

BIOMIMETICS IN ARCHITECTURE



TU Delft | Faculty of Architecture | Explore Lab | Biomimetics in Architecture | P5 Presentatie

Mireille Langendijk | 1361309 | 03 juli 2014

"Nature does nothing uselessly."

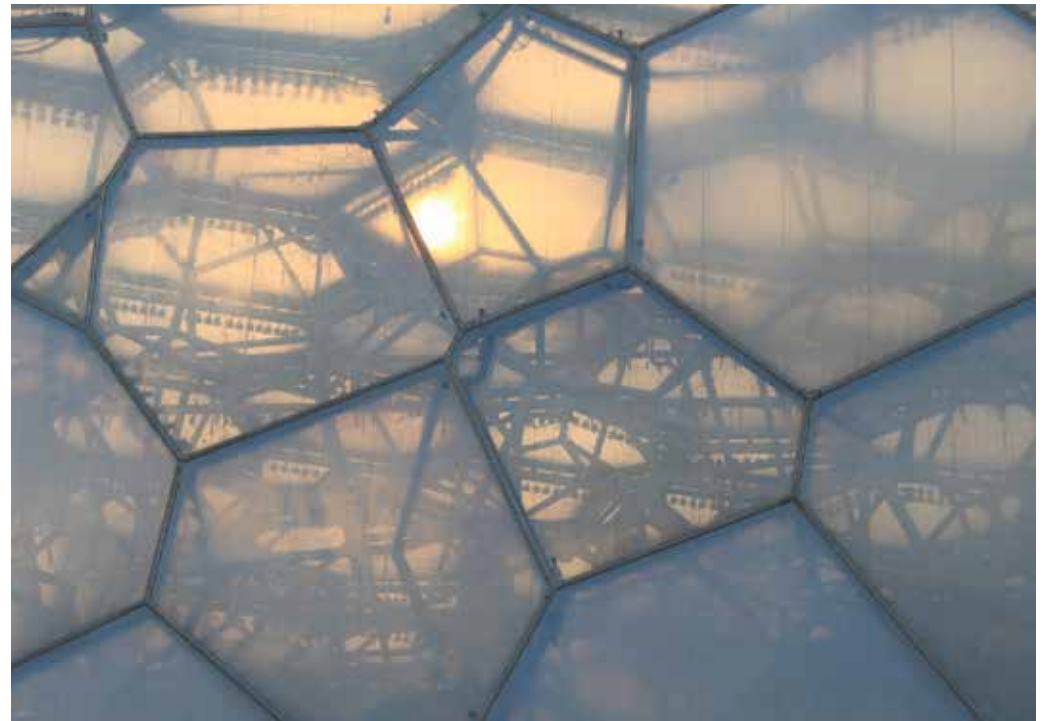
[Aristotle]



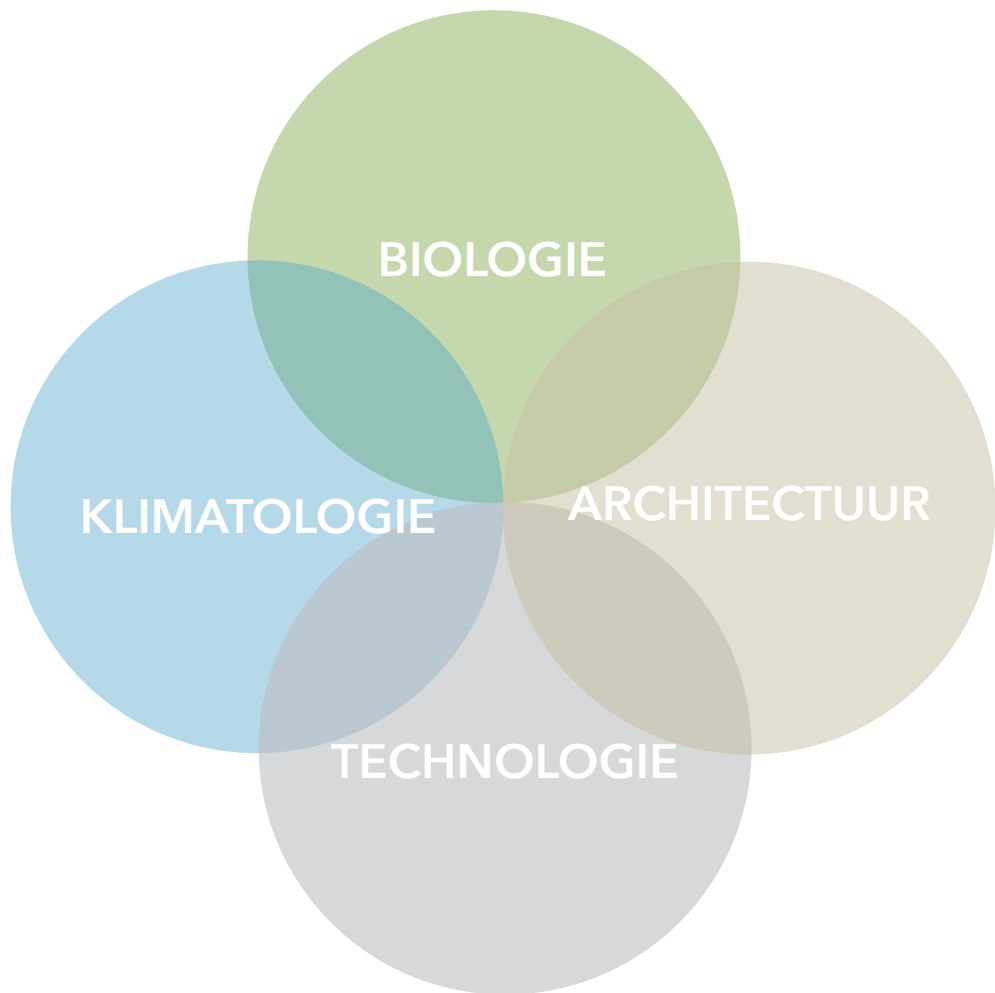
Project: Eden Project
Plaats: Bodelva [Engeland]
Architect: Nicholas Grimshaw
Functie: Botanische tuin



Project: Watercube
Plaats: Beijing [China]
Architect: Chris Bosse, Rob Leslie-Carter
Functie: Waterpark



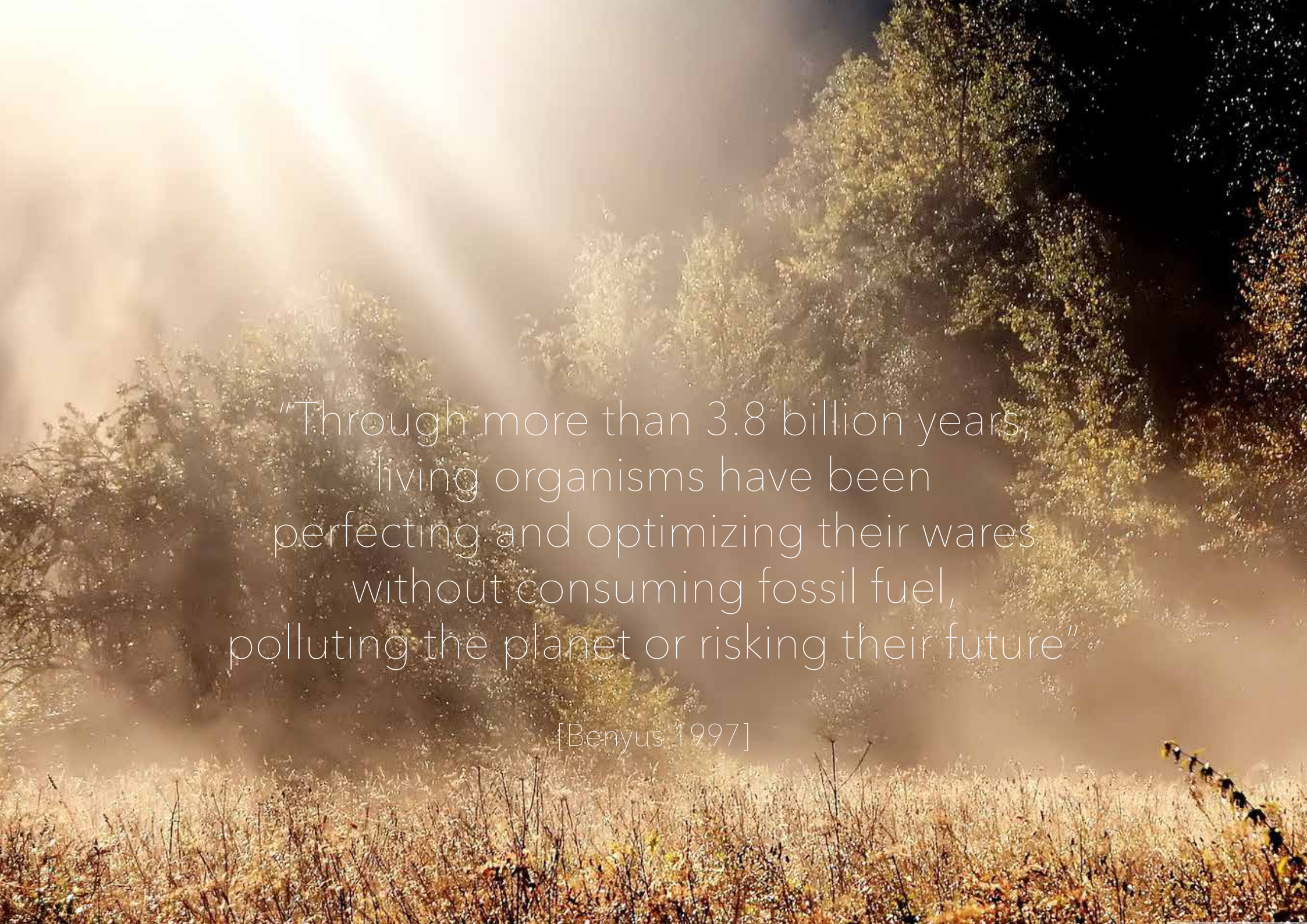
ARCHITECTUUR + BIOLOGIE



[Olgyay 1963]

BIOMIMETICS

Innovation inspired by nature

A misty forest scene with sunlight filtering through the trees and a field of tall grass in the foreground. The text is overlaid on the image.

"Through more than 3.8 billion years,
living organisms have been
perfecting and optimizing their wares
without consuming fossil fuel,
polluting the planet or risking their future"

[Benyus 1997]



"It is not the strongest of the species that survives,
nor the most intelligent that survives.
It is the one that is most adaptable to change."

[Charles Darwin]





Rudofsky "Architektur ohne Architekten" 1965





PROBLEMEN VOORKOMEN I.P.V. OPLOSSEN

BIOLOGISCHE SYSTEMEN

VS.

MENSELIJKE SYSTEMEN

Complex

Simpel

Kringloop processen

Lineaire processen

Onderlinge verbindingen en geïntegreerde systemen

Op zichzelf staande systemen met een specifieke functie

Aanpasbaar aan veranderende omstandigheden

Resistent voor verandering

Geen afvalproducten

Verspilling

Divers

Focus

Zon-economie

Fossiele brandstoffen

Geoptimaliseerd als totaal systeem

Ontworpen voor een specifieke taak

Herstellend

Wegwerpmaatschappij

Gebruik van locale materialen

Gebruik van wereld producten



ESTHETIEK vs FUNCTIONALITEIT





AANPASBAARHEID



PROGRAMMA

- Gebouw type: Paviljoen
- Functie: Ontmoetingsplek, educatiefcentrum, heisessie, café
- Locatie: De Veluwe, Nederland
- Capaciteit: ± 40 mensen
- Bezoekers: Passanten [wonderlaars/fietsers], school klassen, werkgroepen, zakelijk
- Oppervlak: ± 350 m²
- Bezoektijd: $\pm 1 - 8$ uur

STEDELIJKE UITGANGSPUNTEN

- Aanpasbaar aan de omgeving [begint punt ontwerpproces]
- Samenwerken met en gebruik maken van de natuur [lokale materialen, kringloop]
 - Impact op de omgeving beperken

ARCHITECTONISCHE UITGANGSPUNTEN

- Zichtbaar aanpasbaarheid [educatief]
- Efficient materiaal gebruik [constructie, krachten, spanningen]
 - Functioneel ontwerp [versus esthetiek]



LOKATIE

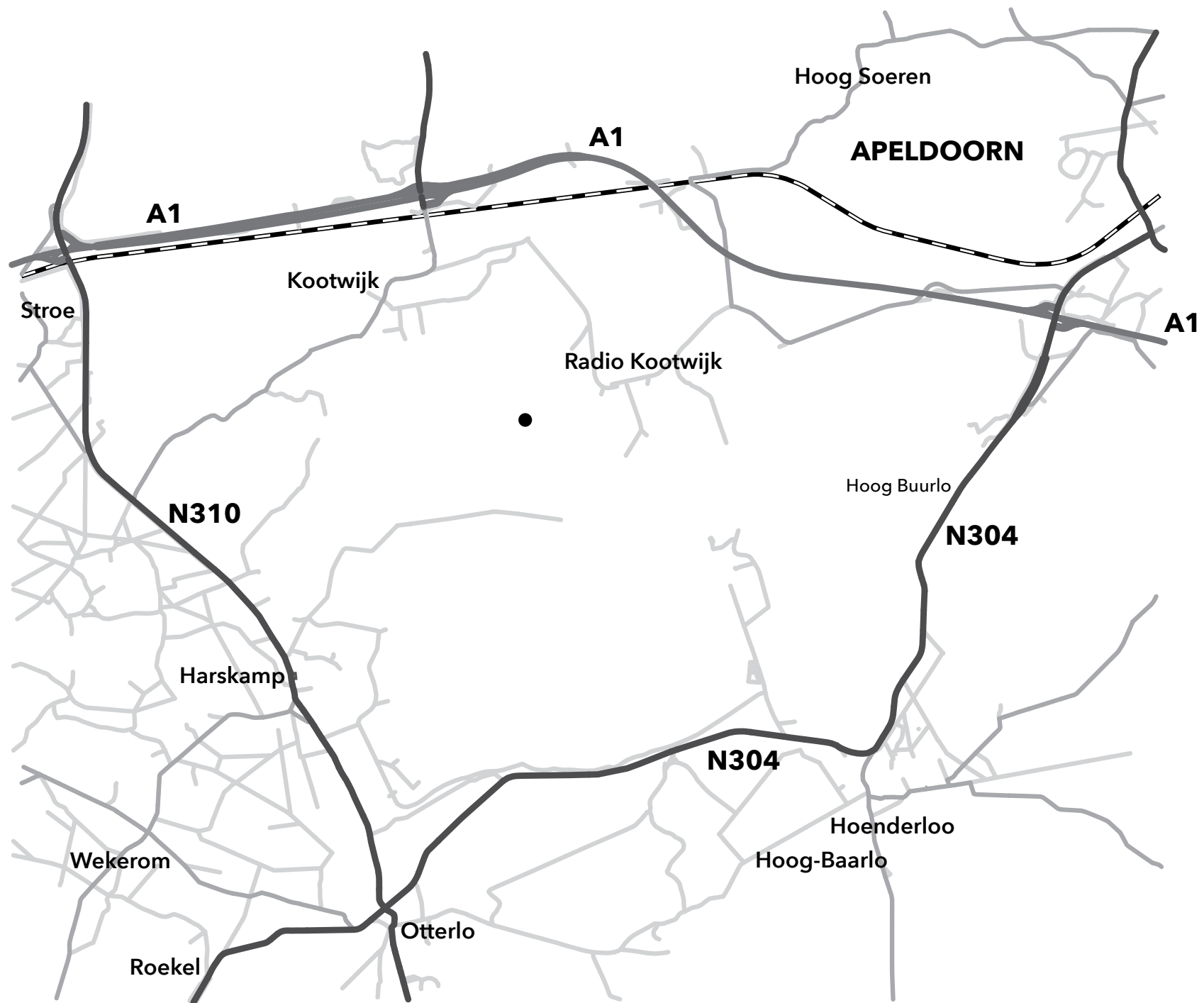
Nederland [Gelderland]

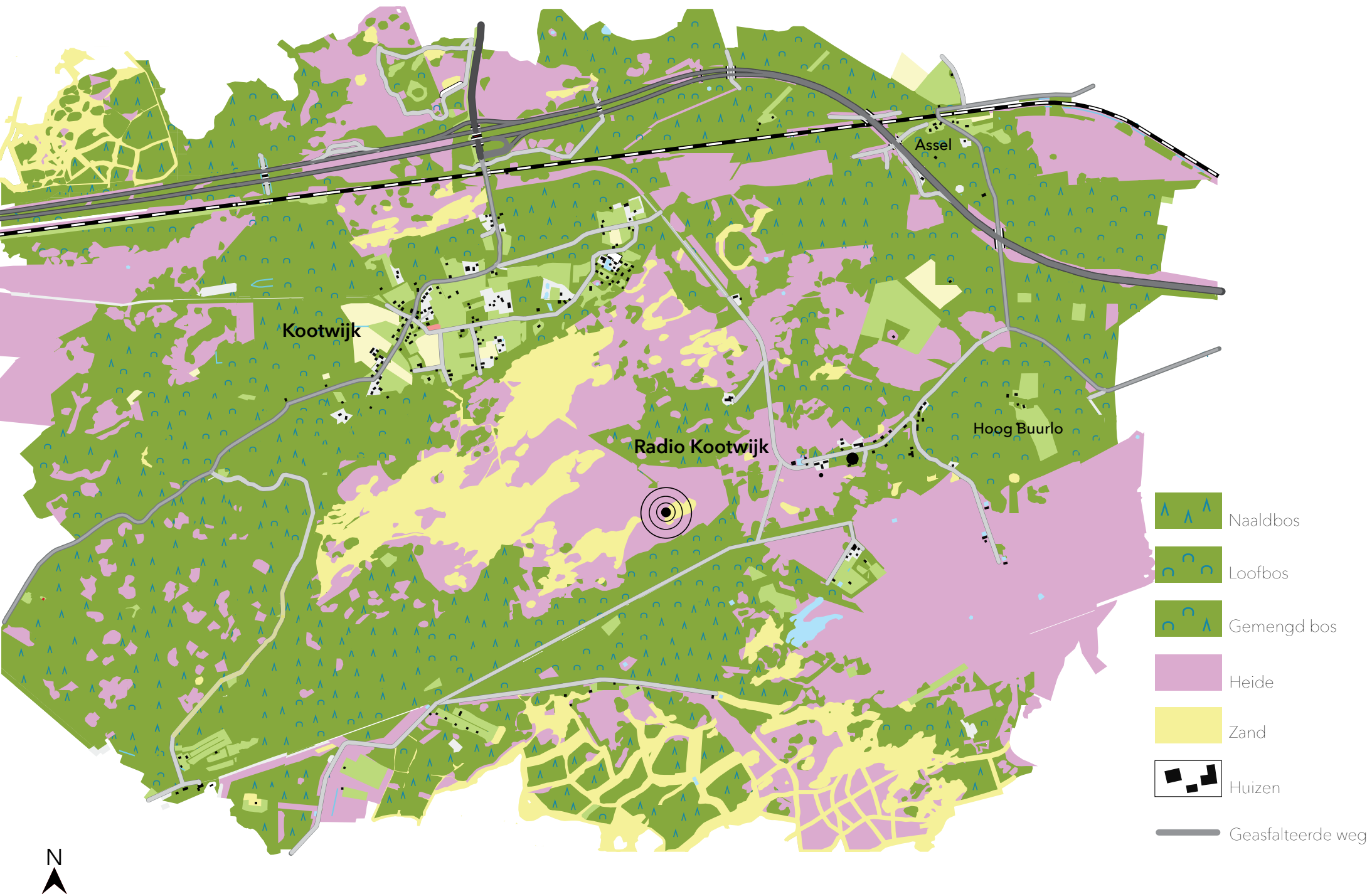
Veluwe [1100 km²]

20-50 m boven N.A.P.

Groot gebied bestaat uit stuwwallen
[ijstijd, Saalien, 150.000 jaar geleden]

Verschillende landschappen:
Stuifzanden, zandverstuivingen,
heides, loofbossen, dennenbossen,
landgoederen, weidegronden,
moerassen, meren en rivieren







RADIO KOOTWIJK

HERONTWIKKELING

VERBINDING VAN NATUUR EN CULTUUR

- Luisteren en kijken naar de natuur
[Planten, dieren, weer en de seizoenen]
- Verblijven in de natuur
[Kort en lang verblijf, actief en passief]
- Architectuur en herbeleven van de historie
[Zendgebouw]
- Kijken naar en maken van kunst
[Individueel en groep, museaal en ateliers]
- Genieten van podiumkunsten
[In gebouwen en natuur]
- Maken en luisteren naar muziek
[Concerten en masterclasses]







- Passant [fietsers, wandelaars]
125.000 bezoekers
- Doelgericht [horeca, bezichtiging...]
50.000 bezoekers
- Op uitnodiging/deelnemers [activiteit]
35.000 bezoekers

TOTAAL: 210.000 bezoekers per jaar

















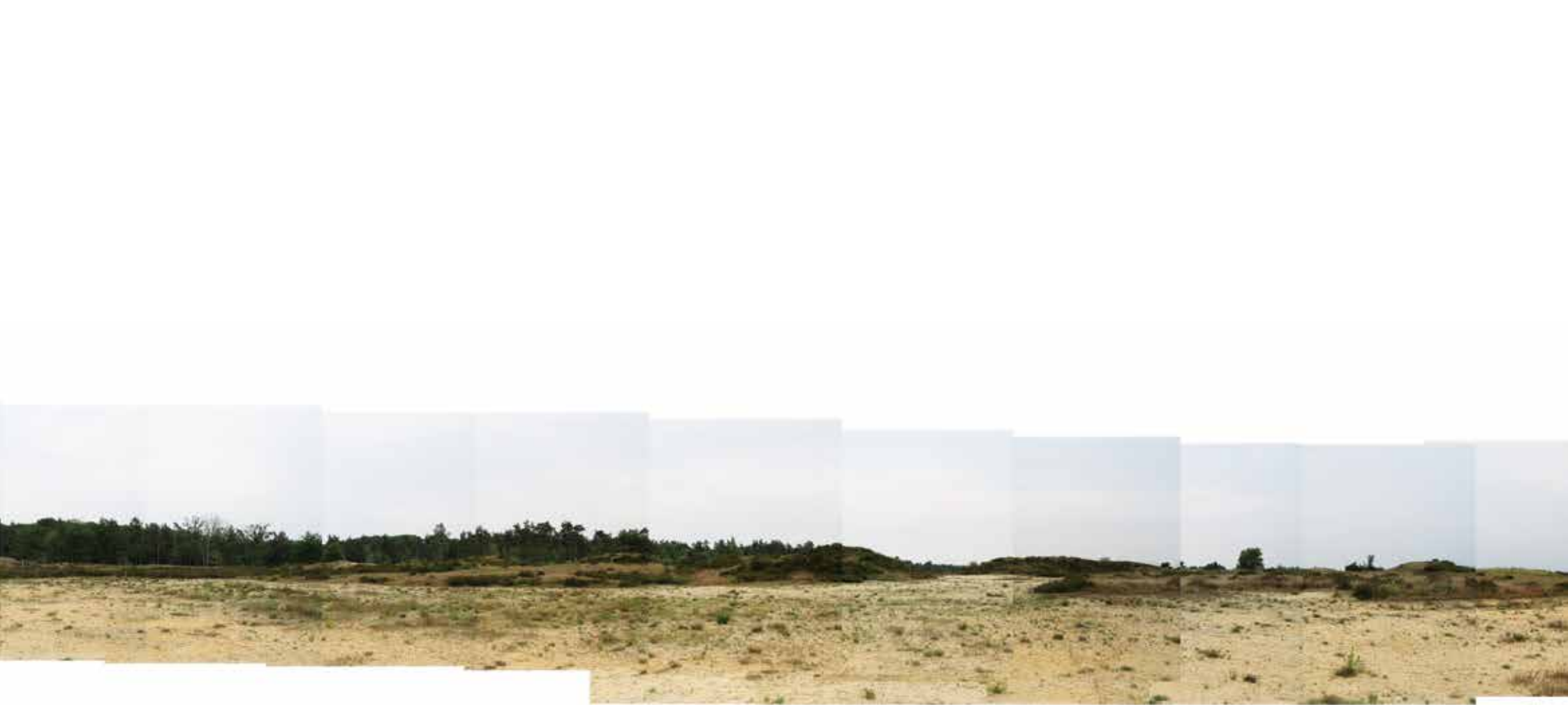




Locatie

Radio Kootwijk



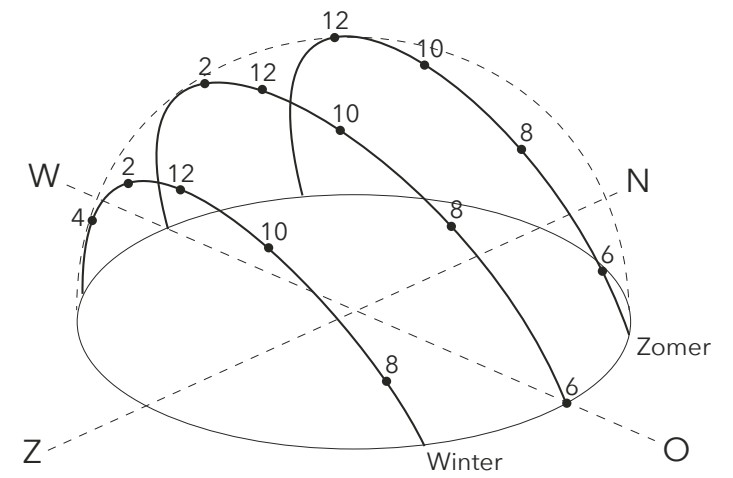
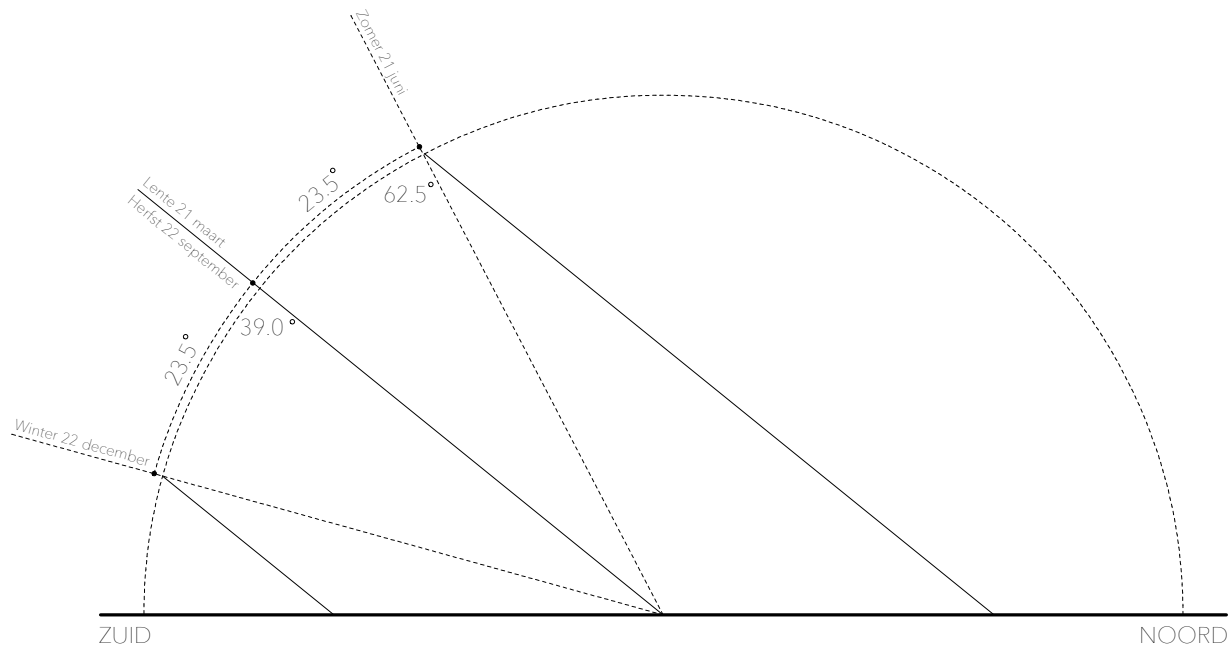




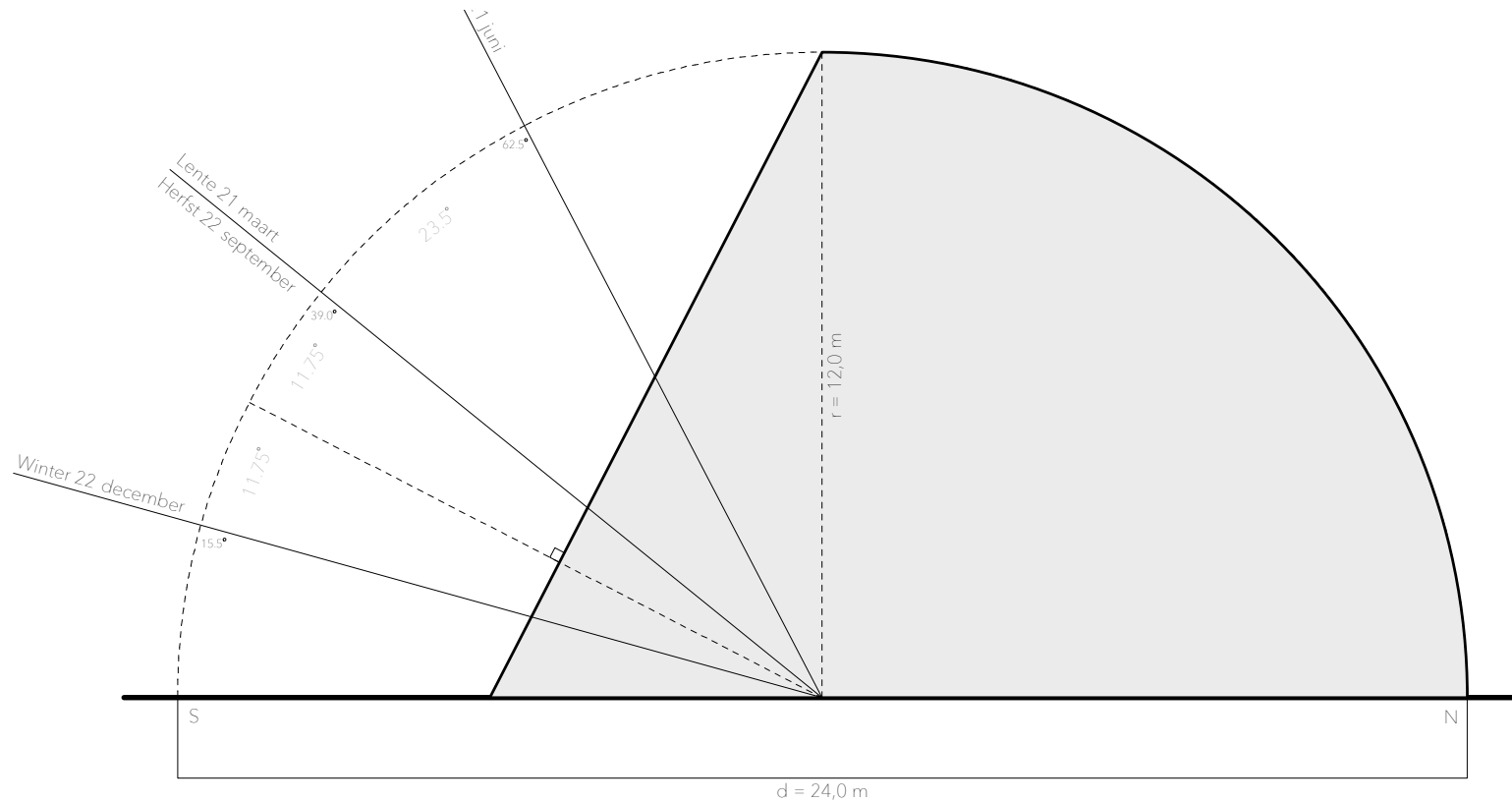
FACTOREN

- Continu
- Variabel

ZONNECYCLUS

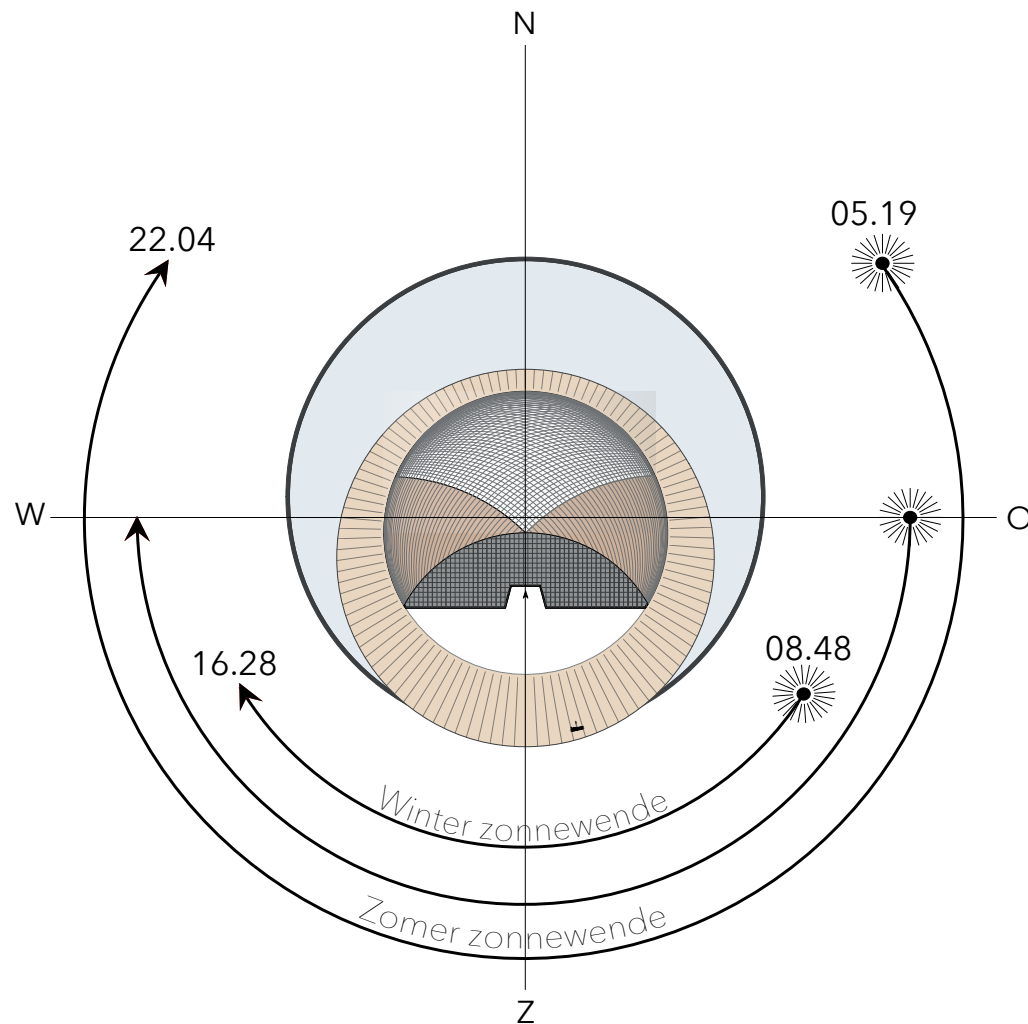


PRINCIPE UITGANGSPUNT ONTWERP



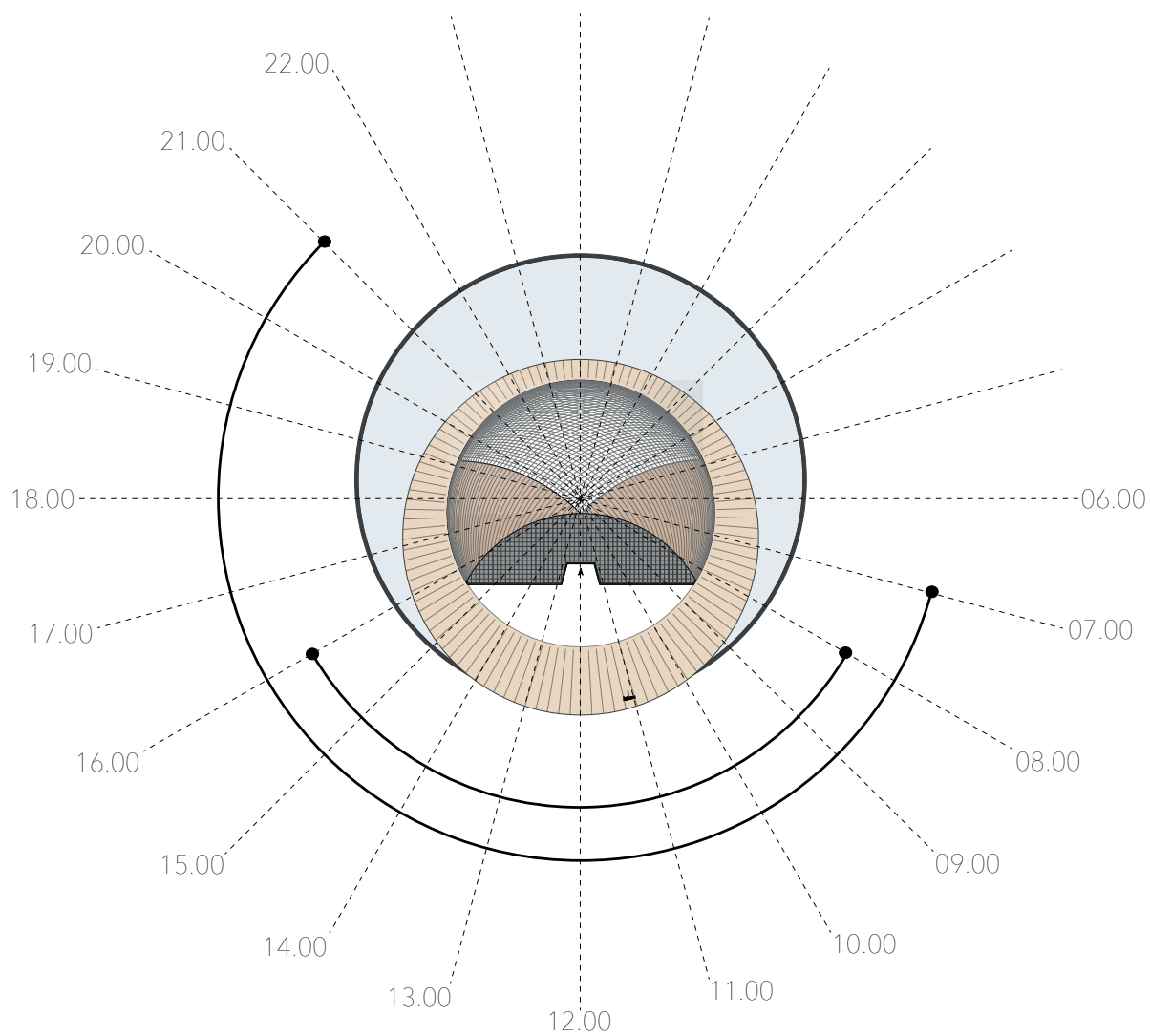
Schuine zijde staat loodrecht op de lijn die tussen de winter en herfst/lente staat.
[Voldoende energie zowel in de zomer als in de winter]

Seizoen	Maand	Aantal dagen	Aantal uren zon per dag	Gem. instraling [W/m² per dag]	Gem. instraling [W/m² per seizoen]	Gem. Instraling opp. [kW]	Hoek zon [graden]	Rendement	Rendement opp. [kW]
Winter	December	31	8	75	74530	14906	15,5	90,0%	13415
	Januari	31	9	70					
	Februari	28	10	130					
Lente	Maart	31	12	195	102030	20406	39	90,0%	18365
	April	30	14	235					
	Mei	31	15	290					
Zomer	Juni	30	16	290	388905	77781	62,5	80,0%	62225
	Juli	31	15	285					
	Augustus	31	14	270					
Herfst	September	30	13	215	162000	32400	39	90,0%	29160
	Oktober	31	11	150					
	November	30	9	100					
						Aantal kopjes koffie per dag			
						Winter	5962		
						Lente	8162		
						Zomer	27655		
						Herfst	12960		



ZON OPKOMST/ONDERGANG

Vroegste opkomst	JUNI	05.19 u
Laatste opkomst	DECEMBER	08.48 u
Vroegste ondergang	DECEMBER	16.28 u
Laatste ondergang	JUNI	22.04 u



OPENINGSTIJDEN

WINTER

December | Januari | Februari

8.00 u - 16.00 u

LENTE

Maart | April | Mei

7.00 u - 21.00 u

ZOMER

Juni | Juli | Augustus

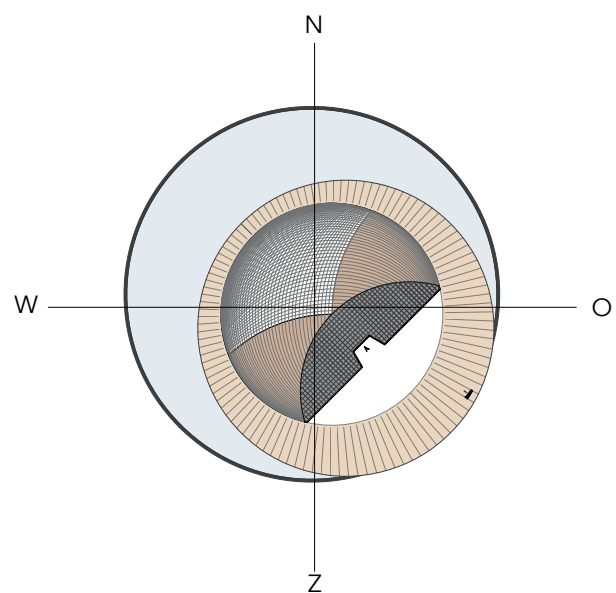
7.00 u - 21.00 u

HERFST

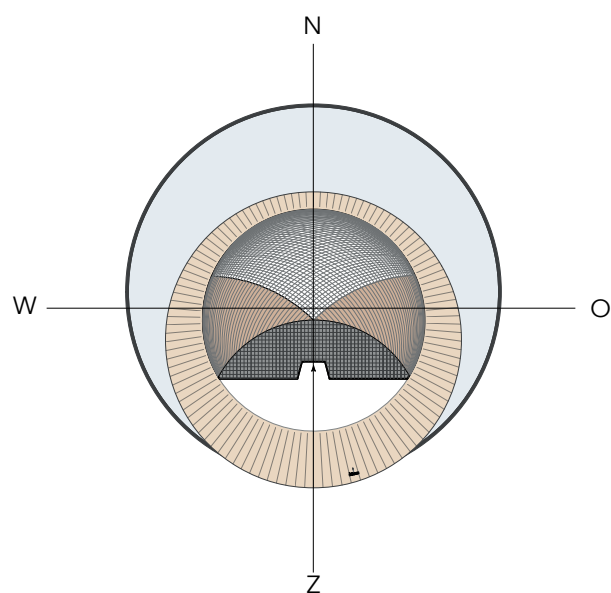
September | Oktober | November

8.00 u - 16.00 u

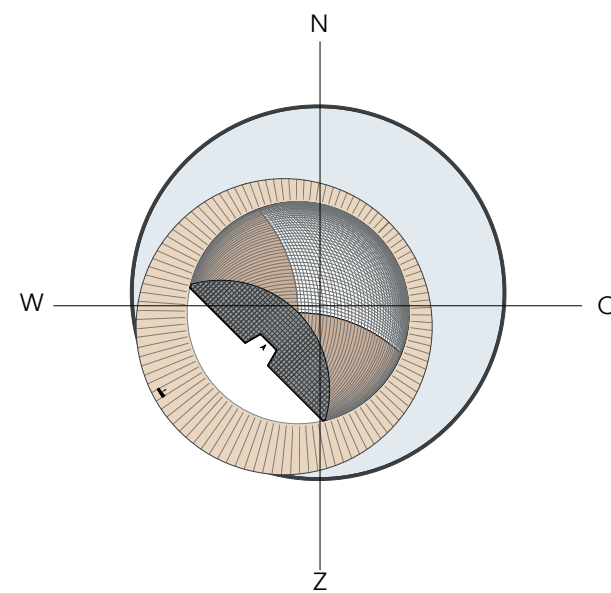
DRAAING VAN HET PAVILJOEN



09.00 uur



12.00 uur



15.00 uur

WINTER



SPRING



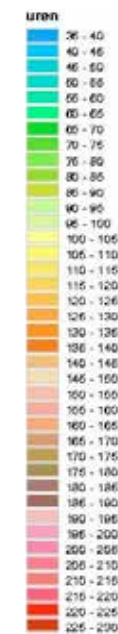
SUMMER



AUTUMN



GEM. TEMPERATUUR



WINTER

December



January



February



SPRING

March



April



May



SUMMER

June



July



August



AUTUMN

September



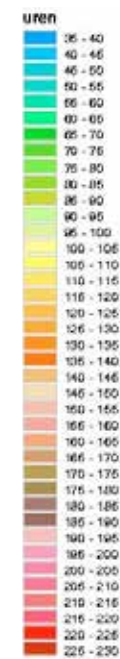
October



November



GEM. UREN ZON

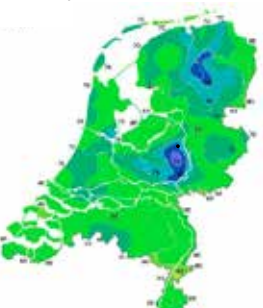


WINTER

December



January



February



SPRING

March



April



May



SUMMER

June



July



August



AUTUMN

September



October

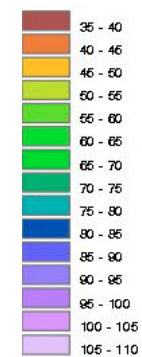


November

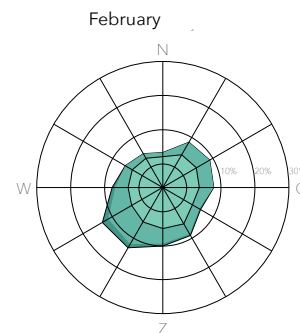
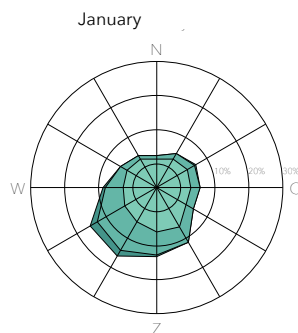
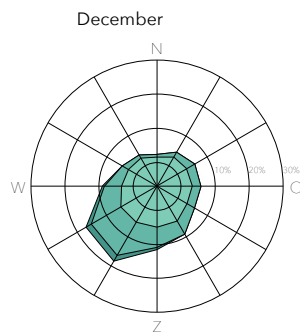


GEM. REGENVAL

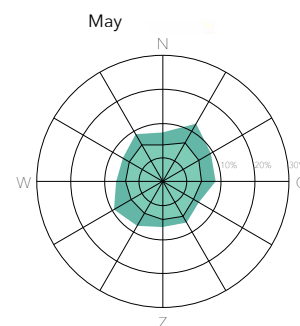
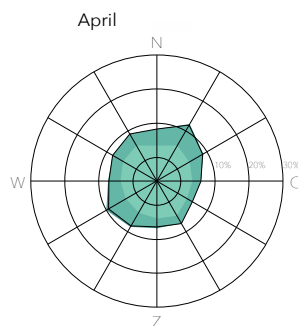
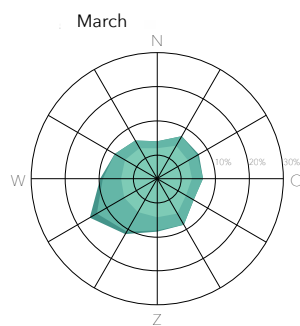
mm



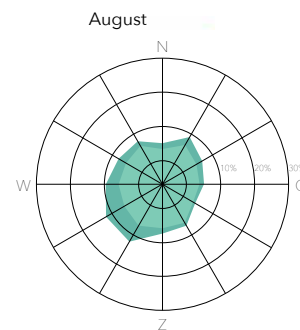
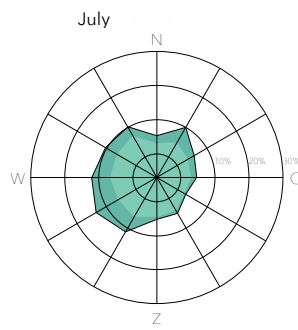
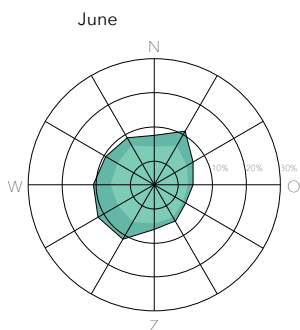
WINTER



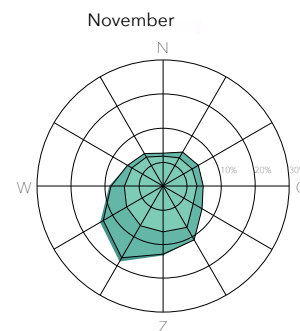
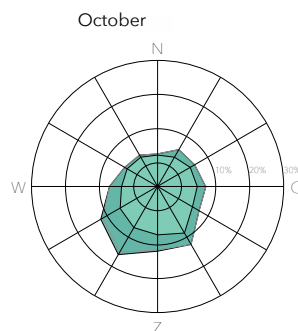
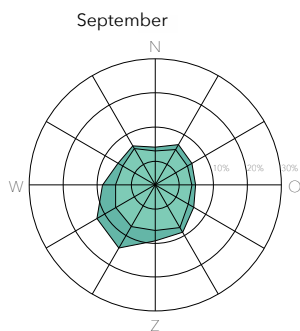
SPRING



SUMMER



AUTUMN



GEM. WINDSNELHEID

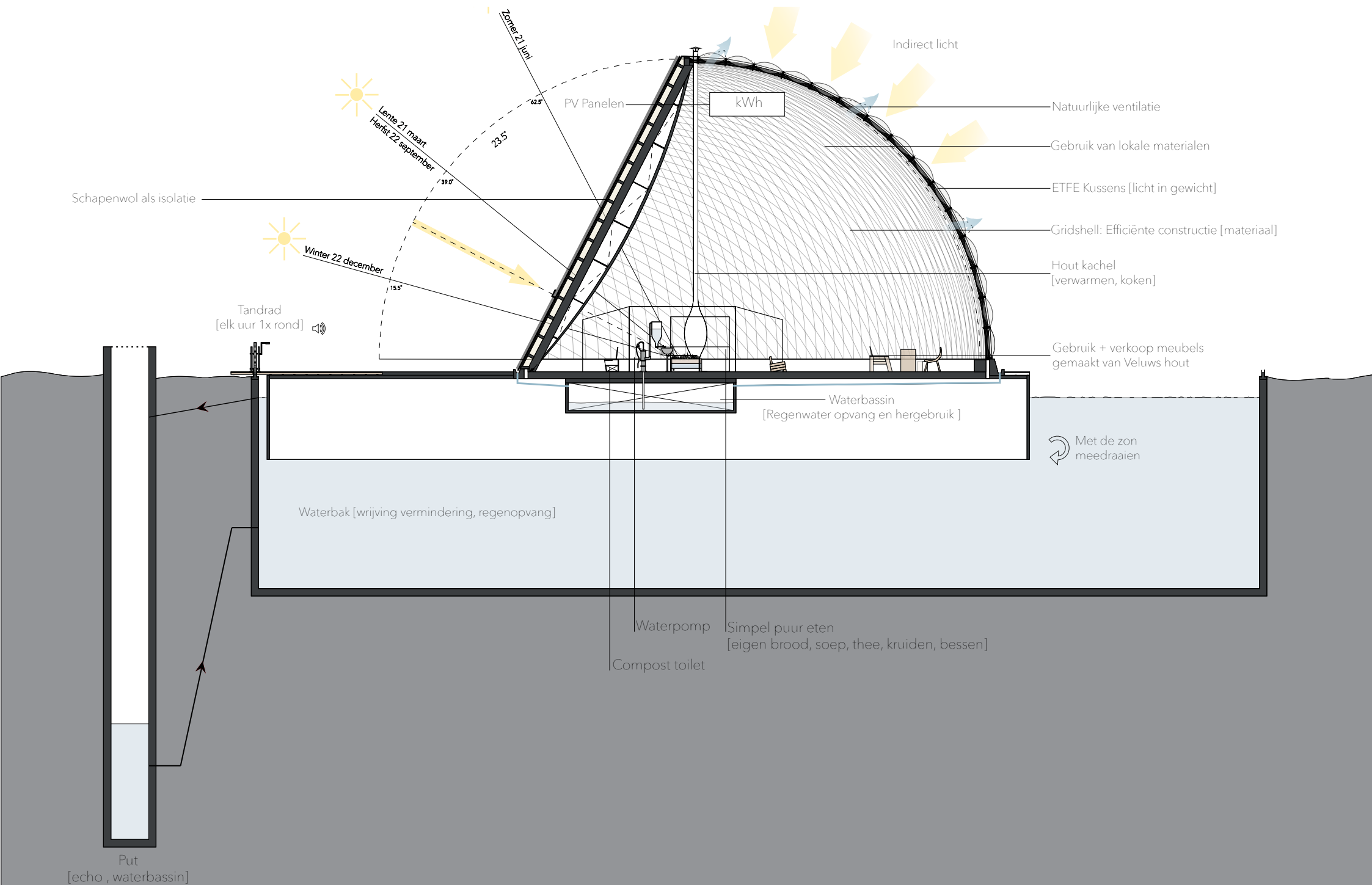




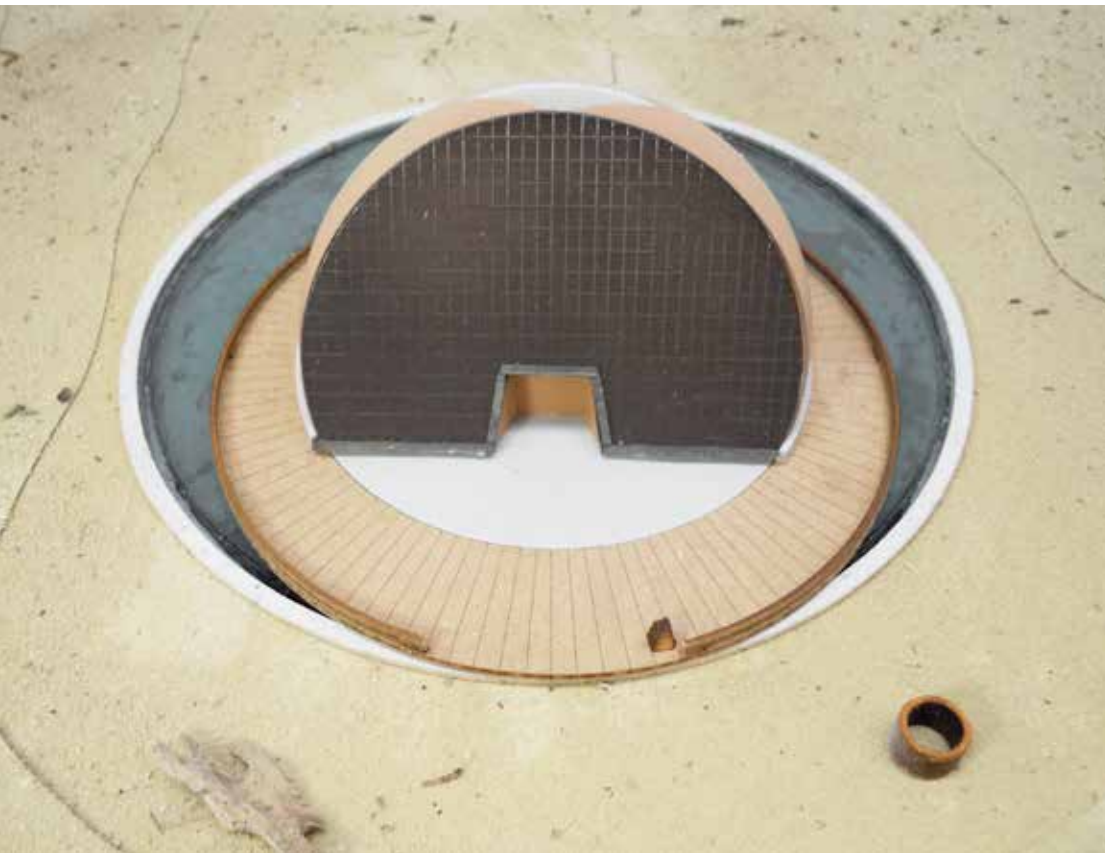
VELUWS HOUT

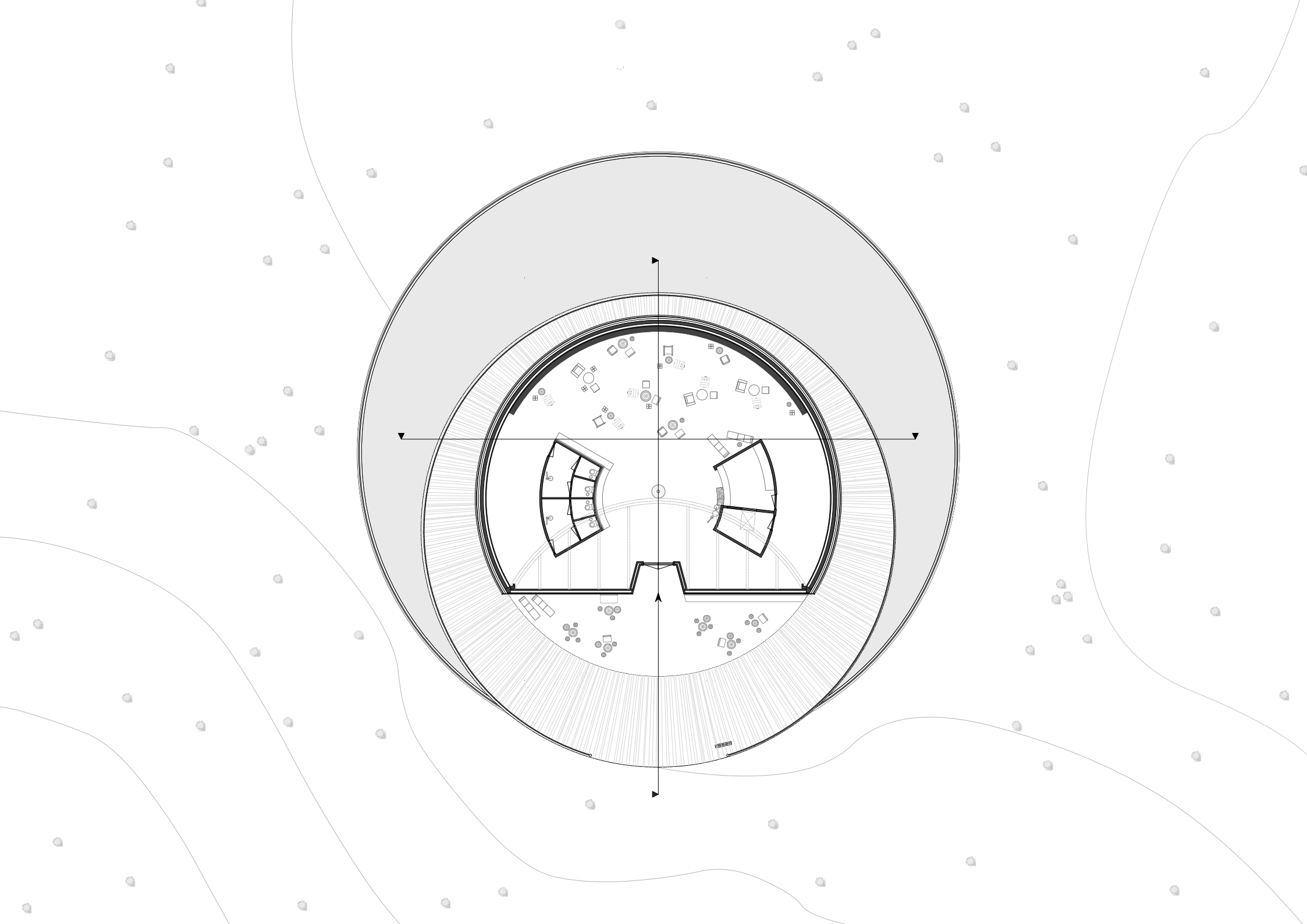


SCHAPENWOL









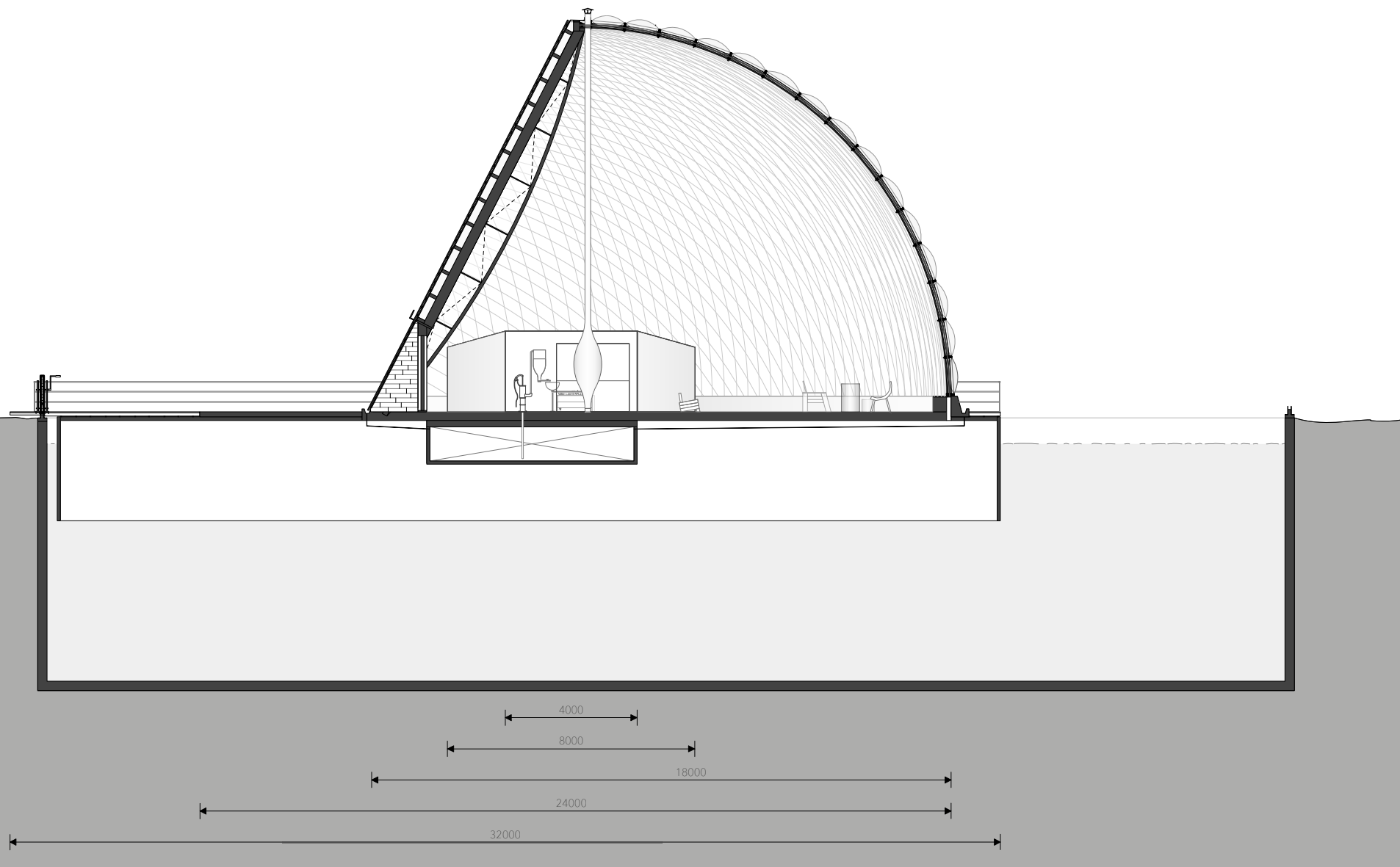


+16300 ▼

+200
+0

+3200

+8400

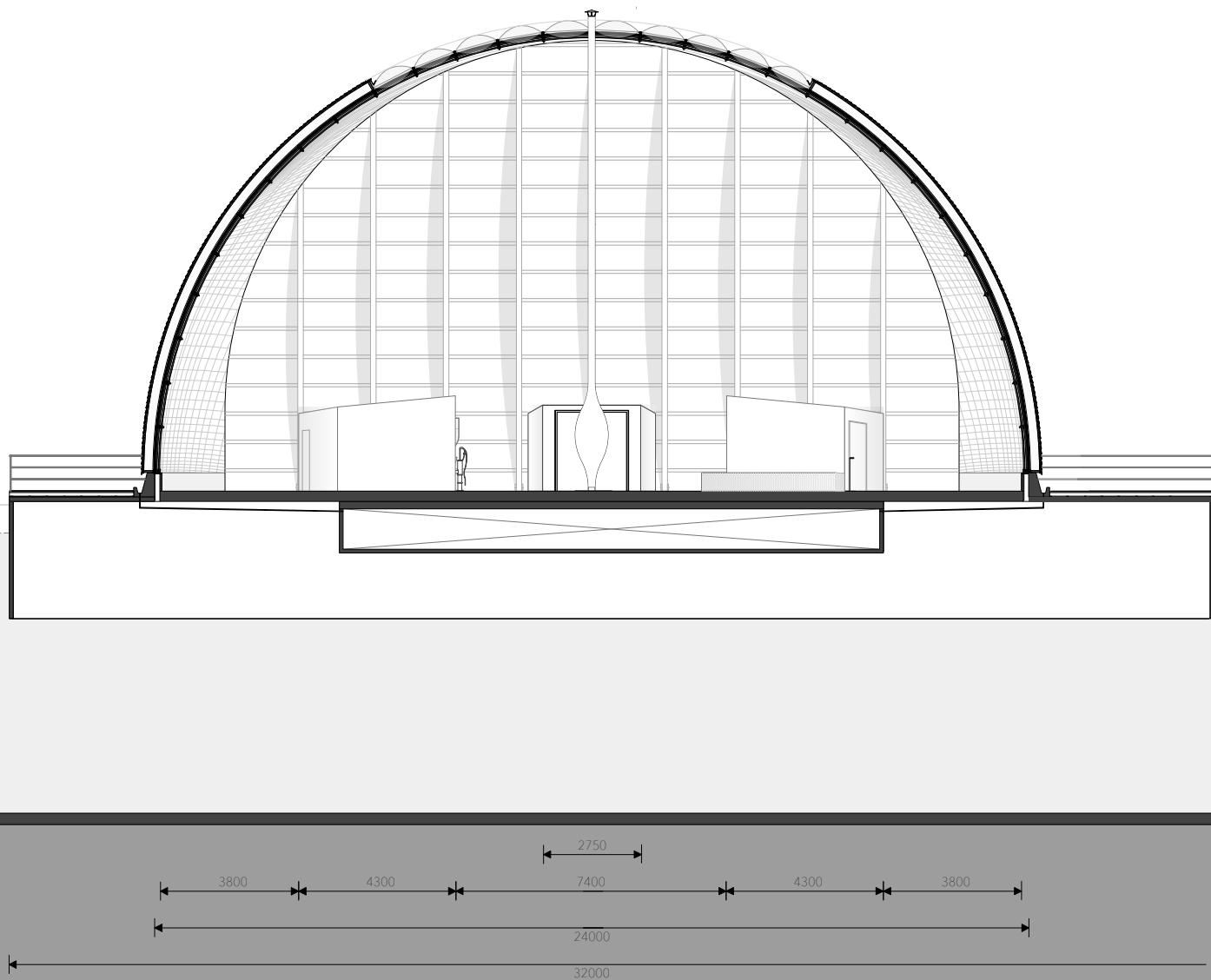


+16300 ▼

+200 ▼
+0 ▼

+3200 ▼

+8400 ▼









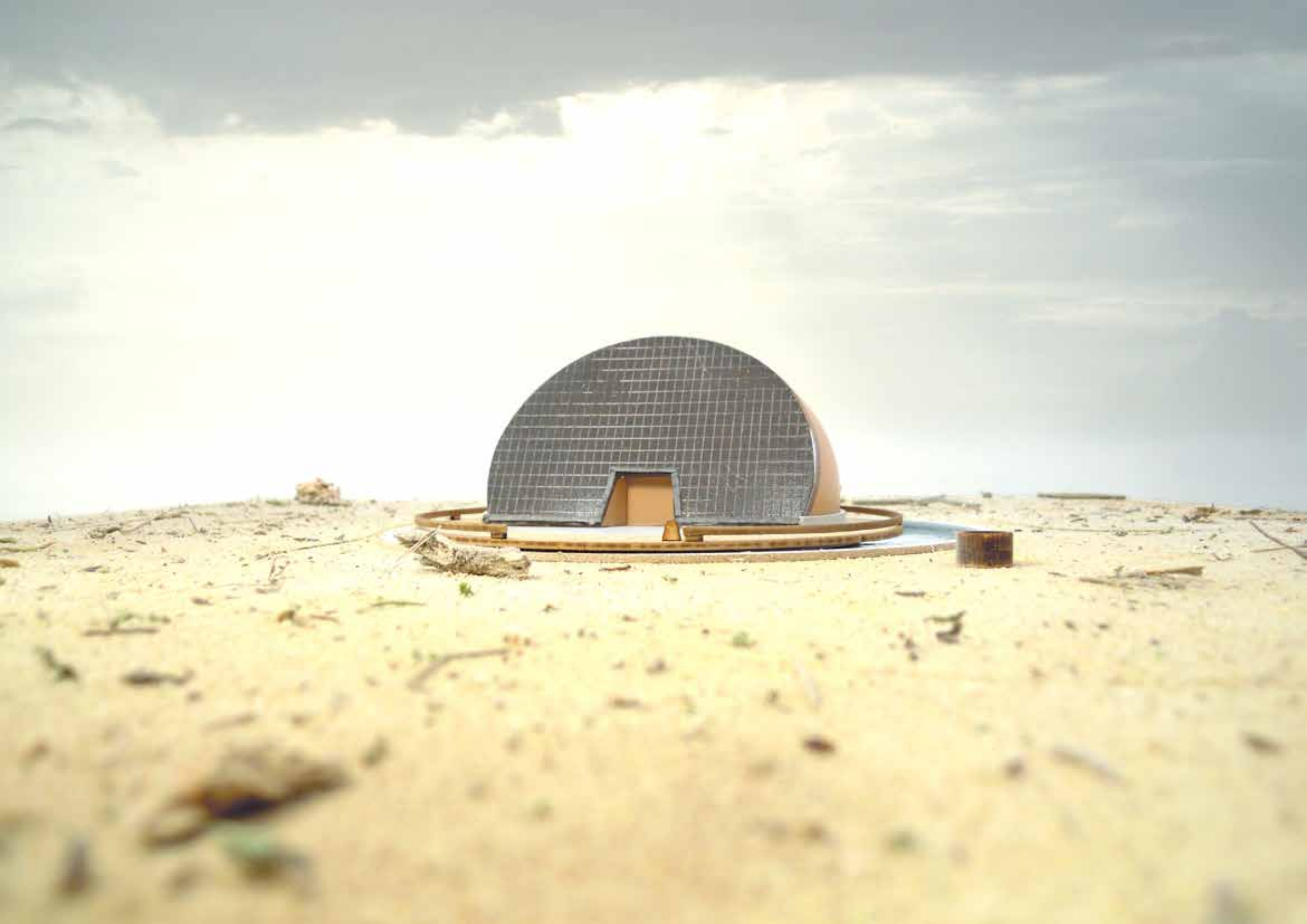
















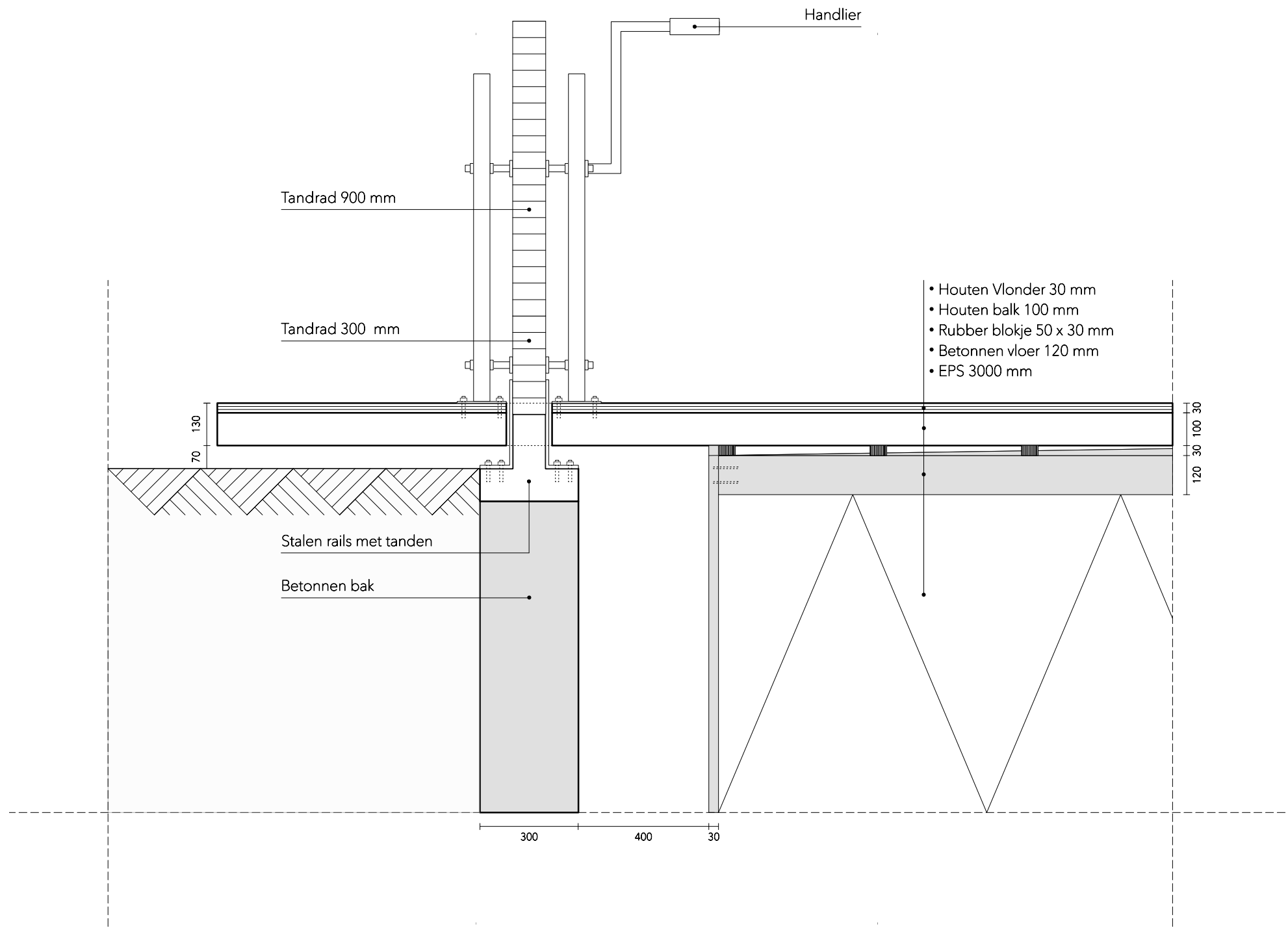


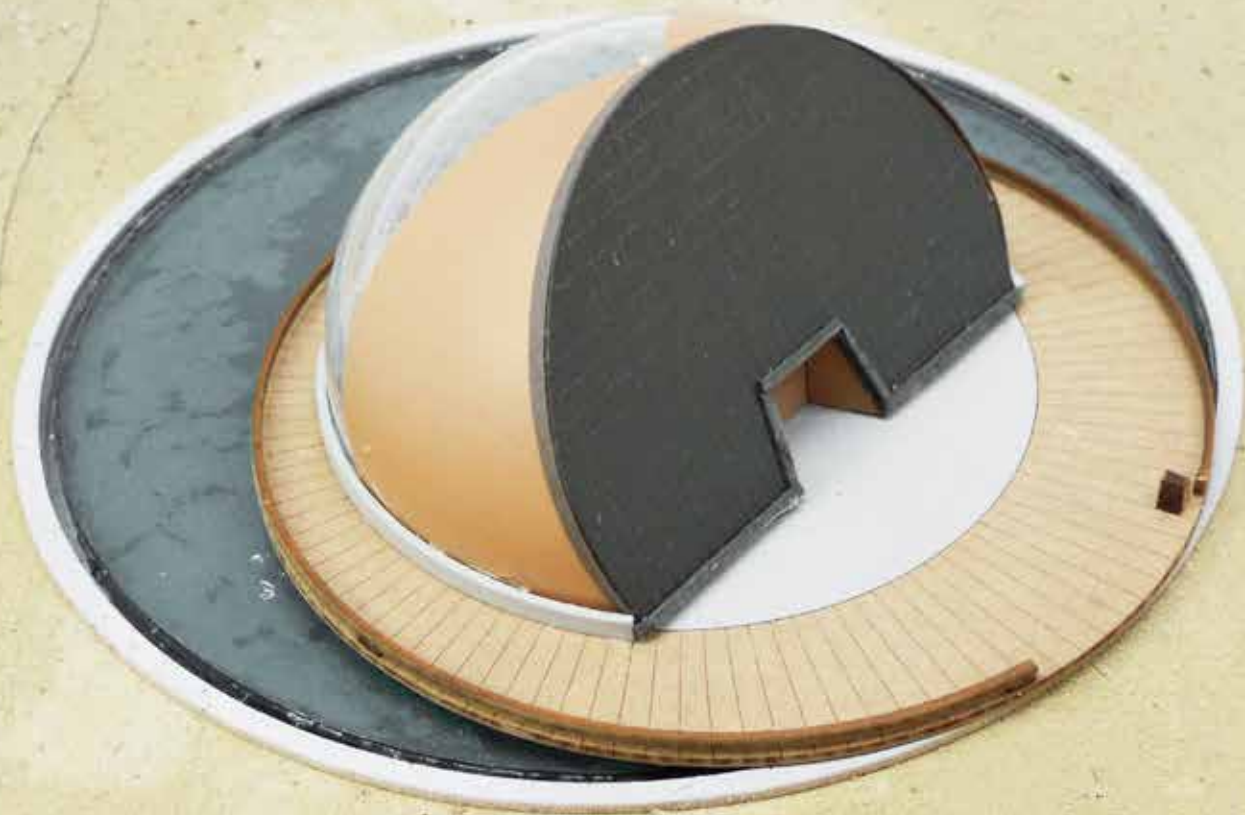




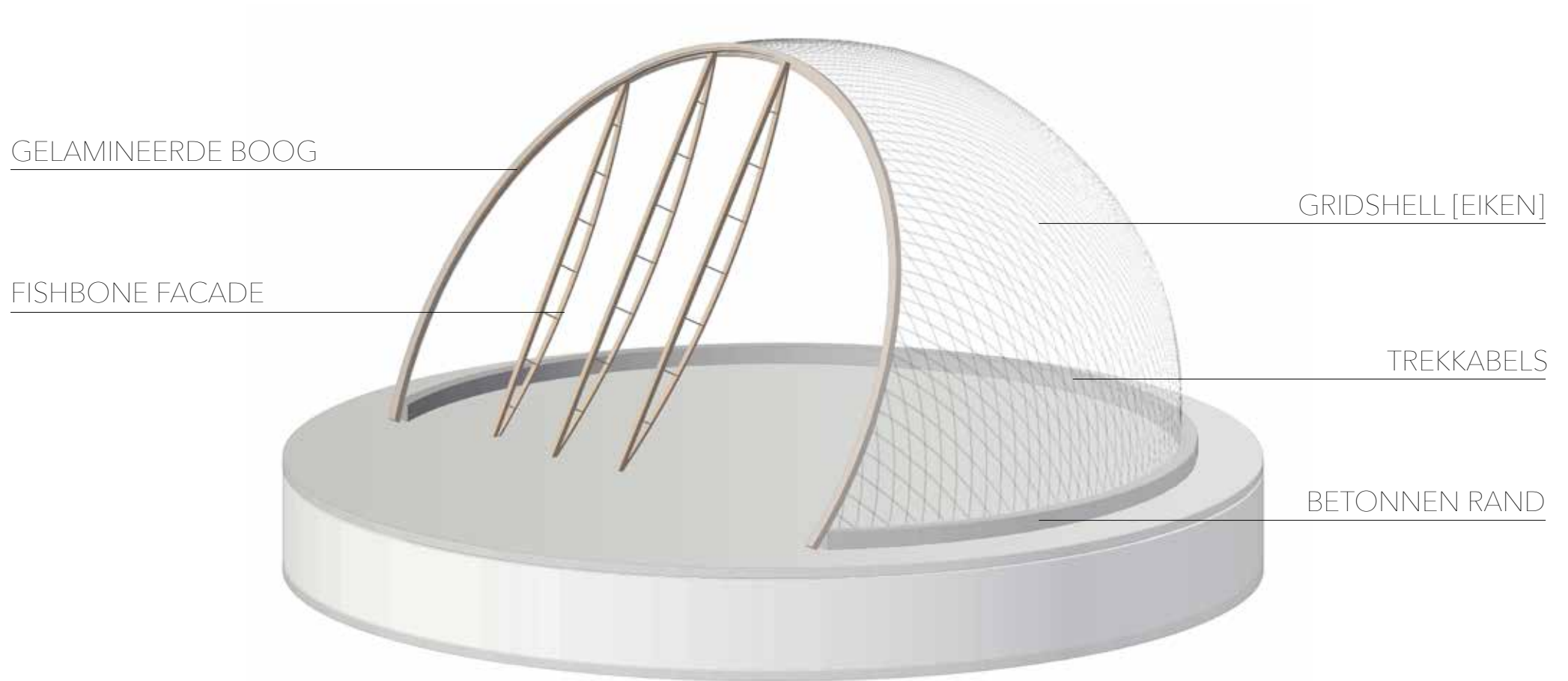






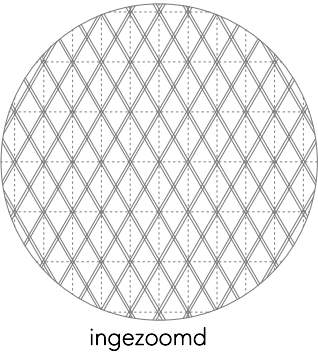


CONSTRUCTIE CONCEPT



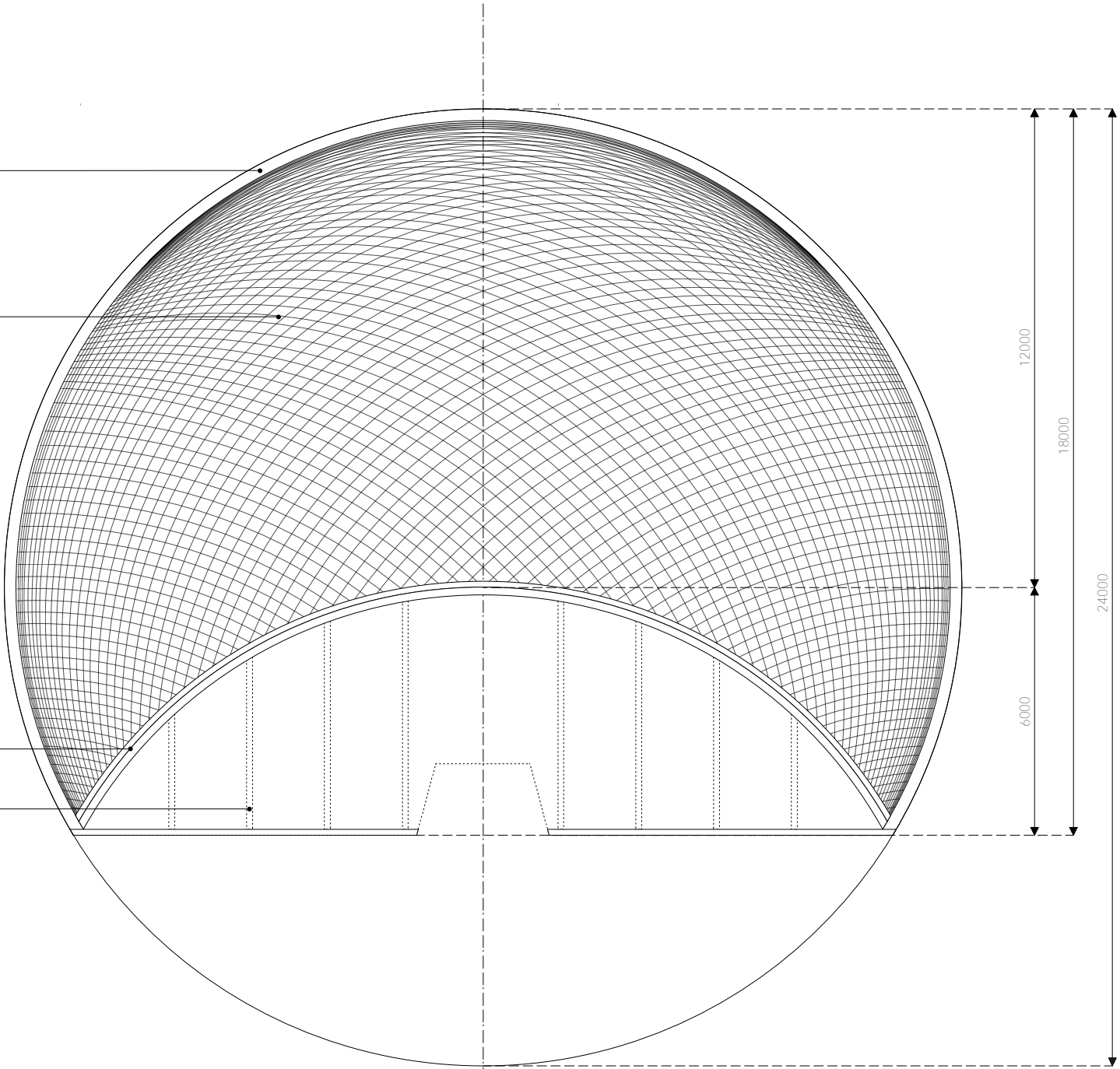
Betonnen rand

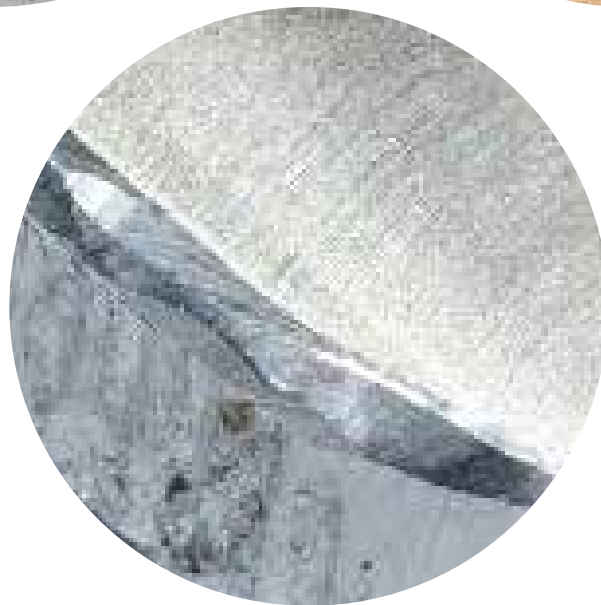
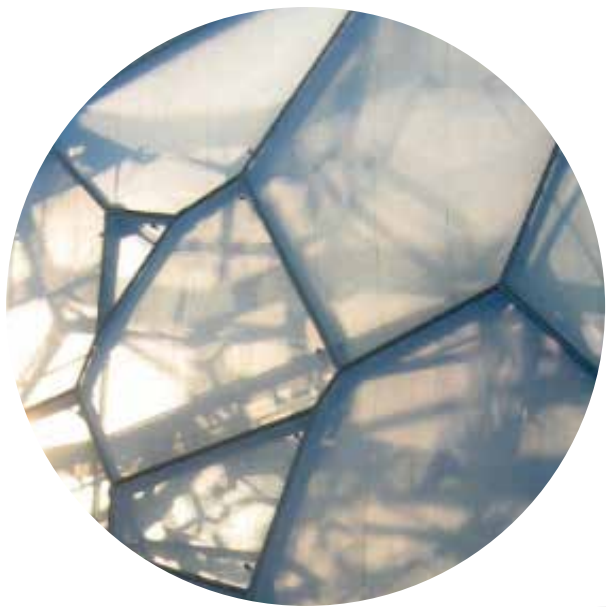
Gridshell met trekkabels
Constructieopbouw bestaande uit:
4 layers van gelamineerde eiken latten 50 x 35 mm



Gelamineerde bogen, eikenhout, verlijmd
200 x 300 mm
150 x 100 mm

Fishbone constructie





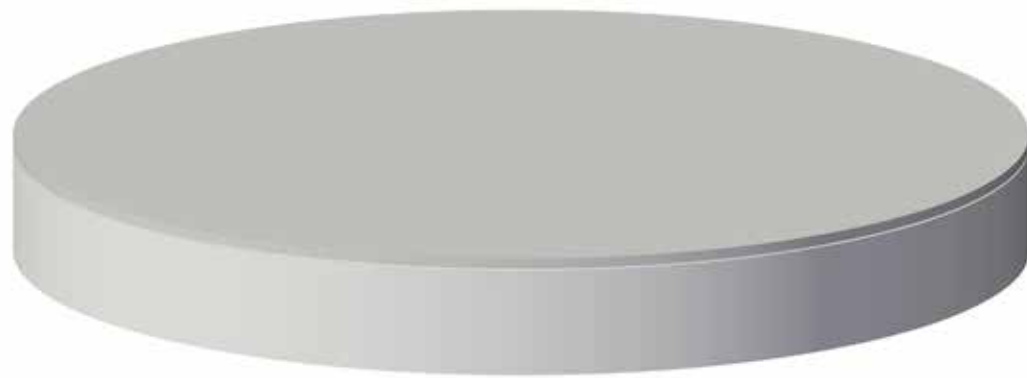
GEBRUIKTE MATERIALEN CONSTRUCTIE



1. Fundering van EPS op het water gebouwd.



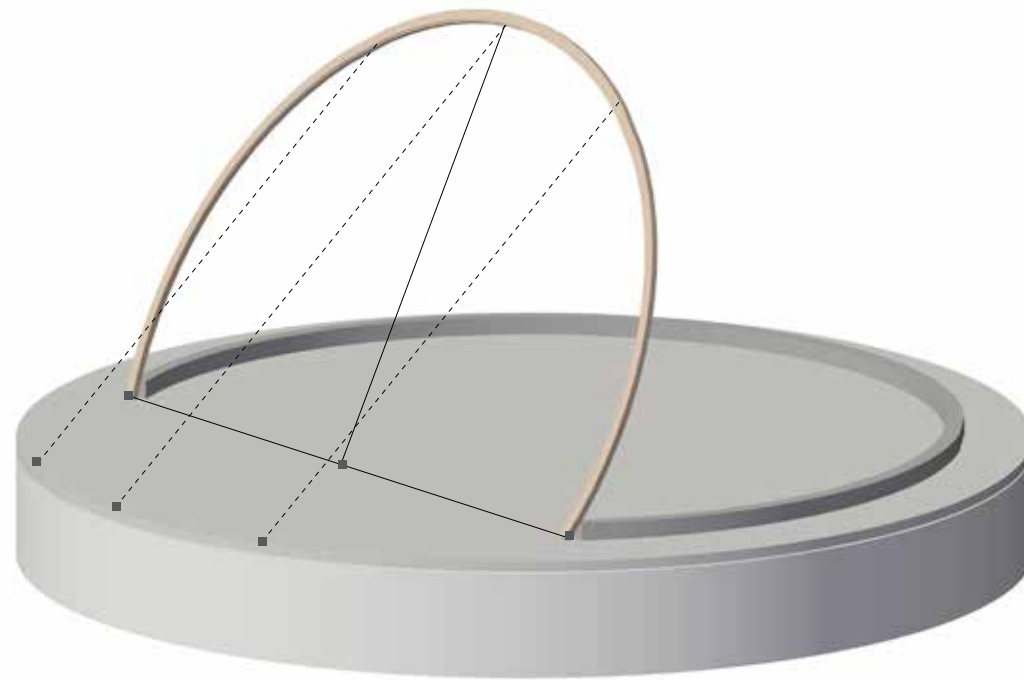
2. Vezelcement elementen rond het EPS [afwerking]



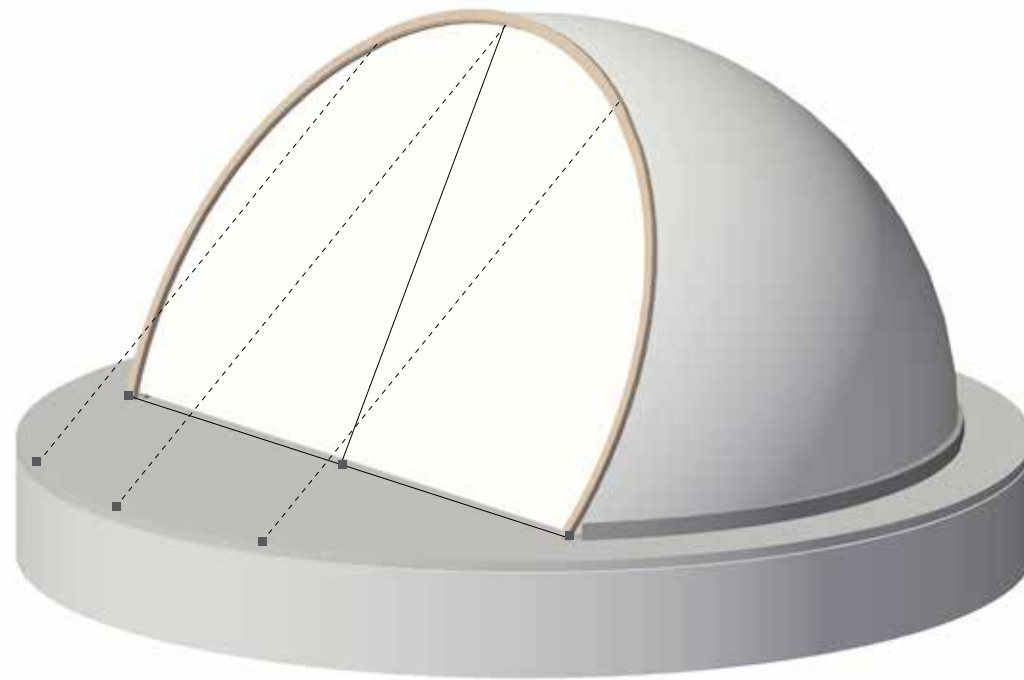
3. Storten betonvloer



4. Plaatsing betonnen rand



5. Gelamineerde houten boog [ondersteuning van trekkabels]



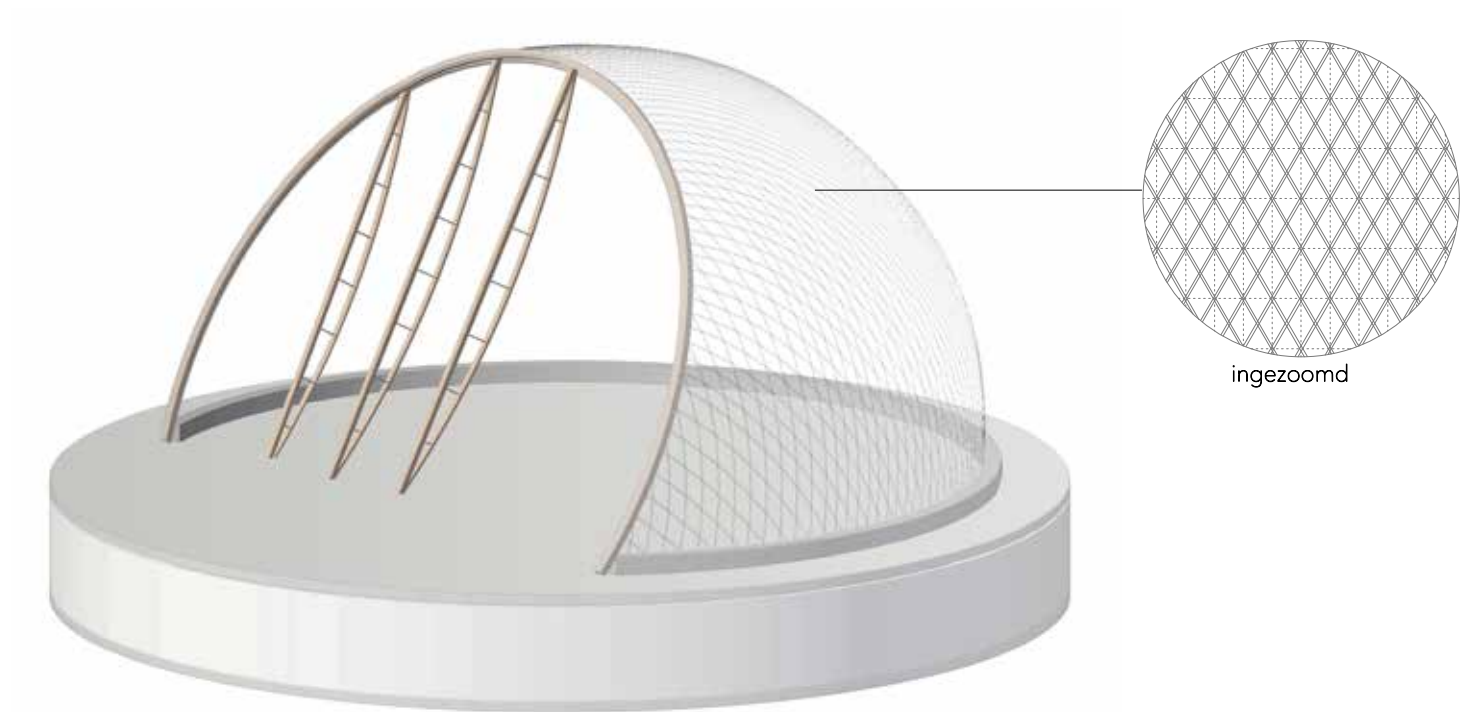
6. Gridshell gelamineerde latten in 1 richting [gebruik maken van mal]



7. Gridshell gelamineerde latten in andere richting

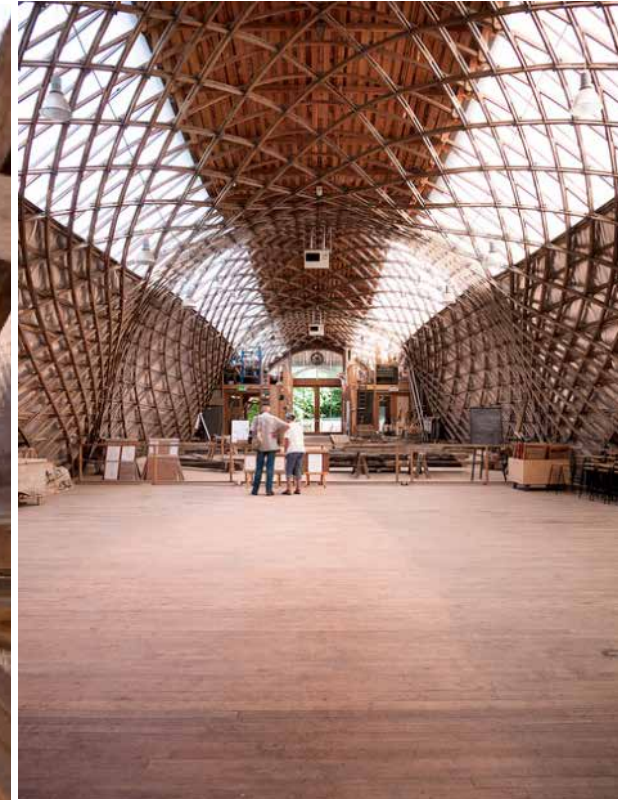


8.Fishbone facade in schuine vlak

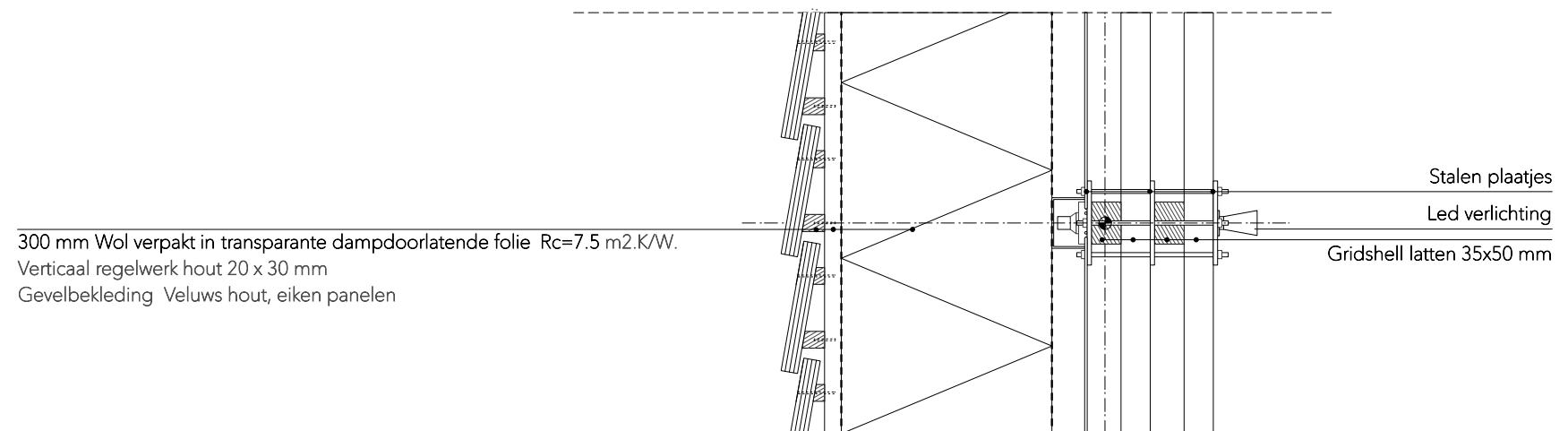
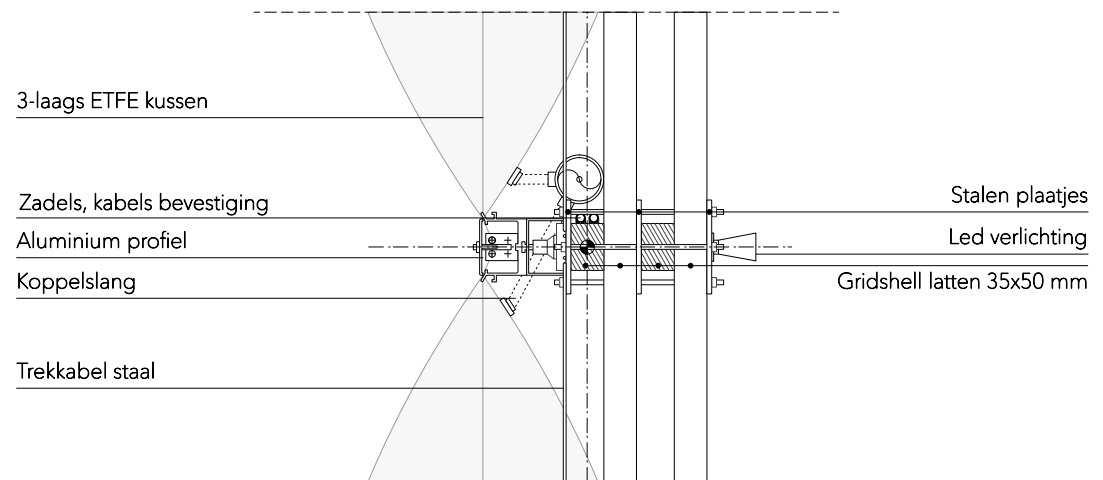


9. Trekkabels rond gridshell

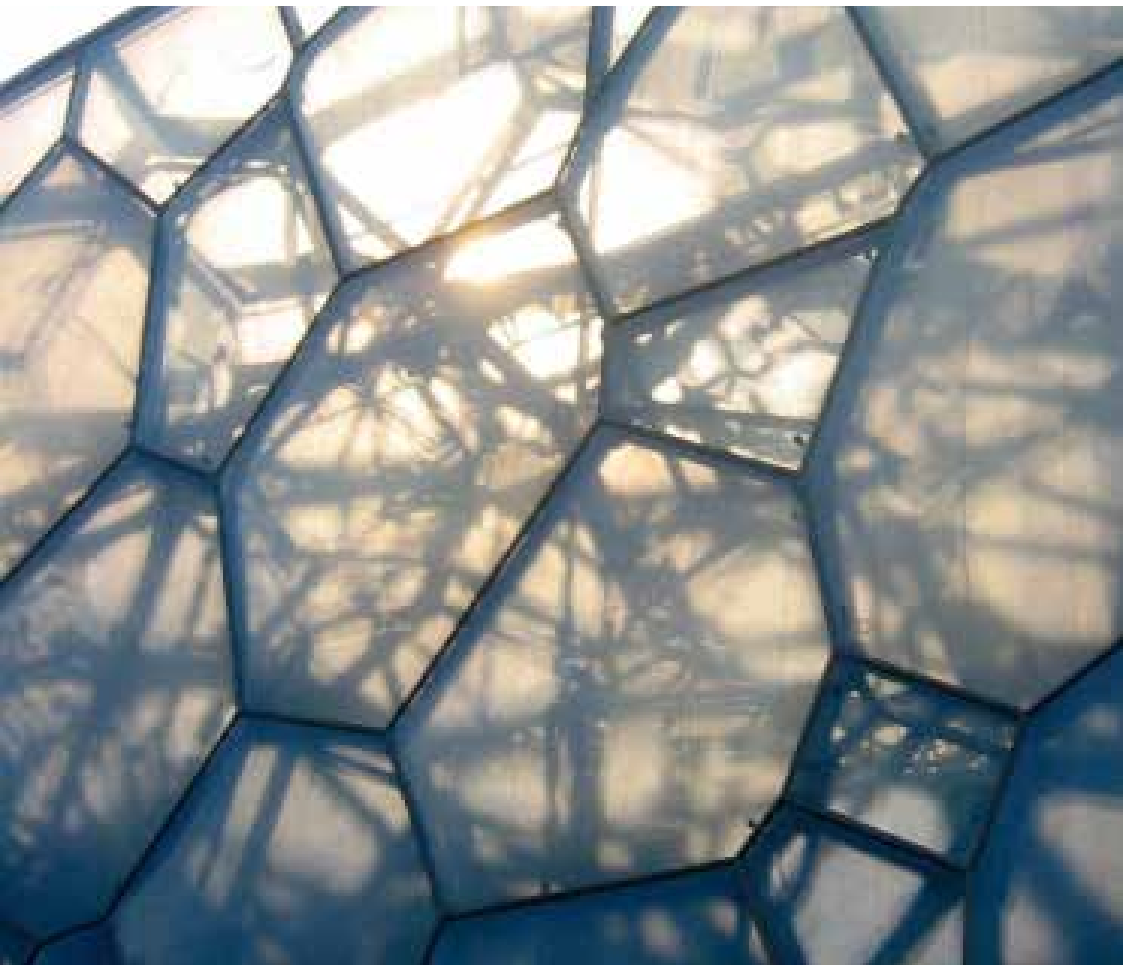
GRIDSHELL







ETFE KUSSENS



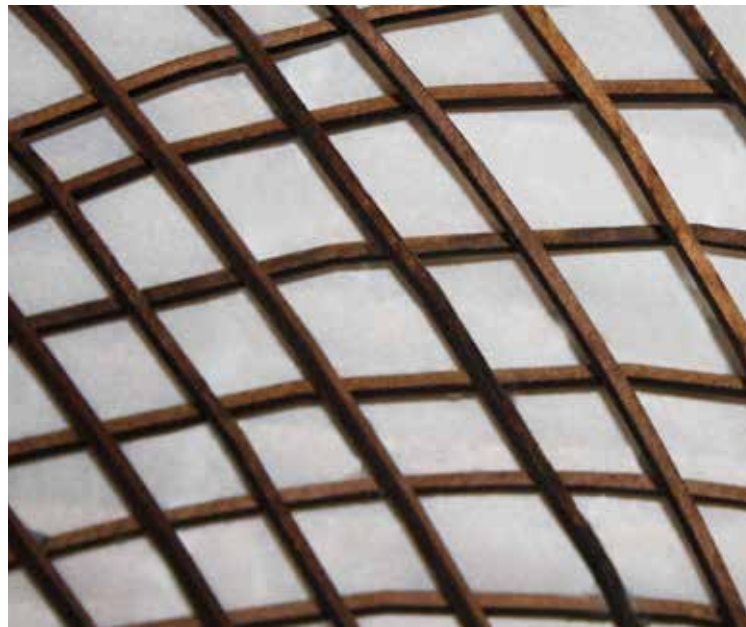
VELUWS HOUT - PANELEN





ISOLATIEMATERIAAL -SCHAPENWOL

IMPRESSIE CONSTRUCTIE INTERIEUR



Gevelbekleding Veluws hout, eiken panelen
Verticaal regelwerk hout 20 mm
Wol 250 mm $R_c=7.0 \text{ m}^2\text{K/W}$.

Gridshell

Prefab betonelement met geïntegr. goot

Wol 150 mm

Betonnen rand 50 x500 mm

Gevlinderd beton 250 mm

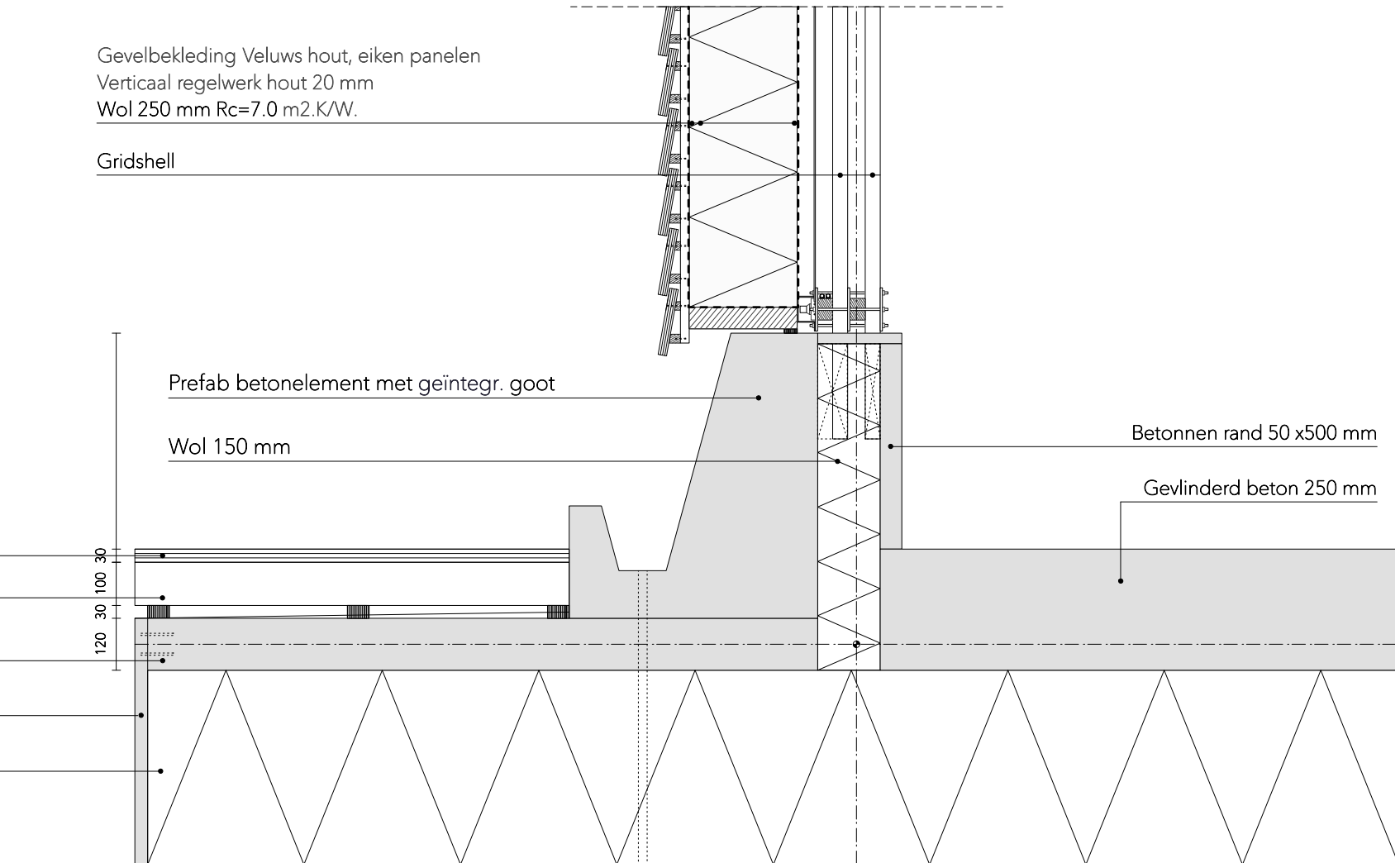
Houten vloer 30 mm

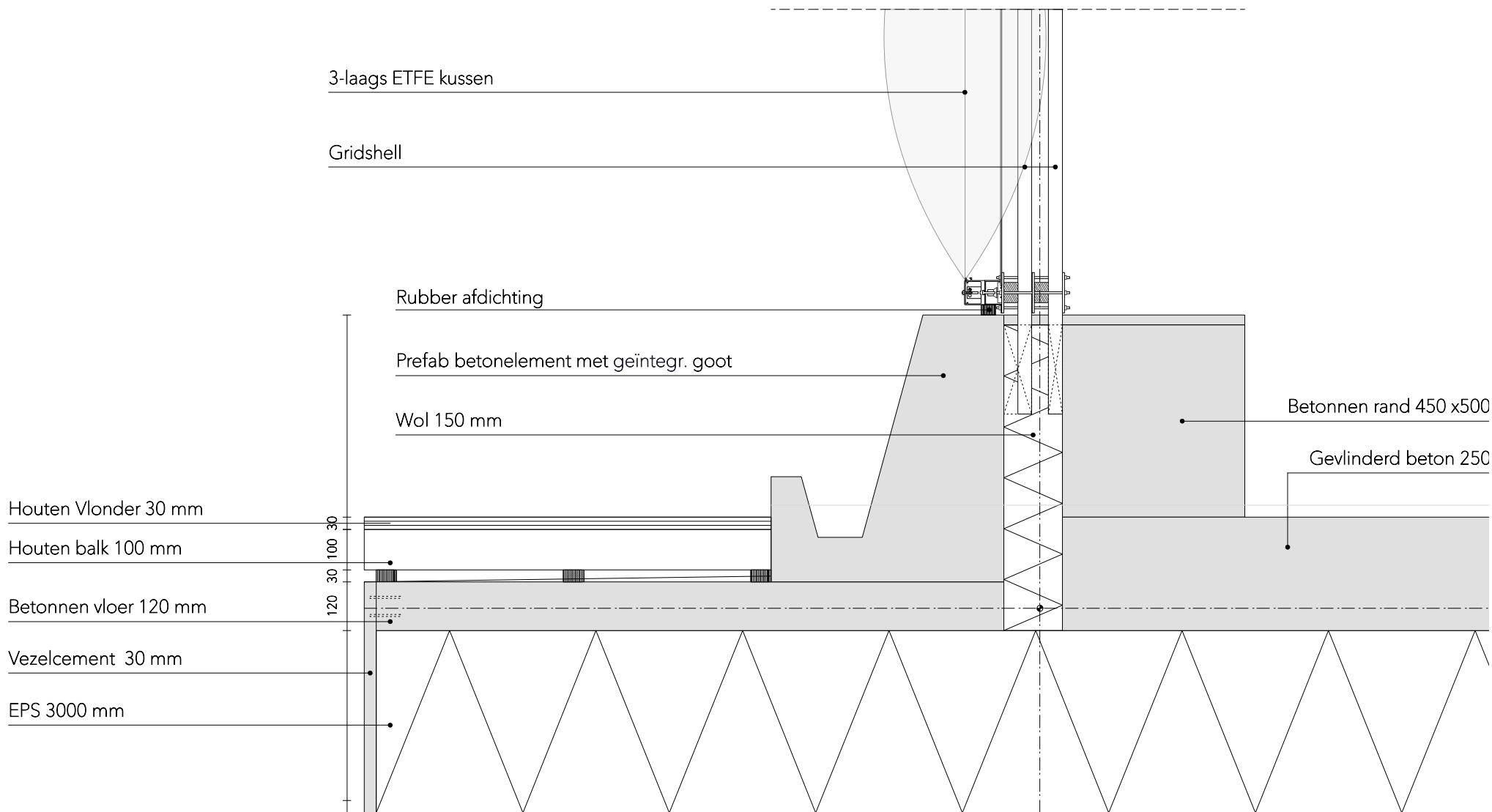
Houten balk 100 mm

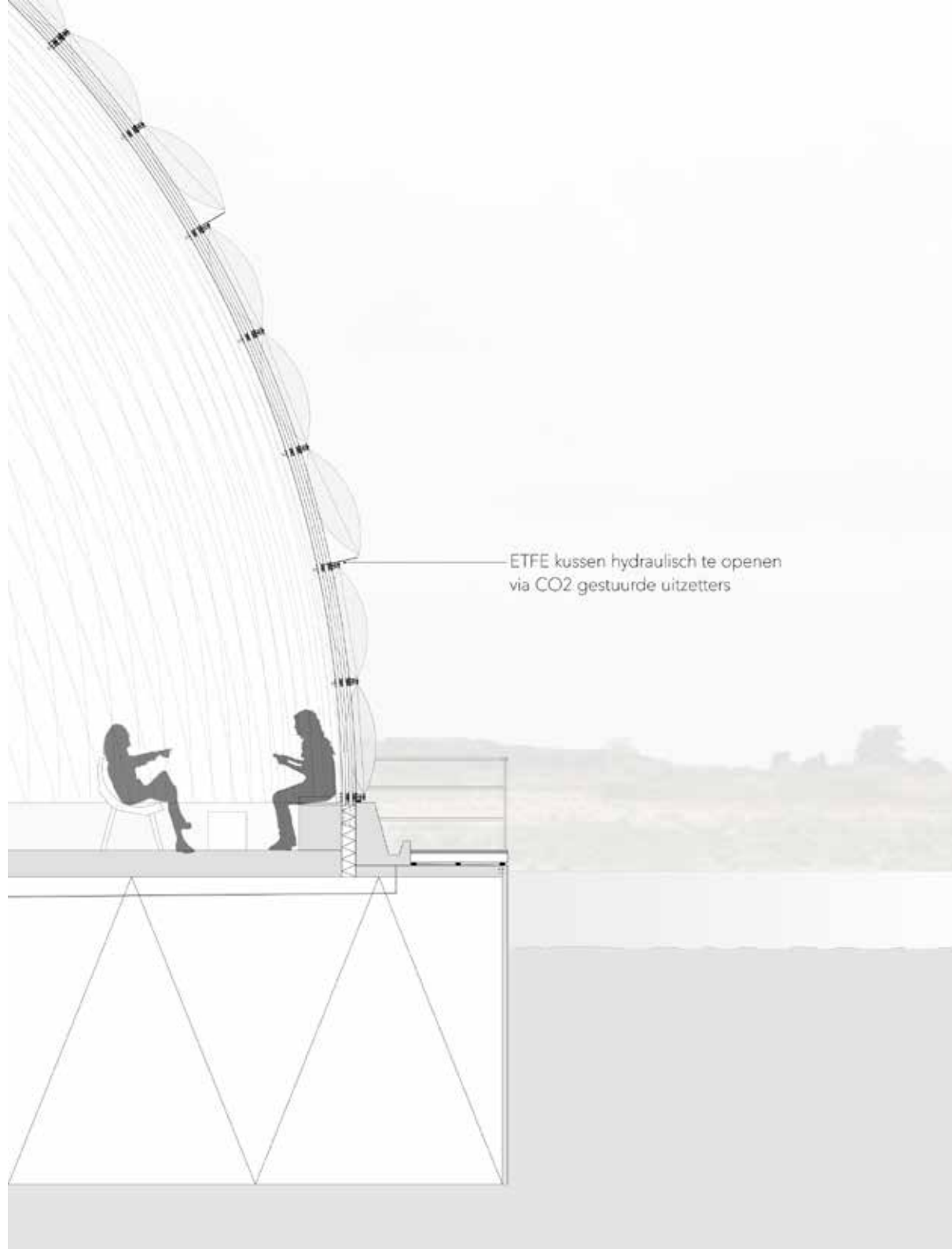
Betonnen vloer 120 mm

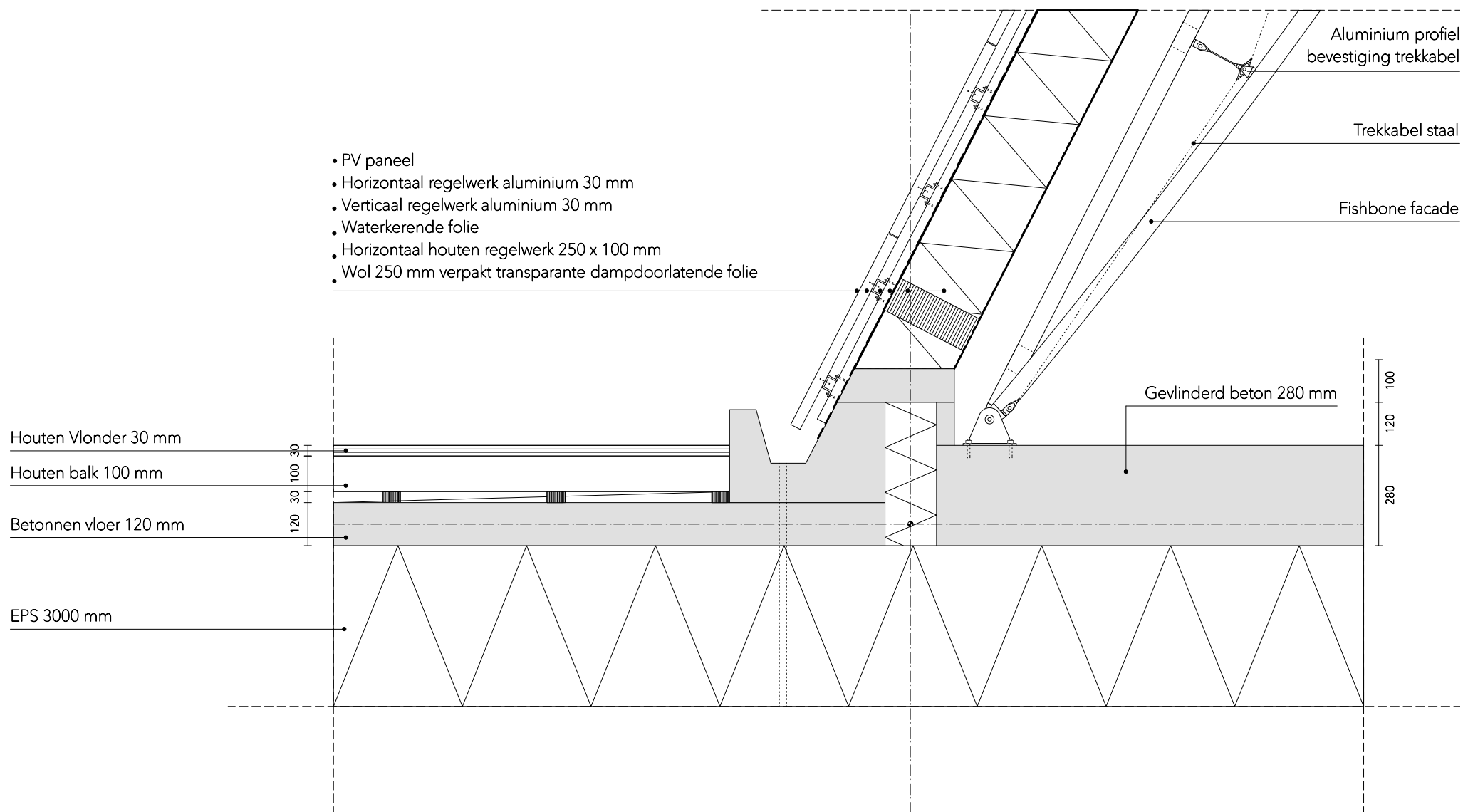
Vezelcement 30 mm

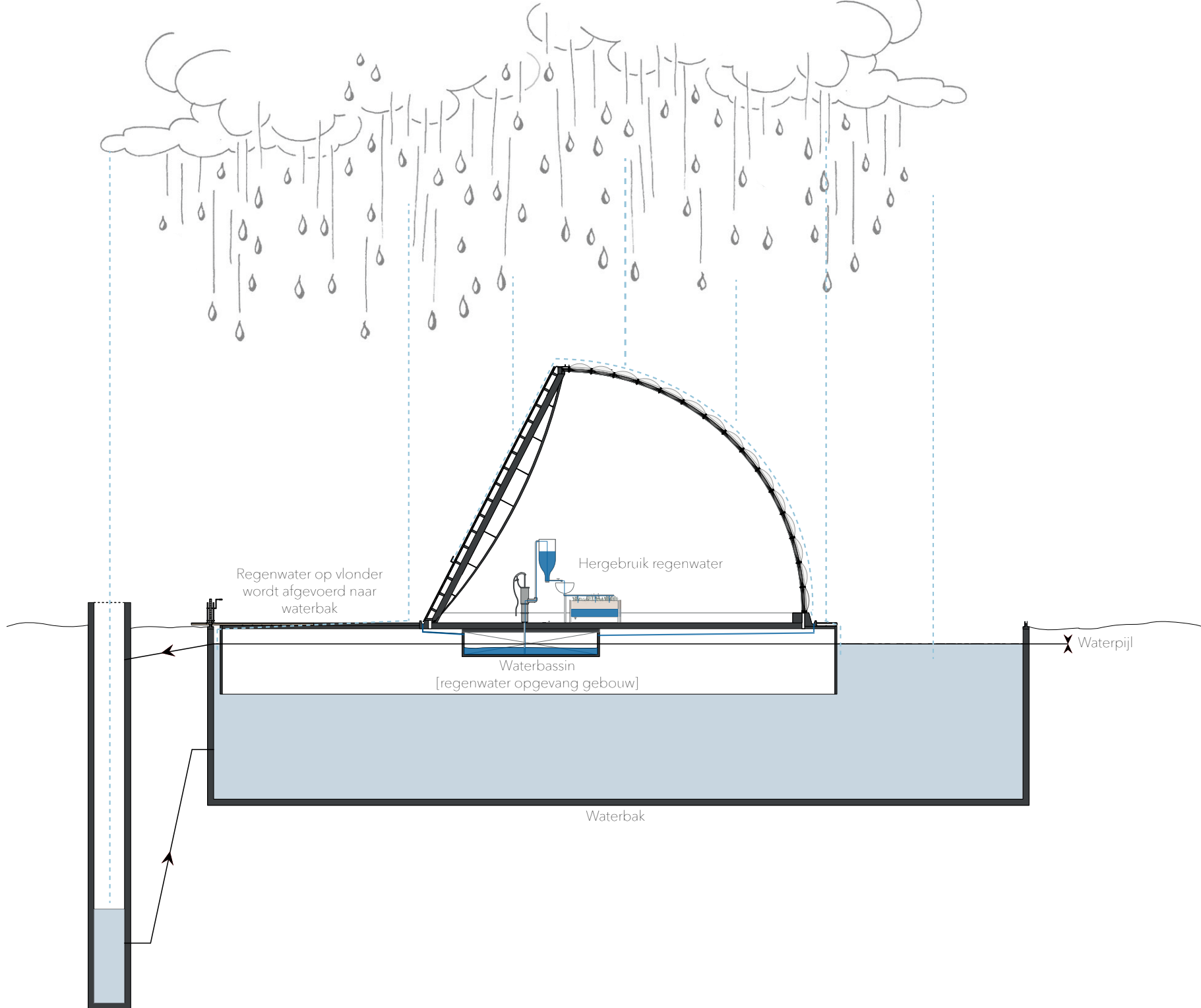
EPS 3000 mm











Seizoen	Maand	Aantal dagen	Gem. regenval [mm per m²]	Gem. regenval per seizoen [mm per m²]	Opvang regenwater paviljoen [waterbassin] [m³]	Opvang regenwater waterbak [Opp. waterbak min opp. paviljoen] [m³]
Winter	December	31	95	235	90	205
	Januari	31	85			
	Februari	28	55			
Lente	Maart	31	85	200	77	175
	April	30	50			
	Mei	31	65			
Zomer		30	85	220	84	192
	Juni	31	70			
	Juli	31	65			
	Augustus					
Herfst		30	75	250	96	218
	September	31	80			
	Oktober	30	95			
	November					
					Inhoud waterbassin 92 m³	Inhoud waterbak 7863 m³
Oppervlak paviljoen					383 m²	
Oppervlak terras					86 m²	
Oppervlak flonder					804 m²	
Oppervlak waterbak					1256 m²	
Diepte waterbak					9 m	

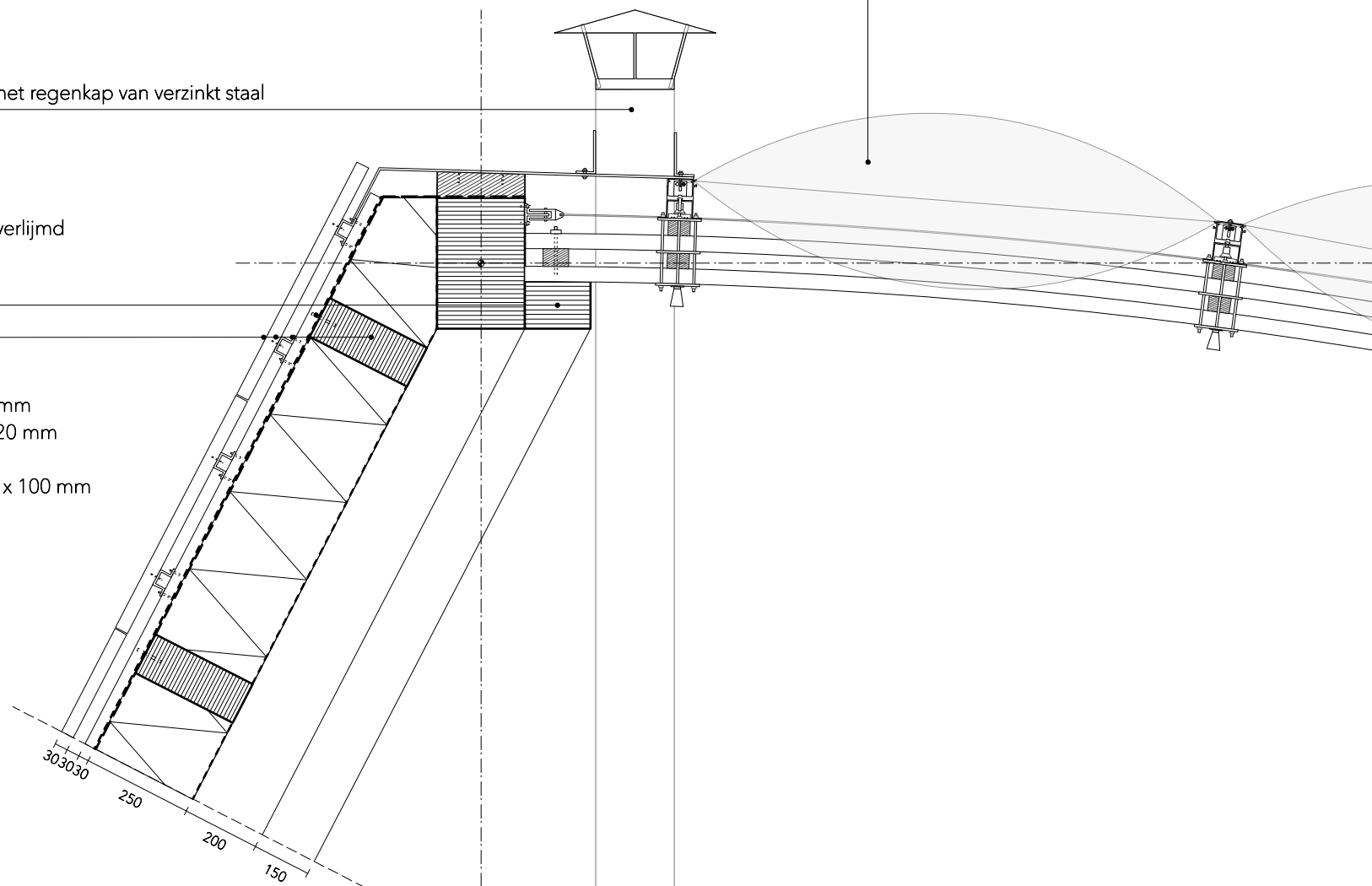


Dubbelwandige pijp Ø 200 mm met regenkap van verzinkt staal

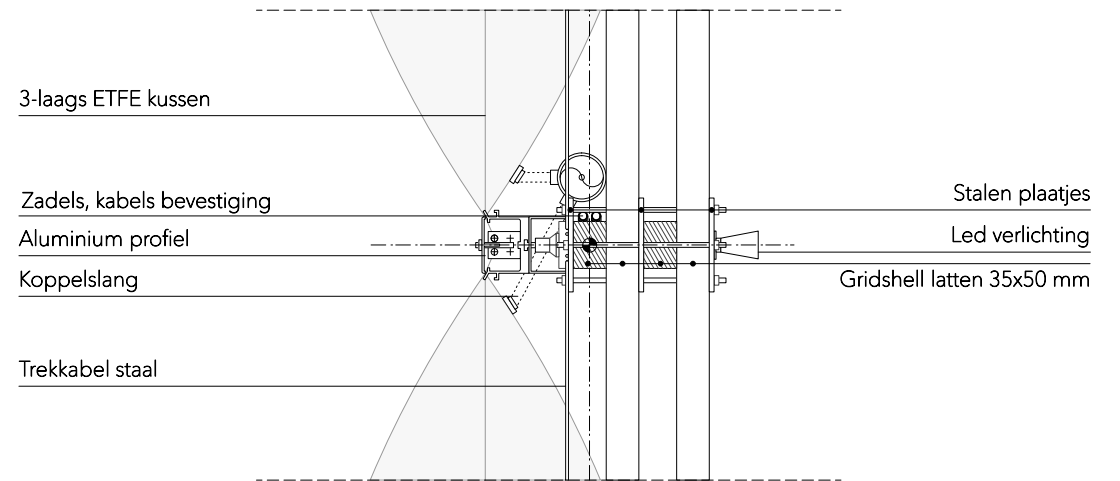
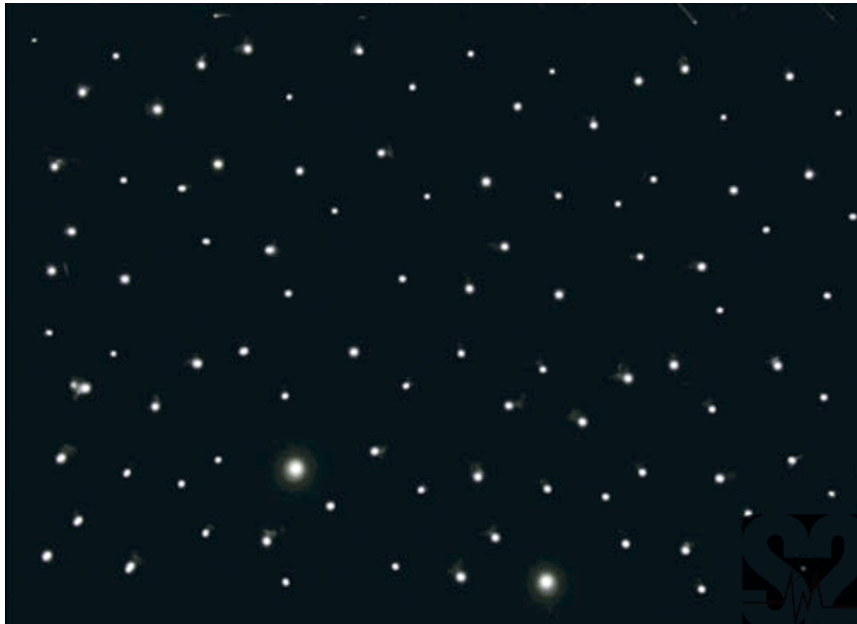
Houten boog gelamineerd hout verlijmd
200 x 300 mm
150 x 100 mm

- PV paneel
- Aluminium U-profiel 30 mm
- Verticaal regelwerk aluminium 30 mm
- Horizontaal regelwerk aluminium 20 mm
- Waterkerende folie
- Horizontaal houten regelwerk 250 x 100 mm

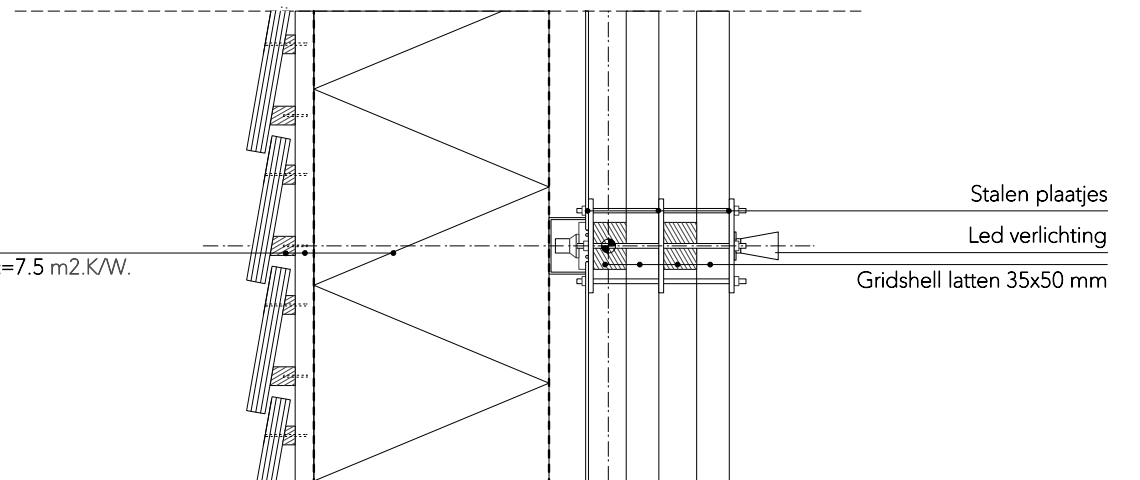
3-laags ETFE kussen







300 mm Wol verpakt in transparante dampdoorlatende folie $R_c=7.5 \text{ m}^2\text{K/W}$.
 Verticaal regelwerk hout 20 x 30 mm
 Gevelbekleding Veluws hout, eiken panelen







VERKOOP



IDENTITEIT



EXPOSITIE



VERSCHILLENDE POSITIES







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