

**Uncontrolled Movement
and Collision
on the
Angels Flight Railway
Los Angeles, California
February 1, 2001**



National Transportation Safety Board



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Issues

- Safety oversight
- Design of the reconstructed system
- Braking system design and maintenance
- Maintenance and operating procedures



Notification

Launch



Parties to the Investigation

- California Public Utilities Commission
- City of Los Angeles Community Redevelopment Agency
- Angels Flight Railway Foundation



Staff

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Investigative Areas

- Splines sheared within gearbox
- Emergency brakes were nonfunctional
- Cars not equipped with back-up stopping system
- State regulator and railway owner allowed passenger operation with known safety concerns



Funicular Railway



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Reconstruction

- **Owner** **Redevelopment Agency**
- **Project Advisor/
Specifications Designer** **Parsons**
- **Construction Manager** **Harris**
- **General Contractor** **Pueblo**
- **Builder** **Yantrak**



Operation

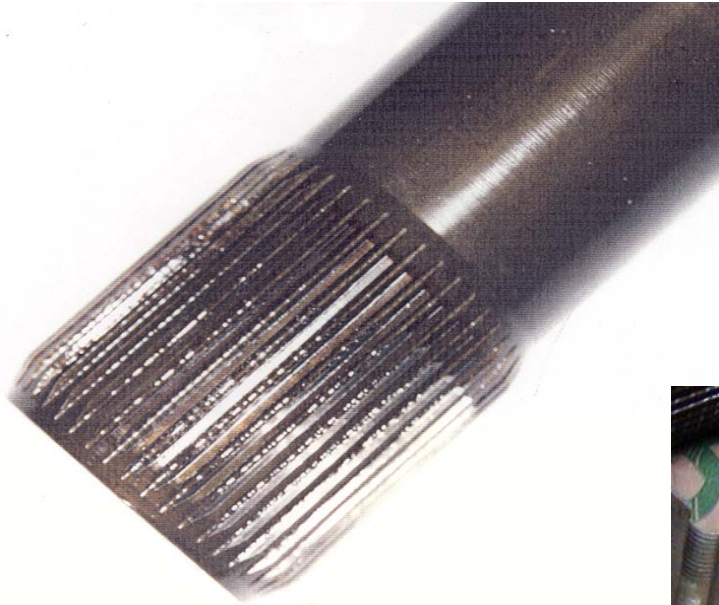
- Reopened February 1996
- Maintenance and inspection



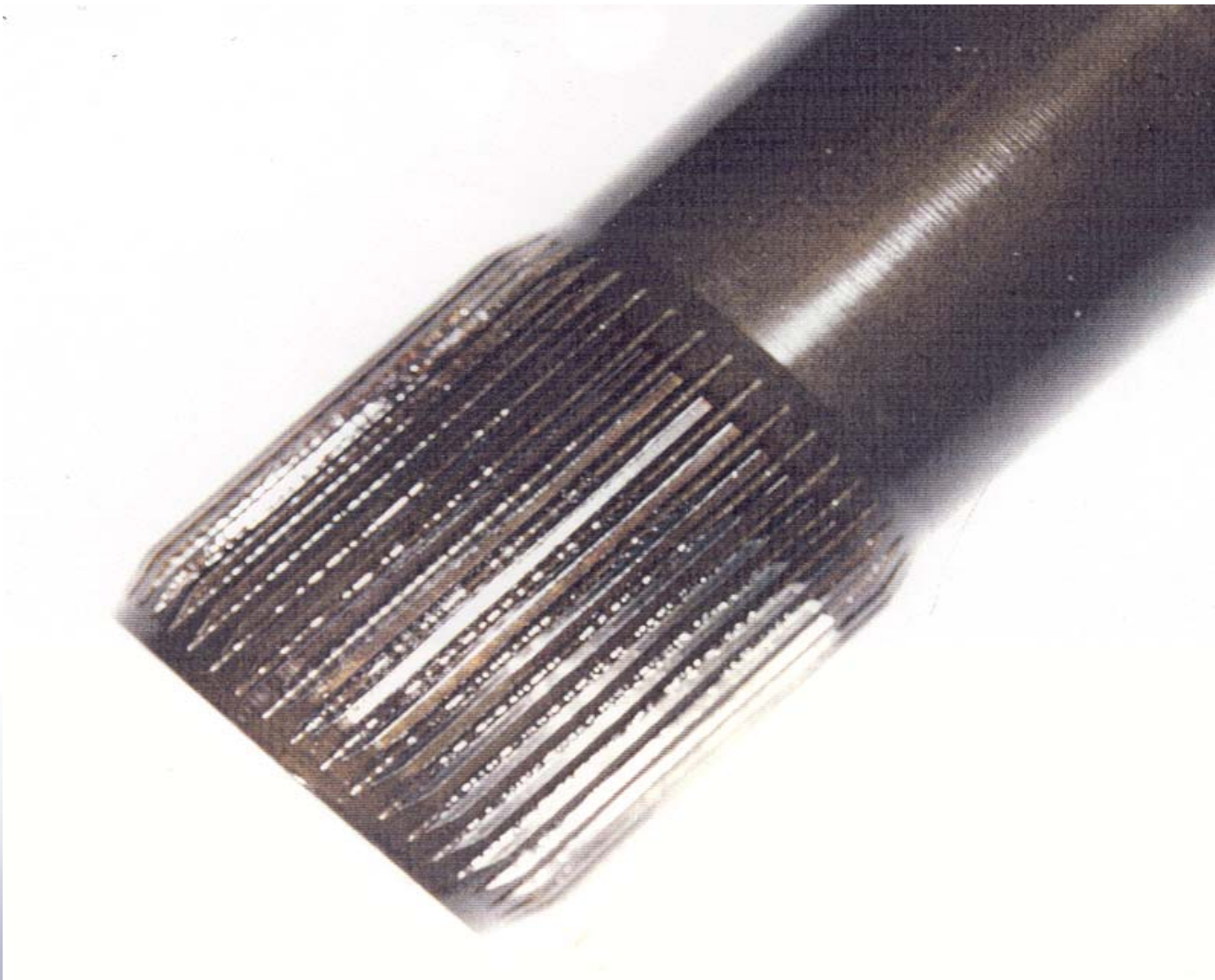
Funicular Design Standards - 1991

- No California funicular standards
- Multiple general engineering standards
- No ANSI funicular standards
- Some ANSI guidance
- Colorado funicular standards





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Gearbox Overheating

- Overheating developed early on
- Unscheduled stops between terminals
- Oil cooler installed after 15 months



Oil Testing and Analysis

- Required every 6 months or 18,000 cycles
- Actual testing 1997 – 1999
- 1999 test results
- Postaccident test results



Emergency Brakes Nonfunctional

- Failed to apply during accident
- Inoperative solenoid
- Inoperative as designed
- Non-failsafe as implemented



Brake Testing

- Independent testing requirement
- Testing performed



Safety Stopping Device

- Track brakes
- Safety cable



End Gates



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Emergency Walkway



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Evacuation



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Re-opening Issues

- No track brakes or a 2nd safety cable
- No end gates
- No emergency walkway



Acceptance

- Parsons Brinckerhoff Quade and Douglas
- Pueblo Contracting
- Harris Engineering
- Community Redevelopment Agency
- California Public Utilities Commission

