Fekri House in Hormozgan province, Bandar-Lengeh city. Source: Jaseem Tamimi.

Dezhgan Mosque in Hormozgan province, Bandar-Lengeh city. Source: Jaseem Tamimi.

Analysis of structure and function of natural air-conditioning elements in the traditional context of Bandar-Lengeh

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Abstract: Bandar-Lengeh features a stable pattern in the local architecture of South Iran, including two operative natural air-conditioning elements: Moshabak and Wind catchers. Since there are quantitative studies on these stable elements, this study aims to qualitatively analyze the structure and function of these local elements in Bandar-lengeh. In the first stage, information is obtained from the library, valid resources, and formal documents. Subsequently, active observation is conducted at the presumed location to collect, analyze, and extract natural air-conditioning elements (Wind catchers and Moshabak) from 273 buildings aged between 40 and 70. Additionally, in the third stage, the effect of temperature was observed by combining Wind catchers and Moshabak and placing them in various locations. Consequently, after evaluating and examining, the results indicate that every architectural element effectively met the residents' needs for natural air-conditioning.

Keywords: Local architecture; Bandar-lengeh; stable elements; natural air-conditioning; Moshabak.

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1. Introduction

The most critical issue today is saving energy (Maleki, 2011). Approximately 40 percent of Global energy is used in the construction industry (Steemers, 2003; Quirós, 2006; Sisson et al., 2009; Hennicke & Bodach, 2010; Taghizade et al., 2019). Most of this consumption concerns buildings' heat systems and air-conditioners, and engineers and designers are working on new techniques to reduce energy usage (Chenari et al., 2016; Grütter, 2019). One of these methods is in line with taking advantage of natural air-conditioning instead of electrical systems (Mazraeh & Pazhouhanfar, 2018). This results from centuries of experience, contemplation, and a constant source of knowledge for dealing with harsh weather conditions (Abro, 1994; Rudiak-Gould, 2011; Mirmoghtadaee, 2016).

The Islamic Republic of Iran has a vast climate area. Architects and inhabitants have attempted to use the country's particular natural elements to stabilize their construction. Therefore, diverse building and construction styles can be perceived against harsh weather conditions throughout the country.

One of these regions is Bandar-lengeh in the south of Iran. In this area, natural air-conditioning elements such as Wind catchers and Moshabak are used in various forms and sizes to stabilize and enhance buildings against water, hot weather, and other regional difficulties. For instance, most Wind catchers and Moshabak research focuses on hot and dry areas. Therefore, this study analyzes and assesses the structure and function of these two architectural elements (Wind catchers and Moshabak) in local houses. It explores how past architects and users of these houses have utilized wind power to create stable architecture.

2. Research Methodology

This study explores a unique aspect of architectural design, focusing on utilizing natural air-conditioning elements in a region with hot and humid conditions. The outcome of this research is a testament to the inhabitants' innovative thinking in a specific area with a rich historical perspective; a comprehensive data collection process involved examining documents, library resources, and field observations. To understand the function of these unique local architectural elements in Bandar-lengeh, 273 houses, aged between 40 and 70, were meticulously observed and analyzed regarding their natural air-conditioning elements (Wind Catchers and Moshabak).

3. Realm of study

Bandar-lengeh is 251 kilometers southwest of the center of Hormozgan province (Figure 1). The area experiences hot and dry coastal air masses and wet and moderate marine air masses due to its proximity to the sea. This can result in winds reaching up to 60 kilometers per hour. However, it undergoes an unpleasant weather situation; it has a vibrant and local architecture that provides the people with comfort and an easy way of living (Santamouris, 2003; Rapoport, 2005; Sobh, Belk, Wilson, & Ginena, 2012; Khalili & Amindeldar, 2014). In the past, people from the Arab region around the southern Persian Gulf frequently traveled for vacation (Mazraeh & Pazhouhanfar, 2018).

According to temperature measurements in summer, it varies from 33 to 45 centigrade degrees (Table 1). The hottest months are June and September, which leads to users' dissatisfaction. Furthermore, humidity (on behalf of closeness to the sea) is considered highly humid and reaches 100 % in some cases. The hot and humid weather

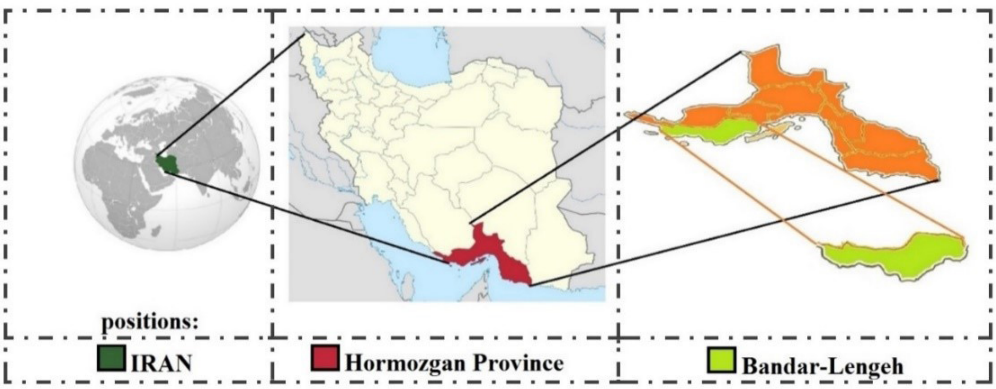


Figure 1 | The geographical location of Bandar-lengeh on the map.

Table 1 | Values (PET) for different months in Bandar-lengeh (Roshan et al., 2018).

Jan	Feb	Mar	Apr	May	Jun
Comfortable	Comfortable	Slightly warm	Warm	Hot	Very hot
19.5	21.3	24.9	31.2	37.6	41.4
Jul	Aug	Sep	Oct	Nov	Dec
Very hot	Very hot	Hot	Warm	Slightly warm	Comfortable
43.2	43.1	40.1	34.7	27.3	21.8

has created a very uncomfortable situation, which traditional architecture in Bandar-lengeh would have been able to address in order to ensure people's comfort in traditional buildings (Moghaddam et al., 2011).

4. Natural air-conditioning and thermal comfort

Natural air-conditioning refers to moving air within a space to replace hot and humid air with fresh air, creating a cooler and more comfortable environment for humans (McLellan & Selkirk, 2006; Mazraeh & Pazhouhanfar, 2018, 2020). Natural air-conditioning in building design helps control hot weather and maintain internal thermal comfort using minimal energy. Much research on Iranian local architecture focuses on the thermal function of the air-conditioning system (Bahadori & Yaghobi, 2006; Allard & Ghiaus, 2012; Foruzanmehr, 2015). For instance, natural air-conditioning systems in Bandar-lengeh can be Moshabak and Wind catchers (Mazraeh & Pazhouhanfar, 2018). One Arabic example of such a system is "Mashrabia," composed of a penetrated window with holes to emit little light into the inner space while operating as a natural air-conditioning (Kenzari & Elsheshtawy, 2003). Another improved version is the Moshabak on the openings of the walls of old constructions.

4.1. Natural Ventilation in the Environment

In Iran, two climates (hot-dry and hot-humid) are more conducive to natural ventilation than other regional climates. Architects at the time considered these climates. For example, the cities of Yazd and Kashan, known for their historic use of the windcatcher natural ventilation element, are in hot-dry climates. Due to the lack of ambient humidity, local architects utilized a triangle consisting of ventilation elements (windcatchers and water pools (or hand-dug wells) along with a space element (rooms) to create environments suitable to human life (A in Figure 2). In Bandar Langeh, the local architects constructed the buildings along the coast due to the hot-humid climate. This allowed the architects to catch the sea breeze using natural ventilation elements like wind catchers and lattice windows, channeling it into spaces like Babar rooms and other living areas and creating a comfortable environment for the inhabitants of the structures (B in Figure 2).

5. Natural air-conditioning elements

5.1. Moshabak

Research has demonstrated that people naturally experience light reception rather than through artificial and electronic means (Aries et al., 2010; Alawadhi, 2018). Studies indicate that the use and reception of light naturally can save up to 15% of energy in buildings (Yun et al., 2010; Choi et al., 2016). These Moshabaks play the role of thick curtains against heat and sunlight. Moreover, they provide us with a more pleasant interior space, maintaining the building's privacy and vision from outside for the user inside the building (Mazraeh & Pazhouhanfar, 2020). That has been common in Iran since the Safavieh-era (Makani et al., 2012; Kirimtat et al., 2016). With unique geometry and interception in windows, it is possible to have light and shade in various forms in a room (Robison, 1991). Bandar-lengeh's Moshabaks are supposed to be a set of small windows, commonly on top of the doors or on the sides, for light reception or fresh air (for indoor spaces) (Figure 3).

5.1.1. Reticulated windows materials

In the past, Moshabak was constructed using materials like brick, mortar, plaster, and wood in different shapes, such as rectangles, squares, circles, or a combination of triangles and squares with curves. People used to consider the climate and available materials when choosing construction materials. For instance, wood was commonly used in "Gilan" (Pirani et al., 2011), while brick was the preferred material in "Yazd" (Dormohamadi & Rahimnia, 2020) and "Kerman" (Moghaddam & Khoshnevis, 2014). Additionally, plaster and mortar were commonly used in "Bandar-lengeh" due to the hot climate and the availability of local construction materials.

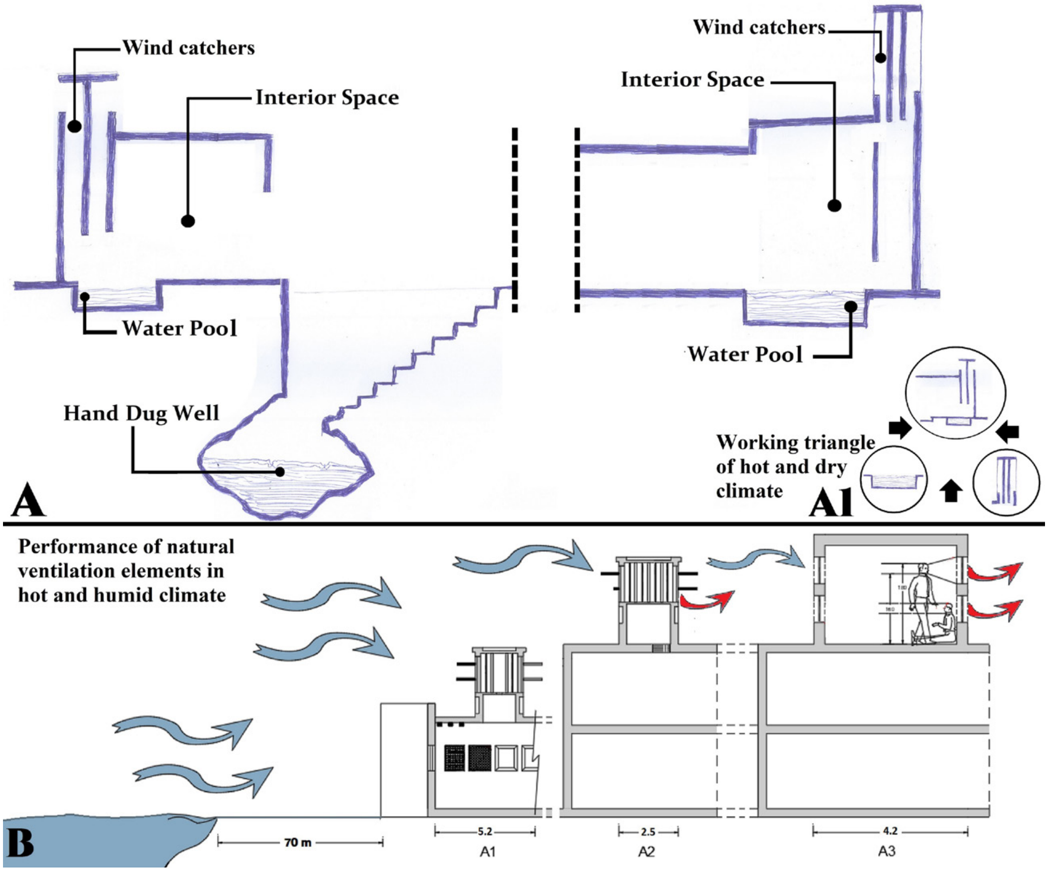


Figure2 | Natural Ventilation in the hot, dry, and humid climates of Iran.

Figure 3 | The most everyday positions for Moshabak to be devised among traditional buildings.

5.1.2. Positions

The position of reticulated windows in the plan

This setup causes the wind entering the room to circulate and ultimately exit through the opposite side. For instance, the breeze entering from the coast through the south wall (B in Figure 4) flows into the inner space and exits through the opposite side (D in Figure 4).

Position of the placement of reticulated windows on the plan

Four generations of Moshabaks have been found and identified during the field observation. Among these generations, the first type of Moshabaks (70-year-old buildings or older) can be seen to have a height of bump up to 40 centimeters from end to end, which had been an attempt to provide the users with comfort,

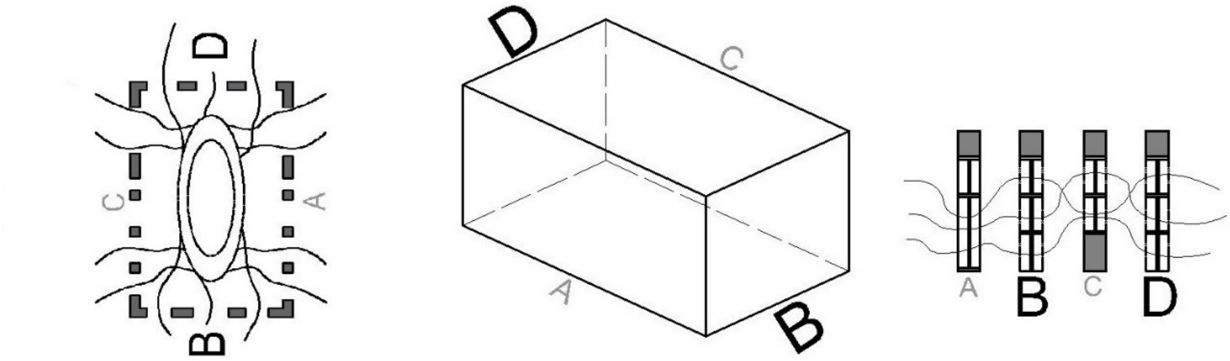


Figure 4 | Functional structure of natural air-conditioning in the room.

mainly when they sit or lie down to benefit from the movement of wind (A1 and A2 in Figure 5). The second generation of Moshabaks (60-year-old buildings or older) can be identified by the name of Baber-Room as the ultimate local architectural space of Bandar-lengeh. The building, designed with the extensive use of Moshabaks on all four sides, aimed to provide comfort for its users. After this generation, there has been less focus on adapting architecture to climate change due to the advent of electrical systems (B1 and B2 in Figure 5).

The third generation of Moshabaks (50-year-old buildings or older) can refer to those spaces in this generation that take advantage of Moshabak at the same height as the yard, ramp, or roof of the building. Moreover, it has been applicable in many cases with different altitudes to provide a more comfortable environment than the first Windows sample for users. Even children used windows to get in/out. Adults sat/lay down to benefit from the breeze and moving wind (C1 and C2 in Figure 5). Furthermore, using Moshabak on the top of the doors became more common (D in Figure 4). The fourth generation of Moshabaks (40-year-old-buildings or older) refers to spaces with many windows on two sides and direction of the walls (facing north and south) and the least possible windows on the other two sides and directions (facing East and west) at the height of 1.6 to 2.4 centimeters from one side of the ground to another side where the room had been built. The design of this structure utilizes the openings of the walls to provide natural air conditioning and offer increased comfort for users while maintaining privacy. Compared to 1st and 3rd generation buildings, this approach results in better natural air conditioning and wind absorption (E1 and E2 in Figure 5).

5.1.3. Types of Moshabaks

In the past, architects considered geometry a determining factor in construction (Mazraeh, 2015; Navarra, 2011). According to field observation, 42 types of different Moshabaks were found among 273 local buildings.

Each Moshabak, on behalf of its shape and geometry, is a sign of the inhabitants' creativity and the architects' novelty (Mazraeh & Pazhouhanfar, 2020). The situation in Moshabak can be categorized as practical, damaged, and destroyed. Among the examined Moshabaks devised in local buildings, it can be comprehended that the frequent causes of their destruction are lack of attention and care for Moshabaks by users, architects, and, more importantly, Iran's cultural heritage and tourism organizations.

A significant number of the most beautiful Moshabaks were destroyed, and a minimal number of them is demonstrated in Figure 6 (rows 26/27/35/36/38/39/41/42 are on the list of destroyed samples, and no such Moshabak exists in Bandar-lengeh).

It has been time-consuming to conduct long-term examinations and identify the types of Moshabak for two main reasons. Firstly, counting has been a challenging task. Secondly, mistakes can be made when counting for each specific shape and geometry. Based on (Diagram 1 and Figure 6), it can be concluded that Moshabaks No.23, with 104 instances, have been the most numerous in the selected architectural context of Bandar-lengeh. Moshabak No.29 is present in 84 buildings, and Moshabak No.24 is present in 67 buildings, making it the third most common type due to its

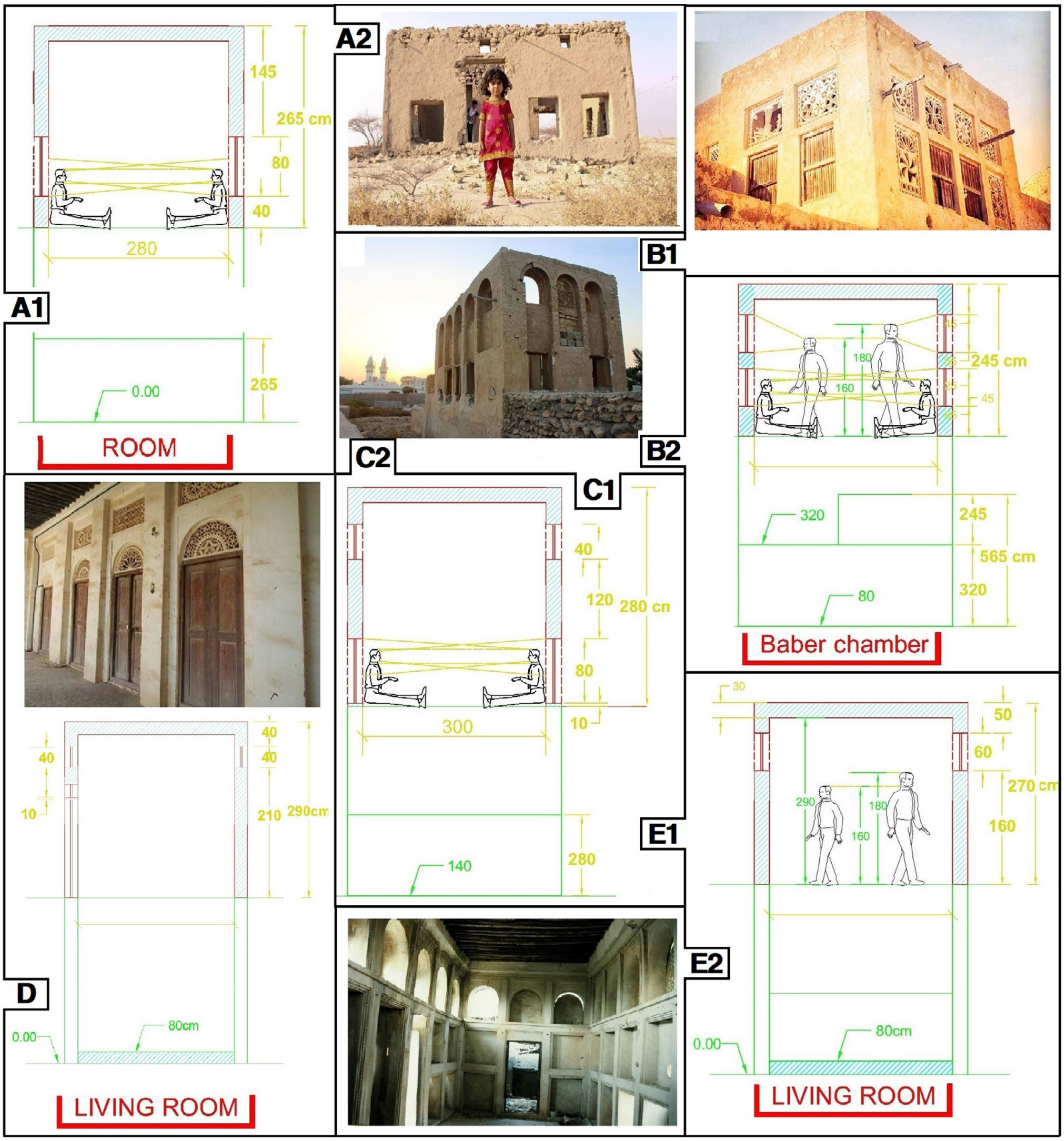


Figure 5 | Placement position of Moshabak within the walls.

ease of implementation. Additionally, it is concluded that out of 273 local buildings, 491 Moshabaks were obtained. Among these, 199 (40.53%) were found in proper condition, 151 (30.75%) were found in a damaged condition, and 141 (28.72%) were found in a destroyed condition.

Based on the initial review, photographs, and mapping, it has been illustrated that the “Amir Khan” building, along with its numerous and beautiful Moshabak designs, was in good condition in 2016. However, by 2020, it had been transformed into a dilapidated structure. Given that it was considered one of the most important residential buildings,

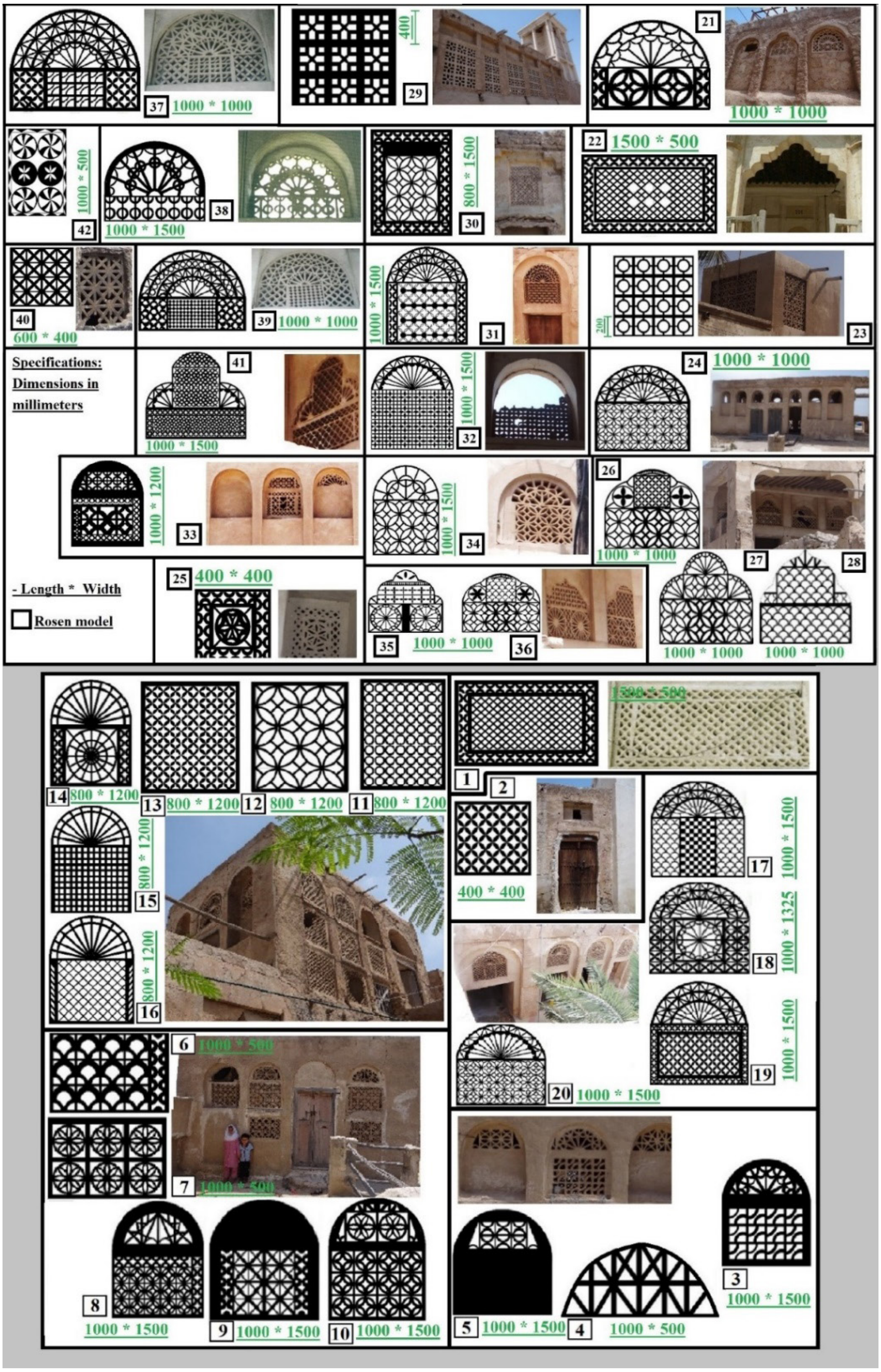


Figure 6 | Types of Moshabak devised in the existing context of Bandar-lengeh. *Source:* All the Figures originated from the cultural heritage and tourism organizations of Bandar-lengeh, except 22 and 38.

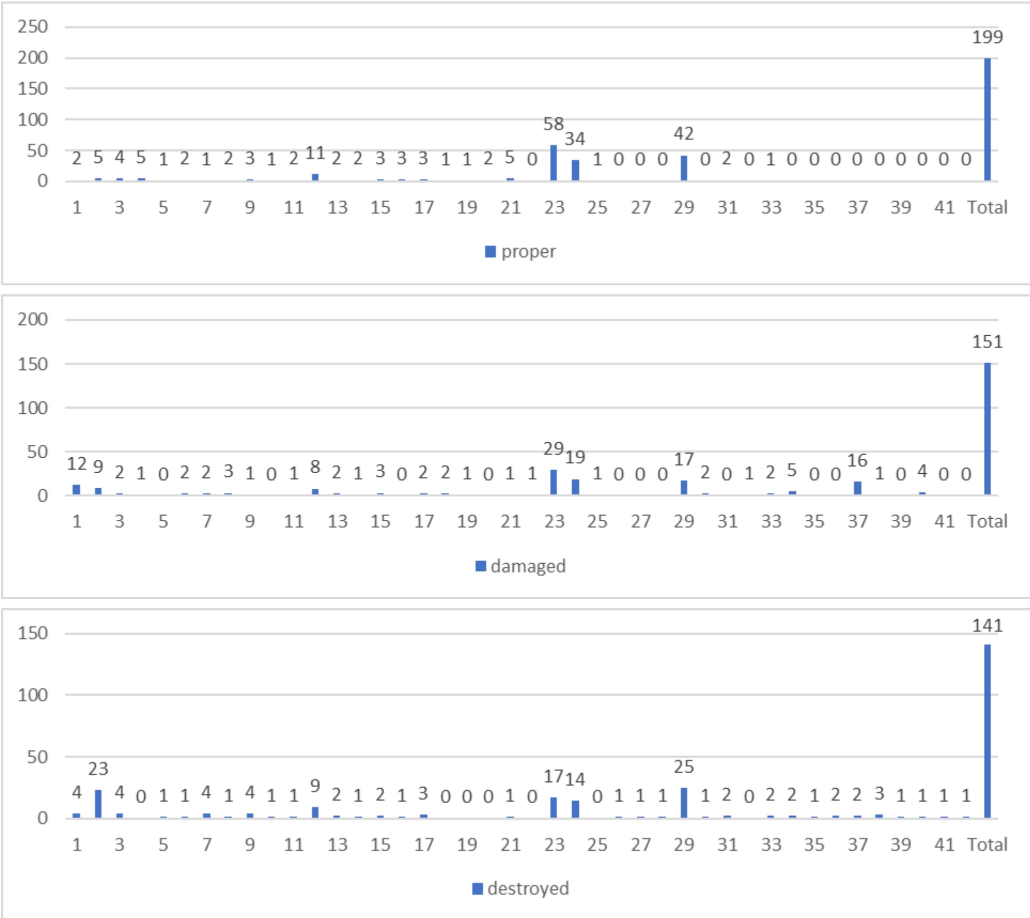


Diagram 1 | Current number and function of Moshabaks in Bandar-lengeh.

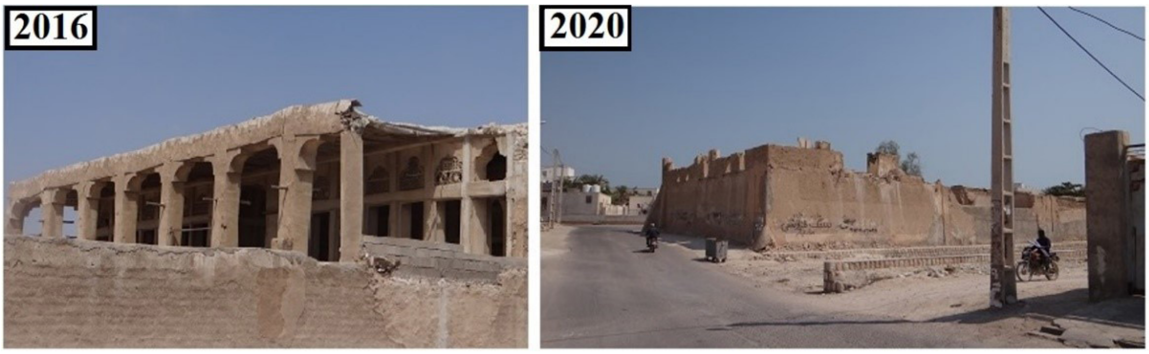


Figure 7 | The destruction of the "Amir-Khan" building.

featuring intricately designed Moshabak, the owner had repurposed it for livestock storage in recent years. Currently, the building can be observed in its ruined state within the urban fabric of Bandar-Lengeh (Figure 7).

5.1.4. The proportion of usage of each Moshabak in each space

Based on data collected from 273 constructions, which included 491 Moshabaks, it was found that the most common use of Moshabak is for Baber-Room,

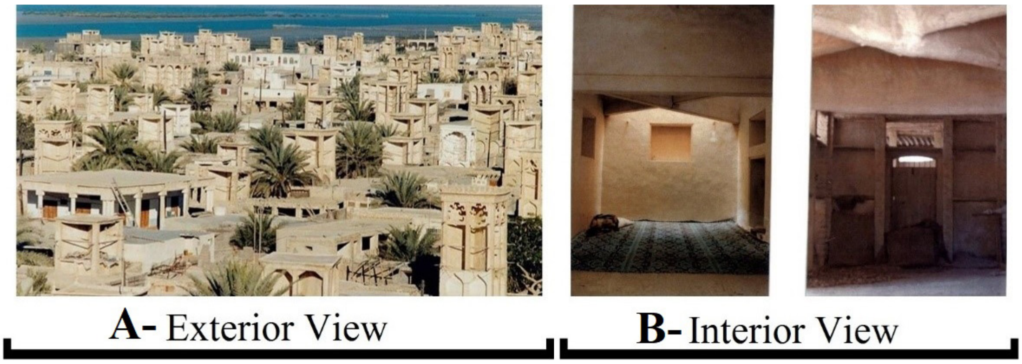
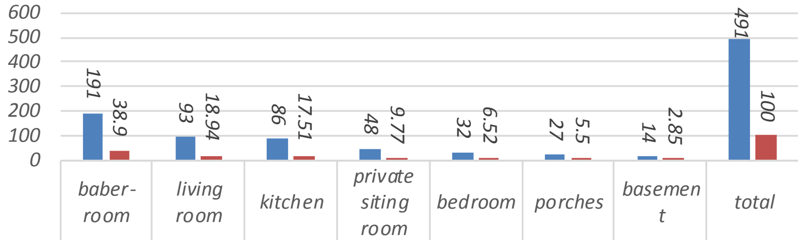


Figure 8 | Old context of Bandar-lengeh and Moshabaks devised in constructions.



	baber-room	living room	kitchen	private siting room	bedroom	porches	basemen t	total
the number of moshabaks	191	93	86	48	32	27	14	491
precent	38.9	18.94	17.51	9.77	6.52	5.5	2.85	100

Diagram 2 | Distinct positions of Moshabaks in the openings of different spaces.

accounting for 191 of them (38.9%). These Moshabaks are typically observed on all four sides of the wall openings. As illustrated in Figure 5 (B1 and B2), the openings in the Moshabaks affected the room regarding sitting, standing, and inscriptive position. For the point that Baber-Room on the top of the building had been capable of receiving more appropriate wind, users could experience more thermal comfort. The living room has the second highest number of Moshabaks, with 93 (18.94%) after Baber-Room. Moshabaks add a sense of beauty to the living space. The kitchen is third, with 86 (17.51%) used to eliminate the heat from cooking. Other places like private sitting rooms have 48 Moshabaks (9.77%), the bedroom has 32 Moshabaks (6.52%), porches have 27 Moshabaks (5.5%), and stores have 14 Moshabaks (2.85%) among traditional spaces (Diagram 2).

5.2. Wind catchers

Wind catchers are natural air-conditioning elements used in hot, humid, and dry regions to naturally provide indoor spaces with fresh air. Moreover, they are placed on the roofs of buildings (Bahadori, 1994; Battle et al., 2000; Nouanégué et al., 2008; Zarandi, 2009). These local architectural elements were used in various places, including the living room, dining room, and Bedroom (B in Figure 8). In the local context of Bandar-lengeh, it has been identified that more than 90 percent of buildings between 40 and 70 years old had wind catchers on the roof for indoor natural air-conditioning (A in Figure 8). The wind catchers were typically positioned around the corner of a building.

5.2.1. Materials and composing elements

Wind catchers in any climate have divergent functions and forms (Ghaemmaghami & Mahmoudi, 2005). They were built with materials accessible to the region and particular weather conditions (Foruzanmehr, 2015). The architecture of Bandar-lengeh, rich in historical context, primarily utilized two primary materials: 1- adobe, mud, and wood (for structures aged 50 years or older) 2- brick, adobe, mud, and wood (for structures

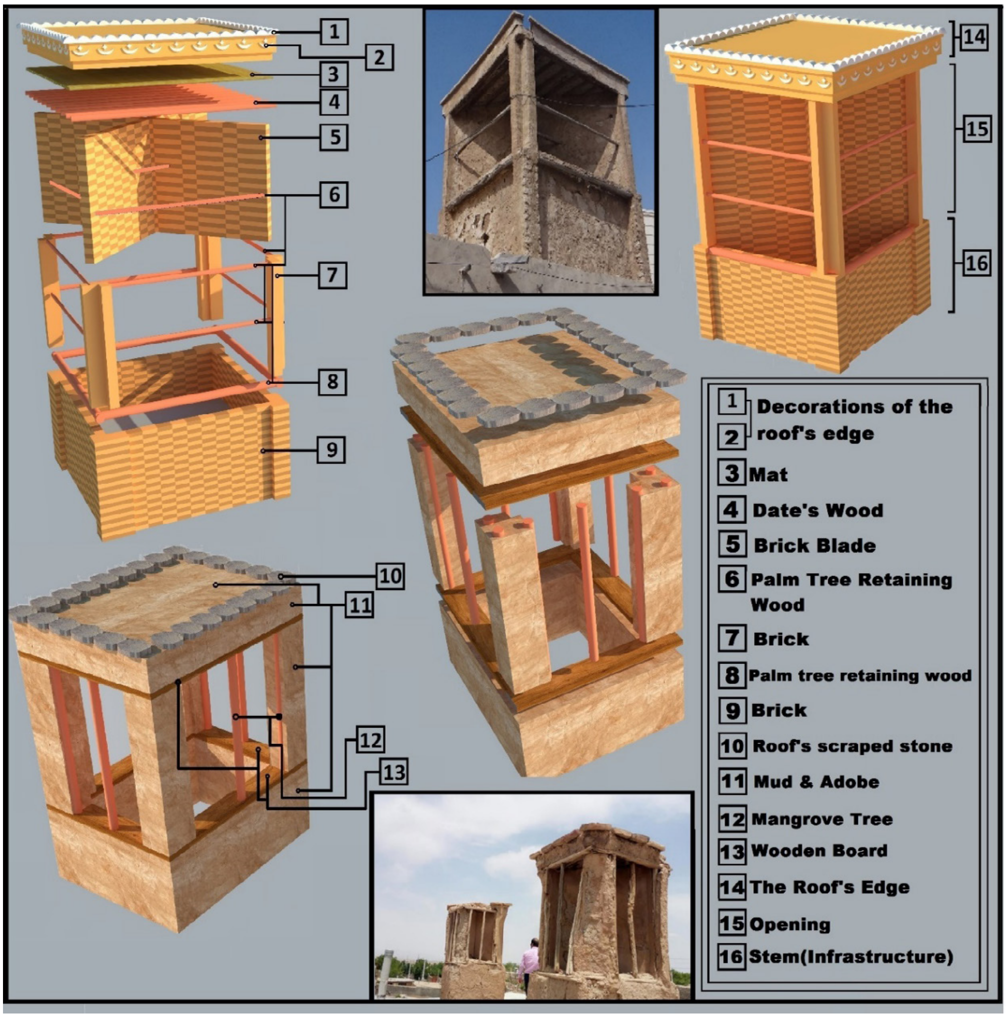


Figure 9 | Methods of making wind catchers with traditional materials.

aged 50 years or less) (Figure 9). These materials, chosen for their durability and local availability, are a testament to the region's architectural heritage.

In terms of composing elements, a wind catcher is not just a functional structure but a work of art divided into three parts: stem, opening, and roof. Stem is defined as the infrastructure of the wind catchers and their decorations in the shape of perforated volumes. The opening consists of a blade (in one, two, three, or four directions) to receive the wind and conduct it into indoor space. The roof is a kind of added beauty with decorations for the wind catchers in different forms and volumes. These unique architectural features will intrigue and inspire architects and historians alike.

5.2.2. Types of wind catchers existing in Bandar-lengeh

Bandar-lengeh is home to 273 wind catchers, encompassing six distinct types: Octagonal, hexagonal, and cylindrical. It is worth noting that the wind catchers of types H, D, and I have been lost to time, with only archived figures remaining. We have unilateral, bilateral, and four-sided wind catchers to further elaborate on the different types of wind catchers. These include three implementation methods with different openings to absorb wind (E, F, and G) and one bladeless method (C).

Understanding the functionality of these wind catchers is critical. Unilateral Wind catchers, for instance, are designed to guide the wind's entrance

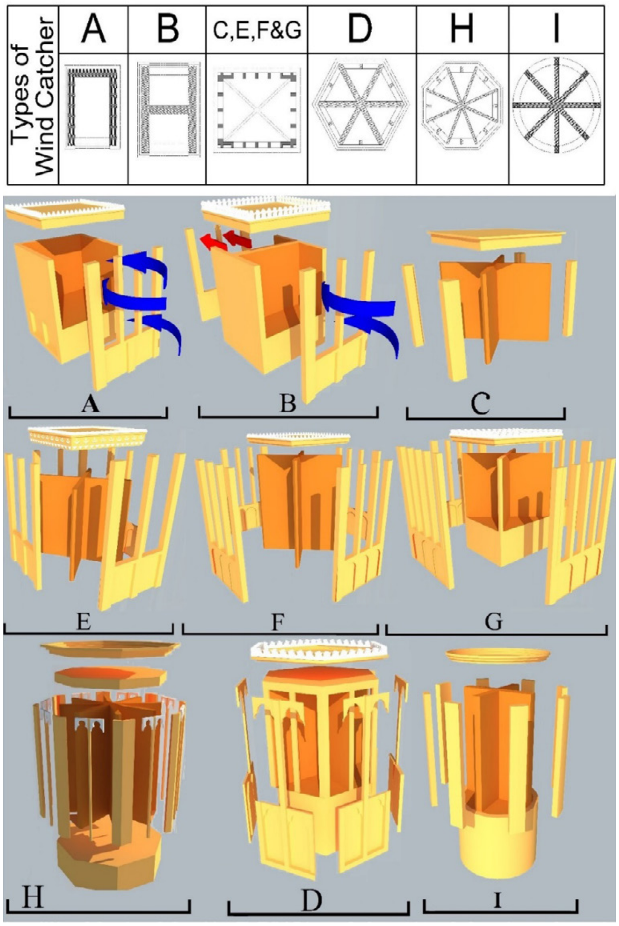


Figure 10 | Plan and 3D elaboration of wind catcher types in Bandar-lengeh.

(Blue arrow) into the room. Bilateral Wind catchers, on the other hand, facilitate both the wind's entrance (Blue arrow) and its exit on the opposite side (Red arrow). Lastly, regardless of the direction of the wind, the four-sided wind catchers efficiently channel it into the room and disperse it from other sides (Figure 10).

5.2.3. Proportionality of types of wind catcher

The size and proportionality of wind catchers are evaluated based on climate and placement position (Mazraeh & Pazhouhanfar, 2020; Noroozi, 2020). Wind catchers are divided into two parts, stem and opening, in terms of proportionality. The opening takes three forms: square, rectangle, and vertical rectangle, while the stem takes the forms of square, rectangle, and horizontal rectangle. The tallest wind catcher is measured to be 650 centimeters, which is related to a four-sided wind catcher with a stem; on the other hand, the shortest wind catcher is measured to be 210 centimeters, which is related to a four-sided wind catcher without a stem (Figure 11).

5.2.4. Decorations

Wind catchers are natural air-conditioning elements in the local context possessing geometrical decorations (Mazraeh & Pazhouhanfar, 2020) and proportionalities in different forms (Burckhardt, 2009; Dabbour, 2012). They are highly appreciated among people for their economic value and aesthetics (Winthrop, 2014). The decorations used in wind catchers can be seen in the stem, opening, and roof.

5.2.5. Stem

The stem, often considered the foundation of the wind catcher (part 19 in Figure 9), is a testament to the precision and beauty of its design. It bears the weight of the wind catcher, conducting it to the roof. The wind catcher is a sight to behold with its perforated geometry and one to four apertures. It takes on diverse forms from 80 to 240 centimeters, from long vertical rectangles with symmetrical geometry to simple squares and long horizontal rectangles (Figure 12).

5.2.6. Openings

The number of openings in wind catchers (part 15 in Figure 9) varies based on the landlord's wealth and capital. It is expected to have one, two, three, or four

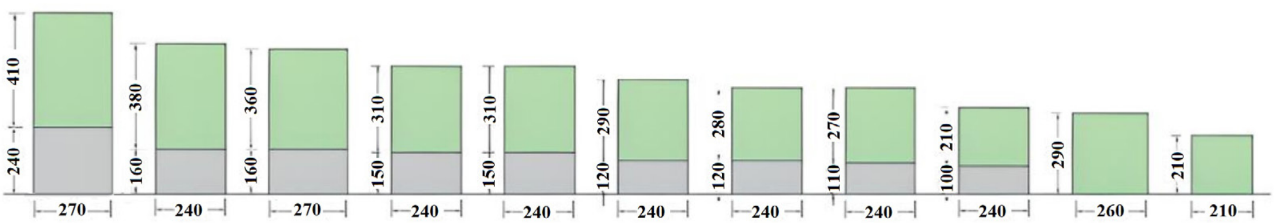


Figure 11 | Proportionality from stem and openings of wind catcher types existing in Bandar-lengeh.

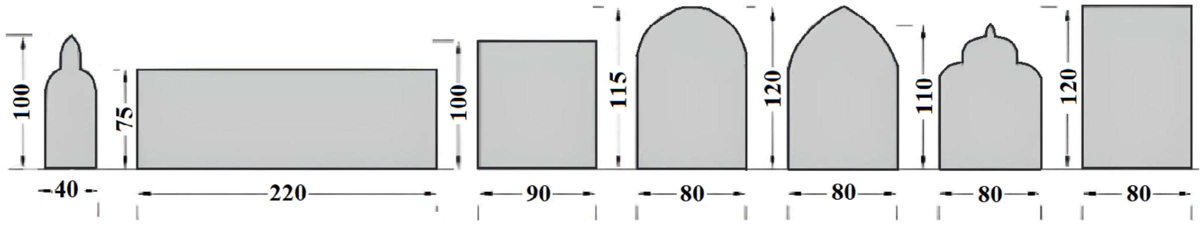


Figure 12 | Different forms assumed by wind catchers.

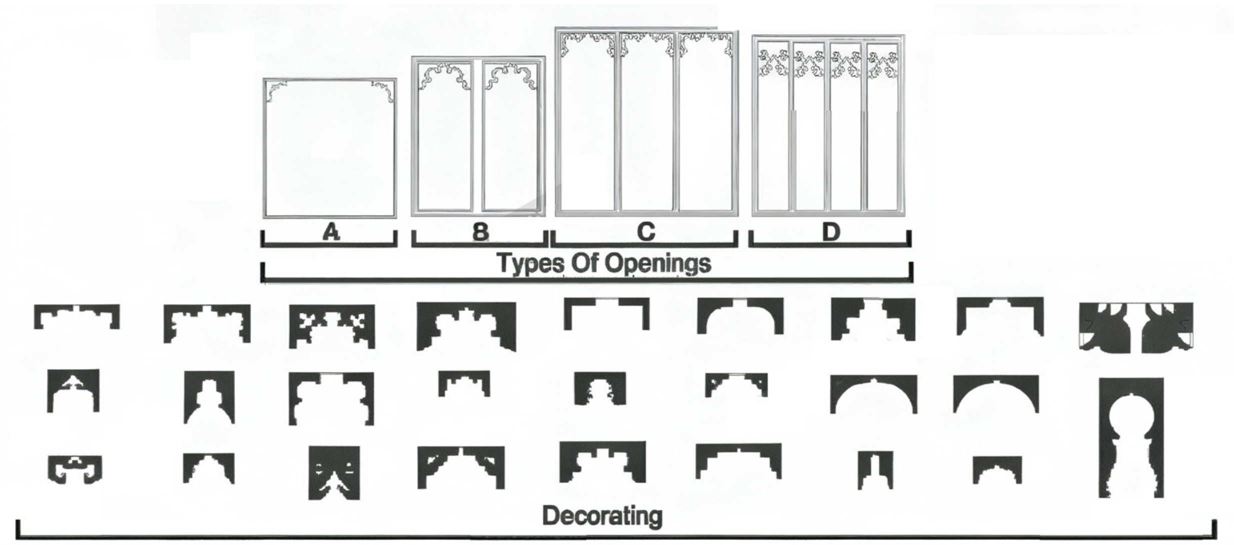


Figure 13 | Various numbers and types of decorations on openings in wind catchers.

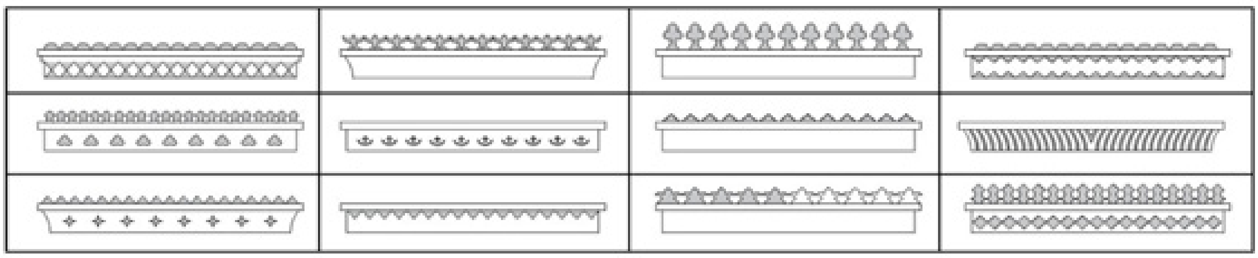


Figure 14 | Types of decorations used on the roof of wind catchers.

ones (A, B, C, and D in Figure 13). These would have been decorated with simple drawings or beautiful shapes. Through observation, it is determined that 26 models of openings with flower decorations and geometrical drawings exist in the context of Bandar-lengeh, which is a sign of beauty, function, and practicality among local architectural elements (Figure 13).

5.2.7. The roof of the building

Drawings such as Manikins, bushes and flowers, geometrical shapes, and birds have been used to decorate the roof. According to field observation, 12 models exist among Bandar-lengeh wind catchers to be used for the roof's decoration (Figure 14).

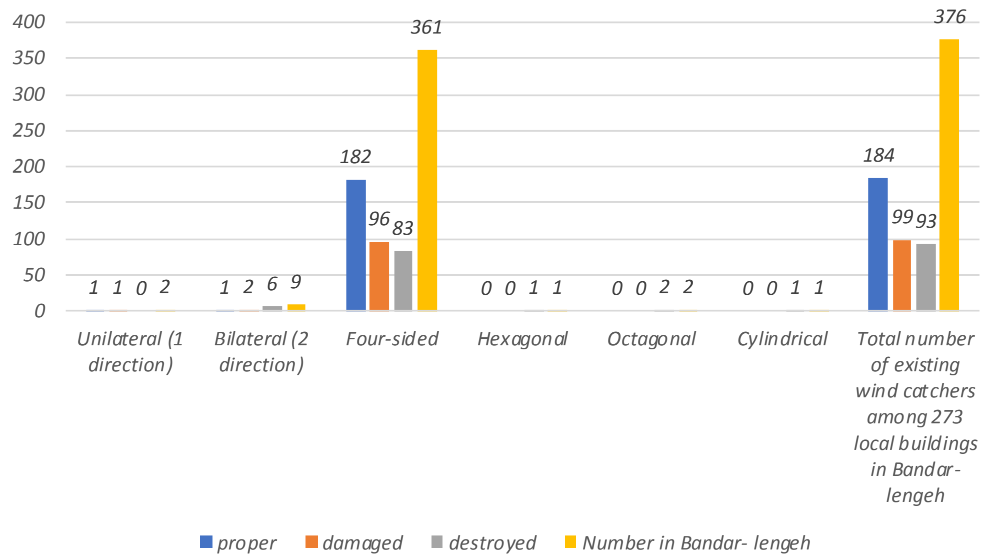
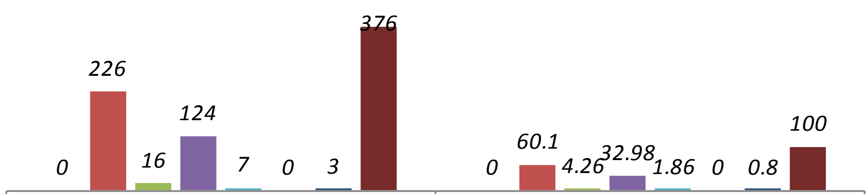


Diagram 3 | The number and situation of existing wind catchers in Bandar-lengeh.



	the number of moshabaks	precent
baber-room	0	0
living room	226	60.1
kitchen	16	4.26
private siting room	124	32.98
bedroom	7	1.86
porches	0	0

Diagram 4 | Distinct positions of wind catchers in different places.

5.2.8. The situation of each wind catcher in the urban context of Bandar-lengeh

After analyzing 273 buildings, 376 wind catchers were found on the roof of buildings, among which 93 (24.73%) were destroyed, 99 (26.33 %) were damaged and on the verge of destruction, and only 184 (48.94%) were functionally proper. The most common types of wind catchers, in descending order, are 361 four-sided ones (96.01%), nine with bilateral (two-directional) openings (2.39%), as well as unilateral (one-directional) and octagonal with two (0.53%) each. Additionally, there are hexagonal and cylindrical wind catchers, with only one (0.27%) of each found (Diagram 3).

5.2.9. The ratio of every type of wind catcher in each space

Based on field observation, it was found that out of the 376 wind catchers in the selected areas, the most common location was the living room, with 226 (60.1%). Following that, private sitting rooms had 124 (32.98%), kitchens had 16 (4.26%), bedrooms had seven (1.86%), and basements had three (0.8%). These wind catchers are used in the local architectural context of Bandar-lengeh to provide thermal comfort and pleasant conditions in spaces where people gather more frequently (Diagram 4).

6. The analysis of spaces including two elements (Windcatcher and Moshabak) in local architecture

6.1. Analysis method

To measure the thermal and comfort conditions among the local houses regarding the climate of Bandar-lengeh, a thermometer, "Lutron YK-90HT," has been used to measure the interior space's temperature. This device has a thermal sensor compatible with this purpose (Figure 15).

Figure 15 | The device "Lutron YK-90HT "for taking the temperature.

6.2. Results of analysis

Since the Octagonal, hexagonal, and Cylindrical wind catchers belong to the destroyed category of wind catchers in the context of Bandar-Lengeh, and there is no access to assess and examine them, we have only focused on the unilateral (one direction), bilateral (two directions), and four-sided wind catchers. Conducting sea-breeze through wind catchers and Moshabaks into the interior space can bring about more comfortable thermal conditions indoors (Freitas et al. 2007, Mazraeh and Pazhouhanfar 2018). In this case, we chose three buildings (Figure 16) constructed with adobe and mud, including four-sided, unilateral, and bilateral Moshabaks, to help us analyze the room's temperature.

The temperature of wind entering from the opening of the wind catcher was taken to be 38.7 centigrade degrees; on the other hand, the minimum temperature of interior space at its best condition is taken to be 33.7 centigrade degrees, which is 5 degrees less as a result of a combination of Windcatcher and Moshabak.

The wind catcher operates by circulating and cooling the interior space using Moshabaks with temperatures of 38.3, 38.6, and 38.9 degrees, while the front side of the wind catcher registers 43.2 degrees. This indicates that the four-sided wind catcher effectively handles hot air masses with the assistance of Moshabaks. After the four-sided wind catcher, a bilateral (two directions) wind catcher is considered. When wind enters the wind catcher at 39.2centigrade degrees, the minimum temperature inside the space is expected to be 36.1 centigrade degrees, which is 3.1 degrees lower than the temperature of the wind catcher opening. In this way, the combination of the wind catcher and Moshabak demonstrates that the air mass moving out from the Moshabak is 42.4 and 43.9 centigrade degrees, and the temperature of the moving air mass from the front side of the wind catcher is 44.3 centigrade degree that provides relatively acceptable condition comparing to four-sided room. In addition, after four-sided and bilateral (two-direction) wind catchers, the unilateral (one-direction) wind catcher revealed that the temperature of the entrance of wind from the wind catcher is taken to be 41.5 centigrade degrees, which would change to 37.4 at its best condition, hence, 4.1 degrees less in comparison. The combination of wind catcher and Moshabak led to 40.8 centigrade degree moving out air mass, which is a satisfactory result compared to four-sided and bilateral wind catchers. Since the wind catchers' openings face the sea, the hot air entering the interior will only escape through Moshabaks.

7. Conclusion

The local architecture of Bandar Langeh can be considered a sustainable model from a time when no mechanical ventilation systems existed. This architectural design effectively lowered temperatures, particularly during summer, when temperatures are between 33°C and 45°C. Wind catchers and lattice windows created a suitable living environment for humans. These elements (wind catchers and lattice windows) were prevalent in both hot and humid, and hot and dry climates of Iran and were constructed using local materials. They were placed to capture wind, particularly the sea breeze, as the breeze flows from the sea toward the coast, making the sea-facing directions the most effective for capturing wind.

Lattice windows were used in various ways, depending on the structures and locations. For instance, in Babar rooms, architects considered people's posture in the space. The lattice windows were connected to the floor for sleeping positions, placed 40 cm from the floor for sitting positions, and placed 160 cm for standing positions. The placement of lattice windows also depended on the room's function, such as a kitchen, a storage room, or a living area.

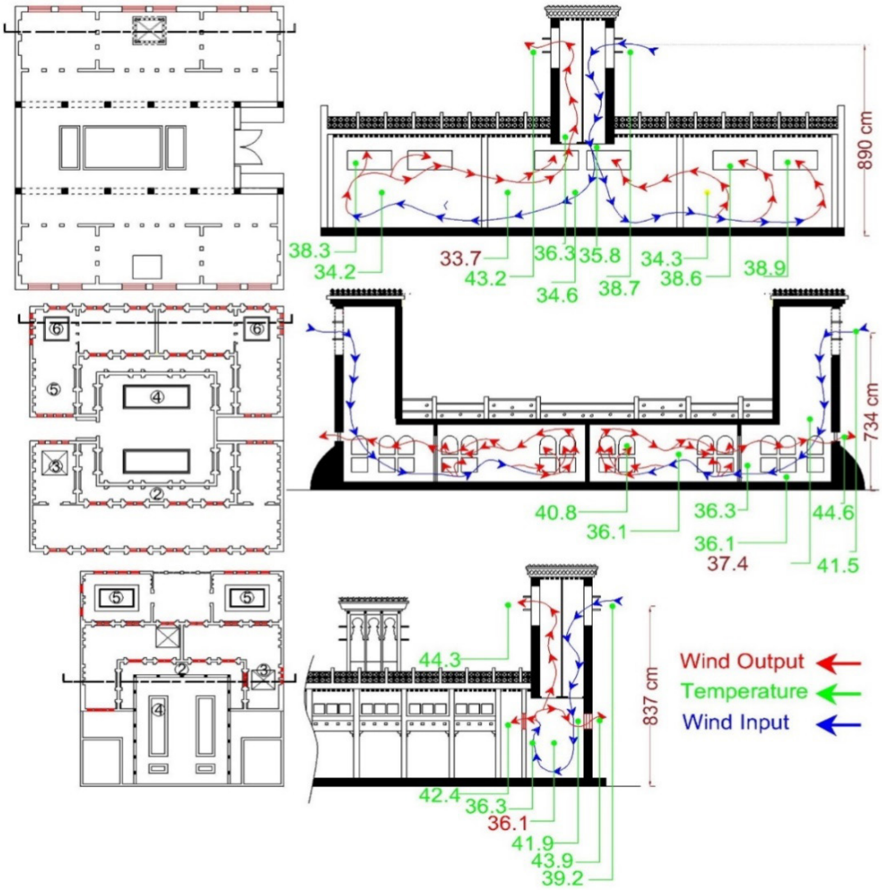


Figure 16 | Wind performance in different spaces.

Field investigations revealed that 42 types of lattice windows were constructed in 273 selected buildings. Of these, 8 models were identified to have been destroyed. The most frequently used intact lattice window forms were model 23, with 58 cases; model 29, with 42 cases; and model 24, with 34 cases. Regarding the windows currently being damaged, the most frequent were model 23, with 29 cases; model 24, with 19 cases; and model 29, with 17 cases. The fully destroyed lattice windows are most frequently observed in model 29, with 25 cases; model 2, with 23 cases; and model 23, with 17 cases. As for the spatial application, lattice windows were most frequently installed in Babar rooms at 38.9%, living rooms at 18.94%, and kitchens at 17.51%.

Like the lattice windows, windcatchers were constructed applying locally available materials. They were designed in six different forms, with heights ranging from 210 cm to 650 cm, and a stem. The windcatchers were adorned with various ornaments; there were seven ornaments for the stem, 26 for the openings across four different construction styles, and 12 along the roof edge. In the 273 selected buildings, a total of 376 windcatchers were identified. The four-sided windcatcher was the most frequently used style, appearing in 361 cases, of which 83 were damaged. Two-sided windcatchers were identified in nine cases, of which six were destroyed. The hexagonal, octagonal, and cylindrical windcatchers were destroyed. The primary spatial uses of windcatchers included living rooms (60.1%), private living areas (32.98%), and kitchens (4.26%).

Regarding function, there are three types of existing wind catchers: four-sided, bilateral, and unilateral. Moshabaks are devised inside the walls. It is observed that four-sided wind catchers had the best performance, lowering 5 degrees inside the building to provide more satisfactory thermal conditions compared to bilateral wind catchers, which lowered 3.1 degrees, and unilateral wind catchers, which lowered 4.1 degrees.The use of Moshabaks facilitates the performance of wind catchers, boosts the speed of moving air, and provides better circulation inside. This air circulation requires a unilateral (one-directional) wind catcher, and the exit of air mass happens only through Moshabaks. It can be considered that wind catchers and Moshabaks are the symbol and identity of Bandar-lengeh. We can preserve architectural decorations and construction methods using field observation and photography. This will help maintain, save, and reconstruct 23.27% of wind catchers and 28.72% of Moshabaks, which will greatly contribute to the local architecture of the region.

It is suggested that modern architects, users, and buildersrecognize the significance of these elements and apply them in the construction of sustainable spaces. This approach would fulfil human needs and contribute to protecting the environment.

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