NORDIC FAÇADE FORUM

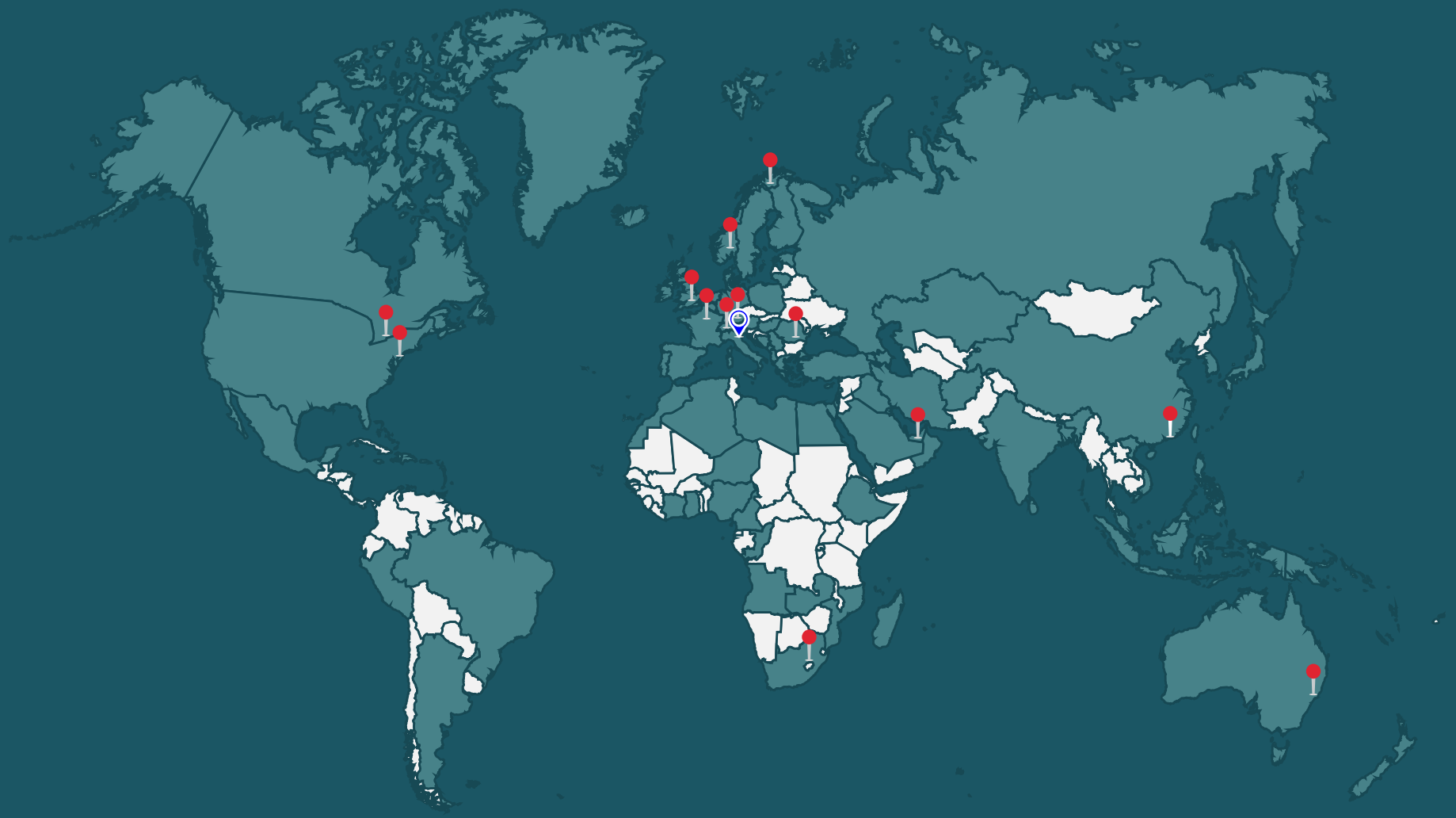
HOLISTIC PARAMETRIC FAÇADE OPTIMISATION

enhancing sustainability, performances, and wellbeing

MAFFEIS engineering

OUR PRESENCE

MAFFEIS engineering



HEADQUARTER
Solagna
Milano

INTERNATIONAL OFFICES

OUR ACTIVITIES

+ 4.500 PROJECTS WORDLWIDE

+ 60 COUNTRIES

13 INTERNATIONAL OFFICES

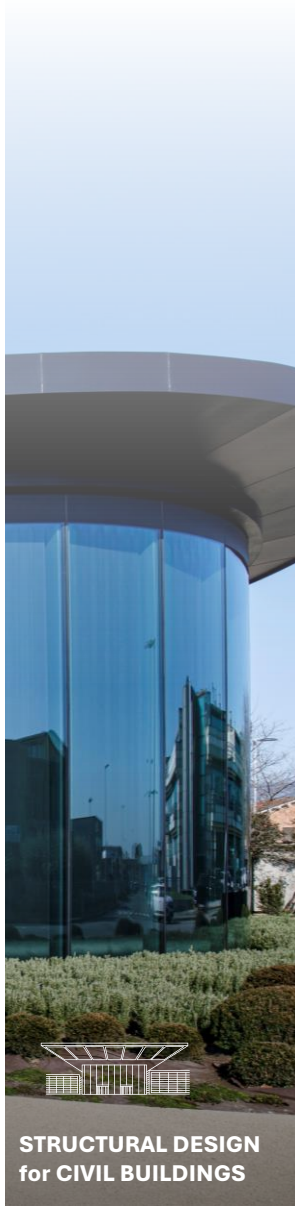
312 EMPLOYEES

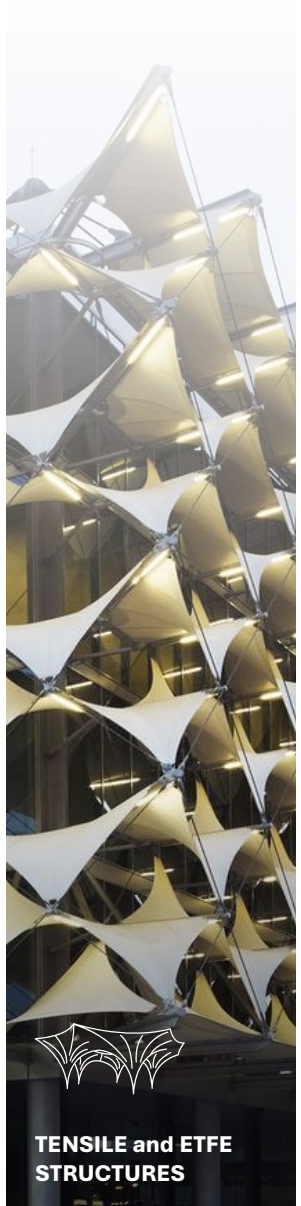
224 ENGINEERS

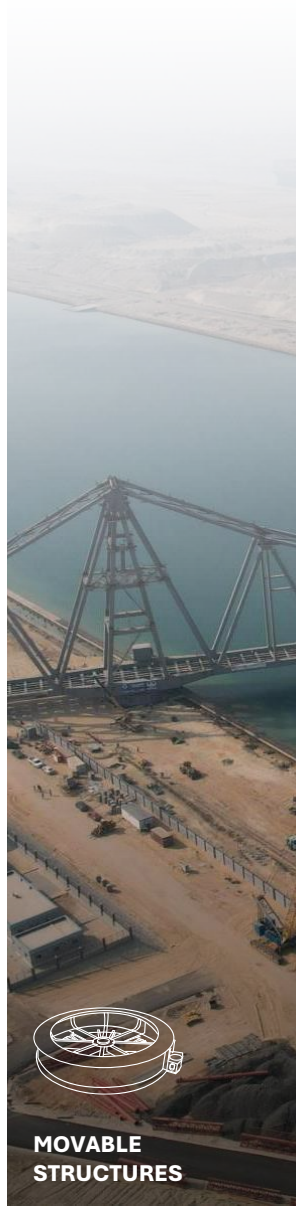
51 ARCHITECTS

OUR SERVICES

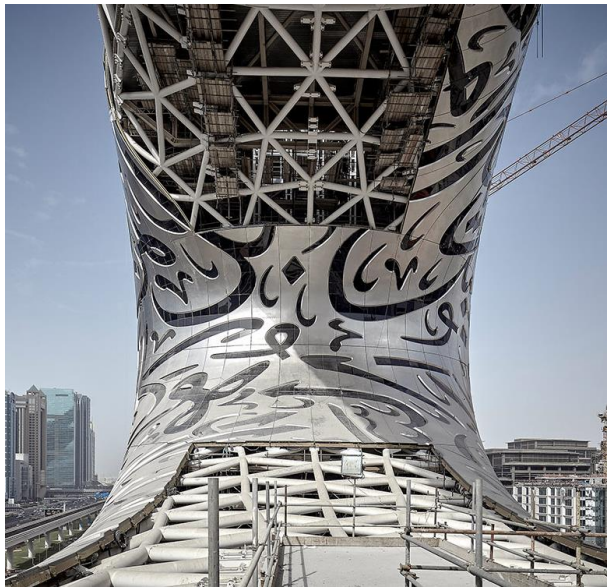
MAFFEIS engineering





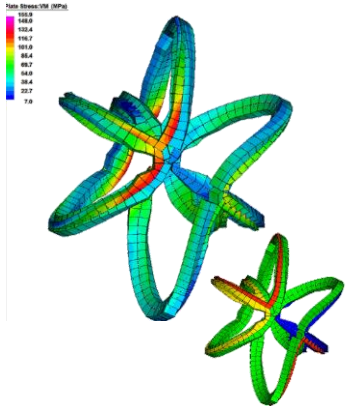


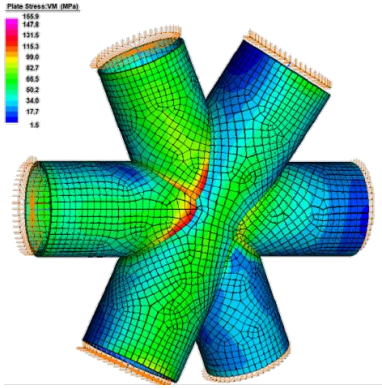
WORKING WITH FABRICATORS

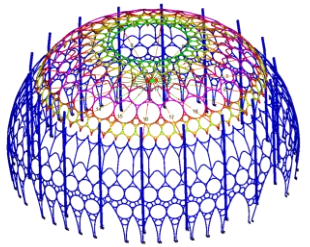


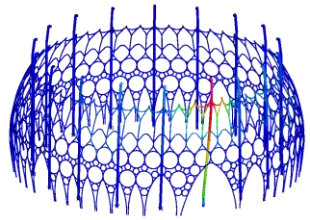
OUR APPROACH

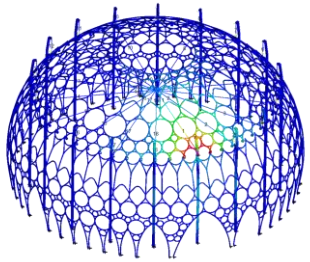
MAFFEIS engineering

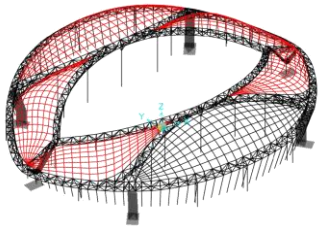


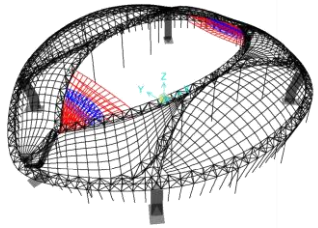


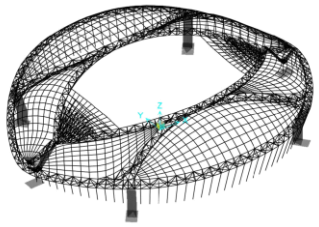


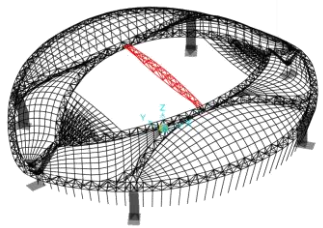


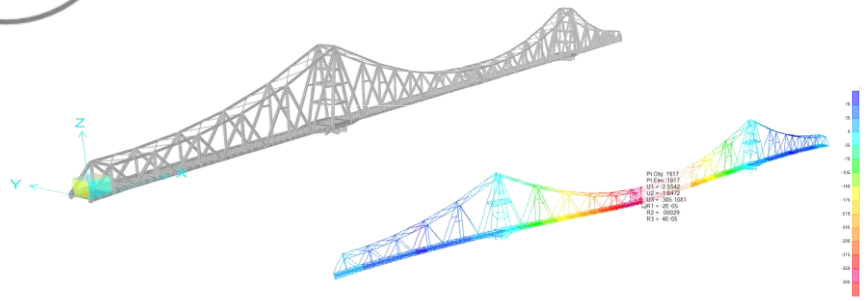


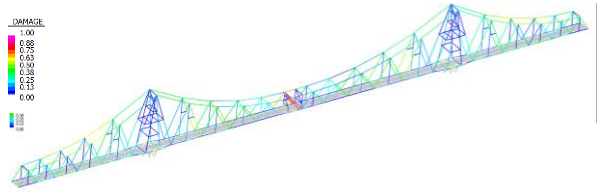




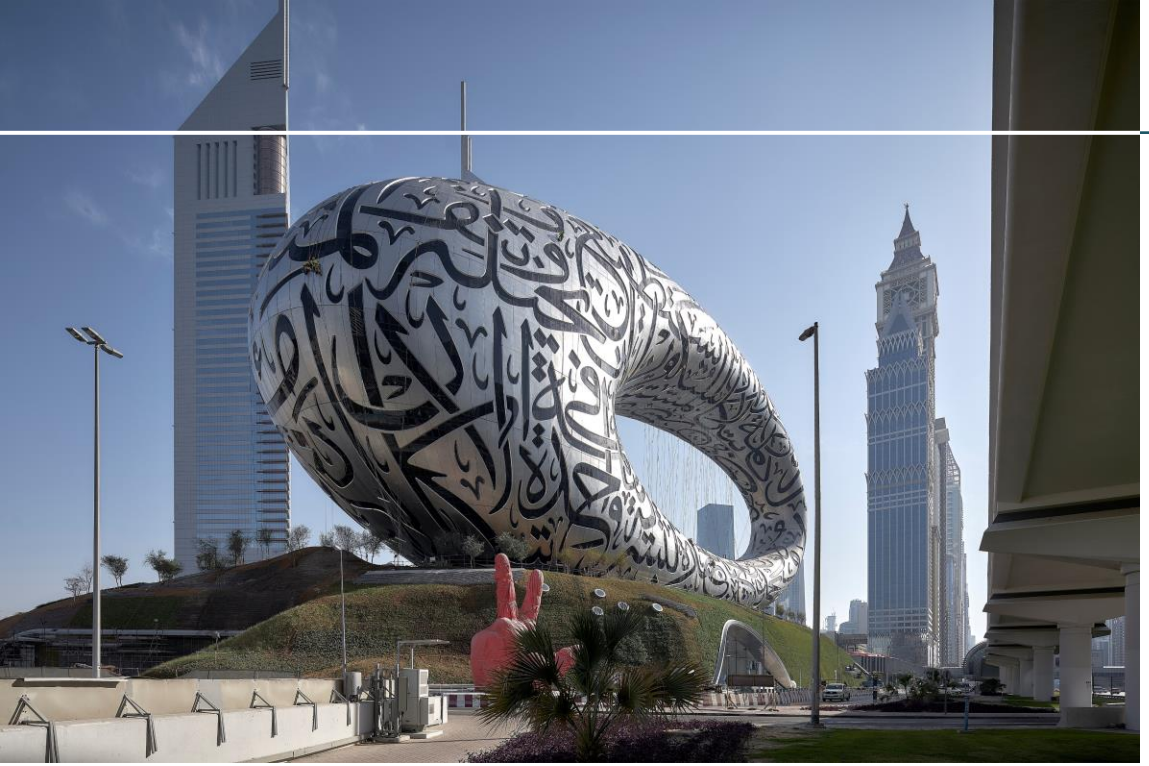


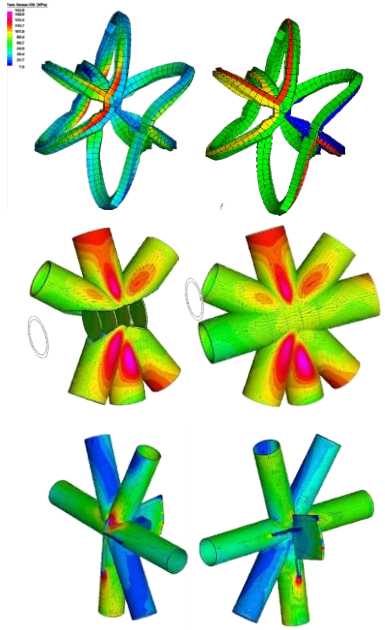


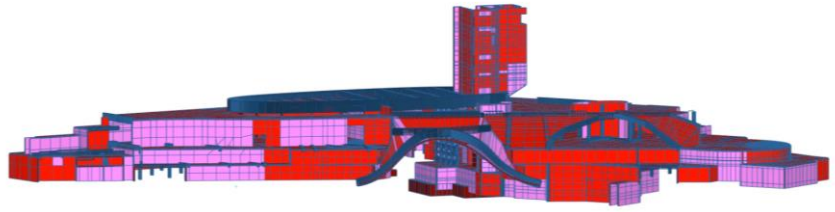


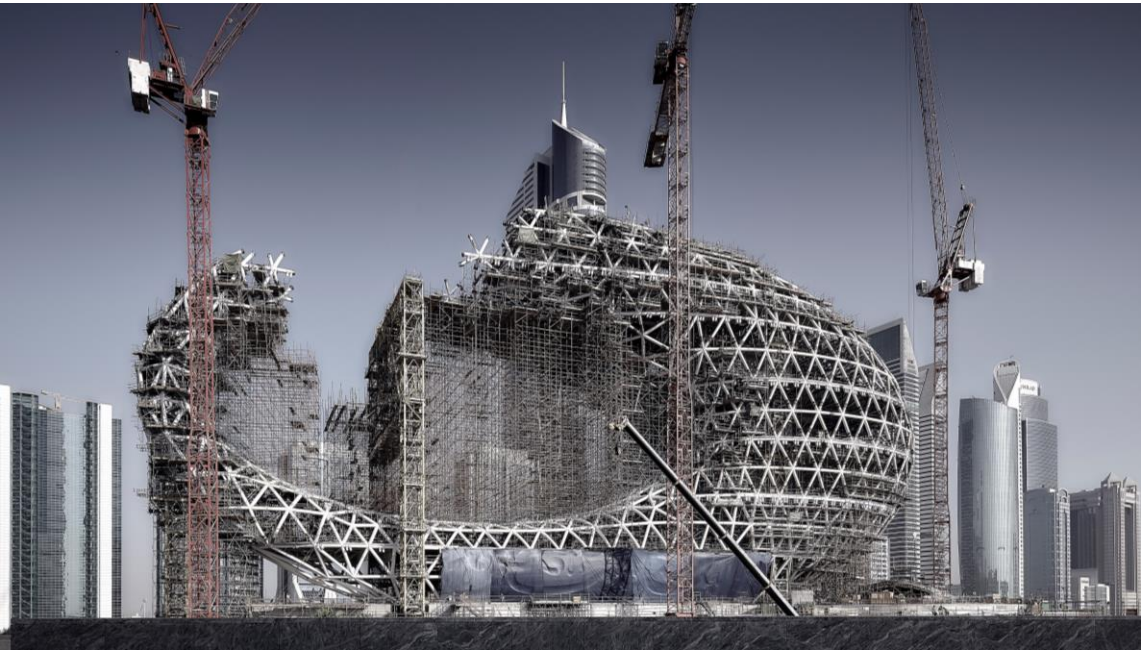


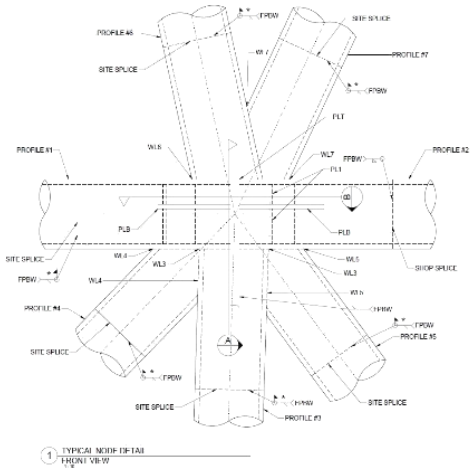
OUR PROJECTS

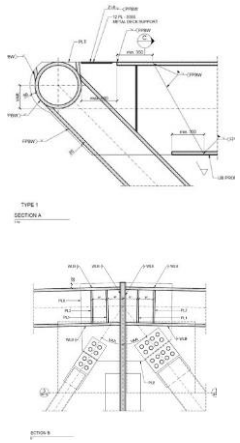


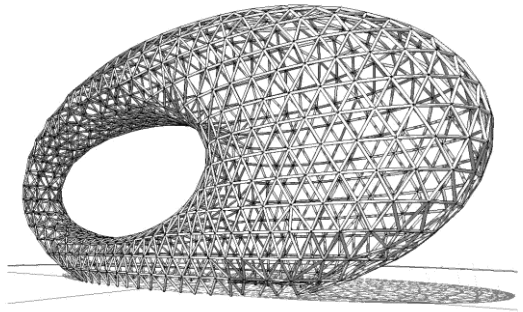












MUSEUM OF THE FUTURE

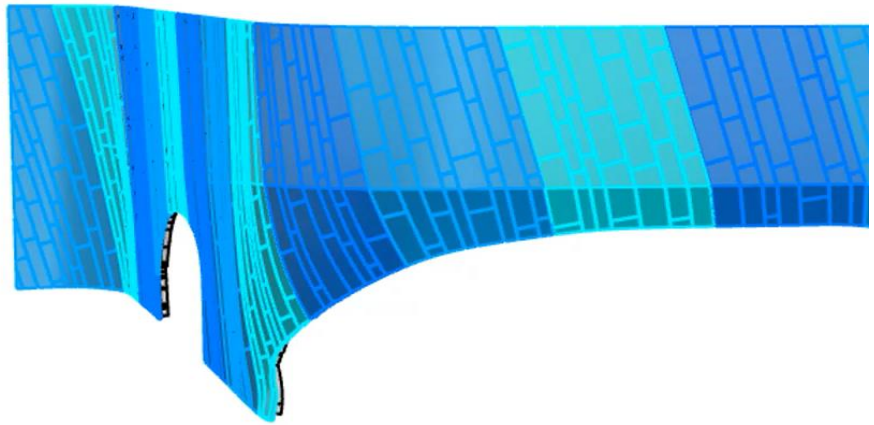
MAFFEIS engineering

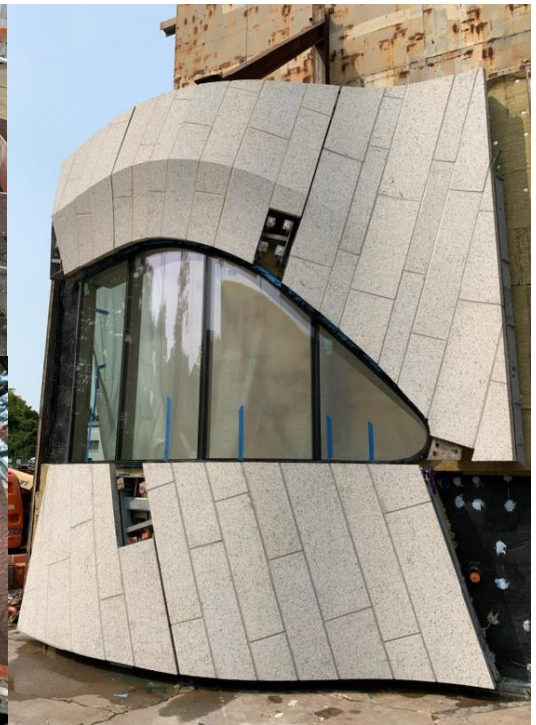
DUT TOWER

DUBAI UPTOWN TOWER

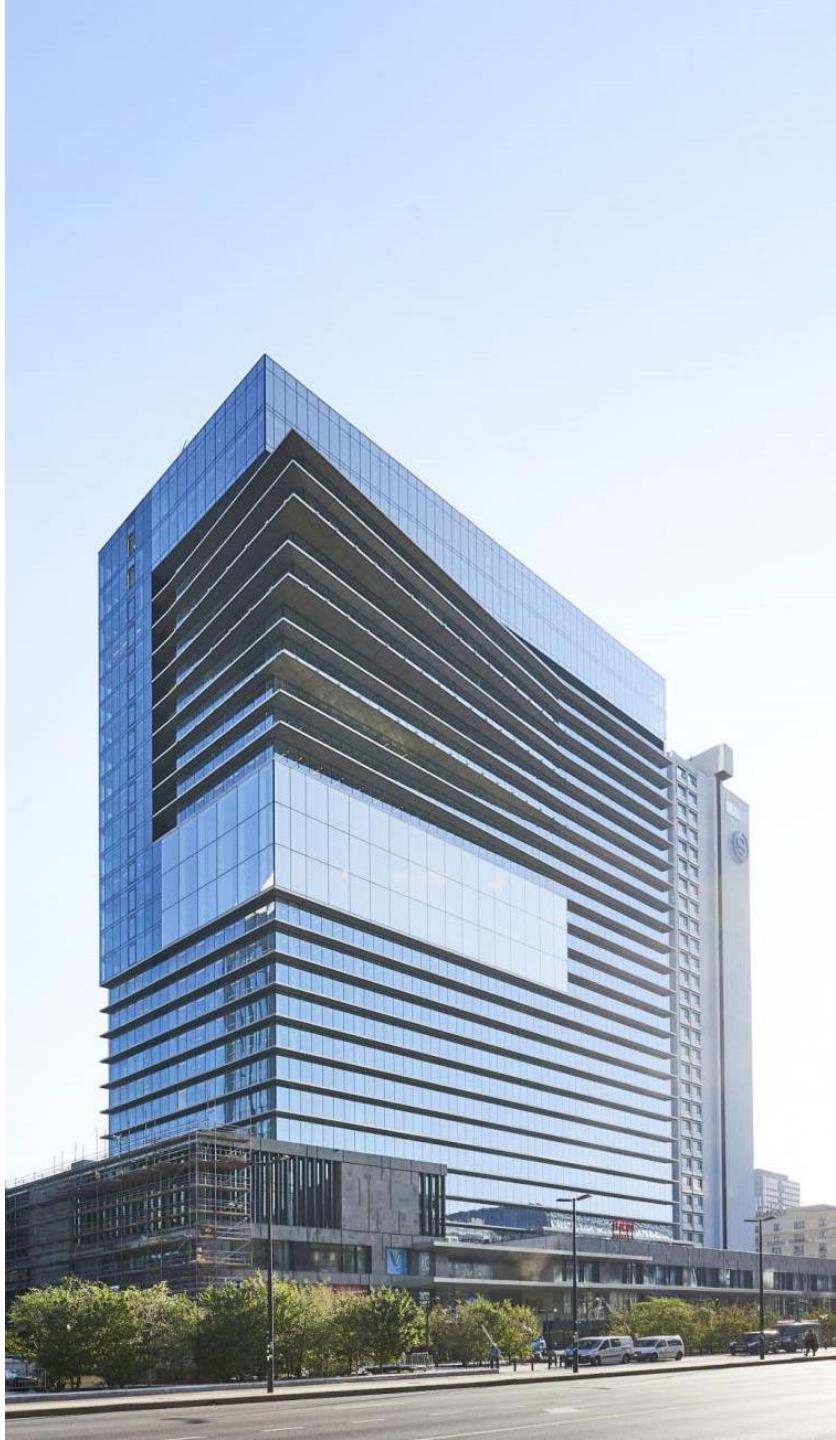
MAFFEIS engineering

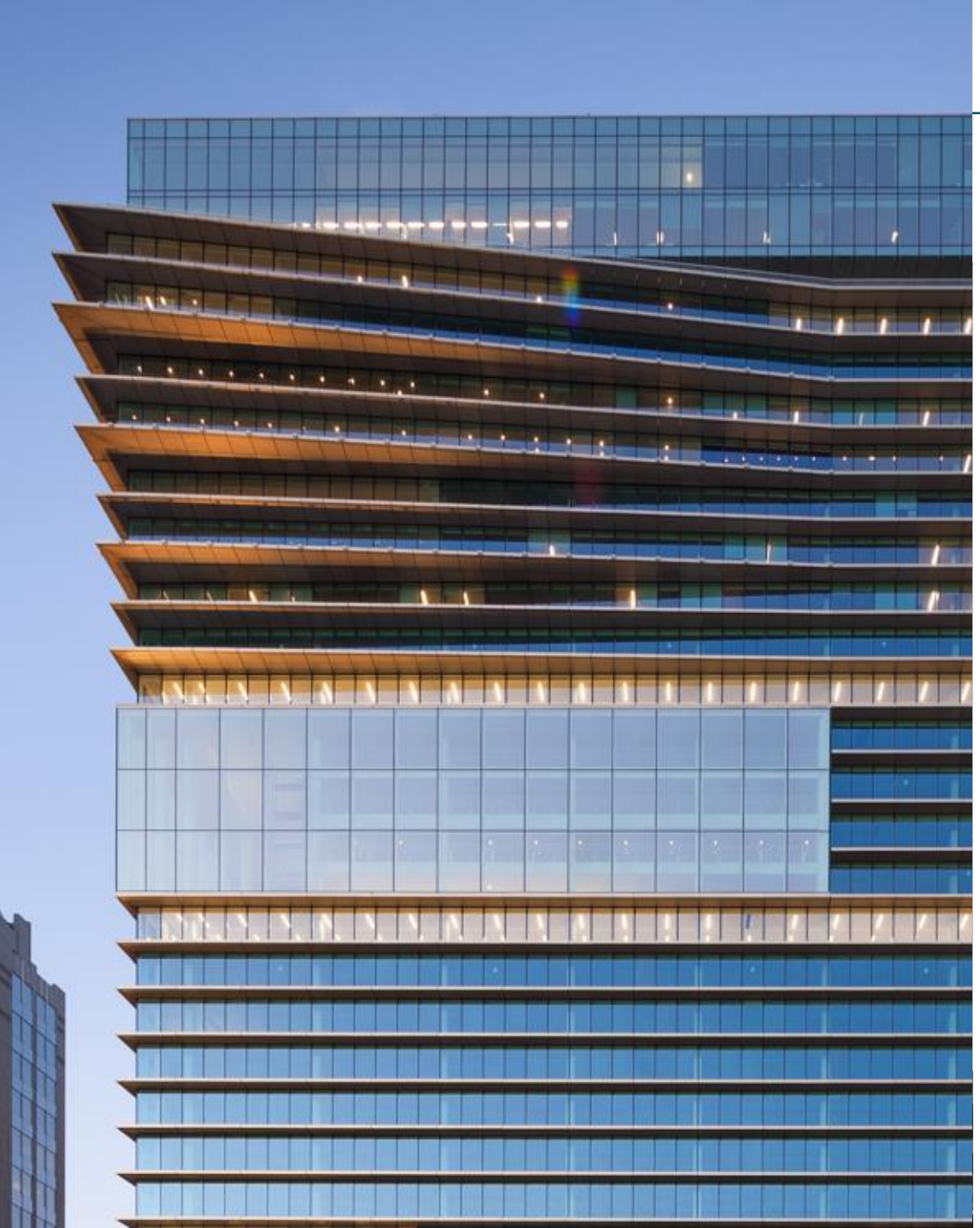
ONE ZA'ABEEL TOWER



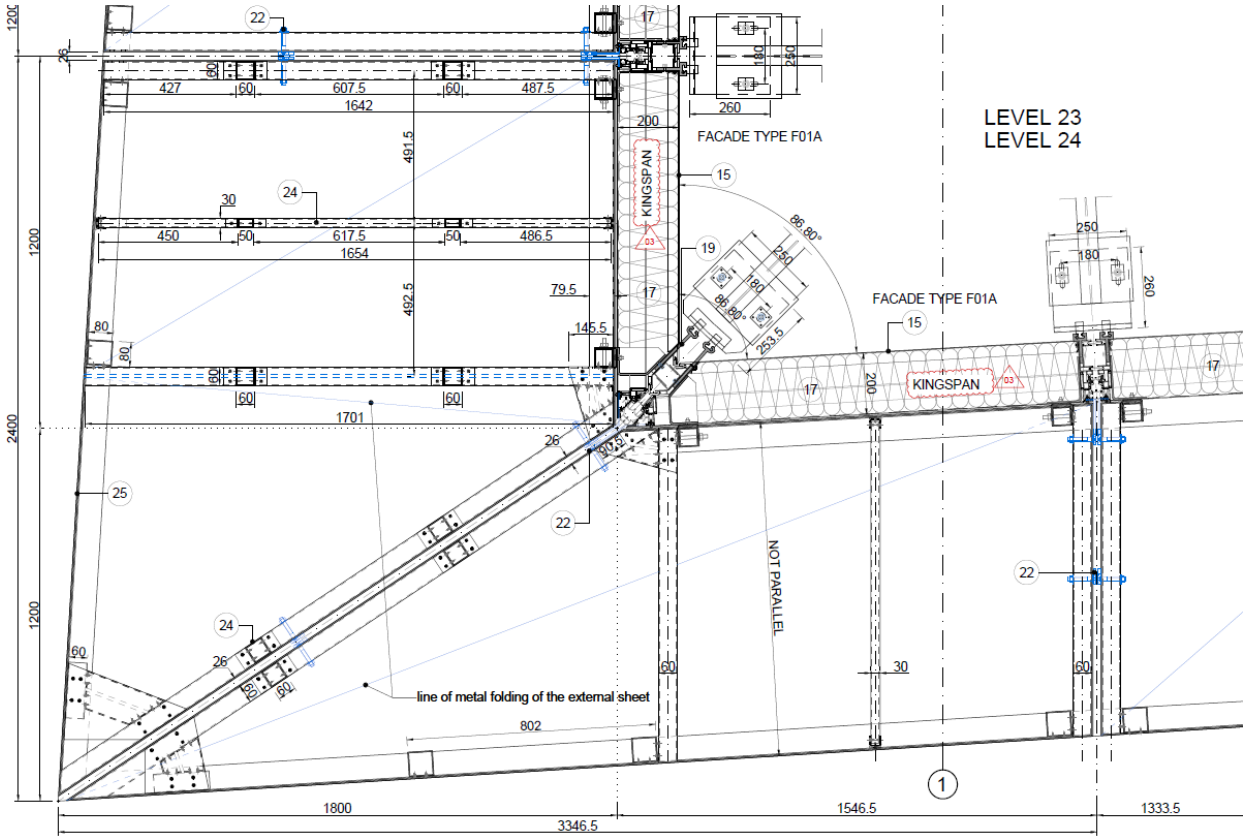


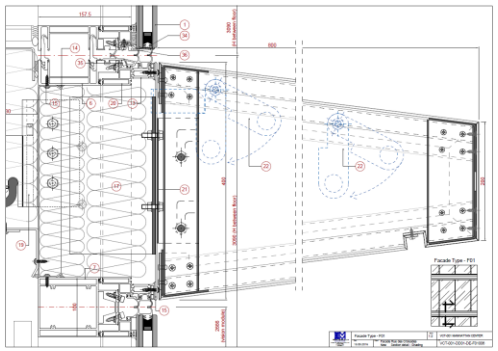
GILDER CENTER

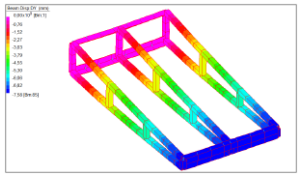


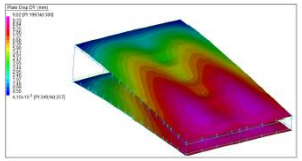


MAFFEIS engineering



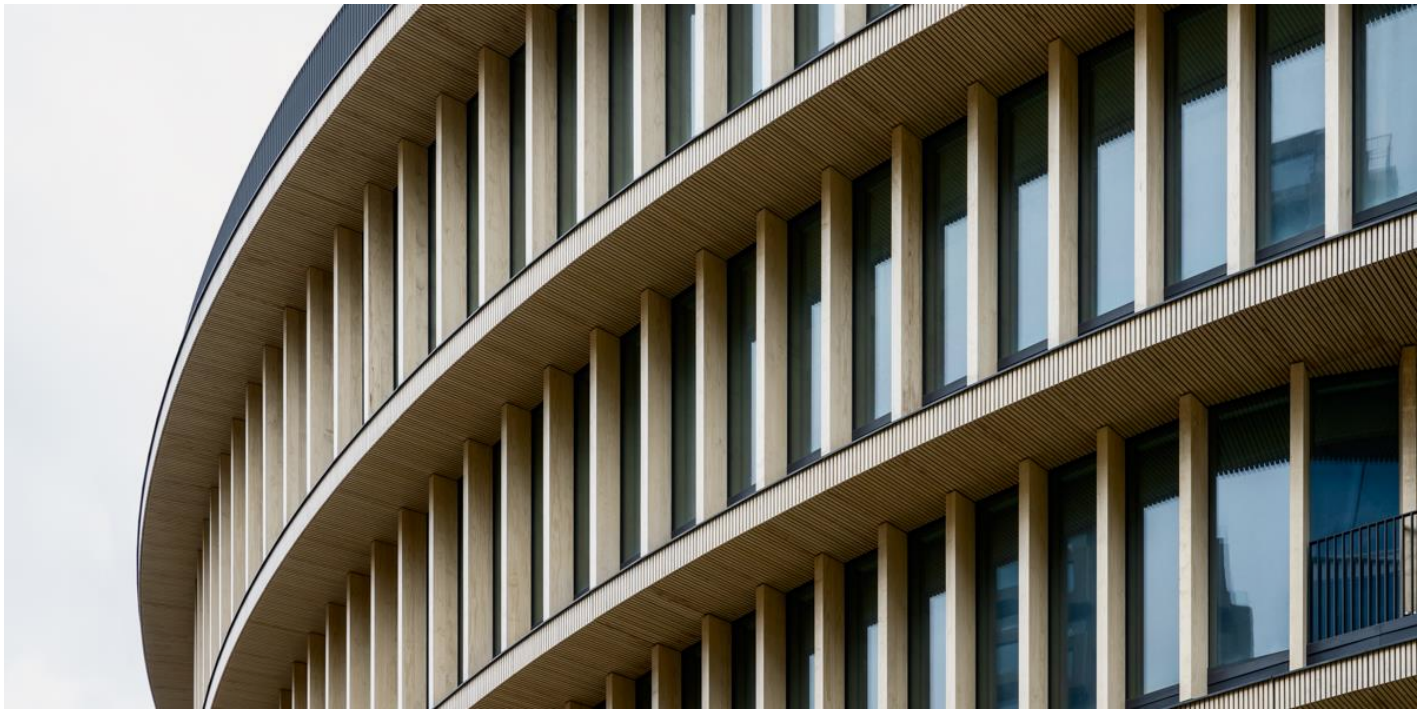






MANHATTAN PROJECT


Elekta
ATLAS ANTIBODIES
ØFORSKAREN
URBAN DELI



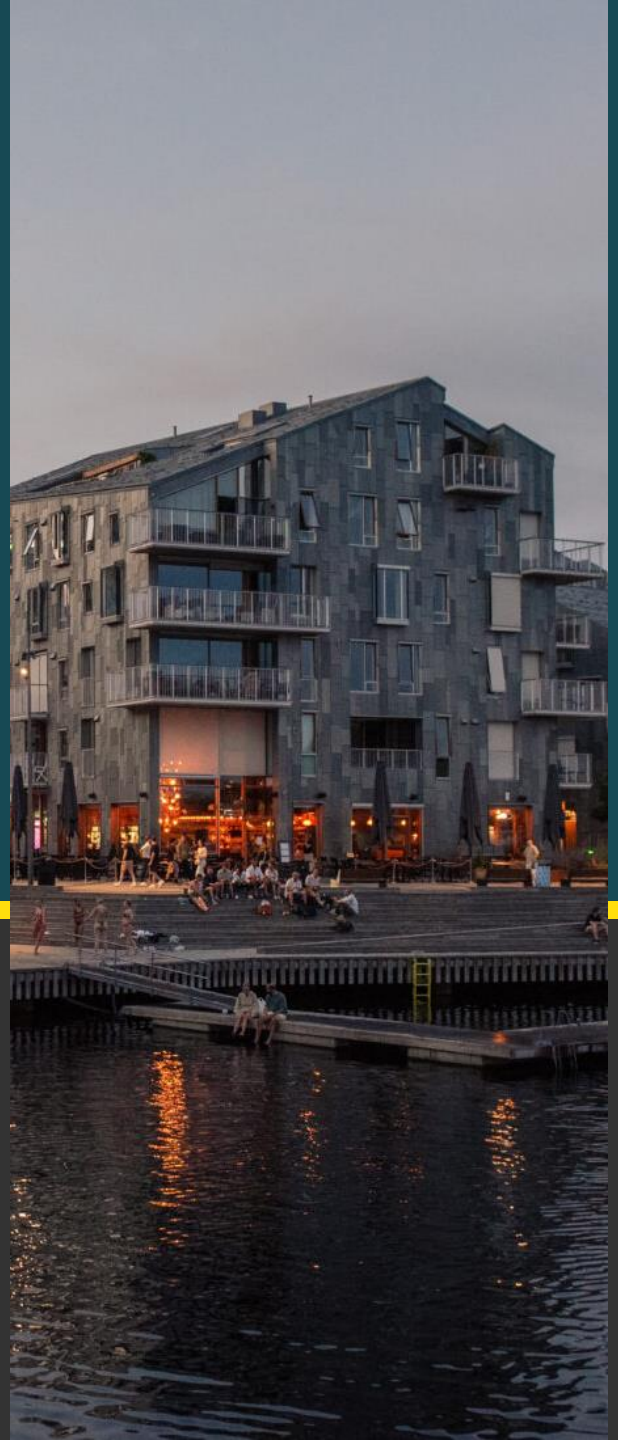
MAFFEIS engineering

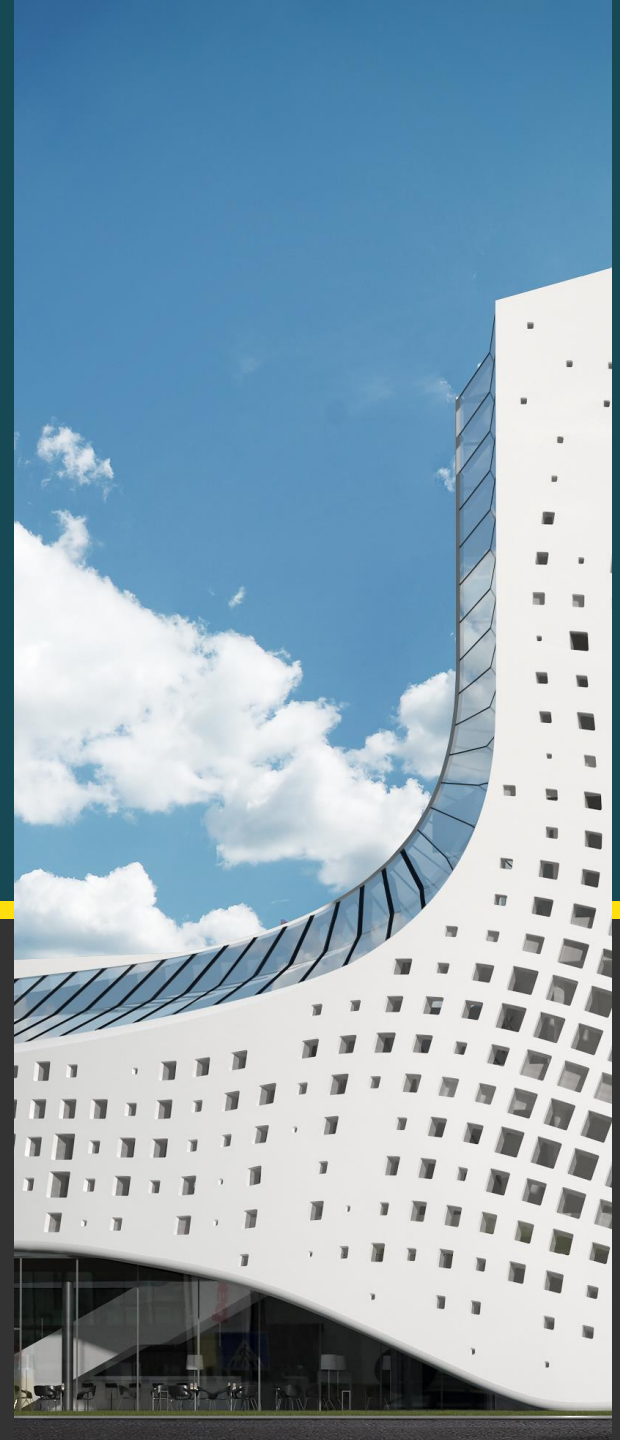
FORSKAREN

MAFFEIS engineering

NYT HOSNORD HOSPITAL

CASE STUDIES



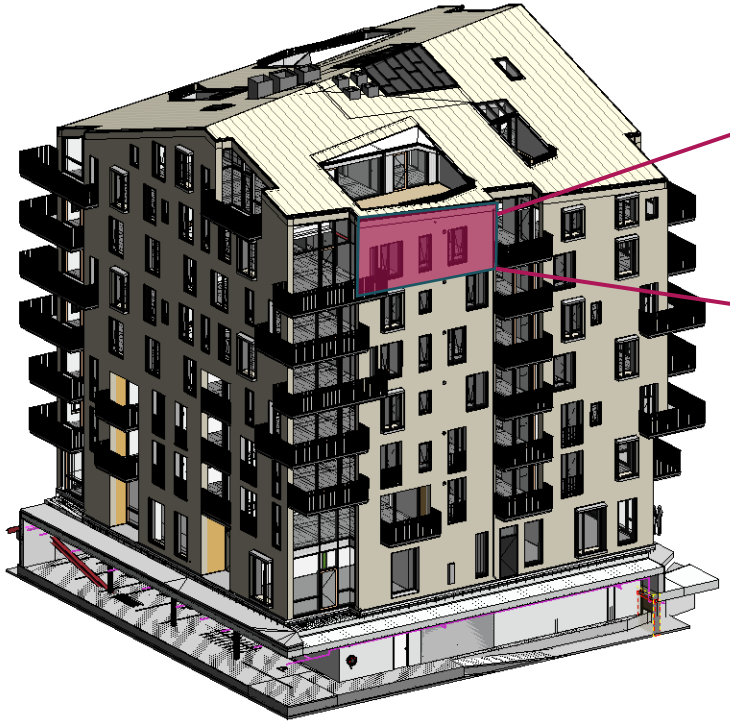


BISPEVIKA B6A

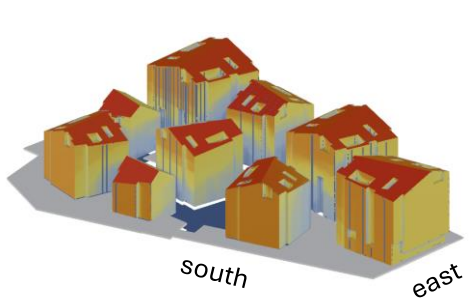
MAFFEIS engineering

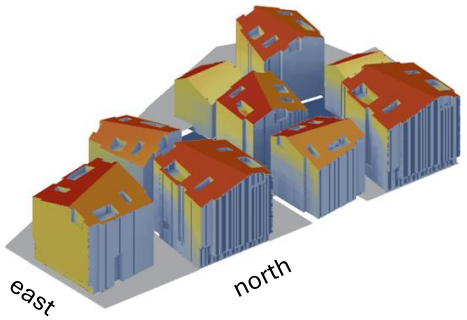
BISPEVIKA B6A

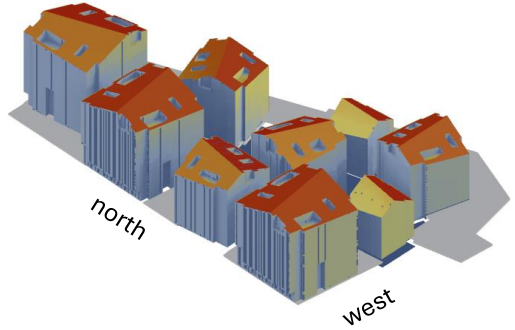
FAÇADE OPTIMIZATION

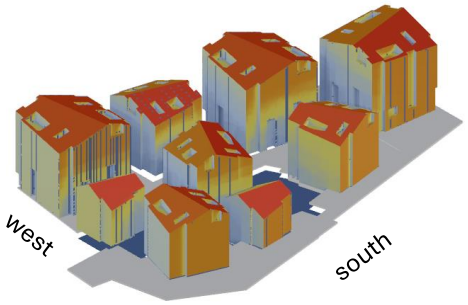


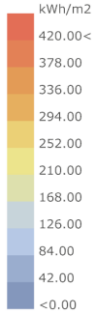
For the optimization of façade using timber prefabricated panels the first focus is on the repeatability of the single panel. Considering as a first step a standard product range for large timber panels of 3m x 12m, the goal is to rationalize opening size and façade panel patterns







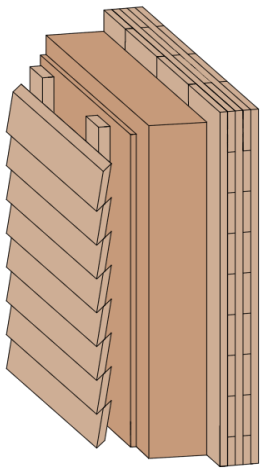


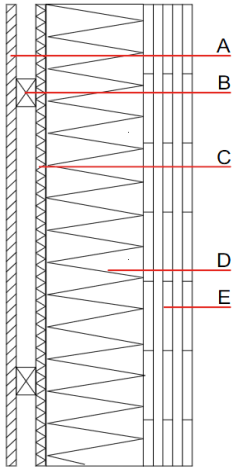


BISPEVIKA B6A

FAÇADE OPTIMIZATION

Exterior wall – solid timber construction, rear ventilated, visual surface quality: AW03 b





Building physical and ecological rating

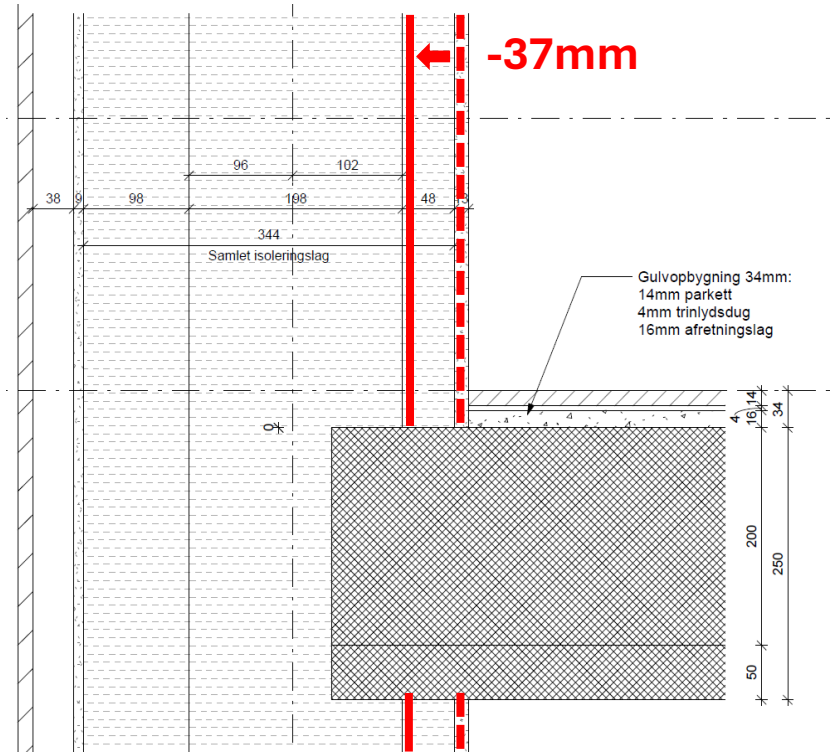
	Fire protection	REI i → o	60
	max. unsupported length l = 3 m; max. load ($q_{fi,d}$) = 60 [kN/m]		
	Heat insulation	U [W/m²K]	0.150
	Sound insulation	R_w [dB]	44
	Ecology	ΔOI3	40

Building material specifications for construction, layer structure I from the inside to the outside

	Thickness [mm]	Building material	Heat conductivity λ [W/(m · K)]	Gross density ρ [kg/m³]	Flammability class EN 13501-1
A	19	Wooden exterior wall cladding	0.15	525	D
B	40	Wooden battens (40/60; e = 625)	0.13	475	D
C	22	Under-ceiling board, wood fibre insulation panel	0.05	250	E
D	200	Wood fibre insulation panel	0.04	110	E
E	100	CLT BBS, 5-layered	0.12	450	D
Total	**38.10 cm**			**84.30 kg/m²**	

REDUCTION OF THICKNESS

- S= 381mm (Δ = 418mm – 381mm = 37mm)
- Uvalue=0,15 W/m2K

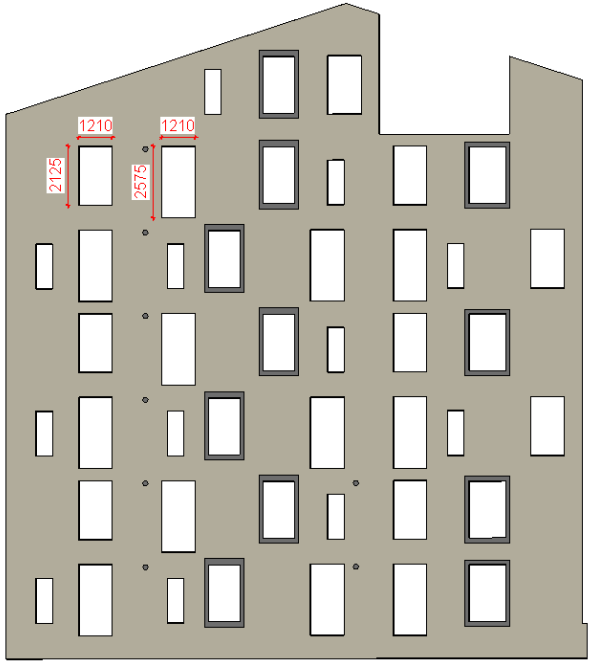


CALCULATION OF SURFACE INCREASE

$$\Delta = \frac{1144900-1000000}{1000000} x100 = +14{,}5\%$$

BISPEVIKA B6A

FAÇADE OPTIMIZATION



5 or 10 mm

50 or 66 mm

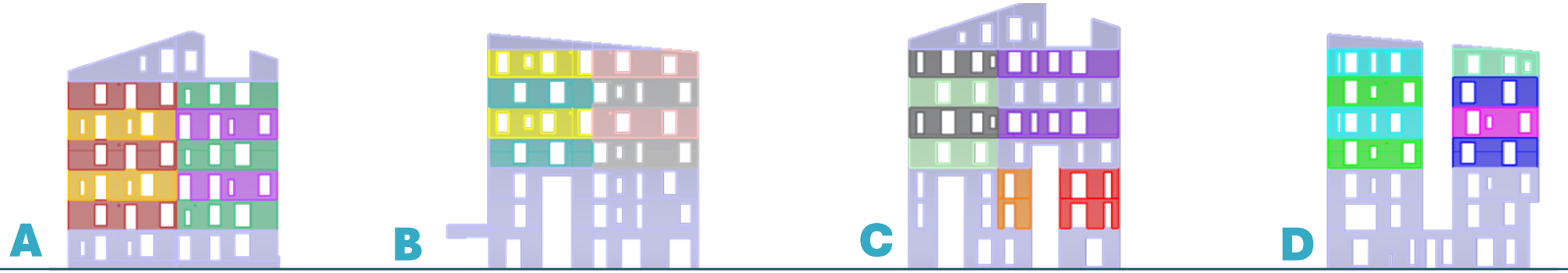
100 mm

A first analysis has been conducted considering:
- Internal layout (room type)
- Wall openings type/size
- Elevation

Reducing typologies by matching openings with similar size.

BISPEVIKA B6A

STARTING PANELISATION



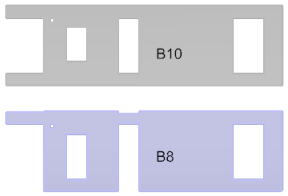
TOTAL NUMBER OF UNIQUE PANELS: **52**

BISPEVIKA B6A

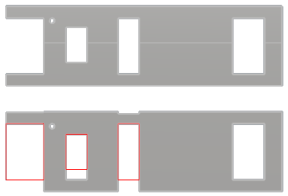
NEGLIGIBLE CHANGES

B

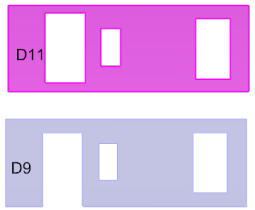
D



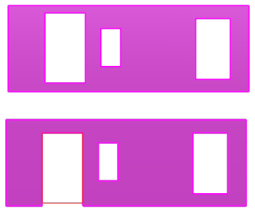
No. of Previous Unique Panels: 2



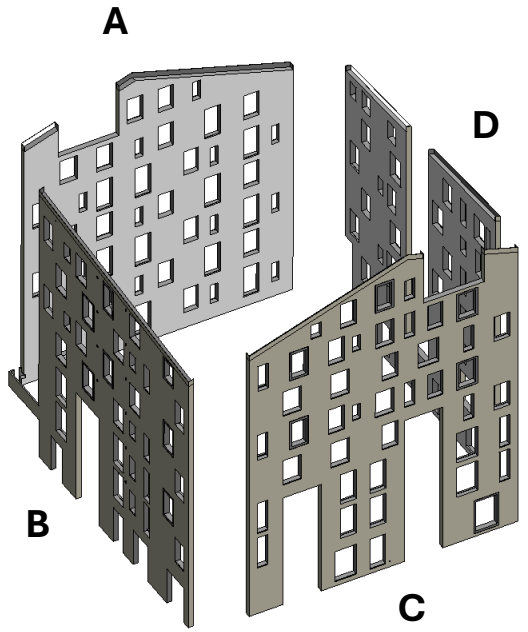
No. of Unique Panels after this step: 1



No. of Previous Unique Panels: 2



No. of Unique Panels after this step: 1



Total number of unique panels: **50**

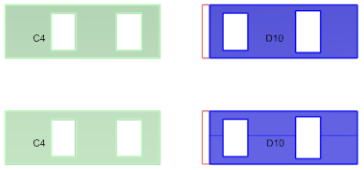
Saving: 3%

BISPEVIKA B6A

MINOR ARCHITECTURAL CHANGES

D

D



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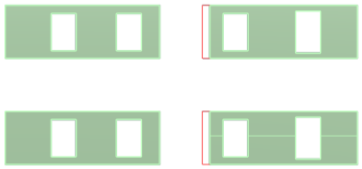
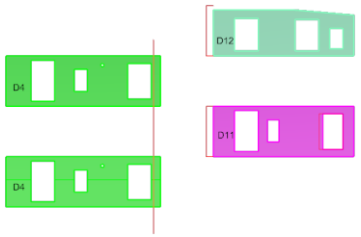
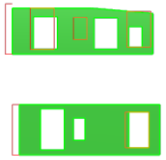


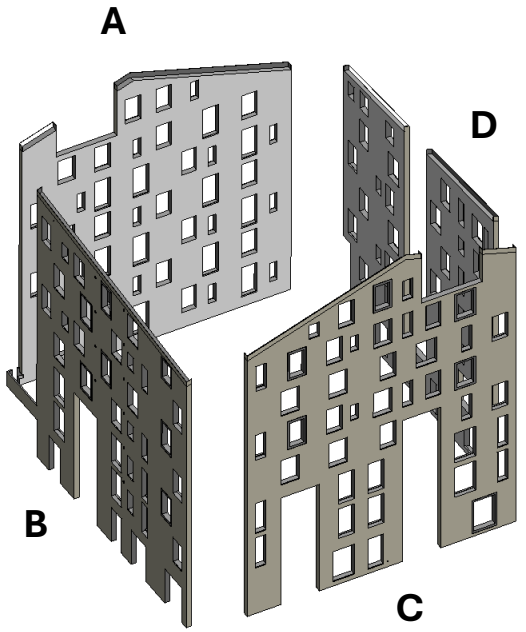
No. of Unique Panels after this step: 1



No. of Previous Unique Panels: 3



No. of Unique Panels after this step: 1



Total number of unique panels: **42**

Saving: 19%

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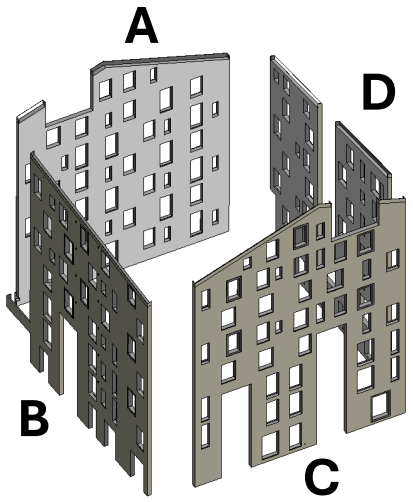
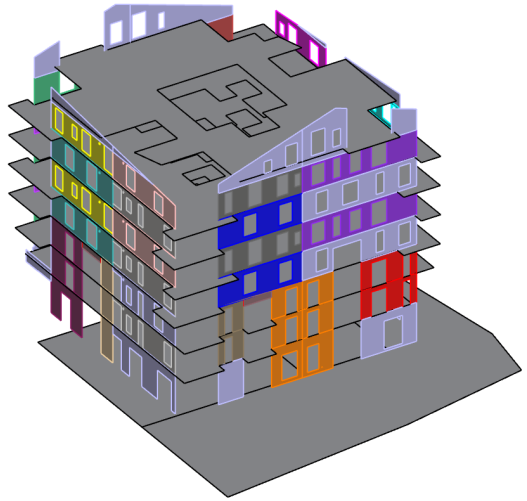
ORIGINAL STATE - NO CHANGE



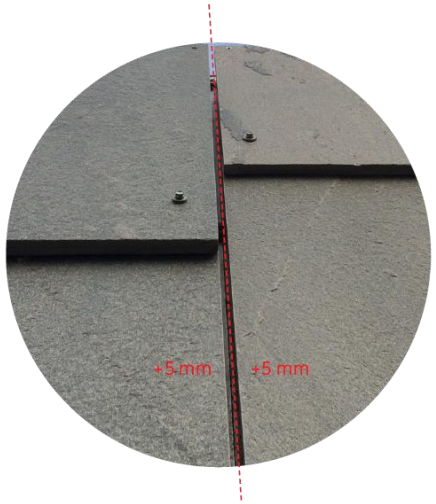


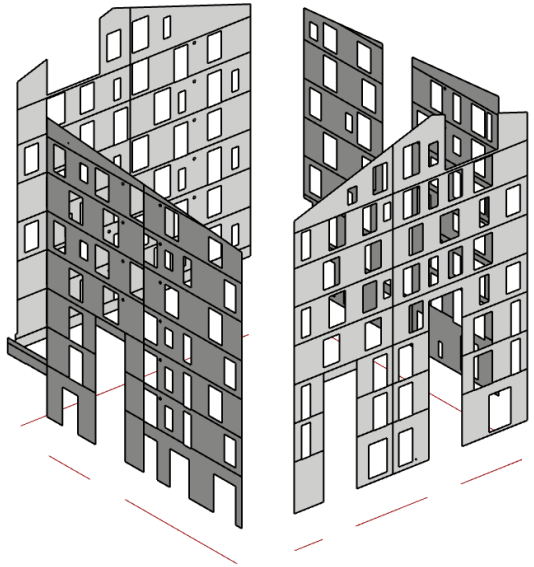
TOTAL NUMBER OF UNIQUE PANELS: **39** **Saving: 25%**

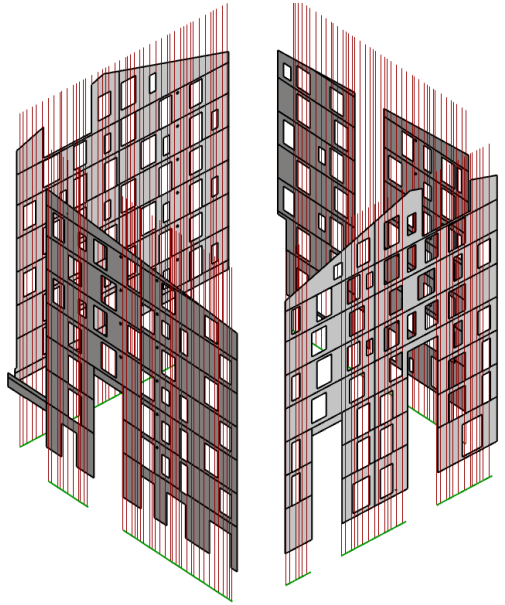
BISPEVIKA B6A

FAÇADE PANEL LAYOUT OPTIMIZATION

- Façade footprint defined considering all **openings and geometry**.
- Modular subdivision based on slate panel widths:
  200 / 300 / 400 / 500 / 600 mm.
- Slate **thickness: 15 mm**.
- Shifter module centered over **10 mm vertical joints** for seamless continuity.
- Minimum **100mm overlap**.
- Parametric script enables automatic population of each façade with randomized vertical axes. Intelligent grid generation for optimized substructure coordination.



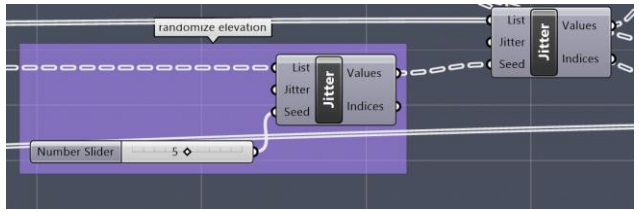


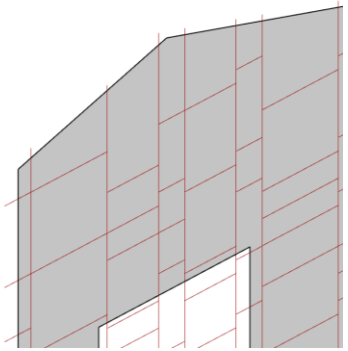


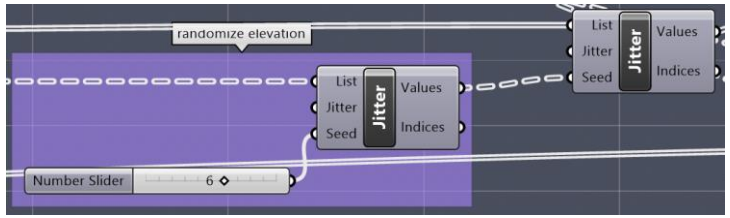
BISPEVIKA B6A

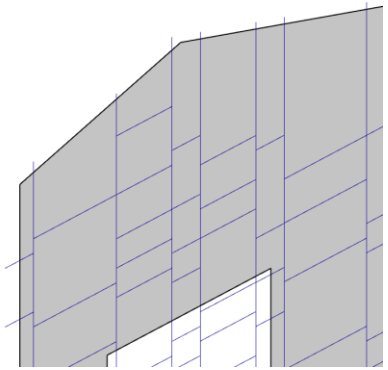
FAÇADE PANEL LAYOUT OPTIMIZATION

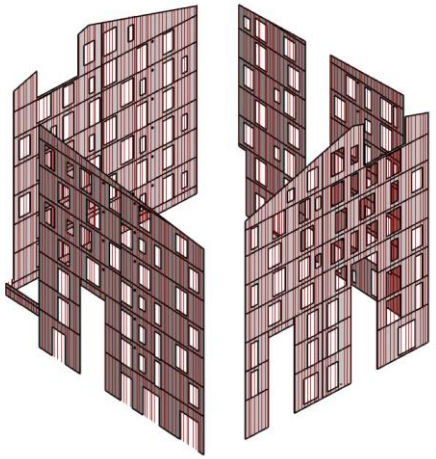
- A custom script randomly segments each steel axis, based on panel lengths and dimensions.
- Enables dynamic panel distribution while respecting material constraints.
- Architectural freedom preserved: panel layout can be reshuffled by modifying the random seed.

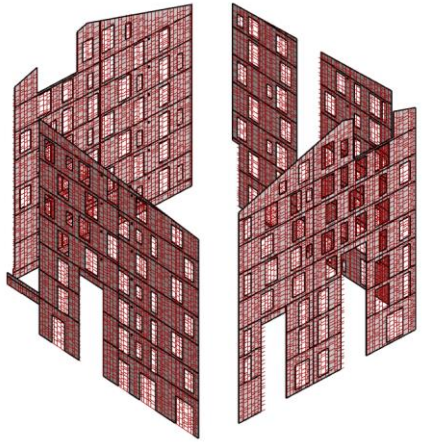




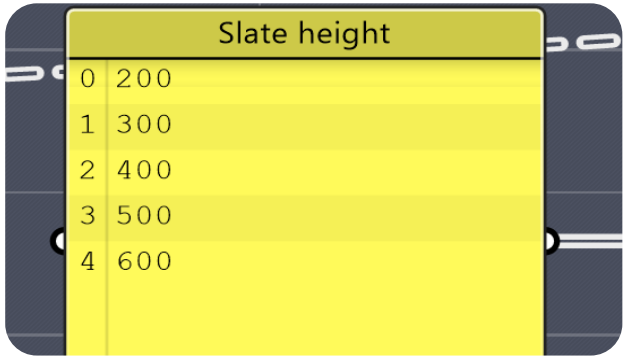






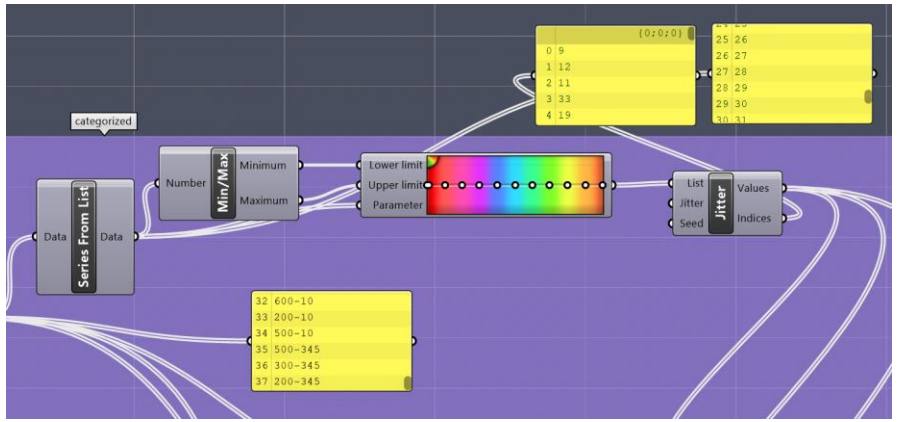


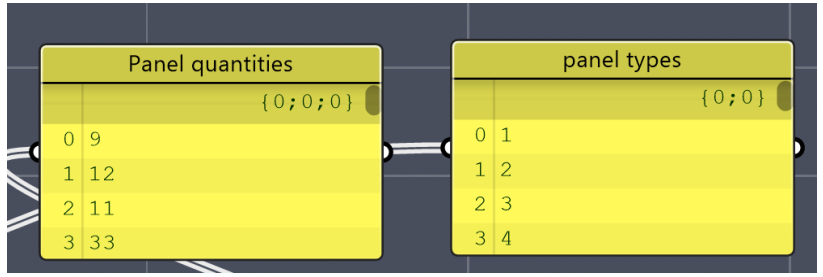
- The script allows architects to modify base panel dimensions based on supplier specifications.
- Panelisation adapts automatically, updating the layout with the new dimensions.
- Random positioning logic recalibrates to maintain variation and alignment.

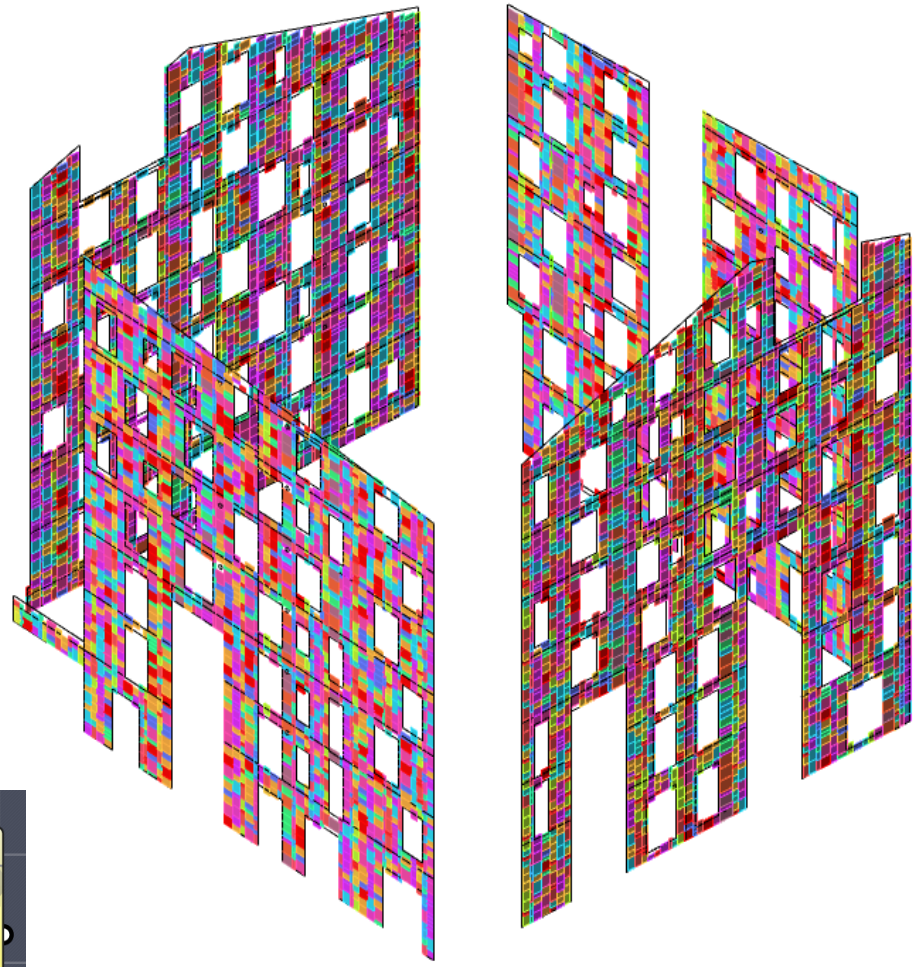


FAÇADE PANEL LAYOUT OPTIMIZATION

- Each panel is categorized by base dimensions (width × height).
- Combining width and height yields 38 unique panel types for this configuration.
- For each type, the system generates:
- Exact quantity
- Precise location on the façade
- Total panel count: 8,397







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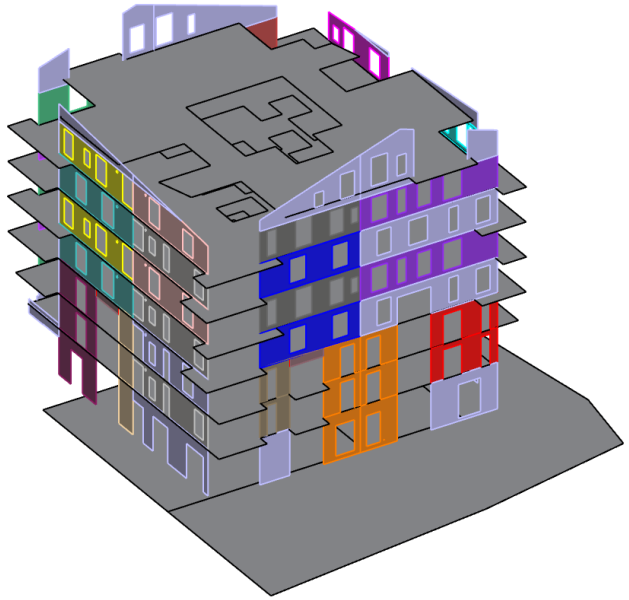
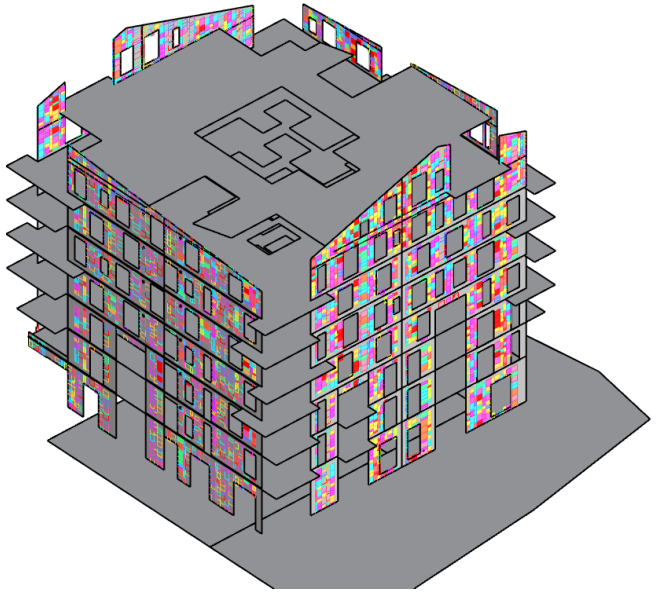
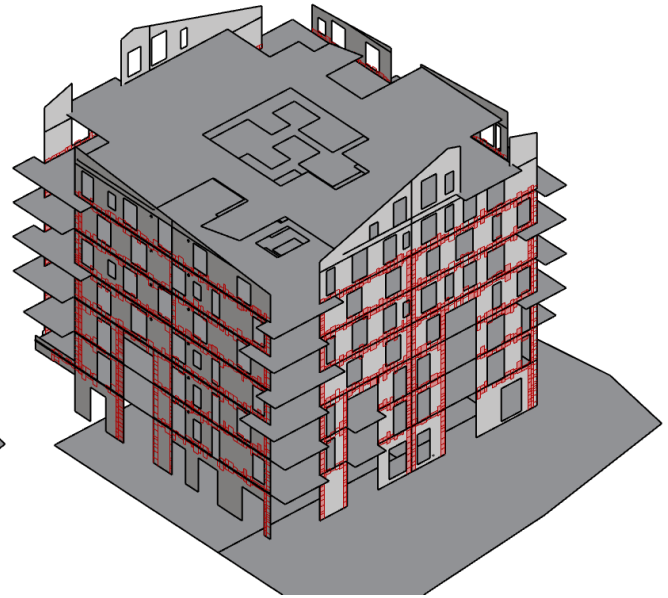
FAÇADE PANEL LAYOUT OPTIMIZATION

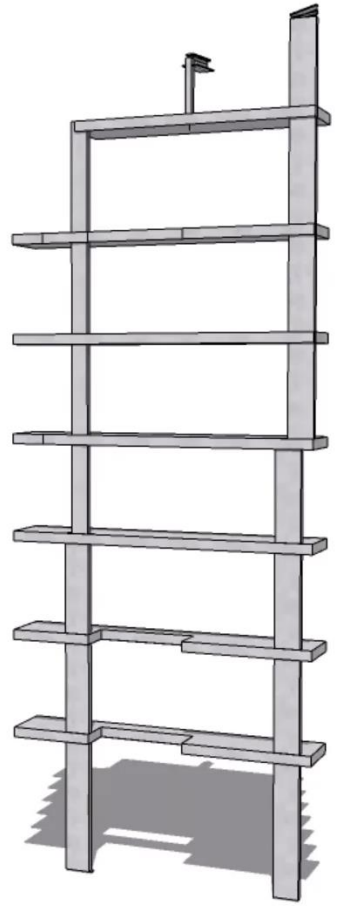
- To optimize fabrication, façade panels are pre-mounted during the timber panel production phase.
- This significantly reduces on-site assembly time and improves installation accuracy.
- A custom grouping system was developed to:

Associate each slate panel with its corresponding timber prefabricated unit.
Identify edge panels to be installed on site, at junctions between prefabricated blocks.









BISPEVIKA B6A

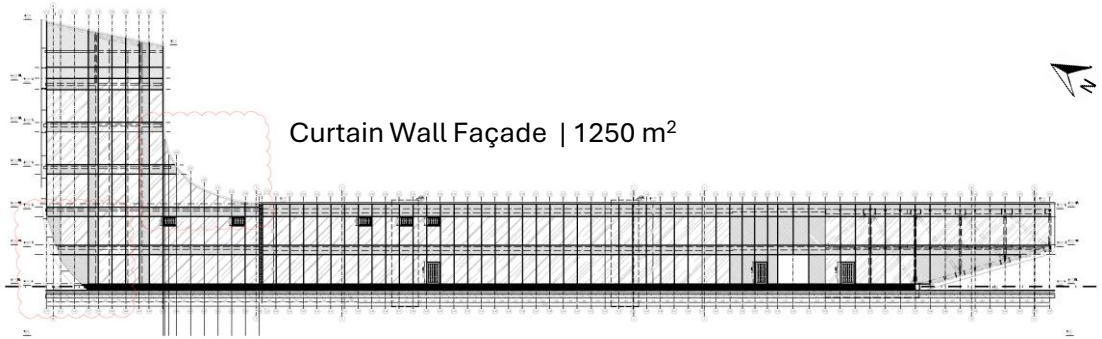
OSLO

DURST HEADQUARTER

BRIXEN

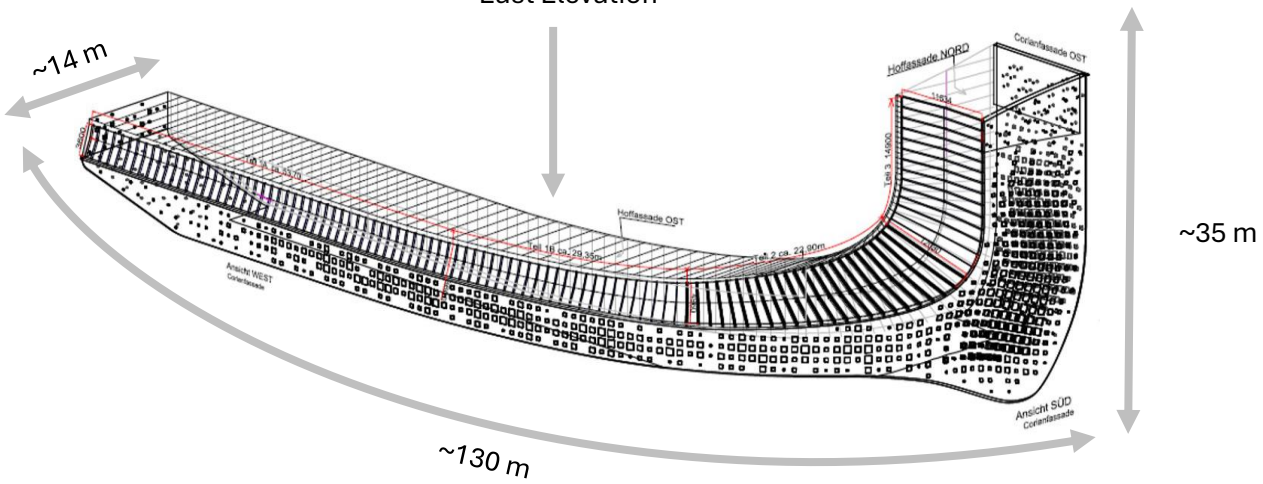
MAFFEIS engineering

DURST HEADQUARTER



Curtain Wall Façade | 1250 m²

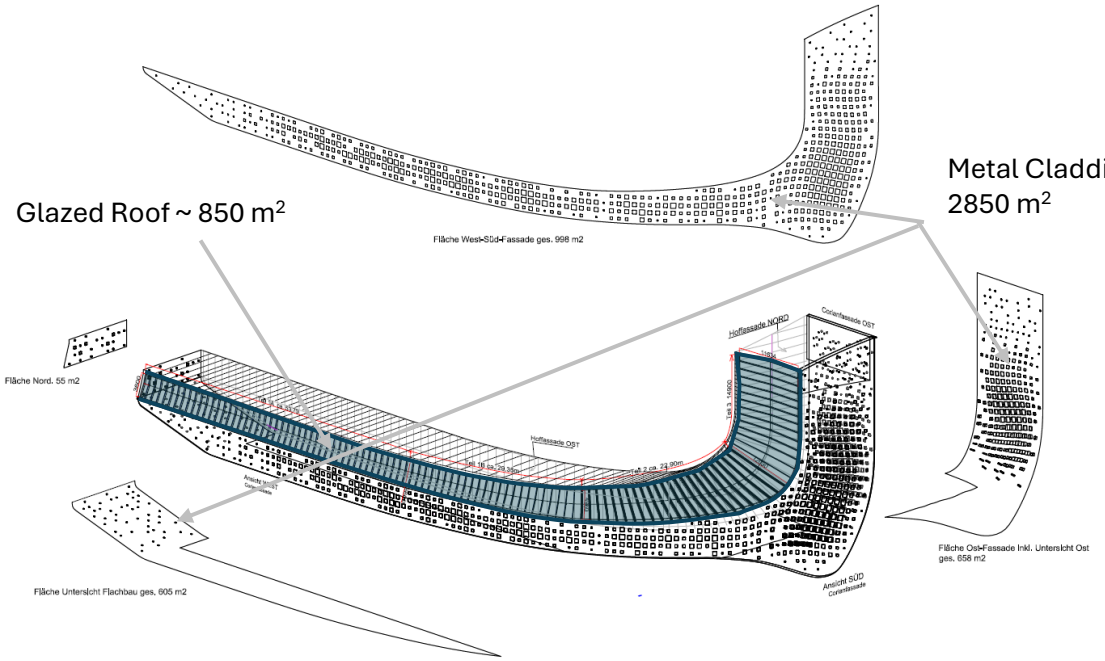
East Elevation



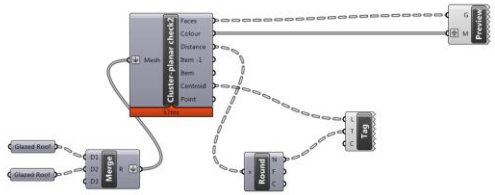
Steel Structure - Glazed Roof - CLT - Aluminum Façade

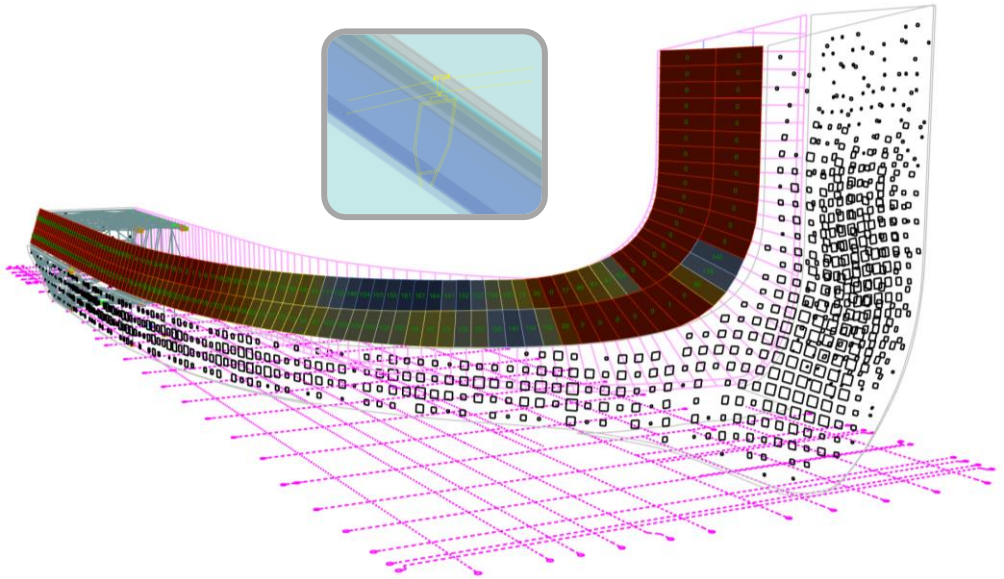
Glazed Roof ~ 850 m²

Metal Cladding
2850 m²

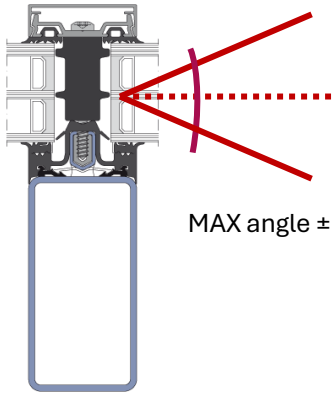


Preliminary Geometrical Analysis

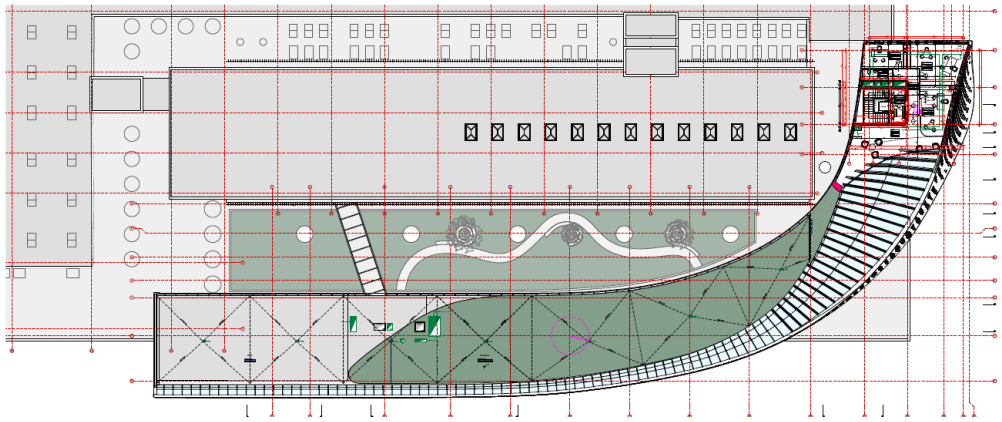




CURTAIN WALL FACADE SYSTEM FEASIBILITY



MAX angle ± 3.5°



DURST HEADQUARTER

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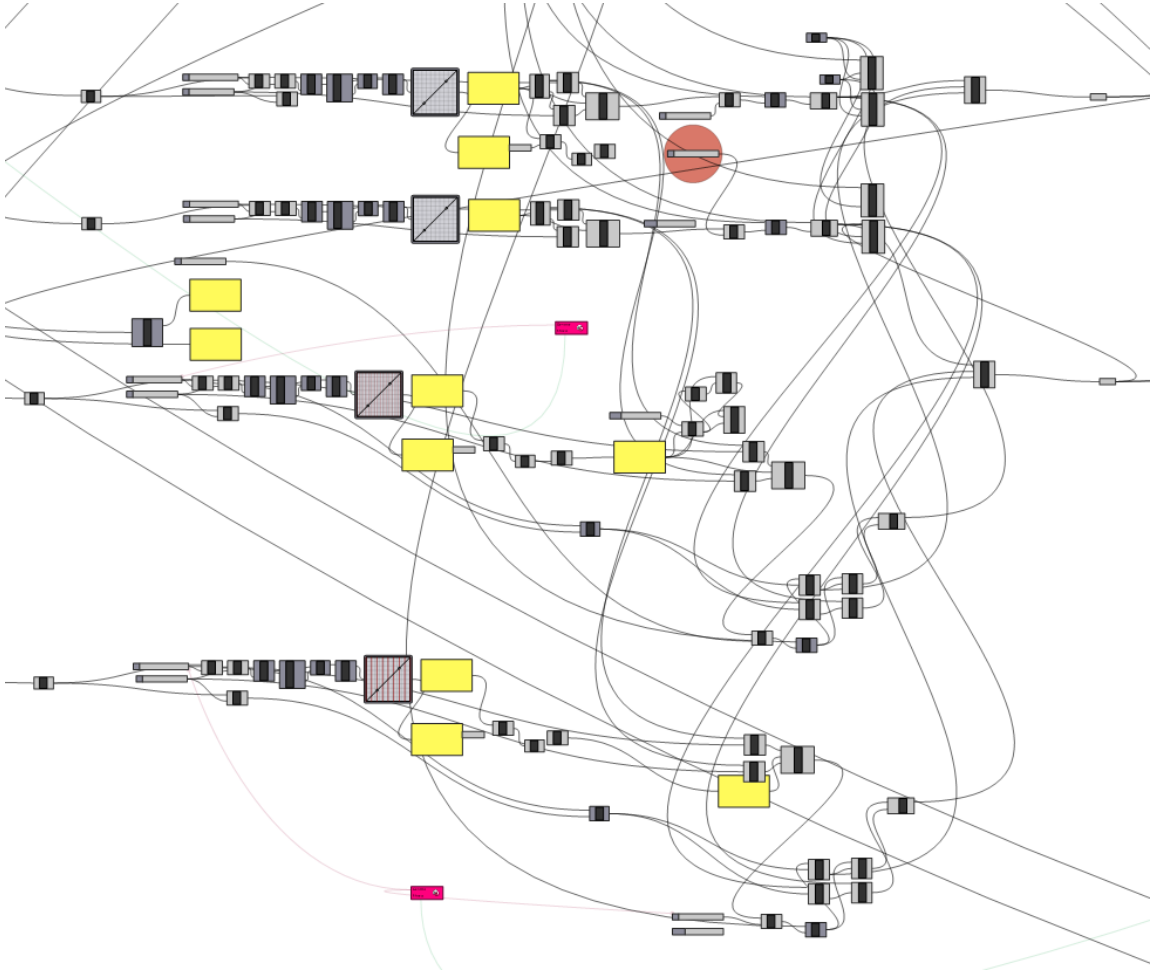
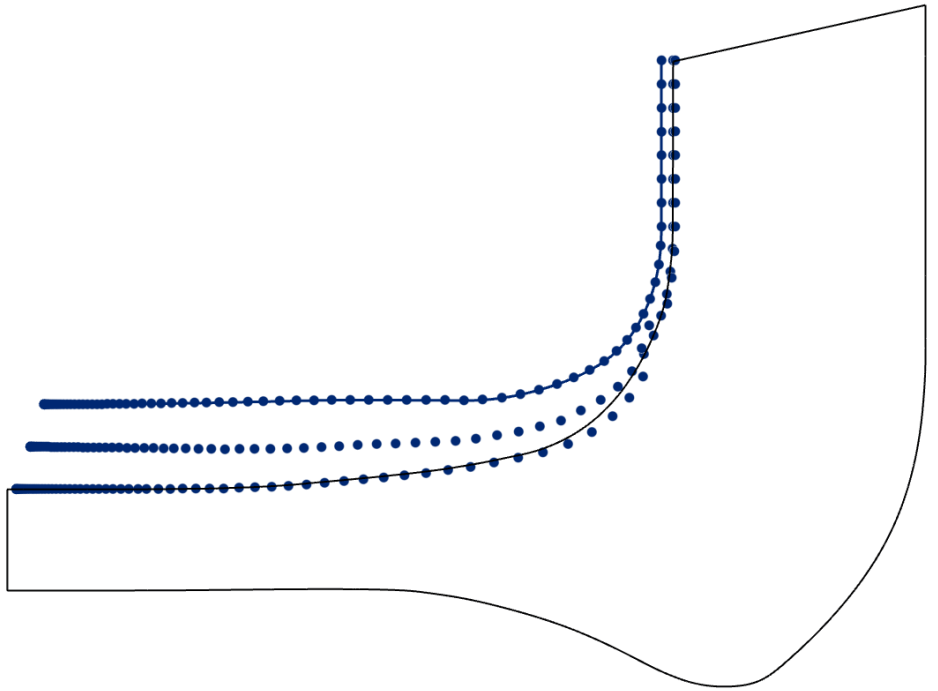
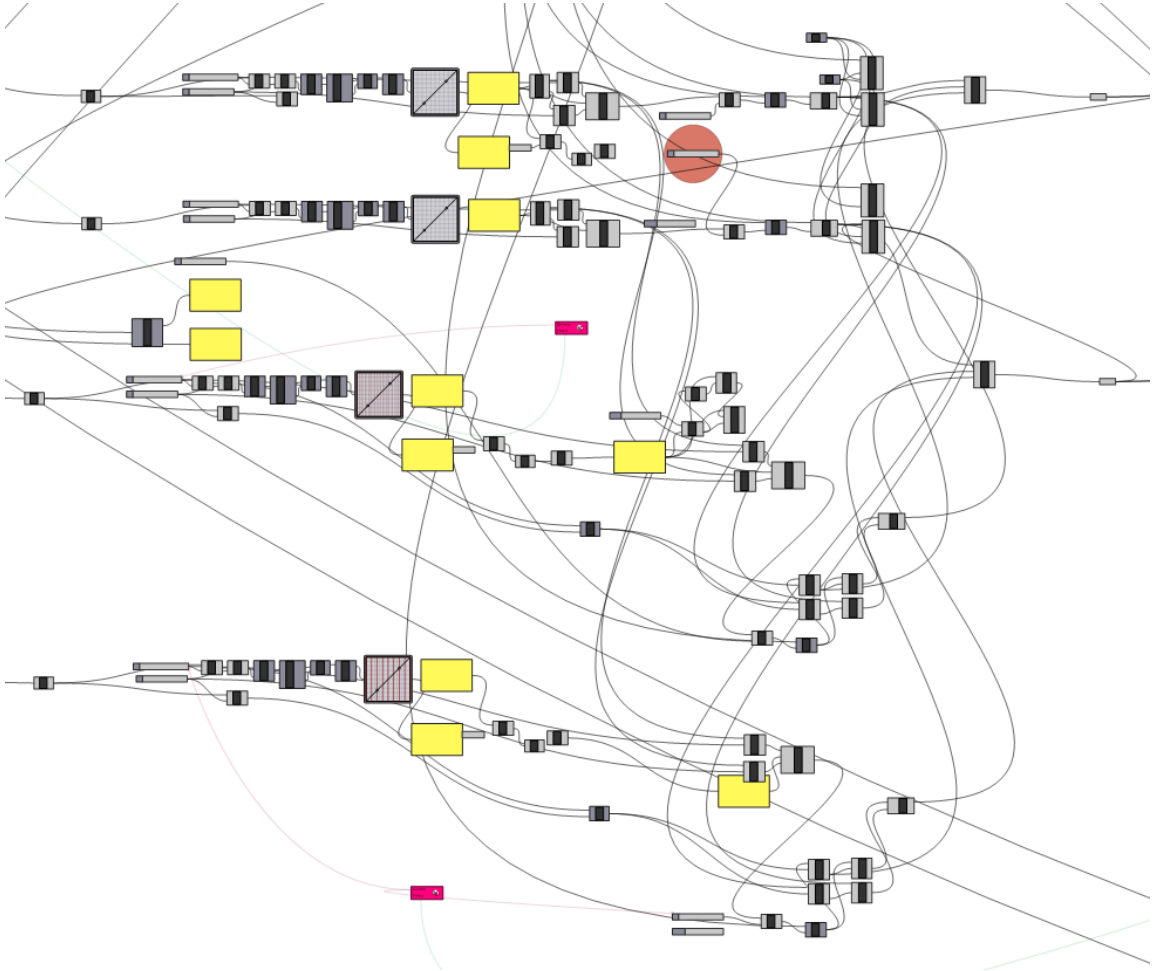


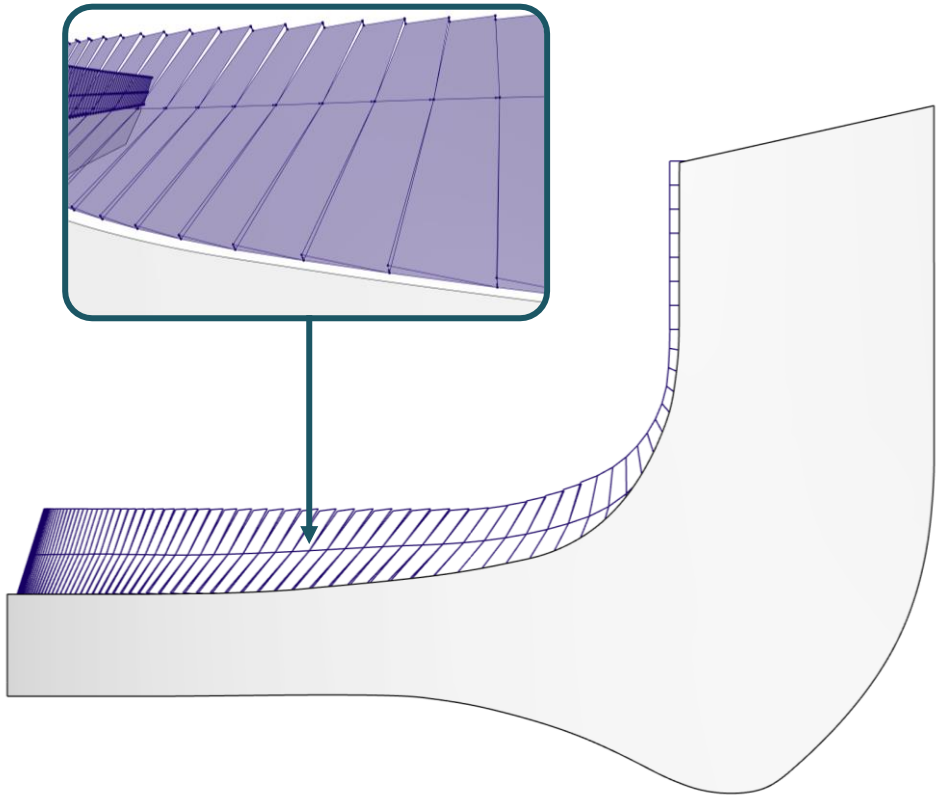
galapagos



DURST HEADQUARTER

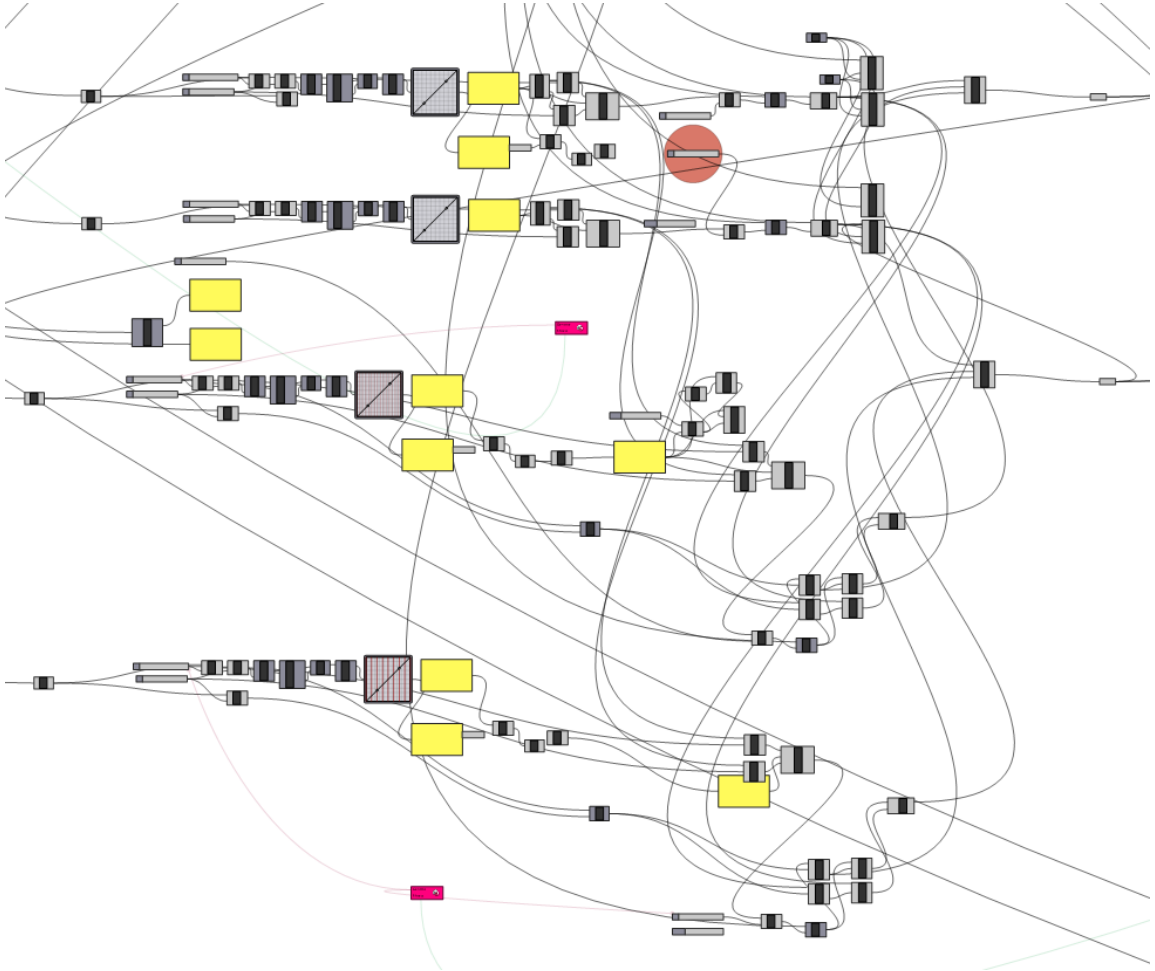
MAFFEIS engineering

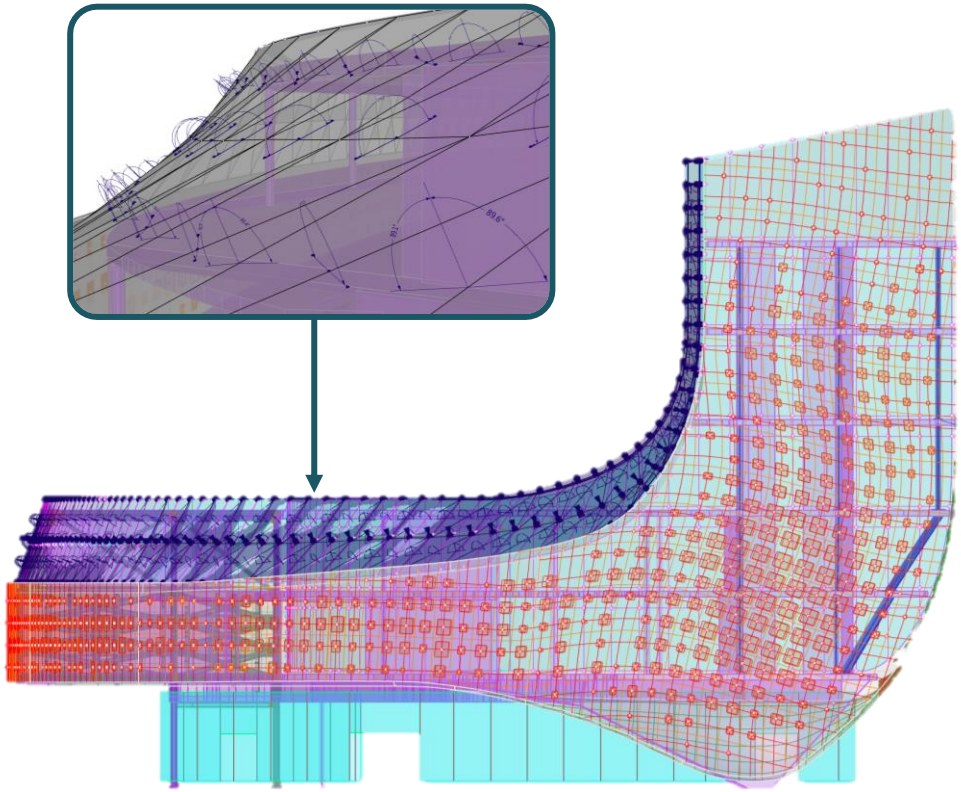




DURST HEADQUARTER

MAFFEIS engineering





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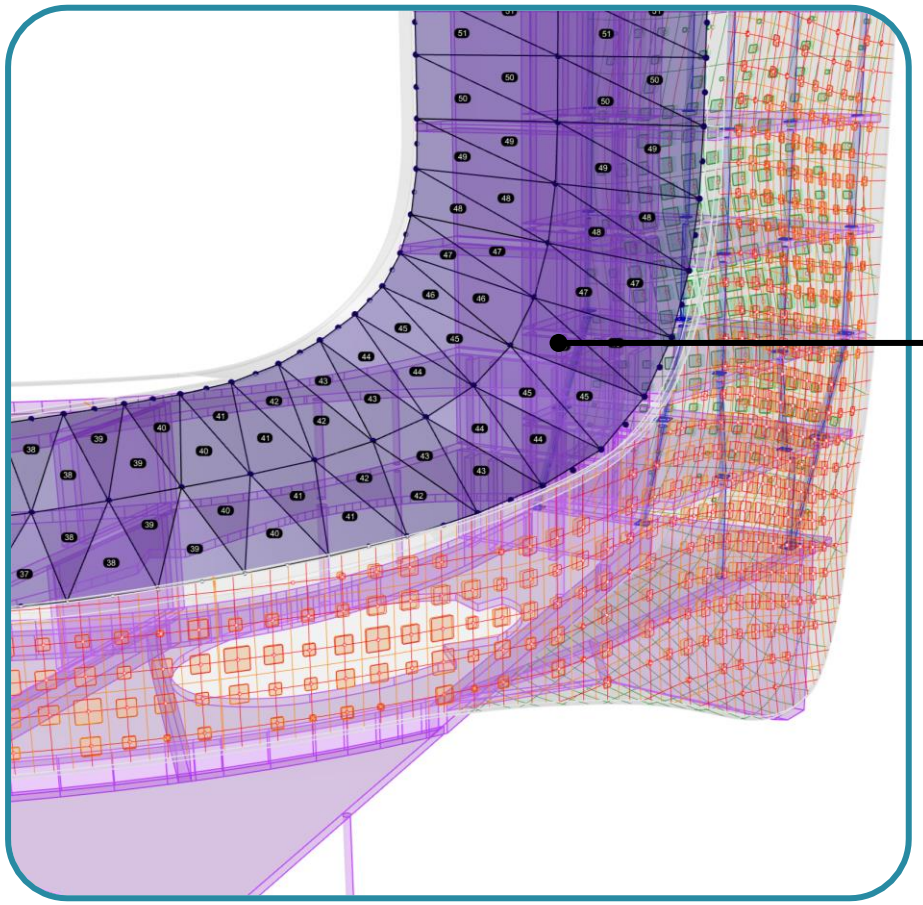
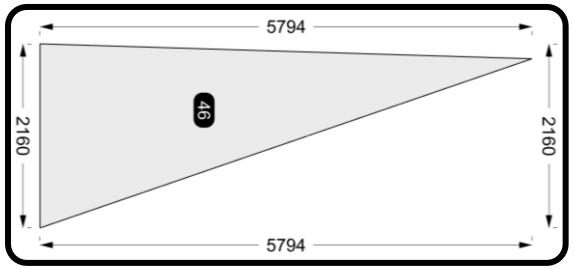
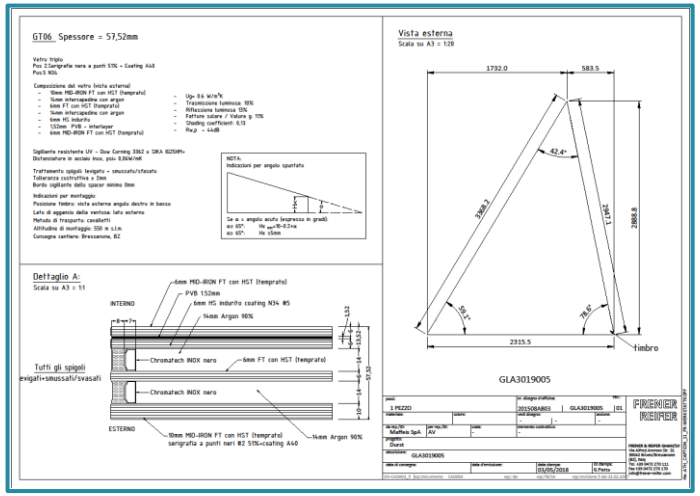
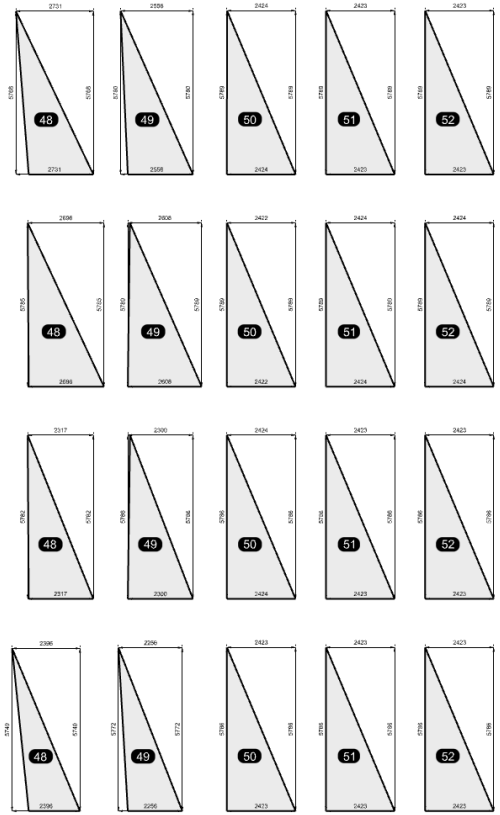


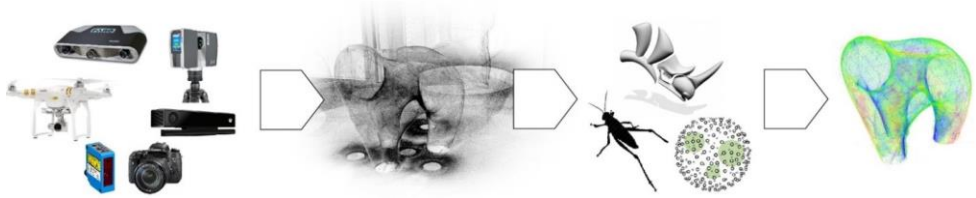


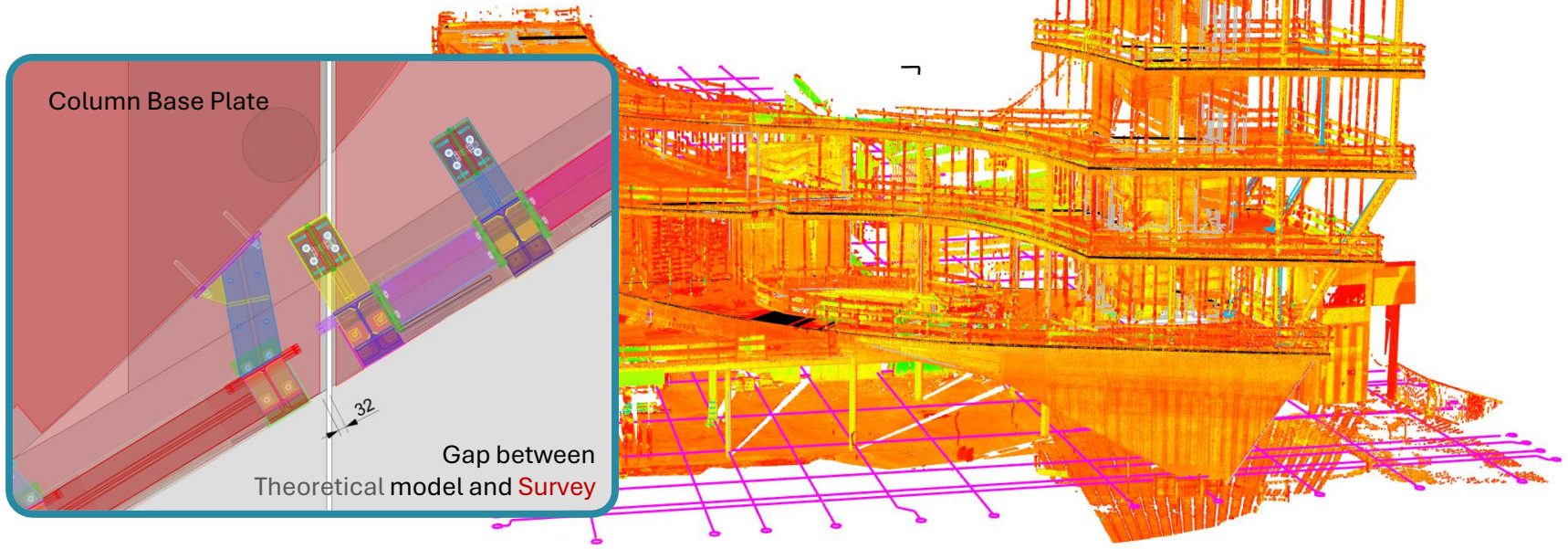
Shop Drawings





Concrete - Geometry Check from Cloud Point Survey [Volvox]

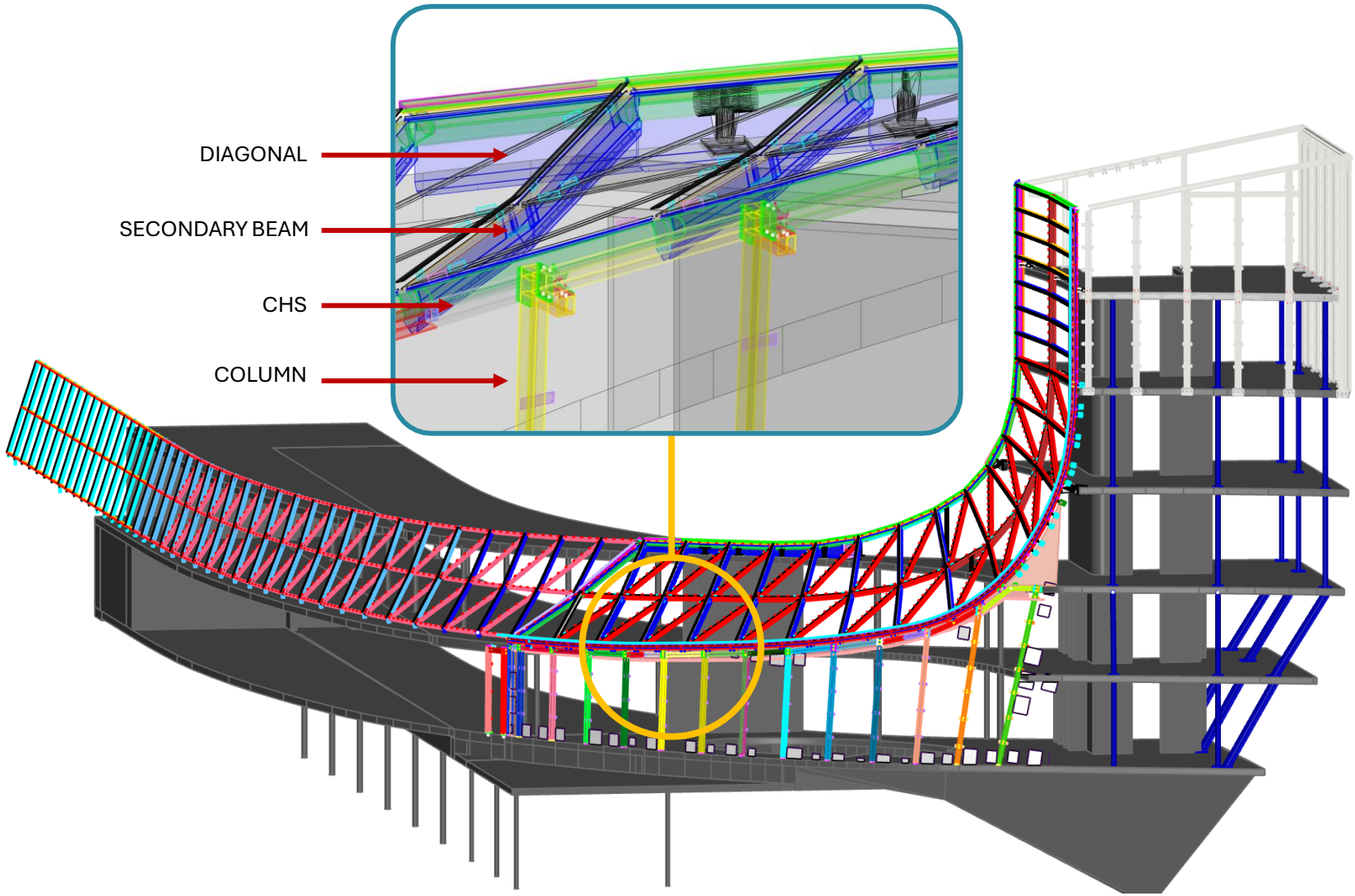




DURST HEADQUARTER

MAFFEIS engineering

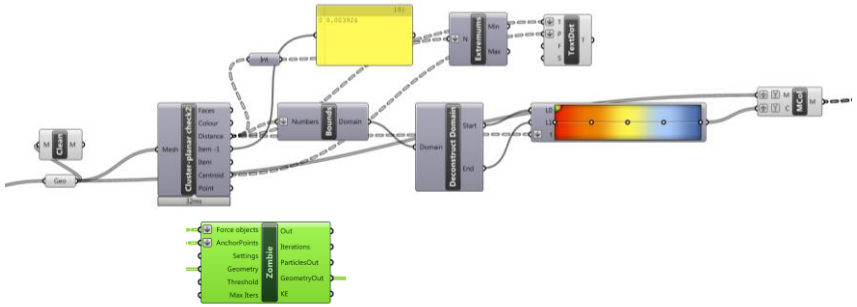
Steel Structure



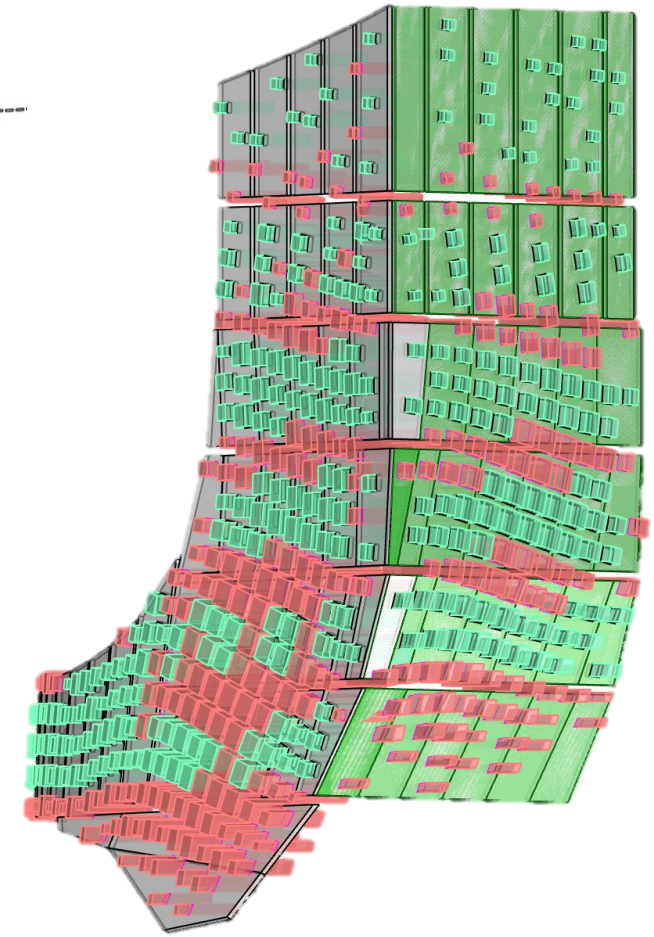
DURST HEADQUARTER

A facade using **X-Lam as a backing wall** has the lowest embodied carbon and could even be **carbon negative over its lifespan** considering sequestration.

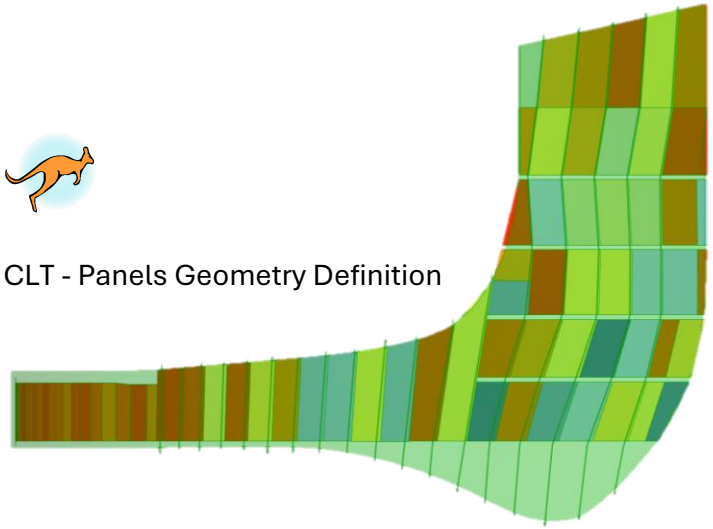
CLT - Out of Plane Optimization



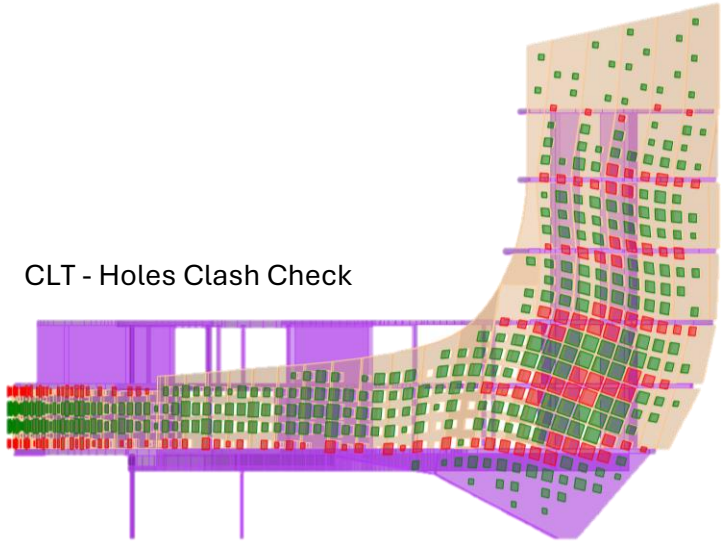
CLT - Holes Cutter Definition



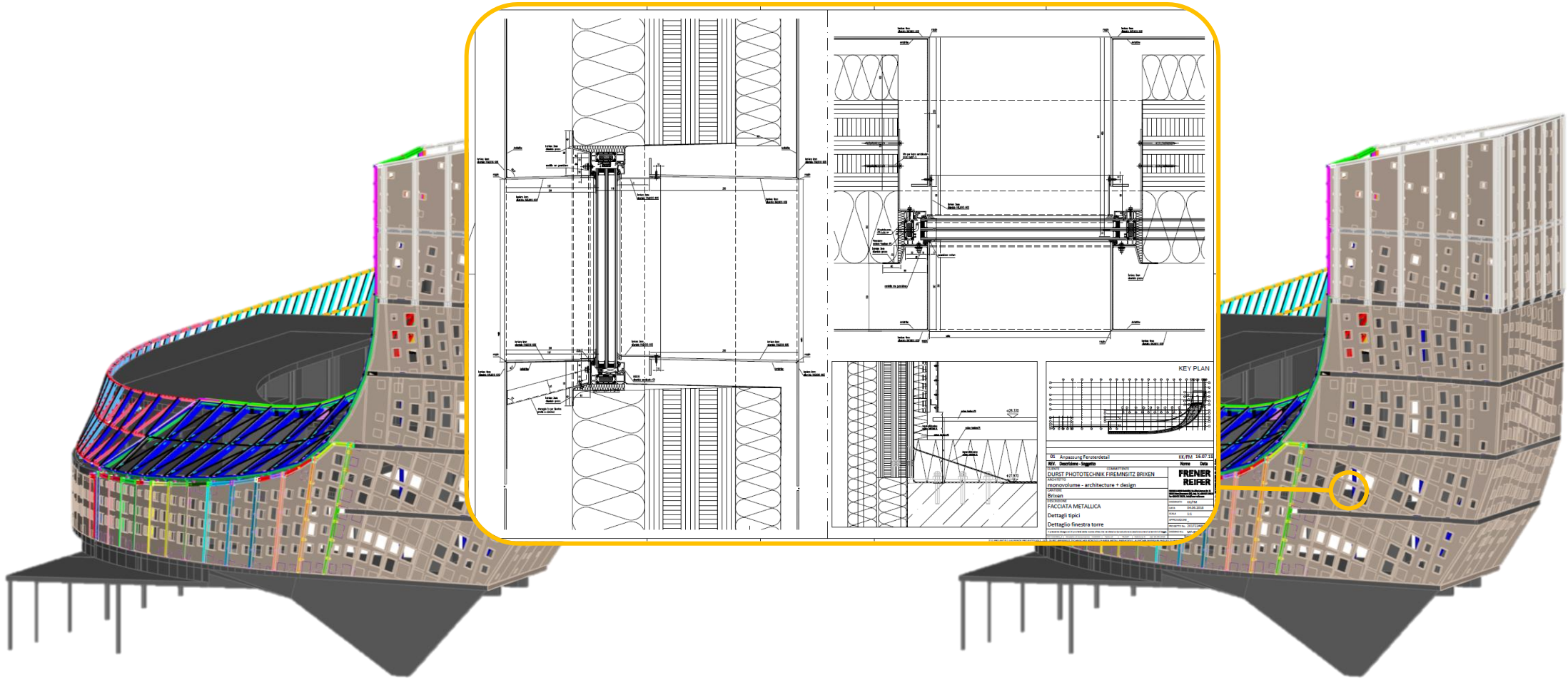
CLT - Panels Geometry Definition



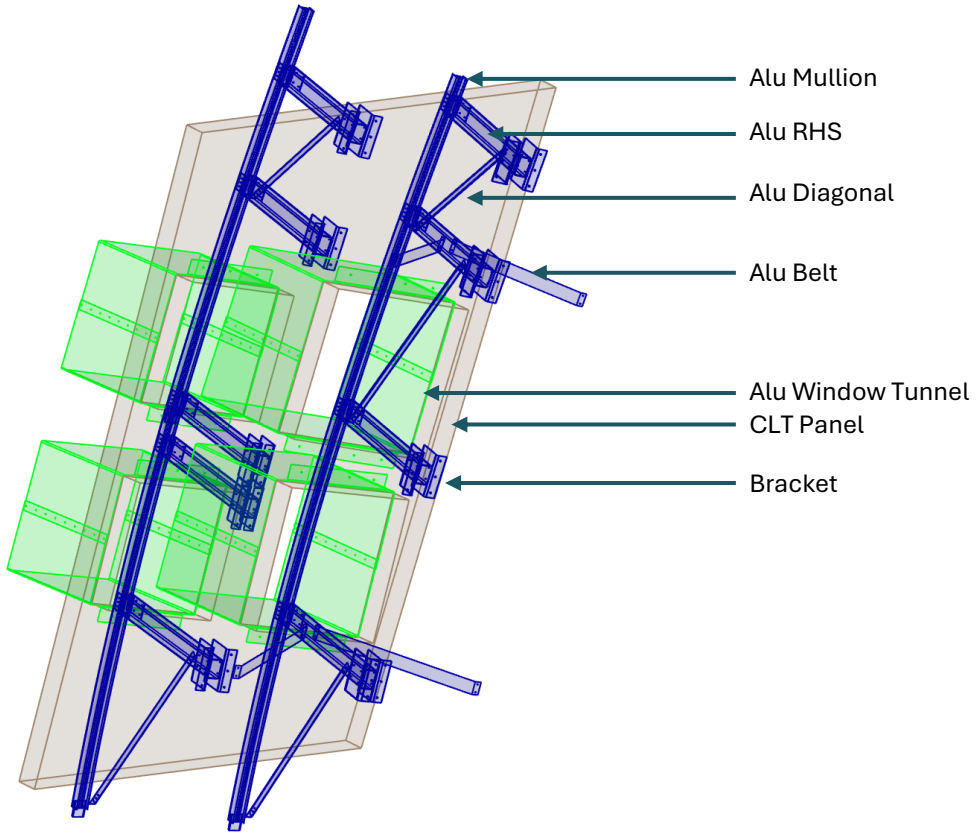
CLT - Holes Clash Check



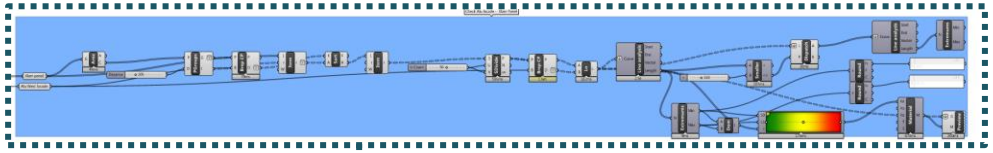
DURST HEADQUARTER

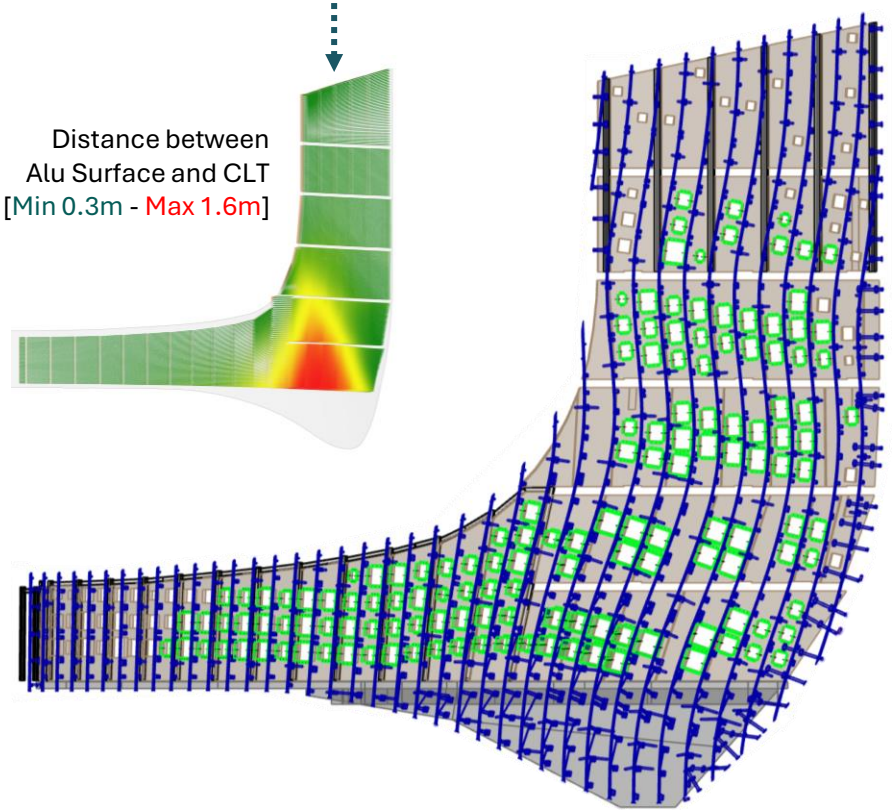


DURST HEADQUARTER



ALU Panels - Façade Substructure





DURST HEADQUARTER

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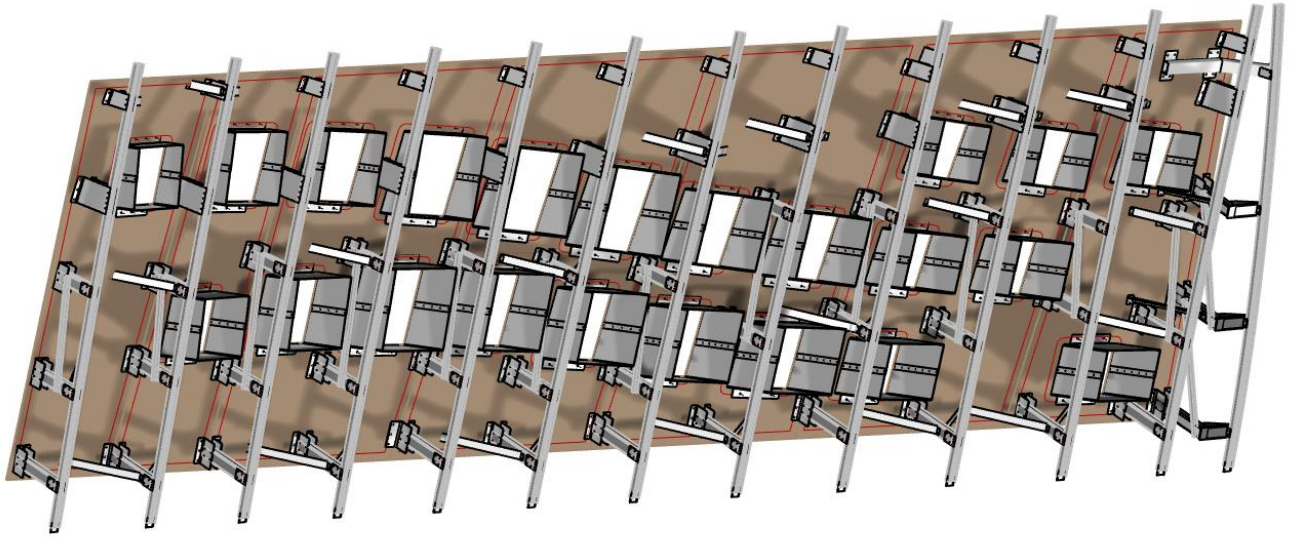
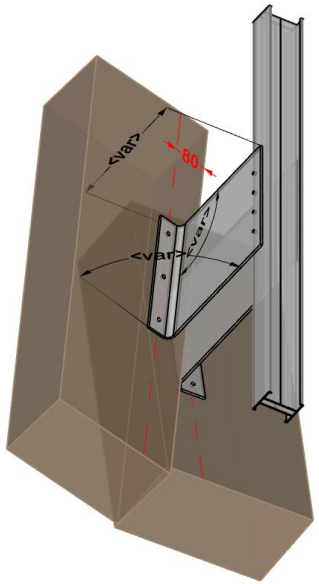
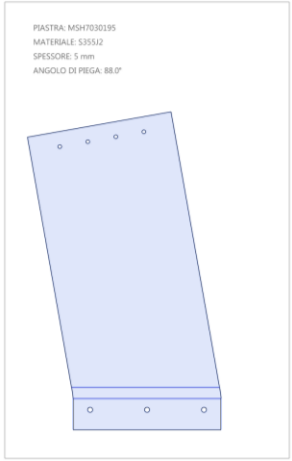
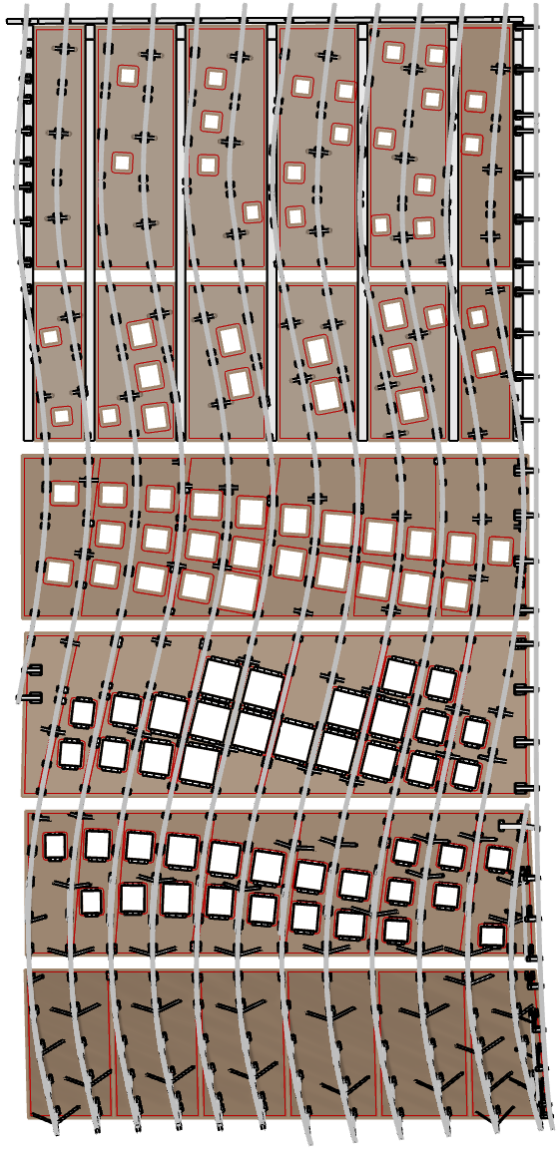
ALU Panels
Façade Substructure



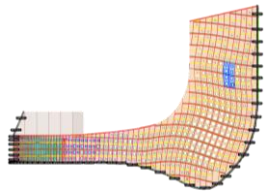


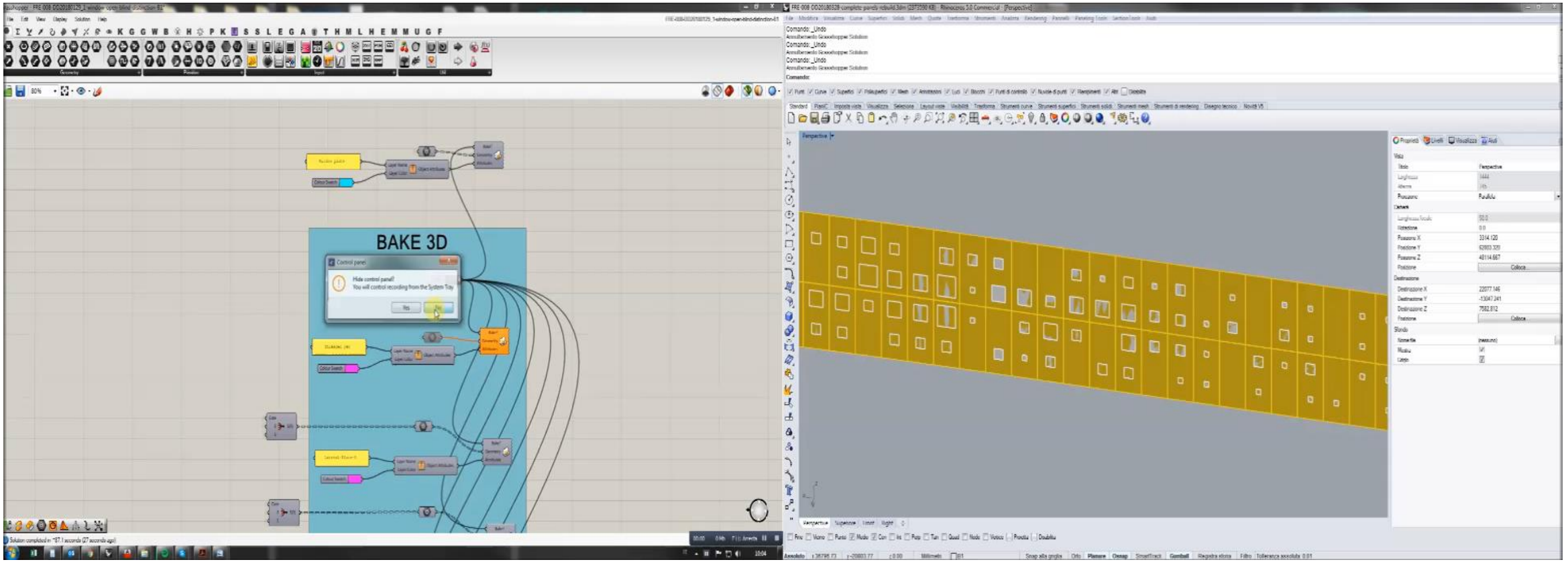




ALU Panels - Assemblies

AUTODESK® INVENTOR®



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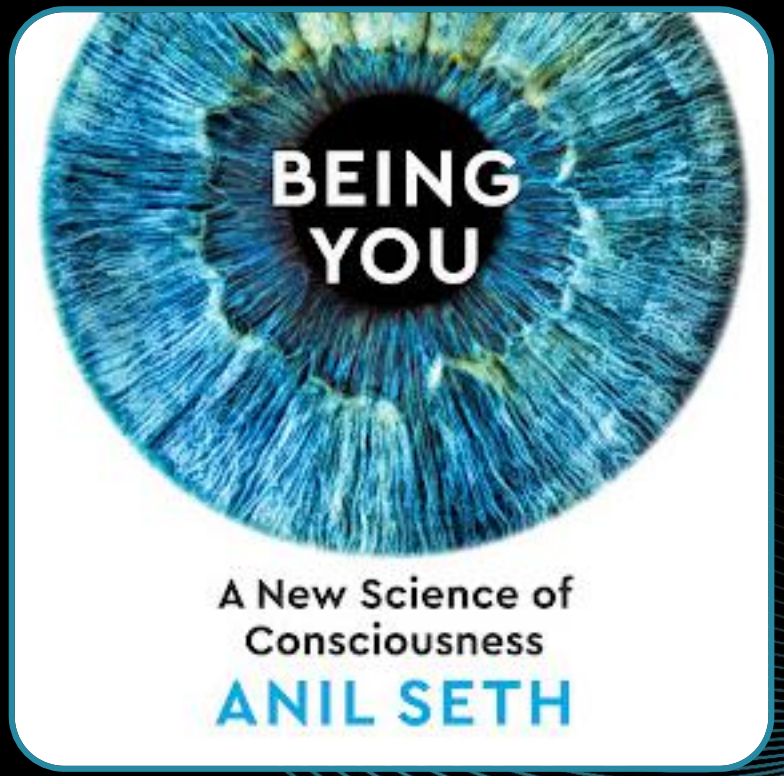
THINK DIFFERENTLY

MAFFEIS engineering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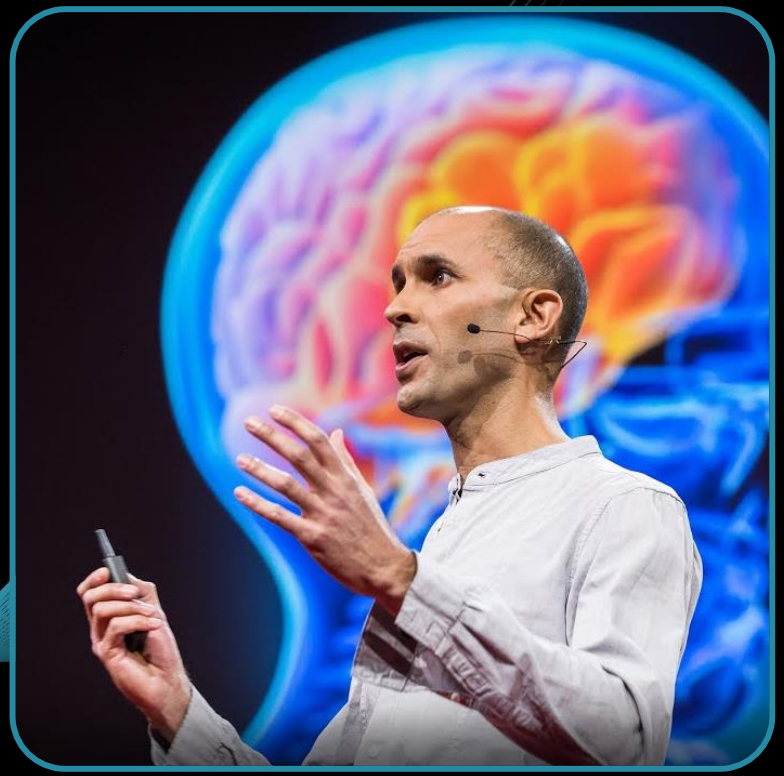
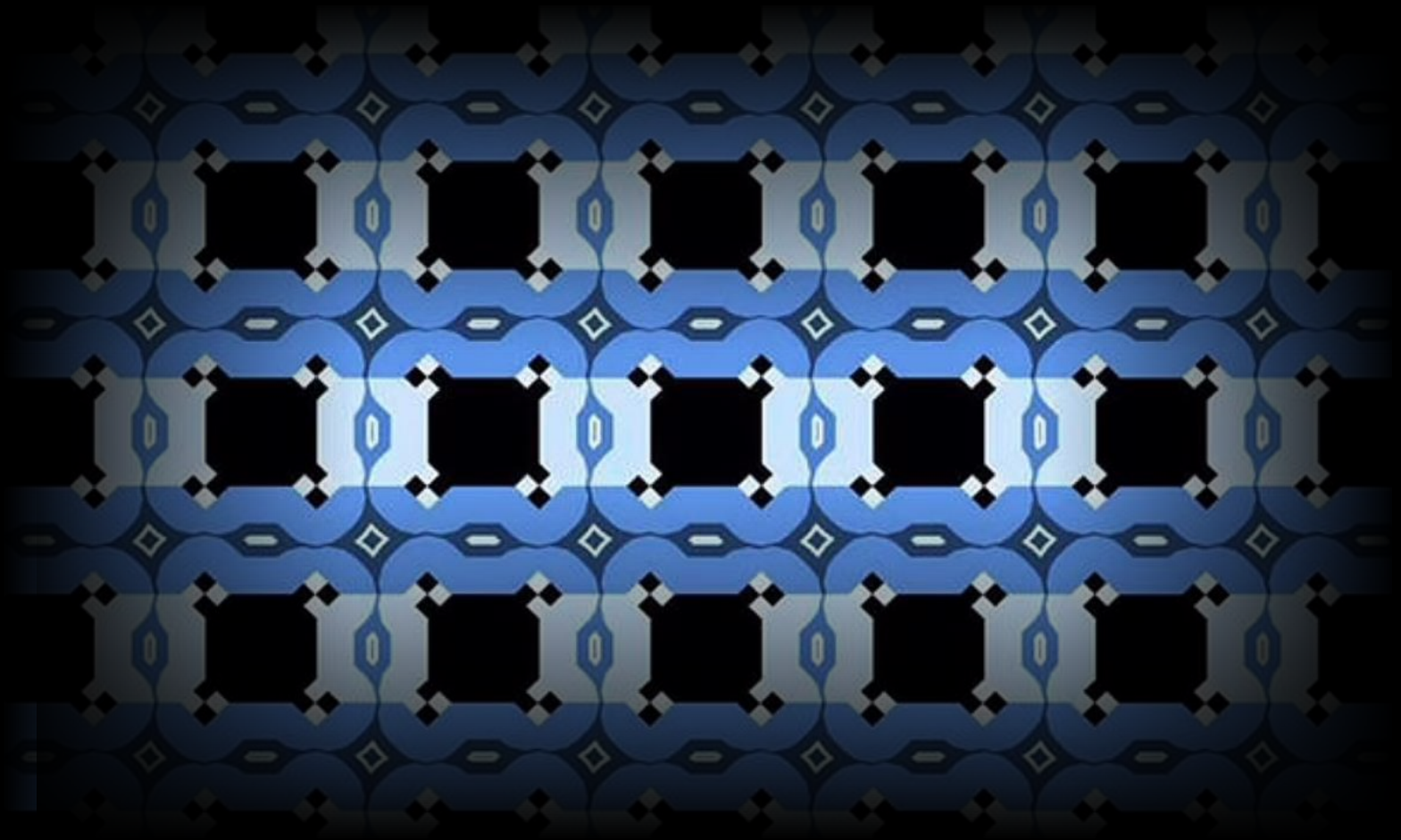




DATA DRIVEN PARAMETRIC OPTIONEERING DESIGN TOOL

Typology

Precast	Stick	Unitized

Window

Double Glazing	Triple Glazing

Input

Window Height

1200	1500	2000

Opaque Width

500	700

Window With

1000	1200	1500	2000

Output

U Value Total Facade (W/m2*K)

0.455	0.456	0.458	0.460

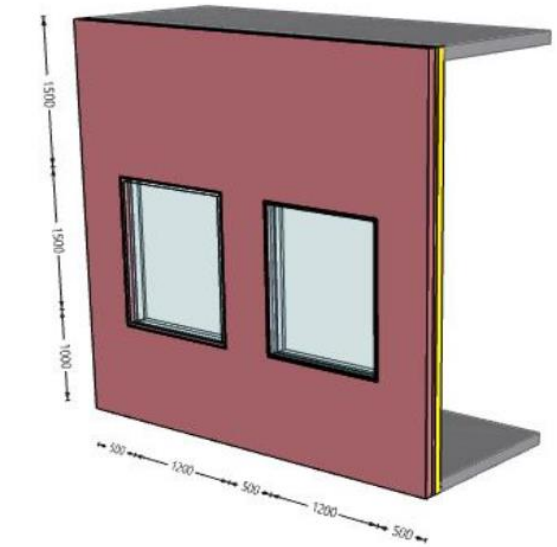
EUI (kWh/m2/year)

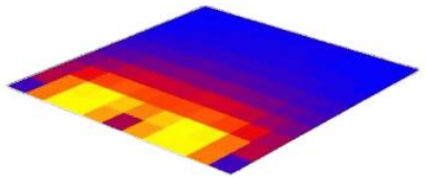
139.97	140.30	140.84	141.17

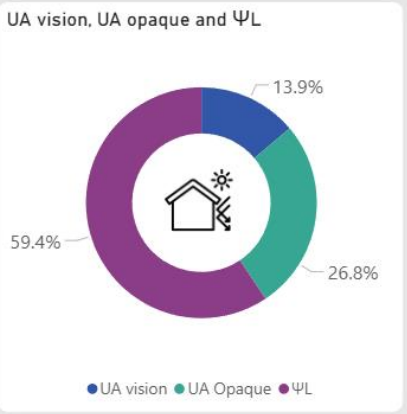
MDF %

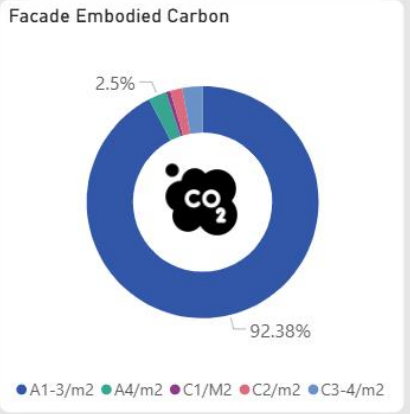
1.38	1.39	1.39	1.40	1.41

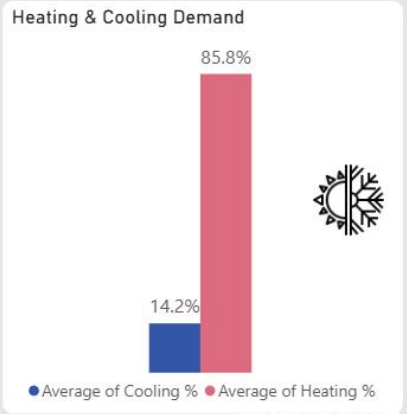
159.24	2.38	0.629	151.61	0.23
Avg of EUI (kWh/m2/Year)	Avg of MDF	Avg of Total Facade U-Value...	Avg of Total Facade Embodied...	Avg of WWR











Typology

Precast | Stick | Unitized

Window

Double Glazing | Triple Glazing

Input

Window Height

1200 | 1500 | 2000

Opaque Width

500 | 700

Window With

1000 | 1200 | 1500 | 2000

Output

U Value Total Facade (W/m2*K)

0.455	0.456	0.458	0.460

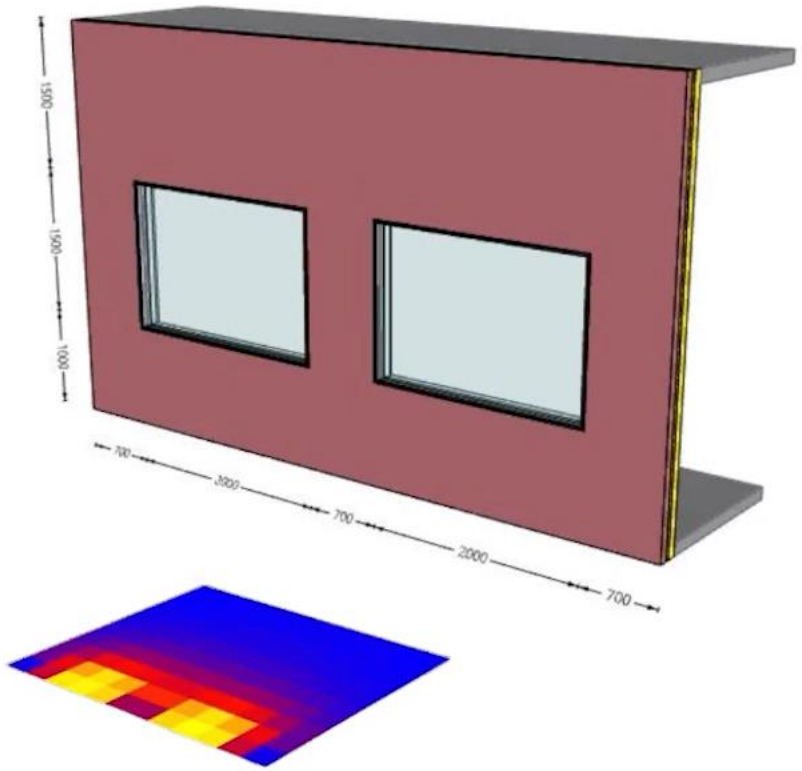
EUI (kWh/m2/year)

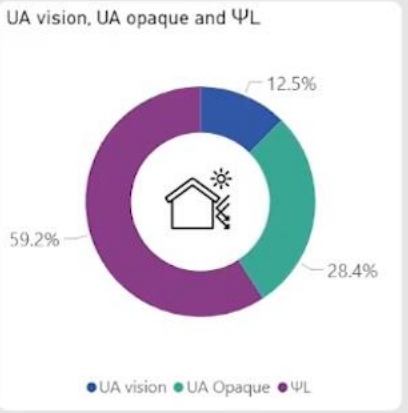
139.97	140.30	140.84	141.17

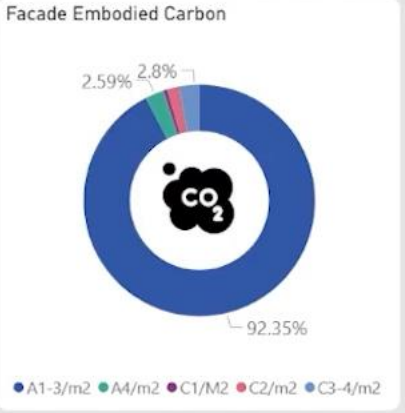
MDF %

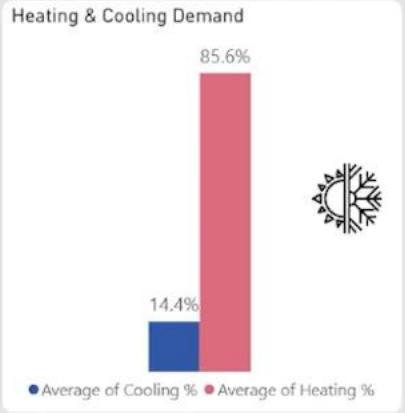
1.39	1.39	1.53	1.58	1.61

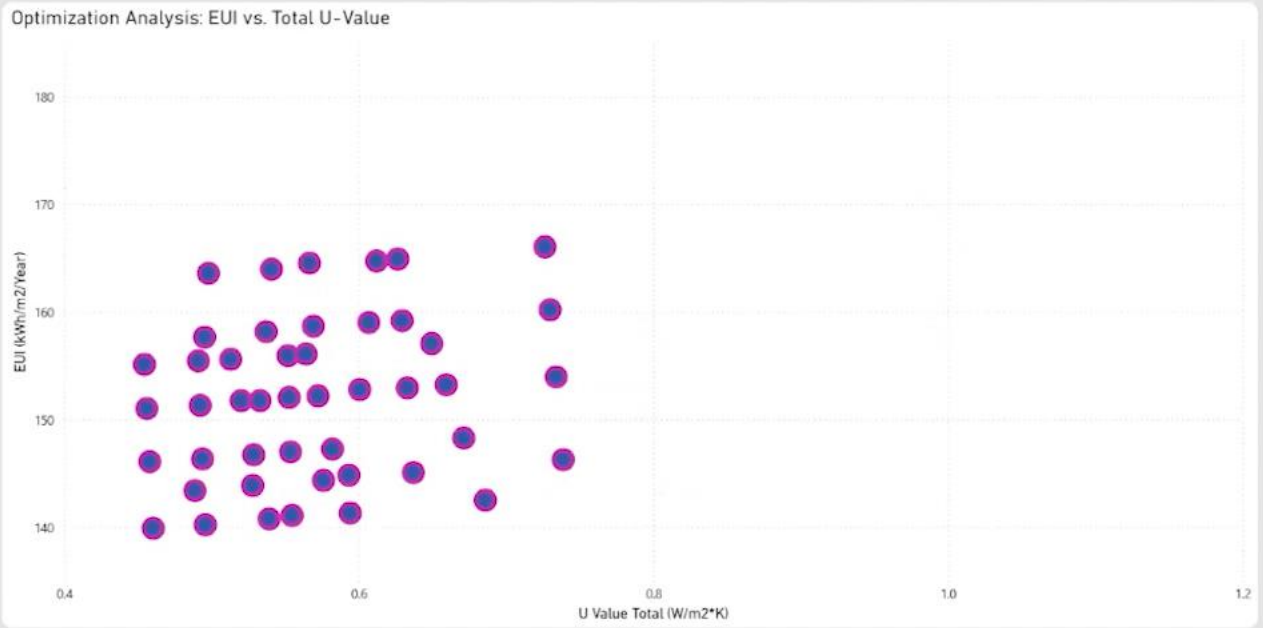
152.02	2.68	0.572	151.74	0.24
Avg of EUI (kWh/m2/Year)	Avg of MDF	Avg of Total Facade U-Value...	Avg of Total Facade Embodied...	Avg of WWR

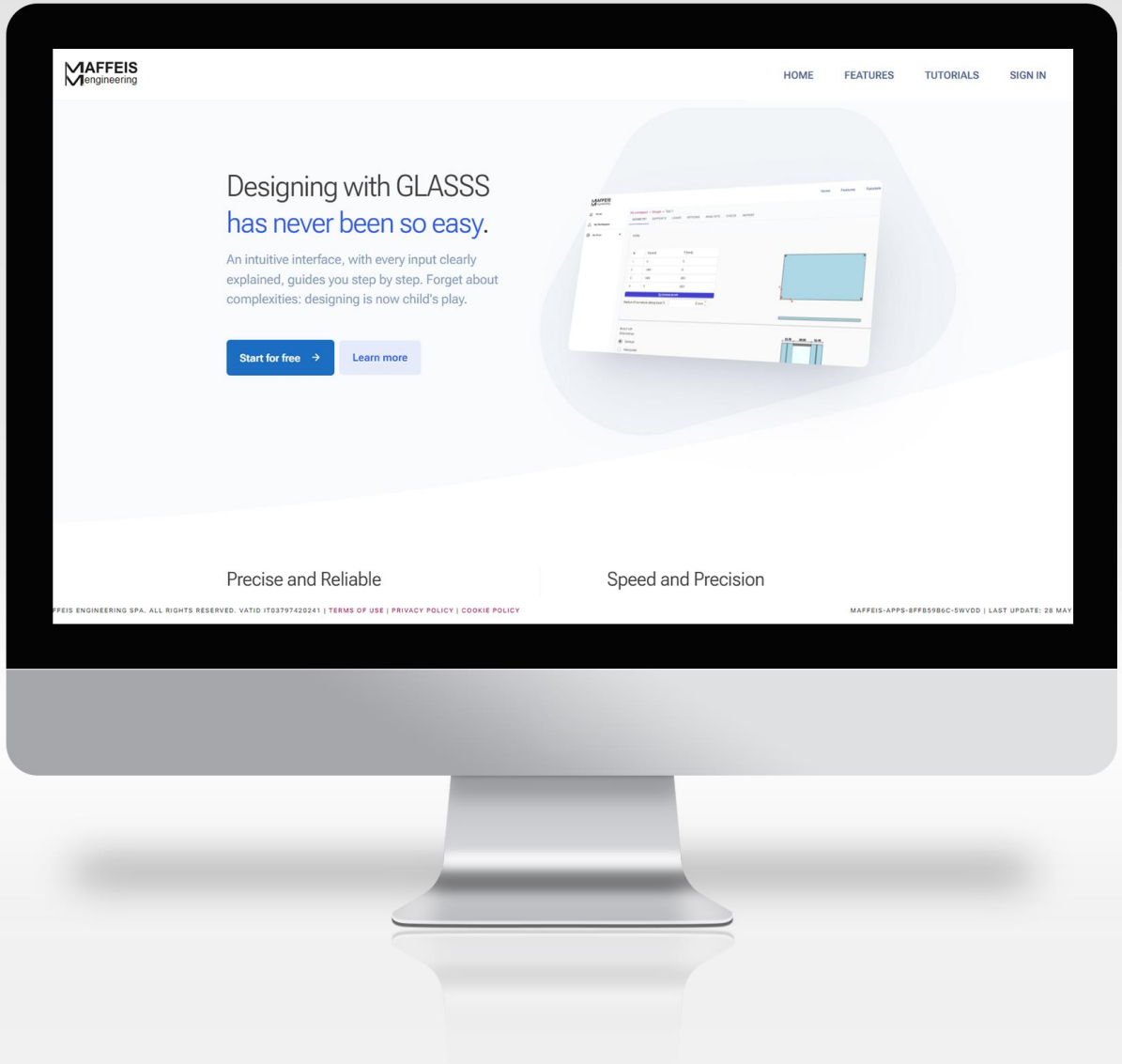












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01

IT'S FREE

We want everyone to experience the power of an intelligent system without financial barriers

02

IT'S POWERFUL

It leverages the full power of Grasshopper, expanding its capabilities with a smarter, more responsive, more intuitive interface

03

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our work with you

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