- Introduction
- Idea & Development
- Technology & Production
- **Applications**

Solid **T**imber **C**onstruction **(STC) ...**

- ... is a building technique using elements out of **C**ross **L**aminated **T**imber (**CLT**) for structural walls and ceilings in supernatural buildings
- ... enables **industrialisation** of timber constructions
- ... a **reason** why timber is coming **back to town**:

not only ...

Vienna (AT) - 6F

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London (UK) - 8F

© Pirmin Jung

Milano (IT) - 9F

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Solid **T**imber **C**onstruction **(STC) ...**

- ... is a building technique using elements out of **C**ross **L**aminated **T**imber (**CLT**) for structural walls and ceilings in supernatural buildings
- ... enables **industrialisation** of timber constructions
- ... a **reason** why timber is coming **back to town**:

... but also

St. Loup (FR)

© Milo Keller

Graz (AT)

Graz (AT)

© Paul Ott

Solid **T**imber **C**onstruction **(STC) ...**

- ... currently leads to **competitions to maximize dimensions**
- aspects like
  - wider in application
  - longer in period of use
  - higher in quality
- should not be forgotten when thinking in **comparatives** and **superlatives**

→ improving the **efficiency** of building with CLT

→ thinking and acting **interdisciplinary**

... to guarantee **high quality** and **durability**

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general FACTS

- Housing
  - 2 buildings
  - 3 storeys
  - 22 flats in STC (60 ÷ 90 m²)
- Dimensions
  - 2,600 m² total area
  - 1,600 m² living area
  - € 3.3 million (STC ~ 20%)

  → € 2,000 per m² living area

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general FACTS

- 560 m³ CLT elements used for
  - walls (210 m³ | 5 layers)
  - floors (280 m³ | 5 layers)
  - roofs (70 m³ | 5 layers)

  → **0.21 m³ CLT / m² total area**

  → **0.35 m³ CLT / m² living area**

  → **25.0 m³ CLT / flat**
- project duration: 20 months
- **STC** assembly: 1 month (5%)

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using hardwood for CLT production

- walls of 1 flat out of **birch-CLT**
- ruled by
  “approval on individual basis”
  - → material tests of boards and finished lay-ups
  - → delamination tests on spot core samples
  - → long-time monitoring

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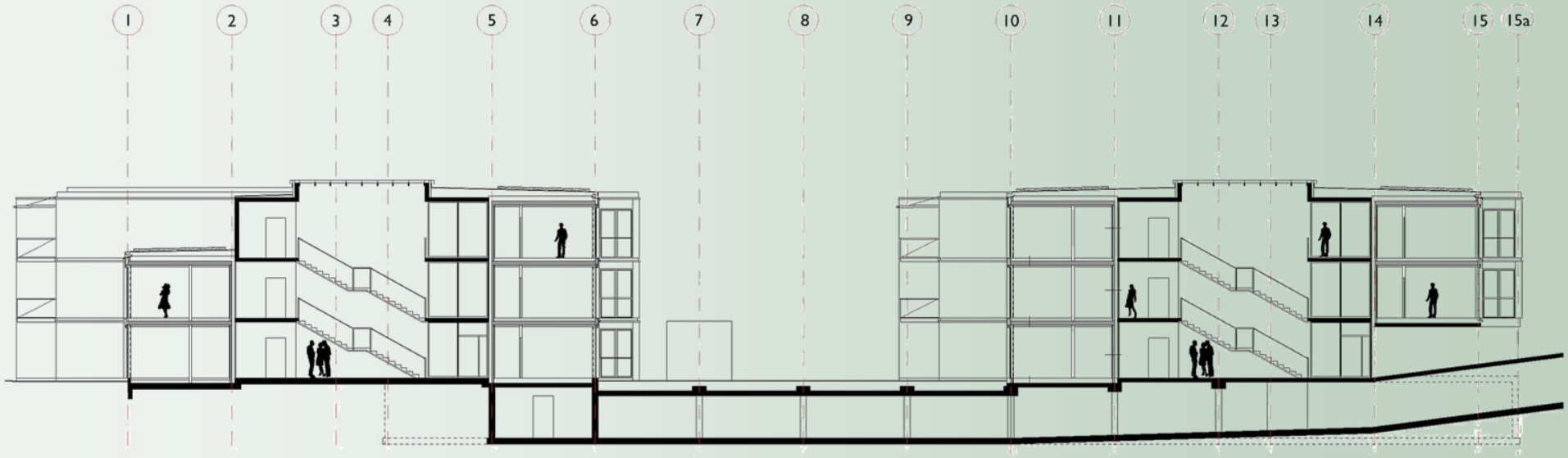
principles of the structural system



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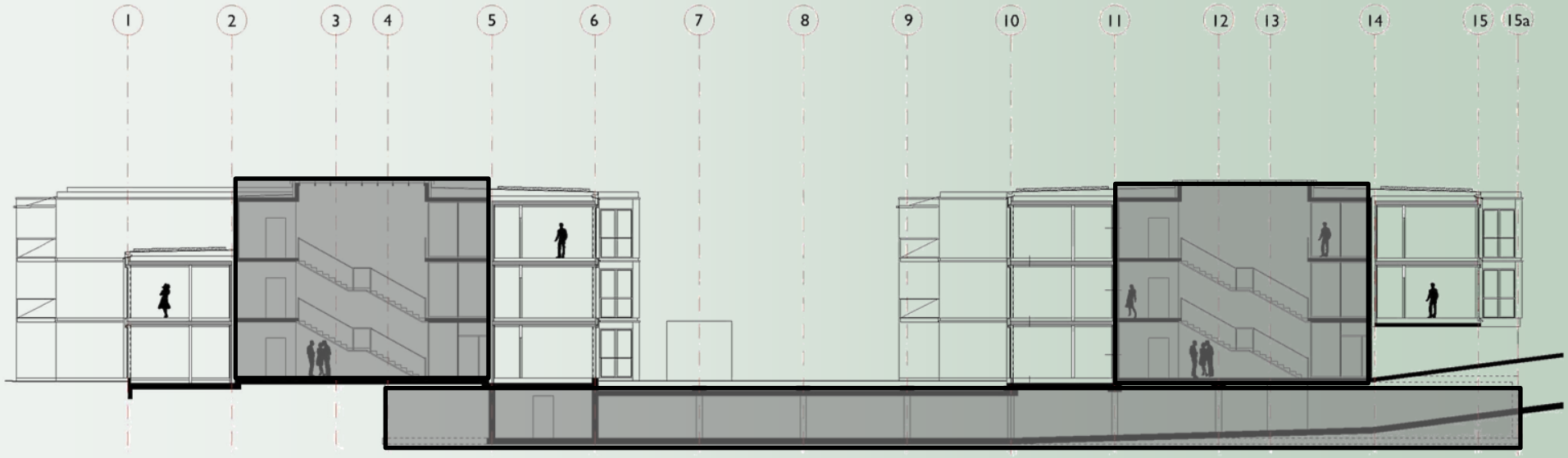
principles of the structural system



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inner core | underground parking

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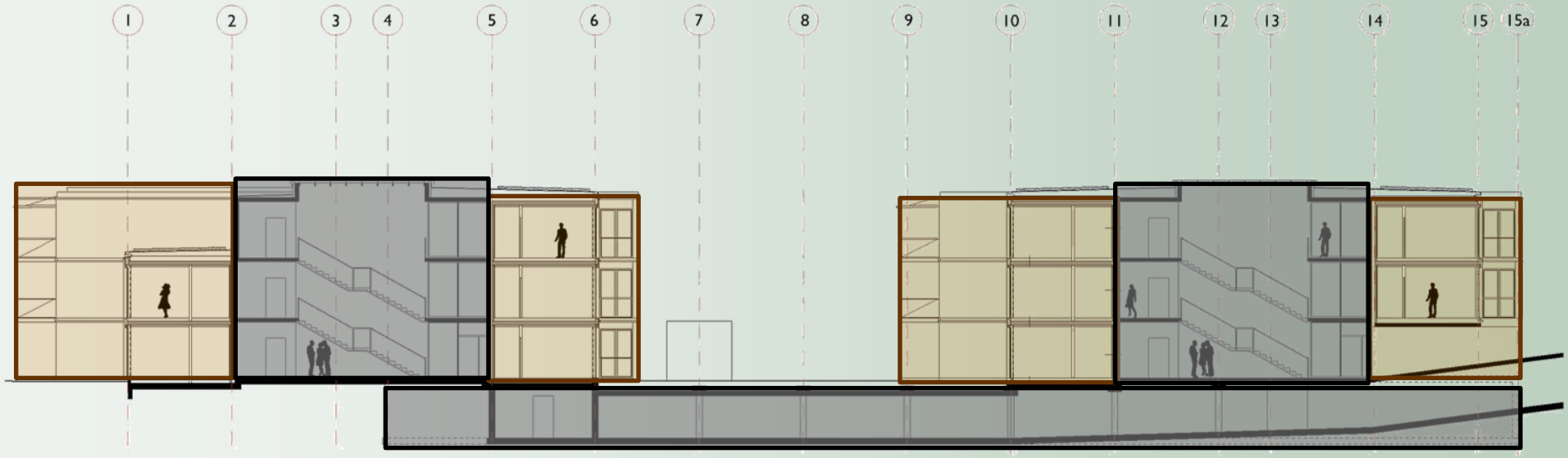

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inner core | underground parking

flats in STC

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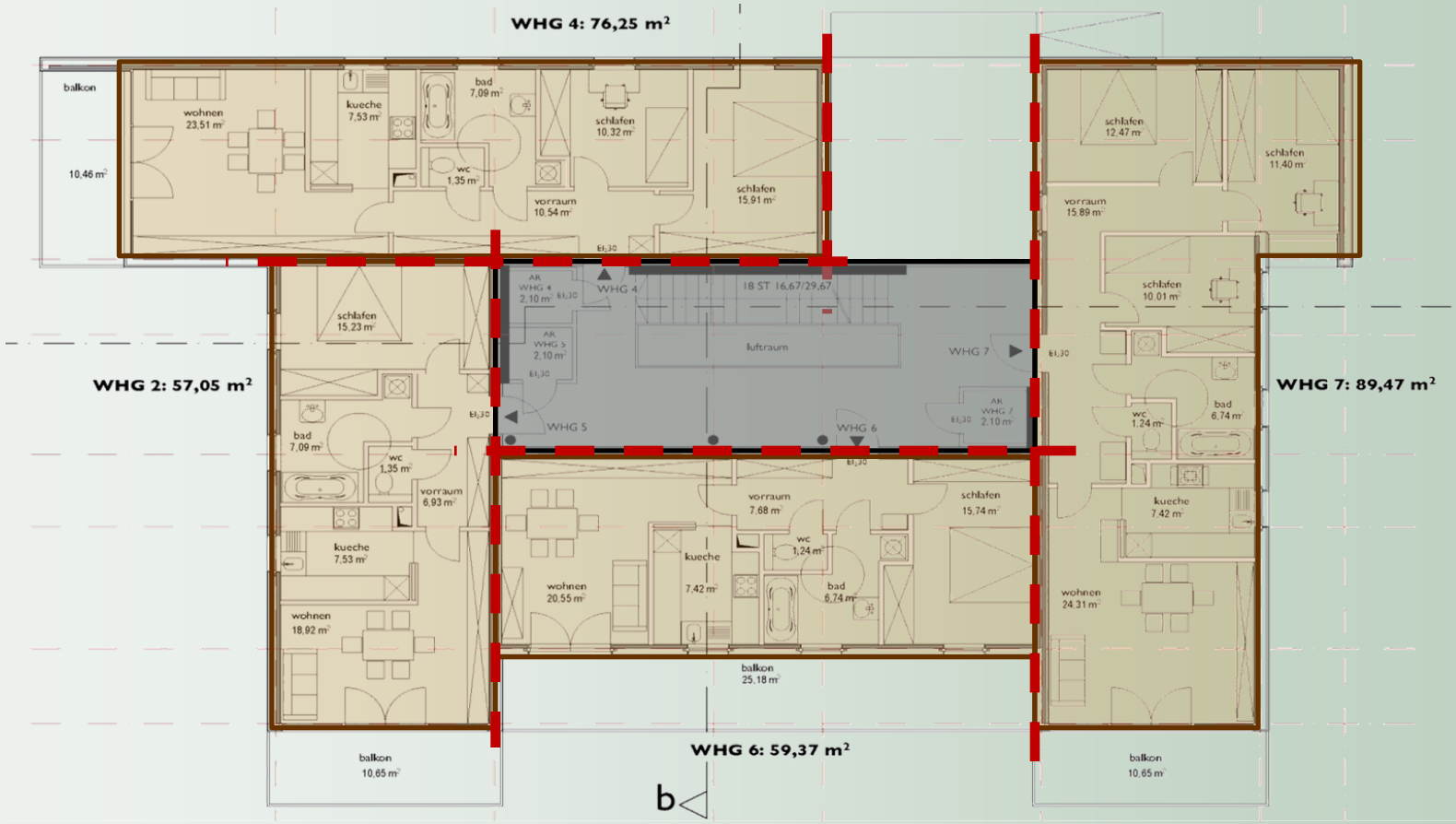

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expansion gaps

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expansion gaps

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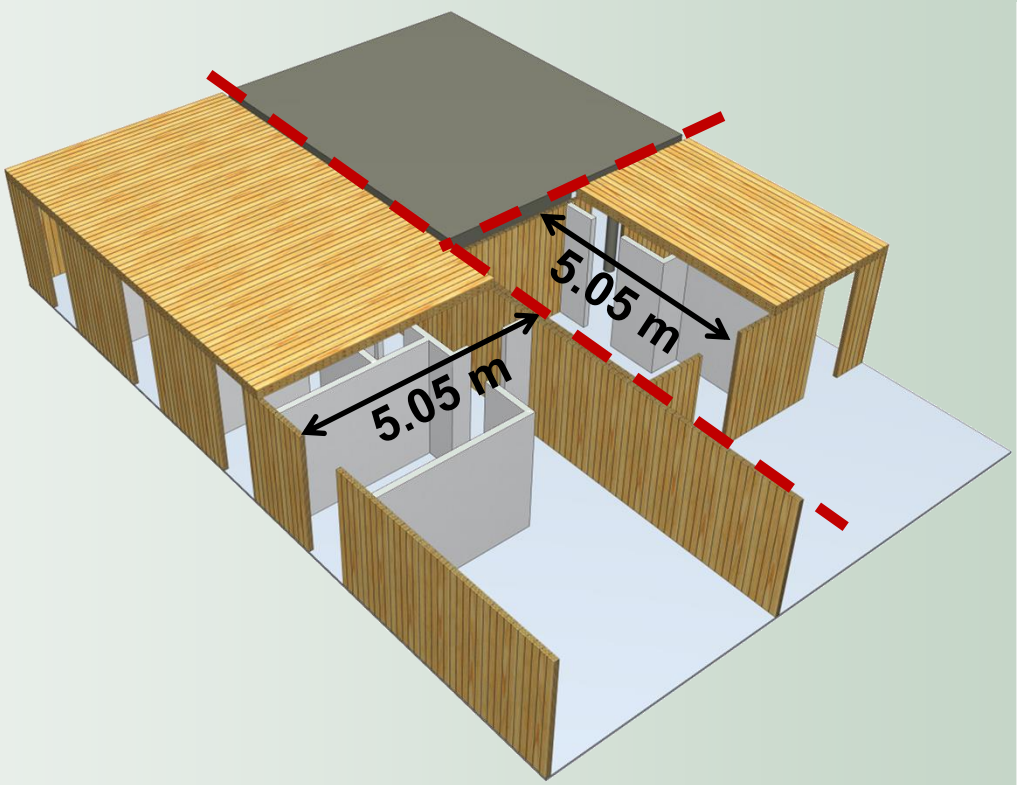

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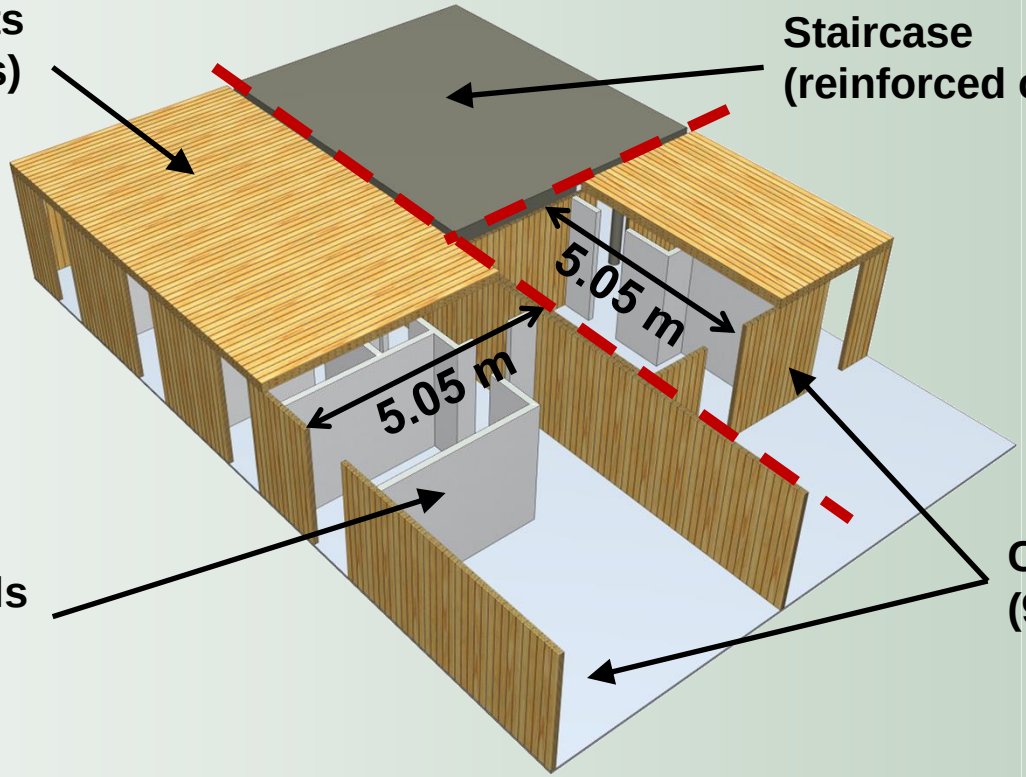

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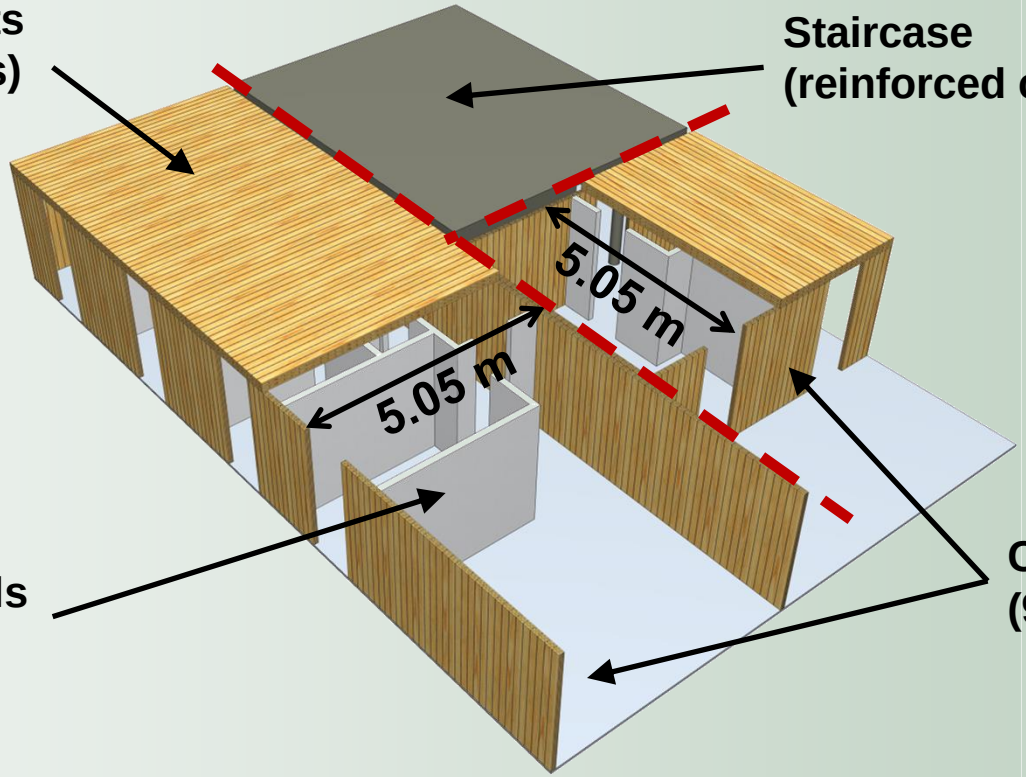

→ **uniform** and **economical** span widths simplify structural design and assembly

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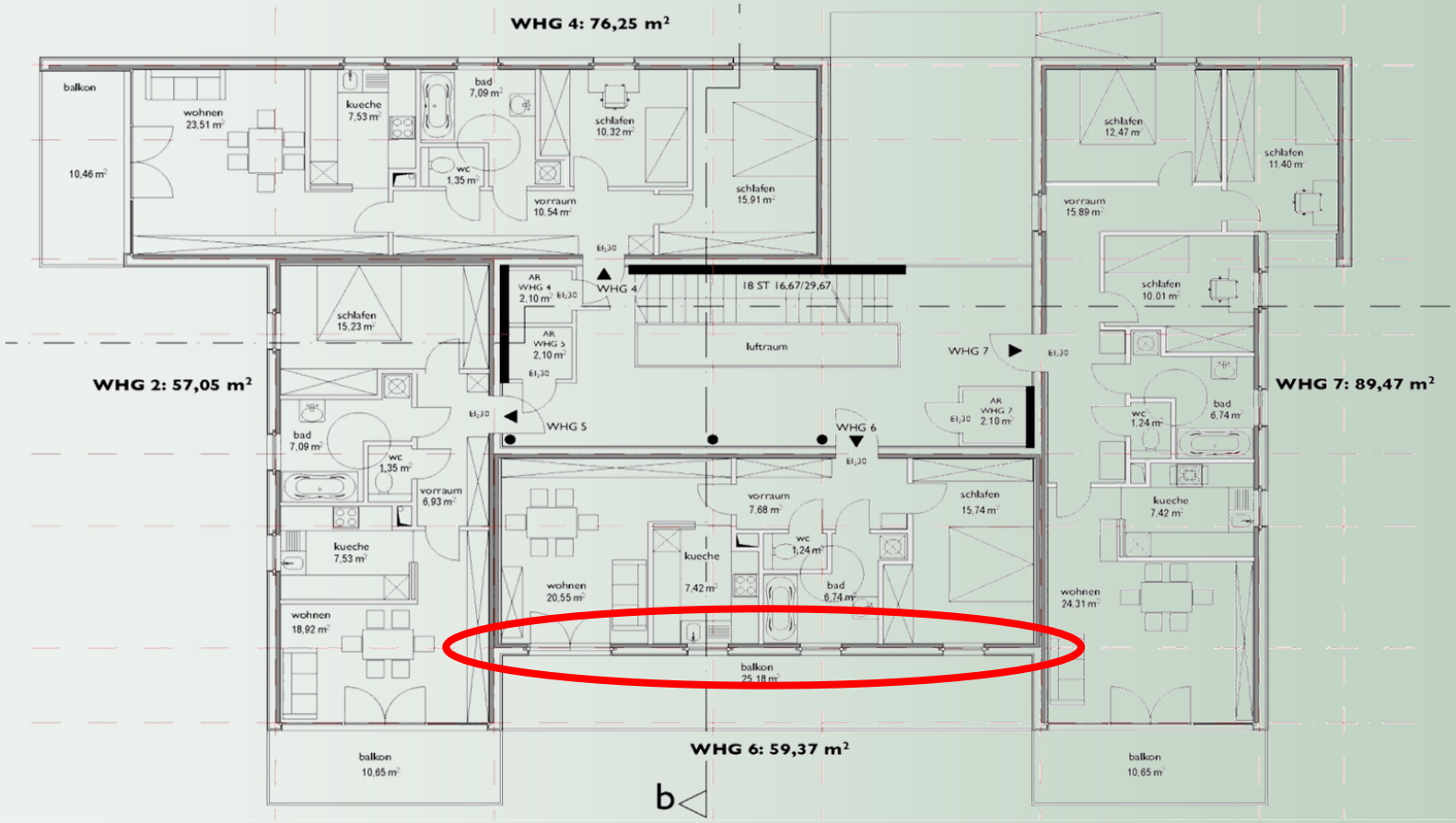
principles of the structural system



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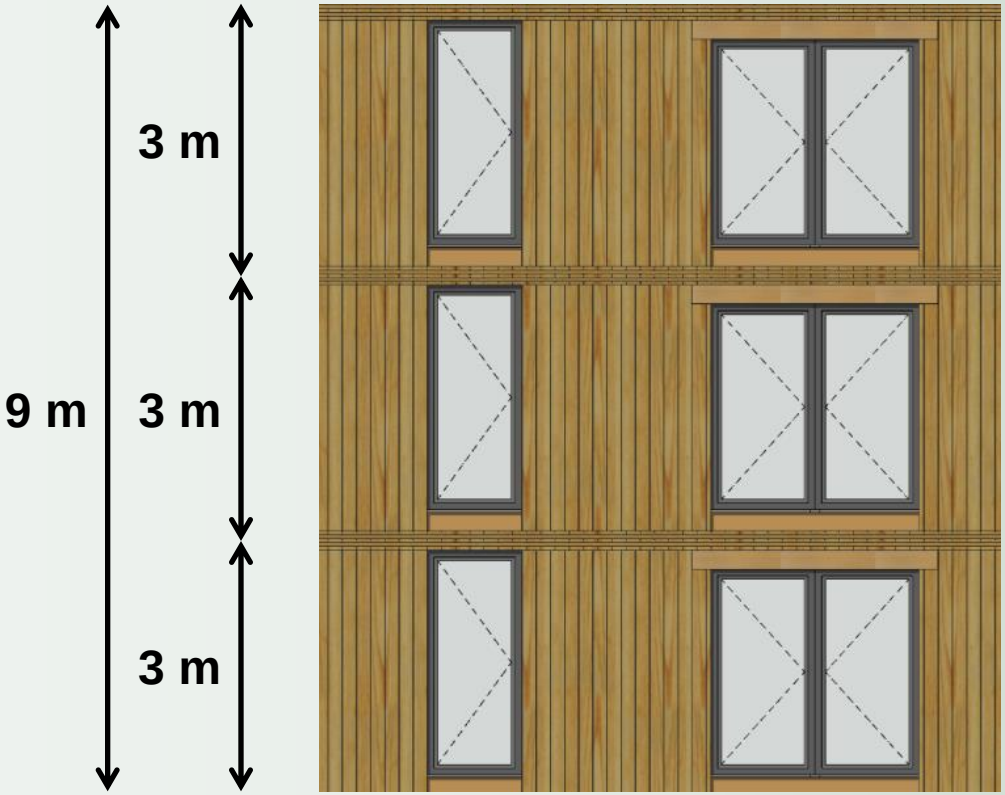

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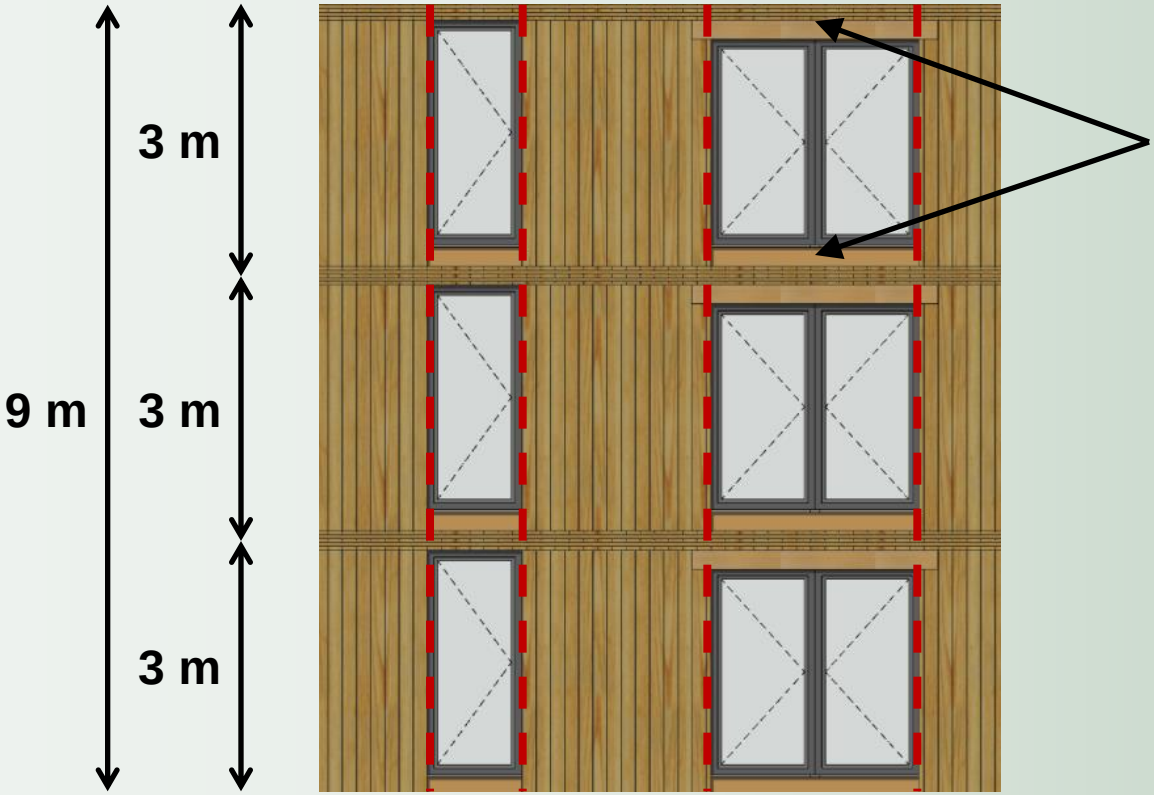

secondary components:

- pre-fabricated
- supporting beams if necessary

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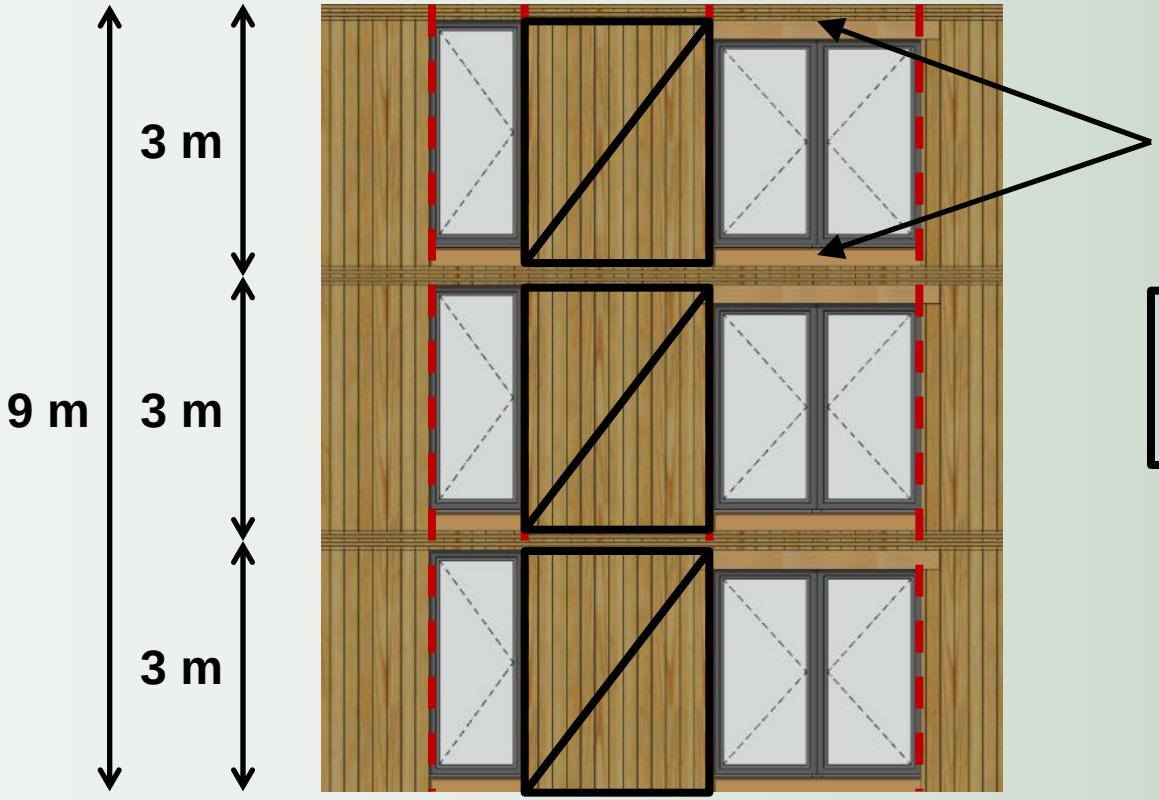

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Var 1:
room-high CLT wall elements instead of large cutouts

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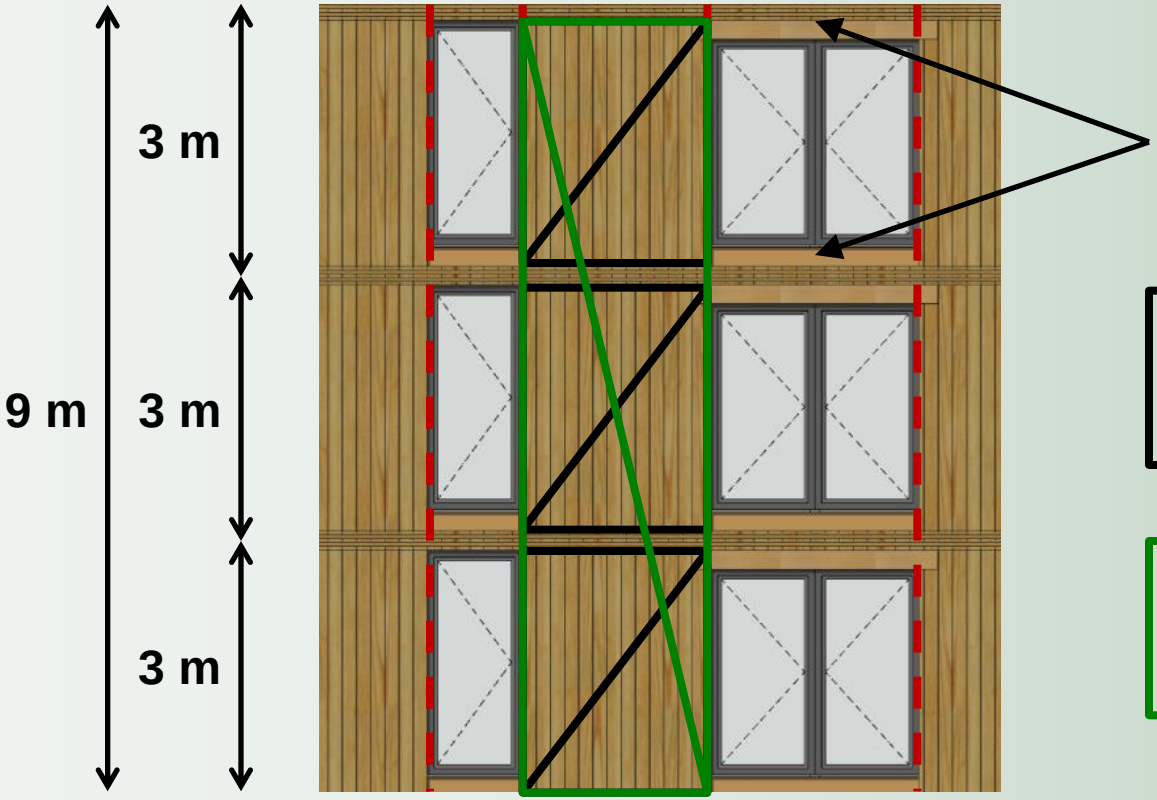

secondary components:
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Var 1:
room-high CLT wall elements instead of large cutouts

Var 2:
continuous CLT elements over the whole height of the building

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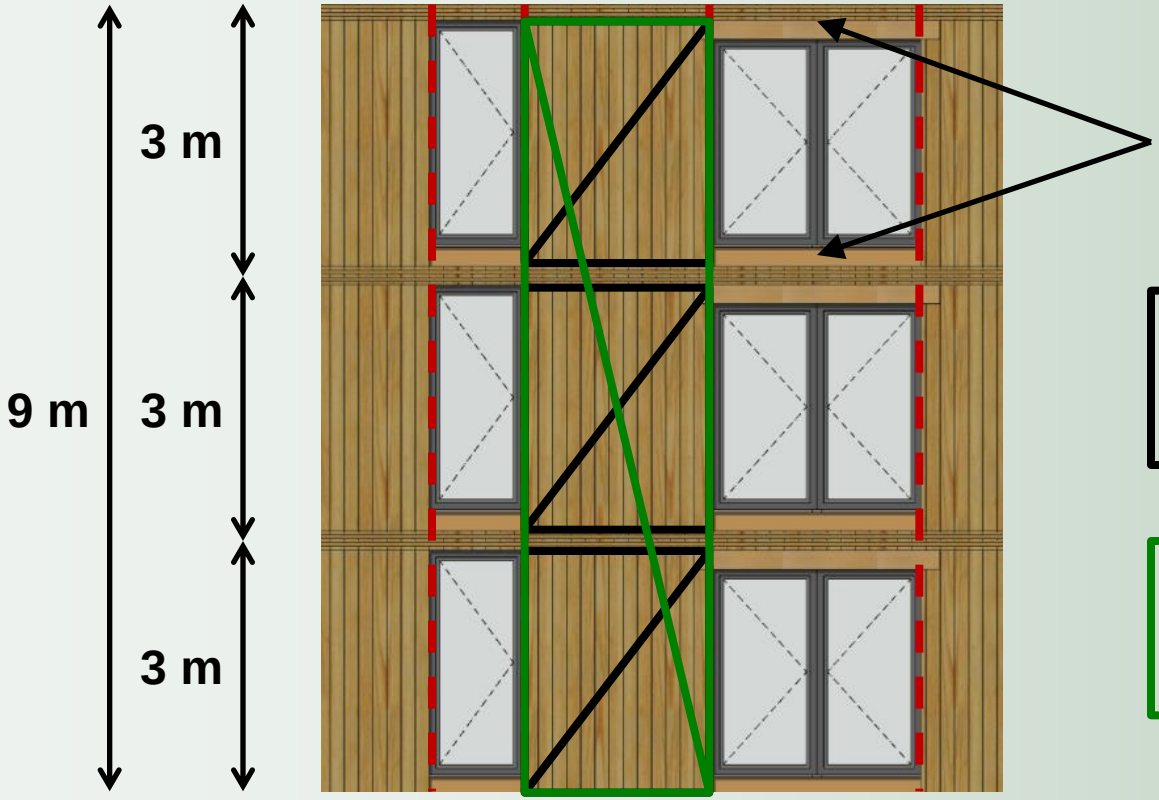

secondary components:
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Var 1:
room-high CLT wall elements instead of large cutouts

Var 2:
continuous CLT elements over the whole height of the building

→ **continuously** situated **full storey walls** avoid **waste of CLT** and simplify **fastener design**

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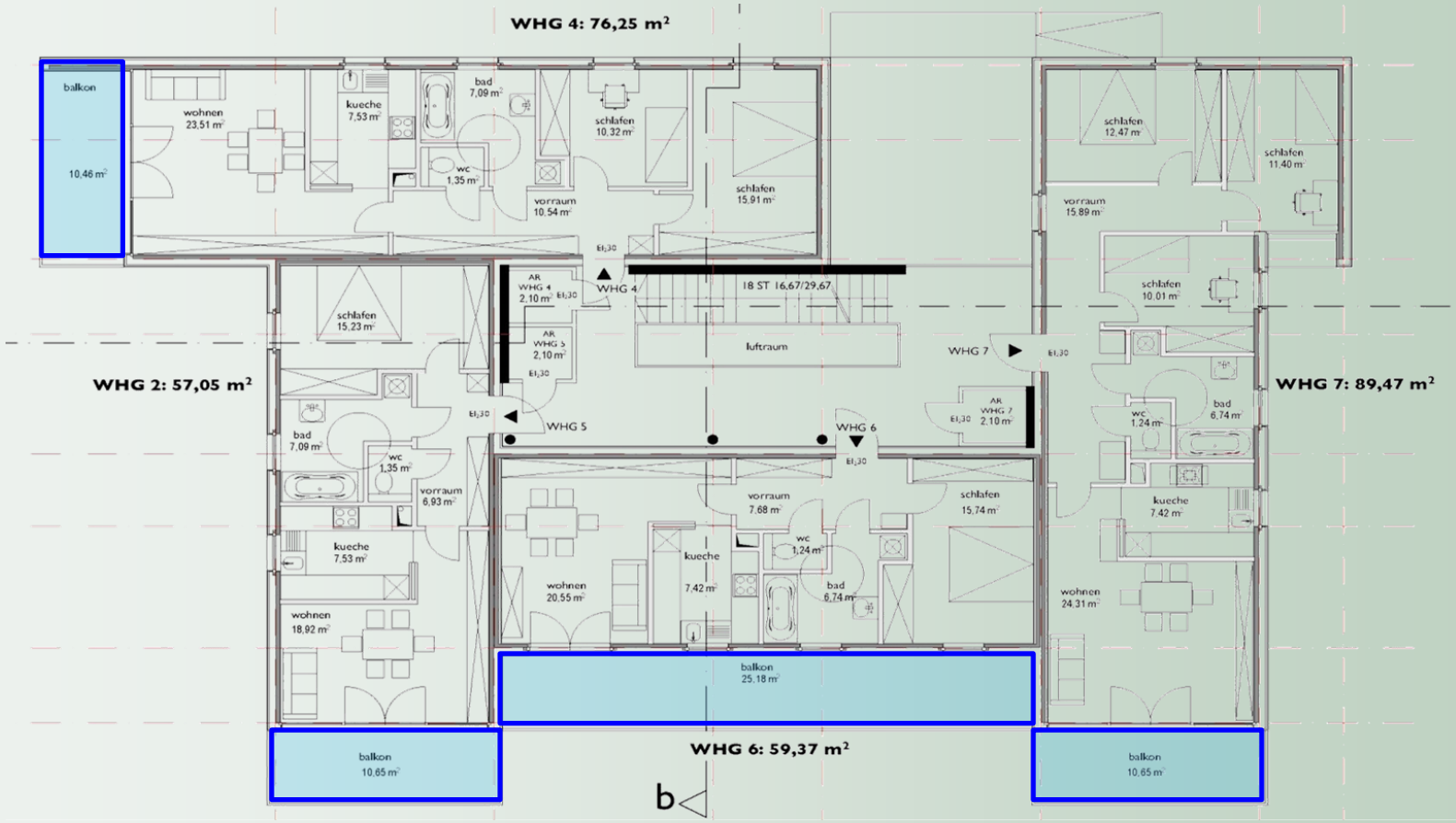
principles of the structural system



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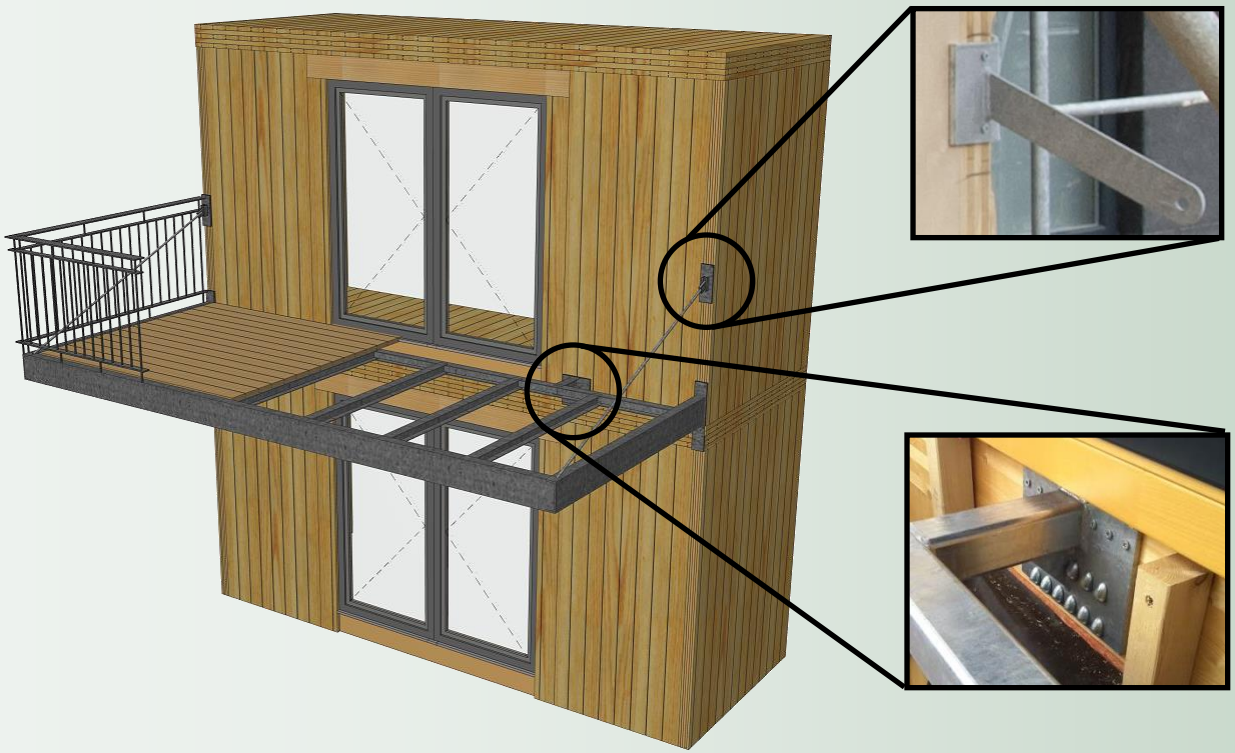

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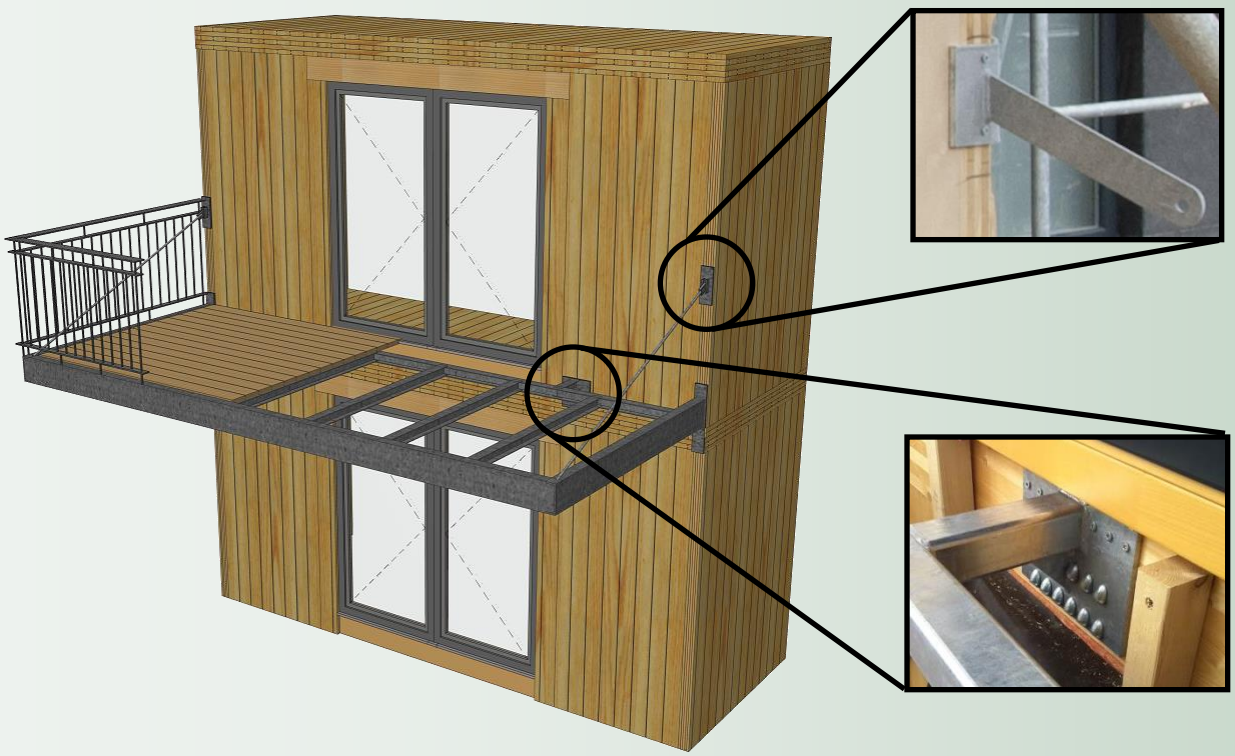

balcony as part of primary structure (cantilever system):

- different life cycles
- thermal bridges
- moisture and air transfer

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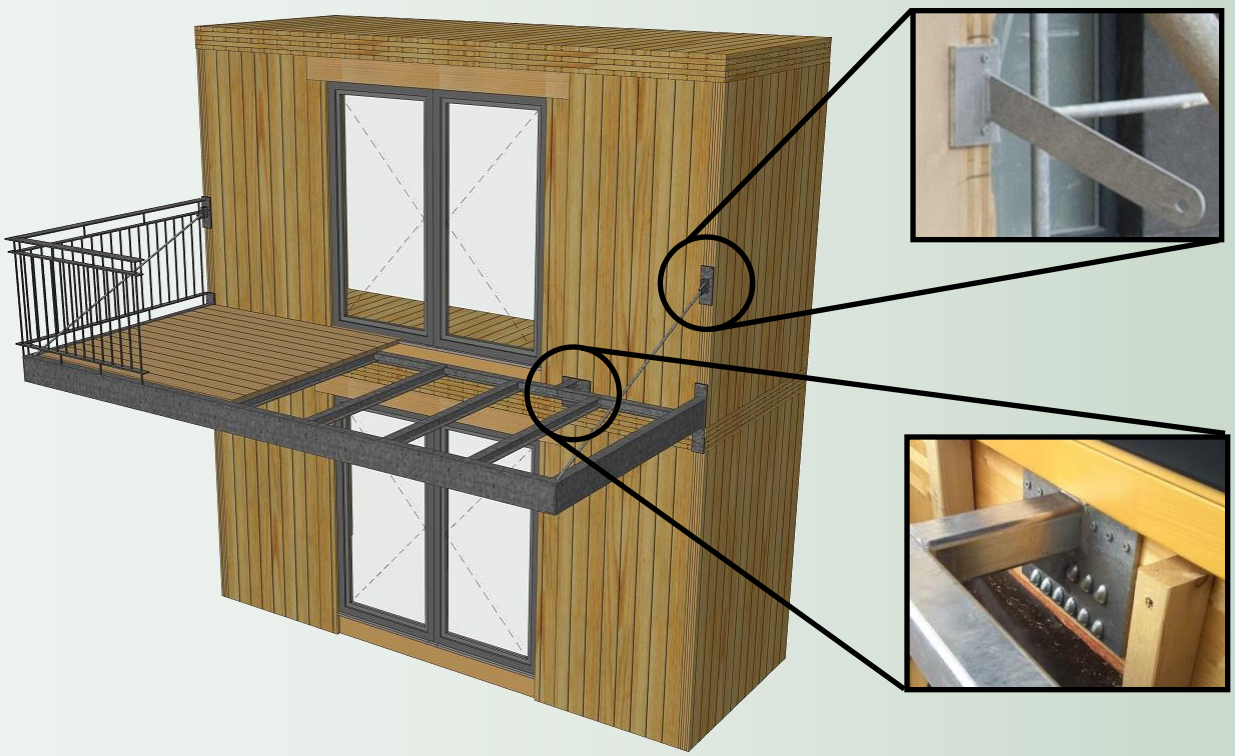
principles of the structural system



balcony as part of primary structure (cantilever system):

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balcony as secondary construction:

- pre-fabricated and fast to assemble
- no height compensation necessary
- easily to replace

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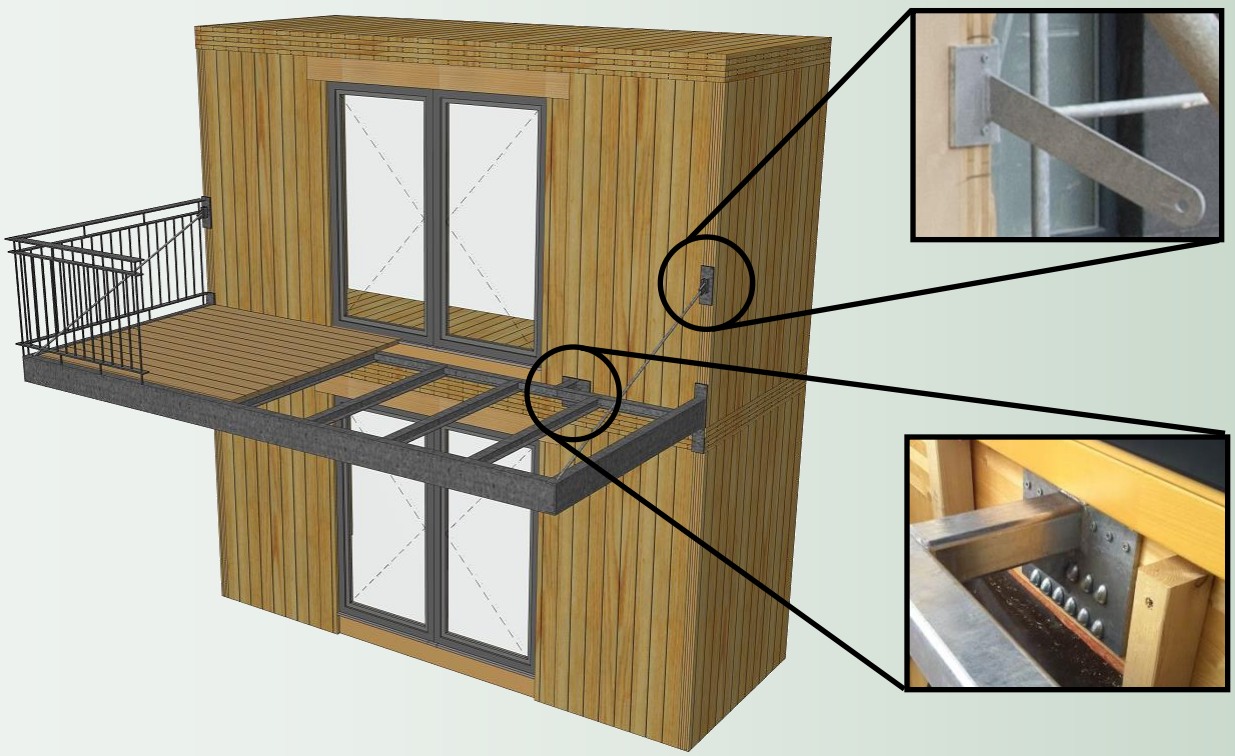
principles of the structural system



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→ components with **different life cycles** should be structurally disconnected

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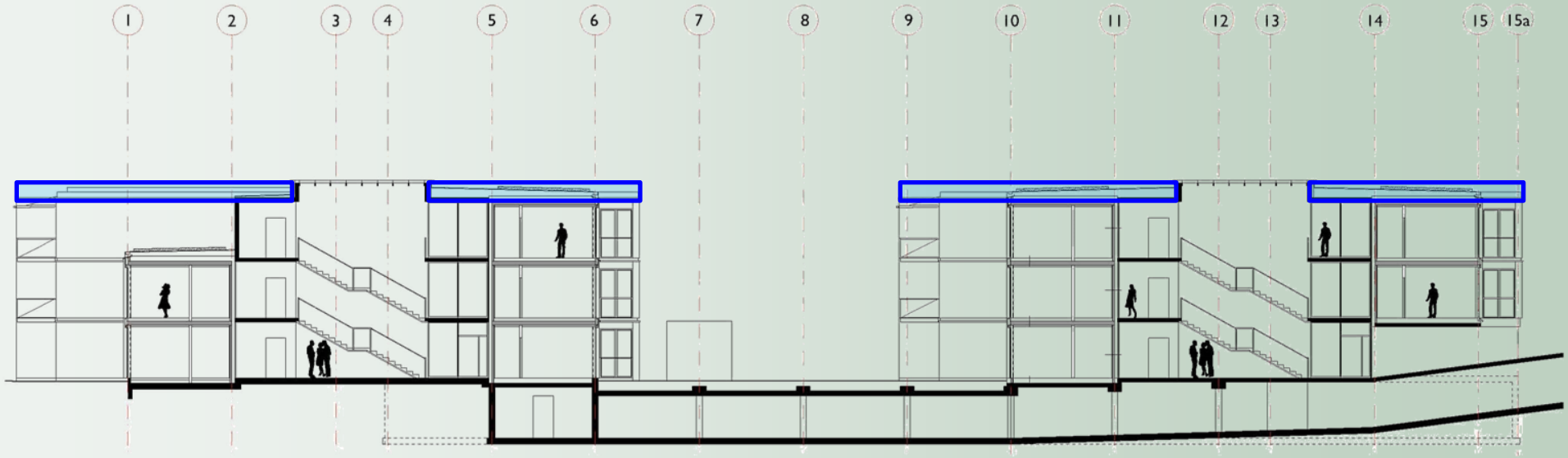
essential constructive aspects



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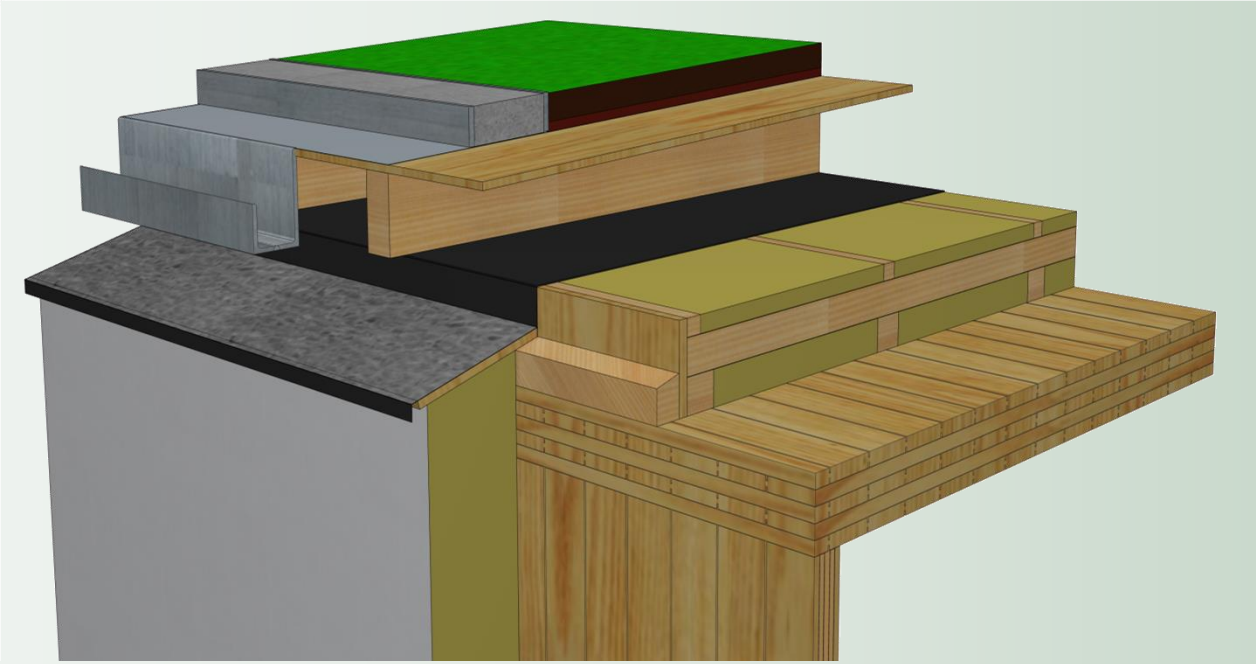
essential constructive aspects



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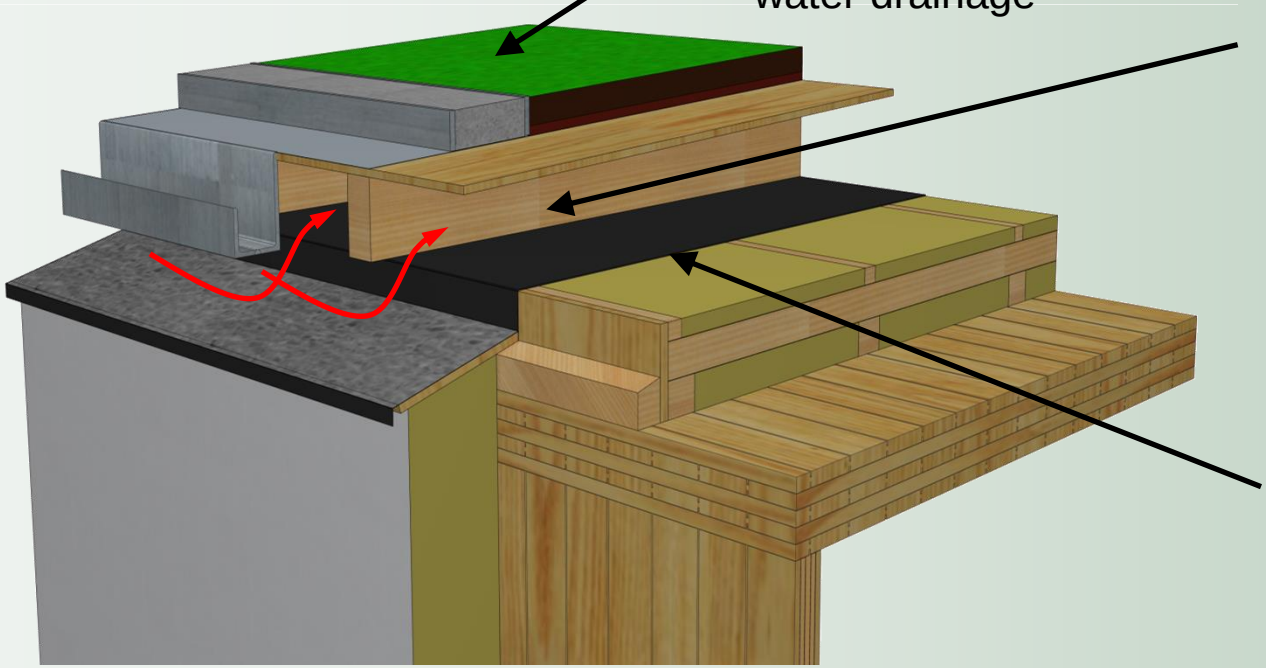
essential constructive aspects

layer of vegetation:
- green roof function
- water drainage



ventilation zone:
- protects against overheating
- secondary construction can dry out
- should have accessible height

second insulation layer:
- additional protection against moisture ingress
- should be positioned inclined

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essential constructive aspects

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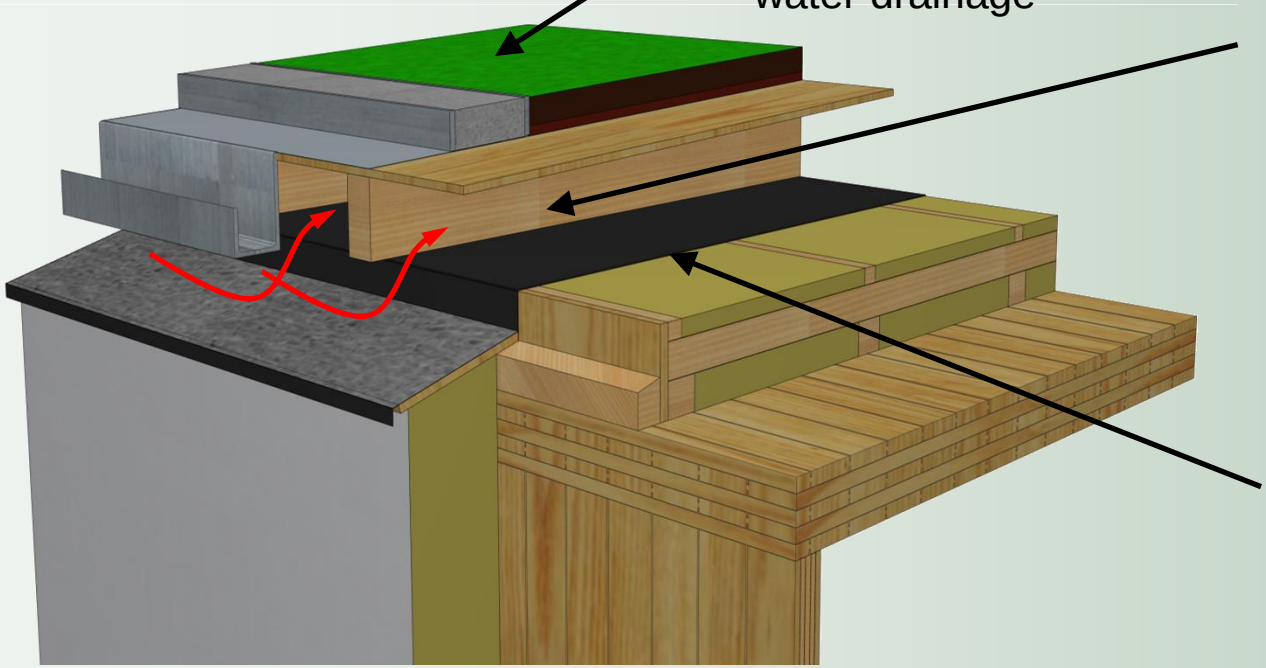
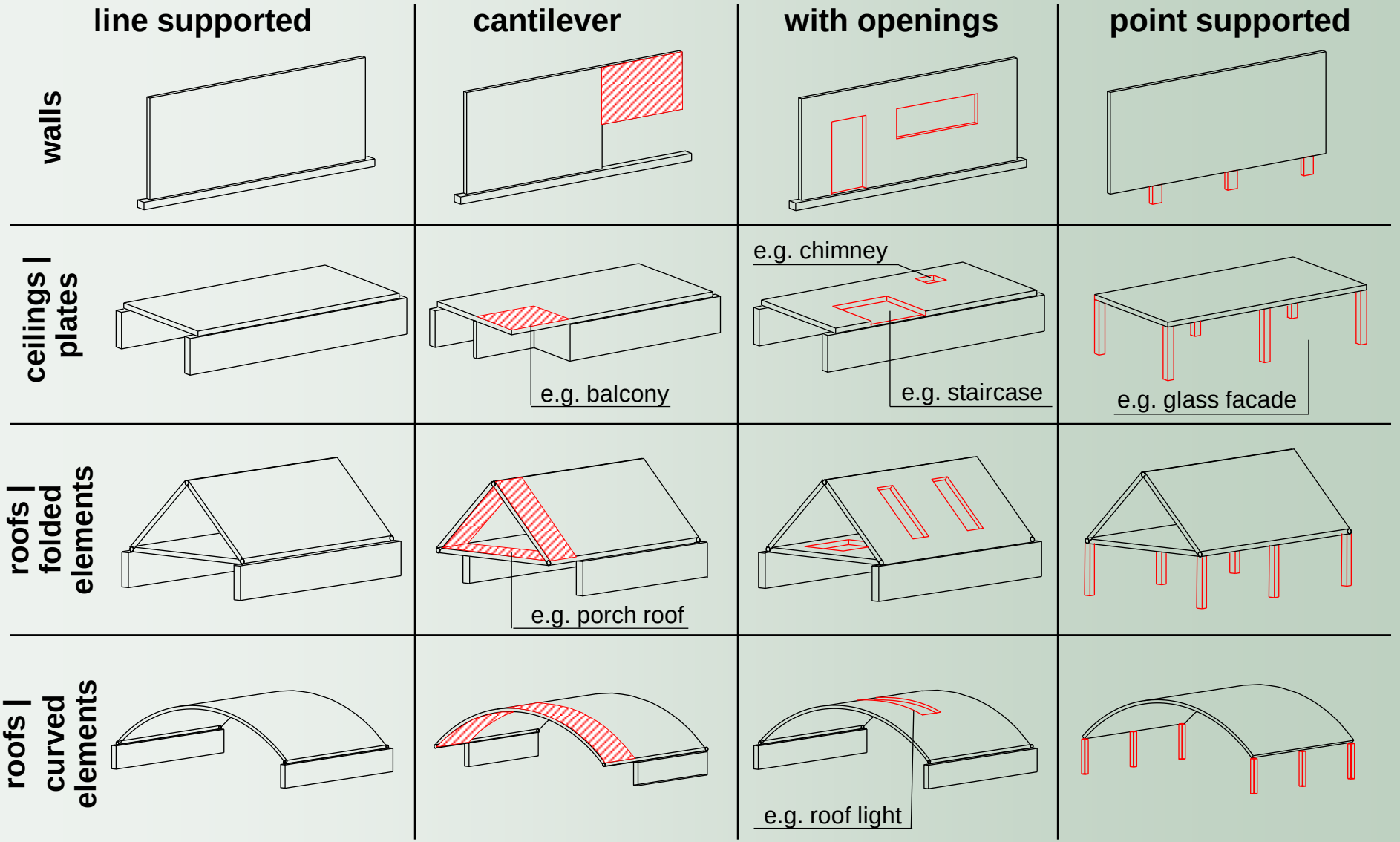


ventilation zone:
- protects against overheating
- secondary construction can dry out
- should have accessible height

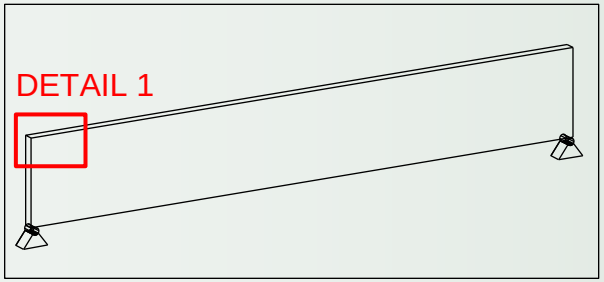
second insulation layer:
- additional protection against moisture ingress
- should be positioned inclined

→ vulnerable building zones should be easy to **maintain**, **control** and **repair**

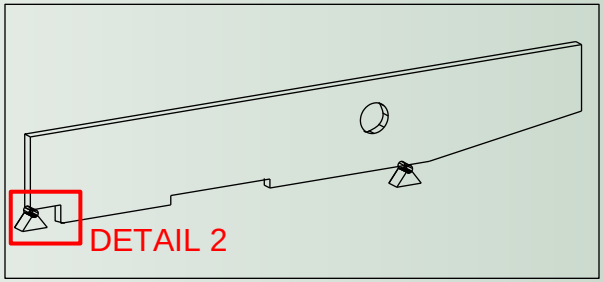
Use of CLT as 2D Elements



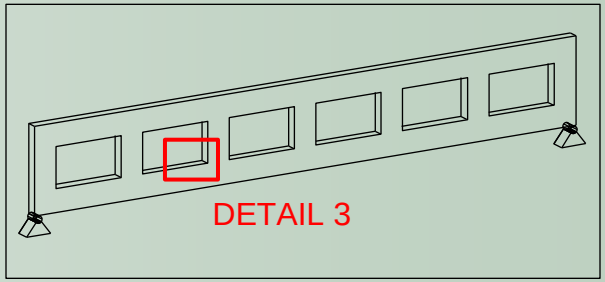
Use of CLT as 1D Elements



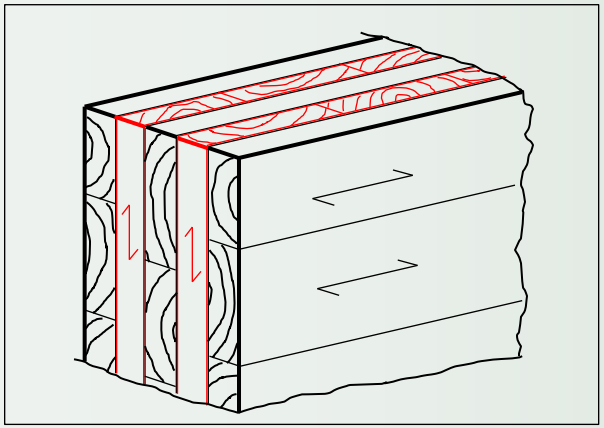
beam
without openings



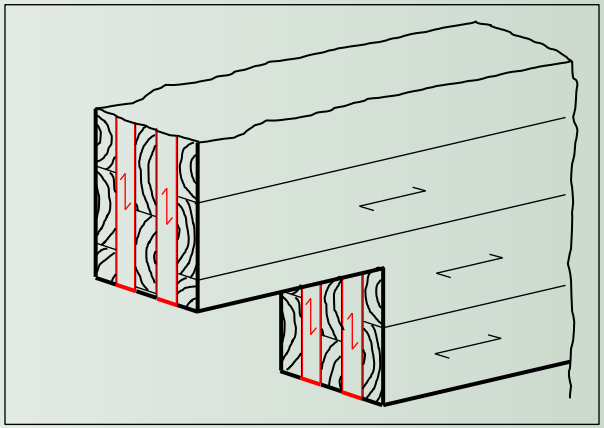
tapered beam with notched support
and openings



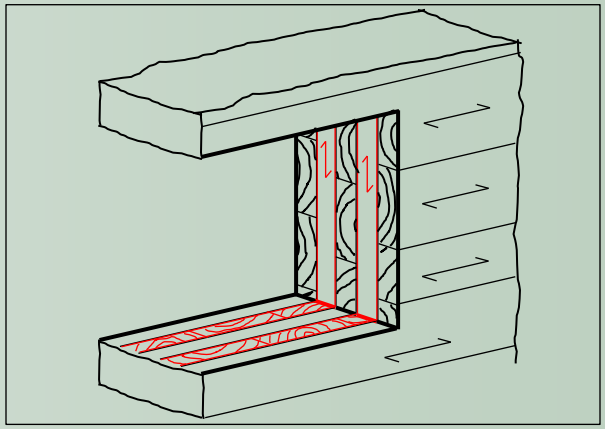
beam as `Vierendeel system´



detail 1:
built up of a 5-layered
beam element



detail 2:
notched support



detail 3:
opening

vertical (cross) layers as `reinforcement´ of CLT
(high capacity in shear and tension perp. to grain)

→ Research activities are needed!

Residential Buildings

Hartberg (AUT) | 2008
CLT by KLH

Graz (AUT) | 2007
CLT by Mayr-Melnhof Kaufmann

Eichgraben (AUT) | 2008
CLT by Stora EnsoTimber

Multi-Storey Buildings

3-storey building
Judenburg (AUT) | 2002
CLT by KLH

4-storey building
Judenburg (AUT) | 2002
CLT by KLH

5-storey building
Berlin (GER) | 2010
CLT by KLH

Multi-Storey Buildings

5-storey building
Vienna (AUT) | 2005
CLT by KLH

8-storey building
London (UK) | 2008
CLT by KLH

10-storey building
Melbourne (AUS) | 2012
CLT by KLH

Kindergarten

© Pictures: Mayr-Melnhof Kaufmann

© Pictures: Binderholz Bausysteme GmbH

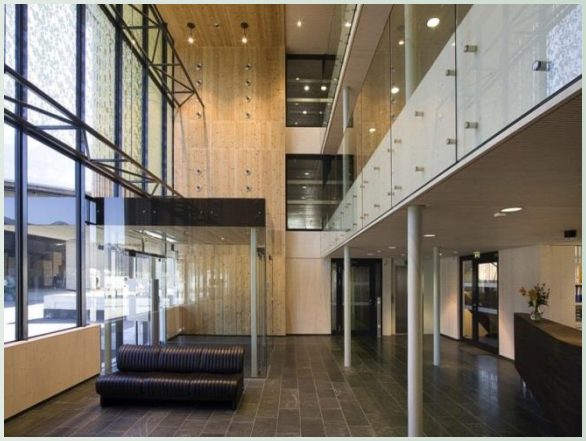
© Pictures: KLH

Peggau (AUT) | 2009
CLT by Mayr-Melnhof Kaufmann

Innsbruck (AUT) | 2008
CLT by Binderholz Bausysteme

Augsburg (GER) | 2013
CLT by KLH

Office Buildings



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Headquarter Mayr-Melnhof
Leoben (AUT) | 2008
CLT by Mayr-Melnhof Kaufmann

© Pictures: Binderholz Bausysteme GmbH

Headquarter Binder Holz
Fügen (AUT) | 2007
CLT by Binderholz Bausysteme

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Building Research Center
TU Graz (AUT) | 2006
CLT by Holzleimbau Stingl

Special Constructions

© Pictures: KLH

Vennesla Library
Vennesla (NOR) | 2011
CLT by KLH

© Pictures: Mayr-Melnhof Kaufmann

Swimming Pool at top level
Hagenberg (AUT) | 2010
CLT by Mayr-Melnhof Kaufmann

© Pictures: holz.bau forschungs gmbh, Graz

Footbridge over the river Raab
Feldbach (AUT) | 1998
CLT by Holzleimbau Stingl

Special Constructions

© Pictures: KLH and Stora Enso

Timber Tower®
Hannover (GER) | 2012
CLT by KLH and Stora Enso

© Pictures: Schillinger

Monte Rosa
Valais (CH) | 2010
CLT by Schillinger

© Pictures: AHEC

Endless Stair
London (GBR) | 2013
CLT by Imola Legno

THANKS FOR ATTENTION!

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