

Review of a Thesis abstract

“Compressed-bending wooden elements with malleable bonds in the form of unidirectional carbon fiber tapes of a closed loop” by Irene A. Ladnykh, which is presented as Ph.D. qualification in technical sciences (05.23.01 – building structures, buildings and constructions)

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1. General review of presented Thesis abstract

In this work and performed scientific research, a new type of structural strengthening of timber elements subjected to simultaneously acting axial compression and single axis bending has been proposed, analyzed and confirmed by natural tests. Structural strengthening has been developed in the form of a unidirectional carbon-fiber fully enclosed strips along the height of the built-up cross section.

In the Thesis the mechanical characteristics, nature of work, failure mechanisms and stiffness coefficients for a given malleable bond have been experimentally determined. It has been confirmed that strengthened built-up timber element according to the developed methodology and loaded under simultaneously action of compression and single axis bending complies with design criteria of equivalent massive section. The compliance coefficients k_w (stress analysis) and k_i (displacement analysis) were determined for a new type of structural connection according to two groups of limit states and selected number of enclosed strips bonds.

The proposed new type of structural connection can be used in the design of new and strengthening of existing built-up timber elements under combined actions of compression and bending.

Scientific achievements consist of the following:

- > A new type of mechanical connection has been proposed in the form of a unidirectional carbon fiber strip of a fully closed loop for uniting of wooden compressed and bending elements along the height of the cross section, which can be used to create new wooden elements of a composite section and strengthen existing timber elements, including laminated beams;
- > Based on experimental data, the nature of the structural performance and the failure mechanism, the numerical values of the stiffness factors of the mechanical connection by the means of a fully enclosed unidirectional carbon fiber strip have been established, as well as the relationship between the stiffness factors and the reinforcement ratio for the proposed mechanical connection;
- > Based on experimental data, structural performance of a timber compressed-bending element with the proposed mechanical connections in the form of a unidirec-



tional bonded strip was confirmed as a built-up element with elastic deformable joints, and the relevant stiffness factor has been experimentally determined.

2. Notes on presented Thesis abstract

2.1 Presented Thesis on the structural performance of compressed-bending wooden elements with malleable bonds in the form of unidirectional carbon fiber tapes of a closed loop, is valuable scientific research in the field of structural strengthening of existing timber elements and an option for obtaining built-up cross sections for new structural timber elements.

2.2 Obviously conducted theoretical investigations and natural tests and obtained results can be regarded as a sound design basis for structural implementation of the proposed new structural type of bonded connection by the means of unidirectional carbon fiber strips in the mentioned above fields of application.

2.3 Determined K_w and K_i factors can be used according to Belarus national design code for timber structures as well as according to Bulgarian national design code for timber structures, as it seems that we use the same design approach.

2.4 For further investigation and scientific research I would propose the following topics:

- To compare obtained results from natural tests and theoretical investigation with the theoretical background and γ factor method provided in The European Standard EN 1995-1-1:2004, Annex B;

- To investigate influence of environment conditions (moisture and temperature) on the structural performance of the new type of bonded connection. In particular, it is important to verify if shrinkage effects in the wooden material do not deteriorate established mechanical parameters;

- To investigate the structural performance of strengthened with proposed new structural bonded joint of a timber column with built-up section considering buckling effects.

3. Conclusion

Let me congratulate Mrs. Irene Ladnykh for the remarkable and undoubtedly important scientific and engineering research. I strongly recommend the Ph.D. thesis "Compressed-bending wooden elements with malleable bonds in the form of unidirectional carbon fiber tapes of a closed loop" by Irene A. Ladnykh as a qualification work for Ph.D. degree in in technical sciences on specialty 05.23.01 – building structures, buildings and constructions.)

Sofia, Bulgaria

Signature:



Отзав научния съвет 13.12.23
Благодаря Р.В. /

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