Consideration regarding seismic performance of panel structure by Cross Laminated Timber

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1. Introduction

As a general rule, it is constructed by wooden construction regarding low rise architectural structure due to the Act for Promotion of Use of Wood in Public Buildings. However structure method of large scale wooden architectural structure is needed to be generalized to make public building wooden. As a structure method to do large scale wooden architectural structure possible, there is a box-frame construction using panel of Cross-Laminated-Timber （Cross-Laminated-Timber : CLT）, and it is required to be generalized from home and abroad. CLT construction method uses thick panel of lamina that is orthogonalized and done lamination glueing (Picture 1). The structure method comes from Europe. Therefore the consideration regarding earthquake protection securement has just begun.

This experiment is implemented as a first step for a final purpose that is a formulation of earthquake-resistant design measure of the CLT structure method.

Picture 1 Cross Laminated Timber (CLT) Panel

2. Specimen and experimental method

CLT panel that is originated and produced in Europe, it is possible to produce width about up to 3 m and length about up to 20 m, and its aperture is normally formed by cutting from rectangle panel. But this time, 1 m wide panel was used as wall panel, cross member panel and floor panel, and a structure method that constructs the building frame by jointing each panel with bolts was adopted. The specimen (picture 2 4 m×8 m×9.5 m) was assumed as a 5 story building and put weights on the top of structure of the third story, and the weights were about 400 kN that correspond to fixed load of 2 story. In response to that, using large scale earthquake resistant experiment facility of National Research Institute for Earth Science and Disaster Prevention, artificial seismic wave that corresponds to earthquake that rarely and / or very rarely occurs which is required by the Building Standards Act and observed wave from the South-Hyogo Earthquake in 1995 (JMA Kobe) were entered in long axis direction.

Picture 2 Appearance of specimen

3. Experimental result

As a result of the shaking test, the maximum interlaminar deformation was developed at the second story (picture 1), but for the artificial seismic wave that corresponds to earthquake that very rarely occurs which is required by acts related to the Building Standards Act, it was about 1/166 rad, and for the JMA Kobe, it was about 1/61 rad, and the both went no further than that. It is corresponded to quite small deformation than the result of numerical analysis that was done previously based on the result of shear test of joint part 1) and horizontal shear test of plane frame elements 2).

Because there was no big damage observed for both of them, and damage boundary of CLT panel structure of this structure method was taken as damage boundary deformation of wooden building 1/120 rad, and it indicated a good possibility.

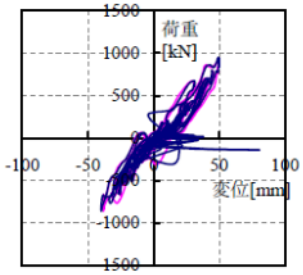

Chart1 Load deformation relationship

The details of the experimental result should be referred to literature 3). This research was implemented as part of a collaborative research by three that were NILIM, NIED (National Research Institute for Earth Science and Disaster Prevention) and Nihon System Sekkei, Inc.

(Sources)

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