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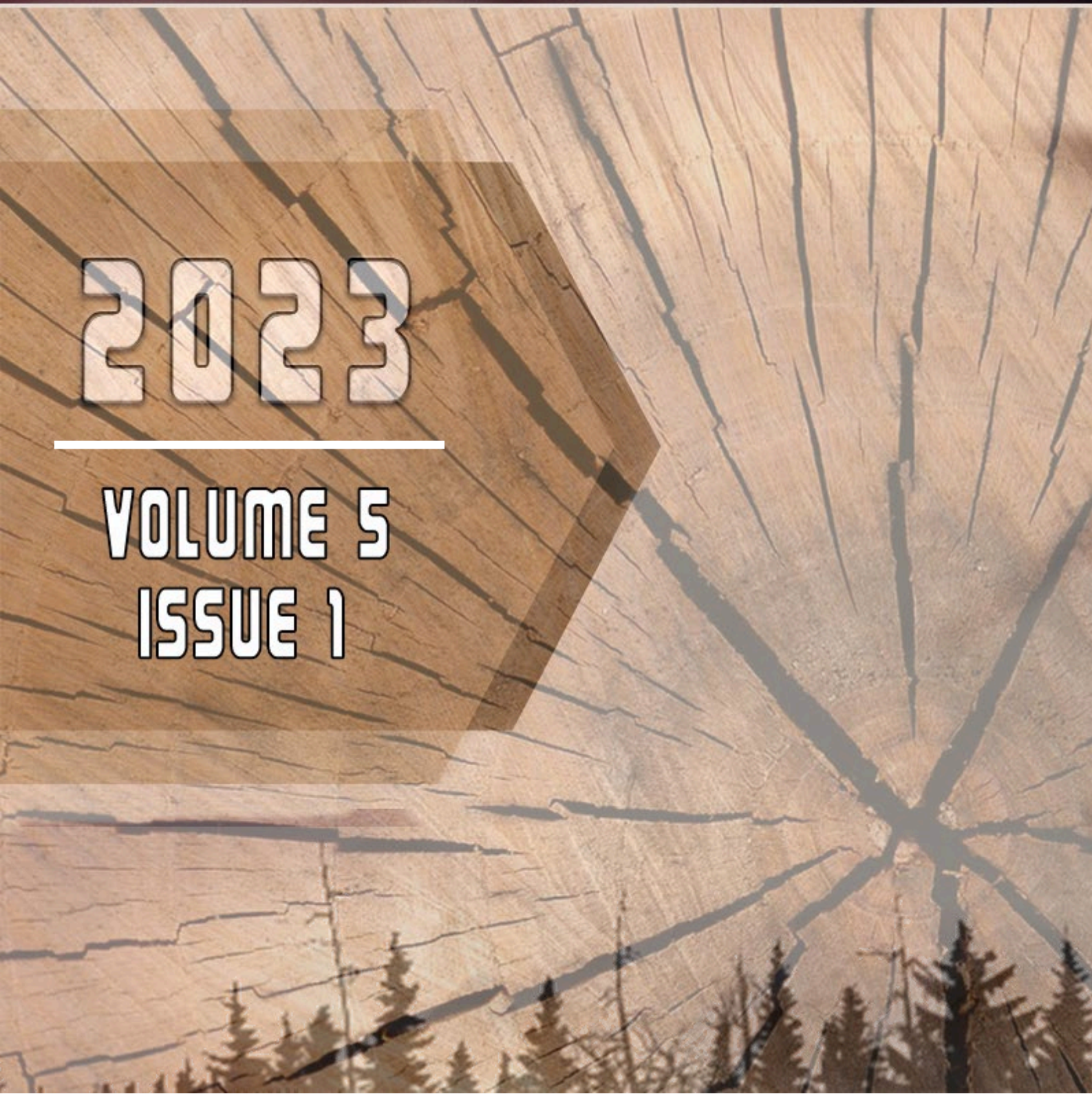
Wood Industry & Engineering

ISSN 2687-6043
e-ISSN 2687-6035



2023

VOLUME 5
ISSUE 1

https://dergipark.org.tr/en/pub/wie

Wood Industry and Engineering

ISSN: 2687-6043 **e-ISSN:** 2687-6035

YEAR : 2023 VOLUME : 5 ISSUE : 1

Wood Industry and Engineering (WI&E) is a peer-reviewed international scientific journal and published twice in each year (January-June and July-December). Publication language is English and Turkish.

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https://dergipark.org.tr/en/pub/wie

ISSN: 2687-6043
e-ISSN: 2687-6035

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June 2023, Trabzon, TURKEY

Wood Industry and Engineering

ISSN: 2687-6043 **e-ISSN:** 2687-6035

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ISSN: 2687-6043
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https://dergipark.org.tr/en/pub/wie

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2023
pp. 1-6

SCAN ME

Wood Industry and Engineering
International Scientific Journal

A RESEARCH ON DETERMINING THE PERFORMANCE PROPERTIES OF ENGINEERED WOOD PRODUCTS

Okan İlhan[1]

Citation

Ilhan O. A Research on Determining the Performance Properties of Engineered Wood Products. ***Wood Industry and Engineering****. 2023; 5(1): 1-6.*

Abstract

In this study, the survey was carried out on academicians as well as engineers and architects who are in the engineering wood products sector. Determination of the performance characteristics and research needs of engineered wood products was investigated under the name of a survey study. In the study, the survey results were evaluated in the SPSS program.

As a result of the study, the participants concluded that the structural performance, environmental performance, and fire performance of structural wood products are important. Based on this, it is thought that the negative phenomena of the final consumers who will be used in the building sector will be destroyed by this study.

Keywords

Survey
SPSS Program
EWP
Performance Characteristics

Paper Type

Research Article

Article History

Received: 09/02/2023
Accepted: 13/04/2023

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A RESEARCH ON DETERMINING THE PERFORMANCE PROPERTIES OF ENGINEERED WOOD PRODUCTS

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1. Introduction

In view of provable threats to the natural environment, the need to drive development in the built environment along the path of sustainability in line with the United Nations Millennium Development Goals (MDGs) has necessitated the call for environmentally responsive practices in the built environment (Ortiz et al., 2009; Pacheco-Torgal and Labrincha, 2013). The call for this paradigm shift comes on the heels of provable threats to the sustenance of earth's non-renewable resources and the overall environmental well-being (Mehta et al., 2008; Ametepey and Ansah, 2014). Currently, topical research and development issues in construction materials revolve around priority areas such as sustainability, energy efficiency, climate change, and environmental friendliness (Pocheco-Torgal and Labriancha, 2013). Hence the focus is on sustainable and renewable building and civil engineering materials (Ekundayo et al., 2020).

Wood utilization in construction is a practice as old as human civilization (Gu et al., 2021). Accretion value wood products harvested from forests have been used as building materials for thousands of years. With global forest resources strained, research in the fertile use of harvested wood materials with engineered wood products (EWP) used in buildings has a long history. From forest wood harvested wood to engineered wood products to sized lumber veneers/yarns, at least three basic processing steps are required: peeling or cutting, drying, and strength grading. Within the step of peeling or cutting, barks and surface defects of the round wood are removed, and the processed round wood is subsequently peeled or cut into lumber veneers/strands or dimensional lumber, respectively (Sun et al., 2020). Then the processing step of drying should be conducted because wood commonly with a moisture content of one hundred percent or even more is vulnerable to fungal degradation; besides drier lumber can provide a more receptive substrate for gluing (Pratt et al., 2010). Based on the processing step of drying, an upper limit of twenty percent moisture should be satisfied for the wood with structural applications (EN 338, 2009). The step of strength gradation ensures the engineered wood can ensure expected and stable mechanical properties for applications. These processed lumber veneers/strands or dimensional lumber combined with adhesives can be manufactured into various engineered wood products, with the advantages of increased dimensioned stability, more stable mechanical properties, greater durability, etc. (Sun et al., 2020). Engineered wood products (EWP) used in buildings have a long history. Traditional wood building products, such as plywood, oriented strand board (OSB), and I-Joists, are now pericenter by emerging mass timber products, such as cross-laminated timber (CLT), glue-laminated timber (GLULAM), nail laminated timber (NLT), and dowel laminated timber (DLT) (Karacabeyli and Douglas, 2013). Over the past few years, wood structures have been recognized and promoted by all sectors of society for their features of saving materials, large span, reasonable structure, good durability, fast construction speed and convenient construction (Brandner et al., 2016; Ramage et al., 2017). In addition, engineered wood products (e.g., glued wood, and CLT) are outstanding to natural wood in terms of structural and material properties and can be used instead of precious natural wood in the structural and wall construction systems of the building, solving the problems of structural timber, and saving natural resources and building energy (Smith et al., 2006; Takino et al., 2018; Yang et al., 2018). In addition, the prejudice that our country's forest resources are insufficient and will decrease due to wooden structures also reduces the demand for wooden structures. However, the forest area in Turkey covers approximately 24% of the country's surface area with 22.933.000 hectares. Many people in Turkey think that the wood will burn immediately, and the forests will disappear. Therefore, it is necessary to prevent such misperceptions and to improve the studies on wooden building materials.

This study is a study to determine the performance properties of engineered wood construction products in Turkey. Determining the research needs for the performance properties of EWPs in our country and considering these parameters are among the objectives of the study, with a survey conducted based on the sector and academic scope of wooden structures. It is aimed to determine the performance properties of engineered wood construction products in buildings with wooden carrier systems by architects, engineers, and academicians, and to evaluate their advantages and disadvantages.

2. Materials and Methods

Businesses to be surveyed; It has been determined from the list of companies that are members of the National Wood Association, from companies participating in the 22nd Furniture Side Industry Accessories Forest Products and Wood Technology Fair, from company representatives participating in the 2018 KTU International Forest Products Congress (ORENKO), and via Google on the internet. In our country, 25 enterprises operating directly or indirectly in the wood construction sector were described and a survey was sent to all of them. A total of 78 engineers and architects working in 18 of these businesses provided feedback. In addition to engineers and architects, a survey was conducted with 48 academicians from different universities who have scientific studies in the field of wooden building materials.

As a result of the application, the study was carried out on 126 surveys that could be evaluated. A 4-point Likert Scale was used to express the level of agreement regarding the items in the scale.

2.1. Evaluation of Suitability of Data for Factor Analysis

Check on the data obtained from the study group is suitable for exploratory factor analysis and can be explained with the Kaiser-Mayer-Olkin (KMO) and Barlett tests (Karagoz and Kosterelioglu, 2008; Buyukozturk, 2010). A high Kaiser-Mayer-Olkin value means that each variable in the scale can be estimated perfectly by other variables. If the values are zero or close to zero, no interpretation can be made based on these values because there is a scatter in the correlation distribution. As a result of the Kaiser-Mayer-Olkin test, it is making a remark that factor analysis cannot be sustained if the value is less than 0.50 (Cokluk, et al., 2012). Field (2000) stated that 0.50 should be the lower limit for the Kaiser-Mayer-Olkin test and reported that the data set will not factor for KMO≤0.50. Accordingly, it is expected that the Barlett Test will be greater than 0.50).

3. Results

The result of the Barlett Test and Kaiser-Mayer-Olkin test are given in Table 1.

Table 1: The result of the Barlett Test and Kaiser-Mayer-Olkin test

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.761
Bartlett's Test of Sphericity	Approx. Chi-Square	5107.935
	df	2080
	Sig.	0.000

As seen from Table 1, the KMO value was determined as 0.76 and it was concluded that this value was ''perfect'' for the factor analysis of the sample size. In addition, the results of the Barlett sphericity test showed that (p≤0.1) value was significant.

3.1. Area of Expertise

The distribution of the fields of expertise of the respondents is given in Figure 1. The survey data of 47 engineers, 31 architects, and 48 academicians who participated were evaluated by performing variance analysis in the SPSS package program. The results of the survey study handled to determine the performance properties of EWP are shown in Figure 2.

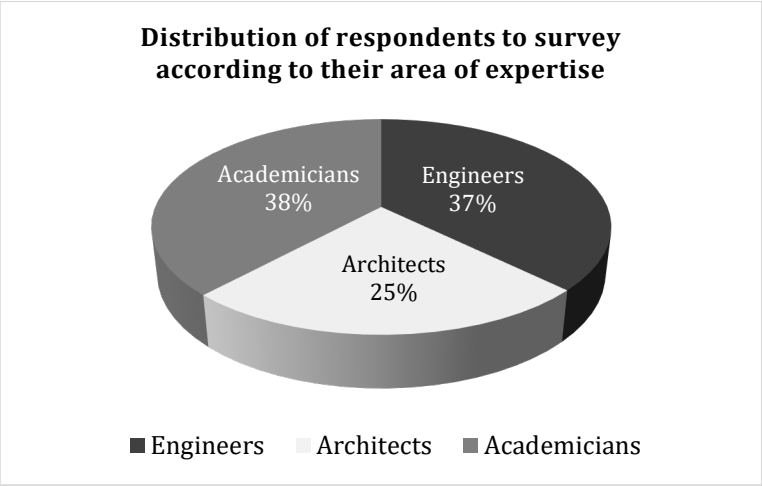

Figure 1: Area of Expertise

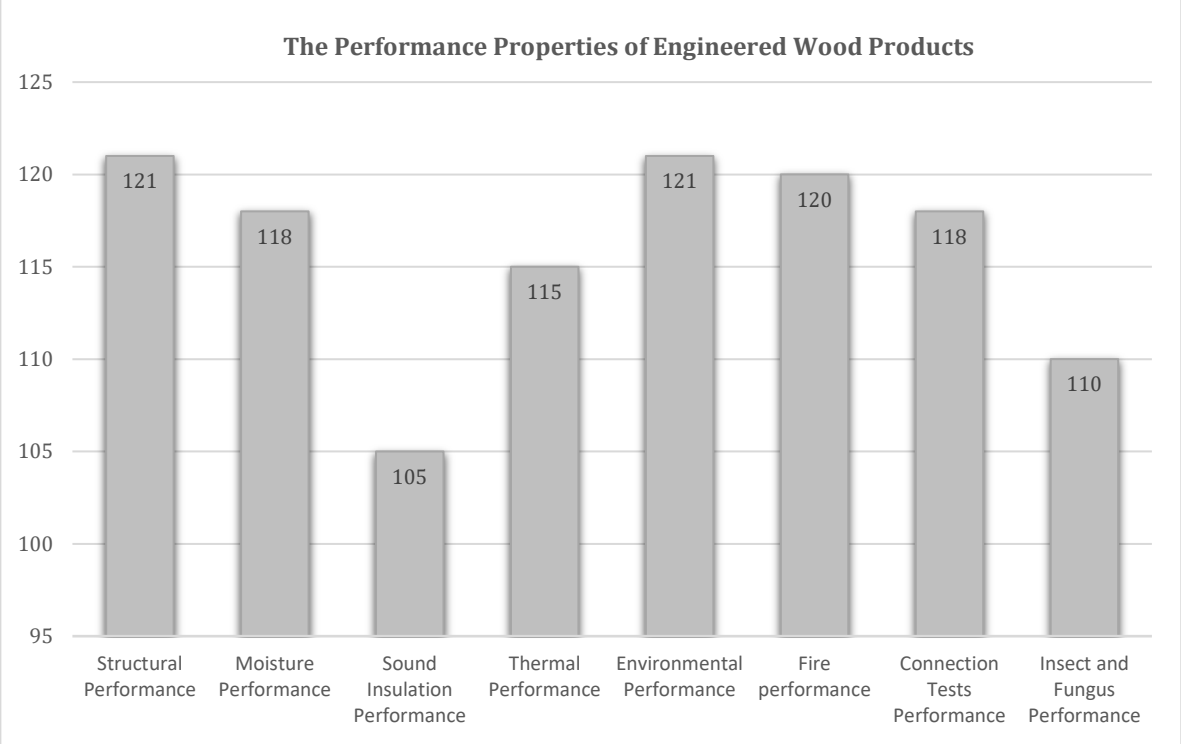

Figure 2: The results of the survey study conducted to determine the performance properties of EWP.

As seen in Figure 2, it can be concluded that the participants adopted the fact that the structural, environmental and fire performance properties of engineered wood products were significantly good. However, the participants emphasize that the sound insulation performance in the building is not very important.

4. Discussion

Accordingly, it can be deduced that all occupational group participants adopt the view that the environmental performance of wood material is significantly good as well as its structural performance and earthquake resistance. Researchers have performed comprehensive seismic tests on engineered wood products and have been found to perform quite well, especially in multi-layer applications, without permanent deformation. In addition, an American Standard has been developed for laminated wood materials based on their structural performance, particularly in terms of flexural and shear strength, strength, and deflection (APA, 2013).

It can also be interpreted that the survey participants argue that the environmental performance of the wood material is very important. The importance of the environmental performance of wood has been emphasized in scientific studies. Trees efficiently store carbon because of the photosynthesis process by converting carbon dioxide (CO_2) into biomass (Lehmann and Hamilton, 2011). It is known that one cubic meter of wood stores approximately 1.10 tons of CO_2 (Puettmann and Wilson, 2005).

The fire performance feature is related to the fire resistance of the wood material and the duration of the collapse time of the carrier systems. Many studies have been done on this. Experimental fire resistance testing has been conducted on several CLT masonry by the American Timber Council. All wall specimens stood for more than 180 minutes before collapsing.

5. Conclusion

As a result of this study, in terms of the use of wooden building materials; most engineers, architects, and academicians agreed that wood is renewable and environmentally friendly. In addition, it can be concluded that wooden structures are one of the effective solutions in earthquake zones with their strength, lightness, and flexibility.

With this study, the importance of the performance characteristics of EWP's was determined by the architects and engineers working in the sector, as well as the academicians of the wood mechanics technology department, and the misperceptions in Turkey were supported by literature studies. While the engineers and architects using this material know the superior performance properties of the wood material, the final consumer who will use it in practice is unaware of it. With this study, it is thought that the final consumers will be clarified.

6. Acknowledgement

Ethical approval for this study was obtained from The Ethical Committee of Karadeniz Technical University.

Disclosure Statement

No potential conflict of interest was reported by the author.

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