



**Metro**

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Metropolitan Transportation Authority

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**October 2, 2015**

**TO:** BOARD OF DIRECTORS

**THROUGH:** PHILLIP A. WASHINGTON *PAW*  
CHIEF EXECUTIVE OFFICER

**FROM:** JAMES T. GALLAGHER *JTG*  
CHIEF OPERATIONS OFFICER

**SUBJECT:** ANGELS FLIGHT RAILWAY

**ISSUE**

In July 2015, a Motion by Mayor Eric Garcetti (Attachment A) directed the CEO to report on items related to the operations of the Angels Flight funicular railway operating in the Bunker Hill area of downtown Los Angeles.

**BACKGROUND**

Angels Flight opened on December 31, 1901 connecting Bunker Hill with Hill St. and the Downtown area. Also known as the "World's Shortest Railroad", Angels Flight is internationally recognized and a historic landmark in the City of Los Angeles.

In 1962, the Community Redevelopment Agency of the City of Los Angeles (CRA/LA) was undertaking redevelopment in the downtown Bunker Hill area. The CRA/LA purchased the railway from its private operator. In May 1969, in response to an outcry of citizen support for preservation, the Los Angeles City Council directed that the CRA/LA carefully dismantle the railway and store the equipment until the railway could be reinstalled in a few years.

Eventually, with the CRA/LA providing project funding and oversight, the railway was reconstructed and reopened in 1996. Since 1997, Angels Flight has been effectively owned by the Angels Flight Railway Foundation (AFRF) through a 99-year ground lease. Through May 31, 2015, the Angels Flight Railway Company (AFRC) exclusively operated Angels Flight on behalf of the Foundation. AFRF has not appointed a new operator.

## Safety Record and Findings

In February of 2001, Angels Flight suffered a serious accident, resulting in one fatality and seven injuries. The National Transportation Safety Board (NTSB) determined that the probable cause of the accident was the CRA/LA's vendor's "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."

The NTSB called for emergency stopping under all foreseeable failure modes, an independent backup system to prevent runaway, containment of passengers within the vehicles in the event of a collision and guide way emergency ingress / egress for passengers and emergency responders.

Angels Flight was reopened in March 2010, pursuant to CPUC authorization, with improved safety features that included a secondary safety cable and redundant fail-safe braking systems. The mechanical drive was re-designed, a new system controller was installed and the entire system was refurbished in conformance with funicular mechanical standards. Passenger containment was addressed, including the addition of end-gates to the cars, and guide way emergency ingress/egress was approved by the Los Angeles Fire Department (LAFD).

On June 17, 2010, California Public Utilities Commission (CPUC) staff discovered that Angels Flight was being operated while the new end-gates on one car were not closing. The railway was ordered to cease operations until the gates were repaired and working as designed.

A CPUC inspection on June 10, 2011, asserted there was excessive and abnormal wear between the wheels and rail. The railway was ordered to cease operations. Repairs were completed, including a new wheel design, providing better navigation of the track geometry, as well as a more detailed inspection protocol. Service was resumed on July 5, 2011.

In September of 2013, a derailment occurred and service was suspended. There were no injuries and all passengers were evacuated by LAFD within 16 minutes of the cars stopping. The NTSB found the probable cause of the derailment was "the intentional bypass of the funicular safety system with Angels Flight management knowledge; and Angels Flight management continuation of revenue operations despite prolonged, and repeated, unidentified system safety shutdowns." The NTSB issued a Safety Recommendation on October 10, 2013 (Attachment B), citing specific issues to be satisfactorily addressed before consideration is given to allow resumption of service. These included recommendations on issues involving:

1. Rail and Wheel Wear Interface
2. Track Brake System
3. Safety System Bypass
4. Vehicle Occupant Protection
5. Guide Way Emergency Ingress and Egress

The CPUC issued a response to the NTSB on November 8, 2013 (Attachment C) affirming their actions in support of the recommendations.

On February 18, 2015, the CPUC issued Resolution ST-170 (Attachment D), ordering the AFRC to file a safety certification plan and a safety certification verification report prior to resuming revenue service. Additionally, the Railway must conform to CPUC directives addressing the five issues listed above. When all issues are satisfactorily addressed, the Railway may apply for formal approval from the CPUC to resume service.

### **NEXT STEPS**

Staff will meet with AFRF and the CPUC to advise on a path forward. Metro staff will recommend that the AFRF conduct a detailed analysis on the following to determine if they should resume operating the railway:

- Determine a source of funding for safety improvements, preventive maintenance and operations;
- Perform a comprehensive system inspection and operations assessment;
- Determine an optimal staffing plan for resuming operations;
- Calculate the annual maintenance and operating costs;
- Determine the costs and feasibility of completing the repairs and system safety improvements as outlined by the NTSB and concluded from the comprehensive inspection.

### **ATTACHMENT**

Attachment A: Item 76 – Motion on Angels Flight

Attachment B: NTSB Safety Recommendation – October 10, 2013

Attachment C: CPUC Letter to NTSB – November 8, 2013

Attachment D: CPUC Resolution ST-170 – Angels Flight Railway Company,  
February 18, 2015

Metro



Board Report

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File #:2015-1149, File Type:Motion / Motion  
Response

Agenda Number:76.

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**REGULAR BOARD MEETING  
JULY 23, 2015**

**Motion by:**

**Mayor Eric Garcetti**

July 23, 2015

**Item 76 (2015-1149): Angels Flight**

CONSIDER **Motion by Mayor Garcetti** to direct the CEO to report back in 60 days on the following items related to the operations of Angels Flight; the historic funicular operating in the Bunker Hill area of downtown Los Angeles:

- A. A historical summary of operations for Angels Flight including past closures and safety related issues;
- B. A summary of State and Federal safety findings pertaining to Angels Flight; and
- C. Recommendations for resuming operations.



## National Transportation Safety Board

Washington, DC 20594

### Safety Recommendation

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**Date:** October 10, 2013

**In reply refer to:** R-14-004 (Urgent)

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

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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.<sup>1</sup> 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

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<sup>1</sup> 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.nts.gov/doclib/reports/2003/RAR0303.pdf](http://www.nts.gov/doclib/reports/2003/RAR0303.pdf)

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 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.<sup>2</sup> Safety requirements for the height of entry/exit gates are generally 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.<sup>3</sup> 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-14-004) (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

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<sup>2</sup> 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.

<sup>3</sup> 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.



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](mailto: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.

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

*[Original Signed]*

By: Deborah A. P. Hersman  
Acting Chairman

## PUBLIC UTILITIES COMMISSION

505 VAN NESS AVENUE  
SAN FRANCISCO, CA 94102-3298



November 8, 2013

Ms. Deborah A Hersman  
Chairman  
National Transportation Safety Board  
Washington, DC 20594

Re: NTSB Letter of October 10, 2013, Safety Recommendation R-13-037 (Urgent)

Dear Chairman Hersman:

The California Public Utilities Commission appreciates the opportunity to work with the National Transportation Safety Board (NTSB) on the investigation of the derailment and subsequent passenger evacuation of the Angel's Flight Railway Company (AFRC) that occurred on September 5, 2013, in Los Angeles.

As a result of this preliminary investigation, the NTSB developed five recommendations as described in the NTSB letter of October 10, 2013. I describe the actions we will take to address each recommendation below.

As you are aware, the Commission's Safety and Enforcement Division (SED) directed AFRC to cease service until all identified issues and concerns are corrected. Our staff (Staff) will discuss with the NTSB all proposed solutions and corrections of the recommendations. The CPUC will not allow AFRC to resume service until each recommendation has been adequately addressed.

**Recommendation 1: Preventing excessive wheel and track wear.**

Staff will investigate and discuss alternative wheel-axle assemblies and other wheel/track wear-reducing measures with AFRC. One solution may be installing articulated axles on the vehicles. Staff will ensure that AFRC eliminates contact between the wheel flanges and rail fasteners before allowing any service resumption. Additionally, Staff will continue, as in the past, to regularly monitor wheel and rail wear.

**Recommendation 2: Providing emergency stopping under all foreseeable failure modes.**

AFRC indicates the existing spring-applied carrier brakes will be replaced by a new safety rope carrier brake. Staff will review the entire AFRC braking system. Staff will review the design of the rope carrier brake, inspect the subsequent installation, review the test procedure, and witness testing. Staff will ensure a reliable secondary braking system is in place.

**Recommendation 3: Ensuring safety systems are not bypassed.**

AFRC indicates it will replace the currently installed "start button" with a "required release switch" and also perform a complete system review to determine, and correct, the frequent unintended stops of the cars experienced prior to the derailment, which resulted in the bypass of existing safety systems. Staff will review and evaluate AFRC's assessment and corrective action

## ATTACHMENT C

Chairman Deborah Hersman  
November 8, 2013  
Page 2 of 2

plans for adequacy, and when Staff believes those plans are sufficient, will confirm that the appropriate actions are taken.

Staff believes the System should be reprogrammed so that any faults related to the braking system will shut down the vehicles from the main control room and that a Supervisor should be required to reset the entire system before the safety features will allow vehicles to operate.

Staff will require that AFRC submit all of their Unusual Occurrence Logs to Staff each month so that Staff is aware of any hazards that AFRC may be experiencing.

Staff will ensure that operational procedures are introduced that will prevent recurrence of a similar type of derailment, and that all AFRC operators are trained in these procedures.

Recommendation 4: Preventing passenger ejection in the event of a collision.

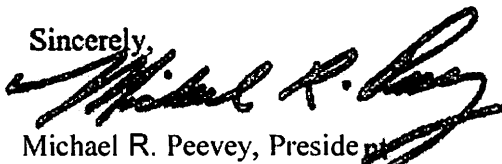
Staff will require that the exit gates at the end of each car be replaced with gates that are at least 42 inches in height or higher if deemed advisable by anthropometric design guides. Staff will assist and advise AFRC on the design of these gates as necessary.

Recommendation 5: Emergency egress for passengers and ingress for emergency responders.

Staff will ensure that AFRC improves emergency access. We understand from our previous correspondence that we and the NTSB apparently received different, albeit informal, interpretations of the standards for an "adjacent path" from ANSI. Through that correspondence we understand the NTSB's recommendation is for a surface that passengers can access without ladders or concerns about traversing the cement ties. Even in the case that ANSI were to provide a formal interpretation consistent with the informal one we received, we will require implementation of means of egress and ingress consistent with the NTSB's view. We understand this to be a track-level walkway with handrails and with suitable structures that might be needed to get to the walkway, such as metal grating on the track-way.

We look forward to our continuing collaboration and to the satisfactory implementation of these recommendations.

Sincerely,



Michael R. Peevey, President  
California Public Utilities Commission

cc: Paul Clanon, Executive Director, CPUC  
Brig. Gen. (CA) Emory J. Hagan, III, Director, SED  
Paul King, Deputy Director, Office of Rail Safety, SED  
Daren Gilbert, Program Manager, Rail Transit and Crossings Branch, SED  
Stephen Artus, Program and Project Supervisor, Rail Transit and Crossings Branch, SED  
Donald Filippi, Supervisor, Rail Transit and Crossings Branch, SED  
Noel Takahara, Supervisor, Rail Transit and Crossings Branch, SED

# ATTACHMENT C

Dave Watson, Senior Investigator, NTSB .

SED/RTSB/PWK/vdl

Date of Issuance 2/18/2015

**PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA**

Safety and Enforcement Division  
Rail Transit Safety Branch

Resolution ST-170  
February 12, 2015

**RESOLUTION**

RESOLUTION ST-170 ORDERING THE ANGELS FLIGHT RAILWAY COMPANY TO FILE A SAFETY CERTIFICATION PLAN AND A SAFETY CERTIFICATION VERIFICATION REPORT UNDER THE PROVISIONS OF GENERAL ORDER 164-D.

**Summary**

This resolution affirms the requirement for the Angels Flight Railway Company to file a Safety Certification Plan and a Safety Certification Verification Report according to the requirements in General Order 164-D, and ratifies California Public Utilities Commission President Michael Peevey's directive by letter of November 8, 2013, to Angels Flight Railway Company.<sup>1</sup> The Safety Certification Plan must include a commitment to implement all the recommendations issued by the National Transportation Safety Board and subsequently directed by President Peevey. Prior to resuming revenue service, a Safety Certification Verification Report must be filed and approved according to General Order 164-D and as ordered herein.

**Background**

Angels Flight is a landmark funicular railway that was originally built in 1901 in the Bunker Hill region of downtown Los Angeles. Since 1997, Angels Flight has been effectively owned by the Angels Flight Railway Foundation (Foundation) through a 99-year long-term ground lease with the Community Redevelopment Agency of the City of Los Angeles

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<sup>1</sup> Included as Attachment A.

(CRA/LA). The Angels Flight Railway Company (AFRC) operates Angels Flight on behalf of the Foundation.

Between 1901 and 1969, Angels Flight was owned by six different entities. CRA/LA was the eventual owner of Angels Flight and dismantled the funicular in 1969. In 1996, after 27 years of storage, CRA/LA oversaw the project to restore and reconstruct Angels Flight. The funicular was reopened to the public after being reinstalled two blocks south of its 1969 location. The track structure was rebuilt and the drive system was redesigned.

In 2001 the redesigned drive system failed, resulting in one of the cars rolling free down the 33-degree incline before colliding with the other car. Five passengers received serious injuries, two passengers received minor injuries, and one passenger died as a result of his injuries. Additionally, debris from the collision fell and injured a nearby pedestrian. The accident was thoroughly investigated by the California Public Utilities Commission (CPUC or Commission) and the National Transportation Safety Board (NTSB). The funicular was taken out of revenue service at this time.

One of the greatest concerns raised by the NTSB was that tests for metal particles in gear box oil were discontinued after an increased amount of metal in the oil was identified, in spite of a recommendation from the firm testing the oil to increase testing frequency because of the test results.<sup>2</sup> The gear failure that resulted from the accelerated wear indicated by the oil tests was the primary cause of the accident. The NTSB concluded that if the testing had been increased and the results appropriately recognized, the accident could have been prevented.<sup>3</sup>

In January 2007, AFRC personnel met with CPUC staff (Staff) to communicate their intent to refurbish and re-open Angels Flight. AFRC contracted engineering and manufacturing services to refurbish Angels Flight.

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<sup>2</sup> National Transportation Safety Board, *Uncontrolled movement, collision, and passenger fatality on the Angels Flight Railway in Los Angeles, California, February 1, 2001*, NTSB/RAR-03/03, adopted August 5, 2003. p. 23. See also: [http://www.kts-cb.com/angel\\_flight\\_accident.htm](http://www.kts-cb.com/angel_flight_accident.htm), last paragraph.

<sup>3</sup> *Ibid.*, pp. 37-38.

Angels Flight was once again reopened to the public in March 2010, with improved safety features that included a secondary safety cable, redundant fail-safe braking, and fail-safe carrier track brakes. The mechanical drive was once again redesigned, a state-of-the art controller was installed, and the entire system was refurbished in conformance with funicular standards (ANSI B77.2 - 2004) developed by the American National Standards Institute.

### Discussion

Since the March 2010 reopening there have been three major maintenance and operational-related issues, including a derailment, which led to Staff directing AFRC to cease revenue service operations each time.

The first major issue occurred on June 17, 2010, when Staff discovered that Angels Flight was being operated when the end gates were not closing. Staff immediately directed Angels Flight to cease service until the end-gates were fixed and working as designed.<sup>4</sup>

The second major issue occurred on June 10, 2011, when Staff inspectors discovered excessive wheel flange wear during a routine inspection. Staff determined that continuing operations without providing mitigation was an unacceptable hazard that could lead to derailment, and directed AFRC to cease service.<sup>5</sup> AFRC addressed the issue by replacing worn wheels, revising maintenance procedures to include detailed inspections of flange wear, and developing a condemnable flange wear limit that would specify when wheels needed replacement. AFRC was authorized to resume service operations by Staff on July 5, 2011.

The third major issue was a derailment that occurred on September 5, 2013, in which a downward moving Angels Flight car derailed. Several contributing factors were identified as causes of the derailment, including improper operating practices that bypassed safety functions of the

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<sup>4</sup> June 17, 2010, letter from CPUC Rail Transit and Crossing Branch Program Manager, Georgetta Gregory, to AFRC President John Welborne.

<sup>5</sup> June 10, 2011, letter from CPUC Consumer Protection and Safety Division Director, Richard Clark, to AFRC President John Welborne.

funicular system, inadvertent carrier brake activation, and carrier brake design issues. The NTSB determined:

[The] probable cause of the September 5, 2013, accident was the intentional bypass of the funicular safety system with Angels Flight management knowledge; and Angel Flight management continuation of revenue operations despite prolonged, and repeated, unidentified system safety shutdowns.<sup>6</sup>

Angels Flight has been shut down since this derailment.<sup>7</sup>

This derailment was investigated jointly by Staff and NTSB personnel, who worked together with AFRC to develop a corrective action plan. Some individual components of the plan, as well as the number and critical nature of the tasks, define the work under the plan as “major projects” under the provisions of General Order 164-D.<sup>8</sup> For example, the corrective action plan includes the redesign and installation of the carrier brake, start button reconfiguration, safety function reprogramming, fault logger reprogramming, replacement of wiring, operator training, better protection against passenger ejection, and construction of an evacuation walkway. We note that General Order 164-D requires a Safety Certification Plan (SCP) to be filed with the Commission when a project or projects of such magnitude are conducted, especially following an accident and a lengthy out-of-service period. General Order 164-D states:

Each RTA [Rail Transit Agency] shall prepare a Project specific Safety Certification Plan (SC Plan) for each of its Projects. Applicable FTA [Federal Transit Administration] guidelines shall be used as a reference.

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<sup>6</sup> National Transportation Safety Board, June 23, 2014, Railroad Accident Brief, *Angels Flight Railway Derailment*. p. 5.

<sup>7</sup> September 6, 2013, letter from CPUC Deputy Director, Safety & Enforcement Division, Office of Rail Safety, Paul W. King, to AFRC President John Welborne.

<sup>8</sup> See General Order 164-D, Section 2.12, Major Projects (Projects) means new rail systems or extensions, the acquisition and integration of new vehicles and safety critical technologies into existing service or major safety critical redesign projects, excluding functionally and technologically similar replacements. (Underlining added.)



Each RTA shall submit the SC Plan to Staff for review and Commission approval during the preliminary engineering phase. The RTA shall revise and expand the SC Plan as the Project progresses, as necessary. The RTA shall file any revision of the SC Plan with Staff. Within 45 calendar days, Staff shall approve or reject the proposed revisions.

We affirm that due to the nature and extent of new and modified technical and operational systems proposed, the AFRC corrective action plan should have been formalized in an SCP, yet it was not. Though the redesign and installation of the carrier brake, start button reconfiguration, safety function reprogramming, fault logger reprogramming, replacement of wiring, and operator training have been completed and reviewed, there still are major projects that have not been completed, as described below. Accordingly, we direct that an SCP be filed with the Commission that includes all the items in the corrective action plan, the NTSB's recommendations, and President Peevey's directive.<sup>9</sup>

The two issues that remain open were in response to the 2001 collision and passenger fatality – lack of end-gates that would effectively prevent ejection, and lack of an adjacent evacuation walkway. In the 2001 collision, a passenger was ejected and suffered serious injuries.<sup>10</sup> An effective end-gate would have prevented his ejection, and likely would have minimized the extent of his injuries. Also, after the 2001 fatality, the NTSB concluded:

The absence of an emergency walkway hampered access by emergency responders to passengers in this accident, made difficult the evacuation of the injured, and increased the risk to both passengers and emergency responders.<sup>11</sup>

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<sup>9</sup> General Order 164-D also requires that a Safety Certification Verification Report be filed with the Staff and approved before service is resumed. While General Order 164-D allows Staff to give provisional approval, in this instance, given the long and unsuccessful history of implementing engineering safety features and the NTSB recommendations, we will require formal Commission approval.

<sup>10</sup> See National Transportation Safety Board, *Uncontrolled movement, collision, and passenger fatality*, p. 5. See also, <http://articles.latimes.com/2001/feb/03/local/me-20617> and <http://abcnews.go.com/US/story?id=94217>

<sup>11</sup> National Transportation Safety Board, *Uncontrolled movement, collision, and passenger fatality*, p. 43.

[The] probable cause of [the February 1, 2001] 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.<sup>12</sup>

Regarding the lack of end-gates and an adjacent walkway, the NTSB found that in contrast to the original 1993 engineering plans,<sup>13</sup> which included a formal risk analysis, that CRA/LA successfully persuaded the engineering firms to drop both features, in spite of warnings such as the following for the walkway:<sup>14</sup>

Under California Government Code Section 835, a public entity is liable for injury caused by a dangerous condition of its property if the dangerous condition was created by a negligent or wrongful act or omission and failed to take appropriate measures to protect against the dangerous condition... a successful effort by others to override the Public Utilities Commission and/or the Fire Department on the need for the emergency staircase... would place the Community Redevelopment Agency in jeopardy.

After the reconstruction project was completed in March 2010, Staff authorized AFRC's return to operation. Immediately after revenue operations commenced, however, the NTSB informed Staff that the NTSB recommendations had not been implemented as intended. Debate amongst the three organizations on how the recommendations should be implemented would continue due to differences in the interpretation of the ANSI B77.2 Funicular standards.

The two safety issues that have not been completely resolved are the issues of passenger containment with effective end-gates, and emergency egress/ingress for passengers and emergency responders via an adjacent evacuation walkway. In letters dated May 18, 2010, December 29, 2010,

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<sup>12</sup> National Transportation Safety Board, June 23, 2014, Railroad Accident Brief, p. 2.

<sup>13</sup> Ibid., p. 15.

<sup>14</sup> National Transportation Safety Board, *Uncontrolled movement, collision, and passenger fatality*, pp. 18-19.

and October 10, 2013, the NTSB clarified that its recommendations were for a track-adjacent emergency walkway with handrails and suitable structures that might be needed to get to the walkway (such as metal grating on the track-way) and for an end-gate at least 42 inches high or higher if deemed advisable by anthropometric design guidelines.<sup>15</sup> This clarification was repeated in President Peevey's November 8, 2013, letter to the NTSB Chairman. In a May 13, 2014, letter replying to President Peevey, the NTSB Acting Chairman responded in agreement.<sup>16</sup>

This resolution affirms our concurrence with the NTSB's recommendations and President Peevey's directives, and directs that the SCP must contain plans for constructing those safety enhancements, and be submitted for our approval. We ratify President Peevey's November 8, 2013, letter.

Additionally, because of the long and unsuccessful efforts to ensure that all NTSB recommendations are implemented, we require formal Commission approval of the Safety Certification Verification Report before Angels Flight is allowed to resume revenue service. Also because of the history of systemic safety problems, and the fact that the NTSB has opposed AFRC's proposed alternatives, which could be deemed "workarounds" to the NTSB's recommendations, and because the NTSB has approved the CPUC's response without such alternatives or workarounds, we conclude that workarounds or open items will not be appropriate in this case. We will not allow any such workarounds or open items in our approval to resume passenger service, and instead require full implementation of all NTSB recommendations and CPUC directives.

### Notice

On October 21, 2014, this Resolution was published on the Commission's Daily Calendar.

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<sup>15</sup> NTSB Acting Chairman Deborah A. P. Hersman's October 10, 2013, letter to President Peevey (NTSB Safety Recommendation 14-004) summarizes these recommendations and is included herein as Attachment B.

<sup>16</sup> Staff subsequently received a copy of an August 27, 2014, letter from AFRC President John Welborne to NTSB's Railroad Division Chief, and three August 28, 2014, letters from engineering firms. These letters reargue the end-gate and walkway issues that the NTSB and President Peevey's letters have already resolved.

### Comments

The draft resolution of the Safety and Enforcement Division in this matter was mailed in accordance with Section 311 of the Public Utilities Code and Rule 14.2(c) of the Commission's Rules of Practice and Procedure. Editorial corrections were received informally and are addressed in this resolution. No other comments were received.

After the close of the comment period, Angels Flight transitioned to new management on December 10, 2014. As a courtesy to the new management, Staff held this resolution from the voting agenda to allow for meetings with the new management. On January 20, 2015, Staff met with Angels Flight's new president, the new Chairman of the Board of Angels Flight, and a consulting engineer. At this meeting, the new Angels Flight President presented a new proposal for addressing the evacuation requirement.

On February 5, 2015, Staff again met with Angels Flight personnel and consultants to gather information regarding proposed options for evacuation. It became clear during these meetings that there was a need for a listing of criteria for any evacuation structure, to ensure that proposed designs could be accepted. Staff has attached as Attachment C a compilation of NTSB recommendations and clarifications regarding an evacuation structure, as well as end-gates that would satisfy the NTSB specifications. Further clarification is provided in Attachment C by the correspondence between the NTSB and the CPUC that confirms what the NTSB accepts as meeting their recommendations. In summary, for the car end-gates, the NTSB recommendations specify:

- Entrance and exit gates 42 inches or higher based on an anthropometric-based design.<sup>17</sup>

For the evacuation structure, the NTSB recommendations specify:

- Walkway adjacent to the trackway that would extend the entire length of the trackway.<sup>18</sup>

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<sup>17</sup> October 10, 2013, NTSB Safety Recommendation letter R-13-037 (Urgent), pp. 3-4.

<sup>18</sup> National Transportation Safety Board, Uncontrolled movement, collision, and passenger fatality, p. 40.

- Track-level walkways with railings.<sup>19</sup>
- Allows passengers to leave the stranded vehicles at any place along the guideway.<sup>20</sup>
- Direct passenger egress along the guideway.<sup>21</sup>
- Safe egress for passengers that self-evacuate without waiting for emergency response personnel.<sup>22</sup>
- Addition of a structure to fill the gaps between ties to keep passengers from having to evacuate across open gaps.<sup>23</sup>

**Therefore, IT IS ORDERED that:**

1. The Angels Flight Railway Company shall file a Safety Certification Plan that adopts the recommendations of the National Transportation Board in its October 10, 2013, letter, and the directives of California Public Utilities Commission President Peevey in his November 8, 2013, letter.
2. This resolution ratifies California Public Utilities Commission President Peevey's directives regarding the Angels Flight Railway Company in his November 8, 2013, to the National Transportation Safety Board, and the Angels Flight Railway Company shall implement those directives, without workarounds, as described in President Peevey's letter, prior to resuming revenue service.
3. The Angels Flight Railway Company shall not resume revenue service operations without filing a Safety Certification Verification Report, which must receive formal approval from this Commission before service is resumed.

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<sup>19</sup> Ibid., p.1.

<sup>20</sup> May 18, 2010, letter from Deborah A.P. Hersman, Chairman, NTSB, to Michael R. Peevey, President, CPUC.

<sup>21</sup> December 29, 2010, letter from Deborah A.P. Hersman, Chairman, NTSB, to Michael R. Peevey, President, CPUC.

<sup>22</sup> June 23, 2014, NTSB Railroad Accident Brief, Angels Flight Railway Derailment, p. 3.

<sup>23</sup> Ibid.

SED/RTSB/PWK/vdl

**ATTACHMENT D**

Resolution ST-170

February 12, 2015

**This resolution is effective today.**

I certify that this resolution was adopted by the Public Utilities Commission at its regular meeting held on February 12, 2015. The following Commissioners voting favorably thereon:

/s/ MICHELLE COOKE for

TIMOTHY SULLIVAN

Executive Director

MICHAEL PICKER

President

MICHEL PETER FLORIO

CATHERINE J.K. SANDOVAL

CARLA J. PETERMAN

LIANE M. RANDOLPH

Commissioners

SED/RTSB/PWK/vdl

**ATTACHMENT D**

Resolution ST-170

February 12, 2015

Attachment A

November 8, 2013, letter from Michael R. Peevey, President, CPUC

To

NTSB Chairman Deborah A. Hersman



SED/RTSB/PWK/vdl

**ATTACHMENT D**

Resolution ST-170

February 12, 2015

**Attachment B**

October 10, 2013, letter from Acting Chairman Deborah A. P. Hersman  
(NTSB Safety Recommendation 14-004)

To

Michael R. Peevey, President, CPUC

Attachment C

National Transportation Safety Board Recommendations and  
Correspondence with the California Public Utilities Commission  
Regarding End-gates and Evacuation Structure  
On Angels Flight Railway

(Underlining added)

***NTSB Accident Report RAR-03-03, Uncontrolled Movement, Collision, and Passenger Fatality  
on the Angels Flight Railway in Los Angeles, California, February 1, 2001***

Parsons's original design called for a walkway along the entire length of the guideway for the evacuation of passengers from stranded vehicles. Preservationists raised concerns about the historical accuracy of the walkway as early as 1993, pointing out that Angels Flight did not have such a walkway between 1901 and 1969. Parsons wrote a memorandum to Harris on December 6, 1993, on the subject of safety versus historical accuracy issues:

...the Project Owner [Community Redevelopment Agency] must exercise final approval on various Project features, characteristics, etc. i.e., it cannot delegate certain policy matters to its consultants. Under California Government Code Section 835, a public entity is liable for injury caused by a dangerous condition of its property if the dangerous condition was created by a negligent or wrongful act or omission... and failed to take appropriate measures to protect against the Factual Information 19 Railroad Accident Report dangerous condition... a successful effort by others to override the Public Utilities Commission and/or the Fire Department on the need for the emergency staircase... would place the Community Redevelopment Agency in jeopardy.

The Community Redevelopment Agency's deputy director of engineering detailed his position concerning the necessity of an emergency walkway next to the Angels Flight trackway in a memorandum to the Community Redevelopment Agency director of engineering dated March 2, 1995. In that memorandum, he stated that the Community Redevelopment Agency's acting administrator and senior staff concurred with the need for an emergency walkway and raised concerns that Angels Flight might not be insurable without it. Pgs. 18-19.

Between 1993 and 1996, Parsons and Harris submitted copies of the preliminary hazard analysis report, the preliminary operations and evacuation plan, and the emergency evacuation plan to the Public Utilities Commission. The preliminary hazards analysis report identified hazards that needed to be addressed during the reconstruction process. Among the identified hazards were

the lack of end gates on both cars, the lack of track brakes, and the absence of an emergency stairway.... Pg. 31

Rescue efforts were hampered by the absence of emergency walkways that would have facilitated evacuation of injured passengers” Pg. 34

The Community Redevelopment Agency contracted with Harris as construction manager for the project, and Harris subsequently contracted with Parsons for the design specifications for the reconstructed Angels Flight. Parsons’s specifications called for... an emergency walkway to be constructed for the entire length of the tramway to facilitate the evacuation of passengers in the event of an emergency. None of these features was included in the final system build. Pg. 38.

Community Redevelopment Agency officials did require that alternatives to the walkway be included in the final design, including a combination ground-level and elevated stairway separated from the trackway, an auxiliary emergency power supply, reversible funicular controls, and a security system and fence. But none of these alternatives directly addressed the purposes of the emergency walkway, and because of the nature of the accident, these alternatives did nothing to facilitate access to and egress from the funicular vehicles. The Safety Board concludes that the absence of an emergency walkway hampered access by emergency responders to passengers in this accident, made difficult the evacuation of the injured, and increased the risk to both passengers and emergency responders. pg. 40

The original Angels Flight did not have a walkway adjacent to the trackway that would extend the entire length of the trackway. Such a walkway was included as part of the original reconstruction design specifications, but as with the end gates, a conflict soon developed with the historic preservationist viewpoint. Pg. 40.

The Safety Board concludes that the absence of an emergency walkway hampered access by emergency responders to passengers in this accident, made difficult the evacuation of the injured, and increased the risk to both passengers and emergency responders.” Pg. 40

Findings, #5: The absence of an emergency walkway hampered access by emergency responders to passengers in this accident, made difficult the evacuation of the injured, and increased the risk to both passengers and emergency responders. Pg. 43

Recommendations:

To the California Public Utilities Commission:

Before certifying Angels Flight to restart passenger service, independently verify that... the funicular includes provisions for... emergency egress and ingress for passengers and emergency responders. (R-03-15) Pg. 45.

To the City of Los Angeles Community Redevelopment Agency:

Before recommending passenger service on the Angels Flight funicular railway... Direct that the Angels Flight funicular be redesigned in accordance with all applicable funicular safety standards and include provisions for... emergency egress and ingress for passengers and emergency responders. (Recommendation R-03-19) Pg. 45.

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**May 18, 2010, letter from Deborah A.P. Hersman, Chairman, NTSB, to Michael R. Peevey, President, CPUC.**

NTSB Recommendation R-03-15: ... Verify that Angels flight includes provisions for “...(3) emergency egress and ingress for passengers and emergency responders.

As a funicular railway, Angels Flight is subject to (ANSI Funicular standards) which clearly describes the requirements for funicular design, construction, drive systems, braking, and evacuation walkways. Specifically, Section 2.1.1.10.1, “Carrier evacuation,” states the following:

Provisions shall be made in the design of the funicular for emergency evacuation of all passenger types (see 2.3.2.5.7). The Guideway shall contain a service road or path at least on one side. A service road or path shall be provided which allows passengers to leave the stranded vehicles at any place along the guideway, including the passing zone. The service road or pathway shall be a minimum horizontal width of 32 inches.

Despite the CPUC’s commitment to comply with all of the NTSB’s safety recommendations and to ensure their incorporation into the reconstruction of Angels Flight, the reconstructed funicular railway did not include a 32-inch horizontal width pathway along one side of the guideway, including the passing zone, for the emergency evacuation of passengers, as the NTSB recommended in 2003... The NTSB is disappointed that the CPUC approved the AFRC’s SCVR without requiring emergency egress and ingress for passengers and emergency responders...

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**December 29, 2010, letter from Deborah A.P. Hersman, Chairman, NTSB, to Michael R. Peevey, President, CPUC.**

The NTSB is aware that Angels Flight™ funicular railway does not have a service road or path along one side of the guideway that would permit access for emergency response vehicles nor does the walkway allow direct passenger egress along the guideway. Therefore, the guideway's elevation would necessitate the use of extension ladders to evacuate passengers. ...the elevated guideway is located approximately 10-20 feet above the ground and is not readily accessible from the walkway. ...emergency responders would need to evacuate a passenger who is not ambulatory; no provisions have yet been made in the design of the funicular for emergency evacuations, as required by CPUC General Order 164-B. Therefore, this evacuation procedure does not satisfy ANSI B77.2-2004, subsection 2.1.1.10.1.

The NTSB accident investigation report concluded that the absence of an emergency walkway had hampered access for emergency responders, made difficult the evacuation of the injured, and increased the risk to both passengers and emergency responders."

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***October 10, 2013, NTSB Safety Recommendation letter R-13-037 (Urgent), from Deborah A.P. Hersman, Chairman, NTSB, to Michael R. Peevey, President, CPUC.***

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. Pg. 1.

Anthropometric data are readily available for use in the design of occupant protection in transportation vehicles.<sup>2</sup> Safety requirements for the height of entry/exit gates are generally 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. Pgs. 3-4.

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. Pg. 4.

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***November 8, 2013, letter from Michael R. Peevey, President, CPUC, to Deborah A.P. Hersman, Chairman, NTSB.***

Staff will require that the exit gates at the end of each car be replace with gates that are at least 42 inches in height or higher if deemed advisable by anthropometric design guides. Staff will assist and advise AFRC on the design of these gates as necessary."

Staff will ensure that AFRC improves emergency access. [We] will require implementation of means of egress and ingress consistent with the NTSB's view. We understand this to be a track-

level walkway with handrails and with suitable structures that might be needed to get to the walkway, such as metal grating on the track-way.

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***May 13, 2014, letter from Christopher A. Hart, Acting Chairman, NTSB, to Michael R. Peevey, President, CPUC.***

The series of corrective measures you described that will... prevent passenger ejection, and provide a suitable means of emergency egress, when fully implemented, should satisfy Safety Recommendation R-13-37.

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***June 23, 2014, NTSB Railroad Accident Brief, Angels Flight Railway Derailment.***

After the derailment, passengers had to either self-evacuate or be evacuated with the assistance of a firefighter. Video from the Angels Flight cameras showed that one passenger crawled from a stranded car to the upper platform. The passengers had to evacuate across open ties. Angels Flight does not have a suitable evacuation route—walkways, railings, or guide ropes—to prevent passengers or emergency rescue personnel from falling onto the sidewalk 25feet below. Pg. 3.