



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

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Recommendation on Planning and Construction of ropeway installations designed to carry persons

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.



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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Recommendation on Planning and Construction of ropeway installations designed to carry persons

The purpose of the present recommendation is to serve as a guideline for the planning and construction of ropeway installations designed to carry persons and thus as a helpful tool intended for all persons directly involved in activities of ropeway planning (main contractor, planner, designer, constructor etc.) in which they will find an indication of circumstances and aspects that need to be given due consideration when planning or building a ropeway installation.

Chapter I: Planning and Construction

1 Planning

The planning of a ropeway is a rather complex process in which due consideration has to be given to a twofold approach, i.e. a strategic approach, on one side, and the actual design, on the other. This is why it requires an accurate preparation and is carried out by the sponsor, more often than not, with the support of the constructor or an expert appointed by the sponsor.

Seen that the strategic approach and design affect each other the planning process is after all, despite this twofold approach, a dynamic and iterative process.

1.1 The strategic approach

The strategic approach is actually the tangible construct of the sponsor's specifications and objectives. In defining the strategic approach due consideration must be given in particular to the following aspects :

- Purpose of the ropeway (for instance development of a leisure and recreation resort or region, development of traffic and transport facilities which meet real traffic and transport requirements, preservation of a regional settlement, transportation over rough and inaccessible tracts of land, creation of a netted regional transport system with other ropeway installations)
- Running time (whole year, seasonal)
- Type of operation (for instance night runs)
- Type of transport service (transport of passengers, transport of passengers and materials, transport of hikers, transport of passengers with attached snow gliding runners)

- Economy of the ropeway (profit after construction, operation and maintenance cost)
- Rated capacity
- Prestige
- Total time of planning, design and execution, construction time
- Financing, budget

1.2 Design

The assessment of the general reference frame of sponsor's specifications and objectives detailed in the strategic approach and the effect of external action has a decisive importance for the choice of the ropeway system and its feasibility because the assessed details are the fundamental data which have to be referred to for the transposition of the detailed specifications and objectives (Cf chapter II) and has hence also fundamental implications for the planning and design of a ropeway.

As for the assessment of the action of external factors it is in many instances necessary to turn for help and advise to experts having the necessary experience and are hence capable of supplying the required information and documentation (for instance geotechnical assessment of the terrain, ground surveys, assessment of probable loads of the snow).

The specifications of the strategic approach and the assessment of external factors are the fundamental elements which have to be referred to by the designer (ropeway system, site and position of the ropeway) and permit to identify the fundamental prerequisites which have to be met in order to guarantee the success of the project.

1.2.1 General outline of fundamental features of the design

The general outline document ought to include all documents which have to be submitted to the competent body with the request for the authorisation for the implementation of the project, i.e. the following ones :

- Safety analysis* of all safety aspects of the ropeway and of its environment. The analysis ought to include also a survey of past experience.
- Description of the ropeway and of all its ancillary structural works
- Technical data
- Specification of the operational programme (ropeway operated in summer, in winter, all year round, uphill transport, downhill transport, possibly operated by night, transport of goods etc.) operating instructions (operating cycle, manpower, traffic monitoring)
- Plan of the site (recommended scale 1 : 25 000),
- Longitudinal profile of aerial ropeways (description of the terrain, position of stations and line support structures, description of the rope line configuration, sags, crossings etc.) (recommended scale 1 : 500 or 1 : 1000)
- Horizontal projection and longitudinal profile of the track (description of the terrain, position of stations and line support structures, description of the lay out of the rope line, sags, crossings etc.) (recommended scale 1 : 500 or 1 : 1000)
- Standard cross section with precise indication of the kinetic clearance, (clearance gauge limit) recommended scale 1 : 500 or 1 : 1000)
- Line calculation
- Verification of conformity with the specified safety distances in the most unfavourable operating conditions (description of crossings, required distance to fixed structures and other means of transportation) or in the case of a reduced distance from the ground

- Additional verifications which are thought to be necessary to provide additional protection of the ropeway, of passengers and of the staff against the interference of existing ropeway installations in the proximity or prospected new installations to be built in the proximity of the projected ropeway, for instance high voltage line, stock of explosive agents, fuel station, water basins for the production of artificial snow and other waters, inflammable structures
- Description of the station building and structures (recommended scale 1 : 100)
- Description of incoming and outgoing passage ways
- Description of working places of the staff showing the position of commands
- Concept of escape ways within the station
- Assembly drawings and description of mechanic components of the ropeway such as for instance drive and brakes, tensioning device, carriers, ropes, the mechanic equipment of the station and of line support structures, including a description of the principle of their functions
- Description of electrical components
- Assembly drawings of line support structures
- Concept of the rescue system (type of rescue, calculation of the time needed to complete the rescue operation, number of recovery devices etc.)
- Concept of emergencies (for instance fire, transportation of injured persons, natural phenomena)
- Description of guards of the ropeway, guards protecting persons against the hazard of avalanches, creeping snow, falling rock, high-water, fire
- Guards protecting the projected ropeway against hazards of crossings with other means of transportation or the proximity of other means of transportation i.e. other ropeways, roads, railways, aerial lines etc.
- Calculation of the energy consumption, type of power supply

Note* : See also OITAF Recommendation no. 22-1 : Recommendation for the definition of fundamental safety aspects of unidirectional aerial ropeways, recommendation no. 22-2 : Recommendation on safety aspects which ought to be given due consideration in a safety analysis of components of a unidirectional aerial ropeway, Recommendation no. 25-1 Recommendation for the definition of fundamental safety aspects of bicable reversible aerial ropeways, Recommendation no. 25-2 : Recommendation on safety aspects which ought to be given due consideration in a safety analysis of components of bicable reversible aerial ropeways and Recommendation no. 27 : Recommendation on hazardous scenarios which ought to be given due consideration in a safety analysis of electrical components of ropeways.

1.2.2 Detailed design

The set of detailed designs ought to contain detailed documents for all components of the ropeway installation, i.e. all detailed specifications and verifications of all components of the ropeway, as well as a detailed survey of operating conditions and detailed instructions for the maintenance of components.

The set of detailed designs should also contain a detailed description and detailed dimensioning of structural members and parts of the ropeway installation and in particular the detailed design of the following parts and components:

- Ropes

- Drives and brakes
- Tensioning devices
- Mechanic equipment of the station
- Mechanic equipments of line support structures
- Carriers
- Electrical equipment
- Rescue and recovery equipment
- Structural details of the station and its foundations
- Line support structures and their foundations
- Guards

All statements and verifications have to be handed out to the sponsor..

2 Execution

The availability of the following documents and regulations is fundamental for the execution of the project:

- the time needed to carry out the project
- the assignment of responsibilities for the construction of the ropeway
- the coordination of the work
- the safety of the building site
- organisation of the management
- organisation of the surveillance of the building activities
- Statement on the first run of the ropeway which has to be started by the manufacturer of the ropeway

After having been started the ropeway is subjected to several tests which have to be carried out in order to assess the proper functioning of operational and safety functions within the limits of the intended purpose of the ropeway. The results of all tests have to be documented and all documents handed out to the sponsor

The availability of the following documents has a fundamental importance for a good and proper managerial decision on the choice of the most suited type of operation:

- Guidelines for the operation of the ropeway in normal working and in extraordinary working conditions**
- Document on operating conditions***
- Rescue plan****
- Instructions on maintenance
- Master document for the documentation on the operation of the ropeway (log book)

** The following data ought to be listed in the document on the management of the ropeway operation: the number of members of the staff and functions of each member of the staff, results of the monitoring which has to be carried out each time the ropeway has been started, measures which have been taken to eliminate disorders

*** the following data have to be listed in the document on operating conditions: maximum permissible intensity of wind, maximum permissible snow load, extraordinary transports, transport by night

**** The following details have to be listed in the rescue plan: number of members of the rescue team, rescue procedure, behaviour during rescue operations, number of rescue devices and store of rescue devices.

The results of this initial operation of the ropeway by its manufacturer, as well as all documents made available as a guideline for managerial decisions have to be kept in a suited place of the ropeway installation.

Chapter II: General reference frame of conditions and actions of external factors

The following list of reference conditions and actions of external factors includes all likely conditions and actions which might occur in operation. Due consideration ought however be given to the fact that reference conditions and actions depend on the type of the ropeway system, the position of the ropeway and its environment and might hence be different in each specific case. This is why it is necessary to give due consideration to additional factors which either imply the necessity to give due consideration to additional factors or permit to disregard some of the listed conditions and actions.

General reference frame of conditions and actions of external factors

1. Environmental factors
2. National legal provisions and standards
3. Rights of third parties
4. Hazardous scenarios of external factors
5. Effects of conditions and actions affecting the execution
6. Effects of actions affecting the environment

1. The environmental factors which have to be given due consideration are the following ones

- Configuration of the site
- Type and conditions of foundations (permafrost, slope failure, movement of the soil),
- Wind conditions
- Snow loads, thickness of snow layers
- Icing (loads)
- Avalanches, creeping snow , torrent
- Erosion and its action (for instance falling rock)
- Glaciological action
- Atmospheric discharge (lightning)
- Seismic phenomena
- Effect of atmospheric phenomena (air pollution, aggressive components)
- Temperature
- Electromagnetic action

2. National legal provisions which have to be given due consideration are the following ones

- Land planning
- Protection of the nature
- Protection of the landscape
- Protection of monuments
- Forest laws (Forest clearance)
- Water laws
- Fire prevention and control
- Safety of workers

- Regulations and standards relating to ropeway installations
- Operating system
- Building regulations and standards
- Electrotechnical specifications
- Transportation of passengers affected by a mobility handicap

3. Rights of third parties which have to be given due consideration are the following rights

- Right of exploitation
- Neighbourhood
- Noise and acoustic nuisance

4. Hazardous situations due to external factors which have to be given due consideration are the following ones

Crossings and proximity of other means of transportation (other ropeways)

- Railways
- Motor vehicles
- Electrical lines
- Gas pipes
- Water supply conduits
- Petrol station
- Rifle range
- Falling icicles and ice blocs
- Vibrations (for instance due to road traffic, quarries, blasting)
- Stocks of explosive substances
- Water tanks
- Artificial snow producing plants

5. Factors affecting the building activity are the following ones :

- Supply of energy
- Building system, such as for instance blasting
- Accessibility (transportation lanes and roads, maximum permissible loading of bridges)
- Car parking lots
- Connections with other means of conveyance
- Configuration of the site, configuration of the track

6. Factors affecting the environment which have to be given due consideration are the following one

- Obstacles to air traffic
- Environmental pollution (rope lubricants)

The general reference frame of conditions and external action has to be documented and to this end it is necessary to assess the configuration of the site (land surveying) and the conditions of the foundations (geotechnical prospection).

Should it not possible to exclude in an absolute way the probability of an environmental action and if there are no standard specifications, it is necessary to ask an expert to make the necessary assessments and submit a report on the results of his investigations. He ought to be asked to assess in particular the probable intensities of wind, loads and thickness of snow layers, loads of icing, as well as likely effects of avalanches, creeping snow, torrents, erosion (for instance falling blocs) and of the glaciological and seismic phenomena.