



## **ABSTRACT**

Loen Rockfall Centre

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## Introduction

Seven percent of the Norwegian landscape consists of rock and bare mountains, this makes a total of thirteen thousand mountains. The Norwegian culture is strongly influenced by settlements close to the wild mountain landscape. These populations vary from small villages to larger cities. Living close to these natural forces has resulted in many villages getting destroyed by the consequences of rock fall events.

Landslides of more than ten thousand cubic meters of rock are referred to as rockfalls. These have led to some of the worst natural disasters we know of in Norway. In the northern parts of Western Norway, historical documentation shows that there have been two or three disasters associated with large rockfalls and tidal waves every 100 years.

The most famous disasters are the Loen landslides in 1905 and 1936 and in Tafjord in 1934. The landslides caused tidal waves which led to a total of hundred and seventy four people losing their lives.

(ngi.no 2016)

Rock fall events are increasing due to global warming and environmental changes. Increased temperatures, heavy rain and glacier retreat and movement in the earth crust are important factors affecting rock fall caution.

(ngi.no 2016)

My diploma project is a further exploration of the topic, narrowed down to a specific place of relevance: Loen in Stryn Municipality. Loen has been strongly affected by the mountain Ramnefjellet and its rockfall events. I decided to situate my project here based on the historical analysis of national rockfall events I did in my prediploma.

## Problem definition

The verification of architectural quality comes through perception of built space. In addition to discussions of social responsibility, function, spatial quality, and material form; we must be concerned with conception, narrative, context, and format.

My diploma is developed with two aspects of special interest: The architecture's capacity for emotional character and its relationship to place.

The starting point for my thesis is that some events can initiate architectural stories.

Through my project I want to communicate the story of Loen through architectural form, materials and structure.

Through highlighting the specific local events, visitors can relate to the consequences of the phenomenon. The project aims to bring awareness to the critical conditions in the Norwegian mountains and the caution of new landslides as a result of climate change.

## Site and history

Near midnight on the fifteenth of January 1905 a fifty thousand cubic meters of Ramnefjellet cracked loose and fell down five hundred meters into Lake Lovatnet. Sixtyone people were killed by the wave. This was half of the village population. Today three hundred and fifty thousand cubic meters of blocks, stones and gravel still lie in Lake Lovatnet.

The mountain Ramnefjellet was quiet and peaceful for many years. But in the late summer of 1936 almost daily rock falls occurred. Nature gave its signals. Sunday thirteenth of September 1936 One million cubic meters of rock fell down from eight hundred meters height into Lake Lovatnet, pushing up the water and creating three waves. The highest wave was more than 74 meters high, which split in two directions, completely crushing all the farms in Bødal and many of the farms in Nesdal. Seventy four people died. (Christer Hoel)

## Site

The promontory Nesodden, is around two hundred and fifty thousand square meter area consisting of bedrock and forest. The landscape was strongly affected by the rock falls. The area inherits evidence from the catastrophes in 1905 and 1936. The site is accessible by car and bike. It is close to the ferry port of Loen/Olden, which is one of Norway's most popular cruise destinations with around hundred boats per year.

(Norfjordhavn.no. 2021)

## Idea

The project aims to develop Nesodden as a destination to learn about rock fall, and the strong story of Loen. The main ambition has been to strengthen the destination by either giving access to or protecting the already existing qualities of the site. The projects provide parking spaces, and a rest area for visitors that arrive with car and bicycle. The idea is that the visitor center gives a thorough introduction of the theme, before the visitors travel into the landscape and experience the different historical and geological phenomenon's.

The outdoor learning exhibition consists of three stops along an already existing pathway leading from the visitor center down to Lovatnet, facing Ramnefjellet.

The first stop, and place of intervention is the boat-wreck of Lodalen which was thrown five hundred meters from the water and now lies in the middle of the forest. There has been an ongoing discussion for a long time in the local community of making a sheltering structure around the boat to prevent it from weathering.

The second stop, and place of intervention is the monument of the lost, located on the highest hilltop of Nesodden. In 1905 the surviving population of Loen raised a memorial monument for the ones who were lost after the first accident. The monument was washed away as a result of the second wave (in 1936). After 1936 there has been a less permanent wooden cross on the site. As a part of my diploma, I have redesigned a more permanent place of remembrance which brings awareness to the names and where the lost ones came from.

The path ends at the lake Lovatnet. Here the visitors can experience the big rock fall settlements which lie in the middle of the lake. My intervention is a bridge structure that allows the visitors to experience the rock islands up close. This is the end destination of the nature path.

The placement of the visitor center is around seventy meter above the lake. This height has been an important factor when deciding where to place the building. It allows the visitors of the project to experience the height of the tsunami which destroyed the village.

## Program

The program consists of primarily one building, and three outdoor interventions. The building offers a public outdoor viewpoint that is accessible all year. The viewpoint also functions as an outdoor auditorium for guided tourist groups and school class visitors.

The visitor center is separated into two main public programs. A hundred and fifty square meter exhibition/learning space and a seventy five square meter restaurant. The rest of the program goes under circulation, restrooms, storage and administration space.

## **Structural System**

The structural system of the visitor center is a direct reflection of the forces present during a rock fall. Rock fall is a result of big cracks in the mountain that weakens its structural capacity. The primary force of rock fall is shear forces.

When these forces appear, you get pressure at the bottom side of the loose stone volume, and tension at the back. This force relationship together with the self weight of the volume tends to create momentum. This relationship is articulated as the building's structural system.

The principle of foundation is developed to harm the environment as little as possible. The foundation technique is based on the technology of avalanche protection. The construction is visible, allowing the visitors to understand the forces in play, and the buildings relation to the mountain.

## **Materials**

The main material of the project is steel. The material was chosen based on two determining factors. Firstly, the material had to be locally produced. Stryvo is a well established steel producer located thirty minutes away from the site. Using local craftsmanship does provide many benefits both to the project and Stryn.

Secondly the material had to follow the logic of building on a hillside. The constructive elements should be able to consist of mainly prefabricated elements placed on site. The structures of the project exposed to the environment are Corten steel plates. The Corten steel has a material color that blends in with the surrounding natural environment. It has the ability to withstand the sometimes harsh environment in a way that enhances the expression of the material.

## **Design**

The design of the project is based on the relationship to the mountain. The ambition has been to develop a building that allows the visitor to experience the presence of the mountain in different stages. The fragile connection to the mountain is present in the building. This relationship is a spatial reflection of the forces of rock fall. It has been important to design a building that inherents a notion of heaviness and fragility as a reflection of the phenomena.

## **Bibliography**

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