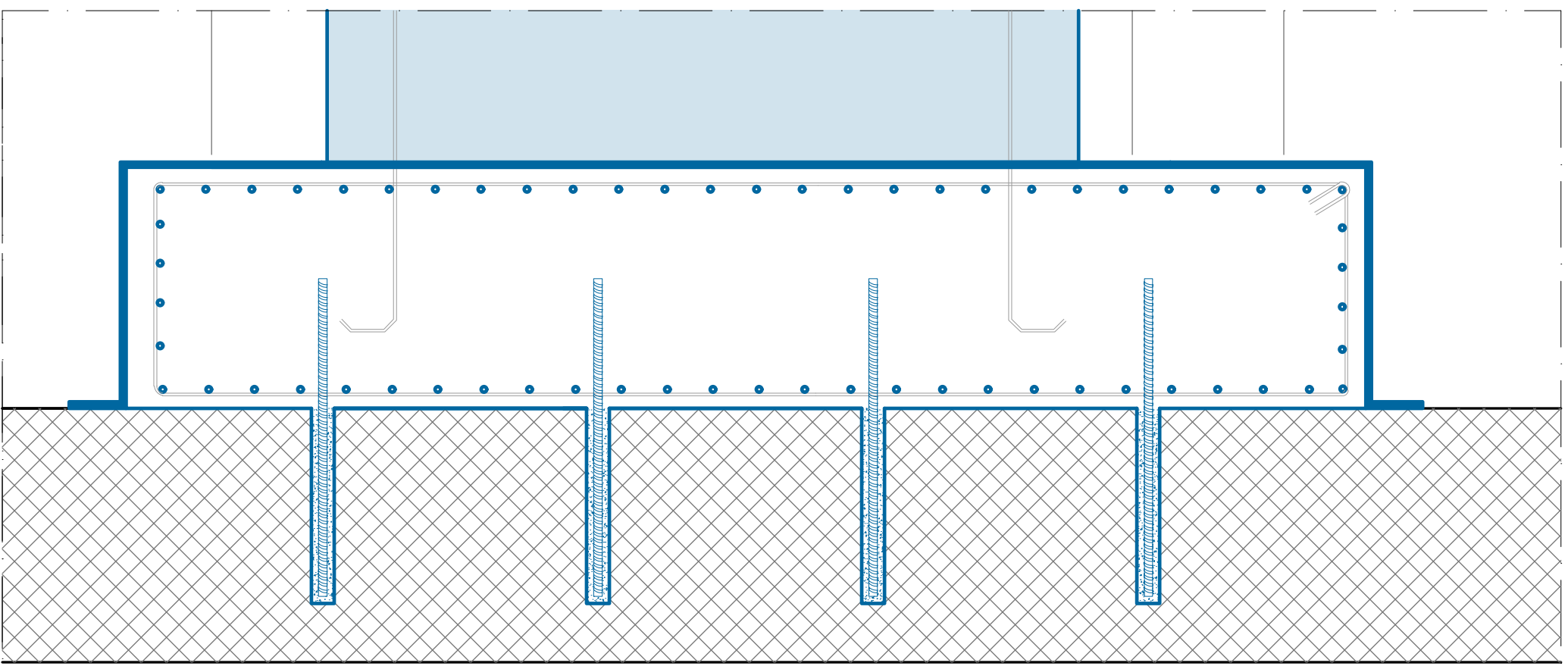
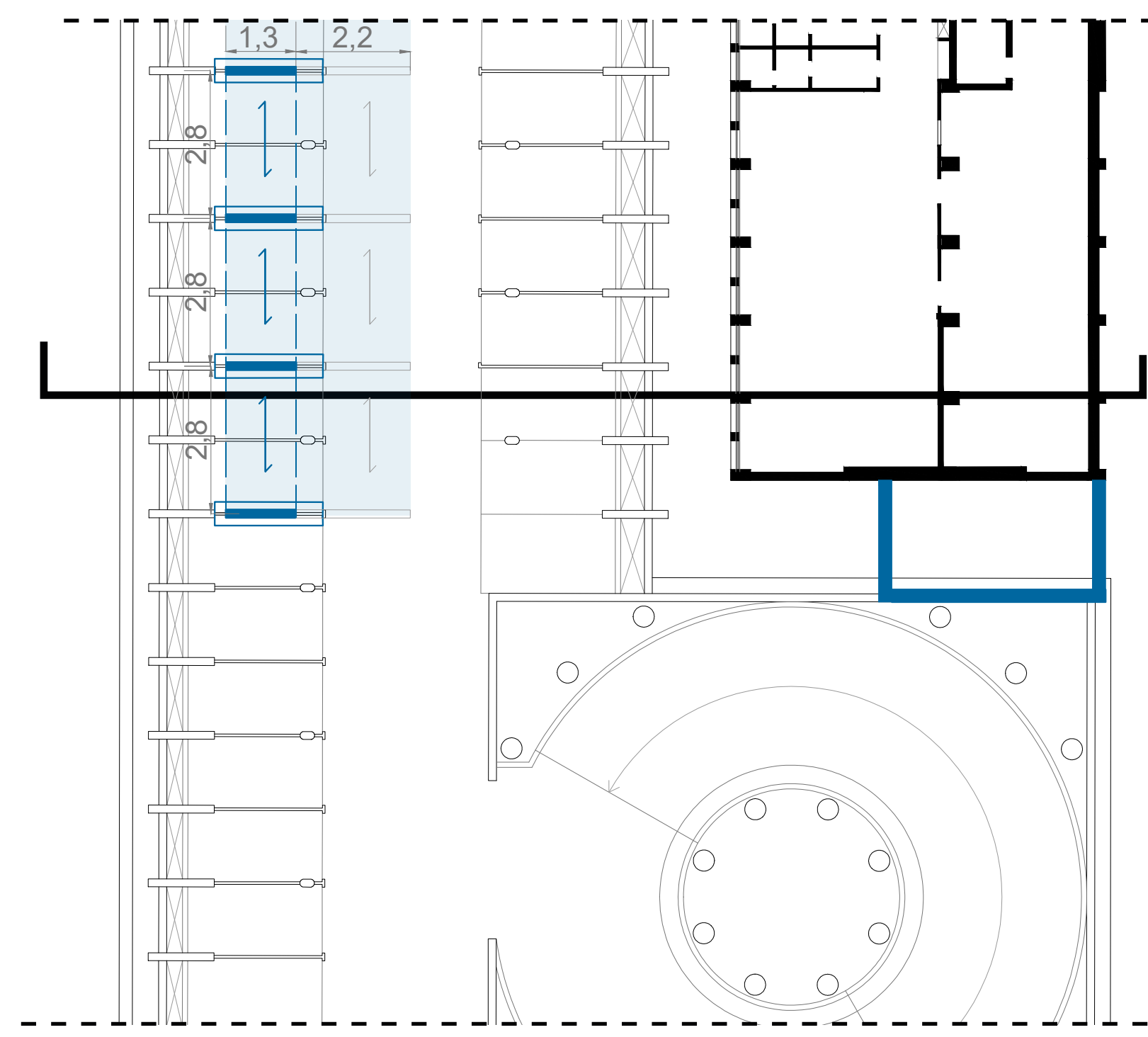
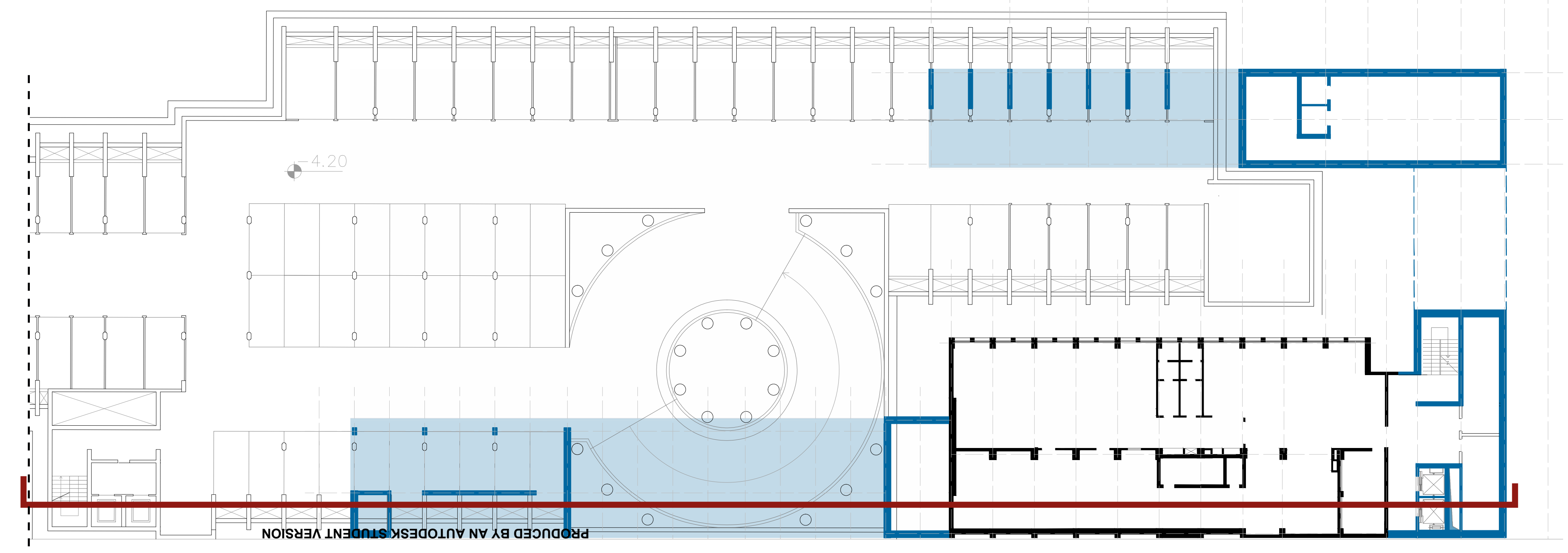
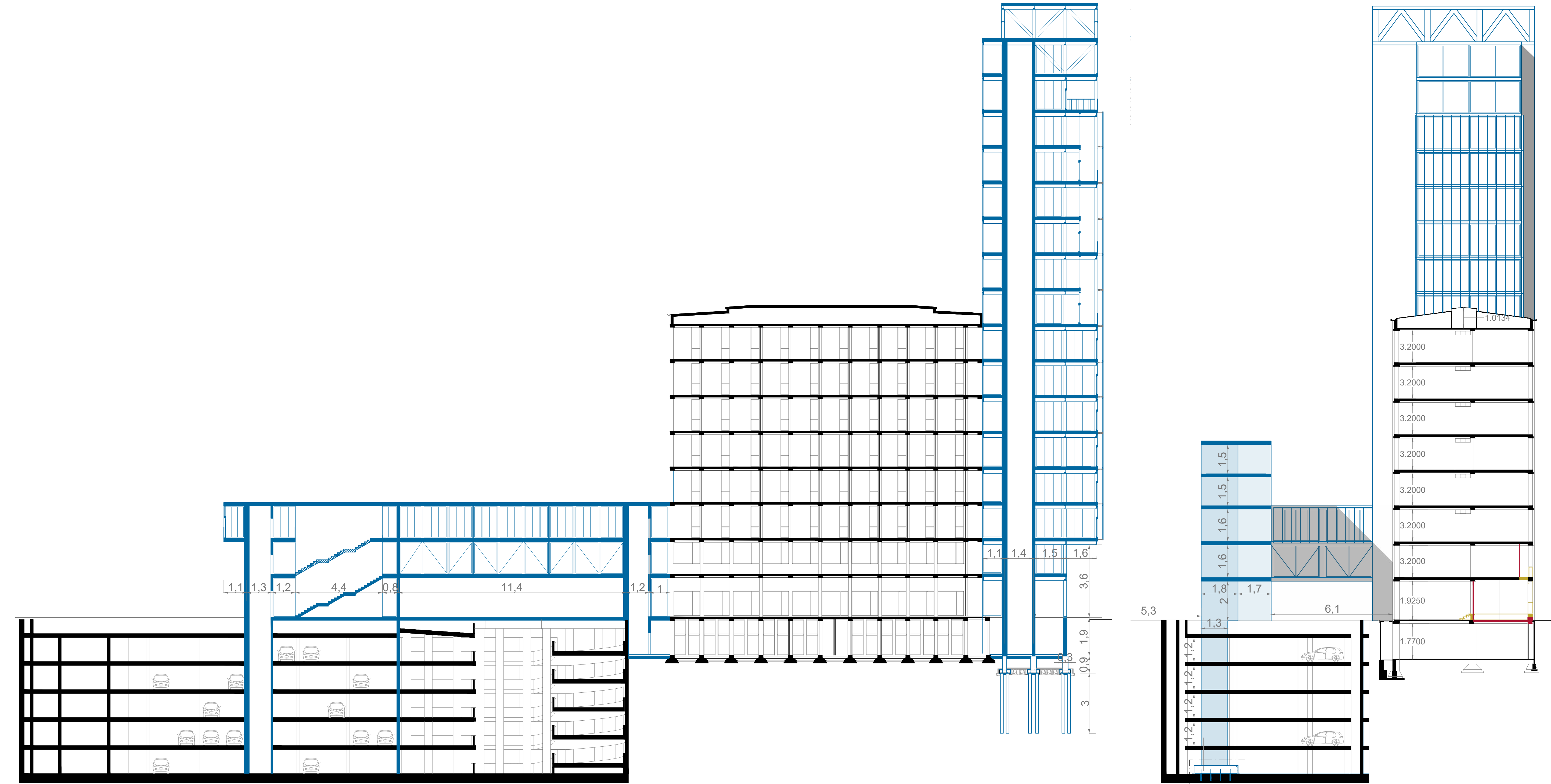


1.10\_Pile Cap foundations



1.10\_Foundations above the existing parking lot



CALCULATIONS

FLOOR PACKAGE

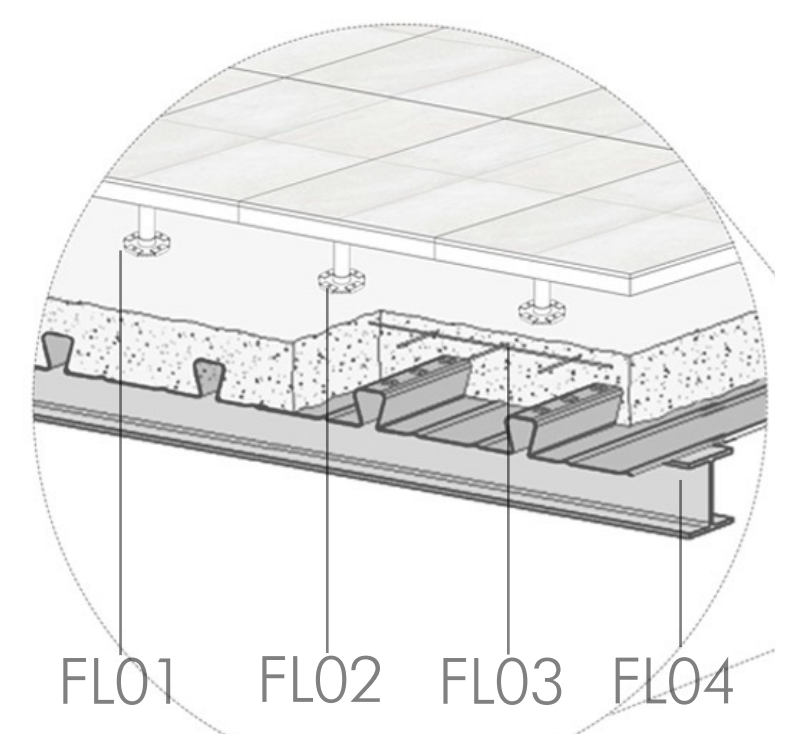
	NUMBER	MATERIAL	THICKNESS (m)	WEIGHT (kN/m²)
Non-structural self-weight G2	1	Composite floor decking	0.0007	0.098
	2	Welded mesh and structural concrete	0.150	1.875
	3	Raised flooring system	0.060	0.248
	4	Finishing layer (Porcelain stoneware)	0.012	0.240
Structural self-weight G1	5	Primary beam HE 300 A	0.29	0.516
TOTAL			0.5127	2.977

$q_{roof} = (G1 + G2) \cdot (1,3) + Q_{snow}(1,5) = 4,4 \text{ kN/m}^2$

$q_{floor} = (2,9) \cdot (1,3) + 5 \cdot (1,5) = 11,37 \text{ kN/m}^2$

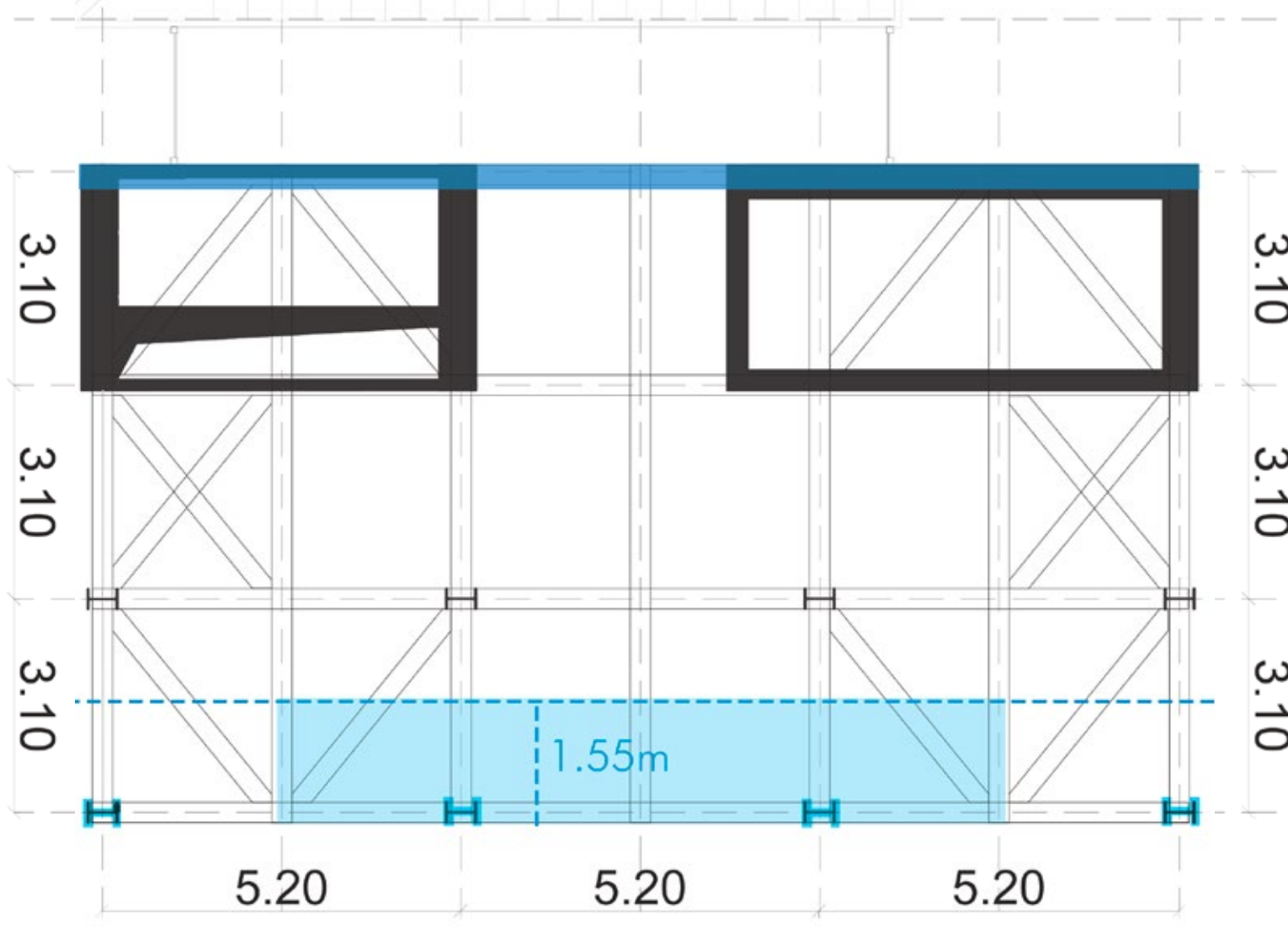
$Q_{total} = [(4,4) + (11,37) \cdot 15] \cdot (1,55) = 271,17 \text{ kN/m}$

COMPOSITE FLOOR SLAB



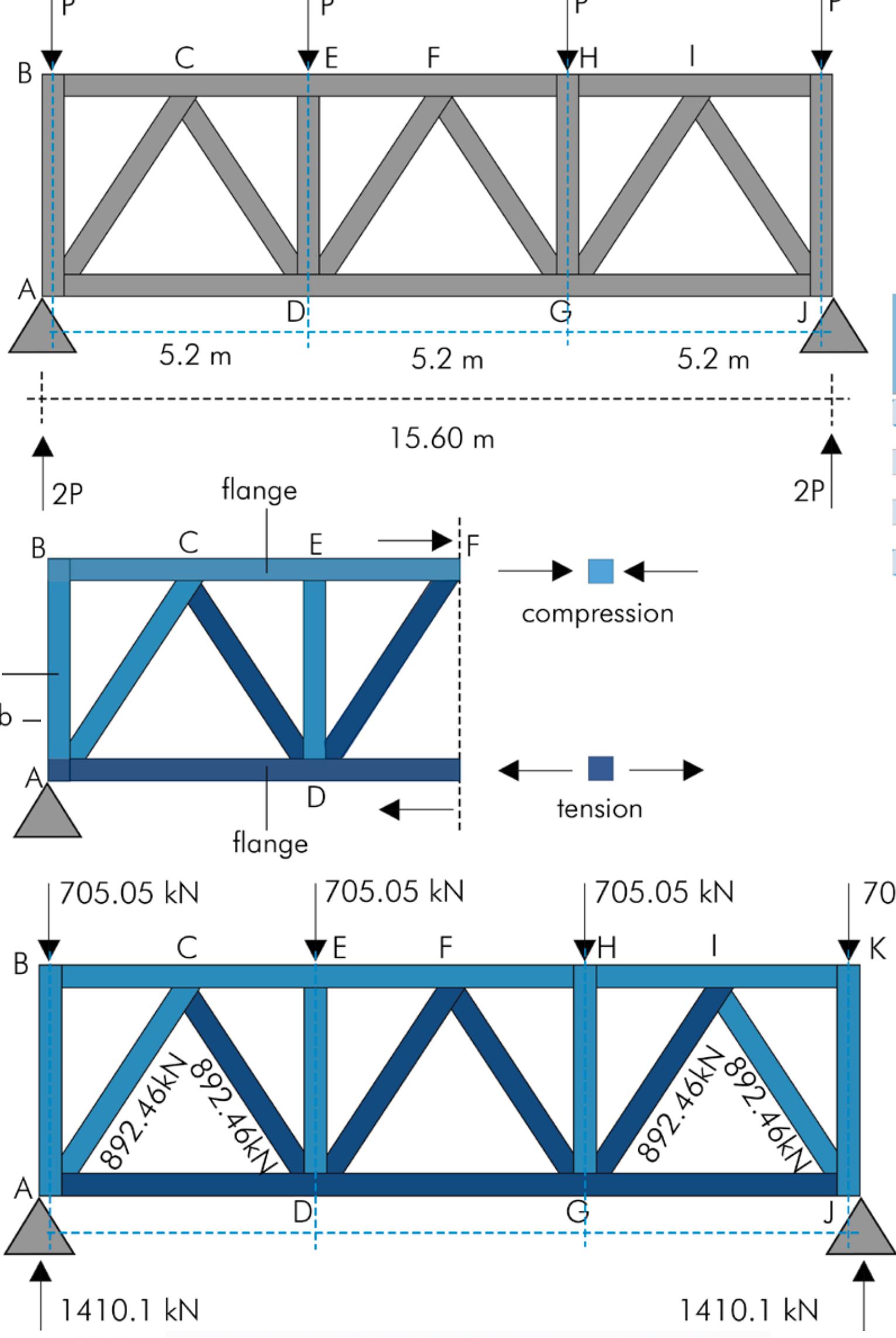
- FLO1 Raised floor
- FLO2 Neoprene Acoustic Insulation
- FLO3 Welded Mesh and structural concrete
- FLO4 HEA 320 Beam

HAT TRUSS ROOF

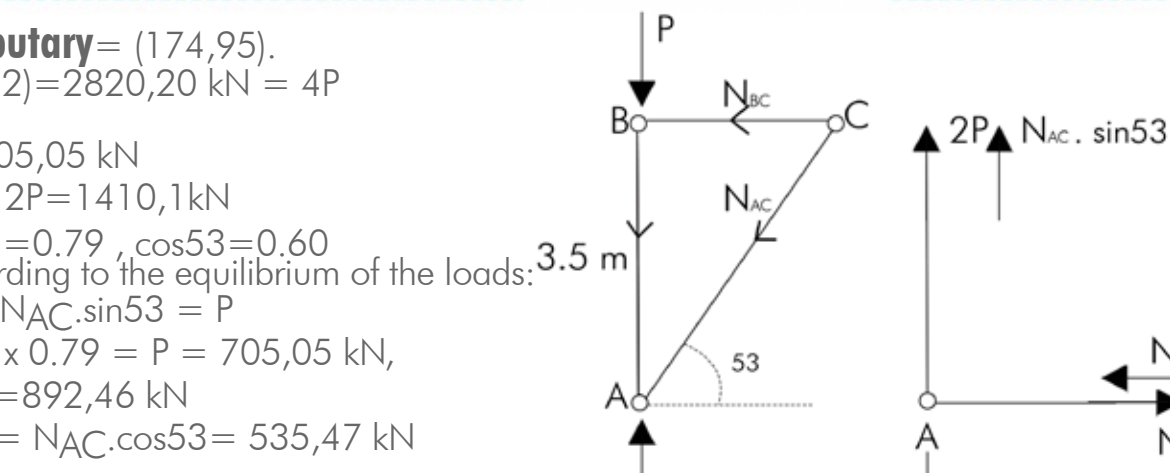


- 1) Calculating the load:  
 $q_{roof} = (G1 + G2) \cdot (1,3) + Q_{snow}(1,5) = 4,4 \text{ kN/m}^2$   
 $q_{floor} = (2,9) \cdot (1,3) + 5 \cdot (1,5) = 11,37 \text{ kN/m}^2$   
 $Q_{total} = [(4,4) + (11,37) \cdot 15] \cdot (1,55) = 271,17 \text{ kN/m}$
- 2) Bending moment calculation:  
 $M_{ed} = q \cdot L^2 / 8 = (271,17) \cdot (15,6m)^2 / 8$   
 $M_{ed} = 8249,10^6 \text{ Nmm}$
- 3) Design Yield Strength:  
 $f_{yd} = f_{yk} / \gamma_m$   
 $f_{yd} = 261,9 \text{ Mpa (N/mm}^2\text{)}$
- 4)  $T = M_{ed} / z$   
 $z = 5,2 \text{ m} = 5200 \text{ mm}$   
 $T = 158,10^4 \text{ N}$
- 5)  $A_s = T / f_{yd}$   
 $A_s = 158,10^4 / 261,9 = 60,32 \text{ cm}^2 = 2 \times 30,16 \text{ cm}^2$
- BOTTOM CHORD:  
For bottom chord we choose 2 x UPN 200
- TOP CHORD:  
For top chord:  
 $A_s = T / 0,5 \cdot f_{yd} = 120,54 \text{ cm}^2 = 2 \times 60,32 \text{ cm}^2$   
For top chord we choose 2 x UPN 320

Ultimate Limit State (ULS) Condition:



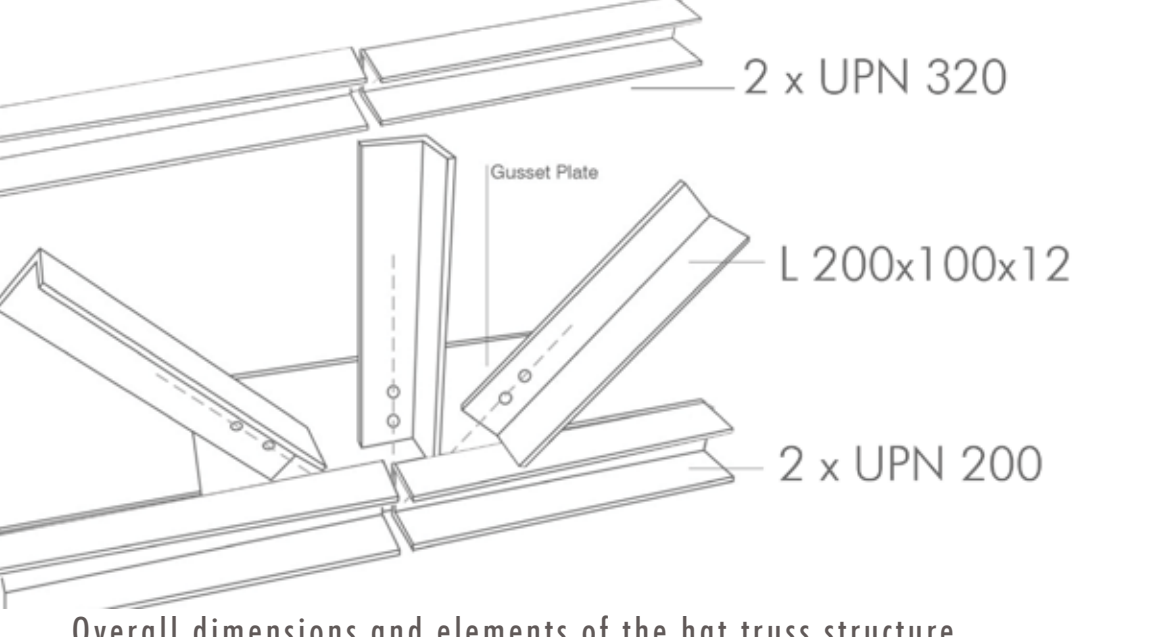
Section	Second moment of area	Radius of gyration	Elastic modulus	Plastic modulus	Torsion parameter	Torsion index	Welding constant	Torsional constant	Area of section
UPN 200	10.900	587	12.1	2.21	679	1.2	6.08	10.9	1.040
UPN 300	6.030	462	11.7	2.55	526	1.0	6.02	10.9	1.040
UPN 200	6.280	389	10.8	2.74	468	1.0	5.52	10.9	1.040
UPN 200	4.820	317	10.0	2.55	371	1.0	4.42	91.6	0.808
UPN 240	3.000	248	9.2	2.42	300	1.0	3.58	75.7	0.808
UPN 220	2.680	197	8.5	2.30	245	1.0	2.92	64.1	0.804
UPN 200	1.910	146	7.7	2.14	191	1.0	2.28	51.8	0.802



Member	Internal Force (kN)	Length (m)
NAB, ED, GH, KJ	705.05 kN	3.50
NBC	535.47 kN	2.60
NAC, CD, DF, FG, GI, JJ	892.46 kN	4.36

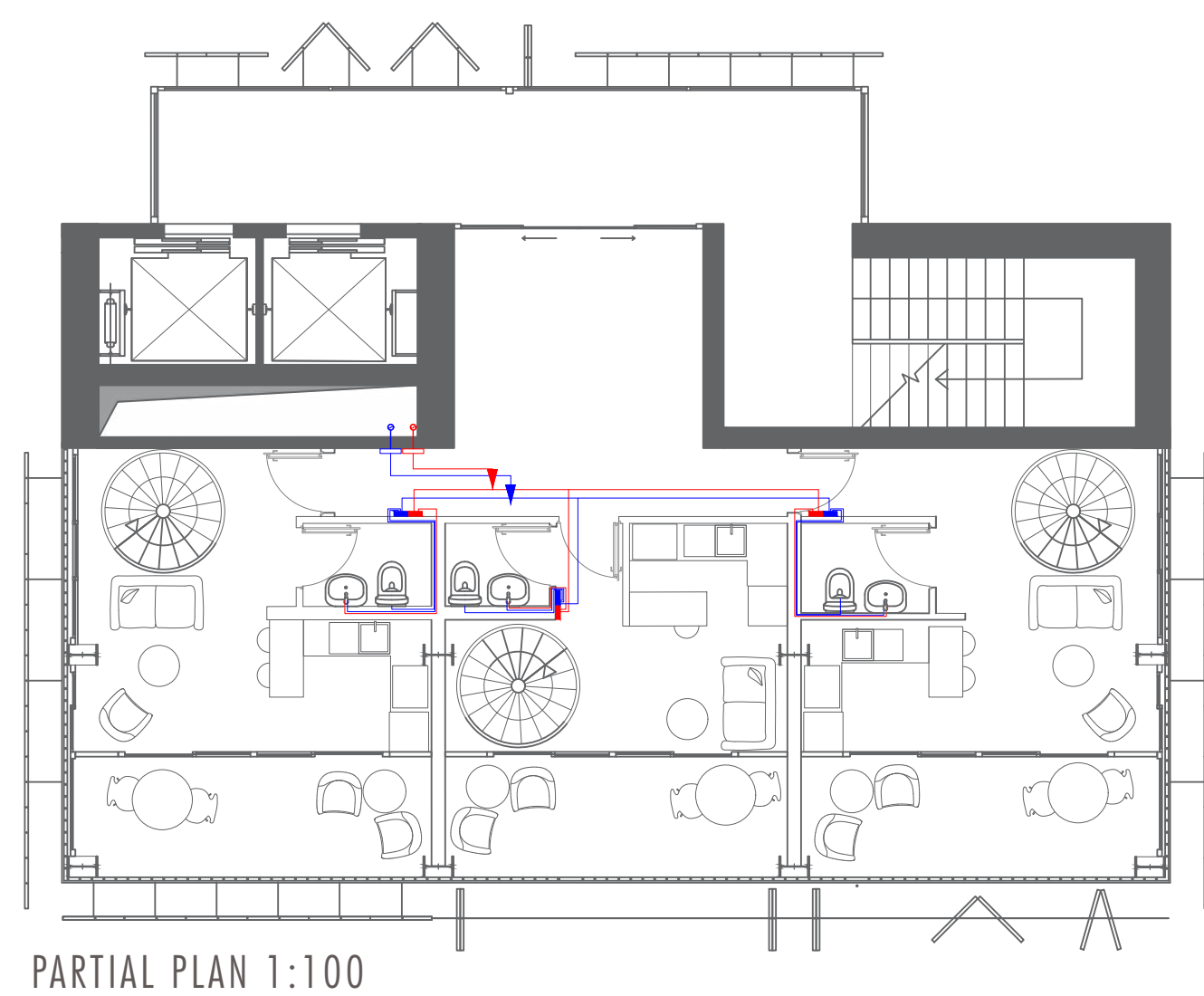
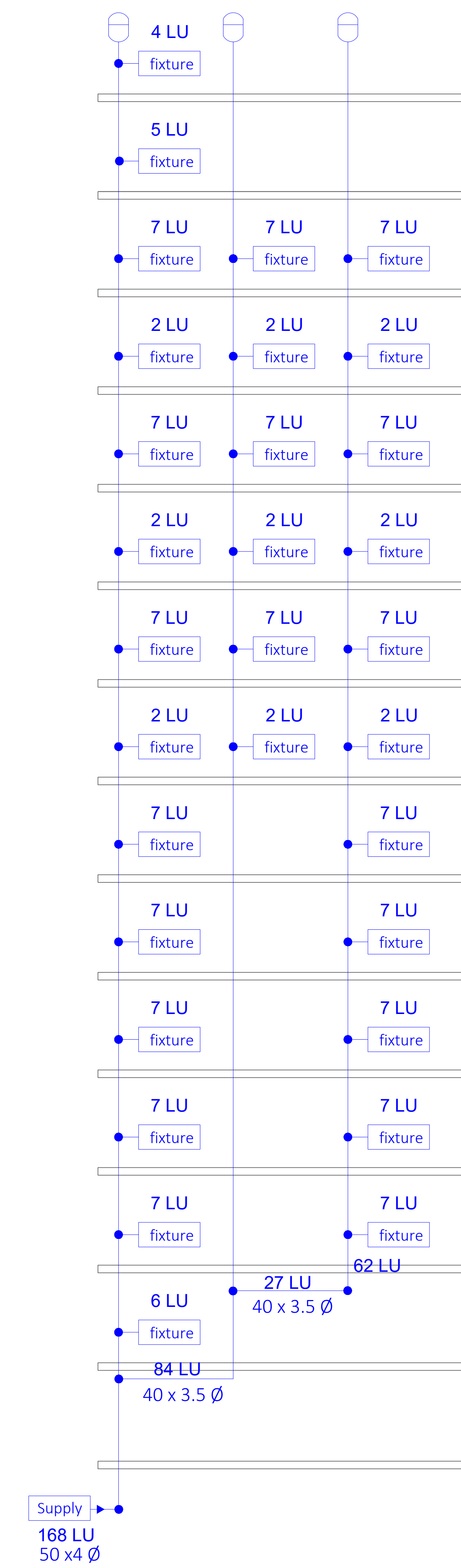
**BUCKLING CHECK**

Highest internal force & largest length  
Critical member : NAC  
 $P_{cr} \text{ design} = 892,46 \text{ kN} \times \text{Safety factor (1.5)}$   
 $1338,69 \text{ kN} = 1338690 \text{ N}$   
 $I = P_{cr} \cdot L^2 / \pi^2 \cdot E$   
 $E = 210000 \text{ MPa (N/mm}^2\text{)}$   
 $I = 1229 \text{ cm}^4$   
We choose L 200 X 100 X 12 for the web members



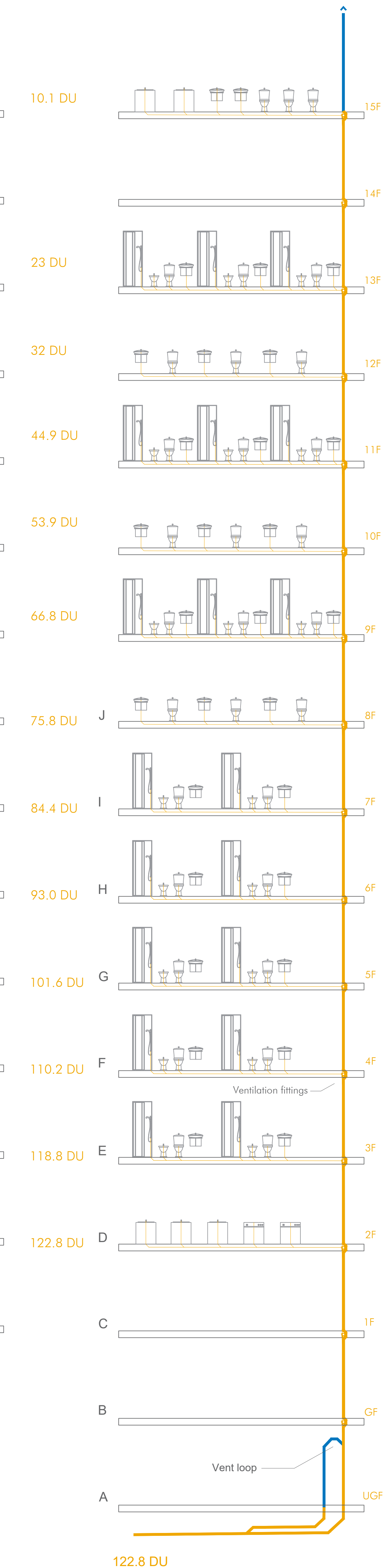
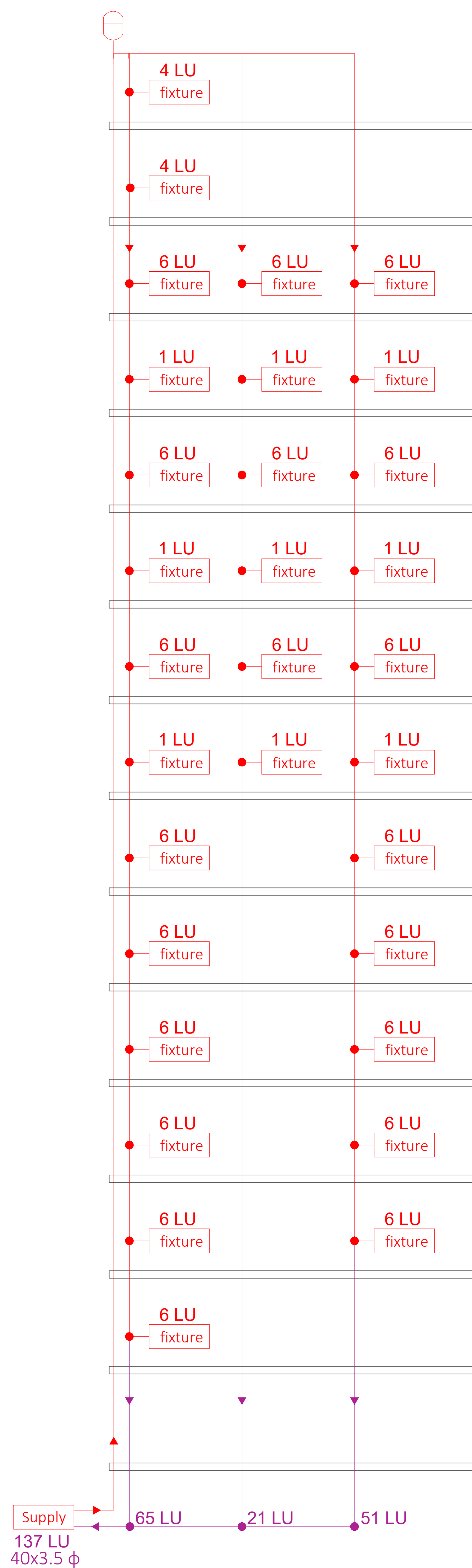


## COLD WATER DISTRIBUTION SYSTEM



PARTIAL PLAN 1:100

## HOT WATER DISTRIBUTION SYSTEM



Total flow:  
 $\Sigma DU = 122.8 \text{ DU}$

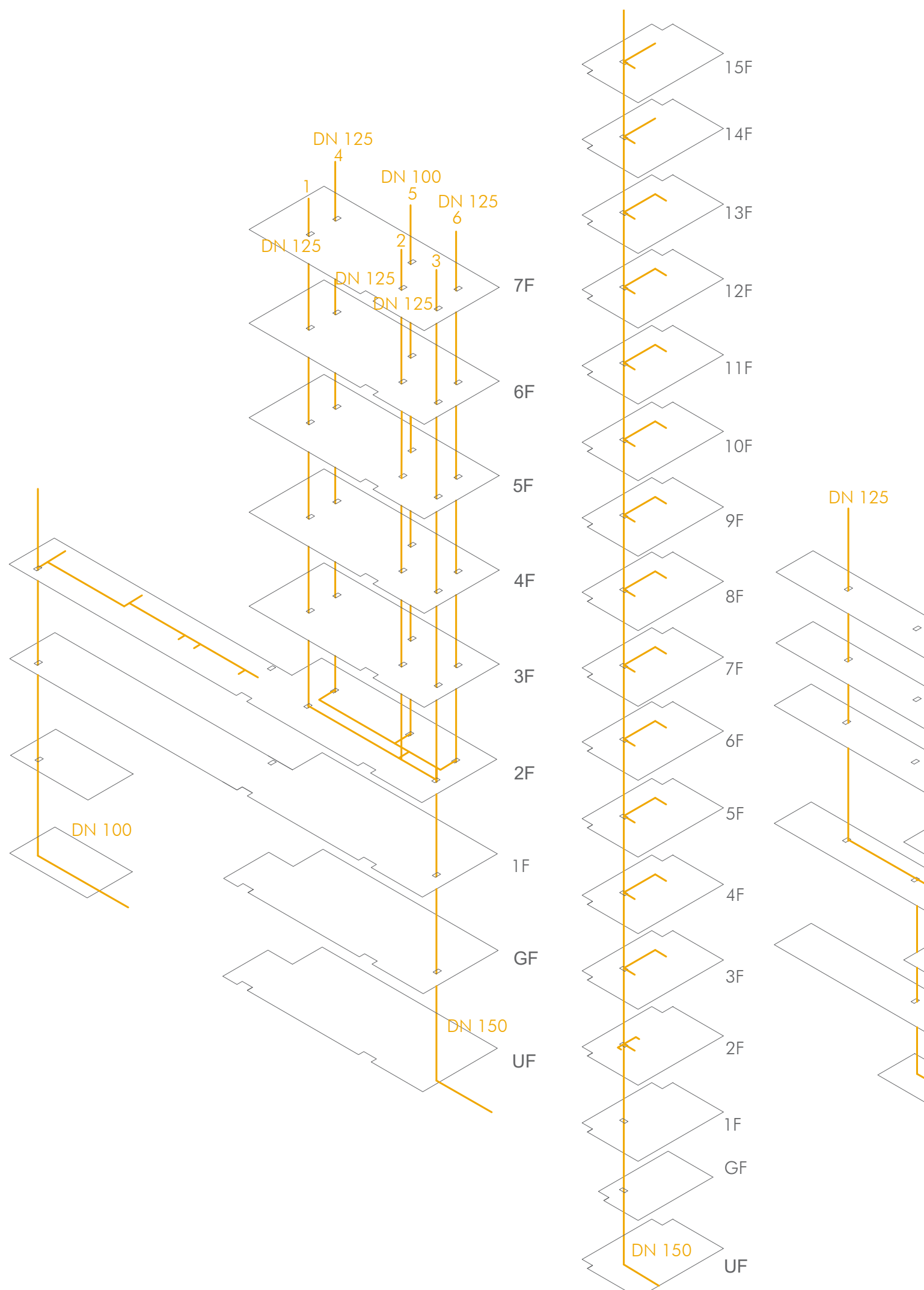
Project flow:  
K=Residential building contemporary use  
degree=0.5

$Q_{ww} = 0.5 \times \sqrt{122.8} = 4.51 \text{ l/s}$   
DN 125 for the diameter of the waste stack, square branch  
(Table 4.9)

DN 125 for the diameter of the waste stack, Angle branch  
(Table 4.9)

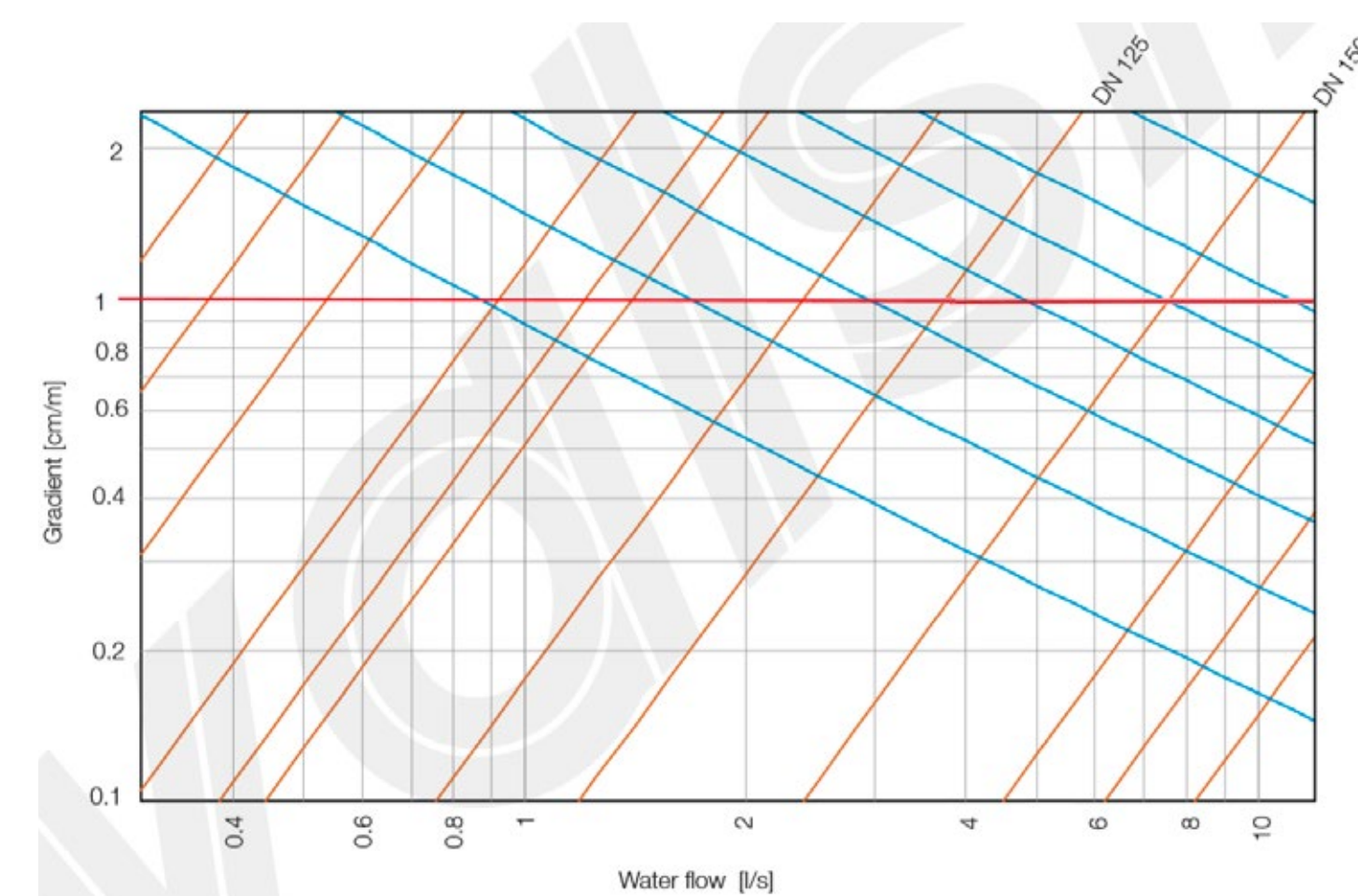
## WASTE WATER SYSTEM

### Waste system with ventilation fittings



### WASTE SYSTEM DIAGRAM OF THE WHOLE PROJECT

REFERENCE TABLES FOR DIMENSIONING PROVIDED BY VALSIR GUIDE

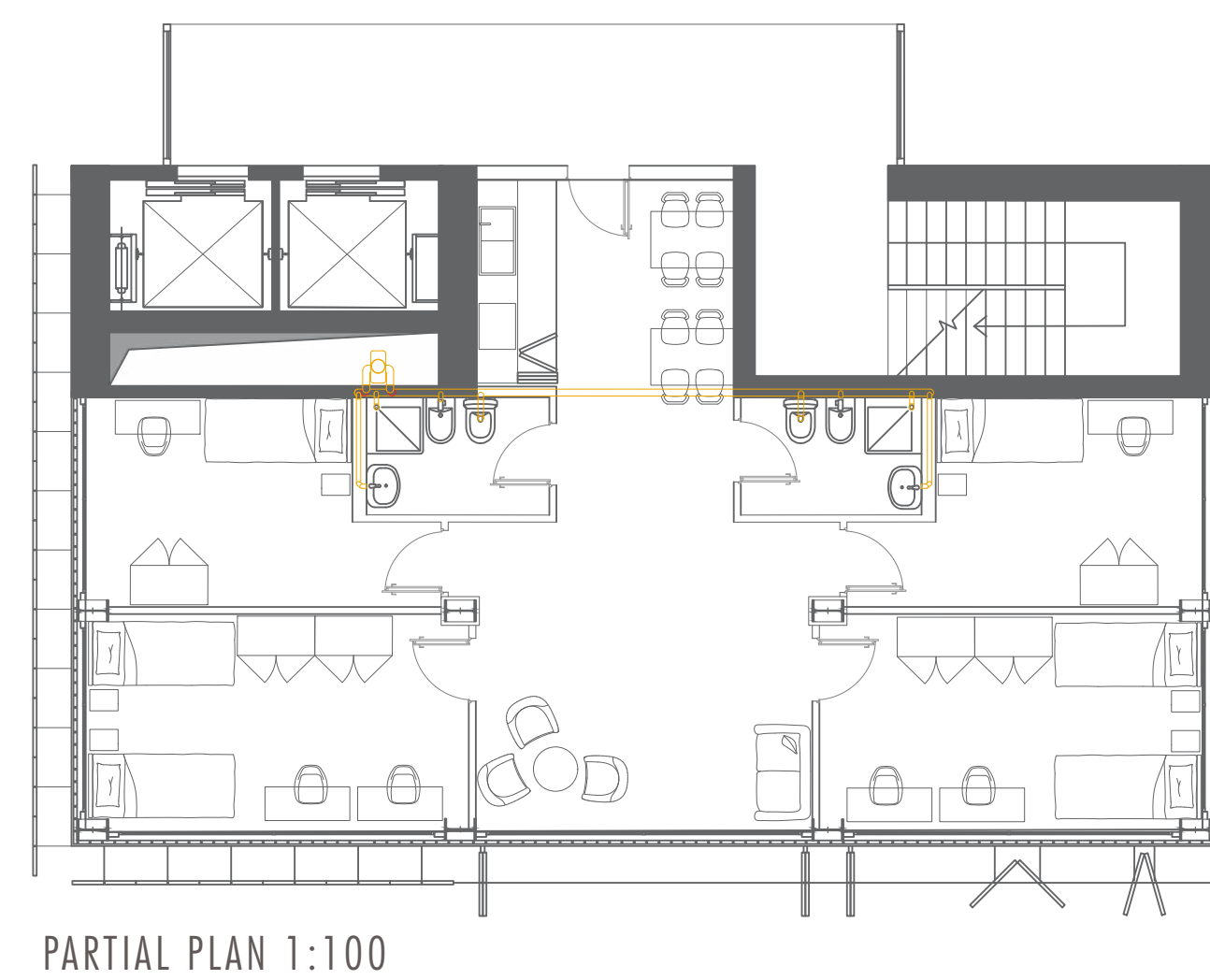


**Table 5.2** Comparison between different waste systems, DN 100 (OD 110) waste stack

Waste system	Max. flow rate $Q_{\text{max, class}}$ [l/s]	
	DN 100 (OD 110)	DN 150 (OD 160)
Primary ventilation with right-angle branch	4.0	9.5
Parallel or secondary ventilation with right-angle branch	5.6	12.4
Ventilation fitting	8.7	18.1

**Table 4.4** Typical flow rates for various types of sanitary fixtures (domestic).

Sanitary fixture	DU [l/s]
Washbasin	0.5
Bidet	0.5
Shower without plug	0.6
Shower with plug	0.8
Urinal with cistern	0.8
Urinal with flush valve	0.5
Wall urinal	0.2
Bathtub	0.8
Kitchen sink	0.8
Dishwasher (domestic)	0.8
Washing machine, max. load 6 kg	0.8
Washing machine, max. load 12 kg	1.5
WC with 6 l cistern	2.0
WC with 7.5 l cistern	2.0
WC with 9 l cistern	2.5
Floor drain DN 50	0.8
Floor drain DN 70	1.5
Floor drain DN 100	2.0



PARTIAL PLAN 1:100

## HEATING SYSTEM



HEATING SYSTEM DIAGRAM OF THE WHOLE PROJECT

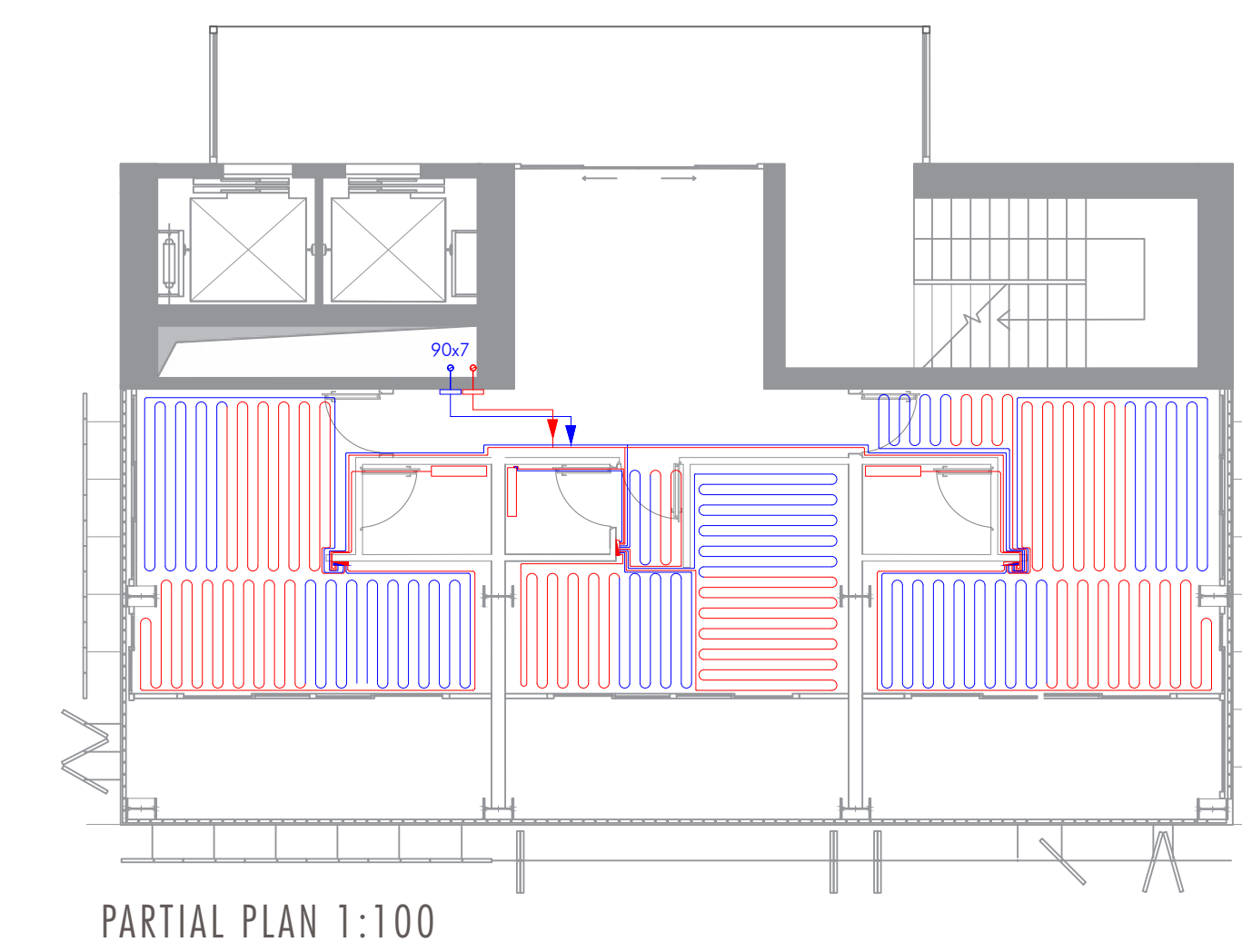
REFERENCE TABLES FOR DIMENSIONING PROVIDED BY VALSIR GUIDE

$\Sigma L_{LU}$	LU	3	4	5	6	10	20	55	180	540	1300	2200*	3400*
$L_{LU, max}$	LU				4	5	5	8					
$d_s \times s$	mm	16x2.5/16x2	18x2	20x2.5	26x3	32x3	40x3.5	50x4	63x4.5	75x5	90x6		
$d_i$	mm	11.5/12	14	15	20	26	33	42	54	65	76		
max pipe length	m	9	5	4									

\*Values not indicated in EN 806 standard, obtained by interpolating

SECTION	OUTPUT [kW]	FLOW RATE [l/s]	PIPE
OP	4.65	0.12	18x2
NO	10.23	0.25	26x3
MN	13.72	0.32	32x3
LM	17.48	0.42	32x3
KL	20.97	0.50	32x3
JK	24.73	0.60	40x3.5
IJ	28.22	0.68	40x3.5
HI	31.98	0.78	40x3.5
GH	38.46	0.96	50x4
FG	44.94	1.08	50x4
EF	51.42	7.97	90x7
DE	57.90	7.97	90x7
CD	64.38	7.97	90x7
BC	72.14	7.97	90x7
AB	77.01	7.97	90x7

TOWER - DIMENSIONING OF WATER DISTRIBUTION PIPES

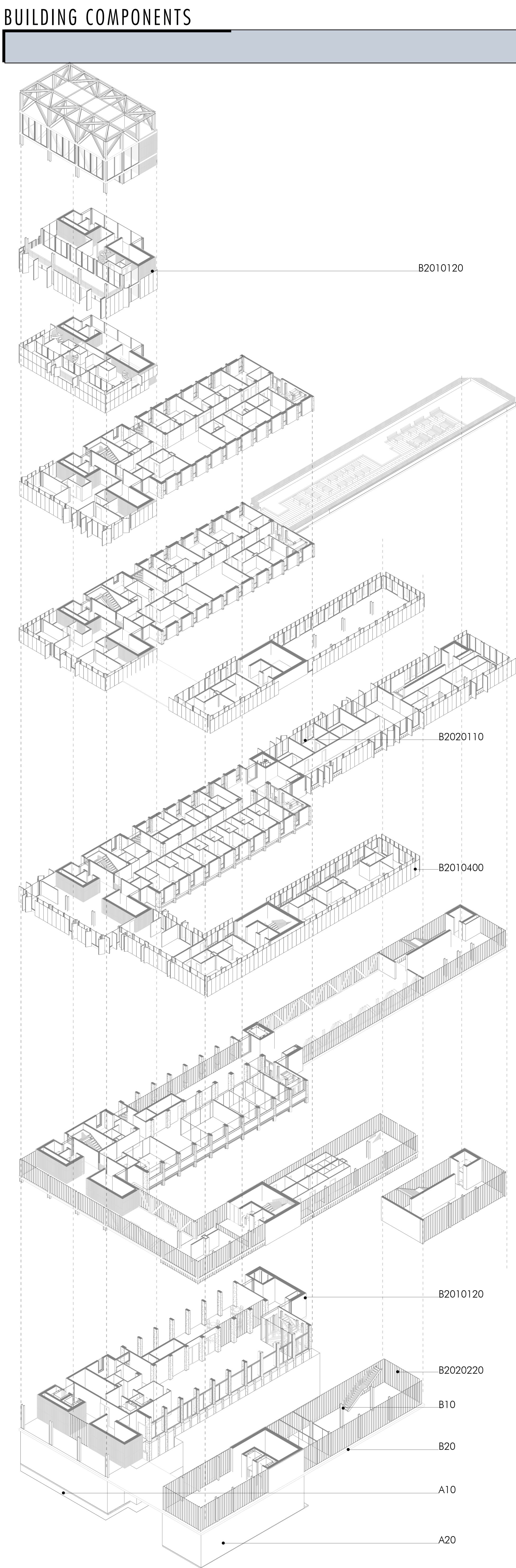
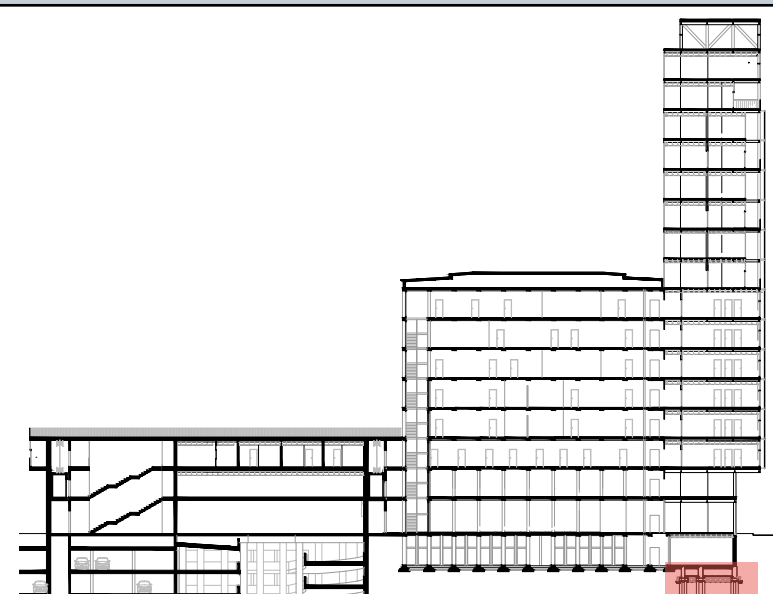
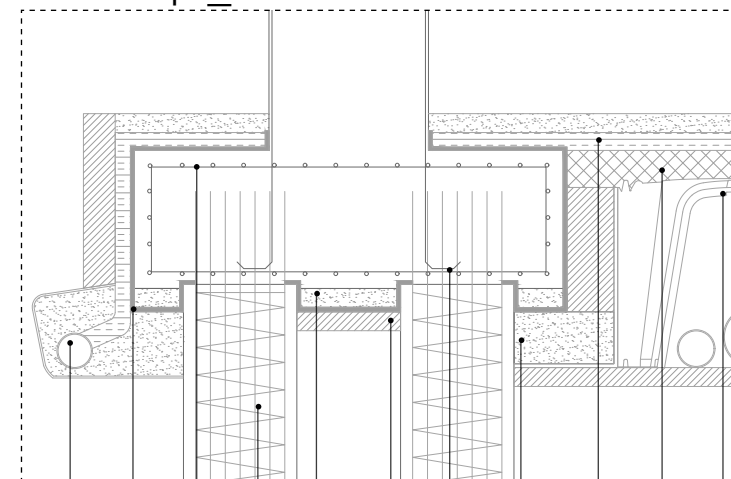
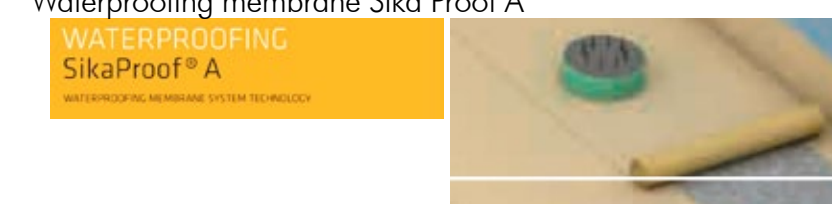


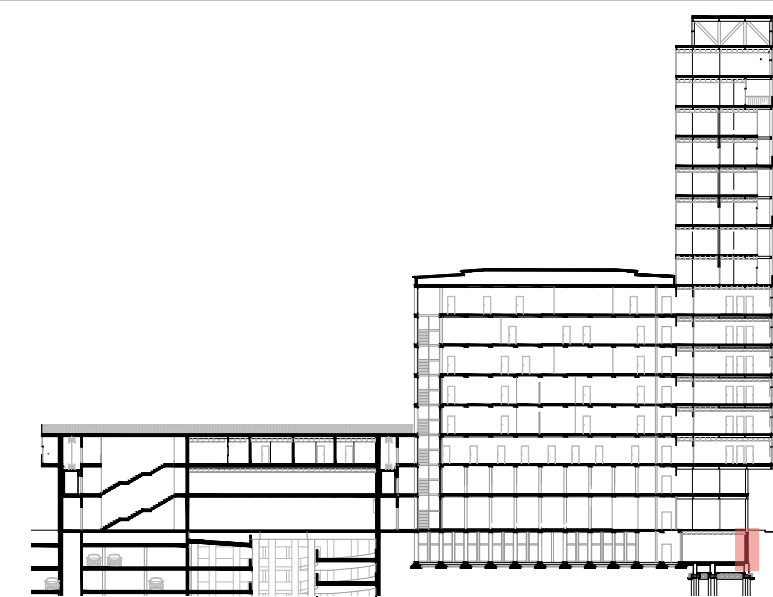
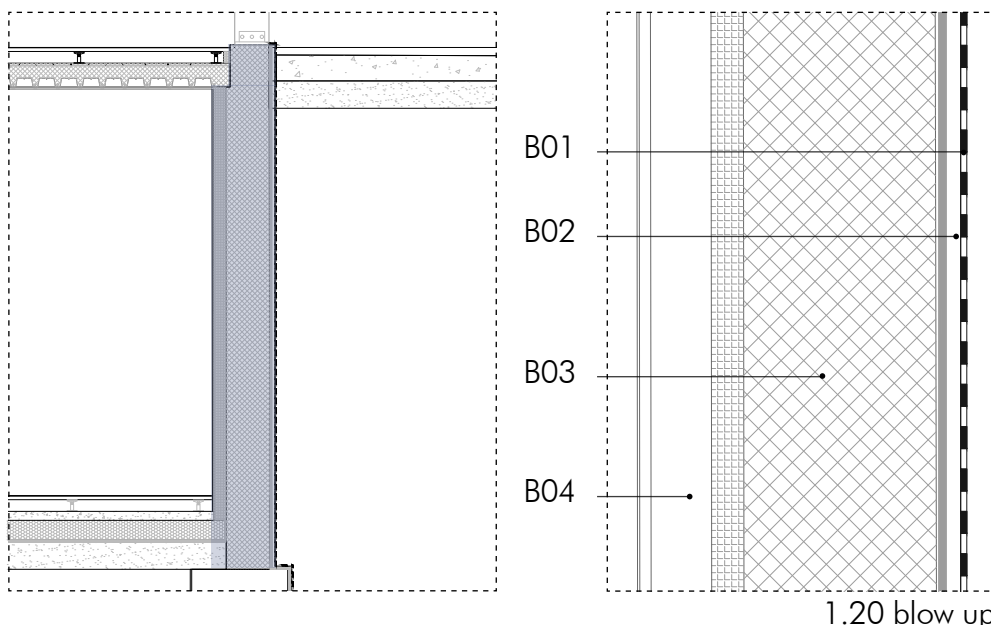


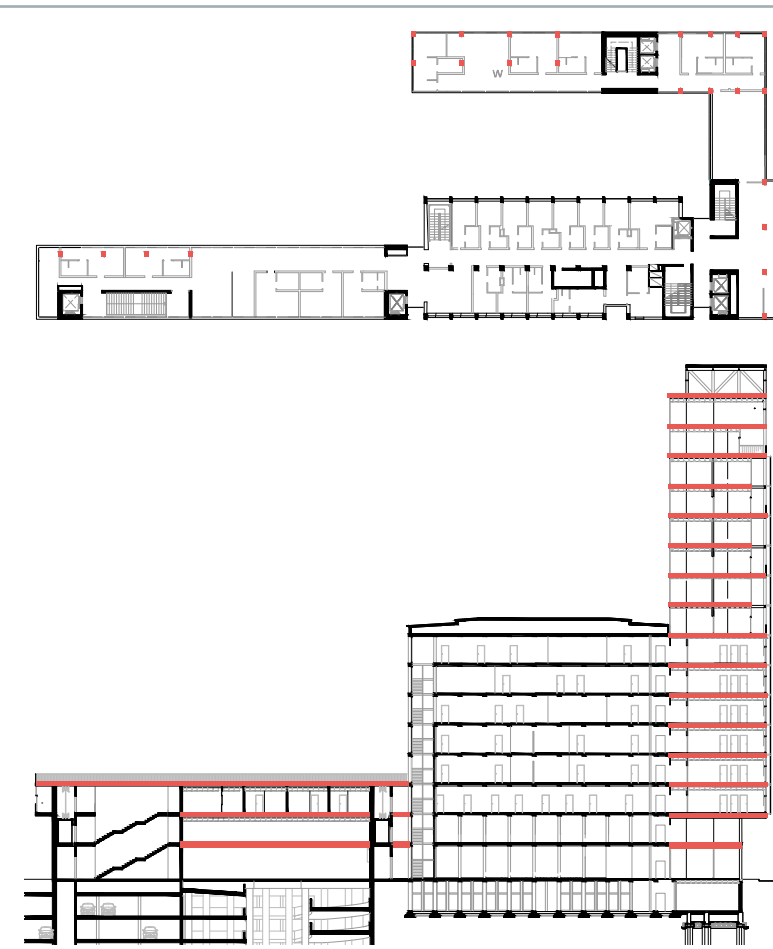

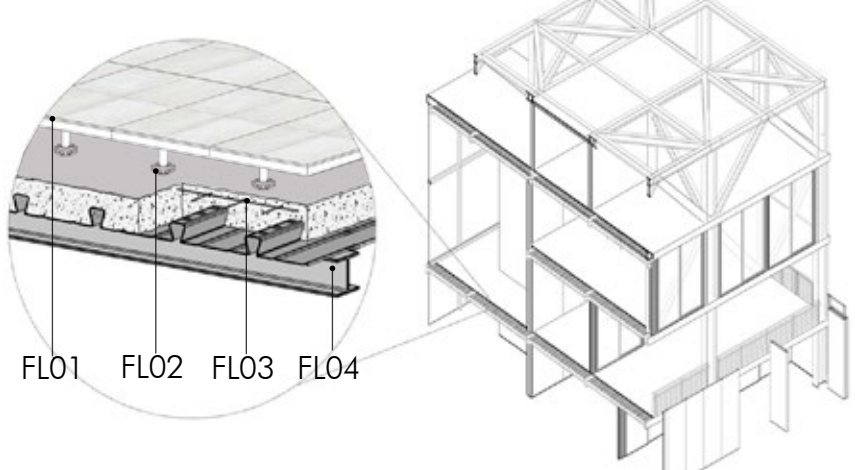




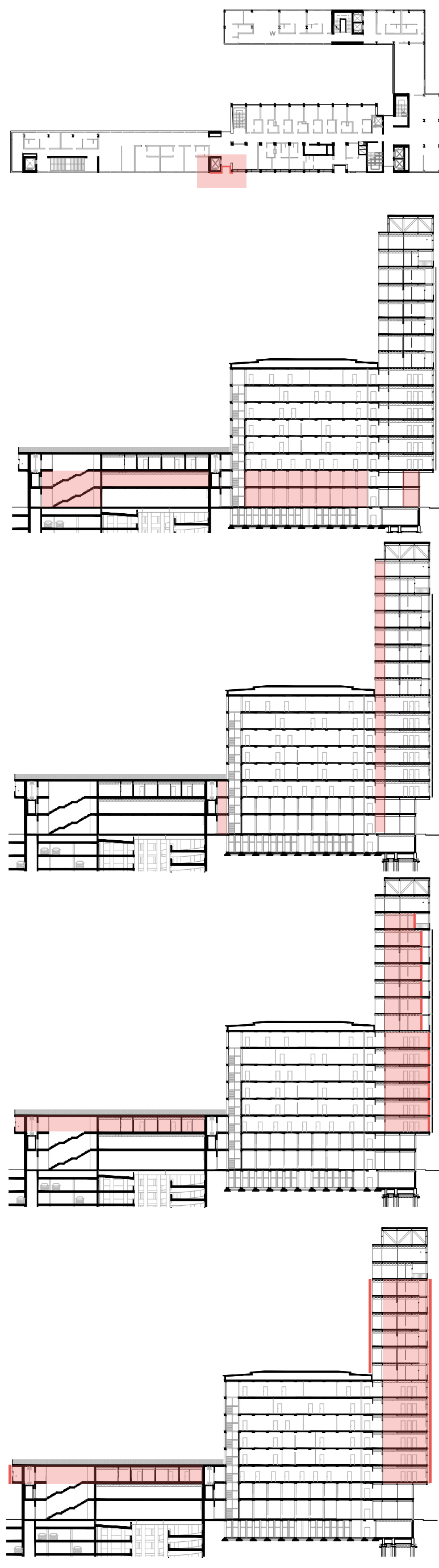
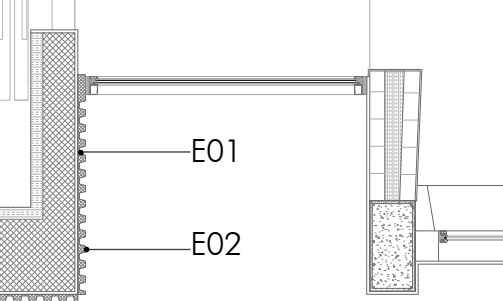
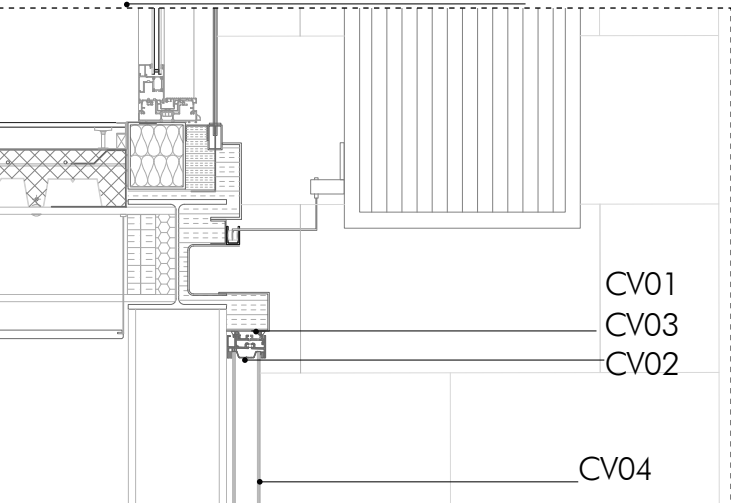
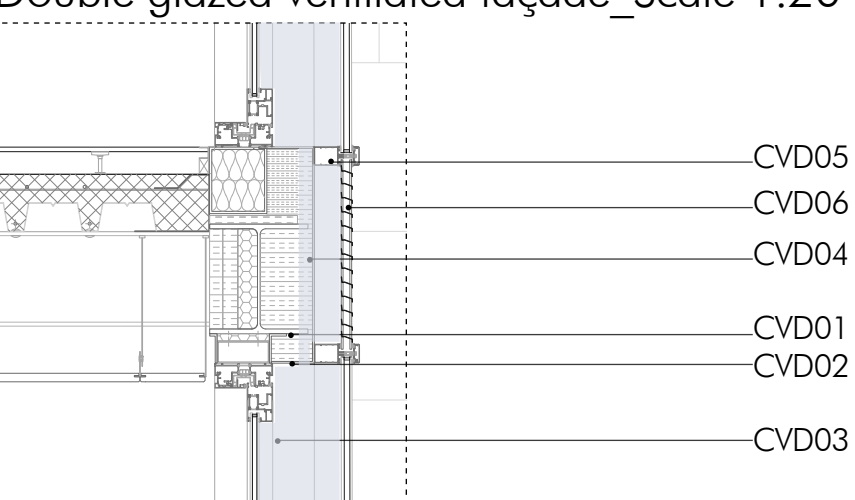
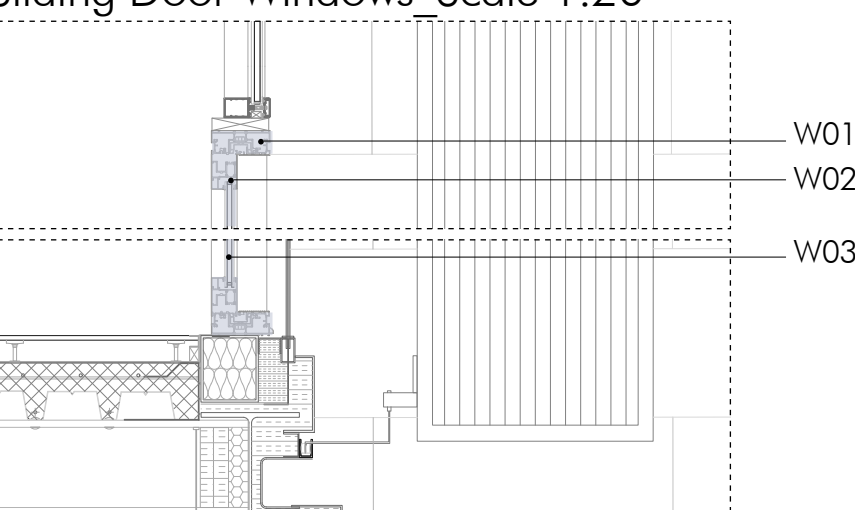
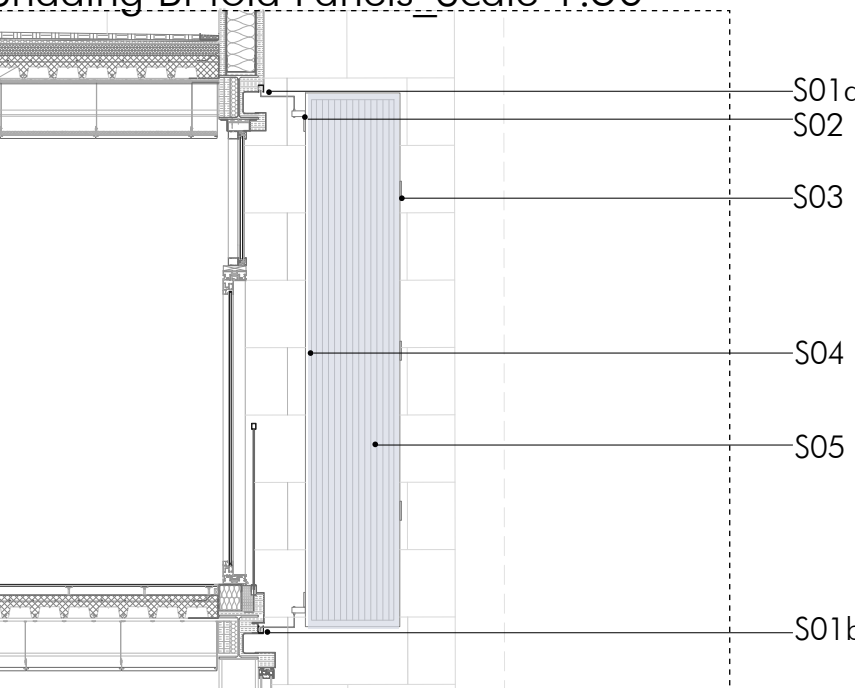

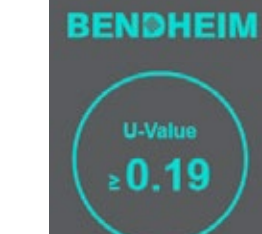



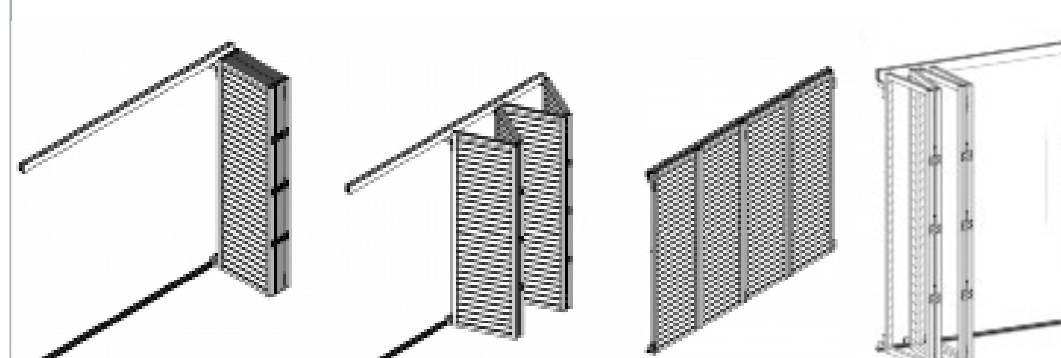
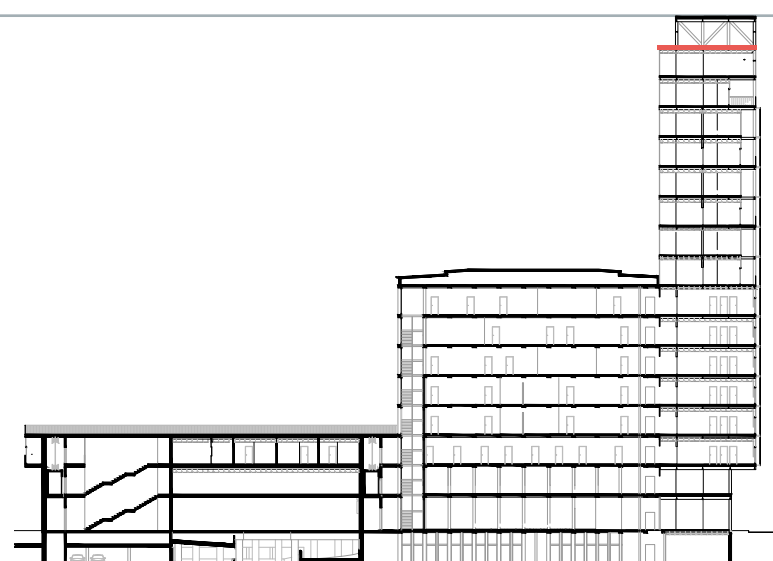
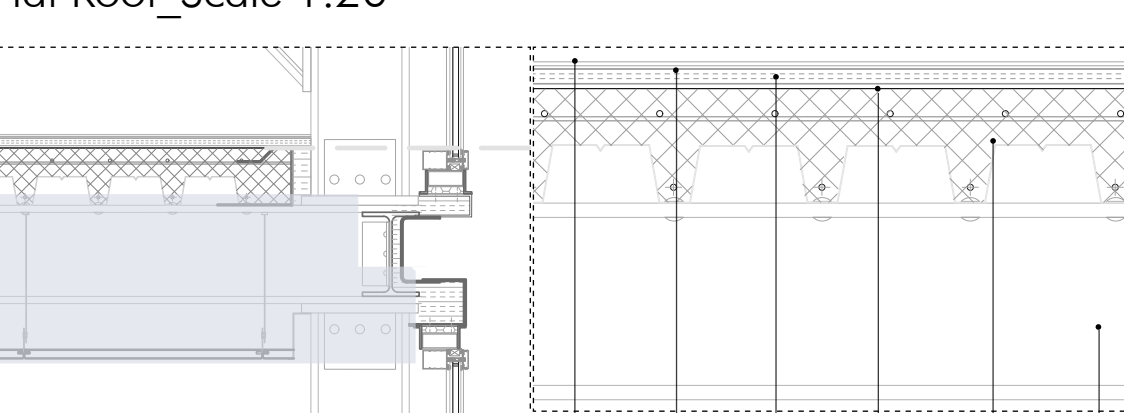






PARTIAL PLAN 1:100







BUILDING COMPONENTS									
Major Group Elements		Group of Elements	Individual Elements	Keyplan	Detail	Code		Producers	
	A - SUBSTRUCTURE	A10 - Foundations	A1010 - Standard Foundations A1010100 - Footing & Pile Caps A1010130 Pile Caps		Pile Cap _Scale 1.20  F09 F03 F04 F01 F02a F06 F05 F02b F07 F08 F10	F01 Foundation piles F02a Screed 10 cm F02b Screed 5 cm F03 Waterproofing membrane Sika Proof A F04 Top reinforcements F05 Reinforcement bars F06 Concrete 5 cm F07 Water repellent thermal insulation F08 Rof slab F09 DeltaDrain drainage F10 Disposable formwork for ventilated floor cavities/crawlspace	F03 Waterproofing membrane Sika Proof A  F09 DeltaDrain drainage  F10 DeltaDrain drainage 		
		A20 - Basement	A2020 - Basement walls A2020100 - Basement walls Construction		Foundation Wall _Scale 1.50  B01 B02 B03 B04 1:20 blow up	B01 Protefon Tex_ B02 Selfene BASE Polyester Waterproofing Membrane B03 Concrete basement walls B04 DryCore Smartwall drywall panels - High-Density Graphite Infused EPS Insulation - Basement wall plaster 3 cm - Basement wall finishing	B04 DryCore Smartwall drywall panels  		
	B - SHELL	B10 - Superstructure	B1010 - Floor Construction B1010200 - Upper Floor Framing Vertical Elements B1010250 - Columns - Steel B1010300 - Upper Floor Framing Horizontal Elements B1010370 - Deck - Metal  B1020 - Roof Construction B1020200 - Flat Roof Framing Horizontal Elements B1020260 - Deck Metal		Partial Pillar Detail _Scale 1.50  VE01  Composite Floor Slab  FL01 FL02 FL03 FL04	VE01 Steel pillar HEA 320  FL01 Raised floor FL02 Neoprene Acoustic Insulation_Farrat FL03 Welded Mesh and structural concrete FL04 HEA 320 Beam	VE01 Steel pillar HEA 320  FL02 Neoprene Acoustic Insulation Farrat  FL03 Welded Mesh and structural concrete Composite floors decking with dovetail  Colastro® 40 		
		B20 - Exterior Enclosure	B2010 - Exterior Wall B2010100 - Exterior Wall Construction B2010120 - Precast B2010400 - Exterior Sun control devices  B2020 - Exterior Windows B2020100 - Windows B2020110 - Windows Aluminium B2020200 - Curtain walls B2020220 - Curtain wall panels		Fluted Concrete _Scale 1.50  E01 E02  U-Channel Glass _Scale 1.20  CV01 CV03 CV02 CV04  Double glazed ventilated façade _Scale 1.20  CVD05 CVD02 CVD06 CVD04 CVD01 CVD02 CVD03  Sliding Door Windows _Scale 1.20  W01 W02 W03  Shading Bi-fold Panels _Scale 1.50  S01a S02 S03 S04 S05 S01b	E01 Concrete formworks E02 Concrete anti-dust coating  CV01 Sealant CV02 Head Plastic Insert CV03 Head extrusion CV04 U Channel glass panel  CVD01 Aluminium window frame CVD02 Aluminium sliding window sash CVD03 Double glass panel CVD04 Steel supporting profile CVD05 Fixed window mullions CVD06 Metalling grid for ventilation  W01 Aluminium window frame W02 Aluminium sliding window sash W03 Double glass panel  S01a Top track S01b Bottom track S02 Free folding hardware S03 Hinge for the panel movement S04 Metal profile S05 Aluminium vertical shadings, standard natural anodized, polyester powdercoated	E01 Concrete formworks  1/31 RIB TYPE C A clear and smooth rib pattern with an extremely high strength-to-weight ratio, recommended for all concrete wall panels. CV01 U-Channel Glass  U-Value 0.19 CVD Double glazed façade  DOUBLE FAÇADE Duowall – twice the protection The basic concept of a second, non-insulated layer of glass in front of an internal heat-insulated façade with opening sashes can be achieved with various combinations of WICONA systems. The W Sliding Door Windows  SlimPatio 68 SlimPatio 68 sliding window Vista panoramica e comfort ottimale  S DUCOSlide QuadraFold system 		
B30 - Roofing	B3010 - Roof Coverings B3010100 - Roof Finishes B3010130 - Roofing Preformed metal B3010300 - Roof Insulation & Fill B3010310 - Insulation Rigid		Flat Roof _Scale 1.20  RF01 RF02 RF03 RF04 RF05 RF06 1:10 blow up	RF01 Waterproofing Capping sheet Karat 5.2 mm RF02 Waterproofing membrane UL 50 4.2 mm RF03 Bauder Pir Tapered Insulation 20mm RF04 Vapour barrier 4mm RF05 Welded mesh and structural concrete RF06 HEA 320 Beam	RF01 Waterproofing Capping sheet Karat 5.2 mm RF02 Waterproofing membrane UL 50 4.2 mm RF03 Bauder Pir Tapered Insulation 20mm RF04 Vapour barrier 4mm RF05 Welded mesh and structural concrete RF06 HEA 320 Beam	RF01 Waterproofing Capping sheet Karat 5.2 mm  RF02 Waterproofing membrane UL 50 4.2 mm RF03 Bauder Pir Tapered Insulation 20mm RF04 Vapour barrier 4mm RF05 Welded mesh and structural concrete RF06 HEA 320 Beam   Composite floors decking with dovetail Colastro® 40 			





BUILDING COMPONENTS		Major Group Elements	Group of Elements	Individual Elements	Keyplan	Detail	Code	Producers
		B - SHELL	B30 - Roofing	B1020 - Roof Construction B1020200 - Flat Roof Framing Horizontal Elements B1020260 - Deck Metal  B3010 - Roof Coverings B3010100 - Roof Finishes B3010130 - Roofing Preformed metal B3010300 - Roof Insulation & Fill B3010310 - Insulation Rigid		Green Roof_Scale 1.10 	GRF01 Substrate with plants: -Acacia palmatum verde; -Oleander; -Spiraea x vanhouttei; -Cornus alba elegantissima; -Ligustrum japonicum; -Hydrangea paniculata; -Alnus; -Viburnum davidii; -Philadelphus tomentosus; -Rosa rugosa; -Lonicera xylosteum; -Hemerocallis.  GRF02 Filtering Geotextile element GRF03 Draining Components GRF04 IsoDeck PV Steel	
				C10- Partitions C1010 - Partitions			DW01 Plaster finishing DW02a Gypsum wall board 12.5 cm DW02b Gypsum wall board 10 cm DW04 U profile standard metallic structure for drywall	
				C2010 - Stair Construction C2010100 - Regular Stairs C2010130 - Stairs Steel C2010300 - Spiral Stairs C2010310 - Metal  C2020 - Stair Finishes C2020100- Stair, Tread and landing finishes		Convitto self standing steel staircase 	STsf 01 Modular Steel Bearing Structure STsf 02 Extruded aluminium profile Landing STsf 03 Extruded aluminium profile Steps STsf 04 Glass Parapet STsf 05 Wood circular cross section hand railing profile	
		C - INTERIORS	C30 - Interior Finishes	C30 - Interior finishes C3010 - Wall finishes C3020 - Floor Finishes C3030 - Ceiling finishes		Raised floor_Scale 1.20 	RFL01a Covering of chipboard RFL01b Chipboard flooring layer RFL01c Steel sheet bottom surface RFL02 Aluminium pedestal RFL03 Acoustic insulation	
				D1010 - Elevators & Lifts D1010100 Passengers Elevators  D2010 - Plumbing Fixtures  D2020 - Domestic Water Distribution  D2030 - Sanitary Waste  D2040 - Rain Water Drainage  D3010 - Energy Supply  D3020 - Heat Generating Systems  D3030 - Cooling Generating Systems  D3040 - Distribution Systems  D3050 - Terminal & package units  D3060 - Controls & Instrumentation  D3070 - Systems testing & Balancing		Suspended CounterCeiling_Scale 1.20 	SCL01 Fleece-coated, highly absorbing acoustic tile SCL02 Steel mounting substructure	
				F10 - Special Construction F1010 - Special Structures  F2010 - Building Elements Demolition			Cooling and Ventilation AHU01 AHU_VEX500 Air Handling Unit (Up to 7000m3/h) AHU02 Distribution ducts AHU03 Air Terminals	
		D - SERVICES	D10 - Conveying	D1010 - Elevators & Lifts D1010100 Passengers Elevators  D2010 - Plumbing Fixtures  D2020 - Domestic Water Distribution  D2030 - Sanitary Waste  D2040 - Rain Water Drainage  D3010 - Energy Supply  D3020 - Heat Generating Systems  D3030 - Cooling Generating Systems  D3040 - Distribution Systems  D3050 - Terminal & package units  D3060 - Controls & Instrumentation  D3070 - Systems testing & Balancing		Domestic Water Distribution_Scale 1.20 	EL01 Car Top Railing EL02 Passenger Cabin EL03 Access door  DHW1 Main Pipes DHW2 Distribution Plumbing DHW3 Manifold	
				D20 - Plumbing  D2010 - Plumbing Fixtures  D2020 - Domestic Water Distribution  D2030 - Sanitary Waste  D2040 - Rain Water Drainage  D3010 - Energy Supply  D3020 - Heat Generating Systems  D3030 - Cooling Generating Systems  D3040 - Distribution Systems  D3050 - Terminal & package units  D3060 - Controls & Instrumentation  D3070 - Systems testing & Balancing		Radiant floor Heating 1.200 	EL01 Car Top Railing EL02 Passenger Cabin EL03 Access door  DHW1 Main Pipes DHW2 Distribution Plumbing DHW3 Manifold	
		F - SPECIAL CONSTRUCTION & DEMOLITION	F10 - Special Construction	F1010 - Special Structures  F2010 - Building Elements Demolition			Cooling and Ventilation AHU01 AHU_VEX500 Air Handling Unit (Up to 7000m3/h) AHU02 Distribution ducts AHU03 Air Terminals	
				F1010 - Special Structures  F2010 - Building Elements Demolition			Cooling and Ventilation AHU01 AHU_VEX500 Air Handling Unit (Up to 7000m3/h) AHU02 Distribution ducts AHU03 Air Terminals	