

Summary of the report on the greenhouse gas balance of the timber deck system made of cross laminated timber by Timber Structures 3.0 AG (TS3): Onepager 06/2022*

CSD INGENIEURE AG was commissioned by Timber Structures 3.0 AG (TS3) to calculate the greenhouse gas reduction potential for the TS3 construction method compared to a concrete ceiling.

1. Basics

The baseline scenario is a concrete floor slab. The TS3 system (Timber Structures 3.0) is a timber ceiling system made of cross laminated timber (CLT).

The calculations of the structure heights were made according to TS3's specifications.

Brief description Baseline concrete ceiling: Floor construction with parquet, anhydrite underlay, impact sound insulation and reinforced concrete. Concrete slab thickness 0.24 m. The average reinforcement content is 77 kg/m³. Payload office areas (3.0 kN/m²), column grid 6x6m.

Brief description of TS3 CLT floor: loads and grid according to baseline. Floor structure with parquet, anhydrite underlay, sound insulation, bound chippings fill and cross laminated timber ceiling.

The CLT-panels are joined by TS3-joint to biaxial load-bearing ceilings. The ceiling thickness of the CLT-panels is 0.27 m.

Delimitation: Service life and maintenance are not taken into account. Possible different construction details (for optimisation, due to further requirements, etc.) are not taken into account.

Selection of the LCA data: For the life cycle assessment, on the one hand the life cycle assessment data of KBOB (CH) [1], as of 03/2022, as well as that of ÖKOBAUDAT (DE) [2], as of 05/2016 (modules A to D).

In addition, the timber calculator [3] was used with specific inputs for the cross laminated timber boards used by TS3.

Cross laminated timber: CH: Timber calculator Cross laminated timber, indoor application, 100% Swiss, sawmill = cross laminated timber plant => transport 1km (because at the same location)

DE: Cross laminated timber (average DE)

Casting resin (2-component polyurethane):

CH: 2-component adhesive, DE: PUR sealing compound

Screws: CH: galvanised sheet steel; DE: steel screws.

Chippings: DE, CH: crushed gravel,

Binder Köhnke: CH: polyethylene film (PE) [4], DE: drinking water pipe (PE-X).

Glass wool: CH: Isover glass wool, DE Saglan glass wool with bio-based binder

EPS: CH: EPS, DE: Insulation board with Neopor Plus

Underlayment: CH, DE: Anhydrite underlayment

Parquet: CH: 3-layer parquet, DE: Multi-layer parquet

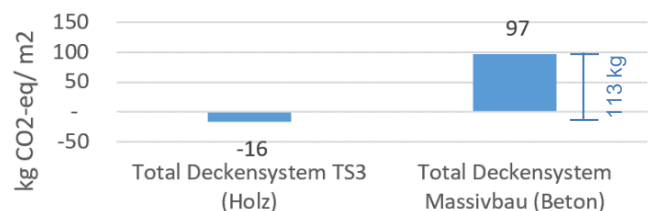
Methodological differences CH-DE: In the Ökobaudat, wood is considered a CO₂ sink when harvested (module A1-A3), but this CO₂ is emitted again when burned (module C3). If module D (load or benefits from reuse, recycling, external gains), e.g. thermal recovery, is included, the timber product retains a negative CO₂ value. In the Swiss method, this "module D" is not included. Both variants were calculated to show the big difference with "reuse, recycling, external gains" and "without".

2. Comparison of slab variants in concrete and in wood with TS3 (column grid 6x6 m)

Life cycle assessment according to ecoinvent data from KBOB (CH)	THGE kg CO ₂ -eq/ m ²
Cross laminated timber board (Schilliger) Timber calculator (385 kg/m ³)	29.2
TS3 Casting resin (2-component polyurethane) (2.3 kg/m ³)	3.7
Screws (approx. 0.5kg/m ³ construction)	0.6
Chippings (gravel)	0.7
Binding agent of the fill (Köhnke)	4.9
Impact sound insulation (glass wool, Isover)	2.6
Anhydrite underlay	10.1
Parquet flooring (3-layer)	7.6
Total TS3 ceiling system (wood)	59.4
Structural concrete	55.8
Reinforcing steel (71kg/m ³)	28.1
Impact sound insulation (EPS)	4.1
Anhydrite underlay	10.1
Parquet flooring (3-layer)	7.6
Total ceiling system Solid construction (concrete)	105.6
Better position of ceiling system-TS3 compared to - solid construction	46 kg (-44%)
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Life cycle assessment with Ökobau.dat data (DE)	THGE kg CO ₂ -eq/ m ²
Total ceiling system TS3 (wood)	-16
Total ceiling system Solid construction (concrete)	97
Better position of ceiling system-TS3 compared to - solid construction	113 kg

With the KBOB balance (CH), a TS3-floor slab (~59 kg CO₂-eq./m²) is about 44% better than concrete slab (~105 kg CO₂-eq./m²). The Swiss method takes into account the storage of the CO₂ in wood (during its period of use as building material). However, every cubic metre of wood used binds approximately 1 tonne of CO₂. This is another advantage that must be taken into account when comparing the TS3 ceiling system with solid construction. [5]

With the Ökobaudat balance (DE) the statement can be made that 1 m² TS3 ceiling system is a sink for ~16 kg CO₂-eq. and 1 m² in concrete emits ~97 kg CO₂-eq. This results in a difference of ~113 kg CO₂-eq/ m² (see bar chart).



[1] www.eco-bau.ch [2] www.oekobaudat.de [3] <https://treeze.ch/de/rechner> [4] Consultation LCA election with M. Pöll, HBA ZH on 24.06.2021

[5] <https://www.holzstgenial.at/blog/mehr-holz-weniger-co2/>

*Onepager 06/2022 (KBOB LCA data 03/2022) updated based on calculation Onepager 08/2021 (KBOB LCA data 12/2016) by CSD INGENIEURE AG, Liebefeld.