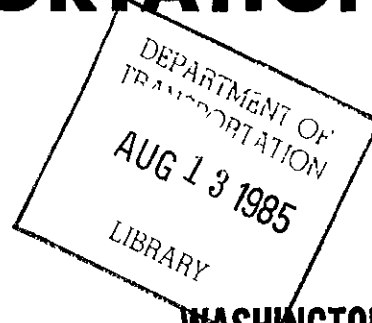


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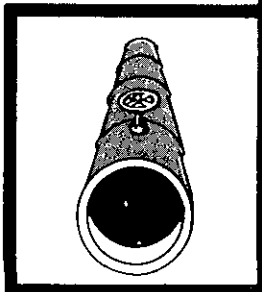
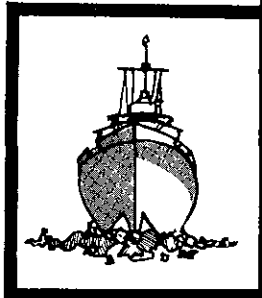
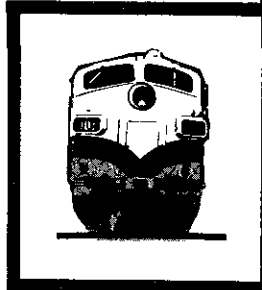
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# NATIONAL TRANSPORTATION SAFETY BOARD



WASHINGTON, D.C. 20594



## RAILROAD ACCIDENT REPORT

DERAILMENT OF  
NEW YORK CITY TRANSIT AUTHORITY  
SUBWAY TRAIN IN THE  
JORALEMON STREET TUNNEL  
NEW YORK, NEW YORK  
MARCH 17, 1984

NTSB/RAR-85/07.

UNITED STATES GOVERNMENT

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16. Abstract About 5:27 p.m. on March 17, 1984, a 10-car subway train operated by the New York City Transit Authority derailed in the Joralemon Street tunnel under the East River about 1,900 feet south of the Bowling Green Station in New York, New York. The train, which was loaded to virtual capacity with about 1,500 passengers, was exceeding the 10-mph speed restriction established because the track section was under repair. The derailment did not result in serious injuries to the passengers or significant damage to the equipment. After extensive delay, the passengers detrained and walked about 700 feet to an emergency exit, where they climbed a staircase from the tunnel to the street. A second train stalled in the tunnel just south of the Bowling Green Station when the derailment interrupted traction power to the train. Passengers from this train were evacuated onto the station platform through another train which was positioned for this purpose.  The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to require the contractor making the repairs to shore up the skeletonized track in conformity with NYCTA procedures, the failure to erect slow speed signs in compliance with NYCTA policies, and the release by the contract inspector of the improperly skeletonized track to the desk trainmaster for revenue train operation.					
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**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D. C. 20594**

**RAILROAD ACCIDENT REPORT**

**Adopted: May 13, 1985**

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**DERAILMENT OF  
NEW YORK CITY TRANSIT AUTHORITY  
SUBWAY TRAIN IN THE  
JORALEMON STREET TUNNEL  
NEW YORK, NEW YORK  
MARCH 17, 1984**

**SYNOPSIS**

About 5:27 p.m. on March 17, 1984, a 10-car subway train operated by the New York City Transit Authority derailed in the Joralemon Street tunnel under the East River about 1,900 feet south of the Bowling Green Station in New York, New York. The train, which was loaded to virtual capacity with about 1,500 passengers, was exceeding the 10-mph speed restriction established because the track section was under repair. The derailment did not result in serious injuries to the passengers or significant damage to the equipment. After extensive delay, the passengers detrained and walked about 700 feet to an emergency exit, where they climbed a staircase from the tunnel to the street. A second train stalled in the tunnel just south of the Bowling Green Station when the derailment interrupted traction power to the train. Passengers from this train were evacuated onto the station platform through another train which was positioned for this purpose.

The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to require the contractor making the repairs to shore up the skeletonized track in conformity with NYCTA procedures, the failure to erect slow speed signs in compliance with NYCTA policies, and the release by the contract inspector of the improperly skeletonized track to the desk trainmaster for revenue train operation.

**INVESTIGATION**

**The Accident**

About 5:25 p.m. on March 17, 1984, the 4:38 p.m. New York City Transit Authority (NYCTA) southbound subway train on the Lexington Avenue line from Woodlawn to Utica Avenue departed the Bowling Green Station in Manhattan about 13 minutes late. The train consisted of 10 cars which were loaded virtually to capacity with about 1,500 passengers. The train's next scheduled stop was to be at the Borough Hall Station in Brooklyn. The train was routed on track No. 2 through the Joralemon Street tunnel under the East River. (See figure 1.) A general order had been issued on February 27, 1984, alerting traincrews that repairs were being made to certain sections of track No. 2 between the two stations and that a speed restriction would be indicated by slow signs in the repair areas.

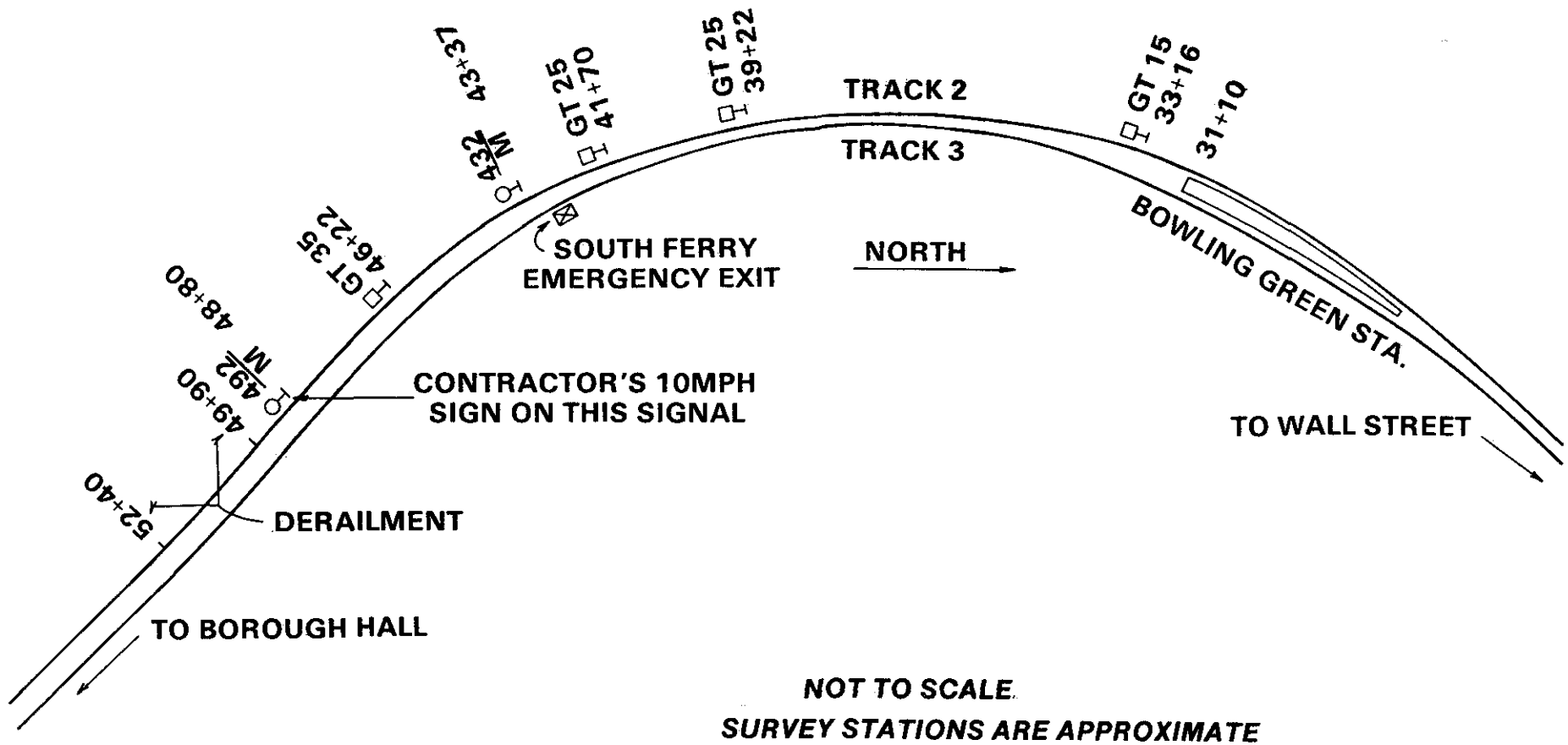


Figure 1.--Diagram of track showing relative locations of signals and appurtenances in the Joralemon Street tunnel.

According to the train operator, he moved out of the Bowling Green Station slowly because of the 15-mph speed restriction over a switch and the grade time sign <sup>1/</sup> just beyond the station. The train operator recalled next seeing a 25-mph grade time sign just before seeing a temporary 10-mph slow sign that was displayed on grade time signal No. 492. The 10-mph slow sign was 70 feet in approach to an approximately 80-foot-long section of track from which concrete ballast support had been removed and timbers had been put in place to shore up the track. Although he did not know his exact speed, the train operator immediately applied the brakes. Immediately after the train entered the repair area beyond the slow sign, the train brakes applied automatically in emergency at 5:27 p.m. The train operator notified the NYCTA command center that he had stopped and had lost traction power. After the train stopped, the train operator asked the conductor to have a road car inspector who was on board check the train. The road car inspector reported back to the operator through the conductor that the rear four cars were derailed. The train operator notified the NYCTA command center of the derailment at 5:38 p.m.

The third-rail power on the southbound track was interrupted by the derailment, and a following NYCTA train, with an estimated 1,200 passengers on board, stalled with its rear end just south of the Bowling Green Station. The operator of the stalled train informed the NYCTA command center at 5:28 p.m. that he had lost power. The NYCTA Assistant General Superintendent learned of the accident from the command center and began walking through the tunnel from the Borough Hall Station to the derailment site. Through the command center, he ordered a trainmaster who had arrived at the Bowling Green Station to take charge of the evacuation of the passengers from the stalled train. The trainmaster boarded a third train that was then in the station, asked the passengers to get off, and moved the train southward up to the stalled train. The passengers from the stalled train walked through the third train and got off at the Bowling Green Station. The evacuation of the passengers from the stalled train was completed by 6:32 p.m.

The Assistant General Superintendent was the first rescuer to arrive at the derailed train at 6:13 p.m.; he found that although the crew had been able to keep the passengers calm, the passengers were becoming restless. He determined that it would be best to have the passengers get off the train, walk northward about 700 feet in the tunnel to the South Ferry emergency shaft, and climb stairs to the street level. (See figure 1.) The evacuation began shortly after 6:20 p.m. NYCTA employees responding to the emergency were posted along the track between the derailed train and the South Ferry emergency shaft to direct the passengers. By 6:30 p.m., personnel from the New York Police and Fire Departments were providing lights and assistance in the tunnel. The evacuation of the 1,500 passengers was completed by 9:19 p.m. Power was not restored to the third rail on the southbound track until after the evacuation.

Two train crewmembers and about 17 passengers from the derailed train were treated either at the scene or at hospitals for such complaints as dizziness, chest pains, shortness of breath, and anxiety.

<sup>1/</sup> Grade time signs indicate the average speed that a train may maintain through the block without encountering a stop aspect at the next time signal. The grade time signals are regulated so that they will display a stop aspect when a train moves through the block faster than the grade time sign indicates.

**Injuries to Persons**

<u>Injuries</u>	<u>Crewmembers</u>	<u>Passengers</u>	<u>Total</u>
Fatal	0	0	0
Nonfatal	0	0	0
Minor	2	17	19
None	1	1,500+	1,500+
Total	3	1,500+	1,500+

**Damage**

The damage to the cars from the derailment was minor.

About 250 feet of track was torn up by the derailment and the subsequent re-railing operations. Because the track was undergoing renovation, the NYCTA did not place a dollar value on the track damage.

**Train Information**

The derailed train consisted of a mixture of R-17- and R-21-type, self-propelled electric subway cars with four-wheel trucks. Traction power is picked up from a third rail through a current collector shoe on each truck. Although the exact dimensions of these cars vary, the general dimensions of the cars are 51 feet long, 8 feet 9 inches wide, and 12 feet high. The cars have three double-leaf doors on each side at the middle and each quarter point and a door in each end. There are sill steps at the ends of the cars for dismounting onto the roadbed.

Each car has an operating cab on each end in which there is a brake valve and handle and a master controller. The brake system uses both dynamic and electropneumatic braking and is controlled by the train operator with the brake valve handle. The train operator controls the speed of the train with the master controller. The master controller handle must be depressed while the train is moving under power; otherwise, the "deadman" feature will apply full emergency brakes. There are no speed indicators on the cars, but the train operator can estimate his speed by reference to the maximum speed at the marked positions of the controller. A trainmaster stated that in the second position, the train would attain a maximum speed of 15 to 18 mph and in the third position, parallel mode, the train could accelerate to a maximum of 50 mph.

The cars on the derailed train were Nos. 6722, 6674, 6581, 6814, 7057, 7063, 6556, 6632, 6828, and 6713. The two sealed-beam headlights and the two lights adjacent to the illuminated route number and destination sign on the lead car were lit as were the four red rear lights on the last car in the train. Emergency, battery-powered lights came on in all the cars when the third-rail power was lost.

**Personnel Information**

The crew of the train consisted of the train operator and a conductor. Both were qualified under NYCTA operating rules. In addition, a road car inspector was on board

because the train operator had reported earlier that the train was slow accelerating. Although not part of the operating crew, there were several off-duty employees on board the train at the time of derailment.

For more information on the traincrew and other NYCTA personnel, see appendix B.

### Track Information

The train derailed on the No. 2 track, normally a southbound track, of the Lexington Avenue line in the Joralemon Street tunnel between Bowling Green Station in Manhattan and Borough Hall Station in Brooklyn. The tunnel under the East River consists of two circular steel tubes with one track in each tube. A number of cross passageways connect the two tubes.

Proceeding southward from Bowling Green Station, the train went around a left curve down a 2-percent grade for about 1,000 feet and then down a 3-percent grade for 900 feet to the point of derailment. Several hundred feet before the derailment point, the track curved slightly to the right. The derailment occurred near the end of that right curve. (See figure 1.)

The NYCTA described the track as Type II modified. The 100-pound A.R.A.-B 2/ rail was joined by 6-hole, 36-inch joint bars. Every fifth crosstie was 6 inches by 8 inches by 8 feet 6 inches and also supported the third rail; intervening were 6-inch by 10-inch by 30-inch tie blocks. The rail rested on 8-inch by 14-inch tieplates and was fastened by two line and two anchor spikes. The track was supported by concrete up to the tops of the crossties and the tie blocks with a trough in the center of the track. Tie spacing averaged 20 1/2 inches.

The track involved in the derailment was undergoing rehabilitation as part of a project in which a contractor was replacing the bolted rail and tieplates with continuous welded rail and container plates.<sup>3/</sup> The work in the derailment area had begun on March 13, 1984. Because some of the crossties and supporting concrete ballast were found to be deteriorated, an additional work order had been issued to replace the deteriorated crossties, tie blocks, and concrete at some locations. At these locations, the concrete around and under the crossties had been removed, leaving only the rail and appurtenances fastened to the crossties. The "skeletonized" track was then shored up to the required grade to permit train operations at restricted speed.

The shoring was accomplished by using 4-inch by 4-inch timbers longitudinally spaced 2 to 3 inches apart under the crossties and tie blocks and directly under each rail. To bring the track to proper grade and cross level, wooden wedges had been driven between the bottoms of the ties and the tops of the timbers. The wedges were nailed to the timbers with 10-penny nails. In some places the lateral stability of the track was dependent on pieces of concrete or cinderblocks that were wedged between the ends of the crossties and the sides of the tunnel. In other places the lateral stability of the track was dependent on the lower edges of some of the crossties contacting the sides of the tunnel. In this skeletonized section the spaces between the ends of the crossties and the tunnel wall allowed as much as 1 inch lateral movement. (See figure 2.) The NYCTA had not advised the contractor that use of wedges to shore up skeletonized track for revenue train use was prohibited by its internal policy.

2/ 100-pound A.R.A.-B section refers to a rail which weighs 100 pounds per lineal yard and at the time of its manufacture was a standard rail section recommended by the American Railroad Association.

3/ A container plate is a tieplate designed to retain a crosstie pad used with it.





Figure 2.--Broken cross-tie and contractor's shoring, including wedges, at the derailment site.

The contractor had determined and had informed an NYCTA contract inspector that 98 percent of the crossties needed to be replaced. The crossties generally were in a seriously decayed condition, and the contractor had marked a number of crossties in the area for removal subject to the NYCTA inspector's approval. None of the crossties had been replaced at the time of the accident.

As trains moved southward on the No. 2 track from the Bowling Green Station, they encountered skeletonized track at the following locations (see figure 1):

<u>Survey stations</u>	<u>Distance</u>
Sta. 41+50 to 41+82	32 feet, both rails
Sta. 43+50 to 43+77.5	27.5 feet, one rail 19 feet, other rail
Sta. 49+50 to 50+33	83 feet, one rail 77 feet, other rail
Sta. 52+00 to 52+62.5	60.5 feet, one rail 62.5 feet, other rail

The track work by the contractor was under the direction of a project engineer from the NYCTA Engineering and Construction Department. Under the direction of the project engineer, two NYCTA contract inspectors provided daily inspection and coordination of the contractor's work. The senior NYCTA contract inspector was responsible for (1) inspecting the track at the end of a work period, (2) advising the desk trainmaster that the work was completed for the day and that the track was available for service as provided by the general order, and (3) assuring that the first revenue train passed over the completed work safely. The NYCTA Engineering and Construction Department procedures were not specific as to how the inspector was to determine this; however, until the accident, it was acceptable for the inspector to remain at the first station beyond the work area until the first train arrived. No one inspected trains as they were passing over the newly skeletonized track. After the accident, instructions were issued requiring the inspectors to observe the first train as it passed over the track.

Regular Maintenance of Way Department (now Track and Structures Department) trackwalkers also inspected the track, including the skeletonized track, in the Joralemon Street tunnel on alternate days. The trackwalkers were not expected to make judgments about whether the contractor's work met NYCTA standards; however, they were expected to report any track conditions which made a track unsafe for the operation of revenue trains. Before this contract, the Maintenance of Way Department employees performed most of the track work which resulted in the operation of revenue trains over skeletonized track. The Maintenance of Way Department developed and implemented NYCTA standards for skeletonizing track over which trains were to operate.

The heads of the Engineering and Construction and the Track and Structures Departments reported to two different vice presidents who were responsible to the president of the NYCTA. (See figure 3.) There were no specific procedures that required either department head to be sure that the skeletonized track was shored up according to the provisions of the Track and Structures Department standards and directives. Although

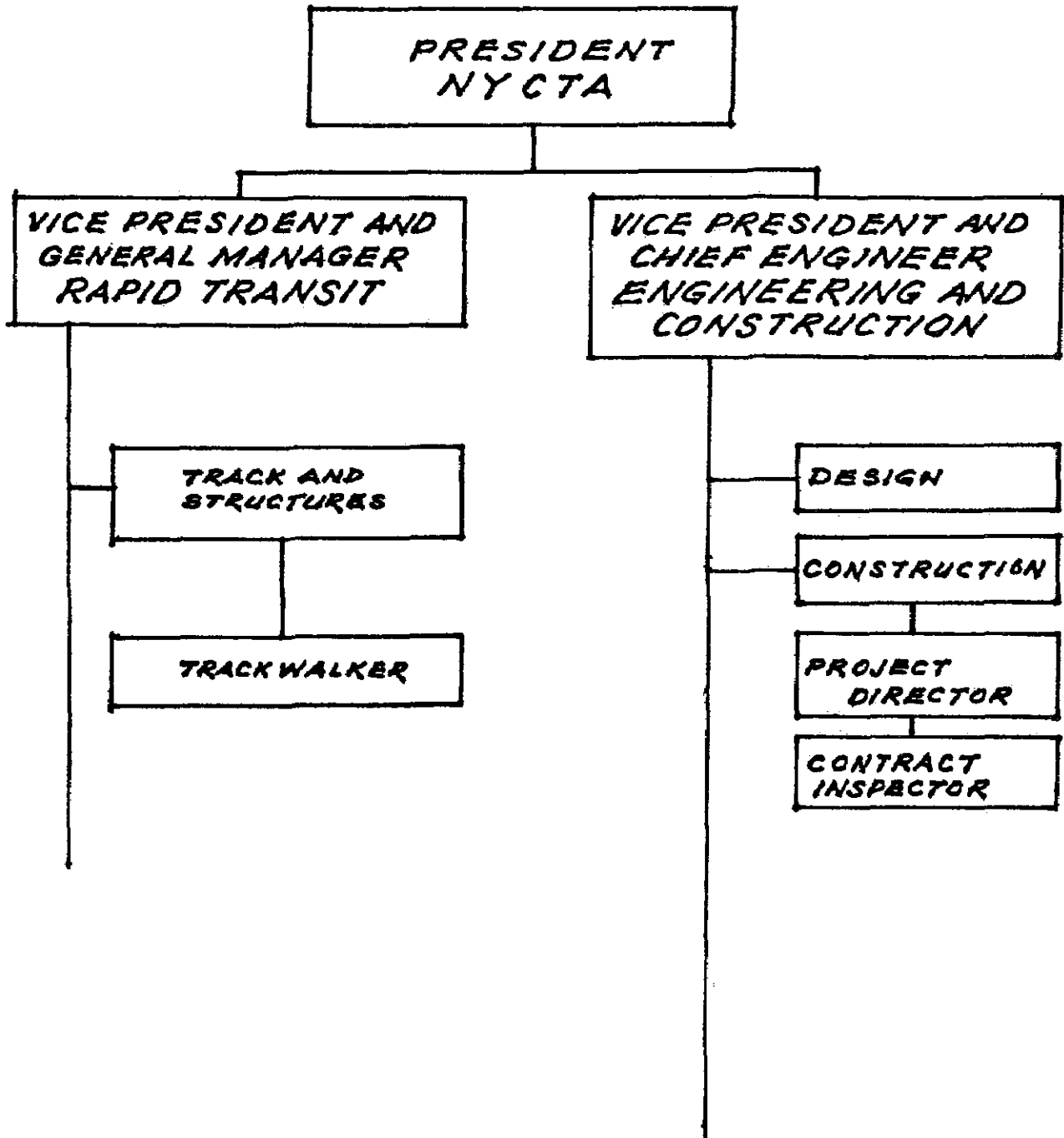


Figure 3.—Relationship between elements of the Track and Structures Department and the Engineering and Construction Department.

the head of the Engineering and Construction Department was aware that he was responsible for providing standards to the contractor for track that was safe for revenue train operations, no one in his department came to an understanding with the contractor regarding detailed specifications for skeletonizing the track in the Joralemon Street tunnel.

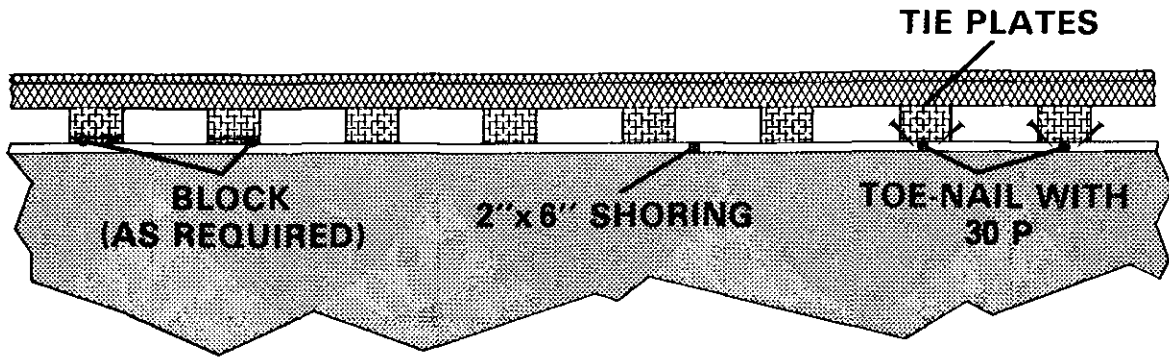
The senior contract inspector had limited on-the-job experience with skeletonized track over which revenue trains were to operate. He said he depended on the contractor to develop and use acceptable methods. The senior contract inspector and the contractor's supervisors said that the basic document used as guidance for the shoring of the skeletonized track in the Joralemon Street tunnel was a drawing submitted by the contractor as part of a plan for work between Sterling Street Station and Newkirk Avenue Station on another line. The contractor's drawing provided that two (four per track) timbers with a minimum width of 6 inches and spaced a maximum of 6 inches apart and braced to prevent lateral movement be placed under each rail. (See figure 4.) The NYCTA had approved that drawing in principle in January 1983. The tunnel for which the drawing was made and approved had vertical sides at track level. The drawing showed blocks, tightened by wedges, between the ends of the crossties and the vertical walls in order to secure the track laterally. The tubes in the Joralemon Street tunnel were circular in cross section, and the contractor did not secure the track against lateral movement. The contractor depended upon the lower edges of some of the crossties bearing on the circular tunnel wall to provide lateral securement. The drawing had been revised to include comments by the NYCTA about track support details, but had not been returned to the contractor as an approved plan at the time of the accident. The senior contract inspector had not seen the revised plan and had not established with the contractor the standards to which the contractor would shore up the track and secure it against lateral movement.

As noted earlier, standards for shoring up skeletonized track over which revenue trains would operate had been published by the NYCTA Track and Structures Department. The Superintendent of the NYCTA Track Division had issued a memorandum on November 20, 1981, that reiterated a prohibition against the use of wedges in shoring up track to be used in revenue train operations. (See figure 5.) Neither of these documents were part of the additional work order under which the track work was being done, and both the contractor and the contract inspectors said that they were not aware of the documents.

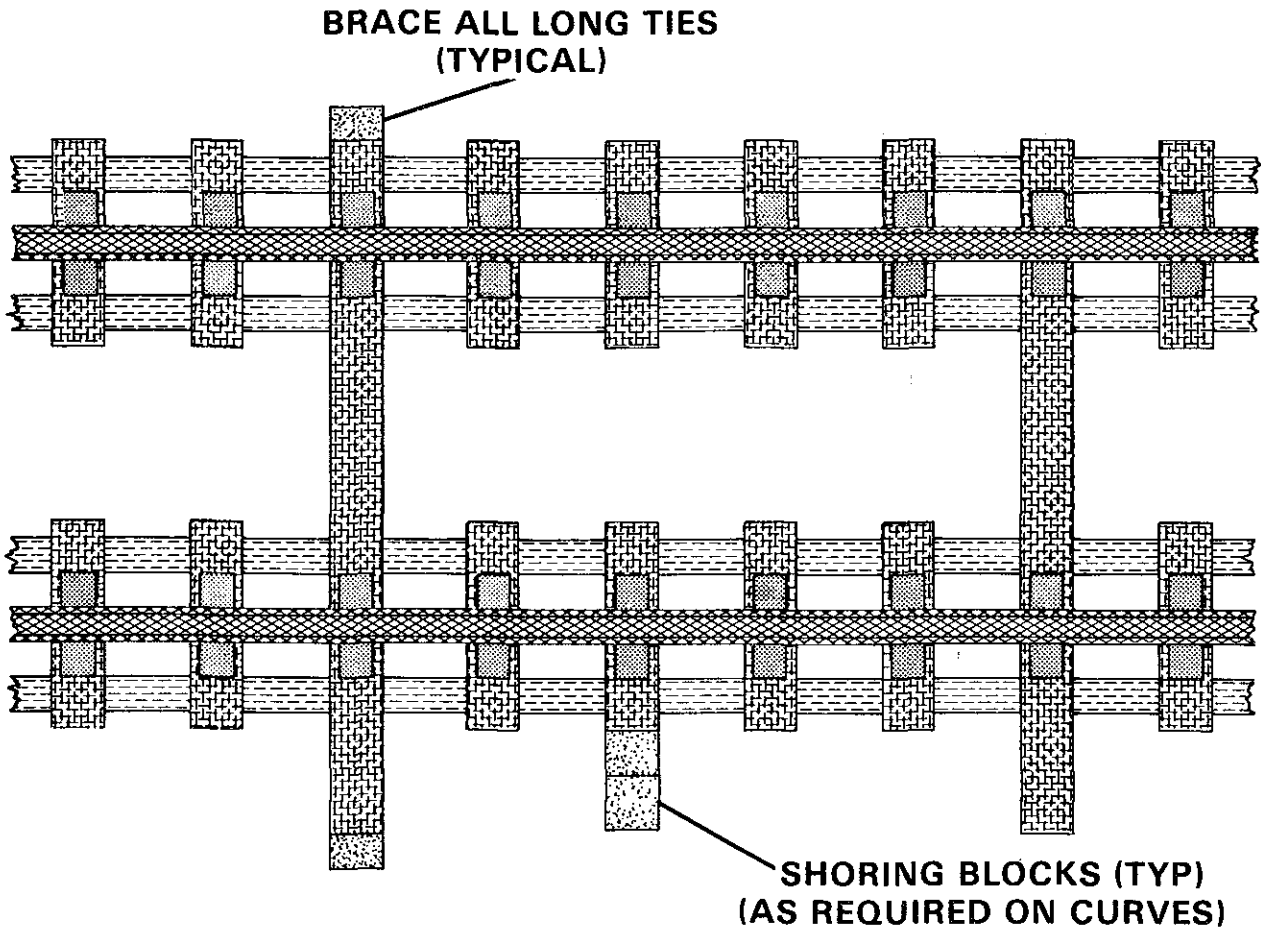
Neither the contract inspectors nor the regular trackwalker took exception to or reported the unapproved method of shoring up the skeletonized track. The chief engineer of the Engineering and Construction Department had no track maintenance experience, and there was no one with this expertise on his staff. There were no procedures for coordination between the Engineering and Construction Department and the Track and Structures Department. No one in the Engineering and Construction Department determined whether the NYCTA project engineer and the contract inspectors were familiar with the Track and Structures Department standards for skeletonized track.

NYCTA standard operating procedure File Number 1.03.006 defines the duties and responsibilities of trackwalkers who are under the control of the Track and Structures Department. Included in Section 5, Inspection, are the following duties:

In the course of their inspection special attention is to be given to . . . project areas where the track is supported by temporary shoring or blocking.



### SIDE VIEW



### TOP VIEW

Figure 4.--NYCTA skeletonized track support system.

NEW YORK CITY TRANSIT AUTHORITY  
MAINTENANCE OF WAY, TRACK

NOVEMBER 20, 1981

FROM: N. F. STREETER, SUPERINTENDENT, TRACK DIVISION  
TO: ALL SUB-DIVISION HEADS  
SUBJECT: PROPER METHOD OF SHORING UP TRACK.

It has come to the attention of this office, that field forces are still using wedges to shore up tracks. This practice must cease immediately. Moreover, track is only to be shored with "FLAT SURFACE LUMBER", (ties or tie blocks, slatting or guard timber, or plywood shims).

Field forces have been using wedges in place of plywood shims in an attempt to compensate for  $\frac{1}{4}$ " or  $\frac{1}{2}$ " low track. In the future when shoring up track, and, foreman observes that he needs  $\frac{1}{4}$ " or  $\frac{1}{2}$ " plywood shims to make a firm bearing and there are no plywood shims available, the foreman is advised to drop his track down to  $\frac{1}{4}$ " or  $\frac{1}{2}$ ", to build up shoring. In no case, is a foreman to use WEDGES to raise shoring, to make a firm bearing.

Each sub-division head or his designee will visit areas in his sub-division, where track is shored up, or a shoring job is in progress and, inspect these areas to ascertain if wedges are installed or are being installed under shored tracks. If wedges are observed, they are to be removed immediately. Moreover, all foreman in your sub-division are to be instructed on how to PROPERLY SHORE UP TRACK.

BE GOVERNED ACCORDINGLY!

  
N. F. STREETER,  
SUPERINTENDENT,  
TRACK DIVISION

NOTICE NO: 890-81  
FILE NO: - 111017  
01215:NS:ln  
cc: E. PATTON  
E. GUNDERSON  
FILE (2)

Figure 5.--NYCTA memorandum concerning the proper method for shoring up track.

\* \* \*

Trackwalkers also report conditions, which are under the jurisdiction of other departments, that might result in delays to service or pose a hazard to personnel.

Trackwalkers inspected the No. 2 track in the Joralemon Street tunnel on March 5, 7, 9, 12, 14, and 16, 1984; however, no reports of deficiencies in the tunnel were made.

### Method of Operation

NYCTA subway trains on the Lexington Avenue line are operated by signal indications of the automatic block signal system, timetables, and "Rules and Regulations Governing Employees Engaged in the Operation of the New York City Transit System."

NYCTA General Order No. 134-84, issued February 27, 1984, removed from service Track No. 2-Joralemon Street Tube on the Lexington Avenue Line "from south of Bowling Green (South of Switch No. 47A) to North of Borough Hall (Home Signal No. 132)," as follows:

- (1) Between the hours of 10:00 p.m. and 4:45 a.m., from 10:00 p.m., Sundays, to 4:45 a.m. Fridays, (FIVE (5) NIGHTS A WEEK), and
- (2) From 10:00 p.m., Friday CONTINUOUSLY to 6:00 a.m. Sundays, (THIRTY-ONE (31) CONTINUOUS HOURS). Beginning 10:00 p.m., Monday, March 5, 1984, and ending 4:45 a.m., Monday, June 18, 1984.

Under the General Order appear the following notes in "Other Departments Involved":

POWER WILL BE REMOVED by the IRT Division Desk Trainmaster (B-4111) upon the request of Contract Supervisor In-Charge.

CONTRACT SUPERVISOR IN-CHARGE will notify the IRT Division Desk Trainmaster (B-4111) before starting and upon completing work.

SIGNAL SECTION will arrange for the proper placement of Lamps and Portable Train Stops to adequately protect and confine the work area.

(The contract inspector was the employee expected to notify the IRT Desk Trainmaster "before starting and upon completing work.")

The NYCTA command center directs and coordinates all train movements. Train dispatchers and employees at the command center give instructions to train operators on trains by radio. Train dispatchers and employees at the command center communicate by telephone and radio.

The speed of southbound trains leaving Bowling Green Station is governed by grade time signs. The first grade time sign, 15 mph, is about 205 feet south of the station; the second grade time sign, 25 mph, is about 810 feet south of the station in a left-hand curve; the third grade time sign, 25 mph, is about 1,060 feet south of the station; the fourth grade time sign, 35 mph, is on tangent track about 1,512 feet south of the station

and about 260 feet north of grade time signal No. 492. (See figure 1.) In conjunction with the general order, the Deputy Chief Engineer had requested by memorandum on March 8, 1984, the following:

In order to permit the contractor to perform invert repair work in the Joralemon Street Tunnel, which will involve skeletonizing various lengths of track, it is requested that a "Slow Speed" order of 10 mph be issued for Track #2 effective March 13, 1984 (Tuesday Morning). . . . The work area extends from south of Bowling Green to north of Boro [sic] Hall but the actual location of the 10 mph signs will be governed according to the actual invert removed and will be adjusted nightly . . . .

At the time of the accident, a black-and-white, 10-mph sign, which had been placed by the contractor, was on grade time signal No. 492. The contract inspector had instructed the contractor to put up the 10-mph sign because of the general order that was in effect to protect the track work. The contractor's sign had the legend "10 miles" in black letters on a white background instead of the NYCTA standard black letters on a yellow background. There were no other slow signs north of the derailment to protect the other sections of skeletonized track, and the grade time signs had not been covered as required by NYCTA procedures. Seventeen trains passed over the skeletonized track between the time the contract inspector returned the track to service and the time of the derailment.

The train operator had operated trains over skeletonized track in the tunnel previously. He said that although he knew the various grade time signs were in the tunnel, on the day of the derailment he perceived only 15-mph and 25-mph grade time signs. He recalled the 10-mph slow sign to have been ". . . almost directly just in front of the 25." He had seen 10-mph slow signs on previous days at different locations. He said that although the signs were not NYCTA standard, he treated them with the same respect.

Under a "slow order," no separate order is issued, but the NYCTA requires that a "slow" sign be located at the entrance to a section of track on which trains are required to run at reduced speed. The sign must be placed at signal locations in approach to the work locations to allow sufficient distance for deceleration by the train operators. "Resume speed" signs must be placed at the nearest signal after the reduced speed area that ensures a minimum distance of 10 cars before speed is resumed. Only signal supervisors are authorized to issue instructions to signal maintainers as to the placement and removal of signs. In this case, the project engineer, at a regular construction meeting on March 14 requested the contractor to put up a 10-mph sign.

### Emergency Response and Evacuation

NYCTA records are not clear on when or how emergency response personnel were notified of the accident because the desk trainmaster did not note the time in his log. New York Fire Department (NYFD) personnel had responded to an unrelated circuit breaker fire at the north end of the Borough Hall Station and were there when the Assistant General Superintendent arrived at the station at 5:37 p.m. The superintendent and the NYCTA command center requested the fire department to assist in the evacuation of the passengers from the derailed train.

The command center did not ascertain the derailed train's exact location or its location relative to emergency exits. The train operator did not report, and the command center did not request from him, the train's location relative to a signal number, an emergency alarm box number, or a telephone box number. The exact location of the train



was not known until the Assistant General Superintendent arrived at the derailment site at 6:13 p.m. In the meantime, the command center gave out some incorrect and misleading statements about the train's location and the proposed evacuation routes. Until 6:20 p.m., the desk trainmaster was telling emergency response personnel that the evacuation would be through the emergency exits at Joralemon Street and Willow Place. The NYCTA police log indicates that as late as 6:34 p.m. the detectives and rescue units were being given this incorrect information.

When the Assistant General Superintendent arrived at the derailment site, he decided that because of debris in the passageway between the southbound and northbound tunnels and the difficulty of getting passengers off the derailed train, over the third rail, and into another train on the track in the other tunnel, it was impractical to use a rescue train for evacuation. At 6:20 p.m., the Assistant General Superintendent advised the command center that the best way to evacuate the passengers would be through the South Ferry emergency shaft. The command center coordinated the evacuation under the direction of the Assistant General Superintendent with the assistance of fire, police, and emergency medical services personnel in addition to NYCTA employees.

The Assistant General Superintendent reported at 6:30 p.m. that the evacuation was progressing satisfactorily. Passengers exited the door in the north end of the last car of the train and climbed down a ladder to the track. NYCTA employees, with flashlights to supplement the emergency tunnel lighting, were stationed between the rear of the train and the South Ferry emergency shaft to assist the passengers. Firefighters and emergency medical services personnel also were in the tunnel and provided additional lighting and assistance as needed. NYCTA employees and rescue personnel said that the emergency lighting generally was acceptable but that passengers needed additional light while getting off the train and while walking through the skeletonized track areas. At 9:19 p.m., the Assistant General Superintendent reported that the evacuation was completed. He said that even though the evacuation went slowly, it was more effective to continue the evacuation plan rather than to change it after the evacuation began.

NYCTA procedures do not specify the preferred means of evacuation from the Joralemon Street tunnel; however, NYCTA instruction and training manuals show the locations of the cross passageways and suggest that their use is acceptable in evacuations. When the passengers are not threatened by fire or smoke in the train, NYCTA procedures call for crewmembers to keep the passengers in the cars until supervisors decide on a mode of evacuation.

### **Tests and Research**

Investigators determined that the first derailment mark was made by a brake trip cock on the lead truck of the seventh car that struck the west rail near survey station 49+90 when the truck's wheels dropped inside the gage and overturned the east rail. (See figure 1.) Investigators determined that the crossties in the area were deteriorated and that a crosstie which had decayed internally failed in tension under the west rail at that point. (See figure 2.) The train moved 200 feet beyond the first derailment mark, and the lead car of the train stopped at survey station 54+96. The destruction of the track was such that the exact prederailment profile of the track could not be determined. None of the shoring material failed because of deterioration or excessive vertical loads before the derailment. However, some of the wedges and shoring which had no derailment marks had shifted.

Using NYCTA's "Emergency Braking Distances" chart for R-21-type equipment and a descending track grade of 3 percent, the NYCTA computed that the train was moving at a speed of 26.5 mph when the brakes were applied in emergency. The values in the chart

were determined based on all wheels being on the rails, which results in maximum adhesion between the wheels and the rails. The NYCTA said,

If 40% of the train's wheels were off the rail (as was the case with the derailed train), one can reasonably assume that the emergency braking distance will be longer for a given train speed and track grade; or as in this case, that train speed will be lower for a given brake distance and track grade. However, the likelihood of such a condition (some wheels off the rail) resulting in the actual speed of the derailed train being one and one-half times lower than the speed as shown on the braking chart (10 mph versus 26.5 mph), is remote. Therefore, it has been determined that the speed of the train was, most likely, greater than 10 miles per hour at the time of the derailment. 4/

The effects of derailed wheels bouncing over and crushing crossties and shoring material and of cars scraping against tunnel walls and the third rail were not considered in the NYCTA calculations.

### Other Information

At the time of the accident, no Federal, State, or local agency was exercising independent safety oversight over the NYCTA. The Urban Mass Transportation Administration (UMTA) has authority under the Urban Mass Transportation Act of 1965 as amended as noted below:

Sec. 22. The Secretary may investigate conditions in any facility, equipment, or manner of operation financed under this Act which the Secretary believes create a serious hazard of death or injury. The investigation should determine the nature and extent of such conditions and the means which might best be employed to correct, or eliminate them. If the Secretary determines that such conditions do create such a hazard, he shall require the local public body which has received funds under this Act to submit a plan for correcting or eliminating such condition. The Secretary may withhold further financial assistance under this Act from the local public body until he approves such plan and the local public body implements such plan.

UMTA's Director of the Office of Safety and Security stated that, "We [UMTA] have an oversight role in terms of trying to provide maximum safety, generic safety that can be used by all transit systems. But we don't get involved in the operation, the safety operation of transit systems. That's left to the local transit authorities." UMTA does not conduct safety or accident investigations, even in projects that have been funded by UMTA capital grants. The safety of a system or project is left solely to the local agency. UMTA has recently released emergency preparedness guidelines and recommended practices. These guidelines approach emergency preparedness from a broad perspective. They will not be mandatory.

Some of the funding for the track work in the Joralemon Street tunnel was provided by UMTA. No safety plan was required from the NYCTA as part of the application for funds. UMTA's Office of Safety and Security did not participate in any safety review of

4/ NYCTA Board of Inquiry, Final Report, Joralemon Street Tube Derailment, March 17, 1984, dated April 23, 1984.

the application and had not monitored the project to ensure that there was no serious hazard of death or injury. UMTA will not require NYCTA to certify that the completed project is safe.

The New York Department of Transportation is precluded by New York law from regulating or monitoring safety in rail rapid transit. The New York State legislature recently has created a New York Public Transportation Safety Board (NYPTSB). The NYPTSB's authority to function became effective on May 1, 1984. The NYPTSB has been empowered to investigate all rail and bus accidents occurring on facilities operated by public authorities. Accident reporting and monitoring systems will be established by the NYPTSB. Public authorities, like the NYCTA, will be required to submit a system safety plan for their operations every 2 years. The NYPTSB will review the safety plan, the authority's operations, and its standards. If the standards are not adequate, the NYPTSB will assist the authority in developing standards that will ensure a safe operation. Emergency preparedness and plans for evacuation of passengers will be a part of the required safety plan. If the transit authority fails to submit satisfactory plans, the State may withhold all State mass transportation operating assistance from that authority's system.

## **ANALYSIS**

### **The Derailment**

The investigation revealed that the crossties in the skeletonized track at the accident site were deteriorated and that a decayed crosstie had failed under tension at the point of derailment. The crosstie failure under tension could have been caused only by lateral movement of the rail. The skeletonized track had not been shored up according to NYCTA standards or to acceptable engineering standards. Based on an examination of the debris in the way of the disrupted track at the derailment site, including the presence of undamaged shoring material and wedges, and because loose shoring was found under skeletonized track north of the derailment site, the Safety Board concludes that the track at the accident site had not been adequately supported by the contractor making the track repairs. The weight and vibration of the accident train moving over the insufficiently shored-up track, especially since it was moving at a speed of more than 10 mph and the engineer had applied the brakes to slow it, would have caused shifting and failure of the shoring, lowering of the rail, shifting of weight to the outside rail in the curve, the outward movement of the rail by lateral wheel loads, and the failure of the crosstie. Any slack action that might have accompanied the braking could have accentuated the lateral loads. After the crosstie failed, nothing held the track gage for the span of more than 16 feet between the two crossties adjacent to the broken crosstie. Since the track was not secured well against lateral movement, the rail moved enough to allow the wheels of the last four cars of the accident train to drop inside the track gage.

The investigation could not determine whether the accident train caused all the track movement that led to the failure of the shoring and crosstie or whether the track movement was the result of repeated crossings by many trains. Since the 10-mph sign was only 70 feet from the skeletonized area and the grade time signs were not covered as required, preceding trains probably were moving at a speed of more than 10 mph and braking as they entered the skeletonized track where the accident train derailed.

The train should have been moving at no more than 10 mph when it came to the first skeletonized track section at survey section 41+50 about 1,000 feet after the train left the Bowling Green Station. The uncovered grade time signs and the posting of the 10-mph slow sign only 70 feet from the insufficiently shored-up track may have led the train operator to approach the area at a speed above 10 mph. However, the train operator

knew that there were areas of skeletonized track on his route because he had operated over them previously in the week. He also knew about the general order regarding track repairs in the area and knew from previous trips over the area that 10 mph was the required speed over skeletonized track; therefore, he should have been more aware of the train speed and should have managed the train so as not to have exceeded 10 mph over the skeletonized sections of track.

The precise speed of the train at the time of the derailment could not be determined; however, the NYCTA's calculation based on a descending 3-percent grade, with all wheels on the rail, and an emergency braking distance of 200 feet indicated a speed of 26.5 mph. In this case, the derailed cars were dissipating energy in crushing and climbing over the crossties and shoring material and in scraping against the tunnel and third rail; therefore, in the view of the Board, the retardation may have been greater than if all wheels had been on the rail. Consequently, the Board concludes that the speed of the train at the time of the derailment was significantly above the 10-mph limit and probably was about 25 mph. The excessive speed would have increased the probability of the failure of the shoring because of increased loads on the track structure.

The contractor-installed slow sign was a non-NYCTA standard sign, but more importantly it was located improperly. The NYCTA requires that a slow sign be located far enough in advance of a restricted area to allow a train operator to decelerate the train to the designated maximum speed. Moreover, all other signs such as the 25-mph and 35-mph grade time signs which were superseded by the slow sign should have been covered. With the slow sign only 70 feet from the restricted area, it is possible that the train operator accelerated to a speed as high as 30 mph before seeing the 10-mph slow sign. The grade time signals which allowed 25 mph and 35 mph successively would not have precluded an acceleration to 35 mph. The signal supervisor should have ensured that a 10-mph slow sign was installed by the NYCTA to protect the entire work area including the two skeletonized sections north of the derailment site.

### **Track Rehabilitation**

The Track and Structures Department of the NYCTA had developed adequate standards for skeletonized track over which revenue trains were to operate, but the contractor and the Engineering and Construction Department, for whom the contract inspector worked, were not made aware of them. Therefore, the standards were ineffective in ensuring safe track for the operation of revenue trains in projects administered by the Engineering and Construction Department. The contractor had submitted a drawing previously for skeletonized track on another job involving a tunnel with vertical walls and of questionable applicability to the Joralemon Street tunnel which has curved sides. The NYCTA had found the drawing to be essentially acceptable, but it had annotated some changes. Those changes had not been delivered to the contractor at the time of the accident. Moreover, the contract inspector was not aware of the changes to the drawing. There also was a memorandum from the Superintendent of the Track Division which reiterated a prohibition against the use of wedges in skeletonized track, but the Engineering and Construction Department had not seen it. Even though the Engineering and Construction Department was unaware of the Track and Structures standards, the Engineering and Construction Department, with proper attention to the contractor's drawing, could have established acceptable engineering standards for shoring up the skeletonized track in the Joralemon Street tunnel for use by revenue trains. NYCTA directives stated requirements for erecting slow signs to protect the skeletonized track, but the senior contract inspector who released the track for revenue service either did not know about them or paid no attention to them. However, both he and the project director did instruct the contractor, who had no responsibility for operations, to erect a 10-mph slow sign, but no one told the contractor how or where to place it.

The coordination between the Engineering and Construction Department, which was providing the contract inspectors, and the Track and Structures Department, which was responsible for track safety, was practically nonexistent in this case. The Chief Engineer, who had no track maintenance experience himself, and his staff, who had no such expertise, were unaware of the Track and Structures Department standards for skeletonized track. The senior contract inspector's release for revenue service of the insufficiently shored-up, skeletonized track at the end of each work period indicates the result of his limited experience and his lack of understanding of what was required for safe operation of trains. Besides, it was impossible for him to observe the reaction of the shored-up track as the first train passed over it if he was located 1,000 feet from the skeletonized track. These circumstances also indicate a serious deficiency in the management and functional procedures of the NYCTA. It is fundamentally unsafe to assign major projects to a contract inspector with inadequate work or professional experience and without documented standards and guidelines.

The NYCTA's failure to install a proper slow sign for operation over the skeletonized track is an unacceptable operational deficiency. The evidence does not explain how or why procedures had become so lax that train operators and their supervisors passed the improperly installed and missing slow signs numerous times without reporting the deficiencies. Numerous trains passed over the skeletonized track north of the derailment area after the work started on March 13, 1984, without any recorded reports of deficiencies. The NYCTA needs to ensure that inadequate and improper procedures are reported invariably to supervisors. As a first step, operating personnel and their supervisors must be taught the operating rules and procedures and instructed to follow them precisely and conscientiously. The failure of the trackwalker to note the improperly shored-up skeletonized track and to report it is another indicator that employees are not following NYCTA procedures.

During its investigation of this accident, the Safety Board issued the following Safety Recommendations to the NYCTA on April 9, 1984, to which the NYCTA responded on December 4, 1984:

Recommendation R-84-17:

Immediately require all existing construction contracts to provide plans that meet approved engineering, construction, and maintenance specifications of the New York City Transit Authority, and require that all future contracts contain such provisions.

The NYCTA responded that all present contracts have been amended to contain, and future contracts would contain, a requirement that contractors performing track reconstruction work involving skeletonization of track submit a shop drawing for approval to the Engineering and Construction Department before commencing work. The drawings must provide all the necessary details which indicate the method by which the track is to be supported and blocked, as well as the specific procedures to be followed. The drawing must conform to NYCTA's established standard for skeletonized track work. Based on this positive action, Safety Recommendation R-84-17 has been placed in a "Closed--Acceptable Action" status.

Recommendation R-84-18:

Immediately evaluate the New York City Transit Authority maintenance division standards for supporting skeletonized track, and insure that the standards provide for the safe operation of trains. Provide those standards to all divisions involved in the construction and maintenance of track, and incorporate those standards in all work plans.

The NYCTA responded that it had reviewed the established Track and Structures Department standards for skeletonized track work and determined that the standards provide for the safe operation of passenger trains. Through the combined efforts of the Track and Structures and Engineering and Construction Departments, new drawings have been developed for use as the detailed standard for skeletonized track work and have been distributed to all contractors presently performing such work. The drawings will be incorporated in all contract documents which require track skeletonization. The NYCTA intends to issue one set of complete drawings regarding skeletonized track to all divisions involved in the construction and maintenance of track. Based on this positive action, Safety Recommendation R-84-18 has been placed in a "Closed--Acceptable Action" status.

Recommendation R-84-19:

Require that inspectors responsible for insuring safe conditions of track know the necessary standards for maintaining those conditions.

The NYCTA responded that its Rapid Transit Training Division has developed training courses for improving the expertise of track inspectors and track construction engineers and to provide an intensive training program for "new" track inspectors. Based on this positive action, and pending the receipt of further information on the total number of employees that are to receive the training and the projected completion date for training the track construction engineers and the new track inspectors, Safety Recommendation R-84-19 has been placed in an "Open--Acceptable Action" status.

Safety Oversight

The circumstances that led to the accident would not have occurred if the NYCTA had had an effective system safety plan backed up by good inspection and supervision. The Safety Board has investigated several transit accidents that might have been prevented by effective safety oversight. <sup>5/</sup> The riding public deserves the assurance of knowing that a project costing millions of tax dollars is planned and carried out with careful attention to the prevention of accidents.

The Safety Board has advocated previously that applicants for Federal grants be required to submit a system safety plan as part of the application and that UMTA use the evaluation of that plan as a partial basis for selecting those to be funded. <sup>6/</sup> At one time, UMTA developed a reasonably effective safety and system assurance program, but UMTA never made its requirements mandatory. The NYPTSB's initiation of safety oversight of NYCTA's operations is a progressive step in promoting rail rapid transit safety in New York. Effective review by the NYPTSB of NYCTA's system safety plan and continued monitoring of its operations should enhance the safety of that system and motivate the NYCTA to undertake a more effective safety program.

<sup>5/</sup> Railroad Accident Reports--"Rear End Collision of Three Massachusetts Bay Transportation Authority Trains, Boston, Massachusetts, August 1, 1975" (NTSB-RAR-76-05); "Rear End Collision of Two Greater Cleveland Regional Transit Authority Trains, Cleveland, Ohio, August 18, 1976" (NTSB-RAR-77-05); "Head-on Collision of Two Greater Cleveland Regional Transit Authority Trains, Cleveland, Ohio, July 8, 1977" (NTSB-RAR-78-02); "Derailment of New York City Transit Authority Subway Train, New York, New York, December 12, 1978" (NTSB-RAR-79-08); "Rear End Collision of New York City Transit Authority Subway Trains 142NL and 132NL, Brooklyn, New York, July 3, 1981" (NTSB-RAR-82-02); "Derailment of Washington Metropolitan Area Transit Authority Train No. 410 at Smithsonian Interlocking, January 13, 1982" (NTSB-RAR-82-06).

<sup>6/</sup> "Special Study of Rail Rapid Transit Safety," June 16, 1971 (NTSB-RSS-71-1).

### Emergency Response and Evacuation

The response to the emergency was complicated by the unrelated fire at the Borough Hall Station at about the same time as the derailment. The NYCTA command center log does not indicate at what time initial notification was made or by whom, but the logs do indicate conversations about the derailment with Brooklyn and Manhattan Fire Department units and emergency medical services personnel shortly after the derailment. The NYCTA logs indicate also that by 6:30 p.m., firefighters and police were in the tunnel with additional lights to assist in moving passengers out of the train, to the South Ferry emergency shaft, and up the steps to the street.

The NYCTA employees were successful in keeping the passengers calm and on the train until a decision was made to evacuate them through the South Ferry emergency shaft. The Assistant General Superintendent arrived at the derailed train about 6:13 p.m. and made a reasonably quick decision to evacuate the passengers. By 6:30 p.m., the evacuation had begun in an orderly manner, and by 9:19 p.m., the evacuation of the 1,500 passengers was completed without serious mishap. The elapsed time from derailment to evacuation was almost 4 hours.

Although the evacuation went smoothly, it took an unacceptably long time. If a train were to stop in a similar location because of an incident which generated a lot of smoke, many casualties could result from smoke inhalation if the evacuation were not rapid. The long evacuation was the result of the absence of effective documented plans and drills to train employees in the skill of quickly evacuating passengers from stalled or disabled trains. Although NYCTA publications refer to the passageways between the two tubes, employees have been given no advice, criteria, or training in the use of these passageways for evacuation. A complete analysis of the means of evacuating passengers from the Joralemon Street tunnel when trains stop in emergency conditions would show that the passageways could be used effectively. The third rails could be relocated at the passageways so that passengers could go from a train in one tube to a rescue train in the other tube without danger from the third rail. Effective use of the passageways would require good housekeeping to avoid debris and maintenance materials which would impede an evacuation.

Response to the derailment was complicated also by the absence of good information about the derailed train's exact location. The NYCTA command center did not know the train's location until the Assistant General Superintendent walked to it from the Borough Hall Station. As soon as the train operator reported the derailment, the command center should have determined the train's location relative to the possible emergency exits. This could have been done by the train operator's telling the command center the number of the nearest signal, emergency alarm box, or telephone. NYCTA's emergency procedures should be revised to include a rapid and precise way of establishing the location of a train in relation to emergency exits and passenger stations. This procedure should include a means of notifying the appropriate New York City emergency response units.

As a result of a 7-day on-site special investigation in December 1984 of the large number of fires that occur annually in the NYCTA subway system, the Safety Board issued several Safety Recommendations to the NYCTA, the NYPTSB, and the NYFD on March 28, 1985, which are relevant to the issues in this accident. The Safety Board recommended that the NYCTA:

Immediately train its command center personnel in the terminology used by the New York Fire Department to facilitate better communications during an emergency, and provide the fire department training materials for its use in familiarizing its personnel with essential terminology used in train operations. (R-85-28)

Provide to appropriate NYCTA operating, maintenance, and emergency response personnel and to the New York Fire Department maps which show all emergency exits and correlate subway track locations with street locations. (R-85-29)

Immediately establish a safe procedure for the New York Fire Department to use in an emergency to remove the third-rail power on the subway system, and disseminate the procedure to all affected parties. (R-85-30)

Immediately develop procedures for notifying its command center and the New York Fire Department when an emergency exit is unusable and for returning the exit to service as soon as possible. (R-85-31)

that the NYPTSB:

In consultation with the New York City Transit Authority, establish an action plan for the implementation of Safety Recommendations made to the New York City Transit Authority by the National Transportation Safety Board as a result of its special investigation of fires on the NYCTA subway system. Advise the National Transportation Safety Board of the timetable for the implementation of the recommendations, and furnish progress reports of the implementation. (R-85-35)

and that the NYFD:

Cooperate with the New York City Transit Authority (1) to develop procedures to reduce communications problems between the two agencies caused by differences in terminology, (2) to develop adequate maps of the NYCTA subway system correlated to street locations, (3) to improve procedures for shutting off third-rail power safely, and (4) to implement Safety Recommendations made to the NYCTA by the National Transportation Safety Board as a result of its special investigation of fires on the NYCTA subway system. (R-85-36)

The Safety Board may issue more Safety Recommendations in these subject areas when the special investigation is completed. If the Board's recommendations in this case and those from the special investigation are implemented, the safety of the NYCTA's rail rapid transit system will be enhanced.

## CONCLUSIONS

### Findings

1. The crewmembers of the train were qualified to run the train under New York City Transit Authority rules.
2. The skeletonized track was not shored up in compliance with NYCTA requirements.
3. Revenue trains were authorized to use the skeletonized track in the Joralemon Street tunnel by General Order No. 134-84, issued February 27, 1984, except when the contractor was working.



4. The NYCTA had documented standards for skeletonized track which were designed for train operation at a speed not to exceed 10 mph.
5. The contract inspector and the contractor were not familiar with the current NYCTA standards that prohibited the use of wedges in skeletonized track to be used by revenue trains.
6. The NYCTA did not require the contractor to submit specifications for shoring up the skeletonized track in the Joralemon Street tunnel.
7. The contractor and the senior contract inspector believed that the shoring was to be done in conformity with a plan previously submitted by the contractor for another job; however, that plan did not comply with existing NYCTA requirements for skeletonized track.
8. Neither the drawing submitted by the contractor for work at another location, with the annotations by the NYCTA, nor the memorandum reiterating the prohibition against the use of wedges in skeletonized track to be used by revenue trains were part of the additional work order; neither had been seen by the contract inspectors or the contractor.
9. The senior contract inspector allowed the contractor to use unapproved methods for shoring up skeletonized track, and thereafter he released the track for use by revenue trains.
10. Although the timbers used for shoring and blocking did not comply with NYCTA standards, there was no failure of the materials before the derailment.
11. The NYCTA trackwalker did not note and report the improperly shored up skeletonized track.
12. The signal supervisor did not install slow signs and cover grade time signs as required to protect the skeletonized track in the Joralemon Street tunnel.
13. The project director instructed the contractor to install a slow speed sign, but he did not specify the location.
14. The slow sign installed by the contractor in response to the request from the contract inspector did not conform with NYCTA standards and was not located in accordance with NYCTA policy.
15. The location of the slow sign only 70 feet from the skeletonized section of track which failed and the uncovered grade time signs may have led the train operator to exceed the speed authorized by the general order.
16. The train operator knew about the general order and knew from previous trips over the skeletonized track in the Joralemon Street tunnel that the maximum authorized speed over the skeletonized track was 10 mph.
17. The train was going significantly faster than the allowable 10 mph when it derailed--possibly more than 25 mph

18. The train operator did not report, and the desk trainmaster did not request, the exact location of the derailed train relative to the passenger stations or possible emergency exits.
19. The exact location of the derailed train was not ascertained until the Assistant General Superintendent arrived at the derailment site at 6:13 p.m.
20. The lack of information about the exact location of the train resulted in the NYCTA command center giving misleading information to NYCTA and emergency response personnel that confused and delayed the decision as to the evacuation route and method.
21. No Federal, State, or local agency was exercising independent safety oversight over the NYCTA at the time of the accident.
22. Since May 1984 the New York Public Transportation Safety Board has been exercising independent safety oversight over the NYCTA.
23. The Urban Mass Transportation Administration does not exercise its safety oversight authority under Section 22 of the Urban Mass Transportation Act of 1965.
24. The trackwork involved in the derailment was being performed under an UMTA grant, and UMTA required no safety plan or other safety certification from the NYCTA.

#### **Probable Cause**

The National Transportation Safety Board determines that the probable cause of this accident was the New York City Transit Authority's failure to require the contractor making the repairs to shore up the skeletonized track in conformity with NYCTA procedures, the failure to erect slow speed signs in compliance with NYCTA policies, and the release by the contract inspector of the improperly skeletonized track to the desk trainmaster for revenue train operation.

#### **RECOMMENDATIONS**

As a result of this investigation, the National Transportation Safety Board issued the following recommendations on April 9, 1984, to the New York City Transit Authority:

Immediately require all existing construction contracts to provide plans that meet approved engineering, construction, and maintenance specifications of the New York City Transit Authority, and require that all future contracts contain such provisions. (R-84-17)

Immediately evaluate the New York City Transit Authority maintenance division standards for supporting skeletonized track, and insure that the standards provide for the safe operation of trains. Provide those standards to all divisions involved in the construction and maintenance of track, and incorporate those standards in all work plans. (R-84-18)

Require that inspectors responsible for insuring safe conditions of track know the necessary standards for maintaining those conditions. (R-84-19)

In addition, the National Transportation Safety Board recommends that the New York City Transit Authority:

Develop and enforce procedures to ensure that appropriate signs and signals are displayed to indicate restricted speeds. (Class II, Priority Action) (R-85-57)

Educate contract inspectors, trackwalkers, train operators, and supervisors in the applicable crafts in their responsibilities for reporting discrepancies in track conditions, including lighted and unlighted signals and signs, and establish appropriate measures to promote compliance. (Class II, Priority Action) (R-85-58)

**BY THE NATIONAL TRANSPORTATION SAFETY BOARD**

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ G.H. PATRICK BURSLEY  
Member

May 13, 1985

**APPENDIXES**

**APPENDIX A**

**INVESTIGATION**

The National Transportation Safety Board was notified of the accident about 9:40 p.m. on March 17, 1984, by the National Response Center. In addition to the routine notification, the Safety Board duty investigator was informed that an investigator from the Safety Board's New York Office, who was alerted to the accident by public radio, had been on scene since shortly after the accident occurred. The Safety Board dispatched an investigator-in-charge and a track expert to the scene.

A 4-day public hearing was held on May 1-4, 1984, in Brooklyn, New York. Parties to the hearing were the New York City Transit Authority, Slattery Associates, the Urban Mass Transportation Administration, the Transport Workers Union of America, and the Engineers Union of the New York City Transit Authority. Testimony was taken from 26 witnesses.

**APPENDIX B**  
**PERSONNEL INFORMATION**

**Train Operator**

The train operator was hired in June 1970 as a conductor. He became a train operator in 1972 and progressed through yard service to qualification as a road train operator. He was qualified on all lines in the A Division and had been operating on the Lexington Avenue line since he qualified on the road. He received routine instruction in emergency procedures at yearly rules classes, but had not attended the NYCTA "Panic School" or its "Fire School."

**Conductor**

The conductor was hired in July 1982 as a conductor. He qualified as a conductor by means of passing the company test on rules and regulations, proper train operation, and proper handling of train breakdowns. He had attended the NYCTA "Panic School" and its "Fire School."

**Assistant General Superintendent, Rapid Transit Operations**

The superintendent began work with the New York Metropolitan Transportation Authority in 1977 and worked in various operational and consulting assignments until 1981. In March 1981, he was employed by the New York City Transit Authority as a Special Assistant to the President of the NYCTA and served in that position for 3 years with responsibility to respond to all unusual occurrences in Rapid Transit. In addition, during that period he served as the NYCTA liaison with the New York City Office of Civil Preparedness and represented the NYCTA on matters that dealt with different emergencies that affected New York City.

**Project Engineer**

The project engineer graduated from the Polytechnic Institute of Brooklyn in 1959 with a Bachelor of Civil Engineering degree. He is a professional engineer with a New York State license. He was hired by the New York City Transit Authority in 1959 as a Junior Civil Engineer. He progressed through the positions of Assistant Civil Engineer, Civil Engineer, Senior Civil Engineer to become Administrative Engineer in 1974. With the exception of about 6 months of that time, he had worked for the NYCTA, and 20 years of that time was in construction administration. At the time of the accident, he was the project engineer in charge of the Zone 1 rehabilitation construction project including the track work in the Joralemon Street tunnel which was involved in the accident.

**Contract Inspector**

The contract inspector was hired by the New York City Transit Authority as a Junior Draftsman in 1966. He had taken pre-engineering courses at Brooklyn College and had worked elsewhere as a draftsman since 1957. He was promoted to senior engineering technician in 1968. His functional title at the time of the accident was contract inspector, and he was the senior of two inspectors on the job on the day of the accident.

**Contract Inspector**

The junior contract inspector began work with the NYCTA in 1980 and had worked in various inspection activities since. He graduated from New York City College in a nonengineering curriculum. He took various engineering courses at other technical schools. On the day of the accident, he was the junior of two contract inspectors assigned to the project.