

JOURNAL OF RESEARCH IN URBAN PLANNING AND
ARCHITECTURE-ENVIRONMENT IDENTITY (JRUPA-EI)

NO.1 (3), Summer 2020

<http://www.ei-journal.ir>

P.16-28

**Recognition of the nature of Sabat in historical contexts
(Case study of Sabats of the neighborhoods of Naein historical context)**

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Received: 18- August-2020

Accepted: 20- September-2020

Abstract

Sabbat is one of the architectural elements of Iranian urban spaces, which is still found in the passages of many historic cities such as Naein. The conceptual and structural assessment of the exciting analyses about Sabbat shows that most of them are descriptive and are not provided by a clear methodological principle. However, new dimensions of Sabbat's nature is obtained in this paper by exploring Sabbat via both qualitative and quantitative analyzes in the historical context of Naein. In this research, interpretive-historical, descriptive-analytical methods, content analysis, and case studies have been used for providing a special model to analyze the Sabbats. These analyses are carried out by the historical documents and interviews about the oral history of the Sabbats, field observations. Quantitative and qualitative components have been studied separately in the neighborhoods of Naein historical context, in this study, due to more detailed study and also the importance and lack of studies in the field of physical cognition of Sabbats. The qualitative section results indicate that the construction of Sabbat and the creation of more space has made the high surface of passage more application. This space is limited to two bodies of the passage. Therefore, it belongs to the two properties which are located on both sides of the passages. By constructing and using the Sabbat, secondary, social, climatic, and defensive functions are arranged, and it is transformed from a merely covering element into a multifunctional element. The results in the quantitative section show the volumetric composition of Sabbat in the upper level of the passage has been designed in open, closed forms with opening in the facade and a semi-open with the porch in front of the closed space of Sabbat. Also, the Sabbats with east-west stretches have more shading than the north-south Sabbats.

Keywords: Passage, Sabat, Historical Context, Naein, Qualitative Analysis, Quantitative Analysis

Reference to article: Mithra Azad , Mahdi soltaniMohamadi Khatereh Talebi(2020): Recognition of the nature of Sabat in historical contexts(Case study of Sabats of the neighborhoods of Naein historical context).Journal of Research In Urban Planning and Architecture - Environment Identity (JRUPA-EI) NO.1 (3), Summer 2020.P.16-28.

http://www.ei-journal.ir/article_119529.html?lang=en

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Research questions

1. Which methods can be used to analyze the nature of Sabat in the historical context of Naein?
2. What are the qualitative and quantitative characteristics of the historical context of Naein?

Introduction

Passages have been considered as one of the main elements of the structure of historical cities, in which the main network of transportation and urban communication took place and, neighborhoods and different urban areas were connected in all areas of the city (Tavassoli 2012, 69). Naein's historical context consists of seven neighborhoods, which are connected to the city's bazaars and gates by main thoroughfares and passages. Sub-passages also play a major role in providing communication between different points within a neighborhood (Sultanzadeh 2011, 98). The elements covering these passages fall into two types. One type has been constructed as single arches or pews between two passages. These arches have no use and do not create a continuous, tunnel-like cover for the passage; rather, they are simple braces to control the thrust of the forces of the walls on both sides of the passage. The role of these arches is purely structural and they can be called groin due to their structure. The other category which is the subject of this article is sabats; they act as bridge-like covers on passages. A primary assessment of the study (architecture, urban planning) that referred to the subject of Sabat shows that different and sometimes contradictory definitions of Sabat have been presented and most of these studies are within the framework of physical descriptive studies; and Sabat's main situation in Iran's past architecture and urban planning has not been determined. However, Sabat has had many functional values in the climatic, structural, social and even defense fields. This research claims that new analytical frameworks appropriate to each space can be designed and produced at any time in order to analyze the sabats of historical contexts of Naein, considering the gradual evolution of concepts and methods of analysis in design knowledge. Such research requires a variety of aspects such as climate, culture, historical and social background, etc., as well as the use of appropriate and up-to-date methods to understand the nature of Sabat. Therefore, based on the nature of the sabats of Naein's historical context, various analytical methods have been used to understand these hidden dimensions and a new approach has been proposed in understanding the nature of the sabats of historical neighborhoods.

Theoretical Foundations

The study of the formal-spatial structure in architecture can be considered to be among systematic studies. As a whole or a system, architecture has components among which mass, space, and the interaction between them have been more discussed and criticized by experts in the form of formative-structural analyses (Falahat & Shahidi, 2015, 29). Understanding architectural characteristics and the systematic components of Sabats' architecture entails a general understanding of these spatial characteristics (mass and space) and their interaction, which makes physical-perceptual and physical-functional structures understandable. As an element covering the pathways, Sabats must have formative features that can respond to the responsibility of sheltering pathways. On the other hand, Sabats have specific uses, so they can facilitate conditions where they can be used directly, be used as a means to an end, or both. This architectural element has two surfaces including the lower surfaces (the public street) and the upper surface that covers the pathway. The ownership of a Sabat belongs to either side of the pathway.

Research method

Based on the scattered content about sabat and relying on field observations, analysis of available documents and information and in-depth interviews, the present research studies and analyzes the sabats of historical context in both functional and physical dimensions (Table 1). The method of data collection and analysis was as follows:

- Documentary studies: This section is based on the collection and study of books and documents related to Naein, including historical, cultural, social books, as well as architectural and urban planning resources, which have brief references to Sabat during their main topics. In this regard, sources such as Nasser Khosrow's *Safarnama*, selected history of Hamdollah Mostofi, etc. were referred; but the most important source in this field is the five-volume book on the history of Naein,

written by Abdolhajeh Bolaghi in 1369 AH that, other sources and books after this date are somehow adapted from this source.

- Field surveys and impressions: by focusing on the objectives of research in field studies, in the first stage, the sabats of Naein historical context were identified and then harvested and documented.

- In-depth interview: The necessity of conducting an in-depth interview in this research is to adapt the content as much as possible and to be aware of the hidden dimensions of the Sabats in the seven neighborhoods of Naein's historical context. During this process, first, by adjusting the structure of the interview in accordance with the goals and needs (various evolutions of sabats in the field of ownership, use, body, etc.), the interviewees were selected, so local informants in each neighborhood were identified. These people were often over 65 years old. The reason for choosing these people was their appropriate historical memory and permanent presence in the neighborhoods and awareness of the ownership and historical evolution of the Sabats in each neighborhood. A total of 26 people were interviewed in depth.

Table 1. Components, Dimensions and Research Method; Source: Authors.

Analysis component	Analysis dimensions	Research and data collection method
Qualitative	The process of development and change of neighborhoods and cities Climate social Defense	Interpretive-historical analysis based on basic sources and interviews with local informants
		Descriptive, analysis based on observations, field interviews, and review of existing library resources
quantitative	Dimensions and proportions Orientation and elongation Volumetric composition Materials and type of covers	Drawing maps of sabats

Research background

The study of the background of the research conducted in relation to the concept and nature of Sabat; Pirnia has defined Sabat as follows: Intermediate building for the convenience of travelers; such that a part of the road was covered and had several rooms or platforms on both sides; Like a bazaar (Pirnia 1973, 122). Homo states that the word Sabat penetrates almost languages of the East, the West, the Aramaic, and the French, and it has ancient roots in Persian; it is made up of two parts, "sa" + "bat", which is equivalent to "comfort" + "building". The suffix "bat" is also used in some words such as "robat", "carbat" and "qarabat". The sabat was generally used for the place instead of today's sanatorium and resort. Also, all the buildings established for the purpose of comfort, both in the city and outside it, were called sabat and this word is still used in its proper place in the southern cities of Iran (Pirnia 2005, 231). Naima (2004) in the book of "Dezful, the city of brick" considers Sabat as a room above passage, the construction of which, in addition to meeting architectural needs, also considers climatic aspects. Pirnia's (2005) reference to the correct use of this word in the southern regions of Iran in accordance with Naima's explicit definition of Dezful's Sabats as a room above passage confirms that Sabat refers to the space on the passage, but this application can be open or closed. Sultanzadeh (2013) in the book "Urban Spaces in Historical Contexts", has considered the covered room on the road as Sabat. In the book "Naein the city of historical millennia", Homo (2011) studies the sabat in the section introducing the urban spaces of Naein as the neighborhood passages section, and calls it the covered space on the passage, which often plays the role of neighborhood. Ghobadian (1994) in the book "Climate Survey of Traditional Iranian Buildings" calls Sabat a room above the passage and makes brief references to Sabat's climatic differences. Tavassoli (2012) in his book "Construction of the city in hot and dry climate", considers Sabat to be clearly a corridor and a

covered passage. The climate of the Sabat element is also one of the items that most experts have pointed out.

1. Sabats of Naein's historical context

Naein is one of the cities of Isfahan province in the central part of Iran that, the antiquity of this city can be attributed to pre-Islamic times based on the available physical evidence, such as the Naryn castle, the temples, as well as special customs, such as paying attention to fire and water, and the reflection of this issue in proverbs, etc. The position that Naein has maintained throughout history as a middle city has caused it not to undergo major changes or stagnation and has always been gradually changing (Sultanzadeh 2012, 43). This feature makes the context rich and dense. The urban and neighborhood fabric of Naein, which is organically formed, consists of seven neighborhoods named Bab al-Masjid, Kalwan, Nogabad, Panjah, Chehl-e Dokhtar, Koi Sang, and Sarai No. Sabats are also scattered in these seven neighborhoods, including 2 Sabats in Bab al-Masjid neighborhood, 3 Sabats in Panjah neighborhood, 6 Sabats in Nogabad neighborhood, 3 Sabats in Kalwan neighborhood, 2 Sabats in Sarai No neighborhood and 4 Sabats in Chehel Dokhtaran neighborhood (Figure 1).

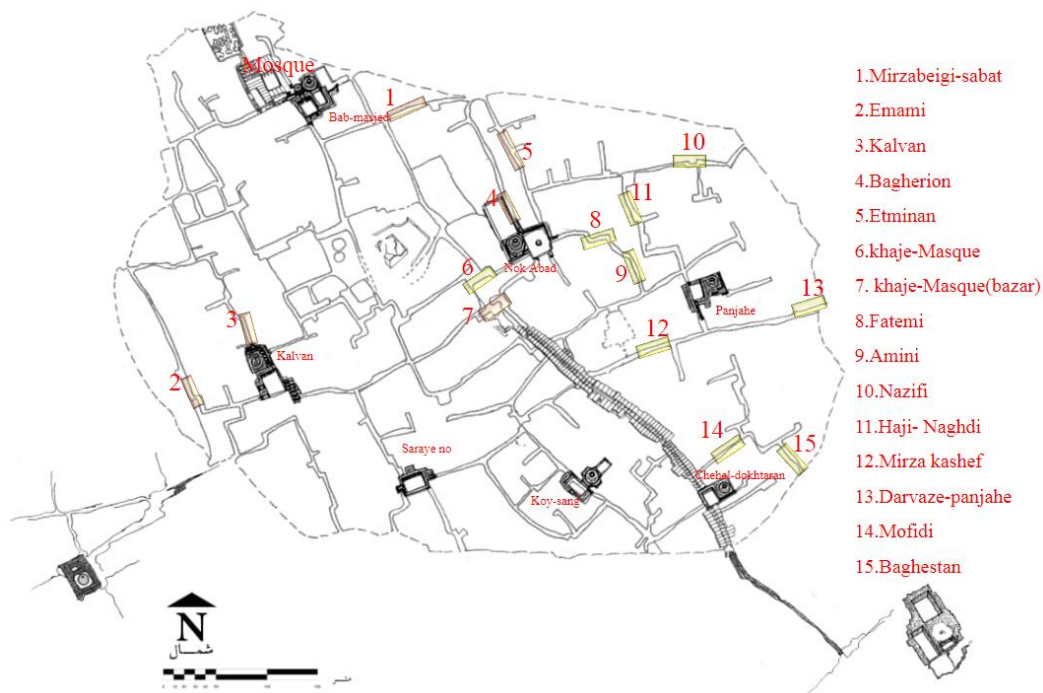


Figure 1. The location of the fifteen sabats studied in the historical context of Nain, specified in the basic map drawn based on the aerial photograph of Nain for the year 1956; Source: Authors.

2. Research findings

2.1 Qualitative analysis of sabats

Qualitative knowledge of Sabat requires a study of the set of characteristics and features that this element has, both independently or in context and in total. According to the initial studies, the functions of creating extra space on the passage, creating privacy in public spaces, optimizing the underpass by controlling the two climatic components of temperature and wind, and defensive as the functions of sabats are identified and examined in the qualitative part as follows.

2.1.1 Creation of extra space on the passage Sabat has two levels, the lower level of the passage used as public street and the level on the passage that has application. In fact, an extra space is created on the passage with the formation of sabat, which could not be used in other circumstances. The space created by Sabat is limited to two passage bodies and therefore belongs to one of the two neighbors located on both sides of the passage and, the owner who first decides to build Sabat builds Sabat with the consent of the other owner (Amini Sabat, Emami Sabat, Mofidi Sabat, Etninan).



Figure 2: Sabat of Baba Abdullah Mosque with entrance of the mosque embedded under Sabat. Source: Authors.



Figure 3. Sabat of Khajeh Mosque next to Nogabat Reservoir with moonlight use. Source: Authors.

In general, the ownership of the space created on the Sabat is both private and public. In the historical context of Naein, the ownership of Sabat in three examples belongs to the public building of the mosque (two Sabats of Khajeh Mosque) and in another example, it belongs to one of the gates of the city (Sabat, the gate of Panjahe). Another type of sabat, in which only the space created by it under the passage, acts as a pre-entrance space for a public building, has been used in two mosques of Baba Abdullah and Mirza Kashefi (Figure 2). In this case, the space created by Sabat in the passage, in addition to defining the entrance of the building, also leads to the creation of public space and the possibility of gathering people. Depending on the decision of the owners, the definition of land use in Sabats whose ownership is related to residential houses can include permanent or temporary residence. These uses are usually a combination of two or more rooms with a porch that, with Sabat retreating from the main edge of the façade and creating privacy and shade, Sabat becomes a first-class space. In one case, in the Sabat of Khajeh Mosque, it is related to the public space of the mosque. In the common past life, many of these sabats belonged to members of the family who, although are residents of that house, but their residency is both temporary and important, such as young brides and grooms or the stay of close guests for several months.

2.1.2 Creating private spaces in public spaces

This feature can be considered at both the upper and lower passage levels. At the lower level of Sabat, which includes the public passageway; the presence of Sabat in the passage leads to the creation of private space for the residents of both sides of the passage and makes it possible to install one or more entrances. Private, secondary, main entrances, or those retreated from the edge of the passage, etc., are the functional results of Sabat. Although this space does not belong to any of the owners and is considered a public stress, but it becomes a place for residents to come together and intensify a sense of solidarity and neighborliness between them (Figure 4). This type of privacy, depending on the type of property used on both sides of the passage, can be classified into the private space of a property, the common space between several properties, or the public space. A space created on the upper surface of the Sabat that includes the open or closed space above the passage; provides one-way view for Sabat residents due to its higher height than the passage level; this means that residents will be able to have an intangible presence at social events without being exposed to the public and their privacy being compromised. The retreat of Sabat's closed space from the main edge of the facade (in the form of a porch) is one of the measures that leads to the creation of such spaces (Figure 5). Another type of private space has been created in public buildings (two mosques of Baba Abdullah Mosque and Mirza Kashefi Mosque), which, in addition to defining the entrance of the building, also leads to the creation of public space and the possibility of gathering users. In fact, these types of sabats are not used on the surface of the sabat due to their ability to create space and emphasize the importance of the building.



Figure 4. Installing the entrance under the sabat and creating space in the public space; source: Authors.



Figure 5. Retreat of Sabat's closed space from the main edge of the facade in the form of a porch and creating a space; source: Authors

2.1.3 Climatic function by optimizing the passage by controlling the two climatic components of temperature and wind

Naein city is located in the northeast of Isfahan province and is located at 53.05 longitude and 32.52 latitude. According to the climatic classification, it is located in a hot and dry desert climate, which has an average annual temperature above 18 degrees and dry season in summer (Naein master plan 123, 2008). The urban context in the hot, dry and desert climate of Naein is dense and its passages are narrow, irregular and tortuous. The passages in this climate are low-width with high walls and are generally made of thatch, all of which are subject to climate-appropriate thinking. The low width of these passages is a function of human scale and has visual coherence and unity in terms of shape, color and type of materials. The high walls of the passages help to create shade and protect the city's passages from direct sunlight (Ghobadian 135, 1998). Sabats formed on the urban space and along the passages, create a different temperature from the outside on the passage by shading the passage. The winding passages in the hot, dry climate, which often extend in the direction of a broken line, define and guide the direction of the wind. As the width of the passage gradually changes, the wind speed increases. As a result, the friction of the air molecules with the walls under the passage is intensified, and consequently the air molecules absorb heat from the body wall, and consequently the wall temperature will decrease (Bahadori Nejad 1981, 160). In addition to creating shadows in the passage, the Sabat accelerates the flow of air by combining with the passage bodies and also reduces the temperature stored in these bodies, which reduces the night radiation of the heat stored during the day from the wall of Sabat to the surrounding space. As a result, Sabat has a longer length, smaller openings and rough-textured materials with bright colors and high heat capacity (generally thatch) in warmer and drier climates and, so it provides the natural conditions for comfort by controlling the two climatic components of sunlight and temperature on the one hand and wind on the other.

2.1.4 Defensive function

In the past, biological complexes had to operate independently and be able to defend themselves. This capability is manifested in the form of introverted architecture with winding and very narrow passages. The height of the passages was greatly reduced by the construction of sabats, which made it impossible for the rider and his animal to pass through these passages simultaneously. Thus, Sabat was considered as a factor in the passages, which separated the rider and his animal from each other and moderated the offensive force of the enemy to a great extent. In addition, in times of danger, it was possible to move and help the residents of the houses through these sabats, which connected the two adjacent houses in the form of a bridge.

2.2 A quantitative analysis of the historical context of Naein

Since the Sabat is a covering element, it must have features and forms in terms of shape and form that can perform the function of covering a space. In quantitative study, sabats can be examined in terms of volume composition and dimensions, facades, proportions and openings, covers and materials.

2.2.1 Dimensions and proportions

What is important in the physical analysis of Sabats and the basis of climatic analysis is their difference in the type of shading rate in relation to the ratio of the dimensions of the Sabats to each other. Sabats in the historical context of Naein have almost the same dimensions. Their shading, on the one hand, is influenced by Sabat's height, width, length, and, on the other hand, the angle of the

sun's rays. Therefore, the higher height of Sabat increases its shading. In fact, the proportions of the sabat and the low width are such that it provides the least penetration of radiation into the space inside the passage. Table 2 has shown the average dimensions of the sabats in length, width and height.

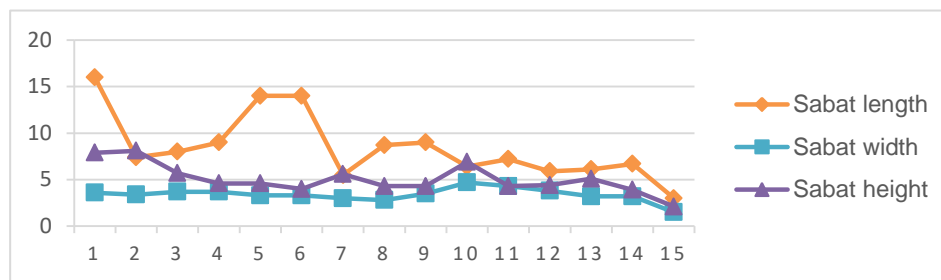


Figure 6. Dimensions of Sabats; Source: Authors.

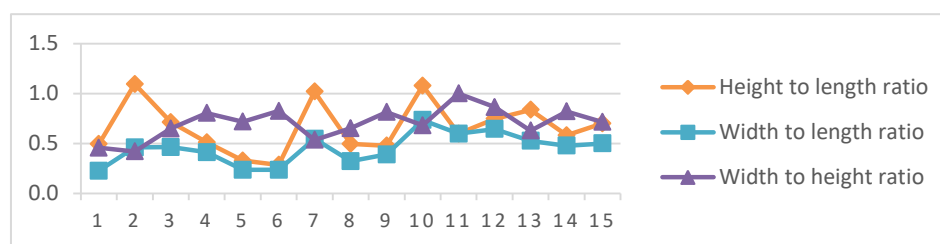


Figure 7. Sabat proportions; Source: Authors.

Table 2. Average proportions of Naein sabats (metric); Source: Authors

Average length	Average width	Average height	Average width-to-length	Average width-to-height	Average height-to-length
8.550	3.40	5.10	0.5	0.7	0.7

2.2.2 Volumetric composition


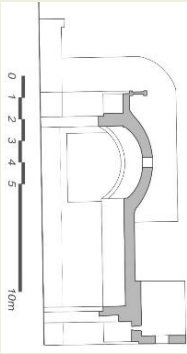
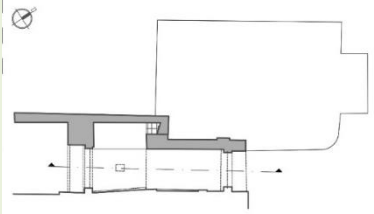

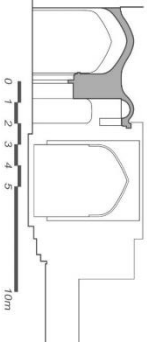
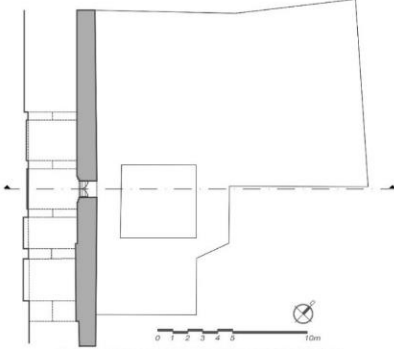

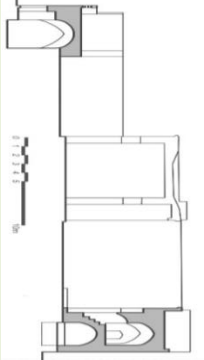
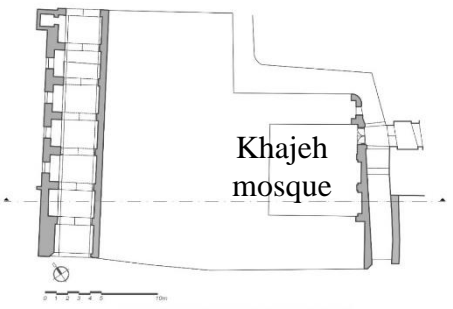
The lower level of these multifunctional elements present in urban spaces is related to public passage and has an I-shaped plan. Sabat's volumetric composition at the upper level of the passage according to the intended use type, the width of the passage and the height of the bodies has been designed in open (bridge between adjacent houses, entrance definition), closed forms (one or more rooms) with opening in the facade and semi-open form, with the porch in front of the closed space of Sabat. The openings and semi-open surfaces of the sabats have been defined in relation to the hot and dry climate of Naein. Semi-open surfaces include a porch in front of the Sabat closed space. This mode acts as a barrier layer in front of the main space, and therefore is intended to create more shadow depth of the porches. In some Sabats, the interior views in the underpass level have pores and skylights that are either open from the body of the sabat to the passage, such as (Amini Sabat) or, conversely, from the building parallel with the passage, openings have been opened into the sabats (Cheldokhtaran and Baqerion Sabats).

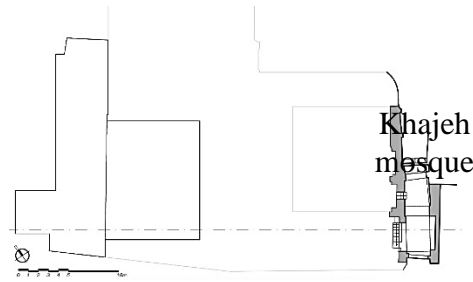
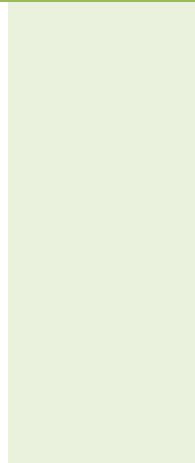
2.2.3 Materials and cover

The main materials used to make Naein sabats are in the body and clay cover, which are also lined with straw mortar in the walls. This type of material has a rough context, light color and high thermal

capacity. It is the best choice in response to the hot and dry climate of Naein with intense sunlight and high temperature. To cover most of the Sabats, the song arch, the arch and groin, the colonnbo arch, and the Kajaveh arch have been used (Tables 3 and 4).



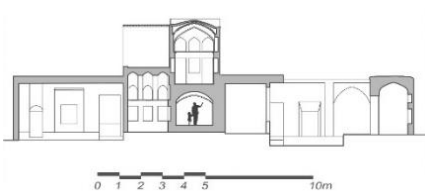
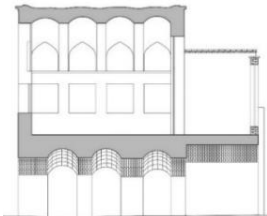
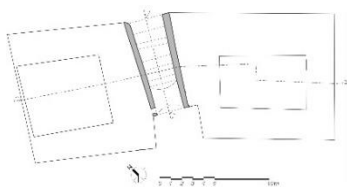
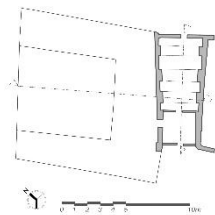
Table 3. Map and View – Shear of two Sabat samples with personal use; Source: Authors.

picture	View – Shear	map	sabat
			<p>panjaheh</p>
			<p>kaseefi</p>
			<p>khajeh</p>



khajeh

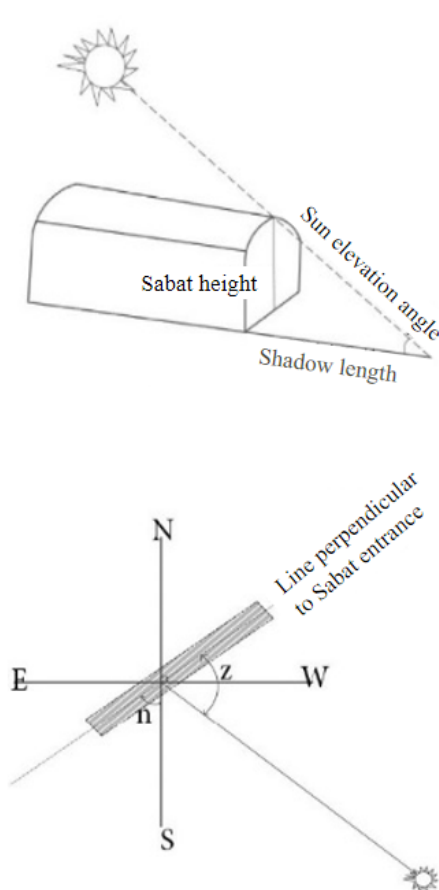
Table 4. Map and View – Shear of two Sabat samples with PUBLIC use; Source: Authors.

picture	View – Shear	Map	sabat
 	 	 	<p>amini</p>

2.2.4 Stretching of sabats

Of the fifteen Sabats studied in the historical context of Naein, ten Sabats have an east-west stretch and five Sabats have a north-south stretch. To get the length of the shadow created by the canopies; variables such as the direction and angle of the sun's rays are required (Kasmaei 2012, 53). According to the calculations performed on the dimensions of the sabats (length, width and height), the orientation and the predominant degree of their placement relative to the assumed axis and also the calculation of the direction of radiation and the angle of radiation, the average shadow length values of 6.40 meters for east-west Sabats and 3.20 for North-South Sabats were obtained (Figure 8). Therefore, the east-west passages during the day create a longer shadow in the passage space. In addition, the east-west passages and Sabats on these passages can work more efficiently for directing the wind (due to the prevailing wind direction of Naein) and subsequently in Cooling urban space and cooling the transition walls.

Figure 8. Calculation of the shading of Sabats; Source: Authors.



*Calculate the angle of the sunlight

$$\sin(B) = \sin(L) + \cos(L) \sin(d) \cos(t)$$

*Calculate the direction of sunlight

$$\sin(z) = \sin(L) \cos(d) / \cos(b)$$

$$t = -45, d = 23.5, b = 50, z = 90$$

*Calculate time

$$T = 12 - T \cdot 15$$

The distance between two orbits on the surface of the earth = 15

Official time = 12

$$\text{Time, } T = (9.15)$$

*Calculate the length of the shadow

$$D = \frac{h \cos(z + N)}{\tan B}$$

Angle between the line perpendicular to Sabat and south = N, Angle of radiation = Z, Angle of radiation = Tan B, Shading depth = D

Conclusion

Sabat, on the one hand, is a spatial-physical structure which is related to the social structures of neighborhoods and personal and public spheres, on the other hand. This has led to the fact that it has played a key role in neighborhoods and turning from a cover-up with a mere shading role into a multifunctional element. This research emphasizes that based on Sabat's sampling in historical contexts, based on qualitative and quantitative methods, new dimensions of the nature of Sabats in the structure of neighborhood passages can be found. Also, from a methodological point of view, the production of analytical models requires preconceptions based on historical interpretive analysis of ownership documents, observations and field observations and reference to the oral memory of residents, to analyze the process of space production over time. Based on this methodological view, the qualitative and quantitative characteristics of the historical context of Naein can be stated as follows:

Qualitative	Creating extra space on the passage	✓ The lower level of the passage that is used as a general stress and the level on the passage that has an application. And its ownership belongs to one of the owners of both sides of the passage.
	Social	<ul style="list-style-type: none"> ✓ Creating private space with confinement, roofing and height difference with the overall space ✓ A place to gather residents of several houses and create a sense of solidarity and local neighborhood
	Climate	<ul style="list-style-type: none"> ✓ Tolerance to harsh conditions of Nain desert climate - Combining shadows created by Sabat walls - Increasing shading surfaces - Protecting passers-by from the intense sun and desert winds - Absorbing heat from the body wall and reducing the wall temperature
	Defense	<ul style="list-style-type: none"> ✓ Separating the rider from the animal and adjusting the offensive power of the attackers ✓ Helping each other in times of siege from above the sabat
Quantitative	Dimensions and proportions	✓ Average length of 8.50 m, average width of 3.40 m, average height of 5.10
	Volumetric composition	✓ Open (bridge between adjacent houses, entrance definition), closed (one or more rooms) with opening in the facade and semi-open with the porch in front of the closed space of Sabat have been designed
	Materials	✓ Has rough texture, light color and high thermal capacity (clay and mud)
	stretching	✓ Ten sabats with east-west stretch and five with north-south stretch

Subscripts

1. In Dehkhoda's Persian dictionary, Sabat is considered an Arabic name and its definition is as follows: The passer-by cover, the roof between the two walls below it, the passage between the two houses that lead to the house, and the arch built on both sides of the road by the benefactors (Dehkhoda 1973, 13185). The definitions of sabats proposed by Dehkhoda have architectural functions and definitions: The definition of sabat as the passage between two houses through which they pass from one house to another is a reference to the connection of two or more properties on either side of the passage through the sabat and the connection of the two at the top of the passage to each other. Therefore, the above phrase also contains the functional aspect of the roof. Also mentioning Sabat with this title that it is an arch built in the passages and between the alleys by the benefactors could be a reference to covering up the passage and protecting it from the weather, which is a climate solution, or creating more space for benefactors, which has a public and utilitarian aspect.

In other Persian dictionaries, such as Moin Encyclopedic Dictionary, Amid Encyclopedic Dictionary, Nafisi Encyclopedic Dictionary, and Bozorg Sokhan Encyclopedic Dictionary, Sabat is known as an Arabic name and means the passage cover.

2. Mr. Javad Jebeli and Hossein Mirza Beigi in Bab Al-Masjad neighborhood, Mr. Barkhordar Vatan and Mr. Javad Yadegari in Kalvan neighborhood, Mr. Haidar Ali Mofidi and Mr. Saqabashi in Chehel Dokhtaran neighborhood, Mr. Nikzad and Mr. Abbasi in Koi Sang neighborhood, Mr. Safaei and Shadfar in Sarai No neighborhood, Mr. Ali Naghi and Anousheh in Nogabad neighborhood, and Mr. Yousef Mohseni and Ferdowsizadeh in Panjah neighborhood are among the interviewees.

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