1180

(11) The operator of any ski area shall maintain a readily visible sign on each rope tow, wire rope tow, j-bar, t-bar, ski lift, or other similar device, advising the users of the device that:

(a) Any person not familiar with the operation of the lift shall ask the operator thereof for assistance and/or instruction; and

(b) The skiing-ability level recommended for users of the lift and the slopes served by the device shall be classified "easiest", "more difficult", and "most difficult".

NEW SECTION. Sec. 2. (1) In addition to the specific requirements of this section, all skiers shall conduct themselves within the limits of their individual ability and shall not act in a manner that may contribute to the injury of themselves or any other person.

(2) No person shall:

(a) Embark or disembark upon a ski lift except at a designated area;

(b) Throw or expel any object from any tramway, ski lift, commercial skimobile, or other similar device while riding on the device;

(c) Act in any manner while riding on a rope tow, wire rope tow, j-bar, t-bar, ski lift, or similar device that may interfere with the proper or safe operation of the lift or tow;

(d) Wilfully engage in any type of conduct which may injure any person, or place any object in the uphill ski track which may cause another to fall, while traveling uphill on a ski lift; or

(e) Cross the uphill track of a j-bar, t-bar, rope tow, wire rope tow, or other similar device except at designated locations.

(3) Every person shall maintain control of his or her speed and course at all times, and shall stay clear of any snowgrooming equipment, any vehicle, any lift tower, and any other equipment on the mountain. Snow grooming equipment or any other vehicles shall be equipped with a flashing yellow light at any time the vehicle is moving on or in the vicinity of a ski run.

(4) A person shall be the sole judge of his or her ability to negotiate any trail, slope, or uphill track and no action shall be maintained against any operator by reason of the condition of the track, trail, or slope unless the condition results from the negligence of the operator.

(5) Any person who boards a rope tow, wire rope tow, j-bar, t-bar, ski lift, or other similar device shall be presumed to have sufficient abilities to use the lift. No liability shall attach to any operator or attendant for failure to instruct the person on the use of the device, but a person shall follow any written or verbal instructions that are given regarding the use.

(6) Because of the inherent risk in the sport of skiing all persons using the ski hill shall exercise reasonable care for their own safety. However, the primary duty shall be on the person skiing downhill to avoid any collision with any person or object below him or her.

(7) Subsection (6) of this section notwithstanding, any person skiing on other than improved trails or slopes within the area shall be responsible for any injuries or losses resulting from his or her action.

A-Engrossed

Senate Bill 329

Ordered by the Senate May 4
(Including Amendments by Senate May 4)

Sponsored by Senators HEARD, JERNSTEDT, Representatives LOMBARD, THROOP

SUMMARY

The following summary is not prepared by the sponsors of the measure and is not a part of the body thereof subject to consideration by the Legislative Assembly. It is an editor's brief statement of the essential features of the measure.

[Sets forth rights and duties of skiers and ski area operators. Requires ski area operators to maintain a specified series of signs and warnings in ski area. Prohibits certain activities by skiers. Limits liability of ski area operators for injuries caused by dangerous ski trail or ski slope conditions unless conditions result from negligence of ski area operator. Limits liability of ski area operators based upon failure to instruct on use of towing devices. Requires skier involved in ski accident to provide identification before leaving scene of accident. Makes leaving scene of ski accident without providing identification a Class A misdemeanor. Requires ski area operators to maintain specified liability insurance. Requires actions against ski area operators to be commenced within two years after injury and after specified notice.]

Declares policy. Defines terms relevant to this Act. Specifies that an individual engaging in specified skiing activities assumes and accepts certain risks associated with such activities. Requires that notification of an injury to a skier must be given to a ski area operator by registered or certified mail within 180 days of the injury. Establishes a two-year limitation for commencement of an action against a ski area operator for recovery of damages. Requires ski area operators to provide skiers with information concerning notification requirements. Specifies duties of skiers. Specifies that violation of such duties entitles ski area operators to withdraw skier's privilege of skiing. Requires ski area operators to notify skiers of duties established by this Act.

A BILL FOR AN ACT

Relating to skiing.

Whereas it is the purpose of this Act to clarify the policy of this state governing the duties of skiers and the liability of operators of ski areas with respect to skiing injuries resulting from alpine or nordic skiing; and

Whereas the Legislative Assembly affirms the principle that certain risks are inherent in the sport, and that, as a matter of public policy, no person engaged in such sport shall recover damages from a ski operator for injuries resulting from those inherent risks; now, therefore,

Be It Enacted by the People of the State of Oregon:

SECTION 1. As used in this Act:

(1) "Inherent risks of skiing" includes, but is not limited to, those dangers or conditions which are an integral part of the sport, such as changing weather conditions, variations or steepness in terrain, snow or ice conditions, surface or subsurface conditions, bare spots, creeks and gullies, forest growth, rocks, stumps, lift towers and other structures and their components, collisions with other skiers and a skier's failure to ski within the skier's own ability.

(2) "Injury" means any personal injury or property damage or loss.

(3) "Skier" means any person who is in a ski area for the purpose of engaging in the sport of skiing or who rides as a passenger on any ski lift device.

(4) "Ski area" means any area designated and maintained by a ski area operator for skiing.

(5) "Ski area operator" means those persons, and their agents, officers, employes or representatives, who operate a ski area.

NOTE: Matter in **bold face** in an amended section is new; matter *[italic and bracketed]* is existing law to be omitted; complete new sections begin with SECTION.

SECTION 2. In accordance with ORS 18.470 and notwithstanding subsection (2) of ORS 18.475, an individual who engages in the sport of skiing, alpine or nordic, accepts and assumes the inherent risks of skiing in so far as they are reasonably obvious, expected or necessary.

SECTION 3. (1) A ski area operator shall be notified of any injury to a skier by registered or certified mail within 180 days after the injury or within 180 days after the skier discovers, or reasonably should have discovered, such injury.

(2) When an injury results in a skier's death, the required notice of the injury may be presented to the ski area operator by or on behalf of the personal representative of the deceased, or any person who may, under ORS 30.020, maintain an action for the wrongful death of the skier, within 180 days after the date of the death which resulted from the injury. However, if the skier whose injury resulted in death presented a notice to the ski area operator that would have been sufficient under this section had the skier lived, notice of the death to the ski area operator is not necessary.

(3) An action against a ski area operator to recover damages for injuries to a skier shall be commenced within two years of the date of the injuries. However, ORS 12.160 and 12.190 apply to such actions.

(4) Failure to give notice as required by this section bars a claim for injuries or wrongful death unless:

(a) The ski area operator had knowledge of the injury or death within the 180-day period after its occurrence;

(b) The skier or skier's beneficiaries had good cause for failure to give notice as required by this section, or

(c) The ski area operator failed to comply with subsection (5) of this section.

(5) Ski area operators shall give to skiers, in a manner reasonably calculated to inform, notice of the requirements for notifying a ski area operator of injury and the effect of a failure to provide such notice under this section.

SECTION 4. (1) Skiers shall have duties which include but are not limited to the following:

(a) Skiers who ski in any area not designated for skiing within the permit area assume the inherent risks thereof.

(b) Skiers shall be the sole judges of the limits of their skills and their ability to meet and overcome the inherent risks of skiing and shall maintain reasonable control of speed and course.

(c) Skiers shall abide by the directions and instructions of the ski area operator.

(d) Skiers shall familiarize themselves with posted information on location and degree of difficulty of trails and slopes to the extent reasonably possible before skiing on any slope or trail.

(e) Skiers shall not cross the uphill track of any surface lift except at points clearly designated by the ski area operator.

(f) Skiers shall not overtake any other skier except in such a manner as to avoid contact and shall grant the right of way to the overtaken skier.

(g) Skiers shall yield to other skiers when entering a trail or starting downhill.

(h) Skiers must wear retention straps or other devices to prevent runaway skis.

(i) Skiers shall not board rope tows, wire rope tows, j-bars, t-bars, ski lifts or other similar devices unless they have sufficient ability to use the devices, and skiers shall follow any written or verbal instructions that are given regarding the devices.

(j) Skiers, when involved in a skiing accident, shall not depart from the ski area without leaving their names and addresses if reasonably possible.

(k) A skier who is injured should, if reasonably possible, give notice of the injury to the ski area operator before leaving the ski area.

(L) Skiers shall not embark or disembark from a ski lift except at designated areas or by the authority of the ski area operator.

(2) Violation of any of the duties of skiers set forth in subsection (1) of this section entitles the ski area operator to withdraw the violator's privilege of skiing.

SECTION 5. Ski area operators shall give notice to skiers of their duties under section 4 of this Act in a manner reasonably calculated to inform skiers of those duties.

Utah

(INHERENT RISKS OF SKIING)

1979

GENERAL SESSION

S.B. No. 146

By [illegible] ANDERSON
IVAN M. MATHESON
MARK N. SNOW, JR.
[illegible]
RONALD L. HALVERSON
CHARLES A. BULLEN
[illegible] JENSEN
KARL G. SWAN
[illegible] EDWARDS

AN ACT RELATING TO THE SPORT OF SKIING; RECOGNIZING THE INHERENT RISKS INVOLVED IN THAT SPORT; DECLARING THAT ANY PERSON ENGAGING IN THAT SPORT SHALL BE PRECLUDED FROM MAKING ANY CLAIM AGAINST, OR RECOVERING FROM, ANY SKI AREA OPERATOR FOR INJURY RESULTING FROM RISKS INHERENT IN THAT SPORT; PROVIDING FOR POSTING OF NOTICES IN SKI AREAS LISTING THE INHERENT RISKS OF SKIING; REQUIRING NOTICE TO SKI AREA OPERATORS WITHIN A SPECIFIED TIME OF ANY INJURY TO A SKIER; AND PROVIDING A STATUTE OF LIMITATIONS ON ANY ACTIONS AGAINST SKI AREA OPERATORS FOR INJURIES TO A SKIER.

Be it enacted by the Legislature of the State of Utah:

Section 1. The legislature finds that the sport of skiing is practiced by a large number of residents of Utah and attracts a large number of non-residents, significantly contributing to the economy of this state. It further finds that few insurance carriers are willing to provide liability insurance protection to ski area operators and that the premiums charged by those carriers have risen sharply in recent years due to confusion as to whether a skier assumes the risks inherent in the sport of skiing. It is the purpose of this act, therefore, to clarify the law in relation to skiing injuries and the risks inherent in that sport, to establish as a matter of law that certain risks are inherent in that sport, and to provide that, as a matter of public policy, no person engaged in that sport shall recover from a ski operator for injuries resulting from those inherent risks.

Section 2. As used in this act:

(1) "Inherent risks of skiing" means those dangers or conditions which are an integral part of the sport of skiing, including, but not limited to: changing weather conditions, variations or steepness in terrain; snow or ice conditions; surface or subsurface conditions such as bare spots, forest growth, rocks, stumps, lift towers and other structures and their components; collisions with other skiers; and a skier's failure to ski within his own ability.

(2) "Injury" means any personal injury or property damage or loss.

(3) "Skier" means any person present in a ski area for the purpose of engaging in the sport of skiing.

(4) "Ski area" means any area designated by a ski area operator to be used for skiing.

(5) "Ski area operator" means those persons, and their agents, officers, employees or representatives, who operate a ski area.

Section 3. Notwithstanding anything in section 70-27-37 to the contrary, no skier shall make any claim against, or recover from, any ski area operator for injury resulting from any of the inherent risks of skiing.

Section 4. Ski area operators shall post trail boards at one or more prominent locations within each ski area which shall include a list of the inherent risks of skiing, and the limitations on liability of ski area operators, as defined in this act.

Section 5. (1) Any claim against a ski area operator arising out of any injury to a skier shall be forever barred unless that ski area operator is notified of that injury within 90 days after its occurrence or within 90 days after the skier discovers, or through the use of reasonable diligence should have discovered, that injury.

S. B. No. 146

(2) No action shall be maintained against a ski area operator arising out of an injury to a skier FROM THE INHERENT RISKS OF SKIING, unless that action is commenced within two years from the date of the occurrence of the injury.

SUMMARY OF PROPOSED LEGISLATION

146

By: SENATOR FINLINSON

Title: INHERENT RISKS OF SKIING

Summary: Th is bill decloses certain risks to be inherent in the sport of skiing and precludes any recovery for injuries resulting from the risks.

MANAGEMENT AND FISCAL ANALYSIS

S. B. No. 146

It is estimated that this proposed bill would not have any fiscal impact on State agencies.

It could offset the insurance rates paid by ski area operators for liability insurance.

OFFICE OF THE LEGISLATIVE FISCAL ANALYST

An Act

SENATE BILL NO. 203. BY SENATORS Bishop, Barnhill, H. Fowler, L. Fowler, Hatcher, Soash, Allshouse, Anderson, McCormick, and Noble; also REPRESENTATIVES Theos, Davoren, Fine, Herzberger, Hinman, Hudson, Lillpop, Marks, DeNier, Jones, and Winkler.

CONCERNING SKIING, AND ESTABLISHING RESPONSIBILITIES AND LIABILITIES OF SKIERS AND SKI AREA OPERATORS.

Be it enacted by the General Assembly of the State of Colorado:

SECTION 1. Title 33, Colorado Revised Statutes 1973, as amended, is amended BY THE ADDITION OF A NEW ARTICLE to read:

ARTICLE 44

Ski Safety and Liability

33-44-101. Short title. This article shall be known and may be cited as the "Ski Safety Act of 1979".

33-44-102. Legislative declaration. The general assembly hereby finds and declares that it is in the interest of the state of Colorado to establish reasonable safety standards for the operation of ski areas and for the skiers using them. Realizing the dangers that inhere in the sport of skiing, regardless of any and all reasonable safety measures which can be employed, the purpose of this article is to supplement the passenger tramway safety provisions of part 7 of article 5 of title 25, C.R.S. 1973; to further define the legal responsibilities of ski area operators and their agents and employees; to define the responsibilities of skiers using such ski areas; and to define the rights and liabilities existing between the skier and the ski area operator and between skiers.

33-44-103. Definitions. As used in this article, unless the context otherwise requires:

CAPITAL letters indicate new material added to existing statute; dashes through words indicate deletions from existing statutes and such material not part of act.

(1) "Base area lift" means any passenger tramway which skiers ordinarily use without first using some other passenger tramway.

(2) "Competitor" means a skier actually engaged in competition or in practice therefor with the permission of the ski area operator on any slope or trail or portion thereof designated by the ski area operator for the purpose of competition.

(3) "Conditions of ordinary visibility" means daylight and, where applicable, nighttime in nonprecipitating weather.

(4) "Passenger" means any person who is lawfully using any passenger tramway.

(5) "Passenger tramway" means a device as defined in section 25-5-702 (4), C.R.S. 1973.

(6) "Ski area" means all ski slopes or trails and other places under the control of a ski area operator and administered as a single enterprise within this state.

(7) "Ski area operator" means "operator" as defined in section 25-5-702 (3), C.R.S. 1973, and any person, partnership, corporation, or other commercial entity having operational responsibility for any ski areas, including an agency of this state or a political subdivision thereof.

(8) "Skier" means any person utilizing a ski area for the purpose of skiing or for the purpose of sliding downhill on snow or ice on skis, a toboggan, a sled, a tube, a ski-bob, or any other device.

(9) "Ski slopes or trails" means those areas designated by the ski area operator to be used by skiers for any of the purposes enumerated in subsection (8) of this section. Such designation shall be set forth on trail maps, if provided, and designated by signs indicating to the skiing public the intent that such areas be used by skiers for the purpose of skiing. Nothing in this subsection (9) or in subsection (8) of this section, however, shall imply that ski slopes or trails may not be restricted for use by persons using skis only or for use by persons using any other device described in subsection (8) of this section.

33-44-104. Negligence - civil actions. (1) A violation of any requirement of this article shall, to the extent such violation causes injury to any person or damage to property, constitute negligence on the part of the person violating such requirement.

(2) A violation by a ski area operator of any requirement

of this article or any rule or regulation promulgated by the passenger tramway safety board pursuant to section 25-5-710 (1) (a), C.R.S. 1973, shall, to the extent such violation causes injury to any person or damage to property, constitute negligence on the part of such operator.

(3) Notwithstanding the provisions of section 24-4-103 (5), C.R.S. 1973, all rules adopted or amended by the passenger tramway safety board on or after July 1, 1979, shall expire June 1 of the year following their adoption unless extended by the general assembly acting by bill. The general assembly, in its discretion, may postpone such expiration as often as necessary, but no such postponement shall exceed two years. All rules and amendments thereto shall be submitted pursuant to section 24-4-103 (8) (d), C.R.S. 1973.

33-44-105. Duties of passengers. (1) No passenger shall board a passenger tramway if he does not have sufficient physical dexterity, ability, and knowledge to negotiate or use such facility safely or until such passenger has asked for and received information sufficient to enable him to use the equipment safely. A passenger is required to follow any written or verbal instructions that are given to him regarding the use of the passenger tramway.

(2) No passenger shall:

(a) Embark upon or disembark from a passenger tramway except at a designated area except in the event of a stoppage of the passenger tramway (and then only under the supervision of the operator) or unless reasonably necessary in the event of an emergency to prevent injury t the passenger or others;

(b) Throw or expel any object from any passenger tramway while riding on such device, except as permitted by the operator;

(c) Act, while riding on a passenger tramway, in any manner that may interfere with proper or safe operation of such passenger tramway;

(d) Engage in any type of conduct that may contribute to or cause injury to any person;

(e) Place in an uphill track of a J-bar, T-bar, platter pull, rope tow, or any other surface lift any object that could cause another skier to fall;

(f) Embark upon a passenger tramway marked as closed;

(g) Disobey any instructions posted in accordance with th article or any verbal instructions by the ski area operat regarding the proper or safe use of a passenger tramway unle such verbal instructions are contrary to this article or t

rules promulgated under it, or contrary to posted instructions.

33-44-106. Duties of operators - signs. (1) Each ski area operator shall maintain a sign system with concise, simple, and pertinent information for the protection and instruction of passengers. Signs shall be prominently placed on each passenger tramway readable in conditions of ordinary visibility and, where applicable, adequately lighted for nighttime passengers. Signs shall be posted as follows:

(a) At or near the loading point of each passenger tramway, regardless of the type, advising that any person not familiar with the operation of the device shall ask the operator of the device for assistance and instruction;

(b) At the interior of each two-car and multicar passenger tramway, showing:

(I) The maximum capacity in pounds of the car ard the maximum number of passengers allowed;

(II) Instructions for procedures in emergencies.

(c) In a conspicuous place at each loading area of two-car and multicar passenger tramways, stating the maximum capacity in pounds of the car, and the maximum number of passengers allowed.

(d) At all chair lifts, stating the following:

(I) "Prepare to Unload", which shall be located not less than fifty feet ahead of the unloading area;

(II) "Keep Ski Tips Up", which shall be located ahead of any point where the skis may come in contact with a platform or the snow surface;

(III) "Unload Here", which shall be located at the point designated for unloading;

(IV) "Safety Gate", which shall be located where applicable;

(V) "Remove Pole Straps from Wrists", which shall be located prominently at each loading area;

(VI) "Check for Loose Clothing and Equipment", which shall be located before the "Prepare to Unload" sign.

(e) At all J-bars, T-bars, platter pulls, rope tows, and any other surface lift, stating the following:

(I) "Remove Pole Straps from Wrists", which shall be placed at or near the loading area;

(II) "Stay in Tracks", "Unload Here", and "Safety Gate", which shall be located where applicable;

(III) "Prepare to Unload", which shall be located not less than fifty feet ahead of each unloading area.

(f) Near the boarding area of all J-bars, T-bars, platter pulls, rope tows, and any other surface lift, advising passengers to check to be certain that clothing, scarves, and hair will not become entangled with the lift;

(g) At or near the boarding area of all lifts, regarding the requirements of section 33-44-109 (6).

(2) Other signs not specified by subsection (1) of this section may be posted at the discretion of the ski area operator.

(3) The ski area operator, before opening the passenger tramway to the public each day, shall inspect such passenger tramway for the presence and visibility of the signs required by subsection (1) of this section.

(4) The extent of the responsibility of the ski area operator under this section shall be to post and maintain such signs as are required by subsection (1) of this section in such condition that they may be viewed during conditions of ordinary visibility. Evidence that signs required by subsection (1) of this section were present, visible, and readable where required at the beginning of the passenger tramway operation on any given day raises a presumption that all passengers using said devices have seen and understood said signs.

33-44-107. Duties of ski area operators - signs required for skiers' information. (1) Each ski area operator shall maintain a sign and marking system as set forth in this section in addition to that required by section 33-44-106. All signs required by this section shall be maintained so as to be readable and recognizable under conditions of ordinary visibility.

(2) A sign shall be placed in such a position as to be recognizable as a sign to skiers proceeding to the uphill loading point of each base area lift depicting and explaining signs and symbols which the skier may encounter at the ski area as follows:

(a) The ski area's least difficult trails and slopes, designated by a green circle and the word "easiest";

(b) The ski area's most difficult trails and slopes designated by a black diamond and the words "most difficult";

(c) The ski area's trails and slopes which have a degree of difficulty that falls between the green circle and the black diamond designation, designated by a blue square and the word

"more difficult";

(d) Danger areas, designated by a red exclamation point inside a yellow triangle with a red band around the triangle and the word "Danger" printed beneath the emblem;

(e) Closed trails or slopes, designated by an octagonal-shaped sign with a red border around a white interior containing a black figure in the shape of a skier with a black band running diagonally across the sign from the upper right-hand side to the lower left-hand side and with the word "Closed" printed beneath the emblem.

(3) If applicable, a sign shall be placed at or near the loading point of each passenger tramway, as follows:

"WARNING: This lift services (most difficult) or (most difficult and more difficult) or (more difficult) slopes only."

(4) If a particular trail or slope or portion of a trail or slope is closed to the public by a ski area operator, such operator shall place a sign notifying the public of that fact at each identified entrance of each portion of the trail or slope involved. Alternatively, such a trail or slope or portion thereof may be closed with ropes or fences.

(5) The ski area operator shall place a sign at or near the beginning of each trail or slope, which sign shall contain the appropriate symbol of the relative degree of difficulty of that particular trail or slope as set forth by subsection (2) of this section. This requirement shall not apply to a slope or trail designated "easiest" which to a skier is substantially visible in its entirety under conditions of ordinary visibility prior to his beginning to ski the same.

(6) The ski area operator shall mark its ski area boundaries in a fashion readily visible to skiers under conditions of ordinary visibility. Where the owner of land adjoining a ski area closes all or part of his land and so advises the ski area operator, such portions of the boundary shall be signed as required by paragraph (e) of subsection (2) of this section. This requirement shall not apply in heavily wooded areas or other nonskiable terrain.

(7) The ski area operator shall mark hydrants, water pipes, and all other man-made structures on slopes and trails which are not readily visible to skiers under conditions of ordinary visibility from a distance of at least one hundred feet and shall cover such obstructions with a shock-absorbent material that will substantially lessen injuries. Any type of marker shall be sufficient, including but not limited to wooden poles, flags, or signs, if the marker is visible from a distance of one hundred feet and if the marker itself does not constitute a serious

hazard to skiers.

33-44-108. Ski area operators - additional duties. (1) Any motorized snow-grooming vehicle shall be equipped with a light visible at any time the vehicle is moving on or in the vicinity of a ski slope or trail.

(2) Whenever maintenance equipment is being employed to maintain or groom any ski slope or trail while such ski slope or trail is open to the public, the ski area operator shall place or cause to be placed a conspicuous notice to that effect at or near the top of that ski slope or trail.

(3) All snowmobiles operated on the ski slopes or trails of a ski area shall be equipped with at least the following: One lighted headlamp, one lighted red tail lamp, a brake system maintained in operable condition, and a fluorescent flag at least forty square inches mounted at least six feet above the bottom of the tracks.

(4) The ski area operator shall have no duty arising out of its status as a ski area operator to any skier skiing beyond the area boundaries marked as required by section 33-44-107 (6).

(5) The ski area operator, upon finding a person skiing in a careless and reckless manner, may revoke that person's skiing privileges.

33-44-109. Duties of skiers - penalties. (1) Each skier solely has the responsibility for knowing the range of his own ability to negotiate any ski slope or trail and to ski within the limits of such ability.

(2) Each skier has the duty to maintain control of his speed and course at all times when skiing and to maintain a proper lookout so as to be able to avoid other skiers and objects. However, the primary duty shall be on the person skiing downhill to avoid collision with any person or objects below him. It is presumed, unless shown to the contrary by a preponderance of the evidence, that the responsibility for collisions by skiers with any person, natural object, or man-made structure marked in accordance with section 33-44-107 (7) is solely that of the skier or skiers involved and not that of the ski area operator.

(3) No skier shall ski on a ski slope or trail that has been posted as "Closed" pursuant to section 33-44-107 (2) (e) and (4).

(4) Each skier shall stay clear of snow-grooming equipment, all vehicles, lift towers, signs, and any other equipment on the ski slopes and trails.

(5) Each skier has the duty to heed all posted information

and other warnings and to refrain from acting in a manner which may cause or contribute to the injury of the skier or others. Each skier shall be presumed to have seen and understood all information posted in accordance with this article near base area lifts, on the passenger tramways, and on such ski slopes or trails as he is skiing. Under conditions of decreased visibility, the duty is on the skier to locate and ascertain the meaning of all signs posted in accordance with sections 33-44-106 and 33-44-107.

(6) Each ski used by a skier while skiing shall be equipped with a strap or other device capable of stopping the ski should the ski become unattached from the skier. This requirement shall not apply to cross country skis.

(7) No skier shall cross the uphill track of a J-bar, T-bar, platter pull, or rope tow except at locations designated by the operator; nor shall a skier place any object in such an uphill track.

(8) Before beginning to ski from a stationary position or before entering a ski slope or trail from the side, the skier shall have the duty of avoiding moving skiers already on the ski slope or trail.

(9) No person shall move uphill on any passenger tramway or use any ski slope or trail while such person's ability to do so is impaired by the consumption of alcohol or by the use of any narcotic or other drug or while such person is under the influence of alcohol or any narcotic or other drug.

(10) No skier involved in a collision with another skier or person in which an injury results shall leave the vicinity of the collision before giving his name and current address to an employee of the ski area operator or a member of the voluntary ski patrol, except for the purpose of securing aid for a person injured in the collision; in which event the person so leaving the scene of the collision shall give his name and current address as required by this subsection (10) after securing such aid.

(11) No person shall knowingly enter upon public or private lands from an adjoining ski area when such land has been closed by its owner and so posted by the owner or by the ski area operator pursuant to section 33-44-107 (6).

(12) Any person who violates any of the provisions of subsection (3), (9), (10), or (11) of this section is guilty of a class 2 petty offense and, upon conviction thereof, shall be punished by a fine of not more than three hundred dollars.

33-44-110. Competition. (1) The ski area operator shall, prior to the beginning of a competition, allow each competitor a

reasonable visual inspection of the course or area where the competition is to be held.

(2) The competitor shall be held to assume the risk of all course conditions including, but not limited to, weather and snow conditions, course construction or layout, and obstacles which a visual inspection should have revealed. No liability shall attach to a ski area operator for injury or death of any competitor proximately caused by such assumed risk.

33-44-111. Statute of limitation. All actions against any ski area operator or its employees brought to recover damages for injury to person or property caused by the maintenance, supervision, or operation of a passenger tramway or a ski area shall be brought within three years after the claim for relief arises and not thereafter.

SECTION 2. Effective date. This act shall take effect July 1, 1979.

SECTION 3. Safety clause. The general assembly hereby finds, determines, and declares that this act is necessary for the immediate preservation of the public peace, health, and safety.

Fred E. Anderson
PRESIDENT OF
THE SENATE

Robert F. Burford
SPEAKER OF THE HOUSE
OF REPRESENTATIVES

Marjorie L. Rutenbeck
SECRETARY OF
THE SENATE

Lorraine F. Lombardi
CHIEF CLERK OF THE HOUSE
OF REPRESENTATIVES

APPROVED May 25, 1979 — 11:20 AM

Richard D. Lamm
GOVERNOR OF THE STATE OF COLORADO

Original sponsors: Colletta and Kerttula

Offered: 5/8/80
Referred: Rules

IN THE SENATE BY THE STATE AFFAIRS COMMITTEE

CS FOR SENATE BILL NO. 470

IN THE LEGISLATURE OF THE STATE OF ALASKA

ELEVENTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act relating to the inherent risks of skiing; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. LEGISLATIVE FINDINGS AND INTENT. The legislature finds that the sport of skiing is practiced by a large number of residents of the state and attracts a large number of nonresidents, significantly contributing to the economy of the state. It further finds that insurance carriers are increasingly reluctant to provide liability insurance protection to ski area operators and that the premiums charged by insurance carriers have risen sharply in recent years due to confusion as to whether a skier assumes the risks inherent in the sport of skiing when he participates actively in the sport. It is the intent of the legislature in enacting this Act to clarify the law in relation to skiing injuries and the risks inherent in that sport and to provide that, as a matter of public policy, a person engaged in that sport may not recover from a ski area operator for injuries resulting from those inherent risks.

* Sec. 2. AS 09.10 is amended by adding new sections to read:

ARTICLE 2. LIMITATIONS ON CLAIMS ARISING FROM INHERENT RISKS OF SKIING.

Sec. 09.10.300. LIMITATIONS ON CLAIMS. A skier may not recover from a ski area operator for injury resulting from an inherent risk of skiing unless the injury occurred when the ski area operator was not providing the information required by AS 09.10.310.

Sec. 09.10.310. INFORMATION FOR SKIERS. A ski area operator shall

post trail signs at prominent locations within a ski area which shall include a list of the inherent risks of skiing and the limitation on liability of the ski area operator provided by AS 09.10.300.

Sec. 09.10.320. DEFINITIONS. In AS 09.10.300 - 09.10.320

(1) "inherent risks of skiing" means the dangers or conditions which are an integral part of the sport of skiing, including, but not limited to,

(A) changing weather conditions;

(B) variations or steepness in terrain;

(C) snow or ice conditions;

(D) surface or subsurface conditions such as bare spots, forest growth, and rocks;

(E) collisions with lift towers, other structures, and their components unless the skier is on the lift;

(F) collisions with other skiers; and

(G) a skier's failure to ski within the limits of his own ability;

(2) "injury" means a personal injury or property damage or loss;

(3) "skier" means a person in a ski area engaged in the sport of skiing, sliding downhill on snow or ice on skis, a toboggan, a sled, a tube, a ski-bob, or other device for recreation in snow;

(4) "ski area" means all ski slopes, trails and other places under the control of a ski area operator and administered as a single enterprise in the state;

(5) "ski area operator" means the operator of a ski area.

* Sec. 3. AS 18 is amended by adding a new chapter to read:

CHAPTER 76. SNOW SAFETY.

Sec. 18.76.010. SNOW SAFETY AND OPERATION PLAN. (a) A ski area

may not be operated except under a snow safety and operation plan approved by the commissioner of public safety under regulations adopted by him.

(b) A ski area operated on land owned by the United States shall comply with a snow safety and operation plan required by the agency of the United States that manages the land on which the ski area operates.

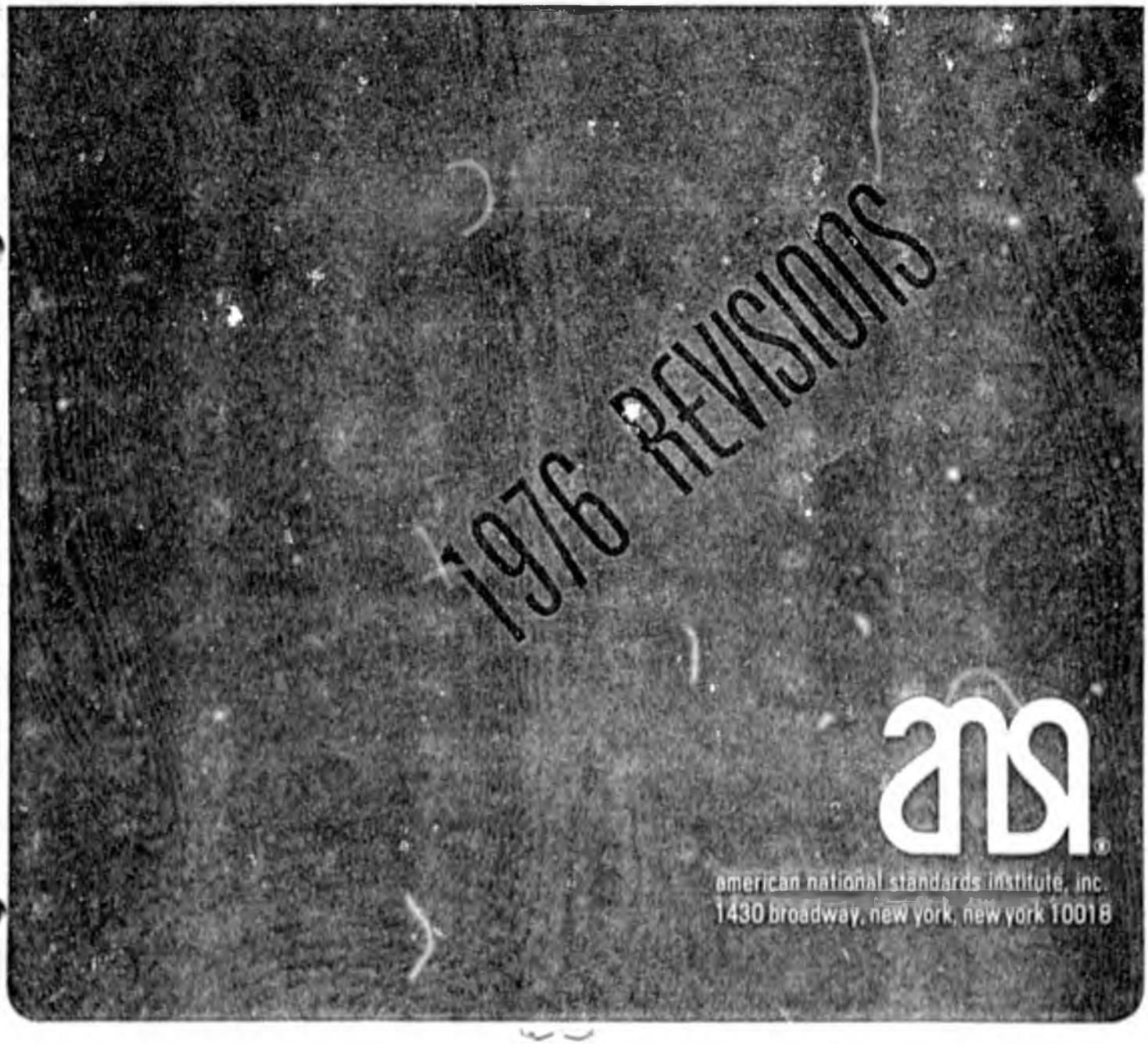
* Sec. 4. AS 05.20.012 is repealed.

* Sec. 5. This Act takes effect immediately in accordance with AS 01.10.-070(c).

change to approval by the agency (commissioner of public safety for U.S. Agency) or the other

American National Standard

safety requirements for aerial passenger tramways



american national standards institute, inc.
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B77.1-1976

American National Standard

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Foreword

(This Foreword is not a part of American National Standard Safety Requirements for Aerial Passenger Tramways, B77.1-1976.)

This standard is a revision of American National Standard Safety Requirements for Aerial Passenger Tramways, B77.1-1973. Previous editions of the standard were approved in 1960 and 1970. Both the original standard and subsequent revisions were developed under the committee procedures of the Standards Institute.

This project had its inception in 1956. At that time, the industry dealing with recreational passenger transportation had reached such proportions that safeguards were required for the protection of the public and the 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 Standards Institute established the B77 Committee, composed of operators, users, designers, and manufacturers of aerial tramways, to develop safety requirements for the equipment. The standard was approved June 8, 1960.

The present revision brings the standard up-to-date with the latest developments in the field. It was approved as an American National Standard by the Standards Institute on November 19, 1975. The secretariat of B77 is held by the National Ski Areas Association.

Suggestions for improvement of this standard will be welcome. They should be sent to the American National Standards Institute, 1430 Broadway, New York, N Y 10018.

This standard was processed and approved for submittal to ANSI by American National Standards Committee on Aerial Passenger Tramways, B77. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the B77 Committee had the following members:

William A. Norton, Chairman
Cal Conniff, Secretary

Organization Represented	*Name of Representative*
American Society of Civil Engineers	David L. Fleming
American Society of Mechanical Engineers	Victor L. Hall
California Division of Industrial Safety	(Representation Vacant)
Colorado Tramway Safety Board	Stephen Bradley
Cordage Institute	Franz J. Haas
Eastern Ski Association	Ben Bucko
Institute of Electrical and Electronics Engineers	John Fletcher
Massachusetts Tramway Safety Board	Channing Murdock
Michigan Tramway Safety Board	LaVerne Tripp
National Safety Council	(Representation Vacant)
National Ski Areas Association	Ruth Barringer
	Richard Randolph
	Walter Stopa
National Ski Patrol System	Robert Miller
New Hampshire Tramway Safety Board	Albert W. Currier
	Stanley Judge
New York Tramway Safety Board	(Representation Vacant)
Pacific Northwest Ski Areas Association	Nelson Bennett
	Mel Borgersen
U.S. Department of Agriculture, Forest Service	Charles F. Dwyer
Wire Rope Technical Board	J. W. Armstrong
	R. P. Ramsey
	William M. Schwenke
	A. B. Whitlock, Jr.
Individual Members	Hugo Birdsall
	Harold L. Chester
	Robert Heron
	J. R. Sowder

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SECTION PAGE

American National Standard Safety Requirements for Aerial Passenger Tramways

1. General

1.1 Scope. This standard establishes safety regulations for recreational transportation of passengers on devices which are usually referred to by the following names:

(1) Reversible aerial tramways (single and double)

(2) Aerial lifts (gondola lifts, chair lifts, skimobiles, and similar equipment)

(3) Surface lifts (T-bar lifts, J-bar lifts, platter lifts, and similar equipment)

(4) Tows (wire and fiber rope tows)

1.2 Intent. The intent of this standard is to establish practical factors of safety and adequate safety features for the design, construction, operation, and maintenance of aerial passenger tramways.

It represents the combined efforts of a cross section of the industry and existing regulatory agencies and should form the basis for safety regulations to be established by federal and state governments, other legal agencies, insurance companies, and interested industrial and engineering associations.

1.2.1 Other Classifications. Tramway configurations that may be proposed and do not conform to any of the classifications specified in 1.1, but fall within the general category of reversible aerial tramways, aerial lifts, surface lifts, and tows, should not be free from control. Each configuration should be evaluated by the authority having jurisdiction (see 1.5) on the basis of an interpretation of this standard, pending wide enough use of such a configuration to justify a separate category and addition to the standard.

1.2.2 New Materials, Devices, or Types of Aerial Passenger Tramways. If a designer or manufacturer of equipment wishes to use materials, devices, or components for reversible aerial tramways, aerial lifts, surface lifts, or tows not covered by this standard, full information shall be submitted to the authority having jurisdiction.

1.2.3 Exceptions. Wherever it may be proposed to depart from the provisions of this standard, due to special difficulties, the authority having jurisdiction (see 1.5) 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 Existing Installations. Installations operating prior to the approval date of this revision and with a good safety record need not comply with the new or revised requirements of this edition except where specifically required by the authority having jurisdiction. Operation and maintenance procedures shall be in compliance with this standard.

1.2.5 Interpretation of Standard. In cases where additional explanation or interpretation of this standard is required, such requests should be referred to Standards Committee B77, American National Standards Institute, 1430 Broadway, New York, N.Y. 10018.

1.2.6 Existing Laws or Ordinances. This standard shall be considered as supplementary to any existing law or ordinance covering the installation or operation of these facilities.

1.3 Reference to Other Codes and Standards. The design, installation, operation, and maintenance of aerial passenger tramways and their components should conform to standards or codes published by recognized agencies listed herein. Unless otherwise specified, the designer shall select codes or standards of these agencies. To the extent that they are available, applicable codes or standards shall be selected to cover all features, including, but not limited to, allowable unit stresses and properties of materials. Each code or standard should be of the most recent issue, and the designer shall state which he has followed. The following agencies are hereby recognized:

American Association of State Highway Officials
American Concrete Institute
American Gear Manufacturers Association
American Institute of Steel Construction
American Institute of Timber Construction
American Insurance Association
American National Standards Institute
American Society for Testing and Materials

American Society of Civil Engineers
American Society of Mechanical Engineers
American Welding Society
Institute of Electrical and Electronics Engineers
National Forest Products Association
Society of Automotive Engineers

Authorities having jurisdiction (see 1.5) may supplement the foregoing with additional recognized codes, special codes, or regulating requirements pertaining to the specific field of jurisdiction. Features not covered by this standard, recognized codes, special codes, or regulating requirements shall be handled in accordance with sound engineering judgment to the satisfaction of the authority having jurisdiction.

1.4 Mandatory and Advisory Rules. In this standard, the word "shall" is understood as mandatory and the word "should" as advisory.

1.5 Authority Having Jurisdiction. The phrase "authority having jurisdiction" means the authorized public or private body that is empowered by law or common agreement to enforce provisions of this standard. Where no such body exists, the phrase "authority having jurisdiction" shall be considered synonymous with "owner."

1.5.1 Approved. The word "approved" means "approved by the authority having jurisdiction."

1.6 Aerial Passenger Tramway Classifications

1.6.1 Reversible Aerial Tramways. That class of aerial passenger tramways and lifts wherein the passengers are transported in carriers and are not in contact with the ground or snow surface, and in which the carriers reciprocate between terminals.

1.6.1.1 Single-Reversible Tramways. That type of reversible aerial tramway having a single carrier, or single group of carriers, that moves back and forth between terminals on a single path of travel. This type is sometimes called a "to-and-fro" aerial tramway.

1.6.1.2 Double-Reversible Tramways. That type of reversible aerial tramway having two carriers, or two groups of carriers, that oscillate back and forth between terminals on two paths of travel. This type is sometimes called a "jig-back" aerial tramway.

1.6.2 Aerial Lifts and Skimobiles. That class of aerial passenger tramways and lifts wherein the passengers are transported in carriers and are not in contact with the ground or snow surface and in which the carriers circulate around a closed system and are activated by a wire rope or chain. The carriers usually make U-turns in the terminals and move along generally parallel and opposing paths of travel. The carriers may be open or enclosed cabins, chairs, cars, or platforms. The carriers may be fixed or detachable.

1.6.2.1 Gondola Lifts. That type of lift wherein the passengers are transported in open or enclosed cabins. The passengers embark and disembark while the carriers are stationary or moving slowly under a controlled arrangement.

1.6.2.2 Chair Lifts. That type of lift wherein the passengers are transported in chairs, either open or partially enclosed.

1.6.2.3 Skimobiles. That type of lift wherein the passengers are transported in open or enclosed cars that ride on a rigid structural system and are propelled by a wire rope or chain.

1.6.2.4 Similar Equipment. Lifts that utilize carrier configurations not specified in 1.6.2.1, 1.6.2.2, or 1.6.2.3, but do not require that the passenger remain in contact with the ground or snow surface.

1.6.3 Surface Lifts. That class of conveyance wherein the passengers are propelled by means of a circulating overhead wire rope while remaining in contact with the ground or snow surface. Transportation is limited to one direction. Connection between the passengers and the wire rope is by means of a device attached to and circulating with the haul rope known as a "towing outfit."

1.6.3.1 T-Bar Lifts. That type of lift wherein the device between the haul rope and passengers forms the shape of an inverted "T," propelling passengers located on both sides of the stem of the "T."

1.6.3.2 J-Bar Lifts. That type of lift wherein the device between the haul rope and passenger is in the general form of a "J," propelling a single passenger located on the one side of the stem of the "J."

1.6.3.3 Platter Lifts. That type of lift wherein the device between the haul rope and passenger is a single stem with a platter (or disk) attached to the lower end of the stem, propelling the passenger astride the stem of the platter (or disk).

1.6.3.4 Similar Equipment. Lifts that utilize towing device configurations not specified in 1.6.3.1, 1.6.3.2, or 1.6.3.3, but require that passengers remain in contact with the ground or snow surface, and conform to the general description of 1.6.3.

1.6.4 Tows. That class of conveyance wherein the passengers grasp the circulating haul rope or a handle attached to the circulating haul rope, or attach a gripping device to the circulating haul rope, and are propelled by the circulating haul rope. The passengers remain in contact with the ground or snow surface. The upward-traveling haul rope remains adjacent to the uphill track of the passengers and at an elevation that permits them to maintain their grasp on the haul rope, handle, or gripping device throughout the portion of the tow length that is designed to be traveled.

1.6.4.1 Fiber Rope Tow. A tow having a fiber (natural or synthetic) haul rope.

1.6.4.2 **Wire Rope Tow.** A tow having a metallic haul rope.

1.7 Tramway, Lift, and Tow Systems

1.7.1 **Monocable System.** A system using a moving haul rope to both support and control motion of the carriers.

1.7.2 **Bicable System.** A system using separate cables to support and control motion of the carriers.

1.8 Definitions

1.8.1 Rope and Strand

1.8.1.1 **Rope.** Unless otherwise specified, the term "rope" shall mean wire rope. (The terms "rope," "wire rope," and "cable" are interchangeable, except where, by the context, "cable" refers to a strand used as a track cable.)

1.8.1.2 **Strand.** Unless otherwise specified, the term "strand" shall mean wire strand, consisting of several wires twisted together (as compared with wire rope, which consists of several strands twisted together).

1.8.2 **Fiber Rope.** A stranded or braided rope made from natural or synthetic fibers.

1.8.3 **Sheaves.** Pulleys or wheels grooved for rope.

1.8.3.1 **Haul Rope Sheaves.** Sheaves that support or hold down the haul rope at towers or terminals. (The angle of deflection is usually small.)

1.8.3.2 **Rollers.** Sheaves of small diameter used to guide or restrain the rope from leaving its proper alignment.

1.8.3.3 **Terminal Sheave.** A haul rope sheave at a terminal that rotates continuously when the haul rope is moving and deflects the haul rope by an angle of 10 degrees or more.

1.8.3.3.1 **Deflection Sheave.** A terminal sheave that deflects the haul rope at least 10 degrees but less than 150 degrees.

1.8.3.3.2 **Bull Wheel.** A terminal sheave that deflects the haul rope 150 degrees or more. When under power, the sheave is referred to as a drive sheave (or drive bull wheel); when acting as a movable tensioning device, it is referred to as a tension sheave (or tension bull wheel); and when it is acting simply as a fixed return for the haul rope, it is referred to as a fixed return sheave (or fixed return bull wheel).

1.8.3.4 **Counterweight Sheave.** A sheave used in the counterweight roping system that is active during normal operations.

1.8.4 **Diameter.** Wherever the term "diameter" is used in specifying sheaves, it refers to the diameter at the bottom of sheave grooves (tread diameter).

1.8.5 **Safety Gate.** A type of automatic stopping device that, when actuated by a passenger's weight, contact, or passage, will automatically stop the tramway, lift, or tow.

1.8.6 Capacity

1.8.6.1 **Design Capacity.** The capacity established by the designer as the optimum operating capability of the equipment.

1.8.6.2 **Operational Capacity.** The capacity for which the installation has been tested and approved.

1.8.7 **Qualified Engineer.** An engineer who by training or experience, or both, is qualified to design, survey, supervise construction, supervise maintenance, or perform inspections, as the case may require, of tramways, lifts, or tows, and who meets the requirements of the authority having jurisdiction.

1.8.8 **Operator.** An individual in charge of a tramway, lift, or tow.

1.8.9 **Attendant.** An individual assigned to particular duties or functions in the operation of a tramway, lift, or tow.

1.8.10 **Conductor.** An attendant assigned to duties or functions in an enclosed carrier.

1.8.11 **Supervisor.** An individual in responsible charge of aerial passenger tramway operations and personnel.

2. Design and Installation

2.1 General

2.1.1 **Design Passenger Weight (All Classifications).** For purposes of design, a passenger shall be considered as having a weight of 170 pounds.

2.1.2 **Location (All Classifications).** In selecting the location and alignment of an installation, consideration shall be given to the following:

(1) Electric power lines
(2) Railways
(3) Highways
(4) Structures
(5) Rock and earth slides, cave-ins, washouts, etc
(6) Snow creep and avalanches
(7) Wind action
(8) Icing
(9) Ski slopes and trails
(10) Rivers and gullies
(11) Buried installations, including pipelines

Location with respect to such conditions shall meet the requirements of the authority having jurisdiction.

2.1.2.1 **Surface Lifts — Additional Requirements**

2.1.2.1.1 **Ski Track Gradient.** The maximum permissible grade of the ski track shall be 100% for surface lifts using single passenger towing outfits, and 50% for surface lifts using towing outfits for more than one passenger. No reverse grades shall be permitted except for very gradual inclines at loading and unloading areas.

unless otherwise permitted by the authority having jurisdiction.

2.1.2.1.2 **Cross Slope.** The cross slope of a ski track shall not exceed 5% except at unloading areas, for surface lifts using towing outfits for more than one passenger. For single-passenger surface lifts, the cross slope shall not exceed 5% except at towers and unloading areas. The cross slope at towers shall not exceed 10% and shall slope away from the centerline of the lift.

2.1.2.1.3 **Ski Slopes and Trails.** No ski traffic shall be allowed to cross the surface lift line except where specifically permitted by the authority having jurisdiction.

2.1.2.2 **Tows – Additional Requirements**

2.1.2.2.1 **Ski Track Gradient.** The maximum grade of a ski track shall be regulated for the use intended. In no case shall the grade exceed that recommended by the tow design engineer or the supplier. No reverse grades shall be permitted except for very gradual inclines at loading and unloading areas unless otherwise permitted by the authority having jurisdiction.

2.1.2.2.2 **Cross Slope.** The cross slope of a ski path shall not exceed 5% except at unloading areas, and on wire rope tows any cross slope shall be away from the tow.

2.1.3 **Width of Clearing (All Classifications).** The clearing shall be wide enough to prevent interference with the tramway, lift, or tow by adjacent vegetation. Such clearings shall be protected, if necessary, to avoid washouts that might endanger the installation. Potentially dangerous trees shall be cleared far enough back to avoid their falling on the tramway, lift, or tow.

2.1.3.1 **Surface Lifts – Additional Requirements**

2.1.3.1.1 **Track Clearing.** A minimum track width shall be cleared and maintained in such a manner that no rocks, stumps, or other obstructions project above the snow surface from the point where the passenger embarks on the lift to the point beyond the safety gate where the passenger would stop under the most adverse conditions. The minimum total snow track width shall be 2 feet 6 inches times the design number of passengers per carrier. In no case shall the track clearing width be less than 6 feet.

2.1.3.1.2 **Ski Track Width.** A minimum skiable track width of 2.5 feet times the design number of passengers per carrier, but not less than 4 feet, shall be maintained free of obstructions through the length of the track clearing described in 2.1.3.1.1.

2.1.3.2 **Tows – Additional Requirements**

2.1.3.2.1 **Track Clearing.** A minimum track width of 3 feet on each side of the centerline of the uphill track shall be cleared and maintained in such a manner that no rocks, stumps, or other obstructions project above the snow surface from the point where the passenger embarks on the tow to the point beyond the safety gate where the passenger would stop under the most adverse conditions.

2.1.3.2.2 **Ski Track Width.** A minimum skiable track width of 4 feet shall be maintained free of obstructions through the length of the track clearing described in 2.1.3.2.1.

2.1.4 **Path of Rope (All Classifications).** Terminals and towers shall be designed and installed to provide the clearances as herein specified and to minimize surge of the line under operating conditions. Local wind conditions shall be taken into consideration. Clearing shall be accomplished in such a manner that cabins or carriers will not come in contact with trees or vegetation during operating surges of the line, maximum design wind conditions, or any combination of these two conditions. In no case shall trees or vegetation extend within 5 feet of any portion of a carrier under normal (nonsurge) operating conditions.

2.1.4.1 **Reversible Tramways – Additional Requirements**

2.1.4.1.1 **Vertical Clearances.** Under the most adverse loading conditions, a minimum space of 5 feet shall exist between the lower edge of the carrier or ropes and the terrain or other possible obstacles, including snow pack. Whenever the clearance is less than 15 feet, no surface transportation shall be permitted beneath the tramway. Whenever the clearance is less than 8 feet, provision shall be made to prevent access to the area beneath the tramway by unauthorized persons.

2.1.4.1.2 **Horizontal Clearances.** The minimum distance between two passing carriers, each swung 10 degrees inward from the vertical, shall be 2 feet 6 inches, or the following, whichever is greater

$$0.02\,(V)\left(1 - \frac{V}{S}\right) \qquad \text{(Eq 1)}$$

where

S = the slope length of the span, in feet

V = the slope distance, in feet, from the point of the carriers passing to the nearest tower or track rope supporting structure

The distance between haul ropes (or track cables), for the purpose of these checks, shall be considered as equal to the gage of the line.

2.1.4.1.3 **Path of Rope Adjustment.** Terminals and towers containing provision for change in height of rope or track supports, or both, shall be used only with the approval of the authority having jurisdiction.

2.1.4.2 **Aerial Lifts – Additional Requirements**

2.1.4.2.1 **Vertical Clearances.** Where skiing is permitted beneath the lift line, or at points where ski trails cross under a lift line, a minimum vertical distance

of 13 feet between the design maximum snow depth and the top of the carrier seat shall be maintained under conditions of maximum sag.

Whenever the clearance is less than 15 feet, no public transportation shall be permitted beneath the tramway. Whenever the clearance is less than 8 feet for gondolas and empty chairs or 10 feet for chairs carrying foot passengers, provision shall be made to prevent access by unauthorized persons to the area beneath the tramway. Under the most adverse loading conditions, a minimum space of 5 feet shall be maintained between the lower edge of carriers or ropes and the terrain or other possible obstacles, including snow path.

2.1.4.2.2 **Horizontal Clearances.** The minimum distance between passing carriers, each swung 10 degrees inward from the vertical, shall be the greater of the following:

(1) 2 feet 6 inches

(2) 1/2% of the span length (applies to gondolas only)

The distance between haul ropes (or track cables), for the purpose of these checks, shall be considered as equal to the gage of the line.

2.1.4.2.3 **Path of Rope Adjustment.** Terminals and towers containing provision for change in height of rope or track supports, or both, shall be used only with the approval of the authority having jurisdiction. Such provision, if made, shall be controlled in a manner to avoid overloading or underloading tower units. The control shall be provided in the following manner.

There shall be made available to the designer not only the profile of the natural terrain along the line but also profiles, approved by the owner, of the various anticipated snow depths for which he wishes the lift to be designed. The designer shall select one set of tower locations that will be suitable for all of these profiles. For each profile he shall determine the proper number and height of sheaves for each tower. The sheave units furnished for each tower shall be suitable for all of these profiles. Each tower shall be marked with the location of the assigned height for the sheave units for each profile, giving each profile a serial number or letter, such as A, B, C, D, etc. The operating instructions shall clearly state that when the sheaves on one tower are at location A, for example, then the sheaves on all towers shall be at location A, and similarly for all other serial letters. The instructions shall also include a standard procedure for determining which serial designation to use to suit the snow conditions existing at any given time. The owner shall make sure that these instructions are followed. After any such change the lift shall not be started until the alignment of the sheave units has been checked.

Skimobiles – Additional Requirements. Trestles shall be bridged over ski trails with an opening wide enough and high enough to permit the passage of skiers.

2.1.4.4 **Surface Lifts – Additional Requirements**

2.1.4.4.1 **Vertical Clearances.** Terminals and towers shall be located so that, under the most adverse conditions, the towing outfit will not lift a passenger from the snow surface. Also, under the most adverse conditions, the haul rope shall be high enough to clear a passenger's head by at least 2 feet, and keep down-coming, empty towing outfits clear of the snow. The down-coming, empty towing outfits shall clear a passenger's head by at least 2 feet at any area where the passengers cross the path of such outfits.

The towers shall be of such a height and so located that if the up-going haul rope comes off the supporting sheaves of one tower, the towers (or terminal) on either side will support the rope clear of the design ski track by a minimum of 2 feet.

2.1.4.4.2 **Path of Rope Adjustment.** In areas of deep snow, it may be imperative to use variable rope sheave heights. In such cases, changes in tower height shall be controlled in a manner to avoid overloading or underloading tower sheave assemblies. This control shall be provided in the same manner as for aerial lifts (see 2.1.4.2.3).

2.1.4.5 **Tows – Additional Requirements**

2.1.4.5.1 **Vertical Clearances.** At no point between the loading and discharge areas shall the rope exert a downward force greater than 35 pounds, or an upward force greater than 30 pounds, when held at a height of 2 feet above the snow surface by a single passenger.

(1) Fiber rope tows: When the down-coming rope is less than 7 feet above the ski track, protective fencing, or other approved means, shall be provided to prevent persons from coming in contact with the down-coming rope.

(2) Wire rope tows: Towing devices shall not contact the ground or snow surface at any point along the tow.

2.1.4.5.2 **Horizontal Clearances.** There shall be a minimum distance of 3 feet between the up-going rope and any pole located between the loading and discharge areas.

2.1.4.5.3 **Other Clearances.**

(1) Fiber rope tows: There shall be a minimum distance of 5 feet between the up-going rope and the down-coming rope poles for 50 feet uphill of the loading area.

(2) Wire rope tows: The distance between the up-going and down-coming ropes shall at all points exceed twice the projection of any towing device attached to the haul rope, but in no event be less than 4 feet 6 inches.

The uphill track shall be so located that a passenger cannot be struck by a down-coming towing device.

2.1.4.6 Bicable Systems – Additional Requirements

2.1.4.6.1 Track Cable Saddles. The tower and terminals shall be arranged so as to keep the track cable in the saddles under the most adverse conditions. These provisions shall not interfere with any track cable movement or any track cable brake operation.

2.1.4.6.2 Haul Rope Sheave Units. Haul rope sheave units are generally of the support type. "Depression" or "hold-down" sheave units shall be subject to the requirements of 1.2.2.

2.1.4.6.3 Fair Leads. All line sheave units, including both high and low tower roller assemblies, shall be provided with fair leads or guides to accomplish the following:

(1) Permit the unobstructed passage of a carrier gripped to the haul rope regardless of the position of the haul rope guided by the fair leads as the carrier approaches the sheave assembly.

(2) Return the haul rope to the sheave groove when it has been lifted in normal operations or for other reasons.

(3) Provide the rope guidance necessary beneath sheave assemblies and adjacent structures to prevent entanglement of the haul rope as it is returned by the carrier to normal operating position from any location it may assume due to deropement or other displacement.

2.1.4.6.4 Intermediate Structures. Auxiliary intermediate structures shall be provided to support sheave units as required to maintain a minimum clearance of 8 feet between the haul rope and the snow profile.

2.1.5 Capacity and Speed

2.1.5.1 Reversible Tramways

2.1.5.1.1 Capacity. The design capacity of each carrier shall be posted conspicuously in each carrier and at each loading area. (See also 2.1.12.1(1).)

2.1.5.1.2 Speed. The maximum carrier speeds, in feet per minute, shall be as follows:

Condition	*Monocable System*	*Bicable System*
Clear spans	2000	2000
Across towers	1000	1500*
Entering terminals	300	300

*This maximum speed for bicable systems is based on the assumption that track cable saddles are so designed that the carriage wheels ride directly on the track cables over the saddles as well as in the spans, and do not come in contact with, or ride on, any part of the saddles, or retaining clips, if used. If this condition does not exist, speed over the saddles shall be reduced to a maximum of 800 feet per minute.

When there is no conductor in a carrier, the foregoing maximum clear-span speeds shall be reduced 25% and the across-tower speeds shall be reduced 30%.

2.1.5.2 Aerial Lifts

2.1.5.2.1 Gondola Lifts and Detachable Chair Lifts. Rope speed shall not exceed 800 feet per minute, unless approved by the authority having jurisdiction. Smooth acceleration of the carrier shall be accomplished from and to full rope speed. Provisions shall be made to space the carriers at prescribed intervals, never less than that contemplated in the design.

2.1.5.2.2 Chair Lifts – Fixed Grips. The maximum carrier speed shall be as shown in Table 1.

Higher speeds may be approved by the authority having jurisdiction. The speeds listed in Table 1 may be increased if a lift is slowed or stopped for loading and unloading, but in no case shall the speed exceed 700 feet per minute.

2.1.5.2.3 Skimobiles. As a general rule, skimobiles should not be operated at speeds in excess of 550 feet per minute. The loading interval for single-passenger cars should not be less than 4 seconds.

This speed may be increased if a lift is stopped for loading and unloading.

Furthermore, although the foregoing speed and interval have been proved successful by experience, higher speeds and shorter intervals may be approved by the authority having jurisdiction if a proposed scheme can be shown to represent safe operation.

2.1.5.3 Surface Lifts. The speed of the lift and the spacing of the towing outfits shall be such that the minimum loading intervals designated in 2.1.5.3.1 and 2.1.5.3.2 are maintained, unless reduced time intervals are approved by the authority having jurisdiction.

For lifts with detachable grips, means shall be provided to maintain the minimum distance between successive skiers that was used in the design of the lift. The skier(s) shall not be loaded until the skier(s) ahead has (have) traveled this minimum distance from the loading point.

Automatic launching devices meet the requirements of 2.1.5.3 when timed to release to meet the minimum loading interval.

2.1.5.3.1 Single-Passenger Carriers. The minimum loading interval shall be 3 seconds plus the time required to extend the towing outfit to such a point that the passenger starts to move.

2.1.5.3.2 Multiple-Passenger Carriers. The minimum loading interval shall be 4 seconds plus the time required to extend the towing outfit to such a point that the passengers start to move.

2.1.5.4 Tows

2.1.5.4.1 Capacity. The loading interval and capacity shall be regulated to suit the design limitations

Table 1
Maximum Carrier Speed, in Feet per Minute, for Chair Lifts with Fixed Grips

Conditions of Use	Single Chair	Double Chair	Triple Chair	Other Chairs
Skiers	600	550	500	450
Foot passengers	350	300	275	250

of the equipment as well as the slope gradient and the ability of the skiers to load and leave the tow safely.

2.1.5.4.2 Fiber Rope Tows. The rope speed shall not exceed 1500 feet per minute for passenger operation, with the following exceptions and qualifications:

(1) Higher speeds may be used to transport ski patrol members on emergency missions.

(2) In the case of each tow, speed of operation should be specifically approved by the authority having jurisdiction. The authority may require lower speeds under some conditions and may also grant special exceptions for operation at higher speeds if safe operation can be demonstrated to the satisfaction of the authority having jurisdiction.

2.1.5.4.3 Wire Rope Tows. The rope speed shall not exceed 800 feet per minute for passenger operation.

2.1.6 Structures and Foundations (All Classifications). All structures and foundations shall be designed and installed in conformance with applicable criteria listed in 1.3. Applied design loads shall include dead, live, snow, wind, and dynamic loads due to normal or emergency operation.

Structures and foundations located in snow creep areas shall be designed for such conditions and loads or be protected by snow breakers or shears.

2.1.6.1 Structures. Where structures are bolted to foundations, double nuts, lock nuts, or equivalent means of locking nuts shall be used.

2.1.6.1.1 Bicable Sytems – Additional Requirements. On bicable systems, torsional displacement of towers under the most adverse conditions shall be limited to a value that will not cause deropement of the track cable from the saddle.

2.1.6.2 Foundations. In determining the resistance of the earth to motion of the foundation, the subsoil conditions at the site shall be considered, including any buoyancy due to groundwater that may be present. If the resistance of the soil is not practically determinable, the foundation or anchorage should be designed as a gravity anchor using a coefficient of friction appropriate to the general character of the soil. Bottoms of foundations shall be below the normal frost depth unless resting on solid rock, and tops shall be a minimum of 6 inches above the finished grade. Foundations on rock shall be firmly anchored to solid rock unless designed as gravity foundations.

2.1.6.2.1 Factor of Safety. The design shall have a factor of safety of 2 in resisting overturning or sliding under dead load and live load, and 1.5 under these loadings plus wind acting simultaneously.

2.1.6.3 Anchorages – Tows. All structures shall be supported on sills or other supports that, however temporary, are capable of carrying the loads imposed by structural and machine elements under static or operating conditions without shifting or settlement that will impair the operation of the tow.

Anchors may be natural objects or devices installed in a manner capable of withstanding tensions and uplift imposed by tow installation. See 2.2.10.

2.1.6.3.1 Factor of Safety. The design shall have a factor of safety of 2 in resisting overturning, sliding, or withdrawal under dead and live load.

2.1.7 Wire Rope and Strand to Be Used as Haul Ropes, Counterweight Ropes, and Track Cables (All Classifications)

2.1.7.1 Specification. Wire rope or track strand shall be specified by the designer. The specification shall include the following:

(1) Diameter
(2) Diameter tolerance
(3) Number and arrangement of wires
(4) Strength grade
(5) Type of core for wire rope
(6) Lay of wire rope or strand, or both
(7) Nominal breaking strength

This specification shall also state that the rope or strand member shall comply with all provisions of 4.1.

This specification shall be referred to herein as the Approved Specification. Copies of the Approved Specification shall be furnished to the manufacturer, owner, and authority having jurisdiction.

Only wire rope and track strand that are the subject of and in compliance with an Approved Specification shall be installed on a tramway.

2.1.7.2 Tests. Before installation, a certified test report covering the tests required in 4.2 shall be provided from a testing laboratory in the United States acceptable to the authority having jurisdiction. Unless otherwise specified, the manufacturer of the wire rope or track strand is responsible for performance of all testing requirements of this standard. Copies of the test report (see 4.2.2) shall be furnished to the manufacturer, owner, and authority having jurisdiction.

2.1.7.3 Approval of Specifications and Tests. Copies of the specifications (see 2.1.7.1) and tests (see 2.1.7.2) shall be furnished to the owner and authority having jurisdiction. The authority having jurisdiction

may designate detailed specifications and test procedures to supplement the requirements of 2.1.7.1 and 2.1.7.2.

2.1.7.4 Splices

2.1.7.4.1 **Haul Ropes.** Splicing shall be performed by an experienced splicer acceptable to the authority having jurisdiction. The minimum length of the splice shall be 1200 times the nominal rope diameter. The tails, or lengths of the rope strands tucked into the core of the rope on splicing, shall be a minimum of 30 times the nominal rope diameter in length.

When two or more contiguous long splices occur in a rope, they shall be separated by an undisturbed length of rope that is a minimum of 2400 times the nominal rope diameter.

No type of connection other than the conventional "long" splice shall be used in a haul rope without specific approval of the tramway designer and the authority having jurisdiction.

(1) Reversible bicable systems: Splicing of haul ropes on reversible bicable systems shall not be permitted, with the following two exceptions:

(a) The infrequent case that this rule would result in a shipping package that is too large to handle by existing means of transportation.

(b) When two haul ropes are used, either of which would sustain the maximum load with a static factor of safety of 5 if the other haul rope were broken.

(2) Exception — wire rope tows: Sleeve-type splices or wedge-splice handles are permitted when installed in accordance with the lift manufacturer's instructions. This type of splice shall be replaced annually.

2.1.7.4.2 **Emergency Repairs (Patch).** In the event that damage occurs to the wire rope and such damage is confined only to a single strand of the rope, replacement of the damaged strand will be permitted on an emergency basis and the rope may be continued in service under the following conditions:

(1) Prior approval is obtained from the authority having jurisdiction for such repairs.

(2) A competent wire rope splicer verbally advises the authority having jurisdiction, with written confirmation to the authority having jurisdiction prior to the rope's being placed back in operation, that a suitable replacement strand was available and that all other conditions were such that he was able to make a proper repair to the rope by the use of this method.

(3) The minimum length of the new piece of strand is at least 360 times the nominal rope diameter between end tucks, and the length of tail tucked into the core at each end shall be at least 30 times the nominal rope diameter.

(4) The repaired area is outside of an existing splice, and both new tucks are at least 960 times the nominal rope diameter from the end tuck of an existing splice.

(5) The repaired area is inspected daily for the first 5 days of operation and once weekly thereafter during the operating season, but is removed from operation immediately if core collapse, pulling, high stranding, or other significant distortions occur.

(6) This procedure is a temporary emergency repair. It is intended to permit operation for the remainder of a season but in no case more than 6 months. At the end of the season or after 6 months, whichever comes first, the damaged section shall be cut out and a full-splice repair will be made.

(7) Documents showing the splice diagrams and overall length of the patch, as prepared by the competent wire rope splicer, are filed with the authority having jurisdiction and also placed in the owner's wire rope log for that rope.

2.1.7.4.3 **Counterweight Ropes.** No splices shall be permitted in counterweight ropes.

2.1.7.4.4 **Track Cables.** Track cable couplings shall not be used. No splices shall be permitted in wire rope used as track cables.

2.1.7.5 **End Connections**

2.1.7.5.1 **Haul Ropes — Bicable Systems.** Sockets shall be capable of developing the full strength of the rope to which they are attached. If types of end connections are proposed that are other than the current standard types used in the United States, their suitability should be established by tests. The authority having jurisdiction shall have the right to approve or disapprove the use of the proposed connection even though such tests have been made.

2.1.7.5.2 **Counterweight Ropes.** End connections shall not fail or slip under a tension equal to 80% of the strength of the rope. End connections shall satisfy the recommendations of the manufacturers of the fittings involved. Sections of rope permanently deformed or damaged by the application of wire rope clips, or bent around thimbles, sheaves, or other anchoring devices not meeting the minimum diameters specified in 2.2.7.3, Condition C, shall not be relocated or reused as a part of the section under load.

2.1.7.5.3 **Track Cables.** Rope and cable sockets shall be designed so that they shall not be stressed beyond the yield point of the material used when the ropes or cables they are for are under tensions equal to their nominal breaking strength.

The method of attachment shall be one currently in practice in the United States or established by tests, and shall develop at least 90% of the nominal breaking strength of the cable.

The authority having jurisdiction shall have the right to approve or disapprove the use of the proposed connection even though such tests have been made.

2.1.8 Communications (All Classifications). A permanently installed two-way voice communication system shall be provided between the motor control point, loading stations, and unloading stations. The power for this system shall be independent of the primary power source.

2.1.8.1 Reversible Aerial Tramways – Additional Requirements. An additional system of two-way voice communication from operating room to all carriers and to opposite terminal platform shall be provided where carriers are attended by a conductor.

2.1.8.2 Surface Lifts and Tows – Exceptions. Voice communication systems are not required for those conveyances qualifying for operation by a single operator, as defined in 3.2.2.3.1 and 3.2.2.4.

2.1.9 Electrical Design and Installation (All Classifications)

2.1.9.1 Applicable Codes. All electrical work shall comply with American National Standard National Code, C1-1975 (NFPA No. 70-1975), and American National Standard National Electrical Safety Code, C2 (1973 Edition), including C2.1-1971, C2.2-1960 and Supplement C2.2a-1965, C2.3-1973, and C2.4-1973.

2.1.9.2 Location. All exposed electric power transmission wiring shall be so located that in case of collapse or breakage of the power line it will not come in contact with carriers, ropes, or passengers.

2.1.9.3 Protection. All transformer stations and other electric equipment shall be protected so as to prevent unauthorized persons from entering the area or coming in contact with any portion of the equipment or wiring. All power equipment shall be protected against overloads by proper circuit breakers or fuses.

2.1.9.4 Signal, Communication, and Control Circuits. Only signal, communication, and control circuits are permitted to be supported between towers that support the tramway, lift, or tow. Voltage on overhead or exposed circuits shall be limited to 55 volts.

2.1.9.5 Electric Stop Circuits. All electric stop control circuits shall be energized circuits so that, in the event of electric power failure, the system will fail-safe and the tramway, lift, or tow shall be inoperative. Circuits shall be all-metallic. An inadvertent ground shall cause the system to fail-safe. Circuits may be grounded during lightning storms and when the installation is unattended.

Where guillotine-type switches are used to sever wires in the emergency stop circuit upon deropement from line sheaves, solid conductors shall be used.

Interruption of the emergency stop circuit shall stop the prime mover or auxiliary prime mover, whichever is in use at the time.

When there is only one stop circuit, it shall be classified as the emergency stop circuit.

2.1.9.5.1 Stop Switches. All stop switches in the safety control system shall be of the type that must be reset manually.

2.1.9.6 Grounding. All metallic structures shall be individually grounded using No. 4 copper wire or larger and 5/8-inch diameter by 8-foot-0-inch-long copper-coated steel grounding rod or the equivalent. If the ground connection is not visible, the construction shall be certified in writing by a qualified engineer acceptable to the authority having jurisdiction.

Except for the haul rope on reversible tramways, grounding wheels or equivalent means shall be provided at all terminals and stations for the purpose of grounding track and haul cables, as applicable.

2.1.9.7 Night Lighting. For nighttime operation, operating tramways, lifts, and tows shall be provided with lighting facilities. For aerial tramways and aerial lifts, lighting shall be provided at loading and discharge areas. For surface lifts and tows, the entire path of travel, including the loading and discharge areas, shall be lighted.

2.1.9.7.1 Illumination. Lights shall be located in a manner to provide generally uniform illumination.

2.1.9.7.2 Types. Lamps shall be of a type suitable and rated for minimum temperatures of the location. Fixtures shall be designed to maintain proper lamp operating characteristics.

2.1.9.7.3 Location. Lights shall be mounted on substantial poles or standards. Lift tower and terminal structures may be used for supporting lights subject to the following requirements:

(1) Approval shall be obtained from a qualified engineer and the authority having jurisdiction.

(2) The service conductors to each lift tower or terminal structure shall be underground or in rigid raceways. No wiring shall be supported between towers and no open wiring shall pass over or under the lift line.

(3) A separate enclosed disconnect or circuit breaker shall be required for each tower or terminal structure.

(4) All metallic raceways on a tower or terminal structure shall be grounded.

(5) The lighting installation shall not conflict with other requirements of this standard and shall not interfere with operations of the tramway, lift, or tow in any manner.

2.1.9.7.4 Emergency Lighting. Emergency lighting shall be provided in the event of electric power failure, to permit

(1) Regular unloading of tramway, lift, or tow facilities.

(2) Emergency evacuation of carriers.

2.1.10 Internal Combustion Engine Installation

2.1.10.1 Fuel Storage. Fuel tanks, except for diesel fuel, shall be of adequate capacity to permit un-

interrupted operation during the normal operating period. Where internal combustion engines are located in weatherproof equipment rooms or buildings, fuel tanks shall be located at least 5 feet from the outside of the rooms or buildings for surface tanks or in an underground installation. The fill pipe shall be capped and locked, and located to avoid toxic fumes and fire hazard during refueling. Stopcocks shall be provided on fuel lines at points where the lines enter the building in underground installations or where the lines leave the tanks for aboveground installations.

Integrally mounted fuel tanks are permissible on auxiliary engines located in other than weathertight rooms.

In all respects the installation shall comply with American National Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, B176.1-1974 (NFPA No. 37-1970).

Exception: Integrally mounted steel fuel tanks may be located within or beneath weathertight buildings supported on, or enclosing, combined drive-tension carriages, provided that the end of the fill pipe is located beyond the sides of the building, has a locked fill cap, and is in such a location as to avoid toxic fumes and fire hazard during refueling.

2.1.10.1.1 **Applicable Specifications.** Liquid fuels shall be stored and handled in accordance with American National Standard Flammable and Combustible Liquids Code, Z288.1-1974 (NFPA No. 30-1973), and American National Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, B176.1-1974 (NFPA No. 37-1970). Liquefied petroleum gas installations shall be made in accordance with American National Standard for the Storage and Handling of Liquefied Petroleum Gases, Z[illegible].1-1974 (NFPA No. 58-1974).

2.1.10.2 **Exhaust Systems.** Exhausts shall be designed and installed to discharge to the atmosphere. Exhaust stacks within reach of personnel shall be equipped with guards or heat shields.

2.1.10.3 **Gear Shifts.** Where gear shift levers are used on internal combustion engines, provisions shall be made to prevent accidental shifting of levers into speed ratios exceeding design or accidentally into reverse gear during public operation. Gears shall not be shifted when the lift is moving.

2.1.11 **Loading and Unloading Areas.** Platforms, ramps, and related units comprising the loading and unloading areas of all aerial tramway types are integrally related to the safe operation of that unit. They shall be designed and installed in conformance with applicable criteria listed in 1.3.

2.1.11.1 **Reversible Tramways.** Platforms shall be provided with sufficient space for passengers waiting to embark and for passengers disembarking. Provisions shall be made for separation of incoming and outgoing passengers. Railing shall be provided to guide passengers safely to and from the carriers. The platforms should be as level as possible. Steps should be avoided where possible.

Guide rails with curved ends shall be provided so that entrance and exit of carriers to and from the platforms can be accomplished smoothly and with minimum impact when carriers are deflected from the vertical 10 degrees laterally and, simultaneously, 10 degrees longitudinally.

2.1.11.2 **Aerial Lifts – Fixed Grips.** Handrails, safety nets, or ramps shall be provided where required for the protection of the passengers and operating personnel. The haul rope shall approximately parallel the platform.

Carriers passing loading and unloading areas shall not vary in height above the area greater than 4 inches under the most adverse conditions of design loadings and rope tensions.

Intermediate unloading and loading stations, when located in tandem to permit simultaneous unloading and loading at an intermediate station, shall be separated by an adequate distance that will permit the safe exit of the unloading passenger and the reloading of the vacated carrier. In no case shall the distance, in feet, from the unloading point to the loading point be less than 8 times the maximum rope speed in feet per second. Provisions shall be made to provide safe egress from and ingress to these areas. When either area of the combined station is not in operation, a sign shall be so displayed, and the ingress closed.

2.1.11.2.1 **Loading Areas.** Loading areas shall have sufficient level length to permit passengers to load safely. The minimum length shall be 8 feet.

Towers adjacent to loading areas shall be protected to prevent ski tips of passengers from becoming entangled in the towers.

2.1.11.2.2 **Unloading Areas.** Unloading areas shall have sufficient length to permit passengers to unload safely. A minimum length of 8 feet shall be provided that is inclined along the direction of carrier travel not more than 10% downward or upward. The entering end of this section shall be fitted with inclined guards to prevent ski tips of unwary passengers from being caught under the edges of the platform.

Ramps sloping downward from the exit of the unloading area shall not be steeper than 40%.

Bull wheel unloading. When a lift and unloading area are designed for passengers to disembark in close proximity to the upper terminal bull wheel, normally designated as "bull wheel unloading," the following requirements shall be met:

(1) The beginning of the exit ramp shall be so situ-

ated that the combination of ramp slope and distance from point of tangency of bull wheel to top of ramp shall be such that the passengers shall clear the carrier as they ski down the ramp under most adverse conditions of snow friction.

(2) A safety gate shall be required to stop the lift in the event a passenger fails to unload. Provision shall be made to unload passengers from the carrier in this event without either lift reversal or carrying passengers beyond the downhill end of the unloading area.

(3) The discharge ramp shall be clearly identified by a pronounced break having a minimum gradient of 12%.

(4) There shall be a sign clearly identifying the unloading point: "Unload Here."

(5) There shall be no impediment to unobstructed passage of persons inadvertently failing to unload.

(6) Any ramp on the return side shall be required to have proper protection for ski tips of passengers who actuate the safety gate and pass around to this ramp.

2.1.11.3 Aerial Lifts – Detachable Grips. Handrails, safety nets, or ramps shall be provided where required for the protection of the passengers and operating personnel.

2.1.11.4 Surface Lifts. Loading areas shall be of sufficient length and grade to permit the passenger to embark safely.

Unloading areas shall be of sufficient length and grade to permit the disembarking passenger to leave the towing outfit safely. The area shall contain an approximately level section followed by a slight downgrade to assist the passenger skiing away from the towing device.

The distance between unloading area and upper terminal guides shall be sufficient to allow towing outfits to become retracted and to permit their oscillations to diminish adequately before entering the terminal.

2.1.11.5 Tows. Loading areas shall be nearly level. The area shall be free of obstructions and fenced in a manner to guide passengers to the loading point.

Unloading areas shall be nearly level or graded to form a ramp inclined downward in the direction of travel and outward from the line of the uphill track to provide movement away from the tow.

2.1.12 Signs (All Classifications). All signs for instruction of the public shall be bold in design with wording short, simple, and to the point. All such signs shall be prominently placed.

Entrances to all machinery, operators', and attendants' rooms shall be posted to the effect that unauthorized persons are not permitted therein.

The sign "Men Working on Lift" or a similar warning sign shall be hung on the main disconnect switch and at control points for starting the auxiliary or prime mover when men are working on the passenger tramway. See 2.1.15 for additional requirements.

2.1.12.1 Reversible Aerial Tramways and Gondola Lifts. The interior of each carrier shall be prominently posted to show:

(1) The maximum capacity of each carrier in pounds and number of passengers. (This shall also be posted at each loading area.)

(2) Instructions for procedure in emergencies.

2.1.12.2 Aerial Lifts (except Gondola Lifts). The following signs shall be posted:

(1) "Prepare to Unload" (not less than 50 feet ahead of unloading area)

(2) "Keep Ski Tips Up" (ahead of any point where skis may come in contact with a platform or the snow surface)

(3) "Unload Here"

(4) "Safety Gate" (if applicable)

(5) "Remove Pole Straps from Wrists" (at loading area)

(6) Sign visible at all points of downhill loading, listing downhill capacity of lift.

2.1.12.3 Surface Lifts. The following signs shall be posted:

(1) "Prepare to Unload" (not less than 50 feet ahead of unloading area)

(2) "Stay in Track"

(3) "Unload Here"

(4) "Safety Gate"

(5) "Remove Pole Straps from Wrists" (at loading area)

2.1.12.4 Tows. The following signs shall be posted:

(1) "No Loose Scarves
No Loose Clothing
No Long Hair Exposed"
(at loading area)

(2) "Stay in Track"

(3) "Unload Here"

(4) "Safety Gate"

2.1.12.5 Night Lighting (All Classifications). All signs required for normal daytime operation shall be in place, and those pertaining to the tramway, lift, or tow operations shall be adequately lighted for night skiing.

2.1.13 Evacuation – Reversible Aerial Tramways and Aerial Lifts. These installations shall be provided with approved means to evacuate passengers from stranded carriers. For heights over 250 feet, or for locations over obstacles such as rivers, etc, evacuation equipment shall include an emergency carrier system or other approved equivalent rescue device.

All nonmetallic rope used for evacuation shall be of synthetic polyester fiber[1] or of a hard lay nylon with a minimum diameter of 7/16 inch and a minimum break-

[1] For example, Dacron.

ing strength when new of 5000 pounds. No natural fiber or polypropylene ropes shall be used.

These ropes shall be carefully stored when not in use, and they shall be examined after each complete lift evacuation and prior to each season of operation, both summer and winter, to ascertain that they are in satisfactory condition.

Carabiners, if used, shall be of the locking type.

2.1.14 Acceptance Tests and Inspection (All Classifications). Before the system is opened to the public, it shall be given thorough inspection and tests by qualified personnel to verify compliance with the plans and specifications of the designer and all applicable regulations of the authority having jurisdiction. The designer or manufacturer shall propose and submit a load test procedure for approval by the authority having jurisdiction.

It shall be the responsibility of the owner to see that the following conditions have been met:

(1) Tightness of all structural connections

(2) Lubrication of all moving parts

(3) Alignment and clearances of all open gearing

(4) Installation and alignment of all drive components

(5) Position and freedom of movement of counterweights or other tensioning means and carriages

(6) Haul rope alignment at entrance to bull wheels

(7) Operation of all electrical components, including circuit protection and grounding

2.1.14.1 Reversible Aerial Tramways and Aerial Lifts – Additional Requirements. Inspection shall also cover:

(1) Track cable and haul rope sags under the most adverse static loadings.

(2) Alignment of track cable saddles and haul rope sheave units.

(3) Evacuation equipment and procedures, including an actual test at the most difficult location.

(4) Towers and terminals, for correct location and installation in accordance with plans and specifications. A certification from a representative of the designer may be accepted as evidence of compliance with this provision.

(5) Thorough operating tests under full loading and any partial loadings that may provide the most adverse operating conditions. Test load per carrier shall be 110% of the design live load. For chair lifts wherein loaded chairs can pass around the terminal (see 2.2.11.2.2(1)), the test shall include passing a loaded carrier with twice the design live load around the bull wheel at full speed. The functioning of all push-button stops, automatic stops, limit switches, selected detrapement switches, and communications shall be checked. Acceleration and deceleration rates shall be satisfactory under all loadings. Motive power and all braking and backstops shall be proved adequate under the most adverse loadings. The tests shall include at least 6 hours of continuous operation with empty carriers to check for overheating of moving parts, excessive vibration or deflection of mechanical or structural components, free movement of tensioning systems, etc.

(6) For systems using detachable grips, all transfer, launching, and grip-testing equipment shall be thoroughly checked both before and during the continuous run test.

2.1.14.2 Surface Lifts – Additional Requirements. Inspection shall also cover:

(1) Alignment of haul rope line sheave units.

(2) Haul rope sags.

(3) Retraction of towing outfits.

(4) Towers, bents, and terminals, for correct location and installation in accordance with plans and specifications. A certification from a representative of the designer may be accepted as evidence of compliance with this provision.

(5) Thorough operating tests. The functioning of all push-button stops, automatic stops, safety gates, limit switches, selected detrapement switches, and communication devices shall be checked. Braking shall be proved adequate. The tests shall include at least 3 hours of continuous operation with empty carriers at full speed to check for overheating of moving parts, excessive vibration or deflection of mechanical or structural components, free movement of tensioning systems, etc.

2.1.14.3 Tows – Additional Requirements. Inspection shall also cover:

(1) Horizontal and vertical clearances. See 2.1.4.5.

(2) Terminals for correct location and installation in accordance with plans and specifications.

(3) Thorough operating tests. The functioning of all push button stops, safety gates, etc, shall be checked. Braking shall be proved adequate. The tests shall include full-speed operation for as long as required to check for overheating of moving parts, excessive vibration or deflection of mechanical or structural components, free movement of tensioning systems, etc.

(4) Rope twist or spiraling.

2.1.15 Safety of Operating and Maintenance Personnel (All Classifications). Provision shall be incorporated in an aerial tramway design to render the system inoperable when necessary for the protection of personnel working on the tramway.

2.2 Terminals and Stations

2.2.1 Prime Mover (All Classifications). All prime movers shall have capacity to handle the most unfavorable design loading conditions, including the starting of a fully loaded tramway, lift, or tow.

Where manual multispeed transmissions are used on either the prime mover or auxiliary prime mover, gears shall not be shifted when the tramway is moving.

Where reverse capability is provided on the prime mover or auxiliary prime mover for any tramway, provisions shall also be made to prevent accidentally shifting into reverse whenever the tramway is operating.

2.2.1.1 Auxiliary Power Unit – Reversible Aerial Tramways and Gondola Lifts. An auxiliary power unit with an independent power source shall be provided that can readily be used to move the carrier(s) to a terminal in the event of failure of the primary power unit, unless other means acceptable to the authority having jurisdiction are provided. A single auxiliary power unit shall not be used except to unload passengers and for maintenance purposes. The auxiliary engine shall not depend upon the mechanical integrity of a single prime mover to drive the unit.

2.2.1.2 Auxiliary Power Unit – Aerial Lifts (Other than Gondola Lifts). An auxiliary power unit with an independent power source shall be provided that can readily unload the line in the event of failure of the primary power unit. As a minimum, the auxiliary power unit shall be capable of starting and moving a fully loaded line in a forward direction at not less than 100 feet per minute or at an average speed in feet per minute equal to 1/60 the slope length of the lift in feet, whichever is greater. The auxiliary engine shall not depend upon the mechanical integrity of a single prime mover to drive the unit.

A single auxiliary power unit shall not be used except to unload passengers and for maintenance purposes unless the following requirements are met.

(1) All automatic brakes, the manual brakes, and backstop are functional with the auxiliary drive. The automatic brake may be manually operated if an attendant is specifically assigned to this function and has no other duties.

(2) All control circuits, safety gates, and stop switches are functional and control the auxiliary drive.

(3) Temperature and weather conditions are such that a 2-hour waiting period in the carrier would not be injurious to passengers.

(4) Evacuation gear and personnel are immediately available in sufficient number and quantity that the entire lift can be evacuated in a 2-hour period. Demonstration of the capability will be required before authorization is granted to use the auxiliary power unit for passenger operations.

(5) If downhill capacity is desired, 2.2.4.2 must be complied with.

2.2.1.3 Auxiliary Power Unit – Surface Lifts and Tows. None required.

2.2.2 Speed Reducers and Gearing (All Classifications). All speed reducers and gearing shall have capacity for starting a tramway, lift, or tow under the most unfavorable design loading conditions, and shall comply with the following standards of the American Gear Manufacturers Association,[2] as applicable:

Surface Durability (Pitting) of Spur Gear Teeth, AGMA 210.02, 1965

Surface Durability (Pitting) of Helical and Herringbone Gear Teeth, AGMA 211.02, 1969 (R1974)

Surface Durability (Pitting) Formulas for Straight Bevel and Zerol Bevel Gear Teeth, AGMA 212.02, 1964 (R1974)

Information Sheet for Surface Durability (Pitting) of Spur, Helical, Herringbone and Bevel Gear Teeth, AGMA 215.01, 1966 (R1974)

Surface Durability (Pitting) Formulas for Spiral Bevel Gear Teeth, AGMA 216.01, 1964

Rating the Strength of Spur Gear Teeth, AGMA 220.02, 1966

Rating the Strength of Helical and Herringbone Gear Teeth, AGMA 221.02, 1965

Rating the Strength of Straight Bevel and Zerol Bevel Gear Teeth, AGMA 222.02, 1964

Rating the Strength of Spiral Bevel Gear Teeth, AGMA 223.01, 1964

Practice for Gearmotors Using Spur, Helical, Herringbone and Spiral Bevel Gears, AGMA 460.05, 1971

Practice for Spur, Helical and Herringbone Gear Shaft-Mounted Speed Reducers, AGMA 480.05, 1974

2.2.3 Bearings, Clutches, Couplings, and Shafting (All Classifications). Bearings, clutches, and couplings shall be selected on the basis of the manufacturer's published recommendations for the particular use. If published data are not available for the specific use, the manufacturer's approval shall be obtained. Bearings, clutches, and couplings of special design, if used, should have the approval of a qualified mechanical engineer.

Provision shall be made for adjustment and lubrication of all bearings, clutches, and couplings when required.

All shafting shall be designed in accordance with accepted standard practices.

2.2.4 Acceleration and Speed Control.

2.2.4.1 Reversible Aerial Tramways. Acceleration and speed controls are prime considerations for

[2] Available from American Gear Manufacturers Association, 1330 Massachusetts Avenue, N.W., Washington, D.C. 20005.

this type of tramway in order to avoid discomfort to the passengers caused by undue longitudinal swinging of the carrier or by excessive acceleration or deceleration and in order to start and stop the carriers smoothly and safely.

In addition, the following requirements shall be incorporated in the design:

(1) Provision shall be made for smooth deceleration of the tramway prior to the actuation of one of the automatic drive terminal brakes described in 2.2.5.1. The operation of the drive sheave brake or track cable brake shall not result in deceleration of the tramway that exceeds 7 feet per second squared under the most adverse design conditions.

(2) Carrier(s) shall be brought to a stop for loading and unloading, and provision shall be made to keep the carrier(s) stationary during loading and unloading periods. The control room shall contain, in full view of the operator, indicators that will show the location of the carrier(s) at all times.

(3) Provision shall be made for an overhauling load so that the system shall always operate at a controlled speed not exceeding design speed by more than 6%. The energy developed by the overhauling load shall be dissipated in a satisfactory manner without using the brakes specified under 2.2.5.1.

2.2.4.2 Aerial Lifts. The drive equipment shall be designed to accelerate the line smoothly and to avoid severe oscillation or undulation under any loading condition.

For lifts in this category that have stationary loading and unloading, the acceleration and deceleration of the carrier to and from the design rope speed shall be of such rate as not to endanger the carrier or the passenger. The interval between carriers shall be controlled by automatic carrier spacers or other suitable devices. Unbalanced loading shall be controlled to the extent required by the design through the use of automatic carrier counters or other suitable devices.

The drive shall be capable of rotating the unloaded system at reduced speed for rope inspection and equipment maintenance. This reduced-speed operation may be obtained by the use of the auxiliary engine.

On installations in which an overhauling condition exists:

(1) Provision shall be made for an overhauling load so that the system shall always operate at a controlled speed not exceeding design speed by more than 6%. The energy developed by the overhauling load shall be dissipated in a satisfactory manner without using the brakes specified under 2.2.5.2.

(2) Provision shall be made for slowing and stopping the lift drive automatically if the line speed exceeds the design speed by more than 10%. The service brake (see 2.2.5.2.1) shall slow and stop the tramway automatically if the line speed exceeds the design speed by more than 10%, and the emergency brake shall automatically slow and stop the tramway if the line speed exceeds the design speed by more than 15%.

Design values of line speed pertain to the design speed for the particular condition of operation (that is, winter operation with skiers, summer operation with foot passengers, etc).

All installations in which downhill traffic is either limited or not permitted shall be so identified with clearly visible signs at loading or unloading areas, and this information shall be further contained in operating instructions posted in these areas.

2.2.4.3 Surface Lifts and Tows. Acceleration of a drive shall be regulated with regard to lift or tow type, profile, speed, and use to the satisfaction of the authority having jurisdiction.

2.2.5 Brakes (All Classifications). All braking systems shall be capable of operation to comply with daily inspection required by 2.2.4.2(4). All emergency brakes shall be capable of retarding the speed within 5 seconds after the operator or attendant reacts to the stimulus to apply the brake.

2.2.5.1 Reversible Aerial Tramways. Each reversible aerial tramway shall have the brakes designated in 2.2.5.1.1 through 2.2.5.1.3.

2.2.5.1.1 Service Brake. An automatic brake to stop and hold the tramway system under maximum load when power is shut off or the tramway is stopped for any reason. This brake shall be applied to a drive shaft so that there is no clutch, or similar device, between the brake and the drive sheave.

The brake shall be automatically applied mechanically by springs or weights except in cases wherein another type of fail-safe brake has been specifically approved by the authority having jurisdiction. In all cases the brake shall be normally in the applied position. It shall be held open for operation of the tramway by a device that is automatically cut out when power is shut off or the tramway is stopped. This device shall be placed in operation before the tramway is started. This brake shall decelerate the tramway at a minimum rate of 1 foot per second squared when operating under the most unfavorable condition of overhauling load and at full speed.

2.2.5.1.2 Overspeed Device. An automatic overspeed device that will interrupt the power to the prime mover and actuate the service brake or a similar independent brake if the speed of the tramway can exceed the rated speed by more than 10%.

2.2.5.1.3 Emergency Brake. An emergency brake located on the main drive sheave with controls within reach of the operating attendant. It shall be ap-

plied automatically if the speed of the haul rope exceeds the design speed by more than 15% or if the carriers travel beyond their stopping position in either terminal.

The automatic actuation of this brake should be fail-safe, powered either by springs or weights. This brake, when set automatically, shall stop and hold a fully loaded tramway at a deceleration rate not to exceed 7 feet per second squared and not less than 1.5 feet per second squared when operating under the most unfavorable condition of overhauling load and at full speed.

A qualified engineer shall furnish a written procedure to be followed and specify the auxiliary equipment necessary for periodic testing and adjustment of the holding power of the emergency brake on the drive sheave. Such testing shall be accomplished as part of normal maintenance during the operating season, but shall be performed when the tramway is not open to the public.

2.2.5.2 **Aerial Lifts.** Each aerial lift shall have the brakes designated in 2.2.5.2.1 through 2.2.5.2.4.

2.2.5.2.1 **Service Brake.** An automatic brake to stop and hold the lift under maximum load when power is shut off or the lift is stopped for any reason. This brake shall automatically be applied mechanically by springs or weights. The rate of application of this brake shall not cause an excessively rapid stop so as to cause undue swinging of the carriers or oscillations of the haul rope under any operating conditions.

This brake shall be adjusted so as to stop the lift from full speed when empty or when loaded under the most unfavorable overhauling condition. The stopping distance shall not exceed 10 feet or the distance $d = V^2/8000$, where d is the stopping distance in feet and V is the lift speed in feet per minute, whichever is greater.

This brake shall be applied to a drive shaft so that there is no clutch, or similar device, between the brake and the drive sheave.

The hydraulic system of an aerial lift using a hydraulic motor geared directly to the bull wheel, so designed that the system can operate to perform the function required of a service brake, may be used in place of a mechanical brake, with the approval of the authority having jurisdiction.

2.2.5.2.2 **Emergency Brake.** An emergency brake located on the main drive sheave, with controls located at the operating station. It is not permissible to locate the controls to the emergency brake in a position such that the operator would be required to pass through the path of moving carriers to operate same. Operation of the emergency brake shall automatically stop the prime mover of the lift on installations that are regenerative or have brakes not applied by human force.

A qualified engineer shall furnish a written procedure to be followed and specify the auxiliary equipment necessary for periodic testing and adjustment of the holding power of the emergency brake on the drive sheave. Such testing shall be accomplished as part of normal maintenance during the operating season, but shall be performed when the tramway is not open to the public.

2.2.5.2.3 **Backstop Brake.** A backstop brake to automatically prevent reverse rotation of the tramway. The backstop brake shall act directly on a bull wheel, on a ring gear attached to a bull wheel, or on the haul rope. The backstop brake shall not be located on other than the drive sheave unless its location on other bull wheels will not decrease the factor of safety of the haul rope below the minimum permissible value when the backstop brake operates.

The bull wheel backstop brake and any other low- or high-speed backstop installed in addition to the bull wheel backstop brake shall have the capability of being inactivated during testing periods.

2.2.5.2.4 **General.** The service brake, emergency brake, and backstop brake shall be independent systems, such that failure of one system will not impair the function of the other systems.

Suitable protection shall be provided to assure operation under all anticipated weather conditions.

2.2.5.3 **Surface Lifts.** Each surface lift shall have the brakes designated in 2.2.5.3.1 and 2.2.5.3.2.

2.2.5.3.1 **Backstop Brake.** A backstop brake shall be provided to automatically prevent reverse rotation of the lift under maximum load.

2.2.5.3.2 **Stopping Brake.** Unless an unloaded lift operating at maximum speed will stop in 25 feet or the distance $d = V^2/18\,000$, where d is the stopping distance in feet and V is the lift speed in feet per minute, whichever is greater, an automatic brake shall be provided to assure this stopping distance. This brake shall be applied by springs or weights when any stop switch or safety gate is actuated. If the prime mover is an internal combustion engine, the compression of the engine may serve as a brake when this unit is not declutched by activation of the stop circuit. When the motive power is an internal combustion engine, a positive system shall be provided to stop the lift.

2.2.5.4 **Tows.** Each tow shall have the brakes designated in 2.2.5.4.1 and 2.2.5.4.2.

2.2.5.4.1 **Backstop Brake.** A backstop brake to automatically prevent reverse rotation of the tow is required on all tows having an average grade in excess of 15%. If it can be demonstrated that the tow will not roll back (if declutched) under the most adverse loading, a backstop is not necessary.

2.2.5.4.2 **Stopping Brake.** Unless an unloaded tow operating at maximum speed will stop in 25 feet or less, an automatic brake shall be provided to assure this

stopping distance. This brake shall be applied by springs or weights when any stop switch or the safety gate is actuated. When the motive power is an internal combustion engine, a positive system shall be provided to stop the tow.

2.2.6 Location of Machinery (All Classifications)

2.2.6.1 General. Moving machine parts that normally may be in reach of personnel shall be fitted with safety guards conforming to American National Standard Safety Standard for Mechanical Power Transmission Apparatus, B15.1-1972.

Protection against lightning and static electricity shall be provided.

Fire-fighting devices shall be available.

2.2.6.2 Machinery Not Housed in a Machine Room. Provisions shall be made to keep the public away from the machinery. All power units, all components of the drive train, and all safety devices, such as backstops, brakes, relays, etc, shall be protected from the weather.

2.2.6.3 Machinery Housed in a Machine Room. The machine room shall be well ventilated. It shall have a permanently installed lighting system adequate for proper machinery maintenance and safety of operating personnel. The arrangement shall permit proper maintenance. A door with a suitable lock shall be provided, and the design shall keep the public away from the machinery. When a passageway is provided between machines or machinery and walls, a minimum passageway width of 18 inches shall be maintained. Means shall be provided to heat the machine room unless the designer or manufacturer certifies in writing that the drive machinery is rated for operation in an unheated room.

2.2.7 Sheaves in Terminals and Stations (All Classifications)

2.2.7.1 General. All sheaves, including their mountings and frames, shall be designed to withstand static and dynamic loads. Sheave bearings and mountings shall be selected, designed, and installed in accordance with the recommendations of the manufacturers of the bearings.

When unlined sheave grooves are used for wire rope, they should be V-shaped and shall have rounded bottoms with a radius equal to approximately 55% of the rope diameter.

When lined sheave grooves are used, the allowable bearing pressures of the liner material shall not be exceeded.

2.2.7.2 Haul Rope Terminal Sheaves (Bull Wheels and Deflection Sheaves)

2.2.7.2.1 Reversible Aerial Tramways and Aerial Lifts. Haul rope terminal sheave frames shall be so designed as to retain the rope in the event of sheave, shaft, or mounting failure. In instances where the sheave is cantilevered, the design working stresses shall not be more than 60% of those otherwise allowable.

The minimum diameter of terminal sheaves shall be 72 times the nominal diameter of the haul rope, provided that no gripping device passes around the sheave. The minimum diameter shall be 96 times the nominal haul rope diameter in cases where gripping devices pass around the sheave. The sheave assembly shall be designed to retain the haul rope in the event of a deropement from the sheave. A flange extension of 1-1/2 times the rope diameter (measured from the bottom of the rope groove) shall be deemed adequate for retention when the provisions of 2.2.7.4.1 are fully complied with.

Haul rope terminal sheaves that act as driving, braking, or holding sheaves shall be so designed that the haul rope does not slip in the sheave groove. The design coefficient of friction for a particular sheave liner shall not exceed the following values:

Sheave Liner	*Coefficient of Friction*
Steel or cast iron grooves	0.070
Leather	0.150
Rubber or neoprene	0.205

For other sheave liner combinations, values shall be determined to the satisfaction of the authority having jurisdiction, but in no case shall the value exceed 0.205.

2.2.7.2.2 Surface Lifts and Wire Rope Tows. Haul rope terminal sheave frames shall be so designed as to retain the sheave in the event of shaft or mounting failure. In instances where the sheave is cantilevered, the design working stresses shall not be more than 60% of those otherwise allowable.

The minimum diameter of terminal sheaves shall be 72 times the nominal diameter of the haul rope, provided that no gripping device passes around the sheave. The minimum diameter shall be 80 times the nominal haul rope diameter in cases where gripping devices pass around the sheave. In the latter case, means shall be provided to guide towing outfits or towing handles into, around, and out of terminal sheaves and to prevent the towing outfits or towing handles from swinging excessively while passing around the sheave. The sheave assembly shall be designed to retain the haul rope in the event of a deropement from the sheave.

Haul rope terminal sheaves that act as driving, braking, or holding sheaves shall be so designed that the haul rope does not slip in the sheave groove.

For wire rope tows, provisions shall be made to permit adjustment of the terminal sheaves to control the rotation of the haul rope and towing devices.

Table 2
Minimum Diameters for Counterweight Rope Sheaves and Sheaves Not Specifically Covered Elsewhere

	Sheave Diameter		
Rope Type	Condition A	Condition B	Condition C
6 × 7	72*d*	42*d*	24*d*
6 × 19	45*d*	30*d*	20*d*
6 × 37	27*d*	18*d*	12*d*

NOTE: *d* equals the nominal rope diameter.

2.2.7.2.3 Fiber Rope Tows. Sheaves shall be of such design and so arranged as to prevent unnecessary stressing, wear, or disfiguration of the fiber haul rope. They shall be of sufficient strength and properly balanced to prevent excessive vibration at any operating speed. A suitable method shall be provided to retain the rope in the terminal in the event of a deropement from the sheave.

2.2.7.3 Counterweight Rope Sheaves and Sheaves Not Specifically Covered Elsewhere (All Classifications). The minimum diameters for these sheaves shall be as indicated in Table 2.

Condition A is applicable where bending over sheaves is of major importance. This condition shall be used as a minimum design criterion for track cable counterweight ropes.

Condition B is applicable where bending over sheaves is important, but some sacrifice in rope life is acceptable to achieve reduction in weight, economy in design, etc.

Condition C is applicable to sheaves that are not intended to rotate due to any tension sheave movement but are intended to rotate only due to counterweight adjustment.

In the case of locked coil track cable passing over a sheave or roller chain and connected directly to a counterweight, the radius of curvature of the sheave or the roller chain shall not be less than 100 times the cable diameter or 1200 times the greater dimension of the cross section of the largest wire of the cable, whichever is greater.

Provisions shall be made to assure that all counterweight sheaves rotate freely.

2.2.7.4 Haul Rope Line Sheaves (All Classifications). The requirements of 2.3.3 are applicable to haul rope line sheaves used in terminals and stations, with the following exceptions:

(1) Sheaves that carry no load other than the weight of the rope and carriers.

(2) Where the sheaves are located such that the weight of carriers is either wholly or partially supported on tracks or by other means.

(3) Where the sheaves are located such that carriers attached to the cable are not passing onto the sheaves.

In such cases the design shall be modified to meet the requirements of the particular installation.

2.2.7.4.1 Aerial Lifts with Fixed Grips Only. Guide sheaves shall be located in order to prevent misalignment of rope entering and leaving the drive and return sheaves. Such sheaves shall be as close as practicable to the drive and return sheaves, but not farther than one diameter of the drive or return sheave from the point of tangency. Shoes, rollers, or sheaves shall be placed on the opposite side of the rope adjacent thereto to prevent deropement in that direction.

2.2.7.4.2 Surface Lifts. On all installations except floating tension sheave carriages (see 2.2.8.4) the requirements of 2.2.7.4.1 are applicable.

2.2.7.4.3 Tows. In the event auxiliary terminal guide sheaves are required, they shall be sized and located, have sufficient guides, and be otherwise designed to present no operation hazard to passengers, operating personnel, or mechanical elements of the tow.

2.2.8 Tension Sheave Carriages (All Classifications). The available travel of the tension sheave and carriage shall be adequate for the maximum limits of motion under normal operation.

2.2.8.1 Reversible Aerial Tramways – Rigid Mounted Carriages. For all carriage arrangements other than those whose motion is vertical, the mounting that travels under the action of the counterweight shall be supported on rigid straight rails by means of wheels. For carriage arrangements with vertical motion, guides shall be provided.

2.2.8.2 Aerial and Surface Lifts – Rigid Mounted Carriages. The sheave carriage shall be supported from the ground by a rigid structure. The mounting that travels under the action of the counterweight shall be supported on rigid, straight rails by means of wheels. Torsional loads due to driving torque, braking torque, or reactions of a backstop shall be considered, and the structure and carriage shall adequately transmit these loads to the foundations.

Mechanical stops shall be provided to prevent overtravel of the carriage and the tension sheave. These stops and the terminal structure shall be designed so as to resist, at normal design stresses, an unbalanced horizontal force on the bull wheel applied in the direction of the opposite terminal and equal in magnitude to 30% of the counterweight reaction on the bull wheel.

2.2.8.3 Aerial Lifts – Floating Tension Sheave Carriages. The sheave mounting shall be installed and operated in such a manner that the haul rope, in every case, considering every possibility of overloading, remains in the center of the sheave groove. The lateral

tilt of the sheave shall not exceed 2 degrees from the horizontal when in a stationary position and when the up-going and down-going unloaded carriers are equidistant from the sheave.

To prevent excessive lateral tilt in case a loaded carrier passes around the sheave, the counterweight or anchor cables shall be connected to at least two points on the mounting frame of the sheave. The connections of the counterweight or anchor cables to the sheave frame and the support points of the cables shall be spaced a minimum of 70% of the pitch diameter of the sheave and increased as necessary to limit the allowable lateral tilt of the sheave to a maximum of 6 degrees from the static position when passing a carrier with full design load.

The design shall incorporate provision for adjustment to control the position of the haul rope entering the terminal sheave.

2.2.8.4 Surface Lifts – Floating Tension Sheave Carriages. A floating tension sheave carriage may be used and operated with a lateral tilt of more than 6 degrees if it is of the type that has proved to give satisfactory service in the industry, or that has been specifically approved by the authority having jurisdiction. Otherwise, the provisions of 2.2.8.3 shall apply. In any event, adequate control measures shall be taken to prevent the rope from riding on the flanges or derailing from the terminal sheave and the tower sheaves on the nearest line tower.

2.2.8.5 Tows. The idler terminal sheave may be supported by a rigid structure or carried in a floating manner. The assembly shall not be subject to collapse in the event of detopement and the subsequent retaining of the rope by the structure or sheave mounting.

2.2.9 Counterweight and Tensioning Systems

2.2.9.1 Counterweights (Reversible Aerial Tramways, Aerial Lifts, and Surface Lifts). Counterweights or other suitable devices shall be provided to determine and regulate the tension of all haul ropes. Counterweights, when used, shall be arranged to move freely up and down. Enclosures for counterweights shall be provided where necessary to prevent snow or ice from accumulating under and around the counterweights and interfering with their free movement. When a counterweight is contained in a structural frame, guides shall be provided to protect the frame, and to ensure free movement of the counterweight. Where snow enclosures are not required, guardrails or enclosures shall be provided to prevent unauthorized persons from coming in contact with or passing under counterweights.

The counterweight, or other suitable device, shall have sufficient travel to take care of all normal operating changes in loading and temperature. Counterweights, if used, shall determine and regulate the tension during all operating periods. Where counterweights or other devices are used for track cables the same provisions shall apply.

2.2.9.2 Counterweight Ropes (All Classifications). Counterweight ropes shall have a minimum factor of safety of 6, when new. The factor of safety is equal to the nominal breaking strength of the rope (see 4.1.2) divided by the maximum static design tension. On arrangements involving rope reeving, the maximum design static tension, with sheave friction taken into account, shall be the basis for determining factor of safety.

Counterweight ropes shall be adjusted so that the counterweight will reach the end of its travel before the attached tension sheave carriage comes within 6 inches of the end of its travel.

See 2.1.7 for additional requirements.

2.2.9.3 Tensioning Devices (Wire Rope Tows). An approved mechanical or hydraulic tensioning system shall be provided to ensure that the haul rope tension does not exceed a value of one-fifth its nominal breaking strength under the most unfavorable accumulation of stress due to loading, operating, temperature, and like considerations. A visual means of verifying this restriction shall be provided.

2.2.9.4 Tensioning Devices (Fiber Rope Tows). All installations shall have provisions for adjusting rope tension. For installations using a bottom drive or others where the designer or authority having jurisdiction deem it necessary, an approved counterweight or other suitable device shall be installed to maintain proper tension.

2.2.10 Anchoring Devices (All Classifications). All anchoring end connections shall be above finished grade. Any portion of an anchorage below ground shall be protected against loss of strength due to corrosion.

Sections of wire ropes bent around thimbles, sheaves, or other anchorage devices not meeting the minimum diameters specified by Condition C in 2.2.7.3, or permanently deformed or damaged sections, shall not be relocated or reused as a part of the section under load.

Wire ropes, or strands, and their connections, used to anchor, tension, or otherwise secure terminal structures, shall be designed with a minimum factor of safety of 6. Where adjusting devices are used in the arrangement, the devices must be capable of being securely locked or removed during operation.

2.2.10.1 Counterweight Winches. Winches that are used for counterweight system take-up and remain a permanent part of the system shall have a factor of safety of 6 against their ultimate capacity. They shall have a positive lock against release. Where this factor of safety cannot be established by manufacturer's endorsement, a safety device shall be installed on the counterweight rope ahead of the winch that will keep

the tensioning system intact in the event of failure or release of the winch.

2.2.11 Manual and Automatic Stops (All Classifications). All stop circuits and switches shall conform to the requirements of 2.1.9.5.

2.2.11.1 Reversible Aerial Tramways

2.2.11.1.1 Manual Stops. The following manual stop switches shall be installed:

(1) A stop at each terminal platform

(2) A stop on the conductor's control console in each carrier when a conductor is required in the carrier (see 2.4.5.1.2(1))

(3) An operator's stop

2.2.11.1.2 Automatic Stops. The following automatic stop switches shall be installed:

(1) A stop that will be actuated in the event manual or automatic controls fail to reduce tramway speeds to design values at critical control points along the line.

(2) A stop that will stop the tramway before the carrier reaches its limit of travel. An adequate bumper system shall also be installed.

(3) Stops to stop the tramway before any counterweight or tension sheave carriage reaches either end of its travel.

(4) Stops that will be actuated by the application of a track cable brake. These stops shall activate both the service and emergency brakes.

2.2.11.2 Aerial Lifts — Fixed Grips

2.2.11.2.1 Manual Stops. Manual stop switches that will stop the prime mover and apply the service brake shall be installed in all attendants' and operators' stations, in machine rooms, and out-of-doors in close proximity to all loading and unloading areas.

2.2.11.2.2 Automatic Stops. The following automatic stop switches shall be installed:

(1) Stops beyond each unloading area. For actuating devices of the suspended type, the suspended portion shall be part of the safety circuit, and each side shall be detachable and shall interrupt the safety circuit when detached. The location of the automatic stop switch shall be in accordance with the following:

(a) Intermediate stations. Required only when traffic is not permitted beyond the intermediate station. The device shall automatically stop the lift in the event a passenger rides beyond the intended point of unloading.

(b) Terminal unloading areas. If danger to passengers or equipment would result in the event the passenger entered or passed around a terminal at full speed, the stop shall be so located that the distance from the stopping device to the first obstruction or tangent of the bull wheel, whichever is less, is 150% of the distance required to stop with the lift operating at maximum speed and the most unfavorable loading condition.

If no danger to passengers or equipment would result in the event the passenger entered or passed around the terminal at full speed, the stop shall be so located that the lift is stopped before the passenger passes beyond an unloading area on the opposite side of the lift from the normal unloading point and adjacent to the terminal, under conditions of maximum speed and the most unfavorable loading condition.

(2) Automatic stopping devices to stop the tramway if the rope leaves the bull wheel groove, or departs from its normal running position.

(3) Stops to stop the lift before any counterweight or tension sheave carriage reaches either end of its travel.

2.2.11.3 Aerial Lifts — Detachable Grips

2.2.11.3.1 Manual Stops. Manual stop switches that will stop the prime mover and apply the service brake shall be installed in all attendants' and operators' stations, in machine rooms, and out-of-doors in proximity to all loading and unloading areas.

2.2.11.3.2 Automatic Stops. The following automatic stop switches shall be installed:

(1) A stop, or stops, that will stop the lift in the event a carrier grip does not engage properly to the haul rope at every grip attachment point.

(2) A stop, or stops, that will stop the lift in the event a carrier does not disengage properly from the haul rope at every grip disengaging point. This stop shall actuate both the service brake and the emergency brake.

(3) Stops to stop the lift before any counterweight or tension sheave carriage reaches either end of its travel.

2.2.11.4 Surface Lifts and Tows

2.2.11.4.1 Manual Stops. Manual stop switches that will stop the prime mover and apply the service brake shall be installed in all attendants' and operators' stations, in machine rooms, and out-of-doors in close proximity to all loading and unloading areas.

2.2.11.4.2 Automatic Stops. The following automatic stop switches shall be installed:

(1) Stops beyond each unloading area. For actuating devices of the suspended type, the suspended portion shall be part of the safety circuit and each side shall be detachable and shall interrupt the safety circuit when detached. The location of the stop shall be in accordance with the following:

(a) Intermediate unloading stations. Required only when skiers are not permitted beyond the intermediate unloading station. The device shall automatically stop the lift in the event a skier or an untethered towing outfit passes beyond the intended point of unloading.

(b) Terminal unloading areas. Always required. The device shall automatically stop the lift in the event a skier or an untethered towing outfit passes beyond

the safety gate. The gate shall be so located that the distance from the stopping device to the first obstruction or point of reversal of direction of the towing outfits is 150% of the distance required to stop the empty lift operating at maximum speed.

A device shall be installed on the down side of surface lifts to stop the lift in the event a towing outfit fails to retract. This device shall be located as near to the upper terminal as practical, but in no event be further downhill than opposite to the unloading area.

(2) For surface lifts only, stops to stop the lift before any counterweight or tension sheave carriage reaches either end of its travel.

(3) For fiber rope tows, a device (safety gate) that actuates the automatic stop. This device shall encircle the up-going rope.

2.2.12 Wind Gages

2.2.12.1 **Reversible Aerial Tramways.** A wind gage shall be installed on the most exposed point along the tramway line unless an exception is made by the authority having jurisdiction. When there is a wind gage, a conspicuous warning device shall function to alert the operator when wind velocity reaches the established maximum. When wind conditions, as determined by such a device or by observation of an operator or attendant, make operations dangerous, the tramway shall be unloaded and the operations discontinued.

2.2.12.2 **Aerial Lifts.** A wind gage shall be installed on the most exposed point along the aerial lift line if required by the authority having jurisdiction. When there is a wind gage, a conspicuous warning device shall function to alert the operator when wind velocity reaches the established maximum. When wind conditions, as determined by such a device or by observation of an operator or attendant, make operations dangerous, the aerial lift shall be unloaded and the operations discontinued.

2.3 Line Structures

2.3.1 Towers

2.3.1.1 **Reversible Aerial Tramways, Aerial Lifts, and Surface Lifts.** The design of the tower structure and foundation shall be in accordance with the requirements of 2.1.6. Where guyed towers are used and guys intersect the ground within or near ski runs, the guys shall be marked for visibility, preferably with boards painted with black and yellow stripes.

Means shall be provided for ready access from the ground to all tower tops. This requirement will be fulfilled if the tower structure is such that it is safe to climb. Otherwise, means such as permanent or light, portable ladders shall be provided. The latter, if used, shall be in at least sufficient quantity to be available at each point where attendants are stationed.

Towers shall be identified with successive numbers clearly visible when looking up the tramway or lift line.

Where towers are designed to permit variations in rope height, sheave unit supports shall be guided and attached so as to prevent misalignment by rotation during normal operation.

2.3.1.2 **Trestles and Monorails.** The design of trestles and monorails shall satisfy the requirements of 2.1.6 and any further portions of 2.3.1.1 that may be relevant to the particular design.

Provision shall be made for expansion and contraction of the actual track (or rail). Facilities shall be provided for maintenance and emergency access to the trestle track deck from the ground at intervals not exceeding 800 feet, and to the monorail at any point.

Bents shall be clearly identified with successive numbers.

2.3.1.3 Tows

2.3.1.3.1 **Fiber Rope Tows.** The intermediate supports for return fiber rope sheaves shall be in accordance with the requirements of 2.1.6. When guys or braces are used, they shall be clearly marked and conform to the clearance requirements of 2.1.4.5.2 and 2.1.4.5.3.

There shall be no spikes, hooks, or other projections on the fiber haul rope side, or on the downhill side of the tower lower than 7 feet above the snow surface of the uphill track.

2.3.1.3.2 **Wire Rope Tows.** There shall be no intermediate line structures on a wire rope tow having towing devices attached to the rope. When towing devices are not permanently attached, line tower structures will be permitted between the loading and discharge points to carry the return rope only; provisions of 2.1.4.5.3(2) and 2.3.1.3.1 are applicable. No guyed towers shall be permitted.

2.3.2 Guards and Clearances

2.3.2.1 **Reversible Aerial Tramways.** Suitable guards shall be provided to prevent the carriers from contacting intermediate towers or other fixed objects.

On bicable tramways with track rope brakes, the guards shall be designed to limit swing to that permitted by the relationship between brake and saddle. If open windows are used on the tower side, a clearance of at least 18 inches shall be maintained at the window height when the carrier is swung inward the maximum amount permitted by the design.

On unattended carriers, windows on the tower side shall be kept closed or screened.

2.3.2.2 **Aerial Lifts.** All towers shall be equipped with guards to prevent contact of carriers or hangers with a tower structure or tower machinery except that such guards shall not be required if such contact does

not occur when the carrier is swung laterally 15 degrees from the vertical position.

In the absence of the guards described herein, the following minimum clearances shall prevail when the carrier is swung inward laterally 10 degrees from the vertical position:

(1) On chair lifts and monorail lifts:

(a) 18 inches between inside limit of passenger seat and tower clearance line or surface

(b) 12 inches between innermost point on chair structure and tower clearance line or surface

(2) On gondola lifts:

(a) With open windows on the tower side, 18 inches between innermost point on carrier and tower clearance line or surface

(b) With screened or closed windows on the tower side, 12 inches

Guards shall be so shaped and located that a 30 degree lateral swing from vertical shall not place any part of the loaded or empty carrier on the inner side of the guard.

On all towers, with or without guards, when a carrier is swung longitudinally by 15 degrees, there shall be no contact between any obstruction and any part of the carrier.

2.3.2.2.1 **Special Requirements for Chair Lifts.** The following clearance requirements shall be met to prevent entanglement of skis with tower structure. Clearance is here defined to mean the distance between inner limit of passenger seat and clearance line or surface of tower.

With the chair swinging in laterally 10 degrees from the vertical position, or to the limit permitted by the guards, if any, if clearance is less than 24 inches from any open frame tower or 18 inches from any closed tubular tower, guards shall be provided on the up going side to keep skis from being caught in the structure. Such guards shall be at least 72 inches in height, extending 36 inches above and 36 inches below average foot level.

A tubular tower with permanent ladder rungs shall be considered as an open frame tower, with the following exceptions:

(1) If the ladder rungs are on the uphill side and are covered by simple fascia boards or equivalent over the previously mentioned 72 inch range, the tower may be considered as a closed tubular tower with respect to uphill skier traffic.

(2) If it can be demonstrated that ski tips cannot be caught in the rungs of the ladder, the tower may be considered as a closed tubular tower.

2.3.2.3 **Surface Lifts.** A minimum clearance of 30 inches shall be maintained between the base of the tower and the vertical plane of the upward traveling cable. With respect to the downward traveling cable, a minimum clearance of 24 inches shall be provided between the towing outfit in its normal position and the tower. This paragraph is not to be construed as preventing the authority having jurisdiction from requiring larger minimum clearances, at its discretion. A definite need for additional clearance arises when it is proposed to transport more than two skiers per towing outfit.

2.3.2.4 **Tows.** Moving parts (other than the haul rope) that are less than 7 feet above the snow surface shall be guarded in such a manner as to prevent accidental contact by the public or skiers using the tow. Persons shall be prevented from passing under the counterweight, or contacting any attachments thereto, by fences or guards.

2.3.3 **Haul Rope Sheaves and Mounts.** The requirements in 2.3.3 and 2.3.3.1 through 2.3.3.3 apply generally to sheaves that support or hold down the haul rope at towers on a monocable system, but where applicable shall also apply to the haul rope of a bicable system. The angle of deflection of the haul rope per sheave is usually small.

The diameter of a haul rope sheave shall not be less than 10 times the nominal diameter of the haul rope for metallic sheaves or 8 times for sheaves with elastomer treads.

2.3.3.1 **Reversible Aerial Tramways, Aerial Lifts, and Surface Lifts.**

2.3.3.1.1 **Maximum Allowable Sheave Load.** The maximum allowable load per sheave should be determined by the tramway or lift designer.

2.3.3.1.2 **Sheave and Sheave Unit Design.** Sheave flanges shall be as deep as possible considering other features of the system. At the same time, rope grips shall be designed in relation to the sheave groove so as not to contact sheave flanges during normal operations, taking into consideration the anticipated amount of wear on the sheave grooves. Grips shall be allowed to contact sheave flanges adjacent to the haul rope when the carrier swings, provided that this is considered in the design of grips and sheaves. Furthermore, rope grips, sheave flanges, and hanger guides shall be designed so that hangers cannot be caught behind guides, and so that ropes and grips cannot be derailed from sheaves if the carrier is swung within design limits as it approaches or passes the tower.

Suitable guards shall be installed to prevent the rope from falling into a dangerous position within the tower structure.

The construction of the entire sheave unit shall be such that the rope cannot become entangled in the sheave unit in the event the rope leaves the sheave toward the outside.

On hold-down sheave units, rope catching devices

shall be installed to prevent the rope from moving upward in the event of deropement. On support sheaves, rope-catching devices shall be installed to prevent the rope from falling in the event of deropement. The device shall extend a minimum of two cable diameters beyond the sheave flange and be located less than one sheave diameter above or below the normal operating position of the rope. On both hold-down and support sheaves, suitable devices shall be installed and maintained that will stop the lift in case of deropement. The foregoing provisions shall apply to both hold-down and support sheaves on both sides of the tramway.

If the gage of the haul rope system is varied at any point along the line, the horizontal departure at any one tower shall be provided for in the design so that deropement cannot occur by virtue of such departure.

Sheave mounts or mounting frames shall be designed to be adjustable laterally and rotationally so that the sheave units can be aligned and held in the plane of the rope.

See also 2.1.4 for effect of tower height and location on sheave units.

2.3.3.1.3 **Haul Rope Retention.** Provisions shall be made to retain the haul rope in the line sheave groove under all anticipated conditions of loading. This criterion shall be deemed to have been met if any of the following conditions is fulfilled.

(1) Condition A. Under the most adverse design loading conditions (excluding dynamic effects) the minimum load of the haul rope on a group of support sheaves at a tower shall not be less than the largest of the following values: 100 pounds per sheave, or 300 pounds per tower group, or a value in pounds equal to two-thirds the sum of the adjacent span lengths expressed in feet of slope length.

When the tower top in question lies below the straight line joining the adjacent tower tops, the haul rope shall not leave the group of sheaves when the haul rope tension is 1.5 times its maximum design value at that point using unloaded carriers. On detachable systems, this criterion shall be met with the bare cable.

The minimum load of the haul rope on a group of hold-down sheaves at a tower, under the most adverse loading conditions, shall not be less than the larger of the following values: a value in pounds equal to the dead plus live load of the carrier, or a value in pounds equal to the sum of the adjacent span lengths expressed in feet of slope length. In no case shall this load be less than 225 pounds per passenger.

(2) Condition B. Combination sheave units that incorporate support and hold-down sheaves shall be designed with the retaining sheaves always in contact with the haul rope. When retaining sheaves are mounted to deflect to allow passage of a carrier grip, such deflection shall not occur until the sheave is loaded to one-half of the maximum design sheave loading. The retaining sheaves shall have the same maximum design loading as the other support or hold-down sheaves on the tower. If the design satisfies loading requirements in Condition A, nothing in this paragraph shall preclude the use of rollers or guides opposite the tower sheaves that do not necessarily contact the rope.

(3) Condition C. For line structures where the carrier is either wholly or partially supported on tracks or by other means, in lieu of retaining the haul rope in the sheave groove the following design criteria shall be fulfilled without exceeding the maximum allowable loads. Under the most adverse loading conditions the load of the carrier onto the track when fully engaged shall not be less than the largest of the following values: 450 pounds; or the design gross load per carrier; or a value in pounds equal to two-thirds of the sum of the adjacent span lengths expressed in feet of slope length.

The carrier shall not leave the track if the design cable tension is increased by 50% or decreased by 33%.

2.3.3.2 **Surface Lifts — Additional Requirements.** When single sheaves are used for other than guide sheaves, which normally carry no load other than the weight of the rope and carriers, the sheave diameter should not be less than 20 times the nominal rope diameter. The sheaves for the return rope shall be installed in a manner to prevent a passenger from contacting the rope or being hit by one of the returning towing outfits. All line sheaves shall be so guarded that towing devices or attachments cannot become entangled in the sheaves or sheave supports. If unloading is permitted ahead of any intermediate tower, the layout of the unloading area shall satisfy the requirements of 2.1.11.4, and the tower shall be so guarded as to prevent the released towing devices from becoming entangled with it.

2.3.3.3 **Tows.** The return rope sheaves shall be mounted high enough on the intermediate towers to hold the rope at least 7 feet above the snow surface of the tow path. The sheaves shall also be 7 feet clear above the snow surface of the tow. The sheave mountings shall be sufficiently strong to prevent failure under the most adverse design load conditions. If the vertical component of the rope tension is not sufficient to hold the rope in the sheave groove at all times, then an approved device shall be used to prevent deropement from the sheave. This applies to both sheaves supporting the rope and those holding it down. (See 2.3.1.3.2 for limitations for wire rope tows.)

2.3.4 **Track Cable Saddles and Mounts (All Classifications — Tracable Systems).** The radius of a track cable saddle shall be determined by the one of the following criteria that requires the largest radius:

(1) That it be large enough to minimize bending

stresses in the cable. In any event, the radius must be equal to at least 1200 times the largest dimension of the outer wire of the cable.

(2) That it be large enough to provide smooth transition of the carrier trucks from span to span.

(3) That it be large enough to reduce the bearing pressure to a value that will permit proper lubrication of the cable to facilitate sliding in the saddle groove.

(4) That it be large enough so that if the carrier trucks were to travel over the saddle at twice normal speed, the centrifugal force would not produce enough uplift to make the truck wheels lose contact.

The saddle shall be long enough to ensure that under maximum loading conditions the cable will not come into contact with the end of the saddle groove.

Saddles shall be designed so that the track cable brake, if any, may function at the time the carrier is passing the saddle without derailment of the trucks.

Saddles shall permit free passage of the carrier trucks even when the carrier is swinging laterally to its design limit as it approaches or passes the tower.

If the gage of the tramway is varied at any point along the line, horizontal departure at any one tower shall be kept to a minimum to avoid derailment of the carrier trucks as they pass over the saddle.

See also 2.1.4 for effect on saddles of height and location of towers.

2.4 Line Equipment

2.4.1 Haul Rope (All Classifications). See 2.1.7 for basic requirements for all wire haul ropes.

2.4.1.1 Factor of Safety. Haul ropes shall have a minimum static factor of safety of 5 when new. Static factor of safety is equal to the nominal breaking strength (see 4.1.2) divided by the computed maximum tension caused by design loads, including the effects of friction, but excluding dynamic loads, in the section of rope that is most highly stressed.

Where a spliced haul rope with an independent wire rope center is used, the nominal strength of an equivalent wire rope with a fiber core shall be used.

2.4.1.2 Special Requirements — Haul Ropes for Fiber Rope Tows. The haul rope shall be natural or synthetic fiber rope manufactured for ski tow use with a special lay or braid to minimize twist. Fiber ropes shall be reeled in a manner so as to minimize twist, and the manufacturer's instructions for unreeling and installation shall be followed.

Splices shall be made by qualified personnel in accordance with the manufacturer's recommendations. All splices shall be long or transmission splices.

Sheave adjustment or other means shall be provided to regulate rotation of the up-going rope and limit spiraling to one complete revolution in 200 feet of travel.

The minimum factor of safety shall be 5 based upon the manufacturer's catalog breaking strength of the new rope divided by the maximum full-load static tension in the haul rope.

2.4.2 Track Cable (All Classifications). See 2.1.7 for basic requirements for all track cables. Track cables consisting of one strand made up entirely of round wires (commonly called "Smooth Coil Track Strand") shall not be permitted. Wire rope, if used as track cables, shall have an independent wire rope or strand center (see 2.1.7.4.3).

2.4.2.1 Factor of Safety. Track cables shall have a minimum static factor of safety of 3 and a minimum dynamic factor of safety of 2.5 when new. Dynamic loads shall include that imposed upon the track cable due to application of track cable brakes.

2.4.3 Haul Rope Grip (All Classifications)

2.4.3.1 General (Fixed and Detachable). The rope grip shall be of a type that has been proved to give satisfactory service by the industry or that has been specifically approved by the authority having jurisdiction.

Haul rope grips are those devices by which carriers are attached to the haul rope. Fixed grips remain on the haul rope during normal operation; detachable grips are normally removed from the haul rope at stations or terminals during normal operation.

The rope grip shall be designed to pass smoothly over and under line sheaves that have flanges of adequate depth to discourage the haul rope from leaving the sheaves.

The design shall incorporate provisions to accommodate a 10% reduction in haul rope diameter. The designer's instructions shall provide details for the proper initial setting of the grip and a method to assure an operator or inspector that the grip has not reached an operational limit of the clamping components.

2.4.3.2 Slippage (Fixed and Detachable). The rope grip shall be designed and maintained during use so as to resist a force, tending to slide it along the haul rope, that is a minimum of 3 times the force required to move a carrier along the steepest incline of the haul rope under the most adverse conditions of carrier loading and with a properly lubricated haul rope. The grip shall automatically adjust to maintain this gripping force with a 3% reduction in haul rope diameter.

2.4.3.3 Strength (Fixed and Detachable). The strength of the grip shall be based upon the following criteria:

(1) A factor of safety of 6 shall exist in all parts of the grip wherein stress is proportional to the dead and live load of the carrier. This factor of safety is defined as follows: With the grip in its operating condition gripping the rope or equivalent, a load applied in the usual

direction (that is, downward when grip is in the operating position), equal to the dead load of the carrier plus 6 times the design live load, shall not cause any part of the grip to fail.

(2) Those parts whose stress is not changed by application of live load shall be designed on the basis of an allowable stress of not more than yield point divided by 3.0. In the design of springs, where used, the allowable stress may be increased if load tests are conducted by an approved testing laboratory to provide assurances that the fatigue life of the actual spring is more than ample for the various applied loads.

(3) For stresses caused by lateral loading, such as centrifugal force, the provisions of 2.4.5.2.2 shall apply.

(4) The material of which the grip is made shall be selected or selected and treated to obtain optimum impact resistance.

(5) Special attention shall be paid to fatigue considerations. A grip that has not been proved in service should be subjected to fatigue tests.

(6) Grips made up of cast parts shall be proof-loaded with forces equal to the gripping force and 3 times dead plus live load.

By inspection, using methods approved by the authority having jurisdiction, confirmation shall be obtained that the grip and its parts meet the foregoing criteria.

2.4.3.4 Maximum Loads (Fixed and Detachable). The maximum total vertical load on a single grip shall not exceed 1/14 of the minimum tension in the haul rope.

Where two grips are used for a single carrier, the foregoing requirement may be applied to each grip, provided that:

(1) The two grips are independent of each other (that is, there are two hangers articulated in such a manner that they are independently loaded).

(2) The clear length of haul rope between the two grips equals or exceeds one-half rope lay.

2.4.3.5 Detachable Grips — Additional Requirements.

2.4.3.5.1 Positive Attachment. A detachable grip shall be designed and constructed in such a manner that it grips the haul rope positively without damaging the haul rope and in such a manner that it cannot become accidentally uncoupled, even by rope vibrations.

2.4.3.5.2 Incorrect Attachment — Gondola and Chair Lifts. At each carrier launching position (any area where a grip is designed to attach to the haul rope), devices shall be installed that will stop the lift if any grips are incorrectly attached to the haul rope (see 2.2.11.3.2).

2.4.4 Track Cable Trucks — Bicable Systems (All Classifications).

2.4.4.1 Wheels. On bicable systems, the weight of the loaded carrier shall be so distributed over all truck wheels that the load per wheel shall not exceed that recommended by the track cable manufacturer or that permitted by the wheel liner material. The diameter of the wheels shall be selected on the basis of recommendations of the track cable manufacturer and of allowable bearing pressure of the wheel liner material. In no event shall the load per wheel exceed 1/80 of the minimum design tension in the track cable when track strand is used. When wire rope is used as a track cable, the load per wheel shall not exceed 1/40 of the minimum design tension in the track cable.

Wheels shall be designed to prevent them from leaving the track cable under all operating conditions.

2.4.4.2 Track Cable Brakes (Reversible Aerial Tramways Only). Each carrier on a reversible aerial tramway using the bicable system shall be equipped with a brake that will grip the track cable. The brake shall be capable of stopping and holding a fully loaded carrier at the point of maximum gradient of the track cables.

The brake shall function automatically in case of a haul rope failure. It shall be capable of being manually applied by the carrier conductor. The track cable brake shall provide smooth stops without damage to the track cable, carrier, or structures, under all design conditions, and shall conform to the requirements of 2.1.4.6.1. Application of the track cable brake shall automatically disconnect or stop the prime mover.

The track cable brake may be omitted if two or more haul ropes are used, or if the profile of the tramway is such that an uncontrolled carrier will not reach abnormal speeds or crash into a terminal.

2.4.5 Carriers.

2.4.5.1 Reversible Aerial Tramways and Gondola Lifts. The carrier and all components shall be designed by qualified engineers in accordance with accepted practices of design. If the design has not had prior successful use for passenger transportation, its adequacy shall be verified by test loadings, trial operations, and tests under repeated loadings.

2.4.5.1.1 Hanger. The hanger shall be securely attached to the track cable trucks or haul rope grip and to the cabin in such a manner that it cannot work loose.

The hanger shall be of sufficient length vertically that under the worst condition of longitudinal swing the top of the cabin cannot strike the haul rope, the track cables, or the bottom of a tower saddle. In any event, the carrier must be able to swing longitudinally, without interference, to an angle of 15 degrees from the vertical at the most adverse locations.

Sway damper. Sway dampers designed to reduce the longitudinal sway of the carriers shall be used if recommended by the tramway or lift designer. Such

ity having jurisdiction. Where used, they shall operate smoothly and without danger of deropement of the track cable trucks or the haul rope.

2.4.5.1.2 **Cabin (or Gondola).** Passenger cabins shall be enclosed and ventil. ted. They shall be equipped with doors that fill the entire entrance opening. Each door shall be provided with a lock located in such a manner that it cannot be unlocked except by authorized persons o: automatically by means approved by the authority having jurisdiction.

All windows shall be of shatterproof material.

Means of emergency evacuation of passengers shall be provided that are acceptable to the authority having jurisdiction. For cabins having a capacity of more than six passengers, the evacuation equipment shall be located in the carrier.

The maximum capacity of each cabin, both in pounds and number of passengers, shall be posted in a conspicuous place in each cabin.

(1) Conductor: Unless a greater capacity is specifically approved by the authority having jurisdiction, each carrier having a capacity of seven o. more passengers shall be served by a conductor.

(2) Reversible aerial tramways — additional requirements: Cabin floor space available to passengers shall not be less than 2.5 square feet per person for the first 15 passengers and 2.0 square feet per passenger thereafter.

A key shall be placed under glass, posted to prohibit use except under specified emergency conditions.

(3) Gondola lifts — additional requirements: All carriers shall be clearly identified with numbers located on each end of each carrier.

(4) Other configurations: Open and semiopen carriers shall be considered as special exceptions by the authority having jurisdiction, and the requirements of 1.2.2 are applicable.

2.4.5.2 **Chair Lifts**

2.4.5.2.1 **Vertical Loads.** With respect to vertical loads, chair lift carriers shall be designed to support a vertical load 4 times the design load without permanent deformations of the assembly or component parts.

2.4.5.2.2 **Horizontal Loads.** With respect to horizontal loads, such as centrifugal loads that stress the hangers as they pass around terminals, the parts of the assembly, including hangers and grips, shall be designed with a factor of safety of 3.0 with respect to the yield point of the material(s). For this purpose, the applied load is to be taken as the compo. t force, considered as a static load.

When safety stops are not provided to prevent the passage of loaded chairs around the bull wheels, lift components such as chairs, hangers, grips, bull wheels, guides, etc, shall be designed to withstand, with a factor of safety of 2 with respect to the yield point of the materials involved, the stresses developed when a loaded carrier passes around the bull wheel at full speed.

2.4.5.2.3 **Identification.** All carriers shall be clearly identified with successive numbers visible to the operator and attendant.

2.4.5.2.4 **Chair Safety Details.** Each chair shall be equipped with a railing at each side, to a height of not less than 4 inches above the seat for a distance of not less than 12 inches from the back of the seat.

Summer operation: For summer operation, each chair shall be equipped with a safety bar or belt that will not open under forward pressure.

2.4.5.3 **Skimobiles.** The relevant requirements of 2.4.5.2 apply, with the exception that, in determining ultimate load, the car shall be considered as being supported at the maximum grade existing on the line, and as being supported by its wh.els on the track as well as by the haul rope.

There shall be a shield (or dashboard) on the front of the car, an adequate step, and a handrail to facilitate embarking and disembarking. When operated for skiers, ski racks shall be pr vided.

2.4.5.4 **Surface Lifts**

2.4.5.4.1 **Loads.** With respect to vertical loads, the surface lift carriers shall be designed to support a vertical load 4 times the design load without permanent deformations of the assembly or component parts.

2.4.5.4.2 **Vertical Clearances.** When a towing outfit is swung longitudinally by 15 degrees from the vertical position, or when it is in its most extreme operating condition, whichever is more severe, there shall be clearance in the vertical plane between the towing outfit or hanger and any obstruction, such as sheaves, guards, etc.

2.4.5.4.3 **General.** The bar, platter, or other device in contact with the skier shall be so designed that the passenger can embark and disembark safely. Devices that envelop the passenger, such as a strap, are prohibited.

The length of the towing outfit shall be such as to permit the shortest passenger to remain in firm contact with the uphill track and to satisfy the requirements of 2.1.4.4.1.

2.4.5.4.4 **Retractable Towing Outfits — Additional Requirements.** Retraction of a towing outfit shall be so controlled that it may be released from a fully extended position without causing injury to passengers or damage to the towing outfit, or causing such violent oscillations as to expose any part of the towing outfit to entanglement with the haul rope, sheaves, other structures, or equipment.

2.4.5.5 Tows

2.4.5.5.1 **Fiber Rope Tows.** Towing outfits and rope grippers shall not be permitted except by specific approval by the authority having jurisdiction.

2.4.5.5.2 **Wire Rope Tows (with Fixed Towing Devices).** Provisions shall be made for attaching towing handles to the haul rope. Such devices shall be designed to prevent sliding along the haul rope when subject to twice the pull required to move a passenger along the ski track at the steepest point. The device shall be designed to preclude entangling gloves or clothing, or pinching fingers between the device and the haul rope. Attaching the device to the haul rope shall in no way impair the strength of the haul rope. The devices shall be relocated on the haul rope in accordance with the manufacturer's recommendations, but in no case less frequently than once annually.

2.5 Provisions for Operating Personnel (All Classifications). Operator and attendant stations shall be located to provide visual surveillance of the line and station. When enclosed, they shall be heated, ventilated, and lighted as required to perform the function of the station. They shall contain (1) the communications and controls required of the station, (2) operating instructions and emergency procedures, and (3) a fire extinguisher if required by the authority having jurisdiction. All enclosed stations shall be locked to prevent unauthorized entry.

2.5.1 **Reversible Aerial Tramways.** The operator shall be located where he can observe the tramway in operation. The operator's controls and communicating devices shall be within his reach without his leaving his position.

2.5.2 **Aerial Lifts and Surface Lifts.** The operator shall be located where he can observe the lift in operation. All primary lift controls and communications shall be immediately available to him. Loading and unloading areas shall have lift-stopping devices located so that they are available to the attendants assigned to those areas.

2.5.3 **Tows.** When the tow is operated by an operator without the use of other attendants, the operator shall be located where he can observe the full length of the tow, including loading and unloading. The operator shall have the primary tow controls immediately available to him.

When attendants are on duty on a tow, suitable means of communication between the operator and attendants shall be provided. Each attendant shall have a stopping device located so that it is available to him.

2.6 Operational and Maintenance Manuals.

2.6.1 **Operational Manual.** The designer of each tramway, lift, or tow shall prepare an operational manual for use with each installation. The manual shall describe the function and operation of the components, and instructions for the correct usage of the installation.

2.6.2 **Maintenance Manual.** The designer of each tramway, lift, or tow shall prepare a maintenance manual for each installation. The manual shall describe recommended maintenance procedures, including:

(1) Types of lubricants required and frequency of application

(2) Definitions and measurements to determine excessive we

(3) Recommended frequency of service to specific components, including relocation of fixed grips, if applicable

3. Operation and Maintenance

3.1 General. Section 3 of this standard is intended to encompass the requirements for operation and maintenance of all types of tramways, lifts, and tows. Many requirements are listed in the preceding sections since they also regulate installation and design. It is imperative that operating and maintenance personnel be familiar with applicable provisions of the entire standard.

3.1.1 **Personnel Safety.** Operation and maintenance of aerial tramway equipment can be dangerous to personnel performing these tasks. Procedures for performing these functions shall require precautionary measures necessary to assure the safety of the personnel involved. Implementation of the procedures intended for the protection of the public and operating and maintenance personnel is the responsibility of the owner, supervisor, and the individual workman.

3.2 Operation

3.2.1 **Personnel.** All facilities covered by this standard shall be operated by trained and competent personnel, and the owner shall be responsible for their supervision and training. One or more persons familiar with emergency procedures shall be on the site at all times when the facility is in regular operation.

3.2.1.1 **Supervision.** One individual shall be in responsible charge of all operating personnel and attendants. He shall be responsible for safe operation, and shall have the authority to deny access to the facilities to any person who in his opinion is not fit or competent to use the facilities without danger to himself, others, or to the equipment. He shall also have the authority to prohibit operation of the facilities under adverse weather or operational conditions. Although he may delegate authority to others, he has the final responsibility.

3.2.1.2 **Operators.** An operator shall be in charge of each tramway, lift, or tow. He shall be trained and

experienced in normal operational and emergency procedures.

3.2.1.3 **Attendants.** An attendant will be assigned to particular duties under direction of the operator. He shall be familiar with operational and emergency procedures pertaining to his assignment. His training shall include instruction for observation of any potentially dangerous operational or mechanical developments within his view.

3.2.1.4 **Conductors.** A conductor shall be trained for duty in connection with enclosed carriers, including loading and unloading procedures, communications, and the use of door locks and keys. He shall be familiar with load limits and applicable safety regulations, well versed in the use of any safety switches under his control, and thoroughly drilled in the use of emergency evacuation equipment and procedures.

3.2.1.5 **General Requirements.** All personnel shall practice good housekeeping, with particular emphasis on avoiding the development of any condition that might contribute to personal injury. Personnel shall comply with the operational rules and safety regulations of the specific tramway, lift, or tow.

3.2.1.6 **First Aid.** One or more persons trained to administer first aid shall be available at all times when a tramway, lift, or tow is operating and transporting passengers.

3.2.2 **Minimum Operating Personnel**

3.2.2.1 **Reversible Aerial Tramways.** The following regulations shall be observed:

(1) An operator shall be in charge of the tramway.

(2) One attendant shall be on duty at each loading/unloading platform or station.

(3) A conductor shall be in each carrier having a capacity of seven or more passengers (see 2.4.5.1.2(11)).

3.2.2.1.1 **Exceptions.** Upon specific approval of the authority having jurisdiction, a conductor may also act as a platform or station attendant.

3.2.2.2 **Aerial Lifts and Skimobiles.** The following regulations shall be observed:

(1) An operator shall be in charge of each aerial lift or skimobile.

(2) One attendant shall be on duty at each loading area.

(3) One attendant shall be on duty at each unloading area.

NOTE: An operator may serve concurrently as an operator and an attendant at a loading or unloading area that may be adjacent to the operator's station unless the duties of that area preclude his maintaining reasonable surveillance of the entire lift operation.

3.2.2.2.1 **Exceptions.** An intermediate station used for both loading and unloading may be manned by a single attendant at the loading area when both the loading and unloading can be kept under surveillance by the attendant.

3.2.2.2.2 **Detachable Grip Lifts – Additional Requirements.** Additional attendants shall be assigned to handle carriers at terminals and stations of aerial lifts with detachable grips as required by the specific design and installation.

3.2.2.3 **Surface Lifts.** The following regulations shall be observed:

(1) An operator shall be in charge of each surface lift.

(2) One attendant shall be on duty at each loading area.

(3) One attendant shall be on duty at each unloading area.

NOTE: An operator may serve concurrently as an operator and an attendant at a loading or unloading area that may be adjacent to the operator's station unless the duties of that area preclude his maintaining reasonable surveillance of the entire lift operation.

3.2.2.3.1 **Exceptions.** The authority having jurisdiction may permit surface lifts to be operated with a single operator at the loading station provided that the following conditions are met:

(1) The length of the lift, measured from the loading area to the safety gate, does not exceed 800 feet.

(2) Both terminal areas, loading and unloading areas, and the entire line are clearly visible to the operator.

(3) The lift has a clearly identified stop switch located at the unloading area, in addition to the required safety gate switch (see 2.2.11.4.2).

(4) The operator has all lift controls immediately available to him.

(5) Restarting of the lift following actuation of a safety or stopping device is impossible until clearance is assured and the safety or stopping device(s) has been reset by an authorized person.

3.2.2.4 **Tows.** A single operator may operate a tow provided that the following conditions are met:

(1) The length of the tow, measured from loading area to the safety gate, does not exceed 800 feet.

(2) Both terminal areas, loading and unloading areas, and the entire tow are clearly visible to the operator.

(3) The operator can start the tow while maintaining the surveillance required in (2).

If the foregoing criteria are not met, an additional attendant(s) is required. Each attendant shall be furnished with a stopping device and communication with the operator.

3.2.3 **Duties of Operating Personnel**

3.2.3.1 **Supervisor.** The duties of the supervisor shall be as follows:

(1) To determine that all tramways, lifts, or tows are operational and that all operating personnel are

trained, equipped, and fit to perform their duties

(2) To discontinue operations on any tramway, lift, or tow due to physical, weather, personnel, or other reasons

(3) To enforce operational, maintenance, and safety rules

3.2.3.2 Operator. The duties of the operator shall be as follows:

(1) To assume responsible charge of the tramway, lift, or tow

(2) To assign and supervise all attendants on his tramway, lift, or tow

(3) To maintain an operational log book as required in 3.5.1

(4) To advise the supervisor of any condition or occurrence that may adversely affect the safety of the operation

3.2.3.3 Attendant and Conductor. The duties of the attendant and conductor shall be as follows:

(1) To maintain orderly passenger traffic conditions within his area of jurisdiction

(2) To advise and assist passengers as required

(3) To maintain surveillance of his area of jurisdiction

The operator shall be advised of any unusual or improper occurrences. Should a condition develop in which continued operation might endanger a passenger, the attendant shall stop the tramway, lift, or tow immediately and advise the operator. The operator shall also be advised of changes in weather, ground, or snow surface conditions.

3.2.4 Operational Procedures. The required operational procedures as set forth in 3.2.4.1 through 3.2.4.3 shall be supplemented by specific requirements as specified in the designer's operational manual (see 2.6). Requirements and procedures may be modified, with the consent of the authority having jurisdiction, to meet specific circumstances.

3.2.4.1 General Requirements

3.2.4.1.1 Control of Passengers. Each tramway, lift, or tow shall have a definite method for marshaling passengers for safe loading and unloading. Fences and gates may be required to implement the system.

3.2.4.1.2 First Aid. There shall be ready access to first aid supplies and equipment, including provisions for transporting an injured person to an enclosed and, if required, heated shelter.

3.2.4.2 Daily Preoperational Inspection. Prior to transporting passengers, a daily inspection shall be conducted. As a minimum, the inspection shall consist of the following:

(1) A visual inspection of each terminal, station, and the entire length of the tramway, lift, or tow.

(2) Assurance that tension carriage, counterweights, or other tensioning devices are functional and have adequate travel with clearance at both ends of travel.

(3) Operation of all manual and automatic switches in terminals, stations, and loading and unloading areas.

(4) Operation of all braking systems.

(5) Operation of communication systems.

(6) Operation of the tramway, lift, or tow, including a visual inspection of all ropes and carriers.

For those tramways, lifts, and tows having internal-combustion engines, the fuel supply shall be determined. For primary power units, there shall be sufficient fuel to conduct the anticipated period of operation without refueling. For those installations having auxiliary internal combustion engines, the fuel supply shall be adequate to unload the tramway or lift. During refueling, power units shall be shut down.

Tramways and lifts having auxiliary power units shall have the auxiliary engine(s) checked during this inspection and operated at least once each week.

3.2.4.2.1 Reversible Aerial Tramways and Detachable Grip Aerial Lifts — Additional Requirements. Loading and unloading facilities shall be inspected and, if necessary, cleared of ice and snow to permit the safe ingress and egress of passengers. Mechanical features of the carriers shall be inspected and checked for correct operation.

3.2.4.2.2 Aerial Lifts — Additional Requirements. Loading and unloading areas shall be inspected and prepared for the safe ingress and egress of passengers. Carriers shall be cleared of ice to the extent necessary to permit safe operation, and mechanical features shall be inspected and checked.

3.2.4.2.3 Surface Lifts and Tows — Additional Requirements. Loading and unloading areas shall be inspected and prepared for the safe ingress and egress of passengers. The lift or tow track shall be inspected and, if necessary, tracks shall be established. Tracks shall be established beyond the safety gate for a distance necessary for passengers to stop should the passenger pass through the safety gate. The towing seats shall be cleared of ice to the extent necessary to permit safe operation. (See 2.1.3.1.1.)

3.2.4.3 Operational Requirements

3.2.4.3.1 General. The supervisor and operator of each tramway, lift, or tow shall review the requirements of Section 2 of this standard to ascertain that original design and installation conditions have not been altered in a manner such as to violate the requirements of the standard.

3.2.4.3.2 Starting. No tramway, lift, or tow shall be started except at the direction of or following clearance by the operator.

3.2.4.3.3 Stops. After any stop of a tramway, lift, or tow, the operator shall determine the cause of

the stop, and not restart until clearance has been obtained from all attended stations.

3.2.4.3.4 **Damage to Carriers.** Should any carrier become damaged or otherwise rendered unfit for passenger transportation during normal operations, it shall be clearly and distinctively marked, and not used for passengers until repaired or replaced. It shall be removed from the line, when feasible.

3.2.4.3.5 **Hazardous Conditions.** No tramway, lift, or tow shall be operated when wind or icing conditions may be such as to endanger passengers or equipment. No tramway, lift, or tow shall operate when there is an electrical storm in the immediate vicinity. Should such conditions develop while the tramway, lift, or tow is in operation, loading of passengers shall be terminated, and operation shall be continued only as long as necessary to discharge all passengers. When such shutdown has been caused by an electrical storm, grounding of control circuits and haul ropes that are used as conductors in communication systems is permissible. Such grounding shall be removed prior to resumption of passenger operations.

3.2.4.3.6 **Evacuation of Reversible Aerial Tramways and Aerial Lifts.** Provisions shall be made for the emergency evacuation of reversible aerial tramways and aerial lifts (see 2.1.1.3). These shall include a detailed plan of evacuation, equipment necessary for evacuation, and adequate training of personnel. Evacuation drills shall be conducted at established intervals not to exceed one each 12 calendar months, and such drills recorded in the operational log of each tramway or lift (see 3.5.1).

3.2.4.3.7 **Termination of Daily Operations.** Procedures shall be established and approved by the authority having jurisdiction for terminating daily operations in such a manner that passengers will not be left on the tramway, lift, or tow after it has been shut down. Loading ramps, as required, shall be closed and so marked.

3.2.4.3.8 **Operational Log.** A daily operation record shall be maintained as required under 3.5.1.

3.3 Maintenance

3.3.1 **General.** Foundations and all structural, mechanical, and electrical components shall be inspected regularly and kept in a state of good repair. The maintenance requirements of the designer (see 2.6) shall be followed. Maintenance records shall be kept (see 3.5.3).

A written schedule for systematic maintenance shall be developed and followed. The schedule shall establish specific frequencies for periodic lubrication, inspection, and adjustment. The schedule shall include, but not be limited to, the following:

(1) All wire ropes and cables (see 3.3.2)
(2) Line sheave units, sheaves, bearings, and liners
(3) Bull wheels, bearings, and liners
(4) Counterweight or tensioning systems
(5) Drive system, including bearings and couplings
(6) Braking systems
(7) Electrical control systems
(8) Communication systems
(9) Carriers

3.3.1.1 **Fixed Rope Grips – Additional Requirements.** The initial installation and each relocation of a clamp-type grip shall be field-checked by a method established by the designer to provide assurance that the requirement of the first sentence of 2.4.3.2 has been met. All fixed grips shall be moved at least once every 24 calendar months. The grips should be moved a uniform distance each time and in the same direction. The designer's instructions or the requirements of the authority having jurisdiction shall be followed if they are more restrictive than these requirements. Movements shall be recorded in the maintenance records (see 3.5.2 and 3.5.3).

As each grip is relocated, the haul rope shall be examined for deterioration at or near the grip location. The initial location and each subsequent relocation shall be marked by a spray paint or other marking on the rope to identify slippage. A movement of the clamp along the haul rope at a rate that would exceed 12 inches in 500 hours of operation shall be considered excessive and cause for adjustment or replacement of the grip.

3.3.1.2 **Detachable Rope Grips – Additional Requirements.** Detachable rope grips shall be disassembled for inspection, adjustment, and replacement of worn parts at intervals not to exceed those recommended by the designer.

3.3.2 **Wire Rope.** Wire rope maintenance shall include the following:

(1) Lubrication. Type and frequency as recommended by the rope manufacturer or designer. Ropes that have little or no motion, such as counterweight ropes and guys, require special consideration for protection against corrosion.

(2) Inspection. In addition to the required daily operational inspection, all ropes, including track cables, shall be subject to detailed inspections at regularly established intervals, not to exceed 1 year. Splices and fixed grip locations shall be given close attention in haul ropes. End connections and saddle areas of track cables require close attention.

3.3.2.1 **Replacement or Repair of Wire Rope.** If an inspection indicates that a rope is damaged so as to make it unsafe, the rope shall be repaired or replaced. Repair of wire rope shall conform to the requirements of 2.1.7.4.

No rope shall be permitted to remain in service if the number of broken wires in the length of one rope lay exceeds that listed in the following table. Snagged or nicked wires shall count as a broken wire.

	Maximum Number of Broken Wires	
Rope Type	*In One Strand*	*In All Strands*
6 X 7	2	4
6 X 19	4	6
6 X 37	6	10

In addition to broken wires, the following criteria shall be used by the inspector in deciding upon retirement or repair of the rope:

(1) More than one valley break in one lay. Breaks that occur in the valleys between strands indicate some abnormal condition, possibly fatigue and breakage of other wires not readily visible.

(2) Abrasion, scrubbing, or peening causing loss of more than one-third of the original diameter of the outside wires.

(3) Evidence of rope deterioration from corrosion.

(4) Severe kinking, severe crushing, or other damage resulting in distortion of the rope structure.

(5) Evidence of any heat damage. Sources could be a torch, or an arc caused by contact with electrical wires, or natural electrical charges.

(6) Reduction from nominal diameter to a diameter less than shown in Table 4. (This table is based on 94% of original nominal rope diameter.) For diameters of unlisted sizes, multiply the original nominal diameter by 0.94. This procedure includes wear of the outer wires.

(7) Evidence of pitting from corrosion, or development of any broken wires in the vicinity of attached fittings.

(8) Any significant increase in the lay length.

(9) Any significant increase in the overall stretch after original constructional stretch has been removed. This can be determined by records showing the movement of the tension carriage.

(10) The condition of the splices. At the time of inspection, all tucks of all splices must be located. The splice must be properly repaired or replaced if more than the allowable number of broken wires are found at the tucks, if there is any sign of slipping, if significant distortion of the rope at the tucks has occurred, or if horns have pulled apart and permitted the outside strands to distort.

If the rope damage is local, it is permissible to splice in a section of rope of the same size and construction. Fittings can be reattached. Splices often can be corrected by proper repair.

On an emergency basis, damage confined to a single rope strand may be repaired by replacement of the damaged strand to permit the rope to be continued in service. This type of repair is permitted only on an emergency basis and under the conditions specified in 2.1.7.4.2.

If operating equipment that contacts the rope is the cause of damage, it should be examined immediately and proper repairs should be made before a new rope is installed, or immediately if the safety of the lift is endangered.

All ropes shall be inspected for their full length. In the case of moving haul ropes, the inspection shall be made by slowly moving the rope past a fixed inspection station. Frequent stops shall be made to permit detailed inspection and make necessary measurements. The rope must be stopped to examine the splice in detail.

The inspector must be positioned sufficiently close to the rope to visually observe and physically examine it.

Retirement of a rope from service shall be decided on the basis of the foregoing criteria, general conditions, and the history of the rope. Regardless of these and other considerations, no rope shall be permitted to remain in service when, in the opinion of a qualified inspector (see 3.4.2), the strength has been reduced to less than 80% of the nominal breaking strength.

3.3.2.1.1 **Bicable Systems – Additional Requirements.** At an interval established by the tramway designer the track cable shall be moved so as to place a different section of cable over the saddles, and the cable shall be carefully checked for fatigue and other damage.

3.3.2.1.2 **Wire Rope Tow – Additional Requirements.** No haul rope shall be permitted to remain in service when broken wires are visible on the exterior portions of the strands.

The terminal sheaves shall be kept in adjustment to control rotation of the haul rope and towing devices.

3.3.3 **Fiber Rope.** No fiber rope tow shall be permitted to operate when the up-going rope rotates more than one revolution in 200 feet of travel.

Replacement of fiber ropes shall be in accordance with 2.4.1.2.

3.4 **Annual Inspections**

3.4.1 **General Inspection (Reversible Aerial Tramways, Aerial Lifts, and Surface Lifts).** Each tramway and lift shall be inspected annually by a specialist acceptable to the authority having jurisdiction. The inspection shall cover the requirements of this standard. A report shall be filed with the owner and the authority having jurisdiction. Any items of noncompliance with this standard shall be noted therein.

3.4.2 Wire Rope Inspection (Reversible Aerial Tramways, Aerial Lifts, Surface Lifts, and Wire Rope Tows). A detailed wire rope inspection shall be made upon a recommendation by the general inspection (see 3.4.1) or immediately after any accident affecting the possible integrity of the wire rope. The inspection shall be made by a qualified wire rope inspector, and a written report of the inspection shall be filed with the owner. A copy of this inspection shall be included in the wire rope log (see 3.5.2).

3.5 Records

3.5.1 Operational Log. A log book shall be maintained for each tramway, lift, or tow. Daily entries shall be made giving the following minimum information:

(1) Date

(2) Names and duty stations of operating personnel

(3) Operating hours and purpose of operations

(4) Temperature, wind, and weather conditions

(5) Record of compliance with daily operational inspection

(6) Position and condition of the tension carriage, counterweights, or other tensioning devices

(7) Accidents, malfunctions, or abnormal occurrences during operation

(8) Signature of operator

3.5.2 Wire Rope Log. A log book shall be maintained for each tramway, lift, or wire rope tow giving the following information on each rope

(1) Approved Specification

(2) Copy of certified test report

(3) Date installed

(4) Splicing certificate for each splice

(5) Record of lubrication, including type of lubricant and date applied

(6) Record of maintenance inspections (see 3.3.2(2))

(7) Report of wire rope inspection (see 3.4.2)

(8) Report of accidents or injury to rope

3.5.3 Maintenance Log. A signed complete log shall be maintained wherein the actual execution of maintenance work shall be recorded daily. The log shall state components serviced, and the condition of the components. A record shall be kept of replacement of components.

3.6 Passenger Conduct

3.6.1 Dexterity and Ability. A skier or foot passenger who uses a tramway, lift, or tow shall be presumed to have sufficient physical dexterity or skiing ability to negotiate the tramway, lift, or tow.

3.6.2 Embarkation and Disembarkation. A passenger shall get on and get off a tramway, lift, or tow at designated areas.

3.6.3 Riding. Passengers, while riding an aerial tramway or lift, shall not throw or expel therefrom any object, nor shall any passenger do any act or thing that shall interfere with the operation of the tramway or lift. Passengers shall not willfully engage in any type of conduct that may contribute to, or cause, injury to any other person.

Skiers, when using a surface lift or tow, shall not willfully place in an uphill track any object that can cause another skier to fall.

3.6.4 Downhill Skier. Each skier should maintain control of speed and course at all times.

4. Wire Rope and Strand Requirements

4.1 Dimensional Properties

4.1.1 Diameter Tolerances

4.1.1.1 Wire Rope. The diameter tolerances of wire rope shall be in compliance with Tables 3 and 4.

Table 3
Wire Rope Diameter Tolerances for New Rope

Nominal Diameter (inches)	Undersize (inch)	Oversize* (inch)
0 to 3/4	0	1/32
13/16 to 1-1/8	0	3/64
1-3/16 to 1-1/2	0	1/16
1-9/16 to 2-1/4	0	3/32
2-5/16 and larger	0	1/8

*A question may develop as to whether or not the wire rope complies with the oversize tolerance. In such cases, a tension of not less than 10% or more than 20% of nominal required breaking strength is applied to the rope and the rope again measured while under this tension.

Table 4
Minimum Acceptable Wire Rope Diameter in Service

Nominal Rope Diameter (inches)	Nominal Rope Diameter (mm)	Minimum Acceptable Diameter (inches)	Minimum Acceptable Diameter (mm)
1/4	6.350	0.235	5.969
3/8	9.525	0.352	8.954
1/2	12.700	0.470	11.938
9/16	14.288	0.529	13.431
5/8	15.875	0.588	14.922
3/4	19.050	0.705	17.907
7/8	22.225	0.822	20.892
1	25.400	0.940	22.876
1-1/8	28.575	1.058	26.861
1-1/4	31.750	1.175	29.845
1-3/8	34.925	1.293	32.830
1-1/2	38.100	1.410	35.814
1-5/8	41.275	1.469	38.798
1-3/4	44.450	1.645	41.783
1-7/8	47.625	1.762	44.768
2	50.800	1.880	47.752

Table 5
Bright (Uncoated) or Drawn Galvanized Wire Rope, Fiber Core,
Nominal Breaking Strength in Tons of 2000 Pounds

Nominal Diameter		Classification and Grade				
		6 × 7	6 × 19 (Any Operation) 6 × 37 (Single Operation)		6 × 37 (Multiple Operation)	
(inches)	(mm)	Improved Plow Steel	Improved Plow Steel	Extra-Improved Plow Steel	Improved Plow Steel	Extra-Improved Plow Steel
1/4	6.35	2.64	2.74	3.02	2.59	2.85
5/16	7.94	4.10	4.26	4.69	4.03	4.43
3/8	9.52	5.86	6.10	6.71	5.77	6.35
7/16	11.10	7.93	8.27	9.09	7.82	8.60
1/2	12.70	10.30	10.70	11.80	10.20	11.20
9/16	14.30	13.00	13.50	14.90	12.90	14.10
5/8	15.90	15.90	16.70	18.30	15.80	17.40
3/4	19.00	22.70	23.80	26.20	22.60	24.80
7/8	22.20	30.70	32.20	35.40	30.60	33.70
1	25.40	39.70	41.80	46.00	39.80	43.70
1-1/8	28.60	–	52.60	57.90	50.10	55.00
1-1/4	31.70	–	64.60	71.00	61.50	67.70
1-3/8	34.90	–	77.70	85.40	74.10	81.50
1-1/2	38.10	–	92.00	101.00	87.90	96.60
1-5/8	41.30	–	107.00	118.00	103.00	113.00
1-3/4	44.40	–	124.00	136.00	119.00	130.00
1-7/8	47.60	–	–	–	136.00	149.00
2	50.80	–	–	–	154.00	169.00
2 1/8	54.00	–	–	–	173.00	190.00
2 1/4	57.10	–	–	–	193.00	212.00

Measurements to determine diameter shall be in accordance with 4.2.1.2.

4.1.1.2 Track Strand. The diameter tolerances of track strand shall be as shown on the Approved Specification.

4.1.2 Nominal Breaking Strengths

4.1.2.1 Wire Rope. The strength of the wire rope on which the designer shall base the calculations for factor of safety shall not be more than the nominal breaking strength listed in 4.1.2.1.1, 4.1.2.1.2, and Tables 5 and 6, for the diameter, classification, and grade selected by the designer.

4.1.2.1.1 Bright (Uncoated) or Drawn Galvanized Wire Rope, Fiber Core (See Table 5). Nominal breaking strengths of galvanized ropes manufactured from wire galvanized at finished size shall be taken as 90% of the bright wire nominal breaking strengths shown in Table 5.

In a test, an acceptable rope shall not break under a tension less than 97-1/2% of its nominal breaking strength.

Certain types of tramways may require wire rope diameters other than the fractional sizes shown in Table 5, in order to be compatible with the equipment design. Nominal breaking strengths for ropes having nominal diameters between those listed in Table 5 shall be determined by the following formula.

$$NBS = \frac{nbs \times D^2}{d^2} \qquad \text{(Eq 2)}$$

where

NBS = Nominal breaking strength of size required
nbs = Nominal breaking strength of closest nominal size listed in Table 5
D = Nominal diameter of size required
d = Nominal diameter of closest nominal size listed in Table 5

The tolerances for ropes having nominal diameters between those listed in Table 5 shall be equal to the tolerances required for the closest nominal size listed.

4.1.2.1.2 Bright (Uncoated) or Drawn Galvanized Wire Rope, Independent Wire Rope Center (See Table 6). Nominal breaking strengths of ropes manufactured from wire galvanized at finished size shall be taken as 90% of the bright wire nominal breaking strengths shown in Table 6.

In a test, an acceptable rope shall not break under a tension less than 97-1/2% of its nominal breaking strength.

Table 6
Bright (Uncoated) or Drawn Galvanized Wire Rope,
Independent Wire Rope Center,
Nominal Breaking Strength in Tons of 2000 Pounds

Nominal Diameter		Classification and Grade			
		6 × 19 (Any Operation) 6 × 37 (Single Operation)		6 × 37 (Multiple Operation)	
(inches)	(mm)	Improved Plow Steel	Extra-Improved Plow Steel	Improved Plow Steel	Extra-Improved Plow Steel
1/4	6.35	2.94	3.40	2.78	3.20
5/16	7.94	4.58	5.27	4.33	4.98
3/8	9.52	6.56	7.55	6.20	7.14
7/16	11.10	8.89	10.20	8.41	9.67
1/2	12.70	11.50	13.30	11.00	12.60
9/16	14.30	14.50	16.80	13.90	15.90
5/8	15.90	17.90	20.60	17.00	19.60
3/4	19.00	25.60	29.40	24.30	27.90
7/8	22.20	34.60	39.80	32.90	37.80
1	25.40	44.90	51.70	42.80	49.10
1-1/8	28.60	56.50	65.00	53.90	61.90
1-1/4	31.70	69.40	79.90	66.10	76.10
1-3/8	34.90	83.50	96.00	79.70	91.70
1-1/2	38.10	98.90	114.00	94.50	108.00
1-5/8	41.30	115.00	132.00	111.00	127.00
1-3/4	44.40	133.00	153.00	128.00	146.00
1-7/8	47.60	—	—	146.00	168.00
2	50.80	—	—	165.00	190.00
2-1/8	54.00	—	—	186.00	214.00
2-1/4	57.10	—	—	207.00	239.00

Certain types of tramways may require wire rope diameters other than the fractional sizes shown in Table 6, in order to be compatible with the equipment design. Nominal breaking strengths for ropes having nominal diameters between those listed in Table 6 shall be determined by the following formula:

$$NBS = \frac{nbs \times D^2}{d^2} \qquad \text{(Eq 3)}$$

where

NBS = Nominal breaking strength of size required
nbs = Nominal breaking strength of closest nominal size listed in Table 6
D = Nominal diameter of size required
d = Nominal diameter of closest nominal size listed in Table 6

The tolerances for ropes having nominal diameters between those listed in Table 6 shall be equal to the tolerance required for the closest nominal size listed.

4.1.2.2 Track Strand. The strength of strand on which the designer shall base the calculations for factor of safety shall not be more than the nominal breaking strength shown on the Approved Specification. In a test, an acceptable strand shall not break under a tension less than 97-1/2% of its nominal breaking strength.

4.1.3 Tensile Strengths

4.1.3.1 Minimum Wire Tensile Strength for Main Rope Wires. This strength shall be as shown in Table 7. Main rope wires shall comply with this requirement.

Table 7
Tensile Strength Requirements
for Main Rope Wires

Wire Diameter (inch)	Tensile Strength (minimum), Bright or Drawn Galvanized Wire	
	Improved Plow Steel (psi)	Extra-Improved Plow Steel (psi)
0.000-0.030	244 000	268 000
0.031-0.060	238 000	262 000
0.061-0.100	230 000	253 000
0.101-0.140	225 000	248 000
0.141-0.190	218 000	240 000

Filler wires and wires of core strand or rope need not comply.

4.1.3.2 Minimum Wire Tensile Strength for Track Strand Wires. This strength shall be as shown on the Approved Specification.

4.1.4 Torsion Requirements

4.1.4.1 Wire Torsion Values for Wire Rope. Wire torsional value shall be determined by either of the two following methods:

(1) Wires shall be tested prior to fabrication into strand or rope.

(2) Wires shall be removed from a rope after fabrication and tested.

Whichever of these methods is used, the wires shall meet the applicable torsional values shown in Table 8. For galvanized wire, see Table 9.

Table 8
Torsion Values for Main Rope Wires

Wire Diameter (inch)	Revolutions in a Gage Length of 8 Inches*	
	Improved Plow Steel	Extra-Improved Plow Steel
Wires Tested prior to Fabrication of Rope		
0.000-0.079	$\frac{2.36}{d} - 2$	$\frac{2.20}{d} - 2$
0.080-0.159	$\frac{2.36}{d} - 2$	$\frac{1.92}{d} - 2$
Wires Removed from Rope after Fabrication		
All diameters	$\frac{2.24}{d} - 2$	$\frac{2.16}{d} - 8$

NOTE: d equals diameter of wire in inches

*To convert to torsions (revolutions) in 100d, multiply values by 12.5d.

Table 9
Torsion Value Reductions for Wire Galvanized at Finished Size

Wire Diameter (inch)	Torsions, as Percentage of Torsions of Bright or Drawn Galvanized Wire
0.039-0.079	50%
0.080-0.119	40%
0.120 and larger	30%

NOTES:

(1) These torsions are for wire galvanized at finished size unless the manufacturer is claiming bright strength, in which case torsions for bright wire shall apply.

(2) Wires of 0.039-inch diameter and smaller are normally drawn galvanized.

Unless specifically requested by the authority having jurisdiction, wire torsion tests are not required for counterweight ropes.

For a description of the ductility test for track strand wires see 4.2.1.5.3.

4.1.4.2 Wire Torsion Values for Track Strand. These values shall be as shown on the Approved Specification.

4.2 Testing

4.2.1 Testing Procedures. Before installation, a certified test report covering the tests required herein shall be provided from a testing laboratory in the United States acceptable to the authority having jurisdiction. Unless otherwise specified, the manufacturer of the wire rope or track strand is responsible for performance of all testing requirements in this standard.

4.2.1.1 Sampling – Wire Rope and Track Strand. A sample long enough to provide 9 feet of free length shall be cut from each manufactured length to be used for the rope breaking strength test and diameter measurement.

If tensile and torsion tests are to be performed on wires removed from the finished rope, a second sample 3 feet long shall be cut.

When wires are tested prior to fabrication, the same density of sampling shall be employed and adequate records shall be kept by the manufacturer to enable identification of such wires with the actual rope produced.

4.2.1.2 Examination of Diameter – Wire Rope and Track Strand. The diameter shall be measured on the long sample (9 feet) at the center of its length and 3 feet on each side of center. The average of these three measurements shall be the diameter of the wire rope or track strand being inspected.

4.2.1.3 Ultimate-Strength Tests. An ultimate-strength test shall be made on a complete rope or strand. The tests shall be made on the long sample (see 4.2.1.1).

4.2.1.4 Wire Tensile Tests. Samples for tensile tests may be obtained prior to or after fabrication. In either case the density of samples shall be equivalent to the following: not less than six wires of each size in the rope except for the center wires. At least two samples of the center wire will be required.

The free length of wire shall not be less than 10 inches. The speed of the head during the test shall not be more than 1 inch per minute. The tensile strength shall conform to Table 7.

For track strand the density and test parameters shall be negotiated with the manufacturer.

When wire tensile tests are performed on wires prior to fabrication, the same sample density shall be employed and adequate records shall be kept by the manu-

facturer to enable identification of such wires with the actual rope produced.

Unless specifically requested by the authority having jurisdiction, this test is not required for counterweight ropes.

4.2.1.5 Wire Torsion Tests. When wire torsion tests are performed on wires prior to fabrication, adequate records shall be kept by the manufacturer to enable identification of such wire with the actual rope produced.

Unless specifically requested by the authority having jurisdiction, wire torsion tests are not required for counterweight ropes.

4.2.1.5.1 Test Procedure. From each short sample, not less than one specimen of each size of main wires from each strand shall be taken. The total number of specimens shall be not less than 15% of the total number of main wires. Wires for the torsional test shall be hand straightened. The free length of wires in the testing machine before the test shall be 8 inches (± 1/16 inch). One clamp in the testing machine shall be movable parallel to the axis of the tested wire, and an axial tensile force in accordance with Table 10 shall be applied to keep the tested wire straight during the test. The tested wire shall be twisted by either of two methods. Both clamps may be rotated in opposite directions or one clamp may be rotated while the other is held stationary at a uniform rate of not more than 60 revolutions per minute. In either case, the total rotations will be counted.

Table 10
Tensile Force on Wires during Torsional Test

Wire Diameter		Tensile Force	
From (inch)	To (inch)	Minimum (pounds)	Maximum (pounds)
0.000	0.009	0.5	1.0
0.010	0.014	1.0	2.0
0.015	0.019	1.5	3.0
0.020	0.029	2.0	4.0
0.030	0.039	3.0	6.0
0.040	0.049	4.0	8.0
0.050	0.059	5.0	10.0
0.060	0.069	6.0	12.0
0.070	0.079	7.0	14.0
0.080	0.089	8.0	16.0
0.090	0.099	9.0	18.0
0.100	0.109	10.0	20.0
0.110	0.119	11.0	22.0
0.120	0.129	12.0	24.0
0.130	0.139	13.0	26.0
0.140	0.149	14.0	28.0
0.150	0.159	15.0	30.0
0.160	and up	16.0	32.0

4.2.1.5.2 Alternate Test Procedure. Because the number of revolutions in the torsional test is proportional to the free length, the inspector may approve a free length before the test of 4 inches (± 1/16 inch) for wires up to 0.040 inch in diameter or of 6 inches (± 1/16 inch) for wires not more than 0.060 inch in diameter. The wire specimens with a free length of 4 inches shall not break when twisted one-half the number of revolutions shown in Table 8. The wire specimens with a free length of 6 inches shall not break when twisted three-fourths the number of revolutions shown in Table 8. Testing shall be done in the same manner as described in 4.2.1.5.1.

4.2.1.5.3 Ductility Test for Track Strand Wires. Wires for track strand shall withstand one 90-degree bend over a round mandrel whose diameter is three times the largest dimension of the wire being tested. (For round wire this is equal to three times the wire diameter.) The wire shall be bent in the same plane as it will bend when in the rope. The test shall be performed prior to fabrication. The wire shall not split or crack when so tested.

4.2.2 Test Reports

4.2.2.1 Wire Rope. The test reports for wire rope shall include the following:

(1) Complete description of wire rope furnished for the test, including number and arrangement of wires, strength grade, type of core, and nominal breaking strength

(2) Actual rope diameter

(3) Actual breaking strength of complete rope

(4) Actual breaking strength and size of wires tested

(5) Actual torsions of wires tested

4.2.2.2 Track Strand. The test reports for track strand shall include the following:

(1) Complete description including number and arrangement of wires, strength grade, and nominal breaking strength

(2) Actual strand diameter

(3) Actual breaking strength of complete strand

(4) Actual tensile strengths and sizes of individual wires

4.2.3 Rejects and Retests

4.2.3.1 Rejects. If only one test sample is supplied from a manufactured length, and any test specimens taken from this sample fail to pass any specified tests, all reels or coils of strand or rope from that manufactured length shall be rejected.

If a separate test sample is furnished from each piece of strand or rope that is reeled or coiled for shipment, failure of any test specimens to pass any specified tests shall be cause for rejection of only the particular reel or coil from which the faulty specimens have been taken.

4.2.3.2 Retests. In tensile or torsion tests of

wires, one wire may fall below the requirement, but by not more than 20% below. In such a case, six additional wires of the same size shall be tested, all of which shall pass.

In tensile test of the wire rope or track strand, if the strength falls below the requirement, one retest shall be made on a sample from the same reel or coil and shall pass for acceptance.

Where the test specimen breaks in the jaws of the machine or at a terminal, the results may be discarded and another specimen tested without considering it a retest.

5. Revision of American National Standards Referred to in This Document

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply:

American National Standard Safety Standard for Mechanical Power Transmission Apparatus, B15.1-1972

American National Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, B176.1-1974 (NFPA No. 37-1970)

American National Standard National Electrical Code, C1-1975 (NFPA No. 70-1975)

American National Standard National Electrical Safety Code, C2 (1973 Edition), including C2.1-1971, C2.2-1960 and Supplement C2.2a-1965, C2.3-1973, and C2.4-1973

American National Standard for the Storage and Handling of Liquefied Petroleum Gases, Z106.1-1974 (NFPA No. 58-1974)

American National Standard Flammable and Combustible Liquids Code, Z288.1-1974 (NFPA No. 30-1973)

Index (Numbers refer to sections in this standard.)

This index is intended as a supplement to the Table of Contents to aid the reader in finding particular subjects or requirements described in this standard. It is not all-inclusive, but rather is directed to the most commonly encountered topics and most frequently used lift types. When a specific section is referenced, the subsections following should also be checked for possible additional requirements. Conversely, it is understood that when a subsection is referenced, the general requirements of its main section are applicable and should be considered.

For conciseness, the alphabetical listing of subjects is followed by only three categories of lift types: chair lifts, surface lifts, and tows. Sections referenced under chair lifts are equally applicable to gondola types unless followed by an asterisk (*), which indicates that additional or special requirements are applicable for gondola types. In the sections referenced under tows, a dagger (†) indicates the presence of additional or special information for wire rope tows.

*See additional information for gondola types

*See additional information for gondola types.

†See additional information for wire rope tows.

*See additional information for gondola types.

†See additional information for wire rope tows.

†See additional information for wire rope tows

*See additional information for gondola types

†See additional information for wire rope tows

†See additional information for wire rope tows

American National Standards

The standard in this booklet is one of nearly 6500 standards approved to date by the American National Standards Institute.

The Standards Institute provides the machinery for creating voluntary standards. It serves to eliminate duplication of standards activities and to weld conflicting standards into single, nationally accepted standards under the designation "American National Standards."

Each standard represents general agreement among maker, seller, and user groups as to the best current practice with regard to some specific problem. Thus the completed standards cut across the whole fabric of production, distribution, and consumption of goods and services. American National Standards, by reason of Institute procedures, reflect a national consensus of manufacturers, consumers, and scientific, technical, and professional organizations, and governmental agencies. The completed standards are used widely by industry and commerce and often by municipal, state, and federal governments.

The Standards Institute, under whose auspices this work is being done, is the United States clearinghouse and coordinating body for voluntary standards activity on the national level. It is a federation of trade associations, technical societies, professional groups, and consumer organizations. Some 1000 companies are affiliated with the Institute as company members.

The American National Standards Institute is the United States member of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Through these channels U.S. standards interests make their positions felt on the international level. American National Standards are on file in the libraries of the national standards bodies of more than 60 countries.

For a free list of all American National Standards, write:

American National Standards Institute, Inc
1430 Broadway
New York, N.Y. 10018

ALYESKA SAFETY AND OPERATION PLAN

ALYESKA SKI AREA

ANCHORAGE AREA OFFICE
CHUGACH NATIONAL FOREST
1979-80

ALYESKA SAFETY AND OPERATION PLAN

Prepared by _____ Date 11/16/79
Alyeska Hill Chief

Reviewed by _____ Date 11/14/79
Snow Ranger

Reviewed by _____ Date 11/14/79
R.M.A. Anchorage District

Recommended by _____ Date 11/13/79
Recreation Manager

Approved by _____ Date 11/14/79
Forest Supervisor

Alyeska Resort
Permittee by _____ Date _____
Vice President and
General Manager

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OBJECTIVES

A. The primary objective of this plan is to provide guidelines to insure maximum safety to the users of the lifts, slopes, and other facilities in the area. It is intended to be a coordinated plan for the safest possible winter operation of the entire area.

B. This plan is prepared pursuant to the October 17, 1973 revision of the Term Special Use Permit to Alyeska Resort, and the Forest Service manuals and handbooks covering ski area administration. This plan does not supercede or amend any articles of the Term Special Use Permit as reviesed October 17, 1973, or the Special Use Permit dated March 11, 1970, for the ski slopes, but acts as a supplement and guide for the permittee. All articles of safety in the Special Use Permit are automatically assumed by this plan.

C. The plan seeks to provide a designation of responsibilities and authorities for all individuals and groups involved in the administration, supervision, and operation of the area. Generally, these groups are the Alyeska Resort and its employees, the U.S. Forest Service and the National Ski Patrol System. It will further clarify what actions will be taken by the Forest Service Administrator (Snow Ranger), what action will be the responsibility of the permittee, and what areas will require coordination and cooperation.

Responsibilities U.S.F.S.

A. One of the many operational objectives of the Forest Service is making National Forest lands available for public recreational purposes. One of the prime objectives in winter sports administration is to prevent accidents related to ski lifts, tows, and avalanche hazards. The Snow Rangers will provide supervision and inspection of the Alyeska ski area so that the following operational functions are carried out to standards referred to in this plan:

1. Prevention of lift and tow accidents by pertinent inspections carried out by qualified Forest Service Engineers and/or Snow Rangers.

2. Assist and/or work cooperatively with permittee personnel in marking the ski area boundaries.

3. Insures that the public as well as the permittee maintains a high standard of safety.

4. Participate with ski area personnel in collecting and interpreting weather data and formulating avalanche hazard predictions.

5. Determine that the terms of the special Use Permits are being followed by means of periodic inspections.

Safety Program

Duties of the Snow Rangers will include but are not limited to the following:

1. To see that the terms of the Special Use Permit and stipulations of the safety plan are being followed by the Permittee with consideration given to existing circumstances.

2. Conducting inspections on all lifts located on National Forest in compliance with current American National Standard Safety Requirement for Aerial Passenger Tramways, hereafter referred to as ANSI requirements. Qualified Forest Service Engineers will conduct one annual inspection of lifts and facilities. The Snow Ranger and Engineer should be accompanied by the mountain manager or lift foreman, so that the inspection will fit and the permittee schedule arrangements should be made in advance.

3. Inspecting for various aspects of slope safety to see that reasonable care is taken to identify and mitigate hazards on primary ski slopes; slope hazards are discussed in greater depth through this plan.

4. That Permittee will make all reasonable efforts to recognize and minimize avalanche hazards within the designated ski area. The Snow Rangers will participate with Alyeska Avalanche Technician in collecting and interpreting weather data and formulating avalanche hazards predict' ns. Snow Rangers will also provide advice, as needed, to area ski patrol personnel so that plans can be formulated and executed.

5. Providing assistance in training personnel related to safety operation involving explosives, avalanches, and administrative subjects.

6. Provide training for Permittee's personnel (Hillchief Avalanche Tech.) in the use of avalanche control artillery.

7. Assuming the responsibilities that methods of proper storage, transportation, and handling of artillery ammunition is being followed.

8. Assisting the Permittee's personnel, as needed, with decision making as to whether or not area slopes are safe for skiing and whether the slopes should remain open or closed. Snow Ranger has full authority to close down lifts or ski runs on the basis of his experience, judgement and appraisal of avalanche or lift dangers and give specific reasons for action taken in advance to Permittee's management personnel, unless it is an emergency.

9. Inspecting and insuring (and participating on a time permitting basis) hazard reduction tasks carried out by Alyeska Ski patrolmen. Hazard reduction may involve preparing and throwing hand charges onto slide paths and skiing slopes to determine snow stability.

10. Forest Service personnel have the responsibility of seeing that records are kept on ammunition accountability. All duds will be located and recorded as to location and date of occurence. A diligent effort will be made by the Permittee to locate unexploded wareheads. Snow Rangers will perform the firing of the 75mm and 105mm rifle and will maintain daily Artillery Control records.

11. Directs the recording of all avalanche records and weather records on a daily basis, at the end of each month sends monthly summaries to Ft. Collins, Colorado.

12. Timekeeping for firing artillery is a function of the Alyeska Snow Ranger.

13. Be available to provide coordination, leadership, and technical assistance for the State Troopers in search and rescue in cases involving avalanche, missing or lost persons if requested.

14. Will issue Federal citations to Avalanche closed areas violators and will be required to make court appearances.

15. Represent the permittee in matters dealing with the U.S. Army concerning rifle storage, rifle maintenance, ammunition storage and procurement.

B. The Permittee will be notified as soon as possible by the Forest Service should a Snow Ranger not be able to be on duty. The Hill Chief and/or the Avalanche Tech. should be notified.

C. Permittee

1. Alyeska Resort is to prepare the Alyeska Operation and Safety Plan with the concurrance of the U.S. Forest Service. Annual review will be made at the beginning of each ski season.

2. The Permittee will make every reasonable effort to continue the safety programs outlined in this plan, whether using company employees, contractors, or persons working for other gratuities. Everyone concerned in the operation of the area should be familiar with this plan.

CHART OF ORGANIZATION -- Forest Service

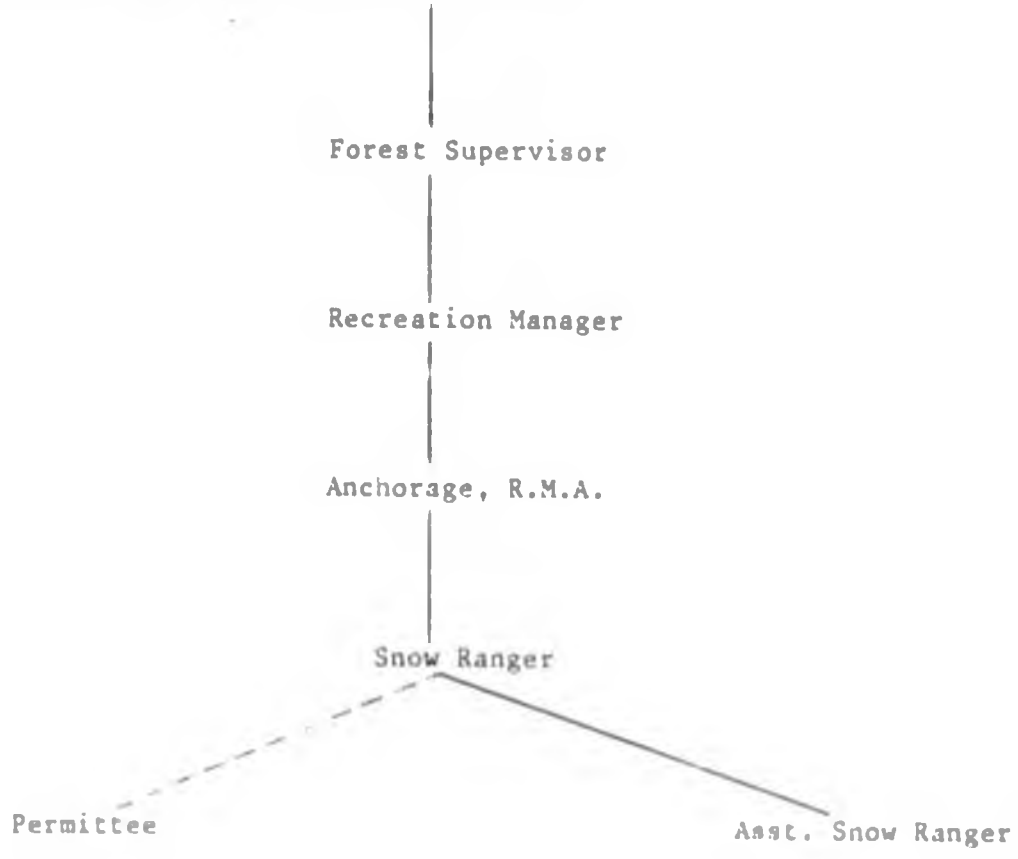

CHART OF ORGANIZATION (Permittee)