Withdrawal resistances by screw-based probes for in-situ assessment of wood

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Abstract Semi-destructive assessment method of wood integrity using withdrawal resistances of probes had been proposed by author. The probes used in this semi-destructive assessment method are required to be long and have small diameter threads. Satisfying these requirement, a new type of probes manufactured from long metric screws without heads(threaded rod) are proposed. For the purpose to evaluate performance of metric screw type probes, withdrawal tests using metric screw type probes were conducted. Measured withdrawal resistances by metric screw type probes are compared to those by wood screw type probes. Although the threads of these two probes are different, but differences between these two average distribution of withdrawal resistance are not mush. Test results suggest that metric screw type probes are possible to measure withdrawal resistances as well as wood screw type probes. Metric screw type probes are preferable to make longer probes with smaller thread than wood screw type probes.

Keywords screw withdrawals, wood screw, metric screw

1. INTRODUCTION

Semi-destructive assessment method of wood integrity using withdrawal resistances of probes had been proposed by author. The probes has a short thread at a tip of them. Mutiple withdrawal resistances along the depth of pilot holes provide a distribution of withdrawal resistances along the depth of pilot holes on wood. The probes used in this semi-destructive assessment method are required to be long and have small diameter threads. Satisfying these requirement, a new type of probes manufactured from long metric screws without heads(threaded rod) are proposed. Purpose of this research is to evaluate performance of metric screw type probes for semi-destructive assessment method of wood.

2. EXPERIMENTS

Two types of screws are used for the probes. One is long metric screws without heads(threaded rod). The other is commercially available(C.A.) wood screws which are called ‘Coarse thread’. C.A. wood screw type probes have larger thread than that of metric screw type probes. These two probes are shown in Photo1. The two screw-type probes are driven into a pilot hole on wood over the multiple length of threads. The probes are pulled out and the maximum strengths (withdrawal-resistances) are measured by the loading apparatus shown in Photo 2.

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Photo 1 – Metric screw type probes (above) and wood screws type probes(below)

Photo 2 – Withdrawal test of two type probes using loading apparatus

3. RESULTS AND DISCUSSION

Figure 1 shows average distributions of withdrawal resistances by metric screw type probes. Figure 2 shows averaged distributions of them by C.A. wood screw type probes. Figure 1 and Figure 2 indicates metric screw type probes are possible to measure withdrawal resistances instead of wood screw type probes. It will be possible to obtain distributions of withdrawal resistances inside of large timbers using longer metric screw type probes. Longer probes and smaller diameter threads will expand application scope of semi-destructive assessment method using withdrawal resistances. Another advantage of metric screw type probes is that metric screws(threaded rod) are commercially manufactured in many countries under the same standard ISO. Measured withdrawal resistances are divided by outer cylindrical areas of the probe threads for normalization. It was confirmed that this normalization was effective in these tests.

4. CONCLUSIONS

In case of metric screw type probes, the average distribution of withdrawal resistances in wood is affected by rate of loading a little. In case of C.A. wood screw type probes, the average distribution of them is also affected by rate of loading a little. Comparing the average distributions by these two type of probes, although the threads of these two probes are very different, but differences between these two sets of the average distributions of withdrawal resistances are not much. Test results suggest that metric screw type probes are possible to measure withdrawal resistances as well as wood screw type probes. Metric screw type probes are preferable to make longer probes with smaller thread than wood screw type probes. These features of metric screw type probes are important for the probes used in semi-destructive assessment method using withdrawal resistances.

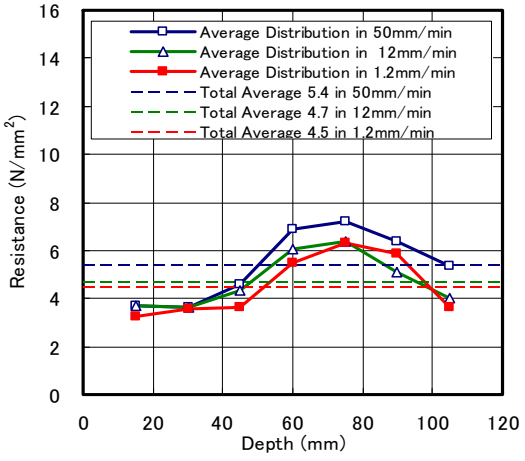

Figure 1 – Average distributions of withdrawal resistances by metric screw type probes in 1.2mm/min, 12mm/min, 50mm/min

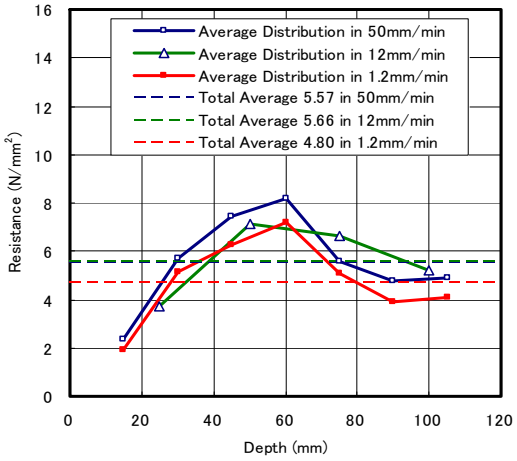

Figure 2 – Average distributions of withdrawal resistances by C.A. wood screws type probes in 1.2mm/min, 12mm/min, 50mm/min