

Providing Thermal Comfort in Tourist Walkways (Case Study : Bypass Located at the Contour between Vakil Bazaar (market), Karim Khan Zand Castle and Pars Museum)

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ABSTRACT:

The design of tourist walkways and developments of strategies for more prolonged presence of people at ancient contextures are considered as vivid multiple procedures in protecting of contexture, tour guiding and urban sustainability. Shading in open spaces and pathways, especially in tourist areas, is one of the most important factors in providing the thermal comfort perception. So in innovation of architectural shading samples, some strategies and variable sunshades are needed by consideration of climate changes in any specified area and the changes of the sun position in the sky during days and different times of the year, alternately. This study analyzes the proportion of the thermal comfort in one of the tourist paths of the Zandieh complex located in Shiraz. This path lacks the appropriate function based on the researches by the thermal comfort means, so identifying a path and an appropriate place pause concerning climate conditions, environment, bed and contexture of specified area, presents you a suitable and effective pattern of a sunshade for the mentioned path, towards urban sustainability. This research is carried out by practical and scientific method of descriptive and bottom-up type. New hypothesis are generated from collected data. Data collection is based on library and metrical method.

Keywords: *Tourist walkway, Urban-sustainable development, Required climatic calendar, Shade veil, sun path diagram.*

INTRODUCTION

“The design of tourist walkways in ancient contexture, as a mutual action or multiple actions for protection of the contexture and guidance of tourists can revive the ancient texture as a <former action>. Also, it could protectively result in restoring the life of the contexture” (Habibi, 2003, 43). One of the most important matters in tourist walkways is providing thermal comfort condition by shading in hot and sunny weather, in locations of pause and designed chairs in the walkways. “One of the tropical zone features is the clear blue sky and direct sunlight in most time of the year. In this situation, Shading the pathways and open places can be an effective factor in a fresh environment and decreasing the temperature of hot weather if this shading will not prevent the sunlight in cold weather. This aim is achieved if there would be enough recognition from the area, human’s comfort and the

sun positions in the sky” (Tahbaz, 2007, 28). Lack of spatial considerations in open places may cause a reduction of usage or lack of use of these places in some parts of the day (Fig. 1b). So in this research one of the several rows of designed seats is considered in the walkway of contour between Vakil bazaar (market), Karim Khan Zand castle, pavilion building of Pars museum and Melli bank central branch in Shiraz where there is not any visitor in mean time from 10:00 to 17:00 because the lack of the shadow(Fig. 1a). This example shows paying essential attention to the climatic condition of area and proper sunshade in providing thermal comfort.

In his book "Comfort with architecture in harmony with the climate" (Razjoyan, 1988), thermal comfort criteria and method of calculation and optimal design drawings are investigated by using climate graphs.

In a research entitled "Stable construction in relation to the traditional architecture" (2001), KhodaBakhshi and Mofidi stated the traditional architectural features of the climate

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Resort to the shade of trees and sitting in the little garden as the lack of shadow in seats location.

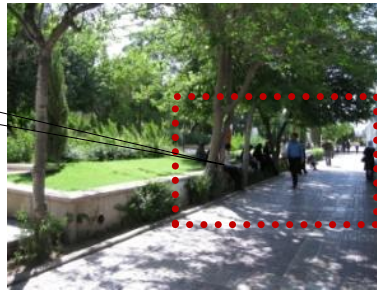


Fig. 1a: Lack of seats sunshade and resort to shade of trees. Time: 16:30'.



Fig. 1b: Seats designed in the path. Time: 11:00.

in different regions and finally persistent communication architecture model has been provided for efficient use of energy and environmental sustainability in any region.

In a research entitled "Tourist walkway", Habibi (2003) has explained the walking path for tourism within the framework of a strategy by maintaining the old texture that he knows it as attractive for tourists.

In a research entitled "Design of outdoor shade", Tahbaz (2007) reviewed the thermal comfort in outdoor castle Bam lacking vegetation and finally has offered a pattern of temporary shelter in this space. But due to the constraints of a permanent sunshade design pattern that is presented in historical context, this study analyzes the access to the thermal comfort in urban open space with vegetation.

Hosseini et al. (2009), in a research entitled "Environmental stability in open spaces: Qualitative evaluation of residential localities in Tabriz" (2009), introduced sustainable urban development that has been one of the strategies in a stable urban design to emphasize on urban open spaces.

In a research "To determine thermal comfort in dry climate (case study: Yazd city)", Sadeghiravesh and Tabatabai (2009) have set thermal comfort method (Olgay's chart) in Yazd city. Finally, they proposed thermal limits, which prevent the use of unsustainable energy.

In a research "Evaluation of affective bio-climatic coefficients in human conformity (sample study: Yazd city)", Sadeghiravesh (2010) evaluates data based on Habitat Climate Yazd indicators (Olgay, Backer, and Terjung). Finally, he came to the conclusion that Olgay's index is more appropriate than other indices for evaluating the comfort zone at 40 degrees latitude.

The most part of this research deals with investigation and determination of the scope of comfort in varying climates and less viable strategy for how to present their position in this range.

MATERIALS AND METHOD

This essay evaluates the balance of thermal comfort supply in one of the tourist walkways contours between Vakil bazaar (market), Karim Khan Zand castle and Pars museum in Shiraz. Hence, first of all by using climate data of Shiraz synoptic weather station, essential climate calendar of drawn region on their climaxes, when occasion serves to the sun and shadow, and region design priority of specified city will be distinguished. Then, the bed and contexture of specified region is presented by use of Olgay's veiled shadow and calculated methods of one performed and proper method through consideration of urban stable developments and urban ecology. At the end, the rate of suggested sunshade during the year is considered and analyzed by Ecotect program.

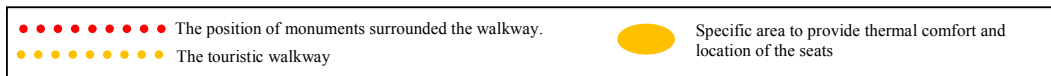
Tourist Walkways

"One of the strategies in a stable urban design is to emphasize on urban open spaces" (Hosseini et al., 2009, 173). "Constitution of a city regardless of its features and a city without any citizen caused making an effort to receive some proper strategies to design and ideal city for citizens. It has been reconsidered to provide walking movements in the city, more prolonged presence in urban environment, suitable urban spaces in order to hold the meetings, discussions and exchange of views and thoughts, which is possible for one who utilized the spaces" (Habibi, 2003, 46). "By the aim of providing tourist's needs, designing of walkways is an action that could be one of the first movements in protection of contexture or may be affective as supplement design in productive designs" (Ibid, 44). The design of walkways and open places is a reason for a kind of social stability through urban stability (Fig. 2a). This matter not only makes protection for contexture but also it brings about the tourist's attractions. In this essay, a contour path between three monuments in Zandieh age and one monument in the age of second Pahlavi



Fig. 2a: Above - Tourist walk way and its surrounded monuments.¹ (Source: wikimapia, 2013)

Fig. 2b: Down- panorama photograph from specific area.²



are considered as a high potential touristic walkway for attraction of tourists (Fig.2b).

Passerby

“Human being as a generator and creator of city has been living in the city. He lives in and does some activities. He is permanently present in the city, either as a resident of a part of it or as a passerby in some other parts. In later case, the fulfillment of human’s needs by his temporary presence in the city is a claim in which the security, comfort, safety and acquiescence of presence in urban areas are contemplated and it requires some equipment and facilities to be able to provide the presence possibilities” (Habibi, 2003, 47). In other words, one of the welfare inducements in these paths is the providing thermal comfort. This matter could be done by designing a proper sunshade to the area in urban open spaces. If it’s necessary and possible, humidity and air flow can be fulfilled.

Pedestrian Crossings

“It is the simplest approach that may be expressed about the purpose of the tourist walk ways designs. Paying attention to the related qualitative and quantitative factors, which are influenced by its traverser (human) and its traversed (time) defined in connection with the mass and space (place), desirability of pedestrian crossing may be achieved by this. It can be followed by points below:

Paying attention to biological aspects in sidewalk movements such as comfort, pleasant, water and climate protection, prevention from visual, auditory, olfactory pollution,... providing of recreational spaces in synthesis with natural spaces” (Ibid, 48).

“If intervention in the paths forwarded to ancient contexture with the protection from contexture (as the ultimate goal of intervention), organizes a suitable place to fulfill the needs of resident and passersby (tourists) by respecting to the contexture

and its belongings, it can be the first step in a conscious intervention in the ancient contexture to re-create the public scope and lost identity and removed memories without any conflict" (Ibid, 48). In this regard, in order to provide the comfort in the specific direction, considers to the mentioned points by minimal intervention in environment and respecting to the contexture has been put on the agenda.

Urban Stable Developments

"More than 50 different definitions of sustainable development have been presented throughout issues the world" (Moztarzadeh et al., 2013, 68). "In recent decades, urban stable development has been put on agenda in many urban movements such as the 21th the United Nations agenda. Human development's report of the United Nations in year 2003 and charter of modern urbanism has been existed in industrialized and developing countries. The new patterns of urban designs such as ecological city, compact city without automobile are known as scientific affects in this view" (Hosseini et al., 2009, 147). "(CIB)³ in 1994 defined the purpose of sustainable architecture creating and innovate an artificial healthy environment based on ecologic design and resources efficiency"(Zabihi et al., 2013, 50). "In addition to large scale of urban design during recent decade, attention was also paid to small scale. One of the most important aspects of a stable urban design is the design of the contexture and open places with the aim of welfare of citizens in small-scale areas including thermal, visual, audio, wind, comfort and urban morphology. This approach can be achieved by upgrading the adequacy of the texture and facilitating the use of reproducible energy in urban environment. Accordingly, texture and open spaces can be environmentally assessed in small-scale areas and climate as the smallest social unit and urban framework" (Hosseini et al., 2009, 147). "Outdoor spaces are important in sustainable cities because they accommodate pedestrian traffic and outdoor activities, and contribute greatly to urban livability and vitality. In the global context of climate change, outdoor spaces, which provide effectively a pleasant thermal comfort experience for pedestrians, improve the quality of urban life. The influence of thermal comfort on outdoor activities is a complex issue comprising of both climatic and behavioral aspects; however, current investigations lack a general framework for assessment" (Chen & Ng, 2012, 118). "In development process along with the environment, the environmental studies play an important role. Some of these studies are biological-climate studies which are the foundation of the architecture, urbanism, tourist works and etc... therefore; this condition should be evaluated locally. However, since over 60% of the Iran's latitudes covered in dry climatic conditions and ultra dry climates, identifying the environmental-climate conditions in these districts are really important" (Sadeghiravesh, 2010, 77). As Shiraz is considered in dry climate location, providing shadow in opens spaces at one direction without considering the long term of

environmental –climate for providing comfort is impossible.

Climate and Architecture

"The link between climate and architecture is more likely to the relation between an infant and embrace, any herb and the soil or safe privacy and a bed growing. The dependency pauses evolutional, aspired but not causes limits. Architecture is born in environment and is shared in some conditions. The climate as far as is concerned to man, it is the result of the interplay of elements such as sunlight, temperature, humidity, wind and rain falls" (Kasmai, 2008, 3). "How to deal with the nature and how to conduct architecture on it, is a reaction that anybody is exposed it and will have been faced with it in different parts of Earth planet. And, precious architecture remained from the past; presents perfect or incomplete overcoming over factors such as climate, water and air. Thus, we could see different countries in the world with different native architectures proper with the area and the culture that show their specific characteristics of their regions. Due to the different conditions of climate and culture, Iran needs to specified and a different architecture in harmony with climate that has been created" (Khodabakhshi & Mofidi, 2001, 601). "Providing thermal comfort in spaces of human life is one of the primary goals of architecture consistent with climate. By the way, providing the comfort in open spaces depends on the knowledge about climate and environmental conditions more than interior spaces. On the other hand, achieving comfort conditions in open spaces prepares the ground to achieve the comfort in the internal spaces of the buildings as open spaces are the covering bed and small creator of the climate in the environment surrounded the buildings. So by the observance of the architecture's principles aligned with the climate of open spaces, providing comfort conditions will be facilitated in interior spaces and the considerable saving energy will be done"(Tahbaz, 2007, 28).

Thermal Comfort

"Thermal qualities- hot, cold, wet, cool, asteriated and comfortable- are important elements in an experienced space. These qualities affect on not only what people are doing in spaces but also on their senses about the space" (Moore, 2003, 43). "Thermal comfort is a pleasant inner mood that conditions and individual factors as well as a set of interrelated factors could change it. Ashrae⁴ Association defines thermal comfort as: the interior conditions in which the human satisfaction from the thermal environment could be done" (Moore, 2003, 47). "During recent years they have witnessed issues related to thermal comfort gaining more momentum in tropical countries. The thermal adaptation and thermal comfort index play a significant role in evaluating the outdoor thermal comfort" (Md Din et al., 2014, 6). "By mentioned definition, thermal comfort is a range of humidity and temperature in which the body's heat regulation is at minimum level of activity. Due to the fact that people feel the same temperature conformability

Table 1: Climatic means of Shiraz Synoptic weather station in statistical period of years 1350 – 90. (Source: Farsmet, 2013)

Longrun term	Mean of temperature						Monthlyrelative humidity			Rain in mil			Snowheight (mil)	Evaporation	Sunshine Hours	Number of frost days	Max of wind			
	Min	Max	Mean	Absolute max	Day	Absolute min	Day	Min	Max	Max	Amout	Rainy					Max daily	Side	Speed	
April	8.1	22.3	15.2	-3.2		31.2		24	72	48	38.2	8	40.40	0	179.5	260.6	0	251	15	
May	12.9	28.9	20.9	3.4		37.8		16	57	37	12.3	4	44.20	0	279.4	302.4	0	256	15	
June	17.2	35.2	26.2	8		41		10	39	25	0.4	0	580	0	387	363.7	0	271	13	
July	20.6	38.2	29.4	13		43.2		10	38	24	0.5	8.1	15.6	0	407.2	346.7	0	224	12	
August	20.6	37.7	29.2	12.4		42		11	41	26	1.2	1	22.6	0	376.3	338.6	0	249	12	
Sep	16.9	35.2	26.1	8.3		39.6		11	44	28	0.1	8.1	2.6	0	324.3	328.6	0	248	12	
Oct	11.7	29.8	20.8	1.6		36.2		12	52	32	1.6	1	25.5	0	229.2	294.4	0	275	12	
Nov	6.4	22.7	14.6	-5		30.2		21	67	44	19	4	56.9	0	133.1	248.2	1	259	11	
Des	2.2	16.2	9.2	-7.4		24.4		31	78	54	62.9	7	100.4	0	65.2	214.8	9	238	12	
Jan	0.6	12.7	6.6	-14.4		22.4		37	85	61	77.8	8	63.2	2	48.6	210.5	16	234	12	
Feb	1.1	13.5	7.3	-9.6		23.6		32	81	57	60.3	9	59.3	0	61.9	223.9	13	237	13	
March	4.4	17.8	11.1	-6.8		30.6		26	76	51	49.6	9	39.2	0	107.5	225.8	3	234	15	
Total											324.1	50		2	2599.1	3358.2	42			
Mean	10.2	25.9	18					20	61	41		24						4	248	13
Absolute max				-14.4																
Absolute min						43.2							100.4							30

in the same climate, it is necessary to accurately determine the thermal comfort zone for each climate area” (Sadeghiravesh & Tabatabai, 2009, 43).

RESULTS AND DISCUSSION

Thermal Comfort in Open Spaces and Analysis of Climatic Conditions

“In most researches about approach to thermal comfort of users, it is emphasized that there is a significant relationship between outdoor temperature, radiation and climate comfort. The mean radiant temperature of outdoor urban space for users impacts tangibly on their welfare at one point of time and geographic location.” (Behzadfar & Monam, 2010, 30) So reducing the temperature of the radiation in the summer for a climate similar to Shiraz has a direct impact in the realization of thermal comfort for users.

To design the urban open spaces in line with architecture accommodated to the climate, the adequate knowledge should be available about the climate. The most common method in definition of climatic condition of a location is climate statistic analysis which is usually provided by metrological organization. There are several criteria for analyzing and evaluating the statistics that can help to identify the needs of local climate (Table 1).

In this study, assessment of thermal comfort in open space is done by Olgay Method in which the range (21.5 - 29 ° C) for Shiraz in summer and in winter (20 to 27.5 ° C) was calculated. Relative air humidity of 30 to 65 percent is intended in the chapter. So a monthly transfer and review of the climate graphs

of Olgay in Shiraz Station notify that there has been the range of thermal comfort in several months and the outside these months and the need for air flow and sunlight to create thermal comfort.

Required Climatic Calendar

By drawing these temperature thresholds on required climatic calendar, it can be realized that:

“When it needs the sun for feeling of comfort in the year;

When the shade is important and it needs to be;

and finally The time a gentle breeze or wind or evaporative cooling is essential to achieve comfort.” (Razjoyan, 1988, 132)

To draw this calendar first, Shiraz several years’ weather data must be extracted and statistical models should be based on an annual average (Table 1). By using these statistics, Shiraz climate would be analyzed and its required climatic calendar is needed to be drawn. “This calendar consists of two axes perpendicular to each other_ day of the year and time_ this calendar covers all during the year and climatic events can be displayed on it (Fig.3a). Required climatic calendar of different cities especially warm areas states that when heated, one of the welfare conditions is to provide adequate shade (Fig. 3b). The time needed to shade in every climate depends on the heat. In tropical areas it can be included more than two-thirds to three-quarters of the year. Now the question is that how can we provide or maintained needed shades at desired location in such conditions while, not denying the pleasant sunshine when it’s cold?”(Tahbaz, 2007, 29-30). Consideration of Shiraz climatic calendar suggests that:

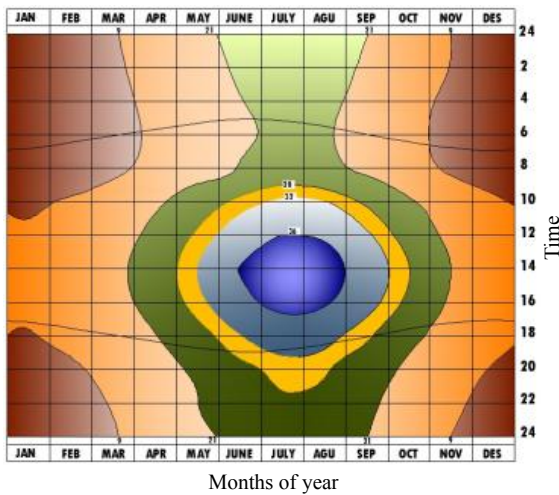


Fig. 3a: Required climatic calendar of Shiraz for open spaces.







	temperature thresholds	Percent	temperature
	Cold circumstance	20%	0-9
	Proper conditions in the sun	37%	9-21
	Appropriate in light of the circumstances	26%	21-28
	In appropriate circumstances and in light of airflow	5%	28-32
	Appropriate circumstances and in light of the addition of air	8%	32-36
	Warm circumstance	3%	More 36

Fig. 3b: Analysis of required climatic calendar of Shiraz for open spaces.

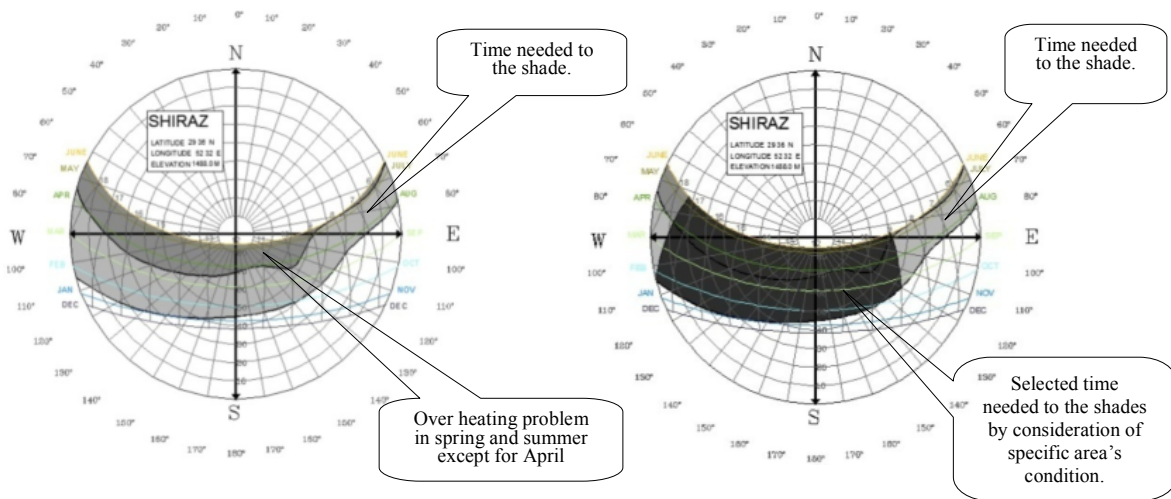


Fig. 4a: Shiraz sun route diagram with different conditions needed the shades on the diagram.

Fig. 4b: Selected time needed to shade on Shiraz sun route diagram.

In 37% during of the year the sun is needed to provide the comfort.

20% of time is cold and to provide comfort, heating equipment is needed.

More than 42% of time in a year is warm and to provide the comfort in this period in open spaces in Shiraz, there is a need to shade. Also, need of air flow is important.

Providing Needed Shade Concept of Sky's Dome and the Sun path Diagram

“Shadow is the dark area behind the objects that blocks the light and heat energy from irradiation source. However, there will be situations to make the shadows when the sun is defined as a source of heat and light radiation. Concept of (Sky's dome) is a simple graphical approach that has been invented by a Swedish architect Garner Plied in year 1945 and since then it has always been used by architects in various ways (Fig.4). Different kinds of graphs and drawn solar overlays make it possible for the sun's position to be determined with sky's dome method and provide the conditions of shade for the architect” (Tahbaz, 2007, 30). According to analysis of Shiraz required climatic calendar and the need to transfer the analysis to the sun path diagram, we found that:

To determine the time of using open spaces which will be easily accomplished when there is the shade providing, wind and evaporative cooling. Due to excessive heat or cold, determination of the critical moments remains problematic

when using open spaces.

By given climatic features of Shiraz city, the required area to provide the shade can be indicated on the sun route diagram. Accordingly, we find that in summer season and months of May and June from 9:30 A.M till the sunset, as there is excessive heat, the shade and air flow is required in open spaces. During March, April, July, August, September, October and November moths, we need shade from 6 to 10:00 A.M till the sunset in order to sit in open spaces (Fig. 4a). At next level, due to the marked time needed to shade on the sun route diagram, elected hours for using the seats in the specific walkways should be drawn on the diagram. To achieve this aim, this time from 9:0Am to 5:30 Pm is selected and is drawn on the sun path diagram (Fig. 4b).

Shade Veil

Using shade veil technique refers to a method that considers and designs a suitable sunshade in any architecture from open spaces or interior spaces of building without any graphic operations. This method has innovated by using the sun route diagram and protractor shade finder by an American architect Victor Olgyay. Its characteristics can be outlined as follows: No need to extract the angle of height and the angle of sun direction (as a level of the operation) and just detecting the time needed to shadows and sunlight is adequate.

The operations related to drawing shadow of different samples will be removed that will cause a considerable saving in time.

To draw the shade veil of the specific area first, detailed diagram



Fig. 5: Aerial photographs from the area and to determine the scope of design and location of shading obstacles (trees) in proportion to the seats.
 (Source: Wikimapia (2014))

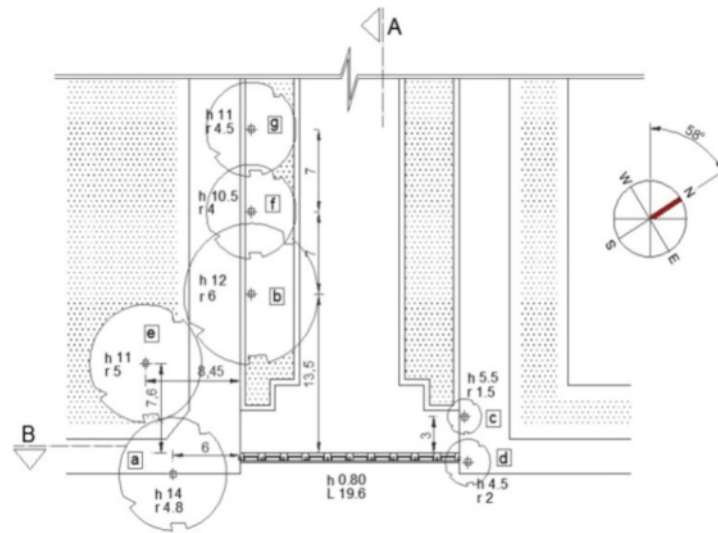


Fig. 6: Diagram of the specific area to provide shade, dimensions and positions of shading obstacles (trees) in proportion to the seats.

of area with the dimensions of shading on that area should be determined. Due to this matter, shading masses in the required range of shadow providing are the trees (Fig. 5). It is necessary to get diameter of the trees in that area, and to get the height of the trunk from the ground before start of the tree branches and leaves, also to get the height of initial zone of tree branch and leaves to the top of the tree (Fig. 6).

By determined angles related to the set of trees, trees' shade veils will be drawn on specific area (Seat location) (Fig. 8a). The drawn shade is matched on sun route diagram. This is easily done and It's Important to note that according to the angle of the seats along with the North, which is based on the diagram of area, the angle of 58 degrees towards the North is tilted towards the West (Fig. 8b).

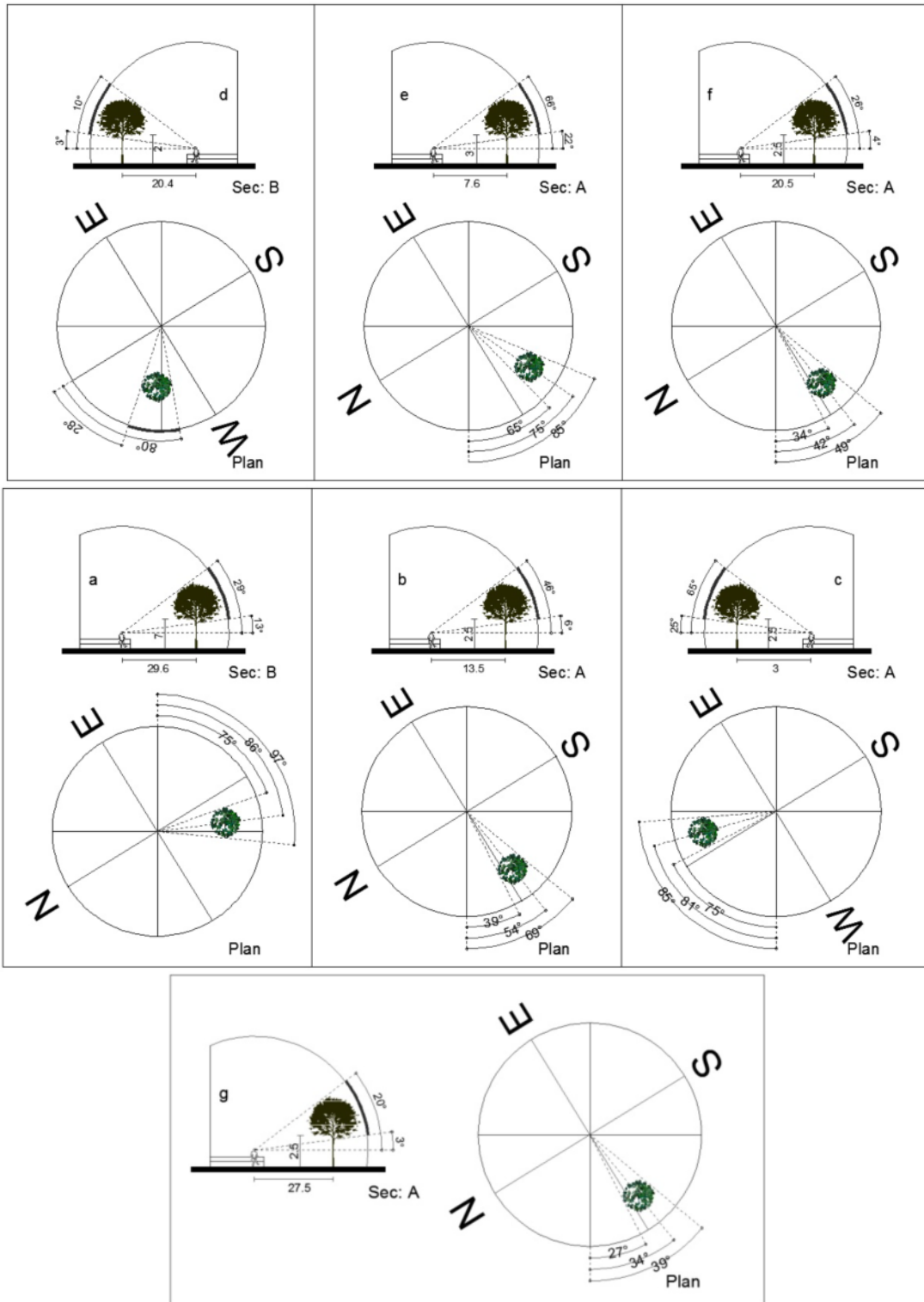


Fig. 7: The condition shading obstacle (tree) on the specific area.

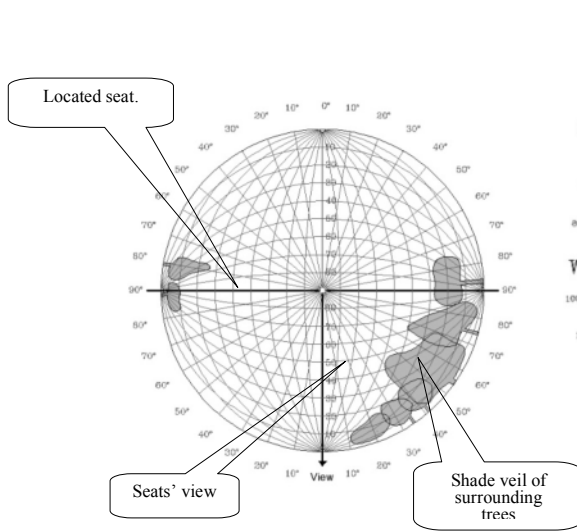


Fig. 8a: shade veil of surrounded trees.

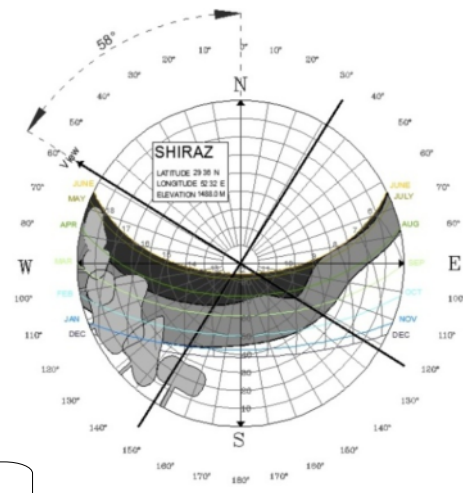


Fig. 8b: Adaptation of shade veil on diagram.

Prototype Sunshade

After matching the shade veil of trees on the selected areas needed shade, efficiency of trees to provide the shade will be determined. It is obvious by the left graph of figure 8 that shading of trees in the specific area is insignificant. In order to have shadow, a shade veil should have been offered that:

- To provide the most covering in hot weather by the left graph of fig. 4.
- While not denying the sun when it's cold.

Prototype Shade veil is not the original design of shading. In fact, it is an area that should be covered by a shade and provided the necessary shading. By considering the condition and tourists visits the time of providing the shade for creating welfare condition is considered at 9:00 A.M to 5:30 P.M. This is one of the most important of features of touristic walkways. In this regard, prototype sunshade should cover the needs of shade during a year within the mentioned period. This matter is shown on the sun path diagram (Fig. 9b). To draw the prototype sunshade, all of the cross sections, views and essential plans should be drawn

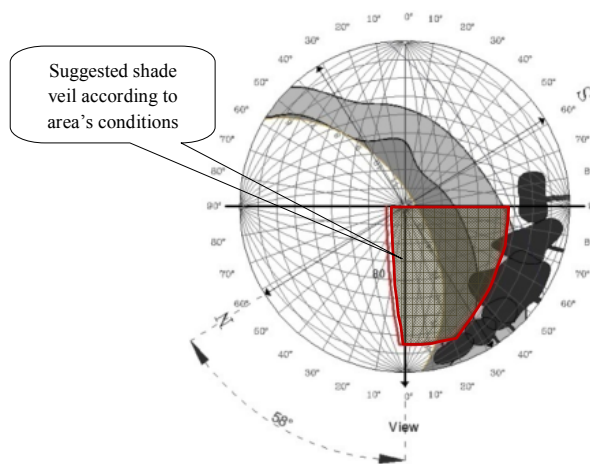


Fig. 9a: suggested shade veil according to the seats conditions.

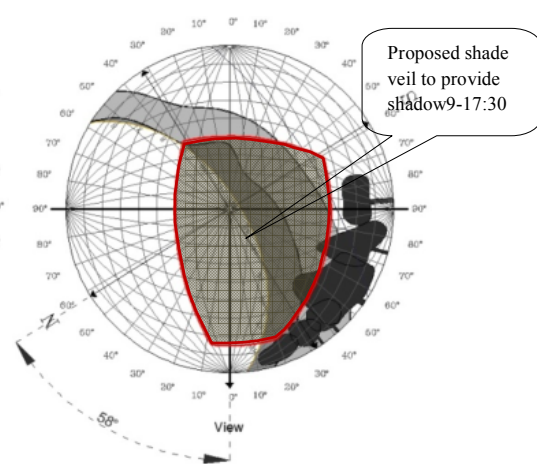


Fig. 9b: suggested shade veil for sunshade.

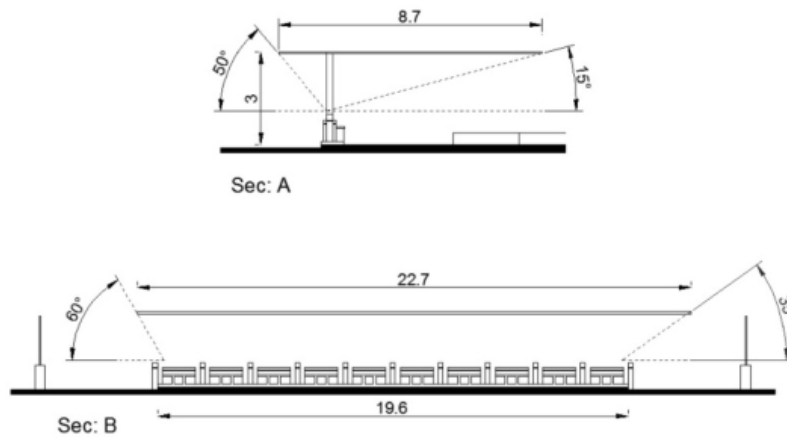


Fig. 10: Seats row cross sections and angles of required sunshade.

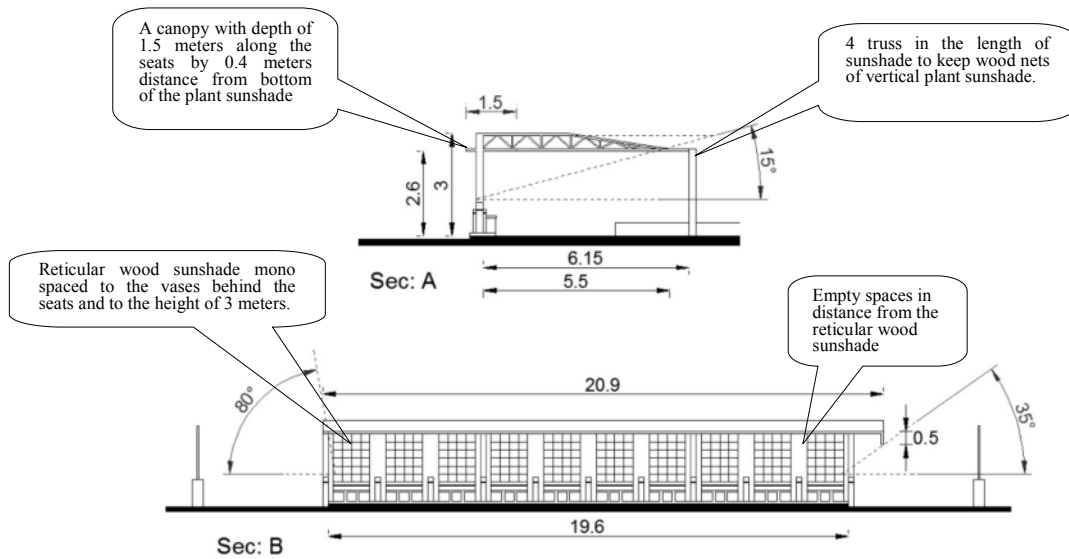


Fig. 11a: Sec A- Position of the plant sunshade model in proportion to the available seats with ventilation.

Fig. 11b: Sec B- Position of the plant sunshade model in proportion to the available seats with ventilation.

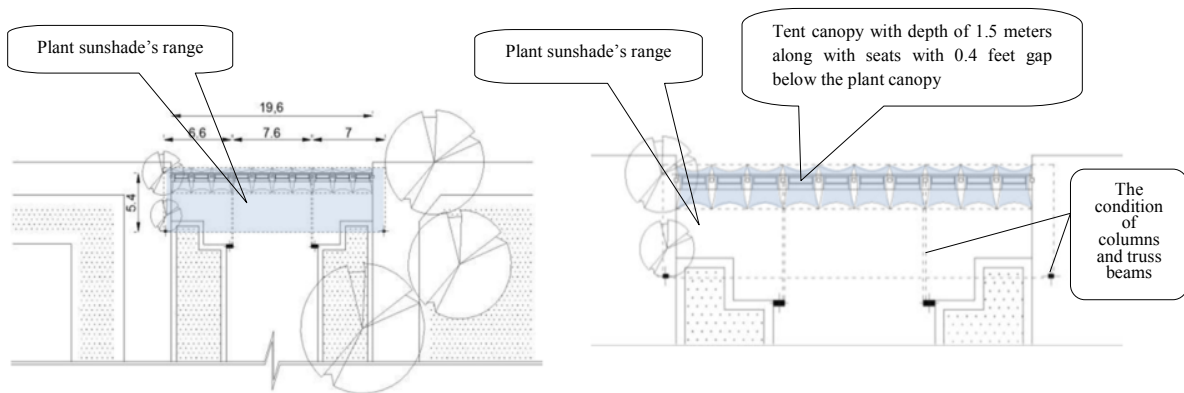


Fig. 12: Proposed canopy trusses and steel columns, and plan positioning of seats.

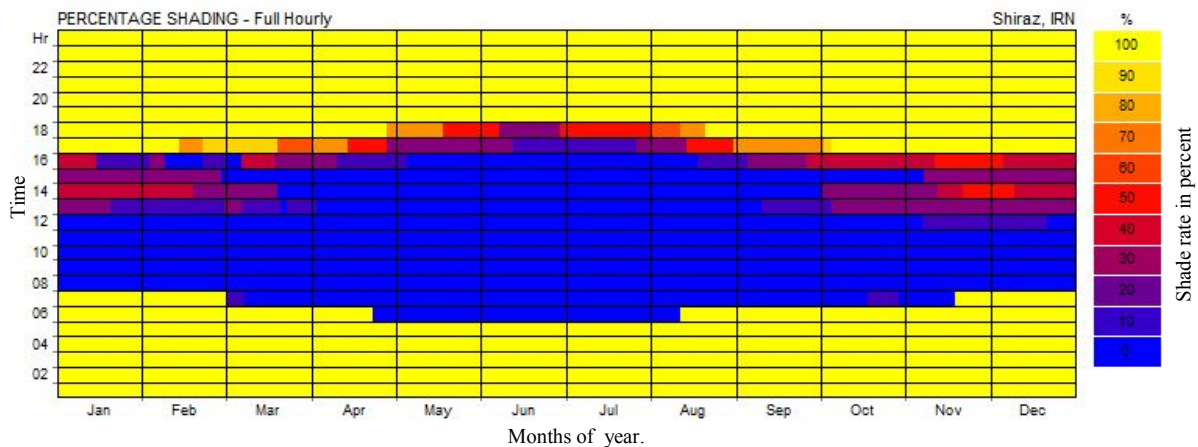
from the specific area then by using the determined angles in the model of sunshade veil; the covered areas by sunshade can be assessed.

By considering to the figure 9(b), there are 4 angles that determine the length and depth of the sunshade model, which is the best cover to create the shade for specified seats during the year. Two angles of 15 degrees and 50 degrees, in proportion to observer's eye line, determine the depth of the sunshade in horizontal cross section perpendicular to the seat and two angles of 35 and 60 degrees in proportion to observer's eye line in vertical cross section in parallel to the row of seats which are posed at ends of seat's row, determine the length and exact position of sunshade in proportion to the seats (Fig. 10).

CONCLUSION

The path is an urban space, which does not play the role as a touristic motive factor to reach the destination and availability is one of its operations. What make it valuable are its inductor roles between the past, present and the future. Its social function is variable of the presence of people. Therefore, the path is a public

scope. It should be under some conditions to underlie the presence of people. So creating a sunshade and shadow in one tourist-historical walkway is to provide thermal comfort of tourists and visitors in one of the underlying ways for presence of people. Creating a sunshade in such a path should be accompanied with lack of coordination with the environment. In graph of figure (9a), angles and dimensions of suggested sunshade is obtained by designs ideas that in this regard, suggested sunshade is located in a historical texture to prevent the lack of coordination, economic reason and also to match the seats with the vases is considered natural and green. As the seats are closed to the street and in order to define the privacy walk, sunshade is considered like a green vertical wall of plants, its original quality stemmed from the wood that is selected in reticulated wall to transfer the plants (Fig. 11a). In order to have air flow, this reticulated wall (sunshade) is considered with space. This wall is not so vast along the street consists of a viewable paused space (Fig. 11b). At height of 2.60 meters above the seats and below the green plant sunshade by depth of 1.5 meters is covered by a light colored cotton canopy to be an obstacle from passing any dust or



TOTAL MONTHLY SOLAR EXPOSURE
 Shiraz, IRN
 Object: 5 (13.720 m2) (Azi: 122.00 °, Alt: 90.00 °)

MONTH	AVAIL. wh/m2	AVG SHADE	REFLECT wh/m2	INCIDENT wh/m2	TOT. wh	ABSORBED wh/m2	TOT. wh
Jan	172958	13%	0	109985	1509000	40475	555312
Feb	151658	17%	0	109389	1500817	40255	552300
Mar	192920	12%	0	145302	1993539	53471	733623
Apr	207369	7%	0	165932	2276590	61063	837786
May	238968	7%	0	188203	2582142	69259	950228
Jun	232268	4%	0	202103	2772858	74374	1020413
Jul	241951	5%	0	208331	2858306	76666	1051857
Aug	229087	8%	0	194427	2667533	71549	981652
Sep	217276	10%	0	173642	2382366	63900	876711
Oct	198797	12%	0	145095	1990698	53395	732577
Nov	152454	15%	0	103353	1418001	38034	521824
Dec	187267	15%	0	102838	1410940	37844	519226
TOTALS	2422973		0	1848600	25362792	680285	9333509

Fig. 13: Analysis of canopy's shading on the seats during a year.

garbage on the seats in rainy days (Fig. 12).

At the end, in order to make sure of suggested sunshade performance, it's necessary to be checked and analyzed by Ecotect program which its external data indicates the performance of sunshade by shading during a year by considering Shiraz climatic data. There is an important point that the considerations in this program are done by foundation of the shape, from location of the sunshade in proportion to the row of seats and not by the kind of sunshade (plant sunshade). This point affects on efficiency of sunshade when it is cold (Fig. 14-13). Initially, in order to realize the subject of sunshade providing and design of sunshade for these seats, the balance of the tree's shadings and other shading factors on the seats during a year by Shiraz city climate data is considered. The level of shade on the seats is indicated in red rectangular, in below table by taking the months of a year apart. This is the indication of just weakness and inefficiencies of trees shading and presents the essential need to sunshade for this space. According to the data in the table, we realize that in three hot months i.e. July, August and September there should be the maximum rate of shade on the seats. The percent of provided shading are 4, 5 and 8 that is

the minimum existence rate (Fig. 13).

As it noticed, the aim of this research is to create a pause space in tourist walkways. In this research rows of seats are selected because of their positions, open views and their perspectives. In next step, we can realize by presented theoretical basics that one of the most important features for a paused space in tourist walkway is providing thermal comfort for visitors which this matter caused a social stable development. The suggested sunshade is natural and green with a close height to walls of surrounded buildings as the side bed is a historical - cultural texture. This sunshade has minimal intervention into the texture. This matter is performed to have an ecologic and a green city. The sunshade is designed that to have maximum shading in warm seasons while not be an obstacle from the sun shine in cold seasons. The sunshade is made by deciduous plants. Finally, by checking this sunshade in Ecotect program it can be realized that the rate of shading on the seats through three warm months (July, August and September) is 60%, 57% and 58%. The minimum of shading is in cold seasons. The mean of provided shade by a sunshade during a year is calculated

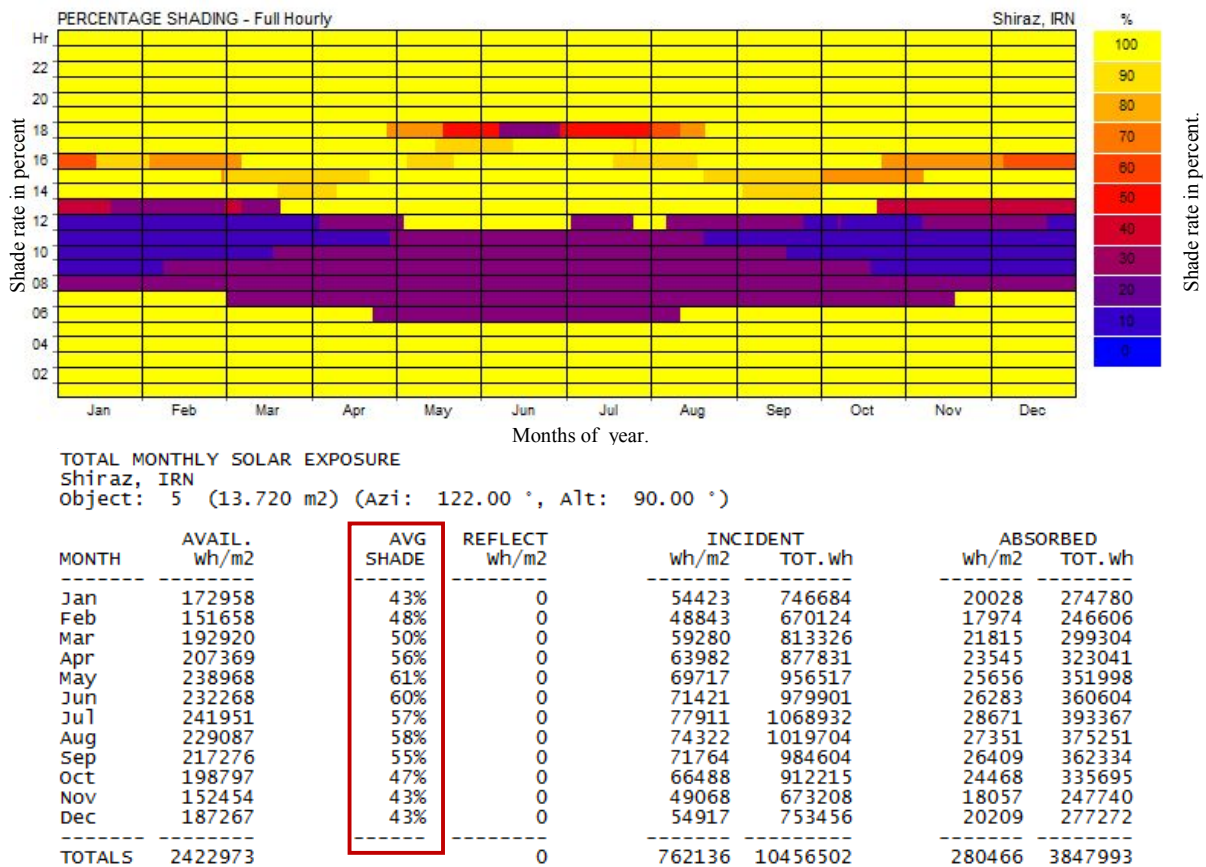


Fig. 14. Analysis of sunshade's shading on the seats during a year.

into month divided in the red rectangular (Fig. 14).

ENDNOTES

1. Description for fig. 2a-
 1. Aerial photograph from direction's position.
 2. Karim Khan Zand castle.
 3. Karim Khan Zand castle.
 4. Melli bank Shiraz central branch.
 5. Melli bank Shiraz central branch.
 6. Pavilion building of Pars museum.
 7. Vakil bazaar.
 8. Vakil bazaar.
2. Description for fig. 2b-
 9. A 180 degree picture from the specific are.
3. CIB -Is an abbreviation for "International Council of Building".
4. ASHRAE - Is an abbreviation for "American Society of Heating, Refrigerating and Air-Conditioning Engineers".

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