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**NATIONAL TRANSPORTATION SAFETY BOARD
Public Meeting of May 21, 2019
(Information subject to editing)**

**Amtrak Passenger Train 501 Derailment
DuPont, Washington
December 18, 2017
RRD18MR001**

This is a synopsis from the NTSB's report and does not include the Board's rationale for the conclusions, probable cause, and safety recommendations. NTSB staff is currently making final revisions to the report from which the attached conclusions and safety recommendations have been extracted. The final report and pertinent safety recommendation letters will be distributed to recommendation recipients as soon as possible. The attached information is subject to further review and editing to reflect changes adopted during the Board meeting.

Executive Summary

On December 18, 2017, at 7:34 a.m. Pacific standard time, southbound Amtrak passenger train 501, consisting of 10 passenger railcars, a power railcar, a baggage railcar, and a locomotive at either end, derailed from a bridge near DuPont, Washington.

When the train derailed, it was on its first revenue service run on a single main track (Lakewood Subdivision) at milepost 19.86. There was one run for special guests the week before the accident. Several passenger railcars fell onto Interstate 5 and hit multiple highway vehicles. At the time of the accident, 77 passengers, 5 Amtrak employees, and a Talgo, Inc., technician were on the train. Of these individuals, 3 passengers were killed, and 57 passengers and crewmembers were injured. Additionally, 8 individuals in highway vehicles were injured. The damage is estimated to be more than \$25.8 million. At the time of the accident, the temperature was 48°F, the wind was from the south at about 9 mph, and the visibility was 10 miles in a light rain.

The following are safety issues in this accident:

- Individual agency responsibilities in preparation for inaugural service
- Multiagency participation in preparation for inaugural service
- Amtrak safety on a host railroad
- Implementation of positive train control
- Training and qualifying operating crews
- Crashworthiness of the Talgo equipment
- Survival factors and emergency design of equipment
- Multiagency emergency response

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Findings

1. None of the following was a factor in this accident: the mechanical readiness of the train, the condition of the track or signal system, the weather, cell phone use, medical conditions of the Amtrak engineer; use of alcohol or other drugs, fatigue, or any impairment or distraction.
2. This accident has demonstrated the value of image and audio data for the accident investigation and development of safety recommendations.
3. The Federal Railroad Administration has demonstrated an unwillingness to implement the recommendations and regulation that would require inward-facing video and audio devices that are critical to accident investigations and improving safety on our nation's railroads.
4. Inward-facing recorders with both image and audio capabilities can increase the understanding of the circumstances of an accident, and, ultimately, provide greater precision in safety recommendations and subsequent safety improvements.
5. Had the positive train control system been fully installed and operational at the time of the accident, it would have intervened to stop the train prior to the curve, thus preventing the accident.
6. The Amtrak qualification program for the Point Defiance Bypass did not effectively train and test qualifying crewmembers on the physical characteristics of a new territory.
7. Amtrak did not provide sufficient training on all characteristics of the Charger locomotive.
8. The engineer's unfamiliarity with, and fixation on, the audible and visual alerts associated with the overspeed alarm reduced his vigilance of events outside the locomotive moments before the accident.
9. Engineers could better master the characteristics of a new locomotive with the use of simulators.
10. A systematic approach to training would have aided Amtrak managers in recognizing the challenge of operating new equipment on new territories.
11. Supplemental warning plaques, such as distance ahead plaques, or other types of conspicuous signs strategically positioned after an advance warning speed reduction sign would provide enhanced visibility as an added level of safety for operating crews of passenger and freight trains.
12. Crewmembers qualifying on a territory can and should play an active role in establishing and maintaining safe train operations.
13. Had the Washington State Department of Transportation, Central Puget Sound Regional Transit Authority, Amtrak, and the Federal Railroad Administration been more engaged and assertive during the preparation of the inaugural service, it would have been more

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likely that safety hazards, such as the speed reduction for the curve would have been better identified and addressed.

14. The Federal Railroad Administration did not use its authority provided under the Fixing America's Surface Transportation Act to approve speed limit action plans with conditions to require inclusion of planned and under-construction alignments owned or operated by railroads and require periodic updates to railroads' speed limit action plans, which led to no speed limit action being developed.
15. The Federal Railroad Administration should have ensured that speed limit action plans include new or updated routes owned or operated by railroads, using its authority in the Fixing America's Surface Transportation Act.
16. Central Puget Sound Regional Transit Authority did not update the timetable on its Lakewood Subdivision to identify the curve at milepost 19.8 as a crew focus zone, which would have helped to mitigate the overspeed derailment risk.
17. Amtrak failed to update the operating documents prior to starting revenue service which would have highlighted the speed reduction at the accident curve.
18. Central Puget Sound Regional Transit Authority's omission of the final activities of the certification process resulted in the failure to control the identified hazardous condition of an overspeed derailment at the accident curve.
19. Central Puget Sound Regional Transit Authority failed to implement effective mitigations in lieu of positive train control to control the hazard at the accident curve.
20. There was no requirement for the Washington State Department of Transportation, Central Puget Sound Regional Transit Authority, or Amtrak to provide additional protection for the accident curve.
21. Because the Federal Railroad Administration did not act on the recommendation to add technology to assist engineers in determining their location, an opportunity to improve safety was overlooked.
22. Washington State Department of Transportation should have provided greater oversight of Central Puget Sound Regional Transit Authority's safety certification process.
23. The Federal Railroad Administration's current requirement to review, but not approve, system safety program plans does not achieve the level of safety oversight expected from the Federal Railroad Administration.
24. Without positive train control and the lack of oversight to implement mitigations, there was an increased safety risk to the traveling public.
25. Amtrak did not take an active enough role in reviewing safety aspects during the preparation of the Point Defiance Bypass to ensure a safe operation.

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26. Amtrak failed to assess, evaluate, and act upon readily identifiable safety hazards to ensure the safety of the Point Defiance Bypass for the traveling public and its own train crews.
27. Amtrak needs to implement a safety management system on all of its operations whether internal, host railroad, or in states that own infrastructure over which Amtrak operates.
28. The repeated postponement of Title 49 *Code of Federal Regulations* Part 270, “System Safety Program,” has delayed needed safety improvements for the passenger rail industry, rail employees, and the traveling public.
29. The use of risk assessments to identify, mitigate, and control risk on new and upgraded service will increase the level of safety to Amtrak operations over all territories.
30. The Talgo Series VI passenger railcar AMTK 7424 (8) did not provide adequate occupant protection after its articulated connections separated, resulting in complex uncontrolled movements and secondary collisions with the surrounding environment which led to damage so severe to the railcar body structure, that it caused passenger ejections.
31. The failure of the articulated connections of both Talgo Series VI passenger railcars AMTK 7422 (10) and AMTK 7504 (7), the detached rolling assembly from AMTK 7422 (10) and its secondary collision with AMTK 7504 (7) directly resulted in three fatalities and two partially ejected passengers who had been traveling in AMTK 7504 (7).
32. The safety straps used for the Talgo Series VI trainset rolling assembly retention modifications were degraded due to their use in exposed outdoor conditions and were used far past their service life.
33. During the grandfathering approval process the Federal Railroad Administration failed to consider the limited useful service life of the nylon straps used for the Talgo Series VI trainset rolling assembly retention modifications which had degraded and failed to improve the crashworthiness of the train.
34. The Talgo Series VI trainset is structurally vulnerable if it is involved in a high-energy derailment or collision due to its lack of crashworthiness protections and is at risk to severe and catastrophic loss of survivable space.
35. The Talgo Series VI trainset designated as Amtrak train 501 was not in compliance with the terms and conditions of Federal Railroad Administration’s grandfathering agreement.
36. Allowing the grandfathering provision to remain in Title 49 *Code of Federal Regulations* 238.203(d), “Grandfathering of noncompliant equipment for use on a specified rail line or lines,” is an unnecessary risk that is not in the public interest nor consistent with railroad safety.
37. The Talgo Series VI trainset does not meet current United States safety standards and poses unnecessary risk to railroad passenger safety when involved in a derailment or collision.

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38. The lead locomotive's crashworthiness design and crash energy management features minimized the severity for injuries and fatalities to the train crew by performing as intended in this accident.
39. After the Talgo trainset separated from the power cars, there was no power to the train for emergency lighting which hampered the ability of passengers to evacuate the train and the ability of the first responders to conduct rescue operations within the railcar.
40. The lack of emergency lighting hampered the ability of passengers to evacuate the train and the ability of the first responders to conduct rescue operations within the railcar.
41. The instructional signs located above the railcar door exit controls and manual release mechanisms lacked the required high performance photoluminescent material or suitable alternative that would have allowed them to be visible and read in low-light or no-light environments.
42. The inability of the passengers to see and read the instructional signs regarding the exit controls and manual release mechanisms resulted in the inability of the passengers to use that point of egress for escape and delayed their evacuation from the train.
43. The rotation of the train seats (1) minimized the effectiveness of compartmentalization by allowing passengers to travel greater distances within the railcar during the accident, (2) caused injury to several passengers, (3) decreased the available aisleway space for passenger egress.
44. Existing procedures and design standards for antirotational seat locking mechanisms do not adequately protect passengers in accidents.
45. The failure of the articulated connections defeated the compartmentalization feature of AMTK 7421 (11) and provided a pathway for passenger ejection.
46. When the articulated connections failed, it resulted in a secondary collision that caused railcar AMTK 7424 (8) to roll over onto its roof and collapse its structure which dislodged the windows and allowed passengers to be ejected.
47. Limited research has been conducted into the effectiveness of compartmentalization in passenger railcars for individuals that fall outside of the testing standard range, such as small children.
48. The inability to secure child safety seats in a passenger train results in an undue risk to children due to uncontrolled or unexpected movements during a derailment or collision.
49. Amtrak should develop a policy for safely accommodating parents traveling with small children restrained in child safety seats.
50. This accident shows the need for the Federal Railroad Administration to take the action on Safety Recommendations R-16-35 and -36, which addressed the Federal Railroad Administration's occupant protection standards.

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51. Since there was no common incident command radio channel between fire and rescue agencies, law enforcement, and emergency management, the emergency response lacked efficient coordination.
52. The lack of interoperability of the emergency communications system used by Joint Base Lewis-McCord resulted in poor communications that adversely affected the coordinated rescue effort.
53. Incompatible radio frequencies or similar communication issues may exist at other locations where military and civilian agencies coordinate their emergency response.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the Amtrak 501 derailment was Central Puget Sound Regional Transit Authority's failure to provide an effective mitigation for the hazardous curve without positive train control in place, which allowed the Amtrak engineer to enter the 30-mph curve at too high of a speed due to his inadequate training on the territory and inadequate training on the newer equipment. Contributing to the accident was the Washington State Department of Transportation's decision to start revenue service without being assured that safety certification and verification had been completed to the level determined in the preliminary hazard assessment. Contributing to the severity of the accident was the Federal Railroad Administration's decision to permit railcars that did not meet regulatory strength requirements to be used in revenue passenger service, resulting in (1) the loss of survivable space and (2) the failed articulated railcar-to railcar connections that enabled secondary collisions with the surrounding environment causing severe damage to railcar-body structures which then failed to provide occupant protection resulting in passenger ejections, injuries, and fatalities.

Recommendations

New Recommendations

As a result of this investigation, the National Transportation Safety Board makes the following new safety recommendations:

To the Secretary of Transportation:

1. Require the Federal Railroad Administration to issue regulations for inward-facing recorders that include image and audio recordings as recommended by the National Transportation Safety Board in R-10-01 and R-10-02.

To the Federal Railroad Administration:

2. Study the efficacy of how signs used in other modes of transportation may be effectively used in the railroad industry.

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3. Require railroads to periodically review and update their speed limit action plans to reflect any operational or territorial operating changes requiring additional safety mitigations and to continually monitor the effectiveness of their speed limit action plan mitigations.
4. Require railroads to apply their existing speed limit action plan criteria for overspeed risk mitigation to all current and future projects in the planning, design, and construction phases, including projects where operations are provided under contract.
5. Prohibit the operation of passenger trains on new, refurbished, or updated territories unless positive train control is implemented.
6. Remove the grandfathering provision within Title 49 *Code of Federal Regulations* 338.206(d) and require all railcars comply with the applicable current safety standards.
7. Use your authority and compel all commuter and passenger railroads to meet the requirements outlined in Title 49 *Code of Federal Regulations* Part 238 without delay, such that in the event of a loss of power, adequate emergency lighting is available to allow passengers, crewmembers, and first responders to see and orient themselves, identify obstacles, safely move throughout the railcar, and evacuate safely.
8. Reevaluate existing seat securement mechanisms and their susceptibility to inadvertent rotation, to identify a means to prevent the failure of these devices to maintain seat securement.
9. Conduct research into the effectiveness of occupant protection through compartmentalization for passengers whose size (including children) is not within the current range of anthropomorphic passenger sizes in Federal Railroad Administration standards.

To the United States Department of Defense Fire and Emergency Services Working Group:

10. (1) Identify all military installations that provide emergency services to areas outside of their installations, make them aware of this accident, and determine the effectiveness of the communications system between that military installation and the adjacent jurisdictions. (2) Implement a plan to address any deficiencies with interoperability caused by the incompatibility between the US Department of Defense communications system and that of adjacent civilian agencies.

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To the Washington State Department of Transportation:

11. Discontinue the use of the Talgo Series VI trainsets as soon as possible and replace them with passenger railroad equipment that meet all current United States safety requirements.

To the Washington State Department of Transportation, Amtrak, and the Oregon Department of Transportation:

12. Develop and implement a program by which all railcar seats that are designed to rotate be checked for proper positioning and securement in place before the railcar can be placed into or returned to passenger carrying service.

To Amtrak:

13. Ensure operating crewmembers demonstrate their proficiency on the physical characteristics of a territory by using all resources available to them, including; in-cab instruments, signage, signals, and landmarks; under daylight and nighttime conditions; and during observation rides, throttle time, and written examinations.
14. Revise your classroom and road training program to ensure that operating crews fully understand all locomotive operating characteristics, alarms and the appropriate response to abnormal conditions.
15. Require that all engineers undergo simulator training before operating new or unfamiliar equipment (at a minimum, experience and respond properly to all alarms), and when possible, undergo simulator training before operating in revenue service in a new territory and experience normal and abnormal conditions on that territory.
16. Implement a formal, systematic approach to developing training and qualification programs to identify the most effective strategies for preparing crewmembers to safely operate new equipment on new territories.
17. Work with host railroads and states that own infrastructure over which you operate to conduct a comprehensive assessment of the territories to ensure that necessary wayside signs and plaques are identified, highly conspicuous, and strategically located to provide operating crews the information needed to safely operate their trains.
18. Conduct training that specifies and reinforces how each crewmember, including those who have not received their certifications or qualifications, may be used as a resource to assist in establishing and maintaining safe train operations.

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19. Update your safety review process to ensure that all operating documents are up to date and accurate before initiating new or revised revenue operations.
20. Incorporate all prerevenue service planning, construction, and route verification work into the scope of your corporate-wide system safety plan, including your rules and policies, risk assessment analyses, safety assurances, and safety promotions.
21. Work collaboratively with all host railroads and states that own infrastructure over which you operate in an effort to develop a comprehensive safety management system program that meets or exceeds the pending Federal Railroad Administration regulation Title 49 *Code of Federal Regulations* Part 270, "System Safety Program."
22. Conduct risk assessments on all new or upgraded services that occur on Amtrak-owned territory, host railroads, or in states that own infrastructure over which you operate.
23. Develop policies for the safe use of child safety seats to prevent uncontrolled or unexpected movements in passenger trains and provide customers with guidance for securing these child safety seats.

To Central Puget Sound Regional Transit Authority:

24. Immediately conduct a review of all operating documents and ensure that safety mitigations are applied with uniformity throughout the entirety of your territory.
25. In areas of your territory where you are a host of a tenant railroad, coordinate with all current and any prospective tenants on the development of operating documents including timetables, general orders, and special instructions.
26. Review your internal process for safety certification and verification, perform a gap analysis, and develop an action plan to address the deficiencies identified in the gap analysis and detailed in this report to enhance the verification activities on projects.

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Reiterated Recommendations

As a result of this investigation, the National Transportation Safety Board reiterates the following previously issued recommendations:

To the Federal Railroad Administration:

1. Enact Title 49 *Code of Federal Regulations* Part 270, “System Safety Program,” without further delay. (R-17-17)
2. Conduct research to evaluate the causes of passenger injuries in passenger railcar derailments and overturns and evaluate potential methods for mitigating those injuries, such as installing seat belts in railcars and securing potential projectiles. (R-16-35)
3. When the research specified in Safety Recommendation R-16-35 identifies safety improvements, use the findings to develop occupant protection standards for passenger railcars that will mitigate passenger injuries likely to occur during derailments and overturns. (R-16-36)

Classified Recommendations

To the Federal Railroad Administration:

1. Require railroads to install devices and develop procedures that will help crewmembers identify their current location and display their upcoming route in territories where positive train control will not be implemented (R-16-32)

Safety Recommendation R-16-32 is classified *Open—Unacceptable Response*.

2. Conduct research to evaluate the causes of passenger injuries in passenger railcar derailments and overturns and evaluate potential methods for mitigating those injuries, such as installing seat belts in railcars and securing potential projectiles. (R-16-35)

Safety Recommendation R-16-35 is classified *Open—Unacceptable Response*.

3. When the research specified in Safety Recommendation R-16-35 identifies safety improvements, use the findings to develop occupant protection standards for passenger railcars that will mitigate passenger injuries likely to occur during derailments and overturns. (R-16-36)

Safety Recommendation R-16-36 is classified *Open—Unacceptable Response*.