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Typology of Arak Monuments with the composition features standard[1]

Ali Mashhadi[1]**-***Graduated PhD in Architecture at the University of Fine Arts, Yerevan, Armenia and Master of Architecture, University of Art, Tehran, Iran*
Ahmad Aminpoor[1]**-***Associate Professor, Department of Architecture, Isfahan University of Arts, Isfahan, Iran*

Abstract
Historical fabric of Arak, as one of the most important inorganic cities in urbanization history of Iran, has been implemented from the beginning based on predetermined plan and project. During the age that majority of cities in Iran used to be created organically and gradually based on public needs, all steps of construction of Arak City including spatial organization, physical structure, communicative network system, activity distribution pattern and composition of urban elements were firstly designed and then implemented. The main objective of this study is to identify and analyze the physical features of monuments of Arak city to discover the behavioral system of monuments with the composition features standard. According to the research objective, the method applied is descriptive, analytical and comparative method based on field and library investigations. In this study, first architectural composition features including scale, proportion, hierarchy, axis, focus point, composition center, modulus, flexibility, rhythm and geometry are analyzed in each monument. Then, the monuments were classified in sub-factors of each composition feature and then, through comparing the classified groups, common features of monuments in each sub-factor with most frequency are extracted. The results obtained from the study showed existence of unit behavioral system in special groups of monuments compared to architectural composition features leading to typology of Arak's historical monuments.

Key words: *typology, composition features, monuments, Arak*

1.Corresponding Author, Tel: +98-09124567865 Email Address: Alimashhadi3070@yahoo.com

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Introduction

The clearest difference of Arak historical fabric with majority of old cities of Iran is the inorganic spatial-physical organization and construction of the city during early period of the life of this city, since the city was designed at the first in form of a military castle with all elements and components of city and was constructed in a rectangular land with chess design and inspired of cities of Islamic Era. In the original plan, special attention is paid to fundamental functions of the city and special attention is also paid to meet facilitated and safe residence of different social classes, economic and service equipment of the city, the communications and motions of people and commodities. Also, important urban elements such as market, Great Mosque, government Citadel, neighborhoods, streets, spaces and public facilities have been created desirably in the city. Hence, the main feature of historical fabric of Arak in integration of spatial and functional organization and the elements are in harmonized with each other and are in consistence with the regional climate in terms or architecture. As a result of saturation of population in the castle, the neighborhoods located in suburban areas of the early city, which their initial center was created non-continuously and in agricultural lands and adjacent gardens, were developed and created the fabric of new city continuously and organically. Hence, the second physical skin of the city was formed and regular physical construction of the city gained irregular physic after connection with several automatically grown cities and duality was created in physical fabric of the city. Hence, social ecology of the city has different structure and vision from the early era. Historical fabric of Arak has some valuable historical monuments with unique physical features and has designations that could be classified in a typological system through following fabric systematic urbanization. The main objective of this study is identification and analysis of physical features of monuments of Arak to explore behavioral system of monuments with composition features standard. Because of valuable role and position of this fabric in macro to micro scale, protecting it to play dynamic role in the current urbanization is required. Therefore, for consciousness leading of the fabric to accept dynamic role at the city, it is essential to recognize and analyze its typology. Moreover, analysis of monuments of Arak is required because of having unique features and position in the typological studies of Iranian and Islamic cities.

Methodology

The methodologies used in this study are as follows:

1. The descriptive-analytical methods to analyze composition features in Arak's monuments
2. Hierarchical top-down method in analysis of physical features of monuments
3. Analytical-comparative study in comparing classified groups and extraction of typology

Results

The results obtained from the study show existence of unit behavior in specia groups of monuments compared to architectural composition features leading to typology of monuments of Arak. Through analysis of architectural composition features including scale, proportion, hierarchy, axis, focus point, composition center, modulus, flexibility, rhythm and geometry in each monument and classification of the monuments in sub-factor of each composition features and comparing classified groups, a typology in monuments of Arak is achieved. In next step, through comparing frequency percent of monuments in each sub-factor, relevant designing models of each composition feature is extracted and hence, the field of using and generalizing the designing model in historical fabric of Arak is provided tangible.

Definition of composition features

• Scale:

Scale is one of the principal features of morphology of urban fabrics, which could define

the relationship of space (monument) with surrounding spaces or monuments. In historical fabric of Arak, monuments are classified based on 3 scales of small, medium and large.

• Open space status in monument:

In terms of open space status compared to the built space, monuments of Arak are classified in 3 types of side yard, central courtyard and perimeter yard.

1- Side yard: in this mode, open space is placed in one or more sides of roofed space; although it has not the focal role of central courtyard in terms of designing principles.

2- Central courtyard: in this mode, the open space is located at the center of monument and is ended in the built area from 4 sides.

3- Perimeter yard: in this mode, the built space is located in center of open space and the yard is perimeter on the building.

• Hierarchy of space closeness:

Historical fabric of Arak with plate morphology is a chess complex and continued with filled and empty spaces and the passages have linked the spaces as fabric vessels. One factor to create harmony and integration in this fabric is hierarchy of space closeness in urban spaces and architectural monuments in consistence with space function.

Types of degrees of space closeness:

1. Totally closed spaces: these spaces are limited from all dimensions and without skylight or has skylight with the mediators.

2. Closed spaces: these are closed spaces that could be accessible through openings. In most cases, these spaces are linked to the open space by the mediation of semi-closed and semi-open spaces

3. Semi-closed spaces: roofed spaces with opening from one or two sides and playing form and link role among functional units.

4. Semi-open spaces: roofed spaces with opening from one or more directions unlimitedly and the elements and spaces between them and open space are just symbolic elements.

5. Open spaces: unroofed spaces and with least spatial closeness.

Monuments of Arak are classified in4 groups in terms of hierarchy of space closeness:

1. Without hierarchy: in this mode, closed spaces are linked to open space with no spatial joint and mediation.

2. Composite hierarchy of closed, semi-closed and semi-open spaces: in this mode, closed spaces are linked to semi-open spaces through semi-closed spaces.

3. Hierarchy of closed, semi-open and open spaces: in this mode, closed spaces are linked to open spaces through semi-open spaces.

4. Composite hierarchy of closed, semi-closed, semi-open and open spaces: in this mode, closed spaces are linked to open spaces through middle two-layer of semi-closed and semi-open spaces. This mode is the most complete hierarchy of space closeness and its examples are observed in public monuments of Arak's historical fabric.

• Symmetry Axis

Arak's monuments are classified in 4 modes in terms of space typology with the symmetry axis criterion.

1- One symmetry Axis: in this mode, spatial elements are symmetric to a longitudinal or transverse axis.

2- Two Symmetry Axes: in this mode, the elements of space are symmetric to a longitudinal and a transverse axis.

3- Three symmetry axes: in this mode, spatial elements are symmetric to two longitudinal and one transverse axes or two transverse and one longitudinal axes.

4- No symmetry axis: in this mode, the space has no symmetry.

• Positions of symmetry axes to focus points:

Symmetry axes in Arak's monuments have 3 positions to focus points of the monuments:

1. Axes passing through the geometric center of monument

2. Axes passing through composite center of monument

3. Axes passing through the entrance

• Position of composite center

The composite center in Arak's monuments is in 4 positions:

1. Uncertain position
2. At the end of symmetry axis
3. Adjusted with geometrical center of space

• Indication of composite centers

The composite centers in Arak's monuments have been indicated compared to surrounding elements:

1. Urban sign
2. Form and decorations
3. Function

• Modulus

In modular system, a forma collection of forms are repeated in certain rows according to a special order. In addition to be independent, each modulation is a part of bigger design created by extension of modulations. In the system structure of each modular, the more the similarity of base forms is, the more legibility and readability of the collection would be.

• Proportion

As historical fabric of Arak is constructed based on predetermined plan and design, a logical and regular proportion and relationship is created among different dimensions of forms in all scales.

In the historical fabric of City of Arak, the designer could achieve special proportions and dimensions of a space based on 4 factors.

1. Spatial modular system: in this fabric, using modular system, multilateral harmony used to be created between urban elements and architecture and the designers could achieve a harmony and good form in this modular system through creating appropriate proportions. This system is founded based on numerical system caused by multiplication of base number of 13.3cm.

2. Dimensions and proportions of Iranian Carpet: an effective factor in proportion of spaces was the size and proportions of Iranian carpet. The dimensions of carpet to 3*4m was considered as a model in proportions of the space and the spatial dimensions were considered in such manner that the space could be covered by one or two carpets and no space was remained in addition to carpet dimensions.

3. Defining one dimension of space based on odd numbers: one of the key factors determining the proportions is defining one of the spatial dimensions based on odd numbers. According to this attitude, number of openings was based on odd numbers, so that they were named respectively as three-door, five-door, and seven-door. For example, in a three-door room, using small modulation based on value of 13.3cm, width of the entrance doors used to be considered to 93cm and the pillars between doors used to be considered as one module. According to this module, height of doors was equal to 1.87m, which was an integer multiple of 13.3.

4. Golden proportion: ancient artists used to apply golden proportions to create sense of harmony and glory in an artistic work, statue or monument and the proportions were typically derived from the nature. The said proportion was a mathematical proportion based on ratio of 1.618. one feature of Arak's historical fabric is using proportions close to golden proportion in some urban, architectural and decorative elements of fabric.

• Flexibility

Functional flexibility

Historical fabric of Arak has been adjusted with the physic in best manner through creating functional, structural and spatial flexibility in fixed, semi-fixed and variable elements. In the monuments of Arak, a unit space could show response to various functions at the same time or in different times and could provide appropriate spaces with different behavioral patterns with no need to physical changes.

Climatic flexibility

In historical fabric of Arak City, the climatic flexibility has been created with the surrounding environment in several ways:

1. Hierarchy of placement of closed, open and semi-open spaces in buildings

2. Placement of various spaces in different directions of central courtyard for unit functions such as summer, winter and spring spaces.
3. Changing degree of continuity and access in openings based on climatic function of the space
4. Change in color and texture of materials due to climatic function of architectural elements

Geometric flexibility

In historical fabric of Arak, geometric flexibility with the surrounding environment is created in several ways:

1. Role of module in flexibility of architectural spaces

In historical fabric of Arak, regular geometry in skeleton of the fabric has been changed into semi-organic fabric in the urban modules and monuments, so that change in type of structural modules has led to spatial flexibility and diversity.

2. Change in geometry of open and closed spaces in monuments

In historical fabric of Arak, various types of arrangement of open and closed spaces showing formation of these spaces with regard to surrounding environment.

• Rhythm

Rhythm is one of the features of form composition and refers to regular and sequential repetition of elements, lines, forms and shapes and is used as a technique in field of organizing form and space in architecture and urbanization. To organize the elements inside a rhythmic complex, they have not to be absolutely similar. They may have a common feature and they could be belonged to a family and be independent at the same time.

Examples of rhythm in designing process could be classified in 4 groups:

1. Uniform rhythm: in this type of rhythm, an element is repeated uniformly and sequentially. This rhythm could lead to a kind of automatic reaction in audience and in case of more repetitions; it creates a strict and inflexible order.
2. Alternative rhythm: in this type of rhythm, an element or a series of elements are repeated with alternative variations, so that a kind of expectation for following the repetition and continuing rhythm is created in audiences.
3. Evolutionary rhythm: in this type of rhythm, repetition of an element begins from a special level and mode and reaches to new status gradually with some changes, so that a kind of growth and evolution is followed in these changes.
4. Waved rhythm: this type of rhythm uses curved movement of surfaces and lines and has also a mind of alternation. This kind of repletion is a perfect example of imaginary rhythm existed in architectural space and urban fabric.

Typology of Arak's monuments

Typology of historical monuments of Arak is determined based on a 2-D matrix. One dimension of this matrix is function of building including 6 groups of religious, general, residential, public, monumental and small architectural forms and another dimension is based on formal structure of building including block structures, central yard, block structure composition and multi-yard structure. Through considering this matrix, the buildings have same behavior in terms of composition features in functional compositional groups and formal structures. In the following, behavior of these compositional groups is described for each type.

In this type, the building has no yard and includes a continuous block.

Block structure – religious monuments

1. This group of religious monuments has small and medium scale.
2. In all monuments belonged to this group, yard is located in one side of building and the access point of building is in the yard.
3. In this group of religious monuments, architectural plan has no hierarchy and with no spatial hierarchy, people enter to the yard and then, to the roofed space.
4. Majority of monuments belonged to this group have a symmetry axis passed through the altar.

5. In this group of religious monuments, compositional center is located in the place of altar and at the end of symmetry axis. This point is indicator in terms of rom and decorations.
6. In all monuments belonged to this group, structural units have been repeated based on a modular network and a uniform rhythm.

Block structure – general buildings

1. This group of general monuments has small and medium scale.
2. This group of general monuments has no yard and is formed of a lobby in center of volume and rooms around lobby.
3. In this group of general buildings, architectural plan on the longitudinal symmetry axis has spatial hierarchy. All monuments belonged to this group have spatial hierarchy in terms of degree of closeness of space (closed, semi-closed and semi-open spaces).
4. Majority of monuments belonged to this group have a symmetry axis and the entrance is placed on this axis.
5. In this group, compositional center is placed at the end of symmetry axis. This point is indicator in terms of dimensions, function, form and decorations.
6. In all monuments belonged to this group, structural units have been repeated based on a modular network and uniform rhythm and the size of modules changes in the intersection of symmetry axes.
7. In all monuments belonged to this group, links of spaces with each other and with lobby are through spatial joints.
8. In all monuments belonged to this group, architectural spaces have followed two small and large modules, so that the main spaces are made based on large modules and linking joints are made based on small modules.

Block structure - residential buildings

1. This group of residential buildings has large and medium scale.
2. In this group, roofed space is located in center of yard, so that the building is linked to open spaces from 4 sides.
3. Majority of monuments belonged to this group have no symmetry in plan.
4. All monuments belonged to this group have spatial hierarchy in terms of degree of closeness of spaces (closed, semi-open and open spaces). In average, 20% of area of roofed spaces is belonged to semi-open space (porch).
5. In this group, the location of compositional center is variable and follows no special rile. This space has larger area than other spaces.
6. In this group of residential buildings, dimensions of structural units are different and have no rhythm and are not placed on modular network.
7. In all monuments belonged to this group, link of spaces is direct and without spatial joint.
8. In all monuments belonged to this group, functional flexibility is existed, so that each space has several functions.

Block structure – public buildings

1. All public buildings have block plan and have no yard.
2. Architectural plan of all public buildings is a combination of two or more complexes with organic geometry, so that the complexes are independent and have no functional and formal relations.
3. In all public monuments, form of each space has regular geometry and has one or two symmetry axis.
4. All public buildings have no spatial hierarchy in terms of degree of closeness of space and all spaces are closed and there is no semi-closed, semi-open and open space.
5. In public buildings, each space includes a center independently, which is adjusted with geometric center of the space.
6. The size of structural modules in each complex of public monuments is different and changes due to the spatial scale.
7. In all public buildings, the links of spaces with each other is created by spatial joints and is along with change in direction.
8. In all spaces of public buildings, functional flexibility is existed, so that each space has in-

dividual and social functions.

Block structure – monumental buildings

1. All monumental buildings have block plan and have no open space.
2. Architectural concept of all monumental buildings is in form of a rigid cube, so that the cube is just linked from one dimension to outside.
3. Form of all monumental buildings has regular geometry and a symmetry axis.
4. All monumental buildings have no spatial hierarchy in terms o degree of closeness of space, so that the whole space is semi-closed and there is no semi-closed, semi-open and open space.
5. In monumental buildings, combinational center is adjusted with geometric center of space and on symmetry axis.

Block structure – small architectural forms

1. All architectural small forms have block plan.
2. Architectural concept of all small forms is in form of a regular geometry placed in center of an urban or architectural space in a completely symbolic form.
3. All architectural small forms have central symmetry to the center of form.
4. In all small forms, compositional center is adjusted with geometric center of form.

In this type, the building includes a courtyard in geometric center, so that the courtyard is surrounded by the buildings around it.

Courtyard structure – religious buildings

1. This group of religious buildings has large scale.
2. In all buildings belonged to this group, the yard is placed in center of building and has pure and geometric form.
3. This group of religious buildings has hierarchy in open and closed spaces, so that the yard is linked to porch (semi-open space) and porch is linked to dome (closed space). Moreover, the building has hierarchy in internal circulation.
4. All buildings belonged to this group have a longitudinal symmetry axis and a transverse symmetry axis and the intersection of the two axes is adjusted with geometric center of courtyard.
5. In this group, compositional center is placed in space of dome and at the end of symmetry axis. This point has an indicator dome acting as an urban signal.
6. In all buildings in this group, structural units have been repeated based on a modular network with width of 4m.
7. All religious buildings with structure of central courtyard have uniform and alternative rhythm in structural modules and architectural forms.

Courtyard structure – general buildings

1. This group of general buildings has small and medium scale.
2. This group of buildings is in form of central courtyard and s formed of a layer of portico in the distance between closed and open spaces.
3. All buildings in this group have spatial hierarchy in terms of degree of closeness of space (closed, semi-open and open spaces).
4. All buildings in this group have at least one symmetry axis and the entrance is placed on this axis.
5. This group has no compositional center.
6. In all buildings of this group, are structural units repeated based on a modular network and a uniform rhythm and the size of modules is same in whole building.
7. In all buildings in this group, the connections of spaces with each other and with courtyard are provided through the portico.

Courtyard structure – residential buildings

1. This group of residential buildings has small and medium scale.
2. In this group of residential buildings, the courtyard is in center of building and roofed space is located in its 3 or 4 directions.
3. All buildings in this group have at least one symmetry axis in plan, which passes throughout the geometric center of courtyard.
4. All buildings in this group have spatial hierarchy in terms of degree of closeness of space (closed, semi-open and open spaces). In aver-

age, 10% of area of roofed spaces is belonged to semi-open space (porch).
5. In this group, compositional center is placed on symmetry axis and this space has larger area than other spaces.
6. In all buildings belonged to this group, structural units have been repeated based on a modular network and a uniform rhythm and the size of modules varies in 3 sizes.
7. In all buildings in this group, the connections of spaces are provided through spatial joint (semi-open spaces).
8. In all buildings, functional flexibility is existed, so that each space has several functions and several spaces are considered for a single function.

In this type, formal structure is a combination of block and central courtyard types.

Block and courtyard structure – general buildings

1. This group of buildings has large scale.
2. This group of general buildings is combination of a building with block structure and a building with central courtyard structure.
3. In this group, architectural plan is based on symmetry axes with spatial hierarchy. This group of buildings has the most spatial hierarchy in terms of degree of closeness of space, so that types of closed, semi-closed, semi-open and open spaces are existed.
4. In buildings in this group, block building has two symmetry axes and the entrance of building from passage and entrance to courtyard are in line with symmetry axes.
5. In this group of buildings, compositional center is located in end of symmetry axes. These points are indicator in terms of dimensions, function, form and decorations.
6. In all buildings of this group, structural units have been repeated based on a modular network and the size of modules changes in the intersection with symmetry axes.
7. In all buildings in this group, connection of spaces with the courtyard is provided through the portico and the connection of spaces with lobby is provided through spatial joints (semi-closed spaces).
8. In buildings of this group, architectural spaces have followed two small and large modules, so that the main spaces have been made based on large modules and linking spaces based on small modules. Repetition of these spaces encompasses types of uniform, alternative, evolutionary and waved rhythms.

In this type, the building includes several yards combined in different forms.

Multi-yard structure – residential buildings

1. This group of residential buildings has large scale.
2. This group has a main courtyard with large and several secondary yards with small dimensions. The yards are independent from each other in terms of form and function.
3. All buildings of this group have at least one main symmetry axis and several secondary axes. The main symmetry axis passes through the geometric center of courtyard.
4. These buildings have spatial hierarchy in terms of degree of closeness of space (closed, semi-open and open spaces). In average, 5% of area of roofed spaces is belonged to semi-open space (porch).
5. In this group, the main compositional center is placed on the main symmetry axis and the secondary compositional center is located on secondary symmetry axes.
6. In all buildings belonged to this group, structural units are placed on a modular network and size of modules varies in 3 sizes. Arrangement and repetition of modules is based on types of uniform, alternative, evolutionary and waved rhythms.
7. In all buildings in this group, connection of spaces with each other is provided through spatial joint (semi-open spaces).
8. In all buildings in this group, functional flexibility is existed, so that each space has several functions and several spaces are allocated to a single function.

Conclusion

In field of typology of monuments of Arak, architectural composition characteristics are analyzed in each monument and the monuments have been classified in sub-factors of composition features. Then, the classified groups have been compared. The common features of monuments with most frequency in each sub-factor are extracted. The results obtained from the study have shown existence of unit behavioral system in special group of buildings compared to architectural composition features, which have led to typology of Arak's monuments. According to obtained results, Arak's monuments are investigated in terms of typology based on a 2-D matrix, in which one dimension is building function and another dimension is formal structure of building. In terms of function, buildings have been divided to 6 groups of religious, general, residential, public, monumental and small architectural form and are divided to 4 groups of block, central courtyard, compositional structure and multi-yard groups in terms of structure. The results show that each building has same behavior in terms of composition features with regard to position of building in functional compositional groups and formal structure.

According to the procedure, religious buildings are classified to two types of block and central courtyard; general buildings are classified in 3 types of block, central courtyard and compositional structure; residential buildings are classified in 3 types of block, central courtyard and multi-yard types; and public buildings, monumental buildings and small architecture forms are classified in a single block type in terms of typology. As the presented typology in this study is based on architectural composition features including the factors creating harmony, natural features of rom and factors creating order; it contains in its type a;; architectural design criteria and is comprehensive, so that it has led to extraction of designing models in consistence with climatic and cultural conditions of Arak. Typology of monuments of Arak play very important role in arrangement of designing regulations and instructions in field of enhancing the quality and identification of architecture and urbanization of City of Arak.

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