Avalanche safety in ski areas – the legal position in Austria

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ABSTRACT: The avalanche safety in the area of ropeways is regulated on the basis of the Austrian Ropeway Act 2003 (version of 2012) in the so-called “Avalanche-Decree” of the Federal Ministry for Transport, Innovation and Technology. This legal norm (enacted in 1975) was re-enacted in 2011 and determines the assessment of avalanche hazards for ropeways, the ensuring of the safety for the construction as well as the safety of operation, the safety for the “associated” ski slope, the avalanche safety concept that is necessary for the authorization procedure according to the Ropeway Act 2003, the supervision of the ropeway by a local avalanche commission and some exceptions for the replacement or rebuilding of existing ropeways. The paper gives an overview of the legal norm, the historical development and some experiences with the formal application.

KEYWORDS: avalanche safety, Austrian Ropeway Act 2003, ski areas, avalanche commission, cableway, ropeway installation

1 INTRODUCTION

Austria is a mountainous country and famous for a high density of excellent ski areas. The first skilift was built in 1926, now we have 254 ski areas with more than 3000 cableway installations (1800 draglifts and 1200 cableways) and in the winter season of 2011/2012 the number of transportations was 554 millions (Wirtschaftskammer Österreich 2012). The economical value of winter tourism in Austria is enormous, approximately 50% of the total number of 130 Mio overnight stays of tourists occurs during the winter season. This high number of ski areas in alpine areas leads to a high number of persons in potential avalanche areas both along the roads leading to the ski resorts and within the ski areas themselves. Despite the high number of ski tourists, avalanche victims within ski areas are extremely seldom. This is due to the strict legal regulation since 1975. The average number of avalanche victims in Austria is 26, most of them are back country skiers (outside of the secured ski area).

2 HISTORY

In December 1974, an avalanche accident with 13 victims happened within the ski area of Kitzbühel. Ten days later, twelve people were killed by an avalanche while they were waiting in a queue at the downhill station of a ski lift in the ski area of Gaschurn.

These two bad avalanche accidents in the winter of 1974/75 in ski areas showed the safety problem that arose due to an increasing number of people in winterly alpine surroundings. For a good ski area, you need steep slopes with deep snow, which are the same ingredients as for avalanches. Ski areas therefore are always strongly connected with avalanche danger. To confront the increasing avalanche danger – caused by the increasing number of ski areas – the Federal Ministry for Transport, Innovation and Technology in 1975 enacted a strict regulation in form of the first version of the “Avalanche-Decree”. The basic message of this decree was, that both, the ropeway and at least one associated skirun must be absolute safe regarding to avalanche hazard, either because of a natural safe position or because they are protected by permanent avalanche protection measures. The goal was to achieve the “maximum” avalanche safety, a return period for potential avalanches was not defined. Temporary avalanche protection measures like artificial avalanche release were not allowed to protect the constructions and the components of a cableway or the one associated permanent safe skirun. They were only allowed to protect further ski runs in the ski area. Another strong restriction applied to the accessibility of the ropeway - it had to be always possible in a safe way, even under worst avalanche conditions.

In 1996, the replacement of cableways, that were erected before the enacting of the Avalanche-Decree 1975 was regulated in a supplementary legal norm to the Avalanche-Decree. Some of these cableways were situated in areas, where the protection with permanent measures was not possible afterwards and a strict application of the Avalanche-Decree would not have allowed a replacement. A solution with temporary safety measures was al-
allowed - this decision has to be made in form of an exemption by an expert commission. Pre-condition for an exemption solution was a distinct and clear increase of the security level, even under taking under consideration the increasing transport capacity of the replaced cableway. How do you increase a safety level, when it’s already high in the specifically affected case? And how do you quantify a safety level? These points were discussed very often in expert meetings during the procedures of authorization.

The demand for a permanently safe ski slope sometimes leads to alignments that are not suitable for skiing purposes and for environmental protection. (Fig 4 and 5)

In 2004, the same exemption solution was allowed not only for the replacement of cableways, the solution was also allowed for additional ropeways in an already developed ski area. This led to discussions as to what is an “already developed ski area” and what is an additional cableway that belongs to that area and what is a totally new cableway (that will be built in a not developed new ski area). This distinction was important, because for ropeway installations in a new area the strict regulation of the decree 1975 was already fully valid. The result of this regulation with the two supplements of 1996 and 2004 were different safety levels in depending on the definition of a new, additional or replaced cableway.

Some discussions about these questions arose between the ropeway (permission) authorities, the avalanche experts and the ropeway operators during the permission procedures. The existence of different safety levels, the need for definition of a design event – that means a recurrence period for avalanches - and the arguments, that the quality of temporary protection measures increased in the last decades dramatically led to a discussion process that resulted in the new “Avalanche-Decree 2011”.

3 AVALANCHE-DECREE 2011

The Avalanche-Decree was enacted by the Federal Ministry for Transport, Innovation and Technology in the year 2011 (BMVIT, GZ 238.961/0006-IV/SCH3/2011 from 12. Sept. 2011). There are some essential innovations compared with the “old” regulation. The aim of the new regulation is to improve and harmonize the security-level in the area of ropeways.

3.1 Design event, recurrence period

According to the Austrian guidelines for Hazard mapping the recurrence period for the design event was chosen with 150 years.

3.2 Structure safety (Safety of the installation)

The principle of the structure safety is that the whole structure (including stations, pylons and the ropes) must withstand avalanche pressure without damages. The construction of stations is not allowed in areas that correspond to Red Hazard Zones according to Austrian Hazard Zoning Guidelines. These are areas where an expected avalanche pressure is higher than 10 kN/m². In preparation for the planning of a station, a hazard map for this area has to be prepared to find out the safest place for erecting a station. If there is no possibility to situate a station out of Red Hazard Zones, permanent measures are necessary to protect the station and the surrounding area (areas with the potential of high concentration of people). The position of a station must be definitely outside of the Red Hazard Zone and therefore the effect of permanent measures has to be pointed out in an additional map. The construction of a station is allowed in a Yellow Hazard Zone, but the construction must withstand the expected avalanche forces because of permanent protection measures. That means that all constructions and components of the cableway must endure any damage caused by avalanches until the 150-year design event.

Figure 1. Avalanche Hazard Zones on a potential position for a bottom station for a new cableway. (the position for the station is the pink rectangular)
Figure 2. Avalanche Hazard Zones on a potential position for a bottom station for a new cableway (the position for the station is the pink rectangular); The effect of an avalanche protection wall is shown by the reduced Red Hazard Zone;

Beside the area of the stations the points where pylons are planned have to be investigated and the pylons have to withstand avalanche forces according to the Austrian regulations ONR 24805 and ONR 24806.

Figure 3. Schematic diagram of the impact pressure distribution due to an avalanche on a pylon according ONR 24805; (\(p_{hl}\) = snow cover; \(p_{l}\) = pressure dense flow layer; \(p_{u}\) = pressure saltation layer; \(p_{s}\) = pressure suspension layer)

The ropes (track and haul rope / haul rope) of the ropeway have to be situated in a height above ground that they can not be damaged by the suspension layer (powder part) of an avalanche. The height of the suspension layer may be estimated with the formula

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h_p = 10^{-4} l v^2
\]

\(h_p\) = height of suspension layer (m)
\(l\) = length of avalanche path (m)
\(v\) = avalanche velocity (m/s)

Pressure of the suspension layer has to be estimated according to ONR 24805

3.3 Safety in operation

The operation of the ropeway is only allowed when the safety of the passengers and the operation staff is guaranteed. Operation includes the use of the cableway, the accessibility (and leaving possibility) within the ski area and the possible rescue operation in case of failing of the ropeway.

To ensure the safety in operation, additional temporary measures like the closure of the cableway or the use of artificial release of avalanches after judgement by an avalanche commission is possible.

3.4 Associated main ski slope

The ropeway operator is responsible for the safe transport on the cableway and he is also responsible that the skiers can come back to the valley in a safe way. For that reason, at least for one associated main slope of the cableway installation a safety plan has to be developed. In contrast to the old regulation, the application of temporary measures is allowed as well. Until 2011, also for the associated ski slope a permanent safety was necessary as well as for the ropeway. Now each avalanche path that can reach the ski slope has to be mapped and be investigated related to it’s run out distances. For each path a safety concept has to be made. The investigation is not as strict as for stations, a distinction between Red and Yellow hazard zone is not necessary. A map of scale 1:10 000 is sufficient for the ski slope and the position of avalanche paths.

Figure 4. Avalanches with different recurrence periods and run out distances along a ski slope. The run out distance determines whether artificial release is necessary or not.
4 AUTHORIZATION PROCEDURE

According to the Ropeway Act 2003 (Bundesgesetz über Seilbahnen 2003) each new cableway has to be authorized by the Federal Ministry for Transport, Innovation and Technology or the cableway authorities of the federal states. One of the documents that have to be delivered to the responsible authority is an Avalanche safety concept for the planned cableway and the associated main skislope. This concept has to contain all documents (especially safety analyses) that an evaluation of the avalanche situation is possible by an officially appointed expert during the permission procedure.

4.1 Avalanche safety concept

It has to contain:

- Maps and description of the new cableway
- Overview maps of the avalanche situation (M 1:10000)
- Optimisation of the position of the cableway regarding to the avalanche situation
- Detailed investigation of the areas for stations without and with countermeasures; Mapping of the station areas M1:2000; Description and mapping of areas with remaining risk after implementing technical measures.
- Detailed description and evaluation of construction safety
- Detailed description and evaluation of operation safety including normal operation, accessibility and evacuation operation in case of failure or halt of the cableway
- Applicability of temporary avalanche protection like artificial avalanche release according to the check list in the guideline
- Rules of procedure for the responsible avalanche commission and the cableway operator in case of avalanche hazard

The positive evaluation of the safety concept is a prerequisite for the legal authorization of the new cableway.

3.5 Guideline for experts

To unify and ease the task of the official approved expert within it’s assessment, a guideline was developed by the authorities. The main part of the guideline is a checklist to check the safety standards and a check list to check the applicability for artificial avalanche release. The basic for the artificial avalanche release checklist is the checklist that is published in Switzerland to test the applicability of artificial avalanche release above houses. (Stoffel L., Margreth S. 2009) and the guideline for assessment of secondary avalanches after artificial release. (Stoffel L., Margreth S. 2012). Artificial avalanche release is barred when any hazard is possible for infrastructure or houses even after taking into account secondary and distant release of avalanches.

5 PRACTICAL EXPERIENCES

The new avalanche safety regulation in Austria is now two years old and about 60 new cableways and ski lifts have been built during that time. The authorization process may seem more extensive, but it is based on the newest findings in avalanche protection and on clear regulations. So it has to be examined case by case which method of avalanche protection is the best to be used for. The safety standard for the users of the cableways is higher than before because of the clear regulation in operation safety and the permission for the application of additional temporary protection measures.

Important for the permission procedure is an early close contact between the ropeway operator that wants to invest in a new cableway including it’s planners and the experts to discuss different protection measures and possibilities. The step towards increasing consideration of temporary avalanche protection is based on the much higher quality of these methods than at the stage, when the first “Avalanche-Decree” was released in 1975.
Figure 5. A planned cableway in the community of Galtür based to the “old” regulation. The associated ski slope had to be permanent save or – at least – protected with permanent measures. The only possibility was to build the ski slope along the mountain ridge and then along the slope with supporting structures.

Figure 6. A planned cableway in the community of Galtür based to the “new” regulation. The associated ski slope may be protected with artificial avalanche release, a much better alignment is necessary.

6 REFERENCES


Austrian Standard Institut 2010: ONR 24805; Permanent technical avalanche protection – Terms, definitions, statical and dynamic load assumptions.


