J. Appl. Environ. Biol. Sci., 4(12S)38-46, 2015

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Comparison of the standard equivalent temperature (SET) in the houses of Yazd (case sample: the house of Lariha, Arabzadeh, Shokuhi, Golshan, Mahmudi, Lariha2, Olia)

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Received: November 21, 2014
Accepted: January 25, 2015

ABSTRACT

The architecture of Iran's desert cities shows important points about designing urban and residential open spaces. It is trying to provide an opportunity for easy life for its residents in spite of its environmental conditions. Man was always looking for a way to achieve comforts; therefore, from providing shelter and making food to conditions in which human feels comfortable are all considered as the factors of his comfort. The standard equivalent temperature (SET) is one of the effective factors in determining the thermal comfort. The aim of this study is the relationship between the index of the thermal comfort of standard equivalent temperature (SET) and its effective factors in the residential open space. This study is in an analytical-descriptive method. Several houses were selected as samples in Yazd due to its special climate and the minor effect of climate on the houses of Yazd. Then, field observation was performed there and the amount of SET was calculated for each house by Ray Man software. Considering the samples, it was determined that the index of SET is within the limit of comfort in the considered houses. It shows the undeniable minor effect of climate on open space, moderating the environmental conditions and energy saving..

KEYWORDS: standard equivalent temperature, SET, houses of Yazd, thermal comfort, climate

1. INTRODUCTION

Building designing is the first defense line in front of the climate factors out of the building. Climate designing is a way for decreasing energy cost of a building in all aspects in all kinds of weathers. The buildings designed to the principles of the climate designing decrease the necessity of the mechanical heating and cooling to the least and use the natural energy around the building in turn(Watson and Lebz, 1937:4). The role of the open spaces in adjusting the climate conditions is very important for users in Iran due to the variation and severity of climate in the desert districts. They can make different conditions in the view of minor climate due to the establishment, dimensions and proportions and used material (Tahbaz& Jalilian, 2011, 89-131). Not paying attention to the sustainable basics of Iranian traditional architecture and its effective various factors has left the urban texture a worn out body. Technology advancement is a necessity which cannot be ignored, undoubtedly. However, it shouldn't risk our values especially in the field of environmental sustainability. Maintaining the temperature balance between human body and its surrounding means maintaining the temperature of internal textures of the body in a certain limit despite high variability of the external environment. One of the most important designing factors for human is providing climate comfort in different spaces (public/ private, open/closed). Researchers like Giovanni (1988) believe that the main aim of urban designing and architecture in hot and dry districts according to their climate should be decreasing the amount of stress caused by the weather in the people (Giovanni, 1988:6).

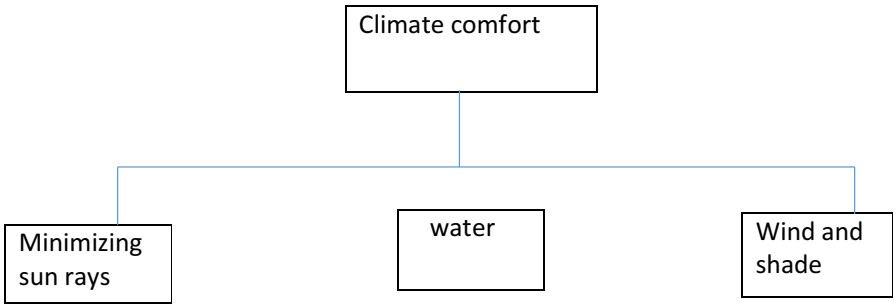

Figure1. The graph of providing climate comfort in hot and dry districts (reference: Giovanni)

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2. The Standard effective temperature

The effective temperature is the temperature of the static air saturated by the water vapor which can make the same feeling of thermal comfort without radiation as it is possible in a real environment .The standard effective temperature (SET) is the most comprehensive temperature index for human activities and in fact it is equivalent with temperature in the standard environment. It is the temperature of an environment whose relative humidity is 50% and air is quite. This temperature is equivalent with the mean temperature radiated from a healthy human body in the same environment so that he receives the same temperature as he loses with the standard level of covering in the temperature exchange with the environment (Gauge, 1986). So, the effective temperature cannot be a fixed number and it is dependent to the physiological conditions, the amount of cover and the activity rate of human. It is usually obtained by the graphic method on the empirical graph.

Table1. the threshold amount of SET index in the different degrees of human sensitivity(reference: Matzarakis et al)

Comfort factor	Factor SET
Extremely hot	More than 30
sultry	to3027/5
Very hot	25.6 to27.5
hot	22.2 to 25.6
comfort	17.8 to22.2
cool	15.5 to17.8
Very col	16.7 to15.5
cold	1.67 to -10
Very cold	-10 to -20
Extremely cold	Less than -20

3. Effective factors in thermal comfort (SET) in the residential open space of hot and dry climate

Considering the effective factors in the conditions of thermal comfort and satisfaction rate from open space depend on mental factors as well as the environmental factors. Temperature index like SET can be used as a reference in evaluating the preference of the individuals in the physical factor of minor climate. The quality of open spaces is closely related to the condition of the minor climate as a part of its physical environment.

Minor climate factors strongly effects temperature feeling as well as using open spaces. Although there may be an unconscious reaction toward the environment, different climate conditions relate to various applications of open space and it may lead to a different seasonal application pattern. Air temperature is the most important meteorological parameters of open space effecting on the indoor conditions. Some air and temperature exchange can be achieved by opening and closing the windows. The temperature of the walls of the buildings can highly increase because of absorbing sun radiation during the day. So, the structure of the surface, temperature capacity and temperature conduction play certain roles in surface temperature. Simply saying, we should be able to change the climate factors such as humidity, air and temperature current in a positive direction by suitable designing of house using two recent factors of the surface temperature of the wall internally and externally related to each other. The effect of wind: wind and its running in the space and complete ventilation effect on the comfort conditions by the cells and trapdoors. But comfort in the open space largely depends on the amount of sun radiation so making shade is the best way for improving thermal comfort . However, the effect of wind is less than that of the shade in different ways. The amount of shade is somewhat determined by its direction. A long rectangular east- west yard has the least shade and the least comfort. Therefore, the direction of the open spaces can improve their temperature behavior and at the same time have their effect regardless of the angle direction of the sun and wind.

4. The architectural features of the houses of Yazd

The traditional architecture of Iran in the desert districts has a rich and strong support of different sustainable aspect, so studying these features can be served for planning, designing and publicizing today's life setting. In following, the special architectural features of the desert districts (Yazd) will be studied. Improving the capability of the building in providing indoor spaces which provide climate comfort and need the minimum energy spending is one of the goals of sustainable architecture in dry and hot districts.

Table 2: the features of the houses in Yazd (reference: Golkar, Kasmaii, Ghobadian)

The main form of the building	Square plan, pressed design, introspective, very high, central yard in the center of the building, very thick brick and adobe walls built for tolerating the heavy load of the domed and arched ceilings. These walls decrease the temperature changes during day and night (Ghobadian, 2003, 129). The clear indicator of jam: it is the ratio or the result of dividing the surface of the building exposed to the natural conditions to the covered surface (the sub base area) (Golkar 2000:49). The best form of the secondary building loses the least temperature in winter. So, the square plan of the best form has the least external area although it is the most voluminous (Kasmaii 1999:116).
orientation	South-east south (less heat absorbance), the sever sun radiation cause elongation in the direction of east-west (Kasmaii, 1999:116).
material	High temperature capacity and the light color of the building reflect the light of the sun. Abode and brick are used as material. They were provided from the local sources. The late اپیرنیا بوم آورد called it and proposed it as one of the principles of desert traditional architecture (Golkar2000:49).they get hot late in days and lose their temperature late at night times. Balancing the temperature change in during day and night.
Inactive systems and equipment	In the desert cities, elements and establishments like windward, reservoir, glaciers and water and wind mills provided cheaper services which are now provided by the electrical devices like cooler, refrigerators and etc by spending energy

5. Common factors in achieving thermal comfort (SET) in the houses of Yazd

We will consider the climate strategies in achieving comfort in the houses of Yazd in following table.

Table 3: the factors making comfort

radiation	**It is the main factor determining the rate of comfort in the yard**
The effect of wind	It ventilate the air by the open trapdoors and cells above the earth, canals and by spinning in the house; wind canaling entering from canal to the yard decrease the air temperature 2-3 degrees. The trapdoors on the ground (sub base window) increase the air current and temperature changes in summer and it has a vice versa effect in winter; therefore, all of the trapdoors should not be closed in winter. They prevent the heat to waste and the entering air current. The effect of yard on the temperature function of the building can make natural ventilation and thermal comfort in the spaces which have trapdoors toward outside environment and are effective in improving heat conditions around the house. The amount of SET will increase 9-12◦c in the conditions of minor wind according to the analyses of Morakami.
shade	There is no temperature difference between the area with shade and without shade. Making shade is an important factor for decreasing the temperature tension outdoor. According to the analyses of Morakami, vegetal shades can decrease the temperature of the ground surface about 2-4◦c and the amount of SET about 7.5◦c.
proportions	The height of the building is one of the features of the architecture in the hot and dry districts. The proportion of width to the height plays an effective role in making shade. In summer, the wall prevents extreme heating in the yard by preventing the severe radiation of the sun. The height of the southern veranda plays an applicable role due to its orientation. It is recommended that the yard to be 5m-7m-9m-10m high.
The shape of plan and orientation	The proportions of the plan should be designed in a way that the amount of heat obtained from the north and south views equals that of east and west fronts in the hottest time of the year. $$\frac{L}{W} = (E + W) + (N + S)$$ According to this formula, the proportion of the plan should be 1 to 1.57 to obtain the least energy during the hottest day of the year.
The area of cover and humidity	Trees in the places with shade can more increase the level of comfort. Vegetal and tree covering and adobe floor covering have cooling effect in summer and heating effect in winter. Water pools have the same effect on their surroundings. Trees and water pool decrease SET a lot. Spraying water on the floor of the yard is an effective strategy to cool the yard in summer. Trees decrease the amount of SET about 0.5 unit.

5.1 Field study in Yazd

At first, seven houses were selected in Yazd with suitable distances from each other in the historical texture of Fahadan, Sahl ebne Ali and the square of Amir Chakhmagh. It was tried that the selected houses to be different according to their scale (small, medium and big) and to have a yard, an internal and external yard and the hole of garden. They had all of the special architectural capacities of desert. Sampling was performed during 5 consecutive days from 21-24 of December, 2012 between 8a.m to 3p.m. the relative humidity and dry temperature was recorded by a portable device and Fish I image capturing was done at the same time.

5.2. Method of doing the task

The portable device was turned on for 5-10 minutes. It was placed in the height of 1-1.20 meters from the earth to be adapted with the ambient temperature. Then, the dry temperature and relative humidity were recorded in four fronts and middle of the yard. Fish I image capturing was done at the same time in the distance of 50-60 cm from the wall and 20-30 cm from the earth. The collected information was entered in Ray Man software after sampling and the amount of SET was calculated by the software.

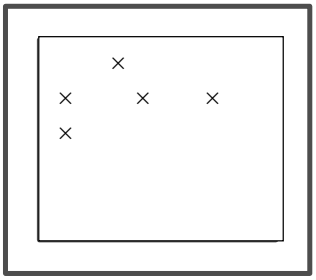
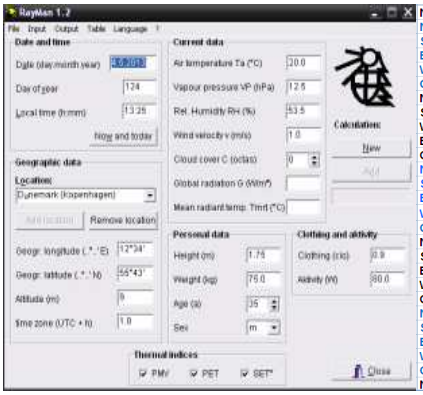


Figure2: method of performing the task (reference: the drawers)

6. Method of calculating SET by RayMan software

This software is designed by Dr. Anderbas Matzarakis et al (1999) in order to calculate the radiation fluxes especially in the urban buildings and it is applicable freely. It is one of the suitable methods of calculating the average radiation temperature. It is used for calculating SET too. It can calculate SKV,PMV,PET. There is a window for entering data like day, year, hour, month, dry temperature and relative humidity in the model of RayMan. Having entered the information of this part of Input menu, we enter the Fish I image (the factor related to the sky view). Then, the software calculates the amount of SET according to the introduced information. Urban terrain like buildings The factor related to the view of sky is one of the important capabilities of this model. The amount of cloudiness of the sky and its effect on radiation fluxes, the role of shade making of natural and artificial phenomena are considered in this model. It is possible to calculate hour average, daily average, duration of sun radiation, radiation fluxes of long and short wave with and without topography in this model.



Name	Data	Day	Time	Sun rise	Sun set	Gact	Sact	Dact	Ts	Ta	Tmrt	PMV	PET	SET	SKV
N-fa-golshan.1	20/12/2	355	15:20	06:49	16:49	257	172	76	21.2	15.9	26.9	0	20.1	19.7	/.802
S-fa-golshan1	"	"	15:29	06:45	16:49	90	0	15.7	15.7	15.9	19.8	-0.7	16.6	16.8	/.794
E-fa-golshan.1	"	"	15:24	"	"	248	172	72	20.6	14.9	25.7	-0.2	18.8	18.9	/.802
W-fa-golshan.1	"	"	15:31	"	"	"	"	75	19.9	14.2	25.1	-0.3	18.1	18.4	"
C-fa-golshn.1	"	"	15:35	"	"	212	134	77	17.5	14	21.1	-0.6	16.2	16.8	1
N-fa-golshan.2	20/12/2	"	15:37	"	"	196	129	67	19.3	15.5	23.1	-0.3	18	18	/.800
S-fa-golshan.2	"	"	15:42	"	"	74	0	74	13.2	14	15.6	-1.2	13.6	14.5	/.808
W-fa-golshan.2	"	"	15:40	"	"	156	98	58	16	13.8	18.4	-1	14.8	15.6	/.800
E-fa-golshan.2	"	"	15:45	"	"	125	75	50	15	14	15..9	-1.2	13.7	14.7	"
C-fa-golshan2	"	"	15:50	"	"	116	66	50	13.8	14	13.4	-1.4	12.6	13.7	1
N-fa-Arabzade	20/12/2	"	14:53	"	"	325	241	84	24.7	16	31.4	0.4	22.4	21.6	/.805
S-fa-Arabzade	"	"	14:44	"	"	349	263	86	23.7	14	30.8	0.1	21	20.8	/.815
E-fa-Arabzade	"	"	14:56	"	"	317	233	83	24	15.6	30.6	0.3	21.8	21.2	/.805
W-fa-Arabzade	"	"	14:47	"	"	341	256	85	25.1	15.6	32.1	0.4	22.6	21.8	"
C-Fa-Arabzade	"	"	14:58	"	"	320	229	92	23.3	15.7	29.4	0.2	21.2	20.7	1
N-fa-lari.honar	19/12/2	354	14:49	"	"	339	251	88	21.3	12	28.6	-0.2	18.7	19.3	/.882
S-fa-lari.honar	"	"	14:52	"	"	339	251	88	20.5	11.2	28	-0.4	18	18.8	/.894
E-fa-lari.honar	"	"	14:50	"	"	337	249	88	20.7	11.6	28	-0.3	18.2	18.9	/.882
W-fa-lari.honar	"	"	14:54	"	"	326	239	87	20.3	11.6	27.6	-0.4	18	18.8	"
C-fa-lariha.hona	"	"	14:54			329	236	92	20	11.7	27	-0.4	17.8	18.6	1
N-fa-shokohi	22/12/2012		10:33	"	"	510	419	91	37.6	22	45.2	2.3	33.5	29.7	/.830
S-fa-shokohi	"		10:25	"	"	498	406	91	32.9	17.5	41.2	1.5	28.8	26.6	/.845
E-fa-shokohi	"		10:30	"	"	505	418	91	32.5	16.6	40.9	1.3	28.1	26.2	/.830
W-fa-shokohi	"		10:35	"	"	512	422	91	36.4	20.6	44.2	2.1	32.2	28.8	"
C-fa-shokohi	"		10:40	"	"	526	429	97	38.5	22.9	45.8	2.5	34.4	32.2	1
N-fa-mahmodi	22/12/2012		16:00	"	"	60	0	60	15.9	16.9	17	-0.8	16	16.1	/.830

Figure 3: the method of calculating SET in RayMan software (reference: Mazarakis)

7. The house of Lariha (unit of cultural heritage protection)

This house is located in the center of neighborhood of Fahadan and it dates back to 150 years ago (middle time of Ghajar). It is about 1700 square meters and its subbase is 1200 sq.ms. it has a central yard. The original and traditional architectural structures of desert is followed in the whole shape of the house. The right public pattern and the life culture of the dwellers are observed there. The used materials are adobe, mud, straw and plaster which are according to the architecture of this region. There is 3 internal and external yards in there. The internal part is toward Ghebleh and consists of a big 21*33.8 rectangular yard, a pool, a stone Pashure and cover area. Measurement was performed on 22 of December, 2012 at 10-10.50 a.m. in this yard. The axis of planting the tree and of the pool is along the north-south walls of the yard and its center which is completely suitable. The area of planting and the pool consist 13% and 8% of the yard, respectively. The yard floor is covered by adobe which has high thermal capacity. The walls are 7.33 m in the yard and 10.5 in the south veranda which are in accordance to the proposed height. The southern veranda of the southern yard is within the SET comfort. There is a little heat tension in the rest of the yard. In sum, the existed heat is suitable according to the month.

Table 4: comparison of dry temperature, humidity, SET (reference: the drawers)

	Middle of yard	west	east	south	north
Dry temperature	30.35	18	19.14	21.28	14.87
Relative humidity	19.51	33.46	30.88	28.59	38.55
SET	27.4	27.8	26.8	19	27.9

8. The house of Arabzadeh (the museum of coin and demography)

This house is located in the neighborhood of Fahadan and it belongs to the period of Ghajar. there are two entrances there one of which is in the eastern front in the arch of the house. The house has a 22*12.20 rectangular yard , a rectangular pool in the middle and vegetal covers. It is elongated from the north to the south. Measurement was performed on 21 of November, 2012 at 3 p.m. the axis of the yard and of the pool is along the north-south walls of the yard and its center which is very suitable. The planting area and the pool constitute 12% and 15% of the yard, respectively. The amount of SET is in the minimum level in the center of the yard with N-S trees because this part is under the shade of buildings and trees. So, the tree and water pool decrease the amount of SET very much in the center of the yard. The center of the yard is closer to the limit of comfort. The walls of the yard and of the southern veranda are 5.5 and 7.5 ms. High which are according to the recommended height. All of the fronts of the yard are in the comfort limit of SET. The yard of this house is smaller than that of Lariha and its more comfortable.

Figure 4: the house of Arabzadeh (reference: the drawers, Dargah)

Table 5: comparison of dry temperature, humidity, SET (reference : the drawers)

	Middle of yard	west	east	south	north
Dry temperature	15.68	15.75	15.32	16.09	13.99
Relative humidity	29.40	31.41	34.02	30.60	32.71
SET	20.7	21.8	21.2	20.8	21.6

9. The house of Shokuhi (cultural heritage)

This building is located in the neighborhood of Fahadan near Masjed Jame' and it belongs to the late of Ghajar and early days of Pahlavi. It has a central yard and three yards including the internal, external yard and orangery (Narenjestan). The bigger internal yard is 18*20.80. the hall and wind ward is located on the southern side. The pool and waterfront are built along the yard and the cover area. The yard of orangery is square and its octagonal pool is in the center. The main entrance of the house is on the west side. It is first connected to the arch and then to the internal part by a L shape corridor. The external yard is in the eastern south. It is smaller than the internal yard and bigger than the orangery. The proportions observed in the building are important from the perspective of aesthetics and suitability with the climate condition. Measurement was performed on 23rd of November, 2012 in the internal yard. The axis of planting and the pool is along the north-south walls of the yard and in the center which is very suitable. The planting part and the pool constitute 24% and 12% of the area of the yard, respectively. the floor of the yard is covered by adobe which has high thermal capacity. The walls are 5.38 and 6.8 m.s high in the yard and southern veranda, respectively; which is according to the recommended height. The southern veranda has the least SET and it decrease the amount of heat tension so it is more comfortable.

Figure5: the house of Shokuhi (reference: the drawers)

Table 6: comparison of dry temperature, humidity, SET

	Middle of yard	west	east	south	north
Dry temperature	22.88	20.62	16.63	17.55	22.06
Relative humidity	34.88	37.6	46.05	43.09	35.31
SET	32.2	28.8	26.2	26.6	29.7

10. The house of Lariha (the college of art and architecture)

This building is located in the center of the old texture in the neighborhood of Sahl ebne Ali (next to the house of Rasulian). It belongs to the late of the Islamic period of "the period of Zandi". The plan is square. The central yard is designed in two stories of "garden hole". The down yard is 14.4*9.4 m.s. brick working of the house causes that the introspective architectural soul dominated to the building to be increased. The designing of the internal spaces are performed in the same manner in the 4 sides of the yard in both stories. The measurement was performed in 20th of November, 2012 at 3 p.m. the axis of the pool is along the north- south walls of the yard and its center which is very suitable. The pool constitutes 7% of the humidity level of the yard. The floor of the yard is covered by adobe which has high thermal capacity. SET is in the minimum level in the center of the yard due to humidity. Because it is the garden hole and its high walls prevents much radiation of sun in most of the points due to being two stories, this house is within the SET comfort in all sides as the house of Arabzadeh. SET is mainly determined in the yard because of the amount of radiation. The walls of down stair yard are 5 m.s high and of the southern veranda is 8.3 m.s high which are according to the proposed height. Trapdoor and cells of the floor of the down stair yard are effective in ventilation and the corridor of the up stair yard causes the running of the air; therefore , they make the environment thermally more comfortable. The temperature in the up stair yard is close to the threshold of SET comfort. This house shows the success of desert special architecture of "garden hole" in providing the comfort condition of human.

Figure 5: the house of Lariha (reference: the drawers, Dargah)

Table 7: comparison of dry temperature, humidity, SET

	Middle of yard	west	east	south	north
Dry temperature	-	13.06	13.45	16.69	12.73
relative humidity	-	34.77	33.06	29.60	34.71
SET					

Table8: comparison of dry temperature, humidity, SET

	Middle of yard	west	east	south	north
Dry temperature	11.70	11.63	11.63	11.61	11.99
Relative humidity	39.03	40.53	38.31	41.26	39.74
SET	18.6	18.8	18.9	18.8	19.3

11. The house of Mahmudi

This complex is consisted of two houses dating back to 130 years ago. It is almost along the western north – eastern south. All of the yards are rectangular and toward GHebleh. There is a big 16.7*24.16 m.s yard there and its small yard is located in the eastern south of the main yard. There are separate entrances for these two yards. The western south front of the main yard is deeper than the other fronts and the hall of the house which is in its center is cross shaped. The measurement was performed on 23rd of November, 2012 at 4:00 p.m. in the main yard. The axis of planting the trees and of the pool is along the north-south walls of the yard and its center, which is very suitable. The planting area and the pool consist 22% and 11% of humidity level in the yard, respectively. The floor of the yard is covered by adobe which has high thermal capacity. There are much smaller shadeless areas in part in which the trees are in the center than the same part with N-S trees. The amount of SET is within a little cool in the center of the yard with N-S trees because this area is under the shade of both the buildings and the trees. So, the trees and the water pool decrease the amount of SET very much in the center of yard. In fact, the trees in the center decrease the amount of the comfort. The

walls of the yard and the walls in the southern veranda are 7.32 and 9.2 m.s high which are according to the proposed height. The corridor near the veranda has effective role in air running and it decreases the amount of SET. The southern and western verandas have shade so they decrease the heat tension of the environment. In sum, all parts of the yard are within the comfort of SET as the houses of Arabzadeh and Lariha.

Figure 6: the house of Mahmudi (reference: the drawers. Dargah)

Table 9: comparison of dry temperature, humidity, SET (reference: the drawers)

	Middle of yard	west	east	south	north
Dry temperature	15.58	16.84	18.28	17.22	16.87
Relative humidity	42.23	40.15	38.80	37.85	41.26
SET	15.8	16	17.1	17.6	16.1

12. The house of Golshan (the hotel of Laleh)

The building is in the neighborhood of Tal and belongs to the period of Ghajar. It includes three connected houses, three yards of the internal and external and orangery. The external yard is 14.77*19 m.s and 5.4 m.s high. The southern veranda is 7.5 m.s. the internal yard is 15.60*12 m.s and 5.4 m.s high and its southern veranda is 7.23 m.s. the height of the yard is according to the proposed height. Measurement was performed on 21st of November 2012 at 15:20 o'clock. The axis of planting the tree and of the pool is along the north-south walls of the yard and its center. The planting area and the pool consist 14% and 11% of the area of humidity in the external yard, respectively. The planting area and the area of pool is 16% and 9% of the humidity area in the internal yard, respectively. The yards are connected to each other by a corridor. The current of the wind and its ventilation are effective on the conditions of comfort. The floor of the yard is covered by adobe which has high thermal capacity. There are much smaller shadeless areas in part in which the trees are in the center than the same part with N-S trees. The amount of SET is in the minimum level in the south of the yard because this part is under the shade of both the buildings and the trees. It is within the a little cool. The trees and the water pool decrease the amount of SET very much in the center of yard. And the center of the yard is closer to a little cool. The southern and western verandas have shade so they decrease the heat tension of the environment. The rest of the fronts of the external yard are in the limit of comfort. The amount of SET is in the limit of a little cold I the internal yard in all fronts. As the house of Mahmudi, we didn't have sun radiation in this house due to the time of the measurement.

Figure 7: the house of Golshan (reference: the drawers)

Table 10: comparison of dry temperature, humidity, SET-1

	Middle of yard	west	east	south	north
Dry temperature	14.07	14.21	14.90	15.88	14.06
Relative humidity	30.55	29.84	28.47	31.85	30.72
SET	16.8	18.4	18.9	16.8	19.7

Table 11: comparison of dry temperature, humidity, SET-2

	Middle of yard	west	east	south	north
Dry temperature	13.29	13.72	13.60	13.65	13.38
Relative humidity	38.44	35.26	35.26	37.74	32.86
SET	13.7	14.7	15.6	14.5	18

13. The house of Olia

This building is located in the square of Amir Chakhmagh next to the mosque and belongs to the period of Ghajar. The internal yard is 36 sq.ms. There is a pool and a stone waterfront in the external yard. It is smaller than the internal yard which is 11.7*14.7 and is connected to it by a corridor. The ceiling of the spaces is measurement was performed on 23rd of November, 2012at 8:00 o'clock. The axis of planting is along the north – south walls of the yard and its center. It is largely near the limit of comfort. The planting area consist 20% of the yard. The floor of the yard is covered by adobe which has high thermal capacity. There are much smaller shadeless areas in part in which the trees are in the center than the same part with N-S trees. The amount of SET is in the minimum level in the western part. The trees have largely decreased the amount of SET in the middle of the yard. The center of the yard is in the limit of comfort. The rest of the fronts of the yard are in the limit of a little cool. The walls of the yard are 5 m.s high which are according to the proposed height.

Figure 8: the location of the house of Olia (reference: Dargah)

Table 12: comparison of dry temperature, humidity, SET (reference: the drawers)

	Middle of yard	west	east	south	north
Dry temperature	13.79	13.8	13.47	13.56	13.6
Relative humidity	51.8	51.3	50.42	49.88	50.12
PET	17.4	13.7	14.1	13.9	14.1

There is a consistency between the measured data in the houses and the mean data of meteorology in December and January. This shows that the measure data are calculated correctly. The mean of SET in each house is in the limit of its comfort which shows the effective strategies of desert architecture in the ambient conditions.

Table13: the mean of dry temperature, humidity and SET (reference: the drawers)

	SET	humidity	temperature
The house of Lariha	25.78	32.36	18.46
The house of Arabzadeh	21.22	31.62	15.41
The house of Shokuhi	28.7	39.13	19.92
The house of Lariha; downstairs	18.88	39.76	11.62
The house of Lariha; upstairs		33.03	13.98
The house of Mahmudi	16.52	40.05	16.86
The house of Golshan, 1	18.12	30.28	14.62
The house of Golshan,2	15.3	36.11	13.52
The house of Olia	15.54	50.70	13.64

14. Conclusion

1- It was established that the traditional architecture of the desert land is completely consistent with the principles of the sustainable architecture by studying the main components of the sustainable architecture with the architecture of the desert district.

2- All of the studied houses were in the comfort limit of standard effective temperature (SET) which causes more applicable use of the space and energy saving.

3- In fact, the traditional city building and architecture in Iran confirm that there a suitable conditions in the central yard with pool and flowers and plants in the desert districts where the air temperature increase to 45◦c. these climate strategies cause energy saving undoubtedly.

4- It is possible not only to provide the comfort in open and closed spaces but also to take a great step toward the sustainable development and to return the lost identity of these city to them by reusing these strategies in the architecture of the desert cities.

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