Abgabe der Übungen auf campUAS /miro / Woche IV

Name_Vorname_G1n_ex01 – Aufgabe Axonometrie – Einschneideverfahren (Scan)

Name_Vorname_G1n_ex02 – Modellieren Sie ihre eigene Holzverbindung* – Erstellen Sie einen PDF Printscreen ihrer Axonometrie

* d.h. der Bügelzapfen aus dem Video gibt nur die halbe Punktzahl

* Screenshot bitte auf miro ablegen

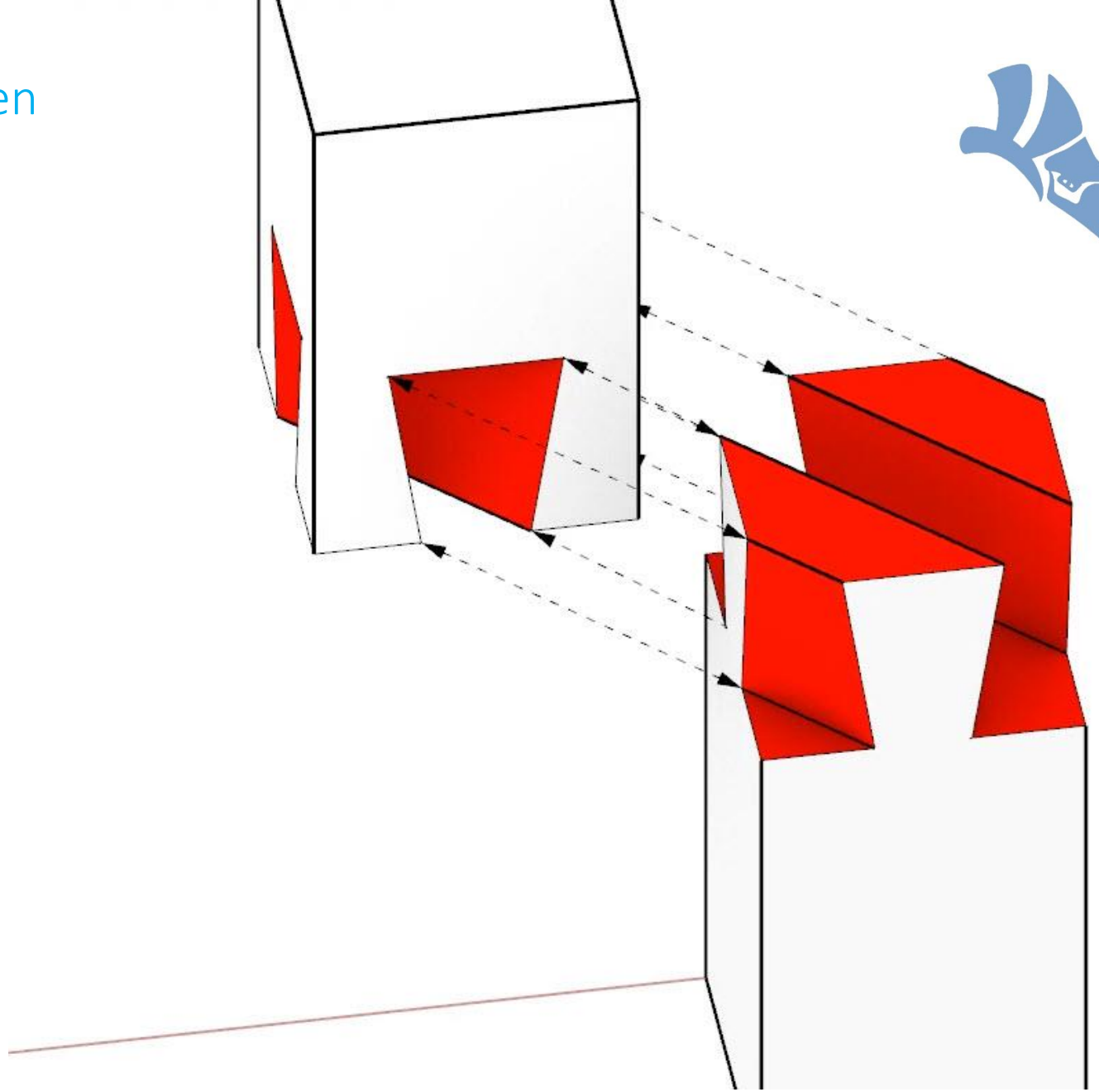
Name_Vorname_UE30 (Optional) – Gebäudeausschnitt – Wiederholung 3-Tafelprojektion (Scan)

PDF prints, Scans und Fotos in einem pdf

bis 06.12.2024 // 21:59

G1n_ex01_Konstruktion_Bügelzapfen

Tutorium / Übung



Recherchieren und Modellieren Sie ihre eigene Holzverbindung, oder suchen Sie sich eine der auf den folgenden Seiten bereitgestellten Verbindungen aus.

Erstellen Sie davon eine normale Axonometrie in Rhino.
Erstellen Sie eine ansprechender Grafik ihres 3D Modelles mit dem ´print´ Befehl.

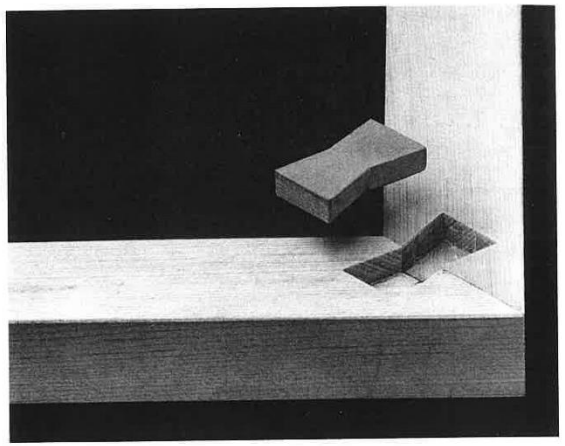
Graubner, W. (1998). Encyclopedia of wood joints. Newtown. The Taunton Press

Butterfly Keys

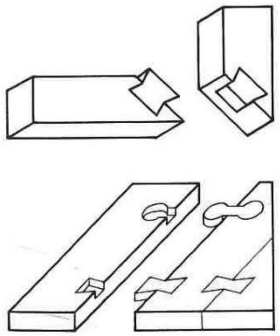
Butterfly keys (also known as **dovetail keys**) are excellent fasteners for joints that must later be disassembled. They hold joint surfaces together effectively, but they cannot withstand bending or twisting. In recent times, butterfly keys have been largely superseded by metal fasteners.

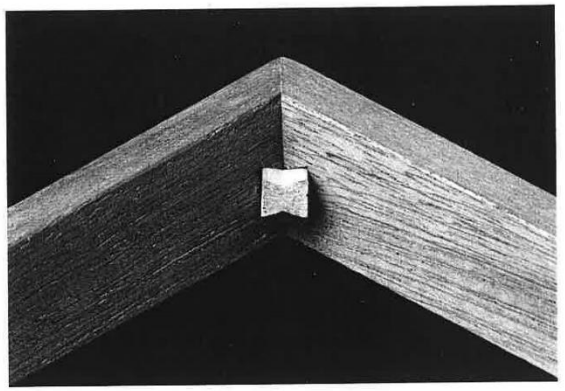
Butterfly keys are still used fairly extensively in Japan to lock mitered frames and edge-join boards.

The keys can be glued when used in interior applications. The round-headed key is a popular variation, because the hollows can be bored easily with a knot-plugging machine or a Forstner-type drill bit.



Butterfly key (Chi-giri-iri-o-dome-tsugi)





Perpendicular butterfly key

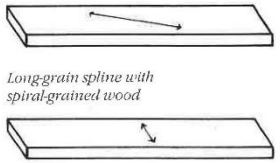
Spline Inserts

Splines of plywood, fiberboard or even cross-grain wood (preferably maple) are used primarily to reinforce corner joints on frames. These joints are similar to the spline-and-groove joints discussed on p. 125. On mitered corner joints, the grooves for the spline must be cut close to the inside corner so that they don't weaken the joint.

A variation on the simple spline insert is the elliptical Lamello biscuit, or joining plate. The biscuits are easily and quickly installed in slots cut with a special plate joiner.

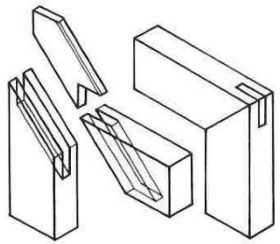
Long-grain splines and **cross-grain splines** reinforce longer edges. Splines with longitudinal grain should be made from wood with spiral grain so that they will be less likely to split out or shear.

Spline miters, which are similar to the Japanese *Shachi-sen* keys (see p. 144), are inserted diagonally across the grain. When glued, they provide a surprisingly strong joint. They can be installed in either diagonal direction, depending on whether the inside or the outside of the joint is to be visible (see the top left photos on p. 144). Splines can also be used unglued to prevent flush, parallel boards from moving out of alignment as a result of warpage, for example between soffit boards.

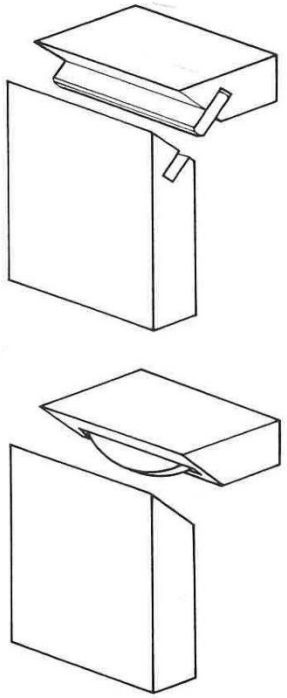


Long-grain spline with spiral-grained wood

Cross-grain spline



Spline-mitered corner joints



Mitered corner joint with Lamello biscuit

Graubner, W. (1998). Encyclopedia of wood joints. Newtown. The Taunton Press

Dovetail Joints

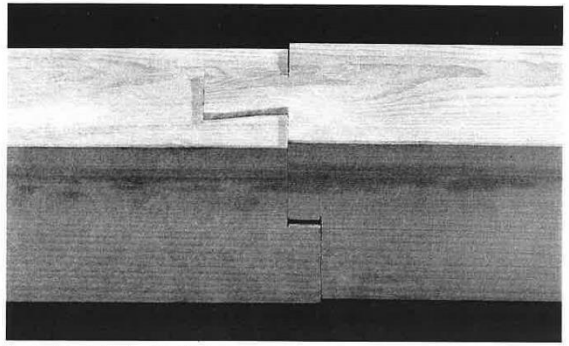
Cutting a dovetail on a tenon makes pullout of the joint impossible. Although dovetail joints are weak in tension because of short grain at the edges of the tails, careful wood selection can reduce the risk of shear failure. Particular attention should be given to the following:

1. Only straight-grained wood should be used for dovetail joints.
2. The tail (or female half) should always be cut on the wood's upper end.
3. The growth rings in the two mating pieces should be parallel in cross section, so that the different rates of shrinkage in a beam's thickness and width (radial and tangential shrinkage) do not result in an imprecise fit.
4. As far as possible, only dry wood should be used.

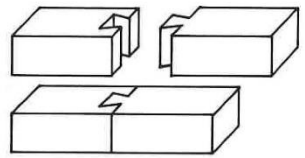
The simple **through dovetail,** which can resist pullout only along its length, is used mainly as a splicing joint on groundsills.

The **lapped dovetail** is a refinement of the through dovetail and provides additional protection against vertical shifting. However, this joint offers little resistance to bowing and twisting, because the dovetail's mating surfaces are very small. In Japan, dovetails are made a little shorter than in the West.

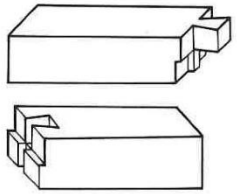
Adding a stub tenon to the lapped dovetail joint greatly improves its resistance to twisting. This joint was devised by Japanese and European carpenters for lengthening sill timbers and roof purlins in light timber-frame construction.



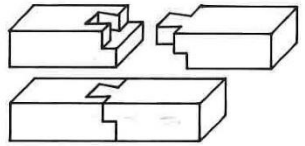
Lapped dovetail joint (Koshikake-ari-tsugi-te)

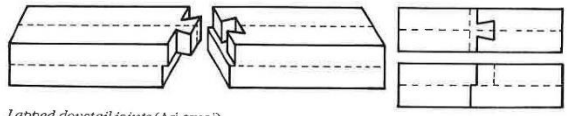


Through dovetail



Lapped dovetail with half-blind stub tenon (Koshi-ire-mechigai-zuki-ari-tsugi)





Lapped dovetail joints (Ari-tsugi)

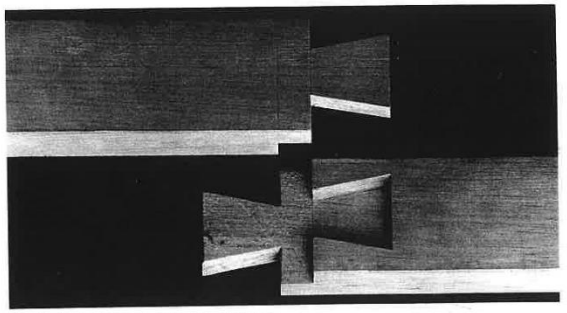
Double dovetails

The **double dovetail joint** is a logical development of the lapped dovetail. The double dovetail has the same surface area on the sides of its mating tails as the simple through dovetail and therefore provides the same resistance to horizontal movement. But because the joint is lapped, it also protects against vertical movement.

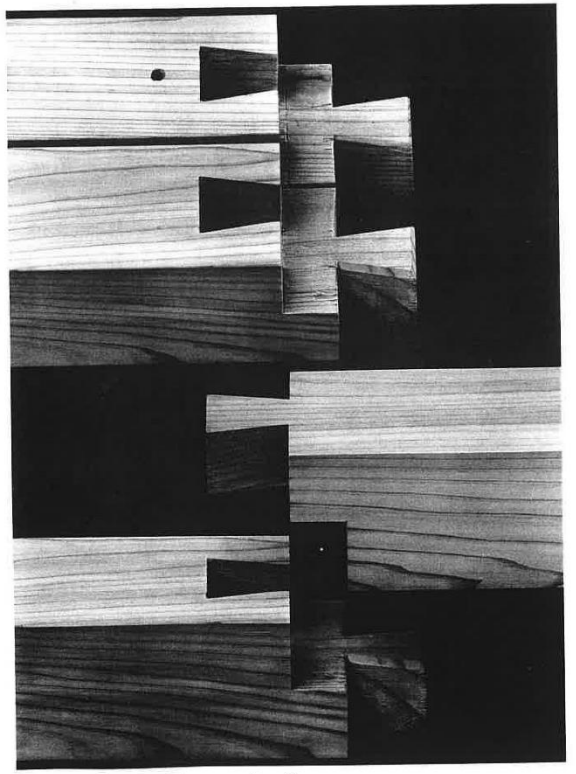
The **double lapped dovetail,** which originated in Japan, represents a transitional stage between the lap joints and the tabled lap joints that will be described later. This joint is also sometimes called a **tabled lap joint with two dovetails**.

Symmetrical joinery is one of the characteristics of Japanese wood construction. The identical mating parts can be marked out together, which makes it considerably easier to construct the joint and ensures a precise fit. It's important to make sure that all the saw cuts are made on the waste side of the scribe lines. Otherwise, you'll end up with a joint line that is the thickness of the sawblade.

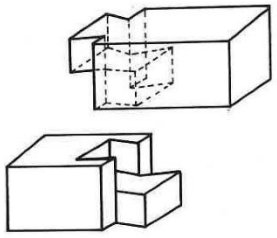
Cabinetmakers use double dovetail joints as decorative elements; carpenters use them where joints under tension are unsupported from below.



Double lapped dovetail (Ni-mai-ari-tsugi)



Double lapped dovetail (Ryo-men-ari-tsugi)



Double dovetail joint

Graubner, W. (1998). Encyclopedia of wood joints. Newtown The Taunton Press

Graubner, W. (1998). Encyclopedia of wood joints. Newtown. The Taunton Press

The Gerber Joint

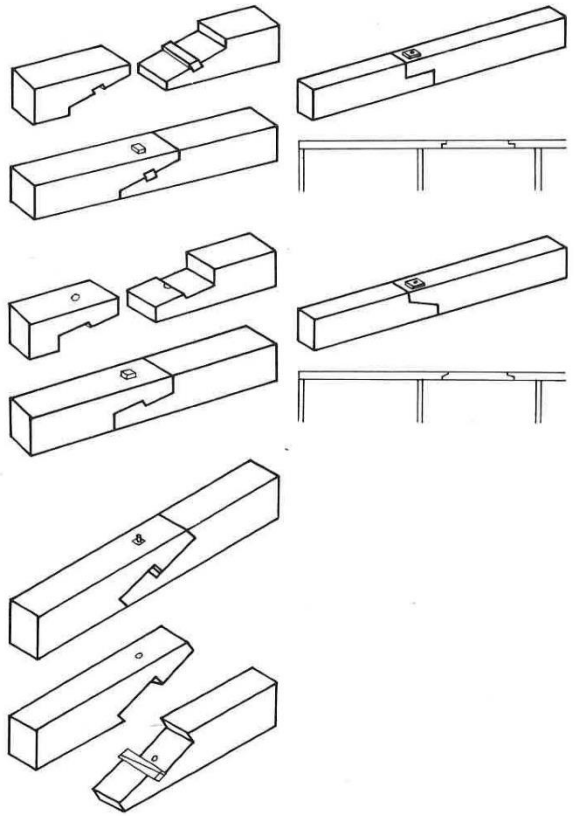
In 1880, Heinrich Gerber developed a special hooked scarf joint for joining purlins in civil engineering. The so-called **Gerber joint** is used to splice a purlin section into position from below. The joint, which is secured with bolts, has two advantages:

1. It can be used without a supporting post directly below the joint. The distance between the end of the spliced section and the nearest supporting post is ⅓ to ½ of the total bearing width. The purlin can be considered as load-bearing along its entire length, which simplifies arithmetic calculations.

2. Because the purlin section is installed from below, it protects the host purlin from splitting.

The Gerber joint can be further reinforced against tension by inserting hardwood keys, wedges or pegs.

The disadvantage of this joint is that it is difficult to position the inserted purlin section.

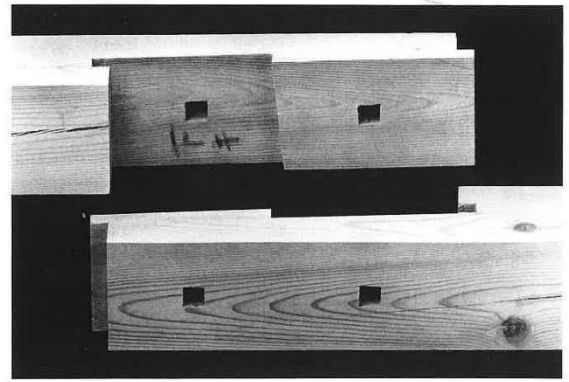


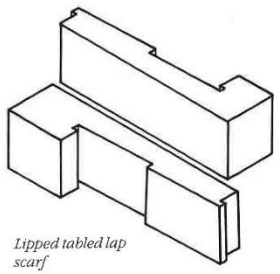
Variations of the Gerber joint

Tabled Lap Scarf Joints

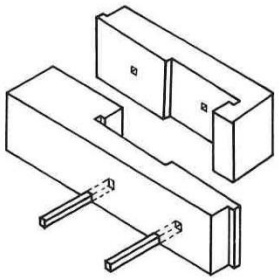
Lap joints can also be tabled. In its basic form, the **lipped tabled lap scarf** has mating surfaces that are aligned vertically (compared with the tabled splayed joint, in which the alignment is horizontal). This orientation decreases stress on the rabbeted lips. The shoulders of the table are cut at a slight taper to prevent vertical shifting.

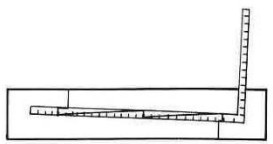
The **pegged tabled lap scarf** is sometimes known as the "arch clasp." Pegging the joint provides better resistance to vertical shifting than tapering the shoulders of the table. This joint is used for joining arched cornice boards and for joining rafters, and it is also used in interior work.



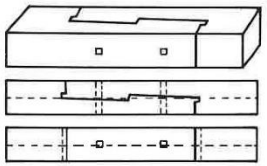


Lipped tabled lap scarf





Layout using the 15-mm (⅝-in.) wide Japanese square

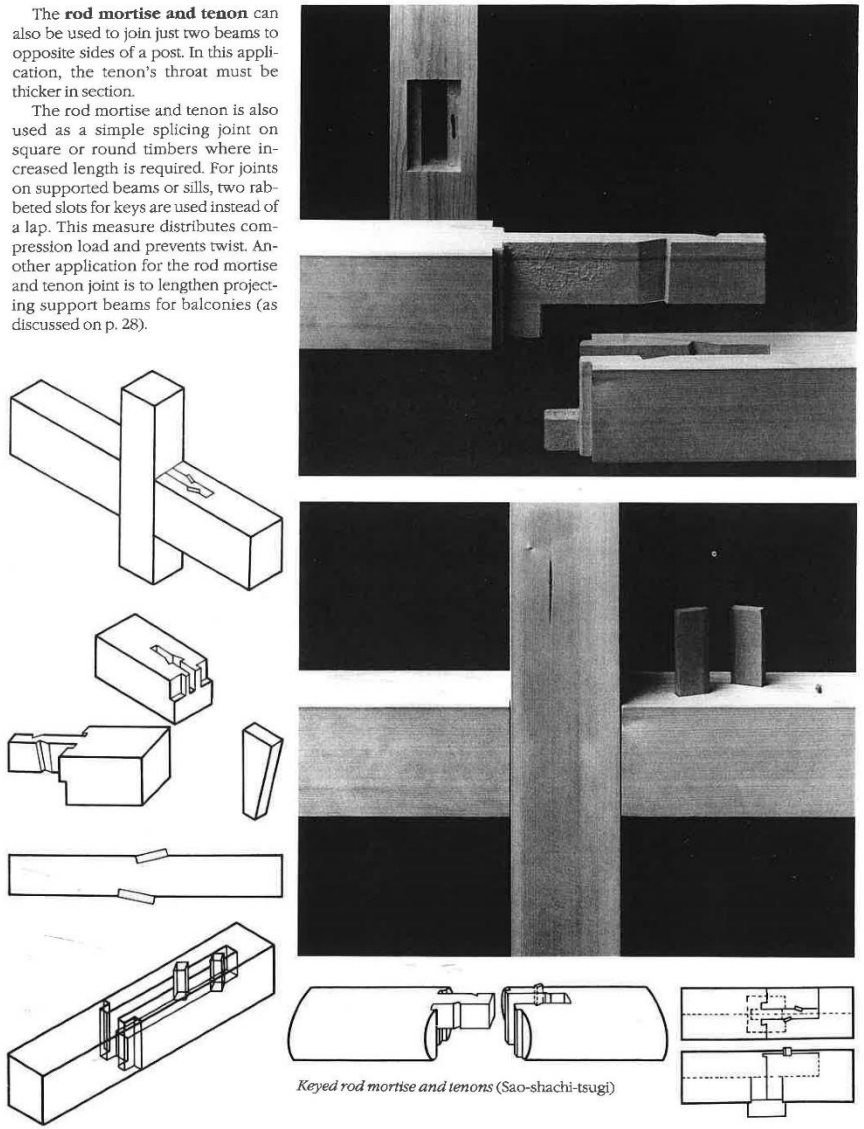


Lipped tabled lap scarf reinforced with pegs (Atsukake-daisen-tsugi)

Graubner, W. (1998). Encyclopedia of wood joints. Newtown. The Taunton Press

The **rod mortise and tenon** can also be used to join just two beams to opposite sides of a post. In this application, the tenon's throat must be thicker in section.

The rod mortise and tenon is also used as a simple splicing joint on square or round timbers where increased length is required. For joints on supported beams or sills, two rabbeted slots for keys are used instead of a lap. This measure distributes compression load and prevents twist. Another application for the rod mortise and tenon joint is to lengthen projecting support beams for balconies (as discussed on p. 28).



Keyed rod mortise and tenons (Sao-shachi-tsugi)

Slot mortise and tenons

Slot mortise-and-tenon joints used for splicing are known in both the West and the East. Except for the bolted bird's-mouth mortise and tenon, the examples in the drawings on this page are taken from furniture construction and are suitable for joining boards of narrow thickness. The stability of the joint is maintained by using wooden dowels or pegs.

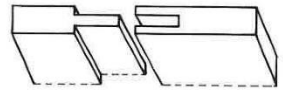
The **slot mortise and tenon with undercut shoulders** is a good glue joint. The end-grain bevels increase the mating-surface area and prevent the mortise from opening.

The **double-tenon joint** is suitable for joining large-dimension frame members.

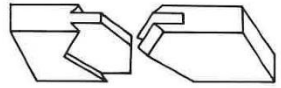
If a length of wood is too short to allow a tenon to be cut, a cross-grain **loose tenon** can be inserted into the mortises at the end of the two mating boards. The loose tenon should not be too thin. One advantage is that the mating parts are identically cut.

Offset double tenons can be used to join thin furniture-frame members through cross pieces. The same joint can also be made with a loose tenon.

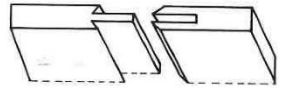
The **upright mortise and tenon,** also known as the scissors joint, and the **bird's-mouth mortise and tenon** are suitable for joining large structural timbers. The mating members of these joints are bolted together.



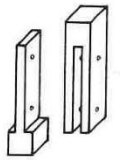
Slot mortise and tenon

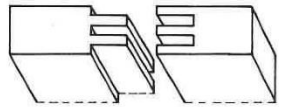


Bird's-mouth slot mortise and tenon with beveled shoulders

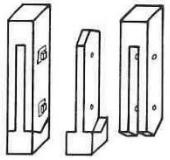


Slot mortise and tenon with undercut shoulders



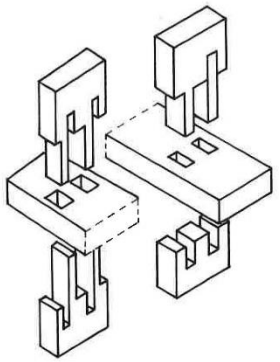


Double tenon joint



Upright mortise and tenon and bird's-mouth mortise and tenon, with bolts

Loose tenon joint



Offset through double tenons