

Sara Culture Centre

- one of the world's tallest timber buildings

Sustainable High Rise Construction Conference
2024-01-30

OSKAR NORELIUS
Architect SAR/MSA, Partner

white



By 2030, all our architecture is carbon neutral through design excellence.





WHITE RESEARCH LAB

Focus on decarbonized construction

- Mass timber
- Circularity
- Social sustainability

SKELLEFTEÅ (SHE-LEFT-YOU)

SKELLEFTEÅ

STOCKHOLM

LONDON

Gulf Stream



TIMBER TRADITION



white

SARA CULTURE CENTRE



- **Best Tall Building Europe, CTBUH 2023**
- International Award for Wood Architecture 2022
- Best Culture Building, World Architecture Festival 2022
- International Urban Design Awards Special Prize 2021
- Holcim Foundation Awards Bronze Medal 2021
- Named “Best Architecture 2021” by The Guardian
- Nominated for EU Mies van de Rohe Awards 2024



Tall Timber Buildings - concept studies

The aim of the project is to show ways to design a 20+ multi-storey building with load-bearing system of timber and build knowledge of the issues among the participating actors; architects, engineers (structural and fire), building systems providers and property owners.

The purpose of the project is to show different possibilities for designing a 20+-storey building with load-bearing structure of timber and building knowledge of the issues among the participating actors. Important areas for the design of the building will be fire, LCA, design calculations related to both static and dynamic loads, eg vertical and horizontal deformations caused by static load and wind load. For some areas, especially deformation in the serviceability limit state, new calculation models will have to be developed and implemented in a form that is useful for practicing engineers.

Summary

PROJECT NAME

Tall Timber Buildings - concept studies

STATUS

Active

RISE ROLE IN PROJECT

Koordinator

PROJECT START

2015-11-01

DURATION

3 år

TOTAL BUDGET

12 375 000

PARTNER

[Linnéuniversitetet](#), [Moelven Töreboda](#), [Fristad bygg](#), [White arkitekter](#), [Berg CF Möller](#), [Bjerring](#), [BTB](#), [HSB](#), [Briab](#), [Brandskyddslaget](#)

FUNDERS

[Formas](#)

COORDINATORS

[Marie Johansson](#)

PROJECT MEMBERS

[Kirsi Jarnerö](#), [Ylva Sandin](#), [Daniel Brandon](#), [Alar Just](#)

Supports the UN sustainability goals



— Research study ran in parallel with development and construction of Sara



Damping for Tall Timber Buildings

Tall buildings are sensitive to wind loads that can cause large motions, especially on the upper floors. For timber buildings, which are light, this phenomenon is dimensioning for buildings over about 15 floors.

In the tallest timber buildings, this problem has been tackled by placing extra weight, in the form of concrete, on the top floors. However, this increases the environmental burden in the form of transportation and material consumption.

The study will use the 20-storey Sara Kulturhus building in Skellefteå as an example to investigate the effect of additional dampers.

Today Sara is used as a case study for research and policy development

Summary

PROJECT NAME

Damping for Tall Timber Buildings

STATUS

Completed

RISE ROLE IN PROJECT

Koordinator

PROJECT START

2022-11-02

DURATION

12 months

TOTAL BUDGET

1 MSEK

PARTNER

[Linnéuniversitetet](#), [Martinsons Byggsystem](#), [Tyréns](#), [Skellefteå kommun](#)

FUNDERS

[LIGHTer](#), [Vinnova](#), [Energimyndigheten](#), [Formas](#)

Supports the UN sustainability goals



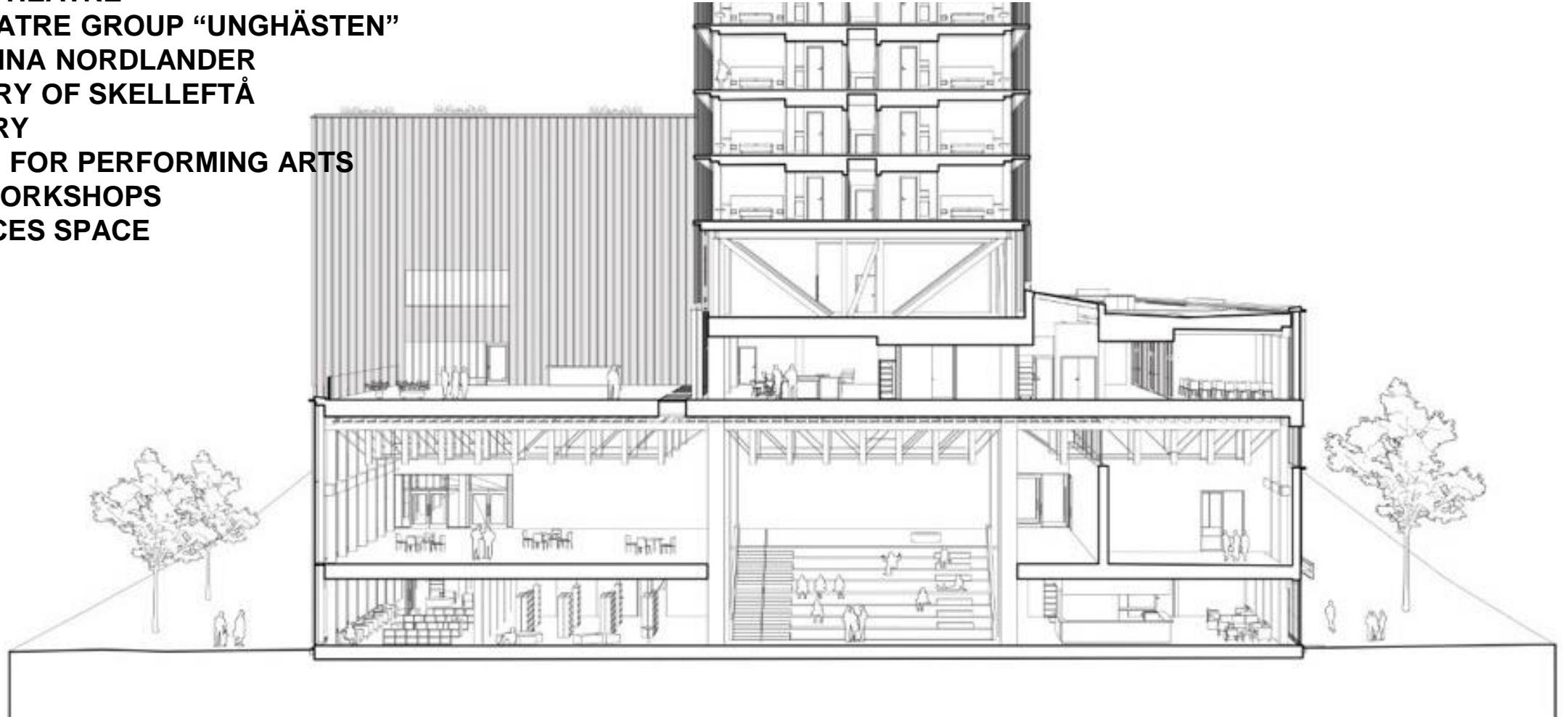
SIDE BY SIDE



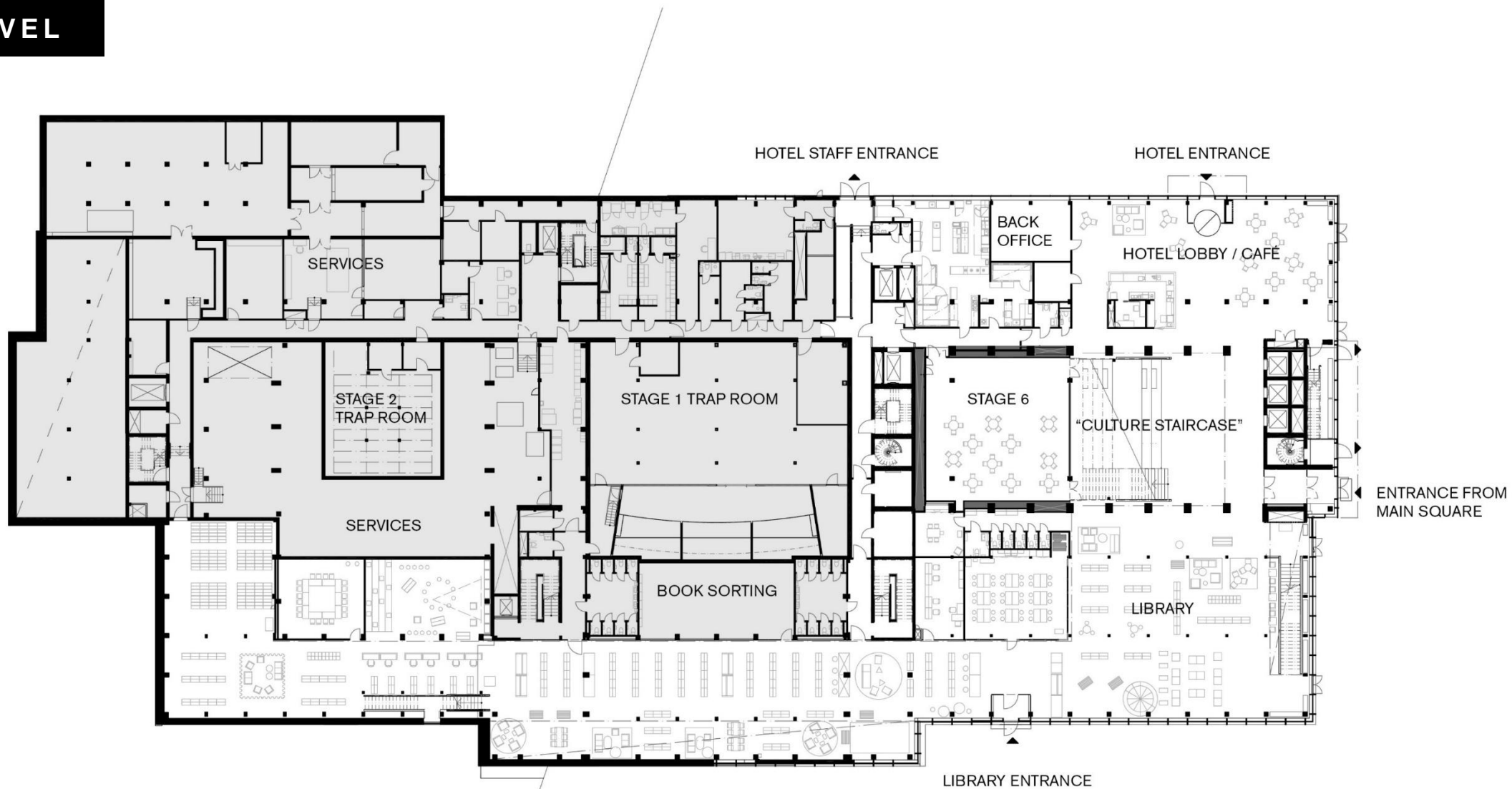
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CULTURE CENTER

- REGIONAL THEATRE
- YOUTH THEATRE GROUP “UNGHÄSTEN”
- MUSEUM ANNA NORDLANDER
- ART GALLERY OF SKELLEFTÅ
- CITY LIBRARY
- SIX STAGES FOR PERFORMING ARTS
- THEATRE WORKSHOPS
- JOINT OFFICES SPACE



GROUND LEVEL



PUBLIC LIVING ROOM



PUBLIC LIVING ROOM



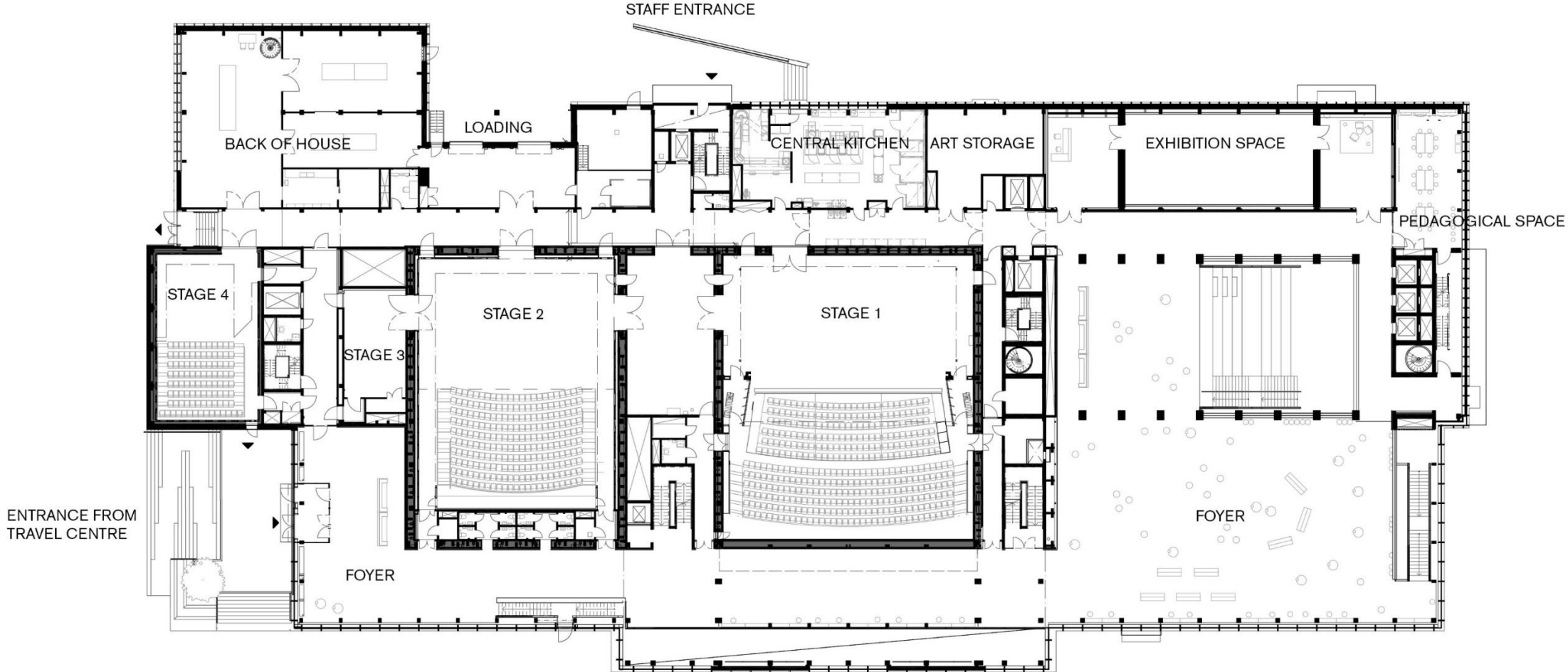
VISIBLE WOOD



MATERIALITY



THEATRE LEVEL



WILSON

FLEXIBLE FOYERS



GRAND AUDITORIUM



1200 SEATS



PLATFORM FOR CREATION



THE WOOD HOTEL



THE WOOD HOTEL

- 205 ROOMS
- THREE RESTAURANTS
- CONFERENCE CENTER
- GYM
- ROOF TOP SPA



HOTEL PLAN

- 18 prefabricated hotel pods
- 2 CLT elevator cores



HOTEL ROOMS



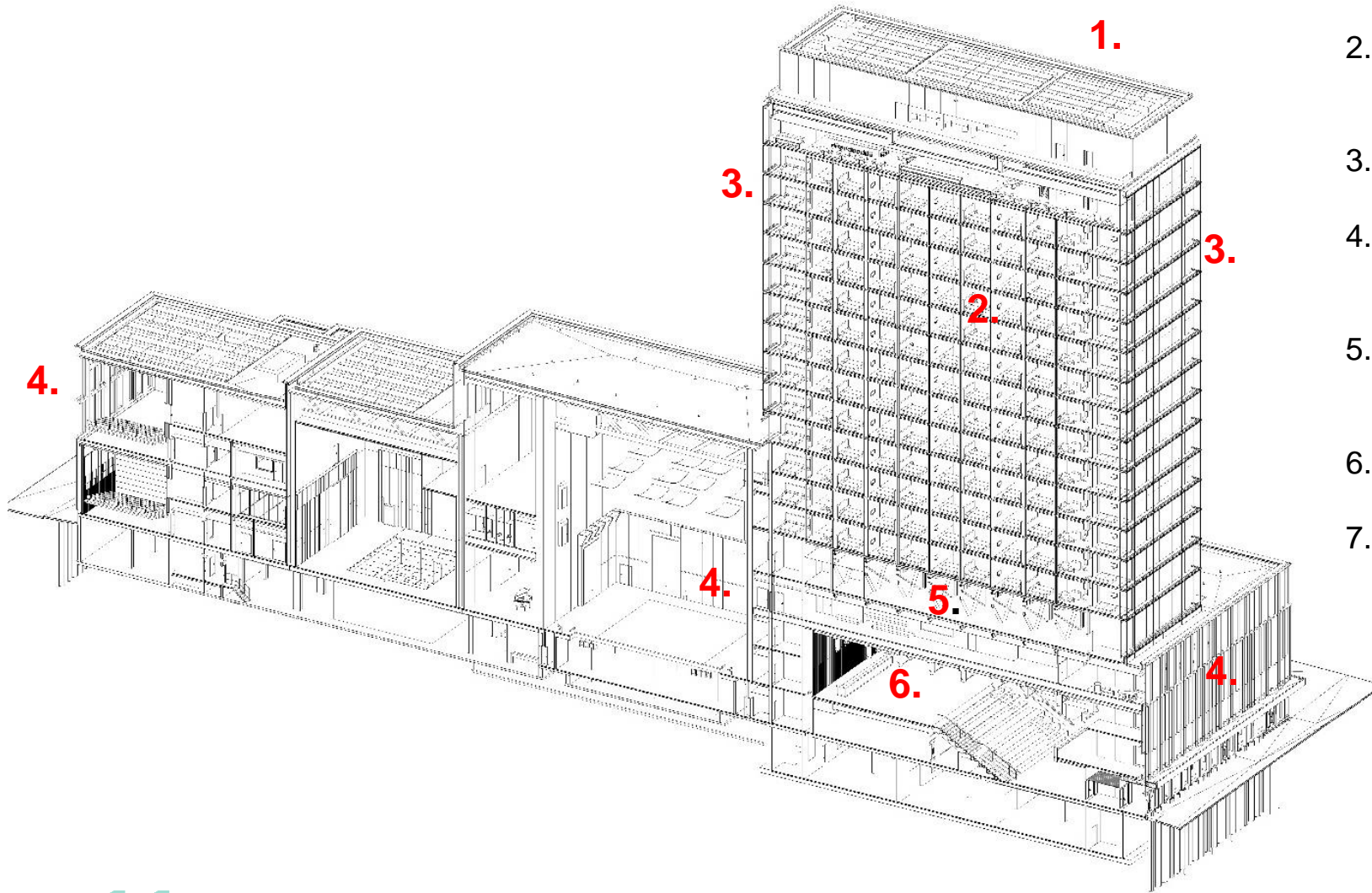
SKYBAR AND RESTAURANT



ROOFTOP TERRACE AND SPA



A LIBRARY OF TIMBER SOLUTIONS

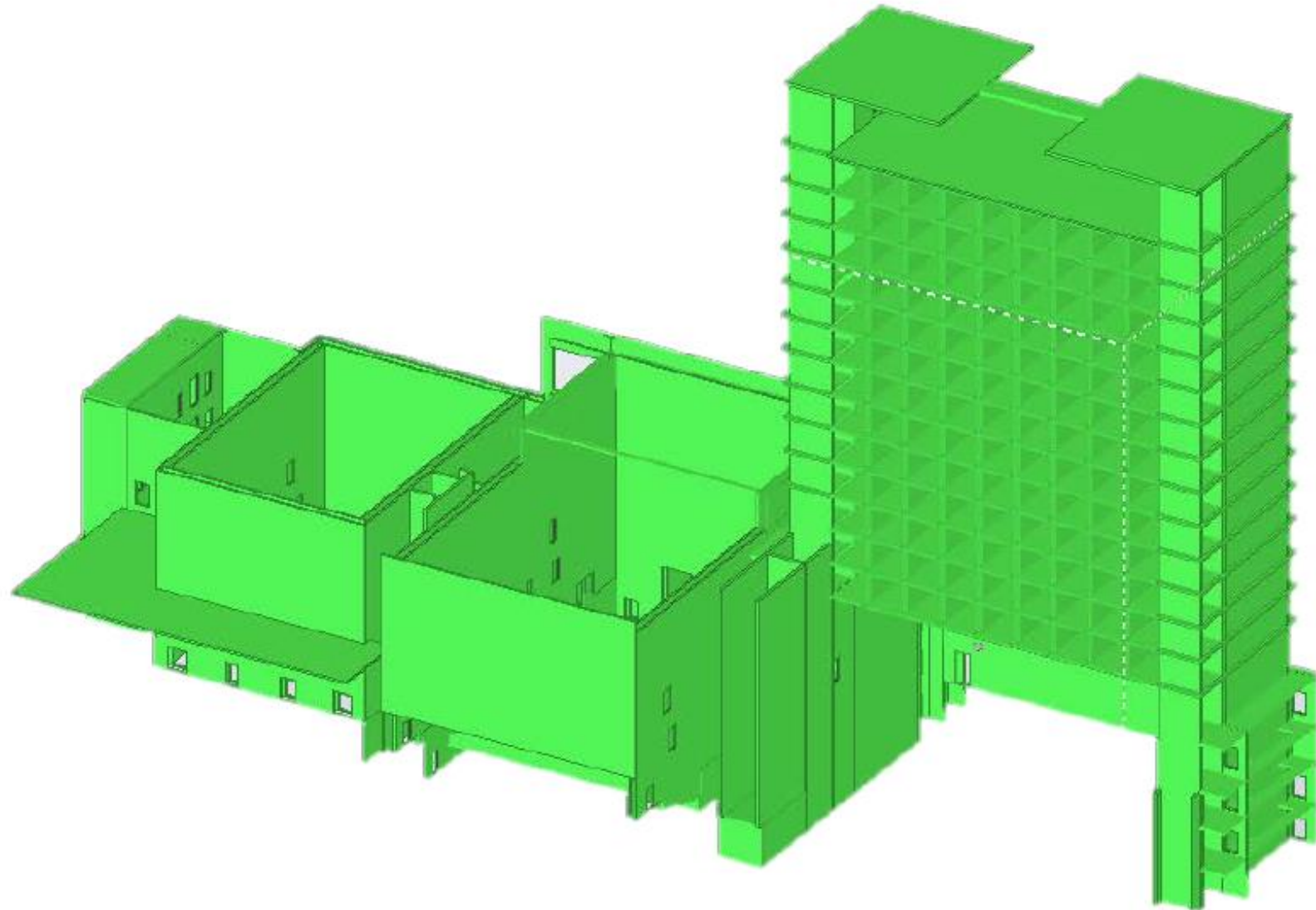


1. Dead weight concrete slabs
2. Prefabricated CLT hotel modules (13 storeys)
3. CLT cores stability (proposed concrete)
4. Combination of glulam frame with CLT walls and floors
5. Transfer structure, steel trusses, plant floor
6. Hybrid GL and steel trusses
7. Concrete foundations

CLT

9500m³

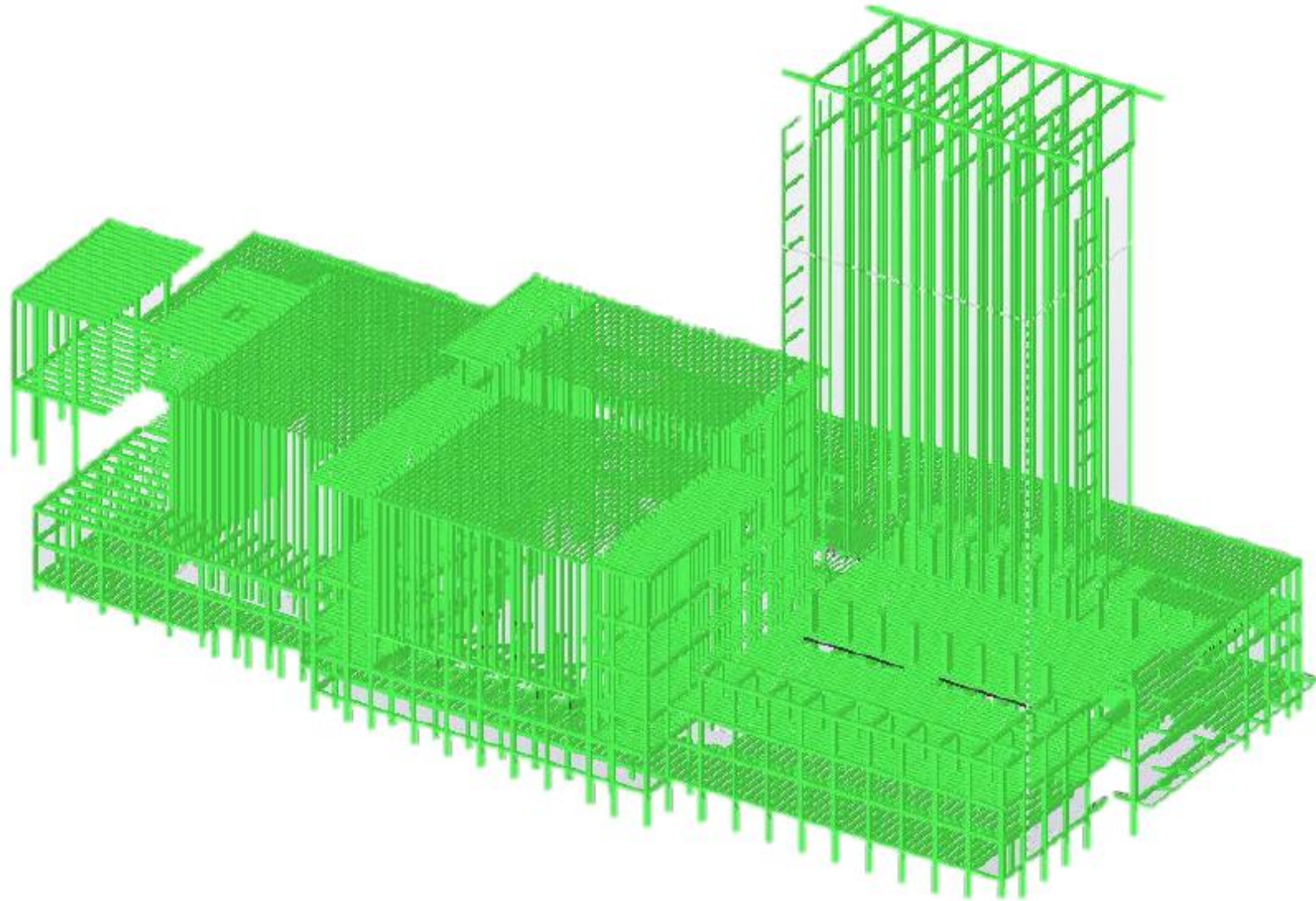
- Elevator cores
- 3D volumetrics
- Shear walls
- Floor slabs



GLUE LAM

2200 m³

- Beams
- Columns
- Trusses

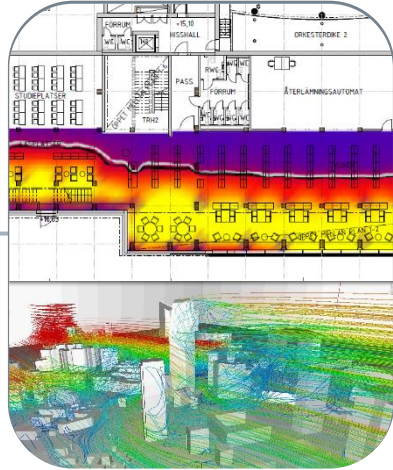


BIM AS A TOOL FOR COLLABORATION

DESIGN



SUSTAINABILITY



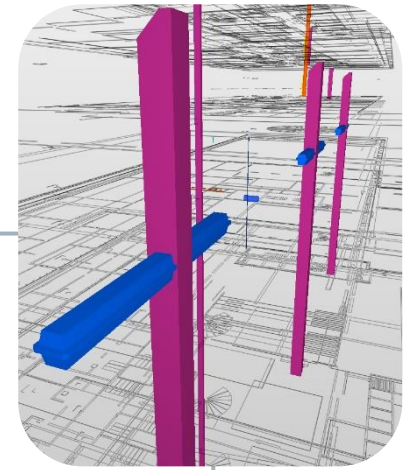
AR/VR



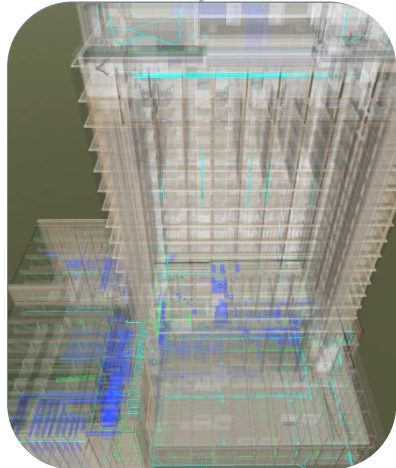
VISUALISATION



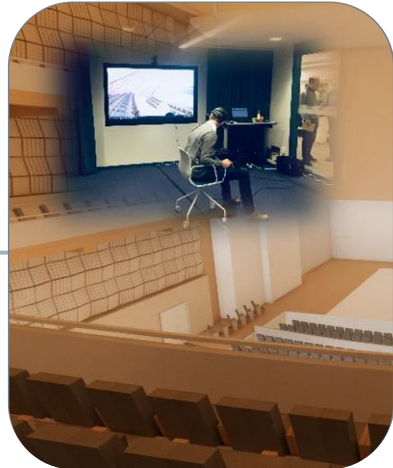
REVIEW COLLISIONS



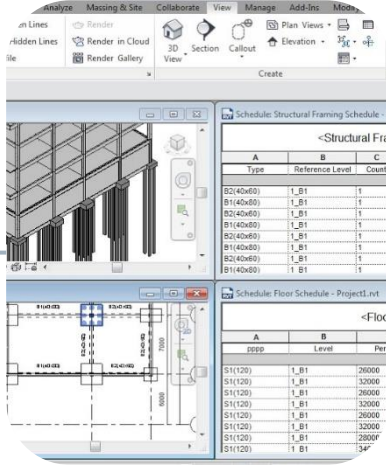
COORDINATION



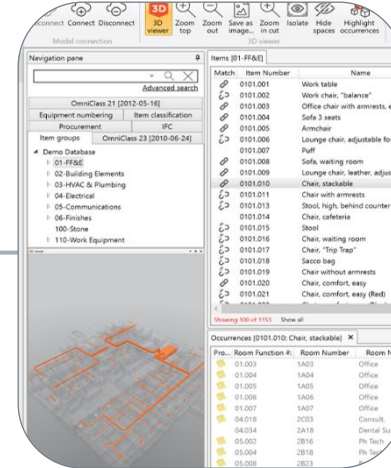
DIALOGUE



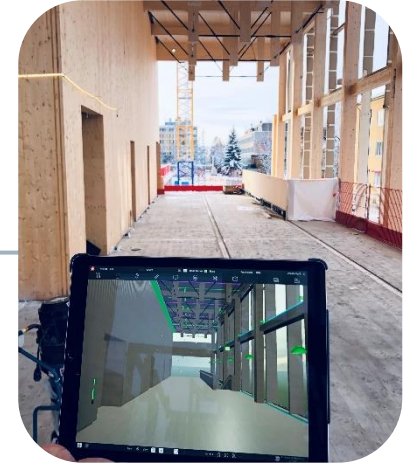
QUANTITY TAKE-OFF



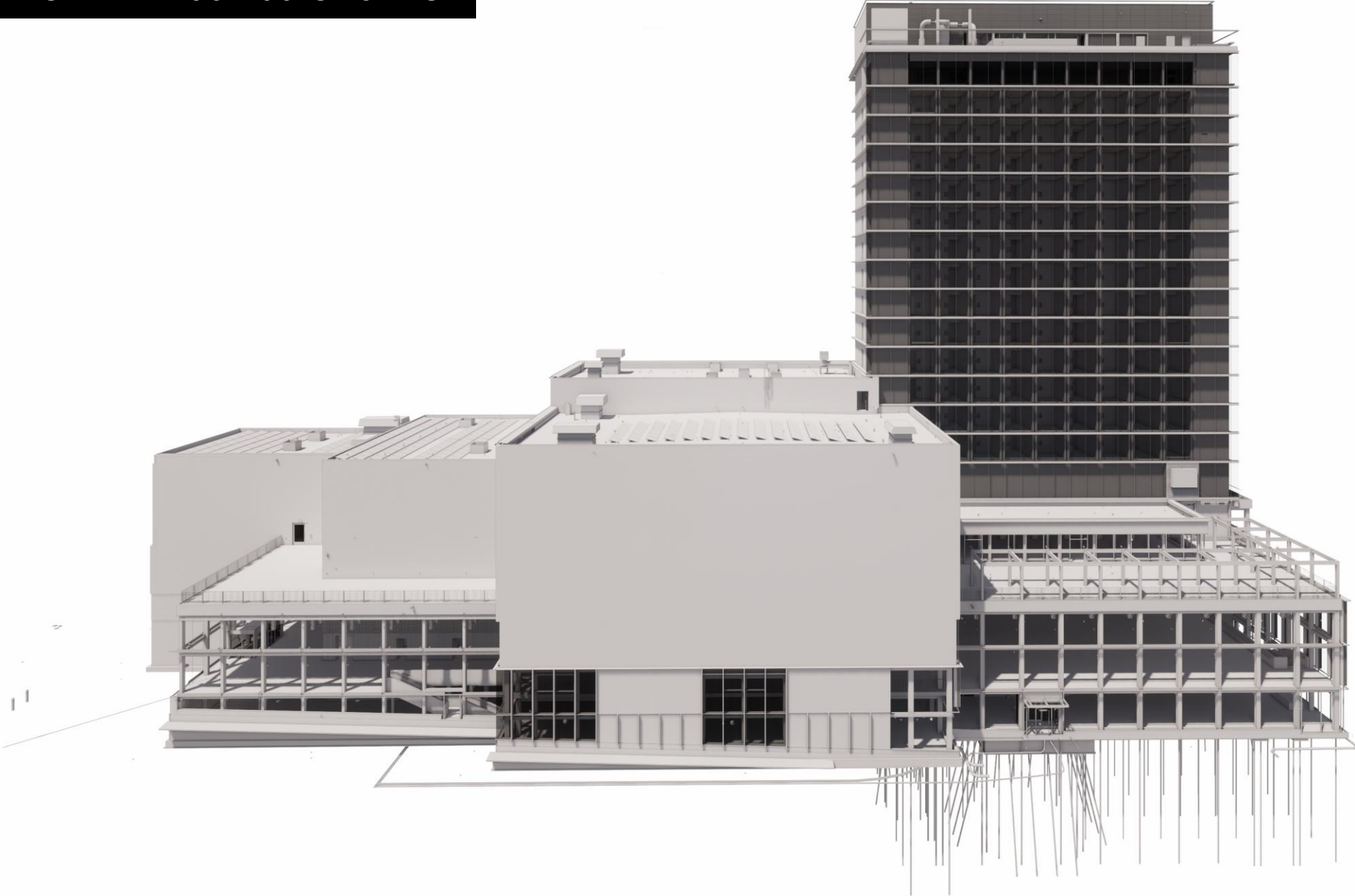
DATABASE



ON-SITE



REVIT MODEL - 298 200 OBJETS



OFF-SITE PREFABRICATION

SUPPLIER: MARTINSSONS (HOLMEN)

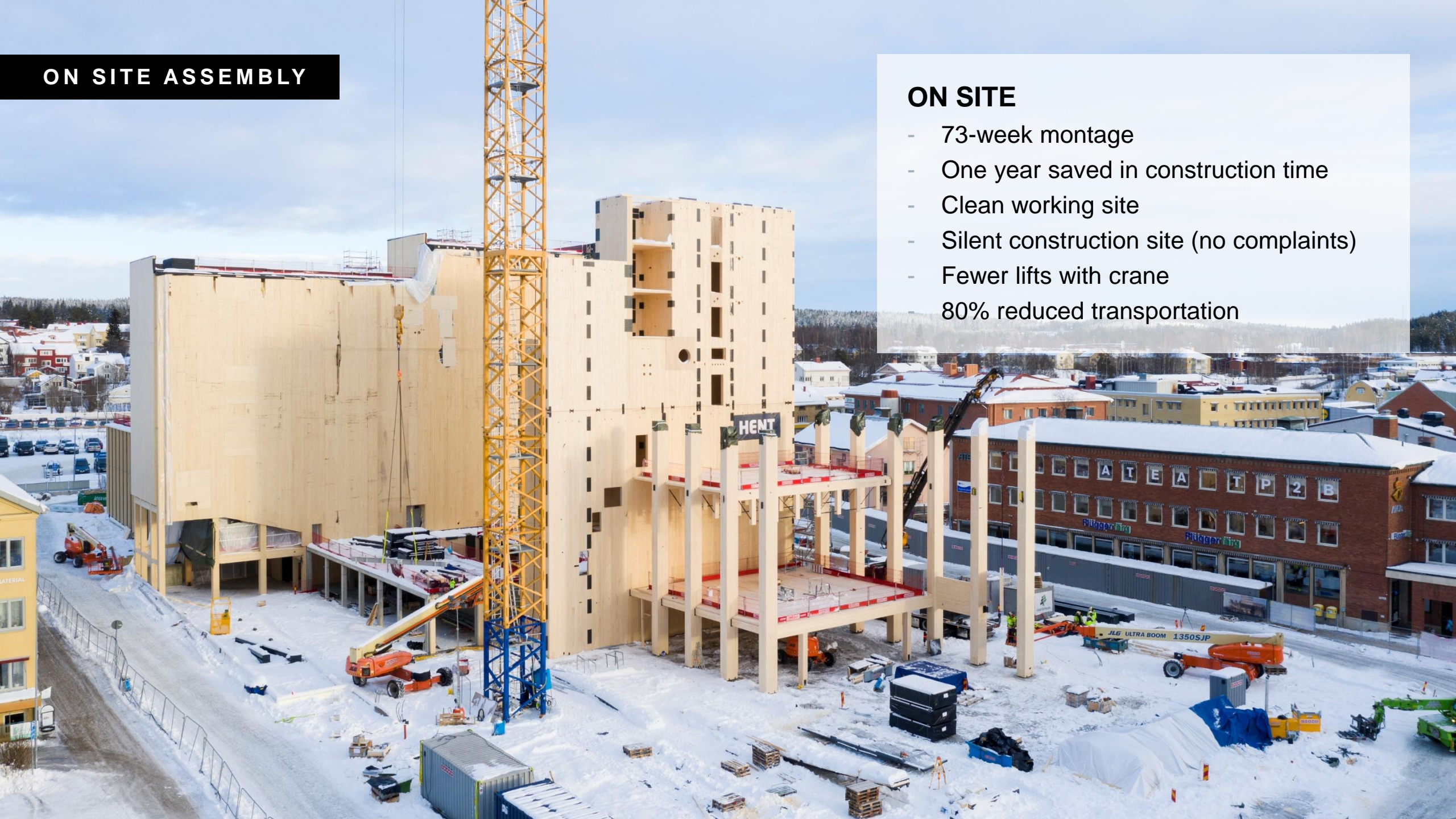
- CLT factory based 50 kilometres from Skellefteå
- Locally-sourced timber
- FSC certification
- Large elements, fewer connectors
- Largest element 27x3m
- Safe working conditions



ON SITE ASSEMBLY

ON SITE

- 73-week montage
- One year saved in construction time
- Clean working site
- Silent construction site (no complaints)
- Fewer lifts with crane
- 80% reduced transportation



CONSTRUCTION PHASING

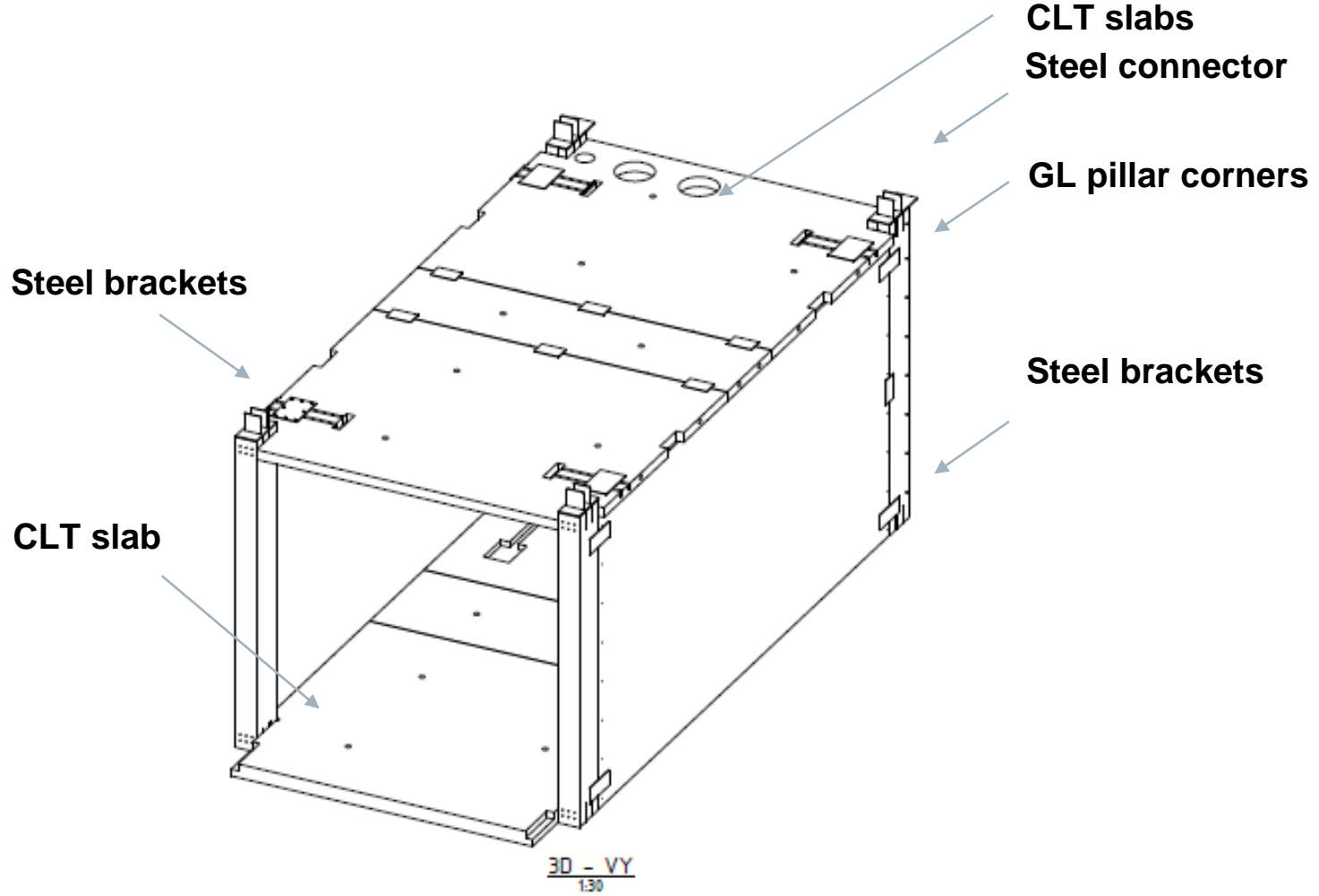


STABILIZING CORES



3D HOTEL ROOM MODULES

Prefabricated 50km from site - Derome



VOLUMETRIC ASSEMBLY



OUTER SKIN MOUNTED ON SITE



FIRE SAFETY

Rated BR0 (Swedish certification)

- Hotel tower R90/R60
- Cultural centre R60/R30
- Evacuation stairs TR1, TR2 and Evacuation lift
- Fully sprinklered
- Overdimensioned timber according to standard charring rate

Exposed timber treatment

- Internal exposed timber fire-coated B-s1, d0
- Facade panels fire-treated 2 metres above ground



A woman in a black dress is looking out from a glass-enclosed balcony. The balcony has a wooden wall on the right and a glass railing. In the background, a city is visible under a sunset sky. Other people are visible on the balcony behind her.

SMART ENERGY SYSTEM

**REDUCES THE CALCULATED ENERGY
BY 45% to 50,6 kwh/sqm/year**

100% RENEWABLE ENERGY

- Electricity from hydropower
- Bio-energy district heating
- District cooling from River Skellefteå

HEAT PUMP – CONNECTED TO THE CITY GRID – AI

- Heating / cooling
- Learns the building's behaviour and optimizes energy use

PHOTOVOLTAICS ON ROOFS AND FACADES

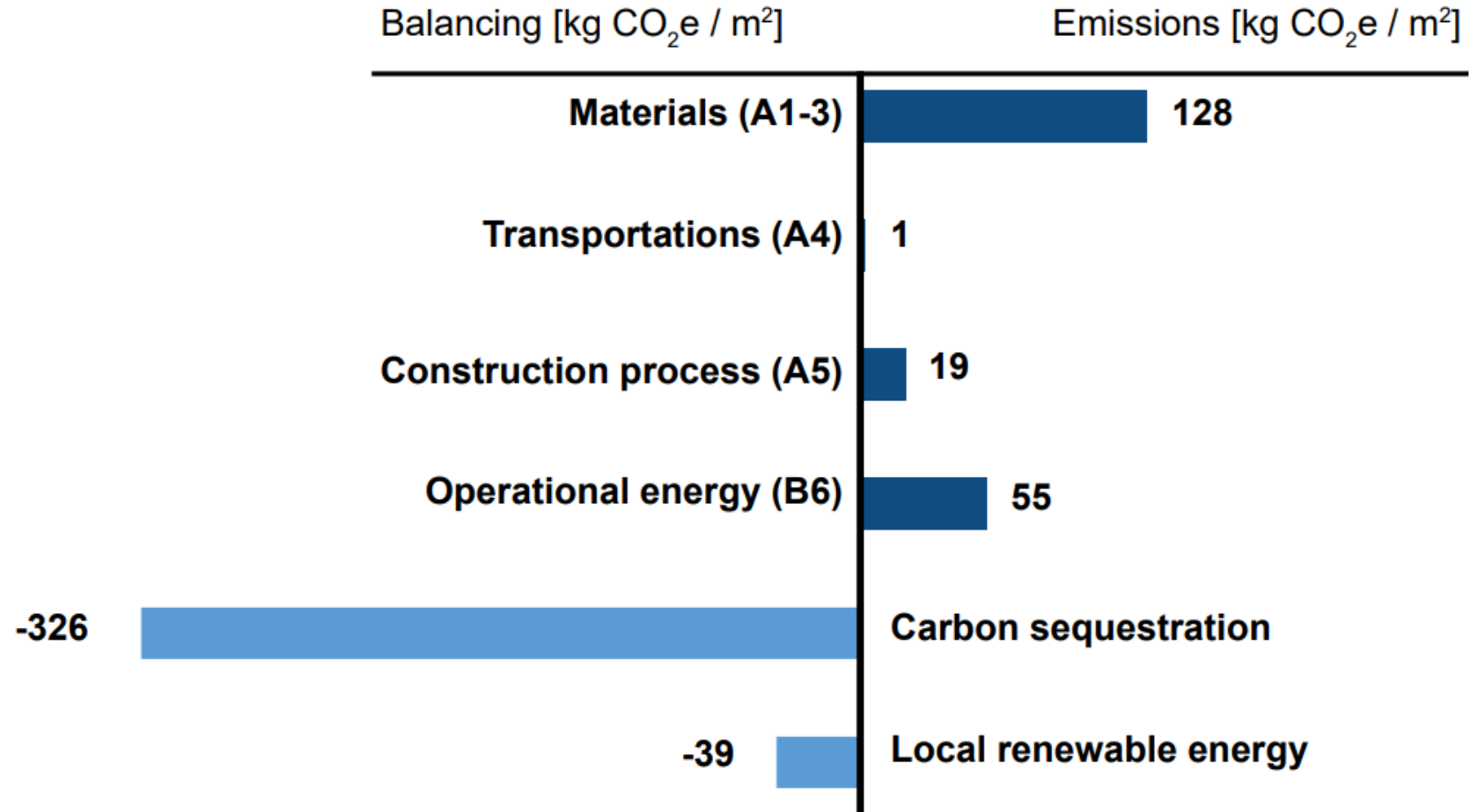
- 1000m² PVs TOTAL 175 KW

BATTER ENERGY STORAGE SYSTEM

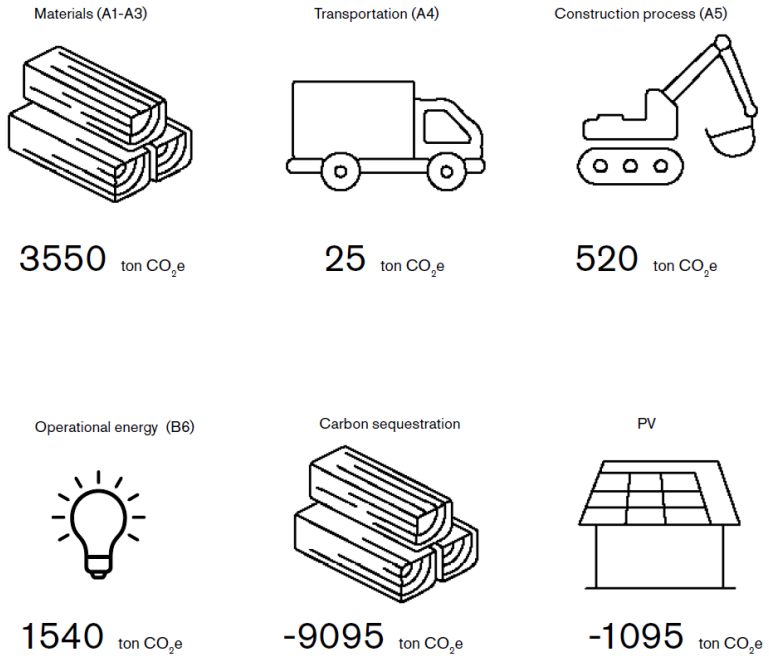
- Back-up sprinkler pump
- Batteries from Northvolt
- Peak shaving, forecasting energy use

CLIMATE POSITIVE BUILDING

LCA/sqm over 50 years



CLIMATE POSITIVE BUILDING



RESULTS

Total emissions, 50 years

5631 ton CO₂-e

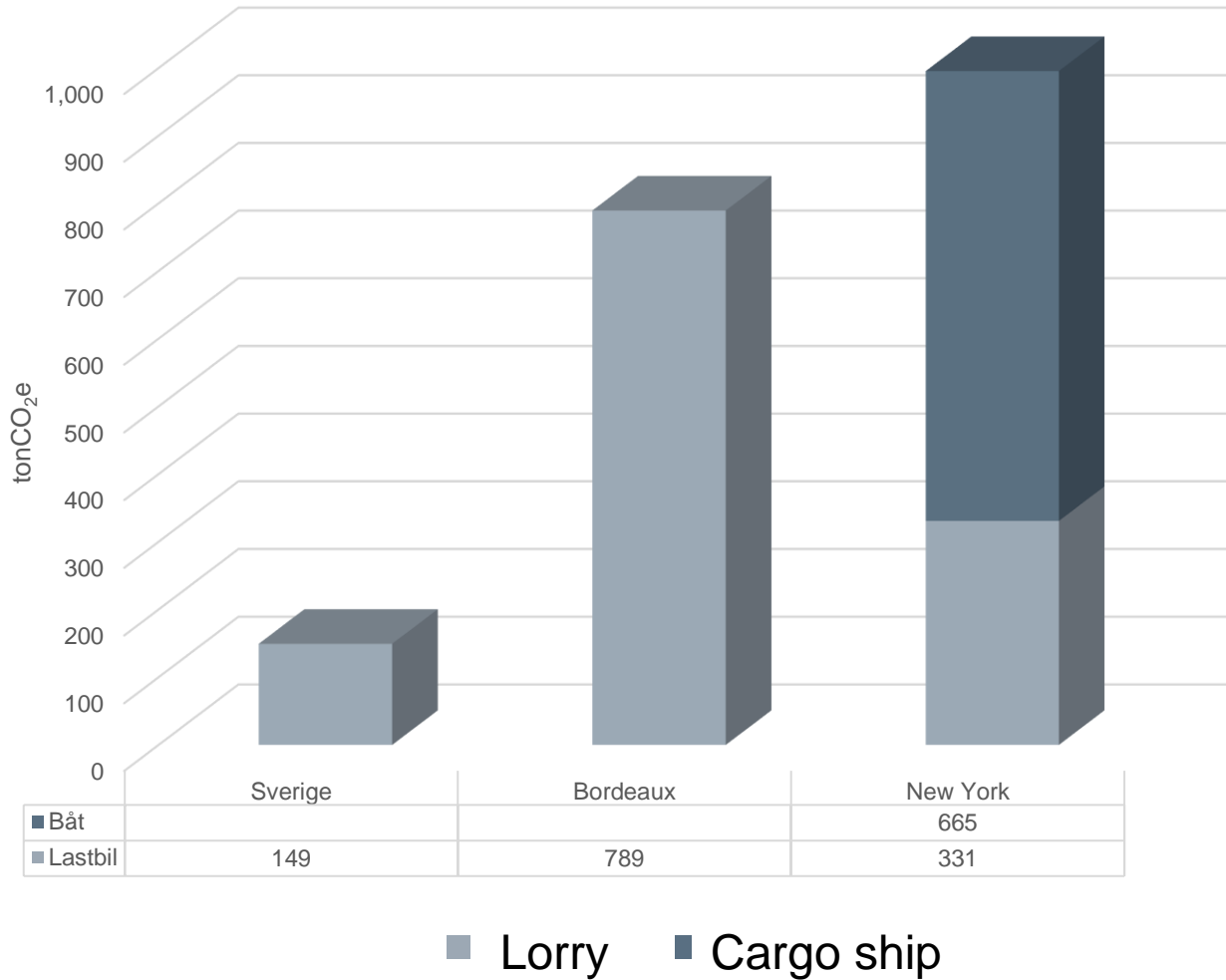
202 kg CO₂-e/ m²

Total balancing, 50 years

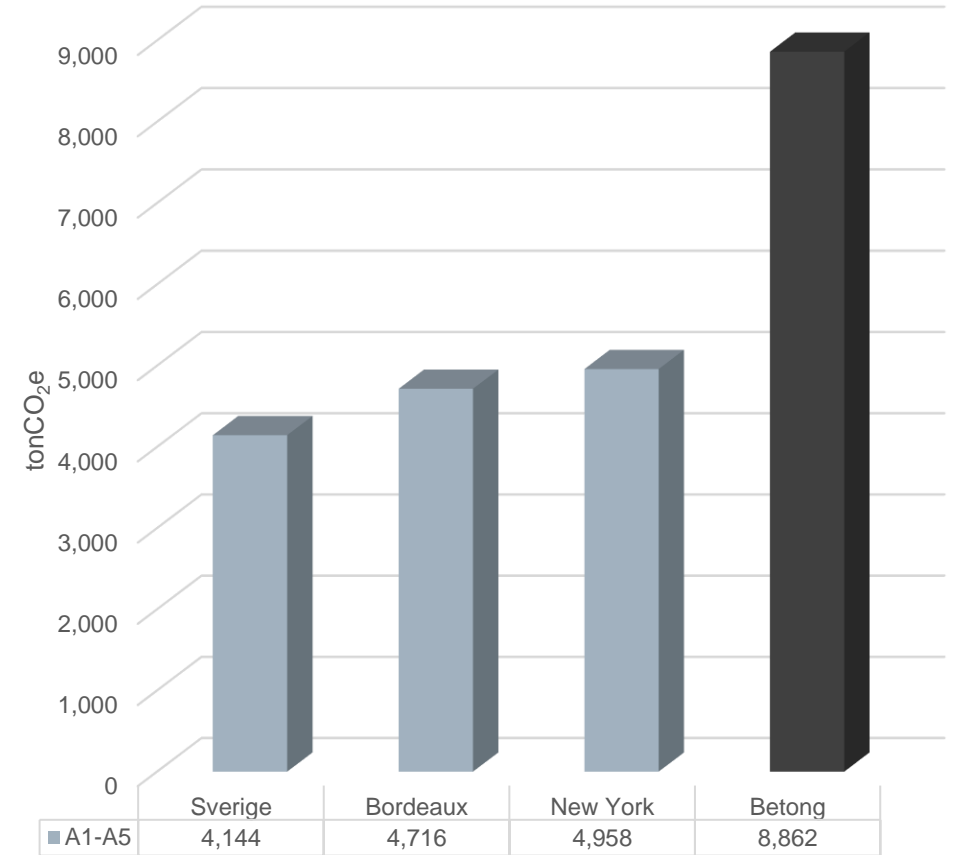
10190 ton CO₂-e

366 kg CO₂-e/ m²

LIMITED IMPACT OF TRANSPORTATION



— Transportation of timber from Skellefteå to building sites



A1-A5 for timber vs concrete building in Sweden

SKELLEFTEÅ; World's Greatest Places

"It's a magnet for modern urbanites, those who want to live in tune with nature rather than in opposition to it"



TIME
WORLD'S
GREATEST
PLACES

2022

STOCKHOLM WOOD CITY – 25 BLOCKS – 250.000 SQM



MAKASIINIRANTA - HELSINKI

