



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Log R 662

Date: March 27, 1996

In Reply Refer To: R-96-8 through -11

Mr. Lawrence G. Reuter, President
Metropolitan Transportation Authority/New York City Transit
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Brooklyn, New York 11201

At 2:39 p.m. on February 9, 1995, a Metropolitan Transportation Authority/New York City Transit (NYCT) northbound M line subway train collided with the rear car of a stopped NYCT B line subway train. The collision occurred on elevated track about 1,011 feet south of the Ninth Avenue station in Brooklyn, New York. Four NYCT employees and 11 passengers sustained minor injuries.¹

As the M train operator approached signal D2-541 south of the Fort Hamilton Parkway station in Brooklyn, the signal was yellow, instructing him to proceed and to be prepared to stop at the next signal (D2-532) at the north end of the station. However, he knew, as he had correctly answered NYCT examination questions on rule 39 and had also correctly described provisions of that rule to National Transportation Safety Board investigators, that as the operator of a light train, he was not permitted by rule 39 to stop in the station. The operator told investigators that he could see signal D2-532 showing red with a white light illuminated at the bottom as he entered the station; however, signal D2-532 was not equipped with a lunar white light. He said that he thought if he approached the signal at the allowable speed, it would clear. The operator likely slowed his train while entering the station because he presumably anticipated that signal D2-532 would clear on time. The operator conceded in subsequent interviews that signal D2-532 is not equipped with a lunar white light.

¹For more detailed information, read Railroad Accident Report--*Collision and Derailment of Two Subway Trains Metropolitan Transportation Authority/New York City Transit in Brooklyn, New York, on February 9, 1995* (NTSB/RAR-96/01).

The difference between grade time (GT) signals that are and are not equipped with a lunar white light may account for the operator misidentifying signal D2-532. An illuminated lunar white light indicates that a GT signal invariably will clear on time if approached at the allowable speed. A light train operator can therefore enter a station with confidence that he will not be stopped in that station. GT signals not equipped with lunar white lights, however, provide ambiguous information because the signal may or may not clear on time, depending on track occupancy. The NYCT system has 213 one-shot GT signals similar to signal D2-532 without a lunar aspect. The NYCT electrical systems manager told Safety Board investigators that although new installations provide lunar white lights at any signal that has a one-shot GT control, the NYCT had no plans to retrofit the 213 existing signals with lunar white lights. To eliminate any ambiguous information about whether a signal will clear on time, the Safety Board believes that the NYCT should ensure that each existing one-shot GT signal is equipped with a lunar white light.

Excluding either an electrical or a mechanical malfunction, a stop arm is in a raised position for only two reasons: the track ahead is occupied by another train; and at GT signals, the striking train has approached and passed the signal at excessive speed. Each strike mark therefore is evidence that a train has been operated at risk of collision or derailment. The Safety Board is concerned, as the NYCT L line survey found after an October 1993 train collision,² that 17 percent of the inspected stop arms had been struck at least once within the past 30 days, which averages 1.4 strikes a day. Because GT signals enforce a predetermined speed on descending grades or at other safety critical locations, the Safety Board has an even greater concern that nearly half of GT signal stop arms had been struck. The percentage of stop arm strikes (45 percent) at GT signals was five times greater than the percentage of strikes (9 percent) at other automatic signals, indicating a disproportionately greater frequency of strikes at GT signals. The disproportion may be caused by display differences since stop arms at GT signals and at other automatic signals, respectively, are normally up until a train approaches at a predetermined speed and down unless the track ahead is occupied. However, the disproportion is more likely because the operators have acquired with experience on the transit system certain expectancies and habits. The 88.7-percent on-time train performance reported by the Rapid Transit Operations (RTO) as of February 1995 indicates that trains are moving without delay most of the time, and presumably operators become accustomed to that flow of traffic. The GT signals usually clear on time as operators approach, and trains proceed without delay; however, the operators' routine expectancies occasionally are not met, and the signal does not clear on time because of track occupancy. The strike arm survey indicates that on some of those occasions, the operators do not stop the train before striking stop arms and passing stop signals, particularly the safety-critical GT signals.

The NYCT has issued a series of directives and bulletins since 1990, each after a rear-end collision, reminding operators to obtain permission before keying by signals. Six rear-end collisions between July 1990 and February 1995 have been attributed to operators keying by

²Railroad Accident Report--Rear-End Collision of Two New York City Transit Authority Trains, Graham Avenue Station, Brooklyn, New York, October 7, 1993 (NTSB/NYC-94-FR-002A/B).

signals without permission. The continuation of rear-end collisions demonstrates a lack of compliance with published operating rules. The NYCT directives and bulletins were inadequately administered to ensure operator compliance with stop signals to prevent subsequent collisions.

A few days after the accident, the NYCT deactivated the automatic key-by feature at signal D2-532. The NYCT reported that since the deactivation, no strike marks have been detected on the stop arm at signal D2-532 and no delay in service on the B line has occurred. Therefore, the Safety Board concludes that the safety of operations at signal D2-532 has been enhanced by the deactivation of its automatic key-by feature. Consequently, the Safety Board believes that the NYCT should deactivate the automatic key-by feature at every one-shot GT signal.

The Safety Board has reviewed the July 26, 1990, NYCT rear-end collision that involved keying by without permission in which the track, signal, and trains were the same as in this February 1995 collision. The RTO was informed by memorandum after the NYCT investigation that the collision was caused "by the failure of the operator, operating the M train, to adhere to the operating rules relative to passing red signals, and failing to pay proper attention to the operation of the train" and was issued a safety recommendation by the Office of System Safety to "instruct local supervisors to increase their observation of operator's performance in their areas of responsibility as a deterrent to improper train operation."

According to the M train operator, he could not remember the aspect of signal D2-532 when he passed it without stopping. Signal D2-532 will display a red signal when a train is ahead in the block. The signal worked properly during the Safety Board stopping distance tests conducted with the test train after the accident, which indicated that signal D2-532 was working as designed. The Safety Board therefore concludes that the M train operator failed to comply with published operating rules that require stopping at a red signal and requesting and obtaining RTO permission to proceed.

After the March 10, 1989, rear-end collision at the 103rd Street station,³ the Safety Board asked the NYCT in Safety Recommendation R-90-4 to conduct random testing, using radar guns, of train speed, with special emphasis given to those locations where speed restrictions are in effect. The NYCT responded that "operators are regularly monitored for their adherence to posted speed limits; we will, manpower permitting, intensify our efforts to ensure that speed restrictions are strictly obeyed." The Safety Board classified Safety Recommendation R-90-4 "Closed--Acceptable Action" in December 1990.

The principal duty of NYCT management to guarantee the safety of its 3.4 million daily passengers is to ensure operating crews compliance with the NYCT published operating rules. In the April 1995 Safety Board interviews with NYCT line superintendents, only the superintendent of the L line stated that he conducted unannounced testing. The NYCT has no unannounced, oral

³Railroad Accident Report--Rear-End Collision of Two New York City Transit Authority Trains, 103rd Street Station, New York, March 10, 1989 (NTSB/RAR-90/01).

or written, operating rule compliance testing program. The NYCT also has no oversight compliance program that includes either speed checks with radar guns or formal written efficiency testing. NYCT operators are passing stop signals without permission and not adhering to the speed restrictions. Therefore, the Safety Board concludes that the NYCT lacks an adequate oversight testing program to ensure operator compliance with critical speed and signal operating rules. An NYCT operational testing program that includes frequent unannounced speed and signal tests as well as radio communication procedure testing to monitor operator performance would not only detect violations but also instruct operators.

The NYCT train service supervisors use the B-Form check list to document operator performance. The NYCT provides no written standardized instruction to them for either filling out or grading the 18 items found on the form, which allows possible subjective performance evaluations. An overall rating is filed on the computer data base and may not adequately reflect the operator's compliance with critical speed and signal rules. The Safety Board believes that the NYCT should revise the Operating Employee Evaluation Check List to effectively determine compliance with operating rules and instructions and include, at a minimum, unannounced speed and signal tests and radio communication procedures. The NYCT should also provide standardized written instructions for administering and grading the evaluation check list.

The Safety Board has long been an advocate of train control systems that provide positive train separation (PTS) and has included PTS on its list of "Most Wanted Transportation Safety Improvements." The newer transit agencies in San Francisco, California; Atlanta, Georgia; and Washington, DC, use PTS systems to control train speed and separation. The PTS system provides an automatic means of backing up the actions of the train operator by monitoring the performance of operator and train when approaching the limits of a signal or speed restriction. Should the operator or the train fail to apply the proper brake action, the PTS system will assume control, automatically apply the brakes, and stop the train.

The NYCT relies on the stop arm to prevent collisions as well as on the operator's understanding of and compliance with operating rules. The collision just south of the Ninth Avenue station demonstrates the limitations of this NYCT control system. The Safety Board concludes that the track section on which the collision occurred lacked a true PTS system because the stop arm did not prevent the *M* train from passing signal D2-532. Consequently, the Safety Board believes that the NYCT should include overspeed protection and PTS in the modernization of its signal system.

Therefore, the National Transportation Safety Board recommends that the Metropolitan Transportation Authority/New York City Transit:

Ensure that each existing one-shot grade time signal is equipped with a lunar white light. (Class II, Priority Action)(R-96-8)

Deactivate the automatic key-by feature at every one-shot grade time signal. (Class II, Priority Action)(R-96-9)

Revise the Operating Employee Evaluation Check List to effectively determine compliance with operating rules and instructions and include, at a minimum, unannounced speed and signal tests and radio communication procedures. Provide standardized written instructions for administering and grading the evaluation check list. (Class II, Priority Action)(R-96-10)

Include overspeed protection and positive train separation in the modernization of the signal system. (Class II, Priority Action)(R-96-11)

The National Transportation Safety Board is an independent Federal agency with the statutory responsibility "to promote transportation safety by conducting independent accident investigations and by formulating safety improvement recommendations" (Public Law 93-633). The Safety Board is vitally interested in any action taken as a result of its safety recommendations. Therefore, it would appreciate a response from you regarding action taken or contemplated with respect to the recommendations in this letter. Please refer to Safety Recommendations R-96-8 through -11 in your reply. If you need additional information, you may call (202) 382-6840.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in these recommendations.


By: Jim Hall
Chairman