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Full Length Research Paper

User preferences and problems encountered in the selection of housing windows in Turkey

Derya Sevim Korkut[1]*, Tuncer Dilik[2], E. Seda Erdinler[2], K. Hüseyin Koc[2] and Ahmet Kurtoglu[2]

[1]Department of Forest Industrial Engineering, Faculty of Forestry, Duzce University, Duzce, 81620, Turkey.
[2]Department of Forest Industrial Engineering, Faculty of Forestry, Istanbul University, Istanbul, Turkey.

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In this study, the most preferred window type relating to housing in Turkey according to the quality of the material used during production, the reasons of preference, the problems encountered during the use of the preferred windows, production defects and the assessments of the users relating to windows production industry have been studied. The study is planned within the scope of Duzce city, a region with a great disaster and damage during the 1999 earthquakes in Turkey. The basic reasons for selecting the region as the study region are the socio-economical structure of the region and its position which makes it open for industrial developments, as well as displaying a faster structuring and renovation process compared to the other regions in Turkey. Direct surveys have been applied to different families living in Duzce city. As a result of the study, it has been determined that the users consider the durability of the window while selecting (71%) and this is followed by affordability (20%), availability of service facilities (7%) and other reasons (2%). Furthermore, it is also determined that the window preferences of the existing users are 54% plastic (PVC), 38% wood and 8% aluminum.

Key words: Turkish window sector, housing windows, window functions, window materials, user preferences.

INTRODUCTION

It has been observed recently that the production amount and quality of windows in the world is changing continuously, and the expectations from windows differ particularly due to developing architectural concepts and construction techniques, changing economical, socio-cultural values and ecological approaches (Dilik et al., 2009). Today, with the population increase in the world, in addition to the quickly changing and developing economy and technology in developing countries like Turkey, the awareness of the consumers increases the life standards of the people. The increasing life standards allow people to select the highest quality and different options among the fittings in shaping the common life areas.

The first material used in woodwork and particularly in window production is wood. Then, with the development of the industry, the usage of iron, aluminum, plastic (PVC) and composite materials, respectively, began in window production (Dilik and Kurtoglu, 1998). Particularly, wood, plastic and aluminum constitute almost the entire material used in window production (95%) (Dilik et al., 2009). The use of PVC and aluminum, as a substitute of wood, has increased recently due to defects of wooden material, easy effects of external factors, the problems arising while in contact with water and the need for continuous maintenance (Kurtoglu and Sevim, 1998).

The focus in all developed countries is that aluminum, the most expensive material in price, is used in industrial and administrative buildings such as workplaces and offices and particularly in curtain wall, roof lighting and special design windows according to the architecture, while the use of aluminum in housing is very low. Aluminum was first used for the renovation of aged windows, but was replaced with plastic and wooden materials (Dilik and Kurtoglu, 1998). Different wall structures and lighting needs are required according to

*Corresponding author. E-mail: deryasevimkorkut@duzce.edu.tr. Tel: +90 380 5421137. Fax: +90 380 5421136.

Table 1. The number of housing affected by the 1999 earthquakes

Building type	Housing (number)
Heavily damaged/ruined	16.666
Averagely damaged	10.968
Minor damage	13.070

the functions of the building such as housing, hospital, office, school and shopping centers. There are several characteristics such as security, inspection, insulation, architectural esthetic and cost limitations influencing the selection of the woodwork material and suitable construction ensuring compliance with different wall structure and sufficient lighting. In general, windows perform the above mentioned functions, while they are also required to have some important characteristics such as ensuring protection against hot and cold and extreme sunrays, decreasing the transmission of sound, being esthetic, easy cleaning and maintenance and affordability. Therefore, it is required to consider the characteristics appropriate to the usage purpose during the design, material selection and production of the woodwork products (Dilik, 1997; Altun, 2006).

According to Binan (1985), the duties which a window is required to perform are (a) Sufficient lighting of interior volumes, (b) efficient ventilation, (c) establishing contact with the exterior for the interior volume, (d) contributing in placement order of the volumes, (e) ensuring protection against hot, cold, rain, wind, noise, light and sun, (f) ensuring easy, useful and convenient cleaning, (g) affordability, not loosing any value during production as a result of affordability and ensuring the protection with the lowest maintenance cost.

On the other hand, it is seen that several factors (such as economic, technologic and ecologic approaches etc.) influence the expectations from windows today, as in the material preferences. Within this scope, the expectations from the windows can be listed as follows (Dilik et al., 2009):

1. Within the scope of the increasing life standards of today, they must offer higher quality and different options to the users.
2. While performing the basic duties such as ensuring the connection with air, lighting, sound, visual relation in the buildings and exterior places, they must also perform several vital requirements such as insulation, security and inspection, in addition to comfort.
3. It should also ensure protection against hot and cold and excessive sunrays, reducing the transmission of sound, being esthetic, ease of cleaning and maintenance and affordability.
4. All materials used today are evaluated with their positive or negative impacts on environmental health. Therefore, the windows are preferred to be produced from a recyclable material suitable for ecological profile.

The study is planned by considering the abovementioned matters and the survey form is prepared and applied according to housing.

MATERIALS AND METHODS

This study is aimed at determining the most preferred window type in housing, the reasons of preference and the problems encountered in the preferred windows. For this purpose, Duzce city and its housing environment were used in this study. Different families living at the region were met in person and a survey was performed. The survey form comprised of six sections with close- and open-ended questions which include: (1) The general characteristics considered in window selection (2) type of window used, (3) reasons of preference of the window types used, (4) problems encountered relating to the windows used, (5) production defects encountered most in the windows used and (6) determining the opinions about the window production industry. The survey results for close-ended questions were transferred to the Statistical package for the Social Sciences (SPSS) environment and evaluated with frequency and percentage distributions.

Duzce city has experienced disaster at the Duzce earthquakes in 1999 and majority of the houses in the region have been completely renewed after the earthquakes, so Duzce city is chosen as the study region for being one of the most important regions of Turkey with its socio-economic structure and industrial developments. The aim of this study is to create a resource for bringing out the impacts of the progresses in preferences in this area for the other regions in Turkey, as well as the world, by suggesting the evaluations of the consumers in window industry during this period of change of the region. According to the address based registration system, it is seen that the population of Duzce city was 335.156 in 2009 (Tuik, 2009) and the sampling size representing this population is determined as 384 with 95% confidence interval and 5% error margin (Yamane, 2001). The survey is applied on 440 people in order to increase the reliability of the survey.

The population of Duzce has been increased by eleven times for the period of approximately sixty years until the 1999 earthquakes. The increased population has also brought the demand for structuring and creating settlement areas. It is seen that the structuring at the city center of Duzce until the 1999 earthquakes was one- or two-floor masonry buildings and reinforced concrete framed buildings with three to six floors and that several buildings, which were contrary to the development plan and with additional floors, were legalized with the development amnesties applied particularly in the years 1982–1984–1985–1996 (Polat, 2009). The housing damage situations in Duzce city as a result of the earthquakes on August 17, 1999 and November 12, 1999 are given in Table 1 (http://www.duzce.gov.tr/). Considering the number of total houses in Duzce, it is been understood that 81% of the houses have been damaged after the 1999 earthquakes and Duzce city center was significantly demolished (http://www.duzce.gov.tr/) (2010).

RESULTS

The characteristics looked for in window selection

The characteristics looked by the users in window selection are given below in Table 2 according to their priority order. The characteristics mainly considered as first by the users in window selection are durability (71.4%), affordability (20%) and service facilities (7%) according to the priority order. Under other (1.6%) option,

Table 2. The characteristics looked for in window selection.

Option	Frequency	Percentage
Durability	314	71.4
Affordability	88	20.0
Service facilities	31	7.0
Other	7	1.6
Total	440	100.0

Table 3. Window type preferred in housings.

Window type	Frequency	%
Wooden window	166	37.7
Plastic window	240	54.5
Aluminum window	34	7.8
Total	440	100.0

the users expressed characteristics such as being healthy, esthetic, ensuring thermal and sound insulation, being functional, easy cleaning, ensuring ease of installation, on-time and quick installation, ease of use (allowing repairing, restoration and replacement), being able to be varnish and paint, being of high quality, ease of transportation and lightness, longevity, having high quality of workmanship, being corrosion proof and having color options.

Window type used

It has been determined that 37.7% of the users prefer wooden window in the houses, while 54.5% prefer plastic window and 7.5% aluminum window (Table 3).

Reasons of preference for the window type used

The reasons of preference for the window type used by the users are given in Table 4. The reasons of preference of the users for the wooden window are determined as esthetic (21.9%), quality (20.6%), wide product range and selection opportunities (18.6%), affordability (14.2%), mechanical and resistance characteristics (13.2%) and functionality (4.9%). Under the other (6.6%) option, the characteristics such as being a healthy material, lightness and ease of use, having a warmer appearance, being natural, being able to be painted and varnished have been specified. The reasons of preference of the users for the plastic window are determined as quality (23.2%), mechanical and resistance characteristics (18.6%), functionality (17.3%), esthetic (16.1%), wide product range and selection opportunities (10.5%) and affordability (10.2%). Under the other (4.1%) option, characteristics such as ensuring thermal and sound insulation, ease of cleaning, durability, high quality, having good workmanship, longevity, being corrosion proof and not requiring painting and maintenance have been specified. The reasons of preference of the users for the aluminum window are determined as mechanical and resistance characteristics (27.8%), quality (22.7%), affordability (12.9%), esthetic (11.9%), functionality (8.9%) and wide product range and selection opportunities (5.9%). Under the other (9.9%) option, the characteristic of having a good appearance has been specified.

The problems encountered in windows used

The problems encountered by users in wooden windows

The problems are determined as becoming stained, not ensuring thermal insulation, wearing, having difficult maintenance due to being ruined by fungi and insects, easy decaying due to water and moisture, rain and wind permeability, fading of wooden material by time, failure to have good varnishing, losing durability by time, the work on wooden material, opening from joints, requiring painting and varnishing every year, swelling and spilling of paint and varnish by time, having short life, deficiencies in sound insulation, swelling of window when it rains (in contact with water), removal of the paste, instability against weather conditions, not accepting nail and screw by time, deficient workmanship, working of wooden material in seasonal changes, instability against fungi, corrosion of surface and appearance deterioration as a result of this, requiring maintenance, poor connection of the grooves due to lack of emery at joints, deformation on window sizes (crooking and bending), low quality in window accessories and non-performance of functions, failure to ensure sound insulation due to poor workmanship, lack of functionality, usage of low quality wooden material, lack of ergonomics, cracks seen in the material, lack of smooth opening and closing, water leakage from the glasses, decaying and decrease in mechanic resistance by time, lack of upper surface functions, heat losses as a result of poor settling of leaves on frames, frequent renewal of surface finishes due to the use of wooden material without impregnation, impairment of metal accessories by time and losing esthetic characteristic due to deterioration of paint and varnish.

The problems encountered by users in plastic windows

The problems are determined as sliver stain, lack of sliver soundness, difficulties in opening and closing due to the slivers, difficulty of cleaning, quick staining, fading in color

Table 4. The reasons of preference for the window type used.

Reason of preference	Wooden window		Plastic window		Aluminum window	
	Frequency	%	Frequency	%	Frequency	%
Wide product range and selection opportunities	79	18.6	75	10.5	6	5.9
Functionality	21	4.9	124	17.3	9	8.9
Mechanical and resistance characteristics	56	13.2	133	18.6	28	27.8
Quality	87	20.6	166	23.2	23	22.7
Affordability	60	14.2	73	10.2	13	12.9
Esthetic	93	21.9	115	16.1	12	11.9
Other	28	6.6	29	4.1	10	9.9
Total	424	100	715	100	101	100

by time, vapor occurrence between double glass, problems arising due to lack of sheet profile, workmanship defects, installation defects, wind and sound permeability, quick defect of window handles due to low resistance, low quality lock system, making the atmosphere of the room airless as it is air-tight and causing humidity, quick defect of mechanisms, staining of colored washers, wind entering from the leaves, scratches and holes on window profile surfaces, scratches on glasses, dropping of window leaves, making sound while opening and closing, lack of ergonomics for the handle while opening and closing, screw defect, difficulties on opening and closing direction, difficult closing if opened on top, occurrence of changes in color due to non-compliance with every kind of cleaning material, being affected by chemical substances, breaking of window handles by time, water leakage of slivers, being affected by sunlight, not ensuring insulation, occurrence of droplets due to hot and cold weather temperature differences, containing carcinogen materials and being easily opened with external forcing (security related problems).

Problems encountered by users in aluminum windows

The problems are determined as difficulty in cleaning, air permeability, sound permeability, instability, being unpractical, heaviness, leaving trace when it is scratched, lack of functionality, rusting and corrosion and color changes.

Production defects encountered in the windows used

Production defects encountered by users in wooden windows

The production defects are determined as defective production of joints, quick deformation due to defects in joints, the poor quality of the wooden material used, poor installation, problem in opening and closing, poor handing of the glass due to insufficient paste and spilling of paste by time, improper installation and quick rusting of hinges, cutting and shaping defects, working of wooden material by time due to use of unseasoned wood, resin leakage by time due to resin material use, use of knotty wood, insufficient use and quick removal of paint and varnish, poor adjustment of thermal insulation, roughness on surface to emery defects, installation defects, non-use of wooden material with equal thickness, poor insulation between the wooden material and glass, improper performance of upper surface finish, insufficient operation margin of leaves, usage of non-impregnated wooden material, incompatibility of frame and window slots and the use of poor material in window handle and hinge systems.

Production defects encountered by users in plastic windows

The production defects are determined as joint defects, damages caused to children due to sharp edges, difficulty in opening and closing, instability and quick failure of window handle, lack of usefulness of slivers (looseness and breaking of slivers), fading in polyvinyl chloride (PVC) color, problems arising from insufficiency of sheet profile used, lock system defects, poor use of silicon, swelling in PVC coatings, poor quality of the material used, non-ergonomic production of window handles, scratches and holes on window profile surfaces, weakness of window profiles, wearing of plastic parts by metal movable parts, non-settlement of flyswats, poor opening of ventilation ducts, instability of mechanical parts, installation problems due to wrong measurements, silicon defects, non-opening of liquid evacuation ducts during production and the poor insulation between double glass.

Production defects encountered by users in aluminum windows

The production defects are determined as

non-soundness and easy failure of hinges, non-soundness of window handles, difficulty in opening and closing, sharp edges, loose and easily removed slivers, breakings due to poor welding and perceptible welding traces.

Opinions of users about window production industry

Opinions of users about wooden window production and recommendations on the industry

Although, the technology used in wooden window production is sufficient, the reasons such as complete hiding of the production and low or none after-sales services cause a decrease in the number of customers. Furthermore, as the users do not know about which materials in which qualities are used in the wooden window production, the use of wooden window has experienced a quick decrease during the recent years. The recommendations determined relating to the wooden window production industry by the users in order to increase the wooden window production and to eliminate the problems are as follows: (1) Production of more durable windows which are rain and water proof; (2) using high quality wooden material; (3) ensuring protection against fungi and insect by better impregnation of the wood; (4) preventing the working of wooden material and increasing the durability by using thicker profile or laminated timber; (5) using more appropriate tree types; (6) development of new window models which are easier to use for the consumers; (7) producing products with wide range and options; (8) carrying out the upper surface finishes with higher quality and care according to the conditions of place of use; (9) creating more appropriate options in terms of appearance, durability and affordability; (10) increasing the number of companies producing wooden window; (l1) producing more esthetic and functional windows; (12) providing after-sales service facilities; (13) making well-arranged production according to the sizes; (14) considering importance on seasoning; (15) considering importance on increasing the quality of the material and workmanship used; (16) using more functional and less maintenance requiring construction; (17) considering importance to publicity.

Opinions of users about plastic window production and recommendations on the industry

The plastic window producers must produce windows by considering importance on the use of environment friendly materials. For this purpose, higher quality materials must be used; customer satisfaction must be considered as important by increasing the after-sales service quality. The plastic windows produced must be opening in all directions with ease of cleaning and good appearance. This is particularly important for the cleaning of exterior of the windows, as well as eliminating the danger of falling down in multi-floor buildings. The recommendations determined related to the plastic window production industry by the users in order to eliminate the problems in plastic window production are as follows: (1) Producing esthetic, sound, health and stain-free (water stain, hand stain etc.); (2) producing windows opening all directions; (3) considering importance to quality and customer satisfaction; (4) ensuring service facilities; (5) child lock for keeping the children away from opening the window; (6) producing functional windows; (7) considering importance to insulation (preventing sweating); (8) ensuring that the PVC material is not scratched easily; (9) producing windows requiring high quality workmanship; (10) increasing the number of varieties; (11) producing window with ease of cleaning and providing the entry of air; (12) being affordable for any kind of budget in terms of price; (13) having alarm system against thieves; (14) checking the resellers; (15) producing environment friendly windows; (16) improving the material and workmanship used; (17) producing different handle models for the windows.

Opinions of Users about aluminum window production and recommendations on the industry

The recommendations determined related to the aluminum window production industry by the users in order to eliminate the problems in aluminum windows production are as follows: (1) Producing windows with more variety and color, warm and attractive appearance; 2) producing durable and affordable products with different designs; (3) as the aluminum woodwork does not provide the appearance characteristics of the wooden material in terms of resistance, carrying out works on this issue.

DISCUSSION AND CONCLUSION

The window industry in Turkey, as in the entire world, is quickly developing, creating added value and having an intense competition. While the broad range and structure of window options in the industry is considered as positive for the consumers, the high use of particularly plastic materials brings the discussion related to the risks arising against the human and environment health due to the recent technological, economical and ecological approaches into the agenda. Therefore, it is considered as inevitable to provide solutions for eliminating the problems by carrying out studies related to the problems encountered by the consumers and to incline towards windows meeting the requirements and expectations, environmentally friendly and not causing any health risks.

PVC, wood and aluminum are the main raw materials generally used in window production. These three materials have strong aspects and weak aspects over each other with their different characteristics and these can be clearly observed in the findings of the study on their effects in user preferences. On the other hand, it is possible to state according to the literature knowledge and study results that the increase in user preferences for window types sold as composite window, which is produced with double or triple combinations (wood + aluminum, wood + plastic, aluminum + plastic etc.) of these three materials subject to the study, has a parallel progress in our country compared to the world and the progress in the plastic window preference is not parallel to the preference in the world. For example, reviewing the literature knowledge related to the preference status and market shares of these materials within the scope of the sectoral studies performed for developed European countries, it is seen that the share of PVC was (45 - 52%) in 1990s and (37 - 38%) in 2000s due to the technologic developments and ecologic approaches recently, the share of wood was (32 - 38%) in 1990s and (33 - 36%) in 2000s and the share of aluminum was (20 - 22%) and (19 - 20%) in 2000s and the share of (wood + aluminum) composite was (3.5 - 4%) in 1990s and (6.5 - 7%) in 2000s. According to this, it can be stated that the preference for PVC and aluminum material is slowed down and the wooden and composite materials have an increasing trend. (Anonymous, 1998; Aksu and Koc, 2001; Anonymous, 2005; Dilik et al., 2009).

Reviewing the preference status of these materials in Turkey, in a study carried out for their use in housings (Sevim, 1997); it has been determined that 64% of the users prefer wooden window, 23% plastic window, 6% aluminum window and 7% other (wood + plastic + aluminum) window types. In this study, it has been determined that the user preferences have been significantly changed and that they prefer plastic window by 54%, wooden window by 38% and aluminum window by 8%. According to these findings, the direction of window material preference in Turkey has progressed on the opposite direction of Europe during the last 10 years. The shrinkage of demand on plastic material as a result of environmental pressures with the ecological approaches settled in developed countries including the European Union member states and directing this demand to the developing countries can be given as one of the most important reasons of the development on this direction. In addition to this, although, it has not been reflected to the figures within the scope of the study, there is a developmental expectation about the massive wood and wooden combined windows in Turkey in parallel to the European Union (EU) legislation. The quick development for compliance to EU legislations and environmental values in Turkey and the natural and esthetic structure of wooden material complying with the ecological approaches are effective in user preferences.

According to the results of the study, the reflection of the expectations from the windows and the evaluations on this matter can be summarized as follows: It has been determined that, during the window selection stage, the users consider the durability (71%), affordability (20%), availability of service facilities (7%) and other reasons (2%). The other reasons are expressed as being healthy, esthetic, ensuring thermal and sound insulation, being functional, easy cleaning, ensuring ease of installation, on-time and quick installation, ease of use (allowing repairing, restoration and replacement), being able to be varnished and painted, being high quality, ease of transportation and lightness, being sound, longevity, having high quality of workmanship, being corrosion proof and having color options. The users prefer the wooden windows particularly for their esthetic (22%) character. This is followed by the quality (21%), wide product range and selection opportunities (19%), affordability (14%), mechanical and resistance characteristics (13%), functionality (5%) and other reasons (6%).

It is been determined that the users consider quality (23%) as important in preferring plastic window and it is followed by mechanical and resistance characteristics (19%), functionality (17%), esthetic (16%), wide product range and selection opportunities (11%), affordability (10%) and other reasons (4%). The reasons of preference for the aluminum windows by the users are determined as mechanical and resistance characteristics (28%), quality (23%), affordability (13%), esthetic (12%), functionality (9%), wide product range and selection opportunities (6%) and other reasons (10%).

As it can be seen above, the characteristics first considered in the preferred windows by the users are esthetic for wooden windows, quality in plastic windows and mechanical and resistance characteristics in aluminum windows. The problems encountered by the users in wooden windows are mainly the wooden defects of the material such as knot etc., occurrence of fungus and insect damage on some sections as a result of failing to paint or varnish uniformly, occurrence of staining and spilling due to the resin problem arising in windows made from pine tree types and the lack of workmanship desired due to the unavailability of qualified personnel. In order to eliminate these problems, to increase the quality in production and to ensure compliance with the standards, the productions must be performed in modern facilities, rather than by carpenters at ateliers. For this purpose, it must be particularly ensured to raise qualified labor such as engineer, technician and skilled workers.

During the selection process of the wooden material to be used in the production of window, characteristics such as the resistance, working, durability, suitability to surface finishes and suitability to gluing of the wooden material are considered (Kurtoglu, 1986). In order to ensure primary preference of the wooden material in window production again, marketing works encouraging and acknowledging the use of healthier and higher quality

window with laminated wooden materials made from suitable tree type and purified from defects must be considered as important. In order to achieve this, the industry must be changed from an industry based on hand-workmanship and producing in small ateliers to an industry carrying out industrial production by using advanced technology. Furthermore, as it can be seen in the literature studies (Dilik and Altun, 2007; Dilik et al., 2009), the characteristics of the wooden windows lower than the plastic and aluminum windows must be ensured to be the same with the quality and performance tests performed for the windows.

The problems encountered by the users in plastic windows are mainly the occurrence of moisture in closed areas for long time, not using galvanized support sheet in some parts of the plastic window, the unavailability of the leaves for cleaning, the use of low quality window handles, installation problems, sliver problems, security problems and discontinuity of window quality. In order to eliminate these problems, the plastic window procedures must take precautions for eliminating negative characteristics such as different profile thicknesses due to the high amount of companies, in addition to increasing positive characteristics such as ergonomic use. Furthermore, care must be provided for ensuring higher quality in the accessories used for the plastic windows. It must be considered as important to carry out more studies on color, pattern and insulation in window production and to produce higher quality products by eliminating the differences between the promoted product and the sold product. Actually, the plastic industry in window production carries out computer aided production and has a wide product range with less defect and higher functionality.

The problems encountered by the users in aluminum windows are mainly the difficulty of cleaning due to sharp joints, slivers not complying with installation and the use of low quality window handle. Wooden colored plastic windows influence the demand to the wooden windows. However, wooden material has superior characteristics compared to other products such as aluminum and plastic. It is resistant against weather conditions and chemical effects. It does not get rusted like aluminum, or becomes breakable in cold weathers like plastic. Furthermore, while the metal and plastic windows are irreparable when they are damaged, it is easy to repair the wood, regardless to the degree of wearing (Sevim, 1997). It is required to increase the opportunity of use for the wooden windows, as they are healthier and more esthetic compared to plastic windows.

As a result, this study suggests that the window industry, quickly developing and offering more product varieties in parallel to the industrial development, is required to consider factors influencing the customer satisfaction like in all other industrial product productions. Furthermore, it is required to determine some certain standards and quality tests for windows and to carry out quality controls according to these. For the quality aspect, the window producers are required to consider importance in increasing the functionality and durability by well selecting the raw material used and to carry out production with the material, design and technologies parallel to the developments in the world. In order to eliminate the problems, it is required to consider importance for the training of the resellers and to perform acknowledgement and surveys related to customer satisfaction.

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