A STUDY ON VISCO-ELASTIC DAMPER EFFECT FOR RETROFITTING OF THE LARGE TIMBER STRUCTURE

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ABSTRACT: Using a damper and the design tool which our study group developed, we carried out a seismic retrofitting of the large wooden building. There is the large wooden construction building which does not reach the present earthquake-resistant standard including shrines, temples architecture and the school building in Japan. We carried out the field work of these buildings and grasped the state of the existing structural element. Using the design tool which we developed, we predicted a response of the seismic retrofitting building by time history response analysis method. The maximum story deformation angle was X direction of 1/94 rad (39 mm), Y direction of 1/109 rad (33 mm) in the first story. We predicted a response of the damper retrofitting building by time history response analysis method. In the maximum story deformation angle, it was with X direction of 1/115 rad (32 mm), Y direction of 1/126 rad (29 mm) in the first story when I installed 41 visco-elastic dampers “TRC-30W” of brace type in the retrofitting building. By the setting of the visco-elastic damper, we were able to confirm a suppressant effect of the transformation of the buildings in X direction of 18%, Y direction of 13%.

KEYWORDS: Seismic Retrofitting, Timber Architecture, Visco-elastic Damper

1 INTRODUCTION

“Revised Seismic Promotion Law” was established in 2006. It is an aim in that to assume 90% of earthquake resistance rates by 2015. In “the legal training for all authorized architects” of Japan Federation of Architects & Building Engineers Associations, contents of the repair of the wooden building were included for the first time in 2010. In “the earthquake-resistant diagnosis and reinforcement method of the 2012 revised edition” of the Japan Building Disaster Prevention Association, there is the method by the horizontal load bearing capacity calculation in 2012. A school and a kindergarten are added to the coverage as well as a house. In addition, the evaluation method of the wall having a control on vibration element is included, too. Do it with aftermath of the 2011 Tōhoku earthquake and tsunami caused by 2011 Tōhoku earthquake and tsunami generated on March 11, 2011, and a Japanese citizen to the quake resistance of the building is interested. While the outbreak such as Tokai earthquake or the southeast sea earthquake or south sea earthquake is concerned about in the Tokai district; inhabitants to the quake resistance of the building is highly concerned. Our research team developed a brace type and an angle brace type of the visco-elastic damper on seismic-response controlled structure for timber structure.[1][2] We performed various dependence evaluations by the materials examination of the styrene olefin-based visco-elastic body which we developed newly.[3] The existing large timber structure needs many structural elements by the earthquake-resistant retrofitting. Therefore it becomes necessary to choose the visco-elastic damper in earthquake proofing retrofitting.

2 OVERVIEW OF FIELD WORK

We can appoint a modulus of elasticity or strength about the wood to install newly, but a modulus of elasticity and strength of used existing wood are unidentified now. Therefore, it is the situation that cannot carry out structure inspection. As the object that it was important in an existing part to remain in after repair, we inspected validity of clarification of the materials strength of the wood and the structured model by a field work. We grasped the situation of the grounds, the basics, structural members, bearing walls, horizontal members and, the joints.
3 RETROFITTING EVALUATION BY VISCO-ELASTIC DAMPER

We inspected the retrofitting building and the building which set up braces type control on vibration damper "TRC-30W" by time history response analysis method. The input earthquake vibration was BCJ-L2. The maximum story deformation angle was X direction of 1/94rad (39mm), Y direction of 1/109rad (33mm) in the first story. Furthermore, we predicted a response of the damper retrofitting building by time history response analysis method.

In the maximum story deformation angle, it was with X direction of 1/115rad (32mm), Y direction of 1/126rad (29mm) in the first story when I installed 41 visco-elastic dampers "TRC-30W" of brace type in the retrofitting building. By the setting of the visco-elastic damper, we were able to confirm a suppressant effect of the transformation of the buildings in X direction of 18%, Y direction of 13%.

4 CONCLUSIONS

Using a damper and the design tool which we developed, we carried out a seismic retrofitting of the large timber building. We carried out the field work of these buildings and grasped the state of the existing structural element. By the setting of the damper, we were able to confirm a suppressant effect of the transformation of the building.

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REFERENCES

