APPROVED CODE OF PRACTICE FOR PASSENGER ROPEWAYS IN NEW ZEALAND

1998 EDITION

INCORPORATING AMENDMENT 1

OSH
occupational safety & health service
te ratonga oranga

DEPARTMENT OF LABOUR
TE TARI MAHI

Acknowledgements and Note on this Code

The Occupational Safety and Health Service of the Department of Labour acknowledges the work of the New Zealand Mountain Safety Council in facilitating the production of the first issue of this code of practice, published in 1991.

The OSH Service's Engineering Safety Group acknowledges participation of the broader New Zealand ski industry group in the course of preparation of this approved code of practice.

By publishing this OSH approved *Code of Practice for Passenger Ropeways in New Zealand*, the 1991 edition of *Code of Practice for Passenger Ropeways in New Zealand,* issued by New Zealand Mountain Safety Council, is hereby repealed.

If, on the promulgation of the Pressure Equipment, Cranes and Passenger Ropeways Regulations, there is conflict between this code of practice and the regulations, the regulations take precedence.

Cover photo: Coronet Peak ski area, Queenstown.
Inset: Opening day at the Hamilton rope tow, Coronet Peak, 1947.
Photographs courtesy of Mount Cook Group Ski Areas.

Amendment 1 has been incorporated into this edition. The amendment replaces clause 2.2.3.1.1 in its entirety. The amendment comes into force on the 28th day after the date of its notification in the *Gazette*.

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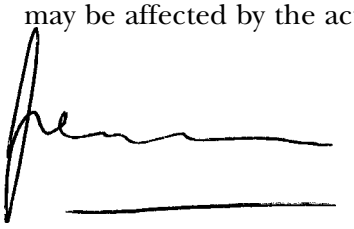
Contents

NOTICE OF ISSUE

I have issued this *Approved Code of Practice for Passenger Ropeways in New Zealand,* being a statement of preferred work practices or arrangements for the purpose of ensuring the health and safety of persons to which this code applies and persons who may be affected by the activities covered by this code.



J. M. Chetwin
Secretary of Labour
November 1998

FOREWORD

I have approved this statement of preferred work practices, which is an *Approved Code of Practice for Passenger Ropeways in New Zealand,* under section 20 of the Health and Safety in Employment Act 1992. When a code is approved, a Court may have regard to it in relation to compliance with the relevant sections of the Health and Safety in Employment Act. This means that if an employer in an industry or using a process to which an approved code applies can show compliance with that code in all matters it covers, a Court may consider this to be compliance with the provisions of the Act to which the code relates.

Hon. Max Bradford
Minister for Enterprise and Commerce
November 1998

SUMMARY OF THE HEALTH AND SAFETY IN EMPLOYMENT ACT 1992

The principal object of the Health and Safety in Employment Act 1992 (HSE Act) is to prevent harm to employees at work. To do this, it imposes duties on employers, employees, principals and others, and promotes excellent health and safety management by employers. It also provides for the making of regulations and codes of practice.

REGULATIONS

Regulations are promulgated from time to time under the HSE Act. Regulations may, among other things, impose duties on employers, employees, designers, manufacturers, and others relating to health and safety. These regulations may apply with respect to places of work, plant, processes or substances and may deal with particular problems that have arisen.

APPROVED CODES OF PRACTICE

"Approved Codes of Practice" are provided for in the HSE Act. They are statements of preferred work practice or arrangements, and may include procedures which could be taken into account when deciding on the practicable steps to be taken. Compliance with codes of practice is not mandatory. However, they may be used as evidence of good practice in court.

EMPLOYERS' DUTIES

Employers have the most duties to ensure the health and safety of employees.

Employers have a general duty to take all practicable steps to ensure the safety of employees while at work. In particular, they are required to take all practicable steps to:

(a) Provide and maintain a safe working environment;

(b) Provide and maintain facilities for the safety and health of employees at work;

(c) Ensure that machinery and equipment is safe for employees;

(d) Ensure that working arrangements are not hazardous to employees; and

(e) Provide procedures to deal with emergencies that may arise while employees are at work.

Taking "all practicable steps" means doing what is reasonably able to be done in the circumstances, taking into account:

(a) The severity of any injury or harm to health that may occur;

(b) The degree of risk or probability of that injury or harm occurring;

(c) How much is known about the hazard and the ways of eliminating, reducing or controlling it; and

(d) The availability, effectiveness and cost of the possible safeguards.

HAZARD MANAGEMENT

Employers must identify and regularly review hazards in the place of work (existing, new and potential), to determine whether they are significant hazards and require further action. If an accident or harm occurs that requires particulars to be recorded, employers are required to investigate it to determine if it was caused by or arose from a significant hazard.

"Significant hazard" means a hazard that is an actual or potential cause or source of:

(a) Serious harm; or

(b) Harm (being more than trivial) where the severity of effects on any person depend (entirely or among other things) on the extent or frequency of the person's exposure to the hazard; or

(c) Harm that does not usually occur, or usually is not easily detectable, until a significant time after exposure to the hazard.

Where the hazard is significant, the HSE Act sets out the steps employers must take:

(a) Where practicable, the hazard must be eliminated.

(b) If elimination is not practicable, the hazard must be isolated.

(c) If it is impracticable to eliminate or isolate the hazard completely, then employers must minimise the likelihood that employees will be harmed by the hazard.

Where the hazard has not been eliminated or isolated, employers must, where appropriate:

(a) Ensure that protective clothing and equipment is provided, accessible and used;

(b) Monitor employees' exposure to the hazard;

(c) Seek the consent of employees to monitor their health; and

(d) With informed consent, monitor employees' health.

INFORMATION FOR EMPLOYEES

Before employees begin work, they must be informed by their employer of:

(a) Hazards employees may be exposed to while at work;

(b) Hazards employees may create which could harm other people;

(c) How to minimise the likelihood of these hazards becoming a source of harm to themselves and others;

(d) The location of safety equipment; and

(e) Emergency procedures.

Employers are also required to inform employees of the results of any health and safety monitoring. In doing so, the privacy of individual employees must be protected.

EMPLOYERS TO INVOLVE EMPLOYEES IN THE DEVELOPMENT OF HEALTH AND SAFETY PROCEDURES

Employers need to ensure that all employees have the opportunity to be fully involved in the development of procedures for the purpose of identifying hazards and dealing with significant hazards, or dealing with or reacting to emergencies and imminent dangers.

TRAINING OF EMPLOYEES

Employers must ensure employees are either sufficiently experienced to do their work safely or are supervised by an experienced person. In addition, employees must be adequately trained in the safe use of equipment in the place of work, including protective clothing and equipment.

SAFETY OF PEOPLE WHO ARE NOT EMPLOYEES

Employers are also responsible for the health and safety of people who are not employees. Employers must take all practicable steps to ensure that employees do not harm any other person while at work, including members of the public or visitors to the place of work.

EMPLOYEES' AND SELF-EMPLOYED PERSONS' DUTIES

Employees and self-employed persons are responsible for their own safety and health while at work. They must also ensure that their own actions do not harm anyone else. However, these responsibilities do not detract from the employers' or principals' responsibilities.

ACCIDENTS AND SERIOUS HARM (RECORDS AND NOTIFICATION)

The HSE Act requires employers to keep a register of work-related accidents and serious harm. This includes every accident that harmed (or might have harmed):

(a) Any employee at work;

(b) Any person in a place of work under the employer's control.

Employers are also required to investigate all accidents, harm and near-misses to determine whether they were caused by a significant hazard.

Employers are required to notify serious harm that occurs to employees while at work to the Secretary (in practice, the nearest OSH office), as soon as possible. In addition, the accident must also be reported on the prescribed form within 7 days. (Forms are included in the Workplace Accident Register, available from OSH offices and selected stationers.)

If a person suffers serious harm, the scene of the accident must not be disturbed unless to:

(a) Save life or prevent suffering;

(b) Maintain public access for essential services, e.g. electricity, gas;

(c) Prevent serious damage or loss of property.

The OSH office will advise whether it wishes to investigate the accident and what action may be taken in the meantime.

HEALTH AND SAFETY IN EMPLOYMENT REGULATIONS 1995

The Health and Safety in Employment Regulations 1995 extend the provisions of section 6 of the Act in relation to the provision of facilities such as toilets, first aid, and washing of hands and body, and the provision of wholesome and sufficient drinking water.

The regulations also place duties on employers in relation to specific hazard; such as work at heights of over 3 metres (regulation 21), scaffolding (regulation 22), notifiable work (regulation 26) and work under raised objects (regulation 16).

Part VII of the regulations places specific duties on designers, manufacturers and suppliers of plants.

PART 1: INTRODUCTION

1.1 PREFACE

This Code of Practice has been developed in collaboration with the New Zealand Mountain Safety Council and the ski industry, ski areas and ski clubs of New Zealand, for the guidance and assistance of all involved with the establishment, maintenance and overall safety of uphill facilities.

1.1.1 BRIEF HISTORY

Under the Boilers, Lifts and Cranes Act 1950, much of the responsibility for "passenger ropeways", and particularly for aerial chairlifts and gondolas, was invested in the Maritime Transport Division of the Ministry of Transport. Public concern in 1983 led to moves to amend the Boilers, Lifts and Cranes Act, in order to introduce a safety regime for all ski lift facilities. These amendments would have included ski-tows under the Act, and would have provided for the safety of all uphill ski facilities to have been administered by the Marine Division of the Ministry of Transport.

Submissions from the ski industry, supported by the Marine Division, recommended the drafting and introduction of a code of practice for all uphill facilities, modelled on the Canadian Standards Association's National Standard, CAN3-Z98-M78 *Passenger Ropeways*, appropriately amended to fit New Zealand conditions. Groups within the ski industry held a series of meetings during 1983-84, assessed and modified the Canadian Standard, and produced the draft code of practice for comments from the Marine Division, and representatives of all areas of the ski industry.

In 1984 legislation was deferred, and the project to produce the code was stalled. However, in 1986, at the request of representatives of the industry, the New Zealand Mountain Safety Council accepted the role as catalyst to bring about the drafting and introduction of an industry code, with the agreement of the Marine Division. During 1986, agreement was reached on the process of implementation, and on much of the detail of the draft code, which became the operational guidelines for ski facility managers.

The *Code of Practice for Passenger Ropeways* was first published in 1991. Comments continued to be invited from all interested parties, including representatives of the ski industry, from ski areas and ski clubs running ski-fields, as well as from the Maritime Transport Division, Ministry of Transport, and the Department of Conservation.

In 1990, the Maritime Transport Division split into regulatory and service delivery sectors. The Engineering Safety Unit had responsibility for setting up the regulatory framework and for drafting the necessary legislation. Marine & Industrial Safety Inspection Services (M&I) were charged with carrying out the design verifications and inspections of equipment.

In 1993, the Engineering Safety Unit moved to the Occupational Safety and Health Service of the Department of Labour, the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations being drafted to fit under the Health and Safety in Employment Act 1992. In 1995-96, work started on redrafting the code as an OSH Approved Code of Practice, also taking the new Canadian standards CAN/CSA-Z98-M91 and Z98-96 into consideration.

In 1995 M&I became a limited liability company (Marine & Industrial Safety Inspection Services Ltd.), operating in a competitive marketplace.

1.1.2 IMPLEMENTATION OF A CODE OF PRACTICE

Three major stages in the overall safety regime for a passenger ropeway were identified:

(a) the design and construction stage (design, design approval, manufacturing, erection and commissioning);

(b) the regular maintenance and annual inspection stage ("warrant of fitness"); and

(c) the day-to-day operational stage, within a code of practice.

It was agreed that the overall regulatory administering responsibility should be vested in one authority only, now the Engineering Safety unit of Occupational Safety and Health Service of the Department of Labour, in liaison with all relevant industry participants.

It was also agreed that the Code should be put out by the Engineering Safety unit of OSH as an approved Code of Practice under the HSE Act 1992 and Pressure Equipment, Cranes and Passenger Ropeways Regulations. This would enable easy amendment and correction, as necessary, over the following years, and with developments in technology, materials and equipment. The current move towards quality management systems approach to management of ski-field facilities, as promoted by Engineering Safety, fits well with the industry's development of this Code of Practice.

Responsibilities of all relevant industry participants (designers, manufacturers, assembly contractors, controllers and inspection bodies) are outlined in detail in the following parts of this Code of Practice.

1.1.3 ACKNOWLEDGEMENTS

As already indicated above, this Code of Practice has been very substantially derived from the Canadian National Standards for

Passenger Ropeways, i.e. CAN3-Z98-M78, CAN/CSA-Z98-M91, and CAN/CSA-Z98-96., with the kind permission and authority of the Canadian Standards Association, to whom due credit is given for much of the technical content.

The New Zealand Mountain Safety Council also wishes to acknowledge the support and assistance provided by many individuals both from within the ski industry and from the Maritime Transport Division, Ministry of Transport, and OSH Engineering Safety. In particular, grateful thanks are given to the following persons for their work and contribution over the last fifteen years:

Graeme Ayres	David Bellett	Peter Bennetts	John Cooper
Chris Corbett	Mike Corner	Jack Critchley	Mato Dugalic
Robin Foubister	Bill Fraser	Bryn George	Shaun Gilbertson
Peter Hayward	Grant Horner	Bruce Jefferies	Peter Judd
Joe Judge	John Leslie	Don Macallan	Brent McKeown
Grant McMasters	John Meikle	Ken Miers	John Millington
Mervyn Moses	Warren Newlands	Kevin O'Connor	Lorenz Riser
Duncan Smith	John Stark	David Stove	Alan Trist
Arthur Tyndall	David Wilkie	Philip Witton	Noel Woodfield
Tony Wright	Peter Yeoman		

It has been the particular work of the above to direct the content of this Code of Practice to meet specific New Zealand conditions, regulatory requirements and good industry practices.

1.2 SCOPE

This Code of Practice establishes safety standards for the transportation of passengers on devices which are usually referred to by the following names:

Aerial ropeways:

Fixed-grip chair lifts,

Detachable chair lifts,

Gondola lifts,

Jig-back tramways.

Surface ropeways:

T-bar lifts,

Platter lifts,

Rope tows.

1.2.1 EXCLUSIONS

This Code of Practice does not cover equipment such as funicular railways, cog railways and cablecars running on rails, nor does it

cover such equipment as “flying foxes”.

Surface ropeways in Parts 5, 6 and 7 of this Code of Practice are not required to be issued with a certificate of inspection, as provided for in Clause 2.6.2.

1.2.2 EXISTING INSTALLATIONS

Operation, inspection and maintenance procedures shall be in compliance with this Code of Practice.

Existing passenger ropeway installations may continue to be operated as long as they remain in good enough condition to be issued with a certificate of inspection.

1.2.3 LEGISLATION

This Code of Practice provides a means of compliance with the Health and Safety in Employment Act 1992, and with the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations, which are administered by the Occupational Safety and Health Service of the Department of Labour.

1.3 DEFINITIONS

“Accredited Inspection Body” - Means an inspection body that holds current accreditation for the inspection work performed and that is recognised by Secretary of Labour. The inspection work may be all or any of: design verification, fabrication inspection or in-service inspection activities, relating to the equipment under the scope of the Pressure Equipment, Cranes and Passenger Ropeways Regulations. An inspection body can be an independent organisation, or part of an entity involved in the manufacture or operation of the equipment and can be of type A, type B or type C, as per BS-EN 45004 (See also Part 2: Application of the PECPR Regulations.)

“Aerial Ropeway” - A passenger ropeway which carries passengers in chairs, or cabins, which are lifted clear of the ground or snow surface and:

(a) attached to or supported by a moving rope or cable; or

(b) attached to a moving rope or cable but supported by a standing rope or cable, or other overhead structure.

“Alter” - To change the design of, add to or take elements away from any equipment where the alteration may affect health or safety, but does not include routine maintenance, repairs or replacements; and *alteration* has a corresponding meaning.

"Anti-rollback device" - A device that prevents a hauling rope from moving in the reverse direction when the power is removed from the rope.

"Assembly Contractor" - Means the individual or organisation that takes responsibility for installation and commissioning of the passenger ropeway or any of its components. This may be controller themselves, if they are responsible for installation and commissioning of the passenger ropeway.

"Authority" - The Occupational Safety and Health Service of the Department of Labour is the Government agency having the delegated responsibility from the Secretary for administering these requirements.

"Cabin" - The passenger-carrying unit of a reversible aerial ropeway or a gondola lift.

"Carrier" - The complete assembly including grip, hanger, T-bar, chair or cabin and used for transporting persons or materials. The carrier is also referred to as a *towing outfit.*

"Chairlift or Gondola Lift" - An aerial passenger ropeway in which passengers are carried on chairs or in gondola cabins, attached to and suspended from a moving wire rope, or attached to a moving wire rope and supported by a standing wire rope or other overhead structure. (See Part 4).

"Clearance" - The clear space allowed for the passing of two objects or parts. (Maximum width shall be used unless stated otherwise).

"Competent Person" - A person who has acquired, through a combination of training, qualification and experience, the knowledge and skills enabling that person to perform the task required. For surface ropeways, competent person is defined by Clause 2.6.3.2.

Note: Persons performing NDT may be deemed competent if they hold current certification from a personnel certification body, e.g. CBIP, in the relevant NDT discipline.

"Controller" - A person who is the owner, lessee, sublessee, or bailee of a passenger ropeway.

"Design Verification" - The establishment by a design verifier, through design control measures, that the design complies with relevant specifications and standards in all respects and with particular regard to safety.

"Design Verifier" - A suitably qualified and experienced person, who is totally independent of the designer and the design team, and who is registered as a design verifier by the Secretary for nominated types and classes of equipment under the PECPR Regulations.

"Design Standard" - The relevant specification or standard used by the designer.

"Diameter" - Wherever it is used in specifying sheaves, wheels, or pulleys, means the tread diameter.

"Equipment Inspector" - A person who is employed or engaged by an Inspection Body, holds relevant CBIP certification and is registered by the Secretary under the PECPR Regulations.

Note: Within the scope of this Code of Practice an equipment inspector means **passenger ropeway inspector**, holding current relevant CBIP certification.

"Factor Of Safety" (Static) - The ratio of the ultimate strength of the material and the maximum static design stress.

"Foot Passenger" - Any passenger on foot, including a skier carrying skis.

"Gondola Cabin" - A cabin for carrying people, on a gondola lift.

"Gripper" - A device which attaches a passenger to a circulating fibre rope as part of a rope tow.

"Machine Room" - That portion of a building or enclosure which houses only the motive power and driving mechanism.

"Passenger Ropeway" - A ropeway or cableway to which the motion of a prime mover is transmitted, used, or designed or intended to be used, for conveying in a horizontal or inclined plane passengers on skis, or supported by chairs, or in enclosed cars which are;

(a) attached to or supported by a moving rope or cable; or

(b) attached to a moving rope or cable but supported by a standing rope or cable, or other overhead structure;

and includes the prime mover and any transmission machinery, supporting structure and equipment, used or intended to be used in connection with a ropeway or cableway.

"Rated Capacity" - The capacity established by the designer of the equipment.

"Repair" - To return to an operating condition, but does not include routine maintenance or replacement.

"Retarding Device" - A device, other than service break, emergency break and anti-rollback device, that maintains normal speed of drive system, where forward overhauling conditions exist.

"Rollers" - Sheaves of small tread diameter, often used to guide the cable or to restrain it from leaving its proper alignment. As here defined, the term does not refer to regular tower sheaves, although the term is sometimes used as a synonym for the phrases "small sheave", "line sheave" or "tower sheave".

"Rope" - Includes the terms "rope", "wire rope" and "cable".

"Rope Tow" - A surface ropeway in which the passengers grasp the circulating hauling rope and are propelled by the circulating hauling rope. The passengers remain in contact with the ground or snow surface. The upward travelling hauling rope remains adjacent to the uphill track of the passengers and at an elevation which permits them to maintain their grasp on the hauling rope, handle or tow belt throughout that portion of the tow length which is designed to be travelled.

(a) *Fibre Rope Tow* - means a tow having a fibre (natural or synthetic) hauling rope.

(b) *Wire Rope Tow* - means a tow having a metallic hauling rope.

"Safety Gate" - A device which will cause the lift to stop when actuated by contact with either a passenger or a non-retracting towing unit.

"Sheaves" - Pulleys or wheels grooved for a rope.

(a) *Drive Sheave* - The main sheave which applies motion to the hauling rope.

(b) *Idler sheave* - A sheave, other than a drive sheave, that guides or carries a hauling rope.

(b) *Return Sheave* - The sheave at the opposite end of the hauling rope to the drive sheave and includes any associated idler sheave that deflects the hauling rope.

(c) *Floating Return Sheave* - A return sheave and its supporting framework, the whole of which is suspended by a system of wire ropes.

"Single and Double Reversible Aerial Ropeway" - An aerial ropeway in which passengers are carried in one or more cabins which go to and from between terminals (see Chapter 7).

"Skier" - A passenger wearing skis or using a similar device.

"Specified Activity" - In relation to aerial passenger ropeways means design verification and equipment inspection. This does not apply to surface ropeways, where the persons being transported remain in general contact with the ground."

"Static" - A component shall be considered to be static when it is stationary or moving at uniform velocity.

"Stop Device" - A device, switch or button, mechanical or electrical, which will initiate the stopping of the ropeway.

"Surface Ropeway" - A passenger ropeway which is not an aerial ropeway, and includes T-bar and platter lifts, rope tows and similar devices, where the passengers remain in contact with the surface.

"Tow Belt" - A belt worn by a skier attached by a short rope to a *rope gripper*, of which the grip on the hauling rope is only maintained by the grasp of the skier.

PART 2: APPLICATION OF THE PECPR REGULATIONS

2.1 INTRODUCTION

2.1.1 Part 2 of this Code of Practice is intended to be read in conjunction with the Pressure Equipment, Cranes and Passenger Ropeways (PECPR) Regulations.

2.1.2 It outlines an approach by which controllers, designers, manufacturers, suppliers, assembly contractors and employees may comply with the duties imposed by the Regulations.

2.2 DUTIES OF CONTROLLERS

2.2.1 GENERAL

2.2.1.1 Information to be held by controllers

2.2..1.1.1 Controllers of passenger ropeways shall:

(a) obtain from the manufacturer, supplier or assembly contractor any drawings, manuals, other data and design verification, inspection and test certificates that are necessary to establish that the passenger ropeway has been designed, manufactured, installed and certified in accordance with the PECPR Regulations;

(b) obtain from the manufacturer, supplier or assembly contractor catalogues, drawings, manuals, specifications or other information required to ensure that all relevant in-service activities can be carried out safely; and

(c) store this data at the place of work where the passenger ropeway is situated so that it is secure and readily available to all persons in that place of work and to any other person requiring access including equipment inspectors. This data shall be kept available for reference until disposal of the equipment.

2.2.1.1.2 Where the information noted in (a) or (b) above is not available from the manufacturer, supplier or assembly contractor, it shall be obtained from some other source. This data shall be confirmed as suitable for the particular passenger ropeway by an

inspection body and used in accordance with the requirements of any quality management system under which the equipment is operated.

2.2.1.2 Accident notification

2.2.1.1 See the Pressure Equipment, Cranes and Passenger Ropeways Regulations.

See also Clause 2.3.2 Controllers' Duties in Relation to Unsafe Equipment.

2.2.1.3 Supervision

2.2.1.3.1 Controllers of passenger ropeways shall:

(a) personally supervise every passenger ropeway and every specified activity or appoint a competent person to carry out this supervision;

(b) ensure that persons appointed are competent to carry out duties allocated to them;

(c) delegate to competent persons, appointed to supervise passenger ropeway, powers required to exercise supervision but shall not assign other responsibilities which could compromise their supervisory role; and

(d) ensure that the name of persons appointed to supervise a passenger ropeway are made known to any persons who carry out a specified activity or any other significant activity associated with that passenger ropeway.

2.2.1.4 Competent person to carry out specified activity*

2.2.1.4.1 Controllers of passenger ropeways shall ensure that only competent persons carry out specified activities.

* For definitions of "competent person" and "specified activity", see Clause 1.3 Definitions.

2.2.2 ERECTION AND COMMISSIONING OF PASSENGER ROPEWAYS

2.2.2.1 Duties

2.2.2.1.1 Assembly contractors* of a passenger ropeway shall ensure that it is erected, commissioned, tested and inspected in accordance with information which is complete and appropriate for safe erection, testing, inspection and commissioning. In the case of an aerial ropeway this information is to be obtained from the manufacturer, whilst for a surface ropeway it shall be obtained from the designer.

* For definition of assembly contractor, see Clause 1.3 Definitions.

2.2.2.2 Records

2.2.2.2.1 Assembly contractors of passenger ropeways shall record every critical safety stage in the erection and commissioning of passenger ropeways.

2.2.2.2.2 Assembly contractors shall ensure that the data from clauses 2.2.1.1.2 and 2.2.2.2.1. are freely available to the controller and the equipment inspector.

2.2.3 OPERATION OF PASSENGER ROPEWAYS

2.2.3.1 Duties

2.2.3.1.1 Controllers of passenger ropeways shall ensure that:

(a) every operational aerial ropeway has a valid certificate of inspection;

(b) every surface ropeway of the overhead travelling wire type (which includes Platter and T-Bar ropeways) has a valid certificate of inspection;

(c) every hand held surface ropeway is inspected at least annually and issued with a detailed report of inspection, the inspection being undertaken by a competent person who has not carried out the ropeway's design, installation or maintenance;

(d) all passenger ropeways are operated safely and within their design limits;

(e) all safety devices are in working condition, every time a passenger ropeway is in operation;

(f) where passenger ropeway operation is covered by the controller's quality management system, the operation is in accordance with that quality management system;

(g) where passenger ropeway operation is not covered by a quality management system, the operation is in accordance with relevant operating manuals/procedures and generally accepted good industry practice; and

(h) all operating procedures relating to passenger ropeways are kept under regular review, improved and updated whenever possible, and implemented by competent persons.

2.2.3.2 Records

2.2.3.2.1 Controllers of passenger ropeways shall ensure that:

(a) where relevant, quality management systems are developed, implemented and maintained;

(b) written procedures are developed for operating the equipment under all reasonably foreseeable conditions, and that all safety requirements are incorporated into these procedures;

(c) records are kept of every critical safety stage in the operation of passenger ropeways;

(d) operating procedures and all other relevant operating records are freely available to any person who operates the equipment; and

(e) all operational data are available for inspection by any authorised person who is involved with the passenger ropeway, including equipment inspectors.

2.2.4 MAINTENANCE OF PASSENGER ROPEWAYS

2.2.4.1 Standards

2.2.4.1.1 Controllers of passenger ropeways shall ensure that:

(a) where they operate a recognised quality management system which includes maintenance activities, the maintenance of passenger ropeways is carried out in accordance with that quality management system, which shall incorporate the manufacturer's maintenance and inspection schedule; and

(b) maintenance of any passenger ropeway not covered by a recognised quality management system shall be performed as per the manufacturer's maintenance and inspection schedule, or, in the absence of an appropriate schedule, as agreed between the controller and the inspection body, or as set by standards of generally accepted good industry practice.

2.2.4.2 Procedures

2.2.4.2.1 Controllers of passenger ropeways shall ensure that:

(a) passenger ropeways, including all safety devices, are maintained in accordance with their maintenance and inspection schedules and are kept in safe working condition at all times;

(b) a procedure is in place which requires any faults found in passenger ropeways to be reported immediately by the person who finds the fault, investigated and, where necessary, maintained, adjusted, repaired or altered;

(c) passenger ropeways that have been subject to maintenance, whether routine maintenance or maintenance in response to a fault found, shall be appropriately tested before re-entering service, to ensure their design compliance; and

(d) all maintenance procedures relating to passenger ropeways shall be kept in controlled status, regularly updated and continually improved and shall be executed by competent persons.

2.2.4.3 Records

2.2.4.3.1 Controllers of passenger ropeways shall:

(a) record the date, time and full details of any maintenance work undertaken and the results of any maintenance procedure carried out;

(b) ensure that maintenance records are available for examination by all persons concerned, including equipment inspectors; and

(c) keep record of running hours and/or number of loading cycles operated by a passenger ropeway and its condition, where a passenger ropeway, or any of its components, is subject to condition monitoring.

2.2.5 REPAIRS AND ALTERATIONS

2.2.5.1 General

2.2.5.1.1 Controllers of passenger ropeways, except surface ropeways, shall ensure that repairs and alterations that require changes in quality of materials used on the passenger ropeway, or changes to the dimensions of components providing structural integrity, are:

(a) subject to design verification;

(b) carried out to the satisfaction of an equipment inspector;

(c) carried out in accordance with the requirements of any recognised quality management system covering that passenger ropeway; and

(d) carried out by competent persons.

2.2.5.1.2 The controller shall also ensure that repairs or alterations to any safety device are carried out in accordance with the manufacturer's specifications and to the satisfaction of an equipment inspector.

2.2.5.1.3 Where appropriate, controllers shall ensure that a passenger ropeway, which is altered or repaired, is issued with a new certificate of inspection before it is put back into service.

2.2.5.2 Alterations

2.2.5.2.1 Major alterations

Alterations or modifications to any or all of the following features of an existing passenger ropeway shall be treated as a new installation requiring design verification and inspection:

(a) location;

(b) speed increase;

(c) capacity increase;

(d) length;

(e) rise;

(f) tensioning system; or

(g) braking system.

Note: This may not apply in the case of location change; for portable surface tows (see Clause 3.20.5).

2.2.5.2.2 Minor alterations

Alterations involving changes to the following shall be appropriately tested prior to being put back into operation:

(a) a drive system component;

(b) a braking component;

(c) control system; and

(d) a tension component.

2.2.5.3 Welding

2.2.5.3.1 Controllers of passenger ropeways, except surface ropeways, shall ensure that any welding is carried out in accordance with welding procedures approved by a CBIP certified welding inspector, and to the satisfaction of an equipment inspector.

Note: This does not apply to any repair that, according to the standards of generally accepted design practice, is minor, on non-critical and non-load-bearing components and carried out as part of routine maintenance.

2.2.5.4 Records

2.2.5.4.1 Controllers of passenger ropeways shall ensure that:

(a) the date, time, full detailed description and inspection and test results of any repair or alteration are recorded; and

(b) records of repairs and alterations shall be available for inspection by any person involved with the operation or maintenance of the equipment, including equipment inspectors.

2.2.6 INSPECTION

2.2.6.1 General

2.2.6.1.1 The assembly contractor or the owner/controller of the passenger ropeway, as appropriate, shall ensure that:

(a) for aerial ropeways:

(i) commissioning inspection has been carried out by an equipment inspector, who shall also witness all relevant tests;

Note: For the purpose of commissioning inspection, the documentation, as outlined in Clause 2.2.6.4.1, shall be supplied to the equipment inspector in reasonable advance. See also Clause 3.3 Commissioning inspection and testing.

(ii) they are inspected in-service at least annually for issue of a certificate of inspection, by an equipment inspector, pursuant to PECPR Regulations; and

(b) for surface ropeways:

(i) commissioning inspection is carried out and tests witnessed by a competent person, as outlined in Clause 3.3.3;

(ii) they are examined in-service at least annually by a competent person, who shall supply to the controller a written detailed report of each of such examinations.

2.2.6.1.2 The annual in-service inspection and/or examination may, in agreement with the equipment inspector or competent person, as appropriate, be scheduled to cover different parts of the installation at different times, provided:

(a) the schedule is to the satisfaction of the equipment inspector or competent person, as appropriate; and

(b) all parts of the installation are inspected within a period not exceeding 12 months.

2.2.6.2 Inspection by equipment inspectors

2.2.6.2.1 In relation to the in-service inspection by an equipment inspector employed by an accredited inspection body, controllers of aerial passenger ropeways shall ensure that:

(a) in the case of a Type A inspection body (BS EN 45004) engagement, the inspection body is not the designer, manufacturer, supplier, installer, controller or maintainer of the passenger ropeway, nor the authorised representative of any of these parties;

(b) in the case of engagement of an inspection body which forms a separate and identifiable part of an organisation involved in the design, manufacture, supply, installation, use or maintenance of the items it inspects, and supplies inspection services to its parent organisation only (Type B - BS EN 45004), that the equipment inspector engaged has clear separation of responsibilities and reporting methods from the personnel employed with other functions relating to the passenger ropeway; and

(c) equipment inspectors are provided with safe and adequate means of reasonable access to the equipment to be inspected.

2.2.6.2.2 The assembly contractor or the owner/controller of the passenger ropeway, as appropriate, shall ensure that equipment, issued for the first time with a certificate of inspection, is permanently marked with the unique identifier assigned by the inspection body.

2.2.6.3 Inspection intervals

2.2.6.3.1 Controllers shall ensure that passenger ropeways are inspected in-service for the issue of a certificate of inspection (aerial ropeways) or reports of examination (surface ropeways) and that they:

(a) are inspected at commissioning, after the first year of service and thereafter at least annually (it may be appropriate to inspect passenger ropeways more frequently, especially ones that operate continually over 12-monthly periods);

(b) are inspected after their re-erection or re-commissioning;

(c) are inspected after major repairs or alterations; and

(d) are inspected in the event that they are seriously damaged.

2.2.6.4 Records

2.2.6.4.1 For the purpose of commissioning inspection and testing of the installation the following documentation, in English, shall be supplied, in reasonable advance, to the equipment inspector, who will be engaged with the inspection;

(a) a completed and signed manufacturer's certificate of compliance;

(b) satisfactory certificates, acceptable to the equipment inspector, which identify with the ropeway components, such as rope, rope grips, hangers, chairs, cabins, hydraulic cylinders etc., as required by this Code of Practice for the particular type of passenger ropeway;

(c) an electrical certificate is required for mains voltage installations only, and shall be signed by a registered electrician, specifying that the design of the ropeway complies in principle with the NZ Electricity Act and appropriate Regulations;

(d) satisfactory evidence, acceptable to the equipment inspector, covering quality of materials used in construction, manufacturing and welding procedures, welder qualifications and other relevant quality records;

(e) registered engineer's certificate, acceptable to the equipment inspector, covering the design and construction of the foundations for towers, top and bottom terminal structures, and any other structures supporting the ropeway load-bearing equipment; and

(f) certificate from assembly contractor, to the satisfaction of equipment inspector, stating that assembly and installation of the passenger ropeway has been done to the best of acceptable standards and good industry practice.

2.2.6.4.2 Controllers of passenger ropeways shall:

(a) record the date, time, details and results of any inspection carried out and the name of the inspection body engaged;

and

(b) keep a record of the type of equipment each inspection body inspects, when more than one inspection body is engaged to provide inspection services.

2.2.7 TESTS

2.2.7.1 General

2.2.7.7.1 Controllers of a passenger ropeways shall ensure that:

(a) all routine tests of emergency procedures, and of alarms, and safety devices, relating to that passenger ropeway, are carried out at the intervals and in the manner agreed between the controller, the manufacturer and/or the inspection body;

(b) every overload test is carried out under strict conditions, is monitored at all times and does not exceed the limits specified in the relevant design or operating standard; and

(c) passenger ropeway is not loaded above its safe working load, except for the purposes of an overload test.

2.2.7.1.2. The designer shall provide a procedure and schedule for the periodic testing of the holding ability of the service brake, emergency brake and anti-rollback device on the basis of the design load, which shall be in accordance with Clause 3.3.2.1.

Note: Where the passenger ropeway is operated within a recognised quality management system which includes operation, the routine tests shall be carried out in accordance with that quality management system.

2.2.7.2 Manufacturer's tests

2.2.7.2.1 The haul rope grip, connection and critical parts of the carrier shall, at the time of manufacture, be non-destructively tested, by a competent person, using a method commensurate with the design and materials to ensure that they are free from flaws or cracks. Certificates to this effect, as outlined in Clause 2.2.6.4.1 (b), shall be provided by the manufacturer stating the serial numbers of the items tested, the tests carried out, the conclusions of the tests, and the installation on which the components are to be used.

2.2.7.2.2 Certification of a test shall be provided by the manufacturer that a loaded carrier with twice the design load had been passed around the bullwheel at full speed of a passenger ropeway and a chair of identical design and fabrication, without any yielding of the carrier tested. This excludes surface ropeways, detachable chair lifts and reversible aerial ropeways.

2.2.7.3 Records

2.2.7.3.1 Controllers of passenger ropeways shall ensure that:

(a) the date, time, details and results of any tests carried out are recorded;

(b) comments on the performance of passenger ropeway in any test, and on any maintenance done or any adjustment, alteration, or repair made as a result of any test are recorded; and

(c) any data arising from testing are readily available for inspection by authorised persons including equipment inspectors.

2.3 DUTIES IN RELATION TO UNSAFE EQUIPMENT

2.3.1 EMPLOYEES

2.3.1.1 Employees shall advise the controller, as early as practicable, of any part of a passenger ropeway or activity which they believe to be unsafe.

2.3.2 CONTROLLERS

2.3.2.1 Controllers shall ensure that notification from any person, advising that a passenger ropeway may be unsafe, is promptly and fully investigated by a competent person.

Where the passenger ropeway is then determined to be unsafe, the controller shall:

(a) withdraw the passenger ropeway from service and render it inoperable;

(b) clearly mark the passenger ropeway as withdrawn from service;

(c) record appropriate details of the passenger ropeway withdrawn from service;

(d) not return the passenger ropeway to service until it has been restored to a safe condition; and

(e) record details of all remedial work and any inspection and testing carried out.

2.3.2.2 Where controllers receive written notice issued by an equipment inspector specifying a particular course of action which is required to restore an aerial ropeway to a safe condition, the controllers shall:

(a) carry out the required action within the time specified;

(b) give the equipment inspector written notice of any action taken; and

(c) record details of all remedial actions.

2.3.2.3 Where a certificate of inspection for an aerial ropeway is cancelled or suspended by an inspection body, the controller shall:

(a) immediately withdraw the passenger ropeway from service and render it inoperable;

(b) clearly mark the passenger ropeway as withdrawn from service;

(c) record details of the passenger ropeway withdrawn from service;

(d) not return the passenger ropeway to service until it has been restored to a safe condition and the certificate of inspection reinstated or a new certificate of inspection issued; and

(e) record details of all remedial work and inspection and testing carried out.

2.3.2.4 In the event that a passenger ropeway, or any of its components, is believed to have a type fault, the controller shall take all practicable steps to ensure that the manufacturer and/or supplier are given a detailed written notice to that effect as soon as practicable. (See the PECPR Regulations).

2.3.3 MANUFACTURERS AND SUPPLIERS

2.3.3.1 Where a manufacturer or supplier is advised in writing of a type fault, under Clause 2.3.2.4, they shall take all practicable steps to ensure that:

(a) manufacture and supply of that passenger ropeway or component is stopped; and

(b) any such passenger ropeway or component in service is withdrawn from service, until the fault is corrected.

2.4 DUTIES OF DESIGNERS, MANUFACTURERS AND SUPPLIERS

2.4.1 DUTIES OF DESIGNERS

2.4.1.1 Designers shall ensure that passenger ropeway is designed so that it is safe for any person who carries out any activity with that passenger ropeway which is in accordance with normal good industry practice.

2.4.1.2 Each part of the passenger ropeway equipment shall be designed and constructed by those competent in this work.

2.4.1.3 Designers shall ensure that every passenger ropeway, or any alterations to it, is designed in accordance with the appropriate standards. Where no standards are specified, a passenger ropeway, or any alterations to it, shall be designed in accordance

with the standards of generally accepted good industry practice.

2.4.1.4 The designer shall determine the design verification and fabrication inspection requirements relating to the passenger ropeway, and any other matter arising in relation to the design, and give this information to the manufacturer. The design verification and fabrication inspection requirements will be determined in accordance with the specific design standard for that particular passenger ropeway.

2.4.2 DUTIES OF MANUFACTURERS

2.4.2.1 Manufacturers shall ensure that the passenger ropeway has been design and design verified by obtaining from the designer a copy of the relevant design verification certificate issued by an independent inspection body. Where it has been determined by the designer, in accordance with this Code of Practice, that design verification by an independent inspection body is not required, then this certificate may be issued by the designer.

2.4.2.2 Manufacturers of passenger ropeways shall ensure that any manufacturing is carried out by competent persons and in accordance with relevant manufacturing standard and design documentation, approved by the designer.

2.4.2.3 Manufacturers shall ensure that passenger ropeway is inspected and tested in accordance with the requirements of the manufacturing standard and any inspection and test plan specified by the designer. An inspection and maintenance schedule shall be drawn up, based on manufacturer's instructions and recommendations, which shall specify the frequency at which each component shall be inspected, and routine maintenance to be carried out.

2.4.2.4 Manufacturers shall ensure that any changes made to the design of passenger ropeways in the course of manufacture are approved by the designer, design verified and recorded.

2.4.3 DUTIES OF SUPPLIERS

2.4.3.1 Suppliers of a new or second-hand passenger ropeways, manufactured overseas or within New Zealand, shall ensure that before such a passenger ropeway is put into operation, or sold, or otherwise transferred within New Zealand, to the control of any other person, that the passenger ropeway has been designed, design verified, manufactured, inspected and tested, and that documentation is supplied to the assembly contractor, or controller, as appropriate.

2.4.4 PROVISION OF INFORMATION

2.4.4.1 Designers shall ensure that manufacturers, manufacturers shall ensure that suppliers (or assembly contractors/controllers, as

appropriate, if supplying directly) and suppliers shall ensure that assembly contractors/controllers of passenger ropeway receive sufficient documentation to ensure that any specified activity can be safely and correctly undertaken.

2.4.4.2 The documentation shall include design verification certificates, inspection and test reports and certificates of inspection. Furthermore, the documentation referred to in this clause shall specify, but not be limited to:

(a) maximum design safe working load of the ropeway;

(b) any design verification and fabrication inspection requirements and any special conditions affecting the carrying out of specified activities;

(c) any hold points and other manufacturing requirements including any provision for lifting or transportation; and

(d) maintenance requirements (maintenance and inspection schedule), the frequency at which maintenance should be undertaken, and the competencies required to carry out those maintenance safely and effectively.

2.4.4.3 Where the item or type of passenger ropeway is designed to last for a finite period, the documentation referred to in this clause shall advise how that period is to be calculated or measured, and the actions to be taken when that period has expired.

2.4.4.4. Availability of records

2.4.4.4.1 Every assembly contractor or controller, as appropriate, of a passenger ropeway shall ensure that erection and commissioning, operational, maintenance, repair or alteration, inspection and test records are available for inspection by any authorised person who is involved with that passenger ropeway, including equipment inspectors.

2.4.4.4.2 Manufacturers shall ensure that every passenger ropeway is permanently labelled with:

(a) the name of the manufacturer, the year of manufacture and the unique identifier assigned by the inspection body;

(b) the relevant operating parameters such as safe working load (in kilograms or maximum number of persons); and

(c) any other data required by the designer.

2.5 ADMINISTRATIVE PROVISIONS

2.5.1 ACCREDITATION BODIES

2.5.1.1 Accreditation bodies have the function of determining whether organisations are competent to operate as inspection bodies or certification bodies. They accredit and audit inspection bodies, certification bodies and testing laboratories.

2.5.2 CERTIFICATION BODIES

2.5.2.1 Certification bodies have the function of certifying and auditing quality management systems, established by passenger ropeways designers, manufacturers and controllers.

2.5.3 INSPECTION BODIES

2.5.3.1 As per PECPR Regulations, inspection bodies have the functions of:

(a) Carrying out design verification;

(b) Issuing certificates of design verification on the recommendation of design verifiers employed by them;

(c) Carrying out equipment inspection;

(d) Issuing, renewing, suspending, or cancelling certificates of inspection on the recommendation of equipment inspectors employed by them;

(e) Assigning a unique identifier to equipment issued for the first time with a certificate of inspection.

2.5.3.2 For purpose of the PECPR Regulations, inspection bodies shall be recognised by the Secretary. There is a set of requirements to be complied with by an inspection body, in order to be recognised to that extent. The vital requirement for an inspection body, however, is to hold appropriate current accreditation, covering the scope of their design verifying and/or inspecting activities.

2.5.4 QUALIFICATION ISSUING AGENCIES

2.5.4.1 Qualification issuing agencies have the functions of:

(a) Issuing certificates of competence;

(b) Establishing equivalence of qualifications obtained outside New Zealand to New Zealand certificates of competence.

2.5.4.2 The Secretary may recognise an organisation as a qualification issuing agency if satisfied that it employs or engages persons who are competent to assess whether or not applicants seeking certificates of competence are competent to carry out specific activities.

2.5.4.3 A qualification issuing agency must ensure that it issues a certificate of competence only after a determination (by way of examination, assessment, or otherwise) that the person concerned has the knowledge, training, skills, and experience to perform safely any activities that a holder of the certificate of competence would be expected to perform safely.

2.5.5 DESIGN VERIFIERS

2.5.5.1 Design verifiers are persons recognised by the Secretary as competent to:

(a) Carry out verification of equipment design, including particular New Zealand seismic conditions' considerations, on behalf of an inspection body; and

(b) Make recommendations to the inspection body, relating to the issue of certificates of design verification.

2.5.6 EQUIPMENT INSPECTORS

2.5.6.1 Equipment inspectors are persons recognised by the Secretary as competent to:

(a) Carry out equipment inspection on behalf of an inspection body; and

(b) Make recommendations to the inspection body, relating to the issue of certificates of inspection and, whether or not that inspection body issued the particular certificate of inspection in question, the renewal, suspension, or cancellation of certificates of inspection.

2.5.6.2 Before, during, or after a passenger ropeway inspection, an equipment inspector shall inform the manufacturer, assembly contractor or controller, as the case requires, of any safety issues relating to the passenger ropeway in question and of any action required to make the equipment safe.

2.6 CERTIFICATES

2.6.1 CERTIFICATES OF DESIGN VERIFICATION

2.6.1.1 A certificate of design verification is a certificate, issued by an inspection body, as recommended by a design verifier, who;

(a) Carries out design verification on the passenger ropeway; and

(b) Has reasonable grounds to believe that the design of the passenger ropeway is safe.

2.6.1.2 Design verification, here, means verification that:

(a) Designs of the passenger ropeway; and

(b) Changes to designs, affecting the operational safety of the passenger ropeway, made in the course of manufacture; and

(c) Designs of any repair or alteration affecting the operational safety of the passenger ropeway repaired or altered or any other equipment; and

(d) The fabrication inspection requirements specified by the designer;

comply, in every respect related to safety, with the requirements of the appropriate design standard and contain every safety feature that is relevant, whether or not referred to in those standards.

2.6.2 CERTIFICATES OF INSPECTION

2.6.2.1 A certificate of inspection is a certificate, issued by an inspection body, as recommended by an equipment inspector, who:

(a) Carries out equipment inspection on that passenger ropeway; and

(b) Has reasonable grounds to believe that the passenger ropeway is safe; and

(c) Has reasonable grounds to believe that the passenger ropeway will remain safe for the duration of the certificate of inspection.

2.6.2.2 Equipment inspection, here, means inspection that is carried out to determine whether the passenger ropeway is safe and is likely to remain safe for a certain period.

2.6.2.3 A certificate of inspection remains in force unless the period specified in it is expired or a new certificate of inspection is issued, as a result of a new equipment inspection carried out.

2.6.2.4 If an equipment inspector is satisfied on reasonable grounds that a passenger ropeway, that has a current certificate of inspection, is, for any reason, unsafe or unfit for use, the equipment inspector shall recommend to the inspection body that the certificate be suspended or cancelled.

2.6.2.5 If the Secretary is satisfied on reasonable grounds that a passenger ropeway, that has a current certificate of inspection is, for any reason, unsafe or unfit for use, the Secretary may suspend the certificate of inspection for such period as the Secretary thinks fit or cancel the certificate of inspection. The controller shall be notified accordingly.

2.6.3 CERTIFICATES OF COMPETENCE

2.6.3.1 A certificate of competence is a certificate issued by a qualification issuing agency, or by the Secretary, as appropriate, stating that the holder is suitably qualified to carry out a specified activity in relation to aerial ropeways.

2.6.3.2 For surface ropeways, a person is deemed competent if they have acquired, through a combination of training, qualification and experience, the knowledge and skills enabling them to perform the task required. The level of competency shall be established by the surface ropeway controller.

2.6.4 DUTIES OF CONTROLLERS AND INSPECTION BODIES IN RELATION TO CERTIFICATES OF COMPETENCE

2.6.4.1 Passenger ropeway controllers and inspection bodies shall take all practicable steps to ensure that every specified activity, carried out by the controller or the inspection body, as the case may require, is carried out only by competent persons.

2.6.4.2 The controllers and inspection bodies may train persons to gain competencies to allow them to carry out specified activities, as long as these persons, while in training, carry out the specified activities under the supervision of competent persons.

PART 3: GENERAL TECHNICAL REQUIREMENTS

3.1 SCOPE

3.1.1 Part 3 covers general requirements, including operation and maintenance, for all categories of passenger ropeways and is intended to be read in conjunction with Part 2 of this Code of Practice. Detailed requirements for the individual categories of passenger ropeways are given in subsequent parts of this Code of Practice.

3.2 DESIGN

3.2.1 GENERAL

3.2.1.1 The design of components for passenger ropeways shall normally include, but shall not be limited to, consideration of the following:

(a) possible impact loads;

(b) static and dynamic loads;

(c) seismic loading;

(d) static properties;

(e) fatigue endurance at a number of load cycles appropriate for the component and the installation;

(f) resistance to brittle fracture; and

(g) protection against corrosion.

3.2.1.2 Designs of ropeway supporting structures and equipment to applicable recognised national standards will be accepted provided they also meet the factors of safety set out in this Code of Practice.

3.2.1.3 For items of ropeway supporting structures and equipment for which this Code of Practice does not specify factors of safety, designs to recognised national standards will be accepted provided the fatigue stresses in the components do not exceed those permitted by BS 2573.

3.2.2 LOADING

3.2.2.1 For the purposes of calculating the design loading, the average passenger shall be considered as having a mass of 77 kg.

3.2.2.2 The designer shall specify the maximum weight that may be carried on any one carrier in the uphill and downhill directions, the maximum number of passengers that the passenger ropeway can safely carry, and the maximum speed at which the passenger ropeway can safely operate.

3.2.2.3 All structures are to comply with the wind, snow and seismic loading requirements of NZS 4203.

3.2.3 PATH OF ROPEWAY

3.2.3.1 Passenger ropeways do not always follow a straight line in plan between terminals. Proposals involving lines with angles shall be given special consideration.

3.2.4 DESIGN VERIFICATION

3.2.4.1 Drawings for aerial ropeways are to be submitted to a recognised design verifier, prior to fabrication, construction, inspection, testing and certification, pursuant to the PECPR Regulations under the Health and Safety in Employment Act 1992 (see Part 2). This may be an accredited inspection body, or, under a recognised ISO 9001 designer's quality management system, in-house. These drawings will include the following:

(a) profiles of installation, specification particulars sheet, and rope specification details;

(b) dimensioned drawings of main structural members sufficient to show construction of towers, top and bottom terminals, bullwheels, sheave batteries and tensioning arrangements; and

(c) calculations (including computer printout) for stress analysis of critical parts of the structure, showing magnitude and direction of rope forces on all towers and top and bottom terminal structures supporting the ropeway. The various individual loading conditions and factors from which the rope forces are derived are to be identified.

Note: Design checks carried out by recognised design verifiers are of structures and equipment supporting the loads imposed by the ropeway system, e.g. terminal station sheaves and support structures, towers, sheave batteries, and are in terms of factors of safety of this Code of Practice and BS 2573, as appropriate.

3.2.4.2 For other structures or buildings housing terminal facilities, see Clause 3.20. Design verification checks do not include these items.

3.2.4.3 For a designer's quality management system to be recognised for the purpose of inhouse design verification under Clause 3.2.4.1 of this Code of Practice, the following documentation needs to be submitted to the Authority:

(a) A copy of the current Quality Management System certificate, including the scope statement.

(b) An "up-to-date" extract from the Quality Manual showing the company's organisational structure and the reporting paths of their QA/QM departments involved with equipment design verification.

(c) Appropriate means of assurance (copies of parts of procedures, etc.) that the seismic design requirements of New Zealand are taken into account within the equipment "design input".

(d) Names and brief details of the qualifications, skills and experience of managers and staff involved with design verification.

3.2.5 MATERIALS

3.2.5.1 Choice, quality testing, and use of materials for aerial ropeways shall be in accordance with the appropriate British Standards, noting that for load-bearing parts, including towers, and drive and return terminal structures, the materials are to comply with the low temperature impact properties of BS 4360 for the minimum operating ambient site temperature.

3.2.5.2 BS 4360 materials of grades for which the standard does not specify low temperature impact properties, will be accepted provided:

(a) tests are carried out in accordance with BS 131; and

(b) certificates of test are supplied to, and approved by, the equipment inspector, showing the material has an average impact property of at least 27J at the temperature representing the minimum operating ambient site temperature.

Note: The minimum operating ambient site temperature is the lowest temperature, whilst the ropeway is in operation, recorded at the site, or at the nearest appropriate metrological station, corrected for altitude.

3.2.5.3 If a designer or manufacturer of equipment wishes to use materials not covered by this Code of Practice, or materials that may be developed in the future, then full information of such materials shall be submitted to the design verifier. The design, details, materials and construction features shall provide safety factors at least equivalent to those specified in this Code of Practice.

3.2.6 FUTURE DEVELOPMENTS

3.2..6.1 Any new configuration or design of passenger ropeway which falls within the intent of this Code as defined in Part 1, yet defies precise classification within the categories described, shall be evaluated by the design verifier on the basis of an interpretation of this Code, pending sufficient use to warrant its specific coverage by a separate chapter in a future issue of this Code of Practice.

3.3 COMMISSIONING INSPECTION AND TESTING

3.3.1 ACCEPTANCE

3.3.1.1 Before a passenger ropeway is placed in operation, it shall be subjected to commissioning inspection and testing, as outlined in Clause 2.7.

3.3.1.2 Thorough tests shall be made under loadings which provide the most unfavourable conditions, where practicable. This shall include an operational check of motive power, acceleration, deceleration, all brakes, all push-button stops, all automatic stops and limit switches, and all communication devices. Prior to acceptance tests the passenger ropeway shall be run for a full day, and checked for overheating of moving parts, excessive vibration or deflection, free movement of counterweights, etc.

Note: In the carrying out of acceptance tests, it must be recognised that loading of rope tows other than with skiers is impossible, and on other surface lifts it is at least impracticable, if not impossible.

3.3.2 INSPECTION AND TESTING OF AERIAL ROPEWAYS.

3.3.2.1 The inspection and testing of an aerial ropeway shall include the following:

(a) visual examination of towers and machinery, for workmanship and correct installation in accordance with plans and specifications;

(b) the operation of the ropeway for a full day continuously to check for overheating of moving parts, excessive vibration or deflection of mechanical or structural components, free movement of tensioning system, etc.;

(c) checking of operational controls for correct functioning, including manually operated stop switches, automatic stop switches, limit switches, deropement switches, brakes, anti-rollback devices, overspeed governor, under main and auxiliary power;

(d) thorough operating tests under full load and any partial loading which may provide the most adverse operating

conditions in terms of load;

(e) overload tests on service brake, emergency brake and drive equipment simulating 10% overload conditions;

(f) tests to establish the ability of the prime mover to start the ropeway under the most unfavourable loading conditions in main and auxiliary power;

(g) check of all communication and alarm devices;

(h) unless previous tests are documented, chairs and cabins, together with hangers, shall be tested as a unit with weight equal to twice their passenger-carrying capacity. While the weights are in place, all attachments to the chairs or cabins under tension shall be proven safe. The average mass of a passenger shall be taken as per Clause 3.2.2.1;

(i) any other tests which the inspection body may consider necessary, or the manufacturer recommends; and

(j) record of all tests and inspections shall be maintained.

3.3.2.2 The manufacturer or the designer shall submit a complete schedule of all proposed acceptance tests to the design verifier before such tests are performed. This schedule shall then be forwarded to the equipment inspector attending the commissioning.

3.3.2.3 In the event of disputes over testing requirements, reference shall be made to OSH.

3.3.3 INSPECTION AND TESTING OF SURFACE ROPEWAYS

3.3.3.1 The inspection and testing of a surface ropeway shall include the aspects covered by Clause 3.3.1.2. as appropriate, together with any other tests considered necessary by the competent person or recommended by the manufacturer.

3.3.3.2 The manufacturer or the designer shall submit a complete schedule of all proposed acceptance tests to the assembly contractor before such tests are performed.

3.3.4 SUGGESTED TEST PROCEDURE

3.3.4.1 The following test procedures are suggested provided they are in accordance with the instructions and recommendations for testing of the particular installation, given by the manufacturer, and meet the requirements of the equipment inspector or competent person, as applicable for the type of ropeway concerned.

(a) Loading test

Load all uphill carriers between the bottom loading ramp and the top unloading ramp. Some carriers may need to be left empty to facilitate this test. Use extra weight to compensate for

the empty chairs. Final calculation and arrangement of test load combinations are to be carried out on site with the approval of the equipment inspector.

Note: Normal design load is defined in Clause 3.2.2.1.

(b) Main drive

1. Set to normal operating condition.

2. Run lift up to design speed for measuring stopping distances.

3. From one of the drive controls make:

(a) motor stop;

(b) service stop (service brake closes);

(c) emergency stop (service and emergency brake closes).

4. Where applicable, hold service brake open and make a service stop when lift is running. Let lift coast to a halt without brakes, which applies maximum load onto high-speed shaft rollback.

(c) Rollback

1. Disengage anti-rollback system.

2. Open service brake manually to allow lift to rollback until the bullwheel rollback switch releases the *emergency brake*.

3. Reset and tie back bullwheel rollback switch.

(d) Brake performance:

Let lift roll back until the first loaded carrier is at the bottom bullwheel.

Service brake:

While lift rolls back, apply service brake and observe the brake performance.

Emergency brake:

While lift rolls back, apply emergency brake and observe the brake performance. Emergency brake only closes as service brake is held open manually.

The rollback speed to observe the brake performance should be at least one third of the design speed, if achievable.

(e) Auxiliary drive

1. Drive lift to design speed.

2. From one of the drive controls make:

- service stop (service brake closes);

- emergency stop (service and emergency brake closes and engine shuts down.)

(f) Emergency drive

Connect drive and drive lift to maximum speed to show that it can unload a loaded lift.

(g) Unload carriers:

1. Check performance of:
   - tower derail switches;
   - communications;
   - controls at each station.
2. Carrier spacing, intervals, cable speed.
3. Inspection ride.
4. Continuously operate empty lift for two hours.

(h) Demonstration of evacuation system.

See Clause 4.5. for evacuation procedures.

3.4 OPERATIONAL AND MAINTENANCE REQUIREMENTS

3.4.1 GENERAL

3..4.1.1 It is imperative that controllers' management, responsible for operating and maintenance of passenger ropeways, are familiar with the applicable provisions of this Code of Practice.

3.4.1.2 The aerial ropeway shall be operated in accordance with the conditions specified and any nominated limits shall not be exceeded.

3.4.1.2 For aerial ropeways, a display shall be placed in a conspicuous location for the operator at the main drive terminal stating the approved limiting operating conditions as follows:

(a) for fixed-grip chair lifts: the total number of chairs (single/ double etc.), the minimum spacing between chairs, the maximum relative speed for foot passengers and for skiers, which shall not exceed 1.8 m/s and 3.1 m/s respectively, and the operational limiting wind velocities;

(b) for fixed-grip gondola lifts: the total number of cars, the maximum number of persons the gondola cars are approved to carry, the maximum line speed, and the operational limiting wind velocities;

(c) for detachable chair and gondola lifts: the total number of chairs (single/double etc.) or gondola cars, the total number of persons the gondola cars are approved to carry, the minimum spacing between chairs or cars, the maximum line speed and the operational limiting wind velocities; and

(d) for reversible ropeways: the total number of cabins, the maximum loading capacity per cabin stated in total number of persons and maximum weight in kilograms, the maximum line speed, and the operational limiting wind velocities.

Note: Where applicable, the nominated limits applying to lifts approved for downhill loading are to be included.

3.4.1.4 Surface ropeways shall not be operated beyond their design capacity or speed.

3.4.2 PERSONNEL

3.4.2.1 All facilities covered by this Code of Practice shall be operated by personnel instructed in the use of the facility, and the management shall be responsible for their training and supervision. In addition to the requirements of Clause 3.4.3, reference shall be made to current industrial operating regimes and requirements regarding total number of personnel, maximum number of hours worked, break availability etc., in relation to conditions at a particular site.

3.4.2.2 Every controller of a passenger ropeway shall ensure that every person who carries out any associated activity is a competent person. Personnel shall comply with the operating and safety rules at a particular site.

3.4.2.3 A sufficient number of personnel shall be trained and familiar with the emergency procedures, and shall be on site or readily available within the locality to deal with any emergency at all times that the ropeway is in operation.

3.4.3 MINIMUM OPERATING PERSONNEL

3.4.3.1 Chair lifts

3.4.3.1.1 There shall be a minimum of one attendant at each station when the station is being used for loading and/or unloading. More may be required to satisfy the fundamental requirements laid down in Clauses 3.3.3.1.2 and 3.3.3.1.3.

3.4.3.1.2 One attendant shall be in charge of the operating crew.

3.4.3.1.3 Attendants shall be stationed at intermediate disembarking points between terminals at all times that the ropeway is in operation. An easily accessible and approved stop device shall be provided at each of such disembarking points.

3.4.3.2 Detachable chair lifts and gondola lifts

3.4.3.2.1 The number of attendants required for detachable chair lifts and gondola lifts shall be the same as for chair lifts in addition to whatever attendants may be required to handle the carriers in the stations.

3.4.3.3 T-Bars, platter lifts and rope tows

3.4.3.3.1 On T-Bars, platter lifts and rope tows, adequate supervision shall be provided.

3.4.3.4 Reversible passenger ropeways

3.4.3.4.1 Each cabin designed to carry more than 15 passengers shall carry an attendant while passengers are being carried.

3.4.4 CONTROL AND SAFETY OF PASSENGERS

3.4.4.1 Control of passengers

3.4.4.1.1 For every ropeway, there shall be a definite plan for marshalling passengers for safe loading and unloading.

3.4.4.1.2 The ropeway manager shall establish and draw up any special instructions necessary to be observed by staff to ensure the safety of children riding the ropeway, and shall ensure that such instructions are implemented and enforced by the staff.

3.4.4.1.3 Loading attendants are to ensure that passengers do not embark on chairs, or in cars or cabins, with equipment which will in any way be a hazard to the safety of themselves or other passengers.

3.4.4.2 Signs

3.4.4.2.1 When relevant to a particular type of ropeway, appropriate signs shall be posted where they may be easily read by all persons using the ropeway. Some commonly used wording suggestions are given in Appendix A. The ropeway management should ensure that adequate provisions, such as pictograms, are made for passengers, who do not read or speak English, to be able to use the ropeway correctly and safely.

3..4.4.2.2 Any additional signs which may be required to ensure the safe operation of the ropeway shall be posted to the satisfaction of a competent person.

3.4.4.3 Markers

3.4.4.3.1 Where guyed towers are used and guys meet the ground within ski-runs, the guys shall be marked for visibility, preferably with boards painted with black and yellow stripes.

3.4.4.4 First aid

3.4.4.4.1 There shall be ready access to first-aid supplies and equipment, and provision shall be made to render first aid in the event of persons being injured on the ropeway. A minimum standard, proposed by OSH, shall be satisfied.

3.4.5 CONTROL OF LIFT OPERATION

3.4.5.1 Starting of ropeways

3.4.5.1.1 Only competent persons authorised by the ropeway management shall start a passenger ropeway.

3.4.5.2 Daily inspections

3.4.5.2.1 Prior to transporting passengers, a daily inspection shall be conducted by a competent person. As a minimum, the inspection shall consist of the following:

(a) inspect visually each terminal, station, and the entire length of the ropeway, lift or tow, including grips, hangers and carriers;

(b) note the position of tension carriages and counterweights, and ensure that the tensioning system is free to move in both directions;

(c) test the operation of all manual and automatic switches in terminals, stations, and loading and unloading areas, as per the manufacturer's specifications;

(d) test the operation of main drive and all braking systems;

(e) test the operation of communication systems;

(f) ropeways and lifts having emergency power units shall have the emergency engine(s) checked during this inspection and operated at least once weekly; and

(g) note the general condition of the hauling rope, including splices.

Note: These daily inspections do not come under the scope of "equipment inspection" for the purpose of issuing a certificate of inspection, and therefore they are excluded from the term "specified activity", as provided for in the PECPR Regulations 1998.

3.4.5.2.2 An inspection record, similar to one in Appendix 2, shall be logged, upon each daily inspection. All abnormalities discovered during the daily inspection shall be recorded, and appropriate action taken. (See Appendix 2).

3.4.5.3 Loading and unloading

3.4.5.3.1 Procedures shall be adopted to eliminate the possibility of collision between passengers and travelling carriers.

3.4.5.4 Stopping devices

3.4.5.4.1 All stop buttons shall be clearly marked.

3.4.5.4.1 Every safety gate shall be clearly marked.

3.4.5.5 Restarting

3.4.5.5.1 After any stop of a ropeway, the operator shall determine the

cause of the stop and not restart until clearance has been obtained from all attended stations (and reversible ropeway cabins).

3.4.5.6 Termination of daily operations

3.4.5.6.1 Procedures shall be established for terminating daily operations to ensure that passengers shall not be left on the ropeway after it has been shut down.

3.4.5.6.2 The permanent bound log book shall be a record of the daily operation of the lift and it shall include, but not be limited to, the following:

(a) names and positions of operating personnel;

(b) weather conditions: snow, temperature, wind and visibility;

(c) operating hours;

(d) time, duration, and cause of abnormal interruptions; and

(e) unusual occurrences involving passengers and equipment.

3.4.6 COMMUNICATIONS

3.4.6.1 Chair lifts and gondola lifts

(a) Both an audible signal system and a two-way voice communication system shall be maintained between the drive station and all loading and unloading stations. If only one system fails to operate, the lift may continue to run, provided the remote attendant stop system is fully operational. In the event of the failure of both communication systems, the lift shall not be operated.

(b) In the latter event, provided that adequate special precautions are taken, the lift may be run for the purpose of evacuation only.

3.4.6.2 Reversible ropeways

3.4.6.2.1 The terminals shall be linked by telephone, and one of the terminals shall be connected with public communication at all times during operation.

3.4.6.2.1 The cabin attendant shall be able to communicate with the driving terminal and the other cabin attendant by means of telephone or radio. An alternative system of communication shall be provided for emergency use.

3.4.7 LIGHTING

3.4.7.1 Adequate lighting shall be maintained when lifts are used as follows:

(a) at loading and unloading areas on all lifts;

(b) on the sections of the surface lifts' tow paths being used; and

(c) in machine rooms.

3.4.8 ENGINE FUEL SUPPLY

3.4.8.1 For those ropeways having internal combustion engines, the fuel supply shall be checked regularly as appropriate for the fuel tank size and the usage. For primary power units, there shall be sufficient fuel to conduct the anticipated period of operation, and to deal with all emergencies, without refuelling. For those installations having emergency internal combustion engines, the fuel supply shall be adequate to unload the ropeway. Power units shall be shut down during the refuelling.

3.4.8.2 Stopping of power units for refuelling need not apply in installations where the engine daily supply fuel tank filling point and the vent are not in the same compartment as the engine.

Note: All tank vents for highly flammable fuels are to be provided with flame and weather protection devices at the discharge opening. The discharge opening is to be located as remote as possible from the engine and preferably outside the engine compartment.

3.4.9 OPERATING UNDER WIND CONDITIONS

3.4.9.1 When wind conditions are sufficiently severe to make operation hazardous to passengers or equipment, based on operational experience on a particular site, the ropeway shall be shut down.

3.4.9.2 Aerial ropeways shall be closed down when the wind velocity reaches the design limit values, as agreed by the design verifier, the lift manufacturer and the lift controller, for the particular operating conditions and particular lift installation. For this purpose, suitable wind gauges shall be installed at appropriate locations to ascertain wind velocity.

3.4.10 PROCEDURES FOR UNUSUAL OCCURRENCES

3.4.10.1 The management shall prepare, and put in the control booth of each lift, procedures to be followed in case of unusual occurrences, such as:

(a) roll back;

(b) overspeed;

(c) counterweight limits reached;

(d) tower deropement switch tripped;

(e) communication system failure;

(f) fire; and

(g) earthquake.

3.4.11 MAINTENANCE

3.4.11.1 General

3.4.11.1.1 All equipment covered by this Code of Practice shall be maintained in a safe condition.

3.4.11.1.2 A systematic routine maintenance and inspection schedule, based on a maintenance and inspection plan, which shall be specified by the designer, shall be developed and set down in writing by the manufacturer of the passenger ropeway. See also Clauses 2.2.4 and 2.4.2.3.

3.4.11.1.3 The schedule shall include the specification of lubricant and frequency of lubrication of each element involving moving parts. It shall stipulate that parts showing excessive wear shall be replaced immediately. Condemning limits or tolerances shall be defined. It shall include a schedule for checking and tightening all bolts, especially on rope attachments.

3.4.11.1.4 Where appropriate for any passenger ropeway, suitable records of the rates of deterioration (such as corrosion, erosion, etc.) shall be maintained.

3.4.11.1.5 Any spare part fitted to, or any consumable product used in, any passenger ropeway shall keep the passenger ropeway to the effective standard intended by its designer and manufacturer.

3.4.11.1.6 Sufficient snow clearance shall be maintained below chairs, gondolas and ropeways throughout the traverse of every ropeway, particularly at loading and unloading points (see Clauses 4.13.1.10. and 8.3). When clearance is less than that stipulated, skiers shall be kept out of the path of the ropeway, and notices shall be posted to this effect.

3.4.11.1.7 Good housekeeping shall be maintained at all times.

3.4.11.2 Grips

3.4.11.2.1 For maintenance and inspection of rope grips, see Clause 4.17.

3.4.11.3 Adjustment of counterweight

3.4.11.3.1 The weight of a counterweight shall not be altered without approval from the manufacturer and the inspection body.

3.4.11.4 Maintenance safety procedures

3.4.11.4.1 Management shall prepare, and put in each lift control booth, a list of safety procedures to be adopted during lift maintenance. These precautions shall include, but not necessarily be limited to, main power lock-out and safe rigging.

3.4.11.5 Maintenance records

3.4.11.5.1 In conjunction with the inspection and maintenance schedules (see Clauses 2.4.2.3 and 3.4.5.2), a record of maintenance carried out on a daily basis shall be established, and shall include, but

not be limited to, the following:

(a) action taken to correct abnormalities reported on daily inspections;

(b) work done in accordance with preventive maintenance schedules;

(c) details of equipment breakdowns, repairs and replacements to correct the same;

(d) non-destructive testing of ropes, structural and mechanical components;

(e) replacement of expendable items, e.g. bearings and liners;

(f) counterweight position at various loads and temperatures; and

(g) operating data, e.g. voltage, amperage, gearbox temperature.

3.5 LOCATION

3.5.1 In selecting the location and alignment of the ropeway, the following shall be taken into consideration, and necessary approvals shall be obtained to meet the requirements of the appropriate authorities:

(a) transmission lines adjacent to, or crossing, the line of the passenger ropeway, referred to below as "the line";

(b) railways adjacent to, or crossing, the line;

(c) highways adjacent to, or crossing, the line;

(d) structures adjacent to, or near, or crossing, the line;

(e) rock and earth slides, cave-ins, or washouts which are on, or adjacent to, the line;

(f) snow creep on the line;

(g) avalanches or lahars on or across the line;

(h) wind action with respect to wind loadings;

(i) icing action with respect to ice loading;

(j) ski slopes and trails with respect to overhead clearance;

(k) rivers and gullies which cross the line;

(l) buried installations, including pipelines which cross the line;

(m) high towers or cables, for compliance with requirements of the Civil Aviation Authority; and

(n) existing ropeways adjacent to, or crossing, the line.

3.5.2 Location with respect to such conditions shall be determined with full and appropriate consultation with all interested parties. Generally, the passenger ropeway shall not be in the immediate

proximity of, or cross over or under, Items (a), (b), (c) or (d) of Clause 3.5.1.

3.6 WIDTH OF CLEARING

3.6.1 Where the passenger ropeway runs through vegetation, the clearing shall be wide enough to prevent interference, or potential interference, with the ropeway by the adjacent vegetation. Such clearings shall have any necessary protection against washouts which might endanger the ropeway or its foundations. Dead trees shall be cleared out far enough back from the line to avoid their falling on the passenger ropeway. Approval of the land managing authority may be required.

3.7 ELECTRICAL PROTECTION

3.7.1 BREAKAGE OF POWER LINE

3.7.1.1 All overhead electrical power transmission wiring shall be so protected that, in case of collapse or breakage of the power line, it will not come into contact with chairs, cars, cables, or passengers.

3.7.2 COMPONENTRY

3.7.2.1 Electrical components shall be of appropriate design for the specific duties intended.

3.7.3 RESTRICTED ACCESS

3.7.3.1 All transformer stations and other electrical equipment shall be protected so as to prevent unauthorised persons from entering the area or coming into contact with any hazardous portion of the equipment or wiring, All power equipment shall be protected against overloads by proper circuit breakers or fuses.

3.7.4 LEGISLATION

3.7.4.1 All installations must comply with current electricity legislation and associated electrical codes of practice.

3.7.5 POLYPHASE MOTORS

3.7.5.1 Electric drives on all lifts except rope tows using a polyphase motor shall be provided with a means which will prevent the lift running if:

(a) The phase rotation is in the wrong direction; or

(b) There is a failure in any phase.

3.8 CONTROLS

3.8.1 GENERAL

3.8.1.1 A manually reset emergency stopping device shall be located at each designated loading and unloading area. The device, when activated, shall apply the emergency brake. See also Clause 4.9.1.1.

3.8.1.2 The emergency stop shall take priority over all other control stops or commands.

3.8.1.3 All emergency stop switches shall be conspicuously marked and, where practicable, shall have red operating handles or push buttons.

3.8.1.4 Loss of power to, or earthing of, any control or safety circuit shall cause the ropeway to stop. All electrical stop circuits shall be normally energised during operation so that, in case of power failure, the system will stop.

3.8.1.5 Consideration shall be made to make controls fail-safe in the case of freezing.

3.8.2 SOLID STATE CONTROLS

3.8.2.1 Protection for electronic controls

3.8.2.1.1 The design of all electronic controls and drives shall consider sensitivity to electrical noise and electrical emissions, such as noise spikes from power lines and lightning, radio transmitters, thyristors (SCR), solenoid, or relay noise at levels and frequencies that could initiate loss of control.

3.8.2.2 Microprocessors

3.8.2.2.1 Programmable logic controllers (PLCs) may be used provided only one main safety function shall be supervised by one PLC unless the PLC is equipped with redundant processors and the failure of either processor will cause a stop.

3.8.2.3 PLC parity error or PLC power supply failure shall cause a stop.

3.8.2.4 Several minor alarms or safety functions may be supervised by one PLC without redundant processors.

3.8.2.5 The manufacturer shall supply instructions to check the operation of any PLC system.

3.8.2.6 All emergency stop switches shall be hard-wired, bypassing any PLC.

Note: The emergency stop system may also be operated by a PLC.

3.8.2.7 The PLC system shall be adjusted only by persons authorised to do so by the lift manufacturer.

3.9 LIGHTNING PROTECTION AND EARTHING

3.9.1 All passenger ropeways shall be protected against lightning and shall be effectively earthed so as to satisfy all applicable regulations.

3.10 FIRE PROTECTION

3.10.1 Fire protection of machinery enclosures shall be maintained. Fire fighting devices shall be installed in accordance with fire protection regulations and they shall be inspected regularly.

3.11 ANCHOR CONNECTIONS

3.11.1 Anchor connections shall at all times be exposed above natural ground level. Any part of the anchorage below ground shall be protected against corrosion.

3.12 MACHINE ROOM

3.12.1 GUARDING

3.12.1.1 All driving units shall be suitably guarded.

3.12.2 GENERAL CONDITION

3.12.2.1 Where a machine room is provided, it shall be properly ventilated, adequately lit, protected against lightning and static electricity, and, where necessary, windows for view of operation shall be provided. Such machine rooms shall comply with Clause 3.12.7.

3.12.3 ACCESS

3.12.3.1 Where a passageway is provided between machines or between machinery and walls, there shall be a minimum 450 mm distance from the machinery.

3.12.4 FIRE EXTINGUISHERS AND EVACUATION

3.12.4.1 Machine rooms shall be equipped with approved fire

extinguishers. An exit shall be near enough to the operator's station to permit rapid evacuation in case a flash fire occurs.

3.12.5 NO UNAUTHORISED ACCESS

3.12.5.1 Unauthorised persons shall not be permitted in the machine room and signs shall be posted accordingly, in suitable positions. All openings over 250 mm square shall be provided with suitable doors with locks.

3.12.5.2 All main controls shall be lockable when not operating, since remotes can be left unlocked.

3.12.6 PROTECTION

3.12.6.1 Cabinet-type power units and machine rooms shall be protected.

3.12.7 FIRE-RESISTANT CONSTRUCTION

3.12.7.1 Upper and lower terminal buildings of aerial passenger ropeways shall be constructed of noncombustible materials, or shall have a fire-resistance rating.* Where evacuation of the ropeway will take longer than 3/4 hour, the fire-resistance rating shall be increased accordingly. When terminal buildings combine passenger handling with any other activity which could increase fire hazard, fire separations shall be provided and an appropriate fire-resistance rating shall be used. In particular, kitchens, workshops, and garages require a minimum 2-hour separation.

* (See the New Zealand Building Act 1991).

3.13 EXPOSED EQUIPMENT

3.13.1 Where no machine room is provided, all equipment shall be of a suitable type for use when exposed to the external weather conditions.

3.13.2 All safety devices, such as backstops, brakes, relays, shall be protected from exposure to the weather conditions, unless specifically designed for exposed operation.

3.14 PROTECTION AGAINST EXPOSED EQUIPMENT'S MOVING PARTS

3.14.1 Moving machine parts which normally may be within reach of personnel shall be suitably guarded.

3.15 PRIME MOVERS

3.15.1 All prime movers shall have the capacity to handle the maximum design loading conditions.

3.16 INTERNAL COMBUSTION ENGINES

3.16.1 EXHAUSTS

3.16.1.1 Internal combustion engine exhausts shall be discharged safely into the outside atmosphere.

3.16.1.2 Engine exhaust pipes shall be suitably lagged in areas adjacent to walkways and shall not pass within 50 mm of any wooden member or other flammable material.

3.16.2 VENTILATION

3.16.2.1 When an internal combustion engine is used as a prime mover, the machine room shall be adequately ventilated.

3.16.3 FUEL STORAGE

3.16.3.1 Flammable liquids or gases shall be stored and handled in accordance with the New Zealand Hazardous Substances and New Organisms Act 1996 (HSNO Act).

3.17 SPEED REDUCERS

3.17.1 All speed reducers and gears shall comply with accepted standard good practices and shall have capacity for starting the ropeway under the maximum design load conditions.

3.18 BEARINGS, COUPLINGS AND SHAFTS

3.18.1 All bearings, couplings and shafts shall be designed and manufactured in accordance with accepted standard good practices.

3.18.2 Provision shall be made for proper adjustment and lubrication of all bearings and couplings, where required by maintenance and inspection schedule.

3.18.3 Bearings and couplings shall be selected on the basis of the manufacturer's published recommendations for the particular use.

3.19 CLUTCHES

3.19.1 Any clutch device used between the prime mover and the drive sheave shall meet the requirements of Clause 3.18 for bearings and couplings.

3.20 FOUNDATIONS

3.20.1 Foundations for anchorage, buildings and tower structures shall be designed in accordance with NZ Building Code, NZS 4203, NZS 3404, and NZS 3101 as applicable.

3.20.2 Bottoms of foundations shall be below the normal frost-line unless they rest on solid rock, and the tops shall be above finish grade.

3.20.3 The foundation shall be designed to resist overturning or sliding with a factor of safety of 2.0 with respect to dead load and live load, and 1.5 with respect to these loadings and wind acting simultaneously. Under the action of all loads, pressure on the underlying earth shall not exceed allowable values for the subsurface material encountered.

3.20.4 Foundations on rock shall be firmly anchored to the rock in accordance with the requirements of the NZ Building Code and NZS 4203.

3.20.5 All portable tows shall be supported and anchored in a manner capable of sustaining the design loads without shifting or settling to the detriment of the tow operation.

3.20.6 A certificate by a practising Registered Engineer is required, certifying that the foundations have been designed and constructed in accordance with the NZ Building Code, NZS 4203, NZS 3404, and NZS 3101 as applicable.

3.21 TENSIONING SYSTEMS

3.21.1 Counterweights or other suitable automatic tensioning systems shall be provided for all hauling and track ropes, except that tensioning systems which are not automatic are permitted on rope tows. All automatic tensioning systems, including those used for track ropes, shall comply with the following:

(a) where counterweights are used;

(i) they shall be arranged to move freely up and down;

(ii) enclosures for counterweights shall be provided where necessary to prevent snow and ice from accumulating under and around the counterweights and interfering with their free travel. Where snow enclosures are not provided, adequate protection shall be provided to prevent unauthorised persons from coming into contact with or

passing under counterweights; and

(iii) they shall be in full suspension at all times of normal operation;

(b) carriages and tensioning systems shall have sufficient travel to take care of all normal operating changes in loading and temperature;

(c) for aerial ropeways, when a tensioning system reaches 150 mm from either end of the travel, it shall trip a limit switch which will interrupt the safety circuit; and

(d) interruption of the safety circuit shall initiate a stop.

3.21.2 Where counterweights or tensioning devices are so arranged that failure of the trolley wheel or axle, or derailment of the trolley, would permit the device to fall, suitable provisions are to be made, such as derailment plates on the trolley way, which will prevent the trolley way from dropping more than 25 mm.

3.21.3 Where hydraulic tensioning devices are used, the system shall incorporate a low-pressure switch and high-pressure relief valve. The low-pressure switch will interrupt the safety circuits. Their settings shall be set so as to reduce pressure when the high-pressure setting reaches 115% of the design load and the low-pressure setting reaches 85% of the design load.

3.22 TENSIONING SYSTEM ADJUSTMENT

3.22.1 Winches and other devices which are used for tensioning and remain a permanent part of the system shall have a factor of safety against their ultimate capacity of 6.0 for rope counterweight systems, and a safety factor of 4.0 for hydraulic systems. 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 which will keep the tensioning system intact in the event of failure or release of the winch.

3.23 BUILDINGS AND STRUCTURES

3.23.1 Buildings and structures which do not support loads arising from the ropeway system shall be designed and constructed to the New Zealand Building Code, with snow, wind and seismic loadings as provided for in NZS 4203 and local body authority fire regulations for fire rating, protection and safety provisions. For other structures and equipment which do support loads arising from the ropeway, see Clause 3.2.

3.23.2 Buildings and structures located in snow or ground creep areas shall be designed for these loads or be protected by snow breakers or shears.

3.24 WIRE ROPES

3.24.1 MANUFACTURE

3.24.1.1 All ropes shall be manufactured in accordance with the best commercial practice. Ropes shall be manufactured in accordance with recognised national standards for ropes applicable to the intended use.

Rope specifically manufactured for use on a particular ropeway, which is outside the scope of the national standard, will be accepted provided that:

(a) a rope certificate is supplied giving full particulars of the rope specification;

(b) the safety factor requirements of this Code of Practice are met;

(c) the rope remains satisfactory in service; and

(d) any replacement rope is to the same specification as the original rope.

3.24.1.2 The rope manufacturer shall supply a certificate giving diameter, length, grade of rope, construction, type of core, lubrication, minimum guaranteed breaking strength, and the actual breaking strength as determined by test to destruction of a length from each rope by an approved testing agency. The manner and location of the break shall be stated.

3.24.1.3 Welding points in the individual wires shall be spaced apart at least 6 times the length of the lay of the rope. The number of welds in a length of 500 m of rope shall not exceed the number of wires in the rope.

3.24.1.4 All ropes shall be properly lubricated during manufacture and while in operation. The lubricants used shall be suitable for the type of service and shall not cause any corrosive action in service.

3.24.2 INSTALLATION

3.24.2.1 During installation, ropes shall not be allowed to bend over sharp edges, or be pulled over rock. If necessary, temporary trestles or other protection shall be provided to prevent damage to the ropes. Locked coil ropes shall not be allowed to rotate during installation.

Note: To provide a reference standard for inspection of the ropes before operation of the ropeway is started, it is recommended that the rope be examined by an electromagnetic testing apparatus or some similar non-destructive testing system which will provide a record of defects in the wires.

3.24.3 SPLICES

3.24.3.1 Splicing of ropes, where permitted by this code, shall be carried out only by competent persons.

3.24.3.2 Splices shall be normally what is known in the trade as "long splices". The length of each splice shall be not less than 1200 times the rope diameter, and the distance between the adjacent ends of any two neighbouring splices shall be not less than 1200 times the rope diameter. The splicing shall be carried out with the utmost care so that variations in rope diameter, especially at the tucking points, are kept to a minimum. The minimum length of strand to be run in as core on either side of a tuck point shall be 50 times the rope diameter, and a fibre core or a core of synthetic or other acceptable material shall be left between adjacent tuck ends.

3.24.4 NON-DESTRUCTIVE TESTING

3.24.4.1 Following the installation of hauling or track ropes on new or existing aerial ropeway lifts, appropriate non-destructive tests shall be performed within a 12-month period by competent personnel.

3.24.4.2 At intervals thereafter, not exceeding 5000 operating hours according to an operating hour meter or 24 months, whichever occurs first, non-destructive tests shall be performed. When the condition of the rope so warrants, or the rope shows signs of deterioration, more frequent non-destructive tests shall be carried out.

3.24.4.3 A copy of the interpretative report based on the foregoing tests shall be forwarded to an equipment inspector in the case of aerial ropeways, and to a competent person in the case of surface ropeways, for retention.

3.24.4.4 Unusual or special loading conditions shall be specified; for aerial ropeways the design verifier may require specific calculations to be submitted or tests to be carried out.

3.24.5 MAINTENANCE AND INSPECTION CRITERIA

3.24.5.1 Lubrication, inspection and replacement of wire ropes shall be incorporated in the maintenance and inspection schedule, as per Clause 2.13. 3.

3.24.5.2 Lubrication

3.24.5.2.1 All wire rope shall be lubricated as follows:

(a) lubrication shall be carried out in accordance with the recommendations of the manufacturer; and

(b) lubrication of ropes shall be carried out on a definite

schedule in order to prevent deterioration of the ropes due to corrosion or internal friction.

3.24.5.3 Inspection of ropes

3.24.5.3.1 Close visual inspection

At established intervals not exceeding 1 year or 2000 hours of operation, whichever comes first, or immediately after any accident which may affect the integrity of the wire rope, the whole length of the rope shall be examined, by a competent person, for conditions such as broken wires, worn spots, pitting, lubrication. Where applicable, the rope shall also be non-destructively tested in accordance with Clause 3.24.4.

3.24.5.3.2 Track ropes

For track ropes, the end connections and areas near saddles shall be inspected, by a competent person, at the specified intervals of time for broken wires and worn spots. At the specified intervals the entire rope shall be inspected. These intervals shall be not longer than those recommended by the ropeway designer and manufacturer.

3.24.5.4 Replacement of ropes

3.24.5.4.1 In deciding when to discard and replace ropes, the following factors shall be taken into account:

(a) the general condition of the rope with particular regard to any distortion which may be present, as well as any loosening of the wire or the strands;

(b) the amount of wear showing on the surface of the rope, which shall not exceed one third of the original diameter of the outside individual wire;

(c) the degree of corrosion present in the rope or the number of broken wires in the rope;

(d) the condition of splices in the rope;

(e) inspection reports of the rope and its predecessors, including records of non-destructive tests and tests to destruction;

(f) extension of a rope lay, averaged from a minimum of 10 lays, measured at three equidistant locations over the whole rope;

(g) reduction of rope diameter;

(h) the amount of rope stretch as recorded when the counterweight position is changed; and

(i) exposure to excessive vibration.

3.24.5.4.2 If reduction in metallic cross-sectional area, due to broken wires, wear, corrosion, wire slackening, or other damage, exceeds those given in Table 3.1, the rope shall be replaced or repaired

TABLE 3.1: WIRE ROPES REJECTION CRITERIA

(d = nominal wire rope diameter)

Track Ropes:			
1/2 or full lock	10% in 200 d	5% in 30 d	
Stranded or Hercules	15% in 200 d	8% in 30 d	
Hauling Ropes:			
All types	25% in 500 d	8% in 40 d	6% in 6 d
Tension Ropes:			
Regular lay	12% in 40 d	6% in 6 d	
Lang lay	8% in 40 d	4% in 6 d	

No rope shall remain in service without repair if the number of broken wires in one lay length of one strand of a stranded rope exceeds the following:

6 x 7 Classification	2 broken wires in one strand
6 x 19 Classification	4 broken wires in one strand
6 x 37 Classification	6 broken wires in one strand

to the satisfaction of the equipment inspector, and ropeway designer or manufacturer.

3.24.5.4.3 When the reduction in strength, determined in Clause 3.24.5.4.1, reaches the following values, a rope shall be discarded:

Note: The strength is not directly proportional to the diameter.

(a) track ropes, tensioning ropes, and emergency ropes: 10%;

(b) hauling and counter ropes on installations where the necessary brake is on the carriage: 15%;

(c) hauling and counter ropes without such emergency brake: 10%;

(d) overhead telephone and signal cables: 20%; and

(e) surface lifts: 15%.

3.24.5.4.4 Sections of a rope shall be replaced if any of the following localised defects occur:

(a) if, in a running rope, six or more broken wires occur in a section of the rope equal to the length of one lay;

(b) if, in a standing rope, three or more broken wires occur in a section of the rope equal to the length of one lay, or two or more broken wires occur at an end connection;

(c) if a reduction of 10% or greater occurs in the original diameter of the rope; and

(d) if there is any evidence of marked corrosion.

3.24.5.4.5 With the exception of end connections, no splices shall be permitted on counterweight ropes.

3.24.5.5 Repair of wire rope

3.24.5.5.1 Protruding broken wires

Broken wires protruding from a rope should not be nipped off with pliers but bent back and forth until they fracture at the surface of the rope.

3.24.5.5.2 Replacement of a single strand

In the event that damage occurs to the wire rope and such damage is confined only to a single strand of rope, replacement of the damaged strand is permitted and the rope may be continued in service under the following conditions:

(a) prior approval for such repairs is obtained from the design verifier;

(b) the repair is carried out by a competent splicer to satisfaction of an equipment inspector;

(c) the ropeway manager is responsible for obtaining from the splicer, and recording, all the details;

(d) the minimum length of the new strand is at least 360 times the rope nominal diameter between end tucks, and the minimum length of strand to be run in as a core shall be 50 times the rope nominal diameter;

(e) the repaired area is outside of an existing splice and both new tucks are at least 105 times the rope nominal diameter from the end tuck of an existing splice;

(f) the repair is to be inspected in accordance with the rope manufacturer's recommendations but not less than daily for the first five days of operation after the repair and once weekly thereafter for a period of six weeks of operation. Thereafter it is subject to routine wire rope inspection. The wire rope shall be removed from operation immediately and the damaged portion repaired or replaced in case of core collapse, pulling, high stranding, or other significant distortions; and

(g) the location and length of the repair, and the name of the splicer, is recorded in the maintenance records (see Clause 3.3.11.5).

3.24.5.6 Repair of track rope strand

3.24.5.6.1 If wire in a track strand is broken, the strand or ropeway manufacturers, or both, and the equipment inspector shall be notified immediately, and an opinion shall be obtained from a competent person regarding the corrective action to be taken.

3.24.5.6.2 If two adjacent outer wires or two outer wires separated by a

wire are broken within one lay length, the ropeway shall be shut down. The strand shall be replaced or repaired by a competent person to the satisfaction of the equipment inspector, the strand manufacturer and/or the ropeway manufacturer and/or a competent person.

3.24.5.6.3 If more than two outer wires are broken within one lay length, the ropeway shall be shut down. Repairs may be considered, and made under the direction of a competent person, but only with the approval of the equipment inspector, the strand manufacturer and/or the ropeway manufacturer and/or a competent person.

3.24.6 ROPE FACTORS OF SAFETY

3.24.6.1 The minimum factors of safety on ropes, based on their ultimate strength and their maximum static axial load, shall be not less than these shown in Table 3.2.

TABLE 3.2: ROPE FACTORS OF SAFETY

Ropes	Factor of Safety Under Operation
Track ropes	3.3
Hauling and Counter ropes	4.5
Tensioning ropes and counterweight ropes	6.0
Emergency ropes	3.3
Emergency ropes (when in use)	4.5
Tower guy ropes (galvanised steel wire)	3.5
Telephone and signal cables	3.3

3.24.7 SOCKETS

3.24.7.1 Sockets shall be so designed that no part shall be stressed in excess of the yield strength of the materials used when the ropes are stressed to their ultimate strength, and their suitability shall be established by tests. Sockets shall conform with the requirements of BS 463.

3.24.7.2 Sockets shall be attached with the utmost care, using the best of socketing materials. Socketing shall be done only by competent personnel using proven methods; see BS 463, Appendix B. On completion of socketing, the assembly shall be subjected to a proof load of twice the safe working load of the rope. The proof test shall be carried out by an approved testing authority and the certificate of test supplied to the controller for retention.

3.25 TELEPHONE AND SIGNAL CABLES

3.25.1 Telephone and signal cables shall be of a type and construction as recommended by the cable manufacturing industry for the intended conditions.

3.25.2 Elevated telephone and signal cables, or their supporting cables, shall have a minimum factor of safety at the time of installation under normal New Zealand conditions of 3.3 and under icing conditions of 2.3 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.1.2.

3.25.3 Overhead telephone and signal cables shall be designed in accordance with Clause 3.24. as far as it can be applied.

PART 4: CHAIR LIFTS AND GONDOLA LIFTS

4.1 SCOPE

4.1.1 Part 4 covers that class of ropeway on which the carriers circulate around one system, travelling from one terminal to the other along one path of travel and returning along another path of travel, making U-turns in each terminal.

4.1.2 Part 4 does not include ropeways where the passengers are in contact with the ground or snow during the trip.

4.1.3 The ropeways covered by Part 4 may be of the multicable or monocable type. The carriers may be chairs or gondola cabins, and they may be permanently attached to the hauling rope or detached at the terminals.

4.2 MAXIMUM SPEED

4.2.1 FIXED-GRIP CHAIR LIFTS (SINGLE AND MULTIPLE SEAT)

4.2.1.1 The designer shall specify the maximum operating relative speed* for skiers and for foot passengers, and shall specify the minimum spacing between chairs.

4.2.1.2 Provision shall be made to slow or stop the lift for loading and unloading purposes. The maximum loading and unloading relative speed for foot passengers shall be 1.8 m/s and the maximum relative speed for skiers shall not exceed 3.1 m/s.

* For the purpose of this part, relative speed means the differential between the speed of the chair and the stationary or moving platform.

4.2.2 FIXED-GRIP GONDOLA LIFTS

4.2.2.1 Where fixed-grip gondola lifts stop to load and unload passengers, the maximum line speed shall be such that acceleration and deceleration will not cause excessive swinging of the carriers.

4.2.3 DETACHABLE CHAIR LIFTS AND GONDOLA LIFTS

4.2.3.1 The maximum speed of detachable carriers along the line shall be such that acceleration and deceleration will not cause excessive swinging of carriers and there will be no potential problems indicated by shock loads, oscillation or vibration.

4.3 MINIMUM SPACING BETWEEN CARRIERS

4.3.1 In the case of detachable chair lifts and gondola lifts, means shall be provided to space the carriers at prescribed intervals, never less than those specified in the design.

4.4 EMERGENCY DRIVE

4.4.1 Except where exempted by the design verifier, an independent emergency drive shall be provided, and adequately coupled for readily unloading the line in the event of failure of the main drive.

4.4.2 The emergency drive shall be designed and installed to unload the fully loaded lift in the normal direction of operation within a maximum running time of 30 minutes and not more than a total elapsed time of 45 minutes. A mechanical or electrical interlock shall prevent the operation of the main drive while the emergency drive is connected.

4.4.3 If the emergency drive is being operated only for the purposes of evacuating the lift, and provided that special precautions are taken, it is permissible to operate without tower switches and remote stops.

4.5 EVACUATION PROCEDURE

4.5.1 Procedures for evacuation of passengers, dealing with all emergencies (including awkward terrain, night time, adverse weather conditions, eventual use of helicopters, etc.) shall be developed and incorporated into a passenger ropeway's evacuation plan. The plan shall include:

(a) the definition of the line of authority in the event of an evacuation, including:

(i) the individuals or positions responsible for ordering an evacuation; and

(ii) the individuals or positions responsible for performing the evacuation, first-aid, and ground care of evacuated passengers;

(b) a description of the equipment necessary for evacuation, the standard which it has been designed and manufactured to,

and where it is stored;

(c) an estimate of the time necessary for the complete evacuation of the ropeway. As a guideline, an evacuation plan that takes longer than one hour should be reviewed and all implications of adverse weather conditions considered;

(d) a description of unusual terrain conditions and how each of these conditions shall be dealt with during an evacuation;

(e) a policy of when an evacuation should begin in the event that the ropeway becomes inoperable;

(f) provision for communication with passengers of an inoperable ropeway, when communication shall start, and how often subsequent communication shall be repeated;

(g) the method of evacuation to be used for a typical passenger and the method to be used for an incapacitated passenger;

(h) provision for communication with the evacuation teams;

(i) provision for suspending the evacuation in the event that the ropeway is made operable during the evacuation;

(j) provision for control and assistance of evacuated persons until released; and

(k) provision for a post-evacuation report.

4.5.2 EVACUATION DRILLS

4.5.2.1 Evacuation drills shall be conducted at established intervals not to exceed 12 months and shall be logged.

4.5.3 EQUIPMENT

4.5.3.1 There shall be sufficient equipment available that the ropeway may be evacuated in a reasonable amount of time.

4.5.3.2 Devices shall be capable of lowering passengers to the ground or rescuing passengers from the locations at which the devices are to be used.

4.5.3.3 Consideration shall be given to the following in determining the equipment required:

(a) probable operating and evacuation conditions;

(b) storage locations;

(c) number of ropeways at a specific location; and

(d) periods of operation which may influence evacuation (day, night or dusk).

4.5.3.4 The following shall apply to the equipment that is provided and maintained for the purpose of emergency evacuation:

(a) when not in use, equipment shall be carefully stored in such

a location that it is readily available for use on a specific ropeway or ropeways;

(b) each device shall be completely inspected annually and after each use, by a competent person and any worn or damaged components shall be replaced or repaired, as appropriate;

(c) all nonmetallic rope used for evacuation shall be of synthetic polyester fibre, or of a hard lay nylon with a minimum diameter of 11 mm and a minimum breaking strength of 22.2 kN, when new;

(d) no natural fibre or polypropylene ropes shall be used;

(e) all carabiners, if used, shall be of the locking type and manufactured to an acceptable standard; and

(f) this equipment shall be designated for evacuation use only.

4.6 ACCELERATION AND SPEED CONTROL

4.6.1 Where the ropeway is designed for overhauling loads in forward direction, a retarding device shall be provided for maintaining normal speed. The power developed by such overhauling load may be dissipated electrically, hydraulically, or by internal combustion engine.

4.6.2 In addition to the requirements of Clause 4.6.1, provision shall be made for slowing and stopping the ropeway automatically and within safe deceleration values if the line velocity exceeds design values by more than 15%. Where the ropeway is designed for overhauling loads in reverse direction, the anti-rollback brake shall be used.

4.6.3 The drive equipment shall be designed to accelerate the line smoothly and to avoid discomfort to the passengers under any loading conditions.

4.6.4 The installation shall be capable of operation at the appropriate speed for rope inspection and testing purposes.

4.6.5 In the case of systems involving detachable carriers, commencement of loading of persons shall be in accordance with the approved design and the manufacturer's operational instructions.

4.6.6 The manufacturer shall specify the maximum weight which can be carried on any one chair in both uphill and downhill directions, and/or the maximum allowable combined weight of maintenance work platform, or freight transporter, and the load which may be suspended at any one point on the rope.

4.7 BRAKES AND ANTI-ROLLBACK DEVICE

4.7.1 DEVICES REQUIRED

All lifts covered by Part 4 shall be equipped with stopping devices required by Table 4.1, where related terms have following meanings:

4.7.1.1 Service brake

4.7.1.1.1 The service brake shall be located at a point in the drive train so that there is no clutch or similar device between the brake and the drive sheave.

4.7.1.1.2 The brake shall be applied by stored energy.

4.7.1.1.3 A convenient means to manually control the brake shall be provided.

4.7.1.1.4 The brake shall be activated as follows:

(a) by actuating of service stops;

(b) by failure of any operating drive except the evacuation drive; and

(c) when the ropeway is stopped.

4.7.1.1.5 The brake shall not release until the drive system has developed the ability to prevent reversal or overhauling under the worst design load condition.

4.7.1.2 Emergency brake

4.7.1.2.1 The brake shall act directly on the drive sheave.

4.7.1.2.2 The brake shall be applied by stored energy.

4.7.1.2.3 The brake shall be applied by:

(a) actuating of emergency stops;

(b) unintended reversal of the drive sheave by not more than 200 mm or a reverse speed exceeding the safe limit in the approved design; and

(c) 15% overspeed as detected from the speed of the drive sheave or haul rope.

Note: The brake may also be applied by actuation of tower switches, carriage switches, or tension system switches.

4.7.1.3 Anti-rollback device

4.7.1.3.1 Where practicable, the anti-rollback device shall act on the drive sheave or haul rope.

4.7.1.3.2 This device shall be activated by unintended reversal of the drive sheave by not more than 200 mm or a reverse speed exceeding the safe limit in the approved design.

4.7.1.4 Notwithstanding Clauses 4.7.1.1 to 4.7.1.3, in installations with low gradient where suitable deceleration is obtained spontaneously by line resistance alone in the most unfavourable load and temperature conditions, the service brake may be omitted. Suitable means shall be provided to prevent unintended reverse motion.

4.8 BRAKING SYSTEMS

4..8.1 General requirements

4.8.1.1 For the purpose of this clause, braking systems shall mean any motion-retarding systems or devices, together with their controls and includes the retarding effects of friction and gravity.

4.8.1.2 When any stop function is initiated, its braking system(s) shall decelerate the rope between a minimum of 0.45 m/s^2 and a maximum of 2.0 m/s^2, for the ropeway's range of design loads, speeds and loading directions.

4.8.1.3 The emergency brake, and the service brake, acting independently, shall decelerate the rope between a minimum of 0.45 m/s^2 and a maximum of 2.0 m/s^2 for the ropeway's range of design loads, speeds and loading directions.

4.8.1.4 The braking distance shall not be greater than the distance between carriers.

4.8.2 REQUIRED STOPPING DEVICES

4.8.2.1 Braking systems shall be provided to meet the requirements of Table 4.1.

4.8.3 BRAKE APPLICATION

4.8.3.1 In order to avoid any braking with consequent violent swinging of the cabin or chair, braking shall automatically be applied in a gradual manner.

4.8.4 BRAKE DESIGN CRITERIA

4.8.4.1 The design of brakes shall meet the following requirements:

(a) Brakes shall have 150% of the torque and energy-absorbing capacity required for deceleration;

(b) Brakes shall be designed and maintained to slow and stop the ropeway moving in either direction; and

(c) The braking force shall be applied by springs, weights, or other acceptable forms of stored energy.

TABLE 4.1: REQUIRED STOPPING DEVICES

Ropeway category	Service brake	Emergency brake	Anti-rollback device	Retarding device
Self-braking A ropeway that decelerates, stops and remains stopped within the service brake performance requirements without a braking device.	Not required	Required	Not required	Not required
Nonoverhauling A ropeway that will not accelerate in either direction when it is not driven, but is not self-braking	Required	Required	Not required	Not required
Overhauling, reverse A ropeway that will accelerate in reverse direction when it is not driven	Required	Required	Required	Not required
Overhauling, forward A ropeway that will accelerate in forward direction when it is not driven	Required	Required	Not required	Required

4.8.5 OVERHAULING LOADS

4.8.5.1 For lifts designed to operate with downhill loads, in addition, the manufacturer/designer shall specify the downhill capacity of the lift together with the maximum allowable safe speed.

4.8.6 PERIODIC TESTING OF BRAKES

4.8.6.1 The manufacturer/designer shall provide a procedure and schedule for the periodic testing of the holding torque of the emergency brake and the service brake. This test shall be conducted at least annually.

4.9 STOPS

4.9.1 GENERAL

4..9.1.1 Manually operated stops shall be installed at all loading and unloading stations, clearly identified, and so located as to be immediately available to the attendants.

4.9.1.2 Electrical stop circuits shall comply with Clause 3.8.1.4.

4.9.1.3 The stop system shall include automatic lock-out devices so that the lift cannot be restarted by anyone until the device which stopped the lift has been manually reset; notwithstanding, the resetting shall not restart the lift.

4.9.2 FIXED-GRIP CHAIR LIFTS

4.9.2.1 If danger to the passengers or equipment could result from a passenger remaining on the carrier while it travels around a drive or return sheave, an automatic safety stop shall be provided at each such terminal to stop the lift before the passenger or equipment becomes exposed to such danger.

4.9.2.2 An unobstructed passage shall be provided around the bullwheel for passengers who fail to unload or who may get caught on the carrier.

4.9.3 DETACHABLE CHAIR AND GONDOLA LIFTS

4.9.3.1 Automatic devices shall be provided in each terminal to stop the lift in the event a carrier does not properly disengage from or reattach to the hauling rope (see also Clause 4.12.2).

4.9.3.2 Provision shall be made to support or stop the carrier, in the event of failure to attach, by:

(a) an automatic device or stop which will support the carrier and bring it to rest; or,

(b) a net or other impact-absorbing device.

4.10 DRIVE AND RETURN SHEAVES (BULLWHEELS)

4.10.1 Drive and return sheave frames shall be so designed that they will retain the sheave and the hauling rope in the event of shaft breakage, bearing failure, or deropement.

4.10.2 All drive sheaves shall be designed to withstand static and dynamic loads. Sheave mountings and bearings shall satisfy the recommendations of the manufacturers of the bearings. Where sheaves are mounted on vertical shafts, such shafts shall be equipped with bearings which will adequately resist the vertical thrust.

4.10.3 Drive sheaves shall be designed so that under all operating conditions the hauling rope will not slip in the sheave groove. Where sheave grooves provide metal-to-metal contact between the liner and the rope, approved materials and design shall be used.

4.10.4 The minimum diameter for drive and return sheaves shall be 80 times the diameter of the rope or 800 times the diameter of the

outer wires of the rope, whichever is greater, provided that no gripping device passes around these sheaves. Where the gripping devices travel around these sheaves, the minimum diameter shall be 96 times the diameter of the rope.

4.10.5 The drive and return sheave mountings at all terminals shall be supported from the ground by suitable structures, and the mounting which travels under the action of the counterweight shall be supported on rigid straight rails. The available travel shall be such that the frame will not reach either limit of motion during normal operations.

4.10.6 Notwithstanding the requirements of Clause 4.10.5, a floating return sheave is permissible where its use is restricted to fixed-grip chair lifts where express provision has been made to prevent passengers from passing around the return sheave while riding in the chairs. Otherwise the provisions of Clause 4.10.5 shall apply.

4.10.7 The wire ropes and wire rope connections used for the suspension of floating return sheaves shall conform to Clause 3.24, with a factor of safety of 6.0 under operating conditions.

4.11 SHEAVES AND BEARINGS

4.11.1 HAULING ROPE SHEAVES

4.11.1.1 When the hauling rope is to be deflected and it is not expedient to use large-diameter sheaves in accordance with Clause 4.10.4, it shall be deflected by the use of a battery of smaller sheaves or rollers. The number of sheaves or rollers required depends on the total pressure from the rope and the total angle of deflection.

Note: It is advisable that the sheaves or rollers be lined with a nonmetallic material. The allowable maximum load for each sheave depends on the characteristics of the lining. For example, using a good-quality rubber, the loads may reach a value of:

$$P = {}^{(d \times D)} / _{25}$$

where: P = *the rope loading per sheave in kg,*

d = *the rope diameter in mm;*

D = *the sheave diameter in mm;*

provided:

(i) the shape and dimensions of the lining fit the rope;

(ii) the values of speed and temperature are compatible; and

(iii) the load does not exceed the allowable maximum.

4.11.1.2 The deflection angle per sheave or roller shall not exceed 4°30'.

4.11.1.3 The maximum allowable load on each sheave or roller without a lining of soft material shall not exceed 200 kg and the maximum

deflection angle shall not exceed 2°30' per sheave or roller.

4.11.1.4 The diameter for sheaves on which the rope deflection does not exceed 4°30' shall be not less than 10 times the diameter of the rope. The maximum allowable load on each sheave shall be governed by the lining material. The principles of Clause 4.11.1.1 shall apply.

4.11.1.5 Where the ropes bend in accordance with the radius of a sheave, the provisions of Clause 4.10.4 shall apply.

4.11.2 COUNTERWEIGHT SHEAVES

4.11.2.1 Counterweight rope sheaves and sheaves not specifically covered elsewhere shall have the minimum diameter as per Table 4.2.

TABLE 4.2: SHEAVE DIAMETER

Rope construction	Condition A	Condition B	Condition C
6 x 7	72 d	42 d	24 d
6 x 19	45 d	30 d	20 d
6 x 37	27 d	18 d	12 d

where:

d = the nominal diameter of the rope,

Condition A - Track Cable Counterweight Ropes;

Condition B - Single Rope Systems Counterweight Ropes; and

Condition C - Sheaves which are intended to rotate only due to counterweight adjustments and not due to counterweight movement.

Notes: 1. When unlined grooves are used, they should be V-shaped with rounded bottoms having a radius equal to 55% of the rope diameter.

2. If anti-friction bearings are used on sheaves which stand without moving for long periods of time, they should be selected on the basis of the manufacturer's recommended static load rating.

4.11.3 HAULING ROPE GUIDE SHEAVES IN TERMINALS

4.11.3.1 Hauling rope guide sheaves shall be located to prevent misalignment of the rope entering and leaving the drive and return sheaves. Such sheaves shall meet the requirements of Clause 4.11.1.4 and shall be as close as practicable to the drive and return sheaves, but not farther than one radius of the drive or the return sheave plus 500 mm from the points of tangency of the hauling rope. Such guide sheaves shall be placed on the

underside of the rope.

4.11.3.2 Hauling rope guide sheaves shall not be considered as load-carrying sheaves in the profile design.

4.11.3.3 Hauling rope guide sheaves shall be independent of load-carrying sheave assemblies.

4.11.4 TOWER SHEAVES AND SWITCHES

4.11.4.1 Chair lifts

4.11.4.1.1 All tower sheave grooves shall be designed to prevent the hauling rope from leaving the sheave.

4.11.4.1.2 Inside guards shall be installed and shall project a distance equal to at least 3 times the rope diameter above the centreline of the rope in its normal position on support towers, and below the centreline of the rope on hold-down towers.

4.11.4.1.3 Outside rope catchers shall be installed and shall extend at least 2 rope diameters outside the sheave flanges and shall be located a maximum of half the sheave diameter below the normal position of the rope on support towers and above the rope on hold-down towers. Rope catchers shall be designed so that rope grips can pass through them when the rope runs in the catchers.

4.11.4.1.4 Devices shall be installed and maintained which will stop the lift in case of deropement. In addition, the requirements of Clause 4.8.1.3 shall apply.

4.11.4.1.5 The requirements of Clause 4.11.4.1 shall apply to tower sheave assemblies on both sides of the ropeway, including load-carrying assemblies in the terminals.

4.11.4.2 Gondola lifts

4.11.4.2.1 On monocable and multicable gondola lifts, the requirements of Clause 4.11.4.1 shall apply as far as practicable, special consideration being given to the configuration of the rope clamps and tower sheave assemblies.

4.11.5 TRACK ROPE DEFLECTING SHEAVES

4.11.5.1 Track rope deflecting sheaves in the terminals shall be designed to withstand static and dynamic loads, and shall also satisfy the allowable bearing load limits of the material with which their grooves are lined.

4.11.5.2 When unlined grooves are used, they shall be V-shaped with rounded bottoms having a radius equal to 55% of the cable diameter. Sheave mountings and bearings shall satisfy the recommendations of the manufacturers of the bearings.

4.11.5.3 Provision shall be made for earthing the rope. Where the rope is used as a conductor in the communication system, lightning protection shall be provided.

4.11.6 SHEAVE AND ROLLER BEARINGS

4.11.6.1 All sheaves or rollers shall be mounted on ball or roller bearings.

4.12 LOADING AND UNLOADING AREAS

4.12.1 FIXED-GRIP CHAIR LIFTS

4.12.1.1 General

4.12.1.1.1 The design of loading and unloading facilities shall take into consideration whether the chair lift is to be used for carrying skiers or foot-passengers, or both (See Part 1). During operation of the lift, a minimum clearance of 350 mm must be maintained between the lowest point of each chair and the surface level of the loading or unloading area.

4.12.1.2 Skier loading areas

4.12.1.2.1 The loading platform or area shall be level and shall have adequate length beyond the actual loading position, to ensure that skis remain in contact with the surface long enough to discourage excessive swinging of the chairs as they leave the loading area. The approach to the loading position may be inclined slightly downwards so as to permit skiers to ski into position, without effort but under control. Whether skiers load off snow or off a synthetic surface, the correct loading position should be clearly marked; in the case of off-snow loading, the device used as a marker should also be used as a means of regulating the height from the chair seat to the snow surface. At loading sites where passengers would face extreme hazard if they were to fall out of a chair after leaving the loading platform, an adequate safety net shall be provided.

4.12.1.3 Foot-passenger loading areas

4.12.1.3.1 Foot-passenger loading shall comply with the following:

(a) Foot-passengers shall be loaded off a level platform.

(b) The length of the platform shall be commensurate with the speed of operation of the chair lift, and there should be ample length on the platform to allow lift operators and/or attendants to stop the lift and render assistance to passengers who are not securely seated.

(c) Where loading platforms are less than 6 m long, safety nets shall be installed at the end of the platform, or the lift must be stopped to load each passenger.

(d) Where platforms are 6 m long or longer, and where passengers would face serious hazard should they fall out of a chair after leaving the platform, adequate safety nets shall be provided, or the lift must be stopped to load each

passenger.

(e) The length of the platform shall be measured from the point of loading to the end of the platform.

4.12.1.4 Skier and foot-passenger loading areas

4.12.1.4.1 At both skier and foot passenger loading areas, provision shall be made to readily unload or assist passengers who have failed to load correctly.

4.12.1.5 Skier unloading areas

4.12.1.5.1 The design of the unloading facility, including the length of level platform at the unloading point and the slope and configuration of the unloading ramp, shall be commensurate with each of the following:

(a) operating speed;

(b) unloading interval;

(c) ability of skiers;

(d) height of platform.

4.12.1.5.2 The leading edges of all platforms shall be fitted with inclined guards to prevent ski tips from being caught under the platform. At unloading sites where premature unloading from the chair would expose skiers to extreme hazard, adequate safety nets shall be provided.

4.12.1.4.6 Foot-passenger unloading areas

(a) Foot-passengers shall be unloaded on level platforms only.

(b) The length of platform shall be measured from the point of unloading to the end of the platform, or to the centreline of the unloading station drive, or return sheave, whichever is closer.

(c) The length shall be commensurate with the speed of the chair lift and whether or not the chairs are slowed or stopped for unloading.

(d) The platform length shall not be less than 5.0 m and whenever it is less than 6.0 m, a safety net shall be installed at the end of the platform, unless the platform extends at least 3.0 m beyond the centreline of the drive or return sheave.

(e) In the case of unloading stations having a travelling drive or return sheave, the measurements above shall be determined with the drive or return sheave in the most unfavourable position.

4.12.1.7 Skier and foot-passenger unloading

4.12.1.7.1 At both skier and foot passenger unloading areas, provision shall be made to readily unload or assist passengers who have failed to unload correctly.

4.12.1.8 Handrails, stairways and steps

4.12.1.8.1 To protect passengers and operating personnel, handrails shall be installed alongside platforms and ramps wherever practicable, and where passengers might fall in the normal course of embarking and disembarking, or where operating personnel might fall in the normal course of their work. Stairways, steps, etc. shall be constructed in accordance with all applicable building and safety codes.

4.12.1.9 Guards

4.12.1.9.1 At both loading and unloading areas, towers, railings, fences and other structures shall be constructed so as to minimise the possibility of ski tips or passengers becoming entangled. Where necessary, appropriate guards shall be installed.

4.12.1.10 Hauling rope supports

4.12.1.10.1 The distance between hauling rope supports on either side of each loading area shall be such that the distance between chair and ground will not diminish excessively under the impact of loading passengers. The same precautions shall be taken between hauling rope supports at unloading areas.

4.12.2 DETACHABLE CHAIR AND GONDOLA LIFTS

4.12.2.1 Sufficient terminal floor space shall be provided for passengers to board and leave the carriers without being crowded. The carrier shall be secured in some manner, or controlled, to prevent excessive swinging during loading and unloading.

4.12.2.2 Provision shall be made at all stations for separation of incoming and outgoing passengers.

4.12.2.3 The stations shall be so arranged that the carriers can enter and leave safely, even when they are swinging laterally.

4.12.2.4 Beyond the points of attachment and detachment of the grips, devices shall be installed to stop the ropeway in the event of faulty detachment or attachment. Such installations shall include bumpers wherever the carriage or carrier could become free-wheeling on an open-end or dead-end track. Switch points in the track system shall be provided with safety devices to minimise the possibility of a derailment at an open switch.

4.13 LINE STRUCTURES

4.13.1 LOCATION AND HEIGHT OF TOWERS

4.13.1.1 Towers shall be located to provide for the proper deflection of the hauling rope so that passengers will not be higher above the ground than necessary or so close as to encourage them to

disembark at locations other than established stations. Consideration shall be given to the use to which the installation is to be put (for carrying skiers or foot-passengers) and to the rescue procedures to be provided. Where chair-seat heights on the fully loaded side exceed 11.0 m above the bare ground, special equipment suitable for heights greater than 11.0 m shall be provided for the safe removal of passengers in an emergency, and such equipment shall be kept operational at all times that the ropeway is in use, its adequacy being demonstrated to the equipment inspector as required. Provision shall be made for the proper storage and handling of such equipment.

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

4.13.1.3 Adjustment of tower sheave heights, where applicable, shall be made in a manner to avoid overloading or underloading tower sheave units.

4.13.1.4 If the heights of tower sheaves are to be varied to suit varying profiles, allowance shall be made for this in the design, and towers shall be suitably marked to ensure Clause 4.13.1.3 is complied with.

4.13.1.5 For the interrelation between location and height of towers and the design of sheave units and track rope saddles, see Clause 4.11.1 and 4.13.2.

4.13.1.6 Local wind conditions shall be taken into consideration when selecting tower location, to minimise possible collision of passing carriers.

4.13.1.7 Towers shall be equipped with hanger guides to prevent contact of carriers or hangers with a tower or sheave assembly, except that hanger guides shall not be required if contact does not occur when the carrier is swung laterally 15° from the vertical position. Hanger guides shall be so shaped and located that a 30° lateral swing from the vertical shall not place any part of the loaded or empty carrier on the inner side of the hanger guide. On all towers, with or without hanger guides, when a carrier is swung longitudinally by 15°, there shall be no contact between any obstruction and any part of the carrier. In the absence of hanger guides, the following minimum clearances shall prevail when the carrier is swung toward the tower laterally 10° from the vertical position:

(a) On chair lifts:

(i) 450 mm between the inside limit of the passenger seat and the tower clearance line or surface;

(ii) 300 mm between the innermost point on the chair structure and the tower clearance line or surface.

(b) On gondola lifts:

(i) With open windows on the tower side, 450 mm between the innermost point on the carrier and the tower clearance line or surface;

(ii) With screened or closed windows on the tower side, 300 mm.

4.13.1.8 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. Tower guy ropes shall be manufactured from galvanised steel wire and shall have a minimum factor of safety of 3.5.

4.13.1.9 Means shall be provided for safe access from the ground to the top of all towers. If a tower's structure is such that it is not safe to climb, permanent ladders shall be installed.

4.13.1.10 Where ski-runs cross under the line, the towers shall be high enough to ensure clearance for the skiers of at least 2.8 m below a gondola and 3.6 m below the seat of a chair under design snow conditions.

4.13.1.11 Towers shall be consecutively numbered with figures at least 75 mm high.

4.13.1.12 On chair lifts where non-lattice-type towers are used or where the tower design would not permit skis to become entangled in the towers, the minimum clearance* between the chair in its normal position and the tower shall be 1.0 m. On lattice-type towers, or where the tower design would permit skis to become entangled in the tower, the minimum clearance between the chair in its normal position and the tower shall be 1.3 m.

* Clearance shall be defined as the distance from the tower to the centreline, along the line of travel, of the seat for the passenger nearest to the tower.

4.13.1.13 If the gauge of the ropeway is varied along the line, radical change of gauge at any point shall be avoided to minimise the possibility of deropement.

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

4.13.1.15 On monocable ropeways, single sheaves shall not be used except for drive and return guide sheaves.

4.13.1.16 Multi-sheave assemblies shall be completely articulated to provide uniform distribution of pressure. Notwithstanding, on gondola lifts where separation rails are provided at hold-down batteries, the sheaves of such batteries need not be articulated.

4.13.1.17 The minimum load on any one sheave in the most unfavourable conditions, including starting, accelerating and stopping, shall be not less than 50 kg, and the minimum load on the battery of sheaves shall be not less than 200 kg. Under these conditions, if

a 30% increase in tension lifts the rope from the sheaves, then hold-down rollers shall be used.

4.13.1.18 For hold-down towers, the reverse requirement to Clause 4.13.1.17 shall be applied.

4.13.1.19 Chairlift suppliers shall incorporate in their maintenance and operating manual information regarding the possibility of lift-off on towers while running the lift without chairs during maintenance.

4.13.2 TRACK ROPE SADDLES AND MOUNTS

4.13.2.1 The radius of a track rope saddle shall be large enough to provide smooth transition of the carrier from span to span. The radius of the track rope saddle shall be not less than 300 times the diameter of the track rope.

4.13.2.2 The saddle shall be long enough to ensure that at no time does the rope come into contact with the ends of the shoes.

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

4.13.2.4 Saddles shall permit free passage of the carriage even when the carrier is swinging laterally within design limitations as it approaches or passes the tower.

4.13.2.5 If the gauge of the ropeway is varied at any point along the line, horizontal departure at any one tower shall be kept to a maximum of 0.5%.

4.13.2.6 Tower heights and locations shall be so arranged that the track ropes cannot lift out of their saddles under the most adverse operating conditions, including a 30% increase in tension due to a surge.

4.13.2.7 For hold-down towers, the reverse requirement to Clause 4.13.2.6 shall be applied.

4.14 ROPE AND CONNECTIONS

4.14.1 HAULING ROPE

4.14.1.1 Hauling ropes shall have a minimum factor of safety at the time of installation of 4.5 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

4.14.1.2 The tension in the hauling rope shall be not less than 14 times the maximum vertical load on a single grip.

4.14.2 TRACK ROPE (MULTICABLE LIFTS ONLY)

4.14.2.1 Only locked coil ropes or suitable stranded ropes shall be used for track rope applications. Spiral strands having only round wire in the outer layer shall not be used on passenger-carrying ropeways.

4.14.2.2 Track ropes shall have a minimum factor of safety, at the time of installation, of 3.3 and based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

4.14.2.3 Track ropes shall be kept under constant tension by means of counterweights or equivalent systems.

4.14.2.4 In special circumstances, the track ropes may be anchored at both ends, provided the calculations, prepared and approved by an engineer*, demonstrate that the maximum tension in the ropes meets these specifications, when allowance has been made for temperature, wind, ice, earthquake and the worst possible operating conditions, and provided the ropes are installed in accordance with the design. Provision shall be made in the installation for measuring and adjusting the rope tension.

* For the purposes of this clause, in the case of a ropeway designed by an overseas aerial ropeway company, the calculations shall be verified by the company's chief design engineer, under a recognised designer's quality management system.

4.14.3 COUNTERWEIGHT ROPES

4.14.3.1 Counterweight ropes shall have a minimum factor of safety at the time of installation of 6.0 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

4.14.3.2 With the exception of end connections, splices shall not be permitted in counterweight ropes. Handmade eye splices shall not be made on rope over 38 mm (1.5 in) in diameter. Eye splices shall be provided with thimbles. Mechanical splices shall be protected against corrosion.

4.14.4 ANCHOR CONNECTIONS

4.14.4.1 Anchor connections for track ropes, counterweight ropes, tower and station anchor ropes or guys, shall meet the requirements of Clause 3.11. Tower guy ropes (galvanised steel wire) shall have a minimum factor of safety at the time of installation of 3.5 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

4.15 SERVICE AND INSPECTION PLATFORM

4.15.1 The service and inspection platform shall be approved by the ropeway designer and by the design verifier. The maximum permissible load to be carried on this platform shall be specified by the ropeway designer, and this maximum load shall be posted on the platform.

4.15.2 For aerial ropeways, the persons using the service and inspection platform shall be supplied with a communications system and evacuation equipment.

4.16 PASSENGER CARRIERS

4.16.1 CHAIR SEATS AND HANGERS

4.16.1.1 Chair lift carriers shall be designed to support a vertical load four times the design load without permanent deformation of the assembly or component part. Prototype testing is to be carried out accordingly to ensure the design meets this provision. The manufacturer is to supply the certificate of test, identifying the carrier concerned, which must also be identifiable with the carriers fitted to the ropeway. For carriers manufactured in New Zealand, the prototype test is to be witnessed by an equipment inspector.

4.16.1.2 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 3.6 with respect to the yield point of the material(s). For this purpose, the applied load is to be taken as the computed force, considered as a static load.

4.16.1.3 Each chair shall be equipped with a railing at each side, to a height of not less than 100 mm above the seat for a distance of not less than 300 mm from the back of the seat.

4.16.1.4 Each chair shall be designed and equipped with a restraining bar or belt which will not open under forward pressure.

4.16.1.5 Chair hangers shall be manufactured from suitable material, as per Clause 3.2.5, of sufficient section modulus to withstand bending, impact, and fatigue encountered in use.

4.16.1.6 Before being put into service, chairs shall be tested with weight equal to twice their passenger-carrying capacity (see Clause 3.2.2.1). While the weights are in place, all attachments to the chairs under tension shall be proven safe. Manufacturer's tests certificates, according to Clause 2.8.2., shall be provided.

4.16.1.7 Each chair hanger shall be stamped with a serial number at the time of manufacture.

4.16.1.8 Chairs shall be consecutively numbered with at least 25 mm high figures.

4.16.2 GONDOLA CABINS AND HANGERS

4.16.2.1 Gondola cabins and hangers shall be designed to support a vertical load 4 times the design load without permanent deformation of the assembly or component parts.

4.16.2.2 The carrier and all components shall be designed by competent 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 a prototype test, incorporating repeated test loadings and trial operations. The manufacturer is to supply satisfactory evidence of previous successful use for passenger transportation, or supply a copy of the certificate of prototype test; in either case, identity of the carriers is to be given, which must be identifiable with the carriers fitted to the ropeway. For carriers manufactured in New Zealand, the prototype test is to be witnessed by an Equipment Inspector. Before being put into service, cabins together with hangers shall be tested as per Clause 3.3.2.1.(h).

4.16.2.3 The gondola hanger shall be securely attached to the track cable trucks or hauling rope grip and to the cabin.

4.16.2.4 The hanger shall be of sufficient length vertically that under the worst condition of longitudinal swing the top of the cabin cannot strike the hauling rope, the track ropes, or the bottom of a tower saddle. Notwithstanding the foregoing, the cabin shall be capable of swinging longitudinally, without interference, to an angle of 15° from the vertical at the most adverse locations. Sway dampers designed to reduce the longitudinal sway of the cabin shall be used if recommended by the ropeway or lift designer. Where used, such dampers shall operate smoothly and without danger of deropement of the track cable trucks or the hauling rope.

4.16.2.5 Gondola cabins shall be ventilated. They shall be equipped with doors which fill the entire entrance opening, and each door shall be locked during each trip in such a manner that it cannot be unlocked except by authorised personnel or automatically. The key shall be kept where it is not accessible to the passengers.

4.16.2.6 When necessary for access to cabins for safety reasons, a key shall be available.

4.16.2.7 Open and semi-open carriers may be considered as special exceptions by the design verifier, but other requirements of Clause 4.16.2.5. shall apply.

4.16.2.8 The number of passengers in a gondola cabin shall be limited by declared number or weight and the capacity of each gondola cabin shall be posted in a conspicuous place in the cabins and at each loading area.

4.16.2.9 Each gondola system shall be equipped with a means of emergency evacuation of passengers which is acceptable to the equipment inspector.

4.16.2.10 All gondola cabin windows shall be of shatterproof material.

4.16.2.11 Each gondola cabin hanger shall be stamped with a serial number at the time of manufacture.

4.16.2.12 Gondola cabins shall be numbered with at least 75 mm high figures at each end of the cabin.

4.17 ROPE GRIPS

4.17.1 GENERAL (FIXED AND DETACHABLE)

4.17.1.1 The rope grip shall be designed to operate so as not to damage the rope or distort it unduly.

4.17.1.2 The rope grip shall be of a type which has been proven to give satisfactory service by the industry.

4.17.1.3 The rope grip shall be designed to pass smoothly over and under line sheaves.

4.17.1.4 Rope grips shall be designed to discourage contact between the rope and sheave flanges during normal operation, allowance being made for the anticipated wear of the sheave grooves.

4.17.1.5 The design of the rope grip 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 that the grip is operating within design limitations.

4.17.1.6 The strength of the rope grip shall be based upon the following criteria:

(a) With the grip in its operating condition gripping the rope or equivalent, a load applied in the usual direction 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.

(b) 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 the 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 a recognised testing laboratory to provide assurance that the fatigue life of the spring is adequate for the applied loads.

(c) For stresses caused by lateral loading, such as centrifugal force, the provision of Clause 4.16.1.2 shall apply.

(d) The grip material shall be suitable to resist impact loads.

(e) Special attention shall be paid to fatigue considerations. A

grip which has not been proven in service shall be subjected to fatigue tests.

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

4.17.1.7 Confirmation shall be provided by the manufacturer that the grip and its parts meet the criteria in Clause 4.17.1.6.

Note: For purposes of sub-clauses (a), (e) & (f) above, copies of appropriate certificates of test are to be included in the evidence supplied.

4.17.1.8 Each rope grip shall be stamped with a serial number at the time of manufacture.

4.17.1.9 Each rope grip and critical parts of chair and gondola hangers (i.e. swivel connection to the rope grip, highly stressed portions of the hanger, and connection to the chair and gondola) shall, at the time of manufacture, be non-destructively tested by a competent person, using method commensurate with the design and materials to ensure that they are free from cracks and detrimental flaws. Certificates to this effect shall be submitted by the manufacturer to the equipment inspector, stating the serial numbers of the items tested, the tests carried out, the conclusions from the tests, and the project on which the items are to be used.

4.17.1.10 Before the lift is placed in service, the manufacturer shall supply the controller with instructions and a recommended schedule for inspection, testing, and maintenance of rope grips.

4.17.1.11 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 three 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. The manufacturer/ designer shall provide a procedure and schedule for periodic testing of the resistance to sliding for clamp-type grips.

4.17.1.12 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, this requirement may be applied to each grip, provided that

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

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

4.17.1.13 Routine, non-destructive testing of rope grips shall be carried out by a competent person as follows:

(a) At intervals recommended by the manufacturer, but not exceeding 1 year, rope grips and hangers shall be separated, cleaned and visually inspected in accordance with the manufacturer's instructions. Consideration should be given to more frequent inspection and testing of the detachable rope grips, especially ones that are used continually over 12-monthly periods (see also (b) and (c) below).

(b) After inspection, grips or hangers with suspected cracks or detrimental flaws shall be non-destructively tested. All cracks or detrimental flaws shall be repaired in accordance with procedures recommended by the manufacturer and a record shall be made of the serial numbers of grips and hangers which were repaired.

(c) In addition, at the same intervals, 20% of all grips and hangers shall be non-destructively tested on a rotational basis so that no grip or hanger will be in use for more than 5 years without being tested.

(d) During operation, at least once every 500 hours of operation, grips and hangers shall be visually inspected for detrimental flaws in critical areas specified by the manufacturer.

(e) In the event that detrimental flaws are detected, either by visual inspection or by non-destructive testing, and a particular, significant detrimental flaw affects 10% or more of the grips or hangers at one time, then the frequency of visual inspection or non-destructive testing for this particular detrimental flaw shall be increased to once every 100 hours of operation until a modification or repair is shown to have satisfactorily controlled the problem.

4.17.1.14 For the purpose of Clauses 4.17.1.9 and 4.17.1.13, "detrimental flaw" is defined as any flaw which, by nature or location, is unacceptable to the equipment inspector.

Note: Cracks are not acceptable in any of the structures covered by Clauses 4.17.1.9 and 4.17.1.13.

4.17.2 DETACHABLE ROPE GRIPS (ADDITIONAL REQUIREMENTS)

4.17.2.1 Detachable grips shall be designed and constructed in such a manner that they cannot become accidentally uncoupled.

4.17.3 FIXED ROPE GRIPS (ADDITIONAL REQUIREMENTS)

4.17.3.1 Fixed rope grips shall be designed to pass smoothly around drive and return sheaves.

4.17.3.2 Provision shall be made in the design of grips to facilitate periodic relocation. They shall be moved at least once in every 12 calendar months a uniform distance each time, in the same

direction. Manufacturer's instructions shall be followed if they are more restrictive than above (see also Part 3). As each grip is moved, the rope shall be examined for deterioration at or near the grip location.

4.17.3.3 The manufacturer/designer shall provide information regarding identification of excessive slippage.

4.18 CARRIAGE WHEELS

4.18.1 See Clause 8.12.1 in Part 8 of this Code of Practice.

4.19 COMMUNICATIONS

4.19.1 Both an audible signal system and a two-way voice communication system shall be maintained between the drive station and all loading and unloading stations. If only one system fails to operate, the lift may continue to run, provided the remote attendant stop system is fully operational. In the event of the failure of both communication systems the lift shall not be operated.

4.19.4 In the latter event, provided that adequate special precautions are taken, the lift may be run for the purposes of evacuation only.

4.20 OPERATIONAL WIND LIMITS

4.20.1 Suitable wind gauges are to be provided and located so that ropeway operators are able to determine when operational limiting wind velocities are reached.

PART 5: SURFACE ROPEWAYS OF THE T-BAR, PLATTER AND SIMILAR TYPES

5.1 SCOPE

5.1.1 Part 5 covers that class of passenger ropeway on which passengers are transported uphill by means of devices propelled by a main overhead travelling wire rope, while the passenger remains in contact with the surface. These ropeways are normally of the monocable type, and the rope is usually supported on intermediate towers on both the uphill and the downhill side. Either fixed or detachable grips may be used.

5.2 LOCATION

5.2.1 In addition to the general requirements of Part 2 and Part 3 of this Code of Practice, the following requirements with respect to location shall also apply:

(a) Location shall be selected so that the ski track will always have, or can be made to have, a level or an upward slope. Reverse slope should be avoided except for mild inclines at loading and unloading areas.

(b) Selection of the site shall also involve consideration of maximum permissible slope of the ski track. In no case shall it be steeper than 38^{O} for double-towing outfits or 45^{O} for single-towing outfits.

(c) Surface water which might make icy tracks shall be avoided.

(d) The lift shall be located so that, as far as practicable, the lift line intersects the contour lines at right angles.

5.3 LOCATION AND HEIGHT OF TOWERS

5.3.1 Location and height of towers shall be determined by the terrain as well as by the following considerations:

(a) Towers shall be located so that, under the most adverse loading conditions, the towing device cannot lift any passenger off the snow, and the hauling rope shall be high

enough to clear the passengers' heads by at least 600 mm. The towers shall also be arranged so that the down-coming, empty towing outfits will be clear of the snow.

(b) Adjustment of tower sheave heights, if practised, shall be made in a manner to avoid overloading or underloading tower sheave units. Suitable information to achieve this should be written in the Maintenance and Operations Manual.

5.4 CAPACITY, SPEED AND LOADING INTERVAL

5.4.1 COMPUTING CAPACITY

5.4.1.1 Clause 3.2.2.1. shall apply.

5.4.2 SPEED AND LOADING INTERVAL

5.4.2.1 The speed of the lift and the spacing of the towing outfits shall be such that the loading intervals are as designated in Clauses 5.4.2.3 and 5.4.2.4.

5.4.2.2 For lifts with detachable grips, means shall be provided to ensure that the distance between successive skiers is no less than that which was used in the design of the lift. The skier(s) shall not be loaded until the skier(s) ahead has (have) travelled this minimum distance from the loading point. Automatic launching devices meet the requirement of this clause when they are timed to meet the minimum loading interval.

5.4.2.3 For 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.

5.4.2.4 For 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. At no time should these loading intervals be less than the designer's specifications.

5.5 TERMINALS

5.5.1 ACCELERATION SPEED CONTROL

5.5..1.1 Where necessary to satisfy the requirements of Clause 5.4, a variable- speed drive shall be used, so that the speed of the rope can be changed to suit variations in snow conditions and the skiers' ability to load.

5.5.1.2 The drive equipment shall be capable of accelerating the line safely under all conditions of loading.

5.5.2 AUTOMATIC AND MANUAL STOPS AND BRAKES

5.5.2.1 Means to prevent reversal

5.5.2.1.1 The lift shall have a means to prevent its reverse motion.

5.5..2.2 Brakes

5.5.2.2.1 Unless an unloaded lift operating at maximum speed will stop within the greater of the distances of 8.0 m or the distance given by the formula $d = 1.2v^2$ (d = stopping distance in metres, v = lift speed in m/s), 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.

5.5.2.3 Electrical stop circuits

5.5.2.3.1 Electrical stop circuits shall be energised circuits, so that in case of power failure the system will stop. An earth shall cause the ropeway to stop.

5.5.2.3.2 A stop switch shall be installed at each loading and unloading point. Additional switches may be required for long installations and for installations where a passenger is not continuously in the operator's line of vision.

5.5.2.3.3 All stop switches shall be clearly identified, and those located at the loading area shall be immediately available to attendants. Emergency stop switches shall be located in conspicuous positions where the public can stop the lift in the case of an emergency.

5.5.2.3.4 The stop system shall include automatic lockout devices so that the lift cannot be restarted by anyone until the device which stopped the lift has been manually reset; notwithstanding, the resetting shall not restart the lift.

5.5.2.4 Safety gate

5.5.2.4.1 A safety gate, actuated by contact with either passenger or towing device, shall be provided at the unloading terminal to stop the lift. When operated, this safety gate shall stop the lift (even when operating at maximum speed) before the passenger has travelled half the distance to the first obstruction.

5.5.2.4.2 The safety gate shall be marked in an approved colour or other attention-arresting device.

5.5.2.4.3 The safety gate shall be designed and installed in such a manner that:

(a) it shall comply with Clause 5.5.2.3.1;

(b) it is of the manually reset type;

(c) the current-carrying conductor shall extend fully across the tow path, or an alternative fitted, which has been approved by a design verifier; and

(d) the maximum of 600 mm of movement of the cross member shall break the circuit.

5.5.2.4.4 A safety gate or other means shall be provided to stop the lift in the event that a towing unit fails to retract.

5.5.3 DRIVE AND RETURN SHEAVES

5.5.3.1 The requirements of Clause 4.10 shall apply for drive and return sheaves. In addition, a floating return sheave is permissible, provided it complies with the requirements of Clause 4.10 where applicable.

5.5.3.2 The wire ropes and wire rope connections used for the suspension of floating return sheaves shall conform to Clause 3.24, with a factor of safety of 6.0 under operating conditions.

5.5.4 GUIDES

5.5.4.1 Guides or equivalent means shall be installed to lead the towing outfits into and out of terminals and around the drive and return sheaves without hazard to equipment, terminal structures or personnel.

5.5.5 SHEAVES AND BEARINGS

5.5.5.1 Hauling rope sheaves

5.5.5.1.1 Where deflecting sheaves are required, they shall satisfy the requirements of Clause 4.11.1.

5.5.5.2 Counterweight sheaves

5.5.5.2.1 All counterweight sheaves and adjustment sheaves shall meet the requirements of Clause 4.11.2.

5.5.5.3 Hauling rope guide sheaves in terminals

5.5.5.3.1 Where deemed necessary, guide sheaves shall be placed to prevent misalignment of the rope entering and leaving the drive and return sheaves. Such sheaves when used shall meet the requirements of Clause 4.11.3. Where necessary to minimise the possibility of the rope leaving these sheaves, counter sheaves shall be installed adjacent to and as close to them as is practicable.

5.5.5.3.2 Provision shall be made for earthing the wire rope when necessary.

5.5.5.4 Tower sheaves and switches

5.5.5.3.4.1 The requirements of Clause 4.11.4.1 shall apply.

5.5.5.5 Sheave and roller bearings

5.5.5.5.1 All sheaves or rollers shall be mounted on ball or roller bearings.

5.5.6 LOADING AND UNLOADING AREAS

5.5.6.1 Loading areas shall be of sufficient length and grade to permit skiers to start with maximum ease and comfort and to become adjusted to the towing outfit before they begin to go uphill.

5.5.6.2 Unloading points shall be a sufficient distance from any safety gate to permit satisfactory unloading. They shall be inclined to aid the passengers to ski away from the towing device.

5.5.6.3 Except where towing outfits are designed to unload in the terminal, the distance between unloading areas and upper terminal guides shall be sufficient to allow the towing outfits to become retracted and to permit their oscillation to diminish adequately before they enter the terminal. Distances will vary to suit the combination of type of towing outfit and line velocity.

5.5.6.4 If intermediate unloading is permitted, the unloading areas shall be arranged to minimise the possibility of retracting towing devices becoming entangled with a tower.

5.6 LINE STRUCTURES

5.6.1 TOWERS

5.6.1.1 A minimum clearance of 900 mm shall be maintained between the base of the tower and the vertical plane of the upward-travelling rope. With respect to the downward travelling rope, a minimum clearance of 600 mm shall be provided between the towing outfit in its normal position and the tower.

5.6.1.2 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. Tower guy ropes shall be manufactured from galvanised steel wire and shall have a minimum factor of safety of 3.5.

5.6.1.3 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.

5.6.1.4 All towers shall be earthed, where applicable and practicable.

5.6.1.5 Towers shall be consecutively numbered with readily visible figures, at least 75 mm high.

5.6.1.6 Where towers are designed to permit variations in rope height, sheave unit supports shall be attached so as to prevent misalignment.

5.6.2 GUARDS

5.6.2.1 The requirements of Clauses 4.11.4 and 5.6.3.8 shall apply for guards.

5.6.3 HAULING ROPE SHEAVES (OR ROLLERS) AND MOUNTS

5.6.3.1 Sheaves shall have flanges as deep as is practicable.

5.6.3.2 If the gauge of the ropeway is varied along the line, radical change of gauge at any point shall be avoided to minimise the possibility of deropement.

5.6.3.3 Sheave mounts or mounting frames shall be designed to be adjustable, laterally and rotationally, so that the sheave units can he adjusted and secured in the plane of the rope.

5.6.3.4 Multi-sheave assemblies shall be articulated to provide uniform distribution of pressure.

5.6.3.5 The minimum load on any one sheave in the most unfavourable conditions, including starting, accelerating, and stopping shall be not less than 34 kg, and the minimum load on the battery of sheaves shall be not less than 135 kg. Under these conditions, if a 30% increase in tension lifts the rope from the sheaves, then hold-down rollers shall be used.

5.6.3.6 For hold-down towers the reverse requirement to Clause 5.6.3.5 shall be applied.

5.6.3.7 The sheaves for the return rope shall be installed in a manner to minimise the possibility of a passenger contacting the rope or being struck by one of the returning towing outfits.

5.6.3.8 All line sheaves shall be guarded to minimise the possibility of towing devices or attachments becoming entangled in the sheaves or sheave supports.

5.7 ROPES AND LINE EQUIPMENT

5.7.1 ROPE

5.7.1.1 Hauling rope

5.7.1.1.1 Hauling ropes shall have a minimum factor of safety, at the time of installation, of 4.5 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

5.7.1.1.2 Hauling ropes shall be kept under constant tension by a freely moving counterweight or hydraulic tensioning.

5.7.1.2 Counterweight rope

5.7.1.2.1 Counterweight and tensioning ropes shall have a minimum factor of safety, at the time of installation, of 6.0 based on their ultimate strength, as determined in accordance with the requirements of Clause 3.24.

5.7.1.2.2 With the exception of end connections, splices shall not be permitted in counterweight ropes.

5.7.1.2.3 Where applicable, counterweight or hydraulic tensioning systems shall be designed so that the counterweight or hydraulic ram will reach the end of its travel when the corresponding sheave carriage comes within not less than 150 mm of the end of its travel, and shall be prevented from coming in contact with the counterweight sheave.

5.7.2 TOWING OUTFITS

5.7.2.1 General

5.7.2.1.1 *Factor of safety.* The towing member or hanger shall be designed with a factor of safety of 6.0 while towing a skier alone in either a single or double-towing outfit, or while towing two skiers on a double-towing outfit up the maximum grade under the most unfavourable snow conditions.

5.7.2.12 *Bar or platter.* The bar or platter shall be designed to minimise the potential injury to the skier during loading, unloading, or along the line.

5.7.2.13 *Length.* The length shall permit the skis of the shortest user to remain in firm contact with the snow.

5.7.2.2 Retracting type

5.7.2.2.1 *Telescoping type.* Retraction of the device shall be controlled to limit the possibility of hazard to passengers or equipment and to minimise the possibility of entanglement with the hauling rope, sheaves, or other structures or equipment.

5.7.2.2.2 *Spring-box type.* The provisions of Clause 5.7.2.2.1 shall apply for the spring-box type, with special consideration given to retraction, which could be more critical in this case.

5.7.2.3 Rope grip

5.7.2.3.1 *General.* The grip shall be designed to operate in such a way as not to damage the rope or distort it unduly.

5.7.2.3.2 *Factor of safety.* The factor of safety to be used in the design of all critical parts of grips shall be not less than 5.0.

5.7.2.3.3 *Resistance to sliding.* Rope grips shall be designed to pass smoothly over or under line sheaves and around drive and return sheaves. The gripping action on the rope shall ensure a resistance to sliding along the rope of not less than 3 times the component of the loaded carrier measured at the steepest point

of the tow path, under the most unfavourable snow conditions.

5.7.2.4 Detachable grips

5.7.2.4.1 Detachable grips shall be designed in such a manner that they cannot become accidentally uncoupled, under rope vibration.

5.7.2.5 Fixed grips

5.7.2.5.1 Provision shall be made in the design of grips to facilitate periodic relocation. They shall be moved at least once in every 12 calendar months a uniform distance each time, in the same direction. Manufacturer's instructions shall be followed (see also Part 3). As each grip is moved, the rope shall be examined for deterioration at or near the grip location.

5.8 SERVICE AND INSPECTION PLATFORM

5.8.1 A service and inspection platform, when provided, shall be approved by the ropeway designer. The maximum permissible load to be carried on this platform shall be specified by the ropeway designer, and this maximum permissible load shall be posted on the platform.

Note: It is recommended that a service and inspection platform be provided.

5.9 COMMUNICATIONS FOR MANNED STATIONS

5.9.1 A voice communication system shall be maintained between all manned stations, which shall operate satisfactorily at all times, except where the lift is so short that direct communication is possible.

PART 6: SURFACE ROPEWAYS (FIBRE ROPE) WITH INTERMEDIATE SUPPORTS

6.1 SCOPE

6.1.1 Part 6 covers that class of passenger ropeways on which passengers are transported uphill by grasping hold of the circulating rope with a rope gripper attached to a tow belt while the passenger remains in contact with the surface. On such tows, the hauling rope is supported by intermediate supports and sheaves, at a height of between a minimum of 0.5 m and a maximum of 1.0 m. The return rope may also have intermediate supports.

6.2 LOCATION

6.2.1 GENERAL

6.2.1.1 The location shall be selected so that the ski track will always have, or can be made to have, a level or upward slope. Reverse slopes should be avoided except for mild inclines at loading and unloading areas.

6.2.2 GRADIENT OF TRACK

6.2.2.1 Selection of the site shall also involve consideration of maximum permissible slope of ski track. In no case shall the ropeway exceed a gradient of 40°.

6.2.3 SURFACE WATER

6.2.3.1 Surface water which will make the track icy should be avoided.

6.2.4 TERRAIN CONTOUR LINES

6.2.4.1 The lift shall be located so that, as far as practicable, the lift line intersects the contour lines at right angles. If the cross slope is

unavoidable the lift line must be on the lower part of the cross slope.

6.2.5 WIDTH OF CLEARING

6.2.5.1 The tow path shall be cleared of all obstructions to a skier on both sides of the normal uphill rope path.

6.3 PATH OF THE ROPE

6.3.1 DOWNHILL ROPE

6.3.1.1 The tow shall be constructed so that the downhill rope will not come into contact with the passenger.

6.3.2 TOW PATH

6.3.2.1 The tow and tow path shall be so designed that a skier can be transported to the extreme limits of its travel, the skier being in contact with the snow on the tow path at all times. This will include a minimum of twice the distance between the safety gate and the point where the unloaded tow stops after the safety gate has been actuated.

6.3.3 ROPE FORCE

6.3.3.1 At no point between the loading and discharge areas shall the rope exert a downward force greater than 160 N or an upward force greater than 140 N when held at a height of 0.6 m above the snow surface by a single passenger. The requirements of Clause 6.3.2.1. shall also apply.

6.4 SPEED

6.4.1 Normal operating rope speed shall not normally exceed 4.0 m/s, unless specially approved.

6.5 ACCELERATION AND SPEED CONTROL

6.5.1 A satisfactory method of obtaining safe acceleration of the rope shall be provided. If the prime mover is an internal combustion engine, the speed shall be controlled by a governor.

6.6 BRAKES AND STOPS

6.6.1 GENERAL

6.6.1.1 Unless a minimally-loaded lift operating at maximum speed will stop within 8.0 m, an automatic brake shall be provided to ensure this stopping distance. The brake shall be applied by springs or weights when any stop switch or safety gate is operated.

6.6.1.2 Anti-rollback device

6.6.1.2.1 In all cases, the lift shall have a means to prevent more than 1 m of its reverse motion under full load.

6.6.1.3 Brakes with electric motors

6.6.1.3.1 All tows driven by electric motors shall be equipped with automatic brakes.

6.6.1.4 Safety circuits and safety systems

6.6.1.4.1 All safety circuits, safety systems, terminals and machinery housings shall be sealed, locked or otherwise secured against unauthorised access or interference with the equipment. All electrical stop circuits shall comply with Clause 3.8.1.4.

6.6.2 STOP SWITCHES

6.6.2.1 A stop switch shall be installed at the bottom station and at each major loading and unloading area. Additional switches may be required for long installations and for installations where the passenger is not continuously in the operator's line of vision.

6.6.2.2 All stop switches shall be clearly identified and shall be located in conspicuous positions immediately adjacent to where the public would stop the lift in cases of emergencies.

6.6.2.3 The stop system shall include automatic lockout devices so that the lift cannot be restarted by anyone until the device which stopped the lift has been manually reset; notwithstanding, the resetting shall not restart the lift.

6.6.2.4 All stop systems shall be clearly marked with signs stating their method of operation.

6.6.3 SAFETY GATE

6.6.2.1 A safety gate shall be installed beyond the final unloading area. The location of the gate shall be on the uphill side of the unloading area. There shall be a safety gate which, when operated, will stop the tow before the passenger has travelled half the distance to the first obstruction. This stopping distance shall not be exceeded even though the actuating passenger is the

sole rider and the tow is operating at full speed.

6.6.2.2 The safety gate shall be designed and installed in such a manner that:

(a) its dimensions are such that the contacting passenger cannot avoid or pass through it without actuating the stop circuitry;

(b) it complies with Clause 3.8.1.4;

(c) it is of the manually reset type;

(d) a maximum of 300 mm of movement of the cross member breaks the circuit (measured along the line of the uphill tow path);

(e) it will operate when a force not exceeding 40 N is applied on the same horizontal plane as the rope;

(f) the passenger stops at least 2.0 m before the return sheave or any other obstacle.

6.6.4 SHEAVES

6.6.4.1 General

6.6.4.1.1 All sheaves shall be of such design and so arranged as to minimise the possibility of loss of groove contact, slippage, over-stressing, excessive wear, or damage to the hauling rope. Each shall be properly balanced to prevent excessive vibration and properly aligned to avoid inducing rope twist at operating speed. They and their mountings should be adequate to withstand design loadings.

6.6.4.2 Intermediate sheaves

6.6.4.2.1 Intermediate sheaves shall be fully adjustable vertically and shall be adjusted to keep the rope at a convenient level for the passengers at all times.

6.6.4.2.2 At all times, the rope at the sheaves shall be between 0.5 m and 1.0 m above the track level.

6.6.4.2.3 Where sheaves are used in tandem, and the rope passes over the top of one and under the other, the circumference of one sheave shall not be closer than 200 mm to the circumference of the other, and the loading of the rope on either sheave shall be kept to the minimum.

6.6.4.2.4 Where required to prevent the rope becoming hooked behind the sheave, there shall be rope guards at the top and/or bottom of the sheave.

6.6.4.2.5 The force between the rope and the sheave when the rope is stationary shall in no case exceed 200 N.

6.6.4.3 Tensioning devices

6.6.4.3.1 The support for a tensioning sheave and its connection to a

tensioning device which could be a counterweight, shall have a minimum factor of safety of 6.0.

6.6.4.3.2 Arrangements shall be made to support the tensioning sheave and confine its travel in the event of failure of the tensioning device.

6.6.5 COUNTERWEIGHT

6.6.5.1 A counterweight, if used, shall be adequate in weight just to balance the uphill rope tension when the rope is in the ideal position in relation to the slope.

6.6.5.1 Bottom-driven tows or tows which slip under full load shall be provided with a counterweight system or equivalent feature on the uphill rope between the drive sheave and the loading point to maintain the slack-side tension.

Notes: 1. "Equivalent" means additional wraps or other means to prevent slippage.

2. On a top-driven tow, a counterweight device is not mandatory since the return rope serves to maintain slack-side tension at the drive sheave.

6.6.6 RETURN SHEAVES

6.6.6.1 The return sheaves shall be grooved and so arranged as to minimise the possibility of the rope coming off the sheave. They shall be mounted or installed in a manner to prevent their falling to the ground in case the hauling rope breaks. Their design and installation shall be in accordance with Clause 6.6.4.1 and the supporting device shall have a minimum factor of safety of 6.0.

6.6.7 LOADING AND UNLOADING AREAS

6.6.7.1 The loading area shall be level, free of obstructions and fenced in a manner to guide passengers to the loading point and shall extend a minimum of 9.0 m before the first tower with sheaves supporting the uphill rope is reached.

6.6.7.2 The unloading area shall be either flat or graded down and outward from the line of the uphill track to provide movement away from the towline.

6.7 SUPPORT STRUCTURES

6.7.1 INTERMEDIATE TOWERS

6.7.1.1 The intermediate supports for rope sheaves shall be sufficient size to prevent failure under the most adverse design loading.

When guy wires or braces are used, they should be clearly marked and located so as to provide minimum clearance as required in Clause 6.3.1.1. There shall be no spikes, hooks or other projections, other than support for intermediate sheaves, on the hauling rope side or on the downhill side lower than 2.0 m above the surface of the tow path. Where this is not possible, the total length of the tow line shall be fenced to prevent contact by passengers or skiers actively using the slope.

6.7.2 SHEAVES AND MOUNTINGS

6.7.2.1 The rope sheaves shall be mounted high enough on the intermediate towers to hold the hauling rope between 0.5 m and 1.0 m above the tow surface, and the return rope at least 2.0 m above the tow surface. The sheave mountings shall be sufficiently strong to prevent failure under maximum design conditions. If the vertical component of the rope tension is not sufficient to hold the return rope in the sheave groove at all times, then hold-down rollers shall be used to prevent the rope from leaving the sheave.

6.7.3 LOCATION AND CLEARANCE

6.7.3.1 All structures, installations and supports shall be located to avoid obstruction to any user, and have a minimum clearance of 0.5 m from the haul rope.

6.7.3.2 Guy wires and struts supporting any pylons, towers or machinery which are likely to be struck by skiers, shall be adequately marked and protected.

6.7.3.3 All moving parts, except the hauling rope, which might cause injury shall be suitably guarded.

6.8 LINE EQUIPMENT

6.8.1 HAULING ROPES

6.8.1.1 The hauling rope shall be manilla or synthetic fibre rope manufactured for ski tow use, with a minimum factor of safety of 5.0, based on nominal strength. It shall be installed in accordance with the manufacturer's instructions. In operation the sheave adjustment specified in Clause 6.6.4. shall be used to minimise the rotation of the uphill rope.

6.8.2 ROPE GRIPPERS

6..8.2.1 These shall be so designed that when the skier's hold on the gripper is released, the gripper automatically disengages from the rope.

6.8.2.2 The rope gripper shall be attached to the tow belt from its end point furthest from the gripping end.

PART 7: SURFACE ROPEWAYS WITHOUT INTERMEDIATE SUPPORTS

7.1 SCOPE

7.1.1 Part 7 covers that class of passenger ropeways, wherein passengers grasp the circulating hauling rope or towing device and are propelled uphill. On such devices the uphill rope spans without intermediate support from the loading to the unloading area. The return downhill rope may have intermediate supports.

7.2 LOCATION

7.2.1 GENERAL

7.2.1.1 The location shall be selected so that the ski track will always have, or can be made to have, a level or an uphill slope. Reverse slopes should be avoided except for mild inclines at loading or unloading areas.

7.2.2 GRADIENT OF TRACK

7.2.2.1 Selection of the site shall also involve consideration of maximum permissible slope of the ski track. In no case shall the track be steeper than a grade of 22^{O}.

7.2.3 SURFACE WATER

7.2.3.1 Surface water which will make the track icy should be avoided.

7.2.4 TERRAIN CONTOUR LINES

7.2.4.1 The lift should be constructed so that, as far as possible, the lift line intersects the contour lines at right angles. If a cross slope is unavoidable, the lift line must be on the lower part of the cross slope.

7.2.5 WIDTH OF CLEARING

7.2.5.1 The tow path shall be cleared of all obstructions to a skier on both sides of the normal uphill rope path.

7.3 PATH OF ROPE

7.3.1 DOWNHILL ROPE

7.3.1.1 The tow shall be constructed so that the downhill rope will not come into contact with the passenger.

7.3.2 TOW PATH

7.3.2.1 The tow and the tow path shall be designed so that the skier can be transported to the extreme limits of its travel, the skier being in contact with the snow on the tow path at all times. This will include a minimum of twice the distance between the safety gate and the point where the unloaded rope stops after the safety gate has been actuated.

7.4 SPEED

7.4.1 Normal operating speed shall in no case exceed 4.0 m/s.

Note: For beginner tows, the ratio of speed in [m/s] to average tow slope in [%] should not exceed 0.20.

7.5 TERMINALS

7.5.1 ACCELERATION AND SPEED CONTROL

7.5.1.1 A satisfactory method of obtaining safe acceleration of the rope shall be provided. If the prime mover is an internal combustion engine, the speed shall be controlled by a governor.

7.5.2 BRAKES AND STOPS

7.5.2.1 Brakes

7.5.2.1.1 Unless the unloaded lift, operating at maximum speed, stops within safe limits as defined in Clause 7.5.4., an automatic brake shall be installed.

7.5.2.2 Anti-rollback device

7.5.2.2.1 In all cases the lift shall have means to prevent more than 1 m of reverse motion of the lift under full load.

7.5.2.3 Stop circuits

7.5.2.3.1 All electrical stop circuits shall comply with Clause 3.8.1.4.

7.5.3 STOP SWITCHES

7.5.3.1 A stop switch shall be installed at each loading and unloading point. In the case of long installations, or wherever a passenger is out of the line of vision of the operator restarting the lift, additional switches shall be provided which shall include automatic lock-out devices so that the lift cannot be restarted by anyone until the device which stopped the lift has been manually reset; notwithstanding, the resetting shall not restart the lift.

7.5.3.2 All stop switches shall be clearly identified, and those located at the loading area shall be immediately available to attendants. Emergency stop switches shall be located in conspicuous places where the public can stop the lift in case of an emergency.

7.5.4 SAFETY GATE

7.5.4.1 A safety gate or gates shall be installed beyond each unloading area. The location of the gate shall be on the uphill side of the unloading area. There shall be a safety gate which will stop the tow before the actuating passenger has travelled half the distance to the first obstruction. This stopping distance shall not be exceeded even though the actuating passenger is the sole rider and the tow is under full speed operation. (See Clause 7.3.2.1.).

7.5.4.2 The safety gate shall be designed and installed in such a manner that:

(a) its dimensions are such that the contacting passenger cannot avoid or pass through it without actuating the stop circuitry;

(b) it complies with Clause 3.8.1.4;

(c) it is of the manually reset type;

(d) a maximum of 300 mm of movement of the cross member (measured along the line of the uphill tow path) breaks the circuit;

(e) it will operate when a force not exceeding 40 N is applied on the same horizontal plane as the rope; and

(f) The passenger stops at least 2.0 m before the return sheave or any other obstacle.

7.5.5 SHEAVES

7.5.5.1 General

7.5.5.1.1 All sheaves shall be of such a design and so arranged as to

minimise the possibility of loss of groove contact, slippage, over-stressing, excessive wear, or damage to the hauling rope. Each shall be properly balanced to prevent excessive vibration and properly aligned to avoid inducing rope twist at operating speed. They and their mountings should be adequate to withstand design loadings.

7.5.5.2 Unloading sheave

7.5.5.2.1 The unloading sheave, located at the top of the uphill rope, shall be capable of fine alignment adjustment to eliminate residual rope twist in the uphill rope.

7.5.5.3 Loading sheaves

7.5.5.3.1 A grooved sheave or sheaves may be installed so as to hold the uphill rope 0.5 - 1.0 m above the snow at the loading position. Where used, these shall be so arranged as to prevent the rope from being pulled out of the groove by the passengers.

7.5.5.4 Intermediate sheaves

7.5.5.4.1 There shall be no intermediate sheaves on the uphill rope between the loading and unloading areas.

7.5.5.5 Terminal sheaves for wire ropes

7.5.5.5.1 The minimum diameter of the terminal sheaves shall be 72 times the nominal diameter of the hauling rope, provided no gripping device passes around the sheave. Where gripping devices pass around the sheave, the minimum diameter shall be 80 times the nominal hauling rope diameter.

7.5.5.6 Intermediate sheaves for wire ropes

7.5.5.6.1 The diameter of intermediate sheaves, where installed in return downhill line, shall not be less than 10 times the nominal diameter of the hauling rope for unlined sheaves and 8 times the nominal diameter of the hauling rope for lined sheaves.

7.5.5.7 Sheaves in tows with towing handles or towing outfits

7.5.5.7.1 A 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 when passing through the sheaves.

7.5.6 TENSIONING DEVICE

7.5.6.1 The support for a tensioning sheave and its connection to a tensioning device, which could be a counterweight, shall have a minimum factor of safety of 6.0.

7.5.6.2 Arrangements shall be made to support the tensioning sheave and confine its travel in the event of failure of the tensioning device.

7.5.7 COUNTERWEIGHT

7.5.7.1 A counterweight, if used, shall be adequate in weight just to balance the uphill rope tension when this rope is in the ideal position in relation to the slope.

7.5.7.2 Bottom-driven tows or tows which slip under full load shall be provided with a counterweight system or equivalent feature on the uphill rope between the drive sheave and the loading point to maintain slack-side tension.

Notes: 1. "Equivalent" means additional wraps or other means to prevent slippage.

2. On a top-driven tow, a counterweight device is not mandatory since the return rope serves to maintain slack-side tension.

7.5.8 RETURN SHEAVES

7.5.8.1 The return sheaves shall be grooved and so arranged as to minimise the possibility of the rope coming off the sheaves. They shall be mounted or installed in a manner to prevent their falling to the ground in case the hauling rope breaks. The area beneath the return sheave shall be suitably fenced or guarded. Their design and installation shall be in accordance with Clause 7.5.5.1. and supporting devices shall have a minimum factor of safety of 6.0.

7.5.9 LOADING AREA

7.5.9.1 The loading area shall be as nearly level as possible. The area shall be free from obstructions and arranged and fenced so as to guide skiers to the loading point.

7.5.10 UNLOADING AREA

7.5.10.1 The unloading area shall be arranged to permit the skier to unload from the rope with as little effort as the terrain will permit.

7.6 LINE STRUCTURES

7.6.1 INTERMEDIATE TOWERS

7.6.1.1 For surface ropeways without intermediate supports, but having installed intermediate towers on their downhill rope path, Clause 6.7.1.1 applies.

7.6.2 GUARDS

7.6.2.1 All moving parts, except the hauling rope, which might cause injury shall be suitably guarded.

7.6.3 SHEAVES AND MOUNTINGS

7.6.3.1 The return rope sheaves shall be mounted high enough on the intermediate towers to hold the rope at least 2.0 m above maximum snow conditions. The sheave mountings shall be sufficiently strong to prevent failure under the maximum 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 the rope from leaving the sheave.

7.7 LINE EQUIPMENT

7.7.1 FIBRE OR SYNTHETIC HAULING ROPES

7.7.1.1 The hauling rope shall be a manilla or synthetic fibre rope manufactured for ski tow use with a minimum safety factor of 5.0 based on nominal strength. It shall be installed in accordance with the manufacturer's instructions. In operation, the sheave adjustment specified in Clause 7.5.5.2 shall be used to regulate the rotation of the unloaded uphill rope to less than 2 revolutions over the length of the tow.

7.7.2 WIRE HAULING ROPES

7.7.2.1 Only steel wire rope as specified by the tow manufacturer shall be used. It shall be installed in accordance with the manufacturer's instructions. In operation, the sheave adjustment specified in Clause 7.5.5.2. shall be used to regulate the rotation of the unloaded uphill rope to less than 2 revolutions over the length of the tow.

7.7.3 ROPE GRIPS (FIXED AND DETACHABLE)

7.7.3.1 General

7.7.3.1.1 The rope grip shall be designed to pass smoothly over and under sheaves which have flanges of adequate depth to discourage the hauling rope from leaving the sheaves.

7.7.4 STRENGTH OF ROPE GRIPS

7.7.4.2 The strength of the grip shall be based on the following criteria:

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

(b) grips shall be proof-loaded with forces equal to the gripping force and three times the force required to move a skier under the most adverse conditions.

7.7.5 TOWING DEVICES

7.7.5.1 Rope grips shall be designed and maintained in use to prevent sliding along the hauling rope when subject to three times the force required to move a passenger along the ski track at the steepest point under the most adverse conditions of carrier loading and with a properly lubricated hauling rope. The device shall be designed, operated and maintained to minimise the possibility of gloves or clothing becoming entangled or fingers being pinched between the device and the hauling rope.

7.7.5.2 Attaching the device to the hauling rope shall in no way impair the strength of the hauling rope. The device shall be relocated on the hauling rope in accordance with the manufacturer's instructions.

7.7.6 WIRE ROPE WEAR

7.7.6.1 No hauling rope shall be permitted to remain in service when ends of broken wires protrude above the surface of the rope.

PART 8: REVERSIBLE AERIAL PASSENGER ROPEWAYS

8.1 SCOPE

8.1.1 Part 8 covers the class of passenger ropeways wherein the cable-supported carriers reciprocate between the stations. The requirements of this part have been formulated for reversible ropeways wherein a haul rope (or ropes) is used to move the carriers along the track rope(s).

8.1.2 The requirements of this part shall apply in addition to those of Part 2 and Part 3 of this Code of Practice..

8.2 GENERAL CABIN CLEARANCES

8.2.1 The minimum clearance from the cabin in any direction when the cabin is clear of towers and station shall be 2 m.

8.3 VERTICAL CLEARANCES

8.3.1 Where persons are permitted under the ropeway, a minimum clearance of 4 m shall be provided between the underside of a carrier and the snow profile, ground ,and any obstruction.

8.3.2 Where persons are not permitted under the ropeway, a minimum clearance of 2.4 m shall be provided between the underside of a carrier and the snow profile, ground, and any obstruction, except in loading and unloading areas.

8.3.3 Where public vehicles are permitted under the ropeway, a minimum clearance of 5.5 m shall be provided between the underside of a carrier and the road surface, except where means are provided to restrict and control the vehicle height.

8.4 HORIZONTAL CLEARANCES

8.4.1 Horizontal clearances shall conform to the following:

(a) For spans up to 300 m in length, the gauge of the track ropes shall be such that there is at least 1 m of clearance between the cabins when swung 12^{o} towards each other. For spans greater than 300 m, with the cabins passing in the

middle third, the clearance shall be increased by 0.2 m for each additional 90 m of span. For spans greater than 300 m, with the cabins passing but not in the middle third, the increase in clearance may be reduced proportionately. In the latter case the gauge at the middle of the span shall meet the requirements of Clause 8.4 (b).

(b) For spans where the cabins do not pass, or for single reversible ropeways, the separation at the middle of the span between the cabin swung 12^{O} inwards and any rope with which it may come into contact, shall be at least 1.8 m for spans up to 300 m in length. For spans greater than 300 m, the separation shall be increased by 0.3 m for each additional 150 m of span.

(c) The cabin shall be permitted to swing freely 20^{O} off the vertical in the plane of the rope.

8.5 WIND FORCE

8.5.1 WIND ON CABINS AND HANGERS

8.5.1.1 Where no test results are available for wind loads on the cabin hanger and carriage, the following shape factors shall be used;

(a) carriage and hanger: 1.6; and

(b) cabin: 1.0.

8.5.2 WIND ON ROPES

8.5.2.1 On spans over 400 m, wind forces due to gust speeds shall be considered as acting on a length of rope equal to 240 m plus 40% of the length of the span.

8.6 TOWERS AND TRACK ROPE SADDLES

8.6..1 Tower heights and locations shall be arranged so that the track ropes cannot lift out of their saddles under the operating conditions including a 30% increase in tension.

8.6.2 The minimum pressure on the track rope saddle shall be not less than 1.5 times the pressure required to hold the rope in contact with the saddle when a wind pressure of 0.29 kPa is applied upward on the rope, parallel to the reaction on the tower.

8.6.3 The track rope shall be free to slide over the saddle to balance rope tension.

8.6.4 The coefficient of friction of a track rope sliding in a saddle shall be taken into account.

8.6.5 Provision shall be made for lubrication of the saddles.

8.6.6 The weight of a loaded carrier passing over a tower shall be considered as a static load.

8.6.7 Torsional displacement of the tower, including the saddle, shall be limited to a value such that deropement shall not occur under the most adverse design conditions.

8.6.8 The radius of the track rope saddle shall be large enough to provide smooth transition of the carrier from span to span, and shall not be less than 300 times the diameter of the track rope.

8.6.9 The radial acceleration of the carrier shall not exceed 2.0 m/s^2 when travelling over the track rope saddle.

8.6.10 The saddle shall be long enough to ensure that the track rope does not contact the ends of the saddle.

8.6.11 Saddles shall permit free passage of the carriage when the carrier is swinging laterally within design limitations as it approaches or passes the tower.

8.7 HAUL ROPE GUIDES

8.7.1 All line sheave assemblies shall be provided with guides to:

(a) permit the unobstructed passage of a carrier gripped or attached to the haul rope, regardless of the position of the haul rope as the carrier approaches the sheave assembly; and

(b) ensure the return of the rope to the sheave grooves with winds across the line of the rope.

8.8 CABIN GUIDES

8.8..1 Where necessary, towers shall be equipped with cabin guides to reduce the lateral swing to a maximum of 8^{O} from the vertical where a cabin is passing a tower. At no time shall any part of a cabin or its suspension system make contact with any other part of the tower.

8.8.2 When open windows are used on the tower side, a clearance of not less than 450 mm shall be maintained at the window height when the carrier is swung inward by the maximum distance permitted by the design.

8.9 SHEAVES - TRACK ROPE TO COUNTERWEIGHT

8.9..1 When a locked coil rope passes over a sheave or roller chain and connects directly to a counterweight, the radius of curvature of the sheave or roller chain shall be not less than 100 times the rope diameter.

8.10 DRIVES

8.10.1 MAIN DRIVE

8.10.1.1 The main drive shall provide for the regulation of cabin speed when the cabin enters and leaves stations and, if necessary, when it passes over towers

8.10.2 EVACUATION DRIVE

8.10.2.1 When V-belts are used for the evacuation drive, the minimum number shall be 4.

8.11 BRAKING SYSTEM

8.11.1 GENERAL REQUIREMENTS

8.11.1.1 For the purpose of this part, braking system shall mean any ropeway motion-retarding system or device, together with their controls, and includes the retarding effects of friction and gravity.

8.11.1.2 Each ropeway shall be equipped with three means of braking: an emergency brake, a service brake, and another means of braking, which may be dynamic braking or a third friction brake

8.11.1.3 When any stop function is initiated, its braking system(s) shall decelerate the rope between a minimum of 0.5 m/s^2 and a maximum of 2.0 m/s^2 for the ropeway's range of design loads, speed, and loading directions

8.11.1.4 The emergency brake and the service brake, acting independently, shall decelerate the rope between a minimum of 0.5 m/s^2 and a maximum of 2.0 m/s^2 for the ropeway's range of design loads, speed, and loading directions.

8.11.2 SERVICE BRAKE

8.11.2.1 In addition to the requirements of Clause 4.7.1.1, the service brake shall operate when:

(a) a cabin fails to reduce speed on approaching and entering stations or, where necessary, when passing towers;

(b) a cabin reaches the normal stop position;

(c) a remote stop from a cabin is actuated;

(d) any safety device is operated; and

(e) insulated haul or counter ropes are electrically grounded.

8.11.3 EMERGENCY BRAKE

8.11.3.1 In addition to the requirements of Clause 4.7.1.2, the emergency brake shall operate when a cabin overruns a normal stop position.

8.12 CARRIAGES

8.12.1 WHEELS

8.12.1.1 The maximum load carried by each carriage wheel shall be not more than 1/80 of the minimum tension of the rope; or the load per wheel divided by the cross-sectional area of the rope shall not exceed 5 MPa, whichever is less.

8.12.1.2 The carriage shall be equipped with a device that will hold the carriage on the track rope should the wheels derail.

8.12.1.3 Where icing conditions may exist, the carriage shall be equipped with ice-removing devices that shall not contact the track rope.

8.12.2 CARRIAGE BRAKES

8.12.2.1 The carriage on a bicable system shall be equipped with a brake that will grip the track rope. The brake shall be capable of stopping and holding a fully loaded carrier at the point of maximum gradient of the track ropes. The brake shall function in the event of:

(a) a haul rope, counter rope, or connection failure; and

(b) application by the cabin attendant.

8.12.2.2 It shall be possible to release the carriage brake from the cabin when at any location on the line.

8.12.2.3 The carriage brake shall provide smooth stops without damage to the track rope, carrier, or structures under all design conditions.

8.12.2.4 Application of the carriage brake shall stop the drive.

8.12.2.5 A procedure shall be provided to test the carriage brake and its application in the case of loss of rope tension, and its ability to hold the load.

8.12.2.6 The carriage brake may be omitted if the ropeway profile is such that an uncontrolled carrier will not reach abnormal speed and will not contact a station.

8.13 HANGERS

8.13.1 Hangers shall be equipped with a platform for the inspection of the carriage and ropes.

8.14 CABINS

8.14.1 Cabin doors shall be equipped with locks. Door interlocks shall prevent the ropeway from starting with open doors.

8.14.2 Each cabin with an attendant shall carry evacuation equipment.

8.14.3 Floor space for passengers shall be not less than 0.25 m^2 per person for the first 15 passengers, and 0.18 m^2 per person thereafter.

8.14.4 The windows on the tower side shall be kept closed or screened where the cabins are unattended.

8.14.5 Cabin windows shall be of shatter-resistant material

8.14.6 Materials used in the structural members of cabins shall be noncombustible.

8.15 LOADING AND UNLOADING AREAS

8.15.1 ENTRANCE GUIDES

8.15.1.1 Entrance guides shall be provided at the entrance to each station to guide a cabin swinging in any combination of 10^{O} longitudinally and 10^{O} laterally into the cabin guide.

8.15.2 CABIN GUIDES

8.15.2.1 Guides shall be provided within the station to prevent lateral swing of the cabins when loading or unloading.

8.15.3 CARRIER STOPS

8.15.3.1 Devices shall be provided to stop the cabins at the correct locations in the stations.

8.15.4 PLATFORMS

8.15.4.1 Platforms shall be provided with sufficient space to accommodate passengers waiting to embark and passengers disembarking from the cabins. Provision shall be made for the separation of embarking and disembarking passengers.

8.16 CONTROLS

8.16.1 GENERAL

8.16.1.1 The following controls and/or devices shall be provided:

(a) automatic deceleration to prevent a cabin from entering the terminals at speeds in excess of 0.45 m/s. This requirement shall not override the requirements of item (c);

(b) automatic stop of a cabin, should it fail to decelerate as required by item (a);

(c) automatic stop of the drive system in the event of loss of the supervisory control system, excessive torque in the drive system, speed in excess of predetermined safe speeds at the zone checkpoints, or application of any brake;

(d) automatic indexing of the zone speed programmer that controls acceleration, deceleration, starting, crawling, and stopping at each station;

(e) a minimum of three independent checks of cabin speed when cabins are approaching the stations, each of which when compared with predetermined safe speed, shall initiate a stop if the predetermined speeds are exceeded;

(f) a minimum of two independent checks of overspeed conditions which shall initiate a stop; and

(g) an independent system to check the zone speed system to ensure compliance with Items (e) and (f).

8.16.2 CONTROL ROOM

8.16.2.1 At least the following equipment shall be installed in the control room:

(a) a cabin speed indicator;

(b) a cabin position-on-the-line indicator;

(c) a manually operated cabin speed control;

(d) a wind speed indicator;

(e) an indication of failure of the cabin supervisory control system;

(f) a torque overload indicator; and

(g) an indication of overspeed in the slow station and tower zones.

8.16.3 MANUAL STOP SWITCHES

8.16.3.1 Manual stop switches shall be installed at the following locations:

(a) the operator's station;

(b) loading and unloading platforms; and

(c) inside carriers where an attendant is required.

8.17 COMMUNICATION

8.17.1 A telephone system and a second form of communication shall be provided for communication to both terminals and between cabins.

8.18 EVACUATION

8.18.1 For evacuation procedure, see Clause 4.5.

8.18.2 Ropeway shall be provided with a means to evacuate passengers from standard carriers at all positions along the line of travel of the carrier.

8.18.3 Where the ropeway passes over terrain where access by foot is difficult, or where the cabin height makes descent by escape rope impractical, an independently driven rescue system, such as a rescue cabin, shall be installed. For aerial ropeways, the persons using the rescue cabin shall be supplied with a communications system and evacuation equipment.

8.18.4 Where the ropeway passes over terrain which is easily accessible by foot, evacuation by rope directly from the cabin shall be permitted. Evacuation equipment and method shall be taken into account in the cabin design.

8.18.5 Each cabin shall be equipped with a first-aid kit and emergency lighting. The minimum requirements on first-aid kit contents are set by OSH.

APPENDIX 1: SIGNAGE

Some commonly used wording, suggested for use in connection with passenger ropeways signage is as follows:

All lifts:

If not familiar with use of lift, ask attendant for instructions

Chair lifts (except gondola lifts):

Prepare to unload *(Not less than 15 m ahead of the unloading area)*

Keep ski tips up *(Ahead of any points where skis may come into contact with a platform or the snow surface)*

Unload here

Do not swing or bounce chairs *(On first or second tower)*

Surface lifts

Prepare to unload *(No less than 15 m ahead of unloading area)*

Stay in track

Unload here

Rope tows

No loose clothing or long hair exposed *(At loading area)*

Stay in track

Unload here

Remove pole straps from wrists *(At loading area)*

APPENDIX 2: DAILY INSPECTION RECORDS

Daily inspections shall be recorded on a printed checklist which indicates the condition of the component, and the abnormalities noted.

For aerial ropeway systems, in addition to data contained in the checklist, the daily inspection record book shall include for each day a statement to be completed by the person in charge of inspections required under Clause 3.4.5.2.1, as follows:

"I *(full name of person)*, being the person in charge of inspections under Clause 3.4.5.2.1 of the *Code of Practice for Passenger Ropeways in New Zealand*, 1998 Edition, hereby certify that, at *(time)* on *(date)*, the daily inspections have been completed to my satisfaction and the ropeway established to be in good order and condition.

Remarks (if any):

Signature:.....

APPENDIX 3: THE NEW ZEALAND MOUNTAIN SAFETY COUNCIL

NEW ZEALAND MOUNTAIN SAFETY COUNCIL INC.

PO Box 6027, Wellington

Phone (04) 385-7162

Fax (04) 385-7366

MEMBER ORGANISATIONS OF THE NEW ZEALAND MOUNTAIN SAFETY COUNCIL

Accident Rehabilitation Compensation Insurance Corporation

Department of Conservation

Federated Mountain Clubs

Federation of NZ Youth Organisations

NZ Alpine Club

NZ Deerstalkers Association

NZ Defence Force

NZ Land Search and Rescue

NZ Outdoor Instructors Association

NZ Police

NZ Shooting Federation

NZ Ski Council

NZ Sports Industry Association

Tourism Industry Association of New Zealand

THE NZ MOUNTAIN SAFETY COUNCIL'S VISION

The Council's vision is that all New Zealanders have access to information, training and resources, so they can enjoy their outdoor experiences safely.

THE COUNCIL'S MISSION

The Council's mission is to:

- enable people to enjoy their recreation safely in the outdoors;
- foster positive community support for outdoor safety; and
- promote the development and maintenance of national outdoor safety standards for land-based activities.

THE COUNCIL'S FOCUS

To promote safe practices in land-based recreational, educational, and adventure activities outdoors, the New Zealand Mountain Safety Council will:

- promote and encourage safe practices;
- train people to develop their outdoor skills;
- educate people to develop their knowledge, attitudes, and values;
- provide written and other resources;
- set and promote standards;
- engage in and promote research; and
- provide support to other agencies with complementary aims and intentions.