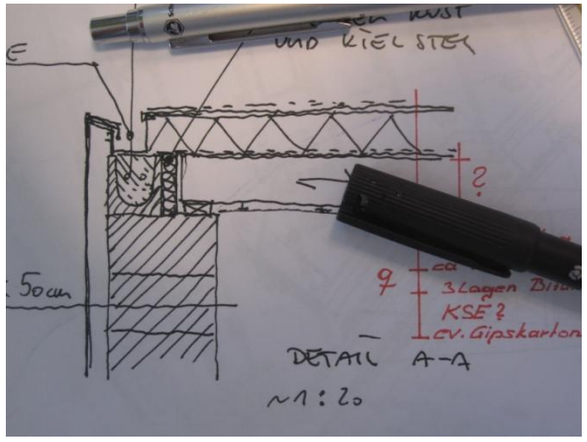
CONSTRUCTION GUIDE

FOR KIELSTEG ELEMENTS

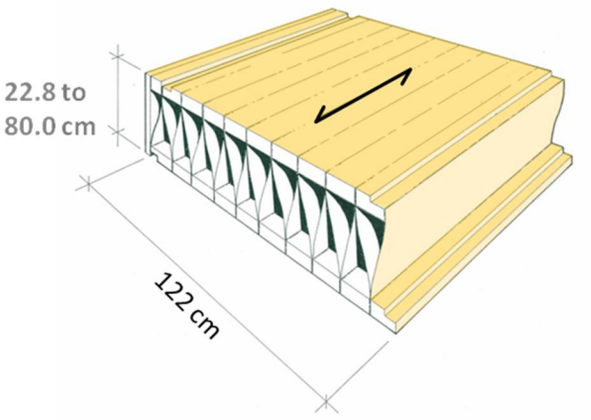


INNOVATION IN WOOD

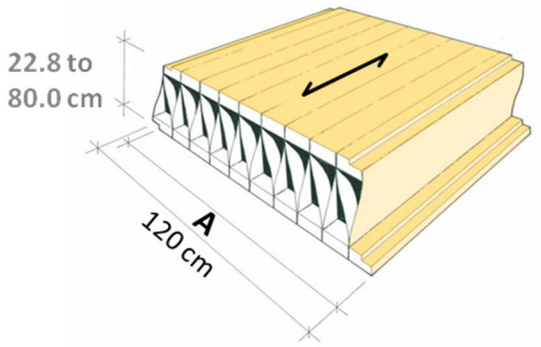
Version 06. 2012

Basic information:

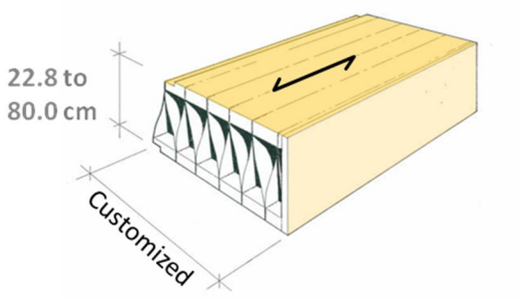
Kielsteg elements are wooden structural floor and roof elements with a prestressed, linear structure, which should not be restricted in their shrinkage and swelling movements. Standard Kielsteg elements are 120 cm wide. For dimensional calculation and construction, the laid unit width "**A**" is defined as 116.5 cm plus a joint allowance. The joint allowance is calculated on a case-by-case basis by the designer. The last element in a floor or roof is of customized width.



First element



Standard element



Last element

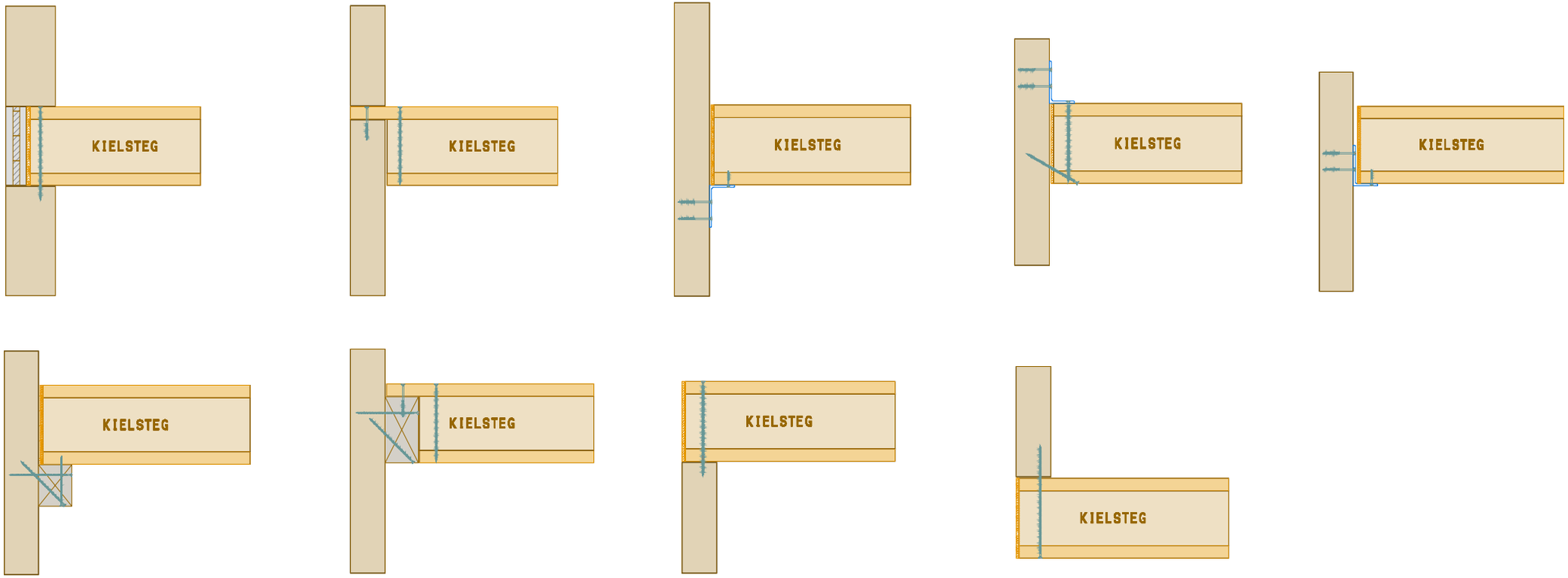
The joint allowance:

Due to the natural shrinkage and swelling of wood, Kielsteg elements are susceptible to dimensional changes, most strongly in the lateral direction. The dimensional changes depend on the climatic conditions the Kielsteg assembly is exposed to in service. In order to reliably predict the range of movement to be allowed for, the designer must take into account air temperature, humidity and measures to ensure regular ventilation. When these parameters are known, the joint allowance can be defined. The wood moisture content of the Kielsteg elements is 12±3% on delivery. In service, variations in the wood moisture content of up to ±6% are possible, which leads to changes in the width of the elements of ±1.5 %.

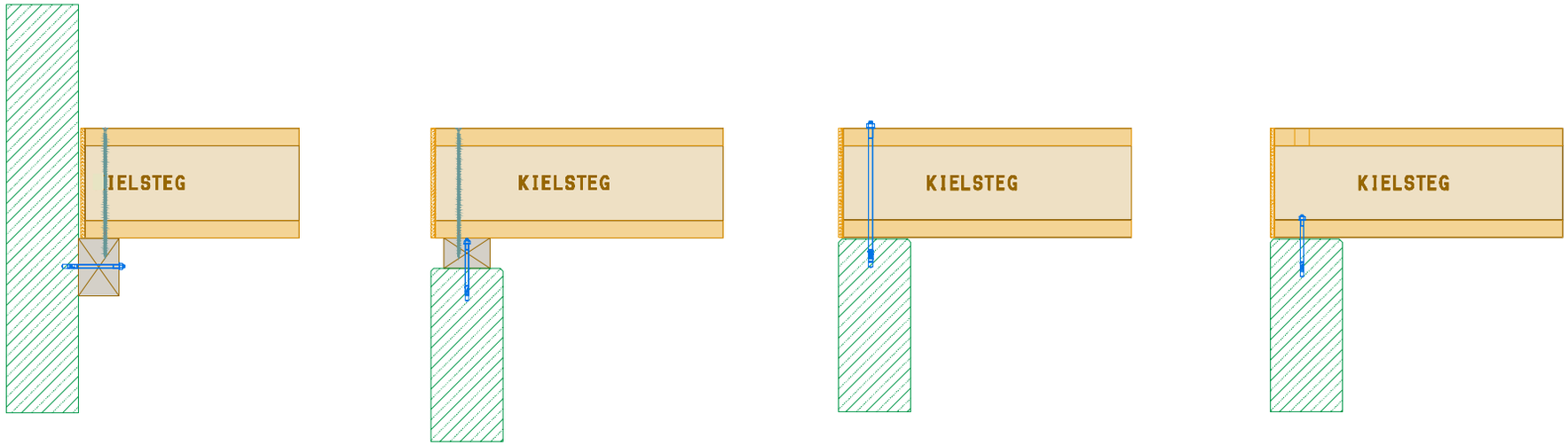
Support variants:

As linear construction elements, Kielsteg elements are generally to be supported on linear substructures and should be fastened to the supports with screws. The variants shown in the diagrams below should give an overview of the support and fastening options for Kielsteg on wooden, concrete and steel substructures.
The minimum length of the element that must lie on the support (not counting the OSB end piece) is 10.0 cm for elements up to KSE 560. For thicker elements, the minimum length of the supported ends is 15.0 cm.

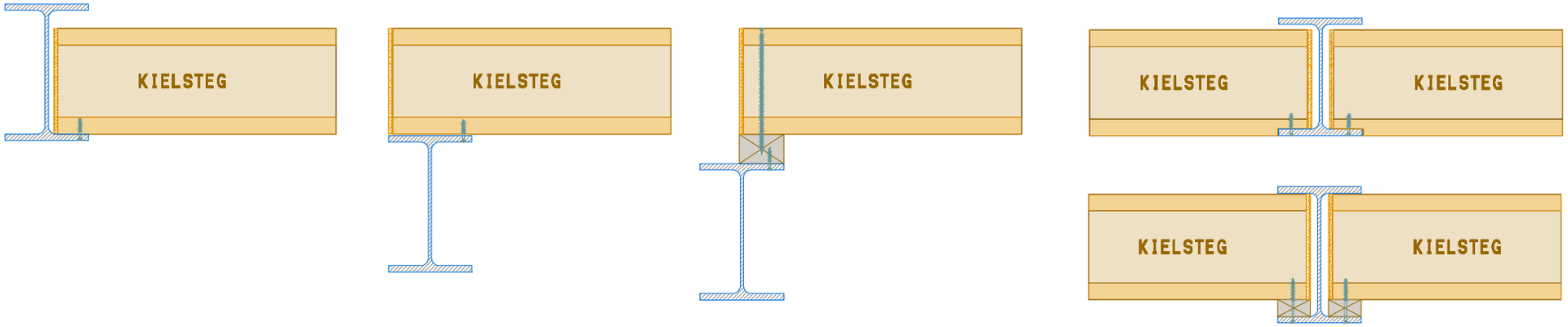
On wooden supports:



On concrete supports:



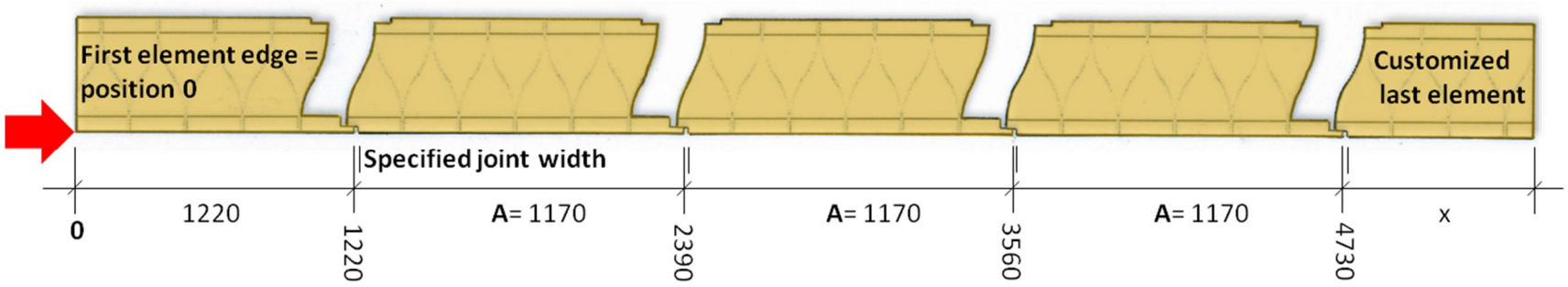
On steel supports:



Laying the elements:

The element positions are calculated from the perpendicular outside edge of the first Kielsteg element 0. The calculated width runs to the leading edge of the bottom profile piece. The laid unit width is equal to the element width of 1165 mm plus the specified joint width of 5 or 10 mm. The example in the diagram shows 5 mm joints, so that the laid unit width is 1170 mm.

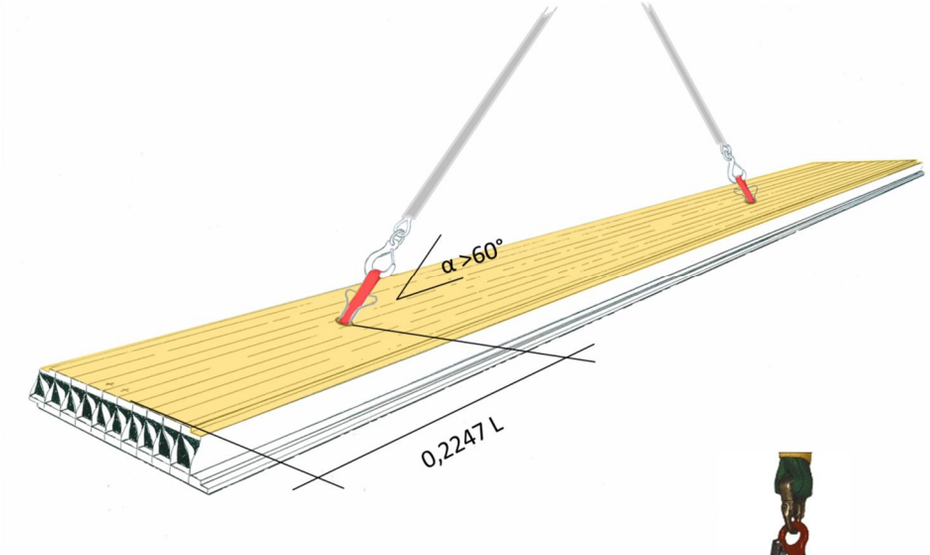
First element (with perpendicular edge): 1220 mm
Standard element: 1165 mm + joint
Last element: x



Lifting the elements:

It is recommended to lift the elements using at least a two-point lifting arrangement.
The ideal position of the lifting points is best measured from the ends of the element according to the following formula:

Element length [m] x 0.22 = distance of lifting point from end [m]



On request, the holes for the lifting gear, to suit the special lifting pins, can be factory bored with a diameter of 50 mm. The maximum allowable loading of the belts is 1500 kg.
Caution! Calculate the increase in the belt load if the element is lifted in a tilted position!

The reusable lifting belts are delivered with the elements and should be returned to the supplier after use.
After the elements have been lifted into place, the lifting holes must be closed.

Photos: Zurrfix.ch

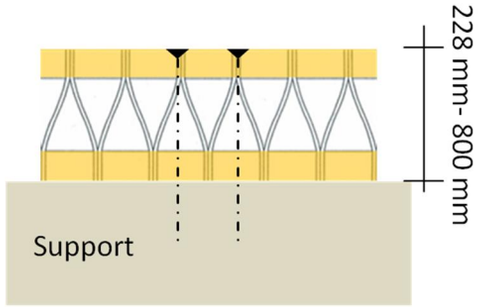
Weight values for Kielsteg elements

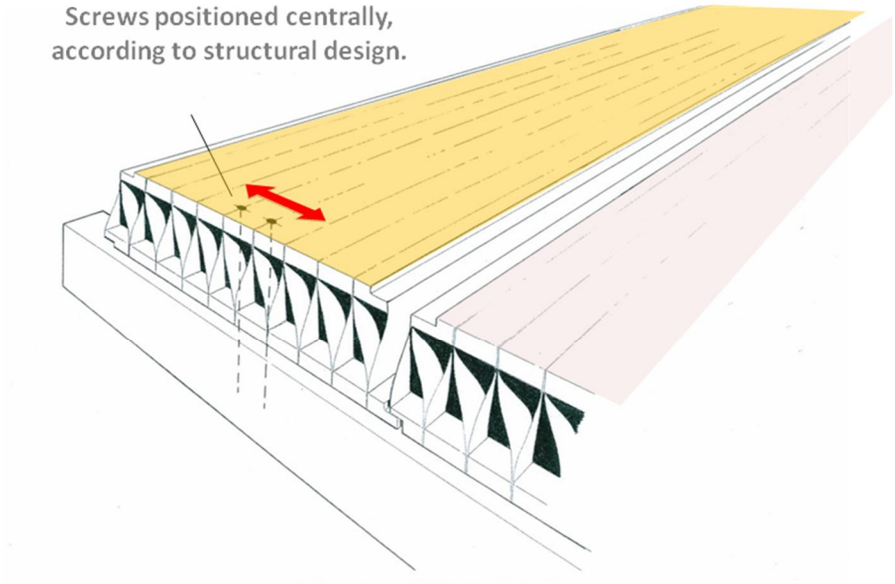
Element type		kg/linear metre	Element type		kg/ linear metre
KSE 228	REI 30	52.1			
KSE 280	REI 30	52.4	KSE 280	REI 60	67.7
KSE 380	REI 30	54.4	KSE 380	REI 60	69.6
KSE 485	REI 30	78.5	KSE 485	REI 60	94.9
KSE 560	REI 30	91.8	KSE 560	REI 60	105.8
KSE 615	REI 30	119.4	KSE 615	REI 60	128.3
			KSE 730	REI 60	164.8
			KSE 800	REI 60	167.5

Elements weighing more than 2600 kg (tilted lifting under 60°) should be lifted using 2 belts and 4 lifting pins.

Screw fastening to the supports:

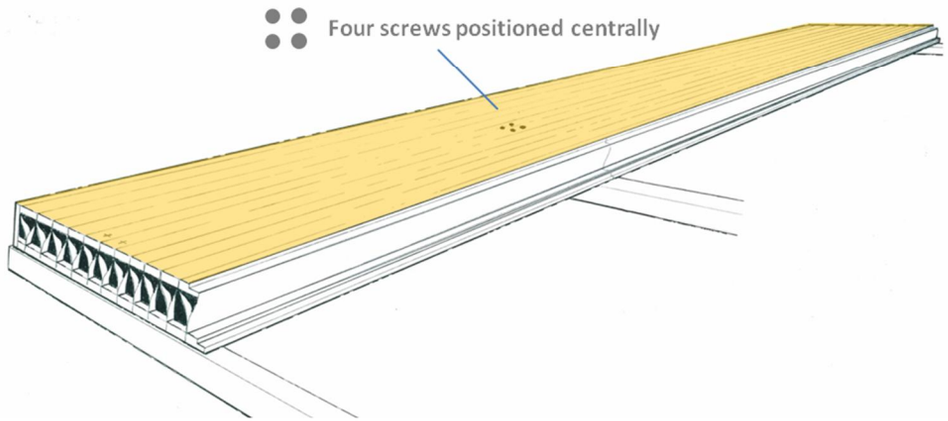
Kielsteg elements are screw fastened to the supports with a configuration of screws that specifically allows for the shrinkage and swelling so that no stress arises in the elements. The screws are positioned close to the centre line of each element, so that each element is able to move laterally to both sides from the central fixing point.
Fully-threaded screws should be used and they should be positioned so that they enter the element through the web material on top and leave it through the flange material at the bottom.





Screw fastening to a middle beam:

As for the end support, the elements are screwed to a middle beam using screws grouped around the centre line of the element, entering the element in the visible strip of OSB or plywood where the two webs join. The required number of screws are arranged in two rows.

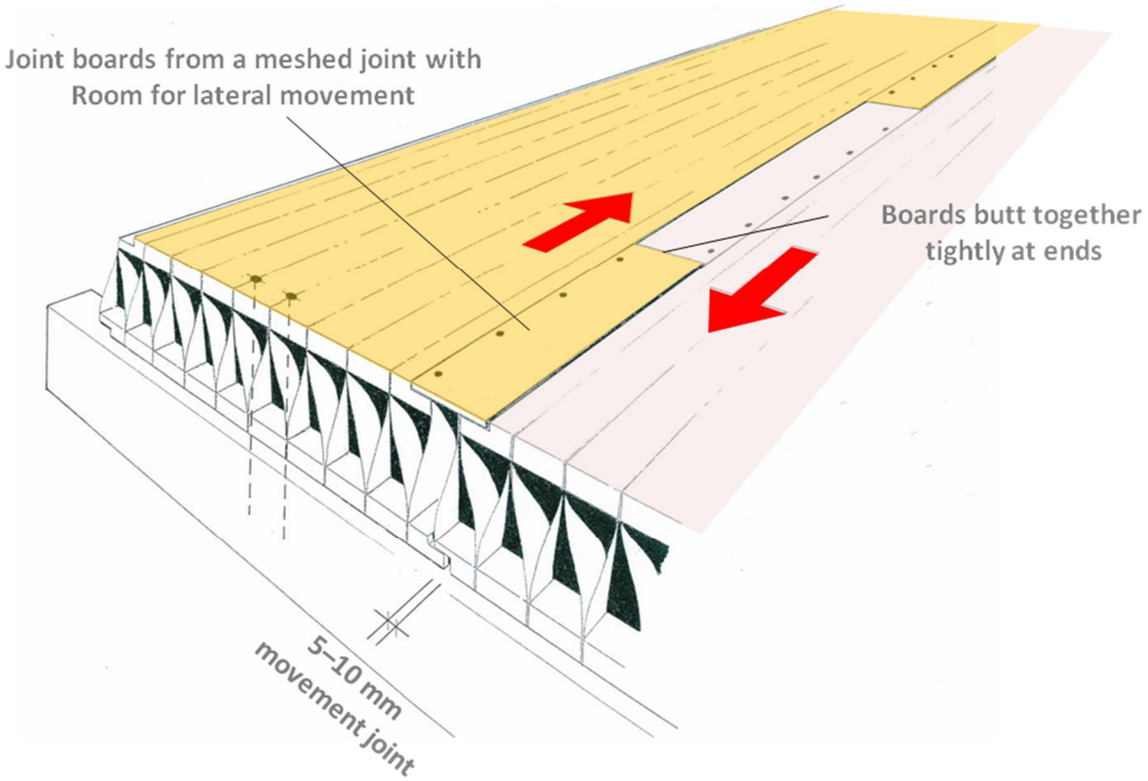


Special screw configurations:

Special structural requirements may require other configurations of screws, which should be designed by the structural engineer responsible.

Shear joints:

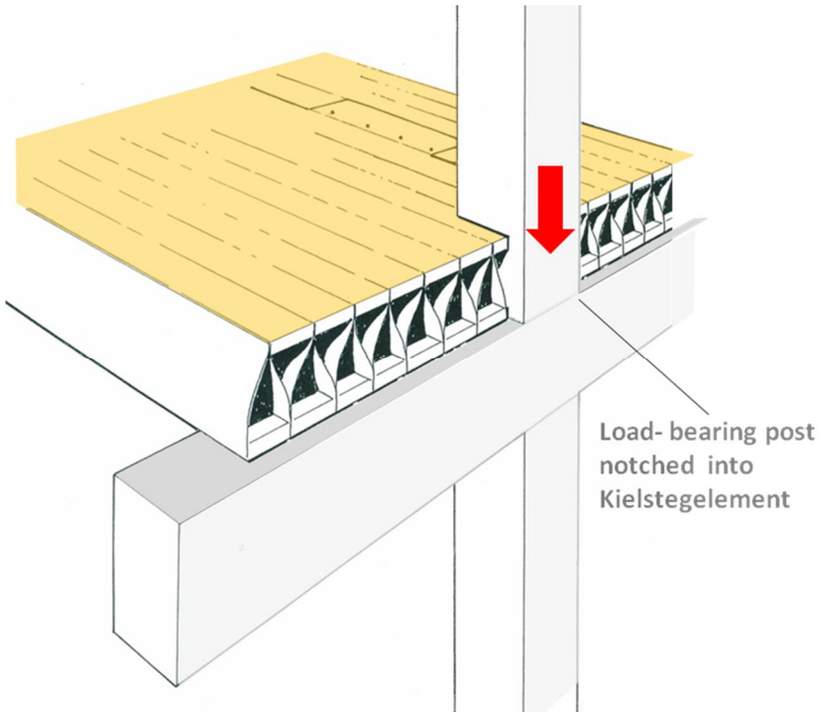
The Kielsteg elements can be joined to each other to form a rigid diaphragm structure, which contributes to bracing the building, by screwing joint boards into the rebates on the top long edges of the elements. Short lengths of board are nailed or screwed alternately to one of the neighbouring elements and then to the other. This creates a joint that allows lateral movement of the elements but has a meshing effect along its length. To ensure that the joints transfer shear forces, the ends of the alternating joint boards must butt tightly together.

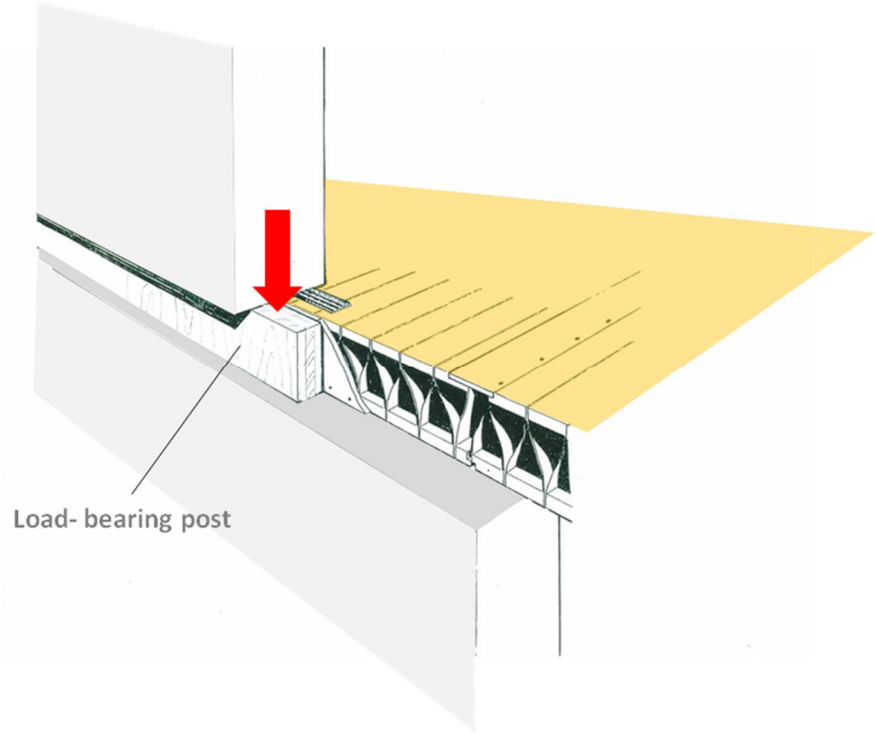


Vertical load transfer:

The Kielsteg elements must never be subjected to concentrated vertical loads from posts or walls.

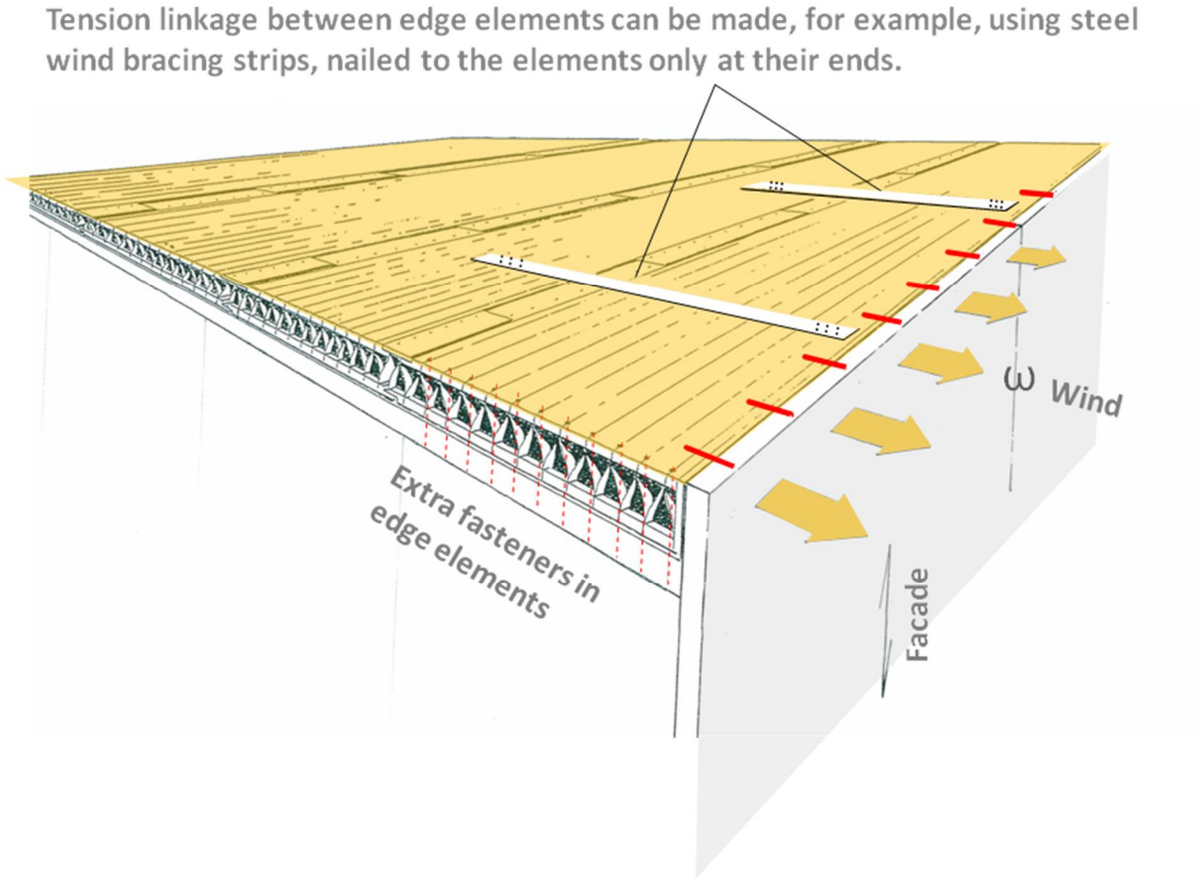
If the Kielsteg elements are used to make a structural floor whose ends are inserted into the walls, the vertical loads of the wall above should be transferred to the wall below using load-bearing pads. If load-bearing framed walls or single posts are used, upright KVH timbers should be used to carry the loads. The corners of the Kielsteg elements should be notched to make room for these posts; they are invisible in the final construction. In load-bearing wooden frame walls, the top and bottom sills are responsible for load distribution.





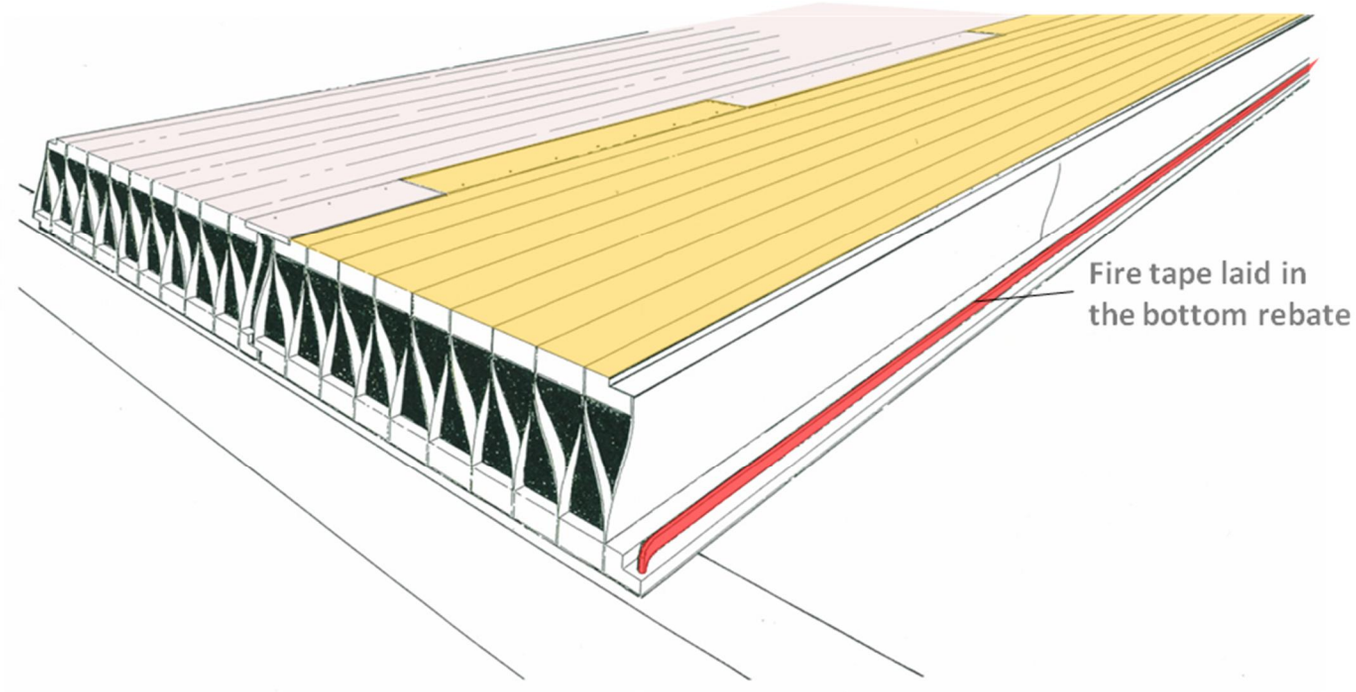
Lateral linkage and fastening of the elements next to the gable wall:

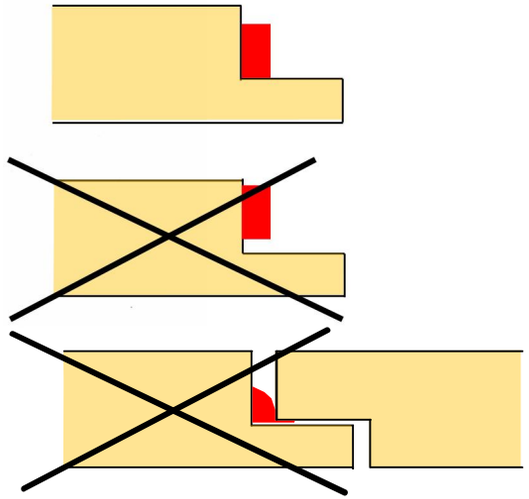
If a roof or floor is intended to function as a rigid diaphragm, the fastening of the edge elements to the supports needs to be reinforced. The reason for this is that wind loads from the façade structure need to be transferred into the diaphragm in a linear manner. The type and number of additional fasteners should be specified by the structural engineer.



Fire resistance:

To ensure adequate fire resistance, the joints between the elements must be lined with fire joint tape. The tape must be laid without stretching and must be positioned exactly in the corner of the bottom rebate, as shown. The tape must be protected from wetting because there is a danger that the fire-retardant impregnation could be washed out.

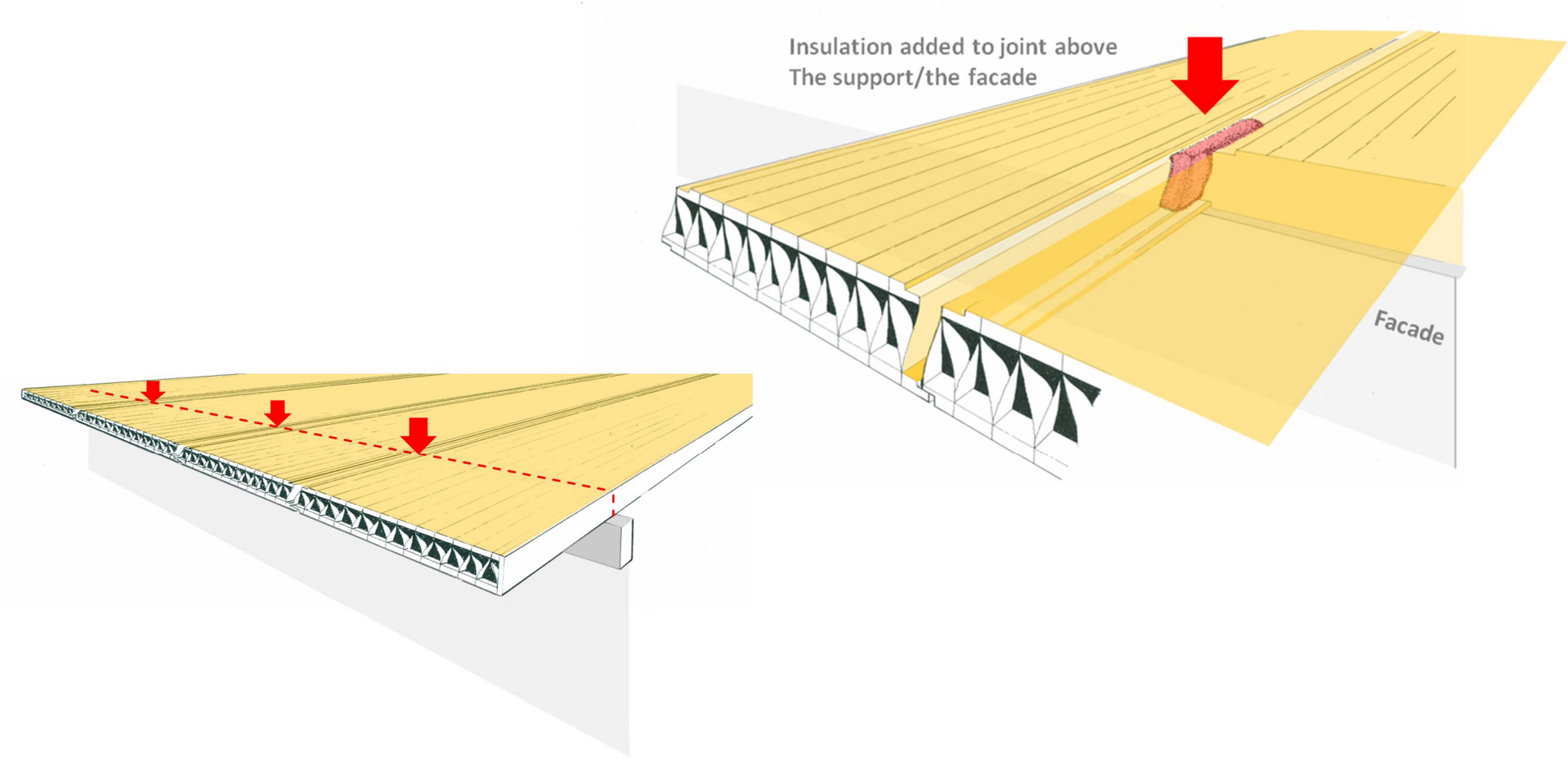




When laying the element it must be ensured that the joint tape is not crushed.

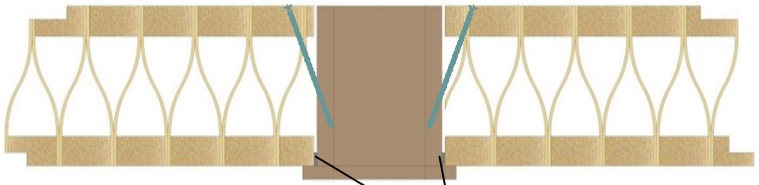
Insulation of the element joints in cantilevered projecting roofs:

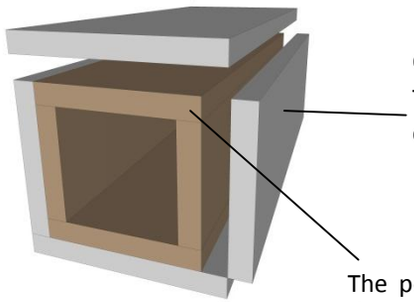
Cantilevered projecting Kielsteg roofs are thermally decoupled from the interior of the building by filling the cavities in the elements with insulating material around the point where they pass through the building envelope. To make this decoupling complete, the joints between the elements must also be filled with insulating material in the areas above the support. Normally this is done after laying the elements and before the joint boards are fastened in place. The insulation material should be stuffed into the joint over a distance of about 30-40 cm and so that it has to be pushed down with the joint board: the aim is to prevent any draughts along the inside of the joint.



Penetrations:

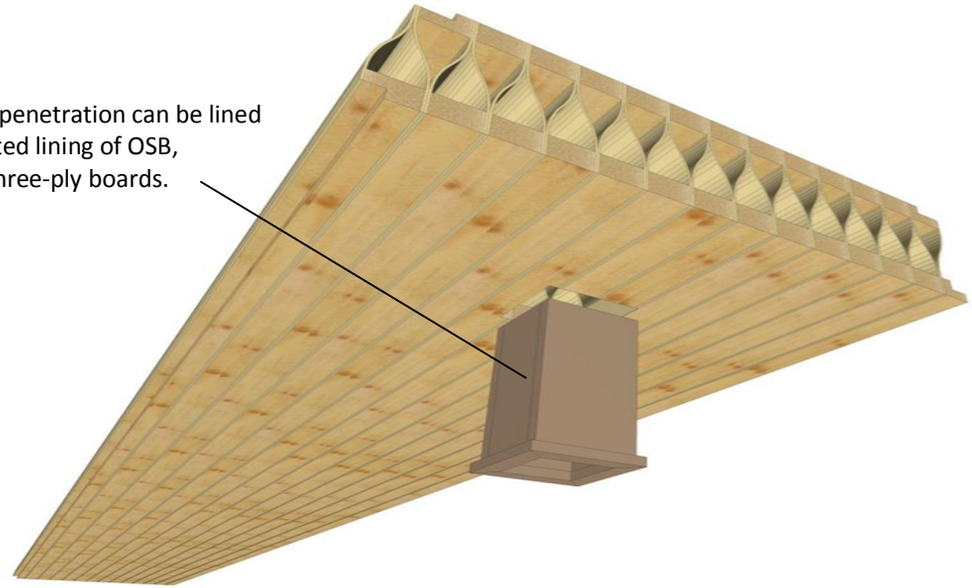
Small penetrations such as those for pipes and ducts up to a size of 25x25 cm are allowed, as long as the total strength of the element concerned is not compromised (i.e. bending and shear strength of the residual cross-section are adequate). The penetration should be reinforced using simple construction measures so that the integrity of the Kielsteg element as a space-enclosing partition for fire-protection purposes is preserved.





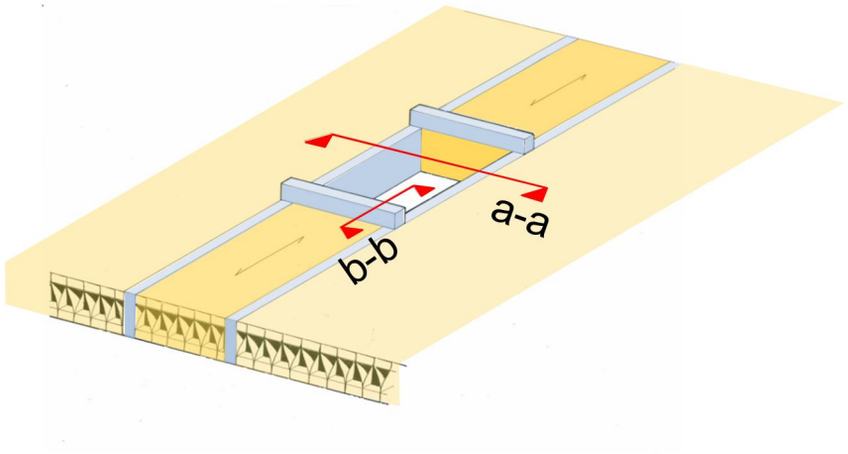
The penetration lining/covering should be made in a way that meets the requirements as to appearance and for the specified fire resistance class.

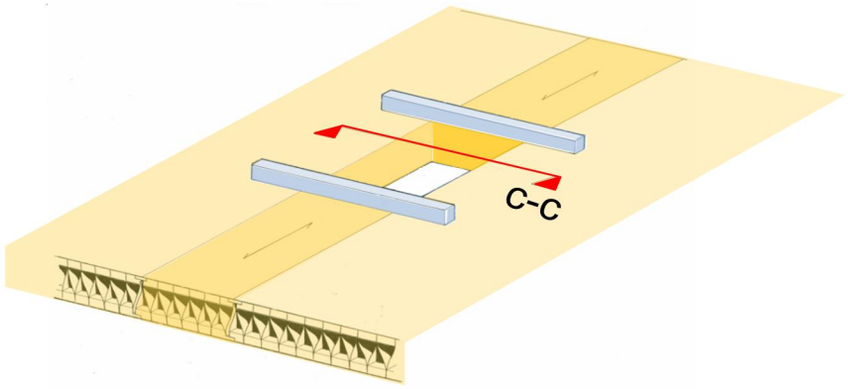
For example, the penetration can be lined with a prefabricated lining of OSB, plasterboard or three-ply boards.

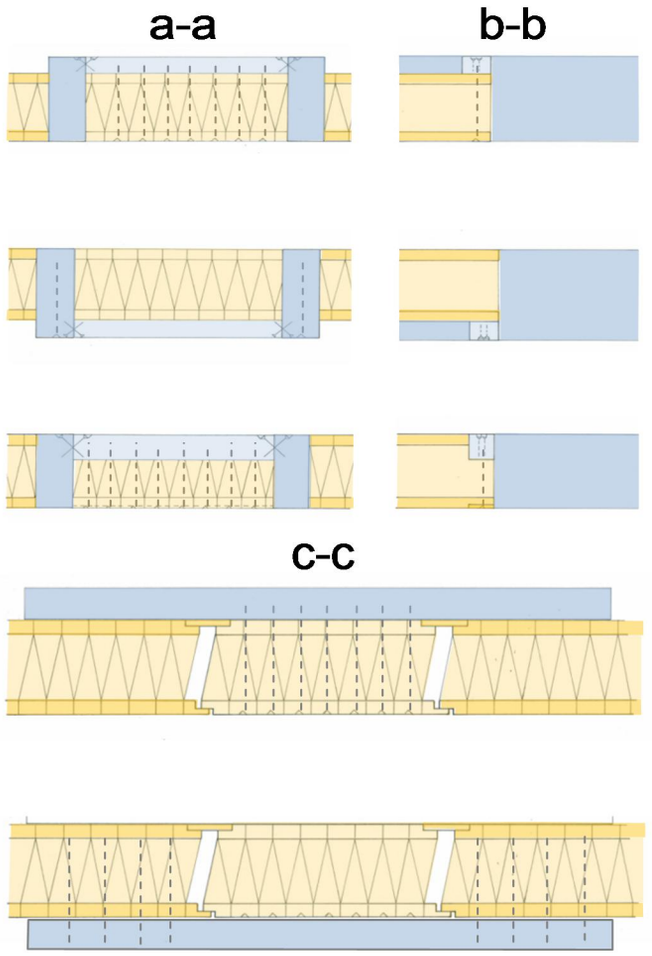


Support for openings:

Skylight openings should be made according to individual structural calculations. Some possible configurations are shown in the diagrams. Any other large openings and cutaways should equally be calculated and released by the structural engineer.

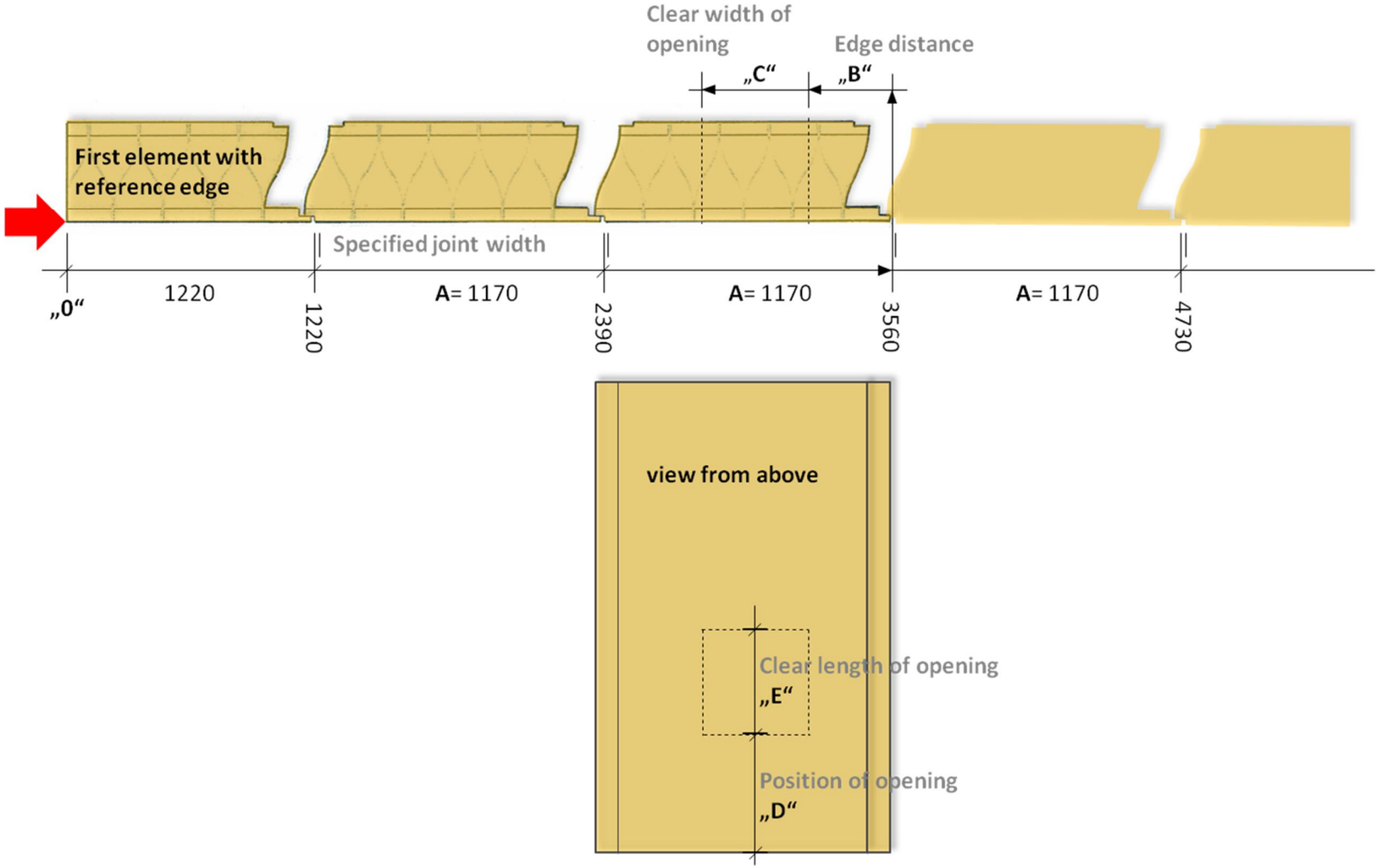






Measurement convention for openings:

The position of an opening should always be measured from the "**0"** edge of the first element. From this point, the laid widths of the elements should be added up until the leading edge of the bottom flange of the element to be cut is reached. From this position, the (minimum) edge distance **"B"** is measured back from the edge. The clear width of the opening "**C**" should be measured from this point. The longitudinal position of the opening "**D**" and the length "**E**" should be measured from the end of the Kielsteg element.



Protection from weather:

Like all other wooden constructions, Kielsteg elements must be protected from the weather and from wetting during the construction phase. Protective measures should be planned at the design stage.

Surface:

Kielsteg elements are usually installed with one face visible. Care should be taken not to damage or soil the visible side of the elements when lifting them, and also when they are being stored, transported and installed.

Storage:

The elements must be supported at small enough intervals and must be stored in a horizontal position without twisting, so as to avoid deforming them before they are laid. They should be adequately protected from moisture.

Tools:

All on-site work steps on the Kielsteg elements such as cutting to angles, cutting to length, notching, drilling and cutting of openings can be done with the usual hand-held tools such as chainsaws, circular saws, jigsaws, planes, routers and drills.