

# TECHNICAL MANUAL

## DELTABEAM® Slim Floor Structure With Timber Construction

Version PEIKKO GROUP 01/2023



# DELTABEAM® Slim Floor Structure

## With Timber Construction

- Suitable with various types of timber and composite timber floors
- Saves building height
- Allows architectural freedom and open spaces with minimum columns
- Eases HVAC installation
- Has integrated fireproofing without additional protection
- Enables fast and safe erection process
- Is a certified product (CE mark and EPD certifications)

DELTABEAM® Composite Beam allows combining a renewable and ecological material, timber, with two of the strongest materials, steel and concrete. DELTABEAM® is an excellent solution for creating a slim floor structure with timber slabs, which is generally not possible for traditional timber structures on long spans. Typically, DELTABEAM® timber composite solution reduces construction height between 10 to 30 percent.

DELTABEAM® composite action between concrete and steel allows long spans that create open spaces with minimum columns. The beams are integrated in the slabs, which guarantees architectural freedom. Smooth ceilings enable additional room height and easier technical installations. Additionally, fireproofing is already integrated into DELTABEAM®, eliminating the need for complex fire protection on-site.

DELTABEAM® Green matches perfectly with the sustainability of timber floors, as it is made with 90% recycled steel. The environmental impact of DELTABEAM® Green has been reduced significantly compared to traditional steel structures. The environmental impacts are confirmed by EPD and the carbon footprint is minimized in combination with timber floors.

Since 1989 DELTABEAM® Composite Beams have been used in thousands of buildings globally. DELTABEAM® Composite Beams have been subjected to a rigorous testing program and the solution is widely approved in various countries. Peikko technical support is always available to help you to find the most suitable solution for your project



# CONTENTS

<b>About DELTABEAM® Slim Floor Structure .....</b>	<b>4</b>
<b>1. Product properties .....</b>	<b>4</b>
1.1 Structural behavior .....	6
1.1.1 Temporary conditions .....	6
1.1.2 Final conditions .....	7
1.1.3 Accidental situations and extreme load case scenarios .....	10
1.1.4 Fire situation .....	10
1.2 Application conditions .....	14
1.2.1 Loading and environmental conditions .....	14
1.2.2 Positioning of DELTABEAM® .....	16
1.2.3 Interaction with floor units .....	16
1.2.4 Expansion and construction joints of the slabs .....	19
1.2.5 Holes and additional connections .....	20
1.3 Other properties .....	20
1.4 DELTABEAM® Green .....	23
<b>2. Resistances .....</b>	<b>24</b>
<b>Selecting DELTABEAM® .....</b>	<b>25</b>
<b>Design phases and delivery process .....</b>	<b>28</b>
<b>Annex A – Initial information .....</b>	<b>29</b>
<b>Annex B – The possibilities DELTABEAM® offers .....</b>	<b>30</b>
<b>DELTABEAM® with Timber Floors Installation Instructions .....</b>	<b>33</b>

## About DELTABEAM® Slim Floor Structure

### 1. Product properties

DELTABEAM® is a slim-floor composite beam that is integrated into the floor. The beam is completely filled with concrete on-site. The infill concrete and DELTABEAM® form a composite structure after the concrete has hardened. DELTABEAM® acts as a steel beam before the infill concrete has reached the required strength. DELTABEAM® is made of cut steel plates and welded together at the factory (*Figure 1*).

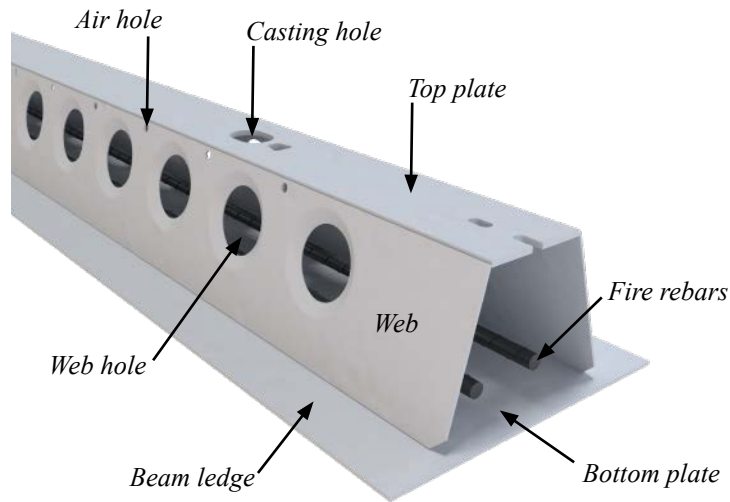


Figure 1. DELTABEAM® parts.

There are two types of DELTABEAM® (*Figure 2*). The D-type DELTABEAM® has ledges on both sides of the beam. This beam type can carry floor units on both sides of the beam. The DR-type DELTABEAM® has a one vertical web and ledge only on one side. DELTABEAM® Composite Beams can be used as single-span beams or in multi-span beam construction.



Figure 2. DELTABEAM® types with timber floors.



DELTABEAM® Composite Beams can be used with timber, concrete, steel and composite columns. Columns can be single or multistorey, so that DELTABEAM® Composite Beams are connected either with corbels or fixed to the top of the column with bolts or welds respectively. More information about different usage alternatives of DELTABEAM® can be found in DELTABEAM® Composite Beams Technical Manual.

Complex architectural shapes can be achieved with DELTABEAM® (Figure 3). The bottom plate of DELTABEAM® can even be covered with timber boards so to have a complete timber ceiling. The interior design and aesthetic are then enhanced.



Figure 3. Examples of complex architectural shapes and well-refined interior spaces.

DELTABEAM® Composite Beam can be used with several types of timber floors, including mass timber slabs (CLT, GLT, NLT, DLT) and composite timber slabs or beam decks. Precast composite units can be used as well. Examples of timber floor systems with DELTABEAM® are shown in Figure 4. In the case of composite slabs, concrete topping can be either flush or overlapping with DELTABEAM® top plate, depending on the thickness of beam and slab. DELTABEAM® can be also provided with a downstand (Figure 5), if needed.

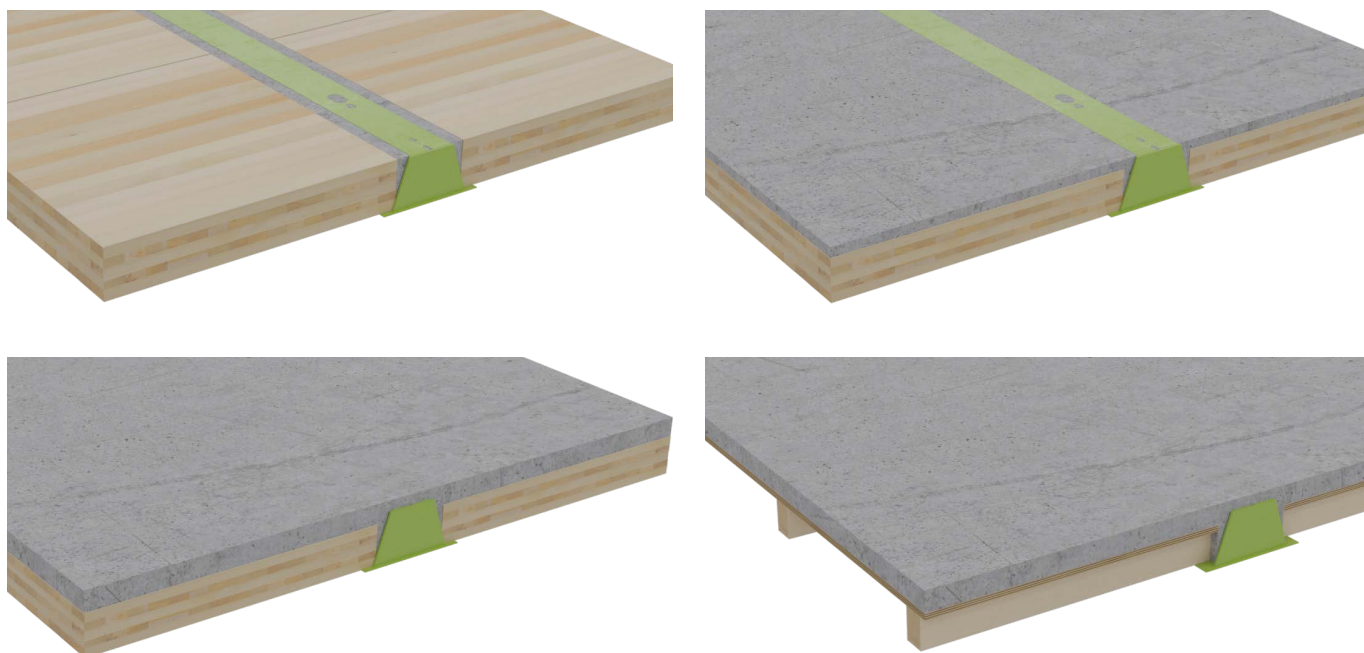


Figure 4. Examples of timber floor systems with DELTABEAM®.



Figure 5. DELTABEAM® with downstands.

## 1.1 Structural behavior

Two stages can be identified in the design of DELTABEAM®. DELTABEAM® acts as a steel beam in a temporary stage while the composite action of DELTABEAM® and concrete is achieved only in the final stage.

### 1.1.1 Temporary conditions

DELTABEAM® acts as a steel beam before the infill concrete has reached the required strength. During the erection stage, all loads are transferred to DELTABEAM® through the beam ledges (Figure 6). It is important to position the timber slab unit end correctly onto the beam ledge because this affects DELTABEAM® design (see Section 1.2.2).

The erection stage design is carried out in accordance with elastic design principles, with the loads acting in the erection stage. The precamber of DELTABEAM® compensates for the deflection in the erection stage. The amount of precamber depends on the length of DELTABEAM®, on the loads in the erection stage and on the selected static system.

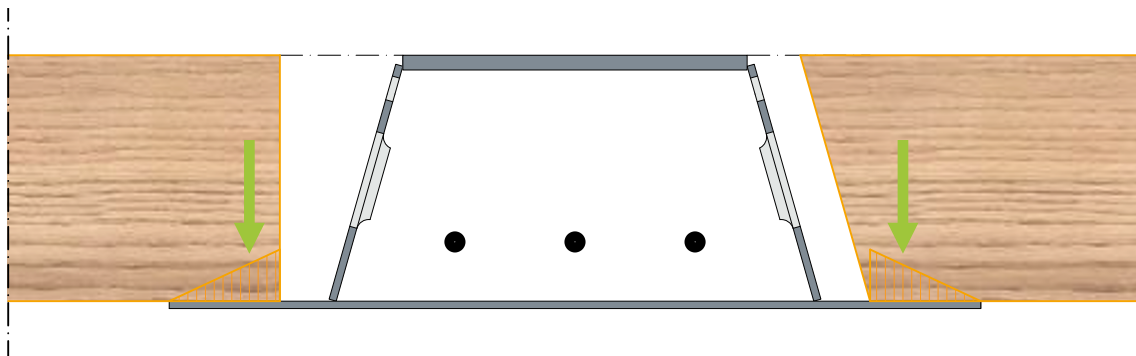


Figure 6. Load transfer in the temporary condition.

The effects of loads such as torsion during the erection stage must be taken into account when designing the connection details and the supporting structures. For example, variable beam spacing, variable load values, or asymmetrically assembled floors can cause torsion.

Temporary propping of DELTABEAM®, slab units or both can be used to take the loads acting in erection stage (Figure 7). Propping needs to be carried out in accordance with the project's erection method statement. Props should not be removed until the slab cast and the infill concrete of DELTABEAM® have reached the required strength. Peikko shall be informed about how the floor system will be propped as it affects DELTABEAM® design.

As DELTABEAM® connection to the column is generally pinned, it is recommended to prop DELTABEAM® against torsion in the area of the column in order to prevent the beam from rotating at the supports. If no propping is used, DELTABEAM® connections and supporting structures must then be designed to carry all the erection loads including torsion.

More information about propping can be found in Section “DELTABEAM® with timber floor installation instructions”. Peikko technical support is always available to help with any installation and propping issues.



Figure 7. Examples of propping method DELTABEAM®.

### 1.1.2 Final conditions

The infill concrete and DELTABEAM® form a composite structure after the concrete has reached the required strength. In the final condition, the loads are transferred to DELTABEAM® through a compression arch against an inclined web (Figure 8). Transverse reinforcement, which is assembled through the DELTABEAM® Composite Beam's web holes, secures the load transfer from the slab to the beam. Full shear connection between the infill concrete and DELTABEAM® is formed by the dowel action of the web holes. Torsion can be handled either by designing DELTABEAM® for torsion or adding torsional ties (see Paragraph 1.2.3).

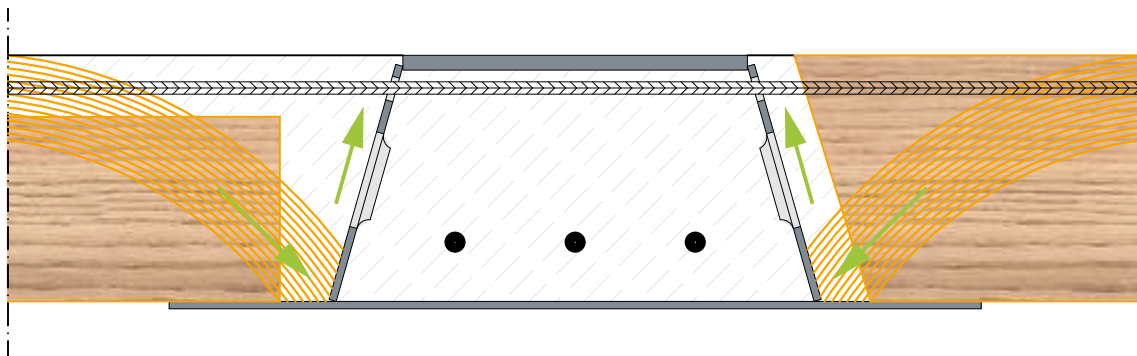


Figure 8. Load transfer in the final condition.



The effectiveness of load transfer has been experimentally assessed (*Figure 9*). Both plain timber and composite timber slabs were loaded up to failure so to maximize the vertical shear on DELTABEAM®. DELTABEAM® was tested with and without the beam ledges, the latter case simulating the fire condition (see Section 1.1.4).

The peak resistance was always higher than the estimated failure load. Additional information can be found in our White Paper - “DELTABEAM® with Timber Floors Load Transfer Tests” ([www.peikko.com/whitepapers](http://www.peikko.com/whitepapers)).



*Figure 9. Load transfer tests DELTABEAM® timber floor system: general and close-up view.*

The structural engineer designs the connections between DELTABEAM® and the supporting structure so that beam's support reactions are transferred to the bearing element, such as column, wall or another beam. Peikko shall be informed about the selected connection type in order to design DELTABEAM®. Peikko is also responsible for designing the internal beam-to-beam connections, such as Gerber and side connections.

Indicative connection types with timber, steel and concrete columns are shown in *Figure 10*. RAMCO® Hidden Corbel enables connecting DELTABEAM® Composite Beam to tall, multi-story columns. RAMCO® Hidden Corbel connects to columns with shear plates and dowel bars. More connection examples can be found in ProdLib, which includes a library of Peikko products ([www.prodlab.com/peikko](http://www.prodlab.com/peikko)).

The appearance of the connection can be finished by beveling or arching the DELTABEAM® bottom plate according to the connection detail.



*Figure 10. Examples of connections between DELTABEAM® and timber, steel, and concrete columns. Bottom center is Peikko's RAMCO® Hidden Corbel.*



In the case of composite timber slabs, the structural engineer is responsible for the design of the connection between the concrete topping and timber floor units or deck. As a rule of thumb, the thickness of concrete topping is 1:3 and that of timber part is 2:3, which generally fulfills the environmental requirements efficiently (see Section 1.2.1). The composite action between timber and concrete can be achieved with Peikko's NILCO® Wood-Concrete Composite Slab Connector which transmits forces between a CLT slab and topping concrete. NILCO® Wood-Concrete Composite Slab Connector is pressed onto the slab and it transfers forces through nails (*Figure 11*).

Also, other type of mechanical connectors, such as screws or hooks, or notched connections can be used (*Figure 12*).

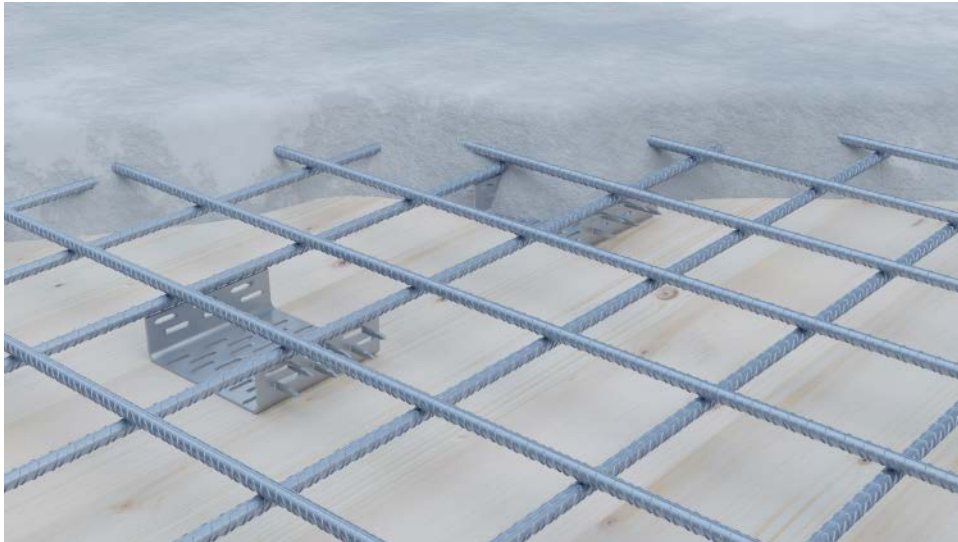


Figure 11. NILCO® Wood-concrete Composite Slab Connector.

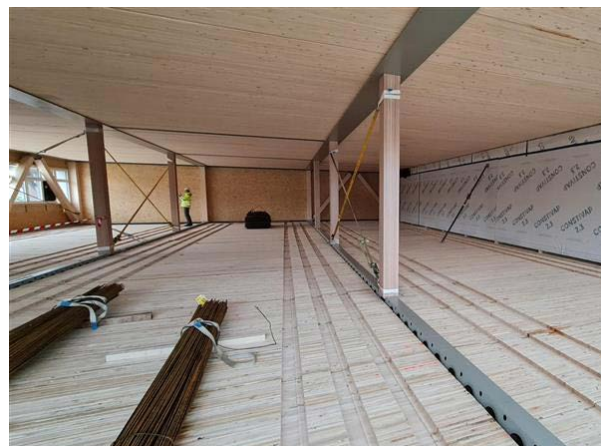


Figure 12. Examples of connection between concrete topping and timber floors.

If needed, the shear connection between concrete topping and DELTABEAM® is achieved by reinforcement bars through the beam and/or by headed studs or hooks on DELTABEAM® top plate, when concrete covers the beam (*Figure 13*). Peikko designs the needed number of connectors and rebars depending on the horizontal shear forces that the slab is transferring to DELTABEAM®.

### 1.1.3 Accidental situations and extreme load case scenarios

Buildings should be designed to carry the extent of localized failure from an unspecified cause without a disproportionate collapse. Extreme load case scenarios, such as an earthquake event or a column loss, should also be considered. Adequate reinforcement and proper connections should be therefore designed in both transverse and parallel directions of the beam in order to transfer in-plane forces.



*Figure 13. Shear connection between concrete topping and DELTABEAM®.*

### 1.1.4 Fire situation

The evaluation of the fire resistance of DELTABEAM® is based on standard fire tests and design guidelines obtained from tests. High fire resistance is achieved by infill concrete and fire rebars, that are installed inside DELTABEAM® at the factory, when needed. In fact, DELTABEAM® fire rebars and webs act as tensile reinforcement in the event of a fire, so that additional fire protection is not needed. DELTABEAM® is designed in compliance with the fire rating requirements of the project, which are generally governed by the fire rating of timber elements. Please contact Peikko local technical support for further information about local approvals.

Despite the presence of steel parts in contact with timber, DELTABEAM® has no negative impact on the fire performance of the timber slab. In fact, the charring rate of the CLT panel is not affected in the joint area. This was proved by charring test, which included details used in practice. Moreover, DELTABEAM® Composite Beam in the charring test were not fireproofed in any of the cross-sections. The results support the observations received from the previously completed small scale test with similar setup (*Figure 18*).

There are different options for the edge geometry of the timber slab, like vertical or inclined end cut shown in *Figure 22*. The geometry of the CLT slab end does not affect the load-bearing capacity of the structure. Both vertical and inclined end cuts can be used in CLT slabs. The effective charring depth in the joint area is about the same for both cuts.



Transverse horizontal reinforcement is needed to tie the floor slab and DELTABEAM® together in order to secure the load transfer in the fire situation (*Figure 14*). The cross-section reduction of the timber panel due to charring changes the load transfer path during time in fire condition. The load arrangement in the 90-minute fire test simulated DELTABEAM® structure with 8 m CLT span, 1.7 kN/m<sup>2</sup> permanent load and 5 kN/m<sup>2</sup> live load ( $\psi_f = 0.7$ ). The performed 90-minute fire test with loading (*Figure 15*) proved that the interface between DELTABEAM® Composite Beam and timber floor can transfer loads in the fire conditions in edge and intermediate beam situations. There was no additional fire proofing used in DELTABEAM® Composite Beams or in CLT slabs. All REI90 requirements were met.

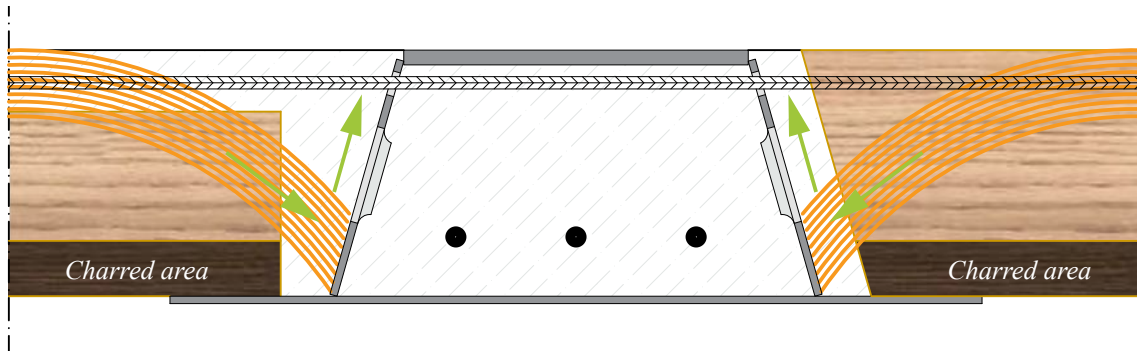


Figure 14. Load transfer in fire situation.



Figure 15. Specimen for REI90 fire test with loading.



After the REI90 fire test, the specimen was demolished to investigate the charring of the structure. According to the measurement data and observations during demolition (*Figure 16*) after the fire test, DELTABEAM® ledge has a protecting effect concerning the charring depth development. The charred timber above the DELTABEAM® ledge stays in place and keeps protecting the joint area after the first lamella of the CLT slab has fallen.

As seen in *Figure 17* the charring happens only at the bottom as expected. The joint concrete is clean without any damage. The fire has not burned through the joint. About half of the second lamella still remains in the joint area while in the middle of the CLT span the second lamella is already fully charred. More information about the charring test and REI90 fire test can be obtained from our White Paper – “High fire performance of DELTABEAM® slim floor joints with timber slabs”.



Figure 16. Specimen from below after REI90 fire test.



Figure 17. Charring in the DELTABEAM® and CLT slab joint, next to the joint concrete.



Figure 18. Small scale test on DELTABEAM® and timber floor.

In addition to all the above-described full-scale loaded fire tests, the satisfactory performance of DELTABEAM® with timber floor systems was experimentally assessed by performing load transfer tests in a simulated fire situation by assuming two worst case scenarios. In the first case, the supporting ledge was removed to simulate the stiffness degradation of DELTABEAM® ledge in fire condition (see Section 1.1.2). In the second case, the cross-section of the timber floor panel was artificially reduced to simulate the charred area (Figure 19).

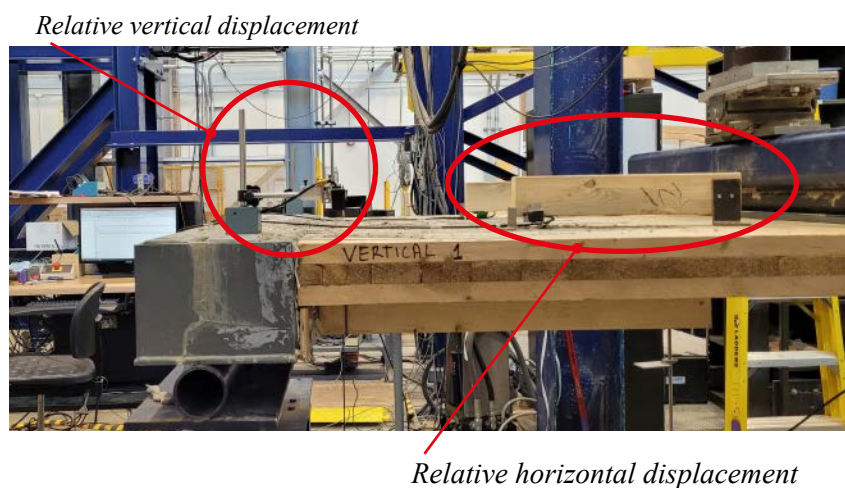


Figure 19. Load transfer tests simulating the fire situation.



## 1.2 Application conditions

### 1.2.1 Loading and environmental conditions

Serviceability limits states need to be considered carefully for timber floor systems as they might be governing the design beside the ultimate load capacity. In particular, deflections and vibration of the floor system and sound insulation should be preferably checked at the early stage of the design as they might affect structural design choices.

The designer is responsible for checking the components of the slab deflection resulting from a combination of actions and at different design stages. Requirements for the maximum allowed deflection might depend on the specific project, national rules and/or material codes. Smaller deflection limits can be applied as well, if needed (e.g. in case of brittle non-structural elements). DELTABEAM® deflections are checked accordingly. DELTABEAM® steel profile can be precambered in case to reduce the final deflection.

Timber floors are sensitive to human-induced vibration due to walking excitation. The response of the floor system is mainly defined by the mass and the stiffness of beams and floor units. Design criteria may then depend on floor fundamental frequency. Vibration analysis of the timber floor structure needs to be done according to EN 1995-1-1. DELTABEAM® is designed to fulfill the same requirements, as being the supporting structure. Optimal solution in terms of slab type and thickness, span length, and costs should be selected accordingly. In general, composite timber slab are more likely to comply with vibration requirements compared to plain timber slab as the length of the span increases.

Vibration requirements for the specific project should be given by the customer. Peikko offers support either by providing needed DELTABEAM® data for the frequency calculation or by performing numerical analyses to verify the fundamental frequency of the floor. Vibration analysis of DELTABEAM® floors due to walking excitation can be carried out as well upon request (Figure 20). According to EN1995-1-1:2004, residential floors should possess a fundamental frequency greater than 8 Hz. If the fundamental frequency is lower than or equal to 8 Hz, a special investigation should be made. In any case, the fundamental frequency should not be lower than 4.5 Hz.

In this regard, National Annexes may provide different limits and additional information. Other ways to provide a criterion for limiting vibration are also possible and may bring satisfactory performance levels even with optimized solutions. Additional information can be found in our White Paper – “Performance Of DELTABEAM® – CLT Floors in Human-Induced Vibration” ([www.peikko.com/whitepapers](http://www.peikko.com/whitepapers)).

If sound insulation requirements exist, the designer is responsible for checking that they are being followed. DELTABEAM® does not affect the acoustic performance of the structure, which is generally determined by components with lighter mass, such as timber slabs and non-structural elements (e.g. partitions). As a general recommendation, composite slabs have better acoustic performance compared with pure timber slabs.

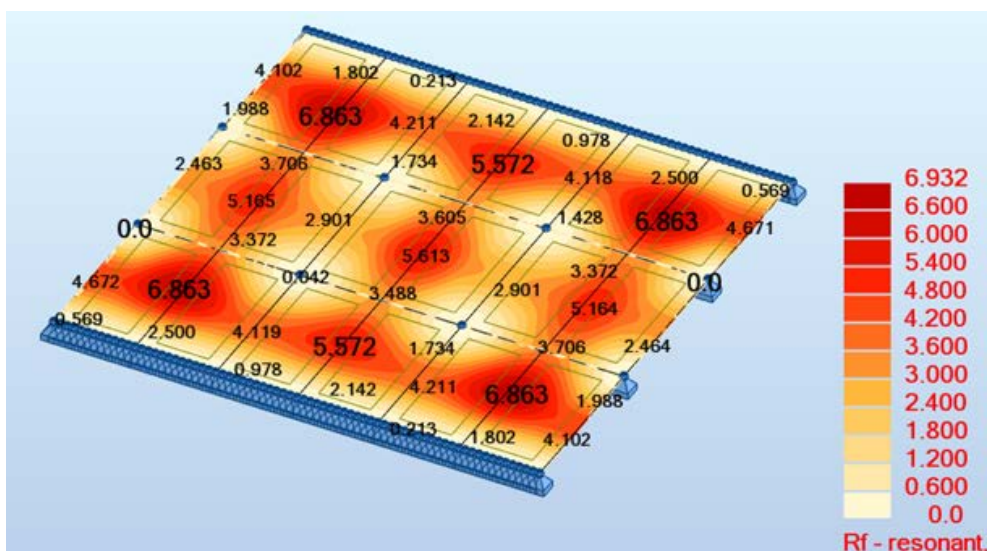


Figure 20. Example of vibration analysis of DELTABEAM® floor.



The order of concrete casting significantly affects DELTABEAM® Composite Beam design. DELTABEAM® should always be cast in full in one run. It is also assumed as a default that the topping concrete of the flooring is cast in a separate phase after the infill concrete of DELTABEAM® has reached the required strength, whenever possible. Peikko should be informed whether the topping concrete is to be cast simultaneously with the infill concrete, for example in case of composite timber slabs where concrete topping surface is flush with DELTABEAM® top plate.

The minimum infill concrete grade in the DELTABEAM® design is C25/30 unless otherwise stated. The recommended maximum aggregate size is 8 mm. This guarantees that concrete is cast smoothly inside DELTABEAM® profile and in the gap between DELTABEAM® inclined web and the edge of the slab. It is also recommended that water-reducing agents are used rather than a high water-cement ratio to improve concrete workability during casting. In any case, guidelines for prevailing environmental conditions and project specific instructions should be followed to achieve proper concrete mix.

The main engineer is responsible for selecting the proper moisture handling method during concrete casting. It is recommended to put expanding tape on ledge bearing areas, i.e. between the ledge and the slab, to prevent water leakage. It is also recommended to protect the end face of the timber slab units that are in contact with concrete, for example with a moisture membrane, to prevent moisture damage to wood structures. This aims to limit the water absorption of the end grain during concrete casting and to keep the relative humidity at an acceptable level. Excessive water absorption may cause concrete cracking during the drying time or aesthetic issues at the bottom surface of the slab. Moreover, the bearing area should be cleaned carefully of any impurities and especially of any saw dust or other excess organic materials before casting. The slab producer should inform if any specific recommendation needs to be followed, such as maximum water to cement ratio, humidity control, or others.

Deltabeam® Composite Beams are either primed or hot-dip galvanized. These surface coating techniques also ensure durability during delivery and installation. DELTABEAM® visible bottom parts, web plates from the edge of the bottom surface to height 50 – 100 mm, end plates, all connections, formworks, and downstands are primed to a minimum 80 µm. Other surfaces are primed to 40 µm. The customer usually does the final painting on-site and it is not a part of standard DELTABEAM® Composite Beams delivery.

HVAC systems can be installed below the floor or, in some cases, inside the floor. Benefits of having a smooth ceiling are the ease of installation and space flexibility (*Figure 21*). If the DELTABEAM® Composite Beams web holes are used for HVAC installation, the impact must be considered when DELTABEAM® is designed. Therefore, Peikko must be informed in order to find the optimal location for the piping.



Figure 21. Integrated HVAC system with smooth ceiling.

### 1.2.2 Positioning of DELTABEAM®

The bearing length of the timber slab unit on DELTABEAM® ledge should allow the compression stresses in the contact area to not exceed the orthogonal compressive strength of timber depending on the design loads. At the same time, the remaining gap between the edge of timber slab, either vertical or inclined, and the root of DELTABEAM® inclined web should be enough for smooth and proper concreting. The recommended minimum gap is 40 mm (Figure 22). Different detailing (such as holes, chamfers, cuts...) of timber edge could be used to ease casting of concrete.

Peikko should be informed about the design bearing length as it affects the dimensioning of DELTABEAM®. If requested by the supplier of the timber slabs, DELTABEAM® with wider ledges can be delivered.

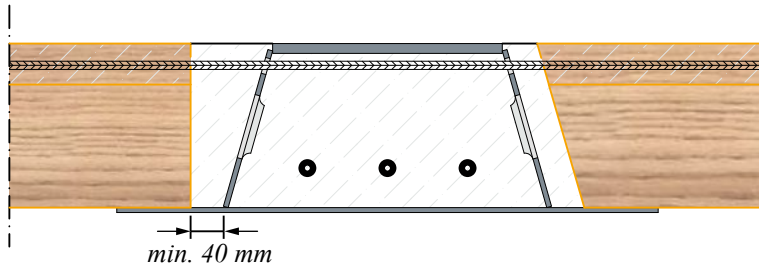


Figure 22. Minimum gap between DELTABEAM® and timber slabs.

### 1.2.3 Interaction with floor units

Transverse reinforcement ensures the load transfer from the floor to DELTABEAM® and provides horizontal tying in the direction orthogonal to DELTABEAM®. Horizontal force transfer in the direction parallel to DELTABEAM® is generally not provided by timber floor units or slabs. The minimum amount of reinforcement depends on design load cases.

Transverse reinforcement is assembled through DELTABEAM® Composite Beam, where rebars can be placed through air holes, web holes or additional web holes. It is anyway preferable to place transverse reinforcement in the most upper part of the cross-section as possible, so that it is located away from expected charred area in case of fire (Figure 23). In case additional web holes are needed, please contact Peikko's technical support.

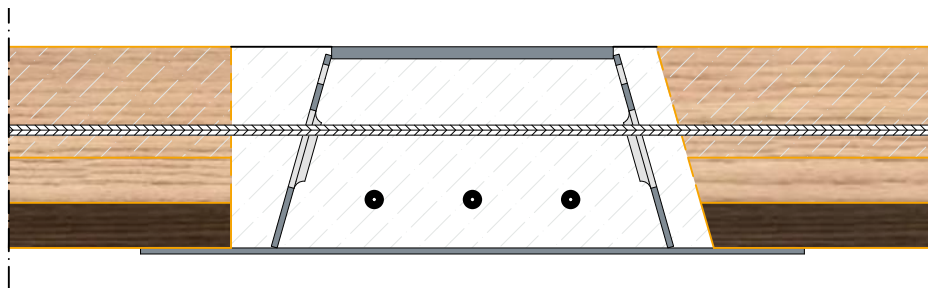
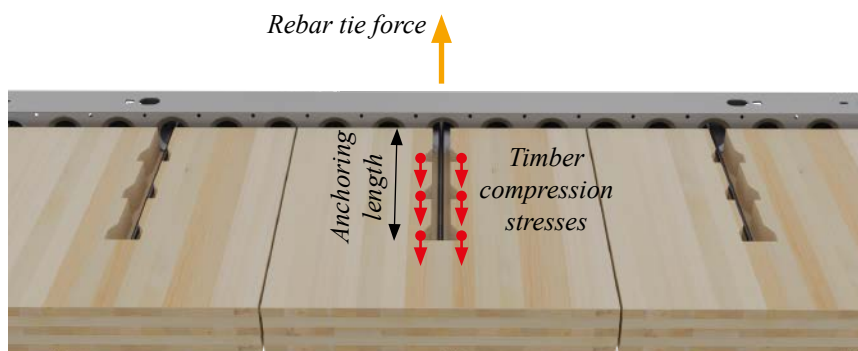


Figure 23. Possible position of transverse rebars.

In case of composite slabs, the transverse reinforcement that is placed through air holes or additional web holes can overlap to reinforcement of the concrete topping. Adequate anchoring length must be provided. In case of mass timber slabs or composite slabs where the transverse reinforcement is placed below concrete topping level, grooves must be cut in the timber panels in order to place the transverse rebars. The following aspects need to be considered:

- The position of the grooves must be defined so that Peikko can design web holes to match the grooves.
- The length of the groove must be sufficient for securing the load transfer, for ensuring proper anchoring length of the rebar and for enabling installation of the rebars on site.
- Width and depth of the groove should guarantee adequate filling of the concrete.

A proposal for the shape of the groove is shown in *Figure 24*. Depth of the groove depends on the depression of the rebar inside the cross-section. It is important to have wide enough grooves especially when the transverse rebar is not only securing the load transfer but also carrying an unsymmetric load, for example. Having a wide enough concrete block along with sufficient amount of reinforcement prevents the concrete from cracking. Compression stresses arising between concrete and the sides of the groove shall not exceed timber compression strength so as to ensure the tying of the slab unit to the beam. Reinforcement must extend beyond the last notch to the end of the groove.



*Figure 24. Example of grooves for joint rebar installation.*

Transverse rebars can act as reinforcement for torsion as well in order to balance back load eccentricities that might arise from uneven load distribution of adjacent spans or in case of edge beams. The magnitude of the torsion varies depending on whether propping is used during the erection stage. The structural engineer in cooperation with Peikko is responsible for the design of reinforcement against torsion.

In case of limited torsional moment, transverse rebars located near the upper surface of the slab might be sufficient to carry tension forces, while compression is taken by the lower part of the timber slab (*Figure 25*). This might be the case of middle beams with uneven span load distribution and/or with hogging bending moment. When torsion effect is more significant, such as in the case of edge beams, transverse rebars should be placed as low as possible so to maximize the internal lever arm (*Figure 26*). In fire situation the elevated temperatures must be considered when placing the transverse rebars.

After the wood under the groove has charred away the concrete starts to heat up following the standard fire exposure. This is a safe assumption when defining the strength of the transverse rebar in fire situation. Since the loads transfer differently in the temporary condition and the final condition, the variation of the lever arm generating the torsional moment during the construction phases shall be considered.



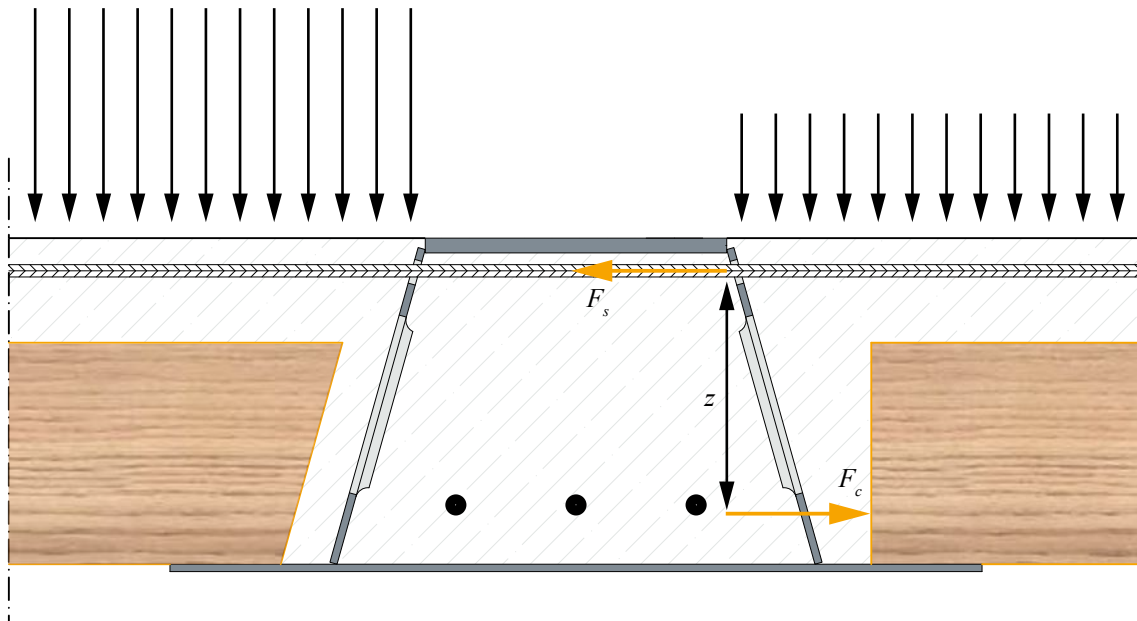


Figure 25. Example of torsion reinforcement in case of D-type DELTABEAM®.

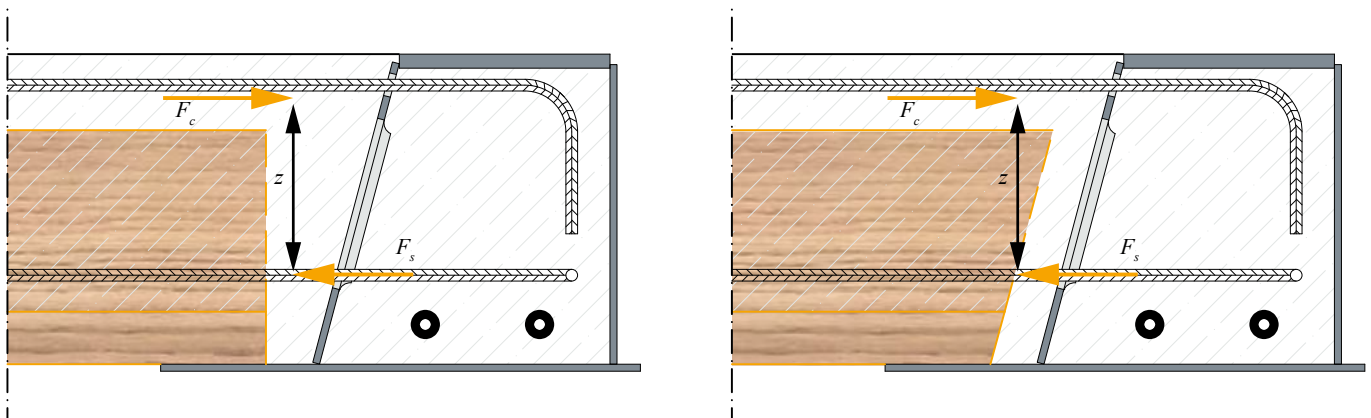


Figure 26. Example of torsion reinforcement in case of DR-type DELTABEAM®.

With the D-type DELTABEAM®, straight rebars assembled through the web holes are anchored with full anchorage length to the slabs on both sides of the beam. The anchorage length of the reinforcement starts from the end of the floor unit. When DELTABEAM® is used as an edge beam, the reinforcement should be anchored inside the beam with hooks.

Mechanical connection is not recommended. If the space inside DR-type DELTABEAM® is not adequate, also the D-type DELTABEAM® may be used as it allows more space for reinforcement between DELTABEAM® and the formwork sheet (Figure 27). Such space can be used to place ring reinforcement as well, if needed.

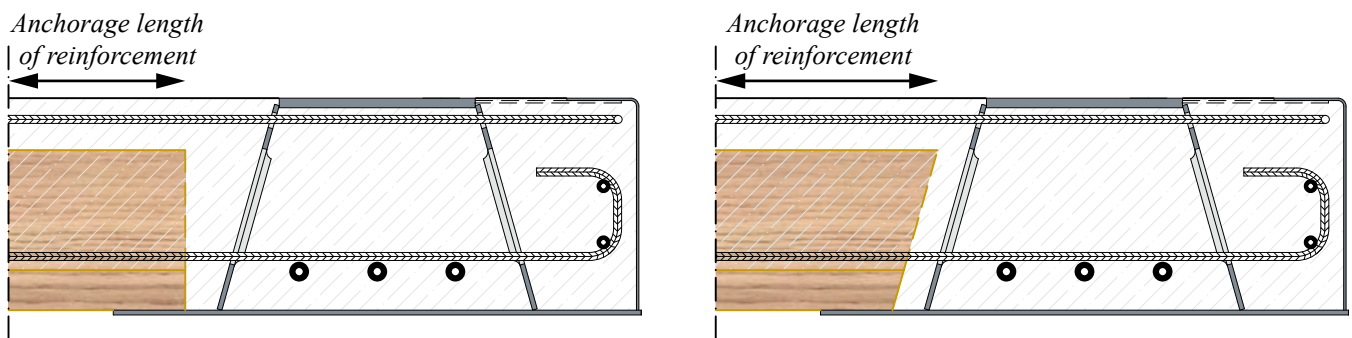


Figure 27. D-type DELTABEAM® used as edge beam with transverse and ring reinforcement.

In case axial resistance is needed, rebars can be placed alternatively inside DELTABEAM® profile or between the timber slab units and the inclined web of DELTABEAM® as ring reinforcement. In case of composite slabs, adequate thickness and reinforcement of concrete topping activates the diaphragm action between slab units. Where concrete topping is not present or adequate, timber slab units can be tied together by transverse reinforcement placed into grooves or pockets cut in the timber slab. In any case, Peikko must be informed if it is required to transfer normal forces through DELTABEAM® profile.

Shear connections account for horizontal shear force transfer between slab units and DELTABEAM® (Figure 28). Participation of the outer concrete to composite interaction is then activated and the slips in both directions are minimized. In the case of composite slabs, shear transfer is provided either by transverse rebars, shear studs or hooks on DELTABEAM®, or both. Concrete topping shall then be connected to timber slab units by proper shear connection, such as screws or notches. In the case of solid timber slab, shear transfer can be provided by screws, pockets and/or rebars placed along the edge of the panel.



Figure 28. Examples of shear connections between DELTABEAM® and timber slab.

#### 1.2.4 Expansion and construction joints of the slabs

DELTABEAM® timber floor systems can integrate expansion joints to allow transverse and longitudinal slab movements, if needed. The structural engineer and/or the slab producer should inform Peikko where such joints are located and how they will be designed, as their presence affects DELTABEAM® design.

The transverse expansion joint acts in the direction of DELTABEAM® longitudinal axis and it is usually solved by console coupling at beam-column connection. A transverse expansion joint can also exist between DELTABEAM® adjacent beams by means of Gerber connection.

The longitudinal expansion joint of the slabs allows the movement of the flooring. The longitudinal expansion joint may be achieved by building double columns and DELTABEAM® Composite Beams. An alternative solution is to place the joint on the beam ledge. In this case, all the loads are transferred through the beam ledge.

DELTABEAM® Composite Beams with expansion joints must be protected against fire from below. When the expansion joint is on the beam ledge, the entire width and length of the beam must be protected against fire (Figure 29). When the expansion joint is at the end connection or the side connection, the protected length must be evaluated on a case-by-case basis.

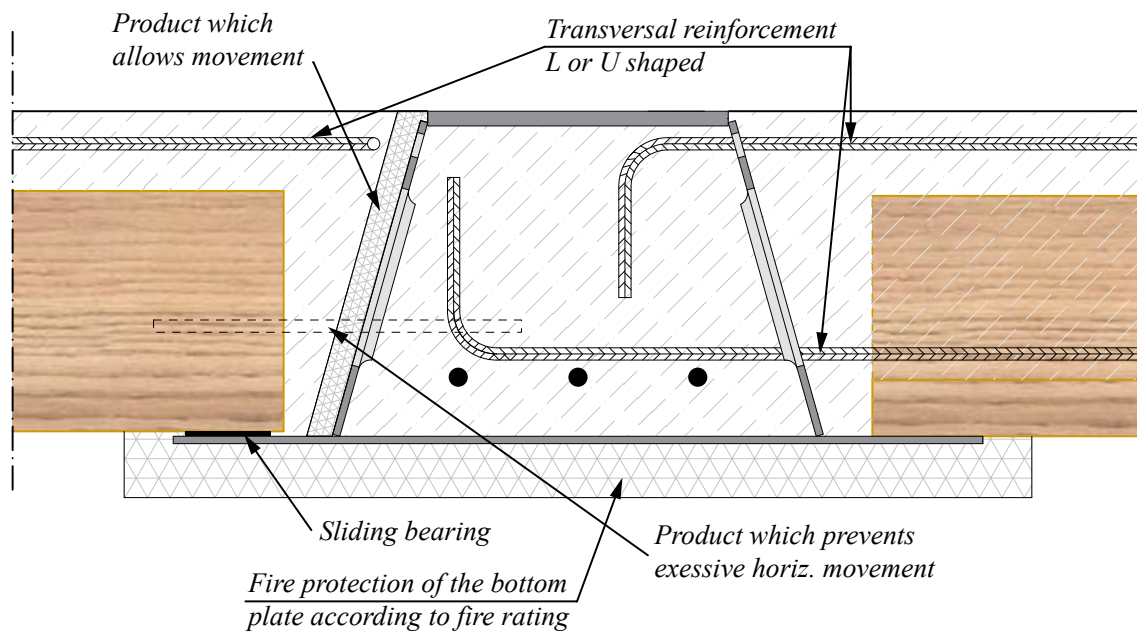


Figure 29. Special bearing to enable movement and fire protection.

The construction joints are placed on a case-by-case basis in co-operation with Peikko so that they can be considered when performing strength calculations. The construction joint should not be built inside DELTABEAM® because DELTABEAM® must always be cast full of concrete in one run.

### 1.2.5 Holes and additional connections

It is preferable to have all the holes made at the factory. Information on holes and attachments should be included in the initial information. Peikko must be always contacted if any changes are to be made. All on-site connections in DELTABEAM® Composite Beams are to be installed in compliance with the instructions provided by the structural engineer. If additional connections are required, Peikko must always be contacted.

## 1.3 Other properties

DELTABEAM® Composite Beams are fabricated from cut steel plates and welded together at the factory. The required number of fire rebars is also assembled inside DELTABEAM®. The properties of the materials are as follows:

<b>Steel plates</b>	S355J2 + N	EN 10025-2
<b>Ribbed bars</b>	BSt500S / B500B	DIN 488
	A500HW / B500B	SFS 1215 / SFS 1268
	B500B	EN 10080
	K500B-T	SS 212540

Steel plates are cut thermally or mechanically. Rebars are cut mechanically. Welding is done with metal active gas welding (MAG) or with submerged arc welding (SAW). The welding class is C (EN ISO 5817).

Peikko Group's production units are externally controlled and periodically audited based on production certifications and product approvals by various organizations.

DELTABEAM® has manufacturing tolerances in accordance with EN 1090-2 Annex D.2, Tolerance Class 1.

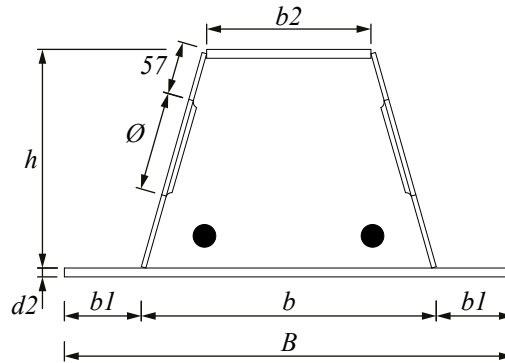
DELTABEAM® Composite Beams are fabricated according to execution class EXC2. If separately agreed with Peikko, DELTABEAM® Composite Beams can also be fabricated according to execution class EXC3.



The DELTABEAM® product sticker includes the DELTABEAM® Composite Beam's type approval, the project information, the beam type, the weight of the beam, and the length of the beam. DELTABEAM® Composite Beams are CE marked and the CE marking sticker is placed on DELTABEAM® Composite Beams.

The standard D-type DELTABEAM® profiles with dimensions can be seen in *Table 1*. The standard DR-type DELTABEAM® profiles with dimensions can be seen in *Table 2*.

*Table 1. The standard D-type DELTABEAM® profiles.*

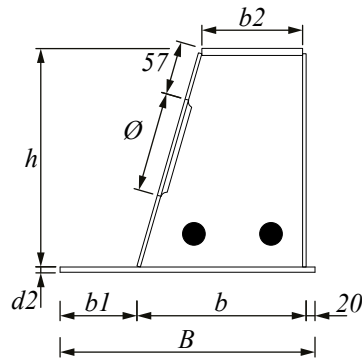


<i>b</i>	<i>B</i>	<i>b1</i> *	<i>b2</i>	<i>d2</i>	<i>h</i>	<i>Ø</i> *
[mm]						
D20-200	395	97.5	100	5 – 30	200	80
D20-300	495	97.5	180	5 – 30	200	80
D20-400	660	130	278	5 – 30	200	80
D22-300	495	97.5	170	5 – 30	220	80
D22-400	660	130	270	5 – 30	220	80
D25-300	495	97.5	155	5 – 30	250	150
D25-400	660	130	255	5 – 30	250	150
D26-300	495	97.5	148	5 – 30	265	150
D26-400	660	130	245	5 – 30	265	150
D30-300	495	97.5	130	5 – 30	300	150
D30-400	660	130	230	5 – 30	300	150
D32-300	495	97.5	110	5 – 30	320	150
D32-400	660	130	210	5 – 30	320	150
D37-400	660	130	180	5 – 30	370	150
D37-500	760	130	278	5 – 30	370	150
D40-400	660	130	180	5 – 30	400	150
D40-500	760	130	278	5 – 30	400	150
D50-500	760	130	230	5 – 30	500	150
D50-600	860	130	330	5 – 30	500	150

\* standard size unless the customer otherwise defines (minimum 40 mm).

\*\* c/c distribution for web holes is always 300 mm.

Table 2. The standard DR-type DELTABEAM® profiles.



<i>b</i>	<i>B</i>	<i>b1</i> *	<i>b2</i>	<i>d2</i>	<i>h</i>	<i>Ø</i> **
[mm]						
DR20-215	335	100	148	5 – 30	200	80
DR20-245	365	100	180	5 – 30	200	80
DR22-250	370	100	180	5 – 30	220	80
DR25-260	380	100	180	5 – 30	250	150
DR26-230	350	100	148	5 – 30	265	150
DR26-260	380	100	180	5 – 30	265	150
DR26-290	410	100	210	5 – 30	265	150
DR26-325	445	100	245	5 – 30	265	150
DR30-270	390	100	180	5 – 30	300	150
DR32-250	370	100	148	5 – 30	320	150
DR32-285	405	100	180	5 – 30	320	150
DR32-310	430	100	210	5 – 30	320	150
DR32-365	485	100	245	5 – 30	320	150
DR37-325	475	130	210	5 – 30	370	150
DR40-295	445	130	180	5 – 30	400	150
DR50-350	500	130	210	5 – 30	500	150

\* standard size unless the customer otherwise defines (minimum 40 mm).

\*\* c/c distribution for web holes is always 300 mm.

## 1.4 DELTABEAM® Green

DELTABEAM® Green is the way to go if you wish to lighten your building's environmental footprint (see *Figure 30*). It is a product manufactured from recycled steel with the same structural benefits of a regular DELTABEAM®.

Over 90% of DELTABEAM® Green manufacturing materials are recycled. The environmental impacts are confirmed in our 3rd party verified Environmental Product Declaration. Project-specific calculations of CO<sub>2</sub> emission are made based on this EPD. DELTABEAM® Green is the perfect solution when you're calculating the total life-cycle emissions of your project – it cuts CO<sub>2</sub> emissions by up to 50% compared to standard steel, composite, or concrete beams.

Whether your aim is to reach high on BREEAM or LEED standards or reduce the CO<sub>2</sub> emission on your project, DELTABEAM® Green is an easy and efficient solution. See *Figure 31* with DELTABEAM® Green and cross-laminated timber (CLT) slabs.



Figure 30. DELTABEAM® Green benefits.

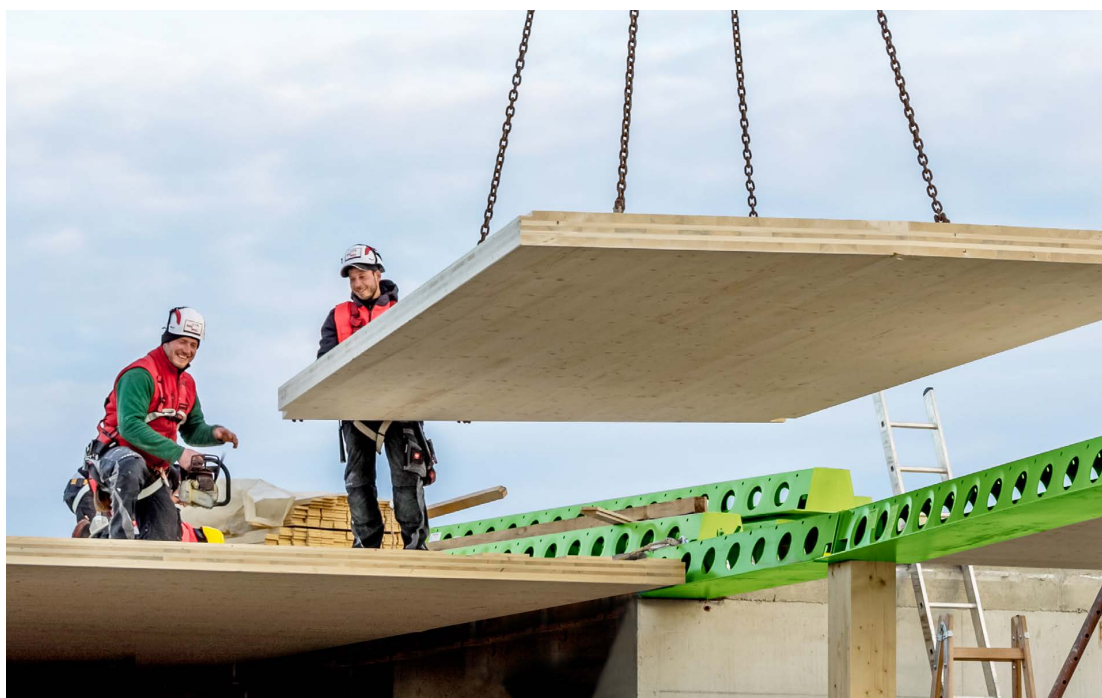


Figure 31. DELTABEAM® Green with CLT slabs.



## 2. Resistances

DELTABEAM® Composite Beams are CE marked through harmonized standard EN 1090-1. Eurocodes and National Annexes are considered in the designs of DELTABEAM® Composite Beams. The resistances of DELTABEAM® Composite Beams are determined by a design concept that refers to the following standards:

- EN 1990
- EN 1991
- EN 1992
- EN 1993
- EN 1994

With timber floors, the dimensions of the structural grid are usually governed by serviceability limit states of the slab. DELTABEAM® profile selection is based on span lengths and acting loads.

The predimensioning of DELTABEAM® Composite Beams can be carried out by using Peikko Designer® DELTABEAM SELECT Software ([deltabeamselect.peikkodesigner.com](https://deltabeamselect.peikkodesigner.com)).

## Selecting DELTABEAM®

The preliminary DELTABEAM® profile selection is made based on *Table 1* and *Table 2* and the basis of Peikko Designer® DELTABEAM SELECT software. If a special DELTABEAM® profile is needed, please contact Peikko technical support.

The standard depth of DELTABEAM® is 200 – 500 mm. Minimum depth is 180 mm and maximum depth is 700 mm. DELTABEAM® profiles are usually with beam depths equal to the depth of the flooring units. If a deeper DELTABEAM® profile is needed, it is possible to use a downstand on the beam ledge. DELTABEAM® downstand depth may vary from side to side of the beam to accommodate differing slab profiles.

The standard maximum DELTABEAM® length is 13.5 m. If DELTABEAM® Composite Beams longer than 13.5 m are needed, please contact Peikko technical support. Longer DELTABEAM® Composite Beams usually require special shipping arrangements.

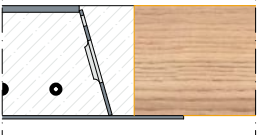
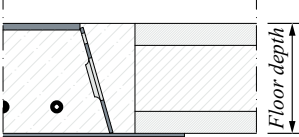
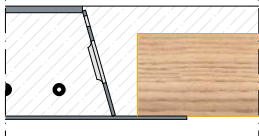


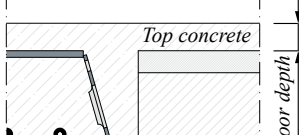
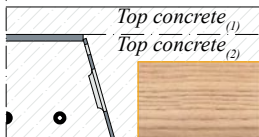

### Peikko Designer® DELTABEAM SELECT Software

Peikko Designer® DELTABEAM SELECT is a free dimensioning software that is available online on Peikko website ([deltabeamselect.peikkodesigner.com](http://deltabeamselect.peikkodesigner.com)) and included in Peikko Designer® software as well. It can be used to select DELTABEAM® profiles for a quotation request.

The preselection procedure is typically as follows:

#### USER INPUT

- Project data
- DELTABEAM® data
- Slab data
- Timber slabs are not yet included in the software. The user should select the hollow-core slab type with the thickness closest to the floor depth, in case of both plain timber slab and composite timber slab. Floor depth is meant to be as equal as height of DELTABEAM® profile. Top concrete going over DELTABEAM® profile should be input separately (see the table below).
- Loads
- The slab weight should be modified considering the area load of the floor i.e., timber panel plus part of top concrete flush with DELTABEAM® if exists. The weight of top concrete going over DELTABEAM® profile is automatically considered by the software.
- Fire resistance.

Design Case	DELTABEAM® SELECT option	Example
		CLT panel 200 mm Floor depth = 200 mm $\Rightarrow$ select HC20 Slab weight = Panel weight = 1.50 kN/m <sup>2</sup>
		CLT panel 180 mm / 80 mm top concrete Floor depth = 180 mm + 80 mm = 260 mm $\Rightarrow$ select HC27 Slab weight = Panel weight + top concrete weight = 1.35 kN/m <sup>2</sup> + 2.00 kN/m <sup>2</sup> = 3.35 kN/m <sup>2</sup>
		CLT panel 200 mm / 100 mm top concrete Floor depth = 200 mm $\Rightarrow$ select HC20 Top concrete = 100 mm Slab weight = Panel weight = 1.50 kN/m <sup>2</sup>
		CLT panel 200 mm / 70+50 mm top concrete Floor depth = 200 mm + 70 mm = 270 mm $\Rightarrow$ select HC27 Top concrete <sub>(1)</sub> = 50 mm Slab weight = Panel weight + top concrete <sub>(2)</sub> weight = 1.50 kN/m <sup>2</sup> + 1.75 kN/m <sup>2</sup> = 3.25 kN/m <sup>2</sup>

\* Note: When timber floor unit is thinner than DELTABEAM®, the user has to split the top concrete in two parts:  
Top concrete<sub>(1)</sub> = top concrete going over DELTABEAM®  
Top concrete<sub>(2)</sub> = top concrete within DELTABEAM® depth

PROJECT CASES

New case

LOCATION

SPACE TYPE

BEAM

SLAB

Left

Right

LOADS

7000 mm

7000 mm

z

CASE PROPERTIES

SLAB OPTIONS

Slab type

Hollow-core

Slab model

HC27

Top concrete

0

mm

Slab dimensions

Slab depth

200

mm

Slab weight

2.35

kN/m<sup>2</sup>

Slab span

7000

mm

Slab only this side of the beam

☐

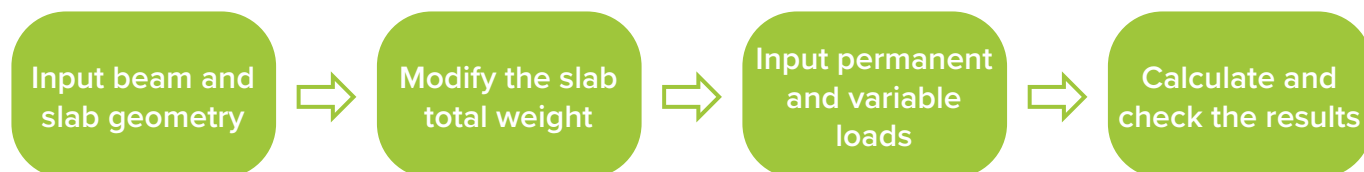
26

DELTABEAM® SLIM FLOOR STRUCTURE - TIMBER CONSTRUCTION



## SOFTWARE OUTPUT

- Result of the analysis, which consist in one to three recommended DELTABEAM® profiles.
- The software generally provides two slim floor options with standard and wider DELTABEAM® profile and an option with downstand.
- The bending moment values and diagrams in the erection stage, final stage, and fire design.
- The shear force values and diagrams in the erection stage, final stage, and fire design.
- Total deflection in final stage with DELTABEAM® precambering.
- NOTE! SLS utilization ratio is indicative. Calculated deflection might be lower than the real one in case of plain timber slabs. Check of the exact values is carried out by Peikko when dimensioning DELTABEAM®. Vibration analysis is not a feature of DELTABEAM SELECT.
- Economically efficient solution.
- The CO<sub>2</sub>e values calculated for plain DELTABEAM® profile in A1 – A3 stages.



Peikko Designer® DELTABEAM SELECT software calculations are based on basic Eurocode design considering both ultimate and serviceability limit state. Some special designs are excluded (e.g., accidental design, frequency, and flexible shear) as well as local design requirements. The calculation of forces, moments and deformations of the beam structure is based on FEM (Finite Element Method).

Peikko always makes the final design for DELTABEAM® Composite Beams based on exact information from the project.

## Design phases and delivery process

The typical workflow from preliminary design up to delivery is shown in *Figure 32*. Peikko website [www.peikko.com](http://www.peikko.com) contains more information about management of DELTABEAM® projects. Please contact the local Peikko unit to agree on delivery dates.

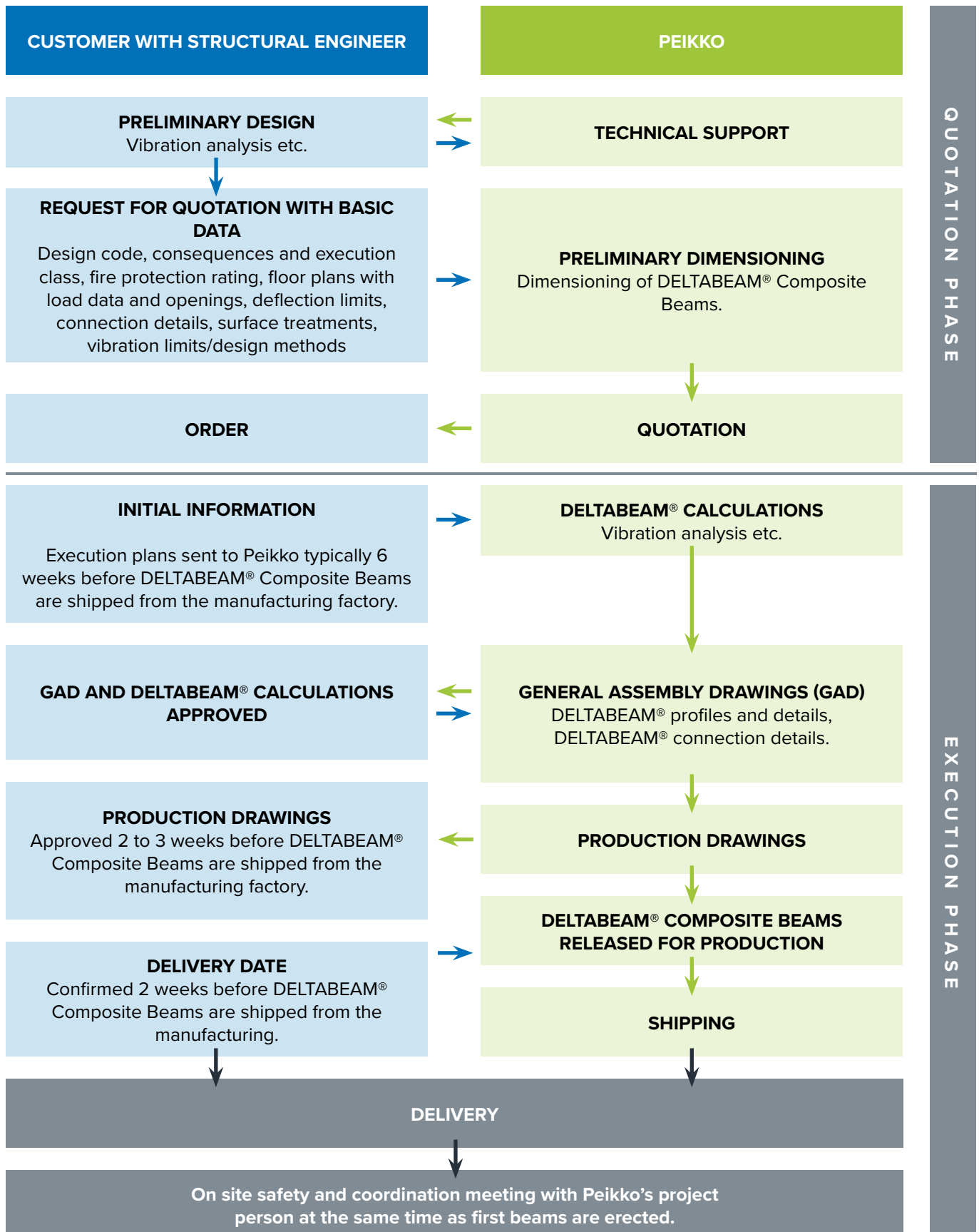


Figure 32. Typical design workflow of DELTABEAM® projects.

## Annex A – Initial information

The following information is required for manufacturing DELTABEAM® Composite Beams and making design calculations:

- Structural drawings in DWG and IFC (floorplan and section drawings) Design code and load data
  - Loads
  - Loading class
  - Fire rating
- DELTABEAM®
  - Connection details
  - Concrete class
  - Special requirement (i.e., extra holes, surface treatment etc...)
- Timber slab type
- Thickness of concrete topping, if exists
- Floor vibration requirements
- Project & contact information (Project Manager, location, preliminary schedule)



## Annex B – The possibilities DELTABEAM® offers

DELTABEAM® Composite Beams have already been successfully used in projects with timber slabs. Peikko DELTABEAM® is an excellent choice as it gives architects the freedom to combine the attractive appearance of wood with the strength of steel and concrete in their designs, and it lets them use long spans and slim floors for the maximum usable interior volume.

Reference projects include different construction types, such as retail and office buildings, residential houses, and educational structures.

77 Wade Ave, Toronto,  
Canada



A 15,000 ft<sup>2</sup> project consisting of 7 floors of office space above 2,500 ft<sup>2</sup> of retail space on the ground floor.



Images courtesy of Next Property Group

# Hopealaakso Kindergarten, Helsinki, Finland



A 2,150m<sup>2</sup> structure consisting of two floors with massive timber slab system topped with structural concrete.



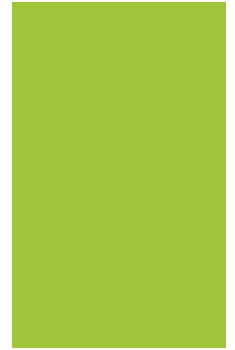


### Gastrochem, Ruggell, Liechtenstein

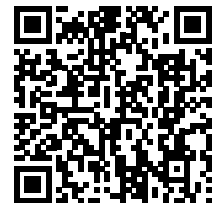


In Ruggell, Liechtenstein stands a unique building in terms of combining different construction materials.

It is where Peikko's DELTABEAM® Composite Beam was used for a wood-concrete composite deck for the first time.



### Frankfurt Westend School Campus, Frankfurt, Germany



Peikko designed the slab system for the demanding building project using a timber-concrete composite structure.





## DELTABEAM® with Timber Floors Installation Instructions

The following DELTABEAM® installation instructions are intended to complement the project's erection method statement. Peikko technical support is available to assist with the erection method statement if required. If there are differences between the erection method statement and this document, the differences should be approved by the structural engineer.

**NOTE:** IF THE INSTALLATION TOLERANCES OF DELTABEAM® ARE EXCEEDED, PEIKKO MUST BE CONTACTED. DELTABEAM® OR CONNECTIONS BETWEEN DELTABEAM® COMPOSITE BEAMS CANNOT BE MODIFIED WITHOUT PERMISSION FROM PEIKKO.

### Deliveries

DELTABEAM® Composite Beams are delivered to the site in accordance with the agreed project schedule. The delivery of each shipment should be confirmed with Peikko two weeks before shipping. At the factory, DELTABEAM® Composite Beams of different lengths are not loaded in the order of installation because that would not be economical or practical. The beams are marked with identification codes in accordance with the drawings.

### Storage on site

The visible bottom parts of DELTABEAM®, web plates from the edge of the bottom surface to height 50 – 100 mm, end plates, all connections, formworks, and downstands are primed to a minimum 80 µm of anticorrosive primer. Other surfaces are primed to 40 µm. The customer does the final painting on-site and it is not a standard part of DELTABEAM® delivery. Special painting can be done upon request.

For long-term storage, the beams must be covered. Piling strips are used under the beams to protect surface treatment. Piling strips should be free from grease or other substances that may damage surface treatment. When storing beams in piles, the bearing capacity and the level of the surface should be verified.



### Lifting and moving

DELTABEAM® can be lifted and moved using ordinary lifting equipment, such as cranes or forklifts. The weight of each DELTABEAM® is displayed on the product sticker on the beam and in the fabrication drawings. The CE marking sticker, QR-Code sticker which will link to these installation instructions, and DELTABEAM® trademark can also be found on the beam.

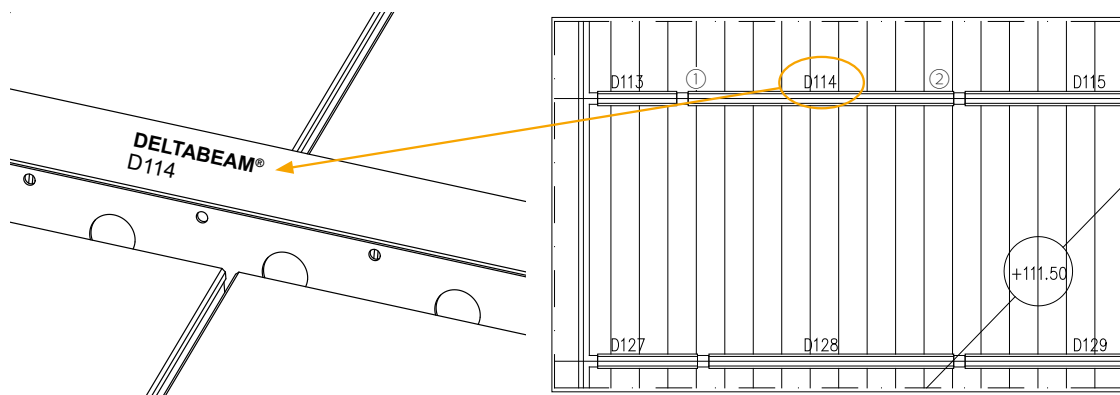
DELTABEAM® must be lifted using the lifting holes on the top plate symmetrically to the axis of the center of mass. The maximum allowed lifting angle of the chains must be observed. In special cases, when there are no lifting holes, DELTABEAM® can be lifted with chains attached to the web holes. In some cases, a third chain is needed to lift DELTABEAM® and maintain its balance. For example, DELTABEAM® with wide formwork sheets should be lifted using the lifting holes and a third chain should be attached to the formwork structure.



**NOTE:** ALWAYS USE APPROVED LIFTING CHAINS AND LOCK THE CHAIN HOOKS. NO LIFTING STRAPS OR CHAINS AROUND DELTABEAM® AS THIS WILL INVOLVE A RISK TO HEALTH AND SAFETY!

## Assembling DELTABEAM®

The project's erection method statement must be followed. Every DELTABEAM® has the DELTABEAM® trademark and identification code on the top plate near the beam end ①. The beams are installed in such a way that the identification code on the top plate of DELTABEAM® can be read in the same direction as marked in the element layout drawing.



## Connecting DELTABEAM®

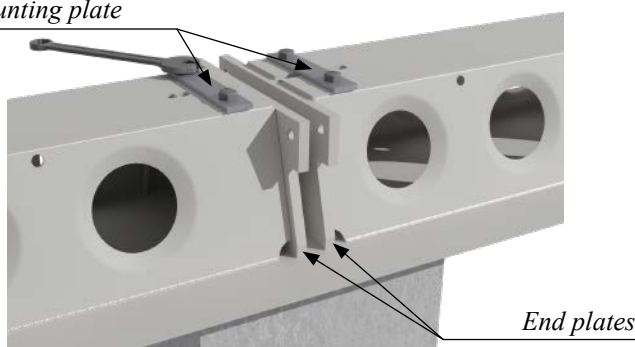
DELTABEAM® Composite Beams are connected in accordance with the project's erection method statement, the installation plans, and the connection details. The connection details are specified in the construction plan for each project. Shim plates and steel packs should be placed in accordance with the project related erection method statement. The DELTABEAM® delivery only includes installation material for the connections between DELTABEAM®, i.e., Gerber and side connections.

During the installation of the slabs, maintaining the frame stability requires connecting DELTABEAM® before assembling the props and floor units. This prevents the beams from moving. If on-site welding is required, the process and the qualification of the welders should be in accordance with the erection method statement.

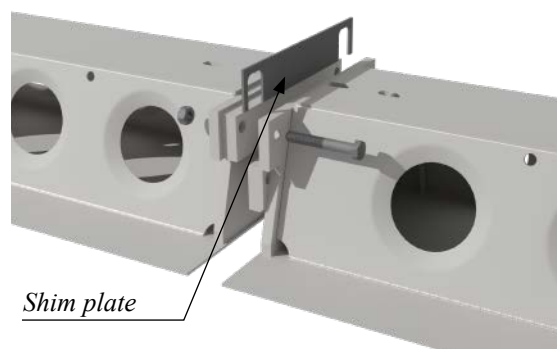
Shim plates in Gerber and side connections are used by default to allow installation tolerance. Installation tolerance is +5 mm / -10 mm, and the maximum thickness of the shim plates is 15 mm. DELTABEAM® lengths have been designed including a shim plate; a 5 mm shim plate is set to every connection after DELTABEAM® is installed and before the bolts are tightened. Any variations to the designed total length of the beam line are considered by adding or removing the number of shim plates from other connections within the allowed tolerances.

Connection with HPM® anchor bolts

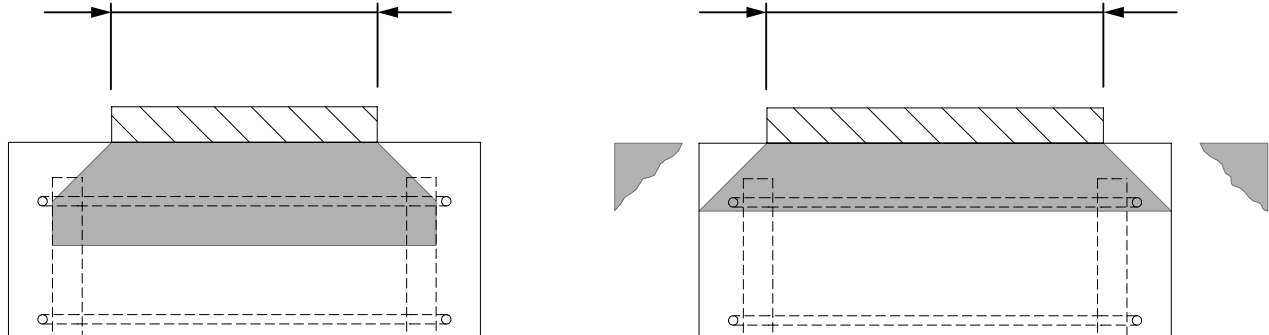
Mounting plate



Gerber connection



When assembling continuous DELTABEAM® Composite Beams, the location of each DELTABEAM® and the total length of the beam line should be confirmed before tightening the bolts in the Gerber connections and other connections. The ends of the continuous beam lines must be prevented from uplifting during installation. Steel packs are placed on the reinforced concrete structure so that the effect of the contact stress remains inside the perimeter of the stirrup reinforcement. The risk of spalling can be reduced by applying chamfers to the edges of the concrete structure. The usage of neoprene is not recommended between DELTABEAM® and the support.



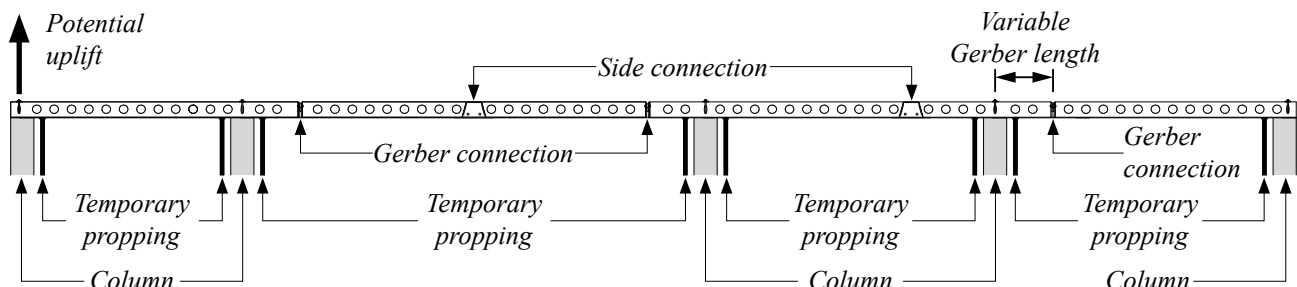
**NOTE:** DELTABEAM® CUTTING, OPENING OUT BOLT HOLES, ETC. REQUIRES PERMISSION AND INSTRUCTIONS FROM PEIKKO.

### Propping DELTABEAM®

Propping needs to be carried out in accordance with the project's erection method statement before assembling the floor units. DELTABEAM® must be connected in accordance with the erection method statement, the installation plans, and the connection details before propping. Only certified props are to be used. Their quantity and placing must be in accordance with the propping plan made by a structural engineer.

The stability of the props must be confirmed when they are assembled. The foundation for the props must also be secure and solid. The props shall be assembled as close to the beam support as possible, as they are aimed to prevent the beam from rotating at the supports. The props are placed at the loaded side of the beam, below the web. The props may be removed only when the joint concrete and the infill concrete of DELTABEAM® have reached the required strength.

Propping in the position of Gerber and side connection is not required, as both connections are designed to take the torsion from loads acting in the erection stage. The possible uplift effects of loads during the erection or final stage must be considered when designing the connection details and supporting structures of DELTABEAM® by the structural engineer responsible for the project. For example, Peikko PCs® LOCK Corbel is designed to uplift. Please refer to PCs® Corbels Technical Manual for more information.



The DELTABEAM® wide formwork sheet must always be supported. If this is not possible, special agreement with Peikko technical support is needed. The continuous support is placed along the edge of under the corner of the wide formwork sheet. The continuous support is supported with props, and it shall be the same length as the supported formwork sheet.





Special attention should be paid to asymmetrically support beams, long beam spans, or tall propping heights. When the propping heights are tall, traditional methods such as temporary columns or towers are used. Peikko technical support can help with demanding propping issues.

### Assembling floor units

The designer of the slab is responsible for informing Peikko whether particular installation requirements exist depending on the type of timber floor. In any case, DELTABEAM® connections and the props must be securely installed and tightened before assembling the floor units. After the slabs are installed the necessary formwork, edge forming, and slab reinforcement will be carried out.

To minimize the rotation of the beam, the floor units should be assembled alternately on different sides of the beam. If one side is loaded, erection props must be designed accordingly. It is possible to secure the floor units onto DELTABEAM® ledge with screws from the bottom. DELTABEAM® ledge can be provided with holes drilled on both sides, if requested. Such connection is meant to only secure erection of floor elements.



During installation, timber slab units might need to be protected by weathering according to the slab producer's instruction. Wood end grain absorbs moisture and releases it again according to the relative humidity and temperature of the air. Excessive or too low humidity levels may cause swelling and shrinkage cracks respectively. Generally, recommended optimum humidity is between 40% and 60%.

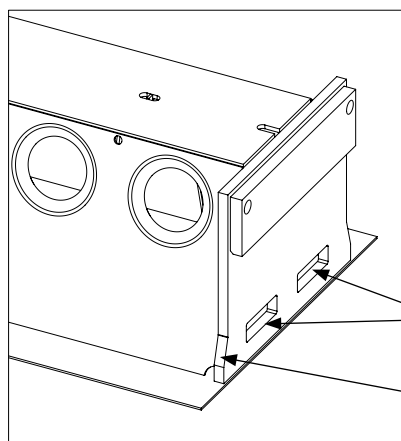
### Reinforcement

Reinforcement is installed in accordance with the erection method statement. The needed amount of rebars for joint and torsion reinforcement and shear connectors, if needed, shall be placed according to the design. The transverse reinforcement should pass through the air holes, web holes or additional web holes of the DELTABEAM®. The positioning of transverse reinforcement depends on the design, the type of slab and the height of DELTABEAM® profile with respect to the thickness of the slab.

The transverse reinforcement in composite slabs can be placed either within concrete topping thickness or within the timber portion of the slab. In this latter case and in case of solid timber slabs, grooves need to be cut out in the timber panel so to allow rebar installation through DELTABEAM® holes. The length of the groove must be sufficient for both ensuring proper anchoring length of the rebar and for enabling easy installation.

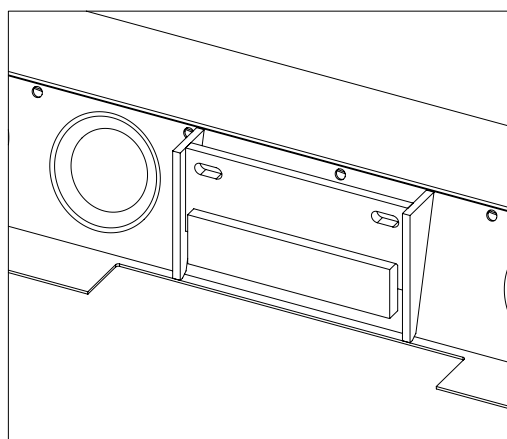


When Gerber connection is used, the end plate has a modified shape that allows installing ring reinforcement between DELTABEAM® ( $h \geq 300 \text{ mm}$ ) and the floor unit. Cut-outs in Gerber plate serve for purpose of concreting of joint. There are two cut-outs in DELTABEAM® with width  $b \geq 600 \text{ mm}$ .

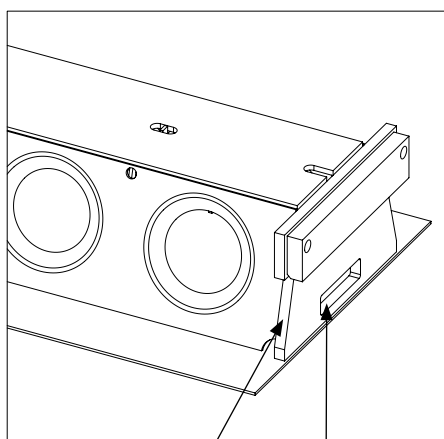


*Two cut-outs for DELTABEAM®  $b \geq 600$  mm*

*End plate shape for DELTABEAM®  $h \geq 300$  mm*



*End plate shape for DELTABEAM®  $h < 300$  mm*



*Cut-out for DELTABEAM®  $b < 600$  mm*

## Casting the concrete

DELTABEAM® must be filled with concrete in one run to secure the properties of a composite beam. Whenever possible, the topping concrete of the flooring is cast in a separate phase after the infill concrete of DELTABEAM® has reached the required strength. In case of composite timber slabs where concrete topping surface is flush with DELTABEAM® top plate, the topping concrete is cast simultaneously with the infill concrete.

Structural concrete is always used when casting concrete. The concrete grade is in accordance with the project's erection method statement. The concrete's properties are determined in accordance with the project's concreting plan. The recommended maximum aggregate size is 8 mm (in any case, not more than 16 mm). The maximum aggregate size should ensure that the concrete fills properly all the gaps between DELTABEAM® web plate and the grooves where transverse rebars are placed. Joint sealant or tapes can be used at the support of the floor unit on DELTABEAM® ledge or at any other needed location to prevent concrete leakage during the casting phase, for further questions contact Peikko.



Timber material might be sensitive to water. Protective treatment might be needed on timber end grain in contact with concrete according to timber slab producer's instructions. The drying time of concrete can be reduced by limiting the amount of water required. This can be done by using concrete with low water/binder ratio ( $w/c < 0.5$ ), or stronger concrete made with water-reducing agents. On-site drying time can be influenced by the guidelines for prevailing environmental conditions and project specific instructions.

The lower parts of Gerber and side connections must be properly filled with concrete. Topping concrete is cast in accordance with the erection method statement.

### Process of casting the concrete:

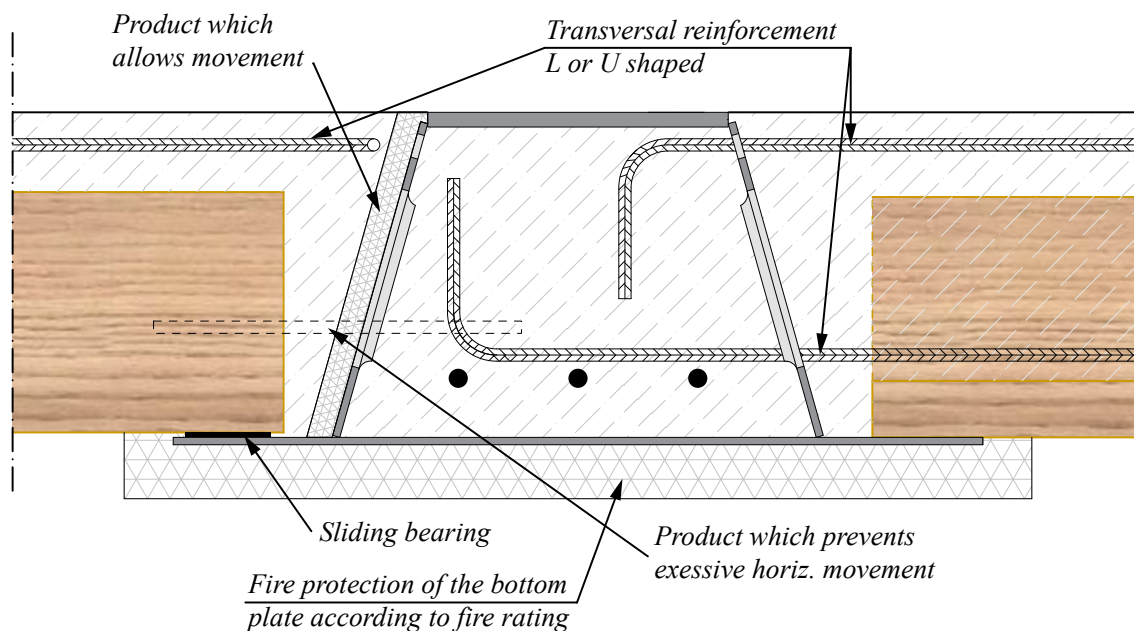
1. Use only the concrete mix defined by the structural engineer responsible for the project.
2. Ensure that there is no water in the beam and that water drainage holes are open.
3. Ensure that DELTABEAM® is clean for casting.
4. If there are pre-installed heating wires inside the DELTABEAM®, ensure that the socket of the wire is taken out of the beam before casting the concrete.
5. Ensure that the formwork and the reinforcement are in accordance with the design.
6. Initial infill may be done through the casting holes in the top plate. DELTABEAM® is filled with concrete up to the bottom edge of the web holes.
7. After the initial infill, the final concreting is done only from one side of DELTABEAM®. The entire infill process may be done through the casting holes in the top plate, but it will be slower and require more work with the poker to run the concrete.
8. Ensure that DELTABEAM® is filled with concrete by checking the air holes on the opposite side of DELTABEAM®. The beam is full when concrete runs through the air holes. Concrete spillage over the beam must be avoided as this will make it harder to observe whether the beam is full.
9. Compact the concrete with poker or vibrator while concreting. Vibration of concrete can be done through holes in DELTABEAM® top plate and through pockets or chamfers cut along timber floor edge to ease the process. Mind the formwork plate and the vertical web when using a poker.

**NOTE:** MATERIAL MUST NOT BE STORED ON THE FLOOR BEFORE THE INFILL CONCRETE HAS HARDENED. THE FLOOR ABOVE MUST NOT BE BUILT UNTIL THE INFILL CONCRETE HAS HARDENED.



## Additional fire protection

Additional fire protection is done according to the project's erection method statement. The DELTABEAM® with expansion joints must be protected against fire from below. When the expansion joint is on the beam ledge the entire width and length of the beam must be protected against fire. The expansion joint can also be located at the end connection or the side connection.



The vertical web of the DR-type DELTABEAM® must be protected against fire on-site if the vertical web is not protected against fire by permanent structures such as walls or façades. A wall would act as permanent structural fire protection.

If DELTABEAM® is being connected to a fire-protected steel structure, the extent of fire protection must be done according to the erection method statement. Unprotected DELTABEAM® will conduct heat to the steel structure through the connection.

### After installation

Any damage to the surface treatment should be repaired as soon as possible. The surface treatment should be completed with the top layers as soon as possible.

### Safety

All valid health and safety rules must be followed during installation. Fixing points for handrails and other safety products can be ordered separately.

### On-site checklist

- **Storage on-site**
  - Use piling strips or timber boards to protect surface treatment.
  - Cover DELTABEAM® Composite Beams when long-term storage on-site.
- **Lifting and moving**
  - DELTABEAM® is lifted by using the lifting holes located on the top plate. Always lock the chains.
  - Note the maximum allowed lifting angle of the chains.
  - DELTABEAM® self-weight is given on a product sticker.
  - **NO LIFTING STRAPS OR CHAINS AROUND DELTABEAM® AS THIS IS A HEALTH AND SAFETY RISK!**
- **Assembling DELTABEAM®**
  - First, check the instructions and the requirements in the erection method statement.
  - The direction of the identification codes of the installed beams should be the same as in the element layout drawing.
  - The beams must be connected (with bolts or welds) to supports before the assembly of the floor units.
  - Before tightening the bolts on the Gerber connections, check the location of each DELTABEAM® and the total length of the beam line.
  - As far as the propping, the erection method statement is followed.
  - Remove only after the concrete has hardened.
- **Assembling floor units**
  - Assemble the floor units directly on the beam ledge without any layers between, unless a sealing tape is needed.
  - Recommended minimum 40 mm gap between the web of the DELTABEAM® and the end of the floor unit.
  - To minimize the rotation of the beam, assemble floor units alternately on different sides of the beam.
- **Reinforcement**
  - Installed transverse reinforcement shall comply with design drawings.
  - Alignment of DELTABEAM® holes with grooves in timber floor units shall be provided to allow rebar installation.
  - In edge beams use L or U-shaped rebars.
- **Casting the concrete**
  - Concrete fulfills the specification given in the project-related erection method statement.
  - Fill in one run, fill only from one side, observe from the other side. The beam is full when concrete starts to run through the small air holes in the upper part of the web. Mind the formwork plates when using a poker/vibrator.
  - Ensure that concrete fills the gap between Gerber and side connections.

DELTABEAM® CUTTING, OPENING OUT BOLT HOLES, ETC. REQUIRES PERMISSION AND INSTRUCTIONS FROM PEIKKO.

MATERIALS SHOULD NOT BE STORED ON THE FLOOR BEFORE THE INFILL CONCRETE HAS REACHED THE REQUIRED STRENGTH.

THE FLOOR ABOVE MUST NOT BE BUILT BEFORE THE INFILL CONCRETE HAS REACHED THE REQUIRED STRENGTH.

## Revision History

### **Version: PEIKKO GROUP 01/2023. Revision: 002**

- Added picture of DELTABEAM® with downstands.
- Updated figures related to DELTABEAM® Composite Beam with timber slabs by adding also inclined end cut for CLT slab.
- New information about RAMCO® Hidden Corbel and NILCO® Wood-Concrete Composite Slab Connector added.
- Added new figures, deleted some old figures, and replaced some with more recent ones.
- New information added about fire situation.
- New information added about interaction with floor units.
- Updated figure about movement joint on the beam ledge.
- New chapter about DELTABEAM® Green added.
- Additional information added to Selecting DELTABEAM® section about Peikko Designer® DELTABEAM SELECT Software.
- Updated figure about typical design workflow of DELTABEAM® projects.
- Rewording of many paragraphs for easier understanding.

### **Version: PEIKKO GROUP 02/2022. Revision: 001**

- First publication.

# Resources

## DESIGN TOOLS

Use our powerful software every day to make your work faster, easier, and more reliable. Peikko design tools include design software, 3D components for modeling programs, installation instructions, technical manuals, and product approvals of Peikko's products.

[peikko.com/design-tools](https://peikko.com/design-tools)

## TECHNICAL SUPPORT

Our technical support teams around the world are available to assist you with all of your questions regarding design, installation etc.

[peikko.com/technical-support](https://peikko.com/technical-support)

## APPROVALS

Approvals, certificates, and documents related to CE-marking (DoP, DoC) can be found on our websites under each products' product page.

[peikko.com/products](https://peikko.com/products)

## EPDS AND MANAGEMENT SYSTEM CERTIFICATES

Environmental Product Declarations and management system certificates can be found at the quality section of our websites.

[peikko.com/qehs](https://peikko.com/qehs)



COMPANY WITH  
MANAGEMENT SYSTEM  
CERTIFIED BY DNV  
ISO 9001 • ISO 14001  
ISO 45001