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Evaluation of Load-Carrying Properties of Asian Traditional Timber Structures.

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There still exists unique and important culture of traditional timber buildings in Asian countries, including earthquake prone area like Japan. Since the viewpoints based on such culture gives important suggestions for realization of the sustainable society, it is important to preserve and inherit them. Their characteristic feature is timber frame structure, so the joints play important role to resist against earthquake attack. The load-carrying performance of joints is generally depending on the wood-to-wood interlocking without using any metal fasteners. This makes it difficult to predict their strength performance due to influence of complicated shape and enormous number of combination of different wood materials. Recently, in response to the rise of a sense of crisis to a large-scale earthquake disaster, the project which establishes the design method of tradition timber structures is advanced. For exact estimation of a proof strength of the building, the calculation formula which predicts load-displacement relations of joint is demanded. Our laboratory is doing experimental and analytical research to find solutions to evaluate the structural performance of some of main wood-to-wood joints or structural components, from the viewpoint of materials properties, the proposal of allowable strength based on mechanical model analysis to an application of the practical behavior of traditional buildings.

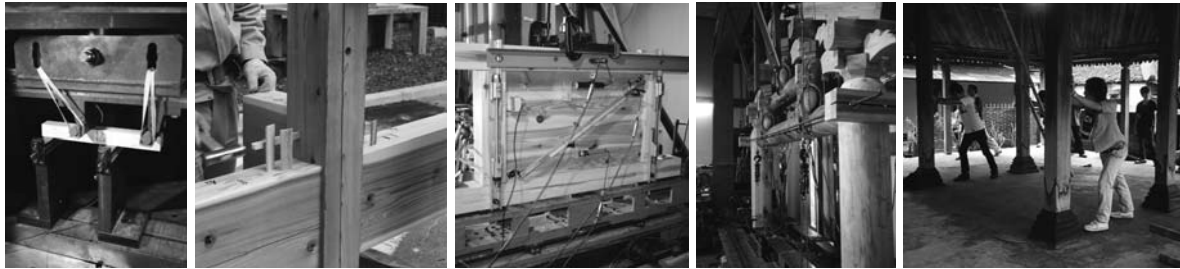


Figure 1. The photo of the experiment. From left to right: Material test of hardwood used as fasteners of the joint; Complicated Japanese traditional joint specimen; Small scaled in-plane shear test of plank shear wall with hardwood shear key; The racking strength test of Taiwanese traditional frame; In-situ measurement of dynamic vibration property of Indonesian traditional building.

Figure 2 shows an example of the comparison between estimated and experimental moment-rotation curves of one of the most popular Japanese traditional spline-shear key column to beam joint. The predicted curve was illustrated by considering two different resistance mechanisms which can be calculated from material properties and size parameters, so that the calculation formula can be applied to any different combination/size of joint. We are proposing easy design formulas for several kind of structural elements of traditional building which is composed of complicated shaped members. It is expected that this kind of research approach will contribute to the expanded possibility of timber structures.

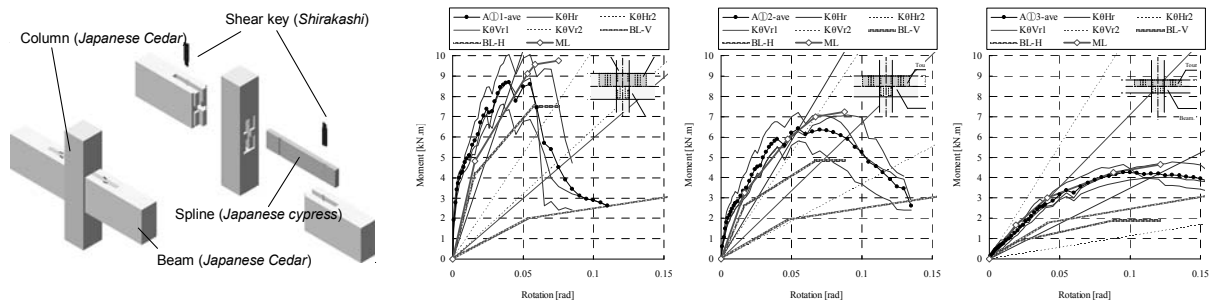


Figure 2. Comparison of experimental and estimated result of rotation property of Japanese traditional joint with spline and shear keys.