Landscape design of snow avalanche protection structures in Siglufjörður, Ólafsfjörður and Seyðisfjörður

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ABSTRACT

The vast scale of snow avalanche protection structures has a great impact on the surroundings and is therefore prone to meet some resistance from the local community. The main challenge is therefore to adapt and integrate the structures into the landscape. A vital part of making the project socially acceptable, is to soften the visual impacts and give the structures an alternative purpose. In Siglufjörður, Ólafsfjörður and Seyðisfjörður, the structures are designed to function as recreational areas for the communities, thus giving the new landscape more meaning – creating a place!

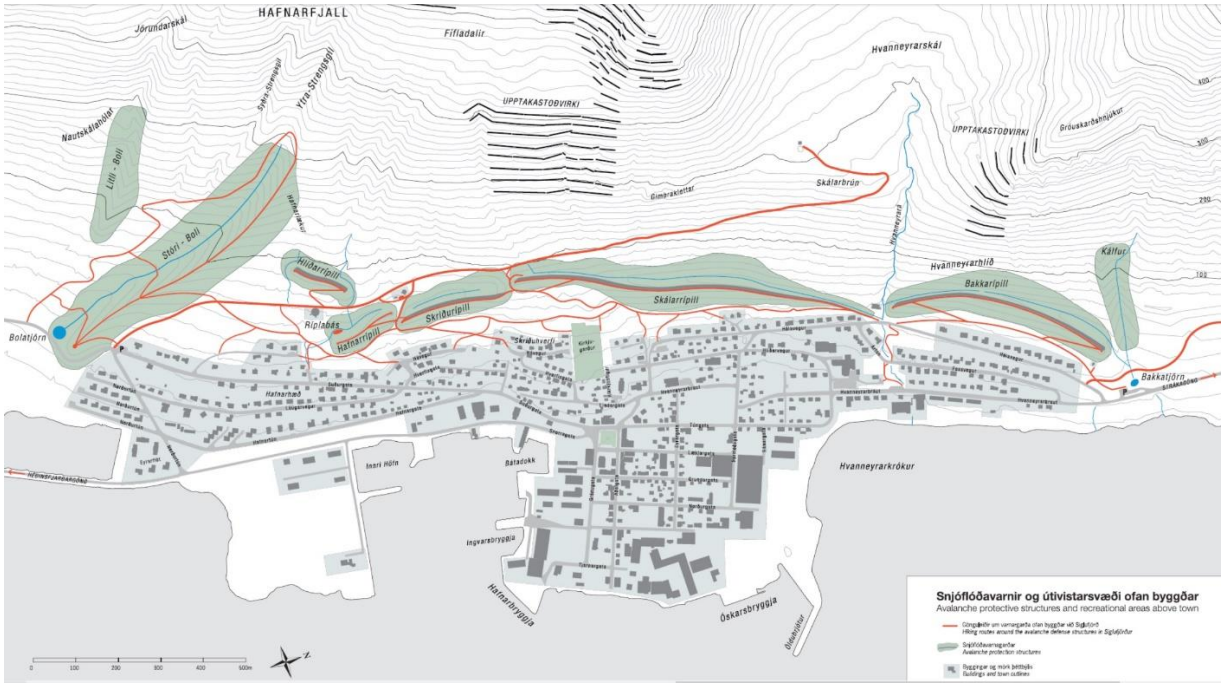

Figure 1 An overview map from an information sign about the avalanche protection structures in Siglufjörður.

1. INTRODUCTION

Since 1901, more than two hundred lives have been lost in Iceland because of snow avalanches and landslides. In 1995, two snow avalanche catastrophes resulted in massive destruction and 34 fatalities in the small towns of Súðavík and Flateyri. After these devastating losses, the nation rallied to action. In 1997, the legislature passed an "Act on Protective Measures Against Avalanches and Landslides" to begin appropriate planning and constructions and reduce risk.

The law established preventative measures including hazard zoning, land use and planning criteria, snow observations, avalanche warnings, and evacuation plans. Since then, Iceland has embarked on the implementation of defence structures in the areas of greatest vulnerability.

The design of avalanche defence structures is, in principle, based on the civil engineers' and geotechnical specialists' ingenuity. One might therefor ask what the role of landscape architects is in the design process. To answer that question, the vast scale of such projects needs to be taken into consideration and the large impact the, sometimes invasive structures, have on the local landscape and the appearance of the environment.

2. SOCIAL ASPECTS

Drastic changes in the landscape close to the communities concern the inhabitants directly and they can, therefore, be expected to have different views on mitigation projects involving large avalanche protection dams. People's attitudes towards the project are often negative at first, and even though a risk assessment is available, many believe that action is unnecessary or excessive. People tend to be rather negative towards the invasive alteration of the landscape so close to home. Therefore, the social aspects need to be taken into consideration and not just the technical aspects of the design.

The Icelandic Avalanche and Landslide Fund for avalanche-prone areas has recognized this issue and, therefore, a part of the budget includes environmental improvements and reclamation of the area in order to adapt the structures to the existing landscape and make the project more socially acceptable. For this reason, landscape architects are included in the design team and our role is to make recommendations about the shape of the structures and land reclamation, give advice on the implementation of the project and present the projects visual effects on the surroundings, to the community. The goal is to reduce negative impacts of the projects by utilizing the opportunities that arise to create new recreational areas and experiences.

Figure 2 Catching dams above the town of Siglufjörður, N-Iceland. The ends of the dams are formed like sloping bastions with a public viewpoint.

3. DESIGN

For centuries, grass and rock were the main building material in Iceland. Even small structures such as the ruins of old farms still stand out in the landscape in many places and bear witness to ancient residence. When it comes to extensive structures such as avalanche protection structures, great care needs to be taken in their implementation. The structures need to fit as well as possible in the existing landscape and their appearance must be acceptable. By thinking of the project, not only as building protective structures for safety reasons, but giving the structures and the surroundings an alternative purpose as a recreational area, the project is much more likely to have a positive impact on the community.

In Siglufjörður, the recreational areas consist of over 9 km of hiking paths, green open spaces, new forestation and open playgrounds. The design team realized that these gigantic structures could not be hidden, nor could they count on tall-growing trees to camouflage them from view. Therefore, they chose rather to make an architectural statement or landmark out of the structures while adapting them to the shape of the mountain. In order to avoid the structures from looking too dominating, their width varies thereby creating a variable form on one side of the wall, contrasting its steep dominating form on the other side. The landscaping and final design of all the structures was based around the concept of a waving line in the landscape. While the dominating upper aspect of the dams must be steep in order to deflect or stop avalanches, their visual impact is offset by a smoother lower edge. Varying in width, this serves to give them an organic, ridged, yet undulating form. The ends of the structures are formed like a sloping bastion with a public viewpoint at the top, giving them an architectural appearance.

3.1 The path network

An important aspect of the recreational area is the path system. The network of hiking paths connects the different areas together and has many connection points to the town's existing pedestrian walkways, for ease of access to the area. The paths run around and on top of the structures providing scenic views over Siglufjörður. An informal path on the crown of Stóri-Boli provides access to the mountainside. Wherever possible, former construction roads have been incorporated in the path system, which contributes to minimizing construction costs. Dedicated rest areas are strategically placed to welcome tourists and locals to the site. The rest areas are equipped with information signs with essential information about the project. Car parking is provided in connection to the rest areas for motorists.

Figure 3 Stóri-Boli, deflecting dam, in Siglufjörður, N-Iceland. An informal path to the mountainside.

In Ólafsfjörður, skiing has been an inseparable part of daily life throughout the years. With modern communication and travel, skiing is still a very popular recreational activity and in the last decades the inhabitants of Ólafsfjörður have been amongst the most energetic skiers in the country. Tracks for cross-country skiing, which function as hiking paths during summer, have been developed on the mountainside in the outskirts of the town. The deflecting dam above Hornbrekka health clinic, is placed midst among the cross-country skiing tracks. It was, therefore, emphasized by the municipality, that a connecting path should be constructed to connect the areas on either side of the dam.

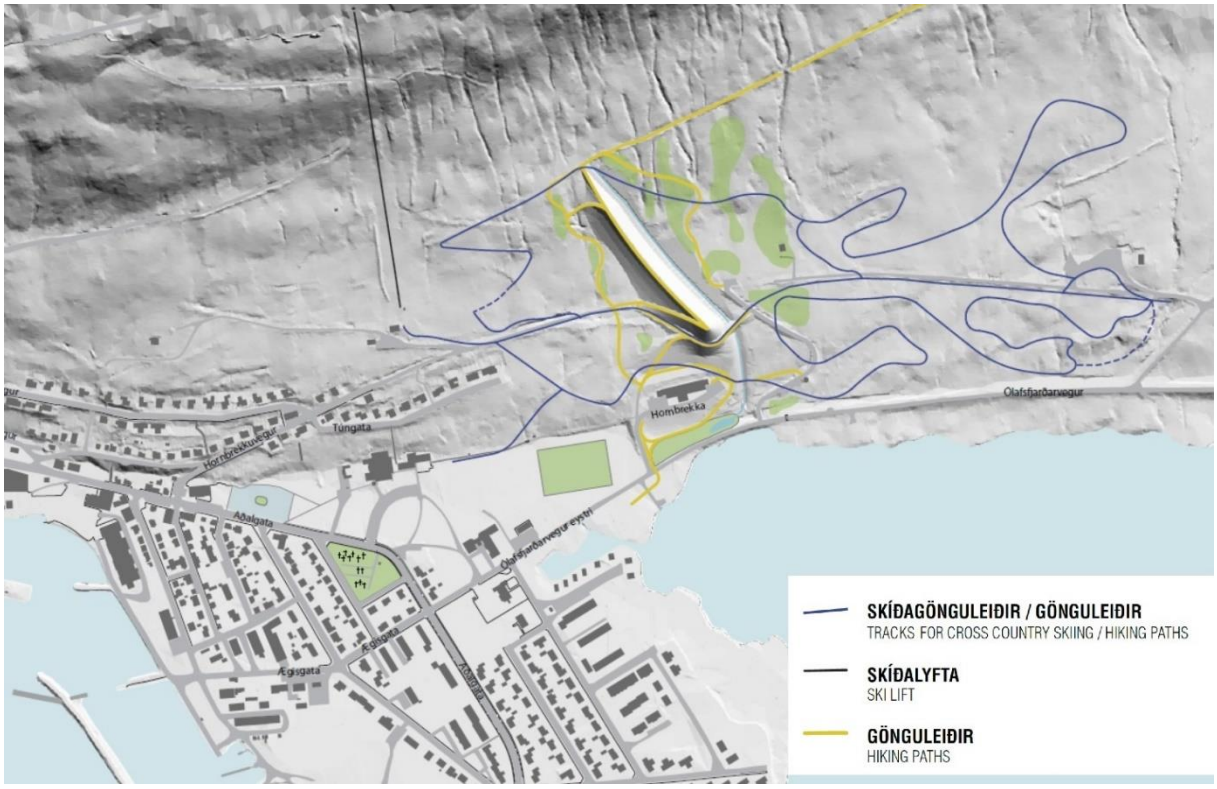

Figure 4 An overview map from an information sign about the avalanche protection dam in Ólafsfjörður, N-Iceland.

3.2 **Cultivation**

It is important to reclaim the vegetation. It helps the structures to blend into the environment, minimizing the visual impact and prevents soil erosion. The tall protection structures, with their steep slopes, need special care to ensure a successful cultivation. In Siglufjörður and Ólafsfjörður, a long-term cultivation program helped to start the cultivation, following the reclamation of the local vegetation.

4. VISUALIZING THE PROJECT

It can be of great value to be able to visualize the project beforehand. This is useful in the design, to determine the visual impact of the structures and the optimal placement and shape of the structures. The visualizations are also useful for presenting the project to the local community. Reynir Vilhjálmsson, who lead the team of landscape architects in Siglufjörður, made many hand-drawn sketches during the design process.

Figure 5 A hand-drawn sketch by Reynir Vilhjálmsson of a catching dam in Siglufjörður, N-Iceland.

As technology has progressed, computer-generated images have now, for the most part, replaced the hand-drawn sketches. In Seyðisfjörður, a computer model was constructed where the planned deflecting and catching dams were fitted into the existing landscape.

Figure 6 A computer-generated perspective image of planned snow avalanche protection structures in Seyðisfjörður, E-Iceland.

5. CONCLUSION

By thinking of avalanche protections projects, not only as safety measures but an opportunity to create an inviting landscape, the sometimes invasive structures are more likely to be accepted by the local community. The avalanche protection structures in Siglufjörður and Ólafsfjörður are an active part of a recreational area with various opportunities for outdoor activities. The structures are designed to adapt to the landscape by mimicking natural forms found in the surroundings and using local materials. The planned structures in Seyðisfjörður are designed with the same principles in mind.

The Icelandic Avalanche and Landslide Fund for avalanche-prone areas has included these environmental improvements in the projects budget, thus making these visions a reality. A design team with broad expertise has been involved in the design of these projects from the start, which has resulted in projects that are well received by the community, and outdoor recreational areas which is frequently used by the inhabitants. The project in Siglufjörður has been reviewed by several journals and it was nominated for the Rosa Barba European Landscape Award in Barcelona in 2003.

Figure 7 Stóri-Boli, deflecting dam in Siglufjörður, N-Iceland.