

Uppsala Concert and Congress Hall (UKK)

Bachelor project presentation

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A comprehensive Analysis
the UKK through building
stability and environmental
resilience.



Address: Street Vaksalagatan 1, Uppsala, Sweden.
Year of construction: 2005
Height: 37 meters.
Area: 14.600 m²

Agenda

01
Project
Introduction

02
Architecture and
stabilizing system

03
Project purpose

04 Applied loads
Wind, snow, dead,
live, seismic loads.

05
Designed elements
Timber/Concrete

06
Sustainability report

07
Conclusion

Project introduction/background description



- A modern architectural masterpiece seamlessly interacting with the historical charm of the city of Uppsala.

- Very successful multipurpose venue.

- An impressive number of 2000 cultural events hosted.

Project introduction/background description



- Construction stands tall at 37 meters of 8 structural floors of sleek design.

- Building consists of open café and atrium, banquet and exhibition area, offices, conference rooms, rehearsal spaces, grand foyer, a secondary concert hall and the main concert hall.

- Main concert hall accommodates up to 1.250 persons.

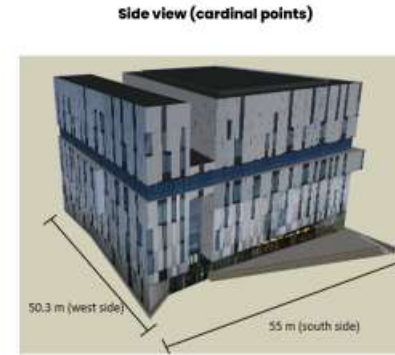
Architecture and stabilizing system

Architecture and
stabilizing system



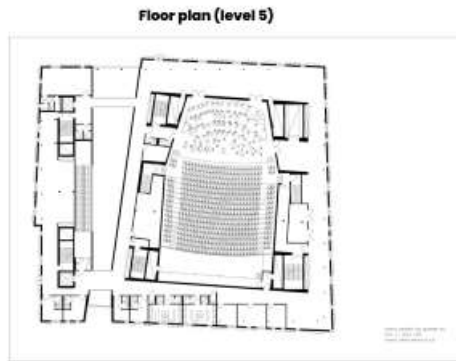
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Architecture and
stabilizing system



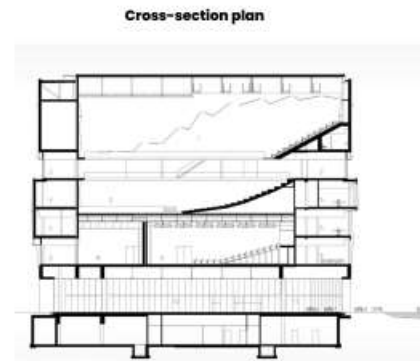
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Architecture and
stabilizing system



9

Architecture and
stabilizing system



10

Architecture and
stabilizing system



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Architecture and
stabilizing system



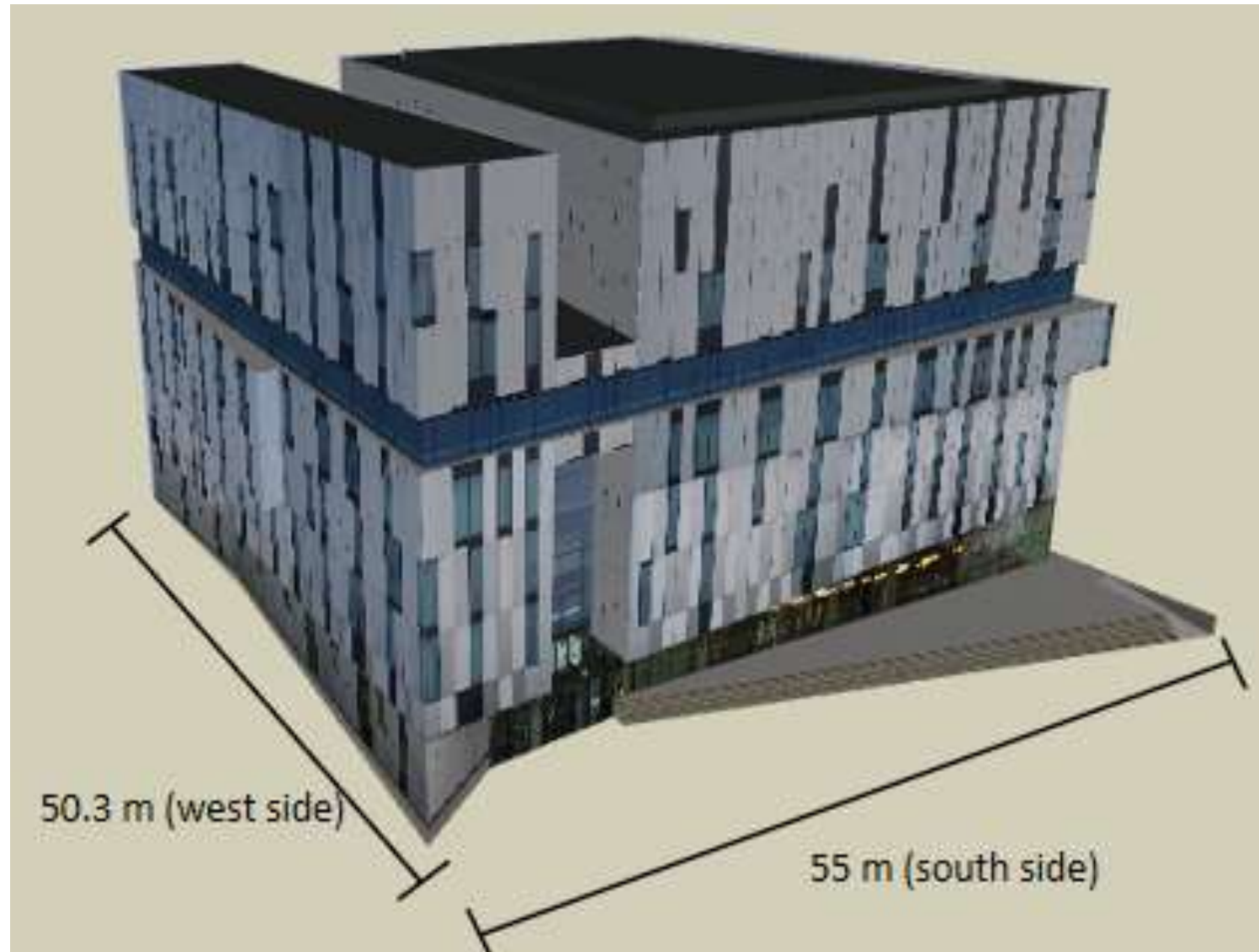
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Architecture and stabilizing system

Top view

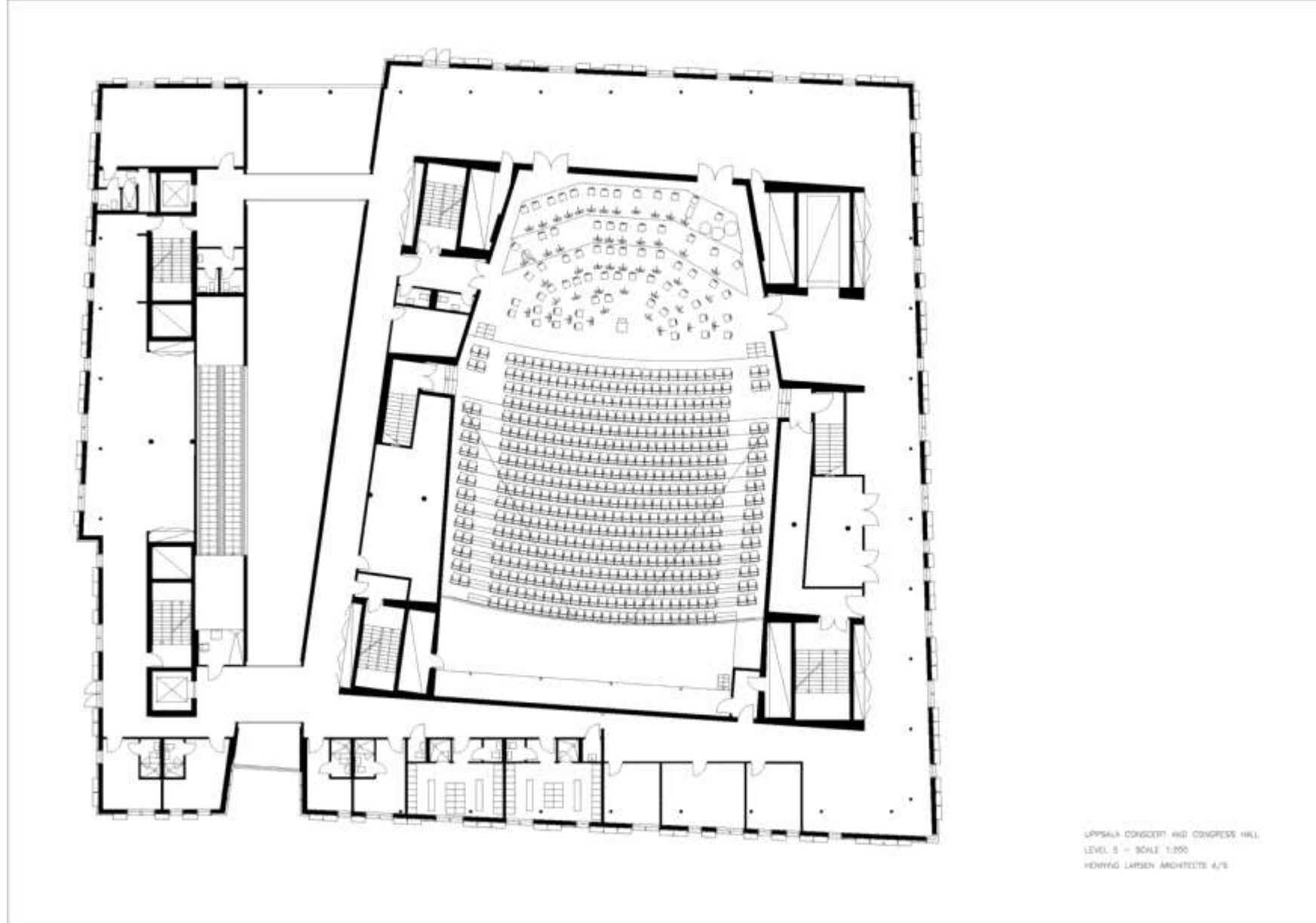


Side view (cardinal points)

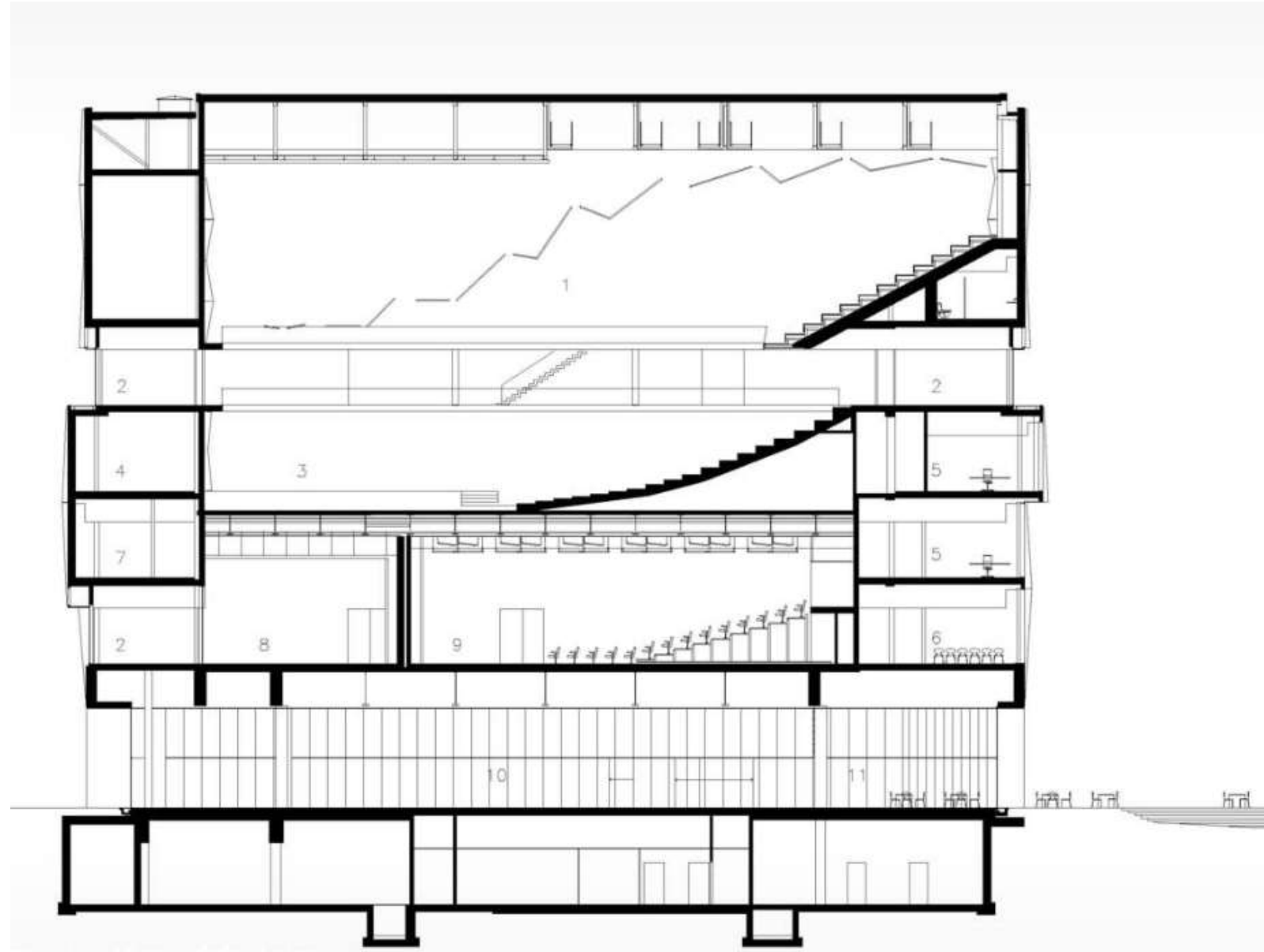


Architecture and stabilizing system

Floor plan (level 5)



Cross-section plan



Architecture and stabilizing system

Foyer opening view (level 3)

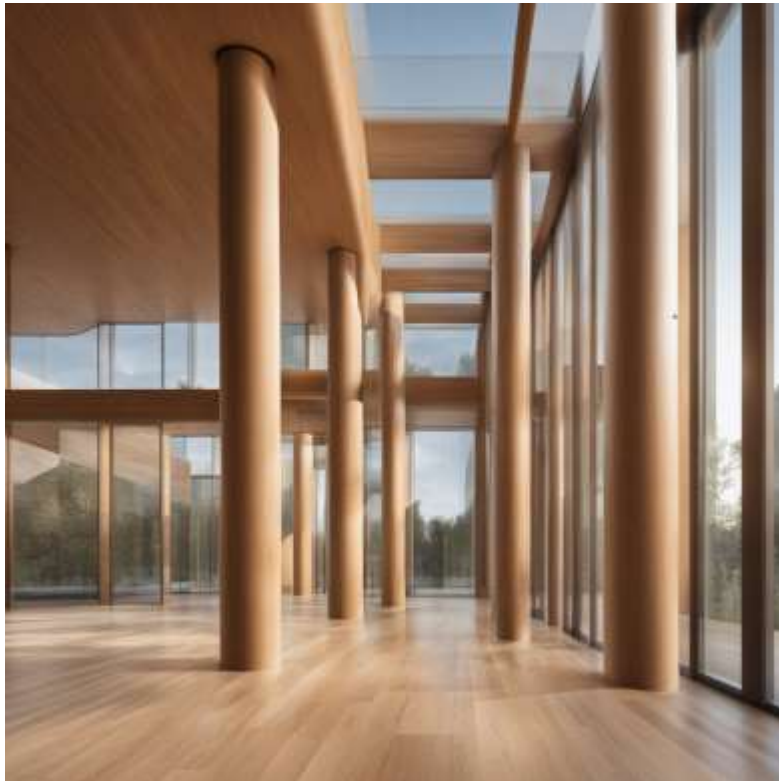


Architecture and stabilizing system

Open café view (ground-floor)



Project purpose

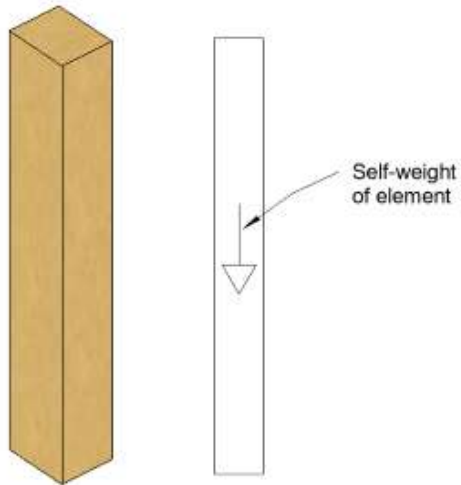


- Development of a structural analysis design of the superstructure.
- Buildout of an environmental and sustainable framework for both the construction and ongoing operation of the building.
- Replacement of steel/concrete elements to timber elements.

Applied loads

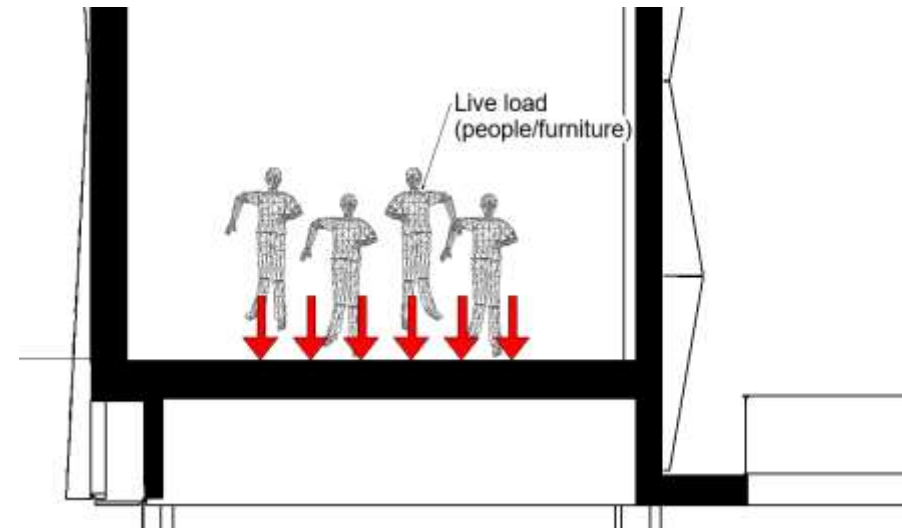
Dead load (self-weight of elements)

- Material used
- Density of material
- Geometry of elements



Live load (imposed load)

- Room use and area



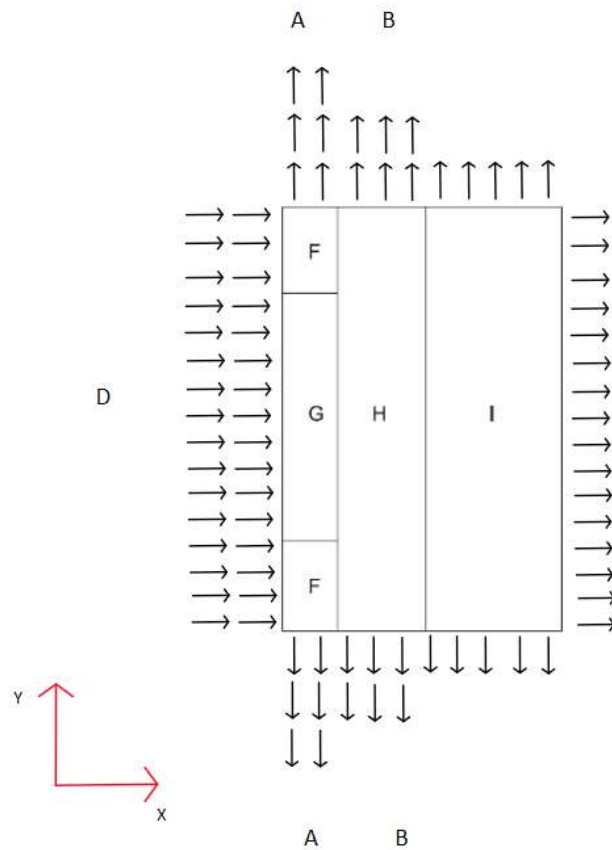
Sumation of total load per floor (level 5)

10804,43571

kN

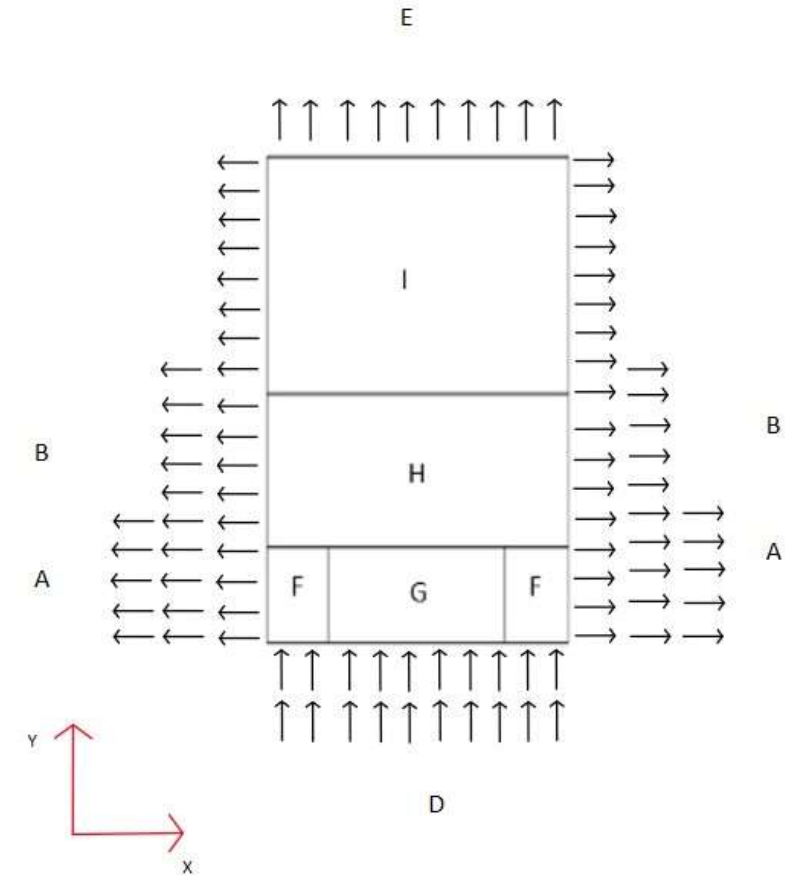
Applied loads

Wind load on façade/gable and roof



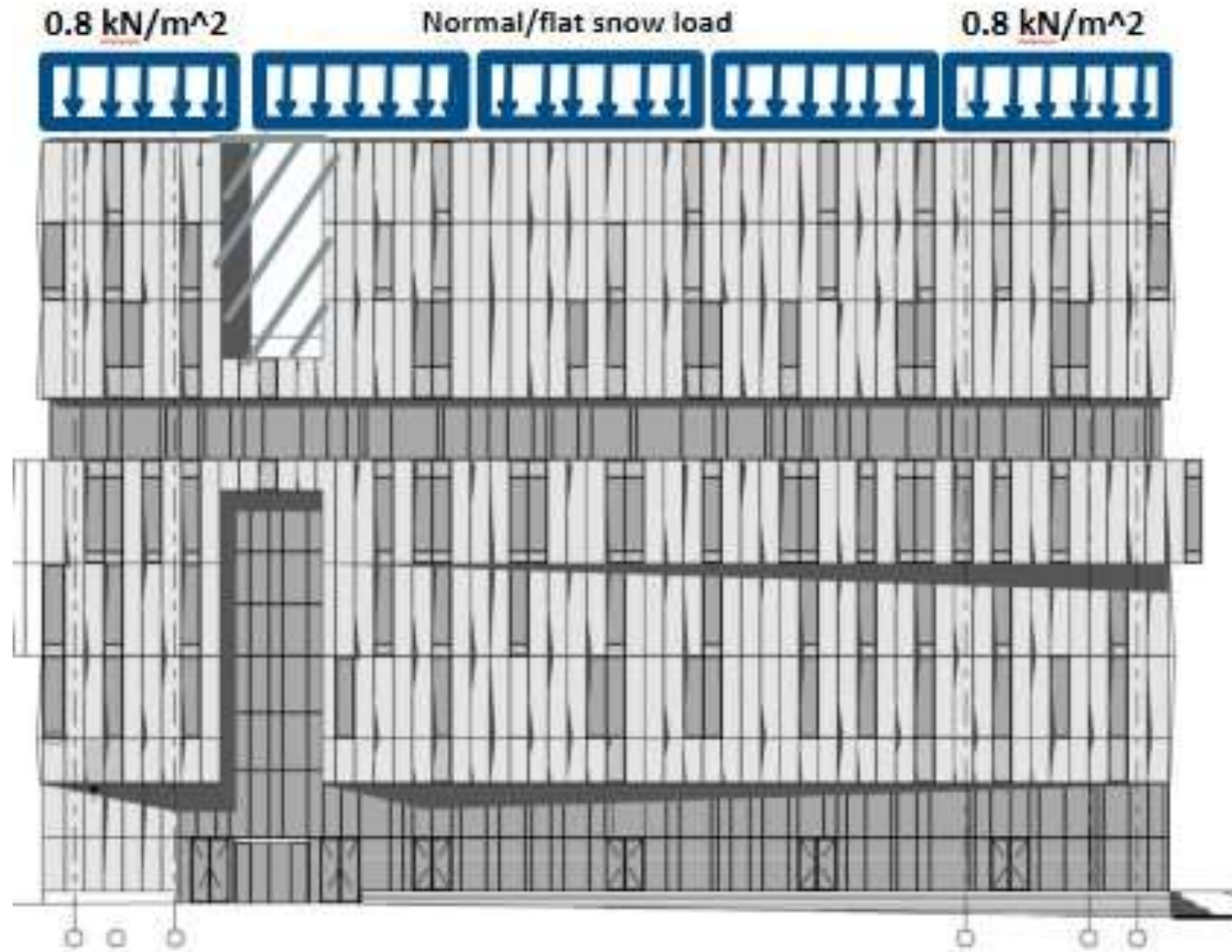
E

roof		Façade	
zone	Wind pressure(kN/m ²)	Zone	Wind pressure(kN/m ²)
F	-1,4256	A	-0,9504
G	-0,9504	B	0,6336
H	-0,5544	C	-0,396
I (1)	0,1584	D	0,612216
I (2)	-0,1584	E	-0,35244
		Gable	
		Zone	Wind pressure(kN/m ²)
		A	-0,9504
		B	0,6336
		C	-0,396
		D	0,612216
		E	-0,337392



Applied loads

Snow load



Applied loads

Seismic load (accidental load)



floor	seismic load value (kN)
level 5	598.985

Load comparison (wind-seismic)

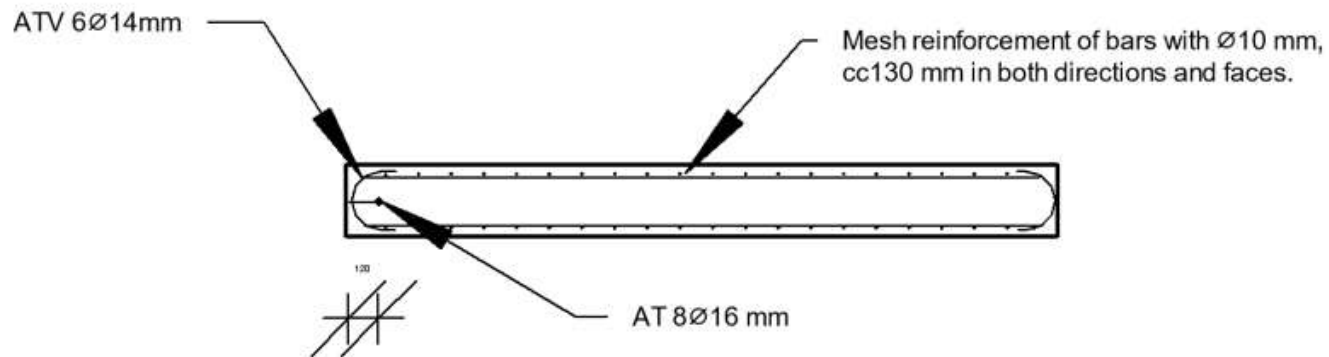
Floor	Dominant load
Roof	SEISMIC
level 7	WIND
level 6	SEISMIC
level 5	SEISMIC
level 4	SEISMIC
level 3	SEISMIC
level 2	SEISMIC

Designed elements

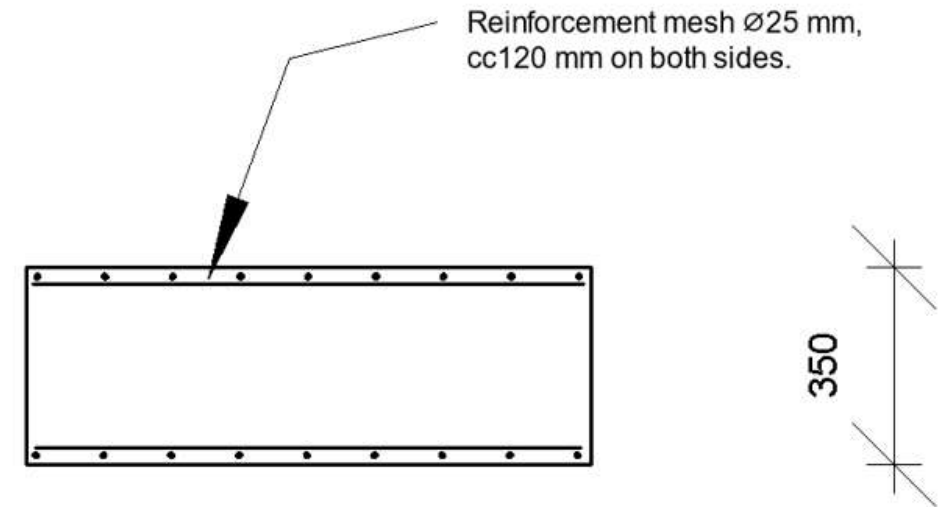
Designed elements <i>Table 5 Designed elements.</i>			
Element	ID of element	Location	Designed for (limit states)
1. Shear wall	W212	Level 2	ULS.
2. Bearing wall	W330	Level 3	ULS.
3. Diaphragm	D05	Level 5	ULS.
4. Concrete Slab	S05	Level 5	ULS, SLS.
5. Concrete beam	B224	Level 2	ULS, SLS.
6. Concrete column	C223	Level 2	ULS, ALS.
7. Timber beam	B312	Level 3	ULS, ALS, SLS.
8. Timber column	C310	Level 3	ULS.
9. Timber connection	B312-C311	Level 3	-

Designed elements

Concrete shear wall (design against failure of material)

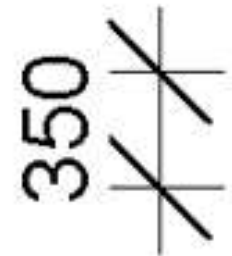
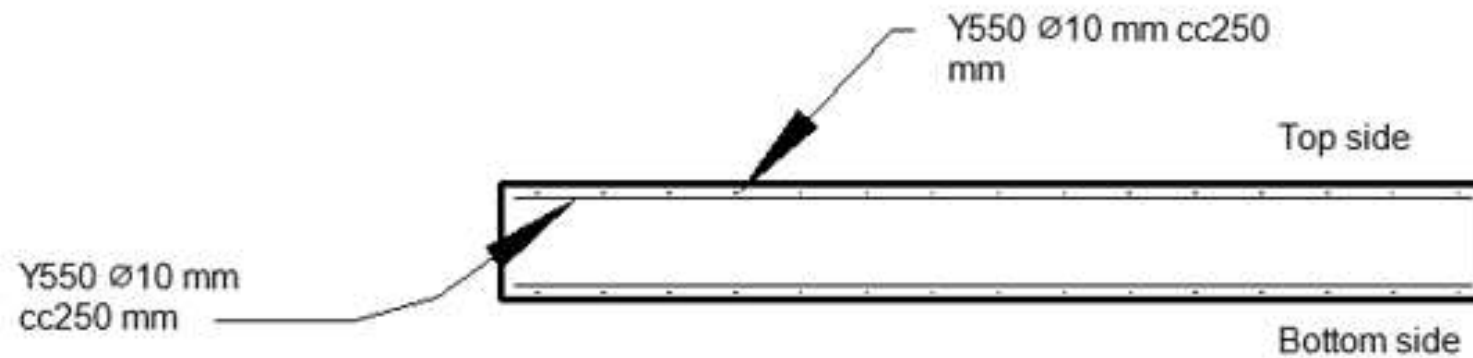


Concrete bearing wall (design against failure of material)



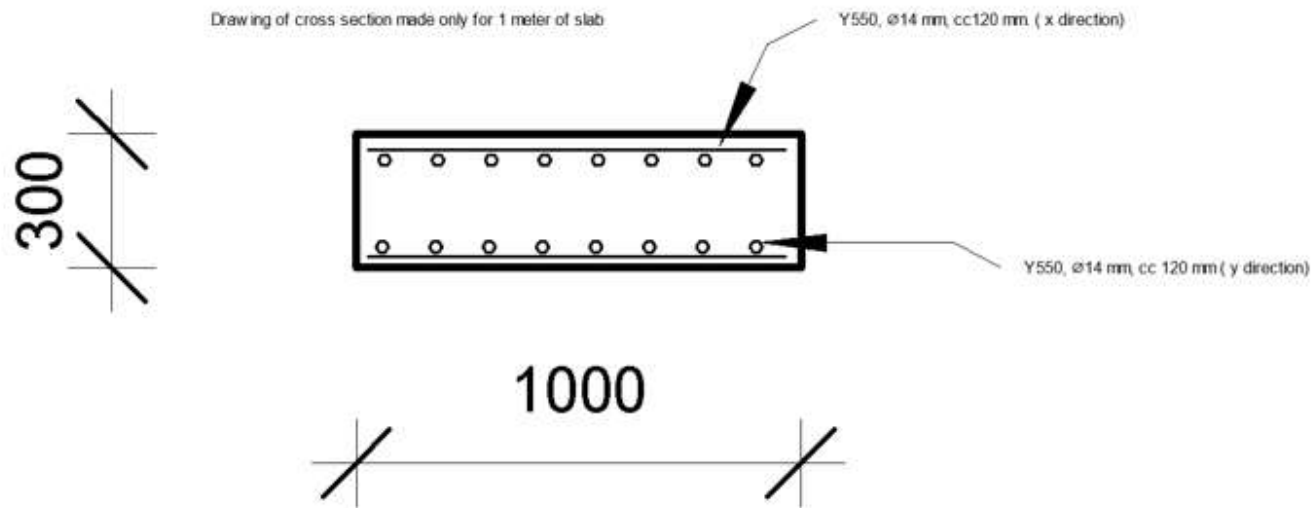
Designed elements

Concrete diaphragm



Designed elements

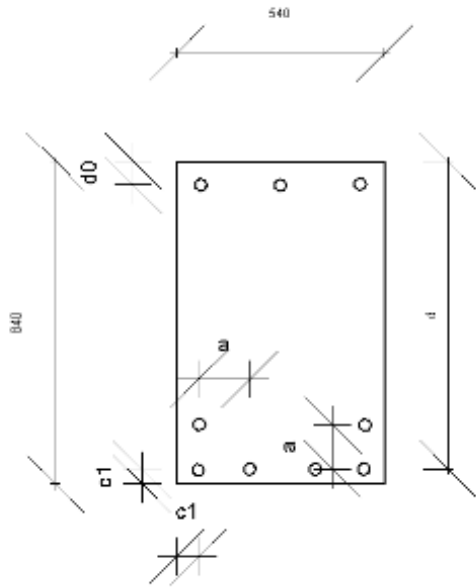
Concrete slab (design against failure of material and check of maximum deflection for both directions)



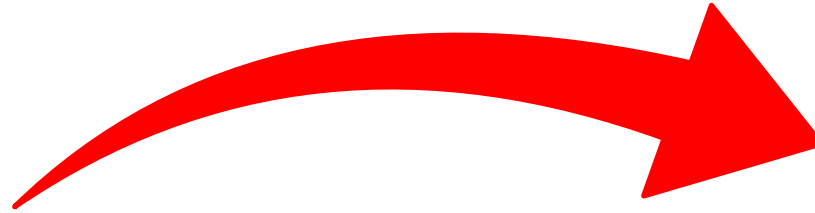
$u_{x\text{direction}} = 22.73 \text{ mm}$	deflection found for the slab in x direction
$u_{max} = 55 \text{ mm}$	maximum allowed deflection for x direction
$u_{x\text{direction}} = 55.73 \text{ mm}$	deflection found for the slab in y direction
$u_{max} = 98 \text{ mm}$	maximum allowed deflection for direction

Designed elements

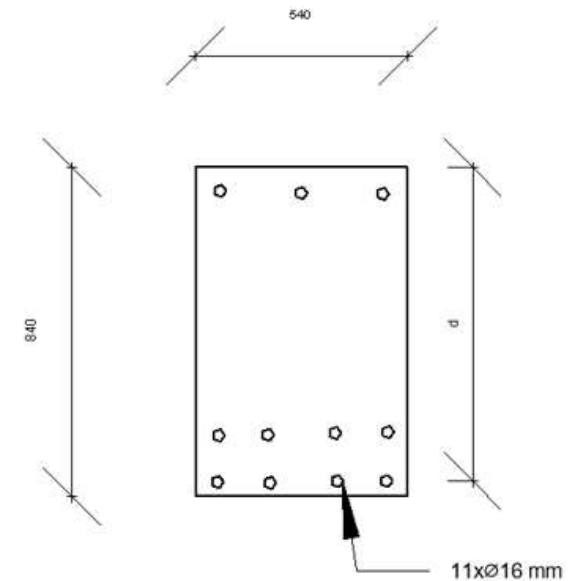
Concrete column (design for failure of material)



+2 reinforcement bars

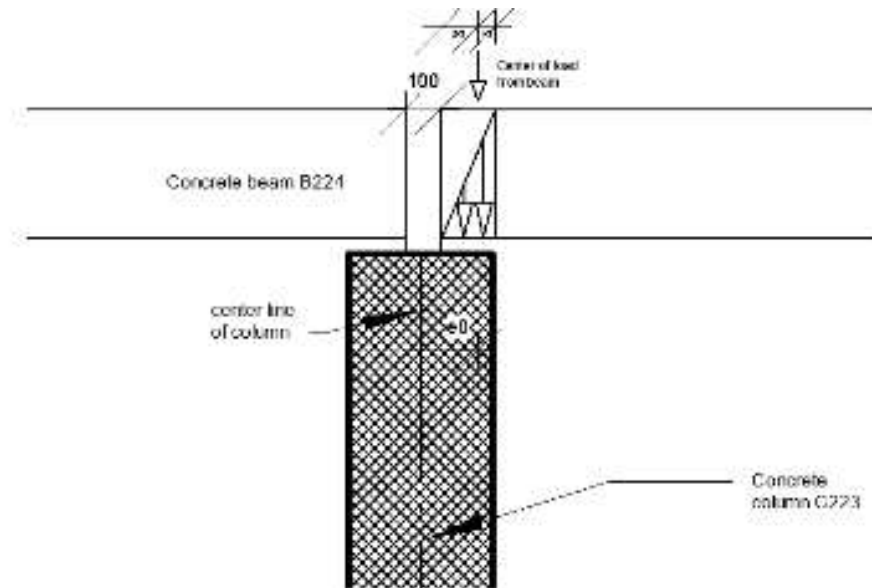
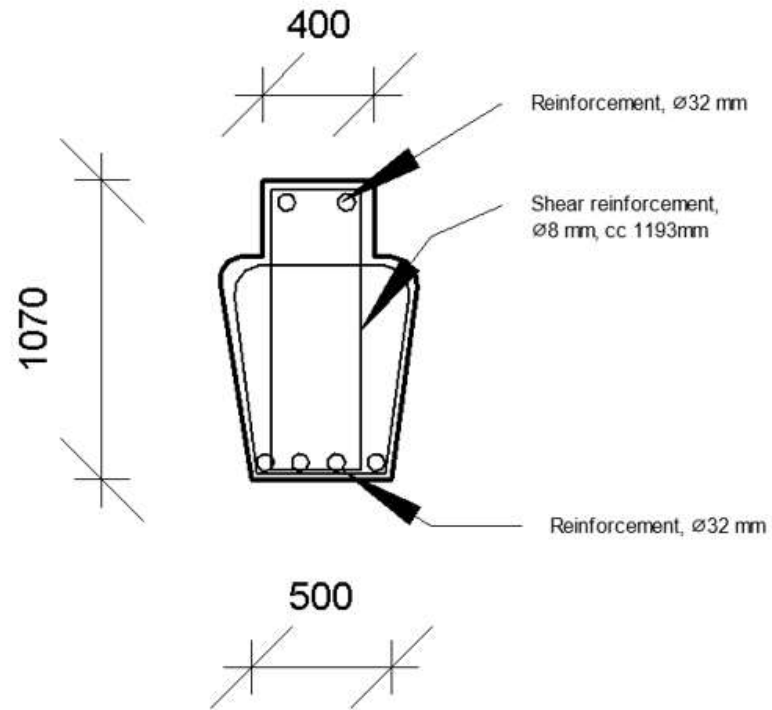


Concrete column (design against fire exposure)



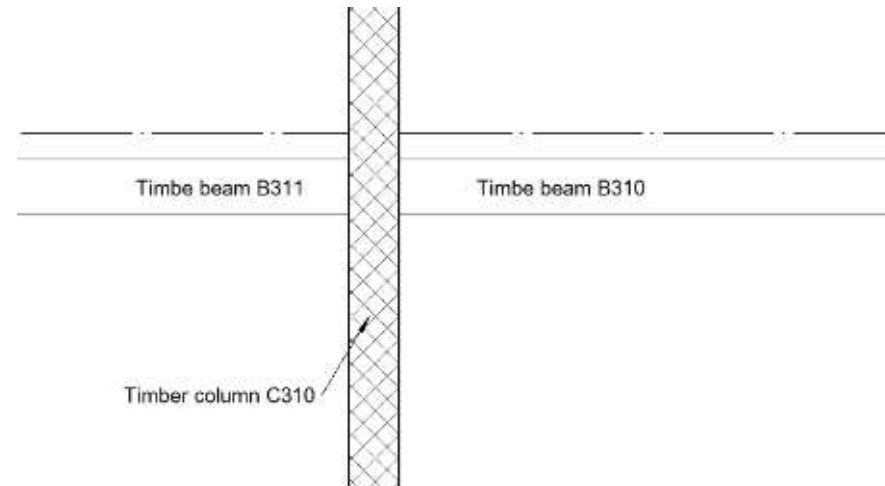
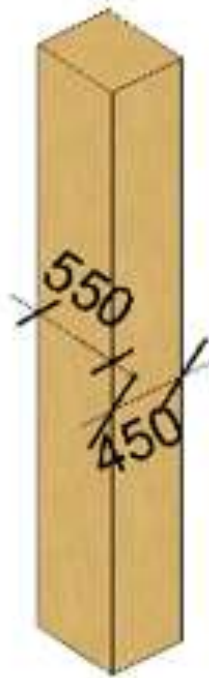
Designed elements

Concrete beam (design of cross section against failure of material)



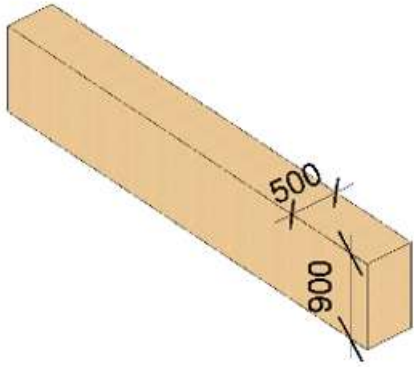
Designed elements

Timber column (design of cross section
against failure of material)



Designed elements

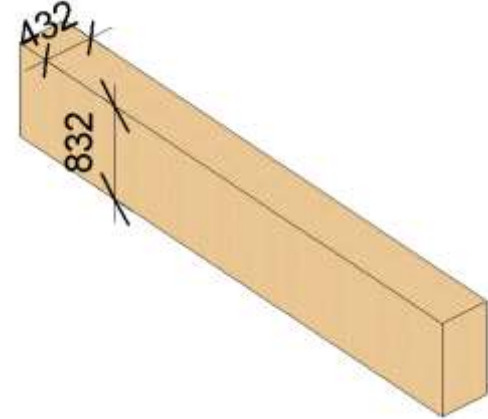
Timber beam (design against failure of material)



-68x68 mm of material cross-section

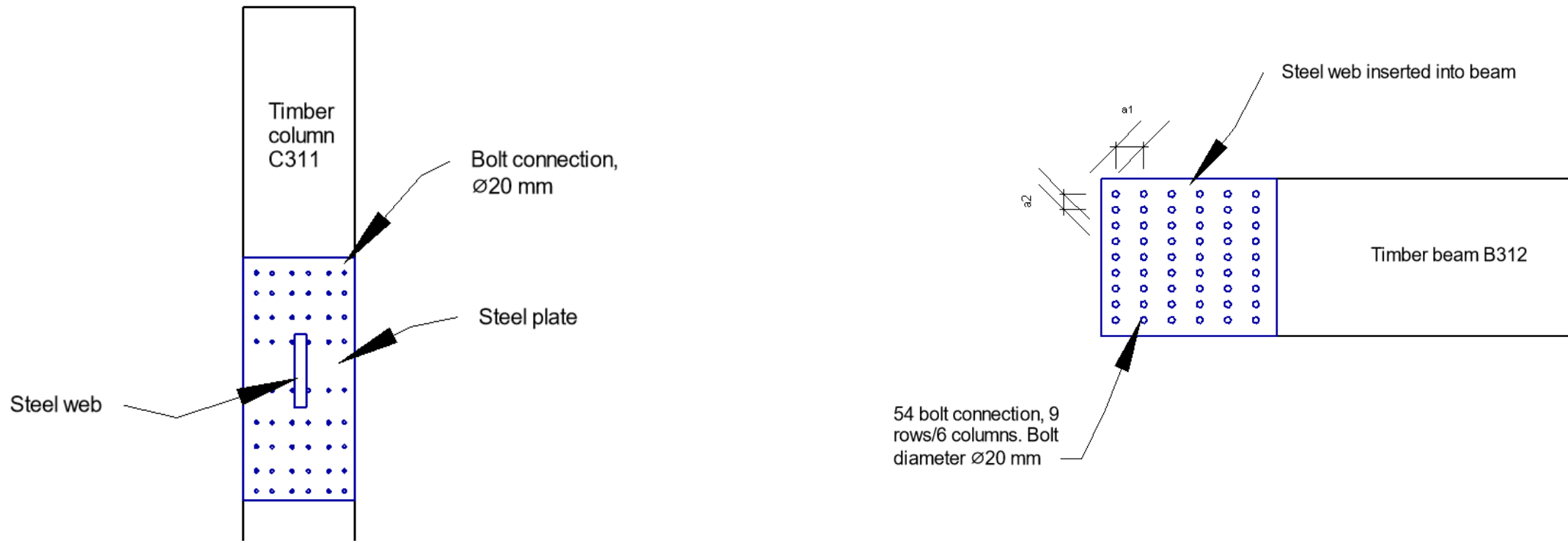


Timber beam (design against fire exposure)



Designed elements

Connection design between timber beam
and timber column



Sustainability report

CO₂ emissions from use of cellulose insulation

-161 tons CO₂

Cellulose insulation CO₂ emission.

-18.167€

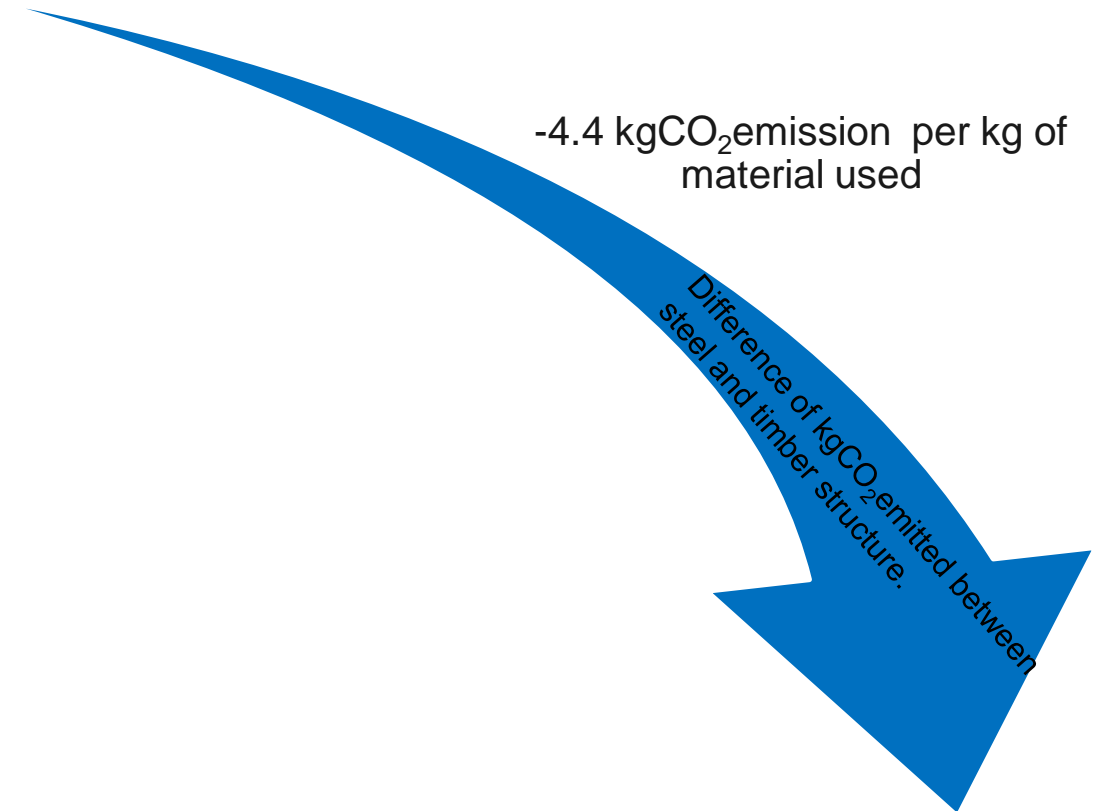
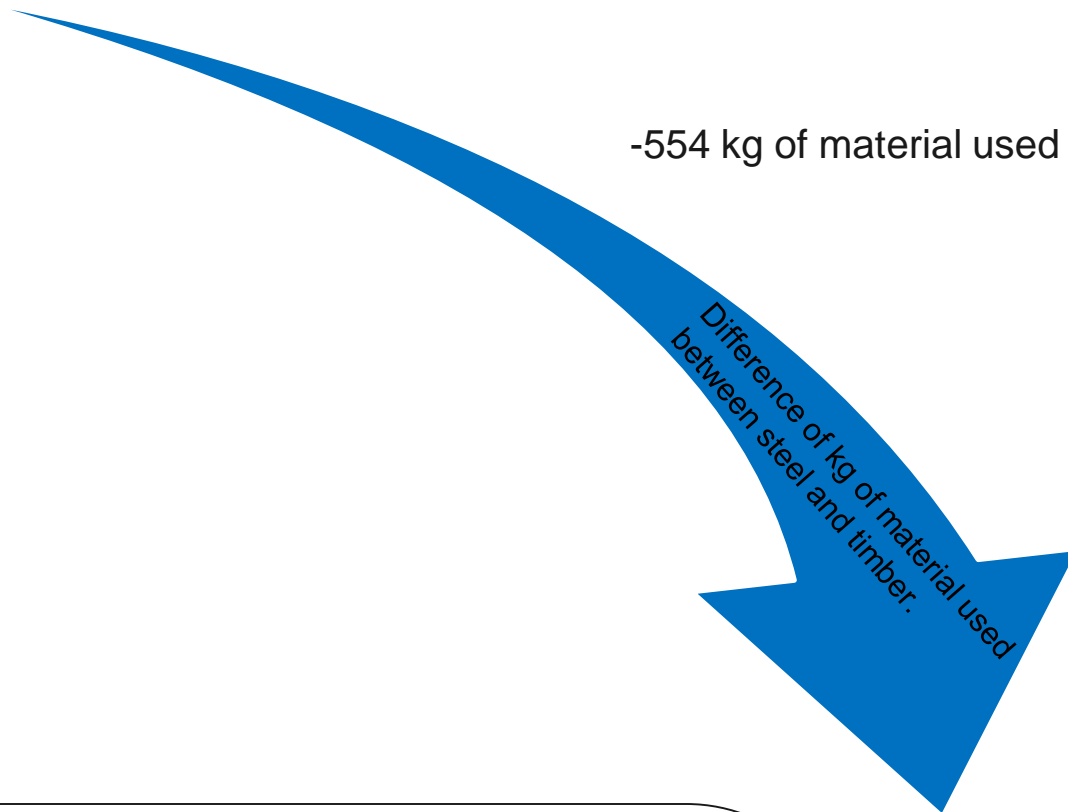
Climate change cost reduction.

-46.5 kgCO₂emmissions

CO₂ emission saved from transportation.

Sustainability report

CO2 emission resulted from the addition of timber structure.



Conclusion



Summarizing the agenda and the main purpose of the project:

A total of 161.45 tones of CO ₂ saved through environmental choices of construction and usage.	History and ethics between the modern architecture and the city of Uppsala are contended.	Statical system of the building is developed fulfilling the initial architectural outlined proposal.	Stability analysis and framework of the superstructure developed.	Overall, 8 structural elements studied and outlined.
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Thank you for your attention!

- Questions?