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Study of Talesh City Architectural Design Based on Regional Climate

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ABSTRACT: Architecture climatology is a branch of applied climatology that affected human life. The structure of buildings in various areas affected by climate and culture. Attention to area climate influences on building design, to increase people comfort, is inevitable. Due to humans are affected by the area climate, climate scientists and architects due to climates in different regions, working together to enhance people comfort. In this study, the case study is Talesh city that located in West of Guilan. It has temperate and humidity climate. To study of area climate and type of buildings and their adaption to area climate, Mahoney indicator is used. Because of the lack of the climatic data of Talesh, Rasht climatic data as: temperature, humidity, rainfall, prevailing wind direction, wind calm percent, cloudy days and sunny hours that are similar to Talesh climate were used. This data are taken from the Meteorological organization which related to the years of 1992 to 2012.

Keywords: Climate, Architecture, Talesh, comfort, Mahoney

ORIGINAL ARTICLE

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INTRODUCTION

Humans are inevitably influenced by their surroundings climate, and the climate determine the kinds of living and the ways of providing his needs. When the first humans to live better brought on to social life, and left their first location, were in caves and rocks, always have tried to have easier, better and more beautiful shelter. Thus, human found in experience how to build a building suitable for any environment (Zahedi, 1998). Building is considered as one of the first human needs, in addition to, the functions of urban housing, are also play an important economic role. Among the natural factors, climate as an important factor affects buildings (Khorani, 2006). Architecture is one of the greatest human achievements in different people and different climate with form, color and various applications (Kasmaee, 2005). Creating comfortable and favorable conditions for life and providing inhabitants security against unfavorable environmental and climatic conditions, are an integral principles of architecture and construction (Moradi, 2005). The influence of climate on architectural in this area, requires comprehensive studies. Especially in Iran, where climatic variability is more evident, extensive research in this area is inevitable. Due to the formation and composition of vernacular architecture in different regions, we find that, different characteristics of each climates have a great influence in shaping of cities and architecture of this regions. Therefore, determining the exact geographical areas in different parts of the country and accessing to climatic information is important to purposed of appropriate schemes and consistent with the climatology of each region. Guilan province and Talesh city are the rainiest region in North of Iran, which have high humidity and hot weather in summer. Therefore continuous rain and high humidity are the first information factor of the architectural area (No pars, 2006). Due to the climatic characteristics influences in buildings, is important in several ways: one, buildings consistent with area climate to provide comfort, have more qualification. In the other hand buildings consistent with area climate can save fuel (Zahedi, 1998). Due to the study, Talesh city architecture is dependent on its culture, however, wood, pottery and ... are seen in Talesh architecture, that indicate the effects of the geographical environmental on the region housing (Rafi far and Ghorbani, 2007). Abdoli in Talesh Nomadic society book, classified Talesh housing in two groups of plains and mountainous (Abdoli, 2001). Buga and ola to determine reliable indicators of heat stress protection in Nigeria, various indicators, including indicators Mahanoy, Evans, Biological graphs, effective climate and temperature compared together (Olu Ola Bogda, 2003). Emanuel studied the effects of land-cover changing on thermal comfort in Colombo Sri Lanka, and concluded that increasing in thermal comfort due to land cover changing, especially are in buildings and roads (Emmanuel, 2005). Frajzadeh and associates studied the Sanandaj architecture due to the environmental and climatic conditions with Mahoney method, and concluded that old town is more consistent with regional climate (Farajzadeh, and, Associates, 2007). Kyfa to provide general information to passive solar energy in urban planning and building design, with Mahanoy tables, analyzed climatic elements in period of 25 years for Nicosia in Cyprus, and calculated and presented the pre-planning strategies (Kefa, 2004). Lashgari and et al with using of synoptic weather data, evaluated the climatic environmental situation in Ahwaz and concluded that the establishment of optimal construction must be stretched in northeast along the North – South side (Lashgari et al., 2011). Sam and Cheng in Hong Kong in a study investigated crucial elements to architectural design and energy of construction, and

suggested that the area climate conditions to improve climate designing and building energy simulation (Hui, Chung, 1997). Sarafroozeh in her master's thesis studied Urmia residential areas with Penn vardan, Mahoney, Tar Jung indicators and also offered solutions (Sarafroozeh, 2007). Zahedi on his research studied about the influences of climate on City Architecture, and concluded that it is better to human comfort that architecture be consistent with regional climate (Zahedi, 1998). The aim of this study is investigation the influence of climate on Talesh architecture.

MATHERIALS AND METHODS

The case study area

This city with an area of 6/2215 Square kilometers is located in west of Giulan province, between Astra city in north, Rezvanshahr in south, Ardabil in west and the Caspian Sea in east. And is located between longitude 48 degrees 32 minutes and 49 degrees 32 minutes east at 38 degrees 16 minutes north. The height of the City center is 80 meters and the height of the sea coast beach is about 5/26 meters. According to the elements of climate such as: Precipitation, temperature (heat rate), current weather, relative humidity, far and near the Caspian Sea and altitude and latitude, Talesh (Eastern slopes of the ridge) has Caspian wet weather in the plains areas and wet mountain climate in the highlands.

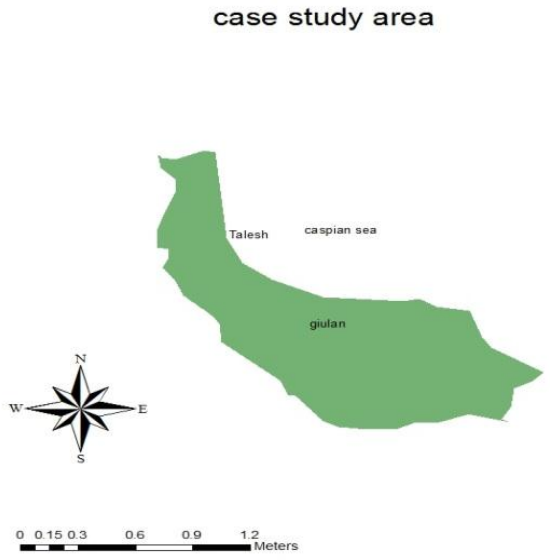

Figure a: the case study area

Talesh climate

Talesh has humid and temperate Caspian climate. This type of climate contains Plains of the Caspian Sea until to the northern foothill of Alborz Mountains. In these areas due to limited distance between mountains and sea, moisture is accumulate. Significant rainfall and moderate temperatures can be mentioned as its consequence. Spatial distribution of mean annual rainfall in the coastal strip of the West to the East is associated with decreasing, however spatial distribution has more or less regularly situation, and the maximum precipitation in autumn and minimum in spring. In parameter of temperature have been observed that due to the high humidity and high number of overcast days, temperature is moderate and the temperature range is limited, this situation leads to hot summers, wet and mild winters with occasional frost. The most important factors that effect on weather, on the coast of the Caspian Sea are:

- Latitude that the amount of solar radiation depends on it
- Atmospheric pressure in neighboring areas
- Alborz mountainous range is located like wall on the north currents and cause precipitation on the northern slopes of the mountain.
- Direct proximity of sea that modified the weather which provide rainfall
- The air masses that effect on Caspian region: high pressure stream of Siberia, Scandinavia and the Mediterranean currents (Zahedi, 1998).

Traditional architectural pattern

Anywhere in Guilan, climatic characteristics causes particular kind of architecture as an outward-oriented architecture, regardless of the technical contradictions and complexity construction and variety in operation of Indigenous and accessible materials, Similarities are seen in the overview of this type of architecture, these buildings are similar in most aspects:

1. Porch and hall on the four walls of building are the most important of living spaces.
2. Place in a confined space surrounded by hall and porch for the winter time
3. residential area elevation of the ground
4. Four-slope roofs and the fast steep of roofs
5. Multiple layers of the Main features and the maximum pore spaces in the outermost surface
6. Comfortable position without wooden satires that connecting house to yard
7. Using plant materials and wood-free coated and Amood (A kind of Straw).
8. Interconnected among inside and outside of the building and even the residential area
9. The simple appearance of houses without plenty luxury-oriented and decorating (Khakpoor, 2006).

Due the spatial organization, Buildings are arranged in decentralized and scattered form. Because of heavy rainfall in this area roofs are built steeply (Zahedi, 2006).

Table 1. Climate characteristics of Rasht in 1992 to 2012

Total Rainy days	Sunny Hours	Percent calm wind	Snow Days	The minimum temperature	The maximum temperature	Maximum humidity	Minimum humidity	Prevailing wind	Average rainfall
163.4	1487..895	64.67	180	11.95	20.46	96.90	67.75	258.75	1177.8

Formation of residential areas in Talesh city

Talesh climate is abiding by Caspian coast, has intensify rainfall, humidity and Thermal equilibrium conditioning (Zahedi, 1998). Talesh Housing and the types of materials that used in its construction, represents people adaption with the environmental conditions. These efforts in plains area are currents in other ways and rapidly exits from depending on nature framework. But in the mountainous area is strongly exist in previous procedure (Abdoli, 2001). In plains, wooden materials are used less than others. Conversely mountainous areas still using clay and straw for covering the roof. Although Aleppo and Granit recently are most common, frame houses and enclosures often in the past were made of wood and mud. But baked bricks and stone blocks are replaced with them. Most houses are built in low thermal capacity, weight and thickness of building materials has been kept in minimum. Natural ventilation and air conditioning are most common in all of these areas, generally buildings have large open plans with long and narrow geometric shapes to maximum use of wind for ventilating the rooms. Where wind is strong and long, wind ward parts of building are completely closed (Zahedi, 1998). Totally Talesh buildings are in two groups: 1- The plain houses 2- Highland housing (Abdoly, 2001).

The plain houses

The complete set of plain houses which used in farmer's family, is composed of the following units:

✓Ka: residential unit with wood-frame which sheathing is thatch and roof is lined up

✓Kerej: is barn of straw, that also have a straw roof covering

✓Kuti: a five meters square building, without full walls, and has long ceiling and tapered, with a very steep gradient, which is located on the wooden Column. The inside of conical roof is the location of accumulating burden

✓Dua –Ka: A building that is constructed near the house and most of the cooking is done here on warm days

✓Teliavar and garma-xuna: The first room is a salon with different width and length that the walls are made of anchoring, reed and wood. The second one is a relatively small enclosure that walls are made of adobe.

Nomadic

✓Takhta- ka: Residential unit in a cube form with two slopes roof which extends on length of its sides.

✓Pargah**:** a residential unit that similar to takhta ka but the ceiling is arched and covered with black Tent.

✓Ovala: (temporary tempt) is made of tree branches, covering with black tent and the ceiling is in arched shape. Ovala is temporary house, that farmers use it in pastures.

✓Gac-parga: Like Parga and its inside space is three parts: first part is farmer location, the second part of the whereabouts of the Lambs and third part is hostel of animals.

✓Vuna: Emergency stalls that is used on cold days

Non-tribal

- Ka: is similar to traditional plain houses, the roof is covered with a black tent.
- Barn: Overnight animals accommodation
- Store: Similar to kerej and is used for storing hay
- Gaca: Is small place that made of wood, and calves are kept in it
- Karja- lun: Implantation fowl (Abdoli, 1992).

Talesh city has hot and humidity summers, during the months of June to September is controlled with air conditioning. To deal with these problems the following strategies have been proposed:

- Providing shade from opening the roof
- Air conditioning through the construction of scattered tissue
- Air flow around and under buildings through the creation of an outdoor on

Open space around the building

- Using shade and wind (day and night) with porch or hall (Tahbaz and jalilian, 2011).

Annual rainfall over 2000 mm is the other properties in this area, following strategies have been implemented to deal with it:

- Rain water draining with sloping roofs
- Controlling wind through the opening roof to prevailing wind
- Controlling rain with lowering the edge of the roof to ground
- Due to the low radiation in the house the windows are made in height
- Building materials are: wood in the parts of the buildings, and low thermal capacity materials.

Mahoney Index

Mahoney method is in four series of tables, in this method with the mean annual temperature and the mean monthly relative humidity, determined the comfort of each location, then according to the parameters, features of the building are determined on climatic condition (Sarafroozeh, 2005). Now the architecture of Talesh city on its climate is studied in Mahoney method:

Table 2. The Mahoney tables

location	Rasht
Longitude	49 39 E
Latitude	37 21 N
Sea level	36.7 M

Table 2-1. Temperature

MONTH INGRIDENT	January	February	March	April	May	Jun	July	August	September	October	November	December
Average Maximum Monthly	11.155	10995	12.84	19.657	23.845	28.16	30.37	29.925	26.705	21.825	16.945	13.23
Average minimum monthly	-2.72	-2.745	0-..45	4.12	9.505	14.99	17.205	17.8	13.325	8.745	3.115	-0.88
Average Monthly fluctuations	8.43	8.1	12.79	15.55	14.34	13.1	13.17	12.12	13.38	13.08	13.83	13.14

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Maximum	30.37
minimum	-0.45

Table 2-2. Relative

Humidity group	
Relative humidity is less than 0.030	1
0.050 -30	2
0.070 -50	3
More than 0/70	4

Table 2-2. Relative Humidity

Relative humidity	**January**	**February**	**March**	**April**	**May**	**Jun**	**July**	**august**	**September**	**October**	**November**	**December**
Average Maximum Monthly	96.95	97.05	97.3	96.5	96.75	95.4	95.15	95.7	97.05	98.1	97.8	97.1
Average minimum monthly	71.15	70.1	71	64.1	63.15	60.5	60.8	64	68.6	72.7	73.75	72.25
Average	25.8	26.95	26.3	32.4	33.6	34.6	34.35	31.7	28.45	25.4	24.05	24.85
Humidity group	1	1	1	2	2	2	2	2	1	1	1	1

Table 2-3. Rainfall of case study

	January	**February**	**March**	**April**	**May**	**Jun**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Rainfall	17.46	126.856	109.125	55.695	47.585	40.54	38.605	76.295	163.825	235.925	189.27	143.555	1364.745

Table 2-4: Wind

Month	**January**	**February**	**March**	**April**	**May**	**Jun**	**July**	**August**	**September**	**October**	**November**	**December**
Prevailing wind	N	N	N	N	N	N	N	N	N	N	N	N
Second wind	NW	NW	NE	E	SE	SW	EN	EN	EN	EN	EN	EN

Table2-5: Comfort

	Annual average temperatures over 0.20		**15-0.20**		**Less than 0.15**	
humidity	day	night	day	night	day	night
1	26-34	17 -25	23 -32	14-23	21 -30	12 -21
2	25 -31	17-24	22 -30	14 -22	20 -27	12 -20
3	23 -29	17 -23	21 -28	14 -21	19 -26	12 -19
4	22 -27	17 -21	20 -25	14-20	18 -24	12 -18

	January	**February**	**March**	**April**	**May**	**Jun**	**July**	**August**	**September**	**October**	**November**	**December**
Average Maximum Monthly	11.155	10.995	12.84	19.675	23.845	28.16	30.37	29.925	26.705	21.825	16.945	13.23
The high level of comfort Day	30	30	30	30	31	31	31	31	31	32	30	
Low comfort Day	21	21	21	22	25	25	25	25	25	25	23	21
The average minimum Monthly	-2.72	-2.745	-0.45	4.12	9.505	14.99	17205	17.8	13.325	8.745	3.115	-0.88
The high level of comfort Night	21	21	21	22	24	24	24	24	24	24	23	21
Low comfort Night	12	12	12	14	17	17	17	17	17	17	14	12
Thermal conditions Day	cold	cold	cold	cold	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate	cold	cold	cold
Thermal conditions Night	cold	cold	cold	cold	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate	Appropriate	cold

Table 2-6: Mahoney Indicator

	January	February	March	April	May	Jun	July	August	September	October	November	December
Humidity												
H1												
H2												
H3										*		
Aridity												
A1			*	*	*	*	*	*	*	*	*	*
A2												
A3	*	*	*	*						*	*	*

Table 2-7: Meanings of indicators

	Temperature condition		Rainfall	Humidity	Fluctuation
	Day	Night			
Airflow is essential	Hot			4	
	Hot			2 & 3	Less than 10
Optimal airflow	Appropriate			4	
rain Protection			More than 200		
Heat capacity is essential				1 & 2 & 3	More than 10
Free space is essential for sleep		Hot		1 & 2	
	Hot	Appropriate		1 & 2	More than 10
	Cold				

Study area	Indicators of thermal status					
Preliminary proposals Architecture	A3	A2	A1	H3	H2	H1
	7		9	1		

Table 2-8: Style of Building

Length of the building along the east-west	1	*	10-0*				
		5-12	11,12				
Compact architecture backyard	2	14-*0					

Open wide collection to using yard	3						11,12
As above - to prevent wind and cold conditions	4						2 – 10
Compact set	5	*					×0 ،10

Air flow

Predicted steady stream of air to all rooms	6								3 -12
Arch sticking predict airflow	7	*			0-5				1,2
					6-12				
						2-12			
There is no air flow required	8						1 & 0		0

Openings

Large openings 80-40	9		0		0& 1			
Very small openings 10-20	10	*	1 & 10		11&12			
Medium openings 20 - 40	11						Any other conditions	

Walls

Built-style, low-latency	12				0-2			
Inside and outer heavy walls	13	*			3-12			

Roofs

Style roofs with thermal insulation	14	*		0-5				
Heavy roofs with a time delay of more than 8 hours	15			×6 -12				

Outer Space

Forecasting space for sleeping in outdoors	16			10-12				
Forecast rain gutters	17	*				10-12		
Protection against heavy rains	18	*			3-12			

Dimensions openings

Big 40-80	19		0		0-1			
Medium 4-20	20							
					2-5			
Small 25-15	21	*			6-10			
Very small	22		0-3		11-12			
Medium	23		4-12					

Openings Position

The north and south walls of the body height and height	24							12-3
					5 -0			2-1
Same as above, also openings in interior walls	25	*			12 - 6			
								0

Openings Protective

Avoid direct sunlight	26		0-2					
Protection against rain	27	*				2-12		

Walls and floors

Lightweight and low thermal capacity	28				0-2			
Heavy delay time up to 8 hours	29				3-12			

Roofs

Lightweight and low thermal capacity	31				2-0			10-12
Light and Heat	32				3-12			
					0-5			0-9
Heavy delay time up to 8 hours	33	*			6-12			

External details

Local forecast to sleep in the open air	34			2-12				

According to Mahoney tables, Building should be in the east-west direction and encompassing compact set, arches stuck and compact direction of air flow, Very small opening, exterior heavy walls, and style roofs with thermal insulation, forecast rain gutters to protection against heavy rains, small openings of 15-25, position openings like this, the openings in interior walls, pop shield protects against rain, the walls are heavy with delay time up to 8 hours.

RESULTS

The aim of study of Talesh city architecture and consistent with the climatology, to minimize the costs of heating and cooling of buildings and providing comfort of people. Talesh city has Caspian region climate, high rainfall, abundant moisture, and hot summers, to cope with these characteristics, providing the welfare of people, that Buildings designing should be adapted with the climate. Summary of climatic design of Talesh is as follows:

- Using building materials which adapted with environmental condition
- Building on a wooden base to protect from moisture
- Steep roofs and gables forecast
- Building windows in high elevation to penetrate light into homes
- Use the front canopy roofs to protection light and rain
- Building on south face

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