Structural Performance Evaluation of Column-Nuki Connection in Traditional Japanese Wooden Buildings

Satsuki Murai* and Mitsuhiro Miyamoto†

* Department of Safety Systems Construction, Graduate School of Engineering, Kagawa University
2217-20 Hayashi-cho, Takamatsu, Kagawa 761-0396, Japan
e-mail: s19g407@stu.kagawa-u.ac.jp

† Department of Engineering and Design, Faculty of Engineering and Design, Kagawa University
2217-20 Hayashi-cho, Takamatsu, Kagawa 761-0396, Japan
Email: miyamoto@eng.kagawa-u.ac.jp - Web page: https://www.kagawa-u.ac.jp/kagawa-u_ead/

ABSTRACT

Traditional Japanese wooden buildings have been constructed using internal wooden frame structures. Plus-shaped column-nuki connections are important to evaluate the seismic performance of these buildings, and these connections include several joint types, one of which is the oblique scarf joint. However, only very few extant studies have examined column-nuki connections and oblique scarf joints.

In seismic evaluations of traditional Japanese houses, the extant design equation has been considered only for continuous nuki. As shown in reference [1], oblique scarf joint nuki are evaluated as 0.5 of the design equation for continuous nuki in traditional Japanese houses. Therefore, there exists a possibility that structural-performance evaluations of column-nuki connections with oblique scarf joint nuki are inaccurate. Thus, this study aims to evaluate the structural performance evaluation of column-nuki connections in traditional Japanese wooden buildings.

Full-scale tests were performed on specimens with either the continuous or oblique scarf joint nuki, and results obtained were compared based on parameters, such as the type of connection and number of dimensions. Subsequently, corresponding analytical results were calculated using an extant design equation, and the same were compared against experimental values to determine the validity of using the design equation for column-nuki connections in traditional Japanese wooden buildings.

Results obtained in this study demonstrate the initial stiffness to be approximately identical for specimens with continuous or oblique scarf joint nuki. The yield and ultimate bending moment of oblique scarf joint nuki specimens were observed to be approximately 10–70% smaller compared to those corresponding to continuous nuki specimens. In addition, all oblique scarf joint nuki specimens demonstrated an initial cleavage failure followed by multiple failures. Results of these comparisons demonstrate that failure can be partially estimated using the extant design equation considered in this study.

REFERENCES