



COST Action CA 20139

Holistic design of taller timber buildings (HELEN)

Training School

"Case Studies in Taller Timber Buildings"

19-20 May 2025, Zurich, Switzerland

Edited by

Pedro Palma, Maria Felicita, and Steffen Franke (list of speakers in page iii)

Organised by  **Empa**
Materials Science and Technology

ETH zürich

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General info

This report comprises the slides of the presentations held during the Training School "Case Studies in Taller Timber Buildings", which took place on 19-20 May 2025, in Zurich, Switzerland, and was organised by Working Group (WG) 1 of COST Action CA20139 "Holistic Design of Taller Timber Buildings" (HELEN). WG 1 "Design for robustness, adaptability, disassembly and reuse, and repairability" is coordinated by Pedro Palma.

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The sole responsibility of the content of the various presentations lies with their authors.

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Foreword

The increasing demand for timber buildings for different kinds of uses presents challenges in the planning, construction, use, repair, and decommissioning phases. In the Training School "Case Studies in Taller Timber Buildings", we invite practitioners involved in different aspects of timber construction to share their experience and approaches regarding architectural and structural design, fire safety, durability, acoustics, construction, dealing with authorities, repair, and design for disassembly, amongst other topics. The event allowed for an open exchange of practical knowledge and ideas on how to successfully deal with the many specific, and sometimes conflicting, aspects of timber buildings.

List of speakers

(listed alphabetically by the last name)

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Fire-safety of timber buildings and facades

Thomas Engel

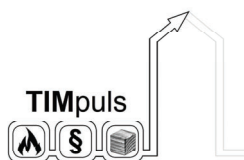
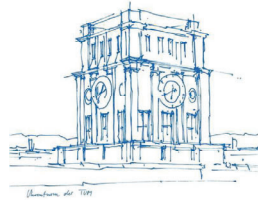
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Fire-safety of timber (buildings) & facades

Dr.-Ing. Thomas Engel
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Chair of Timber Structures and Building Construction

COST Action CA20139 Holistic Design of Taller
Timber Buildings – HELEN - Online, 19th May 2025



Technical University of Munich
Technische Universität Braunschweig
Magdeburg-Stendal University of Applied Sciences
Institute of Fire and Civil Protection
Heyrothsberge



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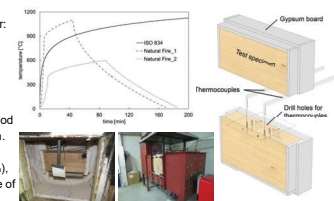


More Information: <https://doi.org/10.14459/2022md1661419>

Charring under different temperature conditions

42 one-dimensional and two-dimensional charring tests with different wood types under:

- Nominal temperature-time curve,
- A high natural fire curve,
- A moderate natural fire curve with a long duration.



Particular consideration was given to hardwood species with a regard to forest reorganisation.

The values (charring rate) for ash (0,75 mm/min), beech (0,7 mm/min) and oak (0,5 mm/min) are one of the bases for the new EC5.

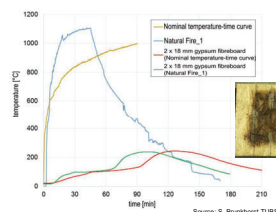
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More Information: <https://doi.org/10.14459/2022md1661419>

Behavior of fire protection lining / system



The behaviour was investigated under

- different temperature conditions
- and with different board thicknesses, numbers and types (gypsum plasterboard or gypsum fiberboard).

The protection time of a lining corresponds to the time until 300°C (ignition temperature of wood) is reached behind the lining.

It was shown that the protection times are significantly longer than those of the test methods currently used in Germany.

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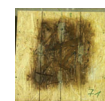
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Key point about fire protection lining

Both K classes and protection time t_{ch} – prevent extended ignition and can be used in the assessment

- **Capsule Lining K_2**
 - 2 x 18 mm gypsum boards K_2 60
 - 1 x 18 mm gypsum board K_2 30
- **Fire protection system t_{ch} (including discolouration and charring)**
 - 2 x 18 mm gypsum board over 90 min ETK
 - 2 x 15 mm / 1 x 25 mm gypsum board over 60 min ETK
 - 1 x 18 mm gypsum board over 30 min ETK



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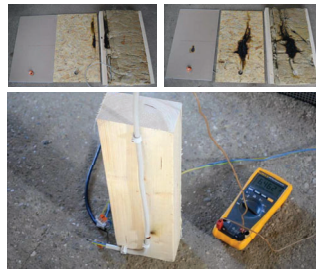
More Information: <https://doi.org/10.1002/bate.202000076>

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Arc faults

The investigation focussed on the question of whether an arc fault is able to cause an independent burning of the timber structure.

There was no independent burning of the timber structure in any of the investigated scenarios on different components with significantly longer exposure times than in reality.



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TIMPuls full-scale compartment fire tests

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Fire Dynamics

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Methodology:

- One full-scale compartment fire test as a reference building - non-combustible construction.
- Four compartment fire test, each with an increasing exposed timber surface at the beginning in addition to the only initially protected timber surfaces.
- Façade shield with thermocouples and bidirectional probes for measuring temperature, heat flux density and flow velocity.



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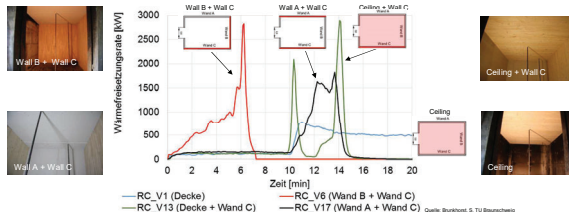
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Test series of compartment fires

Influence of quantity and geom. Arrangement of visible timber surfaces on the fire dynamics



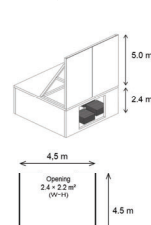
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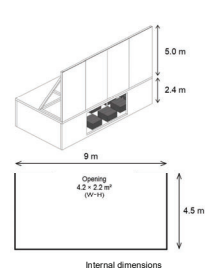
Concept

- Mass timber or light timber frame walls and ceilings
- Compartment floor area: 20,25 m² or 40,5 m²
- Opening: 5,28 m² or 9,24 m²
- Opening factor = 0,094 m^{0.5}
- Movable fire load = 1.085 MJ/m² approx. 74 kg/m² wood = 1.5 t (V0, V1, V2) and approx. 3 t (V3, V4)

V0, V1 and V2



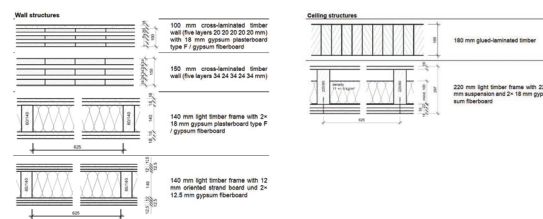
V3 and V4



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Bauteile



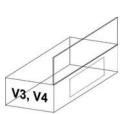
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Aufbau der Brandversuche

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Test	V0	V1	V2	V3	V4
Compartment size (W x L x H)	4.5 m x 4.5 m x 5.0 m	4.5 m x 4.5 m x 5.0 m	4.5 m x 4.5 m x 5.0 m	4.5 m x 9.0 m x 5.0 m	4.5 m x 9.0 m x 5.0 m
Floor space	20.25 m ²	20.25 m ²	20.25 m ²	40.5 m ²	40.5 m ²
Opening size (W x H)	2.4 m x 2.2 m (W-H)	2.4 m x 2.2 m (W-H)	2.4 m x 2.2 m (W-H)	4.2 m x 2.2 m (W-H)	4.2 m x 2.2 m (W-H)
Fire load density	1085 MJ/m ²	1085 MJ/m ²	1085 MJ/m ²	1085 MJ/m ²	1085 MJ/m ²
Wall 1	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF
Wall 2	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF
Wall 3	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF
Wall 4	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF
Ceiling	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF	100 mm CLT 2 x 25 mm GPF
Linear components	-	-	-	-	2 x Colosseum 1 x Besser
Exposed surface (solid)	-	35%	35%	42%	58%



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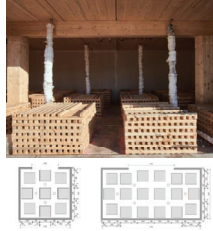
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Fire Load

For the tests, a fire load density was selected that is appropriate for residential buildings. According to DIN EN 1991-1-2/NA:2015-09, this results in a characteristic fire load density of 1085 MJ/m² for the 90% quantile.

- Equally distributed wooden cribs, each measuring 1,000 x 1,000 mm, made of rods with dimensions W x H = 40 x 40 mm
- The material to air ratio of the cribs is 1:1.
- Taking into account the moisture content and raw density of the wooden cribs (pine), the fire load described above of 1085 MJ/m² corresponds to:
 - approx. **74 kg/m²** wood
 - approx. **1.5 tonnes of wood** (total) in a small compartment (4.5 x 4.5 m) from 9 cribs
 - approx. **3 tonnes of wood** (total) in a large compartment (4.5 x 9 m) from 18 cribs



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Brandidynamik

Test 0: Reference building



Test 1: Ceiling



Non-combustible on all sides
2 x 25 mm gypsum cladding



Unprotected GLT ceiling, walls with
1 x 18 mm gypsum plasterboard

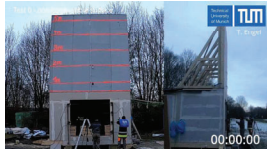
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Brandidynamik

Test 0: Reference building



Non-combustible on all sides
2 x 25 mm gypsum cladding

Test 1: Ceiling



Unprotected GLT ceiling,
walls with 1 x 18 mm
gypsum plasterboard

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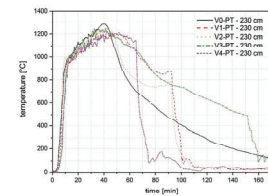
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More Information: <https://doi.org/10.1007/s10694-022-01346-8>
<https://doi.org/10.1016/j.firesaf.2024.104179>

Gas temperature TIMPuls tests

- V0 - V4: Similar fire development phase
- V0 - V4: Comparable fully developed fire phase
- V0 - V4: Different decay phase
 - V0: Burning of the movable fire load
 - V1: Renewed temperature rise after 85 min.
 - V2: Renewed temperature rise after 80 min.
 - V3: Slowly falling temperature
 - V4: Extinguishing measures after 65 min.



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Impact of mass timber compartment fires on façade fire exposure

Research questions:

- Determine how the flame length, temperature and heat flux on the façade are influenced by additional structural (immobile) fire load.
- Quantify the influence of additional structural (immobile) fire load on the time of the flashover and consequently on the fully developed fire on the façade.
- Findings based on real fire tests without scaling effect and with residential-type fire load.



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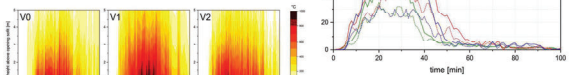
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Impact of mass timber compartment fires on façade fire exposure

Results:

- In the fully developed phase, approx. 200°C temperature difference between V0 and V1.
- In the fully developed phase, peak deviations of up to 35 kW/m² difference in relation to the heat flux between V0 and V1.



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More Information: <https://doi.org/10.1007/s10694-022-01346-8>

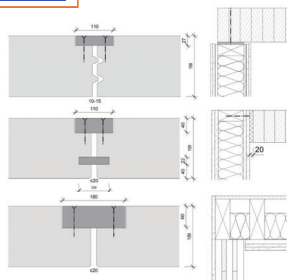
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More Information: <http://dx.doi.org/10.13140/RG.2.2.29537.33121>



Fire-safe design of joints and intersections

- Review of the design principles
- In addition to measures to prevent the spread of fire, the focus was also on measures to prevent the spread of smoke.
- Identification of the general design principles based on the test results.



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V2 - after the end of the test



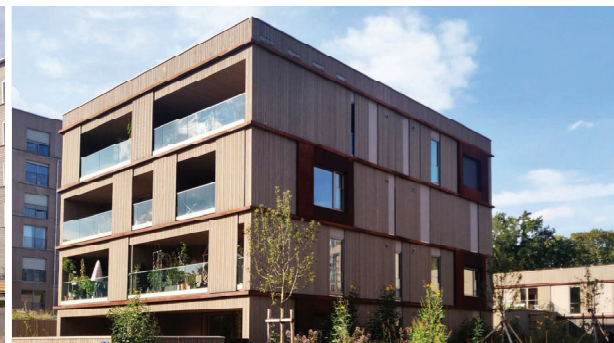
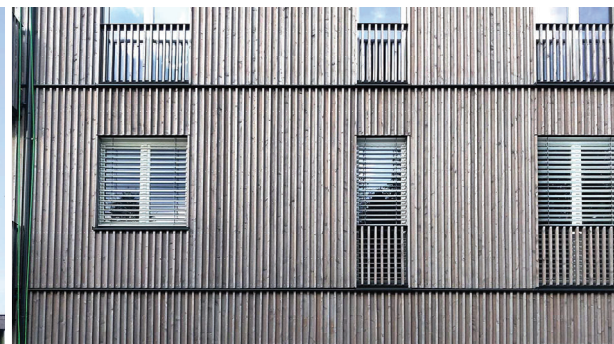
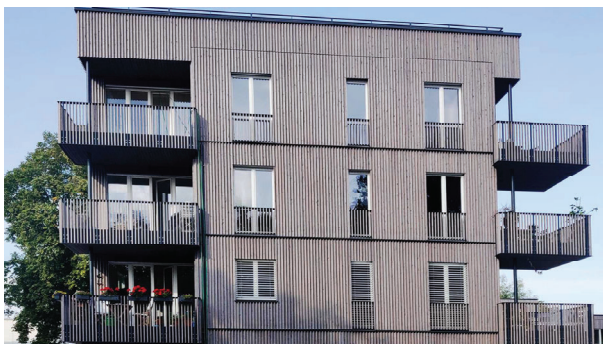


Structural Means for Fire-Safe Wooden Façade Design



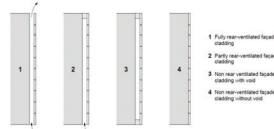
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Research questions:

- Obtain knowledge on how fire stops in particular limit the vertical spread of fire over longer periods of fire exposure.
- Development of further design principles for the fire safety optimisation of wooden façades.



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Wooden façades

Methodology:

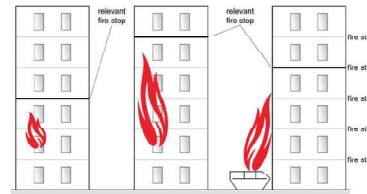
- Six fire tests with different types of wooden façades.
- Evaluation of independent burning above the primary flame.
- Different variants and constructive designs.
- Further full-scale tests to verify the results.



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Fire Stops



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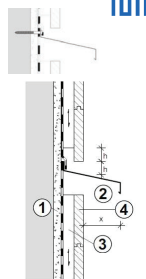
Structural Means

If the exterior walls are made of combustible materials, non-combustible fire protection cladding must be applied to the exterior. ①

Fire spread on wooden façades can be effectively limited by projecting fire stops made of sheet steel arranged on each floor. ②

The horizontal fire stops on each floor must be designed in terms of their dimensions, in particular the horizontal projection in front of the exterior wall cladding, depending on the type of façade used. The more open, the worse from a fire protection perspective. ② ④

The spacing and size of the fasteners must be selected so that thermal stresses do not lead to deformation. Fastening with steel screws $\phi \geq 4$ mm, spacing ≤ 200 mm. ②



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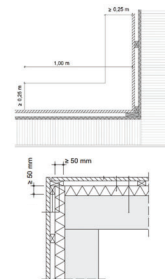
Structural Means

- Inner corners are very critical points in terms of fire spread, as significantly higher flames develop here. Larger projections are necessary here. ②

- This is considered to be fulfilled with a blocking in the ventilation gap of the external corner with wooden battens at least 50 mm wide. ③

- The fire brigade must be able to extinguish the facade. This means that they must be able to reach it. ④

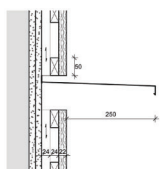
More Information: <https://doi.org/10.1007/s10694-021-01174-2>



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Fire Test - Open Cladding



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Combination of green façade & wooden façade

Research questions:

- Knowledge of the interactions between wooden and green façades in the case of fire.
- Quantification the influence of short-term heat fluxes from dry plants on the wooden cladding. Is the heat flux sufficient to ignite a wooden façade cladding, or are fire protection measures (fire stops) negatively affected?
- Does burning climbing plants lead to fire spread on the wooden façade above the fire stops?



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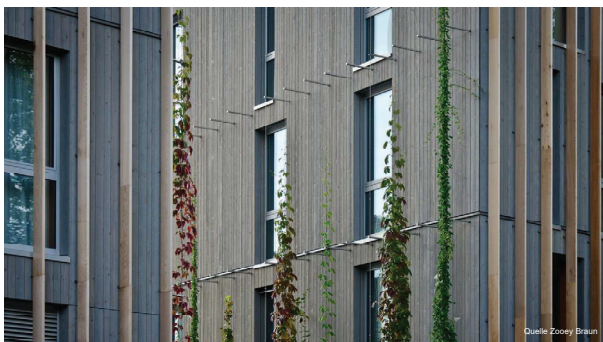
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Types of green façades



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Green façade & wooden façade in combination

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Methodology:

- One façade fire test on medium scale without plants as a reference test.
- Two façade fire tests on medium scale with high-density vital plants of ivy (*Hedera helix*).
- In this context, high density means uncultivated and high mass (max. 8.3 kg/m²).
- 110 mm distance between trellis and wooden cladding. Gap between wood and trellis completely filled with plant material.



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Combination of green façade & wooden façade

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Results:



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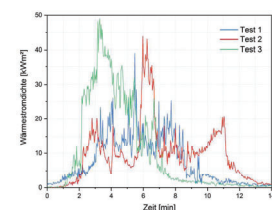
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Combination of green façade & wooden façade

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Results:

- In conclusion, it can be stated that burning plants does not ignite the wooden façade behind them.
- The requirement for this specification is a minimum distance of 110 mm between the trellis and the wooden cladding and regular care and maintenance of the plants (removal of dead wood).



More Information: <https://mediatum.ub.tum.de/7715368>

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Full-scale "wall test" vital vs. dry

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Full-scale „balcony test“

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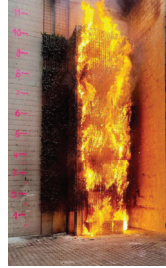
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Full-scale „balcony test“



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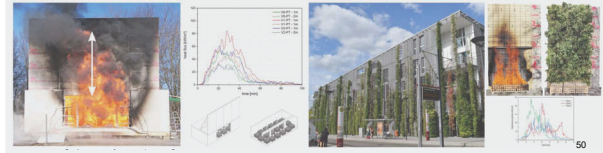


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Thank you for your attention



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Acoustics in timber buildings: research and practice in Switzerland

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Acoustics in timber buildings: research and practice in Switzerland


PART 1

COST Action HELEN
June 20th 2025

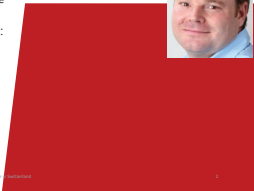
Stefan Schoenwald
stefan.schoenwald@empa.ch
Laboratory for Acoustics/Noise Control



Stefan Schoenwald



- Studied Building Physics at HfT Stuttgart
- Ph.D. from TU Eindhoven, Netherlands:
 - Sound transmission through lightweight framed double leaf walls
- Research Officer at National Research Council Canada:
 - Sound insulation in timber buildings
 - Tall wooden buildings in Canada
- Scientist at Empa Lab for Acoustics/Noise Control:
 - Modelling and optimising performance of timber elements and buildings

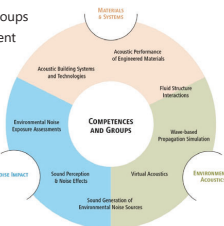



Overview Laboratory for Acoustics / Noise Control

- Laboratory with 40 employees, organized in three groups
- Focus on transportation noise and the built environment


Mission:
Reduce noise and foster pleasant acoustic environments

Approach:
Develop smart materials and noise reduction technologies







Generation




Propagation



Exposure



Perception & Assessment




Annoyance & Health Effects

Control Sound to Reduce Noise

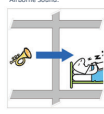
Content of Part 1

- State-of-the-Art:
 - Introduction to sound insulation in building
 - EN ISO 12354 prediction method
 - Case study on flanking sound transmission
- New approaches:
 - Efficient FEM-modelling of mass timber elements
 - Cross laminated timber floor with acoustic black holes




Sound Insulation in Buildings

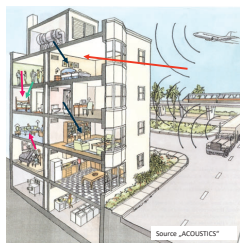
- Protection occupants against noise from:
 - Interior sources: People talking, Hi-Fi, home theatre, people walking, HVAC-equipment,...
 - Exterior sources: traffic, aircraft, road, industrial
- Reduce sound transmission through the building structure



Airborne Sound



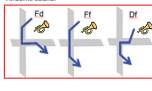
Impact Sound




Source: "ACOUSTICS"

Sound Transmission in Buildings

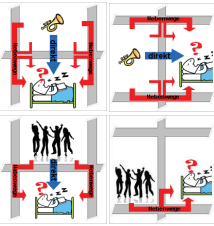
- Apparent sound insulation in buildings, due to...
 - **Direct sound transmission:** partitions like floors and walls
 - **Flanking sound transmission:** structure-borne sound through connections of flanking elements
- Flanking sound is often problematic, especially for airborne transmission, due to multiple paths.
- Flanking paths at one junction:



Airborne Sound



Impact Sound



Noise control design in timber buildings

- Post-Completion Testing:
 - Required by most builders



Airborne Sound



Impact Sound Sources: <Standard Walking Persons>




Mock-up of wooden building

- Challenges:
 - Lack of noise control tools and data for some construction types
 - Noise control designs for wooden buildings often rely on engineers' knowledge and experience
- Risks:
 - Overdesign: Increased costs, reduced sustainability
 - Failure: Expensive repairs, bad reputation, tenant turnover

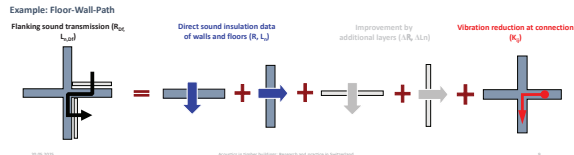
Noise Control Design Method

- EN ISO 12354 "Prediction of sound insulation in buildings from the performance of elements":
 - Developed since the 1990s
 - Requires limited expert knowledge
 - Uses a spreadsheet solution – computationally cheap
- Application:
 - Well established for concrete and masonry buildings
 - Works with simple line-connected building elements
- Input data:
 - For masonry – most necessary input data provided by standard
 - For timber – data still limited



EN ISO 12354 – Calculation Scheme

- Prediction of flanking sound transmission for every path from:
 - Walls and floors: Direct sound insulation (airborne R_a and impact L_n)
 - Floating floors, wall linings, hung ceilings: Improvement of sound insulation (ΔR_a , ΔL_n)
 - Connections: Vibration reduction (K_j)



Element Data for EN ISO 12354

- Available data for airborne and impact sound insulation of walls and floors and additional layers:
 - Tests according to EN ISO 10140 are required for product «certification»
 - Installation, adding and modifying flooring system is simple
- Databases available, e.g. www.lignumdata.ch



Vibration Reduction at Connection for EN ISO 12354

- Limited data on connections:
 - Vibration Reduction Index (K_{ij}) - Derived from measured surface velocity level differences of connected elements
 - Set-Up - Connections between full-scale floors and walls
 - Typical Connections - Focus on «strongest» connections -> acoustic worst case



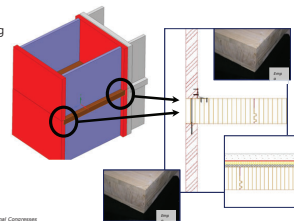
$$K_{ij} = \frac{D_{v,ij} + D_{v,ji}}{2}$$

$$D_{v,ij} = L_{v,i} - L_{v,j}$$

$$D_{v,ji} = L_{v,j} - L_{v,i}$$

Case Study - Application of EN ISO 12354

- Two rooms one-above the others, (3 m x 4 m)
- Separating floor (Glulam) with ballast and floating floor topping:
 - 70 mm floating concrete screed
 - 30 mm impact sound insulation, glass fibre, 6 MN/m²
 - 30 mm Polystyrene foam insulation (resilient EPS)
 - 90 mm gravel ballast
 - Glulam-floor (220 mm, 102 kg/m²)
- Flanking CLT walls (100 mm, 48.4 kg/m²)
- Framed decoupled lightweight walls:
 - not taken into account
 - better performance due to decoupling



Case Study - Noise Control Measures

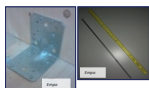
"Rigid" connection – base line:

Connectors:

- Upper wall: 3 angle brackets
- Lower wall: 14 screws

Flanking walls:

- No lining



"Wall lining":

Connectors:

- Upper wall: 3 angle brackets
- Lower wall: 14 screws

Flanking walls:

- 15 mm gypsum fibre board, on
- 40 mm wooden battens, spaced 625 mm
- 40 mm glass fibre insulation



"Resilient" connection:

Connectors:

- Upper wall: 12 mm PUR-foam
- 3 resilient brackets
- Lower wall: 14 screws

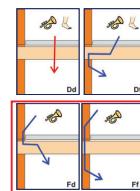
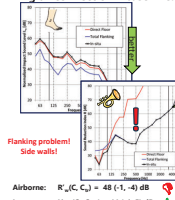
Flanking walls:

- No lining



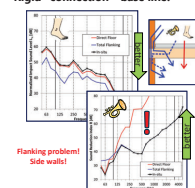
Case Study - Prediction Results

"Rigid" connection – base line:



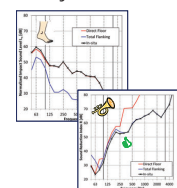
Case Study - Prediction Results

"Rigid" connection – base line:

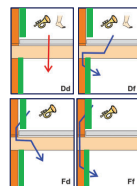


Airborne: $R'_{a,w}(C, C_w) = 48 (-1, -4)$ dB
Impact: $L'_{n,w}(C_w, C_{n,w}) = 44 (-1, 5)$ dB

"Wall lining":

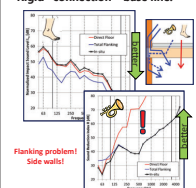


Airborne: $R'_{a,w}(C, C_w) = 61 (-3, -10)$ dB
Impact: $L'_{n,w}(C_w, C_{n,w}) = 44 (-1, 5)$ dB



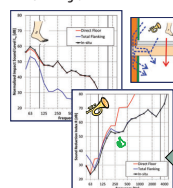
Case Study - Prediction Results

"Rigid" connection – base line:



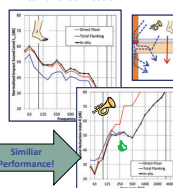
Airborne: $R'_{a,w}(C, C_w) = 48 (-1, -4)$ dB
Impact: $L'_{n,w}(C_w, C_{n,w}) = 44 (-1, 5)$ dB

"Wall lining":



Airborne: $R'_{a,w}(C, C_w) = 61 (-3, -10)$ dB
Impact: $L'_{n,w}(C_w, C_{n,w}) = 44 (-1, 5)$ dB

"Resilient" connection:

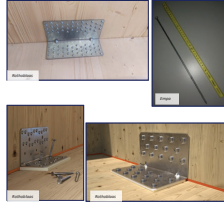


Airborne: $R'_{a,w}(C, C_w) = 58 (-2, -7)$ dB
Impact: $L'_{n,w}(C_w, C_{n,w}) = 44 (-1, 5)$ dB

Conclusions on Engineering Methods

- Processes to predict sound insulation in mass timber buildings exist
- Noise control measures can be optimised for given situations
- However, input data for prediction is still limited:
 - Time consuming and costly experiments
 - Connection details affect flanking:
 - Type of connectors
 - Number of connectors
 - ...
- Numerical modelling of connections to augment experimental data?

The presented research are results of the Lignum project "Sound Insulation in Timber Buildings" funded by the Aktionsplan Holz of Swiss Federal Office for Environment (FOEN)



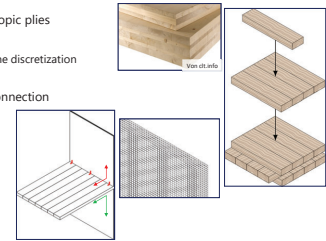
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Finite-Element-Model for Connections of CLT Elements

- Layered composite material with orthotropic plies
- Standard Finite Element Model (FEM):
 - Frequency range up to 5 kHz requires fine discretization
 - Computationally very costly
- Several CLT elements are coupled at a connection
- Computational efficient FEM-Model for element required!



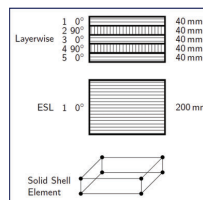
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Efficient FEM-Modelling of CLT Element

- Homogenisation key feature of efficient model [1]:
 - Representation of layered plate as single equivalent layer
 - Use of solid-shell-elements
 - Taking into account 1st order shear deformations
- Material data of the single plies from model updating using results from one experiment



[1] S. Vahaly and S. Schoenwald, "An efficient analytical method to obtain the homogenised frequency-independent elastic material properties of cross-laminated timber elements," *Journal of Sound and Vibration*, vol. 546, 2023

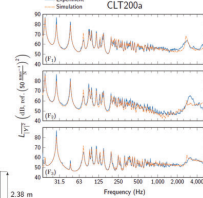
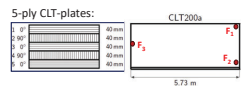
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Validation of FEM Model - Structural Vibration

- Accuracy:**
 - Excellent agreement of predicted and measured **average surface mobility**
- Efficiency:**
 - Computation time **less 10min**
 - 1200x speed up** compared to model with solid elements



From Vahaly, S., & Schoenwald, S. (2024). Higher order model parameter estimation and verification of cross-laminated timber plates for structural-acoustic analysis. *Acta Acustica*, 6, 52 (15 pp) / <https://doi.org/10.3329/acta.2024.000404>

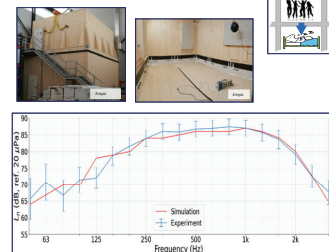
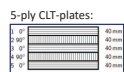
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FEM Model - Prediction of Impact Noise

- Post-Processing:**
 - Adjustment of boundary conditions
 - Consideration of impact force
 - Radiation of impact sound
- Accuracy:**
 - Very good agreement between predicted and experimental impact sound



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New Approach – Acoustic Black Holes

Replacement of full-surface gravel ballast with "Acoustic Black Holes" for impact sound reduction

We gratefully acknowledge...

The financial support of the Swiss Federal Office for Environment (FOEN) under its Environmental Technology Promotion program
The support by Strüby Holzbau AG, Seewen (SZ) and by Timber Structures 3.0 AG, Thun, Switzerland for realization of the test set-ups

<https://www.bnl72506430404>



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Impact Sound Insulation of Mass Timber Floors - Current Solutions

- Increase Mass:**
 - Add gravel ballast to double or triple the mass of the bare floor
- Additional Floor Toppings:**
 - Use floating screeds on a resilient interlayer



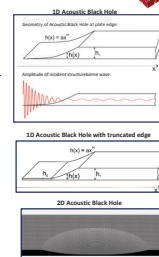
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Principle of «Acoustic Black Holes» (ABH)

- First described by Mikhail Mironov in 1988 [1]:
 - Ideally graded plate edges follow a power law to infinitesimal thickness.
 - No reflection of incident bending waves.
 - Complete absorption of waves above ABH cut-on frequency
- Practical ABH with «truncated» edges [2]:
 - Increase of wave amplitudes
 - Vibration reduction due to enhanced damping of structure-borne sound at ABH
 - ABH effect depends on geometrical parameters and damping



[1] Mironov, M. A. "Propagation of a flexural wave in a plate whose thickness decreases smoothly to zero in a finite interval." *Soviet Physics Acoustics* 34.3 (1988): 318-319
[2] A. Pele, A. Gaudier, S. C. C. Santos, and F. Semperlotti, "The acoustic black hole: A review of theory and applications," *Journal of Sound and Vibration*, vol. 476, 2020.

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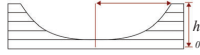
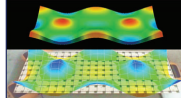
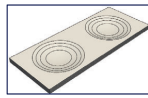
ABH Design for CLT Floors

Challenges:

- No simple analytical relationship for ABH geometry
- Layered composite with orthotropic plies
- Local variation of plies and thickness in ABH

Solution:

- Use our efficient FEM model for CLT floors as a test case



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Full-size CLT Floor with ABH - Specimen and Test Set-up

Specifications:

- CLT: 200 mm, 5-ply, 5.73 m x 4.76 m
- With and without 4x ABH (Ø 220 mm, depth 160 mm)
- Gravel filled only 60% more mass than reference without ABH
- Floating 70 mm concrete slab on resilient interlayer (glass wool, 6 MN/m³)

Impact sound testing according to EN ISO 10140-3



REPORT ABH DESIGN - LOW NOISE ENGINEERED WOOD BUILDING ELEMENTS (WOLFGANG DIERKE)



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CLT Floor with ABH and Floating Floor – Test Results

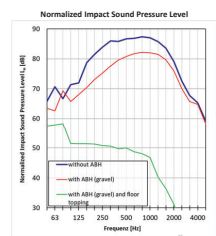
- Legal requirements and stricter recommendations for impact sound between habitable rooms in Switzerland can be met:

Floor Performance	47	45	50
StA 185 - Minimum Requirement	≤53	≤53	≤50
StA 185 - stricter Requirement	≤49	≤49	≤50
Lignum - Min. recommendation	≤49	≤49	≤50
Lignum - Higher comfort class	≤49	≤49	≤50
Lignum - Highest comfort class	≤49	≤49	≤49

- Without flanking sound transmission -> however, we have a safety margin
- Limits expressed as $L_{n,T,w}$ -> for receiving room volume >30 m³ smaller $L_{n,T,w}$ -values for floor

Requires only 30% of the additional mass of a current full gravel ballast

REPORT ABH DESIGN - LOW NOISE ENGINEERED WOOD BUILDING ELEMENTS (WOLFGANG DIERKE)



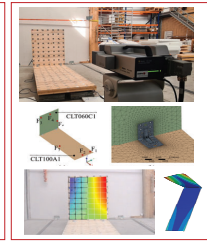
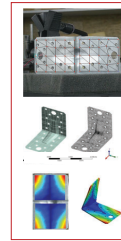
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Conclusions

- Current approach: Sound insulation design of mass timber buildings relies on experimental input data
- Emerging Trend: Numerical models are increasingly effective for solving acoustic issues
- Goal: Numerical data will complement experimental data
- Key: Optimized and new noise control solutions



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PIRMING JUNG



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PART 2

19 Mai 2025 – Renzo Cremonini

Renzo Cremonini



- Studied civil engineering at the University of Ferrara (IT)
- PhD in sound insulation and acoustics in Ferrara
- Research work in sound insulation and acoustics in Ferrara
- Graduate acoustician SGA
- With PIRMING JUNG Schweiz AG since 2013
- Project manager for sound insulation and acoustics
- Contact: renzo.cremonini@pirminjung.ch

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PIRMING JUNG Switzerland AG

- Sustainability and ecology
- Heat and moisture protection
- Noise protection, sound insulation and room acoustics
- Simulations



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Contents

- Practical examples of standard timber building structures in Switzerland
- Practical examples of timber construction details
- Planning and execution errors

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Practical examples of standard timber building structures

Practical examples of timber construction details

Planning and execution errors

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Practical examples of standard timber building structures

Note

- The details on the following pages are only examples of robust standard timber building structures and details for the Switzerland, ideal for residential construction
- These structures and details ensure compliance with the increased requirements of standard SIA 181: $D_{n,T,w} + C \geq 56$ dB, $L'_{n,T,w} + C_i \leq 49$ dB
- The term "robust" refers to a structure or detail that is less susceptible to planning and execution errors

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Practical examples of standard timber building structures

Materials

Flexible panelling

- Plasterboard 12.5, 15 and 18 mm
- OSB boards up to 18 mm (but less mass)
- (clay building boards)



Rigid panelling

- Plasterboard 20mm or more
- Wood-panels
- Cement-bonded boards



Unsuitable gravel ballast

- Cement-bound gravel ballast



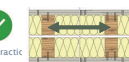
Suitable gravel ballast

- (approx. 1,400 kg/m³, max. grain size 8 mm)
- Loosely laid gravel ballast (unbound)
- Elastic-bonded backfill



Distance between wall studs

- At least 600mm



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Practical examples of standard timber building structures

Solid wood panel with gravel ballast and concrete screed

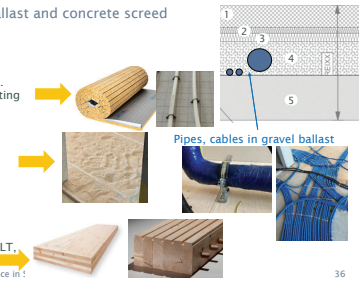
- Concrete/anhidrite screed 65-80 mm

- Glass wool with s' max. 6 MN/m³ (e.g. glass wool 30 mm with paper for heating pipes)

- (possibly intermediate layer, strongly recommended)

- Gravel ballast with a density $\geq 1'400$ kg/m³: Loosely laid or elastic bonded gravel ballast 120 mm

- Solid wood panel 140 mm or more (CLT, glue laminated timber etc.)



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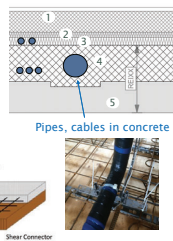
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Practical examples of standard timber building structures

Timber-concrete composite floor with concrete screed

- Concrete/anhidrite screed 65-80 mm
- Glass wool with s' max. 6 MN/m³ (e.g. glass wool 30 mm with paper for heating pipes)
- Installation layer (better rock wool) at least 30mm for remaining electric cables
- Concrete plate 120/140 mm (better 140mm) with reinforcing steel
- Solid wood panel 140 mm or more (CLT, glue laminated timber etc.)

Same as before



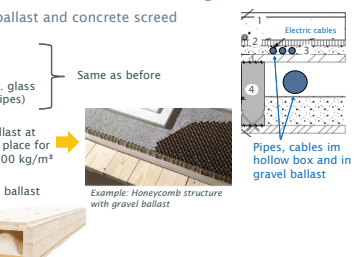
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Practical examples of standard timber building structures

Hollow box ceiling with gravel ballast and concrete screed

- Concrete/anhidrite screed 65-80 mm
- Glass wool with s' max. 6 MN/m³ (e.g. glass wool 30 mm with paper for heating pipes)
- Installation layer with loose gravel ballast at least 30 mm (better 50-60 mm, more place for crossing electric cables), density ≥ 1400 kg/m³
- Hollow box element with loose gravel ballast inside (density ≥ 1400 kg/m³)



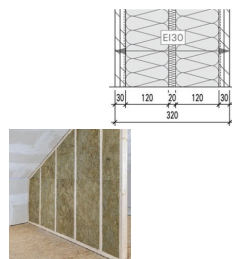
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Practical examples of standard timber building structures

Partition wall double shell

- 2x15 mm gypsum fibre board (1150 kg/m³)
- 120 mm timber frame with 120 mm mineral fibre
- 20 mm separation
- 120 mm timber frame with 120 mm mineral fibre
- 2x15 mm gypsum fibre board (1150 kg/m³)

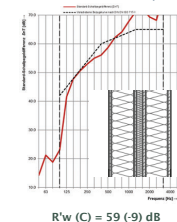


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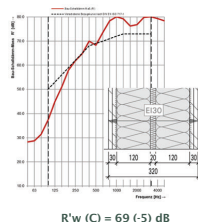
Practical examples of standard timber building structures

Influence of the inner panels in a partition wall



$R'w(C) = 59 (-9)$ dB

The thickness (320 mm) and the mass (4x15 mm gypsum fibre board) are the same for both walls. However, the panels are positioned differently. The inner panels reduce sound insulation, especially in the low frequency range, due to cavity resonance.



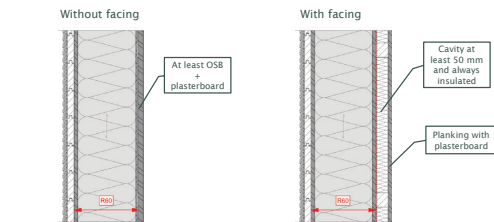
$R'w(C) = 69 (-5)$ dB

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Practical examples of standard timber building structures

Interior panelling exterior wall



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Practical examples of standard timber building structures

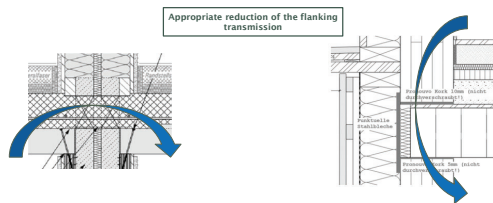
Practical examples of timber construction details

Planning and execution errors

Acoustics in timber buildings: research and practice in Switzerland

Practical examples timber construction Details

Purpose

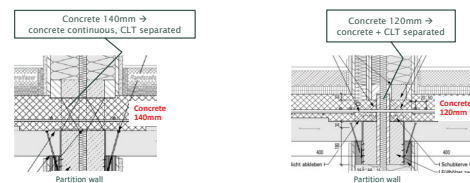


Acoustics in timber buildings: research and practice in Switzerland

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Practical examples timber construction Details

Timber concrete composite floor connection with partition wall

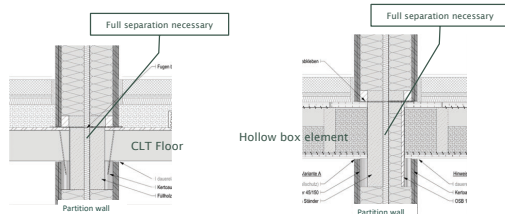


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Practical examples timber construction Details

Connection of timber floor with partition wall

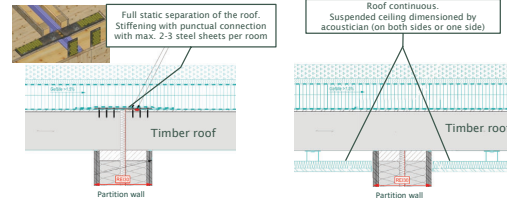


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Practical examples timber construction Details

Timber roof connection with partition wall

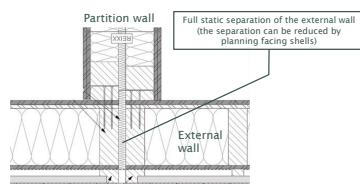


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Practical examples timber construction Details

Horizontal connection external wall with partition wall

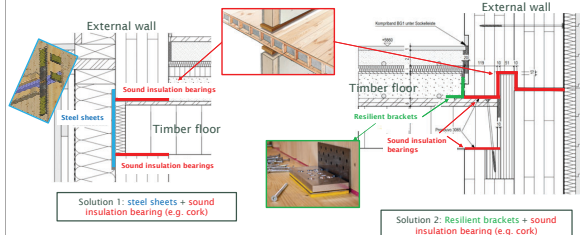


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Practical examples timber construction Details

Connection between timber floor and solid timber wall

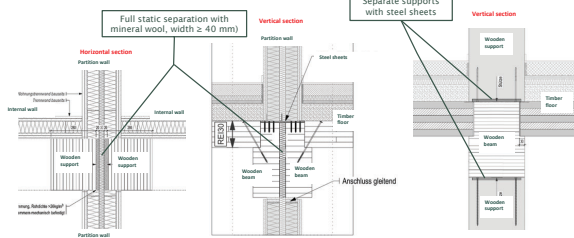


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Practical examples timber construction Details

Visible wooden supports and beams



Acoustics in timber buildings: research and practice in Switzerland

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Practical examples of standard timber building structures

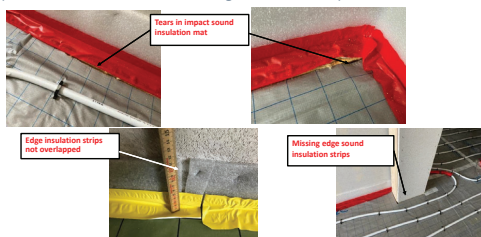
Practical examples of timber construction details

Planning and execution errors

Acoustics in timber buildings: research and practice in Switzerland

Planning and execution errors

Impact sound insulation mat and edge insulation strips

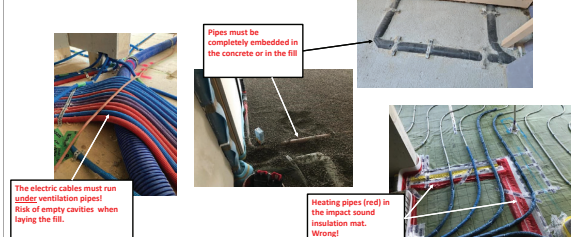


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Planning and execution errors

Horizontal cable



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Planning and execution errors

Interior staircase

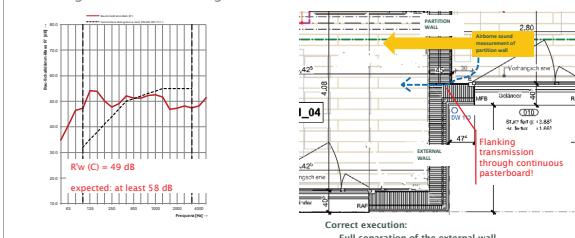


Acoustics in timber buildings: research and practice in Switzerland

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Planning and execution errors

Flanking transmission through external wall

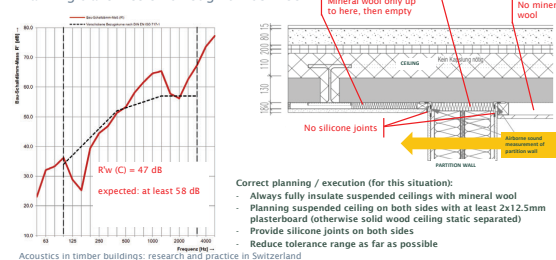


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Planning and execution errors

Flanking transmission through timber floor

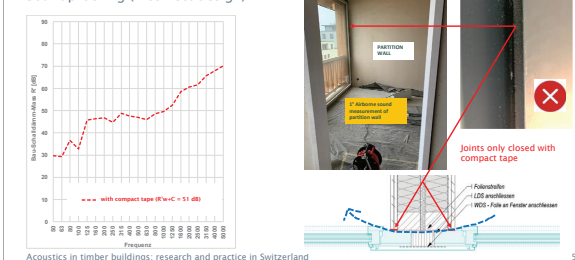


Acoustics in timber buildings: research and practice in Switzerland

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Planning and execution errors

Soundproofing (incorrect design)

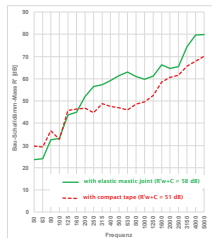


Acoustics in timber buildings: research and practice in Switzerland

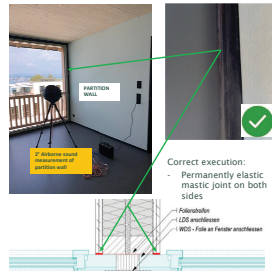
56

Planning and execution errors

Soundproofing (correct design)



Acoustics in timber buildings: research and practice in Switzerland



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"The most beautiful
experience we can have is
the experience of the
incomprehensible"
Albert Einstein



Acoustics in timber buildings: research and practice in Switzerland

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Designing to attract insurance for mass timber buildings

Jim Glockling

University of Central Lancashire / Glockling Consulting, United Kingdom
jim@glockling.co.uk



19th May 2025
Professor Jim Glockling
Visiting Professor University of Central Lancashire



New construction methods – designing to 'attract' insurance and required fire service engagement'




Glockling

Presenter: Dr Jim Glockling

Credentials:

FORMERLY

- Degree Chemical Engineering
- PhD Nuclear Engineering
- Post Doc. Watermist Modelling
- Forensic Fire Investigator Burgoyne
- Associate Director Loss Prevention Council LPC
- Associate Director Building Research Establishment BRE
- Technical Director FPA & RISCAuthority

NOW

- Visiting Professor University of Central Lancashire
- Principle Engineer BMT (Naval Engineering)

SPECIALISM

- Resilience (Insurance Property Protection, Business Resilience, Military)



Contents

Life safety rather than property protection dominate many countries building codes. In respect of business and property protection, insurers and fire services will inevitably play a vital role in determining the future resilience of the built environment.

Many factors, mostly associated with the pursuit of net-zero, are introducing risks that challenge the most basic principles of loss estimation.

Who needs to adapt? The insurer, architects, the building design and construction fraternity, or all parties?

Sadly – many recent loss events are currently damaging the reputation of Mass Timber within the insurance sector

- Sky Building
- Google Building

- How do insurers measure risk?
- What factors contribute to 'insurability'?
- The mass timber insurance playbook (ASBP)
- Mass Timber Buildings – Unthinkable without
- Examples of damage
- Concrete – friend or foe?
- Design solutions



Insurance - Estimated Maximum Loss



Smoke
Smoke
Fire
Water

EML ~ 4 floors of 17

But what if certain design features or materials stop this model from working?












Trusted and good technical understanding = choice, excess capacity, and competition





BROKER

RSA 100%^C


100% Allianz

100% QBE

100% ZURICH

100% AVIVA

100%



Munich RE

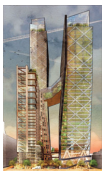
Swiss Re









A lack of trust / technical concern = a lack of available insurance capacity





BROKER

RSA 20%


20% Allianz

20% QBE

20% ZURICH

10% AVIVA

10%



Munich RE

Swiss Re

Underwriting Relevant Building Features

[illegible]

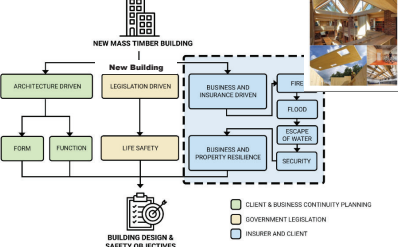
<https://www.thefpa.co.uk/advice-and-guidance/public-toolkits/building-risk-evaluation-tool>

- The definitive guide on the resilience challenges of mass timber buildings
- Endorsed by the Association of British Insurers
- Now released in the US
- Accepts the challenges (rather than denies them) and provides a framework for addressing them.

- Fire
- Escape of Water
- Flood



11



<https://asbp.org.uk/project/mass-timber-insurance-playbook>

- Fire Sprinklers (with suitably adapted installation rules)
- Water & Moisture Detection and Control Systems
- Hybridisation with low carbon concrete
- Non-combustible cladding materials
- Control of combustible voids
- Specific measures to support Fire Service Effectiveness
- Additional research:
 - Fixings into timber ceilings
 - Damage assessment & repair

Would like these measures to be viewed as 'enabling' greater use of timber.



- Selection of sprinkler head type, water provision, response time, depth of installation, and head spacings
 - Wall wetting
 - Ceiling Wetting
- Installation of pipework
 - Rules for firestopping through combustible walls
 - Routing guidance
 - Areas of protection
- Management of dropped water to reduce consequential damage
 - See water & moisture management
- Ignore
 - Self-extinguishment by design
 - "Watermist"

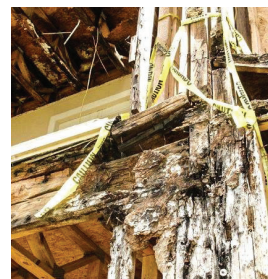


Table of Contents (ongoing work):

1. Building resilience and insurance implications of water exposure
2. Timeframes for damage
3. Transportation and construction
 - a. Transportation weather protection
 - b. Construction weather protection
 - c. Construction site controls on EoW
4. Occupied protections:
 - a. Escape of water detection and control systems (including from installed suppression systems)
 - b. Water ingress detection and alerting systems
 - c. Condensation detection and alerting systems
 - d. Building health monitoring (timber moisture content)
 - e. Designs for 'drain to safe'
 - f. Designs for 'leak to visible'
 - g. Designs for resilience to flood and EOW
5. Construction management systems (Mechanical Ventilation and Heat Recovery Systems)

This is currently the most urgent issue that requires solving – and will be the most likely factor that will contribute to timber's success or demise.

It is essential to detect and act on water when the damage is only cosmetic



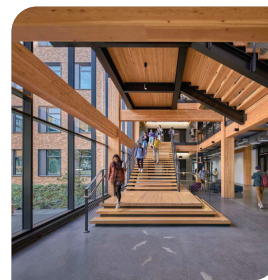
Location of all plant and electrical intakes in concrete

- **Location of all plant and electrical lines in concrete core, and vertical routing of services – this:**
 - Replaces significant concrete usage with timber
 - Reduces combustible void challenges
 - Improves building stability
 - Supports freighting activities
- **Locating all bathrooms and kitchens within a concrete core of a massive timber building – this:**
 - Replaces significant concrete usage with timber
 - Reduces the potential for escape of water damage
 - Supports built in drain-to-safe features
- **CLT panel waterproofing membrane – this:**
 - Reduces the potential for water damage during delivery and construction before weather proofed.
- **Alternating CLT floors in concrete or steel framed buildings – this:**
 - Reduces concrete usage
 - Preserves a higher level of (insurance relevant) conservation
 - Improves building stability under fire
 - Supports freighting activities.



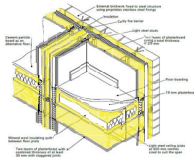
- Through the occupied spaces
- Over the external surface of the building
- Through voids

1. Occupied spaces – normally well catered for by building codes and passive FP requirement
2. Over the external surfaces of buildings – combustible cladding can transport fire into every compartment via windows and vents which will defeat all forms of protection.
3. Through voids – see next slide



Control of combustible voids

- International Building code (IBC) forbids combustible voids. If any exists they must be:
 - Filled with non-combustible insulation material, or
 - Lined with fire resisting board
 - Sprinkler protected

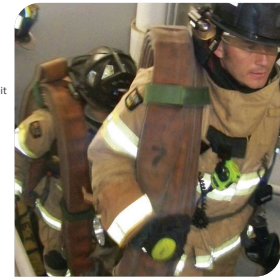


Support for firefighters

If Firefighters are referenced in the building's safety case it must be done with their approval. To this end, just like designers need to attract the insurance the building needs, it is vital they design to attract the level of FRS intervention required.

- Are they well enough resourced?
- Do they have the right equipment?
- Do they have the risk appetite?
- Fire will be more prevalent
- Fires will be larger
- Less of the building will remain
- Fire will be harder to tackle
- Fires will be more dangerous to tackle
- Fire 'events' may last many days
- Fires may be more 'legally' challenging
- Other NetZero factors may compound the situation
- Perceptions of FRS success may have to change

<https://www.linkedin.com/pulse/building-designers-expectations-fire-service-you-expect-glockling-anete>



Fixings into timber ceilings

Due for Publication in Fire Journal "*Reduction of load capacity of fixings into a timber soffit during and after fire*", Dale Kinnersley, Richard T Hull, James L D Glockling, Stuart Campbell

- A startling loss of strength of timber fixings under fire conditions
- Bigger, not always better (there transport more heat to the threads around which charring occurs)
- Premature loss of strength in fire poses risk of crush and entanglement from M&E systems to:
 - Evacuees
 - Firefighters
- A significant potential barrier to fire service effectiveness
- Reduced firefighter support has consequences for insurability

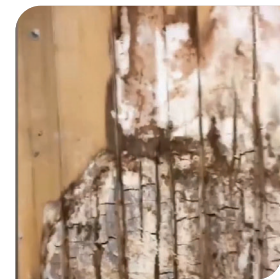


Damage Assessment & Repair

Little information or experience in the public domain on:

- How to assess the extent of damage
 - How to repair the damage
- For fire damage, water exposure, rot, infestation, aging, etc.
- Without this information:
- More may be replaced than is necessary – more costly and damages green credentials
 - Methods and associated costs remain unknown requiring insurers to use 'safe' (punitive) estimates

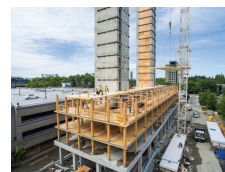
COST Action Helen WGI has produced a outline for guidance requirements



Water damage from 'normal' bathroom exposures



Concrete – friend or foe to sustainability?



In truth, it is an integral part

- The sustainability credentials of all materials are under scrutiny and different equations can yield different result. All that aside:
 - Since 1993 industry has achieved 53% reduction in absolute CO₂ emissions (1.5% of UK GHG emissions)
 - This is x5 lower than global average
- 95% is produced in the UK with resource capacity for self-sufficiency
- Further improvement requires:
 - De-carbonisation of the electric grid and transport system
 - Fuel switching to biomass and other renewables
 - Lower carbon cement and concrete

Manufacturers of ALL materials are making progress towards NetZero

UK insurer 'building of the year' 😊

- Non-combustible materials of construction (properly 'non combustible')
- Excellent compartmentation
- Little or no reliance on 'systems' (human or mechanical) to deal with fire



Architects & Designers

The solution to many of the challenges demands:



- An understanding of the insurer perspective
- Improved understanding of the important perils (fire, water, infestation, and rot)
- An openness to use a combination of 'best athlete' materials and systems to create buildings that are BOTH sustainable and resilient (insurable)
- A need to understand, that in this day and age, insurance must be 'courted' through good design that seeks to achieve more than just 'evacuation before collapse'
- Ditto Fire Service Intervention



19th May 2025
Professor Jim Glockling
Visiting Professor University of Central Lancashire



New construction methods – designing to 'attract' insurance and required fire service engagement'

<https://www.linkedin.com/pulse/fire-toxicity-grenfell-phase-2-reports-raises-very-big-jim-glockling-1d1je>



Glockling
JIM GLOCKLING

Timber construction in an urban context – our 20 years experience

Philipp Zumbrunnen

Eurban, United Kingdom
pz@eurban.co.uk

EURBAN

TIMBER CONSTRUCTION IN AN URBAN CONTEXT

OUR 20 YEARS EXPERIENCE

Philipp Zumbrennen
pz@eurban.co.uk

www.eurban.co.uk
@eurbanlimited
eurban_limited

EURBAN

URBAN TIMBER CONSTRUCTION END TO END QUALITY ASSURANCE



- EURBAN
 - WHO WE ARE & WHAT WE DO
 - OUR APPROACH
 - OUR EXPERIENCE
- OUR LEARNING & CHALLENGES
 - LOGISTICS
 - CONSERVATION AREA
 - OVERSEAS PROJECTS & SKILLS GAP
 - MOISTURE CONTROL
- CONCLUSION & QUESTIONS

COST ACTION – HELEN 2025 – ETH Zurich 19.05.2025

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URBAN TIMBER CONSTRUCTION EURBAN – WHO WE ARE



Specialist Timber Engineers and Consultants
Specialist Sub-contractor delivering mass timber structures
First company to design and install CLT buildings in UK in 2003 and have delivered 400+ Projects over 22 years.
Extensive experience across sectors in delivery of mass timber structures for developers, contractors and direct to clients.
Considered the leading innovator and provider of engineered solid timber building solutions in UK.
Lead in high-quality CLT building solutions with continuous design-to-site infrastructure.
Designing for more than just structure, strong drive to deliver more efficient and sustainable buildings.
Leader in digitalisation design and construction processes / BIM & DfMA.

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URBAN TIMBER CONSTRUCTION EURBAN – WHAT WE DO



MASSTIMBER SPECIALIST – SOLIDTIMBER SPECIALIST

SPECIALIST SUB-CONTRACTOR

DESIGN ENGINEERING

MANUFACTURE

ASSEMBLY

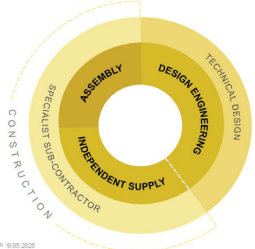
SPECIALIST ENGINEER / CONSULTANT

MASSTIMBER SPECIALIST – SOLIDTIMBER SPECIALIST

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URBAN TIMBER CONSTRUCTION EURBAN – OUR APPROACH THE GOLDEN THREAD



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URBAN TIMBER CONSTRUCTION EURBAN – OUR APPROACH THE GOLDEN THREAD

DAME JUDITH HACKITT

'There needs to be a **golden thread** for **all complex and high-risk** building projects so that the original **design intent** is **preserved and recorded**, and...any **changes** go through a formal review process involving **people who are competent and who understand the key features of the design.**'

– Interim Report following the Grenfell Tower Fire, December 2017

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URBAN TIMBER CONSTRUCTION EURBAN – OUR APPROACH THE GOLDEN THREAD

CHARTERED INSTITUTE OF BUILDING (CIOB)

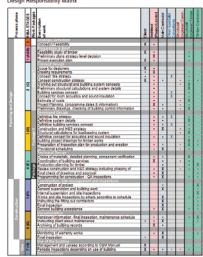
'The **golden thread** is both the **information** that allows you to understand a building **and the steps** needed to keep both the **building and people safe, now and in the future.**'

– The Golden Thread: Understanding the capability and capacity of the UK built environment to deliver and retain digital information. December 2020

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URBAN TIMBER CONSTRUCTION EURBAN – OUR APPROACH SHARED DUTY OF CARE



SHARED-DUTY-OF-CARE APPROACH
vs.
OBSESSION WITH RISK ALLOCATION

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The golden thread should be **an opportunity to drive all-round quality**

URBAN

URBAN TIMBER CONSTRUCTION

OUR EXPERIENCE IN THE UK

400+ PROJEKTE

UK

LONDON

COST ACTION – HELEN 2020 – ETH Zurich 19.05.2020

Philippe Zamboni/Urban Timber Ltd

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URBAN TIMBER CONSTRUCTION
URBAN – OUR EXPERIENCE IN THE UK



URBANTIMBER CONSTRUCTION

OUR EXPERIENCE IN THE UK

EDUCATIONAL PROJECTS








2008 & 2012 ST Agnes	2009 Hackney Academy	2010 LICA	2013 Ickburgh	2014 Mossbourne	2015 Alconbury	2020 Northstowe
						
© Greenline	© Greenline	© Greenline	© Greenline	© Greenline	© Greenline	© Greenline
Manchester	London	Lancaster	London	London	Huntingdon	Cambridgeshire

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Philip Zamboni/Urban Limited

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EURBAN – OUR EXPERIENCE IN THE UK





STUDENT ACCOMMODATION PROJECTS

2009	2014	2015	2017	2018	2018	2022/23
St Catherine's	UEA Crome Court	St Clare's	Mansfield	Sevenoaks School	Somerville	Wellington
						
Cambridge	Norwich	Oxford	Oxford	Sevenoaks	Oxford	Berkshire

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EURBAN – OUR EXPERIENCE IN THE UK

COMMERCIAL PROJECTS

2007	2012	2015	2017	2019	2021/22	2023
Gordon House	Kingswood	Alconbury	CNPA	York House	ABS NTU	Baytree
						
London	Bristol	Huntingdon	Granton-on-Spey	London	Singapore	Nuneaton



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HIGHPOINT TERRACE – LOGISTICS




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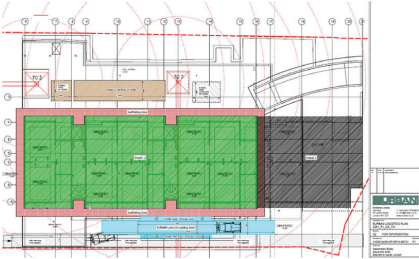
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HIGHPOINT TERRACE – LOGISTICS

47 Storey Tower Reinforced Concrete Superstructure
Constant Material Supply Feed
8 Storey CLT Superstructure
3-4 Deliveries per Week

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HIGHPOINT TERRACE – LOGISTICS



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HIGHPOINT TERRACE – LOGISTICS




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HIGHPOINT TERRACE – LOGISTICS



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EURBAN URBAN TIMBER CONSTRUCTION
HIGHPOINT TERRACE – LOGISTICS

CONCRETE'S BIGGEST RIVAL
Compared to concrete frame, CLT is:

OPERATIONS	8	35
REPAIRS	64	250
WASTE	0	WASTE
REPAIRS	70% LESS	REPAIRS

SAVING £478k AT HIGHPOINT **AN EXPECTED £819k ON FUTURE PROJECTS**

21,000 TREES USED WERE REPLISHED WITHIN 8 HOURS **ALMOST 2,522 TONNES OF CO2 WERE STORED**

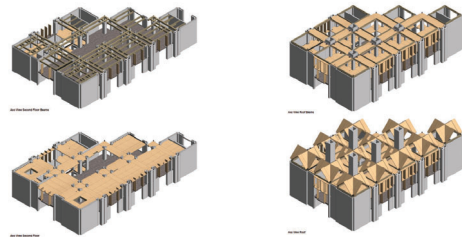
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MAGDALENE COLLEGE – CONSERVATION AREA



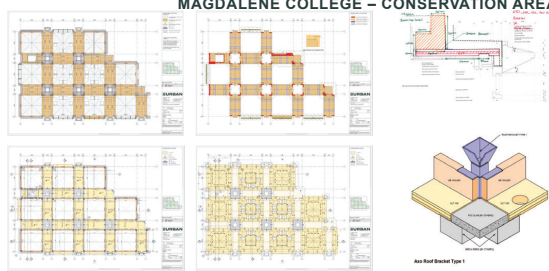
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MAGDALENE COLLEGE – CONSERVATION AREA



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MAGDALENE COLLEGE – CONSERVATION AREA



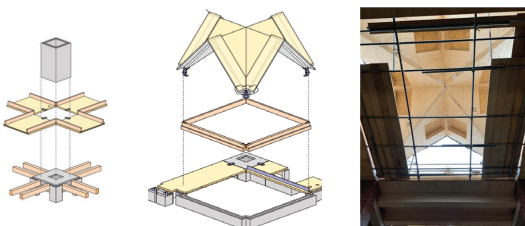
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EURBAN URBAN TIMBER CONSTRUCTION
SINGAPORE NTU – OVERSEAS PROJECTS

- 6 Geschosse
- 47.5m x 220m
- 36,000m²
- 12,800m³ Mass Timber
 - 6,200m³ CLT
 - 6,600m³ BSH
 - 365 Kontainer

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SINGAPORE NTU – OVERSEAS PROJECTS

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EURBAN URBAN TIMBER CONSTRUCTION
SINGAPORE NTU – OVERSEAS PROJECTS

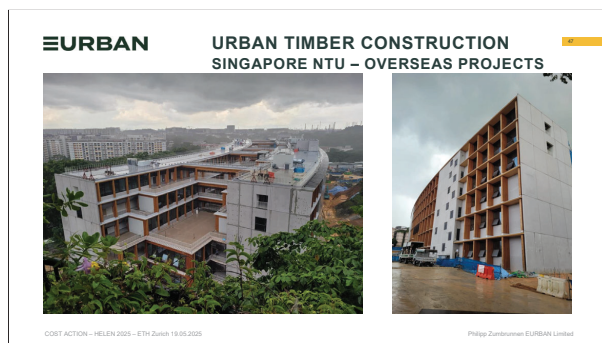
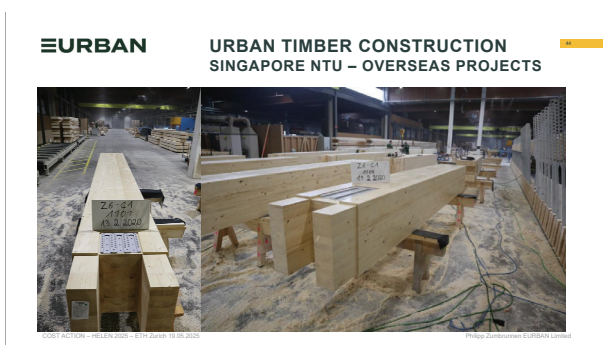
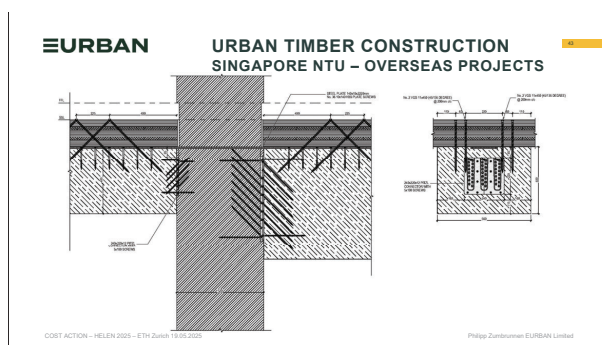
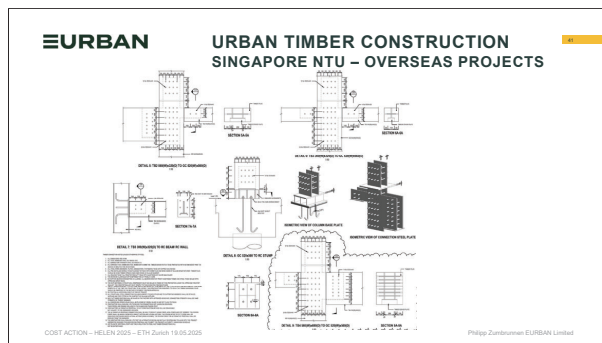
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EURBAN URBAN TIMBER CONSTRUCTION
SINGAPORE NTU – OVERSEAS PROJECTS

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EURBAN URBAN TIMBER CONSTRUCTION
CASCADE CARDIFF – MOISTURE MANGEMENT

- 5 installers
- 1 Tower Crane
- Site Programme of 14.5 weeks
- 16 CLT lorries
- 809m³ of timber

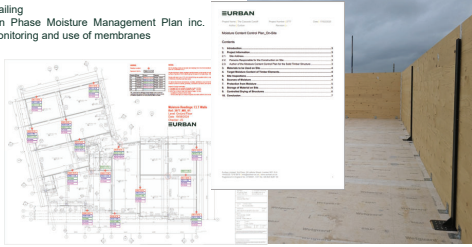


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EURBAN URBAN TIMBER CONSTRUCTION
CASCADE CARDIFF – MOISTURE MANGEMENT

Design and On-Site:

- Robust Detailing
- Construction Phase Moisture Management Plan inc. moisture monitoring and use of membranes



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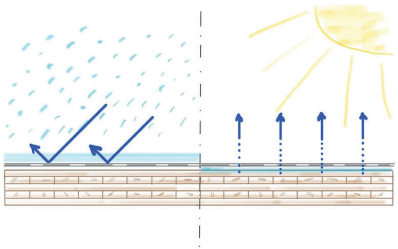
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CASCADE CARDIFF – MOISTURE MANGEMENT



FACTORY APPLIED WEATHER PROTECTION

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EURBAN URBAN TIMBER CONSTRUCTION
CASCADE CARDIFF – MOISTURE MANGEMENT



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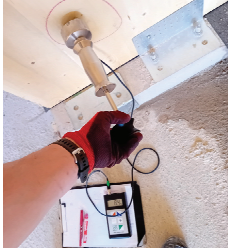
EURBAN URBAN TIMBER CONSTRUCTION
CASCADE CARDIFF – MOISTURE MANGEMENT

Design and On-Site:

- Robust Detailing
- Construction Phase Moisture Management Plan inc. moisture monitoring and use of membranes

In-Use:

- In-use moisture management Strategy including moisture sensors installed to wet areas e.g. underneath shower trays

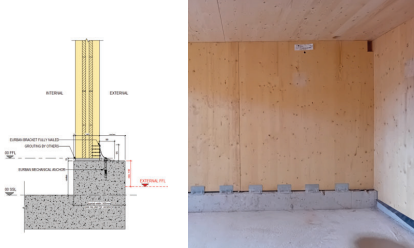


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EURBAN URBAN TIMBER CONSTRUCTION
CASCADE CARDIFF – MOISTURE MANGEMENT

Design and On-Site:


- Robust Detailing



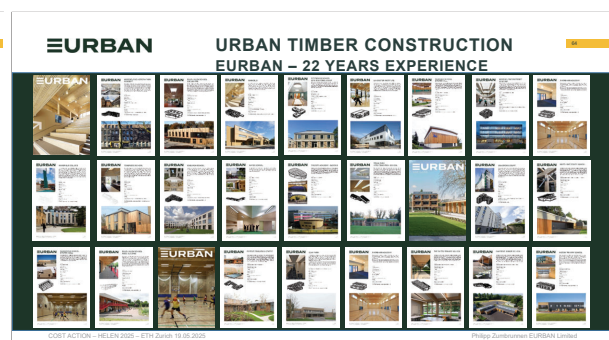
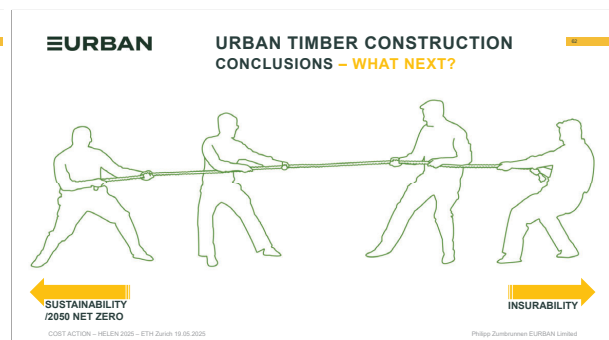
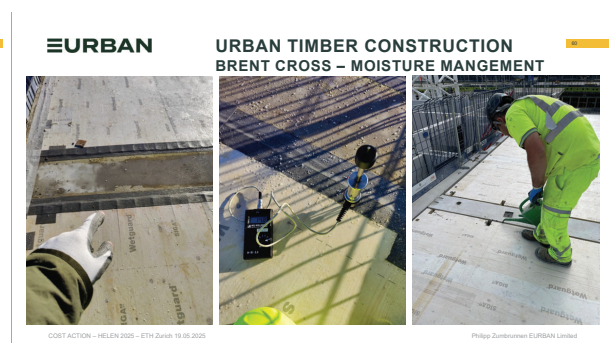
COST ACTION – HELEN 2025 – ETH Zurich 19.05.2025 Philipp Zumbinnen EURBAN Limited

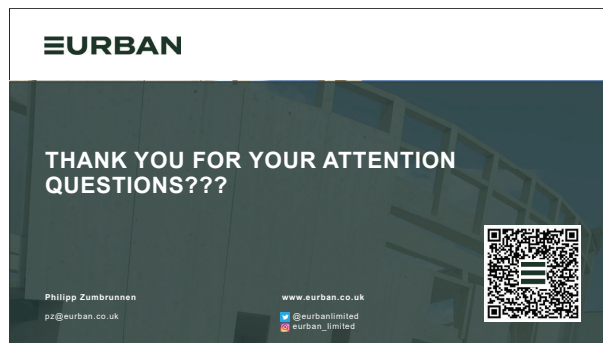


EURBAN URBAN TIMBER CONSTRUCTION
BRENT CROSS – MOISTURE MANGEMENT



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DPG Mediavaert and other Dutch timber buildings

Ronald Stoter

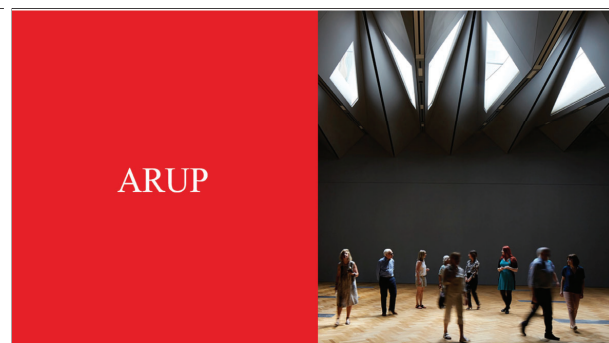
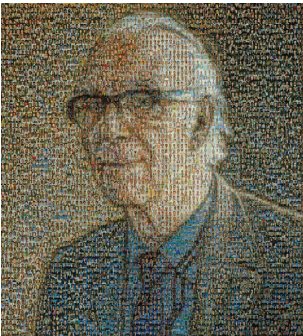
ARUP, The Netherlands
ronald.stoter@arup.com

ARUP

Case Studies on Taller Timber Buildings

DPG Mediavaert and other Dutch timber buildings

Ronald Stoter
May 19 2025

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Employee owned
Values driven

ARUP

Arup

Employee owned & Quality driven

1946
Founded by Sir Ove Arup
18,000+
Members
94
Offices
34
Continents

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Arup




Our knowledge and expertise

STRUCTURAL ENGINEERING	MECHANICAL ENGINEERING	FIRE SAFETY	ACOUSTICS	SUSTAINABILITY
RESOURCES	ELECTRICAL ENGINEERING	BUILDING PHYSICS	LIGHTING	BIM
WIND ENGINEERING	VERTICAL TRANSPORT	FAÇADES	VIBRATIONS	DIGITAL

ARUP

Arup

"Leading sustainable development"






www.arup.com/perspectives/publications/promotional-materials/section-designing-with-timber

www.arup.com/perspectives/publications/research/section-rethinking-timber-buildings

www.arup.com/insights/fire-safe-design-of-mass-timber-buildings/

ARUP



Contact
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Associate / senior structural engineer
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T - +31627892385

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Groningen project

Seismic Assessment and Upgrading of Buildings in the Groningen area

- Need for seismic assessment of 5,000 to 25,000 buildings
- Main Sustainable Goals:
 - Provide safety to residents
 - Reduce the carbon impact by pushing for surgical strengthening rather than demolition and rebuilding




Groningen project

Data driven approach

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Renovation of monumental government buildings

No details / scope is confidential

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De Centrale

Viventium | Hotel De Centrale

Hotel 20.000 m² GFA
Tender winning design

Scope services

- Sustainability
- Tech
- Structures

BREEAM®

HET HOTEL ALS STAD

Elements (aka Amstelkwartier)

Kondor Wessels Vastgoed

Newbuild residential + commercial
ca 14.800 m² (BVO)

Scope services

- Structures
- TECH
- parametric design
- Execution phase working for contractor

pr8 architecten
HVTC
Kondor Wessels Amsterdam

DPG Mediavaert Amsterdam

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DPG Mediavaert Headquarters Amsterdam

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Arup scope services

- Structures
- MEP

DPG Mediavaert, Amsterdam

DPG Mediavaert Headquarters Amsterdam

A brief introduction first

Multi-Media 30,000m² multi-functional floor area, 2-storey parking garage

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A brief introduction first

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A brief introduction first

Options provided during the VO-phase

Design philosophy
"Timber where possible, concrete and steel where required"

Avoid transfer structures between super- and substructure

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A brief introduction first

Ventilation concept

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A brief introduction first

- Options provided during the VO-phase
- Total engineering
- Design philosophy:
"Timber where possible, concrete and steel where required"
- Future flexibility

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A brief introduction first

Ventilation concept

- Floor plenum
- Reduced impact on structure
- Dedicated zones for MEP
- Modular MEP-design
- Modular structural design
- Future flexibility

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A brief introduction first

Modular Glulam beams checked against various codes

Modular Glulam beams were tested with and without reinforcement (= screws)

EN 1995-1-1 (2004) [20]		EN 1995-1-1 (2004) [20]		EN 1995-1-1 (2004) [20]	
Material	Material	Material	Material	Material	Material
Timber	Timber	Timber	Timber	Timber	Timber
Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Steel	Steel	Steel	Steel	Steel	Steel
Timber	Timber	Timber	Timber	Timber	Timber
Concrete	Concrete	Concrete	Concrete	Concrete	Concrete
Steel	Steel	Steel	Steel	Steel	Steel

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A brief introduction first

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"Typical" foundation

- Contour building pit

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"Typical" foundation

- Groundwater level

DPG Mediavaert basement

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"Typical" foundation

- Temporary sheet piles
- Execution phase governs latest moment to remove temporary sheet piles
- Timber superstructure, limited mass present to prevent uplift

DPG Mediavaert basement

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"Typical" foundation

- Pile plan (part B)
- Vibro-combi palen
- GEWI anchors

DPG Mediavaert basement

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"Typical" foundation

- Basement -2 level
- "Concrete where required"

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Cross section main building

Design philosophy
"Timber where possible, concrete and steel where required"

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Plan view

Design philosophy
"Timber where possible, concrete and steel where required"

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TCC floor

Design philosophy
"Timber where possible, concrete and steel where required"

Glulam beams between timber columns
Timber Concrete Composite floor
200mm CLT C24
100mm concrete C30/37
Supporting beams 8,1m etc

Span l	KLH strength	Concrete strength	Total height
6.5 m	182	80	242
7.0 m	182	90	252
7.5 m	182	90	272
8.0 m	CLT 182	95	277
8.5 m	200	95	295
9.0 m	200	100	300

From KLH

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TCC floor vibration checks

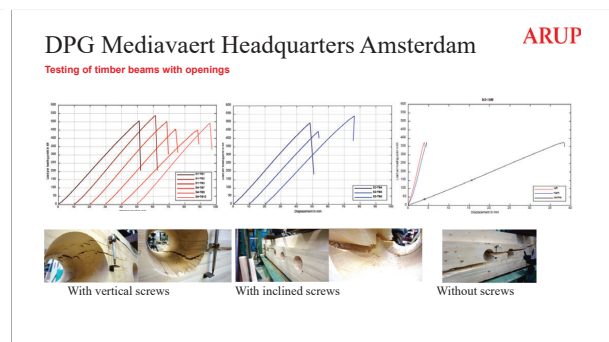
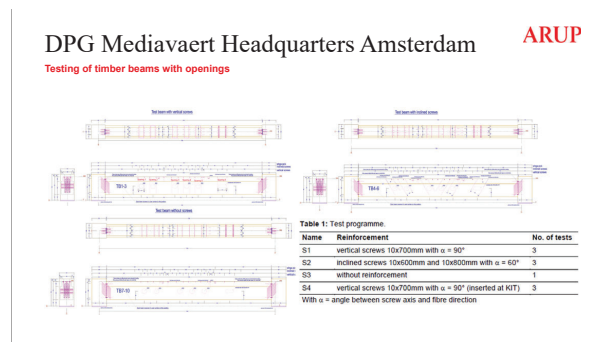
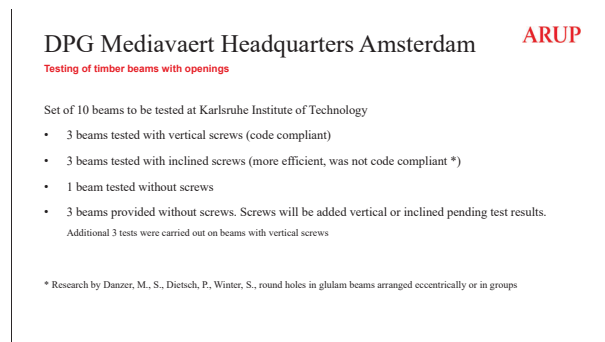
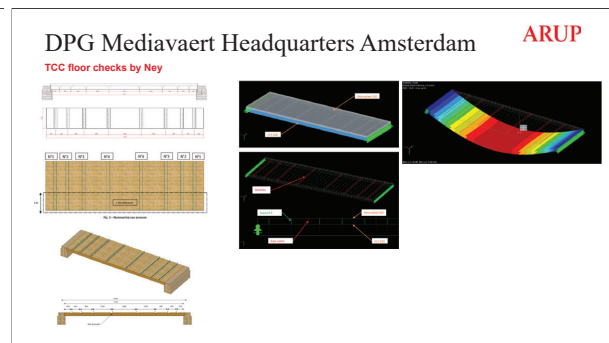
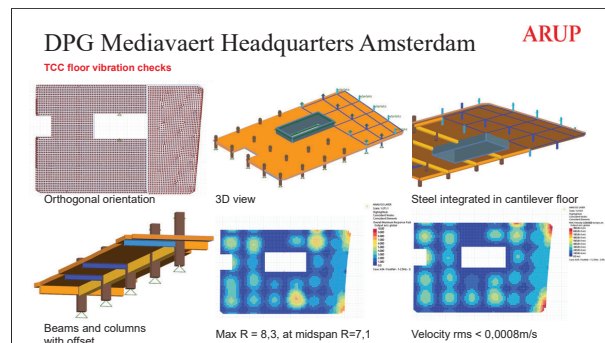
Design philosophy
"Timber where possible, concrete and steel where required"

First eigenfrequentie ca 8 Hz
Max response factor 8 (with 3,5% damping)
Fire resistance 60 minutes
During design phases: vibrations checked by GSA (footfall analyses and sensitivity studies) and Calculatis

Table 1. Tentative floor performance levels for use categories A (residential) and B (office).
Use category: A (residential), B (office).
Level II, Level III, Level IV, Level V, Level VI.

Table 1. Floor vibration criteria according to the floor performance level.

Criteria	Floor performance levels					
	level I	level II	level III	level IV	level V	level VI
Frequency f [Hz] >	4					
Deflection criteria w _{lim} [mm] <	0,25	0,5	0,8	1,2	1,6	
Response factor R	4	8	12	20	20	24
Acceleration criteria a _{lim} [m/s ²] <	R = 0,005					
Vibration criteria when < a _{lim} [m/s ²] <	R = 0,001					



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And build

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And build

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Mediavaert wins big... 3 Awards!

DPG Mediavaert Headquarters Amsterdam **ARUP**

The final result

Architectenweb Award

Best Office Building of 2024

The jury praised the building for its innovative hybrid construction of timber, steel and concrete, its energy-efficient design and integration of green spaces

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The final result

BLT Built Design Award

Commercial category

The use of 7,000m² of timber significantly reduces the building's carbon footprint, while the open, light design of the building enhances the working environment.

An architect should strike a perfect balance between creative expression and functionality; architecture is taking the intended project use, such as the lifestyle and preferences of the occupants, then shaping these, translating and executing until a final form is achieved, based on the times, beliefs, and education. Architectural design is one of our species' oldest creative sciences, whose roots are lost deep in prehistory — and today's architects continue to build upon thousands of years of innovation and creativity.

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The final result

National Timber Build Award 2024 (Nationale Houtbouw Prijs 2024)

Commercial Buildings Category

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The final result

National Timber Build Award 2024

Commercial Buildings Category

Timber commercial buildings are per definition nice buildings to work in. And they always look nice. Investing in a timber building is also investing in the users of that building.

Mediavaert in Amsterdam is a large office building with a complex program of requirements. The fact that this building is developed as timber-hybrid, was no necessity but also no side issue. The timber building execution showed, due to the rapid building speed, a substantial cost-saving.

De jury van de Nationale Houtbouw Prijs 2024 heeft de DPG Mediavaert tot winnaar in de Commerciële Categorie uitgeroepen. Het is een belangrijke erkenning voor het team van architecten, ingenieurs en bouwbedrijven die samen aan deze prachtige realisatie hebben gewerkt. Het gebouw is een voorbeeld van innovatie en duurzaamheid in de Nederlandse bouwsector.

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DPG Mediavaert Headquarters Amsterdam

The Grand Finale

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DPG Mediaveart Headquarters Amsterdam

The Grand Finale
The official opening by the King



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Case Studies on Taller Timber Buildings

Fire safety

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Case Studies on Taller Timber Buildings

Fire safety

Main structure	90 minutes fire resistance required
Reduction	30 minutes due to sprinkler
DPG	60 minutes fire resistance

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NTA 6125

Brandveiligheid massieve houtbouw

- NTA: Nederlandse Technische Afspraak (Dutch technical agreement)
- Fire safety of solid timber construction



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Draft NTA 6125

Draft NTA 6125



- NTA: Dutch technical agreement (Nederlandse Technische Afspraak)
- Public demanding agreement between two or more interested parties
- Consensus not required
- No public comment round
- Short lead time
- Opted for NTA in consultation with Dutch Ministries
- Draft NTA 6125 Fire safety of solid timber construction (for public consultation until 15 April 2025)
- Background report (English; Dutch translation for accessibility)

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Introduction and background

Draft NTA 6125


- NEN NC 351007 "Brandveiligheid van bouwwerken" (Fire safety of solid timber construction).
- Question from the Ministry of Housing, Spatial Planning and the Environment and the objective for NTA
 - Providing insight into gaps in the current building regulations in the field of fire safety.
 - Make it clear what risks this entails.
 - Suggest additional control measures.
- NTA 6125 provides insight into current knowledge, risks and control measures.
- Further considerations about interests and relationship with regulations will be followed by the Ministry of Housing, Spatial Planning and the Environment.
- A more nuanced, improved version with wider application can be achieved after follow-up steps (phase 2)
- Draft NTA 6125, comments received

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Outcome literature study (2022)

NTA 6125

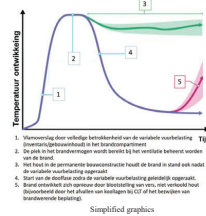
- Current performance requirements are not always sufficiently tailored to assess new types of timber building systems such as CLT, NLT and LVL. This is related to the increased amount of fuel in structures, which may have increased the permanent fire load, fire risks and environmental impacts.
- When the current performance requirements are applied to buildings with the new wooden building systems, this results in a possible underestimation of the achieved safety level, and the functional requirements may not be met.
- Extinguishing a fire and the additional fire risks require extra effort, resources and attention from the fire brigade with regard to extinguishing and completely extinguishing smouldering remains.
- In order to demonstrably meet the functional requirements, an integrated approach based on fire safety engineering is required, in which additional fire risks are assessed and mitigated.



Risks of building in wood

Draft NTA 6125

- Wooden building structures are flammable and contribute to fire. This results in:
 - Larger flames
 - Higher temperatures
 - Longer burn times
- Uncertainty about extinguishing:
 - Fire is not guaranteed to go into extinguishing phase when inventory is burned out.
- Without an extinguishing phase, an interior attack by the fire brigade is not possible.
- Fire continues.
- Building and partition constructions no longer resistant to fire.
- Fire becomes uncontrollable when insufficiently protected



Impact of fire load

Unlimited fire load – Nottingham University Chemistry lab



Task of fire safety specialists

- “Enabling responsible sustainable developments in a fire-safe manner”.

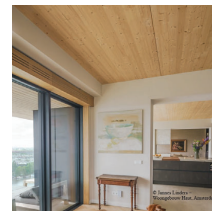


Summery

- The literature review shows regulatory gaps for solid timber construction and proposes a fire safety engineering approach that considers fire risks.
- NTA 6125 (draft):
 - Shows where there are gaps in the regulations and starting points of building regulations
 - Provides insights into the additional risks for solid timber construction
 - Provides a method for conducting fire risk assessments
 - Proposes packages of measures that can be mitigated at a level comparable to that envisaged by the Bbl (*Dutch bouwregelgeving*) for traditional buildings
 - With current knowledge, NTA 6125 makes it possible to make solid timber building constructions more sustainable in a responsible manner without compromising on fire safety
 - Further consideration of interests and relationship with regulations will be followed by the Ministry of Housing, Spatial Planning and the Environment

Next steps (phase 2)

Draft NTA 6125



- NTA 6125 is based on available knowledge and insights
- A more nuanced, improved version with wider application can be achieved after follow-up steps (phase 2)
- TNO is coordinating the next steps with funding from the Ministry of Housing, Spatial Planning and the Environment and market parties
- Expected lead time follow-up steps 2 years
- Interests weighed up by the Ministry about safety, finances and sustainability.

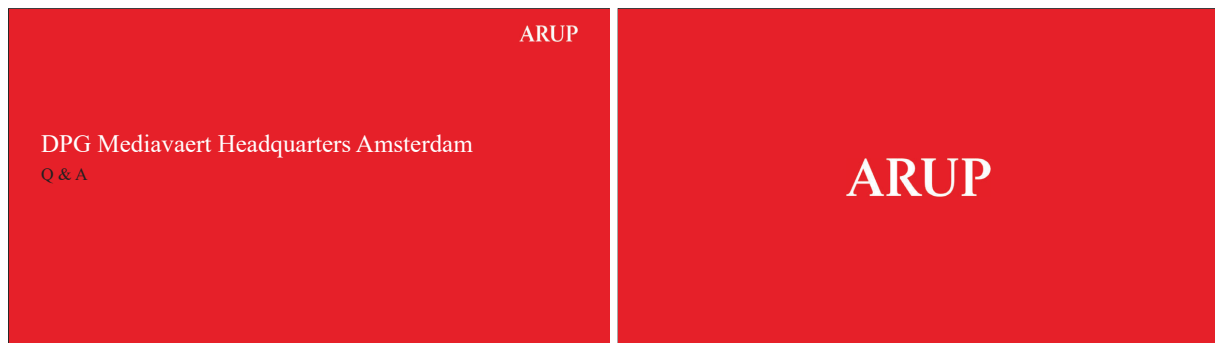
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Lessons learnt

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Lessons learnt

- Provide integral options to the client
- Challenge the client to make a relatively low additional investment
- Don't underestimate positive impact of timber on users
- Faster (=cheaper) execution phase with less heavy equipment
- Lower building weight so lighter foundation
- Prevent water penetrating or staining timber during execution
- “Second line of defense”
- Critical people can become the best ambassadors



Keilaniemen Portti – Designing Finland's tallest timber building

Matti Pirinen

Ramboll Finland Oy, Finland
ext.matti.pirinen@ramboll.fi

KEILANIEMEN PORTTI



DESIGNING FINLAND'S TALLEST TIMBER BUILDING

RAMBOLL

Matti Pienari
28.3.2023

CONTENTS

1. OVERVIEW
2. LATERAL STABILITY
3. ROBUSTNESS DESIGN
4. VIBRATION



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OVERVIEW

- **Architect:** ARCO
- **Structural design:** Ramboll Finland
- **Customer:** VARMIA
- **The main tenant:** Metsä
- 13 timber-hybrid stories above ground
- 2 concrete stories below ground
- Height: 57m
- 20 000m² floor area
- Estimated completion 2026



RAMBOLL

OVERVIEW STRUCTURES

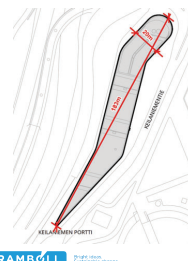
- Consequence class: RC3a
- Fire safety simulations required => R120 used for structural design.
- **Lateral stability:**
 - CIP stair- and elevator shafts (300 mm – 400 mm)
 - CLT-concrete composite floors
- **Columns:** GL-columns 650x650 – 500x500
- **Floors:**
 - Underground stories CIP-concrete
 - Above ground stories CLT-concrete composite floor (on average 7x8 grid)
 - (180 mm – 240 mm) CLT
 - 100 mm concrete
- Peikko Delta beams
- **Roof:** LVL-box slabs + green roof
- **Facade:** unitized facade element (aluminum)+ timber cladding.

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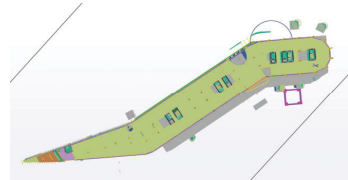
LATERAL STABILITY

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SLENDER BUILDING FRAME



- Building smaller dimension 20 m
- Height to depth ratio around 3
- Larger dimension 183 m
- => Solution: Concrete shafts and composite slabs



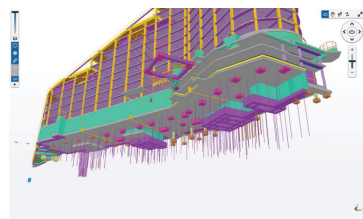
RAMBOLL



RAMBOLL



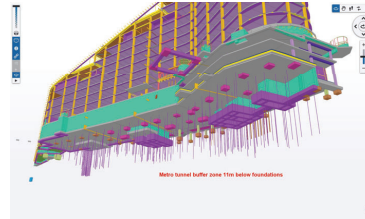
STRUCTURAL ENGINEERING CHALLENGES -BUILDING UNDER SEA LEVEL



- Water tight ground slab.
- Steel pile walls around building
- Large amount of tension anchoring to bed rock

RAMBOLL

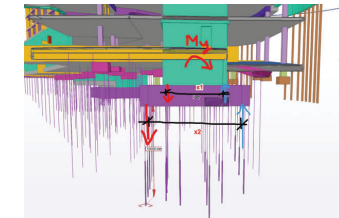
METRO



Espoo metro line goes under the building and the buffer zone for the metro line is located 11m below foundation level.
=> No deep anchoring against lateral loads is possible

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STRUCTURAL ENGINEERING CHALLENGES -METRO

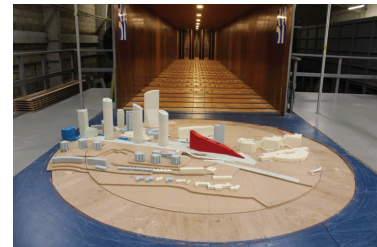


Moment arm of foundations were increased to reduce tensos anchoring length

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WIND TUNNEL TESTS

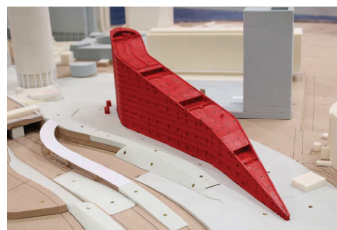
- Consultant: RDWI
- ULS, SLS and outdoor comfortability tests
- EC5 Main sources of uncertainty:
 - Shape of the structure
 - Affect of the surrounding structures
- City officials: strict interpretation of the building code.
- Loads to the expansion joint?



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WIND TUNNEL TESTS - ULS

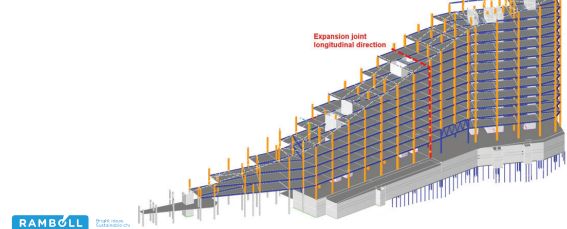
- Consultant: RDWI
- ULS, SLS and outdoor comfortability tests
- EC5 Main sources of uncertainty:
 - Shape of the structure
 - Affect of the surrounding structures
- City officials: strict interpretation of the building code.



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STRUCTURAL ANALYSIS

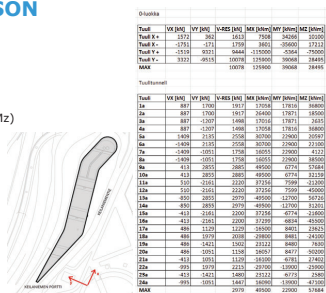
Work horse: RFEM 5.0
Model verification and wind tunnel initial data: ETABS



RAMBOLL

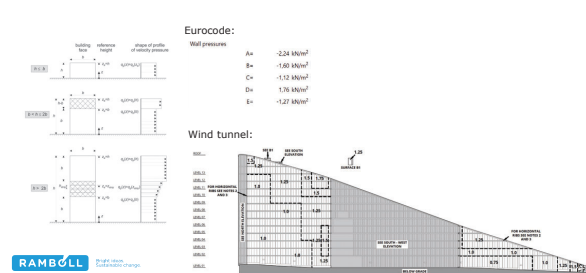
RESULT COMPARISON

- Largest base shear:
 - Eurocode: 10 MN
 - Wind tunnel: 3 MN
- Largest base moment (Mx):
 - Eurocode: 126 MNm
 - Wind tunnel: 50 MNm
- Largest torsional base moment (Mz)
 - Eurocode: 28,5 MNm
 - Wind tunnel 57,8 MNm



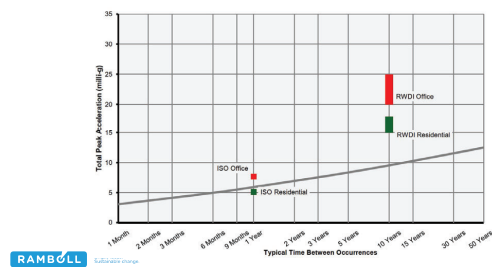
RAMBOLL

WIND TUNNEL TESTS



RAMBOLL

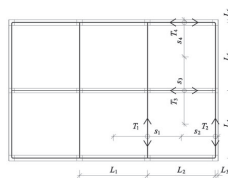
WIND TUNNEL TESTS - SLS



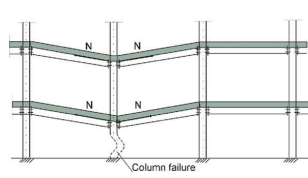
ROBUSTNESS

ROBUSTNESS DESIGN TWO POSSIBLE ROUTES

1. Tie system design

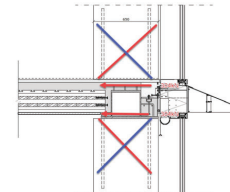


2. Alternative load transfer paths

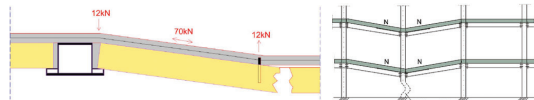


TIE SYSTEM DESIGN

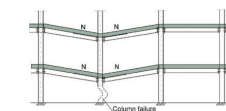
- Tie loads:
 - Tie force in beam direction: 257kN / beam
 - Tie force in slab direction: 77kN/m
 - Column vertical tie force: 220kN
 - Column horizontal tie force: 608kN
 - Very difficult to fulfill



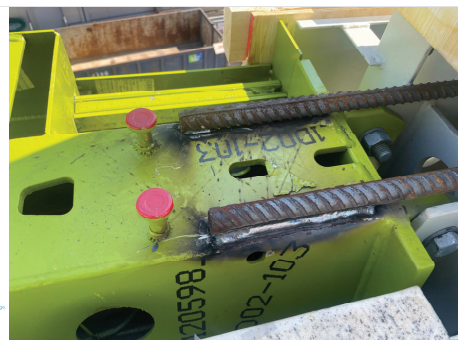
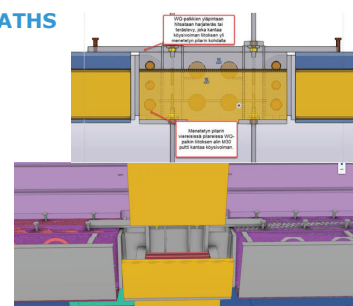
ALTERNATE LOAD PATHS



ALTERNATE LOAD PATHS



Column to beam connection needs two-way rotational ductility.



VIBRATION

RAMBOLL

DESIGN GUIDELINES

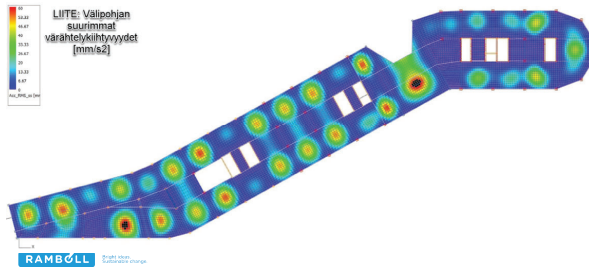
Current regulation in Finland:

- National annex gives guidelines for high frequency floors
 - >9Hz, 1kN point load deflection <0,5mm
- For low frequency floors national annex guides to use "more sophisticated methods"
 - More sophisticated methods:
 - CS1 – P354
 - CS5.T3 – draft

Criteria	Floor performance levels					
	level I	level II	level III	level IV	level V	level VI
Maximum criteria for all floors Max [mm/s]	0,25	0,5	0,8	1,2	1,6	
Response factor R	4	8	12	20	30	40
Maximum criteria for all floors Max [mm/s]			4,5			
Maximum criteria for the maximum vibration design situation Max [mm/s]				0,005 R		
Maximum criteria for the maximum vibration design situation Max [mm/s]					0,0001 R	

RAMBOLL

VIBRATION DESIGN



RAMBOLL

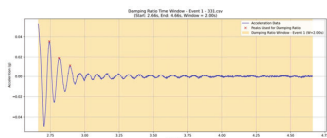
UNCERTANTIES

- Beam connection stiffness
- Composite beam stiffness
- CLT – Concrete composite slab stiffness
- Slab stiffness around center supports
- Material stiffness variance
- Ceiling, nonloadbearing walls and furniture.

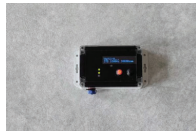
RAMBOLL

VERIFICATION

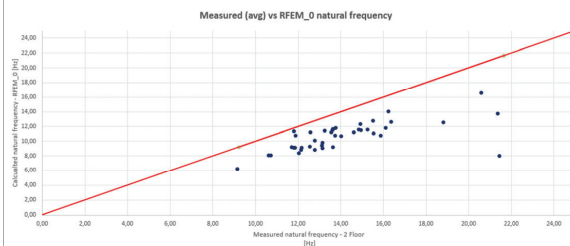
- "Heel drop load" to the center of span
- Measurements after concrete cast and mostly before other internal works.
- Measurements in 4 different floors
- Average results given



RAMBOLL



RESULTS



RAMBOLL

WHERE ARE WE NOW?

RAMBOLL





Lateral load bearing systems and connections in mid-rise timber buildings

Marcel Muster

Timbatec Holzbauingenieure Schweiz AG, Switzerland
marcel.muster@timbatec.ch

Timber and Technology

Lateral load bearing systems and connections in mid-rise timber buildings.

Dr. Marcel Muster



Timbatec
Timber and Technology

Timbagroup Holding

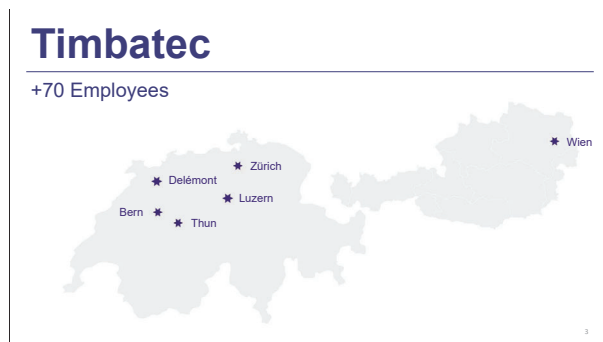
The Timbagroup promotes the use of timber as a raw material and thus makes an active contribution to climate protection. In this way, we also enable future generations to live on our planet.

Timbatec Timber and Technology **TS3** Timber Structures 3.0 **Timbase** Timber Basements **TIMBER FINANCE INITIATIVE**

2


Timbatec

+70 Employees




3


Core competencies




Engineering




Fire safety engineering



Building physics



Construction management



Research & Development

4

Apartment buildings

Sue & Tü Winterthur, 2018



Topping up

Bernaustrasse 1, 2020



5

Hospitals

RFSM Fribourg Hospital, 2021

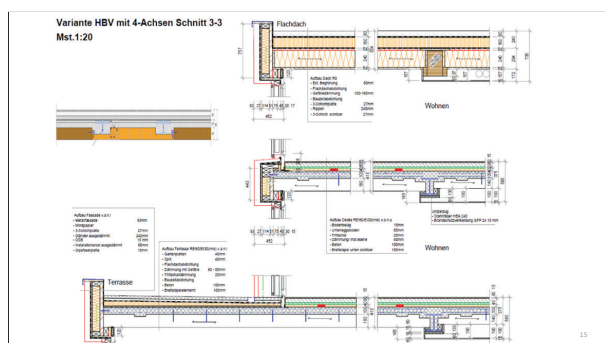
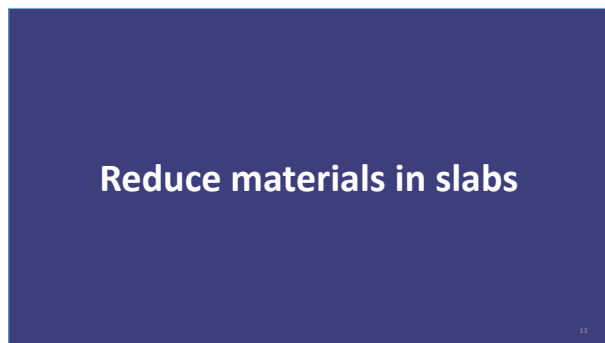
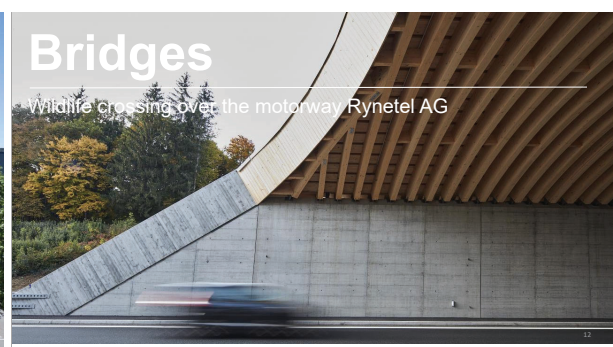
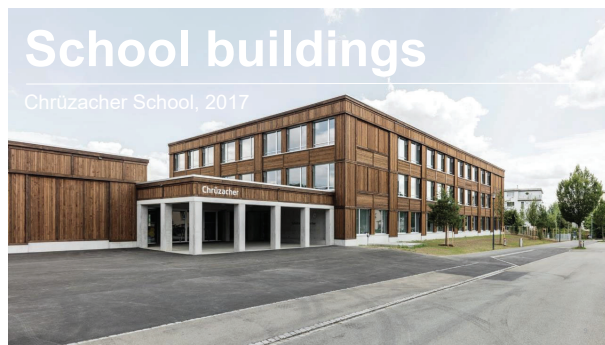


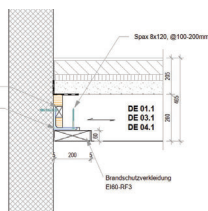
Industry

Loveresse Workshop, 2017



6

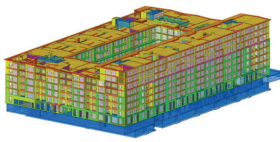




52

Lateral systems

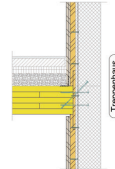
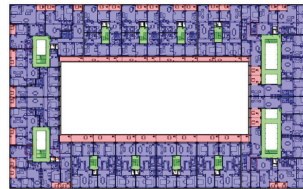
Krokodil 2019



25

Lateral systems

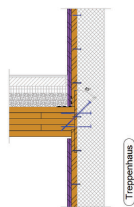
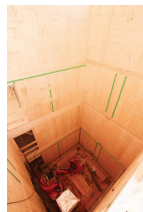
Krokodil 2019



26

Lateral systems

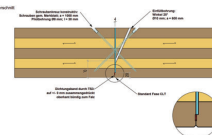
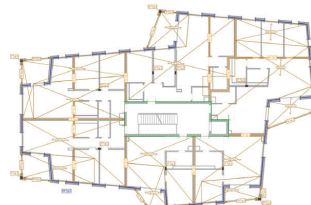
Krokodil 2019



27

Lateral systems

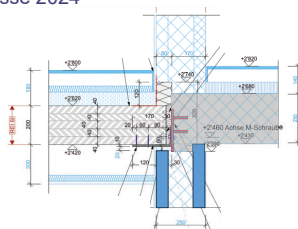
Zelgstrasse 2024



28

Lateral systems

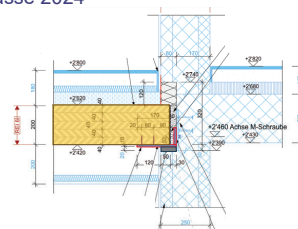
Zelgstrasse 2024



29

Lateral systems

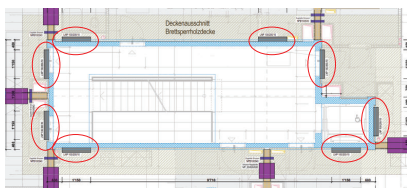
Zelgstrasse 2024



30

Lateral systems

Zelgstrasse 2024



31

Lateral systems

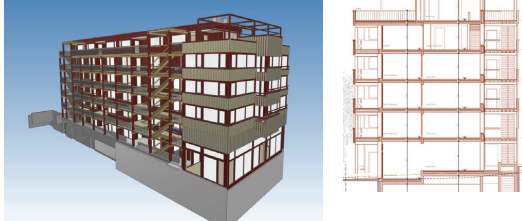
Zelgstrasse 2024



32

Lateral systems

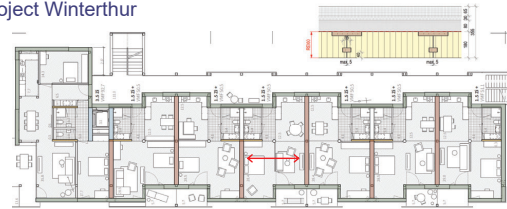
Project Winterthur



33

Lateral systems

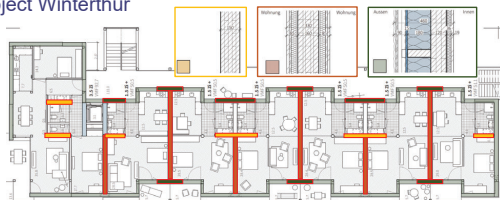
Project Winterthur



34

Lateral systems

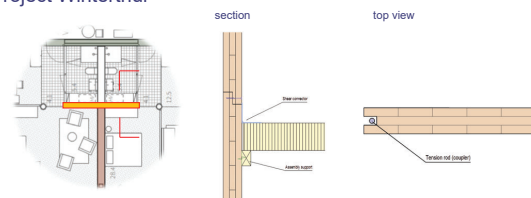
Project Winterthur



35

Lateral systems

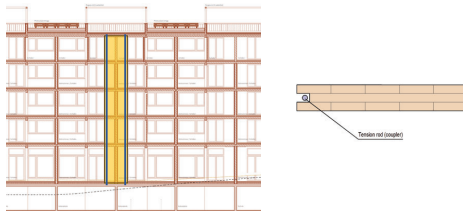
Project Winterthur



36

Lateral systems

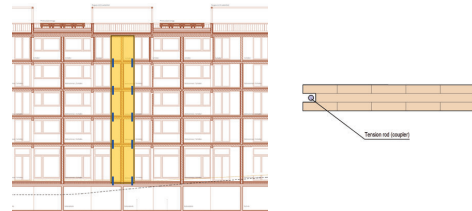
Project Winterthur



37

Lateral systems

Project Winterthur

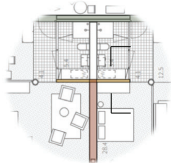


38

Lateral systems

Project Winterthur

Example: Bowdoin College Mills Hall

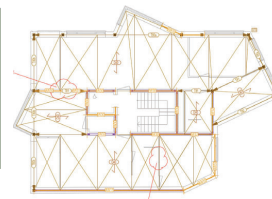


Source: HGA Architects & Engineers

39

Lateral systems

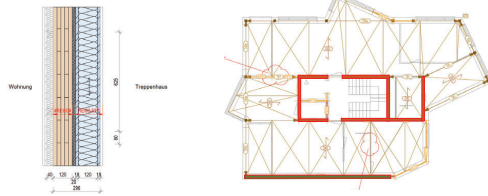
Project Enge



40

Lateral systems

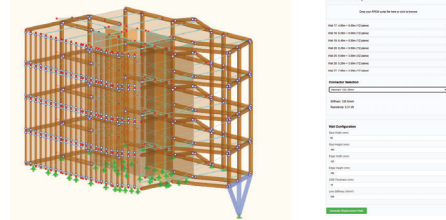
Project Enge



41

Lateral systems

Project Enge



42

Lateral systems

Project Enge

- Designed as a building with a concrete core
- Use CLT instead → Uplift forces of approx. 100 kN
- Lack of experience and available solutions



43

Lateral systems

Project Enge

- Tectonus, Fast+Epp and Dialog:

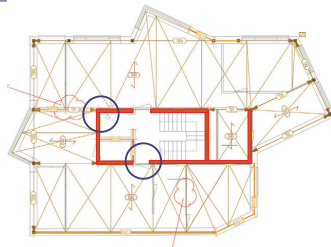


Keith Drive NA. Source: <https://www.tectonus.com/projects/keith-drive>

44

Lateral systems

Project Enge

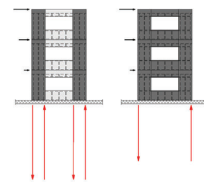


45

Lateral systems

Timber-framed shear walls with large openings

- Use of walls with openings not permitted.
- Research project at BFH, Empa and ETH running



Source: <https://www.bfh.ch/de/lehre/forschung/verstaerkungsfahigkeit-von-glied-gebauden>

46



marcel.muster@timbatec.ch
www.timbatec.ch

Timbatec
Timber and Technology

From roof structures to middle rise buildings – logistics and design efficiency

Sérgio Lucas

Häring AG, Switzerland
sergio.lucas@haring.ch



FROM ROOF STRUCTURES TO
MIDDLE RISE BUILDINGS

LOGISTIC AND DESIGN
EFFICIENCY

HÄRING
INNOVATIVES BAUEN MIT SYSTEM



HÄRING GROUP

IS DRIVEN BY TECHNOLOGICAL INNOVATION APPLIED
TO TIMBER CONSTRUCTION

ESTABLISHED IN 1879, 146 YEARS AGO.

FAMILY OWNED GROUP LEADED BY 5TH GENERATION

HÄRING IS A MARKET LEADER AND REFERENCE IN THE
TIMBER STRUCTURES & MODULAR CONSTRUCTION

CONTINUOUS R&D IN TIMBER STRUCTURES &
INNOVATIVE SOLUTIONS

ACTIVE IN NATIONAL & INTERNATIONAL MARKETS

OVER 130 DEDICATED ENGINEERS, TECHNICIANS &
TIMBER SPECIALISTS

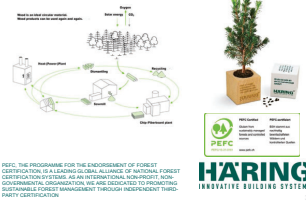
HÄRING
INNOVATIVE BUILDING SYSTEMS



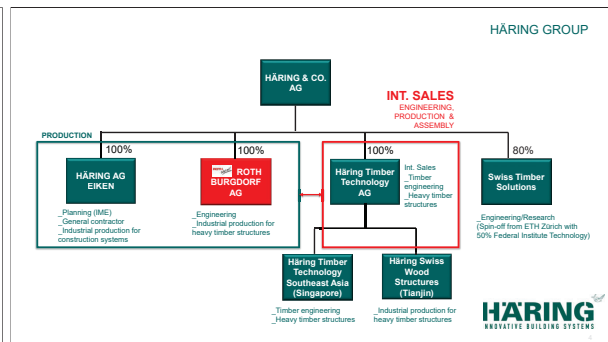
WELCOME TO THE TIMBER AGE

LIGHT, FAST & GREEN

THE MEGATREND OF THE 21ST CENTURY ALSO
APPLIES TO CONSTRUCTION



HÄRING
INNOVATIVE BUILDING SYSTEMS



PRODUCTION UNITS IN SWITZERLAND

SWISS ENGINEERING & PRODUCTION
FOR INTERNATIONAL MARKETS

GLULAM (TIMBER ENGINEER STRUCTURES)
SINGLE, BLOCK OR HOLLOW BOX BEAMS USED IN COLUMNS/BEAMS ARE
PRODUCED AT OUR FACTORY - ROTH IN BURGDORF.

TIMBER ELEMENTS (WALLS, DECKS OR FINISH CLT ELEMENTS)
ARE AVAILABLE FROM OUR FACTORY - HÄRING IN EIKEN.

BOTH LOCATIONS HAVE MULTIPLE CNC MACHINES TO EXECUTE THE
DETAIL JOINERY WORK.

TO REDUCE CARBON FOOTPRINT, GLULAM / CLT CAN ALSO BE PROVIDED
FROM OUR PARTNERS IN EUROPE THAT ARE CLOSER TO THE BUILDING
SITE

HÄRING
INNOVATIVE BUILDING SYSTEMS



TRADITIONAL ROOF STRUCTURES

LOGISTIC AND GLULAM SOLUTIONS

HÄRING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

PREFABRICATED
ELEMENTS

_HOUSES/VILLAS

_APARTMENTS/OFFICES

_SCHOOLS

_RESTAURANTS

HÄRING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

HALL & BRIDGES


_SPORTS ARENA

POSTFINANCE ARENA

BUILT 1967/71 (OVER 54 YEARS)

TIMBER STRUCTURE
HAD ZERO MAINTENANCE


HÄRING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

HALL & BRIDGES
_SPORTS ARENA

VAILLANT ARENA - DAVOS



HARING
INNOVATIVE BUILDING SYSTEMS




REFERENCES

HALL & BRIDGES
_RESEARCH CENTER
SWISS - LIGHT SOURCE (SLS) - PAUL SCHERRER

Ø138M/450FT
OVER 24 YEARS



HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

_PEDESTRIAN BRIDGE





PHOTO JULY 2020
(>35 YEARS OLD)

BASEL, SWITZERLAND

HARING
INNOVATIVE BUILDING SYSTEMS




REFERENCES

STRUCTURES
_CURVED STRUCTURES

TRAIN STATION
BERN - SWITZERLAND

HARING
INNOVATIVE BUILDING SYSTEMS



GLULAM PRODUCTION & LOGISTIC

GLULAM
STRUCTURE
46M MAIN BEAMS

_PRODUCTION AND CNC
WORK
_TRANSPORT PER TRUCK







HARING
INNOVATIVE BUILDING SYSTEMS

INTERNATIONAL

HARING
INNOVATIVE BUILDING SYSTEMS

BUSINESS UNITS

INTERNATIONAL MARKETS


<p>ATTICO</p>  <p>INCREASE APARTMENT HOUSES BUILDING WITHOUT LAND GENERAL CONTRACTOR</p>	<p>REAL ESTATE DEVELOPMENT</p>  <p>DEVELOPMENT ARCHITECTURE / BIM REALISATION</p>	<p>TIMBER CONSTRUCTION</p>  <p>APARTMENT HOUSES INDUSTRIAL BUILDINGS SCHOOLS MODULAR/SYSTEM BUILDINGS GEN CONTRACTOR</p>	<p>TIMBER ENGINEERING DESIGN</p>  <p>STRUCTURAL DESIGN & ENGINEERING STRUCTURES HALLS & BRIDGES CONTROL & MAINTENANCE R&D</p>	<p>TIMBER STRUCTURES</p>  <p>GLULAM STRUCTURES ENGINEERING CNC/DIGITAL PRODUCTION READY FOR ASSEMBLY</p>	<p>HARING-ENSHERE DOME®</p>  <p>GLULAM BULK STORAGE DOME SPORTS BIGDOME GRID-SHELL FREE-FORM</p>
---	--	---	--	---	---

HARING
INNOVATIVE BUILDING SYSTEMS


GENERAL REFERENCES

LIGHT, FAST, GREEN

_HARING-ENSHERE® DOME
STRUCTURES
_INDUSTRIAL BUILDINGS
_SPORTS & MULTIPURPOSE
_SCHOOLS & SERVICES
_MULTIFLOOR BUILDINGS
_BUILDING EXTENSIONS
_HOTELS
_AIRPORTS & TRAIN STATIONS
_DEFENCE FACILITIES





HARING
INNOVATIVE BUILDING SYSTEMS




INTERNATIONAL TRANSPORTS
LOGISTIC OPTIMIZATION – IF 42 METER BEAMS ARE NEEDED

HARING
INNOVATIVE BUILDING SYSTEMS

HÄRING GROUP
TECHNOLOGY TRANSFER

LOCAL PRODUCTION
FOR CHINESE MARKET



HÄRING SWISS WOOD STRUCTURES
_TIANJIN, CHINA

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

_TEMPLES (CHINA)

HARING
INNOVATIVE BUILDING SYSTEMS








HÄRING GROUP
TECHNOLOGY TRANSFER

_TECHNOLOGY TRANSFER
TO ECOWOOD IN GABON
_GLULAM & ELEMENT
PRODUCTION WITH LOCAL
RESOURCES




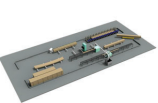


HARING
INNOVATIVE BUILDING SYSTEMS



ECOWOOD

SCHOOL
LIBREVILLE, GABON

HARING
INNOVATIVE BUILDING SYSTEMS

HÄRING GROUP
TECHNOLOGY TRANSFER

_TECHNOLOGY TRANSFERRED TO
BHUTAN (PLANT LAYOUT,
MACHINERY, PRODUCTION
METHODS, ASSEMBLY TRAINING)
_SUPPORT FROM SWITZERLAND
_DESIGN & ENGINEERING
_ASSEMBLY METHOD / SUPERVISION

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

_DINING HALL (BHUTAN)

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

_DINING HALL (BHUTAN)

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

_ DINING HALL (BHUTAN)

HARING
INNOVATIVE BUILDING SYSTEMS




REFERENCES

GRID STRUCTURE
WITH LOCAL WOOD

_ OVER 3200M ABOVE
SEA LEVEL

PROJECT IN BHUTAN
@2021

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

GRID STRUCTURE
WITH LOCAL WOOD

_ OVER 3200M ABOVE
SEA LEVEL

PROJECT IN BHUTAN
@2021

HARING
INNOVATIVE BUILDING SYSTEMS

WELDED WOOD

HARING
INNOVATIVE BUILDING SYSTEMS

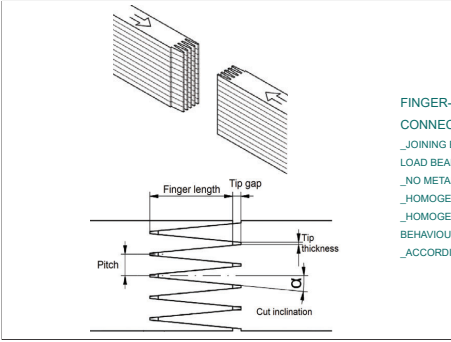


WELDED WOOD

LOGISTIC
KNOWN-HOW

_ CONTAINER SIZE
_ AVOIDS SPECIAL
TRANSPORTS
_ MAKES ASSEMBLY
POSSIBLE AROUND THE
WORLD

HARING
INNOVATIVE BUILDING SYSTEMS



WELDED WOOD

FINGER-JOINT/BEARING
CONNECTIONS

_ JOINING BEAMS WITHOUT LOSS OF
LOAD BEARING CAPACITY
_ NO METALLIC PARTS
_ HOMOGENEOUS LOAD BEARING
_ HOMOGENEOUS MATERIAL
BEHAVIOUR
_ ACCORDING EUROPEAN (DIN) NORMS

HARING
INNOVATIVE BUILDING SYSTEMS




WELDED WOOD

FINGER-JOINT CONNECTIONS

_ ALLOWS NORMAL TRANSPORTS
_ SOLVES TRANSPORT RESTRICTIONS
OR ACCESS PROBLEMS IN CASES OF
VERY LONG BEAMS

_ 80 METER ARCH BEAM OF THE
PROJECT NEMP

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

PROJECTS IN ASIA

_ BEIJING NATIONAL
SWIMMING TRAINING
CENTRE - FIRST PROJECT IN
CHINA

HARING
INNOVATIVE BUILDING SYSTEMS



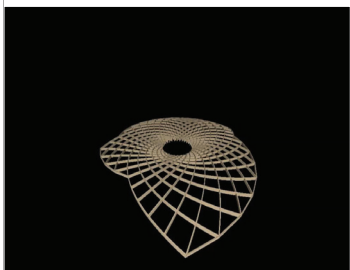
REFERENCES

PROJECTS IN ASIA
_NEMP (CHINA AND SOUTH KOREA)

ARCHES UP TO 80M SPAN




HARING
INNOVATIVE BUILDING SYSTEMS



OPTIMIZED TIMBER DESIGN

_RESOURCES EFFICIENCY
_LOGISTIC
_COLLABORATION / VALUE
ENGINEERING


HARING
INNOVATIVE BUILDING SYSTEMS




REFERENCES

FREE-FORM OR
"BIONIC" STRUCTURES

QUALITY IN
CONSTRUCTION
WITH AN EFFICIENT
COLLABORATION



HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES

STRUCTURES &
ENGINEERING
_HARING-ENSHERE®
DOME

_CLEAR SPAN UP TO 200M
DIAMETER

HARING
INNOVATIVE BUILDING SYSTEMS



REFERENCES



STRUCTURES &
ENGINEERING
_TRIPLE ARCH HYBRID SYSTEM

40TONS LED SCREEN

CHENGDU AGRO EXPO
GROUND AREA 75'000M2
CLEAR SPAN OVER 115M





HARING
INNOVATIVE BUILDING SYSTEMS

REFERENCES

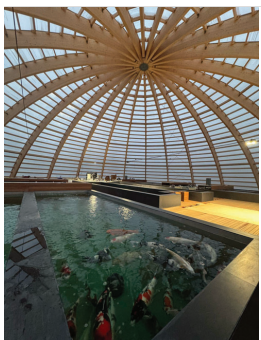
STRUCTURES &
ENGINEERING
_TRIPLE ARCH HYBRID SYSTEM

LOGISTIC
48 GLULAM TRANSPORTS
_AIR CARGO
_SEA CARGO
_TRAIN





G2 HALL = Glulam 1'320M3 – ENGINEERED / PRODUCED AND DELIVERED IN 6 MONTHS

HARING
INNOVATIVE BUILDING SYSTEMS




USA



KOI DOME – DIAMETER 40M WITH 14M HEIGHT
DELIVERED WITH 45FT HQ CONTAINERS
ASSEMBLY 10 WORKING DAYS

HARING
INNOVATIVE BUILDING SYSTEMS

TIMBER CONSTRUCTION – OPTIONS




1. TIMBER ELEMENT
CONSTRUCTION
(LESS WOOD)
UP TO 5 FLOORS

2. GLULAM FRAME
STRUCTURE/ SLABS
BALANCE / RESOURCE
EFFICIENT

3. CLT CONSTRUCTION
WALLS/SLABS
MASSIVE!
MORE EXPENSIVE

HARING
INNOVATIVE BUILDING SYSTEMS

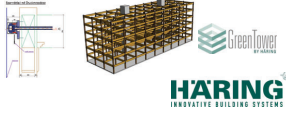


STRUCTURAL SYSTEM

MASS TIMBER TECHNOLOGY

_R&D TOGETHER WITH ETH ZÜRICH **FLEXFRAME**

_FRAME STRUCTURE WITH POST-TENSIONING SYSTEM



HARING
INNOVATIVE BUILDING SYSTEMS

OUR APPROACH

MULTI STOREY TECHNOLOGY
SKELETON IN GLULAM = **FLEXFRAME**

_FRAME SYSTEM ALLOWS OPTIMIZATION IN THE LOGISTIC AND ASSEMBLING PROCESS

_FLEXFRAME IS OPTIMIZED FOR EARTHQUAKE REGIONS

_POSSIBLE TO COMBINE SLABS WITH HOLLOW TIMBER ELEMENTS, CLT OR MIX SLABS TIMBER/CONCRETE




HARING
INNOVATIVE BUILDING SYSTEMS



TIMBER CONSTRUCTION

FLEXFRAME

_USED IN THE HOUSE OF NATURAL RESOURCES (ETH CAMPUS)

_ALLOWS FLEXIBLE INTERIOR LAYOUTS

GreenTower

_THIS IS OPTIMIZED FOR TALLER BUILDINGS


HARING
INNOVATIVE BUILDING SYSTEMS



TIMBER CONSTRUCTION



HARING
INNOVATIVE BUILDING SYSTEMS



HOW TO ACHIEVE? PRODUCTION EFFICIENCY

FLEXFRAME

TIMBER SKELETON FOR TALLER BUILDINGS

@ROTH BURGDORF
BLOCK GLUE PRODUCTION

ACTUAL R&D HIGH STRENGTH COLUMNS

HARING
INNOVATIVE BUILDING SYSTEMS

WHAT OTHER COUNTRIES ARE DOING?

FIREPROOF WOOD MATERIAL COOL WOOD

JAPAN
_FIRST CERTIFICATION FOR 3 HOURS FIREPROOF RESISTANCE


COOLWOOD

ALLOWS FOR THE FIRST TIME TIMBER STRUCTURES ABOVE 15 FLOORS

Fireproof wood structure technology

(Japan forest structure)
(Patent No. 4330575)

1. The internal load-bearing structure is wood
2. The intermediary fire stoppage layer is gypsum board
3. The surface material is wood (columns, beams)



HARING
INNOVATIVE BUILDING SYSTEMS

TIMBER FRAME SLAB



CLT SLAB



GLULAM SLAB



FLEXFRAME CAN BE COMBINE WITH


CUSTOM MADE SOLUTIONS

DRY WALL OR FLOOR SYSTEMS ADJUSTED TO COUNTRY REQUIREMENTS

_FIRE
_ACOUSTIC



HARING
INNOVATIVE BUILDING SYSTEMS




EXAMPLES ABROAD

WE CAN EXECUTE SIMILAR SOLUTIONS ANYWHERE IN THE WORLD.

BY HARING TIMBER TECHNOLOGY

HARING
INNOVATIVE BUILDING SYSTEMS

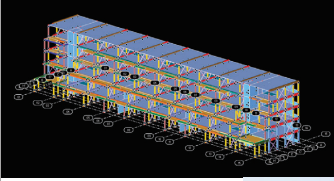


VELDHOVEN – NL

SOCIAL LOW COST APARTMENTS

COLLABORATION FROM EARLY CONCEPT TO PRODUCTION

HARING
INNOVATIVE BUILDING SYSTEMS



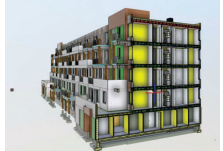
SOCIAL HOUSES VELDHOVEN, NETHERLANDS

TIMBER ENGINEERING
_56 APARTMENTS

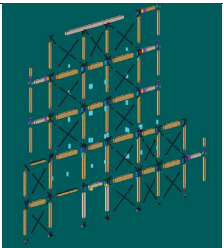
TIMBER CONSTRUCTION
_VARIANTE OF FLEXFRAME
_TIMBER SLAB

REQUIREMENTS:
_FIRE R90 (ORIGINAL R60)
_ACOUSTIC (IMPACT)
_COLLAPSE MECHANISM (IMPOSED AT A LATER STAGE)

BIM INTEGRATION
_100% PREFABRICATION OF ALL ELEMENTS ABOVE GROUND



HARING
INNOVATIVE BUILDING SYSTEMS



TIMBER CONSTRUCTION SYSTEM – FIRE R90

_TIMBER COLUMNS (SKELETON – FLEXFRAME)
_TIMBER BEAMS (SKELETON – FLEXFRAME)
_TIMBER SLABS (HOLLOW ELEMENTS)
_WIND BRACES R60 (PROTECTED INSIDE PARTITION WALLS)

ADVANTAGES:
_LOAD-BEARING SKELETON INDEPENDENT OF PARTITION WALLS (RESOURCES EFFICIENCY + ECONOMIC INTERIOR WALLS)
_DESIGN FREEDOM FOR THE INTERIOR LAYOUTS
_VARIABLE FLOOR PLAN

_OPTIMIZED VERTICAL SHAFTS POSITIONS WITHIN THE TIMBER SLAB ELEMENTS

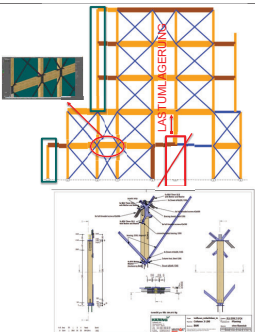
1: Glulam Timber GL24H | EN 14080:2013-08
2: Glulam Timber GL28H | EN 1995-1-1:2009-10
6: Steel S 355 | EN 10025-2:2004-11

HARING
INNOVATIVE BUILDING SYSTEMS

IMPOSED REQUIREMENTS

ROBUSTNESS
LOCAL FAILURE / COLLAPSE MECHANISMS

_IDENTIFIED EXCEPTIONAL EFFECTS
_LOCAL FAILURE = FAILURE OF ANY SUPPORT
_STRUCTURAL DESIGN MUST ENSURE ROBUSTNESS
_AGREED WITH THE CLIENT AND THE RESPONSIBLE AUTHORITY
_LOAD TRANSFER (ALTERNATIVE PATH)
_EXCEPTION – BALCONY COLUMNS - OVERSIZED (GREEN)



HARING
INNOVATIVE BUILDING SYSTEMS



Impact Absorption $L_{int,w} + C_I = 48dB + 1dB$
Lab test at **gbu** constructive thinking



TIMBER CONSTRUCTION

CUSTOM MADE SOLUTIONS FOR THE PROJECT

EXAMPLE BAM VELDHOVEN TESTED IN LAB AND CONFIRMED ON SITE

HARING
INNOVATIVE BUILDING SYSTEMS



TIMBER CONSTRUCTION

CUSTOM MADE SOLUTIONS FOR THE PROJECT

EXAMPLE BAM VELDHOVEN TESTED IN LAB AND CONFIRMED ON SITE

HARING
INNOVATIVE BUILDING SYSTEMS



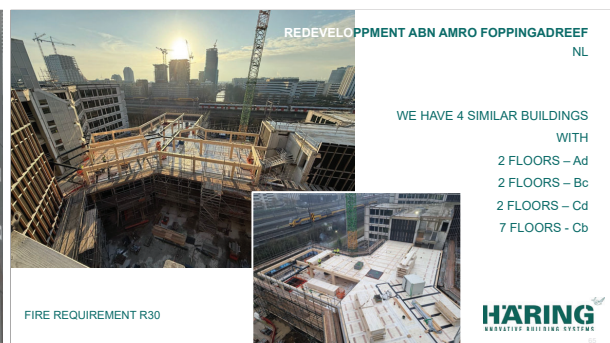
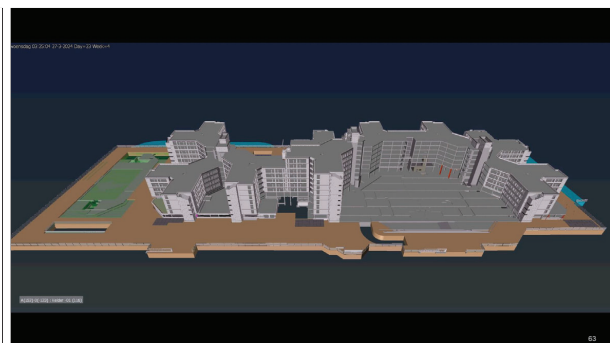
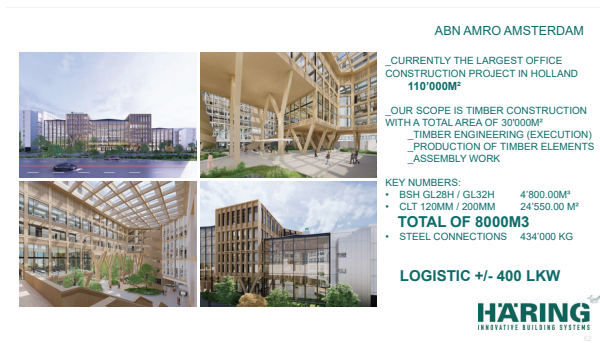
VELDHOVEN

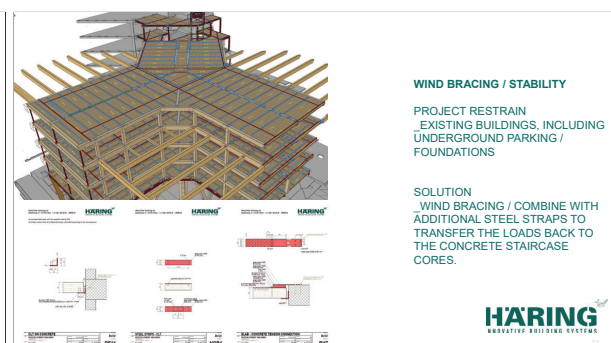
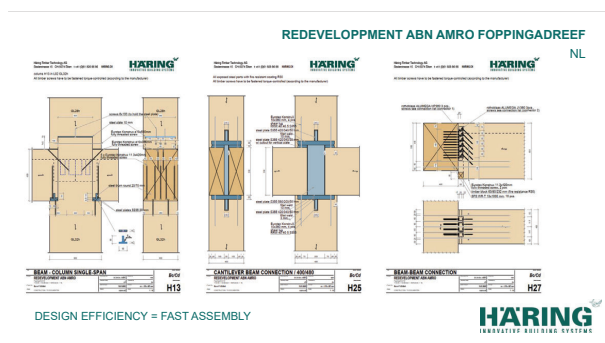
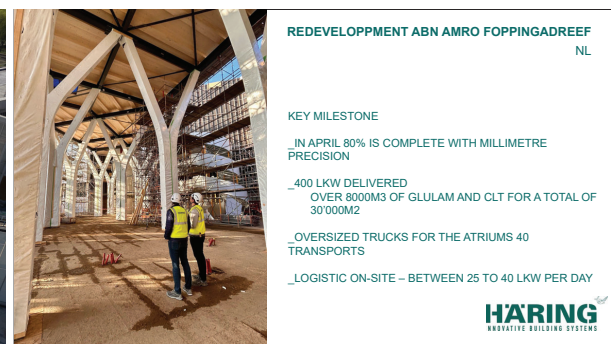
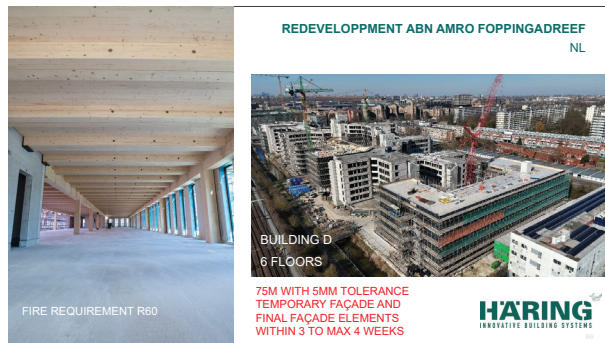
HARING
INNOVATIVE BUILDING SYSTEMS



VELDHOVEN

HARING
INNOVATIVE BUILDING SYSTEMS



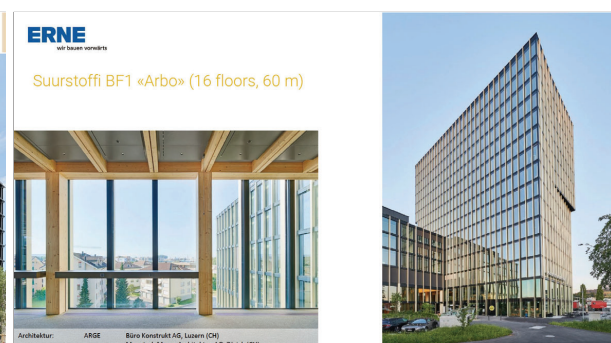
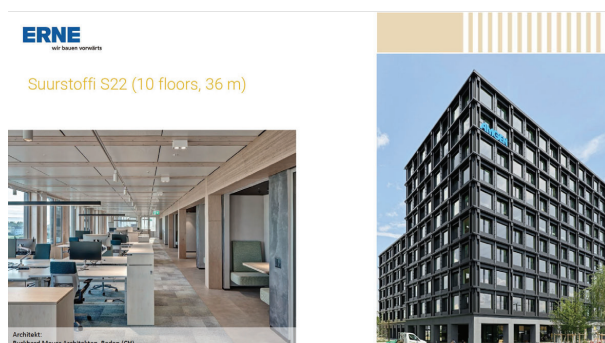
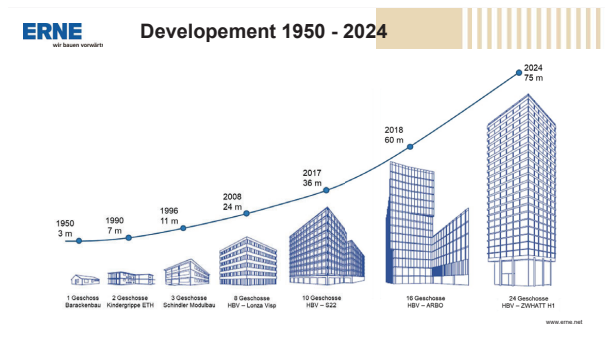
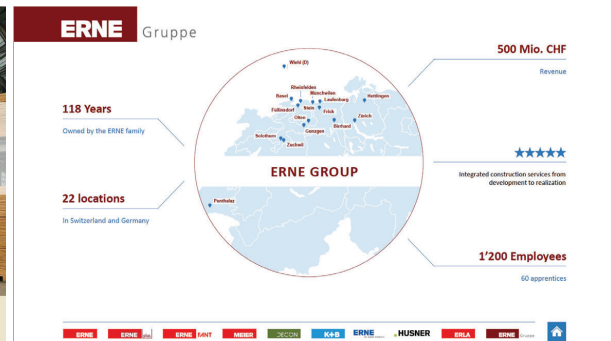
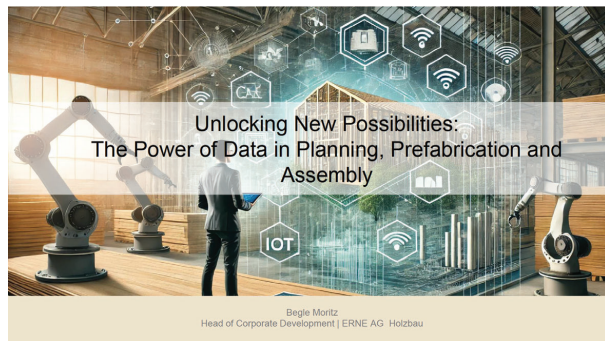




The power of data in planning, prefabrication, and assembly

Moritz Begle

ERNE AG Holzbau, Switzerland
moritz.begle@erne.net



ERNE
wir bauen vorwärts

Can we achieve profitability despite increasing complexity?

Yes, but

You need several components:

- New processes in planning and build
- Help of digitalization (production, planning)
- Humans (mindset)

www.erne.net

ERNE
wir bauen vorwärts

Perspective of timber construction...
...in the digital building industry

ERNE
wir bauen vorwärts

How do we make ideas happen?
Efficient, sustainable, profitable?

ERNE
wir bauen vorwärts

How Projects Really Work (version 1.5)

Create your own cartoons at www.projectcartoon.com

ERNE
wir bauen vorwärts

Strategic planning Pre-planning Project-planning Call for tender Production Build on Site Usage Maintenance

1 Strategic planning
2 Vorstudien
3 Projektplanung
4 Ausschreibung
5 Realisierung
6 Betrieb

Design Start Construction Realising

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ERNE
wir bauen vorwärts

Planning - Process

Production Process

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ERNE
wir bauen vorwärts

The five blocks of digitalization in the building industry

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Building Systems & Coordination

www.erne.net

[illegible]

The graph illustrates the cumulative loss of information over time for two types of workflows. The vertical axis represents 'Project information' and the horizontal axis represents 'Time'. The horizontal axis is divided into four phases: 'Conceptual Design', 'Detailed Design', 'Construction', and 'Operation'. A blue curve, labeled 'Digital workflows', starts at the origin and rises smoothly, representing a continuous accumulation of information. A red line, labeled 'Conventional workflows', starts at the origin and follows a step-like pattern, showing periodic drops in information levels. These drops are labeled 'Information loss'. The area between the blue curve and the red line is shaded gray, representing the information lost in conventional workflows. A solid red line connects the peaks of the red line, showing the cumulative information level in conventional workflows, which remains below the digital workflow curve throughout the project lifecycle.

The diagram illustrates the 4th Industrial Revolution (Industry 4.0) ecosystem, centered around Digitalization. The central hub is connected to four main pillars, each with its own set of sub-components:

- Digital construction** (Yellow boxes):
 - Augmented Reality
 - Digital access (Digital Pass, etc.)
 - Point Cloud (Measurements, visualization)
 - In Situ Robotics
- Digital production** (Blue boxes):
 - Digital Chain
 - Robot manufacturing
 - Modular construction
 - Production
 - 3D printing
- Digital Facility Management** (Orange boxes):
 - Life cycle assessments
 - Digital marketing (Smart, etc.)
 - Digital real estate management
- Digital formfinding** (Blue boxes):
 - Parametric design
 - Simulations (Strength, Costs, etc., etc.)
 - Generative design
 - AI, machine learning
- Digital planning** (Yellow boxes):
 - BIM (Building Information Modeling)
 - Process automation (Smart, etc.)
 - IPD (Integrated Project Delivery)
 - LEAN (Last Planner System)
 - VDC (Virtual Design & Construction)
 - VR (Virtual Reality)

The central hub is labeled **Digitalization**. The diagram is attributed to www.ernw.eu.

IPD - the „NEW“ planning process?

Strategic planning **Pre-planning** **Project-planning** **Call for tender** **Production Build on Site** **Usage Maintenance**

- 1 Strategisches Planning**
 - Visionen
 - Ziele
 - Strategien
 - Konzepte
 - Strategische Entscheidungen
- 2 Vorstudien**
 - Zielvorgabe
 - Zielvereinbarung
 - Zielumsetzung
 - Zielüberprüfung
 - Zielanpassung
- 3 Problemlösung**
 - Problemstellung
 - Problemklärung
 - Problemlösung
 - Problemlösungsüberprüfung
 - Problemlösungsanpassung
- 4 Ausschreibung**
 - Ausschreibung
 - Ausschreibungsvorbereitung
 - Ausschreibungsbegleitung
 - Ausschreibungsbewertung
 - Ausschreibungsergebnis
- 5 Realisierung**
 - Realisierung
 - Realisierungsvorbereitung
 - Realisierungsbegleitung
 - Realisierungsbewertung
 - Realisierungsergebnis
- 6 Betrieb/Instandhaltung**
 - Betrieb/Instandhaltung
 - Betrieb/Instandhaltungsvorbereitung
 - Betrieb/Instandhaltungsbegleitung
 - Betrieb/Instandhaltungsbewertung
 - Betrieb/Instandhaltungsergebnis

Start Construction

Design **Construction**

What to design? **Repeat til end** **How to build?**

○ = Information and cost feedback loop

www.amaa.net



Mindset

we're human, normally

SCHÖN, DASS DU SCHON MAL NEUE TECHNIK BESORGT HAST, ABER VIELLEICHT SOLLTEN WIR ERST EIN PAAR GRUNDLEGENDE DINGE ÄNDERN.



It's great that you've already got some new technology, but maybe we should change a few basic things first.

The diagram illustrates the 'NEW' planning process as a Venn diagram with three overlapping circles: IPD (Integrated Project Delivery), LEAN, and BIM. The central intersection of all three circles is labeled 'HUMAN'.

- IPD (Integrated Project Delivery):**
 - Designing collaboration
 - Finding solutions together at an early stage
 - Working together instead of against each other
- LEAN:**
 - Production management in project
 - Planning and execution for better resource management
 - Risk management
- BIM (Building Information Modeling):**
 - Transparent information management
 - Visualization
 - Integrated information
 - Automation

The central 'HUMAN' circle represents the core of the process, where the integration of IPD, LEAN, and BIM is realized through human collaboration and decision-making.

Datenerhebung	Anwendungsfeld	BA 2016	BA 2017	BA 2018	BA 2019
Zentrale Datenerhebung	Projektplanungen und Meilenstein Schichtplanungen Zugriff auf Modellen Medienloses Live-Management Mobile Erhebung von Bauplanungsdaten Medienloses Raumbuch Daten Erhebung von Bauplanungsdaten	X	X	X	X
Optimale Kommunikation	Abbildung Einflüsse, Kosten und Erlöse Virtual Reality Bewertung, Planung und Vermarktung Projekt Bauplanungs- und Baufortschrittsmanagement Bauplanungs- und Baufortschrittsmanagement	X	X	X	X
Kostenkontrolle / Erlösmanagement / Erlöskontrolle	Filter für Prozesskostenstellen Medienloses Flächen- und Mengenmanagement Bauplanungs- und Baufortschrittsmanagement 4D Simulationen Visualisierung Bauplanungs- und Baufortschrittsmanagement	X	X	X	X
Kostenkontrolle / Erlösmanagement / Erlöskontrolle	Medienloses Projektmanagement Bauplanungs- und Baufortschrittsmanagement Teleoperation der Bauplanungs- und Baufortschrittsmanagement Clouds Nutzung von Bauplanungs- und Baufortschrittsmanagement Mobile Bauplanungs- und Baufortschrittsmanagement	X	X	X	X
Optimale Auswertung	Medienloses Live-Management Bauplanungs- und Baufortschrittsmanagement Medienloses Bauplanungs- und Baufortschrittsmanagement Bauplanungs- und Baufortschrittsmanagement Bauplanungs- und Baufortschrittsmanagement	X	X	X	X
Optimale Übergabe	Medienloses Bauplanungs- und Baufortschrittsmanagement Bauplanungs- und Baufortschrittsmanagement BIM4U Bauplanungs- und Baufortschrittsmanagement	X	X	X	X
Optimierter Betrieb	Datenintegration in ERP/ CRM System des Baubereichs als Grundlage für gesamte Betriebe- und Geschäftsprozesse des Baubereichs	X	X	X	X

The next time we feed an AI with data, we should perhaps place more focus on data quality!

Schematische Darstellung der Modellierung in Revit

Revit-Element	Profilname
TVC-Klasse	ISO44
Typ	AWG 01 AWG 02 AWG 03 AWG 04 AWG 05 AWG 06 AWG 07 AWG 08 AWG 09 AWG 10 AWG 11 AWG 12 AWG 13 AWG 14 AWG 15 AWG 16 AWG 17 AWG 18 AWG 19 AWG 20 AWG 21 AWG 22 AWG 23 AWG 24 AWG 25 AWG 26 AWG 27 AWG 28 AWG 29 AWG 30 AWG 31 AWG 32 AWG 33 AWG 34 AWG 35 AWG 36 AWG 37 AWG 38 AWG 39 AWG 40 AWG 41 AWG 42 AWG 43 AWG 44 AWG 45 AWG 46 AWG 47 AWG 48 AWG 49 AWG 50 AWG 51 AWG 52 AWG 53 AWG 54 AWG 55 AWG 56 AWG 57 AWG 58 AWG 59 AWG 60 AWG 61 AWG 62 AWG 63 AWG 64 AWG 65 AWG 66 AWG 67 AWG 68 AWG 69 AWG 70 AWG 71 AWG 72 AWG 73 AWG 74 AWG 75 AWG 76 AWG 77 AWG 78 AWG 79 AWG 80 AWG 81 AWG 82 AWG 83 AWG 84 AWG 85 AWG 86 AWG 87 AWG 88 AWG 89 AWG 90 AWG 91 AWG 92 AWG 93 AWG 94 AWG 95 AWG 96 AWG 97 AWG 98 AWG 99 AWG 100
Elementname	AWG 01 AWG 02 AWG 03 AWG 04 AWG 05 AWG 06 AWG 07 AWG 08 AWG 09 AWG 10 AWG 11 AWG 12 AWG 13 AWG 14 AWG 15 AWG 16 AWG 17 AWG 18 AWG 19 AWG 20 AWG 21 AWG 22 AWG 23 AWG 24 AWG 25 AWG 26 AWG 27 AWG 28 AWG 29 AWG 30 AWG 31 AWG 32 AWG 33 AWG 34 AWG 35 AWG 36 AWG 37 AWG 38 AWG 39 AWG 40 AWG 41 AWG 42 AWG 43 AWG 44 AWG 45 AWG 46 AWG 47 AWG 48 AWG 49 AWG 50 AWG 51 AWG 52 AWG 53 AWG 54 AWG 55 AWG 56 AWG 57 AWG 58 AWG 59 AWG 60 AWG 61 AWG 62 AWG 63 AWG 64 AWG 65 AWG 66 AWG 67 AWG 68 AWG 69 AWG 70 AWG 71 AWG 72 AWG 73 AWG 74 AWG 75 AWG 76 AWG 77 AWG 78 AWG 79 AWG 80 AWG 81 AWG 82 AWG 83 AWG 84 AWG 85 AWG 86 AWG 87 AWG 88 AWG 89 AWG 90 AWG 91 AWG 92 AWG 93 AWG 94 AWG 95 AWG 96 AWG 97 AWG 98 AWG 99 AWG 100
Profilname	ISO44
cRP4T	ISO44
T-Fensterbankklasse	ISO44
Kantenklasse	ISO44
Profilname	ISO44
Kanten	ISO44
Kante	ISO44
Kante	ISO44

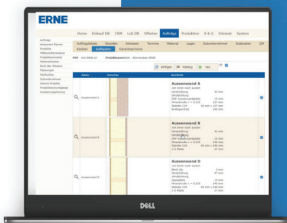
Unlocking New Possibilities: The Power of Data in Planning, Prefabrication, and Assembly

ERNE
We know construction

Construction - Catalog

= single source of information

- Continuity of information across the different project phases
- Single Source of truth (Planning, Calculation)

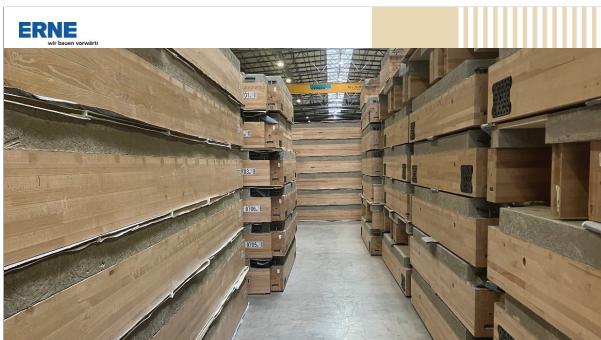
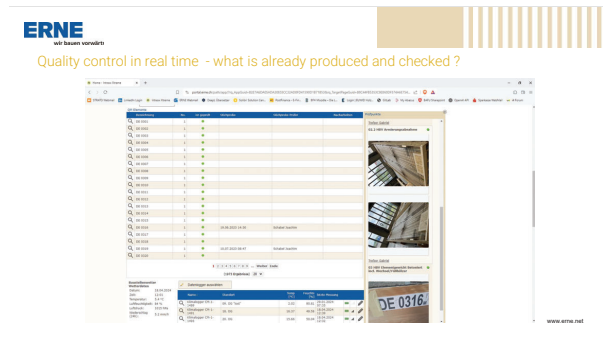
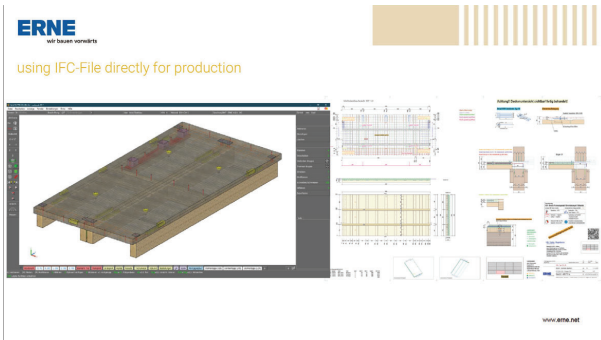
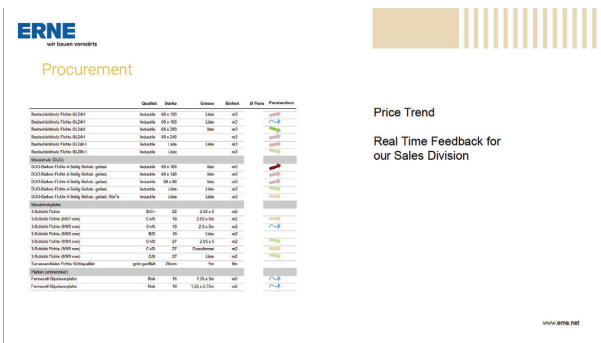
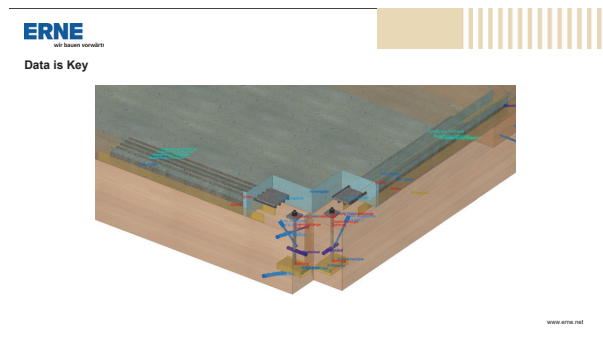


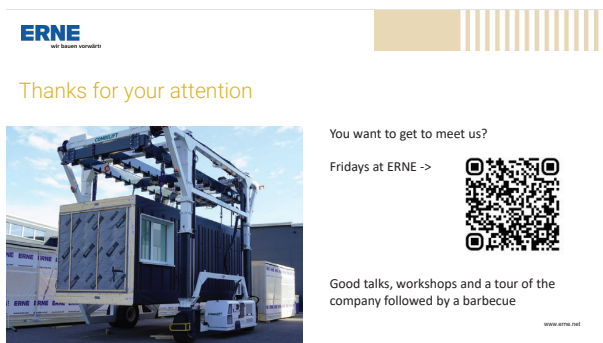
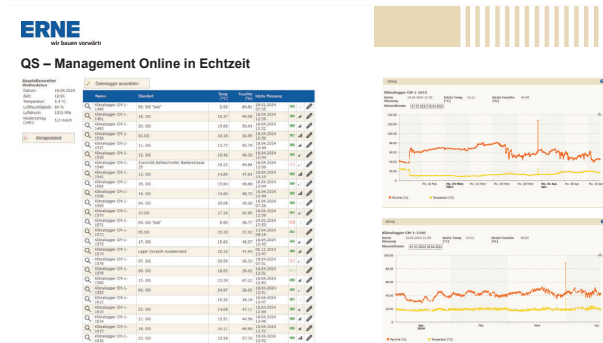
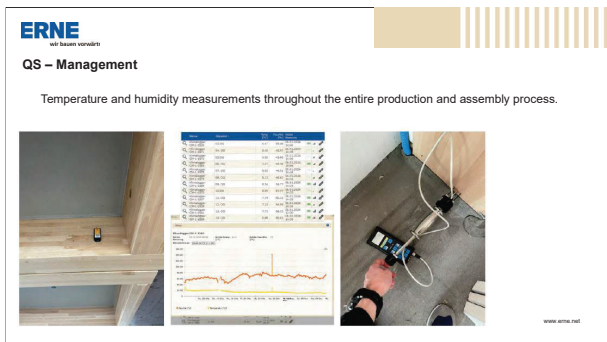
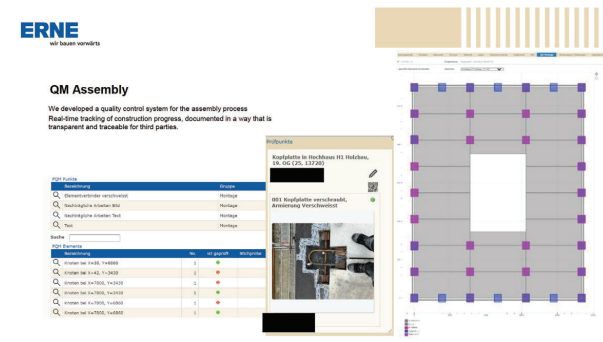
Construction-Catalog Functions

The diagram illustrates the functions of the Construction-Catalog, centered around the 'Aufbaukatalog' (Construction Catalog). The central node is 'Aufbaukatalog'. It is connected to eight surrounding nodes, which are arranged in a circle. The nodes are: 'Planungsbasis' (Planning basis), 'Thermal insulation', 'Sound insulation', 'Life cycle', 'Stability integration', 'Fire protection', 'Moisture verification', and 'Calculation basis'. The nodes are color-coded: 'Planungsbasis', 'Thermal insulation', 'Sound insulation', 'Life cycle', 'Stability integration', and 'Fire protection' are blue. 'Moisture verification' and 'Calculation basis' are light orange. The diagram is set against a light beige background with a decorative pattern of vertical lines in the top right corner.

[illegible]

A 3D architectural rendering of the ERNE modular building system. The main structure is a large, L-shaped building composed of numerous dark-colored modular units with yellow-framed windows and doors. It is situated on a floor made of interlocking wooden planks. In the foreground, there is a smaller, similar modular unit. The background features a light-colored wall with vertical wooden slats. The ERNE logo is visible in the top left corner.





Circular construction with timber

Kevin Straub

PIRMIN JUNG Schweiz AG, Switzerland
kevin.straub@pirminjung.ch



PIRMIN JUNG

Circular Timber Construction
Timber as an Example of Circular Resources
Speaker: Kevin Straub



Kevin Straub

Project Manager Structural Engineering / Circular Construction

- Apprenticeship as a roofer and work as a journeyman
- Further education as a state-certified civil engineering technician, Karlsruhe
- Bachelor's Degree in Civil Engineering at the University of Applied Sciences, Karlsruhe
- Further education as a fire protection specialist at the Association of Cantonal Fire Insurance (VKF), Bern
- Further Education (CAS) in Circular Building, Lucerne University of Applied Sciences
- Further education as a specialist engineer in clay building at Bauhaus University Weimar

kevin.straub@pirminjung.ch
+41 41 459 70 56



Download contact data as vcf file

PIRMIN JUNG



144 Employees across 7 Locations

82 Timber Construction Engineers and Technicians
27 Building Physicists
15 Fire Protection Specialists
20 Organization Staff

Timber Construction Engineering | Building Physics | Fire Protection | Circular Construction | Sustainability



Extensive Know-How and Customized Offerings

Timber Construction Engineering

- Structural Engineering
- Workshop planning
- Building Preservation
- Quality assurance



Brandschutz

- Fire protection concepts and planning
- Coordination and quality assurance
- Expert assessments



Building Physics and Sustainability

- Thermal and moisture protection
- Noise and sound insulation
- Room acoustics
- Life Cycle Assessments, Labels and Certifications
- Renovation/ Expert Assessments
- Simulations (thermal / noise)
- Quality assurance



Digital Construction

- BIM/VDC as an integral part of our daily work



Circular Construction

- Project development and consulting
- Re-use
- Research and development within the circular economy



PIRMIN JUNG

5

Key Message

- We are responsible for our future.
- Circular Construction with timber is possible.
- Timber is part of the solution.

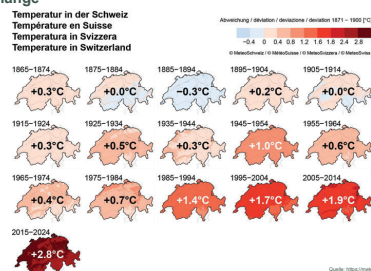
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6

Circular Economy - Why?

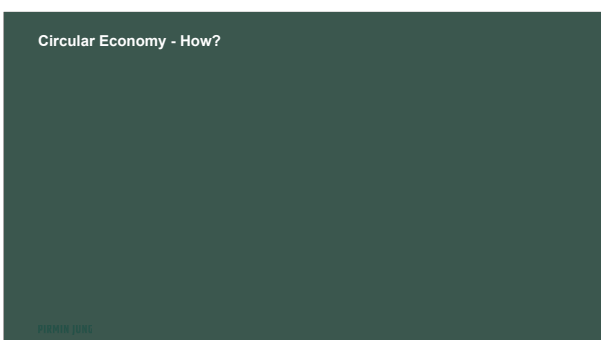
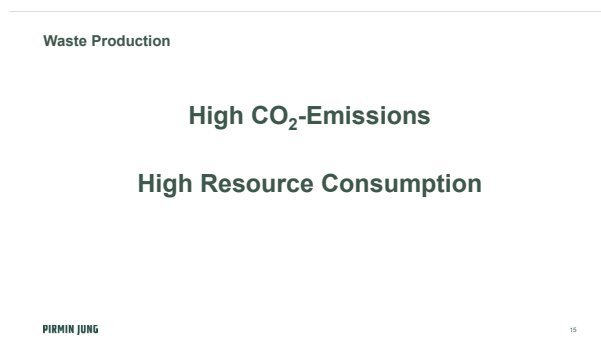
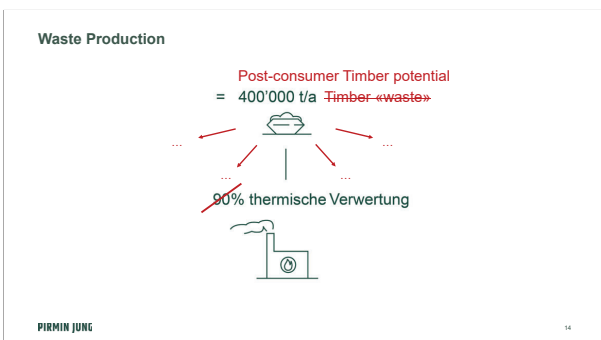
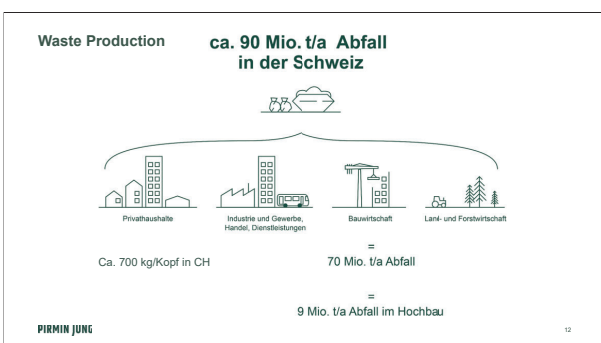
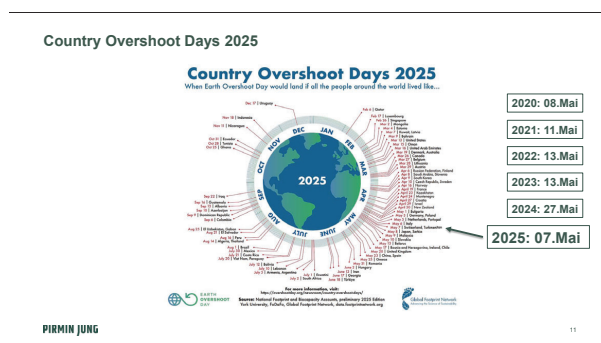
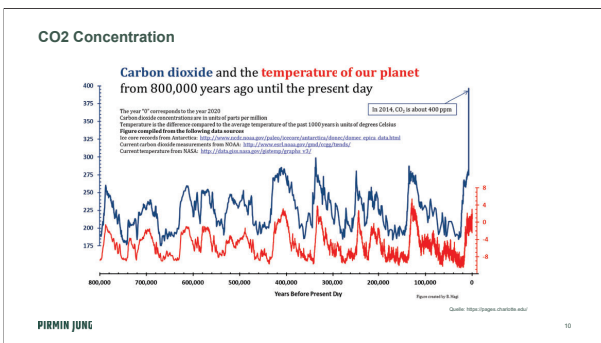
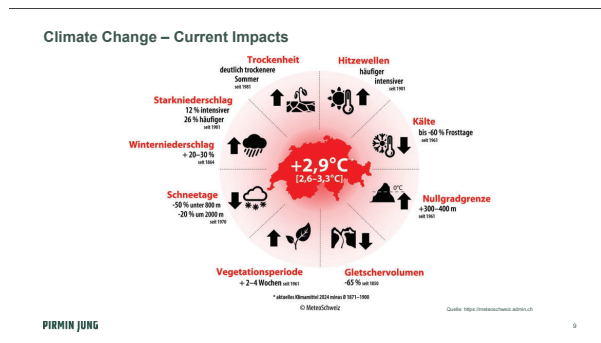
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Climate Change



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8



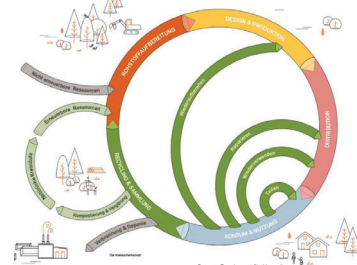
Current Situation – Linear Economic Model



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Source: Bundesamt für Umwelt
17

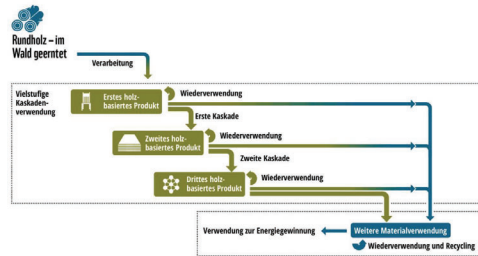
Future – Circular Economy



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Source: Bundesamt für Umwelt
18

Increase the Cascading Use of Timber



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Source: WWF «Altes aus Holz – Rohstoff der Zukunft oder kommende Krise» 2022
19

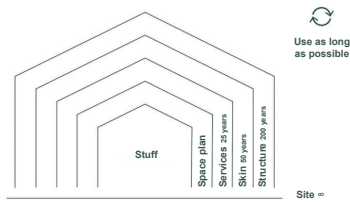
Principles



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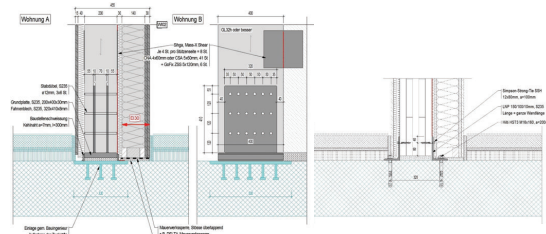
Shearing Layers– Stewart Brand



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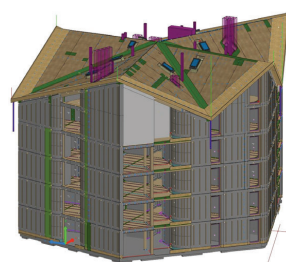
Building Documentation in Timber Construction



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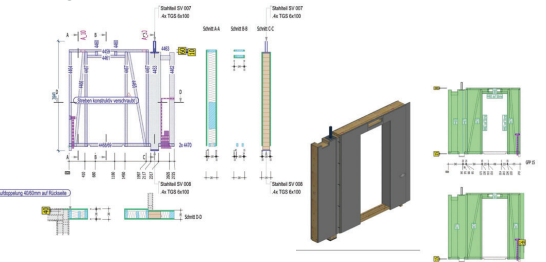
Building Documentation in Timber Construction



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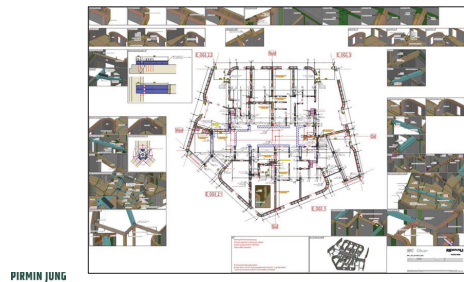
Building Documentation in Timber Construction



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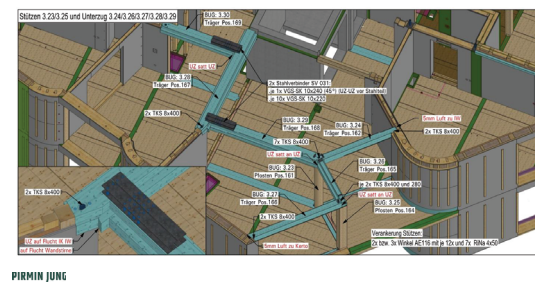
Building Documentation in Timber Construction



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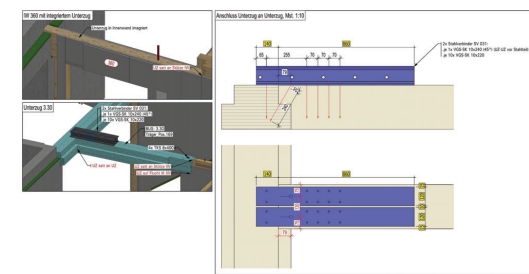
Building Documentation in Timber Construction



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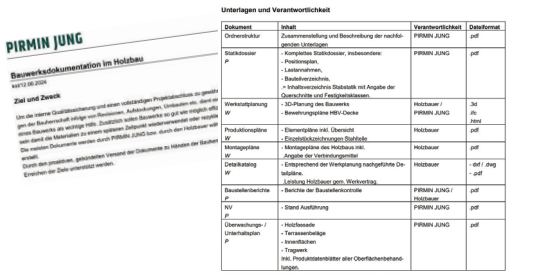
Building Documentation in Timber Construction



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Building Documentation in Timber Construction



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What Contribution Does PIRMIN JUNG Make?

- Research
 - Demolition and Reuse of Timber Buildings, Completion 2022
 - Guideline for Circular Building with Timber, Completion 2025
 - IWAH – Industrial value chain for Post-consumer Timber, Completion 2024
 - Project Regenerative Building «Think Earth»
 - AP5: Recycling and Reclaim of Timber (AHB/ETH), Completion 2027
 - AP7: Assembly and disassembly of structures (ETH), Completion 2028
 - Research project "Re-Use / Reuse of Glulam", Timber Action Plan, Completion 2026

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What Contribution Does PIRMIN JUNG Make?

- Student Research Projects
 - Recycling of Timber Buildings, Completion 2017
 - Demolition and Reuse of Timber Buildings, Completion 2021
 - Timber -Concrete Composite Floors with Recycled Concrete, Completion 2022
 - Separability and Dismantlability of Timber Frame Wall Systems, Completion 2024
 - Circular Material Flow in Timber Buildings, Completion 2025
- Advising
- Just Do It

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Practical Examples



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Re-Use – Once Upon a Time



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- Shelter, Engelbergthal



53

- Elys, Basel



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- Elys, Basel



8

- Haus des Holzes, Sursee



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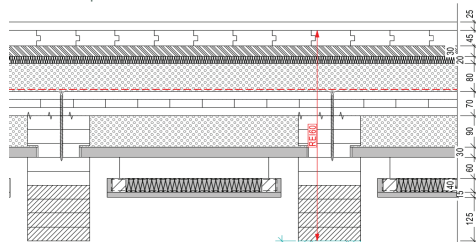
Das Diagramm zeigt den Kreislauf der Wirtschaftsgüter. Es beginnt mit 'Rohstoff', der in das 'Produktionsselement' fließt. Von dort geht es zur 'Nutzungsphase' über. Am Ende der Nutzungsphase steht das 'Verbrauchte Material'. Von diesem Material führen drei Pfade aus: einer zum 'Recycling', einer zur 'Wiederverwendung' und einer zur 'Deponie'. Ein Pfad führt auch von der 'Deponie' zur 'Thermischen Verwertung'. Ein geschlossener Kreislauf wird durch Pfeile von 'Recycling' und 'Wiederverwendung' zurück zum 'Produktionsselement' geschlossen.

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[illegible]

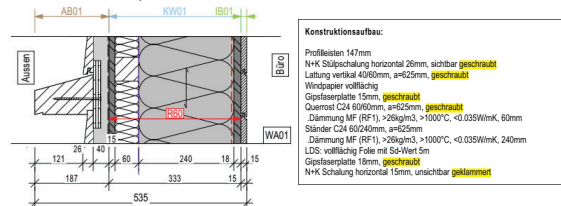
48

- Floor Build-Up



39

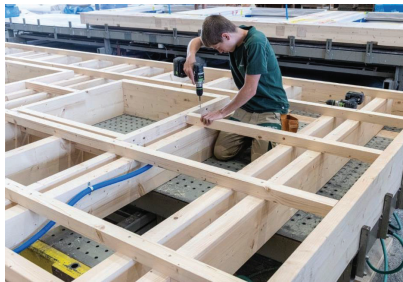
Exterior Wall Build-Up



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Prefabrication

Exterior Wall Build-Up



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Material Selection

- Floor Build-Up



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Structural Joints

- Disassemblability



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Structural Joints

- Processing

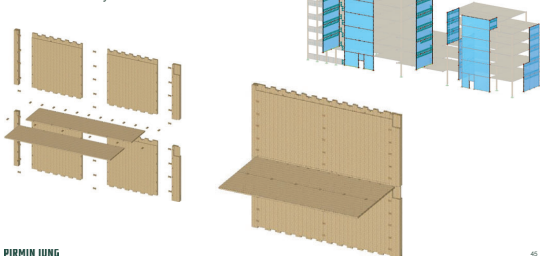


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Structural Joints

- Disassemblability

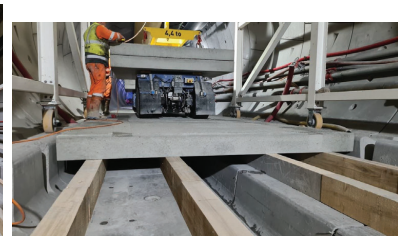


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Practical Examples

- Lysbüchel, Basel – Floor slabs

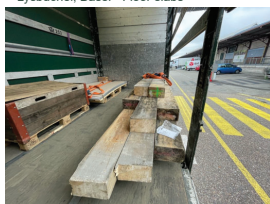


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Practical Examples

- Lysbüchel, Basel – Floor slabs

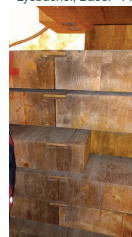


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Practical Examples

- Lysbüchel, Basel – Floor slabs



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Practical Examples

- Lysbüchel, Basel - Ceilings



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Practical Examples

- Lysbüchel, Basel - Walls



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Practical Examples

- Bernapark, Stettlen - Hall



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Practical Examples

- Bernapark, Stettlen - Hall

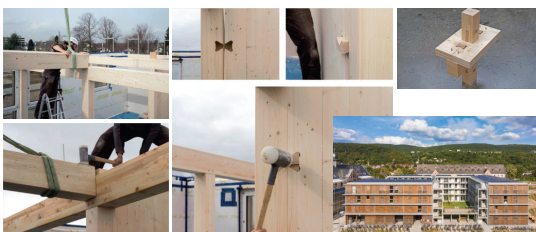


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Practical Examples

- Collegium Academicum



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Joints

- Annweiler Forestry Operations Center



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Joints

- Annweiler Forestry Operations Center



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Joints

- Offset Joint



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Joints

- Offset Joint



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Joints

- Interlocking joint in CLT

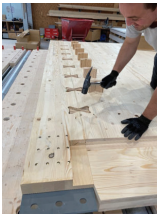


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Joints

- X-Fix Joint



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Joints

- X-Fix + Interlocking joint



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Joints

- Timber – Steel Connections



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Joints

- Timber – Steel Connections



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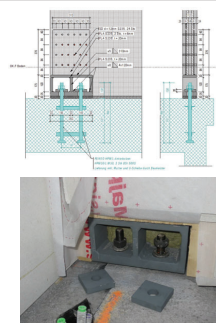
Joints

- Timber – Steel Connections



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Why isn't it working (yet)?

- Disposal is too cheap.
 - 90% of reclaimed timber is "for thermal energy production."
 - In the case of material reuse: only in the form of particleboard (e.g. OSB)
- No legal obligation exists.
 - Currently: "nice to have."
- The deconstruction required for reusing building components is more demanding.
 - Why choose a more complicated and costly approach when there is a simpler and more economical alternative?
- A source building often contains only a fraction of the timber volume required for new construction
 - Multiple source buildings are needed, or only partial reuse is possible.
 - Coordination and planning efforts increase.
- Time gaps between the deconstruction of the source building and the new construction of the target building.
 - Lack of storage options.
- Timber may be destroyed by destructive substances or organisms and requires contaminant tests.
- Circular construction (and planning) is not accounted for in conventional project timelines.

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Key Message

- We are responsible for our future.
 - Build with minimal CO₂ emissions
 - Design for disassembly
- Circular Construction with timber is possible.
 - Design for disassembly
- Timber Construction is part of the solution.
 - Sustainable management of all resources is required

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Questions / Discussion



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Thank You!

Bildquelle: Ute-P. Tiedmann, Eichenring



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pirminjung.de

Incentives and barriers for building with timber: study for the city of Zurich

Miriam Kleinhenz

Basler & Hofmann, Switzerland
miriam.kleinhenz@baslerhofmann.ch

Incentives and barriers for building with timber: study for the city of Zurich

Miniam Kleinhenz, Zürich, 20.05.2025

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About myself

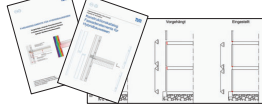


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Projects at TUM (2014-2018)

- Revision of Eurocode 5: Technical Assistant of CEN/TC 250/SC 5 Chairman Stefan Winter
- Timber-frame facade elements for hybrid constructions
- HOMERA – Health interaction between timber, human and indoor environment (indoor health)

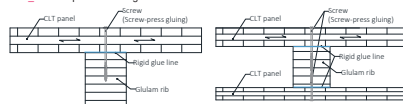


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PhD project at ETH (2018-2022)

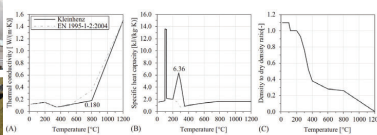
- Cross-laminated timber rib panels in fire
- Collaboration with Stora Enso
- Aims:
 - European Technical Assessment (ETA)
 - Development of design rules for the fire situation



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PhD project at ETH (2018-2022)



$$b_{eff,fi} = 0.60 \cdot b_{ef}$$

Tiefenre Hölzerei | 25.10.2023 | KLM

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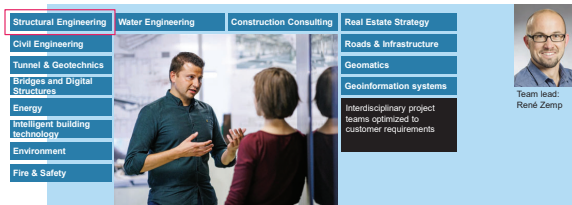
Basler & Hofmann

- Since 1963
- Family owned company
- Engineering and Consulting
- 700 employees
- Company locations:
 - Switzerland (Zürich, Luzern, Lausanne)
 - Germany, Italy, Slovakia, Singapore

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Working at Basler & Hofmann



Team lead:
René Zemp

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B&H projects



Hochhaus-Trio Vulcano Zürich



MFO Park Zürich Oerlikon

Swiss Re Mythenquai Zürich



Neues Rechenzentrum ZRH11 in Winterthur

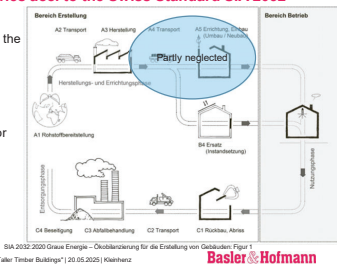


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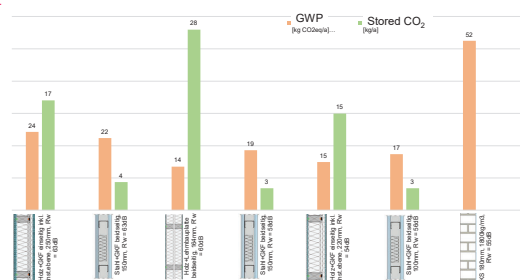
LCA Tool - System boundaries acc. to the Swiss Standard SIA 2032

- The developed tool is based on the LCA database of KBOB, the association of Public Building Owners in Switzerland.
- The tool offers great potential for ecological optimization.



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LCA of the non-load-bearing interior walls (CO₂ emissions per m² of wall surface)



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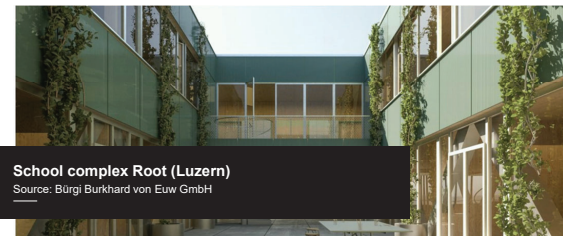
LCA of load-bearing structure: progressive vs. conventional University Library Basel Competition together with Richter Tobler Architekt*innen



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School complex Root (Luzern)

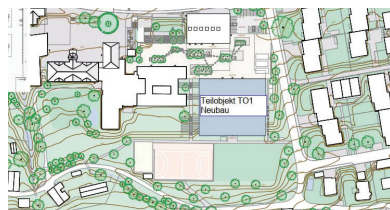
Source: Bürgi Burkhard von Euw GmbH



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New school complex Root (Luzern) – sports hall



Client:
Municipality of Root

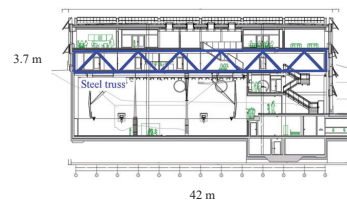
Architect:
Bürgi Burkhard von Euw GmbH

Construction Phase

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Transversal section

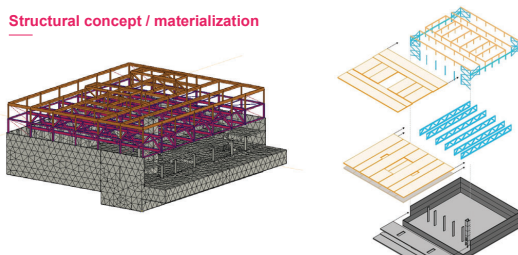


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Structural concept / materialization



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LCA of the slab system and the steel truss

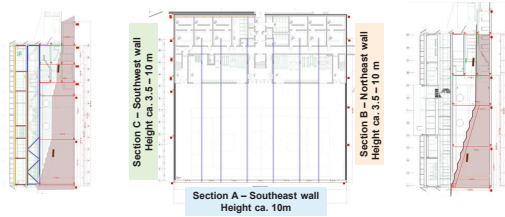
Steel truss	Slab system	GWP [kg CO2eq]	Construction costs incl. acoustics & steel truss [CHF/m2]
	Hollow-core timber slab	6'850	580
	Prestressed box girder floor in concrete	14'050	680
	Reinforced concrete flat slab	20'470	710

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Back and side walls (sports hall)



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Materialization

- Choice of slab system (criteria: costs, CO₂ emissions, construction process)
 - In the basement: classic reinforced concrete construction
 - Above sport hall (1st floor) -> prestressed hollow-core concrete
 - Above 2nd and 3rd upper floors -> hollow-core timber



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Longitudinal section

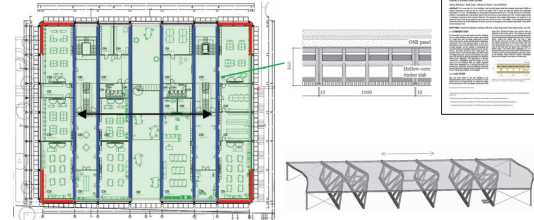


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Hollow-core timber slab (above 2nd floor)

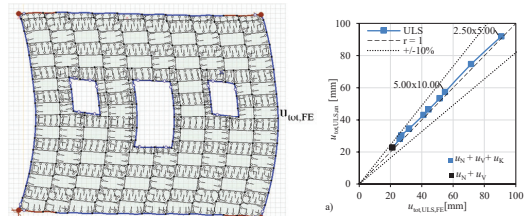


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In-plane displacement of the large-area framed floor diaphragm

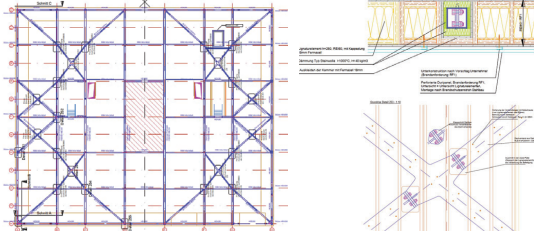


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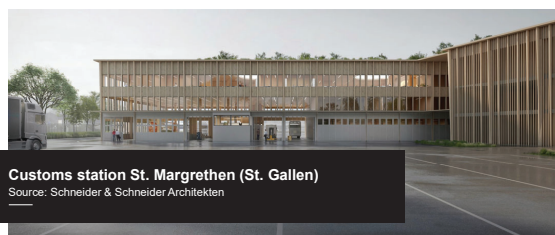
Steel bracing for stiffening of the trusses



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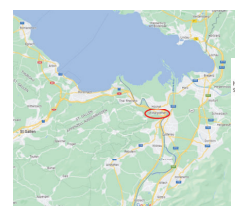
Customs station St. Margrethen (St. Gallen)
Source: Schneider & Schneider Architekten

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Allgemein | Technik | Konstruktiv | Details | Außen | Ansicht

New custom station

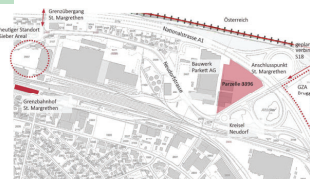


Client:

BBL

Architect:

Schneider & Schneider Architekten



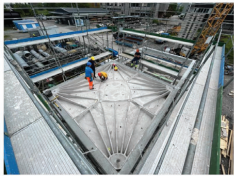
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Algemein | TWK | Konstr. Details | Atrium | Ausblick

Rippmann Floor System (RFS)



First tested and now modular for the construction project in Zug. Subcontract: Rippmann by Göttsche Keller

Prefabricated funicular concrete floor
(ETH spin-off VAULTED AG)

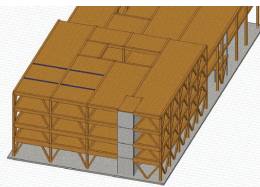



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Algemein | TWK | Konstr. Details | Atrium | Ausblick

Timber skeleton


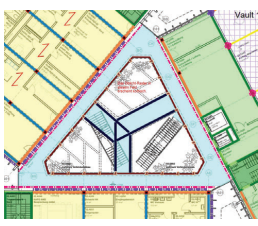



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Algemein | TWK | Konstr. Details | Atrium | Ausblick

Atrium

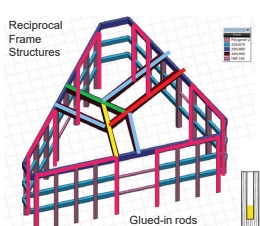
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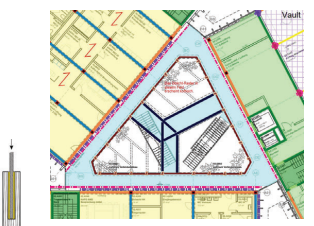
Algemein | TWK | Konstr. Details | Atrium | Ausblick

Atrium

Reciprocal Frame Structures



Glued-in rods
(Neue Holzbau AG)



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Sport Centre Witikon (Zurich)

Source: BUR ARCHITEKT*INNEN AG



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Sport Centre Witikon (Zurich)

Client: City of Zurich
Architect: BUR ARCHITEKT*INNEN AG




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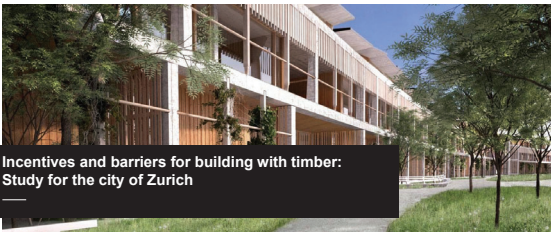
LCA of timber hall roof beams for decision-making

Nr.	Short-name	Building element	P _{Ene} [kWh]	GWP [kg CO ₂ eq]
1	Stabbuiche	P: Primary beam S: Secondary beam	639'686	127'379
2	Spruce glulam	P: 1800x400; S: ca. 900x400	311'586	66'752
3	Steel	P: Steel 1200x400x26x12 S: Spruce glulam ca. 1000x400	476'861	102'645
4	Beech truss	Height 3.4m: Top chord 400x400, strut 280x280	441'558	91'668
5	Spruce truss	Height 3.94m: Top chord 440x440, strut 320x320	306'91	68'457

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Incentives and barriers for building with timber: Study for the city of Zurich



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Study | Facts | Ideal timber construction world | Reference projects | Interview results | Raw material supply | Measurements

Study (December '23 – June '24)



Goals

- The City of Zurich is aware of the most important **incentives and barriers for building with timber in public construction projects**.
- Models for the supply of wooden raw materials** have been derived and prepared with advantages and disadvantages.

Methods

- The incentives and barriers are discussed based on 5 specific **reference projects** (Zurich) and **17 expert interviews** (25 people).
- Practical theses and "learnings" have been formulated (**report**) and were discussed in two **workshops** with participants from the City of Zurich and external parties.

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Facts

Wood quantities [m³]		CH	ZH
Landesforstinventur (WSL, 2028)	Renewable wood volume	9.3 Mio. (100%)	521'000 (100%)
	Forestry	6.9 Mio. (74%)	552'000 (106%)
Holznutzungsstatistik (BFS 2023, Taschenrechner Wald Holz)	Utilized wood volume	5.2 Mio. (100%)	486'000 (100%)
	- softwood	3.5 Mio. (67%)	286'000 (60%)
	- hardwood	1.7 Mio. (33%)	200'000 (40%)
	Trunk wood for timber products	2.6 Mio. (50%)	220'000 (45%)
	Industrial wood for wood-based materials	0.5 Mio. (10%)	37'000 (8%)
	Energy wood	2.1 Mio. (40%)	228'000 (47%)

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Facts

- There is still potential for the use of trunk wood.
- The amount of sustainably renewable trunk wood is limited.
- The entire construction volume cannot be covered with wood.
- There is competition between trunk wood and energy wood



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Reference project: «Crocodile» in the locomotive town

Winterthur (ZH) 2016 – 2021

- 6-storey apartment building
- Adimora investment foundation, Gesewo and Gaiwo cooperatives (private sector)
- Timber frame construction
- Staircase and two basement floors in concrete construction
- Cross-laminated timber slab system
- Spruce wood from southern Germany
- Implenia Schweiz AG Holzbau



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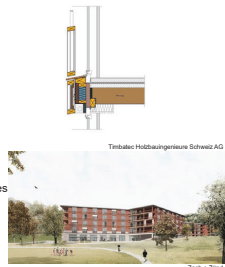
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Study | Facts | Ideal timber construction world | Reference projects | Interview results | Raw material supply | Measurements

Reference project: Care home Wier

Ebnat-Kappel (St. Gallen) 2021 – 2023

- 5-storey hybrid building
- Municipality of Ebnat-Kappel (public sector)
- Timber frame construction
- Staircase, ground floor and basement in concrete construction
- Glulam floor
- Spruce wood from the surrounding Swiss communities
- Production in Toggenburg (St. Gallen)



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Reference project: Zhwhatt H1

Regensdorf (ZH) 2022 – 2025

- 24-storey hybrid building (residential and commercial)
- Pensimio Zurich investment foundation (private sector)
- Timber frame construction
- Staircase, basement and three floors above ground in concrete construction
- TCC slab system
- Solid beech beams (Swiss timber label)
- Production by "Fagus Suisse" and ERNE Holzbau



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Reference project: School «Im Isengrind»

Zürich 2022 – 2026

- 4-storey school complex in hybrid construction
- City of Zurich (public sector)
- Timber frame construction
- Staircase, elevator cores and basement in concrete construction
- TCC slab system
- Mainly softwood as "Swiss wood option"



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Reference project: Sports centre Witikon

Zürich 2024 – 2029

- 4-storey sports centre with sports hall, gymnastics room and wardrobes for outdoor courts
- City of Zurich (public sector)
- Timber frame construction with wide-span glulam beams
- Basement and two floors above ground and under sports hall in CO₂-reduced concrete construction (CEM IIIb)
- Hollow-core timber slab system (Lignatur)



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Interviews

Role	Institution	Person	Reference project	Timber positive
Consulting	Stadt Zürich, Amt für Hochbauten	Manuela Boron	x	
Forest owner	Stadt Zürich, Grün Stadt Zürich	Theres Fankhauser		x
Consulting	Kanton Zürich	Alessandro Ungaro		
Forest owner	Pensimo Immobilien, Zürich	Reto Mohr		
Building owner	Timbatic Holzbaugenieure AG	Patrick Rhyner	x	
Timber engineer	Botshauer Architekten AG	Corinne Döschner	x	x
Architect	PIRMIN JUNG Schweiz AG	Sandro Krättli	x	
Structural engineer	Schneider Puskas	Ana Alberati	x	
Architect	JOM Architekten	Alois Raber	x	x
Architect	BUR Architekten AG	Silvan Stiert	x	x
Timber company	ERNE Holzbau AG	Lukas Wolf	x	
Timber company	Neue Holzbau AG	Mathias Stocker	x	
Wood processor	Blumen-Lehmann AG	Lukas Blum	x	
Wood processor	Schindler & Scheibling AG	Kevin Rahner	x	
Wood processor	Fagus Suisse SA	Stefan Oeschger	x	
Wood processor	Schilliger Holz	Anne Uhlmann	x	
Wood supplier	Zürich Holz AG	Urs Birchmeier	x	
		Thomas Wehrle	x	x
		Reto Schneider	x	x
		Markus Rutz	x	
		Nathanael Weiss	x	
		Fabian Scheibling	x	
		Alex Bennet	x	x
		Valentin Stäheli	x	x
		Philipp Binder	x	
			9	10

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Study | Facts | Ideal timber construction world | Reference projects | Interview results | Raw material supply | Measurements

Questions & statements from the interviews

How high is the proportion of Swiss wood in timber construction? Everyone involved in the project must want to build with wood. All stakeholders must want to use wood regionally.

What does "regionality" mean? Political commitment is crucial. Timber construction must be experienced.

How much is stored CO₂ worth to the city of Zurich? Sustainable production is out of the question. Regionality is overrated.

How much can the city of Zurich build in wood? As much wood as possible but only as much as is reasonable.

Timber construction is only 1 key element of the net zero solution. The CO₂ storage of wood must be taken into account.

Requirements and limit values within the standardization were derived from solid construction. The aim is an assessment using life cycle assessment and environmental impact points as well as an evaluation of a sustainable overall concept across all systems.

Create incentives rather than restrictions (liberal system). Private transport must be reduced and made more expensive. The number of parking spaces and parking lots must be limited.

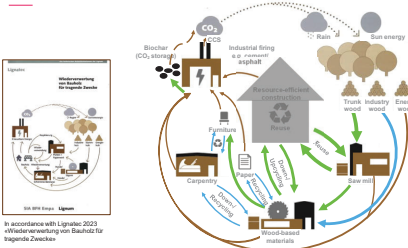
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Ideal timber construction world



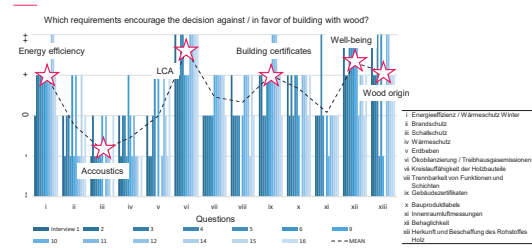
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Evaluation



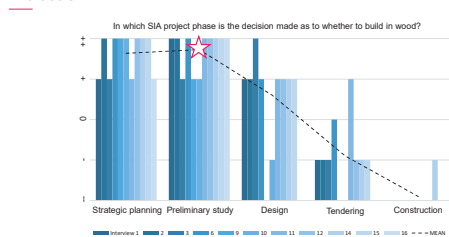
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Evaluation



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Study | Facts | Ideal timber construction world | Reference projects | Interview results | Raw material supply | Measurements

Incentives

Section	Costs	Regulation Techn. solution	Knowledge	Ecology	Raw material availability
Guidelines in competitions		X			
Construction site logistics / construction times / rental	X			X	
Energy efficiency	X			X	
Standards and directives e.g. fire protection standards		X			
New building products	X	X		X	
Building labels		X		X	
Education for wood specialists	X		X		
Potential for Re-Use und Downcycling				X	
Wood as a renewable, regional raw material				X	X
Well-being				X	

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Study | Facts | Ideal timber construction world | Reference projects | Interview results | Raw material supply | Measurements

Barriers

Section	Costs	Regulation Techn. solution	Knowledge	Environment Well-being	Raw material availability
Additional costs (e.g. material, sound insulation and fire protection)	X				
Architectural culture oriented towards solid construction	X				
Lack of mass (sound and summer heat insulation)	X	X		X	
Lack of lobby			X		
Public procurement law		X			
Material requirements	X				X
Timber potential forest	X				X

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Interview results

Homogeneous results

- Positive development of timber construction in recent years
- "Pain limit" for the additional costs for timber construction: 5-10% of the construction costs or 2-3% of the total costs
- Additional costs when using "regional" wood: 2-6% (m³ comparison)
- Positive influence of a CO₂ shadow price in the overall cost comparison



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Measures proposed from the study and the workshops

Bestellungskompetenz	11. Vorgabe zum strukturellen Bauen in Ausarbeitung integrieren	zu prüfen	Holzbauschancen	Netzwerkkompetenz
Involve timber construction specialists in the process at an early stage	12. Ausarbeitung mit Bausa-Maßnahmen für CO ₂		Modular construction and temporary use as viable niches for timber construction	Networking and exchange within the established competence network
Increase the knowhow of timber structures, acoustics, fire	13. Nicht nur Weiterentwicklung aufbauen, sondern auch Vernetzung von Bauteilen		24. Förderung einer kompetenzorientierten Fortbildung der Holzbaubranche	25. Reibernetz Basler / Rückbauwerk als Basis für Innovationen / Fortschritt
4. Kollaboration von Holzbauteilen mit Vergleich von Massiv- und Holzbauteilen	14. Anforderungen an die Holzqualität auf das regionale Holz abstimmen	zu prüfen	26. Zusätzliches Bauteilangebot	27. Projektweisen parallelisierte regionale Informations- und Netzwerke
5. Klugeinsatz von Holzbauteilen in Holzbauteilen für Holzbauteile	15. Proof an anderen Holzbauteilen mit Anzeigebildern			28. Vernetzung und Austausch in regionalen Kompetenzfeldern gemäß Bedarf
6. Holzbauteile als Bauteile in Holzbauteilen	16. Proof an anderen Holzbauteilen mit Anzeigebildern			
7. Holzbauteile als Bauteile in Holzbauteilen	17. Proof an anderen Holzbauteilen mit Anzeigebildern			
8. Holzbauteile als Bauteile in Holzbauteilen	18. BIM als Instrument für die Optimierung von Holzbauteilen			
9. Holzbauteile als Bauteile in Holzbauteilen	19. Muster Tests für Ausarbeitung von Holzbauteilen			
10. Holzbauteile als Bauteile in Holzbauteilen	20. Muster Tests für Ausarbeitung von Holzbauteilen			
11. Holzbauteile als Bauteile in Holzbauteilen	21. Besonderheiten des öffentlichen Bauwerts und Bauteilangebots berücksichtigen	zu prüfen		

CO₂ balances as award criteria in competitions

Proof of sustainable forest management as a criterion

Demand appropriate traceability of the wood

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Models of raw material supply in a regional context

Model	Advantages	Disadvantages
Wood from the own forest	<ul style="list-style-type: none"> Legally compliant, also in the state forestry area Certainty that regional wood is used 	<ul style="list-style-type: none"> Sufficient forest ownership required Processing routes not necessarily optimal Additional effort for wood procurement Scheduling risks
Compensation principle	<ul style="list-style-type: none"> Flexible handling (logging, processing) Minimal intervention in existing processing and process chains 	<ul style="list-style-type: none"> No guarantee of installation of "own" wood To be considered critically with regard to the state contract area
Life cycle assessments / wood calculator	<ul style="list-style-type: none"> Legally compliant Comparability Favors regional wood (penalizes long transport routes) 	<ul style="list-style-type: none"> No guarantee of the use of regional wood
Swiss wood option	<ul style="list-style-type: none"> Legally compliant Guarantee for Swiss wood when using the option 	<ul style="list-style-type: none"> Decision in favor of Swiss wood after the contracting decision Political will or approval of the option required

Problem with public procurement:
Swiss or regional wood shall not be prescribed.

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Reports published April 2025

Link: [Berichte «Holz für Netto-Null»](#)

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Conclusions

- For me, the best projects are within an interdisciplinary project team.
- A neutral and holistic approach to ecology will be essential in the future.
- We use the materials concrete, steel and timber where they play to their strengths.
- The LCA-tool developed by Basler & Hofmann offers great potential for ecological optimization beyond the load-bearing structure.
- The presented study is a clear statement by the city of ZH on timber construction and the "net zero" strategy.
- Public website of the city of Zurich is coming up: "How the city uses wood"

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Thank you for your attention!

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