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INVESTIGATION OF THE NON-DRYING ABILITY AND DEFORMABILITY OF REBAR JOINTS WITH WOOD WHEN PULLING OUT

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The responsible node of the wooden glued columns is the support node, rigidly connected to the foundations. The strength and deformability of the support unit connected to the foundation with the help of glued rods depends on the action of the longitudinal force and bending moment. The article presents experimental data of connections on glued rods when pulling out.

Keywords: Wooden glued column, responsible node, glued metal rod, test results, strength, shear, deformation.

INTRODUCTION

The responsible node of buildings with an all-wood frame is the support node of glued columns, rigidly connected to the foundations. As is known, the strength of such joints depends on the strength and deformability of the connecting elements under the action of longitudinal force and bending moment [1].

There are various variants of the support nodes of glued columns rigidly connected to the foundations [2].

The analysis of the results of the conducted studies shows that the most acceptable nodes are nodes with the use of joints on glued rods, and the study of the strength and deformability of such joints is an urgent task.

To this end, the author set the following main tasks:

- to investigate the actual bearing capacity and deformability of joints depending on the size of the grooves, the diameter and length of the gluing of the rods, as well as the design features of the inclusion of the rods in the work when pulling out;
- determine the nature and nature of the destruction of the joints when pulling out;
- experimentally test the method of approximate calculation of rods glued into the wood for pulling out.

The study of joints in order to study the influence of the size of the grooves during pulling was carried out on samples with a cross section of 80x100 mm and a length of 750 mm.

The samples were wooden prisms: reinforcing rods with a diameter of 16 mm were glued into the grooves. The length of the glued part of the rod l was assumed to be equal to 320 mm. i.e. 20 diameters of the rod.

Thus, the l /d ratio of all tested samples was equal to 20. The grooves had a square cross-section with the dimensions of the sides 2, 4, 6 and 8 mm larger than the outer diameter of the rod. A total of 16 samples were tested (4 samples of the same type for each test).

The general view of the samples, their cross-section and the location of the measuring devices in the reinforcing rods are shown in Figure 1.

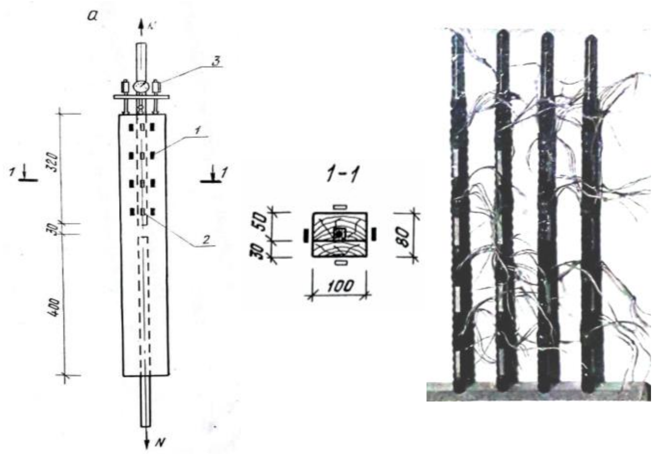

Fig. 1. General view of the sample and the layout of the measuring devices: 1-load cells on wood; 2 – the same on the reinforcement; 3-hour-type indicators (ICH-10).

The pulling test was carried out on a breaking machine R-50; the loading speed was assumed to be equal to 60-50 N / s, and the loading stage

- 5 books.

It can be seen from Figure 1 that when pulling out the rods, the transfer of tensile forces from the rod to the wooden prism was carried out through the glued layer.

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The deformations of pulling out the rods relative to the end of the wooden prism and the deformations of the wooden prism were measured by hour-type indicators with a division price of 0.01 and 0.001 mm.

The photo (Figure 2) shows the process of testing samples for pulling out.

As the analysis of the test results shows, the dimensions of the groove significantly affect the deformation of the joint when pulling out. For example, if at a load of 60 kN, the deformation of pulling the rod out of the groove with a size exceeding the diameter of the rod by 2 mm is equal to 0.23 mm, then with an increase in the difference of these sizes to 4, 6 and 8 mm, the mentioned deformations turned out to be.

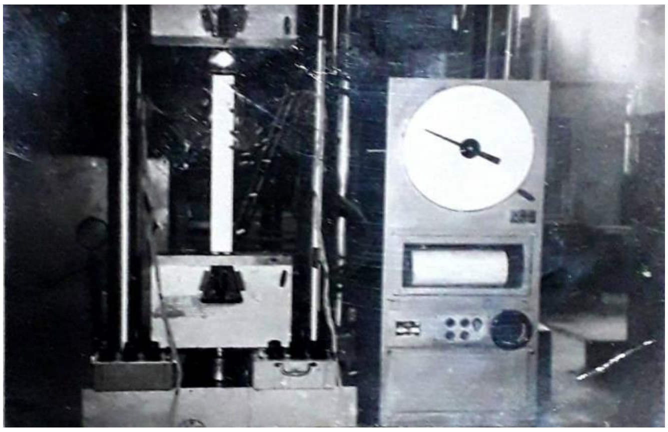

Fig. 2. Samples during testing.

Respectively, equal to 0.27, 0.33 and 0.39 (Figure 3). Thus, with an increase in the size of the groove from 18x18 mm to 24x24 mm, the deformations when pulling the rod relative to the end of the prism increased approximately 1.7 times.

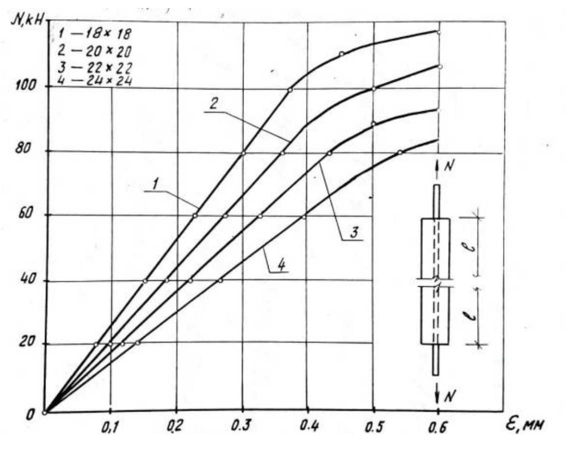

Fig. 3. Deformations of joints during pulling out (average values): 1-for slots with dimensions of 18x18 mm; 2 – the same 20x20 mm; 3-also 22x22; 4-the same 24x24 mm.

As can be seen from Figure 3, the size of the groove significantly affects the bearing capacity of the adhesive joint of the rod with the wood when it is pulled out. So, for example, if the value of the pulling force during the destruction of samples with grooves 18x18mm, was on average equal to 110 MPa, then with an increase in the size of the grooves to the above values, it decreased, respectively, by 9, 19 and 26 percent. Note that the destruction of the samples when pulling out the rods was accompanied, as a rule, by splitting the wood.

The influence of the diameter of the rods and their length during pulling out was studied on samples similar to the samples shown in Figure 1. In this case, the diameters of the rods were taken to be 12, 14, 16, 18, 20 and 22 mm, and the length of the insertion was equal to 15, 20, 25, 30 and 35 rod diameters. The dimensions of the slots for the rods were assumed to be minimal and exceeded their outer diameter by 2 mm. A total of 44 samples were manufactured and tested.

According to the test data of four similar samples, the arithmetic mean value of the pulling force during the destruction of the samples was determined. The test results are shown in Figure 4.

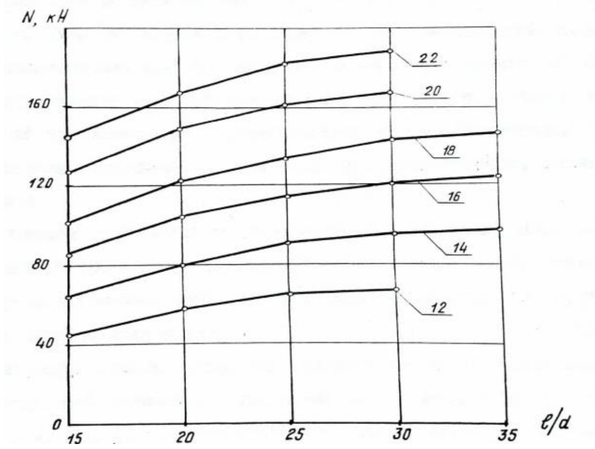

Fig. 4. Values of destructive pulling forces depending on the diameter of the rods and the relative length of their gluing.

CONCLUSION

As can be seen from Figure 4, the values of the pulling forces that cause the destruction of the samples increase with increasing length of the rods. For example, if this value for rods with a diameter of 12 mm with an insertion length of 15d is 45.05 kN, then with the same diameter and lengths of 20, 25 and 30d, the values of the destructive forces increase, respectively, to the values of 52.05, 57.47 and 63.45 kN.

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The size of the destructive forces is also significantly affected by the diameter of the glued rods. If for rods d=12 mm with an insertion length of 20d it is equal to 52.05 kN, then for samples with rods 14, 16, 18, 20 and 22 mm.the destructive force increases to values equal to 76.22, 98.97, 124.15, 147.37 and 163.05 kN, respectively.

The analysis of the results of the conducted studies shows that with an increase in the length of the insertion of rods more than 25-30d, the growth of destructive forces slows down, with the lengths of the insertion more than 30d, and the values do not change significantly.

Evaluating the results of the tests carried out, it can be argued that:

- in order to reduce deformations, the support units on the glued rods should be designed so that the transmission of compressive forces is provided simultaneously to the ends of the rods and to the end of the column;
- the dimensions of the grooves should be taken as minimum, exceeding the outer diameter of the rods by no more than 2 mm;
- it is advisable to assign the length of the gluing rods within 20-30d;
- the obtained data are reliable and can be used for practical calculation of glued rods for pulling out.

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