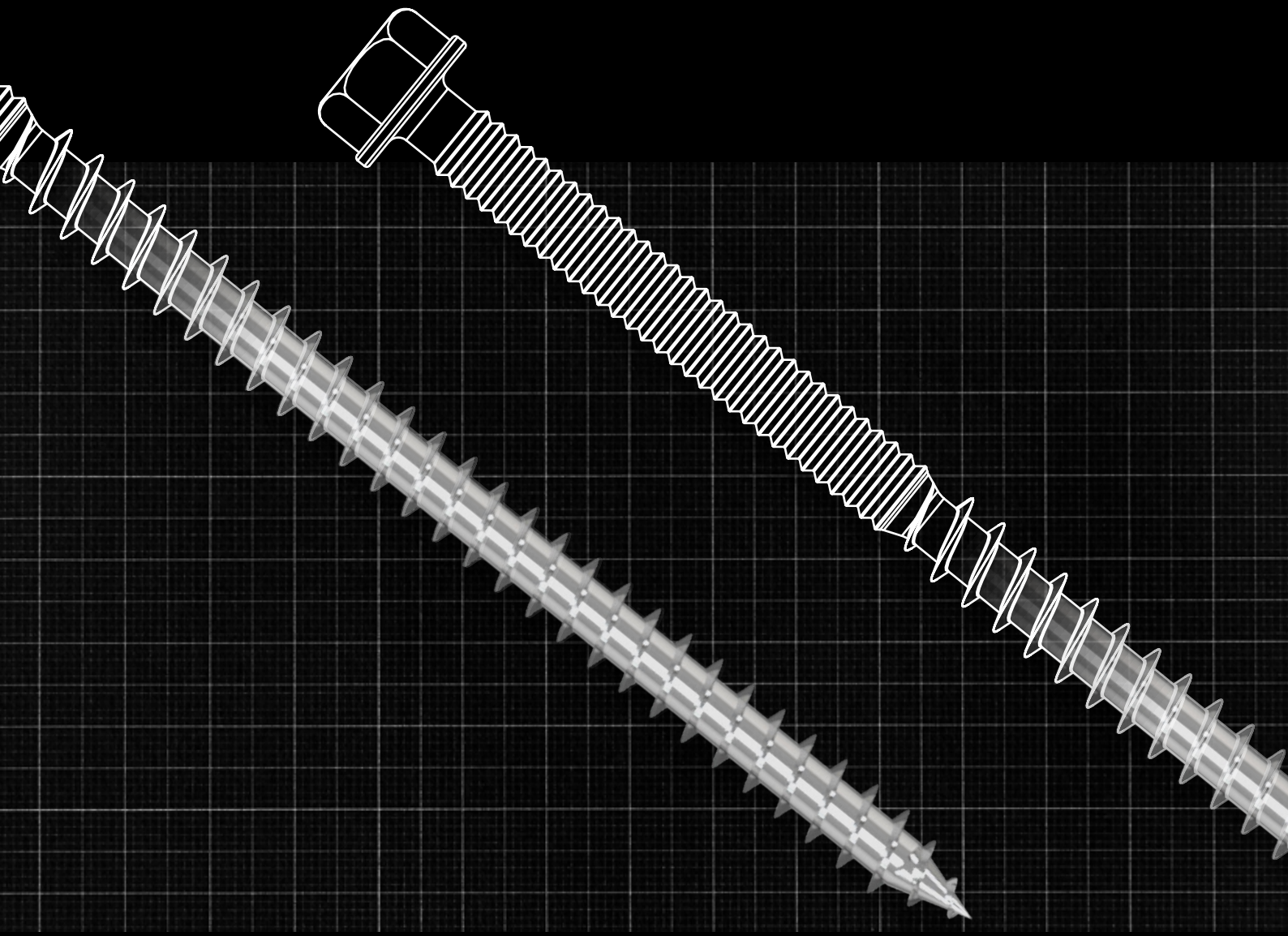
Eurotec®

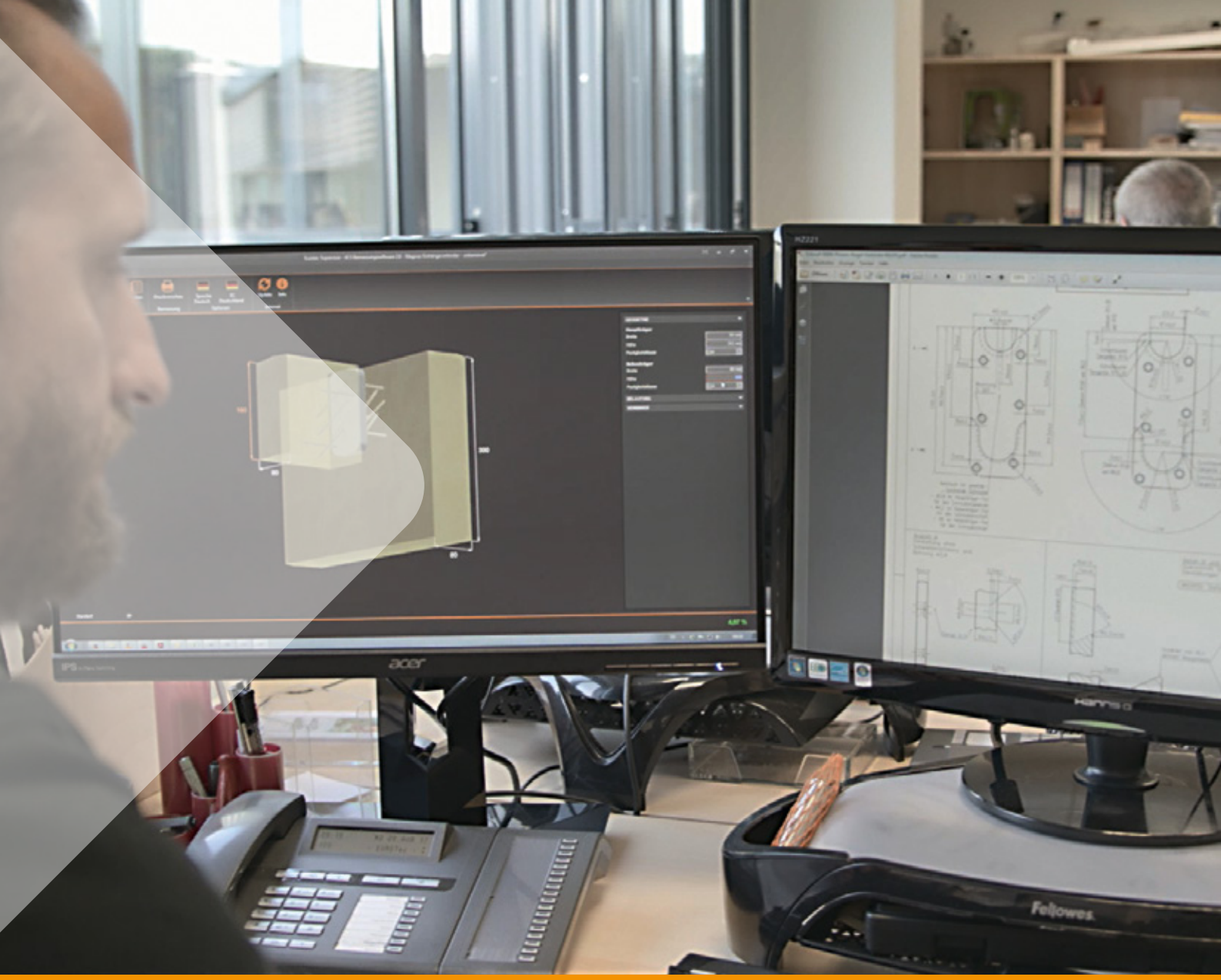
The specialist for fastening technology

TIMBER / CONCRETE COMPOSITE (TCC) SYSTEM

EXPERT KNOWLEDGE FOR USERS



CONTENTS



Our Engineering and Construction Department

OUR CUSTOMERS GET A COMPLETE PACKAGE WHERE PRODUCT QUALITY IS THE TOP PRIORITY.

Many processes and work steps that other companies bring service providers on board to complete are handled in-house at Eurotec.

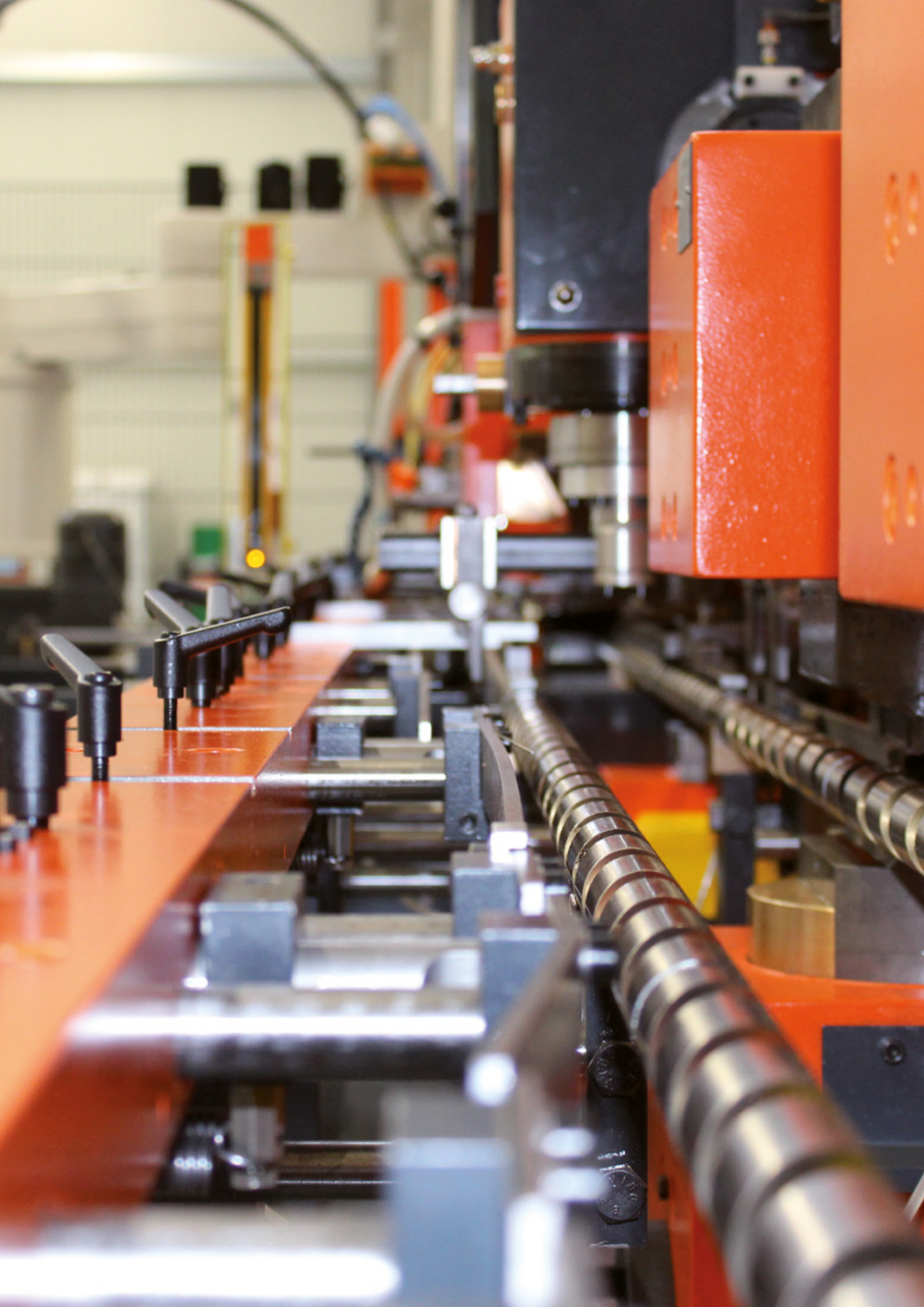
Our approach ensures that our customers receive everything from a single source and have direct contacts for their projects within our company.

Our specialists, who have experience in diverse sectors of the construction industry, design in 2D or 3D, order and check initial samples, prepare approval applications, register patents, issue approvals, monitor series production and much more besides.

All the products in the core range have the construction sector's all-important European Technical Approvals and test reports, reflecting our high quality standards.

We offer a wide spectrum of services too, ranging from free calculations for construction projects and varied sales support in the form of sample shelves and sample terraces, to diverse application videos and external training courses.

Our products allow us to respond to the general needs of the market and work with customers on subject-specific solutions.



EUROTEC CALCULATION SERVICE

We'd be delighted to advise you on your construction project!
Each construction project has to be considered separately, which is why there is no sample solution that's equally suitable for everyone. We're more than happy to handle the preliminary calculation process for you and support you with your individual project.

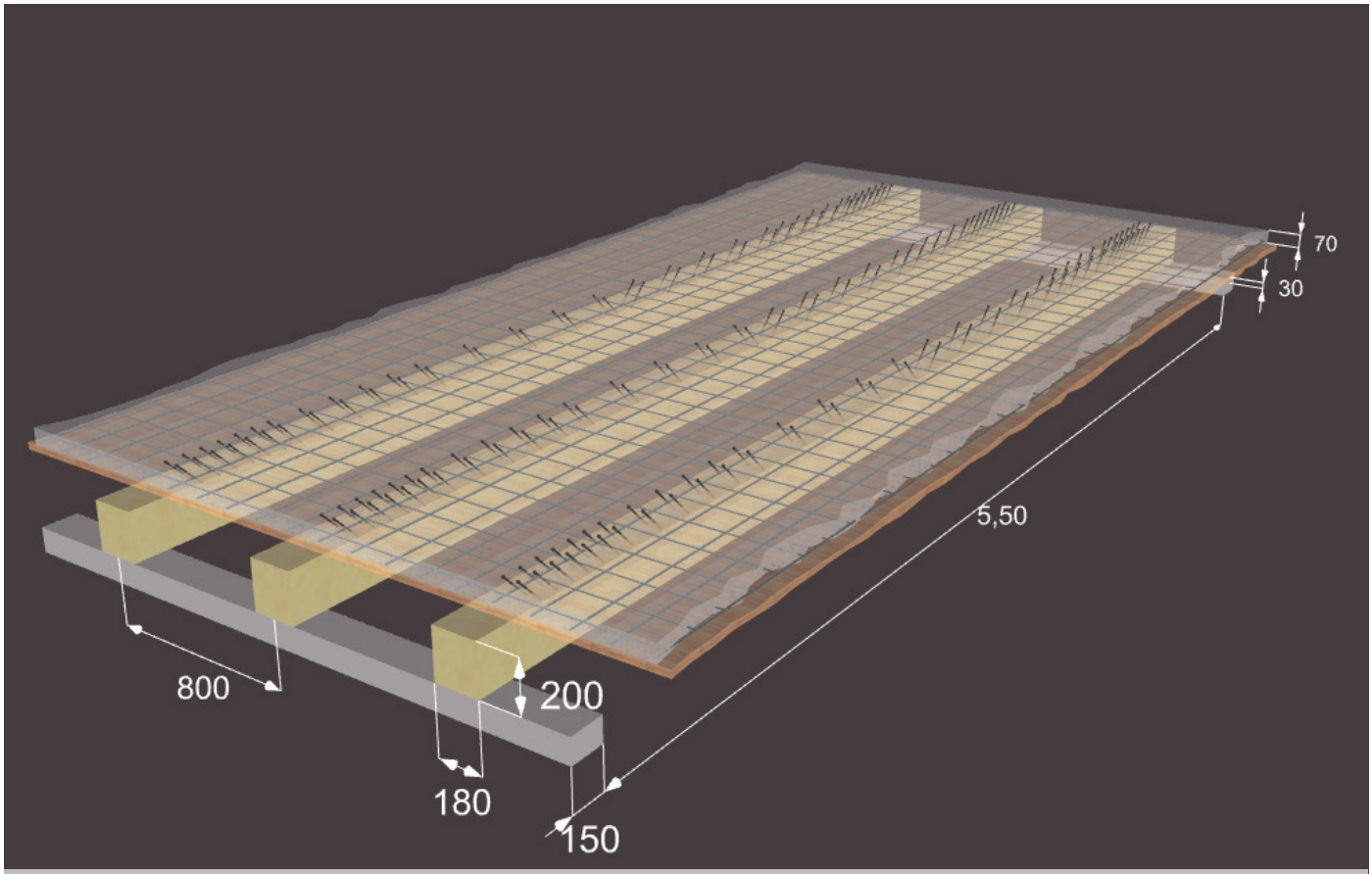
Eurotec provides the free ECS dimensioning software for the preliminary calculation.

How to complete the preliminary calculation process

- Fill out the preliminary calculation form
  - → Collate the necessary key data
- Submit it to Eurotec's Engineering Department
  - → technik@eurotec.team
- The result:
  - → A recommendation for the suitable screw type
  - → The number of screws you need
  - → A verifiable preliminary calculation

Scan the QR code to go directly to our request form!

Scan the QR code to go directly to our ECS dimensioning software!



View of a ceiling in the ECS software

Eurotec measurement service

Wood-concrete composite structure TopConcrete

The specialist for fastening technology

by phone 02331 6245-444 · by fax to 02331 6245-200 · by email to technik@eurotec.team

Contact our Technical department or use the free calculation software in the Service area on our homepage: www.eurotec.team/Service

Contact

Retailers: _____

Contact person: _____

Email: _____

Building project: _____

Executing party: _____

Contact person: _____

Tel: _____

Email: _____

Information about the supporting structure

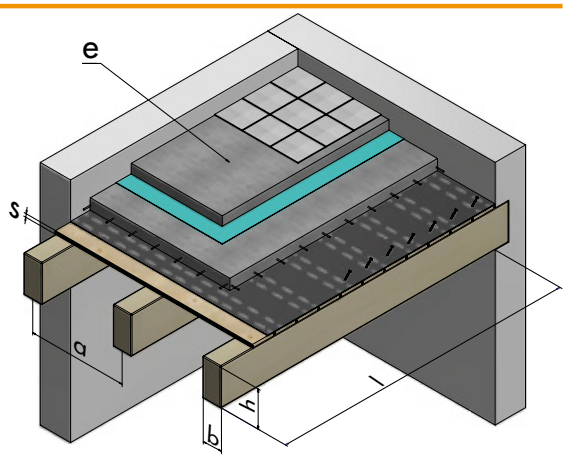
h (mm): _____
(Height of the wooden beam)

w (mm): _____
(Width of the wooden beam)

a (mm): _____
(Largest centre-to-centre distance of the wooden beam)

l (mm): _____
(Span clearance)

s (mm): _____
(Formwork thickness if present)



Information about the supporting structure

e Design and dimension of the planned further floor structure

Screed (mm): _____
(Type: e.g. cement/asphalt/dry screed)

Insulating layer (mm): _____

Flooring (mm): _____
(Type: e.g. tiles, parquet, laminate)

Separating wall addition for walls (including plaster) with a load of:

≤ 3 kN/m wall length	0.8 kN/m²	☐
> 3 kN/m ≤ 5 kN/m wall length	1.2 kN/m²	☐

Information about other loads

Loads under the ceiling, e.g. suspended ceilings: _____

Information about the fire stress

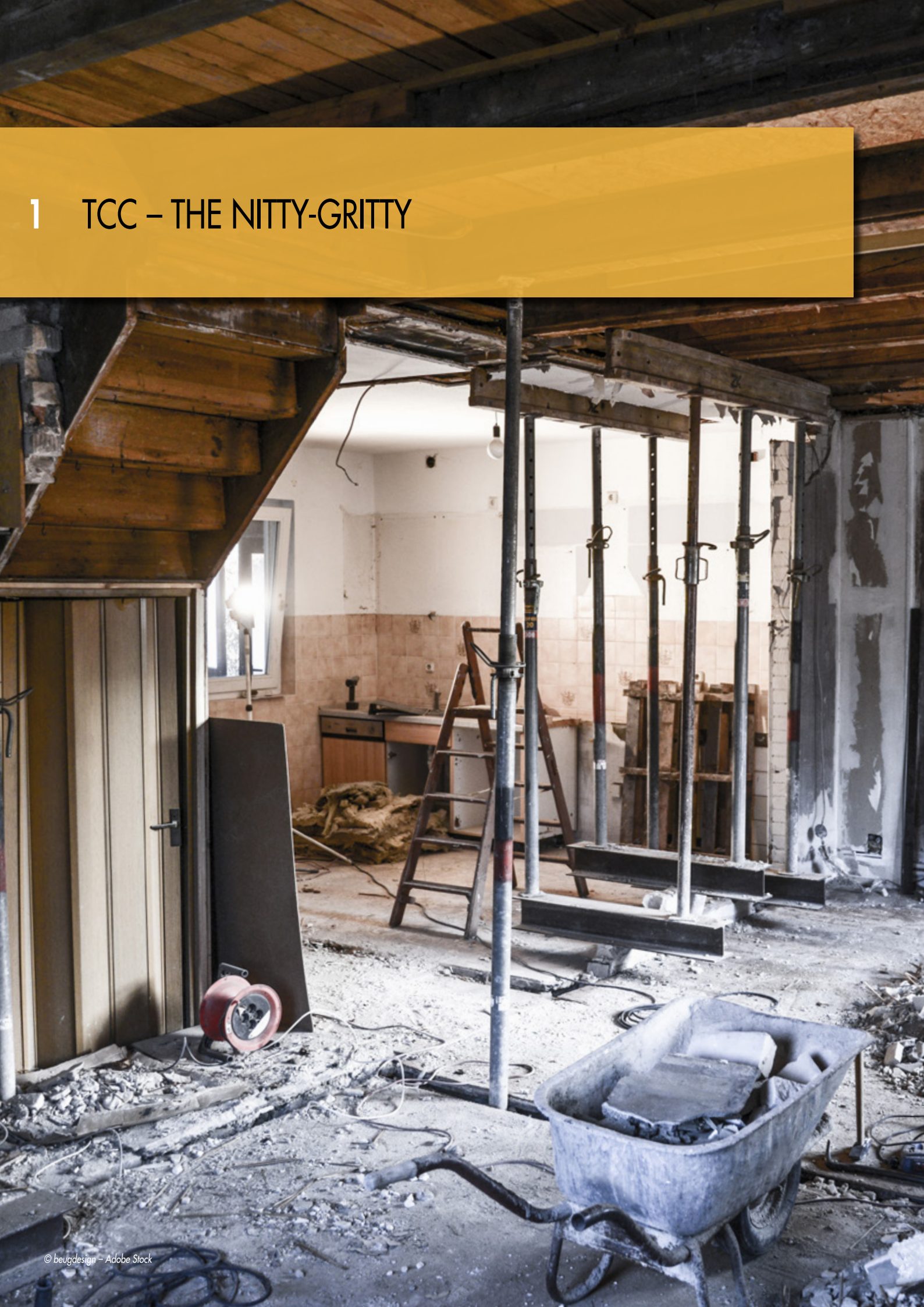
☐ R30 ☐ R60 ☐ R90 ☐ R120

Information about use as per DIN EN 1991-1

☐ Living area / office ☐ space ☐ Sales space Meeting room

Note: A preliminary measurement cannot be used to perform the work. The preliminary measurement only relates to the TCC-Integral method from Eurotec that has been approved by the building authorities. Calculation according to EC 5/DIN EN 1995 and EC 2/DIN EN 1992.

1 TCC – THE NITTY-GRITTY



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1.1 INTRODUCTION

The increasing importance of composite construction (i.e. the idea of joining different materials together in a way that makes them resistant to shear forces and thus exploiting the advantages of a composite effect) has been recognised for some time. This is why reinforced concrete construction is highlighted as a composite of the individual materials steel and concrete.

Timber / concrete composite construction is becoming increasingly important and has gradually established itself in building practice. It is used in the construction of false ceilings and is specifically used in northern Italy, above all else as a supplement to the local timber engineering tradition. Here in the region, too, this option is becoming increasingly interesting for clients, planners and contractors alike. The term has therefore become common in structural engineering for timber ceiling structures. The construction method has proven to be particularly versatile, practical and affordable. A thin slab of concrete already improves the wooden structure's load-bearing capacity many times over.

The combination of different materials opens up new architectural possibilities for planners. In the case of the timber / concrete material composite, the properties of both materials are put to perfect use: Wood absorbs the tensile forces, while concrete takes on the compressive stress. With wood (a renewable raw material), the foundation is laid for sustainable and, at the same time, resource-conserving construction. By combining wood and concrete, structures can be created in an energy-saving, stable, cost-efficient and, above all else, durable manner.

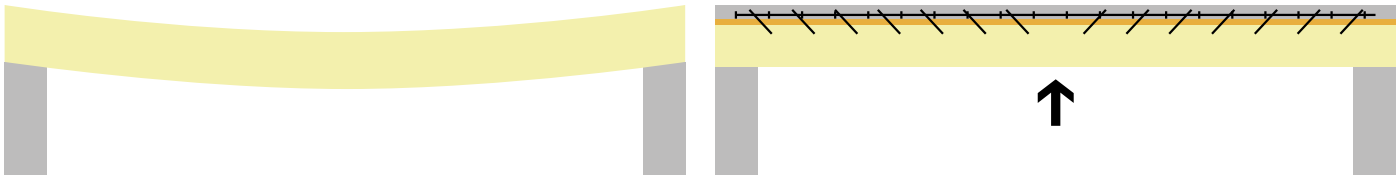
The system's versatility makes it an interesting option for a wide range of applications. In inner-city redensification, this system plays an important role as an affordable and economical option, since it means housing can be provided without building on more land. What's more, it can be used in many other areas such as renovation or new builds.

View inside a house with an old timber beam ceiling

1.2 ADVANTAGES

There are many advantages to having a TCC ceiling. Compared to pure timber beam ceilings, what makes this solution advantageous is essentially the fact that the TCC structure is more rigid. This increases the load-bearing capacity and permits greater span widths. A TCC ceiling is an ideal solution for turning ceilings' ever-increasing span widths into a reality and meeting the associated higher demands placed on building physics. With a pure reinforced concrete ceiling, there comes a point where large span widths can no longer be bridged given the dead weight, while with a pure timber beam ceiling satisfactory results are only achieved with a great deal of effort. A TCC ceiling's greater rigidity and mass lead to better vibration and acoustic behaviour. The result is improved soundproofing. The system offers another major advantage in multi-storey timber construction, in that the composite ceiling's fire resistance time is improved because concrete is a non-combustible material. Another advantage is that a concrete slab has biaxial load-bearing properties. Classic timber beam ceilings can only transfer loads uniaxially. According to EC 1-1-1, higher live loads must therefore be applied than for reinforced concrete ceilings.

What's more, the wooden structure can be raised by auxiliary supports during implementation. The superelevation is preserved in the composite system if the auxiliary supports are not removed until the concrete has fully set. The often existing sags in an old timber beam ceiling can be permanently reduced. This prevents vibrations and creaking noises that are usually common with a pure timber beam ceiling. The overall quality of living can thus be improved. What's more, the construction method is both sustainable and resource-conserving. Other aspects that mustn't be ignored are the aesthetic requirements and details that are preserved with an exposed timber ceiling structure.



Feedback of a sagging timber beam ceiling

A TCC ceiling offers advantages over both a timber ceiling and a reinforced concrete ceiling.

ADVANTAGES COMPARED TO A TIMBER BEAM CEILING

A timber beam ceiling increases the rigidity and load-bearing capacity, so large span widths can be implemented. A TCC ceiling also experiences less deformation than a classic timber beam ceiling. The fire resistance time is increased because the non-combustible concrete prevents flammable gases from penetrating and not only insulates, but also protects, the floors above. Flashover into the next storey is prevented accordingly. A high degree of prefabrication permits swift on-site assembly and thus shortened construction times.

ADVANTAGES COMPARED TO A REINFORCED CONCRETE CEILING

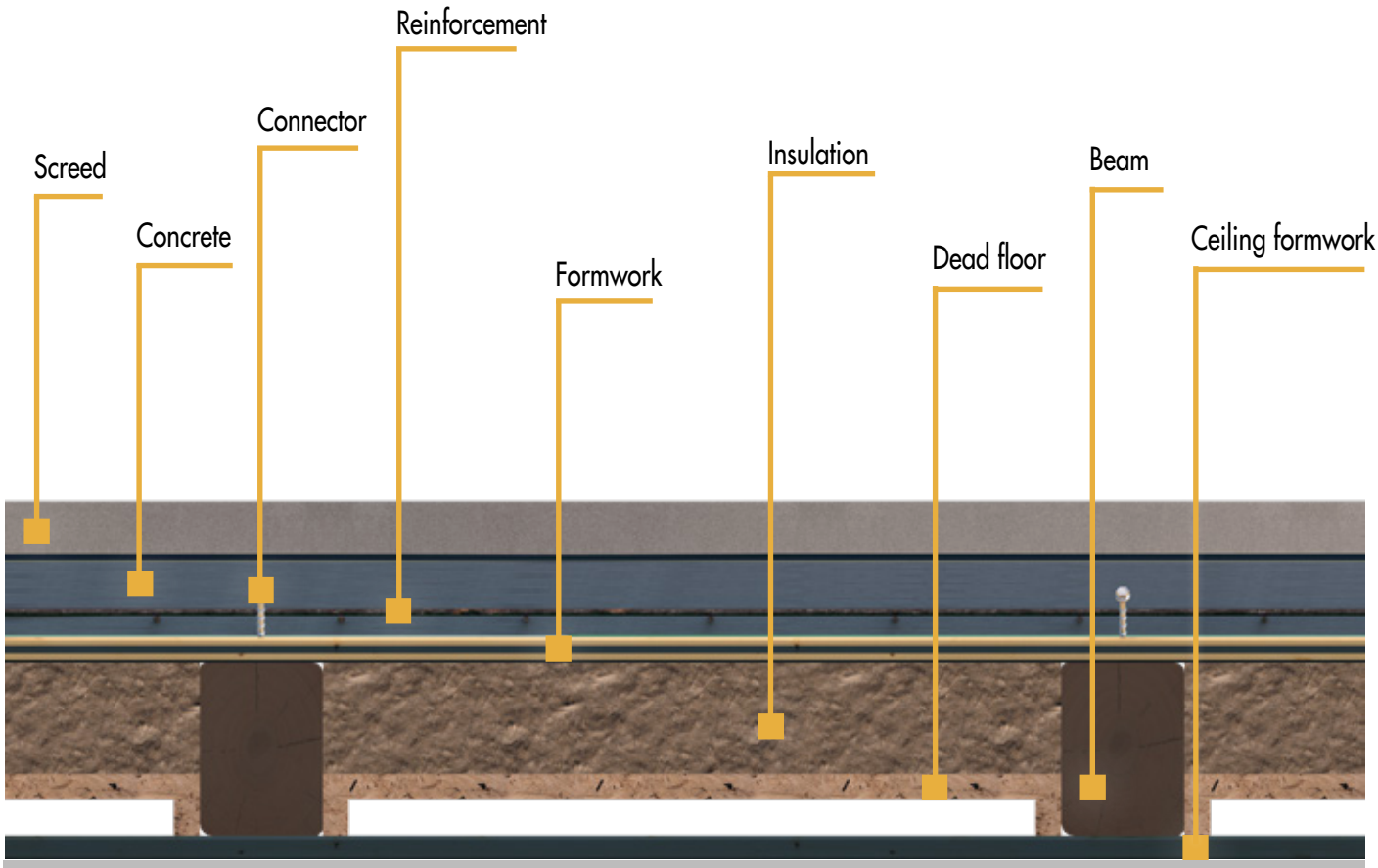
Unlike a reinforced concrete ceiling, a TCC ceiling has a significantly reduced dead weight, but approximately the same load-bearing capacity. A TCC ceiling's life cycle assessment is significantly improved due the use of renewable materials and energy minimisation. In contrast, steel production requires a lot of energy. When the ceiling is demolished, recyclable materials can be separated without any problems, since the two materials are separated by a joint. The construction of a TCC ceiling is significantly sped up and eliminates the need for another ceiling extension if an exposed ceiling is desired. Thanks to the natural aesthetics of wood (as a renewable raw material), there is a vast amount of creative leeway here.

Fire prevention **Soundproofing** **Load-bearing capacity**

1.3 FLOOR STRUCTURE EXPLAINED

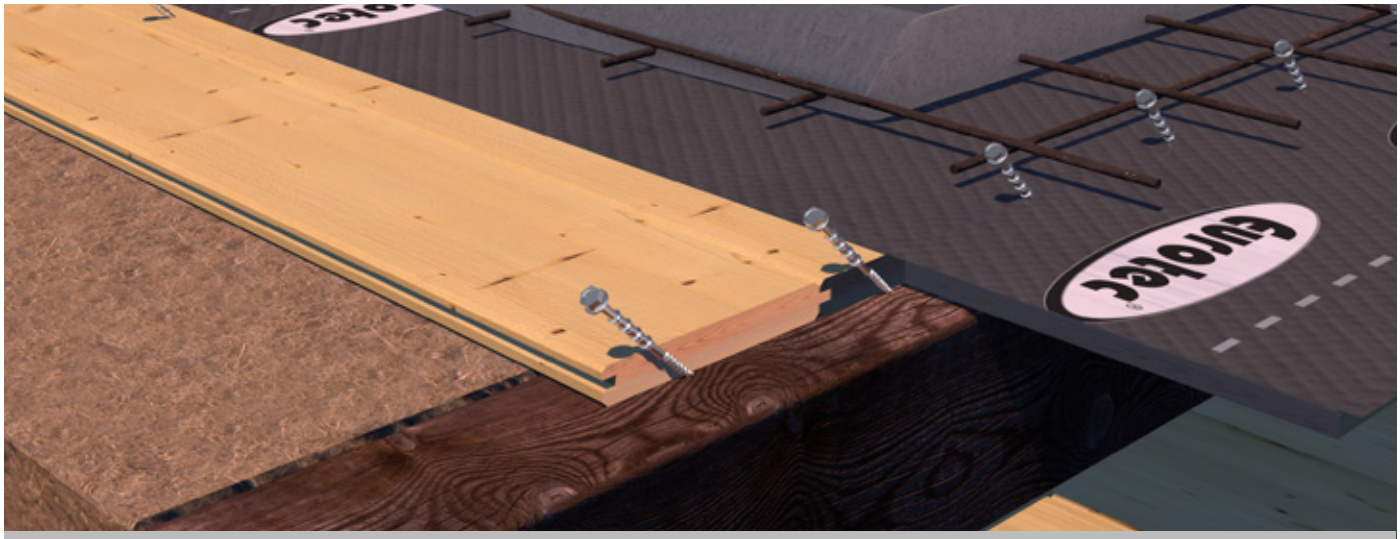
High live loads with maximum span widths need to be highly rigid above all else (i.e. the ceiling structure must only sag slightly when loaded). In terms of usability, timber beam ceilings push the limits of feasibility relatively quickly. Joining wood and reinforced concrete with composite screws effectively exploits the best properties of both materials to create a highly resilient structure.

The timber / concrete composite system is used in the construction of new builds and the renovation of residential and commercial buildings. So, in new builds, larger span widths can be taken into account in planning from the very outset. The strengths of this approach are also and especially evident in buildings affected by changes of use.



Cross-section of a TCC ceiling

When upgrading the load-bearing structure of floor slabs in new builds and renovations, the aim is usually to increase the slab's load-bearing capacity, improve soundproofing and fire protection and enhance the solution's appearance.



TCC ceiling in detail

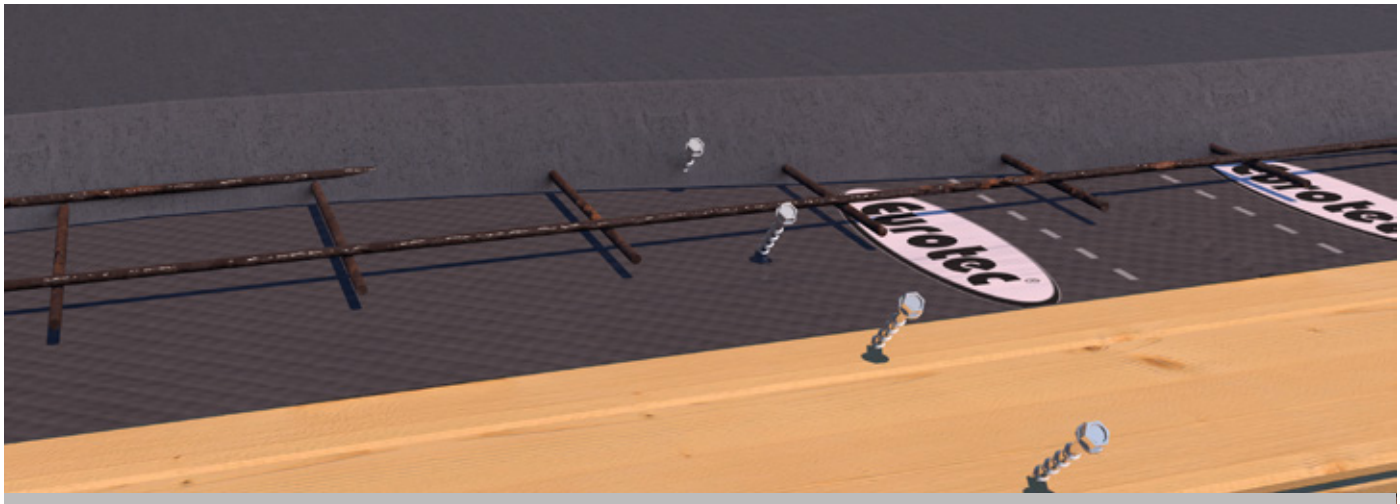
Eurotec

NOTE

Expert tip:

Our TCC connectors can be assembled through the formwork. So there's no need to remove the formwork before assembly.

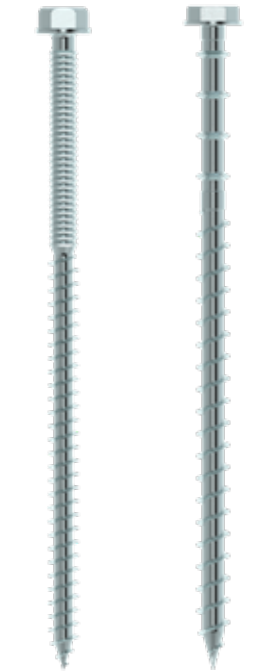
- The ceiling beams can usually be preserved as they are, just like the formwork above the beams.
- The gaps should be sufficiently filled with insulation, which is used to reduce sound and provide thermal insulation.
- Foil is placed above the beams or formwork as a separating layer from the concrete.
- Additional flooring, consisting of the impact sound insulation, screed and floor covering (tiles, parquet, carpet, etc.) can be installed on top of the concrete. This creates one of the greatest advantages of TCC ceilings (soundproofing). Here, the concrete with its mass interacting with the additional flooring contrib utes to this, since the additional massive layers of impact sound insulation, screed and covering improve the acoustic properties.



Layered TCC ceiling

1.4 TIMBER / CONCRETE COMPOSITE SCREW – A PRODUCT OVERVIEW

Timber / concrete composite screws are essential elements for structurally reinforcing floor slabs in new builds and renovations. At Eurotec, we offer special solutions for the TCC bond, the TCC-II 7.3 and TCC-II 9 according to ETA 16/0864. We provide the free ECS dimensioning software for the preliminary calculation.



TCC-II 7.3 TCC-II 9

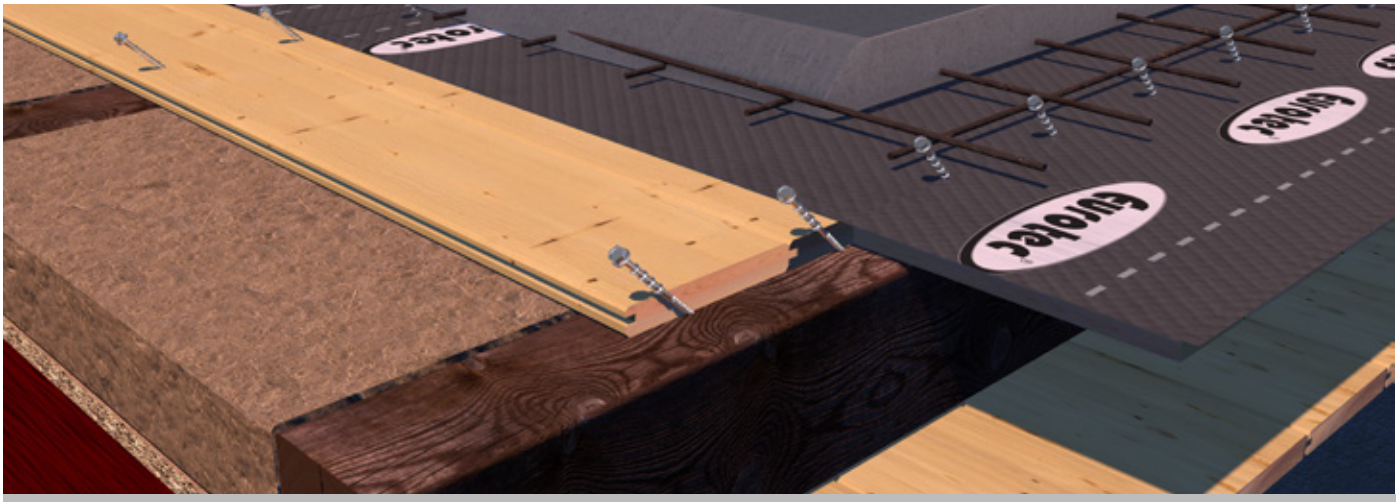
ID	Art. no.	Dimensions	Material	PU
TCC-II 7.3	981841	7.3 x 150	Carbon steel	200
TCC-II 9	903592	9.0 x 180	Carbon steel	200

PROPERTIES

- Creating a shear-resistant bond between wood and concrete
- The special coating stops the screws from corroding
- Drive: Hexagon socket ensures safe driving
- The special thread geometry prevents tearing out
- No need for pre-drilling when screwing in
- A depth stop prevents the screws from being set too deep and is therefore advantageous compared to conventional fully threaded screws
- The special gear teeth geometry ensures a strong hold in concrete and an ideal bond

ADVANTAGES

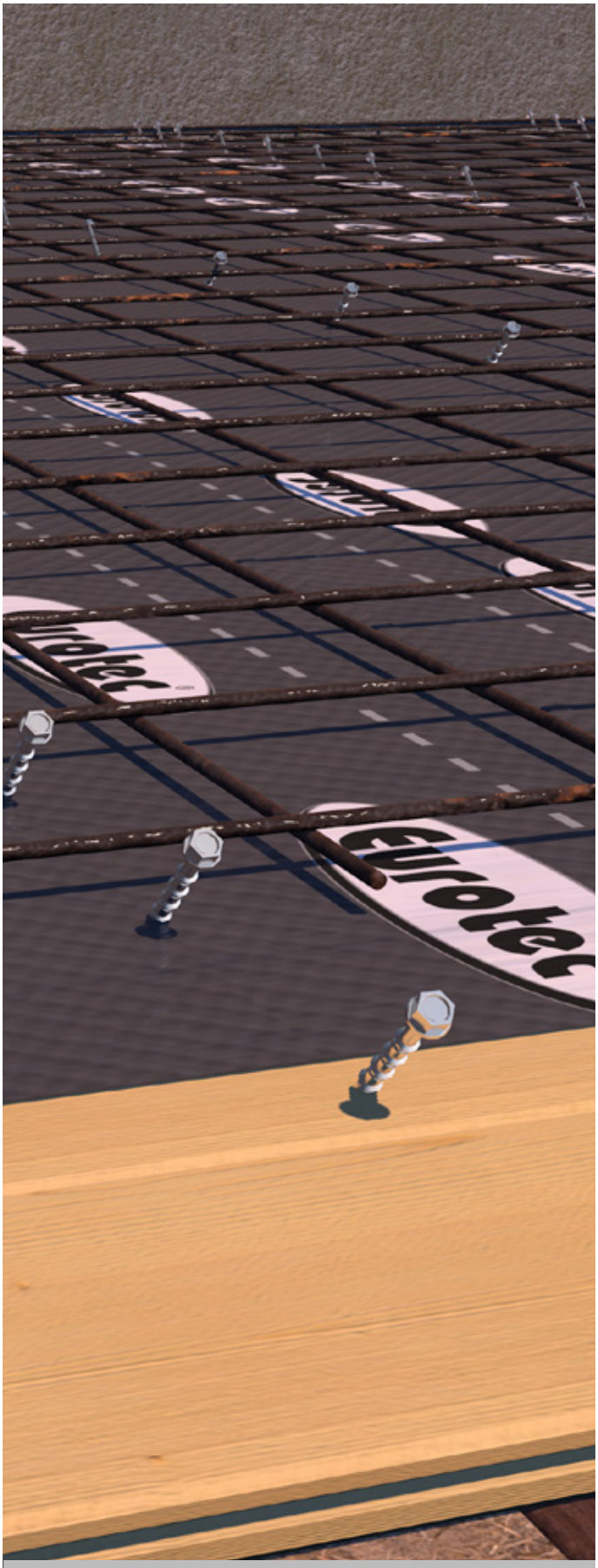
- Increased load-bearing capacity
- Increased rigidity
- Improved soundproofing
- Increased fire resistance
- Existing beams are preserved
- Existing formwork can be preserved



TCC ceiling in detail

2 TIMBER / CONCRETE COMPOSITE SYSTEMS

2.1 AREAS OF USE



Arrangement of reinforcement and shear connectors

Damage to timber beam ceilings (e.g. rotten beam heads, vibrating and sagging ceilings, and the overall lack of load-bearing capacity) are a major disadvantage. It isn't uncommon for all of the damage mentioned above to occur all at once. A dilapidated building usually needs to be upgraded for its fire protection, soundproofing and load-bearing capacity to be improved.

When it comes to listed buildings, an approach such as this is quite often the only way to save them from complete decay. As much of the original structure as possible is preserved during this process.

Timber / concrete composite systems offer a solution for various potential applications. The main area of use is structural reinforcement of floor slabs, both in new builds and in the renovation of timber beam ceilings in old buildings, using a subsequently applied concrete slab. This helps to improve timber beam ceilings' load-bearing behaviour or structural-physical properties in existing buildings. The large number of older buildings opens up a large area of application here. The likes of the top floors, some of which were previously unused, can be retrofitted with a timber / concrete composite ceiling.

The system proves to be an affordable way of renovating old timber beam ceilings. This creates new living space without building on more land, which is scarce in large cities anyway. Particularly in residential construction, timber beam ceilings are costly to renovate, because the old ceilings cannot meet the basic structural requirements. What's more, the soundproofing and fire protection requirements are not guaranteed.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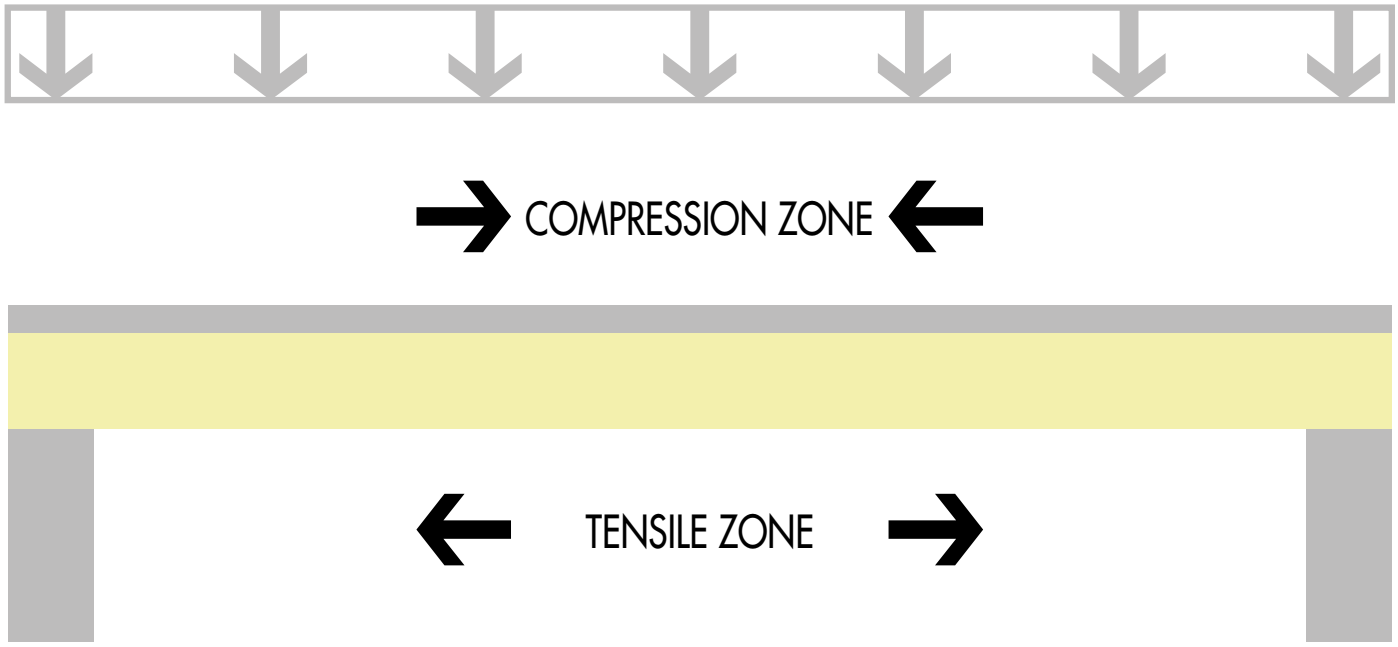
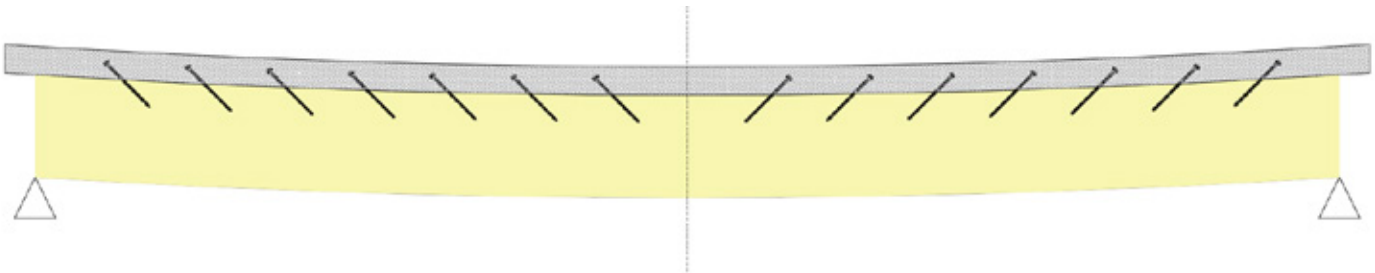
2.2 HOW IT WORKS

In the composite construction method, spatially separated cross-sections of at least two different materials are friction-locked to one another at a joint using a fastener. Reinforced concrete is poured onto the timber ceilings. The concrete is connected to the timber beams using special connectors and is located in the compression zone, so that it absorbs high loads, dampens vibrations and helps with soundproofing and fire protection. The wood is in the tensile zone.



How the TCC ceiling works

The production of a composite of the two materials is unavoidable. The degree of bonding γ between the two materials (wood and concrete) indicates the bonding characteristic. Success depends on how effective a fastener is. So, the bonding effect between wood and concrete should be correspondingly high to ensure both a high load-bearing capacity and usability of the composite cross-section. The more yielding a connection is, the lower its potential in terms of load-bearing capacity and usability. If fasteners are not used, bonding is 0%, after which there would be no bond at all. In this case, the ceiling would sag and mutual displacement of the two materials would take place at the supports.
Only the composite of the two materials reduces the sag and permits higher live loads. A complete bond of γ = 100% could be ensured by bonding the two materials over the entire surface. But this is not feasible in practice.



Mutual displacement of the materials at the supports

There are various possibilities for producing this composite. TCC ceilings were first produced in the 1930s with the aim of saving steel and wood. The research was finally revived in the 1980s. So either glued-in threaded rods, embedded steel dowels or nailed-on joist hangers were used to make these composite ceilings.

These systems were particularly practical, whereas today entirely different options are available. Today, for instance, it is common to use screws that are screwed in at an angle and are mainly subjected to tensile stress. Fully threaded woodworking screws or specifically manufactured shear connectors can be used here. The latter's head is usually a special shape, which ensures a good form fit with the concrete. The screws can be inclined on one side or crossed. Design engineering rules (such as edge distances and minimum dimensions) are regulated in the products' respective approval.

If a timber / concrete composite is to be good, the joining technique must be highly efficient and economical. This depends on how rigid the fasteners are. A distinction is made between rigid (unyielding) and mechanical (yielding) connections.

A rigid bond prevents relative displacements between the individual cross-section parts and would be the ideal connection. But this can only be ensured by activating an adhesive effect in the contact area between the timber beam and the concrete ceiling. Only a yielding bond can be achieved with the point or rod-shaped fasteners. This creates small relative displacements.

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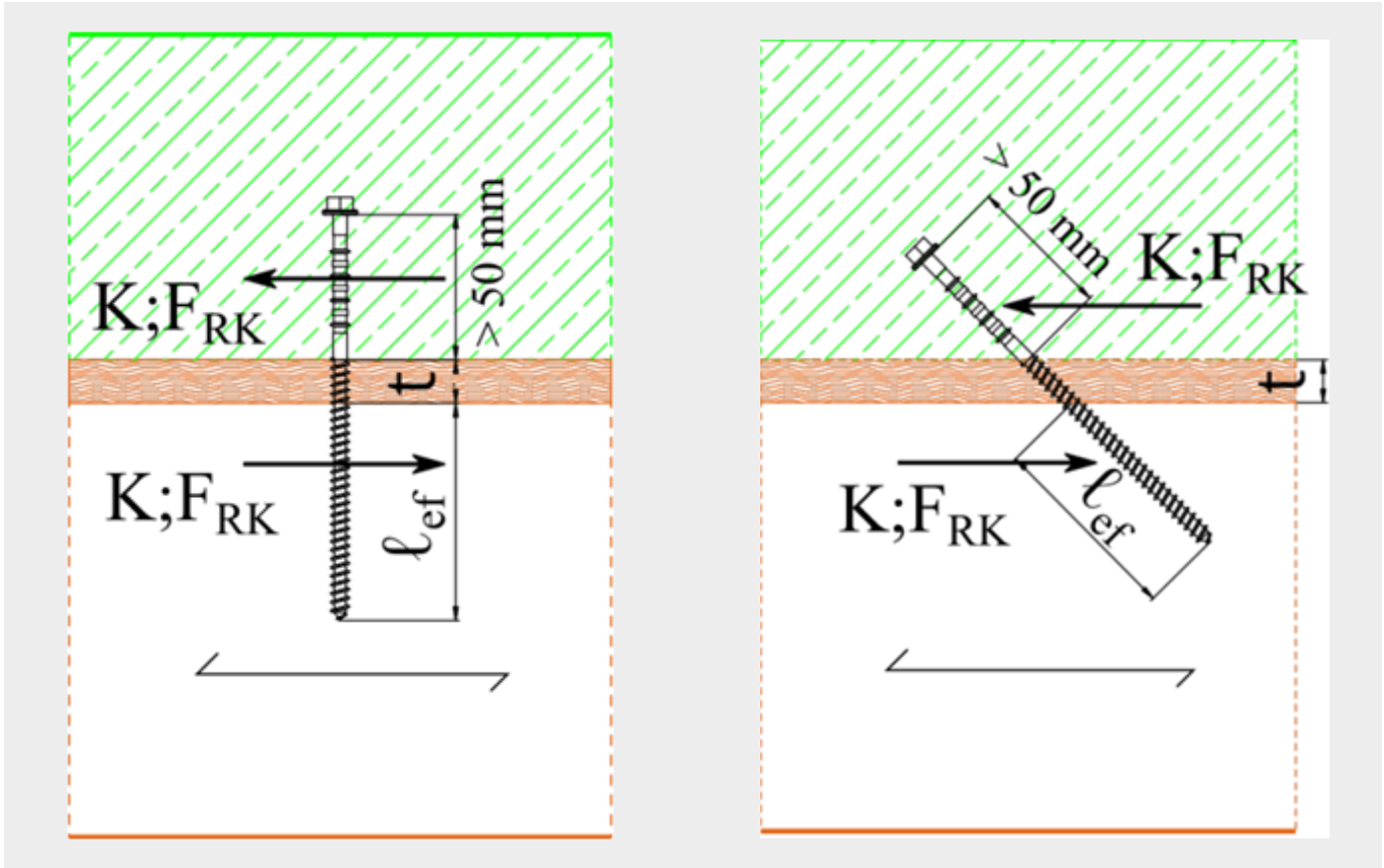
2.3 CALCULATING TCC CEILINGS

An essential difference between the timber / concrete composite and the steel composite structure according to EC 4 or classic reinforced concrete construction is the shear connection's yieldingness between the wood and the concrete component.
The relative displacement follows from the shear connectors' displacement modulus K. K is given in ETA 16/0864. The joint's shear rigidity is important for the design. The number of shear connectors determines how rigid the joint is. The rigidity influences the internal force distribution within the timber / concrete composite component for the given dimensions and loads. The shear bond creates an elastic system, which is why the screws are stressed by shear forces and tear out when overloaded.



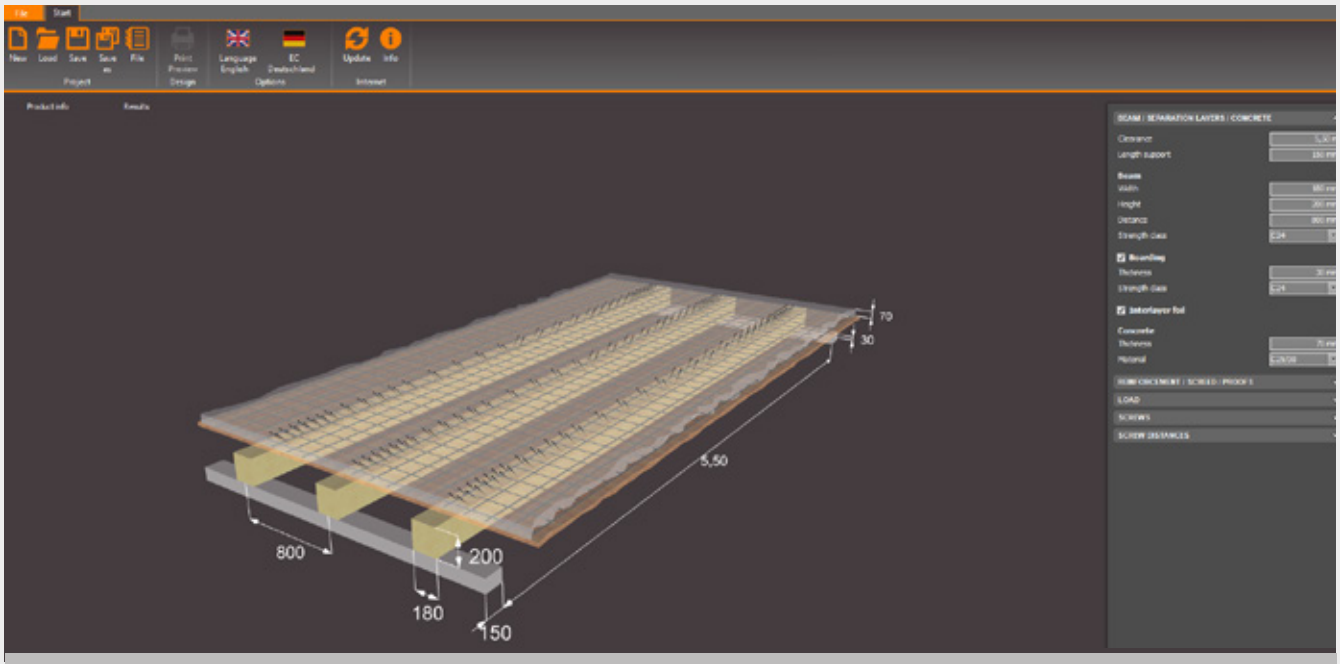
Shear forces for 90° and 45° screw connections

Screws that are screwed in at right angles to the joint behave much more compliantly, making them ineffective. Screws that are screwed in at an angle of less than 90° to the joint (ideally 45°) are much more effective. Values for this are included in the ETA.

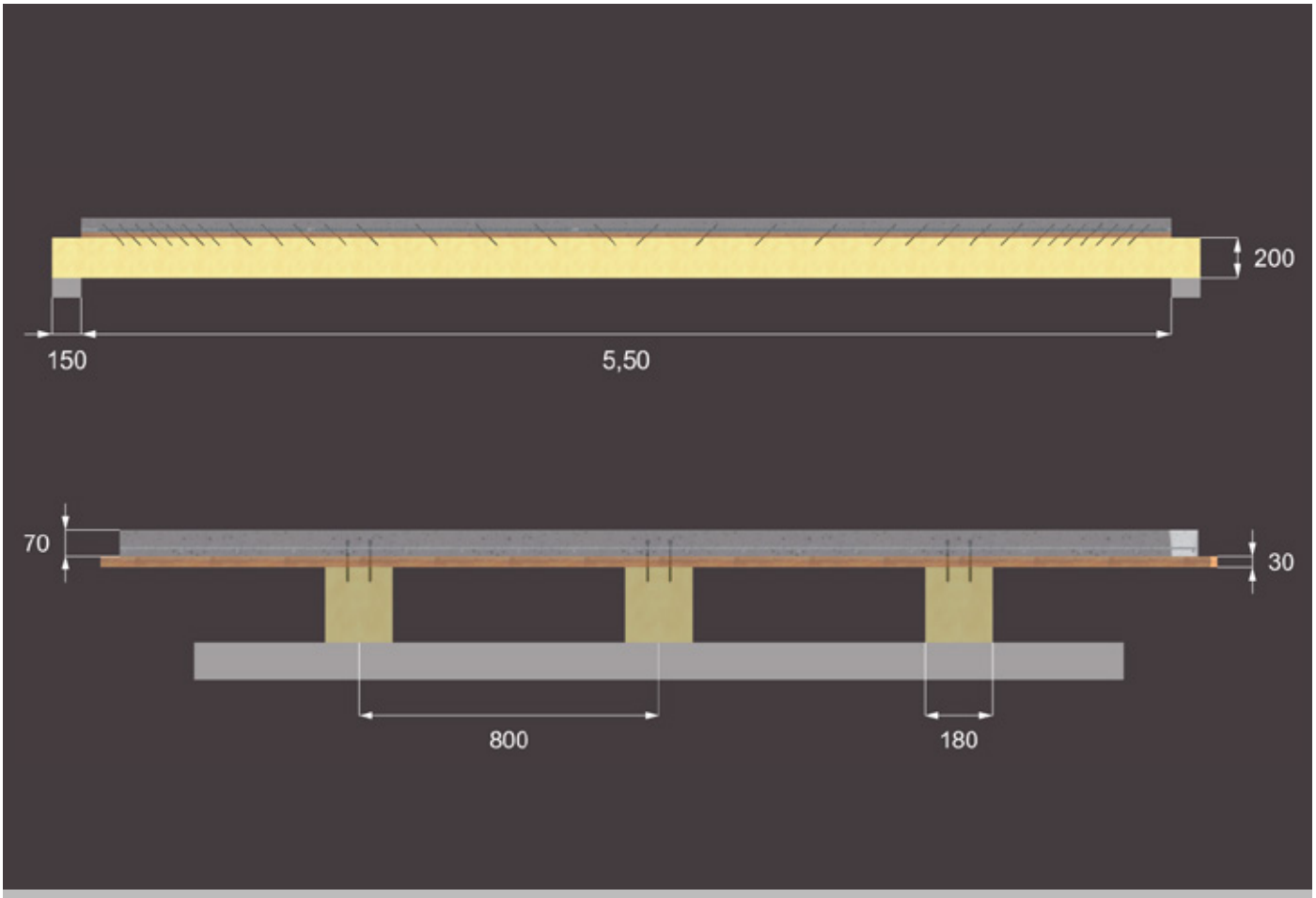
The two materials' different long-term behaviour (particularly the concrete's creep) is another difficulty in designing the composite structure.
Very extensive calculations are required. ECS (the in-house software) was developed based on Mathcad for calculating load-bearing structures to be manufactured. The software is not a black box. It offers insights into the detailed design and generates a comprehensible result in the form of a verifiable preliminary calculation. This generally understandable notation is important for planning engineers, for whom the existence of calculated values is decisive when it comes to selecting a suitable shear connector.

Until now, complex calculation models were must-haves for an exact calculation. In addition to the two shear connectors, we also offer the necessary software so that complex measurements can be made accurately and quickly. The software provides all the necessary arithmetical evidence and verifiable documents.

Launching the ECS program



The ECS program's input screen



2D view of a ceiling in the ECS software

WHAT DO YOU NEED TO PERFORM A CALCULATION

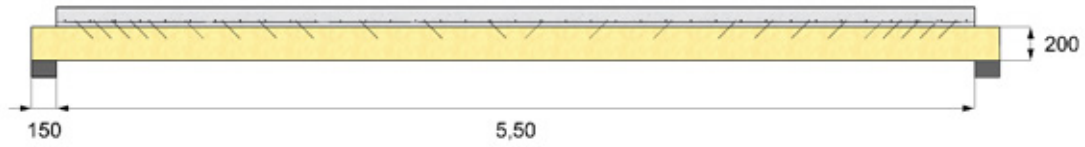
The wood quality, the span width, the centre distance and the cross-section of the ceiling beams are important to calculate the load-bearing capacity for a timber / concrete composite. The thickness of any formwork is important too. Additionally, information should be provided about the desired additional flooring. The expected live loads are vitally important.

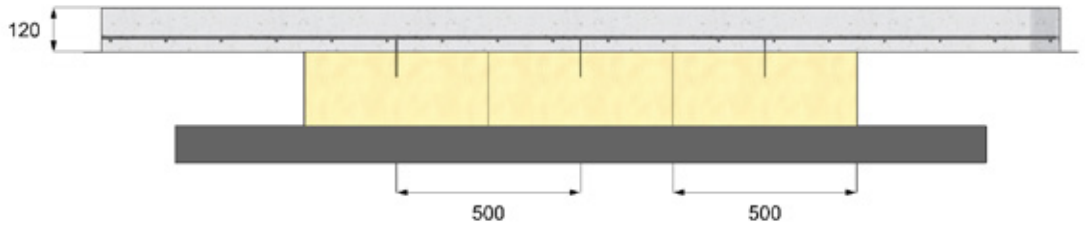
SAMPLE CALCULATION

A preliminary calculation is shown as an example. A CLT ceiling element measuring 200 mm thick is used. The dead load is assumed to be g_k = 5.77 kN/m² and the live load p_k = 2.3 kN/m², including a 0.8 kN/m² partition allowance.

The evidence is kept by the ECS program.

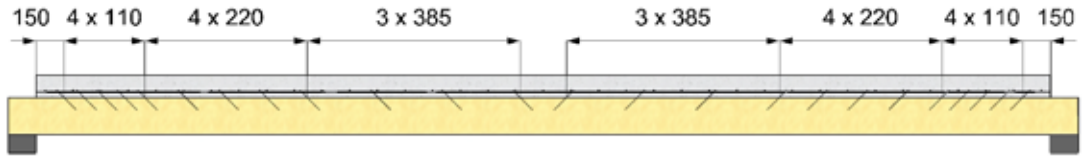
Dimensioning aid
Planned construction





Screw distances

Installation	Screwing angle	45 °
	Installation dimension	150 mm
	Counterbore value	99 mm
Screw distances in fibre direction	S0 Support area	110 mm
	S0 Intermediate area	220 mm
	S0 Middle area	385 mm
Screw distances perpendicular to fibre direction	E90	250 mm



Preliminary calculation for a TCC-II connector for TCC ceilings, number of connectors per beam and per m²

Assumptions

The beams' centre distance [mm]	600		
C25/30 concrete thickness [mm]	70		
C24 formwork thickness [mm]	21		
Maximum sag	winst = l/300	wfin = l/200	wnet,fin = l/300

Dead load (beam, formwork, concrete) [kN/m²]	-
Additional loads (5 cm screed + 1.5 cm tiles + impact sound insulation) [kN/m²]	1.50
Live load [kN/m²]	2.00
Load duration [kN/m²]	Medium

(Not taking fire protection and vibration into account)

TCC-II 7.3 x 150					
Span width [m]		Cross-section of a C24 solid structural timber beam W/H [mm]			
		120/200	120/240	140/240	140/260
3	Connectors per beam	8	8	8	8
	Connectors / m²	4.4	4.4	4.4	4.4
3.5	Connectors per beam	14	10	10	8
	Connectors / m²	6.7	4.8	4.8	3.8
4	Connectors per beam	24	18	16	14
	Connectors / m²	10	7.5	6.7	5.8
4.5	Connectors per beam	32	-	-	22
	Connectors / m²	11.9			8.2
5	Connectors per beam	-	-	-	30
	Connectors / m²				10
5.5	Connectors per beam	-	-	-	36
	Connectors / m²				10.9
6	Connectors per beam	-	-	-	48
	Connectors / m²				13.3

TCC-II 9 x 180					
Span width [m]		Cross-section of a C24 solid structural timber beam W/H [mm]			
		120/200	120/240	140/240	140/260
3	Connectors per beam	8	8	8	8
	Connectors / m²	4.4	4.4	4.4	4.4
3.5	Connectors per beam	10	8	8	8
	Connectors / m²	4.8	3.8	3.8	3.8
4	Connectors per beam	16	10	10	10
	Connectors / m²	6.7	4.2	4.2	4.2
4.5	Connectors per beam	24	18	16	14
	Connectors / m²	8.9	6.7	5.9	5.2
5	Connectors per beam	32	24	24	20
	Connectors / m²	10.7	8	8	6.7
5.5	Connectors per beam	-	-	-	-
	Connectors / m²				
6	Connectors per beam	-	-	-	-
	Connectors / m²				

Expert tip:

The values are intended as a rough guide. When it comes to designing a TCC ceiling, the beams should have as large a cross-section as possible so that large span widths can be created and an economical design is guaranteed.

2.4 IMPLEMENTATION OPTIONS

There are various ways of increasing an old timber beam ceiling's load-bearing capacity:

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TIMBER / TIMBER STRUCTURE

In this case, the load-bearing capacity is reinforced by means of mechanical fasteners or bonding. Additionally, the rigidity is improved and the ceiling's vibrations are reduced overall. However, soundproofing is only inadequately improved because a vibration-damping mass is missing.

TIMBER / CARBON FIBRE STRUCTURE

In a timber / carbon fibre structure, the flexural strength and load-bearing capacity are increased with glued-on carbon fibres. The method can be used in new builds, but is difficult to apply when renovating old ones. The highly flammable carbon fibre poses an additional risk in terms of fire safety.

With this and the variant described before, dilapidated beam heads must be replaced first of all at great expense.

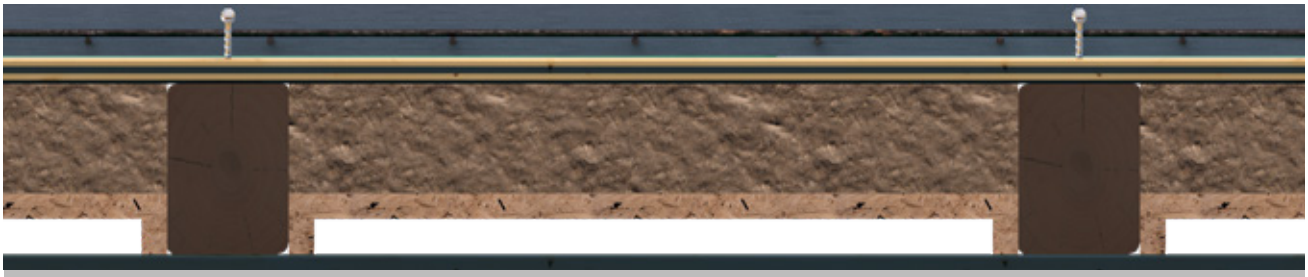
TIMBER / CONCRETE COMPOSITE

In a timber / concrete composite structure, the properties of both load-bearing structures are combined. This causes the ceiling's load-bearing capacity to increase and improves the structural-physical properties. Large span widths are permitted here. The additional weight of the concrete is compensated for by the increase in load-bearing capacity. Ultimately, high rigidity and favourable vibration behaviour are achieved. Improved soundproofing is also provided.

In terms of fire protection, the metallic fasteners are superior to a bonded joint, since a bonded composite joint starts to fail at high temperatures. Furthermore, bolted systems are efficient even under tougher site conditions.

Depending on local conditions and requirements, there are again various options for designing a TCC ceiling. Various types of wood can be used in the composite. When renovating old buildings, solid wood is usually the material of choice, whereas in new builds it is glue-laminated timber (glulam) or cross-laminated timber (CLT). The following are cross-sections of sample implementations. Depending on the requirements, a TCC ceiling can be designed as a standard ceiling (above the beams), as a flat ceiling (between the beams) or as a combination ceiling (combination of between and above the beams).

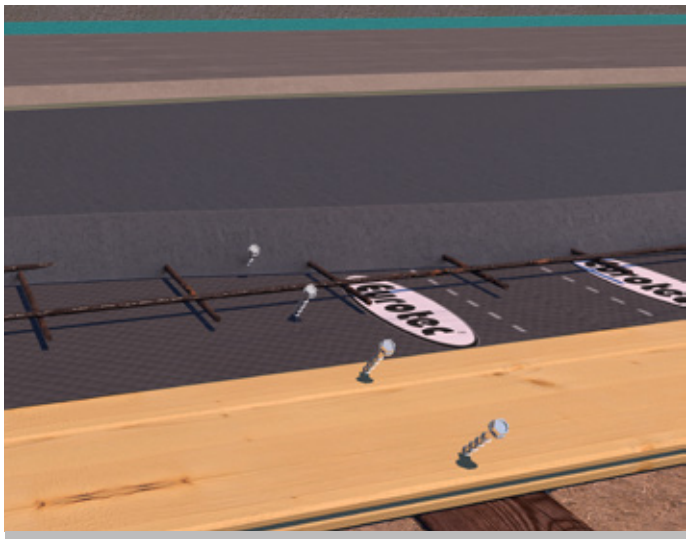
STANDARD CEILING



Cross-section of a standard solid wood ceiling

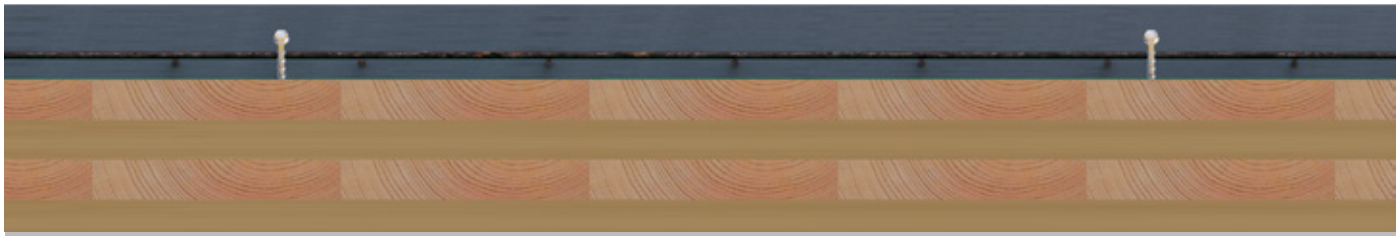
In the classic solution, the concrete ceiling is created directly above the ceiling beams. This is the simplest method and provides the composite ceiling with the greatest possible load-bearing capacity. Any existing formwork can be preserved here depending on the condition and sufficient load-bearing capacity.
The shear connectors are screwed into the beams above.

Since the overall flooring is increased, this turns out to be a disadvantage to some extent. So, depending on the local conditions, offsetting of doors, windows and even radiators is unavoidable.



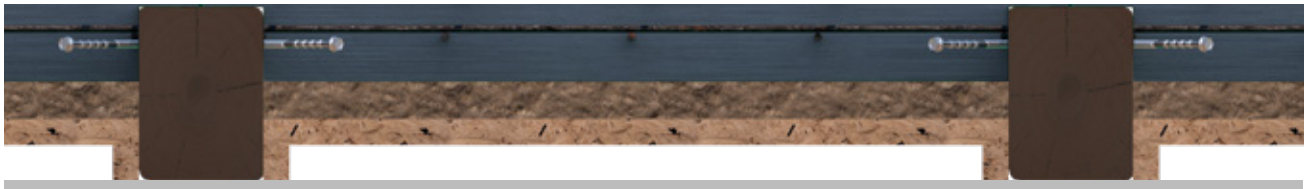
Layered TCC standard ceiling

It is also possible to add wooden components (such as cross-laminated timber) to the surface and thus create a TCC ceiling.



Cross-section of a standard solid wood ceiling

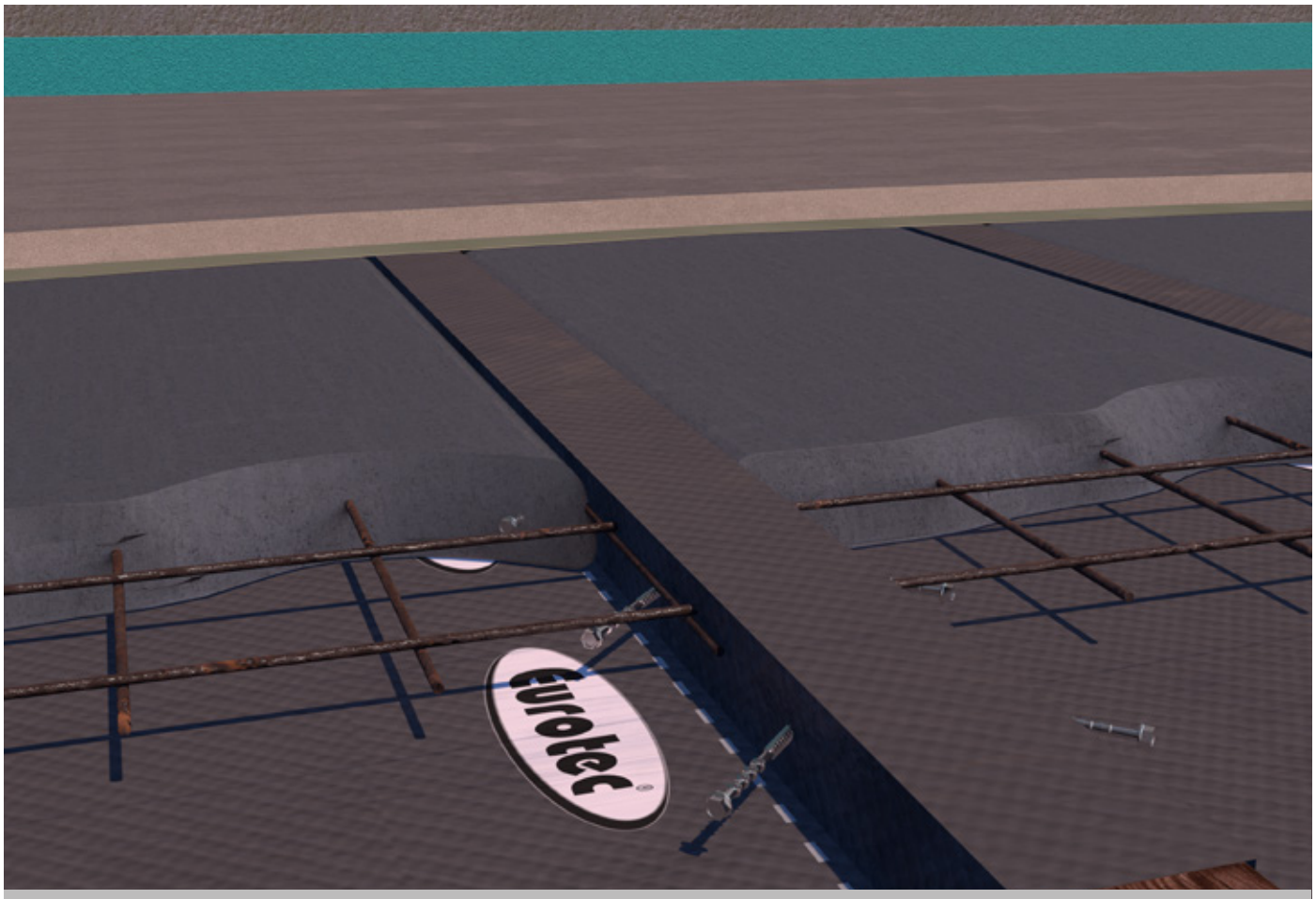
FLAT CEILING



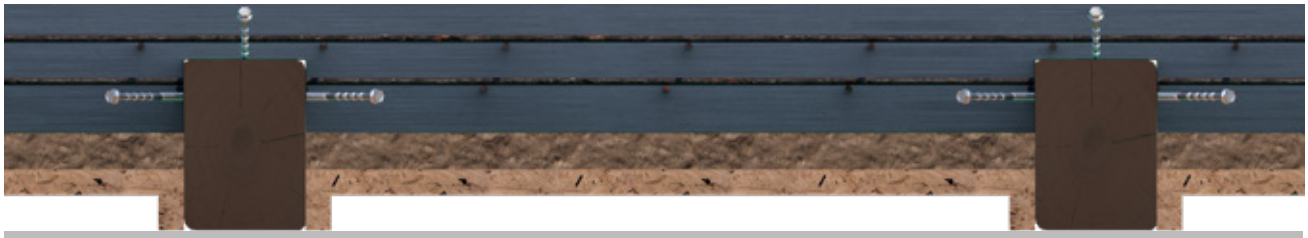
Cross-section of a flat ceiling

If changing the installation height is unavoidable to avoid offsetting doors, radiators and windows, it is advisable to design the TCC ceiling as a flat ceiling.
Here, the concrete layer is applied between the beams. The shear connectors are screwed into the sides of the beams. The reinforcement is placed in the gaps and turns out to be more elaborate than with the standard ceiling.

The installation height remains unchanged. However, this potential design does not provide the same load-bearing capacity as the design as a standard ceiling above the beams.



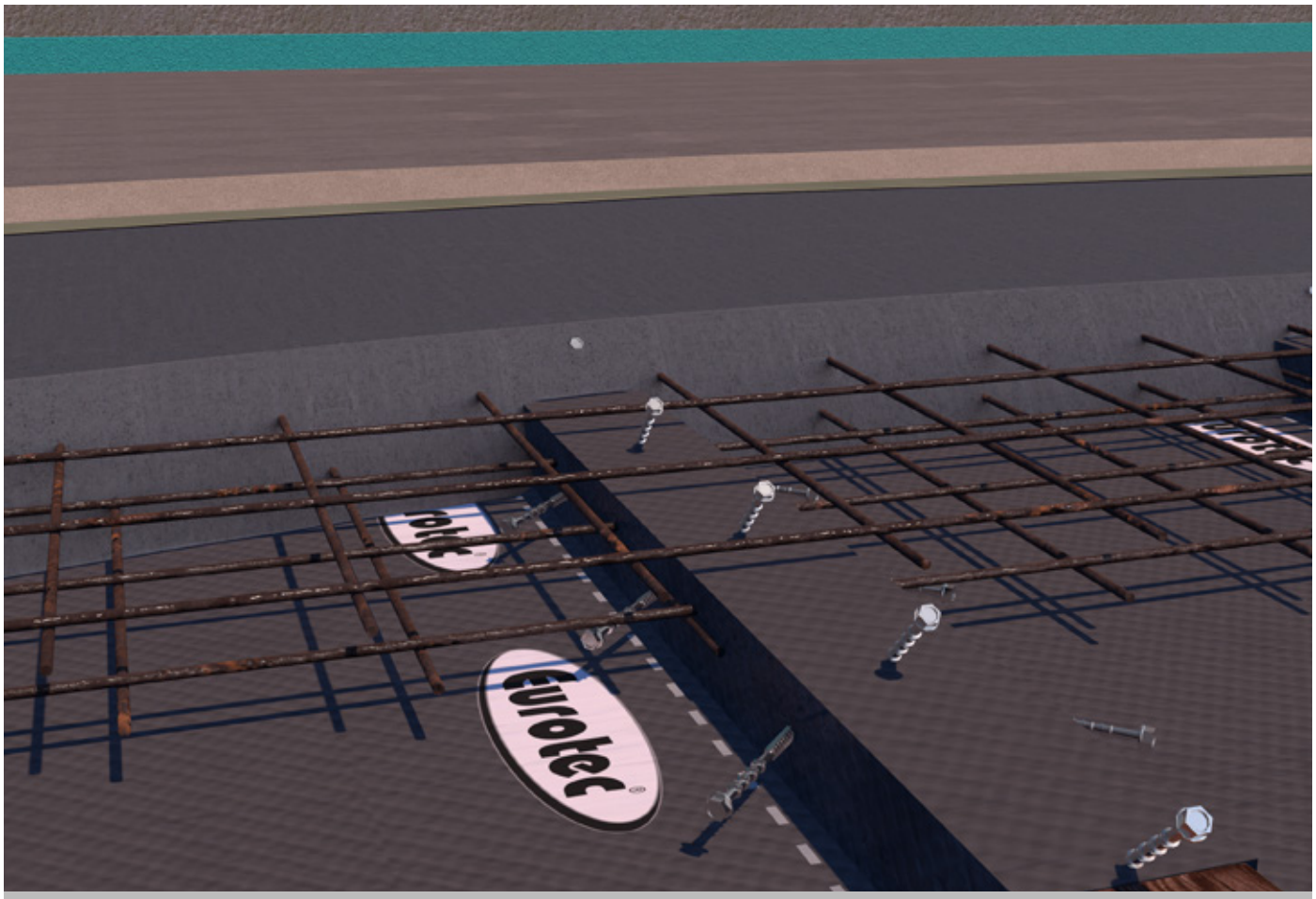
Layered TCC flat ceiling



Cross-section of a combination ceiling

The combination ceiling design is a combination of the standard and the flat ceiling. In this case, the TCC ceiling is created above the beams with an intermediate layer.
The shear connectors are screwed into the beams both laterally and from above. The reinforcement is laid in the gaps and above the beams. Finally, the concrete is poured into the gaps up to above the beams. There is therefore some increase in floor build-up, but less than with the standard ceiling and more than with the flat ceiling.

The load-bearing capacity is also increased less than with the standard ceiling, yet more than with the flat ceiling. So this solution is a compromise of the other two potential designs.



Layered TCC combination ceiling

3 PROCESSING INFORMATION

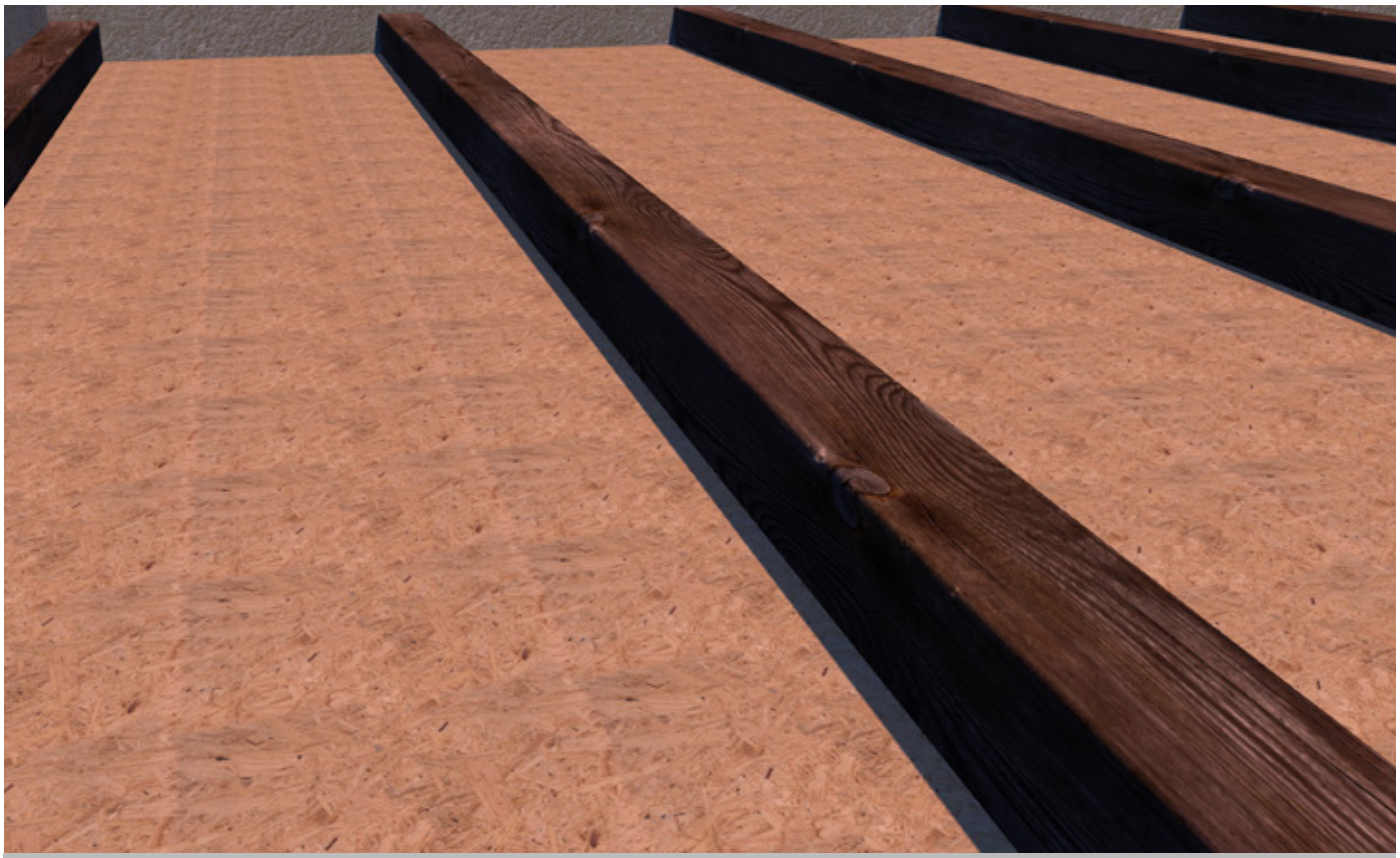
3.1 BUILDING INSPECTION

Before production of the timber / concrete composite system can be started, the condition of the existing ceiling must be inspected. The old wood's residual load-bearing capacity must be checked first of all during this process. It is helpful to open the existing ceiling for this purpose. To do this, remove the top formwork, if there is any, and then remove the fill between the beams and the old insulation until the dead floor is reached. From here, you can now optimally assess the existing ceiling. Here, it is absolutely vital to inspect in the support area. If there is any doubt as to the beams' condition, a wood preservation expert should definitely be consulted. If the beam heads are already dilapidated and unstable, they must be made structurally stable using suitable renovation methods before installing the TCC ceiling. It should be noted that shrinkage cracks and rounded or sloping beam heads can be neglected.

Eurotec NOTE

Expert tip:

We always recommend opening up the existing ceiling to ensure that the inspection is accurate and to fill the cavities with insulation.



Demolishing an existing ceiling

Cross-section of demolishing an existing ceiling

3.2 PREPARING THE EXISTING CEILING

After demolishing and inspecting the existing ceiling (and renovating it too, if necessary), the cavity between the beams must be filled with insulation material. Choose an insulation material that is resistant to foot traffic (e.g. polystyrene or a wood fibre insulation board).

Insulating the existing ceiling

Eurotec NOTE

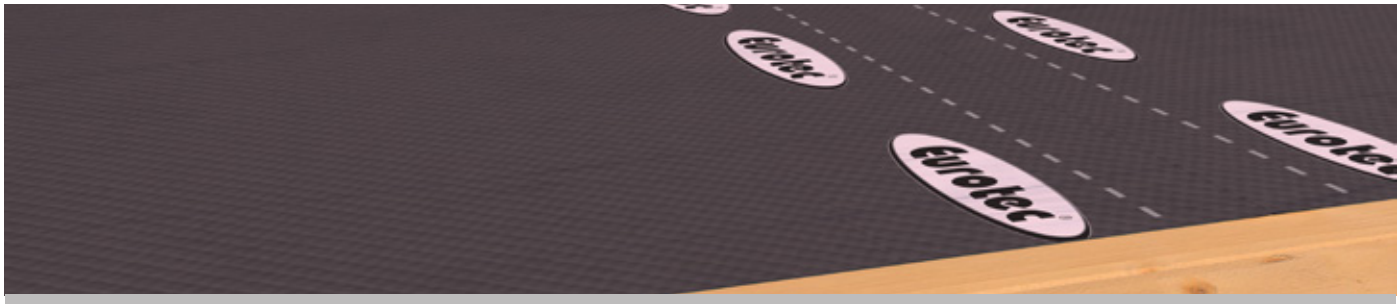
Expert tip:

We recommend fixing the foil with a tacker to ensure tension-free installation. You should also take into account a 30 cm to 50 cm overlap and overhang on the walls.

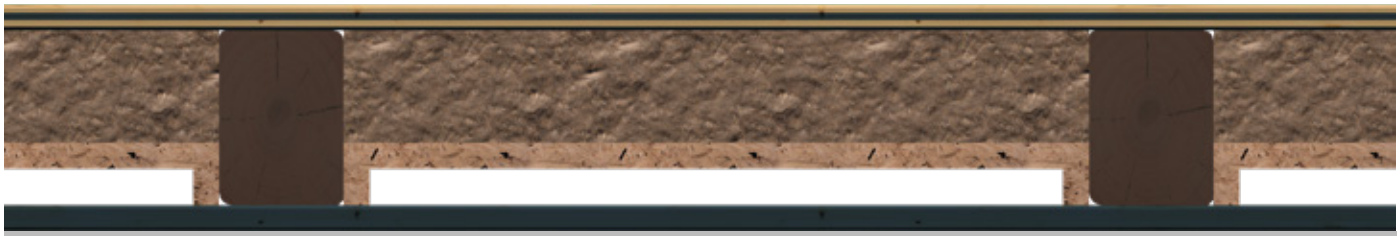
Alternatively or additionally, formwork can be placed above or between the beams. Fixing above the beams is an easier installation process than fixing between the beams.

In contrast, the flooring will be higher overall if you choose to assemble formwork between the beams. These steps are necessary to create a flat surface for the concrete layer.

Furthermore, a foil must be applied to the wood. This acts as a separating and protective layer between the fresh concrete and the timber beams or formwork. The aim of this step is to prevent moisture from penetrating the wood.



Formwork and foil on the existing ceiling



Cross-section of an existing ceiling with insulation, foil and formwork

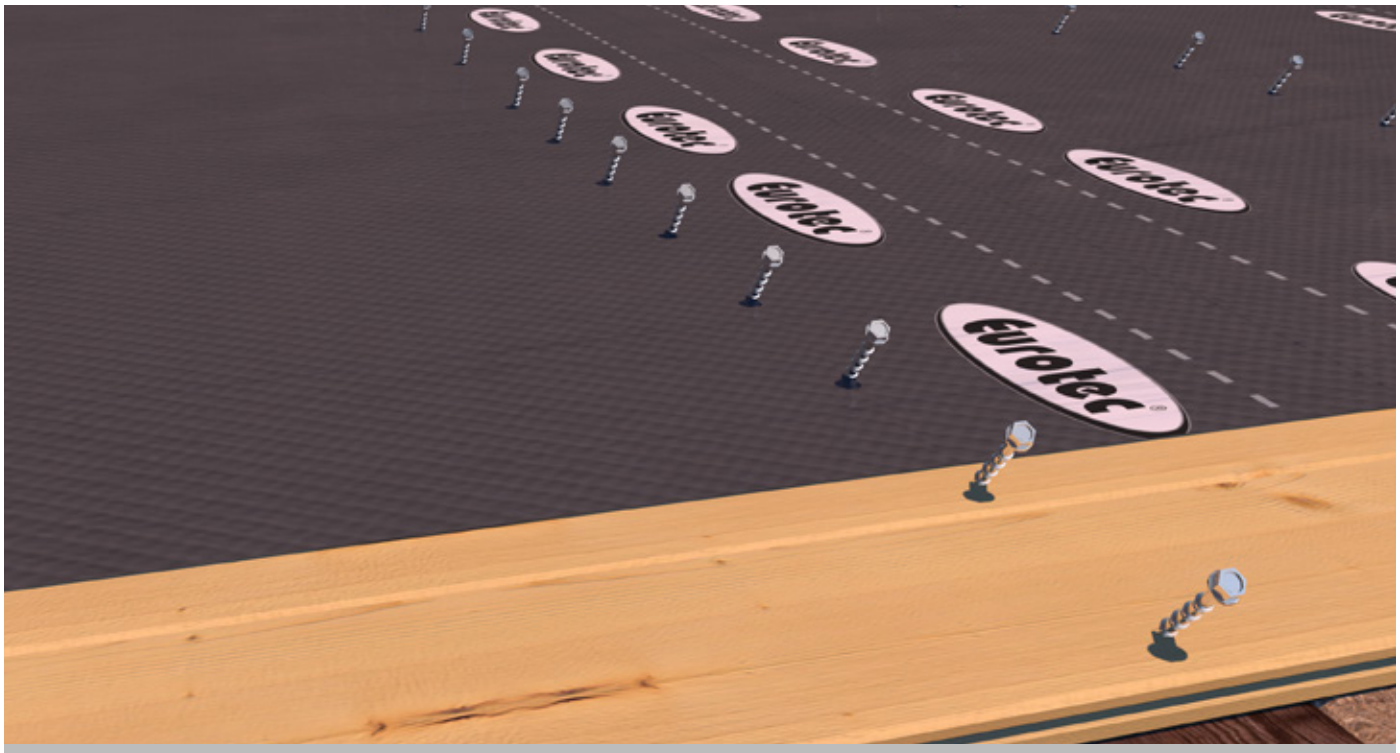
3.3 ASSEMBLING THE CONNECTORS

If the timber beam ceiling has been prepared accordingly, the shear connectors can be set through foil and formwork and into the beam. It is important to observe the static requirement specifications accordingly. The shear connectors are usually arranged at as flat an angle as possible to the shear force. Ideally, they are inclined at a 45° angle to the support. Depending on the static requirements, the screws can be arranged in one, two or more rows. If formwork is present, the anchoring depth in the beam will be less. This is also taken into account during the sizing process or the preliminary calculation. With this system, a sufficient screw head anchoring depth in the concrete is guaranteed.

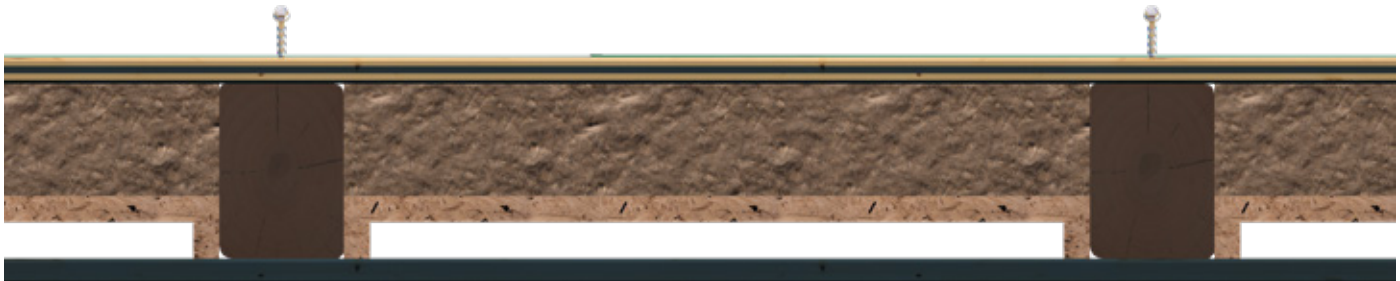
Eurotec NOTE

Expert tip:

When screwing through formwork, we recommend marking the beam edges or the system axis on the formwork surface to ensure that the screw connection is ideal.



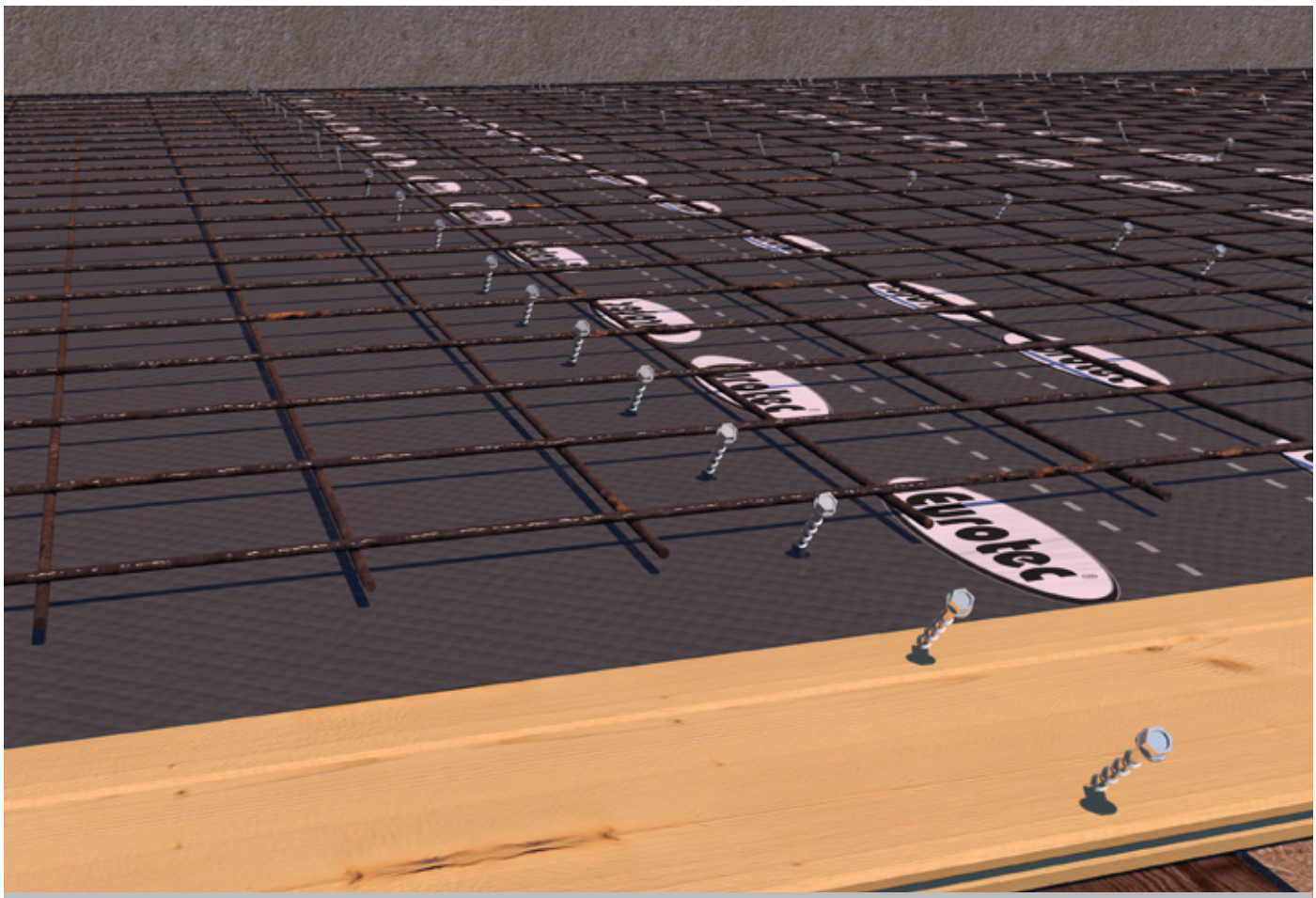
Assembling connectors on the existing ceiling



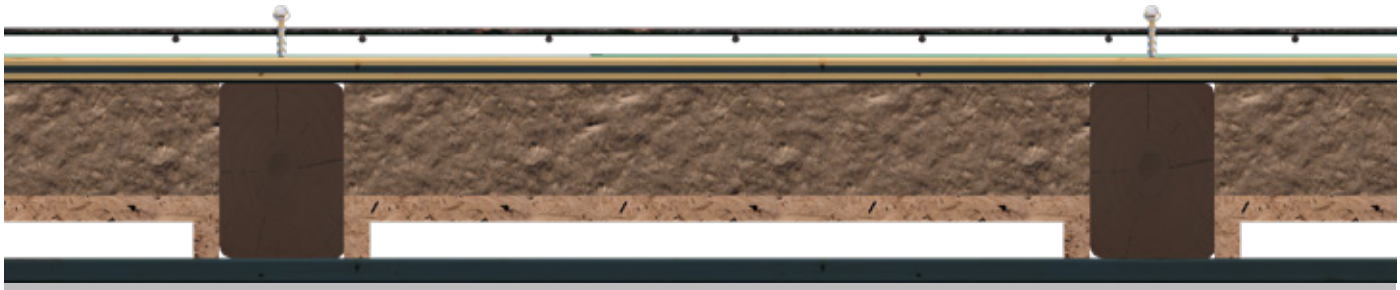
Cross-section of an existing ceiling with connectors

3.4 INSTALLING THE REINFORCEMENT

A minimum reinforcement is prescribed for concrete slabs. It is a good idea to draw up a reinforcement plan in advance so as to not collide with the shear connectors. The reinforcement is laid on spacers. Bar or mesh reinforcement can be installed. It is much easier to install mesh reinforcement, but it has a predefined grid, which can lead to a collision with the shear connectors under certain circumstances. While bar reinforcement does not have a predefined grid, it takes much more time to install.



Installing the reinforcement



Cross-section of reinforcement

3.5 POURING CONCRETE

Before pouring the fresh concrete, it is imperative that the timber beam ceiling is supported on site to prevent additional deformations caused by the concrete's dead weight. Depending on the season and temperature, the supports can be removed again once the concrete has fully set. The concrete should be C20/25 grade as a bare minimum, and is pumped into the desired storey as cast-in-place concrete at the construction site using mixing vehicles. This is followed by smoothing with a surface vibrator. Prefabricated ceiling elements can also be installed in new builds. The wet-poured concrete encases the screw heads. The load from the screw is transferred into the concrete through the contact below the screw head or through the thread flanks and profiling. This prevents conical breakout in the concrete, which limits the screw's load-bearing capacity. After about three days, the concrete layer should be walkable and, with proper curing, it should have reached about 80% of its target strength after 14 days. Regular humidity control is indispensable for post-treatment.

Eurotec NOTE

Expert tip:

To prevent the concrete from drying out too quickly, we recommend covering the fresh concrete layer with foil. This minimises the risk of shrinkage cracks developing.

While the formation of smaller shrinkage cracks can never be ruled out entirely, it can be considered unproblematic, since the shrinkage cracks are automatically pushed back by the compressive flexural stress and, so, the TCC ceiling's load-bearing capacity is not affected. The effort required for post-treatment varies overall and depends on the season and the climatic conditions. The level below the TCC ceiling can still be inhabited and used throughout the entire construction period.

The concrete's target strength is reached after about four weeks of setting time, and the ceiling can be loaded and stressed as planned. The supports can be removed again once setting is complete. The timber beam ceiling's existing sags have been reduced following completion, making the ceiling deformation-free and even.

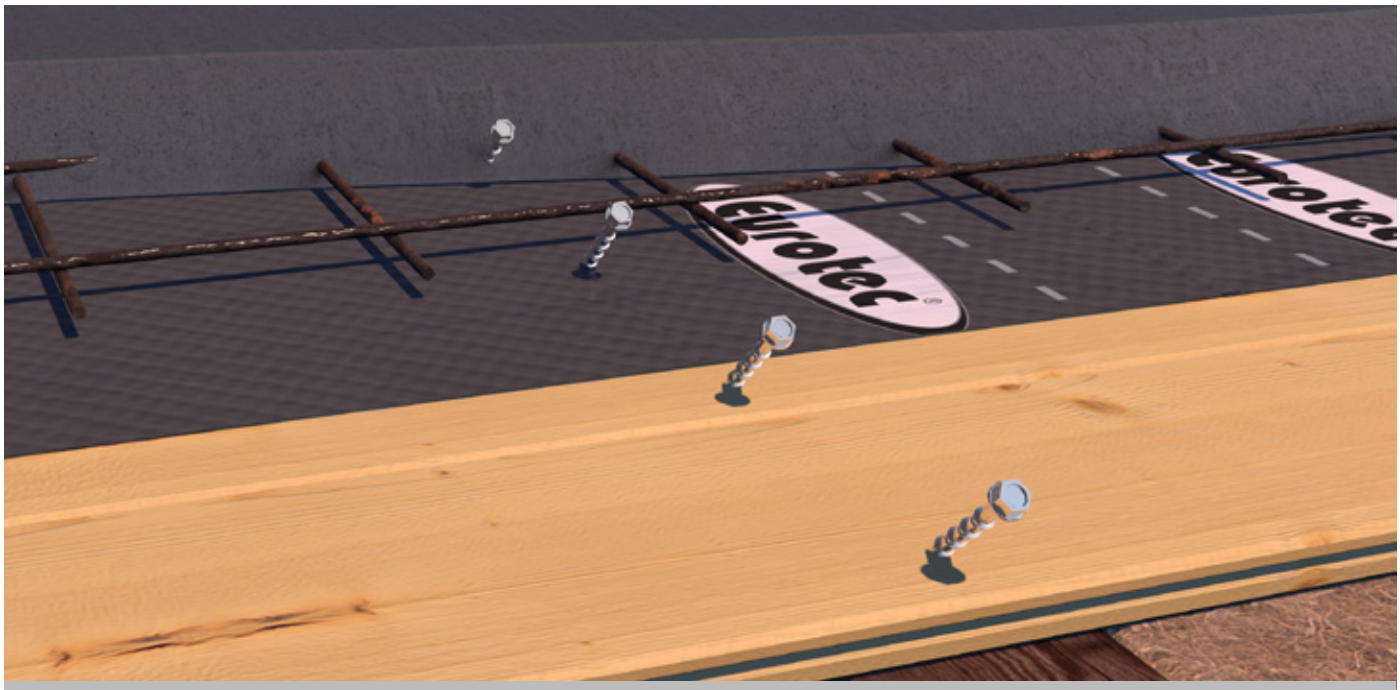
Pouring concrete on the existing ceiling

Eurotec NOTE

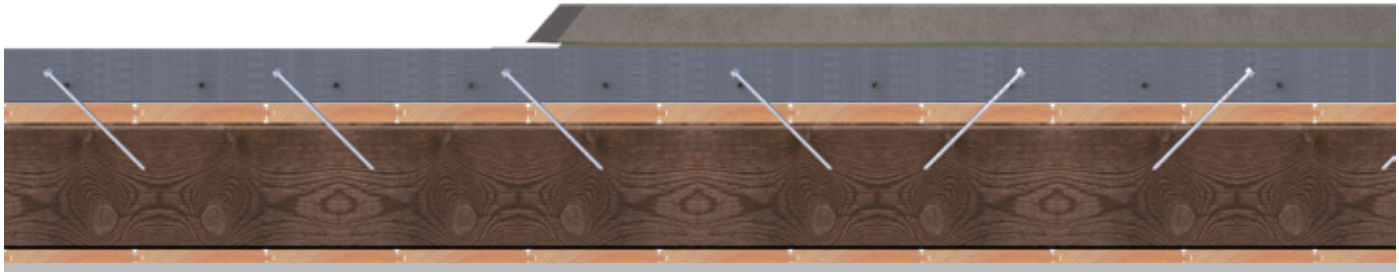
Expert tip:

We recommend using dry screed. It weighs less, a lower installation height can be created, and waiting times are avoided.

Once the concrete has set completely, application of the rest of the floor structure can begin. As a rule, impact sound insulation is laid first of all, followed by the wet or dry screed.
Finally, the desired final covering can be laid on the screed layer. This can be tiles, parquet, laminate, carpet or a similar covering. When laying parquet or laminate, it is also a good idea to lay impact sound insulation on the screed.



Impact sound insulation and screed on the TCC ceiling



Cross-section of TCC ceiling, impact sound insulation and screed

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ANY QUESTIONS? WE'RE HAPPY TO HELP!

Do you have any more questions about TCC or other topics?
Contact **our experts** now!

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