Utilization of Compressed-Sugi Dowels as Joint Material in Timber Structures

Miho Kitagawa

Laboratory of Structural Function, RISH, Kyoto University

INTRODUCTION

Density of Sugi (Japanese Cedar: Cryptomeria *japonica* D.Don) is usually around 300 to 400 kg/m^3 and such low density generally correlates to low mechanical properties. While low density implies that it can be easily compressed into high density material which might has a potential for becoming a strong materials.

The final purpose of this research is to create a high strength material by using low density, weak and not utilized Sugi material. As the first step of this research project, basic pull-out resistance of Sugi compressed dowels was evaluated to examine the potentials as the feature joint material in place of glued-in-hard wood dowels.

CONCEPT of COMPRESSED SUGI DOWEL JOINT

The basic concept of joint member is shown in Figure 1. It was expected that the end part of compressed dowel will be expanded once again into the shape of spindle by absorbing water and that by making use of this volume recovery some sort of pull-out resistance might be obtained.

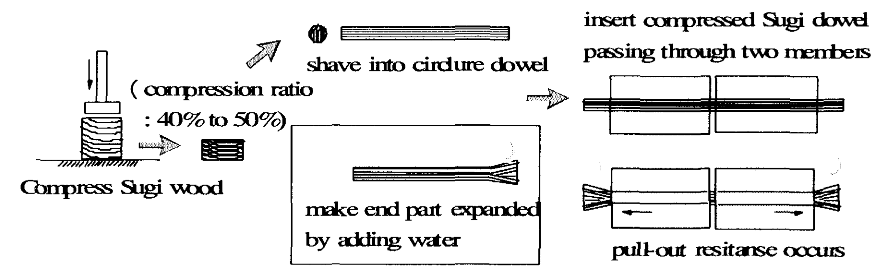

Figure 1. The basic concept of joint member using compressed Sugi dowel.

MATERIALS and METHODS

Dowel was made from compressed Sugi (Japanese cedar). Sugi was fully warmed at 105 degrees C within the press for 10 minutes. Target volume of compressed wood was 45% of the original one. Compressed square woods were shaved into dowels with 12mm in diameter. For evaluation of pull-out resistance, spruce glulam (105x105x×05mm) was used as the main members. After processing 12mm lead hole in main members, a dowel was inserted until the end part coming out then water was applied to make the end part recover its shape. Pull-out tests were done as shown in Figure 2. The parameters set out in this experiment was the grain direction to that of dowel. We defined that L was parallel to the fiber direction, R is perpendicular to the fiber direction (radial direction), and T was tangential direction. The size of dowel was set to '*d*'= 12mm, and '*g*' and '*D*' were also parameters with experimental variation.

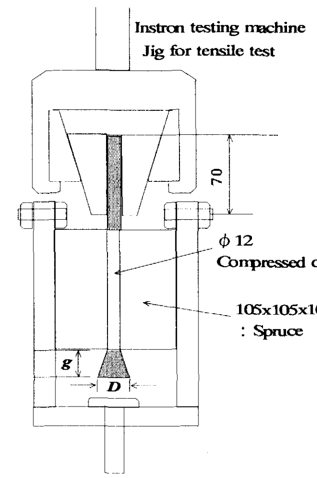

Figure 2 Pull-out test.

RESULTS and DISCUSSION

The relationship between P_{max} and expanded volume V with parameters of dowel directions is shown in Figure 3. It is likely to be proportional between P_{max} and the expansion volume. Moreover, there seemed to be strength anisotropy among dowel directions. R, T specimens were likely to have a higher pull-out resistance than that of L specimen. These relationships could be explained using the ratio of strength anisotropy of wood.

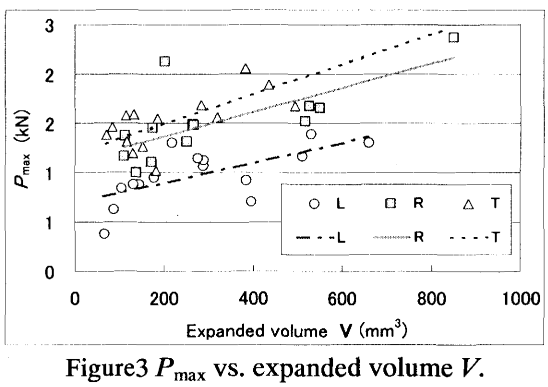

Figure3 P_{max} vs. expanded volume *V*.