

Log # R-666



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: NOV 14 1996

In Reply Refer To: R-96-50

Honorable Jolene M. Molitoris
Administrator
Federal Railroad Administration
400 Seventh Street, S.W.
Washington, D.C. 20590

On October 25, 1995, at 7:10 a.m., the Northeast Illinois Regional Commuter Railroad Corporation (d/b/a Metropolitan Rail) express commuter train 624 struck the rear left side of a stopped Transportation Joint Agreement School District 47/155 school bus at a railroad/highway grade crossing in Fox River Grove, Illinois.¹ After the school bus crossed the railroad tracks and stopped for a red traffic signal, its rear extended about 3 feet into the path of the train. Of the 35 school bus passengers, 7, 24, and 4 passengers sustained fatal, serious to minor, and no injuries, respectively; the busdriver received minor injuries. The 120 passengers and 3 crewmembers aboard the commuter train were uninjured.

Based on review of the train event recorder data, railroad and highway signal system design and calculations, postaccident testing, and witness statements, the National Transportation Safety Board considers that the following event sequence likely occurred immediately prior to the accident. Train 624 approached the railroad/highway grade crossing on a clear signal. Traveling 64 mph, it crossed the narrow band shunt, which was 3,080 feet from the crossing, 32 seconds² before impact. Then, 24 seconds before collision, the railroad system signaled the highway system of the approach of the train, which was 2,400 feet from the crossing and traveling 66 mph. The preemption cycle began 1 second later for the highway traffic signal system; about the same time, the train engineer first saw the school bus on the grade crossing. Still traveling 66 mph, the train was 2,300 feet from the crossing. The pedestrian phase in the highway traffic signal system ended 12 seconds before impact; the train was then traveling 69 mph and was 1,200 feet from the crossing. Ten seconds before the collision, the train engineer began sounding the horn as well as making a throttle reduction to idle and a full-service brake

¹For more information, see Highway/Railroad Accident Report—*Collision of Northeast Illinois Regional Commuter Railroad Corporation (METRA) Train and Transportation Joint Agreement School District 47/155 School Bus at Railroad/Highway Grade Crossing in Fox River Grove, Illinois, on October 25, 1995* (NTSB/HAR-96/02)

²Approximate values are used for this discussion because timing values can fluctuate within railroad and highway signal systems as designed.

application; at this point, the train was still traveling 69 mph and was 1,000 feet from the crossing. The U.S. Route 14 (US 14) yellow indication and the intersection red indication ended 7 ½ and 6 seconds, respectively, before impact. Concurrently, the train was traveling 67 mph and was 600 feet from the crossing when a green indication would have been displayed for Algonquin Road. The engineer placed the train into emergency braking 500 feet from the collision site and 5 seconds before the collision.

The school bus had stopped on the south side of the tracks, proceeded across the tracks, and stopped at US 14 for a red signal indication. The crossing warning devices activated with the lights flashing, the bell sounding, and the gates descending. The passengers in the rear of the bus initially joked about the northern crossing gate descending and striking the school bus on its left side near the 10th window. Then, seeing the train, they yelled warnings about its approach to the busdriver. Traveling about 60 mph, the train struck the bus at a 75-degree angle in the left-side rear and penetrated as much as 3 1/3 feet into the passenger area. The bolts that secured the bus body and chassis sheared; the body and chassis separated. The bus body rotated counterclockwise, scraped the ground, struck and knocked down a traffic light stanchion, and came to rest about 195 degrees from its original orientation. The chassis rotated counterclockwise also, struck the side of the train, and came to rest in the road approximately 45 degrees from its original orientation.

The Safety Board considers that the highway traffic signal sequence may have taken 21 seconds and would only apply when the light for US 14 displayed a green indication within 3 seconds of the preempt signal. However, the school busdriver indicated that the traffic signal displayed a red indication as she approached the crossing and proceeded slowly across the railroad tracks. The train engineer first observed the school bus on the crossing about the same time that the preempt signal was transmitted to the highway signal system. The traffic signal for northbound Algonquin Road displayed a red indication for 3 seconds or more; therefore, US 14 would have had a green indication before the preempt signal. The occurrence of a 21-second traffic signal sequence at the time of the accident is unlikely. The Safety Board determined that the traffic signal had an 18-second cycle before the green indication for northbound Algonquin Road displayed and that the US 14 traffic signal displayed a red indication for several seconds before the collision.

The Federal Highway Administration (FHWA) funded a February 1991 report³ by the University of Tennessee that evaluated motorist responses, warning time expectations, and tolerance levels at three active railroad/highway grade crossings with relatively high train and

³Stephen H. Richards, R.A. Margiotta, and G.A. Evans, *Warning Time Requirements at Railroad-Highway Grade Crossings with Active Traffic Control*, Report No. FHWA-SA-91-007, 1991.

vehicular traffic volumes. The actions of 3,500 motorists were assessed during 445 train crossings. The research results⁴ indicate that extremely short warning times can be dangerous and

Leave little margin of safety and poorly accommodate larger vehicles such as combination trucks and buses, especially if those vehicles must first come to a stop as required by many state laws.

However, the study also found that excessively long warning times (exceeding 40 seconds at flashing light signal crossings and 60 seconds at gated crossings) can cause motorists to lose confidence in the traffic control system. In addition, warning times in excess of 30 to 40 seconds caused many motorists to engage in risky crossing behavior. Specifically, most motorists expect a train to arrive within 20 seconds of traffic control device activation.

All railroads are required by the Federal Railroad Administration to provide a minimum of 20 seconds of warning time before train arrival at a grade crossing.⁵ The circuitry can impart even more time than this, depending on the speed of the train (whether accelerating or decelerating) and the track condition.

Before October 11, 1995, at the Fox River Grove collision site, the thumb wheel⁶ setting for the preempt was set at 30 seconds; however, 2 weeks before the accident, the Union Pacific Railroad Company (UP) reset the thumb wheel to 25 seconds. All postaccident tests conducted by the Federal Railroad Administration, the Safety Board, the UP, and the Illinois Department of Transportation (IDOT) resulted in a warning time of 20 seconds or more before a train reached the crossing.

Because the highway traffic signal system at the accident site did not operate in a coordinated mode after its installation in January 1990, the northbound traffic on Algonquin Road waited for only 6 seconds before receiving a green indication. Therefore, traffic would have had 14 seconds or more to clear the grade crossing before the arrival of a train traveling 69 mph, as was train 624. In October 1994, IDOT installed new traffic signal controllers that automatically displayed the 12-second pedestrian clearance phase from 5:45 a.m. to 10 p.m., and the traffic on Algonquin Road then waited for a minimum of 18 seconds for a green indication. As a result, traffic would only have 2 to 6 seconds (20- to 24-second warning time, respectively) to clear the grade crossing.

After receiving complaints about the short green indication for Algonquin Road, IDOT and its representatives checked the timing sequence numerous times to ascertain whether the highway signal system was operating as programmed. Each time they found it to be so operating.

⁴Stephen H. Richards and K. W. Heathington, *Assessment of Warning Time Needs at Railroad-Highway Grade Crossings with Active Traffic Control*, Transportation Research Record No. 1254, Traffic Control Devices for Highways, Work Zones, and Railroad Crossings, 1990.

⁵49 CFR Part 234.225, "Activation of Warning System." Revised October 1, 1995.

⁶ Warning time switch for a crossing signal.

The IDOT contractor had never inspected the highway signal system during a time that 70-mph commuter trains were in operation. The least time duration of a green indication for northbound Algonquin Road would result from a commuter train approaching the grade crossing. Because the contractor had only been checking the signal system against its program, he had never considered the critical element -- the length of time the green indication provided for northbound Algonquin Road before the arrival of a train. Then, the day before the accident, he recognized that the time of day might have been a factor in the complaints and, as a result of this recognition, he was inspecting the highway signal system at the Lincoln Road and US 14 intersection at the time of the accident.

The school busdriver stated that she never saw a green indication; the student assisting her said that the busdriver was looking in the mirror toward the rear of the bus just before the collision. From the available evidence, the green indication was displayed 2 to 6 seconds before impact. Had she seen the green indication, the busdriver might possibly have responded and moved the bus in the 2 to 6 seconds of the green clearance indication before the arrival of train 624, but very little response time was provided. Highway traffic signal hardware (heads, controllers, masts, posts, and loop detectors) conformed to design standards and operated as intended, but the signal system did not provide sufficient time for northbound traffic on Algonquin Road to clear the grade crossing.

No national data base, including the U.S. Department of Transportation/Association of American Railroads grade crossing inventory, currently identifies and documents railroad/highway grade crossings in which the railroad signal system preempts or interconnects with the highway signal system. Having this documentation available in a data base would have been valuable, especially after the Safety Board issued its urgent recommendations following this accident. Had a data base containing grade crossing signal system information been available after this accident, the States could have more readily identified and then inspected specific crossings to ensure that the signal systems posed no hazards.

Based on the foregoing information, the National Transportation Safety Board makes the following safety recommendation to the Federal Railroad Administration:

In cooperation with the Federal Highway Administration, review and modify the existing parameters of National Highway-Rail Crossing Inventory to ensure that it meets the needs of both railroad and highway users. Include, as a minimum, information on highway/railroad grade crossings having preemptive or interconnected signals. Once modified, review and update the information annually. (R-96-50)

The National Transportation Safety Board is also making safety recommendations to the U.S. Secretary of Transportation, the Federal Highway Administration, the National Highway Traffic Safety Administration, the State of Illinois, the Illinois Department of Transportation, the Transportation Joint Agreement School District 47/155, the National Association of State Directors of Pupil Transportation Services, the American Association of State Highway and Transportation Officials, the National Association of County Engineers, the American Public Works Association, the Institute of Transportation Engineers, the Association of American

Railroads, the American Short Line Railroad Association, the American Public Transit Association, and Operation Lifesaver, Inc. (The Safety Board issued urgent action recommendations following this accident to the Federal Highway Administration, the Federal Railroad Administration, and the State Directors of Transportation.)

The Safety Board is 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 recommendation in this letter. Please refer to Safety Recommendation R-96-50. If you have any questions, you may call (202) 314-6448.

Chairman HALL, Vice Chairman FRANCIS, and Members HAMMERSCHMIDT, GOGLIA, and BLACK concurred in this recommendation.

By:  Hall
Jim Hall
Chairman