American National Standard

for Funiculars -
Safety Requirements

ANSI B77.2-2004

Approved American National Standard
ANSI

ANSI®
B77.2-2004

American National Standard

for Funiculars - Safety Requirements

Secretariat

National Ski Areas Association

Approved December 31, 2003

American National Standards Institute, Inc.

American National Standard

Approval of an American National Standard requires review by ANSI that the requirements for due process, consensus, and other criteria for approval have been met by the standards developer.

Consensus is established when, in the judgement of the ANSI Board of Standards Review, substantial agreement has been reached by directly and materially affected interests. Substantial agreement means much more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that a concerted effort be made towards their resolution.

The use of American National Standards is completely voluntary; their existence does not in any respect preclude anyone, whether he has approved the standards or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standards.

The American National Standards Institute does not develop standards and will in no circumstances give an interpretation of any American National Standard. Moreover, no person shall have the right or authority to issue an interpretation of an American National Standard in the name of the American National Standards Institute. Requests for interpretations should be addressed to the secretariat or sponsor whose name appears on the title page of this standard.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken periodically to reaffirm, revise, or withdraw this standard. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.

Published by

American National Standards Institute, Inc.
25 West 43rd Street, New York, NY 10036

Printed in the United States of America

Contents

Foreword (This foreword is not part of American National Standard ANSI B77.2-2004.)

This standard deals with passenger transportation systems that use wire ropes to provide motion to the carriers that ride on rails or are contained by a guideway. Several names are used regionally to identify these systems (i.e., Cable Railways, Inclines, Planes), but all are considered Funiculars. These systems have unique requirements that rely on ropeway technology. ANSI B77.2 will give guidance to manufacturers of those systems that are not classified as elevators or Automated People Movers.

This is a new standard based on the *American National Standard for Passenger ropeways - Aerial tramways, aerial lifts, surface lifts, tows and conveyors - Safety requirements*, ANSI B77.1-1999.

Section 1 provides the scope and general definitions for Funiculars covered in this standard. Section 2 covers mechanical design, electrical design, and operational requirements. Section 3 addresses wire rope requirements.

Because of the diverse nature of the industries that may use this standard, it is recommended that authorities having jurisdiction consider an effective date of one year from the approval date of the standard. The approval date of this standard is a criterion selected by the committee and not by the American National Standards Institute.

This standard contains four informative annexes, which are not formally considered part of this standard.

Suggestions regarding improvement of this standard are welcome. They should be sent to the ASC B77, c/o National Ski Areas Association, 133 South Van Gordon Street, Suite 300, Lakewood, CO 80228 or e-mailed to ascb77@nsaa.org.

This standard was approved for submittal to ANSI by the Accredited Standards Committee (ASC) B77 on Aerial Passenger Ropeways. Committee approval of the standard does not necessarily imply that all the committee members voted for its approval or the approval of every requirement in the standard. At the time this standard was approved, the ASC B77 Committee had the following members:

Jon Mauch*, Chairman
(Breckenridge Ski Resort)
Sid Roslund*, Committee Administrator
(National Ski Areas Association)
Lawrence Smith*, P.E., Funicular Subcommittee Chairman
(Colorado Passenger Tramway Safety Board)

Organization Represented	*Name of Representative*
Acordia Resort & Recreation	Sam Geise, P.E. Maynard Russell
Aerial Engineering	Jim Ellis*, PE
Alta Ski Area	Onno Wieringa*
ASTM F27 Committee	Rick Gregorio
Beneficial Designs, Inc.	Peter Axelson
Bridon American Corporation	David Sleightholm
Comarco Industrial	Marc Wood, P.E.
Copper Mountain	Jim Spenst
Crystal Mountain	Michael Call
Deer Valley Resort Company	Chris Anderson
Doppelmayr CTEC, Inc.	Mike Kingsley Jan Leonard, P.E. John Pentesco Larry Wollum

Organization Represented	*Name of Representative*
Ericksen Associates, Inc.	Nils Ericksen, P.E.
Fincor Automation, Inc.	Roger Paucek
Gmuender Engineering, LLC	Joe Gmuender, P.E.
Hunter Mountain	Scott Berwick
Hyland Ski and Snowboard Area	David Thomas
Jackson Hole Mountain Resort	Chuck Melichar
Kimley-Horn and Associates, Inc.	James Bunch, P.E.
	Jim Fletcher, P.E.
Leitner-Poma of America, Inc.	Tom Clink
	Brian Kelly
	J.F. Mugnier*
	Nelson Tusberg, P.E.
Loveland Ski Area	Cindy Olson
Magic Carpet Ski Lifts, Inc.	Dave Kelly
Mountain Management Services, LLC	Chris Stoddard
Mountain Wire Rope Service	Dale Walters
Mt. Bachelor, Inc.	Rick Brooks
National Ski Patrol	Mary Davis
Northstar-at-Tahoe	Tim Silva
NYS Department of Labor	David Bayer
Pol-X West, Inc.	Les Okreglak, P.E.
Professional Safety Services	Norm Sothan
Resort Consulting Services	Douglas Clyde
Riblet Tramway Company	Douglas Sowder, P.E.
Sandia Peak Ski Area	George Boyden
Snowbird Ski & Summer Resort	Richard Taxwood
State Of Vermont Tramway Board	Bob Pirie
Steamboat Ski & Resort Corp.	Doug Allen*
Stevens Engineering	Ross Stevens*, P.E.
The Canyons	F. Scott Pierpont*
Tramway Engineering, Ltd.	Charles Peterson, P.E.
USDA - Forest Service	Chris Hanrahan*
	Scott Mitchell
Utah Ropeway Safety Committee	Brian Allen, P.E.
Vail Mountain	Clyde Wiessner
Walt Disney World	Dennis Clark
Willis (MountainGuard Insurance Program)	Selden Hannah, P.E.
	LeRoy Schultz, P.E.
Winter Park Resort	Gary McGraw
Public at Large	Steve Hyland

Honorary Members

	Chuck Dwyer
	Stan Judge

Alternate Members

Aerial Engineering	John Ellis, P.E.
USDA Forest Service	Michael Lane
Willis (Mountain Guard Insurance Program)	Jimmy Lawrence

Observer Members

	Gordon Linebaugh
Aerial NDT Inspection, Inc.	Scott Shanaman
Carrick Engineering Corp.	Jonathan Carrick, PE
Larco, LLC	Dave Larson
State of California	Jorg Ludwig
State of Vermont	Alton Barber
USDA - Forest Service	Heather Blevins
	Nelson Hernandez
	Robert Moore
	Curt Panter
Walt Disney World	Greg Hale

* National Tramway Standards Board Member

American National Standard

for Funiculars – Safety Requirements

Section 1 General requirements

Funicular systems, especially such a system operated on a steep incline with simultaneous ascending and descending carriers on (usually very nearly parallel) guideways counterbalancing one another, are also known as cable railways or inclines.

Carriers reciprocate between the terminals, propelled and controlled by a wire rope or other flexible element operating through drive and tensioning equipment installed in the terminals.

Provisions of this section envision a system having a reversible operating mode. See Subsection 1.1 for applicable component requirements for systems in a continuous or intermittent circulation with stop-to-load features, such as a fixed attachment individual carrier or grouped carrier, which are not covered by this standard.

1.1 Scope

This document establishes a standard for the design, manufacture, construction, operation, and maintenance of funiculars for passenger transport.

Funiculars typically have following characteristics:

- carrier capacity over 20 passengers;
- maximum operating speed over 300 feet per minute (1.5 meters per second);
- complex guideway that may contain curves, variable inclinations and a passing zone;
- direct operator supervision.

There are other types of transportation systems that utilize similar characteristics such as Incline Elevators (see ASME A17), Automated People Movers (see ASCE 40193), etc. The authority having jurisdiction, using information from the manufacturer and owner, shall specify any or all provisions of this standard that apply to the funicular.

1.2 Purpose

The purpose of this standard is to develop a system of principles, specifications, and performance criteria that will meet the following objectives:

a) Reflect current state-of-the-art for funicular design, operation, and maintenance;

b) Be acceptable for adoption by government agencies and others.

It is recognized that certain dangers and risks are inherent in machines of this type and their operation. It is also recognized that inherent and other risks or dangers exist for those who are in the process of approaching, loading, unloading, and departing from funiculars. This system is intended to result in funiculars that are designed, constructed, operated, and maintained in a manner that helps reduce danger and exposure to risk to passengers and maintenance and operational personnel and to encourage improvements in productivity, efficiency, development, and progress consistent with the objectives.

Such a system with these stated objectives constitutes a safety standard.

1.2.1 Other classifications

Funicular configurations that do not fall within the definition specified in 1.4 - *funicular*, but fall within the general category of funiculars should be evaluated by the authority having jurisdiction based upon the design engineer's specifications and the applicable provisions of this standard.

1.2.2 New materials and methods for funiculars

Adoption of technological improvements in materials and advances in techniques is essential to enable the industry to keep pace with progress. If a designer or manufacturer proposes to use materials or methods not covered by this standard, those materials, methods, or both, shall be clearly identified. Complete design and test information shall be provided to the purchaser or the owner and the authority having jurisdiction (see 1.4 – *authority having jurisdiction*).

1.2.3 Exceptions

Strict application of the provisions of this standard may not be appropriate in every instance. Wherever it may be proposed to depart from the provisions of this standard, the authority having jurisdiction may grant exceptions from the literal requirements or permit the use of other devices or methods that provide features comparable to those included in this standard.