



ORGANIZZAZIONE INTERNAZIONALE TRASPORTI A FUNE
INTERNATIONALE ORGANISATION FÜR DAS SEILBAHNWESEN
ORGANISATION INTERNATIONALE DES TRANSPORTS A CABLES
INTERNATIONAL ORGANIZATION FOR TRANSPORTATION BY ROPE
ORGANISACION INTERNACIONAL DES TRANSPORTES POR CABLE

Technical recommendations in effect

BOOK N. 25-1
(June 2009)

Recommended guidelines for the identification of fundamental safety aspects of bicable reversible aerial ropeways

This Recommendation is not mandatory but provides guidance to the profession. Its application would be desirable in all countries, however, without prejudice to national standards as well as requirements specified by public authorities.



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ROMA 1957
 PARIS 1963
 LUZERN 1969
 WIEN 1975
 MÜNCHEN 1981
 GRENOBLE 1987
 BARCELONA 1993
 SAN FRANCISCO 1999
 INNSBRUCK 2005
 RIO DE JANEIRO 2011

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O. I. T. A. F.

Book n° 25 - 1

Recommended guidelines for the identification of fundamental safety aspects of bicable reversible aerial ropeways

Hazardous situations and scenarios which ought to be given due consideration in a safety analyses of this ropeway system

June 2009

Foreword

The O.I.T.A.F. Work committee 1 has been assigned the task to assess the fundamental safety aspects which ought to be given due consideration in a safety analysis of ropeway systems bearing in mind that the experience made so far and gained knowledge teach us that extremely detailed specifications very often represent a hindrance to improvements and further development of the technology. This document is meant as a general survey of hazardous situations and scenarios of current ropeway systems and is definitely not meant as a recommendation for the execution of safety analyses.

The European Directive 2000/9/EC relating to cableway installations designed to carry persons dated March 20, 2000, of the European Council and the European Parliament has been the master document the members of the work committee have referred to. All members of work committee 1, experts of competent European supervisory authorities, notified bodies, ropeway manufacturers, ropeway operators, ropeway designers and research institutes have fully committed themselves to the fulfilment of their assignment by taking part in the discussion and exchange of views on hazardous situations and scenarios, and by so doing, have made a decisive contribution to the compilation and publication of the general survey.

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I. Introduction

All ropeway installations which are being designed to carry persons have to meet, whatever their system, essential safety and health requirements. In order to assess their capacity to meet these requirements, all ropeway installations, seen as a whole, and their subsystems have to be subjected to a safety analysis permitting to identify the likely cause of hazardous scenarios which might impair the safety and operability of the installation while they are being operated or are out of operation, as well as to impair the health of persons, passenger, members of the staff and third persons.

II. The ropeway system

The following recommendations are concerned with bicable reversible aerial ropeways designed to carry persons. The document is not a guide for the execution of safety analyses, but ought to be regarded as a survey describing the manifold hazardous scenarios which might arise during operation of a bicable reversible aerial ropeway or even when it is out of operation. For reasons of transparency it has been decided to tackle one after the other, and wherever possible, independently one from another, the hazardous situations brought about by components of the different subsystems of the ropeway, its infrastructure or its operating conditions. The document is based on the following approach :

- 1 Subsystems
 - 1.1 Ropes
 - 1.2 Rope connections
 - 2. Drives and brakes
 - 3. Mechanical devices
 - 3.1 Rope tensioning devices
 - 3.2 Mechanical devices of the ropeway station
 - 3.3 Mechanical devices of line structures
 - 4. Carriers
 - 4.1 Cabin
 - 4.2 Hanger
 - 4.3 Carrier truck
 - 4.4 Rope end fixing
 - 5. Electrical devices
 - 6. Rescue equipment
- Infrastructure
- 7. Line structures
 - 8. Station structures
- Operation
- 9. Hazardous scenarios due to operating procedures and conditions
 - 10. Operational infrastructure
 - 10.1 Passage ways
 - 10.2 Line
 - 11. External action

Several components of the infrastructure (for instance the track) and electrical devices have not been dealt with in this survey. This is also the reason why relative interfaces have not been dealt with in detail, even though they have of course to be given due consideration in the safety analysis of a ropeway installation. Neither have actions of the environment been dealt with because the environment varies from one case to another and depends on the general conditions and aspects of the project and its location.

III. Hazardous scenarios

Designers, manufacturers and operators of ropeway installations are required to carry out systematic analyses of ropeway installations, seen as a whole, and of their components so as to determine whether the failure or malfunction of a component might impair the safety of all concerned persons and the safety and perfect operation of the ropeway. **Hazardous scenarios listed in the following tables do not claim to be a complete and exhaustive enumeration of all possible hazardous scenarios. Yet Users will be well advised to check their validity and applicability against the specific features of the concerned ropeway or component and, should the need arise, to complete the list by adding additional hazardous scenarios.**

The members of the work committee are confident that the following tables may help and offer guidance to users who are confronted with the task to identify and determine hazardous situations.

Hazardous scenarios and situations	
Hazards due to mechanical components	
- Shape - Relative line-up - Weight and stability (potential energy of components which are likely be induced to move by gravitational action) - Insufficient mechanical strength	
Hazards due to accumulated energy	
- Elastic components - Pressurized liquids or gases - Splitting of invasion of pressurized liquids or gases	
Hazards due to the concurrent action of several moving components	
- Squeezing - Shearing - Cutting or truncating - Snatching or pulling in - Impact - Friction or war - Derailment	
Electrical hazards	
- Direct contact of persons and components carry current - Persons getting in contact with component which have become current carrying as a result of a disorder - Persons getting near to high voltage carrying components - Electrostatic phenomena - Lightning stroke	

Hazards due to the thermal action of heat or cold
- Injury to health due to a cold or hot environment
Hazards due to noise
Hazards due to vibrations
Hazards due to irradiation
Hazards due to the disregard of ergonomic principles
- Unhealthy posture or heavy corporal strain - Disregard of the hand-arm and foot-leg anatomy - Inadequate illuminate - Human behaviour - Operation errors - Inadequate design or improper position of displays and controls
Power supply outage
Failure of control circuits
Insufficiency of stopping devices which can bring the ropeway to a halt or stop specific components
Unauthorized or accidental command to set the installation going or to actuate its components
Unauthorized use of the ropeway
Insufficiency of rescue and evacuation facilities
Imperfect construction of the ropeway, of its installation, its repair or its maintenance due to defective assembly of components
Improper choice of tools and working materials
Insufficient repair and maintenance
Breakage during operation
Dropping or thrown objects
Hazards occurring in access, exit or sojourn areas and on the work place
- Persons stumbling or falling in access, exit or sojourn areas or on the work place - Exhaust gases or oxygen deficiency - Fire, inflammable materials - Explosions - Deficiency of service instructions -
Hazards due to the action of natural phenomena
- Rain - Water - Snow - Ice / frost - Permafrost - Washout - Wind - Falling rock - Avalanches - Fire

- Mudflow
- Earthquake
- Volcanism
- Trees

The surveyed hazardous scenarios are listed in the following tables. Headings and content of the five columns have the following meaning :

Component

Any constituent part of a ropeway installation having a specific designation of destination and feature in the context of the ropeway installation

Function

The intended purpose or action the component is expected to achieve in all circumstances

Requirement

Minimum requirement to be met for the component to guarantee the fulfilment of the intended purpose or function

Hazardous situation

Any situation in which a person is exposed to a hazard or to hazards

Hazardous scenario

Any event which directly gives rise to a hazardous situation

III. Safety analysis

The safety analysis is a procedure which is followed with a view to assessing the safety of all components, the quality of their technical execution and concurrent action (interfaces), as well as the safety of innovative solutions.

The analysis includes the assessment of likely damage or injury suffered by all directly involved persons or by the ropeway installation.

The analysis is inclusive of all chain reactions triggered by the occurrence of an event, but may neglect the simultaneous occurrence of two independent hazardous situations.

IV. Operational requirements

It is imperative to take all necessary precautions and technical measures which provide certainty that the operation of the ropeway installation is conform to the intended use , guarantees the required safety and the regular maintenance of the installation.