

# American National Standard

*for Passenger Ropeways –  
Aerial Tramways, Aerial Lifts,  
Surface Lifts, Tows and Conveyors –  
Safety Requirements*

---





**ANSI**  
**B77.1-2006**  
Revision of  
ANSI B77.1-1999

American National Standard  
for Passenger Ropeways –  
Aerial Tramways, Aerial Lifts,  
Surface Lifts, Tows and Conveyors –  
Safety Requirements

Secretariat

**National Ski Areas Association**

Approved April 17, 2006

**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**CAUTION NOTICE:** This American National Standard may be revised or withdrawn at any time.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**

Copyright © 2006 by American National Standards Institute, Inc.  
All rights reserved.

No part of this publication may be reproduced in any form, in an electronic retrieval system or otherwise, without prior written permission of the publisher.

Printed in the United States of America

# Contents

	Page
<b>Foreword</b> .....	iii
<b>1</b> General requirements.....	1
1.1 Scope .....	1
1.2 Purpose .....	1
1.3 Reference to other codes and standards .....	2
1.4 Definitions.....	2
1.5 Quality assurance program .....	6
<b>2</b> Aerial tramways.....	7
2.1 Design and installation .....	7
2.2 Electrical design and installation .....	19
2.3 Operation and maintenance .....	23
<b>3</b> Detachable grip aerial lifts .....	29
3.1 Design and installation .....	29
3.2 Electrical design and installation .....	47
3.3 Operation and maintenance .....	52
<b>4</b> Fixed grip aerial lifts.....	59
4.1 Design and installation .....	59
4.2 Electrical design and installation .....	75
4.3 Operation and maintenance .....	80
<b>5</b> Surface lifts.....	87
5.1 Design and installation .....	87
5.2 Electrical design and installation .....	97
5.3 Operation and maintenance .....	101
<b>6</b> Tows.....	107
6.1 Design and installation .....	107
6.2 Electrical design and installation .....	113
6.3 Operation and maintenance .....	116
<b>7</b> Conveyors .....	121
7.1 Design and installation .....	121
7.2 Electrical design and installation .....	125
7.3 Operation and maintenance .....	128
<b>8</b> Normative references .....	133

	Page
<b>Annexes</b>	
<b>A</b> Wire rope and strand requirements .....	135
A.1 Physical properties .....	135
A.2 Testing - Wire rope and track strand .....	138
A.3 End connections and splices for wire rope and strand .....	139
A.4 Maintenance and replacement .....	141
<b>B</b> Measuring the diameter of wire rope .....	145
<b>C</b> Examples of allowable broken wires in different wire rope constructions .....	146
<b>D</b> Signs .....	147
<b>E</b> Operator control devices .....	154
<b>F</b> Combustion engine(s) and fuel handling .....	155
<b>G</b> Welded link chain .....	161
<b>H</b> Roller and leaf chains .....	163
<b>I</b> International system of units (SI) metric conversion factors .....	165
<b>Index</b> .....	167

**Foreword** (This foreword is not part of American National Standard ANSI B77.1-2006.)

This standard deals with passenger transportation systems that use cables, ropes or other flexible elements for power transmission in the system. These systems include aerial tramways, detachable and fixed grip aerial lifts, surface lifts, tows, and conveyors.

This standard is a revision of 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 systems covered in this standard. Sections 2 through 7 cover the specific passenger transportation types. Five (5) Normative Annexes and four (4) Informative Annexes are included in the standard. Normative Annexes are considered part of the standard. Informational Annexes are presented for the information provided and are not considered part of this standard.

The B77 standard had its inception in 1956. At that time, the industry dealings with recreational passenger transportation had reached such proportions that safeguards were required for the protection of the public and progress of the industry. At the request of the Eastern Ski Area Operators Association, one of the original sponsors of the project, a general conference was held in New York City. As a result of that conference, the American National Standards Committee B77, composed of operators, users, authorities having jurisdiction, designers, and manufacturers of aerial passenger tramways, was established to develop safety requirements. The first standard was approved by ANSI on June 8, 1960, and revisions were developed and approved in 1970, 1973, 1976, 1982, 1990, 1992 and 1999.

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 "effective date" of this standard is a criterion selected by the committee and not by the American National Standards Institute.

Suggestions for the improvement of this standard will be 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.

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

<i>Organization Represented</i>	<i>Name of Representative</i>
Acordia Resort & Recreation .....	Maynard Russell
	Wally Shank
Aerial Engineering .....	Jim Ellis, P.E.
	John Ellis, P.E. (Alt.)
Alta Ski Area .....	Onno Wieringa*
Beneficial Designs, Inc. ....	Peter Axelson
Colorado Tramway Board.....	Lawrence Smith, P.E.*
Crystal Mountain.....	Michael Call
Deer Valley Resort Company .....	Chris Anderson

<i>Organization Represented</i>	<i>Name of Representative</i>
Doppelmayr CTEC, Inc.....	Paul Ehlert, P.E. Mike Kingsley Jan Leonard, P.E. Larry Wollum*
Ericksen Associates, Inc.....	Nils Ericksen, P.E.
Fincor Automation, Inc.....	Roger Paucek
Geise Engineering .....	Sam Geise, P.E.
Gmuender Engineering, LLC.....	Joe Gmuender, P.E.
Hunter Mountain .....	Scott Berwick
Hyland Ski and Snowboard Area.....	David Thomas
Jackson Hole Mountain Resort.....	Chuck Melichar
Killington Resort .....	Jeff Temple
Leitner-Poma of America, Inc. ....	Tom Clink Brian Kelly, P.E. J.F. Mugnier Nelson Tusberg, P.E.
Loveland Ski Area .....	Cindy Olson
M-Tek Consulting, Inc.....	Marc Wood, P.E.
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
Palm Springs Aerial Tramway .....	Terry Zakotnik
Parametrix, Inc .....	James Bunch, P.E. Jim Fletcher, P.E.
Pol-X West, Inc.....	Les Okreglak, P.E.
Professional Safety Services.....	Norm Sothan
Resort Consulting Services .....	Douglas Clyde
Sandia Peak Ski Area.....	George Boyden
Snowbird Ski & Summer Resort.....	Richard Taxwood
State of Michigan.....	Mark Doman, P.E.
State of Vermont Tramway Board .....	Bob Pirie
Steamboat Ski & Resort Corporation .....	Doug Allen*
Stevens Engineering .....	Ross Stevens, P.E.*
Stratton Mountain Resort.....	Michael Nellis
Tamarack Resort .....	Jim Spent
The Canyons .....	F. Scott Pierpont*
Tram Support.....	Douglas Sowder, P.E.
Tramway Engineering, Ltd.....	Charles Peterson, P.E.
USDA - Forest Service .....	Chris Hanrahan* Scott Mitchell Michael Lane (Alt.) Robert Moore Curt Panter
Utah Ropeway Safety Committee .....	Brian Allen, P.E.
Vail Mountain.....	Clyde Wiessner
Walt Disney World .....	Dennis Clark*
Wild Horse Enterprises LLC .....	Rick Gregorio
Willis (MountainGuard Insurance Program) .....	Jimmy Lawrence Selden Hannah, P.E.
<i>Retired</i> .....	Chuck Dwyer, P.E. Stan Judge Steve Hyland Gordon Linebaugh John Pentesco, P.E. LeRoy Schultz, P.E.

<i>Organization Represented</i>	<i>Name of Representative</i>
<i>Observer Members</i>	
Aerial NDT Inspection, Inc. ....	Scott Shanaman
Bridon American Corporation .....	David Sleightholm
Busch Entertainment Corporation .....	Tim Viox
Carrick Engineering Corp. ....	Jonathan Carrick, P.E.
Larco, LLC .....	Dave Larson
North Carolina Dept. of Labor .....	Thomas Petty
NYS Department of Labor .....	Blaise Thomas
Ropeway Technical Services, Inc. ....	Donald Larson
State of California .....	Jorg Ludwig
Walt Disney World Co. ....	John Harrison

\* National Tramway Standards Board Member

# American National Standard for Passenger Ropeways –

## Aerial Tramways, Aerial Lifts, Surface Lifts, Tows and Conveyors – Safety Requirements

### Section 1 General requirements

#### 1.1 Scope

This document establishes a standard for the design, manufacture, construction, operation, and maintenance of passenger ropeways. For this standard, passenger ropeway categories include:

- aerial tramways (single and double reversible);
- aerial lifts (detachable lifts, chair lifts, and similar equipment);
- surface lifts (T-bar lifts, J-bar lifts, platter lifts, and similar equipment);
- tows (wire rope and fiber rope tows)
- conveyors.

#### 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 the current state-of-the-art in passenger ropeway 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 passenger ropeways. This system is intended to result in passenger ropeways 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 ropeway classifications

Passenger ropeway configurations that do not fall within the categories specified in 1.1, but fall within the general category of passenger ropeways, 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 passenger ropeways

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, and complete design and test information shall be provided to the purchaser or 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.

#### 1.2.4 Installations

##### 1.2.4.1 Existing installations

Existing installations and those with design review completed by the authority having jurisdiction prior to the effective date of this standard need not comply with the new or revised requirements of this edition, except where specifically required by the authority having jurisdiction.

Operation and maintenance shall be in compliance with those requirements specifically listed (not included by reference) in the operation and maintenance subsection (2.3, 3.3, 4.3, 5.3, 6.3, 7.3) and normative Annexes A and D.

NOTE – Additionally, items listed under (2.3.1.1, 3.3.1.1, 4.3.1.1, 5.3.1.1, 6.3.1.1) are considered of special importance. Compliance on ropeways with design review prior to this standard shall be required.