

Avalanche protection measures in Iceland and the Alps

A Swiss point of view

What does your job as a senior scientist and head of the team Protection Measures, at the SLF in Davos in Switzerland, involve and what is SLF's role regarding avalanche research and avalanche hazard in Switzerland?

The WSL Institute for Snow and Avalanche Research SLF was founded after the Second World War at first with the focus to issue avalanche



Stefan Margreth, head of team Protection Measures at the SLF, Switzerland.
Photo: S. Margreth

bulletins for the Swiss Alps. The avalanche winter 1951 with nearly 100 victims in Switzerland called for action to strengthen basic research and practical support on avalanche mitigation. Since then the SLF developed to a worldwide leading research institute which studies snow, natural hazards, permafrost and mountain ecological systems. The SLF is responsible for the avalanche warning in Switzerland. The team protection measures, which I lead, employs three civil engineers with nearly 100 years of professional experience. The main job is to consult the authorities and industry on all kind of avalanche protection measures and hazards assessments. Further we develop guidelines to support the practitioners.

You have worked as a specialist on mitigation measures in Iceland for over two decades. Your work has involved the initial masterplan for protection measures in Iceland in 1997* as well as submitting and reviewing proposals for protection measures in various areas of Iceland and supervising the design of supporting structures. How did your work in Iceland come about?

My first job in Iceland was in 1994 to consult the commune of Ísafjörður after the ski area was mostly destroyed by a large avalanche. I met there the famous snow observer and cross-country skier Oddur Pétursson who gave me very valuable inputs for my hazard evaluation. After the field visit I and my wife had a wonderful trekking trip to Hornstrandir where we could stay in the hut of Oddur in Hesteyri. After the avalanche disasters in Súðavík and Flateyri I was member of the expert team to evaluate the need for avalanche protection in Iceland. This evaluation was very instructive for me to visit all villages in Iceland with avalanche problems and to assess the hazard situation with colleagues from Iceland and Norway. This assessment helped me to understand the avalanche problems of Iceland better and was a good base for future consulting jobs in Iceland.



Oddur Pétursson and Stefan Margreth in the ski area of Ísafjörður in 1994. Photo: S. Margreth

How are conditions in Iceland different from conditions in the Alps, with regard to construction and the need for permanent protection measures?

The biggest difference is the lack of protecting forests in Iceland. In the Alps forests are the most important avalanche protection and further a very good indicator to estimate the avalanche frequency. A next important point is the topography with the flat mountain tops especially in the Westfjords and steep avalanche paths running to the sea. In the Alps such topographies are an exception. Then the winds are much stronger in Iceland compared to the Alps. In Iceland the snow depth at a certain location on a slope depends mainly on the wind situation and the topography. The result is that in gullies the snow depth can be up to 20 m and on the open slopes the snow depth is very small. The density of the snowcover is in Iceland generally higher than in the Alps. In regard of supporting structures the corrosion of steel is in Iceland stronger compared to the Alps because of the proximity to the sea.



Planning supporting structures in Southern Hnífsdalur in 2017. Photo: S. Margreth

Is there a major difference regarding to safety requirements below permanent protection measures in Switzerland and in Iceland?

In Switzerland we do not have such specific safety requirements. There are many locations where after the realisation of permanent protection measures some houses remain in a red hazard zone because a complete protection would be too expensive. Before a project is approved the cost-benefit has to be evaluated. If a project with structural mitigation measures is not economically justifiable the risk is reduced to an acceptable level by temporary measures such as evacuations or artificial release of avalanches. We evaluate the effectiveness of protection measures according to an established procedure that we call “Protect” and reduce the hazard zones if possible. The effect of mitigation measures depends on different aspects such as the age of the structure, the avalanche characteristics and the design.



Tómas Jóhannesson and Þorsteinn Jóhannesson in the Gróuskarðshnjúkur starting zone, above Siglufjörður in 2004. Photo: S. Margreth

Would you consider the implementation of protection measures in Iceland, since 1997, successful?

If I compare the situation in regard of avalanche safety during my first visit to Iceland in 1994 and today there is a very big difference. Today most villages have a much improved protection and reliable hazard map. The protection measures were planned, designed and built in a very professional way. Therefore I rate the implementation of protection measures in Iceland as very successful. I show in my lectures at the ETH in Zurich often protection measures from Iceland as good examples. I like especially the involvement of landscape architects to improve the design of dams. Such a steep is often missing in Switzerland.

What does long term maintenance of protection measures involve and how expensive may it be expected to become in the long term?

In Switzerland the first protection measures in release zones of avalanches as stone walls were built in 1867. These walls are still existing however they are at the end of their service life. In the release area additional steel bridges were built. We plan our mitigation measures for a service life of 80 years. To achieve such a service life a periodic maintenance is crucial. For that a maintenance concept consisting of a data base of all structures with information of their state and a checklist for the structure inspection were elaborated. In average the maintenance cost for supporting structures is around 1% of the construction cost and for avalanche dams 0.5%. After the life time is reached a structure has to be replaced. Avalanche mitigation is a continuous long term task similar to other infrastructure objects such as roads or bridges. Without a regular

maintenance the expected service life is much shorter than 80 years.



Supporting structures in the starting zone of Hafnarhyrna, above Siglufjörður in 2017. Photo: S. Margreth