KLH®

MADE FOR BUILDING
BUILT FOR LIVING

TIMBER CONCRETE COMPOSITES

ORIGINAL 100% KLH® ORIGINAL

IMPRINT

Version: Timber Concrete Composites, 05/2022

Publisher and responsible for content: © KLH Massivholz GmbH

CONTENTS

KLH® TCC SYSTEMS

01 PRODUCT DESCRIPTION

Timber concrete composite technology was first introduced into the construction industry several decades ago. The original application started with upgrading of existing timber beam floors.

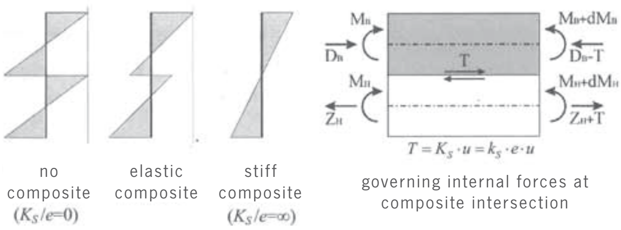
Today the advantages of this technology are also used in new buildings – either with ribs or solid wood slabs.

The combination using KLH® solid wood slabs is an obvious development, which brings technical and economic advantages, especially with large spans.

This combination utilises both the static and physical properties of the two building materials in a very efficient manner. In conventional concrete construction, the concrete, which performs well under compression, is reinforced with reinforcing steel in order to absorb the tensile forces that arise (usually on the underside of the floor).

As timber, unlike concrete, has a high tensile strength, the area of tensile stress is covered by the timber component in TCC applications. When using solid timber panels, the slab is also used as a formwork for the subsequent application of the concrete.

Preparation of KLH® TCC elements for pouring the concrete on site (TimCrete © Ramboll)



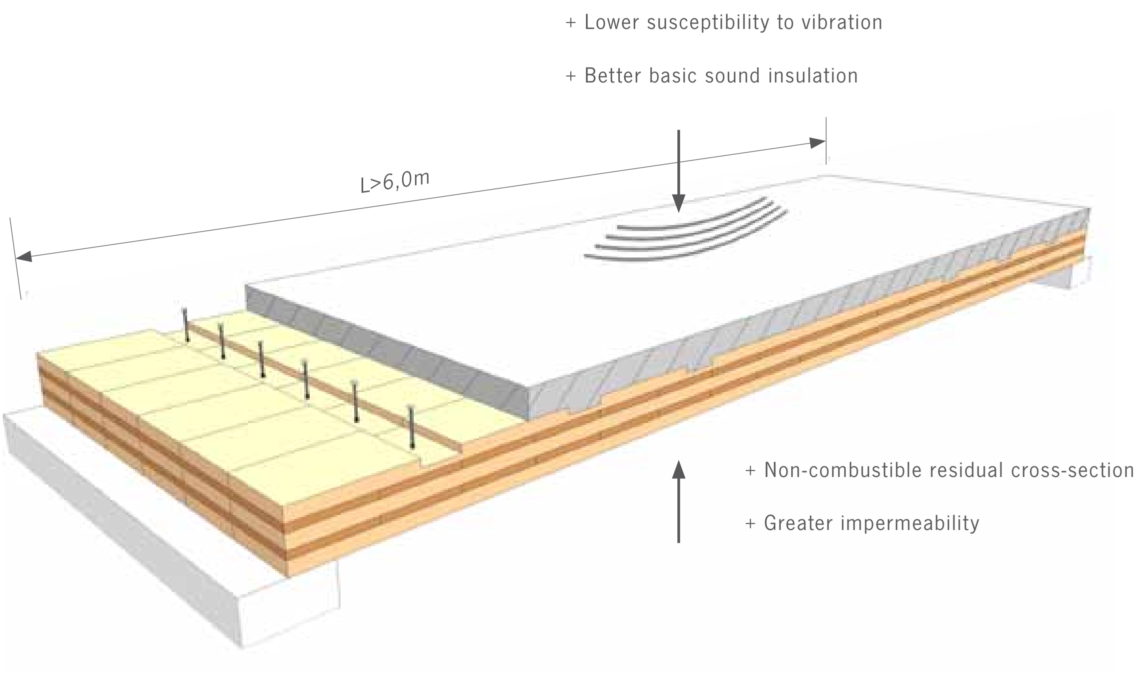
Stress distribution and decisive cutting forces on the composite beam (Holz-Beton-Verbund; König, Holschemacher, Dehn; 2004)

The shear resistant connection between the two building materials plays an essential role in this type of construction. The stiffer the shear connection is executed, the stronger is the TCC element.

02 THE KEY ADVANTAGES

The favourable static properties allow for large spans to be executed with increased stiffness and only a small gain in weight.

Partial prefabrication is often aimed at, for high cost effectiveness. The cost of formwork is reduced to a minimum due to the pre-installed timber slab.



TCC systems have a lower susceptibility to vibration, which has a positive effect, especially with large spans.

The fire resistance of the floor is also improved due to the non-combustible concrete layer. Especially the tightness against gas and fire extinguishing water is ensured over a prolonged period.

The additional weight of the concrete improves the acoustic properties of the floor. Additional mass for acoustic improvement can be largely dispensed with.

03 COMPOSITE SYSTEMS

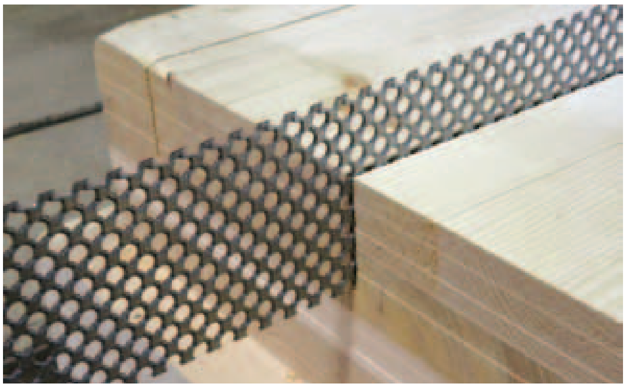
Various composite systems can be used in the construction process. A differentiation can be made here between those methods with and those methods without general building regulations or inspectorate approval. Notched systems are by far the most cost effective systems to use. These systems do not have standard approval and must be calculated individually. However, this method is very efficient because of the minimal material costs and the low labour costs. Approved methods include certain types of screw connections and TCC shear connectors. With these composite systems, the effort for structural analysis is reduced, but they are associated with higher system costs.

NOTCHES

Notches are milled into the timber slab which take over the shear connection between the timber and the concrete. In order to intercept the deflection forces, additional wood screws are used. It is possible to dispense with securing by means of screws, but the screw connection results in a more favourable distribution of forces in the cross-section. This method is one of the most cost-effective variants due to the low consumption of connectors and the standardised milling process.

TCC SHEAR CONNECTORS

In this system, perforated plates or flat steel strips are glued or pressed into the timber slab. There is no need to provide additional securing points against lift off. Mounting of the connecting strips is conveniently carried out in the factory.



Glued perforated plates, TCC-system

SCREW CONNECTIONS

In general, these connections use screws, driven in at a specific angle, with a stop device (dependent on the system) to set the insertion depth.

Elements with notches and wood screws for securing transverse tensile forces (ABA HOLZ van Kempen GmbH, www.aba-holz.de)

On site assembly of elements with screw connectors (www.ancon.at)

04 PRODUCTION

To realise specific project requirements, KLH® relies on its proven expertise and flexibility in production.

KLH® production lines enable the automated milling of the necessary notched sections, required for transmission of the static forces in the TCC floor.

The dimensioning of the notches arises from several factors. The minimum width and number of the notches are specified by the necessary transmission of shear forces. The depth of the notch must be adjusted to the top layer of the KLH® solid wood panel.

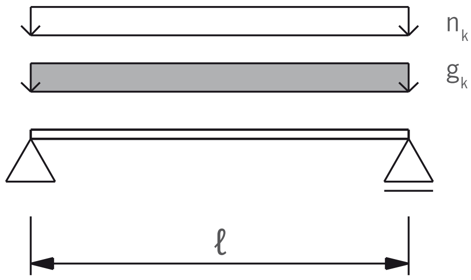
The fabrication of slots for inserting the sheets should also be carried out in the factory. Afterwards, gluing of the perforated plates can also be carried out in the KLH® special production.

The application of the top layer of concrete to the KLH® panel at the factory is not part of the scope of services.

It is mandatory to assure proper handling for transport and assembling of prefabricated elements.

05 KLH® TCC FLOOR ELEMENT – SINGLE SPAN BEAM

VERIFICATION OF VIBRATION FOR FLOOR CLASS I



According to ETA-06/0138
ÖNORM EN 1995-1-1:2019 and ÖNORM B 1995-1-1:2019
ÖNORM EN 1995-1-2:2011 and ÖNORM B 1995-1-2:2011
ÖNORM EN 1992-1-1 and ÖNORM B 1992-1-1
CEN/TC 250/SC 5, TS TCC

Service class 1
$k_{def} = 0,6$
The constant load of the composite component is accounted for in the tables.

Floor vibration class 1
Concrete grade C30/37
Concrete early strength N
Pre-camber in relation to constant load deflection of the KLH® slab
Preliminary design table valid for in-situ concrete with support in midspan for 28 days
Screw type Würth ASSY® VG or equivalent

7ss 200 | 110	Panel type | concrete thickness [mm]
310	Thickness of composite component [mm]
10	Pre-camber w_0 [mm]
4 | 20	Number of notches per side | notch depth [mm]
4 | 10	Number of screws / m² panel | nominal screw diameter [mm]

REI 60
REI 90
REI 120

This table is only intended for structural pre-analysis purposes and does not replace necessary static calculations!

$g_{2,k}$	n_k	SPAN OF SINGLE SPAN BEAM L [m]								
[kN/m²]		6,00	6,50	7,00	7,50	8,00	8,50	9,00	9,50	
1,0	2,5 NA	5s 140|70	5s 150|80	5s 160|90	5s 180|90	5s 200|90	7ss 200|100	7ss 200|110	7ss 220|110	Without wet screed
		210	230	250	270	290	300	310	330	
		7	8	10	11	12	13	17	17	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		3 | 8	4 | 8	4 | 8	4 | 8	3 | 8	4 | 10	4 | 10	4 | 8	
	3,5 NB	5s 140|70	5s 150|80	5s 160|90	5s 180|90	5s 200|90	7ss 200|100	7ss 200|110	7ss 220|110	
		210	230	250	270	290	300	310	330	
		7	8	10	11	12	13	17	17	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	4 | 8	4 | 8	4 | 10	4 | 10	4 | 10	
1,5	2,5 NA	5s 150|70	5s 160|80	5s 160|90	5s 180|90	5s 200|100	7ss 200|100	7ss 220|100	7ss 220|120	
		220	240	250	270	300	300	320	340	
		6	8	10	11	12	13	17	17	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	4 | 8	4 | 8	4 | 10	4 | 10	4 | 10	
	3,5 NB	5s 150|70	5s 160|80	5s 160|90	5s 180|90	5s 200|100	7ss 200|100	7ss 220|100	7ss 220|120	
		220	240	250	270	300	300	320	340	
		6	8	10	11	12	13	17	17	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	4 | 8	4 | 10	4 | 10	4 | 10	4 | 10	
2,0	2,5 NA	5s 150|70	5s 160|80	5s 180|80	5s 200|90	7ss 200|110	7ss 220|90	7ss 220|110	7ss 240|110	With 60 mm wet screed
		220	240	260	290	310	310	330	350	
		6	8	9	10	10	11	13	14	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	3 | 8	4 | 8	4 | 8	4 | 10	4 | 8	
	3,5 NB	5s 150|70	5s 160|80	5s 180|80	5s 200|90	7ss 200|110	7ss 220| 90	7ss 220|110	7ss 240|110	
		220	240	260	290	310	310	330	350	
		6	8	9	10	10	11	13	14	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	4 | 8	4 | 10	4 | 8	4 | 10	4 | 10	
2,5	2,5 NA	5s 160|80	5s 180|70	5s 200|80	5s 200|100	7ss 200|110	7ss 220|100	7ss 220|120	7ss 240|120	
		240	250	280	300	310	320	340	360	
		5	6	7	10	10	11	13	14	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		3 | 8	3 | 8	3 | 8	4 | 8	4 | 10	4 | 10	4 | 10	4 | 10	
	3,5 NB	5s 160|80	5s 180|70	5s 200|80	5s 200|100	7ss 200|110	7ss 220|100	7ss 220|120	7ss 240|120	
		240	250	280	300	310	320	340	360	
		5	6	7	10	10	11	13	14	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	3 | 8	4 | 8	4 | 8	4 | 10	4 | 10	4 | 10	4 | 10	
3,0	2,5 NA	5s 160|70	5s 180|80	5s 200|80	5s 200|100	7ss 220|90	7ss 220|110	7ss 240|110	7ss 260|110	
		230	260	280	300	310	330	350	370	
		5	6	7	10	8	11	11	12	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		3 | 8	4 | 8	4 | 8	4 | 8	4 | 8	4 | 10	4 | 8	4 | 8	
	3,5 NB	5s 160|70	5s 180|80	5s 200|80	5s 200|100	7ss 220|90	7ss 220|110	7ss 240|110	7ss 260|110	
		230	260	280	300	310	330	350	370	
		5	6	7	10	8	11	11	12	
		3 | 20	3 | 20	3 | 20	3 | 20	4 | 20	4 | 20	4 | 20	4 | 20	
		4 | 8	4 | 8	4 | 8	3 | 10	4 | 10	4 | 10	4 | 10	4 | 10	

06 RESIDENTIAL BUILDING IN HAMBURG

Completion: 2013
4-storey residential building
Construction of the shell in 4 weeks

TCC SYSTEM:

- Notches with tensile reinforcement
- Spans of 7.5 m
- Prefabrication in the factory
- Delivery of the finished parts with pre-camber
- KLH® 5s 180 mm DL + 100 mm Concrete

(www.planpark-architekten.de,
Photos: ABA Holz van Kempen GmbH und C. Lohfink)

KLH MASSIVHOLZ GMBH
Gewerbestraße 4 | 8842 Teufenbach-Katsch | Austria
Tel +43 (0)3588 8835 | Fax +43 (0)3588 8835 415
office@klh.at | www.klh.at