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**HAMK**



## SUSTAINABLE, HIGH-PERFORMANCE BUILDING SOLUTIONS IN WOOD

2020-1-LV01-KA203-077513

# Black Rhino Group

## DESIGN COORDINATION

Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk:  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła  
19-05-2022



Sources:

10) <https://www.livekindly.co/british-troops-anti-poaching-endangered-black-rhinos/>



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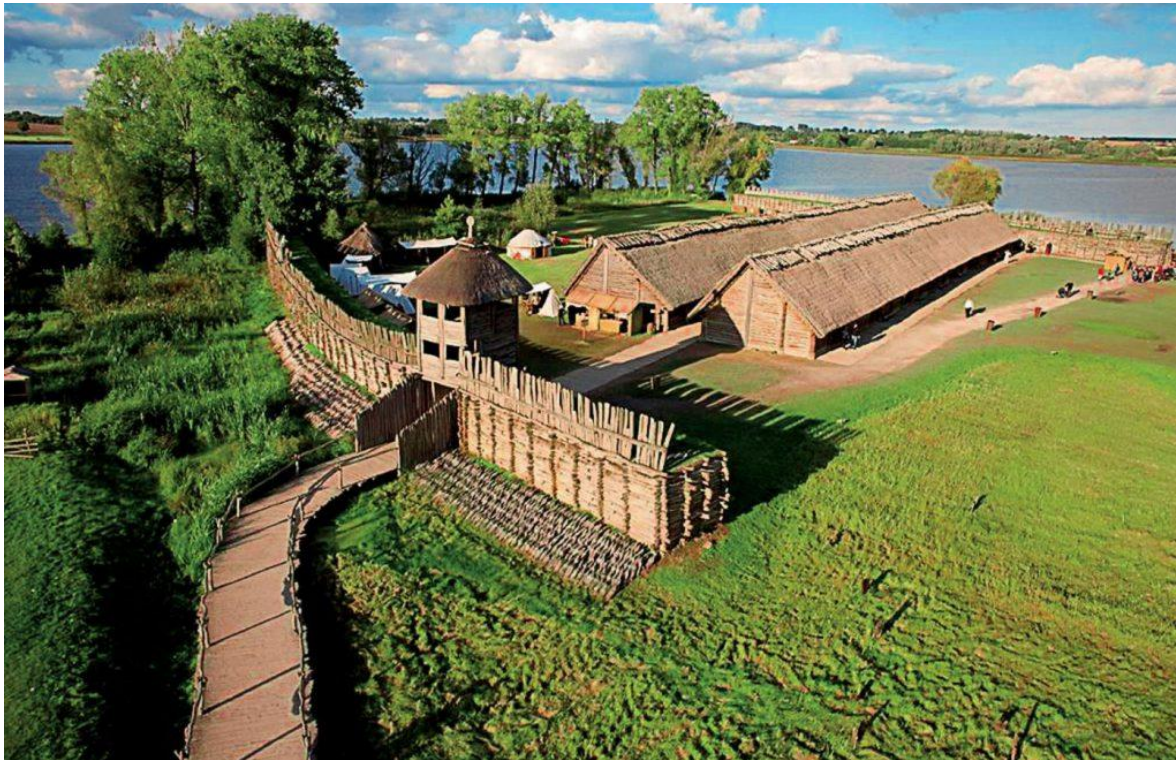


RIGA  
BUILDING  
COLLEGE

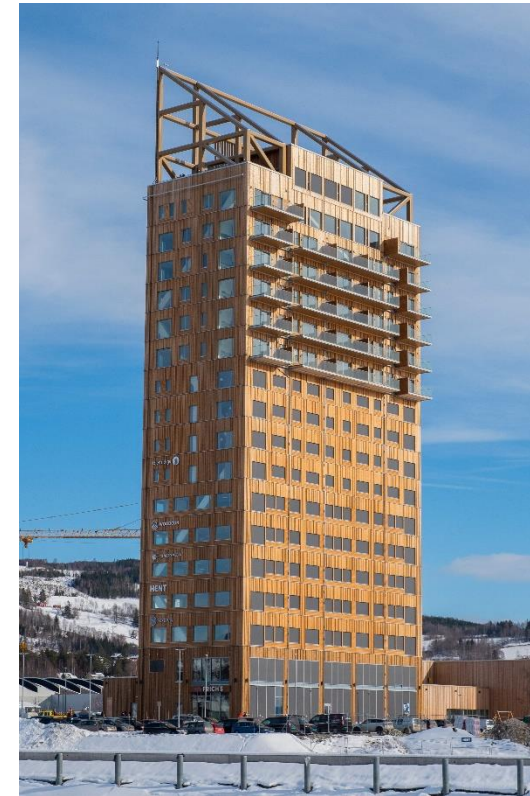


# Introduction

## Biskupin settlement - VIII century b.c



## Mjøstårnet - nowadays



Sources:

- 1) <https://naturadomki.pl/uncategorized/pierwsza-osada-w-Biskupinie/>
- 2) <https://nieruchomosci.wprost.pl/mieszkania/10200533/mjostarnet-najwyzszy-drewniany-budynek-swiata-stoi-w-norwegii.html>



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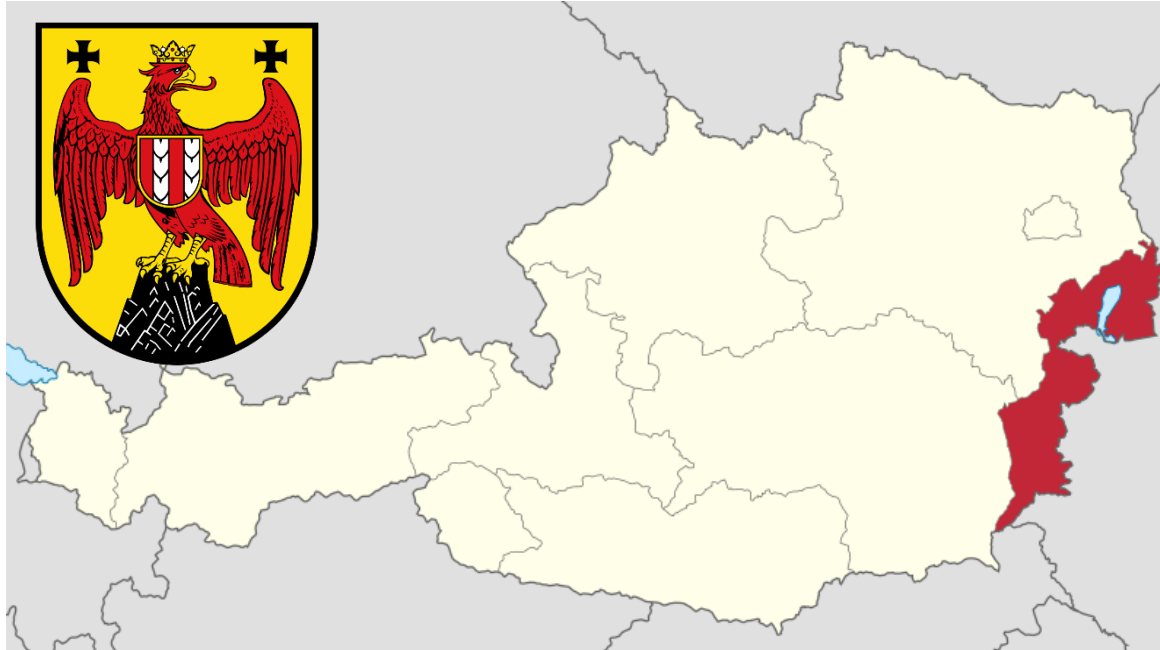


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# Location

## Burgenland



## Stegersbach



Sources:

3) <https://es.wikipedia.org/wiki/Burgenland>

4) <http://www.fahnen-gaertner.com> - [http://www.fahnen-gaertner.com/dl\\_center/index.php?fg\\_fahnenkatalog\\_ebook.pdf](http://www.fahnen-gaertner.com/dl_center/index.php?fg_fahnenkatalog_ebook.pdf), Domena publiczna, <https://commons.wikimedia.org/w/index.php?curid=4990859>

5) <https://www.therme-stegersbach.com/stegersbach-infos/>



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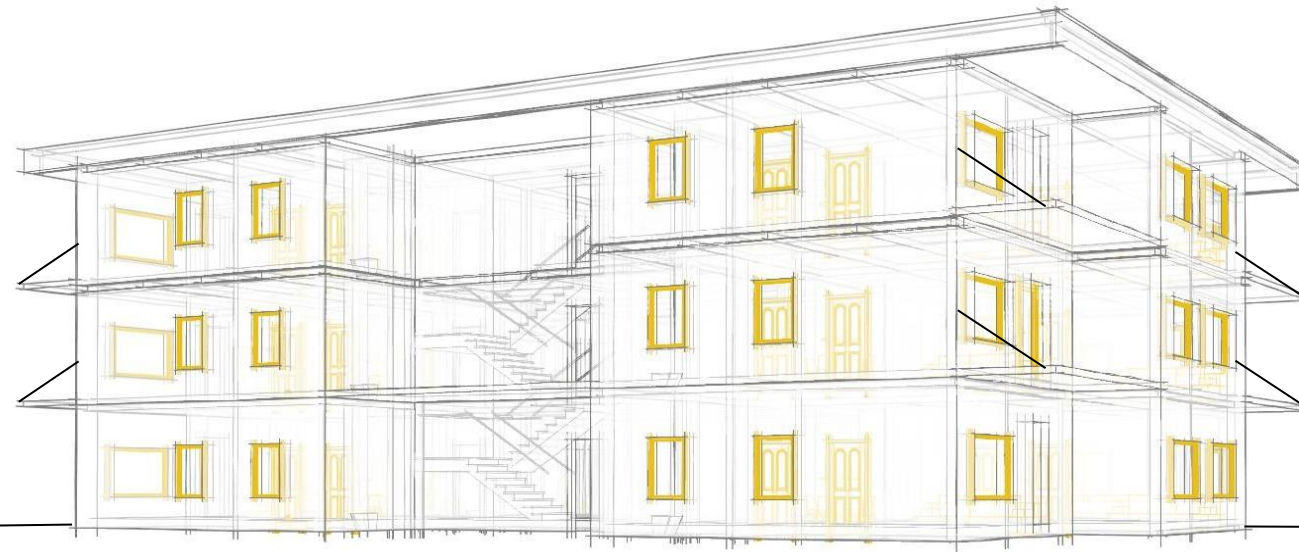
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
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# Architecture

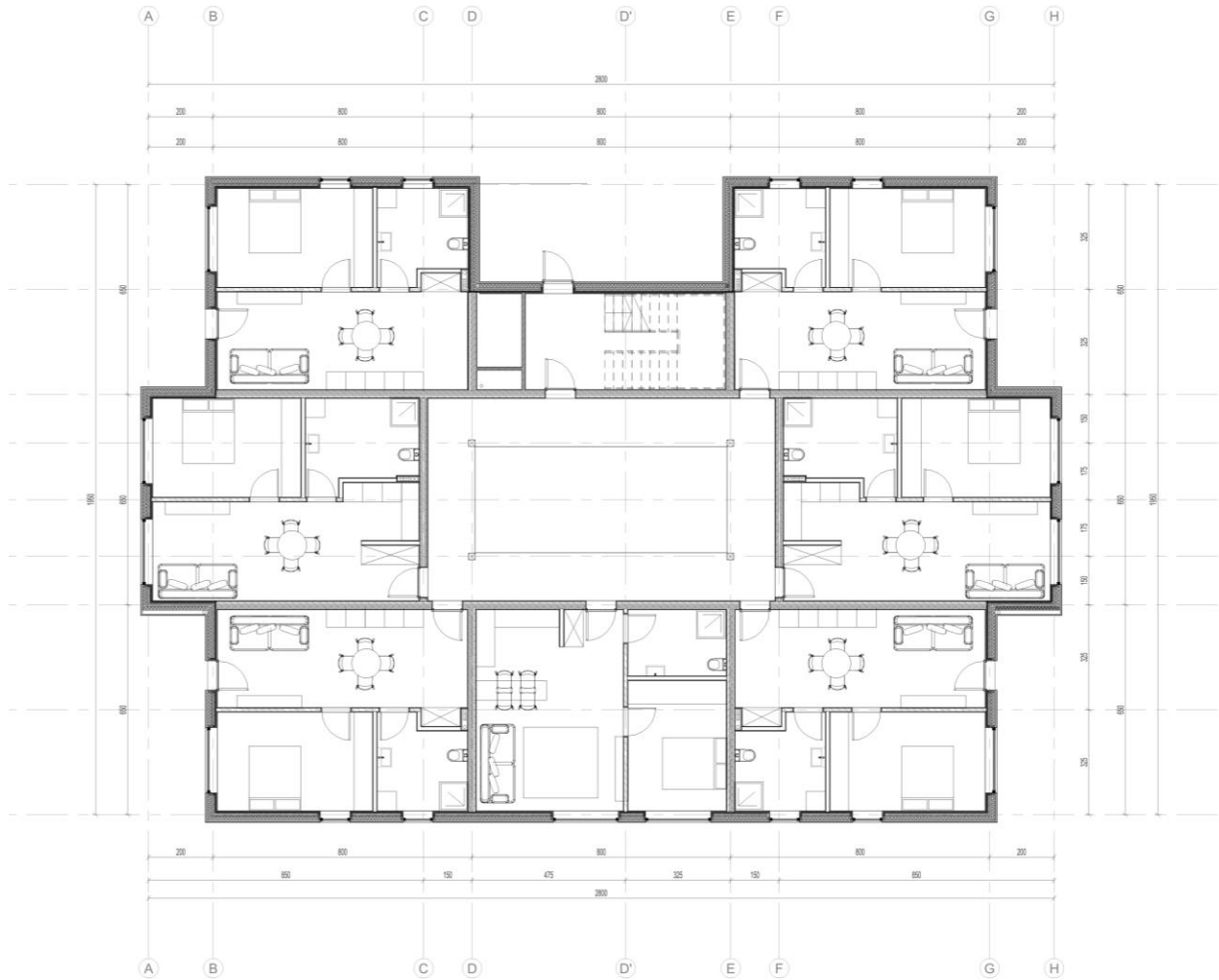




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# Floor plan



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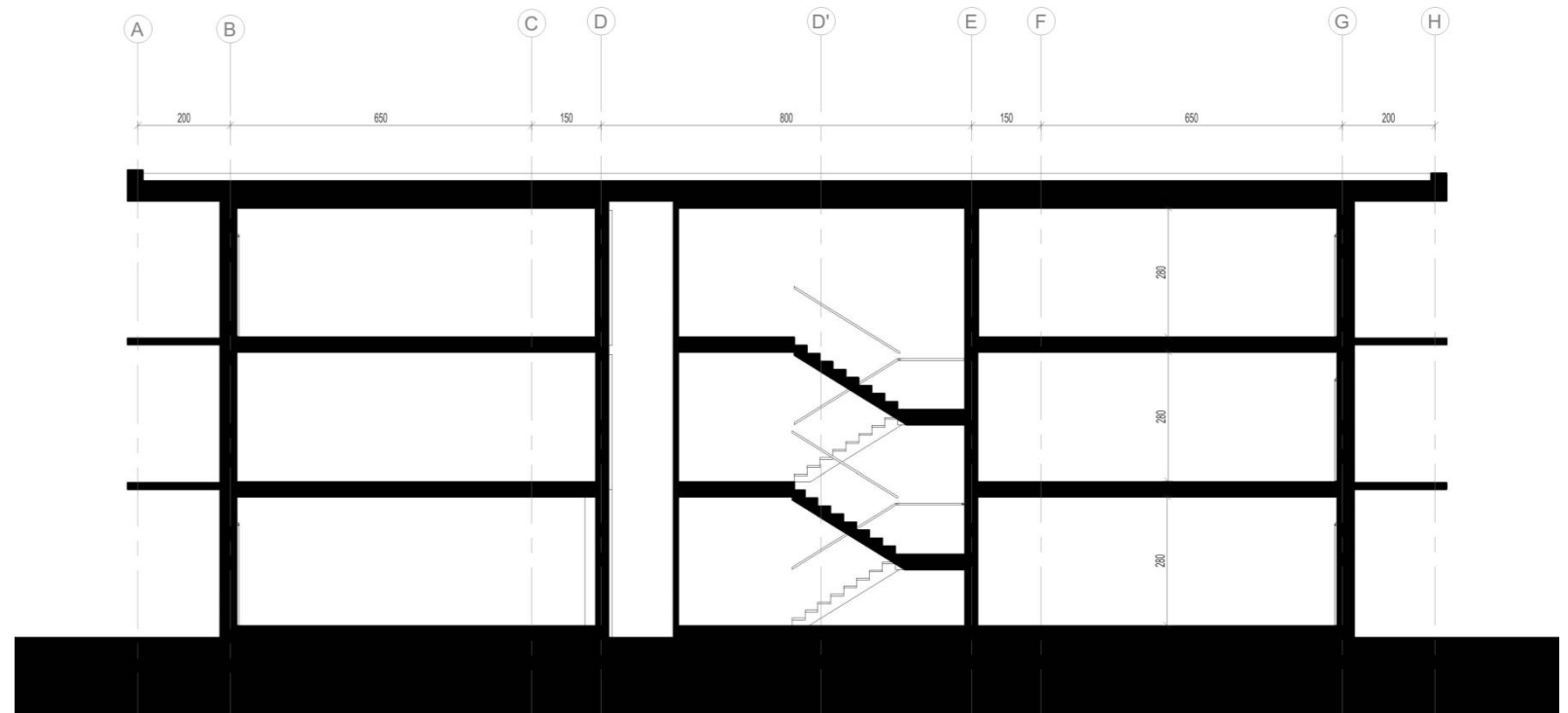


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# Live loads

- Imposed loads
- Snow load
- Wind load
- Accidental loads





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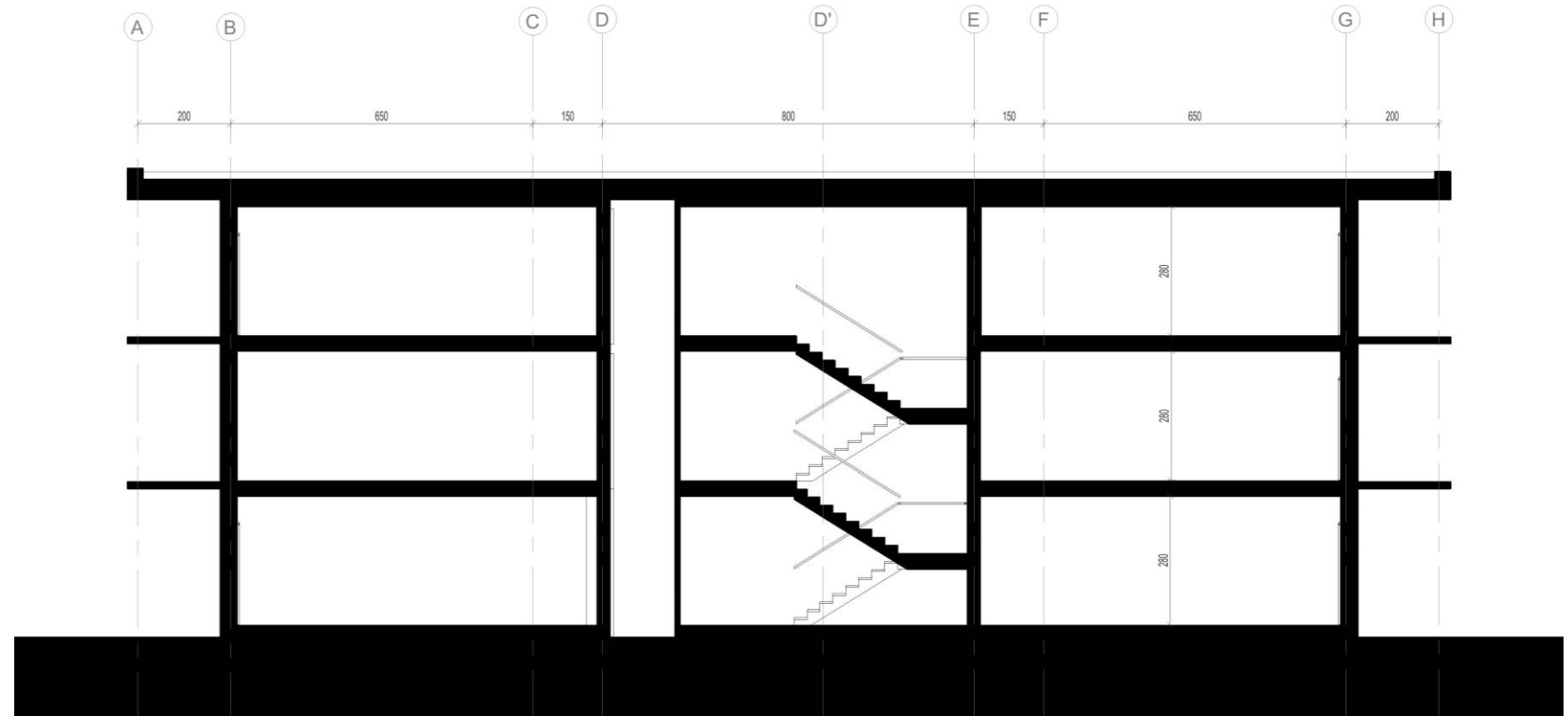
## Design coordination

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# Permanent loads

- Floors
- Roof
- Walls
- Stairs







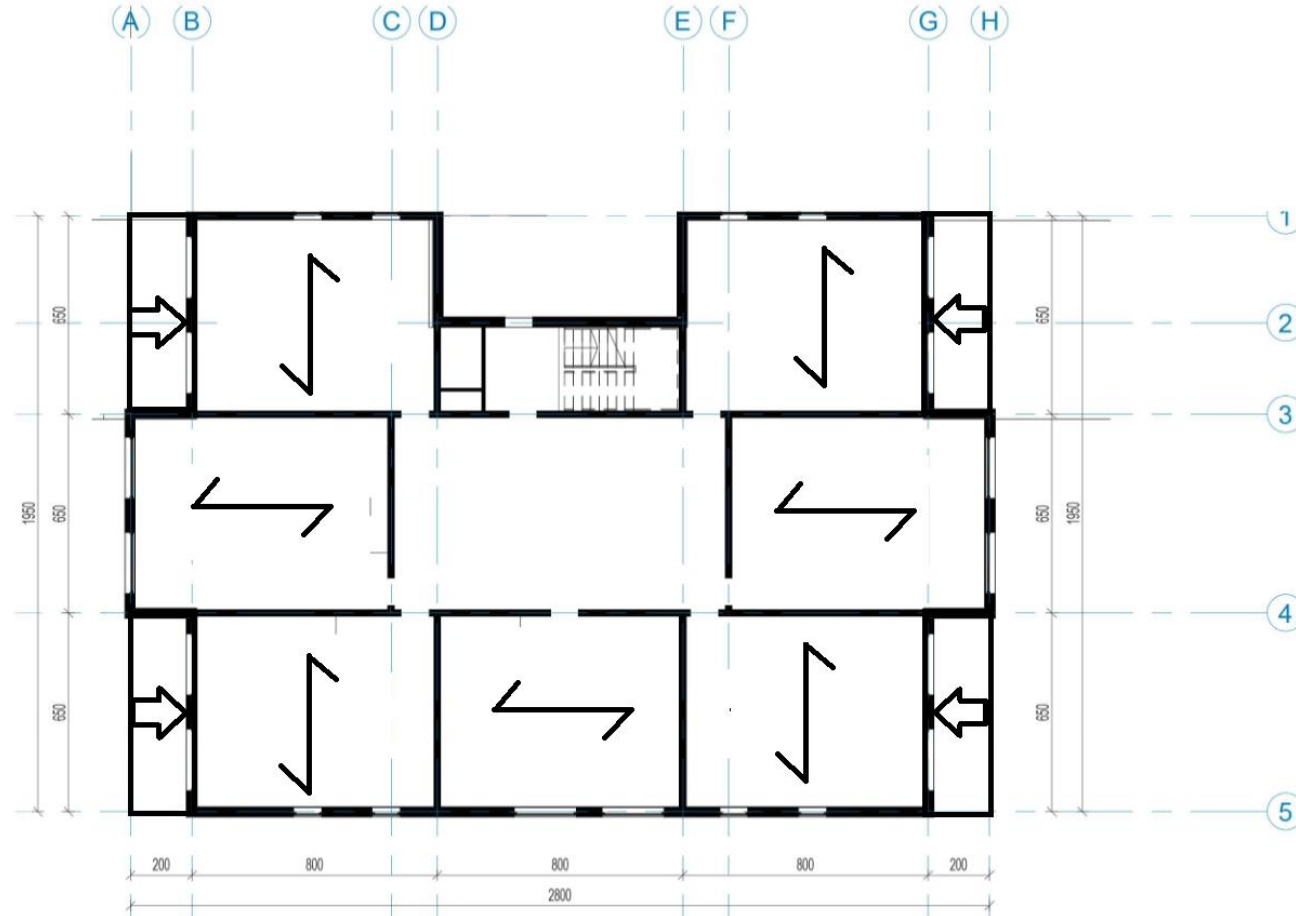
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# Load path





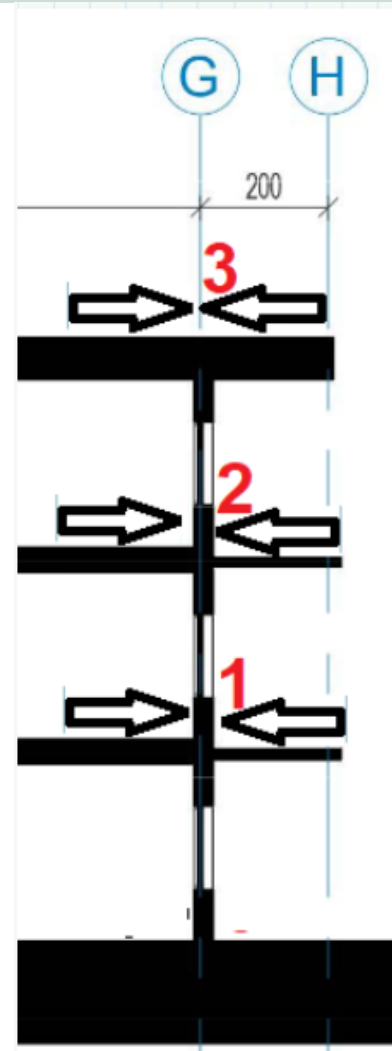
# Load combinations

Persistent and transient design situations	Permanent actions		Leading variable action (*)	Accompanying variable actions (*)
	Unfavourable	Favourable		
(Eq. 6.10a)	$1.35 K_{FI} Q_{kj,sup}$	$0.9 G_{kj,inf}$		
(Eq. 6.10b)	$1.15 K_{FI} Q_{kj,sup}$	$0.9 G_{kj,inf}$	$1.5 K_{FI} Q_{k,1}$	$1.5 K_{FI} \psi_{0,i} Q_{k,i}$

$$\left\{ \begin{array}{l} 1,15 K_{FI} G_{kj,sup} + 0,9 G_{kj,inf} + 1,5 K_{FI} Q_{k,1} + 1,5 K_{FI} \sum_{i>1} \psi_{0,i} Q_{k,i} \\ 1,35 K_{FI} G_{kj,sup} + 0,9 G_{kj,inf} \end{array} \right.$$



# Load calculations example



$$(1) \text{ Live load: } q_{live1} := 2.0 \frac{kN}{m^2} \cdot 4 m + 2.0 \frac{kN}{m^2} \cdot 2 m = 12 \frac{kN}{m}$$

$$\text{Dead load: } q_{dead1} := 0.3 \frac{kN}{m^2} \cdot 4 m + 0.1 \frac{kN}{m^2} \cdot 2 m = 1.4 \frac{kN}{m}$$

$$(2) \text{ Live load: } q_{live2} := 2.0 \frac{kN}{m^2} \cdot 4 m + 2.0 \frac{kN}{m^2} \cdot 2 m = 12 \frac{kN}{m}$$

$$\text{Dead load: } q_{dead2} := 0.3 \frac{kN}{m^2} \cdot 4 m + 0.1 \frac{kN}{m^2} \cdot 2 m = 1.4 \frac{kN}{m}$$

$$(3) \text{ Live load: } q_{live3} := 1.45 \frac{kN}{m^2} \cdot 4 m + 1.45 \frac{kN}{m^2} \cdot 2 m = 8.7 \frac{kN}{m}$$

$$\text{Dead load: } q_{dead3} := 0.12 \frac{kN}{m^2} \cdot 4 m + 0.12 \frac{kN}{m^2} \cdot 2 m = 0.72 \frac{kN}{m}$$

ULS LOAD COMBINATION FOR EACH FLOOR

$$q_{ULS1} := 1.35 \cdot q_{dead1} + 1.5 \cdot q_{live1} = 19.89 \frac{kN}{m}$$

$$q_{ULS2} := 1.35 \cdot q_{dead2} + 1.5 \cdot q_{live2} = 19.89 \frac{kN}{m}$$

$$q_{ULS3} := 1.35 \cdot q_{dead3} + 1.5 \cdot q_{live3} = 14.022 \frac{kN}{m}$$



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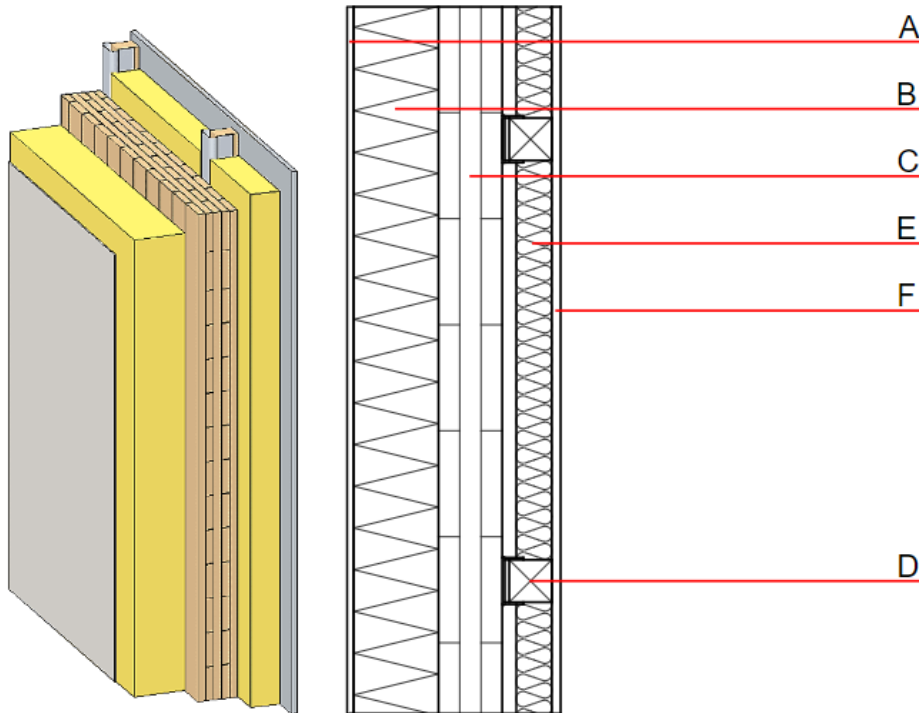
## Design coordination

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# Components

# External walls



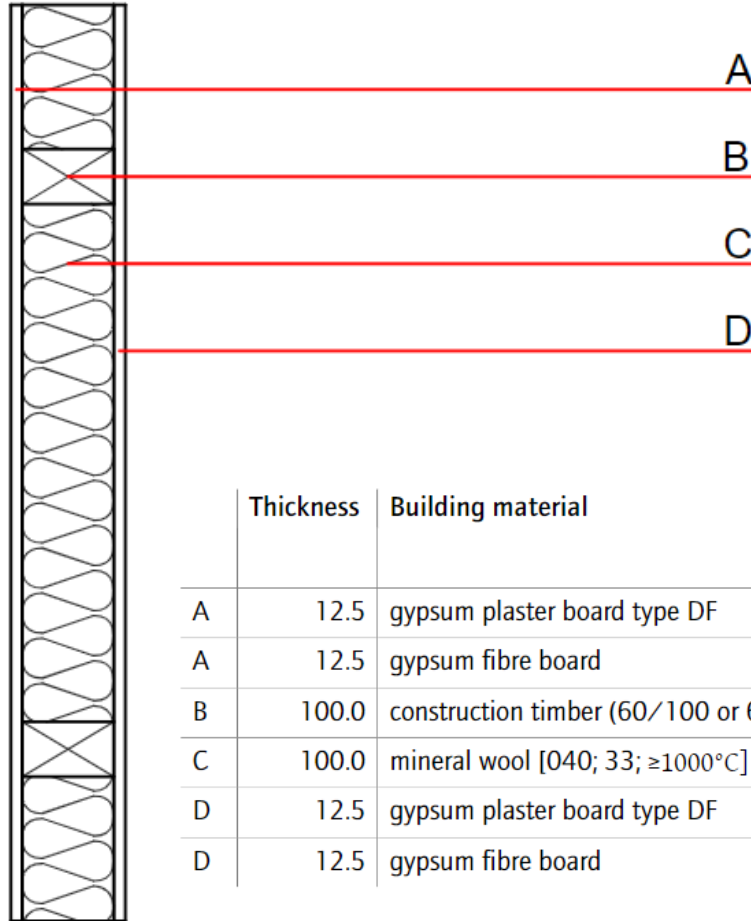
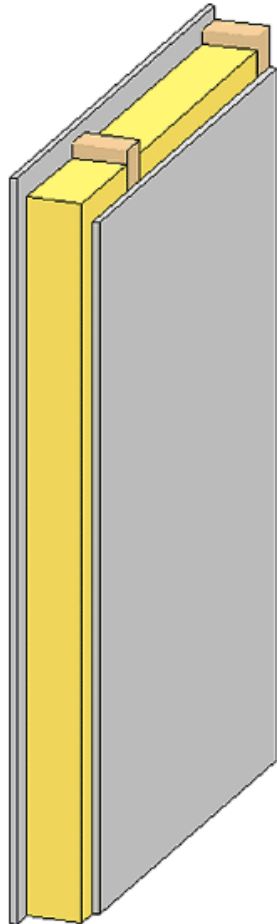
Regulation demands:		
<b>Fire safety:</b> OIB-Richtlinie 2	<b>Sound:</b> OIB- Richtlinie 5	<b>U-value:</b> OIB- Richtlinie 6
REI60	Rw=48 dB	0.35 W/m²K
Technical Information:		
REI90	Rw=48 dB	0.20 W/ m²K

	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A	7.0	plaster	1.000	10 - 35	2000	1.130	A1
B	120.0	mineral wool MW-PT [041; 155] ETICS insulation panel	0.041	1	155	1.030	A1
C	100.0	cross laminated timber	0.130	50	500	1.600	D
D	70.0	spruce wood battens (60/60) mounted on resilient clips; e=660	0.120	50	450	1.600	D
E	50.0	mineral wool [040; $\geq 16$ ; <1000°C]	0.040	1	16	1.030	A1
F	12.5	gypsum plaster board type DF or	0.250	10	800	1.050	A2
F	12.5	gypsum fibre board	0.320	21	1000	1.100	A2



## Design coordination

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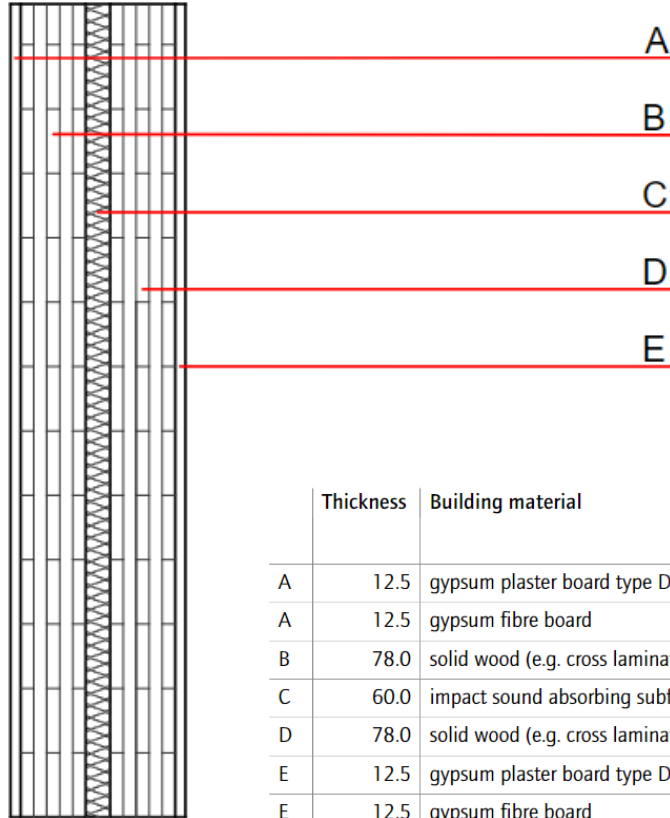
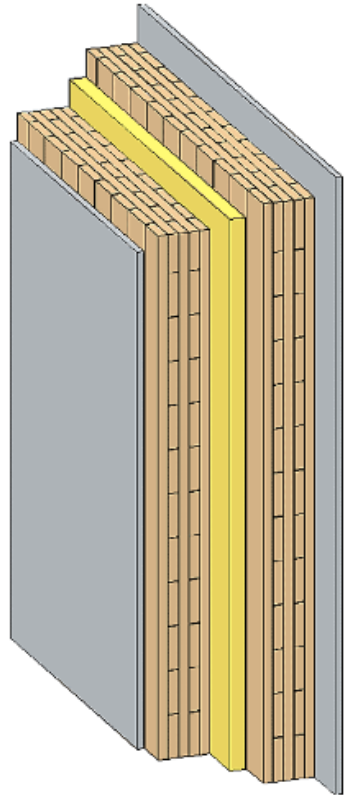
# Partition wall

	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A	12.5	gypsum plaster board type DF	0.250	10	800	1.050	A2
A	12.5	gypsum fibre board	0.320	21	1000	1.100	A2
B	100.0	construction timber (60/100 or 60/160; e=*)	0.120	50	450	1.600	D
C	100.0	mineral wool [040; 33; $\geq 1000^\circ\text{C}$ ]	0.040	1	33	1.030	A1
D	12.5	gypsum plaster board type DF	0.250	10	800	1.050	A2
D	12.5	gypsum fibre board	0.320	21	1000	1.100	A2



## Design coordination

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# Internal walls [60dB]

### Regulation demands:

Fire safety: OIB-Richtlinie 2	Sound: OIB-Richtlinie 5	U-value: OIB-Richtlinie 6
REI60	Rw=60 dB	0,9 W/m²K

### Technical Information:

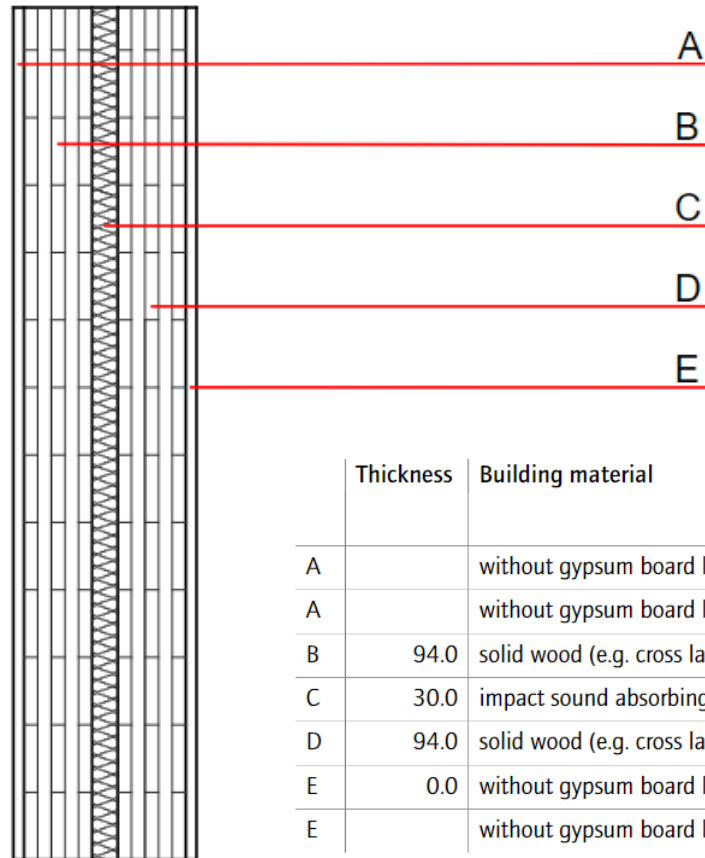
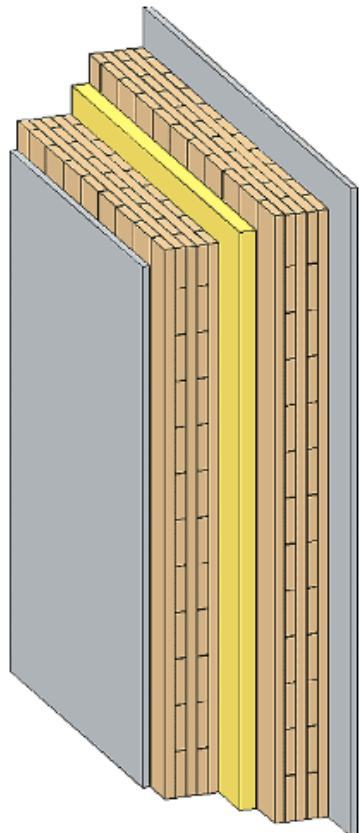
REI60	Rw=60 dB	0,29 W/ m²K
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	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A	12.5	gypsum plaster board type DF	0.250	10	800	1.050	A2
A	12.5	gypsum fibre board	0.320	21	1000	1.100	A2
B	78.0	solid wood (e.g. cross laminated timber)	0.130	50	500	1.600	D
C	60.0	impact sound absorbing subflooring MW-T	0.035	1	68	1.030	A1
D	78.0	solid wood (e.g. cross laminated timber)	0.130	50	500	1.600	D
E	12.5	gypsum plaster board type DF	0.250	10	800	1.050	A2
E	12.5	gypsum fibre board	0.320	21	1000	1.100	A2



## Design coordination

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# Internal walls [48dB]

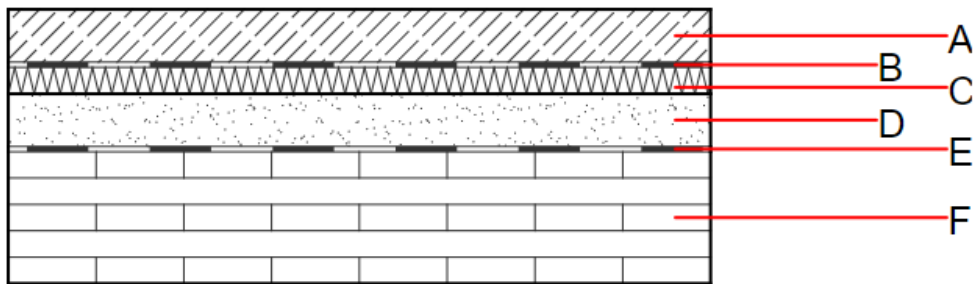
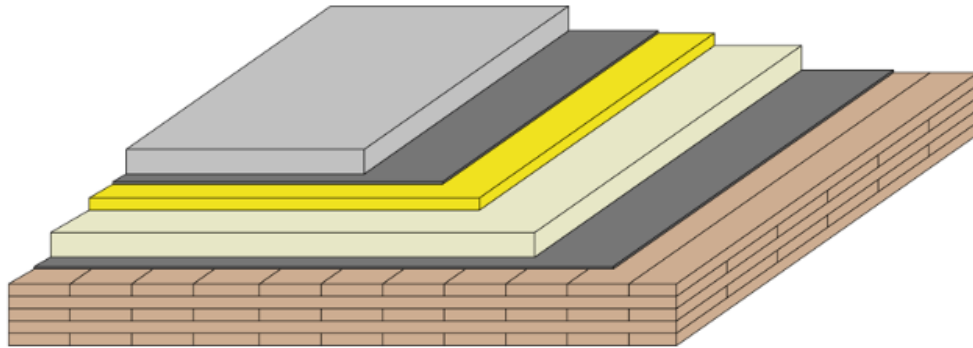
Regulation demands:		
<b>Fire safety:</b> OIB-Richtlinie 2	<b>Sound:</b> OIB- Richtlinie 5	<b>U-value:</b> OIB- Richtlinie 6
REI60	Rw=47 dB	0.90 W/m²K
Technical Information:		
REI60	Rw=48 dB	0.39 W/ m²K

	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A		without gypsum board lining					
A		without gypsum board lining					
B	94.0	solid wood (e.g. cross laminated timber)	0.130	50	500	1.600	D
C	30.0	impact sound absorbing subflooring MW-T	0.035	1	68	1.030	A1
D	94.0	solid wood (e.g. cross laminated timber)	0.130	50	500	1.600	D
E	0.0	without gypsum board lining					
E		without gypsum board lining					





# Intermediate floor



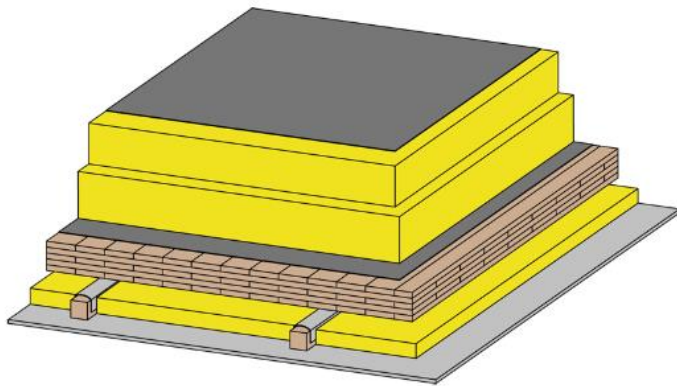
## Regulation demands:

Fire safety: OIB-Richtlinie 2	Sound: OIB- Richtlinie 5	U-value: OIB- Richtlinie 6
REI60	Rw=48 dB	0.9 W/m²K

## Technical Information:

REI60	Rw=54 dB	0,44 W/ m²K
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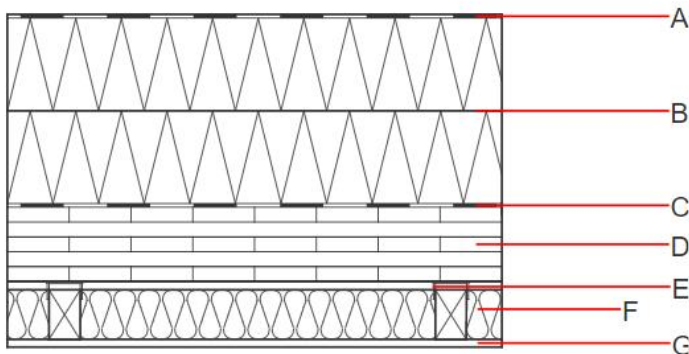
	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A	60.0	cement screed	1.330	50 - 100	2000	1.080	A1
B		plastic separation layer	0.200	100000	1400	1.400	E
C	30.0	impact sound absorbing subflooring MW-T [ $s' = 35\text{MN/m}^3$ ]	0.035	1	120	1.030	A2
D	60.0	bonded chippings	0.700	1	1800	1.000	A1
E		trickling protection					E
F	140.0	cross laminated timber $\geq 140,0$ ; at least 5-layers, top layer at least 26 mm)	0.130	50	500	1.600	D



# Flat roof

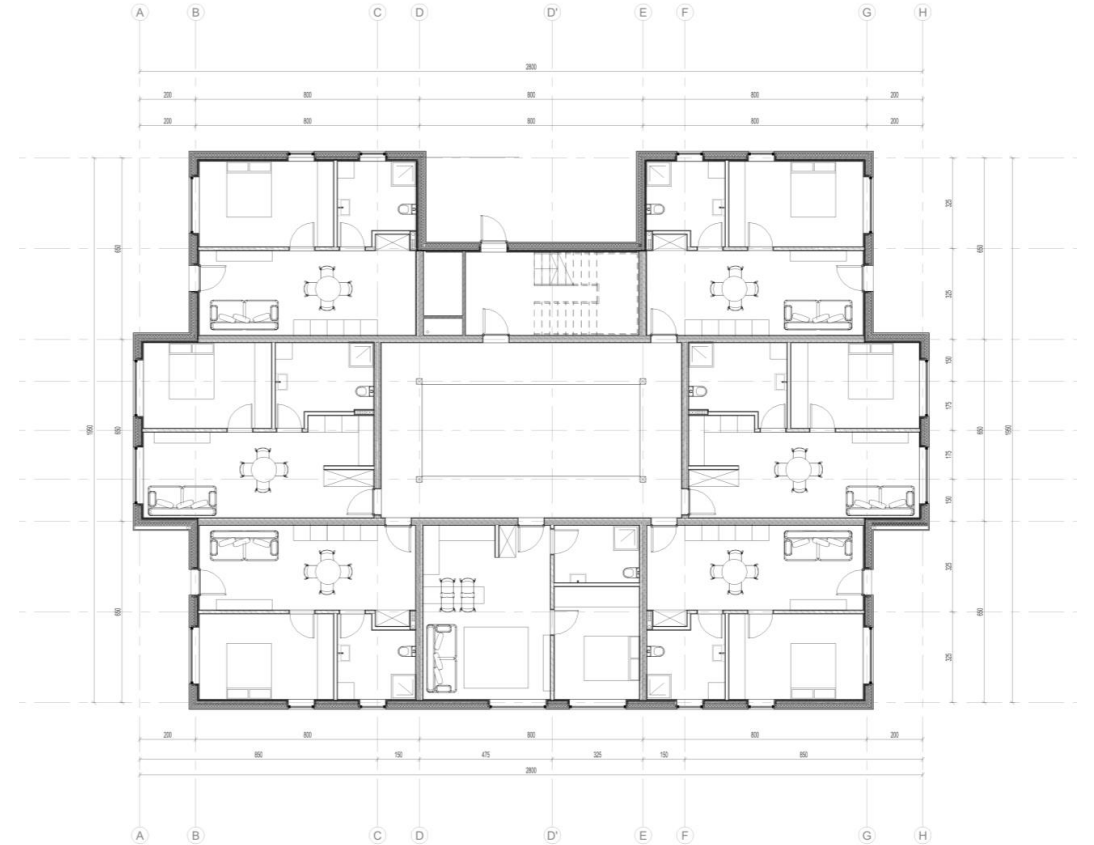
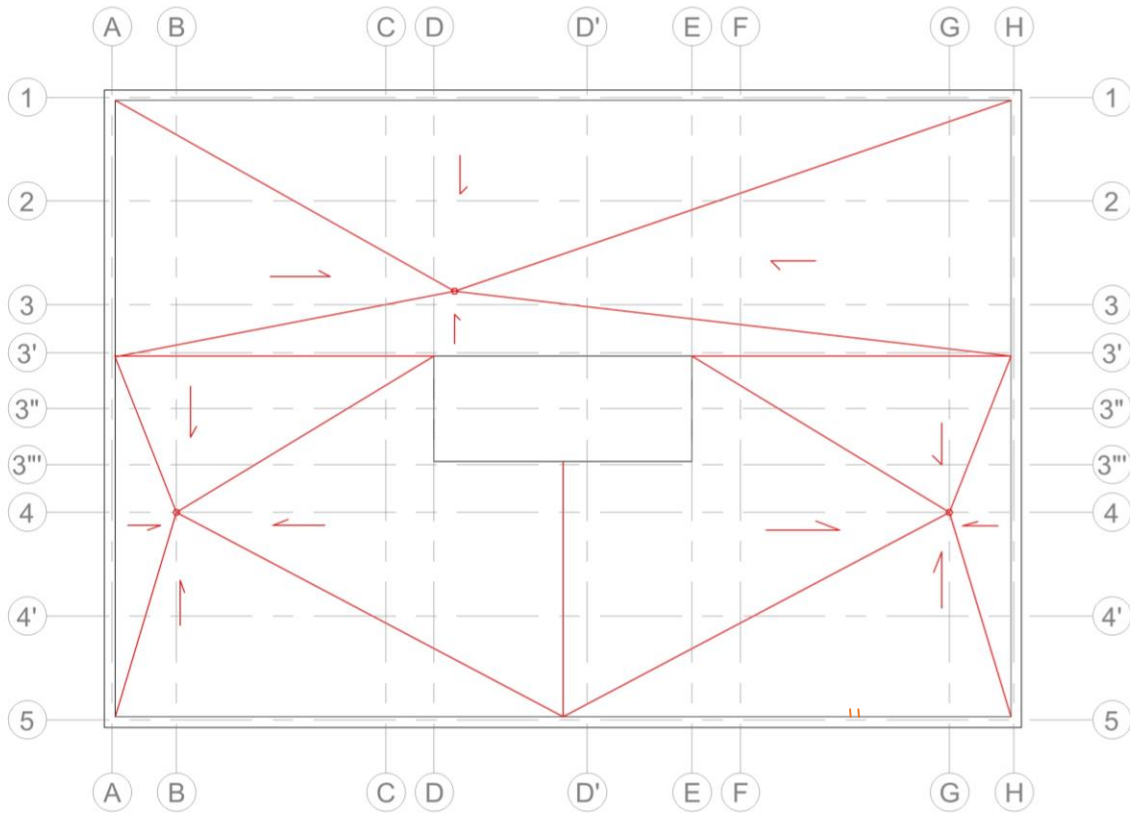
### Regulation demands:

Fire safety: OIB-Richtlinie 2	Sound: OIB- Richtlinie 5	U-value: OIB- Richtlinie 6
REI60	Rw=48 dB	0,15 W/m²K
Technical Information:		
REI60	Rw=48 dB	0,09 W/ m²K



	Thickness	Building material	Thermal performance				Reaction to fire EN
			$\lambda$	$\mu$ min – max	$\rho$	c	
A		Plastic roofing membrane					E
B	300.0	mineral wool [040; 130; $\geq 1000^\circ\text{C}$ ]; pressure-resistant	0.040	1	130	1.030	A1
C		sealing sheet					
D	125.0	cross laminated timber $\geq 125,0$ ; at least 5-layers, top layer at least 27,5 mm	0.130	50	500	1.600	D
E	80.0	spruce wood ; battens on resilient clips (50/80; e=625)	0.120	50	450	1.600	D
F	80.0	mineral wool [040; 18]	0.040	1	18	1.030	A1
G	19.0	3-ply solid wood panel	0.110	50	400	2.500	D

# Drainage system





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# Windows



### Regulation demands:

**Fire safety:**  
OIB-Richtlinie  
2

REI60

**Sound:**  
OIB- Richtlinie 5

Rw=38 dB

**U-value:** OIB- Richtlinie 6

1.4 W/m²K

### Technical Information:

REI60

Rw=45 dB

Up to 0,64 W/ m²K



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# Superstructure catalogue - Details



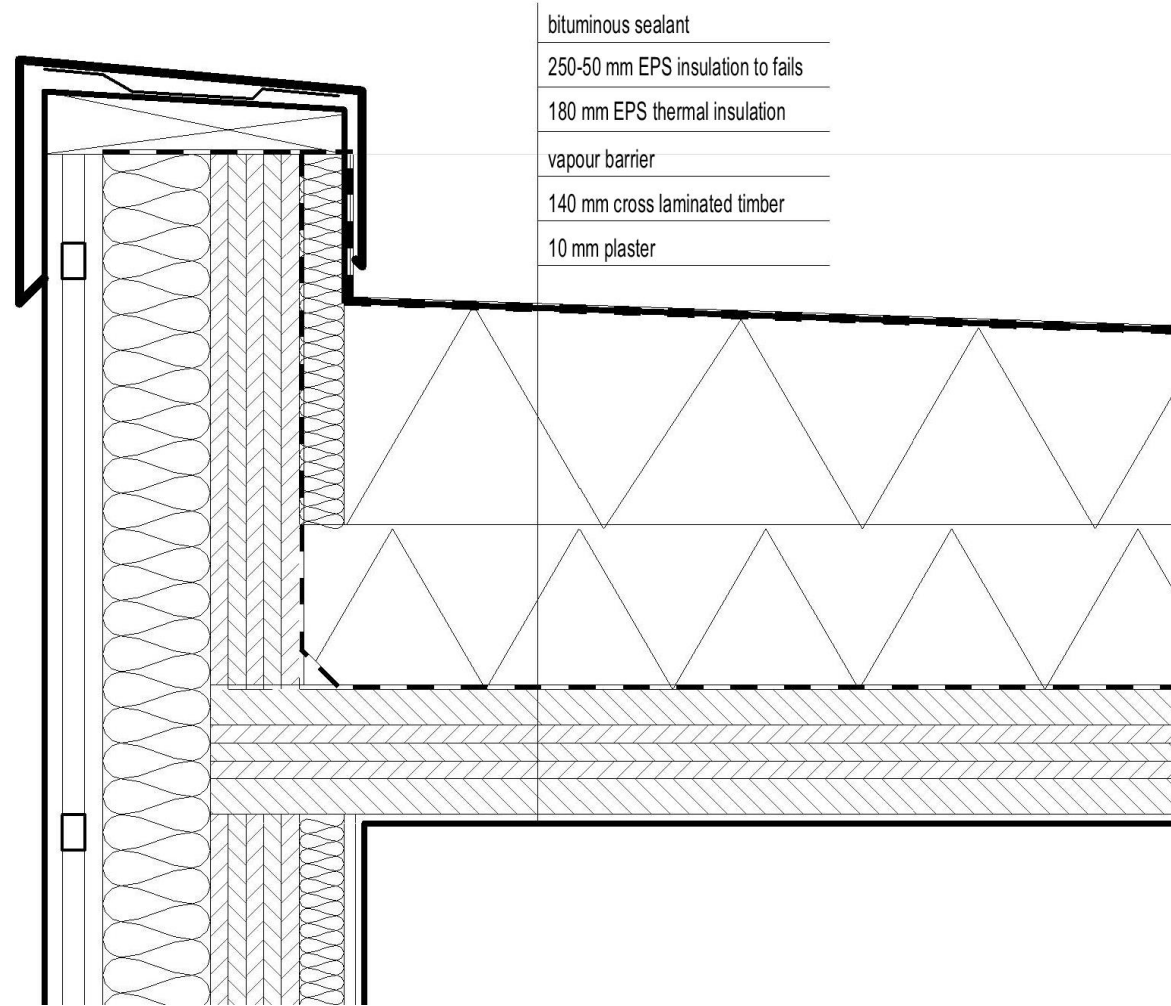
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# Exterior wall-roof





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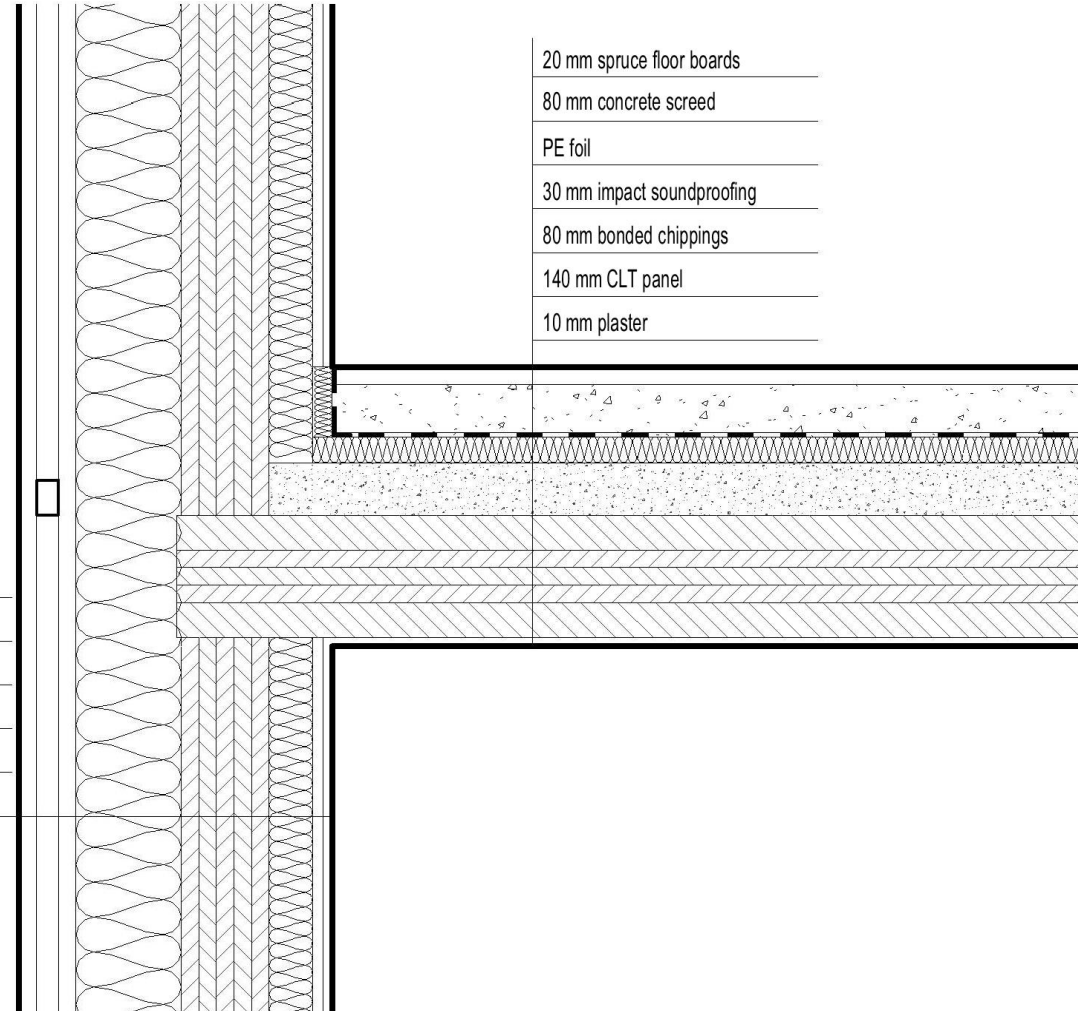


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# Exterior wall-ceiling

10 mm plaster
120 mm mineral wool
100 mm CLT panel
50 mm mineral wool
12.5 mm gypsum plaster board
10 mm plaster



20 mm spruce floor boards
80 mm concrete screed
PE foil
30 mm impact soundproofing
80 mm bonded chippings
140 mm CLT panel
10 mm plaster



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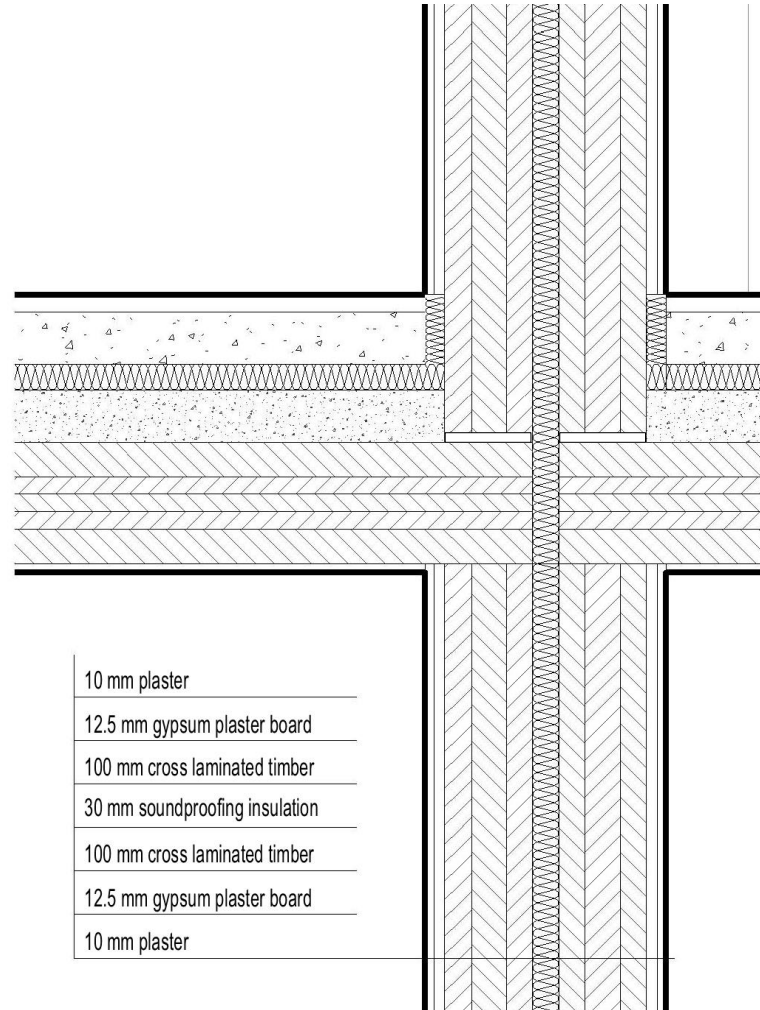
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
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# Interior wall-ceiling



- 10 mm plaster
- 12.5 mm gypsum plaster board
- 100 mm cross laminated timber
- 30 mm soundproofing insulation
- 100 mm cross laminated timber
- 12.5 mm gypsum plaster board
- 10 mm plaster





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FH  
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WIEN  
UNIVERSITY OF APPLIED SCIENCES



RIGA  
BUILDING  
COLLEGE



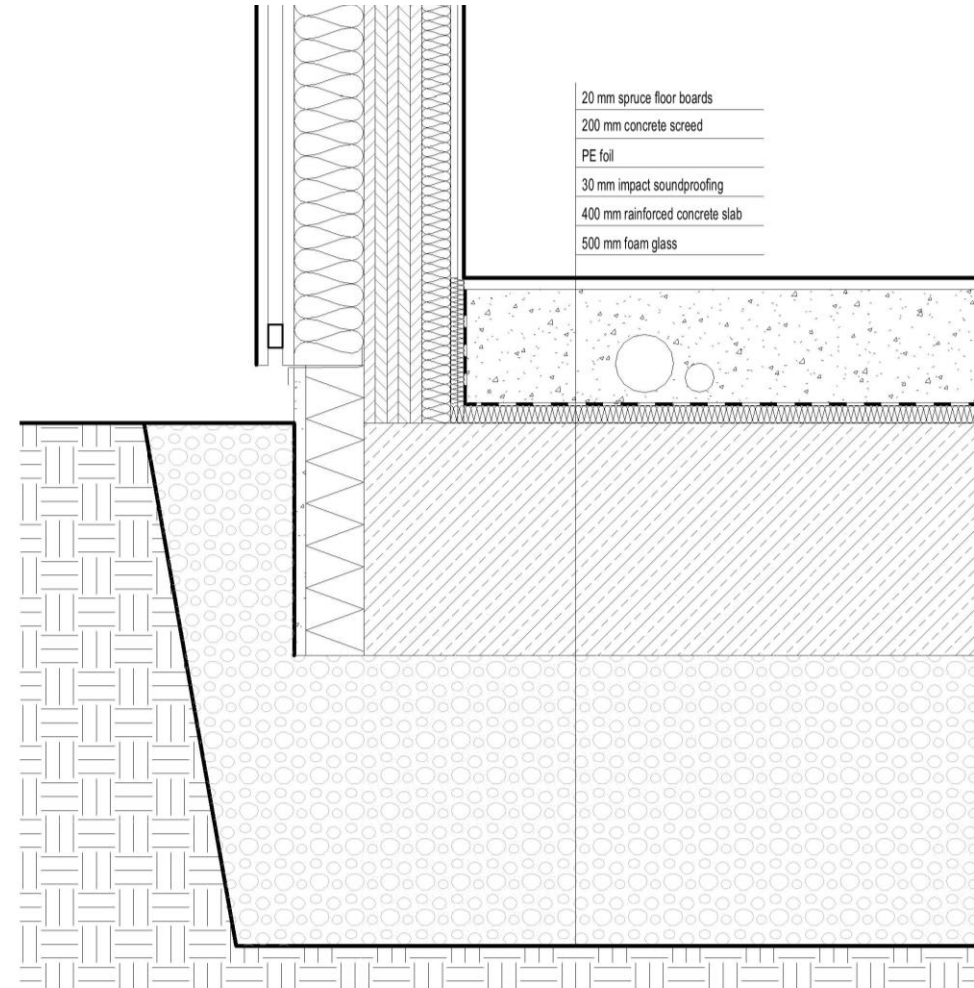
HAMK



KLAIPĖDOS  
VALSTYBINĖ  
KOLEGIJA



# Plinth (exterior wall)





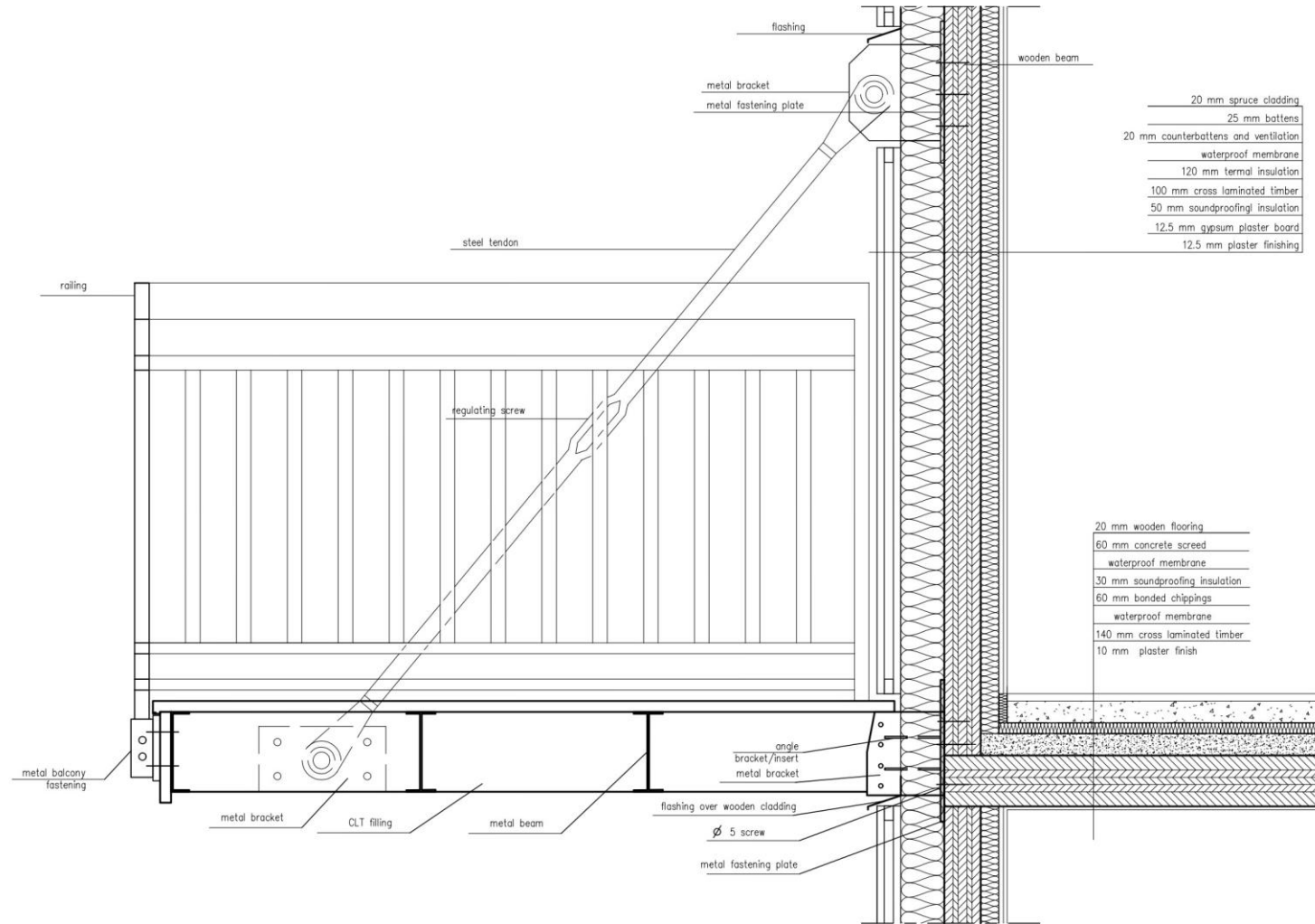
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# Balcony





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## Design coordination

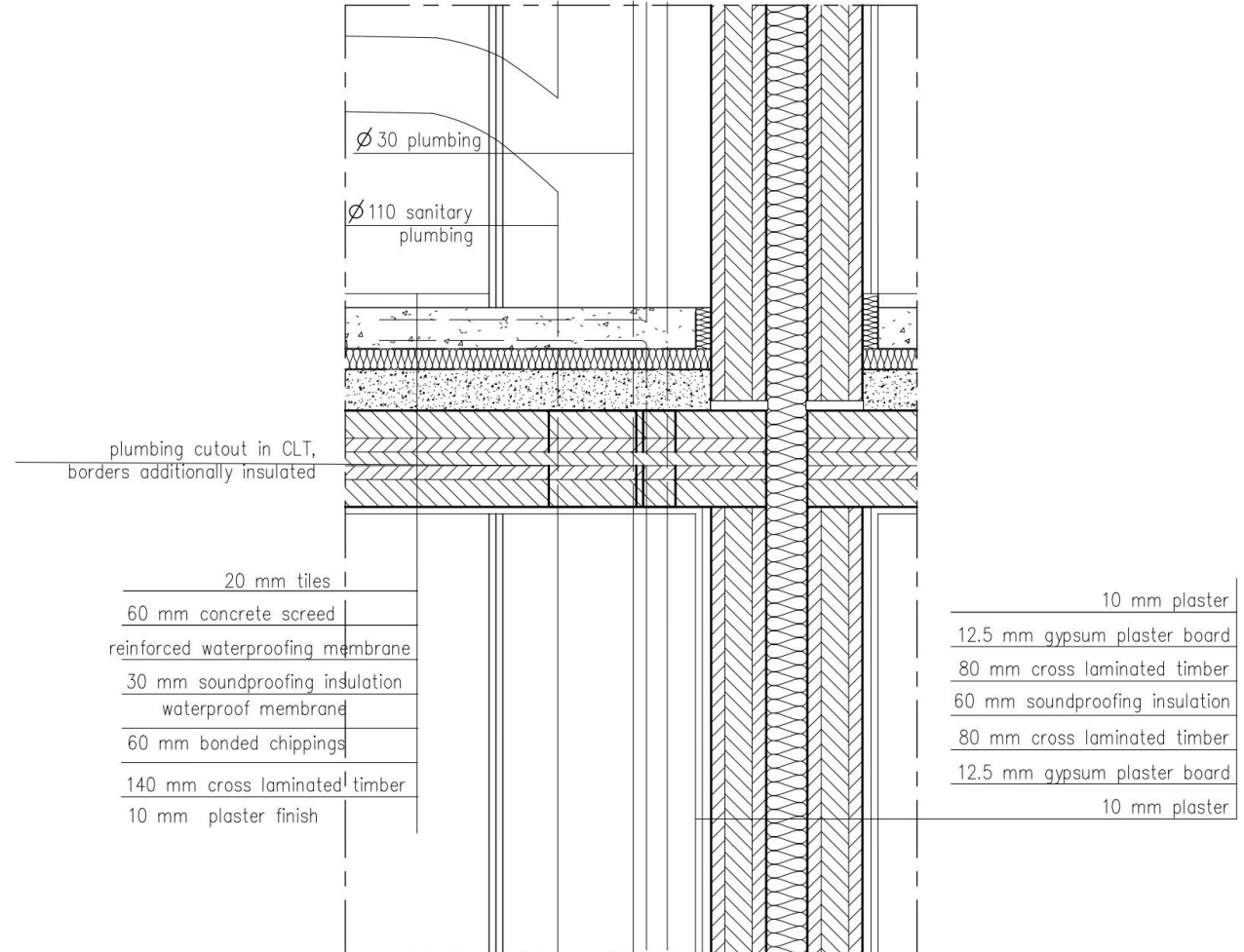
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
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# Plumbing, Intermediate floor





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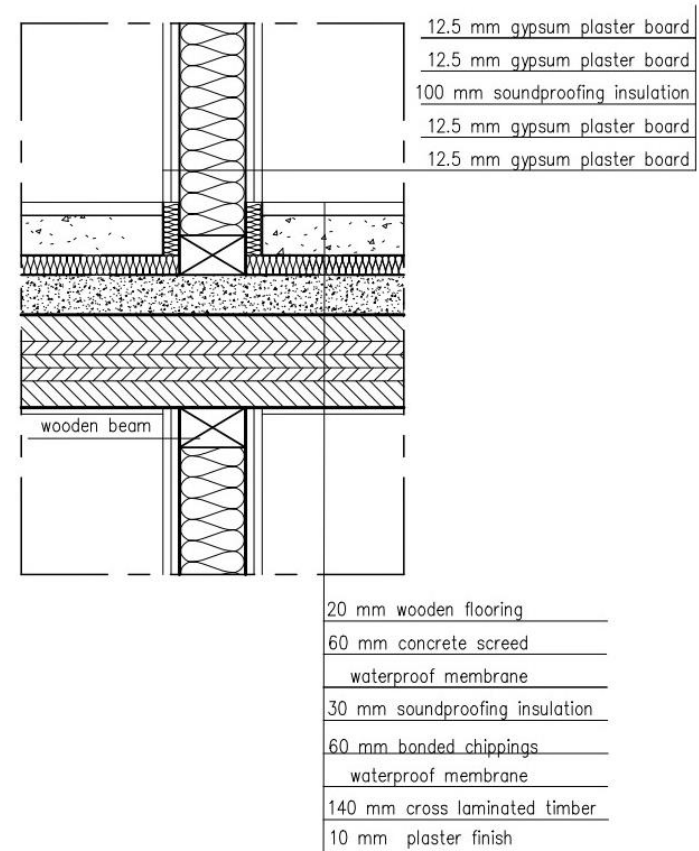
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# Timber frame wall





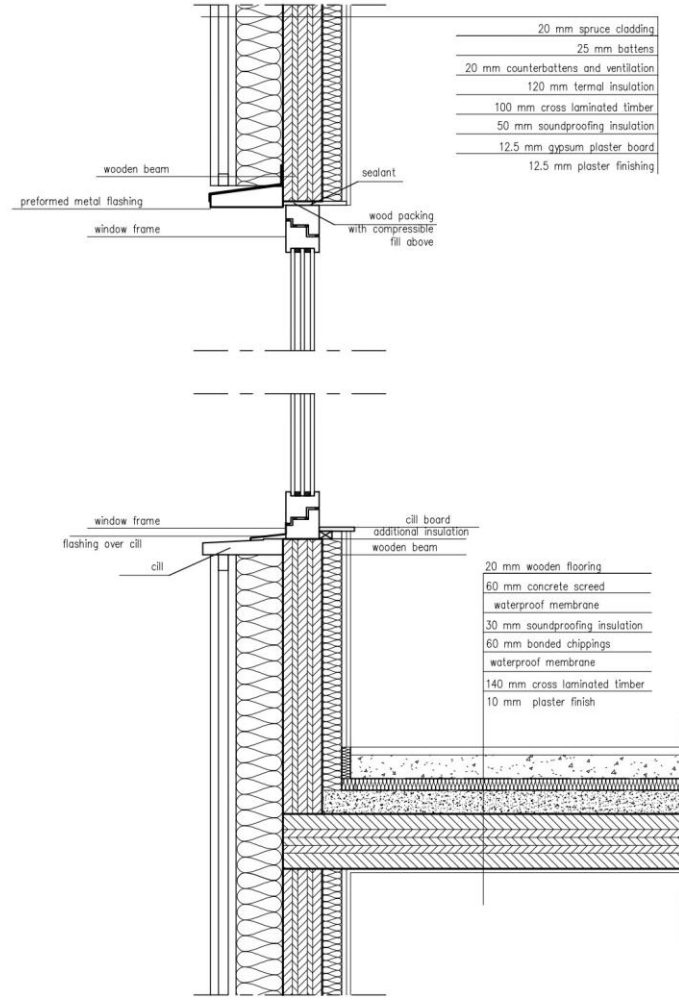
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# Window





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## Design coordination

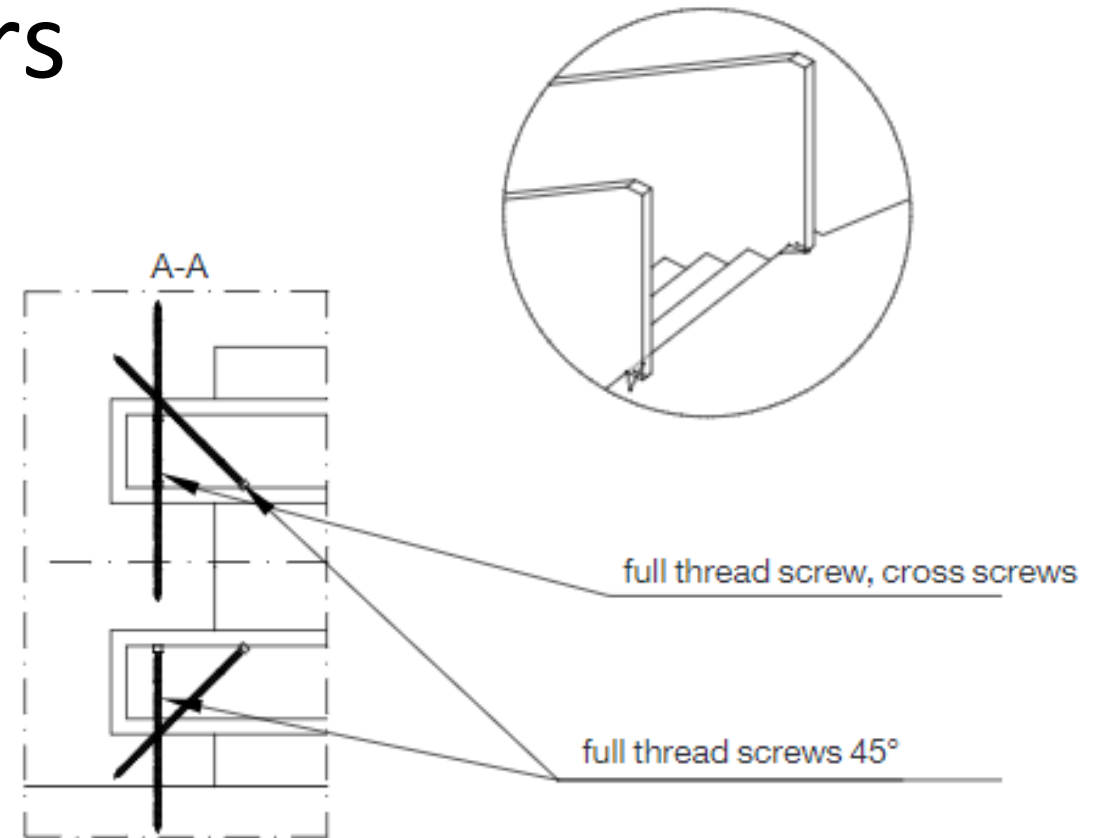
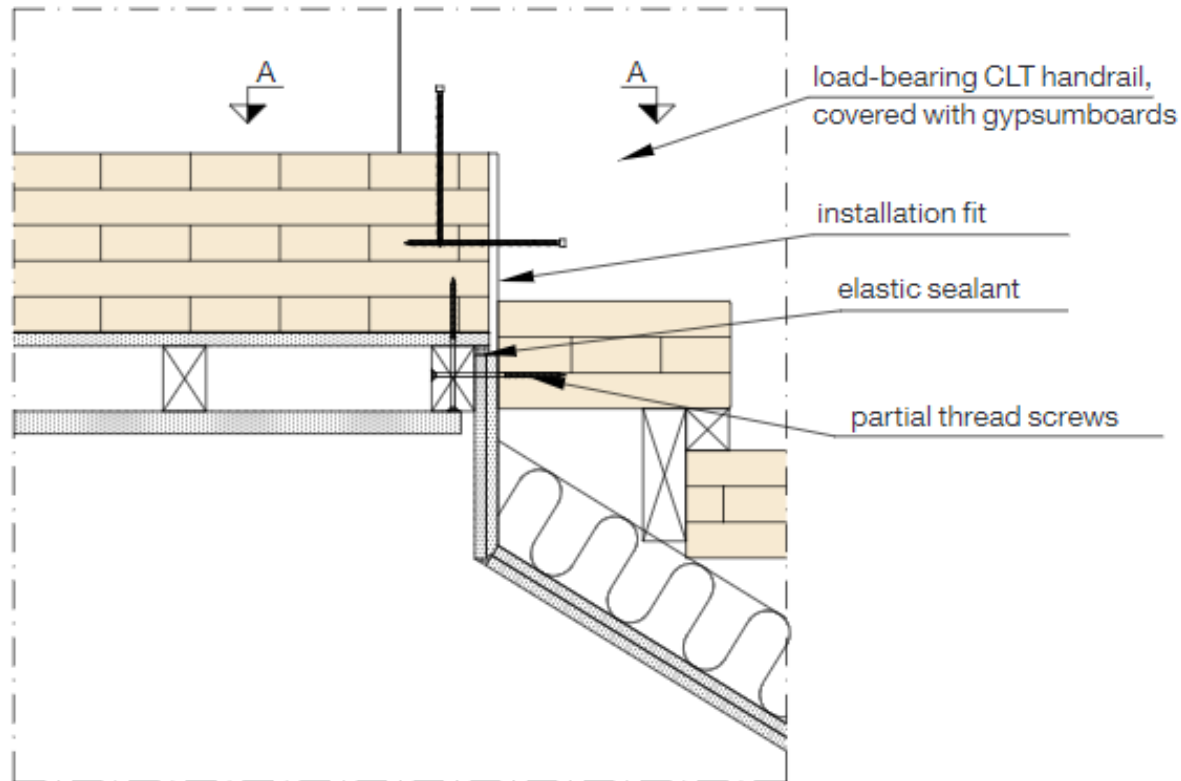
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



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# Stairs





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## Design coordination

Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



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# Superstructures assembly drawings



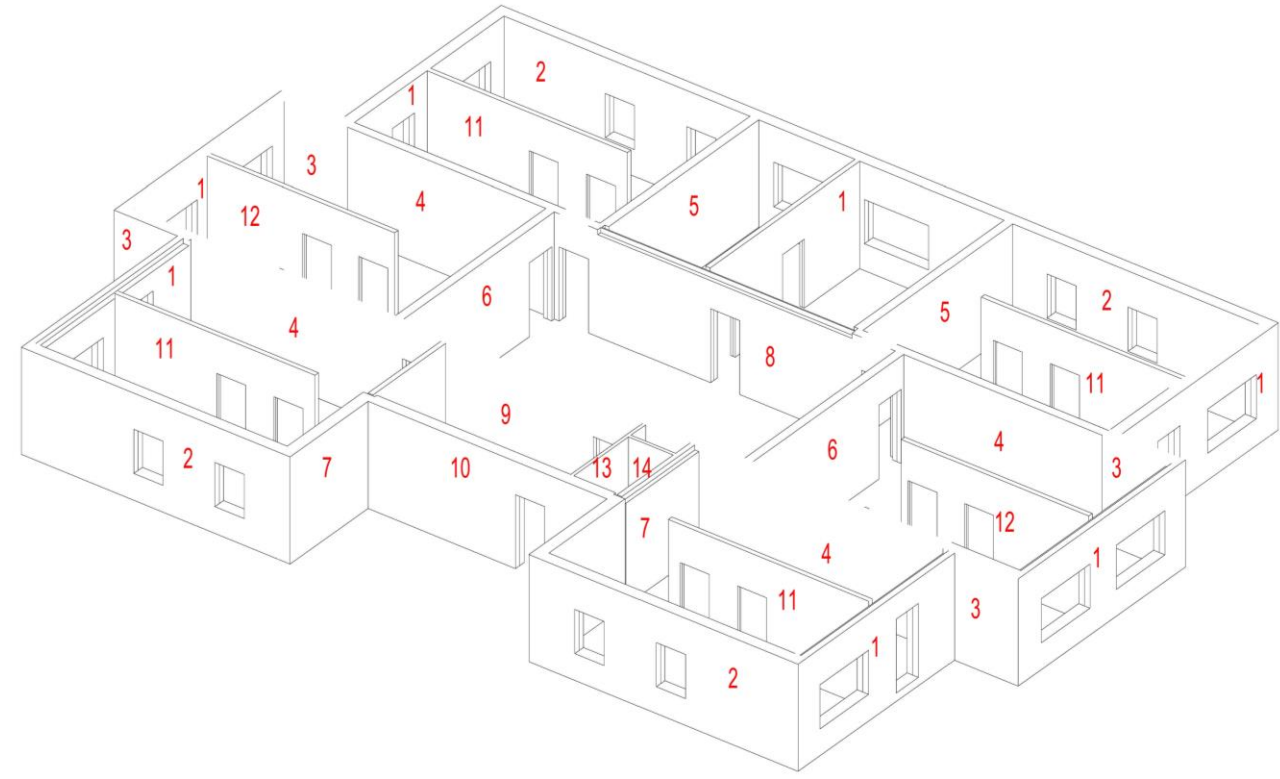
Funded by the Erasmus+ Programme of the European Union

## Design coordination

Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



# Groundfloor walls panels







Funded by the  
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## Design coordination

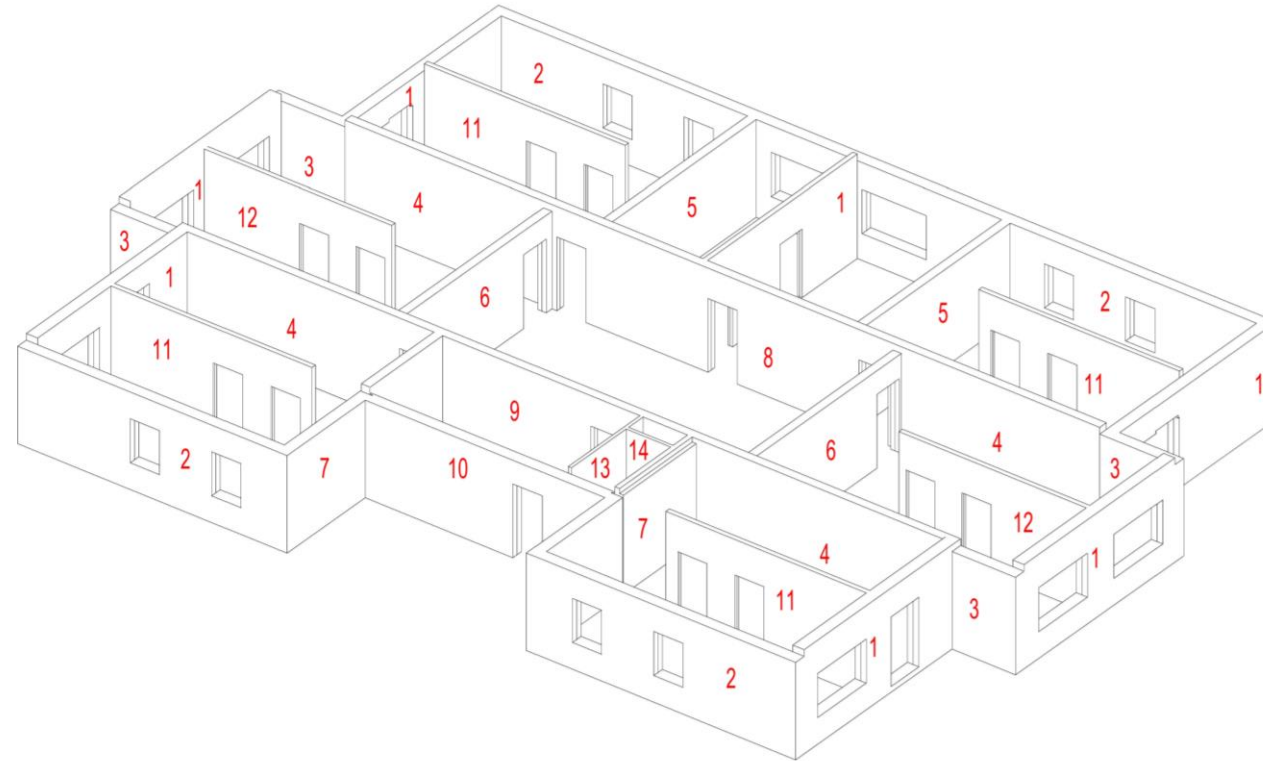
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



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# First and second floors walls panels





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## Design coordination

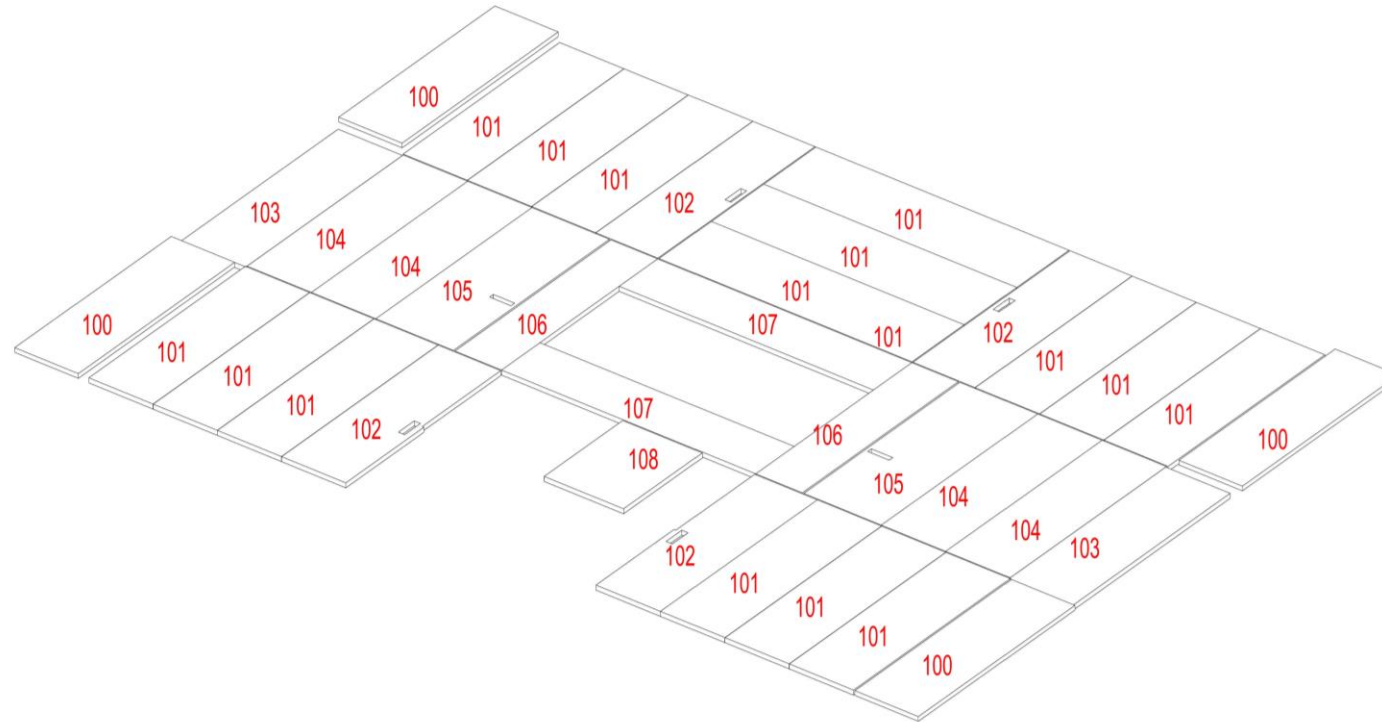
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



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# Groundfloor and first floor ceiling panels





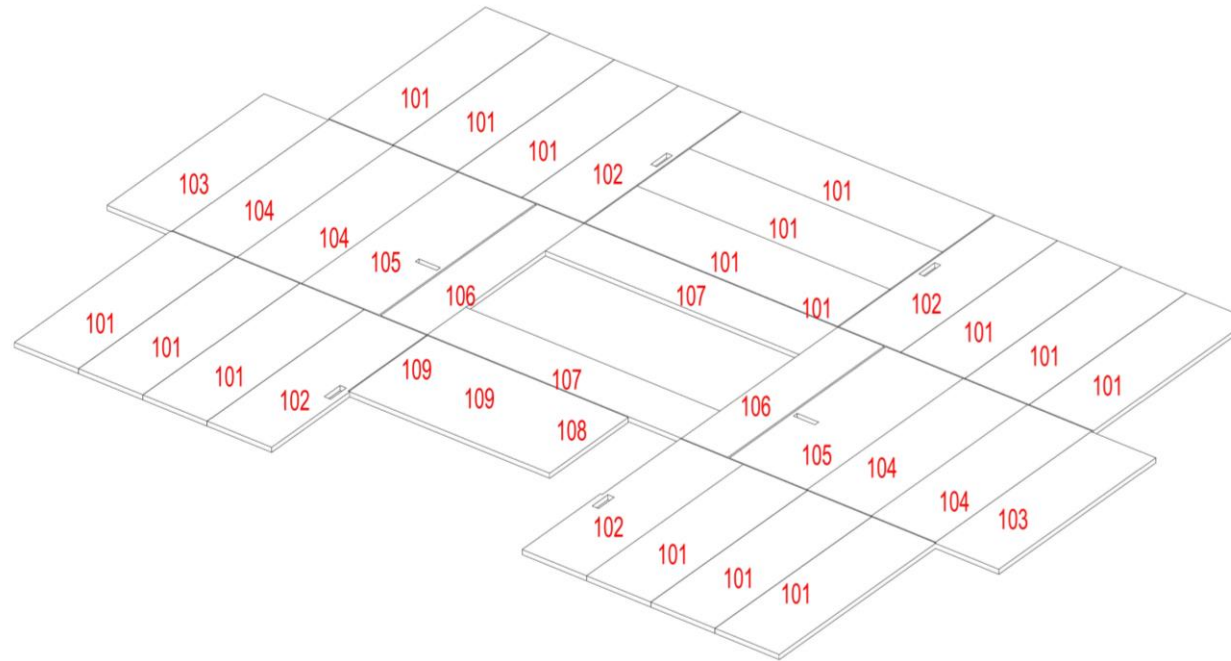
Funded by the Erasmus+ Programme of the European Union

## Design coordination

Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



# Second floor ceiling panels





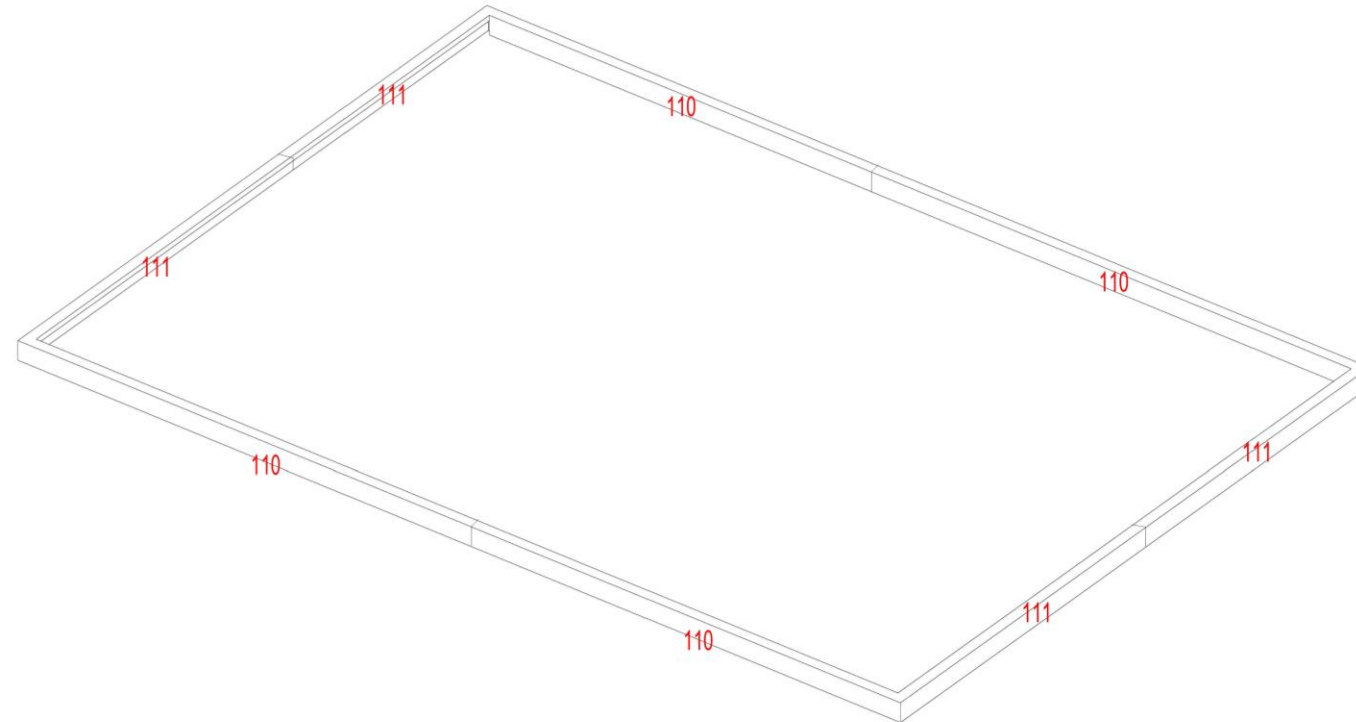
Funded by the  
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of the European Union

## Design coordination

Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



# Attic's panels





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## Design coordination

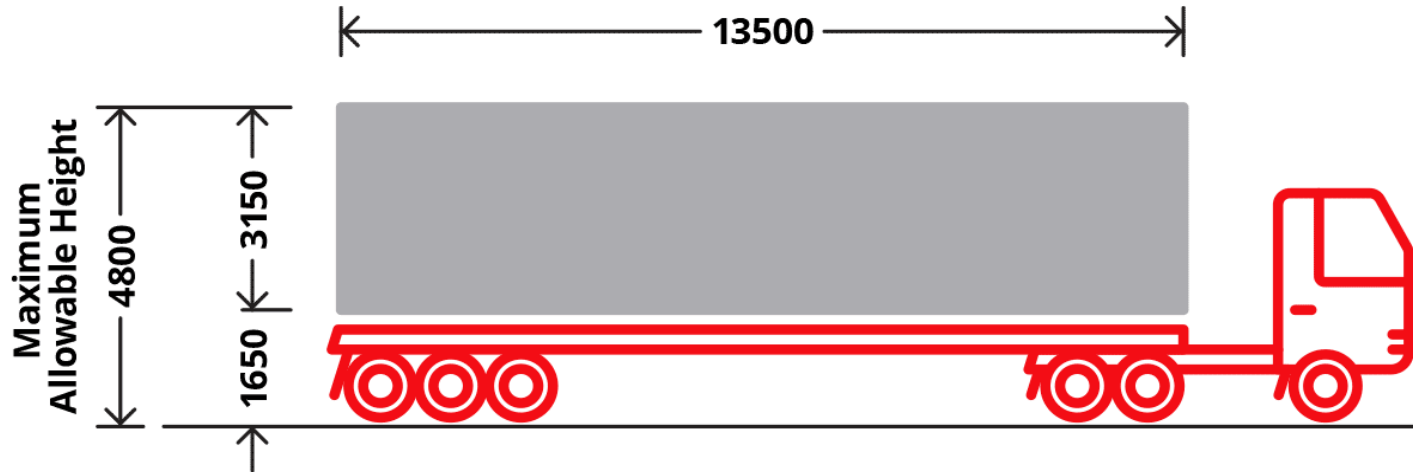
Patrycja Owczarska : Karlis Dreimanis : Anastasiya Skvarniuk  
Viktorija Kuzminskaite : Simonas Opulskis : Piotr Zyguła



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# Logistics



**Internorm<sup>®</sup>**

**SKONTO  
PREFAB**



Sources:

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13. <http://construction-companies.liaa.gov.lv/skonto-prefab>