

TAUBANESENTRALEN

Exploring the potentials of a listed industrial building from the coal mining era

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Picture 1: Wendt, Carl A. 1960/61. Svalbard Museum

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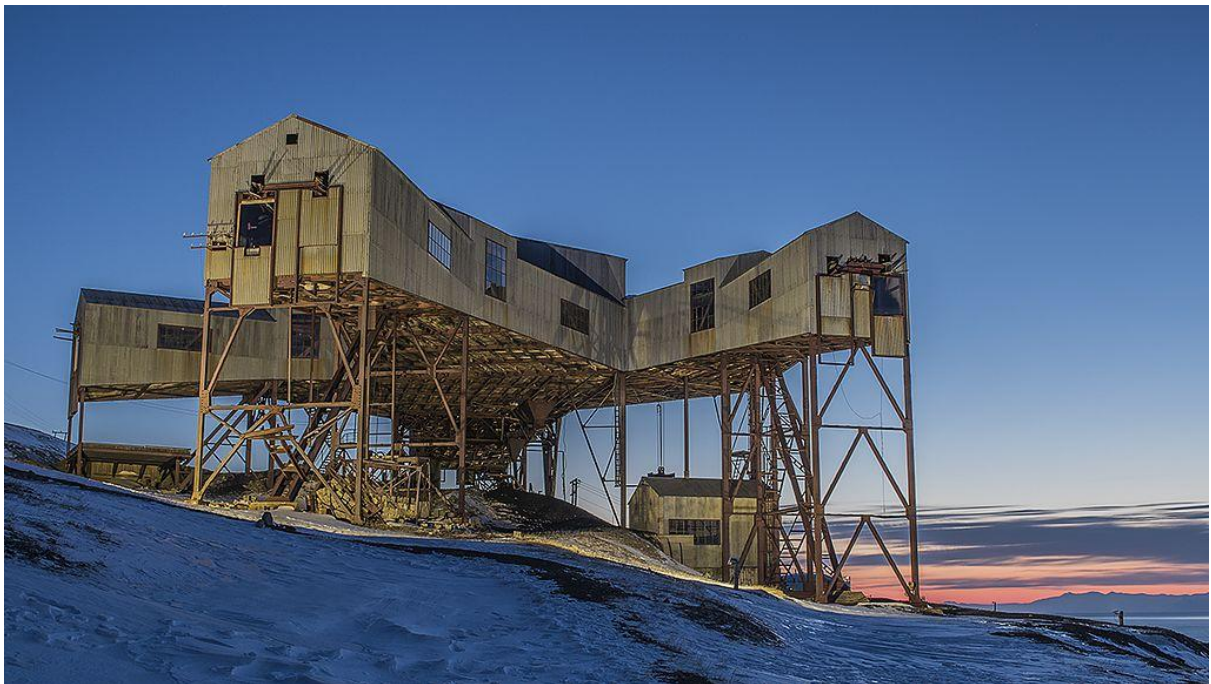
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1.0 Introduction

1.1 About

In Longyearbyen, Taubanesentralen is a majestic monument conveying the history of the coal mining community in the Arctic. It is merely a practical installation shaped without much thought for aesthetics. The ropeway dominates the cityscape and runs both over the Governor's office and residence, as a colossal structure, once a wild and untamed animal, the beating heart of the coal mining industry, now a dead and ruinous structure. While some believe it should be torn down, others want to keep it as a symbol for the mining community's cornerstone business, and the building is therefore listed. Its future is uncertain- perhaps one day it may come back to life.



Picture 2: Siri Uldal. 2016

1.2. Purpose of report

This pre-diploma seeks to investigate and understand Taubanesentralen: its story, importance, knowledge and inherent qualities. Taubanesentralen is today untouchable in many ways. One reason is its dilapidated condition, making it unsafe for public use. Another reason is that Taubanesentralen in 2003 was listed as industrial heritage of national importance, making it impossible to do major alterations and hard to implement new program. The building stands today as somewhat of a question mark and there is no definite answer for its future purpose. It has become a monument completely disengaged from its original function causing a weakened sense of ownership among the inhabitants. Responding to the challenges of the ongoing global climate change, Svalbard aspire to become a zero-emission society. Taubanesentralen conveys a completely different message, commemorating the values of a coal mining society. We wish to tackle these dilemmas through examination and investigation in order to try to discover Taubanesentralen's future purpose in a modern Svalbard.

1.4. Main topics of discussion

While there are many important topics, paradoxes and dilemmas regarding Taubanesentralen, we have highlighted those we believe are the most significant in order to investigate possibilities the future of the building.

Taubanesentralen has clearly been losing its connection to the people, it's more distant and unavailable, and therefore numerous Svalbardians have no relation to it and want to see it removed. How can one create ownership towards a building? Can the building be beguiled in a way that makes people connect with it again? Also, many people question that it occupies one of the most desired sites in Longyearbyen, and at the same it is unavailable to the public. How can it become available again and give something back to the population? How can we defend its existence?

The building is an industrial cultural heritage site that illuminates the history and basis of Svalbard and Longyearbyen. Still, it manifests a time the Svalbardians want to forget. When a building loses its purpose, but not its identity, what role does it play? How can we keep or cope with the memory of the coal mining industry when most of its structures are already in ruin? Has Taubanesentralen already been disconnected from its past and/or can it be reconnected? How do we preserve something that is actually completely disengaged from its original function? Ultimately: what can old industrial architecture be used for? What programs could it possibly accommodate?

The building has become an iconic monument for Longyearbyen, but it also represents a dark past with struggling, bad and demanding conditions for the workers.

There is an ambivalence between pride and shame. How do we proceed to solve this dilemma? Should Taubanesentralen be manifested as a reminder and monument of the past, or as a part of Longyearbyen's future? How did it actually become a monument? How do we lift an old monument into the future?

The listing was done on the basis of certain criteria, mainly as it was recognized as a unique technical industrial heritage that conveyed how the coal mining industry had been so fundamental to Svalbard's history. Because it is listed, future possibilities for the structure are limited and previous suggestions have been rejected (2000, 2007). Now, Tubanesentralen impart undesired memories not even properly conveyed because of its unavailability and its detachment from the rest of the coal mining system. Was the The Directorate of Cultural Heritage (riksantikvaren) too quick to list the building? What were the consequences? What can be done to an industrial architecture that is no longer needed, regardless of the listing? Why should we use time and money to preserve these industrial cultural heritages?

How do we preserve this building? We believe that the answer lays through a new life and use, an aesthetic-, bureaucratic-, programmatic-, architectonic-and ownership discussion.

1.3. Focus and method

The diploma will be an investigative architectural project exploring the future of Taubanesentralen. It will consist of one or more concrete proposals, and will be conducted through analyzes, investigations, experiments, and testing through models, drawings and other media. We will make use of our knowledge from our collaboration in the master studio course "In Balance: Carbon-neutral and climate responsive housing at Svalbard", the pre-diploma, our visit to Svalbard and conversations with Svalbardians. Even though this is a specific project done in a specific area, we believe it might be relevant to a bigger context. There exist similar projects where defunct industrial buildings have an uncertain future and where life cycle assessment, materials and zero emission goals might be an important discussion.

Since there are many aspects to consider when designing in such a unique environment as Svalbard, we must include written research and investigation, but not in the form of an academic paper. We don't want to limit ourselves in regard to economy and we will question the listing of Taubanesentralen and design regardless of the listing. We will of course be aware of these aspects and acknowledge them, but not make it our main priority.

2.0 History and value assessment

2.1. History of Svalbard

2.1.1. Svalbard

The first documented discovery of the polar archipelago, Svalbard, was by a Dutchman named Willem Barentsz in 1596. Svalbard was recognized as a no-man's land that no states claimed. But in 1607 an Englishman named Henry Hudson reported a large occurrence of whale and Svalbard suddenly became an important area for whaling and walrus hunting, mainly operated by Dutch and English hunters. The hunting-adventure had a sudden turn in 1655-60 when the whale population along land was exhausted and they had to continue out in the sea until the 1850s and the whalers left the archipelago. The use of Svalbard remained little until Russian pomors started hunting for animals from approx. 1700-1850. Norwegian hunting gradually took over and lasted until 1937. From the 1950s and onwards, research and expeditions became an important part of Svalbard's history.¹ European scientists recognized the natural resources as an economic asset. The coal mining industry developed during the early 20th century in the Norwegian-American Longyearbyen (1906), the Russian Gurmantbyen (1910), the Swedish Pyramiden (1910) and Svea (1917), and the Dutch Barentsburg (1926).²

During World War II, villages and some mines were bombed and burned down by German and British forces. Other than a German weather station, was Svalbard largely uninhabited during the war.³ After a gas explosion called The Kings Bay accident in Ny-Ålesund in 1962 Norwegians realized that they had a failing management of the mining industry. After this, they focused on gradually changing from temporary shift settlement, also called "company town" to a more robust year-around settlement and family establishment. This occurred in the Norwegian settlements from the 1970s and much later in the Russian settlements.⁴

¹ Sysselmannen 2016

² Avango u.å

³ Svalbard Museum n.a

⁴ Overrein, Henriksen, Johansen, Prestvold 2015

In the 2000s, tourism and research took over as the most important businesses, rather than mining, which until then had been dominant. Today, in Longyearbyen, only mine 7 is still operational by Store Norske Spitsbergen Kullkompani (SNSK) to supply Longyear Energiverk and a minimal export, while Barentsburg still have some export significance. In 2013, for the first time, more than half the population in Longyearbyen was associated with research and university studies. The research is extensive in Longyearbyen and Adventialen with UNIS, as well as in Ny-Ålesund with a number of European research stations.⁵

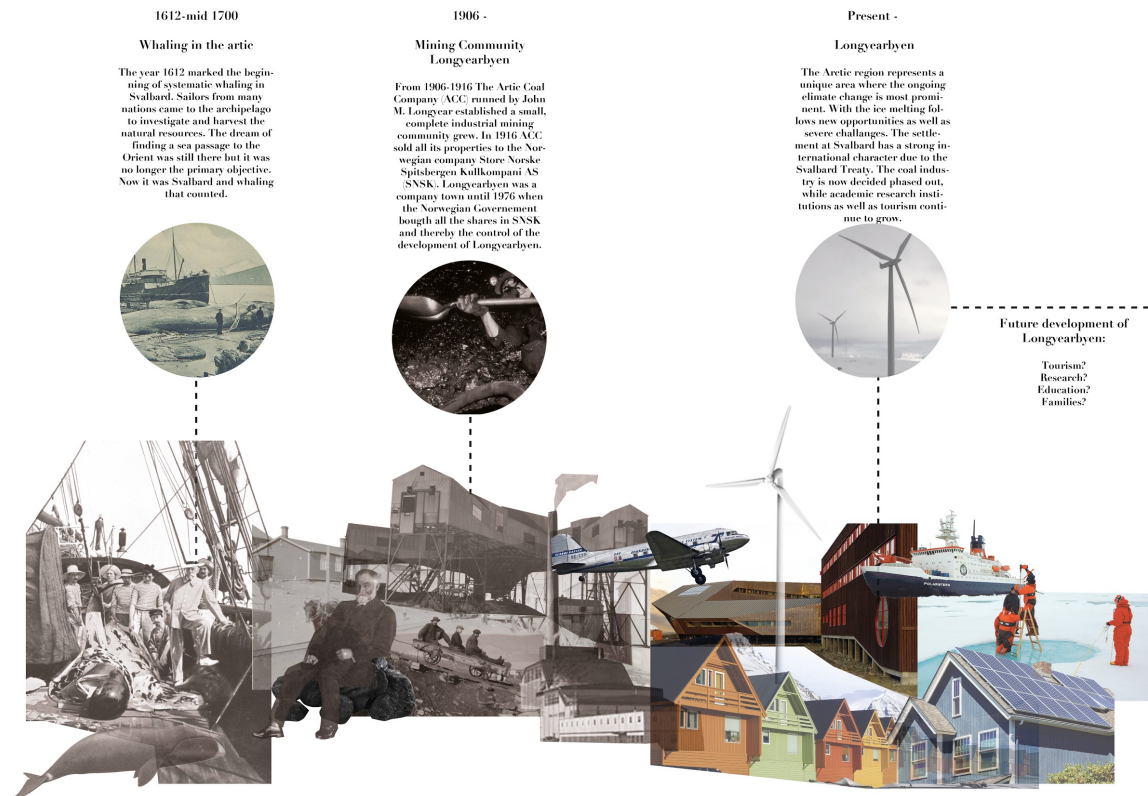


Diagram 1: Timeline collage, made by: Bjørn Mejlænder-Larsen

2.1.2. The Svalbard Treaty

The Norwegian supremacy under the Svalbard treaty lacks legal ownership, and Svalbard is therefore neither a country, colony, protectorate or overseas territory.⁶ In the 1880s, Norway was encouraged by other nations to claim Svalbard, but the authorities in Norway were afraid of possible expenses this would bring. Several conferences on the sovereignty issue were put forward after the turn of the century. It was not until the negotiations in Versailles after World War I in 1920 that an agreement

⁵ Barr, Winther 2017

⁶ Sysselmannen 2016

was reached and signed. This was called the Svalbard Treaty. The Svalbard Treaty secures that any person or company from the 40 states that signed the treaty, the right to conduct business, hunting and fishing on the archipelago and its surrounding waters. In short, the treaty follows these basic principles:

- Svalbard is part of the Kingdom of Norway and it is Norway that adopts and enforces the laws that apply to the archipelago.
- All citizens and companies from countries that signed the treaty have equal rights to work, access and stay in Svalbard. This includes rights to fishing, hunting and all kinds of maritime, industrial mining and trading activities on equal terms.
- Svalbard is not to be used for war purposes and Norwegian military presence are kept on a low level. It is mainly the Coast Guard. Foreign military activities are undesirable.
- Norway has a responsibility to preserve Svalbard's nature.
- All taxes and fees will only benefit Svalbard. Norway shall not use its authority to secure income beyond what is required for the administration of Svalbard.⁷

2.2. History of Longyearbyen

The prelude to coal mining in Longyearbyen started in 1900 when the coal fields were occupied by business people from Trondheim. They formed Kullkompagniet Trondhjem-Spitsbergen, but never really dared to invest totally in coal mining. Therefore, they looked for buyers and in 1905, an agreement was signed for sale to the American businessman John Munro Longyear and Frederick Ayer, a period of the mining industry that was later referred to as the "American Time". They established The Arctic Coal Company (ACC) in 1906. As the company developed, a small mining community grew, a community named Longyear City. Here, a few hundred people were working on an annual basis. Unfortunately, the conditions were primitive, hygiene was poor due to scarce water resources and food was poor. The workers still endured because the salary was good. ACC ran the mine until 1915 and in 1916, everything was sold to Norwegians who founded Store Norske Spitsbergen Kullkompani (SNSK). They norwegianised the name to Longyearbyen. About 180 men were working in the mines at that time, along with them, some women and children also wintered. Until 1920, the number of employees in the mines increased. Throughout the 20th century, the small mining community in Longyearbyen was run as a "company town". It was not built up as a family community, but as a male society where workers lived in barracks. It was not until the 1960s that the demand for modernization and normalization began to emerge. In the 1970s, the

⁷ Norsk polarinstitutt 2012

Norwegian state took over the shares in the company and initiated a Svalbard policy. The state took over the control of Longyearbyen, which was to become a family society at the same level as other settlements in Norway. The airport opened in 1975 and thus the possibility of year-round communication with the outside world. This was a step towards a normalization of society as the aircraft brought newspapers, fresh produce, relatives and friends. Since 1975, Longyearbyen has undergone relatively dramatic changes. It went from a distinctly male society to a family community, even though men were and are still in majority.⁸

2.3. Longyearbyen today

Longyearbyen is under Norwegian administration and is the largest settlement in Svalbard. A total amount of 2258 people live on a permanent basis in Longyearbyen and Ny-Ålesund as of 8. April 2019.⁹ The population of Longyearbyen is young compared to the mainland. There are many children between 0-4 years, but quite few between 15-19 years. Most people are between 25-44 years, however there is almost no one over 70. How long people stay in Longyearbyen varies, but the average residency is about five years.¹⁰

In 2001 local democracy and political elections were introduced. Longyearbyen Community Council was established January 1 in 2002. They are responsible for the infrastructure, community and area planning, financial planning, business, statistic production and development and coordination.¹¹

Longyearbyen has changed dramatically over time. From being a predominantly male society, it has become a family community, even though men are still in majority. From living in homes built by the coal companies, it is now possible to build private homes.

Today coal mining is not as dominant as before, only mine 7 is still active, and Longyearbyen has evolved into a place with varied businesses. Tourism, research and higher education are among the pillars of the society.¹²

⁸ Overrein, Henriksen, Johansen, Prestvold 2015

⁹ Statistisk Sentralbyrå 2019

¹⁰ Lokalstyret 2013: 6

¹¹ Norsk Polarinstitutt 2012

¹² Overrein, Henriksen, Johansen, Prestvold 2015

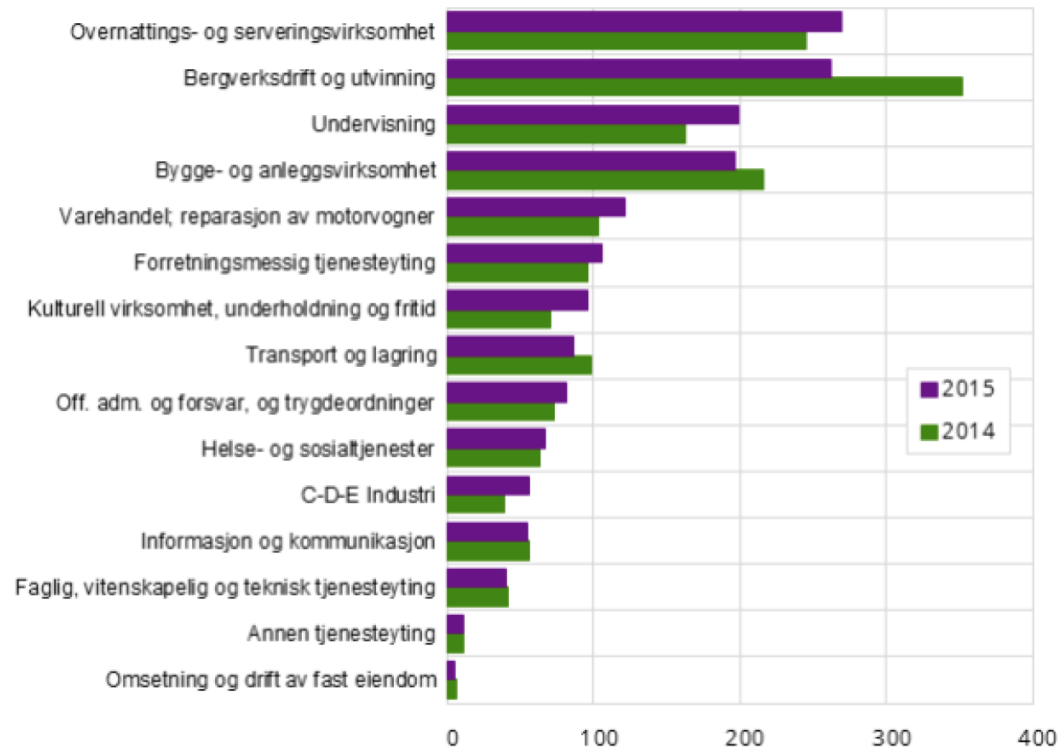


Figure 1: Annual work for companies, by industrial area 2014 – 2015. The figure above highlights that coal-mining(nr 2) is being phased out, while academic research institutions as well as tourism continue to grow.

2.4. Future plans for Longyearbyen

It has been stated that Longyearbyen has three legs to stand on: mining, research and tourism. Longyearbyen is changing as a result of a decline in the mining industry. This means that one of the three pillars is weakened. A strategic business plan for Svalbard has made an estimate of possible growth in various industries for the next 15-20 years. Increased tourism and activities related to education and research and other business development provides an expected population growth and increased service needs.

Longyearbyen Community Council has worked on a new zoning plan for Longyearbyen where they are consciously working on how to ensure that growth is possible. They decided that the center of Longyearbyen should have goals that would facilitate better utilization of the land through forward-looking and environmentally friendly development. The plan is to facilitate the development of an attractive city center for visitors and residents while nature and cultural heritages are protected. See attachment 2. Future plans include:

- Longyearbyen's unique character must be reinforced
- Development of education, research, industry, service production and tourism shall be taken care of in the center plan

- Partial planning for new residential areas and school, kindergarten and sportsgrounds will be started
- Development of Bykaia is important as the harbor receives 50 000 passengers annually
- Better protection from avalanche and flood
- A higher density and transformation because of limited access to unused areas combined with growth in residential development, industry, tourism and research.
- Longyearbyen Community Council is working towards a strategy for future housing development.¹³

2.5. Taubanesentralen timeline

The first Ropeway Hub (*Taubanesentralen*) was built in 1907. It was used for transporting ropeway conveyors (kibber) filled with coal from the mines down to the shipping port. During the second world war, the construction and structure was destroyed when German warships sat Longyearbyen on fire in 1943. It was rebuilt and a new ropeway hub emerged above the former. Ropeway conveyors from four mines in three different directions (Line 1b, 2b and 5) over several kilometers ran together in Taubanesentralen and continued down to the shipping port further out in Adventfjorden with Line 3. This coal-transport-structure became an iconic part of the landscape of Longyearbyen and Adventdalen. The hub together with its connecting conveyors were in use from 1957 to 1987. After that, because of corporate economic reasons the steel waggons transporting the coal from the mines were replaced by trucks driving up and down Adventdalen.

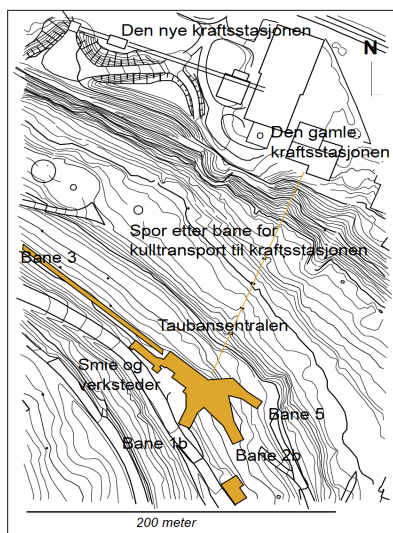


Figure 2: Taubanesentralen and the direction of the ropeways

¹³ Pettersen et al. 2016:81

The iconic building suddenly became completely disengaged from its original function, and its further destiny became a hot topic of discussion in the local community. It occupied one of Longyearbyen's most beautiful plots, visible from most of the valley. The ruins of the ropeway foundation along with Taubanesentralen convey the history of Longyearbyen. An exhibition in the Taubanesentralen was established in 1992 and it opened for guided tours for the public after a collaboration between Store Norske Spitsbergen Kullkompani (SNSK), Svalbard Museum and the Governor of Svalbard. It is being referred to as a "floating museum",¹⁴ but only through its iconic shape and through standalone posters inside is the story being told. Since the building is dangerous, it can only be viewed from the inside by arrangement with SNSK. This makes the museum very unavailable for tourists and locals¹⁵. According to SNSK, Svalbard Museum and LPO architects are there nowhere that the story of coal mining is told collectively in such a way it deserves. This is requested by locals, visitors, tourists, miners and SNSK's own employees.

In fear of leaving Taubanesentralen to "controlled decay", SNSK suggested and planned for new use of the old Taubanesentralen with offices. This was turned down by the Directorate of Cultural Heritage and the building was immediately listed. Other than being used as a museum, the only function the building has today is being a landmark and house Store Norske Mandskor's annual concert.¹⁶



Picture 3: Kent Roar Nybø. 2018

¹⁴ Steenstrup 2001

¹⁵ Go-svalbard 2008

¹⁶ Knudsen, E., Yri, H. T 2010: 58-59

3.0 Value assessment and statement of significance

3.1. The listing of cultural heritages on Svalbard

The archipelago has the world's strictest law on protecting its cultural heritage. All traces of its history, including hunters, scientists, mining and explorers, must be preserved. It is illegal to disrupt or camp in areas closer than 100 meters from listed cultural heritages. Even objects that look like scraps at first glance, like rusty barrels and remnants of wooden buildings, are protected if they were made or used before 1946. Svalbard has, according to Per Kyrre Reymert, an archaeologist and cultural heritage advisor at the Governor of Svalbard's office, a unique cultural heritage law. He believes that no other place takes as good care of their ancient monuments. Svalbard has a lot of cultural heritages despite few years of human activity. There was no native population, but mining companies, scientists, and hunters brought tools and artifacts to the archipelago without taking them back home again. It was left there for the unique climate to (almost) preserve the objects, and for so that visitors and scientists could get an insight into the cultural history. Breaking these laws will result in big fines, even if it is accidental.¹⁷

Right next to Taubanesentralen is the ropeway warehouse (Taubanelageret) built in 1957. Jason Roberts bought the building and used it as a private residence and workplace. When he built an addition to his house, he got 41 days of conditional prison and a 50 000 kr fine, even though it got listed four years after he bought it and started the renovations.¹⁸



Picture 4: Politiet (Police) 2009

¹⁷ Rapp 2011

¹⁸ Rapp 2009

3.2. The listing of Taubanesentralen

Everything built before 1946 is automatically listed at Svalbard, but since the Taubanesentralen and its connecting cable cars and structure was built in 1957, it does not fall within this limit. Previously, the Directorate of Cultural Heritage did not consider it necessary to endorse since Svalbard was so isolated. Nevertheless, in 2003, the Directorate of Cultural Heritage listed Taubanesentralen with its connecting structures after SNSK, the owners of the building, suggested turning Taubanesentralen into offices. ¹⁹The construction was the first recent cultural heritage built after 1946 that was listed at Svalbard since the new law on environmental protection came in 2002. ²⁰

The Directorate of Cultural Heritage decided to preserve and list the cable car complex from Adventdalen to Skjæringa as they recognized the complex as a unique technical - industrial heritage that conveyed how the coal mining industry had been so fundamental to Svalbard's history.

The listing includes all technical installations on the almost 10 kilometer stretch from Mine 5 and 6 to, and including, Taubanesentralen. It was listed according to Svalbardmiljøloven 39c. The complex consists of 100 cable cars, four tension stations, an angle station and Taubanesentralen.²¹

Taubanesentralen with the workshop, (verksted), the forge (smie) and the wax-workshop (smørebu) was listed including exterior, interior and technical installations.

In the area plan for Longyearbyen 2011-2019, most of the ropeway stretches are allocated to nature and recreation combined with security zones (100m) for automatically listed cultural heritages or statutory listed cultural heritages. Both Taubanesentralen and the connecting ropeway conveyors are appointed identity-creating.

The entire facility of Taubanesentralen to the area at Hotellneset has, according to the Governor and Longyearbyen Community Council a high source- and knowledge-value. They believe that the facility is essential for understanding the mining operation. Even though some parts of the structure is almost in ruins, they state that the various functions have been preserved; most of the ducts stands, together with several cargo stations, angle and tightening stations and Taubanesentralen.

They state that Taubanesentralen and the connecting facilities has a high experience value and are important symbols that are identifying for Longyearbyen. ²²

¹⁹ Barr, Tønsberg n.a

²⁰ NRK 2001

²¹ NRK 2003

²² Knudsen, E., Yri, H. T 2010: 58-60

The Directorate of Cultural Heritage (riksantikvaren) justifies the statutory listing with the statement that “Taubanesentralen is part of a cultural monument that is completely unique in a national context since it represents the history of the only place in Norway with coal mining on a large scale. In addition, Taubanesentralen helps creating identity in Longyearbyen”. The Directorate of Cultural Heritage wants the building to be preserved intact and it should be used as a display facility/museum.²³

3.3. The resistance for listing Taubanesentralen

The listing of Taubanesentralen has received resistance from the local community. As mentioned earlier, SNSK wanted to re-establish Taubanesentralen as offices. As owners of the structure, they believe that it is important to manage industrial cultural heritages so that they can not only last for prosperity, but also so that they can be experienced by the population.²⁴ They believe that Taubanesentralen as it stands today has an unresolved potential. The Directorate of Cultural Heritage strongly opposed the proposal and with support from the Governor of Svalbard (Sysselmannen) they turned down the idea. People of Longyearbyen showed massive support for the reuse-suggestion made by SNSK. Svalbard Samfunnsdrift (SSD) stated that they feared the listing would leave Taubanesentralen to controlled decay under supervision. They supported SNSK office suggestion and thought daily use with such purpose would reach a large audience.²⁵

As previously mentioned, the ropeway warehouse was illegally renovated, an incident that got great consequences. People in Longyearbyen, on the other hand, disagreed with the Directorate of Cultural Heritage and the Governor of Svalbard and started a signed petition stating that Jason Roberts, the house owner, took good care of his special home. So even though it was listed and lied right next to Taubanesentralen, people of Longyearbyen did not see it as ruining the building but maintaining it.

²³ Stavanger Aftenblad 2001

²⁴ Sysselmannen 2015

²⁵ Holm 2001:6

3.4. Preliminary value assessment

We recognize Taubanesentralen as one of the most characteristic and important industrial cultural heritages in Longyearbyen. It conveys an important history of the mining industry. Still, we believe as an experience in itself and as an arena for history dissemination, there is a considerable unresolved potential at Taubanesentralen.

Our assessment is that the most character defined feature is the shape of the building. It is a rare and unique structure with a lot of architectural values. Through its “form-follows-function” silhouette it tells the story of the industry where practicality exceeded the aesthetics. The history of Taubanesentralen as a connecting point for the ropeway is being told through the buildings outstretched “arms” and the long load bearing structures the building lies on. By just preserving the shape and the load bearing structures we believe that the building can still convey its historical message. The materials and the technical installations are less important but can be further developed in order to create ownership to the now “ghostlike” building. An idea could be to use similar materials in our new development, to preserve the character of the building, but give it more personality.

We wish to save its historical character, but at the same time make it more available to create ownership to a disengaged building and a new purpose in relation to Longyearbyen`s future goals.

4.0 Industrial Heritage Conservation

4.1. Conservation plan

Taubanesentralen, as mentioned earlier is one of the most characteristic and important cultural monuments in Longyearbyen. The structure overlooks the city and is visible from all over Longyearbyen, this is emphasized even more during the winter when the entire structure is lit up. After 30 years in service, from 1957 to 1987, Taubanesentralen was statutory listed through the Svalbard Environmental Protection Act § 39 c, by the Directorate of Cultural Heritage in 2003. For the owner, Store Norske Spitsbergen Kulkompani AS (SNSK), it is important to manage this industrial heritage site so it can last for future generations and not constitute a security risk. Furthermore, it is important that it can be experienced by visitors, both local and tourists. As an experience in itself, it is also a place for history, an considerable unresolved potential at Taubanesentralen.

A conservation plan is a mapping of the different cultural heritage sites/structures, an assessment of the protection value and recommendation of measures. For Taubanesentralen, there has been developed a management part that intends to clarify roles. As described in the text above, SNSK as the owner of the structure has a role and the responsibility for maintaining Taubanesentralen. Through financial aid from Svalbard Environmental Protection Fund under the supervision of the Directorate of Cultural Heritage.

A maintenance plan is the most detailed plan type. It is about an industrial heritage site or structure and describes the condition and clarify how maintenance and repair work should take place in the years to come. Cultural heritage and cultural environments, if decided that they should not be left in peace, maintained and restored on the cultural heritage's premises, and it is important that the maintenance itself does not reduce the value of the cultural heritage.

Modern maintenance, rehabilitation and reconstruction are measures that are not used on the listed cultural heritage sites.²⁶

Today, Taubanesentralen uses a decay inhibiting maintenance and preservation plan. This includes minor interventions that does not involve changes to the structure. This can consist of digging loose or changing masses around foundations or stabilizing against slipping of masses or attaching loose cladding, covering or changing broken windows. Conservation means maintenance and repair using

²⁶ Douet 2012: 131

traditional methods, materials and tools. Decay can thus be delayed and the structure preserved longer.²⁷

4.2. Adaptive re-use

In short, adaptive re-use refers to the process of reusing an existing building for another purpose than which it was originally built or designed for. There have always been buildings that have survived beyond their original function and then been renovated to house a new one. Or that have been served several uses over time, adapted by builders again and again for another purpose. What we call adaptive re-use today has historically something that was driven by common sense and economy. This is something that will be highlighted further in reference projects later in this paper.

Since the 1980's, with the acceleration of de-industrialization, a large number of abandoned buildings and sites have accumulated that are facing an uncertain fate that await new use or demolition. All these buildings vary in complexity, size, spaciousness, structural diversity and the environmental challenges they represent.²⁸

Another difference today then before is the social roles and the different ambitions in decision making in conversion projects; investors, with no personal relationship to the resulting use, builders with new "aggressive" technology, architects which are trained more in designing from scratch and even people working with heritage, who is still trying to find the way to deal with industrial heritage.

4.3. Adaptive re-use and embodied energy

Building conservation is not about the past, it is about the future. The choices that are made about what to keep from the past are also about what changes to make to those buildings we have inherited. Global climate change is attributed in large measure to emission of Co2 and other gases from the burning of fossil fuels, which has increased exponentially with the industrial revolution.

Building preservation or conservation will save energy by taking advantage of the non-recoverable energy embodied in a building and therefore extending the use of it. Easily put, building materials contain the embodied energy already invested into them, it is the sum of all the energy that was used to build a structure, fuel, building materials, human resources etc. All of the building materials

²⁷ Knutsen 2010: 17

²⁸ Douet 2012: 113

have been transported to the site, at some cost in energy terms. Life Cycle Assessment (LCA) looks at the total environmental impact of a material or product through its life, from raw material, through manufacturing, transportation, use and disposal or recycling. The assumption in LCA is that eventually a building or material will come to the end of its life cycle. Their embodied energy will not be lost if they were designed for disassembly and/or re-use.²⁹

Industrial buildings, where high embodied energy is often locked into heavy construction, could play an important part in reducing carbon emissions if they perform a useful role. By welcoming adaptive re-use, it can seek ways to ensure that the needs of tomorrow can partly be met in buildings of yesterday.

²⁹ Douet 2012:137

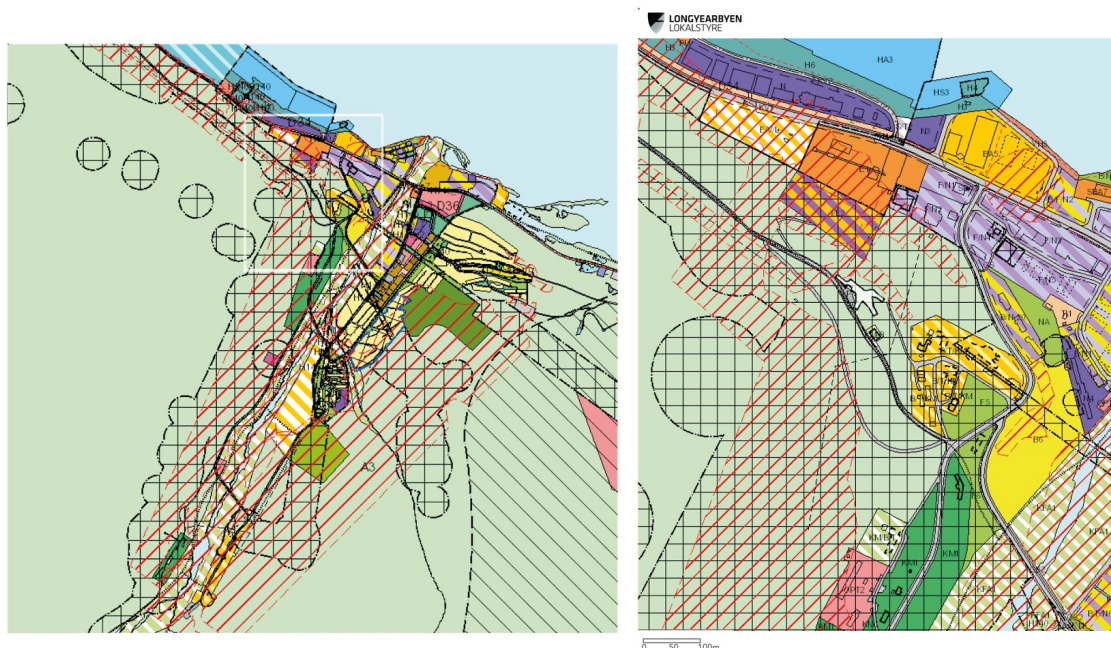
5.0 Regulatory framework

5.1 Zoning and building code

99% of the land area in Svalbard is to be considered as wild-landed nature areas and about 65% of the archipelago is covered by different types of protection. Furthermore, there are seven national parks, six major nature reserves, 15 bird sanctuary and one geothermal area.

Taubanesentralen is situated in a culture-, nature and recreation area which surrounds all of Longyearbyen. Parts of the area is within a protective zone for drinking water, H110_1 (§44.1), danger zones and avalanche risk H310_1 (§43.1), and a security zone for cultural heritage H770_1 (§47.1).

Figure 1: Area zoning Longyearbyen



Left: Overview of Longyearbyen, shows how building code 5150: culture-, nature and recreation area surrounds Longyearbyen. Highlighted in white zoomed in area.

Right: Zoomed in on Skjeringa with Taubanesentralen in white.

6.0 Landscape and site

6.1 Climate

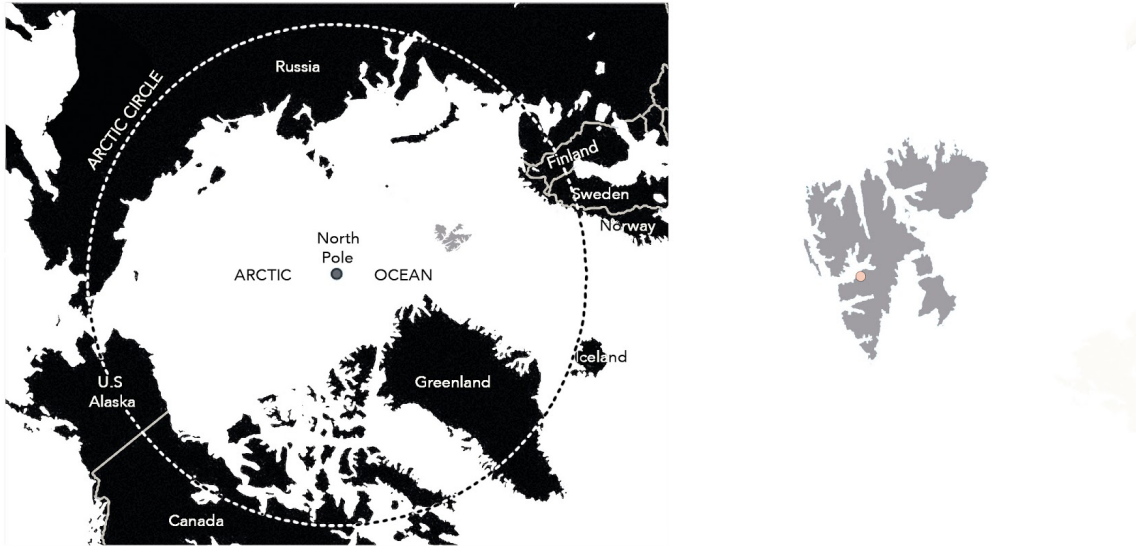


Figure 1: Map over the Arctic Circle and highlighted Svalbard and Longyearbyen, made by Bjørn Mejlænder-Larsen

The climate in Svalbard is subpolar along the west coast, this because it is reached by the last branch of the Gulf Stream. The east coast is polar, because the temperature even during the summer remains around freezing (0°C). In winter, polar ice reaches the north- and east coasts, while leaving free the western coast. This being one of the reasons why the settlements (Longyearbyen, Barentsburg, Pyramiden and Ny-Ålesund) are located on the western side of Spitsbergen where temperatures during the summer months rise above freezing.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Min ($^{\circ}\text{C}$)	-20	-21	-20	-16	-7	-1	3	2	-3	-9	-14	-18
Max ($^{\circ}\text{C}$)	-13	-13	-13	-9	-3	3	7	6	1	-4	-8	-11

Figure 2: Longyearbyen - Average temperatures

6.1.1. Wind

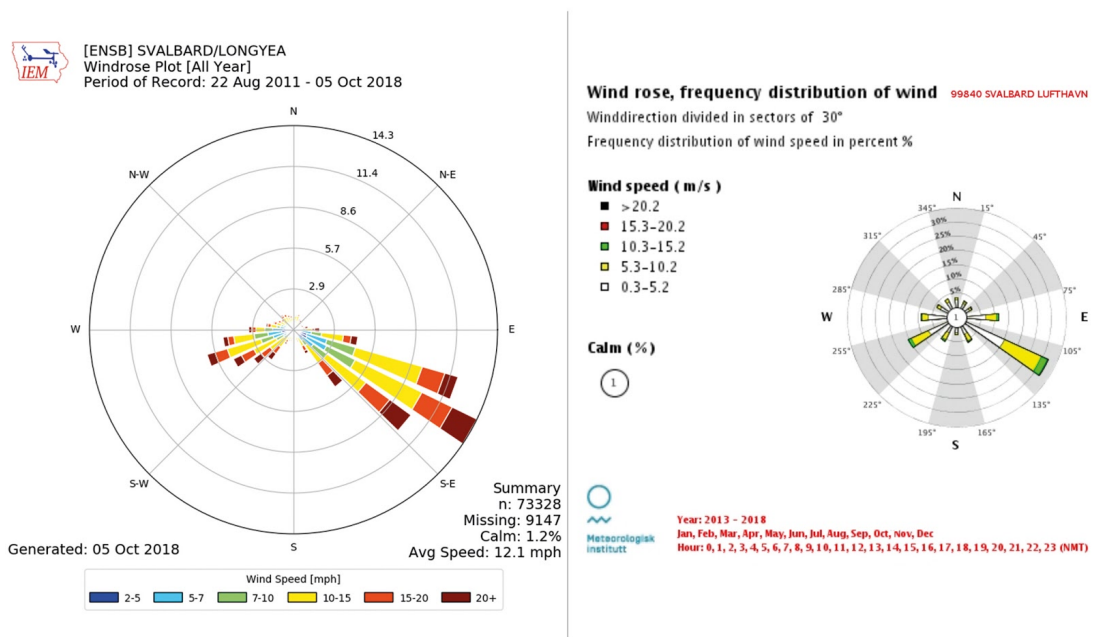


Figure 3: Wind roses, frequency distribution of wind. The wind rose to the left is collected from Iowa State University, the Iowa Environmental Mesonet. website: https://mesonet.agron.iastate.edu/sites/windrose.phtml?station=ENSB&network=NO_ASOS The right windrose is collected from a geotechnical assessment of housing project B14 in Longyearbyen, performed by Rambøll Norge AS for Statsbygg.

The weather and wind direction are largely influenced by the topography of the area. The mountains and the valleys around Longyearbyen make the wind mainly blow in the direction of Adventsdalen. Wind measurements (wind roses above) show that the main wind direction in both autumn, winter and spring is from the southeast.

6.1.2. Precipitation

Svalbard has little precipitation compared to the Norwegian mainland. Measurements from the weather station Svalbard Airport (kt 28) shows an average annual precipitation for the period 2003-2012 of 186 mm. The Norwegian Meteorological Institute defines a desert as an area where there is less than 250 mm of precipitation a year. However, the measured amount of precipitation can be systematically underestimated, since the main amount of precipitation comes as snow under strong wind.³⁰

³⁰ Rambøll 2018:G-not-001_rev01 1350023712

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Prec. (mm)	20	30	30	15	15	20	25	30	25	20	20	25	275
Days	15	14	16	12	10	9	12	14	14	14	14	14	158

Figure 5: Longyearbyen - precipitation 2018

6.1.3 Winter

The winter in Longyearbyen is long and freezing, from October to May with frequent snowfalls in the form of light snow. The average temperature in February in Longyearbyen is -17°C. April and May are still cold, below freezing, but with 24 hours of daylight it is very different from the dark winter months with no sun (October-February). The coldest records are very low, down to -45°C in Longyearbyen. This value is reached very rarely, because the climate at high latitudes in recent decades has been warmed significantly. It is more likely that the temperature in the coldest days of the year is to be around -25/-30°C. Special for this subpolar area is that the temperature can exceed freezing by a few degrees and it can rain. This happens when a cold wave in Europe is about to occur, there is a heat exchange, so warm air from the south travels this far north and in return the polar air moves towards south.³¹

6.1.4 Summer

Summer in Longyearbyen is defined from June to mid-September, though in June and September the temperature is just above freezing, while July and August are the warmest months, with average temperature around 4 to 5 °C. In the warmest days, the temperature can reach up to 18-20 °C inside the largest fjords, where Longyearbyen is located, while in Ny-Ålesund it won't go above 13 - 14 °C. Longyearbyen and other subpolar places are characterized by the midnight sun and polar nights (dark time) In Longyearbyen the midnight sun is from 20th of April to 23rd of August.

In the middle of the summer, the sun in Longyearbyen is about 35 ° above the horizon during the day and 11 ° at night. In contrast, it is dusk and complete darkness several months during the year, this is called polar nights. This is defined when the sun is more than 6 ° below the horizon.³² In Longyearbyen, the period of polar nights last from 11th of November to 30th of January. On clear days, the darkness is often lit by aurora borealis (Northern lights).

³¹ Dannevig, 2018

³² Sysselmannen Svalbard, 2012

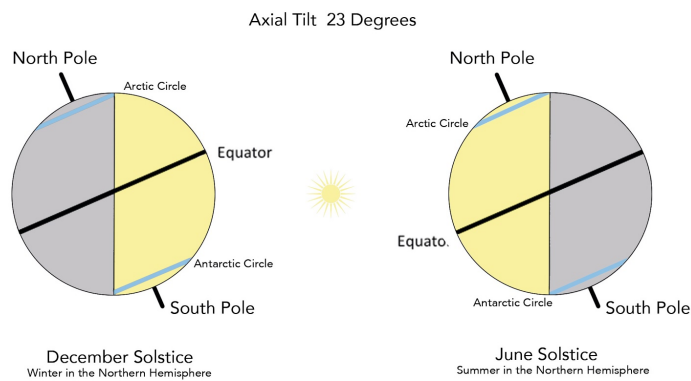


Figure 4: The diagram above shows the December- and June Solstice which explains the midnight sun and polar nights

6.1.5 Sunshine

The amount of direct sunshine in Svalbard is not too good, because the sky is often cloudy. However, the sunniest months are April and May. During the summer, the sunshine gradually decreases. It shines for an acceptable number of hours from June to August. Because of the midnight sun, sunshine remains above the horizon even at midnight.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hours	0	0	2	8	8	6	5	4	2	0	0	0

Table 4: Average sunshine Longyearbyen

6.1.6 End note on Climate

Temperature and precipitation are climatic key elements that affects ecosystems and human activity. During a monitored period of the last 40 years both air temperature and precipitation show an increase. There is also expected to be considerably warmer weather and more precipitation in the Arctic, based on model calculations of how the climate will change as a result of the increased concentration of greenhouse gases in the atmosphere. (see attachment 1.)

6.2 Building on permafrost

Modern buildings built on permafrost need extra considerations for potential thawing. While it is only the top section of the permafrost that concerns builders, permafrost can easily extend several hundred meters deep. This can be a problem; permafrost usually does not begin until about a meter below ground level. As long as this section remains frozen it is both stable and strong. Now, if the frozen ground is met with heat transfer, it will thaw. For this reason, non-insulated structures/buildings built on top of permafrost can potentially gradually sink. This may cause structures to skew and even collapse.³³

6.2.1 Construction issues

Constructing on frozen ground is both challenging and difficult. Huge layers of ice can be formed underground and will thicken over time. This process can make the ground move and expand, this is known as frost heaving. Not only can frost heave lift up the ground, but everything built on top. Heated buildings will radiate heat to the ground. This heat can thaw the permafrost underneath the structure. When the permafrost thaws it will damage the building it supports and can even sink.

Despite the fact that there is knowledge about climate change, and how foundation works and construction on permafrost can rapidly destroy permafrost, it is still built on Svalbard without taking sufficient account for these conditions. Observed damage to newer infrastructure is mainly caused by inadequate or absent planning, design, execution and maintenance. Climate change, even the major changes that have taken place in Svalbard in recent years, is a relatively slow process, compared to uncontrolled building activity.³⁴

³³ Seifert 2012

³⁴ Instanes A, Rongved L. J. 2019

6.2.2 Solutions

There is no doubt that permafrost is an excellent foundation for buildings, as long as it is kept frozen. Permafrost is very sensitive to temperature changes. A building changes the way heat moves in and out of the soil. Buildings heated in the winter will add heat to the soil. A building also shades the soil in the summer, preventing exposure to the sun. The strategy for alleviating the risks can be divided into two:

Elevate the structure either by raising the structure using pilings made of material that limit heat transfer or elevating to allow natural air circulation underneath the structure to minimize heat transfer.

Insulate the ground by a gravel pad, usually up to two meters deep which insulates the active layer or insulating the floor to reduce heat transfer from the structure.

6.3 Documentation and preliminary analysis

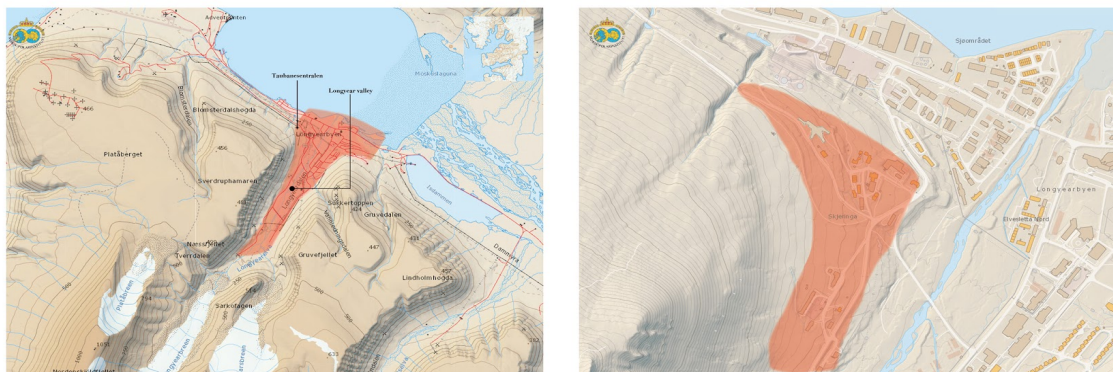


Figure 1: Situation plan over Longyearbyen focusing on the Longyear valley and Skjeringa. Photoshop by: Bjørn Mejlænder-Larsen

The planning area in Longyearbyen is dominated by the open, flat Adventdalen, with several side valleys that flows into Adventdalen. The town center and most of the structures / buildings are located in the Longyear Valley, the first large valley coming south from Adventdalen. Steep mountains surround the whole of Longyearbyen, and the city has an unnatural inquiry in that it descends from the south towards the north.³⁵

³⁵ Longyearbyen Community Council, 2016:929

In the Longyear Valley, the valley floor consists mainly of riverbanks of sand and gravel above more fine-grained masses of silt and clay. There is a great depth down to the rock, a relatively high salt content and certain areas with a higher concentration of ice in the ground. The salt content is typically increasing towards the fjord. For the areas further up the valley sides, such as Skjeringa lower depths to the rock can be expected. In the sea area, riverbanks and other masses/sediments are expected over the old seabed.³⁶

6.3.1 Ground temperature

The main principle for construction in permafrost areas is to avoid alternating the temperature conditions in the ground, when this will in most cases cause the permafrost to thaw. This will normally be solved by lifting up the structure from the ground, either with concrete foundations or by pillars and in this way allow wind blowing under the structure. For structures that are especially sensitive to sinking damages in the ground or the wish for a longer lifespan of the building, one uses artificial cooling to reduce the temperature in the ground and at the same time reduce the sinking velocity in the ground.

Frozen ground, especially where there is a high concentration of salt and ice, like in Longyearbyen there is a high chance of smaller sinking effect when under load from structures. The speed of the sinking is dependent on the temperature profile in the ground. Increasing temperatures in the permafrost could therefore lead to an increase in the sinking effect of the ground, with the consequences varying from increased maintenance, larger sinking effects and eventually can cause fractures in the foundations or building elements.

	Year average temperature		Temperature in the ground				Thaw thickness in the active layer in summer	
			10 m deep		20 m deep			
	2017	2100	2017	2100	2017	2100	2017	2100
City centre	-3,7	-0,4	-3,9	-2,3	-4,2	-3,2	1-1,5 m	ca. 2,5 m
Skjeringa	-3,7	-0,4	-2,8	-1,1	-3,1	-1,4	ca. 1,5 m	ca. 2,5 m
Forskningsparken	-3,7	-0,4	-3,6	-1,9	-3,7	-2,7	ca. 1,5 m	ca. 2,5 m

table 1: The thaw thickness in the active layer (the top layer which melts each summer) and modelled temperatures in the ground in the year 2017 and 2100.

³⁶ Statsbygg, 2018:IAS2171-3_Rev:1

The table above shows the Geothermal calculation done by the Norwegian Meteorological institute in 2018 for the expected temperature development for RCP4.5, the middle-high emission scenario. The calculations show that the thaw thickness in the active layer (top layer of the ground) in the summer is expected to increase from about 1,5 meters to approximately 2,5 meters towards year 2100. The calculations also show that the temperature in the ground from 10-20 meters will increase but much slower than that on the terrain surface.³⁷

Even though the calculations show that there will still be permafrost in Longyearbyen after year 2100, it is expected that increase of temperatures in the ground will lead to a decrease in the structural capacity and an increase in sinking velocity for traditional foundations. The future temperature increase should be taken into consideration for future planning and development for structures and buildings. Possible solutions could be longer pillars drilled even deeper into the ground or increasing the diameter of the pillars. There can also be an increase in the need for active foundation methods, such as artificial cooling specifically for important buildings with a longer lifespan than regular housing projects.³⁸

In areas such as Skjeringa with higher concentration of rocks one solution could be to replace the sediments in the ground or connecting the pillars directly with the rock.

³⁷ Statsbygg 2018:IAS2171-3

³⁸ Statsbygg 2018:IAS2171-3

7.0 Materials and construction

Taubanesentralen is a steel structure with wooden deck and covered with corrugated iron sheets. Exterior stairs are made of steel. The roof was covered with tin plates until it had to be removed for security reasons. Forges and workshops are wooden structures covered with corrugated steel sheets.



Picture 5: Trond Håvelsrud 2018

7.1 Condition assessment

Based on the inspections of Taubanesentralen with the forge, workshop and wax-workshop made in 2010, SNSK, Longyearbyen Lokalstyre and the Governor concluded that the building needed maintenance and repair of broken windows. Also, the roof of the forge had large leaks and the tin plates that covered the roof were about to detach. This made the building a danger to the surroundings - especially since it is located in a windy area. A plan was then made to repair the overall Taubanesentralen with the necessary maintenance work and measures that could make it more accessible in the communication and experience context. A project was initiated with interviews by those who worked at Taubanesentralen to document the operation and working conditions. The exterior was to be maintained in accordance with the conservation regulations.³⁹

³⁹ Knudsen, E., Yri, H. T 2010: 60

7.2 Repair and maintenance

Repairing Taubanesentralen to maintain the cultural monuments and for security reasons is important. In addition, it is important that cultural heritage can be experienced by visitors. Repair and maintenance of Taubanesentralen have been done twice. SNSK applied in 2014 for funding from Svalbard Environmental Protection Fund for change of use and re-opening of Taubanesentralen and was 30. November 2016 granted 150 000 NOK.⁴⁰

The purpose of this project done in 2016 was to maintain Taubanesentralen and make it more available. The measures and purpose that were made were in line with recommendations from the technical-industrial cultural heritage plan for Longyearbyen with the surrounding area, published by the Governor of Svalbard, in collaboration with Store Norske and Longyearbyen Community Council, in 2010. Here it states that the necessary maintenance work and measures shall be considered in order to make Taubanesentralen more accessible in relation to communication and experience. The measures were carried out and completed in 2016. What was done was the following:

- repair of floors
- plexiglass in floor openings, lift wells and ropeway openings.
- A new staircase and emergency exit. There was a relatively steep and demanding staircase and lack of emergency exits of usable standards and it was therefore closed and is rarely used.
- Review of existing lightning installation.
- Replacement of 50 light sources inside the control panel for new 10W LED light sources.
- Installation of 6 12 W LED headlights for lighting of the structure.
- Replacement of 10 rail mounted spotlights for new 6W LED spotlights.
- Controlling and securing disconnected installation parts
- Mounting new 25 W LED outdoor lights in relation to new staircase
- Installation of 5 LED emergency and LED lights
- Vacuuming and cleaning⁴¹

The second repair was done in 2018. SNSK applied in 2015 for funding from Svalbard Environmental Protection Fund for security measures regarding Taubanesentralen and was 22. November 2018

⁴⁰ Svalbards Miljøvernfond 2016

⁴¹ Sysselmannen 2016

granted 300 000 NOK.⁴² The measures were carried out and completed in 2018. What was done was the following:

- The tin plates on the roof was dismantled and packed so that it could be used for other projects on a later occasion.
- Wood, laths, cardboard and insulation were demolished and deposited. Most of the existing insulation was packed together in plastic cassettes, which was unfortunate with regard to condensation. It was replaced with a more diffusion-open insulation and wind barrier that will transport the moisture out of the building.
- New windshields, laths and roof panels were mounted
- The chimney with additions were dismantled and removed from the roof in order to assure that the new plates were mounted and secured properly. The chimney is not remounted yet because an assessment should be made if a new chimney should be mounted so that it can be used in the forge or if the old was should be mounted back for the sake of aesthetics. The condition of the chimney parts and safety of the surroundings must also be taken into consideration. For now, the chimney is stored at the forge.
- It was also vacuumed and cleaned in between the beams so that moisture would not gather and so that it would be easier to possibly change the ceiling plates underneath at a later time.
- Roof over the entrance was repaired in the same way as the rest of the roof, but they also made it more angled since it is affected by the snowfall from the roof above.⁴³



Picture 6: Trond Håvelsrud 2018

⁴² Svalbards miljøvernfond 2018

⁴³ Svalbards Miljøvernfond 2018

8.0 Reference projects

8.1. Allmannajuvet Zinc Mine Museum, Sauda, Peter Zumthor

Peter Zumthor resigned in 2002 a tourist route attraction to bring the old mining history of Sauda back to life. The buildings overlook the old foundations. The design and its simplicity conveys the mining operation, the mining workers hardship struggle and demanding lives in the late 1800s. The entirety of the installation consists of a museum, a cafe, toilet, parking, paths and stairs divided into four buildings.



Picture 7: Aldo Amoretti (n/a)

The building tries to stimulate and provoke a feeling of the place and its history. The architecture reflects the poor conditions of the workers though its simplicity and the straightforward construction. The exterior is simple and the exterior is dark, reflecting the miners work inside the dark mines. The black space also let the color of the nature into the building.⁴⁴ The buildings were prefabricated and assembled on-site. The support system of the exterior consists of creosote (a dark

⁴⁴ Portal Sauda n.a

brown oil distilled from coal) impregnated laminated wood. The exterior walls itself consists of 18 mm plywood sheets.⁴⁵



Picture 8:: <https://portalsauda.no/peter-zumthor-allmannajuvet/>

⁴⁵ Archdaily 2016

8.2. UNIS, The University Center in Svalbard, Longyearbyen. Jarmund/Vignæs AS

Being the largest building in Longyearbyen and Spitzbergen, the structure is an addition to an existing university and research building, which is extended to about 4 times its original size. The project also houses Svalbard Museum. Using advanced 3D climatic simulations, the building works active with the elements, flow of wind and snow passing through the site. Furthermore, how the building assured that the accumulation of snow would not create undesired conditions in front of the doors and windows.



Picture 9: Jenssen, Eva Therese. 2015

Two iconic buildings in Longyearbyen represent a changing logic in Norway's geopolitical interests in the Arctic. Taubanesentralen is an icon of the coal mining history of Longyearbyen. It is a strictly utilitarian structure, a piece of engineering. With a strange geometry it stretches its arms towards the different mines. At a lower point in the city you will find The University Center in Svalbard. Both structures use a special geometric shape but also reflect the particular arctic conditions of Longyearbyen. Taubanesentralen is pragmatically covered to shelter the workers and equipment from the elements, and the expressive form of UNIS is clearly been influenced by Taubanesentralen and the form-generating potential of the extreme climate.

8.3. The Zollverein Coal Mine Industrial Complex, Essen, Germany.

During its active coal mine industrial period, the Zollverein Coal Mine Industrial Complex was the largest coal mine in the world, with the largest coking plant in Europe. Since the final working shift ended in 1986, the Zollverein complex is considered one the most impressive industrial monuments on the planet. Zollverein Coal Mine Industrial Complex was awarded the designation of UNESCO World Heritage site in 2001.⁴⁶ From 2001-2010, OMA together with Rem Koolhaas and Floris Alkemade designed the masterplan for the entire site for the Ministry for Culture, Sports and Housing of Nordrhein-Westfalen, Zeche Zollverein.



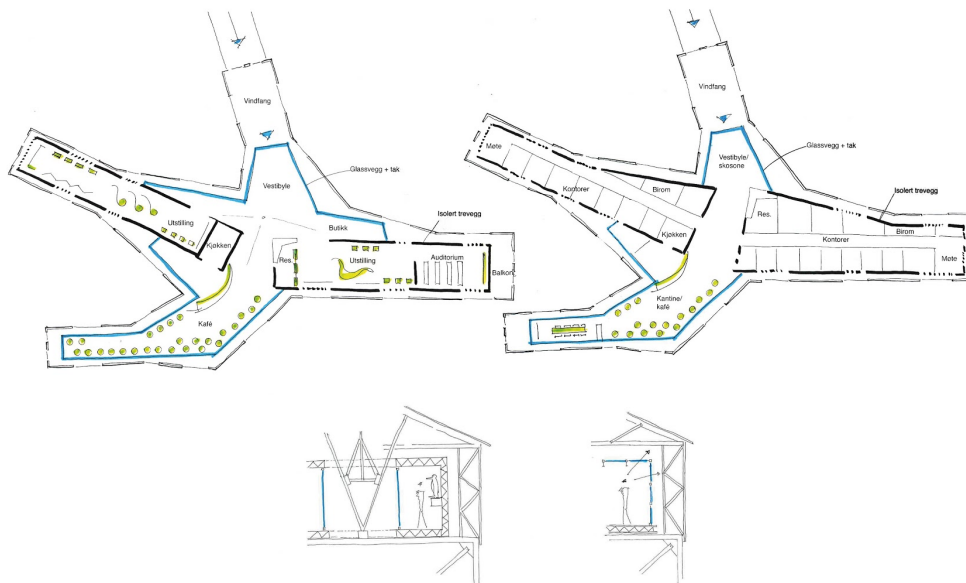
Picture 10 and 11: Jochen Tack, n/a

Previously the site of noise, coal and pollution, today Zollverein offers industrial culture, art, concerts, festival and sporting opportunities set against a truly impressive backdrop.

⁴⁶ OMA Architects. 2010

8.4. Transformation Suggestion #1, Taubanesentralen. 2000, Collaboration: Per Knudsen Arkitektkontor AS, Nilsens Utviklings Prosjekter AS.

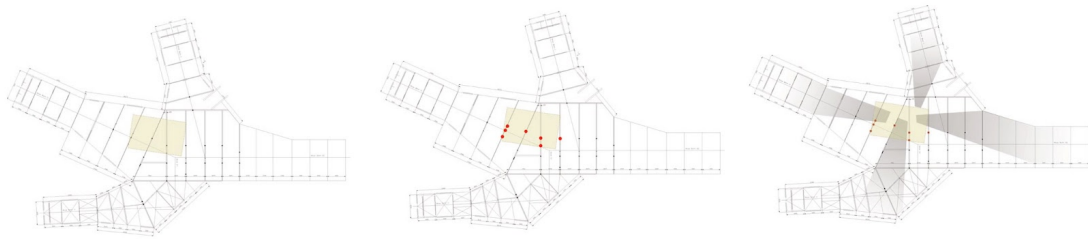
The first of two transformation suggestions introduced two scenarios for transforming the iconic Taubanesentralen. Creating interior spaces with insulated timber walls and glassed walls + roof. The idea was to lift the transformation off the existing flooring, creating a space within the space.⁴⁷



Diagrams: The first suggestion combined exhibition spaces, auditorium, a shop, kitchen, kafe and reception area. The second being an office space with a connected cafeteria.

⁴⁷ PKA / NUPAS 2000

8.5. Transformation Suggestion #2, Taubanesentralen. 2007, Jarmund/Vignæs AS



Diagrams:

The image above highlights the idea of a reversible representation space inside Taubanesentralen. Firstly, defining a small space in the middle of the room, adjusting it incorporate the existing columns inside, lastly locating the space to give equal view to each of the four arms stretching in different directions.⁴⁸

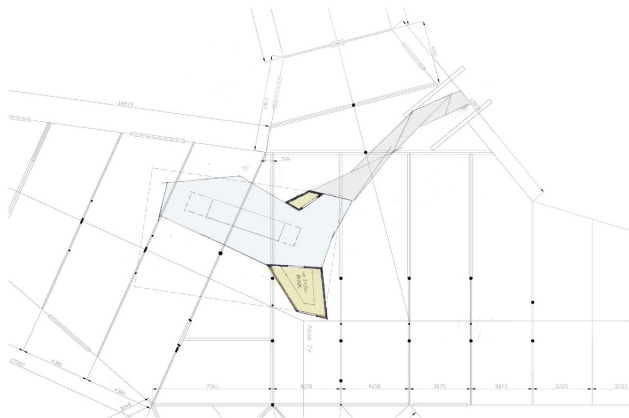


Diagram:

This image shows how the interior space adapted itself to its surrounding structures, columns etc.

⁴⁸ Jarmund/Vignæs AS. 2007

9.0 Semester plan & hand-in list

9.1. Semester plan

AUGUST

- Site model 1:5000
- Working model of Taubanesentralen
- Volume studies
- Concept and program
- Analysis diagrams
- Site analysis

SEPTEMBER

- Concept and program
- Volume studies
- Final concept and program description
- Drawings (plans & sections) 1:200

OKTOBER

- Developed drawings (plans & sections) 1:200
- Model 1:200
- Detail drawings
- Finished overall idea

NOVEMBER

- Final drawings (plans & sections) 1:200
- Final details 1:50
- Final diagrams
- Final illustrations
- Model 1:200

DECEMBER

- Finished model 1:200
- Prepare presentation

9.2 Hand-in list

- Plans drawings 1:200
- Section drawings 1:200
- Facade drawings 1:200
- Detail drawings 1:50
- Situation plans 1: 1000
- Axonometric drawings

- Site model 1:5000
- Project model 1:200

- Concept diagrams
- Site analysis diagrams

- Project description
- Pre-diploma booklet
- Project development booklet

- Interior and exterior illustrations

10.0 Appendices

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10.2 Pictures

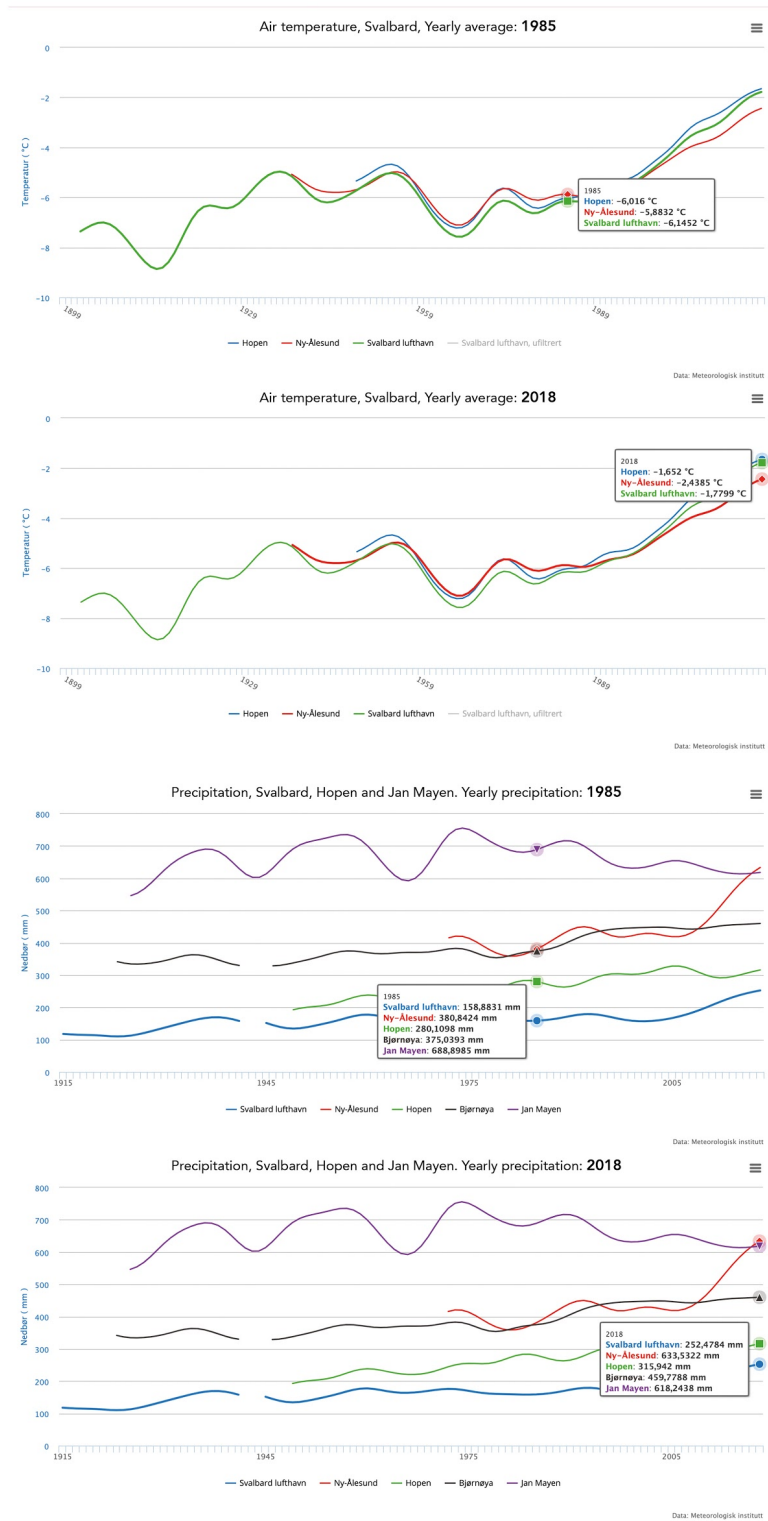
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10.3 Attachments



Attachment 1: Average temperature and precipitation, Longyearbyen, 1985 and 2018

DAGENS SITUASJON
AVGRENSNING AV NY DELPLAN FOR SENTRUM



DAGENS SITUASJON
PROGRAMMERING



Kilde: Forslag til planprogram, 29.januar 2018

UNDERVISNING
 KULTUR
 OVERNATTING
 SERVICING
 BARN/UNGE
 OFFENTLIG
 BUTIKKER
 BOUG

DAGENS SITUASJON
STRUKTUR, FLYT, BYROM OG REKREATIVITET



- Sentrum i dag er karakterisert ved en "strip", hvor livet utspiller seg primært omkring gågaten.
- Sentrum serviceres i dag av de parallelle veiene til parkeringsplasser som fyller mye i bybildet.

GÅGATEFORLØP
URBANT

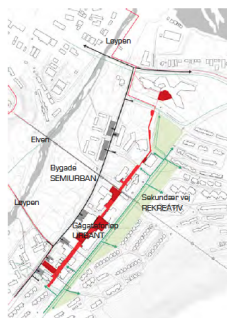
DAGENS SITUASJON
AVGRENSNINGER FOR BEBYGGELSE



- Langs elven er det risiko for flom
- Det er fredet under taubanen
- Det ligger en hensynssone ved siden av akkebakken, knyttet til et kulturminne som er fjernet. Siden vernestatus ikke er endret, vil det fortsatt kunne gi begrensninger for utbygging.

Attachment 2: Development plan 2040, page 82-83

FREMTIDIG SITUASJON
NY MOBILITET



Sentrum organiseres omkring tre hovedbevegelser:

- Bygaten
- En sekundær vei
- Gågateforløpet

FREMTIDIG SITUASJON
BYFELT



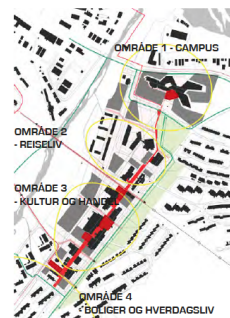
- Styrking av tverrgående forbindelser mellom de tre bevegelsesrommene - byen utvides fra en gate til et større felt

FREMTIDIG SITUASJON
FORTETTINGSFELTER



- Byggefeltene fortetter og styrker sentrums karakteren.
- Bygaten får fronter og innganger som bidrar til liv på begge sider av gaten
- Gågaten fortettes slik at bylivet kommer i fokus og gaterommene understøttes
- Parkeringen blir mindre til stede i opplevelsen av sentrum.

FREMTIDIG SITUASJON
FORTETTINGSFELTER OG
PROGRAMMERING



- 4 områder med hvert deres program som styrkes og intensiveres
- Runde Forskningsparken kan det legges til rette for studentboliger langs sjøkanten og områdene rundt.
- Byggefeltene i byen legger til rette for en høyere utnyttelse og funksjonsblanding som styrker områdenes identitet og attraktivitet. Fortetningsfeltene er eksemplifisert på side BE-87.

Attachment 3: Development plan 2040, page 84-85