D.

P2 Public Building - Music Marvel

Research, design and process documentation

Research Plan

New artist-visitor relations based on sound synthesis

Public Building Graduation studio

2021 – 2022

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Figure 0: Modular Synthesizer Wallpaper. (Rebloggy.com)

What are you interested in?

In our collective abstract we talk about designing a hybrid concert building. A hybrid is defined as "any of mixed origin or composition, or the combination of two or more different things" (Biology online), or "a thing made by combining two different elements" (Lexico, n.d.). In our collective work, hybridity is used to indicate a building that exhibits other functions, in addition to its musical purpose. I however want to see the term hybridity in a different light.

Usually in a concert building, there are already two elements, artist and visitor. Between these, an exchange happens. This exchange is traditionally very linear. The artist gives a performance and the visitor receives this performance. I want to blur the lines between these two, make the visitors more involved in the music, and create a situation where the two come together to create something new. This can take shape not only by interactive performances, but also by giving visitors the tools to become artists themselves.

This musical exchange can be seen as a signal. Using sound synthesis as an analogy, this research will look into ways that the public can not only receive a signal, but can also be involved in making or changing it. A signal can be created and manipulated in different stages of the process. Using the different terms used in synthesis methods, methods will be derived to involve both the artists and visitors in the different stages of the musical process. Terms that immediately come to mind are oscillators, filtering, feedback and modulation. These will be further explored in the rest of the abstract.

Why is that problem important?

In the past decades, the western world has seen large technological, socio-cultural and economic developments. The prosperity resulting from this has lead to higher expectations and demands from consumers. In addition to this, an increased demand for qualitative free time has come forward due to life growing more busy. These developments have lead to significant competition between concert halls. In addition to price, quality and identity have become important determining factors for the success of a concert hall. Interactivity, spectacle, and rememberable experiences are important in providing this identity and giving people the feeling they have had a unique experience. (Vanderbecken, 2004) Establishing this interactivity and the unique nature of this concert hall are ways of providing this identity. At the same time the activities coming from the concept provide a basis for utilization of the concert hall around the clock. This is especially important in times when margins in the music industry are thin, and subsidies are not always guaranteed. More on these activities can be found in the coming paragraphs.

Secondly, developments in interactive and participatory art have already been happening since 1950's(Tate, n.d). Music has however been lacking behind in this field in relation to the other arts. Recently, developments like this have also started to emerge in music (Fitzpatrick, Hödl, Kayali, 2012)(Fiebrink & Wolf, 2019). Examples of its application to an audience in a non-research setting can be found in the Interactive Museum of Music of Malaga (MIMMA, n.d.). An example of a musical performance using this technology happened in Berlin called EXCHANGE, by the IMRSV Arts collective(IMRSV, 2019). The technique has not seen widespread use in concert buildings. The latter example is also limited because the visitors only control the light in the room, while the sound component is still handled by the musicians (IMRSV, 2019). Because of these reasons, a concert hall dealing with these themes can push the envelope of interactivity and participation in music.

How do you want to do it? (Method)

To establish how the design will take shape, and what the relations between artist and visitors will look like, several approaches will be used. Firstly, research will be done into existing theory and examples of participation and co-creation in art. This research will not be limited to just the realm of music, but will involve other arts as well. This is done to get a wider perspective about the subject, and to increase the amount of sources that can be used.

Secondly a framework will be established of the different stages in sound synthesis, and how these can be used as reference for different artist-visitor relations in the creation of live music. In this, the different stages of synthesis will be explained, and related to methods to apply them to music performances. To keep the research manageable, the scope of the research will be kept to additive and subtractive synthesis methods only. These terms will be explained in the next paragraph. If this turns out to be too limiting, or more opportunities arise, this scope can be expanded.

The terms are accompanied by case studies where these ideals are applied in different ways. For each case study there is a short summary. This summary includes a diagrammatic explanation of which ideals apply to which project, and how they are applied. During the design process these projects will be the subject of further research.

Lastly the research will feature interviews with musicians about the subject of participation and co-creation. The interviews will go into their vision on these subjects, and their wishes and recommendations. The subjects of these interviews are yet to be determined.

In short, the research can be summarized in the following questions:

-What are existing methods of involving the visitor in participation in and co-creation of art, both inside and outside the realm of music?

-What are the different stages in sound synthesis, and how can these be used as an analogy for artist-visitor relations in the creation of live music?

-What are existing examples of involving the visitors in changing or co-creating live music, and how can these be schematized using the different stages in sound synthesis?

-What is the vision of several artists that are already partly involved with participation and co-creation in music?

Describe what you want to do

With the design I want to use methods and processes found in sound synthesis as the basis for the relations of artists and visitors with the music. The different methods and processes are described here, along with how they could be applied in architecture. Although the principles described here have not found widespread application in concert halls yet, there are some examples of their application in real world scenarios. The terms in this chapter are therefore illustrated by case studies.

-Additive synthesis: Additive synthesis can be described as creating timbre by adding different sine waves of different frequencies and amplitudes together(Smith III, 2011)(Reid, 2000). Any sound can be made this way. You start by defining the fundamental frequency, followed by the harmonics above this frequency. In the example below you can see how the addition of sine waves leads to the first part of a kick drum.

Figure 1: Additive synthesis. Every bar is a sine wave at different frequencies. (Own Image)

An analogy for this in a concert hall could be where both the artist and audience create part of the music or experience to shape together the whole. A case study example of this is EXCHANGE in Berlin. As mentioned before, visitors unfortunately don't participate in the music, but they do participate in the lighting. Therefore the addition of artist and visitor creates the full musical experience. (IMRSV, 2019)

Figure 2: EXCHANGE in Berlin, the lights are interactive and controlled by visitors. (IMRSV, 2019)

-Subtractive synthesis: Subtractive synthesis is creating a sound by "subtracting unwanted frequencies, to form the sound that you're looking to produce." (Roland, n.d.). You start out with a harmonically rich waveform, and take away parts to sculpt your sound. The diagram below describes the steps in this process. An oscillator creates a waveform in the form of an electric signal. This is the basis for the sound. The sound is then filtered, controlled by another oscillator, and then amplified, controlled by an envelope. An envelope can be seen as a one time oscillator. The process of changing an aspect of the signal is called modulation.

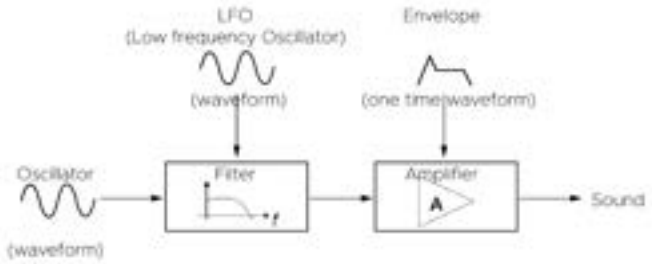

Figure 3: stages of subtractive synthesis. (Own Image)

When looking at ways to apply this to the concert hall, everywhere an oscillator goes in can be seen as a place for input by either artist or visitor. Traditionally the artist handles all these steps, however this doesn't have to be this way. Subtractive synthesis provides an interesting basis for the influencing of music by visitors. A case study example of this is the Museo Interactivo de la Música Málaga. This museum features "Please to play" rooms, in which the public is encouraged to learn through their own experimentation. (MIMMA, n.d.) The application of this form of art installation can be summarized in the diagram on the right. The audience effectively modulates input of the artist.

Figure 4: Interactive art installation in Museo Interactivo de la Música Málaga. (MIMMA, n.d.)

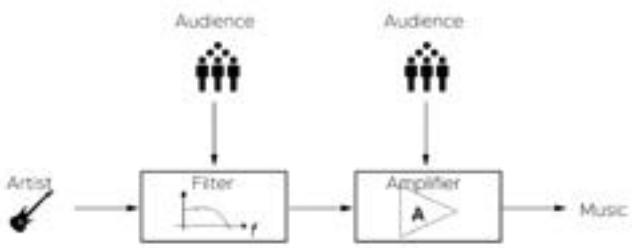

Figure 5: Stages of subtractive synthesis. (Own Image)

-Feedback: “Audio feedback is a special kind of positive loop gain which occurs when a sound loop exists between an audio input and an audio output”(Wikipedia, n.d.). Many synthesizers and audio processing devices feature feedback knobs to feed the output signal back in with the input signal for creative uses. The process is visualized in the image below

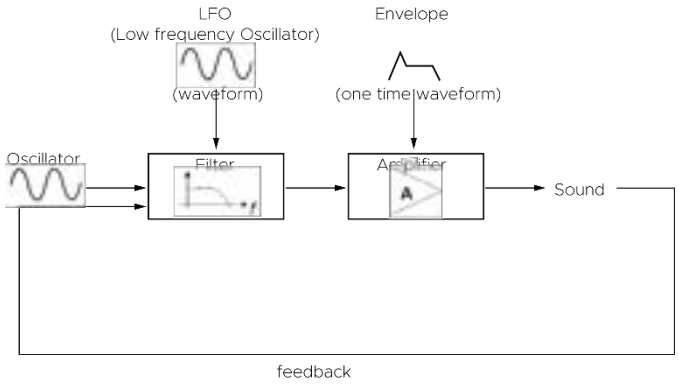

Figure 6: Stages of a feedback loop in additive synthesis. (Own Image)

The way this could be used in a concert hall is to create conditions for the public to feed into the artist pool. Skilled visitors get the opportunity to become the artist and perform to other visitors. The design actively encourages this. This can be summarized in the following diagram:

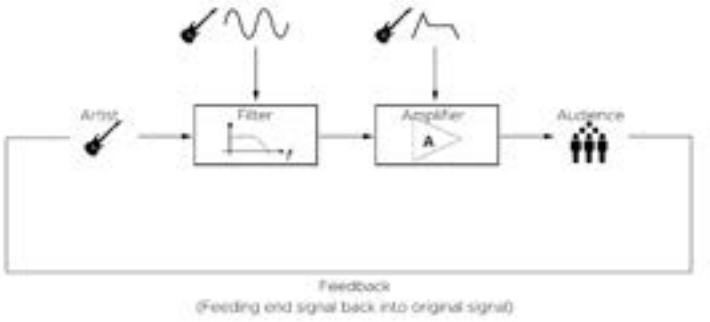

Figure 8: Feedback loop as a means for visitors to become the artist. (Own Image)

Figure 7: dB's Studio in Utrecht. (dB's, 2017)

An example of this is dB’s studio in Utrecht. This is a combination of a concert hall, band practice rooms, and a café. (dB’s, n.d.) dB’s is a well-known musical hub within the city. The practice rooms provide the basis for artists to grow. The location provides them with the network required to get connections in the musical world. Several of the bands practicing here eventually get the opportunity to perform and gain an audience, becoming artists within the same establishment. dB’s also holds band contests to promote this transition. This makes dB’s act as a stepping stone for bands practicing there(visitors) to make it to the stage.

By combining these methods I want to design a building that incorporates the input of visitors in different ways in the music creation process. In addition the design should provide opportunities for talented visitors to make the step up to being an artist. The design will be feature elements from a concert hall, interactive art installation for audio, and a practicing-, studio- and workshop space. In that sense it could also be called a hybrid.

Contribution to society? Think about it

Firstly of course, a concert hall contributes to society by providing art and culture in the city and the wellbeing of people. Due to the strategic position of the Binckhorst, this function has the potential to not only be fulfilled for the Hague, but also for surrounding cities such as Delft, Rijswijk and Voorburg, and possibly for the whole region and country as well. With the feedback principle, the concert hall could also contribute to new artists finding their way to popularity.

Secondly, as has been mentioned before in this research plan, interactivity and co-creation in music has lacked behind the other arts. The design aims to further the development in this field. The design can set an example for how to apply different techniques and technologies in this field. This could even lead to new typologies for concert halls, which have remained largely unchanged for the last 150 years.

Lastly, a concert hall focusing on participation and co-creation also provides opportunities for educational purposes. The Ministry of OCW is trying to get musical education more integrated into primary schools. For this they are also looking into forming public-private relationships. (ResearchNed, 2019) The concert building could respond to this need by providing workshops, interactive performances and other services to children to provide this education. Music education has been shown to provide significant improvements in the cognitive abilities of children. (Honing, Jaschke & Scherder, 2018)

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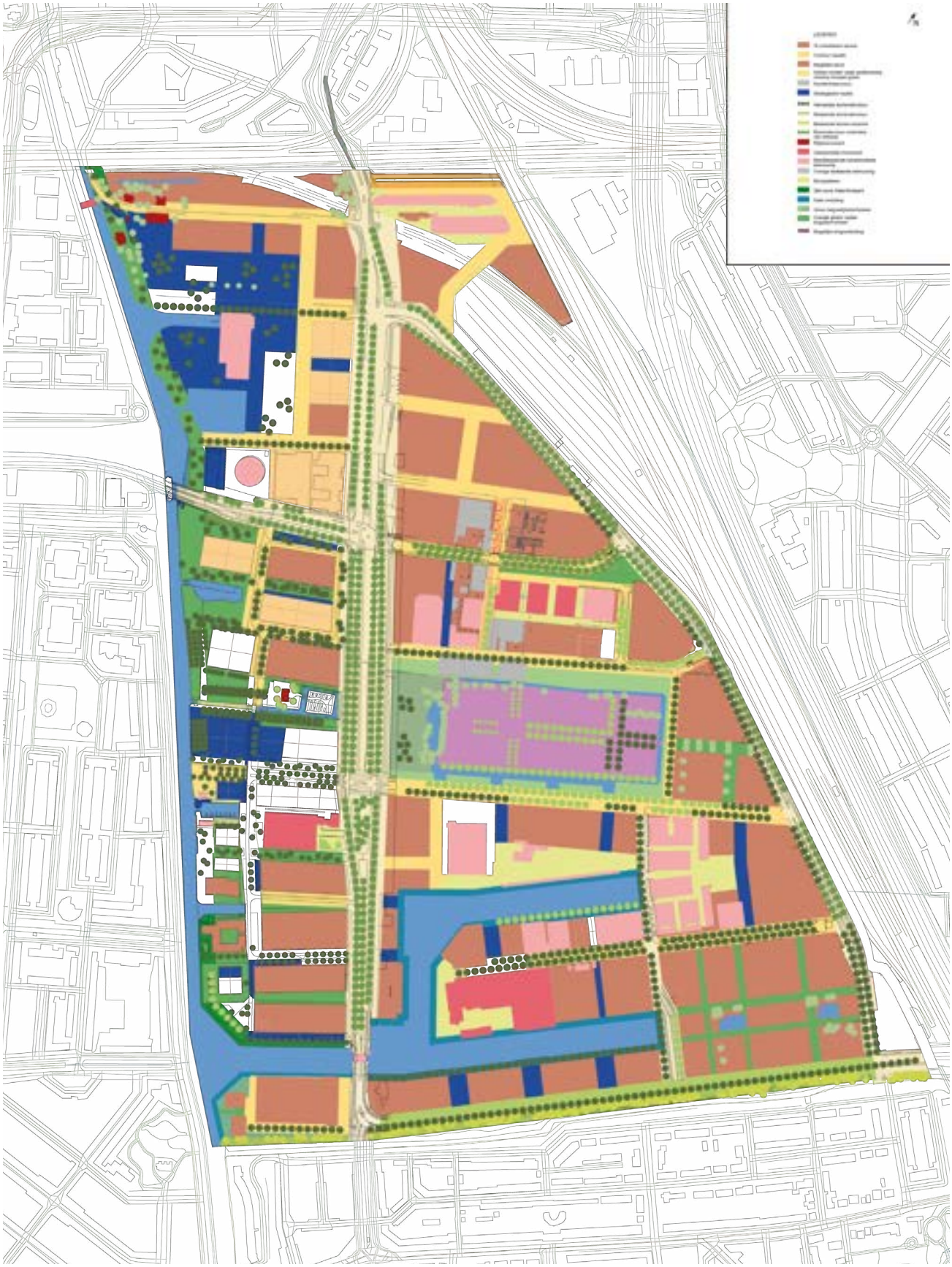
Future map Binckhorst

From the Municipality



Case studies

Getting a better view of different cases

dB's Utrecht



Combination practice space, concert, band contests, open nights. Widely accesible cafe with life music during the day

Kytopia



Network of music studios and artists. Workshops are given. Not necessarily open to public, but those who belong to the inner circle can benefit.

Noisia studio's


You don't necessarily need a tightly fitted room to create studios and practice spaces. You can build boxes within heritage as well. This creates some interesting rest spaces too. Boxes raised and on springs for acoustics

Case studies

Getting a better view of different cases

Warehouse elementenstraat

Research into the architectonic qualities of old warehouses, and tools to utilise them. Industrial character is a quality, as well as low key and re-used furniture and decoration.

SoundLAB

Ways of involving children and schools in architecture. Workshops using custom made electronic instruments. Potential for creative electronic instrument workshops in own building as well

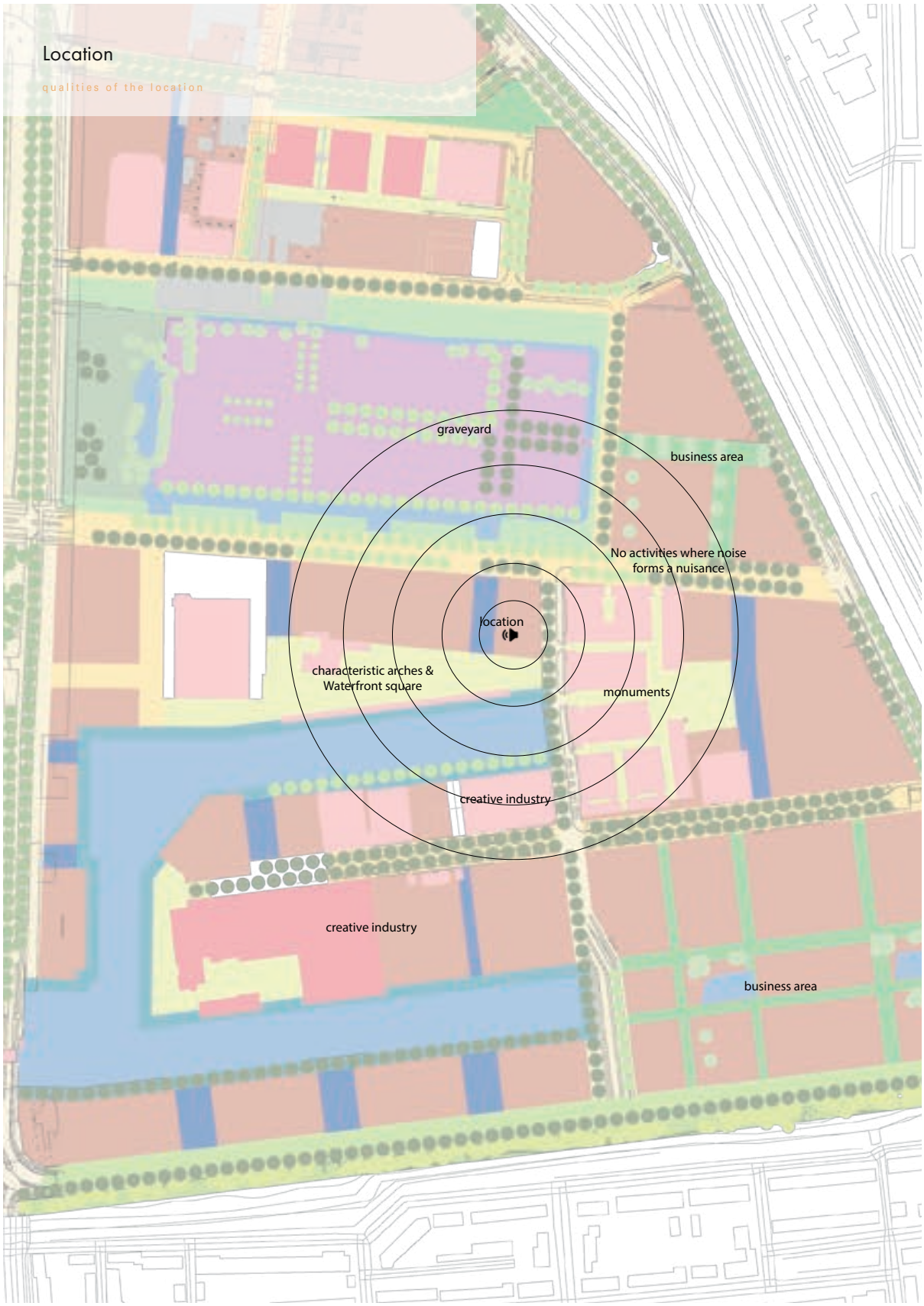
Case study

Pllek, NDSM-Werf

High architectonic quality is possible with makeshift materials. Heavy use of shipping containers

First Sketch Design

Picking location based on acoustics and heritage



First Sketch Design

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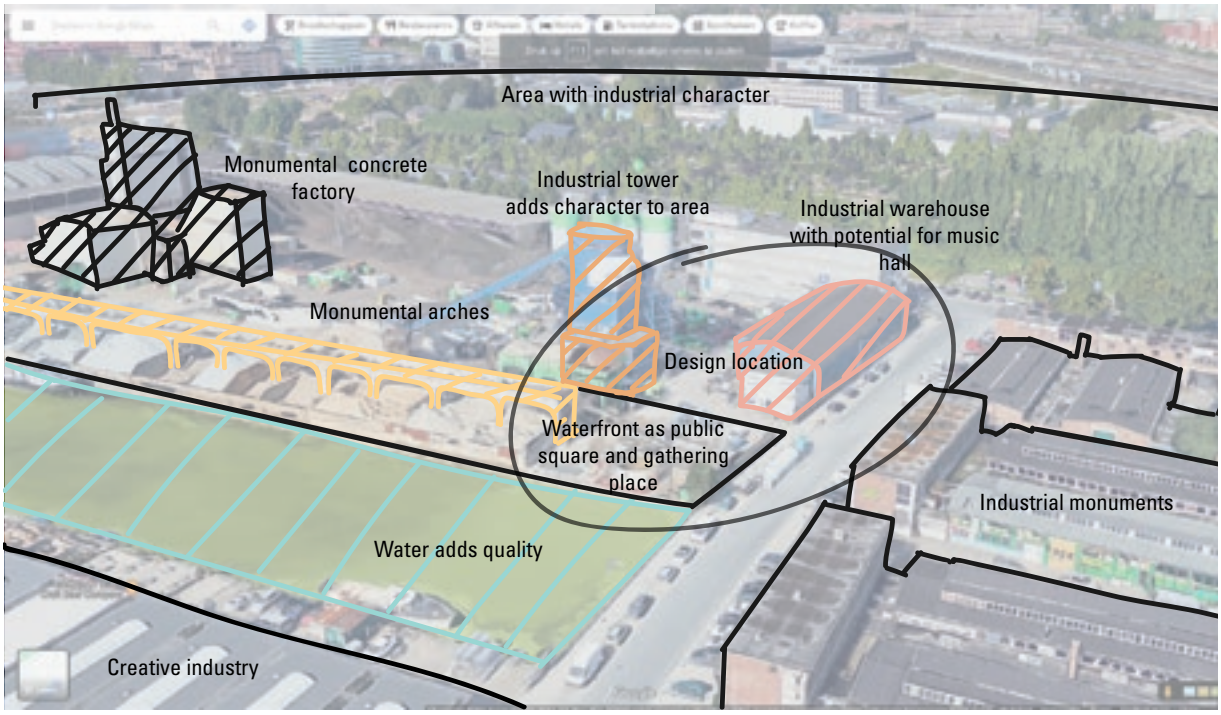
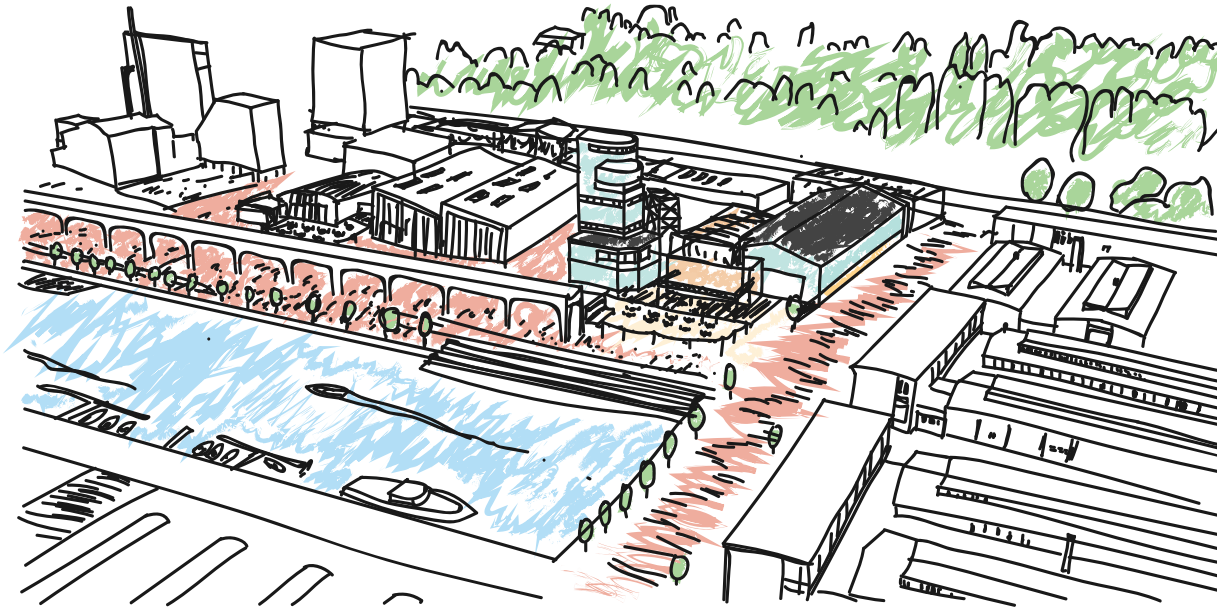
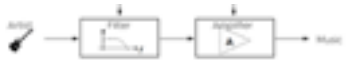




First PvE

Framework of exchange relating to synthesis.

Accomodating functions



Modulation | *audience*

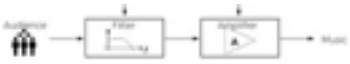
Tools:

consoles

phones

sensors

electronic instruments



Modulation | *artist*

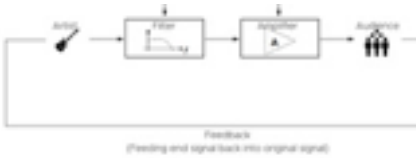
Tools:

consoles

phones

sensors

electronic instruments



Feedback | *audience to artist*

Tools:

practice rooms

studios

workshops

open stage

network

Components

Reference | *Warehouse Elementenstraat*

Reference | *dB's Utrecht*

Reference | *Kytopia Utrecht*

Reference | *NDSM-Werf*

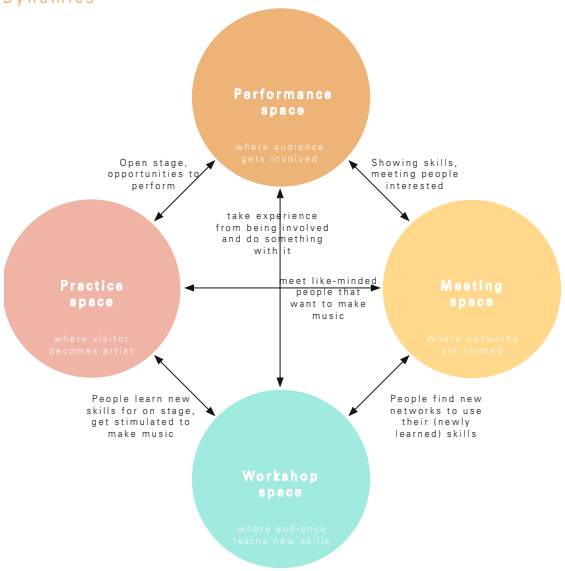
Reference | *Warehouse Elementenstraat*

Reference | *Noisia studio Groningen*

Reference | *SoundLAB Muziekgebouw aan 't IJ*

Reference | *dB's Utrecht*

Dynamics



List of requirements

Performance space:

-Concert hall

-Backstage

-Technical installation

-Bar

-Hangout area / pre-lounge

-Ticket booth

-Toilets

-Storage

Practice space:

-Practice rooms

-Mixing studios

-Lounge

-Toilets

-Storage

Workshop space:

-Workshop rooms

-Toilets

-Storage

-Crew area

Meeting space:

-Bar

-Cafe

-Terrace

-Outdoor tap

-Outdoor Booth + Stage

-Toilets

-Storage

Other:

-Transport space

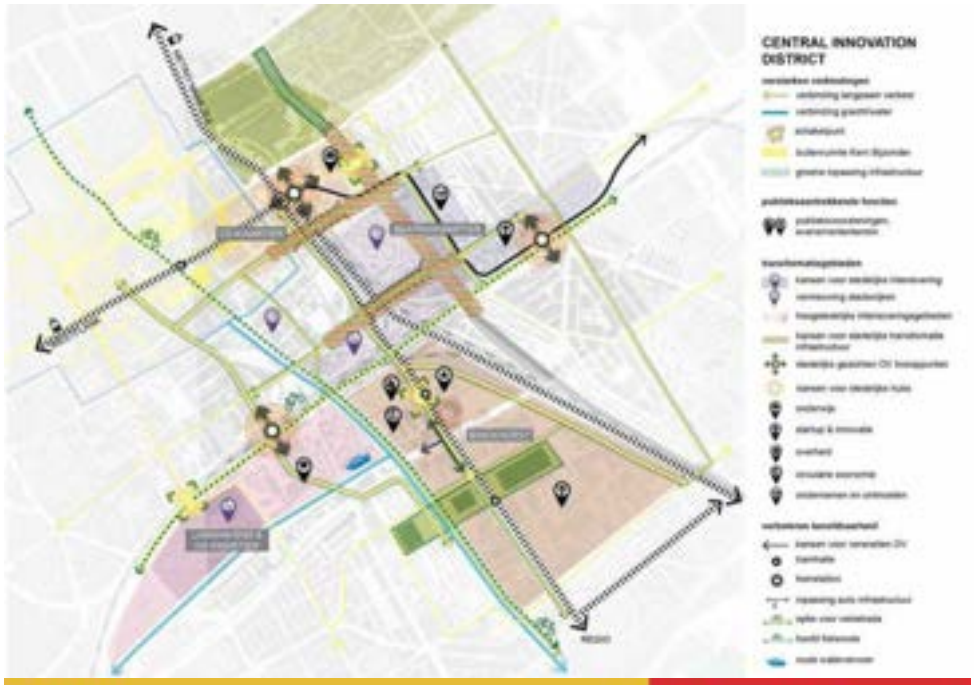
-Loading dock

-Technical rooms

-Fire safety

Central Innovation District

Plans for the area north and including Binckhorst



Goals:

-Transition from business to innovation economy

-building more houses

-mobility transition

-inclusiveness

-make area greener

-energy transition

-contribute to regional knowledge economy

Qualities of the HAC terrain

Analysis of all components in the HAC terrain

Site analysis

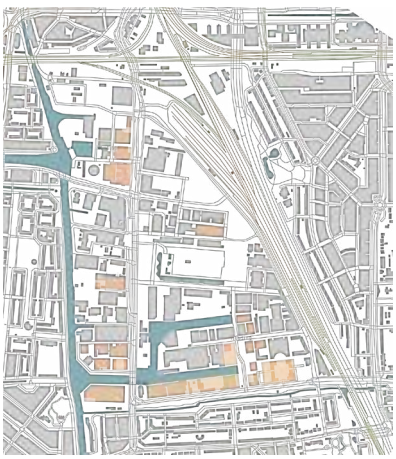
Different buildings on the site

Future build locations and public transit

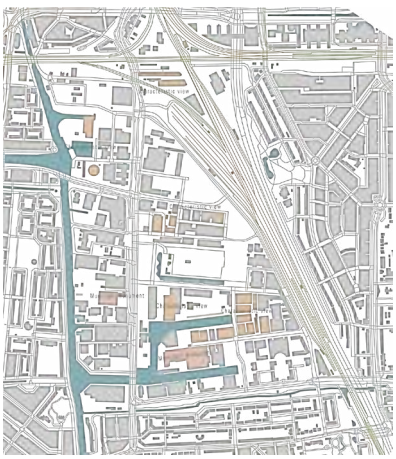
Site analysis

Elements that can impact the design

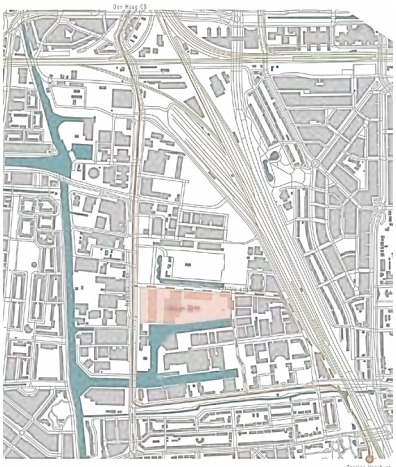
New housing locations



Monuments and characteristic views



New public transit connections



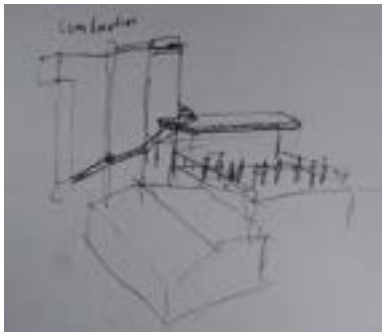
Further research Future Plans

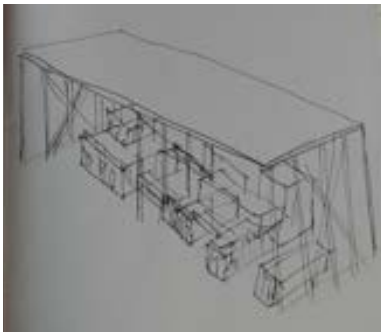
Analysis of future plans and buildings

Future plans Binckhorst

Mapping the future plans for Binckhorst and
start of the 3d model

First sketches for building and surroundings.
Focus is on the re-use of characteristic heritage



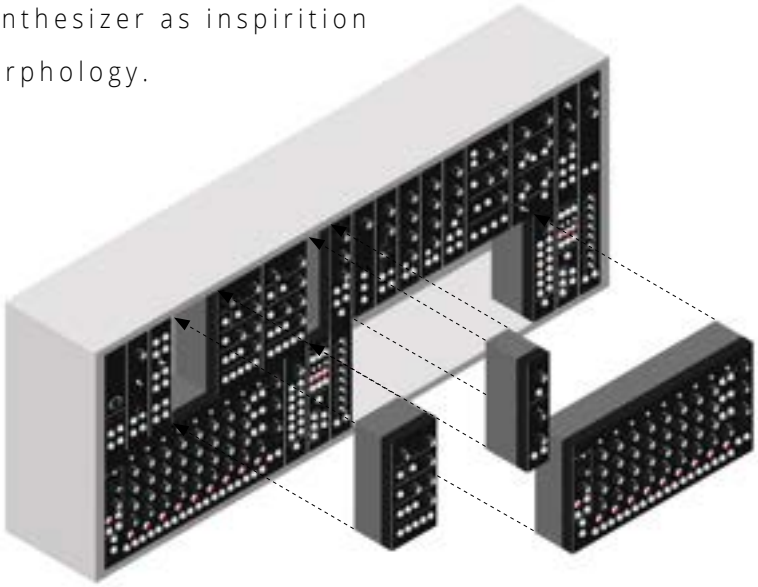


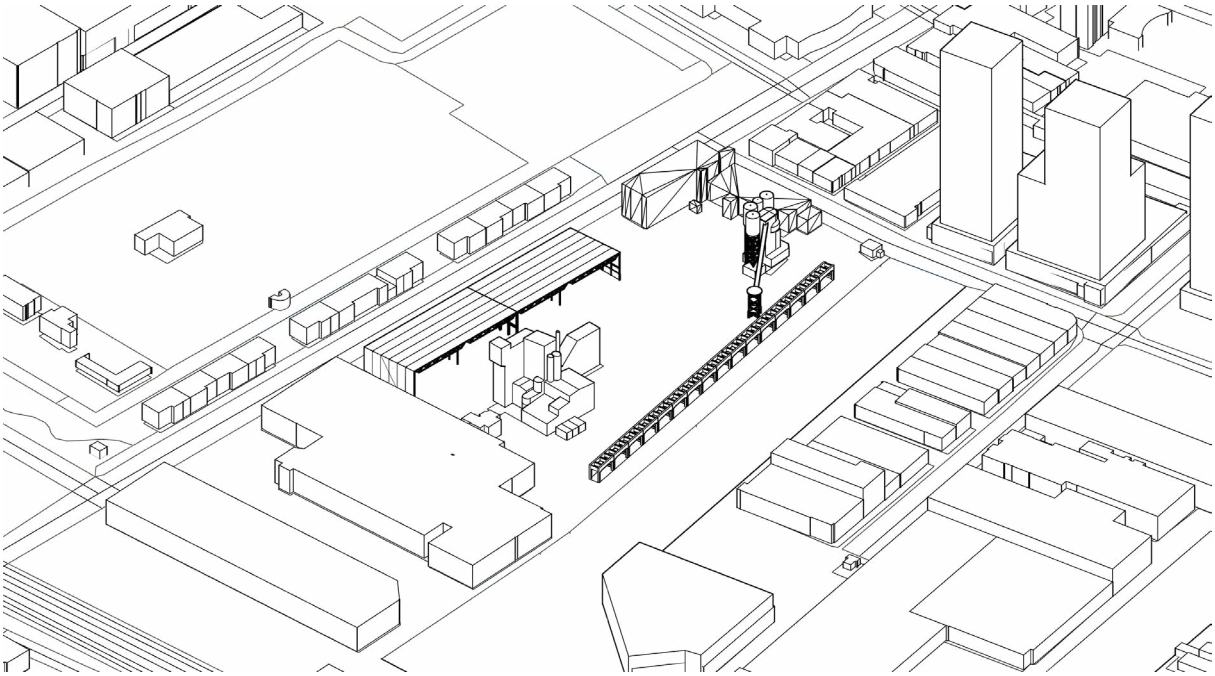
The modular synthesizer as inspirition
for building morphology.

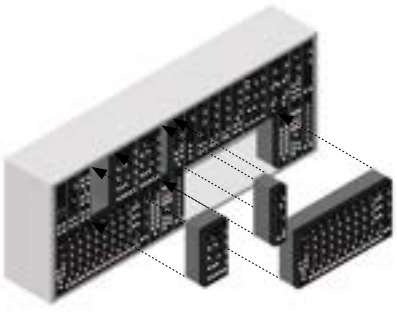
Second sketch design

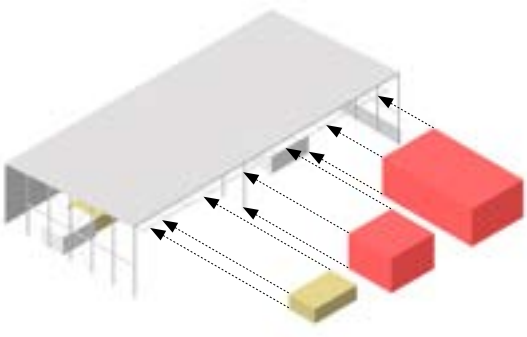
Building shape derived from synthesis

The modular synthesizer as inspirition
for building morphology.









Building program

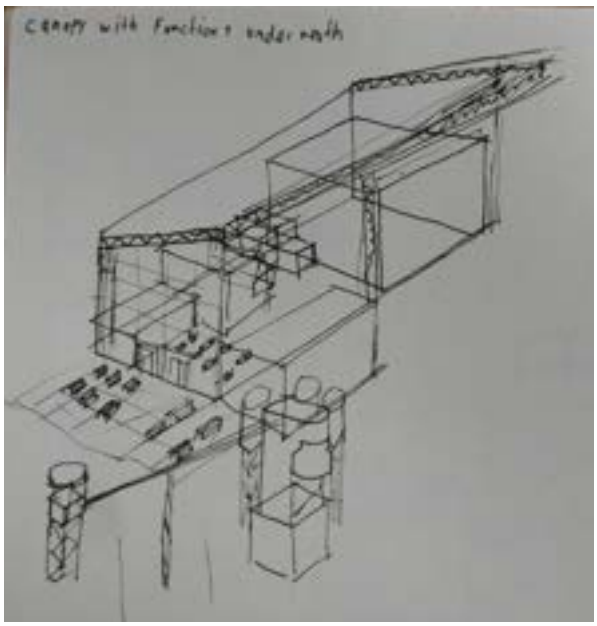
Determining sizes and capacities

Program

Elements and their required floor space

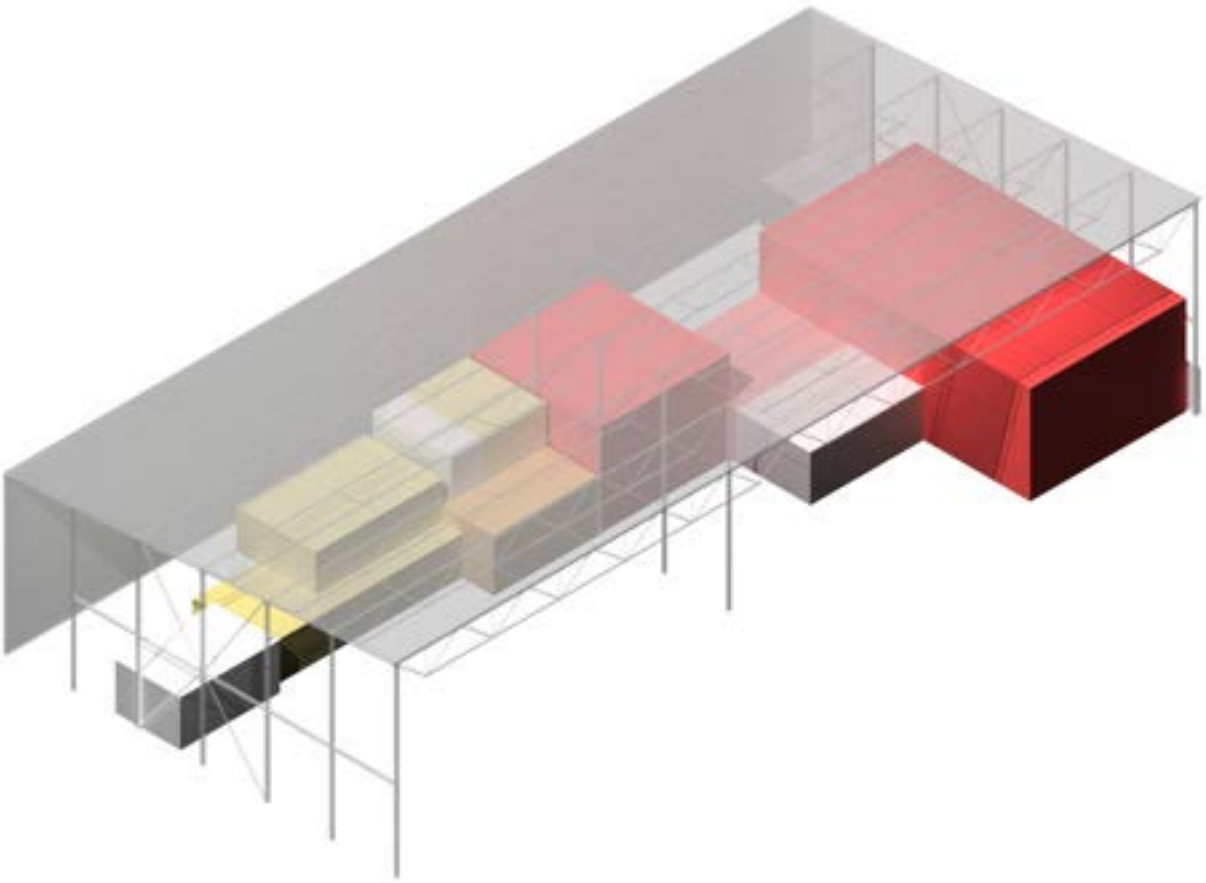
1. Concert spaces				
Main room	**Function**	**Capacity**	**Floor space**	**Technicalities**
	-Concert hall	-500 people	-250 m^2	-Bigger bands, electronic acts, interactive concerts
	-Stage	-	-50 m^2	-Suitable for a large band, technical and art installations
	-Bar	-	-25 m^2	-inside concert room
Second room	-Concert Hall	-150 people	-100 m^2	-For small concerts and expositions, walk in
	-Stage	-	-18 m^2	-Small bands, dj's and other acts
	-bar	-	-	-Outside of hall
2. Audience access:				
Meeting space	-Bar+Kitchen	-	-50 m^2	-
	-Tables+Hangout area	-	-100 m^2	-
Auxiliary	-Garderobe	-650 people's coats+bags	-50 m^2	-coathangers, lockers would need more space
	-Cassier	-	-5 m^2	-Close to entrance
	-Toilet Main Room	-4m+4f	-24 m^2	-Connected to main room (for warmth)
	-Toilet 2nd room + bar	-3m+3f	-12 m^2	-In between bar and 2nd room
3. Workshop+practice				
Workshop Space	-Workshop Space(s)	-100 people	-100 m^2	-One or multiple spaces? can be split up?
	-Storage	-instruments for workshops	-30 m^2	-
		-	-	
Practice & Studio	-Practice Containers	-4	-4 x 30 m^2	-double wide container 4,88 m x 6 m x 2,92 m, heavily insulated
	-Studio Containers	-3	-3 x 30 m^2	-double wide container 4,88 m x 6 m x 2,92 m, heavily insulated
4. Dedicated access				
	-Artist Entrance	-	-	-
	-First Aid Space	-	-8 m^2	-bigger?
	-Office Space	-	-30 m^2	-
	-Backstage	-	-50 m^2	-Whole area behind, principles of Paard & Lowlands
	-Dressing rooms	-	-2x 15 m^2, 1x 30 m^2	-Based on Paard van Troje
5. Support				
	-Loading area		-	-Outside
	-Storage		-60 m^2	-General or split around multiple locations
	-Bicycle Parking		-	-Outside
	-Parking		-	-Outside
	Technical		-120 m^2	

exterior and interior sketches



Second sketch design

Functions in the building



white = bar

yellow = studios & practice rooms

orange = workshop space

red = concer hall

pink = restrooms and garderobe

First version graduation plan

Still focussed on synthesis

Graduation Plan: All tracks

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information	
Name	Bart Thomas Schipper
Student number	4465741

Studio		
Name / Theme	AR3AP100 Public Building Graduation Studio / Music Marvel	
Main mentor	Ir. Paul Kuitenbrouwer	Architecture
Second mentor	Ir. Gilbert Koskamp	Building Technology
Argumentation of choice of the studio	Ever since I was little I've had an interest in music. For several years now I've been involved with music production, performance and the organisation of events. In addition to this I have a fascination for the physics of sound and building acoustics. During my architecture education I have also had an interest in public buildings. This studio provided the perfect opportunity for me to combine my passion with architecture, and to delve deeper and learn more about these subjects.	

Graduation project	
Title of the graduation project	MODULATION
Goal	
Location:	The Binckhorst, The Hague, Former cement factory location in the Binckhorst Haven (Harbor Area)
The posed problem,	Usually in a concert building, there are already two elements, artist and visitor. Between these, an exchange happens. This exchange is traditionally very linear. The artist gives a performance and the visitor receives this performance. I want to blur the lines between these two, make the visitors more involved in the music, and create a situation where the two come together to create something new. This can take shape not only by interactive performances, but also by

First version graduation plan

Still focussed on synthesis

	giving visitors the tools to become artists themselves. This musical exchange can be seen as a signal. Using sound synthesis as an analogy, this research will look into ways that the public can not only receive a signal, but can also be involved in making or changing it. A signal can be created and manipulated in different stages of the process.
research questions and	*Main question:* How can the linear interaction between artist and visitor be changed to a two-way interaction, using sound synthesis as an analogy? *Subquestions:* -What are existing methods of involving the visitor in participation in and co-creation of art, both inside and outside the realm of music? -What are the different stages in sound synthesis, and how can these be used as an analogy for artist-visitor relations in the creation of live music? -What are existing examples of involving the visitors in changing or co-creating live music, and how are these principles integrated into the design -What is the vision of artists and visitors that are already involved with participation and co-creation in music?
design assignment in which these result.	The design assignment that comes forward from these questions is to integrate the elements that promote new artist-visitor relations into one coherent design. All these elements, such as allowing visitors to interface with the music in different ways, or giving them opportunities to make it to the stage themselves have different programmatic requirements.

First version graduation plan

Still focussed on synthesis

	In addition to this, complementary functions need to be considered as well. The goal of the assignment should be to translate all the functions and requirements into a shape, with a strong single theme.

Process

Method description

Research method

To establish how the design will take shape, and what the relations between artist and visitors will look like, several approaches will be used. Firstly, research will be done into existing theory and examples of participation and co-creation in art. This research will not be limited to just the realm of music, but will involve other arts as well. This is done to get a wider perspective about the subject, and to increase the amount of sources that can be used.

Secondly a framework will be established of the different stages in sound synthesis, and how these can be used as reference for different artist-visitor relations in the creation of live music. In this, the different stages of synthesis will be explained, and related to methods to apply them to music performances

The research is accompanied by case studies where these ideals are applied in different ways. These case studies show what measures are taken to integrate visitor-artist interactions in real life examples, and how they function in practice. During the design process these projects will be the subject of further research.

Lastly the research will feature interviews with musicians about the subject of participation and co-creation. The interviews will go into their vision on these subjects, and their wishes and recommendations.

Design method

The conclusions from the research will be used to determine elements that promote the two-way visitor-artist interaction to be integrated into the design. The relations and interdependences between these elements will be plotted out, along with the requirements for each function. This includes the scale, amount of people, required technology, and so on. This will then serve as the basis for a floor plan. The morphology of the building will be based on this floor plan.

Another aspect of the design process will be the re-use of industrial heritage. The Binckhorst cement factory area features a few monumental and iconic buildings. Integrating one or more of these into the design is beneficial from a sustainability standpoint, and can be used to establish character. The design process will therefore also start by analyzing these buildings and determining their qualities.

With the requirements and the qualities clear, the design process will move on to model studies to investigate how the design can take shape. This will be both done with physical models and the computer. Another investigative tool will be the sketch. The

First version graduation plan

Still focussed on synthesis

intention is to get a few options and make a sketch design document. This document will feature different variants for the shape of the building, plans and sections, integration of the program of requirements, user profiles and some first impressions. The sketch design will be the basis for the further design process.

First version graduation plan

Still focussed on synthesis

Literature and general practical preference

Theory:

Interactivity in Music
music (Fitzpatrick, Hödl, Kayali, 2012)(Fiebrink & Wolf, 2019)

Fiebrink, R., Wolf, K. (2019). Personalised Interactive Sonification of Musical Performance Data. *Multimodal User Interfaces* 13, [245–265]. https://doi.org/10.1007/s12193-019-00294-y

Fitzpatrick, G., Hödl, O., Kayali, K. (2012). Designing Interactive Audience Participation Using Smart Phones in a Musical Performance. https://www.researchgate.net/publication/262178344_Designing_Interactive_Audience_Participation_Using_Smart_Phones_in_a_Musical_Performance

Tate. (n.d.). Interactive Art. https://www.tate.org.uk/art/art-terms/i/interactive-art

Music Education
Honing, H., Jaschke, A. C. & Scherder, E. J. A. (2018). Longitudinal Analysis of Music Education on Executive Functions in Primary School Children. *Frontiers in Neuroscience*, 12, [103]. https://doi.org/10.3389/fnins.2018.00103

Qualities of interactivity in music and the current market
Vanderbecken, B. (2004). Concertzaal Tilburg op Zoek naar de Juiste Toonhoogte: Een Kwalitatief Onderzoek Naar de Perceptie en Beleving van Klassieke Concerten onder de (Potentiële) Bezoeker. https://adoc.pub/concertzaal-tilburg-op-zoek-naar-de-juiste-toonhoogte.html

Definitions:

-Biology Online. (n.d.) Hybrid. https://www.biologyonline.com/dictionary/hybrid
-Lexico. (n.d.) Hybrid. https://www.lexico.com/definition/hybrid
-Reid, G. (2000). An Introduction to Additive Synthesis. https://www.soundonsound.com/techniques/introduction-additive-synthesis
-Roland. (n.d.). A Beginner's Guide to Subtractive Synthesis. https://www.roland.com/uk/blog/guide-to-subtractive-synthesis/
-Smith III, J. O. (2011). Additive Synthesis. https://ccrma.stanford.edu/~jos/sasp/Additive_Synthesis_Early_Sinusoidal.html
-Wikipedia. (n.d.). Audio Feedback. https://en.wikipedia.org/wiki/Audio_feedback

Case studies:

dB's, Utrecht
-dB's. (n.d.). 25 Jaar Onafhankelijke Vrijplaats voor Utrechtse Muziek. https://www.dbstudio.nl/dbs-2/

IMRSV – EXCHANGE, Berlin
IMRSV. (2019). EXCHANGE – An Interactive Music Performance. http://imrsvarts.com/exchange/

Kytopia, Utrecht
-Personal research, interviews

First version graduation plan

Still focussed on synthesis

Museo Interactivo de la Música Málaga
- MIMMA. (n.d.). The Museum. https://www.musicaenaccion.com/en/the-museum/

Other sources:

-Interviews with artists, leading figures from said case-studies
-Field research in the Binckhorst

Please not that this is only the current list, and this list can/will grow as the design develops.

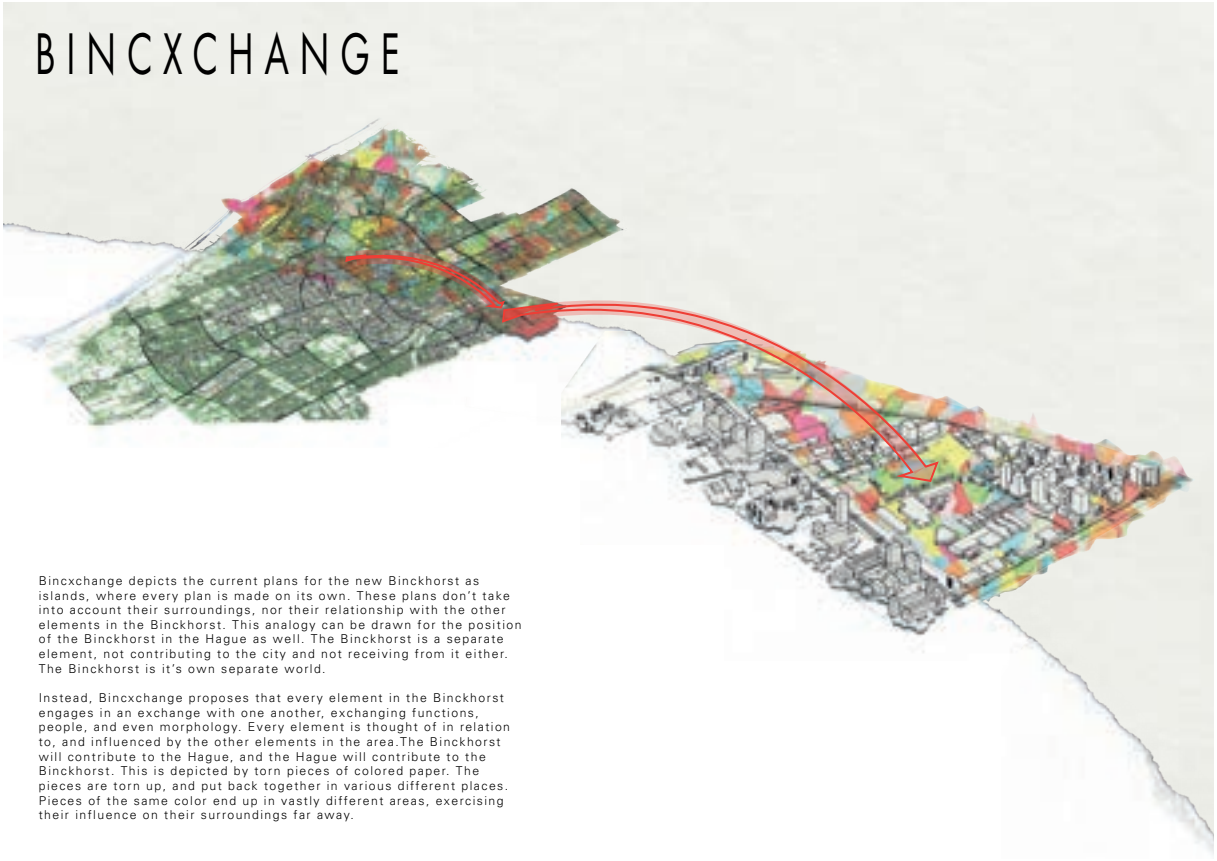
Reflection

1. The studio topic of this course is of course 'Music Marvel'. Although the assignment of the studio is to design a concert hall, Music marvel invites you to push the envelope further. This design intends to do exactly that by changing up the relations between visitors and artists in a music setting. The design is not only focused on concerts, but also auxiliary activities that contribute to this concept. This fits in with the ideals of the Architecture master, which invites students to rethink existing typologies. Rethinking typologies is essential to ensure buildings can adapt to the current day situation and potential futures. The design also builds upon my research into music and acoustics done in MSc1 and heritage in MSc 2. In MSc 1 – Dwelling I created a design which negated the sound pollution from the nearby train in a public space, while at the same time providing music living for the inhabitants of an acoustic themed building. In MSc 2 – Heritage I learned new ways of dealing with heritage. This design feels as a logical extension of these courses.

2. Developments in interactive and participatory art have already been happening since 1950's(Tate, n.d). Music has however been lacking behind in this field in relation to the other arts. Recently, developments like this have also started to emerge in music. However, its application until now has been limited. The design aims to further the development in this field. The design can set an example for how to apply different techniques and technologies in this field.

First version manifesto

Bincxchange

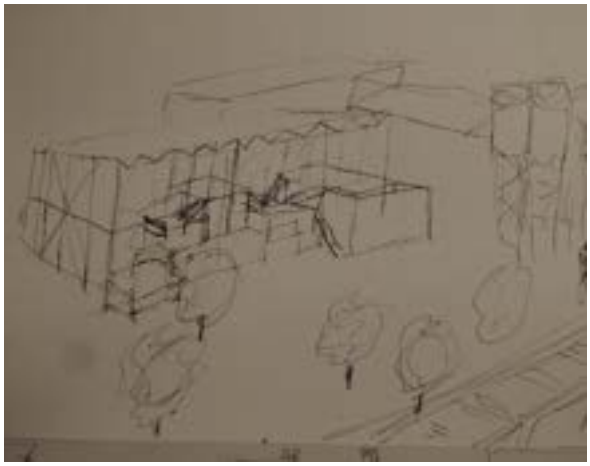


Starting from here more focus on exchange as overarching concept instead of synthesis. Relationship between music and exchange is clear. Binckhorst is lacking exchange

Further development

Further development of the design

New interior sketches



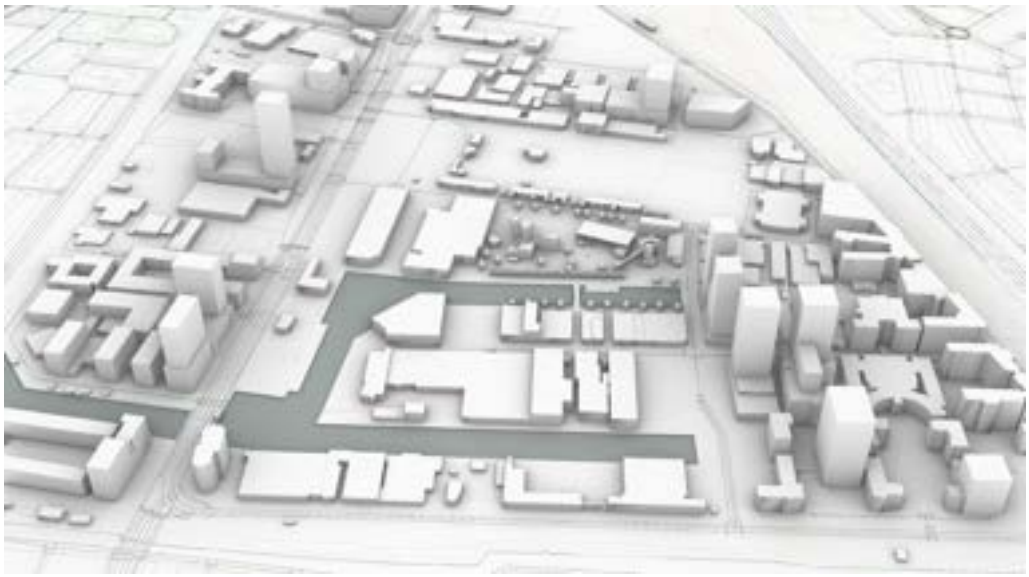
These sketches show the new version of the interior. This version has more verticality and doesn't have all the functions in one continuous block.

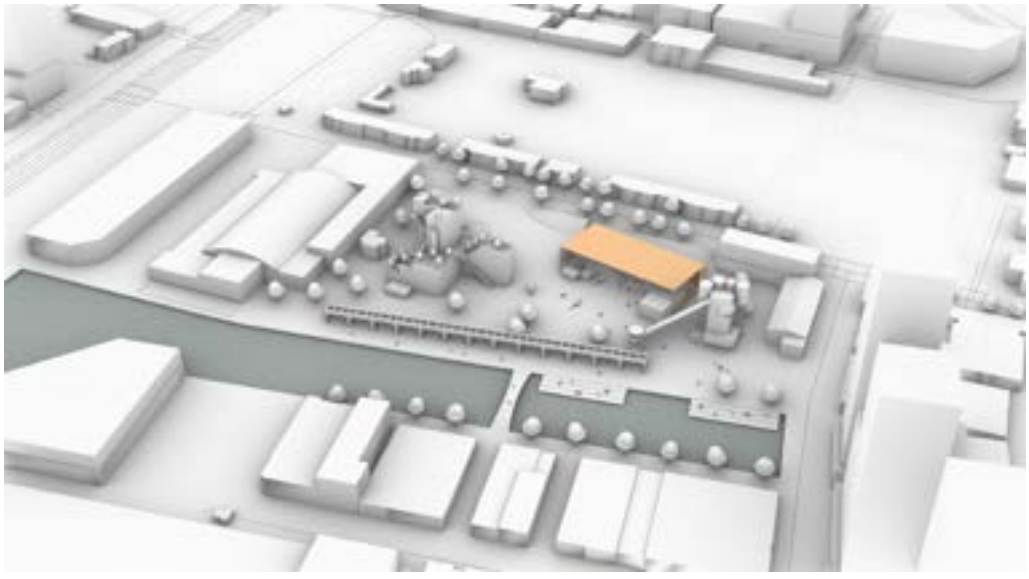
Case study - Centre Pompidou

Case study into the industrial aesthetic of Centre pompidou, relevant because of industrial look of my building. To be continued after P2.

Further development

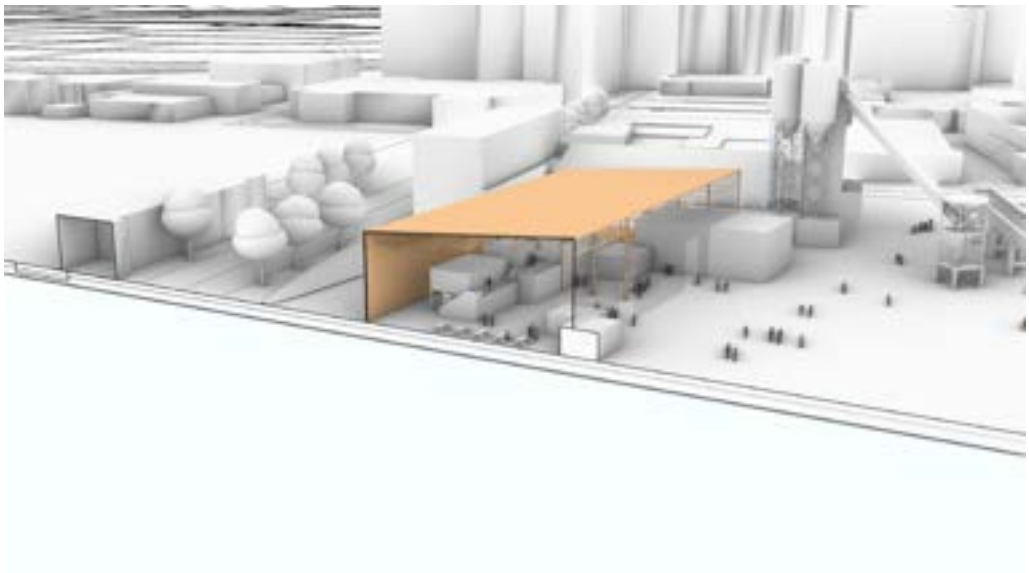
Further development of the design and 3d model





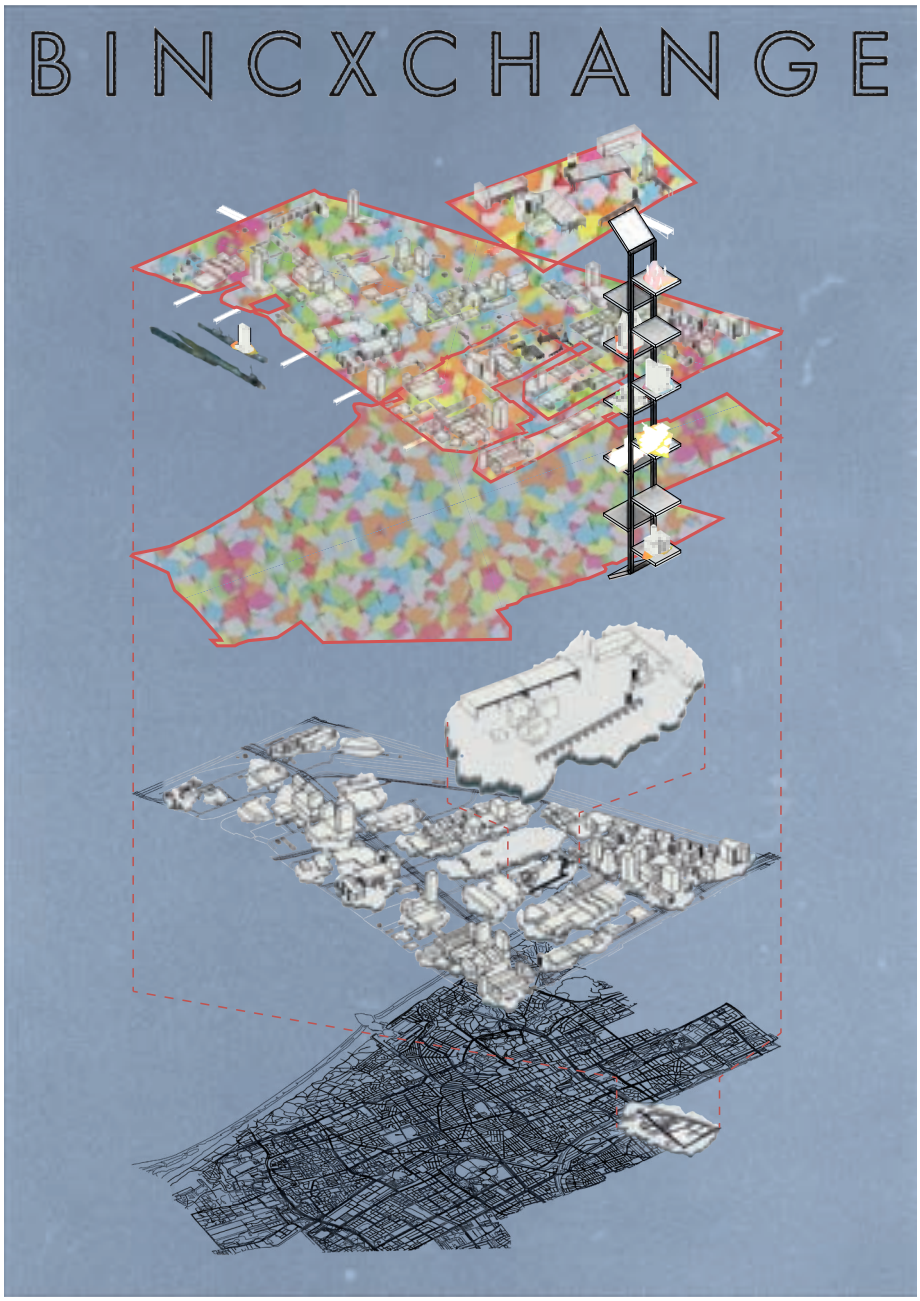
Further development

Further development of the design and 3d model



Second version Manifesto

Making the exchange more clear and focussing on all levels, including HAC



The new version of the manifesto makes more clear that the Binckhorst is lack exchange in the old situation (including future municipal plans). This is depicted by islands. The new version is made up of torn papers(pieces of parts of the Hague and Binckhorst that have intermixed, You can see an elevator exchanging different parts of Binckhorst, HAC and the city such as buildings, architecture, education and people between different levels. The exchange has been taken to the extreme on the HAC terrain by exchanging parts of buildings to create new follies. This is a hyperbolic representation of the exchange that I want to introduce to the Binckhorst.

P2 Presentation

The first attempt of integrating exchange in a building

The Modulator.

HAC Terrain, Binckhorst, the Hague

MSc 3 Public Building - Music Marvel - Bart Schipper - 4465741

SITE PLAN

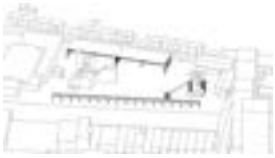
▲ 1:1.000

SECTION PLAN

▲ No Scale

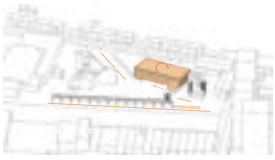
NOLLI MAP

▲ No Scale



1 | Old HAC terrain

2 | Re-use the old canopy and move it a better location. This creates a square and opens up the area.



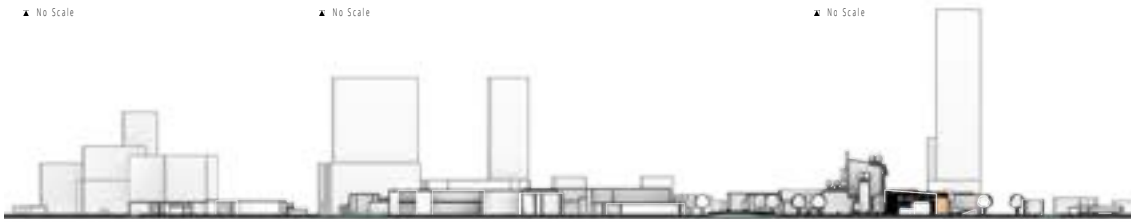
3 | Rotate building to create boulevard. Take away part of craneway to create an entrance to the east.

4 | Activate public space and create vertical park on top of old cement tower.

5 | Activate waterfront and connect to the creative district.

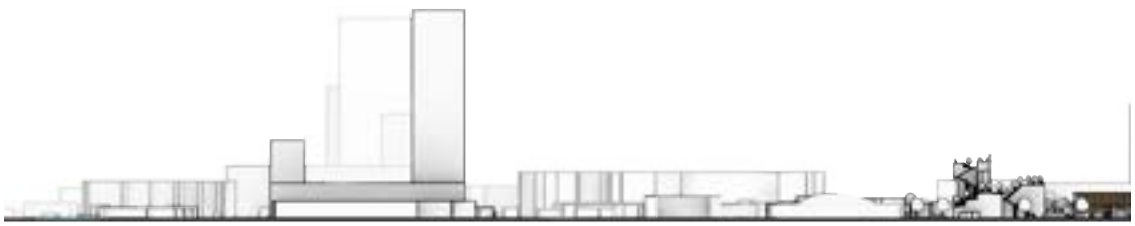
DESIGN STEPS

▲ No Scale



SECTION NORTH-SOUTH BINCKHORST

▲ 1:1.000



SECTION EAST-WEST BINCKHORST

▲ 1:1.000

P2 Presentation

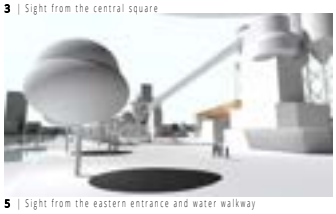
The first attempt of integrating exchange in a building

1 | Overview of the area

2 | Sight from the western boulevard

3 | Sight from the central square

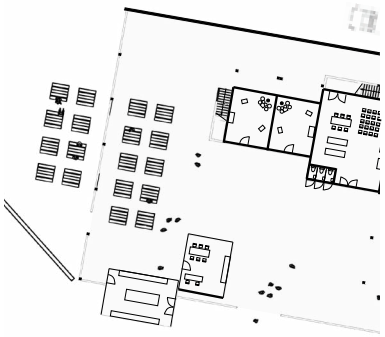
4 | Waterfront impression



5 | Sight from the eastern entrance and water walkway

ROUTING

▶ Building and the HAC terrain



GROUND FLOOR PLAN

▲ 1:200

FIRST FLOOR PLAN

▲ 1:200

Backstage

SECTION AA

▲ 1:200

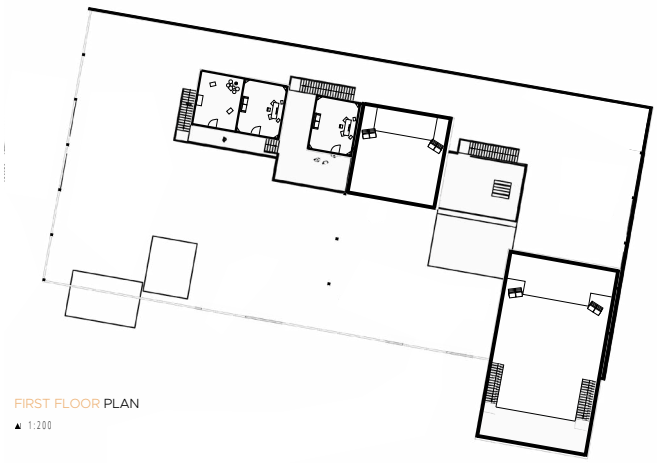
P2 Presentation

The first attempt of integrating exchange in a building

id water walkway

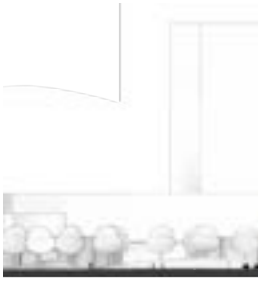
GROUND FLOOR PLAN

▲ 1:200



FIRST FLOOR PLAN

▲ 1:200

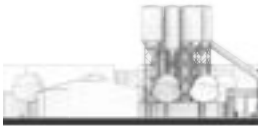


SOUTH FACADE

▲ 1:500

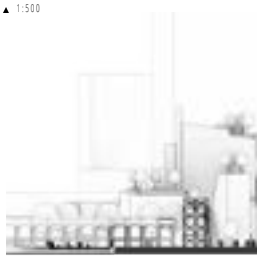
WEST FACADE

▲ 1:500



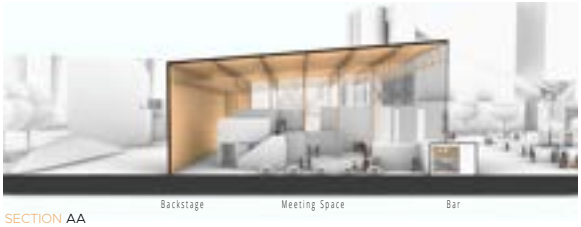
NORTH FACADE

▲ 1:500



EAST FACADE

▲ 1:500



SECTION AA

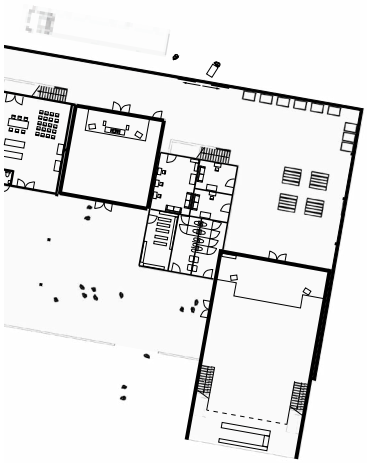
▲ 1:200

SECTION BB

▲ 1:200

P2 Presentation

The first attempt of integrating exchange in a building

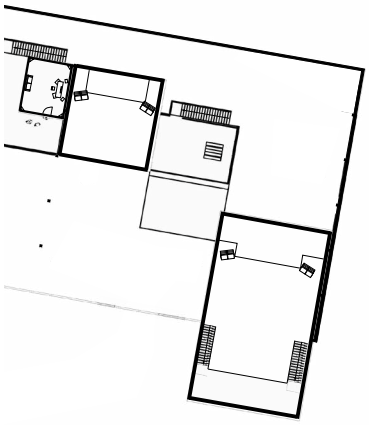


SOUTH FACADE

▲ 1:500

WEST FACADE

▲ 1:500



NORTH FACADE

▲ 1:500

EAST FACADE

▲ 1:500

Meeting Space Bar

Meeting space Practice spaces & studios Workshop space & Studio Second room Dressing rooms Backstage

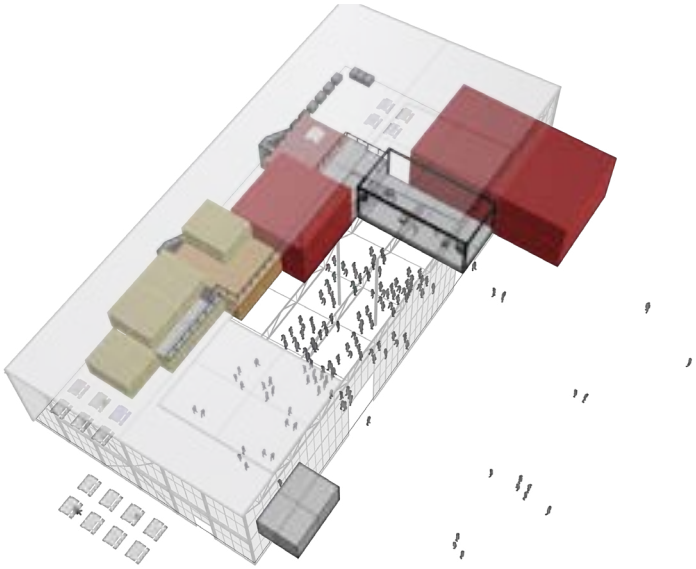
SECTION BB

▲ 1:200

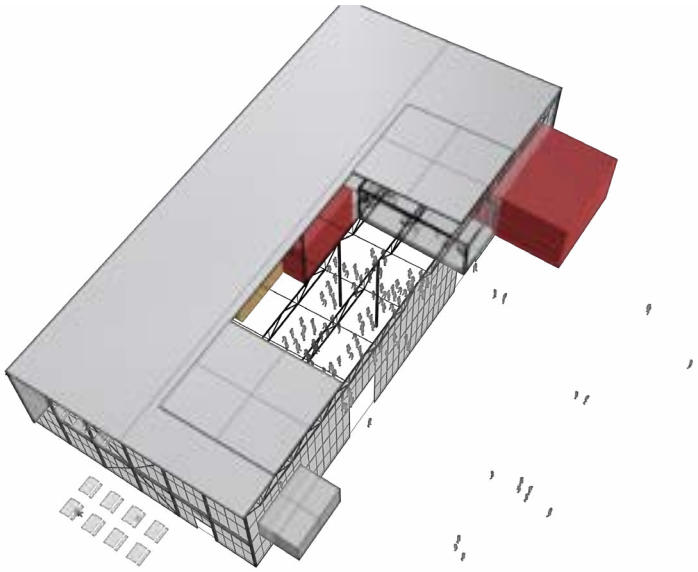
Week 3.1

Reflecting on, and integrating of feedback after P2

After the P2, it became apparent that with the containers there was potential to do more with the design. Because containers are an inherently movable system, I started to experiment what you can do with this.



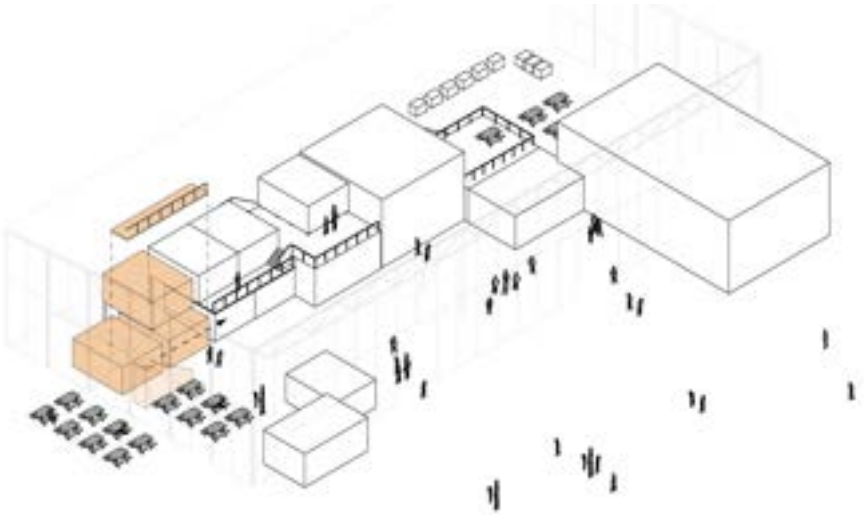
indoor festival composition



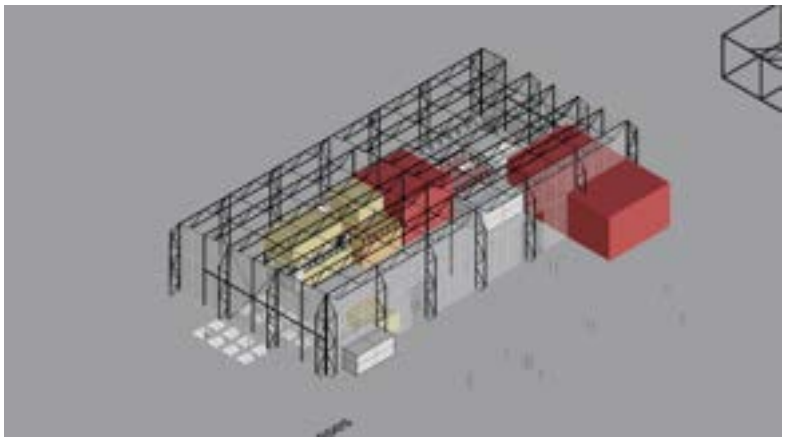
experimenting with opening up the facede for the first time

Week 3.1

Reflecting on, and integrating of feedback after P2



The possibility of additions also came up, the composition was no longer set in stone.



The theme of reuse also started to become more important. This is the first experiment with parts from the second canopy

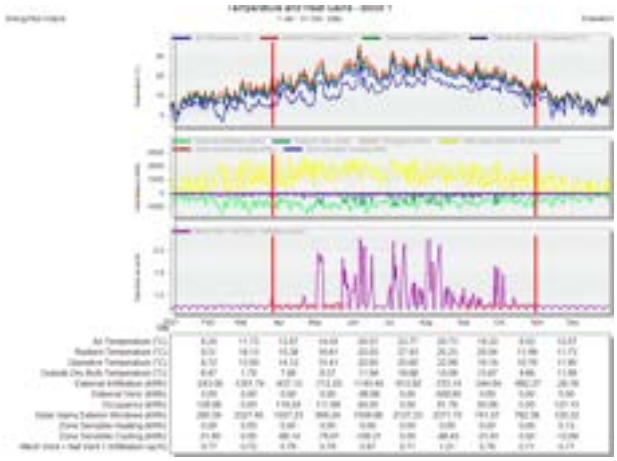
Week 3.2

Group model and focussing on climate

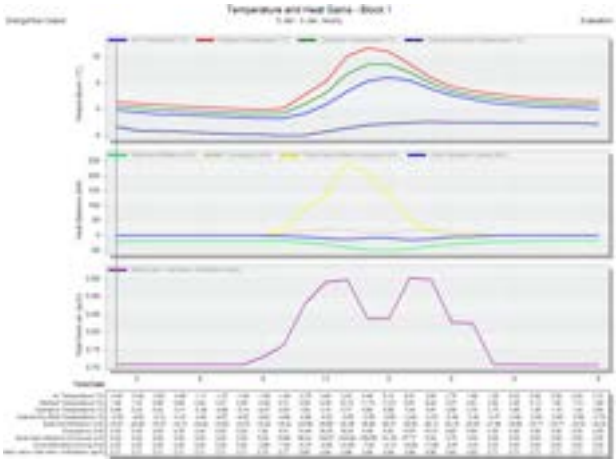
Work on the group model, I made the ground map

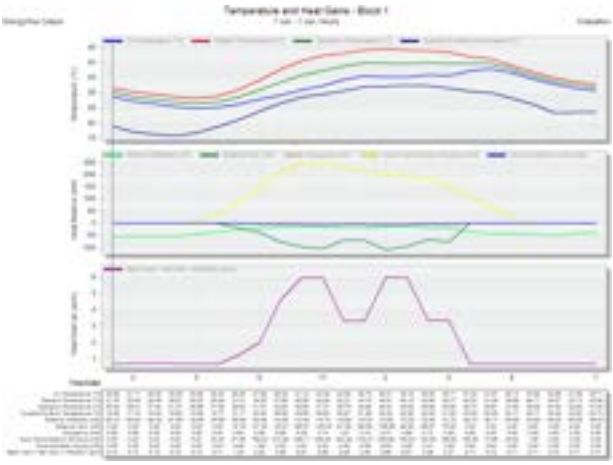
Week 3.2

Group model and focussing on climate



I started learning and analysing the building with designbuilder. This is a climate modelling software. The goal was to see if the building could be conditioned passively. Eventually I dropped this because the building was still changing too much, and it was taking up a lot of time





Week 3.3

Researching modularity

6.976/ESD.937 Quantitative Foundations of Engineering Systems Feb 13-15-21, 2006

Lecture 1-4

Lecturer: D. Shah and S. Mitter *Scribe: J. Laracy and D. Shah*

Architecture: Design Principles

Architecture is an *Art* or *Science* of designing engineering system. It is not an *exact* science but there are well-known general principles or guide-lines that can help in designing better engineering system. These lectures were aimed at explaining these principles mainly covered the following three topics:

1. General system design philosophy: provides broad guide-lines for system design.
2. Modularity: the most general principle for architecture design.
3. Interplay between Theory and Architecture: theory leads to better architecture for certain specific systems.

These were explained in detail using the example of Internet, which will be the running example throughout the course.

1. Design Philosophy

Initially, a system is required to design to fulfill certain requirements. For example, Telephone network was designed to fulfill requirement of real-time long-distance communications. Hence, a natural way to begin thinking about architecture of a system is to start from the essential requirement of the system. That is, the first step should be list all the functional and non-functional requirements of the ideal system that one wishes to design. For example, the primary goal or expected requirement from Internet, when it was designed late 1970s-early 1980s, was the multiplexed operation of multiple, independent, heterogeneous networks.

The next step is to use these requirements to derive the design implications. The requirements naturally put constraints on the type of architecture that can be supported. For example, in the context of Internet, requirement of multiplexed operation of independent networks mean that the architecture can not have any *centralized* operations.

Once such design implications or constraints are derived, the next step is the search of technology that satisfies these constraints and allows one to implemented system with desired requirement.

Certainly there is not any straightforward algorithm for implementing the above three steps, going through series of intelligent system specific guesses with multiple iterations of the above steps can lead to a good architecture design. We note that carrying out the above steps require a lot of system specific knowledge and hence it is impossible to have one design principle for all system architecture. The details of the above steps in the context of the Internet are described in the class-slides.

2. Modularity

The principle of modularity is one of the oldest principle of designing engineering system. It has been used widely in all sorts of architecture. The main idea behind modularity is as follows: divide the overall system into smaller sub-system that can be designed independently of each other such that these sub-system can inter-operate by exchanging appropriate information at the interface to provide the functionality of the overall system. Here are some examples.

1. Objected oriented software architecture: each object in software is a module and the objects interact with each other via appropriate interface to provide overall function of desired software system.

I started looking more in what modularity actually meant. For this I did literature research and looked at case studies

This included a modular festival stage in central Park, New York

Week 3.3

Researching modularity

I looked at systems to make the containers move. A reference for this was art storage in museums. The plan up to this point was still to make the containers move along a system, so not freely

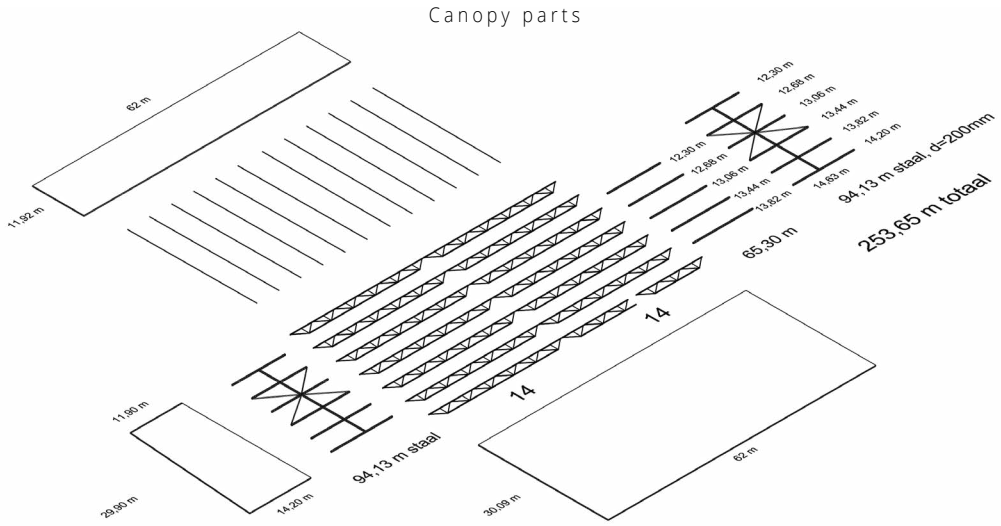
Research into Fabrica de Cultura to see if I could do something with the large amounts of corrugated sheet in the second canopy. I was looking at doing something with perforation on the facade

Week 3.3

Researching re-use

Re-using the 2nd half of the canopy

Canopy parts



I also started mapping the parts that I had available in the second canopy, to see what I had and how to use it

Week 3.4

Looking into concert hall construction and module design

This week I looked at how to construct a concert hall. here you see an example from Ronda in Tivoli Vredenburg. Amplified concert halls generally have a free floating steel construction. The hall is box in box to stop sound from getting out

Week 3.4

Looking into concert hall construction and module design

Looking at reused plastic facades. i was looking for ways to reuse waste from the Binckhorst. I did not know yet that Pretty Plastic was made from PVC. The idea wasleft on hold for a while, to come back later in the design

Week 3.4

Looking into concert hall construction and module design

Another route I was looking at was reusing plastic to make blown up facades similar to ETFE. I also knew by now that i wanted the facade to be openable, so this could prove a lightweight solution to do that. (Later it turned out not to be feasible)

Week 3.5

Catalogue and looking into designing and moving the containers

From the URBAN GROUND to the PLAYGROUND

ARCHITECTURE can PLAY THE GAME!

Seminar II

Nicola Marzot

Course Base AR3AP100
Delineation Research

Chair of Public Building
Delft, September 23th 2021

In week 5 I started researching the possibility of making a catalog for all the items from the Binckhorst i had available to reuse in the design. For this I revisited the delineation research on catalogues

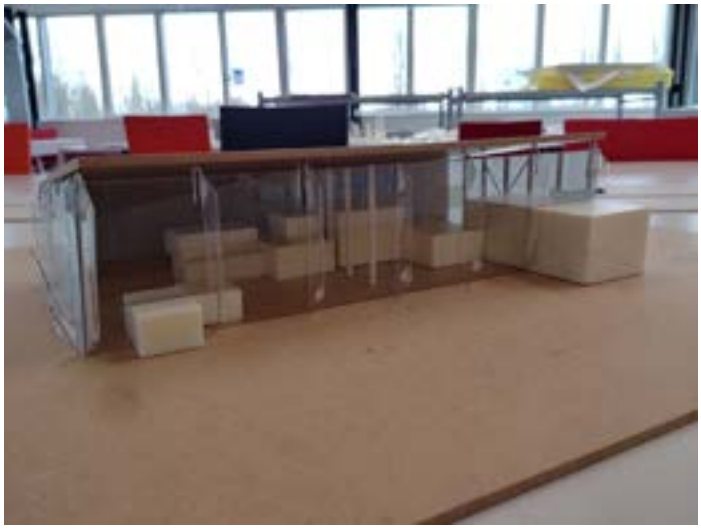



I also looked in possibilities of what I could do with the containers

Week 3.5

Catalogue and looking into designing and moving the containers

To research what compositions I could make with the modules, I made a model. This model also helped with getting a spatial feeling for the building, and explaining the concept during guidance.



Week 3.5

Catalogue and looking into designing and moving the containers

This week I had a tutoring with Nathalie. During this, we came to the conclusion that there was a lot of potential in using the cranes that were already present in the area. The system of potentially moving and stacking them was already there

Week 3.6

Finding systems for the movement and use of containers

This week i really new what direction i wanted the building to go in. I started lo0king at ways how to move the containers after they had been stacked by the crane, methods that could also work inside the building.

Initially i came out at container handelers. These things are however very big and require skill to use. I however wanted something easier to operate, smaller.

A more low-tech solution was a container cradle. There would still need to be a way to lift them onto the cradle however.

Week 3.6

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Week 3.6

Finding systems for the movement and use of containers

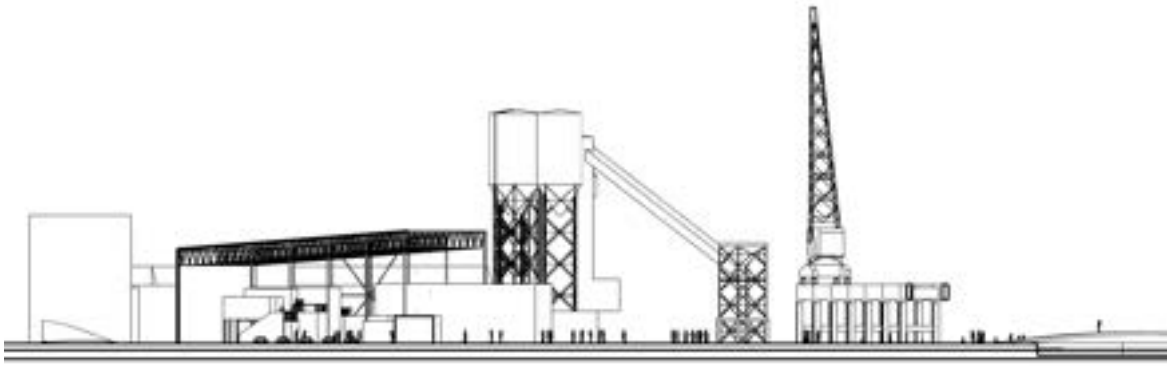
This lead the research to pneumatic pumps and other manually operable systems

The idea of just putting wheels under the container came up. This idea would eventually lead to the transport casettes

Week 3.6

Finding systems for the movement and use of containers

Because the containers would be hard to get wheels under if they got on the ground, I started to look into ways to keep containers permanently a bit off the ground. This is the common system for putting legs under a container,



I also started moddeling the crane and building in more detail

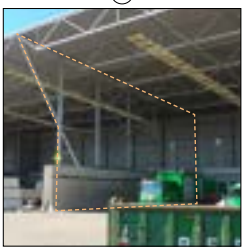
Week 3.6

Catalogue

This week I also dit a site visit to the Binckhorst and made the catalogue. The catalogue looked both at the second canopy and at what was in the area

Picture

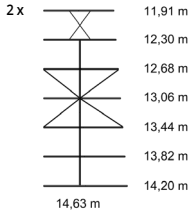
① 

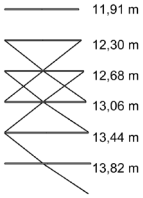
② 

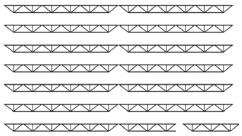
③ 

④ 

Overview







Profile

Info

-The side facades of a frame of HEA columns, with crosses for stability. The frame consists of HE300A steel beams. This frame can be found on both sides of the building

-In the middle of the canopy there's a support frame consisting of HE300A too. The end column is missing to allow more space on the front, which is compenstated by a diagonal beam. This frame features an extra stability cross.

-The roof of the canopy is supported by 14 30m long trusses. The trusses are around 1,5m wide. The long bars of the beam are square profiles of 150mm wide, with round cross beams of 50mm in between

-The back side also consists of a frame of HE300A columns. They are stabilised by double crosses on both sides.

Picture

⑩ 

⑪ 

⑫ 

⑬ 

Picture

Profile

Info

-Concrete panels often used as temporary roads or squares. These can be used to create hardened spaces. Sometimes at festivals these are stacked to create seating spaces or used to stabilise temporary structures.

-Many building materials come packed in plastic foil. Over the course of many building projects in the Binckhorst this can stack up to many tons of plastic. This plastic can be used to create facade panels.

-Existing building sheds could serve as the basis for the larger modular spaces required in the plan. These are already lightweight and highly movable.

-Throughout the Binckhorst, hundreds of containers can be found. These can serve as the basis for the practice and studio spaces. The bottom picture shows a system for attaching and moving containers by using little carts. The containers are on wheels.

Week 3.6

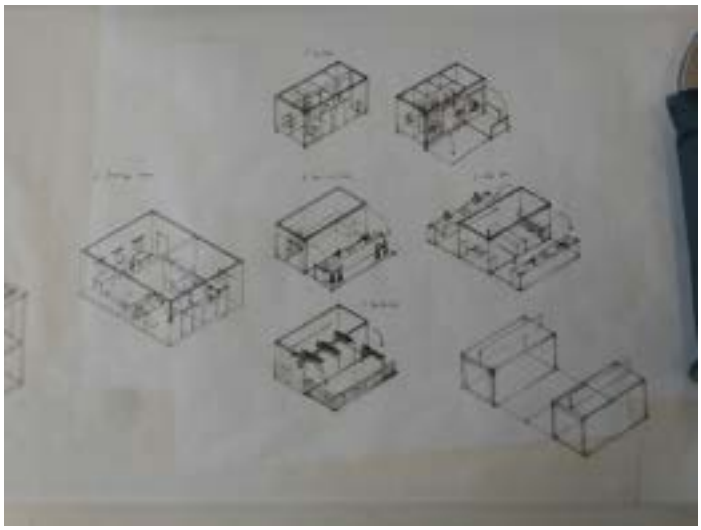
Catalogue

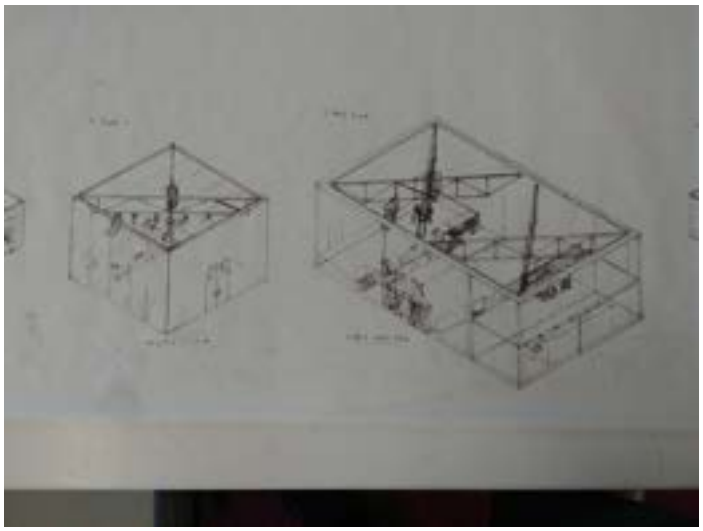
During the site visit I asked some info at the BAM building, which lead to me actually being able to acces the site and interview the head of operations and crane operator. This made me also find out about the capabilities of the cranes. The crane could carry 4 cube of gravel, which equates to a bit over 7 tons of carrying weight.

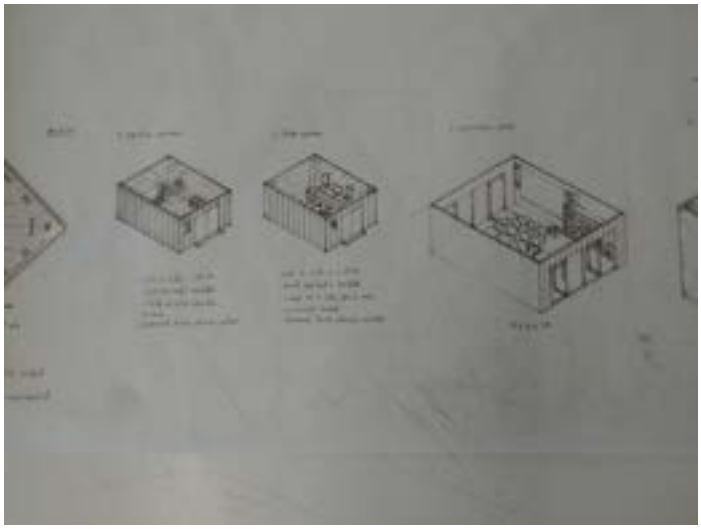
Week 3.7

Module and facade design

After having done a lot of research and spending a lot of time modelling on the computer, it was time to get back to sketch





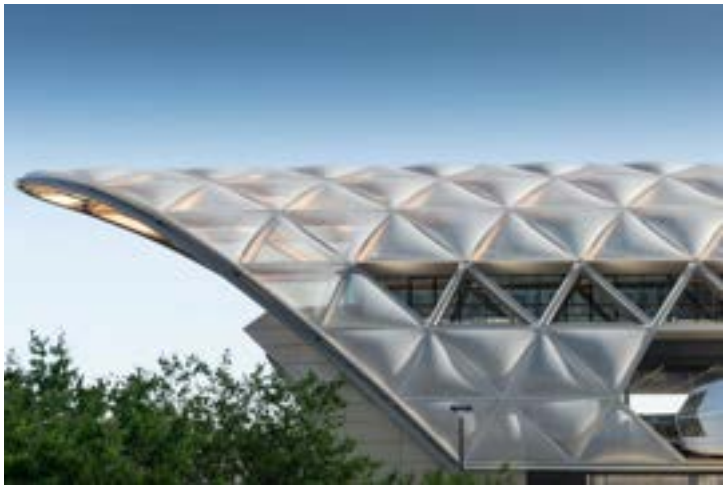


Week 3.7

Module and facade design

I was struggling with finding a method to open the facade. I continued researching ETFE. I found a reference of The Shed, an etfe building that moves.

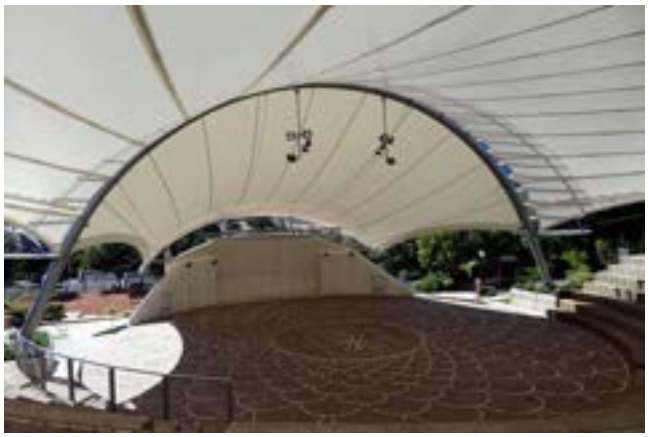
I also continues looking at ETFE solutions



Week 3.7

Module and facade design

From the Catalogue, I knew that I wanted to use recycled PVC. So I also looked at the regular application of PVC in building facades. The first reference is a composite PVC-PET material. The third reference is PVC foil



Week 3.7

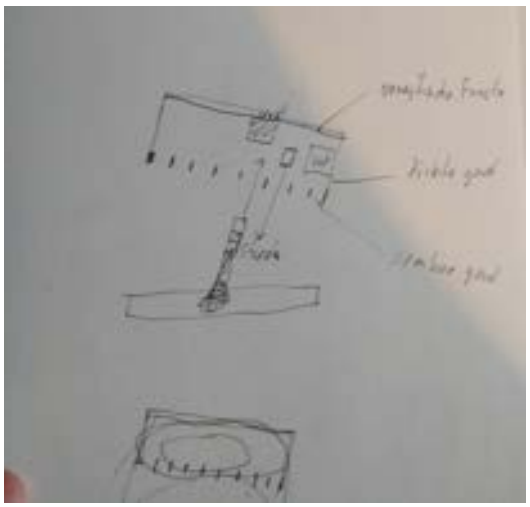
Module and facade design

I was also still looking at alternative facade opening methods, so I looked into installing rolling doors in the building.

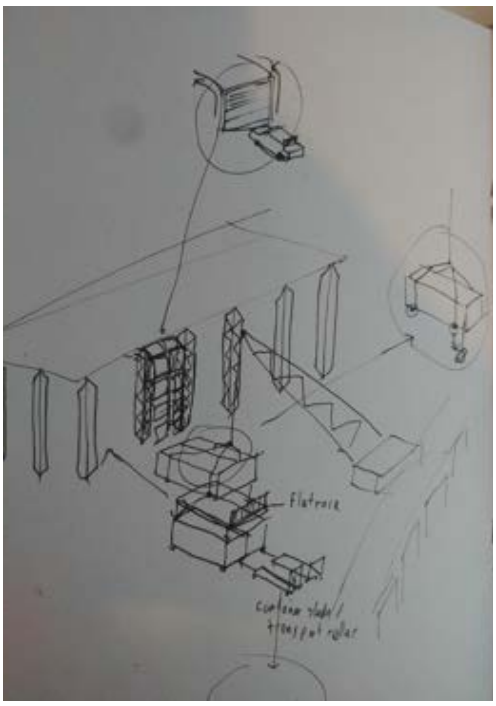
This week I also found out about the existence of transport casettes for heavyweight objects and machinery.

Week 3.7

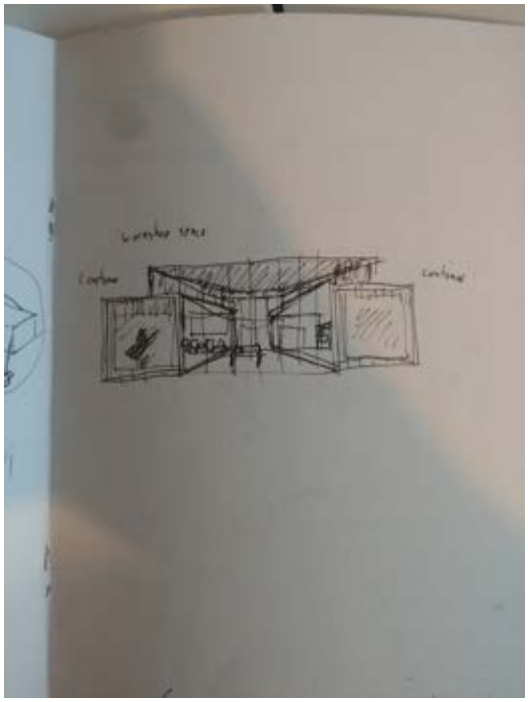
Concept sketches



Sketch for how to display the different compositions for P3



Sketch for thinking about systems for the movement



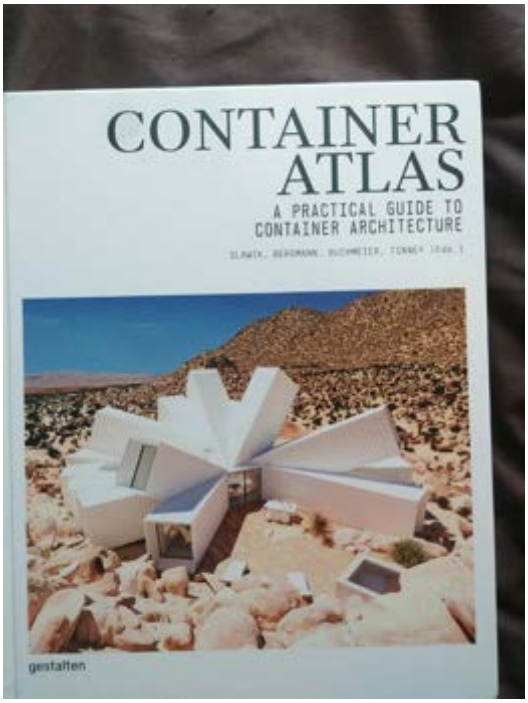
Sketch for the workshop space. This is the first time I considered making openable containers

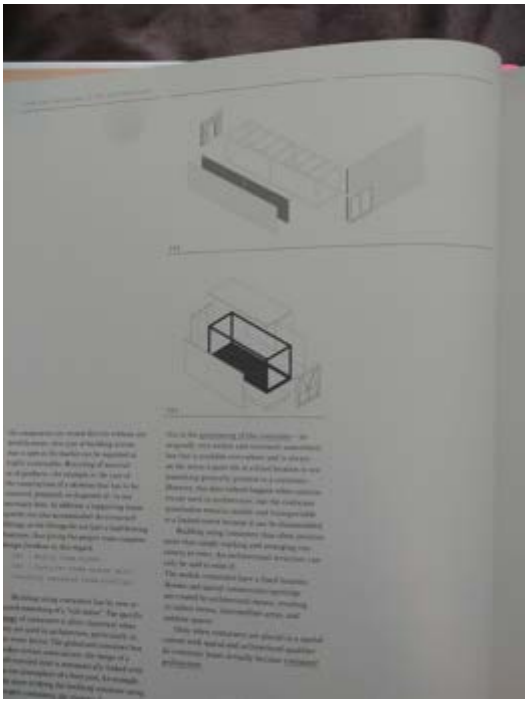
Sketch where I discovered the building was a machine and could look like on.

Week 3.7

Container atlas

For the container design i also bought a book called ‘the Container Atlas’. This book help me with the techniciques and details of designing and gave me a lot of inspiration in the process

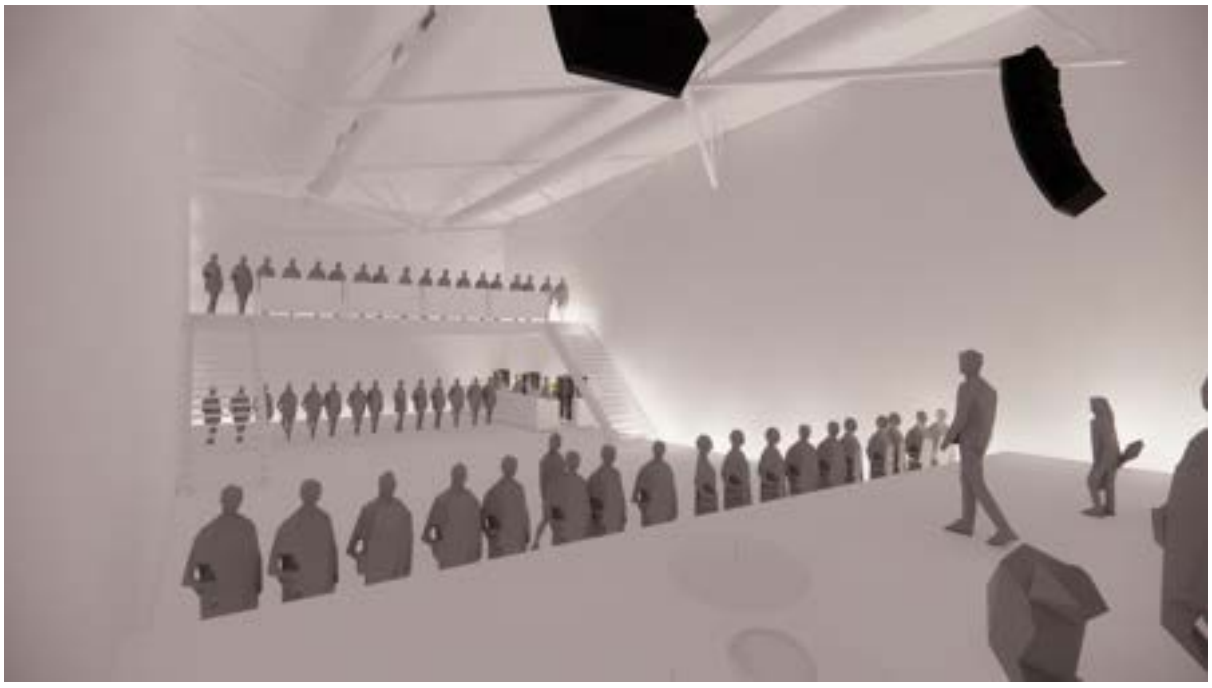




Week 3.8

Preparing for P3

This week marked the preparation for P3. I started modelling the modules and the concert hall. Here you see the first version of the hall



And here you can see the canopy and the first modules. The concert hall still had aluminium cladding instead of Pretty plastic

Week 3.8

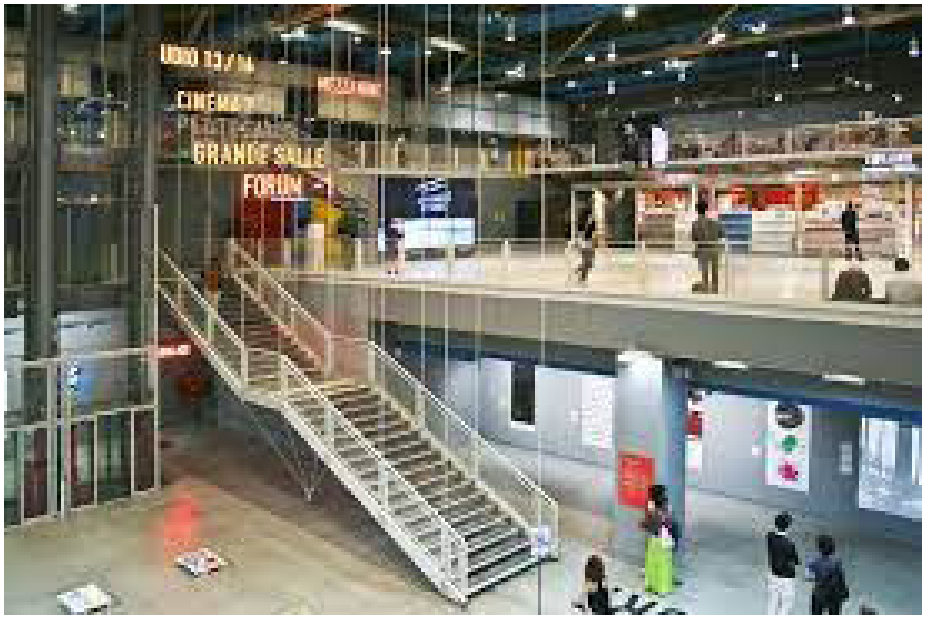
Preparing for P3

For the designing of the building and concert hall I did case study research to halls and concert buildings, aspects I researched were layout, construction, materialss.

Week 3.8

Preparing for P3

I also looked at centre pompidou more for inspiration for the materials and the inerior



Week 3.9

P3

This was the week of P3. In P3 I focussed a lot on all the compositions the building could make. Prior to this, I designed all the compositions in sketch. Unfortunately the photograph of these is lost

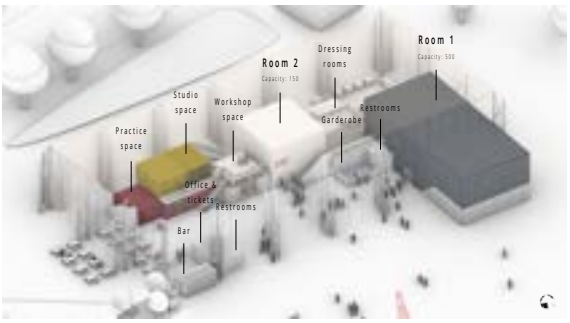
The Modulator.

HAC Terrain, Binckhorst, the Hague

MSc 3 Public Building - Music Marvel - Bart Schipper - 4465741

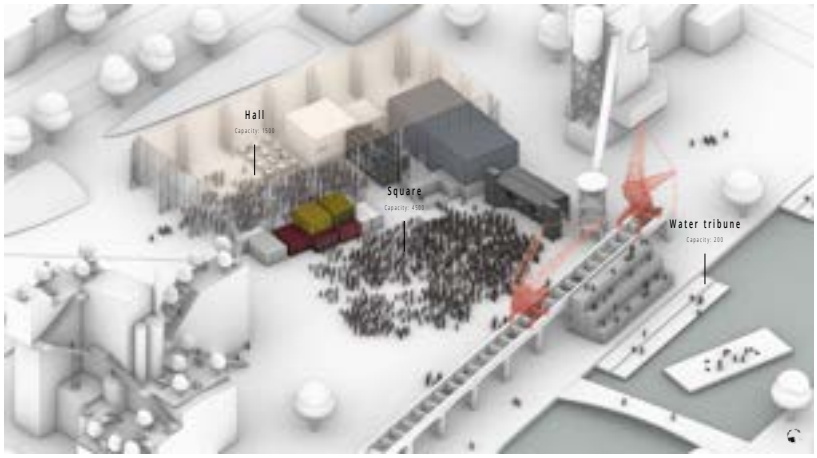
FRAMEWORK OF EXCHANGE

▲ Performance, Practice, Workshop, Meeting



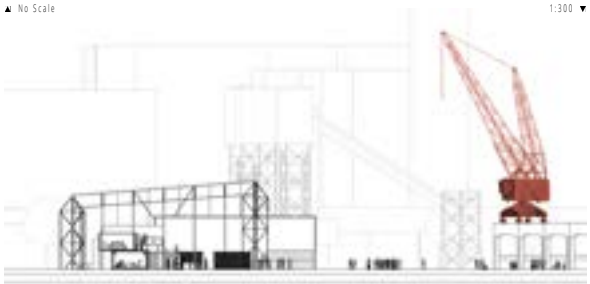
BASE COMPOSITION

▲ No Scale



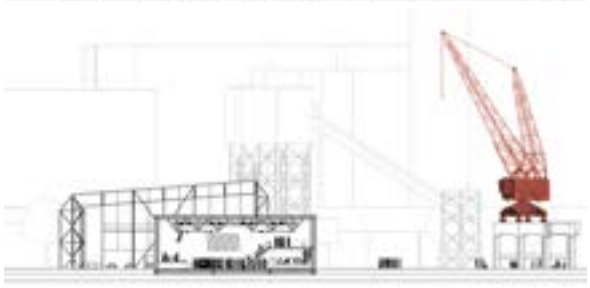
GENERAL IMPRESSION

▲ No Scale



SECTIONS

1:300 ▼



FLOOR PLAN

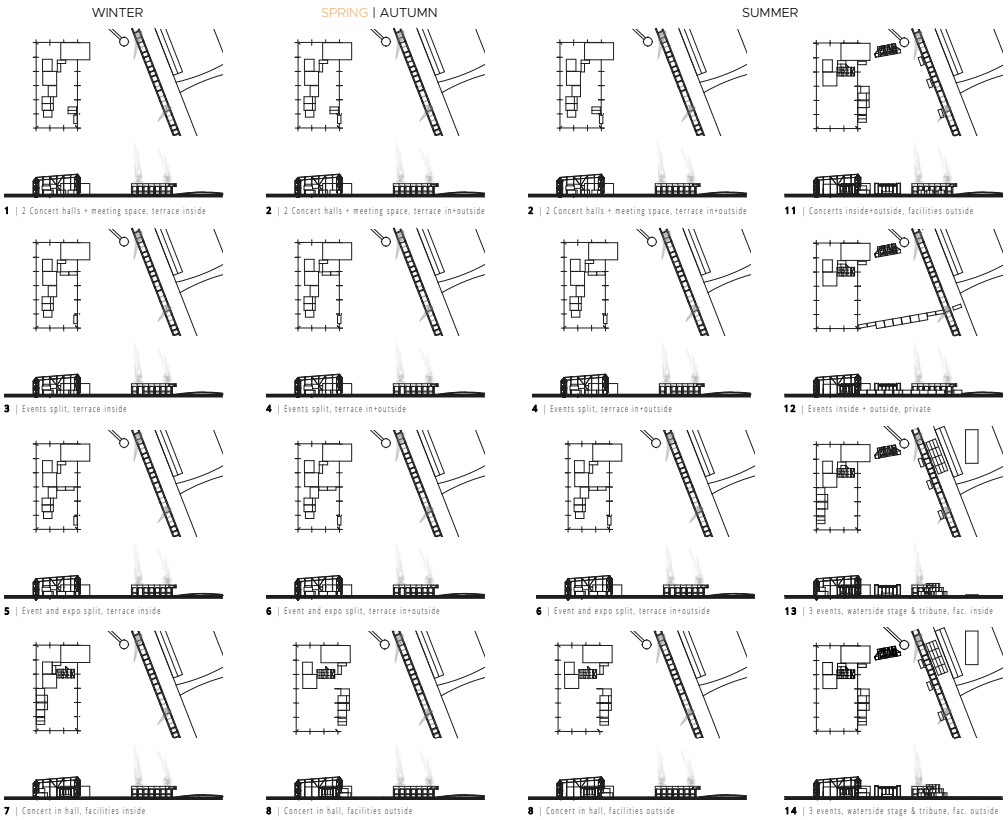
1:250 ▼

Week 3.9

P3

Here you can see all the compositions. They can change depending on the season. In winter there takes place more inside, while the summer gives more opportunities outside. At the bottom are three more detailed versions

Variants



HIGHLIGHTED VARIANTS

2 | 2 Concert halls + meeting space, terrace in+outside

8 | Concert in hall, facilities outside

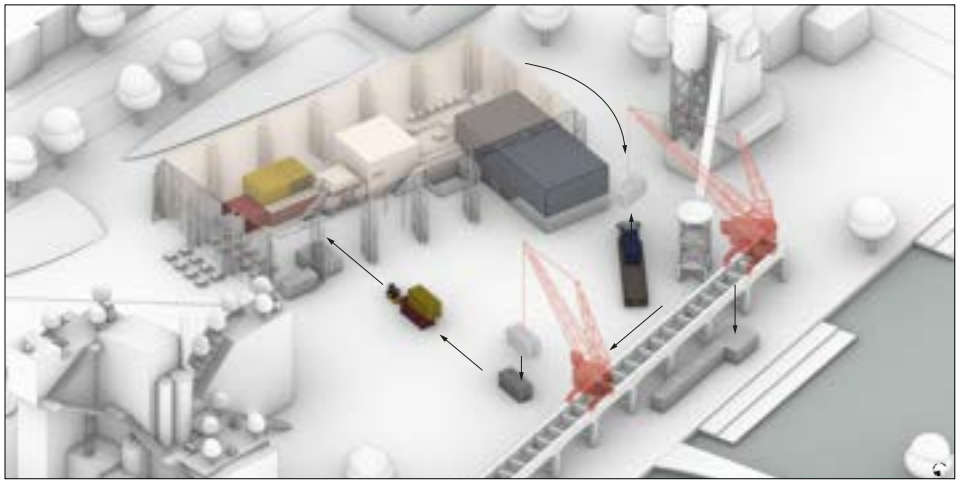
3 events, waterside stage & tribune, fac. outside | **14**

Week 3.9

P3

Here you can see the movement system and the module design. Unfortunately, because so much about my building was still changing, it was hard to do BT. This turned out to be a problem later because I had less feedback on my BT. I was also still struggling with the facade

Modules



GENERAL IMPRESSION

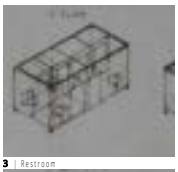
▲ No Scale

MODULES

▼ No Scale

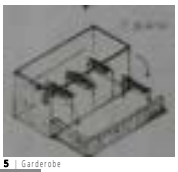
1 | Practice

2 | Studio



3 | Restroom

4 | Restroom, including disabled



5 | Garderobe

1 | Practice

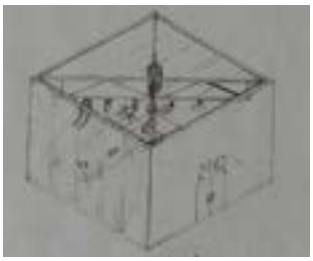
2 | Studio

6 | Bar & catering, 1-sided

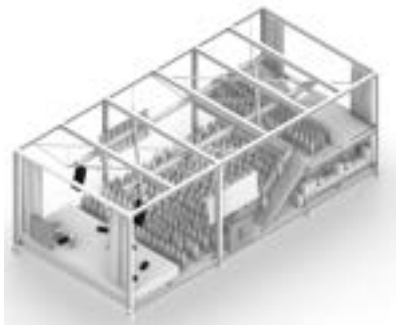
6 | Bar & catering, 2-sided

8 | Workshop

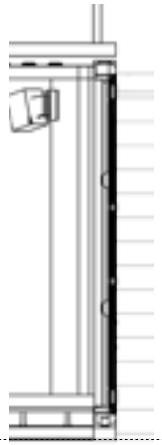
9 | Dressing room, WIP



11 | Room 2



12 | Main Hall



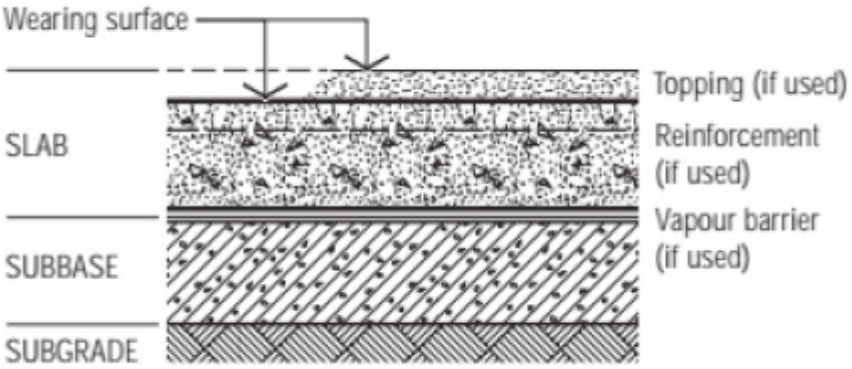
DETAILS MODULE & CONCER HALL

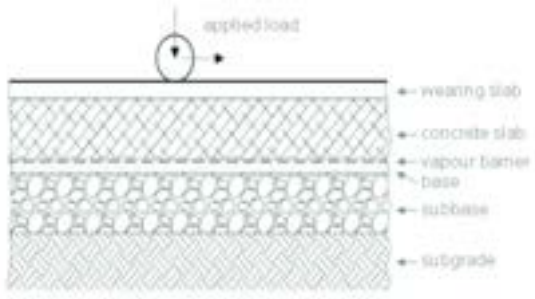
1:20 ▲

Week 3.10

Reflecting on P3 and floor research

My design at P3 was still pretty rough, but the feedback from P3 helped me to reflect on where I wanted to go with the design.
It also made me realise I had to catch up with BT, so this was a strong point of focus starting from now.





I started off by researching the floor, and came to the conclusion that due to the heavy weight of the containers any conventional floor solution would be out of the window. I came out on industrial floors. This would form the basis for my floor later

Week 4.1

Making large BT progress

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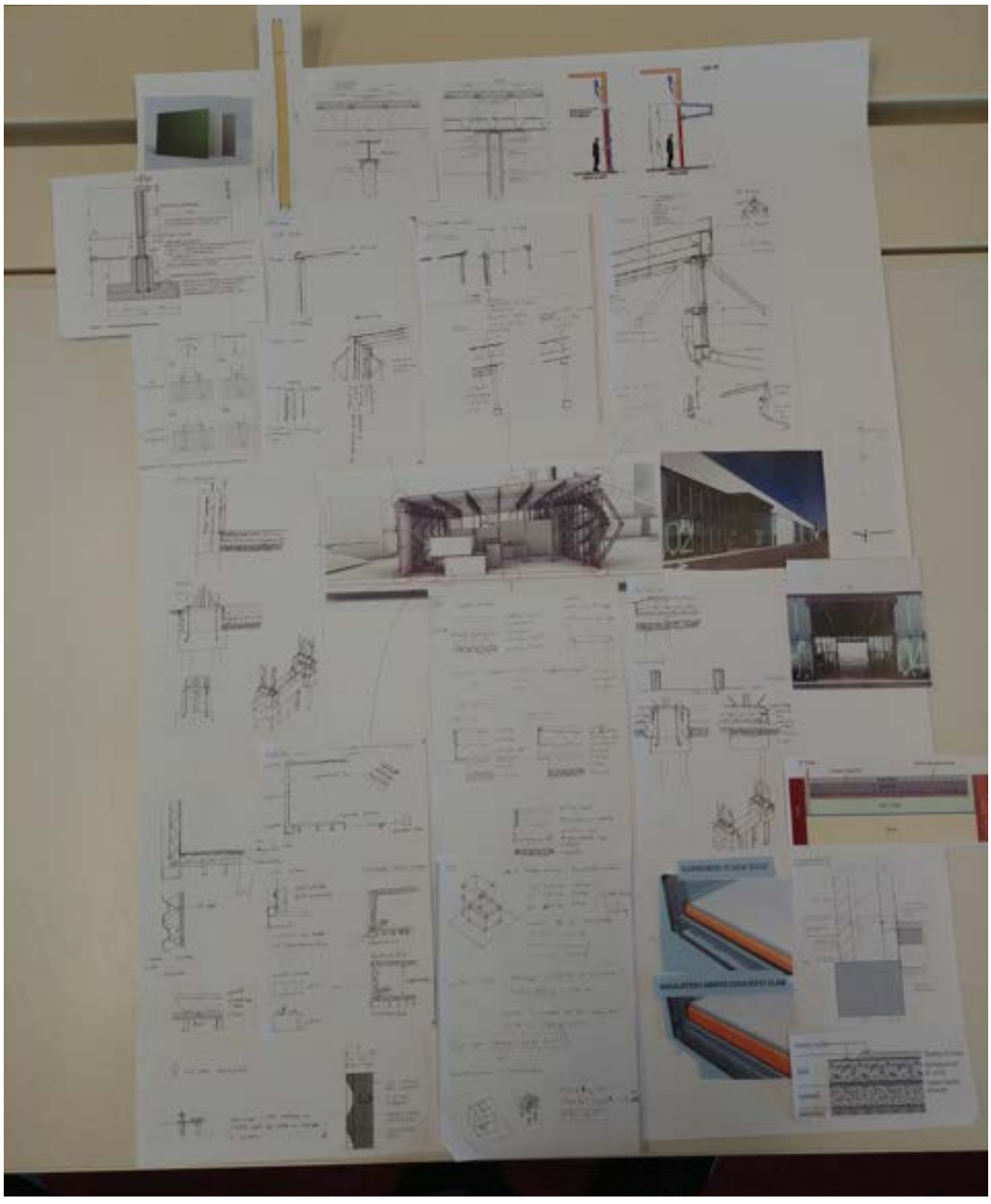
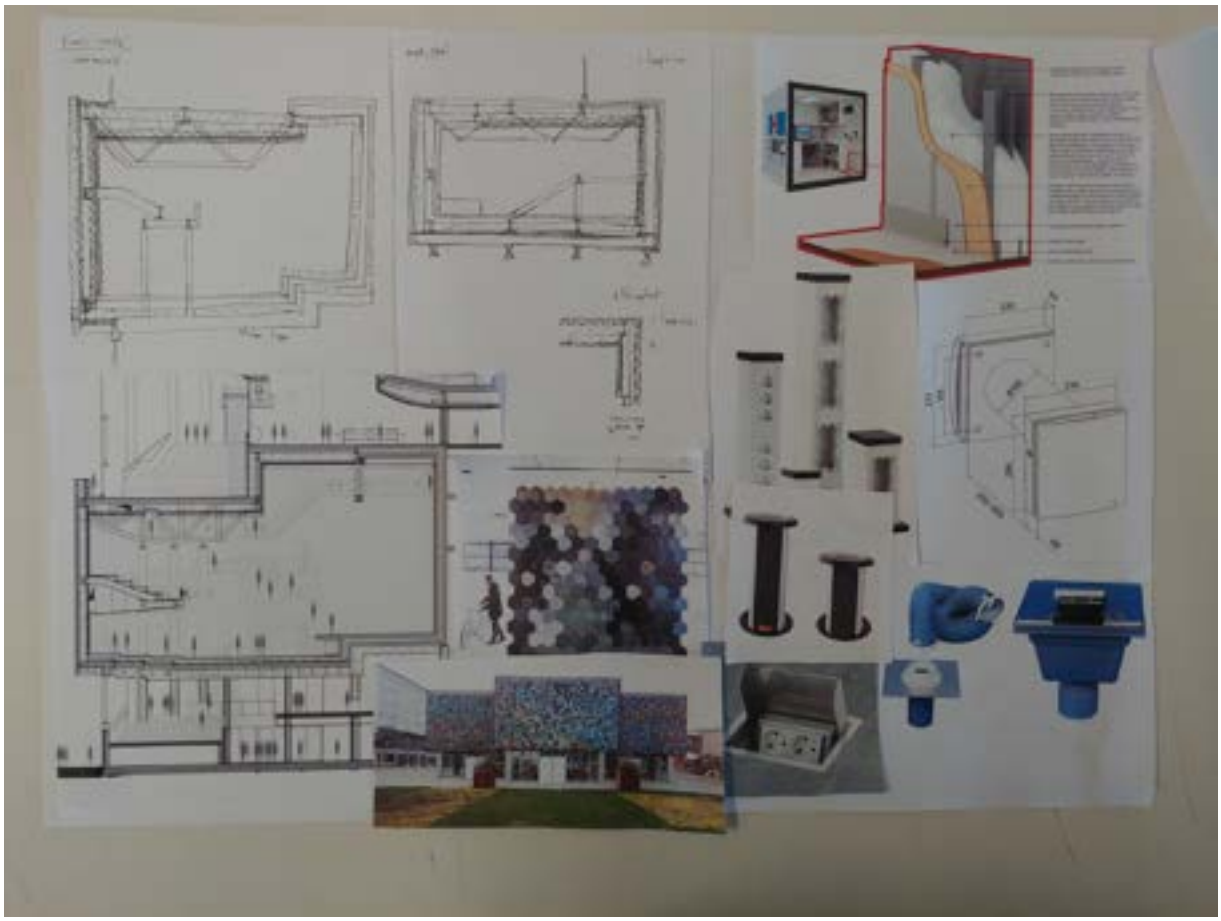


I made a large A1 poster with detailing examples and proposal sketches of every building part in my building. This ranged from the floor, to the facade, to the ceiling and roof edge. It also focussed on the containers and the acoustics

Week 4.1

Making large BT progress

This week also marked my discovery of the Bifold facade system which would end up on my P4 Building. I researched container detailing and discovered that containers need special insulation because the have special damp problems. I also found out again about pretty plastic, a way to recycle the PVC. I looked into ventilation, electricity and sewage for the container



Week 4.1

Case study research

I did case study research into the design of modules, and materialisation of modules in a big industrial hall. The reference you see below is the NDSM-Hal in Amsterdam, which is a good example of how module-like structures work and are materialised in an industrial hall.

Week 4.1

Case study research

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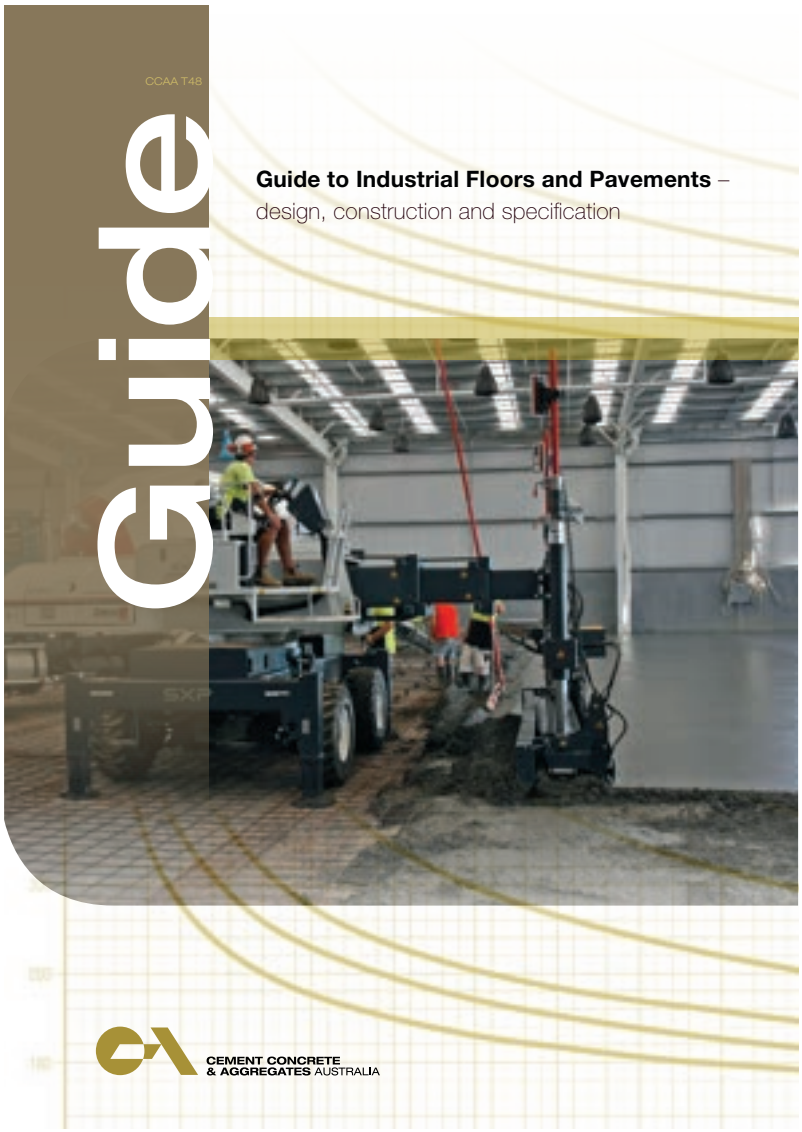
Week 4.2

DC floor calculation

In this week I did a very complex calculation of the pavement floor, based on a guide from the Australian Cement and Concrete Aggerates association. I concluded the floor was the most important structural element for supporting the containers, so this was what I wanted to calculate. From this I came to all the layer thicknesses in the floor. This is dependent on concrete strength, type of ground, type of loads, frequency of use and lifespan of the floor.



The guide

Week 4.2

DC floor calculation

The calculation

DC – Vloer op zand - Pavement
Gebruikte procedure: Guide to Industrial Floors and Pavements. CC&AA. (2009) Guide to Industrial Floors and Pavements – design, construction and specification. https://www.ccaa.com.au/documents/INDUSTRY_GUIDE_T48_Guide_to_Industrial_Floors_and_Pavements_Design_Construction_and_Specification.pdf

Requirement: Minimise number of joints
Reasons for joints:
-Isolation
-Expansion
-Contraction
-Construction

Keuze voor Continuously reinforced -> geen vocht tussen de seams van dinkten. -> Meer wapening nodig, 0,4-0,9% extra

Subbase

Subbase thickness -> 100-150 mm – Midden = 125 mm

Abrasion Resistance

30 mm cover for protection of reinforcement

Wel keuze voor topping, want hoge puntlasten en schuiven met materialmen = potentiële schade. Tevens te maken met vocht(drinken).

Design for Strength

Puntlasten vanwege poten onder containers -> Vergelijkbaar met storage racks with base plates.

Ontwerpprocedure betondikte

3 soorten lasten: (CC&AA, 2009, p.25)
-Wheel loading
-Post Loading
-Distributed loading

Wheel loading
Because wheels move over the base causing rise and falls in stress, failure generally occurs because of fatigue. Because of this, it is necessary to estimate the traffic on the pavement over the design life.

Pressure of moving double containers + a plateau + a moving vehicle = 2*55 kN +10 kN = 10 kN = *130 kN*. -> ** 1,2 safety factor = **156 kN**. Distance between axles is 5 meters max.*

Base design features 15 containers inside. Assumption these can each be moved once per day at a maximum. 2 Days off per week are assumed-> 15 *365/50 *(5/7)= *195.535 repetitions.* This matches with the graph

Post loading
178,5 kN max, zie berekening maximale lading containers op 1 punt

Distributed loads
Loads covering a large area due to material placed directly on the pavement. -> Not relevant

Assesment of design tensile strength

Because the floor doesn't face extreme conditions, but also isn't loaded very lightly, I take the middle of the factor ranges. Therefore:

For the wheel loads in the design, the k1 factor is 0,9

For the post loads in the design, the k1 factor is 0,8

Week 4.2

DC floor calculation

Table 1.17 accounts for fatigue in the concrete. The associated k2 factor for the design is 0,54

Fc = compressive strength of concrete. Normal construction concrete = 40 MPa

Tensile strength wheel loads =

Fcf = 0,7·(40) = 4,427 MPa

f all = 0,9 * 0,54 * 4,427 MPa = *2,15 MPa*

Tensile strength post loads =

Fcf = 0,7·(40) = 4,427 MPa

f all = 0,8 * 0,54 * 4,427 MPa = *1,91 MPa*

Soil assessment

The ground underneath the building is sand.

The building will have both short term and long term loads. The short term Young's Modulus = 45
The long term Young's modulus = 36

Calculating required thickness – Wheel loading

f all = 2,15 MPa
F E1 = 1,35 for 45 MPa internal, 1,46 edge
F H1 = 0,97 for 9 m internal, 0,99 edge

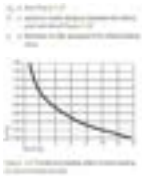
F S1 = table only goes to 3, wheel distance = 5 -> calculate graph with graphing calculator -> x & y inverted for convenience -> formula = 15,19x^2 -24,27x +10,56 -> calc, intersect with y=5 -> *F S1 = 1,32 internal*
Same method for edge: 29,5x^2-51,75x+23,70 - > = 1,24

These factors come from table sheets. These are included in the appendix.

k3 = 1.2 voor internal loading, 1,05 voor edge loading
k4 = 1,16 voor concrete strength 40 MPa

*Internal: F1 = 2,15*1,35*0,97*1,32*1,2*1,16 = 5,17 -> axle load = 256 kN -> **Thickness = 160 mm***
*edge: F1 = 2,15*1,46*0,99*1,24*1,05*1,16 = 4,69 -> **thickness = 250 mm***

For combined wheel- and post loading, a correction factor is required. The formula for this is.



S = assumed distance between post loading and driving containers 1m+. Therefore, S=1

Internal: S/t1 = 1/0,16m = 6.25 -> Ω1= 0,45

Edge: S/t2 = 1/0,18 = 5,55 -> Ω=0,55
P post = 58 kN
P axle = 256 kN

Internal: *F c1* = 1 / (1 + 0,45 * (58/156)) = 0,86
Edge: *F c1* = 1 / (1 + 0,55 * (58/156)) = *0,83*

Final results F c * F c1
Internal: 0,86 * 5,17 = 4,45 -> 180 mm for combined wheel loading
Edge: 0,83 * 4,69 = 3,89 -> 290 mm for combined wheel loading

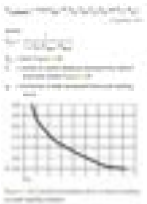
Post Loading

f all = 1,91 MPa
F E1 = 1,34 for 45 MPa at the edge, 1,45 for 45 MPa at the interior
F H1 = zeer vast zand op ca. 9 meter, zand tot 24,5 m. Waarde voor 9m = 0,97
F S1 = Least optimal scenario -> see image
Average post distance = (7*6,06+7*5+4*0,6+4*0)/22 = 2,6 m -> F S1 = 1,425

P = 58 kN

Interior: F 1 = 1000 /(1,91/58) * 1,45 * 0,97 * 1,425 = 66 -> **195 mm**
Edge: F 1 = 1000 /(1,91/58) * 1,34 * 0,97 * 1,425 = 61 -> **360 mm**

For combined wheel- and post loading, a correction factor is required. The formula for this is.



S = 1
S/t1 = internal: 1/0,195 = 5,13 , edge: 1/0,36 = 2,78
Ω1 = internal: 0,045, external: 0,12

Internal: 1/(1+0,045(156/58)) = 0,89
edge: 1/(1+0,12(156/58)) = 0,76

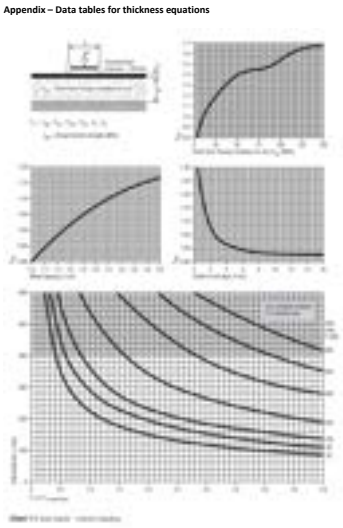
Final results F t * F c1
Internal: 0,89 * 66 = 58,7 -> 200 mm for combined wheel loading
edge: 0,76 * 61 = 46,36 -> 440 mm for combined wheel loading

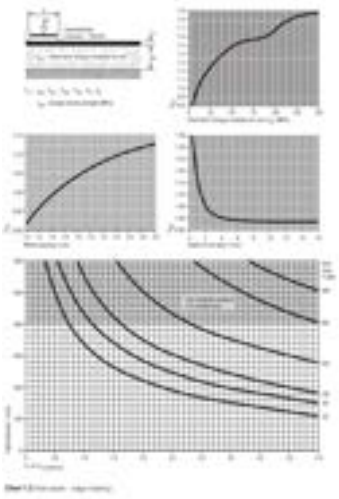
Commented [ES1]: Different graphs for edge loading

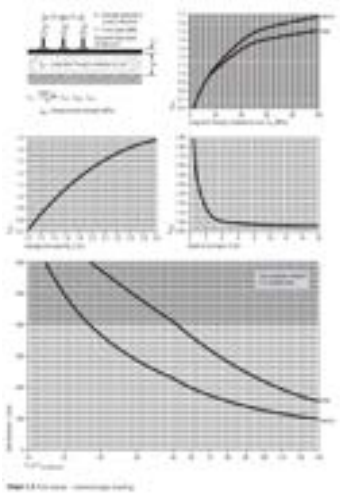
Week 4.2

DC floor calculation

This calculation was very complex, and took a long time. But it was also very important to the BT part of the design. From the research and calculation came a lot of conclusions for the floor detailing.


Appendix – Data tables for thickness equations

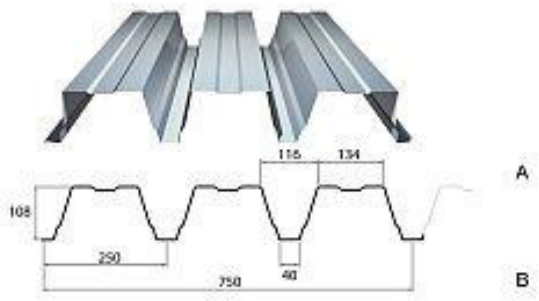




Week 4.3

FUlly designing building parts

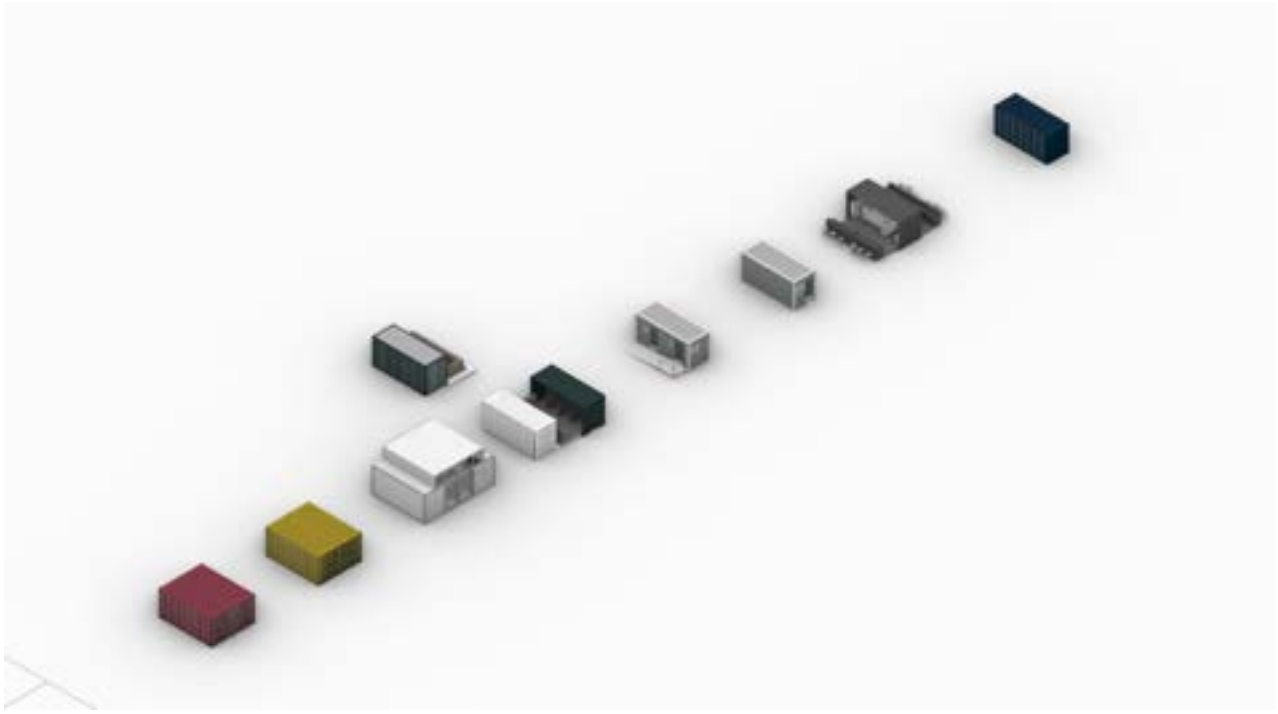
In this week I started working ahead to P4. I designed the final versions of all the containers, looked at the implementation of the pretty plastic, and also the reused materials from the canopy and Binckhorst.

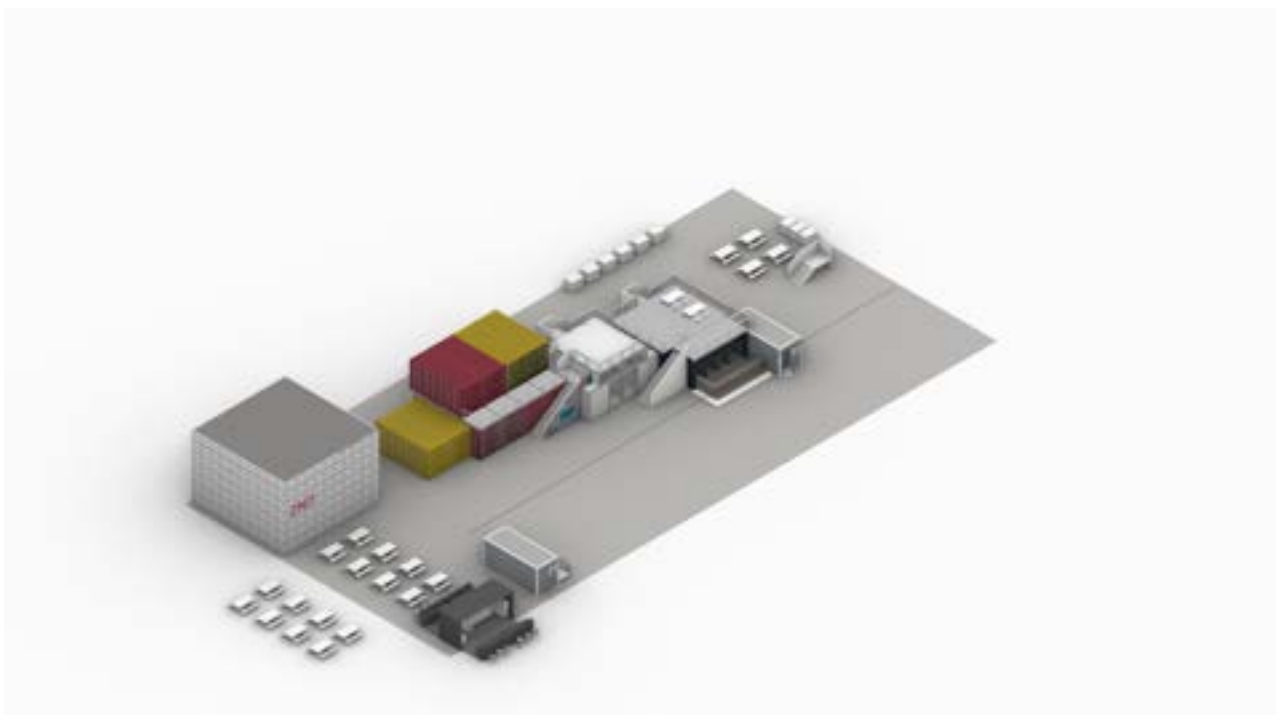


Week 4.3

Fully designing building parts

In this week i also looked at temporary structures for the square for when it's not being used. These could also be in containers and could fulfil a role in the whole. I didn't manage to get this into P4, but this will certainly be something for afterwards





Moving the second concert hall for more freedom in the middle

Week 4.3

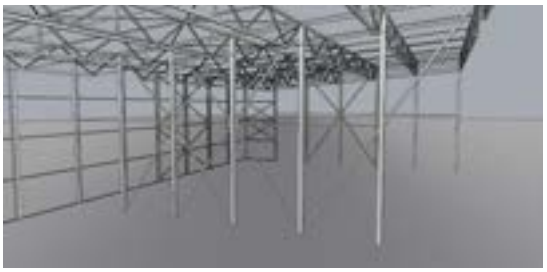
Temporary structures square

In this week i also looked at temporary structures for the square for when it's not being used. These could also be in containers and could fulfil a role in the whole. I didn't manage to get this into P4, but this will certainly be something for afterwards

Week 4.3

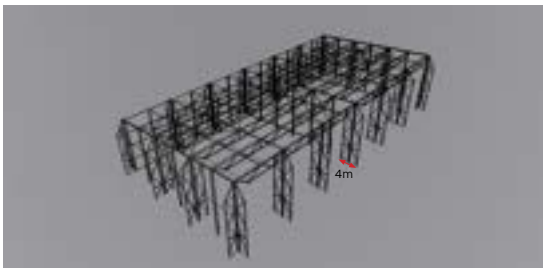
Structural design consultation

Question regarding stability and removing crosses for the space

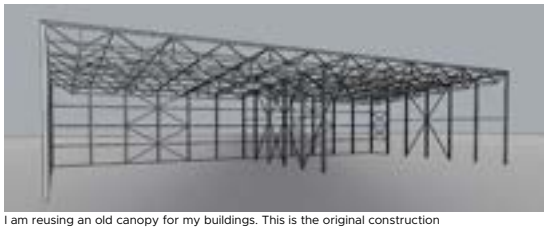


The middle columns and stability crosses look like this

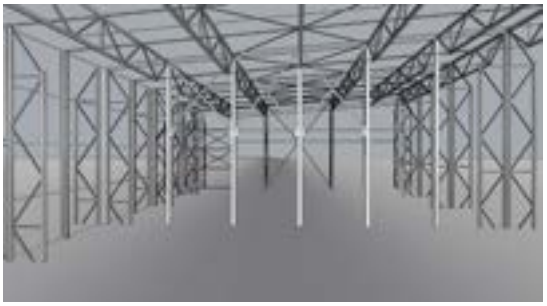
Question 1



I want to however change the building. I have a second canopy, which I want to take apart for parts. The trusses carrying the roof of the second canopy will be added to the facade of the first construction. These will carry the facade.

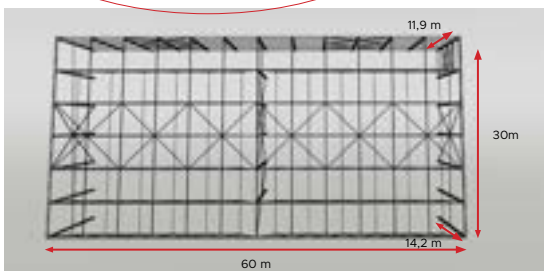


I am reusing an old canopy for my buildings. This is the original construction



To make the hall more of a continuous space, where the stability crosses are not in the way, I want to change them in the middle part to this. The image above shows the new version.

My question is: With the addition of the trusses on the facade, are these crosses enough to keep the construction stable? Would it even be possible to completely remove the wind-crosses in the middle row?



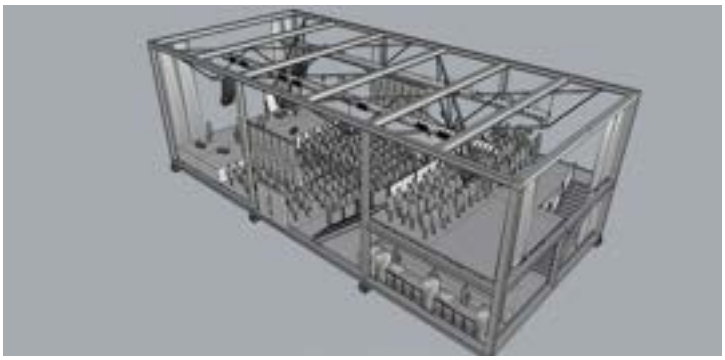
Seen from above it looks like this. The construction features stability crosses at the back-side, top side, and in the 3 planes on the sides and in the middle of the building.

Week 4.3

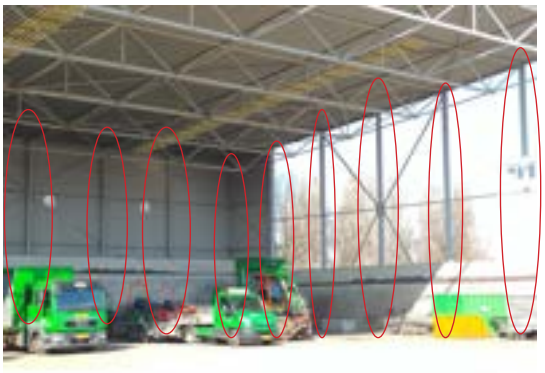
Structural design consultation

Question for welding reused beams

Question 2



I'm making the structure of my concert hall from steel HEA-Beams. These are re-used from the second part of the canopy. This means however that some of these beams are not long enough, and need to be welded to make them the right length.



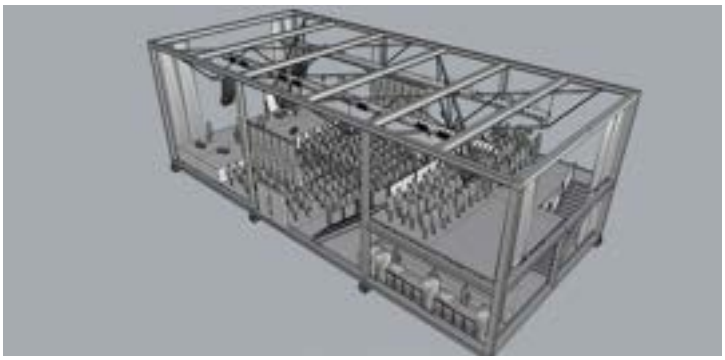
My question is: are welded together steel beams as strong as new HEA-beams? If not, what is the reduction of carrying force I can expect. Can you just weld the heads of beams together, or do you for example need to use an in-between piece. Is it even feasible to do a construction this way?

Week 4.3

Structural design consultation

Question for welding reused beams

Question 2



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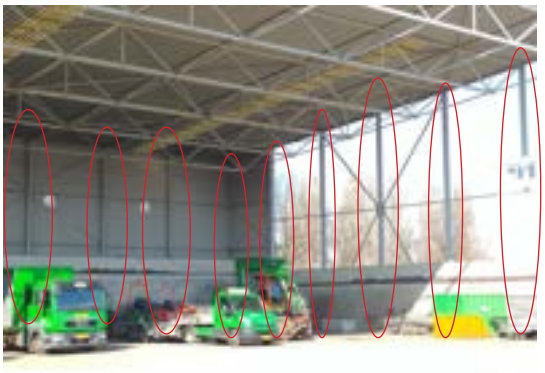

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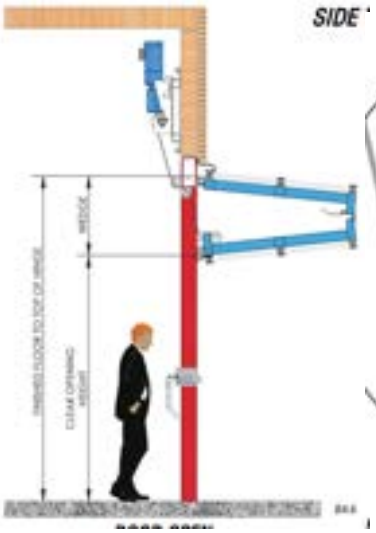
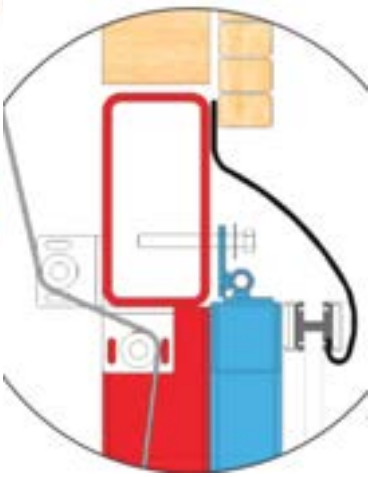
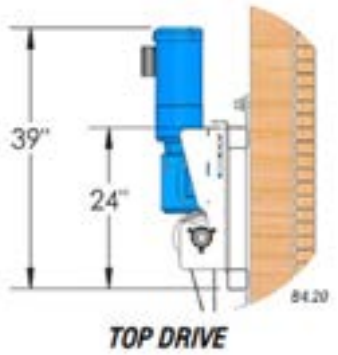
Starting work on 1:20 facade piece. Research into the system, its components and how to integrate it.

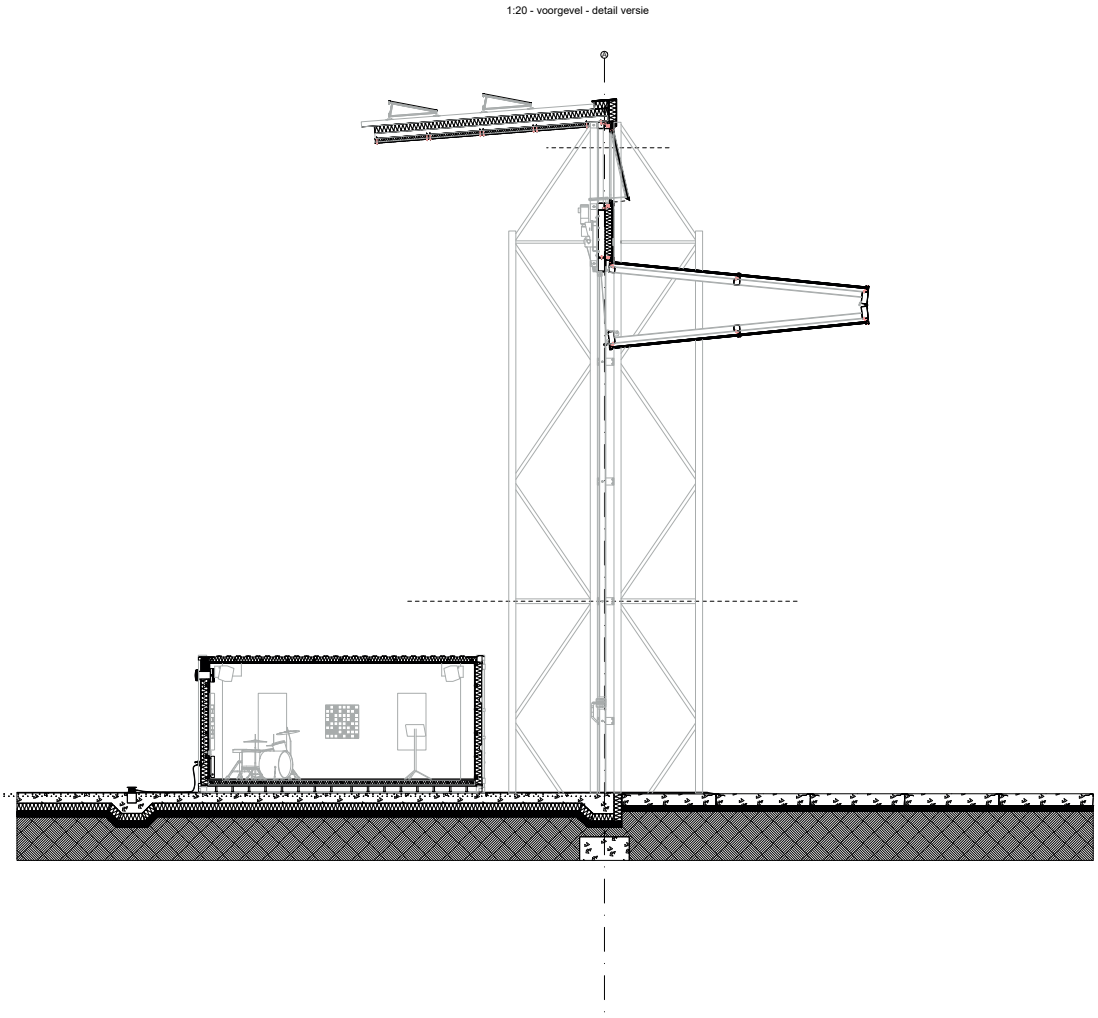






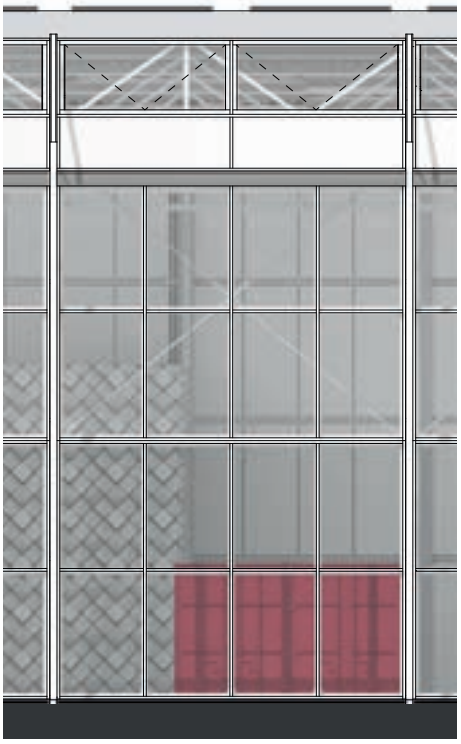
Week 4.3

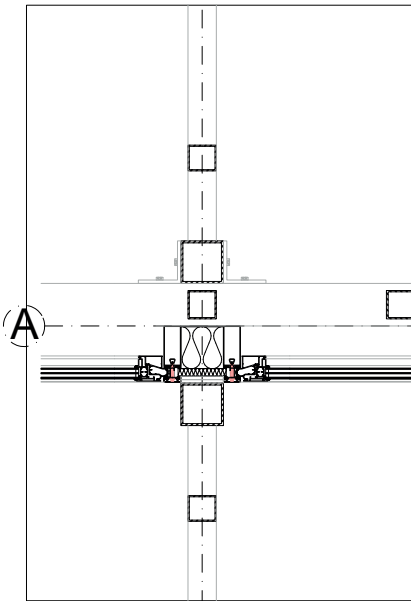
1:20 modelling

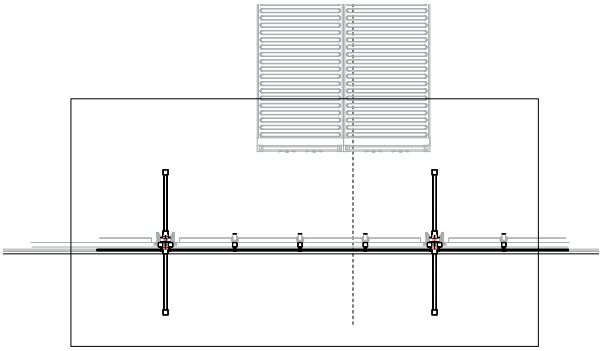


Week 4.4

Designing facade







And the rest is finishing up
the building and working for
P4. You can find this in the
presentation and on the poster