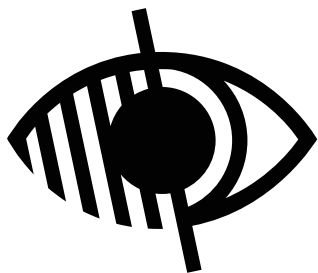


Large print guide



The Craft of Carpentry: Drawing Life from Japan's Forests

木の命を汲む人

Please return after use

Notices

At busy times, you may be asked to wait a while before entering the gallery.

Various types of wood are openly displayed in this exhibition. Visitors with wood allergies should consult a member of staff before entering.

Please refrain from touching items in the gallery.

We encourage you to take photos and videos (for non-commercial use only), but please refrain from filming the video footage in the exhibition.

The consumption of food or drink is not permitted in the gallery.

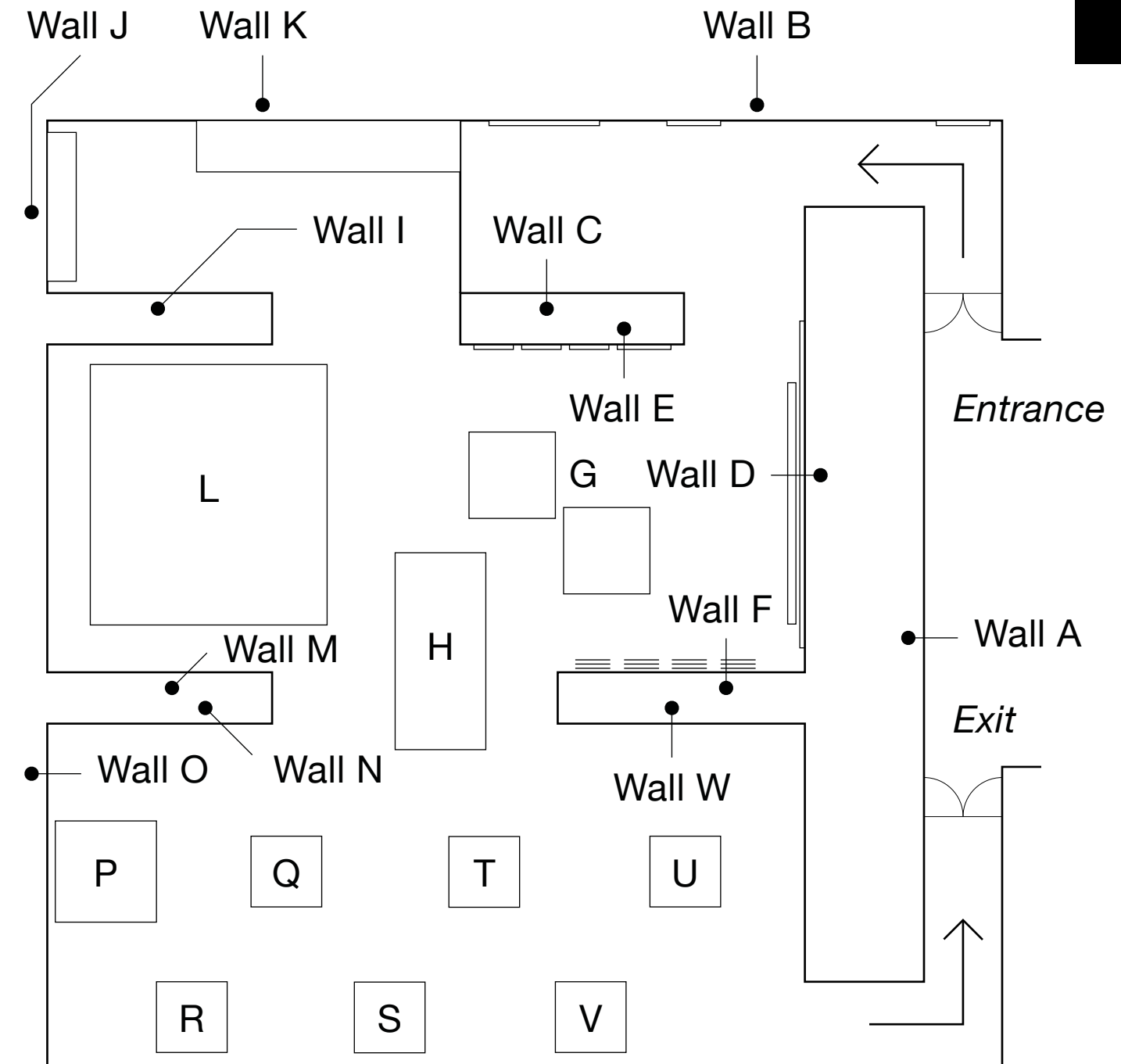
Children must be supervised at all times.

No dogs, except assistance dogs.

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Exhibition Plan



Introduction

Wall A

The Craft of Carpentry: Drawing Life from Japan's Forests

This exhibition reveals the essence of Japanese carpentry in three ways: through the work of temple and shrine carpenters (*dōmiya daiku*); that of teahouse carpenters (*sukiya daiku*); and joinery techniques (*kigumi*).

Since ancient times, Japan's craftspeople have been shaping their social environment. Their work continues to permeate all aspects of life, contributing to everything from the everyday to the most sacred grand designs. Within this society, people have always been grateful for the blessings of nature and revered the innumerable *kami* – spirit-deities – residing in the natural world.

Carpenters and woodcutters respectfully seek forgiveness from the forest *kami* before gathering the raw materials for their work. Understanding the individual qualities of trees and their environment is crucial to their activities.

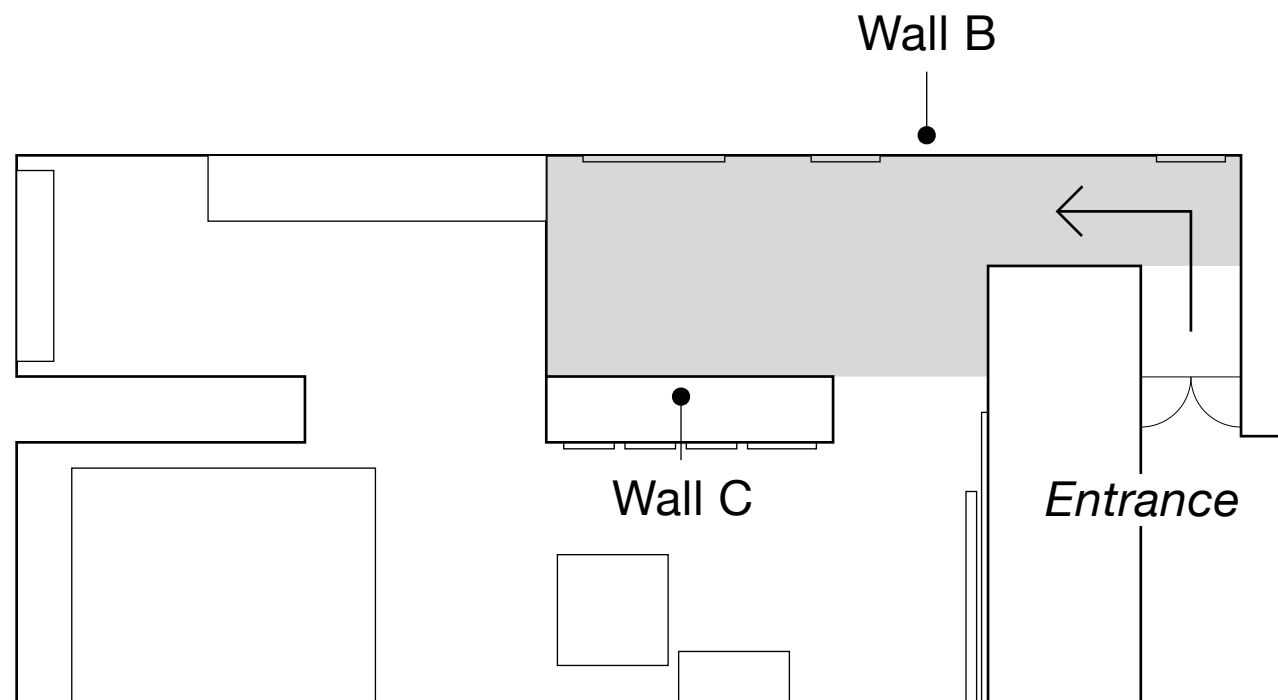
The great 20th-century craftsman Nishioka Tsunekazu laid out a number of key principles. For temple construction, he advised using wood from a single mountain, and understanding the wood's natural curves. Choosing the right wood is vital: trees grown on higher mountain slopes are ideal for structural elements such as beams and pillars, while those in the lower valleys are better for finishing materials. When used correctly, wood can last for generations.

Timber is only a renewable resource if the growth period of the tree and the life of a building align. If we use a 1,000-year-old tree, we need to be prepared to take on more than 1,000 years of responsibility for the building we create.

The precision of Japanese woodworking is deeply rooted in a respect for nature, expressed through highly refined techniques and tools. In a land where iron is scarce, carpenters developed advanced joinery methods that do not rely on the use of nails. As we reconsider our relationship with our planet, these practices offer a wisdom that continues to resonate today.

Nishiyama Marcelo PhD
Associate Director and Chief Curator,
Takenaka Carpentry Tools Museum

Japanese carpentry tools



Wall B

***Maebiki-oga* / Wide blade ripsaw**

In Japan, up until the mid-Muromachi period (1333–1573) there were no vertical saws. Instead, timber was processed using splitting techniques with chisels. With the introduction from the Asian continent of the *oga* (a large vertical ripsaw operated by two people), timber processing improved significantly, greatly advancing architectural production. The *oga* was quickly replaced by the *maebiki-oga* (a one-person ripsaw with a wide blade unique to Japan) and the *gagari* (a saw for small-scale splitting). These remained the main tools for timber processing until the mid-Meiji period (1868–1912).

***Ono* / Axe**

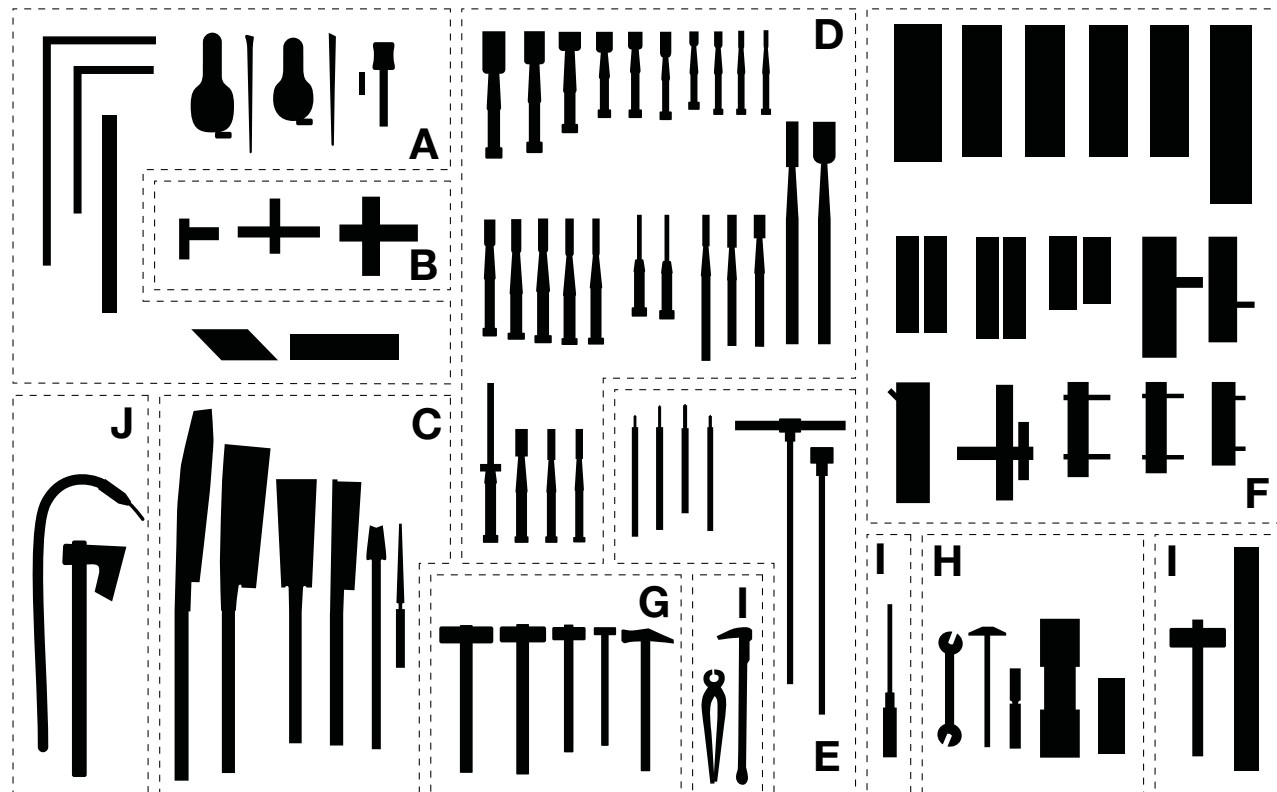
Axes with narrow blades are called *ono*, while broadaxes with wider blades and a tapered edge on one side are referred to as *masakari*.

Ono are broadly divided into two major categories, cutting axes (*kiri-ono*) and splitting axes (*wari-ono*), both used for forestry work. Small splitting axes with a short handle are called *kowari-ono* and are used for splitting timber into small pieces.

Masakari are mainly used to smooth and finish timber. There are two types of *masakari*. One has a longer handle and is used mainly for timber processing. The other, called the carpenter's broadaxe (*daiku-masakari*), has a shorter handle and is used for rough carpentry or making wedges from wood scraps.

Japanese carpentry tools Standard tool set

The defining features of Japanese carpentry tools are their exceptional sharpness and wide variety. A 1943 survey of tools owned by carpenters living in Tokyo found that 179 carpentry tools were necessary to construct a full-scale building. 87 of these tools are exhibited here.



A. *Sumi-kake dōgu* / Marking tools

The *sumi-tsubo* (carpenter's line) originated in China and is a tool unique to Asia. Literally 'ink pot', the *sumi-tsubo* is used for drawing straight lines and marking. Notably it is one of the only tools that is intricately carved.

B. *Suji-kebiki* / Marking gauges

A marking gauge is a tool used to draw lines parallel to a surface used as a reference.

C. *Nokogiri* / Saws

A significant feature of Japanese saws is that they cut on the pull stroke. This allows a thinner blade, enabling more precise work. Depending on the direction of the cut relative to the wood grain, Japanese saws are classified into two types: rip saws that cut along the wood grain and crosscut saws that cut across it. In addition, there are double-edged saws with both ripping and cross-cutting blades.

D. *Nomi* / Chisels

Chisels are broadly categorized into striking chisels and paring chisels depending on their purpose. Striking chisels are used with a hammer or mallet to create mortise holes for joints or to remove excess material. To withstand striking, they have an iron ring called a *katsura* on the head of the handle. Paring chisels are used to finish areas carved with a striking chisel or to smooth small areas that cannot be planed. Chisels come in various blade widths suited for different tasks.

E. *Kiri* / Gimlets

A gimlet, or *kiri*, is a tool used to create round holes by rotating its pointed edge. The shape of the cutting edge varies depending on the purpose and material. Hand gimlets were traditionally used to make nail holes, but with the introduction of European and American-style bolt-based architecture in the Meiji period (1868–1912), screw-shaped gimlets became common.

F. *Kanna* / Planes

Japan is the only country where planes (*kanna*) are pulled rather than pushed. These tools are used to smooth the surface of boards and square-edged timber. There are two blade types: a single blade and a laminated double blade. Originally, all planes had a single blade, but in the late Meiji period (1868–1912), the laminated double blade, or *awase-kanna*, was introduced. This new plane reduced surface irregularities caused by shaving against the wood grain and quickly became the norm.

G. *Gennō* / Hammers

The *gennō*, a type of Japanese hammer, is mainly used for striking chisels or driving nails. There are

several types differing in the shape of the iron head: the *ryōguchi-gennō* has two flat striking faces, called *koguchi*, of equal surface area, whereas the *funate-gennō* and the *kataguchi-gennō* have one end pointed and the other flat.

H. Maintenance tools (left to right)

Double open-ended spanner
Asari-tsuchi / Asari hammer
Metate-yasuri / Saw file
Toishi / Whetstone

Whetstones are used to sharpen the blades of chisels and planes by drawing the blade across the stone at a precise angle. Most Japanese whetstones are made of natural stone shaped into a rectangular form, but in recent years, synthetic whetstones have also become common. In Japan, whetstones are classified into three primary categories according to the grit size of their abrasive particles: coarse (*ara-to*), medium (*naka-to*), and fine finishing stones (*shiage-to*).

Dai-naoshi ganna / Sole tuning plane

I. Other tools (left to right)

Kuginuki (enma) / Pincers

Kuginuki (kajiya) / Crowbar

Flat-blade screwdriver

Kizuchi / Mallet

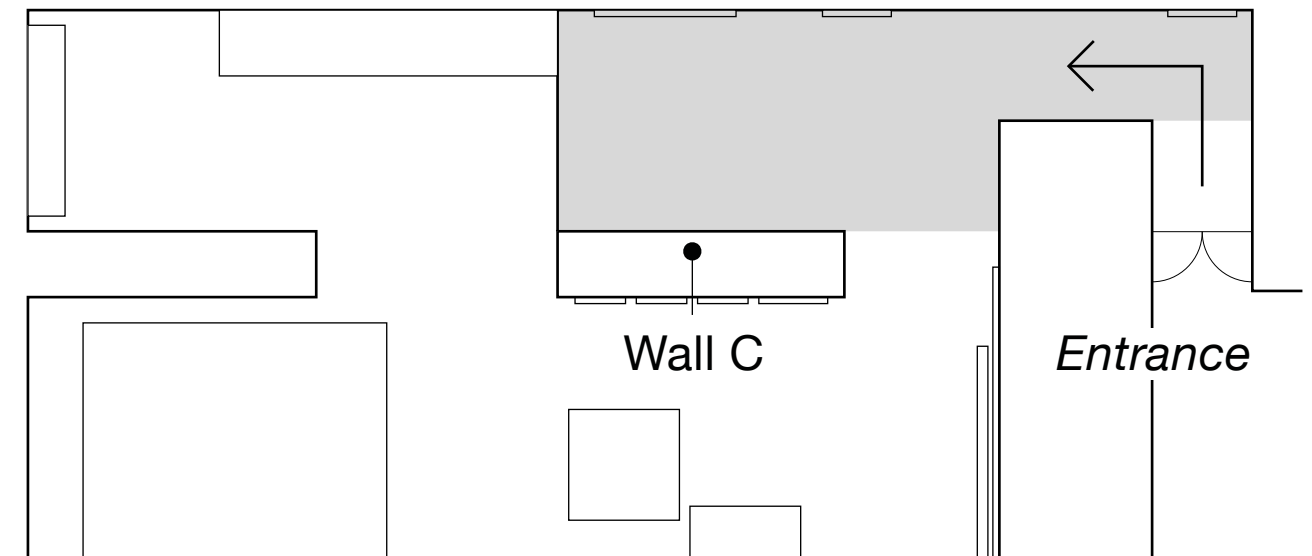
Jōgi / Ruler

J. Ono / Axes (left to right)

Chōna / Adze

Daiku-masakari / Carpenter's broadaxe

Scan the QR code to access
detailed information on
individual tools.



Wall C

Four Social Classes: Artisans

Utagawa Toyokuni III

Ink on paper; original 1858 (reproduction); first edition,
complete set of 3 prints

The scene depicts the construction process known as *tatemaie*, where the framework of a building is assembled. Carpenters stand on various parts of the scaffolding made of logs, passing materials by hand up from the ground. The construction is progressing from right to left, with the two workers on the right lifting components of the roof structure, while the long piece being raised by the two in the centre is likely to be the ridgepole. The two workers on the left are carrying the *kabura-ya* (whistling arrow) and *heigushi* (ritual staff) used in the *Jōtō-shiki* (Topping Out Ceremony), indicating the framework is almost complete.

Plane shavings

Ultra-thin shavings, produced using an *ō-ganna* (large plane) and a *hira-dai-ganna* (flat-base plane), are placed in front of the artwork.

These shavings are approximately 10 μm (micrometres) thick. In precision planing competitions, shavings as thin as 3 μm have been recorded.

Yari-ganna / Spear plane

This tool is used for shaving and finishing the surface of wood. It was the primary type of plane used in Japan from the Kofun period (c. 300–538 CE) through ancient and medieval times until the mid-Muromachi period (c. 1336–1573) when *dai-ganna* (planes with blades mounted on a wooden base) were introduced. Today *yari-ganna* are still used for building repairs and restoration work.

The *yari-ganna* has a double-edged blade with a sharpened pointed tip attached to a handle about the length of an arm and is used for finishing work after rough shaping with an adze (*chōna*). The user grips the handle at shoulder-width and moves it back and forth to shave the wood. Unlike *dai-ganna*, it leaves distinctive ripple marks.

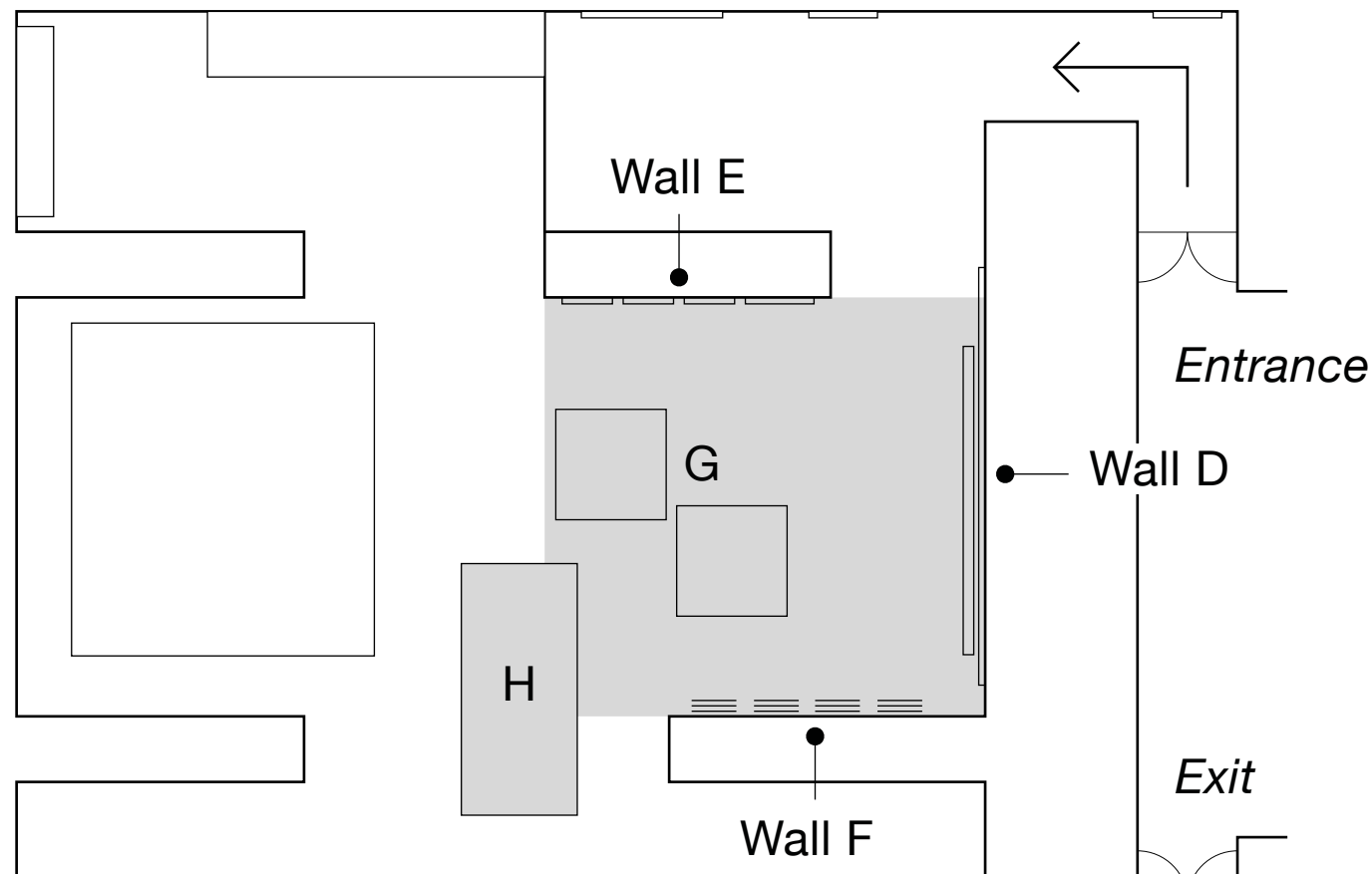
Ō-ganna / Large plane

Cross-section model of a plane

Plane blades are typically arranged in a two-blade setup, known as *awase-ganna*, with a secondary blade called a chip breaker added to prevent tear-out. Tear-out can occur when shaving against the grain, resulting in a rough, uneven surface. Skilled users can achieve a smooth finish even with a single blade, while unskilled users may still cause tear-out even with a double-bladed plane.

Hira-dai-ganna / Flat-base plane

Temple and Shrine Carpentry



Wall D

Temple and Shrine Carpentry

Unlike carpenters who focus on residential projects, temple and shrine carpenters (*dōmiya daiku*) specialize in the large-scale wooden structures of Buddhist temples (*dō*) and Shintō shrines (*miya*).

These carpenters construct majestic sacred buildings designed to endure for hundreds of years. Their

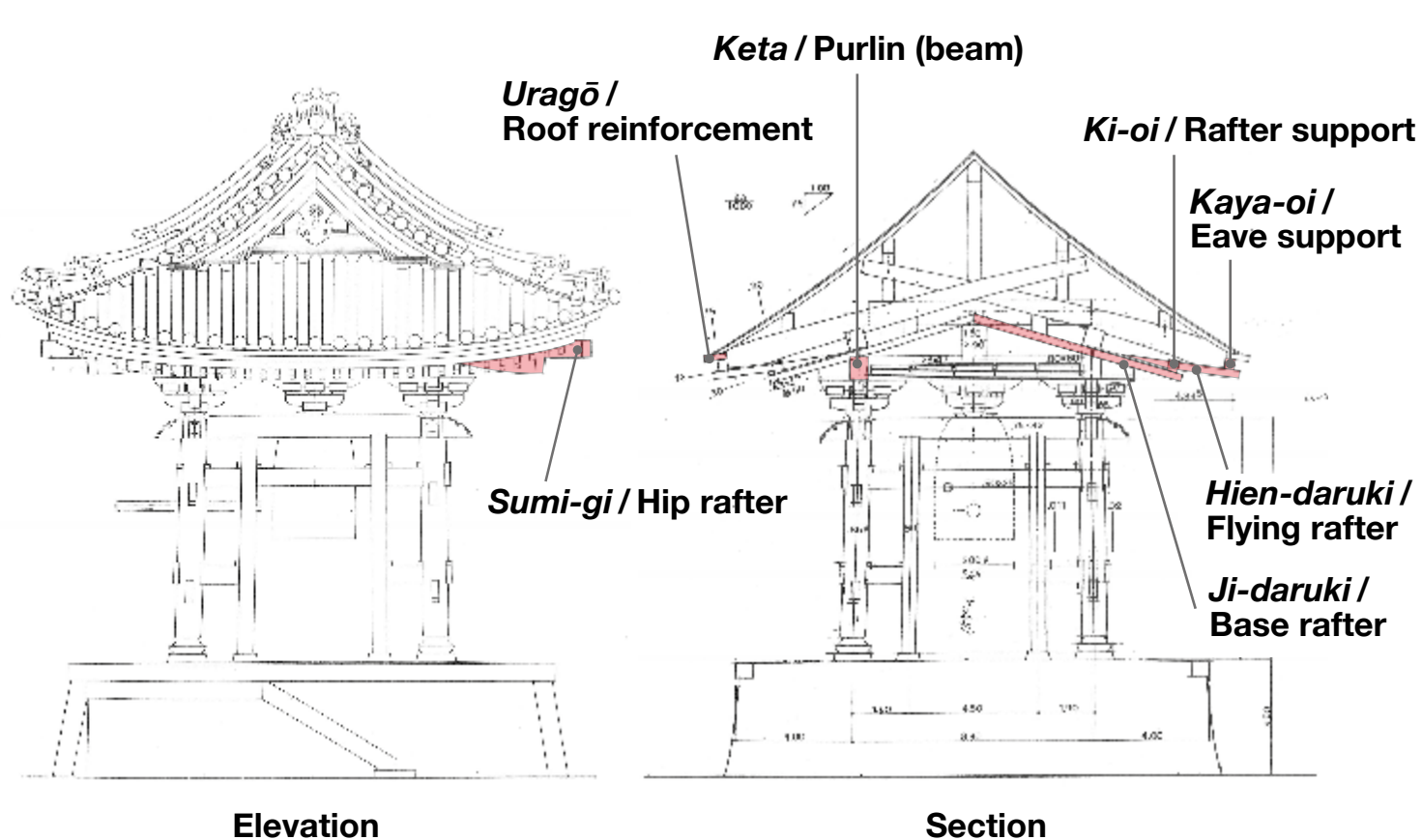
work involves large timbers and requires specialized knowledge of techniques such as complex *tsugite* and *shikuchi* joints, as well as the assembly of intricate bracket systems (*kumimono*) and the creation of cambered roofs.

The head carpenter, or *tōryō*, leads a team of skilled artisans to build temples and shrines, ensuring the buildings can withstand harsh weather conditions for centuries. These master carpenters direct these monumental architectural projects continuing a tradition that spans a millennium. This section introduces the work of a *dōmiya daiku tōryō* through models and architectural drawings.

Technical drawing for the Jigan-ji bell tower eaves

Ikaruga Kōsha
Plywood; 2010

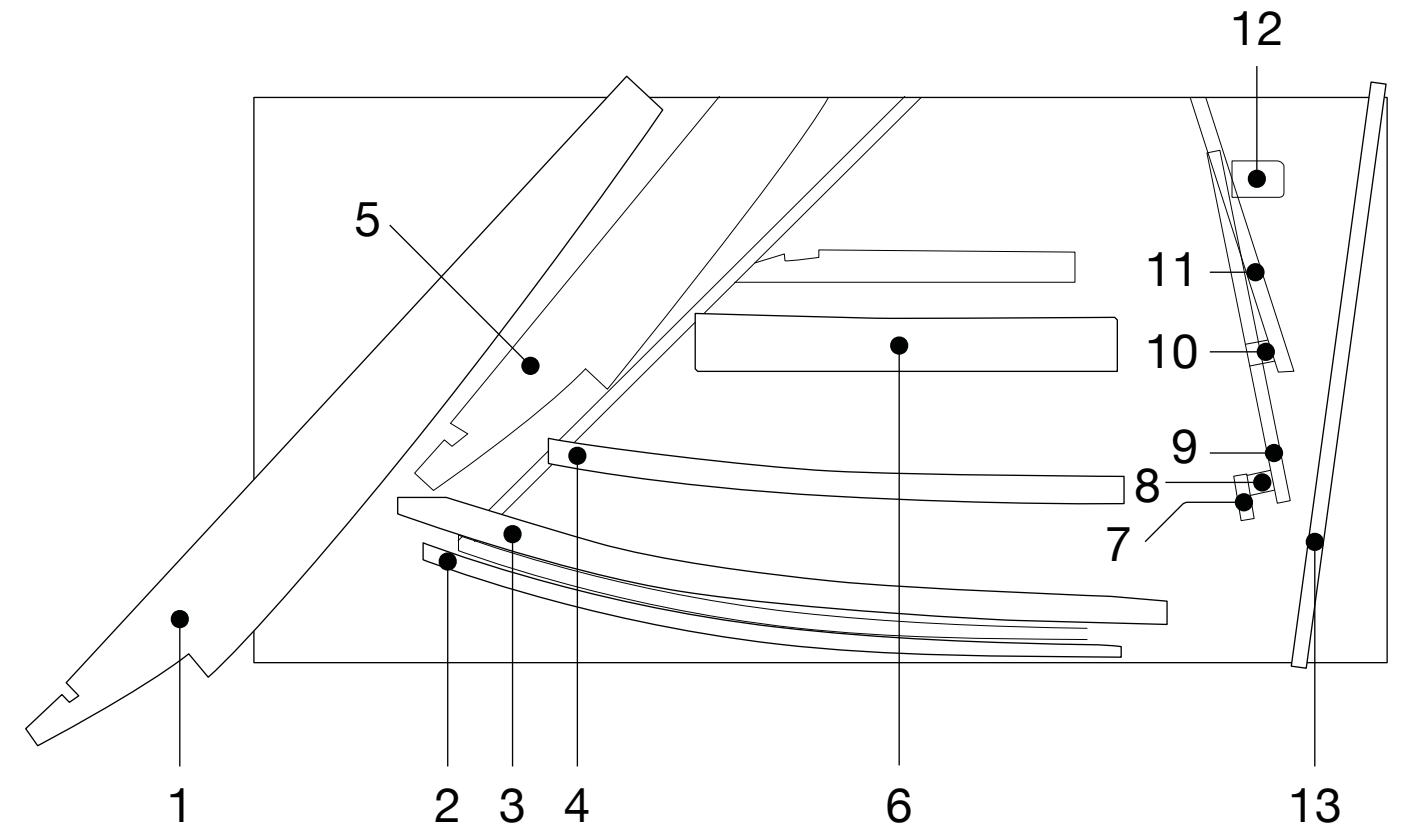
This full-scale technical drawing rendered on plywood was created to clarify unclear details in the design. Such drawings are a characteristic approach used by temple and shrine carpenters who construct large buildings. This drawing features details of a difficult roof corner on the bell tower at the temple, Jigan-ji. It combines elevation, cross-section and 45-degree diagonal elevation views.



Reproduction of a hip rafter (*sumi-gi*) from the Jigan-ji bell tower

Ikaruga Kōsha
Hinoki cypress; 2010
Full scale model

The hip rafter, or *sumi-gi*, is a long structural member that supports the eaves at the corners of a building. Mortise holes are carved into its sides to insert thin rafters. Marking these joint locations and angles presents a complex three-dimensional geometric challenge. This process requires advanced skills in *kiku-jutsu* – a method that applies geometry and measurement techniques to the precise design and construction of intricate architectural components.



1. Template for hip rafter (*sumi-gi*)
2. Template for roof reinforcement (*uragō*)
3. Template for eave support (*kaya-oi*)
4. Template for rafter support (*ki-oi*)
5. *Sumi-gi* / Hip rafter
6. Template for purlin (*keta*)

7. *Uragō* / Roof reinforcement

8. *Kaya-oi* / Eave support

9. *Hien-daruki* / Flying rafter

10. *Ki-oi* / Rafter support

11. *Ji-daruki* / Base rafter

12. *Keta* / Purlin (beam)

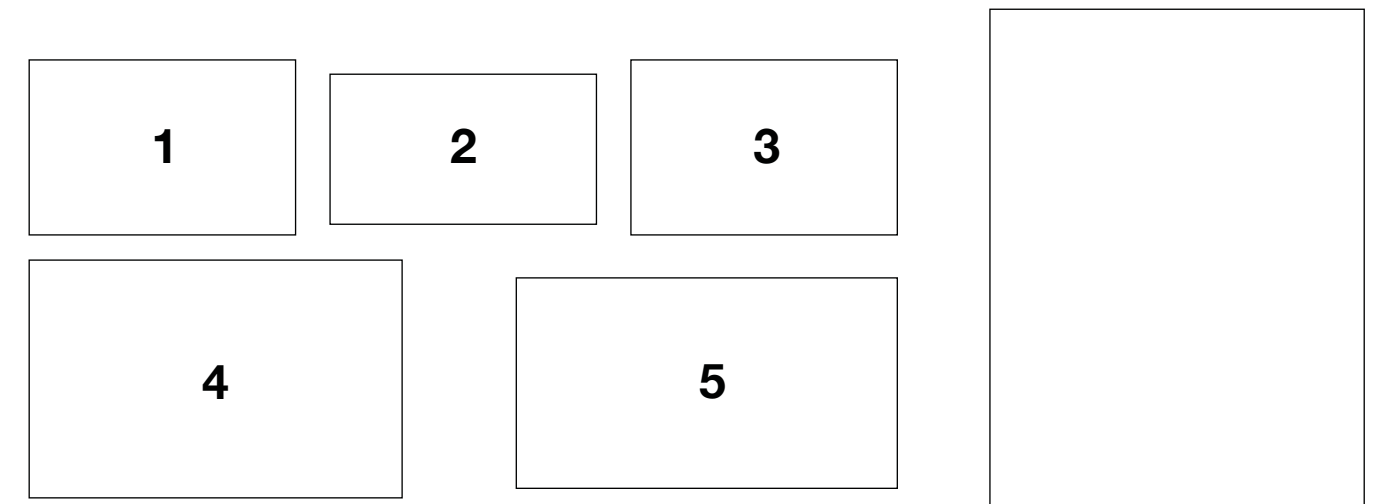
13. *Shaku-zue* / Measuring rod

Wall E

Design boards (*zuīta*) from Hōryū-ji

Nishioka Tsunekazu
Wooden board; 1968

In the past, design plans were drawn on wooden boards because paper was susceptible to damage by the elements. Such drawing boards are rarely seen today. This example was used by master carpenter, Nishioka Tsunekazu, during the restoration of Hōryū-ji, a temple in Ikaruga, Nara.



1. Elevation drawing of bracket tie beam

2. Roof structure plan for the Great Lecture Hall at Hōryū-ji

Scale: 1:100

3. Rafter drawing for the Great Lecture Hall at Hōryū-ji

Scale: 1:10

4. Elevation and section drawing for the Denpō-dō at Hōryū-ji

Scale: 1:20

5. Technical drawing for the Great Lecture Hall at Hōryū-ji

Elevation drawing for the three-storied pagoda at Hōrin-ji

Nishioka Tsunekazu

Ink on paper; 1968

Scale: 1:10

A blueprint for the three-storied pagoda at the temple, Hōrin-ji, in Ikaruga, Nara, rebuilt in 1973. The upper section presents an overhead view and cross-sectional view from the corner (diagonal) direction, while the lower section shows the cross-section from the front.

Wall G

Kataita

wooden design templates

Ikaruga Kōsha

Plywood; date unknown

Kata-ita or *kiyose*, are wooden design templates used to mark the shape of curved architectural elements, such as roof arcs and beams. Even with the same materials, the size and shape can vary subtly depending on the specific building. These templates are one of the essential tools of the *dōmiya daiku* (temple and shrine carpenters) who often work with curved surfaces. They are rarely used in *sukiya* residential construction which primarily employs square-edged timber.

F

Interlocking bracket complex model from the Shariden at Engaku-ji

Ikaruga Kōsha
Hinoki cypress; 2019

Beneath the eaves of a temple or shrine, you can find *kumimono* – intricate wooden brackets that support the roof above the posts. This full-scale model reproduces the elaborate structure of the *kumimono* from the Shariden reliquary hall at the temple, Engaku-ji, in Kamakura. The *masu* (bearing blocks) and *hijiki* (bracket arms) are stacked in all four directions. Once assembled, the weight can be balanced, just as with a set of scales.

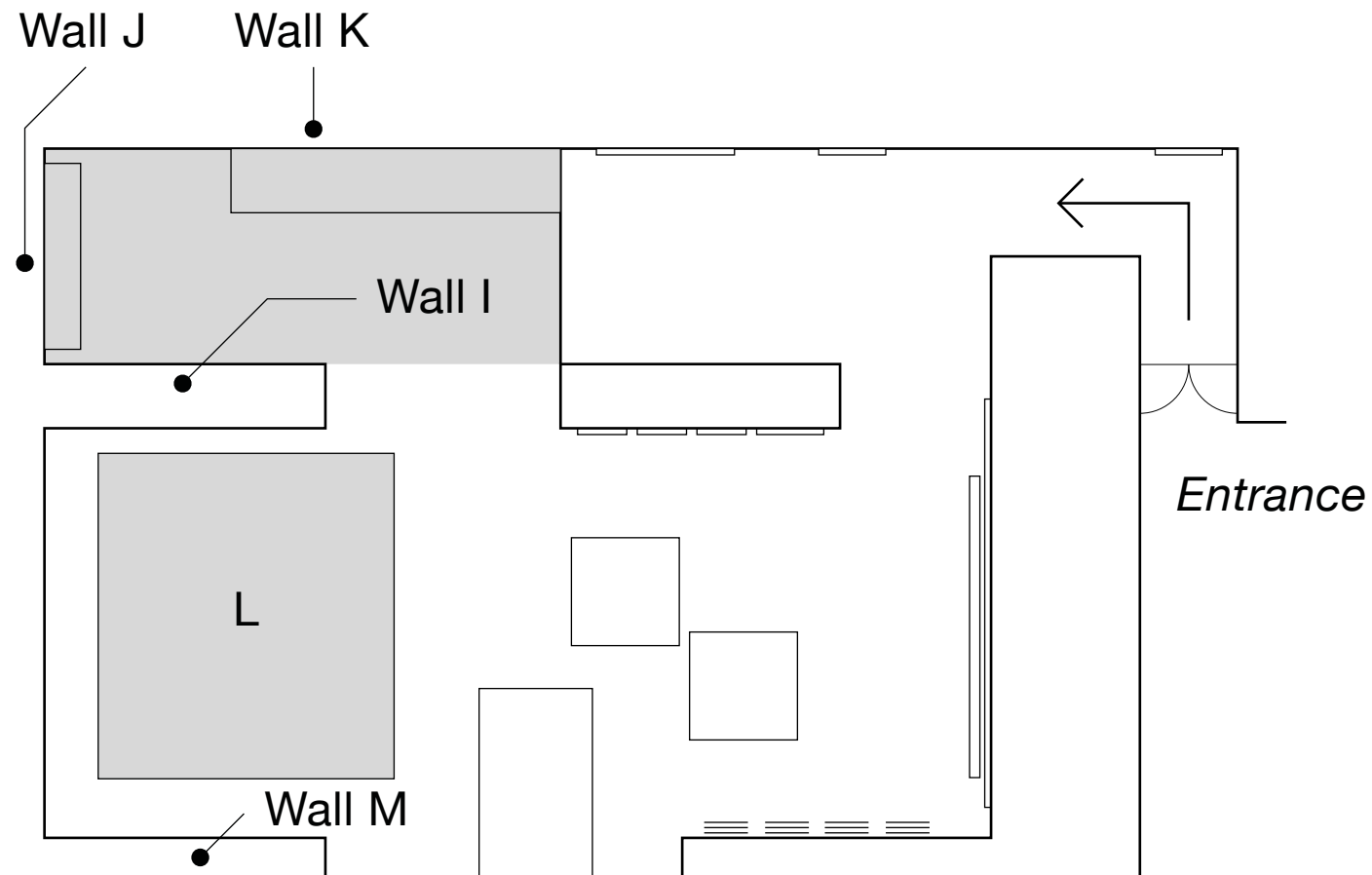
H

Structural model of the Tōindō at Yakushi-ji

Ikaruga Kōsha
Hinoki cypress; 2014

The Tōindō, a hall within the temple complex of Yakushi-ji, was built in the Kamakura period (1185–1333). Here, a section of the roof is reproduced at 1:2 scale using Yoshino cypress. The model highlights the deep eaves formed by delicately curved parallel rafters, a hallmark of Japanese architecture. This feature is achieved through an innovative roof structure incorporating thick timbers, known as *hane-gi*. The model also shows the coffered ceiling with horizontal beams (*nageshi*).

Sukiya Carpentry



Wall I

Sukiya carpentry

Sukiya carpentry is used in the construction of teahouses and residential buildings. A distinctive feature of *sukiya* carpentry is the use of round unprocessed materials, such as natural logs, known as *marumono*. Within the architecture of *chanoyu* (the Japanese way of tea), particularly that of the teahouse, *sukiya* carpenters have refined this technique by integrating it with design. *Sukiya* architecture is characterized by a light, elegant

aesthetic. The roof has a gentle slope, the eaves are deep, the pillars are slender, and the walls are thin. As a result, a special ingenuity is required to realize the interior, hidden from the outside. The sophisticated techniques seen in the construction of the *sukiya* teahouse reflect the highly attuned Japanese sensibility to incorporating nature into living spaces.

Log marking

When using minimally processed logs in construction or as design elements, marking accurate measurements on uneven or textured surfaces is difficult. To address this, a reference line is established passing roughly through the centre of the log. All measurements, such as the dimensions of the flat surfaces and cross sections, are planned based on this reference line.

Marked round column

Logs are usually marked with red ink to guide joint carving. Although not visible once assembled, slender pillars may feature numerous notches and mortise holes. The various height measurements used throughout the teahouse are recorded on a measuring rod with different dimensions marked for each of the four sides including the serving area and the tea preparation area.

Marked round column (back)

Processed round column (front)

– Inside acrylic case –

1. Carpenter's line

2. Bamboo pen

3. Duplicate marking pen

4. Contour gauge (outline duplicate marking tool)

Hikari-tsuke

In buildings where pillars are erected on natural stones, the bottom of each pillar is carved to match the uneven shape of the foundation stone. This process, known as *hikari-tsuke*, involves using a compass or a similar tool to trace the shape of the foundation stone onto the base of the pillar, which is then gradually shaved to ensure a precise fit.

Wall J

Logs and bamboo

An affinity in Japan for log-based construction has been passed down since the medieval and early modern periods. Shōgun Ashikaga Yoshimasa (1436–1490) incorporated logs with the bark intact into the construction of the teahouse at his residence, the Muromachi Palace, and constructed bamboo teahouses (Chiku-tei and Sōsen-tei) at his mountain villa, the Higashiyama Palace (later the temple Jishō-ji, known today as Ginkaku-ji, the Temple of the Silver Pavilion). Bamboo, with its combination of softness, delicacy and physical strength, has long been an accessible and familiar material for Japanese homes built in harmony with nature.

Sugi-maruta Japanese cedar logs

In *sukiya* architecture, Japanese cedar (*Cryptomeria japonica* or *sugi* in Japanese) is often favoured over high-grade *hinoki* cypress for its softer texture. Particularly, Japanese cedar logs from Kitayama in Kyoto, known as Kitayama cedar, are highly prized for their fine-grained quality, a result of their slow growth due to local soil conditions.

Sabi-maruta **Stained logs**

Sabi-maruta, or stained logs, are created by removing the bark during the summer rainy season and applying mould to the surface. This results in unique patterns such as the speckled ‘light and shade’ variation which is particularly popular. Originally, knotted *hiba* wood was used for this purpose, but now *hinoki* cypress is also used.

Logs with natural bark

Logs with the bark left intact are often used in *soan* (thatched hut style architecture) to evoke a rustic atmosphere. The most popular wood for this purpose is Japanese red pine (*aka-matsu*). After the rough outer bark is scraped off, an attractive mottled pattern is left, making it a preferred choice for features such as *toko-bashira* (alcove pillars).

Bamboo

Another characteristic of *sukiya* architecture is the deliberate use of bamboo despite its low durability. Bamboo is used extensively throughout construction for its lightweight and delicate appearance, including for rafters, ceiling rods, *renji-mado* (windows covered with bamboo slats), and *shitaji-mado* (windows

made by exposing the lattice framework of the wall). These elements give the *sukiya* space an airy rustic atmosphere as in a *soan* (thatched hut).

List of logs on display, in order from left:

Polished log

Polished artificially shaped log

Sabi-maruta (stained log)

Hinoki cypress *ate* log

Japanese red pine log

Magnolia *kobus* log

Chestnut log

Naguri chestnut log

White bamboo

Bamboo for rafters

Susu bamboo

Goma bamboo

Yamato (medake) bamboo

Wall K

Kyōkabe

Clay wall section model

The walls of teahouses are thin – less than 42 mm – due to the narrow diameter (84 mm) of the typically round, naturally curved pillars. While the construction process is not significantly different from standard methods for making clay walls, all components (including the base framework, timber, bamboo and rope) are specially prepared to achieve this reduced wall thickness.

***Tatami* surface (*nakatsugi-omote*)**

The surface of the *tatami*, the part we come in contact with, is made by weaving soft rush grass (*igusa*). The example displayed here is a high-grade *nakatsugi-omote*, made with two strands of rush grass spliced together at the centre. This method avoids using the less durable tips of the grass, making it last longer.

***Sukiya*-style *tatami* mat**

In *sukiya* architecture, the standard *tatami* size is the larger *Kyōma* size (955 x 1910 mm), as opposed to the smaller *Edo* and *Chūkyō* sizes.

***Tatami* cross-section**

Tatami mats are made up of three main components: the base, the surface, and the edging. Traditionally, rice straw is used for the base. For high-quality *tatami*, five layers of rice straw are stacked and compressed from a thickness of nearly 40 cm down to approximately 5 cm, increasing durability and adding softness. Framing boards are inserted along the edges to prevent deformation. For teahouses, a simple linen border without any pattern is used.

Ornamental nail-head covering

In the execution of grand architecture in Japan such as shrines, temples and palaces, elaborately crafted metal fittings were widely used as symbols of power and wealth. During the Edo period (1603–1868), the use of such luxurious fittings in ordinary houses was heavily restricted, but they were sometimes used as covers to hide nails (*kugi-kakushi*) or for the handles of sliding doors (*fusuma no hikite*).

Exhibited here are decorative metal fittings used to hide nail heads in beams running between columns. The skilfully engraved designs include motifs such as ‘plum blossoms and raft’, ‘bird and plum blossom’, ‘chrysanthemum’ and ‘bird on pine’.

Door handles

In *sukiya*-style architecture, door handles (*hikite*) used to open and close sliding doors, such as *fusuma* and *shōji*, are decorative as well as practical. This decoration provides an opportunity for homeowners and artisans to express their creativity and playful spirit.

Designs are influenced by the type of room. In teahouses, simple shapes such as circles, ovals and squares, with subdued colours are preferred, complementing the peaceful atmosphere. In contrast, for guest rooms or larger spaces, more elaborate designs may be chosen to reflect the homeowner's personal taste.

Ajiro (yabane)

Woven wood panel with arrow fletch pattern

Ajiro refer to geometric patterns created by weaving thin strips of wood such as *kurobe* (Japanese thuja) or *sawara* cypress. Common patterns include check (*ichimatsu*), tortoiseshell (*kikkō*), and arrow fletch (*yabane*). *Ajiro* woven panels are used for ceilings or incorporated into *shōji* sliding doors. Characterized by a unique lustre and texture, they are essential elements in *sukiya* architecture.

Teahouse nails

Approximately 100 types of nails are used in teahouses. Although they are used throughout, both inside and outside, their presence is barely noticeable. Each small nail is handmade by an artisan and varies in form. They are shaped by hammering hot iron and blackened by smoking with smouldering pine needles. The nails serve a variety of purposes, such as hanging utensils, scrolls and flowers in the alcove (*tokonoma*) to convey the theme or season of a tea gathering.

Koshi-tsuki shoji

Sliding door with lower panel

This type of *shōji* (sliding door or screen) features both a wooden lattice framework with translucent *washi* (lit. 'Japanese paper') and a solid lower section (*koshi*). In this example, used as a teahouse entrance for nobles, the lower *koshi* panel incorporates wildwood boards elegantly finished with smoked bamboo. It is important to design these panels with the brightness of the interior in mind.

L & Wall M

Structural model of a teahouse

Kōbokusha

2014

Full-scale model

Teahouses are constructed using minimally processed natural materials, such as logs and bamboo, reflecting the beauty of the natural world. Special techniques are required to seamlessly combine different materials, such as wood with bamboo or wood with stone. These techniques can be observed throughout the different parts of this structural model.

Portions of the walls, ceilings, and fittings have been partially removed to reveal the craftsmanship of the carpenters and plasterers. Visible areas are constructed using lightweight wooden components, with hidden sections reinforcing the structure. These include the *toshi-nuki*, a long lateral support beam connecting multiple pillars, and the *chikara-nuki*, which supports the ceiling and roof above.

This model is based on Sa-an, a famous teahouse built in 1742 at Gyokurin-in, a sub-temple of Daitoku-ji. The floor plan features three *tatami* mats with an intermediate board, curved pillars, and intricately designed windows and ceilings, embodying the

sophistication of *sukiya* architectural design.

Sa-an Teahouse

Jōshinsai style

1742

Gyokurin-in, Daitoku-ji, Kyoto

Kōnoike Ryōei, an Osaka tea enthusiast and disciple of Jōshinsai (the 7th-generation head of the Omotesenke tea school), built the Sa-an Teahouse in 1742. Situated west of Nanmei-an – an ancestral tablet hall he constructed at Gyokurin-in, a sub-temple of Daitoku-ji – the teahouse was used to host memorial services held in the form of *chanoyu* tea gatherings.

Approaching through the *rojimon* gate to the northwest of the main hall and following the stepping stones, visitors are led to the west-facing exterior of Sa-an. Its gabled roof and deep eaves create the low, crouched appearance of a simple thatched hut.

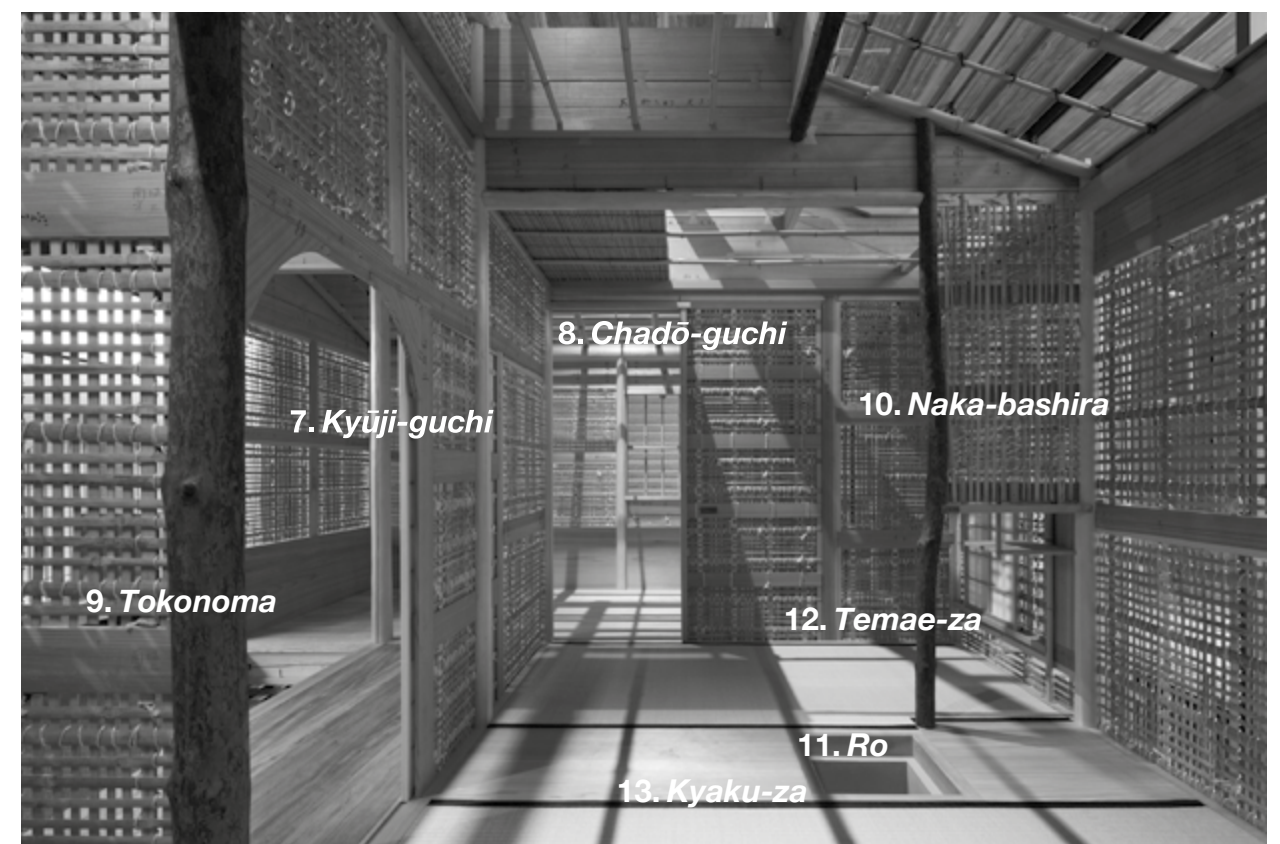
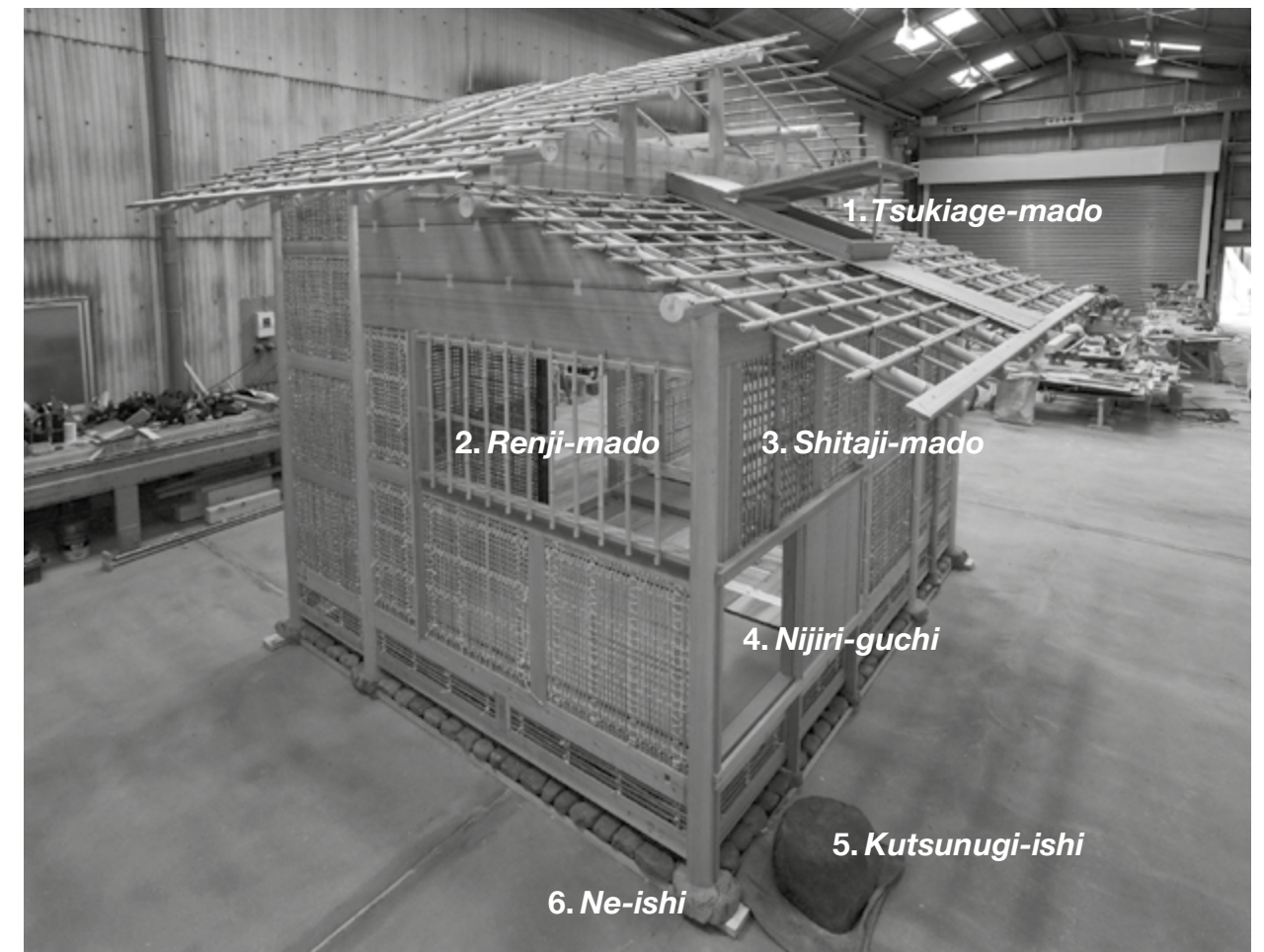
The interior features a three-*tatami* layout. A middle board separates the two *tatami* mats of the guest area and the single *tatami* mat for the tea preparation area which includes a recessed alcove (*tokonoma*). The hearth is set in a recess in the middle board, and a central pillar is erected to form a platform for tea preparation. While the one-*tatami* space for the host

would typically only require a *chadō-guchi* entrance, a secondary *kyūji-guchi* serving entrance is located next to the alcove to facilitate the host's work.

The ceiling is structured in three layers: a flat ceiling above the alcove, a *makomo* or reed-lined dropped ceiling over the tea preparation area, and a hanging ceiling over the *nijiri-guchi* (small entrance). The most eye-catching feature is the central pillar, a slender pine log with its bark left intact, gracefully curving as it stands. Its playful presence is subtly integrated into the structure of the tearoom.

The dim interior lighting aligns with the Senke tea tradition of subdued brightness with only three windows: two *renji-mado* (lattice windows) and a *shitaji-mado* (unfinished lattice window).

Constructed with cedar and red pine, Sa-an reflects the masterful craftsmanship of *sukiya* carpentry.



1 ***Tsukiage-mado* / Hinged skylight**

A *tsukiage-mado* is a type of skylight installed in the ceiling.

2 ***Renji-mado* / Lattice window**

A *renji-mado* is a framed window featuring wooden or bamboo slats arranged in a lattice vertically, horizontally, or in combination, on the exterior.

3 ***Shitaji-mado* / Unfinished lattice window**

A *shitaji-mado* is a window-like opening made by exposing the lattice framework of the wall.

4 ***Nijiri-guchi* / Guest entrance**

The *nijiri-guchi* is a small entrance for guests. Its wooden door is about 70 cm high, requiring guests to lower their heads and crouch as they enter. This gesture symbolizes humility and equality regardless of social status.

5 ***Kutsunugi-ishi* / Stone where footwear is removed**

This flat-topped stone is where footwear is removed before entering the teahouse.

6 ***Ne-ishi* / Base stone**

7 ***Kyūji-guchi* / Service entrance**

This is an additional service entrance. It is occasionally added to the teahouse design if serving through the main tea entrance (*chadō-guchi*) is impractical due to the layout of the room.

8 ***Chadō-guchi* / Tea host entrance**

The *chadō-guchi* is the entrance used by the host when entering the teahouse to prepare tea.

9 ***Tokonoma* / Alcove**

A *tokonoma* is a recessed alcove in a Japanese room or teahouse, used for displaying art, such as hanging scrolls or flower arrangements. It serves as a focal point for the tea experience.

10 *Naka-bashira* / Central pillar

The *naka-bashira* is a central pillar positioned to separate the host's seating area (*temae-za*) from the guest seating area (*kyaku-za*).

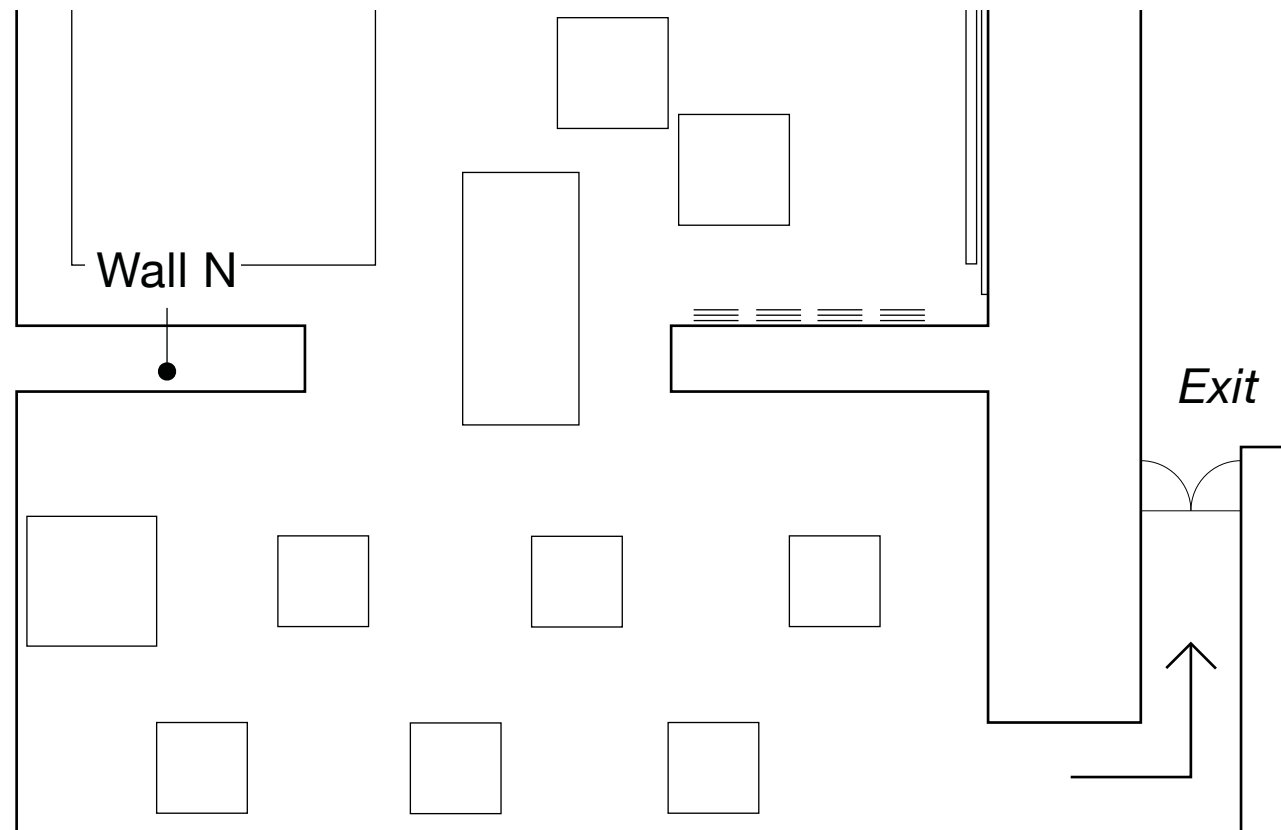
11 *Ro* / Sunken hearth

The *ro* is a sunken hearth used for boiling water for tea.

12 *Temae-za* / Host's seat

13 *Kyaku-za* / Guest seating area

Kumiko latticework



Wall N

Kumiko latticework

Kumiko refers to the intricate latticework used in Japanese architectural fittings (*tategu*) such as *shōji* – translucent, sliding partition screens; *ranma* – decorative transoms; and *tsuitate* – freestanding, movable partition screens. The origins of *kumiko* likely date back to the Kamakura period (1185–1333), with techniques passed down through generations. The

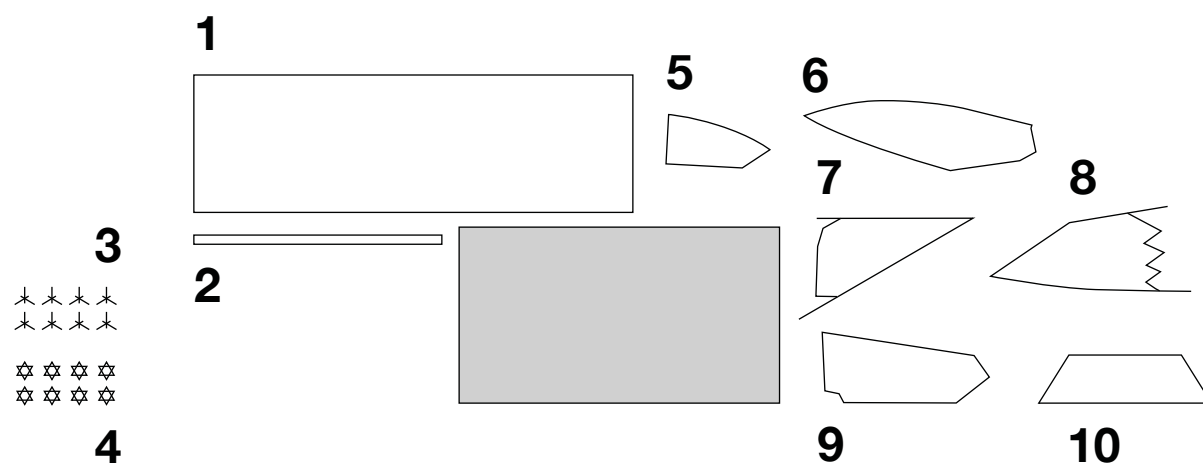
central process involves crafting thin, delicate pieces of wood and assembling them in various geometric patterns to form a seamless surface. This advanced technique was further developed in the latter half of the 20th century. While high-quality, straight-grained *hinoki* cypress is typically preferred, integrating contrasting natural colours from a variety of woods can give *kumiko* works an expressive painterly quality.

Kumiko folding screen

Sakae Tategu Kōgei

Japanese castor aralia (lignitized), Japanese cedar, Japanese whitebark magnolia (lignitized), Japanese cherry, Japanese whitebark magnolia, *Kiso hinoki* cypress, Chinese pyramid juniper, *katsura* (lignitized), Japanese sumac (*urushi*), Japanese whitebark magnolia (sapwood), Chinese cedar
2019

This complex *kumiko* work depicts a mountainous landscape, draped in mist. By applying the design to a folding screen (*byōbu*), the viewer can feel immersed within the surrounding landscape.



1. *Mitsu-kude* / Basic triangle joint

2. *Kude* / Element of basic triangle joint

3. *Yae-kikyō asa-no-ha* (eight-layer bellflower and hemp leaf) pattern component

From top left to right, bottom left to right:

Lignitized Japanese castor aralia

Japanese cedar (*sugi*)

Lignitized Japanese whitebark magnolia

Japanese cherry (*sakura*)

Japanese whitebark magnolia

Kiso hinoki cypress

Chinese pyramid juniper

Lignitized *katsura* (*Cercidiphyllum japonicum*)

4. *Yae asa-no-ha* (eight-layer hemp leaf) pattern component

From top left to right, bottom left to right:

Lignitized *katsura* (*Cercidiphyllum japonicum*)

Japanese sumac (*urushi*)

Japanese whitebark magnolia (sapwood)

Japanese whitebark magnolia

Chinese cedar

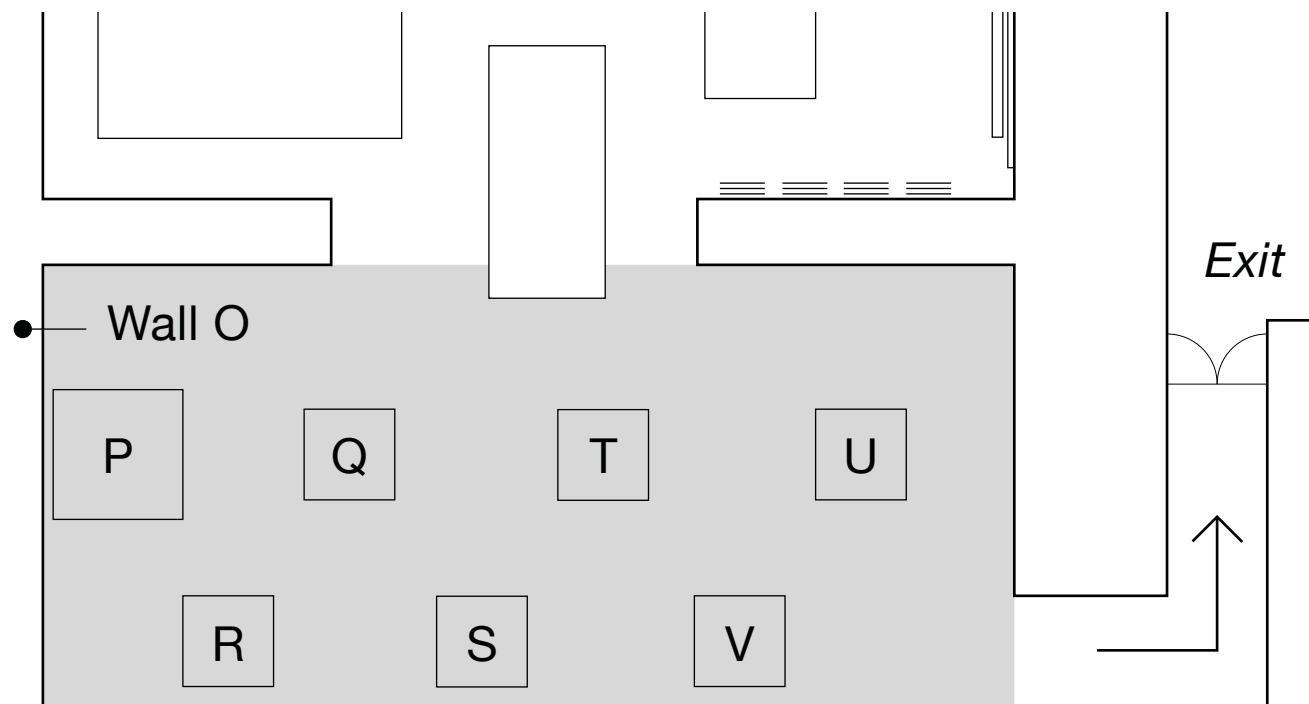
Chinese pyramid juniper

Lignitized Japanese castor aralia

Kiso hinoki cypress

5. ***Yae asa-no-ha*** (eight-layer hemp leaf) pattern
6. ***Rokkaku-tsunagi*** (hexagonal links) pattern
7. **Dahlia** pattern
8. ***Okuri-sayagata*** pattern
9. ***Neji-gumi*** (twisted assembly) pattern
10. ***Kirizai no hitoe-bishi mentori*** (paulownia wood single-layer bevelled diamond) pattern

Kigumi



Wall O

Kigumi

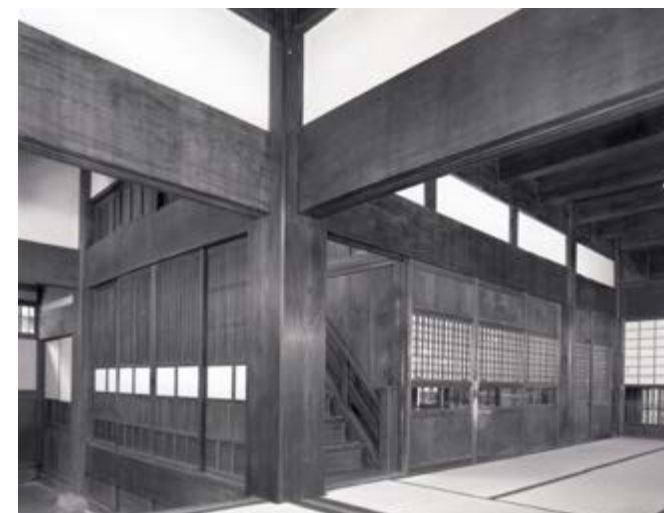
Since ancient times, wood has played an integral role in Japan's cultural landscape. Through daily use and practice, people refined wood joinery techniques, focusing on both functionality and aesthetics. From small everyday objects to grand architecture such as shrines, temples, and palaces, the pursuit of not only practicality but also beauty and precision in wood joining has elevated the craft to a level admired worldwide. These techniques, which create complex yet sturdy shapes, have been applied to architecture, crafts, furniture, household items, and all manner of objects in daily life.

P

Shihō-sashi Quadruple plug

Kōbokusha
Zelkova; 2019

Shihō-sashi is a four-way joint and one of the most complex types of wood joinery. It involves connecting horizontal members to a single post from all four sides, combining straight (*tsugite*) and angled (*shikuchi*) techniques, each with its own joint or fitting. Due to the significant reduction in the cross-section of the post, this method is rarely used. However, in cases when a central post must support horizontal beams or braces – such as jabbing headers (*sashi-gamoi*) or bottom plate beams (*ashi-gatame*) – at the same height in a grid-like layout, a thicker post is used to accommodate this structure.



Shihō-sashi at Former Hara Residence in Kawasaki, Kanagawa Prefecture, Japan.

Q

1. *Neji-gumi*

Twisted joint with a two-stop tenon

The *neji-gumi* joint is considered to be the pinnacle of log craftsmanship. It is used where eave beam logs intersect a post at a building's corners. Once assembled, it is nearly impossible to discern how the pieces fit together. The precise fit of the individual components creates a unique sense of tension that cannot be achieved with metal fasteners.

2. *Shibaru kigumi*

Rope-tied wood joinery

This wood joinery technique is still employed today in Indonesia, using the sturdy leaves of the Lontar palm.

The beginning of kigumi

The most primitive *kigumi* technique was to use ropes and string to tie logs together. Although not having to process the log is a huge convenience, the lack of durability was an issue. This led to the processing and notching of the wood, leading to the development of jointing techniques. Typically, the abutting surfaces were made flat, because gaps lead to a reduction in load resistance. However, during the Edo period, ambitious design aesthetics resulted in the development of fabrication techniques where a curved surface could be retained in a joint, without any resulting gaps. Despite appearing the same from the outside, the techniques and aesthetics driving a *kigumi*'s joint fabrication will likely vary.

R

1. *Komi-sen* Draw pin

This technique involves driving a wooden pin through a hole made in the side of a post, precisely at the location where the tenon of the joining tie beam is inserted. The pin passes through a matching hole in the tenon and secures the tie beam in place. While this method effectively fixes the post and tie beam, it requires precise drilling to align the holes. It is a technique used in many parts of the world, but it is particularly widespread in the European and American tradition, where drills were developed.

2. *Sage-kama* Wedged-through half-dovetail joint

3. *Watari-ago* Cogged lap joint

4. *Hana-sen* Nose pin or external draw pin

A hole is drilled in the tip (*nose* or *hana*) of a long tenon that passes through a post, and a peg is then inserted to secure it. This method is primarily used to resist tensile forces. It is easier to construct than a draw pin (*komi-sen*), and can be found worldwide. In this model, the joint features a slight housing trench to reduce the stress on the tenon.

S

1. ***Sumi-dome*** **Corner mitre tenon joint**

A *sumi-dome* joint is often used at the adjoining corners of foundation beams or floor framing. In this joint, the members are connected together at a 45-degree angle giving a clean appearance. This precision is difficult to achieve.

2. ***Ōire-ari-kake*** **Dadoed, half-lapped, half-blinded dovetail with full mortise and tenon joint**

This technique is used when building a foundation or floor frame. The central mortise is designed for inserting a post. As the joint is relatively shallow, it employs a dovetail joint (*ari-kake* or *ari-otoshi*) with a housing to increase its strength.

T

1. ***Noge-tsugi*** **Rabbeted, blind-mortised and tenoned, scarfed gooseneck joint**

This joinery technique was used in the eave supports of the dining hall at the temple, Engyō-ji, built in Hyōgo Prefecture in the mid-Muromachi period (1336–1573). On the building's front elevation, a more discreet scarf joint (*sogi-tsugi*) was employed, whereas in the rear this stronger *noge-tsugi* joint was used. It is a complex form combining the strength of an abridged gooseneck joint (*ryaku-kama*) and a stub mortise and tenon joint (*mechigai*).

2. ***Hako-daimochi tsugi*** **Shipped, pinned and halved half-lap joint**

This is a cantilevered joint used in the *uchinori-nageshi* (beams for sliding screen framing) of the main hall at Daisen-in, constructed in Kyoto in 1513. For the visually exposed underside and side faces, a simple scarf joint (*sogi-tsugi*) is used. On the back, a box-shaped variation of the abridged gooseneck joint (*ryaku-kama*) is combined with a cross lap joint (*ai-gaki*) and key haunch mortise and tenon joint (*shachi-tsugi*), forming a unified and durable structure.

What are *tsugite* and *shikuchi*?

In Japanese wood architecture's *kigumi*—splicing joints that extend members in the same direction are called '*tsugite*' and connecting joints that are made at right angles, or any other specific angles, are called '*shikuchi*'. Although *shikuchi* are essential to wood construction, *tsugite* are more commonly used in large-scale architecture, where a single length of timber proves to be insufficient.

Today, metal connections requiring minimal time, effort and craft have become mainstream—however, the ancient techniques for connecting wood, passed down by generations of carpenters, offers a unique joy in shaping forms. Here, we reveal the most common examples in a disassembled state, inviting you to take a look at the often hidden craft behind these joints.

U

1. ***Koshi-kake ari-tsugi*** **Splicing lapped dovetail joint**

The *ari-tsugi*, or dovetail joint, is a splicing joint named for its tenon, shaped like an ant's head (*ari* meaning 'ant' in Japanese). It is easier to create and requires less effort than the gooseneck joint (*kama-tsugi*). However, it is comparatively weaker and therefore used less frequently.

2. ***Kanawa-tsugi*** **Mortised rabbeted oblique scarf joint**

This is a standard example of a splicing (*tsugi*) type scarf joint, where both the male and female components are made identical. Adding a T-shaped stub mortise and tenon at each end, and hammering a pin into a central gap, tightens the joint, making it secure in all directions. This joint is twice as strong as the *kama-tsugi* joint and is used for key structural components such as columns, beams, and foundations.

3. *Miyajima-tsugi* Halved oblique scarf joint

The *Miyajima-tsugi* joint is a refined form of a simple scarf joint (*sogi-tsugi*) in which the pieces overlap diagonally. The bottom end fits with a butt joint, making it a preferred choice for applications when three sides are visible, such as in a *saobuchi*-style board-and-batten ceiling.

4. *Kai-no-kuchi tsugi* Shell mouth joint

The *kai-no-kuchi tsugi* (lit. ‘shell mouth joint’) is primarily used in assembling the tall, round central pillar (*shin-bashira*) of a pagoda. The end of each pillar timber is divided into four sections leaving an X shape with a raised collar on two opposing inner sections. The other two sections are spliced down slightly longer than the timber’s diameter. Small grooves at the base of the cuts interlock with the collars of the adjoining piece, tightly securing the two parts.

V

Evolution of the *kama-tsugi* (gooseneck joint)

The gooseneck mortise and tenon joint (*kama-tsugi*) has been the primary splicing joint used in Japan from ancient times to the present day. Ancient *kama-tsugi* joints (8th–12th century CE) prioritized ease of fabrication and were created using only parallel and perpendicular cuts. However, this simplicity compromised strength, and these early joints were only one-third to one-half as strong as those of later periods.

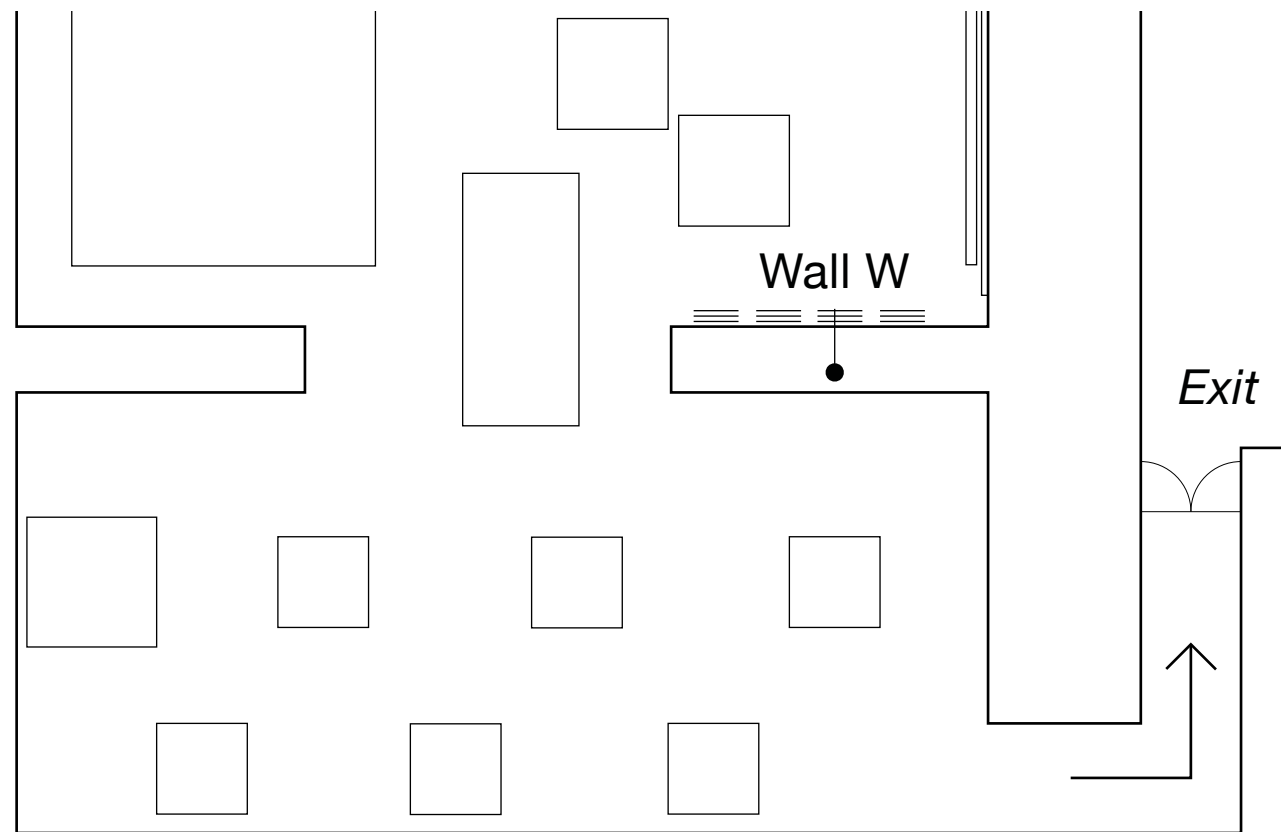
In the medieval period (late 11th – 16th century), carpenters increased the contact surface area by angling the sides of the joints, which reduced the mortise’s volume and improved strength. In the early modern period (17th – 19th century), efficiency became the focus. The neck of the joint was made parallel again, and a lap joint (*koshikake* or seat) was added when additional strength was required. Marking could be done easily using a carpenter’s square, and most of the cutting could be completed with a saw.

After World War II, the increase of metal fittings and hardware allowed for simplified joint processing

without the need for advanced skills. However, the most significant change came in the 1980s with the introduction of prefabricated building technology. This eliminated the need for manual marking, and cutting was automated allowing for more affordable and uniform production. Today, pre-cut materials are used widely in residential construction.

- 1. Ancient *kama-tsugi* (8th – 12th century CE)**
- 2. Medieval *kama-tsugi* (late 11th – 16th century)**
- 3. Early modern *kama-tsugi* (17th – 19th century)**
- 4. Prefabricated *kama-tsugi***
- 5. Composite joint with metal components**

Sashimono joinery



Wall W

Sashimono joinery

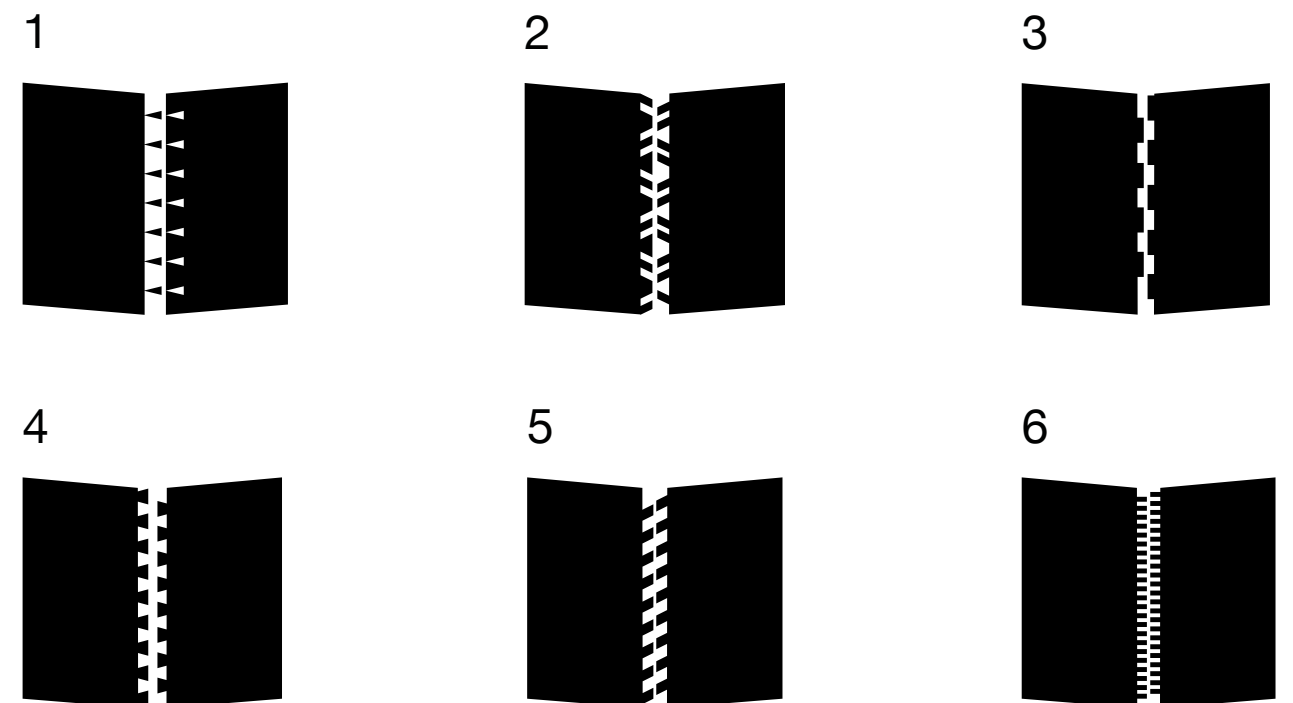
Sashimono is a general term for the joinery technique of assembling wooden boards or rods without nails to create furniture and other items such as shelves, boxes, and fittings. It can also refer to items made using this technique. Mortise and tenon joinery is central to *sashimono*. A joinery craftsman, or *sashimono-shi*, creates a tenon (a protruding piece) on one piece of wood and a corresponding mortise (hole) in another, fitting the pieces together to form complex shapes. In

sashimono, the process of joining two pieces of material together is called *tsugite*, 'making joints'. Different configurations are used depending on the purpose, whether for joining boards to boards, beams to beams, or boards to beams.

Sashimono joinery

Board to board Perpendicular joints

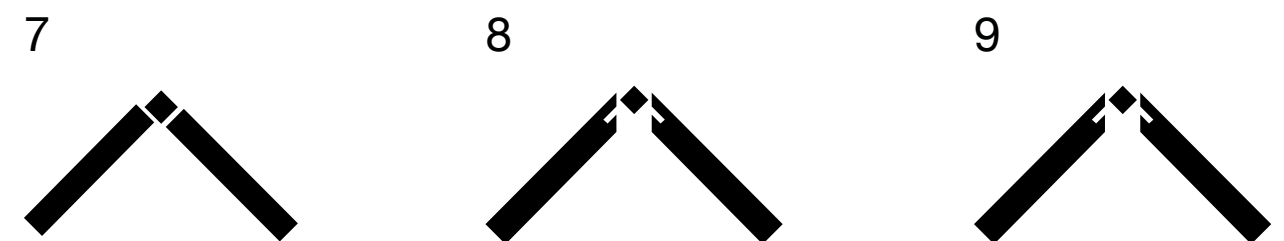
When joining two boards at right angles, there are two types of joints: the mitre joint (*tome-tsugi*) where the corners are cut at a 45-degree angle to conceal both the end grain and the joint, and the box joint (*kumi-tsugi*), where the assembled parts are exposed.



1. *Ari-tenbin*
Wide dovetail joint
2. *Mizu-gumi (nejire-gumi tsugi)*
Water joint (twisted tenon joint)
3. *Tome-gata kakushi ari-gata tsugi*
Hidden mitred dovetail joint
4. *Ari-kumi tsugi*
Dovetail joint
5. *Naname-kumi tsugi (nawa-gumi)*
Slanted joint (rope joint)
6. *Ishidatami-kumi tsugi (senmai-kumi tsugi)*
Stone pavement joint (thousand-pieced joint)

Three-way L-shaped + vertical beam joints

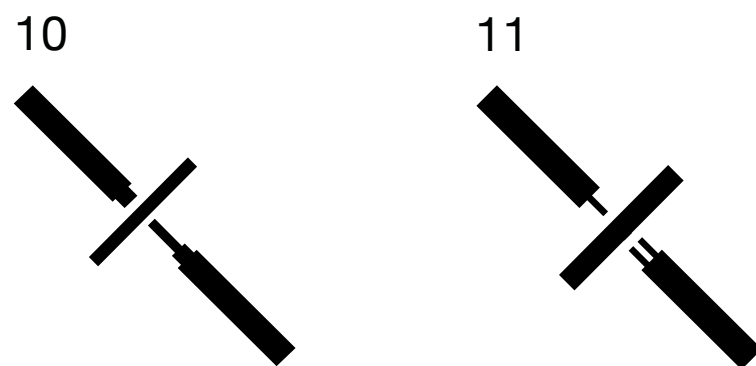
These joint combinations are often used in decorative shelving units, forming an L-shaped horizontal frame around a vertical corner post.



7. *Sanpō-dome tsugi*
Three-way mitre joint
8. *Nagare sanpō-dome tsugi*
Varied three-way mitre joint
9. *Tana to hashira no setsugō bubun*
Shelf-to-pillar joint

Board to beam Board material + rectangular beam joints

In furniture and *sashimono* pieces with decorative shelving, mortise and tenon joinery connects posts to shelves. This requires a high degree of craftsmanship to ensure both strength and the appearance of a single, continuous pillar.

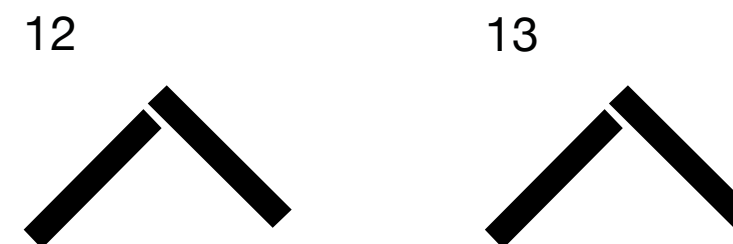


10. *Rōsoku-hozo tsugi*
Hidden stepped double mortise and tenon joint

11. *Sanmai-hozo tsugi*
Triple-tenoned joint

Two-way L-shaped joints

In furniture and *sashimono* pieces, two-way L-shaped joints are particularly useful in frame, shelf and box construction to connect two pieces of wood at right angles.

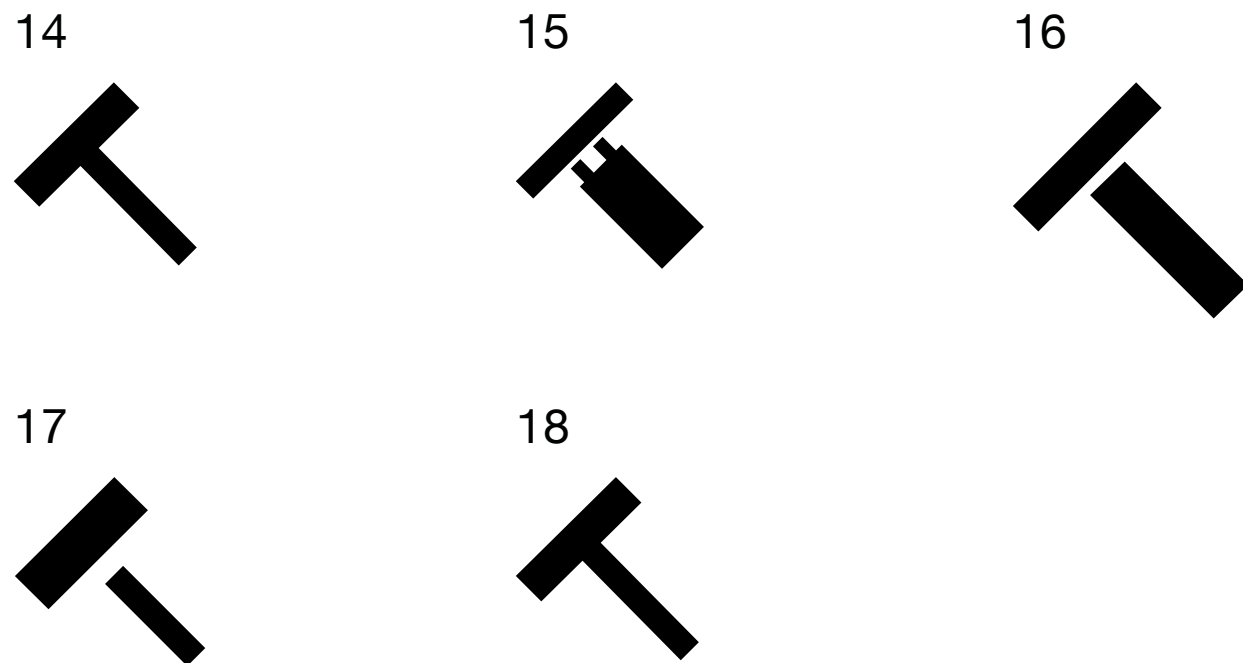


12. *Tomegata-hako-hozo tsugi*
Mitred hidden capped mortise and tenon joint

13. *Tome-gata kakushi nanamai tsugi*
Mitred hidden seven-layered mortise and tenon joint

Beam to beam Rectangular beam + rectangular beam joints

Similar to board joinery, a tenon is created in one beam and a mortise in the other. Both mitre and open-mortised box joints are used when connecting two or more beams.



14. *Jigoku ari-hozo tsugi*
Foxtail wedged tenon joint

15. *Kasane-hozo tsugi*
Split tenon joint

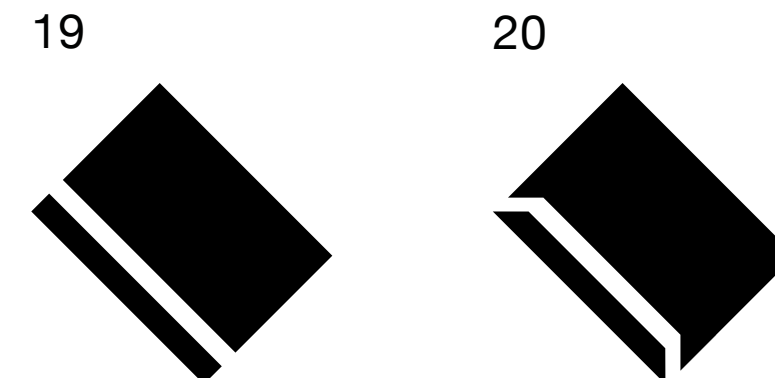
16. *Sumi-dōtsuki-hira-hozo tsugi*
Corner shoulder mortise and tenon joint

17. *Kendome-hozo tsugi*
Tenoned sword-tip mitre joint

18. *Arigata-shikake tsugi*
Cross-lapped slanted dovetail with hidden
mortise and tenon joint

Board to board Edge joints

Edge joints (*hagi-tsugi*) connect the edge grain of two boards producing a wider surface. The technique is commonly used for tabletops.



19

20

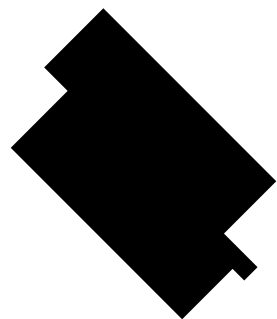
19. *Ari-zane hira-hagi*
Sliding dovetail joint

20. *Yatoi-zane hagi*
Loose tongue joint

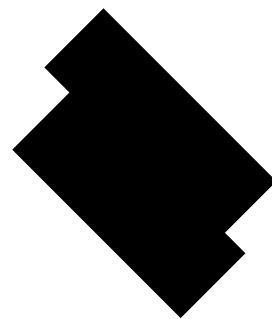
Board to board
End joints

End joints (*hashi-bame-tsugi*) are used to cap the ends of wide boards with crosspieces, concealing the end grain and preventing warping. The grain of the crosspiece runs perpendicular to the main board.

21



22



21. *Hon-zane tome-gata hashi-bame*
Mitred tongue-and-groove edge joint

22. *Hon-zane hashi-bame*
Tongue-and-groove edge joint

Inlaid box of Japanese ash

Suda Kenji

Japanese ash, granadilla, sycamore maple, *nashi* pear, black persimmon, *urushi* lacquer 2018

Crafted by 'Living National Treasure', Suda Kenji, this piece combines five carefully selected types of wood using *sashimono* joinery techniques, bringing out the particular character of each material. A two-tiered box is revealed when the lid is opened. The lid is finished in black *fuki-urushi* (wiped lacquer) enhancing the grain of the Japanese ash, while allowing the wood's natural white hue to subtly emerge through the dark lacquer.

***Shikuchi sashimono* joinery techniques**

In this *sashimono* model, the four corners of the inner box feature hidden mitred dovetail joints (*tome-gata-kakushi ari-gata tsugi*). The junction between the lid and side-board employs a 'secret groove' (*tsutsumi-koana*), while along the upper lip of the inner box, a tongue-and-groove edge joint (*hon-zane hagi*) is implemented. The base plinth is constructed with hidden mitred mortise and tenon joints (*tome-gata-kakushi sanmai tsugi*) at the corners. This meticulous craftsmanship is entirely concealed, leaving no visible trace on the exterior.

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