FH Salzburg

Green Transition in Construction

Wood solutions in construction

Technology
Health
Media

FH Salzburg

Salzburg University of Applied Sciences

Technology
Health
Media

UAS Salzburg

- since 1995
- 4 campuses

- 19 Bachelor degree programmes
- 11 Master degree programmes

- 2,700 students and 6,000 graduates
- 320 permanent staff
- more than 900 contractual lectures

- practice-oriented degree courses
- hall of residences on every campus
- best transportation links
- state-of-the art infrastructure
- excellent industry ties
- very good student-teacher ratio

@ FH Salzburg/Wildbild

Construction Systems

Materials

Market Share

Supporting structure

Load carrying structures in timber constructions can be simplified divided in

- **lightweight** or
- **solid** structures.

Timber constructions – construction systems

Post Contructions

Timber frame constructions

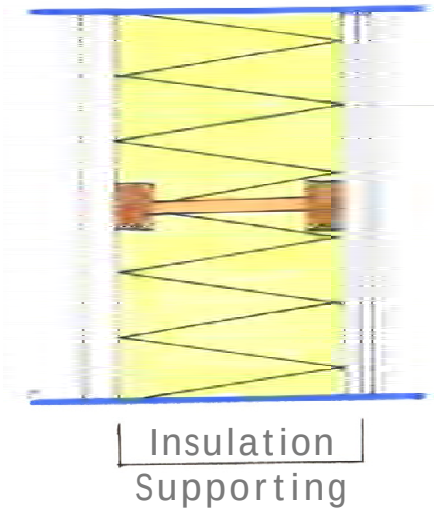
Solid Timber Constructions

Quelle: Informationsdienst Holz

Lightweight constructions

wood panel and timber frame constructions

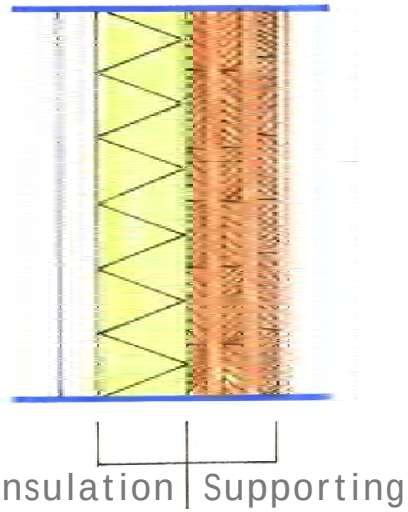
- Load bearing and insulation within one section



Solid constructions

log, laminated and cross laminated timber constructions

- Load bearing and insulation within different sections distributed



Lightweight constructions

wood panel and timber frame constructions

- Minor material use for structure
- Low size-ratio for wall
- Air thightness – accurate design and finish necessary
- Low fire protection, additional layers necessary
- Low storage mass, additional layers/materials necessary

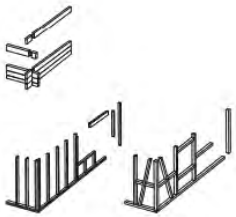
Solid constructions

log, laminated beam, cross laminated timber constructions

- High material use for structure
- High size-ratio for wall
- Air thightness – low vulnerability as structure may be already air thight
- High fire protection without additional layers (no internal fire spread)
- High storage mass if in contact with inner surface

Timber constructions – construction systems

Systems of prefabrication

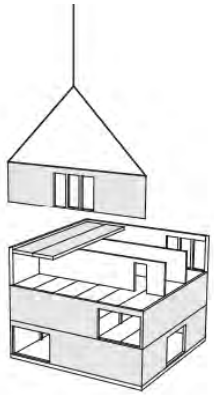


Log, half timbered, balloon + platform frame constructions

Assembly of single elements

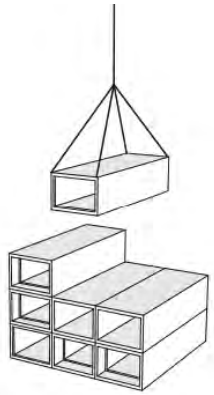
timber frame construction

Combination of assembling single elements together with prefabricated elements



Wood panel and solid timber construction

Prefabricated structural elements - walls + floor slabs



Wood panel and solid timber construction

Prefabricated modules (volume elements)

low — degree of prefarbrication — high

freedom of design/layout

low — high — low

Quelle: ProHolz

Evaluation of timber construction methods in Austria (2011)

Systeme (in %)	timber frame constructions Skelettbau	Log constr. Blockbau	timber post/panel constructions Holzrahmenbau	Solid timber construction (CLT) Holzmassivbau (BSP)
Detached houses	1	10	84	5
Appartment houses	0	1	94	5
Renovation and extensions	62	10	26	2
Public buildings	37	3	55	5
Commercial constructions	16	6	73	5
Agricultural constructions	26	3	70	1

Source: proHolz Austria

Timber constructions – materials

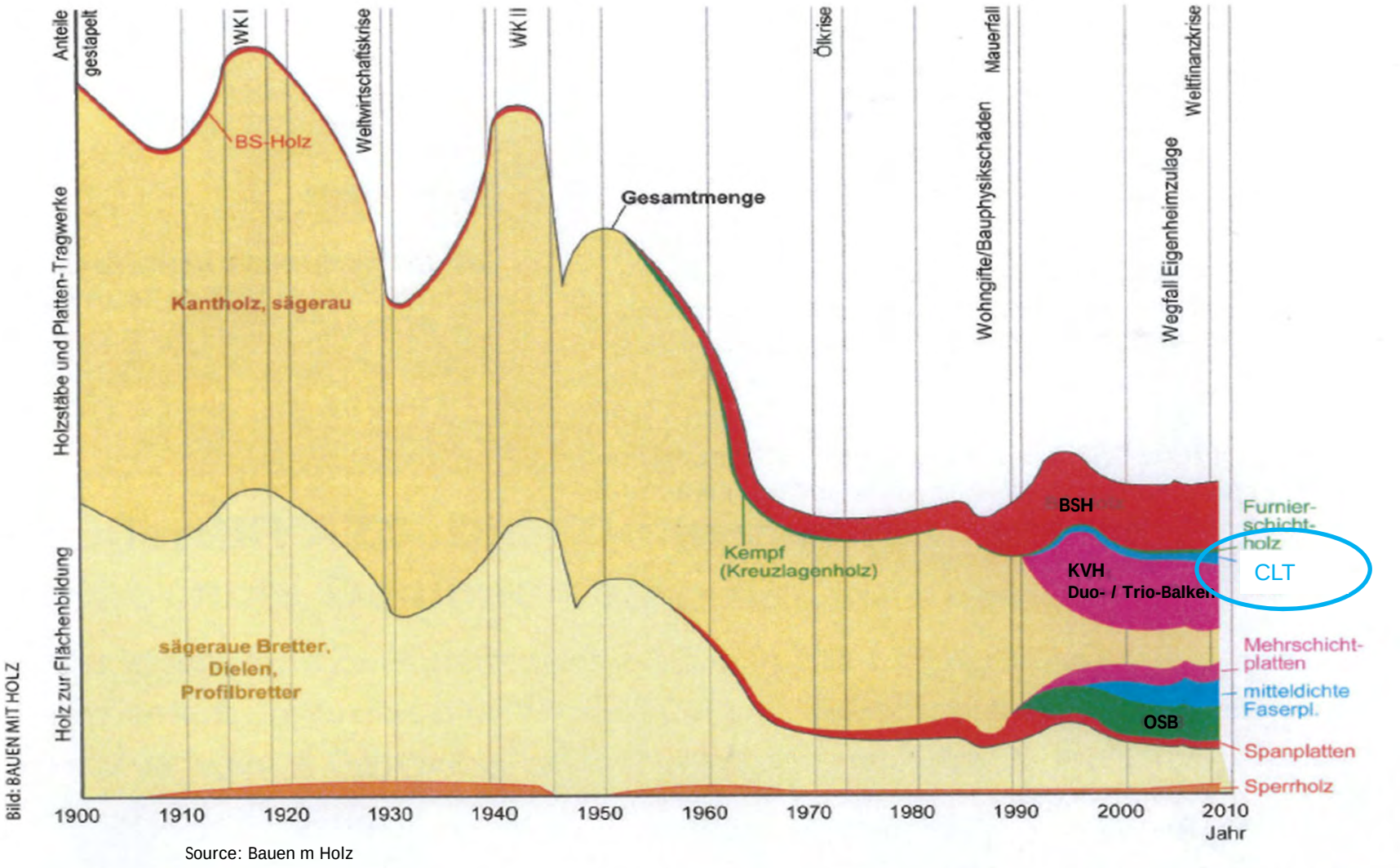
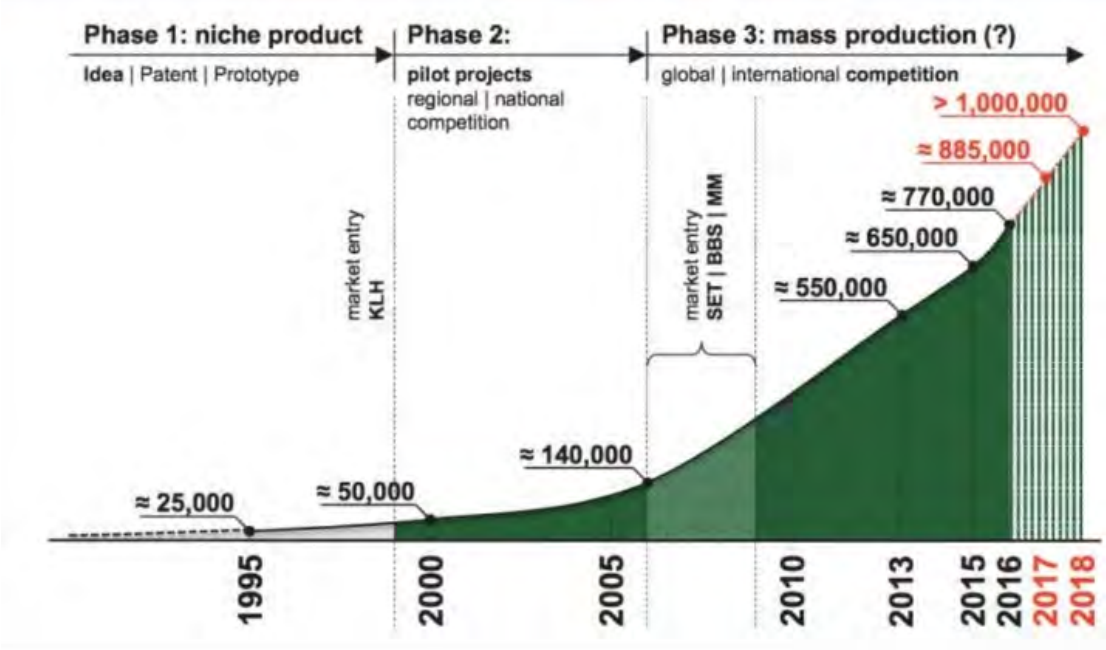


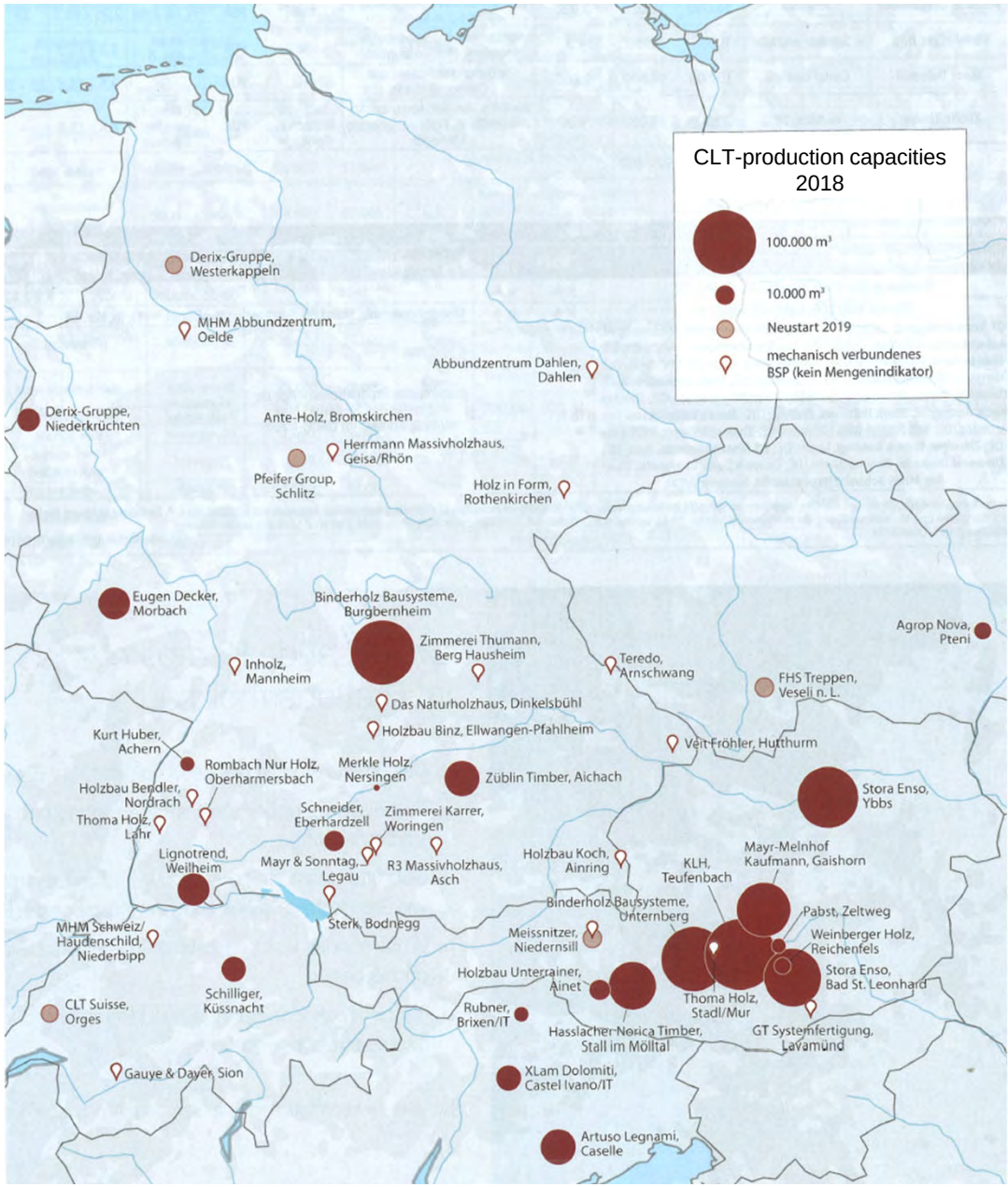
Bild: BAUEN MIT HOLZ

Source: Bauen m Holz

Development of the production capacities of CLT

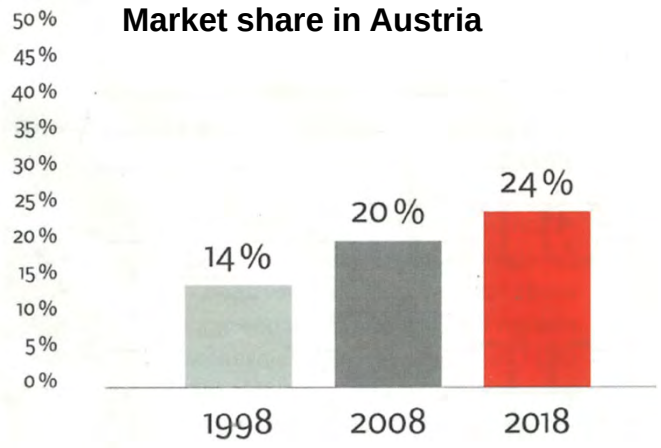


Source: Holzkurier

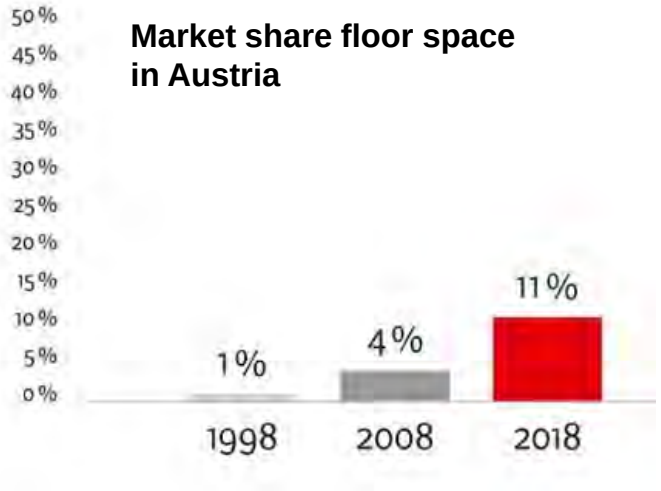


Timber solutions in construction – market share

Market share in Austria

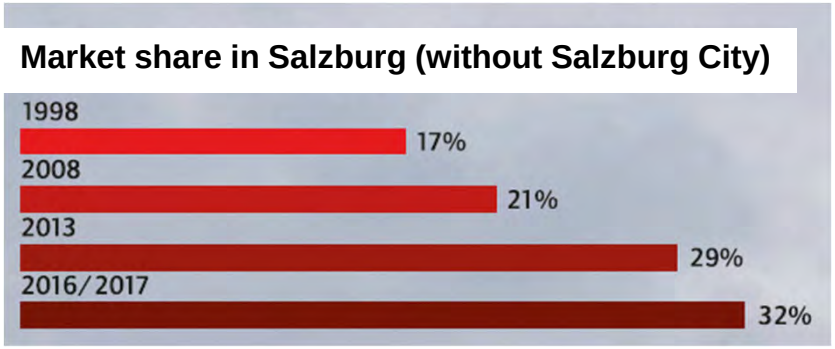


Market share floor space in Austria



Source: proHolz

Market share in Salzburg (without Salzburg City)



Distribution of timber constructions in Austria (2013)

Number of construction projects built with timber

- 79 % Residental buildings
- 3 % Public buildings
- 6 % Commercial constructions
- 12 % Agricultural constructions

Building volume of constructions built with timber

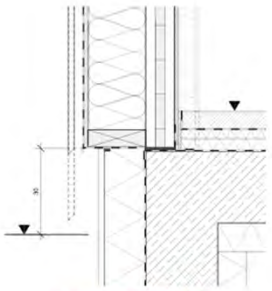
- 52 % Residental buildings
- 4 % Public buildings
- 12 % Commercial constructions
- 32 % Agricultural constructions

Building with wood works well for smaller units (detached house) due to:

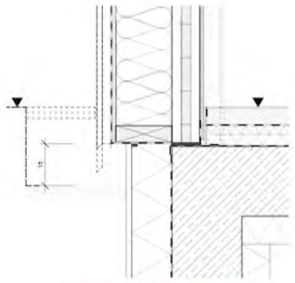
- Suitable details are available – www.dataholz.eu (or details are less critical due to the small volume)
- Building physics is solved (fire and noise protection are usually no issue)
- Short construction time due to prefabrication
- Overall sustainability depend on the indivual desire – materials, surfaces, …
- Cost are not top priority – individual decision with usually less priority on ROI

dataholz.eu

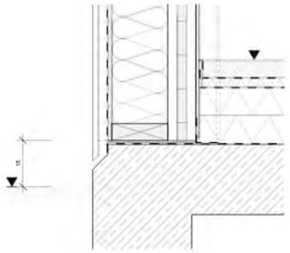
Wandknoten Aussenwand

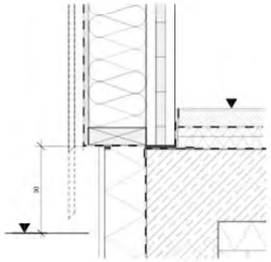


awmxsom01



awmxsom02

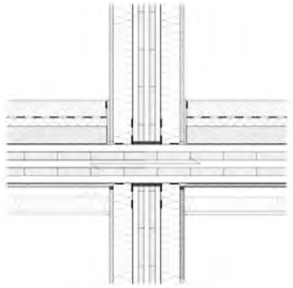




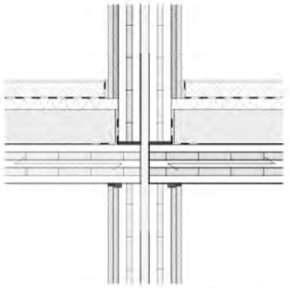
Source: dataholz.eu

dataholz.eu

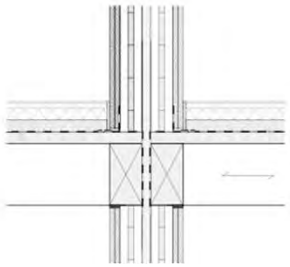
Wandknoten Trennwand

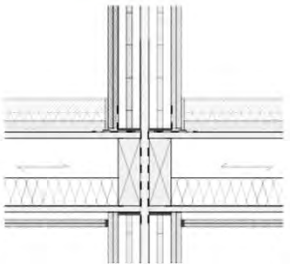


twmxgdm02



twmxgdm05



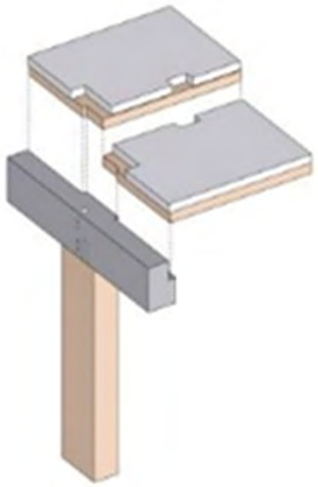


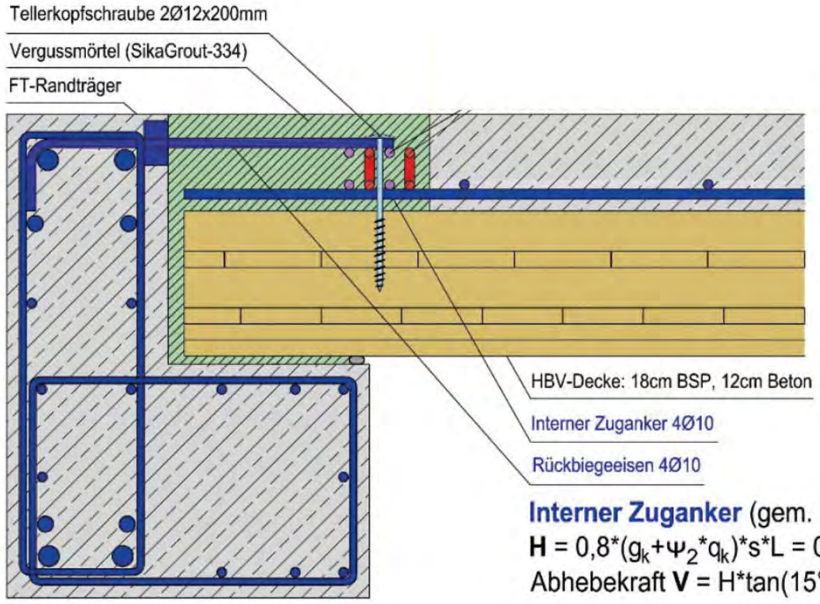
Building with wood works well for smaller units (detached house) due to:

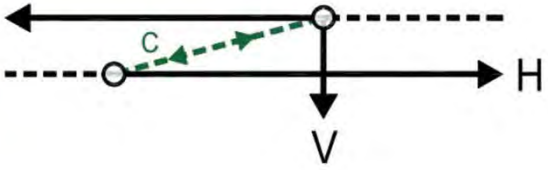
- Proofen details are available – dataholz.eu (or details are less critical due to the small volume)
- Building physics is solved (fire and noise protection are usually no issue)
- Short construction time due to high prefabrication levels
- Overall sustainability depend on the indivual desire – materials, surfaces, …
- Cost are not top priority – individual decision with usually less priority on ROI

Building with wood are much more demanding for bigger units (multi-storey buildings) due to:

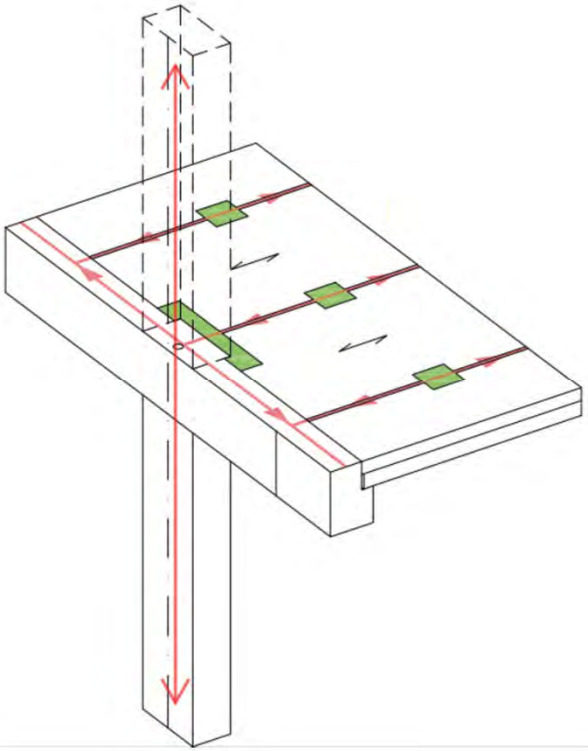
- Default details are not always available, esp. for new construction systems details are to be developed project-related
- Building physics is challenging (esp. fire and noise protection, depending on the building class)
- Sustainabilty may become a marketing instrument – certificates, …
- Cost are top priority (investors need ROI in time)

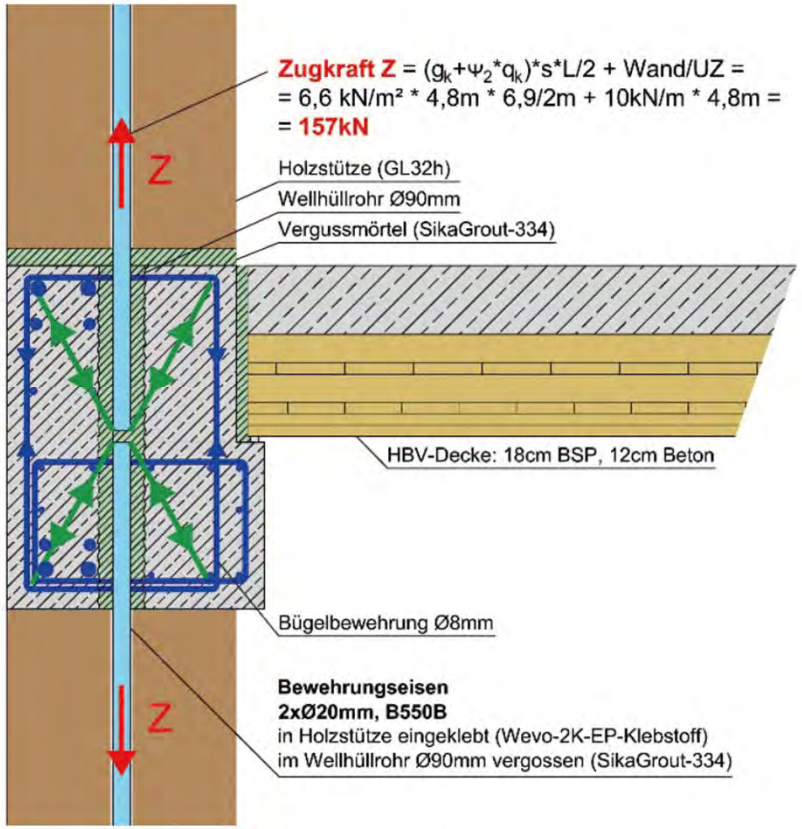


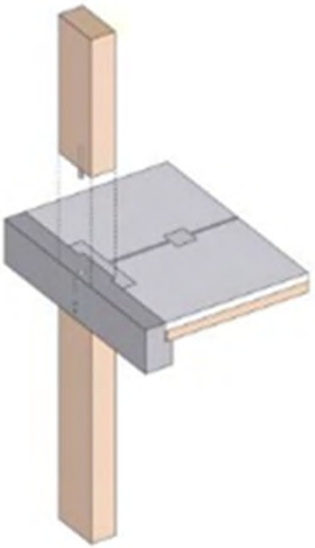




Interner Zuganker (gem. EN1991-1-7, A.5.1, Gl. A.1)
H = $0{,}8*(g_k+\Psi_2*q_k)*s*L = 0{,}8*6{,}6*2{,}4*6{,}9 =$ **87kN**
Abhebekraft **V** = H*tan(15°) = 23kN







HoHo Building - Vienna

Building with wood are much more demanding for bigger units (multi-storey buildings) due to:

- Default details are not always available, esp. for new systems details are to be developed project-related
- Building physics is challenging (esp. fire and noise protection, depending on the building class)
- Sustainabilty may become a marketing instrument – certificates, …
- Cost are top priority (investors need ROI in time)

Timber constructions – costs

SCHWEIZ

Weltweite Nachfrage befeuert Holzpreise

Preisanstiege um bis zu 35% seit Ende November 2020

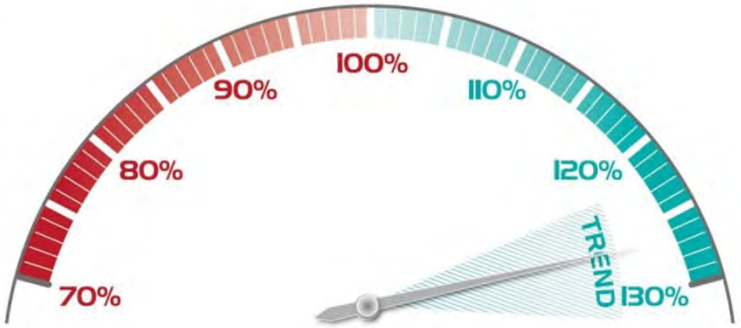
Nadelholz © Martina Nöstler

Ein Artikel von **Philipp Matzku (für holzkurier.com bearbeitet)** | 12.04.2021 - 11:17

Die Schweizer Holzproduzenten haben ihre Preise bisher nur moderat angehoben, am wenigsten bei langjährigen Kunden. Für die kommenden Wochen sind laut dem Verband der Schweizer Holzindustrie (HIS) weitere Preissteigerungen zu erwarten.

ABSATZINDIKATOR | 02/2021

Februar 2021: 125,7 % (April 2006 = 100)



© Holzkurier

GLOBAL

Warum steigen Preise derart stark?

Versuch einer Erklärung

Ein Artikel von **Gerd Ebner** | 24.03.2021 - 08:18

Bei der frischen BSH-Lamelle ist die 300 €/m³-Marke überschritten. Das Fertigprodukt (BSH-Si-Stangen) konnte binnen einem halben Jahr von 400 auf knapp 600 €/m³ in Italien und Deutschland zulegen. Bei KVH erwarten wir 450 €/m³. Was ist los? Warum ist die Preislandschaft derzeit völlig außer Rand und Band? Warum gilt das, was am Montag ausgemacht wurde, am Freitag oft schon nicht mehr? Warum liegen da mitunter 50 €/m³ dazwischen?

ABSATZINDIKATOR FEBRUAR 2021

Historische Preise pulverisiert

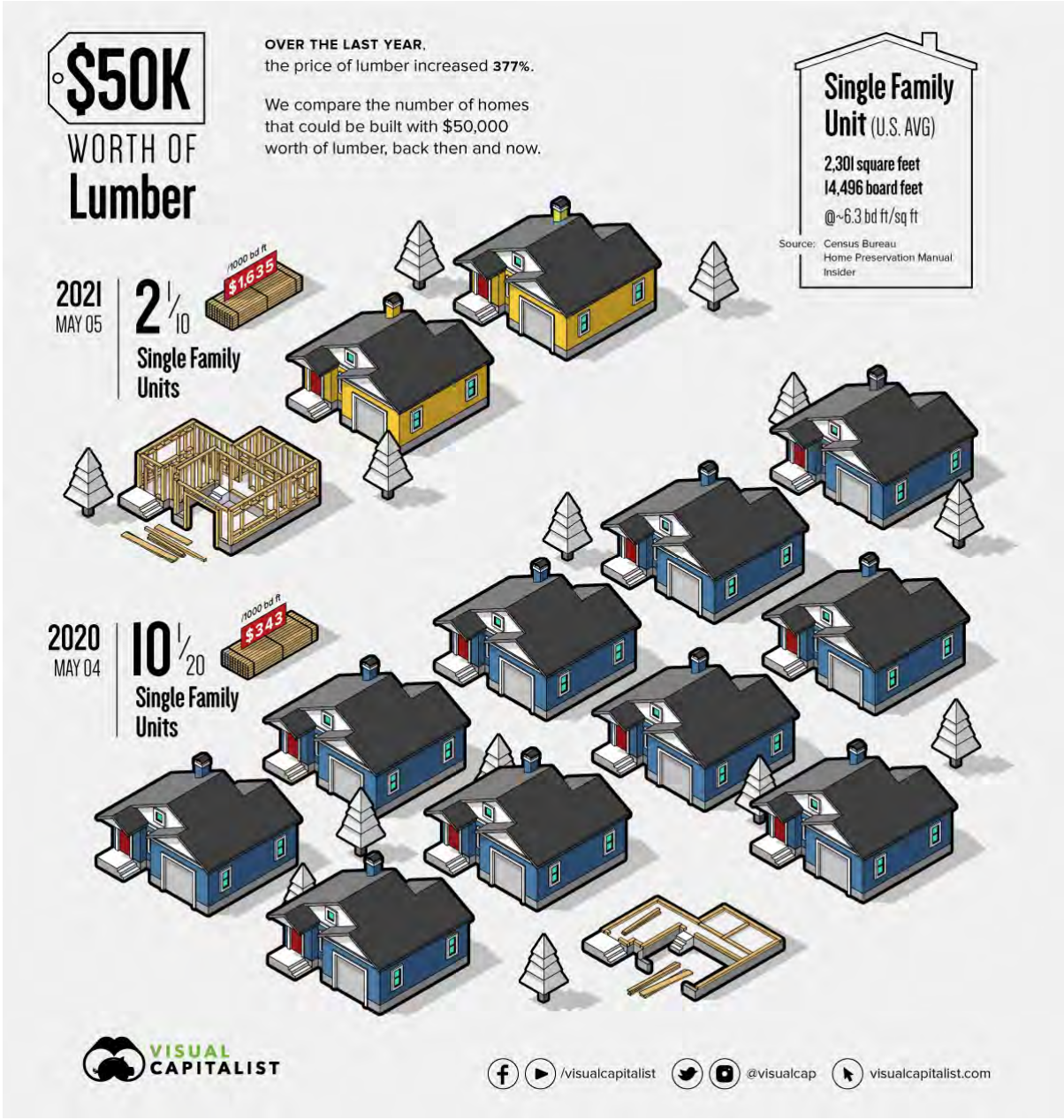
Sechs Sortimente erreichten Höchststände – kein Ende in Sicht

Ein Artikel von **Gerd Ebner** | 04.03.2021 - 08:37

Im Februar wurde mit 125,7 % nicht nur ein neues All-Time-High beim Absatzindikator des Holzkurier erreicht, sondern die Veränderung zum Vormonat war mit +6,9 Prozentpunkten so groß wie niemals zuvor – ein unglaublicher Monatssprung.

Source: Holzkurier

Timber constructions – costs



Source: Visualcapitalist

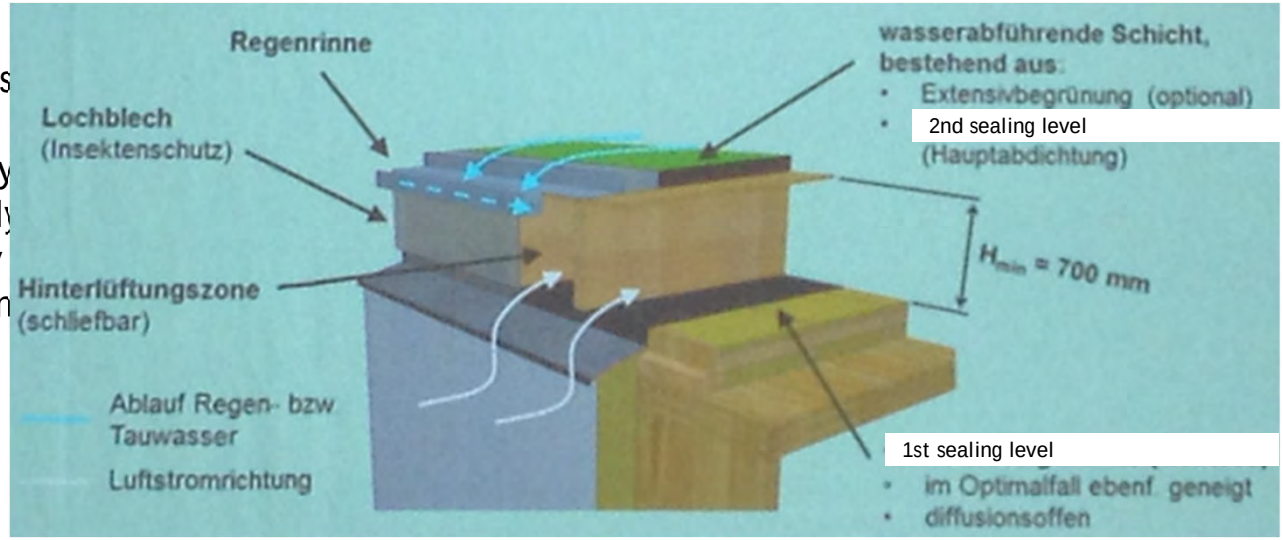
Essential requirements for multistory buildings

Acc. EN 1990:2020 4.1 Basic requirements (2)

- Sufficient load-bearing capacity
- Usability
- **Durability** - *moisture protection, wood protection, building physics, …*

Durable and **enduring** timber cons

- are easy to check for suitability
- are easy to maintain respectivly
- are designed to allow an easily
  from primary structural elemen



Source: TU Graz

Possible goals are:

- Economic feasibilty – service life span (should be based on the life span of the material used, e.g. life span of spruce indoor is 100 years+)
- Enabling later conversions by large-span primary structure- implementing hybrid systems
- additional functions integrated like thermally activated buidling elements for heating and cooling, …
- Easily detachable connectors and dismantling strategy for the structure in order to get out all – still - valuable elements

Timber solutions in

Tabelle 123. Dauerhaftigkeit der Hölzer in Jahren.

Holzart	Im Freien				Immer trocken	Eisenbahn-schwellen (unbehandelt)
	ungeschützt und ungetränkt	ungeschützt, aber mit Teeröl getränkt	unter Dach	unter Wasser		
Fichte, gemeine . . .	10...**15**...30	20...**30**...50	50... **60**... 75	60...100	100... 900	4...5
Tanne, Douglas- . .	10...**20**...40	15...**25**...40	20... **70**... 90	50...**100**... 200	150...1000	—
,, Weiß-	5...**10**...20	10...**25**...40	15... **50**... 70	30... **60**... 100	100... 700	4...5
Kiefer, Schwarz- . .	40...**80**..100	—	150...**200**...300	350...**600**...1000	800...1200	12...18
,, Weiß-	20...**50**...70	30...**60**...80	90...**100**...120	250...**400**... 500	700... 900	7...8
Lärche, europäische .	20...**60**...80	—	100...**120**...150	300...**500**... 700	800...1000	8...10
,, amerikanische	—	—	—	—	—	3...**5**...7
Ahorn	2... **5**... 8	—	5... **15**... 20	30... **50**... 70	400... 800	—
Birke, Weiß-	3... **8**...15	—	5... **20**... 30	20... **40**... 60	300... 500	—
Edelkastanie	30...**70**..120	—	60...**160**...250	300...**500**... 700	700...1000	15...20
Eiche, Trauben- . . .	40...**80**..120	—	100...**150**...200	300...**500**... 800	600...1000	10...20
Erle, Rot-	5...**15**...20	—	7... **20**... 30	10... **30**... 40	100... 400	—
Esche, gemeine . .	15...**40**...60	—	20... **80**...120	60... **90**... 150	150... 500	3...5
Nußbaum, europäischer	10...**50**...80	—	30... **70**...100	50...**200**... 300	600... 800	—
,, Schwarz- .	15...**30**...50	—	25... **80**...120	150...**300**... 500	200... 500	—
Pappel, Silber- . . .	2...**10**...20	—	3... **20**... 30	5... **30**... 50	50... 400	—
,, Zitter- . . .	3...**10**...20	—	5... **25**... 40	5... **30**... 60	80... 500	—
Robinie	25...**40**...70	—	40...**100**...150	100...**300**... 500	300... 700	10...15
Roßkastanie	5... **8**...15	—	10... **20**... 30	20... **30**... 50	200... 500	—
Rotbuche	10...**25**...40	—	20... **40**... 80	30... **70**... 120	200... 700	2...5
Ulme	20...**40**...70	—	30... **70**...100	100...**300**... 400	300... 600	2...5
Weide, Silber- . . .	2... **5**...15	—	5... **10**... 20	10... **15**... 20	200... 500	—
Weißbuche	5...**10**...20	—	10... **30**... 50	20... **60**... 100	300... 700	—

Source: Kollmann

of the material

g hybrid systems
ts for heating and

in order to get out

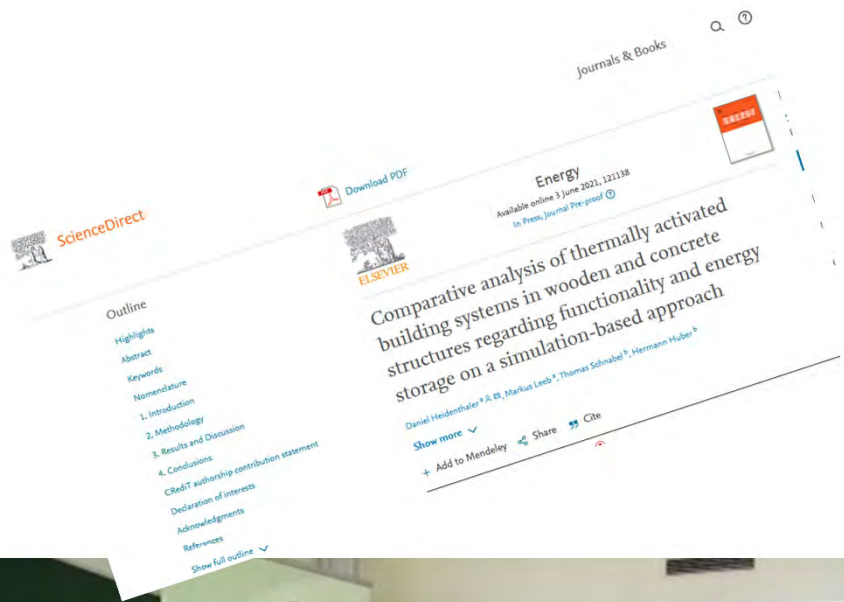
Possible goals are:

- Economic feasibilty – service life span (should be based on the life span of the material used, e.g. life span of spruce indoor is 100 years+)
- Enabling later conversions by large-span primary structure- implementing hybrid systems
- additional functions integrated like thermally activated buidling elements for heating and cooling, …
- Easily detachable connectors and dismantling strategy for the structure in order to get out all – still - valuable elements

Possible goals are:

- Economic feasibilty – service life span (should be based on the life span of the material used, e.g. life span of spruce indoor is 100 years+)
- Enabling later conversions by large-span primary structure- implementing hybrid systems
- additional functions integrated like thermally activated buidling elements for heating and cooling, …
- Easily detachable connectors and dismantling strategy for the structure in order to get out all – still - valuable elements

Timber solutions in construction



FH Salzburg

aHolz

Aktiviertes Brettsperrholz

Die Bauteilaktivierung mit Betonteilen ist im Vergleich zu Massivholz relativ gut erforscht und anerkannt. Hier sieht „aHolz“ Handlungsbedarf:

Im Projekt sollen die wichtigen Materialkennwerte von unterschiedlichen Holzarten und weiteren Materialien im Labormaßstab bestimmt und auf diesen Ergebnissen basierend, verschiedene Aufbauten von Bauteilen entwickelt werden, um die optimale Wärmeausbreitung zu ermöglichen und diese durch numerische Simulationen der stationären und instationären Zustände zu evaluieren.

Ziel des Projekts ist es, mittels der Kennwerte einzelner Materialien sowie unterschiedlicher Kombinationen Aufschluss über die prinzipielle Einsetzbarkeit einer Bauteilaktivierung von Holz sowie über die Weiterentwicklung eines thermisch aktivierten Massivholzbauteils zu bekommen.

Laufzeit: April 2019 - August 2021

Die Umsetzung des Vorhabens wird über das Förderprogramm Wiss2025 vom Land Salzburg unterstützt.

University *of Ljubljana*

LAND SALZBURG

9TH HARDWOOD CONFERENCE
Sopron 21-22 October 2020

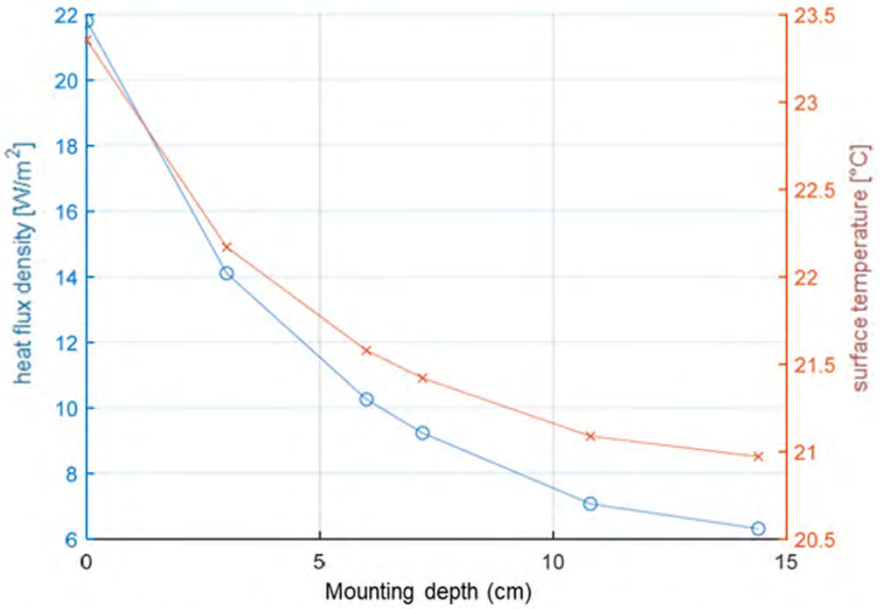


Figure 1: Comparison of heat flux density and surface temperature between various tabs overlapping

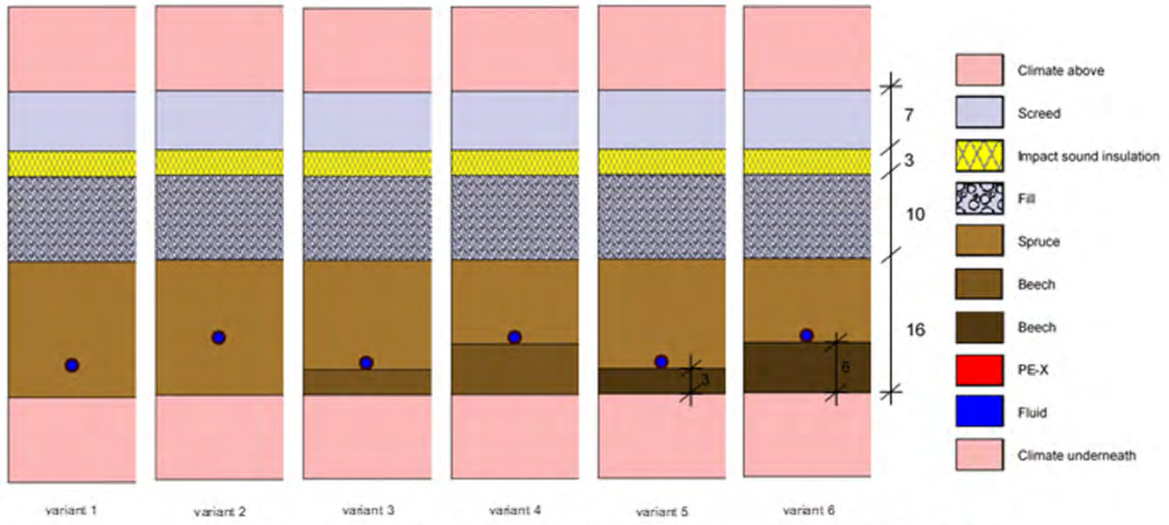


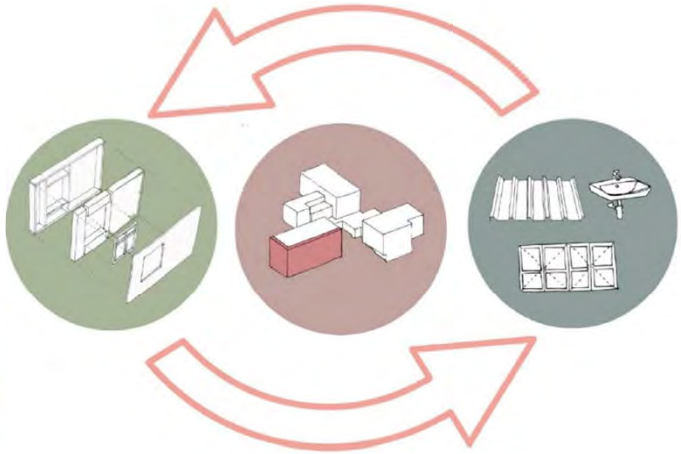
Figure 2: Overview of the structure of the different constructional element

Possible goals are:

- Economic feasibilty – service life span (should be based on the life span of the material used, e.g. life span of spruce indoor is 100 years+)
- Enabling later conversions by large-span primary structure- implementing hybrid systems
- additional functions integrated like thermally activated buidling elements for heating and cooling, …
- Easily detachable connectors and dismantling strategy for the structure in order to get out all – still - valuable elements

Timber constructions

Re-use of materials?



© baubüro in situ ag

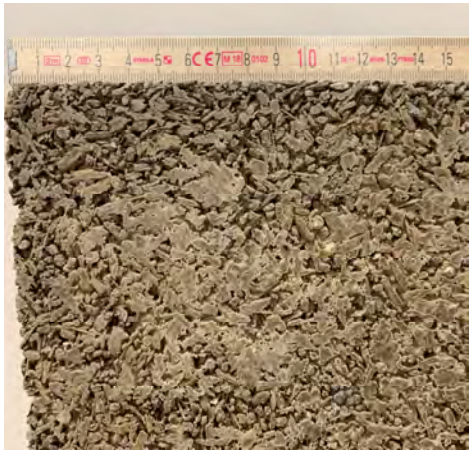
Tabelle 123. Dauerhaftigkeit der Hölzer in Jahren.

Holzart	Im Freien				Immer trocken
	ungeschützt und ungetränkt	ungeschützt, aber mit Teeröl getränkt	unter Dach	unter Wasser	
Fichte, gemeine . . .	10...15...30	20...30...50	50... 60... 75	60...100	100... 900

Spruce after 50 years of use

Timber constructions - recycling

Recycled wooden partikel
bonded with sodium silicate



Recycled wooden partikel
bonded with cement
CEM I 52,5 R (Leube)

Recycled wooden partikel
bonded with urea formaldehyde

Thank you for your attention