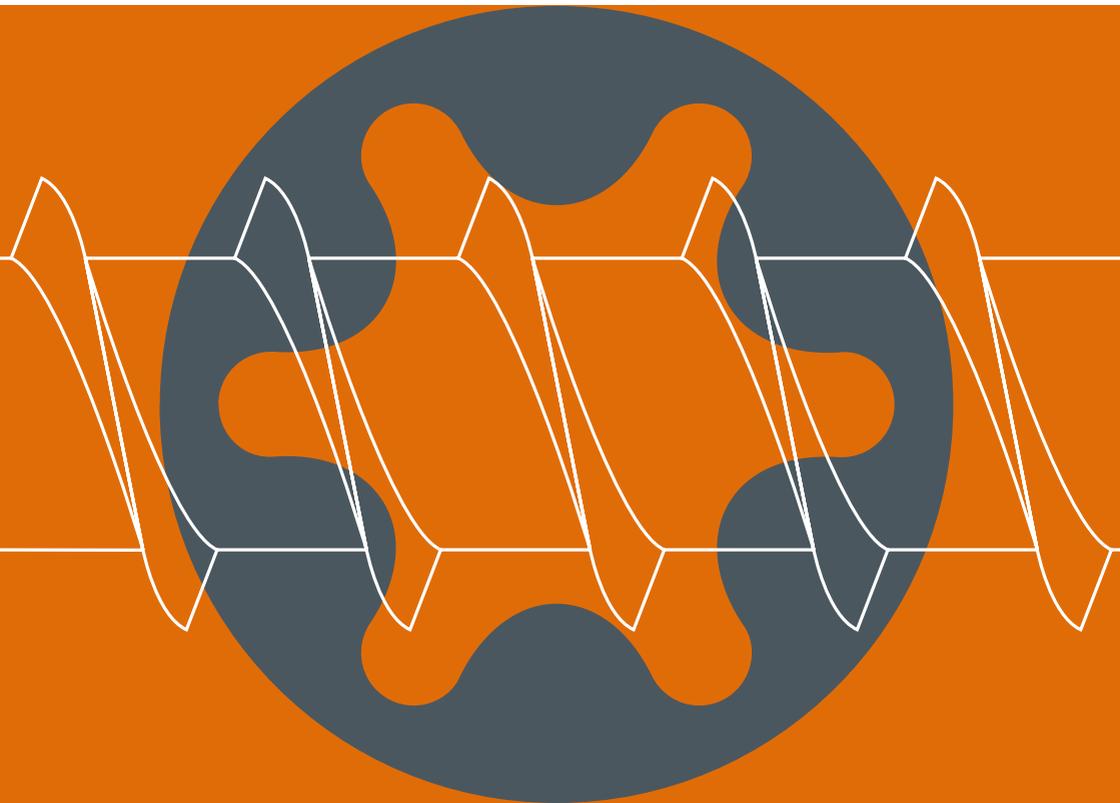


# TIMBER-CONCRETE COMPOSITE *The System*



# TIMBER-CONCRETE COMPOSITE

## Contents

1. ELASCON TIMBER-CONCRETE COMPOSITE	4
2. APPLICATIONS	5
3. CEILING OPTIONS	6-9
4. THE FUNCTIONING OF TCC SYSTEMS	10-11
5. IMPLMENTATION	12-19
6. STATIC VERIFICATIONS OF TCC CEILING	20-25
7. AVAILABLE ELASCON SERVICES	26



## Introduction

In recent years, the demand for refurbishment of existing ceilings and for the installation of new timber-concrete composite floor systems (TCC), has rapidly increased and is still growing. Many designers have recognised that the TCC system is better for increasing the strength of existing timber beamed floor and ceiling structures than any other method. Furthermore, TCC ceilings also constitute optimal solutions in terms of sound insulation and fire protection. Generally speaking, a well designed and implemented timber-concrete composite structure offers outstanding cost-benefits for the most frequently encountered supporting tasks today.

Elascon Connectors provide a particularly advantageous combination of the properties of WOOD subjected to TENSILE and COMPRESSIVE loading with CONCRETE subjected to COMPRESSIVE loading. This produces effective strengthening and remarkable performance enhancement of existing timber beams.

The Elascon TCC system also constitutes a particularly simple and effective method of converting previously unused roof voids into commercially valuable living and/or storage space.

This Document describes the special features and different variants and the general implementation of the Elascon TCC-system, complete with verifiable static TCC information and corresponding work planning procedures.



*H. Rupprecht*  
**Holger Rupprecht**  
Dipl.-Ing. (FH)  
Managing Director  
Elascon GmbH



*W. Kellethofer*  
**Werner Kellethofer,**  
Dipl.-Ing. (Univ.)  
Head of Research & Development,  
TCC-Systems, Elascon GmbH

# ELASCON TIMBER-CONCRETE COMPOSITE

## 1

Whether you are in London, Paris or Berlin: In densely populated urban centres living accommodation is mostly in short supply. In order to create more such space, local authorities nowadays are constantly looking for ways of creating additional living accommodation. Today, they do not only employ infill methods, but also convert unused roof voids in apartment blocks into living accommodation - sometimes also into office space. An essential prerequisite for such a change is that the timber ceilings are adequately dimensioned in order to be able to reliably support the loads generated when used as living accommodation or for commercial purposes. If they do not, they need to be rehabilitated. The safe, reliable and readily implemented and cost-effective solution for rehabilitation is a composite timber-concrete system: the Elasccon TCC system!



Urban development re-purposing of existing buildings with use of dry storage areas and unused roof voids.

# APPLICATIONS

## 2

Wood and concrete composite ceilings are now a proven solution that meets a variety of challenges. They make it possible to optimise existing wooden beamed ceilings in living accommodation and in office and commercial buildings by increasing their load bearing capacity and improving other physical characteristics. They have also found their way into newly constructed buildings, where they improve airborne sound attenuation and fire protection in timber beam ceilings and in timber ceilings with greater span. If required, TCC ceilings can even be provided with integrated floor heating. Such a variant will save a further increase in thickness of some 2 to 3 cm in comparison with a later heating installation.

**Whereas timber beamed ceilings constitute linear supporting elements, TCC ceilings will transform them into semi-level supporting surfaces that act as support in all directions. This produces the following improvements:**

- » Distinct improvement in load bearing capacity by a factor of about three when implemented as a standard ceiling (TCC-S), or by a factor of two, when implemented as a flat ceiling (TCC-F)
- » Improvement in the overall rigidity of the system by up to a factor of ten in comparison with the starting condition.
- » Distinct improvement in the bending strength
- » Distinct improvement in the vibration resistance
  - Improvement of airborne noise attenuation
  - Improvement in fire resistance



Apart from the improvement in airborne noise attenuation and fire protection, the Elasccon TCC system also distinctly improves bending strength and vibration resistance.



TCC-Model structure with integrated underfloor heating

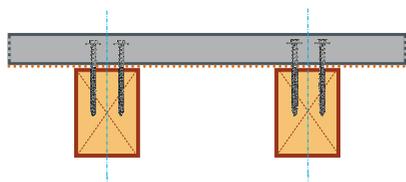
# CEILING VARIANTS

## 3

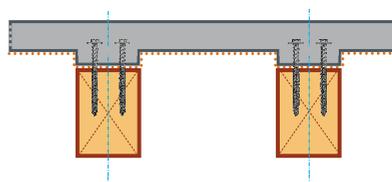
Depending on the area of application, TCC Ceilings may be used in combination with different timber-based materials, e.g. (existing) solid timbers, sheet-laminated timber (BSH) (existing and in new buildings), plywood boards BrSP (in new buildings and dwelling houses and also by manufacturers of prefabricated structures). They may also be used together with veneered laminated timbers FuSch (in new buildings). Depending on the structural requirements, TCC ceilings are also constructed in three different variants, namely standard ceiling (TCC-D), flat ceiling TCC-F or combination ceiling.

### Possible TCC system shown in section

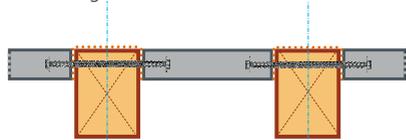
Standard ceiling



Slabbed standard beam



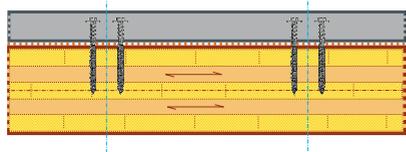
Flat ceiling



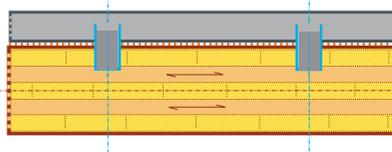
Combination ceiling



Planar timber element, multi-layer-ply board with SFix



Planar timber element, multi-layer-ply board with »HyNo« (Elascon hybrid cam, page 11)



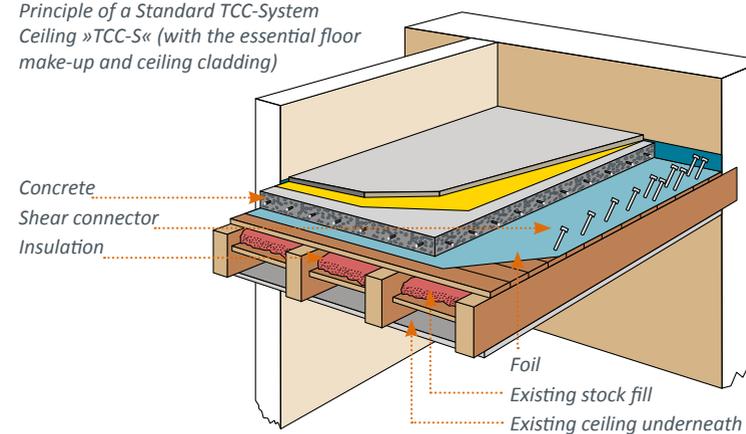
### 3.1 STANDARD CEILING:

In the standard ceiling (TCC-S), the concrete layer of the TCC ceiling is disposed above the timber joist of the existing structure. Precondition for this — most commonly used solution — is that it is permissible / possible to increase the height of the ceiling structure. The shear connectors (Elascon SFix-Type 1, -Type 2 and/or -Type 3) are installed in one row, or in two or several, depending on the loading, and — viewed laterally — they are tightened at an angle of inclination of 45 degrees in the direction of the requisite support (hence the shear connectors are under tensile stress). If shuttering is used (e.g. an OSB slab), then this must reliably support the weight of the concrete as freshly poured. If the shuttering compartment is provided with a pressure tight insulation, the compartment used must be capable of reliably supporting the weight of the concrete as freshly poured.

#### Characteristic features:

- » The most common variant
- » Concrete layer above existing building timber joists
- » The height of the ceiling structure must not be increased by the concrete layer
- » The shear connectors are arranged in single or double, or multiple rows with an angle of inclination of 45 degrees towards the support.

Principle of a Standard TCC-System Ceiling »TCC-S« (with the essential floor make-up and ceiling cladding)





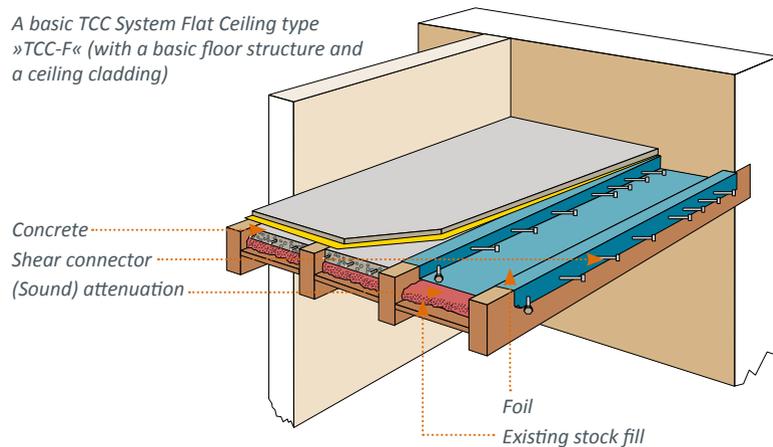
### 3.2 FLAT CEILING:

Flat ceilings (TCC-F) are needed, whenever the ceiling structure must not increase in height, This is the case, for example, if a same level link with an existing staircase is required. In the case of an TCC-F, the concrete layer is disposed between the joists. In the upper area and in the side faces of the timber joists, the shear connectors (Elascon SFix-Type 1, -Type 2 und -Type 3) are bolted into position approximately horizontally and inclined at an angle of 45 degrees relative to the corresponding support. In this variant, it is necessary to ensure that the existing sub-floor is capable of reliably supporting the weight of the freshly poured concrete layer.

#### Characteristic features:

- » A less common variant is used, whenever the height of the ceiling structure must not be increased, where the height available is seriously limited.
- » Concrete layer between the existing structural timbers
- » Thrust connectors screwed laterally into the timber joists
- » This is slightly more expensive than the standard ceiling, owing to the increased installation labour cost.

A basic TCC System Flat Ceiling type  
»TCC-F« (with a basic floor structure and  
a ceiling cladding)



### 3.3 COMBI-CEILING:

In the so-called »Combi-Ceiling«, a combination of a flat ceiling and a standard ceiling, is used, if significant loads act on the ceiling at the same time, and if , at the same time, the structural height of the floor is very limited.

#### Characteristic Feature:

- » Area of Application: High loads acting on the ceiling when height of floor structure is limited.

Prinzip TCC-System Kombidecke  
(mit prinzipiellem Boden-Aufbau und  
Decken-Verkleidung)

