National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: December 2, 2014

In reply refer to: R-14-74

The Honorable Joseph C. Szabo
Administrator
Federal Railroad Administration
Washington, DC 20590

The National Transportation Safety Board (NTSB) urges the Federal Railroad Administration (FRA) to take action on the safety recommendation issued in this letter. This recommendation addresses the structural integrity of passenger car windows and passenger car window safety standards. The recommendation is derived from the NTSB's ongoing investigation of the December 1, 2013, derailment of Metro-North Railroad (Metro-North) passenger train 8808 in The Bronx, New York. As a result of our investigation to date, the NTSB issued three recommendations on February 18, 2014 (one to Metro-North and two to the FRA). This letter transmits one additional safety recommendation, addressed to the FRA. Information supporting this recommendation is discussed below.

The Accident

On December 1, 2013, at 7:19 a.m. eastern standard time, southbound Metro-North passenger train 8808, which departed Poughkeepsie, New York, with a destination of Grand Central Terminal in New York City, derailed at milepost 11.35 on main track 2 of the Metro-North Hudson Line in The Bronx, New York. The train consisted of seven passenger cars and one locomotive at the rear in a push configuration. All seven passenger cars and the locomotive derailed (see figure 1). The derailment occurred in a 6˚ left-hand curve where the maximum authorized speed was 30 mph. The train was traveling at 82 mph when it derailed. Of the estimated 115 passengers and 4 crewmembers onboard the train at the time of the derailment, 4 passengers were killed, and 57 passengers and 4 crewmembers were injured and transported to local hospitals.

The NTSB determined that the probable cause of the accident was the engineer's noncompliance with the 30-mph speed restriction because he had fallen asleep due to undiagnosed severe obstructive sleep apnea exacerbated by a recent circadian rhythm shift required by his work schedule. Contributing to the accident was the absence of a Metro-North Railroad policy or a Federal Railroad Administration regulation requiring medical screening for sleep disorders. Also contributing to the accident was the absence of a positive train control system that would have automatically applied the brakes to enforce the speed restriction.

Contributing to the severity of the accident was the loss of the window glazing that resulted in the fatal ejection of four passengers from the train.

Figure 1. An aerial view of the accident site.

Damage to Passenger Car Windows and Injuries

All of the train cars on Metro-North passenger train 8808 were manufactured by Bombardier Transportation between 1985 and 2002. The first three cars of the train each had 12 windows on the right side. The windows, also called glazing, are single 0.46-inch-thick panes of polycarbonate material retained in the car sidewall by a flexible, neoprene gasket that fits around the perimeter of the window opening. The gasket was designed with a removable insert, or "zip-strip," that can be pulled out to remove the window during emergencies or maintenance. On the accident train's first three cars, for the 12 windows installed on the right side, 2 emergency windows are intended to be opened from the inside of the car; thus, the zip-strips were installed in the inside of the car. For the remaining 10 windows, the zip-strips were installed on the outside of the car. The Metro-North car specification states, "All zip strip mouldings, except for the four (4) emergency escape units are arranged for ease of removal from outside of the vehicle."

During the derailment sequence, the train cars were dragged along the tracks and through the ballast on their right sides. During postaccident examination of the passenger cars, NTSB investigators found that nearly all of the windows and surrounding gaskets were separated from

the right sides of the first three cars. Specifically, in the first and second cars, 9 right-side windows were missing in each car (see figure 2); in the third car, all 12 of the right-side windows were missing. NTSB investigators considered if the windows may have been removed by occupants or responders to exit or enter the cars. However, investigators discounted this possibility because the second and third cars came to rest on their right sides, allowing no usable exit or entry routes on the right sides. The first car had usable car body doors on the left side and both ends of the car for entry or egress, so window exit or entry was not needed. NTSB investigators examined the windows (glazing and gaskets) that remained in the train and found that the windows were intact; however, several other types of failures were observed, including the window/glazing partially separated from its surrounding structure, torn gaskets, and zip-strips that partially separated from the gasket.

Figure 2. The right side of the first car.

The four passengers who were ejected from the train were killed and were found under or adjacent to the first three cars. They were ejected from the cars through the window openings that resulted from the loss of the windows/glazing. Two of the seriously injured passengers were partially ejected and sustained injuries consistent with making contact with the ground outside of the train while it slid along the ballast. The passengers and crew who remained in the train survived the accident. Had the windows remained secured in the cars, the four passengers who were killed would not have been ejected and likely would have survived the accident.

Window Safety Standards for Passenger Cars

Federal regulations (Title 49 *Code of Federal Regulations* [CFR] 223.9) require that passenger cars built or rebuilt after June 30, 1980, must have certified glazing. Appendix A to 49 CFR 223 describes the certification process for glazing materials. The certification tests include a ballistic impact test and a large object test. For the tests, the glazing material is required to be rigidly attached to a fixture. As a result, this test assesses only the strength of the window/glazing material itself and does not test the performance of the window/glazing material, gasket, and window opening as an entire unit.

In addition to the certified glazing requirements, 49 CFR 238.221 describes an additional performance requirement for new Tier I passenger equipment.[1] In new equipment, the glazing is required to remain in place when subjected to the forces due to air pressure differences caused when two trains pass in opposite directions at maximum authorized speed.[2] Unlike the requirements described in Part 223, Part 238 does not require a test to ensure that the glazing performs as required.

Passenger car windows have several crucial, yet potentially conflicting, functions. First, the windows are a functional component of the car body structure and thus serve to maintain the integrity of the passenger compartment. During an accident, the windows should remain in place so that occupants are kept inside of the car and debris, such as ballast and tree limbs, are kept out of the car. In opposition, the windows are one means to exit a car during emergency situations, such as a fire. During an evacuation, the window/glazing can be removed by passengers, crew, and emergency responders. The NTSB notes that no performance standard currently addresses these multiple functions of window structures as an entire unit to keep the window/glazing in place during an accident but still allow it to be removed during an emergency evacuation.

Regulations and research for passenger car windows have focused on the performance of the windows/glazing by itself (the resistance to breaking) rather than the window as an integral functional component of the car sidewall structure.[3] The NTSB is concerned that in this accident, the windows in the first three cars did not remain in their surrounding structures during the accident, which directly resulted in serious injuries and fatalities. The NTSB concludes that while current FRA passenger car window requirements are generally sufficient to ensure the strength of the windows by themselves, current requirements are insufficient to ensure that the window/glazing remains secure in its surrounding structure during an accident. Performance standards for the entire window unit (the window/glazing, gasket, and window opening) are needed to ensure maximum passenger and crew safety.

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[1] Title 49 CFR 238 defines Tier I as passenger equipment operating at speeds not exceeding 125 mph. This requirement applies to passenger cars ordered on or after September 8, 2000, or placed in service for the first time on or after September 9, 2002.

[2] Title 49 CFR 238.421 describes a similar requirement for Tier II passenger equipment (operating at speeds between 126 and 150 mph).

[3] For example, see FRA (Federal Railroad Administration). 2009. *Assessment of Potential Aerodynamic Effects on Personnel and Equipment in Proximity to High-Speed Train Operations.* Washington, DC: US Department of Transportation, FRA.

Therefore, the National Transportation Safety Board makes the following recommendation to the Federal Railroad Administration:

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Develop a performance standard to ensure that windows (e.g., glazing, gaskets, and any retention hardware) are retained in the window opening structure during an accident and incorporate the standard into 49 *Code of Federal Regulations* (CFR) 238.221 and 49 CFR 238.421 to require that passenger railcars meet this standard.

The NTSB is vitally interested in this recommendation because it is designed to prevent accidents and save lives. We would appreciate receiving a response from you within 90 days, as required by 49 *United States Code* section 1135, detailing the actions you have taken or intend to take to implement it. When replying, please refer to the safety recommendation by number. We encourage you to submit your response electronically to correspondence@ntsb.gov.

[Original Signed]

By: Christopher A. Hart,
Acting Chairman