



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: October 26, 2007

In reply refer to: R-07-9 through -12

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On Tuesday, July 11, 2006, about 5:06 p.m., central daylight time,¹ the last car of northbound² Chicago Transit Authority (CTA) Blue Line train number 220 derailed in the subway between the Clark/Lake and Grand/Milwaukee stations in downtown Chicago, Illinois. About 1,000 passengers were on board the eight-car rapid transit train. Following the derailment, the train came to a stop, and electrical arcing between the last car and the 600-volt direct current third rail generated smoke. The single operator in the lead car received a number of calls on the train intercom. The operator exited the control compartment, stepped onto the catwalk, and walked beside the train to investigate.

Electrical power was removed from the third rail, and most passengers walked to an emergency exit stairway about 350 feet in front of the train that led to the street level. Some passengers had to be assisted in their evacuation by emergency responders. The Chicago Fire Department reported that 152 persons were treated and transported from the scene. There were no fatalities. Total damage exceeded \$1 million.³

The National Transportation Safety Board determined that the probable cause of the July 11, 2006, derailment of Chicago Transit Authority train number 220 in the subway in Chicago, Illinois, was the Chicago Transit Authority's ineffective management and oversight of its track inspection and maintenance program and its system safety program, which resulted in unsafe track conditions. Contributing to the accident were the Regional Transportation Authority's failure to require that action be taken by the Chicago Transit Authority to correct unsafe track conditions and the Federal Transit Administration's ineffective oversight of the

¹ All times are central daylight time.

² The Blue Line track is generally aligned in a geographical north to south direction; however, the track in the area of the derailment was aligned in an east to west direction.

³ For more information, see <http://www.nts.gov/publicctn/2007/RAR0702.pdf>. National Transportation Safety Board, *Derailment of Chicago Transit Authority Train Number 220 Between Clark/Lake and Grand/Milwaukee Stations, Chicago, Illinois, July 11, 2006*, NTSB/RAR-07/02 (Washington, DC: NTSB 2007).

Regional Transportation Authority. Contributing to the seriousness of the accident was smoke in the tunnel and the delay in removing that smoke.

Government Oversight

The State of Illinois' Regional Transportation Authority (RTA) hired a contractor to conduct the Triennial On-Site Safety Review of the CTA's System Safety Program Plan. The report from the triennial review performed in 2004 listed numerous track maintenance and inspection safety issues that did not prompt any corrective actions, including the following: skewed or twisted track plates (on the Dearborn Subway) indicating ineffective fasteners that often indicate the existence of wide gage problems; deteriorated half-ties and areas of mud and excessive water on the track structure on the Red and Blue Lines; a large number of gage rods indicating large-scale track issues on the Red Line; lean levels of track inspection personnel as compared to those of other similar transit systems; and inadequate training of track inspection personnel.

The CTA was aware of these track maintenance and inspection deficiencies; however, most of the track deficiencies identified in the triennial review were still present when the accident occurred, about 18 months after the final report had been issued. The Safety Board is concerned that when asked why the RTA did not follow up on all the track safety issues identified in the triennial review, the RTA representative said that the RTA only follows up on findings in the triennial review and it did not consider these observations to be findings that would warrant further action.

Although the system safety reviews were an important step in identifying dangerous conditions on the CTA transit system, the RTA did not fully utilize its oversight authority. The RTA did not require the CTA to prepare corrective action plans to address all safety conditions identified in its review. Further, the RTA report highlighted positive findings that were inconsistent with the additional observations of serious safety conditions. The Safety Board concludes that because the RTA failed to follow up with the CTA and prompt action to correct safety deficiencies identified in the triennial report, unsafe track conditions continued to exist that should have been corrected.

The Federal Transit Administration's (FTA's) transit oversight program requires that FTA inspectors perform an on-site audit of each State's system safety oversight program every 3 years. Prior to the accident, the FTA's last audit of the RTA program was conducted in 2000. With the events of September 11, 2001, the FTA temporarily ceased conducting State system safety oversight program audits and focused its resources on security assessments and evaluations at rail transit agencies. During this period, the FTA revised 49 *Code of Federal Regulations* (CFR) Part 659 and required additional safety and security measures to be taken by transit agencies. The FTA has now resumed its on-site audits of each State's system safety oversight program, and the RTA is scheduled to be audited in 2008.

The FTA did not receive a copy of the RTA's January 2005 Triennial On-Site Safety Review report that identified numerous track maintenance and inspection safety deficiencies. Although the FTA did not review this report, in April 2005 the FTA did revise 49 CFR Part 659 to require State safety oversight agencies to provide in their annual submissions (by March 15 of

each year) a report documenting and tracking findings from triennial safety review activities. This provides another opportunity at the Federal level to ensure rail transit agencies are providing effective safety oversight. However, the Safety Board is concerned that observations or other comments relating to safety deficiencies might not be included in these annual submissions unless they are labeled as a finding in the triennial safety report. The Safety Board concludes that the FTA's oversight of the RTA's Rail Safety Oversight Program was inadequate and failed to prompt actions needed to correct track safety deficiencies on the CTA's rail transit system. Therefore, the Safety Board believes that the FTA should modify its program to ensure that State safety oversight agencies take action to prompt rail transit agencies to correct all safety deficiencies that are identified as a result of oversight inspections and safety reviews, regardless of whether those deficiencies are labeled as "findings," "observations," or some other term.

A 2006 U.S. Government Accountability Office report⁴ on the FTA State Safety Oversight program also recognized that the FTA had failed to keep to its stated 3-year audit schedule of the State safety oversight agencies in the years after September 11, 2001. The report determined that this failure resulted in a lack of information to track program trends and made it difficult for FTA officials to develop performance measures and goals to enhance its System Safety Oversight program. The report also recognized that the FTA faces some challenges in managing and implementing its program because officials interviewed from 16 of the 24 State system safety oversight agencies said that they do not have enough qualified staff to manage their programs. Also, officials interviewed from both transit and oversight agencies stated that there was a need for additional oversight and technical training to ensure uniformity among the various State programs. The Safety Board believes that the FTA should develop and implement an action plan, including provisions for technical and financial resources as necessary, to enhance the effectiveness of State safety oversight programs to identify safety deficiencies and to ensure that those deficiencies are corrected.

Qualifications and Training

The track problems in this accident were evident and should have been identified. This prompted a review of the CTA track inspector training and qualifications as compared to those of other rail passenger programs in the industry. A survey of several transit agencies and passenger railroads revealed that the CTA had the lowest experience and training requirements for its track inspectors. The CTA can select track maintenance workers to become inspectors after only 1 year of track experience. Also, a prospective inspector may have little real track maintenance experience or knowledge. In comparison, the surveyed agencies and railroads have an application process, and only the most qualified senior track workers or foremen are selected to be track inspectors.

The CTA's General Manager of Power and Way Maintenance stated that he believed that a track inspector's position requires more experience and comprehensive training than it is currently given and that the track inspector's status should be higher than that of maintenance

⁴ U.S. Government Accountability Office, *Rail Transit, Additional Federal Leadership Would Enhance FTA's State Safety Oversight Program*, Report to the Committee on Transportation and Infrastructure, House of Representative (Washington, DC: GAO, July 2006).

workers and laborers. He compared the position to that of CTA's signal inspectors, who are required to complete apprenticeships before being considered for those positions.

The CTA's 1 day of classroom training in track inspection that was in place before the accident was the least amount of classroom training required by the transit agencies and/or railroads surveyed. The other agencies and railroads not only select experienced personnel but also typically require from 1 to 4 weeks of training in track inspection and have recurrent training thereafter to ensure that their employees maintain continued competency in critical areas.

The CTA 1-day classroom training covered the CTA's *Track Maintenance Standards Manual*. This manual listed 16 possible indications of a gage problem, including dark streaks on the inside rail of a curve, lateral movement of tie plate on the tie or rail on the tie plate, missing spikes, and poor tie conditions. Most of these conditions were observed during the postaccident inspections of the derailment area. However, as one CTA track inspector pointed out, the class covered too much information in too short a time.

The CTA's classroom training also did not cover conditions found in tunnels or on elevated structures. Unique conditions, such as standing water, electrolysis, and darkness that requires working by flashlight, can occur in tunnels. These conditions can cause track problems to differ depending on the environment and the construction, and track inspection methods may therefore vary depending on the visibility and the location of the track. The Safety Board concludes that the CTA track inspection training program did not adequately prepare inspectors to perform their required duties and it did not address the unique demands of inspecting and maintaining elevated track structures or track structures located inside tunnels. Since the accident, the CTA has informed the Board that it has lengthened its track training program and now mandates track refresher training on an annual basis. It also is developing a new comprehensive track inspection training program to be completed by 2008. The FTA has recognized that most transit agencies need assistance with track inspection and maintenance programs, and it is developing a program that includes workshops, as well as classroom training, to address this need. Although the CTA has taken action to improve its track inspector training program, the FTA is developing a course for all transit agencies' track inspector programs that will likely enhance the CTA's efforts. The Safety Board believes that the FTA should schedule the CTA as a priority for receiving the maintenance oversight workshop and the training course to be developed for track inspectors and supervisors that will address the unique demands of track inspection in the rail transit environment.

Train Evacuation

Instructions for emergencies are posted in each railcar. The instructions tell passengers to listen for instructions and wait on the train. Some passengers exited the train before they were given instructions to do so. Considering the arcing and smoke being generated at the end of the train, it is understandable that passengers in the rear of the train started exiting the train immediately.

According to the CTA's *Rail System Rule Book*, when a train goes into emergency the operator should notify the control center and attempt to find and correct the trouble. After CTA

train number 220 went into emergency, the operator exited the control compartment and walked out onto the catwalk to determine what had happened. He saw thick smoke at the rear of the train and passengers on the catwalk. Using a portable two-way radio, he informed the rail controller of what was happening and went from car to car telling passengers to exit the train. He did not use the intercom to make a train-wide announcement because he had exited the train to assess the situation.

Once the operator had assessed the situation from the catwalk and decided to tell the passengers to exit the train, he could have reentered the control compartment and made an announcement via the intercom rather than run from car to car. Although more passengers would have heard such a train-wide announcement, the actions of the operator were not unreasonable considering how quickly events occurred immediately after the derailment. The operator was in regular contact with the control center using his portable radio, and he could be heard providing information to passengers about how to open the car doors and directing them toward the emergency exit. However, in response to postaccident questionnaires, some passengers stated that they did not hear the operator's instructions.

Tunnel Evacuation

During the early emergency response efforts, the personnel in the control center did not have specific information about the location of the accident train. The operator told the rail controller that his train had been headed northbound approaching Grand/Milwaukee. Based on this information, the power controller activated the emergency lights and announcements at the emergency exit immediately south of the Grand/Milwaukee station. Next, additional emergency exit lights and announcements were activated north of the Grand/Milwaukee station. The lights and announcements were not activated at the closest accessible emergency exit, 300 North Clinton Street, until 5:24 p.m.

Emergency call boxes are one way of determining a person's location, and subsequently a train's location, in a subway tunnel. The call boxes have unique identification numbers that can be used to locate the call box and its user. A passenger using an emergency call box told the CTA power controller that he and other passengers were at box number 52379. The power controller should have been able to determine the location of that call box. Before the accident, however, the emergency call boxes were given new five-digit numbers. The subway maps in use at the time of the accident still had the old seven-digit box numbers. When the accident occurred, the subway maps were being revised. Since the accident, the CTA has revised and distributed its subway maps, and these maps now reflect the current location of all emergency call boxes and their identification numbers.

Initially, emergency responders did not have specific information about the location of the train. In the first call to 911, a passenger told a dispatcher that there was fire and smoke on the Blue Line, the train had derailed, and it was past Clark/Lake. Based on this information, emergency responders were dispatched to the Clark/Lake station. As more information became available, emergency responders were told of different locations (for example, the Grand/Milwaukee station), and they began to respond to each location. The Safety Board concludes that because a train indication system had not been installed on the Dearborn Subway and the CTA's control center could not identify the location of an emergency call box used to

report the accident, the specific location of train 220 could not be determined, which delayed the emergency response and the activation of emergency exit lights and announcements at the closest accessible emergency exit. The CTA has train indication systems on multiple lines that provide train locations to the control center. It reported that a signal replacement project that will provide train locations for the Dearborn Subway is on schedule for completion by 2009.

Tunnel Ventilation

The ability to fully and efficiently control all aspects of a ventilation system can play a pivotal role in removing smoke and aiding passenger evacuation during an emergency. When fire, smoke, or fumes are present, CTA's standard practice is to confirm the location of an incident and the circumstances involved before activating ventilation. This helps ensure that the power controller knows which fans to turn on and in which direction the airflow will best assist emergency response efforts.

The CTA personnel in the northbound tunnel reported (by radio) that smoke was moving toward the Clark/Lake station. Upon receiving this information, the power controller initiated ventilation efforts to remove the smoke at 5:18 p.m., about 11 minutes after the accident. Initially, exhaust fan 133 was activated; then about 8 minutes later, the Clark/Lake station under-platform fan and all the Washington, Monroe, and Jackson continuous platform fans were operated in the exhaust mode. However, fan 133 was north of the accident site, and the other fans were south of the accident site. As a result, the Safety Board concludes that the initial efforts to remove smoke were inefficient because the fans were pulling against each other from opposite sides of the smoke source.

The CTA personnel later reported heavy smoke from the vent shaft for fan 108 just south of the accident site and directed the power controller to put the under-platform fan at the Clark/Lake station and the under-platform fans at the Washington, Monroe, and Jackson stations' continuous platform into the supply mode. Once this was done, the smoke flowed northward through exhaust fan 133, and conditions inside the tunnel and stations improved greatly. However, because fan 133 was not reversible, the smoke had to be exhausted through it and northward in the same direction that people were moving to exit. The Safety Board concludes that had fan 133 been capable of dual direction (reversible), the smoke could have been removed in a direction opposite that of the path of evacuation. Exhaust fan 108, which had been removed in 2001, was located just to the south of the accident site. The Safety Board concludes that if fan 108 had been reinstalled and operational, the smoke could have been eliminated faster and in a direction opposite that of the path of evacuation.

During the accident response, the CTA found that fan 157 would not start. However, once the under-platform fans at the Clark/Lake station and the fans in the continuous platform at the Washington, Monroe, and Jackson stations were put into supply mode, fan 133 efficiently removed the smoke from the tunnel. Therefore, in this case, it does not appear that fan 157 would have appreciably improved the smoke removal process even if it had been operational.

Because of the problems encountered during the emergency evacuation after the accident, the Safety Board believes that the FTA should inform all rail transit agencies about the circumstances of the July 11, 2006, CTA subway accident and urge them to examine and

improve, as necessary, their ability to communicate with passengers and perform emergency evacuations from their tunnel systems, including the ability to (1) identify the exact location of a train, (2) locate a specific call box, and (3) remove smoke from their tunnel systems.

Therefore, the National Transportation Safety Board makes the following recommendations to the Federal Transit Administration:

Modify your program to ensure that State safety oversight agencies take action to prompt rail transit agencies to correct all safety deficiencies that are identified as a result of oversight inspections and safety reviews, regardless of whether those deficiencies are labeled as “findings,” “observations,” or some other term. (R-07-9)

Develop and implement an action plan, including provisions for technical and financial resources as necessary, to enhance the effectiveness of State safety oversight programs to identify safety deficiencies and to ensure that those deficiencies are corrected. (R-07-10)

Schedule the Chicago Transit Authority as a priority for receiving the maintenance oversight workshop and the training course to be developed for track inspectors and supervisors that will address the unique demands of track inspection in the rail transit environment. (R-07-11)

Inform all rail transit agencies about the circumstances of the July 11, 2006, Chicago Transit Authority subway accident and urge them to examine and improve, as necessary, their ability to communicate with passengers and perform emergency evacuations from their tunnel systems, including the ability to (1) identify the exact location of a train, (2) locate a specific call box, and (3) remove smoke from their tunnel systems. (R-07-12)

The Safety Board also issued safety recommendations to the State of Illinois, the Regional Transportation Authority, the Chicago Transit Board, and the Chicago Transit Authority.

Please refer to Safety Recommendations R-07-9 through -12 in your reply. If you need additional information, you may call (202) 314-6177.

Chairman ROSENKER, Vice Chairman SUMWALT, and Members HERSMAN, HIGGINS, and CHEALANDER concurred in these recommendations. Vice Chairman SUMWALT and Member HIGGINS filed concurring statements, which are attached to the Railroad Accident Report for this accident.

[Original Signed]

By: Mark V. Rosenker
Chairman