill ahead of him. (See figure 2.) Since train 135 did not appear to move immediately, the motorman called the controller but no one answered. As he attempted to talk to the controller, he perceived that train 135 was rolling backward. When he realized that train 135 was going to hit train 143, the motorman told the passengers in the head car to move to the rear of the car and lie on the floor or put their heads between their knees. In a moment, train 135 struck train 143. (See figure 3.)

When the trains collided, anticlimbers 3/ of the seventh and eighth cars of train 135 engaged, forced the end sill of the seventh car downward, crushed the car ends, and buckled the car floors upward into the passenger area. The Chicago Fire Department was called immediately by the controller, and a box alarm was made at 5:04 p.m. The box alarm prompted an automatic response of four engine companies, two hook-and-ladder companies, a heavy rescue squad company, an ambulance and emergency medical supervisor, two battalion chiefs, and the deputy district chief. The deputy district chief immediately called for the third rail to be deenergized because passengers were beginning to unload from train 135.

After the collision, the motorman of train 135 radioed the controller and told him that there were injured passengers who needed help. He then began walking through the train, inquiring about passengers' conditions, and directing them toward the rear of the train. He encountered rescue personnel who had boarded the train and directed them to the more seriously injured passengers. He did not assist the seriously injured passengers in the seventh car because rescue personnel were there. The motorman did not order the evacuation of train 135; however, when he got to the eighth car, he found that a ladder had been placed against an open door on the west side of the car, and passengers were using it to get off the train. He had not told the controller to deenergize the third rail, but CTA and rescue personnel on the ground at the rear of the train told him that the third rail was safe. The motorman said that while instructing the passengers as he moved back through the train, he did not think about whether the power on the third rail was off. At the point where passengers were exiting, the third rail was on the opposite side of the train from the open door.

After the collision, the conductor of train 135 continued walking toward the head end of the train and met the motorman in the second car. The motorman was using his portable radio to talk to the controller. The conductor returned to the rear of the train to check on and help the passengers. He attempted to calm the passengers, but he was not sure how to help the seriously injured passengers and decided that emergency medical personnel should assist them. He found that passengers were detraining, and he said that he cautioned them about the third rail. The motorman of train 143, who was on the ground assisting passengers, said that the third rail had been deenergized and was safe. Also, there were other CTA personnel on the ground assisting the passengers, so the conductor helped evacuate passengers by way of the ladder.

After the collision, the motorman of train 143 instructed his conductor to try to calm the passengers and to open the end doors throughout the train so passengers could

3/ Transverse bars across the end sills of the cars. In severe collisions, the anticlimbers engage to prevent one car from overriding the underframe of the other.

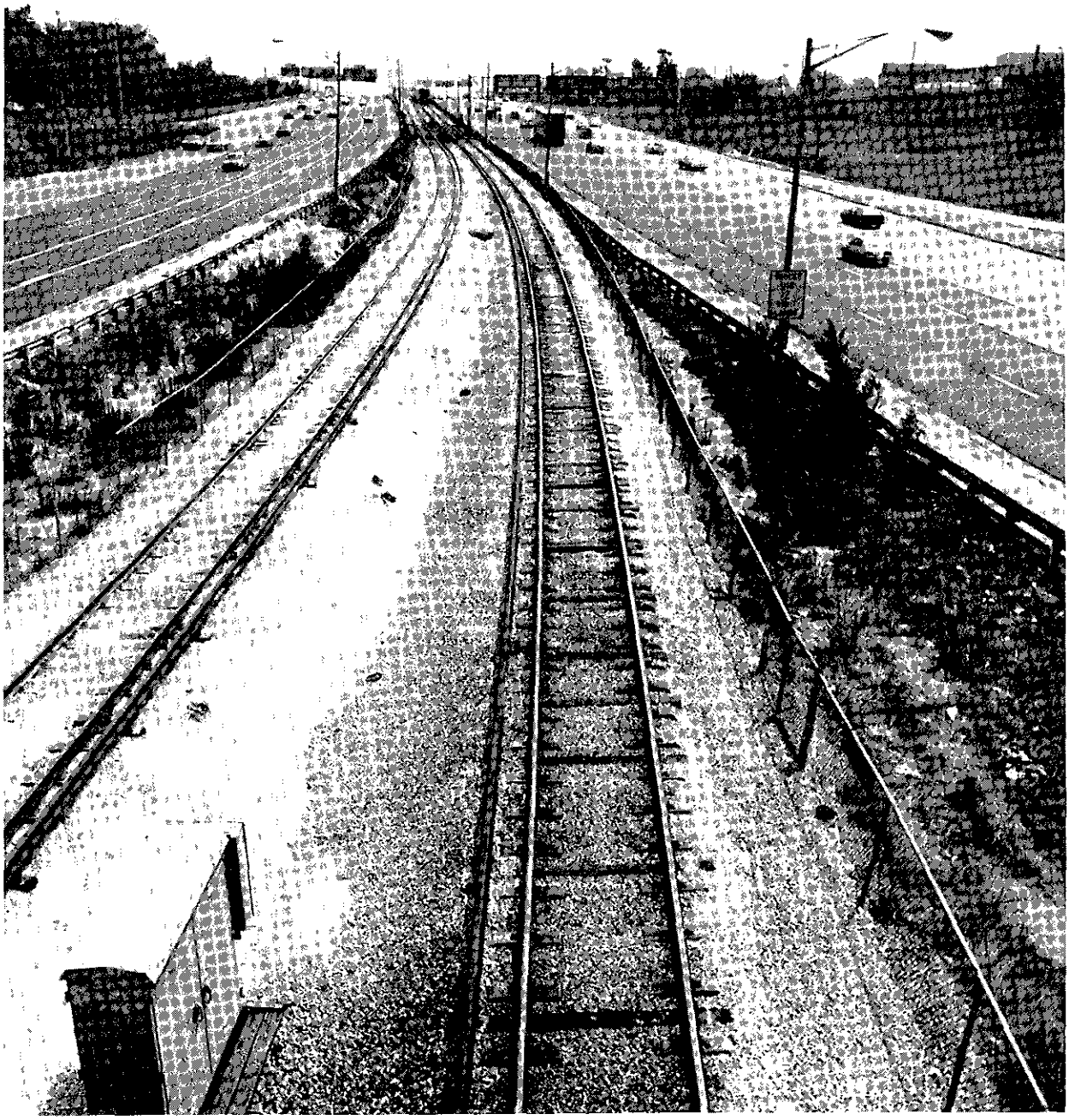


Figure 2.—View of the accident site south of the Montrose Avenue Station.

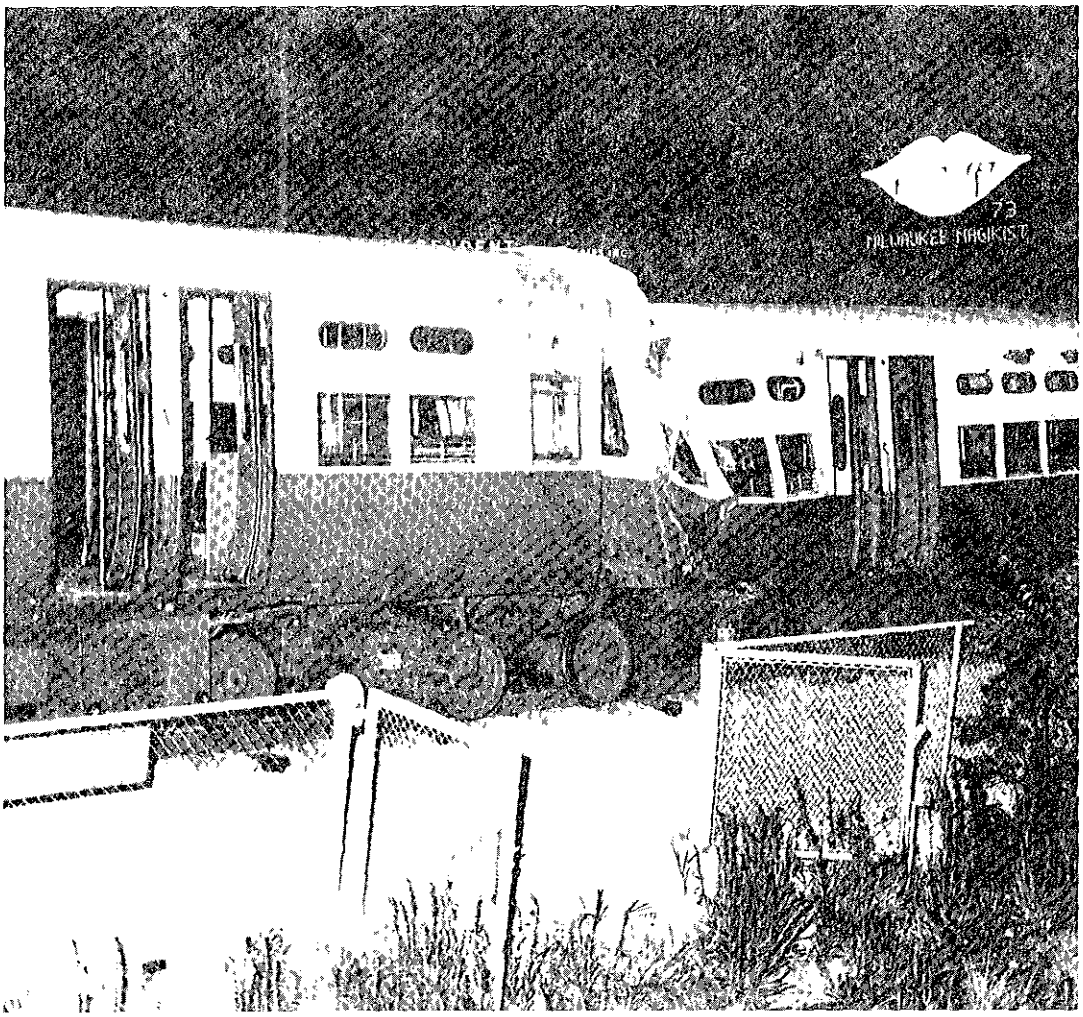


Figure 3.—View from the west side of the crushed end of car 6648.
(Chicago Transit Authority photograph).

walk back through the train to the station platform and unload. The motorman could not contact the controller by radio. He got off train 143 and found a ladder on the ground, which he put up to a door on the west side of train 135. A CTA supervisor from Jefferson Park arrived and contacted the controller to remove power from the third rail, and the controller told the supervisor that power was already off on the southbound track.

As a result of the collision, one passenger on train 135 sitting near the coupling between the seventh and eighth cars was killed when the car ends were crushed. Forty-seven other passengers from train 135 were taken to hospitals, but only four were admitted. The conductor on train 135 received minor injuries. No passengers on train 143 were injured. The motorman and conductor of train 143 received minor injuries.

The weather at the time of the accident was clear with no hindrance to visibility.

Injuries to Persons

Injuries	Crewmembers	Passengers	Total
Fatal	0	1	1
Serious	0	4	4
Minor	3	42	45
None	0	1	1
Total	3	48	51

Train Information

Train 135.--Train 135 consisted of eight CTA 6000-series cars which were built in 1956 and 1957 by the St. Louis Car Company. The car structures were steel and aluminum with a 3/4-inch metal sheathed (underside), rubber-covered (interior) plywood floor. The underframes of the cars were designed to withstand a 100,000-pound force applied over a 4- by 24-inch area of the face of the anticlimber. The anticlimbers are fastened to the transverse end sills at each end of the cars. The vertical end posts are attached to the frames to absorb energy by yielding and deforming rather than breaking away from the frame. Each car is 48 feet long, 9 feet 4 inches wide, and 11 feet 10 inches high and weighs about 44,350 pounds.

The cars are semipermanently coupled at the No. 2 ends (opposite the motorman position) by 8-foot-long drawbars with automatic couplers into consecutively numbered units. The odd-numbered units (6647) are designated "A" cars, and even-numbered units (6648) are designated "B" cars. The car is carried by two four-wheel trucks, with 26-inch wheels, on 33-foot 8-inch centers. The axles are driven through gear boxes by General Electric Company 1220 FI, 55-horsepower, electric motors. Colored lights on the outside of each car illuminate to indicate the following conditions: red, open door; yellow, dynamic brake malfunction; and blue, propulsion failure. The red and yellow lights are located near the eaves and the blue light is located below floor level. Passenger exit doors are located on each side of the cars at their quarter points, and each door has four folding panels. Hinged doors are located in the ends of the cars. There are sill steps but no ladders to detrain passengers when the train stops away from a station platform. The side windows are simple sash, arranged to raise, and are glazed with 7/32-inch-thick laminated safety glass.

Some of the cushioned seats face forward and some face backward. The seatbacks are steel plates enclosed by tubular steel frames and are covered with a light padding. Tubular steel frames across the tops of the seatbacks serve as handholds. Vertical stanchions are located at the doors and at several seat locations throughout the car.

Each car contains an operator's cab at the No. 1 end in the right-hand corner, and each "A" car has a conductor's station at the No. 2 end. The seating capacity is 47 in the "A" car and 51 in the "B" car. There were no permanently installed radios; however, the motorman and conductor had portable radios to communicate with the controller. Each car has public address speakers with microphones at each conductor's position. There is no intercom between the motorman and conductor; however, there is a buzzer system by which the motorman and conductor can communicate five basic messages:

1 short sound	-	Stop or remain standing
2 short sounds	-	Open doors, close doors, or proceed
3 short sounds	-	Don't open doors or missed berthing mark
4 short sounds	-	Need assistance
1 long sound	-	Testing buzzer

The conductor can check the "yellow dynamic" lights by mounting a step at the conductor's station and looking out the window.

The motorman controls the train with a master controller, which controls both braking and motive power. The controller has an "off" position, a center "coast" position, three "power" positions, and four positions for braking. The braking system consists of a dynamic motor brake, a drum friction brake, and a track brake. The dynamic and friction brakes are controlled by the motorman's manipulation of the controller handle; there is a pushbutton for the track brake and a pull cord for emergency braking. In the brake positions, the deceleration is as follows:

Position	Kind of brakes applied	Deceleration rate (mph/sec)
B-1	Dynamic/friction*	1
B-2	Dynamic/friction*	2
B-3	Dynamic/friction*	3
B-4 (Emergency)	Dynamic/friction* and track	Over 6

*Dynamic above 5 mph which blends into friction below 5 mph.

If the motorman releases the master controller handle while the train is in operation, it will brake the train automatically at the B-3 rate; if the motorman removes the master controller key, the friction brakes apply. The maximum acceleration rate, 3.2 mph/second is in the power-3 position. In the B-4 position, the dynamic, friction, and track brakes are actuated; additionally, there is a separate pushbutton which applies the track brake 4/ as long as it remains depressed.

When the train is moving under power and the motorman selects any braking rate except emergency (B-4), the dynamic brakes decelerate the train to about 5 mph, at which speed the dynamic brakes become ineffective gradually, and the friction brakes automatically blend with the dynamic brakes to give a smooth stop. When an emergency brake application is called for, either by the operation of the controller handle, the operation of any track trip, 5/ or the pulling of the emergency cord, the motor power circuit is interrupted, and the dynamic and friction brakes are applied at their maximum value. There are emergency brake pull cords in each operator's cab and at the No. 2 end of each car. A pushbutton is mounted in the motorman's cab which, when operated, will bypass all contacts in the emergency circuit and hold the emergency relay in. In addition to the dynamic and friction brakes, two track brakes are mounted on each truck. A pushbutton in the cab controls the operation of the track brakes on all the cars in the train. Track braking also is provided when the controller handle is moved to the B-4 position. Third-rail power or battery power must be available to use the track brakes.

The cars of train 135 received CTA's 6,000-mile inspection of trucks, brakes, lubrication control, and car body on the following dates:

4/ Track brakes are magnetized bars (brakeshoes) which are lowered to the rail beneath the cars to retard movement.

5/ A track trip is an appliance which functions in conjunction with the signal system and automatically applies the brakes when a car passes a stop signal.

Car number	Dates
6567 6568	January 17, 1984, March 19, 1984, and July 12, 1984
6667 6668	January 23, 1984, March 8, 1984, April 19, 1984, May 30, 1984, and July 5, 1984
6547 6548	January 4, 1984, February 8, 1984, April 13, 1984, and July 5, 1984
6648 6647	February 2, 1984, April 11, 1984, and June 4, 1984.

CTA's maintenance records for these cars show that the reports of defects were checked or tested and the required repairs made.

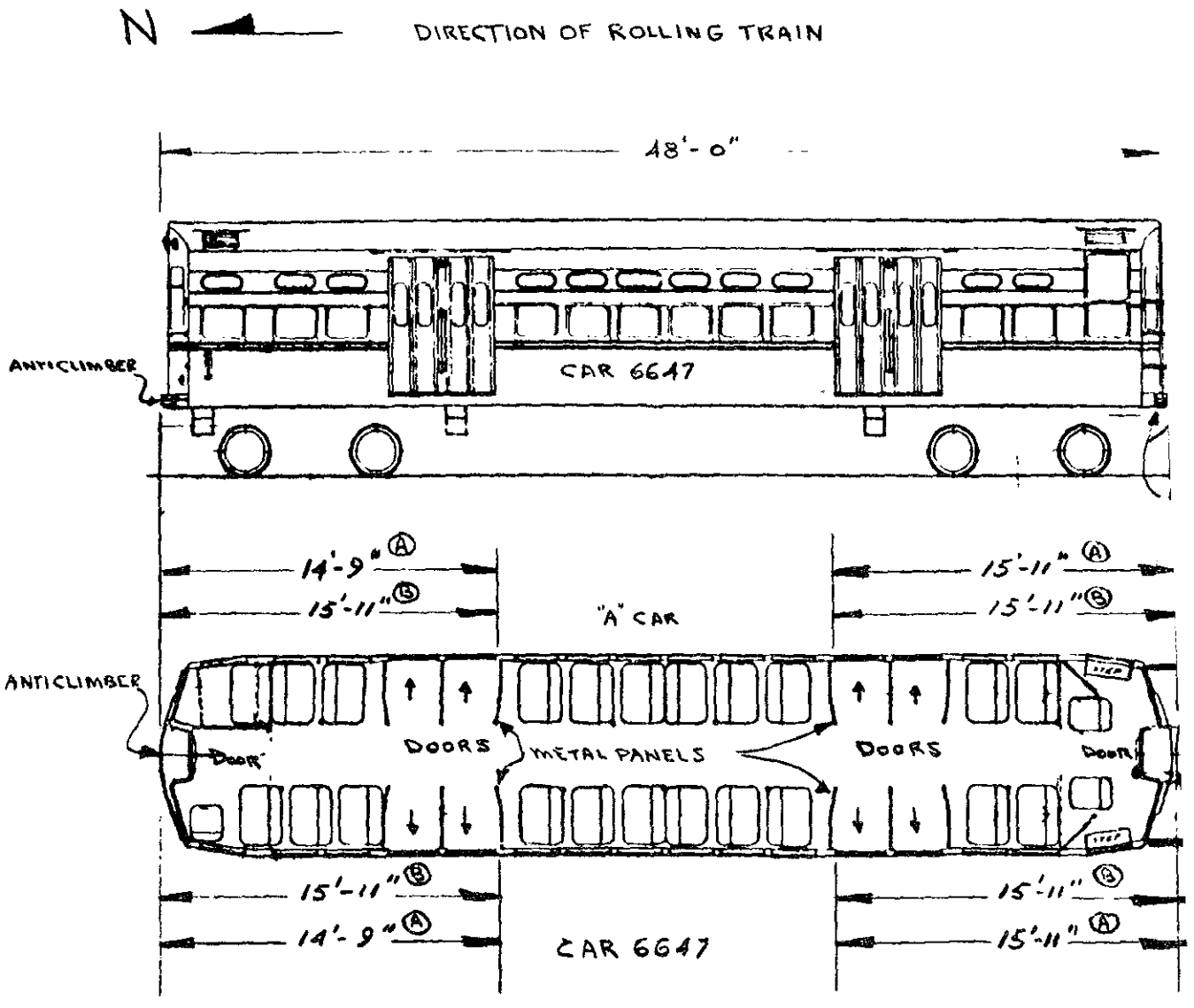
A Safety Board investigator accompanied a CTA inspector on an inspection of train 135 after the collision and found all seven-point switches engaged. An inspection of the brakes by a Safety Board investigator and a representative from the Westinghouse Airbrake Company revealed no defects that would have prevented the brakes from functioning properly at the time of the collision.

CTA has about 350 cars in the 6,000 series. CTA is receiving about 10 replacement cars per month and eventually the 6,000-series cars will be replaced; however, about 100 of the 6,000-series cars will be renovated and will be continued in service for the immediate future. The new cars which will be put into service have the same type of seat arrangement and vertical stanchions as the 6,000-series cars, but they will have fiberglass seats with plastic inserts instead of upholstery.

Train 143.--Train 143 consisted of eight cars of the 2,200- and 2,600-series, built by the Budd Company between 1969 and 1984. Each car is 48 feet long, 9 feet 4 inches wide, and 12 feet high. Constructed of stainless steel, the 2,200-series car weighs 44,500 pounds, and the 2,600-series car weighs 54,300 pounds. The cars are semipermanently coupled at the No. 2 ends into consecutively numbered sets of two; odd-numbered cars are designated "A" cars, and even-numbered cars are designated "B" cars. The "A" cars contain the conductor's station at the No. 2 ends, and each car contains an operator's cab at the No. 1 end in the right-hand corner. The cars are equipped with permanently installed radios.

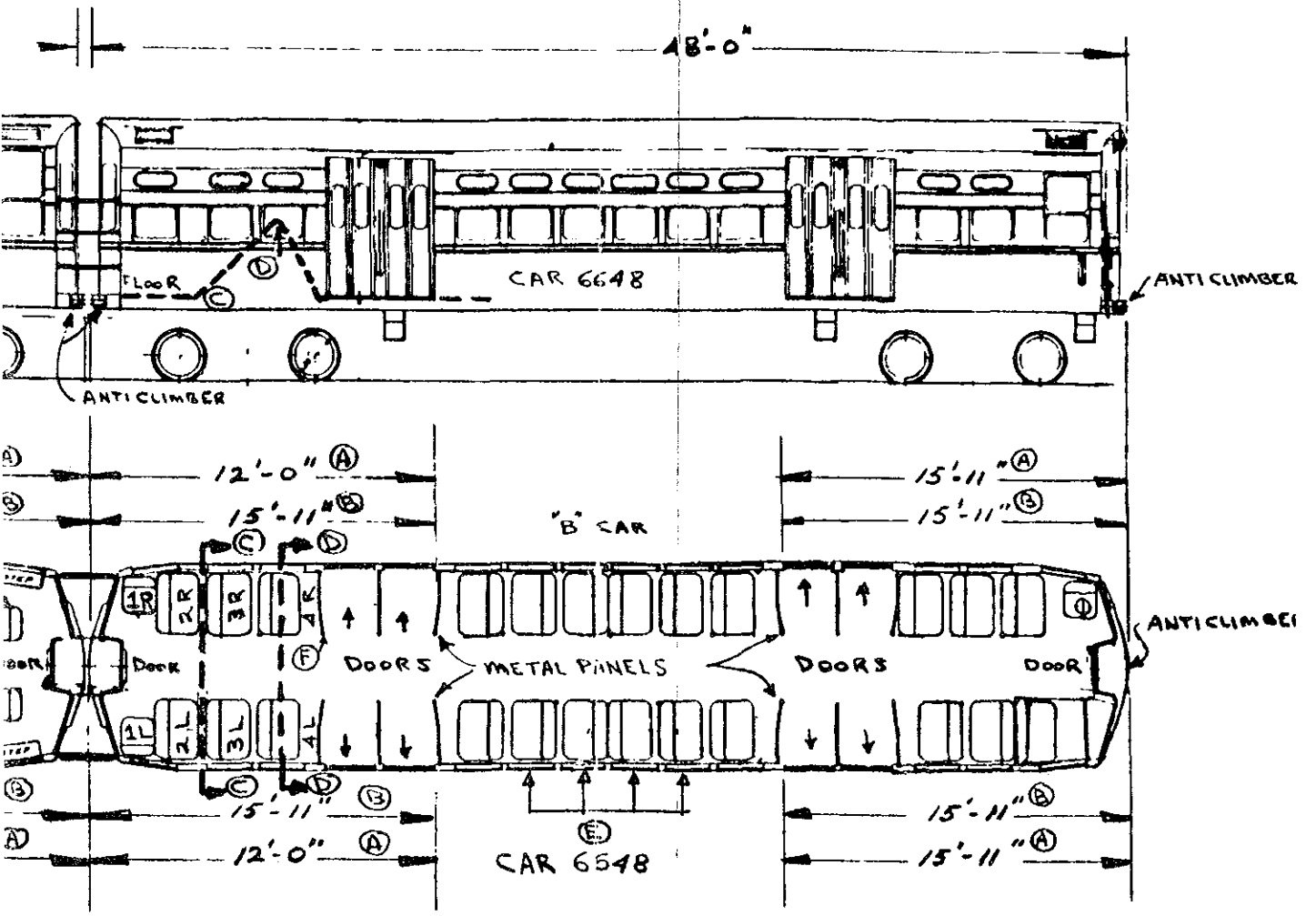
Damage

Train 135.--The No. 1 end of car 6647 of train 135 that struck standing train 143 was crushed inward 1 to 2 feet and downward across the full width of the car. (See figures 4 and 5.) The anticlimber in the area of the end door was crushed inward and downward. The No. 2 end of the car that was coupled to the No. 2 end of car 6648 retained its basic structural integrity; however, the sheet metal at the top end of the roof was bent inward 1 1/2 inchs and the anticlimber was deformed upward. The interior paneling near the ceiling at the No. 1 end was deformed inward; the center door had jammed and could not be opened. The inboard seatback of the first seat behind the motorman's compartment was forced forward 5 inches. The first side seat opposite the motorman's compartment was not attached to the floor, and the front of the car was up



Ⓐ = DIMENSION FROM DOOR FRAME TO ANTICLIMBER AFTER CRASH
Ⓑ = DIMENSION FROM DOOR FRAME TO ANTICLIMBER BEFORE CRASH
Ⓒ = START OF FLOOR BUCKLING
Ⓓ = FINAL POSITION OF FLOOR AFTER BUCKLING
Ⓔ = LATERAL LOADING ON INBOARD SEAT LEGS
Ⓕ = METAL PARTITION PANEL

FIGURE 4 - - SKETCH



TWO-COUPLED PASSENGER MOTOR CARS
CHICAGO TRANSIT AUTHORITY
MAY 1957 MRS-81
GROUP NO. 37 CARS NO 6601-6670

ETCH OF ACCIDENT DAMAGE.

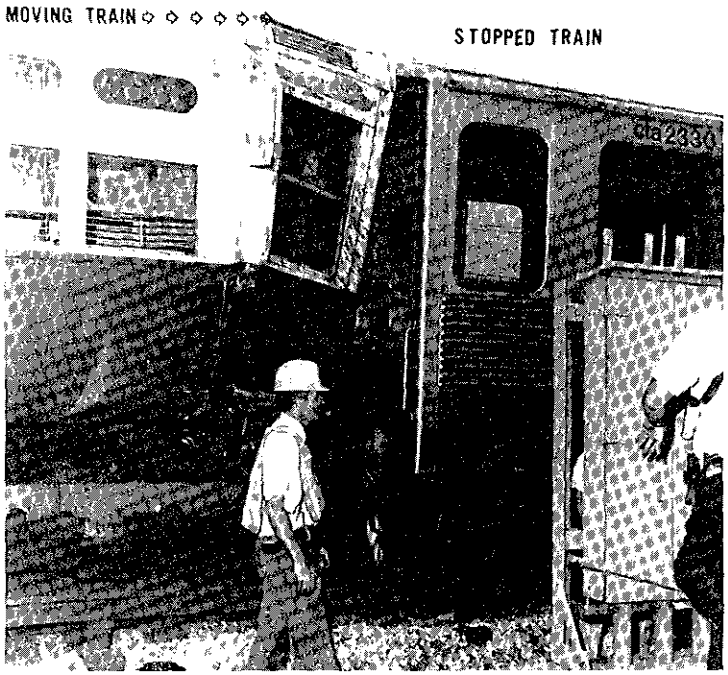


Figure 5.--Collision between last car (6647) of train 135 and first car (2330) of standing train 143.

against the left side of the seat. The inboard legs of the seat were loose and deformed outboard, and the floor under the seat was buckled upward 6 to 8 inches. Seven of the eight side doors could not be opened by hand. The No. 2 end door was partially jammed and could not be opened fully.

The No. 2 end of car 6648 that was coupled to car 6647 was damaged the most severely. The anticlimbers engaged and crushed the car 4 feet inward at floor level across the full width of the car. The sidewalls of the car flared outward 15 inches on one side and 16 inches on the other side. The crushed end of the car also was forced upward, causing the roof to bulge upward 16 inches. The right side of the car was crushed upward, and the left side was crushed inward and ripped open in the area of the first four seats. (See figure 6.) The first four seats on each side and the floor under them were destroyed. That part of the end frame to which the anticlimbers are attached bent downward, and the crushing caused the floor to split across the entire width of the car behind the third seats and buckle upward 53 inches. (See figure 7.) The end windows adjacent to the first seats were out; the end door was jammed and would not open. The No. 1 end of car 6648 retained its basic structural integrity and was not crushed inward; there was only slight damage to the anticlimber. There was no examination of the structural members to determine whether any of the members had deteriorated.

There was no observable damage to the exteriors of the other cars of train 135. There was slight interior damage to cars 6667 and 6647, but no observable damage to cars 6548, 6668, or 6568.

Figure 6.--East side view of crushed end of car 6648. Note upward bend of roof and upward crushing of floor under the passenger seats.

Figure 7.--End of car 6648 that was coupled to car 6647. Note buckled floor and ceiling.

Train 143.--The top edge of the roof of car 2230 that was struck by train 135 was deformed rearward 2 to 3 inches, and the windows in the end of the car and in the end door were cracked. The anticlimber was dented slightly. The floor of car 2230 was buckled slightly. The door to the motorman's compartment could not be opened fully because of the buckled floor, and the window in the compartment door was broken. The motorman's seatback was broken. The left-front window and the center window between the two right-side doors were cracked. There was no observable damage to the other seven cars in train 143.

Track Information

The accident occurred on the CTA's west-northwest route, which extends from O'Hare International Airport southward to downtown Chicago. The west-northwest line is composed of a southbound and a northbound track, each paralleled by a third rail which supplies the traction power. The station at Montrose Avenue is located between the northbound and southbound tracks, just north of the Montrose Avenue overpass. (See figures 1 and 3.)

The track grade through Montrose Avenue Station southbound is 0.5 percent ascending, and at the south end of the station platform, it increases to 3.1 percent ascending for about 1,300 feet. Leaving the station platform, a southbound train enters a 579-foot, 2-degree curve to the left. There is no obstruction to a motorman's view from the beginning of that curve to the apex of the 3.1-percent grade. (See figure 2.)

The third rail supplies 600 volts direct current propulsion power to the trains through conventional sliding current collector shoes on each truck. The third rails have protective circuit breakers that are activated instantaneously when the third rail circuit is overloaded. When the fault-detection device which monitors the system detects no fault after the circuit breakers actuate, the circuit breakers will close again in 8 seconds. If a fault persists for more than 30 seconds, the circuit breaker will lock open and power will remain off.

Method of Operation

Trains are operated on the west-northwest line by signal indications of an automatic block signal system, cab signal indications, bulletin orders, and CTA's "Rail System Rule Book" effective June 1, 1982. Maximum authorized speed is 55 mph.

The motorman is the employee in charge of the train and directs the conductor in matters involving train operation and troubleshooting. The controller directs the movement of trains from CTA's Control Center. He communicates with motormen and conductors by means of a radio on a frequency assigned to rail operations. Although it is not prescribed, operating employees can switch to another available frequency in emergencies. The motorman is required by Rule 9.12 (see appendix B) to notify the controller when a train stops because of a defect and to follow standard troubleshooting procedures. Rule 8.7.4 requires a motorman, when it is necessary to leave his cab, to secure the train against moving and remove the reverser key. The rulebook instructs rail employees to remove the 600-volt third-rail power ". . . whenever it is necessary for the protection of life or property" by communicating with the controller. The controller instructs the power controller to remove the power, usually based on information from the site of the trouble.

Personnel Information

Train 135 Motorman.--The motorman was employed by the CTA as a conductor and worked at that position for about a year before being promoted to motorman. He had worked as a motorman for about 13 years. The motorman first qualified as a conductor by taking the regular conductor training and then by taking the familiarization trips and additional line instruction before going out with an instructor to qualify as a motorman in the actual operation of a train. Training on troubleshooting and emergency response to accidents were included in the motorman's qualification training.

The motorman stated that he was feeling well at the time of the accident. During the week of the accident, the motorman's work hours were fairly constant; he was off on Tuesday and Wednesday and had been on duty about 4 hours when the accident occurred. The motorman's sleep pattern was normal, and there was nothing unusual about his meals.

The motorman's employment record indicates that he was reprimanded once for an operating infraction in 1976 and had been retrained as a result. He has received several commendations and, in one instance as the result of a performance review, the superintendent wrote that the motorman ". . . is considered an outstanding employee, reliable and dependable."

Train 135 Conductor.--The conductor was a college student who was working his third summer as a full-time temporary employee. He received the same instruction and qualified in the same manner as a regular full-time conductor. After the first summer, he was given 1 day of refresher training and then was administered a refresher qualification at the beginning of each summer that he returned. There was nothing remarkable about the conductor's work record.

Train 143 Motorman.--The motorman was hired by the CTA about 11 years before the accident and had worked for about 7 years as a motorman. He had worked as a conductor, a flagman, and a switchman. He was trained and qualified for the motorman's position in the same manner as the motorman on train 135. He had received several commendations for good performance.

Medical and Pathological Information

A 60-year-old male passenger who was sitting in the crushed end of car 6648 on train 135 was killed by massive crushing of his lower body. Of the 47 other passengers taken to hospitals, 4 were admitted. The most seriously injured person suffered a cerebral concussion and cervical strain. Another hospitalized passenger suffered a dislocated lumbar vertebra. Forty-two passengers were treated at hospitals and released the day of the accident. Almost half of the injured passengers complained of cervical strain. Other injuries included nasal bone fractures, facial lacerations, bruised knees, bruised ribs, and muscle spasms of the back and shoulders. One passenger was not injured.

Eight passengers recalled that their heads, faces, and upper bodies struck the horizontal metal bars across the tops of the seats in front of them. Two passengers contacted the vertical stanchions that extended from the floor to the ceiling.

About 2 hours after the accident, blood and urine samples were taken from the motorman of train 135 and screened for a variety of drugs, including amphetamines, tranquilizers, barbiturates, opiates, quinine, and alcohol. All results were negative.

Motormen are required by the CTA to undergo an annual physical examination. The examination assesses reflexes, height, weight, blood pressure, pulse, visual acuity, color and depth perception, and hearing. The examination also includes a scheduled urinalysis and an external examination of the body. According to a physician with the CTA's medical department, the CTA follows U.S. Department of Transportation (DOT) guidelines in determining which medical conditions are considered disqualifying.

When an operating employee has been off because of illness or other medical reasons for more than 7 calendar days, the employee must be cleared by the Insurance Department and then sent to the Medical Department. A CTA doctor examines the employee and decides whether he/she can return to duty. 6/

The motorman of train 135 was examined last by the CTA on November 3, 1983. As a result of that and other examinations, the motorman was required to wear glasses on duty. The examining physician commented "Inter(val) Hist(ory) essent(ially) neg(ative)." The motorman was found to be "fit as m/m (motorman)."

The motorman of train 135 had been diagnosed in 1950 as having Hodgkin's disease. On his initial employment application with the CTA in 1968, the motorman listed under "surgical operations" surgery on his lymph node. His CTA medical records include disability claims for surgery on lymph glands in 1980. His physical examination on July 21, 1981, noted "Biopsy of lymph gland of neck April, 1979. Revealed lymphoma - treated by X-rays." In April 1979 and again in March 1984, the motorman was operated on for removal of lymph nodes which were described as malignant lymphoma, diffuse, lymphocytic type. The motorman has been under treatment as needed, and from 1979 he has been under the care of a physician. Since March 1984, the motorman has been administered a variety of drugs as part of a standard chemotherapy regimen. From March 1984 through the day of the accident, the motorman had been given a combination of chemotherapy agents, including vincristine, prednisone, cyclophosphamide (cytoxan), and cimetidine (tagamet). The particular drugs that were administered to the motorman are reported to have possible side effects of relevance to the duties of a motorman. These can include: 7/

> Vincristine: Difficulty in walking, headache, jaw pain, weakness, pain in fingers and toes, drooping eyelids, double vision. Progressive neurotoxicity develops after two months of treatment and may persist for several days to several months.
>
> Cytoxan: Swelling of feet or lower legs, joint pain.
>
> Prednisone: Mood or mental changes, muscle weakness, decreased or blurred vision. . . .
>
> Cimetidine: Mental confusion, unusual tiredness or weakness.

6/ CTA Administrative Procedure 131, effective July 18, 1984.
7/ United States Pharmacopoeia Drug Index, Rockville, Maryland: United States Pharmacopoeia, 1983.

In April 1984, the motorman's personal physician wrote a letter to the CTA giving the opinion that the motorman was physically capable of returning to work in April 1984. That letter provided no specific information on the precise nature of the motorman's illness or information on the types and dosages of medication prescribed for him. The CTA accepted that opinion with no direct written or oral followup communication with the motorman's physician to learn more about his physical condition or to determine details about medication he was taking.

Because the records of an employee's medical history were separated between the medical department and other CTA units, a CTA physician might not get a complete medical history of an employee by looking only at those records in the medical department. Chronological summaries are kept in the medical department; however, there were no established procedures to ensure that the CTA medical department was informed fully of all the information which the CTA had about an employee's physical condition and medical history. Moreover, there were no procedures either to require an employee to inform the CTA of existing physical conditions that might diminish safety for the CTA or to obtain medical information from an employee's physician after the CTA became aware that an employee might have a physical problem. For example, the letter of April 1984 from the motorman's personal physician was not filed in the medical department but in the insurance department.

Because of the possible side effects of the drugs that were administered to the motorman and their potential relationship to the motorman's performance on the day of the accident, the Safety Board requested that the motorman be given a complete neurological examination and assessment. The examination was conducted on September 10, 1984. In his written report to the Board, the neurologist concluded:

> . . . this man has a mild, predominantly axonol polyneuropathy, most likely secondary to vincristine that was administered during the treatment of his lymphoma. I find no evidence of active neuorological disease or illness likely to impair his consciousness. Although his polyneuropathy has produced a mild sensory impairment, I think it is unlikely that this would have interfered in any way with his performance of his duties at work.
>
> There is no evidence that either of these drugs (prednisone and cimetidine) impaired . . . (the motorman's) performance, though such phamarmocological influence cannot be ruled out.

Although the CTA prohibits by rules and directives the use of alcohol or any drug which alters employee alertness or reaction time while operating personnel are on or subject to duty, the medical director did not believe it was practical to publish guidance for them about which drugs to avoid while on or subject to duty because the drugs are so numerous. The CTA's medical director testified:

> The employee has to make some judgment about whether this medication is affecting them (sic) in some fashion and if it is affecting them they either have to make a decision about talking to their doctor about these effects. . . . we are assuming that employees or patients in society have made certain judgments about how common medications may or may not be affecting them.

Survival Aspects

The first indication that the controller had that all was not normal was a call from the motorman of train 135 at 4:59:58 p.m., advising that the train had rolled back and might have struck the train behind. At 5 p.m. the third-rail power on the southbound track was interrupted by the derailment at 5 p.m. Just before 5:01 p.m., the motorman of train 135 confirmed that his train had struck the train behind. The controller said he called an ambulance at 5:02 p.m. or 5:03 p.m., and the deputy district chief of the Chicago Fire Department said that a box alarm was made at 5:04 p.m. At 5:04 p.m., the motorman told the controller that a man was trapped in the seventh car and that ". . . we need some help as soon as possible." When a CTA supervisor, who had arrived at the scene moments earlier, advised the controller that ambulances were needed, the controller told him that they had been requested. At 5:07 p.m., the supervisor requested that the power be removed on the southbound track because passengers were detraining. At 5:08 p.m., he requested that power also be removed on the northbound track. At 5:09 p.m., the controller advised all units concerned that the power was off in both directions from Jefferson Park to Irving Park. He did not remove the third-rail power earlier because he did not have sufficient precise information to ensure that he would remove the power at the proper location.

The Chicago Fire Department has in effect incident command procedures and mass casualty plans for use by its Emergency Medical Service (EMS) units. The EMS two-level response plans are based on the level of need for personnel and equipment. EMS Response Plan I 8/ is initiated when the onscene incident commander perceives the need for EMS assistance. EMS Response Plan II is implemented when the incident commander determines that additional personnel and equipment are needed. EMS Response Plan II was not implemented at this accident. Both plans establish procedures to be used during mass casualty emergencies and are well developed and extensive. About 5:07 p.m., an officer from the EMS arrived onscene and initiated EMS Response Plan I at 5:10 p.m. The fire department was onscene with four engine battalions, three ladder trucks, two equipment trucks, one triage van, five ambulances, and one volunteer support vehicle. A total of 10 firefighters, 10 paramedics, and 7 staff and command officers were also present within that time, and some additional fire police and EMS units arrived a few minutes later. A fire department command post van was in place within 10 minutes. Communications was established with the Illinois Masonic Hospital, as required by the EMS Response Plan I. The victim trapped in the seventh car was extricated and taken to a hospital. All cars were searched and those passengers who required it were moved to triage areas on stretchers. A total of 47 passengers were processed through the triage areas and transported by ambulances to five area hospitals designated by the Illinois Masonic Hospital. The EMS Response Plan I was ended at 6:07 p.m.

The CTA has no separate emergency plan. The CTA and the fire department had held two disaster drills within the year before the accident. The senior fire department officer in this case said that interagency communications between CTA and the fire department were good.

8/ EMS Response Plan I is: "Request for assistance for fire suppression and EMS personnel necessary to effectively treat and transport a number of seriously ill/injured persons."

Tests and Research

On August 24, 1984, tests were run to determine the train brake holding ability on the grade in various scenarios and the possible speed of impact. It was not the intent of the tests to simulate the scenario of the accident. The test train consisted of the original six lead cars from train 135 and two replacements for the last two cars which were similar to those involved in the accident. The length of the test train was about 390 feet. Since train 135's stopping point on the grade on the day of the accident could not be determined precisely, a point 1,022 feet from the impact point was selected as a point of reference for the tests.

A test was conducted to determine whether the friction brakes would hold the train on the grade. The train was moved up the hill about 1,022 feet from the point of impact and stopped normally with dynamic and friction braking. After the train stopped, the motorman placed the controller in the B-3 position. The train remained stationary.

The second test was to determine whether the track brakes would hold the train on the grade. The brakes were released and the train was allowed to coast a short distance. Then the track brake button was depressed and held. The track brakes functioned on all eight cars and stopped the train. With the train stationary, a test was run to determine how many brakes must be operative to hold the train on the grade. The brakes were cut out on one car and the train remained stationary, but when the brakes were cut out on a second car, the train began to drift downgrade. The train continued to roll down the grade with full friction brakes applied on the six original cars. After stopping the train, the brakes were cut back in on one of the two cars and full friction brakes were applied on seven cars. With full friction brakes on seven of the eight cars, the train stood without movement.

A series of tests involved manipulating the controller between power and brake positions. As the train was moving up the grade, a passenger door was opened which resulted in a shutdown of motive power, and the train stopped. The door was closed, then the operator moved the controller from power to brake and back to power several times and the train began to roll backward. When the alternating movement of the controller between power and brake was stopped and the controller was left in the B-3 position, the train stopped. The train was stalled by opening a door to closely approximate the actual stopping of train 135; there is no evidence that anyone opened a door on train 135 as it was moving up the grade on the day of the accident.

Tests were made to determine whether an emergency brake application would stop the train after it had been drifting downhill for a length of time comparable to that required for the motorman of train 135 to return to the operating compartment and take control when he left the cab, as he did on the day of the accident. The train was moved up the grade and stopped at a point near the crest of the grade. The train was allowed to drift 550 feet and then the brakes were applied in emergency by moving the controller handle to the B-4 position. The train traveled the 550 feet in 35.5 seconds and after the brake application, the rear end stopped short of the original impact point. The 550-foot drifting distance was selected because that is about the maximum distance that the train can coast and still be stopped short of the impact point with emergency braking.

The final test was performed to determine possible impact speeds. The train was moved up the incline to the original stopping point and was allowed to drift without brakes to the impact point. Using a radar gun, an Illinois State policeman measured the train's speed as its rear end passed the impact point. In three tests, the rolling time varied from

39.9 to 41.2 seconds; the speeds varied from 20 to 21 mph. Throughout these tests, the train was rolling without brakes; train 135, on the other hand, began its roll with brakes applied on at least six cars.

Other Information

Communications.--The motormen of both trains experienced difficulty in communicating with the controller during the critical period immediately before and after the collision because of interference by other users on the same frequency. The CTA's records indicate that operating personnel frequently have difficulty trying to communicate with the controller during emergencies. The motorman of train 135 testified that, during his career, on at least three separate occasions he tried unsuccessfully to contact the controller during unusual occurrences. There have been other instances of poor communications between train operating personnel and the controller. For example, on January 9, 1976, two CTA trains collided at the Addison Street Station. In its investigation, the Safety Board found that ". . . the train phone did not operate reliably and it failed to provide the necessary communications with the controller on the morning of the accident." In addition, communications between the motorman and the conductor depend upon the limited number of messages that can be transmitted by a buzzer system. In order to talk directly, they must meet. The CTA discourages motormen and conductors from using their portable radios for intratrain communication except during emergency situations, even on 6,000-series cars which do not have permanently installed radios. CTA's Manager, Operations, Training, and Instruction testified that:

> We do not encourage them to have dialogue between one and the other on the radio. . . . they are required to communicate the problem to the controller. If they do that, then the other would hear and know that there is a problem.

Training.--Motormen must be qualified as a conductor and then a flagman before they are eligible to be trained as a motorman. Motorman training consists of about 10 days of initial classroom training followed by 45 days of subsequent instruction on trains in train operations and route familiarization. In the first 10 days, students are taught signals, single-track operations, fundamentals of electricity, equipment structures and systems, malfunctions and troubleshooting, operating rules, train operations, and yard, tower, and control operations. (See appendix C.) Students are given quizzes on the topics and must pass the quizzes to progress. There is no established fail/pass score; however, students who do not answer all questions correctly are given remedial instruction and then readministered the quiz. This process is repeated until the students pass the quiz.

After the initial 10-day training, students must complete about 20 trips over prescribed routes with line instructor motormen who evaluate the students after each instructional session. Following successful completion of the trips, students can schedule their qualification rides with their instructor. After successfully completing the qualification ride, students are certified as motormen.

Motormen are checked at regular 3-month intervals by a motorman instructor during actual operations. If difficulties are found in the reinspection rides, motormen are given additional training as needed. Motormen are given additional materials to read as

new equipment, procedures, or techniques are introduced. After successfully completing initial training, neither motormen nor conductors are tested formally on the operating rules or tested for knowledge and understanding of new standard operating procedures.

Motormen are not given initial or recurrent training involving actual or simulated emergency procedures. They do not practice emergency procedures in train operations, but they do discuss and are presented with written and oral material on troubleshooting procedures. No initial or recurrent training is given on first aid or recognizing and responding to incapacitated passengers. Motormen and conductors are provided the following guidance, in CTA rule 2.5.2, on dealing with ill or injured passengers:

> When a passenger is ill or injured, the controller must be notified and the controller will determine what action should be taken. Employees must not leave ill or injured passengers alone.

Conductors are trained over an 8-day period. The first 2 1/2 days consist of instruction in conductor duties and responsibilities, fare structures, transfer schedules, announcements, daily record maintenance, introduction to signals, outside light indications, and door operations. They are shown how to operate the fire extinguishers but do not practice operating them. They are also given tours of the yard and control center. Then conductors are given 2 1/2 days instruction in line operations. Following the line operation instruction, 1 day is spent in review and students are administered quizzes on buzzer signals, fare structure, transfers, daily records, and general information. They must pass each quiz, after which they receive an additional day of instruction in line operations. Then 1 day is used for the qualification ride. (See appendix D.)

Full-time temporary employees initially are given the same instruction and must qualify under the same testing procedures as permanent employees. After the first summer, they are given 1 day of refresher training and then administered a requalification ride the next day.

Neither conductors nor motormen receive instruction in first aid. They do not practice evacuation procedures and are not given instruction in motorman-conductor communications.

Safety Department.--The CTA's Manager of Safety testified that he has the responsibility for overseeing the safety of the CTA transit system. The CTA's safety department investigates accidents and incidents and makes recommendations to the department managers for corrective action. The safety department collects accident data and makes regular systematic analyses of rail accidents, in conjunction with other departments, to identify underlying hazards to system safety. The safety department is afforded the opportunity to review plans and specifications for new operations and equipment as an oversight function and can recommend changes as deemed appropriate. It accomplishes changes through other departments and does not interact directly with operating employees.

At the hearing following this accident, the Manager of Safety testified that he reports to the Deputy Executive Director of Administration. He has no line authority over any of the operating or maintenance units. In response to questions, the Manager of Safety testified further that he was ". . . not aware of any weakness in the training and testing program for operating personnel," and that he has never had "problems or concerns" with the CTA medical department.

No independent agency exercises safety oversight over the CTA. The Chicago Regional Transit Authority has authority under its charter to regulate and control the CTA, but at the time of the accident, it was not exercising that authority. The Urban Mass Transportation Administration (UMTA) of the DOT has authority to investigate conditions in any facility, equipment, or manner of operation financed under the Urban Mass Transportation Act of 1965, as amended, which the Secretary of Transportation believes creates a serious hazard of death or injury. The Secretary may withhold further financial assistance until the local public body implements a plan for correcting or eliminating such condition. UMTA has done only one safety investigation and no accident investigations under that authority.

ANALYSIS

The Accident

Tests conducted at the accident site after the accident showed that an eight-car train with the friction brakes set on six cars and cut out on two cars will drift down the 3.1-percent grade; however, the train will remain standing on the 3.1-percent grade with the friction brakes applied on seven or more cars. Therefore, when the motorman of train 135 removed the master controller key before leaving the operator's cab just before the accident, the train would have remained stationary because the friction brakes would have been applied on all of the train's eight cars. The train could not have drifted downhill unless the brakes were released on at least two of the eight cars in the train. The only way to cut out the brakes on a car without mechanical manipulation of the brake rigging is to pull the seven-point switch.

The conductor testified that he thought he was in the seventh car when the train began to drift downhill. The Safety Board believes that as the train left Montrose Avenue Station and the conductor noted the "yellow dynamic" light illuminated on the seventh car, he went back and pulled the seven-point switch as the motorman had instructed him. When the train stopped, the motorman, who had noted a "yellow dynamic" light illuminated on the second car, removed the master controller key, locked the compartment door, and went back to the second car to cut out the brakes. The Board concludes that the motorman pulled the seven-point switch on the second car after the conductor had pulled the switch on the seventh car, and the train then began to drift downhill. Even if the motorman had noticed immediately the train's downhill motion and had reset the seven-point switch, he still faced having to return to the operating compartment at the south end of the first car, unlocking the door, reinserting the master controller key, and applying the brakes in order to obtain braking on seven cars.

The motorman's description of his manipulation of the master controller, his testimony and that of others that the train accelerated until it struck the standing train 143, and the degree of damage, all suggest that the motorman failed to reestablish any braking after the train began to roll backward. The motorman's rapid movement of the controller alternately from power to brake and back again probably resulted in an inadvertent release of the brakes on all cars. The indications are that the motorman never reestablished braking on the train before the collision.

Tests run after the accident indicate that if the motorman had returned to the control compartment and applied the brakes in emergency within 35 seconds, the train would have stopped short of the collision. Even if he had not applied the brakes within 35 seconds, had he moved the master controller to the B-4 position, the friction brakes

and track brake would have applied and would have provided the maximum available retardation. Even though that amount of retardation may not have been sufficient to stop the train short of the collision, the speed of impact would have been reduced. Consequently, the severity of the injuries and damage probably would have been significantly less. An alternative would have been to apply the track brake by pushing the track brake button and holding it in.

The manner in which the motorman manipulated the master controller after the rollback started indicates that the motorman's training and experience had not developed the level of skill required to operate the train safely in abnormal circumstances. Allowing the train to stall on the grade suggests that the motorman was preoccupied with troubleshooting the dynamic brake malfunction and did not apply enough power to continue the train's movement up the grade. Another indication of less than effective training was the motorman's failure to notify the controller, as required by CTA rules, that train 135 had stopped and that he was leaving the cab to troubleshoot. However, the failure to notify the controller did not contribute to the collision.

The actions of the motorman of train 143 did not contribute to the accident. He did not have enough information about what was happening to train 135 to take any action that would have ameliorated the effects of the collision any more than he did.

Communications

Communications between the motorman of train 135 and the controller were poor. When the motorman initially contacted the controller on the radio, he could not establish clear, effective communications with the controller because of interference by other users on the same frequency. The motorman of train 143 had similar trouble contacting the controller after the collision. There were no CTA procedures for clearing the air of nonessential traffic during the emergency or for switching to a discrete emergency frequency. Moreover, since supervisors have discouraged their use as intercoms, the portable radios were not used by the motorman and conductor to clarify between them what had happened and to coordinate their activities. The manner in which the motorman and the controller used the communication system suggests the need for better procedures and better training of employees in the use of radio for train operation and in emergencies. Further, the history of the difficulties by CTA operating employees in establishing communication with the controller precludes Rule 2.5.2 from being effective. It reads:

> In case a passenger is ill or injured, the controller must be notified and the controller will determine what action should be taken. Employees must not leave ill or injured passengers alone.

Postaccident Activities

The testimony of the controller suggests that CTA policy is to await complete, precise information from the scene before deenergizing the third rail. The uncoordinated activities of the several CTA operating employees on the two trains immediately after this accident indicate the need for better procedures and practices for handling third-rail power in emergencies. The unloading of passengers into an area near third rails without first determining whether the third rail has been deenergized is not acceptable. Generally, passengers are ignorant of the hazards of touching energized third rails.

Therefore, passengers must be kept separated from third rails until the power has been removed and confirmation has been received that power will not be restored without warning. The motorman of train 135 said that he was so preoccupied with briefing the passengers that he did not consider whether the third-rail power had been removed.

The ingenuity of the motorman of train 143 in acquiring a ladder to unload the passengers from train 135 facilitated the evacuation of those passengers. A systematic analysis of rail transit operations would have shown the need for a means to evacuate passengers when trains must be evacuated at locations away from station platforms. The logical result of that analysis would have been to provide means for passengers to get from the car to the track level. The sill steps on the sides of the cars are not a practical means of unloading passengers onto the roadbed. Some other transit systems carry ladders on the cars for this purpose.

The emergency response by the Chicago Fire Department and the CTA was timely and effective. The fire department division chief initiated the EMS plan, quickly assigned responding units and called for additional units as needed, called for third-rail power shutdown, and maintained positive control over all working elements using incident command procedures. The fire department successfully established communications with the Illinois Masonic Hospital in conformity with the emergency preparedness plan and routed the injured to the designated hospitals. The manner in which the fire department handled the emergency indicates the value of a plan in which the participants know their roles and are skilled in carrying them out. All emergency operations, including medical stabilization, triage, and transportation of injured persons were completed within 1 hour. Considering the environment and the number of passengers involved, this performance is commendable.

Medical Factors

Based on the neurologist's postaccident evaluation and subsequent testimony regarding the extent to which the motorman's lymphoma and chemotherapy agents may have affected his performance, the Safety Board believes that the motorman's health and medical care were not factors in the accident. The Board believes, nevertheless, that several medically related issues are raised by its investigation of this accident as to the ability of the CTA to monitor effectively the physical capabilities of its operating personnel. CTA officials knew the general nature of the motorman's illness, but they were not aware of its progress, the medications taken, and the dangers and effects they may have had on his coordination and decisionmaking ability. CTA officials did not communicate directly with the motorman's physician to determine the progress of his illness or the types and dosages of his medications. The Board believes that the failure of the CTA to follow up on the nature of the motorman's illness and its treatment indicates deficiencies in supervisory and oversight functions. The Board is concerned that the CTA employed no mechanism to verify that an employee is capable of performing his operating duties safely when his physician indicates that the employee can return to work. If there had been a high probability of impaired safety due to the motorman's condition and medications, the CTA would not have detected the problem. The Board notes that the CTA now has an administrative and medical procedure to screen employees for return to active duty from sick leave.

The CTA medical department should go beyond the mere documentation of a diagnosed illness to a subsequent thorough followup determination of operating personnel's capabilities to perform safely on the job. The medical department, without direct followup communications with the motorman's physician, was not aware of the physician's knowledge of the physical and behavioral requirements of a motorman, the particular medications that had been prescribed to the motorman, and the effect of these medications on his abilities to meet these requirements.

Testimony of the CTA's medical director indicated that records of the medical examinations of the motorman by the CTA medical department were maintained in one file while correspondence from his personal physician was in another file maintained in a different department. Moreover, no mechanism was in place to ensure that the medical department was informed of the contents of the communication from the physician. Perhaps it was as a result of the dual file system that the CTA medical director failed to learn of the specific medications that the motorman was using and their dosages.

The CTA's lack of awareness of the nature of the motorman's treatment and medication is indicative of a weakness in its medical monitoring of employees. The Safety Board believes that the CTA should monitor the prescribed medication that its operating personnel use to ensure that their known side effects do not contraindicate their assignment to their usual duties. The Board cannot understand the reasons for the CTA's assumption, implied in the medical director's testimony, that all physicians prescribing medications fully inform their patients of potential or likely side effects. In point of fact, not all physicians inform their patients, and as a result, many patients are not aware of what effects to anticipate. Moreover, even knowing the side effects, some employees might be prone to continue to work. The burden for the necessary monitoring falls on the CTA and not on the personal physicians of the operating personnel because many physicians do not know the specific on-the-job physical and behavioral skills required of operating employees. Therefore, it is important in the case of employees with safety-sensitive duties that employers such as the CTA have a mechanism to review with an employee's own physician his medications, their dosages, and the side effects.

The Safety Board believes that the CTA should also assist its operating personnel in becoming aware of the adverse effects of certain over-the-counter medications on their performance. The Board does not agree with the logic of the director of the CTA's medical department in testifying that the number of pharmaceuticals available and their possible side effects are so numerous as to preclude developing guidance for its operating personnel on the drugs to avoid while on, or about to be on, duty. Such an attitude about the potential hazards of these drugs assumes that operating personnel will be knowledgeable about the effects of medications they are taking, both over-the-counter and prescribed, an assumption without scientific basis. 9/

The Safety Board believes that it is a relatively simple task to develop a list of classes of commonly used substances that operating personnel should avoid. Antihistamines, for example, are widely available over-the-counter and often used by individuals with colds and allergies. Yet antihistamines are known to have adverse effects on the performance capabilities of pilots, automobile drivers, and other vehicle operators. However, it is unrealistic for the CTA to expect its operating personnel to be aware of the side effects. These medications are advertised in a variety of media, without mention of the side effects. They contain warning labels, but these are often in small print and

9/ Consensus Conference: Drugs and Driving, New York City, December 12, 1984.

sufficiently vague to preclude their being widely noticed and adhered to. The Board believes that the CTA should both educate its operating personnel on the dangers inherent in the use of specific classes of over-the-counter drugs and prohibit their use while on duty or at any time when their use might affect performance on duty. The CTA also should require its operating personnel to inform management of the use of any prescribed medication. In addition, the CTA should monitor the performance capabilities of all personnel taking such medications.

Training

The motorman encountered a routine malfunction of dynamic brakes which he knew how to troubleshoot. His attempting to troubleshoot the problem while ascending the 3.1-percent grade escalated a routine mechanical malfunction into an emergency situation. When the train stopped on the grade, his failure to inform the controller that the train was stopped was a violation of the CTA's operating rules which state explicitly that the controller should be notified when a train is stopped. The motorman compounded the problem by leaving the operating cab while the train was standing on the main track on the fairly steep grade. The Safety Board believes that the motorman's poor decisionmaking and his failure to adhere to the CTA's operating rules can be attributed, in part, to deficiencies in the CTA's training and assessment program for its operating personnel. Any deficiencies in functioning under stress could have been identified and improved by training the motorman in responding to abnormal circumstances and emergencies.

The CTA trains its new rail operating personnel, mostly motormen and conductors, in the rudimentary skills needed to perform their normal duties and responsibilities. Although the curriculum appears effective in teaching operating personnel basic routine operating procedures, it provides little opportunity to motormen and conductors to deal with abnormal and emergency procedures. While troubleshooting is covered, motormen and conductors receive no training in responding to unexpected emergency situations which could give them the skills needed to cope rationally and calmly with the unexpected. As a result, when the motorman of train 135 encountered the unexpected rollback and emergency, he had no training and little experience on which to base decisions. In addition, this training would provide the CTA with the opportunity to assess how well employees are responding to the unexpected.

The motorman had not been taught to deal with a comparable situation, he had not been required to demonstrate his ability to respond to the situation, and he had not been trained to make decisions under the stressful circumstances he faced before and during the accident. The CTA's system of checking motormen in standard operating practices at regular 3-month intervals is fairly effective in assessing performance under routine or normal conditions; however, under these conditions, decisionmaking is not ordinarily at issue, and no stress, other than the instructor's physical presence, is deliberately placed on the motorman. Accordingly, the CTA has no way of determining how the motorman will react in stressful situations. Moreover, because of the way they are carried out, these inspection rides evaluate only routine motorman operating practices. Inspection rides without periodic retraining for proficiency are not sufficient to maintain a motorman's skill at an effective level. The Safety Board believes that the CTA should expose its operating personnel, at regular intervals, to realistic abnormal and emergency-type scenarios requiring nonroutine responses under stress, and it should assess operating personnel's ability to respond in those situations.

The CTA, in addition, does not formally and systematically test its employees to assess their knowledge of operating rules and procedures. Operating personnel are expected to carry the CTA rulebook while on duty and to be familiar with its contents as well as all standard operating procedures. However, with the exception of the quizzes during their initial training period, the CTA does not test their operating personnel periodically on their knowledge of the operating rules. The CTA, therefore, has no formal method to determine if its personnel have kept current on the rules after they first qualify for their assigned duties.

The conductor of train 135 was a full-time temporary employee (FTT) employed by the CTA during his summer vacation from college. The program of employing college students as FTT's assists the CTA in replacing personnel during the summer, when many regular employees take their vacations. The FTT initial training is the same as that of the permanent conductors. The Safety Board believes that this training, as with initial motorman training, is adequate insofar as it provides personnel with a foundation in normal and routine operating procedures. The CTA has recognized the need for recurrent training for FTT's to bridge the 9-month hiatus in which they are away from the job, and it has developed a 2-day program in which each FTT participates every year before beginning the subsequent CTA summer employment.

The conductor routinely is the first CTA employee that passengers come in contact with, and in accidents such as this, passengers look to the conductor for assistance and direction. Therefore, the Safety Board believes that the time devoted to training and practice in emergency procedures in the FTT recurrent training program should be expanded. This topic currently is covered in a classroom setting, within the overall session devoted to general operation and standard operating procedures, and shares time in a 4-hour session with two other topics: fare structures and transfers. (See appendixes C and D.) As a result of the varied number of topics covered in the limited time period, the Board believes that the time devoted to training in emergency procedures is inadequate to prepare an FTT to respond to an emergency effectively and to deal with passengers properly, and therefore, the time should be increased.

Motorman/Conductor Communications

The Safety Board believes that motormen and conductors should not be discouraged by the CTA from using their portable radios for intratrain communications during emergency situations, particularly in the case of the 6,000-series cars that do not have permanently installed radios, unless some communications procedure is substituted. Based on the testimony of the CTA Manager, Operations, Training, and Instruction, the CTA assumes that motormen and conductors will have no need to exchange time-critical information. It also assumes that the operator-controller frequency will be clear of transmissions by operating personnel of other trains at the time that an emergency occurs. These assumptions are not borne out by the findings in this investigation.

In 1976, the Safety Board identified a similar deficiency in communications in its investigation of the CTA accident at the Addison Street Station. 10/ As a result of its investigation, it issued Safety Recommendation R-76-38, which urged the CTA to

10/ Railroad Accident Report--"Chicago Transit Authority Collision of Trains No. 104 and No. 315 at Addison Street Station, Chicago, Illinois, January 9, 1976" (NTSB-RAR-76-9).

> Insure that the train phone system provides dependable, reliable and backup communication for operational control and that proper procedures are in effect to provide emergency warnings and instructions.

In response to the recommendation, the CTA wrote

> Maintenance procedures have been intensified for both carborne and wayside train phone equipment. A survey of signal strength has been made over trackage. This has led to the installation of additional wayside equipment. More train phones are being acquired to provide a greater reserve of spares. Additionally, a radio system is being designed to supplement the existing train phone system which operates over the electrified power rail.

The Safety Board classified the CTA response to the recommendation, which addressed only additional radio and communication equipment and did not address procedural changes to rectify the problem, "Open--Unacceptable Action" because the recommendation calls for more than just hardware. For example, in this accident, the absence of procedures to use available radios and frequencies in the emergency resulted in poor communications between traincrews and the controller at a critical time.

The Safety Board believes that this accident points to the need for a procedure to ensure that immediate communication is always possible between a motorman and a conductor irrespective of the type of train or radio equipment used. The Board reiterates Safety Recommendation R-76-38 and urges the CTA to provide backup communications to "provide emergency warnings and instructions." The Board believes that the CTA should formulate procedures to use the available frequency as a discrete frequency for communications among operating personnel and the controller in emergencies.

Safety Oversight

The responsibility for monitoring and overseeing the various aspects of safety within the CTA lies with the CTA's Manager of Safety. In 1976, the Safety Board, in its investigation of the CTA's Addison Street accident, identified a number of weaknesses in the performance of the CTA's safety department. As a result of its investigation, the Board issued Safety Recommendation R-76-41 which urged the CTA to

> Develop the full potential of the Safety Department, involve it in all phases of the system operation including operations, design, maintenance, and training, and provide it with more than advisory authority so that it can require implementation of system safety programs.

The CTA responded to the recommendation by stating that the safety department was reporting directly to the CTA General Manager and that it was developing a comprehensive safety and system assurance study. The Safety Board classified the CTA's response to the recommendation as "Open--Unacceptable Action" because a change in organizational structure and initiation of a safety and system assurance study alone does little to improve the status and function of the safety department. The testimony of the Manager of Safety in the Board's public hearing held during its investigation of the Montrose Avenue accident indicates that the safety department currently is not a key element of CTA's safety program. Moreover, the Manager of Safety no longer reports to

the General Manager or Executive Director of the CTA but to the Deputy Executive Director of Administration. Although the Manager of Safety stated that his department conducts regular systematic analyses of CTA's rail accidents to identify underlying hazards to system safety, the hazards identified in this accident indicate that CTA's safety department has not developed its full potential. Therefore, the Board will place Safety Recommendation R-76-41 in a "Closed--Unacceptable Action" status.

Since the CTA is not subject to safety oversight by any outside agency, the Safety Board believes that this accident points again to the CTA's need for a rigorous internal program of safety oversight. The safety deficiencies that the Board uncovered in the investigation of this accident could have been identified by an active in-house safety department. The Manager of Safety testified that he was ". . . not aware of any weakness" in the program that tests operating personnel's knowledge of CTA rules and procedures. He testified that in his position as Manager of Safety he never had "problems or concerns" with the CTA medical department. He was unable to state whether he was satisfied that the communication between the motorman's personal physician and the CTA medical department was adequate or if the CTA medical department's own filing system, in which two separate files on the motorman's medical status were maintained in two different departments, was adequate.

The Safety Board believes that the CTA management must assign the safety department the responsibility for and give it the authority to carry out the following functions:

- o Continually identify the risks in the CTA transit system,
- o Assess them as to probability of occurrence and possible loss if they occur, and
- o Recommend preventive and corrective action to CTA management.

Then CTA management should make the appropriate decisions to produce the optimum safety results.

Crashworthiness and Injury Causation

Tests indicated that the speed of impact for an unretarded train could have been as high as 21 mph. However, during the first seconds of the rollback of train 135, brakes were applied on six cars for the period of time that it took the motorman to recognize that the train was drifting, return to the operating cab, unlock and set the master controller in forward position, and begin manipulating the controller. Therefore, the Safety Board concluded that the speed of impact of train 135 was less than 20 mph.

The deformation of all of the cars was as expected, except for car 6648, the second car from the rear in train 135. Although the manner in which the anticlimbers engaged afforded the No. 2 end of car 6648 a greater opportunity to crush, the damage was greater than a precrash analysis would indicate. The No. 2 ends of cars 6648 and 6647 were crushed inward 4 feet and 1 1/2 inches, respectively. The rearward collapse of the No. 2 end of car 6648 caused the 3/4-inch plywood floor to split across the entire width of the car just aft of the rear seat leg/floor attachment fittings of seats 3L and 3R. The fatally injured passenger was sitting in seat 4R. When the floor buckled upward 53 inches, his seat was forced upward and rearward. The modesty panel in front of this seat forced the seat and occupant into the side of the car.

The longitudinal impact forces were directed uniformly across the No. 2 end of car 6648 as evidenced by the 4-foot crush. The manner in which the anticlimbers engaged at impact bent the end of car 6648 downward, resulting in a crushing of the car which buckled the floor upward. The end of car 6647, which struck the stronger car 2230, was depressed similarly to the No. 2 end of car 6648, but the car was crushed only 14 inches. Moreover, the impact forces were just as uniformly distributed across the anticlimber of the No. 2 end of car 6647, but it deformed only 1 1/2 inches. Although the depressing of the end of the car accounts for part of the crushing, it appears that car 6648 had sustained weakening of some of its structural members which made it susceptible to failure under the forces in this accident.

Forty-two passengers were treated at hospitals and released the day of the accident. The most predominant injury was cervical strain, with almost half of the passengers complaining of this injury. Other injuries were nasal bone fractures, facial lacerations, bruised knees, bruised ribs, and muscle spasms of the back and shoulders. In the 6,000-series cars, the metal grab bars across the backs of the seats, the vertical stanchions that extend to the ceilings, and the unpadded side walls are obviously the injury-causing features. In two other CTA accidents 11/ investigated by the Safety Board, one involving 2,000-series and 6,000-series cars and the other involving the 6,000-series cars, the passengers were injured by these same interior features. The CTA is replacing the 6,000-series cars at the rate of about 10 cars per month with new cars being purchased from Transit America (formerly Budd Company). However, about 100 of the 6,000-series cars will be renovated and will continue in service. In view of the manner in which the No. 2 end of car 6648 crushed and buckled the floor, the CTA should examine the structures of those 6,000-series cars which it retains to ensure that they are entirely sound.

The new Transit America cars are designed to withstand a 200,000-pound force on the anticlimbers. The floor assembly is 3/4-inch plywood overlaid with stainless steel (0.15 inch), and underneath the plywood is fiberglass insulation covered with a stainless steel sheet so that the entire floor is encapsulated in stainless steel. The seats on these cars are equipped with metal grab bars and metal vertical stanchions similar to those found in the 6000-series cars. Although crashworthiness improvements (200,000- vs. 100,000-pound end loads) have been made in the newer cars, the same injury-producing features of the seats and vertical stanchions have been carried over. Consequently, passengers will continue to be exposed to needless head and facial injuries when accidents occur.

The CTA has chosen to install seats that are equipped with the metal grab bar for several reasons. First, the CTA believes that vandalism dictates that the materials the seats are constructed of be virtually indestructible. Second, the metal grab bar and metal vertical stanchions are needed for standing passengers and cannot be eliminated. The Safety Board has observed in the three CTA accidents it has investigated that passengers do strike the metal grab bars and vertical stanchions that are used as grab bars. Simple examinations of any CTA rail car will reveal that there is a considerable amount

11/ Railroad Accident Reports--"Chicago Transit Authority Collision of Trains No. 104 and No. 315 at Addison Street Station, Chicago, Illinois, January 9, 1976" (NTSB-RAR-76-9); "Rear End Collision of Two Chicago Transit Authority Trains, Chicago, Illinois, February 4, 1977" (NTSB-RAR-77-10).

of exposed metal in the form of the grab bars for passengers to strike. Also, given that most rail car accidents involve forward or rearward decelerations, it follows that passengers will be propelled forward or rearward into the seats and continue to be injured. The Board is aware also that there is a transit seat that is manufactured with an energy-absorbing frame and grab rail. The grab rail extends across the full width of the seat and is constructed of a tough, thermoplastic that is vandal-resistant. Another model of seat has a grab rail attached to the aisle side of a double transit type seat. The Board recognizes that vandalism of passenger seats can result in an expensive problem for the CTA. However, the CTA also has a responsibility to provide the public with as safe a ride as possible. Therefore, the CTA should provide the replacement cars with interiors that do not unreasonably expose passengers to injury in train accidents.

CONCLUSIONS

Findings

1. Under Chicago Transit Authority rules the crewmembers of both trains were qualified to operate the trains.

2. After train 135 stopped on the 3.1-percent grade south of the Montrose Avenue Station, the motorman removed his key and left the operating compartment to pull the seven-point switch on the second car because a "yellow dynamic" brake light on the car was illuminated.

3. When the train stopped on the grade, the motorman did not advise the controller as required that train 135 had stopped and that he and the conductor were troubleshooting.

4. An eight-car train consisting of the 6,000-series cars will stand on a 3.1-percent grade if the brakes are applied on seven or more cars.

5. While the motorman was in the second car, the train began to drift downhill because the brakes had been cut out on two cars.

6. After the motorman returned to the operating compartment, he manipulated the controls erratically in such a way that he probably released brakes that were set previously, and he failed to reestablish braking to stop train 135's downhill roll before it struck standing train 143.

7. Train 135 struck the standing train at a speed of less than 20 mph.

8. The fatal injuries to the passenger were the result of a failure of the structure of the No. 2 end of car 6648 and the resulting crushing of the passenger space.

9. None of the CTA employees on the trains requested the controller to remove power from the third rail before the passengers began to unload.

10. The passengers unloading from train 135 were not exposed to an energized third rail because the derailment had shorted the circuit and removed the power from the southbound third rail.

11. The actions of the motorman of train 143 did not contribute to the accident.

12. The illness of the motorman of train 135 and the side effects of medications he was taking to treat it were not causal factors in this accident.

13. The CTA was aware that the motorman was ill, but it did not determine the type and extent of medication the motorman of train 135 was taking.

14. The medications the motorman of train 135 was taking for his illness had side effects that could have adversely affected his ability to perform his duties; however, the evidence does not indicate that this occurred.

15. The CTA does not inform its operating personnel of the side effects of certain prescribed and over-the-counter drugs and discourage their use.

16. The CTA maintained separate medical files on the motorman: one was maintained in the medical department and one was maintained in the insurance department.

17. The CTA does not train its operating personnel in decisionmaking in emergencies and does not assess their responses under stress.

18. The CTA does not regularly test its operating personnel to determine the extent of their knowledge and understanding of operating rules and procedures.

19. The CTA does not conduct recurrent training of its operating personnel unless they have committed rule or operating infractions.

20. The CTA does not train its motorman and conductors in simulated emergency situations.

21. The CTA does not train its motormen and conductors together to respond jointly to emergency situations.

22. The CTA does not train its operating personnel in basic first aid.

23. The CTA discourages motormen and conductors from communicating with each other using their portable radios.

24. The CTA procedures do not call for the use of a separate radio frequency in emergency situations by the controllers, motormen, and conductors.

25. The deterioration of structural members of car 6648 may have contributed to the failure of its No.2 end.

26. Many of the injuries resulted from passengers striking exposed, unpadded metal parts, such as seatbacks and handholds.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the motorman of train No. 135 to apply the track brakes while the train was rolling downhill. Contributing to the accident was the failure of the Chicago Transit Authority to assure that the motorman was skilled in emergency procedures.

RECOMMENDATIONS

As a result of this investigation, the National Transportation Safety Board reiterates Safety Recommendation R-76-38 issued to the Chicago Transit Authority on July 8, 1976:

> Insure that the train phone system provides dependable, reliable, and backup communication for operational control and that proper procedures are in effect to provide emergency warnings and instructions.

Also, the National Transportation Safety Board made the following recommendations to the Chicago Transit Authority:

> Provide means for unloading passengers when emergencies require evacuation of trains at locations away from station platforms. (Class II, Priority Action) (R-85-88)
>
> Establish a medical record system which will provide the medical department with full, reliable medical records on operating personnel. (Class II, Priority Action) (R-85-89)
>
> Require the medical department to evaluate the types and dosages of prescribed medications taken by its operating personnel. (Class II, Priority Action) (R-85-90)
>
> Inform its operating personnel at regular intervals of the adverse effects of commonly used over-the-counter and prescribed medications on operating performance. (Class II, Priority Action) (R-85-91)
>
> Provide its rail operating personnel initial and recurrent training both in routine operations and in simulated emergency situations. (Class II, Priority Action) (R-85-92)
>
> Assess periodically the knowledge and understanding that operating personnel have of CTA rules and procedures and their skill in performing the required functions in practice. (Class II, Priority Action) (R-85-93)
>
> Provide motormen and conductors initial and recurrent training in carrying out a coordinated response to emergency situations. (Class II, Priority Action) (R-85-94)
>
> Assign the safety department the responsibility for and give it the authority to carry out the following functions:
>
> - o Continually identify the safety risks in the CTA transit system,
> - o Assess the risks as to probability of occurrence and possible loss if they occur, and
> - o Recommend preventive and corrective action to CTA management.
>
> (Class II, Priority Action) (R-85-95)

Ensure that those 6,000-series cars which will be retained for service are structurally sound before they are returned to revenue service. (Class II, Priority Action) (R-85-96)

In future new rail car procurements, specify energy-absorbing passenger seat grab bars and vertical stanchions. (Class II, Priority Action) (R-85-97)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT
Chairman

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ G. H. PATRICK BURSLEY
Member

August 20, 1985

APPENDIXES

APPENDIX A

INVESTIGATION

1. Investigation

The National Transportation Safety Board learned of this accident through its Chicago Field Office soon after it occurred on August 17, 1984, and an investigator went to the site immediately to begin the investigation. The Safety Board dispatched a team from its Washington, D. C. headquarters composed of an investigator-in-charge and group chairmen to cover the following areas of inquiring: (1) operations, (2) vehicle factors, (3) human performance, and (4) survival factors, including emergency response.

2. Public Hearing

The Board held a 2-day public hearing on November 1 and 2, 1984, in Rosemont, Illinois. Parties to the hearing were the Chicago Transit Authority, Westinghouse Air Brake Company, the Urban Mass Transit Administration, and the Amalgamated Transit Workers' Union. Testimony was taken from 18 witnesses.

APPENDIX B

CTA OPERATING RULES

Excerpts from Chicago Transit Authority's Rail System Rule Book, in effect June 1, 1982.

FOREWORD

Safe, efficient public transportation is essential to the social and economic well being of all the people of the Chicago Metropolitan area.

Employees of Chicago Transit Authority can be proud of the essential public service they perform and they must always be mindful of their continuing obligation for the safety and comfort of passengers. The communities we serve expect and deserve courteous, neat-appearing employees who perform their duties in a diligent, competent and careful manner.

To prepare and assist employees in their important tasks, the Authority has established rules governing conduct and work performance. A century of experience has developed in these rules the most practical approach to a successful and safe career in transit for the employee and simultaneously provides the public the kind of service which it demands.

This is the RAIL SYSTEM RULE BOOK containing rules which are binding upon employees operating rapid transit services of the Authority. Each such employee must know, understand and comply with every one of these rules. Other rules are set forth in the General Rule Book, executive orders and bulletins.

R2.5.2 In case a passenger is ill or injured, the controller must be notified and the controller will determine what action should be taken. Employees must not leave ill or injured passengers alone.

R5.4 Train buzzer signals

The signals prescribed are illustrated by "O" for short sounds and "__" for longer sounds.

Signal	Indication
o	Stop, or remain standing
oo	Open doors, close doors or proceed
ooo	Don't open doors, or, missed berthing mark
oooo	Need assistance Testing buzzer

R7.1 Turning power off

To have the power turned off employees must communicate to the controller:

- Who they are
- Where they are
- The exact location and direction of the trouble
- The nature of the emergency, if any
- What assistance is needed.

Maintain communications until the controller advises that the section is open and is being held open.

R8.7.1 Motorman's operating position

Normally, motormen must operate from the front cab of the train. When pushing another train or when operating a train from a cab other than the head cab, a flagman must be stationed on the forward end of the head car to give the proper signals and to be ready to stop the train.

R8.7.2 Motormen must never back a train if it is possible to change ends. When it is absolutely necessary to back a train, a flagman must first be stationed on the rear end to give the proper back-up signal and be ready to stop the train.

R8.7.3 When changing cabs or when laying up a train, motormen must trim the vacated cab for passenger use, if so designed.

R8.7.4 When it is necessary for a motorman to leave his cab, he must secure the train against moving and remove the reverser key.

R8.7.5 Motormen must not permit any person to ride in the cab, except an employee in the line of duty.

R8.36 Reporting defects

Defects in equipment or any dangerous condition must be reported immediately to the controller.

R9.2.3 If the train is between stations and cannot be moved, the crew must attempt to keep the passengers on the train. If passengers insist on leaving the train, employees must assist them in reaching the nearest exit safely.

R9.2.4 Before permitting any passengers on a track, motormen must request the power off. The controller must be notified as soon as the passengers are in the clear.

R9.12 Procedure in event of other malfunction

When a train is stopped because it is defective, the motorman must notify the controller.
The motorman and conductor must follow standard trouble-shooting procedures.

APPENDIX C

STUDENT MOTORMAN'S SCHEDULE

STUDENT MOTORMAN'S SCHEDULE

Name of Student _____ Badge _____ Section _____

DAY	DATE	TIME	SUBJECT	LOCATION	TYPE OF INSTRUCTION
1st		0730 to 1600	Orientation and Pay Information, Fundamentals of Electricity, Motor and Control Circuits, Equipment Familiarization, Jumper Switches, Coupling and Uncoupling, Schedules, Supervisor's Guide and Running Time Card, Safety Procedures, Single Track Operation, Fundamentals of Signals, Switches, and Review of Line Instruction Assignments..	Training Center 2670 N Clark St	Classroom Lecture/Discussion
2nd		0700	Terminal and Yard Orientation, Equipment Familiarization, Line of Road Tour	Assigned Terminal In Section	Tour Lecture/Discussion Demonstration
		1200	Communications/Power Control Section	Merchandise Mart	Tour Lecture/Discussion
		1400	Tour of Towers	Towers 12 & 18	Tour Lecture/Discussion
		1500 to 1530	Review Signals and Rules Governing Motor Operation	A Selected Loop Station	Lecture/Discussion
3rd		0700	Signal Quiz, Troubleshooting Guide and Communication	Assigned Terminal In Section	Examination Lecture/Discussion
		0830	Master Controller Operation	Yard at Assigned Terminal	Lecture/Discussion Demonstration
		0930	Practice Operation on Equipment Not In Service	Route in Section	Lecture/Discussion Demonstration Practice
		1500 to 1530	Review of 3rd Day	Instructor's Office at Assigned Terminal.	Lecture/Discussion
4th		0700	Review Troubleshooting Guide, Single Track and Slow Zone Operation Quiz.	Assigned Terminal In Section	Lecture/Discussion Examination
		0930	Practice Operation on Equipment Not In Service	Route In Assigned Section	Lecture/Discussion Demonstration Practice
		1500 to 1530	Review of 4th Day	Instructor's Office at Assigned Terminal in Section	Lecture/Discussion
5th		As Assigned	Practice Operation In Service	Route in Assigned Section	Line Instruction
6th		0700 to 1530	Troubleshooting	In Assigned Section	Lecture/Discussion Demonstration Practice
7th		As Assigned	Practice Operation In Service	Route In Assigned Section	Line Instruction
8th		0700 to 1530	Quiz Troubleshooting	In Assigned Section	Lecture/Discussion Demonstration
9th		0700	Quizzes and Review	Assigned Terminal Section	Lecture/Discussion Examination
		0930	Practice Operation on Equipment Not In Service Troubleshooting	Route in Assigned Section	Lecture/Discussion Demonstration Practice
		1500 to 1530	Review of Program Overview of Line Instruction Procedures	Assigned Terminal In Section	Lecture/Discussion
10th		As Assigned	Practice Operation In Service	Route In Assigned Section	Line Instruction

If unable to report for instruction:

When scheduled to report at Training Center, telephone 477 1389 as soon as possible after 0700 hours

When scheduled to report at a terminal, telephone terminal instructor before reporting time:

Ashland	925-2408	Desplaines -	366-5115	95th	264-2577
54th	863-3794	Harlem	366 2293	Howard	262-4163
Jefferson Park	736-1544	Kimball	539-3434	61st Street	363-7515

Days off during training period Sundays and Holidays

cta 183 06 (10/63) Transportation Training Instruction

APPENDIX D

STUDENT CONDUCTOR'S SCHEDULE

STUDENT CONDUCTOR'S SCHEDULE

Class No _____

_____ Name of Student _____ Badge No. _____ Section

DAY	DATE	TIME	SUBJECT	LOCATION	TYPE OF INSTRUCTION
1st		0730 to 1600	Orientation, Benefits and Pay Information, Job Duties and Responsibilities, Equipment, Fare Structure, Transfers, Route Map Familiarization, Schedules, Run Time Card, Run Guide, Announcements, Conductor Daily Record and Transfer Count Card	Training Center 2670 N Clark St	Lecture/ Demonstration
2nd		0730 to 1200	Side Door Operation, Introduction to Signals, Courtesy, Conductor Safety Procedures, Accident Reports, Communications, Sensitivity Security/ Safety Procedures, Communication and Emergency Facilities, Fire Procedures and Home Work Assignment	Training Center 2670 N Clark St	Lecture/ Demonstration
		1300 to 1600	Communication/Power Control Section, Transportation Department Office, Review of 2nd Day	Merchandise Mart	Tour
3rd		0700	Terminal and Yard Orientation and Equipment Familiarization, Hand Jumper Procedures, Operation of Doors, and Public Address System	Assigned Section	Lecture/ Demonstration and Practice
		1000	Practice Operation, Tour of Terminals and Rail Car Equipment Familiarization	Various Routes & Terminals	Tour & Practice on In-Service Train
		1300	Practice Operation in Service	Assigned Route	Line Instruction
4th		As Assigned	Practice Operation in Service	Assigned Section	Line Instruction
5th		As Assigned	Practice Operation in Service	Assigned Section	Line Instruction
6th		0730 to 1600	Review Homework, Final Examinations, Review, and General Review	Training Center 2670 N Clark St	Lecture/ Discussion and Examinations
7th		As Assigned	Practice Operation in Service	Assigned Section	Line Instruction
8th		0600 to 1430	Review Homework (Incident Report), Conductor Qualification and "Flagging Procedure" Orientation by Terminal Superintendent	Assigned Terminal	Final Qualification

If unable to report for instruction:

When scheduled to report at Training Center, telephone 477-1369, as soon as possible after 0700 hours

When scheduled to report at a terminal, telephone terminal before reporting time:

Ashland	925-2408	DesPlaines	366-5115	95th	264-2577
54th	863-3794	Harlem	366-2293	Howard	262-4163
Jefferson Park	736-1544	Kimball	539-3434	61st Street	363-7515

Days off during training period Sundays and Holidays

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