

Effect of Drying Methods on Durability and Strength Performance of Japanese Cedar for Post and Beam Timber Construction

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Introduction

To promote Japanese cedar usage, it is needed to increase reliability of timber as the construction material. To do so, drying techniques that can improve stability or strength and grading techniques that can be done in nondestructive way are important. Although lots of drying schedules of Japanese cedar has been developed, there is not enough information about how much drying atmosphere can affect the characteristics of timbers, especially in full scale. For example, the honeycombs or evaporations of extractives due to high temperature could cause the loss of strength or durability of timber. In this research, to intend to use Japanese cedar as the material for post and beam residential house, Japanese cedar were dried in 4 ways to examine and compare their strength, durability and performance of joint.

Methods

Two hundred forty logs of Japanese cedar in Kyoto were collected and divided into 2 groups according to the color of heartwood (red and black). According to MOE measured by nondestructive way, each 2 groups separated into 4 small groups respectively so that they could have the same average and standard deviation. Each small group was dried in 4 different methods; air drying, mild temperature drying (90 degree Celsius at highest), high temperature drying (110 degree), and high temperature set drying (120 degree). For the indicators of strength, MOE in nondestructive ways (longitudinal vibration method, torsional vibration method, and TGH method), full-scale compression, and full-scale shear test were examined. To evaluate the durability, forced and selective termite test and rotting test were conducted. Finally, to evaluate the joint characteristics, full-scale column and sill pullout test were carried out.

Result and Discussion

Nondestructive test result showed that, as the MOE examined in log was bigger than that in sawn timber, it was better to grade timber after sawing. And it also showed that there was not significant difference between MOE and shear stiffness calculated in different ways. But the shear stiffness of air and mild dried specimen calculated by torsional vibration method were highly decreased and this result indicated that the crack or back split should be taken into account to calculate the shear stiffness traversing the cracks. The strength or stiffness estimated by full-scale compression and shear test didn't show the significant difference. Since they showed good correlation with density and MOE despite of drying schedule, it was confirmed that grading by density or MOE is important to estimate the characteristics of strength. In the fungi and termite test, high temperature dried specimen had reduced its weight more than air dried one. Although it was hard to get the correlation between the reduction ratio of density and compression strength, it became clear that the less the density the specimen had, the less its compression strength or stiffness became. The joint strength didn't show significant difference in any types of joint and this was because there was no difference in compression or shear strength that were the main mechanism of these joint.

Above all, conclusions were as follows:

1. Drying schedule could effect on durability of Japanese cedar.
2. As far as these 4 drying schedule, however, didn't affect on strength or stiffness.
3. Grading is very important to ensure the strength or MOE of timber.