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Synthetic Resin Reinforcement of Timber Joints Deteriorated by Termites

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1 Introduction

This study investigates the possibility of restoring timber deteriorated by termites with little changes in its appearance by using resin filling. Deterioration by termites occurs at the base of the timber. Therefore, the specimen is assumed to be the joint of a foundation and column.

A list of specimens is shown in Table 1. We investigated the change in strength depending on the type of synthetic resin using a two-component mixed type synthetic resin consisting of an epoxy resin (main agent) and a polyamine resin (curing agent). In Table 1, “Resin A” is hard type, and “Resin B” is elastic type. Three specimens were prepared and filled with resin A, and two were filled with resin B. In this test, five restored specimens were used.

2 Shear Test of Pillar-Base Joints

The experimental setup of a joint member with a column and base is shown in Figure 1. Figure 2 shows the skeletal curve between the moment and the deformation angle. Regarding the specimens filled with resin A, a significant recovery in both rigidity and strength was observed. The rigidity and strength of 10-A and 20-A were higher than those of 0-N. The filling ratio of 15-A was about 10%. Therefore, it was observed that there would not be a considerable recovery of rigidity and strength because of insufficient filling. Overall, when the deteriorated timbers were filled with resin A, they exhibited a possibility of recovery in rigidity and strength. In contrast, the strength and rigidity of the specimens filled with resin B did not match that of 0-N. This result might indicate that the low elasticity of resin was not effective for reinforcement.

3 Ultrasonic Pulse Velocity Test

A high correlation was observed between the mass loss rate and the reduction rate of ultrasonic velocity. Hence, the mass loss rate can be identified by measuring the ultrasonic pulse velocity. As a result, it was suggested that the ultrasonic pulse velocity test might be effective in evaluating the deterioration by termites. Also, a high correlation was observed between the filling rate and the increased rate of ultrasonic velocity. Hence, the effectiveness of resin filling

was confirmed by an increase in the ultrasonic pulse velocity.

4 Conclusion

Throughout the shear test of pillar-base joints, filling the deteriorated timbers with the hard type resin led to the recovery of rigidity and strength. Hence, the effectiveness of resin filling as a reinforcement method was demonstrated. Also, a high correlation was observed between the filling rate and the increased rate of ultrasonic velocity. Therefore, the filling rate can be confirmed by an ultrasonic pulse velocity test in a non-destructive manner.

Table 1. Name of specimens and test parameters.

Name	Feeding damage rate [%]	Resin							
		Name	Feature	Materials	Fit ratio	Viscosity [mPa・s]	Compressive Strength [N/mm^2]	Method	Tool
0-N①,②	0	None							
10-N	10								
15-N	15								
20-N	20								
10-A	10	A	Hard type	Epoxy + Polyamine	2:1	6,000	53.3	Filling	Static mixer
15-A	15								
20-A	20								
10-B	10	B	Elastic type		3:2	9,000	18.3		
15-B									

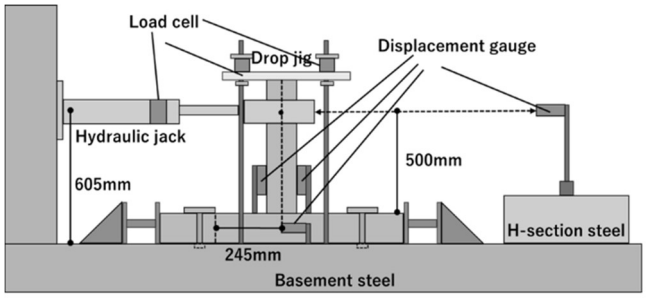

Figure 1. Setup diagram of flexural shear test.

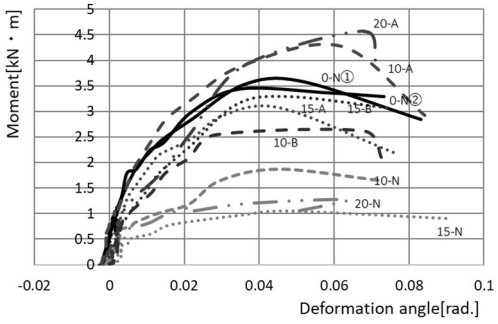

Figure 2. Relationship between moment and deformation angle

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