RIVER

FIUME

RZEKA

FLUSS

河


नदी

River Design Team

River Owner Team

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USA

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Denmark

Hussain Parsianfar
Denmark

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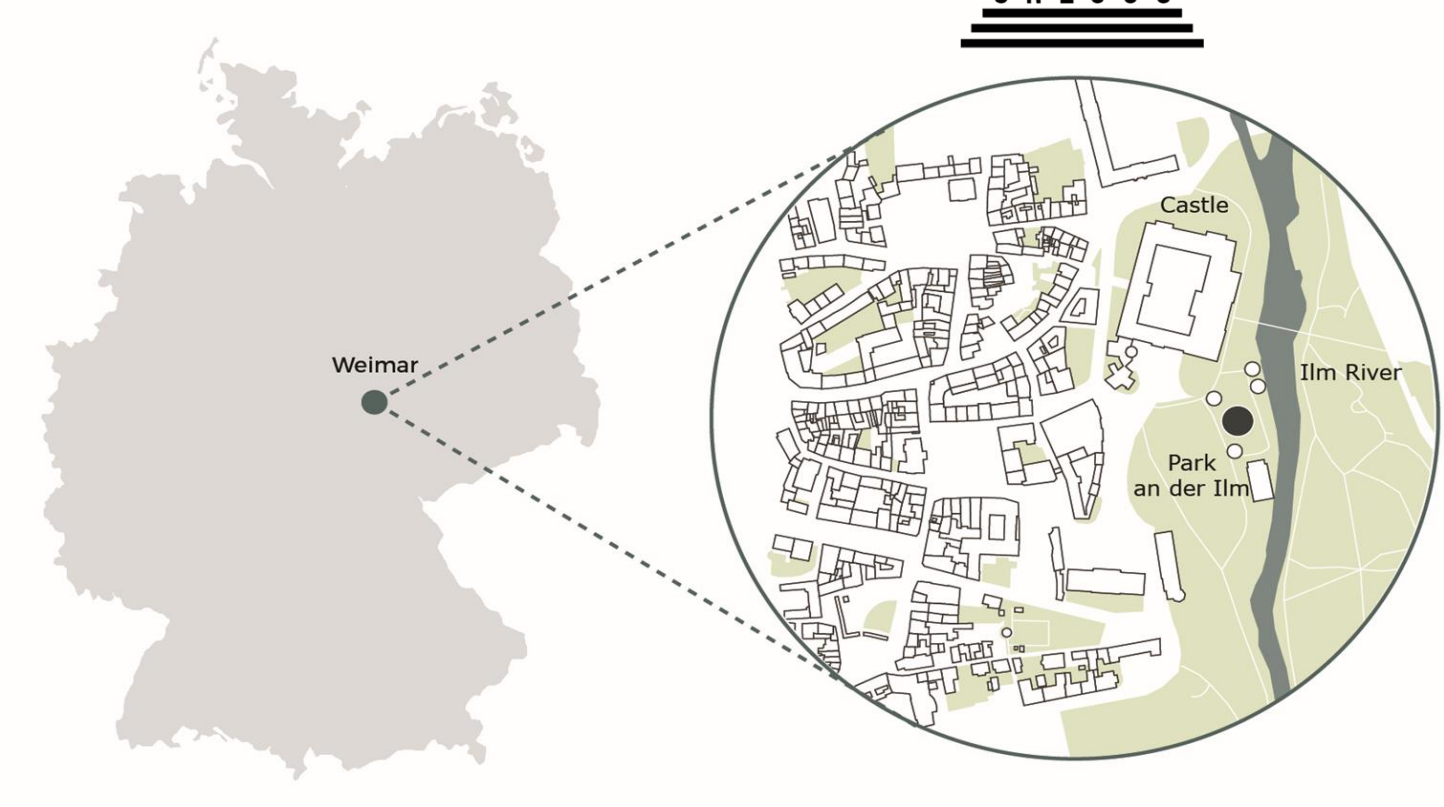
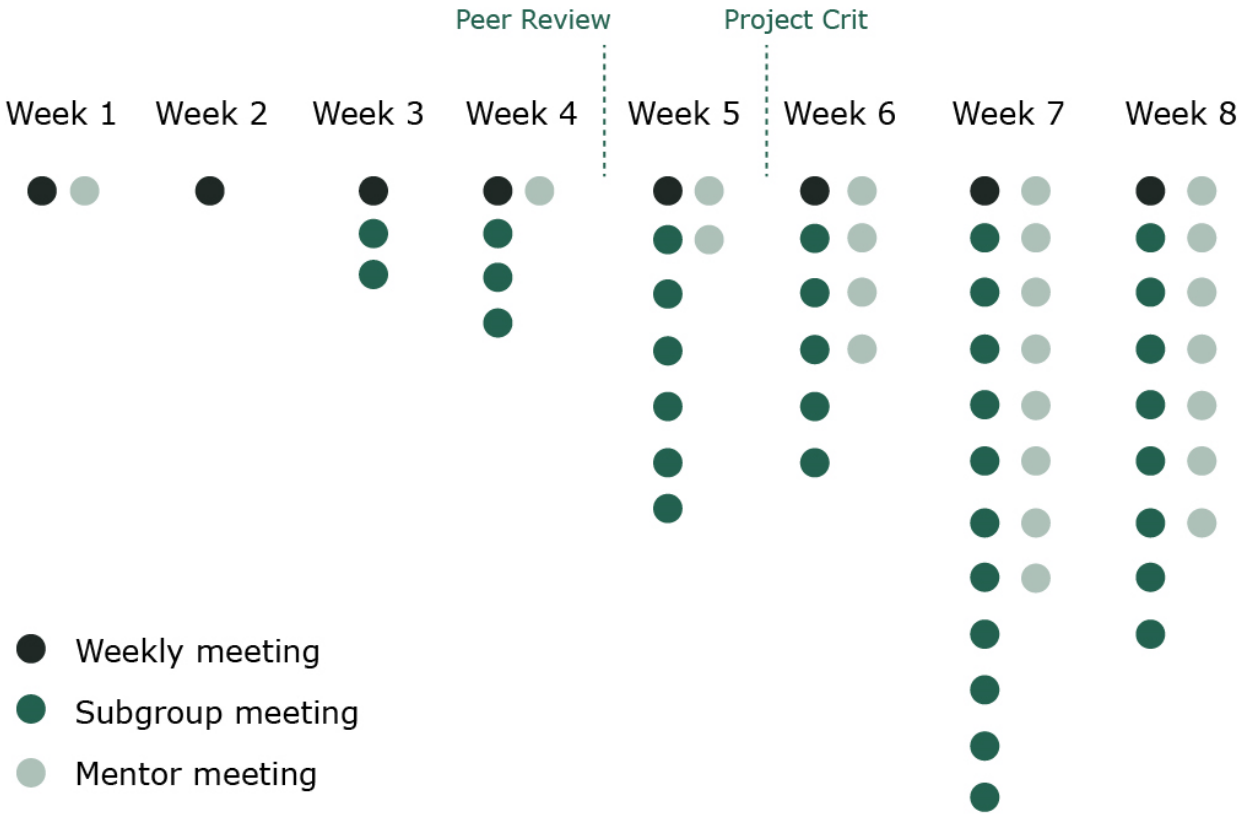
Location Germany, Weimar

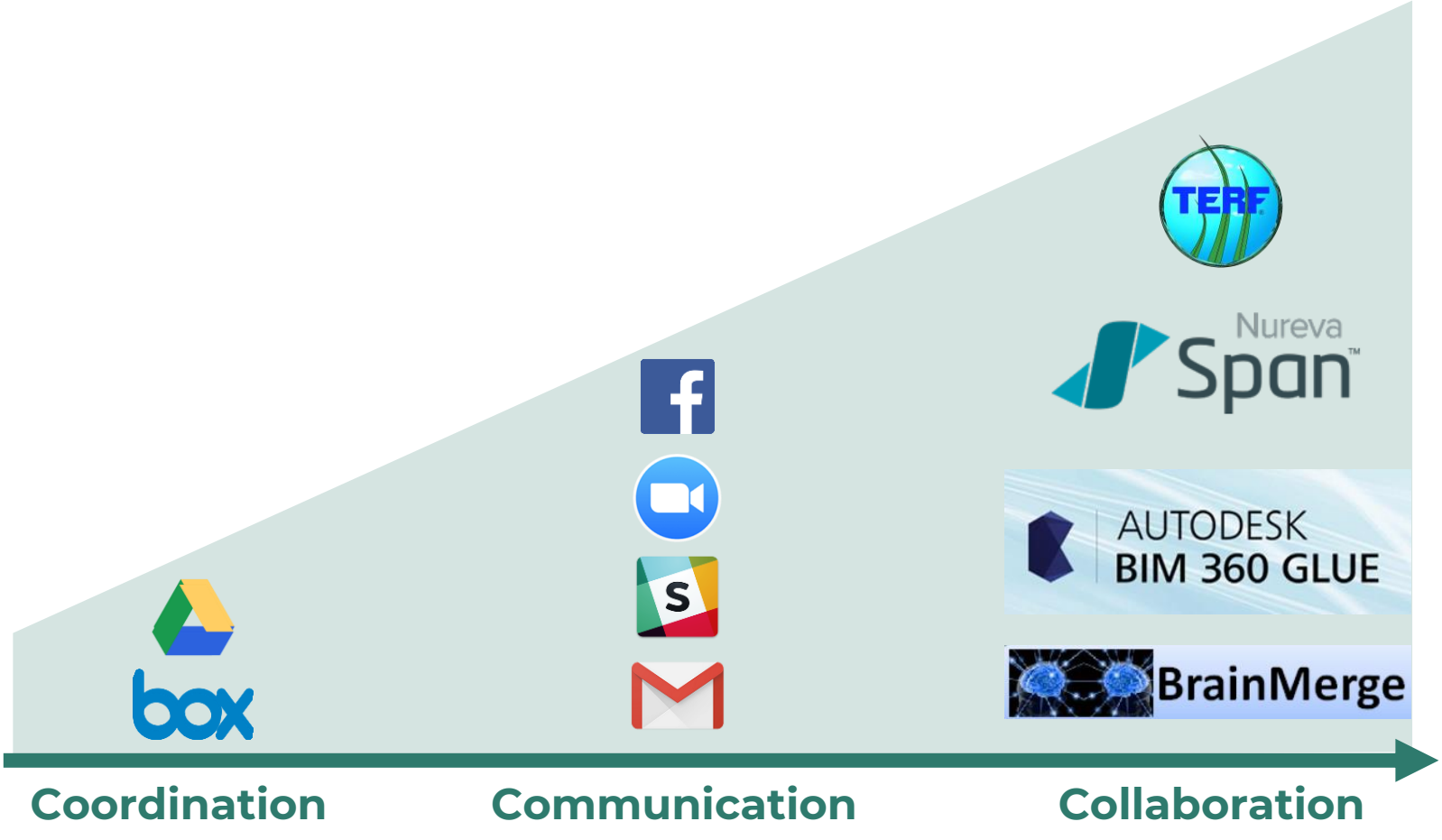


Collaboration

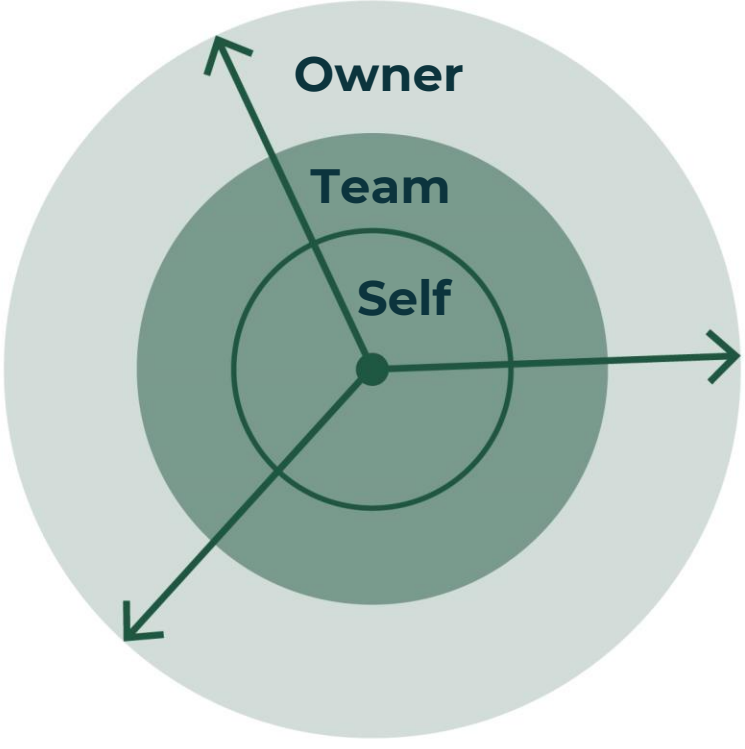
Collaboration Increase



Collaboration Tools



DPR Challenge Transparency



transparency

noun | trans·par·en·cy |
\ tran(t)s-ˈper-ən(t)-sē \

The ability to **effectively communicate** the working process and **foster trust** at three different levels: **Self**, **Team**, and **Owners**

DPR Challenge Team Diary

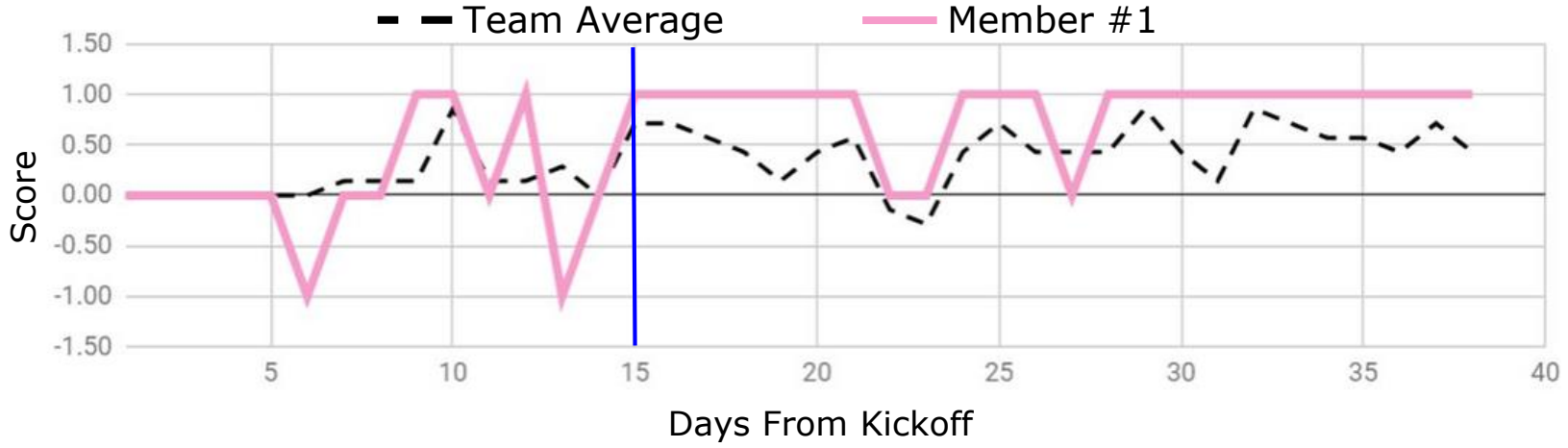
Member Name	3/3/2018
	UPDATE PULL PLAN
#4	Meeting with Sylwia and Belle for Ripple height and shaft location. Revising the load calculations and energy consumption estimates for Ripple.
#5	Scheduled a mentor meeting with Norayr at Bauhaus; Researched and calculated the impact of the green auditorium walls on our LCC;

+1 (On time)

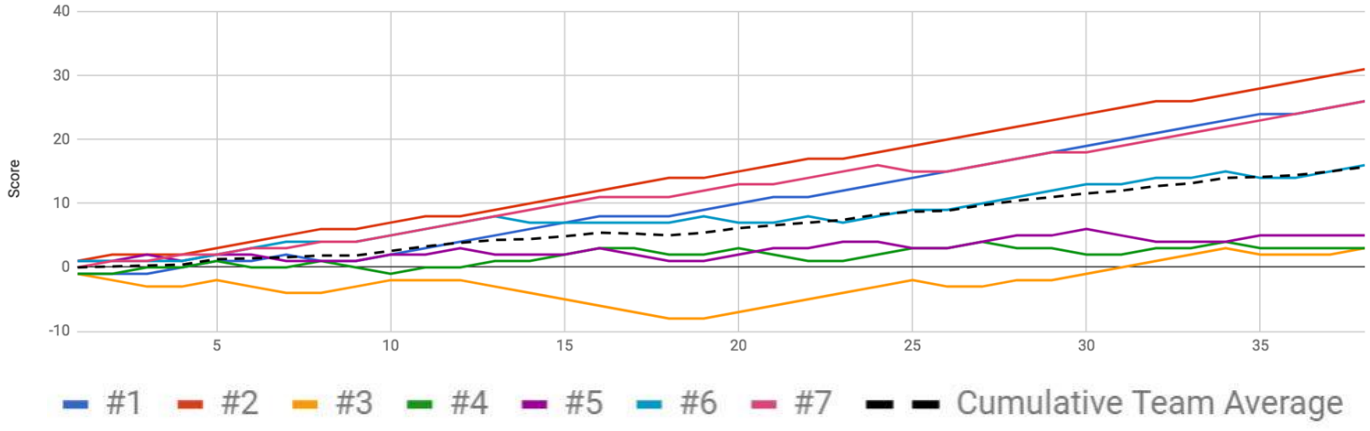
+0 (< 24 hours Late)

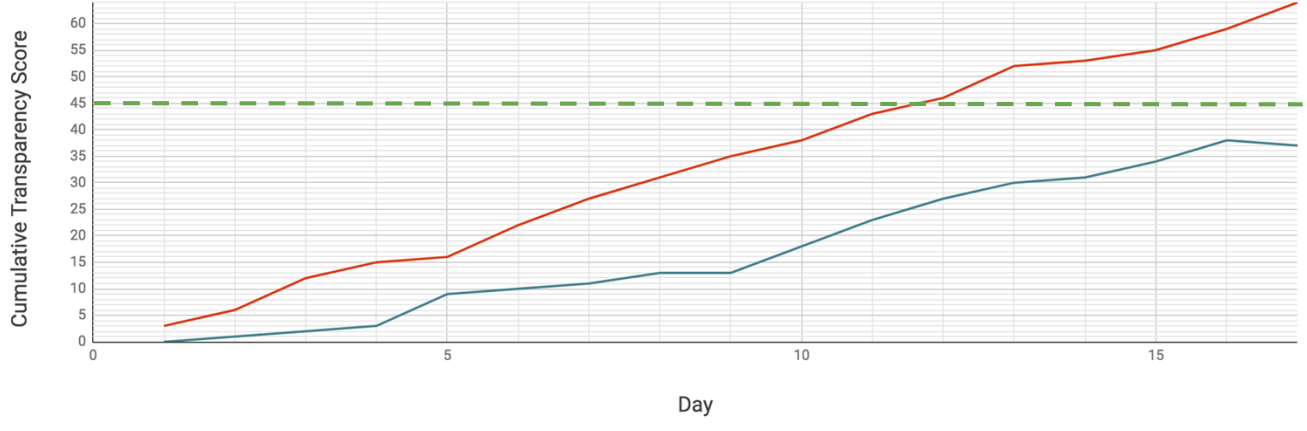
-1 (> 24 hours Late)

Member Name	4/14/2018		4/15/2018		4/16/2018	
	UPDATE PULL PLAN		UPDATE PULL PLAN		UPDATE PULL PLAN	
#4	Fire regulations for emergency staircase and fire extinguisher placement		Ventilation calculations for auditorium and collaboration spaces		Duct sizing based on ventilation calculation results	
	Mentor Meetings:	1	Mentor Meetings:	0	Mentor Meetings:	1
	Subgroup Meetings:	0	Subgroup Meetings:	0	Subgroup Meetings:	1
Pull Plan Activity			Duct Systems	50%	Duct Systems	75%
#5	Preparing Owners presentation for sunday as well as set up the agenda		Sunday Team Meeting with owners, calculating some preliminary numbers for the new concept. Meeting with Austin and Sylwia.		Implementing the landscaping to our cashflow (no numbers yet due to no initial construction costs for landscaping)	
	Mentor Meetings:	0	Mentor Meetings:	1	Mentor Meetings:	0
	Subgroup Meetings:	1	Subgroup Meetings:	0	Subgroup Meetings:	1
Pull Plan Activity	Weekly Meeting Presentation	75%	Weekly Meeting Presentation	100%	Landscape Cashflow	25%



DPR Challenge Team Tracking





SCORING

Filled on time **+1**

Filled < 24 hours **0**

Filled > 24 hours **-1**

Target Team Score

DPR Challenge Owners

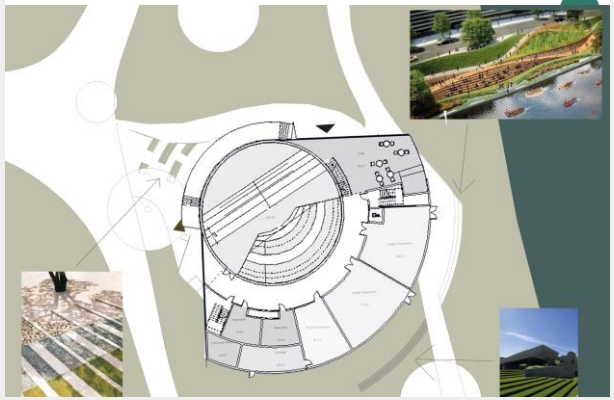
- Decreases construction costs relative to leaving the trees in place
  - Cons:
    - Trees will not survive for many years after being replaced on site
    - [illegible] cost [illegible] ding new space to stor[illegible] trees [illegible]g con[illegible]ruction
- Replace tr[illegible] wi[illegible] new [illegible] tr[illegible] based on landscape around the building
  - Trees can either be relocated or torn down and used as a part of the building, firewood, etc.
  - Pro[illegible]
    - In[illegible]ility on c[illegible]ion site
    - Decrea[illegible]truction costs relative to leaving the trees in place
    - [illegible] to [illegible] landscape ar[illegible]nd the bu[illegible]ing
  - Co[illegible]:
    - Trees will be torn down or not survive long once out of the ground
    - Cost of tree demo/relocation
- **Feasibility of using CLT with flooding and climate?**
- **Idea of having exposed structural elements and concrete**

TOO MUCH TEXT

Landscaping

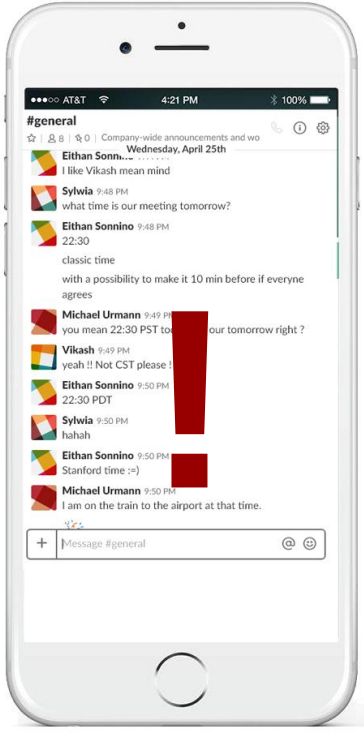
river team

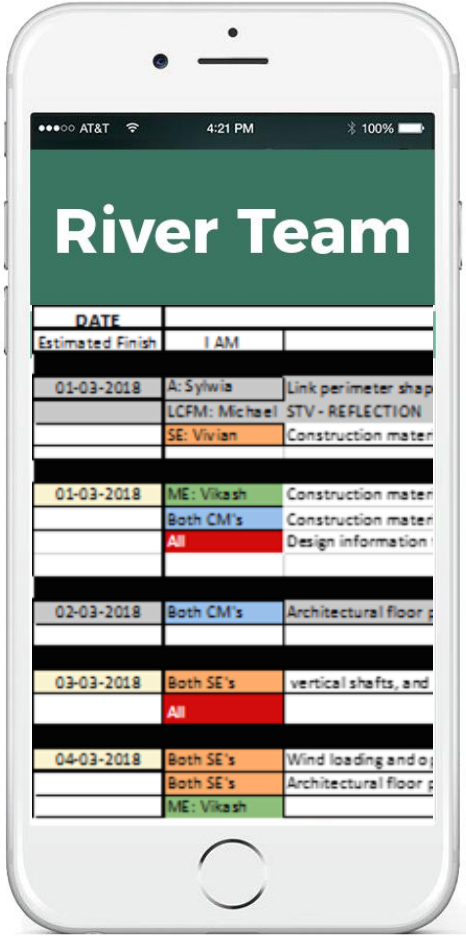
	TEAM		
Option	**Pros**	**Cons**	**Suggestion**
Future landscaping development	• Stabilizing the grounds • Integration with park visitors • Classes outside • Extending space for users in the summer • More directly engaging with the site and river	• Upfront cost • Maintenance cost to keep the site around the building in order • Getting permission from the city-boundary of our development • Need to be careful with alternating natural environment of park with runoff or non-native plant species	• Getting funding from the city • Propose the design for future opportunities- show how our building can be connected to the site (as a guideline)



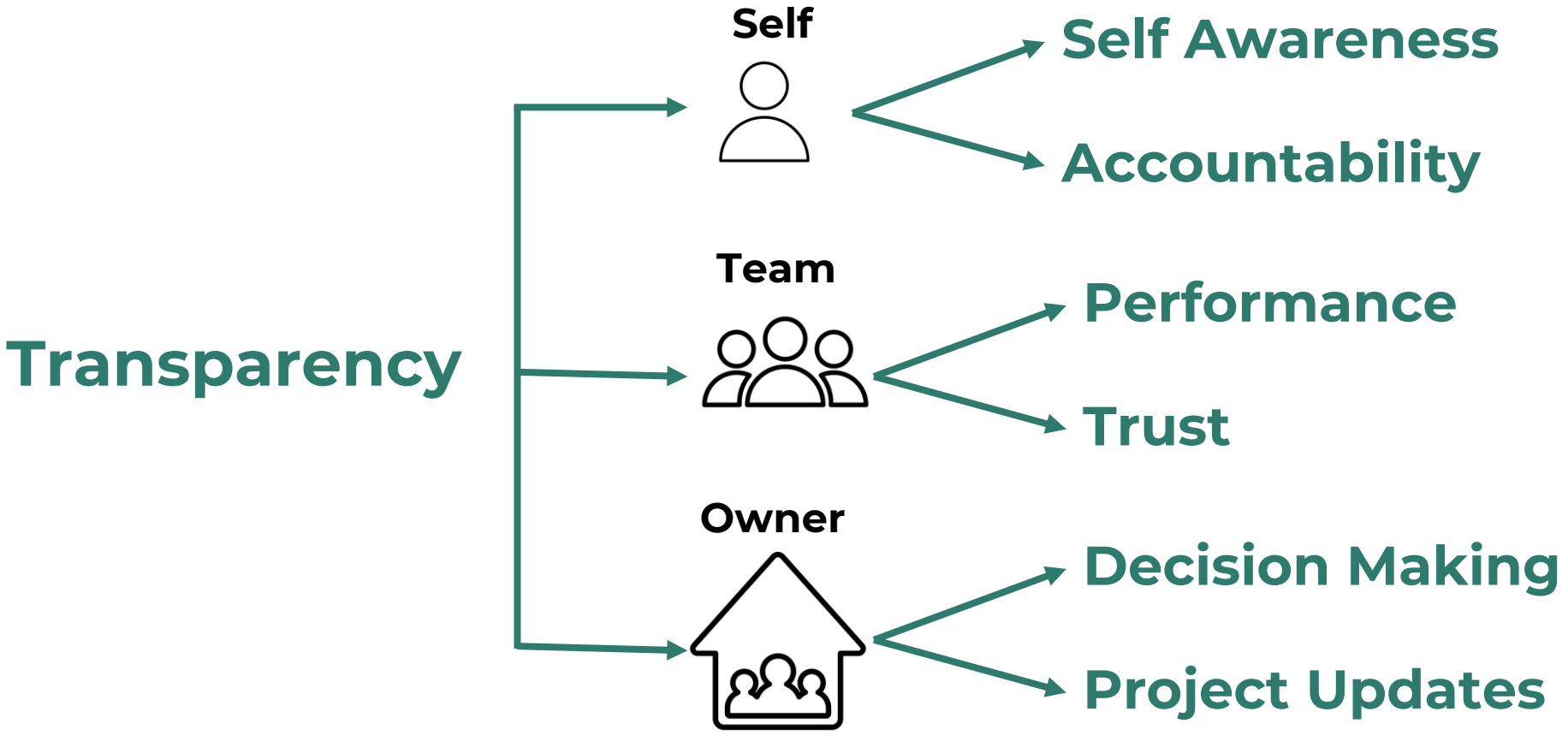
Simplification of Knowledge

DPR Challenge Integration

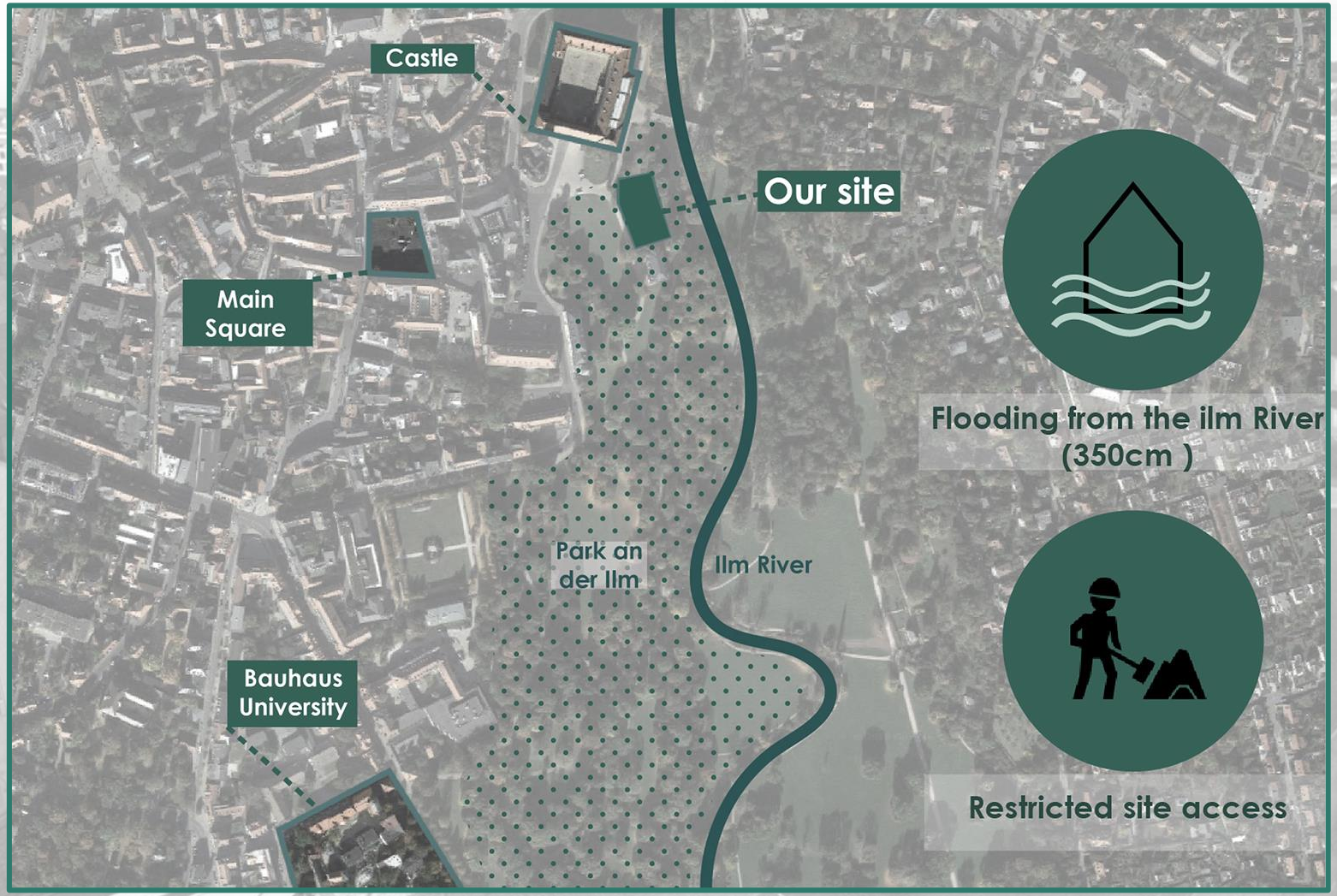




DPR Challenge Values



Site Context

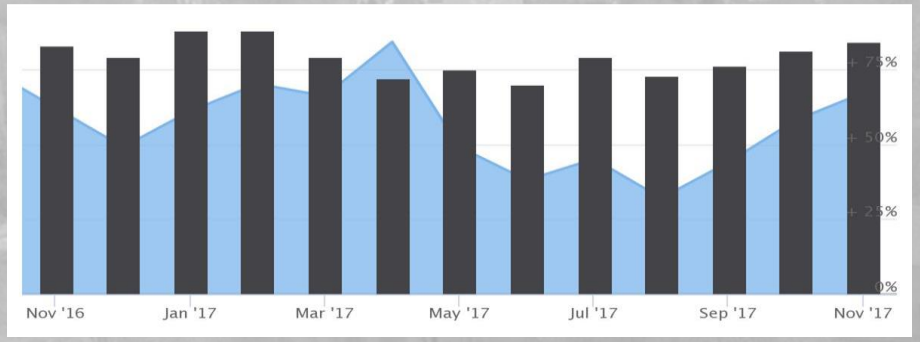


Weather Analysis

Temperature

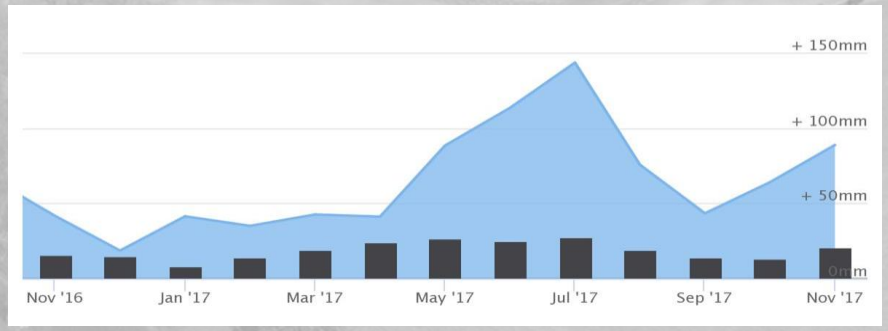
Summer peak: 23 C
Winter peak: -4 C

Humidity



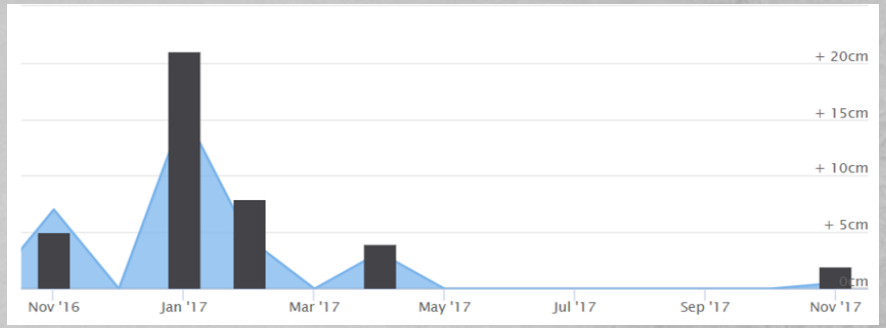
Average humidity: 78%
Peak humidity: 86%

Rainfall



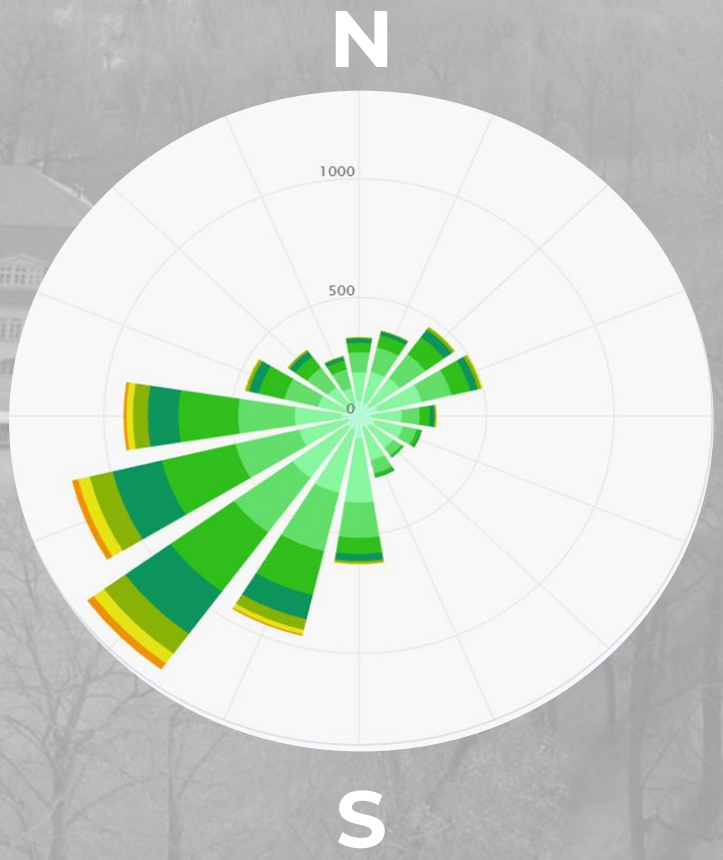
Annual rainfall: 560 mm
Max rainfall: 68 mm

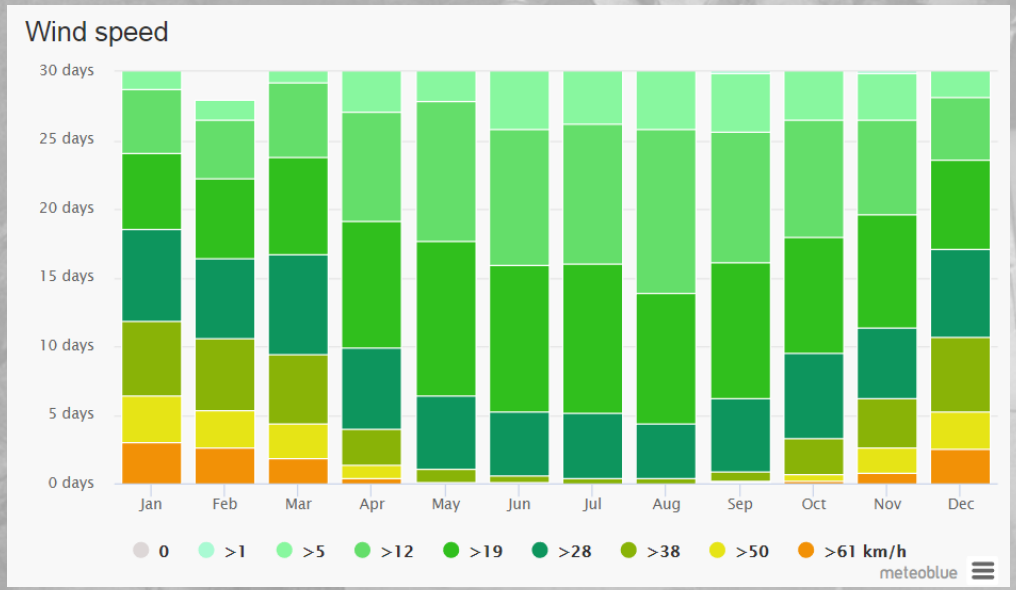
Snowfall



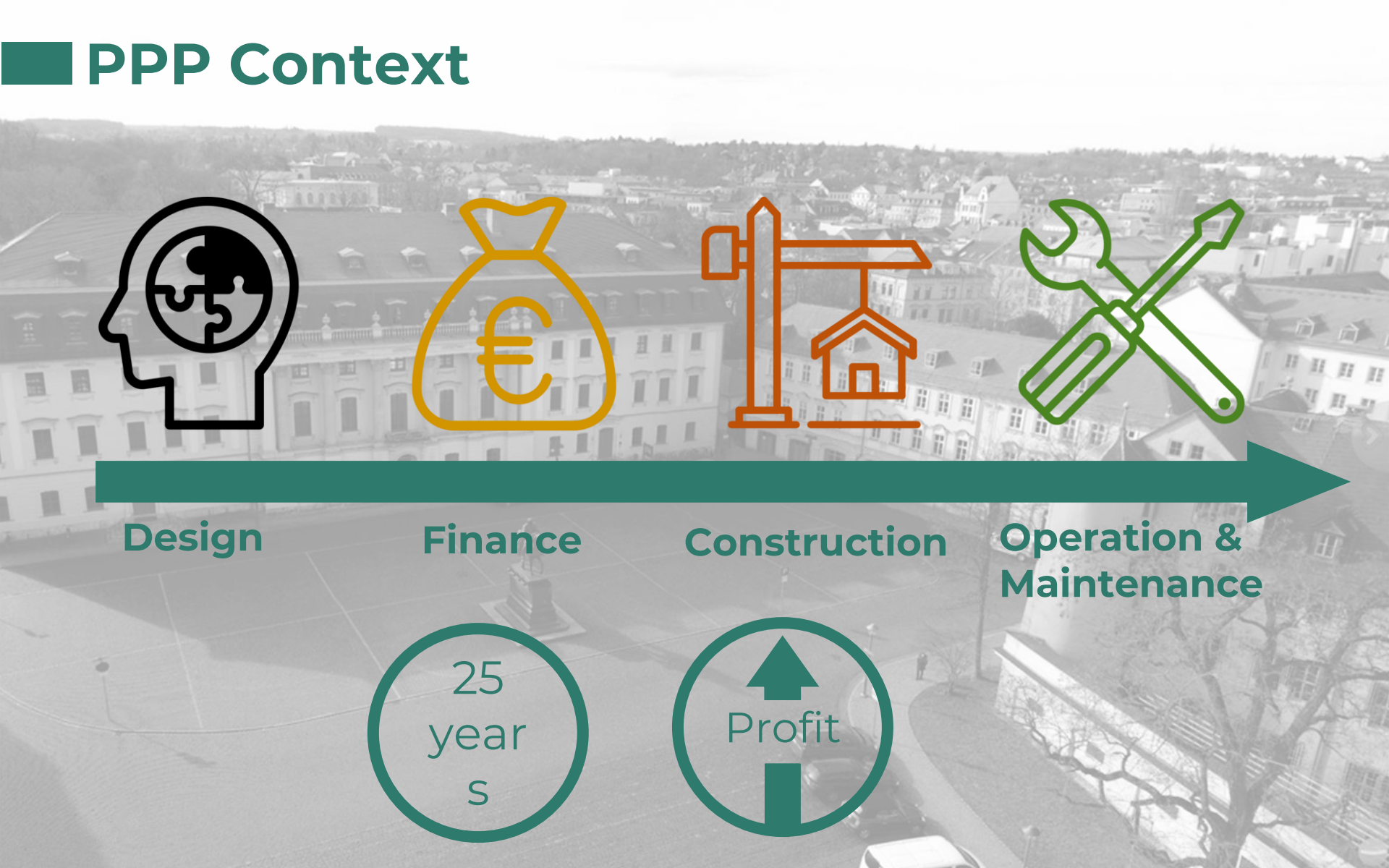
Average snowfall: 16 cm
Max days: 21 in January

Wind Analysis



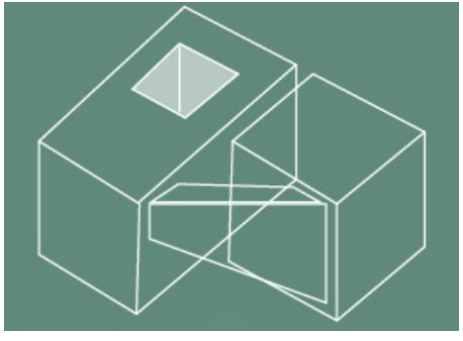


PPP Context


Design
Finance
Construction
Operation & Maintenance
25 years
Profit

Combining Alternatives

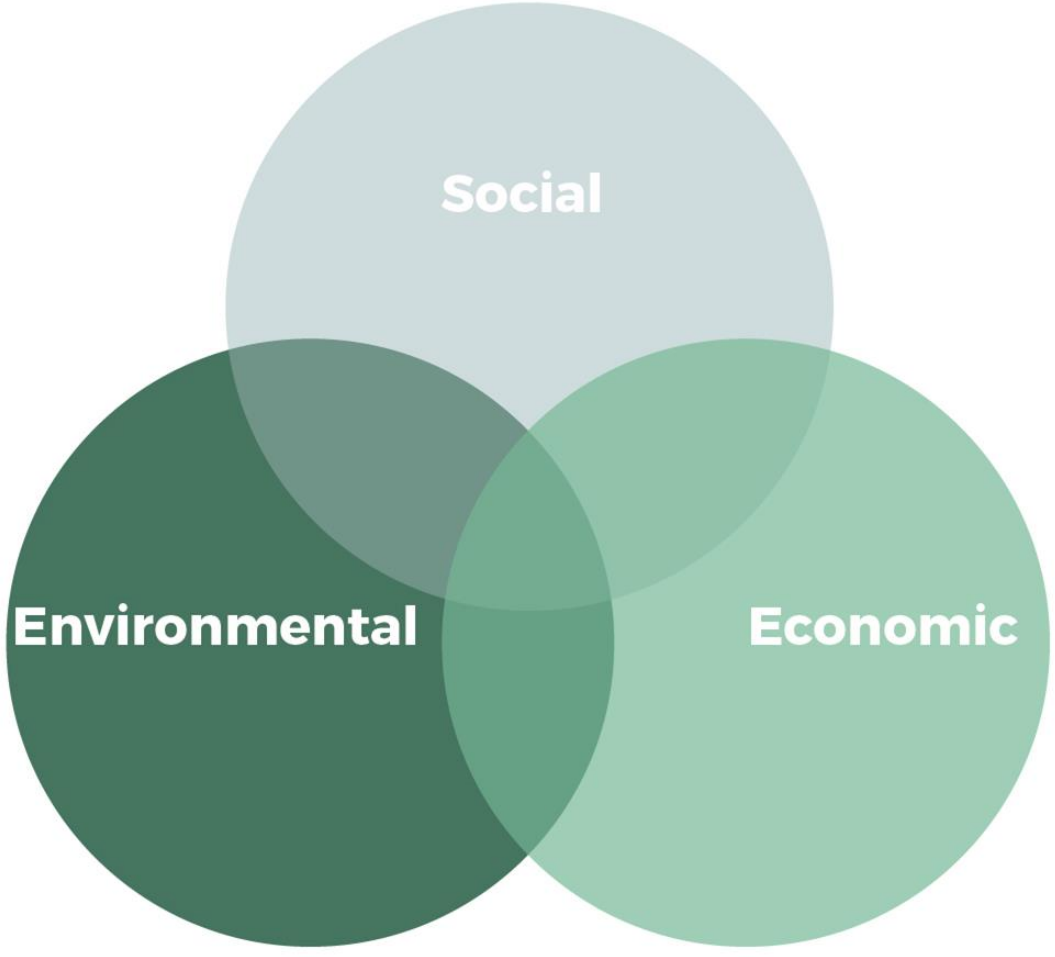
Modern factory -
Bauhaus idea
“School of building”



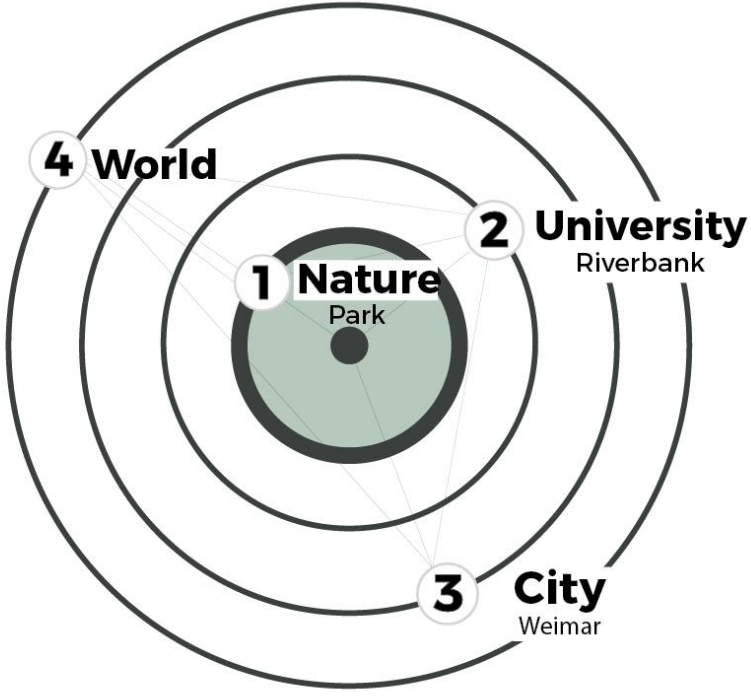
Winter Presentation Alternatives

	RIPPLE Steel	RIPPLE Timber	LINK Steel	LINK Masonry
SCORING	26,89	26,95	26,16	25,83

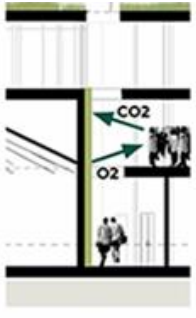
Sustainability Integration

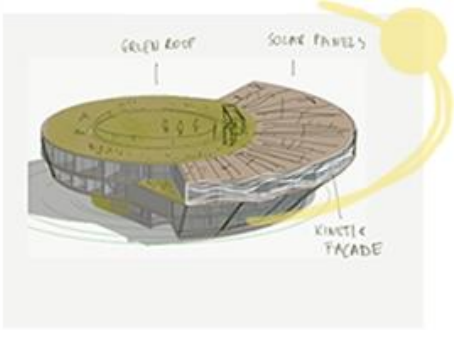


Integration Level 1

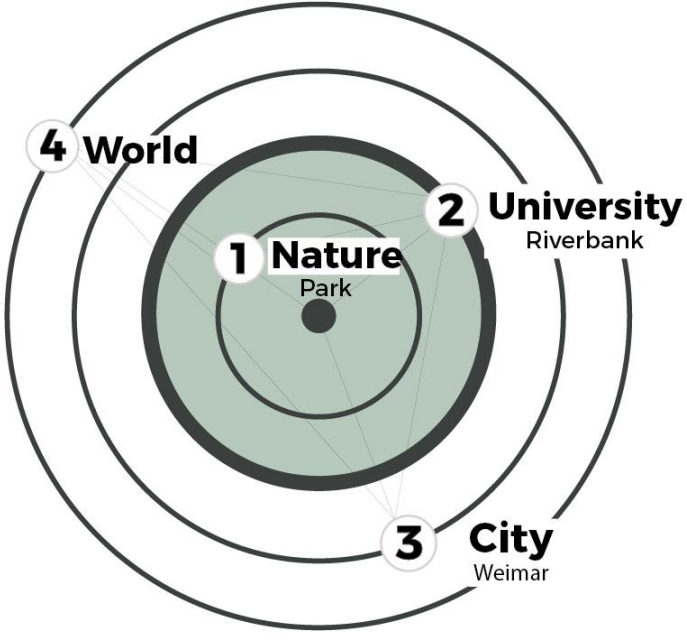


Benefits from nature

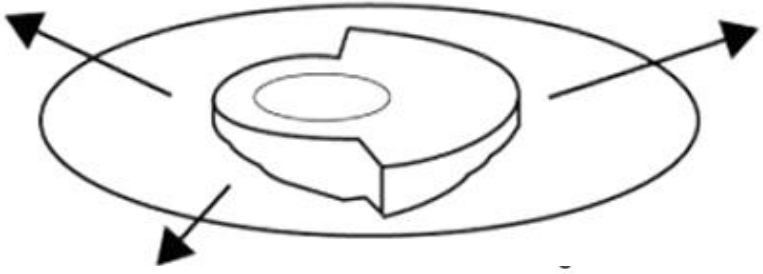




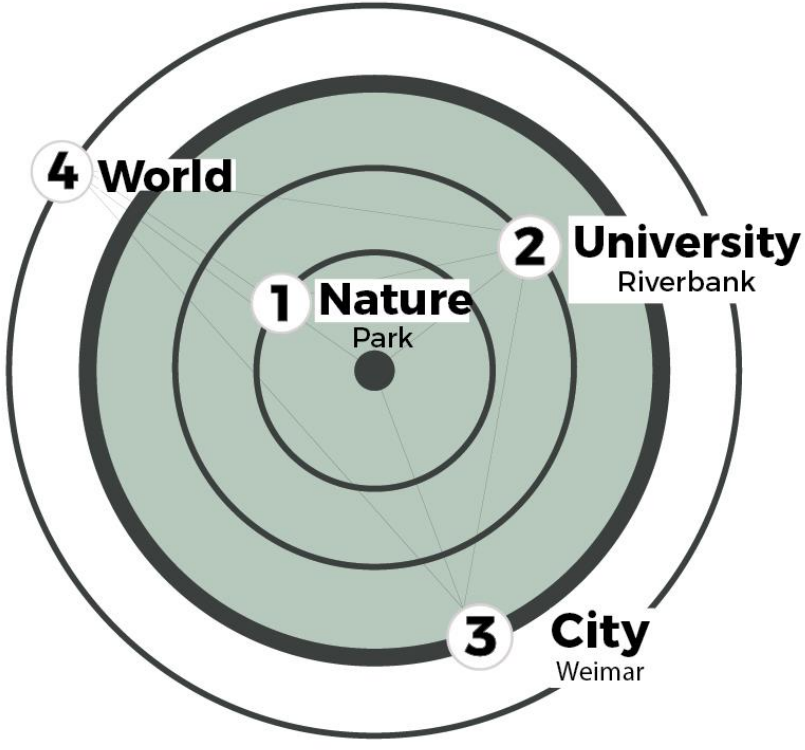
Integration Level 2



Knowledge about
sustainable design
rippling out of the building

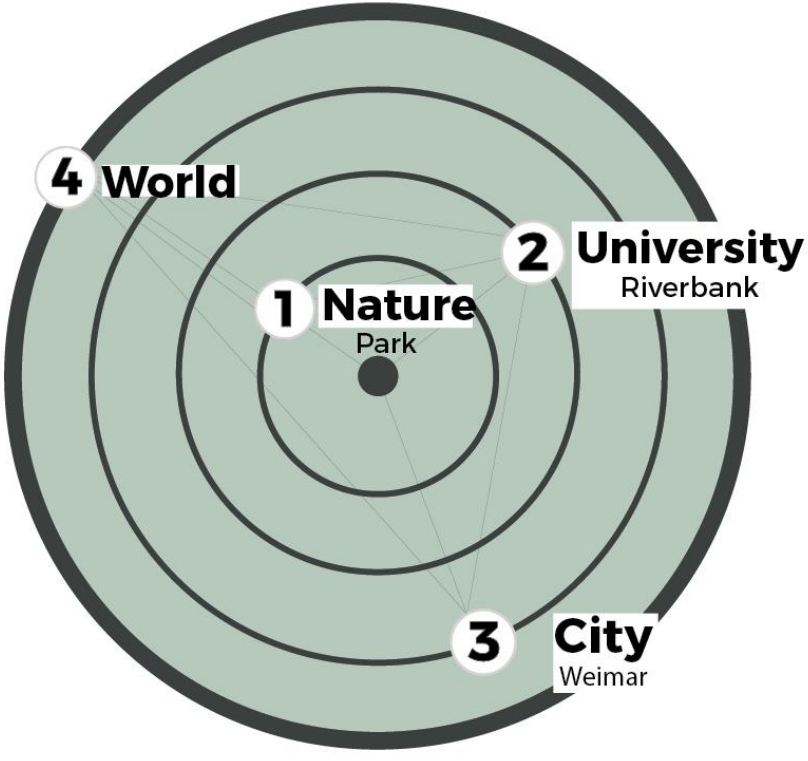


Integration Level 3



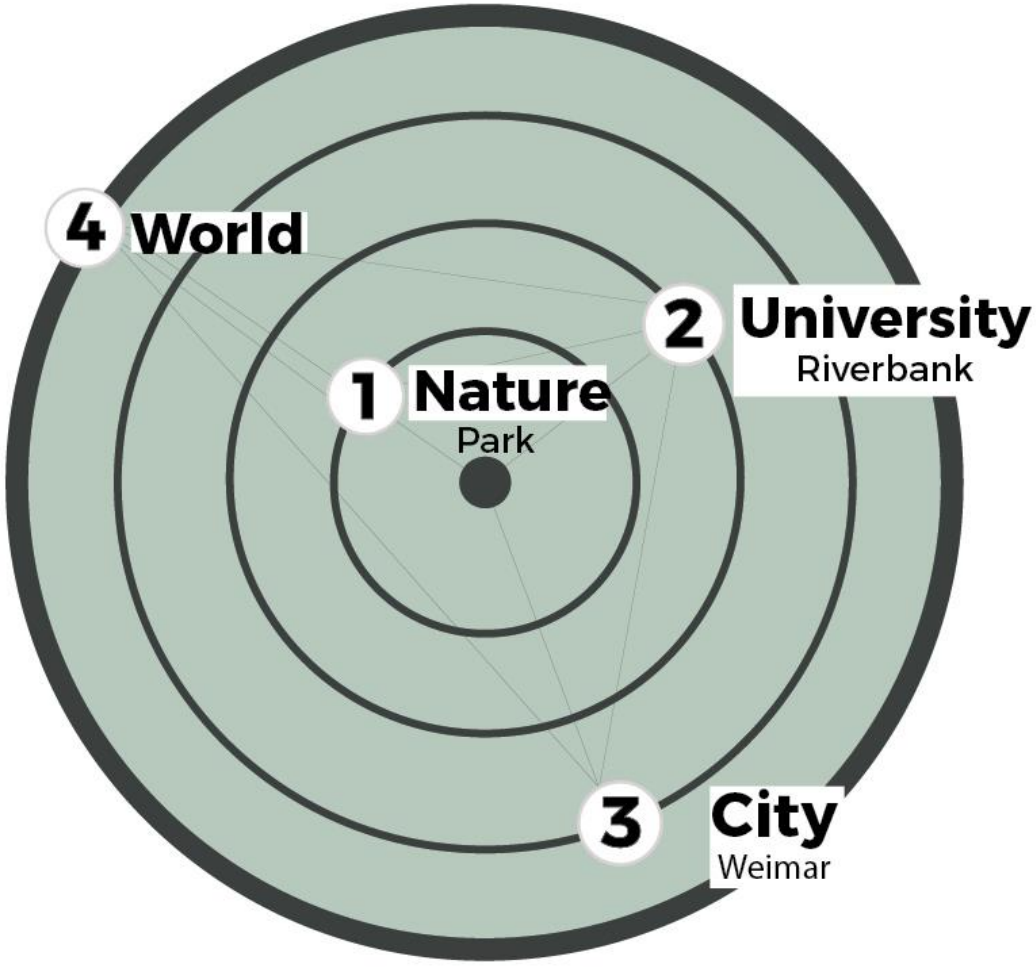
Building as one piece of
bigger development in Weimar

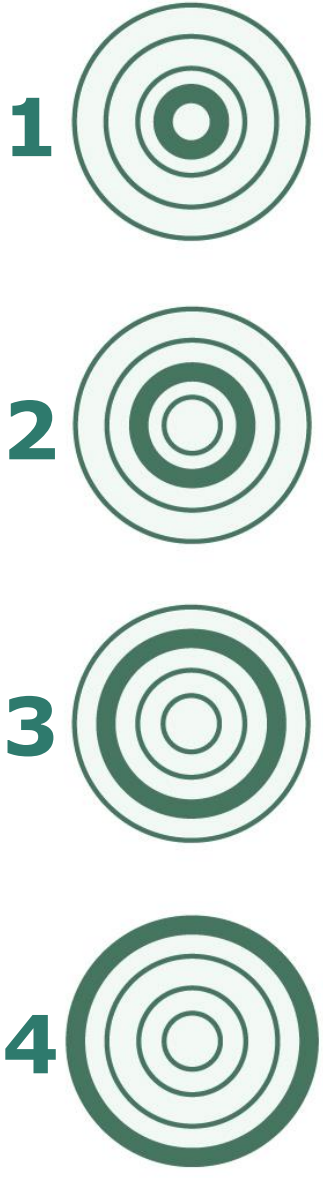
Integration Level 4



Worldwide impact

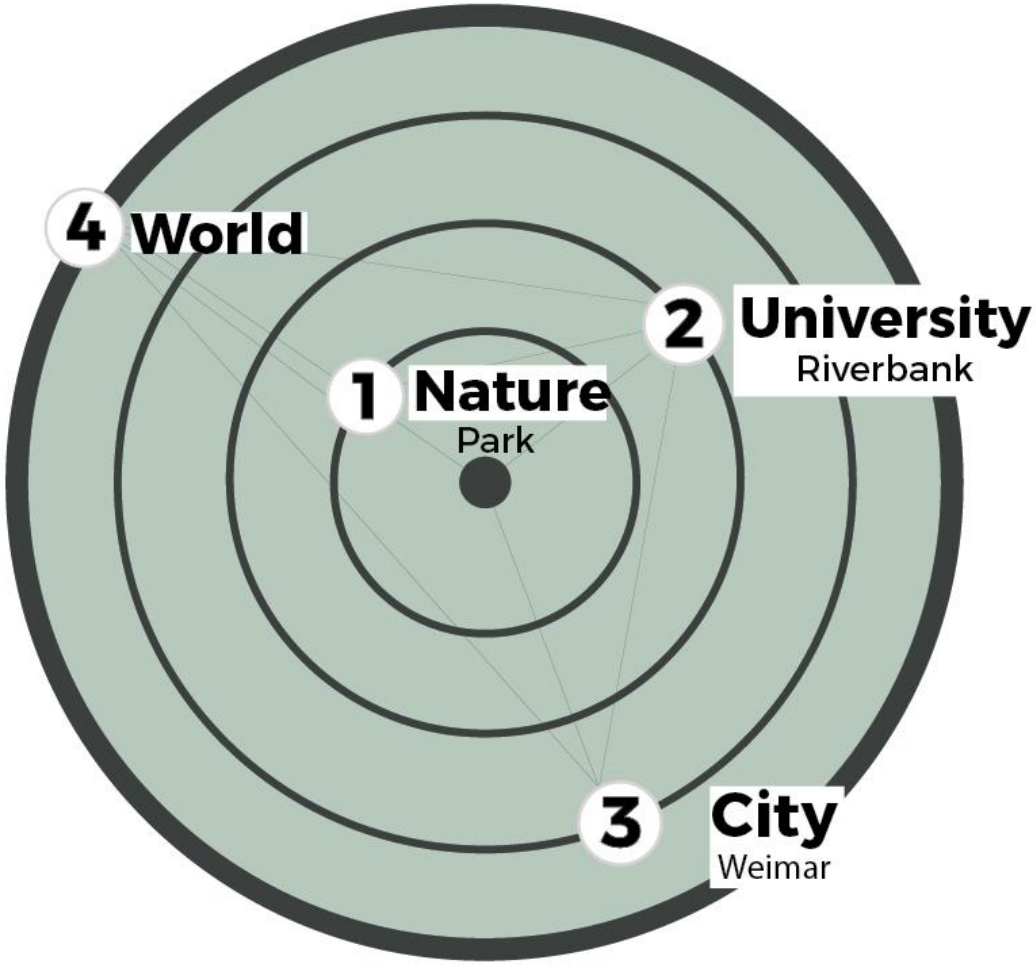
Sustainability Legend

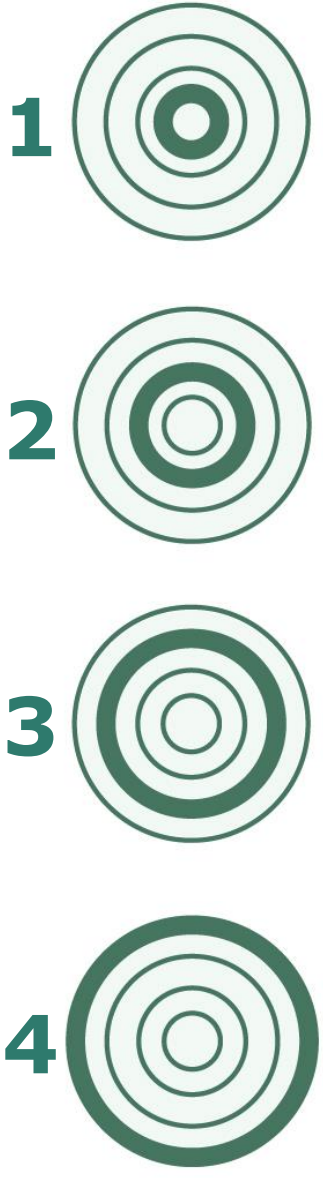




RIPPLE

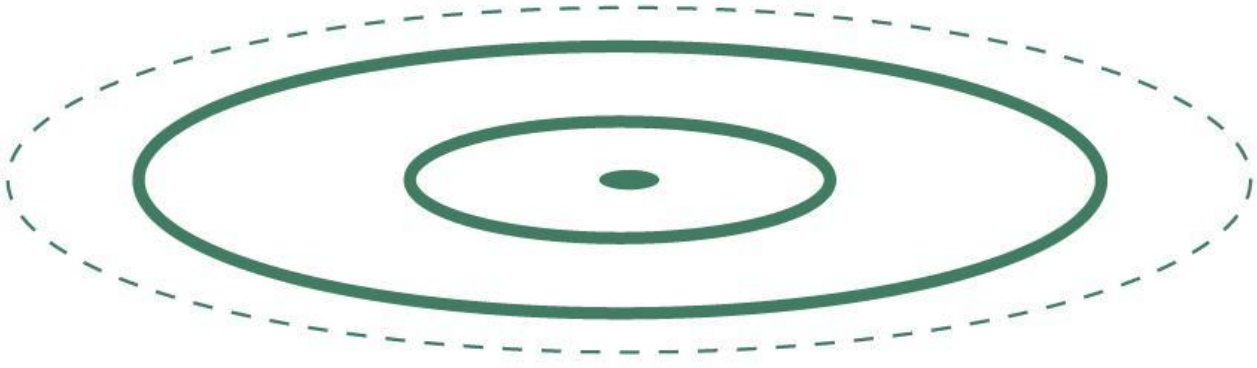
Sustainability Legend





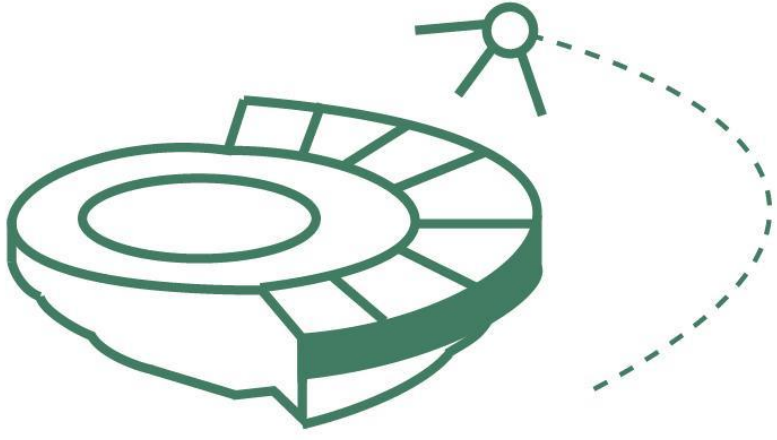
1

Minimal immediate impact
and
positive long term effect



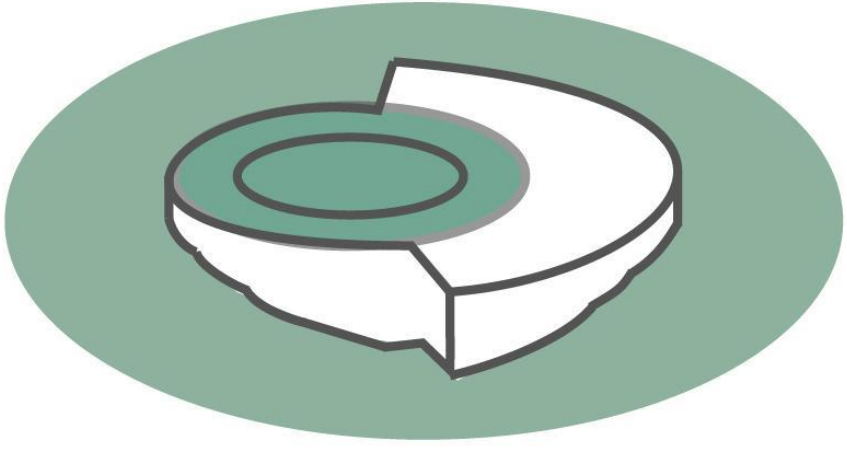
2

Building **adapting to changing surroundings**



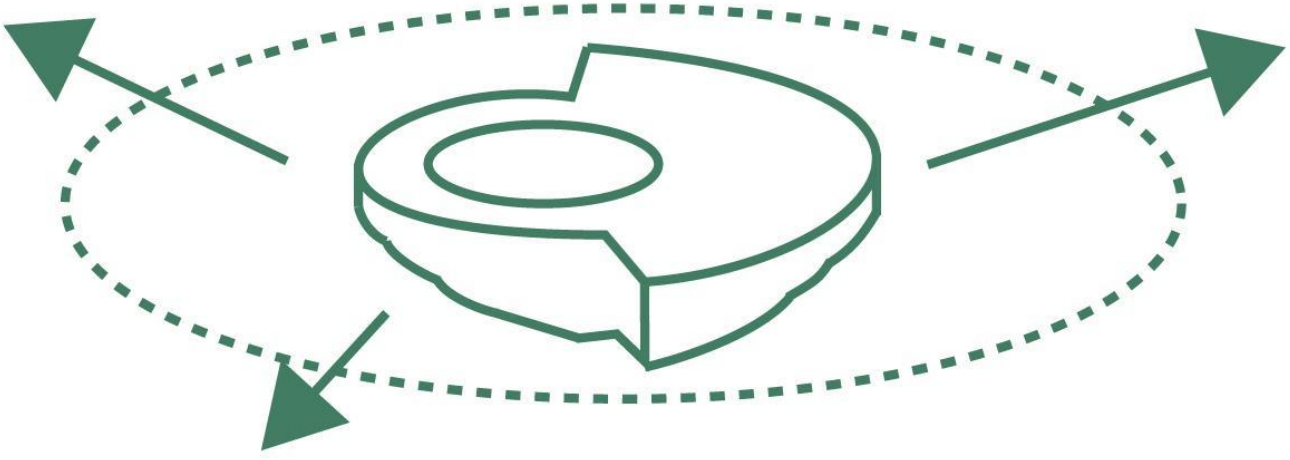
3

Giving back the green
taken away from the park

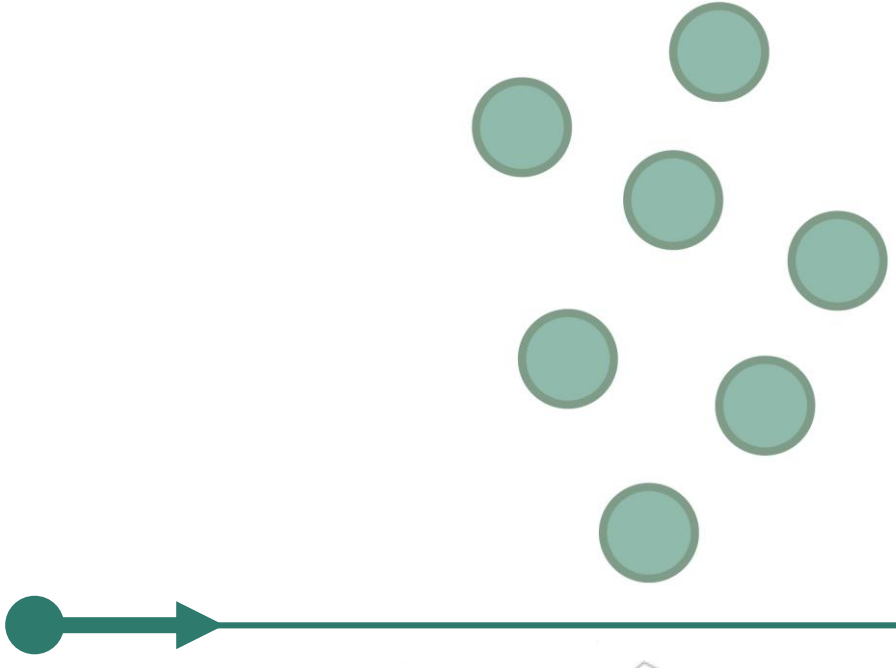


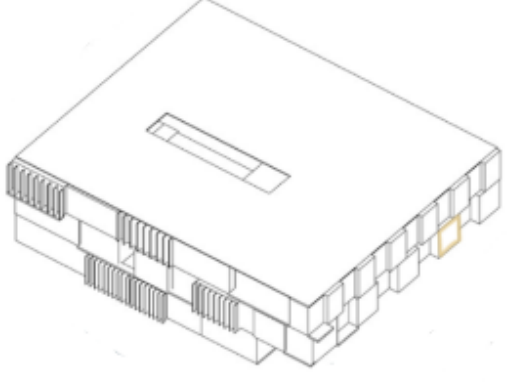
4

Knowledge rippling out of the building

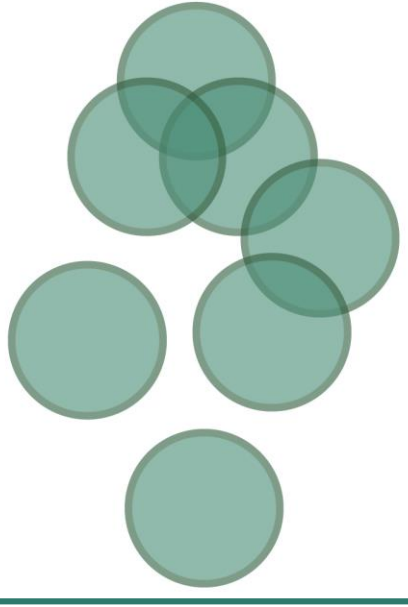


Kickoff

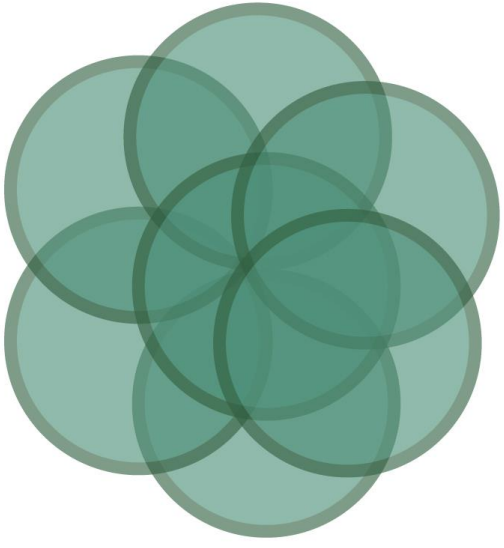


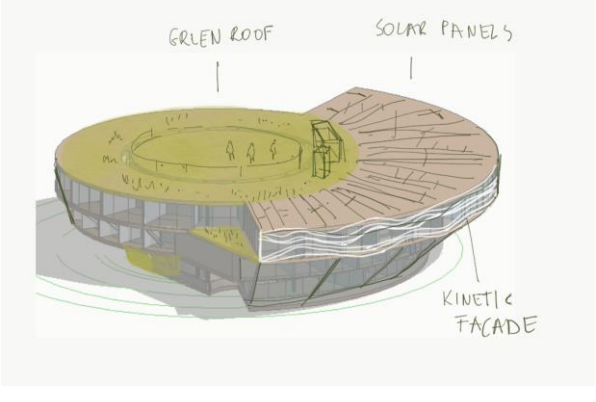


Crit



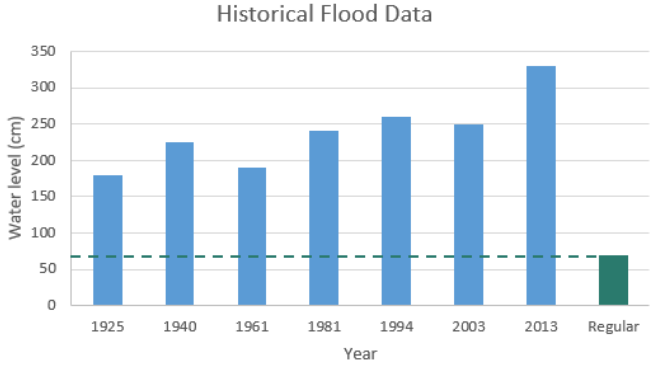
Winter Presentation

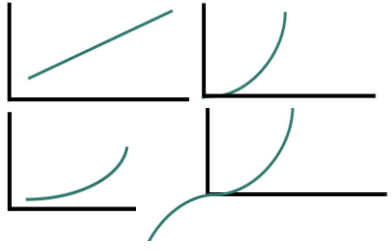




Spring Presentation

Flood Risk





Today:
data from the past

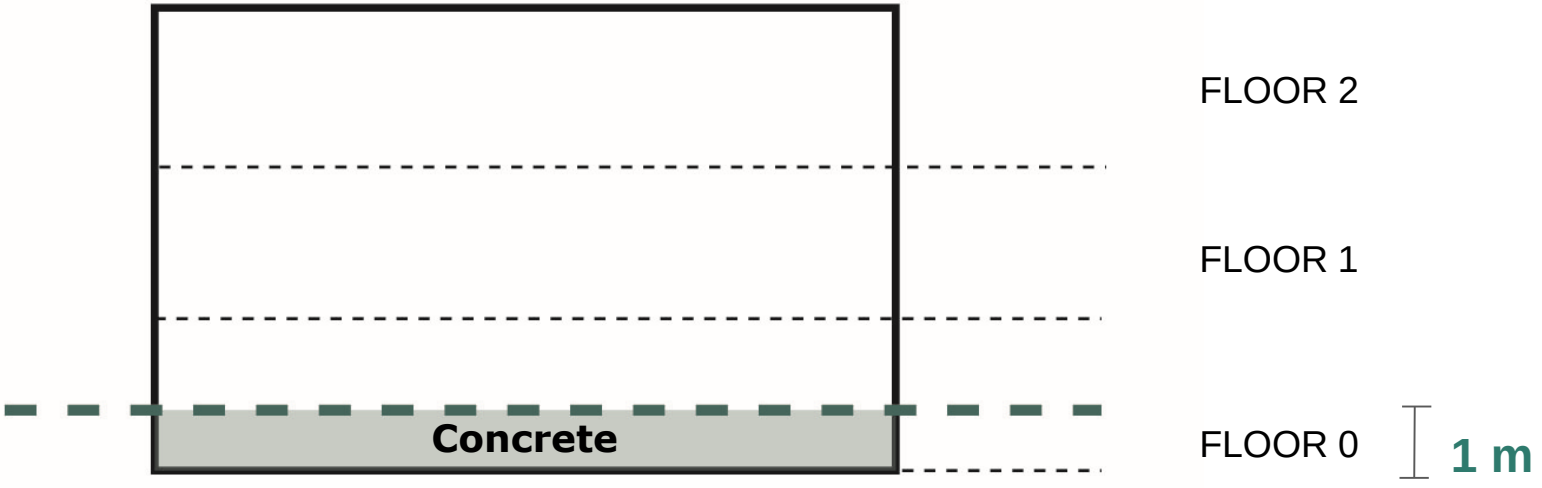
Forecast

2080

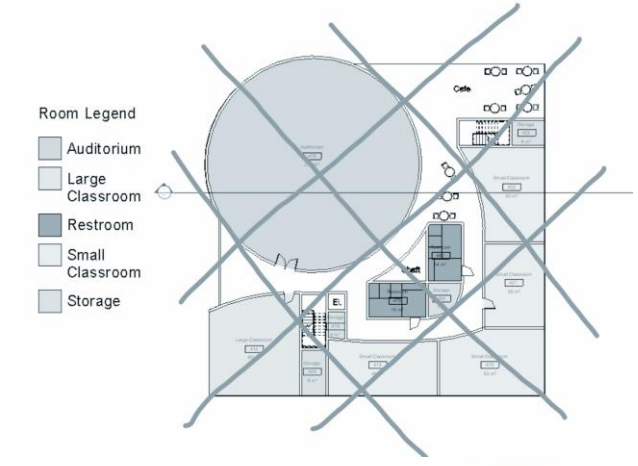
Flood Damage Mitigation

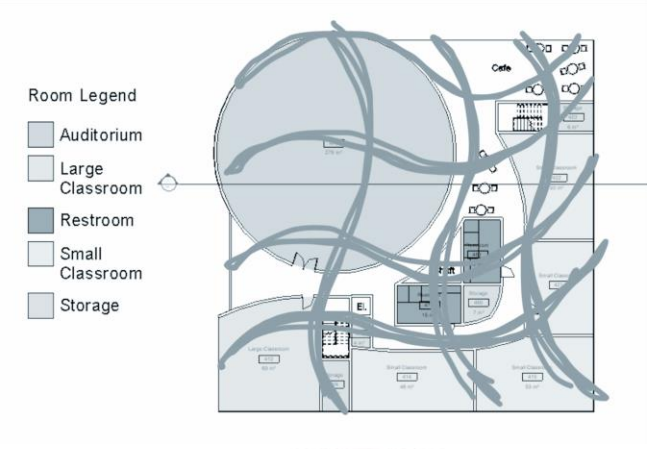
- Raising electrical system components

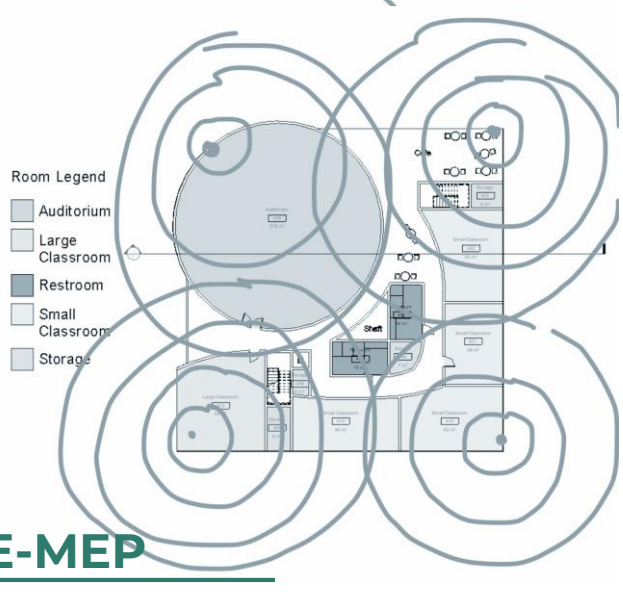
- Concrete structure in the first meter of our building

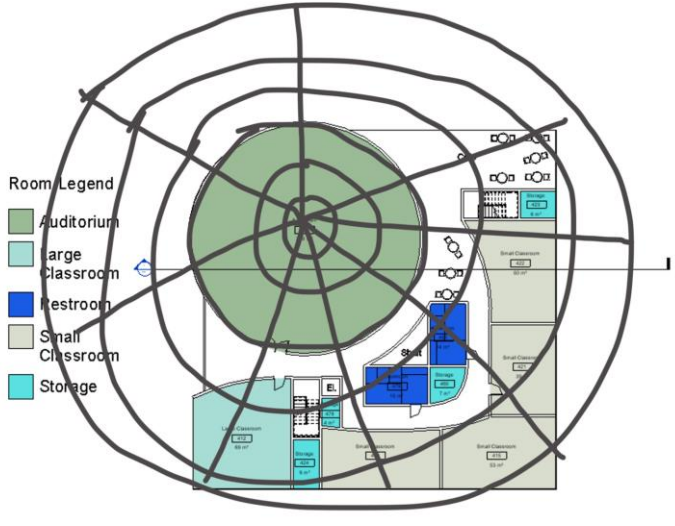


Grid Radical Proposals

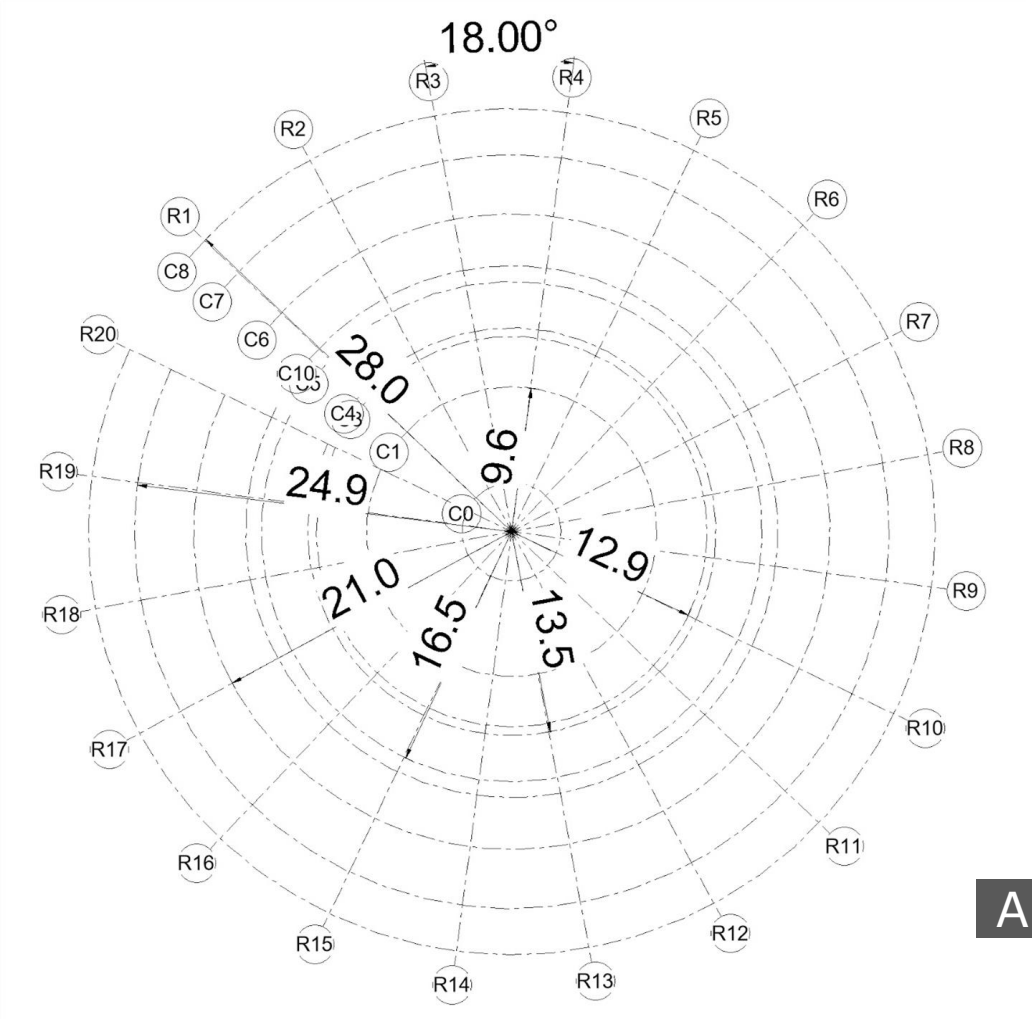






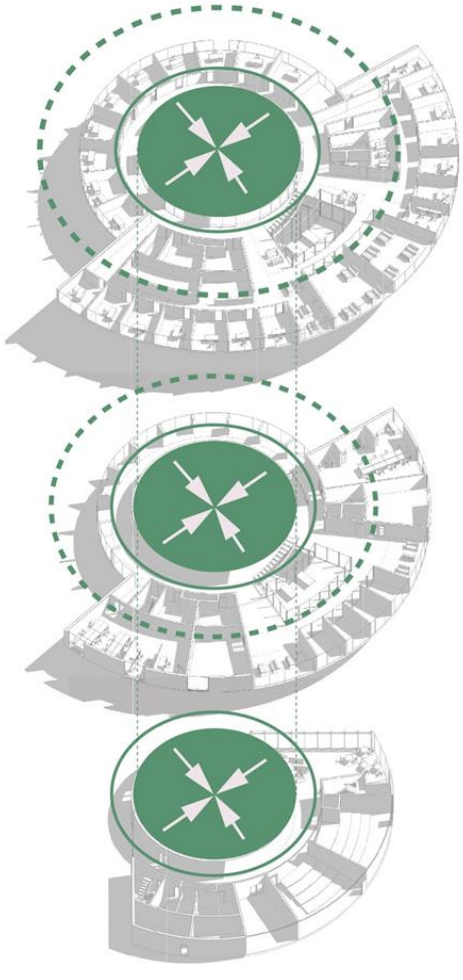


Grid Finalized Dimensions

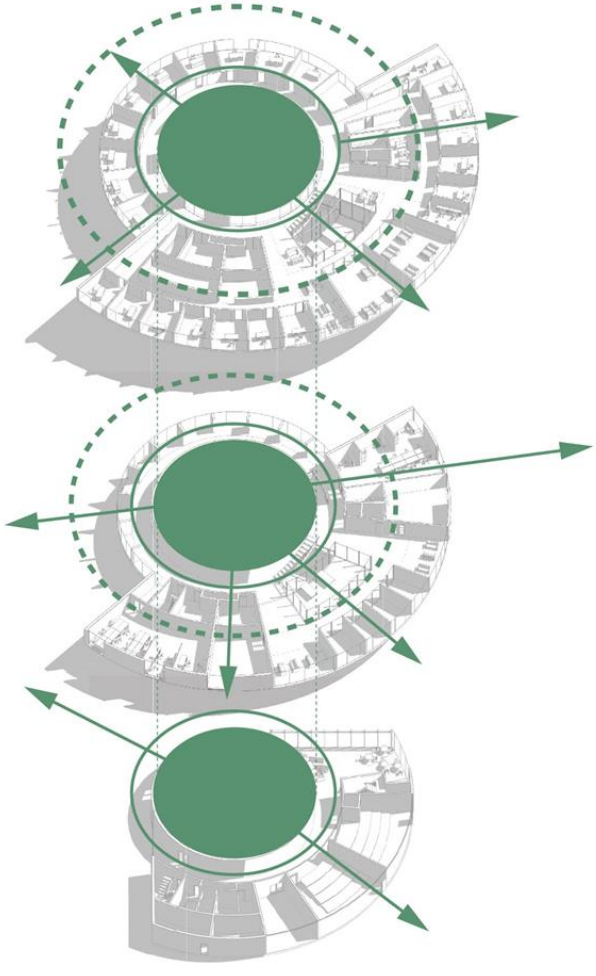


All units in meters.

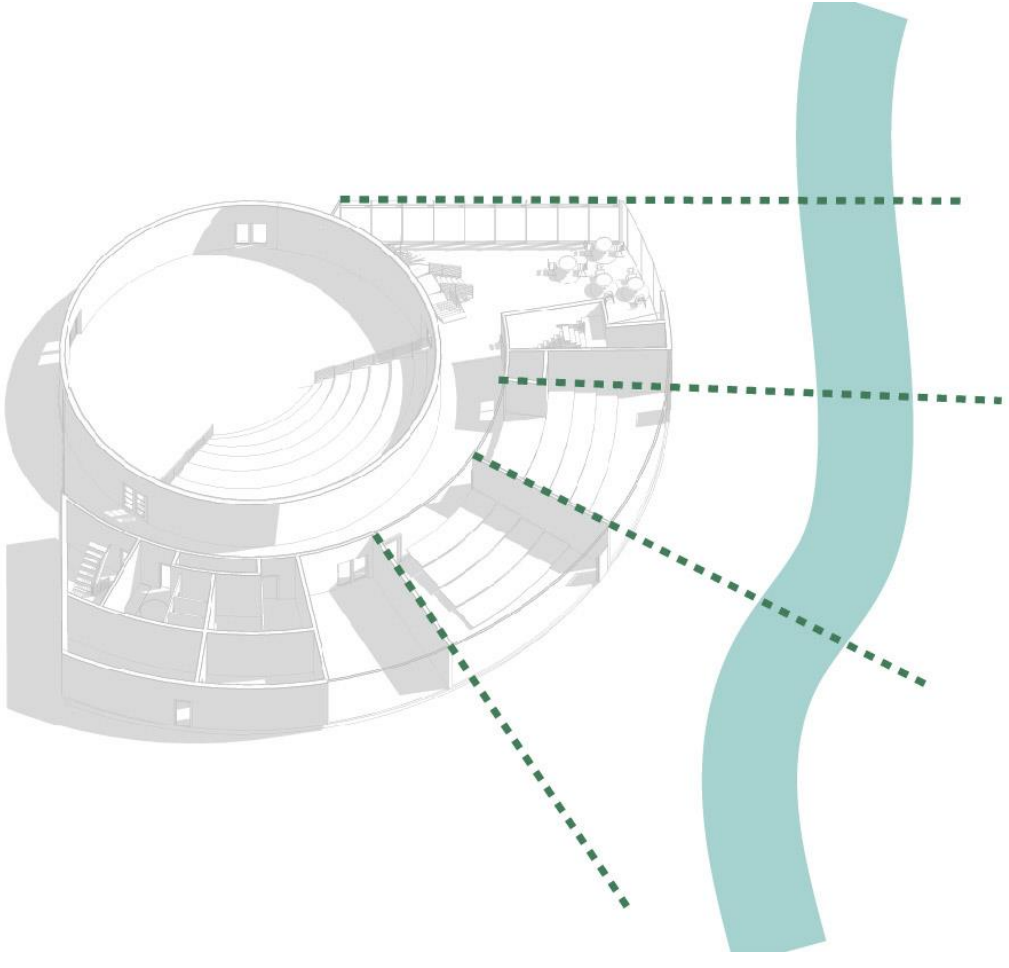
Design Process



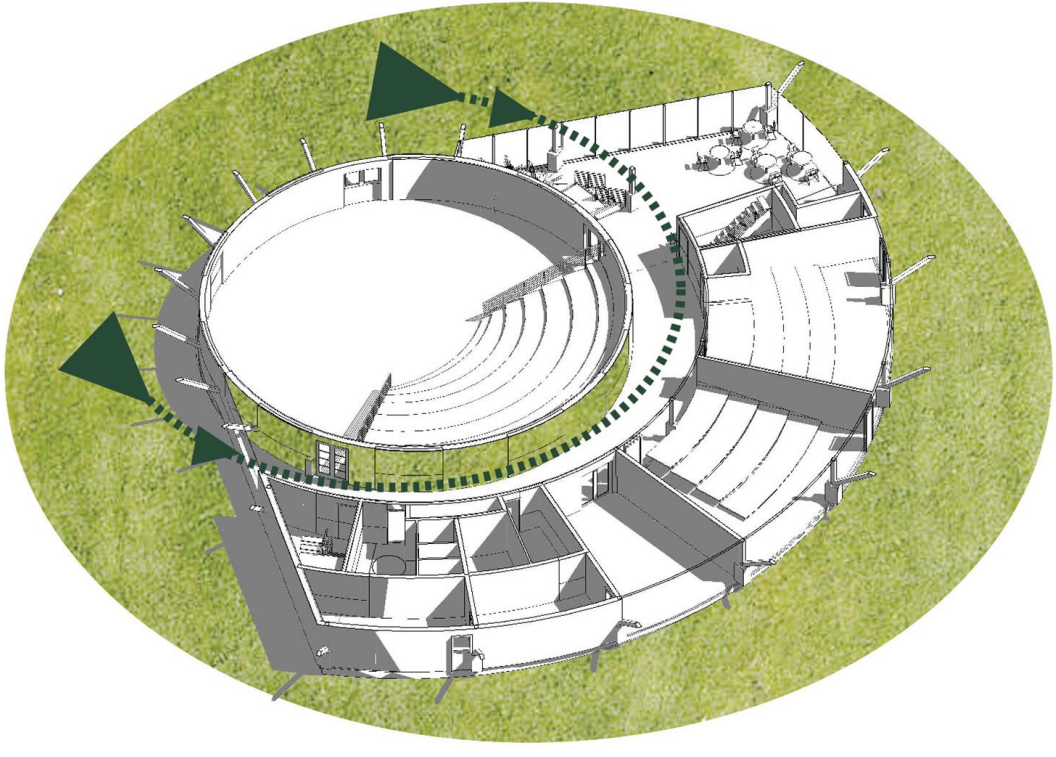
Design Process



Design Process

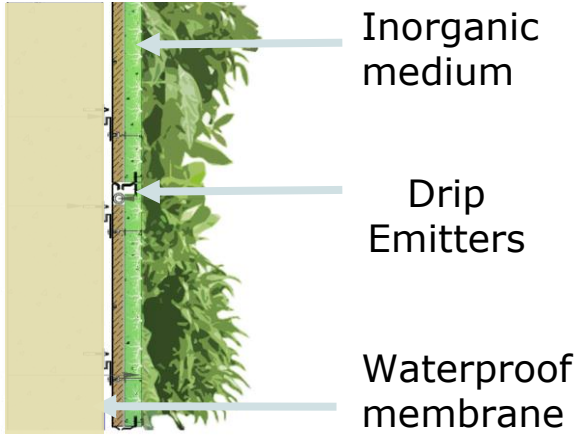


Design Process

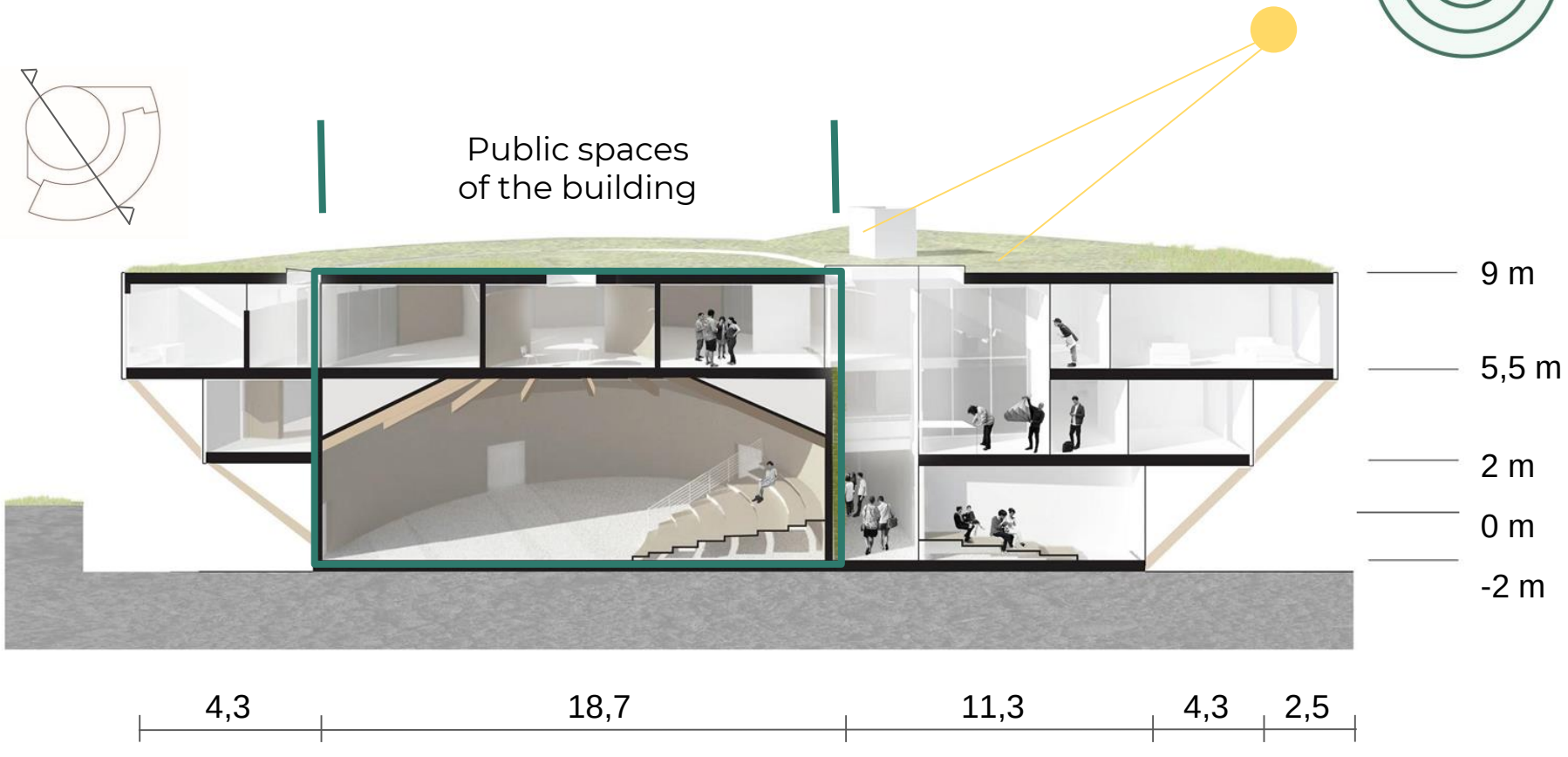


Biophilia Green Wall

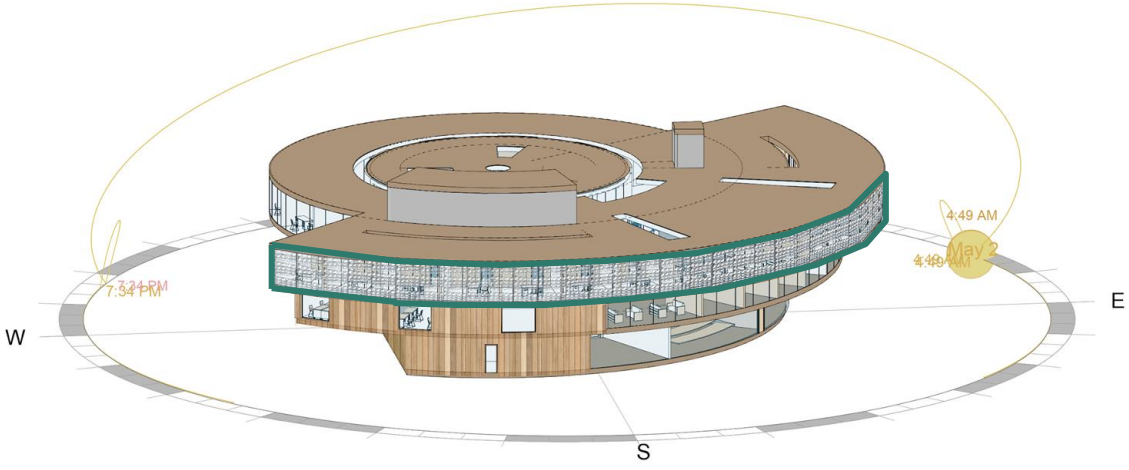
Panel system

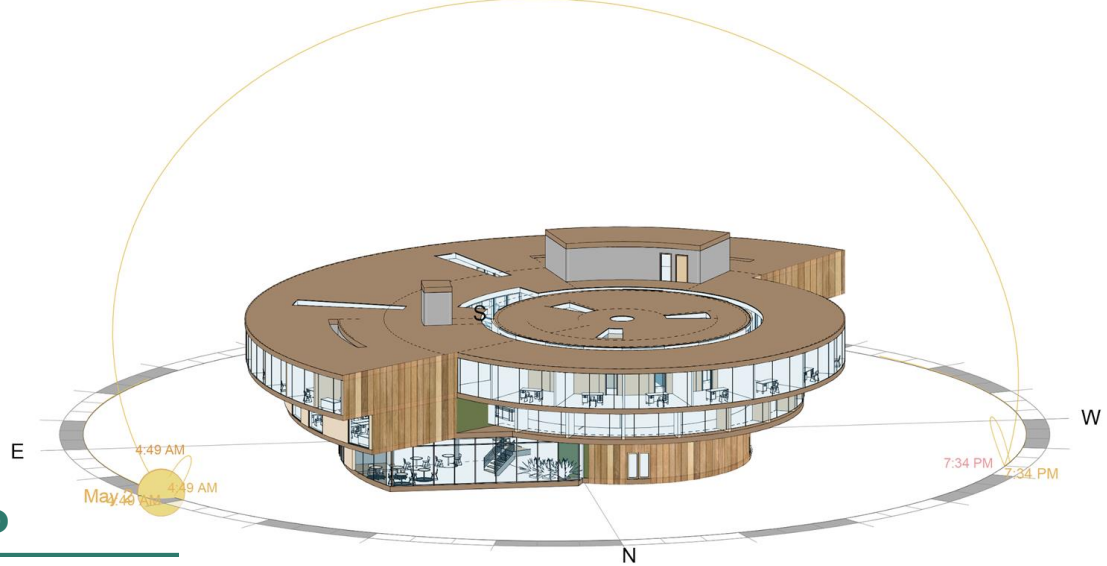


Section



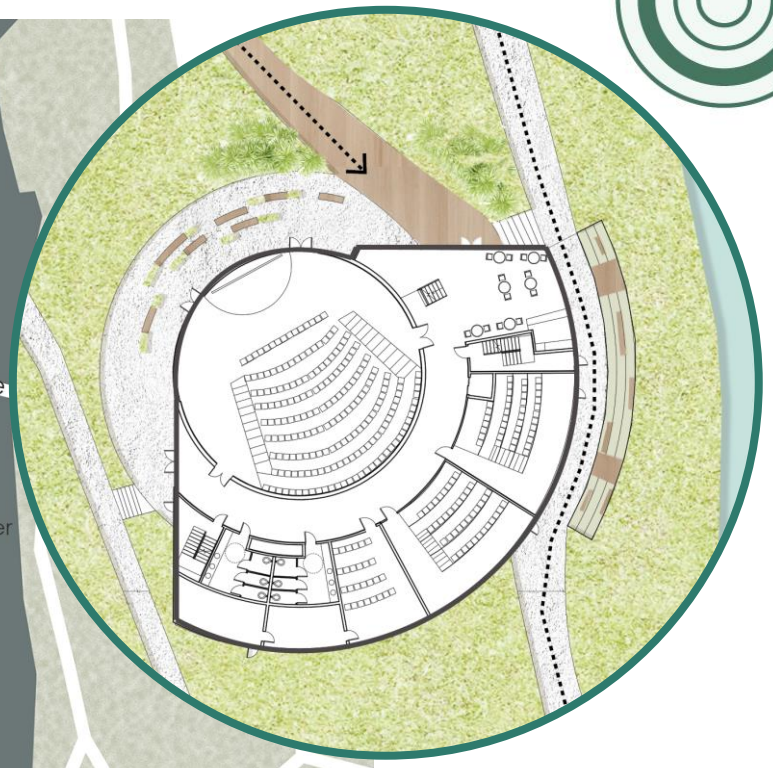
Sun Analysis



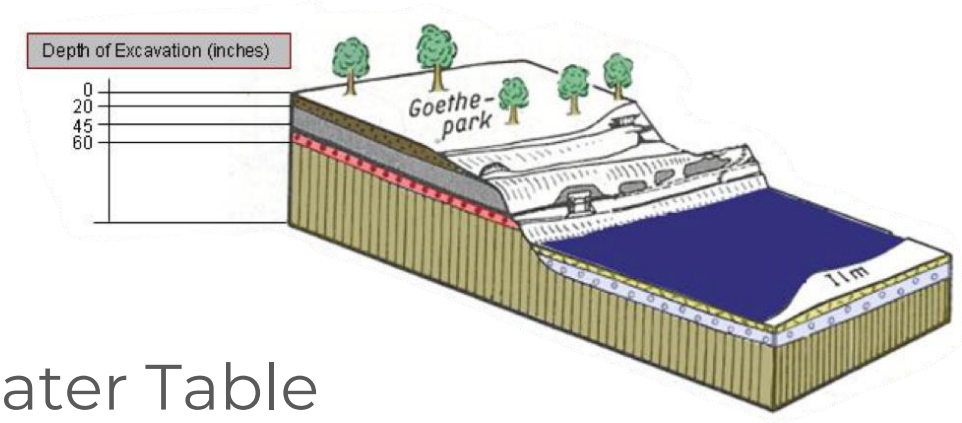


Site Plan


Castle
Bridge
Ilm River
Main entrance
Main Square
South exposure



Site Conditions

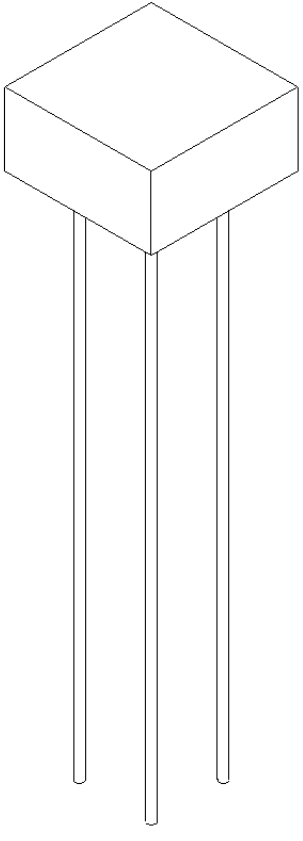


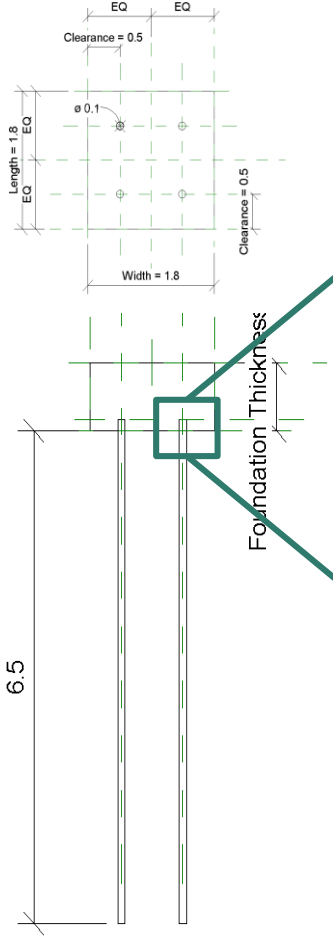
Soil Profile and Water Table

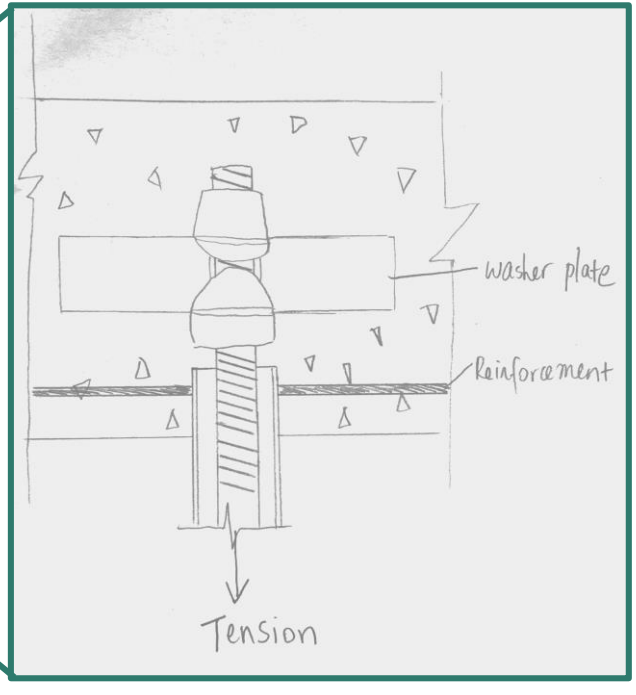
Soil Type	Top Depth (m)	Bottom Depth (m)	Bearing Capacity (kN/m2)
Mould Topsoil	0	0.508	-
Younger Rimstone	0.508	1.143	-
Keuper	1.143	1.524	-
Medium Shell Limestone	1.524	2.1336	239.4
Medium Shell Limestone	2.1336	-	383.04

Water Table
1.2192 m
below grade

Foundations Micropiles







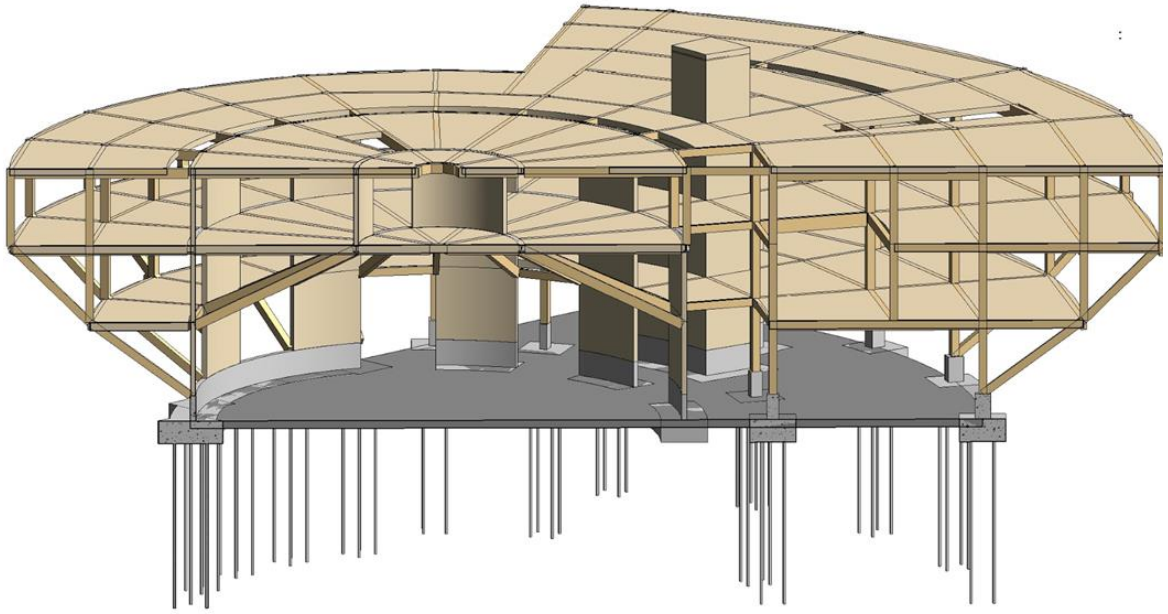
Loads

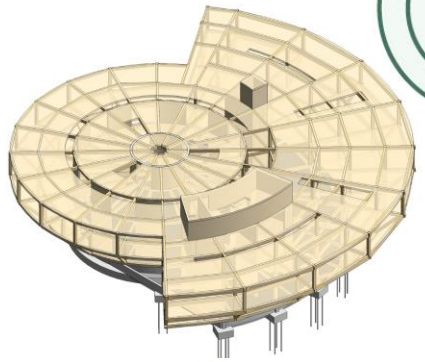
Use	Uniform Load (kN/m^2)
Student & Faculty Offices	3.0
Small Classrooms	3.0
Large Classrooms	4.0
Corridors	5.0
Stairs	5.0
Auditorium	5.0
Assembly Spaces (Atrium and Roof)	5.0

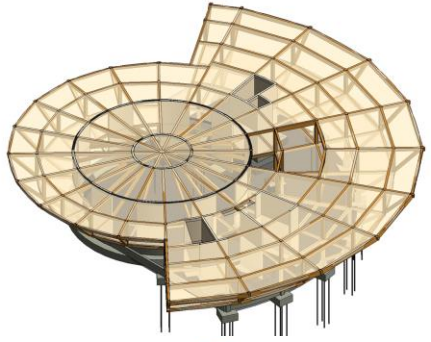
Use	Uniform Load (kN/m^2)
Roof	0.75
Green Roof	2.0 (saturated)
PV Roof Panels	0.2
Snow Load	0.85
Wind Load	0.5 (sustained) 0.1 (gust)
Earthquake Load	NA

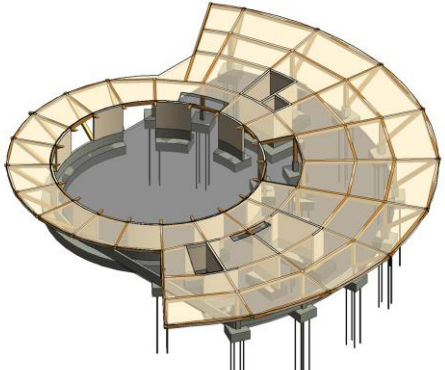
*Values from Eurocodes Table 6.2, EN 1991-1-3, EN 1991-1-4, and EN 1998-1

3D Section Cuts





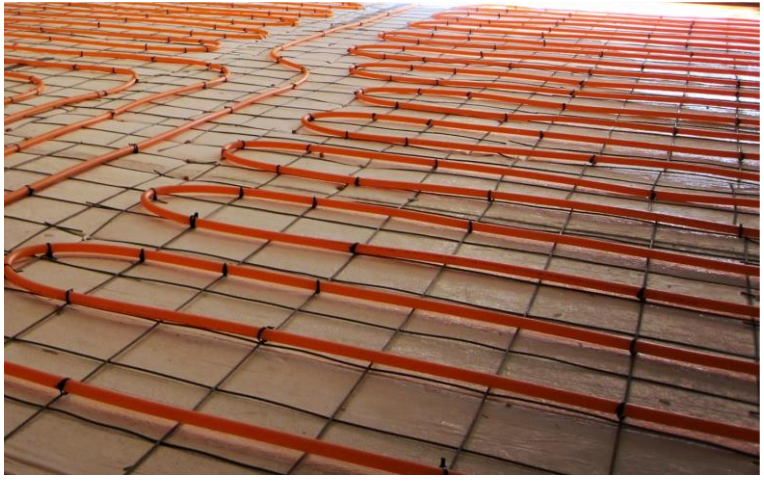




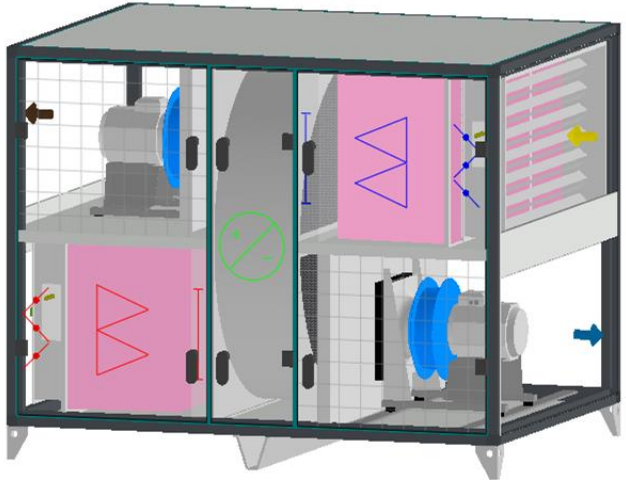
SE

HVAC System

Radiant heating and cooling



Desiccant based ventilation system



Indoor temperature : 24°C

Indoor temperature : 22°C

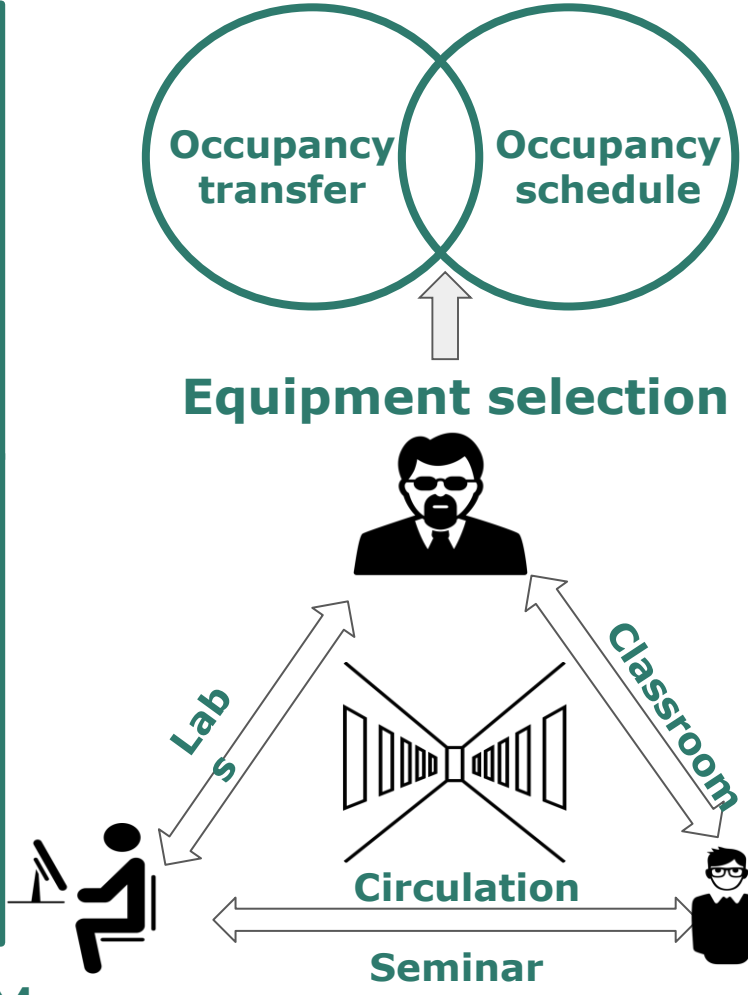
Indoor relative humidity : 55±10%

Noise level : 45 db

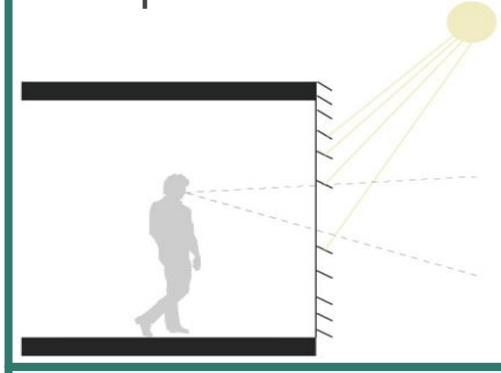
Energy Saving Methodology

R-50 insulation

Heat mirror glass

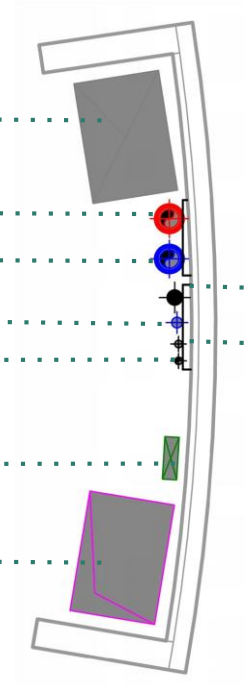


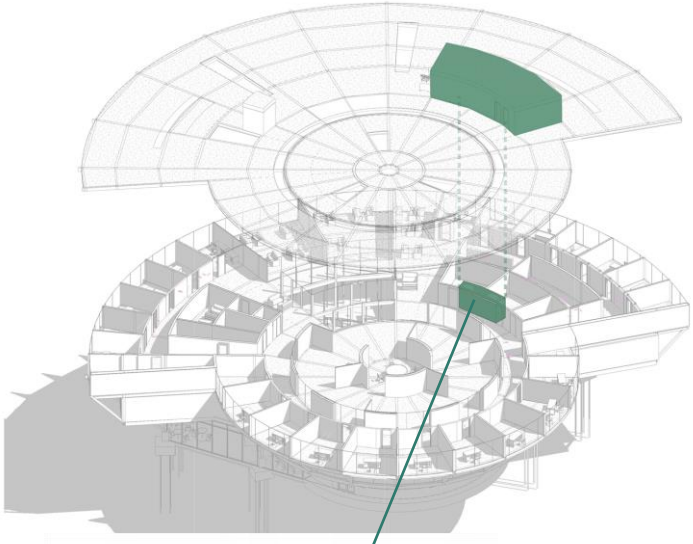
Adaptable Facade

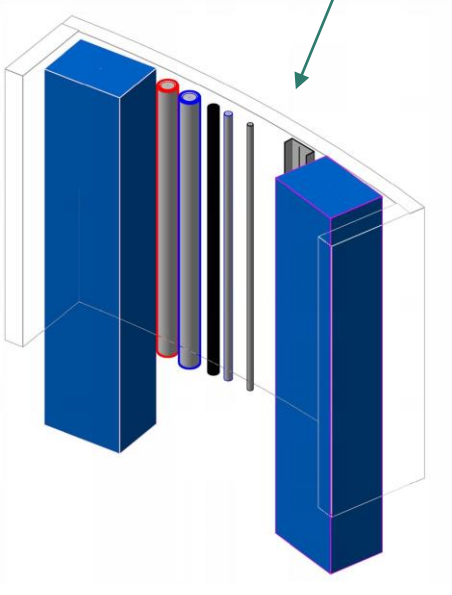


Cantilever

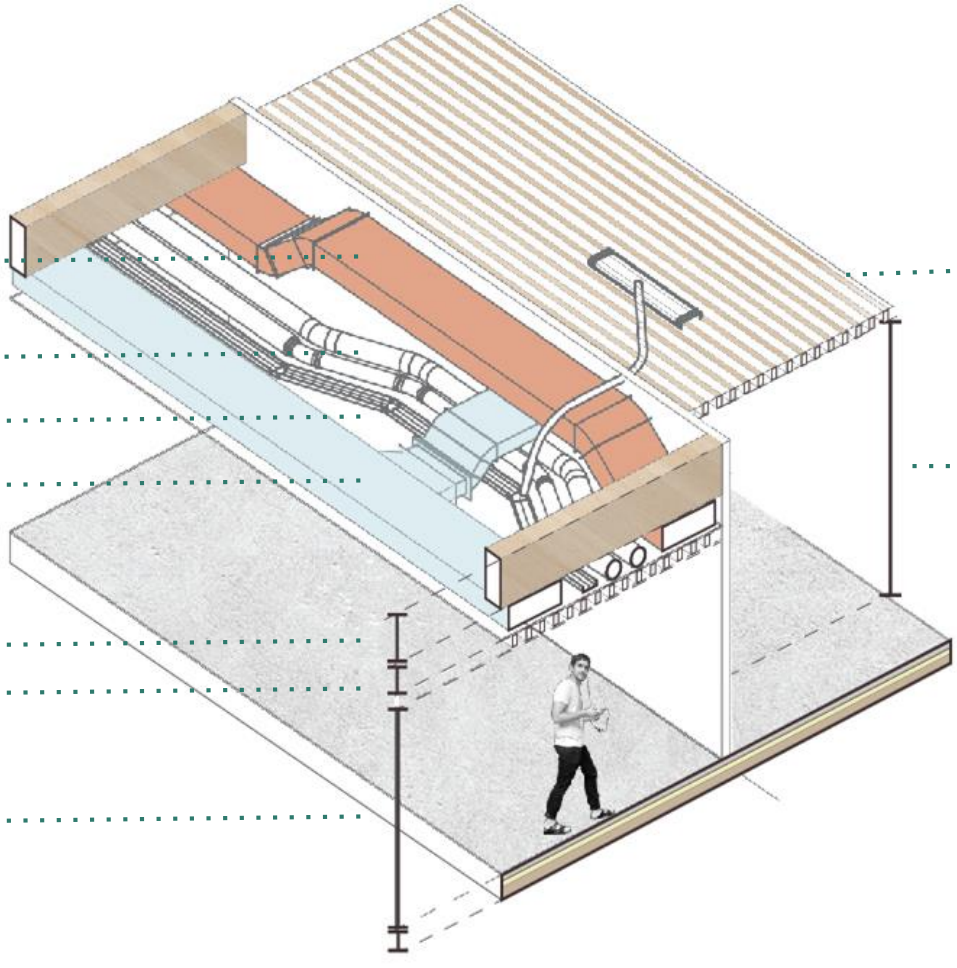
MEP Shaft Detail



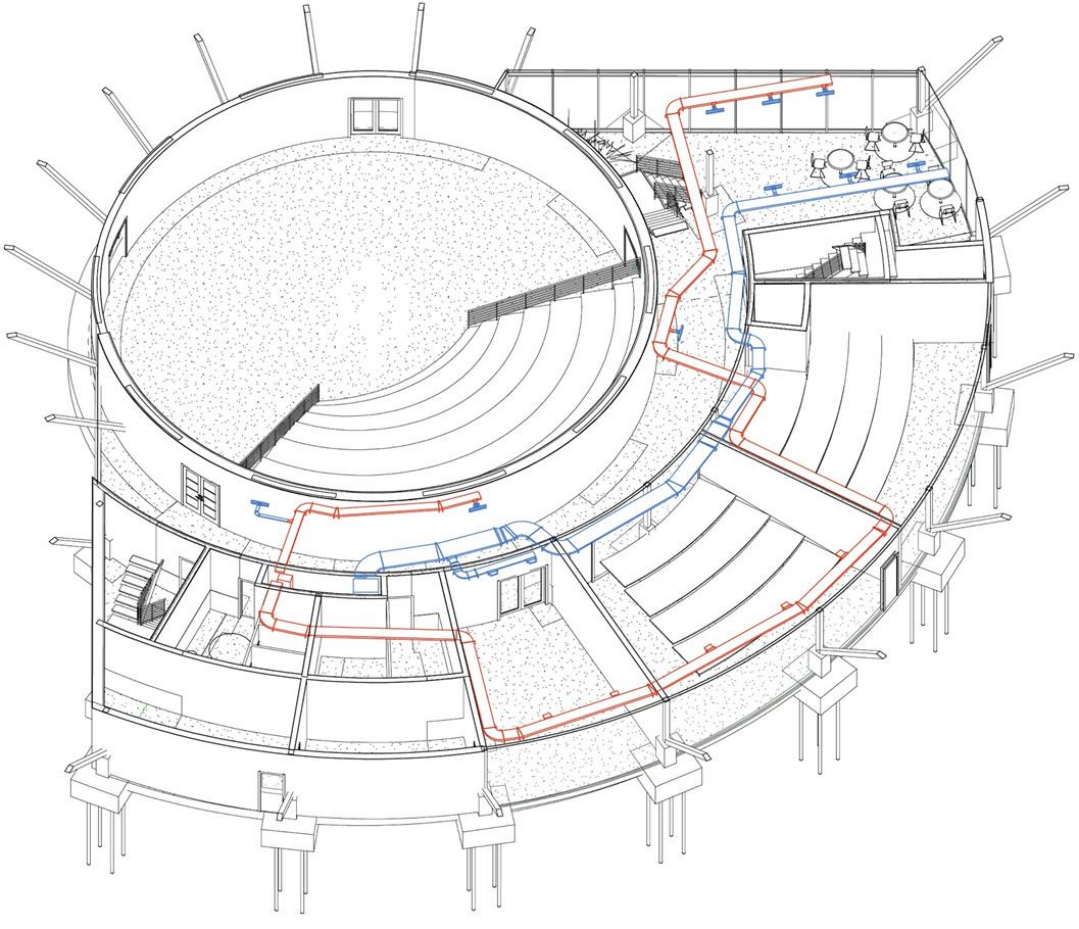




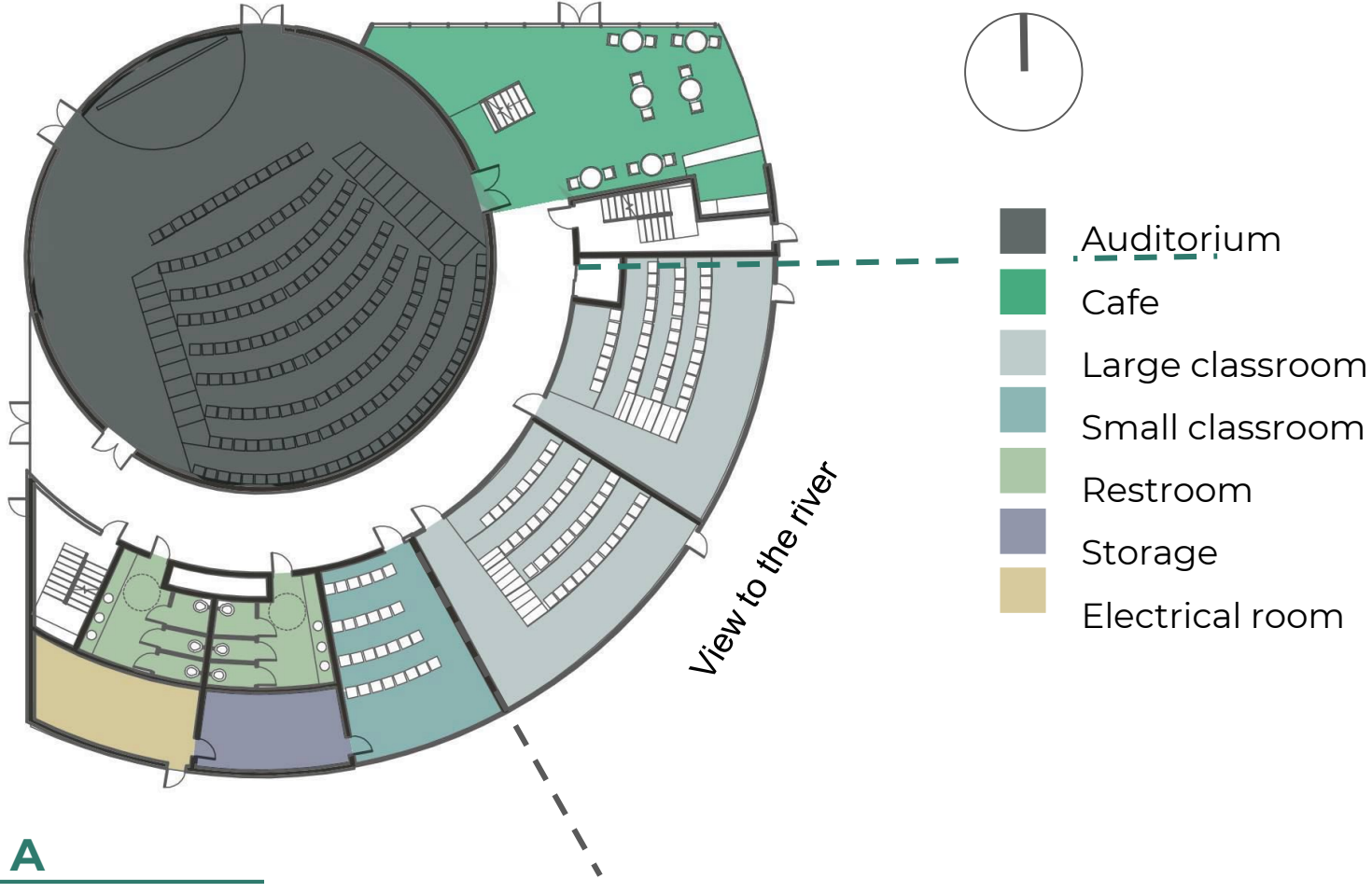
3D-Floor Sandwich



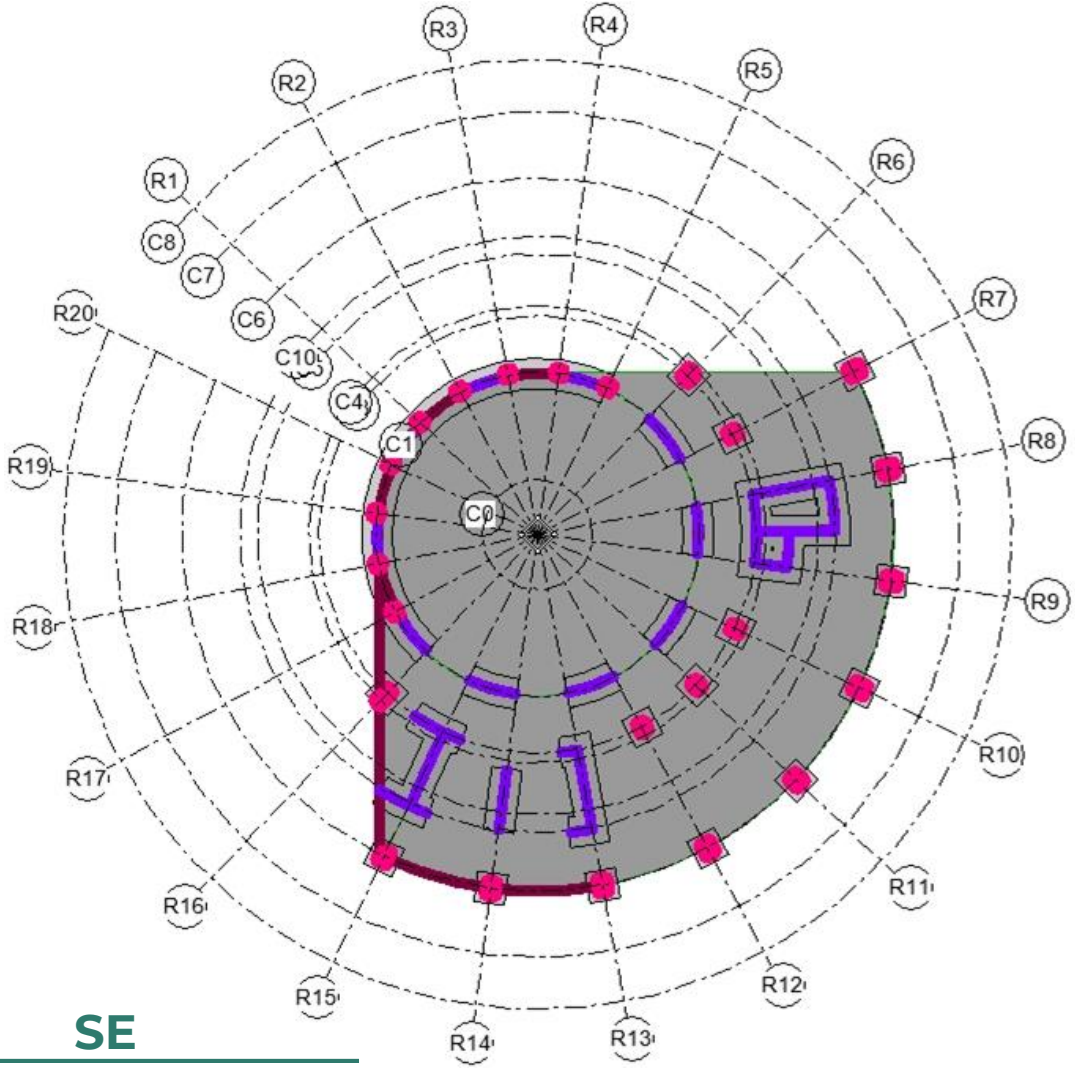
Ground Floor 3D Coordination



Ground Floor Architecture



Ground Floor Structural



CLT 191V Wall Panels

Concrete Retaining Walls

Glulam 305x305

Compression Ring

Tension Ring

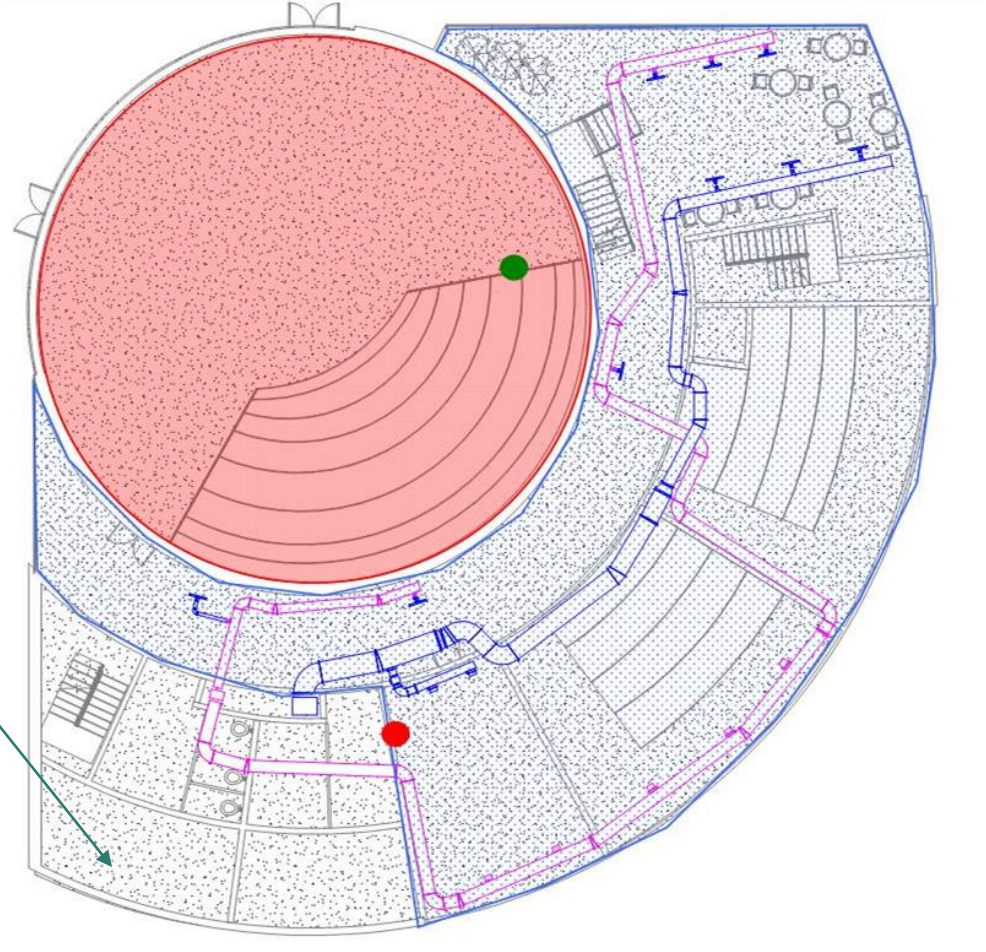
Glulam 171x305

Glulam 222x381

Glulam 222x533

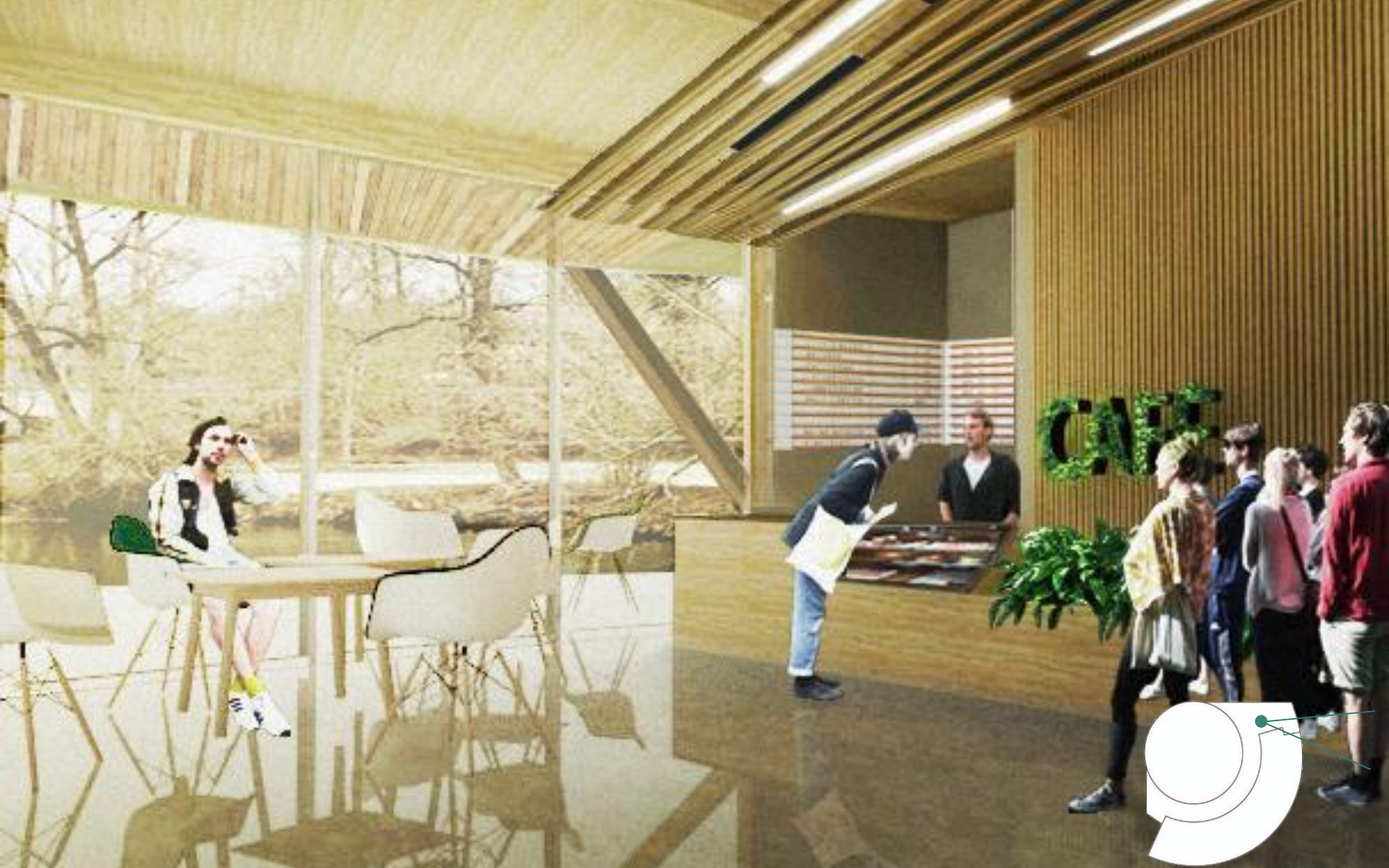
SE

Ground Floor MEP

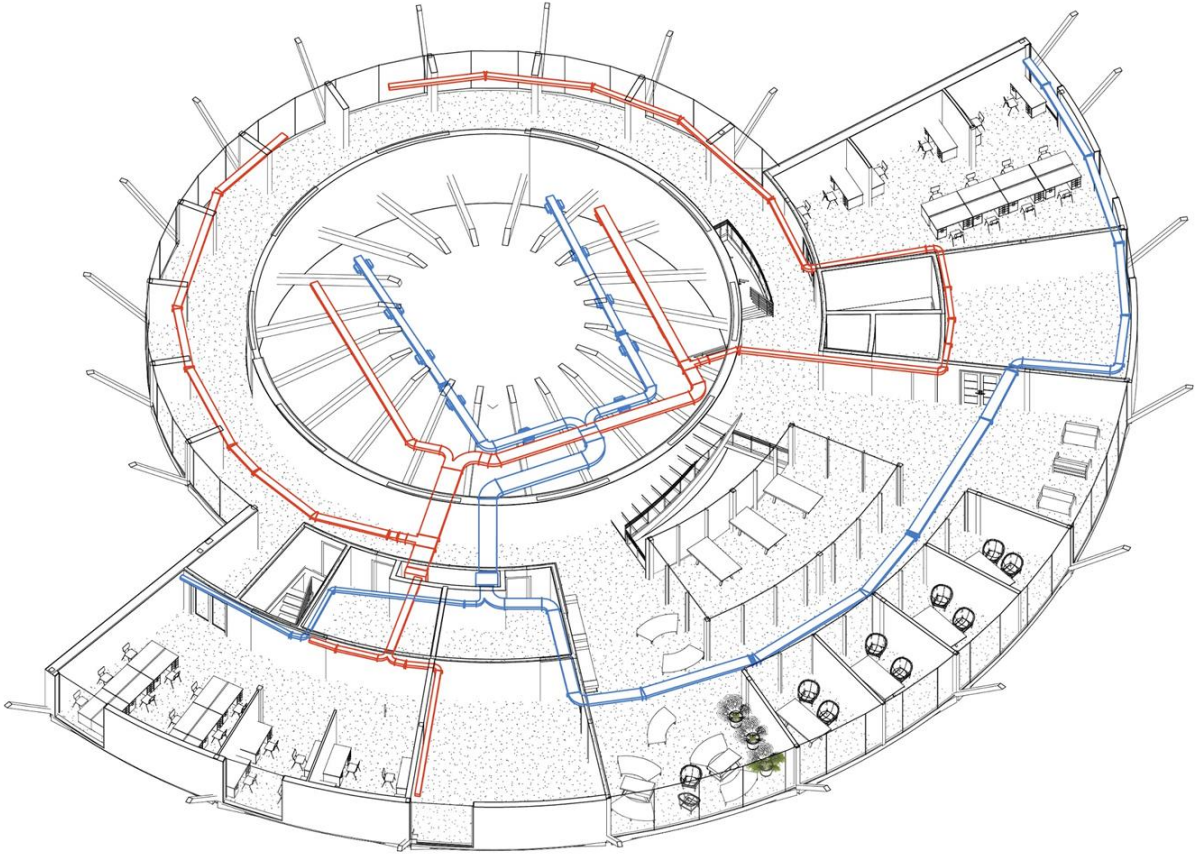


8 Loop manifold

12 Loop manifold

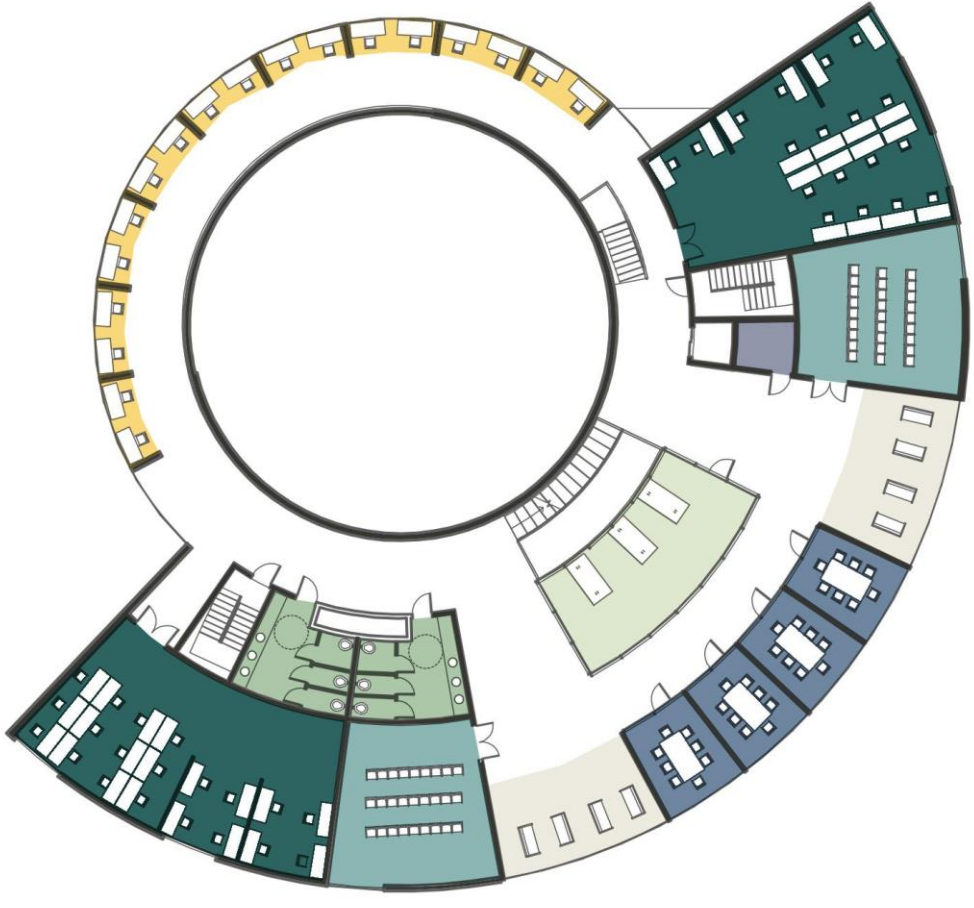

CAFE

First Floor 3D Coordination



First Floor Architecture

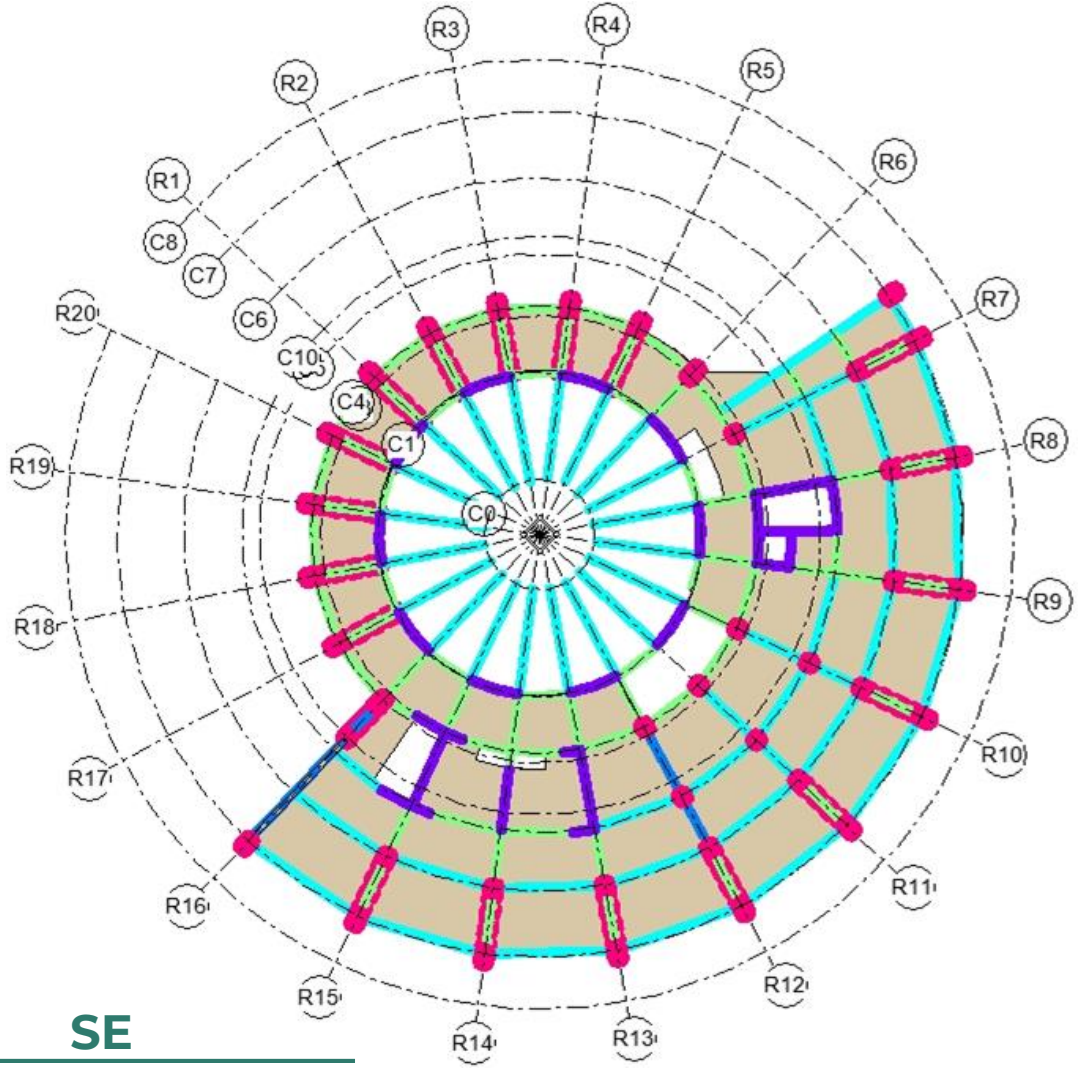
bla



- Lab
- Small classroom
- Seminar Room
- Makerspace
- Lounge
- Student niches
- Storage
- Restroom

A

First Floor Structural



CLT 191V Wall Panels

Concrete Retaining Walls

Glulam 305x305

Compression Ring

Tension Ring

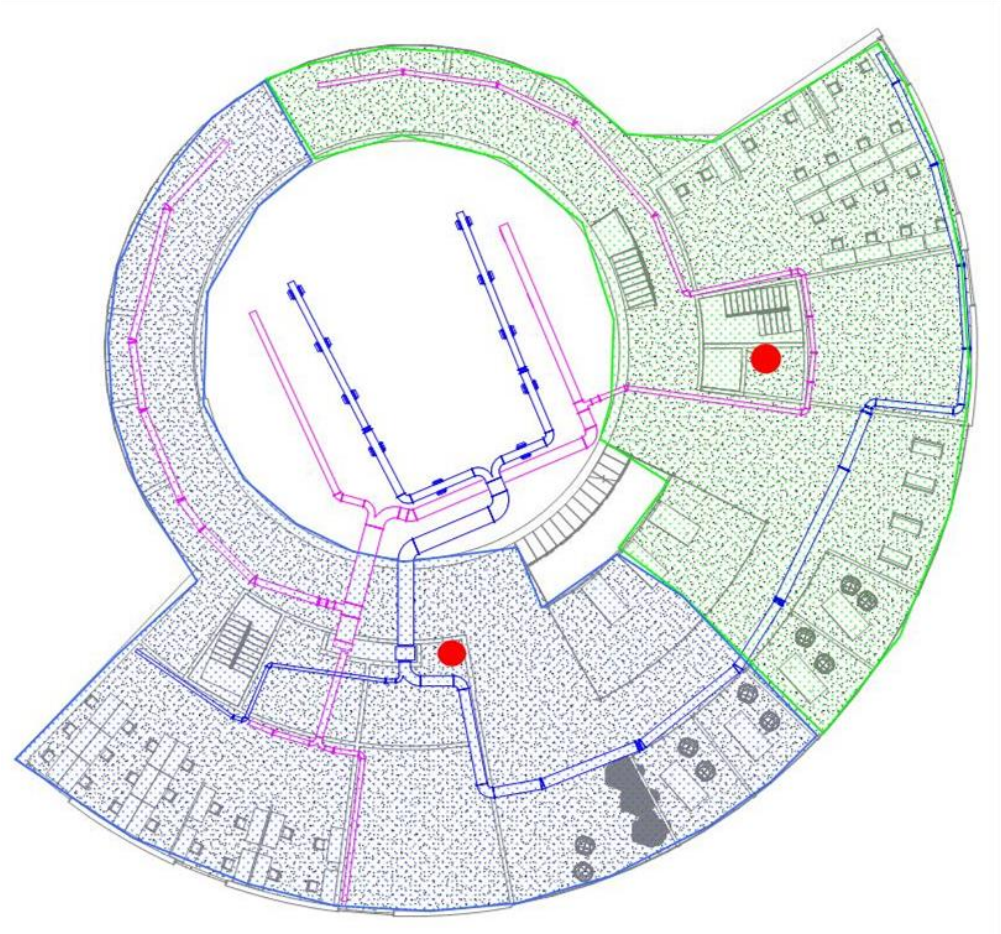
Glulam 171x305

Glulam 222x381

Glulam 222x533

SE

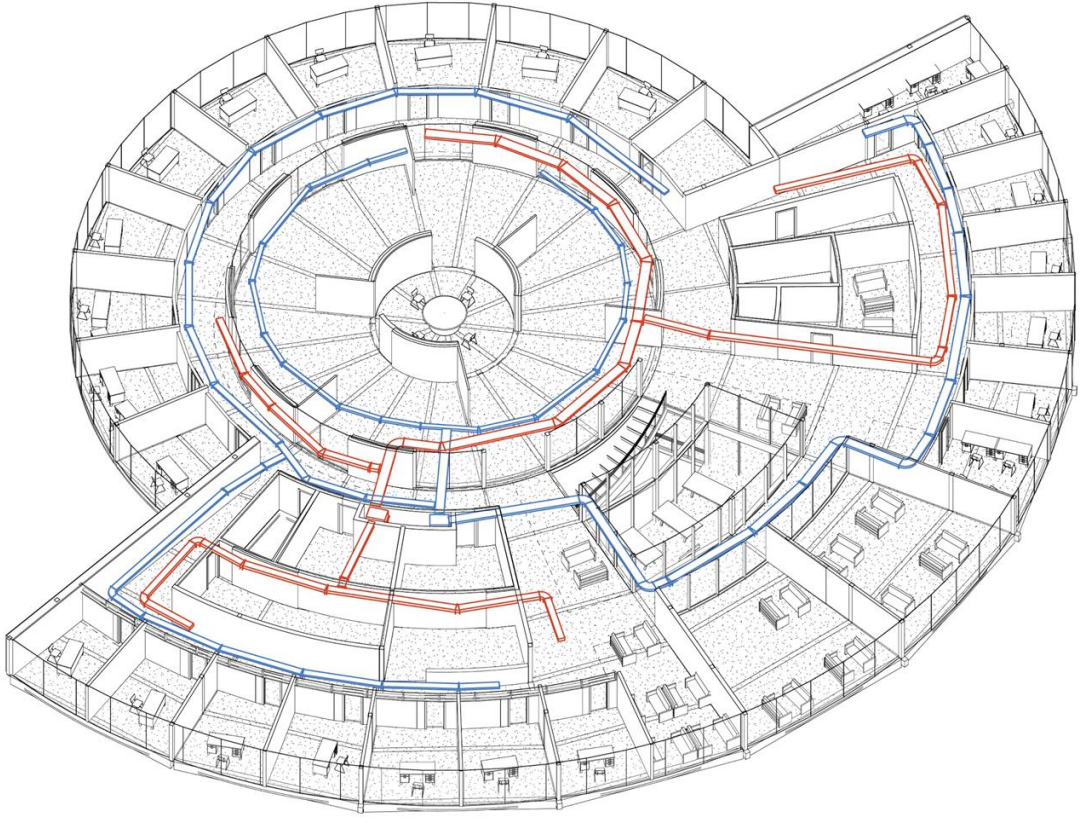
First Floor MEP



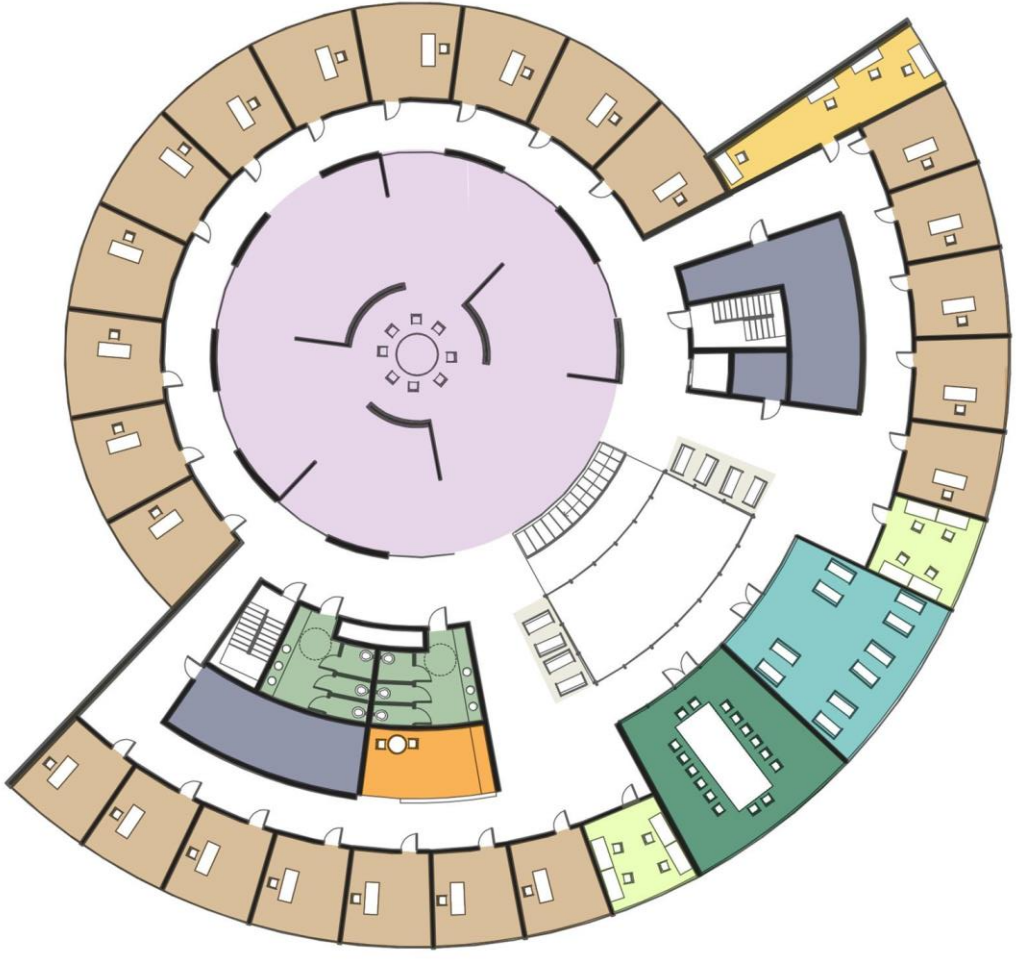
8 Loop manifold

19 Loop manifold

Second Floor 3D Coordination



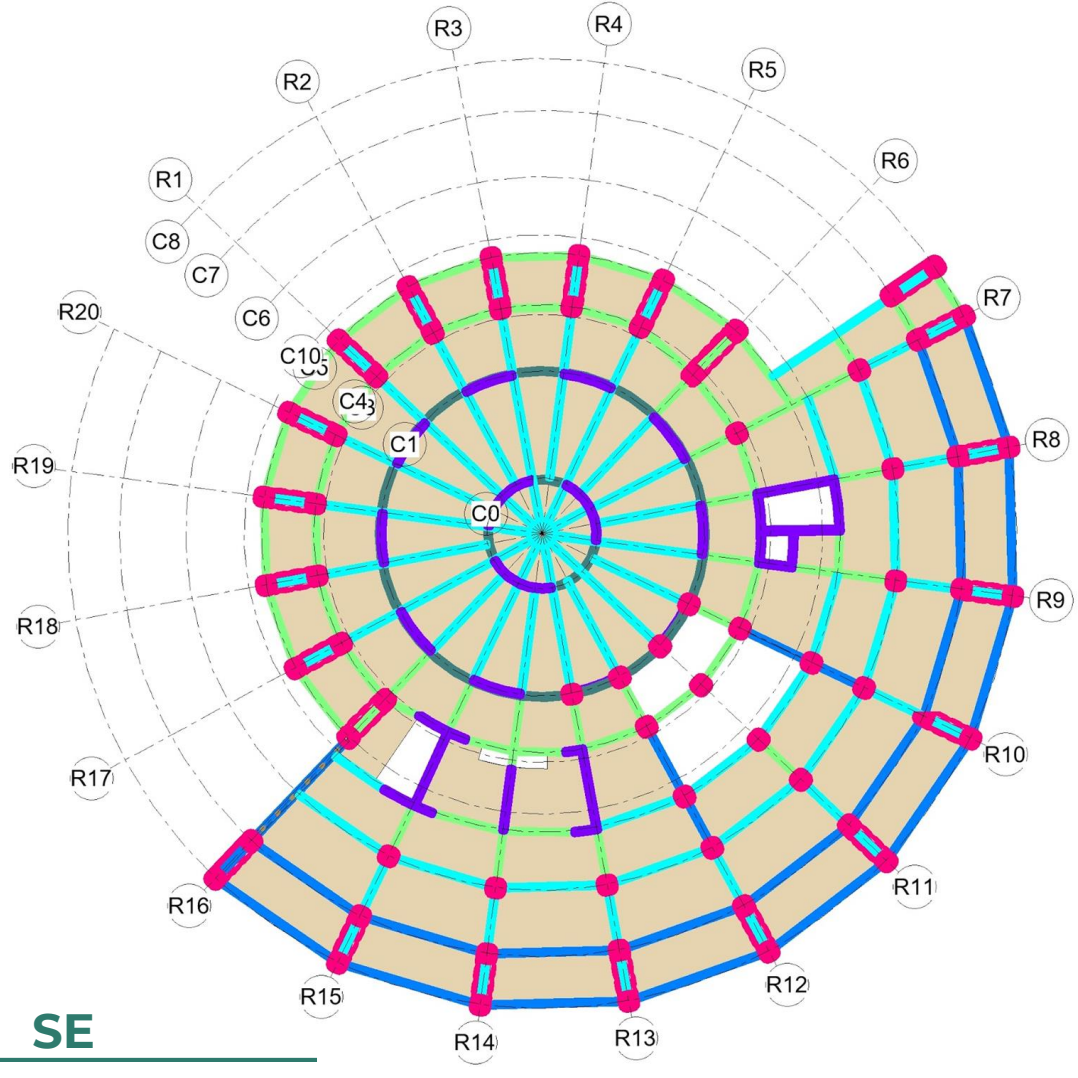
Second Floor Architecture



- Faculty office
- Collaborative space
- Conference Room
- Faculty Lounge
- Industry Office
- Student Office
- Kitchenette
- Storage
- Restroom

A

Second Floor Structural



CLT 191V Wall Panels

Concrete Retaining Walls

Glulam 305x305

Compression Ring

Tension Ring

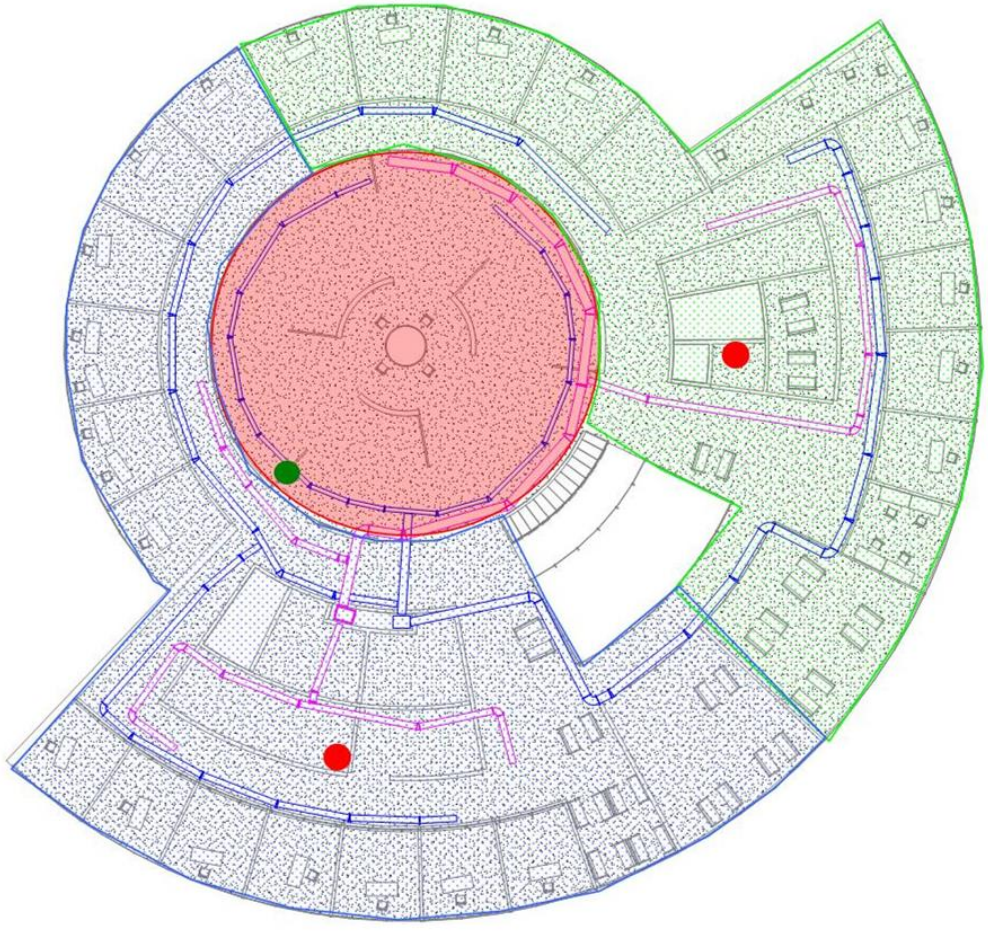
Glulam 171x305

Glulam 222x381

Glulam 222x533

SE

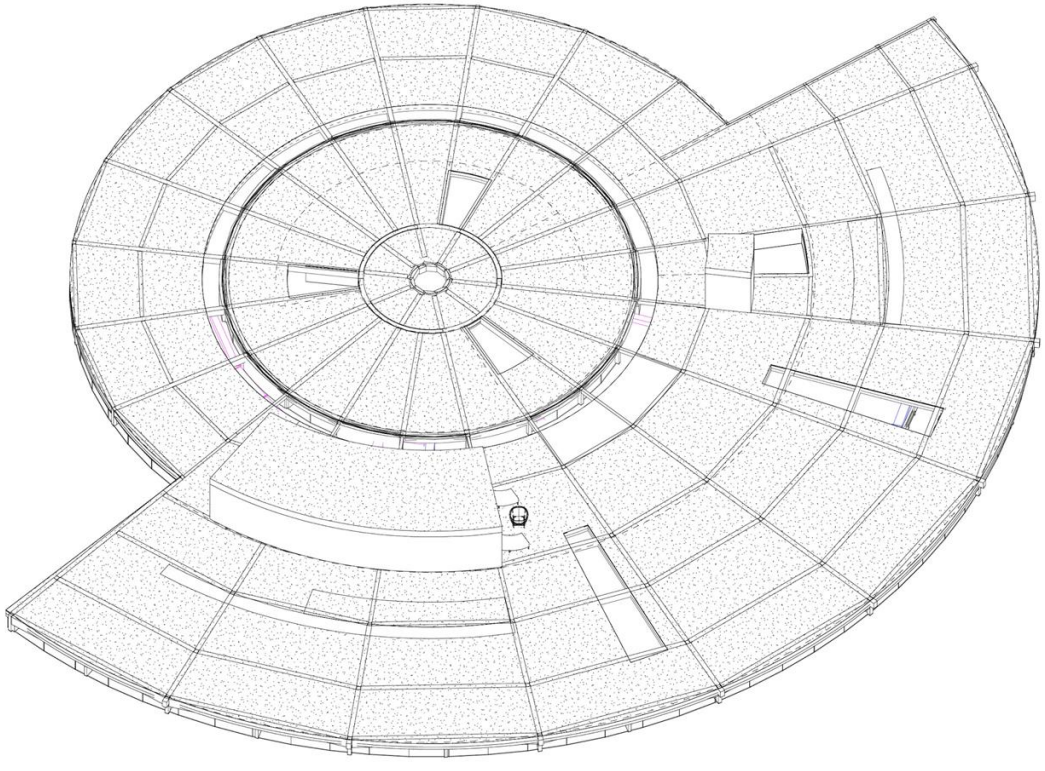
Second Floor MEP



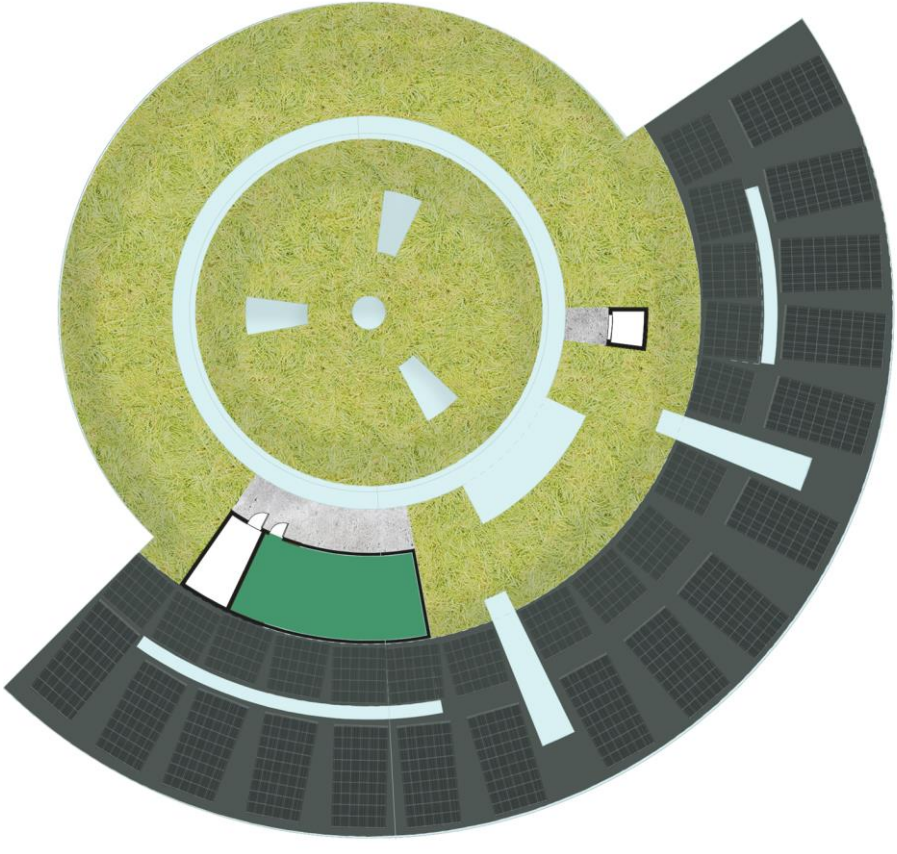
8 Loop manifold

19 Loop manifold

Roof 3D Coordination



Roof Architecture



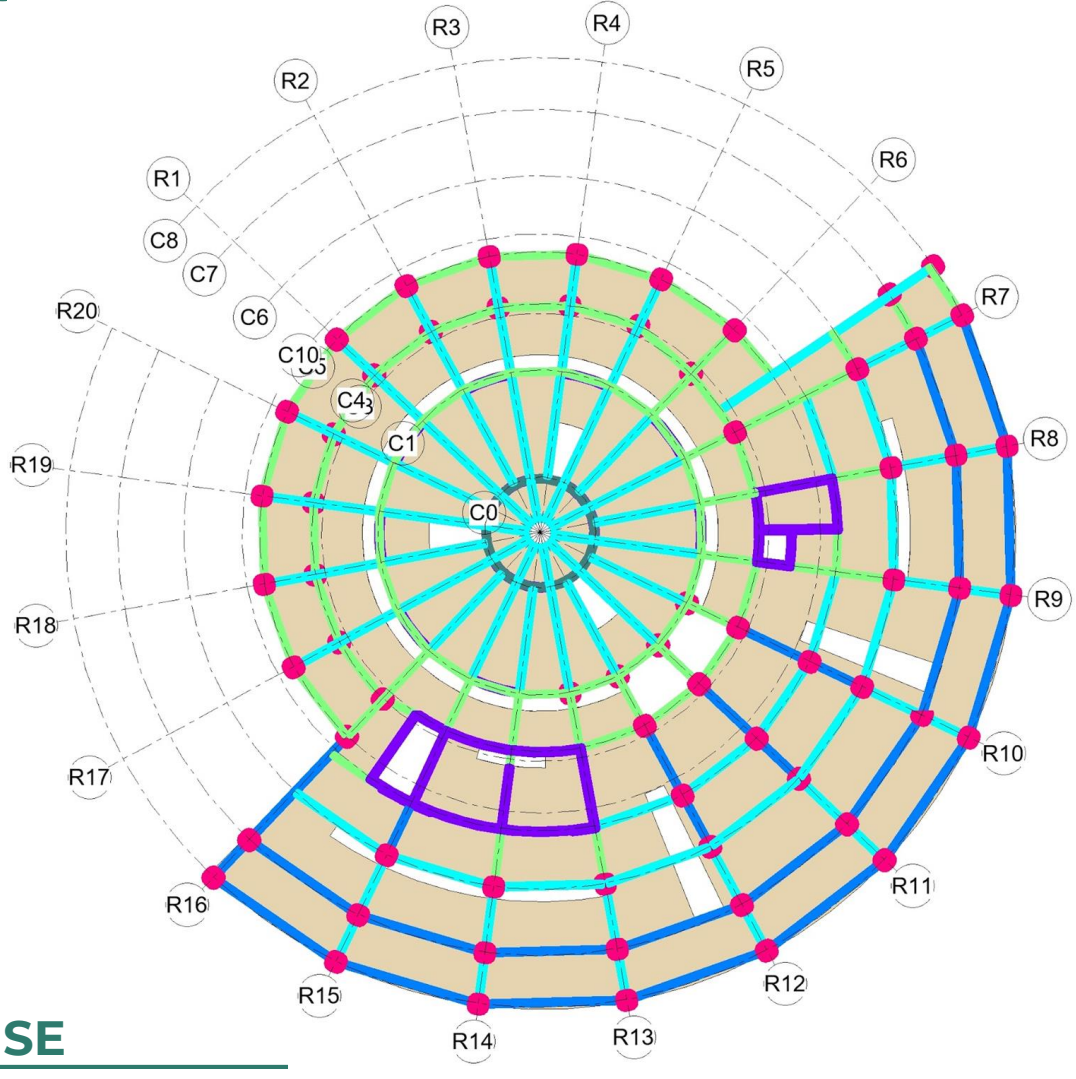
Green roof

PV

Mechanical Room

A

Roof Structural



CLT 191V Wall Panels

Concrete Retaining Walls

Glulam 305x305

Compression Ring

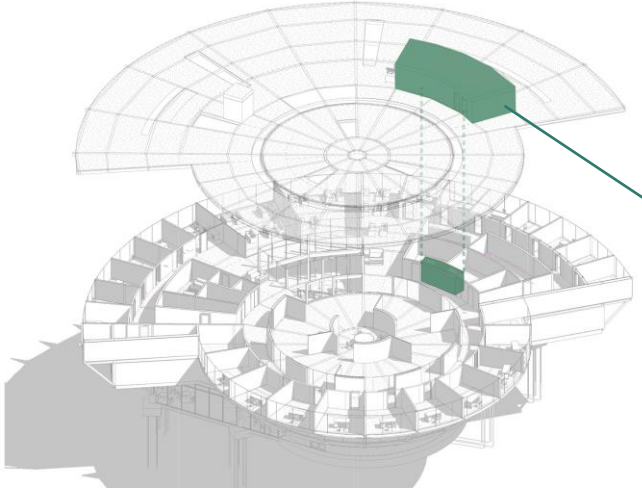
Tension Ring

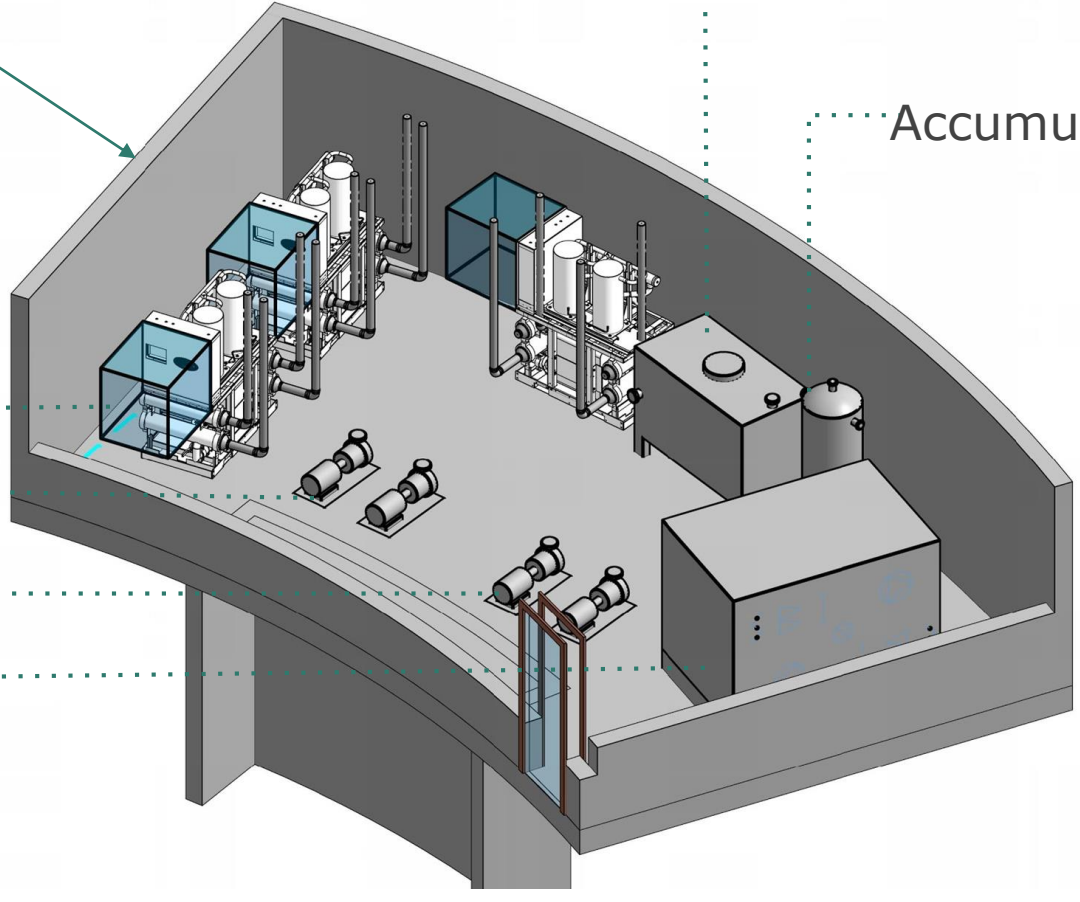
Glulam 171x305

Glulam 222x381

Glulam 222x533

Roof MEP - Mechanical Room





Structural Analysis Ultimate

ETABS

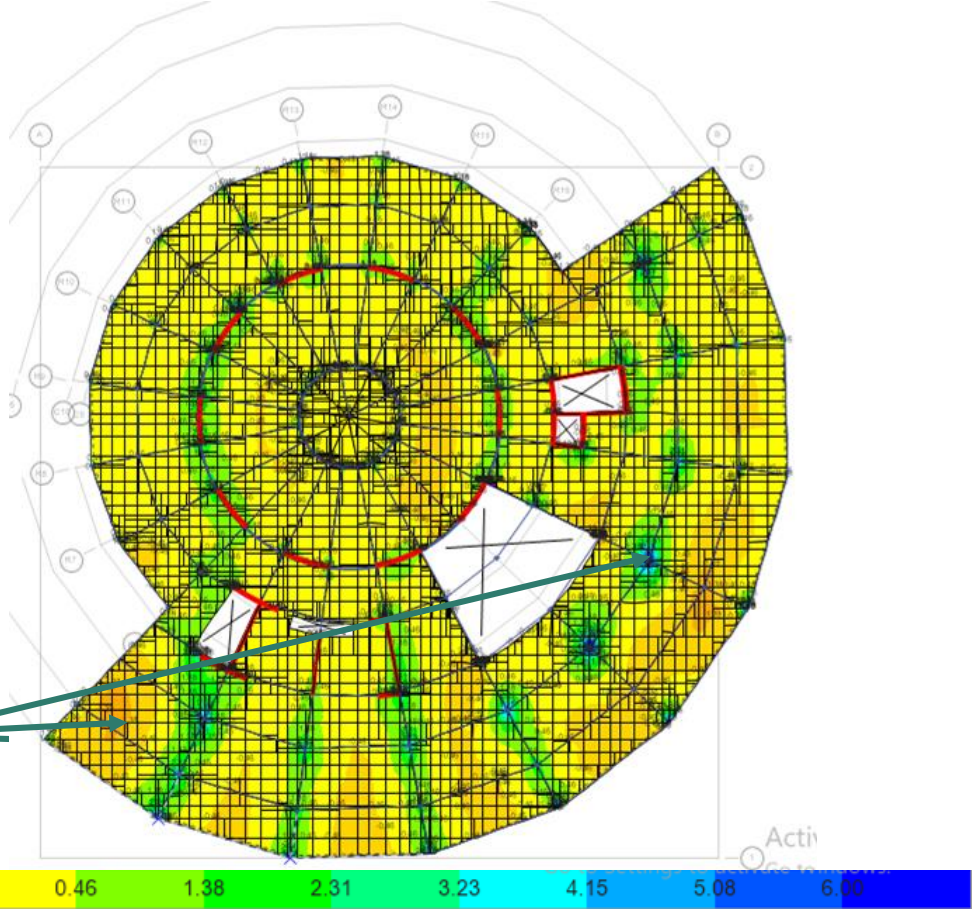
Floor Load Combo:
1.35 DL + 1.05 LL + 0.75 W

Roof Load Combo:
1.35 DL + 1.05 LR + 0.75 S

Allowable Deflection:
15.5 mm < L/500 = 17 mm

Max/Min Stress Range:
-3 to 6 MPa

Max Deflection
= 15.5 mm



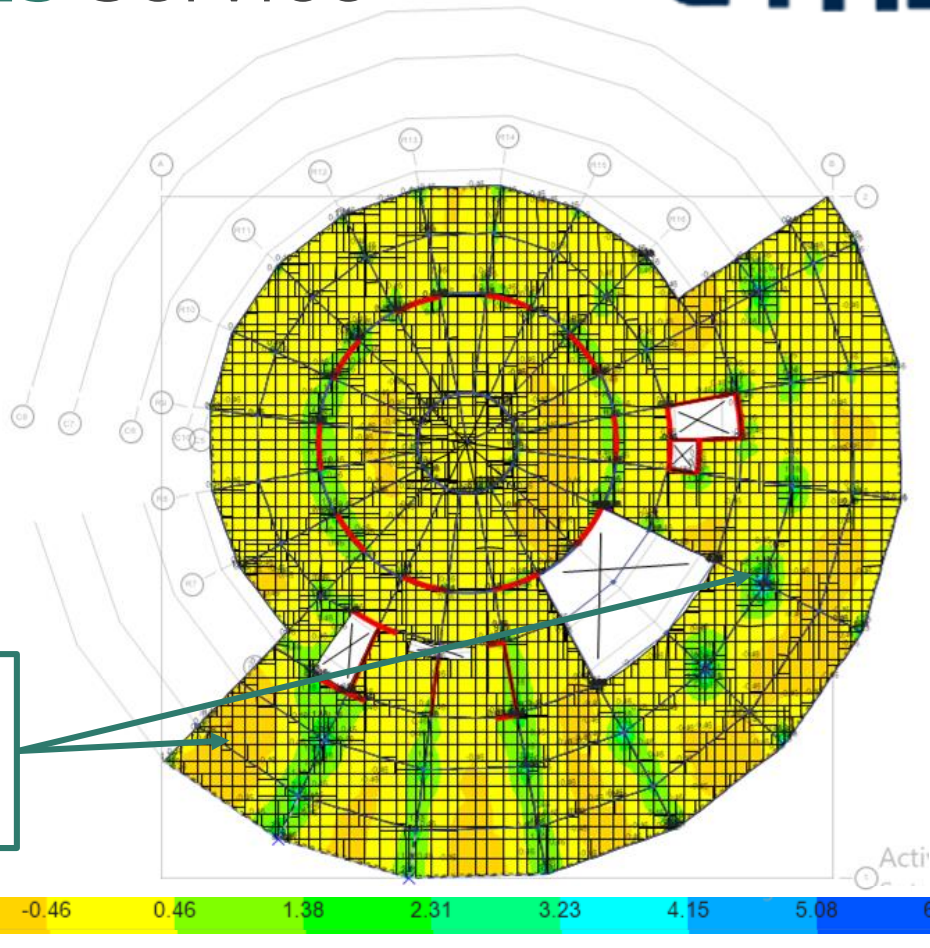
Source: Eurocode 5 (IS EN 1995-1-1)

Structural Analysis Service

ETABS

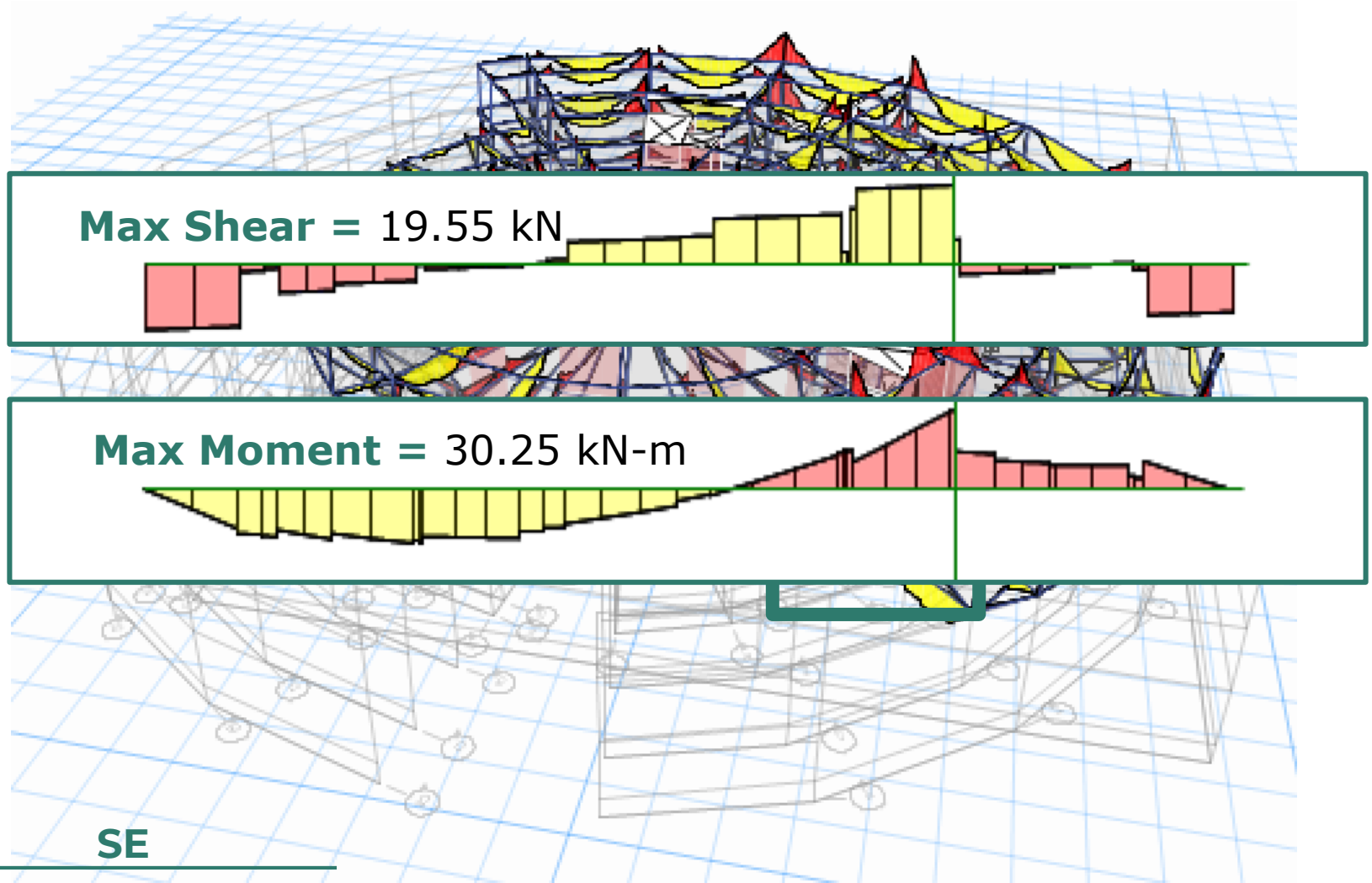
Floor Load Combo:
1.0 DL + 1.0 LL + 0.6 W

Allowable Deflection:
15.5 mm < L/500 = 17 mm

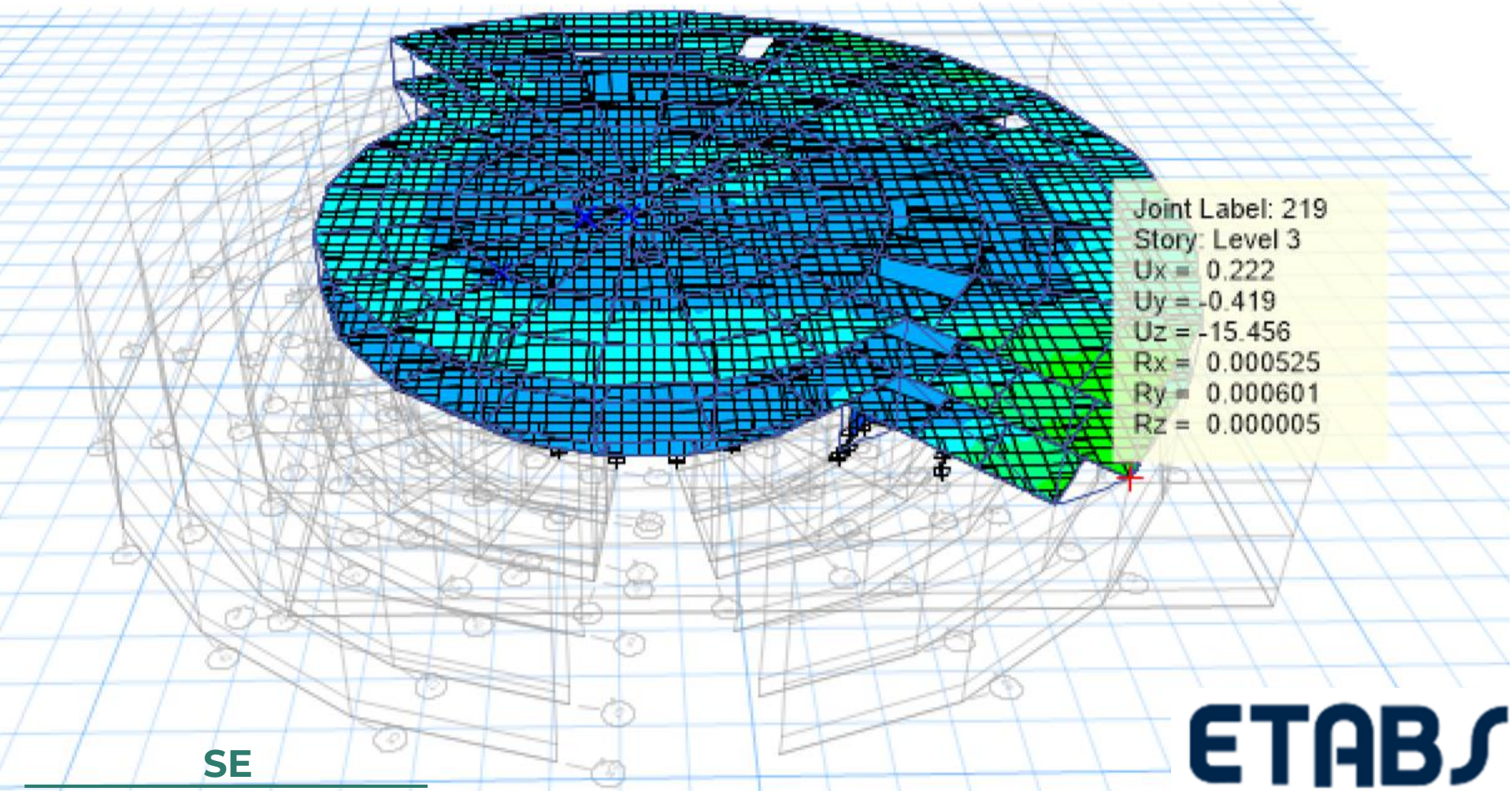


Source: Eurocode 5 (IS EN 1995-1-1)

Structural Analysis Moment



Structural Analysis Refining Design



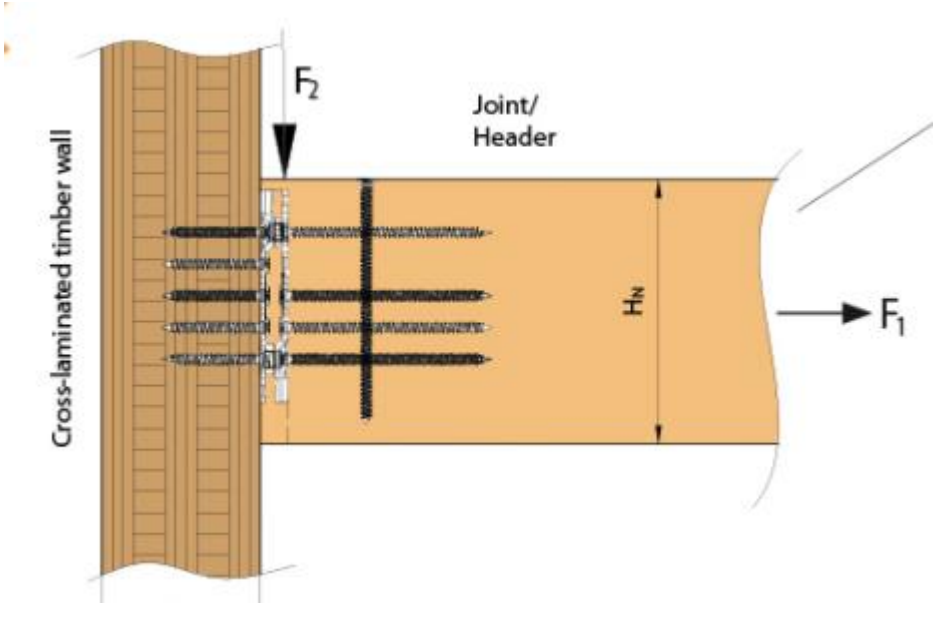
SE

ETABS

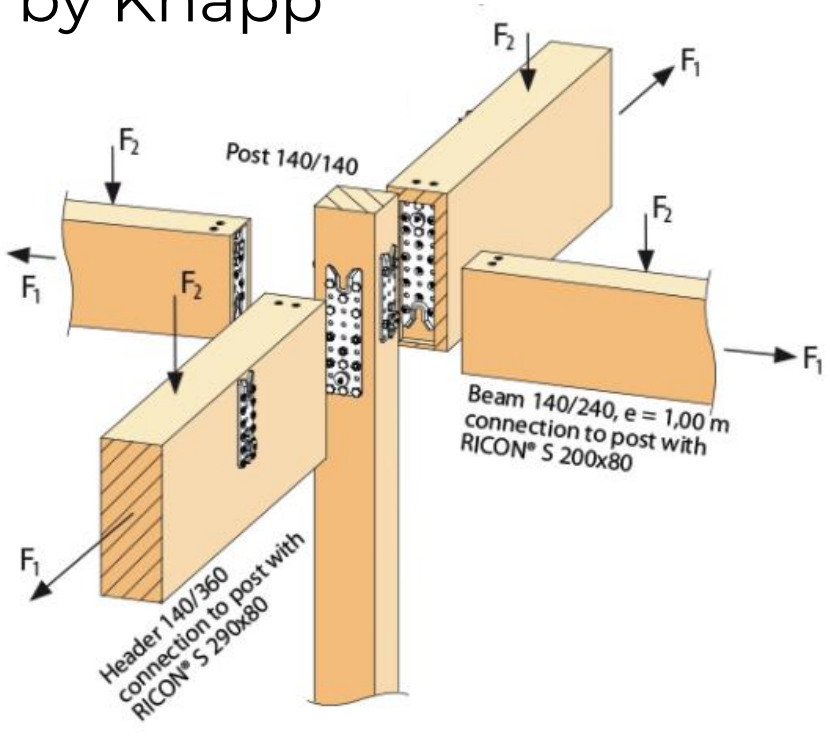
Connections Typical Details

Ricon® S Timber Connection by Knapp

(shear up to 100 kN)



Glulam to CLT Wall

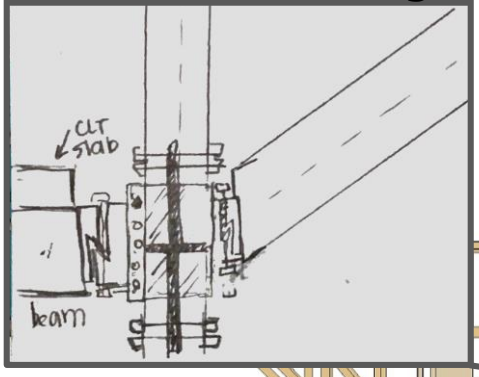


Glulam to Glulam

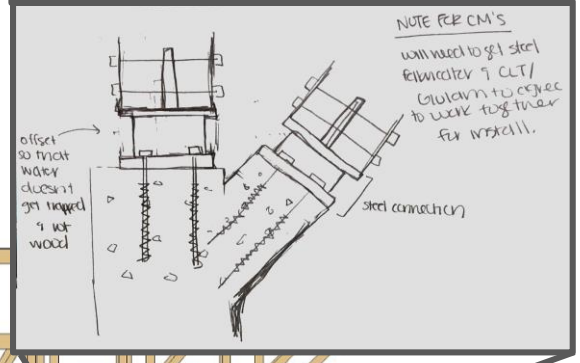
Source: https://www.knapp-verbinder.com/en/

Connections Enabling Details

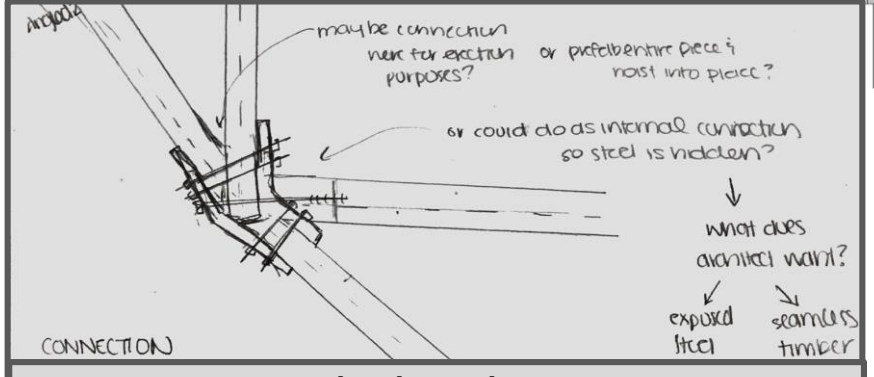
Auditorium Ring



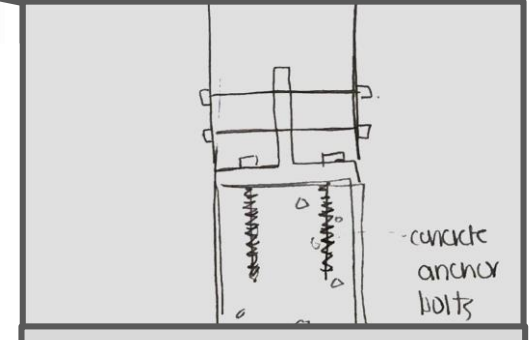
Angled Foundation



Angled Columns

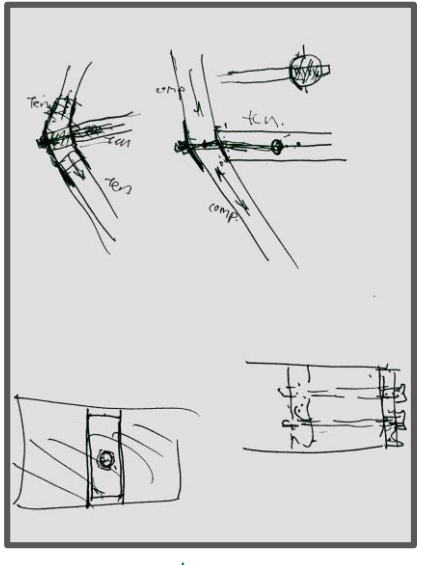


Concrete to Timber

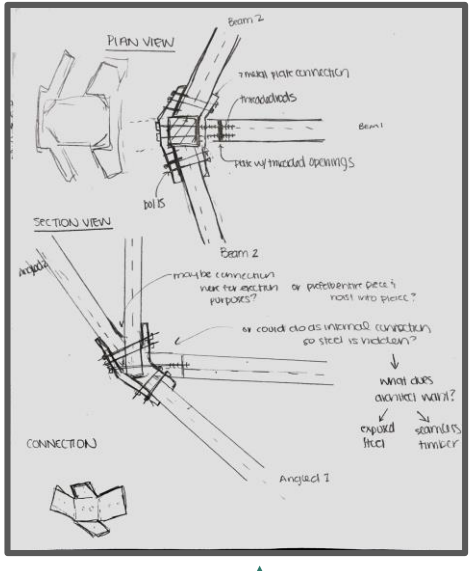


Connections Design Process

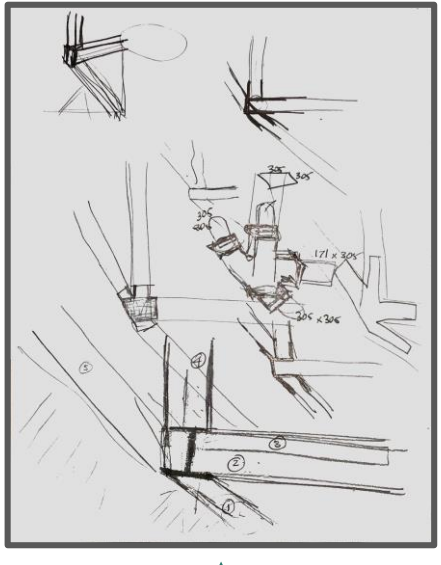
Brainstorming



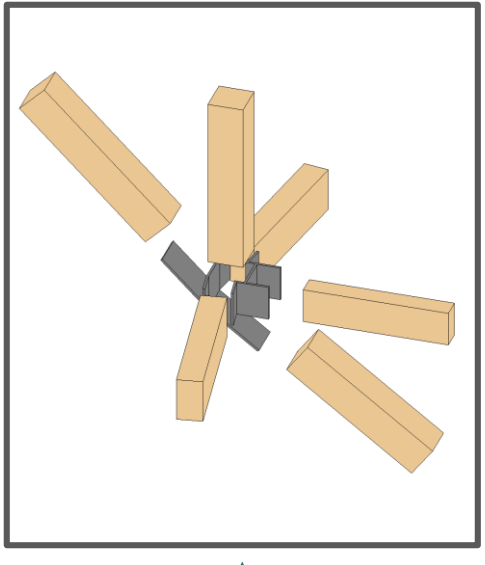
Sketching



Sequencing



Modeling



Mentors

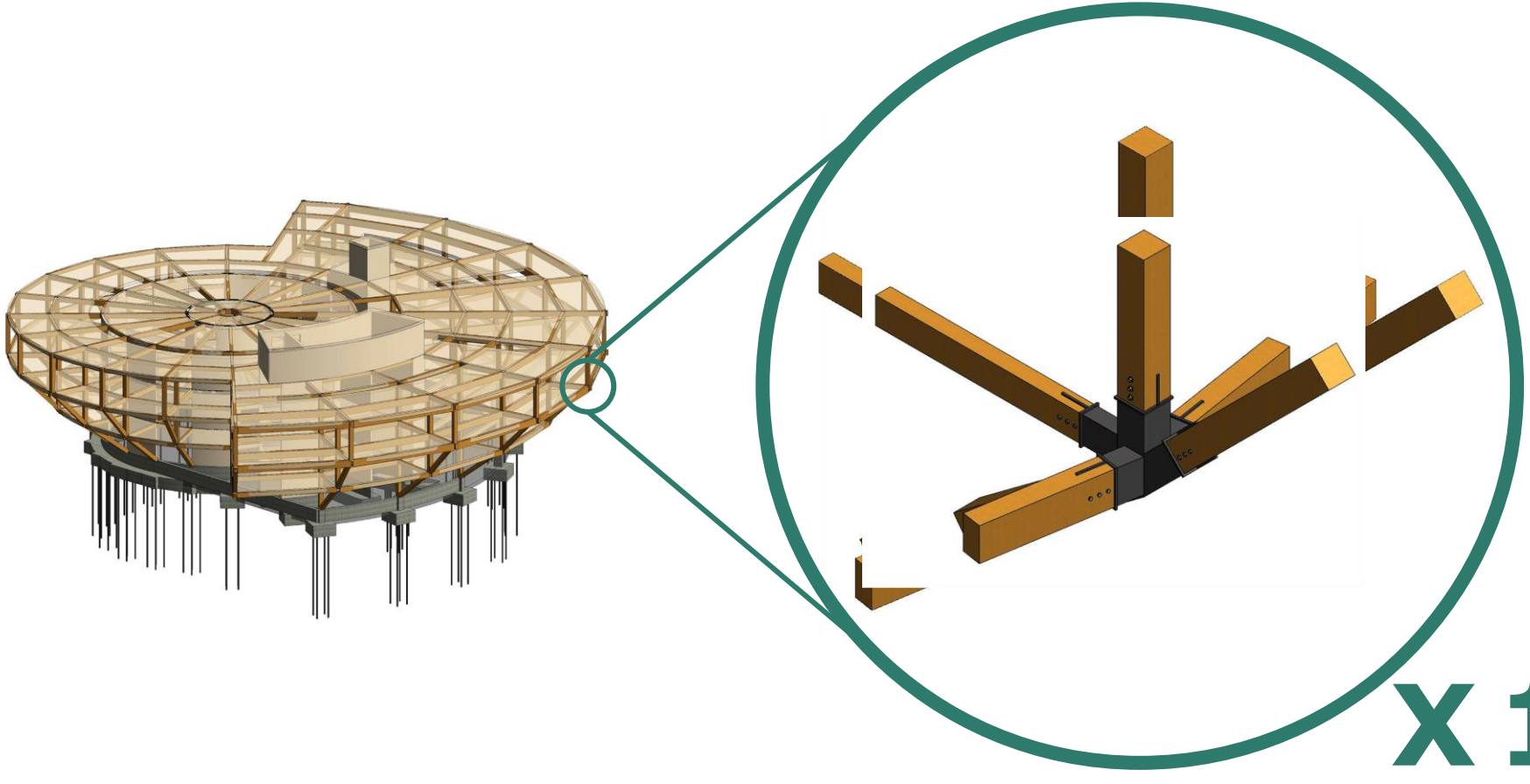
A-SE-CM

SE team

CMs

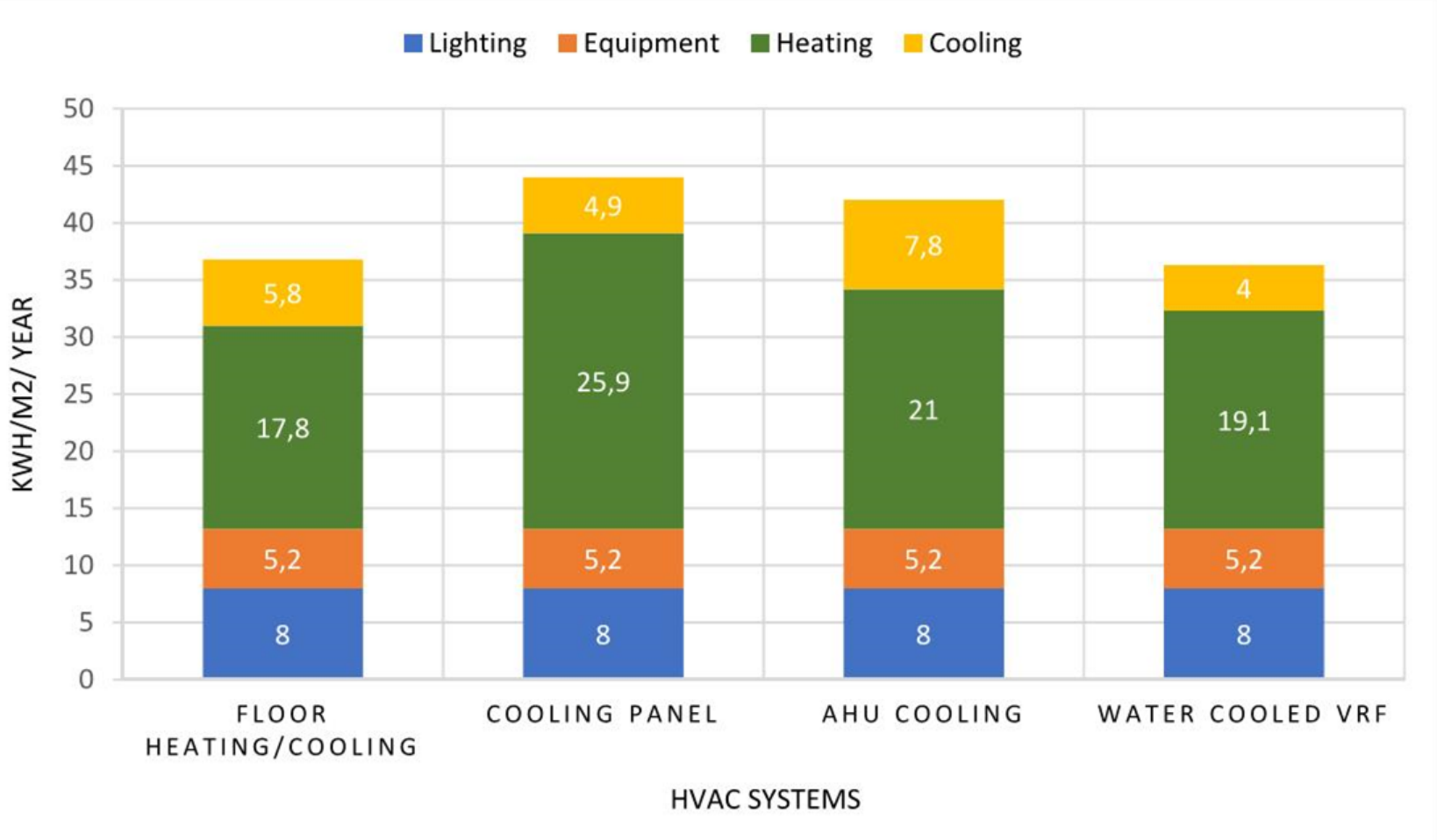
Revit (Glenn)

Connections 6-Member Detail



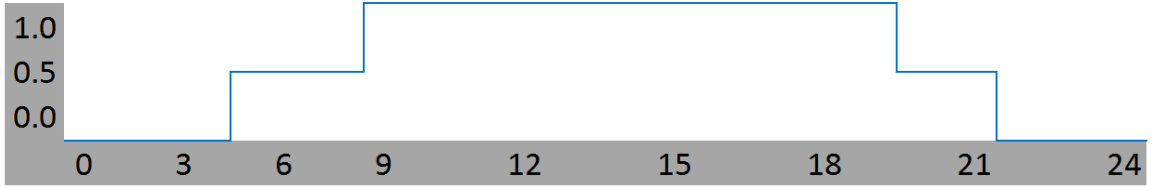
X 17

Energy Analysis

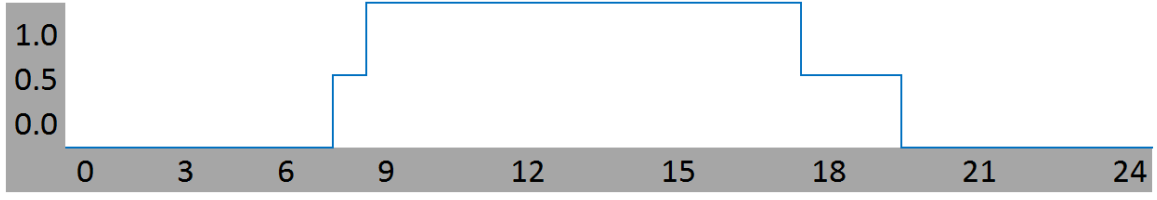


Energy Simulation - Parameters

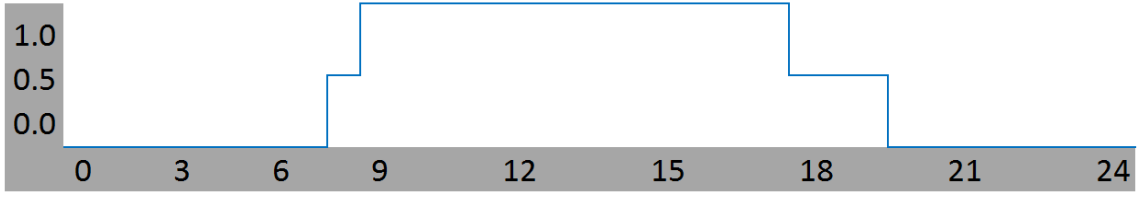
Light schedule



Occupancy schedule



Chiller/ boiler schedule



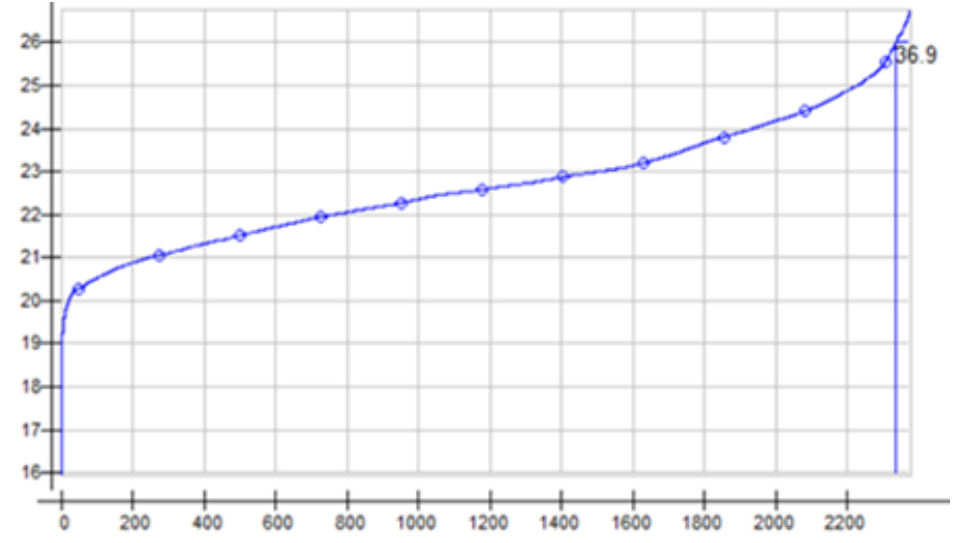
Chilled water temperature - 14,0°C - 19,0°C

Boiler temperature - 35,0°C - 55,0°C

Chiller operation - 10 April to 30 Oct

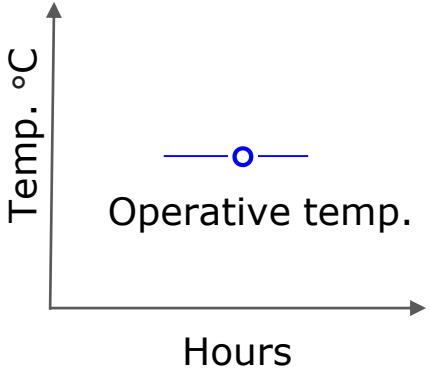
Boiler operation - 31 October to 09 April

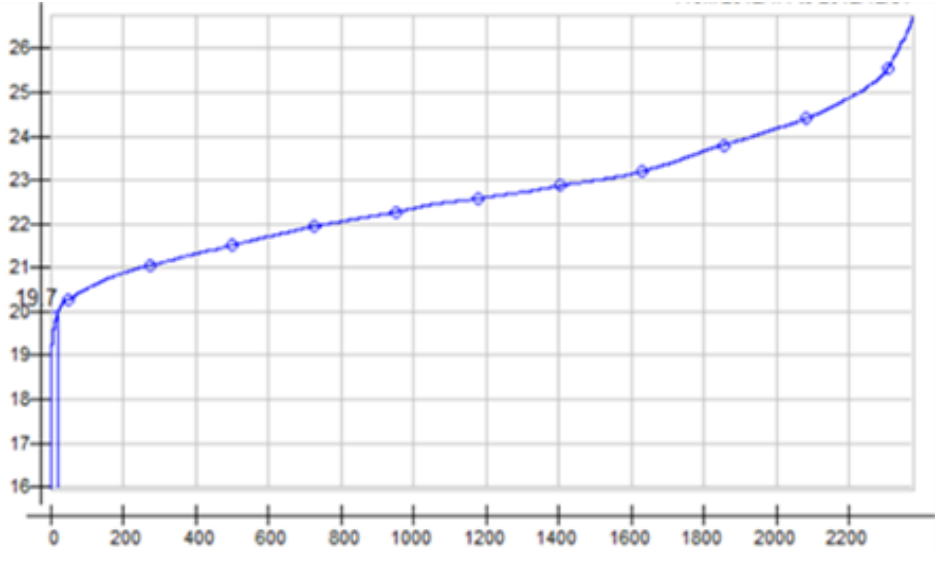
Operative temperature



Undercooled hours - 36,9 Hours

Under Heated hours - 19,7 Hours



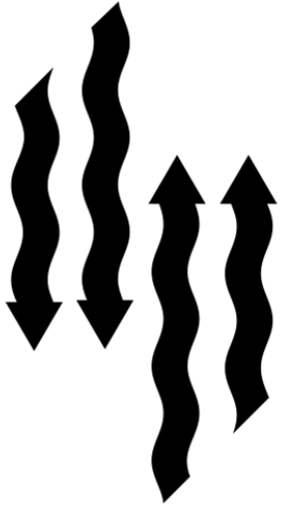


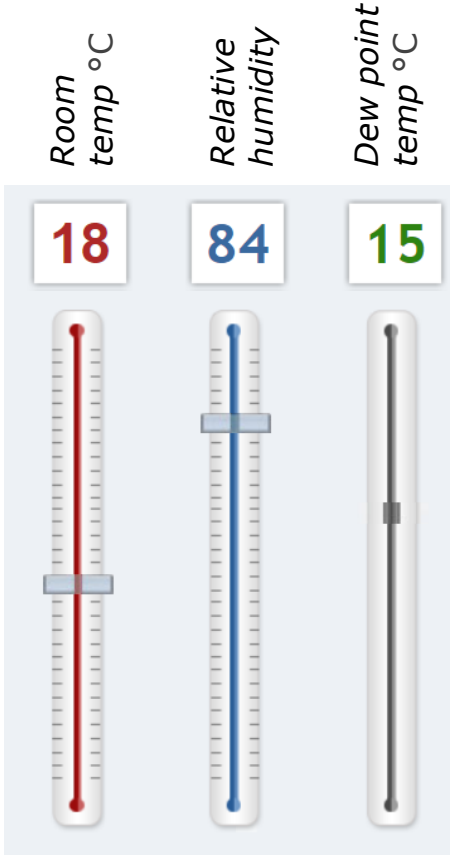
Condensation

Lowest surface temperature °C - 17.8

3-way motorized mixing valve

Always active ventilation system





Equipment Selection

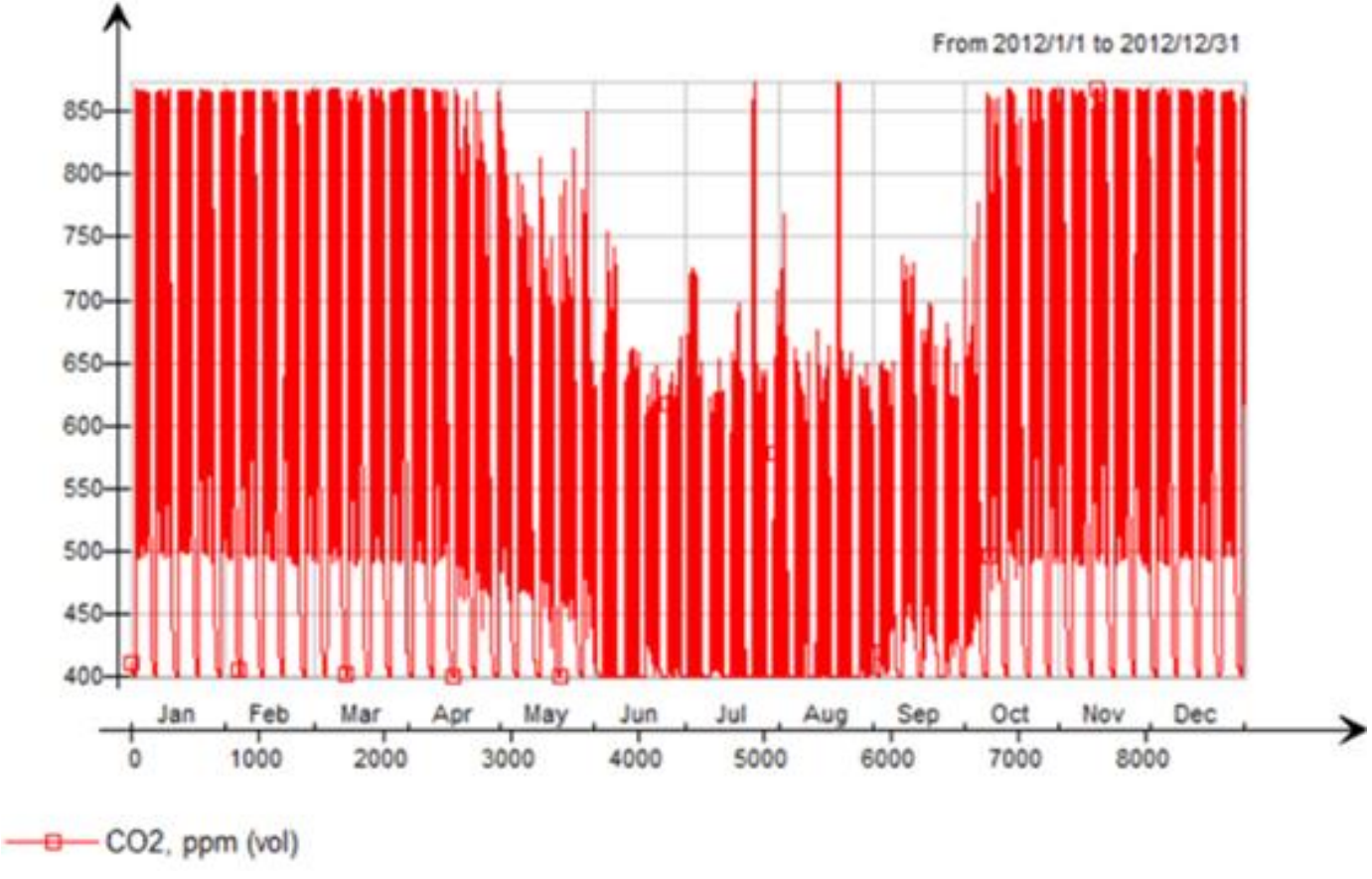
3 number, 116 kW scroll chiller

1 number, 713 kW Electric hot water generator

4 number, Circulation pump

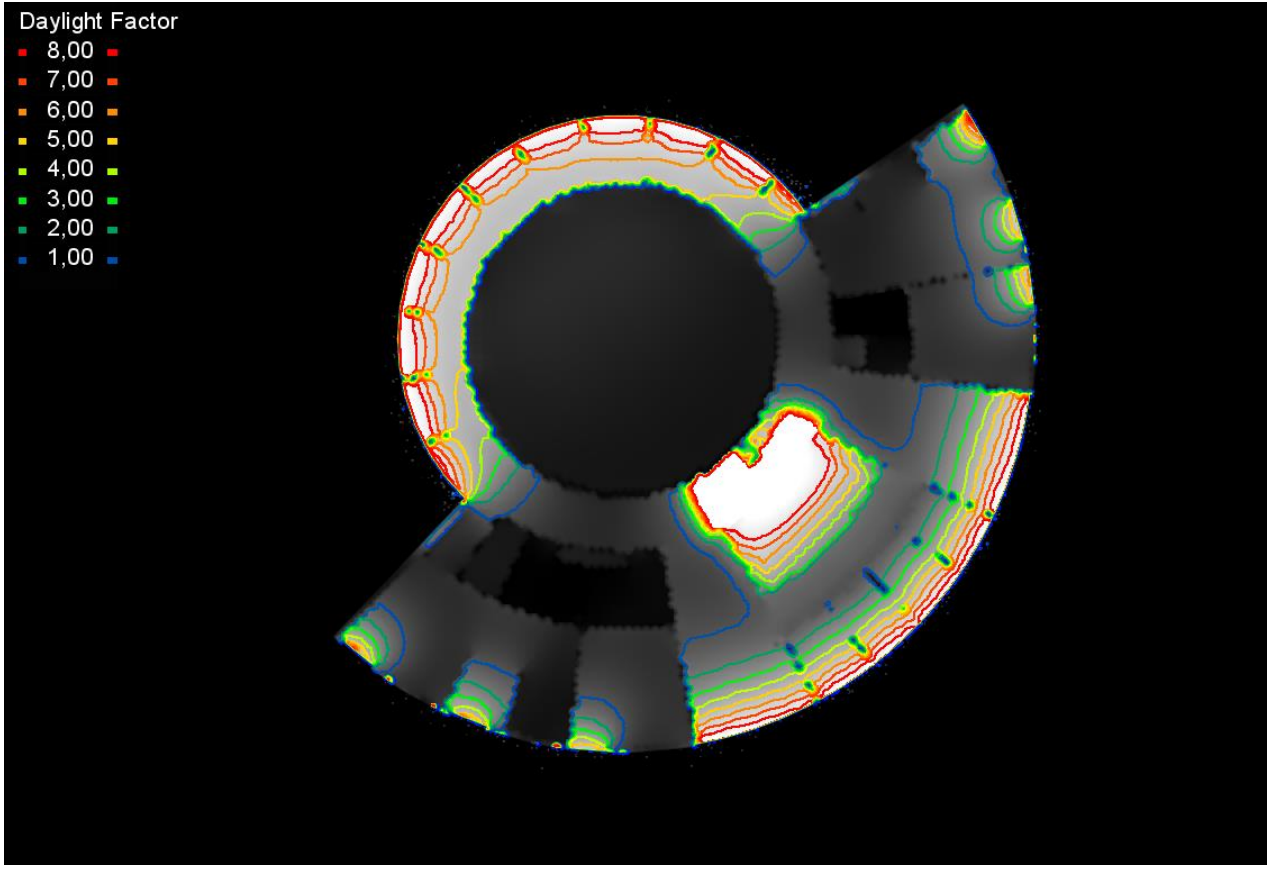
1 number, Dry cooler

Indoor Climate - CO_2 Concentration



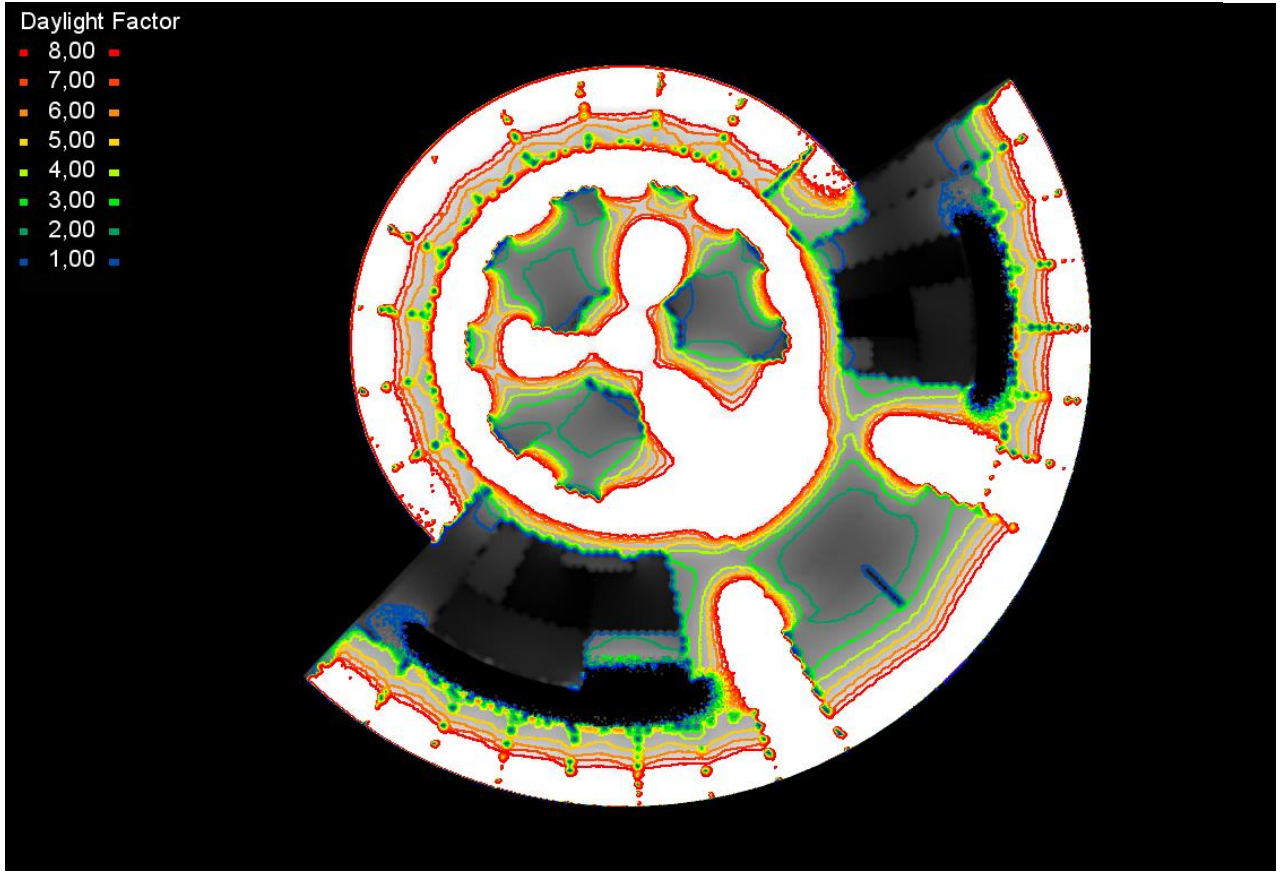
Indoor climate - Daylight analysis

First floor



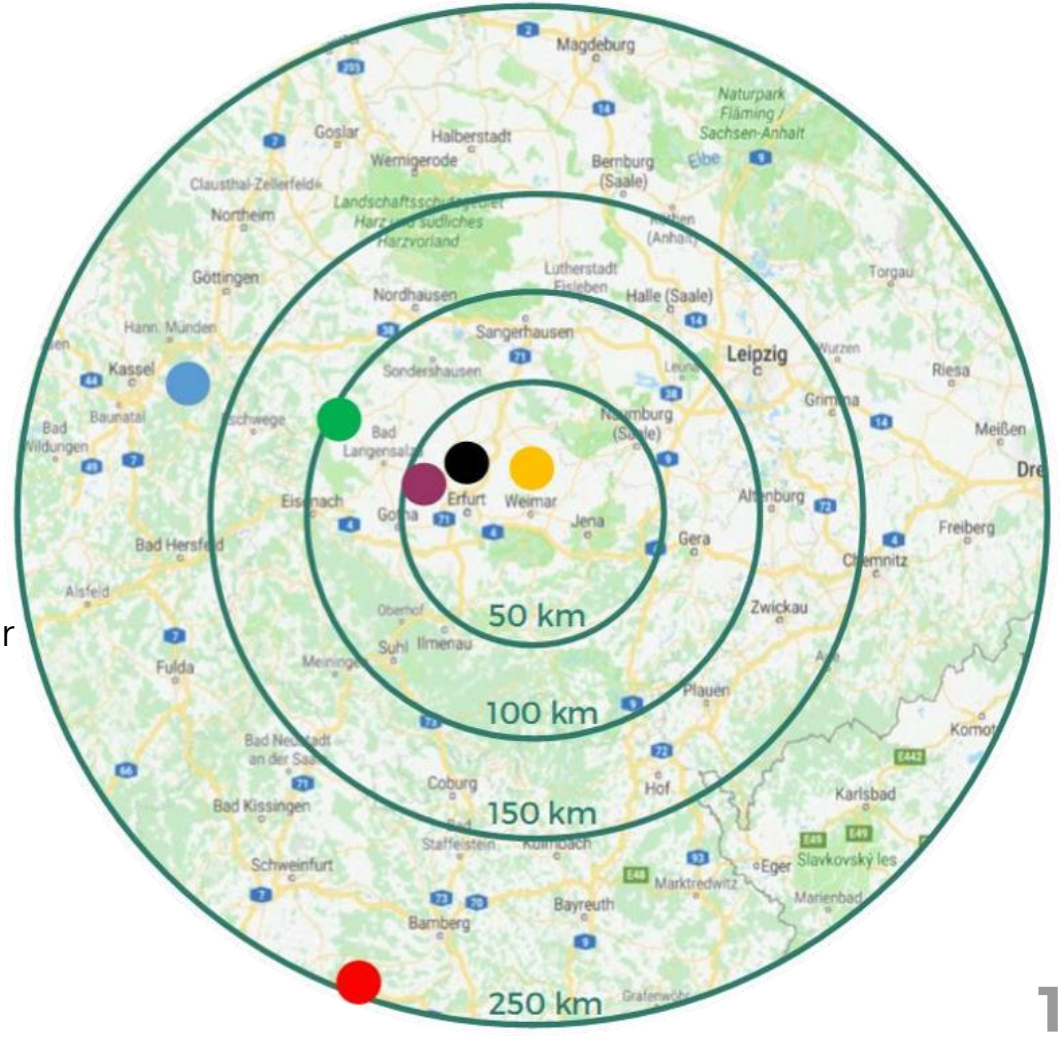
Indoor climate - Daylight analysis

Second floor



Site Access Material Suppliers

- CLT Supplier
- Steel Supplier
- Equipment Rent
- Partition Supplier
- Concrete Supplier
- Curtain Wall/ Skylight Supplier
- HVAC Supplier

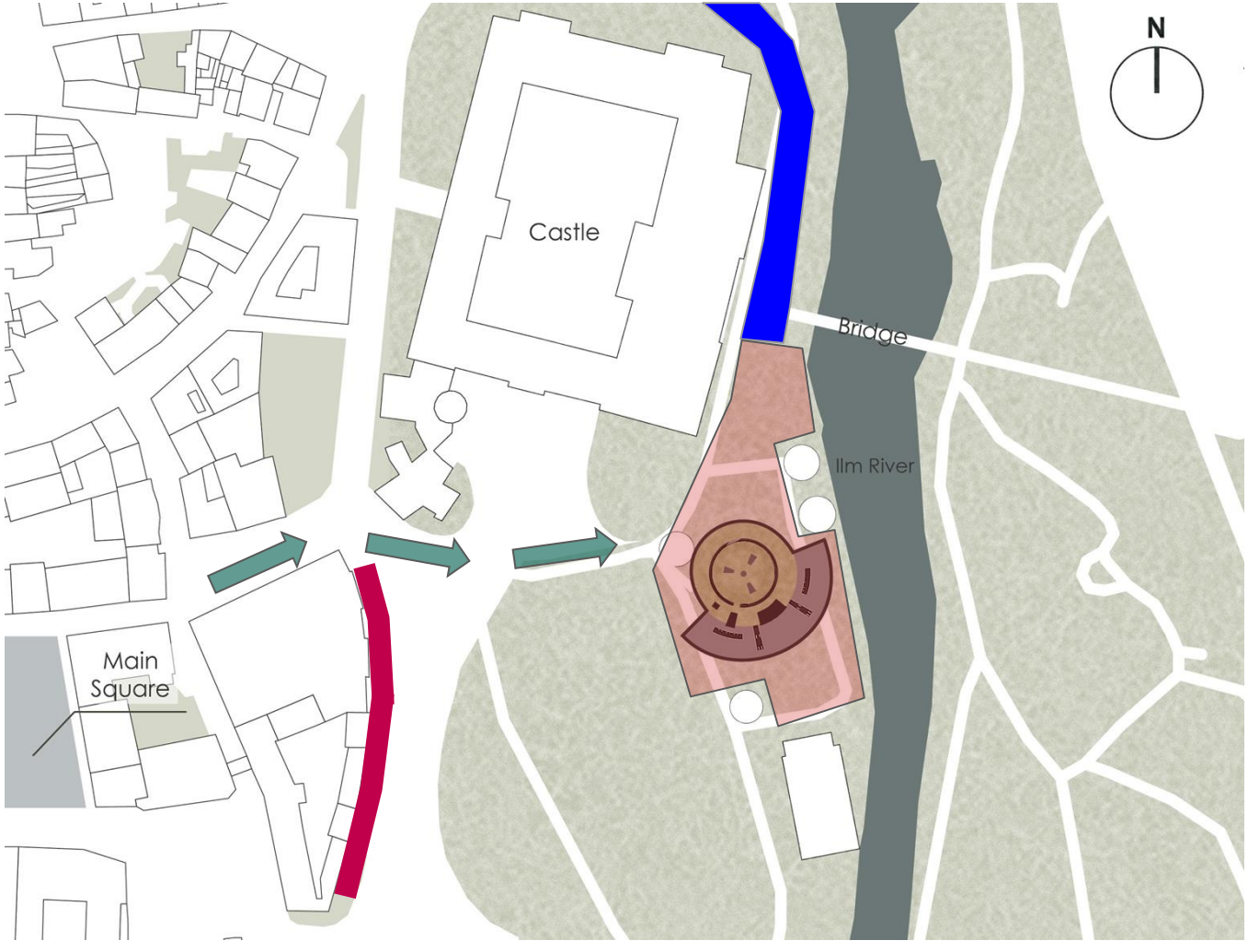


Site Access Material Delivery

Offsite Warehouse

Site

Site Access

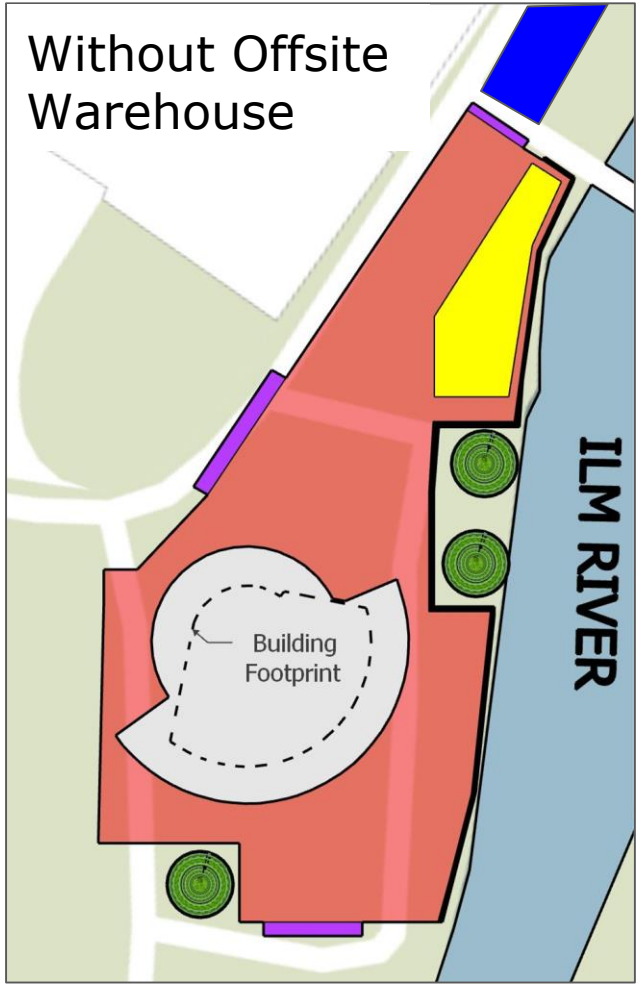


Main Pedestrian Flow

Parking

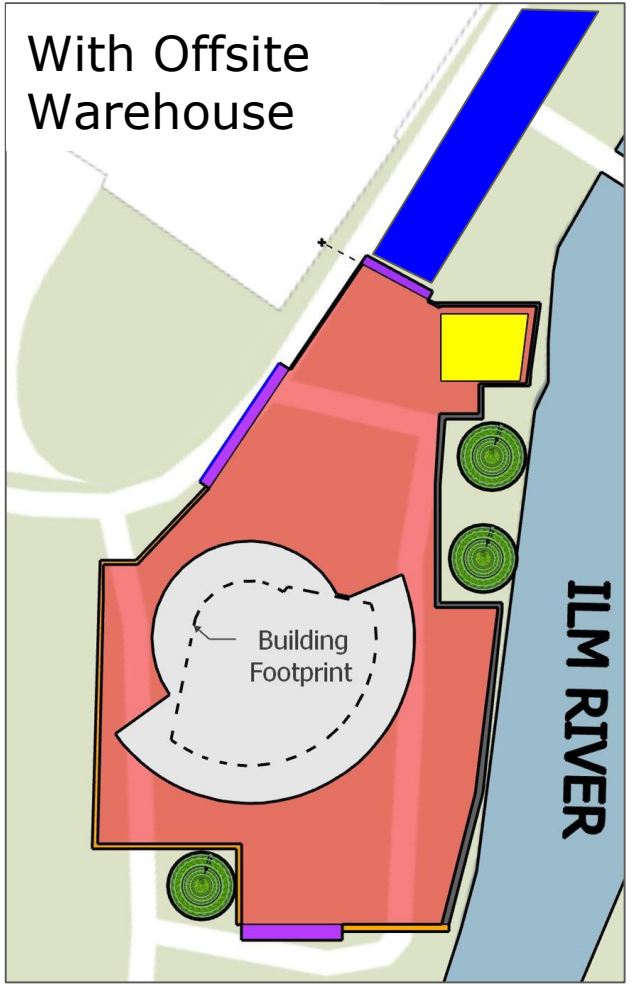
Temporary Road

Site Plan Area Reduction

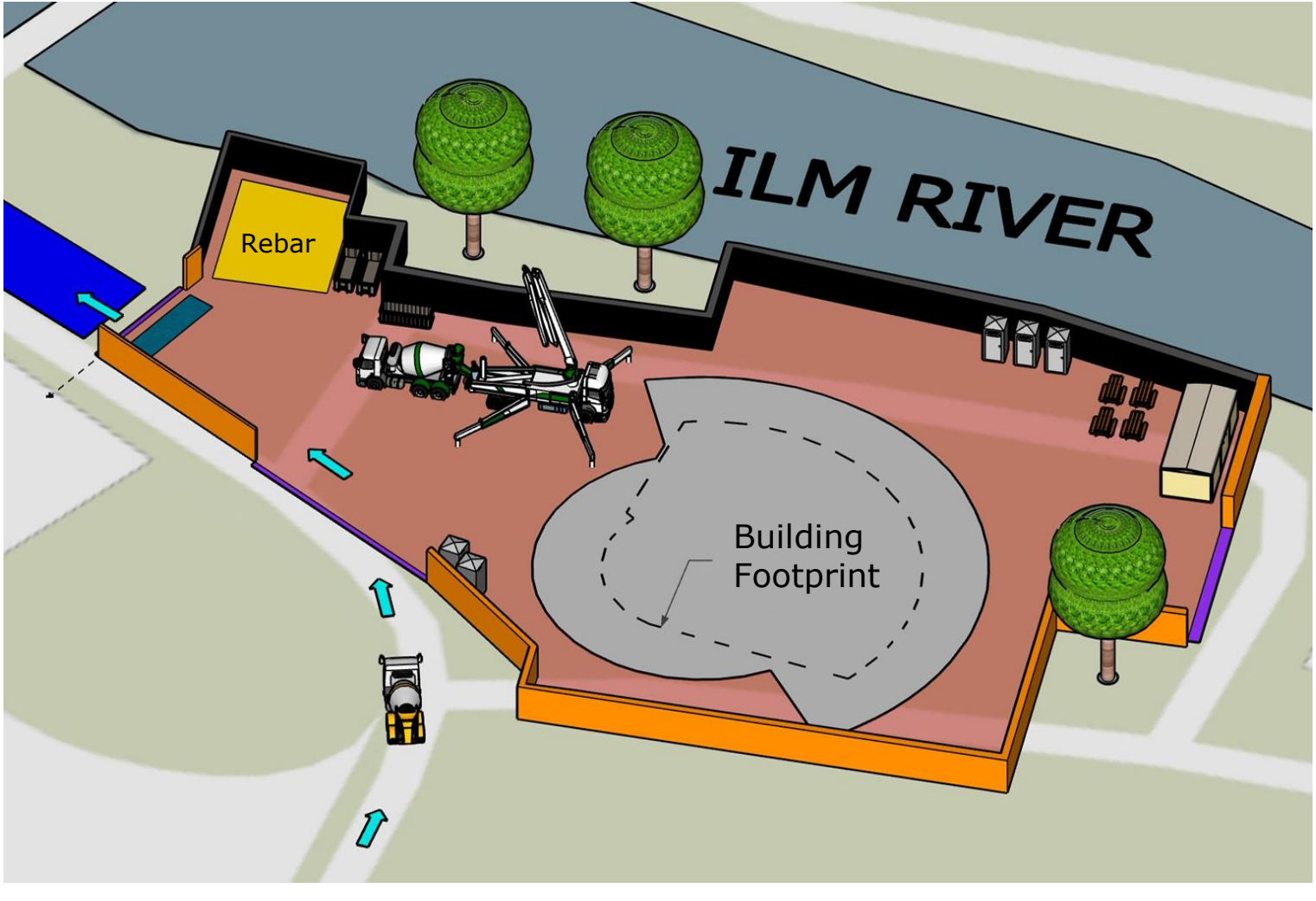


AREA

14%

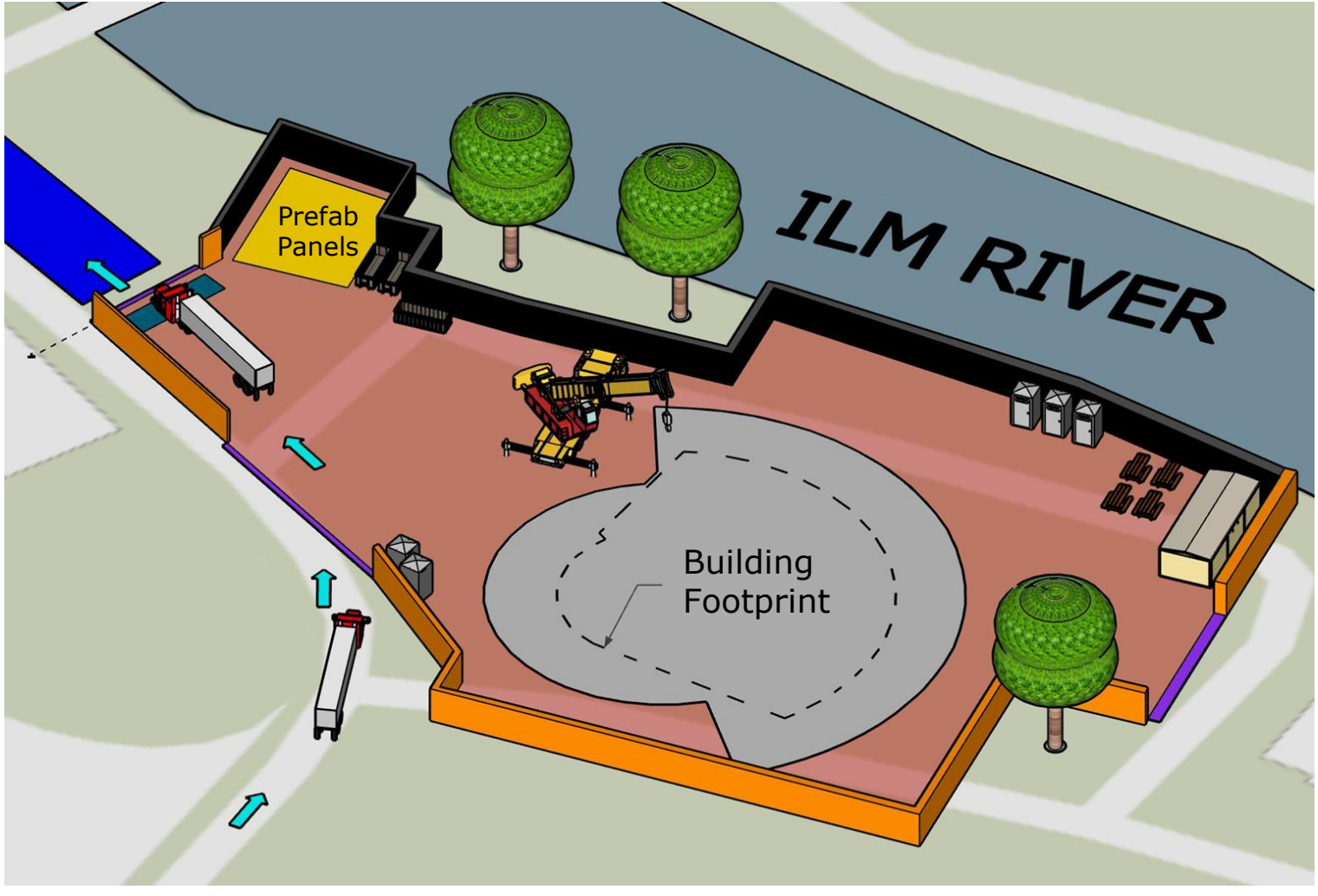


Site Logistics Phase 1



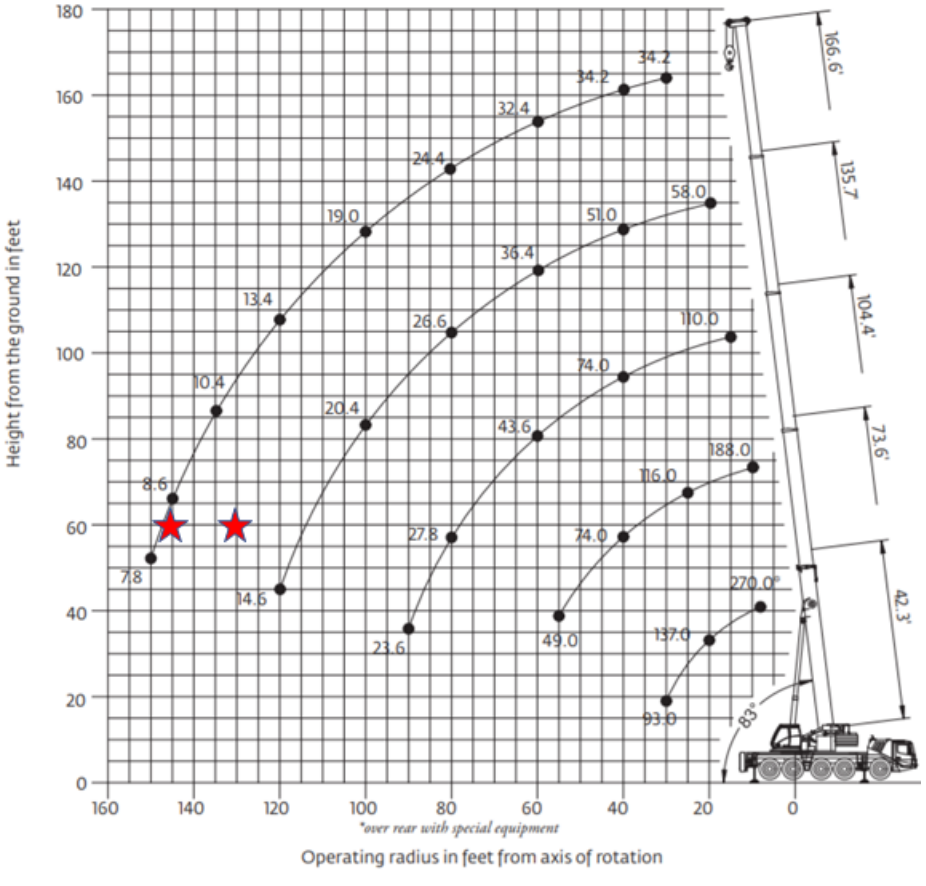
- Entrance/Exit
- Site Fence
- Runoff Avoidance Fence
- Truck Wash
- Material Storage
- Temp Road

Site Logistics Phase 2



- Entrance/Exit
- Site Fence
- Runoff Avoidance Fence
- Truck Wash
- Material Storage
- Temp Road

Equipment Selection Crane



Grove GMK5135

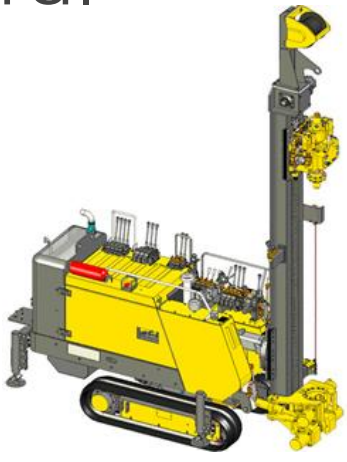
Mobile Crane

Crit. Loads:

1) 2.7 tons at 43.5m
2) 3.4 tons at 41m

Equipment Selection General

Putzmeister 38Z Truck-Mounted Concrete Pump



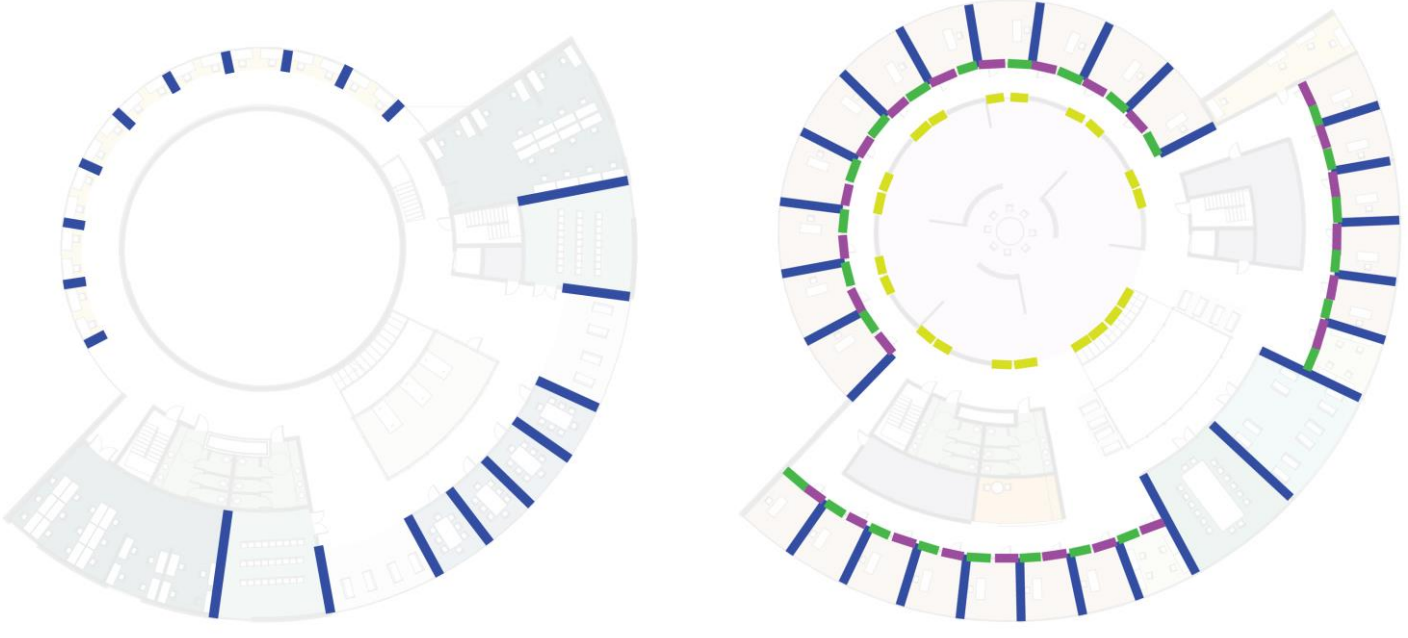
Hydraulic Drilling Rigs

311F L RR Excavator

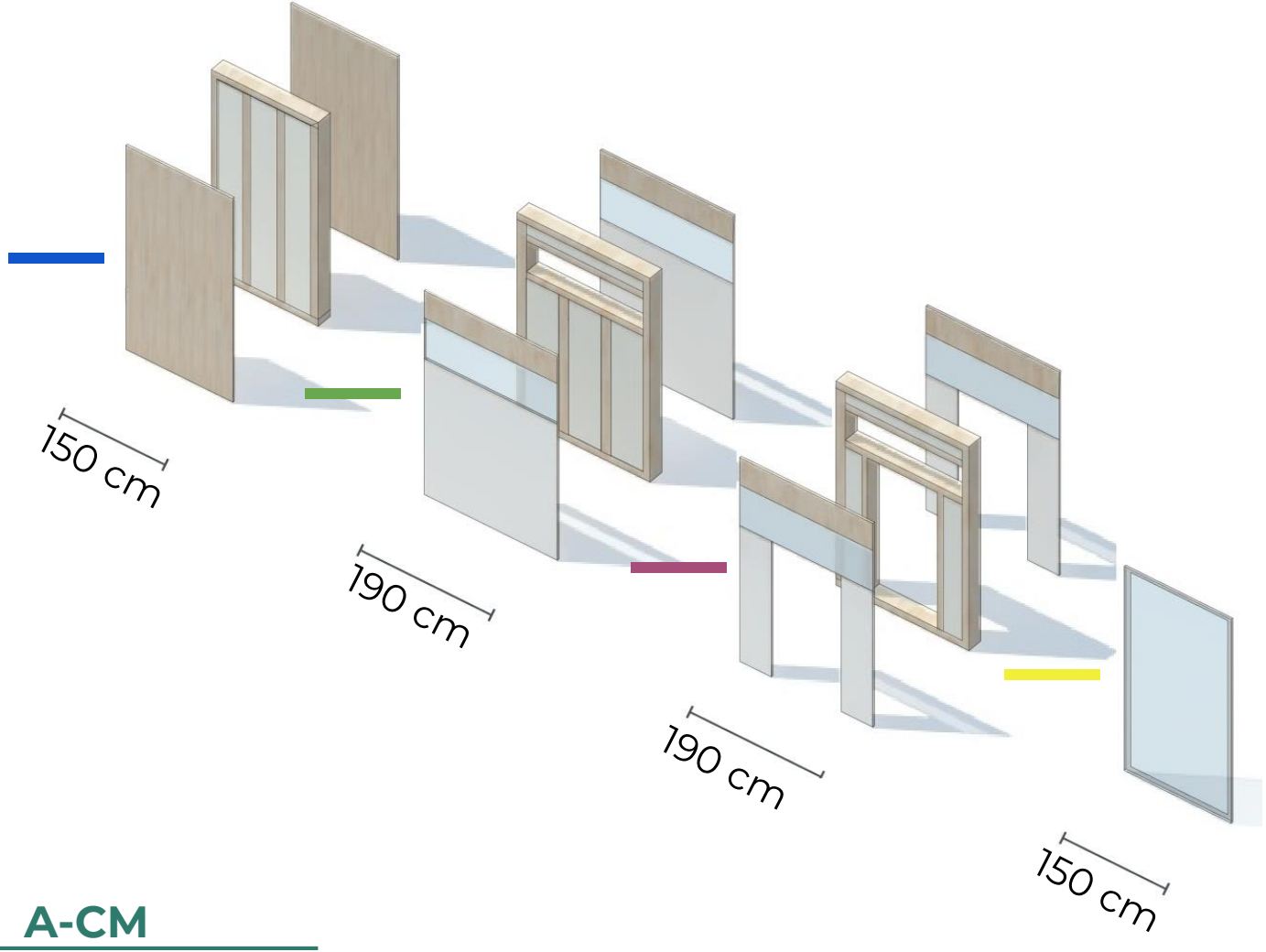
RS8-42 Mark74 Telescopic Handler

Prefabrication Interior Panels

150 cm width	**x 136 panels**
190 cm width	**x 23 panels**
190 cm width (+door)	**x 23 panels**
150 cm width (glass)	**x 14 panels**



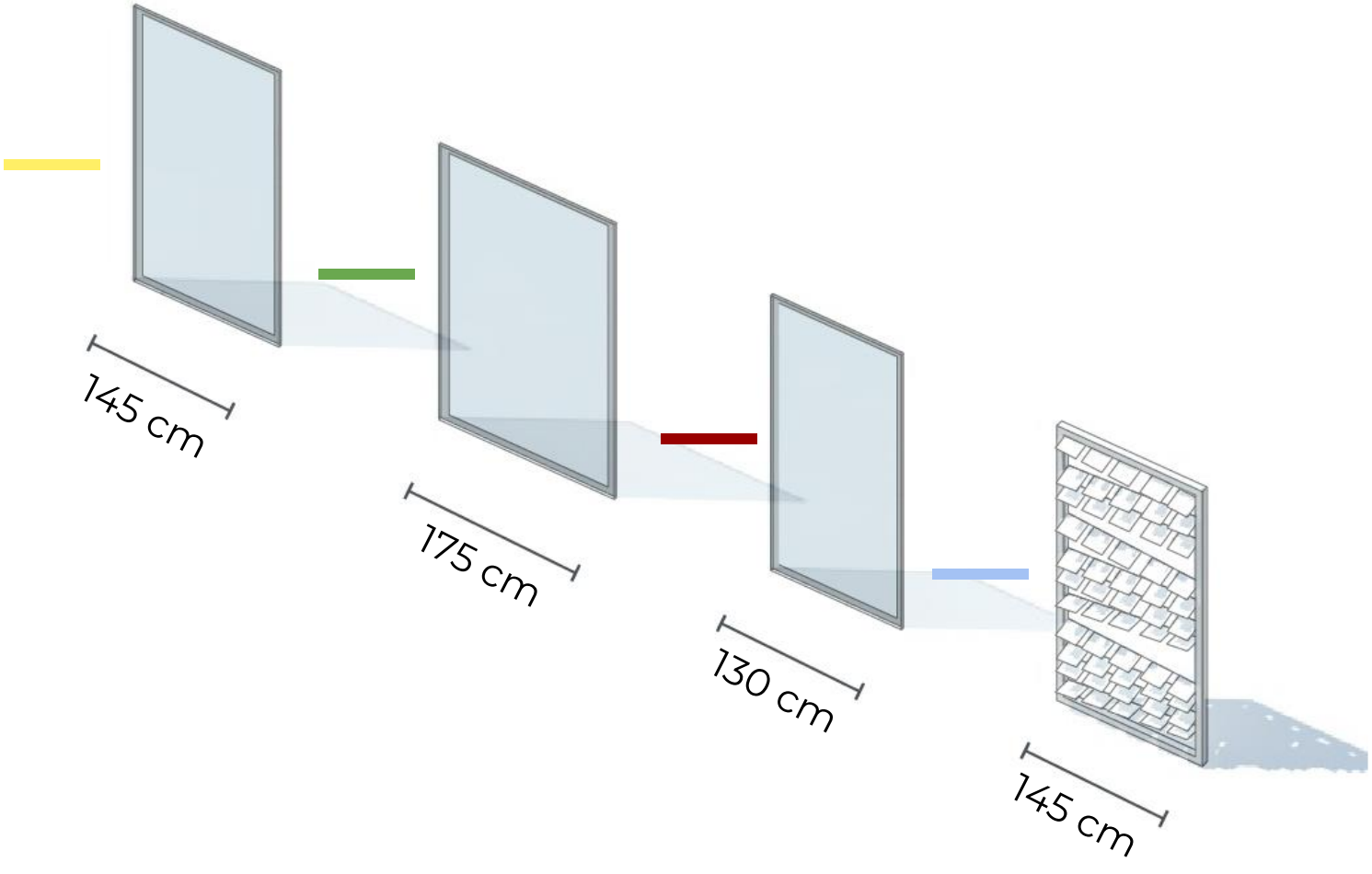
Prefabrication Interior Panels



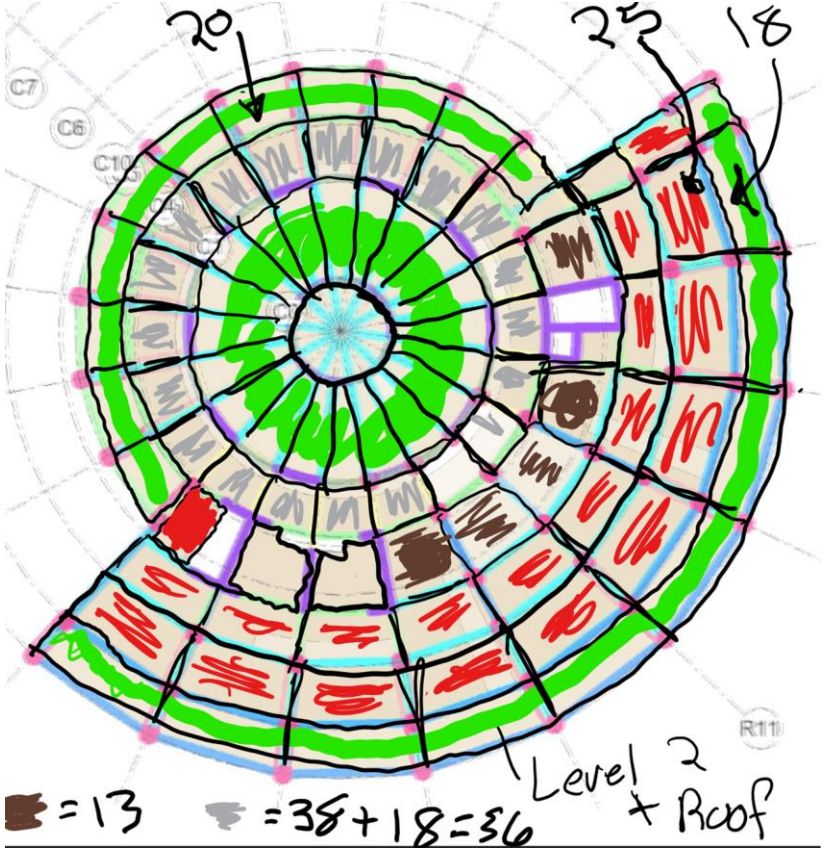
Prefabrication Exterior Panels

- 145 cm width **x 88 panels**
- 175 cm width **x 42 panels**
- 130 cm width **x 48 panels**
- 145 cm width **x 56 panels** (adaptive facade)

Prefabrication Exterior Panels



Prefabrication Floor 1 CLT Slab

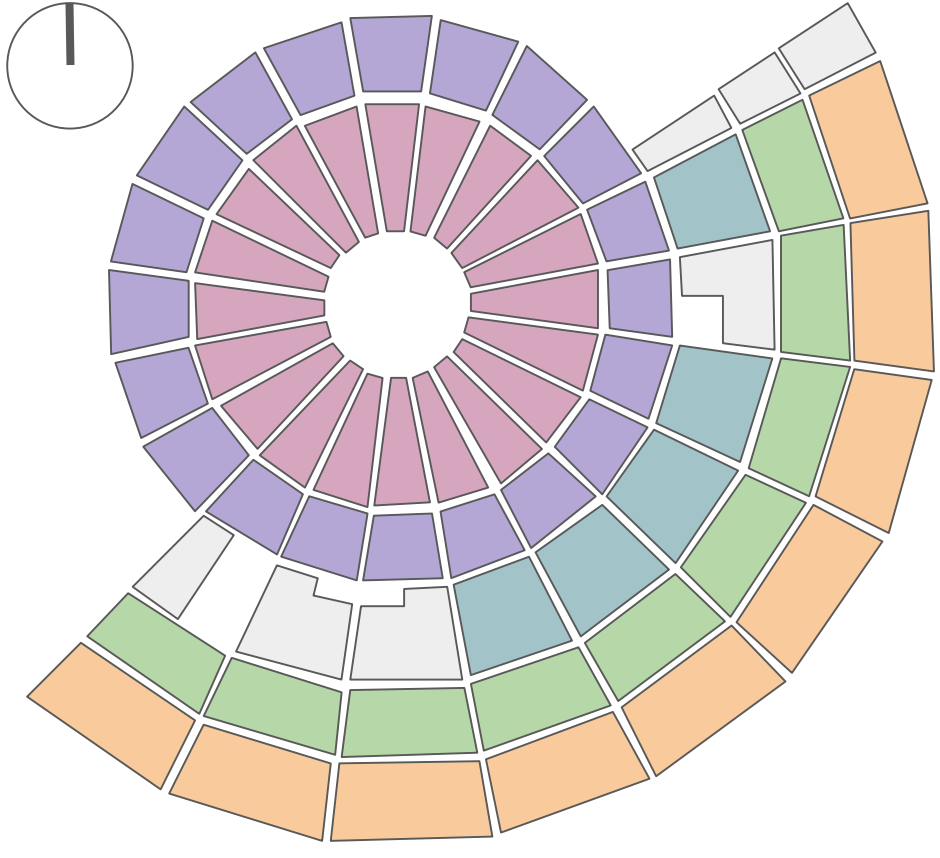


Collaboration Result:

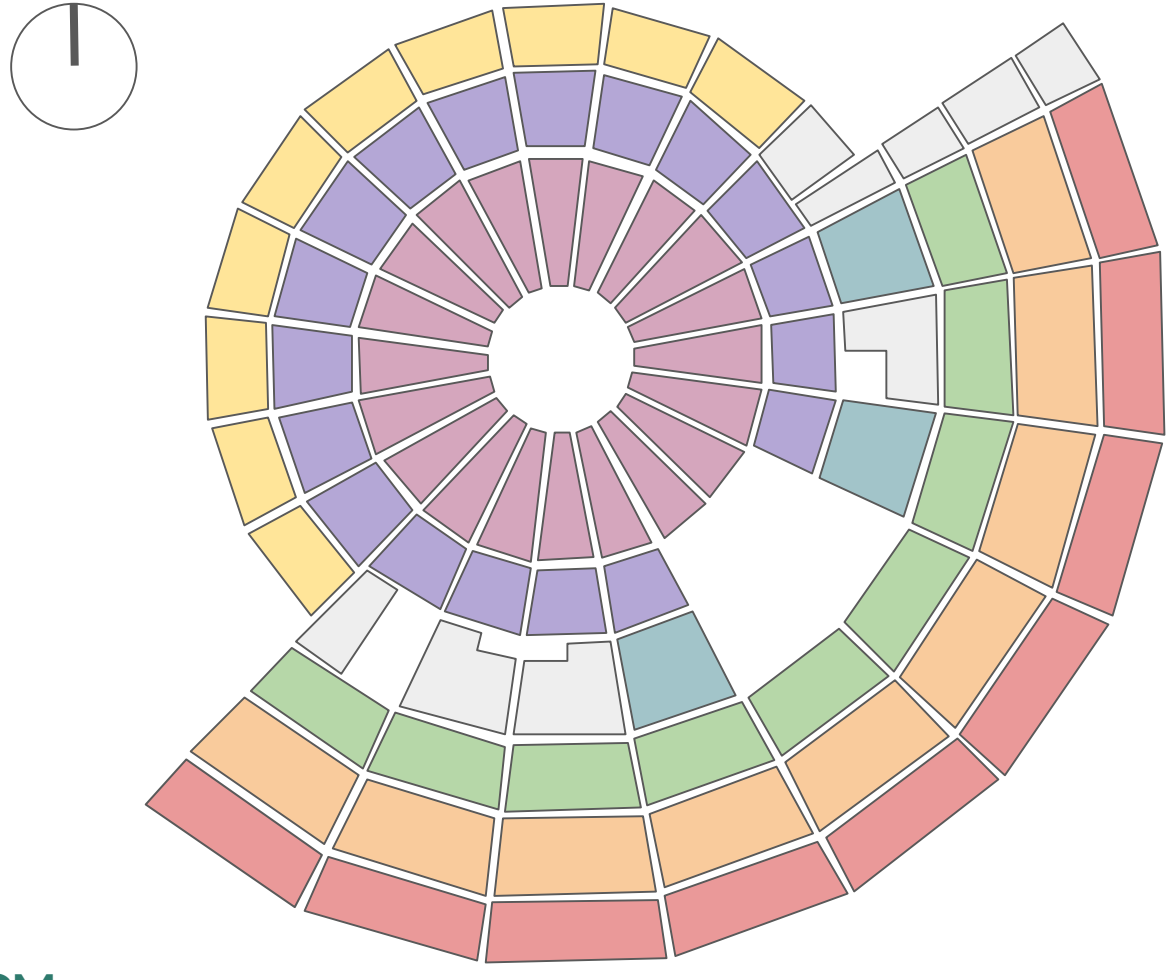
7 Different CLT Panel Types

Prefabrication Floor 1 CLT Slab

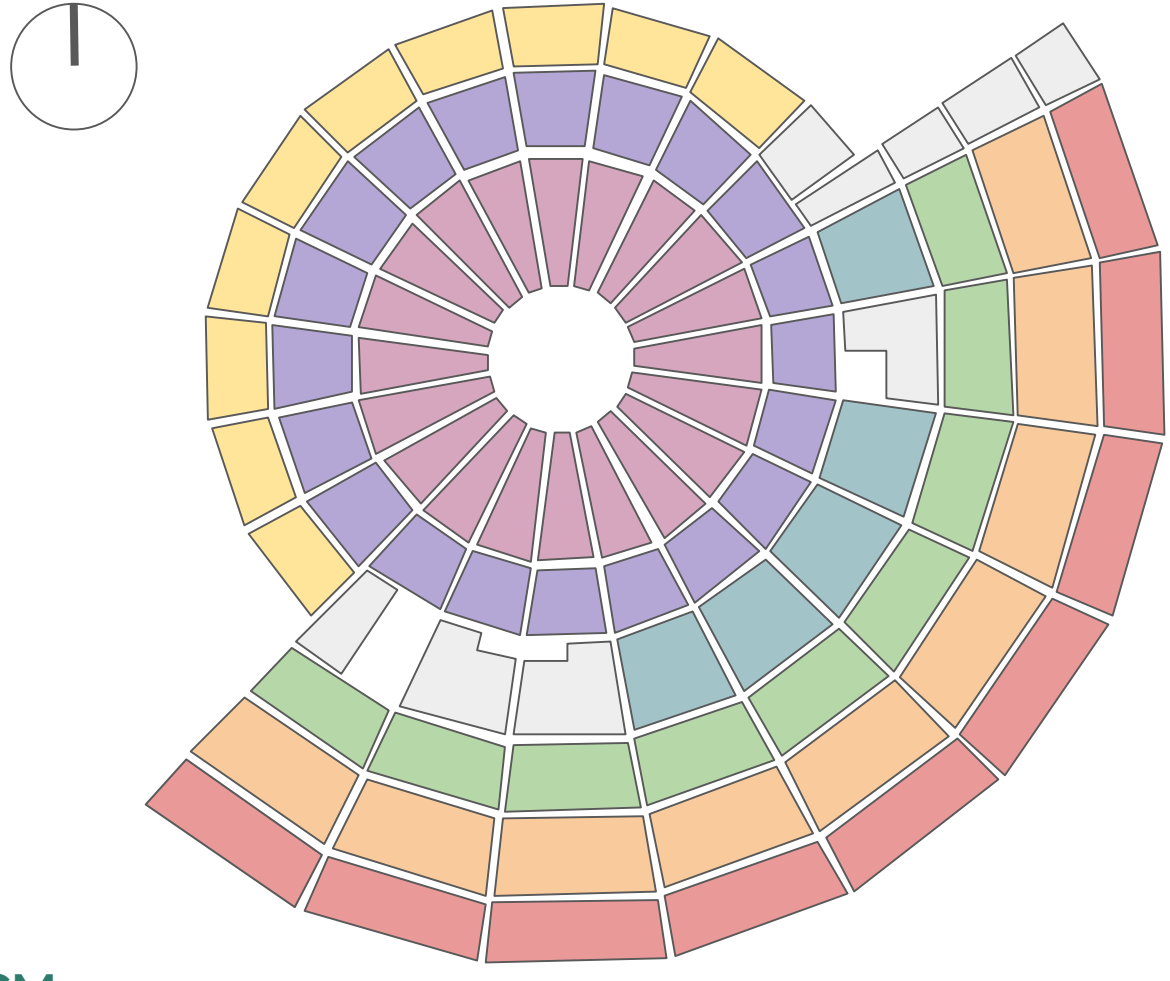
- Type 1 **x 60**
- Type 2 **x 58**
- Type 3 **x 13**
- Type 4 **x 27**
- Type 5 **x 20**
- Type 6 **x 27**
- Type 7 **x 18**



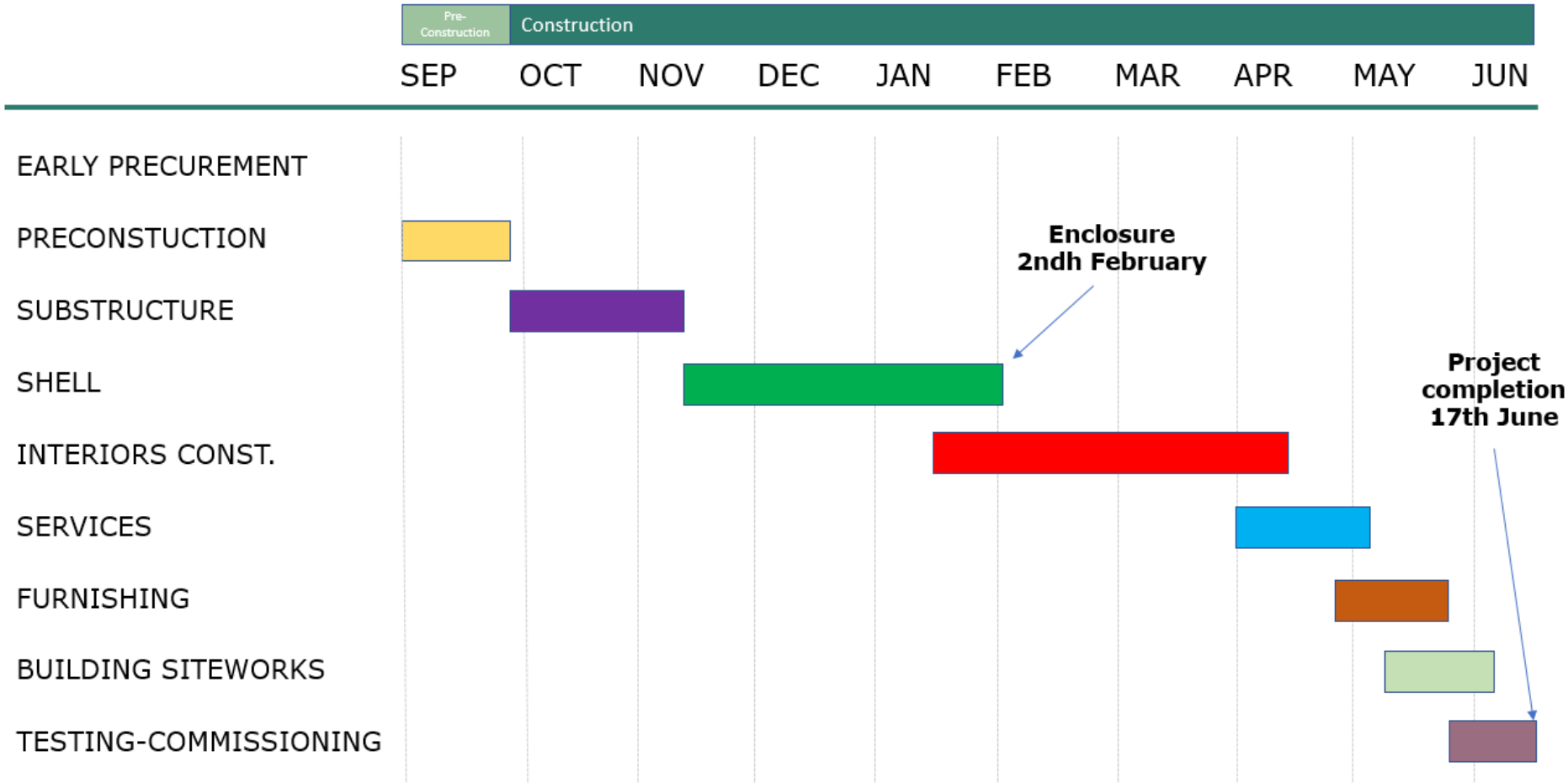
Prefabrication Floor 2 CLT Slab



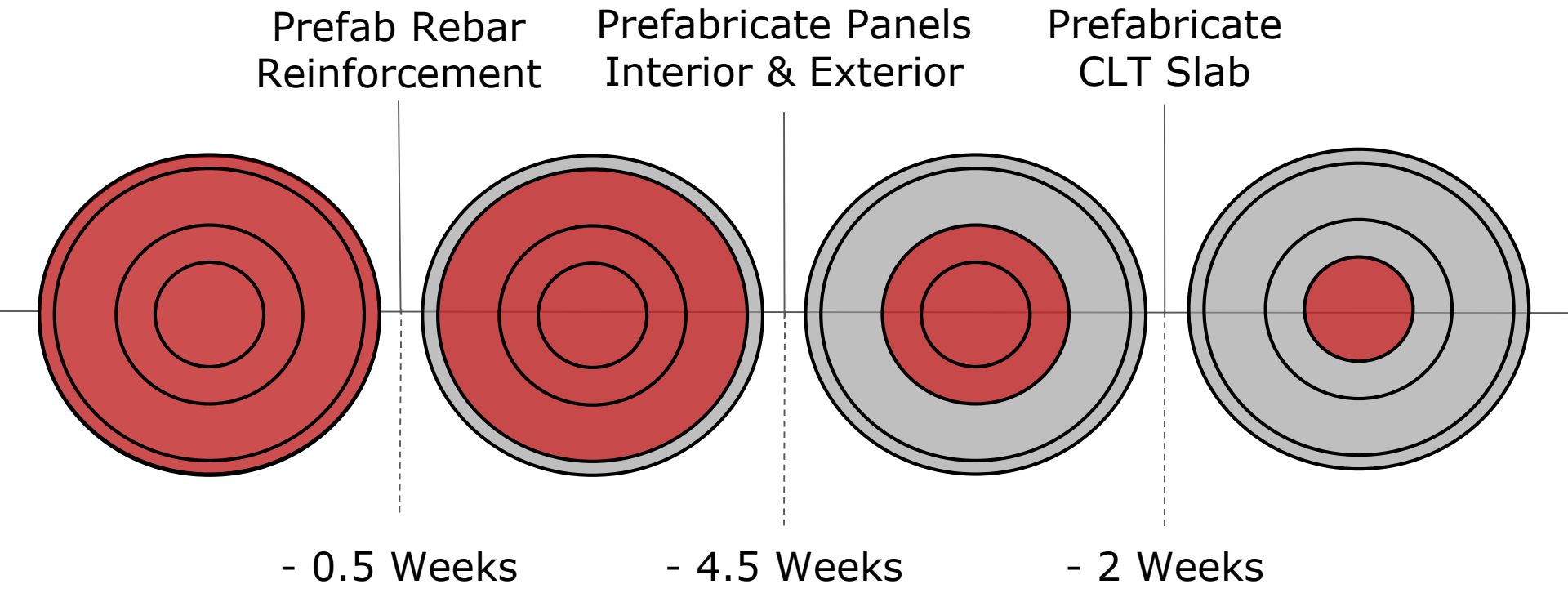
Prefabrication Roof CLT Slab



Schedule Original Duration

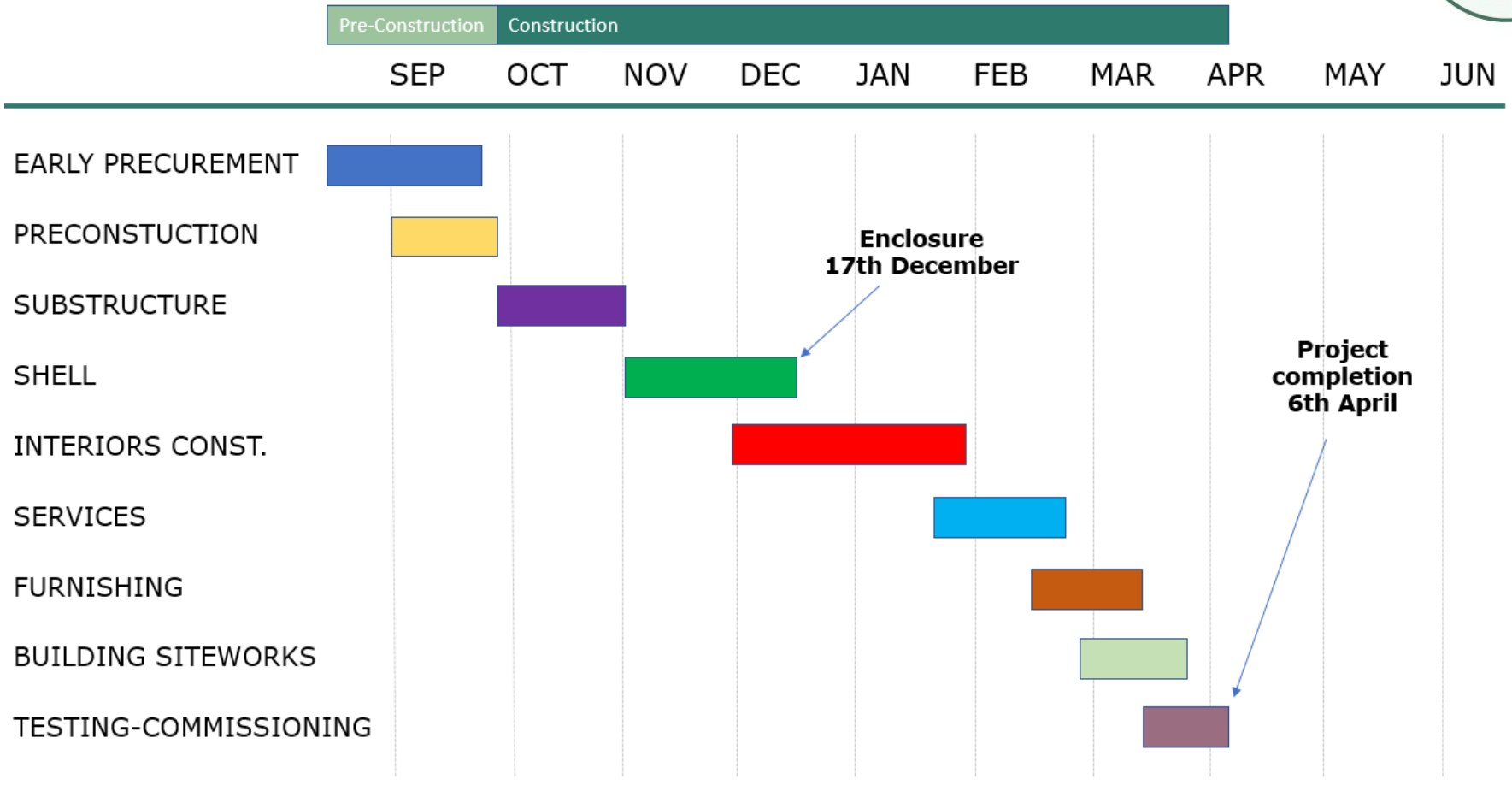


Schedule Negative Impact Reduction

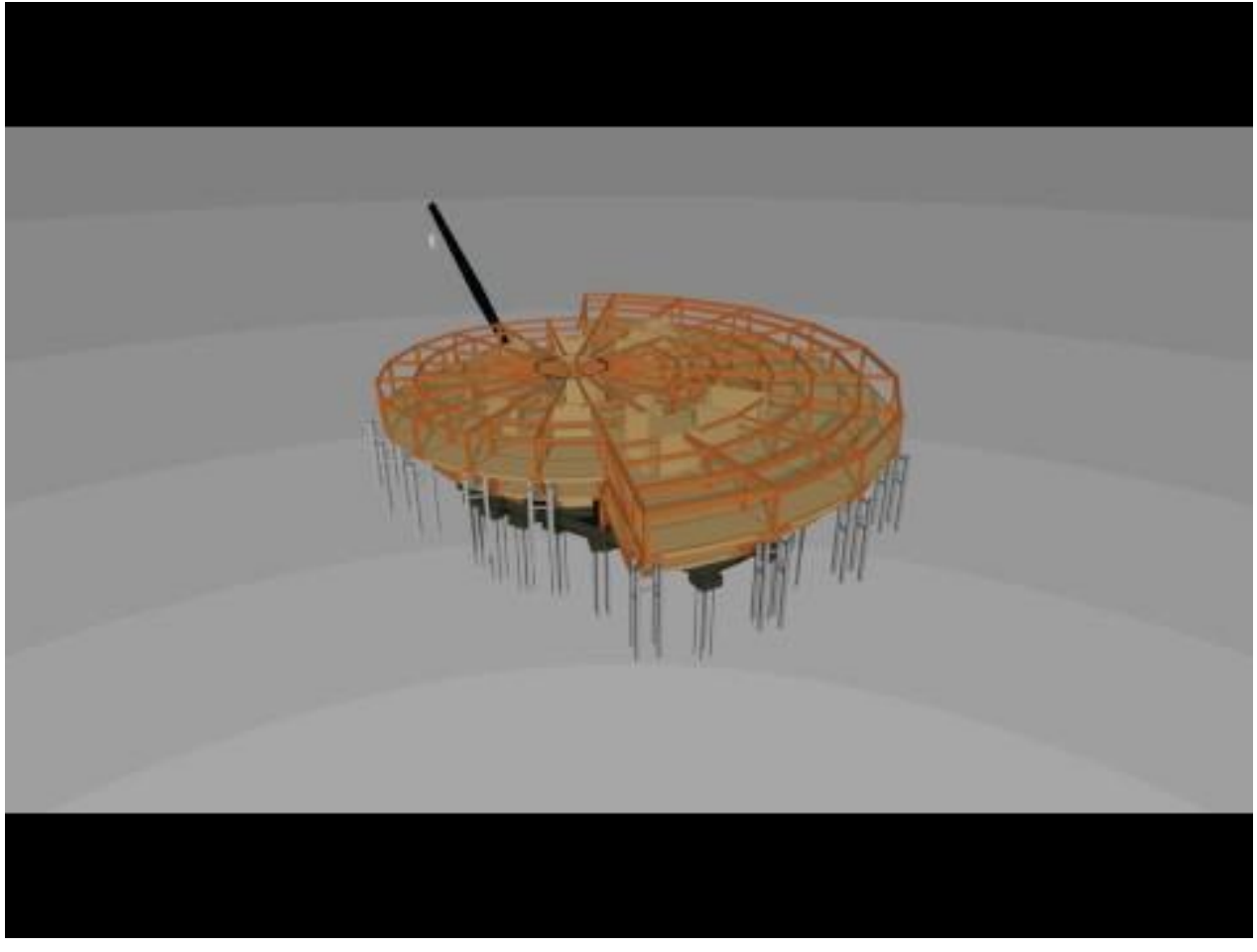


Total Schedule Reduction: 7 Weeks

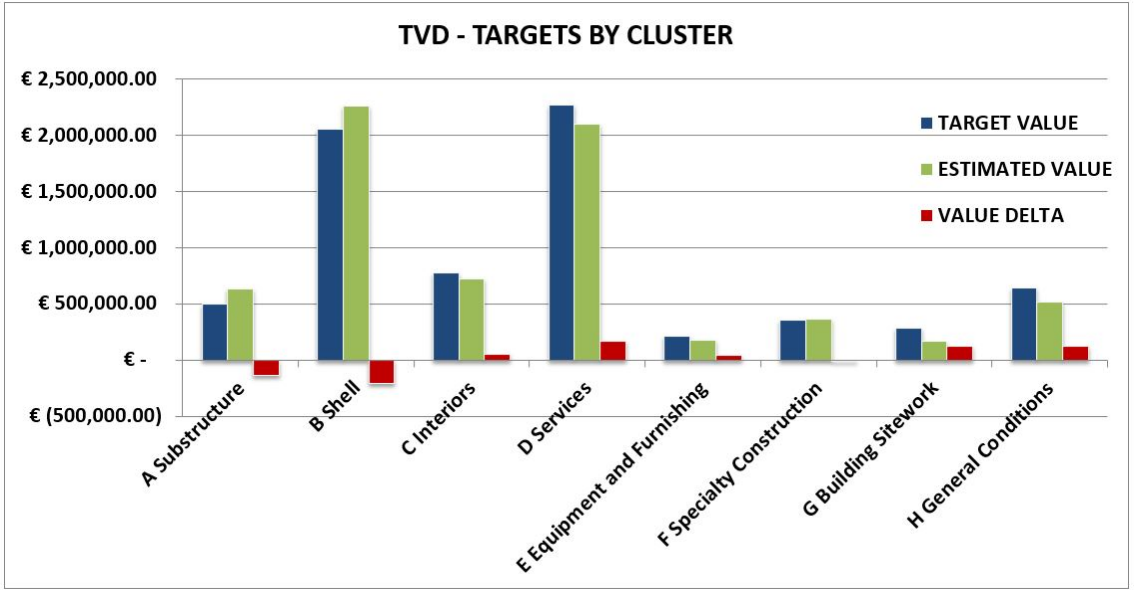
Schedule Expedited

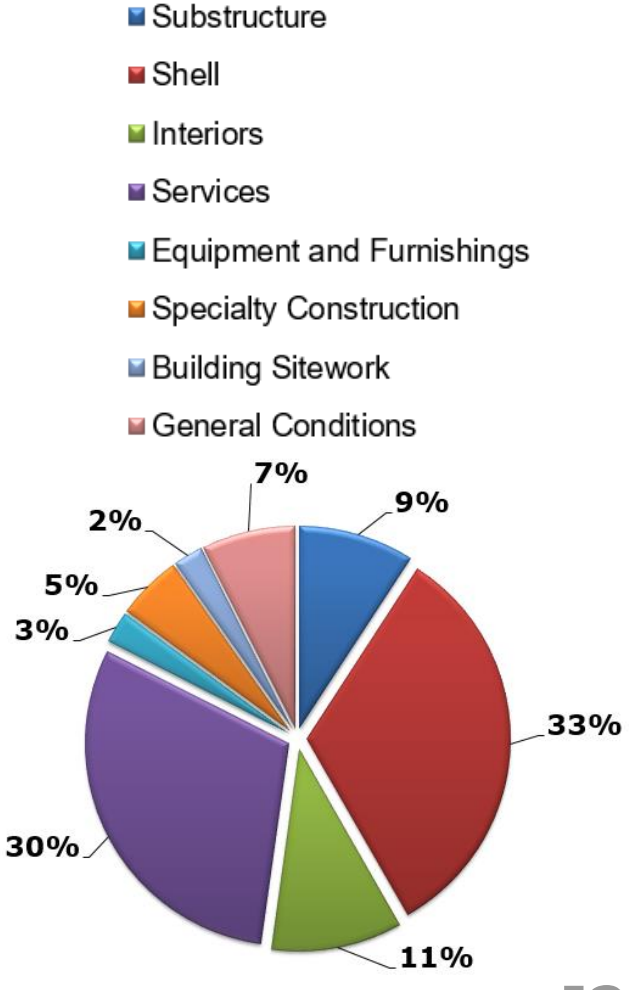


Schedule 4D Construction



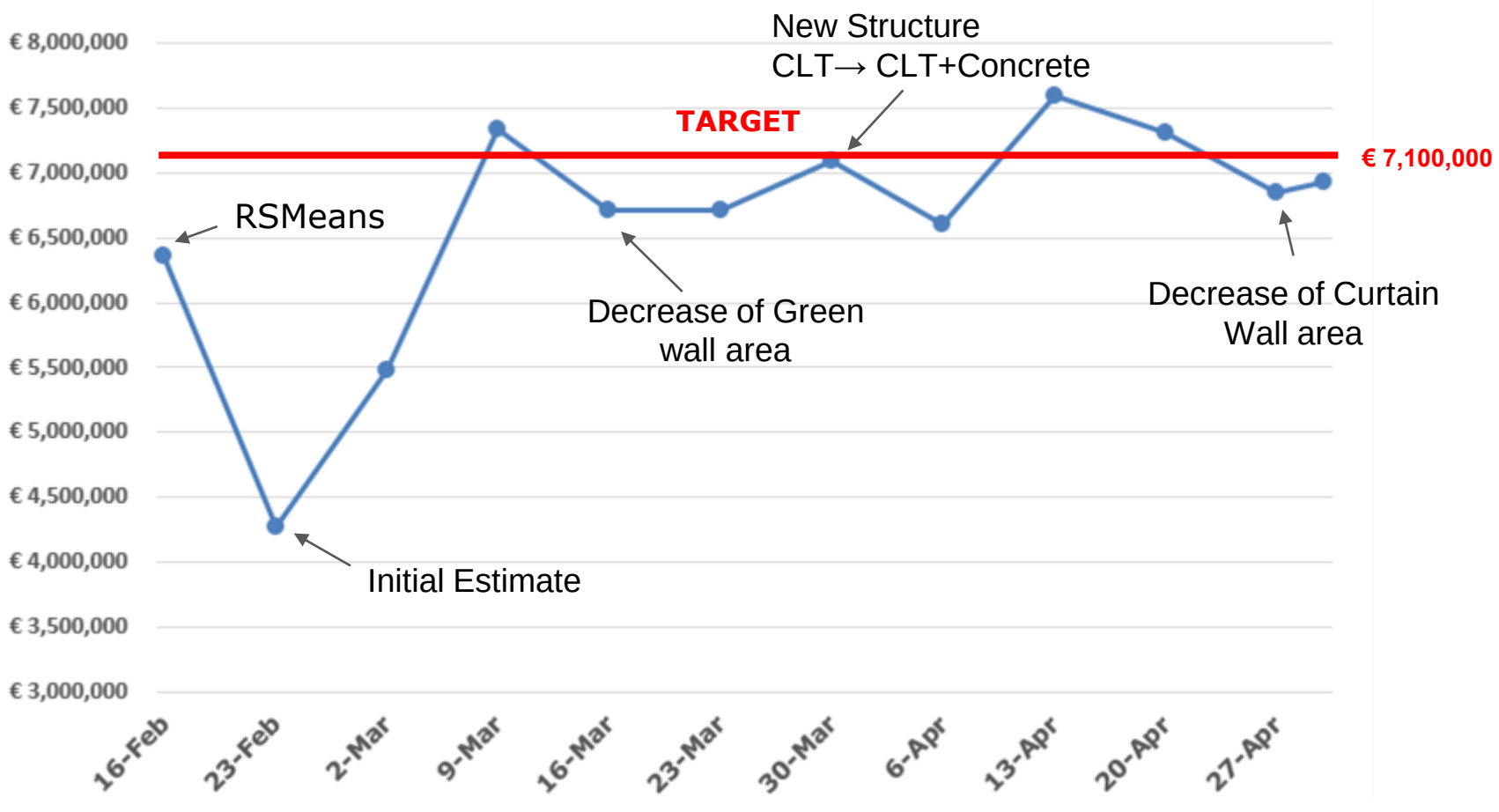
Construction Cost Estimation



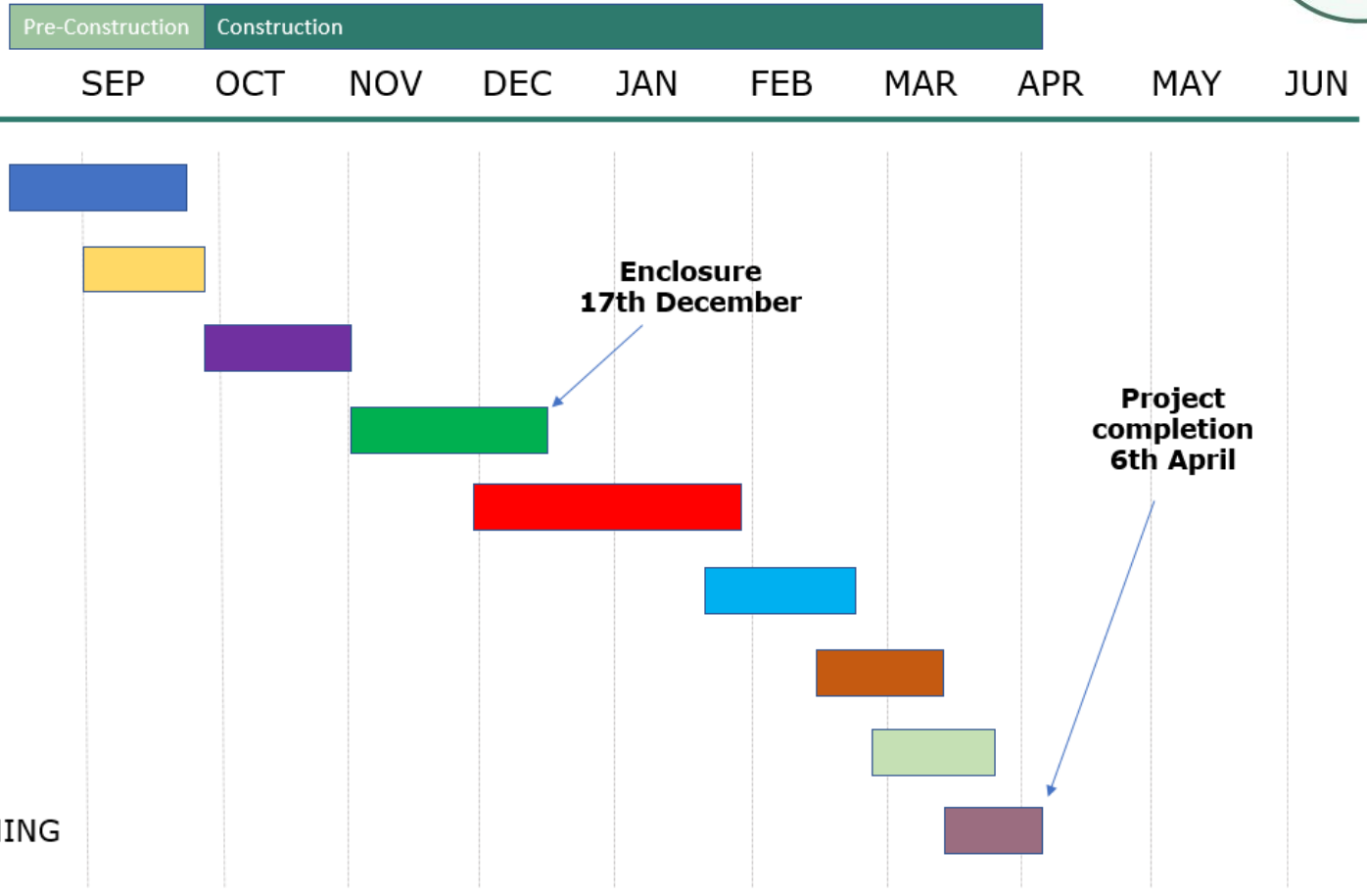


€7 Million

TVD Evolution



Schedule Expedited



MEP – Vikash

MEP Consumption

ARCHITECT – Sylwia

Floorplans

LIFE – CYCLE – COST – ANALYSIS

LCFM – Michael

Construction Costs

CM – Eithan & Austin

Risk Probabilities

SE – Belle & Vivian

Risk Management

RISK-IDENTIFICATION
What risks may occur ?

→

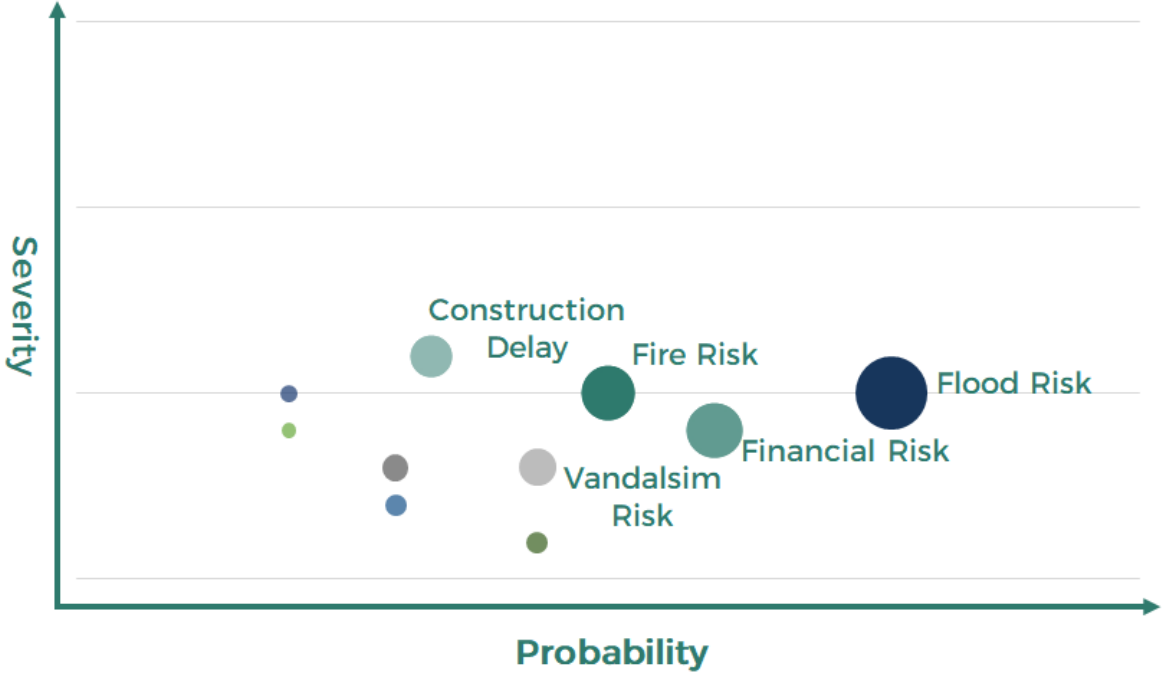
RISK-EVALUATION
Probability & Severity

→

RISK-STRATEGIES
Avoid/Mitigate/
Accept/Transfer

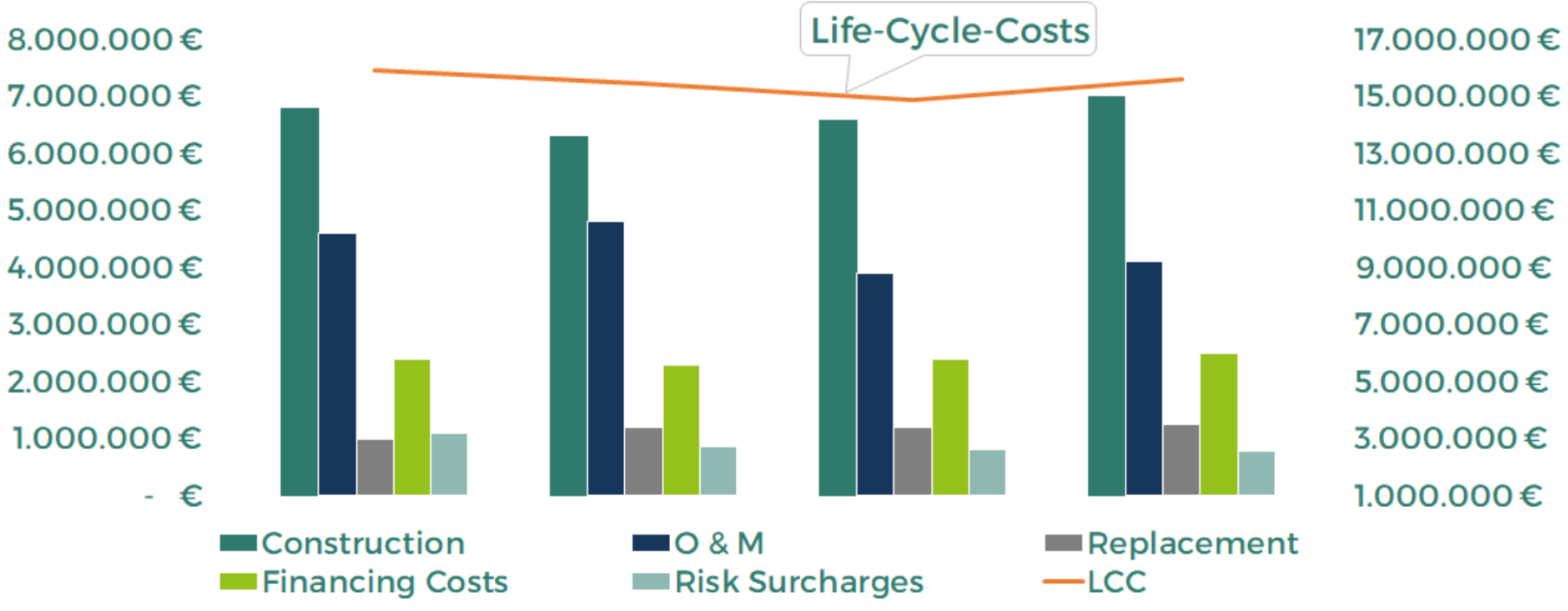
→

RISK-COSTS

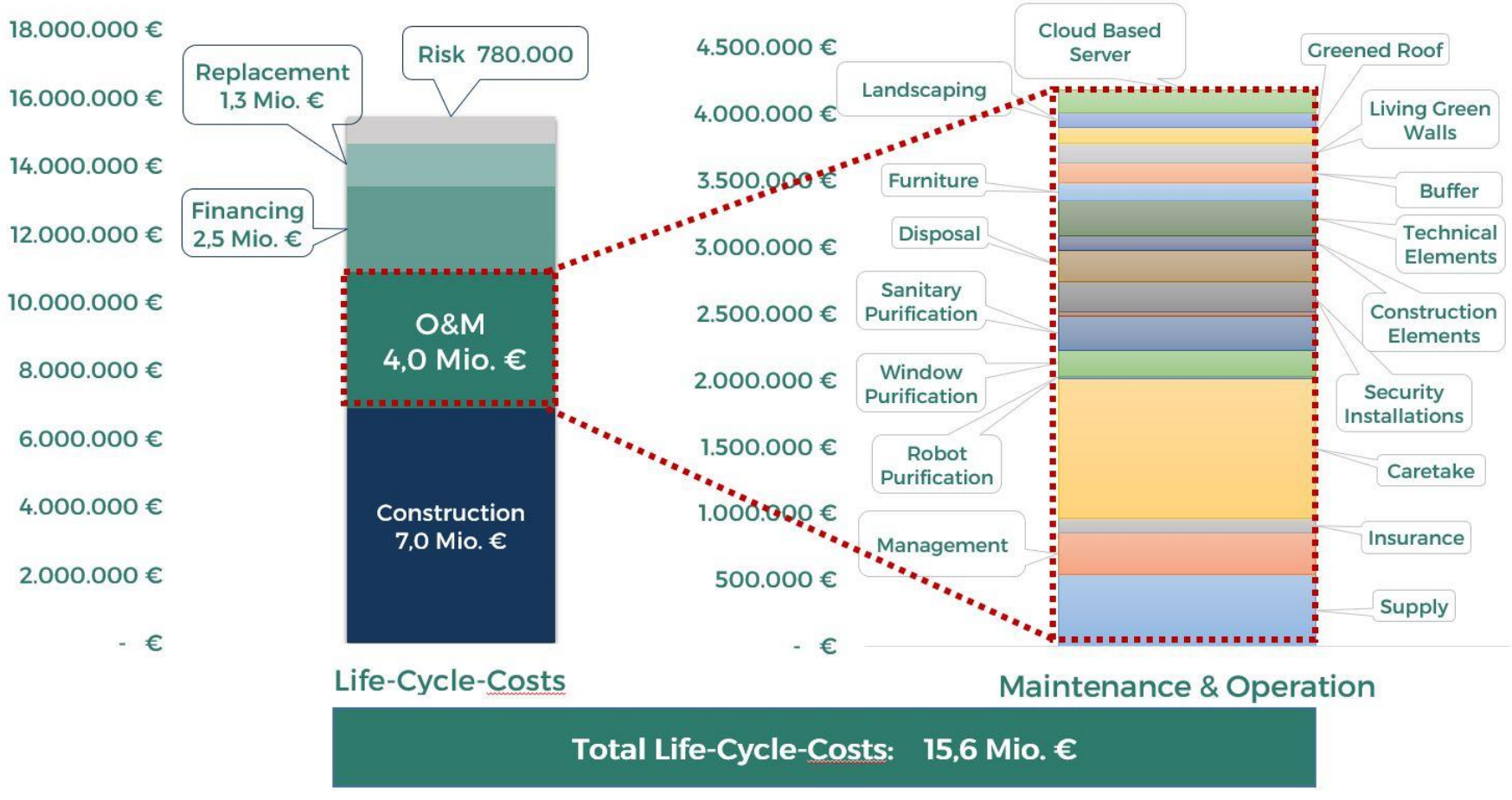


774K €
Life-Cycle Risk Surcharges

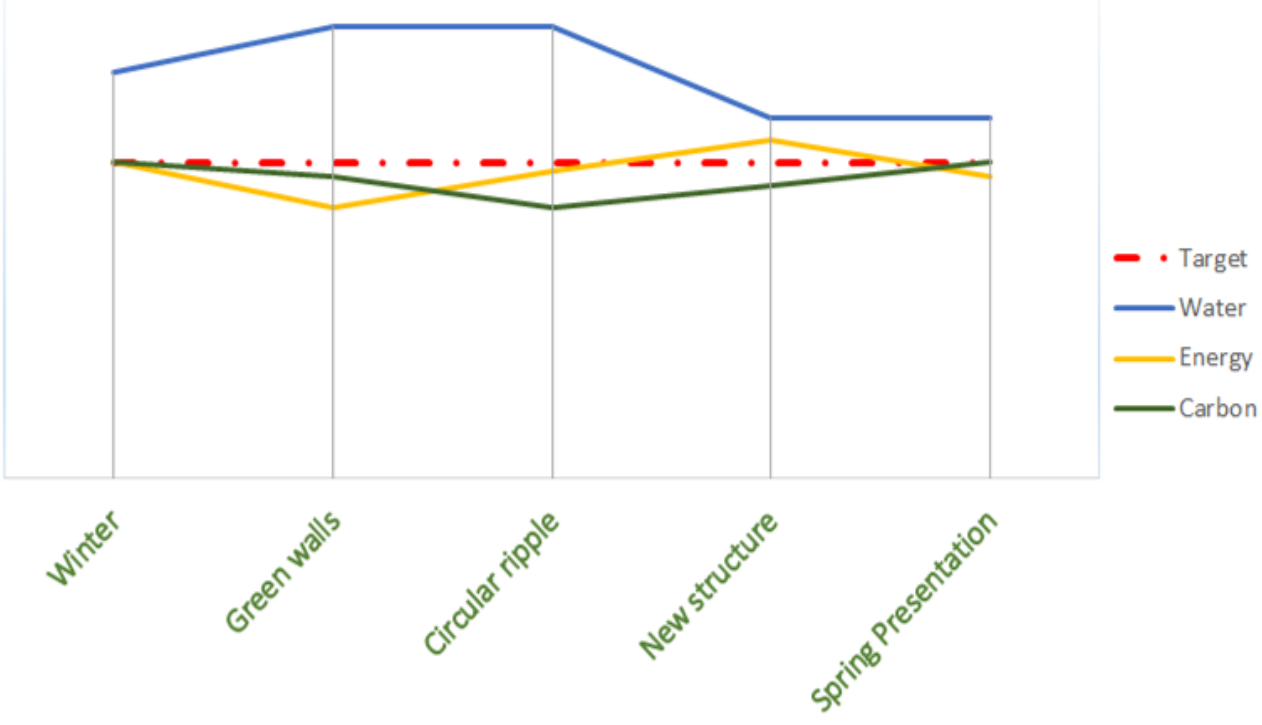
Life-Cycle-Cost Development

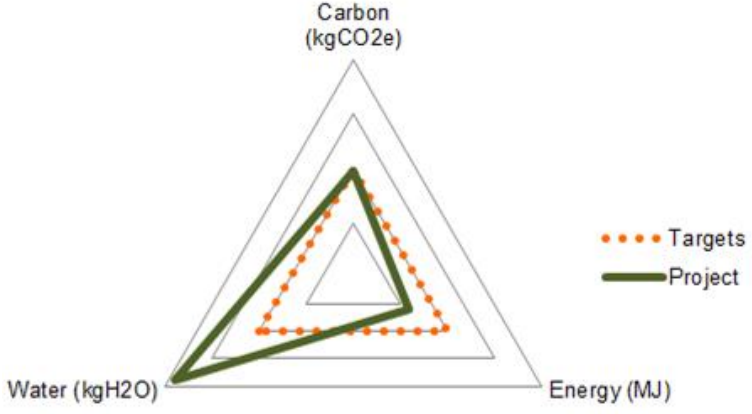


Life-Cycle-Cost Distribution

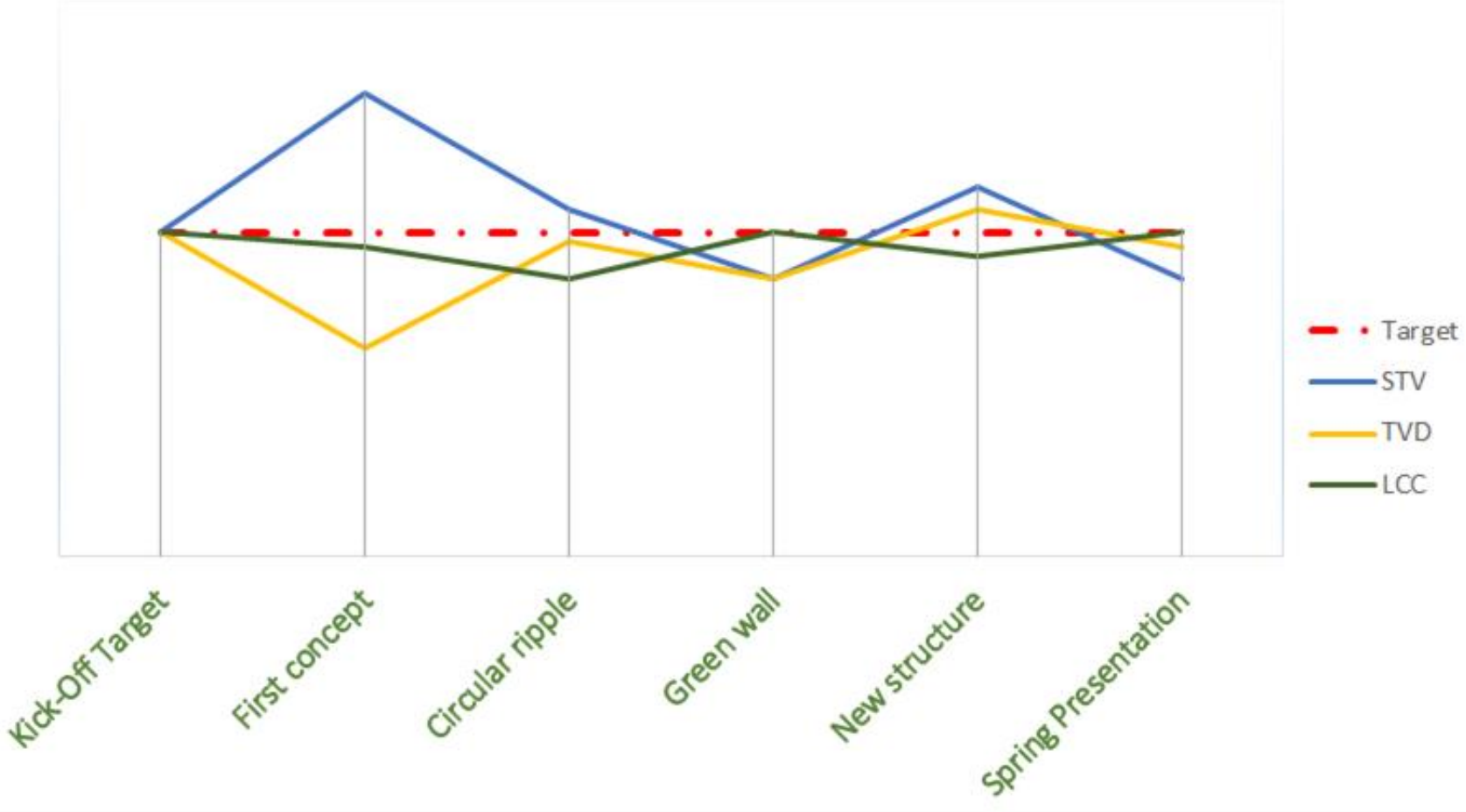


STV Evolution



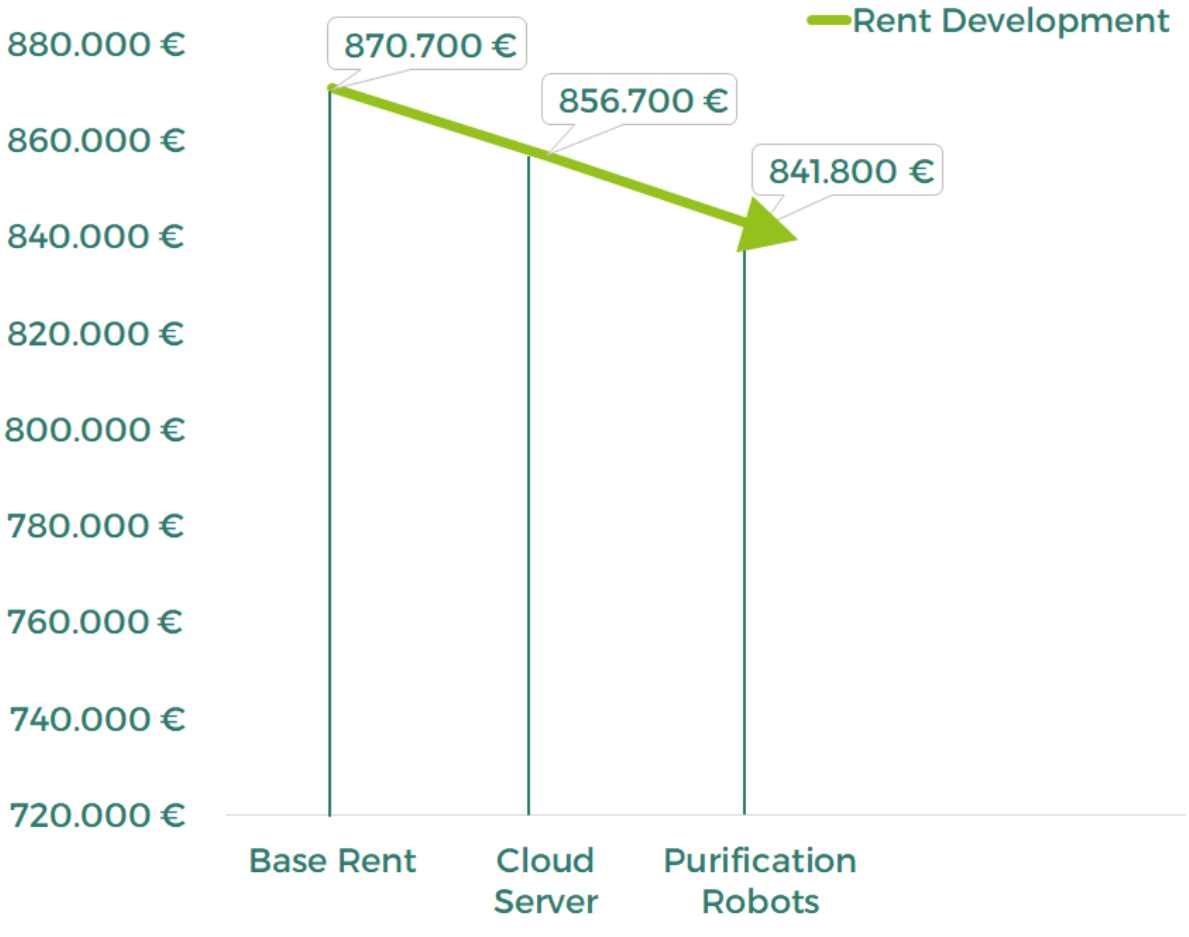


TVD - STV - LCC Development

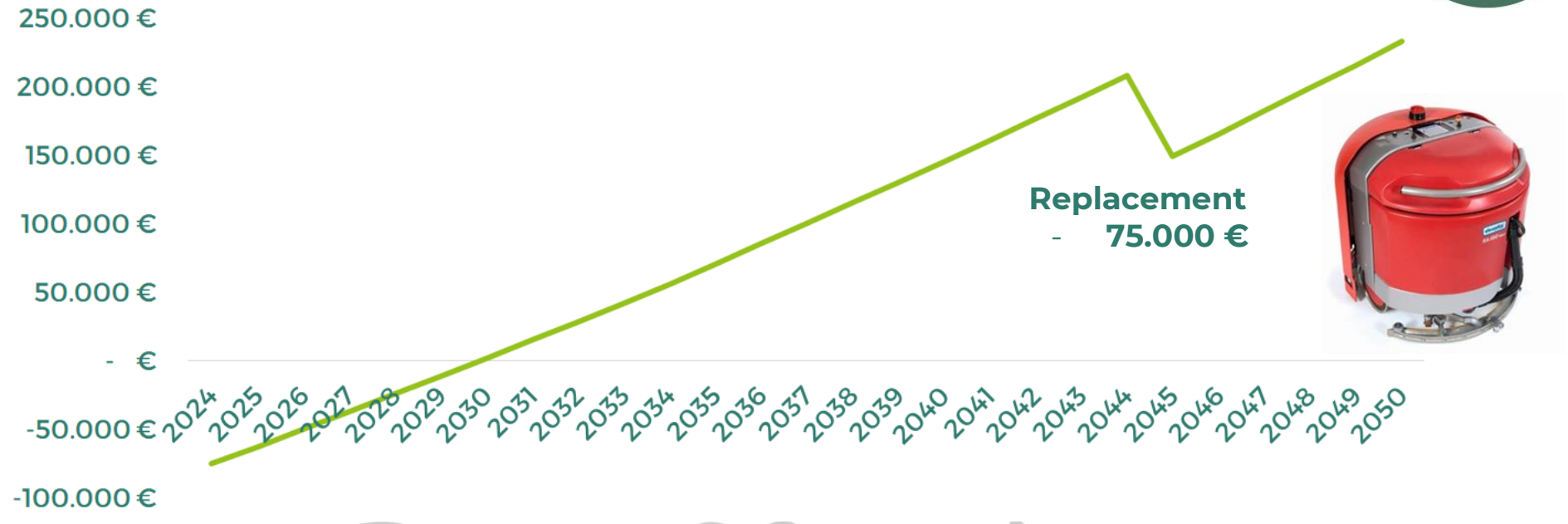


Rent Reduction Strategies

Economic Ecologic



Purification Robots vs. Staff



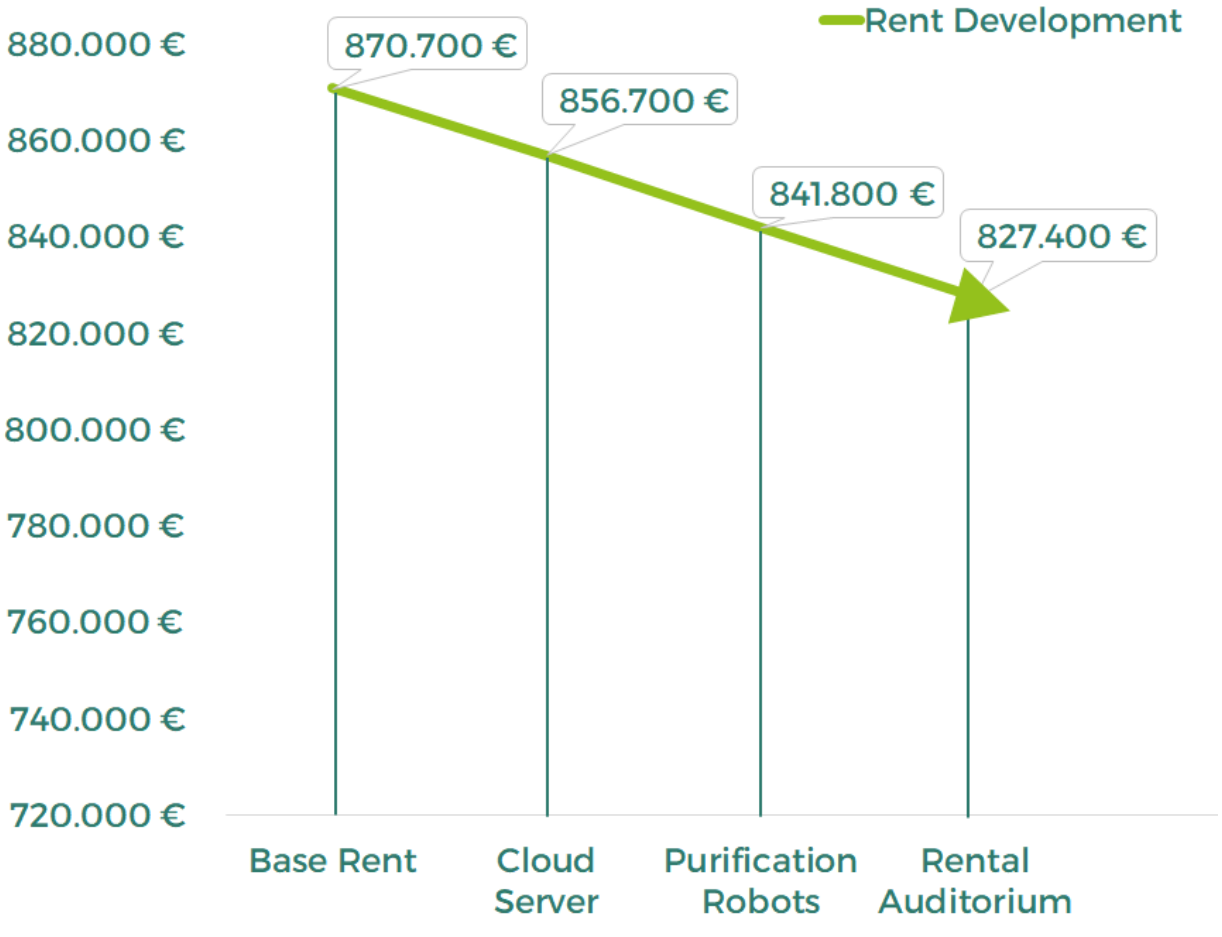
Replacement
- 75.000 €

Drainage Construction
- 5.000 €

M&O Costs
+ 1.000 €
p. a.

28.900 €
Annual Rent Reduction

Rent Reduction Strategies

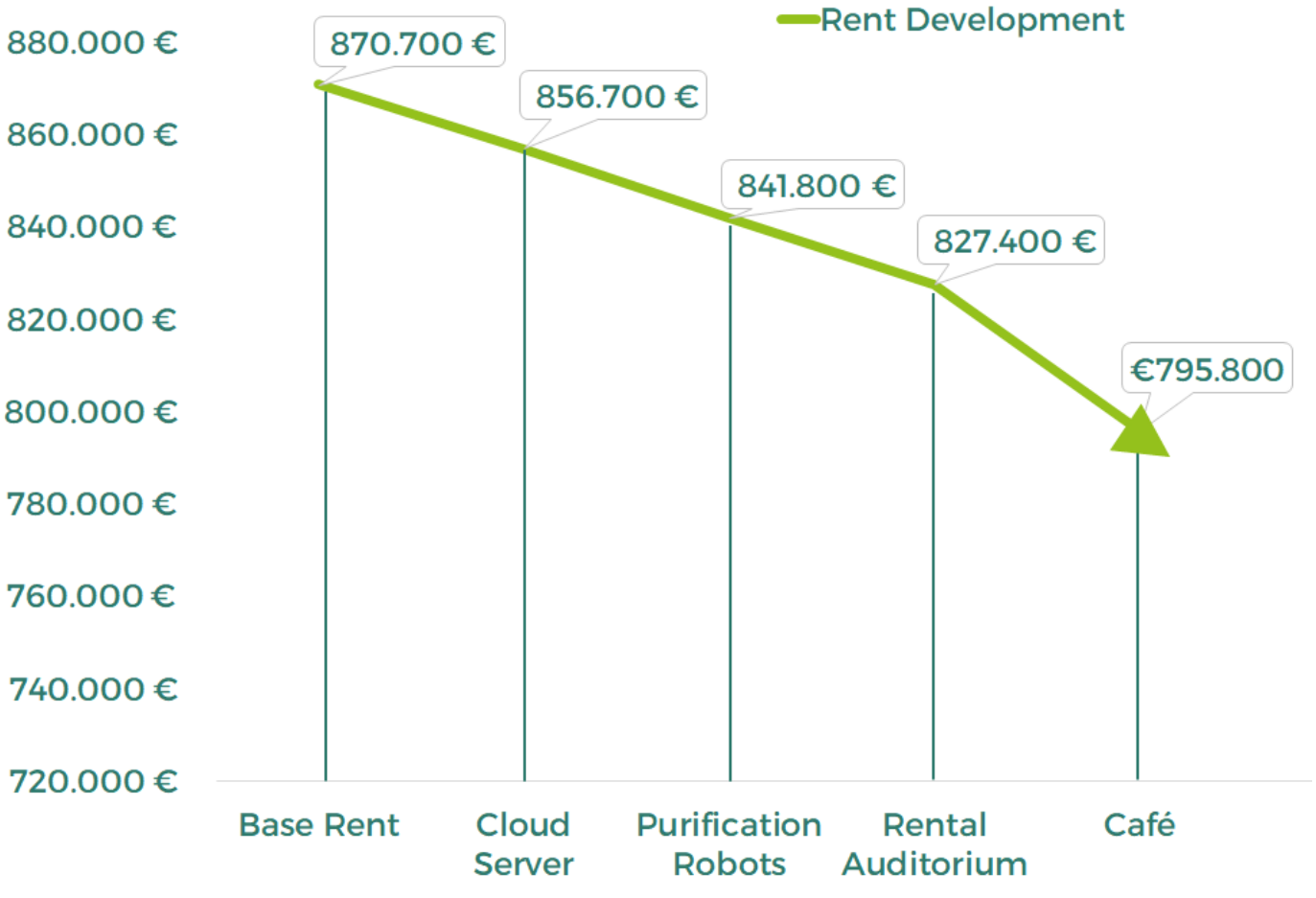


Income Auditorium

14.400 €
Annual Rent Reduction

M&O Costs + 15.000 € p. a.

Rent Reduction Strategies



Additional Income Café

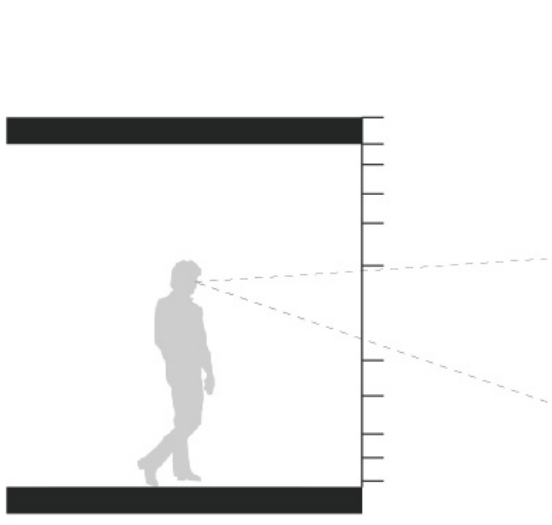
137.300 € Inflow p.a.
- 97.400 € Outflow p.a.

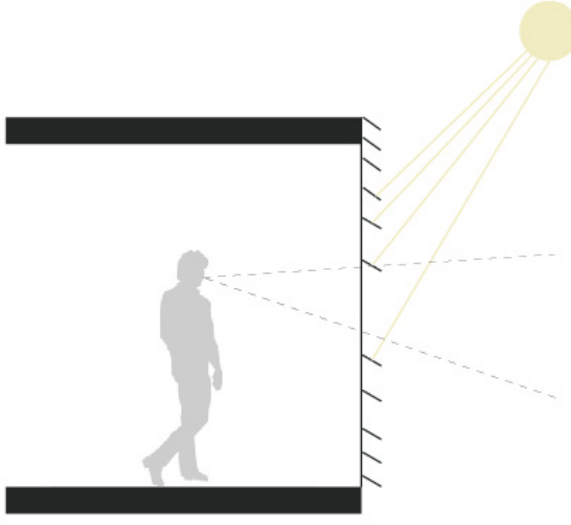
39.900 €
- 5.900 € 15% Corporate Tax
- 2.400 € Commercial Tax

31.600 € Profit p.a.

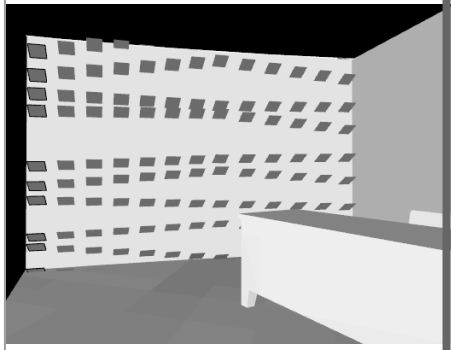
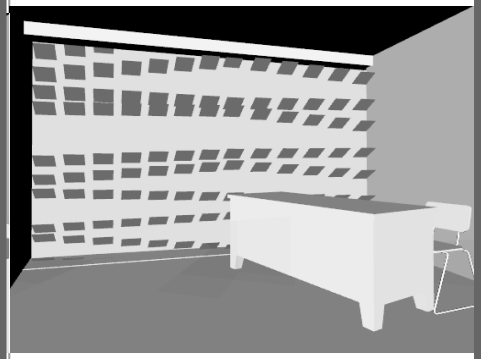
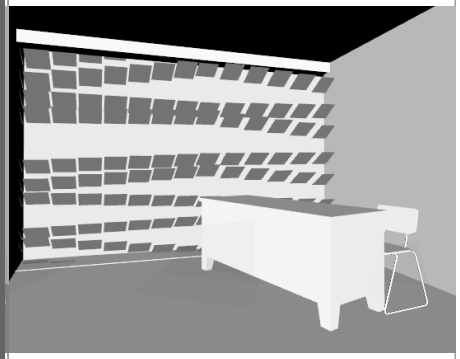
Adaptive Facade

Adaptive Facade

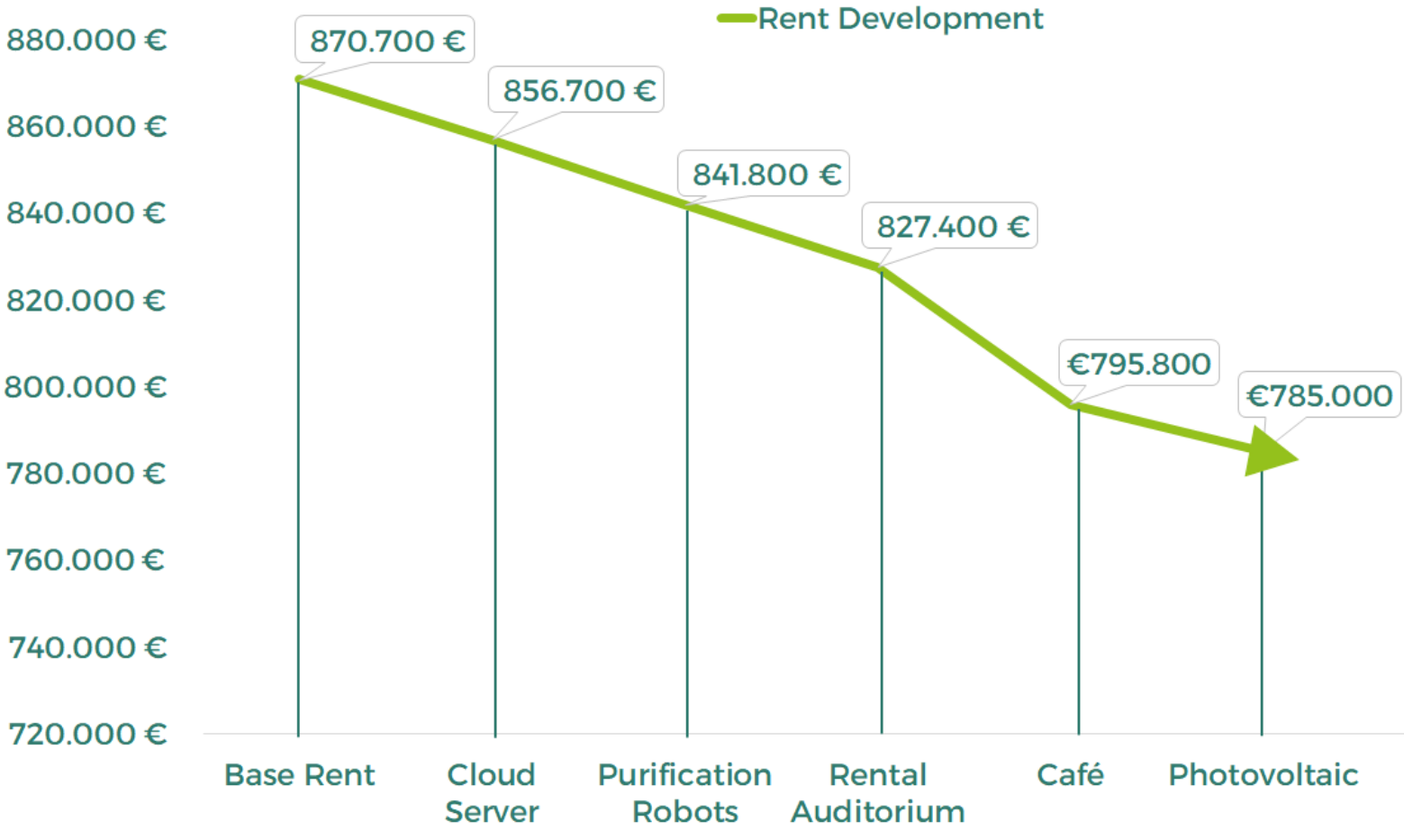




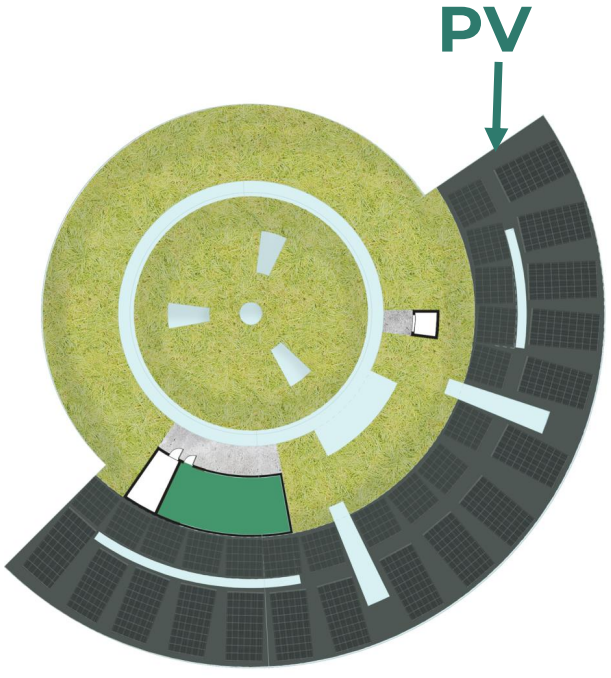
Adaptive Facade Prefabrication

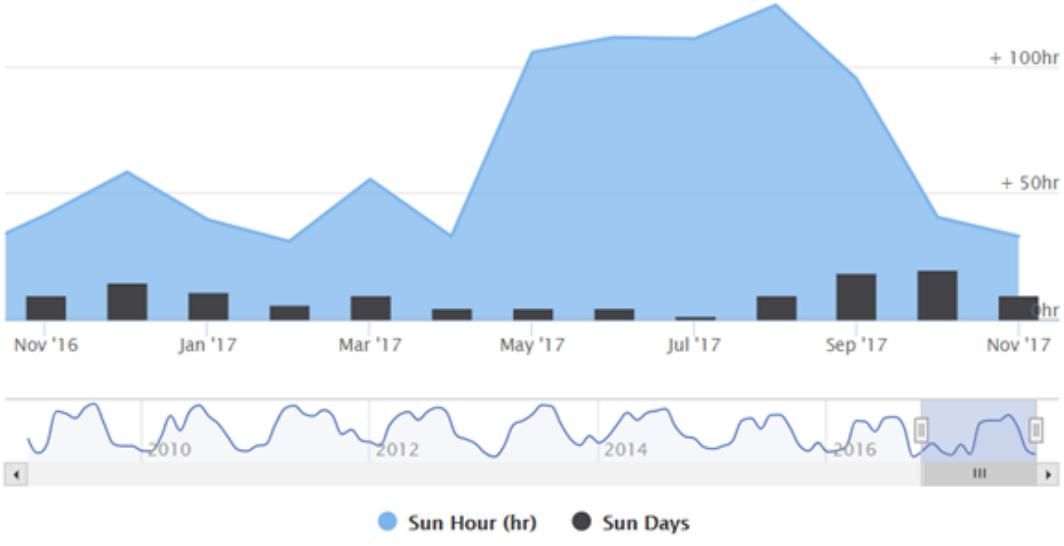
	Option 1 18x18 cm	Option 2 22x22 cm	Option 3 28x28 cm
User Experience			
Initial Cost (€)	76,500	123,250	199,750
Energy Production (kWh)	9,652	15,075	22,493
CO2 Savings (kg)	5,177	8,086	12,066

Rent Reduction Strategies



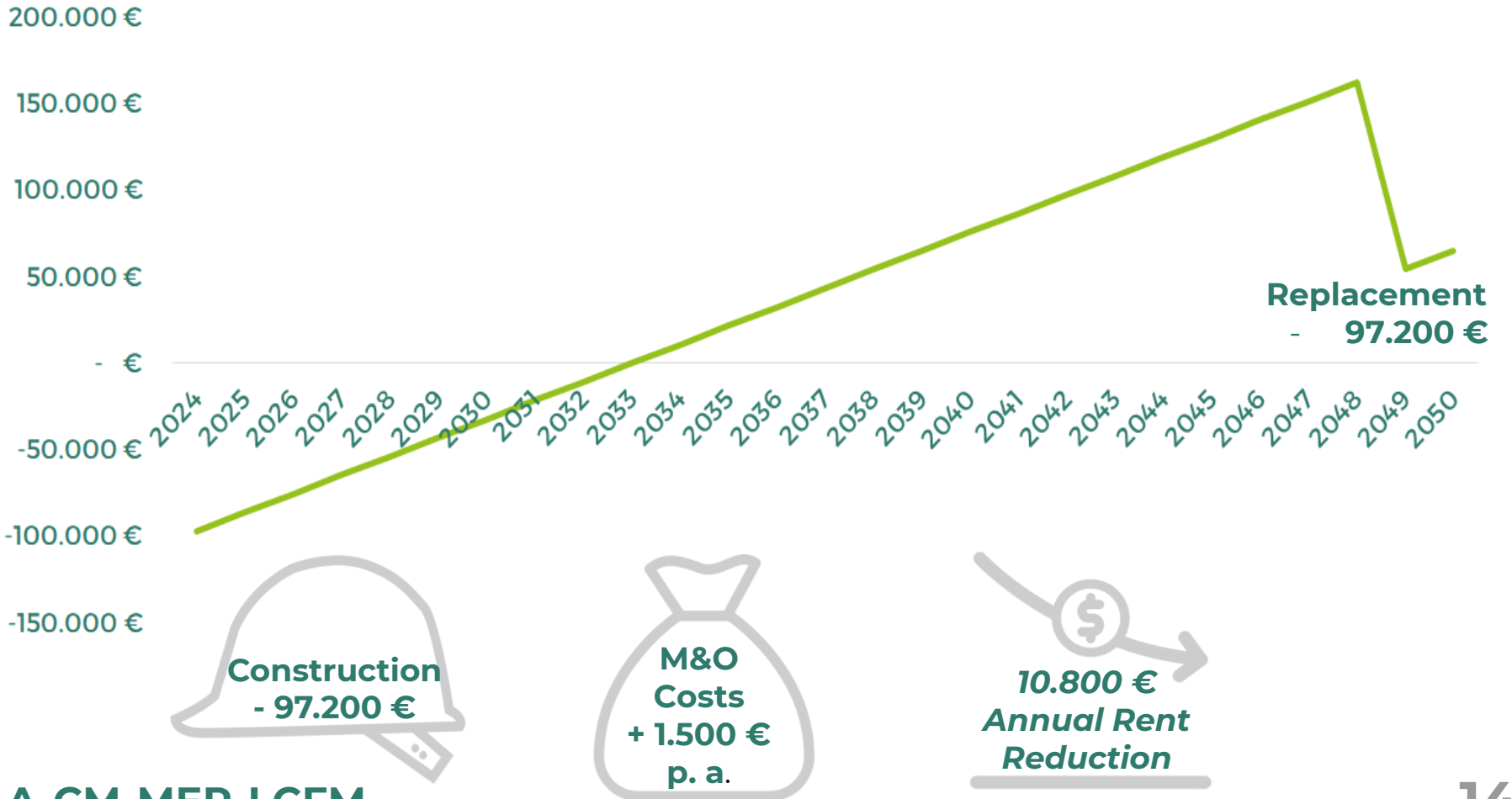
Roof/Facade Photovoltaic





Power consumed	- 108,377
Power produced	- 112,358

Roof/Facade Photovoltaic vs. Grid Energy



M E P

C M

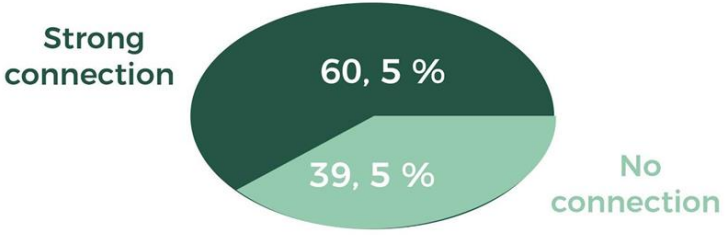
L C F M

A-CM-MEP-LCFM

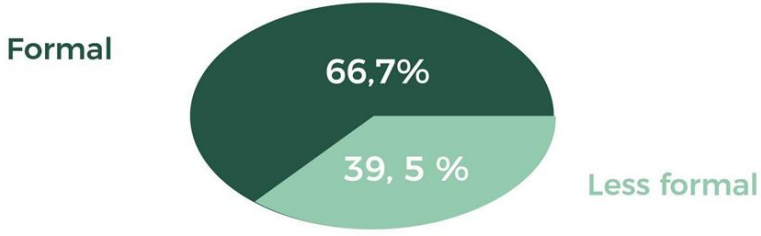
Collaborative Space

Survey - 150 responses

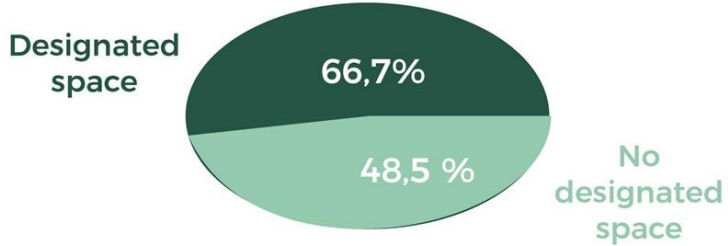
CONNECTION TO THE OUTSIDE



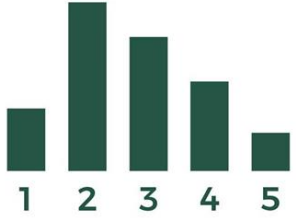
FORMAL VS. LESS FORMAL



ASSIGNED SPACE VS. FREE TO CHOOSE



OPEN SPACE RATING



SEMI- ENCLOSED SPACE RATING

Collaborative Space

Collaborative Space

PPP Contract Leverage

Construction- initial cost

PUBLIC 100%

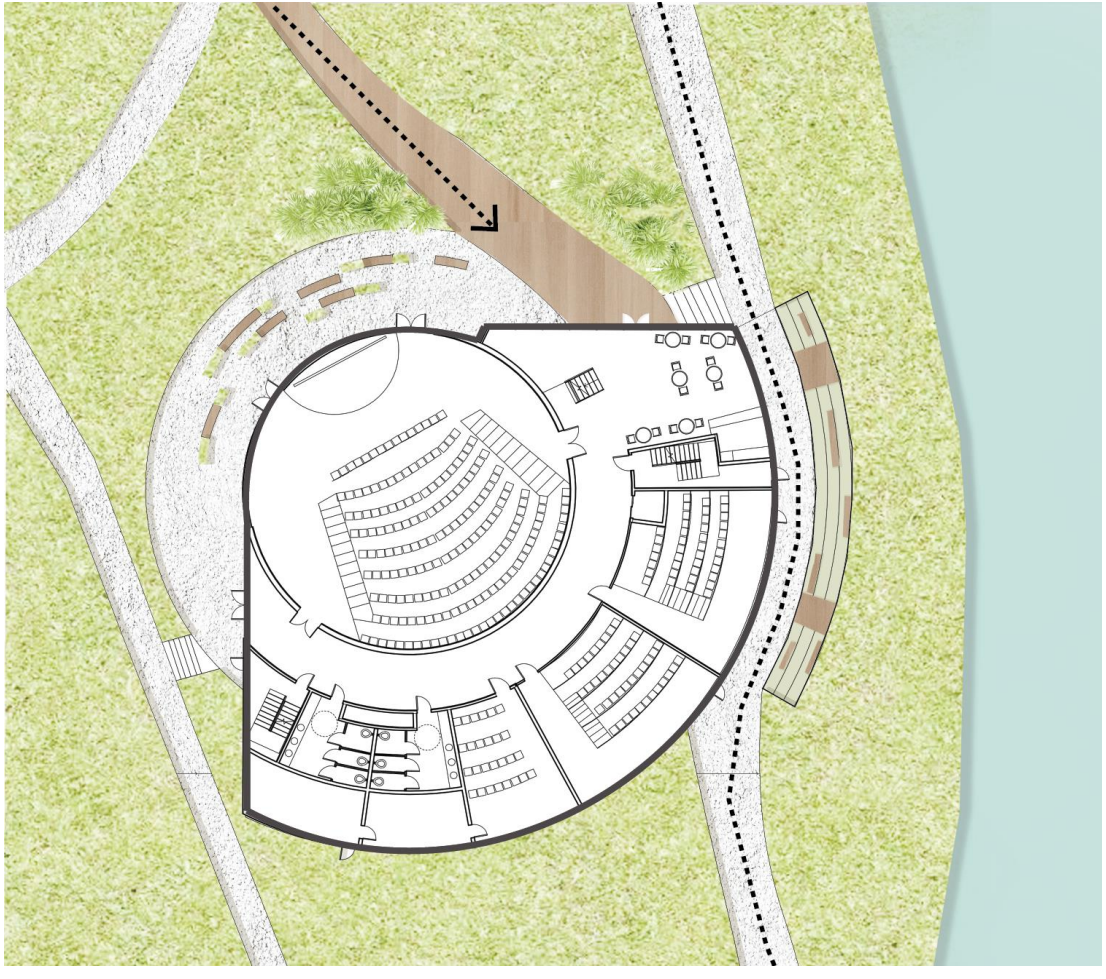
Maintenance and operation cost

PUBLIC 70 %

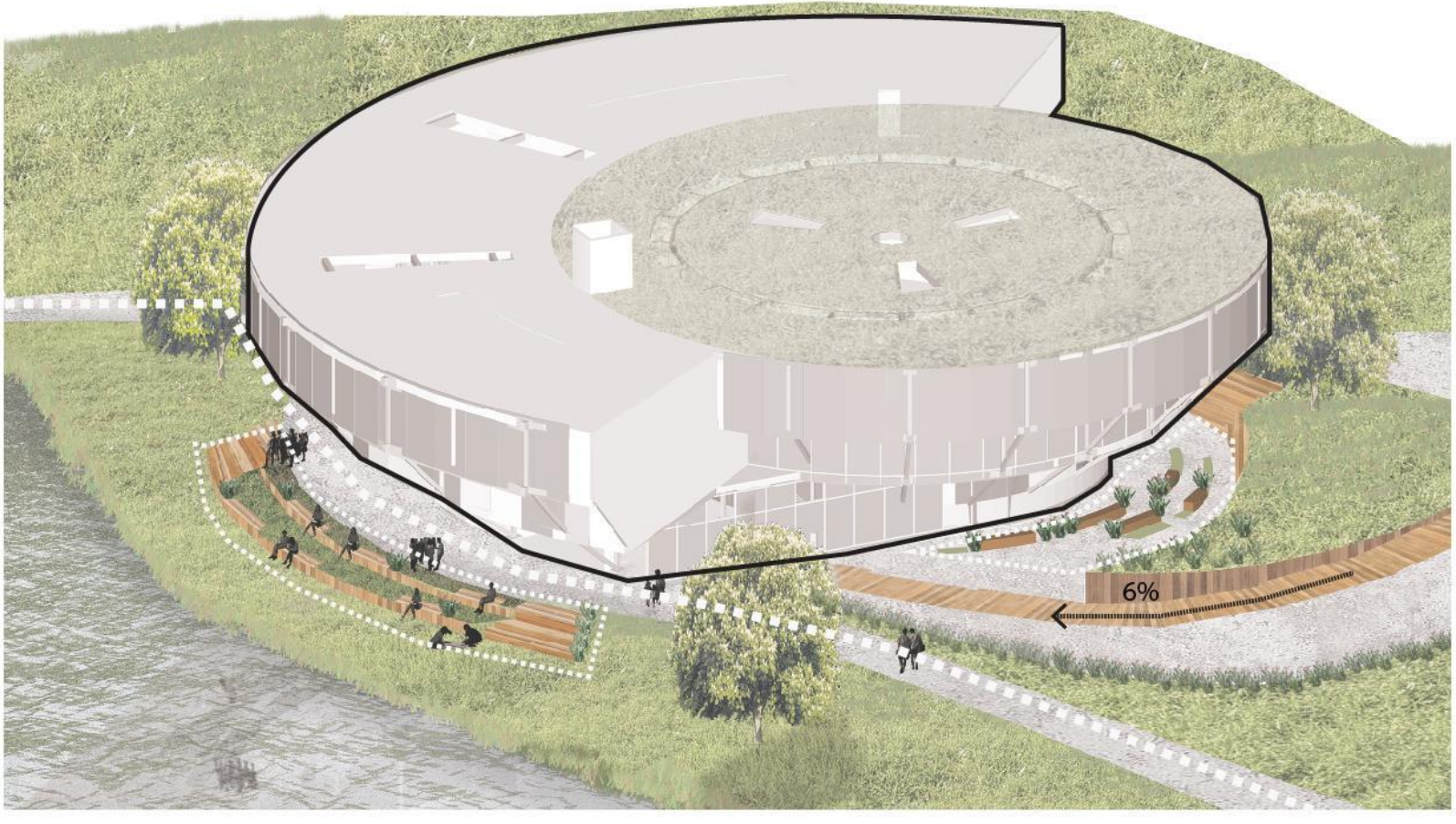
PRIVATE 30% (4.700 € p. a.)

Win / Win

Site plan

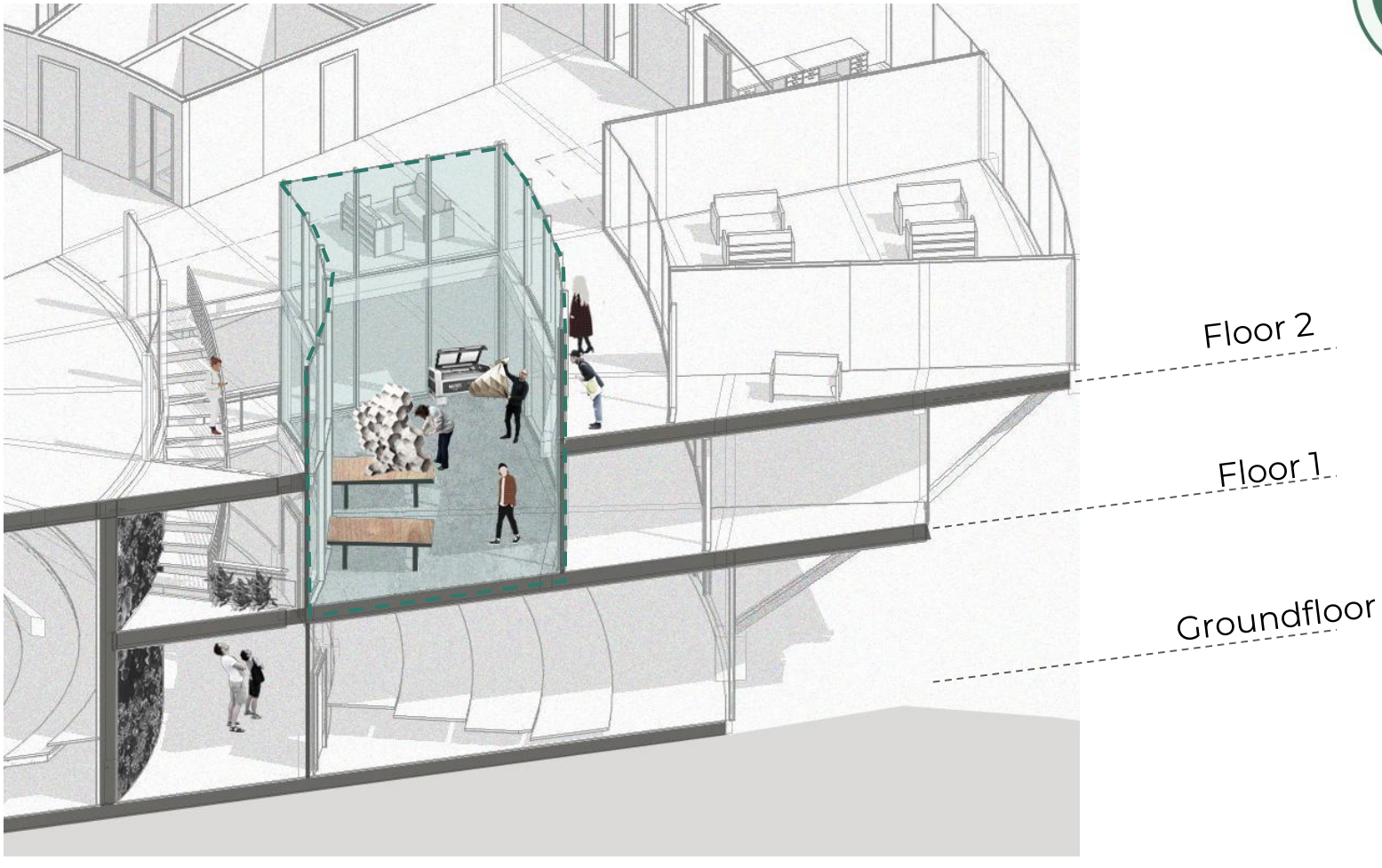


Landscape



Makerspace Tradition

Ripple Makerspace



Sustainability Industry Membership

SIEMENS

Creativity

Hires/Interns

Directly engaged in research

Research

Access to space for events

Innovation

BOSCH

Pilot Programs and prototyping

Summer programs

Visiting scholars

Startup possibilities

Riverbank-Universität Weimar

Access to consumers

Data sets

Research Funding

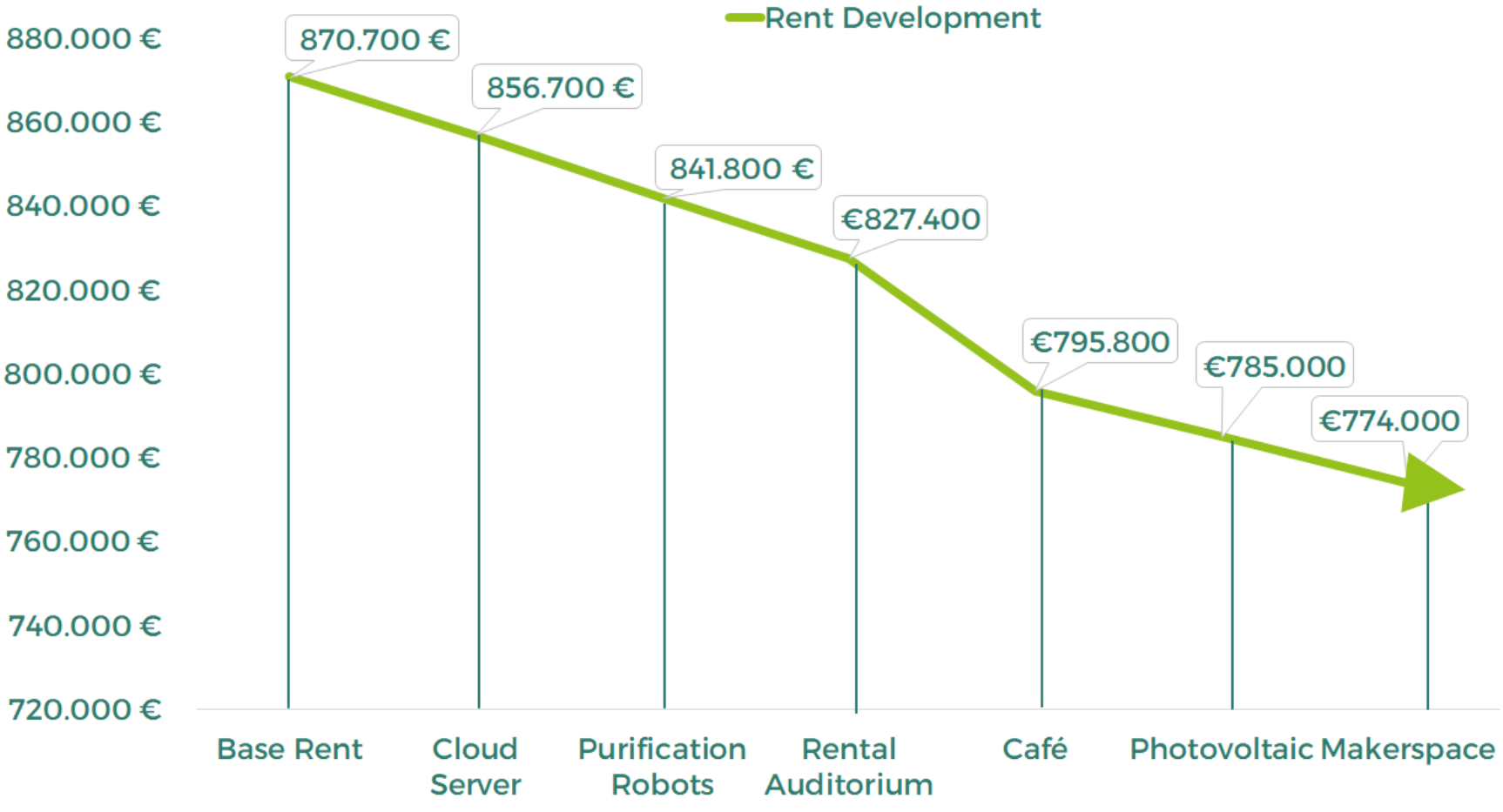
Scholarships

Prestige

Case Studies

Guest Speakers

Rent Reduction Strategies



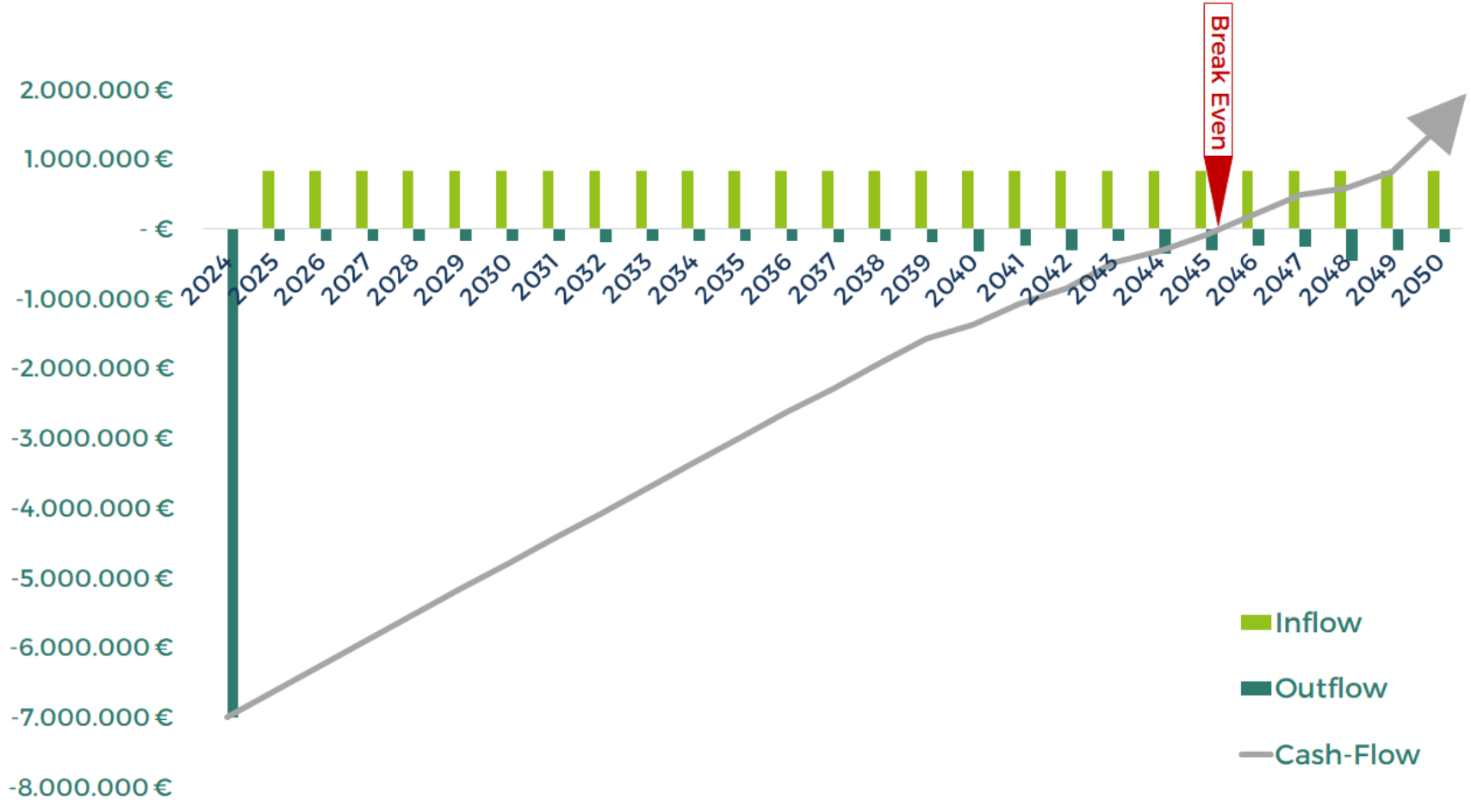
Owners Final Rent

870.700 €
p.a.

- 12,5
%

774.000
€
p.a.

Investors Cash-Flow



Debt Service Cover Ratio / DSCR

LEED/BREEAM

TEAM RIVER
77 points

5	6	11	27
7	15	4	2

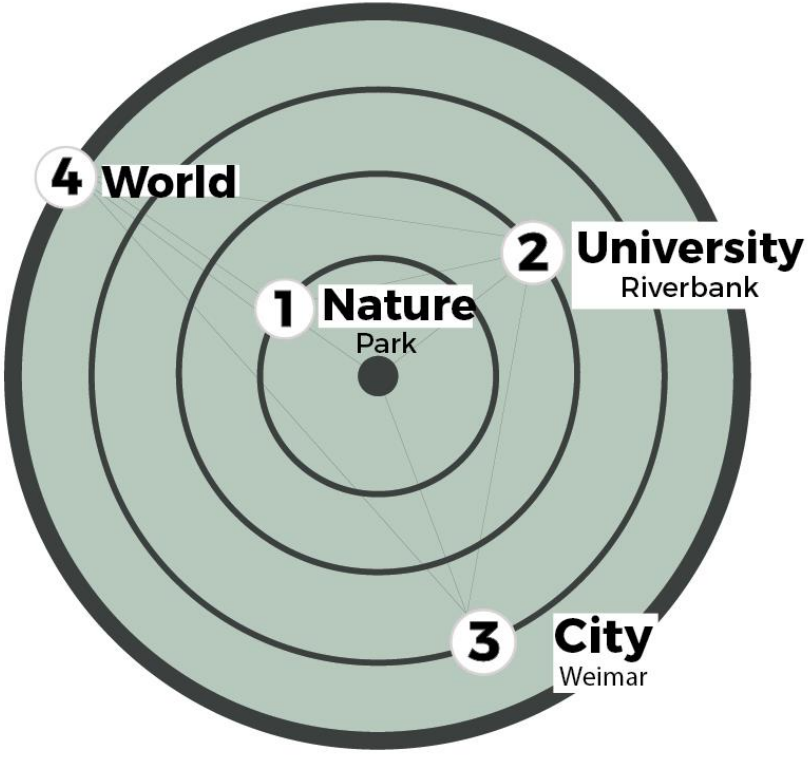
BREEAM®

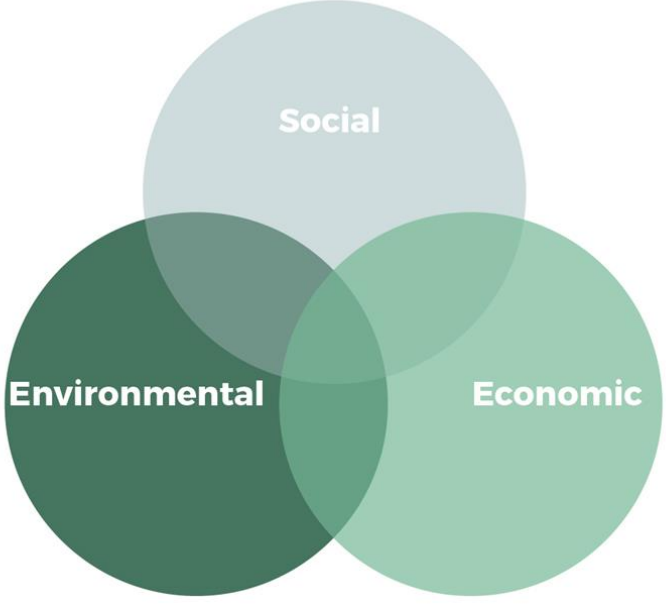
★ ★ ★ ★

EXCELLENT

TEAM RIVER
79%

Categories	% of Credits Achieved	Category Rating
Management	90.9%	Great
Health and Wellbeing	95.2%	Great
Energy	83.9%	Great
Transport	53.8%	Acceptable
Water	66.7%	Good
Materials	71.4%	Good
Waste	100.0%	Great
Land Use and Ecology	50.0%	Acceptable
Pollution	50.0%	Acceptable
Innovation	75.0%	Good
Ripple BREEAM Score:		79.31%


4 World
2 University
Riverbank
1 Nature
Park
3 City
Weimar


Social
Environmental
Economic

Sustainability Integration Summary

Level 1
Park & Nature

- **Adaptive Facade**
- Construction Site & Schedule Reduction

Level 2
Riverbank University

- **Collaboration Space**
- Student Designed Cafe

Level 3
Weimar City

- **Makerspace**
- Micropile Foundations

Level 4
World

- **PPP Contract Leverage**
- Saving Global Resources with Cleaning Robots

Thank You...Dziekuje...Grazie...Vielen Dank...
谢谢...धन्यवाद...

Teaching Staff
Renate Fruchter
Flavia Grey
Glenn Katz

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Andrej Kurent
Luke Lombardi
Hussain Parsianfar

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Adhamina Rodriguez
Henry Tooryani
Charles Quagliana
Norayr Badasyan
John Nelson
Tyler Zastrow

Mentors
DPR Team
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Eric Borchers
Eduardo Miranda
Jason Hsai
Nick Areson
Justin Schwaiger
Erik Kneer
Afaan Naqvi
Briana White

Special thanks to the PBL community & all the 25th Anniversary AEC teams

Team Catchphrases

Guys I need the risk probabilities !!!

Chill + Doors = Success

Do NOT touch the gridlines!

According to Greg Luth...

I am just a simple man who runs ducts.

Everything can be solved with Excel...

greenwalls
Greenwalls
GREENWALLS

Team PBL Takeaways

"Even with the literal blood, sweat, and tears…I wouldn't change a thing!" **-Belle**

"Cross disciplinary collaboration is the key to success in any team"
-Eithan

"There is no such thing as small changes"
-Sylwia

"Anything is possible with some **BS**…**B**rain**S**torming"
-Renate

"Teams that build the best buildings are the best built teams"
-Austin

"Never do duplicate work"
-Vivian

"Yeah, that's possible with some brainmerge"
-Vikash

"The higher the pressure the better the efficiency"
-Michael