

ARCC 2202

Yusuhara Wooden Bridge Museum

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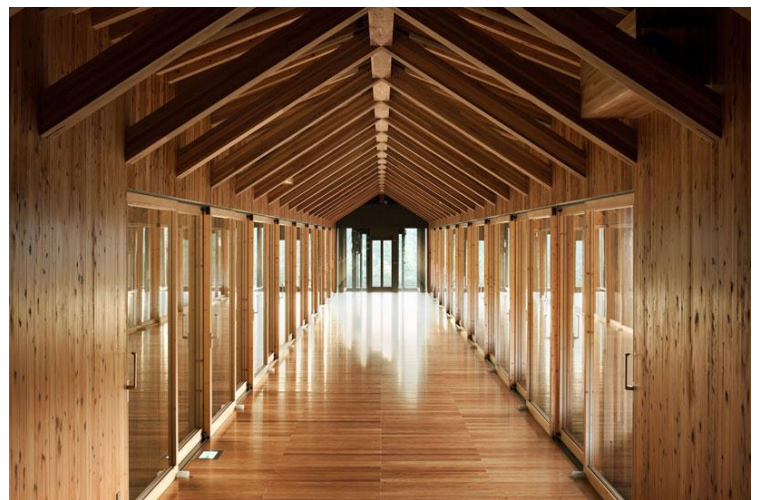
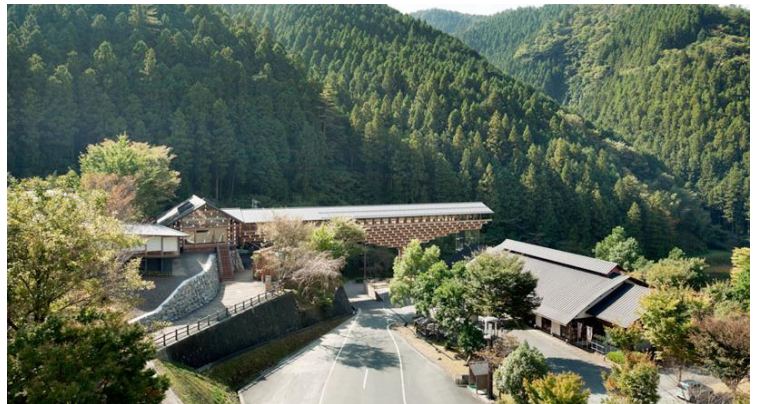
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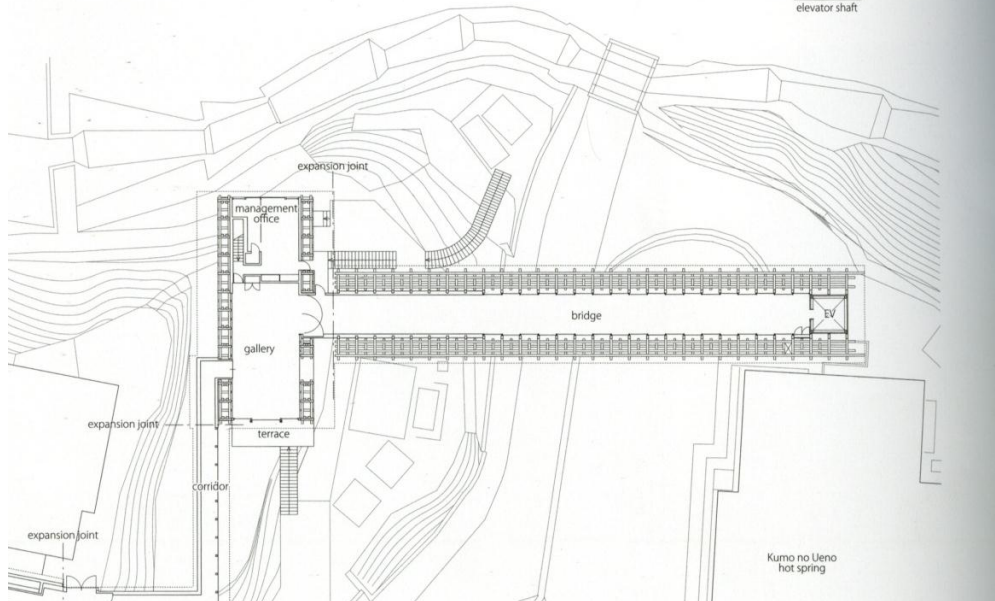
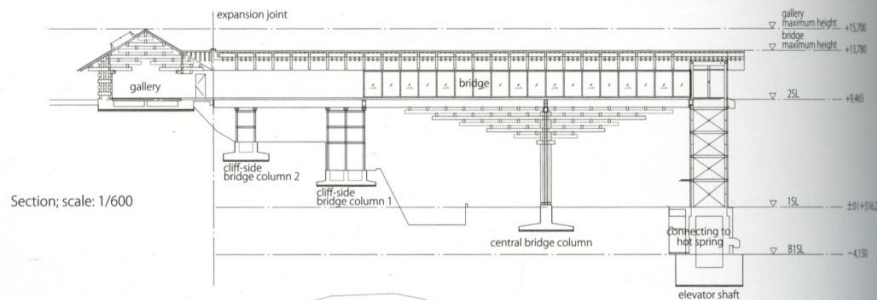
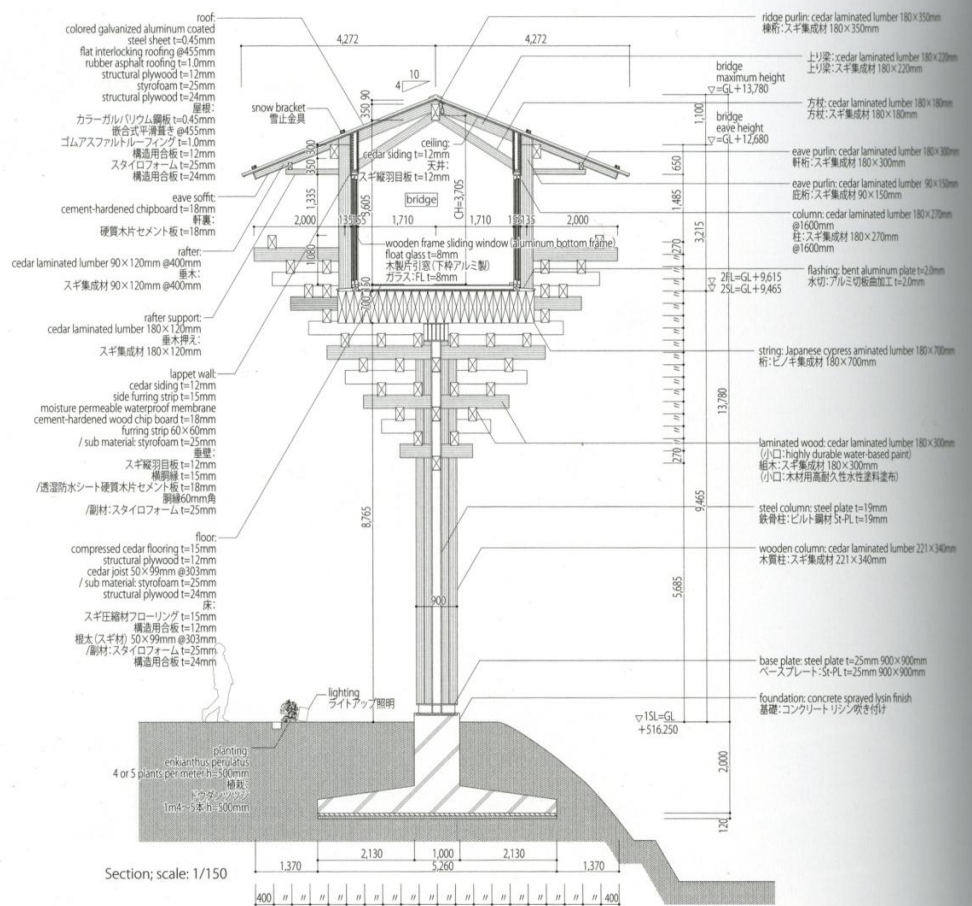


Designed by Kengo Kuma and Associates · Located in Kochi Prefecture, Japan · Built in September 2010

The Yusuhara Wooden Bridge Museum is a covered gallery and pedestrian bridge. On one end it links to a museum building at the top of a hill; at its other end is an elevator shaft leading to a hot springs facility.

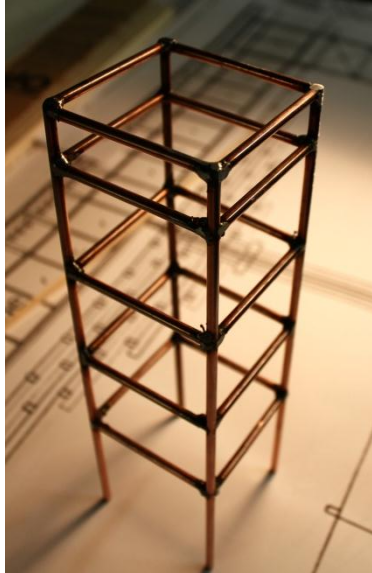
The intention of the architects was that the building exhibit a harmonious relationship with its forested mountain environment. The use of large-scale steel or concrete elements was avoided in favour of small members of glue-laminated local cedar. In order to achieve its 47-metre span, an innovative system of interlocking beams was developed, reinterpreting the traditional Japanese cantilever. Long beams rest above progressively shorter ones, and the entire structure tapers to a point at a central steel-cored wooden column. The two skeletal metal towers supporting the bridge on either end merge visually with their wooded surroundings, evoking the impression that the massive structure is balancing on one slender post. The interior of the gallery mimics the exterior in its materiality and poetic exposed structure, forming a space framed by cedar members and a panoramic view of the landscape.



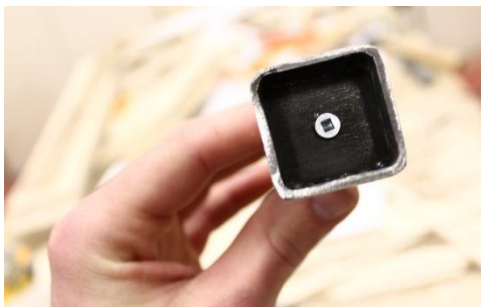
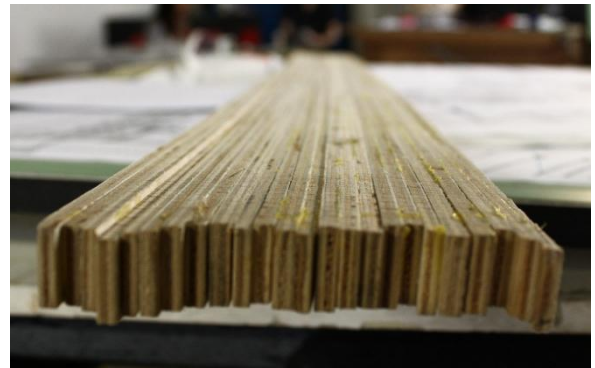


In designing and building the 1: 50 scale model, we focused on conveying the wooden structural systems of the bridge, including joinery details as well as the visual effect of the structure from both the exterior and interior.

First the site model was built and the two steel tower supports were welded.



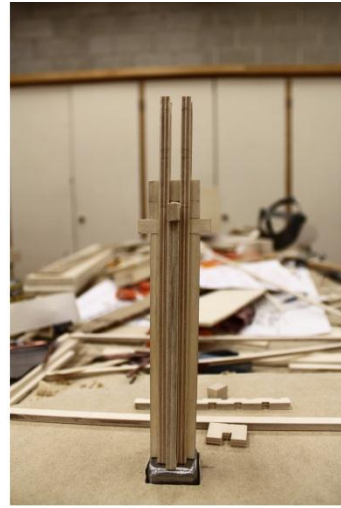
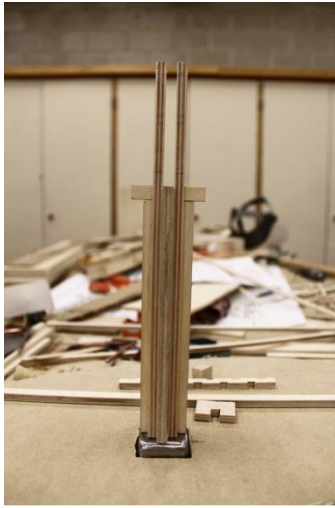
A floor slab was made out of a series of beams, consistent with the construction of the floor in the actual bridge. Holes were drilled in both the landscape and the floor slab to connect the metal towers.



Work on the central wooden column then began, with the assembly of a cruciform shape. The column was screwed into a welded steel base that is recessed into the landscape.



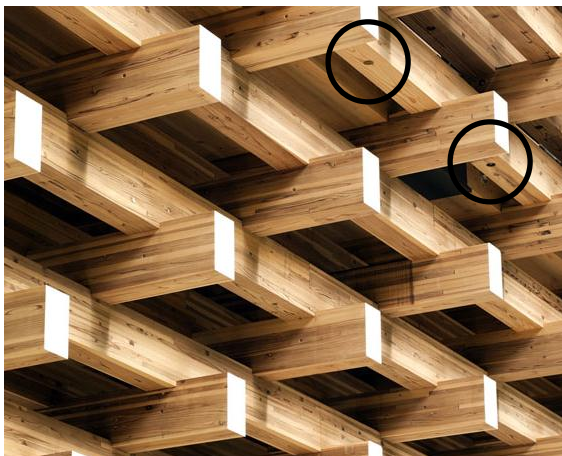
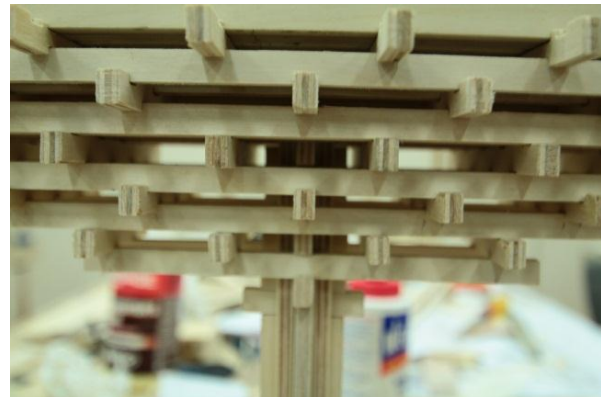
In the actual bridge, the column's core is a hollow steel rectangle, through which the central beams run uninterrupted. Rather than fabricate and cut a steel post, we developed a system of interlocking pieces that allowed the beams to pass through while maintaining the outward appearance of the column.



The cantilevered beam system was assembled from the column upwards. Each set of identical beams was mass produced: strips of plywood were taped together, and then cut to size as a single piece, and notched with precision. In retrospect, efficiency would have increased if the cuts and grooves were made even before the strips were cut, but this would have required a lot of foresight.

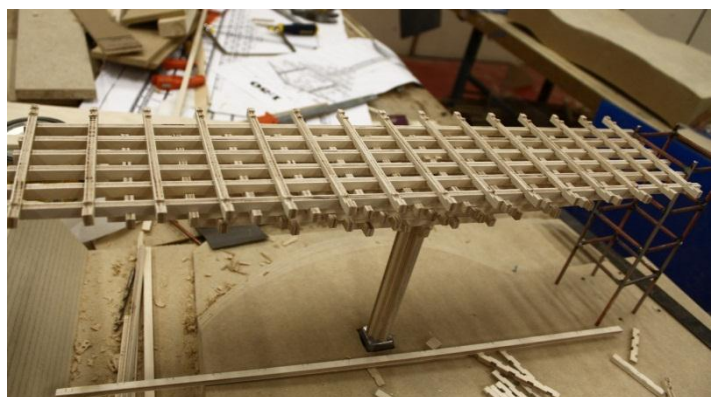


The notches were made in the shorter, lateral-running beams, while the longitudinal beams are left whole. These grooves allow the structure to fit into a precise grid formation and also to be self-supportive without the need for adhesive.



In the actual bridge, the beams below the floor slab are prevented from shifting by the weight of the structure above them. Above the floor slab, the weight on each joint is reduced and the beams are held in position by a bolt drilled up through the bottom beam in each joint. This detail is circled in the photograph to the left.

In our model, we used glue in the place of bolts, to prevent the beams from shifting, but the entire structure was actually capable of supporting itself without the use of adhesive.





The floor was installed in the notches prepared for it.

The elevator shaft was represented by the continuation of the metal tower into the interior space; the tower culminates in two welded steel pediments beneath the roof.

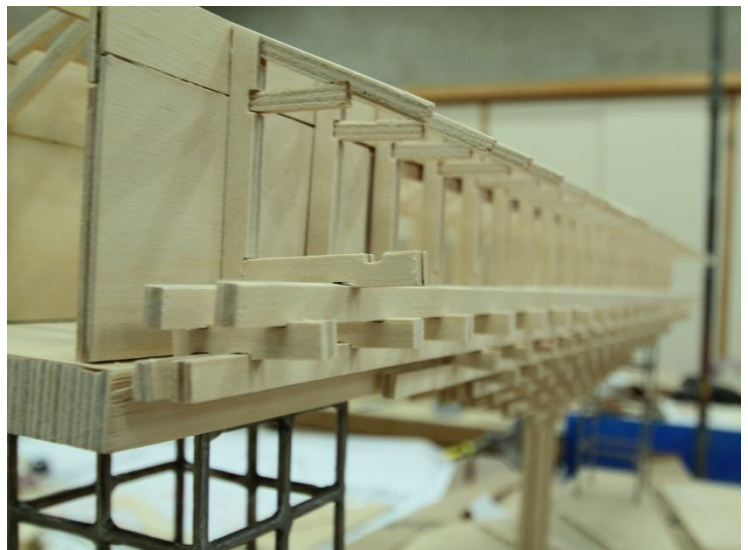


As the bridge structure was being assembled, work on the roof trusses began. We simplified the truss system somewhat, according to the demands of a smaller scale, but both the visual effect and the physical forces acting on the system remain consistent with those in the actual bridge. The posts and rafters were made in the same fashion as the beams, by being taped together before being cut and notched. Each roof truss consists of 8 pieces (including the posts), all of which were jointed together and attached to the ridge beam that spans the entire length of the roof. These trusses fit, at precise intervals, into the strip of plywood that represents the cedar partial walls above the windows in the bridge. We assembled each of the trusses in halves and then attached these to the wall strip. These were assembled together with the ridge beam and glued to the top of the floor.





At this point we finished assembling the cantilevered beam structures, which continue above the floor slab (one row of lateral beams is joined to notches in the roof posts).



Simultaneously the roof was built: four sheets of metal were welded to two smaller strips, each half the length of the roof, and bent at precisely the angle of the trusses. A thin veneer was attached to maintain the atmosphere of the interior gallery space, which has a wooden ceiling. The roof remains removable so that the intricacy of the roof trusses can be revealed. The last step was the installation of the windows. Long strips of transparent plastic were cut with exactitude and slid snugly into place between the roof posts, into a notch that was cut into the strip of plywood above the windows.

