CORRECTED COPY

National Transportation Safety Board

Washington, DC 20594

Safety Recommendation

Date: October 10, 2013

In reply refer to: R-13-037 (Urgent)

Mr. Michael R. Peevy
President
California Public Utilities Commission
505 Van Ness Avenue
San Francisco, CA 94102

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant accidents in other modes of transportation—railroad, highway, marine, and pipeline. The NTSB determines the probable cause of the accidents and issues safety recommendations aimed at preventing future accidents. In addition, the NTSB carries out special studies concerning transportation safety and coordinates the resources of the federal government and other organizations to provide assistance to victims and their family members affected by major transportation disasters. We are providing the following information to urge the California Public Utilities Commission (CPUC) to take action on the urgent safety recommendation issued in this letter.

This urgent recommendation to the CPUC pertains to safety issues involving the Angels Flight Railway in Los Angeles. The recommendation addresses the need for an improved braking system, eliminating contact between the wheel flanges and rail fasteners, installing track-level walkways with railings, installing effective end-gates to protect passengers from ejection and to take action to prevent operators from disabling safety systems. The recommendation was derived from the NTSB's pending investigation of the derailment and passenger evacuation of an Angels Flight car that occurred on September 5, 2013, in Los Angeles. As a result of the derailment, the CPUC ordered the Angels Flight Railway to shut down.

Background

Angels Flight is a funicular railway located in downtown Los Angeles, California. Two cars operate on a 33% inclined guide way by means of a mutually connected wire rope for a travel distance of about 300 feet. Power is supplied from a station house at the top of the guide way. An operator collects revenue, and observes and controls movement from a booth at the top of the system. Movement can be commanded by the operator in either automatic or manual mode. Design speed is 3.5 miles per hour.

At about 11:30 a.m. September 5, 2013, the downward-moving car derailed near the mid-point of the guide way. There was one passenger aboard that car and five passengers aboard the upward-moving car. The operator recognized that the car stopped but was unaware that it had derailed. He initiated manual operation to attempt to berth the cars at their respective gates. Both cars moved about 100 feet, but stopped short of their gates. The operator then reversed the direction of the cars in an attempt to berth the cars. The derailed car moved uphill toward mid-point and again stopped. The operator then recognized a derailment had occurred and notified senior Angels Flight management of the derailment. Angels Flight did not notify the National Response Center, nor did they call 911 for assistance with evacuating the passengers. A citizen notified the fire department of the accident.

The NTSB investigated a prior collision on the Angels Flight Railway that occurred February 1, 2001, which resulted in a passenger fatality.[1] The NTSB determined that the probable cause of that accident was the improper design and construction of the Angels Flight funicular drive and the failure of various organizations involved in that design and construction to ensure that the railway system conformed to initial safety design specifications and known funicular safety standards.

As a result of the 2001 fatal accident, the NTSB recommended that before certifying Angels Flight to restart passenger service, the CPUC should independently verify that the drive system meets accepted industry standards and engineering practices and the funicular includes provisions for (1) emergency stopping under all foreseeable failure modes, including track brakes or some other independent backup system on the cars to prevent a runaway if a failure occurs in the cable or its associated braking systems; (2) containment of passengers in the event of a collision; and, (3) emergency egress and ingress for passengers and emergency responders (R-03-015). Angels Flight reopened on March 15, 2010. On December 29, 2010, the NTSB reclassified Safety Recommendation R-03-015 "Closed—Unacceptable Action" because CPUC did not require Angels Flight to comply with all of the elements of this recommendation before resuming service.

Safety Issues

Based on the September 5, 2013, derailment, NTSB investigators have become aware of a number of on-going safety concerns affecting Angels Flight Railway.

Rail and Wheel Wear

NTSB investigators learned that, during periodic inspections, CPUC inspectors have observed abnormal wheel and rail wear. The wheel-axle assemblies are fixed and do not rotate as the cars move through the passing turnout and the track gage is wider in the two curves to allow the cars to move through the passing turnout. The sliding contact between the wheels and the rail results in wearing the components of the wheel track system. Additionally, wheel flange contact

[1] **National Transportation Safety Board, Uncontrolled Movement, Collision, and Passenger Fatality on the Angels Flight Railway, Los Angeles, California, February 1, 2001, RAR-03/03 (Washington, DC: National Transportation Safety Board, 2003), www.ntsb.gov/doclib/reports/2003/RAR0303.pdf**

with the rail fasteners has worn grooves in the top of all the rail fasteners from the top of the guide way to the bottom, reducing their strength. To mitigate the abnormal wear, Angels Flight periodically applies grease to the entire rail head and the guard rails in the turnout. However, the abnormal wear has not been eliminated.

Track Brake System

The spring-applied track brake is held in the off position by an electro-hydraulic system that allows the cars to move in normal operation. Electric power to the track brake system is supplied from a third-rail located parallel to the guide way, and a set of batteries is installed on each car to provide backup power. Electrical grounding for the track brake system is provided through a car-mounted wire brush that makes contact with a wheel. After the September 5, 2013, accident, it was observed that grease had fouled the brush head and that the batteries were depleted.

The track brake system does not stop the drive system in normal operation. However, following the accident, there was evidence that the track brake had been in contact with the railhead during one or more trips. This contact had occurred since at least the day prior to the derailment when new grease was applied.

Other problems with the track brake system were also noted including multiple cracks on the hardened ram heads, abrasive scoring on the ram heads, metal shavings from the rail head in the grease buildup on the ram heads; and, the friction pads mounted on the bottom of the ram heads were worn smooth. It was also observed that as the downhill car negotiated the turnout, the outside forward wheel lifted off the rail and that the track brake ram was positioned outside the rail-head at two points (as the car entered the top of the turnout and departed at the bottom of the turnout). In summary, multiple issues with the design and operation of the track brake system bring into question its effectiveness as a safety brake.

Safety System Bypass

NTSB investigators learned that Angels Flight had experienced a number of unintended stops for several months. The cause of these unintended stops has not yet been determined. When an unintended stop occurred, the cars would only move if the operator depressed and held the "start" button on the control panel. This safety feature is designed to prevent continued automatic movement of the cars when a fault occurs. At the time of the accident, these undesired stops were occurring multiple times on each trip. The operators had broken a branch off a nearby tree and wedged it against the start button to keep it depressed, negating this safety feature. According to the individual operating at the time of the accident, operators had been using the branch for months, and senior Angels Flight management officials were aware of the practice.

Occupant Protection

Anthropometric data are readily available for use in the design of occupant protection in transportation vehicles.[2] Safety requirements for the height of entry/exit gates are generally

[2] McDowell, M.A., C.D. Fryar, C.L. Ogden, and K.M. Flegal. 2008. "Anthropometric Reference Data for Children and Adults: United States, 2003-2006." *National Health Statistics Reports*; No. 10. Hyattsville, MD: National Center for Health Statistics.

based on the 97.5 percentile height for males. It is assumed that a design based on that height will be sufficient because the 97.5 percentile height for females is less. Therefore, based on hip height and center of gravity, entrance and exit gates at the end of the cars should to be at least 42 inches high to protect occupants from ejection in a sudden stop. The Angels Flight cars are not equipped with gates that reach that height.

Emergency Egress and Ingress

Although there were no passenger or emergency responder injuries during the evacuation, this accident underscores the need for substantial improvements in emergency egress and ingress. Angels Flight cameras recorded the evacuations from both cars and showed a passenger in a 4-point crawl position during his movement from the stranded car to the upper platform. In addition, no form of fall protection or guide ropes were provided to the firefighter who descended from the upper platform to the stranded car, nor to the passengers who evacuated. There was no walkway or railing to prevent either the firefighter or any of the passengers from falling about 25 feet off the ends of the railroad ties to a concrete sidewalk below.

Due to ongoing concerns with the safety of Angels Flight, the CPUC ordered the railway to shut down until all identified issues and concerns are corrected, and the CPUC authorizes resumption of service.[3] Based on the noted safety concerns, the NTSB issues the following urgent safety recommendation to CPUC:

> Before authorizing it to resume passenger service, independently verify that the Angels Flight Railway meets all applicable accepted industry standards and engineering practices including: (1) preventing excessive wheel and track wear; (2) providing emergency stopping under all foreseeable failure modes; (3) ensuring safety systems are not bypassed; (4) preventing passenger ejection in the event of a collision; and, (5) providing a suitable means of emergency egress for passengers and ingress for emergency responders. (R-13-037) (Urgent)

At this time, the NTSB has not yet determined the probable cause of this accident. Nonetheless, the NTSB has identified the safety issues described above, which need to be addressed before Angels Flight returns to service to prevent a recurrence.

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 30 days 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. If your response exceeds 10 megabytes, including attachments, please e-mail us at the same address for instructions. Please do not submit both an electronic copy and a hard copy of the same response.

[3] Letter from Paul W. King, Deputy Director, Office of Rail Safety, Safety and Enforcement Division, CPUC, to John Welborne, President, Angels Flight Railway Company, dated September 6, 2013.

Acting Chairman HERSMAN, and Members HART, SUMWALT, ROSEKIND, and WEENER concurred in these recommendations.

[Original Signed]
By: Deborah A. P. Hersman
Acting Chairman