

Investigation of the Compliance of Architectural Principles of Sustainable Architecture in the Traditional Context of Tabriz: A Case Study of Tabriz Municipality Hall

Elham Kazemi¹, Rasoul Darskhan², Parna Kazemian³

¹East Azerbaijan Science and Research Branch, No. 15, Mehragan Alley, Abresan, Tabriz

²East Azerbaijan Science and Research Branch, Municipality of Tabriz

³East Azerbaijan Science and Research Branch, No. 61, Moze deadlock, Daneshsara Street, Tabriz

*Corresponding author's E-mail: elhamkazemi85@yahoo.com

ABSTRACT: Paying attention to human life and the preservation of its present and future, using materials in the manufacture or use or even destruction that are homogeneous and stable with their environment, minimum use of fuel energy and maximum utilization of natural energies, minimal environmental degradation, improving physical and mental lives of humans and all living things in a healthy environment is a priority for the use of the vernacular architecture can be observed clearly. This paper examines the applicability of the principles of sustainable architecture in the traditional context of an architectural monument (Case Study: Tabriz Municipality Hall). In this study library method was used to check the contents. The results showed that this architecture is often consistent with sustainable architecture. Local buildings are considered dynamic, because they supply their needs with respect to energy on their site and they are compatible with the site and its climate.

Keywords: Sustainable Architecture, Vernacular Architecture, Tabriz Municipality Hall

ORIGINAL ARTICLE
 PII: S225204301500020-5
 Received 13 Aug. 2014
 Accepted 25 Jan. 2015
 Revised 28 Mar. 2015

INTRODUCTION

By studying the local structure in each region, it is clear that all local buildings, are absolutely designed and constructed based on climate and energy in order to make maximum use of natural resources and confronting cold and hot weather, harmony with nature and the environment by taking advantage of the inherent location (relying on indigenous materials) traditions of each of the provinces, preservation of reasonable relationship, the unity between the material and the design of the building are of the main Iran Vernacular architecture specification (www.chtn.ir). Advances in technology and the increased use of fossil fuels results in disregard for nature and have caused increasing damage to the environment. Thus the society seeks to address this problem and find a solution for the following and the term sustainability is in question (Georgi Mahlbani, 2010). Sustainable development is proposed in various sciences and careers, including architecture and urbanism and it roots back at ecological crisis and uncontrolled consumption of fossil fuels in the world. General topics such as global warming, increasing greenhouse gases in the atmosphere that cause global warming. Air and water pollution, soil and climate cause to intensify efforts against environmental degradation and increasing the indiscriminate use of limited fossil energy (Shaghghi and Mofidi, 2009).

Iran Vernacular architecture has an important element in the evaluation of these principles that can be found in common with models of sustainable architecture. Among principles of sustainable architecture, reducing the consumption of natural resources and energy resources due to the coordination of building with earth, making modest changes in the use of renewable and recyclable materials

and maximum protection of the environment nature surrounding the building can be noted. In this study, architectural features, climate, geography and vernacular architecture of Tabriz were investigated and then introduce the architecture of Municipality Hall and the rules and techniques employed in this building, sustainable architecture patterns arise. Then comparative analysis of sustainability indicators has been discussed with the Municipality Hall.

Statement of the Problem

Studying Tabriz Municipality Hall is an architectural indicates that due to the cold climate of Tabriz, in the construction of this building, principles and techniques of sustainable architecture such as using the basement, using the canvas material with high heat capacity Municipality, confronting heat and cold to deal with disruptive human comfort and maximum use of sunlight, shadows and ... that Vernacular architecture has been widely used in the area.

Purpose of the Study

The purpose of this study was to evaluate the adaptability of the traditional principles of sustainable architecture of traditional and Vernacular Tabriz architecture context and especially the Municipality's Municipality Hall building and design strategies to achieve climate design of the buildings of this period, in order to use them in designing new buildings and unlimited use of clean energy and reducing pollution from fossil fuels.

MATERIAL AND METHODS

The research methodology in this paper is descriptive and analytical. In this study, firstly the concept

of sustainable architecture and then analysis of vernacular architecture of Tabriz and the principles of sustainable architecture discussed and finally compliance of sustainable architecture patterns in Tabriz Municipality Hall building are analyzed.

Hypothesis

It seems the principles of sustainable architecture in the old vernacular architecture of Tabriz were applied at Municipality Hall.

Literary Meaning of Sustainability

In Dehkhoda's Dictionary sustainability means durable and lasting. In Moein Dictionary, the term means sustainability and resilience of "Monitoring" infinitive meaning stability and endurance (Dehkhoda Dictionary). The verb Sustain is composed of the Latin root Sustainer and the two components Sus (ie bottom-up) and Tinere (meant to keep - keep up) and has been used in English since 1290. The verb is mixed with concepts such as "support and sustain" and the adjective Sustainable is used in describing "terms, conditions or something," which is supported or has continued due to aid or livelihood (Golkar, 2000).

Definitions of Sustainable Architecture

Sustainable architecture dates back to the 19th century. John Ruskin, William Morris and Richard Lethaby are the vanguard of sustainable architecture. Ruskin says in his book, "The Seven Architecture Torches" that modeled to achieve progress on the nature of the harmonic order. Morris suggested returning to the countryside and green spaces of self-sufficiency and reviving local industries. The purpose of designing sustainable buildings is to reduce damage on the environment, energy and natural resource exploitation, which includes the following rules:

1. Reduction of consumption of non-renewable resources
2. Natural Environment Development
3. Elimination or reduction of the use of toxic materials or harmful materials in the construction industry. (www.pdfactory.com)

However, the following general definitions of sustainable architecture can be raised:

- Building that has the least incompatibility and inconsistency with the surrounding natural environment and in the wider area of the region and the world (www.pdfactory.com).

- According to the OECD Scheme sustainable buildings are the least damaging to the environment made (synthetic) and natural, their immediate vicinity and surrounding area, as well as their general background. Sustainable Buildings consider entire lifecycle of buildings, environment quality, good performance, and the future (Organization for economic cooperation and development).

- The application of sustainability concepts opens new discussions in architecture called ecological sustainable architecture, green architecture, eco architecture, that meets the needs of the present generation without compromising and taking into account the ability of future generations in meeting their needs (Golkar, 1967).

- A development that meets the needs of the present ability of future generations to meet their needs without compromise. In this definition, there are two key concepts:

The concept of "needs," in particular the essential needs of the poor world should be assigned to which priority and more importantly the topic "limit" due to the presence of technology and social organization on the environment's capabilities to meet present and future requirements are imposed (www.unisdr.org).

Using natural resources in a way that natural systems find opportunities to rebuild them and avoid the contamination caused ruining biological systems (www.web-sawy.com).

Principles of Sustainable Architecture

Principles of sustainable architecture is given in the following table (Table 1)

Table 1. Principles of Sustainable Architecture (Qyasvnd, 2006)

The building needs to be constructed so as to minimize fossil fuels.	Article I - conserving energy
The building should be designed in coordination with the climate and energy in construction site	Article II - harmony with the climate -
Buildings should be designed in such a way to reduce the amount of new resources as possible and at the end of its useful life is used to build new buildings as a new source.	Article III - reduced use of new resources, materials
In sustainable architecture meeting the spiritual and physical needs of the residents are of particular importance	Article IV - meeting the needs of residents
Be compatible with the surrounding environment.	Article V - Coordination with site
All the principles of sustainable architecture in the whole process should lead to the construction of a healthy environment	Article VI - holism environment

Studied Region

Tabriz is the capital of East Azerbaijan Province. is located 46 degrees 25 minutes east longitude and 38 degrees north latitude and two minutes of the meridian of Greenwich, its height is 1,340 m above sea level (Shaghghi and Mofidi, 2009).



Figure 1. Map of Iran



Figure 2. Map of Tabriz

Table 2. Characteristics of Tabriz (Information provided by the Tabriz Meteorology)

Population	Frost Days	Annual Rainfall	Altitude	Space	City
7780 People per square km	104 days	310 mm	1348 to 1561 m	23745 MM	Tabriz

Table 3. Vernacular Architecture of cold and mountainous climate (the authors)

	<p>In Tabriz buildings are in the north and south. To protect rooms from winter the windows are built double, two windows that the internal window is toward the interior room and the other opens to the outside</p> <p>The spatial structure</p>
	<p>In Tabriz, due to cold weather, thick walls are usually made of mud bricks and the roof is of straw. vegetation help Adjusting environmental temperature and also has a lot in controlling wind</p> <p>Building materials and vegetation</p>
	<p>In order to have an optimal utilization of solar radiation energy, it is needed that the buildings have a larger South facades (with a standard deviation of 12.5 degrees to 12.5 degrees toward the southeast to southwest) and small eastern – West facade</p> <p>The physical form</p>
	<p>Direction, wind speed, and range are important features of wind and in fact the differences in wind are in the direction, blowing speed of the winds. Winds are also influenced by geographical factors. Mountain ranges influence wind direction and broader water level influence wind temperature and wind influence. Due to the effect of wind on urban design study for climate element has been an inevitable necessity.</p> <p>Wind</p>
	<p>Because of cryogenic seasons in most cold and dry areas ventilation should be avoided as much as possible. And only in a brief period of summer we need air. Average width of the arteries and half-pressed city context creates natural ventilation. The street orientation toward favorable winds is also an important factor in the city's ventilation.</p> <p>Ventilation</p>

Tabriz Municipality Hall

Tabriz Municipality Hall was constructed in 1314 at the abandoned and dilapidated dormitories cemetery under the supervision of German engineers during Mayoralty of Haji Arfa Mulk Jalilii. The building has a four page clock tower with his bells toll every 15 minutes once, reminding passing of time to the people of Tabriz. Tabriz Municipality hall facade was carved of stone and building plans correspond to sample buildings in Germany before World War II.

The building is located in the center of the Municipality of Tabriz in a field called Time Square and currently all the civil and administrative affairs of the town of Tabriz are centered in this Hall (www.tabriz.com).



Figure 3. Tabriz Municipality Hall



Figure8: Northwest staircase



Figure7: Tabriz City council Hall



Figure1: Museum



Figure6: The central staircase

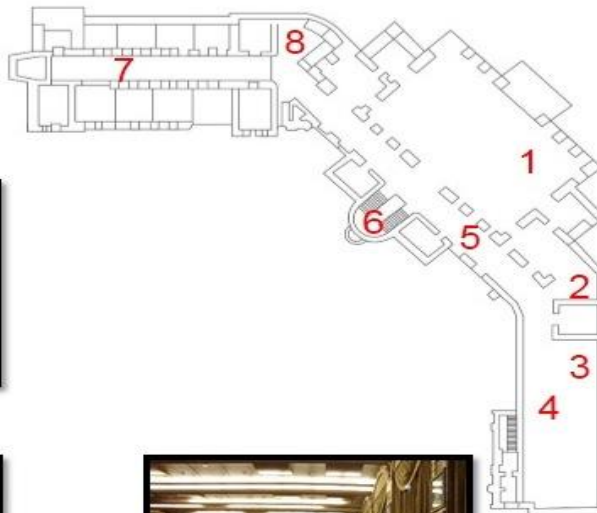


Figure2: Museum



Figure5: Museum



Figure4: Mayor Museum

Figure 4. Plan(Authors)



Figure3: Museum

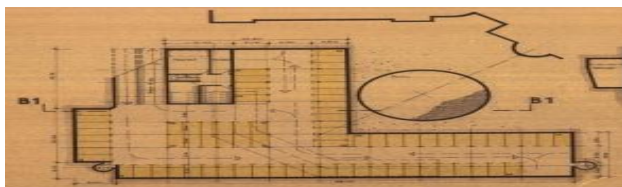


Figure 5. Parking Plan (Authors)

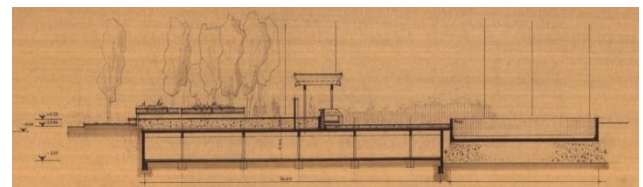


Figure 7. Parking Plan (Authors)

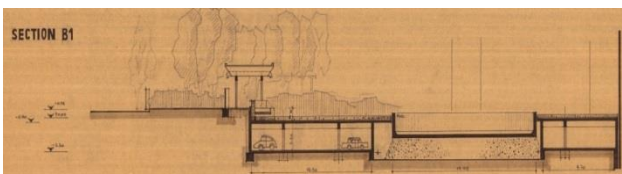


Figure 6. Cut B1 (Author)

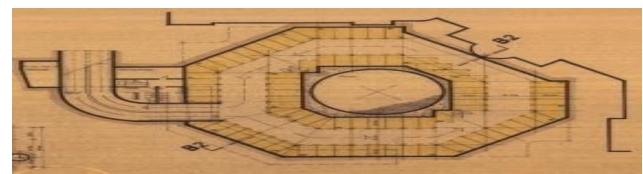


Figure 8. Cut B2 (Author)

A Comparative Study of Vernacular architecture and Sustainable Architecture Patterns Used in Tabriz Municipality Hall. The orientation and proportions of the building: In Vernacular buildings of this region houses have a summer and a winter part, rooms used in summer are located on the north side so that surface is always in the shadow acts as a barrier to the penetration of cold in winter to the interior parts of the home. In winter rooms are located on the south side of the building to make most of the sun's radiant energy.

The south is ideal for main facade and entrance.

For optimal utilization of solar radiation energy in this region it is necessary that the building be in a shape drawn with larger South view and deviation of 12.5 degrees to the southeast to 12.5 degrees southwest and a proportion of 1 to 1.3 to 1.1 in the East - West.

On the south side is chosen to be larger due to the greater amount of solar radiation energy absorption during the winter (Figure 9) (Shaghghi, 2004).

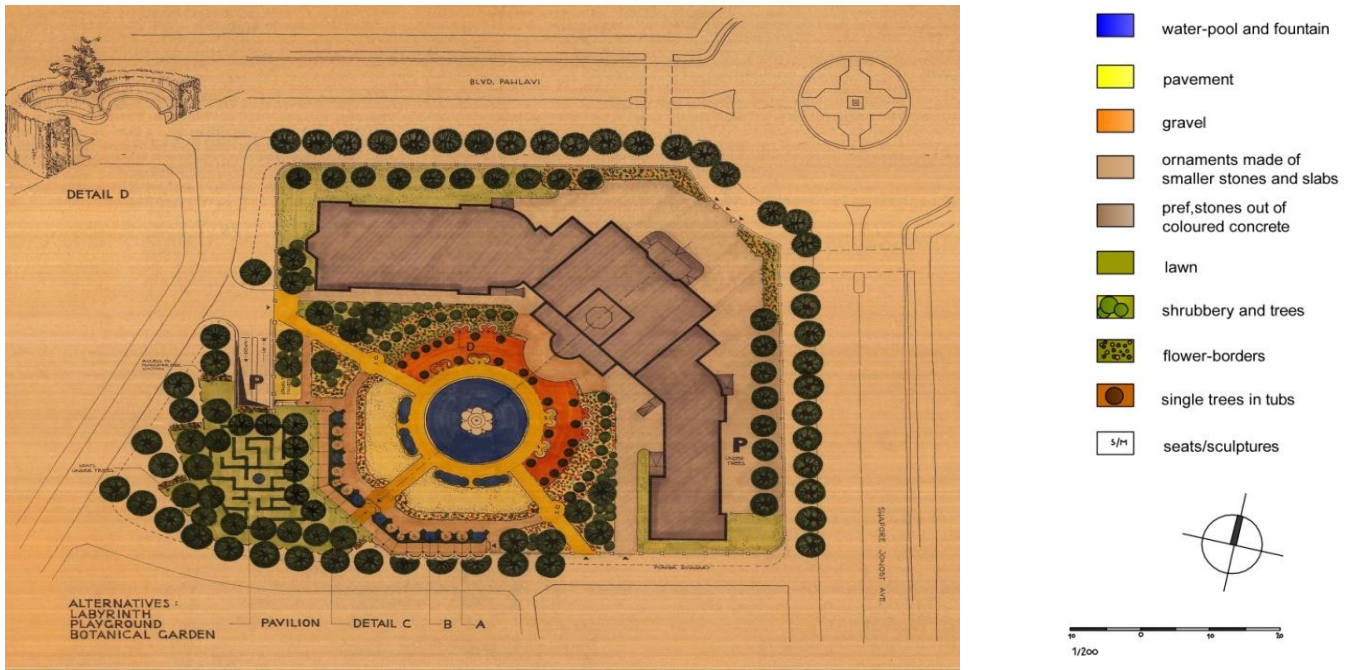


Figure 9. Municipality Hall building orientation

Components and building materials: all components of the building in cold areas should be carefully designed to help create suitable tiny climate. The amount of heat penetration depends on the materials of the ceiling, ceiling of walls, etc. that penetrate from and stores in these elements in warm days and in cool nights releases the heating elements and makes the interior warmer. Body building in cold climates is composed of stone, wood, clay and bricks (Shaghghi, 2004). Materials used in floor and front yard of Tabriz Municipality Hall are of Esperakhon stone (Figure 10). The building is of brick walls (Figure 11). The roof of the building of railway lines was out of service because there was no Welding machines at that time railroads were riveted together with a pin (Figure 13). Wood used in window frames are of Arasbaran forest tree Ardosh or Ardoch woods which were resistant against climate change and had anti-willow cover (Figure 12) (Khamachy, 2009).

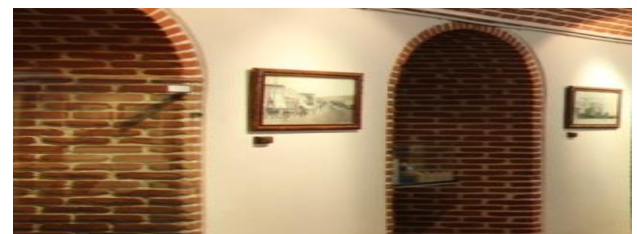


Figure 11. Bricks used in interior wall



Figure 12. Woods used in window frame



Figure 10. Stones used in the façade

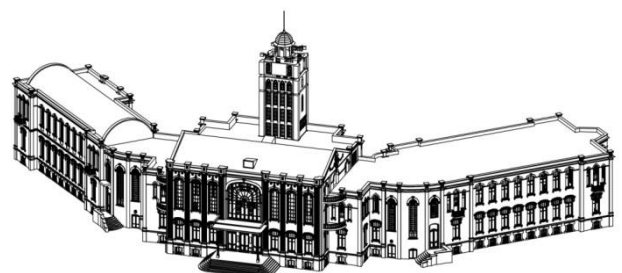


Figure 13. Roof

Use veranda in the building: Since most days of the year in the mountainous areas are cold or very cold most of the daily activities are done in the rooms. Thus, yard dimensions in these areas are somewhat smaller than the area of the Central Iranian Plateau. Buildings in this region have porches that are not used as living room but solely to maintain Drawing upon inputs from rain and snow (Figure 14) (www.parastooderakhshan.blogfa.com).

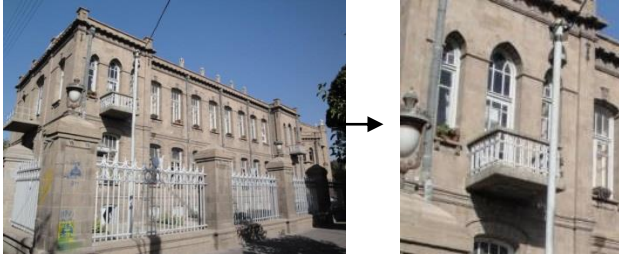


Figure 14. Porch of the building

Openings: In cold climates to prevent heat exchange between interior and exterior building small openings are used few in number. Openings on the south side are selected for much larger and more elongated, high Sunlight (Figure 15). In case of larger windows, using awnings or window placement is required at depth (Figure 16). It is better in cold climates between interior and exterior space, to use a space as a filter in order to minimize the heat exchange between inside and outside space of the building (Figure 17) (Khamachy, 2009).



Figure 15. High and Brushed Openings in southern facade



Figure 16. Setting depth in the window shade



Figure 17. Space as a filter

Thick walls: In cold climates due to cold weather and to prevent it thick walls are used to keep the temperature at equilibrium (Figure 18) (Goodarzi and Morsali, 2011).



Figure 18. The diameter of the inner wall of the building

Water and vegetation: Vegetation and healthy environment helped to adjust the air temperature and has an important contribution in wind control. Deciduous trees as summer shelter are perfect against the sun. The trees that lose their leaves in the fall are also suitable for better absorption of sunlight in winter. Therefore it is better to plant a belt of evergreen trees as a wind break from the northwest to the southeast and to take advantage of sunlight deciduous trees planted in the East and the West and South buildings. Vegetation used in the Municipality Hall, includes black pine, willow, Flosch (Hindi) and deciduous trees on the south side and decorations plants. The trees on the south side are mostly deciduous trees that in summer create shade and in winter the loss of leaves bring sunlight into the building (Figure 19). Fountain on the southern side of the site caused moisture and cool air in summer (Figure 20) (Khamachy, 2009).



Figure 19. Vegetation



Figure 20. Fountain

CONCLUSION

Traditional and Vernacular buildings and monuments are dynamic, because they supply their needs for water and energy in the site and not only compatible with the site and its climate, but share their environment changes, work without pollution and produce no waste work harmful for other types of processes or directly usable in the environment. In this study, the characteristics of vernacular and traditional architecture in Tabriz (Case Study: Municipality Hall) were investigated so this as to note the influence of traditional and vernacular architecture of the building. In examining patterns of sustainable architecture in Tabriz Municipality Hall, the use of materials with high thermal resistance and capacity, the use of solar energy and the use of elements such as porch were built to protect the entrance from rain and snow. In the Municipality Hall climate measures such as placement in dense urban context, proper building orientation with respect to climate, use of underground water and vegetation in the front yard, all of which indicate adaptation and sustainable architectural principles used in the Municipality Hall resulted from examining the principles of sustainable architecture employed in Municipality Hall architecture.

Acknowledgment

Here we need the appreciate efforts of Mr Khamachy, Mr. Pakdel, Mr. Eyvazi, Mr. Khayati, Mr. Irani, Mr. Sadidi.

REFERENCES

- Dehkhoda Dictionary, p 47.
- Georgi Mahlbani, J. (2010). Sustainable architecture and its criticism in the environment", Tehran, Iran Journal of Architecture and Urban Planning, No. 1
- Ghobadiyan, V. (2000). An Investigation of the Traditional Buildings Climate, Tehran, Tehran University Press, p. 42.
- Golkar C. (2000). Sustainable Urban Development in the desert cities" Tehran, Fine Art Magazine, No. 8
- Goodarzi. S, Morsali M. (2011). An Investigation of sustainable architecture elements of traditional architecture in cold climates (Hamadan)" Hamadan, Sama cultural and educational center. Information provided by the Tabriz Meteorology
- John Ruskin (1819-1900). Professor of art, architecture critic.

- Khamachy B. (2009). My city Tabriz, Tabriz, Neday Shams Organization for economic cooperation and development
- Qyasvnd J. (2006). Interaction of Architecture and Renewable Energy (stable). Tehran, Building Magzing No. 38
- Shaghghi Sh, Mofidi, S. (2009). The relationship between sustainable development and design of buildings for cold and dry climate of Tabriz" Tehran, Environmental Science and Technology, No. 10
- Shaghghi Sh. (2004). Clean energy at home, ways to reduce fuel consumption," Tehran, municipal Journal, No. 70
- William Morris (1834-1896). Architect, painter, poet, winter.
- William Richard Lethaby (1857-1931). Architect. www.chtn.ir, Secrets inherent in traditional Iranian architecture
www.parastooderakhshan.blogfa.com
www.pdfactory.com
www.tabriz.com
www.unisdr.org, Brondland Assembly (1967).
www.web-sawy.com.