Determination of the bending strength of corner joint – metal corner brace, for corps furniture made of refined panels of particleboards

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Abstract. This paper presents data about the bending strength of outside corner joint – metal corner brace, for corps furniture made of refined panels of particleboard with a width of 25 mm. The research was conducted on two kinds of samples. The two kinds of sample objects are divided in two groups according to the way of composition as follows:

Group 1: the first are obtained by extraction i.e. cutting up an already constructed element – bedside table which was subjected to a test method for determining strength, durability and stability- furniture for indoor use EN 1730: 2000;

Group 2: the second sample objects were not subjected to any tests and were composed of two parts of particle board with given dimensions in accordance with the normative and are connected with the chosen connective object.

1. Introduction

One of the most studied kinds of strength, which affects the construction of corpus furniture, is the bending strength.

There are a number of studies, which have been carried out most often for particleboards with a thickness of 16 and 18 mm. In this paper, the bending strength of sample objects made of particleboards with a thickness of 25 mm will be experimentally determined.

The very first studies carried out on constructive compositions made of panel elements, were burdened with bending strengths. Those studies were carried out in different countries with very similar methods. In Bulgaria the studies carried out by Kjucukov, Josifov and Zivkov are noted. Analogous studies were carried out in the USA by Eckelman and Zhang. In Germany Albin, Konjer, Kuhne, Beechmann and Hassler published studies on this subject. In Finland Liiri and Haawisto performed analogous surveys. In Macedonia studies of this type were carried out by T. Gruevski and N. Simakoski.

These studies showed results about the bending strength of corpus furniture. Next are the studies of the strength of stretching which were carried out in Germany, Bulgaria as well as Macedonia.

Finally, there were surveys carried out on constructive compositions made of plate elements burdened with shear strength. Gj Gruevski carried one of these surveys out in Macedonia.
2. Purpose and method of examination

Some of the objectives of this study are the following:

- Determination of the specific moments of bending of outside corner joint, demountable composition of refined panels of particleboard with a thickness of 25 mm joined with a metal corner brace (fixed with screws for pates);
- Determination of the specific moments of bending of outside corner joint, demountable compositions of refined panels of particle board with a thickness of 25 mm taken from an object- a bedside table which was previously subjected to a test method EN 1730, joined with a metal corner brace;
- Comparison of the obtained results of the specific moments of bending of a sample object with a joint element a metal corner brace (fixed with screws for pates) cut off a ready-made element a bedside table and an extra made sample object with the same constructive joint.

2.1. Type, shape and dimensions of the sample objects and test fixtures

The object bedside table, made of refined panels of particle board with a width of 25 mm, with dimensions 550/550/450mm, and a front (door) made of MDF wood fiber board with a thickness of 18 mm and dimensions 500/500/18, on which small trestles are fixed, which raise it from the surface about 100mm.

Four bedside tables object have been tested. On each connective side there are two connective joints. Prior to their delivery to the laboratory, they were joined and delivered as whole objects. Before testing, each of the objects was in an acclimatization room for a period of 7 days at a temperature of 15º to 25 Cº. No defects in the product noticed before the testing. These objects were subjected to a test method for determining firmness, durability and stability - furniture for indoor use EN 1730: 2000.

Figure 1. Samples for the examination of outside corner, demountable compositions of refined panels of particle board with a thickness of 25 mm.

Figure 2. Dimension of the test fixtures with metal corner brace.
2.2. Equipment and devices for examining the bending load of sample objects

A machine was used for the examination of sample objects that was installed in the laboratory at the Faculty of design and technology of furniture and interior – Skopje, SCHENKE TREBLE, of German origin and with a digital read-out and high accuracy.

The sample objects are placed on moving trolleys, which are used when examining outside corner joints when bending load is applied by opening and closing the sides of the sample object.

**Figure 3.** Object for the examination of outside corner joints when bending load is applied by opening the sides of the sample object.

**Figure 4.** Object for the examination of outside corner joints when bending load is applies by closing the sides of the sample object.
2.3. Results and discussion

The obtained results for the calculated values of the criteria for the bending strength, in each of the groups of sample objects are shown in tables.

The processing of data from the conducted research is made according to the usual methods of variation statistics. The medium arithmetic values \( \bar{x}_{sr} \), the standard deviation \( S \), the coefficient of variation \( V \) and their errors \( f_{\bar{x}_{sr}}, f_S, f_V \).

| Group 1 | x_{sr} [Nm] | S [Nm] | V [%] | f_{\bar{x}_{sr}} [Nm] | f_S [%] | f_V [%] | n  |
|---------|-------------|--------|------|------------------------|--------|--------|----|
|         | 36.5        | 5.39   | 14.77| 3.81                   | 10.44  | 0.98   | 2.75| 15 |

| Group 2 | x_{sr} [Nm] | S [Nm] | V [%] | f_{\bar{x}_{sr}} [Nm] | f_S [%] | f_V [%] | n  |
|---------|-------------|--------|------|------------------------|--------|--------|----|
|         | 38.94       | 2.96   | 7.61 | 1.96                   | 5.04   | 0.541  | 1.40| 15 |

Table 2. Results from the bending load with closing the sides of the sample object.

| Group 1 | x_{sr} [Nm] | S [Nm] | V [%] | f_{\bar{x}_{sr}} [Nm] | f_S [%] | f_V [%] | n  |
|---------|-------------|--------|------|------------------------|--------|--------|----|
|         | 10.75       | 1.13   | 10.58| 2.73                   | 25.42  | 0.207  | 1.95| 15 |

| Group 2 | x_{sr} [Nm] | S [Nm] | V [%] | f_{\bar{x}_{sr}} [Nm] | f_S [%] | f_V [%] | n  |
|---------|-------------|--------|------|------------------------|--------|--------|----|
|         | 10.58       | 1.14   | 10.81| 2.79                   | 26.38  | 0.21   | 1.99| 15 |

The analysis and discussion of the obtained results if firstly done on the strength that affects the sample objects when opening the sides, and then on the strength which affects the sample objects when is closing the sides. The results are presented in tables and graphics. In addition to this paper there are photos of the sample objects after the examination. Finally, all the results are compared so that the conclusions can be made.

3. Conclusion

The objective results we obtained from this examination when applying the load in bending, give us an opportunity to determine the strength characteristics of the connective objects that are used for the construction of furniture made of refined panels of particleboard with a thickness of 25 mm.

Some of the conclusions are as follows:
1. The strength of bending with the opening of the sides is significantly greater in comparison with the strength of bending with closing the sides of the sample object;
2. Simulated exploitation, test method EN 1730:2000, does not have a significant impact on the bending strength;
3. Factor that has an impact on the diversity of bending strengths is the human factor when mounting and screwing clutches.

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