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Building with dunes; A year round beach pavilion

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Graduation plan

Stagnating grow coastal area

In the interdepartmental study of Kust op Koers is pointed out:
The grow of the coastal areas is stagnating, as a perspective to come out of this down going spiral we have to increase the quality of the existing building boundary, by stimulating the own character of these coastal area´s and to stimulate innovation of the touristic sector

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Graduation plan

Stimulate year round pavilions on the beach..

Strandpaviljoen Take five - Zandvoort

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Graduation plan

Problem 1 : Sand sedimentation blocking

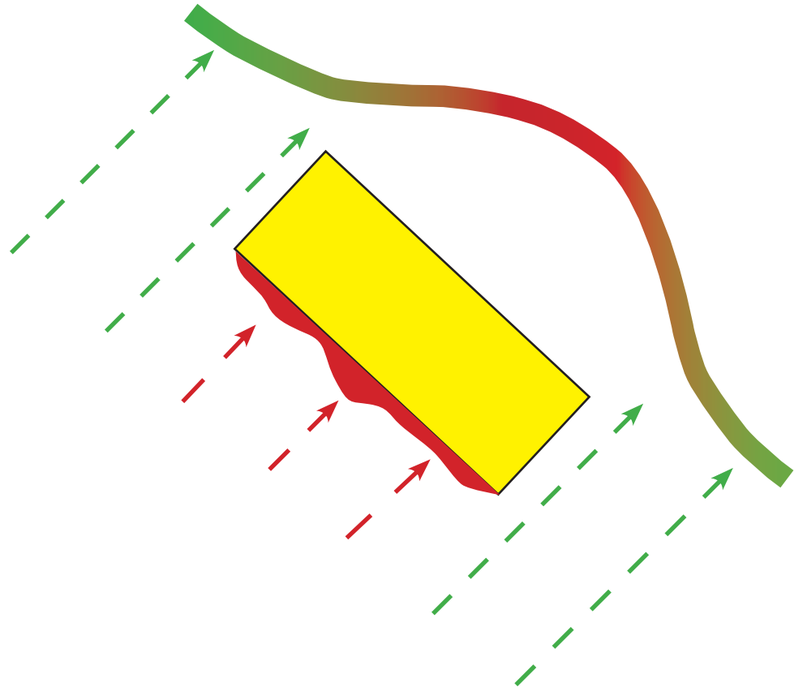
- stagnating grow of coastal area's

- government stimulates year round beach pavilions on the beach

- pavilions in front of the dunes blocks the sand

- dunes cant grow / repair itself

- dunes will get weaker



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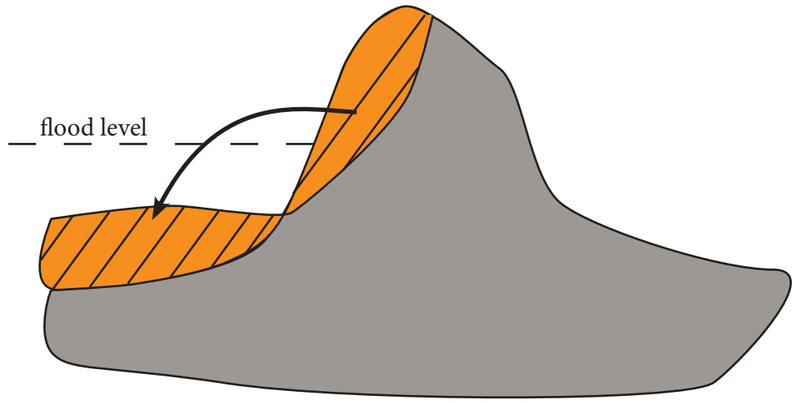
Graduation plan



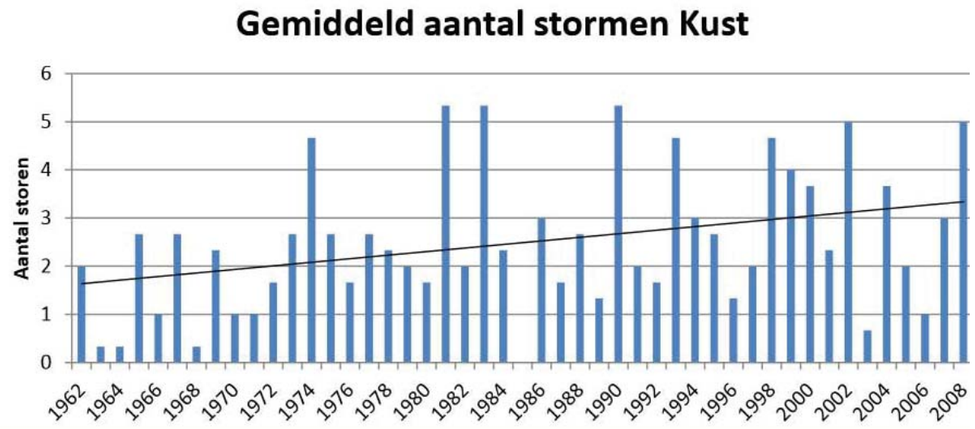
Problem 2 : storm erosion

- Water reaches the dune in times of storm

- waves collapsing on the dune causes dune to deform

- dune loses height and mass

Storm erosie Egmond aan zie 6 december 2013



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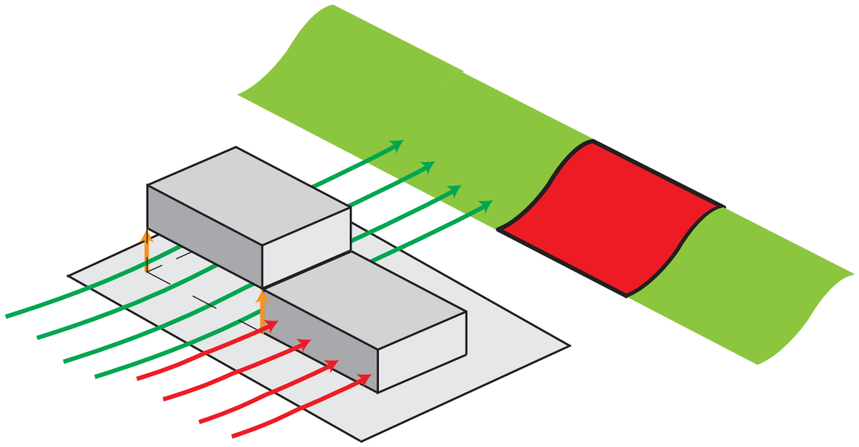
Solution

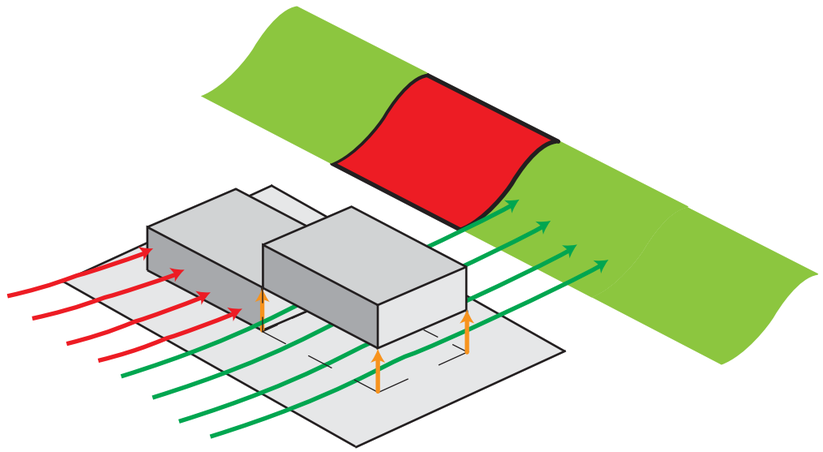
Pavilion that can move up and down

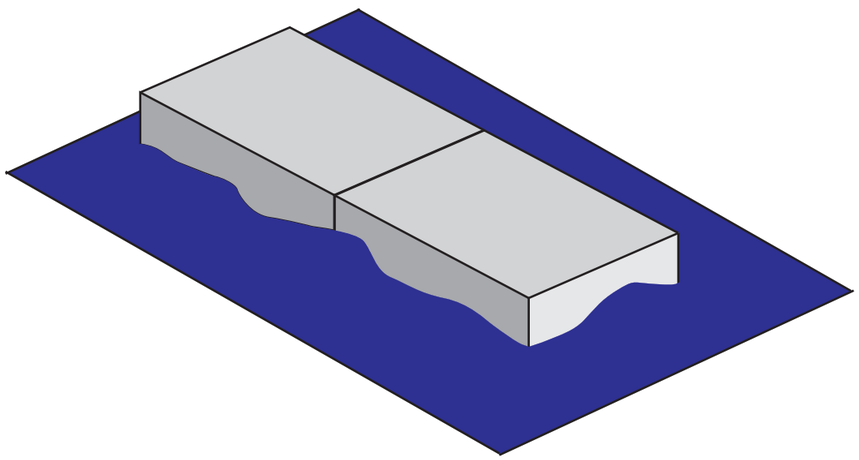
Sand can get to dune underneath the building

By dividing the building into two elements, different parts of the dune are blocked periodically while still having a connection to the ground

Can uset he mass of the downgoing part as counterweight for the upgoing part







In times of storm both parts are brought down to block incomming waves

Reduces the impact force of the water on the dunes

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Mechanical inspiration

Jack up rigs

Basic principle of how the pavilion should move up and down

works on hydraulics

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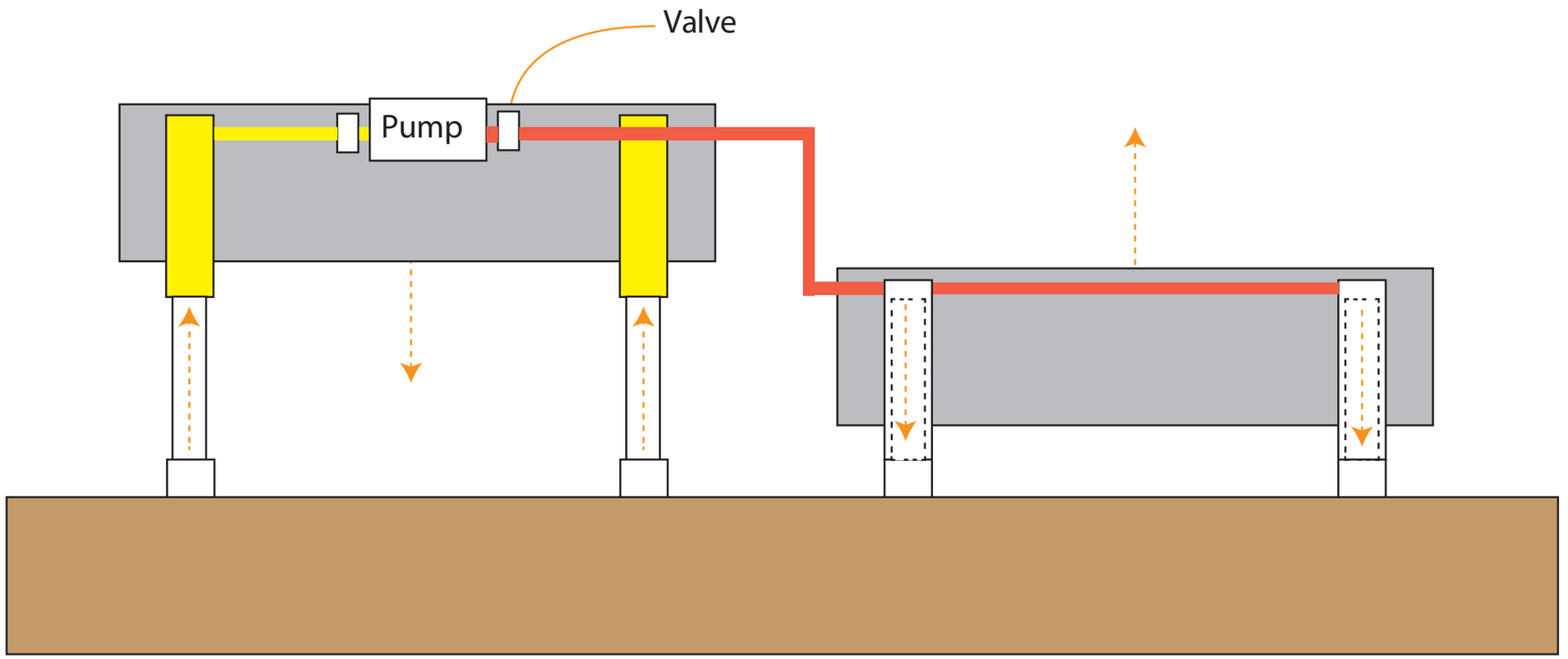
Hydraulic principle

Use weight of one part to move the other part

Pump to produce the the pressure that is still needed and for control

Valves to block the system



Hydraulic fluid supply

Hydraulic pressure

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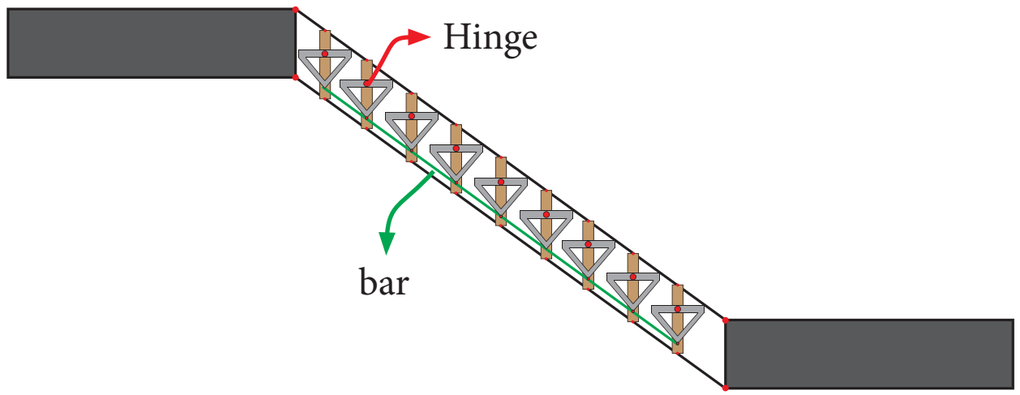
Stairs

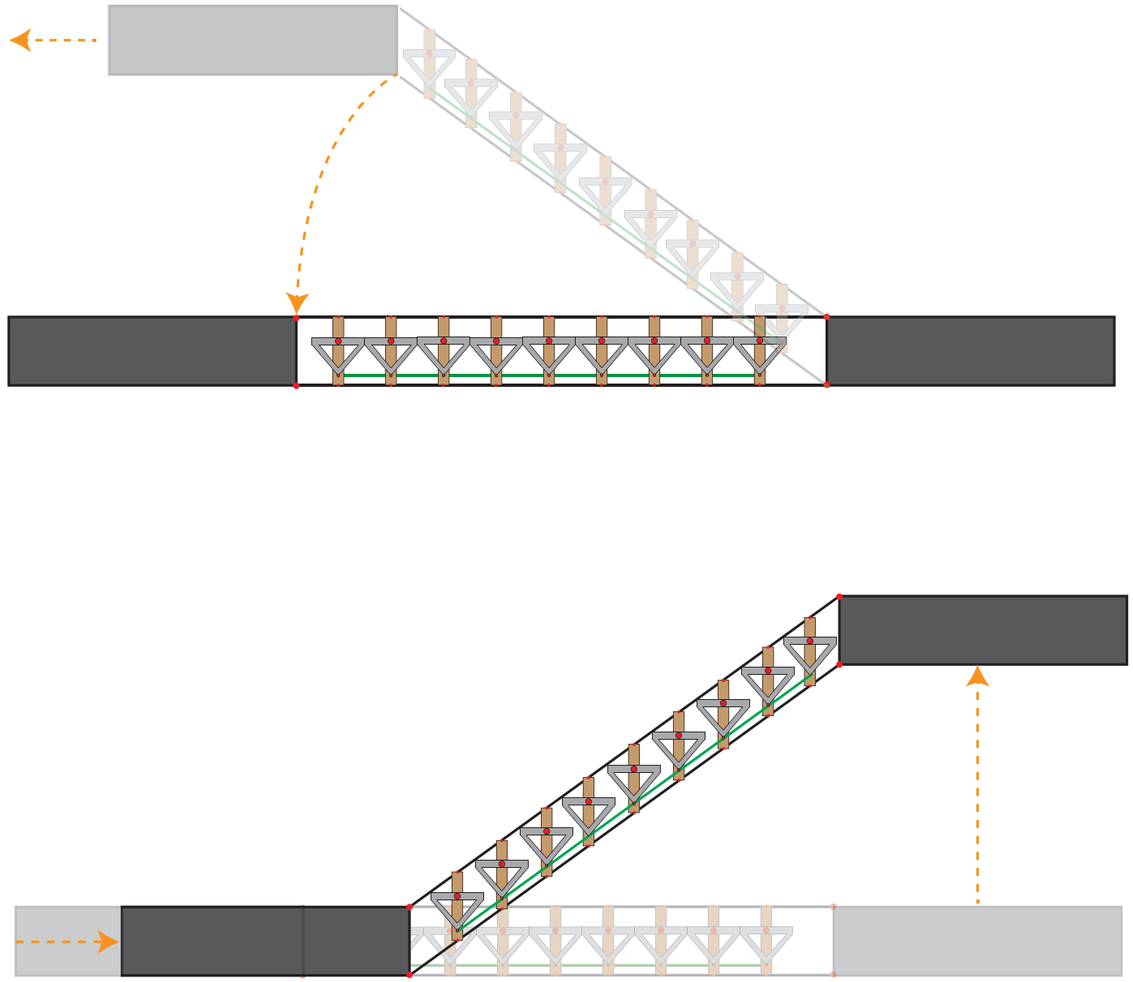
stairs connecting the two parts of the pavilion

- steps connected to a bar at the bottom and to a hinge at the top

- this causes the steps to remain horizontal when moving up or down



- one part of the construction can move back and forth in order to absorb the horizontal movement



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Two functions

Dune protection

Breaking waves

Closed exterior
Strong construction
Watertight

VS

Beach pavilion

lounge and party environment

Open exterior
Light atmosphere

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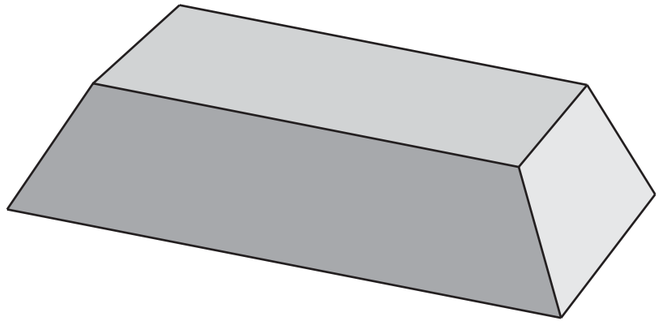
Open vs Closed

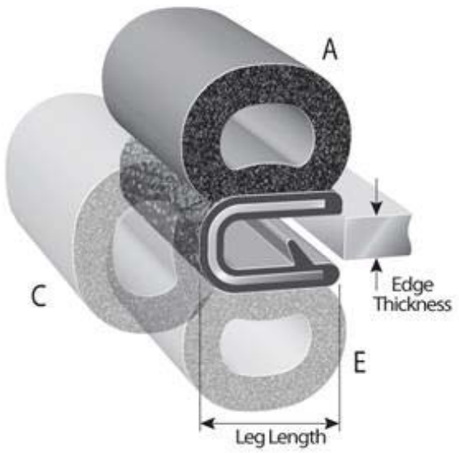
Closed during storms



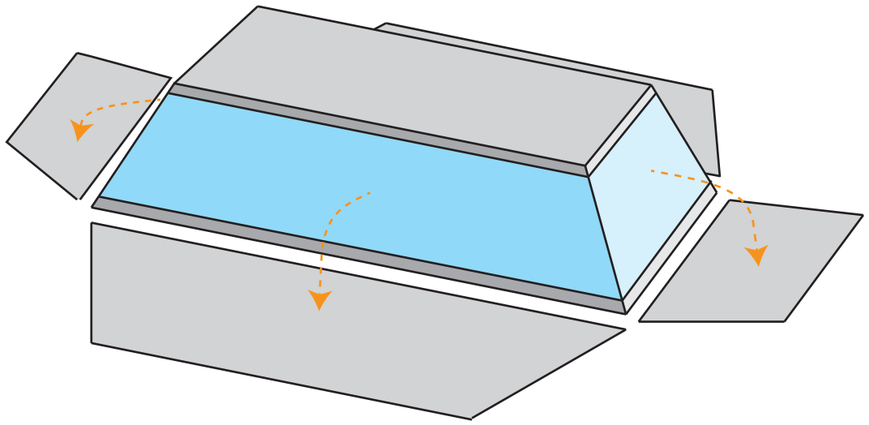
On average about 4 storms a year with wind speed of 9 or higher

protection facade has compression seals along the edges

the facade is pushed against the roof and floor element by hydraulics making it watertight



Open in the rest of the year



Protection facade opens up by hydraulics

Open character

Transparant / translucent facade underneath

Protection facade can be used as terrace

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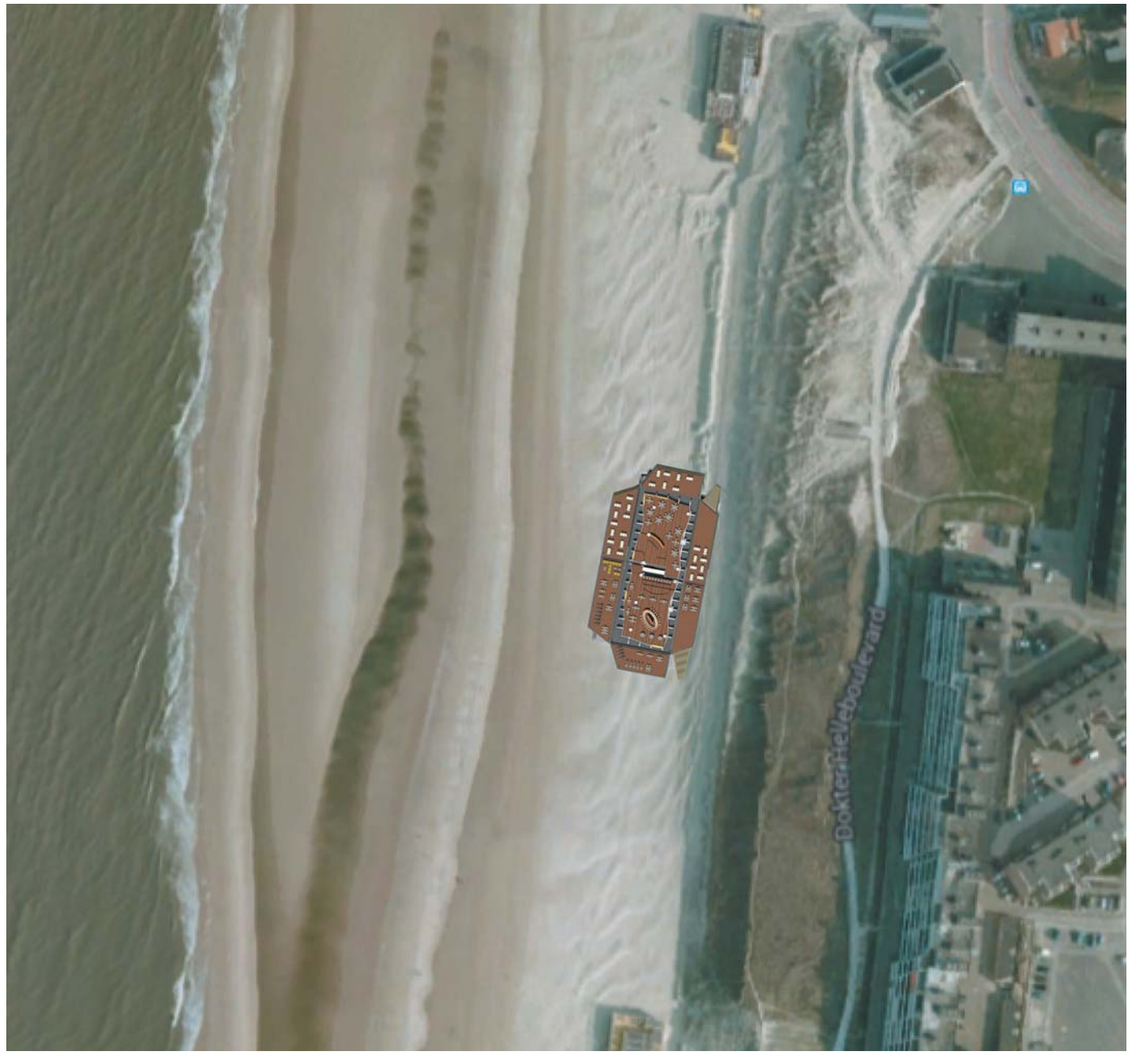
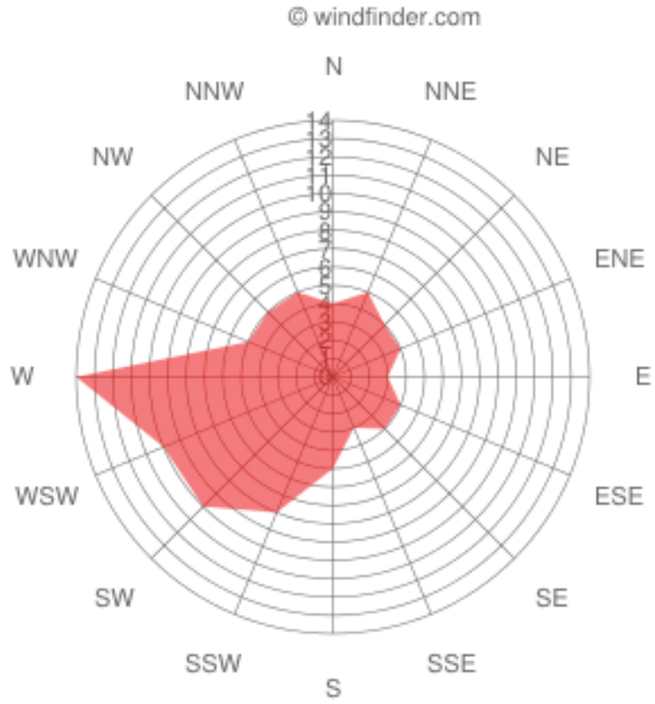
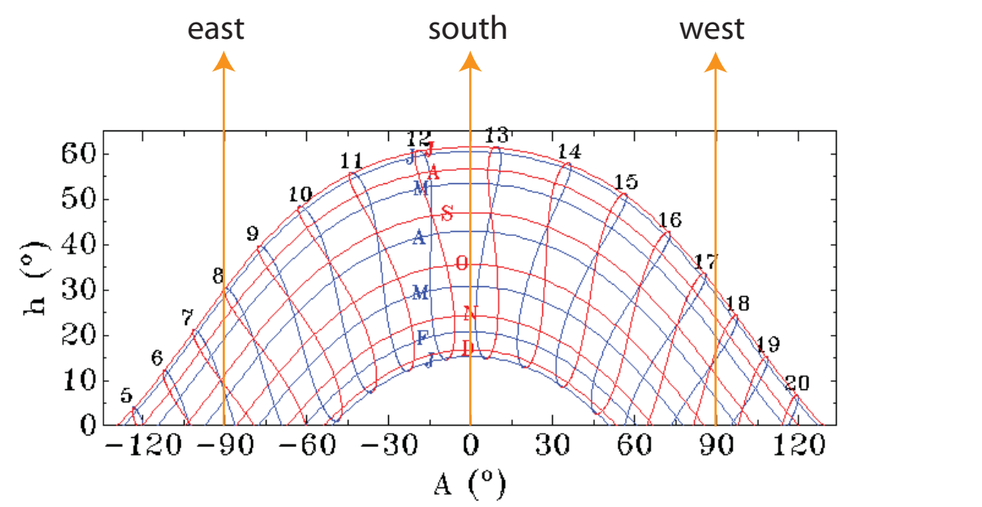
Situation: Egmond aan zee





Main wind direction W - Z/W



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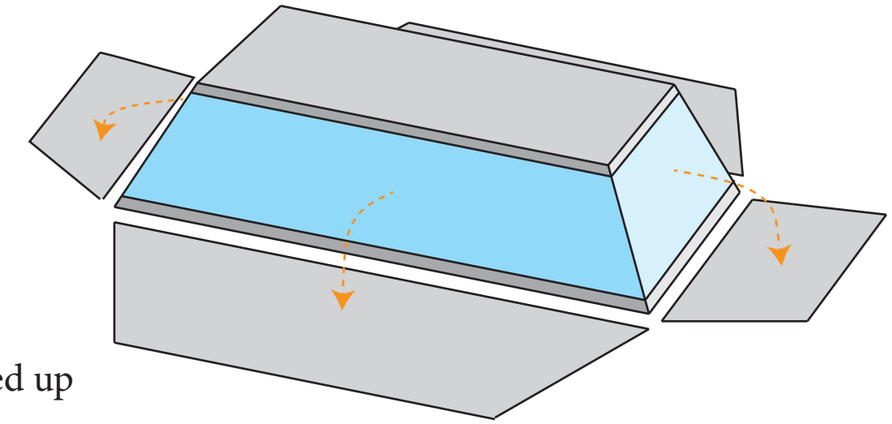
Shape

Rough shape of the building is that of a dike



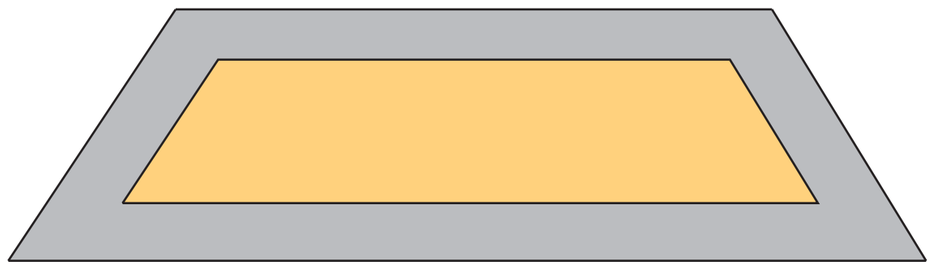
Fits the function of wave breaking

Talud reduces the force of the water on the facade

shape still reminds of dune protection when opened up

Less corners makes water tightness easier

has big flat surfaces so the protection facade can easily be put against the building



Construction on the outside of facade

The protection facade has to rest against it in times of storm

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Facade

Material facade: ETFE

Canvas suits the beach

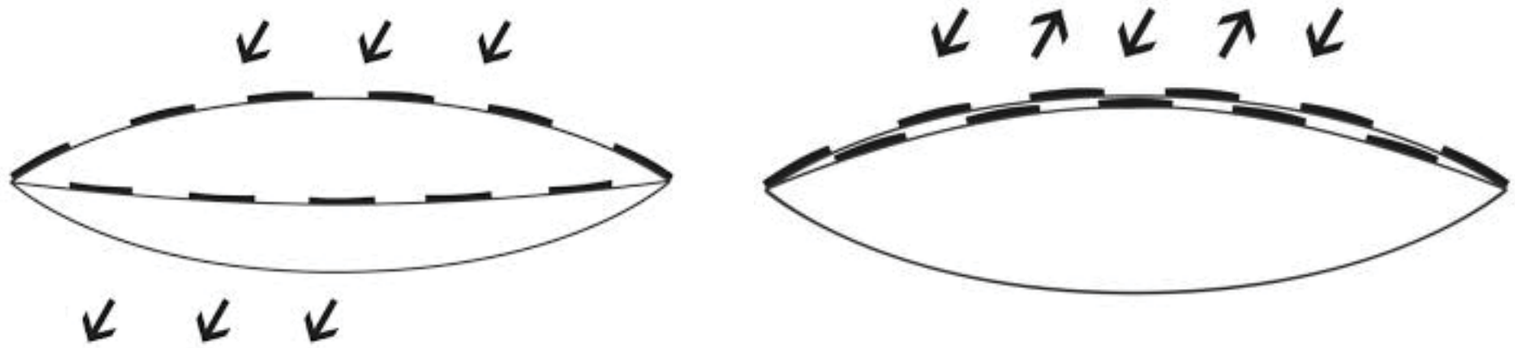
Open character

A lot of light in the building

Facade can light up to create a good atmosphere

Changeable collour to indicate what weather it is going to be or if it is save to swim

Sunshading can be regulated with air pressure and a third layer in between the other two layers



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Facade

Building is in a struggle of what it wants to be, a sollid dike or an open beach pavilion

ETFE takes the shape of the dike, but is trying to open up for the transparant curtain wall underneath

As a result pressure lines in the ETFE construction are noticeable

The facade reflects the dunes and the sea by these waves

Columns amplify the angled shape of the building

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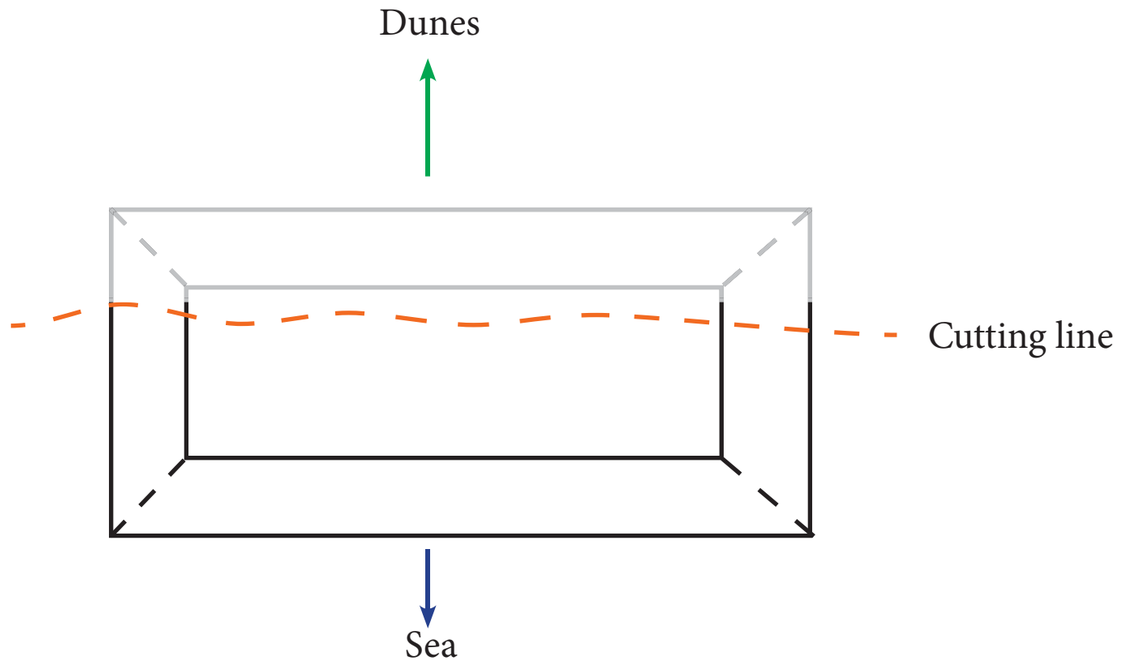
Facade

3 facades with ‘danger’ from the sea

3 facades have a talud with ETFE

Building opens up to the dunes

Facade facing the dune is ‘cut off’ and has a verticall curtain wall



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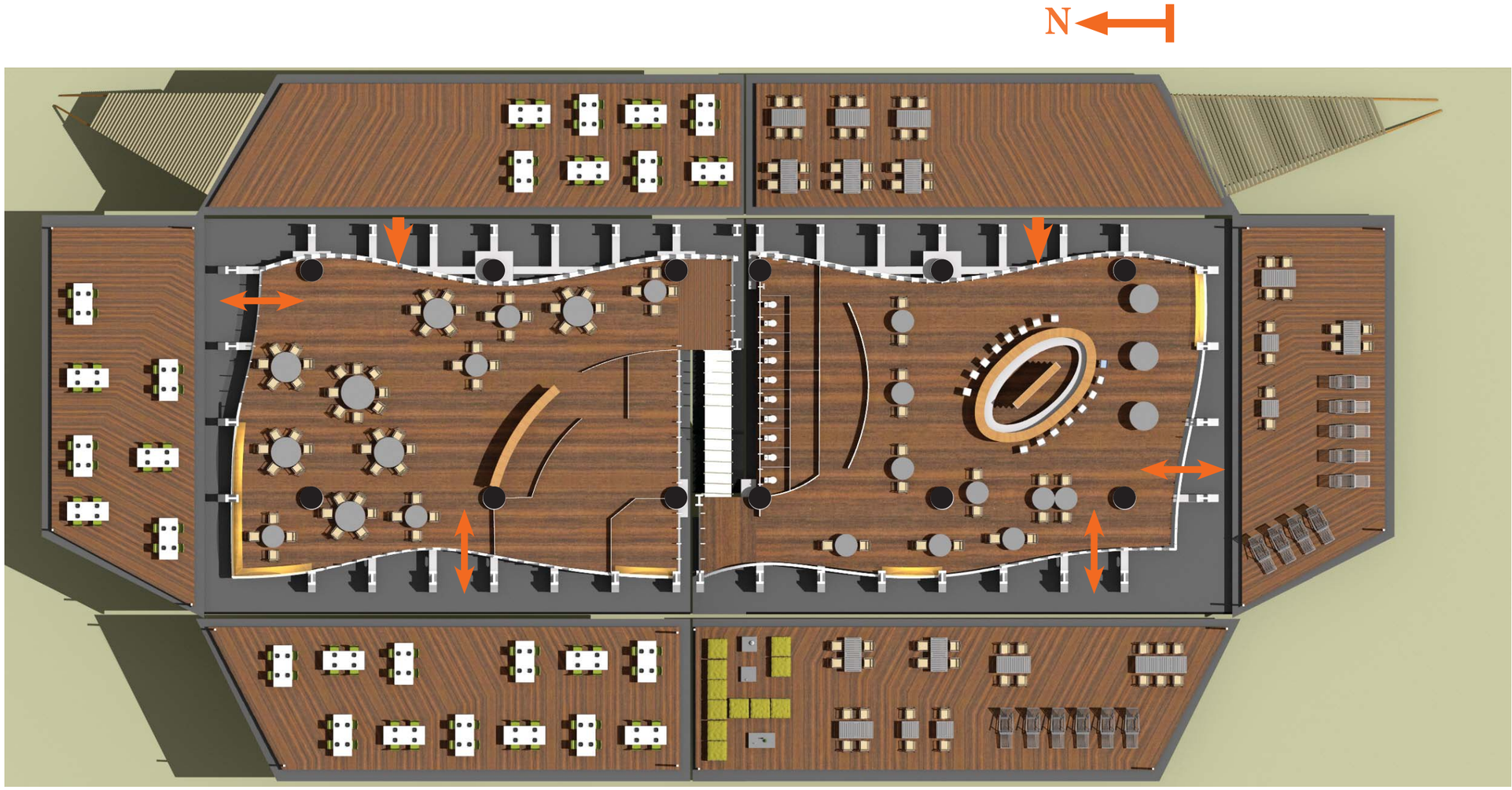
Floorplan

Round shapes in the interior to amplify the rectangular shape of the facade

Left part of the building has a restaurant function

Right part has a bar/lounge function



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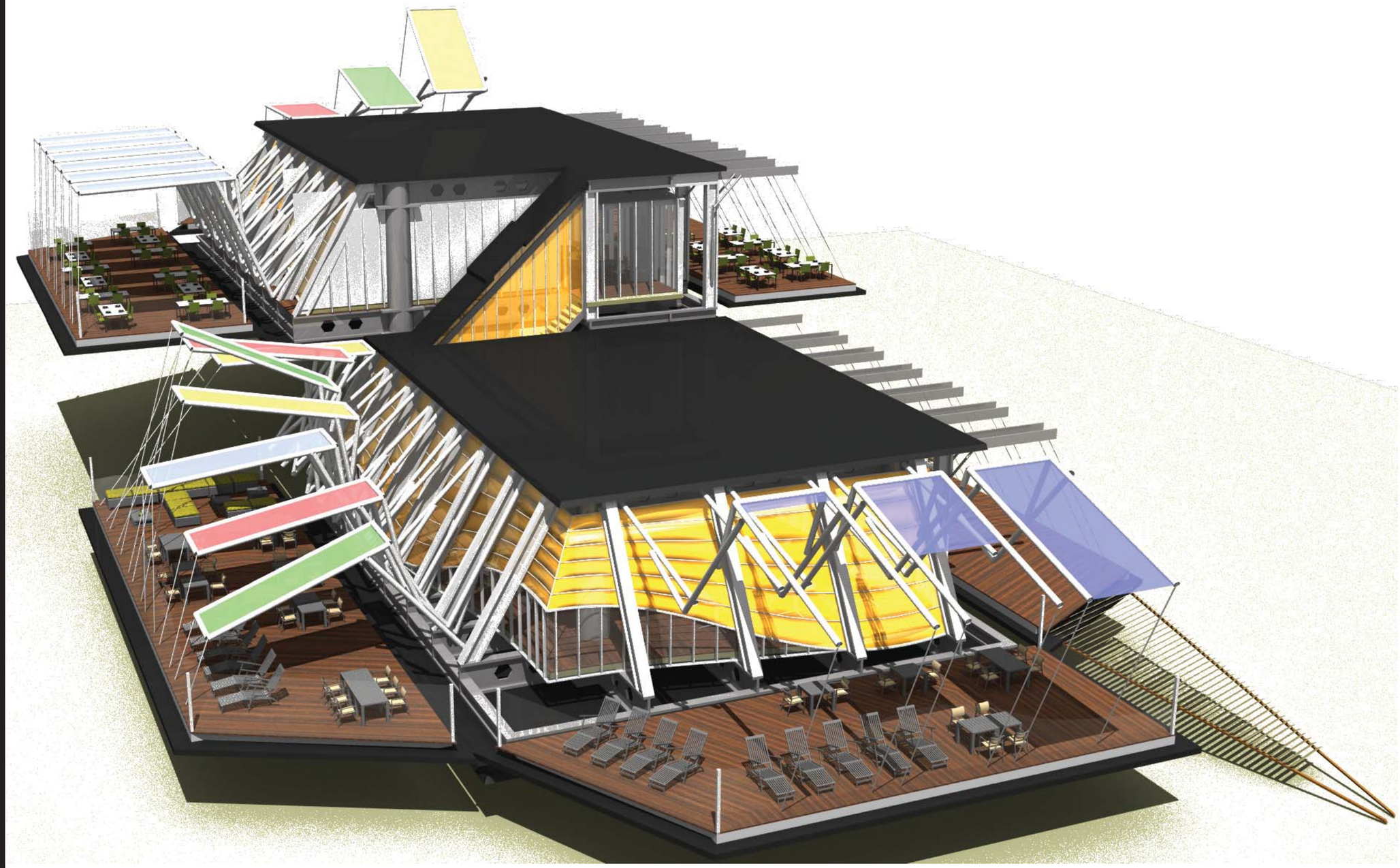
Impression



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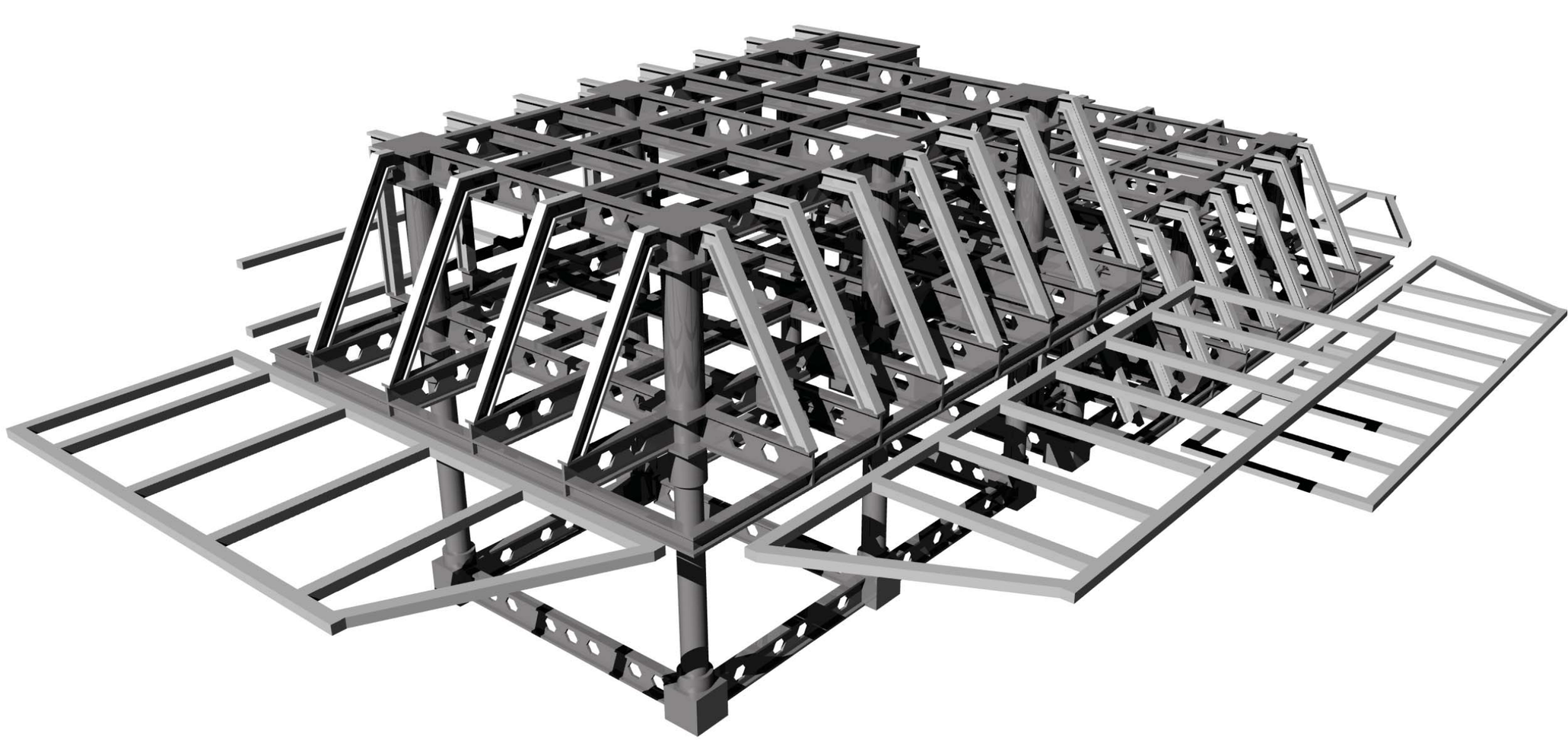
Construction

bottom part : hydraulic part
can move up and down

top part : construction around the building

Facade and insulation placed at the inside
of construction

stiff floor and roof elements



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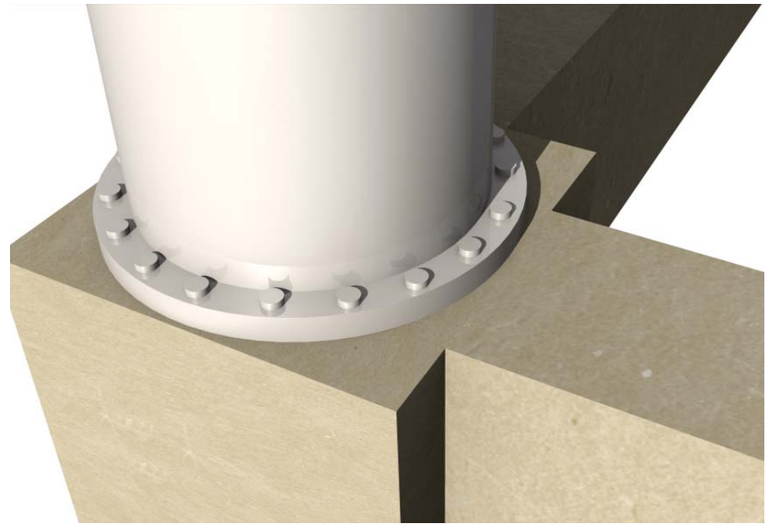
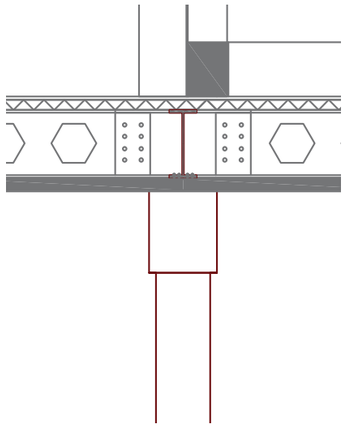
Columns

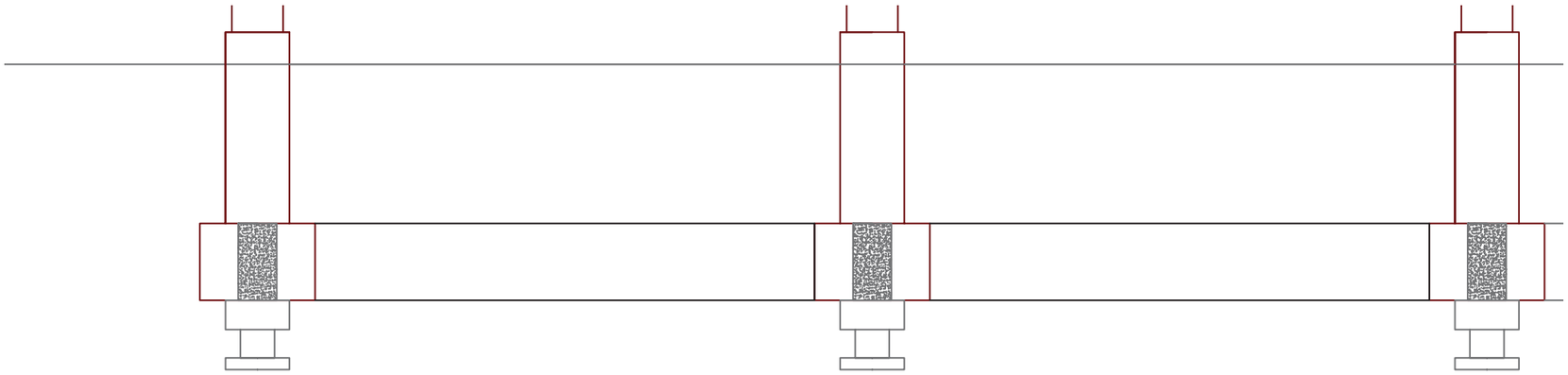
Columns are clamped at the bottom



Hydraulic column elements overlapping eachother for about 2m to create clamp



Manually adjustable foundation to overcome uneven groundlevel



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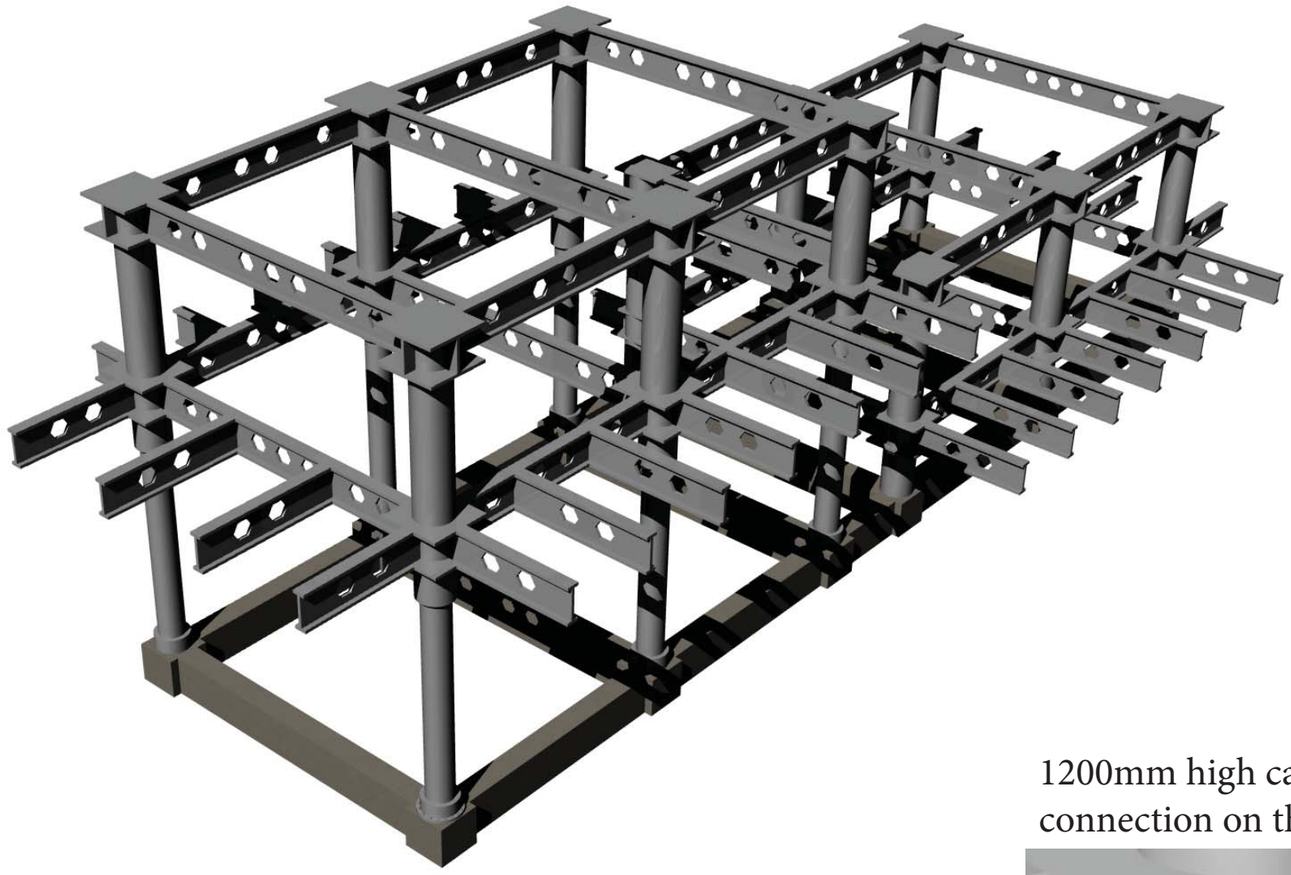
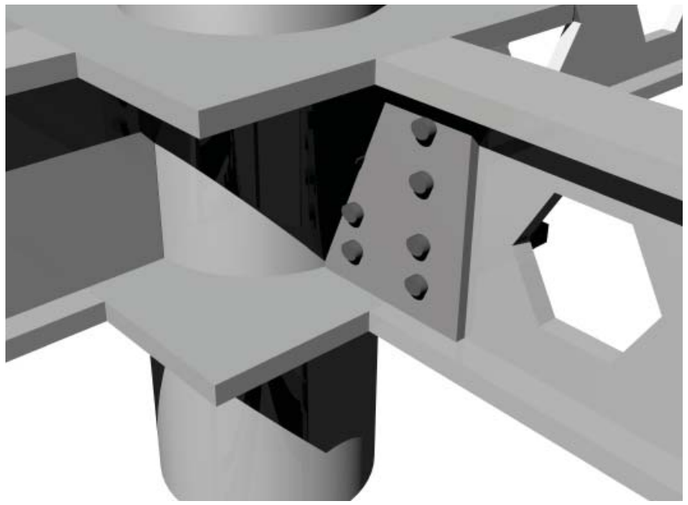
Castellated beams



1200mm high castellated beams to get a clamping connection on the collumns



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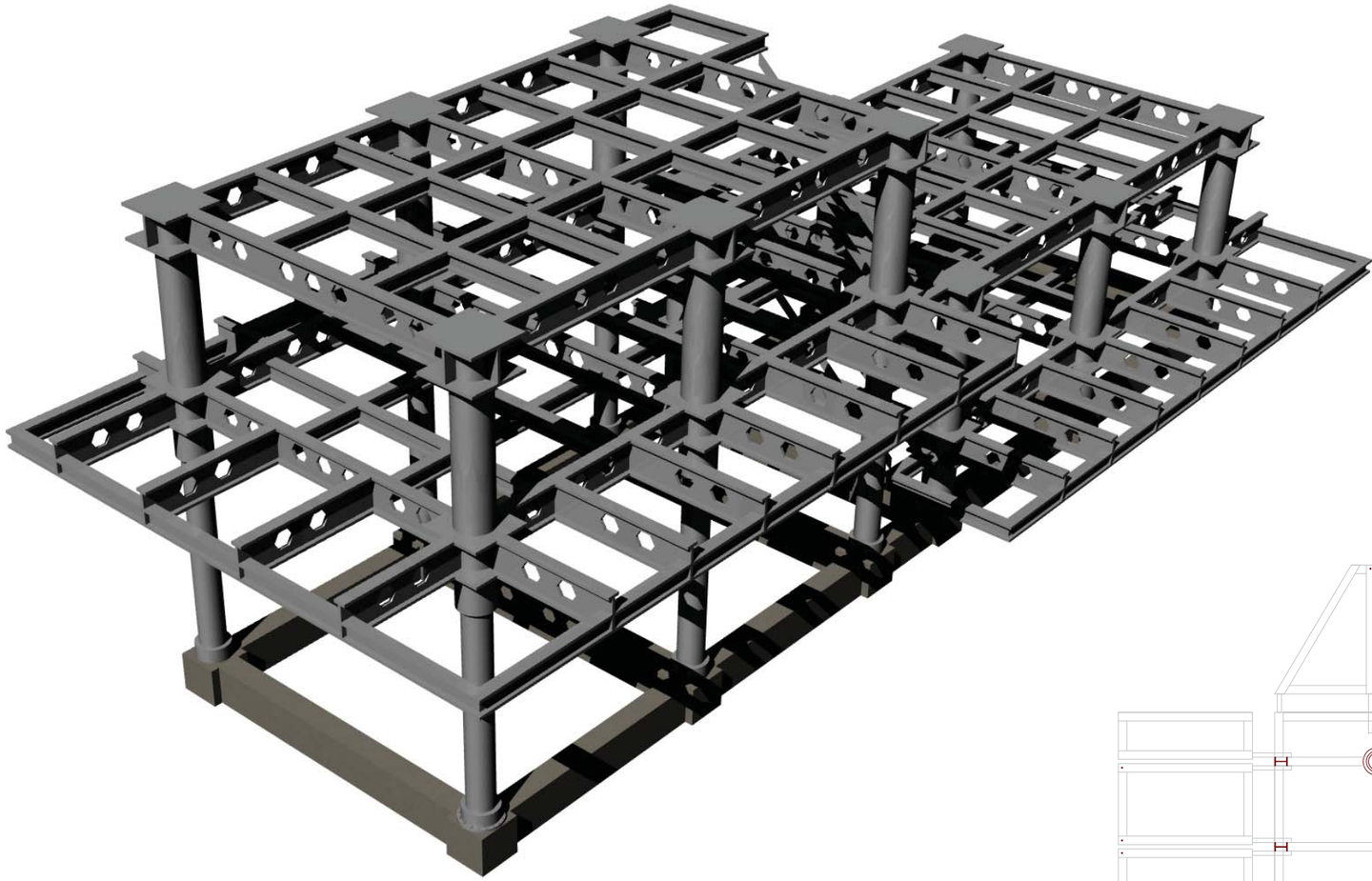
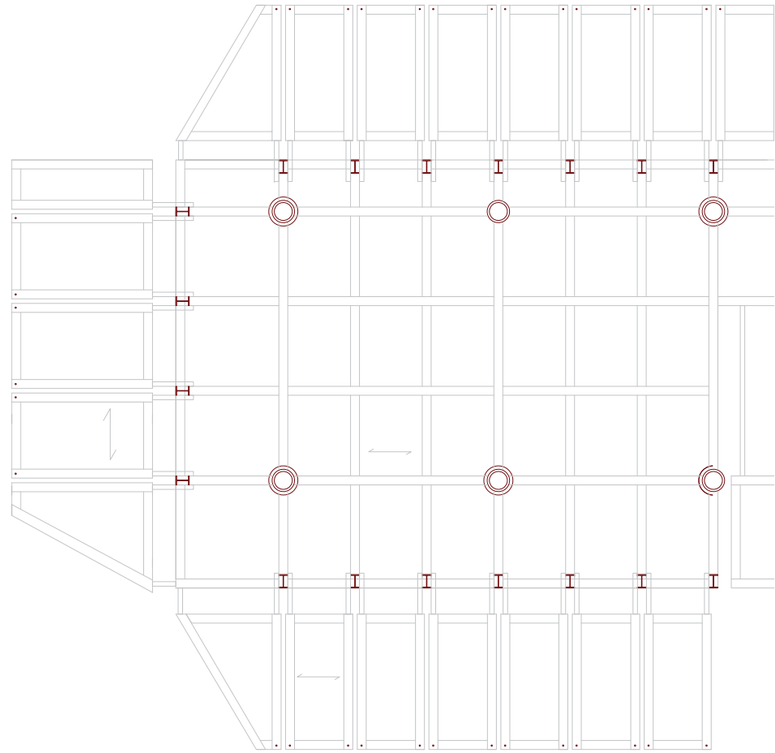
Floor beams

Floor beams connected to castellated beams





Protection plates placed on the outside of the construction

in between the floor beams with a width of 2m becaus of transport

Roof plates placed on top of the beams; floor plates underneath construction

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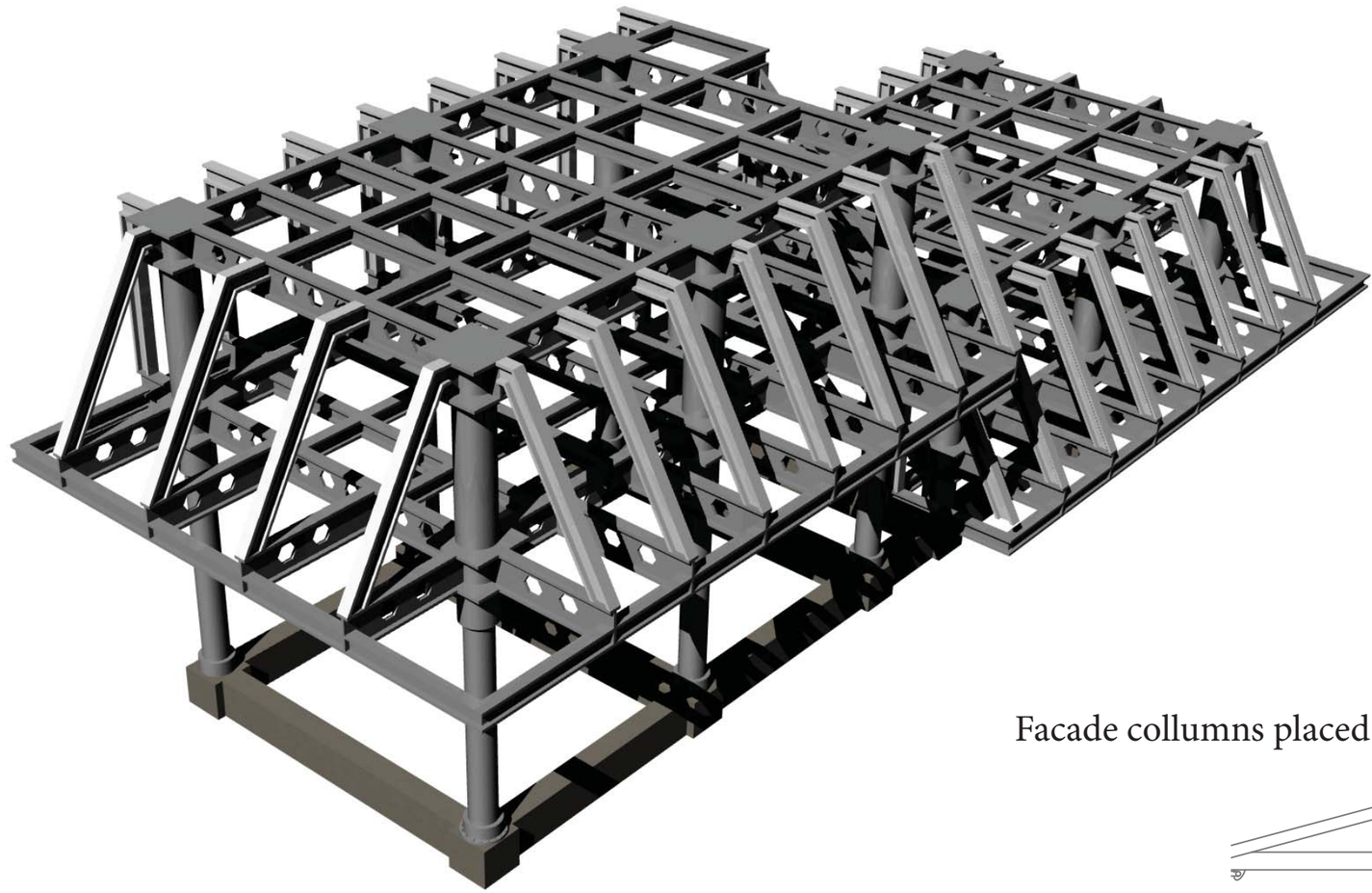
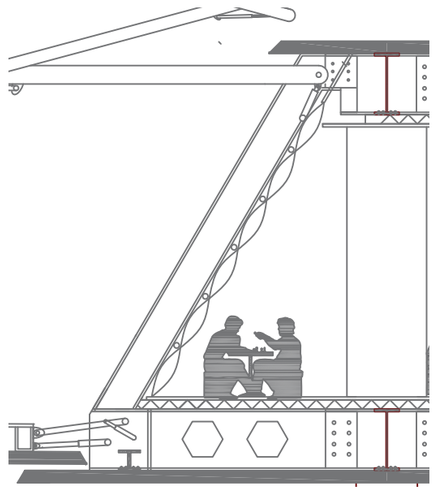
Facade collumns



Facade collumns placed on top of castellated beams



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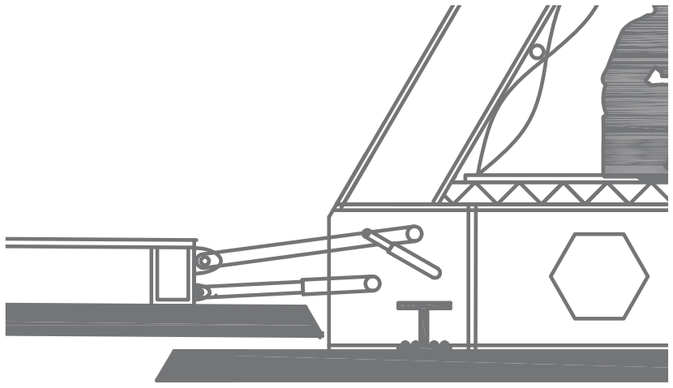
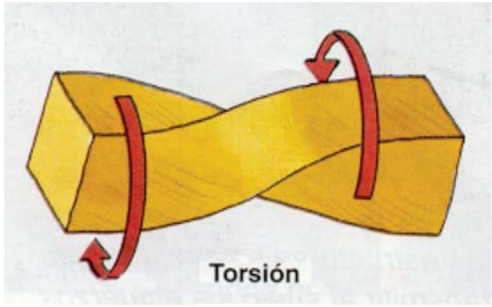
Protection facade / terrace

hydraulic system connected to castellated beams

same lifting principle as a truck door

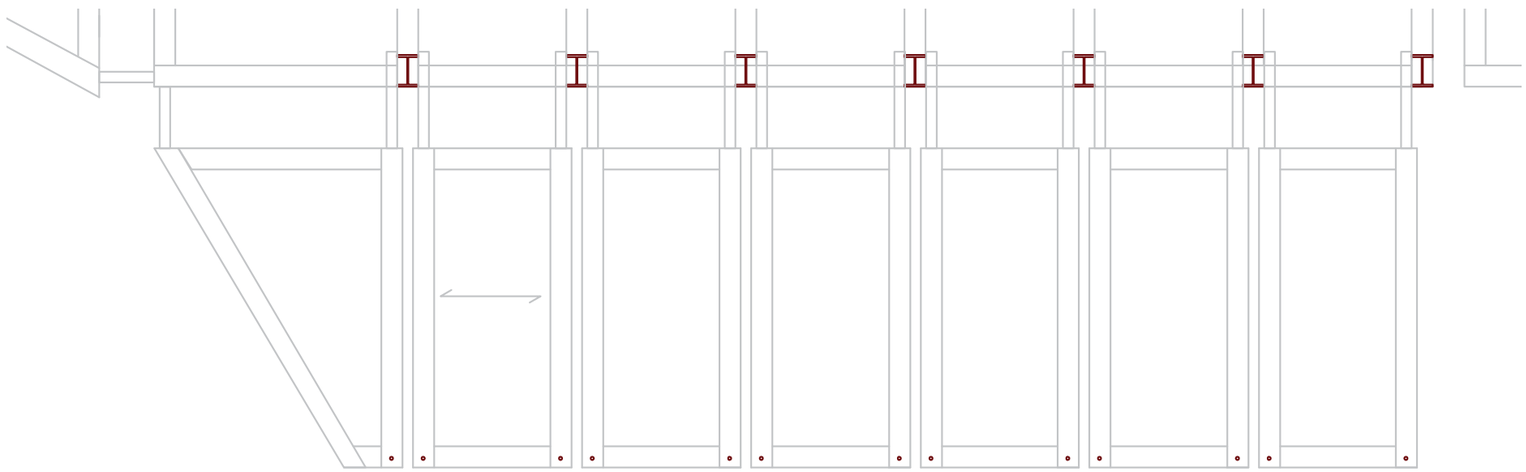


Upper part of the building will get torsion



This will uneven the line in which the hinges of the hydraulic system are placed

protection facade divided into smaller segments to absorb the torsion



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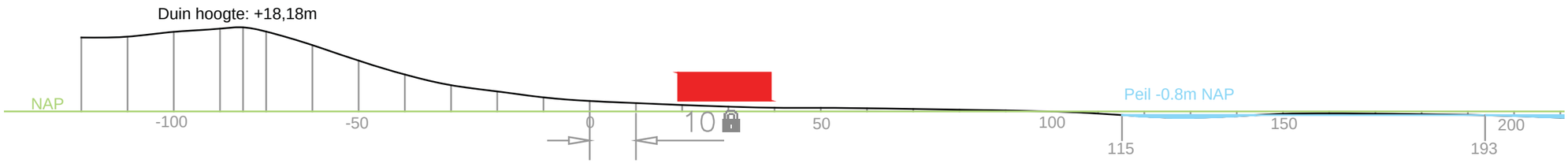
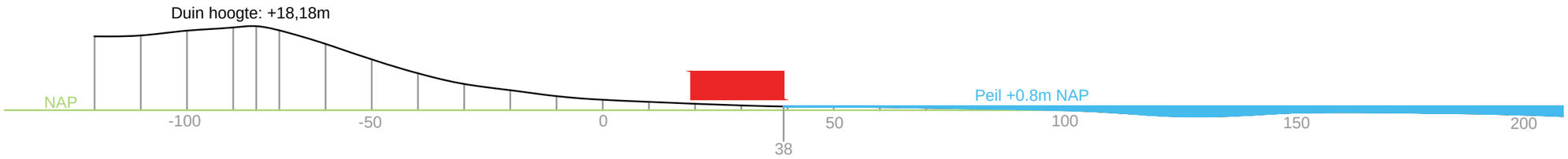
Dune profiles

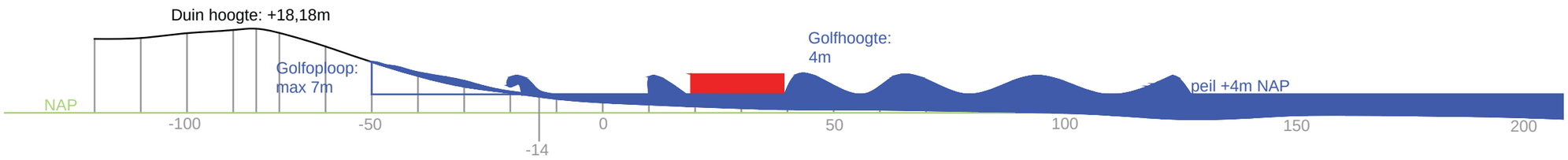
Mean low water



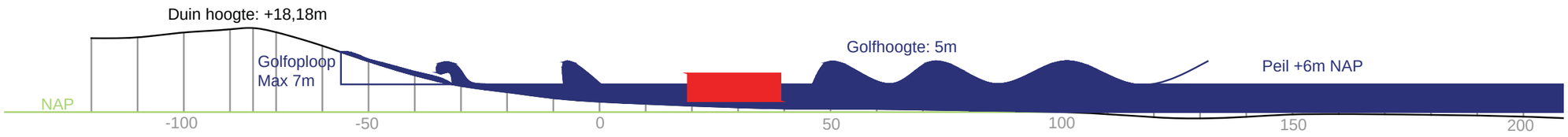
Mean high water



Highest measured



1/10000 year safety factor



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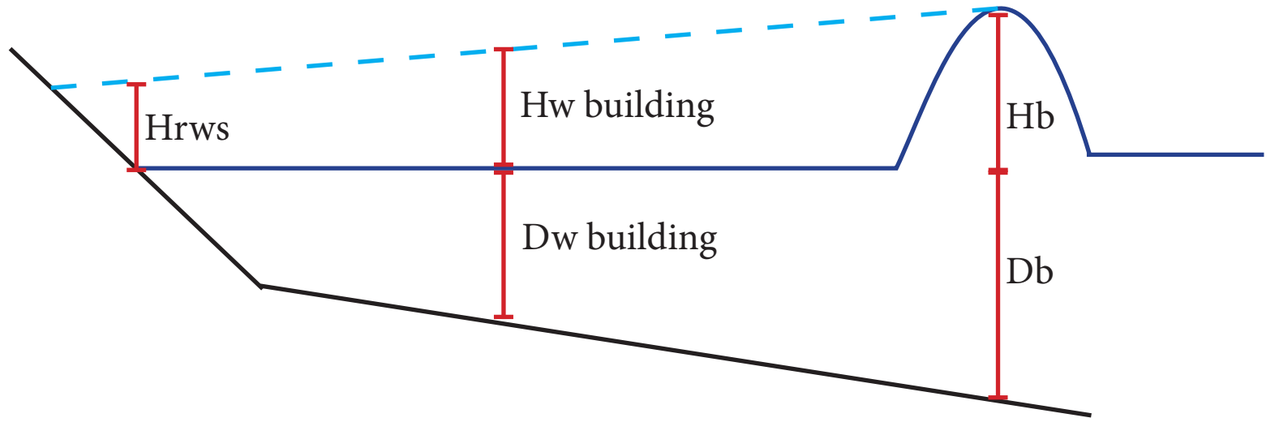
Water height at building

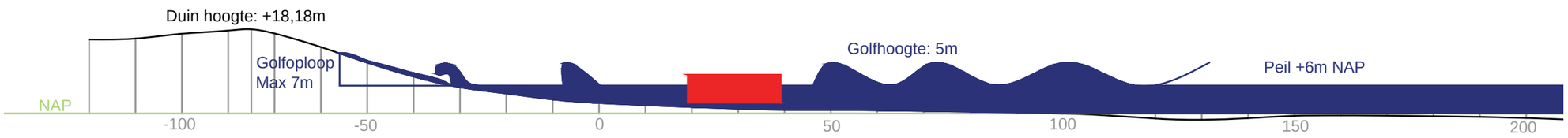


Hb = 0,78 . Db (Wave generally brakes when the height of the wave is 78% of the depth of the water underneath it)

Hw building = (0.2 + 0,58 . (Dw building/Db)) . Hb

Hw building = (0.2 + 0.58 . (5,2 / 6,4)) . 5)) = 3,4 meter

1/10000 year safety factor



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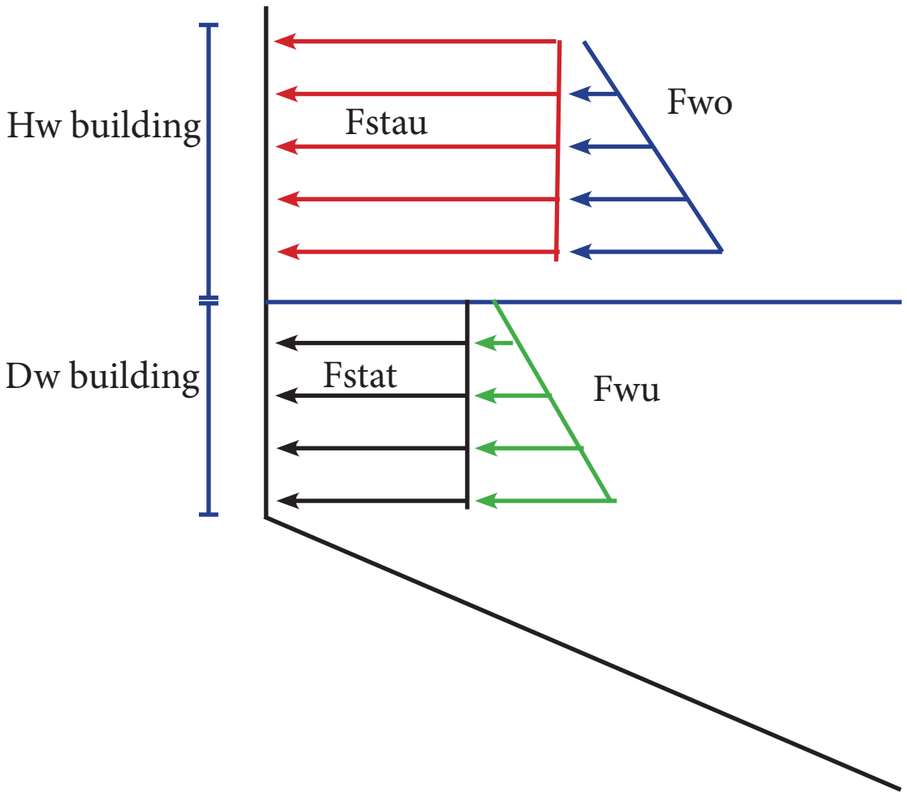
Forces on the building

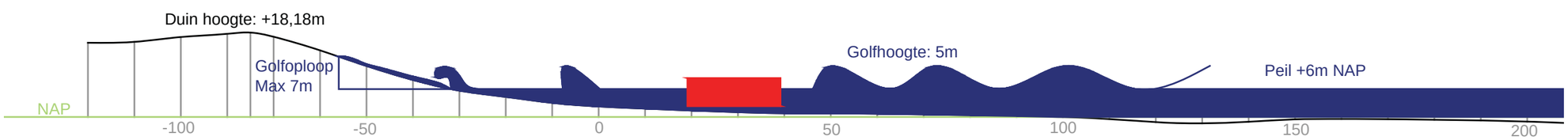


Fwo	= 0.5 . p . g . Hw building^2	[N/m]
Fstau	= 0.5 . p . g . Db . Hw building	[N/m]
Fwu	= p . g . Hw building . Dw building	[N/m]
Fstat	= 0.5 . p . g . Dw building ^2	[N/m]

Hw building	= 3,4	[m]
Dw building	= 5,2	[m]
Db	= 6,4	[m]
g	= 9.8	[m / s^2]
p	= 1000	[Kg / m^3]

Fwo	= 56600 N/m	= 56,6 KN/m
Fstau	= 106600 N/m	= 106,6 KN/m
Fwu	= 173000 N/m	= 173 KN/m
Fstat	= 132500 N/m	= 132,5 KN/m
		= 468,7 KN/m

1/10000 year safety factor



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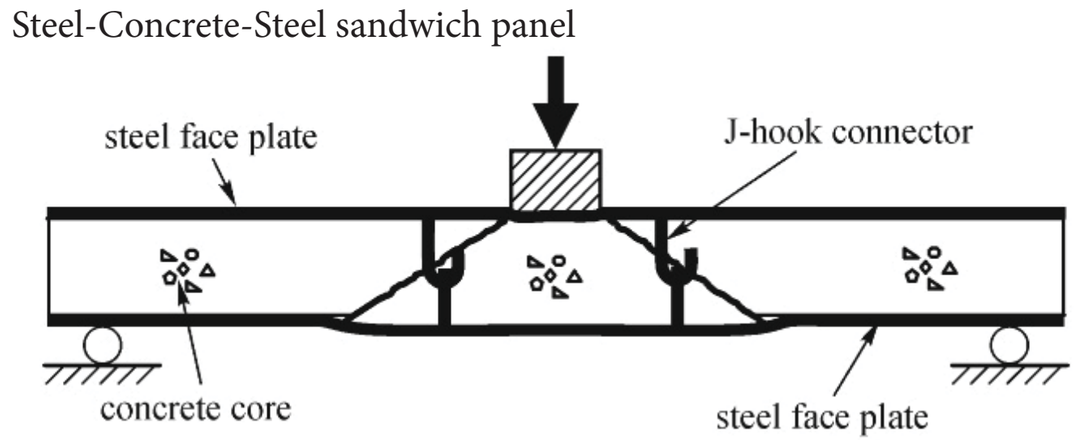
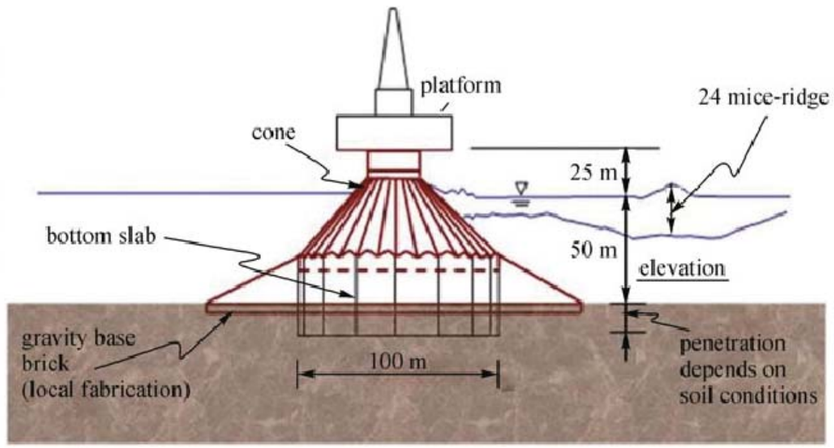
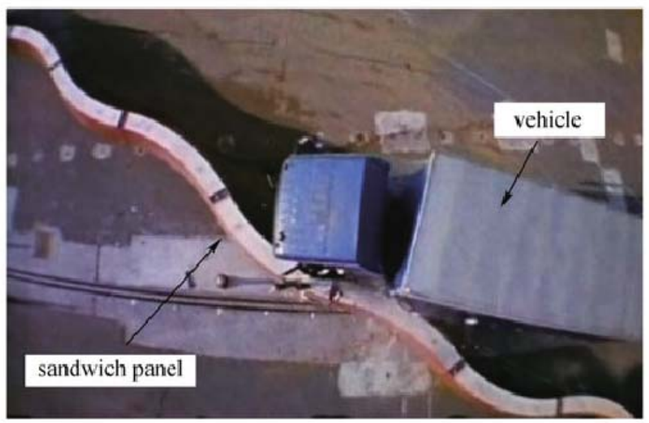
Materialization





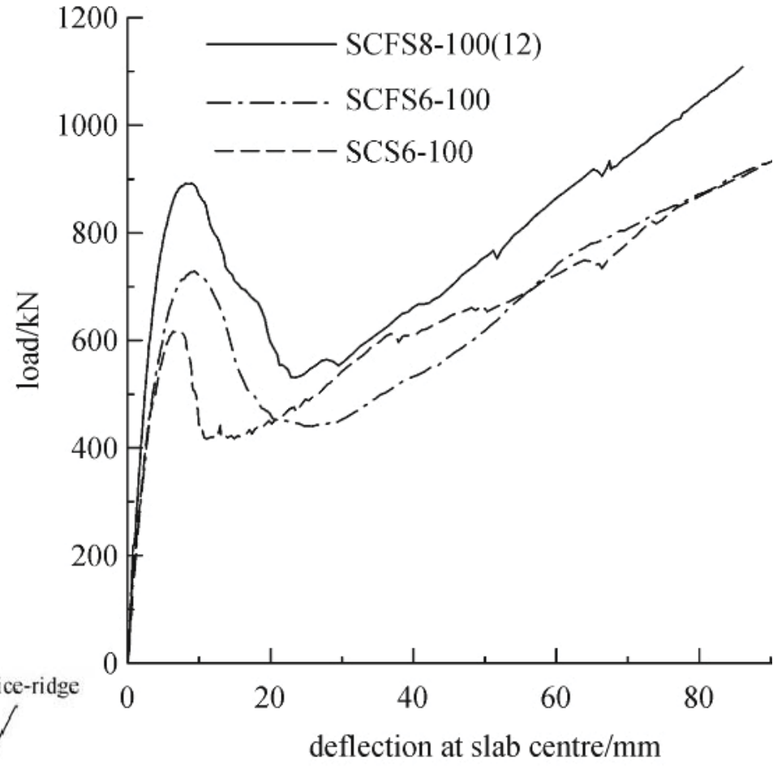
(a)

(b)



(c)

Fig. 4 Example of usage of SCS sandwich system. (a) Offshore structures in arctic region; (b) blast barrier wall; (c) free standing automobile barrier



- Marine technology
- Relative lightweight
- Can resist upto 900KN
- only 100mm thick
- Designed to resist punchloads

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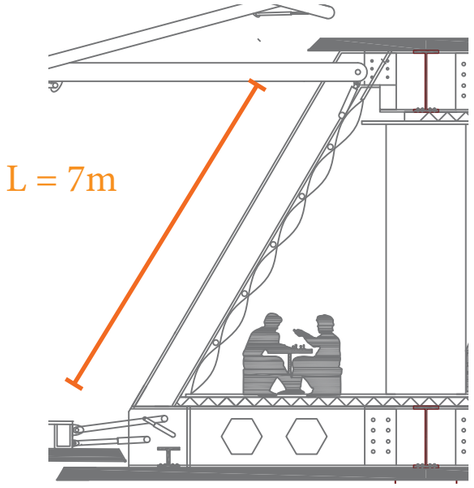
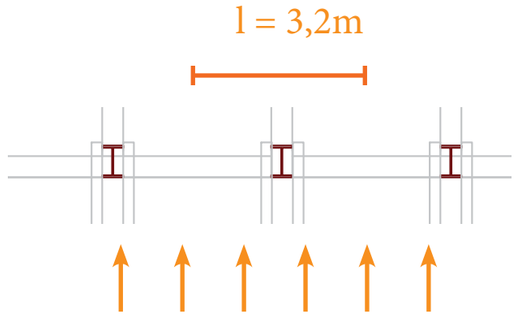
Facade collumns





q= 470 kn/m

F = 3,2 . 468 = 2340 KN

W = 5ql^4 / 384EI

Esteel = 210000 Mpa
I Ipe500 = 48200.10^4 mm^4

W = 103mm

Ubij = 0.003 . L
Ubij = 0.003 . 7 = 21mm

W is 5 keer te groot

Kolom nodig met een 5 keer zo hoge Iwaarde

48200.10^4 . 5 = 194000.10^4 mm^4

HE550M voldoet

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Solar shades

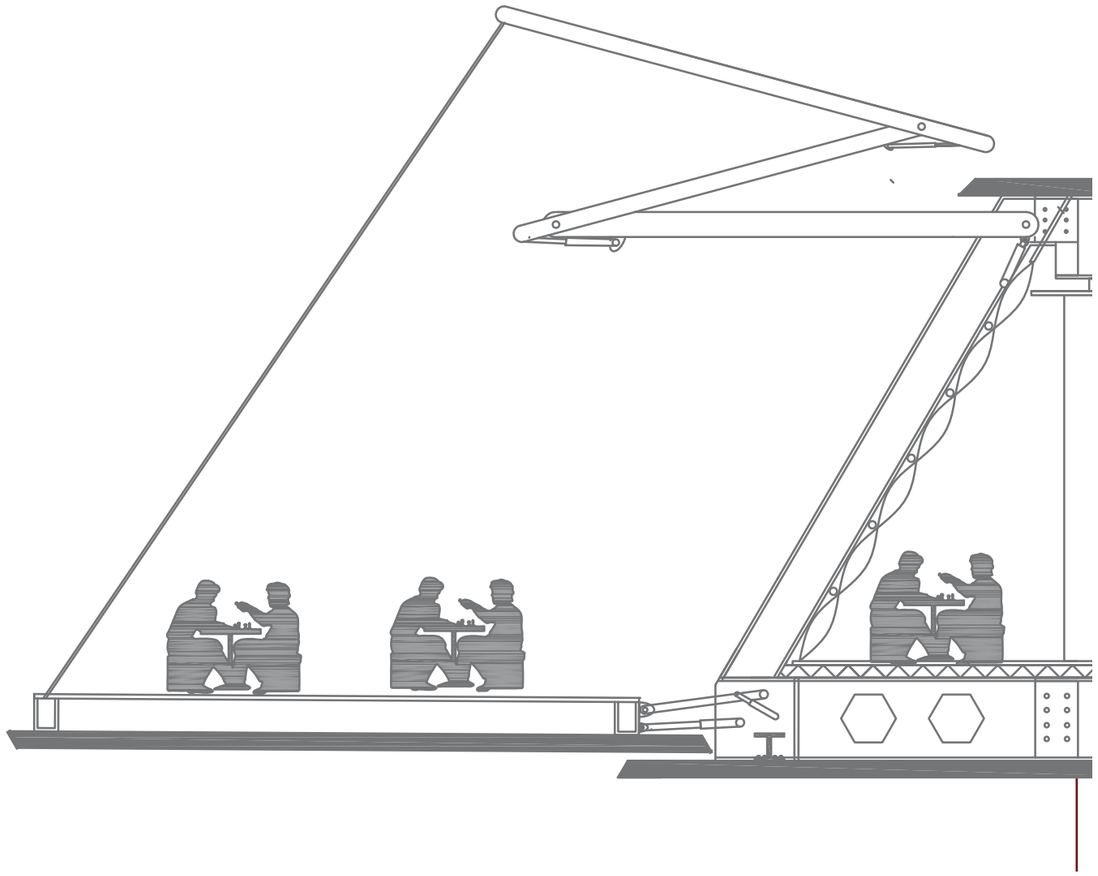
Solar shading construction in between facade collumns; connected at the top of these collumns

moveable by hydraulics

at the end connected to a telescope pole which is connected to the end of the terrace keeping the solar shading in place and supports the terrace

telescoopstang is fixed after construction is in place

transparant windscreen foil around the terrace in between the telescope poles



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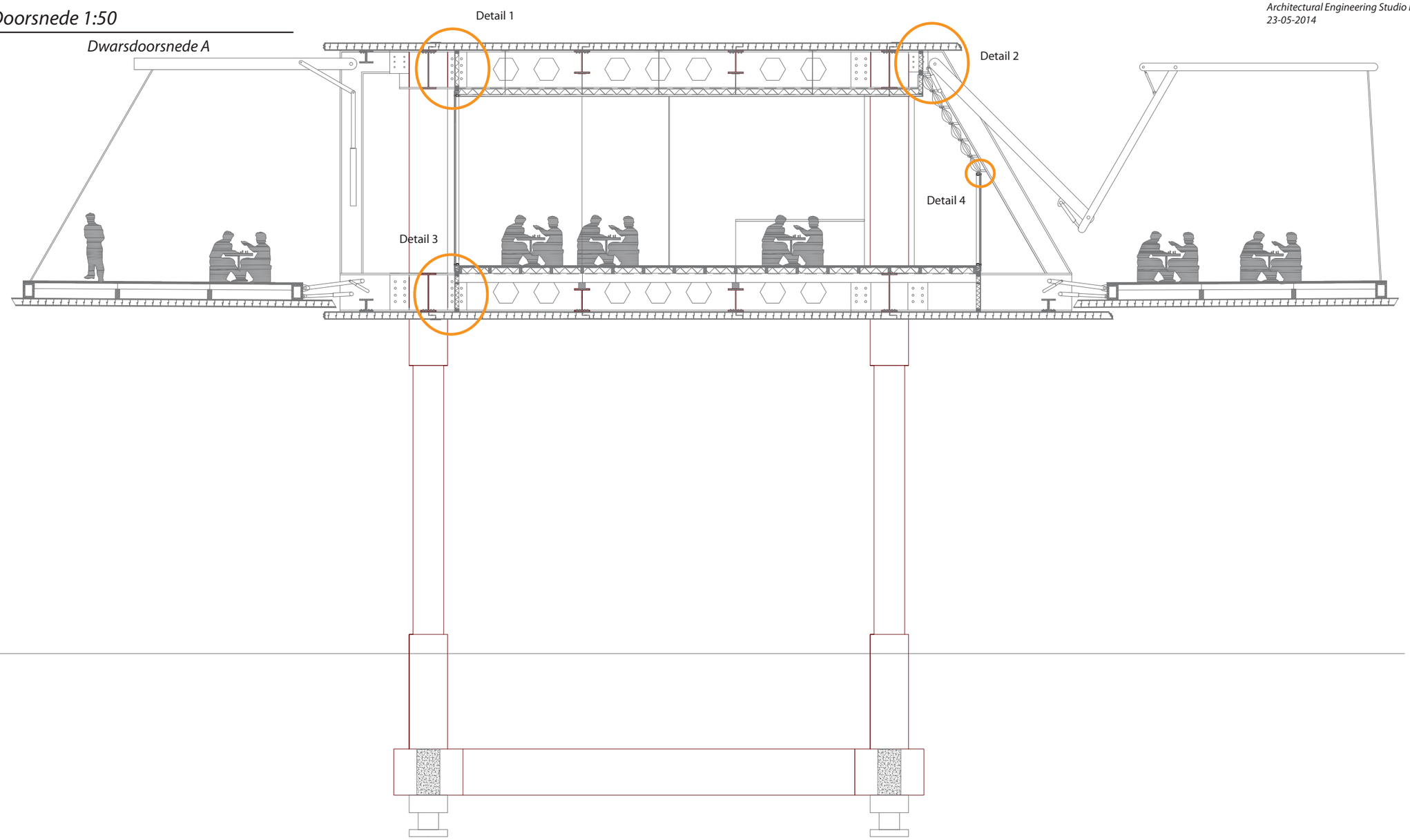
Section A

Doorsnede 1:50

Dwarsdoorsnede A



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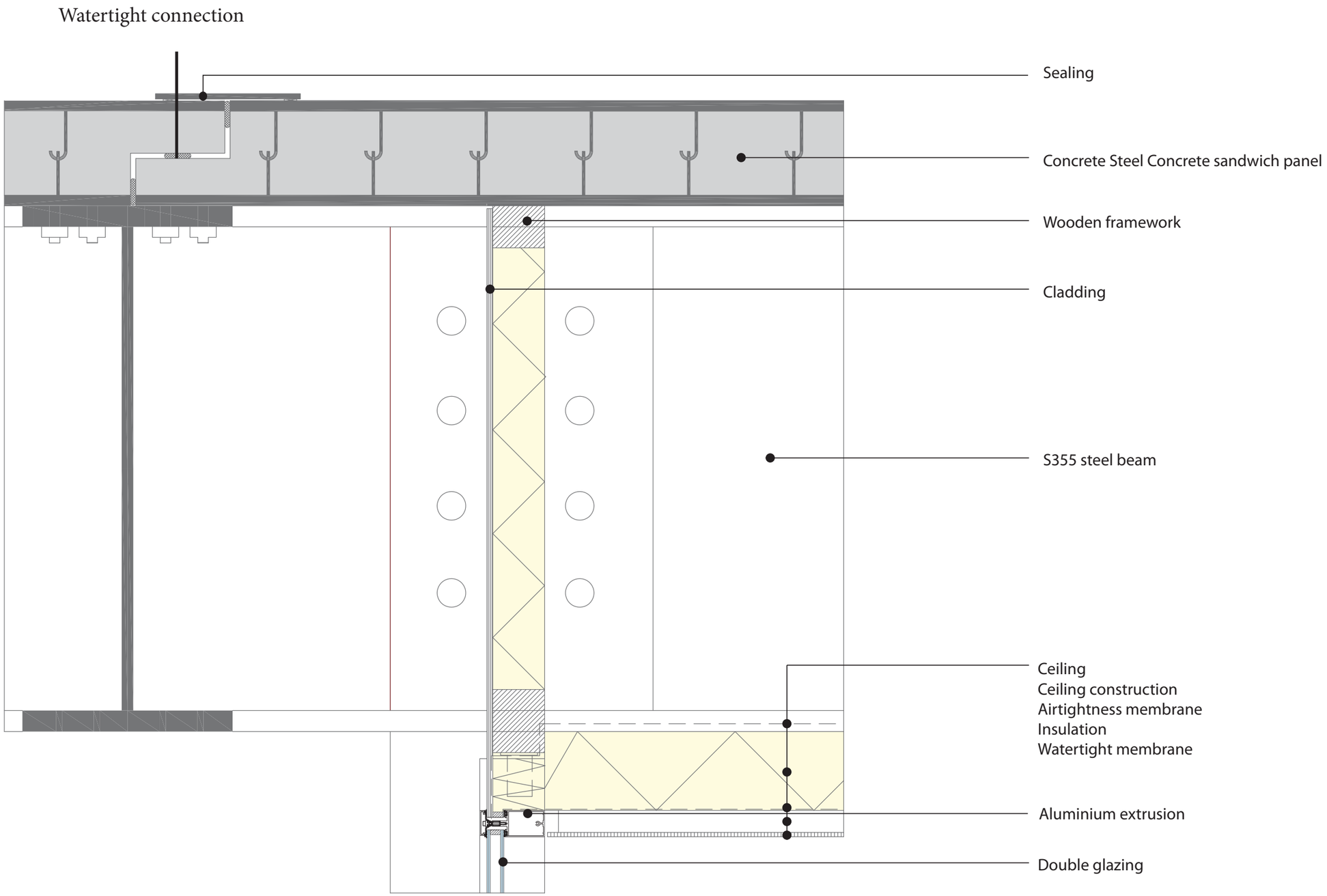
Vertical detail 1



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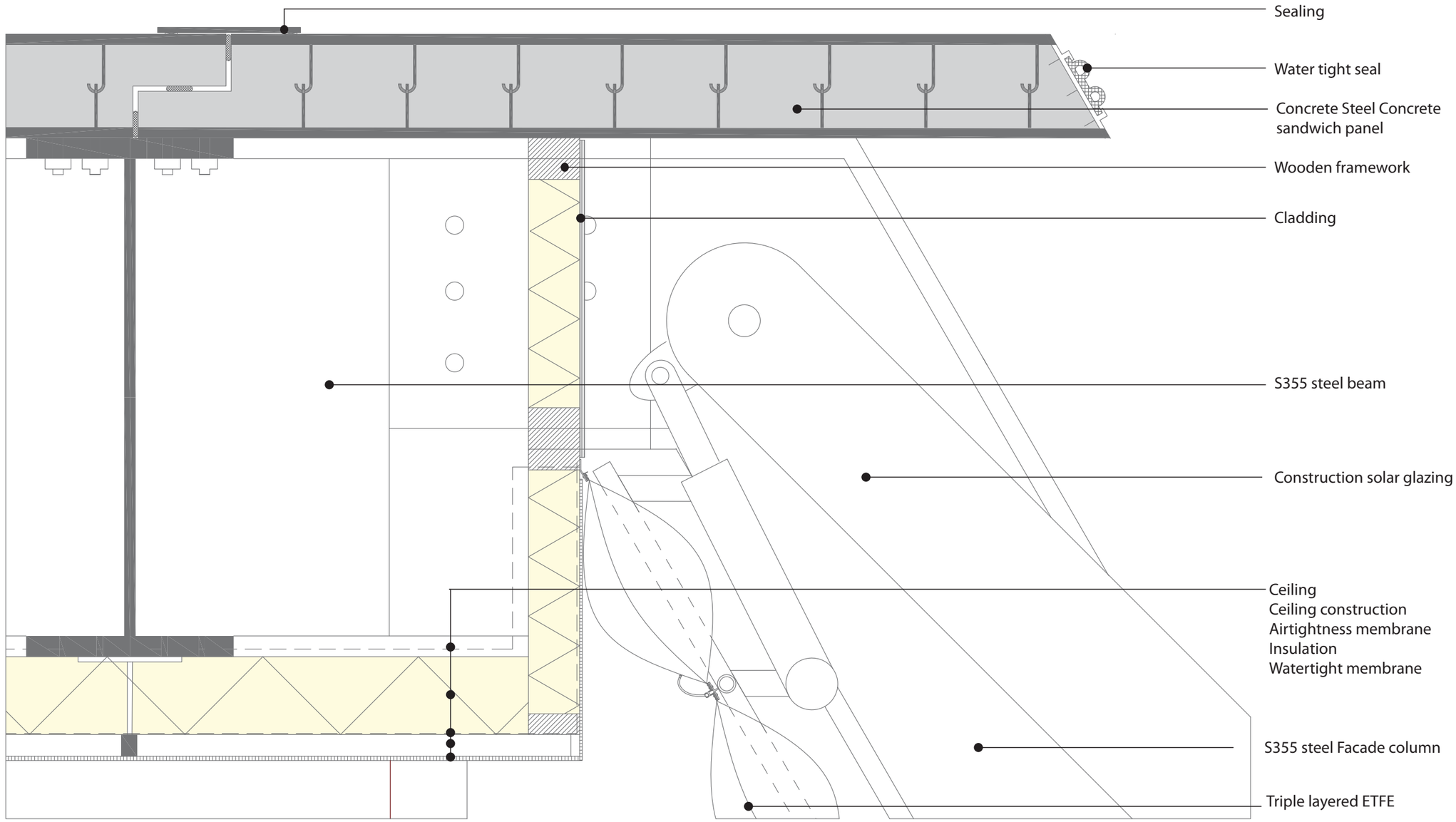
Vertical detail 2



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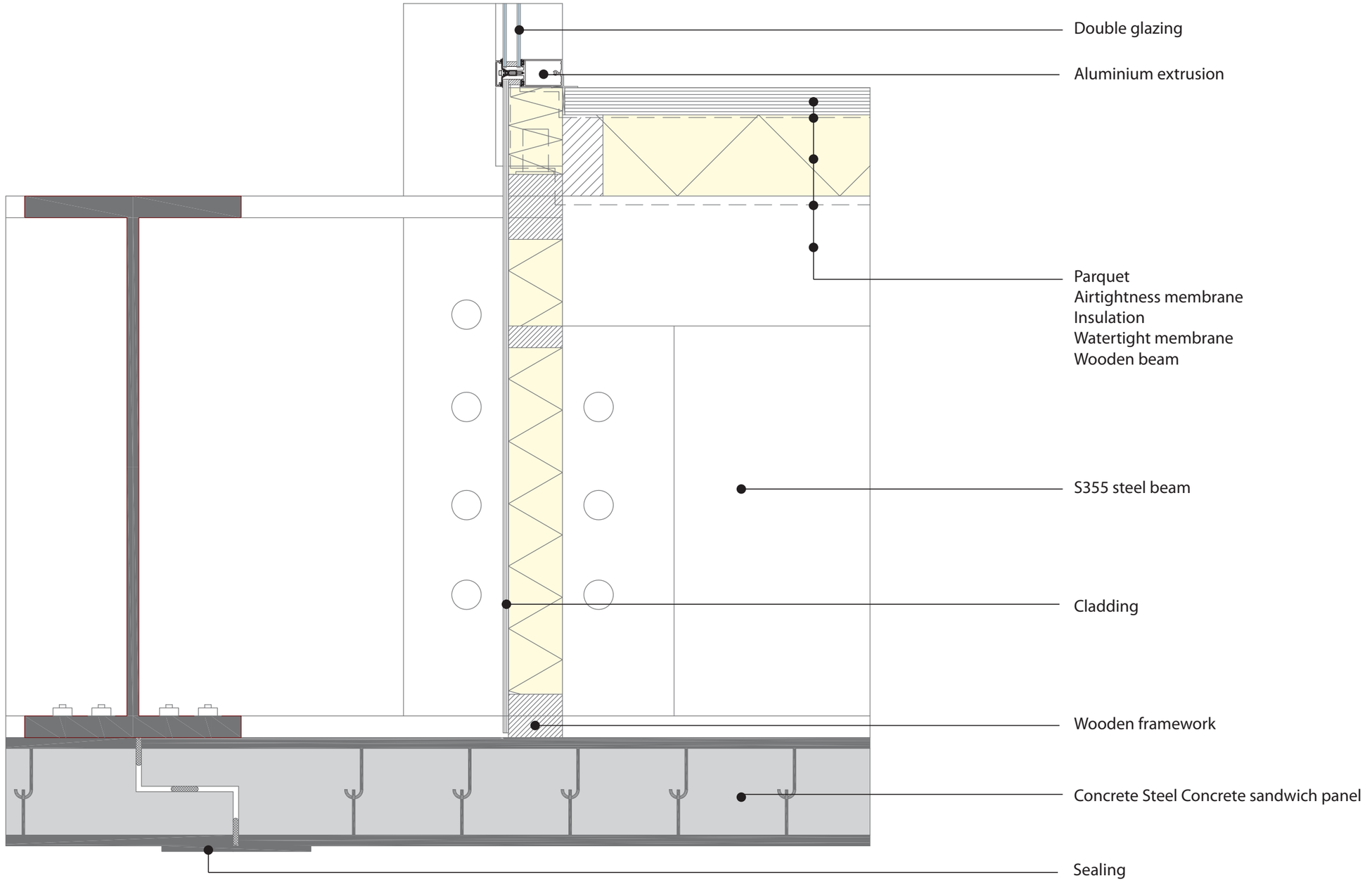
Vertical detail 3



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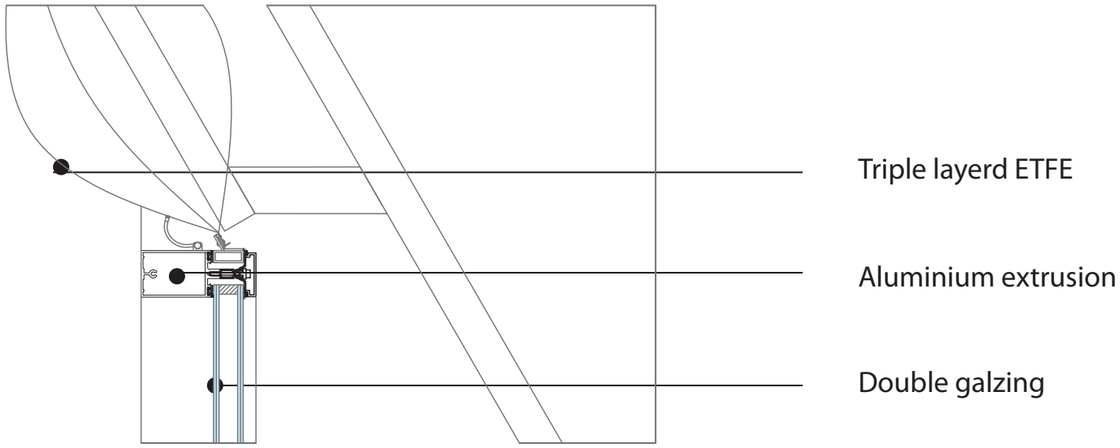
Vertical detail 4



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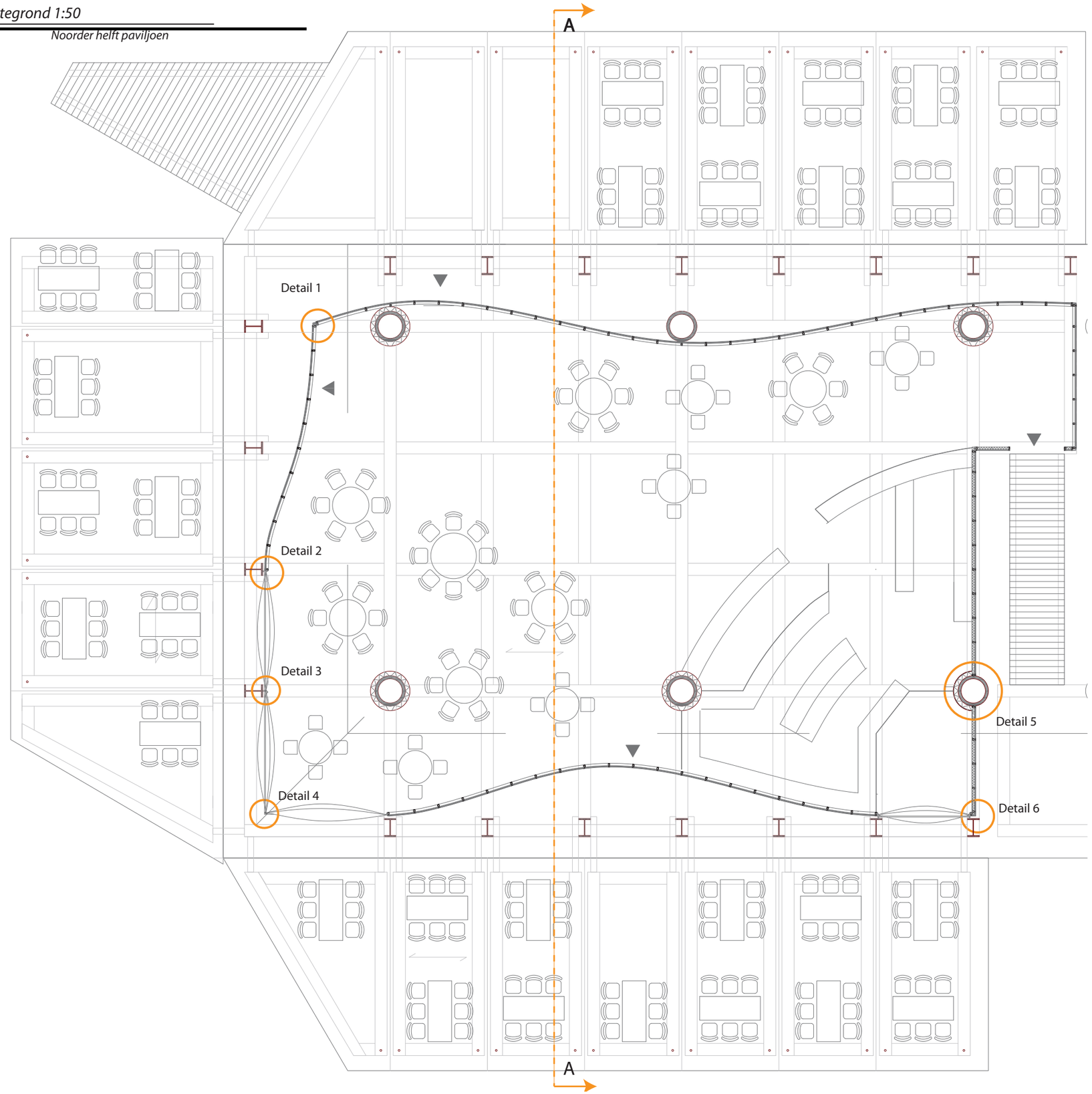
Floorplan

Plattegrond 1:50

Noorder helft paviljoen



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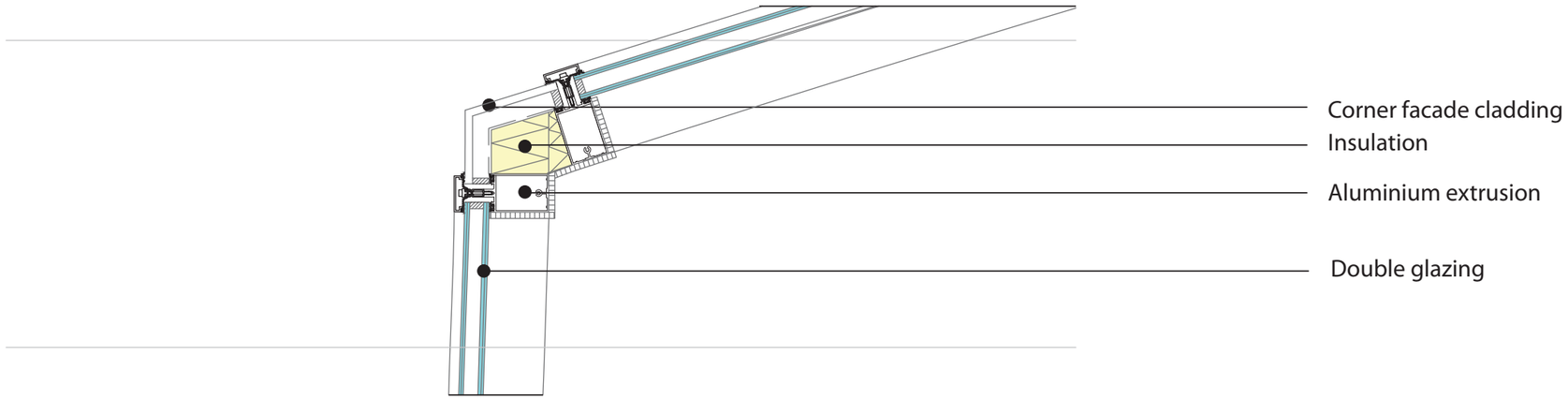
Horizontal details 1 & 2

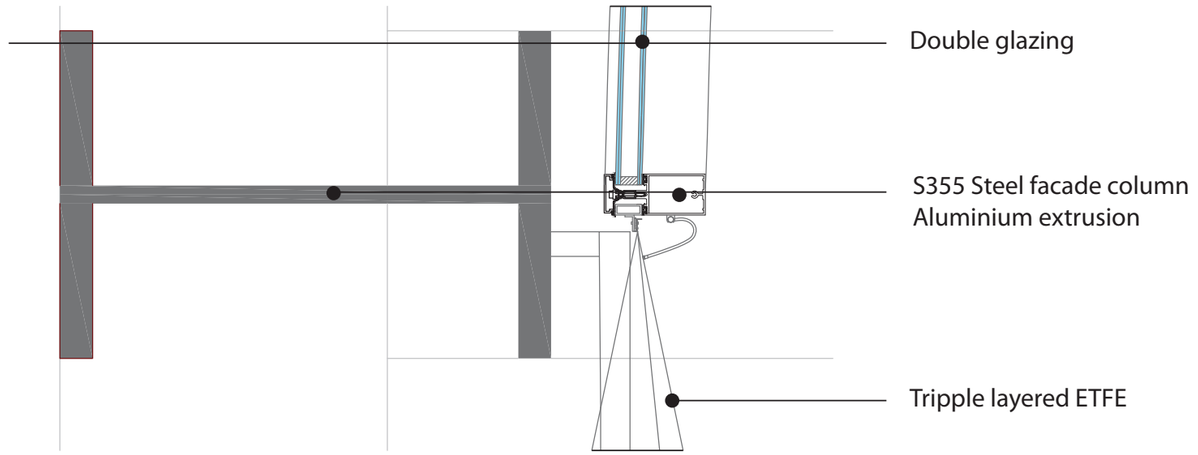
Horizontal details 1:5

Detail 1 Glass - glass corner



Horizontal details 1:5

Detail 2 Glass - ETFE



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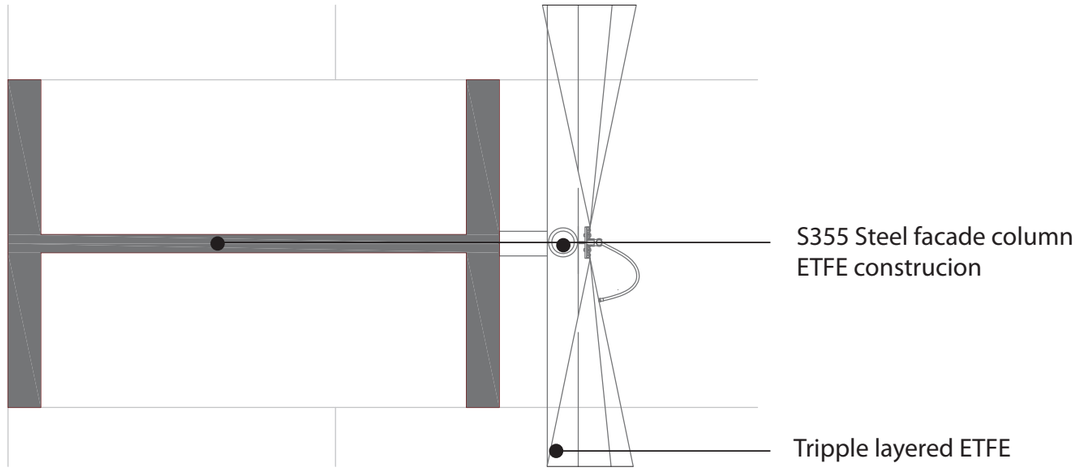
Horizontal details 3 & 4

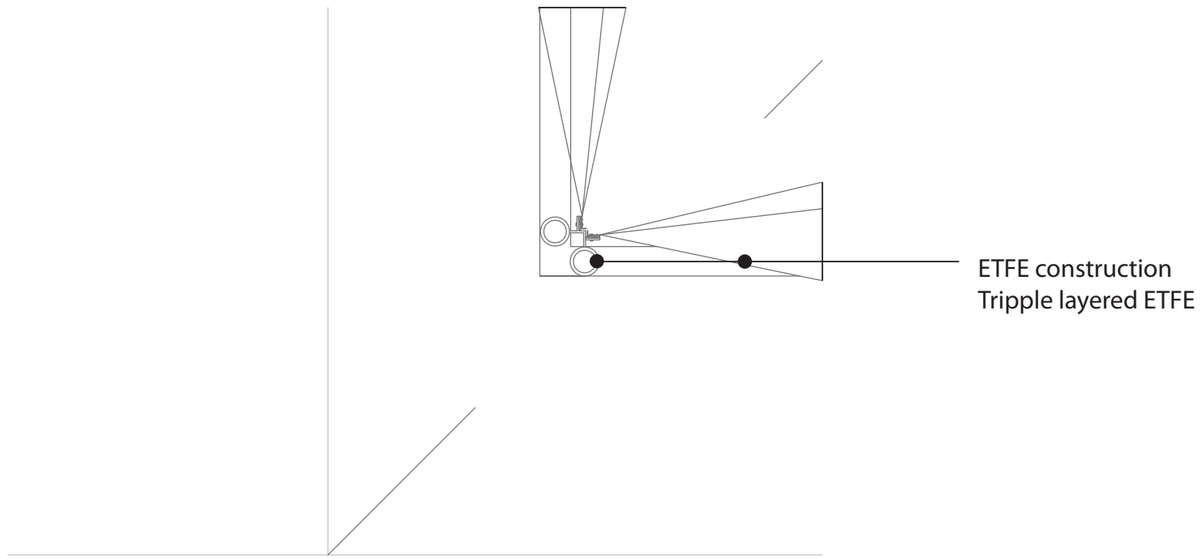
Horizontal details 1:5

Detail 3 ETFE - ETFE



Horizontal details 1:5

Detail 4 ETFE - ETFE corner



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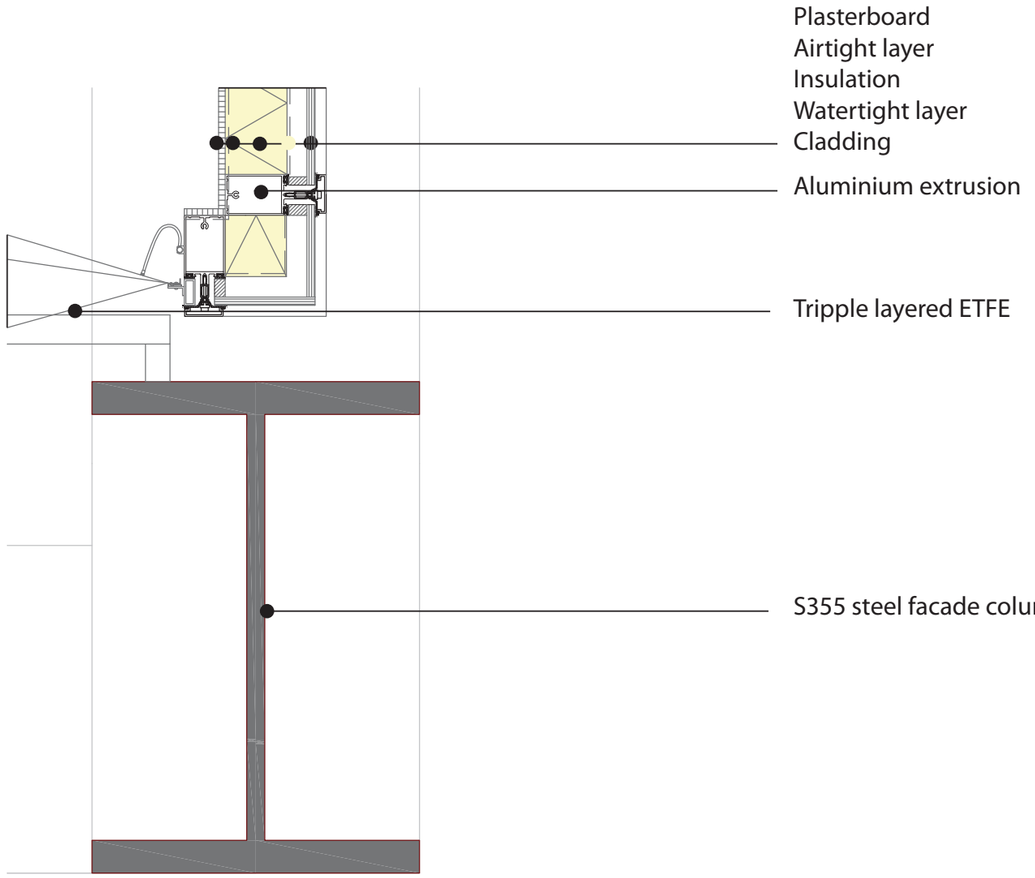
Horizontal detail 6

Horizontal details 1:5

Detail 6 EFTE - Curtain wall corner



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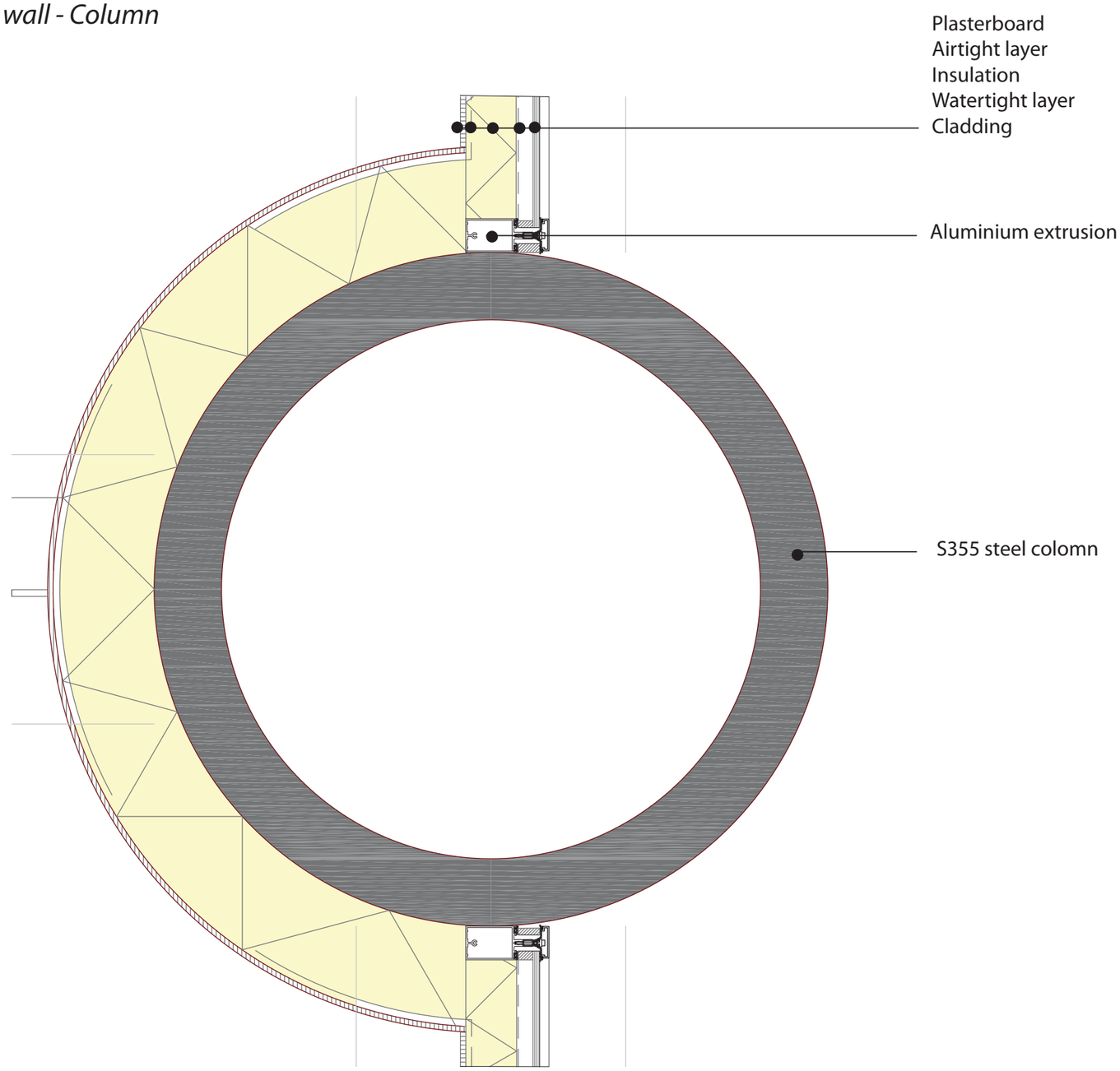
Horizontal detail 5

Horizontal details 1:5

Detail 5 Curtain wall - Column



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Facade fragment