Influence of Static and Dynamic Loading on the Properties of Handmade Persian Carpet

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Abstract

The paper reports the physical and mechanical properties of hand-woven carpets, which have been under static and dynamic forces. Two groups of wool fibres, from two parts of Iran, were prepared to spin pile yarn for the carpets. Each group of the fibres included both conventional and tanned wool. Then two yarn counts, \(N_r = 2/4\) and \(2/6\), were spun for two different knot densities. After weaving the carpets, they were put under static and dynamic forces and their thickness variations were measured and plotted against time (in case of static force) or number of impacts (in case of dynamic force). The resiliency of the carpets piles after eliminating the static and dynamic forces were measured and plotted against time, too. The results were compared to each other and analysed with respect to parameters such as the type and quality of the wool fibres as well as knot density of the carpet.

Keywords: Tanned wool; Physical and mechanical properties; Carpet thickness; Pile resiliency; Static and dynamic forces

1. Introduction

It can be claimed that the hand woven carpet represents the great history of Iranian arts. The oldest sample of Iranian carpets found in city of SARAB (located in north west of Iran) confirms this fact [1]. During a digging, in 1949, in Syberia Mountains an Iranian hand woven carpets, named Pazyryk, was found. The pile of the carpet was made of wool with 200 knots/in\(^2\)[2].

The great period of creativity in carpet making took place in Persia during the Safavid period (1499-1722) under the reigns of Shah Ismail and Shah Abbas. In fact, about 1,500 examples from this period are preserved in various museums and in private collections[2].

The central region is the main producer of Persian carpets in Iran. The capital city of Tehran has a bazaar which is the center for the marketing of Persian carpets. Isfahan is famous for its historical and cultural sites. Qom (Qum) is known for its silk woven carpets. Nain, Kashan and Varamin are also located in this region. Varamin situated in the center of Iran, and was once the capital city[2].

In producing the carpet different materials such as cotton yarns with various counts, twist, and ply are used for warp and weft ends of the carpet. Although, the most obvious fibres which is seen and touched by people is wool. In carpet industry, the coarse and fine wool fibres are mixed and spun. These fibres can be used for carpet when their resiliency, dyability, fibre length, number of crimps, vegetable trash percentages, tenacity, elongation and fineness of the fibres is suitable [3].

Nowadays another type of wool fibre, tanned wool fibre, which is mixed with conventional wool fibre, is used, too. The tanning process can be made in various ways, however it consists of following[2]:

a) Soaking (16 hours)

The skins are rinsed in cold water to remove excess salt and dirt from the wool and pelt. Rehydration (soaking) of the pelt takes place in fresh cold water float overnight.

b) Fleshing

The skins are fleshed using a fleshing machine which removes excess fat and muscle tissue from the back of the skins. This allows for more rapid and complete penetration
of chemicals in the later stages of processing, particularly during pickling and tanning.

c) Scouring (0-45 minutes)
Surfactants are used at 38°C to remove dirt and grease (lanolin) from the wool.

d) Pickling (16 hours)
Prior to tanning, the skins are pickled in a solution containing acid and salt. The salt is added to prevent swelling of the skins by the acid. The internal pH of the skins is lowered to approximately 2.8-3.0, thereby preparing the skins for penetration by the tanning agent.

e) Tanning (16 hours)
Tanning is generally achieved by using chromium salts which form cross-links with the collagen, stabilising the skin structure and preventing putrefaction. The tanning step is conducted at about 25°C and pH 2.5-3.0 to allow for penetration of the chrome. Once penetrated, the chrome is fixed to the collagen by raising the pH to about 3.6 using sodium bicarbonate, and heating to about 35-40°C. This step raises the shrinkage temperature of the skin from about 60°C to around 100°C.

A lot of research works have been carried out in the field of preparing wool from woolskin. These findings have resulted in new view in connection with tanning wool fibres. So that the value of tanned wool is not only lower than conventional wool fibres, but also in most cases its price is similar to it[4].

Iranian Standard (ISIRAN)[5] has advised the use of wool fibres with following specifications for hand woven carpet:
Length: 5 cm and longer
Fineness: at least 20 μ

The physical properties, such as extensibility and resiliency, of wool fibres used for carpet play a fundamental role in quality of the rug. The extend of resiliency of Iranian wool fibres have been worked out within 83.02-95.4 percent which is so higher compared with non-domestic wool fibres, i.e. the Iranian wool fibres have excellent characteristics for hand woven carpet[6].

However the above mentioned standard does not allow the use of tanned wool fibres even as combined with conventional wool fibres for hand woven carpet. The reason for such restriction is due to the lower quality of the wool fibres due to the damages caused by chemical treatments during tanning process. These damages reduce the tenacity and dyeability of the wool fibres, which makes some difficulties in connection with the quality and durability of the carpet[6].

The advantages of a carpet, in addition to decoration features, particularly when it is new, are its comfortability, suitable temperature and safety when walking. Another aspect of the carpet is its acoustic characteristic, which can absorb the foot fall sound[7]. The isolation characteristic of the carpet also prevents heat transfer, so that the buildings having covered by carpet can save up to 5-13% of the costs of heating.

The durability of the carpet is other factor which consumers regard, and it is defined the period takes the knots of the carpet are withdrawn from the carpet so that the warp ends of the carpet are seen. This property of the carpet is linked with the quality and the type of the knots used in carpet. It has been reported that the main abrasion of the carpet occur in turning places of the corridors as well as the edges of the stairs[7].

A lot of works have been carried out to study the effect of the static and dynamic forces on the conventional (non hand woven) carpets, but a little has been done on the hand woven carpets. Ghareaghahi[8] spun the woolen yarn from conventional and tanned wool fibres with different combinations portions to weave the rug. He put the rugs under static and dynamic forces according to relevant standards and measured their thickness. He, also, plotted the recovery of the piles against time for the carpets after eliminating the static and dynamic forces.

2. Experiments

2.1 Materials

With respect to this fact that the aim of this research work was to study and investigate on the mechanical properties of the hand woven carpet, it was necessary to carry out the experiments on the carpets. Therefore, the samples with small dimensions should be cut from the carpet. As the hand woven Persian carpets, in large dimensions, are expensive, cutting the samples from such carpets are not acceptable and the small carpets should be woven for this purpose. Thus, eight carpets, in dimensions of 60×90 cm, were woven. To produce these carpets, two different wool fibres from two parts of Iran were provided. The chosen region were Sirjan (South East of Iran) and Kermanshah(West of Iran). From each region both conventional and tanned wool fibres were obtained. The wool fibres from first region are somewhat finer than the latter region. Then from four groups of the wool fibres two yarns with different counts, Nw = 2/4 and 2/6, were spun to weave eight rugs. The first yarn group, Nw = 2/4, were used for rugs having density of 25 knots per 6.5 cm, and the second group of the yarns, Nw = 2/6, were used to weave the rugs with density of 35 knots per 6.5 cm. The woolen yarns were dyed using vegetable dyestuff in tradition way.
In addition to woolen yarns, as the pile of the carpet, the warp and weft yarns were also required. The warp ends used for two groups of the rugs were as following:

a) Knot density(25): \( N_w = 20/20 \)
b) Knot density(35): \( N_w = 20/12 \)

Two different weft ends were used to bind the knots in the carpet firmly. The count of the weft ends were as follows:

a) Knot density(25)

Thick weft end: \( N_w = 10/20 \) and thin weft yarn: \( N_w = 20/5 \)
b) Knot density(35)

Thick weft end: \( N_w = 10/14 \) and thin weft yarn: \( N_w = 20/3 \)

After setting up the frame of the rugs, they were woven on basis of a simple pattern, designed earlier for this work.

To make the things and not confuse, the carpets were coded as following:

A: Carpet woven from Sirjani wool (Kerman area), knot density of 25/6.5cm
B: Carpet woven from Kermanshahi wool, knot density of 25/6.5cm
C: Carpet woven from tanned wool of Sirjani, knot density of 25/6.5cm
D: Carpet woven from tanned wool of Kermanshahi, knot density of 25/6.5cm
E: Carpet woven from Sirjani wool, knot density of 35/6.5cm
F: Carpet woven from Kermanshahi wool, knot density of 35/6.5cm
G: Carpet woven from Sirjani tanned wool, knot density of 35/6.5cm
H: Carpet woven from tanned wool of Kermanshahi knot density of 35/6.5cm

The specifications of the carpets have been tabulated as following:

<table>
<thead>
<tr>
<th>Carpet</th>
<th>Wool</th>
<th>Type</th>
<th>Knot Per 6.5cm</th>
<th>( N_w )</th>
<th>( \mu )</th>
<th>T. P. M</th>
<th>Break. Stren. (g/Tex)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Sirj*</td>
<td>N***</td>
<td>25</td>
<td>2/4</td>
<td>30.5</td>
<td>80</td>
<td>4.5</td>
</tr>
<tr>
<td>B</td>
<td>Ker**</td>
<td>N</td>
<td>25</td>
<td>2/4</td>
<td>33</td>
<td>80</td>
<td>4.7</td>
</tr>
<tr>
<td>C</td>
<td>Sirj*</td>
<td>T****</td>
<td>25</td>
<td>2/4</td>
<td>30.5</td>
<td>80</td>
<td>4.3</td>
</tr>
<tr>
<td>D</td>
<td>Ker**</td>
<td>T</td>
<td>25</td>
<td>2/4</td>
<td>33</td>
<td>80</td>
<td>5.6</td>
</tr>
<tr>
<td>E</td>
<td>Sirj*</td>
<td>N</td>
<td>35</td>
<td>2/6</td>
<td>30.5</td>
<td>95</td>
<td>6</td>
</tr>
<tr>
<td>F</td>
<td>Ker**</td>
<td>N</td>
<td>35</td>
<td>2/6</td>
<td>33</td>
<td>95</td>
<td>5</td>
</tr>
<tr>
<td>G</td>
<td>Sirj*</td>
<td>T</td>
<td>35</td>
<td>2/6</td>
<td>30.5</td>
<td>95</td>
<td>5.2</td>
</tr>
<tr>
<td>H</td>
<td>Ker**</td>
<td>T</td>
<td>35</td>
<td>2/6</td>
<td>33</td>
<td>95</td>
<td></td>
</tr>
</tbody>
</table>

Where:

Sirj*: Sirjani, Ker**: Kermanshahi, N***: Normal, T****: Tanning

### 2.2 Methods

The rugs woven with above specifications were put under the static and dynamic forces.

To study the effect of the static force on the physical and mechanical properties of the hand woven carpets, the four samples, 50x50mm, were cut from them. Then the samples were placed on the special holding plate and under the piston of the static load instrument, which can be observed in Fig. 1. After, the weight is hung at the end of lever, specified by a round groove. This device, which is basis of similar instrument and according to WIRA standards [9], used these days to create static load on the carpet, has a lever with length rate is 5:1. The hung weight of 9.1kg at the end of the lever, create a pressure of 7kg/cm² on the surface of the sample carpet is being tested.

In this research work the samples were put under the static load for 0.25, 0.5, 1, 2, 5, 8, 12 and 24 hours and their thickness were measured at these times. Then the variations of the pile thickness were plotted against time.

![Fig.1- The WIRA static load device](image)

The static load was eliminated and the recovery of the carpet piles was measured after 0.25, 0.5, 1, 2, 5, 8, 12 and 24 hours and their thickness were measured at these times. Then the variation of the pile thickness was plotted against time.

To investigate the effect of dynamic load on the carpets, 12 samples were cut in dimensions 127x152mm and put on the traversing plate of the dynamic load equipment and fixed firmly by relevant parts, not to move during dynamic loading. The steel plate holding the sample moves forward and backward. The extent of the movement is 3.2mm per dynamic impact. With respect to the extent of movement of the traversing plate and the dimensions of the equipment shoe, the overlap of the impact place of the sample would be half-overlap. The number of dynamic impacts to the sample in a traverse is 25 in which an area of 50x90mm is evenly compressed. The rate of dynamic impacts of the dynamic load instrument, shown in Fig. 2, is 17/min. In this study, the samples were put under dynamic loads of 50, 100, 200, 500, 1000 and 2500 impacts. The heights of the samples were measured and their variations were plotted against number of impacts. In the meantime and after eliminating the dynamic
load, the recovery of the sample piles were measured at similar times of static loading. Then the relevant graphs were plotted, which will be illustrated later.

Fig. 2- The WIRA dynamic loading instrument

3. Results and Discussion

According to the standards, the samples were treated with static and dynamic loads. Then their thickness and recovery variations were plotted, as explained earlier.

3.1 The Influence of Static Load on Properties of Handwoven Carpets

In this section the properties of the hand woven carpet under static load are dealt with. The relevant graphs should be discussed and analysed with respect to parameters like the race and quality of the wool as well as the carpet density. Therefore it is essential to plot the mentioned graphs and compare the curves and discuss the findings.

a) Effect of Wool Fibres Race

As stated earlier, two different types of wool fibres, with different fineness, were used to spin the woolen yarn and finally carpets. To investigate the effect of the race of wool, i.e. fibre fineness, on the properties of the hand woven carpets, the relevant curves are illustrated with respect to this parameter. Fig. 3 illustrates the results in a comparative way. The difference between the relevant curves is the race of used wool. Comparing the thickness variations of two carpets, A and B, indicates that the thickness of carpet A under static load decreases more than thickness of carpet B, the reason for such behaviour may be due to fineness of two wool fibres. It means the carpet A is softer and more comfortable than carpet B.

Considering Fig. 3, also shows the trend of thickness reduction of the carpets C and D, woven from tanned wool of Sirjani and Kermanshahi, are almost alike to similar carpets (carpets A and B). However the carpets C and show more reduction in compared with carpets A and B. It can be explained due to the chemical damages from tanning process. Another difference is less reduction of the thickness of carpets C in compared with carpet D in period of 2-8 hours.

If the behaviour of carpets E and F, is considered, it can be observed that both carpets have similar thickness reduction. So as in first two hours both carpets show similar trend, although the thickness reduction of carpet E is less than carpet F, whereas in previous case, it was different. Comparison thickness of carpets G and H indicates that the thickness reduction of carpet G is higher than thickness reduction of carpet H. it can be due to higher bending of the used wool fibres.

Fig. 3- The thickness variations of the carpets A, B, C, D, E, F, G and H under static load.

b) Effect of Tanning Process (Wool Quality)

As mentioned before, the tanning process can cause the quality of wool fibres to lower. To study the extent of this effect, the behaviour of similar carpets are regarded. Therefore, the carpets are compared in pair, as following:
- Carpets A and C
- Carpets B and D
- Carpets E and G
- Carpets F and H

Considering and comparing the curves of A and C, suggests the thickness reduction of carpets woven from tanned wool of Sirjani is somewhat higher than the carpet woven from conventional wool of Sirjani. The situation is more obvious in case of density of 25knots/6.5cm, but the curves of thickness reduction of the carpets in higher knot density (35knots/6.5cm) are coincided on each other. Although the extent of the thickness reduction of the finer carpets are less in compared with carpet having lower knot density, which is reasonable. The same trend is observed for fine carpets woven from both wools (Tanned and conventional) of Kermanshahi, however, this trend is vice
versa in case of carpets with knot density of 25. This study indicates that the flexibility of the Kermanshahi tanned wool is lower compared with the conventional one. Therefore, for the same reason, the thickness reduction of the carpets, woven from tanned wool fibres, in most cases is less in comparison with carpet woven from conventional wool fibres.

c) Effect of Knot Density of the Carpet
To discuss the effect of this parameter, the thickness variations of the carpets woven from similar wool fibres, but with different knot densities should be compared with each other. Thus, in this part, the thickness reduction of carpets under static load are plotted and compared as following:
- Carpets A and E
- Carpets C and G
- Carpets B and F
- Carpets D and H

The comparison of the above carpets shows that the thickness reduction of the carpets, having higher knot density, is less compared with carpets having lower knot density, which seems acceptable. Since the increase of knot density causes the carpets pile does not bend easily, i.e. the bending resistance of the piles increases, due to the increase of knot density of the carpets.

3.2 The Influence of Dynamic Load on Properties of Handwoven Carpets

Handwoven carpets are also exposed to dynamic load, for instance when people are walking on. The effect of static load and its destructive effects are much greater than the effect of dynamic load. The effect of dynamic load is investigated with regard to similar parameters relevant to static load. The parameters are rate and quality of the wool used as well as knot density of the carpets.

a) Effect of Wool Fibres Race
As mentioned earlier, two types of wool fibres with two method of preparation for two knot densities were used to weave eight rugs. The samples were cut from all rugs according to the relevant standards. As we intend to study the effect of the race of wool on the properties of the rugs under the dynamic load, it is required to compare and analyse these properties for the pairs of rugs. Fig.4, illustrates the thickness reduction of carpets A, B, C, D, E, F, G, and H.

Considering Fig. 4, suggests the rug woven from conventional wool of Sirjani, carpet A, has higher thickness reduction in comparison with similar carpet woven from Kermanshahi wool(B). The behaviour of carpets A and B, under dynamic load is similar to their behaviour under static load. Therefore it can be explained as did in section of static load, which is related to difference between the fineness of the wool fibres, which results in difference in bending characteristics of them. The behaviour of the carpets E and F, as seen from Fig. 4, is alike to similar carpets, A and B, however the difference between them has reduced, which could be due to their higher knot densities.

Viewing the carpet woven from tanned wool fibres, show the same behaviour of the similar carpets, although the difference between the curves has increased.

b) Effect of Tanning Process (Wool Quality)
To investigate the effect of dynamic load with respect to the influence of tanning process, which may affect the quality of wool fibres, the thickness reduction of the rugs under dynamic load should be compared and analysed. Therefore in this study all the parameters of the comparing carpets should be the same and only difference should be related to the quality of the fibres. This investigation shows that the thickness reduction of carpets woven from tanned wool under dynamic load is less than the carpets woven from normal wool fibres. However the behaviour of carpets having higher knot density is quite vice versa.

c) Effect of Knot Density of the Carpet
As observed the mechanical behaviour of the carpets under static and dynamic loads depend on their knot densities. To deal with and analyse the effect of this parameter on the properties of the carpets under dynamic load, it is necessary to view the relevant curves. Referring to these figures, it is found out that the fine carpets, with knot density of 35, show less thickness reduction under dynamic
loads compared with similar carpets with lower density of 25. It should be mentioned the thickness of all carpets decreases as the number of dynamic impacts increases, so that they become flat. The same feature was observed under static load.

3.3 The Study of Pile Recovery of the Carpets after Eliminating Static and Dynamic Loads

As mentioned before, to investigate the property and quality of the carpets, it is essential to deal with the pile recovery of the carpets, after the loads removed. This property of the carpet is defined as facial property of the carpet. In this section, the facial properties of the carpets under static load and then under dynamic load are discussed and analysed.

3.4 The Influence of Static Load on Facial Behaviour of Handwoven Carpets

For a further study, the curves of pile recovery against time should be plotted with regard to the type and quality of the fibres as well as knot density of the carpets.

a) Effect of Wool Fibres Race

To study the effect of wool fibres race on the behaviour of pile recovery of the carpets after removing static load, the relevant curves are plotted and compared with each other. It is noted all the parameters are the same and just one of the parameter is different. Fig. 5 displays the pile recovery of the carpet with respect to fibres race after removing the static load.

![Graph](image)

Fig. 5- The pile recovery variations of carpets A, B, C, D, E, F, G and H, after removing static load

Considering Fig. 5, indicates the extent of pile recovery of carpet B is greater than the pile recovery of similar carpet of A. However, after a while the trends become inverse. Viewing the similar carpets having higher knot density, suggests the trend of pile recovery are quite unlike the carpets having lower knot density. Thus the difference can be referred to the difference between the knot densities of 25 and 35. If the study is extended to the carpets woven from tanned wool, the trend of their curves are inverse, particularly in knot density of 25. i.e. the pile recovery of the carpets woven from tanned wool of Sirjani is greater than the kermanshahi’s ones. The facial property of the carpets with knot density of 35, woven from tanned wool, is quite different. So as, considering Fig. 5 indicates the extent of pile recovery of carpet H until 12 hours is more than the pile recovery of carpet G, but this trend inverts after this period.

b) Effect of Tanning Process (Wool Quality)

One of parameters affecting on pile recovery of the carpets, is the quality of the wool, which may have damaged due to tanning process. As both races of fibres from Sirjani and Kermanshah, were used as normal and tanned fibres, to weave carpets with two different knot densities, thus it is essential to deal with the effect of this parameter. Therefore, the pile recovery of the similar carpets should be compared and analysed, as pairs of carpets having similar knot densities. Considering pile recovery of the carpets A and C, suggests the carpet woven from normal wool of Sirjani has greater recovery in comparison with the carpet woven from similar wool of Kermanshah, and the only difference is at times of 12 and 24 hours. The reason for the difference can be due to the quality of the fibres as well as the error of measuring, during the trials. To study the recovery behaviour of the carpets regarding the race of fibres and higher knot density, the relevant curves should be considered. The study shows within first two hours, the pile recovery of the carpets woven from tanned wool of Sirjani with knot density of 35, s greater than the recovery of similar carpet woven from tanned wool of Kermanshah, although after this period the trend becomes inverse. In connection with the carpets woven from Kermanshah, the trend is interestingly inverse, since its behaviour is unlike properties of the carpets with lower knot density. Thus it is required to deal with the effect of the knot density, either.

c) Effect of Knot Density of the Carpet

The knot density of the carpet is another factors affecting on the pile recovery of them, after eliminating the static load. Viewing the relevant curves with respect to their knot density, indicates that pile recovery of the carpets woven from normal wool of Sirjani, carpet A, mainly is greater than the similar carpet having knot density of 35(carpet E), although after a long time the extent of pile recovery of carpet A, is greater, compared with carpet E. In connection
with carpets woven from normal wool of Kermanshahi wool, it can be observed that the pile recovery of the carpet with lower knot density is higher than the similar carpet having knot density of 35.

If the investigation is extended to carpets woven from tanned wool of Sirjani, it can be seen that the amount of pile recovery of the carpets having higher knot density is often greater than the carpets having lower knot density. The same trend is reported for the carpets woven from tanned wool of Kermanshahi.

3.5 The Influence of Dynamic Load on Facial Behaviour of Handwoven Carpets

The same investigation should be carried out to find out how the piles of a carpet will return to their initial position, when the dynamic load is removed. It is added that number of dynamic impacts to the carpets was 2500. In this study, the parameters affecting on this property of the carpets will be considered.

a) Effect of Wool Fibres Race

As stressed earlier the race of fibres play a substantial role on the carpet properties. With respect to this fact that we used two types of fibres from two different races, it would be useful to plot the curves of pile recovery of the carpets and compare the results. Therefore, the pile recovery of the carpets, after removing the dynamic load, are plotted, as illustrated in Fig. 6.

![Image](image-url)

Fig. 6.- The pile recovery variations of carpets A, B, C, D, E, F, G and H, after removing dynamic load

As can be observed from Fig. 6, the carpet woven from normal wool of Sirjani, carpet A, in comparison with similar carpet woven from normal wool of Kermanshahi, carpet B, has been more compressed under dynamic impacts and consequently its pile recovery is lower. However, its recovery is quicker, whereas, this trend for similar Kermanshahi carpet has almost stopped. It is expected, in longer periods, the Kermanshahi carpet to have greater pile recovery. If the same study is carried out for the carpets, having higher knot density, the same feature can be observed, although the pile recovery curves show insignificant differences. To investigate on the extent of pile recovery of the carpets woven from tanned wool, the relevant curves from Fig. 6, should be considered. Considering this figures suggests the same trends, explained earlier about the carpet woven from normal wool fibres, can be observed.

b) Effect of Tanning Process (Wool Quality)

To study the effect of this parameter, the relevant curves of pile recovery of the carpets should be considered. Viewing the figures, indicates that behaviours of the carpets woven from normal and tanned wool of Sirjani are quite opposite for knot densities of 25 and 35. Whereas the pile recovery of the carpet woven from tanned wool of Sirjani with knot density of 25 is higher than the similar carpet woven from normal wool of Sirjani, which was not expectable. However this trend is quite inverse for the carpets having higher knot density. I.e. in this knot density the extent of pile recovery of the carpet woven from normal wool is greater in comparison with the carpets woven from tanned wool. It is mentioned that the same feature was reported after removing the static load.

If the study is carried out for the carpets woven from Kermanshahi wool, the same trend was observed, as reported for previous case. Although the trend of pile recovery of the carpets woven from normal and tanned wool of Kermanshahi, compared with the similar carpets woven from Sirjani wool, is somewhat different and unclear.

c) Effect of Knot Density of the Carpet

Considering and comparing the pile recovery of the relevant curves shows that the extent of pile recovery of the carpets with greater knot density, woven from normal or tanned wool fibres, are more than this parameter of the carpets with lower knot density. The reason for this behaviour may be due to the effect of the high knot density and its role on the pile recovery. Comparing the pile recovery of the carpet after removing static and dynamic load suggests that there is no similarity between two states.

4. Conclusion

Considering the results reported in this paper indicates unlike the public point of view, the quality of the carpets
woven from tanned wool in comparison with the carpets woven from normal wool, are not only lower but also is the same in some cases. This view has been confirmed in New Zealand, too. The only problem is the difficulties in process of spinning, which is necessary to take account all the measures to prevent the damages to tanned wool.

5. References