

How can the TU Delft accommodate the growing student population whilst complying with its own sustainability goals?

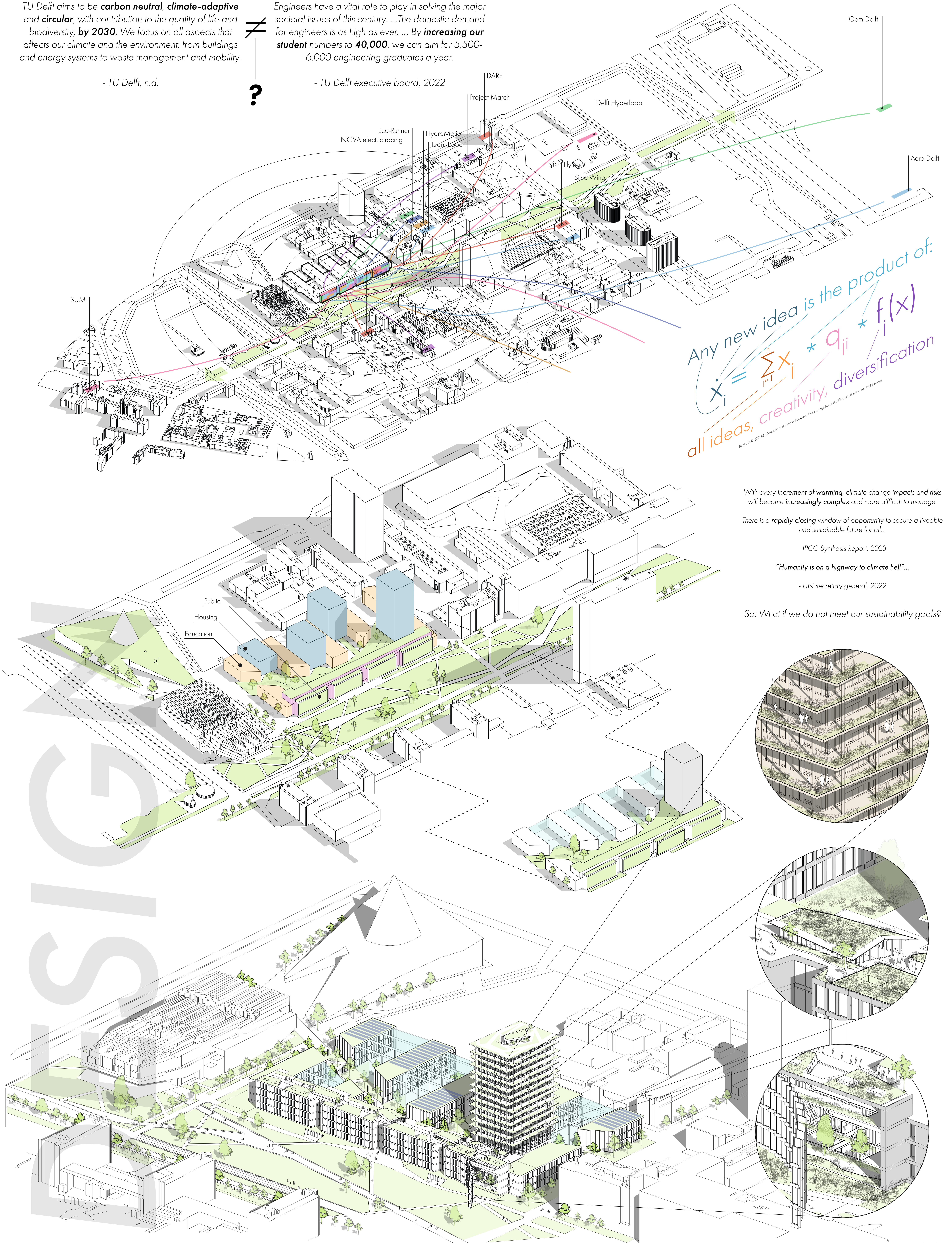
TU Delft aims to be **carbon neutral**, **climate-adaptive** and **circular**, with contribution to the quality of life and biodiversity, **by 2030**. We focus on all aspects that affects our climate and the environment: from buildings and energy systems to waste management and mobility.

- TU Delft, n.d.

Engineers have a vital role to play in solving the major societal issues of this century. ...The domestic demand for engineers is as high as ever. ... By **increasing our student numbers to 40,000**, we can aim for 5,500-6,000 engineering graduates a year.

- TU Delft executive board, 2022

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Any new idea is the product of:
$$\dot{x}_i = \sum_{j=1}^n x_j * q_{ji} * f_i(x)$$

all ideas, creativity, diversification
Based on: C. (2008). Quantum and a neural network. Cloning together and adding input to the historical sciences.

With every increment of warming, climate change impacts and risks will become increasingly complex and more difficult to manage.

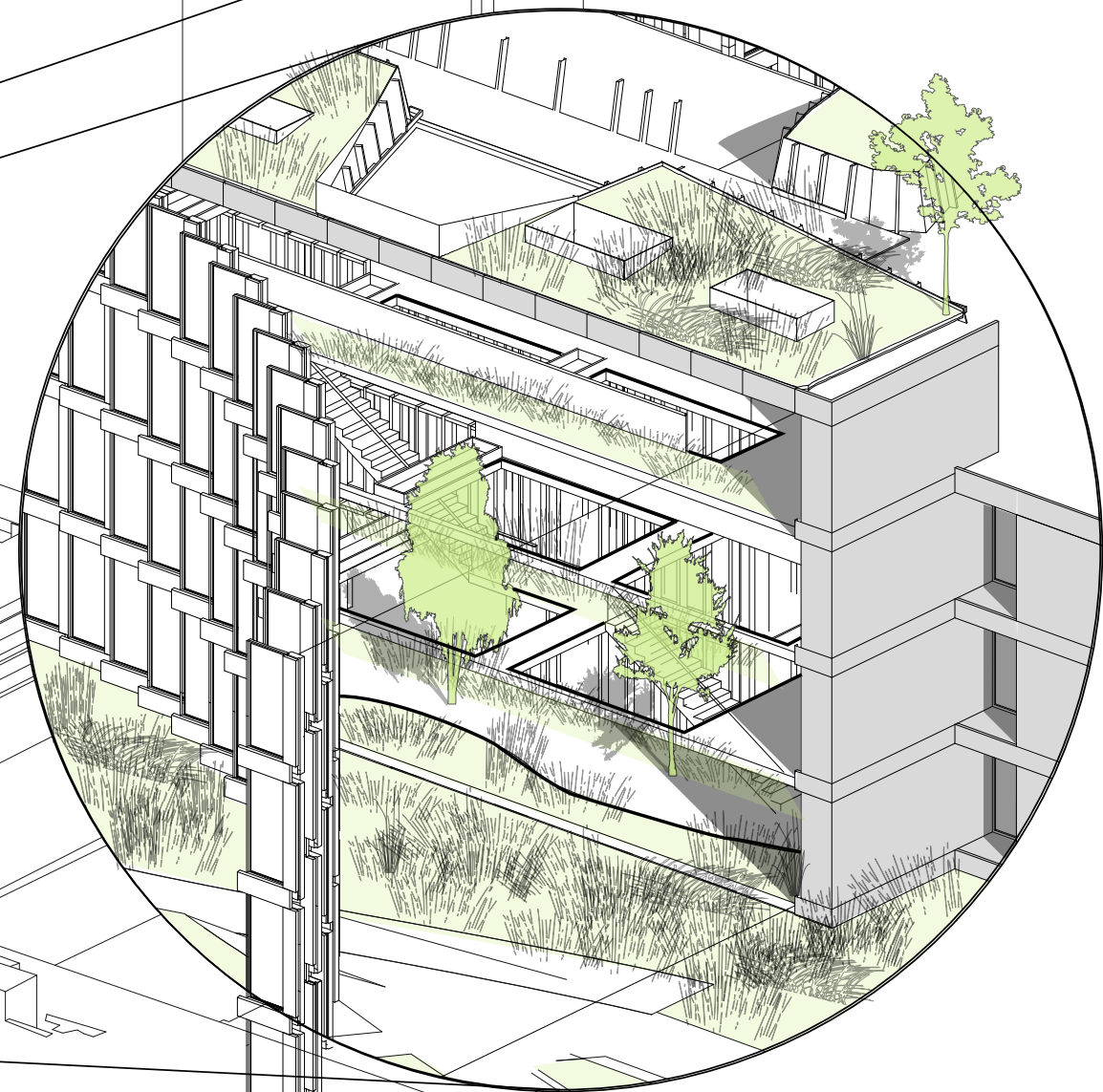
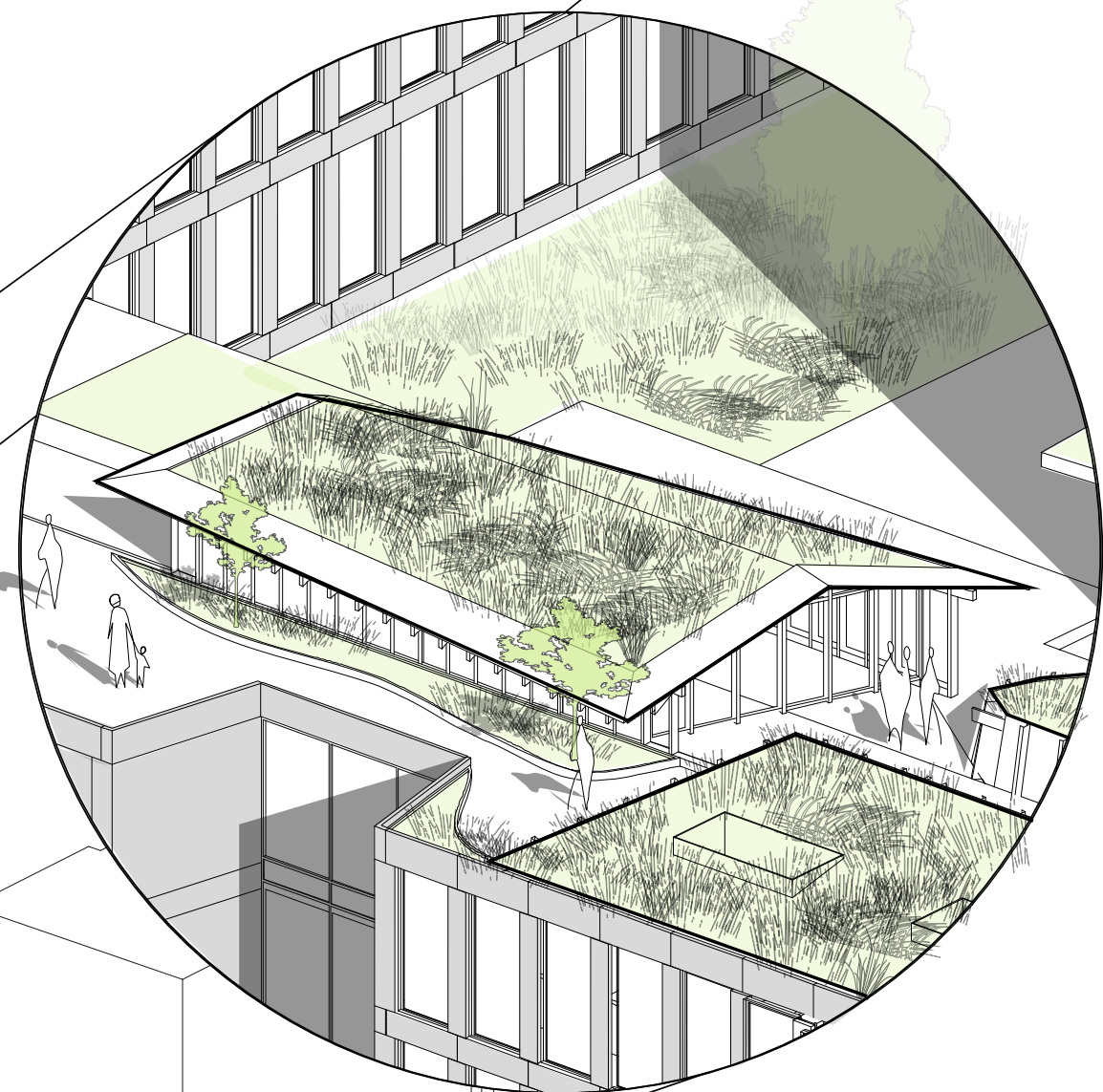
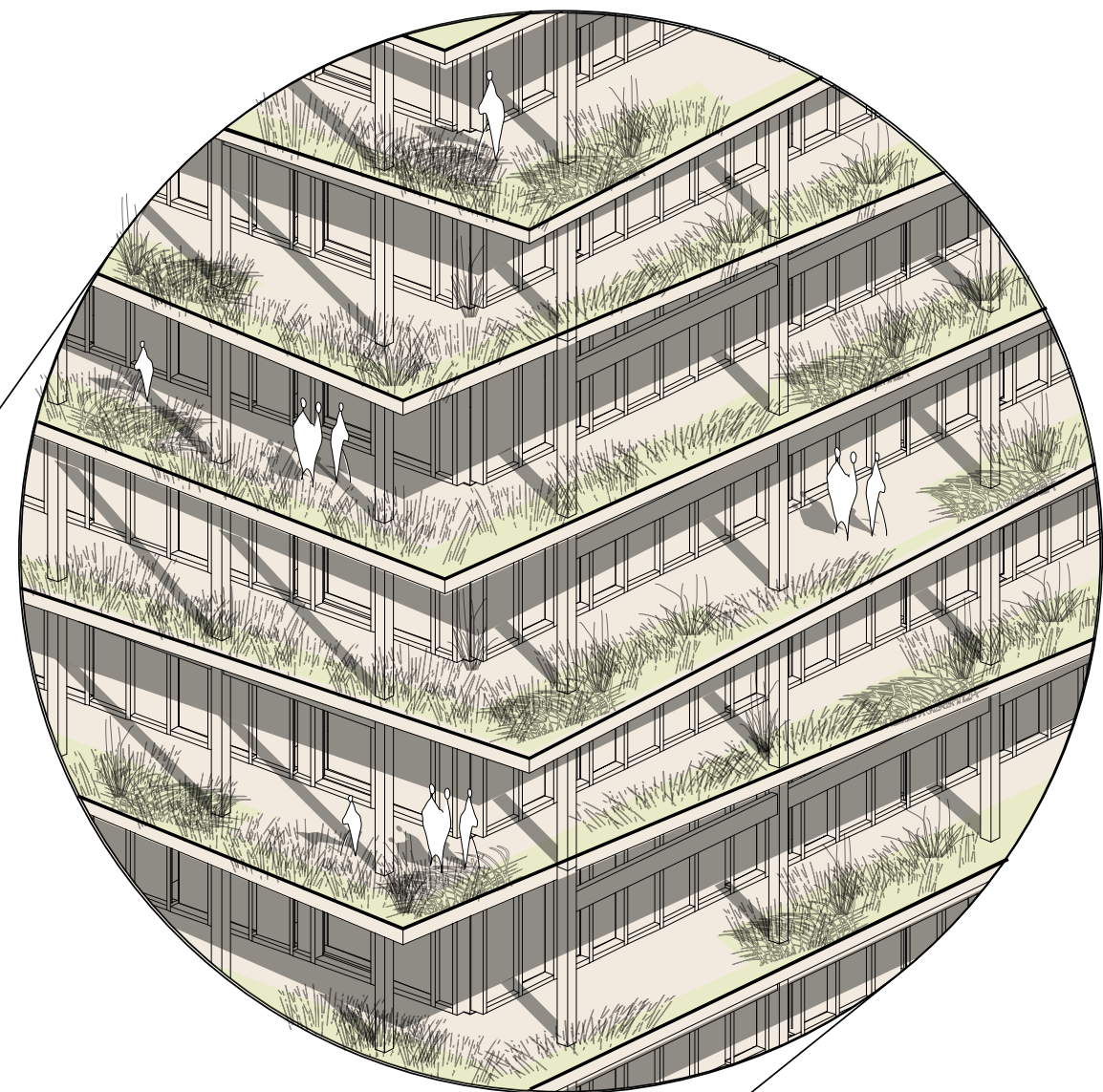
There is a rapidly closing window of opportunity to secure a liveable and sustainable future for all...

- IPCC Synthesis Report, 2023

"Humanity is on a highway to climate hell"...

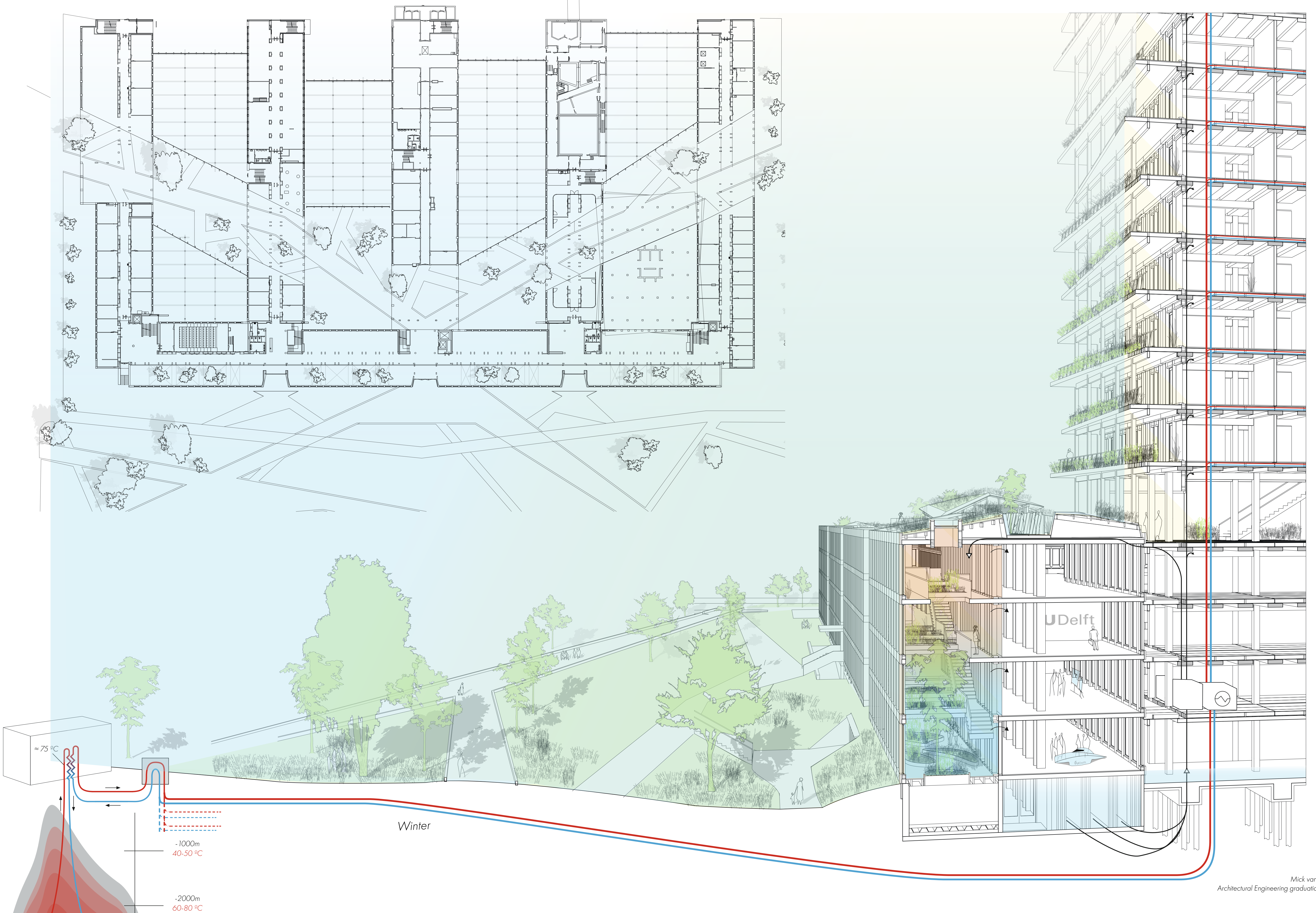
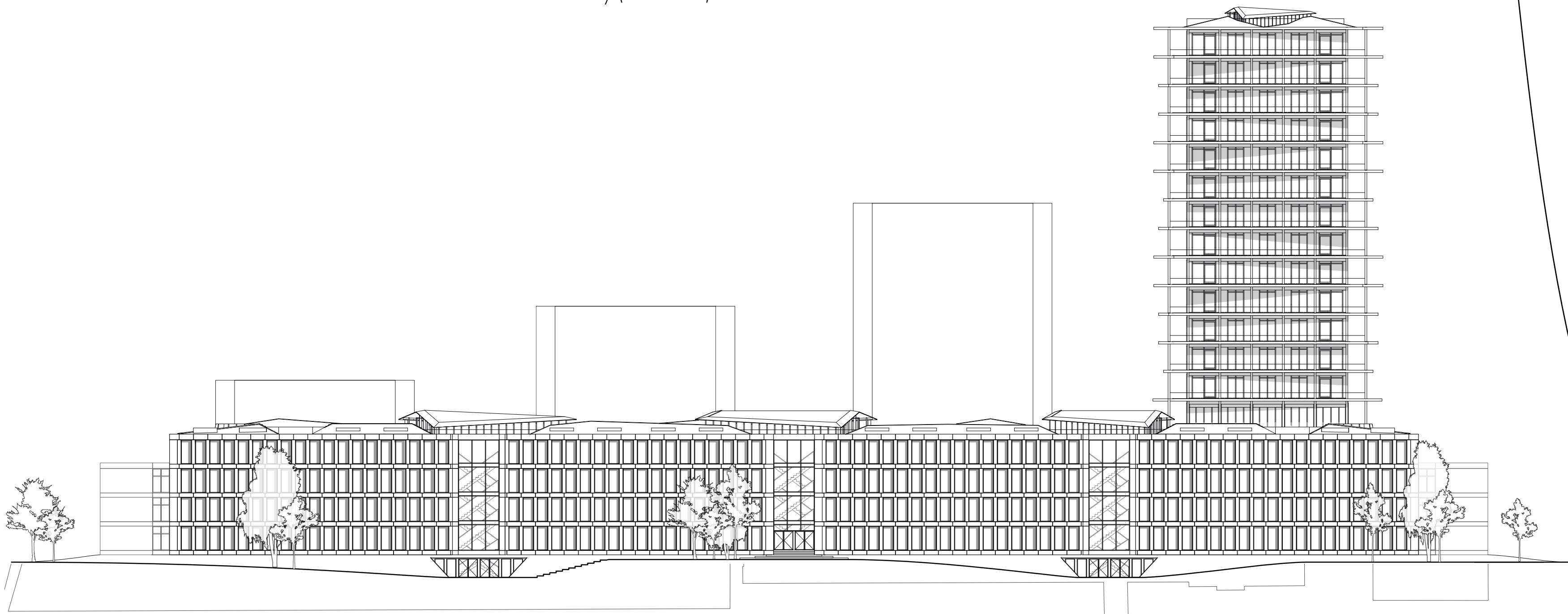
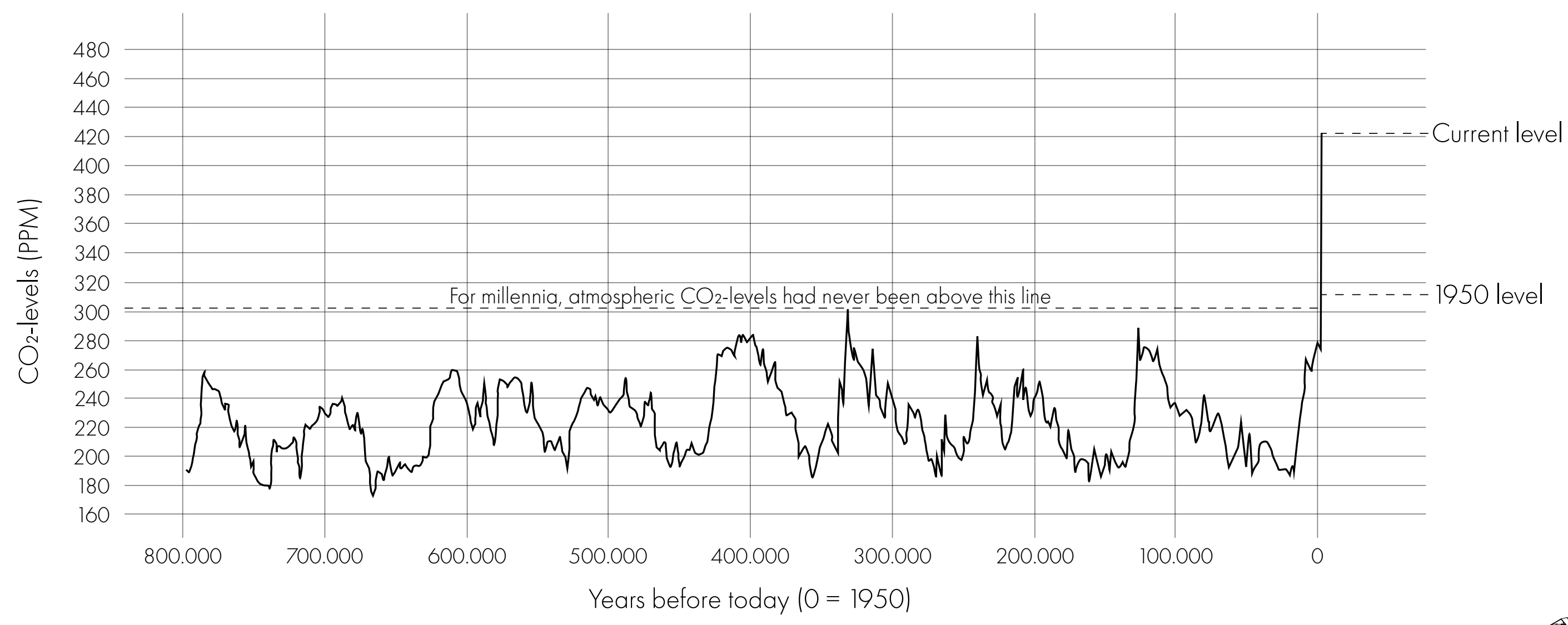
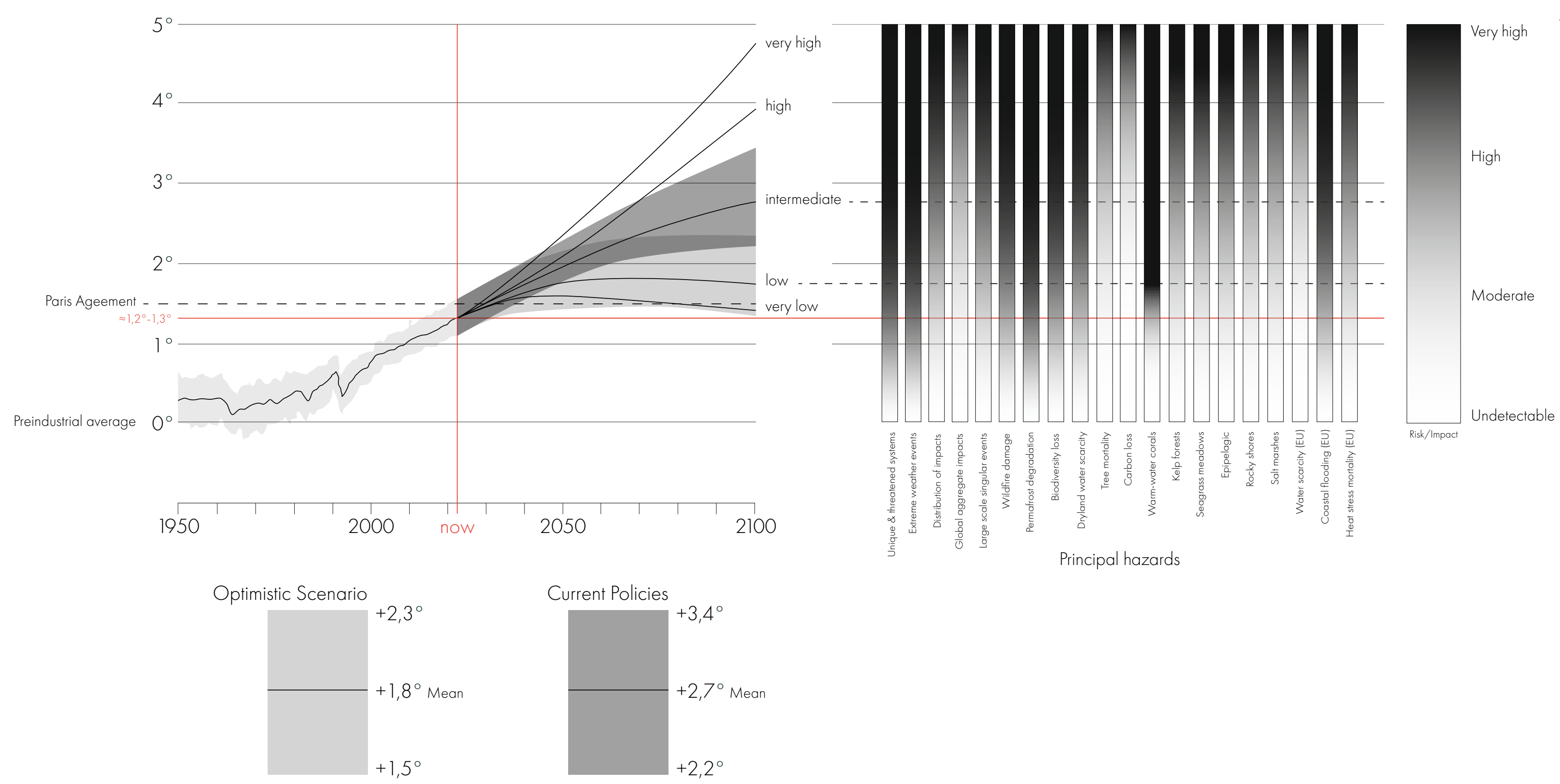
- UN secretary general, 2022

So: What if we do not meet our sustainability goals?

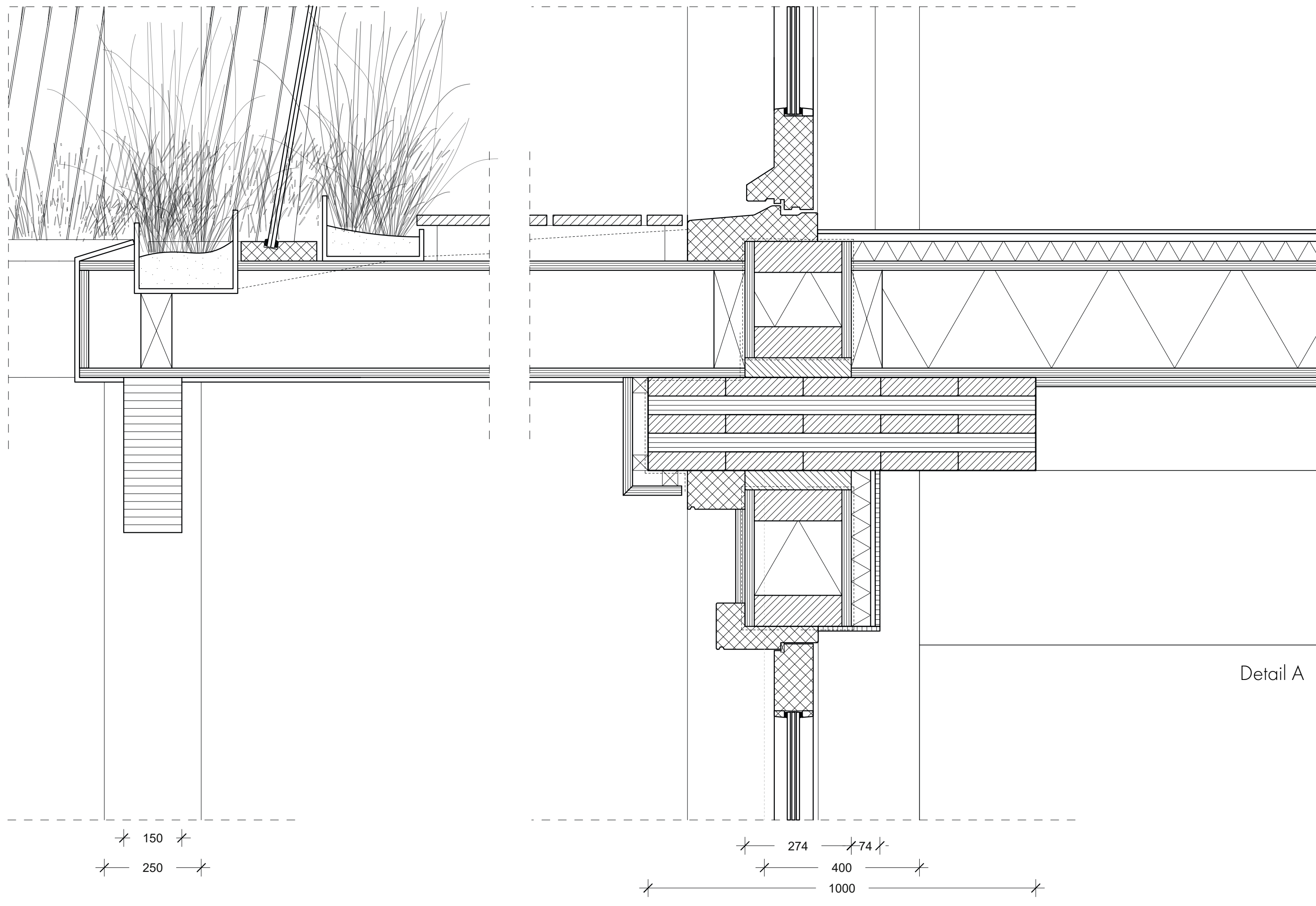


And what if we do not meet our sustainability goals?

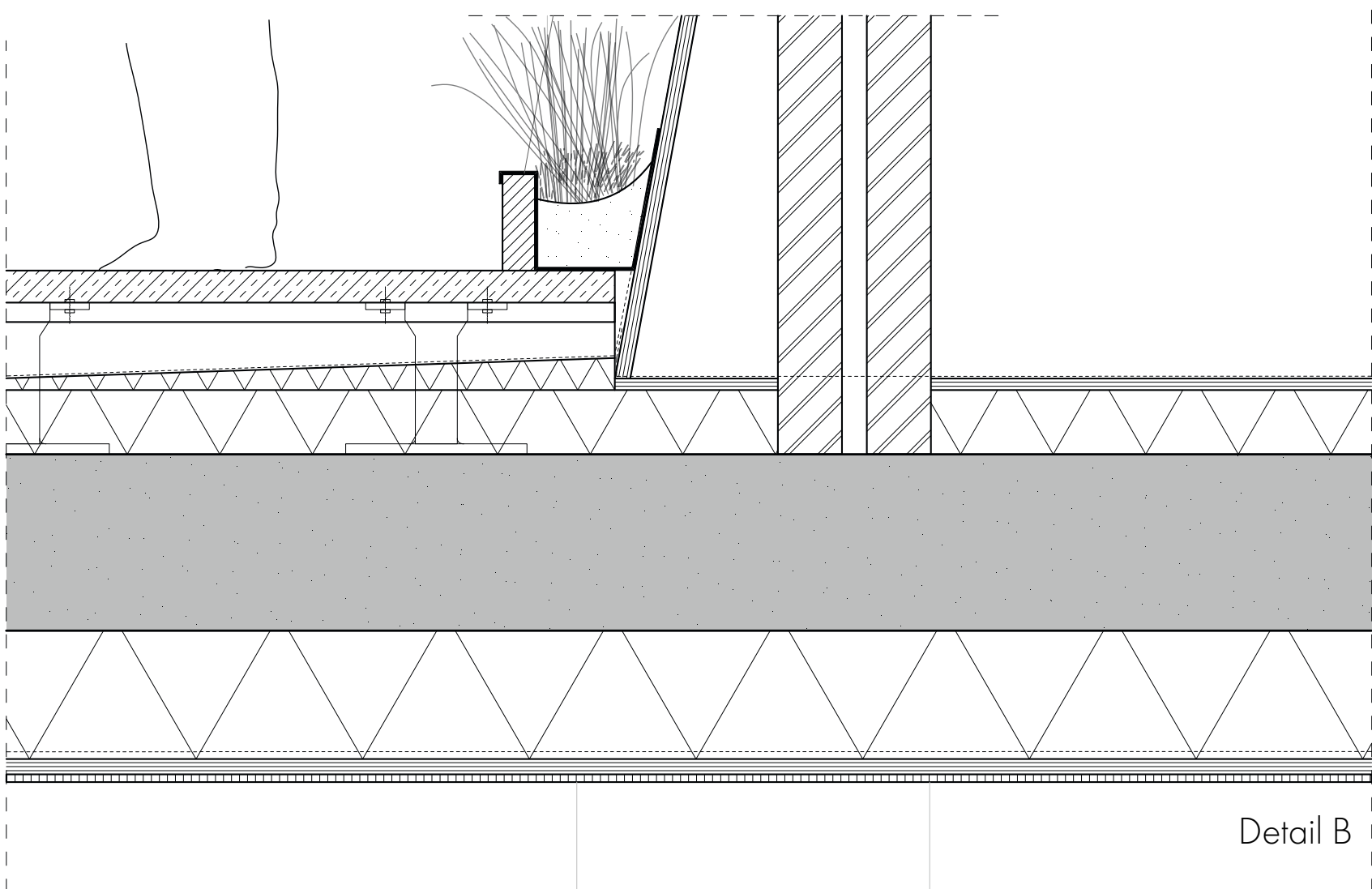
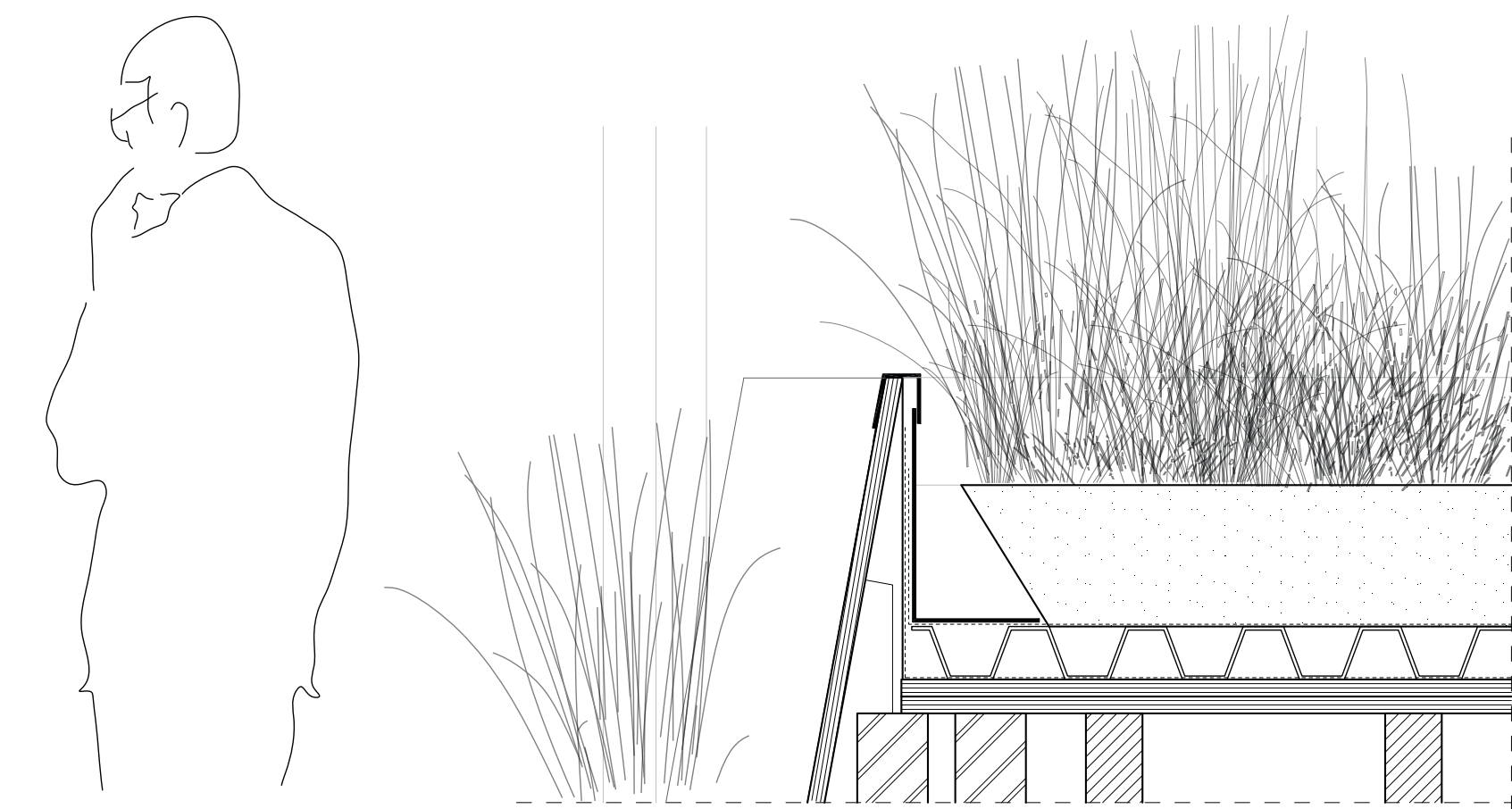
With every **increment of warming**, climate change impacts and risks will become **increasingly complex** and more difficult to manage.



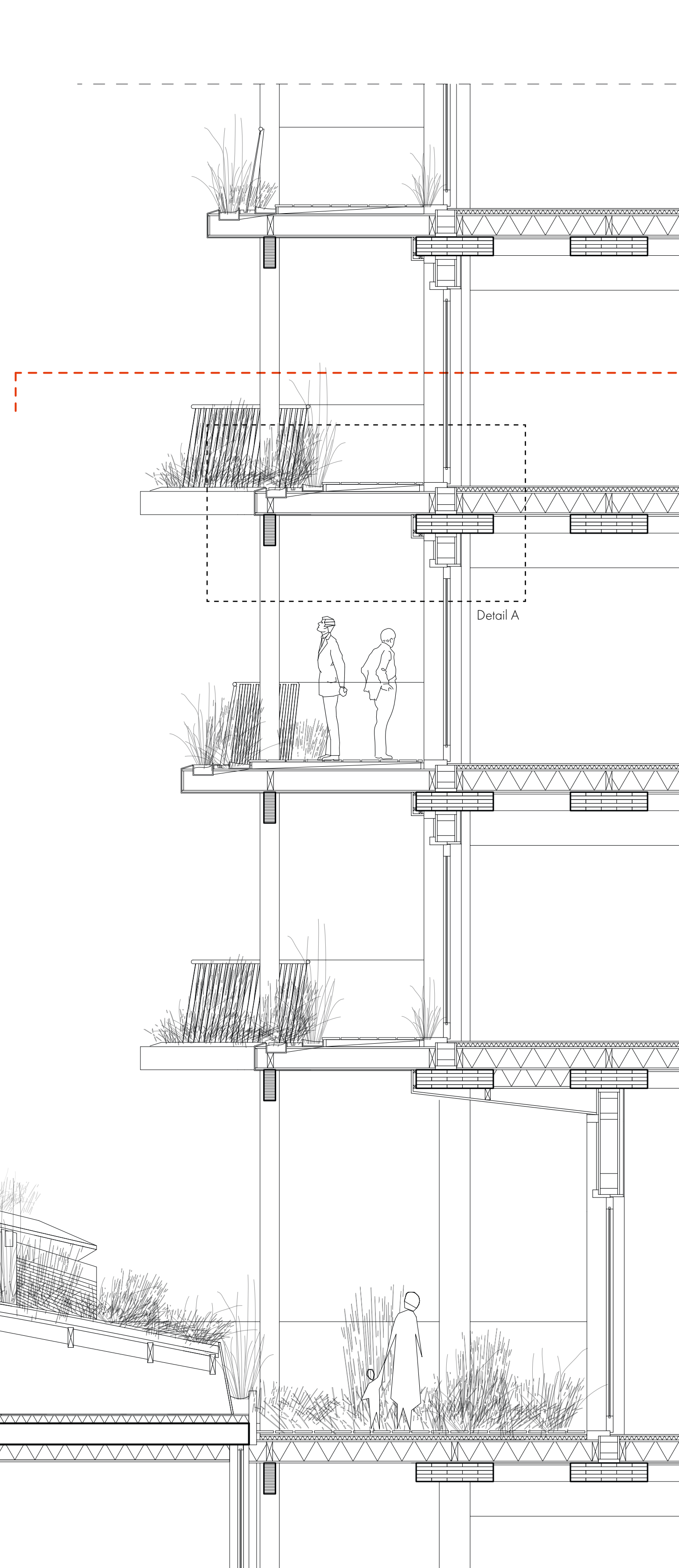
Technical elaboration



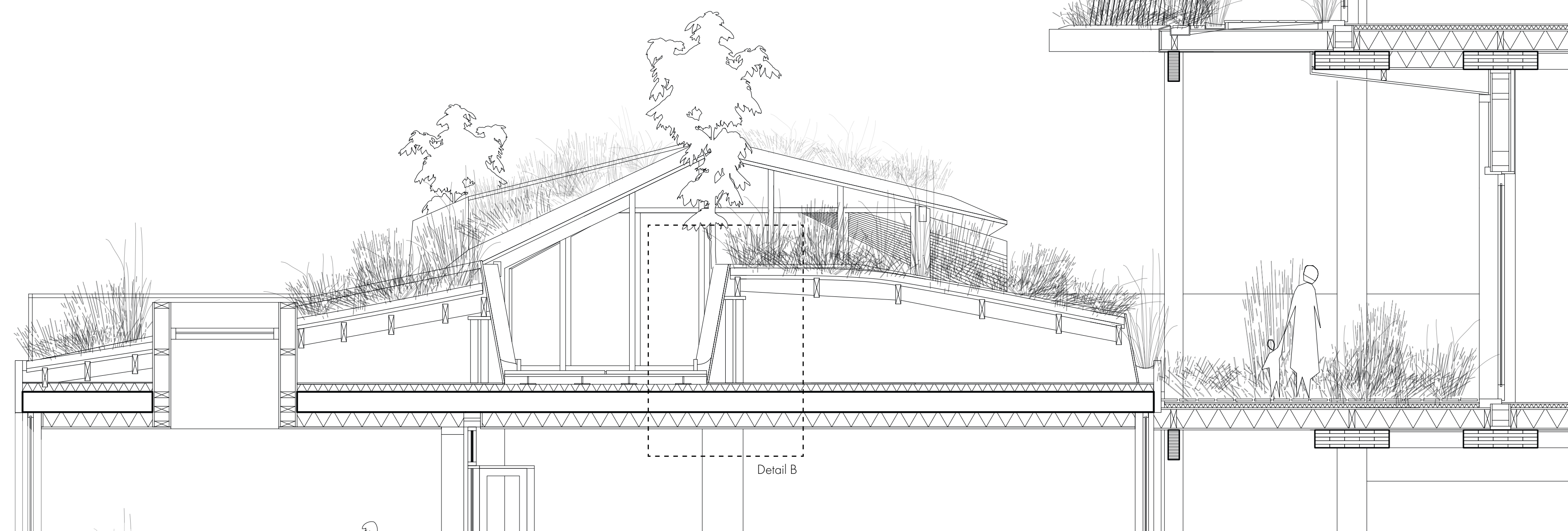
Detail A



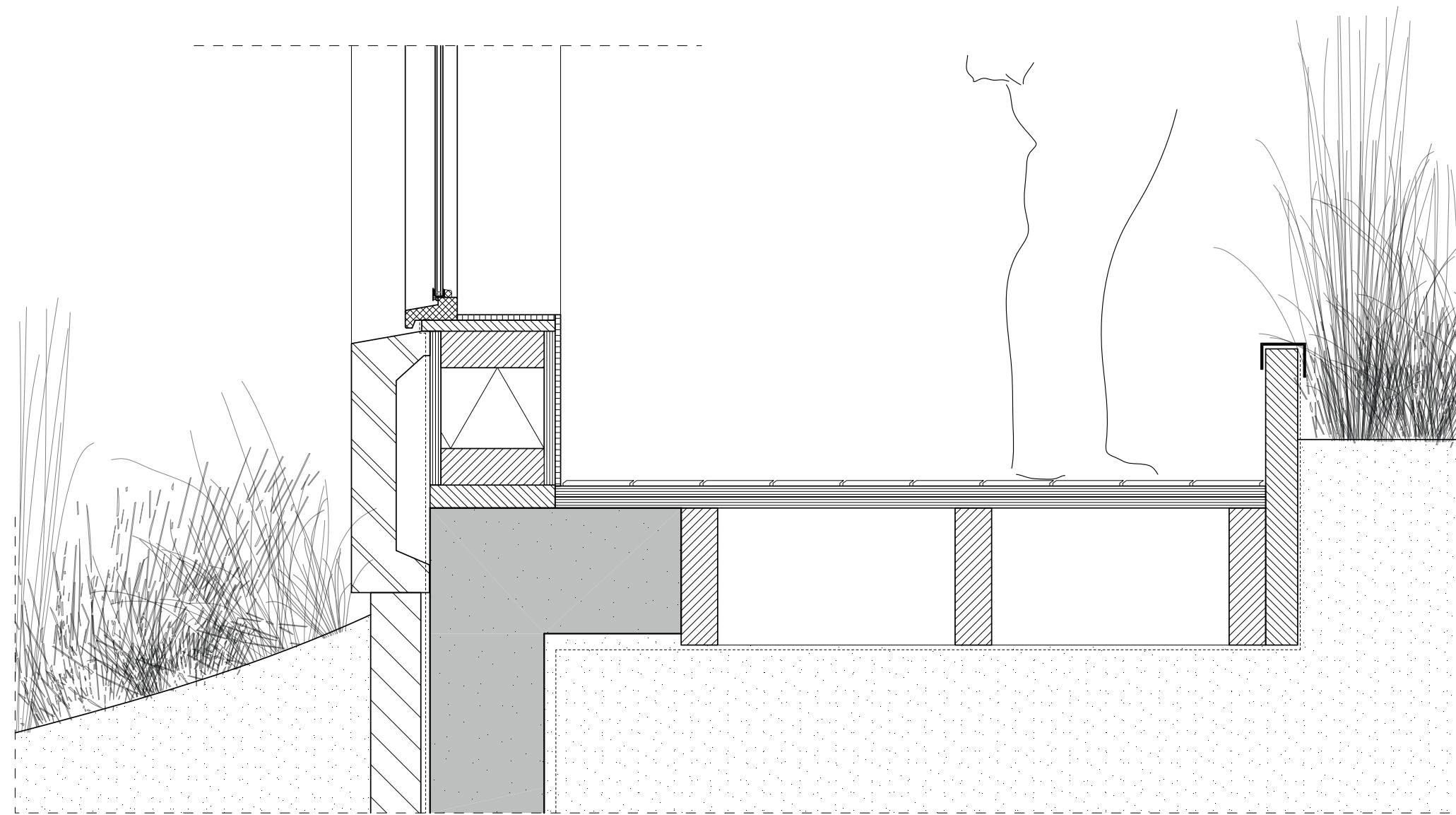
Detail B



Detail A

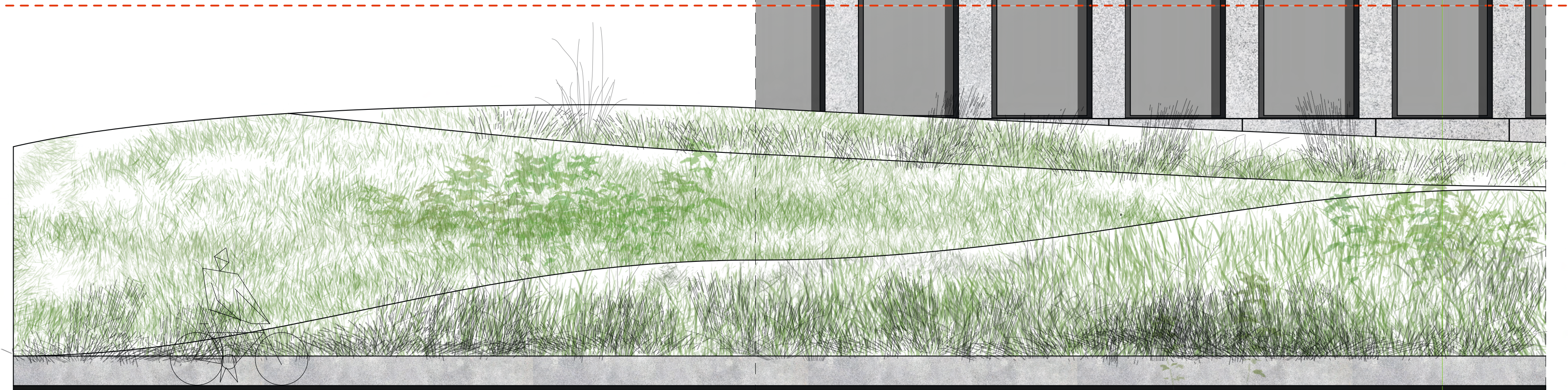
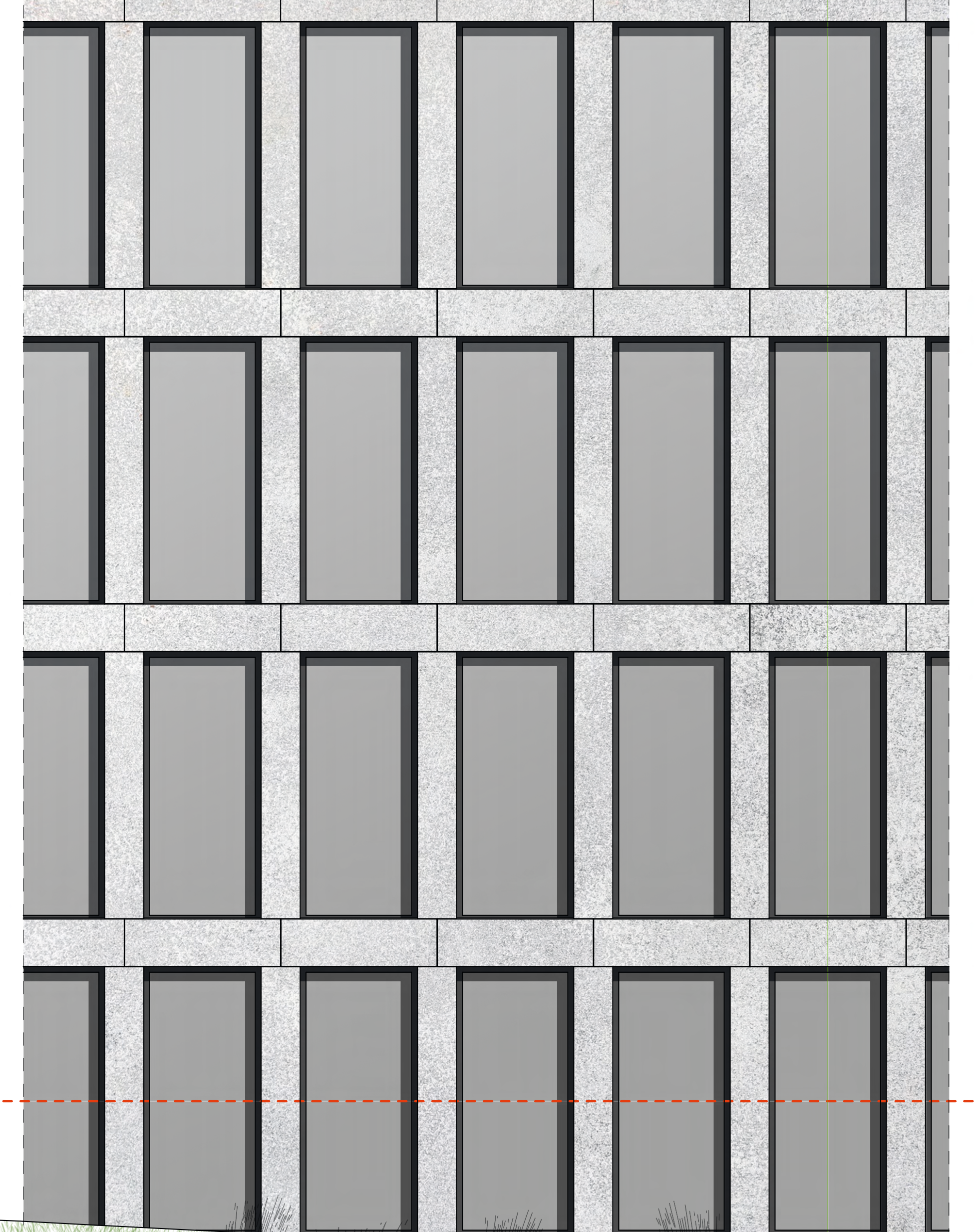
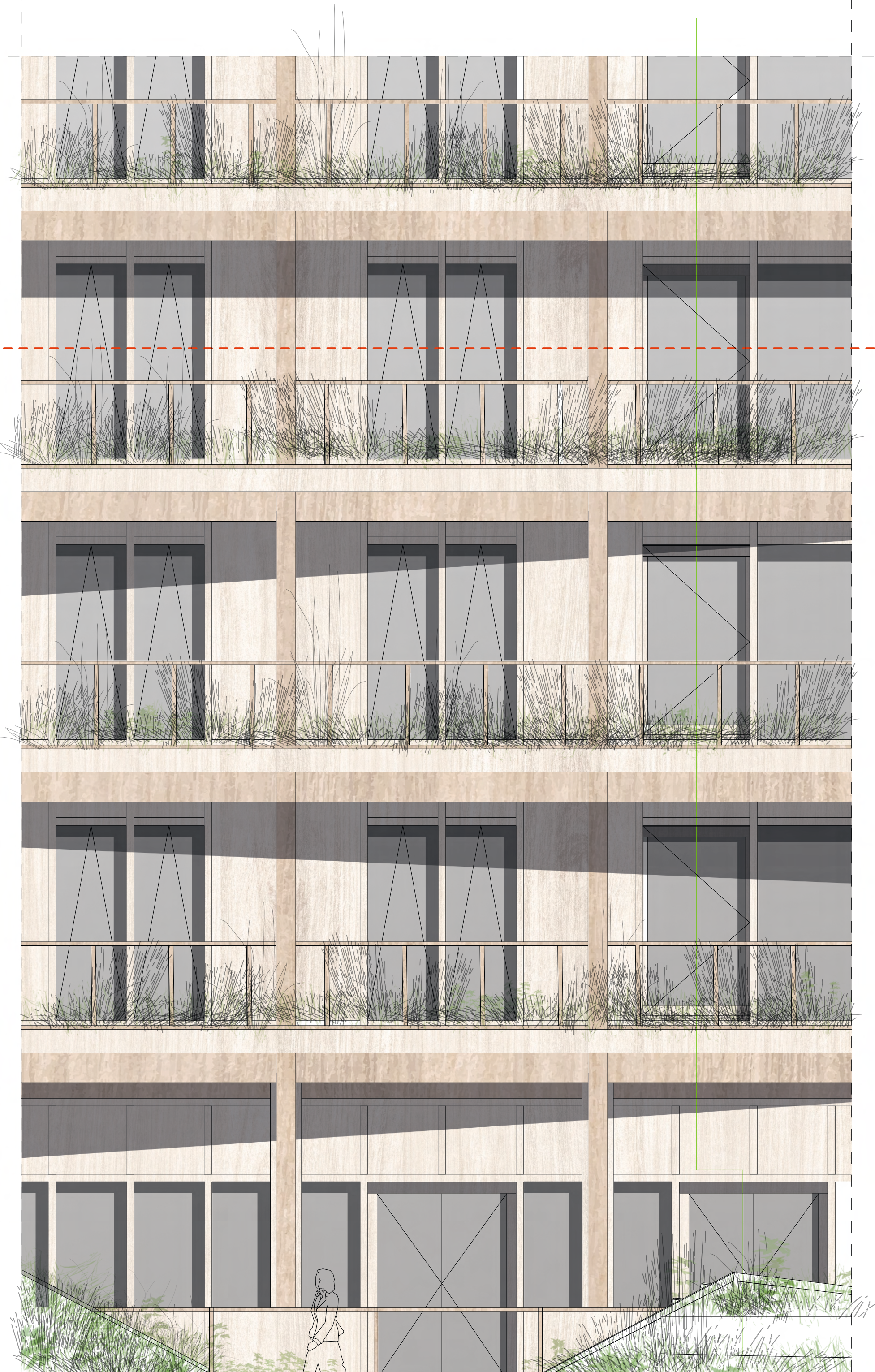


Detail B

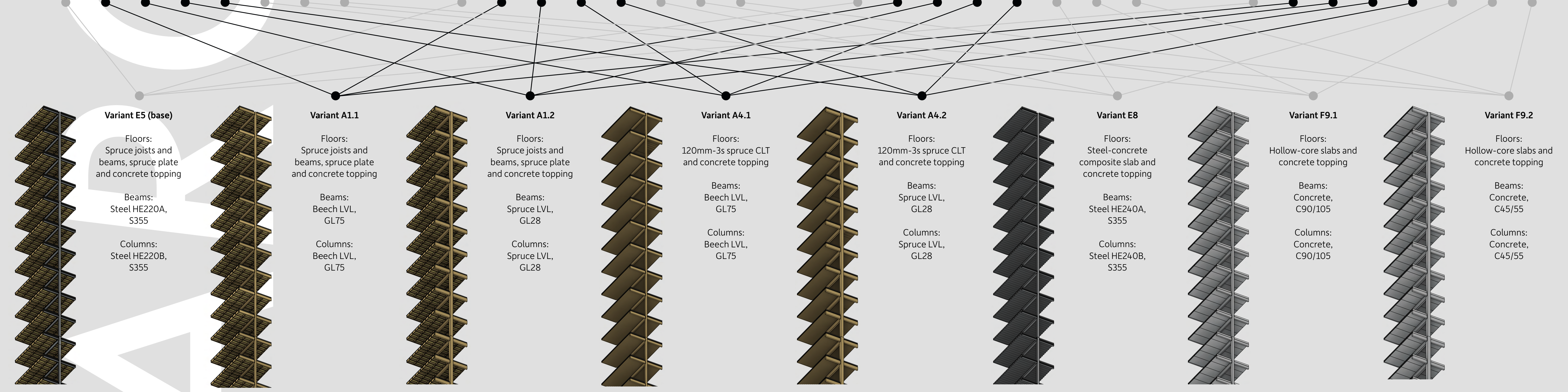
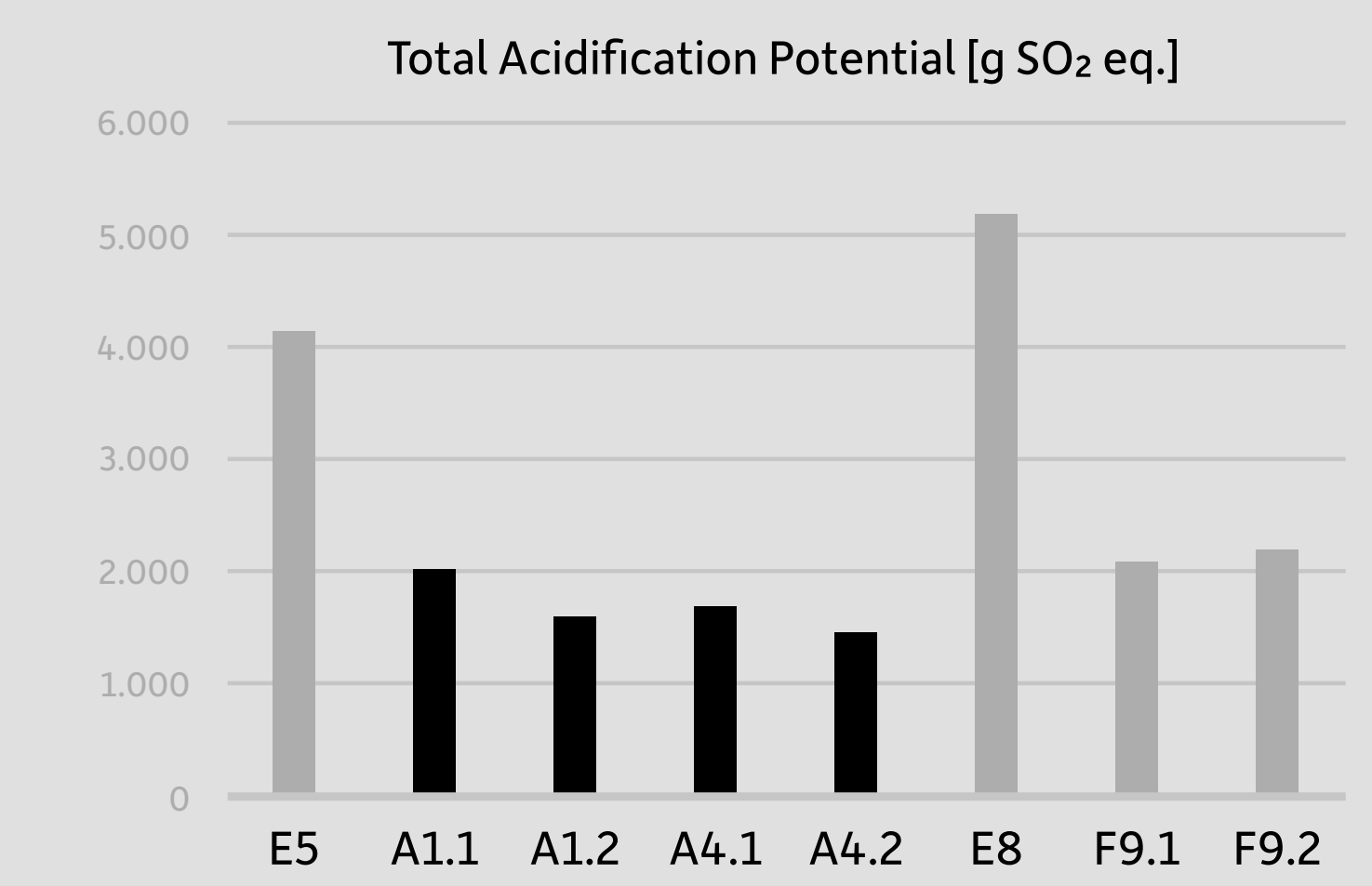
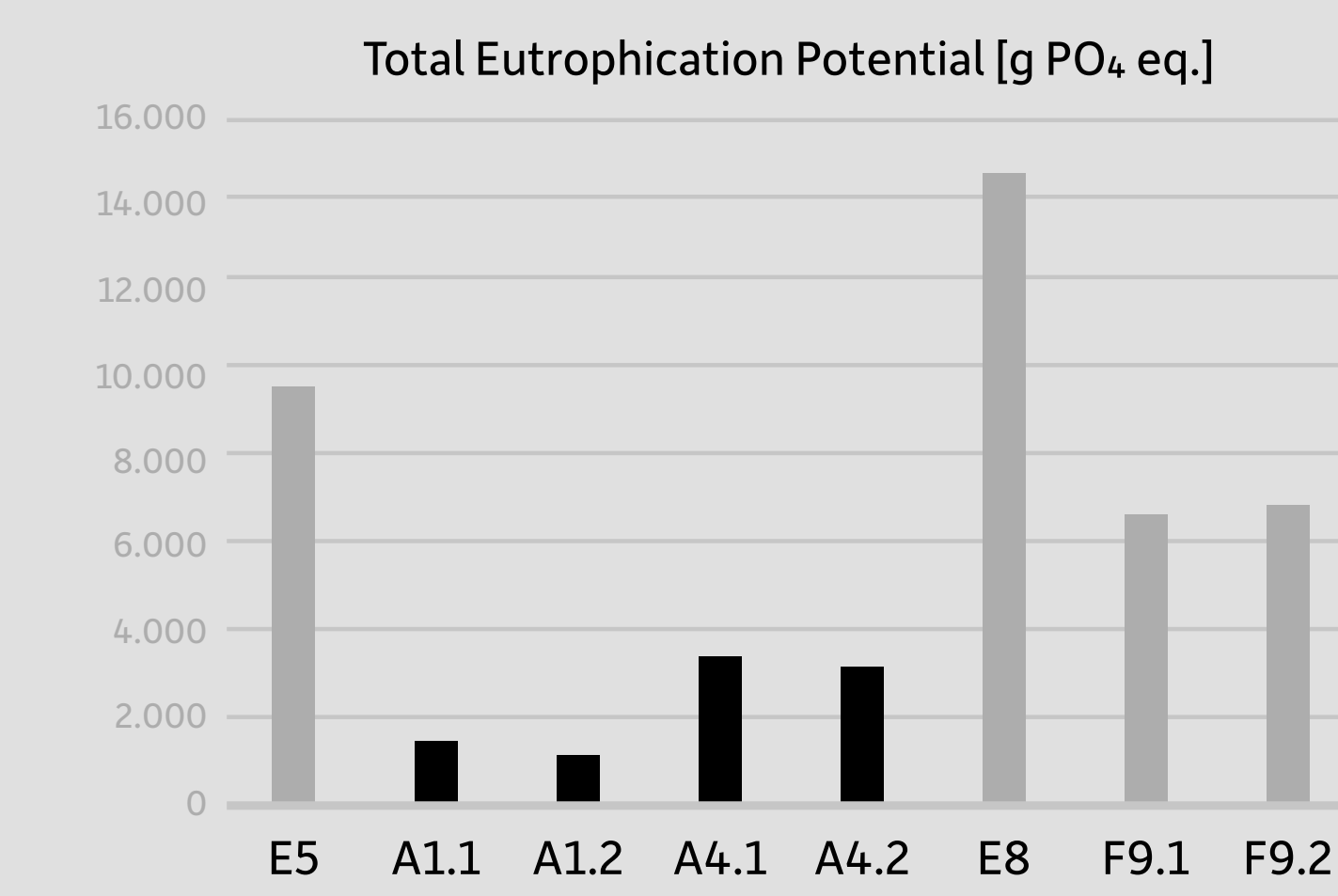
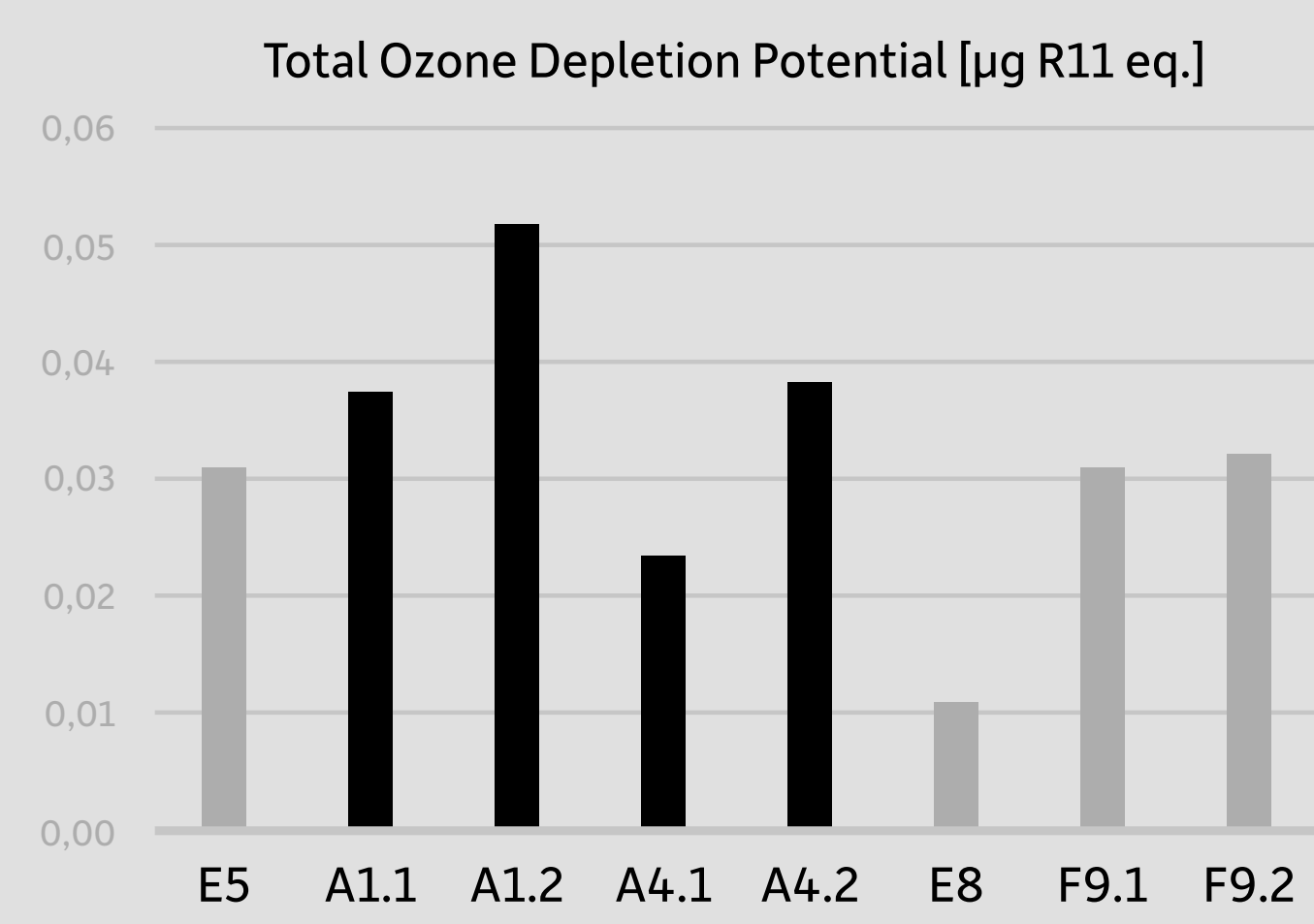
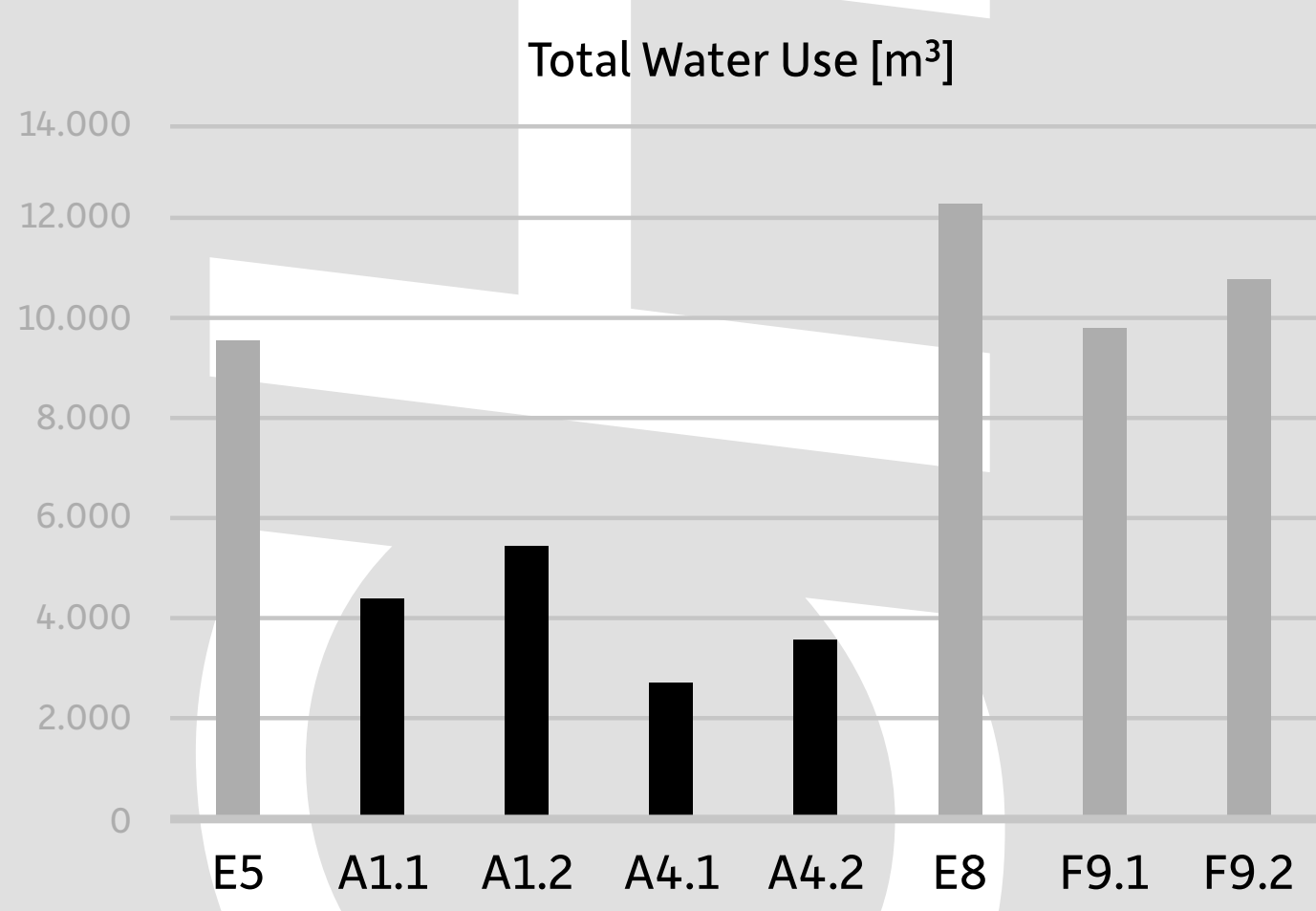
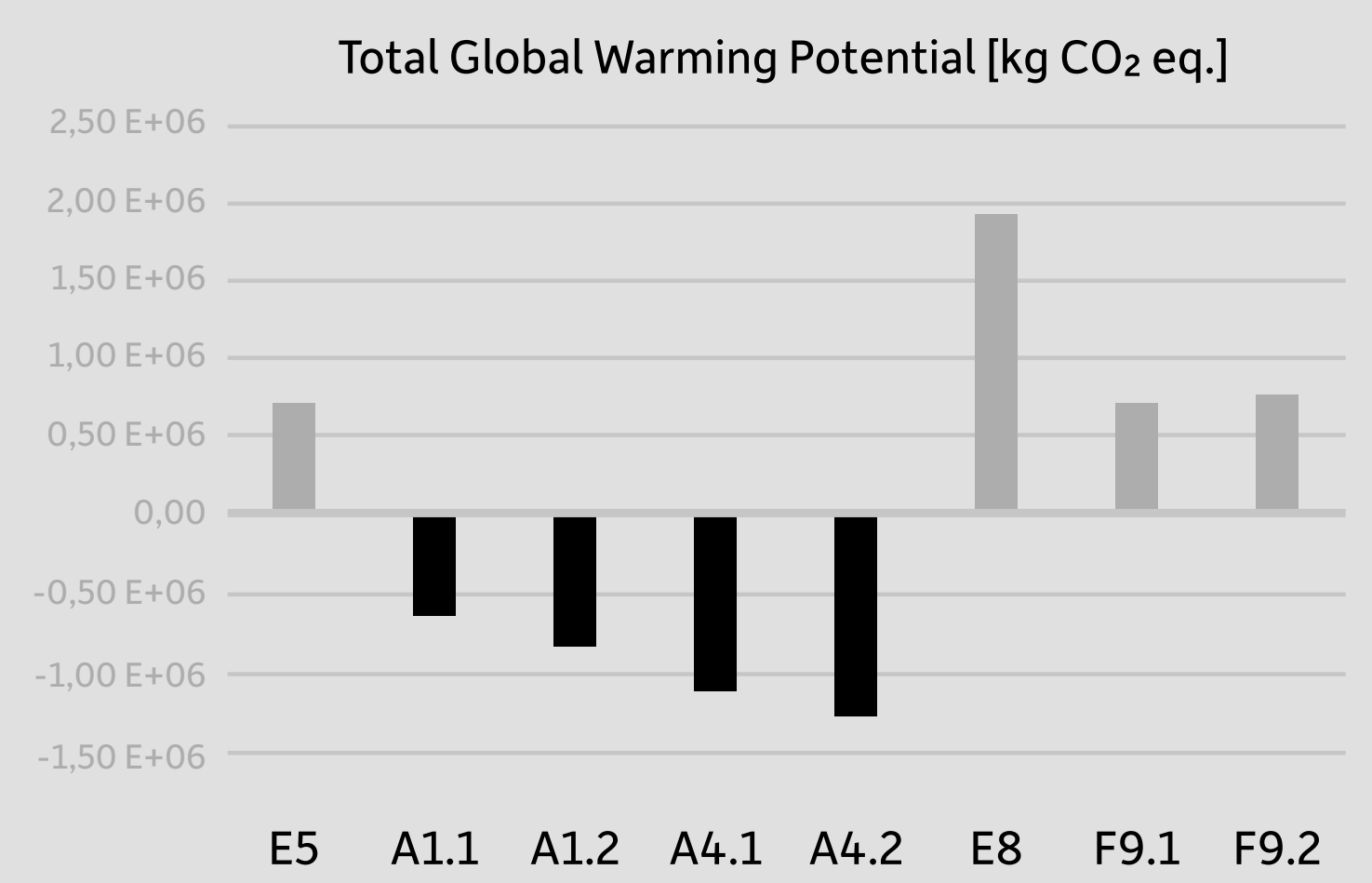
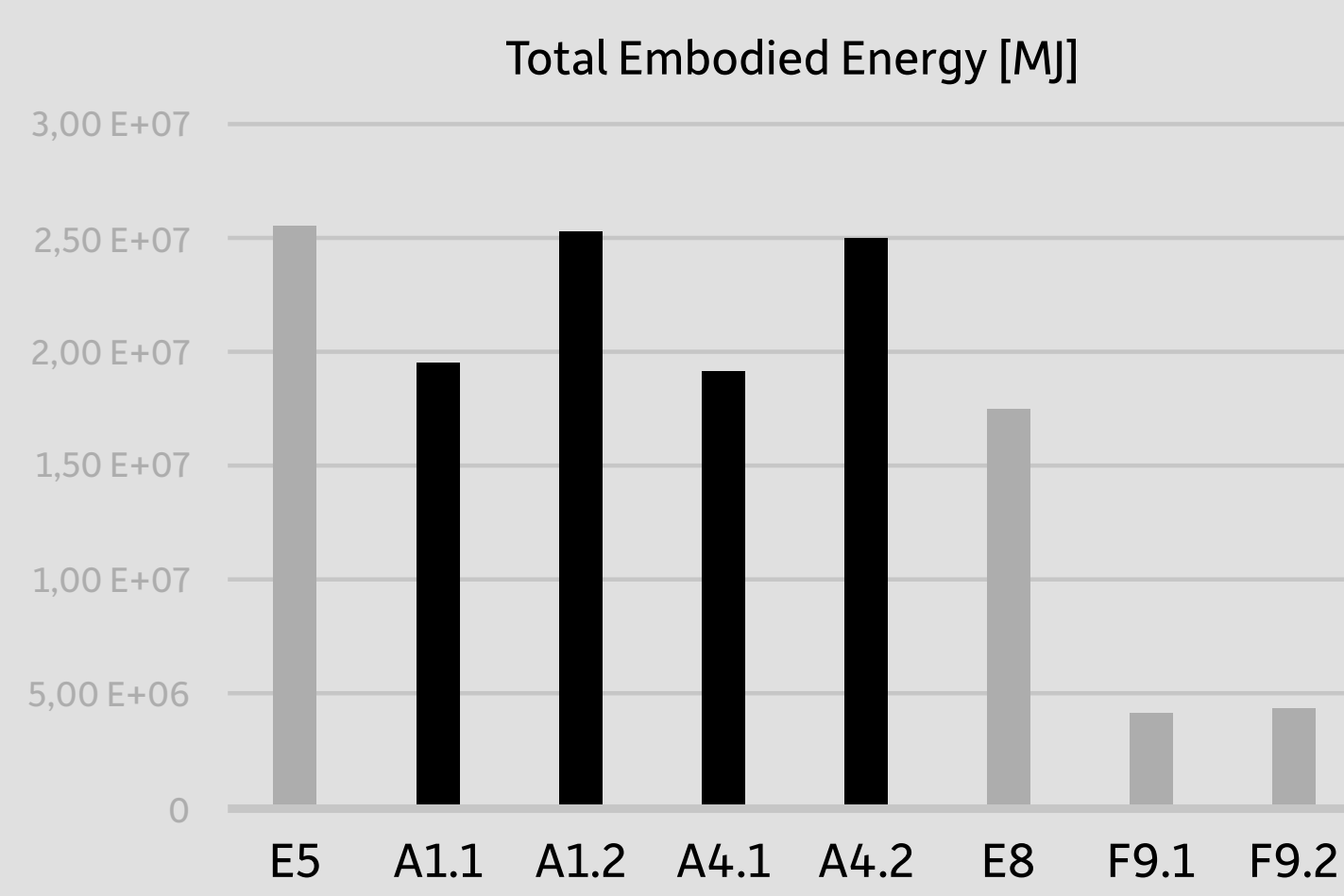
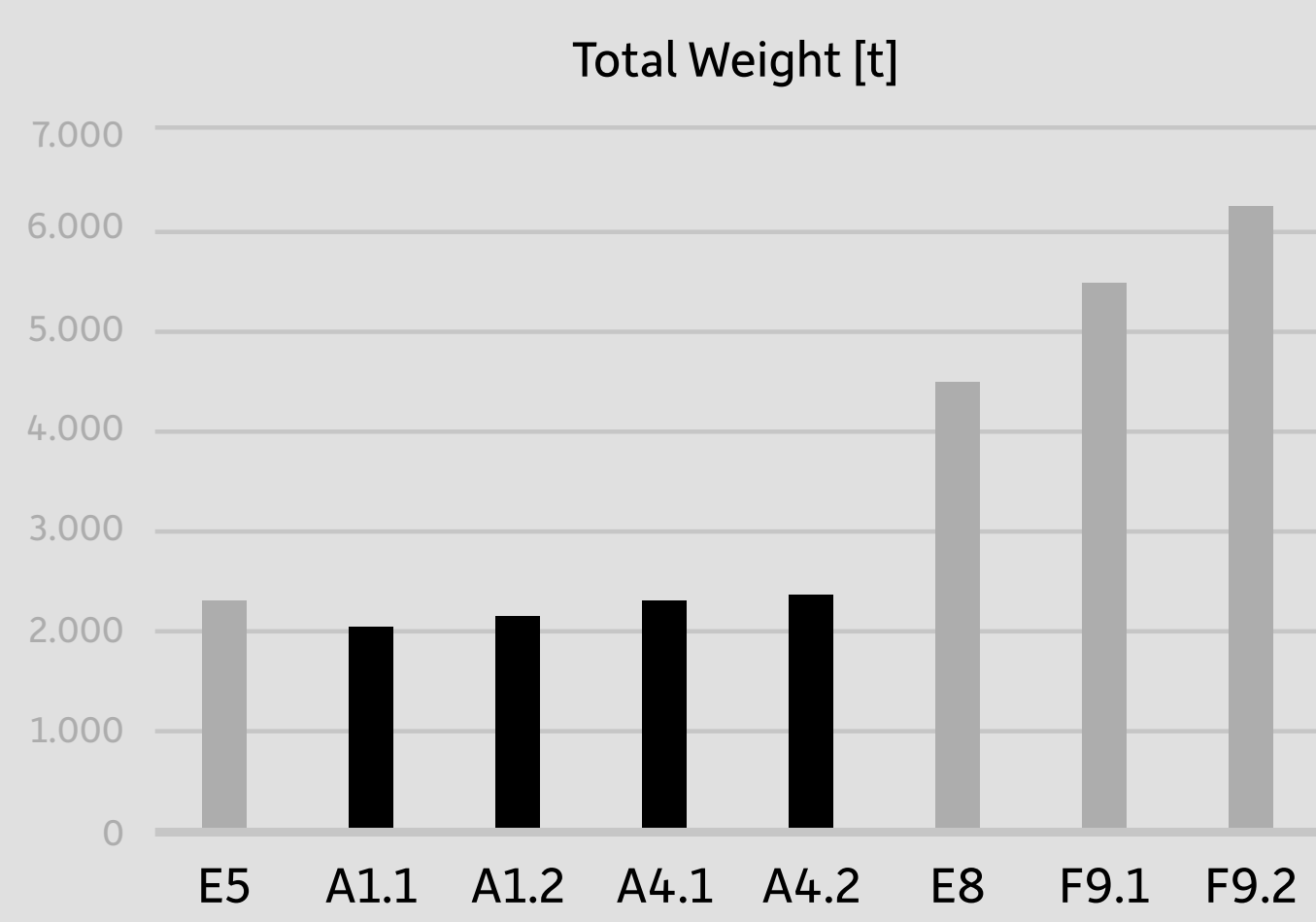
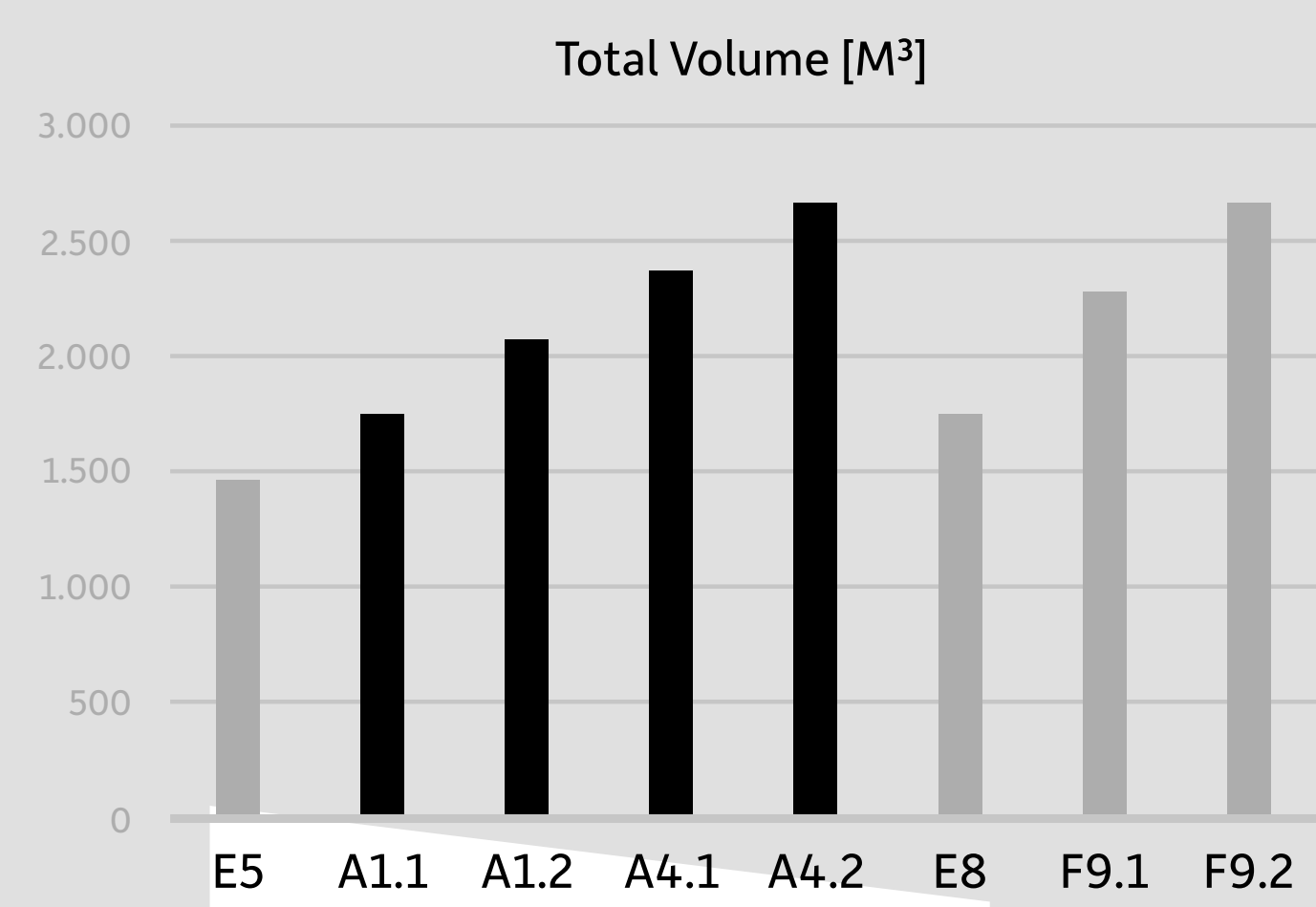
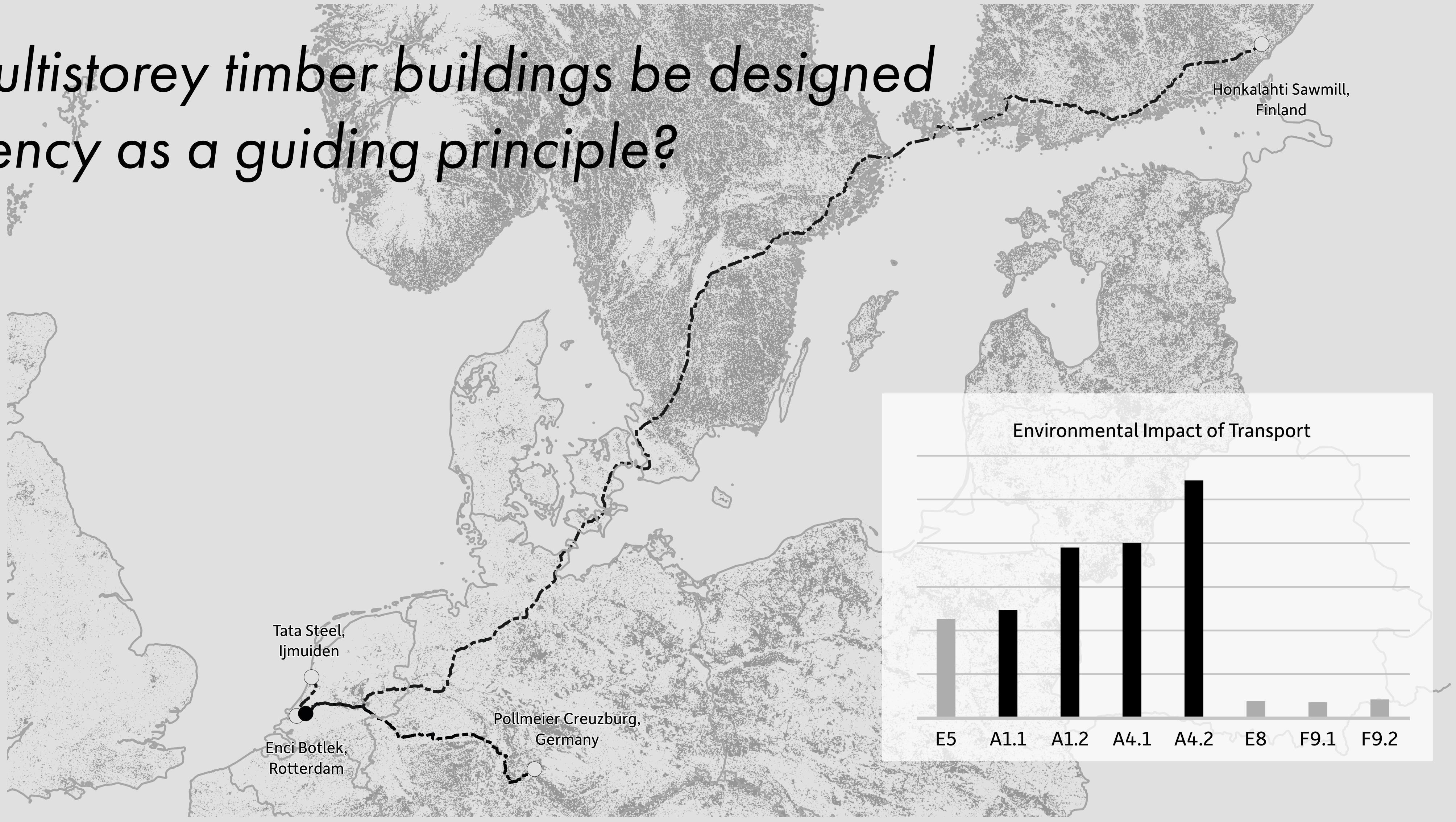
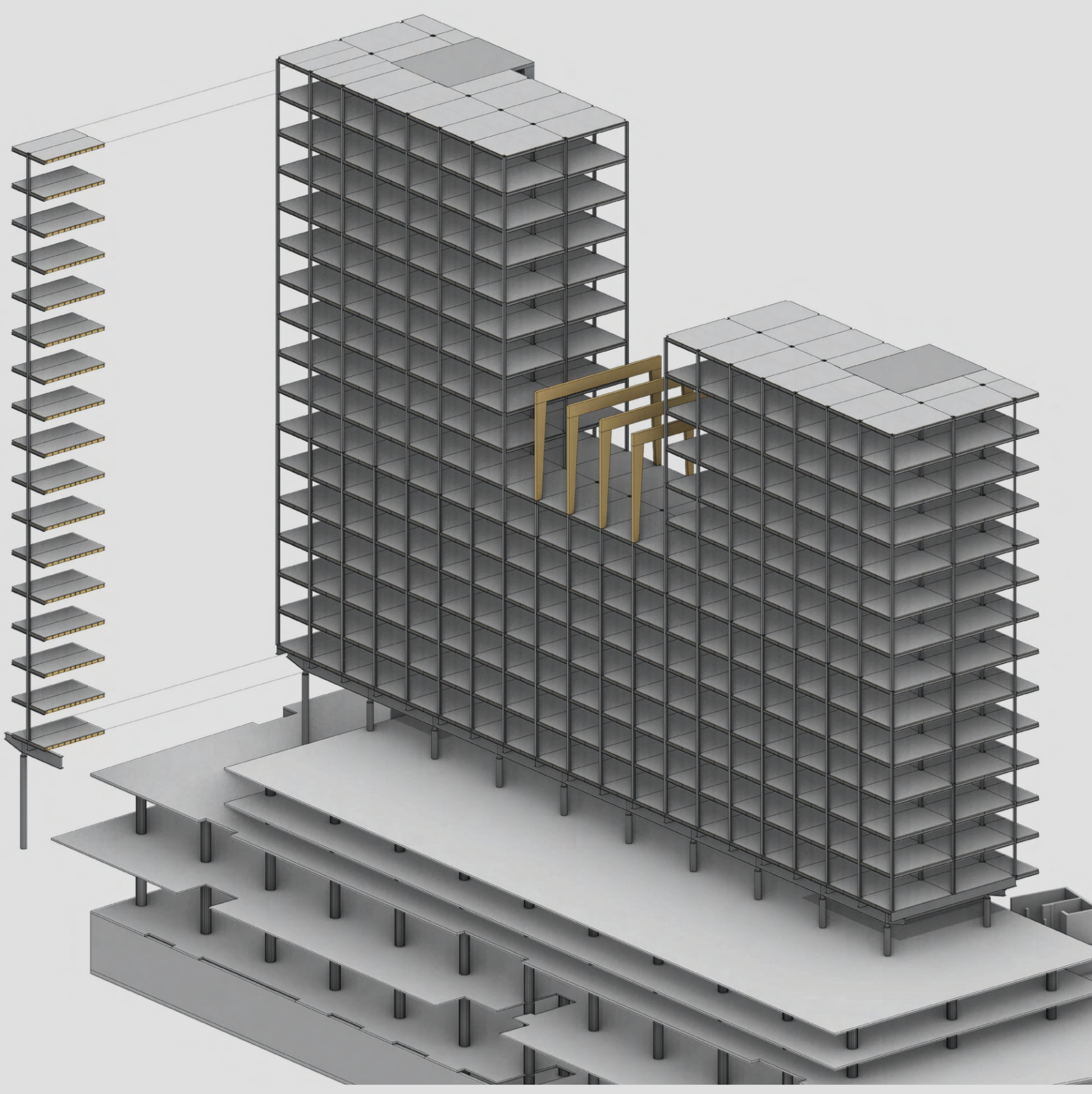





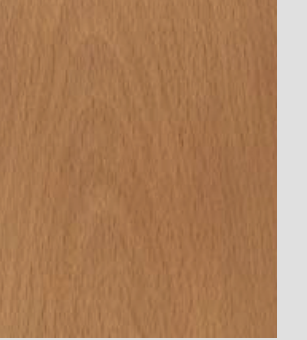





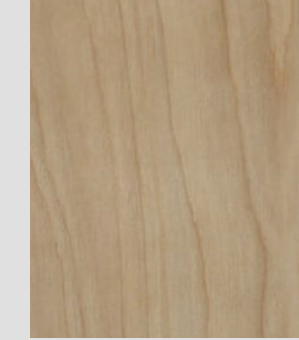
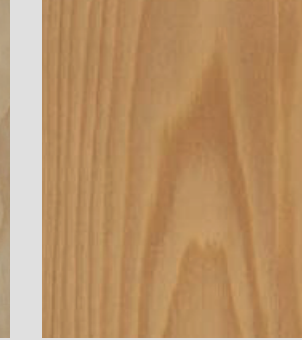





Detail C

250 1544



How can the structure of multistorey timber buildings be designed when taking material efficiency as a guiding principle?



Common name, botanical name, DIN 4076 abbreviation				Common name, botanical name, DIN 4076 abbreviation				Common name, botanical name, DIN 4076 abbreviation				Common name, botanical name, DIN 4076 abbreviation					
Douglas fir, <i>Pseudotsuga menziesii</i> , DCA	Maple, <i>Acer pseudoplatanus</i> /platan, AH	Spruce, <i>Picea abies</i> , P	European beech, <i>Fagus sylvatica</i> , BU	Scots pine, <i>Pinus sylvestris</i> , S	Oak, <i>Quercus robur</i> , Q. <i>petraea</i> , E	European larch, <i>Larix decidua</i> , LA	Robinia, <i>Robinia pseudoacacia</i> , ROB	Pine, <i>Pinus peukeria</i> , P. rigida, + 4	Beech, <i>Fagus pendula</i> L., B	Fir, <i>Abies alba</i> , BA	Chestnut, <i>Castanea sativa</i> Mill., C	Western hemlock, <i>Tsuga heterophylla</i> , HEM	Ash, <i>Fraxinus excelsior</i> , FEX	Western red cedar, <i>Thuja plicata</i> D. RCW	Poplar, <i>Populus nigra</i> L., PO		
																	
Colour of wood, sapwood/heartwood																	
Yellowish white; reddish brown, darkening				Light yellow, tendency to yellow, later reddish		Early wood yellowish white, late wood reddish yellow		Light yellowish white; reddish white, turning to brown		Light yellowish white; reddish white, turning to brown		Grey/grey yellow, darkening to light to dark brown		Yellowish/reddish brown, darkening, late wood very dark brown		Light yellow to greenish yellow/greenish yellow to olive yellow	
Average density [kg/m³]																	
480, 530, 540				530, 630, 960		350, 400, 500		540, 720, 910		500, 520, 540		430, 690, 960		470, 600, 650		720, 760, 800	
Theoretical differential shrinkage in % per 1% moisture change, radial/tangential																	
0.15, 0.19/0.24, 0.31				0.10, 0.20/0.22, 0.30		0.15, 0.19/0.27, 0.36		0.19, 0.22/0.38, 0.44		0.15, 0.19/0.25, 0.36		0.18, 0.22/0.28, 0.35		0.14, 0.18/0.28, 0.36		0.13, 0.15/0.24, 0.29	
Dimensional and form stability																	
Good				moderate to good		good		low		low		moderate		good		very good	
Resistance to fungal attack																	
moderate				very low		low		very low		low to moderate		high		moderate to low		very high	
Resistance to insect attack																	
moderate				very low		low		low		low		high		moderate to high		very high (hermite-resistant)	
1) Availability of Sawn lumber / finger jointed and bending strength [N/mm²]																	
yes/yes				no/no		yes/yes		yes/no		yes/yes		yes/no		yes/yes		yes/yes	
2) Availability of Glued laminated timber and bending strength [N/mm²]																	
yes				no		yes		yes, 28.0-48.0		yes		yes, 31.5/59.0		yes		no*	
3) Availability of Cross laminated timber and bending strength [N/mm²]																	
yes				no		yes		no		rarely		no		yes		no*	
4) Availability of Laminated veneer lumber and bending strength [N/mm²]																	
yes				no		yes		yes, 75.0		yes		yes		no		no*	
5) Availability of Structural plywood/OSB																	
yes/yes				no/no		yes/yes		yes/yes, 80.0		yes/yes		no/no		no/no*		yes/yes, 18.0-14.8	
Burnrate 1(-5) [mm/min]																	
0.65/0.65/0.65/0.65/0.65**				-/-/-/-/-		0.65/0.65/0.65/0.65/0.65*		0.50/0.65/-/0.65/1.0		0.65/0.65/0.65/0.65/0.65*		0.50/0.50/-/-		0.65/0.65/0.65/0.65/0.65*		0.50/-/-/-	
Thermal conductivity 1(-5) [W/mK]																	
0.12/0.13/0.13/0.13/0.13				0.09/0.13/0.13/0.13/0.13		0.13/0.17/-/0.17/0.13		0.12/0.13/0.13/0.13/0.13		0.13/0.17/-/-		0.11/0.13/0.13/-		0.13/0.17/-/-		0.13/0.17/-/-	
Water vapour diffusion resistance 1(-2/3 - 4) [μ]																	
50, 20/30, 20/30, 20				50, 20/30, 20/30, 20		50, 20/220, 90/300, 200		50, 20/220, 90/300, 200		200, 50/-/-		50, 20/50, 20/-		200, 50/-/-		200, 50/-/-	
Highest durability class																	
DC3/moderately durable				DC4/slightly durable		DC4/slightly durable		DC3/moderately durable		DC1/very durable		DC3/moderately durable		DC1/very durable		DC3/moderately durable	

