

# TIMBER BUILDINGS

## References and challenges

Lone Wiggers  
Partner, Architect MAA MNAL



NBT – Temadag – Scandic Infra City Hotel, Stockholm, 12. November 2019

# 'IMPROVE LIFE FOR PEOPLE AND PLANET'

Århus  
København  
Aalborg  
Stockholm  
Oslo  
London  
Berlin

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# SUSTAINABLE DEVELOPMENT GOALS


## INTEGRATION WITH OUR ARCHITECTURAL STRATEGY

(UN GLOBAL COMPACT C.F. MØLLER ARCHITECTS COMMUNICATION ON PROGRESS 2018)

**16** PEACE, JUSTICE AND STRONG INSTITUTIONS



**8** DECENT WORK AND ECONOMIC GROWTH



**13** CLIMATE ACTION



**12** RESPONSIBLE CONSUMPTION AND PRODUCTION



**10** REDUCED INEQUALITIES



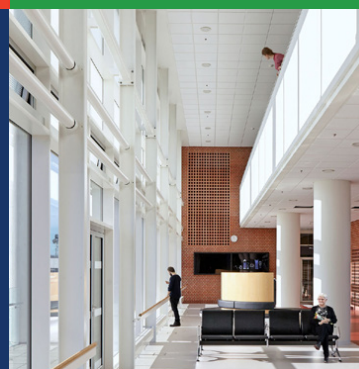
**5** GENDER EQUALITY



**3** GOOD HEALTH AND WELL-BEING



**17** PARTNERSHIPS FOR THE GOALS



# CLIMATEEFFECTS FROM BUILDING MATERIALS

**Energy consumption**

**BR18**

**2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y**

**Production of building  
materials**

**LCA (DGNB-method)**

**4,0 kg CO<sub>2</sub>/m<sup>2</sup>/y**

**Typical**

**Multistorey housing**

# CLIMATEEFFECTS FROM BUILDING MATERIALS

**Energy consumption  
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2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y**

**Production of building  
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LCA (DGNB-method)  
4,0 kg CO<sub>2</sub>/m<sup>2</sup>/y**

**Typical  
Multistorey housing**

**Driftsenergi  
2020-lavenergiklasse  
1,5 kg CO<sub>2</sub>/m<sup>2</sup> år**

**Traditional  
energy savings**

# CLIMATE EFFECTS FROM BUILDING MATERIALS

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2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

Production of building  
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LCA (DGNB-method)  
4,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

**Typical  
Multistorey housing**

Energy consumption  
2020-low energy class  
1,5 kg CO<sub>2</sub>/m<sup>2</sup>/y

**Traditional  
energy savings**

Production of building  
materials  
LCA with DGNB-method  
2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

**New focus on LCA  
& wood in buildings**

# CLIMATE EFFECTS FROM BUILDING

Energy consumption  
BR18  
2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

Production of building  
materials  
LCA (DGNB-method)  
4,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

Typical  
Multistorey housing

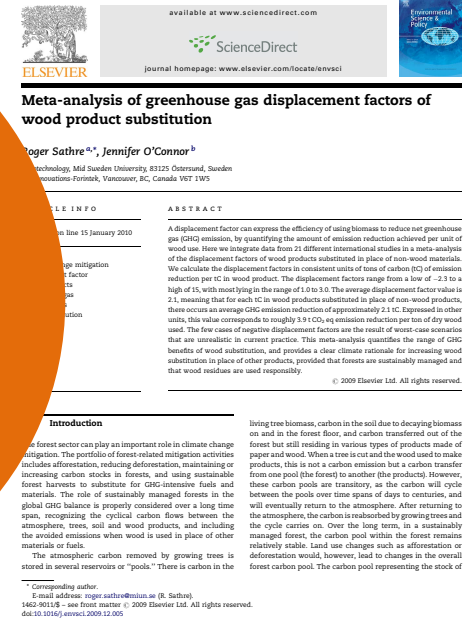
Driftsenergi  
2020-lavenergiklasse  
1,5 kg CO<sub>2</sub>/m<sup>2</sup> år

Traditional  
energy savings

50%  
reduction in  
climate effect  
from exchange of  
load bearing  
construction into  
wood

Production of building  
materials  
LCA with DGNB-method  
2,0 kg CO<sub>2</sub>/m<sup>2</sup>/y

New focus on LCA  
& wood in buildings



# ENVIRONMENTAL IMPACT OF MATERIALS

- Operational energy greatly reduced in new buildings
- More energy used for material production than for 120 years of space heating
- Focus on Life Cycle Analysis
- Focus on Timber Buildings



12 RESPONSIBLE  
CONSUMPTION  
AND PRODUCTION



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# OUR FUTURE CITIES

TRANSFORMATION  
URBAN METABOLISME, FROM CO<sub>2</sub> PRODUCTION TIL CO<sub>2</sub> STORAGE



CONCRETE  
+ 200 KG CO<sub>2</sub>/M<sup>3</sup>




HYBRID  
+/- 0 KG CO<sub>2</sub>/M<sup>3</sup>



W<sub>OOD</sub>  
-1000 KG CO<sub>2</sub>/M<sup>3</sup>

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An architectural rendering of a modern, multi-story building with a light-colored wooden frame and large glass windows. The building features a grid-like facade and rooftop gardens with plants and trees. The building is situated on a city street with other buildings, cars, and pedestrians. A speech bubble is overlaid on the image, containing text about CO2 storage. The sky is blue with some clouds and birds flying.

”Here, we stored thousands of tonnes of CO<sub>2</sub>,- instead of emitting it to the atmosphere..”

## WOOD BUILDINGS IN THE CITY

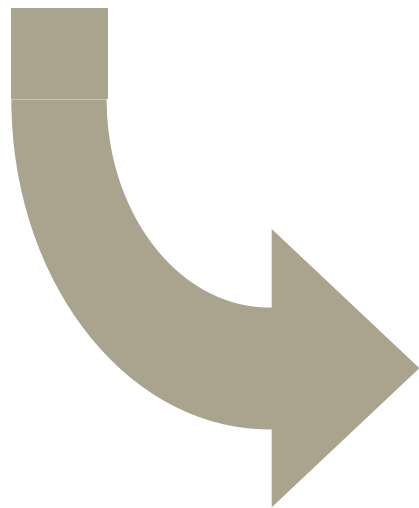
- **EASIER TO ACCESS WITH LIGHTER ELEMENTS IN THE DENSE CITY**
- **“SILENT” BUILDING SITES**
- **5-10 TIMES LESS TRANSPORT**
- **PRECISE AND FAST BUILDING METHOD**
- **LIGHT WEIGHT (IN-FILLS AND ON-FILLS ON EXISTING BUILDINGS AND POROUS UNDERGROUND**

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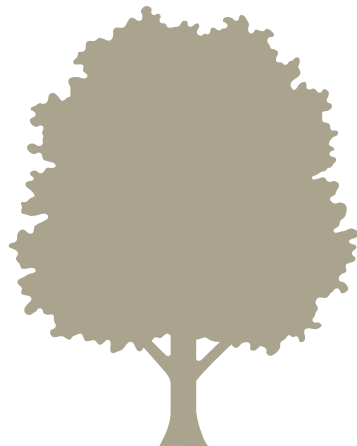
# NORDIC MODEL FOR BIOBASED, CLIMATE NEUTRAL & CIRCULAR ECONOMY

Forrests remove CO<sub>2</sub> from atmosphere

New possibilities for job creation throughout the economy



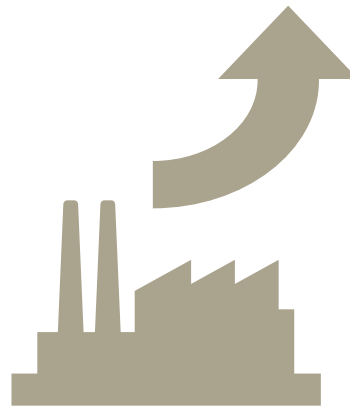
Sustainable forestry



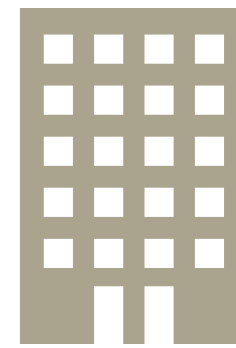
CO<sub>2</sub> sequestration:

50 years

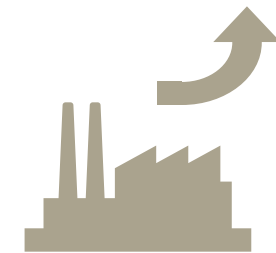
Sustainable production



Sustainable buildings



Circular economy



100 years

100 years

# NEW SUSTAINABLE TIMBER PRODUCTS

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UP TO 10 STOREYS  
**TIMBER**



10+ STOREYS  
**TIMBER-HYBRIDS**



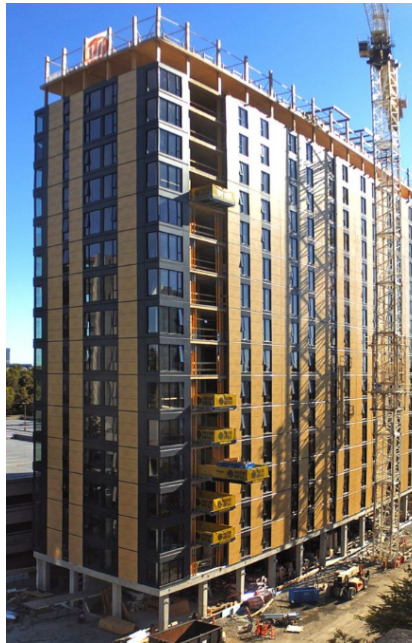


# TALL TIMBER

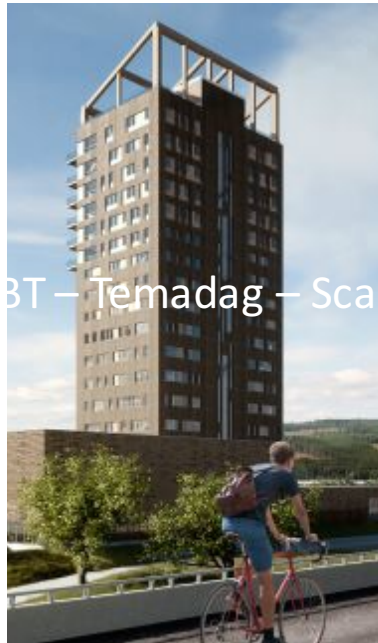


# 10+ STOREYS TIMBER-HYBRIDS

THE RACE IS ON...



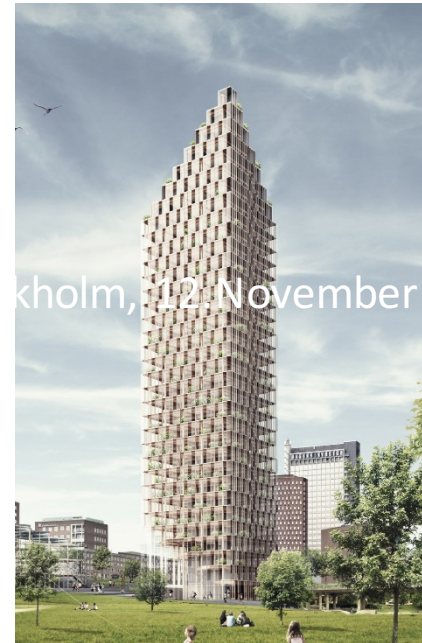
BROCK COMMONS  
VANCOUVER  
18 STOREYS



MJÖSTÅRNET  
BRUMENDAL  
18 STOREYS



HAUT  
AMSTERDAM  
21 STOREYS



HSB 2023  
STOCKHOLM  
34 STOREYS



RIVER BEACH  
CHICAGO  
80 STOREYS



BARBICAN TOWER  
LONDON  
80 STOREYS

BT – Temadag – Scandinavisk Infra City Hotel, Stockholm, 12 November 2019

# HSB JUBILEE PROJECT, STOCKHOLM

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NBT – Temadag – Scandic Infra City Hotel, Stockholm, 12. November 2019





# C.F. Møller & DINELLJOHANSSON

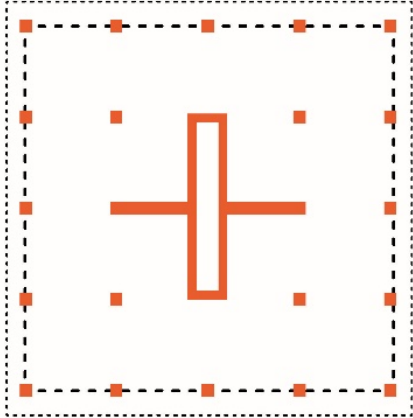


**TYRÉNS**

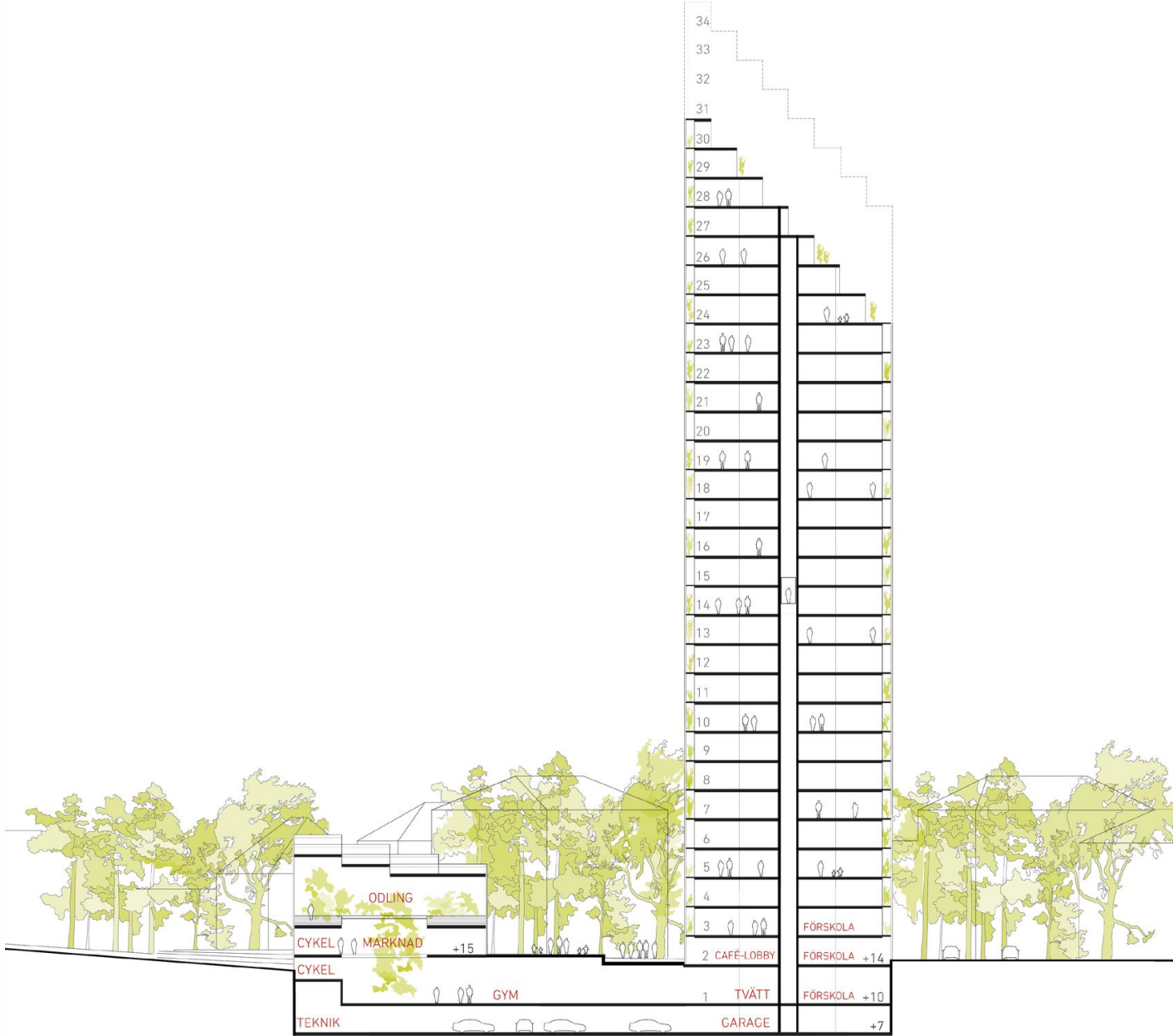
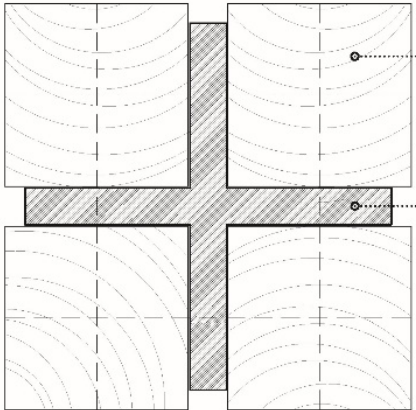


NBT – Temadag – Scandic Infra City Hotel, Stockholm, 12.November 2019

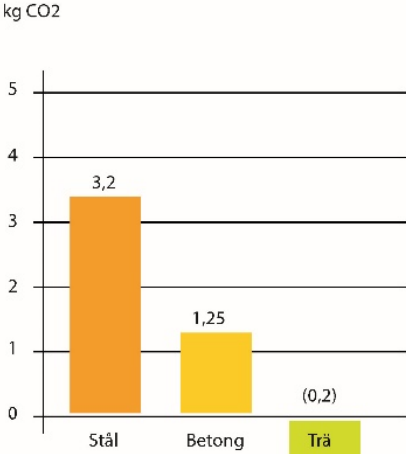
Stabilising structure



Wood composite columns



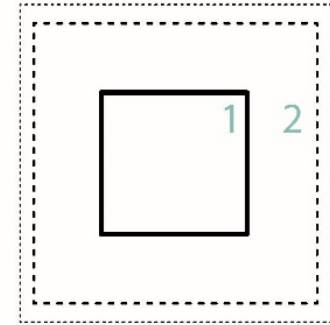
Environmental impact



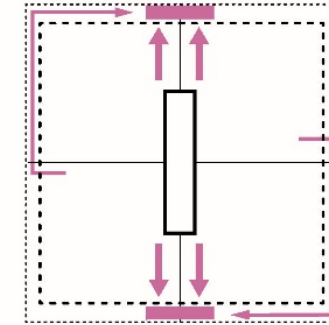
Interior, Västerbroplan



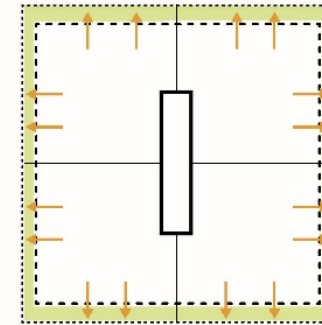
Concept double shell facade



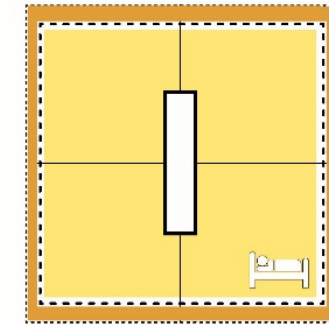
Three layers



External stairs



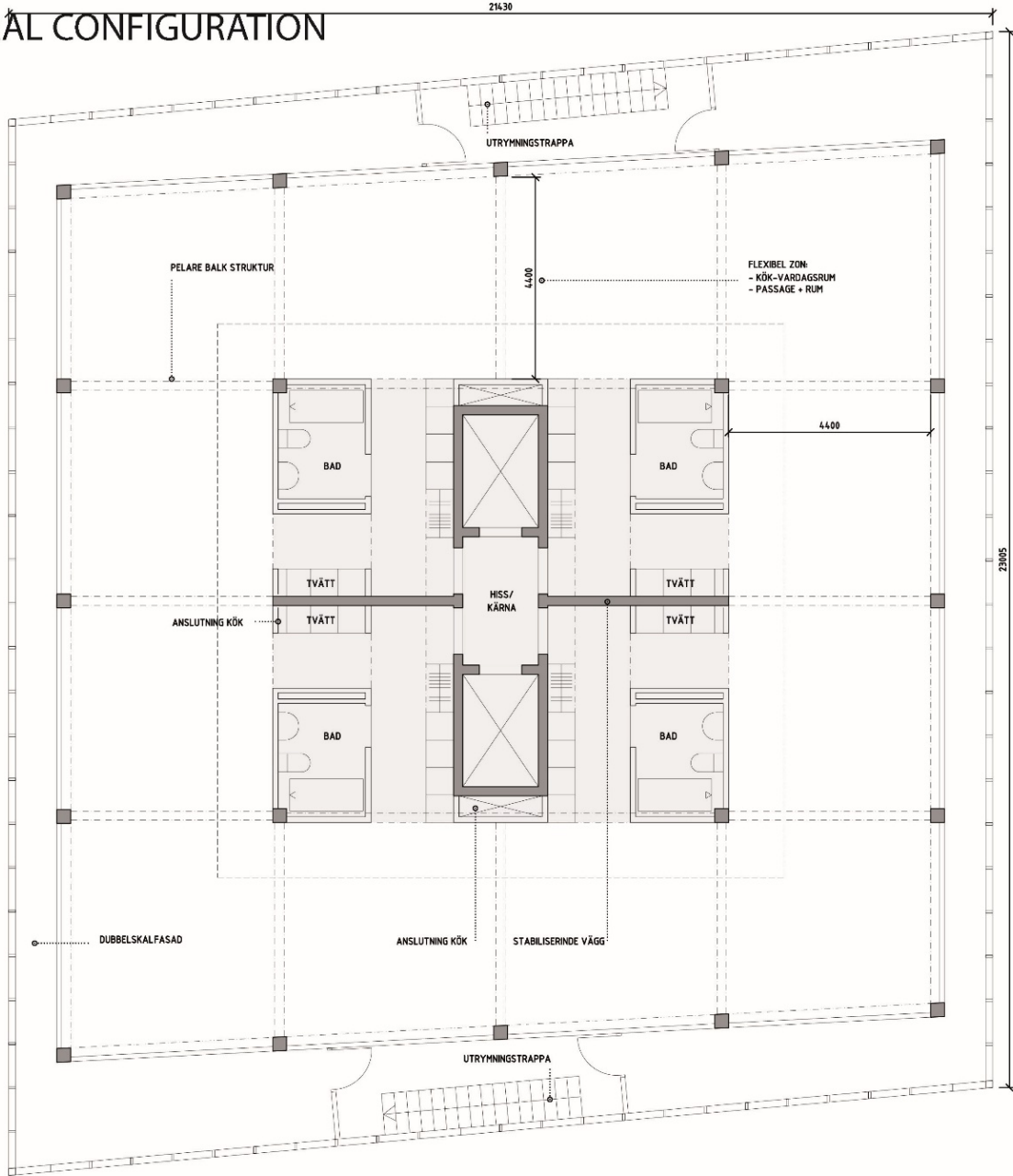
Extra space



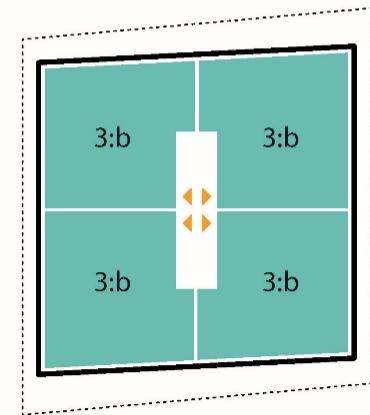
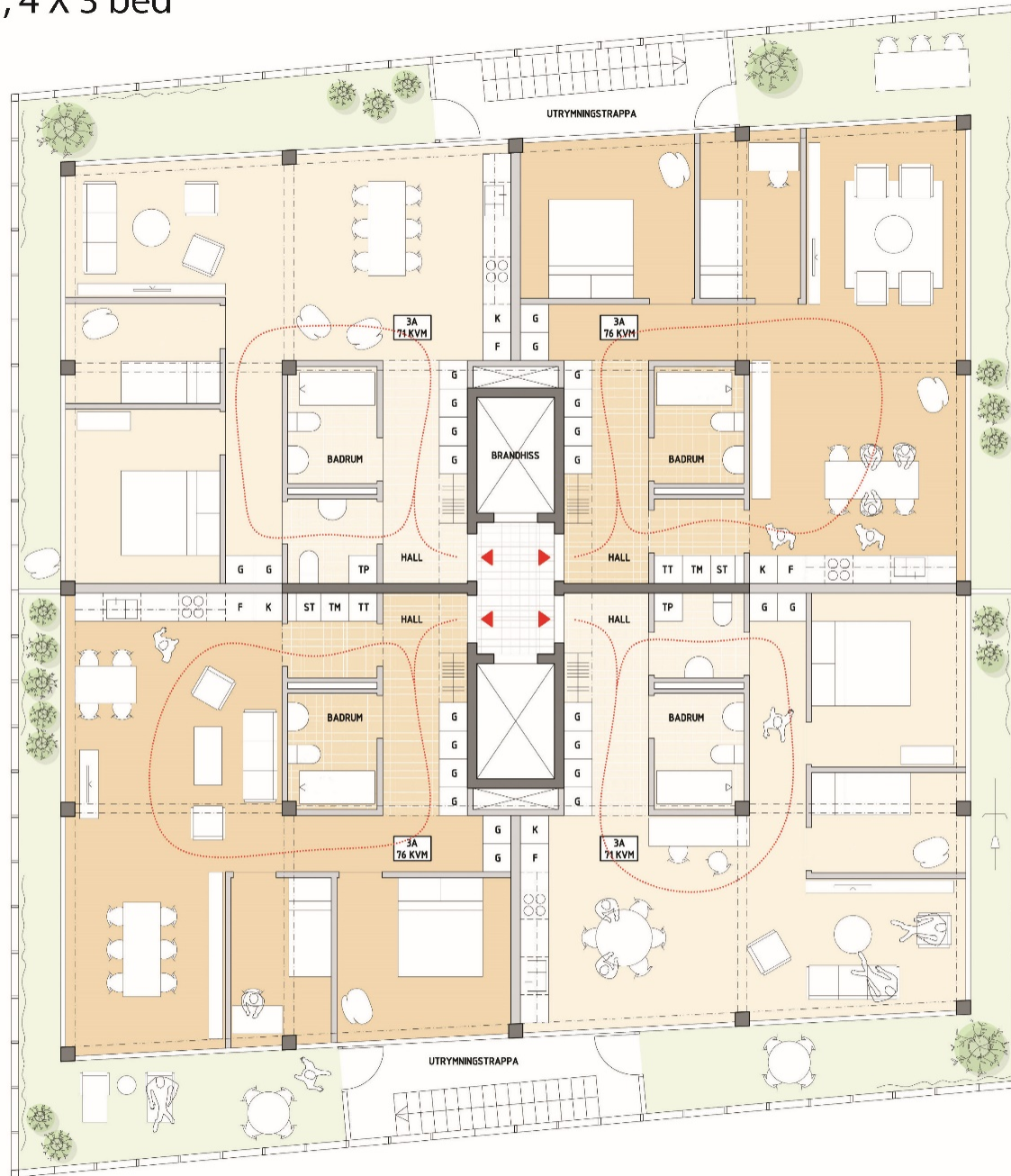
Noise protection



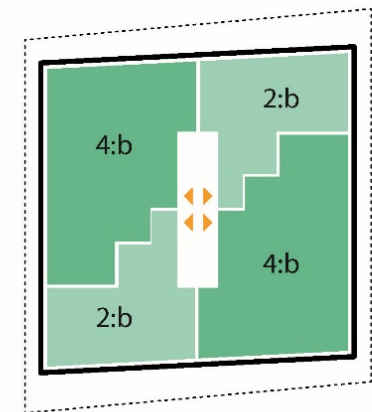
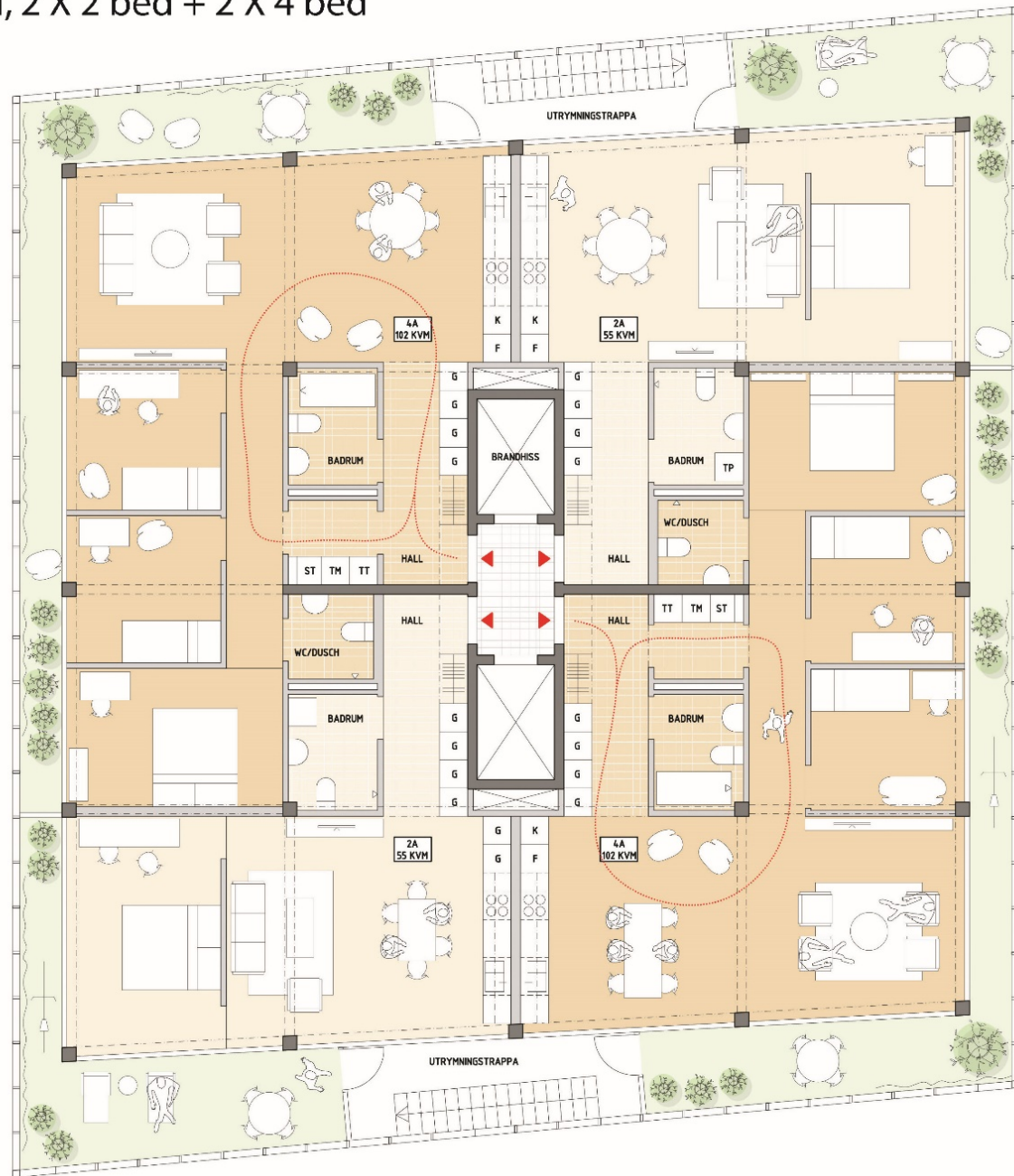
# PLAN BASIC STRUCTURAL CONFIGURATION



# PLAN CONFIGURATION, 4 X 3 bed



# PLAN CONFIGURATION, 2 X 2 bed + 2 X 4 bed





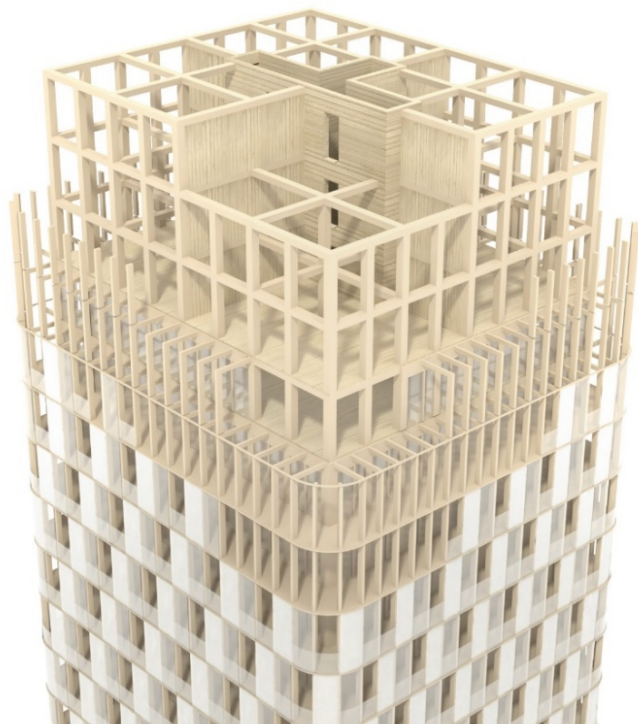
# 12 RESPONSIBLE CONSUMPTION AND PRODUCTION



# TALL TIMBER BUILDING

2015-2018

MULTIDISCIPLINARY RESEARCH SUPPORTED BY  
SWEDISH RESEARCH COUNCIL FOR SUSTAINABLE DEVELOPMENT





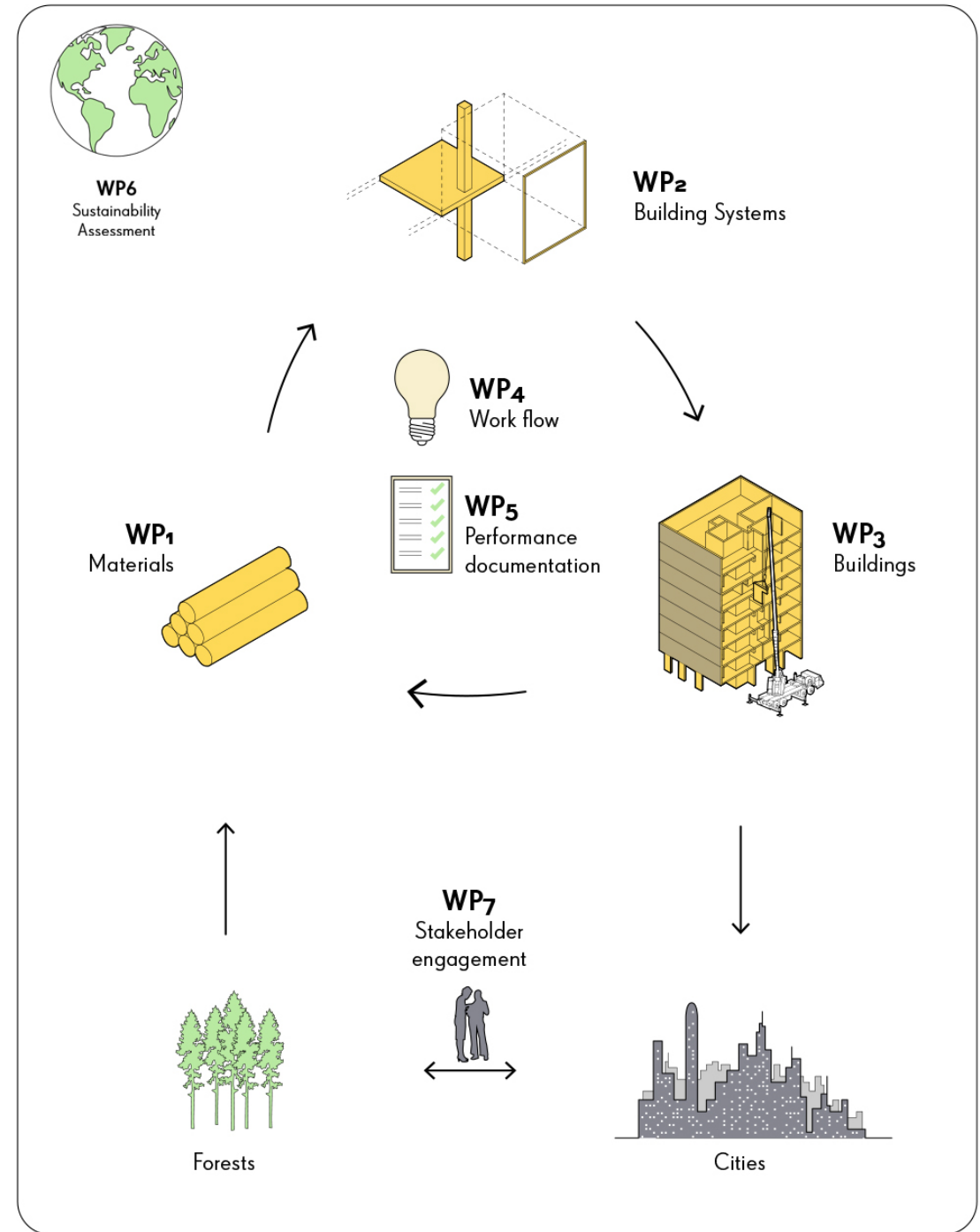
# BUILD IN WOOD



2019-2023

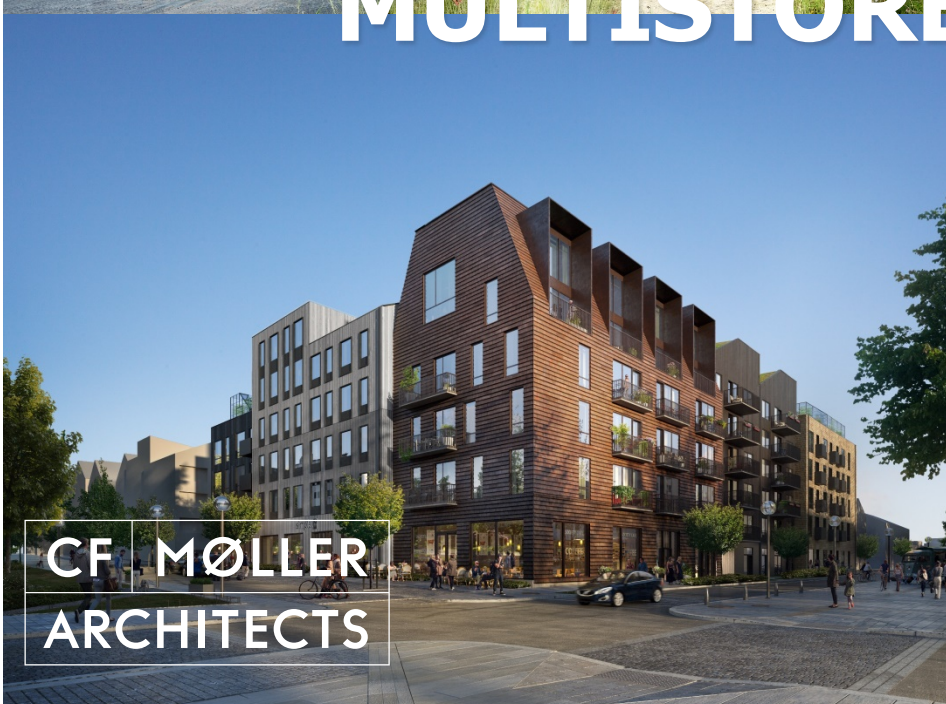
SUPPORTED BY EU HORIZON 2020; € 8,6 MILL.

DEVELOP A SUSTAINABLE AND INNOVATIVE WOOD VALUE CHAIN FOR THE CONSTRUCTION OF MULTI-STOREY WOOD BUILDINGS





# MULTISTOREY BUILDINGS



# UP TO 10 STOREYS TIMBER

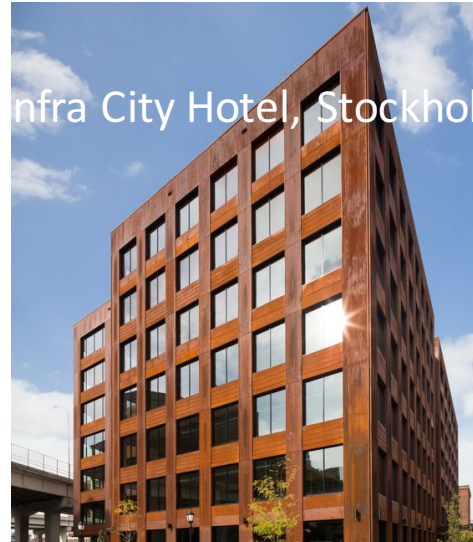
## COMPLETED BUILDINGS



MURRAY GROVE  
LONDON  
8 STOREYS



STRANDPARKEN  
SUNDBYBERG  
8 STOREYS



T3 OFFICE  
MINNEAPOLIS  
7 STOREYS



MOHOLT  
TRONDHEIM  
9 STOREYS



KAJSTADEN  
VÄSTERÅS  
9 STOREYS

BT – Temadag – Scandinaftra City Hotel, Stockholm, 12. November 2019



# ÖRNSRO TIMBER VILLAGE

Building type: **Masterplan & Housing**

Floor area: **19.000 m<sup>2</sup>**

Construction: **CLT & LVL**

Status: **Construction 2019-20**

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# RÅBYLUND LUND

Building type: **Housing**

Floor area: **8.100 m<sup>2</sup>**

Construction: **CLT**

Status: **Construction 2019-20**

NBT – Temadag – Scandic Infra City Hotel, Stockholm, 12. November 2019





NBT – Temadag – Scandic Infra City Hotel, Stockholm, 12. November 2019

# NORRTALJE MARINA

Building type: **Housing & Commercial**

Floor area: **30.000 m<sup>2</sup> (3 phases)**

Construction: **CLT**

Status: **Construction 2019-20**









# LUND CENTRAL STATION



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# KAJSTADEN VÄSTERÅS

Building type: **Housing**

Floor area: **3.500 m<sup>2</sup>**

Construction: **CLT**

Status: **Finished 2019**

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# THE FUTURE IS HERE



## TIMBER

Lifetime -120 years

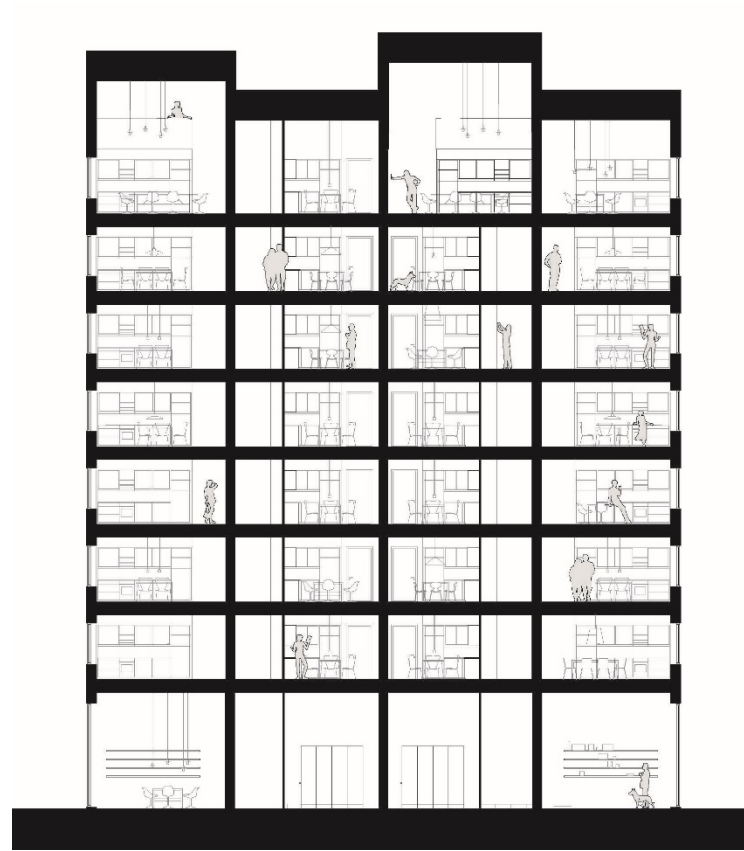
1,5 CO<sub>2</sub>/m<sup>2</sup> per year = **480.000 kg CO<sub>2</sub> (42%)**  
(lifetime)

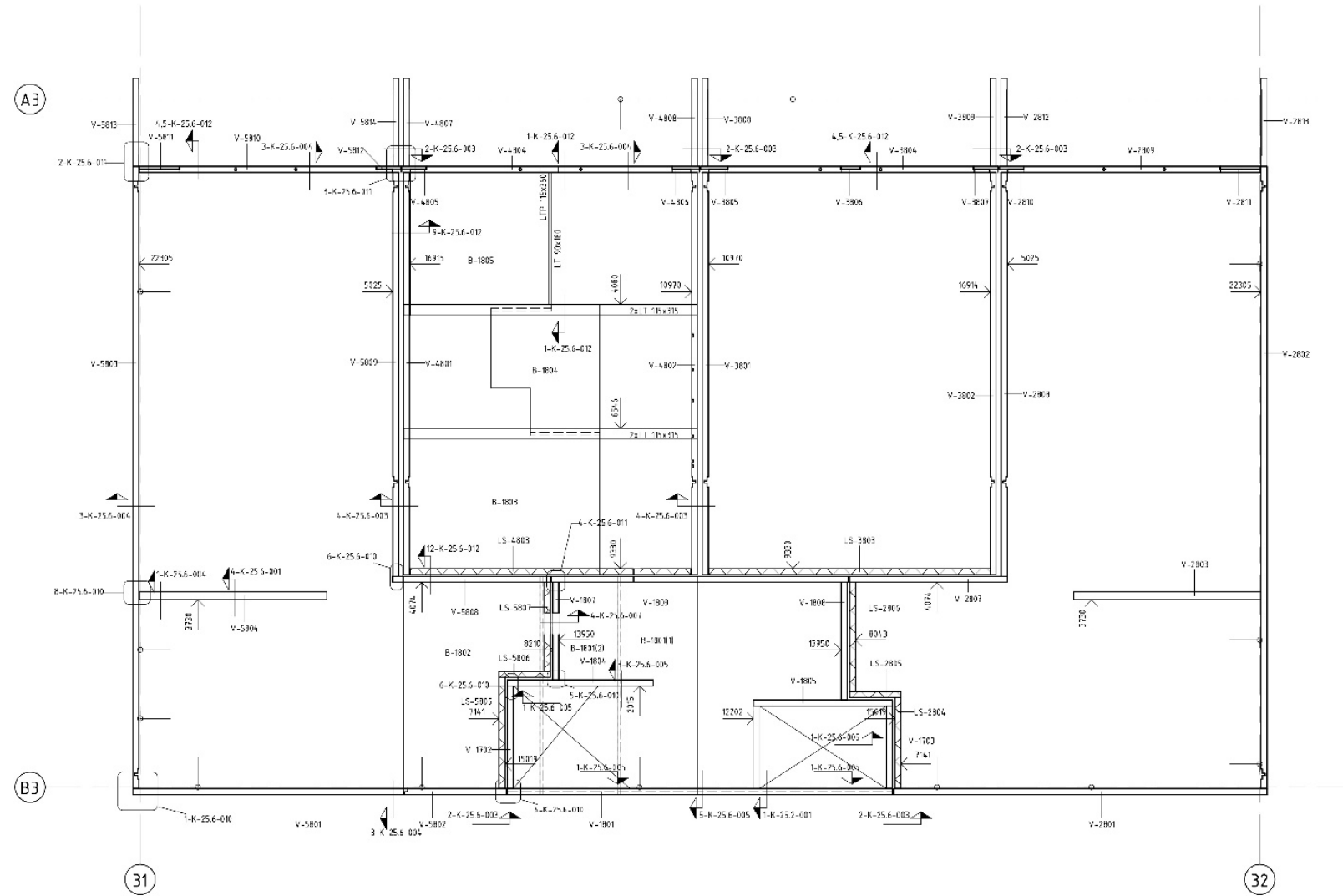
-1,8 CO<sub>2</sub>/m<sup>2</sup> pr år = **-579.000 kg CO<sub>2</sub> (-51%)**  
(recycled+lifetime)

## CONCRETE

Lifetime -120 years

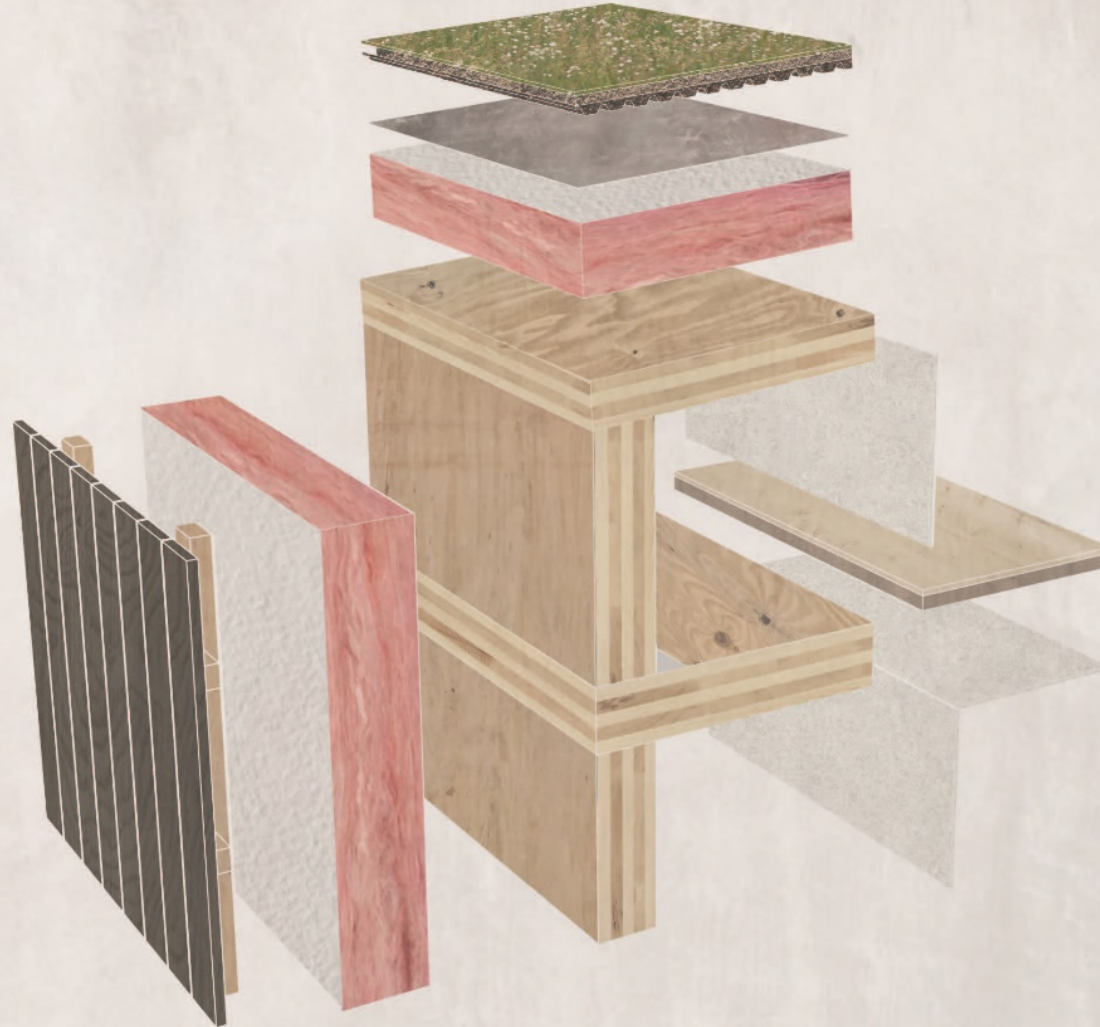
3,5 kg CO<sub>2</sub>/m<sup>2</sup> per year = **1.125.000 kg CO<sub>2</sub> (100%)**  
(lifetime).





# PRINCIPLE

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- Four apartments on each storey
- Vertical fire & acoustic sectioning
- CLT double wall between apartments
- CLT floor deck spans from wall to wall







- Four carpenters built loadbearing structure
- Quick assembly - 3 days per storey
- High precision +/- 1-2mm
- Mechanical joints with long screws



- CLT to elevator shaft



- Movement joints



- CNC-cutting to building services



- CLT walls, floors & roofs

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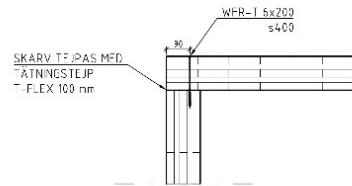
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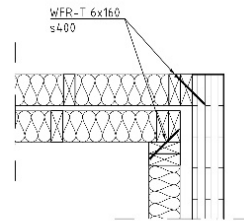
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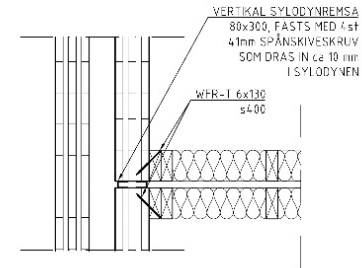
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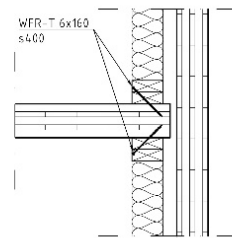
1. 1:10  
YTTERVÄGGSHÖRN - DETALJ | PLAN



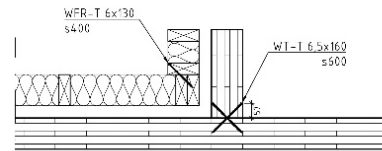
2. 1:10  
PLAN RÖ PASSAGE MOT HISS OCH TRAPPUS - DETALJ | PLAN



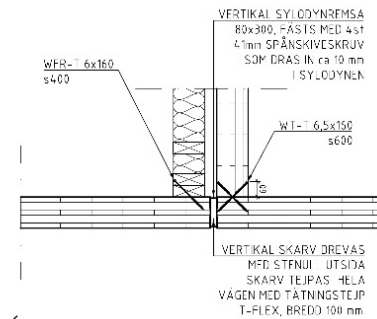
3. 1:10  
LÅGENNETSKILJANDE KL PLAN 10 - DETALJ | PLAN



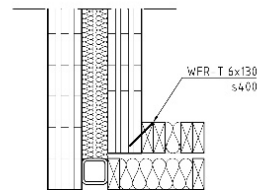
4. 1:10  
PLAN 10 KL-VÄGG MÖTER LGH/TRAPPUSVÄGG - DETALJ | PLAN



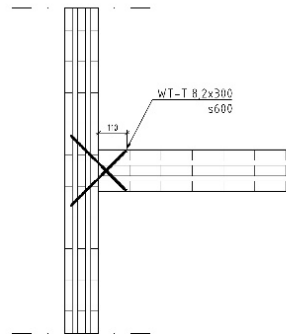
5. 1:10  
PLAN RÖ HÖRN VID TRAPPUS/LGH - DETALJ | PLAN



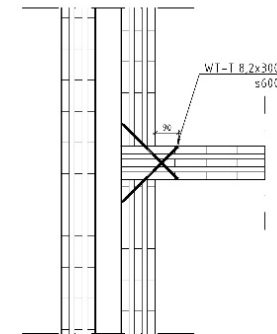
6. 1:10  
HÖRN VID LÅGENHET OCH TRAPPUS MOT YTTERVÄGG - DETALJ | PLAN



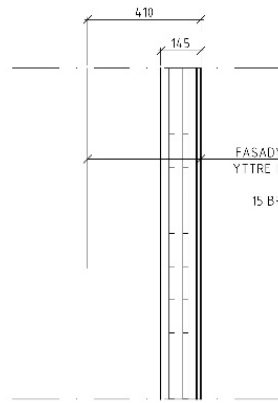
7. 1:10  
PLAN 10 GOLSKILJANDE VÄGG MED BALKHÖLJAC - DETALJ | PLAN



8. 1:10  
ALLA PLAN BARANDE TVÄRVÄGG KL60 INRC (LGH) - DETALJ | PLAN

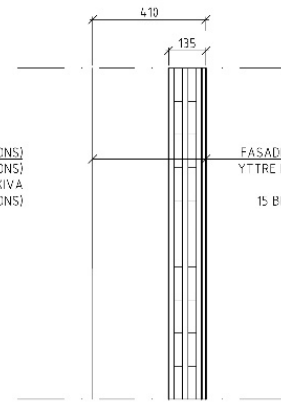


9. 1:10  
PLAN RÖ ENTRETTESVÄGG - DETALJ | PLAN



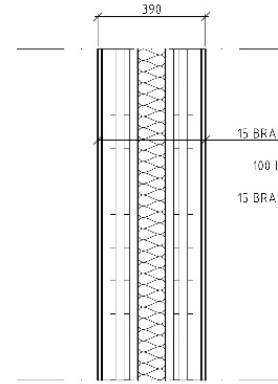
1. 1:10  
YTTERVÆG PLAN 10

FASADMATERIAL (EJ MARTINSONS)  
YTTRRE SOLERING (EJ MARTINSONS)  
130 KL-TRÅSKIVA  
15 BRANDGIPS (EJ MARTINSONS)



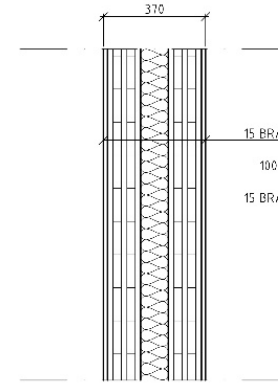
2. 1:10  
YTTERVÆG PLAN 11-12

FASADMATERIAL (EJ MARTINSONS)  
YTTRRE SOLERING (EJ MARTINSONS)  
120 KL-TRÅSKIVA  
15 BRANDGIPS (EJ MARTINSONS)



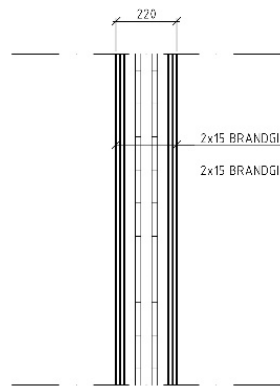
3. 1:10  
LØSNINGSKILLE I ANDE VÆG PLAN 10

15 BRANDGIPS (EJ MARTINSONS)  
130 KL-TRÅSKIVA  
100 LØSULL (EJ MARTINSONS)  
130 KL-TRÅSKIVA  
15 BRANDGIPS (EJ MARTINSONS)



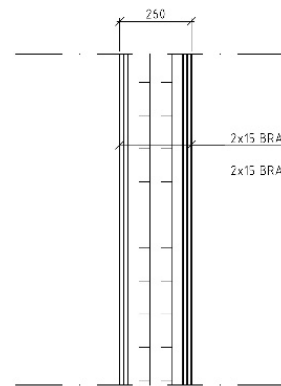
4. 1:10  
LØSNINGSKILLE I ANDE VÆG PLAN 11-12

15 BRANDGIPS (EJ MARTINSONS)  
120 KL-TRÅSKIVA  
100 LØSULL (EJ MARTINSONS)  
120 KL-TRÅSKIVA  
15 BRANDGIPS (EJ MARTINSONS)



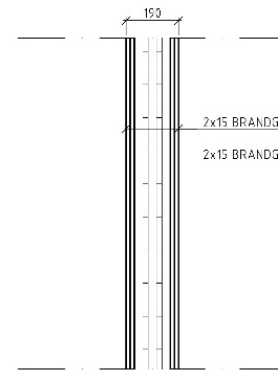
5. 1:10  
INNERVÆG GAVELLÆGNINGER

2x15 BRANDGIPS (EJ MARTINSONS)  
160 KL-TRÅSKIVA  
2x15 BRANDGIPS (EJ MARTINSONS)



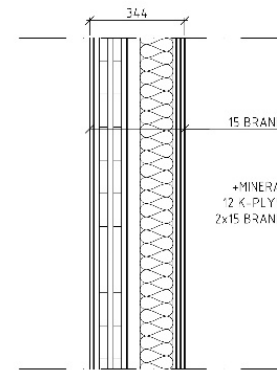
6. 1:10  
INNERVÆG MITTLÆGNINGER

2x15 BRANDGIPS (EJ MARTINSONS)  
200 KL-TRÅSKIVA  
2x15 BRANDGIPS (EJ MARTINSONS)



7. 1:10  
INNERVÆG PLAN 10

2x15 BRANDGIPS (EJ MARTINSONS)  
130 KL-TRÅSKIVA  
2x15 BRANDGIPS (EJ MARTINSONS)



8. 1:10  
VÆG MOT TRAPPE- OG HISS

15 BRANDGIPS (EJ MARTINSONS)  
120 KL-TRÅSKIVA  
LUFTESPALT  
45x170 RFG AR  
+MINERALULL (EJ MARTINSONS)  
12 KL-PLYWOOD (EJ MARTINSONS)  
2x15 BRANDGIPS (EJ MARTINSONS)



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- THERMOWOOD WITH TINTED PROTECTION-STAIN
- JAPANESE BURNT WOOD NOT ALLOWED FOR TALL BUILDING



# CHALLENGES

**HAND-OVER FROM SYSTEM-SUPPLIER/CONTRACTOR TO MAIN CONTRACTOR**

**VISUAL WOOD – FIRE AND INSURANCE COMPANY**

**MOIST DESCRIPTIONS – BUILDINGSITE AND MOIST REPAIRS**

**MEASURABLE EXPENSES COMPARED TO CONVENTIONAL BUILDING**

# STATUS IN DENMARK

- Many timber buildings up to 4 storeys
- Only ONE completed building over 4 storeys



## MOXY HOTEL COPENHAGEN

- 5 floors
- Concrete elements to ground floor
- CLT wall and floor elements to upper floors

## FÆLLESBYG, KØGE KYST

- Up to 7 floors
- LVL post/beam
- CLT/concrete floors
- Sprinkler system
- ~~TIMBER ABANDONED~~
- NOW CONCRETE BECAUSE OF CONSTRUCTIONAL COMPLEXITY

## STUDENT APARTMENTS ØSTERBRO

- 24 apartments
- CREE Denmark
- Composite system
- Glulam/concrete
- Sprinkler system

# FIRE

FIRE REGULATIONS TREAT  
TIMBER DIFFERENTLY  
THAN CONCRETE AND  
STEEL

NEED TO USE TECHNICAL  
FIRE DOCUMENTATION  
FOR MORE THAN 4  
STOREYS

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# Danish Building Regulations 2018

## Preaccepted solutions for multi-storey residential buildings

<b>Number of floors:</b>	<b>1</b>	<b>up to 4</b>	<b>up to 16</b>
<b>Fireprotection:</b>	<b>30 minuts</b>	<b>60 minuts</b>	<b>120 minuts</b>
<b>Wood:</b>	<b>YES</b>	<b>YES</b>	<b>NO</b>
<b>Concrete and steel:</b>	<b>YES</b>	<b>YES</b>	<b>YES</b>

# Danish Building Regulations 2018

## Preaccepted solutions for multi-storey residential buildings

Number of floors:	1	up to 4	up to 8	up to 16
Fireprotection:	30 minuts	60 minuts	90 minuts	120 minuts
Wood:	YES	YES	YES	NO
Concrete and steel:	YES	YES	YES	YES
			NEW SUGGESTION	

**THANK YOU!**

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