The Ammonium Silos

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Project Titel:	The Ammonium Silos
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Program

Thesis

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Introduction

Meeting the Ammonium Silos

Following the busy freeway from Funen, crossing the New Lillebæltbro and entering Jutland, three silos meet you at your right. They almost disappear in the encircling forest, with patterns and moss appearing on the facade from time passing. Their size is hard to grasp from the freeway, where the speed of the traffic is contrasted by their static appearance.

After a short drive from the freeway the Ammonium Harbor, *Ammoniakhavnen,* is reached and reveals itself as a hidden gem. Even though the traffic from the bridge has an auditory presence, the monolithic silos and the view of the belt drowns the place in silence.

The Ammonium Harbor, where the three silos are built, functioned as an industrial harbor from 1964 - 2004 and was impassable for the common man. The small deepwater port was only accessible for the about 300 men working there, and the ships docking to unload. Back then the silos were covered by tanks, compressorhouses, pumps, workshops and big pipes transporting the Ammonium Nitrate.

The harbor closed in 2004, and a large part of the industrial elements were demolished. The workshops and tanks were removed. Then the compressor houses were torn down and lastly the big pipes covering the silos. Since 2011 the area has remained untouched, with only the silos left as a witness of the past. They have been involved in different plans - ranging from private housing to a bioenergy plant, but all the plans have fallen through.

The silos have already gone through a transformation from industry to an unapproachable motive from the past. Their weathered exterior detailing has emerged over the years, underlining the fact that they are left without upkeep and a function. Since 2004 life around the silos have happened spontaneously - people walking in the meadow, anglers fishing at the harbor and divers exploring the water - but the interior still needs to be brought back to life.

Site Photos February , 2022

Project Statement

Buildings, along with everything else in our world, are subject to continual and unavoidable change. In paradoxical opposition, architects often celebrate permanence. The built landscape is the architects' possibility to create something that could live longer than themselves.

We want to question whether any building is ever permanent or always part of a continuum of transformations, additions and subtractions. When is a building ever finished?

Our thesis aims to develop a transformation strategy that balances opportunities and challenges when using the industrial landscape in new contexts. We believe that traces of the past, both the ones commonly viewed as beautiful and the troubling, are important parts of our history and collective memory. Transformations should be done with respect for the past, current and future. The three abandoned silos offer spatial experiences that are unique to their typology, materiality and scale. We want to question how we can transform them without losing these qualities.

The three monolithic silos are unrecognized landmarks of Fredercia and potentially the historic industrial Denmark. An industrial period that most western countries are rapidly moving away from, while the silos remain standing - open for interpretation.

We want to question whether any building is ever permanent or always part of a continuum of transformations, additions and subtractions.

When is a building ever finished?

UN Goals

The following UN Goals are applicable to our thesis project:

9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster Innovation

11. Make cities and human settlements inclusive, safe, resilient, and sustainable

Our strategy addresses a post-industrial landscape, along with the possibilities and challenges that follow any transformation. It is relevant to critically question how we relate to our own history of industrialization and how we create and deal with such landscapes in the future. The Ammonium harbor is part of the greater city of Fredericia, and we aim at it being part of an urban development that moves towards inclusivity and sustainability.

Construction of *Den nye Lillebæltsbro* , 1986

Construction of second silo , 1968

Ammoniakhavnen in use , 1975


128.213 m² plot
Diameter:
Silo 1: 38,3 m
Silo 2: 45,6 m
Silo 3: 57,3 m
Workshop: 262 m²
Silo Price: 3.7000.000 dkk
Plot and Silo Price: 222.000.000 dkk
Silo 2
1968
Silo 3
1972
Silo 1
1964
1 : 2000

Ammoniakhavnen

The Ammonium Harbor

The first of the three silos was built in 1964 by a newly started company called *Dansk Nitrogen Import A/S*. Behind the company was a group of farmers that used the ammonium nitrate as fertilizer and needed silos to store it. Agriculture was a dominating profession in Jutland and Fredericia had an ideal placement - in the middle of Denmark with existing marine infrastructure. Many large industrial companies settled there, including *Kemira A/S*, who became the main shareholder of Ammonikhavnen in 1972 and the owner of a large part of the industrial harbor in Fredericia city. An underground pipeline connected Ammoniakhavnen with Kemiras' plot in Fredericia.

The second silo was built in 1968 followed by the third, and biggest, built in 1972. The silos could contain a total of 83.000 tons of ammonium nitrate shipped by boat from England and Lithuania. In total Kemira provided work for 350 people that managed 200.000-250.000 tons of chemicals annually. In 2004 Kemira A/S closed down in Fredericia city, which resulted in a void with mass firings and an abandoned area of 30.000 m2. *(Hanghøj, N. 24/8. 2019)*

The void in Fredericia was quickly filled by the municipality, who fostered a transformation of the city and the industrial harbor but not Ammoniakhavnen. Today it is privately owned by *Ny-Nitrogen A/S* and the silos are abandoned and for sale. A small yellow brick building stands next to the silos. It was the former office but has fallen into a stage of ruin.

Silos in use , 1964 - 2004

Silos in use , 1964 - 2004

Ammoniakhavnen in use 2022

As the industrial harbor closed, the area opened up for spontaneous activities. It was initiated by the removal of the installations around the silos, making local people see the potential of the surrounding area. Neighbors tore down the fence and started using the green hilly meadow and small forest for walks. The small port attracted anglers and the deep water, quickly reaching a depth of 20 meter, made it ideal for diving. A local divers club uses the area on a weekly basis, with an annual *Diver's Night* - Every year trying to break the world record of the most divers in the water. Next to the port the water is accessible by a beach with clear water and a sandy bottom and a view of Funen and the bridge.

Ammonium harbor, aerial photo 2006

Ammonium harbor, aerial photo 2008

Ammonium harbor, aerial photo 2010

Ammonium harbor, aerial photo 2011

Ammonium harbor, aerial photo 2012

Ammonium harbor, aerial photo 2013

Discontinued plans

Ammoniakhavnen has been the center of different ambitions. After the place was shut down in 2004, the municipality of Fredericia made a masterplan transforming the entire area into private housing and a marina. The plans however were discontinued because of the possibility for a Biogas plant and offices.
(Bymidten - Bydelsplan og lokalplanrammer)

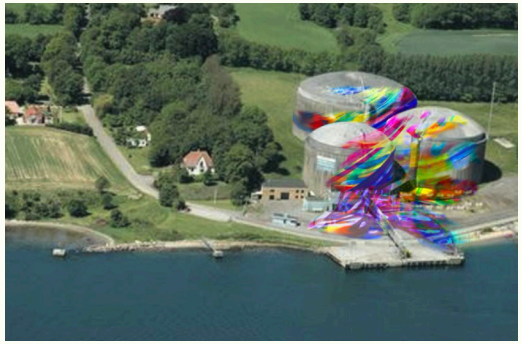
In 2012 *A1 offshore APS* made plans of transforming the silos into process tanks for biogas and 1600 m2 offices. Architectural drawings were made by *C. F. Møller architects*. The plans were discontinued.
(Masterplan for Biogas anlæg & kontor)

In 2019 the curator company *Creator Project* made plans for turning the exterior of the silos into an artwork by *Katharina Grosse*, making them visible from afar. The group tried to raise 3,5 million kroner in cooperation with Fredericia and Middelfart municipalities, but the project was discontinued. *(Hanghøj, N. (18/7 2019)*

As of february 2020 the silos alone are for sale at a price of 3,7 million kroner, and the surrounding plot for 220 million kroners.

Masterplan , 2009

Process tanks and office space , 2012



Art project , 2019

Context

Fredericia

The silos are a testimony of the industrial history of Fredericia. The city harbor is a deepwater port and the biggest in Denmark measured by freight.

The future strategy of Fredericia is influenced by its history as a fortified city. Still today the streets are perpendicular to each other, north to south and east to west. The city center is surrounded by one of Northern Europe's best-preserved ramparts from the 17th century.

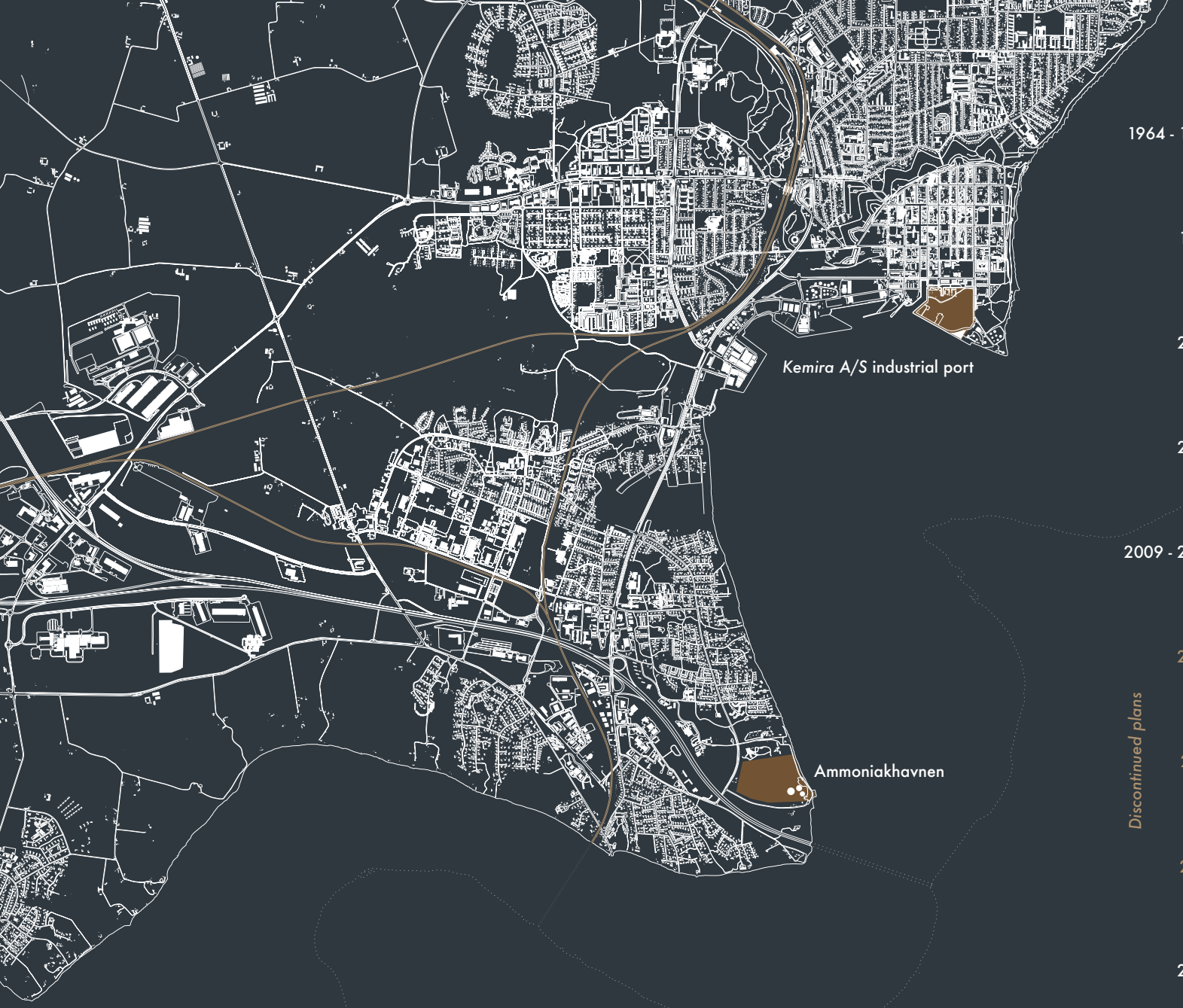
As *Kemira A/S* left their plot at the city harbor in 2004, the foundation of a new district *Kanalbyen* began. The plot grew as the shipyard, also situated at the harbor, closed in 2010/11. The old industrial buildings were torn down to transform and create a new district, where the purpose was to provide accessibility to the harbor and a view of the sea in the city. The new district offers recreational cityspaces, attractive housing, jobs, shopping opportunities, culture and art. The expansion is estimated to run for 20-25 years starting in 2005, with a total of 1200 homes and 2800 jobs.

The end goal is dual - Fredericia is a part of the triangular area *(Billund, Fredericia, Hadersley, Kolding, Middelfart, Vejen og Vejle)* where they have a joint vision of being a competitor to the development in Copenhagen. And *Kanalbyen* is Frederecias way of differentiating themselves from the other cities in the triangular area. *(Udviklingsplan for Fredericia)*

Industrial Port Fredericia , 2005

Transformation of industrial Port Fredericia , 2012


Fredericia municipality
Population: 42.959
Good infrastructural placement
30.000 cars uses *The new Lillebæltsbro* daily
Fredericia
Fredericia industrial port
Ammoniakhavnen
The new
Lillebæltsbro
1970
Middelfart
1 : 20.000



1964 - 1972 — Ammoniakhavnen built, with three silos for storrage of Ammonium Nitrate
Owned by Dansk Nitrogen A/S

1972 — New main shareholder of Ammoniakhavnen
Kemira A/S

2004 — Fertilizer production of Kemira A/S shut down

2004 — Ammoniakhavnen closed and for sale

2009 - 2035 — Transformation of former industrial port of Fredericia to housing, culture and commercial area

Discontinued plans

2009 — Masterplan developed to transform Ammoniakhavnen to housing and a marina

2011 — Project developed using the silos as processtanks for biogas and new office spaces

2019 — Project to decorate the silos by Creator Projects and artist Katharina Grosse

2022 — Silos for Sale

1 : 20.000

Interview

Anne Mette Rahbæk
Projectleader - *Kanalbyen Fredericia*

Have you considered a transformation of the Ammonium harbor in the creation of Kanalbyen?

"It is too expensive a project to realize. You have to get a sustainable economy to realize a project like that."

Instead of tearing the old industry buildings down, could you have used them instead?

"Back then, when we started the project, you did not think in transformations. You would probably do that today."

Is there a lack of a cultural offer in Fredericia today that could be housed in the Ammonium harbour?

"Culture requires an incomebase that must be bigger than the expenses. Think less - maybe make outdoor climbing facilities on the silos."

Site Photos February , 2022

Interview

Ane Hau Christensen
Chiefconsultant, culture, events and urban development - *Kanalbyen Fredericia*
and lives next to the Ammonium harbor

Past

"When I was a child and lived in the area, it (The Ammonium harbor) was in operation. Now it looks like something that is waiting… and has been waiting for many years."

"People (in the area) have knocked down the fence themselves - It has given the place a quiet but active life"

Present

"People do not come by naturally"

"I pass it often, and yesterday I looked up at it, because I was going to talk to you today"

"We only see the decay"

Future

"(...) If they (the owners) get it sold the silos would probably be torn down and an office domicile would be built instead - which is a pity"

"As a local I wouldn't be interested in an event venue but more an excursion destination for city institutions, families and nature lovers."

Timeliness as a strategy

"Time is a factor - there are no quickfixes"

"Art is a gift to get people to use a new place - but it takes time"

"Creating a harborlife where people come by is hard work. People do not naturally pass the ammonia port. It has taken 10 years to get people to use the harbor in town"

"It would take some active cultural offers to make people come there"

Ammonium Nitrate

Ammonium Nitrate NH_4NO_3 is a common chemical used throughout the world. It is primarily used as a fertilizer (approximately 70%) but also for explosives in mining.

It comes as a crystal-like white solid and is made synthetically by reacting ammonia with nitric acid. The chemical is relatively cheap to buy and allows farmers to grow large quantities of crops in a limited area. Using such chemicals is therefore an effective tool in answering the growing global demand for food.

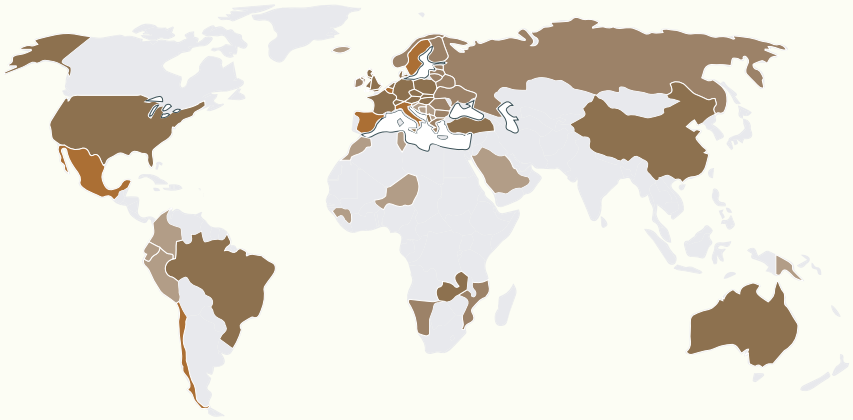
Storing it can, however, be a problem, and it has been related to serious industrial accidents in the past. Ammonium nitrate does not burn on its own but acts as a source of oxygen which accelerates the combustion (burning) of other materials.

As part of our project, we aim at addressing the polluted soil as one of the problems associated with transformations of a former industrial site.

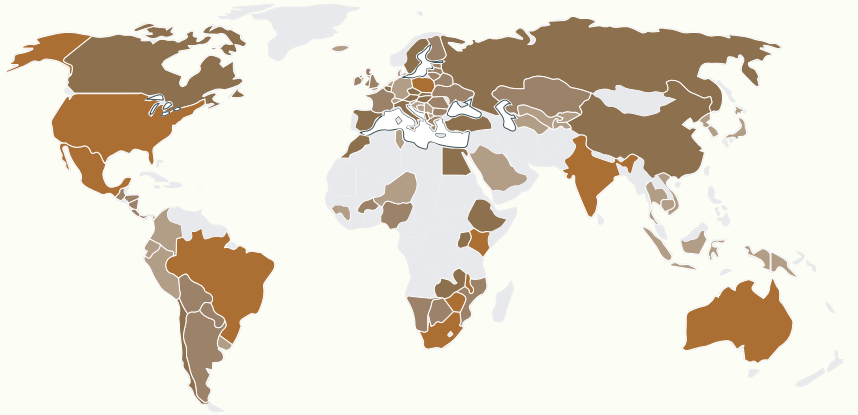
Ammonium Nitrate Storage

Ammonium Nitrate

Increase in the global use



Import 2002

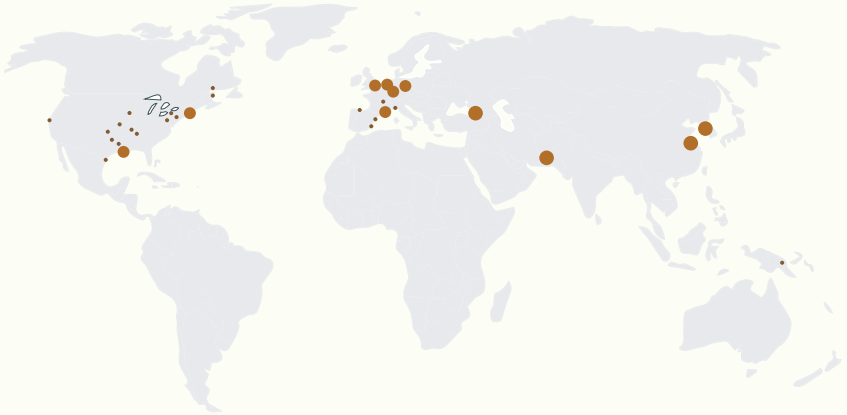


Import 2020

Global imports of Ammonium Nitrate exceeded $477 million

Ammonium Nitrate

Recorded Accidents



Recorded Accidents , 1900-2022

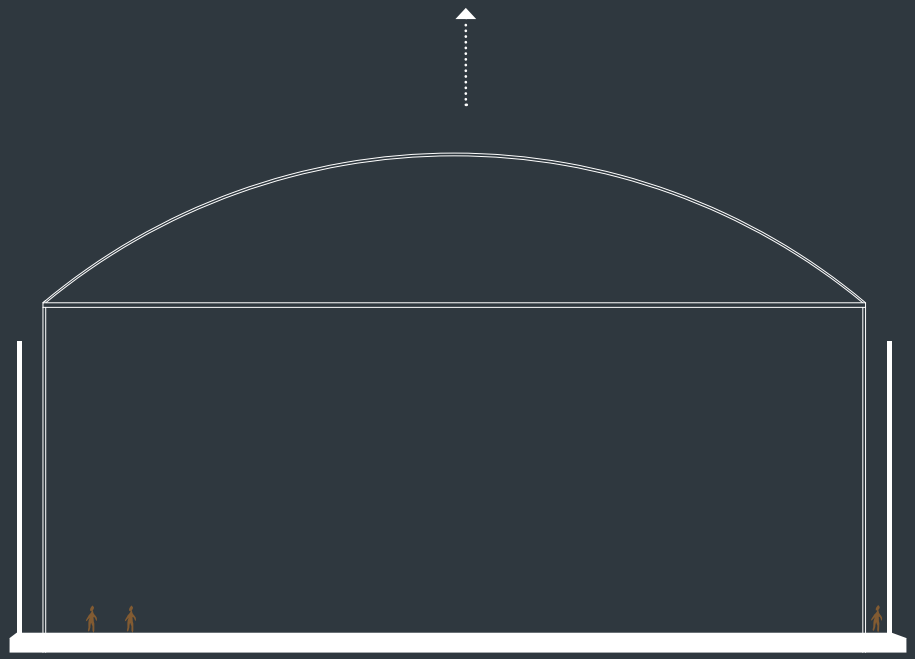
Beirut disaster , 2020

Construction of the Silo

Ammonium Nitrate

The construction of the silos enable them to store ammonium nitrate and prevent massive destruction in case of explosion. The damages would otherwise be extensive, as it was seen in Beirut in august 2020.

The silos are constructed with a foundation-beam placed upon foundation piles buried deep in the ground. The outer concrete shell measures 30 cm in thickness and is built to guide a possible explosion upwards. The inner tank is made from 18cm thick welded steel and stores the ammonium nitrate and carries the roof construction. The exterior of the silos gives the impression that it is a solid form, but it is in fact a building within a building. Providing two spaces - a narrow space of 142 cm in between the concrete shell and the steel tank, and the space within the steel tank itself, approximately reaching a height of 32 meters.



Concrete shell
30 cm

Steel tank
18 cm

1-500

Approach

Points of interest

The Circle

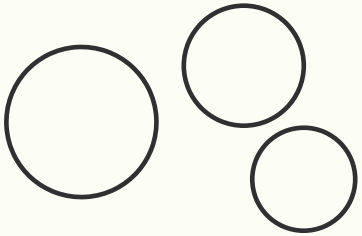
The circular shape of the silos is a strong architectural quality in their own right. We will work with the round spaces through a study of the circle in architecture and art. Looking at how different people and cultures have addressed them in the past.

The Aperture

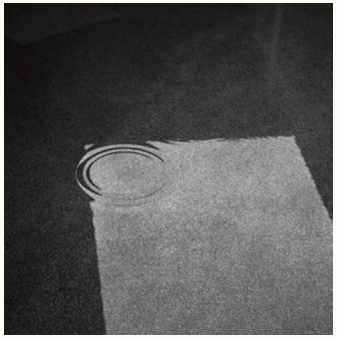
The silos are hermetically closed in their current stage, with no natural light coming into the interior. A crucial point in the transformation will be studying how openings can be made, allowing people and daylight to enter the building.

Weathering

The marks on the surface of the silos tell a story of the time that has gone by since they were first built. We will study these markings as a way of understanding the life and quality of a building over months, years, and decades.



The circle



The Aperture

Weathering

The Circle

"The circle . . . is the synthesis of the greatest oppositions. [It] combines the concentric and the excentric in a single form, and in equilibrium. Of the three primary forms [triangle, square, circle], it points most clearly to the fourth dimension."

Wassily Kandinsky, Bauhaus professor, 1866 - 1944

Ammoniakhavnen , 2015

The Circle

First definition of the circle

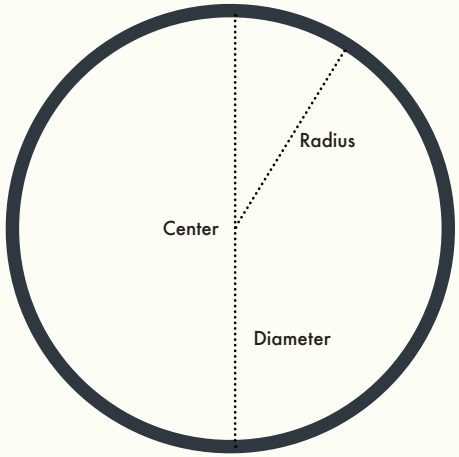
Definition 15.
A circle is a plane figure contained by one line such that all the straight lines falling upon it from one point among those lying within the figure equal one another.

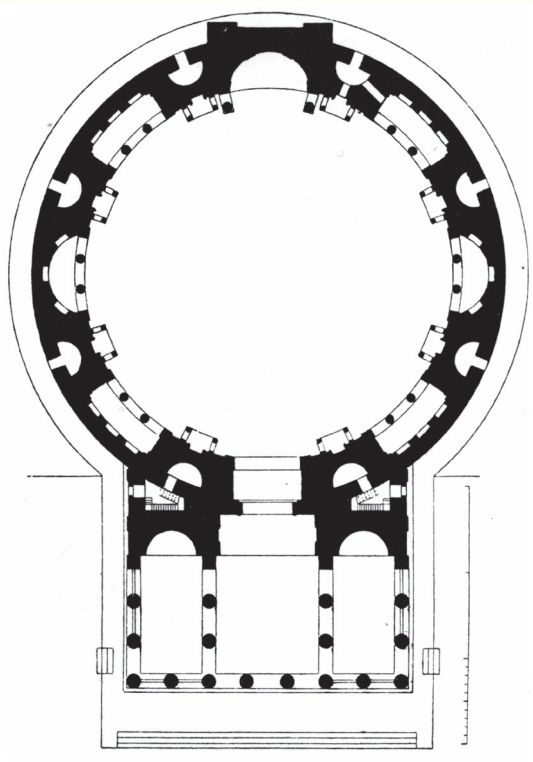
Definition 16.
And the point is called the center of the circle.

Definition 17.
A diameter of the circle is any straight line drawn through the center and terminated in both directions by the circumference of the circle, and such a straight line also bisects the circle.

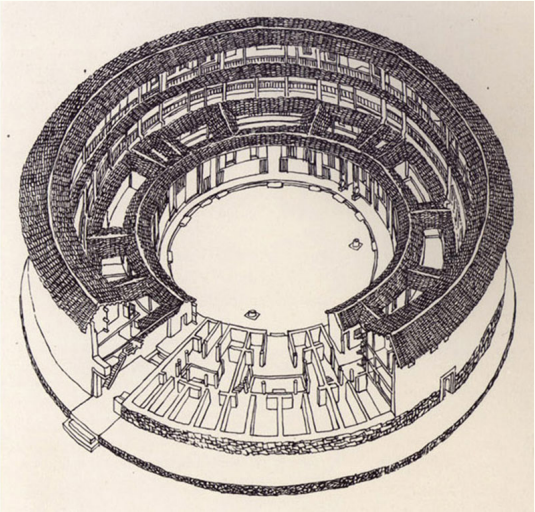
Definition 18.
A semicircle is the figure contained by the diameter and the circumference cut off by it. And the center of the semicircle is the same as that of the circle.

Euclid's Elements , c. 300 BC

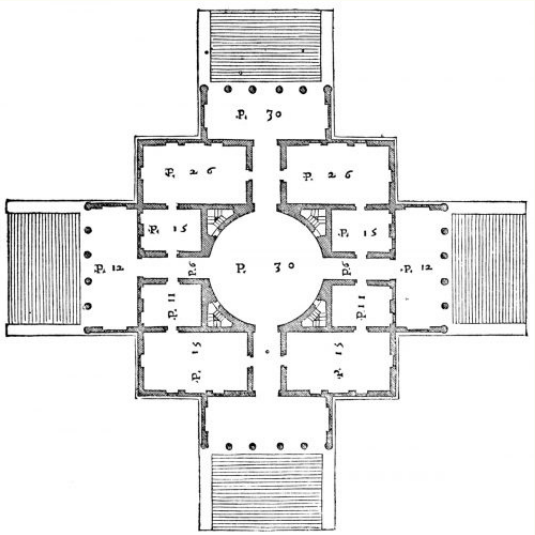




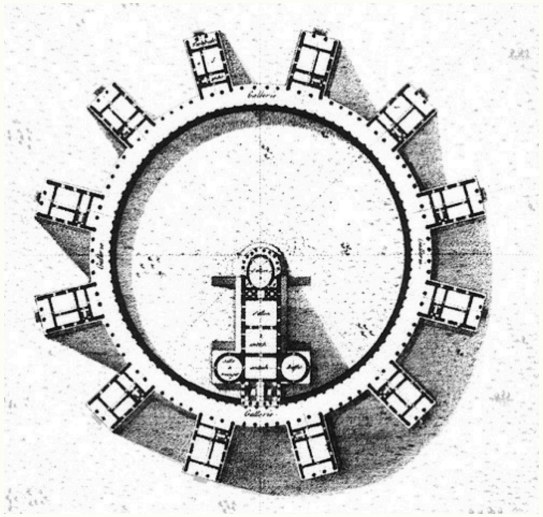
Pantheon , Rome , 126 - 128 A.D.



Tulou house , China , built between 12th and 20th centuries

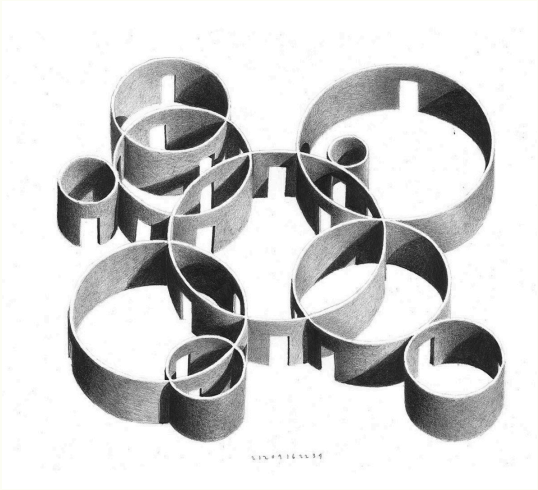


Villa Rotonda , Adrea Palladio , Venice , 1567–1570

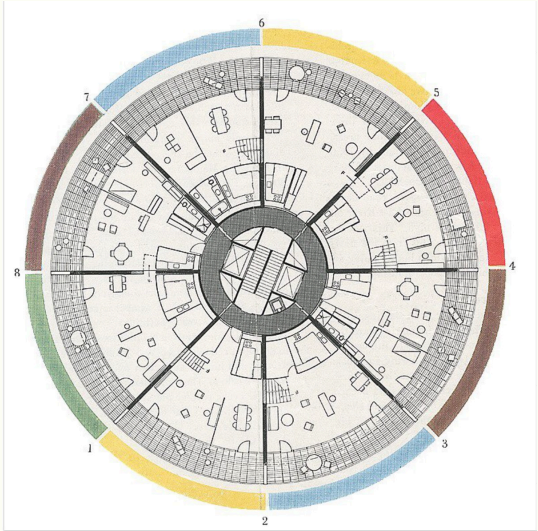


House of Pleasure , Claude Nicolas Ledoux , Paris , 1787

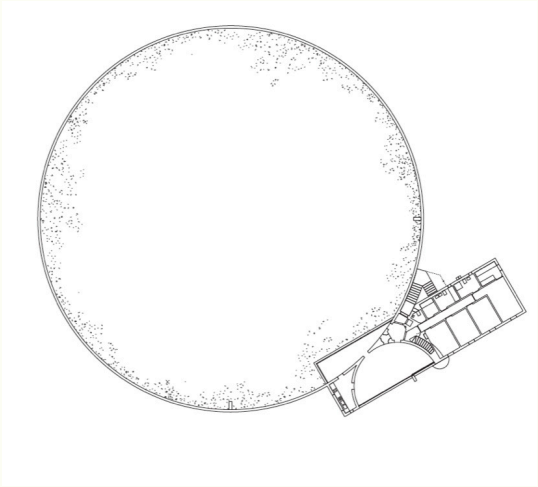
Meditation Space , Tadao Ando , Paris , 1995



Vara Pavilion , Pezo von Ellrichshausen , 15 Biennale di Venezia , 2016



Helical Tower , I.M. Pei , Webb & Knapp , New York , 1949



Rocks and Sea House , Pascal Flammer , 2014

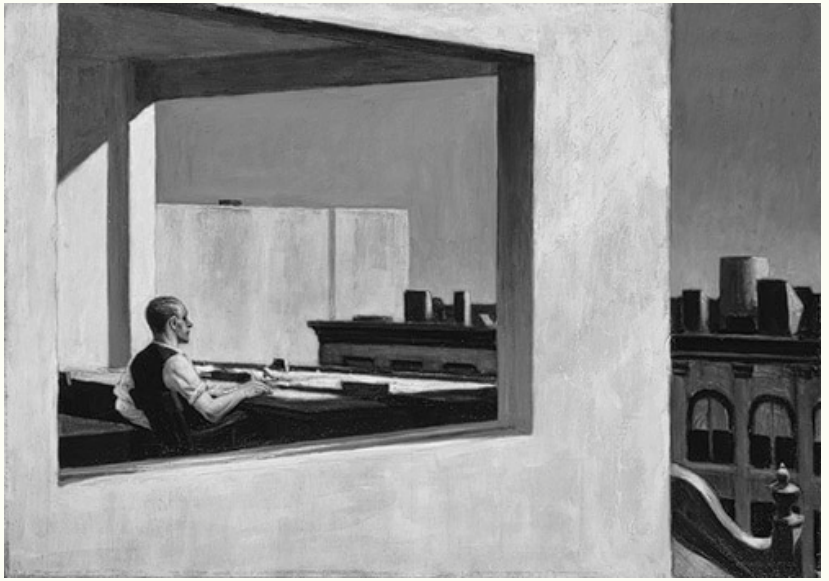
The Aperture

A study of openings

Apertures are the connection point between two divided spaces - the exterior and interior. It is a mediator, a hinge, a boundary. It generally consists of glazing and a frame, fitted into a structural opening. (Deplazed, 2013, p. 209)

Naming it windows is a simplified characterization of an aperture. An aperture is far more than just a window or a hole in a wall. In the book Windows from the 2014 Biennale, Rem Koolhaas and James Westcott divide the functions of the window into four main categories: *Ventilation, Illumination, Filtration* and *Framing* underlining the distinct roles the aperture plays.

As the silos are completely closed in their current state we want to pay close attention to the act of making apertures and adding new layers. Questioning and challenging the functions of the particular aperture.



Edward Hopper , Office in a Small City , 1953

Weathering

Time as a design factor

We place significance on time as a key factor in architecture, and question how the effects of the natural elements play a role in this discussion. As a field, architecture often works directly with elements from the past - balancing the particularities and requirements of various times at once.

The influence of the elements through exposure – sun, wind, rain – is a very direct way of measuring the time gone by. Marks and traces on a façade can therefore help make an abstract notion more comprehensible - but how do we work with them actively?
(*Leatherbarrow, D., 2020)*

We intend on applying thoughts on climate and weathering from Alison, and Peter Smithson and David Leatherbarrow as a basis of discussing permanence versus temporality. Questioning how we as architects position ourselves in working with buildings, that (hopefully) will have a life that reaches further than our own.

Jean Dubuffet , L'Anarchitecte , Les Phénomènes , 1959

Silo facade , 2022

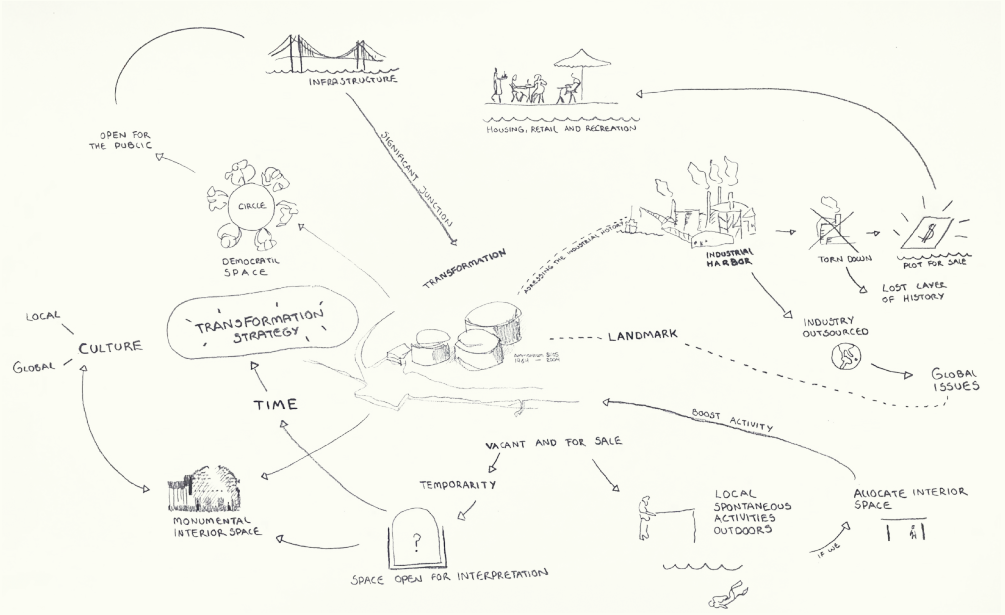
Aim

The project seeks to develop a transformation strategy of the three silos, that unitize their potential as landmarks of Fredericia and as extraordinary interior spaces that speak of their industrial past.

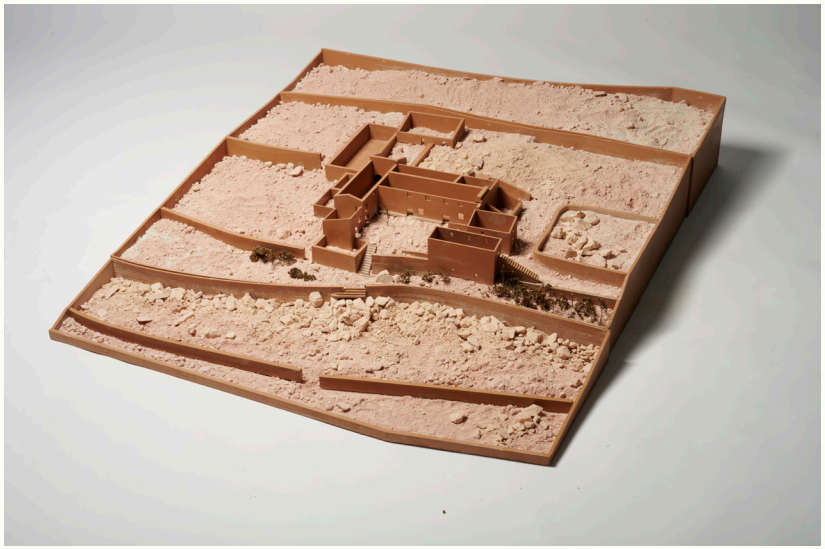
We see the project as a sequence of interventions that gradually inform the next - working as layers on top of each other. The project favors the act of adding, negotiating, and reinterpreting rather than demolishing. The transformation works with different timeframes simultaneously. Some parts of the strategy could include allocating interior space to the local people that are already using the harbor for fishing and diving. This could easily be implemented right away and would be a gesture to the community - potentially generating more spontaneous activity and overall interest in the site. Other strategies work in an independent timeframe, slowly cleaning up the polluted soil with plants that do Phyto-cleaning.

The heart of the transformation lies in making the enormous interior spaces of the silos accessible to the public. Allowing people to experience spaces that normally only exist as inaccessible industrial landscapes, or in the form of religious monuments. Because of their scale the silos offer opportunities to house a substantial number of people or objects under the same roof. Their location is right in the middle of the country at an important infrastructural junction, making it a suitable place to meet in between the bigger cities. We could imagine the silos being part of a cultural institution or as a place to study the influence of our industrial heritage, through research into climate change, pollution etc.

The specific program will be developed through our process, keeping in mind the qualities we see in opening the silos or parts of them to the public. Our transformation should invite you to do further interpretations in the future.



Mapping the Transformation strategy



Christina Ahm & Kristoffer Schmidt 2021
An olivefarm on Mallorca
Sitemodel 1:100

Method

The model

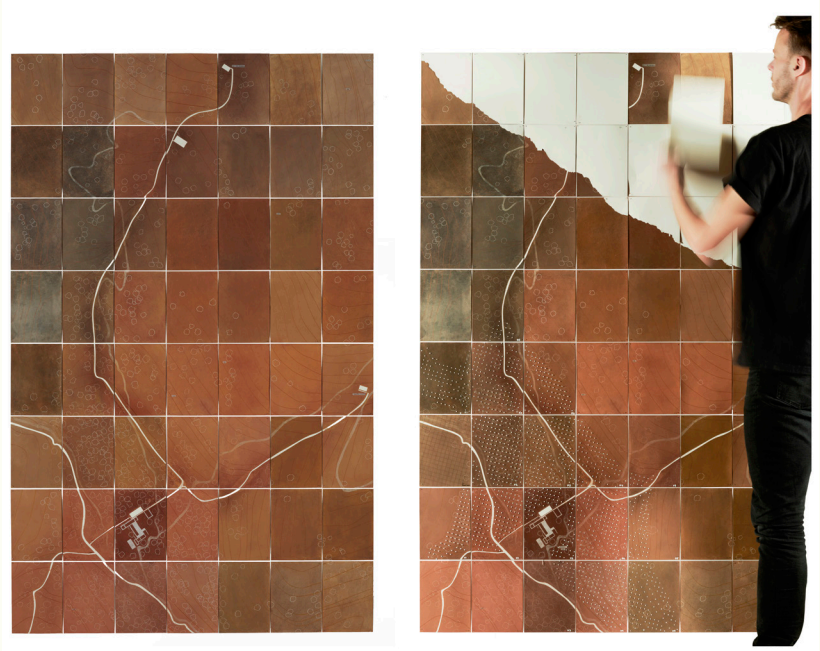
We intend on using models as a primary tool for informing the design process. Models have the ability to make us understand, wonder and investigate. The volume embodies ideas - it forces us to resolve things in three dimensions. They have an inherent quality of surprise and can answer questions while also providing new ones.

The volume of our site and the silos is an important factor to work with. The large scale requires us to work simultaneously at a very large conceptual scale at the area as a whole, as well as the techtonics and materiality of the silos. Constantly creating tension between the whole and the detail.

The context scale will be resolved in a 1:200 site model. Establishing not only an overview but also a feeling of the place away from site. The atmospheric quality of the monolithic silos standing in the soft grass is an important poetic quality to keep and deal with.

The interior scale will be investigated through a series of mediums and scales. Through our research it became clear how the local people think of them as solid, excluding their interior space from the equation. They are inaccessible because the doors have been welded together for safety reasons. That makes it essential for us to create the interior space on the basis of drawings in order to experience it. To understand the grandness and emotional effect of the interior space we will work with sections in 1:50.

To investigate the construction and the materials we will work with tectonic elements in 1:10.
(Teerds, H., & Floris, J. 2011)



Christina Ahm & Kristoffer Schmidt 2021
Landscape collage 1:500

Method

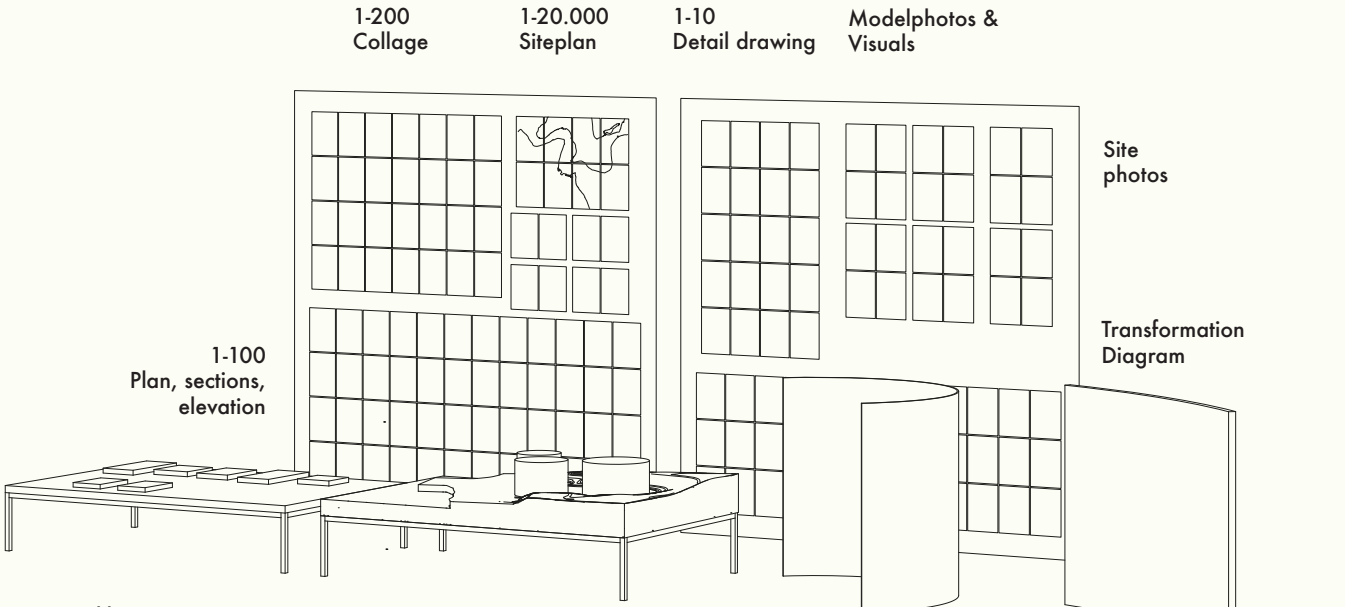
Collage / Bricolage

Time is linked to an object being in the present world, in anticipation of the future, created by the time that has gone before.

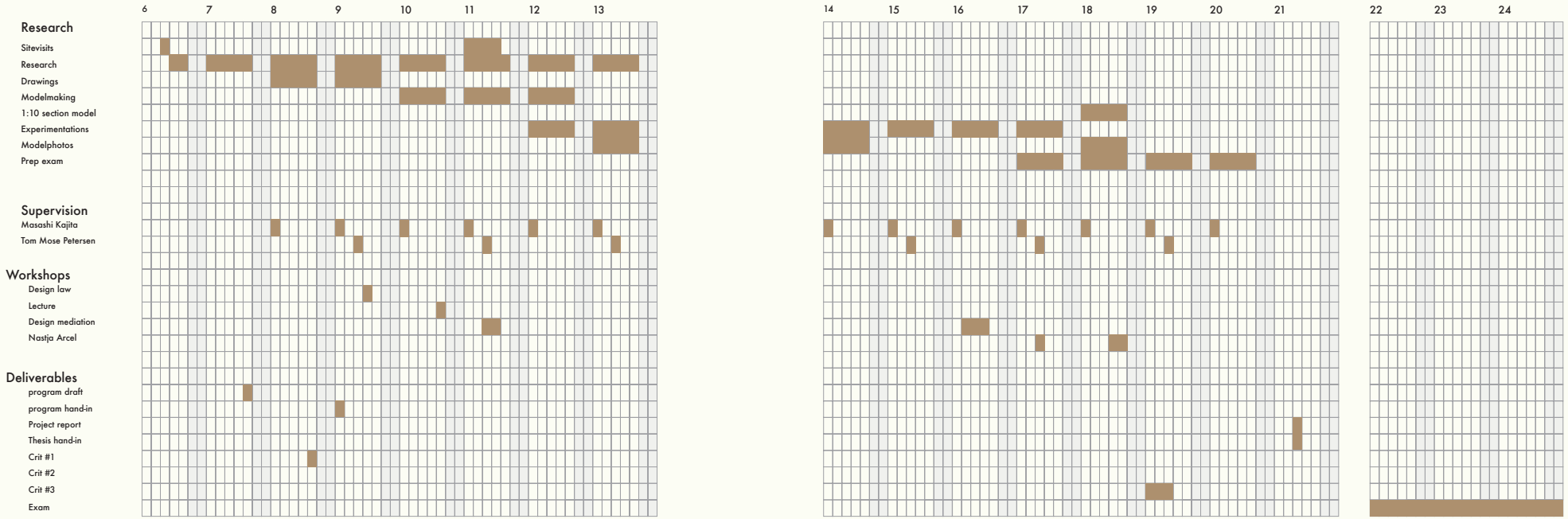
Engaging in a transformation of a site constitutes only a moment of its lifecircle. The Ammonium harbor is in a process of transformation - from an industrial harbor to an abandoned area to something unknown. The Silos may have lost their function, but through the years life has evolved spontaneously around them. Our intervention aims to guide the course for the future while questioning - When is a building ever finished?

As a way of visualizing this transformation and working with the layers of time we will use collages. They allow us to work with different elements from different periods at the same time, as well as proposing quick changes to the whole.

Deliverabels



Schedule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Research
Sitevisits
Research
Drawings
Modelmaking
1:10 section model
Experimentations
Modelphotos
Prep exam
Supervision
Masashi Kajita
Tom Mose Petersen
Workshops
Design law
Lecture
Design mediation
Nastja Arcel
Deliverables
program draft
program hand-in
Project report
Thesis hand-in
Crit #1
Crit #2
Crit #3
Exam

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Arkitekter; C. F. Møller.