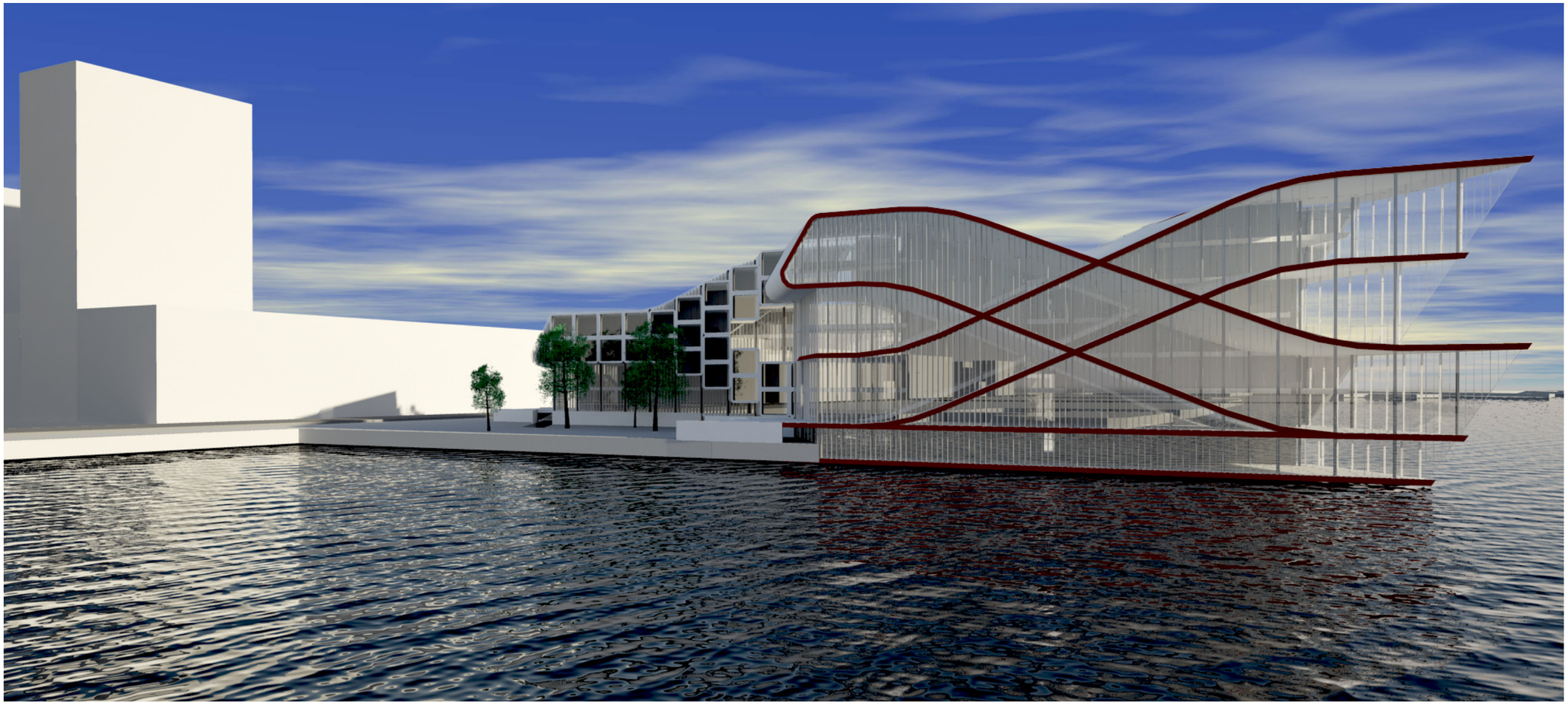
Composite - Hotel Design



P5-presentatie, Lex Oosterom

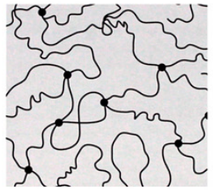
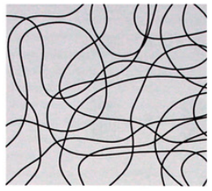
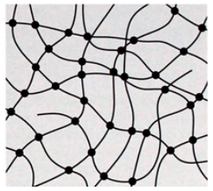
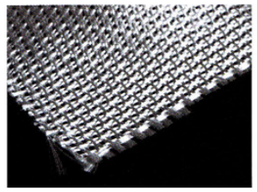
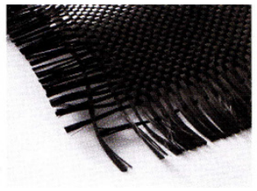
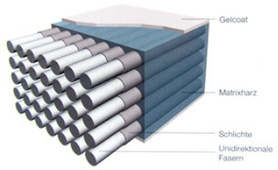
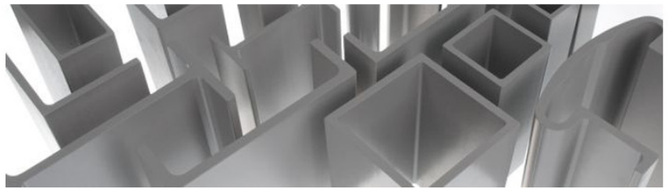
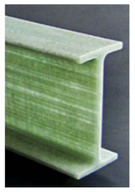
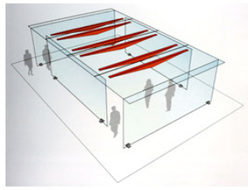
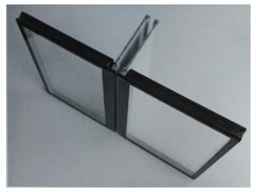
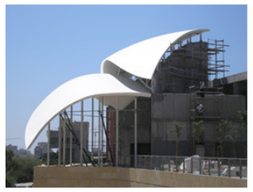
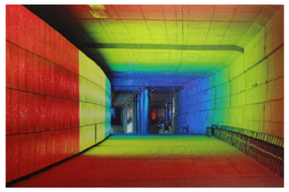
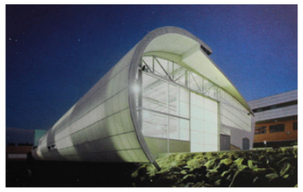
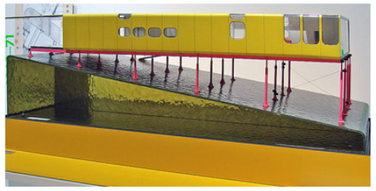
Dual Graduation

Architectural Engineering
Building Technology

vrijdag 9 november, 2012

A-docent: Jan Engels
E-docent: Tillmann Klein

Composiet als Uitgangspunt

Material	      
Semi Finnished product	  
Sub-component	    
Component	  
Building Part	      
Building	   

Part A: Uitgangspunt / Concept

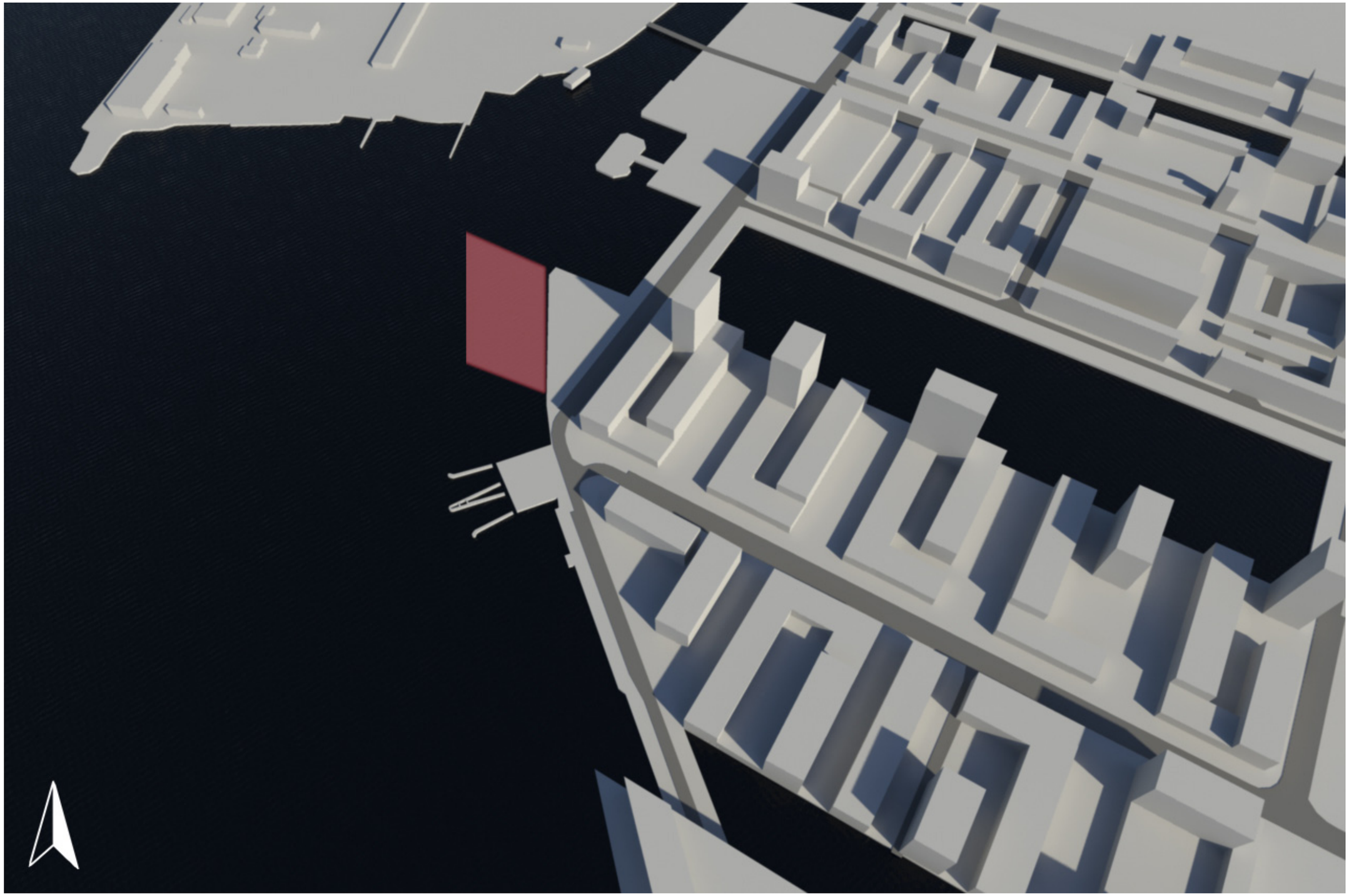
Part B: Ruimtelijke beleving hotel

Part C: Voorzieningen hotel / Kamers

Part D: Gevel

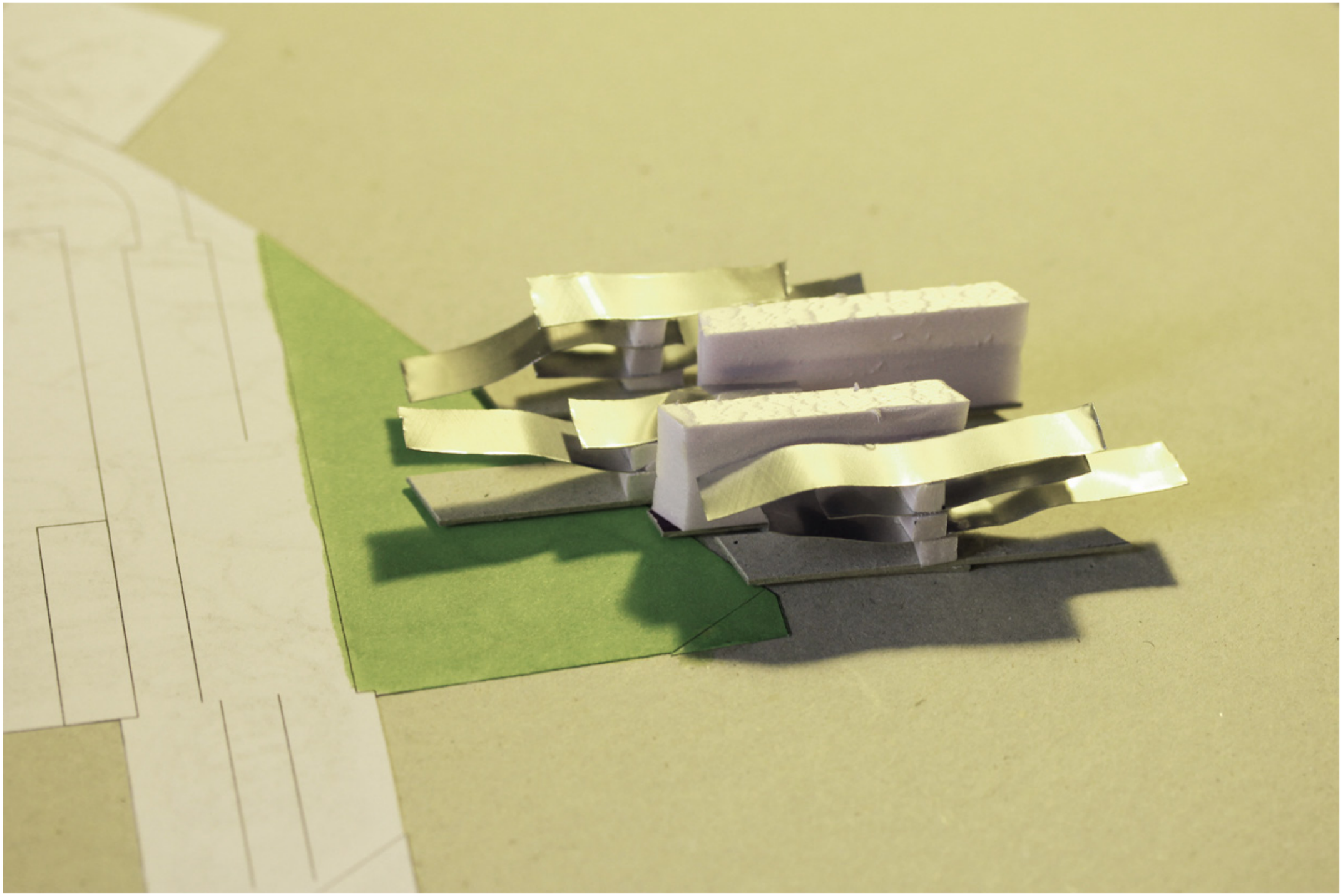
Amsterdam, Buiksloterham

Buiksloterham - Locatie Hotel



Impressie Locatie

Concept



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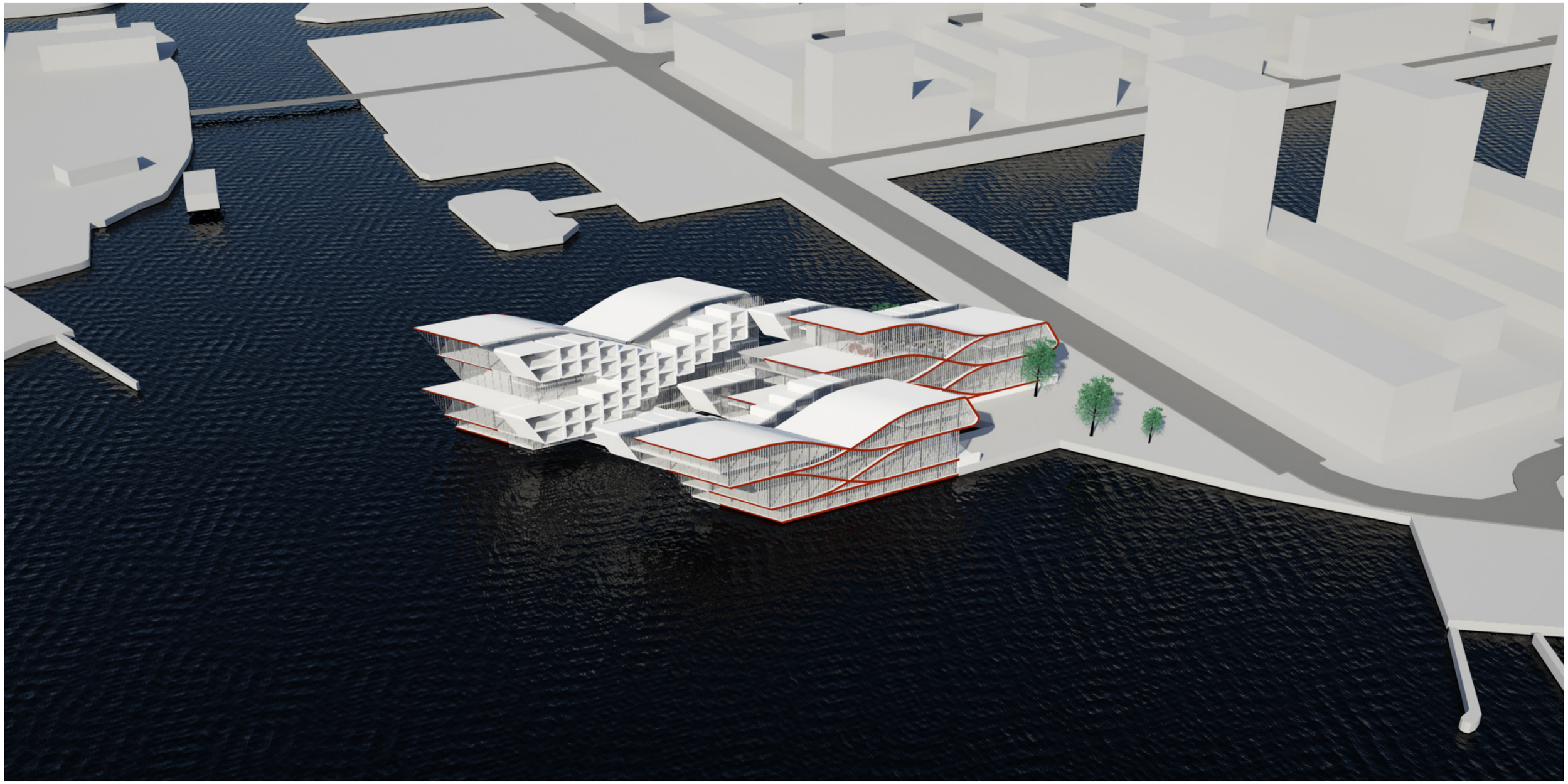
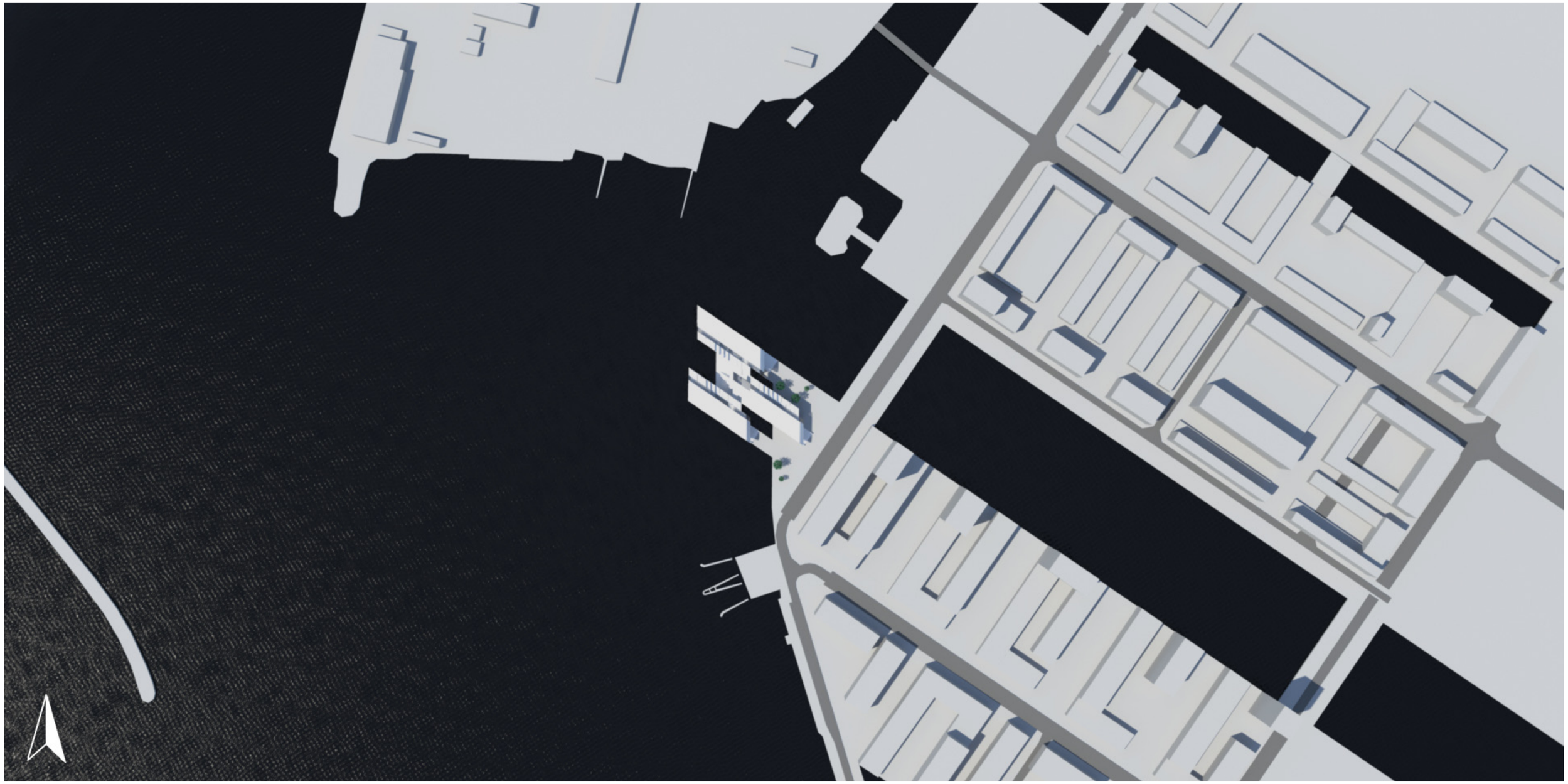
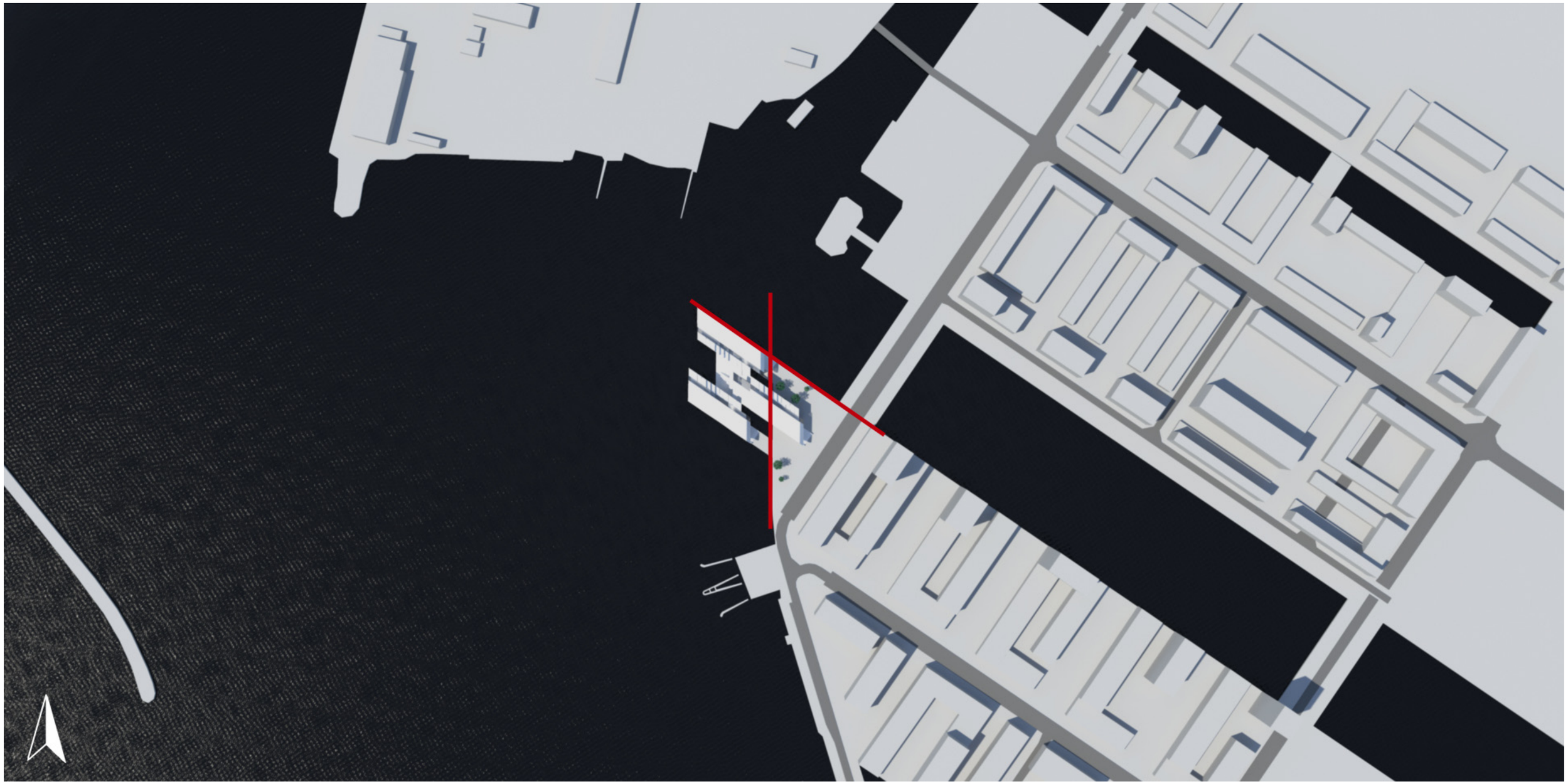


Ontwerp

Compositie Hotel



Compositie Hotel



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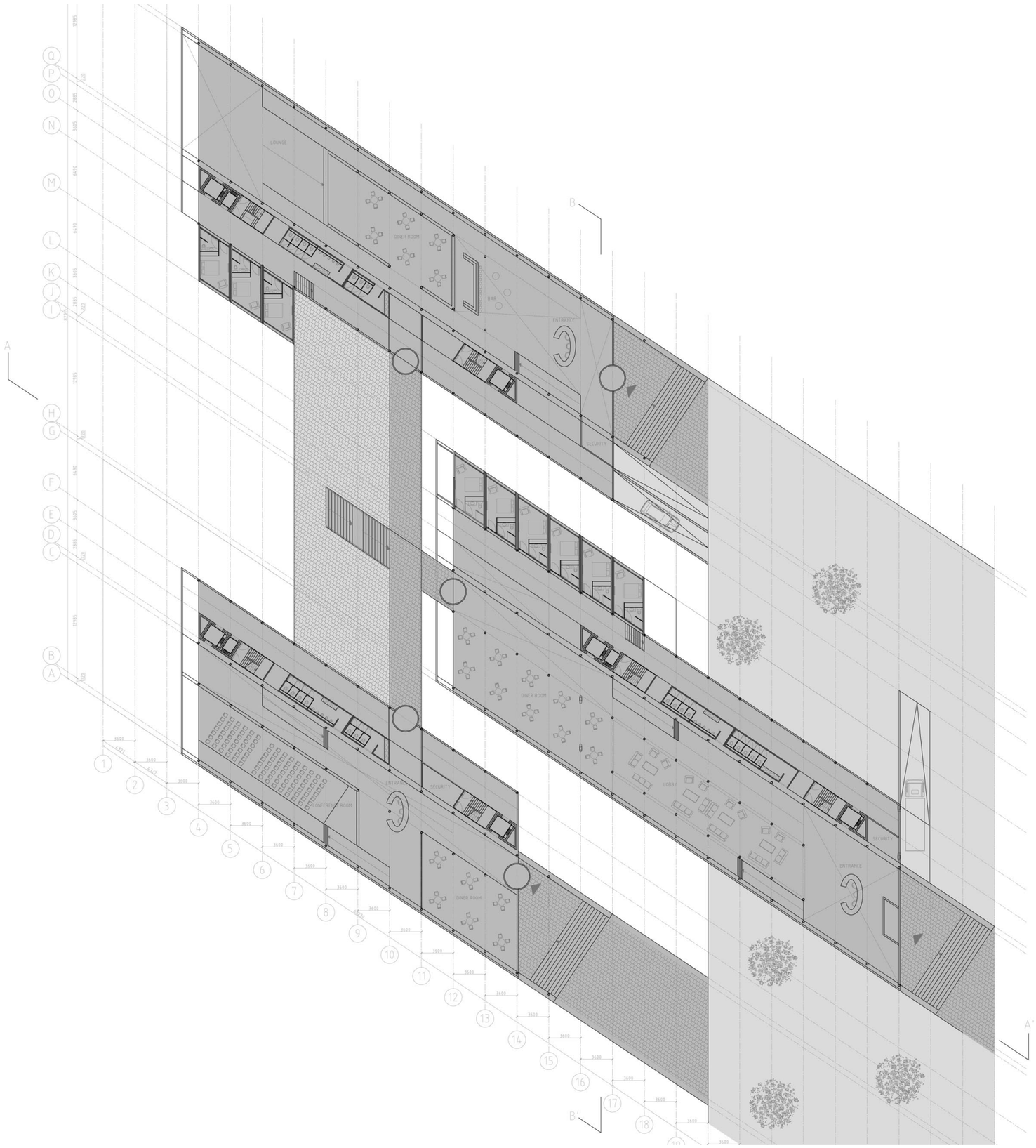

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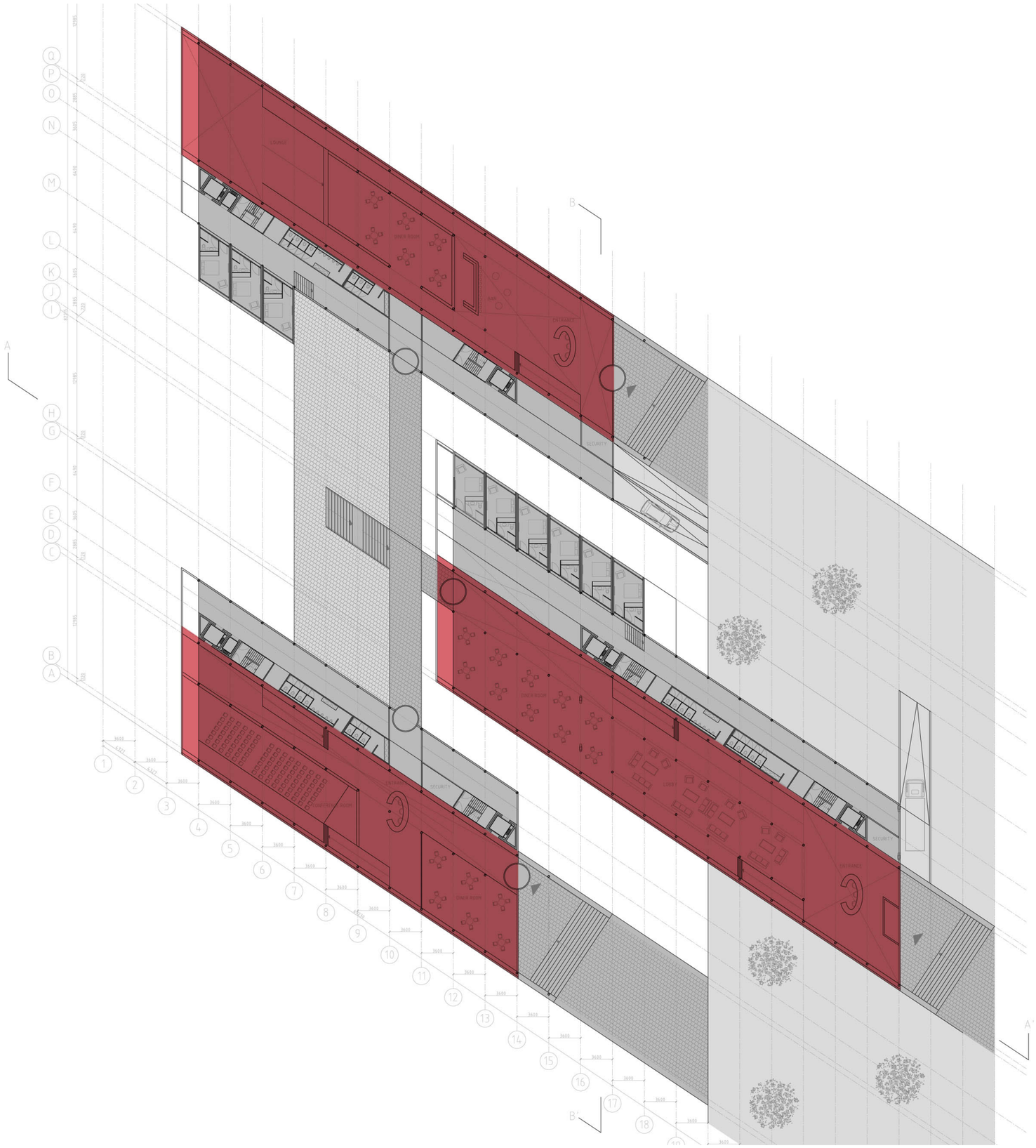

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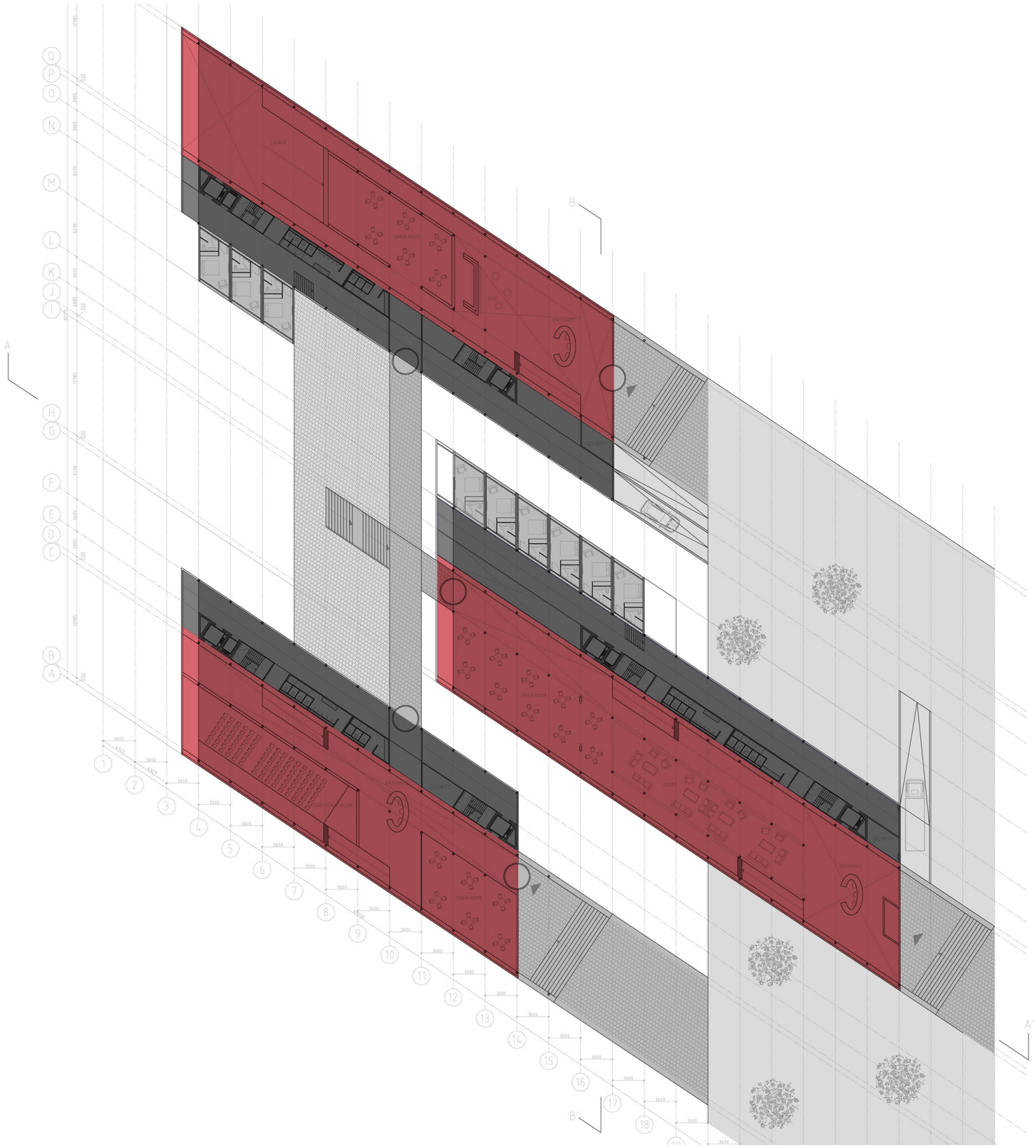

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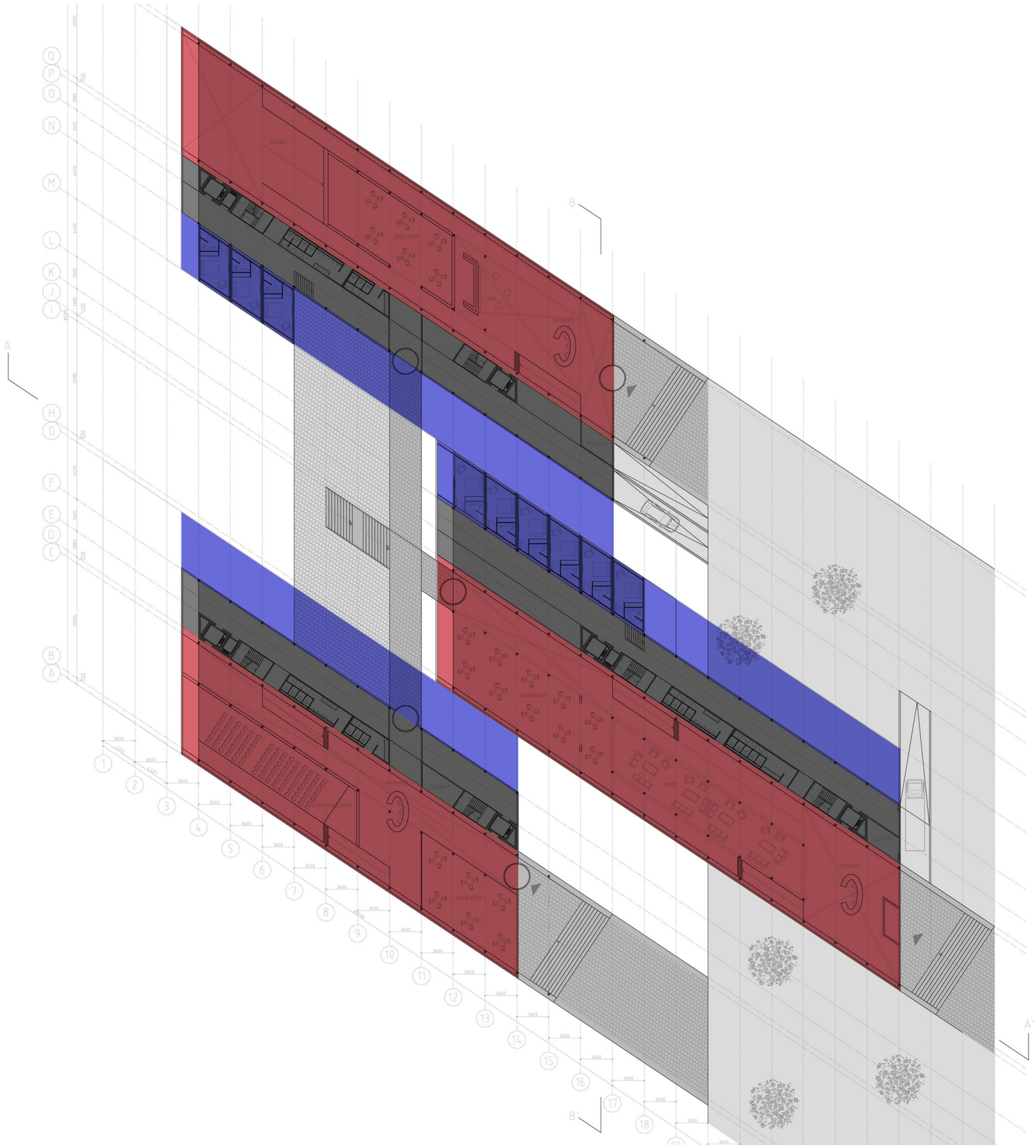

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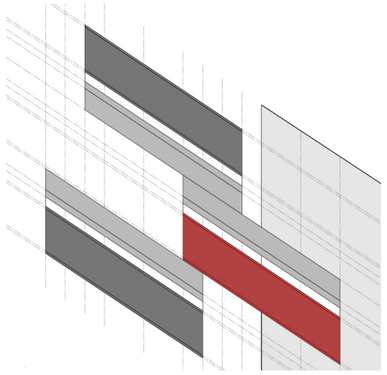

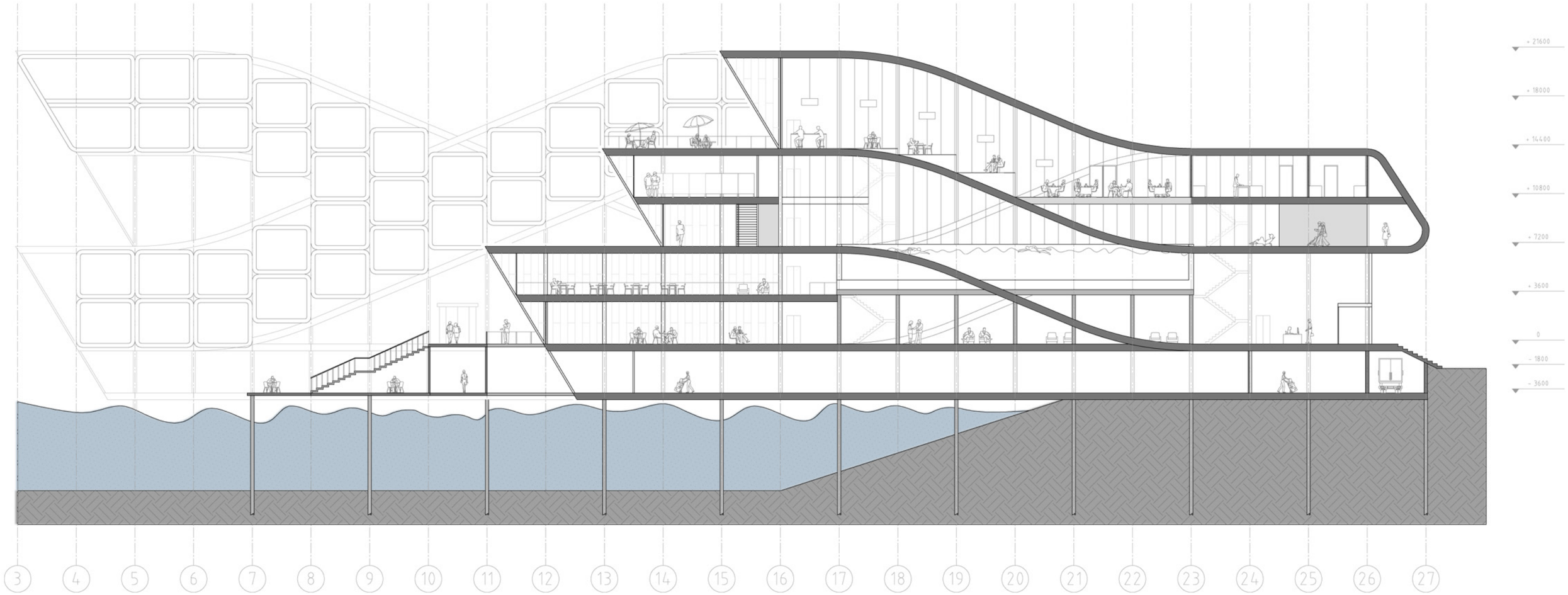

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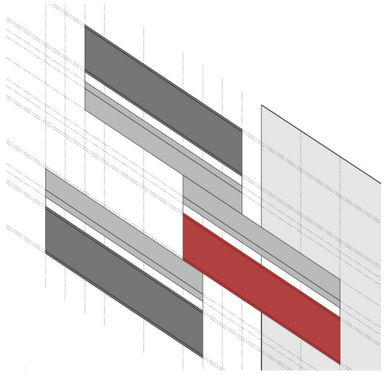

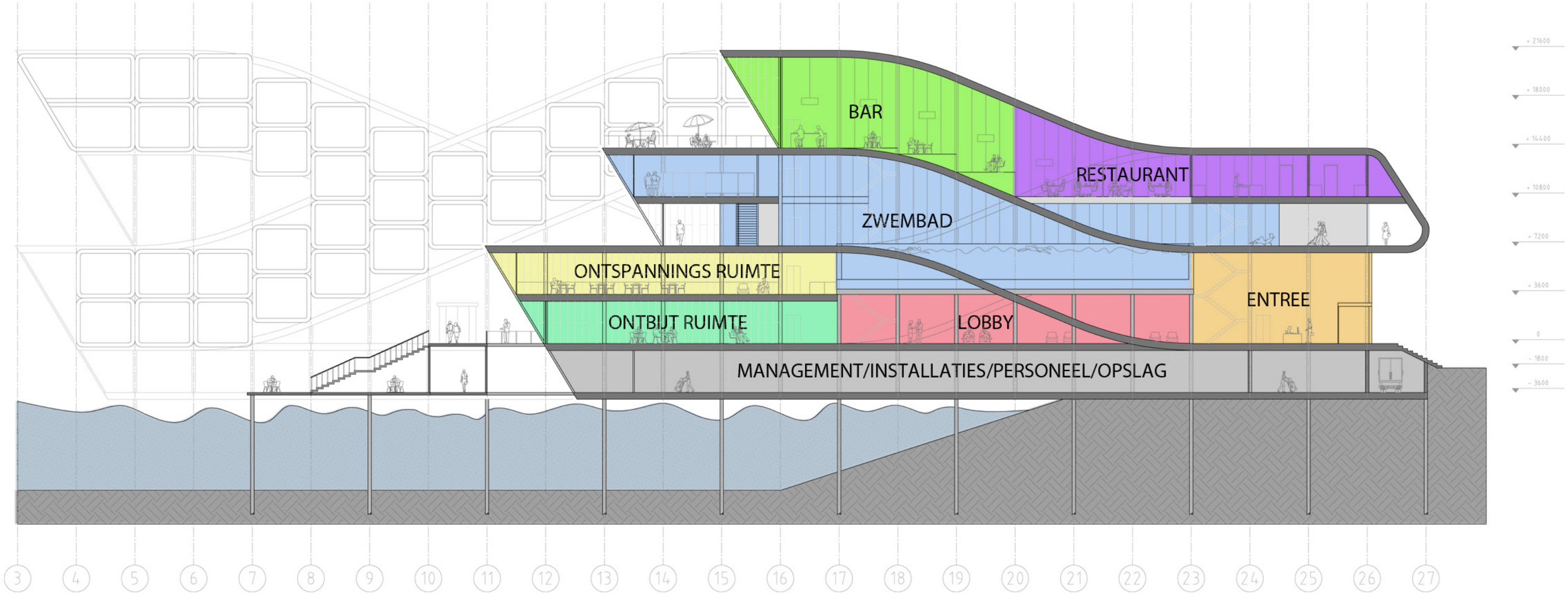

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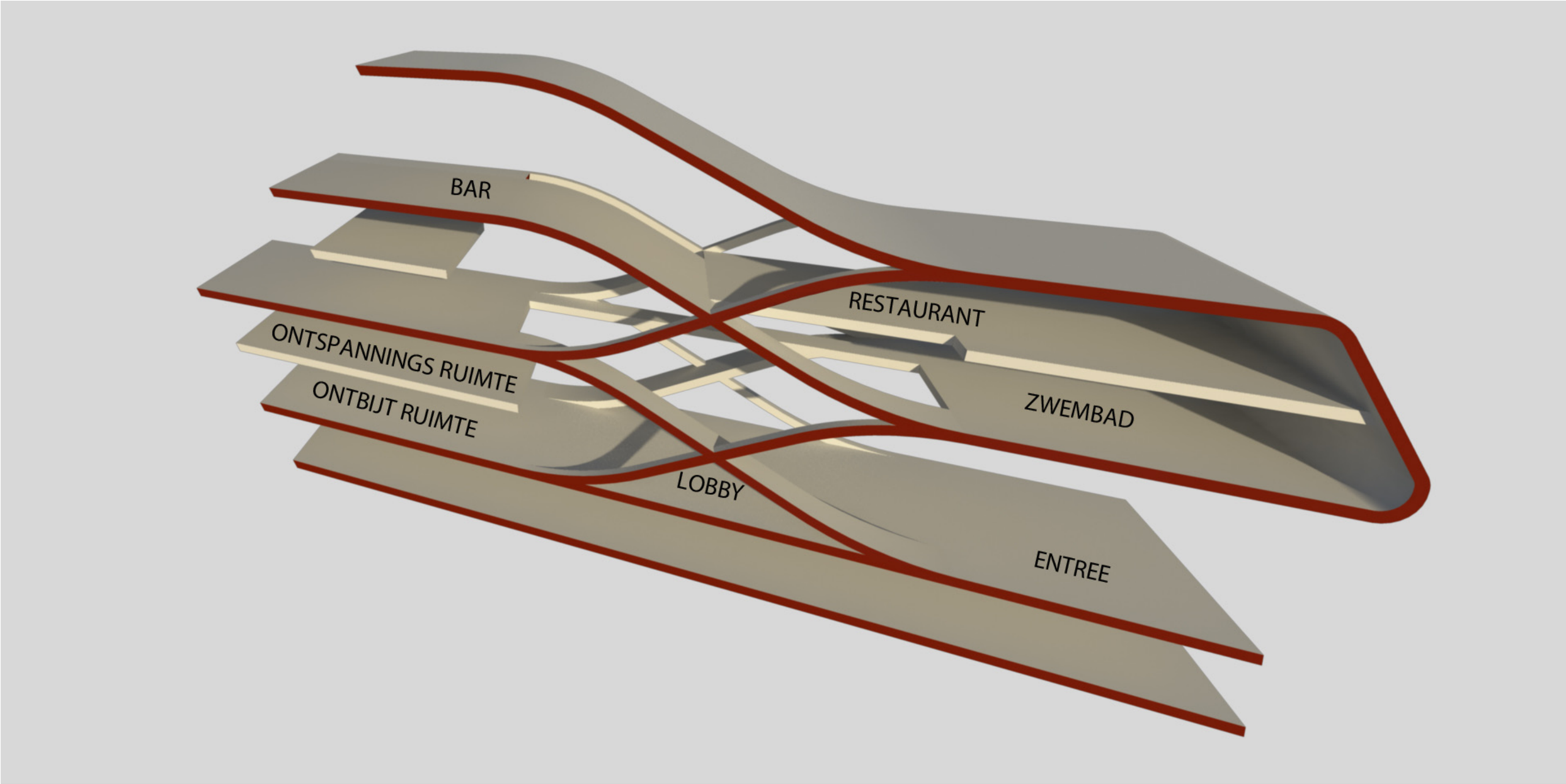
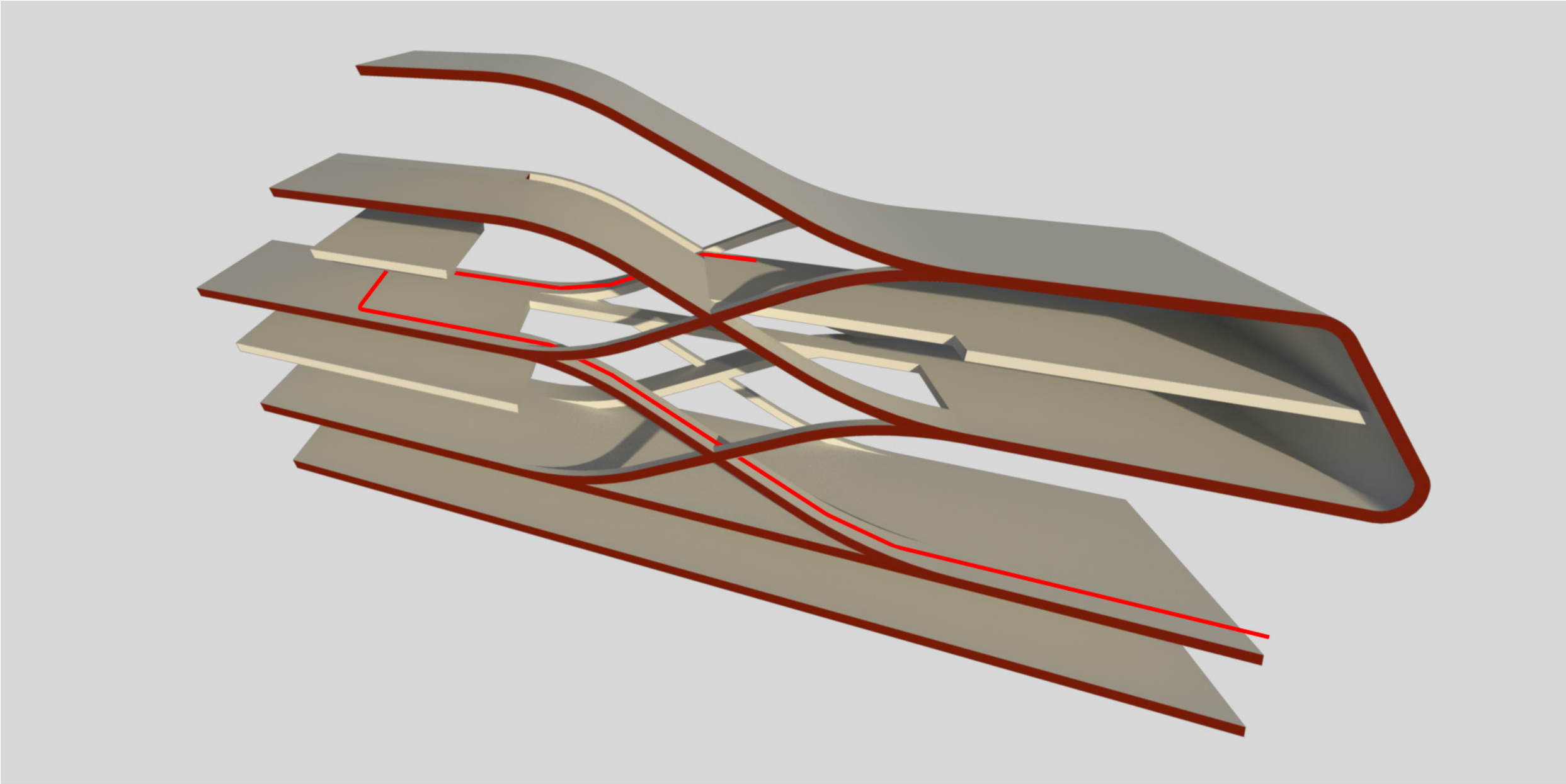


Route Bezoeker



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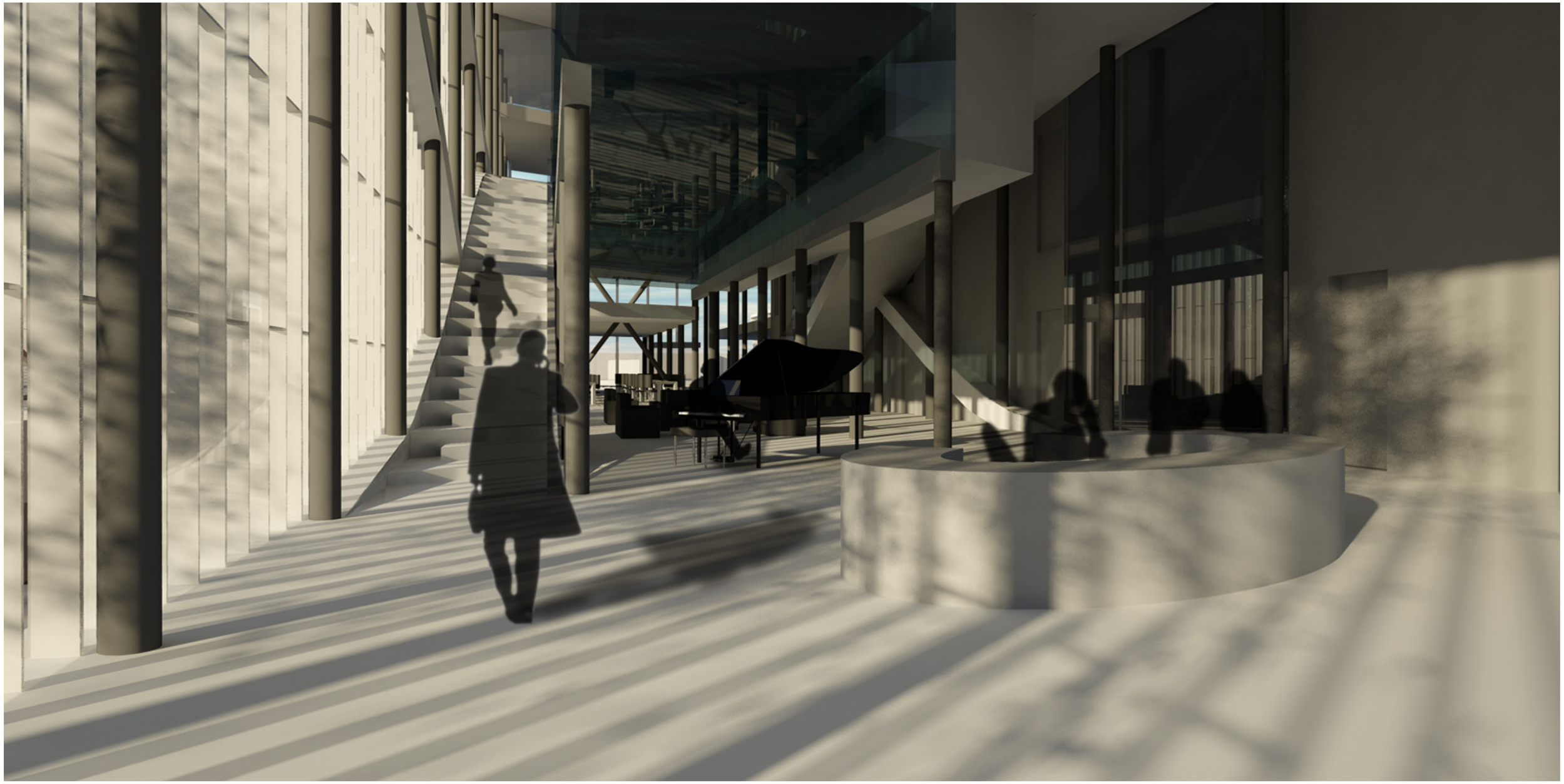
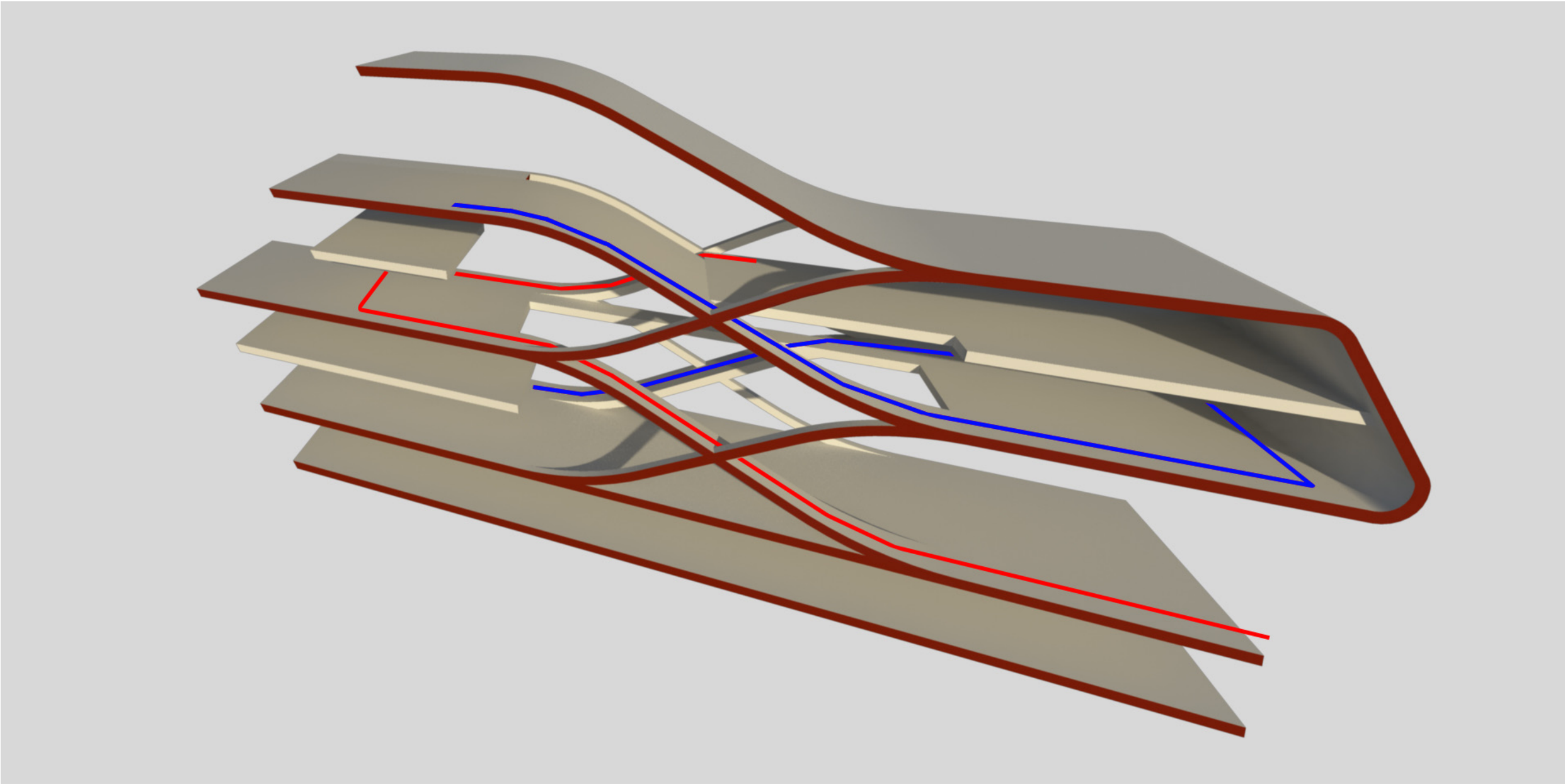


Zwembad

Restaurant

Route Gast

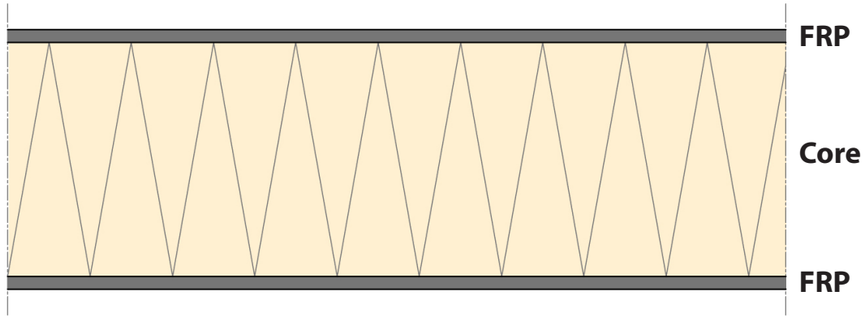


Ontbijtruimte

Zwembad

Bar

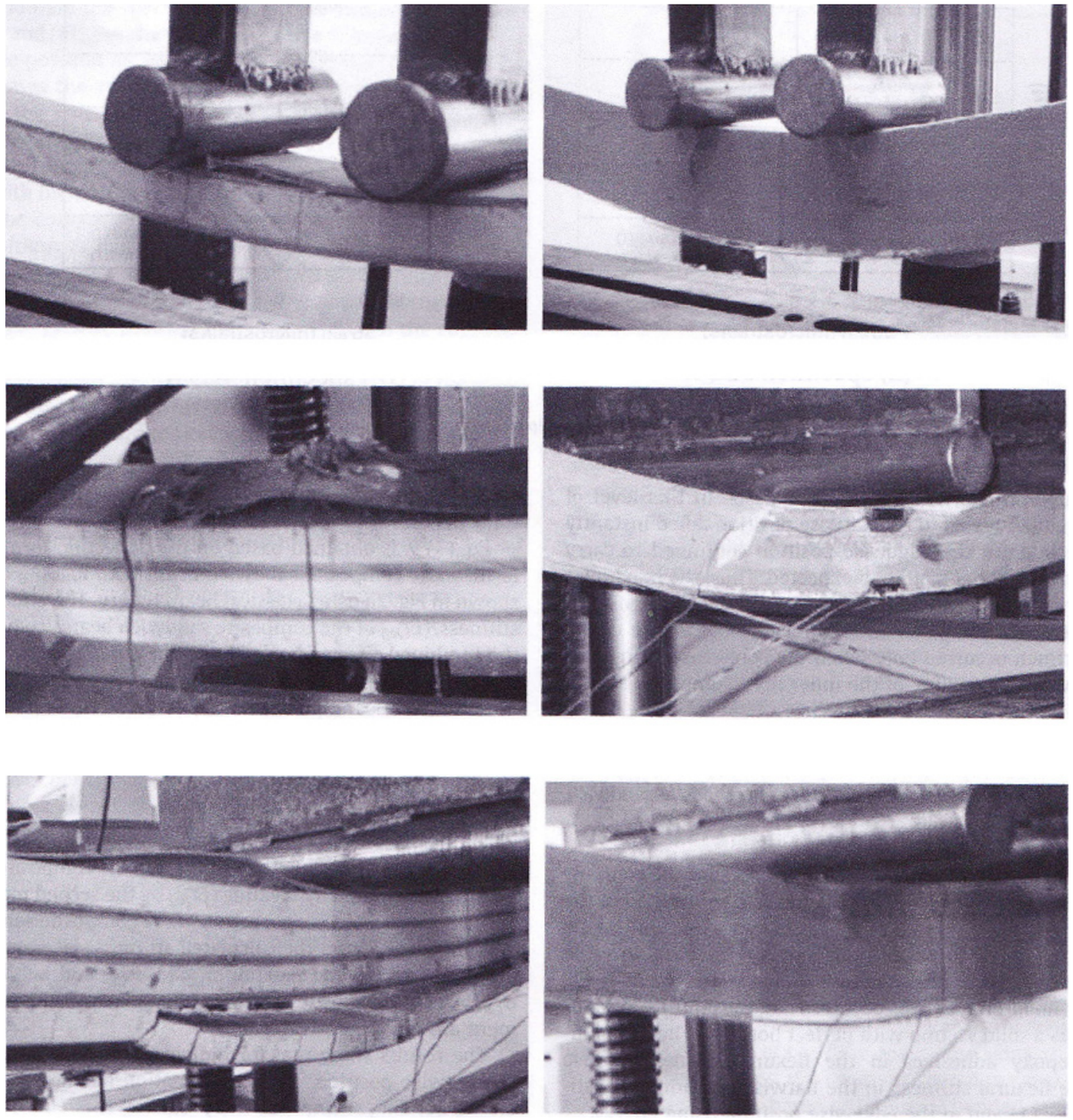
Onderzoek Sandwichconstructies



Verschillende combinaties FRP
- Polyester - Glasvezel
- Epoxy - Koolstofvezel
- Epoxy - Aramidevezel

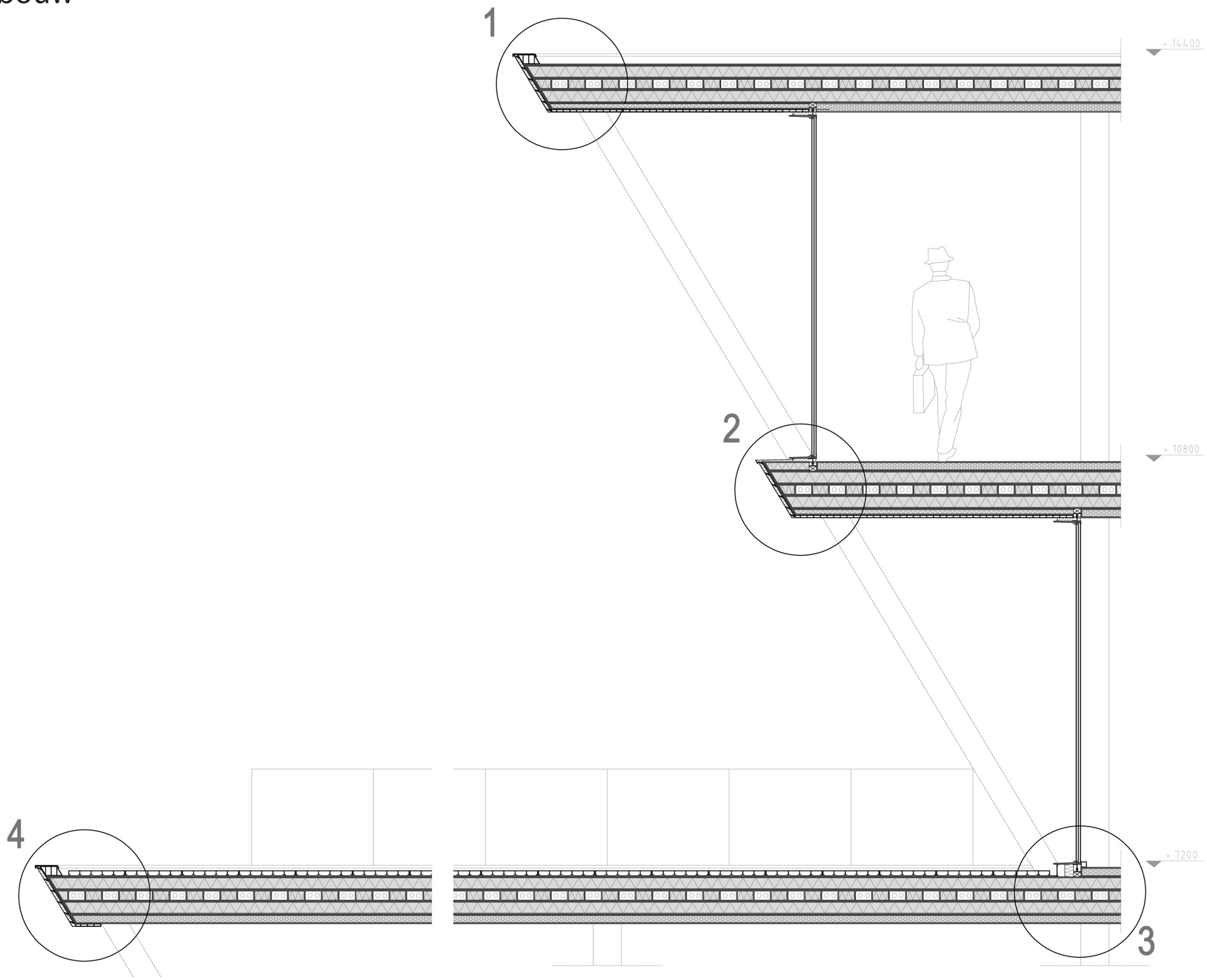
Verschillende Core Materials
- Foam
- Honeycomb
- Holle elementen

Onderzoek Sandwichconstructies



	Thickness, mm	Layer, mm	Composite, mm	Deflection, mm	Load, kN/m2	Weight, kg/m2
Epoxy Carbon 3	309	103	13	36,49	10,61	264,18
Epoxy Carbon 3	300	100	14	36,44	10,62	264,84
Epoxy Carbon 3	321	107	12	36,15	10,62	265,32
Epoxy Carbon 3	312	104	13	35,83	10,63	265,98
Epoxy Carbon 3	333	111	11	36,13	10,64	266,46
Epoxy Carbon 3	303	101	14	35,75	10,64	266,64
Epoxy Carbon 3	324	108	12	35,52	10,64	267,12
Epoxy Carbon 3	294	98	15	35,91	10,65	267,30
Epoxy Carbon 3	345	115	10	36,46	10,65	267,60
Epoxy Carbon 3	336	112	11	35,52	10,66	268,26
Epoxy Carbon 3	348	116	10	35,87	10,67	269,40
Epoxy Carbon 3	363	121	9	36,03	10,71	272,34
Epoxy Carbon 5	320	64	8	36,20	10,71	272,80
Epoxy Carbon 5	305	61	9	36,00	10,72	273,90
Epoxy Carbon 5	340	68	7	36,04	10,73	274,70
Epoxy Carbon 5	290	58	10	36,35	10,74	275,00
Epoxy Carbon 3	381	127	8	36,12	10,76	277,08
Epoxy Carbon 3	384	128	8	35,59	10,78	278,88
Epoxy Carbon 5	280	56	11	35,99	10,79	279,10
Epoxy Carbon 5	365	73	6	35,78	10,79	279,60
Epoxy Carbon 5	270	54	12	35,99	10,83	283,20
Epoxy Carbon 3	402	134	7	36,28	10,84	283,62
Epoxy Carbon 3	405	135	7	35,77	10,86	285,42
Epoxy Carbon 5	260	52	13	36,31	10,88	287,30
Epoxy Carbon 5	395	79	5	35,76	10,88	287,50
Epoxy Carbon 3	429	143	6	36,18	10,96	293,76
Epoxy Carbon 5	255	51	14	35,57	10,97	294,40
Epoxy Carbon 3	432	144	6	35,70	10,98	295,56
Epoxy Carbon 5	430	86	4	36,35	11,01	298,40
Epoxy Carbon 5	245	49	15	36,42	11,01	298,50
Epoxy Carbon 5	435	87	4	35,57	11,05	301,40
Epoxy Carbon 4	360	90	11	39,95	11,09	304,88
Epoxy Carbon 4	348	87	12	39,72	11,10	305,76
Epoxy Carbon 4	376	94	10	39,75	11,11	306,40
Epoxy Carbon 4	336	84	13	39,83	11,11	306,64
Epoxy Carbon 3	462	154	5	36,08	11,12	307,50
Epoxy Carbon 4	324	81	14	40,25	11,12	307,52
Epoxy Carbon 4	392	98	9	40,01	11,12	307,92
Epoxy Carbon 3	465	155	5	35,64	11,14	309,30
Epoxy Carbon 4	316	79	15	40,00	11,16	310,80
Epoxy Carbon 4	412	103	8	40,08	11,17	311,84
Epoxy Carbon 4	436	109	7	40,12	11,25	318,16
Epoxy Carbon 5	485	97	3	35,91	11,28	321,30
Epoxy Carbon 3	501	167	4	36,29	11,32	324,84

1/20 Vloeropbouw



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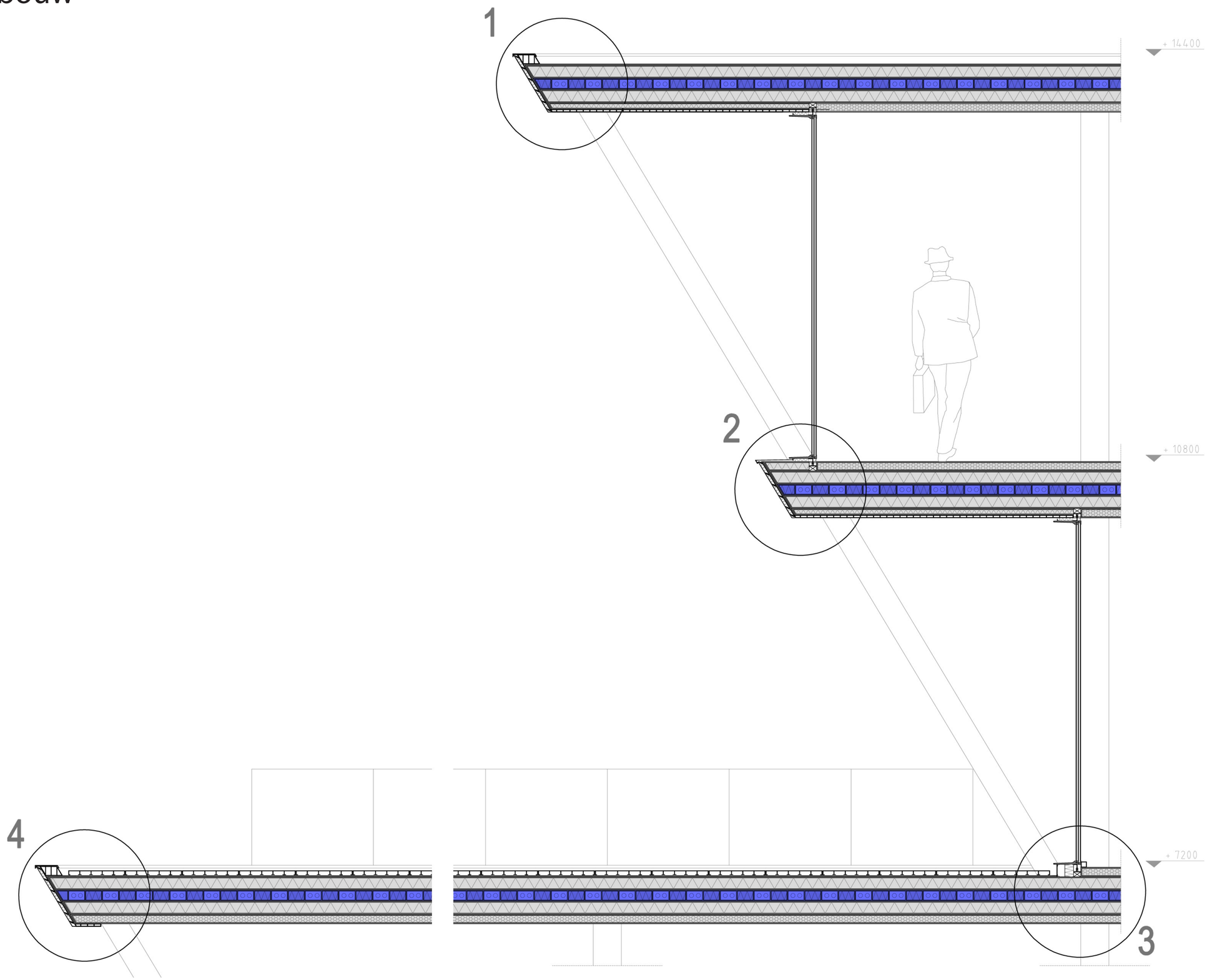

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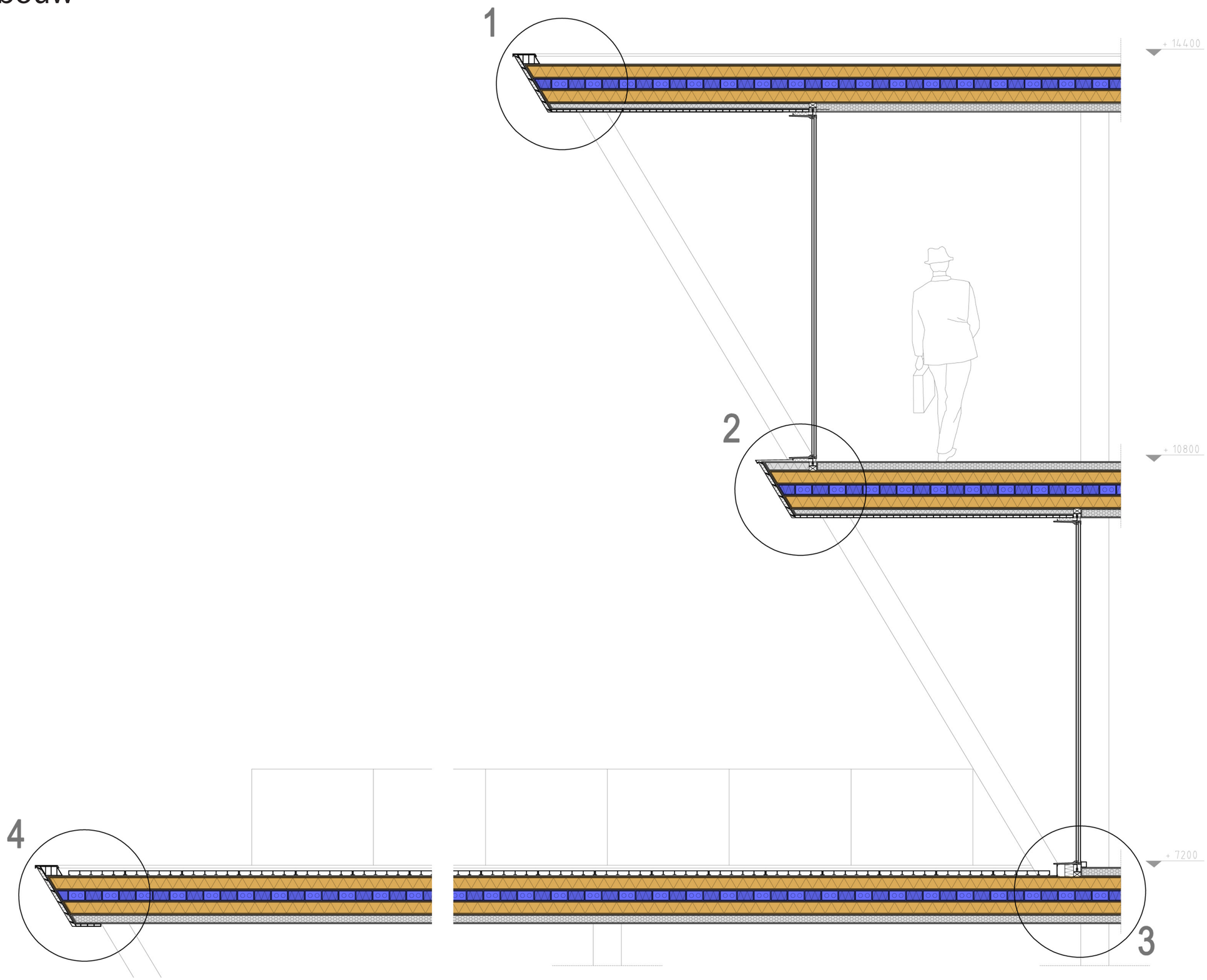

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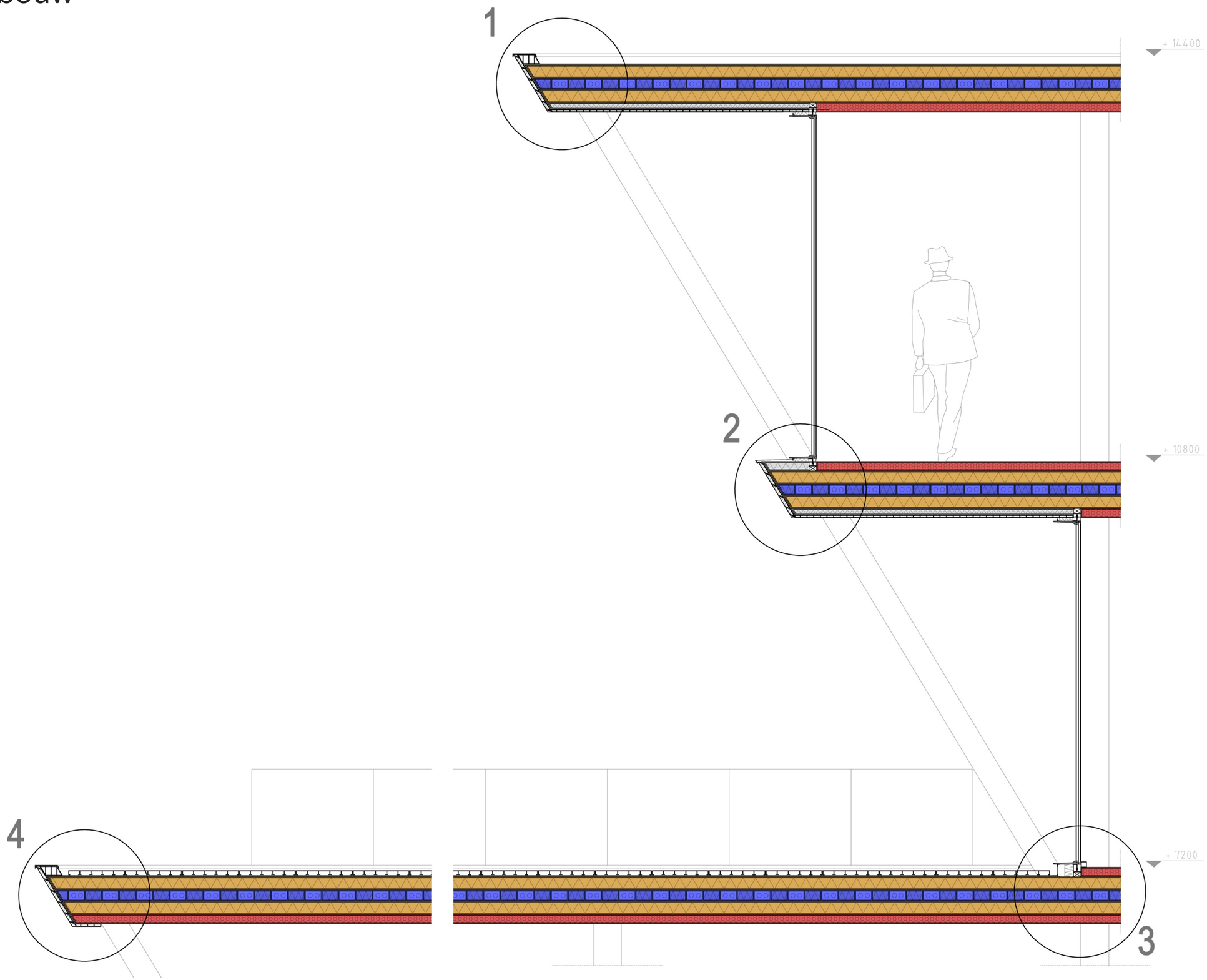
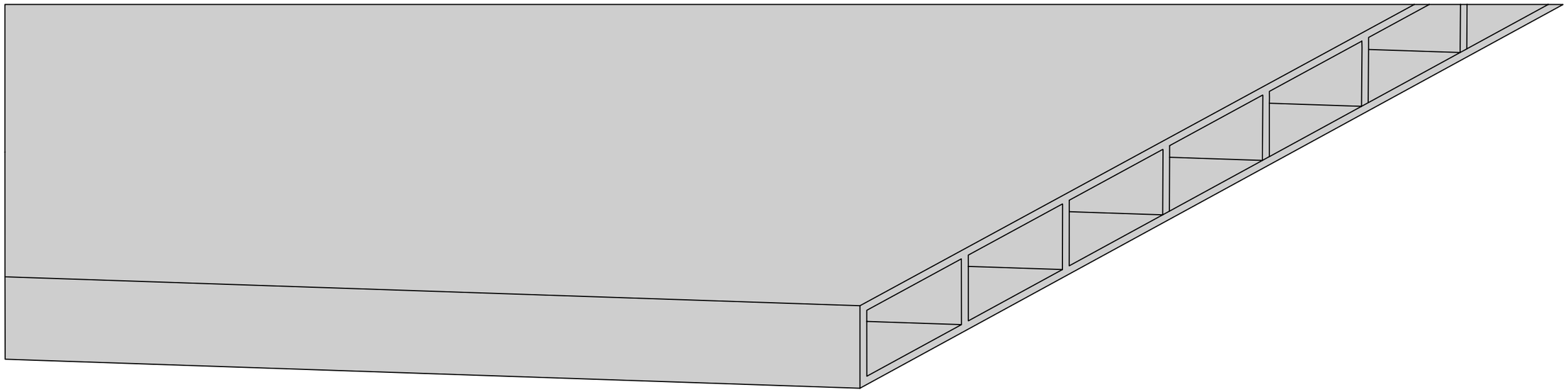


Productie - Constructie opbouw



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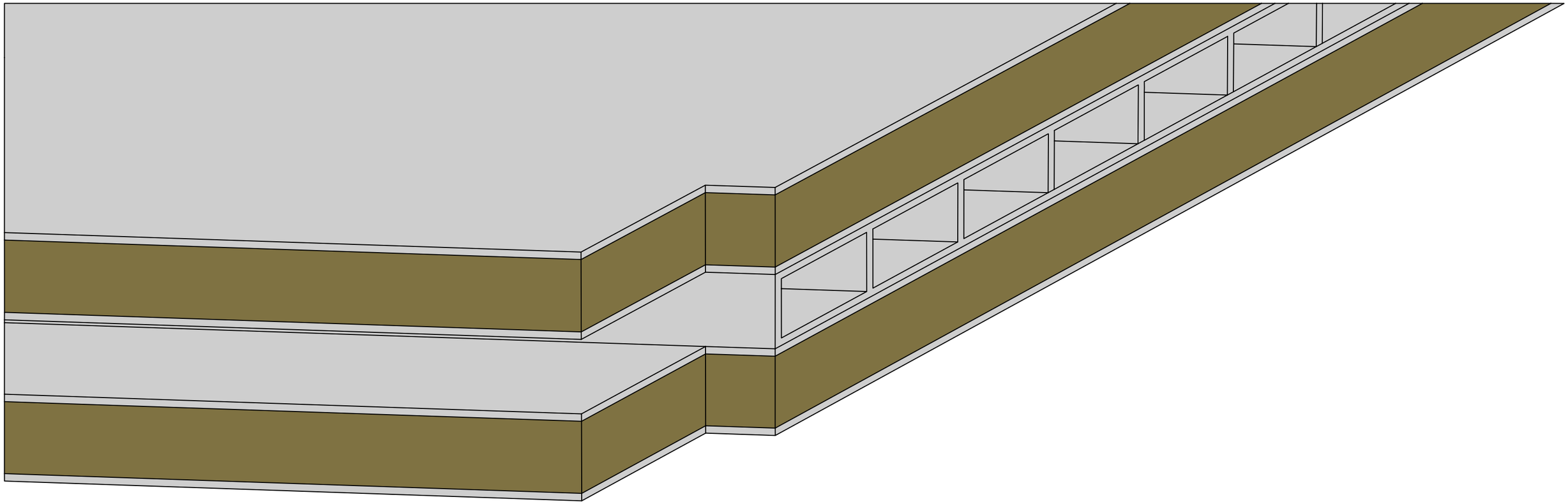

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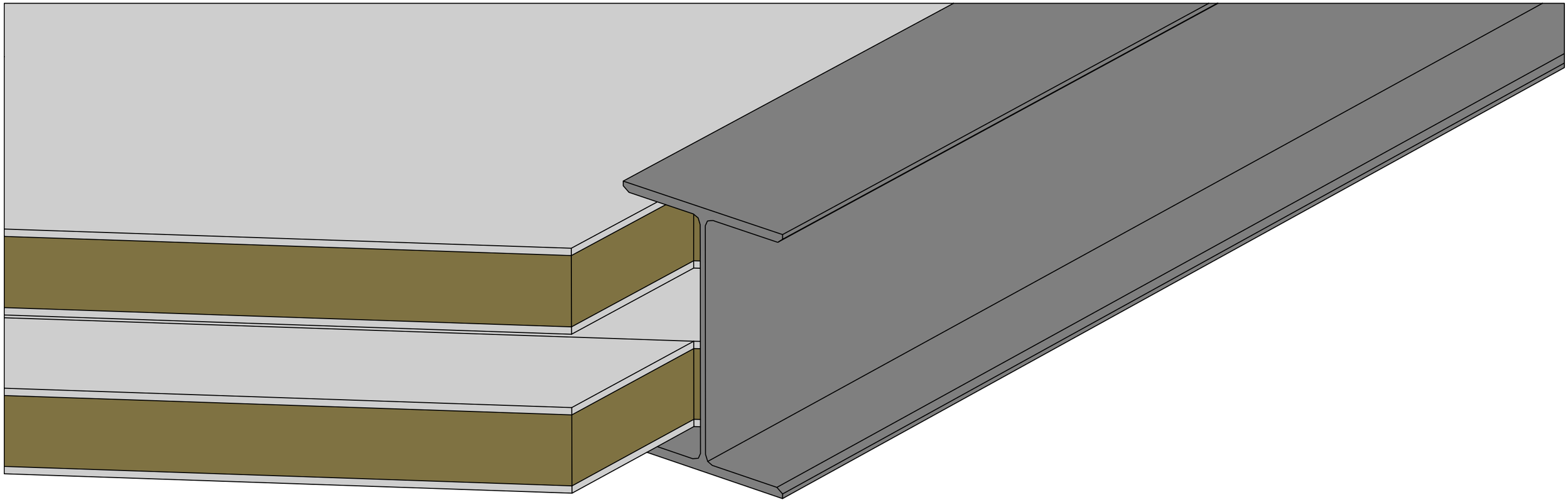

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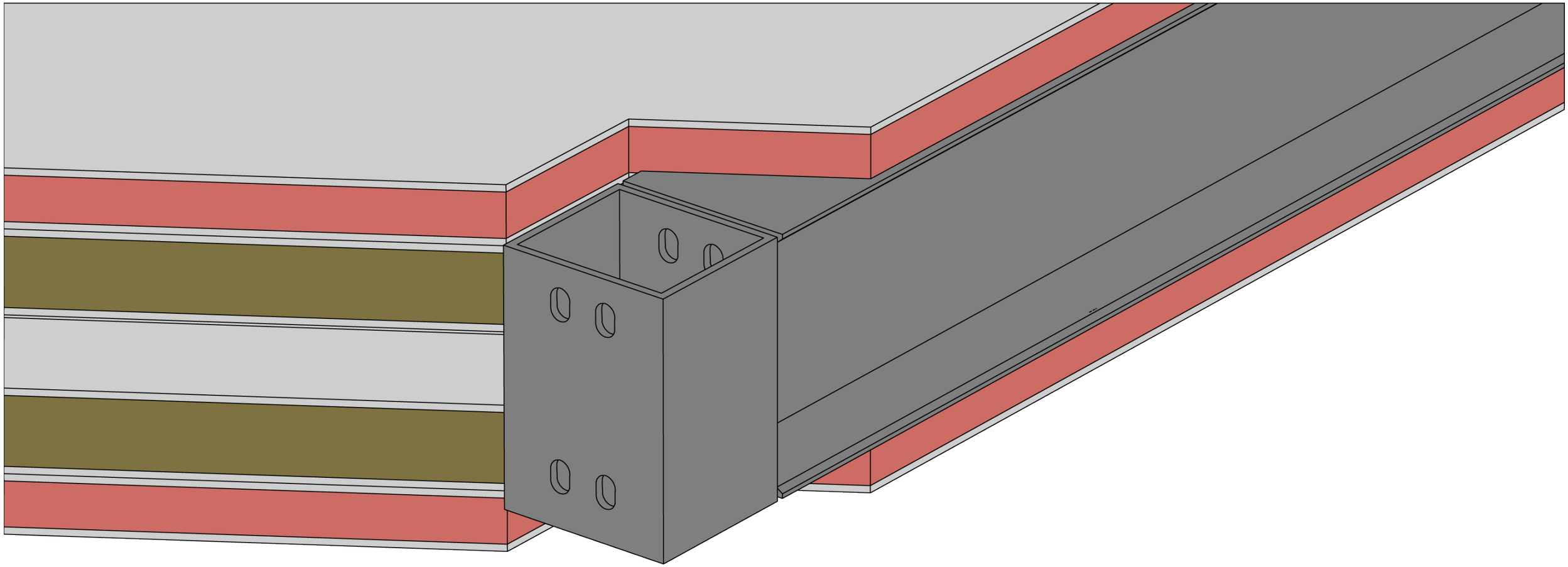

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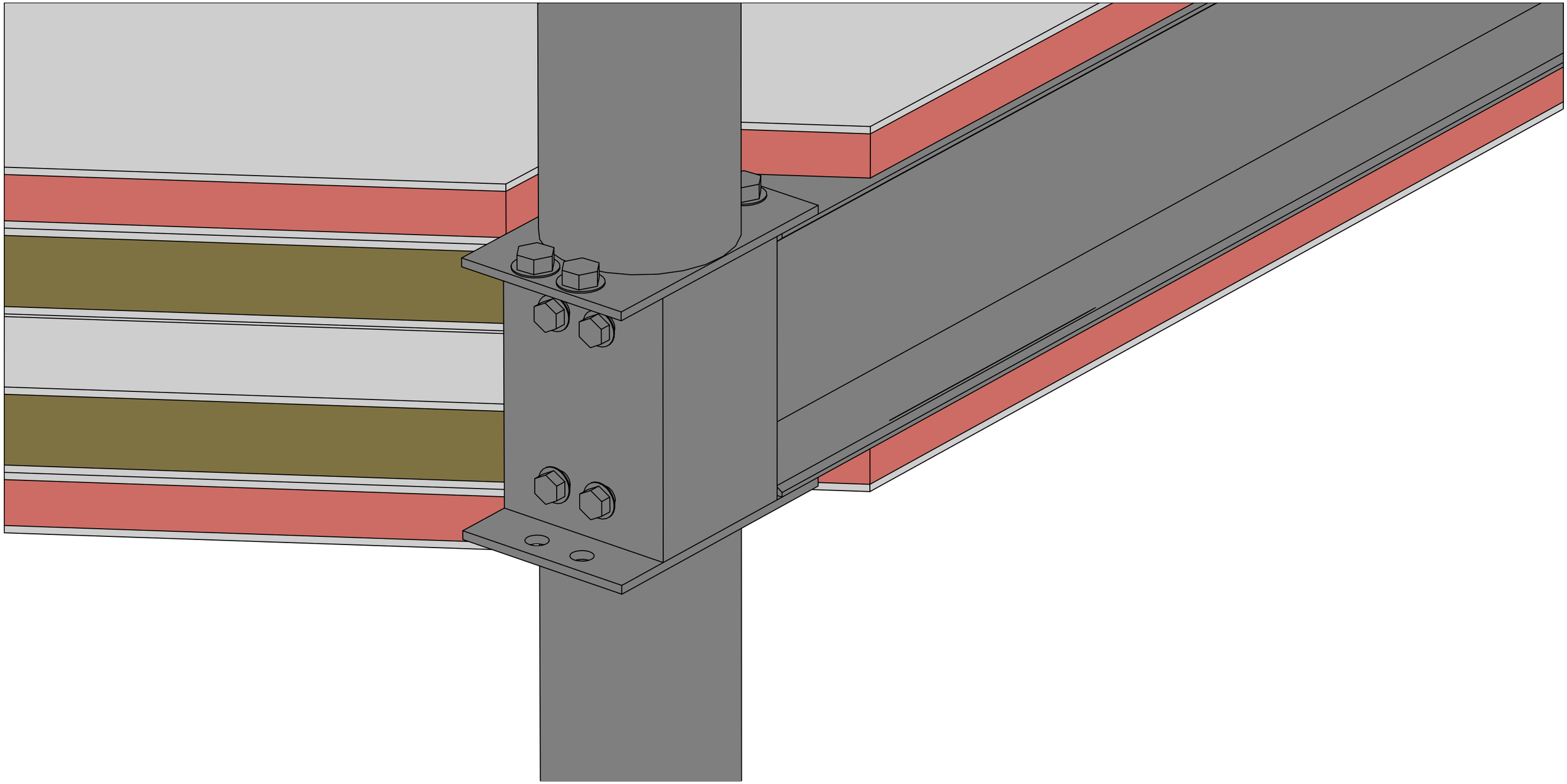
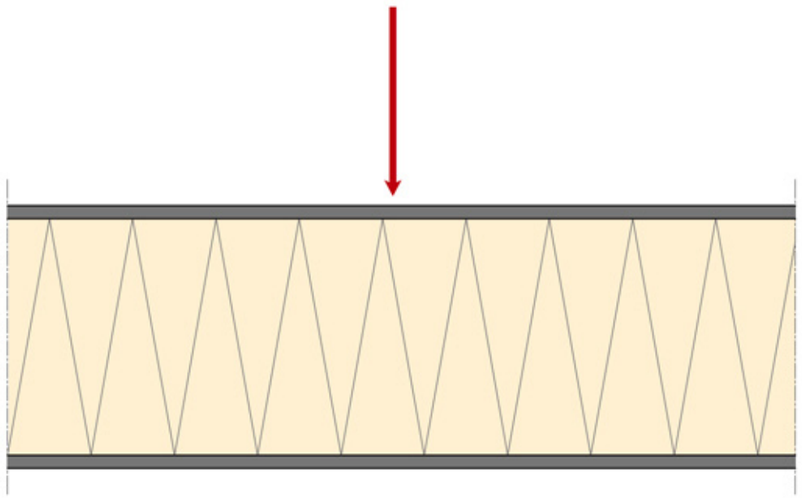
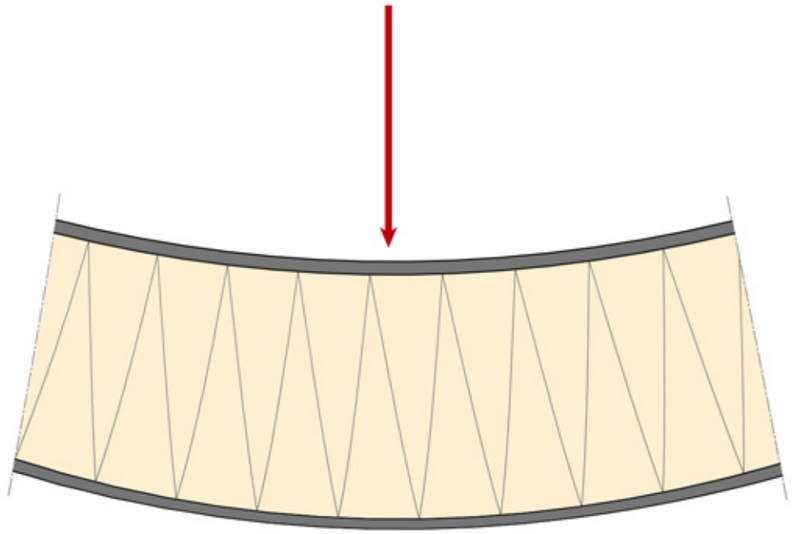
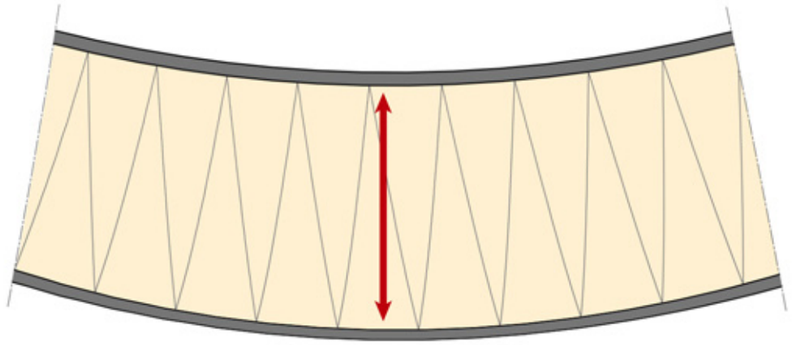
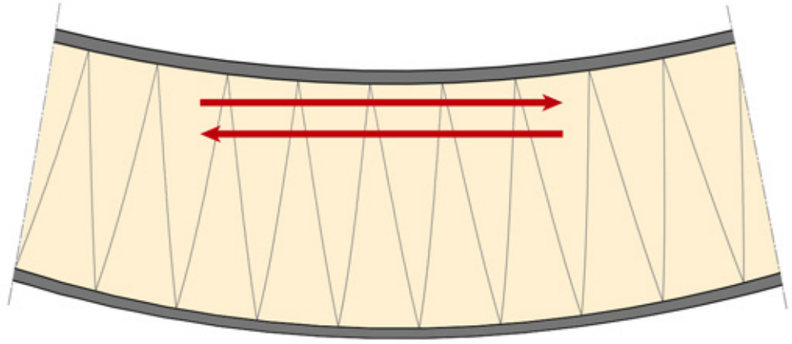


Werking Sandwichconstructie

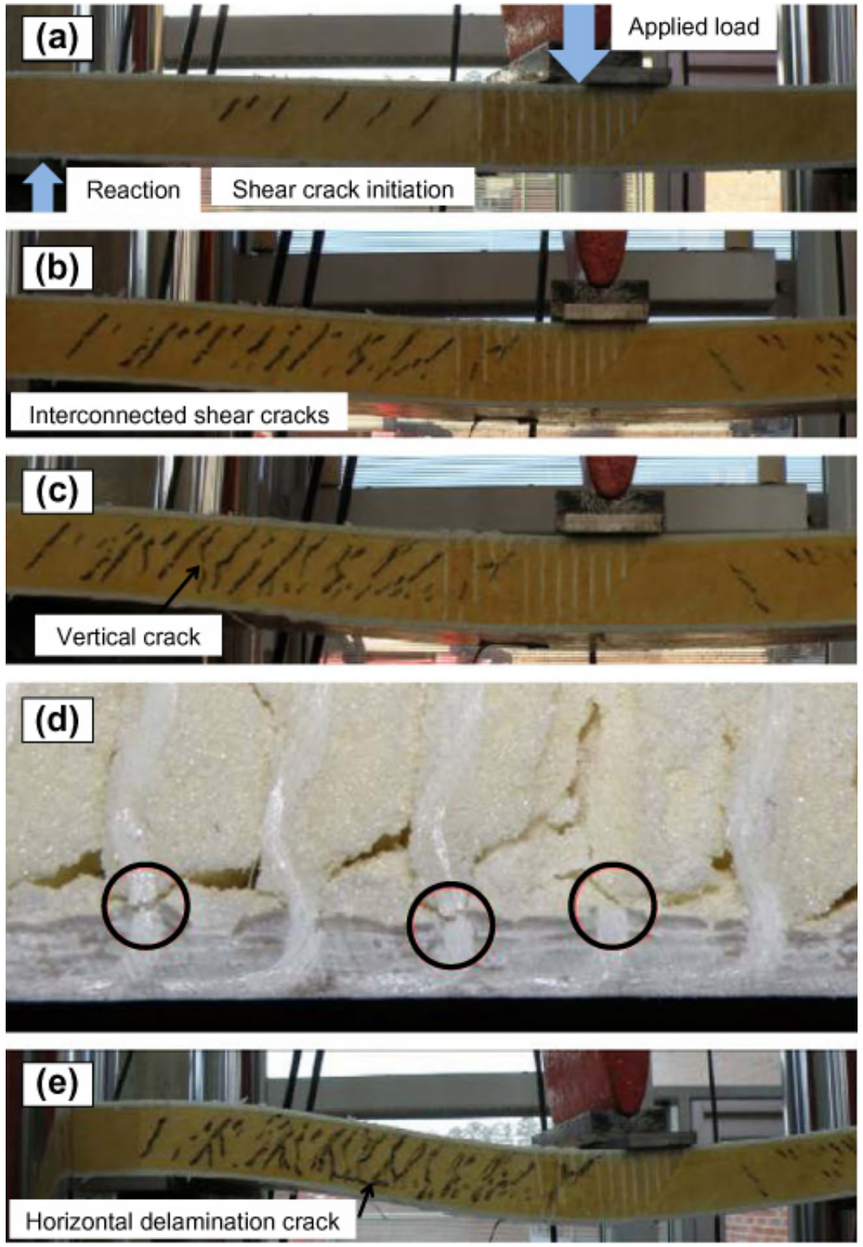








Onderzoek Sandwichconstructies



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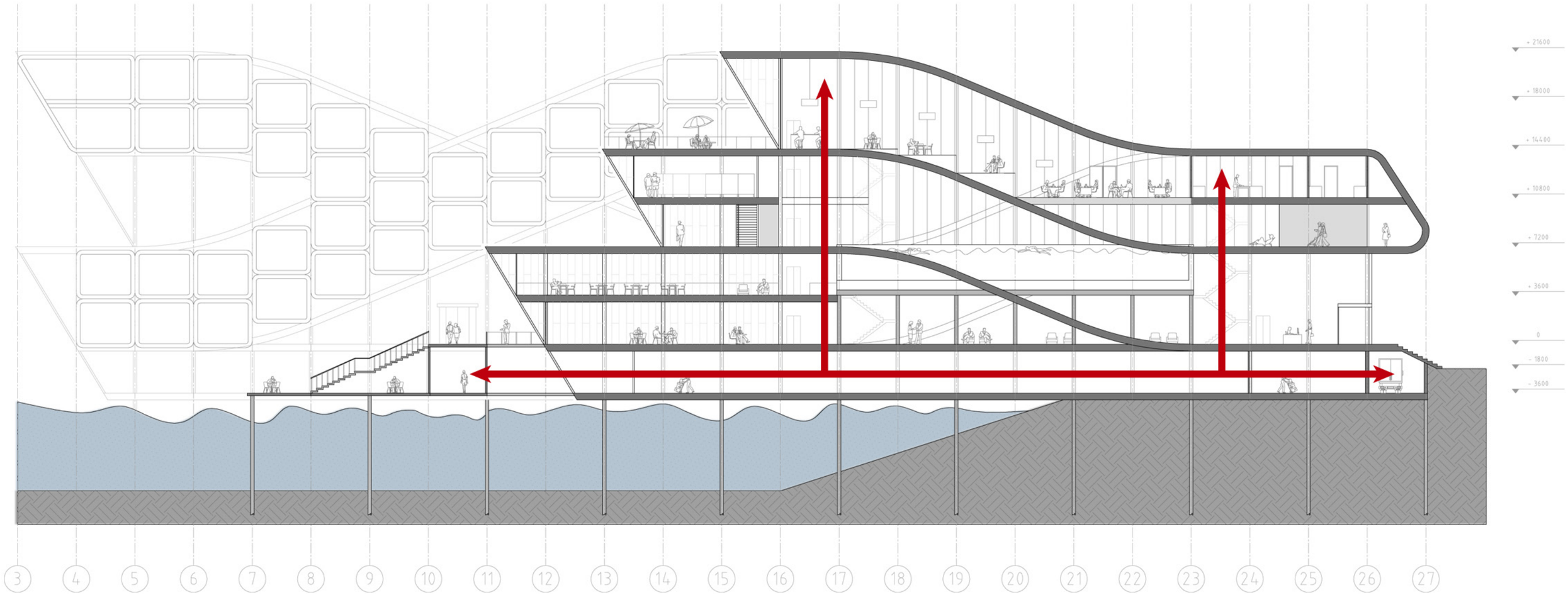

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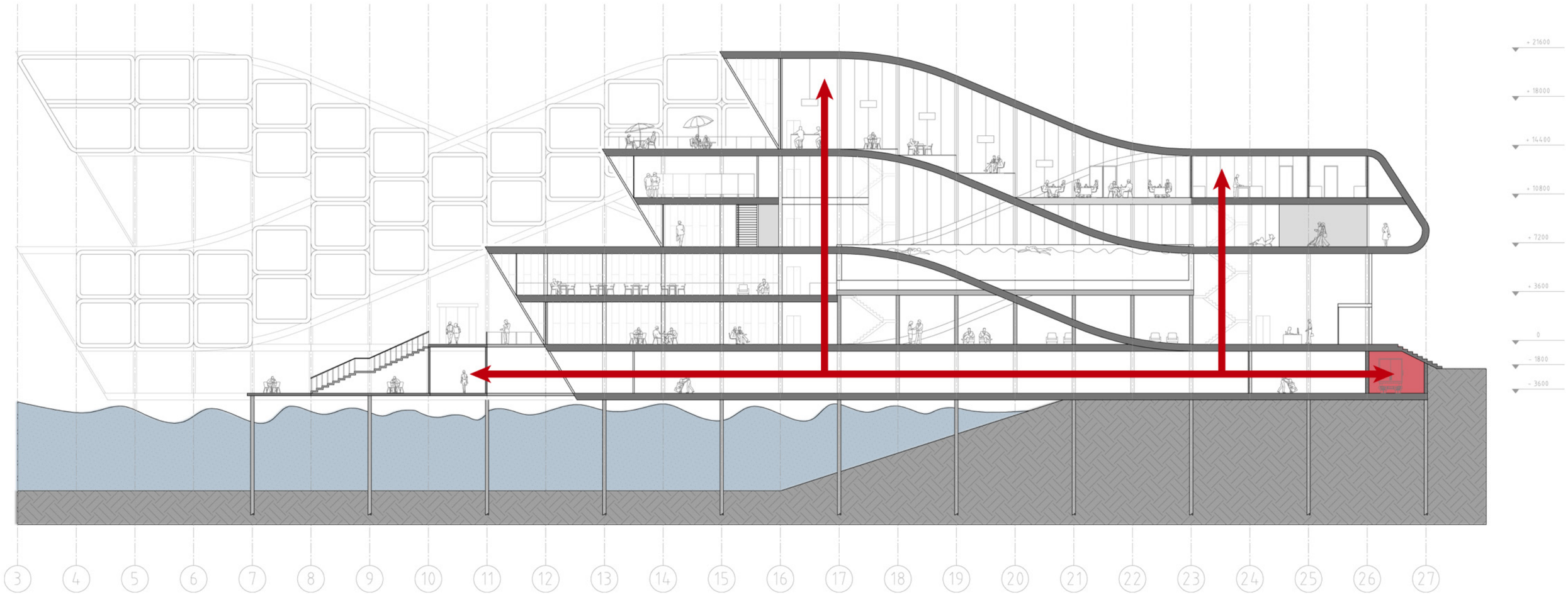
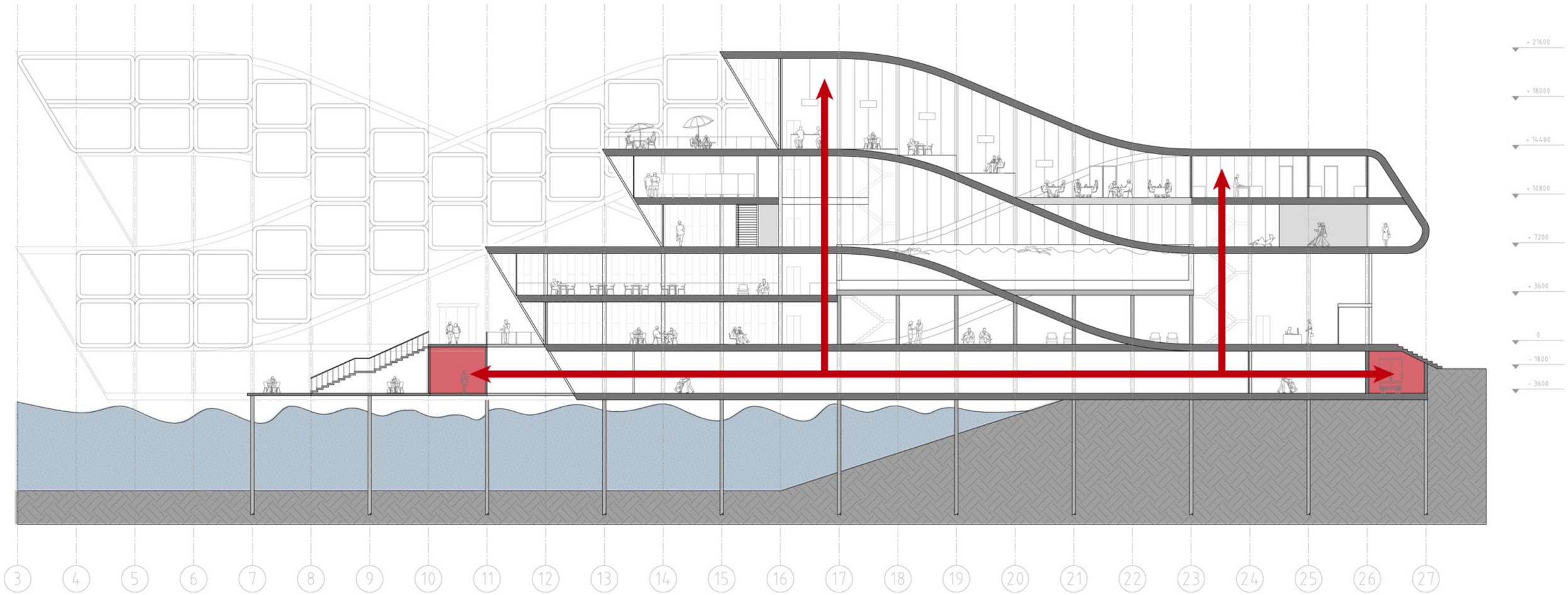


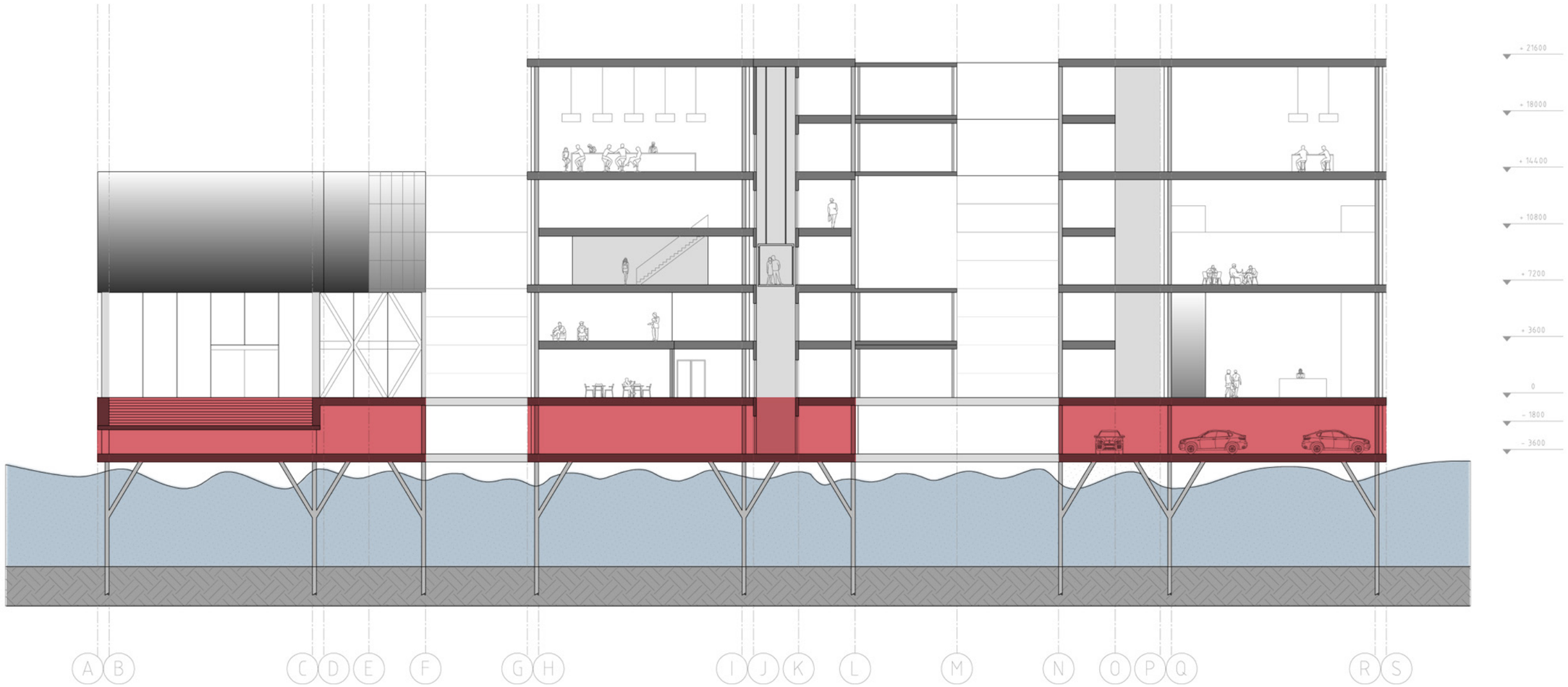
Route Personeel



Deck

Route Personeel

Route Personeel



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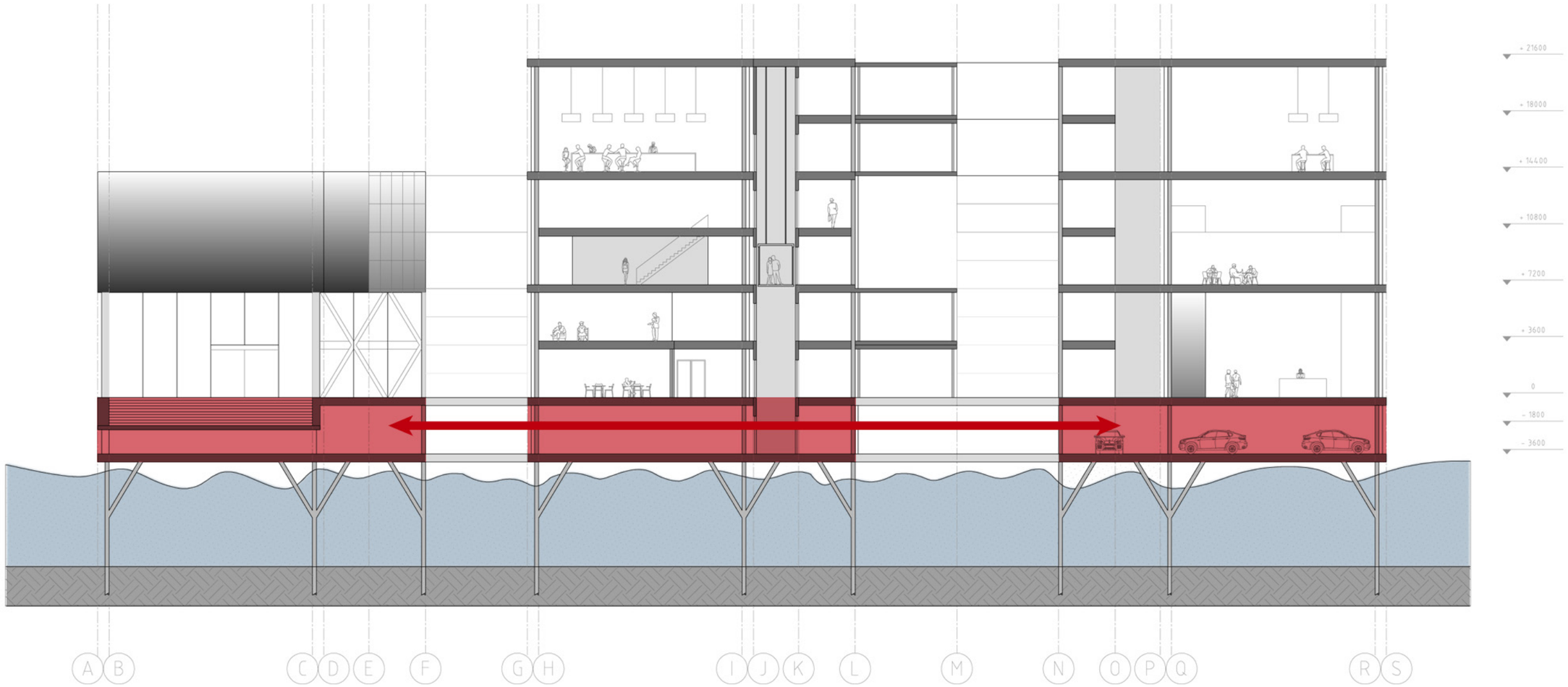

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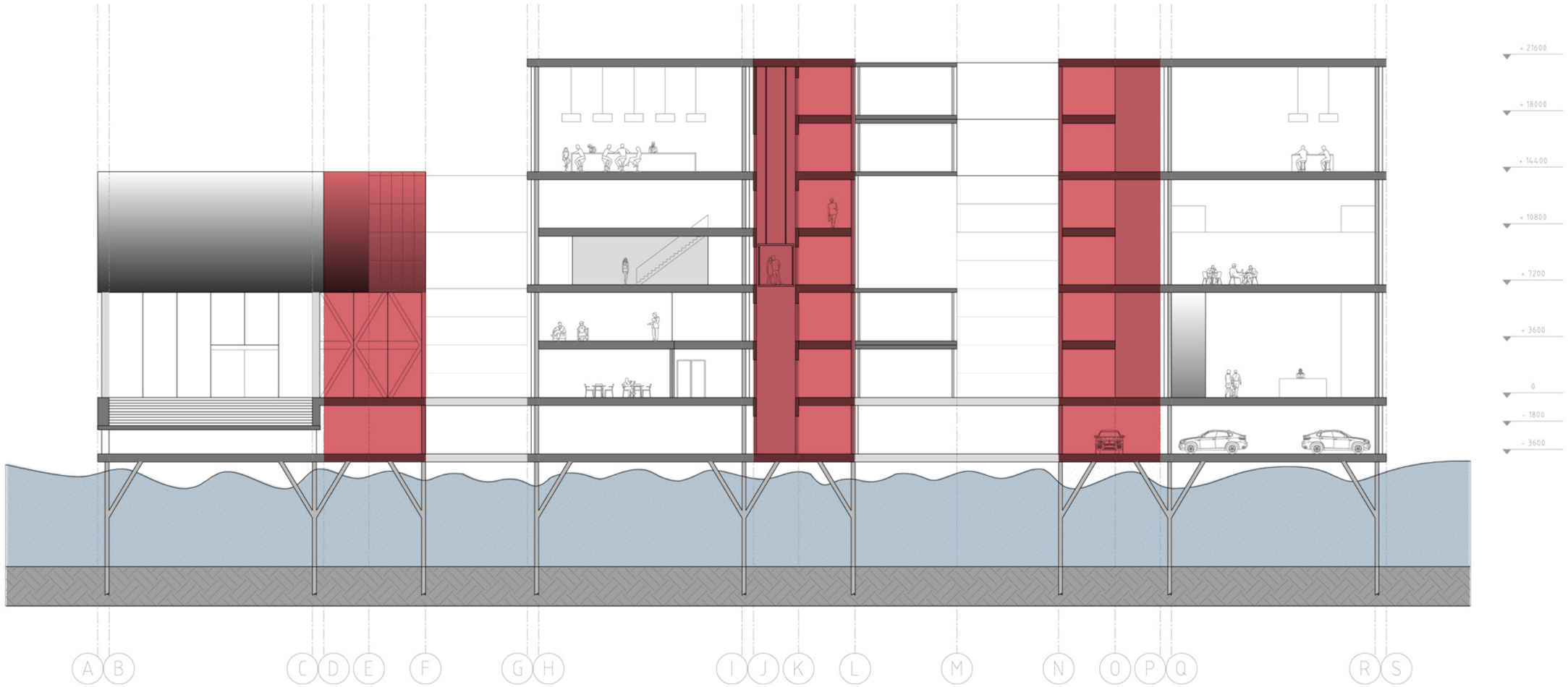

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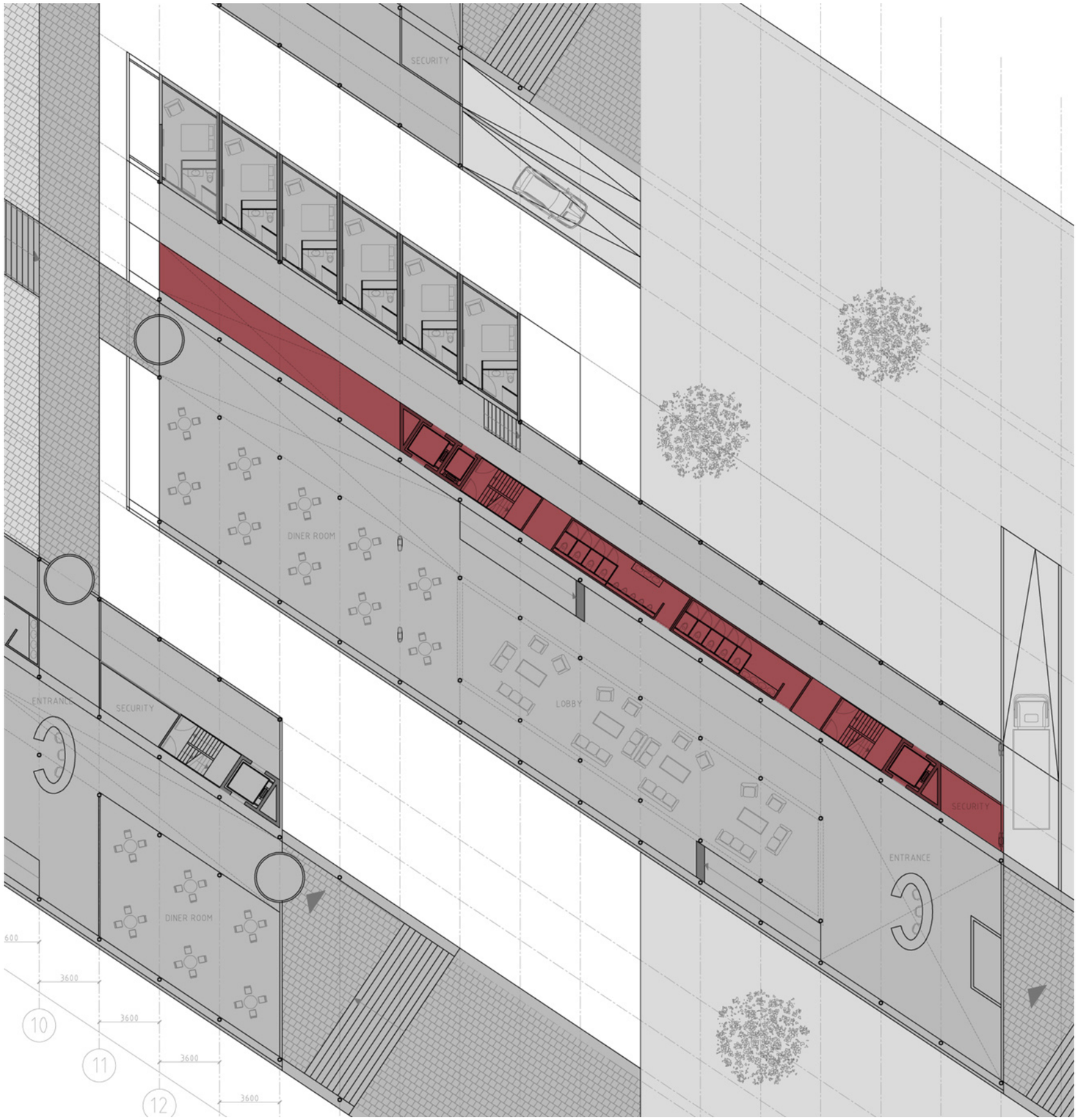

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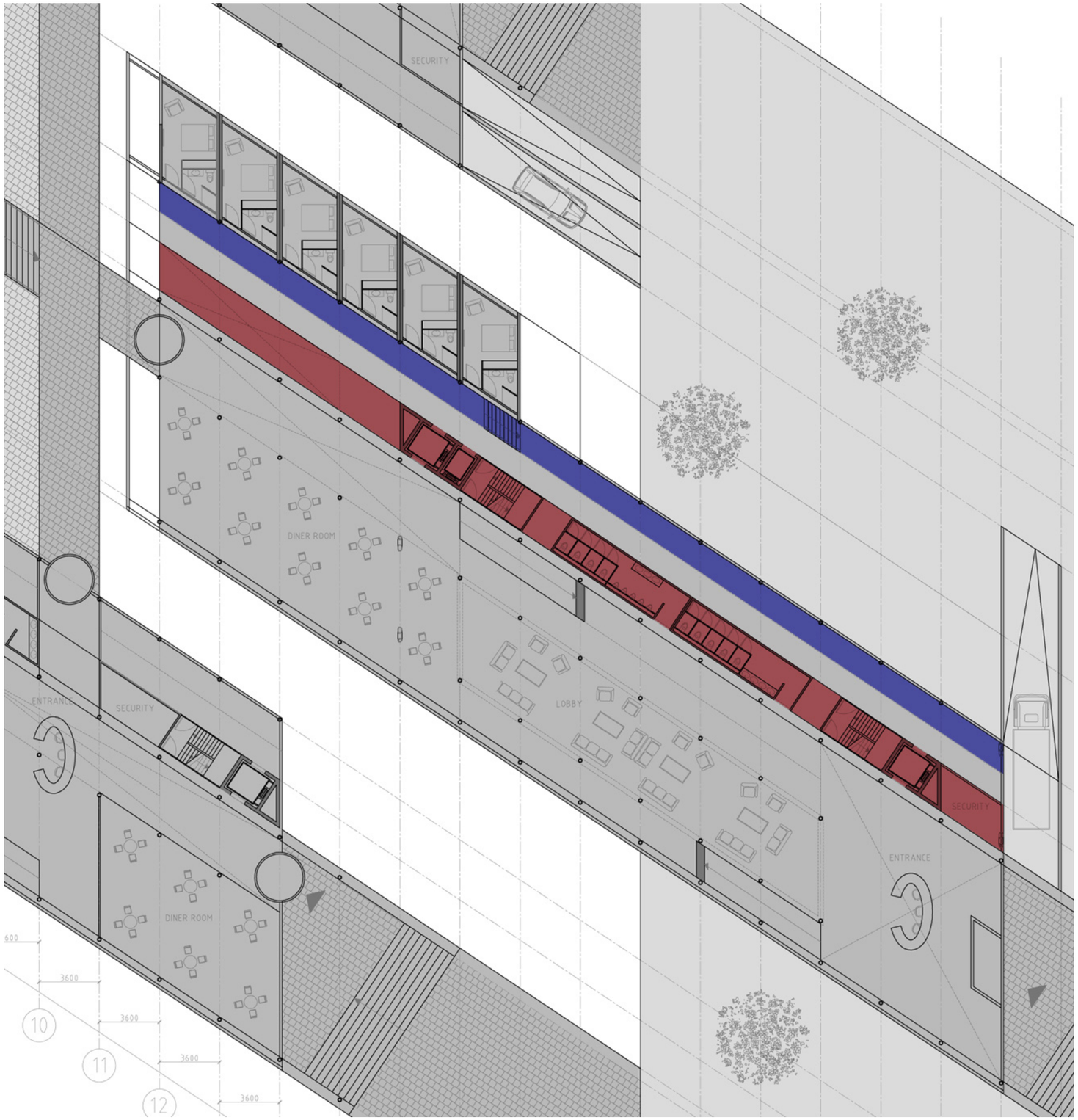

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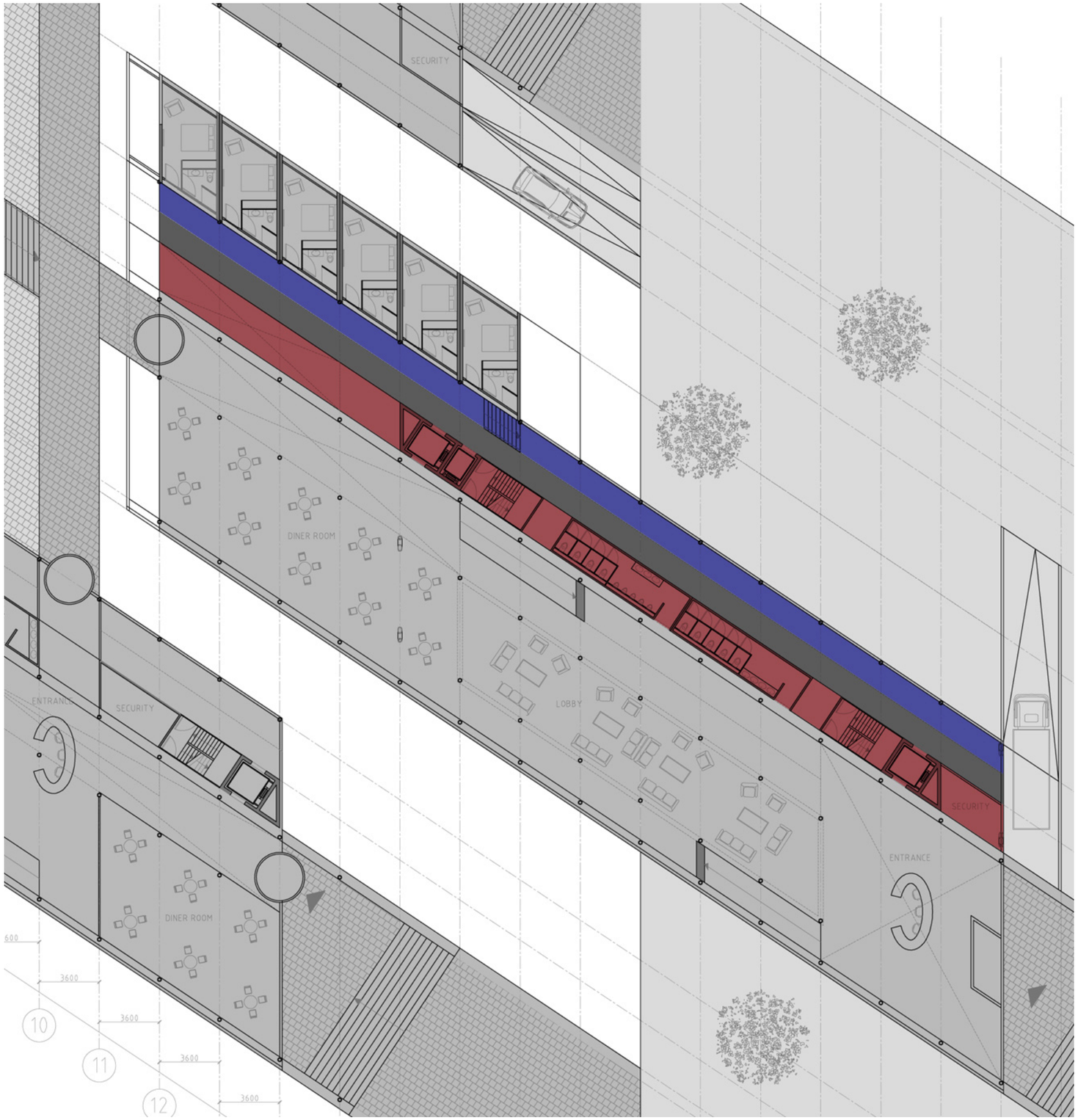

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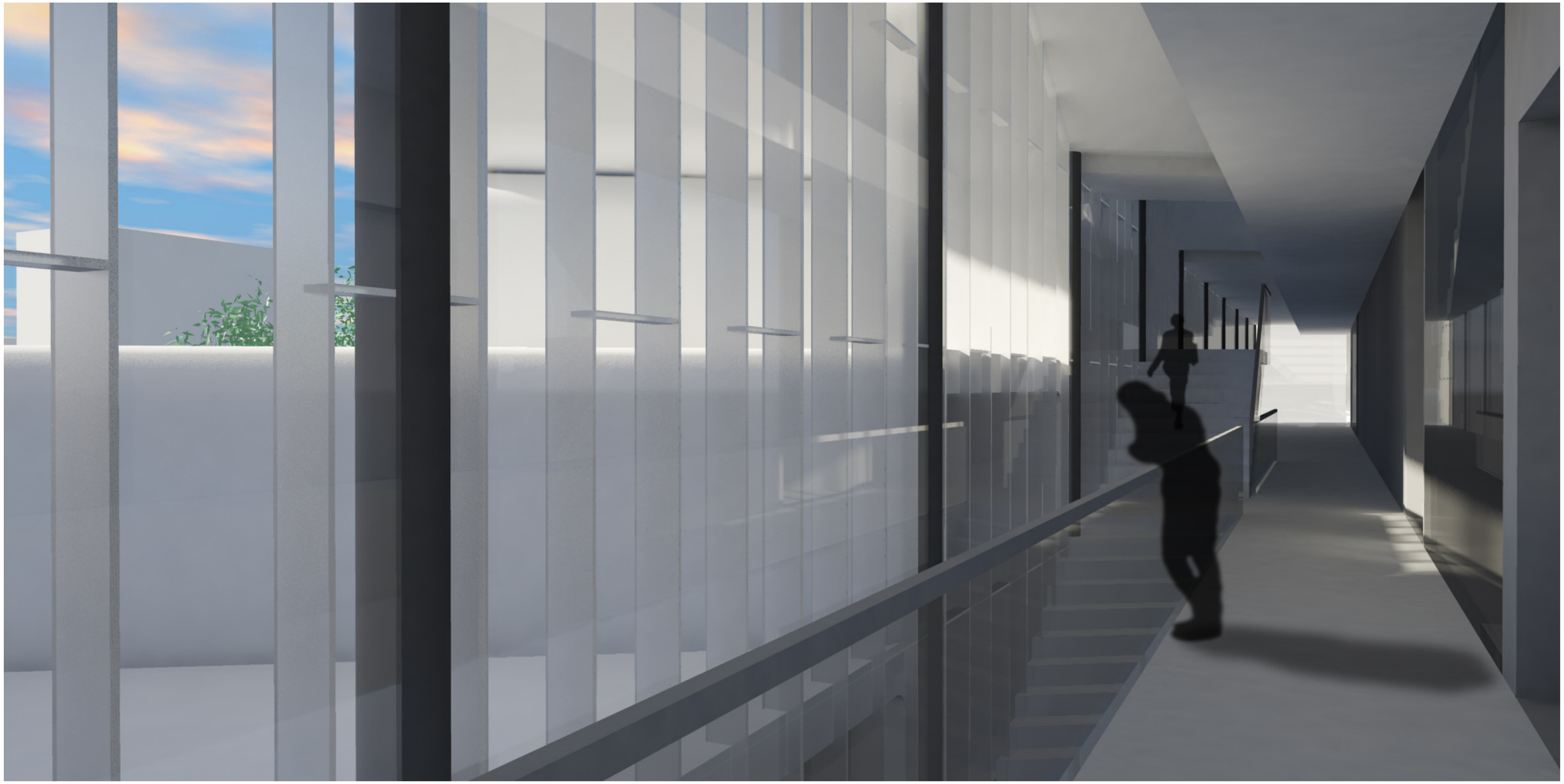

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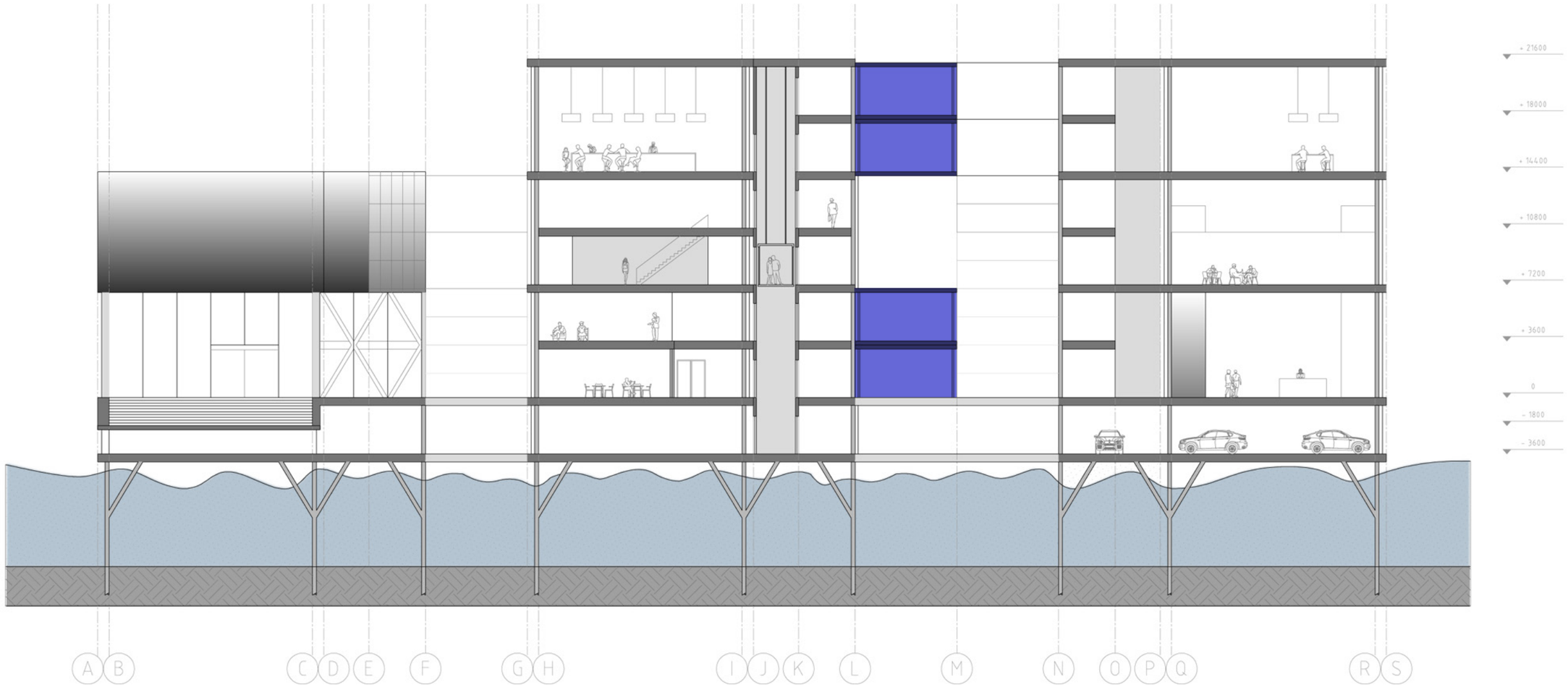
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+ 18000
+ 14400
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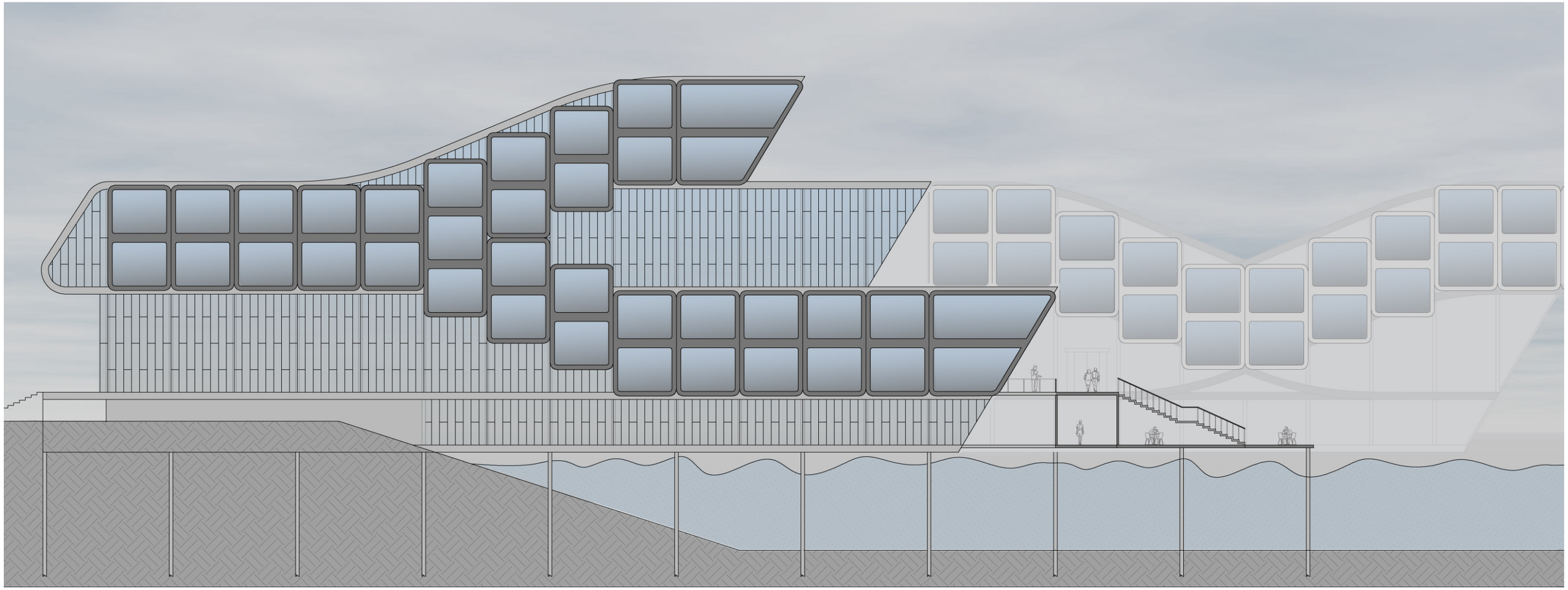
0
- 1800
- 3600
A B C D E F G H I J K L M N O P Q R S

Kamers

Kamers

Kamers



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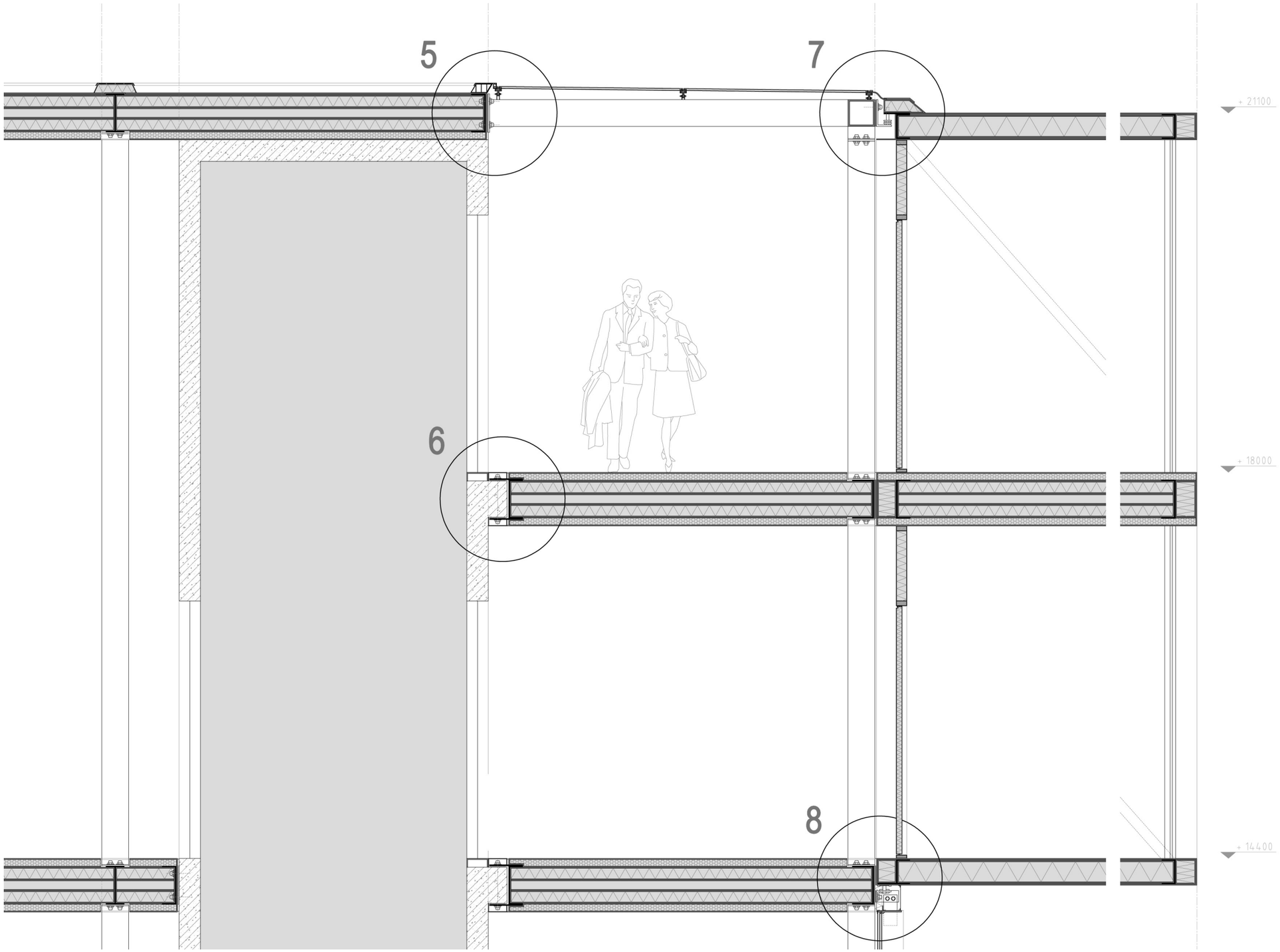

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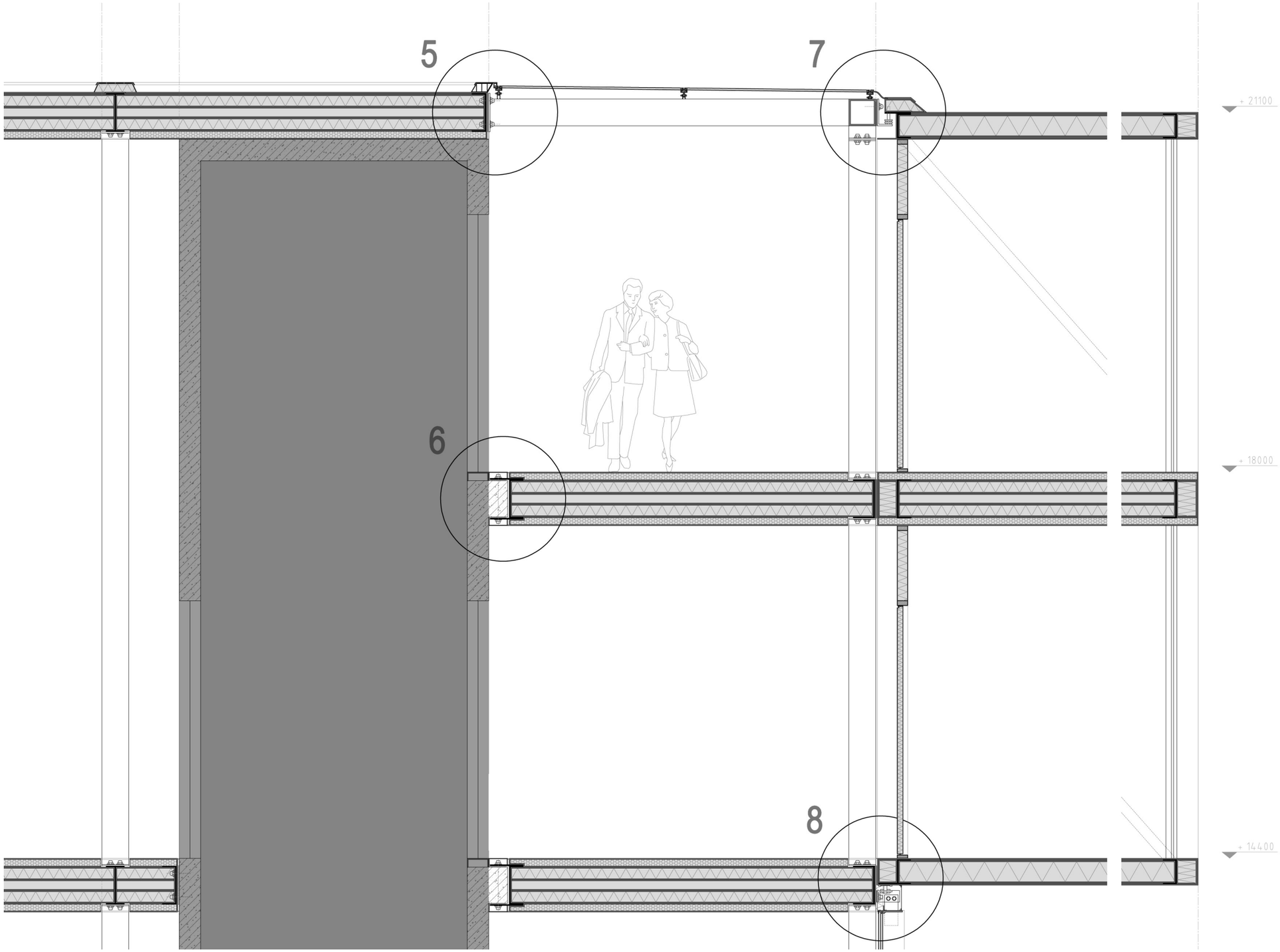

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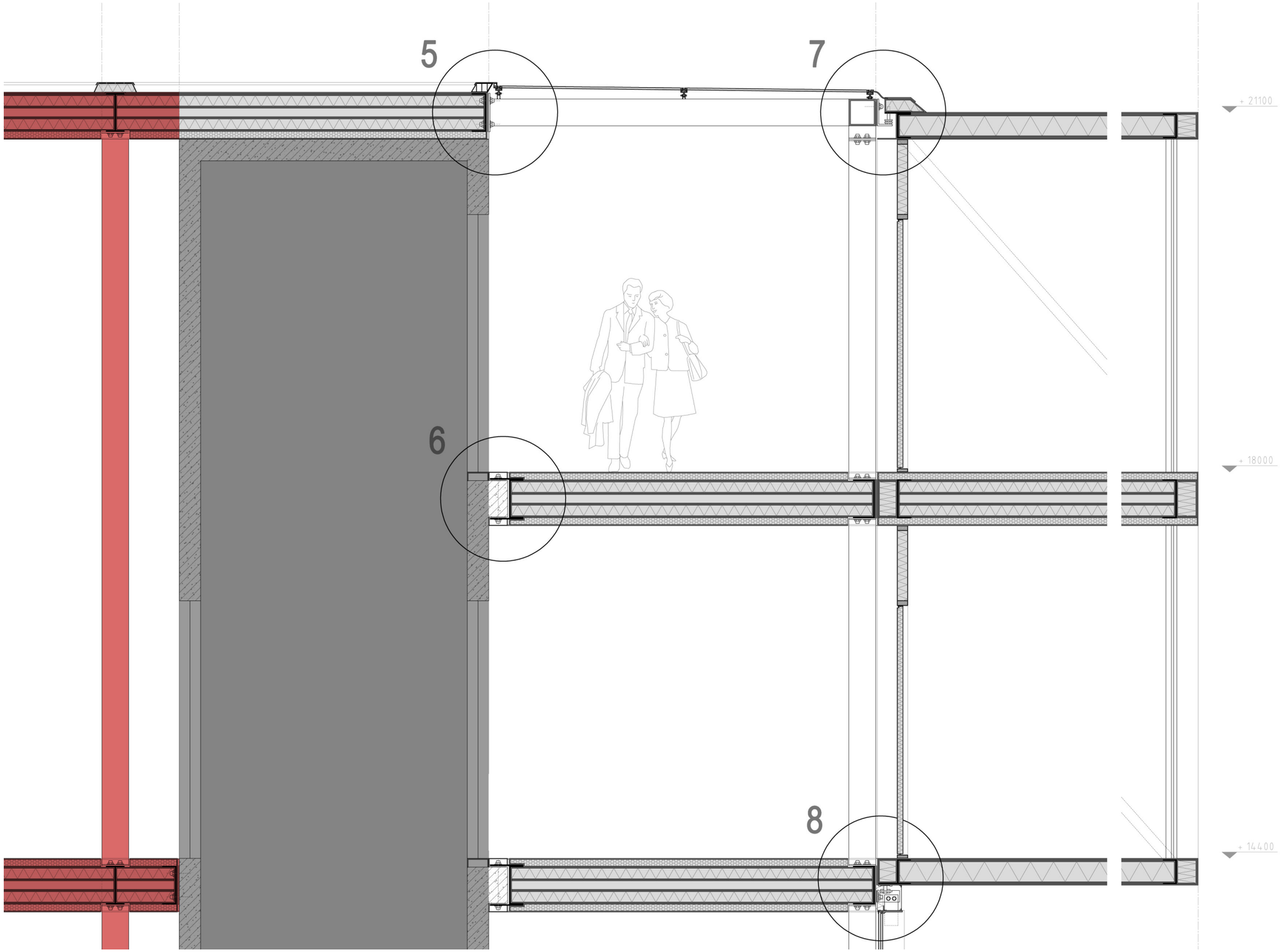

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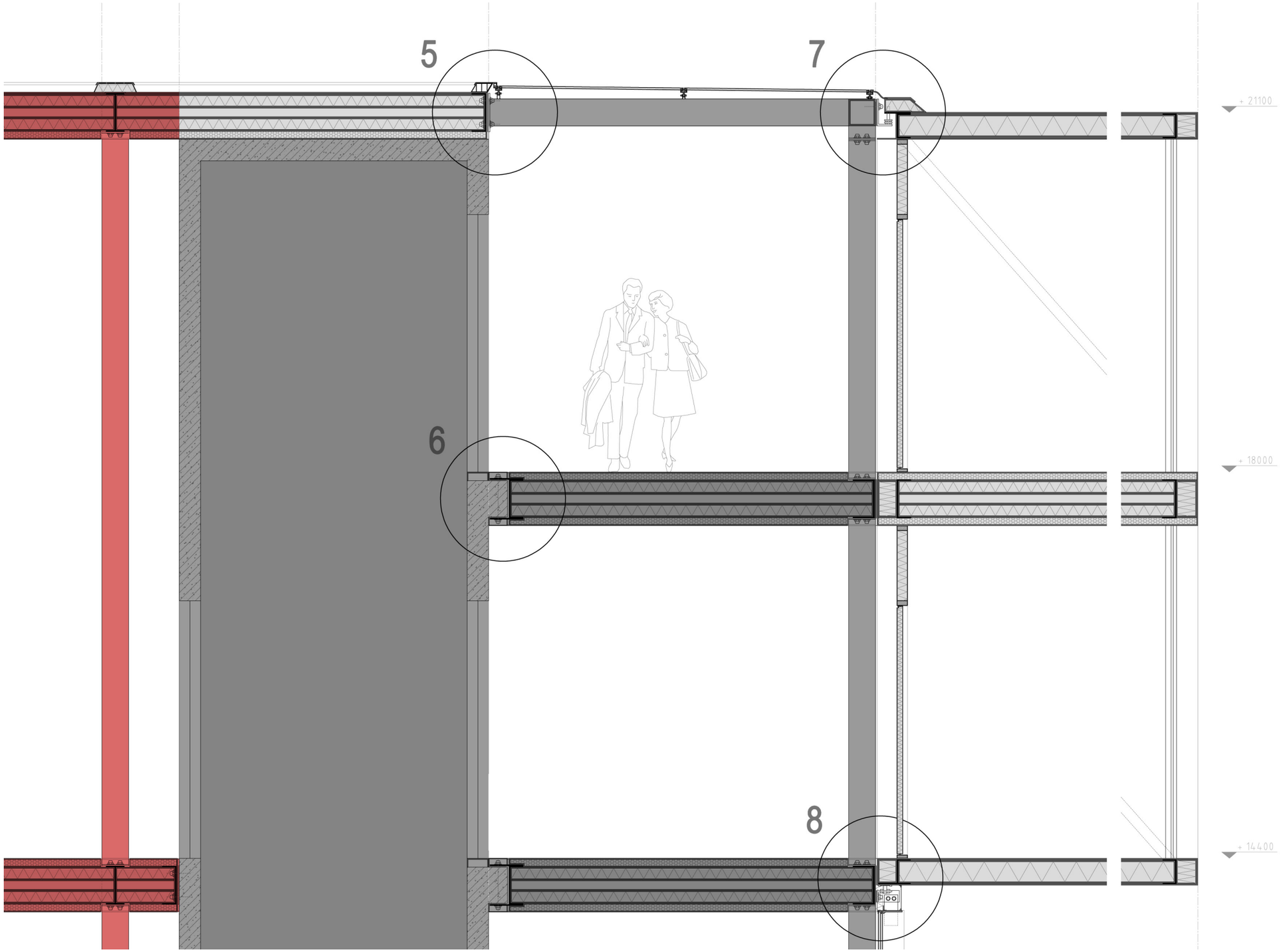

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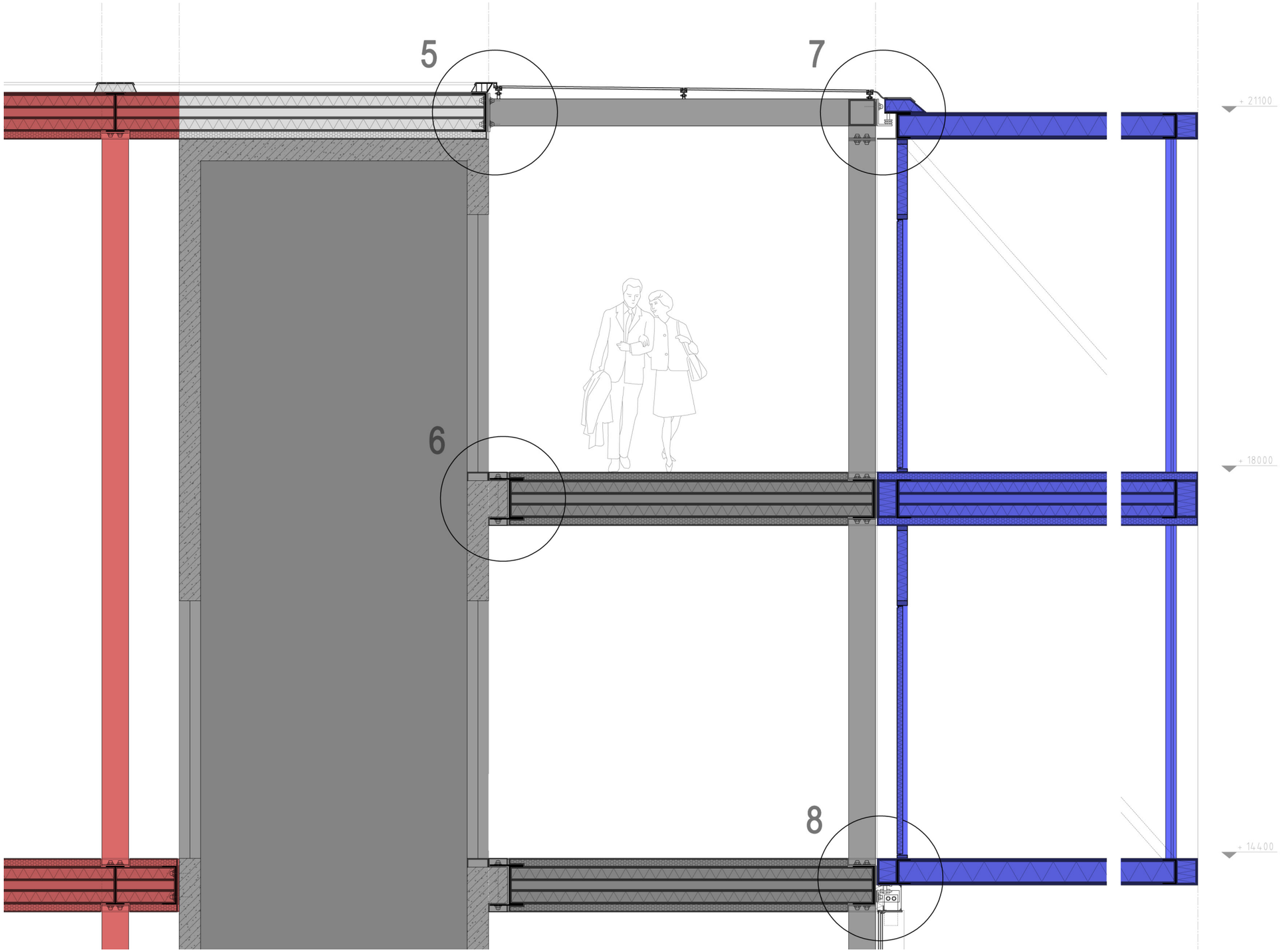

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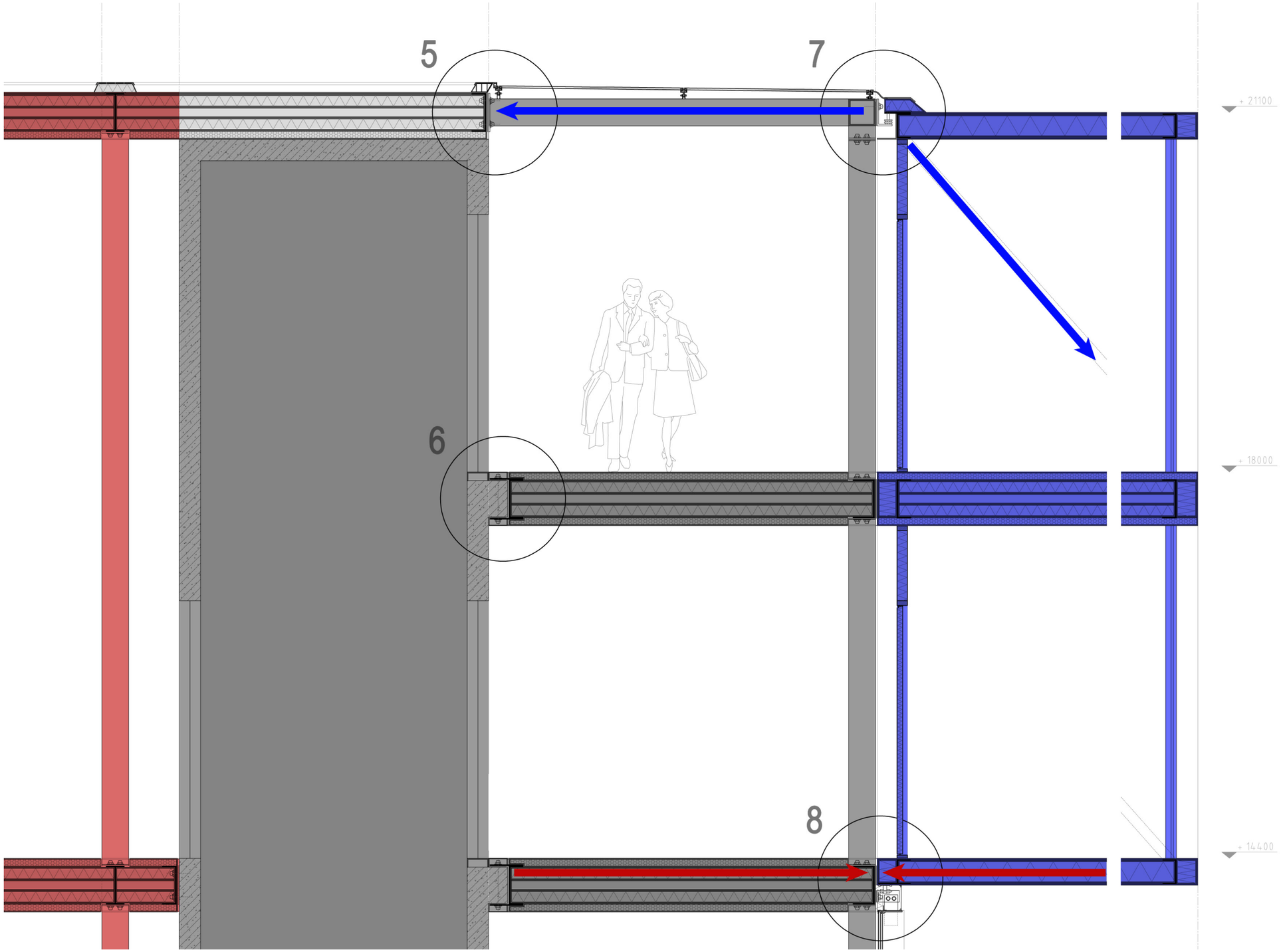
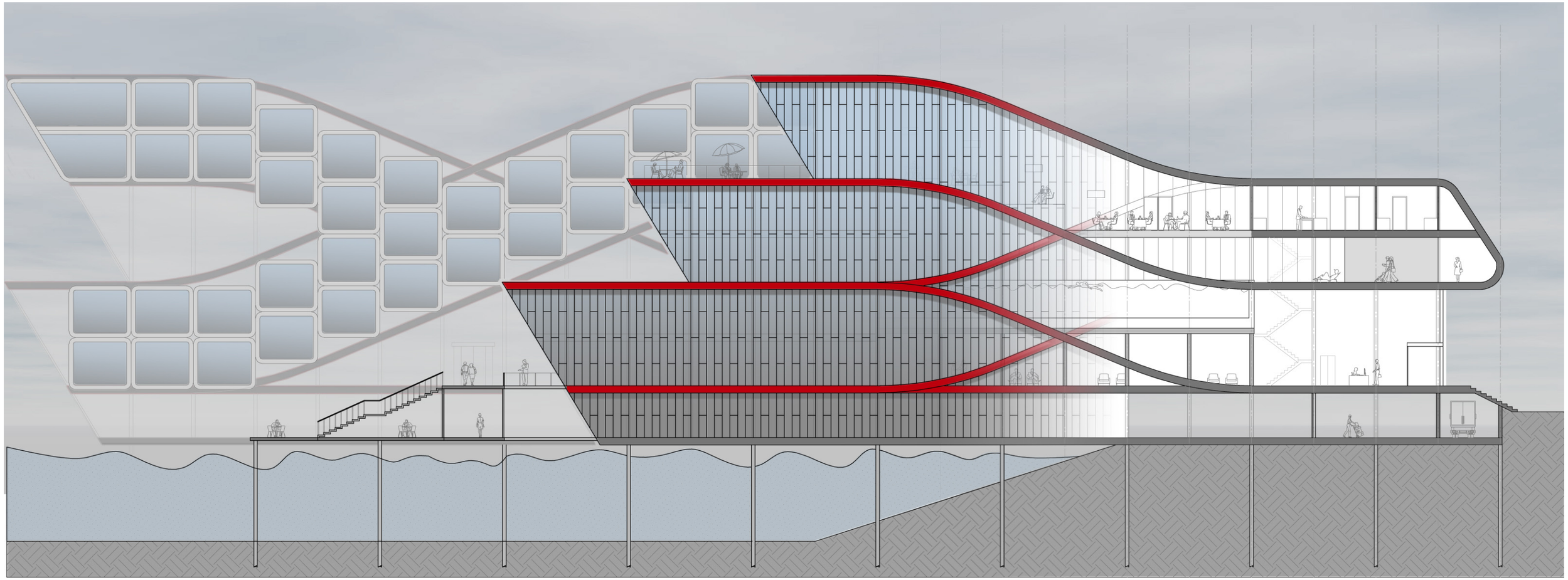
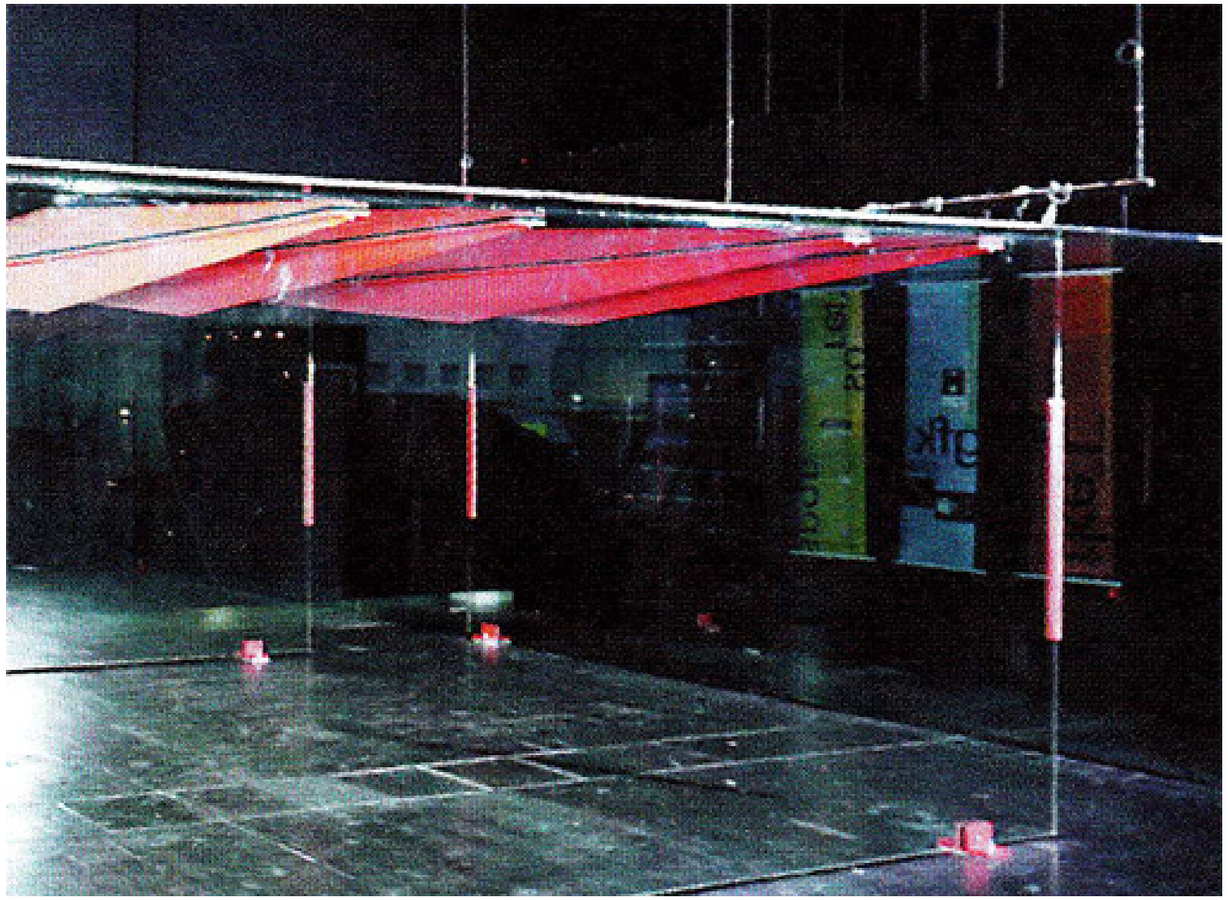
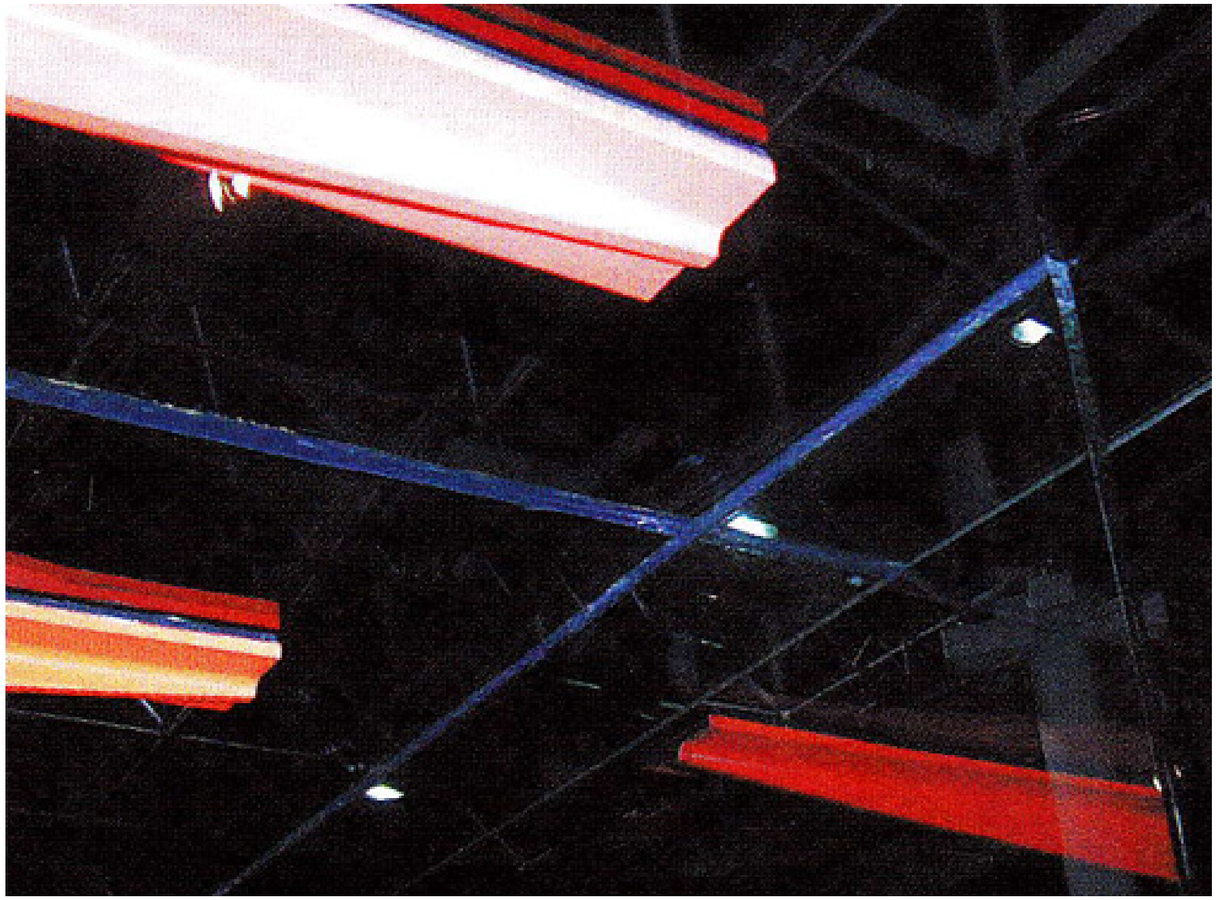


Concept Gevel



Uitgangspunt Constructie





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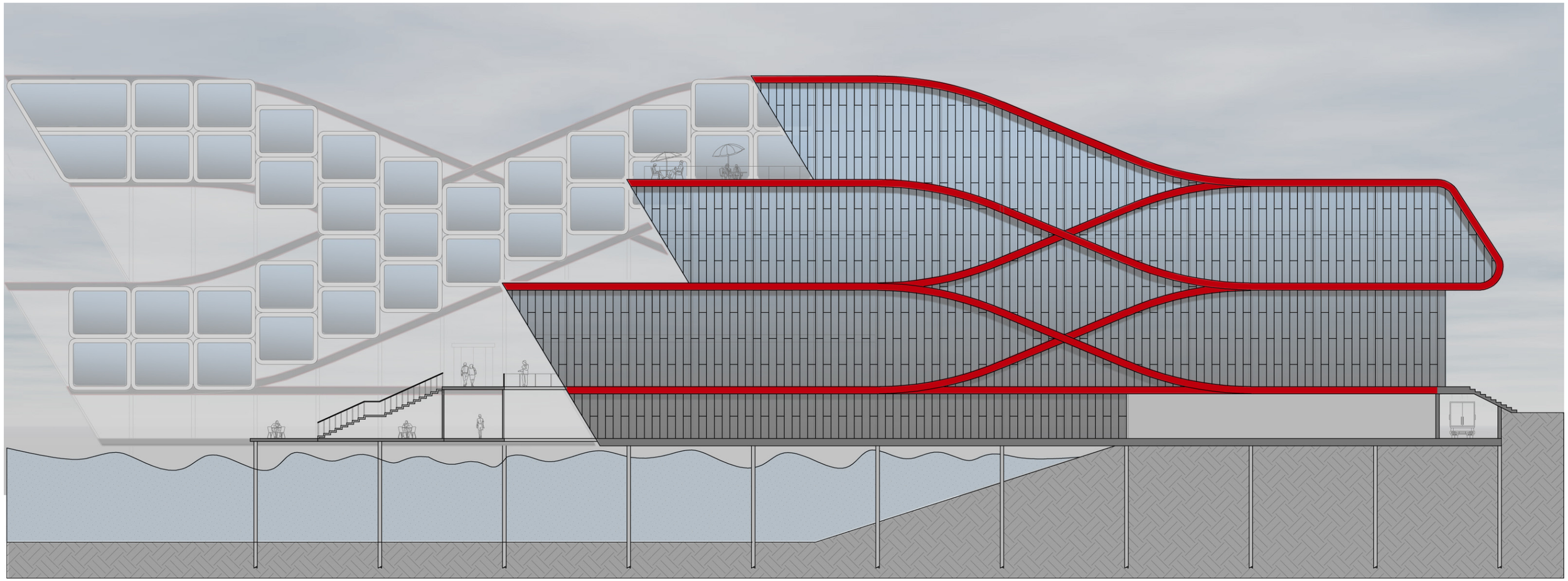
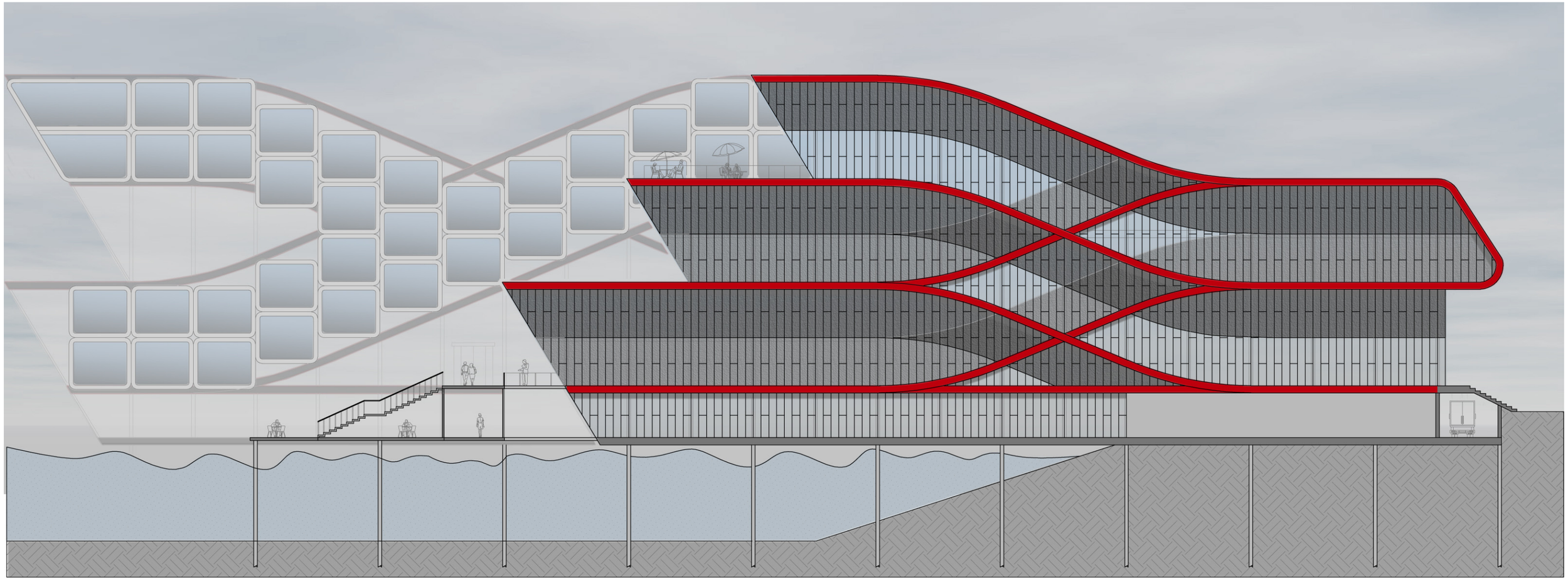
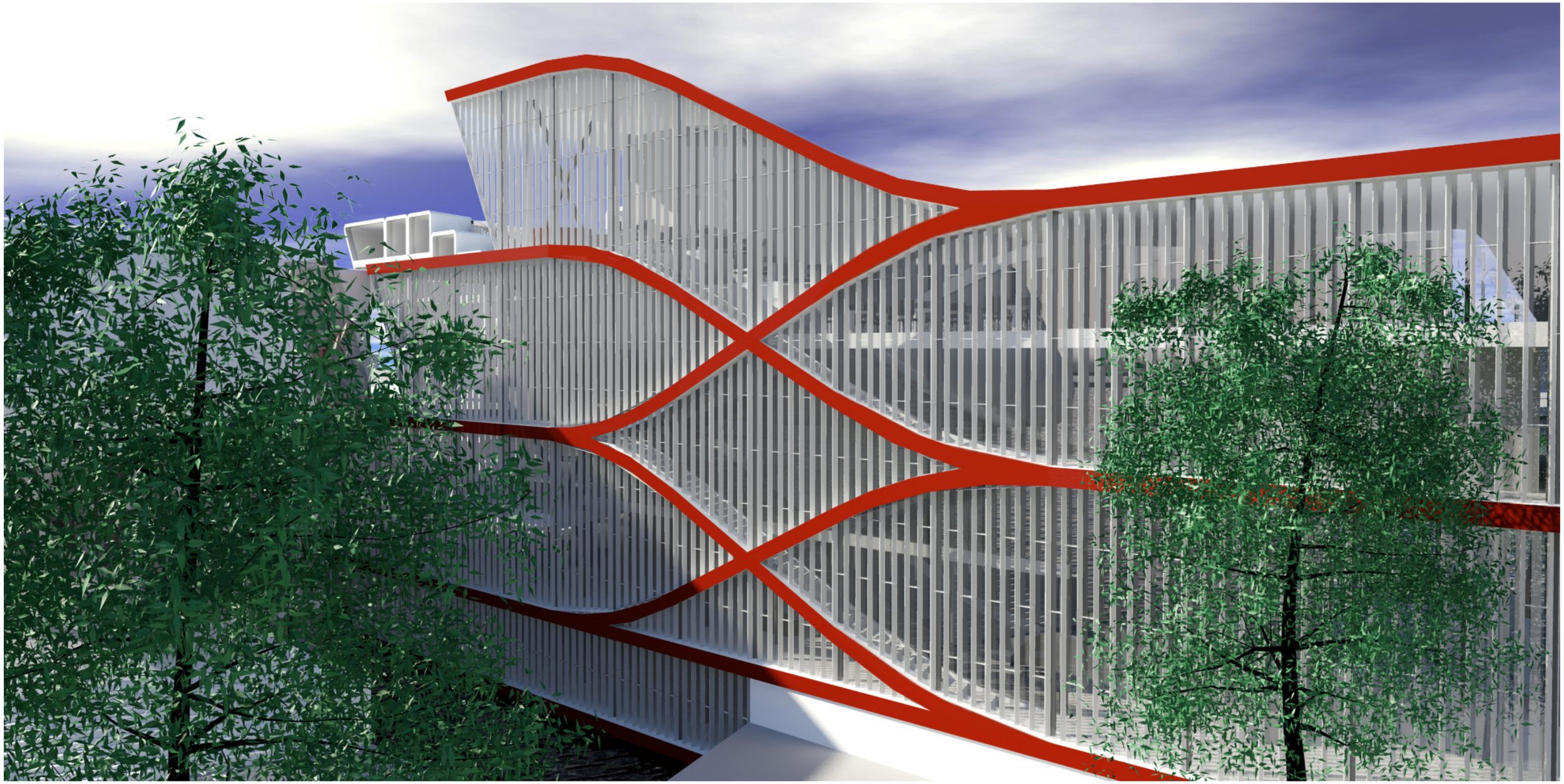


Zonwering



Gevel dicht



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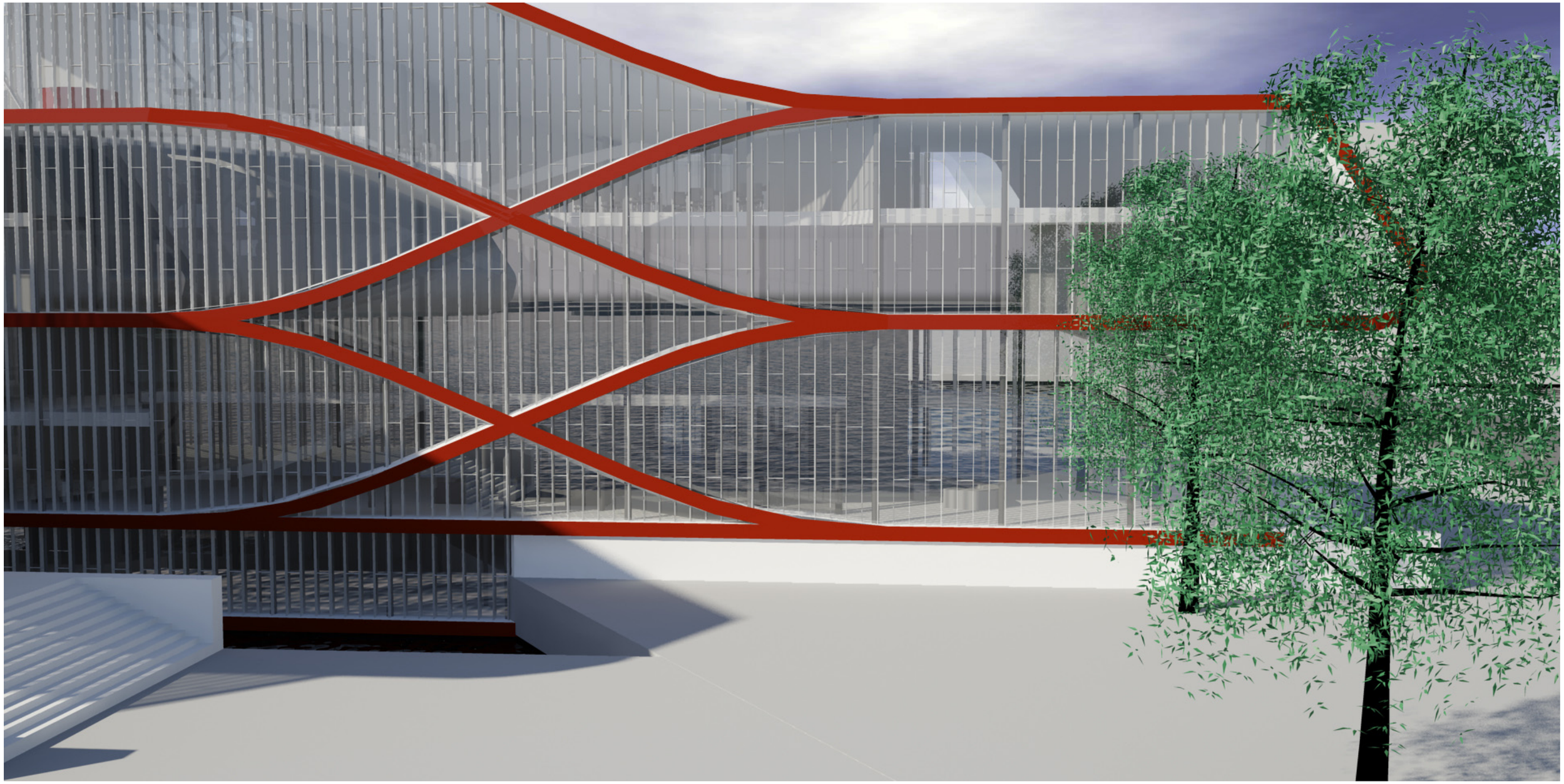

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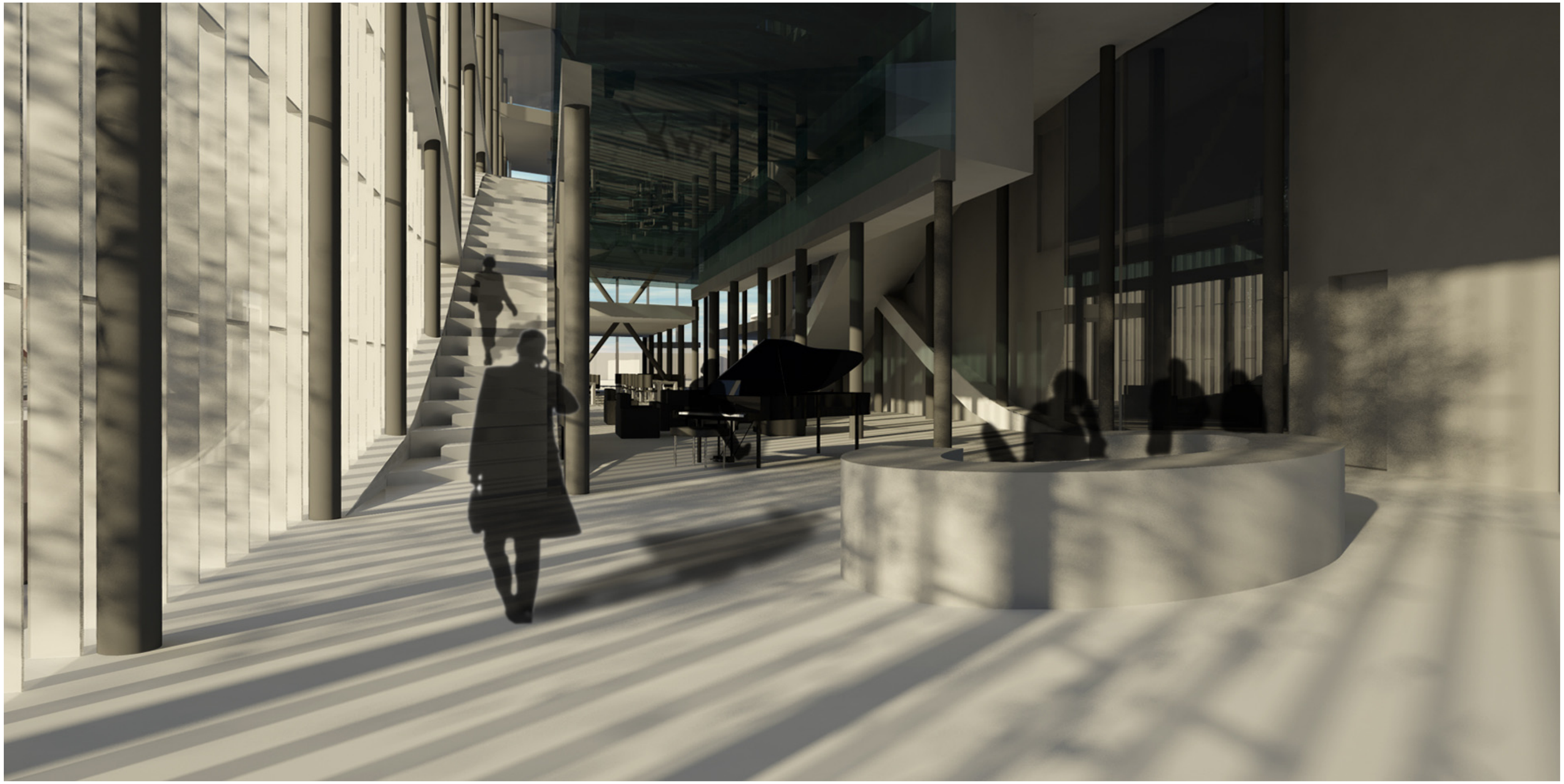
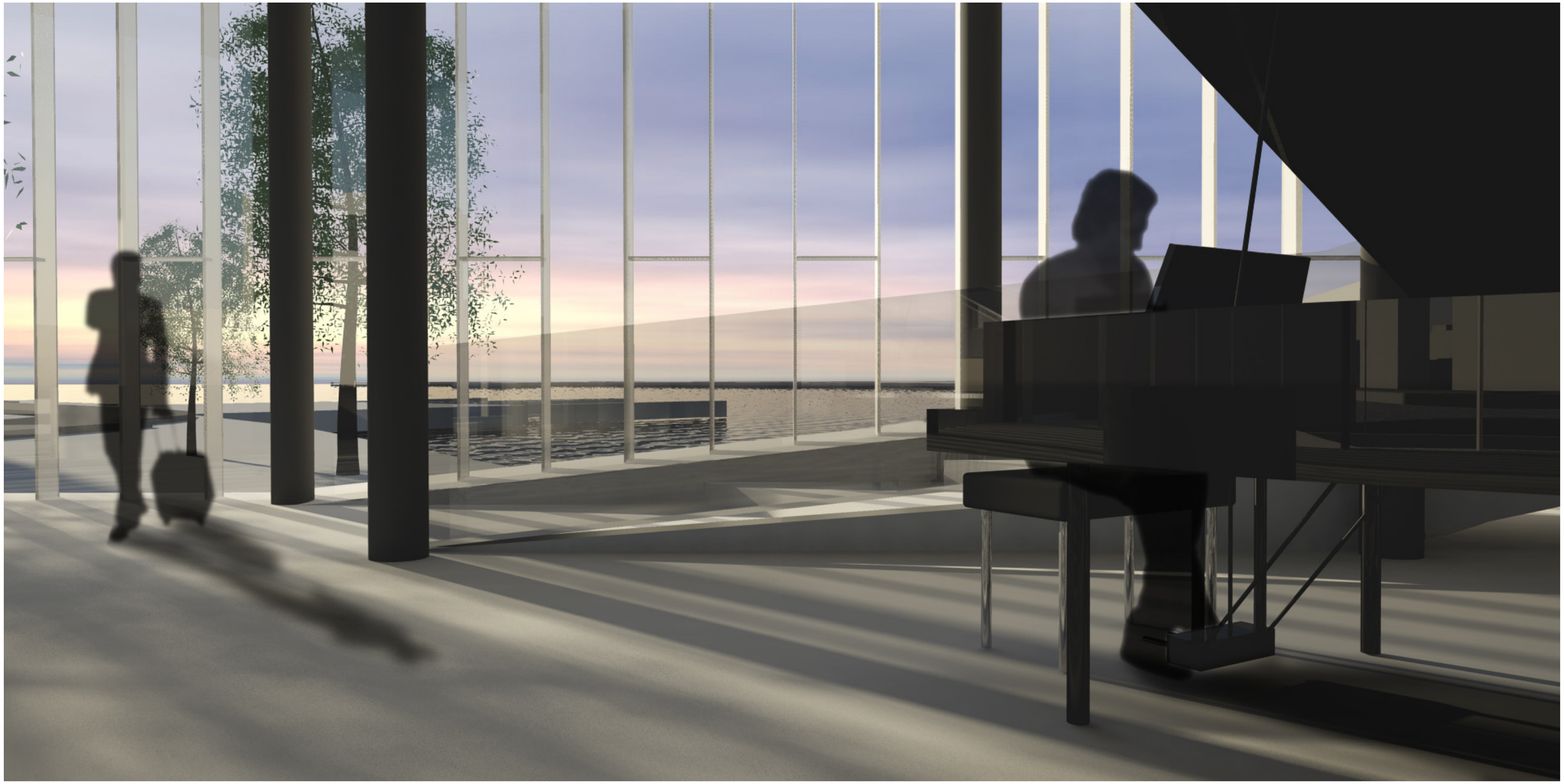
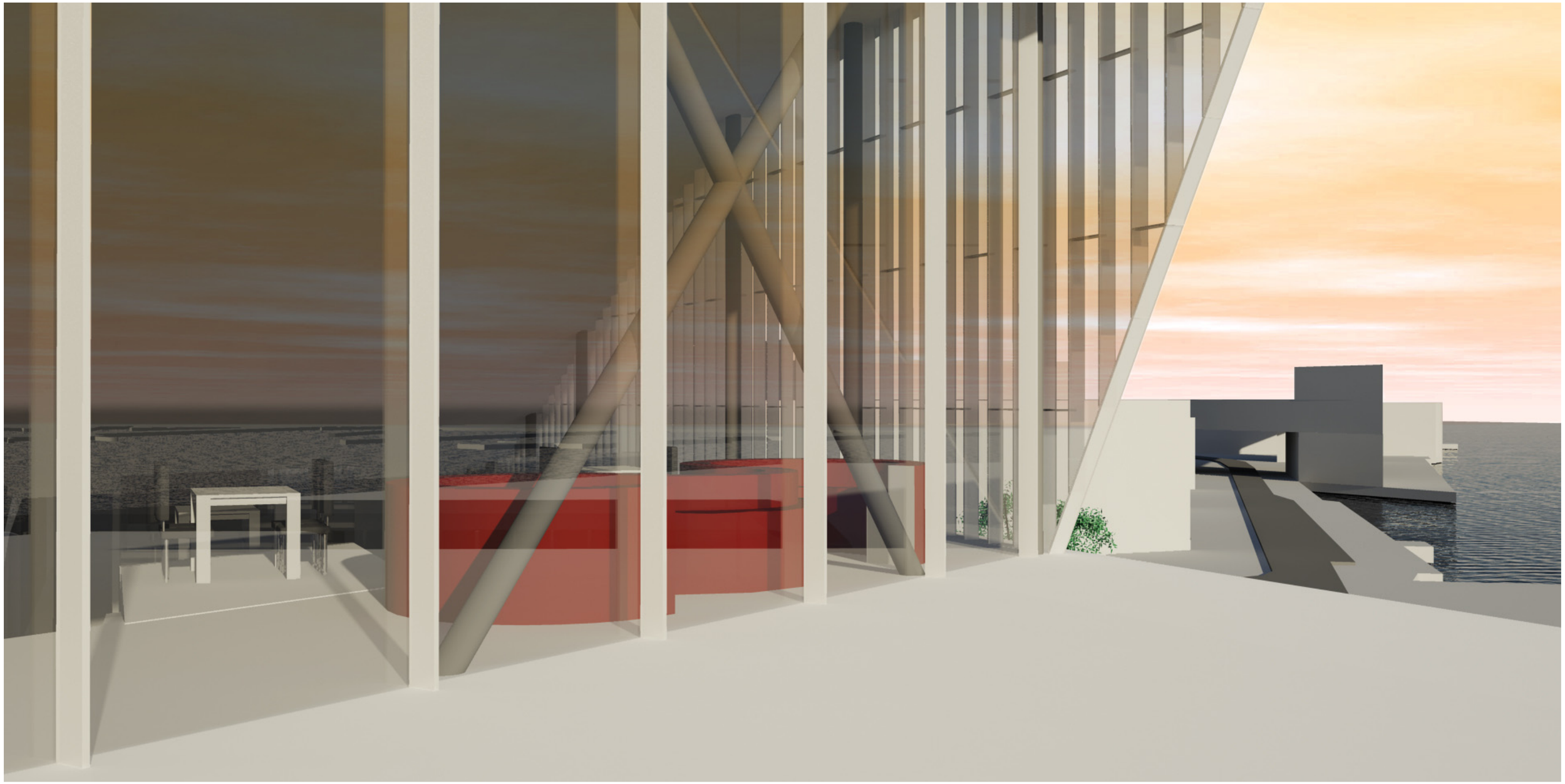


Gevel open

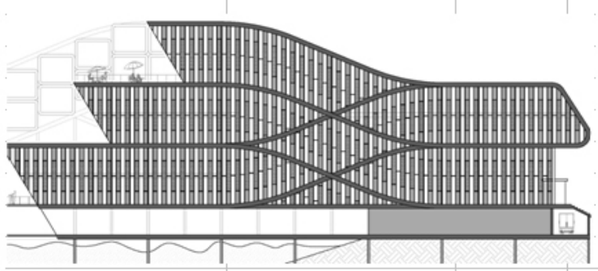


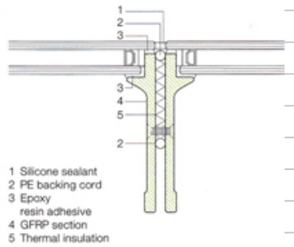
Kopgevel



Rekenmodel

FACADE BUILDING TECHNOLOGY DESIGN





Bending	w	=	36	200
Youngs Modulus	E_FRP pultruded	=	28000	N/mm2
	E_glass	=	68000	N/mm2
	n_composite	=	0,41	
Yield Strength	σ_GRP pultruded	=	193	N/mm2
	σ_glass	=	38	N/mm2
Width Element	b	=	2165	mm
Height Element	h	=	7200	mm
Thickness glass1	t_glass1	=	4	mm
Thickness glass2	t_glass2	=	4	mm
Thickness spacer	t_spacer	=	8	mm
Height FRP	h	=	250	mm
Thickness FRP	t_FRP	=	28	mm
Thickness FRP modi	t_FRP modified	=	11,53	mm
Area	A_glass1	=	8660	mm2
	A_glass2	=	8660	mm2
	A_FRP	=	7000	mm2
	A_FRP modified	=	2882,35	mm2

Centre	z_glass1	=	2	mm
	z_glass2	=	2	mm
	z_FRP	=	125	mm
	z_total	=	239,02	mm
	z_glass-stress	=	26,98	mm
	z_glass1 modified	=	12,98	mm
	z_glass2 modified	=	24,98	mm
	z_FRP	=	114,02	mm
Load Cases	q	=	4,13082	N/mm
Weight	FRP pultruded	=	2100	kg/m3
	Glass	=	2450	kg/m3

$$\sigma = \frac{M}{W}$$

$$W = \frac{I}{Z}$$

$$M = \frac{1}{8} \cdot q \cdot l^2$$

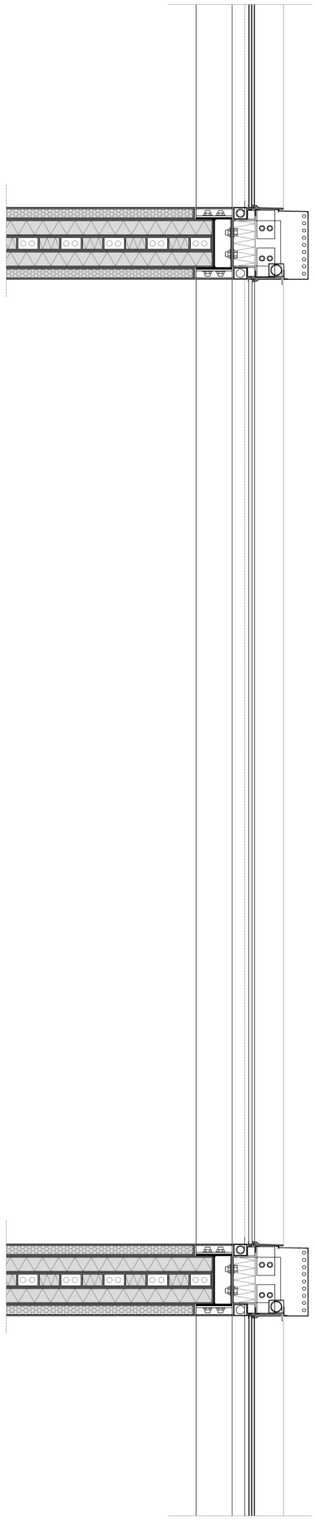
$$I = \frac{1}{12} \cdot b \cdot h^3 + A \cdot z^2$$

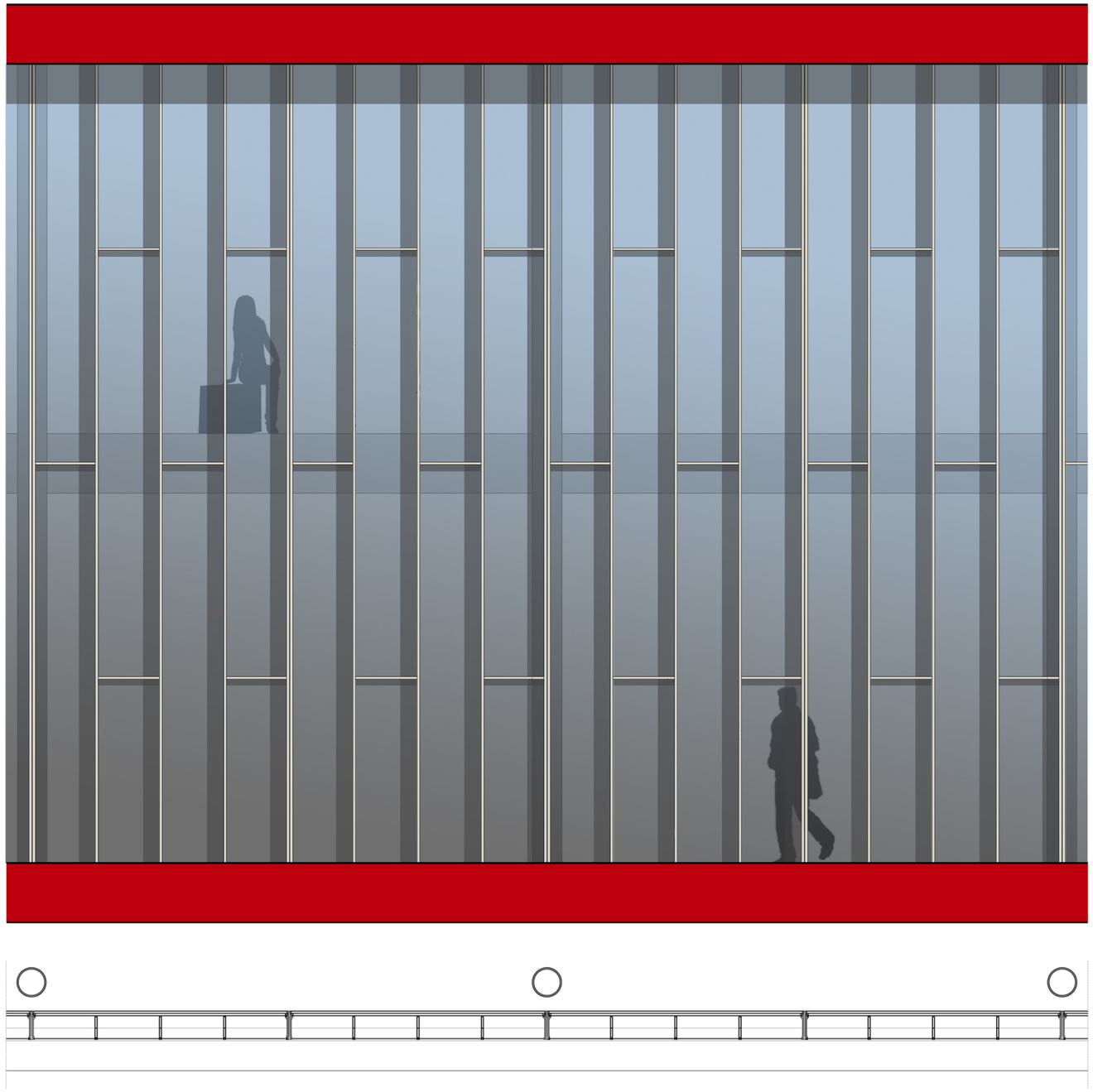
$$w = \frac{5}{384} \cdot \frac{q \cdot l^4}{EI}$$

Load		
Temporary load	0,56	kN/m2
Safety factor	1,5	
Permanent load	0,89	kN/m2
Safety factor	1,2	
Total load	1,908	kN/m2
	0,001908	N/mm2

Bending and Stresses					FRP		Glass	
	I	w	kg/m	M	W	σ	W	σ
FRP pultruded + glass	5,94E+07	3,58E+01	57,13	2,68E+07	2,48E+05	107,77	2,20E+06	12,16
FRP pultruded	3,65E+07	1,42E+02	14,70	2,68E+07	2,92E+05	91,78		

Gevelopbouw 1/20





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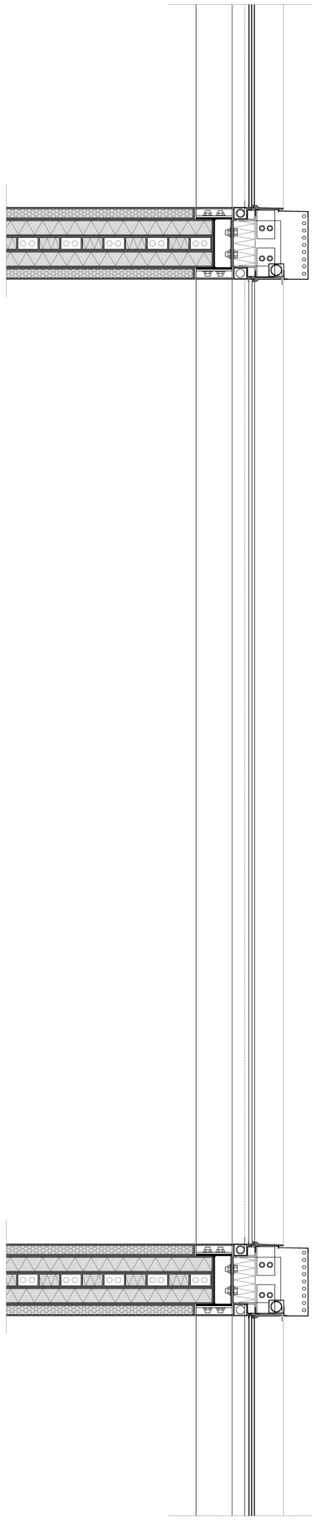
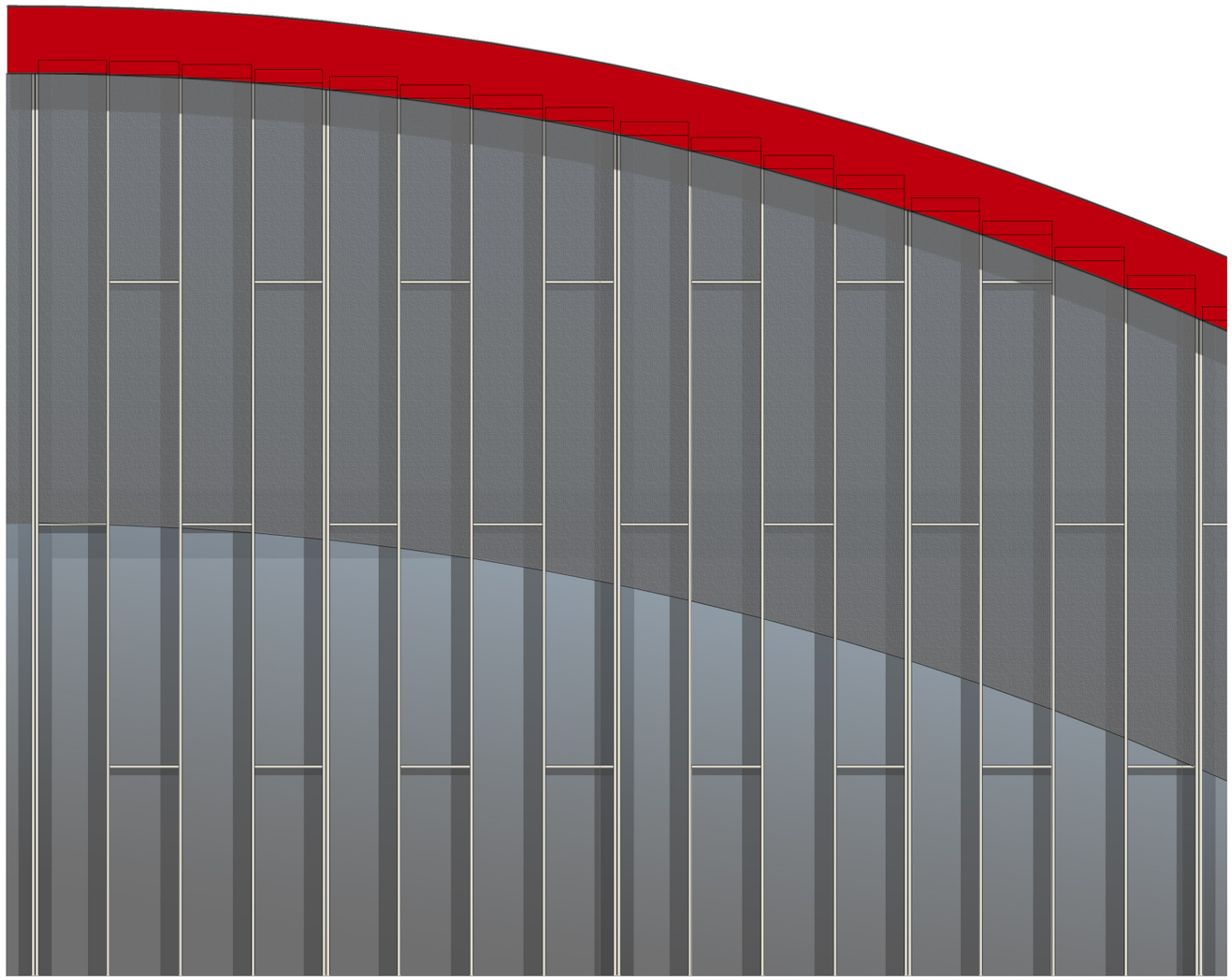
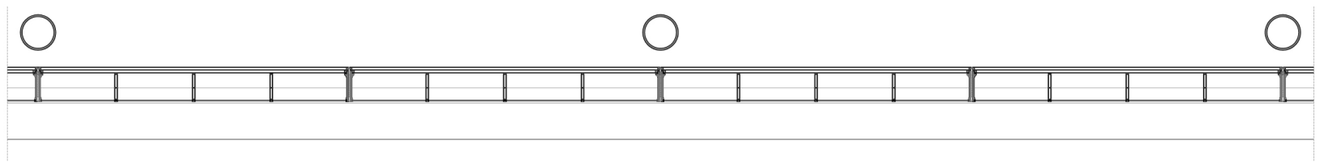
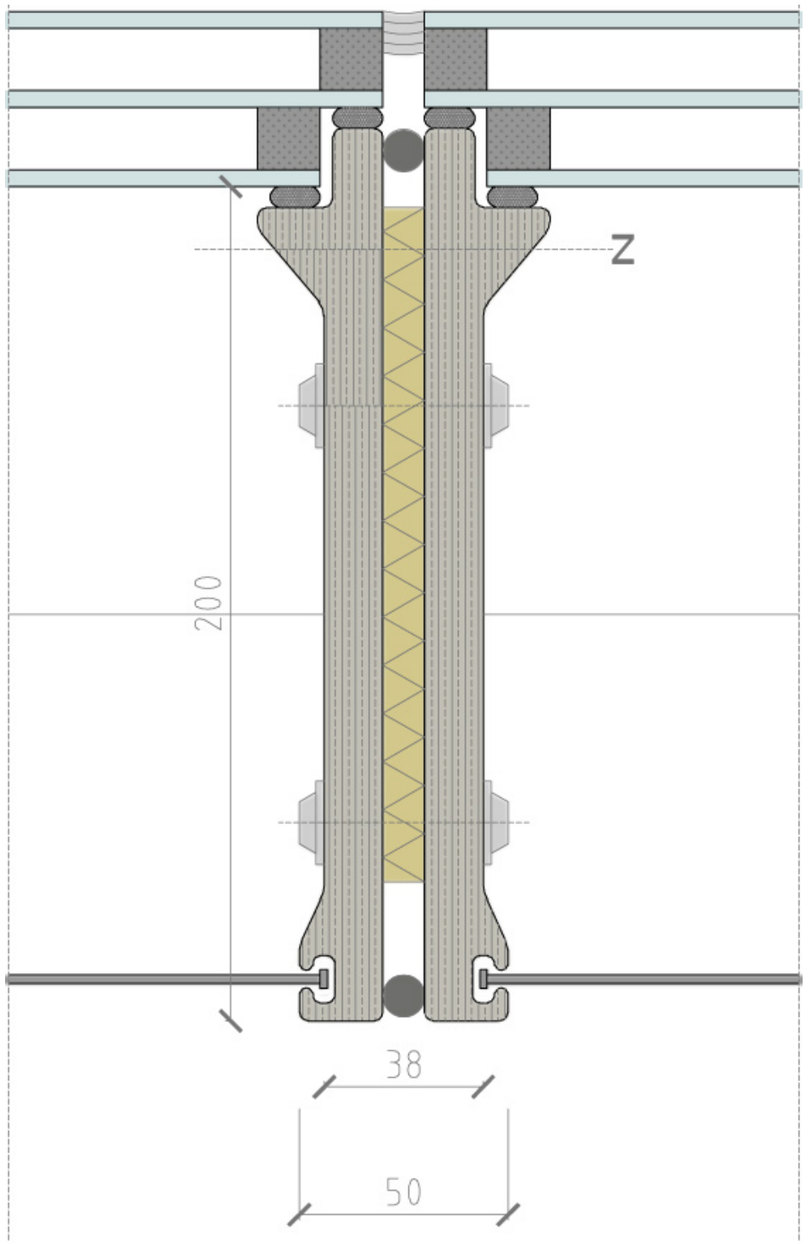
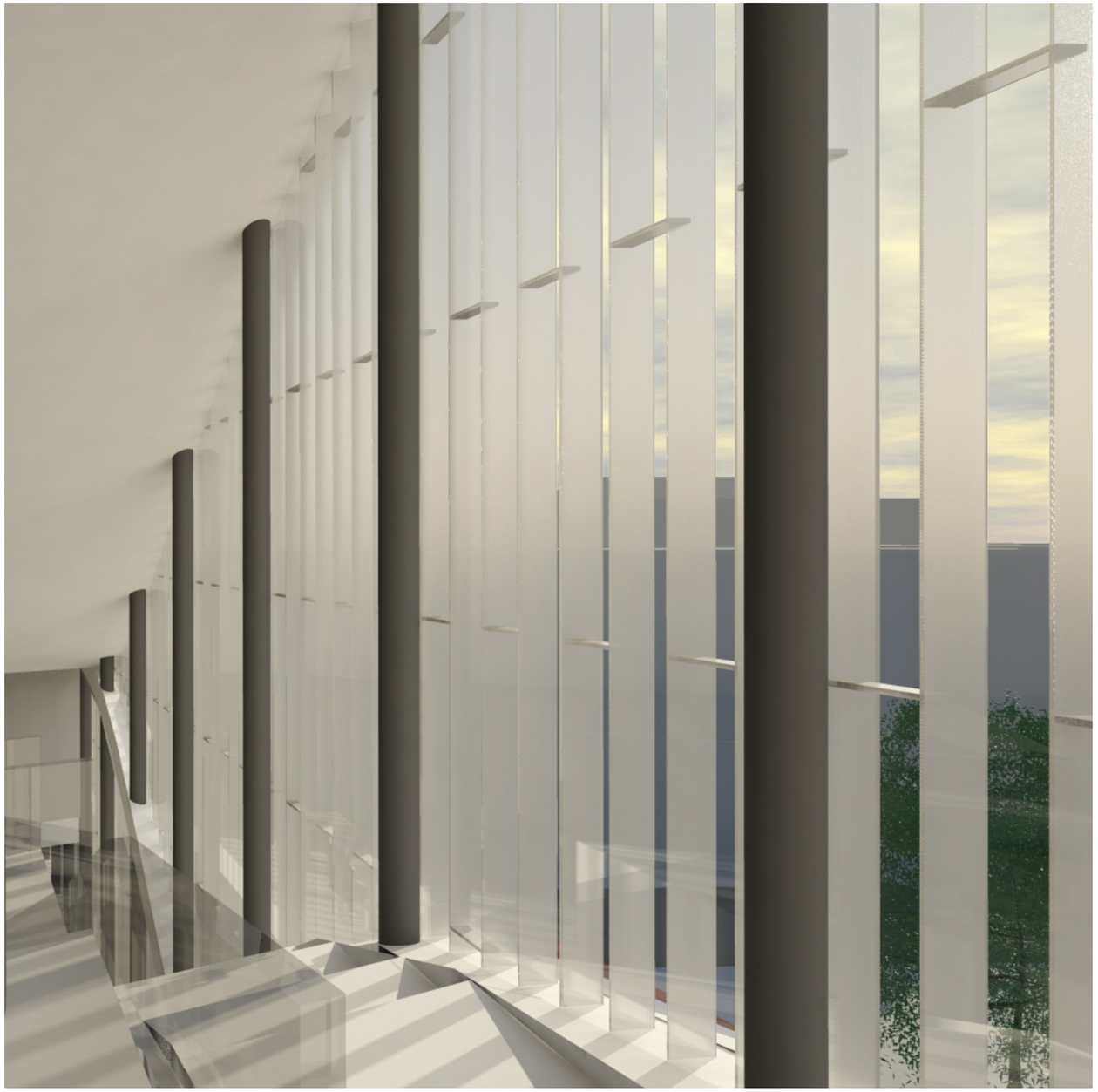






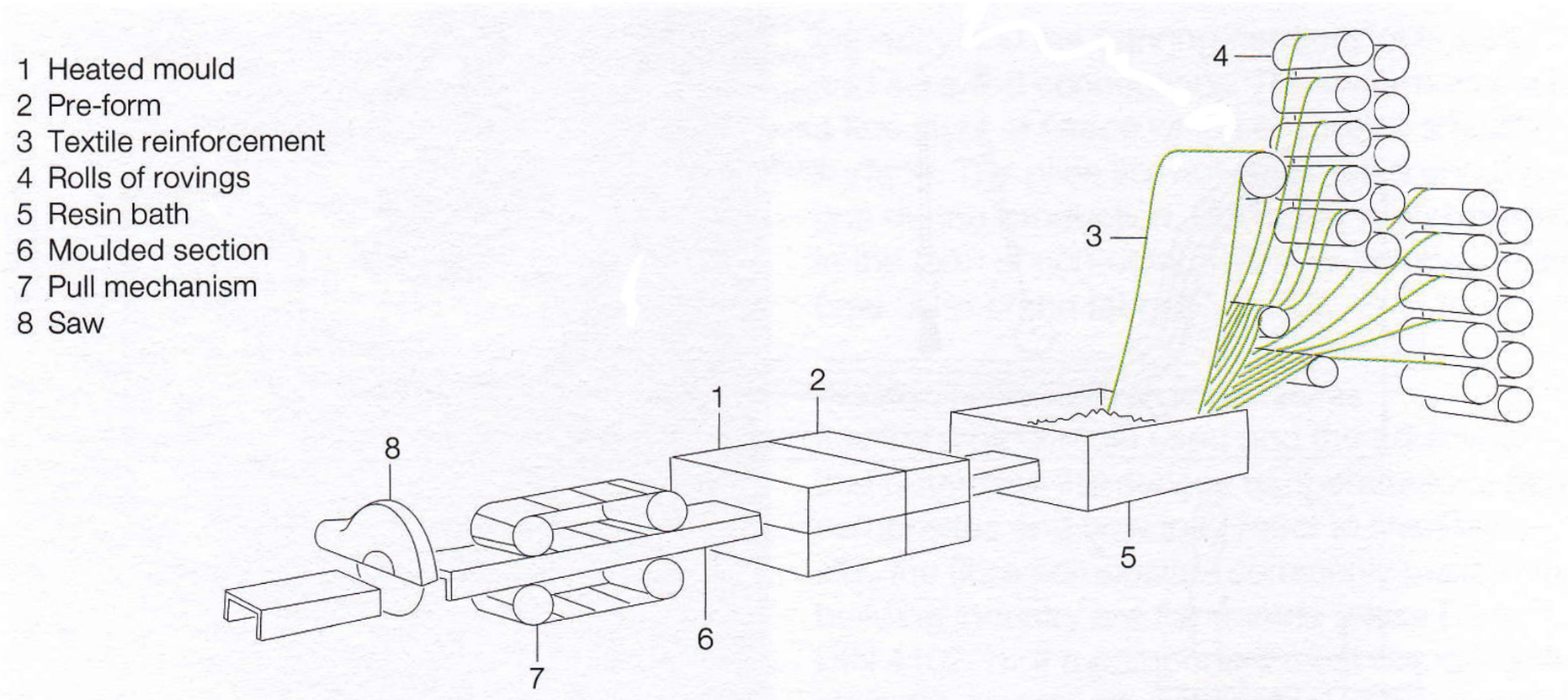
FRP-profiel

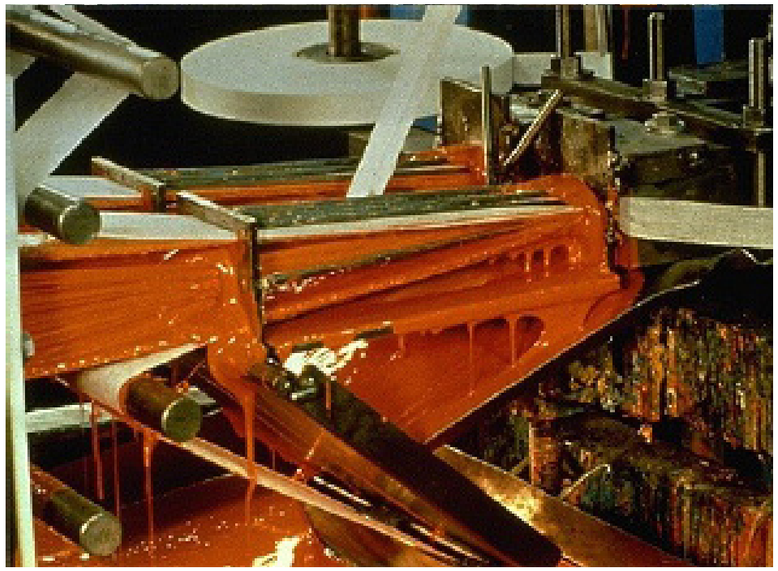


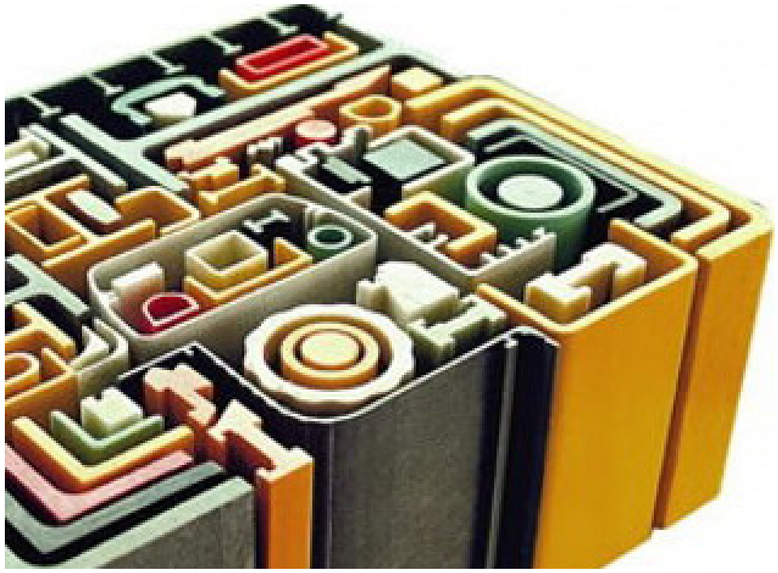


Productie

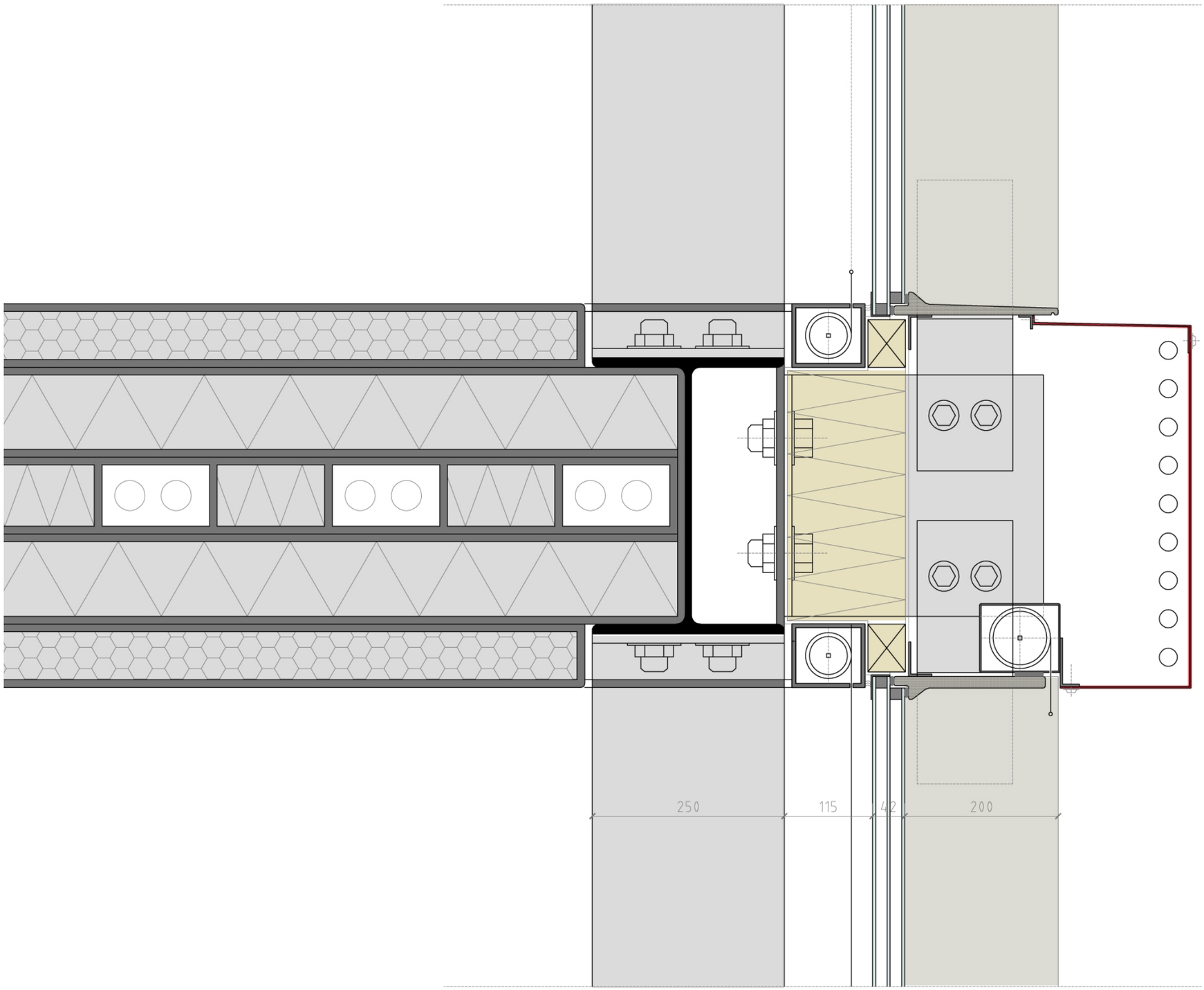
Productie - Pultrusie



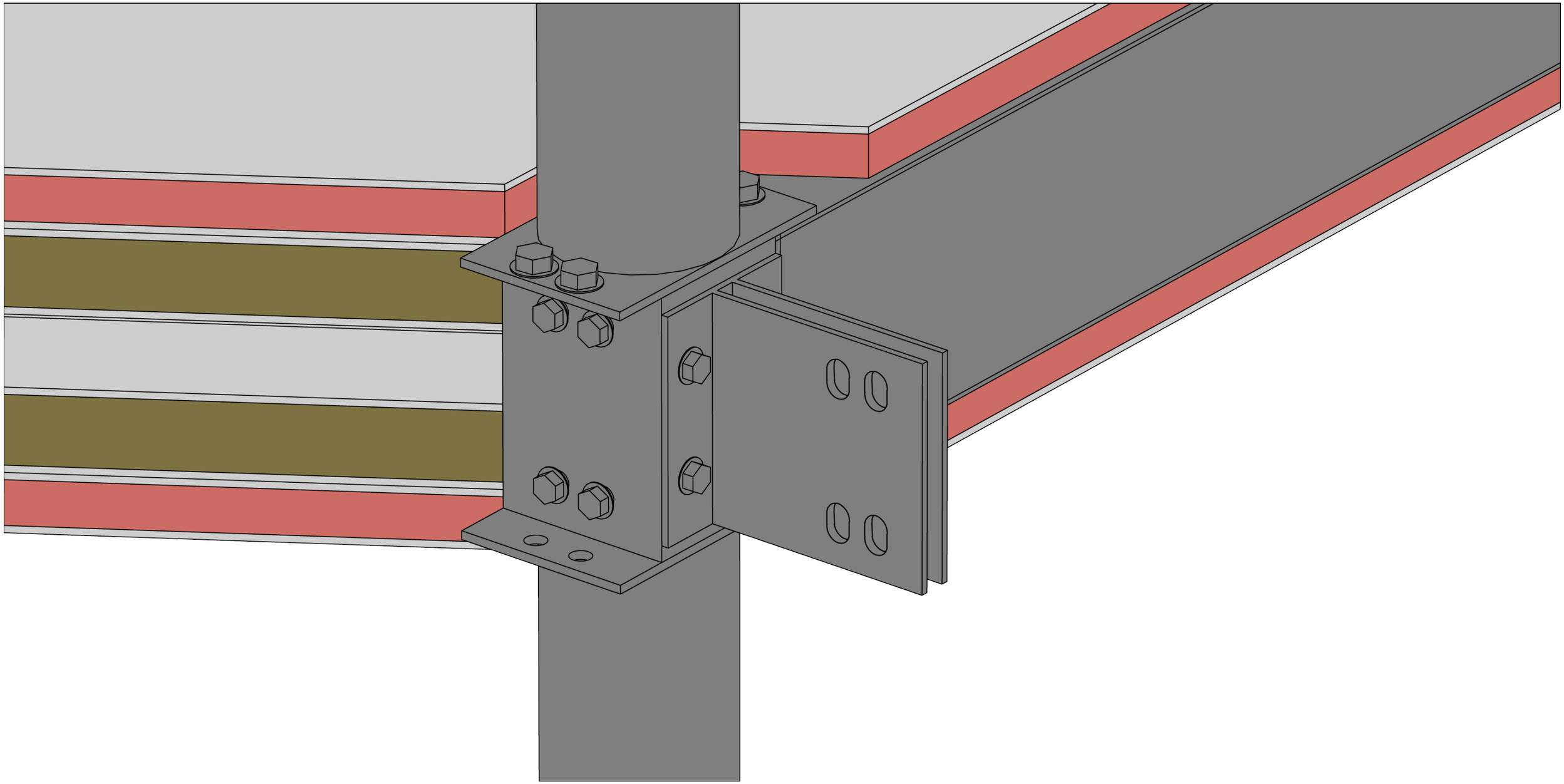




Aansluiting Gevel-Vloer



Productie - Constructie opbouw



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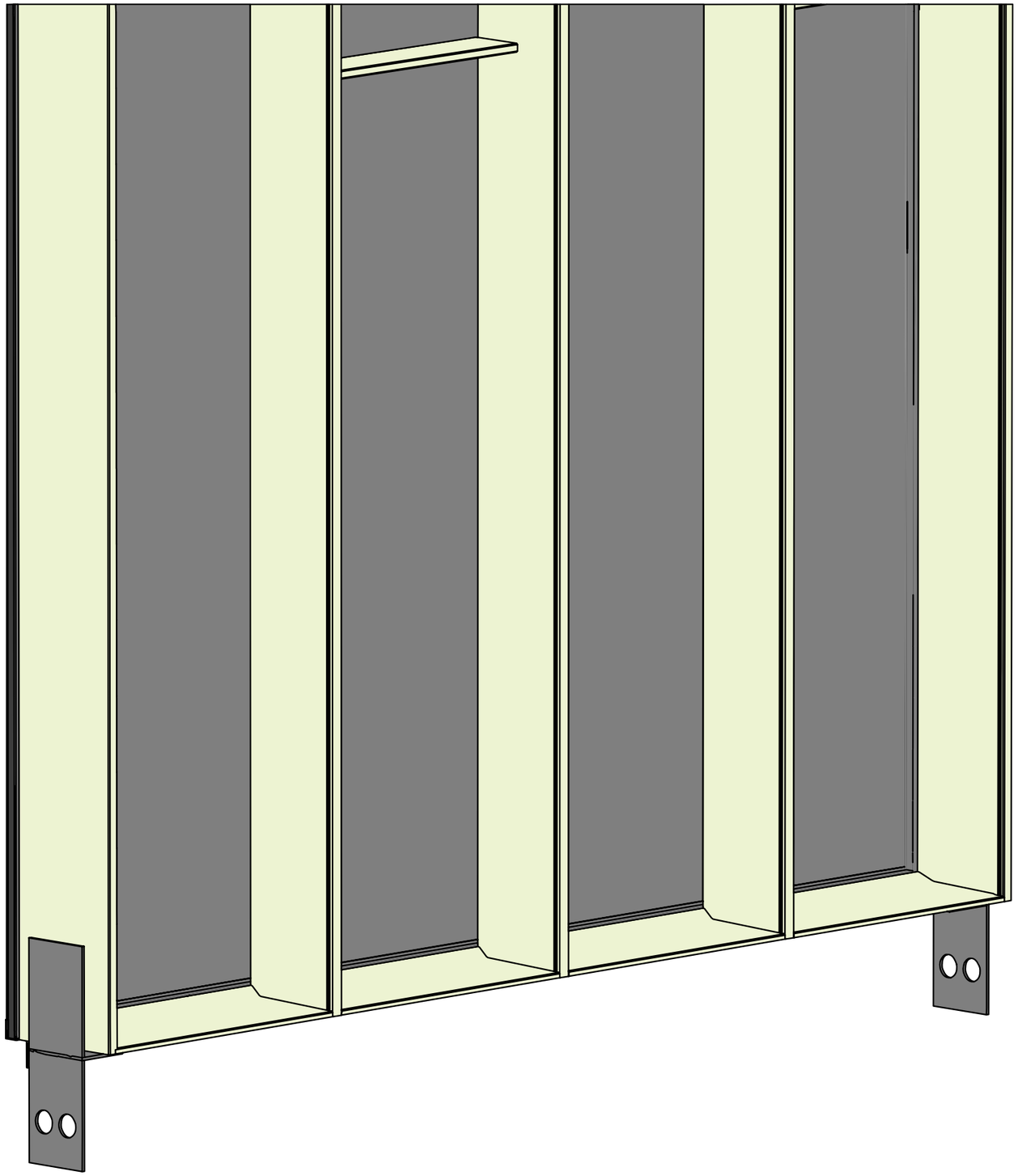

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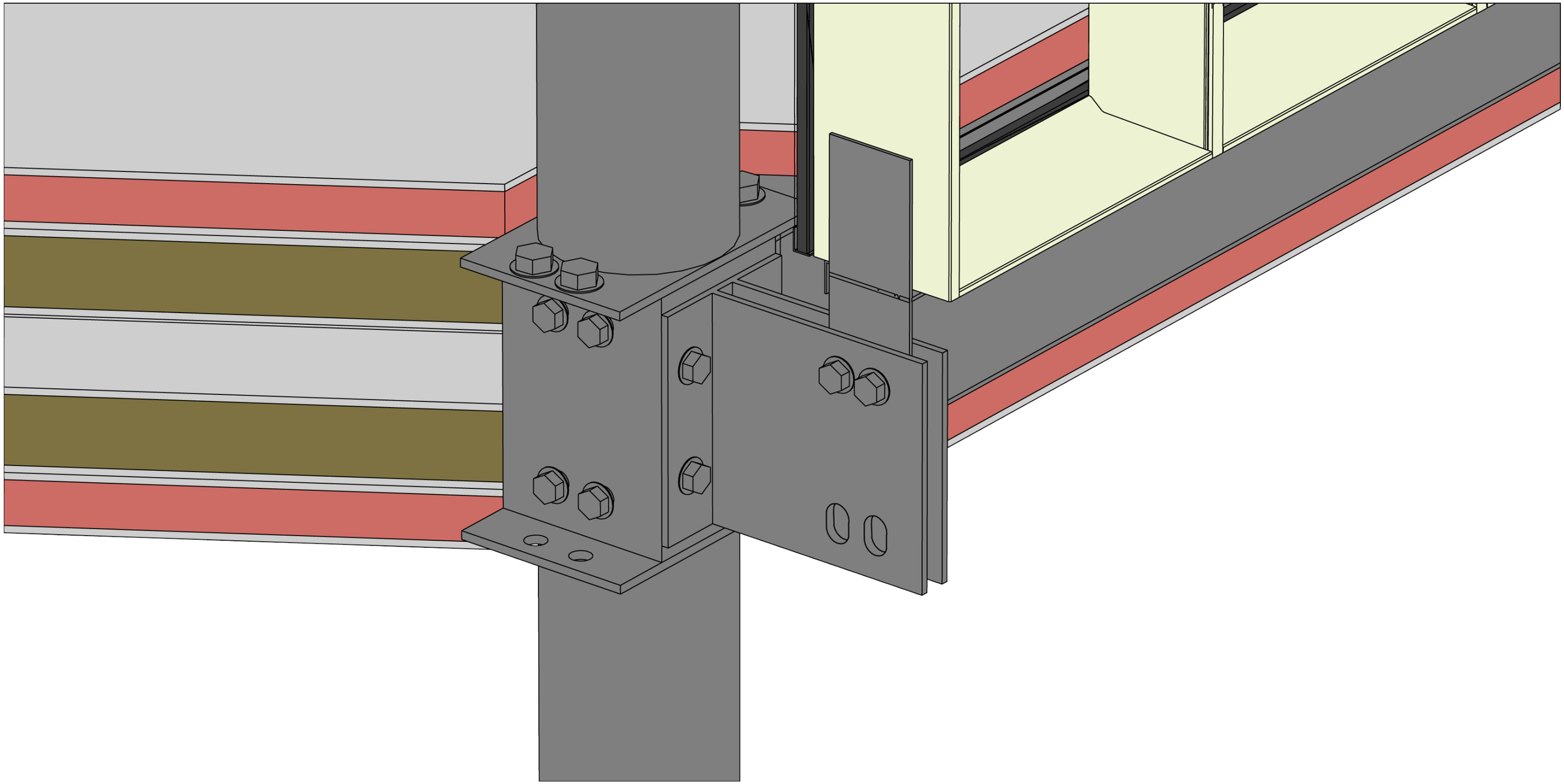

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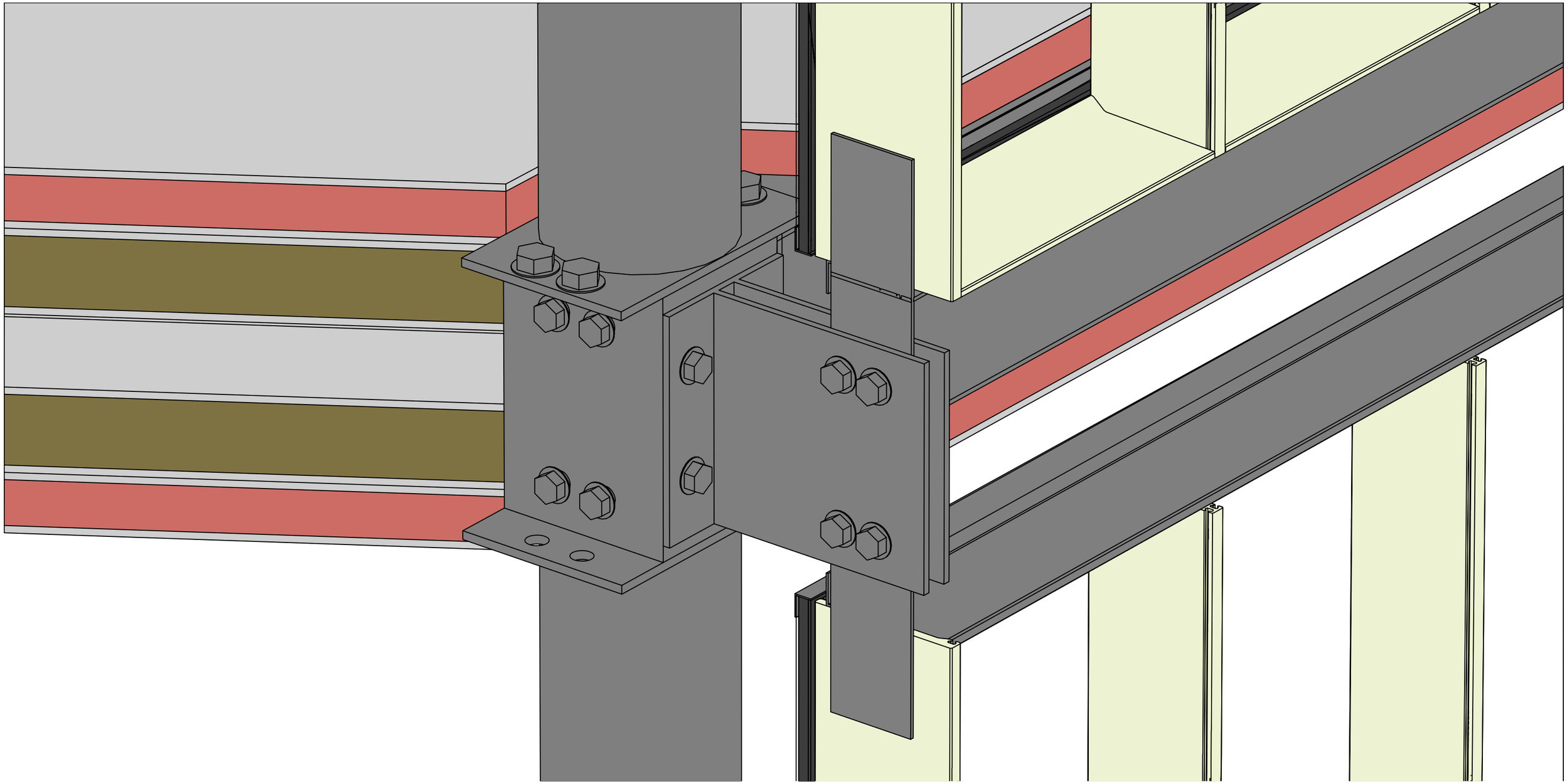

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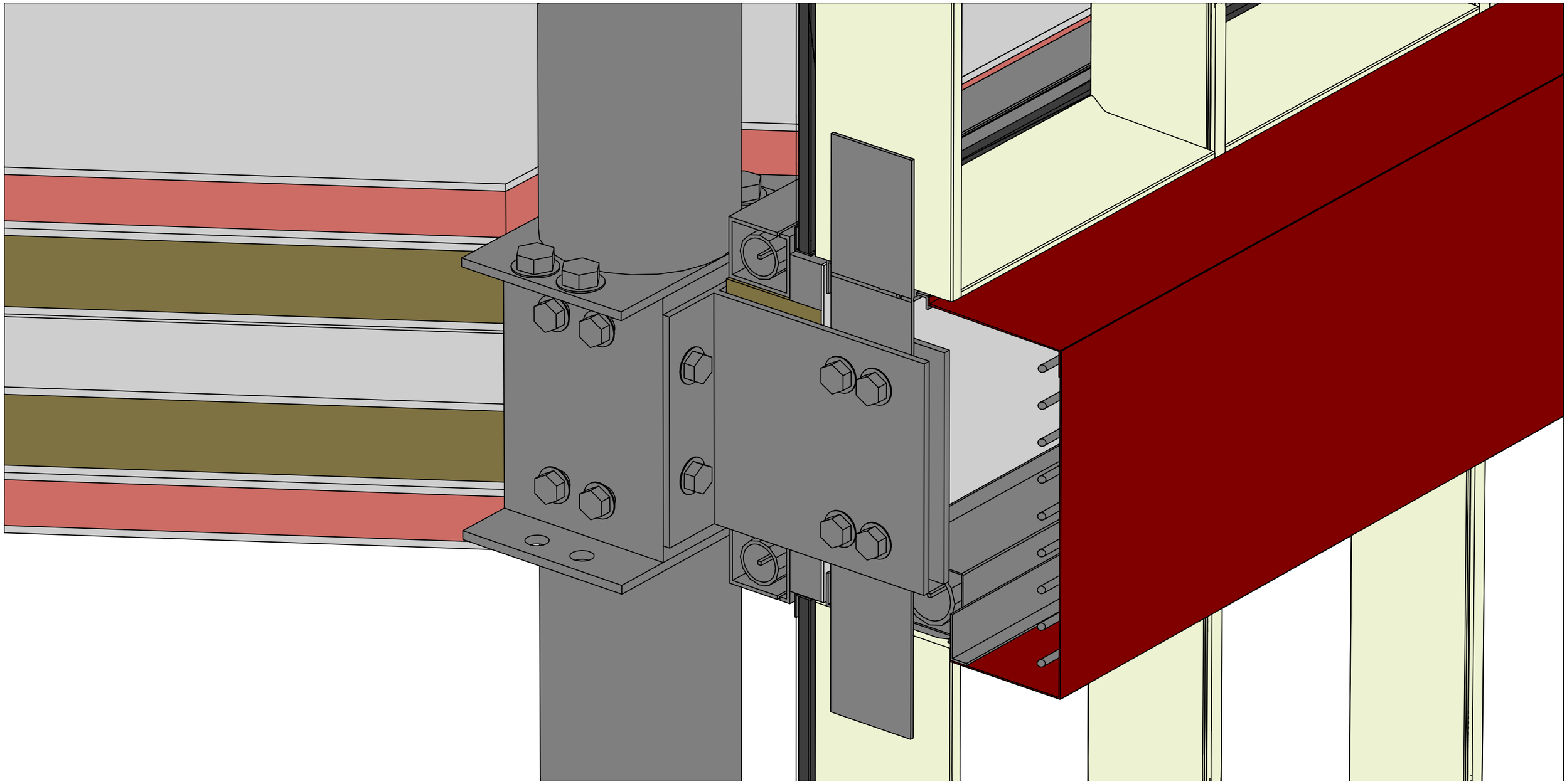

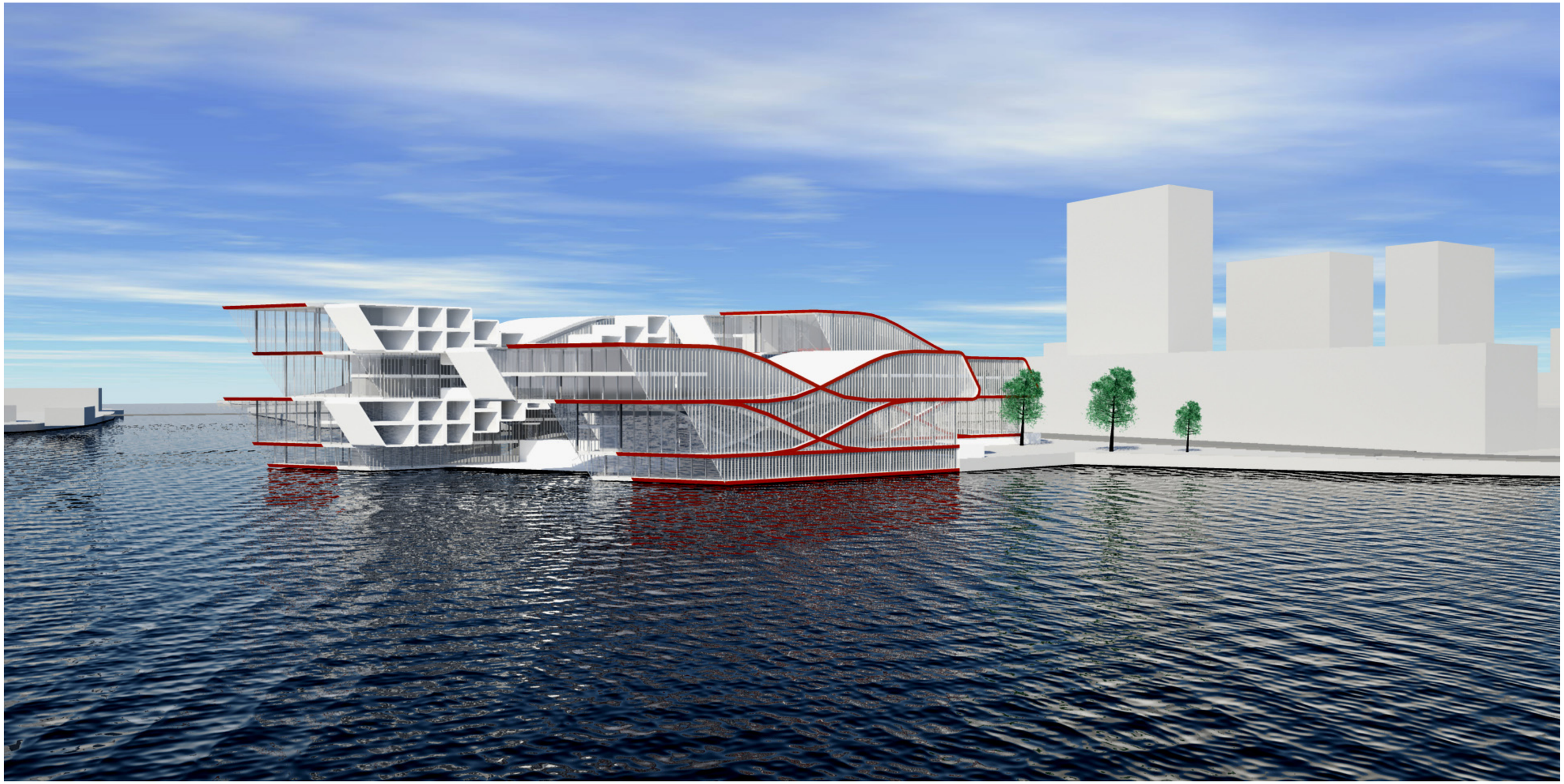

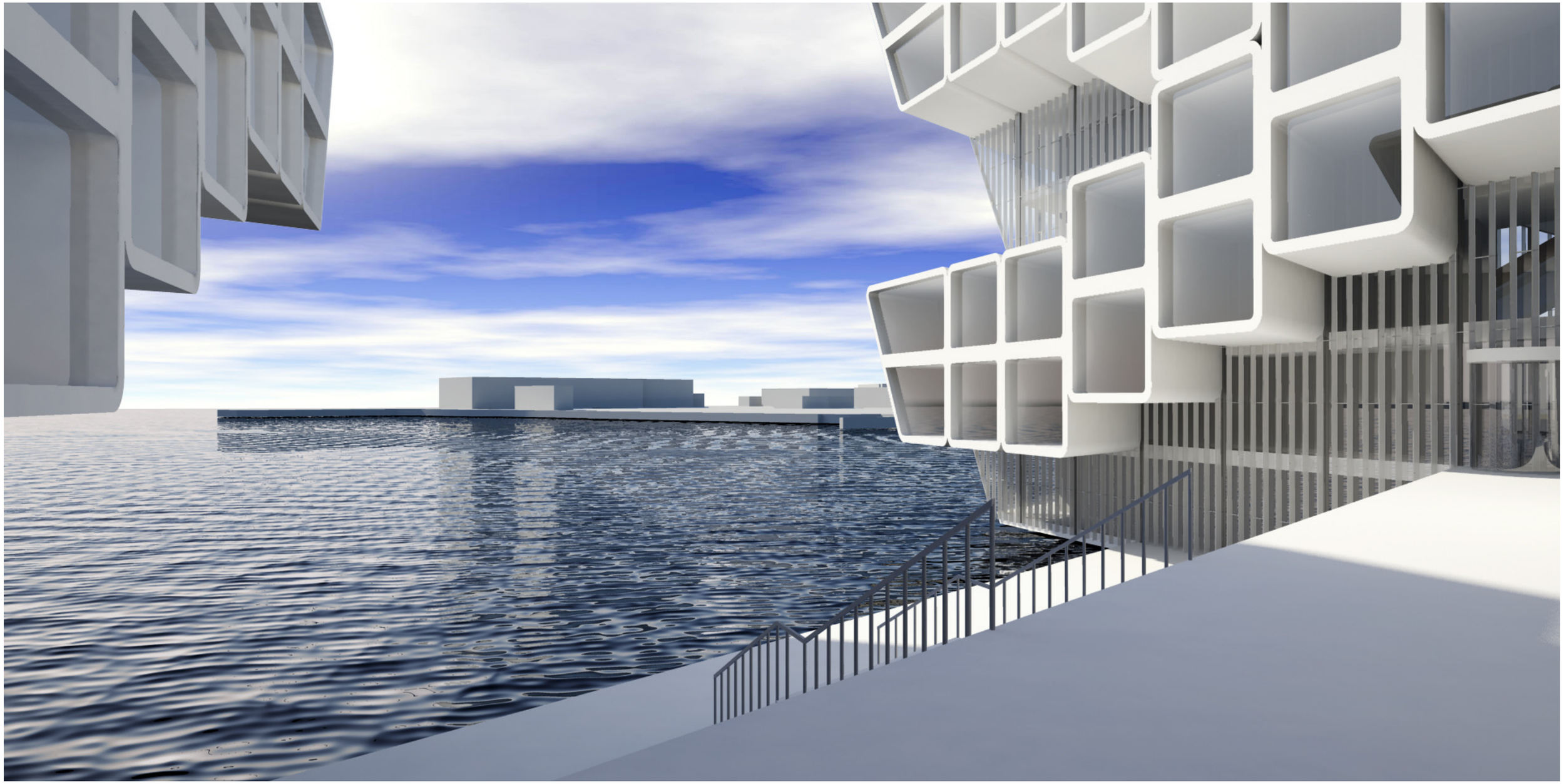

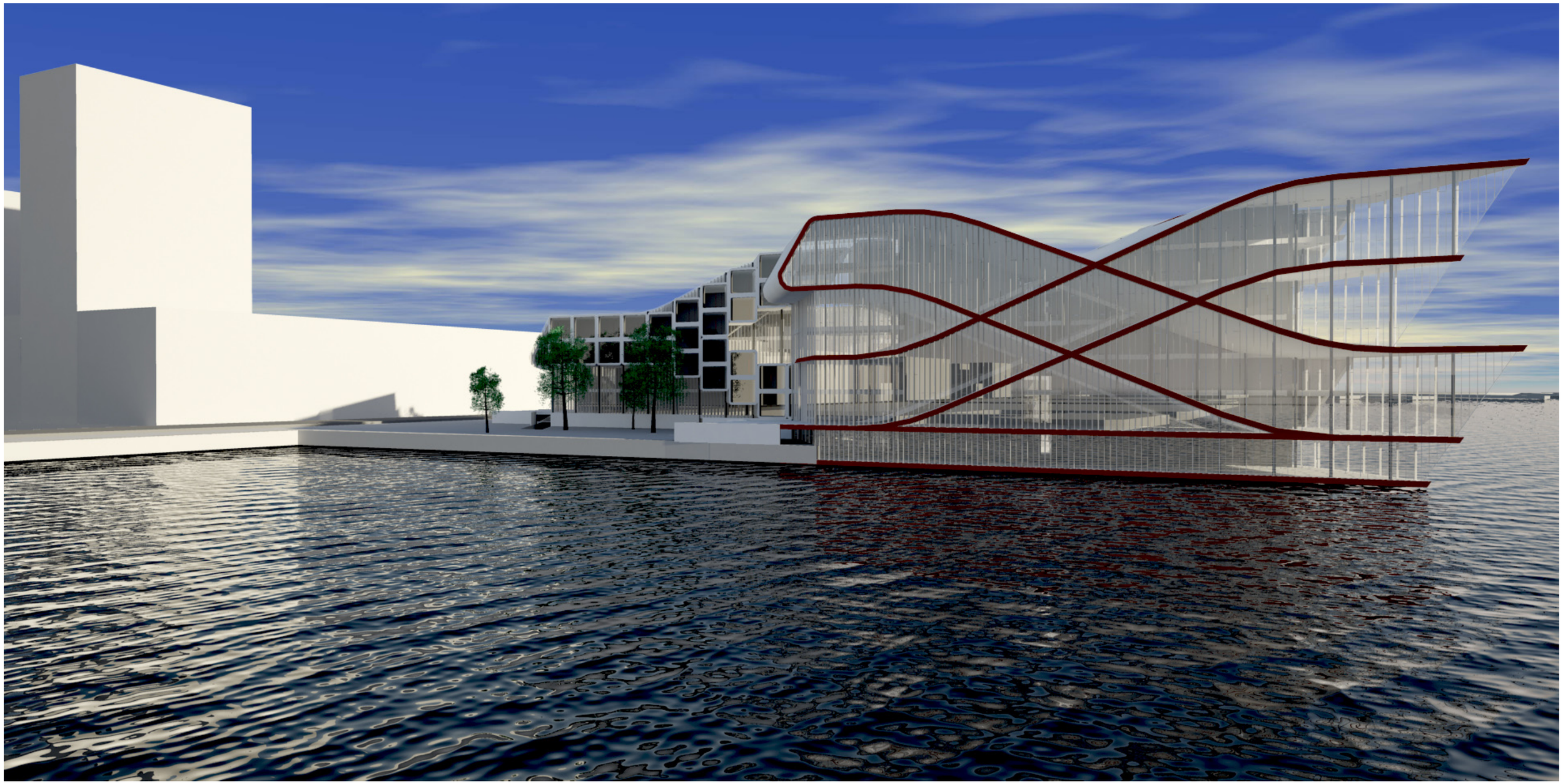

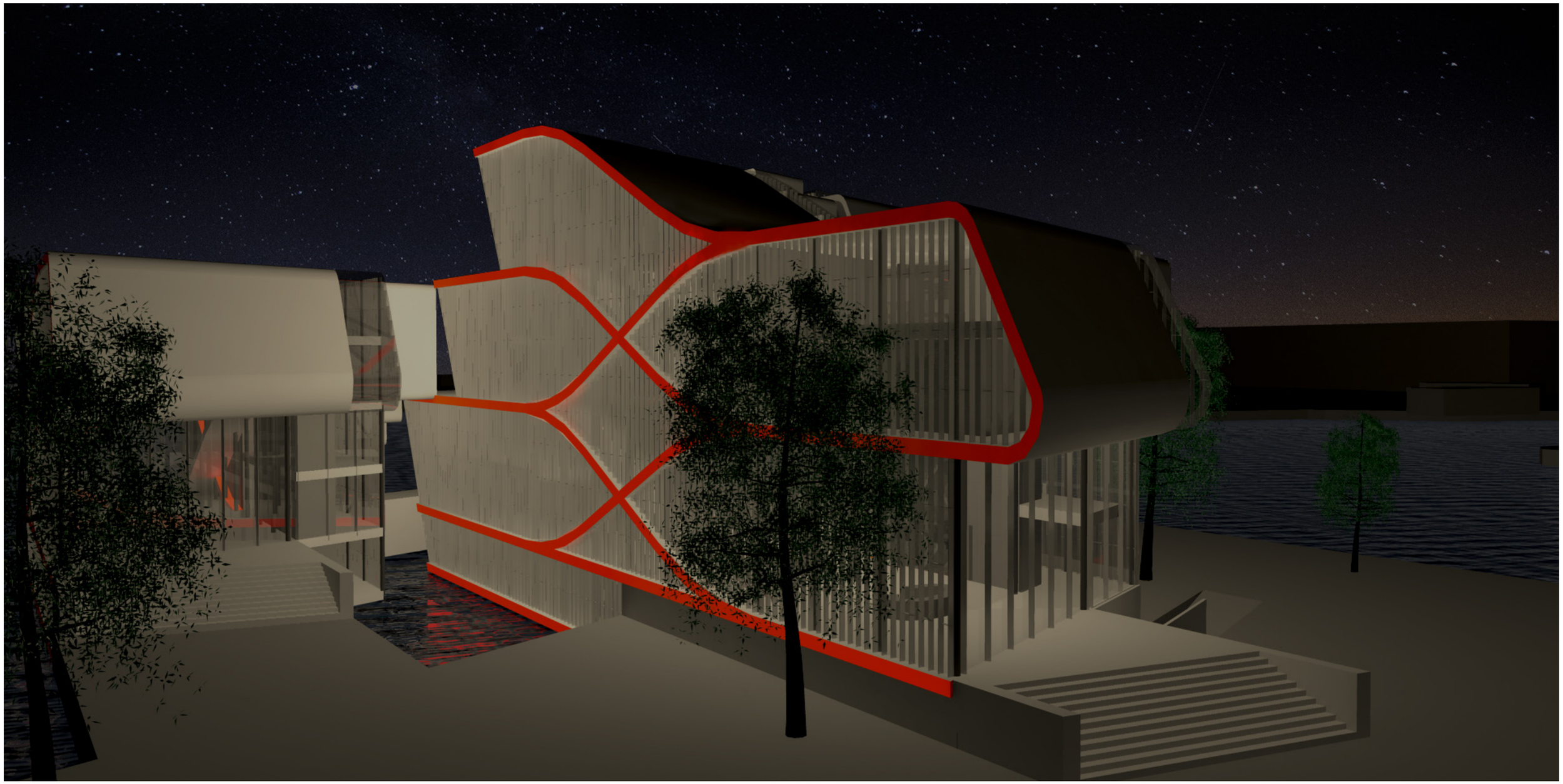

Bijlage

Ontwikkeling FRP in Architectuur

		Appearance of building in urban context	Energy generation	Energy storage	Interior loads	Insulation (heat/cold)	Load-bearing	Natural lighting	Noise	Self-weight	UV protection	Vapor diffusion	Ventilation	View in	View out	Waterproofing	Wind loads		Composite
design:	Richard Hamilton & Marvin Goody																		
location:	California, USA	X				X	X	X	X	X	X	X		X	X	X	X		X
completion:	1957																		
design:	Jean Maneval																		
location:	Nantes, France	X				X	X	X	X	X	X	X		X	X	X	X		X
completion:	1967																		
design:	Wolfgang Feierbach																		
location:	Altenstadt, Germany	X				X	X	X	X	X	X	X	X	X	X	X	X		X
completion:	1968																		
design:	Matti Suuronen																		
location:	different locations worldwide	X				X	X	X	X	X	X	X		X	X	X	X		X
completion:	1968																		
design:	Richard Rogers																		
location:	-	X				X	X	X	X	X	X	X	X	X	X	X	X		X
completion:	1969																		
design:	Matti Suuronen																		
location:	Helsinki, Finland	X				X	X	X	X	X		X	X	X	X	X	X		X
completion:	1971																		
design:	Klein Dytham architecture																		
location:	Tokyo, Japan							X		X	X	X		X	X		X		
completion:	1996																		
design:	Bernhard Franken, ABB																		
location:	Frankfurt, Berlin, Germany	X						X		X		X		X	X	X	X		
completion:	1999																		

		Appearance of building in urban context	Energy generation	Energy storage	Interior loads	Insulation (heat/cold)	Load-bearing	Natural lighting	Noise	Self-weight	UV protection	Vapor diffusion	Ventilation	View in	View out	Waterproofing	Wind loads		Composite
design:	Squire and Partners																		
location:	London, United Kingdom	X						X		X				X	X		X		
completion:	2007																		
design:	Kengo Kuma & Associates																		
location:	Frankfurt am Main, Germany	X					X	X		X		X				X	X		
completion:	2007																		
design:	Zaha Hadid Architects																		
location:	Hong Kong, Tokyo, etc	X				X		X	X	X	X	X				X	X		X
completion:	2008																		
design:	Richard Horden, Wieland Schmidt																		
location:	various	X				X	X	X	X	X	X	X		X	X	X	X		X
completion:	2009																		
design:	Allmann Sattler Wappner Architekten																		
location:	Friedrichshafen, Germany	X				X		X	X	X	X	X		X	X	X	X		
completion:	2009																		
design:	Rietveld Architecten																		
location:	Delft, Netherlands	X				X	X	X	X	X		X		X	X	X	X		X
completion:	2009																		
design:	Selgas Cano																		
location:	Madrid, Spain	X				X	X	X		X	X	X	X	X	X	X	X		X
completion:	2009																		
design:	Foster + Partners																		
location:	London, United Kingdom	X			X			X		X	X			X	X		X		X
completion:	2009																		

Constructie principes

Pultrusie profielen

Sandwich elementen

Gevel P4 Architectuur