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THE INVESTIGATION OF THE RAISED FLOOR PANELS FROM THE ASPECT OF PHYSICAL CHARACTERISTICS

Abdullah Cemil İLÇE*, Ayşe Müge BOZDAYI, İlker USTA*****
*Duzce University, Teknical Education Faculty, Duzce
**Hacettepe University , Department of Interior Architecture and Environmental Design , Ankara.
***Hacettepe Üniversitesi, Wood Product Industrial Engineering, Ankara

Abstract

In this study, the use of wooden composite floor materials in parallel with the development of new materials and technologies was investigated. It was stated that one of the forms of use, which is raised floors, provides a flexible and changeable use characteristic in office settings. It was attempted to determine some negative aspects stemming from the physical characteristics of the materials, which constitute the raised floor panels, from the aspect of the evaluation criteria on the quality and selection of the domestic and foreign materials. The data obtained show that the air dry gravities of the domestic produced panels were low compared to the foreign produced panels. In spite of this, all of the panels had a medium density for air dry gravities and were in conformance with the standards. It was determined that from the aspect of humidity, the foreign produced panels had a greater humidity compared to the domestic produced panels. In spite of this, it was determined that all of the domestic and foreign panels were in conformance with the standards. The foreign produced panels absorbed less water into their structures compared to the domestic produced panels. Just as the ratio of swelling to thickness was at the ratio of absorbing water, it was less in the foreign produced panels and this situation is a desired characteristic. Despite this, it was determined that the ratio of absorbing water was in accordance with the standards in a similar manner in all of the domestic and foreign panels.

Key Words: Raised floor systems, domestic and foreign fabricated panels, particleboard physical characteristics, computerized working environment

1. Introduction

The rapid progression in technology has also brought along some disconformity and problems in furnishings and equipments. In the beginning, a proper worktable for the computer hardware, most of which was put into place at conventional offices, wasn't able to be supplied. Therefore, ergonomic problems emerged on the tables which hadn't been air dryally designed for computer systems, and the users experience many various difficulties. While the use of big screen monitors were forcing the work surface to change, the lack of proper cable channels for computer cables on the tables caused complication and pollution in the place. The systems of archive and storage used in conventional offices completely changed and the archives of smaller-size disk, CD, DVD arose instead of big-size storage units. The presentations and meetings held in the meeting rooms in the past turned into tele-conferences by means of the development in the computer and communication technology. Thus, the limitations in the place were eliminated. Besides, the use of laptop computers, projections, desktop video conference sytems resulted in the demand for new furnishing and infrastructure systems. Thus, the raised floor systems having flexibility and fast solutions started to be preferred very often in the buildings where installation density were experienced, and timing factor was important. This floor system that had been first used in Italy after the World War II was first used (in banks and telecomunication buildings) in Turkey in 1984.

Corresponded Author; cemil.ilce@gmail.com

The raised floor systems are often used in general office sites and telecommunications rooms. Although the upper surface of the floor panels used in general office sites is covered with carpet or HPL, the panels used in the telecommunications rooms need to be covered with a component having electrostatic characteristic. When this system is used,
the gaps between ferroconcrete and ground become suitable for all kinds of installation transition. Thus, many difficulties which architects have experienced up to now disappear and their designs get flexibility.

The raised floor system is formed with the placement of the panels on the legs, the height of which can be adjusted. The legs can be raised easily in the case of demand, and they can be changed according to the properties of the usage area on the panels. The general sizes of the panels are 60 × 60 cm. The raised floor system transfers the weight to the infrastructure via the legs. If the thickness, the under-cover coating, and legs of the panel are chosen by the propeties of the weight on the system, the panels can be used easily in all of the offices. Thanks to this system, all kinds of gaps on the undercoating can be covered aesthetically, contemporarily, and fast without looking at the size of the place.

Application areas where the raised floor systems are mostly preferred are: general offices, meeting/ concert halls, training hails, administration buildings and corridors, computer rooms, telecommunications rooms, web-design offices, cafeterias, bathrooms and lavatories, storage areas, lobbies and reception areas, offices doing business of printing out and printing.

The raised floors were actually developed for the places which host computers were put in. However, nowadays there is an ever-increasing area of usage in the buildings which both are hoped to be restored, and have just been finished to be built. Although the raised floor system with modular panels has high launching cost, it is preferred for the flexibility and advantages it provides for the later changes. Thus, 'Conformity to Change', which is an important factor for the modern office environments can be provided easily with the raised floor systems. The raised floor system consists of the materials which are explained below shortly:

a) The Raised Floor Mid-Layer: Industrial standard measure is 600 × 600, and it can be produced in various thicknesses and special sizes in accordance with the type of the cover coating which will be used. The panel can be made of heavily rosined particle board, MDF,CRS (fiber reinforced calcium silicate), water resistant wooden composite board, PVC board, or galvanized steel material.
b) Edge Coating: The edges of the panel are covered with hard-conductor neopren, or PVC band, thus the panel was protected against the blows, and the moisture.
c) Under Coating: It is chosen from the materials like base HPL, aluminum foil board, garvanized steel. Aluminum foil develops electronic conductivity and makes up a barrier against the moisture, and galvanized steel coating increases its carrying capacity.
d) Cover Coating: It can be chosen in different kinds, and colours from the materials like HPL, PVC, linoleum, carpet, granite, ceramic, inlay in accordance with the demand and the necessity.
e) Carrying System: It consists of legs and cincture on condition that they are steel and aliminum. Carrying systems have types with band and without band. Legs and bands are chosen in accordance with their usage area with the height of the system, and their capacity of weight carrying.
f) Suplementary Materials: In raised floor system; steps, early ending edges, platforms, apparatus to raise the panel, vents, junction boxes for telephone and electric connections, perforated panels, skirting, fire barriers, and many supplementary materials which can be developed are used in case of necessity.

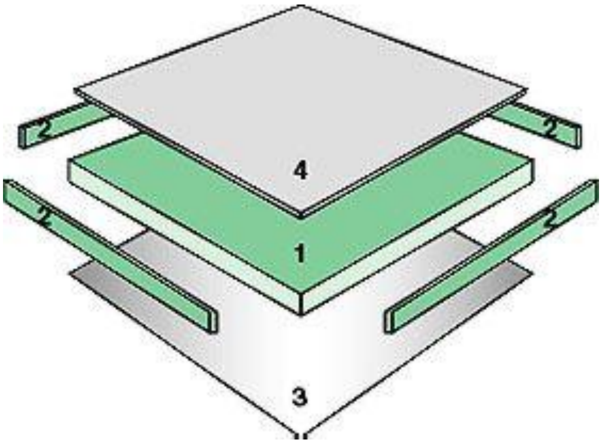

Figure 1. The Raised Floor Panel [9]
(1. Mid-Layer, 2. Edge Coating, 3. Under Coating, 4. Cover Coating)

All of the engineers, designers, and architects have to have a deep knowledge about the properties and the characteristics of the material they aim to use. In this context, it is thought that it is necessary to know the physical, mechanical, chemical, safety, visual forming, socio-psychological, and economic characteristics of the panels in order to use the raised floor systems in any places. The primary aim of this study is to ascertain the negative attitudes which may occur in case that the raised floor panels will come into contact with water, and the secondary aim is to ascertain whether the raised floor panels which are imported have the same quality requirements with the ones produced in our country, or not.

2. Material and Method

This research was planned as an experimental study which the causality between the physical characteristics of domestic and foreign fabricated floor systems was analysed in.

2.1 Appliances

Three different domestic (A, B, C) and foreign (D, E, F) fabricated raised floor panels which are produced in the same conditions as a raised floor panel; cover coating of which is laminate; mid-layer of which is chip plate with medium density, and under coating of which is 0,5 mm steel plate were produced in order to do experiments in paralel with the specified purposes. After the panels had been brought to the sizes of the test sample, they were conditioned in a special air conditioning room which ensure the conditions of 20 ±2 C° temperature and the ratio of % 65 ± 5 relative humidity for 30 days. Lying Cicular Sawing Machine was used to bring the raised floor panels which were bought as ready into the sizes of the test specimen, and Edge Banding Machine was used to band the edges of the panels to avoid its loss of the end-use properties. The masses of the samples were measured with Precision Balance having 0.001 precision, and their length, wideness, and thickness were measured with a digital caliper having 0.01 precision. The samples were submerged into a glass container with ten-litre water capacity. A heater with thermostat was used to keep the temperature of the water in 20 ± 1 °C.

2.2 The Place and Time of Research

The test samples were prepared in the ateliers of Hacettepe University Woodworking Industrial Engineering (WIE) Department, and they were brought into the sizes of the sample for the testes which needed to be actualized. After the edges of the necessary samples were covered, they were conditioned in an air-conditioning room. The physical process applied to the test pieces was actualized in the laboratory of wood physics in Woodworking Industrial Engineeering Department. The experiments were carried out from10th October 2006 to 1st April 2007.

2.3 The Research Universe

Domestic and foreign fabricated raised floor panels formed the research universe.

2.4 Research Sample

Domestic panels from the storages of the producing firms, and foreign panels from the storages of importing companies were chosen and bought as ready in order to determine the test sample. The selection of the sample was done by taking randomly the one standing at the forefront and on the left side of the stack in the storages (and by taking one more panel after a hundred panels),and thus the research sample was formed.

2.5 Ethical Explanation

This study was made up of the Thesis of Proficieny in Arts named as ‘ the Research of the Physical-Mechanical Properties of the Raised Floor Materials’ used in computerized environments accepted by Hacettepe University Institute of Social Sciences. The letters given in an alphabetical order for domestic and foreign firms, materials of which were used in the study, are statistical data codes used to conduct the research. They are not images which will display the trade names of the producing firms where the samples were bought, or which will associate their names.

2.6 Data Collection Method

The data of the research was collected with a data collection form prepared by the researcher. A different data collection form was prepared and used for each test. The methods determined with standards and explained below were followed in the tests.

2.6.1 Determination of the Air dry Density

According to the principles stated in TS EN 323 (1999) [11], totaly 120 (60 × 2) test samples in 50 ± 1mm, in frame size were prepared as 60 pieces for each group. The samples conditioned in accordance with TS EN 326 (1999) [12] standard were weighed with a scale and their sizes were measured with a caliper. The data obtained was put into its place in the following equation (1) and air dry density (δ) value was determined for each sample.

$$\delta = \frac{m}{axbxt} \qquad (1)$$

δ = air dry density (kg/m^3)
m = The weight of test sample (kg)
t = The thickness of test sample (m)
a, b = The lenght and wideness of the test sample (m)

2.6.2 Determination of Moisture Content

The principles in TS EN 322 (1999) [13] were followed in determination of the moisture content. In accordance with TS EN 323 (1999) [11] standard, totaly 120 (2 × 60) test samples in 50 × 1 mm size, and in frame size were prepared as 60 pieces for each group. The edges of the samples were covered and weighed in accordance with the end-use conditions. Then the samples were dried until they reached to the constant weight in temperature of 103 ± 2 °C. After the samples taken from the cabinet drier were cooled in desiccator, their full-dried weight was determined. In light of this data, the moisture content (H) was calculated with the following formula (2).

$$H = \frac{m_h - m_0}{m_0} x100 \qquad (2)$$

H = the moisture content (%)
m_h = weight (g)
m_0 = full-dried weight (g)

2.6.3 Determination of Swelling to Thickness

In accordance with the TS EN 317 (1999) [14] standart, totaly 120 (2 × 60) test samples with 50 ± 1 edge length, in frame size were prepared as 60 pieces for each group in order to determine the swelling to thickness. The samples, edges of which had been covered in accordance with end-use conditions were conditioned in air-conditioning room until they reached to the constant weight, and then their thickness was measured with caliper. Afterwards, the samples were submerged into water in such a way that the samples wouldn't touch each other and the edges and bottom of the container, and they would stay 25 ± 5 mm below the water surface. The thickness of samples which were submerged into water was measured after 2 and 24 hours , the water on their surfaces was wiped up after they were taken from container. Thickness rise (swelling to thickness content (G_t) was calculated with the equality (3) below.

$$G_t = \frac{t_2 - t_1}{t_1} x100$$

G_t = Swelling to thickness content (%)
t_1 = Thickness of experiment piece before submerging it into water (mm)
t_2 = Thickness of experiment piece after submerging it into water (mm)

2.6.4 Determination of absorbing water content

To decide the samples' absorbing water in their structures, the samples which were prepared for the experiment of swelling to thickness were used. After experiment samples were air conditioned, they were weighed. After this process, the samples were submerged into water in such a way that the samples wouldn't touch each other and the edges and the bottom of the container, and they would stay 25 ± 5 mm below the water surface. The thickness of samples were measured every 24 hours by taking them from water after their extra water on their surfaces was taken with a cloth. According to the standart TS EN 317 (1999)[14], Absorbing water content (Sa) was calculated by using the equality (4) below.

$$Sa = \frac{m_2 - m_1}{m_1} x100$$

Sa = Absorbing water content (%)
m_1 = weight of experiment piece before submerging it into water
m_2 = weight of experiment piece after submerging it into water (g)

2.7 Evaluating Data and Analyzing Findings

Survey data was collected by the researcher with the data collection form which were formed by himself. Laboratory attendants in charge helped to the researcher to set the experiment mechanism and to do the experiment. Data was evaluated encoding on the package software 11.0 SPSS (Statistical Programme for Social Sciences), normal distribution analyses of datas were examined according to Fischer's coefficient of skewness and steepness. Data which didn't do normal distribution, data which ruined normality were removed, normal distribution analysis was done again. After it was identified that data showed normal distribution, statistical analysis was made. In these analyses, T test was done to compare domestic and foreign productions, variance analysis (ANOVA) was done to determine if there is a difference between firms. Provided that differences between groups were at % 95 realibility level, differences between avarage values were compared by Duncan and Tamhane tests.

3. Result and Discussion

3.1 Air dry Density

When raised floor panels were compared in terms of their gravities, foreign fabricated panels' gravitiy was more than domestic fabricated panels' density (Table 1). A significant difference was found between foreign fabricated panels and domestic fabricated panels' air dry density averages.

Table 1. The Comparison of air dry density averages in terms of foreign and domestic production

Production Type	N	Mean (g/cm^3)	Standart Dev.	Min (g/cm^3)	Max. (g/cm^3)	t	P
Domestic Production	48	0.845	15.322	0.811	0.875	23.913	0.000
Foreign Production	48	0.907	11.562	0.884	0.927		

When air dry density averages were compared in terms of firms, It was found that foreign D panels have the highest value and domestic C panels have the lowest value.

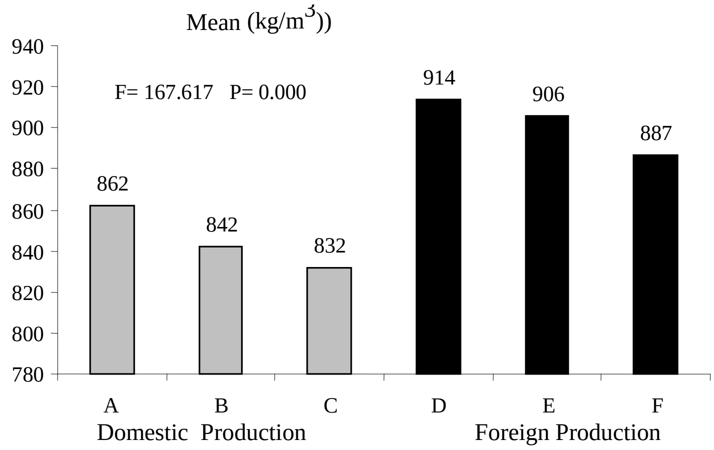

Figure 2. The comparison of the averages of air dry density in terms of companies

In accordance with the results of ANOVA, it was understood that the difference in the averages of the air dry density of the panels produced in all the domestic and foreign companies was meaningful. (P<0.000). The reason of this difference was determined with Tamhane Test (Figure 2). This made it clear that all of the firms were different in terms of their averages of air dry density.

Table 2. The comparison of the ratio of air dry density among firms

Firms (I)	Statistical Values	Firms (J)					
		A	B	C	D	E	F
A	I-J		19.775	30.500	-51.663	-44.300	-25.000
	P		0.000	0.000	0.000	0.000	0.000
B	I-J	-19.775		10.725	-71.438	-64.075	-44.775
	P	0.000		0.001	0.000	0.000	0.000
C	I-J	-30.500	-10.725		-82.163	-74.800	-55.500
	P	0.000	0.001		0.000	0.000	0.000
D	I-J	51.663	71.4375	82.1625		7.363	26.663
	P	0.000	0.000	0.000		0.047	0.000
E	I-J	44.300	64.075	74.800	-7.363		19.300
	P	0.000	0.000	0.000	0.047		0.009
F	I-J	25.000	44.775	55.500	-26.663	-19.300	
	P	0.000	0.000	0.000	0.000	0.009	

(I-J) : Difference in the averages, P: Statistical significance value

3.2 Moisture Content

When the raised floor panels were compared in terms of their averages of moisture content, it was understood that foreign fabricated panels were moisterer than domestic fabricated panels (Table 3). It was found that the difference in the averages of moisture content between domestic and foreign fabricated raised floor panels was important (P<0.005).

Table 3. The comparison of the averages of moisture content in accordance with domestic and foreign fabricated types

Production Type	Mean (%)	Standart Deviation	Min (%)	Max (%)	t	P
Domestic Production	5.21	0.582	4.20	6.00	12.680	0.000
Foreign Production	6.76	0.328	6.20	7.50		

When the average of moisture was compared in terms of firms, the highest ratio of moisture was ascertained in E panels; the lowest ratio of moisture was ascertained in B panels (Figure3)

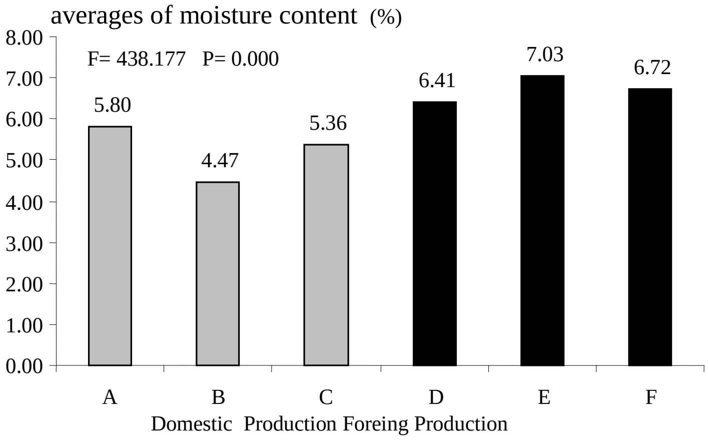

Figure 3. The comparison of the averages of moisture content in accordance with firms

According to ANOVA results, the differences in averages of moisture content of all the panels belonging to domestic and foreign firms was meaningful (P<0.000). The results of Tamhane test made clear that the panels of all firms were different in terms of moisture content (Table 4).

Table 4**.** The comparison of the averages of moisture content among the firms

Firms (I)	**Statistical Values**	**Firms (J)**					
		A	**B**	**C**	**D**	**E**	**F**
A	**I-J**		1.330	0.440	-0.610	-1.227	-0.919
	P		0.000	0.000	0.000	0.000	0.000
B	**I-J**	-1.330		-0.890	-1.940	-2.557	-2.249
	P	0.000		0.000	0.000	0.000	0.000
C	**I-J**	-0.440	0.890		-1.050	-1.667	-1.359
	P	0.000	0.000		0.000	0.000	0.000
D	**I-J**	0.610	1.940	1.050		-0.617	-0.309
	P	0.000	0.000	0.000		0.000	0.000
E	**I-J**	1.227	2.557	1.667	0.617		0.308
	P	0.000	0.000	0.000	0.000		0.000
F	**I-J**	0.919	2.249	1.359	0.309	-0.308	
	P	0.000	0.000	0.000	0.000	0.000	

(I-J): Difference in the averages, P: Statistical significance value

3.3 Swelling to Thickness Content

When the raised floor panels were compared in accordance with their averages of swelling to thickness content, it was ascertained that domestic panels swelled to thickness more than foreign panels after both 2 and 24 hours (Table 5). It was found that the difference in the averages of swelling to thickness content belonging to domestic and foreign panels were important in both situations.

Table 5. The comparison of the swelling to the thickness content in accordance with production types

Physical Properties	Production Type	Average (%)	Standart Dev	Min (%)	Max (%)	t	P
Increase of thickness after 2 hours	**Domestic Production** **Foreign Production**	6.04 1.70	0.820 0.400	5.05 0.75	7.57 2.56	31.490	0.000
Increase of thickness after 24 hours	**Domestic Production** **Foreign Production**	12.54 4.56	3.783 1.004	6.30 2.15	19.41 6.61	15.777	0.000

When swelling to thickness avarages of firms were compared, both after two hours and twenty- four hours domestic A panels had the most swelling, after two hours, foreign D panels had the least swelling and after twenty - four hours, E foreign panels had the least swelling.

According to AVANA results in both two situations, the difference in swelling to thickness averages of all firms was found meaningful (P < 0.000). The firm which caused this difference was determined by Tamhane test.(Table 6 and 7)

Table 6**.** The Comparison swelling to thickness content avarages after staying 2 hours in water.

Firms(I)	**Statistical Values**	**Firms (J)**					
		A	**B**	**C**	**D**	**E**	**F**
A	I-J P		2.7390 0.000	1.3030 0.046	7.0214 0.000	6.5170 0.000	6.1170 0.000
B	I-J P	-2.7390 0.000		-1.4360 0.001	4.2824 0.000	3.7780 0.000	3.3780 0.000
C	I-J P	-1.3030 0.046	1.4360 0.001		5.7184 0.000	5.2140 0.000	4.8140 0.000
D	I-J P	-7.0214 0.000	-4.2824 0.000	-5.7184 0.000		-0.5044 0.000	-0.9044 0.000
E	I-J P	-6.5170 0.000	-3.7780 0.000	-5.2140 0.000	0.5044 0.000		-0.4000 0.000
F	I-J P	-6.1170 0.000	-3.3780 0.000	-4.8140 0.000	0.9044 0.000	0.4000 0.000	

(I-J): The difference among averages, P: Statistical significance value

According to Table 6 and 7, It was ascertained that in terms of swelling to thickness averages after staying in water for 2 hours, all panels were different from each other, In terms of after staying in water for 24 hours, domestic panels were more different than all panels and foreign panels were more different than domestic panels.

Table 7. The comparison of swelling to thickness content averages after staying 24 hours in water

Firms (I)	Statistical Values	Firms (J)					
		A	B	C	D	E	F
A	I-J P		2.203 0.000	8.539 0.000	12.047 0.000	11.520 0.000	11.093 0.000
B	I-J P	-2.203 0.000		6.336 0.000	9.844 0.000	9.317 0.000	8.890 0.000
C	I-J P	-8.539 0.000	-6.336 0.000		3.508 0.000	2.981 0.000	2.554 0.000
D	I-J P	-12.047 0.000	-9.844 0.000	-3.508 0.000			
E	I-J P	-11.520 0.000	-9.317 0.000	-2.981 0.000			
F	I-J P	-11.093 0.000	-8.890 0.000	-2.554 0.000			

(I-J) : The difference among averages, (P) : Statistical significant value

3.4 The Content of Absorbing Water

It was determined that both after 2 hours and 24 hours, domestic fabricated panels absorbed more water than foreign fabricated panels when raised floor panels were compared in terms of their absorbing water amount averages (Chart 8). The difference between both domestic and foreign fabricated panels in terms of their absorbing water averages was found significant in both situations.

Table 8. The Comparison of absorbing water content averages in terms of their production type.

Water absorbing water ratio	Production Type	Avarage (%)	Standart dev.	Min (%)	Max (%)	t	P
After 2 hours	**Domestic Production** **Foreign Production**	14.75 4.48	1.375 0.262	12.32 4.03	16.82 4.98	45.482	0.000
After 24 hours	**Domestic Production** **Foreign Production**	44.05 9.39	10.533 0.264	22.01 8.96	64.37 9.85	25.480	0.000

Absorbing water content avarages were compared in terms of their production type, it was found that domestic A panels had the most amount both after 2 and 24 hours, Foreign D panels had the least amount after 2 hours, Foreign E panels had the least amount after 24 hours.

According to ANOVA results, the difference of absorbing water content averages among all panels was significant in both situations ($p < 0.000$). The firm which caused this was analyzed with Tamhane test (Chart 9 and 10). In terms of absorbing water content averages staying in water for 2 hours, a significant difference was observed between all foreign fabricated panels and all panels and between foreign fabricated panels and only domestic fabricated panels. In terms of after staying 24 hours in water, significant differences were observed between domestic A panels and all panels, between domestic B and C panels and domestic A and foreign panels and between foreign panels and domestic panels.

Table 9. The Comparison of absorbing water content averages after 2 hours among firms.

Firms (I)	Statistical Values	Firms (J)					
		A	B	C	D	E	F
A	I-J P		15.3725 0.000	17.9940 0.000	26.9455 0.000	26.7647 0.000	26.8110 0.000
B	I-J P	-15.373 0.000		2.6215 0.000	11.5730 0.000	11.3922 0.000	11.4385 0.000
C	I-J P	-17.994 0.000	-2.622 0.000		8.9515 0.000	8.7707 0.000	8.8170 0.000
D	I-J P	-26.946 0.000	-11.573 0.000	-8.952 0.000			
E	I-J P	-26.765 0.000	-11.392 0.000	-8.771 0.000			
F	I-J P	-26.811 0.000	-11.439 0.000	-8.817 0.000			

(I-J) : The difference among averages, (P) : Statistical significant value

Table 10. The comparison of averages of absorbing water amount after 24 hours among firms

Firms (I)	Statistical Values	Firms(J)					
		A	B	C	D	E	F
A	I-J P		16.954 0.000	17.488 0.000	46.618 0.000	47.555 0.000	47.504 0.000
B	I-J P	-16.954 0.000			29.664 0.000	30.601 0.000	30.550 0.000
C	I-J P	-17.488 0.000			29.130 0.000	30.067 0.000	30.016 0.000
D	I-J P	-46.618 0.000	-29.664 0.000	-29.130 0.000			
E	I-J P	-47.555 0.000	-30.601 0.000	-30.067 0.000			
F	I-J P	-47.504 0.000	-30.550 0.000	-30.016 0.000			

(I-J) : Differences in averages, P: Statistical significance value

4. Conclusion

Within the scope of this study, performance tests which are in the standarts of determining their usage conditions were conducted on domestic and foreign fabricated raised floor panels. As a consequence of these tests, it was found that both domestic and foreign fabricated raised floor panels are in accordance with standarts in terms of most factors. At the same time, some differences between domestic and foreign fabricated panels were found. When both domestic and foreign fabricated panels met the standarts together , it was suggested to use the domestic panels because it provides employment and reduces unemployement rate. Also, it should be taken into consideration that when foreign fabricated panels are used, there will be outflow of foreign currency and increase of current account deficit. Provided that domestic fabrication and exporting rise, this sector will help our country to earn more currency and it contributes our counry's economy to decrease its current account deficit.

According to "The raised floor systems" standart, TS EN 12825 (2003) [15] which is published by TSE, there is no specific decision about the air dry densities of panels. However, in catalogues of some firms which produce panels, it is stated that the particle board which comprises these panels' raw materials must have medium density. The air dry densities of particle boards with medium density are between 590 and 800 kg / m3. The air dry densities of all domestic and foreign panels are above this value. In the light of this data, it is thinkable that domestic panels can be used in place of foreign panels in terms of their air dry density values . In addition, air dry density increase can enable panels to be resistant to mechanical and physical effects. The reason for foreign fabricated raised panels' having more air dry density value can be related to their particle boards' which comprise of these panels' raw material having higher density value. The reason why particle boards have greater density value can be related to the particle boards' wood's type and geometry, used glue's type and amount, pressing time and temperature.

The researcher Akbulut (1995) [16], who studies on this topic stated that it is possible that the amount of glue and usage ratio of chip in crust may be raised, chips which have about 150 slenderness ratio may be used on the surface layer of light wood types and they might be used in the middle layer of comparatively heavier wood types to increase air dry density [17] said that using glues which have high formaldehyde rate might be effective to increase air dry density, too. As to Özen ve Gözeneli (1992) [18] pointed out that all general features of particle boards are improved by increasing pressing period time, this increase also causes the growth of bending rigidity elastic modulus of boards which have air dry density profile.

When averages moisture rates of domestic and foreign fabricated raised floor panels are compared, it was ascertained that foreign fabricated panels have more moisture than domestic fabricated panels. In "The raised floor systems" standart, TS EN 12825 (2003) [15] there was no definite decision about the moisture value of panels. Neverthless, In TS EN 312 (2005) [19] standart, moisture of boards must be between %5 and 13 after they are produced in the factories and forwarded to. The first moisture rates of all foreign fabricated panels and domestic fabricated A and C panels are between these values. However, domestic fabricated panels' moisture ratio is less than 5%. In this case, it might be said that all panels are suitable for being used indoor except domestic B panel. Gündüz and Masraf (2005) [20] stated that the moisture ratio of particle boards is affected by adjustments like increasing and decreasing the ratio of chip on crust, increasing the time which passes at high – pressure, raising and reducing pressing temperature.

Domestic fabricated panels have more water in their structures than foreign fabricated panels. One of its reasons might be that the panels' first moisture averages are low. In the studies, it was determined that crust rate, pressure, temperature have influence on particle board's water absorbing value. During the experiment in which the water absorbing value is decided, it was observed that bottom and top coatings of some domestic fabricated panels leave their surfaces in three or four hours. Therefore, the fact that the type and the quantity of glue which are used during the process of sticking bottom and top coatings of panels might have influence on water absorbing rate (of panels) should be taken into consideration.The absorbing water ratio of domestic fabricated panels is rather high so it is thought that this will affect swelling ratio to thickness. In TS EN 12825 (2003) [15], "the raised floor systems" standart which is published by TSE there is no determination about accepted absorbing water ratio of panels . In this context, it is evidently visible that a description about accepted absorbing water ratio of panels must be urgently included in related standard.

When compared to foreign fabricated panels, domestic fabricated panels swell more to its thickness. In spite of this, according to the standart EN 13329 (2006) [21] , the swelling ratio of all panels is in accordance with the standard. In this standard, it is demanded that swelling ratio to thickness shouldn't be more than %20 indoor, it shouldn't be more than % 18 in commercial buildings. Domestic fabricated panels swell more to thickness than foreign fabricated panels by absorbing more water in their structures. This case is thought to be related to wood type and its rate of components, glue and additive quantity which is used while producing particle board.

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