Research Article

ADJUSTMENT OF DESIGN OF RESIDENTIAL HOUSES WELL SUITED WITH LOCAL ARCHITECTURE AND CLIMATE (AMOL)

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ABSTRACT

Biological spaces at any region have been formed under influence of cultural, environmental, social, historical and political origins of that region. Without doubt, the early memories and experiences of the man develop at house with an effective role in the world view of any man and as the result the world view of the society. In attention to the man, how to work, lifestyle, man’s experiences and expectations in design of modern house and turning to the imported architecture, crisis of dwelling, low quality of life, annihilation of life, vitality, mobility, sense of belonging and identity. This study examines the elements which develop traditional houses in Amol and their existential factors. Amol traditional house likewise rest of regions in Iran has been developed well suited with environmental, cultural, social and economic conditions. The main purpose of this research is to detect features, principles of formation and spatial species in Amol traditional house and extraction of efficient elements from this house so as to record some of these elements and their existential reasons in addition to receiving the organized concepts and principles of the traditional house in the region under study. The combined descriptive-analytical and historical-interpretative methods have been considered as the research method in this study, conducted by studying documentary sources, presence in historical fabric of Amol, talking to the residents of fabric and interviewing with the architecture professors. The results from this research indicate physical and semantic features of different spatial species in Amol traditional houses in form of tables, images and maps so as to pave the way for proposing design approaches for the modern house well suited with new needs and human values.

Keywords: Residential House, Local Architecture, Climate, Amol

INTRODUCTION

Environment and house in the context of environment as well as the building have been mentioned as the novel and permanent inventions by the man at any culture and civilization, having novelty, desirability and complexity at all dimensions (Abdolhosseini, 2011). Houses have been regarded as the most fundamental and beautiful samples for the local architecture which have been formed well suited with the climate conditions of the region, local materials, construction methods, lifestyle, culture and tradition of any region (Sozen, 2007). The product of architecture in the past has been in line with the environmental conditions, seeking for maintenance of users’ comfort and expression of identity of the society (Ahmad Ali, 2011). Decorating is the only way to get rid of the weight of the world and also, due to the embargo and a ban on the image in the Muslim lead to the specific and philosophical world for Muslim artist. He looked at the nature and discovered the balance in the universe and the nature and by understanding the components of nature led to the art creation. However, the main cause was the contemplation in the nature and universe did not claim the existence of the alleged imitation of nature. There are many decorative signs and images of nature in Iranian art. In a general survey, an intelligent design in favor the human and environment has been considered in the physical structure of traditional houses and an attempt has been being made by the designers of local houses at any time and place to induce life to humanism through making a friendly relationship between environment, culture and form of architecture spaces (Basiago, 1999). It can mention principles of design for these buildings as sustainable environmental design systems (Baran et al., 2011), that particularly the house enjoys a particular status in Iran’s civilization (Haeri,
Traditional houses in historical fabric of Amol represent a successful sample of the man’s effort to create living space by creating utmost material and spiritual convenience under hard climate conditions. Nowadays, inattention to these houses has increased to an extent that if we hesitate on it, all the cultural, identity and architecture values behind non-original contemporary constructions will disappear. An effort to record features and patterns of these houses together protective approaches can be a way to maintain them and avoid forgetting them under deterioration.

**Aim of Research:** aim of any historical research lies on positive effect of recognition of historical learning and use of experiences of the past for today and future in the society, but it should be noted that overview of vernacular buildings is not followed by mimicry from the past and negligence of conditions, but contemporary buildings must develop well suited with human and environmental conditions based on use of new technologies, techniques and materials (Sozen, 2007).

This research intends to study residential spaces in Amol old fabric so as to recognize and record the principles of the traditional housing through proper study on concepts and avoid forgetting these principles.

**Literature Review**

Under development of historical regions in cities around world, excessive deterioration of these regions occurred under “modernization” based on concepts and theories of International Congress of Modern Architecture. Under destruction of ancient sites and establishment of new buildings, unity and uniformity of housing system in organic fabric of historic cities were ruptured. Since the 1960s when modern architecture was questioned, a respect and positive attitude towards historical areas and tendency to conservation, restoration and utilization of old houses began.

In the same decade, the Italian architect "Aldo Rossi" in the book “city architecture” proposed elements and characteristics of the historic fabric of the cities. In addition, hundreds of published books and articles in the 1960s and 1970s paved the way to the recent movements in architecture and urbanization with an emphasis on traditional and historical values (Etesam, 1998). Traces back to the past and attention to residential units for holding International Exhibition of Building and Construction as the inner city area, a place to live in 1957 in Berlin, are considered with 3 objectives: extraction of the model from the past architecture and urbanization for new design, repair the damaged city, the reconstruction of the destroyed city.

Robert and Netware in the book "Complexity and Contradiction in Architecture " in the early 1960s put an emphasis on the need to use symbols and signs in the design of new buildings and proposed our house itself using the existing patterns of traditional houses of the region. Reza Haeri in the book “house, culture, nature”, believes that study on architecture of the traditional houses can be used to access architecture patterns of modern houses in Iran. Gholam Hossein Memarian has characterized traditional houses of Iran based on climate and culture in the book “an Introduction into residential architecture in Iran, introvert and extrovert typology”.

**Research Method**

In this research, two methods have been used to achieve result. Descriptive-analytical method has been used in the first stage by study on library sources, others’ experiences and characterization of documentary information and interpretative-historical method has been used in the second stage by interview with residents.

**Definition for Concepts**

*Concept of House and Residence:* Concept of house has been the same in all territories, but it can infer that people’s evaluation from residential environments differs with little hesitation and attention to diversity of individual perception from lifestyle, needs, demands and values. In Table 1, different definitions have been proposed by theorists who have published their research in the context of architecture of houses and the principles to develop them in books and articles.

*Concept of Vernacular Architecture:* Vernacular architecture which is often called architecture without architect has been mentioned as the most meaningful product by the man that has differed in trajectory from an area to another area well suited with environmental conditions and culture of people at any place,
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appeared at any region well suited with the values. Indeed, vernacular architecture is proposed with the titles such as spontaneous architecture, people, rural, folk, traditional, unpretentious architecture (Falamaki, 1986).

Climatic Characteristics of Amol

With regard to division of Iran’s climate into four climate: mild and humid (Caspian Sea southern coasts), cold (the Western Mountains), hot and dry (Central Plateau) and hot and humid (south coasts), Amol has been located in Mazandaran province and mild climate, for which it can mention the climate features as follow:

Humidity

Humidity is called to an amount of water which exists as vapor in the air. High humidity is mentioned as the climate feature of Mazandaran. Relative humidity percent is very high in this area, exceeded from human comfort (Kasmaee, 2008).

Rainfall

High rainfall in all seasons of the year is another significant climate indicator of this region, which this rate increases in both summer and winter.

Temperature Moderation

Unlike other regions of Iran in which there is high temperature difference between warm and cold days, in this region the temperature is moderate, so that air temperature ranges from 25 to 30 degrees Celsius in summer and usually above zero in winter (Qobadian, 1998).

Vernacular Architecture Principles to Mitigate Climate Indices

Temperature Moderation

Ground floor above the ground surface (Ghobadian, 1998)

Creation of bilateral openings and use of ventilation

Use of current and ventilation is seen in all the vernacular buildings of region (Ghobadian, 1998).

Residential Units as a Complex

Unlike the buildings built in other climates of Iran which have a central courtyard and other building elements have been centralized around this yard, in this climate buildings are found decentralized and scattered due to high humidity greater use of air flow (Khakpour, 1385).

Reduction in Effects of Rainfall

Use of Ivan around building

In order to protect the building from rain, balconies have been created around the rooms (Yousef nia Pasha, 2006).

Steep-Slope Roofs

Due to the high rainfall, there are steep-slope roofs in this area. In some of the buildings, the prevailing winds on roof extend to a lower altitude (Qobadian, 1998).
The materials well suited with climate
In this climate, wood is the construction element in the region due to abundance of mass and scattered forests (Kasmaei, 2008).

Table 1: The Principles in Compliance with Vernacular Architecture in Moderate Climate (Kasmaei, 1999)

<table>
<thead>
<tr>
<th>Type of External Color</th>
<th>Fabric of Complex</th>
<th>The Extent to Use Ventilation</th>
<th>Number of Windows</th>
<th>The Linkage between Building and Ground</th>
<th>The Direction to Sun</th>
<th>Type of Roof</th>
<th>Typ of Plan</th>
<th>Type of Material</th>
<th>Type of Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Scattered</td>
<td>High</td>
<td>High</td>
<td>Wooden Bases</td>
<td>East to South</td>
<td>Steep Slope</td>
<td>Extended</td>
<td>Low</td>
<td>Thermal Capacity</td>
<td>Moderate</td>
</tr>
</tbody>
</table>

General Features of Vernacular Architecture of Region

Extrovert Architecture
Extrovert buildings are called to the buildings which are in connection with their external space including urban elements such as path, passage and other external factors and their internal spaces have the same connection with external space.

These buildings have been built with public architecture more in mosques and holy shrines and residential architecture in different regions of Iran especially in Caspian Sea coasts. A major difference in other buildings especially buildings in central part of Iran lies on an element named yard. Yard in introvert architecture merges out to in, in addition to connective and cohesive functions, whereby most of internal spaces are opened such that the house will have very little linkage with outside. These functional and connective affairs in extrovert houses have assigned to different elements.

Features of vernacular architecture at moderate and mild regions

General features
1-use of indoor balconies around rooms to protect the rooms from rain
2-use of construction materials with least thermal capacity
3-use of extensive and open plans to use wind blow to create ventilation and current inside the rooms
4-establishment of buildings in direction of sea blowing to create natural current
5-decentralized organizing of buildings to use air flow as much as possible
6-steeped roofs due to high rainfall
7-construct building on wooden bases to protect it from excessive humidity of land
8-construct building in western-eastern direction to use sunlight and natural current
Form of Building in Mild and Moderate Climate

Direct effect of climate factors has been recognized in formation of organisms. There is a public rule in natural history which says that the spaces which can adapt themselves with environment, adjust themselves with the materials of their fabric and adjust themselves with internal and external forces, can sustain on their lives. Although the air temperature of moderate regions is to the extent which provides the flexibility in plan of building, expansion of plan along western-eastern direction seems necessary. Concerning the sun radiation and its effect on form of building, there is more freedom of action in these regions, because sun radiation on walls at different directions of building even eastern-western walls is less than other regions. As a result, it can use open and even cross-shaped forms in these regions, but it is still necessary to extend the form of building along eastern-western direction.

The establishment direction of building in mild and moderate climate

In general, selection of establishment direction of building depends on the factors such as natural status of ground, the extent of need to private spaces, control and reduction of sound as well as wind and sun radiation. The major duty of an architect is to establish the building in a direction to acquire the utmost use of sun light in connection with thermal, health and mental conditions.

Creation of current and ventilation in mild and moderate climate

Creation and continuity of current in internal space is the most important factor for creation of convenience in buildings of these regions. Therefore, it must pay a particular attention to the points below in design of building with creation of current inside the building. Height of building from the ground surface is a determinant for amount of wind pressure on building and as a result a determinant for amount of use of wind in creation of ventilation in the building. The buildings which are taller than the trees and buildings around them have better conditions in terms of creation of ventilation than rest of buildings.

In general, in moderate regions due to high importance in current creation, the building direction must be determined in connection with direction of desirable wind blowing so as to use the wind flow in current creation as much as possible. Yet, when color of exterior surfaces is dark or the windows are large and without shelter, attention to radiation of sun and energy from it in different directions is of great importance. In moderate regions, designer of building must pave the way for creation of current in all the rooms, thus, the buildings which include the apartments with an external surface in suction area (leeward) will not be beneficial for these regions. Surplus of size of windows over a certain limit to be protected against sun radiation is not of great importance. It can create current inside the building even with small windows provided that they are in a suitable area in connection with wind blowing. Yet, when there is not
the possibility to create current, large windows will be useful in cooling the indoor air. Further, creation of influential shelters for such windows is of great importance, but creation of shade on large windows especially in case they are in western or eastern windows is difficult. Concerning creation of ventilation and current inside the rooms, it should pay a particular attention into this point that the leading air flow must be conducted to an area in which the residents live.

Residential Architecture

Vernacular architecture of north of Iran has had a particular identity such that all the elements and components of this architecture will be not just subjected to a predetermined coordination but also a natural composition under local conditions, whereby the body proportions will be filled with harmonized composition of vertical, horizontal and diagonal lines. Common features of residential units can be known as match with environmental, social, cultural conditions, application of common construction technique, homogenous materials, spatial order and their special visual qualities as the unity factors. The important factors in creation of diversity include influence from external conditions such as size, form and position of houses, needs and facilities of owner of house, functional needs and quality of constituent elements and components of units.

An Introduction into Several Old Residential Units

Khane Shafahi

Shafahi’s house was built in Qajar era in Amol, Iran, Niaki quarters, Ayatollah Javadi Amoli Dormitory Street, in the old texture of Hasannejad alley which was desirable in the market access and the city center. It has two courtyards in north and south and it was accessible by two doors which were open in the main passageway (Lonji, 1992). The most beautiful view of the building was its sash windows which were located on the main road. It is one of the oldest buildings of Amol, Iran which has almost rectangular plan and consists of 2 floors. The first floor consists of five rooms that make up the public sector of the building. The second floor has one bedroom, two bedrooms with three-door sash. A prominent feature of this building is two-way air conditioned in the building and the extroversison form. The hallways in the building or space division were responsible for organizing spaces. There are roof pottery flooring, decorative building stone, sash windows and skylights lattice. Most materials used in the body of this building were most the building materials and wood and glass were used in the doors and windows construction, the roof was made of wood and the roof was made of pottery.

In the eastern part of the house, stucco decorations were established in Arabesque designs and birds in the form of parrots or phoenix the legendary bird is on both sides of the sash windows. The Qajar windows like all the old houses, made in knot wood or the Persian term puzzle knot. Windows were opened sliding form. There were observed the two columns on the east side of the arches with plaster and wooden vaulted knot in the middle with two windows with wooden light which can be seen in the upper part. In the interior of the main room or reception hall there were observed the stucco decorations of birds and arabeque designs, etc. Also, in the northern and southern parts of the house in reception hall there are three doors which are two ways. The same room in Qajar era which had is six doors and wee to wind turbulences in the hot season. Cypress decorations in the northern and southern parts of the house were
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established with painting. This building had two courtyards in north and south and was recorded with the number of 17802 as national work of the country in 2006. 03. 5.

Figure 6: Plan of Ground at First Floor of Khane Shafahi

Moghim's House

Moghim's house is located in Niaki, Amol neighborhood with registration plate number of 788 and related to Qajar era. In the vicinity of the old city of Amol, Iran which is in a desired location in the market access and it is in the city center. The building was built with a rectangular plan in the east to the west and constructed on two floors and a large pottery crock with multiple food storage installed on the bottom. The first floor had a winter mode and was perfect for summer due to the multiple windows on the second floor and wind. Yard was in the southern part of the building that included a kitchen, pool, kitchen and a crypt. At present the kitchen does not exist, but the pool and the crypt are covered with cement and mud. The building has the plaster decorative and wooden lattice windows, sash with colored glasses, skylights and pottery roofing. In the sash windows the wooden knot or in terms of Persian the puzzle knot were seen. And there are three drawers with metal handles. The Cypress motifs of this house are located in the South side of the house with the protection of birds on either side of cypress tree. Moghim's house was recorded with the number of 15627 as a national work of the country in 2006.06.18.

Figure 7: Moghim's House in Adjacent with Khane Shafahi

Darzi House

The house is situated in the village of Pasha Kola in Amol, Dabudasht, Iran. The owner of this house was Mehdi Sultan who was an officer of Muhammad Ali Shah in Qajar era. Haj Mehdi Sultan's house dating back to the reign Qajar was made with the rectangular plan consisted of a room of three doors and two terraces which were used in winter and summer. Each floor had two warehouses that were used for storing food. There was a brick pond in the front yard which most of it has been buried in the soil. It was built with the Common materials of that period included stone, rubble, brick, lime mortar, mud, wood and pottery. The southern facade of the building at all levels of internal and southern view was decorated simply by plaster coating. Designs of the building were included plaster coating in the internal surfaces with geometric images, flower and bird pattern. And red stone with Berry Seeds methods were used in the southern porch columns of the building. Which was included the very beautiful images of Cypress and were observed in the walls of the south porch. The beauty of the building has been doubled. Also, attract
newcomers. This building was recorded with the number of 5936 as a national work of the country in 2002.07.30

**Figure 8: Haji Ali Arbab House (Darzi House)**

**Manouchehri’s House**
Manouchehri’s house was built in Qajar era in Niaki quarters of Javadi Amoli Street, Alley of Shahid Hasannejad, and the old texture of Amol, Iran. It was built on Qajarian architecture style with rectangular plan on two floors and a basement which were all the elements of a Qajar house. It had Korsi in the east to the west for more than from the sun and a north-south yard. There are plaster decorations wooden sash, colored windows, lion head roof and pottery capped (Ayaz, 2005). The construction of the building was made of Qajar and Pahlavi’s era, which was made with arabesques and floral arabesques projects like the brickwork in the box around the Arabesques using stucco in Qajar era.

**Figure 9: Image of Manouchehri’s House in Qajar Era**

This building was built with sash windows in the north with three wooden doors of wooden knot design and with three wooden doors in the south at the top of the semicircular holes with wooden knot design and colored glasses. Materials such as bricks, wood, stone, limestone and glass, etc. were used in this building. Cypress decorative left hanging in this house which was built around the inner wall of the courtyard of the Qajar era glaring. This house was recorded in national index with the number of 21989 as one of the national works of Iran in 2007.03.17.

**Yousef Malek House**
Yousef Malek house has been located in Ghadi neighborhood at Qajar era in which some changes have been brought about at Pahlavi era. The terrace across river in Shahroud and decorations on walls as well as special order of openings are the architecture features of this house.

**Hashemi Niaki House**
Hashemi Niaki house has been located in Square centered at Niaki neighborhood in adjacency of Sadat Niaki hosseinieh. History of this house dates back to Qajar age. Yet, during this age, numerous changes have raised in façade of this house.

**Amiri House**
Amiri house has been located in Ghadi neighborhood dated back to Qajar age. Pattern of openings and proportions of façade are interesting in this building.
Figure 10: Plan of Ground Floor and First Floor in Malek House

Figure 11: Malek House besides River in Shahroud (Qajar & Pahlavi)

Figure 12: Hashemi Niaki House

Figure 13: Amiri House

Malek's House
Mr Malek's house was built in Qajar's style, in Niaki neighborhood, alley next to Abraham's shrine and Qureshi's house in the old context of Amol. It is desirable in terms of market access and city center. The building was decorated by plaster, wood lattice windows, sash windows, skylight and pottery roof. The
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house has a courtyard on the east and there is a sigh of river which is called Ahi-rood in the west. In the southern part of the house there are stucco decorations and floral and arabesque designs painted in blue and the sides of the bed frame has been on the wall. The ground floor has been transformed in the same style, but the second floor is also in Qajar's style. In the western part of the house, like all houses of Qajar there are motifs of painted Cypress but not as beautiful as other houses' Cypresses.

Figure 14: Houses of Malek’s Brothers in Ibrahim Holy Shrine Street

The elements in residential architecture of historical fabric of Bushehr

Table 2. Typology of house in studying architecture of residential units

<table>
<thead>
<tr>
<th>Element</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door window</td>
<td>The linkage between spaces, ventilation</td>
</tr>
<tr>
<td>Semi-door</td>
<td>Arc light supply</td>
</tr>
<tr>
<td>Shelter</td>
<td>Air passing</td>
</tr>
<tr>
<td>Collared glass</td>
<td>Diversity, light supply, avoid entry of flies and mosquitoes</td>
</tr>
<tr>
<td>Radiation</td>
<td>Shade on walls and corridors</td>
</tr>
<tr>
<td>Wooden shutters</td>
<td>Ventilation, avoidance from disturbing visions, avoidance from sun light to space</td>
</tr>
</tbody>
</table>

Residential houses in Amol have been influenced of different climatic, social and economic factors as well as type of materials, among which climatic factors are accounted as prevailing factor. Form of the houses in old fabric of Amol is diverse. The houses have been built under influence of this form and ground position, taste, demand and economic facilities of residents in different forms and various dimensions, manifested in the old fabric. The hierarchy to achieve spaces of residential units includes:

Public area

This area has been developed from collector grid with winding streets (seven streets), deadlock or halls. Here, it should be noted that corridors, dead end alleys and seven alleys enjoy symbolic index in most cases, inducing concept of territory. Symbolic parameters can be index through the difference of surface between the passage and dead end alleys. The above indices indicate private space than public passage which can be the sign of household residence and/or a particular tribe in that alley or ownership sign of several households than the alley. After passing the public area by means of intermediate space, we enter into the next area by means of entrance door and fence. Concerning study on residential units of old fabric in Amol city, we face an interesting point which is division of the houses belonging to Qajar ear or the early Pahlavi era through wall inside the house. In some cases, with regard to the substantial length of
plaques (rectangular elongation of house) than their depth, the traditional houses have been manipulated and divided into two or three parts. In this regards, performance of cultural barriers of past have been assigned to brick walls.

Semi-private area

This area includes several yards; after the yard, the connection space has been developed from elements of Ivan, stair and/or corridor, where a combination of Ivan, stair and/or corridor is often witnessed.

Private area

This area is usually developed from room, hall (three-door and five-door) and kitchen and the rooms have enjoyed several functions called with ‘poly functional’ comprised of sleep, living and entertainment functions (Flexibility - open plan). With regard to the way for composition of spaces in residential units, since the cities in Mazandaran province have been the central villages which have transformed to village-city and then city, the early core enjoys rural and vernacular architecture characteristics that is accounted as the architecture with identity in these regions, whereby this core gradually has been found with different forms under expansion trajectory.

Figure 15: Hierarchy and Spatial Organization in Shafahi’s House
1 - yard, 2 – Ivan, 3 – dal, 4 – wardrobes, 5 – seating, 6 – stall, 7 – Staircase, 8- three-door, 9 - five-door, 10 - pond, 1 – Stock, 12 – stable, 13 – toilet

Due to adjusted nature, architecture of houses in Amol and old fabric of city are open and extrovert. In general, the Ivans are witnessed between closed spaces of rooms and open spaces of yard which avoid wear due to severe rainfall in the building, however, the rain direction exposes the western front of building to wear.

Figure 16: An Image of Three-Door Space of Darzi House

Vernacular houses of Amol are one-story or two-story, built in eastern-western direction and at the center of yard. Major space of living has been developed from several rooms and indoor ivan which is located in southern front of rooms. The eastern to southern indoor Ivan develops a major space of house in which
most of daily activities including cooking, eating, sleep and playing are fulfilled. With regard to type of plan of house, the linkage between rooms is made through balcony. In two-story houses at Pahlavi age and the late Qajar age, two rooms with multiple functions in first story and two other rooms in second story are built, such that the linkage between stories reaches from a corner of Ivan in low story to the Ivan in high story. In some houses, there are other indoor Ivans in north and east. The rooms have generally located in one or two rows in form of intertwined independent rooms, enjoyed permanent air current by means of windows and openings embedded in their north and south. The windows are relatively large, decorated with Qajar pattern in various form and colored glasses in some traditional houses. In general, houses have a space to host the guest. Yet, this space is not separate from other spaces, which the interior and exterior space is not seen unlike the central regions of Iran. Rooms are generally multifunctional.

Figure 17: The Linkage between Spaces in Plan of Yousef Malek House and Hashemi House

Lightening priority in these houses has been in turn given to living, dining and sleeping room and the connective stairs are inside the building or besides the Ivans. The kitchen is in a direct linkage with dining and seating room and the toilet is generally in yard and open space. The walls in their top part to avoid penetration of moisture have clay coverage to avoid falling the rain on the top surface of wall.

Spatial Organization of Residential Units

In architecture of old fabric of Amol, various functions have been placed in an interesting and beautiful way around the yard. Distribution of spaces of residential units is in an open system which is the result of their climate situation and cultural features. The buildings are in a direct linkage with public spaces of pedestrians, which this linkage has been pragmatized through semi-open space (Ivan) and abundant windows which are opened to them. This vernacular architecture (extrovert architecture) is among special samples in which the architecture has excluded from the center of building, under which more attention is paid to how to place it in the site. In other words, it can say that these buildings have two different images:

1-the first image is placed at the back of the leading façade of building which includes walls, doors and windows.
2-the second image is seen in a different state with wooden fences and columns in front of building.

Figure 18: Spatial Closed, Semi-Closed and Open Layers in Façade of Hashemi House

Vernacular architecture in Amol has been formed with a simple structure developed from wooden beams and columns, which the decorated columns have been used in the connection area in some cases. Therefore, due to the limitations due to moderate climate and lifetime of materials, most of old residential buildings in Qajar and Pahlavi style existing in old fabric of Amol are in one or two story. The interior
spaces and rooms in vernacular architecture of Amol are similar to interior architecture in rest of regions of Iran, which common decorations have given them a particular beauty.

A Study on Façade of Residential Units

Since Amol has been regarded as a big city with rural-urban identity, substantial impacts in terms of influence of culture of western architecture in Qajar and Pahlavi era are not witnessed in old fabric of this city. Some of the features of the facades in traditional houses of Amol are as follows:

1-use of many apertures in façade
2-considering principle of symmetry and using simple rhythms and motifs
3-modeling the entrance of buildings, using decorative elements, integrating frames
4-use of simple plaster and composition in interior façade of buildings
5-use of composition of brick, plaster, wood and stone in exterior decorations of buildings
6-reflectio of structural lines of building in exterior façade

Details and Decorations

Ceiling in vernacular architecture of Amol regarding use of local materials is of great importance. Ceilings encompass all the building using clay coverage. In vernacular architecture of Amol, walls of yard have been steep with clay coverage. The details on wooden beams have transformed simple element to an element with standards of art of architecture. In buildings with clay ceiling, the openings are used to pass air due to warming beneath the ceiling, found as a determinant in changing form of ceilings. The fences with geometrical and grid forms around ivans and balconies have raised a defined space with coverage in ivans, which this is in line with enrichment of architecture spaces regarding standards of architecture art. Accordingly, decoration is seen in the places where two elements reach to each other and connection raises, such as making corner in connection of wall to dome. Such issue is seen in connection of beam to column in vernacular architecture of region. Therefore, the first decorative place can be seen beneath the beams.

Details are seen inside the buildings. Geometrical order of doors and windows inside the rooms which are similar to order of rest of regions of Iran is of great importance. Due to moderate climate in Amol and low lifetime of construction materials, in addition to common decorations of desert architecture on doors, windows, ivans, ceilings and interior spaces which are an integration of wooden and brick motifs,
decorations in form of cross, circle, semi-circle, 45 degree square motifs using plaster with white lines on red brick background are common in vernacular architecture of Amol.

Figure 21: Pattern of Decorations and Openings

MATERIALS AND METHODS

Materials

Brick technology in stage of transfer from a simple cross vault to dome increases other values to the early technique and forms the architecture of linear curve which is seen in southern and central regions, Khorasan and Azerbaijan. This architecture has been formed using small pieces, yet curve is not attained in architecture due to use of wood in architecture of North. However climatic and environmental conditions have major role in these differences, technical features of wood including light weight, ease of access, resistance against tension and modularity have been effective in formation of this type of architecture. Severe rain and humidity have caused vernacular buildings in north of Iran sustain far from the ground, yet the buildings have seen so close the ground in architecture of other regions of country due to severe sun and scarcity of rain. For this, materials have little lifetime in north of Iran, which time-consuming decorations are less likely used in architecture of buildings. Hence, with regard to factors above, major materials used in vernacular architecture of old Amol fabric include brick, stone and wood with a masonry of mortar (a mixture of ash and limestone with rice), decoration with gypsum, limestone and wood and clay roof, floor coverings with stone framed by brick.

Walls

The upper surface like other parts is covered with clay to protect from rain. Exterior walls of building are filled with rubble and mortar to 1 meter height and their entrance is covered with chines clay or brick; wooden coil keeps lateral forces around the building to control them at multiple and vertical distances. Facading walls is in such a way that it reveals the bearing status of building, so that the greater load-bearing parts like walls, columns, load-bearing walls and bottom of the building are displayed more tangible than rest of areas of façade, which this is emphasized by changing type of brick or changing type of materials in this part. This raises desirability of façade in addition to display of geometry of building.

Figure 22: Existing Walls in Old Fabric
Load Resisting Systems and Coverage

Brick load resisting walls have been mentioned as the major components in structure of building which have been used with a particular diversity and beauty and the ceilings have been covered with well-ordered wooden beams. The ceilings have been covered via traditional clay with the four-sided steep slope. The ceiling is put on bressummer in the end side above the wall. Structure of grid is in square-shaped beam and column with a difference with foreign truss on this point that interior beams in Iranian truss are in vertical and horizontal form. Yet, interior beams in foreign truss are in diagonal form. Superiority of Iranian truss lies on this fact that it can use the space beneath the truss for residential or warehouse usage, but the important weakness lies on unsustainability against lateral forces such as wind and earthquake.

![Figure 23: Iranian and Foreign Truss](image)

The coverage of clay in the building in Qajar era has arrived at Iran through Astra from Soviet Azerbaijan; currently most of clay workshops and constructions can be found in this region. Red clay is the early material of clay, which is subjected to air after extraction from mine for six months. Then, it will be subjected to water for one week. Then, it will be mixed and the mix will be put on wooden molds. Then the clay is subjected to open air for eight to twelve days to get dry and then subjected to 950 to 1000 centigrade degree to bake. To connect the clay on truss, firstly a bundle of thin walled straws are connected and knotted and then a bundle of thin walled straws are knotted to the woods above truss, whereby the clays are arranged on a bundle of thin walled straws from up to down. There is no connection between clays and truss and just heavy weight of clays and the friction between clays and a bundle of thin walled straws avoids sliding clays. Yet, steep slope of these roofs is low and the bottom edge of roof comes above to avoid sliding the clays; the roof and edges are covered with the clays.

![Figure 24: How to Arrange Clays on each other in traditional buildings](image)

Durability is the superior advantage of clay which can maintain beauty and strength for many years, found as one of the beautiful construction materials. Further, these roofs with two clay walls on each other and one thick layer of bundle of straws are good insulation against heat and sound.
disadvantages of these roofs include their high price and lack of resistance against lateral force such as earthquake and wind which cause displacement of clays and raise the hazards due to earthquake or winds. Nowadays, a moisture insulation sheet and one thermal insulation layer are used beneath the clay.

Features of Residential Plot

Establishment of building in residential plot
Through overview of façade in existing maps in old fabric of Amol, establishment direction of building has two leading directions.
- east to west direction
- 17.5 deviation degree in eastern south and western south directions
In case of residential plots adjacent to natural disasters such as streams and rivers, segmentation of plaque are proposed based on trajectory of disasters. Establishment in plot is proposed followed by establishment throughout the city, which it should pass the public area to reach to a plot. The public area has been developed from dead end alleys or corridors, separated from public passage in some cases. After passing through the public area, the semi-private area including empty space in yard is proposed. The arrangement of building in a plot makes form of yard. Full and empty composition and arrangement in different parts of city of Amol (old and new fabric) are different.
The access of the residential plots to the local passages
The investigations into how to access to passage in residential plots in old fabric indicate that access of 80.9%, 15.62%, and less than 1% of residential plots have been from yard, building and vestibule to the passages.

![Figure 25: The Pattern of Land Occupation and Building Density](image)

How the mass and space are placed in residential units determines pattern of land occupation. Residential spaces which indicate people’s lifestyle arising from their needs and beliefs have been in line with environmental conditions and climatic factors, based on which the quality of their physical composition is defined. In an urban environment, it can consider constant climatic conditions and know diversity of architecture pattern and the land occupation as the result of economic and social quality of households and the status for natural bed. With regard to the existing status, pattern of mass in residential spaces of neighborhoods with old fabric has been different; in addition to two aforementioned factors in terms of historical periods, we witness diversity in land occupation. Symbolism was an ancient expressing knowledge, the oldest and most basic expression of concepts. Symbolism was shaped in medieval times and obtained a place in the thoughts and dreams of different races and was located beyond the boundaries of communication. Using the symbol was the necessities of human life because there were always existed a non-physical concepts for human beings. The symbol is a tool for the expression of thought or concept that has been absent for the senses and the occult is unknowable, so that the concepts which are not expressible in direct language and language with all of its restrictions are not able to transfer these concepts so templates symbolic to be able to express itself. Art in eastern perspective is mainly the traditional art which is essentially mixed with the religion and the sacred well although efforts have been made to limit the definitions. On the other hand one of the most important components of a traditional art is symbol which is a kind of visual cues. In nature, the concrete can be felt beyond the symbol the nature can be the symbol of divine in general. Buildings with old fabric at Qajar and Pahlavi age have been built...
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in an extrovert form with rectangular or square form, having direct linkage with surrounding environment from four sides; further these buildings are designed through openings to use wind blowing for ventilation as much as possible.

Conclusion

Architecture of traditional house of Amol has proposed special elements in response to unfavorable climate conditions and particular cultural and social status. The most leading aims for formation of these elements in Amoli’s house include conductance of maximum wind flow to space and use of bilateral air current and avoidance from moisture. In this article, cognitive issues, an introduction into vernacular house of Amol, leading spaces, registry of effective elements in their formation in form of tables, images and maps are discussed. The spaces and elements with close linkage with environment and attention to lifestyle and cultural and economic conditions of people in this region have been discussed. In general, it can consider some common features of traditional house of Amol as follow:

1. Sustain the elongation pattern and orientation to the prevailing wind direction
2. Extrovert plans
3. Extraversion on the facade of the outer shell of the house is a climate shell in direction with maximum wind and avoidance from heat and sunlight to building. Form of windows, the interface between inside and outside space by special elements like ivan shows climate role of this front.
4. Establish service spaces on the ground floor due to high humidity and high groundwater levels.
5. Transfer of living space in cold season to the ground floor or the first floor.
6. Establishment of living space in the warm seasons in the first floor or second floor and increase of levels of ivans instead of decrease of the number of rooms.
7. Design wooden shutters.
8. Vertical development of house in order to absorb maximum wind

This article examines the constituent elements in old fabric of Amol and the existential reasons, which it is obvious that more exploration into each element can propose precise findings.

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