Climate-Responsive Architecture for the Residential Houses of Homs[1]: A Comparison of Traditional and Contemporary Houses

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Abstract

Given that high energy consumption in residential buildings is one of the main problems in Syria, applying criteria for a climate-responsive building design is one of the most important ways to reduce energy consumption. This article seeks to study and compare the historical and contemporary residential buildings of the city of Homs and extract the positive and negative aspects of each. The main issue of this research is to identify the traditional and contemporary housing in the city of Homs in terms of environmental model and accordingly provide practical solutions for climate-responsive building design. To achieve this goal, we first studied the criteria of comfort and identified the advantages and limitations of various indicators in a number of climate-responsive designs, and then, we analyzed the housing patterns of the city of Homs. The present research was conducted based on desk studies, including documents, maps, and field observations, with a descriptive-analytical method. The study found that in the historical context of Homs in the Mamluk and Ottoman periods, residents built valuable buildings affected by the dominant culture. In fact, these valuable buildings are now in Syria an essential part of the traditional architecture's identity. French colonization of Syria has changed the form, structure and shape of residential buildings. During the French colonization, in Homs, buildings were influenced by the technology of the industrial age. These buildings are still operating today with high energy consumption. Therefore, it is necessary to propose some climate-responsive solutions for the new buildings constructed in the hot and humid climate of Homs, with a tinge of traditional architecture. The idea put forward in this paper is to create an urban texture. This texture is largely inspired by the Habitat housing units. It is designed in such a way that is flexible to natural growth and expansion and reflects traditional houses. Eventually, relying on the positive points and merits discussed at the end of the paper, construction of climate-responsive houses is a possibility.

Keywords: Housing, Climate-responsive architecture, Traditional houses, New buildings, Homs.

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Introduction

Suffering from the bruises of the 8-year war, the cities of Syria have been grappling with the massive destruction of this conflict for a long time. Syrian cities have lost many of their important urban elements, such as their buildings and infrastructure. Despite the fact that war devastation impeded the development of the city, it provided a great opportunity for its revitalization. Moreover, if we address long-standing issues in the reconstruction strategies and curb them with urban sustainability, these issues can be dealt with. In this concern, one of the most important factors is the use of sustainable natural energy in climate-responsive residential buildings. A successful design depends partly on the different characteristics of each region and their impact on the formation of urban buildings, and is also dependent on applying a variety of renewable energy solutions in new building as was previously applied in traditional architecture. In the past, residential buildings were built of local materials and represented features appropriate to the conditions of the region's climate. In today's architecture, however, residential buildings cause various problems such as energy loss, heedless of environmental issues. Comparing some examples of old and new residential buildings in Homs, this paper studies climate-responsive architecture design. This way, it is possible to offer precise solutions for the construction of post-war houses in Homs. This research seeks to answer the following questions:

- How has the process of evolving the structure of historic houses in the city of Homs been affected by the climate?
- What are the architectural design strategies for having climate-responsive houses in Homs to minimize energy consumption?

Literature Review

Many studies have been conducted on the climate-responsive architecture, all offering the use of naturally available energy to minimize consumption in new houses. The below table lists some of these studies.

According to studies and researches conducted in the field of this paper, there are very few researches related to Syrian architecture. However, there are various researches conducted on the relationship between climate and architecture, especially in Iran. The articles mentioned in the table above are among these researches. The climatic conditions related to different cities of Iran have been studied in the mentioned researches, and finally the main goals of climate-responsive design in these cities are identified and solutions to optimize energy consumption and increase the comfort of residents are presented in a climate plan. In some of these articles, there is a general and brief overview of architectural criteria, and in some of them, the mentioned examples have a detailed and analytical view according to the conditions of the region. Having surveyed the items of a climate-responsive house, we recognized the pros and cons of historical and contemporary residential buildings in the city and examined the measures considered in them.

Book/Paper	Author	Year	Summary
Climate-Responsive Design in Ilam with regard to Status Quo	Behrouz Salehi, Abdolhamid Ghanbaran, Sima Ferdowsian	2017	In this article, the architectural criteria compatible with the climate of Ilam city were reviewed and presented using Mahani bioclimatic index. The criteria that should govern the climate-responsive architecture design in Ilam city were compared and the adherence of each to the desired situation was examined. The results presented in this research can be used as a guide for designing climate-responsive houses in Ilam.
Climate and Architecture	Morteza Kasmaei	2016	This book mentions the climatic conditions of Iran and the principles of residential building design in relation to the climate in different areas, then proposes suitable spaces for thermal comfort.
Elements of Sistan Architecture: Climatic Components of Sustainable Architecture	Salahuddin Mowlanaei, Sara Soleimani	2016	In this research, part of the structure of Iranian indigenous architecture in Sistan region were studied in terms of climatic issues and techniques used in construction to deal with harsh environmental conditions. The results of the research show the use of factors such as *Kharkhaneh*, *Dorcheh*, *Kulk*, *Surak* and *Naza* are very effective. This can help using the aforesaid factors to achieve sustainable architecture that is climate-responsive and to pay attention to the original identity of the Persian architecture.
Climate Design: Theoretical and Practical Principles of Energy Use in Buildings	Mohammad Fayz Mahdavi, Vahid Ghobadian	2013	This book mentions the use of local climatic conditions and site conditions for the design of structures in all areas.

T1. Studies of some researchers in the field of architecture and climate-responsive building design

Adapting the design of Tabriz and Baku residential houses to the culture and indigenous climate	Javad Abdolhosseini	2011	Objective: To study the changes and developments in the structure of residential buildings in the city with the influence of indigenous culture and climate in the selected study area. Finally: Some of the regularities of design methods in accordance with the influential factor of culture and climate in new residential buildings in Tabriz and Baku are specified and new design models are proposed considering the possibilities of new technology and traditional architectural features.
Determining the time range of thermal comfort for the city of Tabriz	Shahin Heidari, Shahla Ghaffari Jabbari	2010	This article uses Ashri Comfort software to examine the good conditions of cold and dry climate and states that heating mechanical equipment should always be used from December to February. In the months of April and May, it is in the range of minimum temperatures.
Method of Meteorological Statistics Analysis for Climate Compatible Architecture Design	Mansoureh Tahabaz	2009	This article begins with the extraction and analysis of climatic statistics using bioclimatic criteria and then presents the rules of building design based on climatic information.
The effect of climate on the energy consumption of residential buildings in Tehran	Mohammad Ali Abdoli, Aflia Fassihi	2005	This article studies the effect of climatic conditions on energy consumption in residential buildings in Tehran. Climatic conditions related to the city of Tehran are studied and finally the main goals of climate design in this city are identified and solutions to optimize energy consumption and increase the comfort of residents are presented through a climate plan.
Contemporary residential architecture on the Syrian coast	Talib Deob, Hala Hussein	2009	The purpose of this study is to monitor the reality of contemporary housing in the coast of Syria, identify its positive features and monitor the negative aspects that the population suffers from due to the rapid development of architecture.
Principles of Sustainable Traditional Architecture in Islamic Perception	Maha Al-Zubaidi, Salman Shahin	2008	This article aims to study the potential of sustainability in the traditional architecture of the Islamic world, especially the house. First, it examines the relationship between humans and the environment from an Islamic perspective, then examines their relationship to the construction of traditional houses.
Traditional Climate-Responsive Architecture	Samira Jamal	2007	This is a research on the impact of architecture on climate factors in the Yemeni Region. In order to examine the degree of conformity of traditional architecture of the Yemeni region with the indicators of its architectural climate, the study has been done and finally it has been pointed out that the architectural solutions of the country are in accordance with its climatic conditions.
Architecture for the Poor	Hassan Fathi	2000	The author sought to create a prestigious environment using traditional architectural techniques compatible with the climate and local materials at the lowest cost. At the end of the book, solutions for building your own climate-responsive housing is presented. This book describes the construction of the village of Gorna, near Luxor, Egypt, without the use of modern and expensive materials such as steel and concrete, and with the use of gypsum bricks, indigenous techniques, and traditional Egyptian architectural designs.
Ablaqia archaeological and heritage architecture	Naeem Salim Zahravi	1997	Author of the book describes the traditional residential buildings of Homs and its special features from the point of view of the residents of the region; And because the author of the book is not an architect, he is a researcher in history; It can be said that the nature of the building is not well explained in terms of architecture

T1. Studies of some researchers in the field of architecture and climate-responsive building design

Research method

This research, on the goal it pursues, has a theoretical approach. In the first part of this research, due to its theoretical nature, a qualitative method has been used based on a descriptive-analytical approach. The technique adopted by the paper in this approach is the technique of case study. The required information has been collected and used through library resources, documents and online resources. In the second part of the research, local residents are interviewed to identify and analyze indigenous housing and compare it with non-indigenous housing through field surveys. In this part of the research, the method of visual expression and physical analysis of pre-war housing plans has been adopted.

Theoretical Framework of the Research

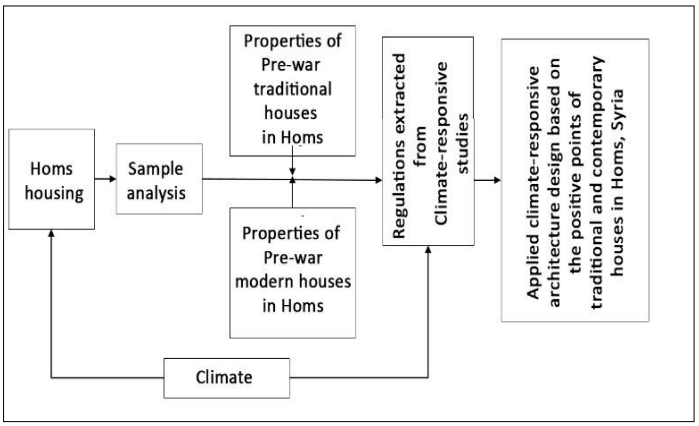
According to the type of research and the contents mentioned in it, we decided to study and analyze the residential architecture of the city of Homs in Syria based on the climate of the region. In summary, in the present study, the criteria of comfort and advantages and limitations of various climate design indicators were studied in order to achieve the main goal of the article and achieve a system of housing in the city of Homs before the war (whether in the indigenous or non-indigenous housing system). Then, the housing patterns of Homs are analyzed. In this analytical approach, the method of visual and graphic expression is used to obtain the constituent spaces and relationships. In order to understand the impact of the region's climate on housing patterns, we first analyzed the impact of climate on the pre-war housing patterns in Homs. The information helped us to meet the needs of the city's future residents. Finally, according to the proposed structural framework for the design of new housing in the city of Homs, design criteria is presented.

The statistical population of this study includes the buildings of organized areas in the city of Homs. In order to examine their compliance with the criteria set out in the

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climate Index, information about residential buildings built in Ottoman, French and post-independence periods was examined. From the first group, only the houses registered in the Syrian cultural heritage were examined, from the second group, the buildings that are still in use and did not change or were damaged, and from the third group, the buildings located in the new area of Homs.



F1. The Structure of climate impact on the formation of Homs housing

Climate-Responsive Architecture

Climate-responsive design maintains the microclimate of the housing within the comfort zone, regardless of the building's outside condition. Comfort zone is a place where about 80% of people feel comfortable (Farajzadeh, 2007: 162). From the climatic point of view, four elements of temperature, humidity, wind and radiation are effective in shaping human comfort. If we make allowances for climatic characteristics of a region in the architecture of buildings, we will be able to provide the best possible thermal conditions inside, and even outside, the buildings and minimize the consumption of fossil fuel. This is quite interesting that the architecture of old times observed all these conditions. (Javadian, 2018: 79)

Case Study

This paper first examines the climate of Homs and the principles of designing traditional and contemporary residential houses and then analyzes the architectural features of housing in this city in light of climatic conditions.

Homs city, Homs province, Syria: An Overview

Homs, Syria's largest province, is located in central part of the country. The name of the province's capital city is also Homs. The province occupies 23.8% of the country's total area, covering 42,223 square kilometers (Al-Musawawa Al-Arabiyah vol. 9, 1999: 541). On the north, the city of Homs borders with Hama and Raqqa provinces, on the northeast with Deir ez-Zor, on the southeast with Iraq and Jordan, on the south with Damascus, and on the west with Tartus and Lebanon. Fenced by mountains and forests in the south, and deserts in the east, the city has a temperate climate. (Al-Mosuli, 1981: 13).

Meteorology of Homs

Temperature and Humidity

The first step we took in this research was to examine the meteorological statistics of Homs during the last 30 years. Table 2 shows the information about the minimum and maximum monthly temperature and relative humidity. The region's weather conditions can be analyzed with the help of this diagram, and information needed to provide solutions for the design of residential buildings can be obtained.

Chart 1 shows the bioclimatic index of the city of Homs. As can be seen, about 6 months of the year the temperature is above 10 degrees Celsius, which indicates that the climate of Homs province is temperate.

Chart 2 shows that the climate of Homs province is temperate, cold and humid in winter and mild, hot and dry in summer. As can be seen in mid-November and

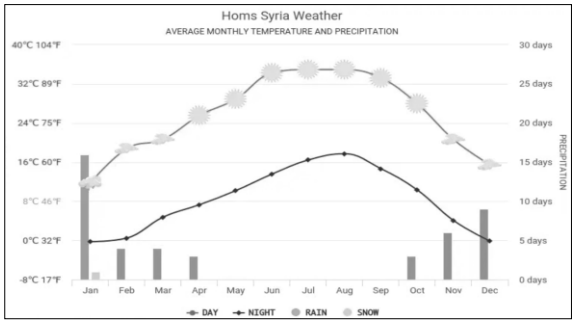
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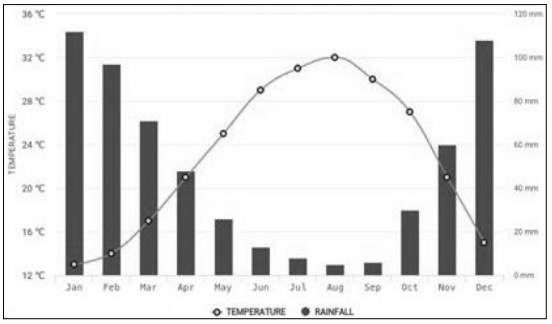
throughout the months of December, January, February, March and early April, in addition to sunlight, auxiliary heating equipment must be used.

	January	February	March	April	May	June	July	August	September	October	November	December
Avg. Temperature (°C)	6.6	8.1	10.6	15	19.5	23.1	25.2	25.5	23.3	18.3	13.2	8
Min. Temperature (°C)	2.3	3.5	5.1	8.9	12.8	16.6	19.1	19.2	16.3	11.2	7.1	3.6
Max. Temperature (°C)	11	12.7	16.2	21.2	26.3	29.7	31.3	31.8	30.3	25.4	19.3	12.4
Avg. Temperature (°F)	43.9	46.6	51.1	59.0	67.1	73.6	77.4	77.9	73.9	64.9	55.8	46.4
Min. Temperature (°F)	36.1	38.3	41.2	48.0	55.0	61.9	66.4	66.6	61.3	52.2	44.8	38.5
Max. Temperature (°F)	51.8	54.9	61.2	70.2	79.3	85.5	88.3	89.2	86.5	77.7	66.7	54.3
Precipitation / Rainfall (mm)	95	74	54	36	16	1	0	0	3	17	38	88

F2. Information on meteorological parameters of the city of Homs (Source: Al-Arsad Al-Jawiya Al-Syria, 2018)



Ch1.Homs Bioclimatic Index (Source: Al-Arsad Al-Jawiya Al-Syria, 2018)



Ch2. Homs Bioclimatic Index (Source: Al-Arsad Al-Jawiya Al-Syria, 2018)

In this study, using the Köppen climate classification, five different types of climate were determined in Homs. This classification method is based on the relationship between the amount and distribution of rainfall during the year with temperature. According to this method, the climate of Homs is temperate (CSA).

In Homs, the average temperature is about 23 degrees Celsius. In August, temperature summits to its highest point with 32 degrees Celsius. The coldest month of the year is in January with 13 degrees Celsius. The average relative humidity in the city of Homs is about 45% which decreases during the warm months and increases during the cold months.

Winds

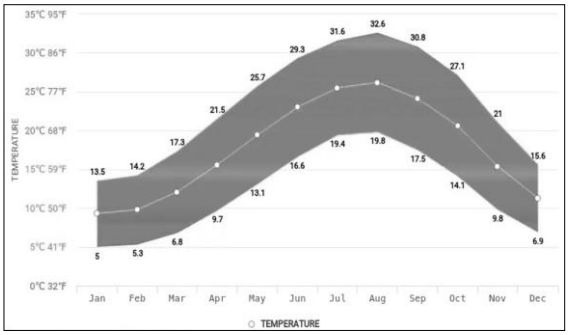
The main winds of the city of Homs blow from the west and southwest to the region and affect this region in different seasons of the year. In this city, the average wind speed is about 3 knots. The highest wind speed occurs at 1074 knots in July, and the lowest wind speed occurs at 1.64 knots in November.

Sunlight

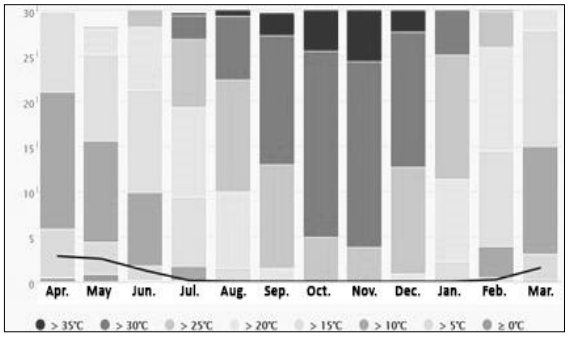
The average daily amount of sunlight in the houses of Homs is higher through the openings. The building walls absorb the sunlight from the south.

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Ch3. Changes in wind speed and direction in Homs (Source: Exporters Public Dept., 2016)



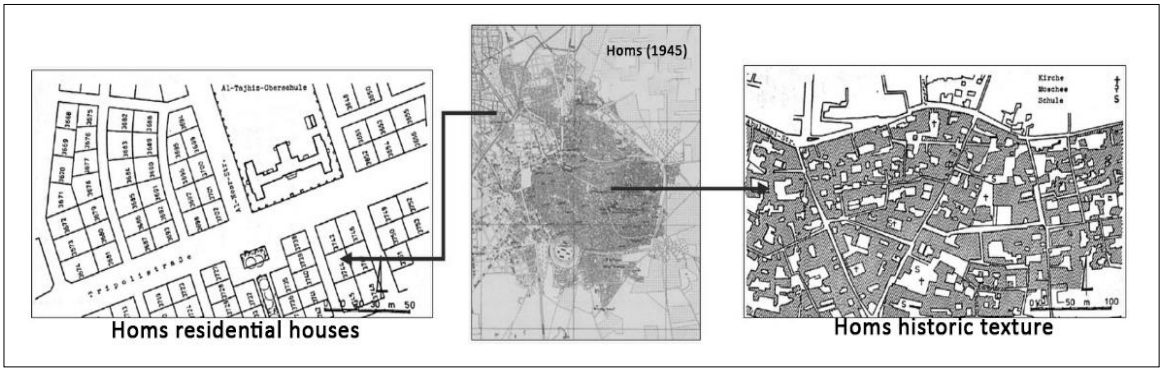
Ch4. Changes in the amount of sunlight in the city of Homs (Source: Al-Madiriyah Al-Alam for Larsad Al-Jawiyah, 2016)

Residential architecture of Homs city

Old Homs was surrounded by walls and defensive towers. The gates of this old city were built in the pre-Islamic period. In the old part of the city, you can find ancient monuments and important historical houses. During French colonization, the country's construction, especially residential buildings, suddenly became obsolete. This westernization had a direct effect on constructions, especially residential buildings, to the point that the original features of the local plan were forgotten and replaced by Western criteria. Eventually, the design of residential spaces became completely inattentive to the inner desires and views of the people. In the following, the most important houses in this area will be examined.

Selected Housing Review

Although several houses can be examined in this study, only a few traditional and contemporary houses were examined in order to observe brevity. In this section having examined the traditional and contemporary housing, we extracted the properties of each and compared them together.



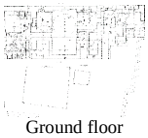
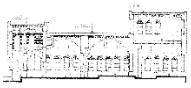
T2. Location of the historic texture and new residential buildings in Homs (1945)

Characteristics of Homs Traditional Houses

The oldest residential buildings in the city of Homs are located in the neighborhoods around the castle. This is partly due to the proximity of this area to the castle, which is home to the most registered houses of Syrian cultural heritage. It is located inside the old fence of the city. In this study, several traditional houses in the city of Homs have been studied to describe the characteristics of traditional houses in the city. The houses were chosen according to their importance in the Syrian Archaeological Heritage. These houses, which are mostly in good condition even today, are as follows:

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Name	Period	Plan	Description	Façade	Today
Qasr-Alzahrawi (296)	A part constructed by Ali Alzahrawi in Mamluk period in 661, a part constructed in the Ottoman period	 Ground floor  First floor	Part One: (Mamluk Part): The spaces of this house are built on two floors. To the south is a large porch and two large rooms next to it. To the east and west are rooms with vaulted ceilings, and to the north is a large hall with a dome. The second part (Ottoman): It has a large courtyard, to the north of it is a large hall and a spring bed, which can be accessed through special stairs. The south side is completely destroyed. The facades of the house are simple and unadorned. This house is made of stone.	 Interior  Source: Author	This house was registered in the cultural heritage in 1967 and in 1978, the Ministry of Cultural Works handed over this house to the museum.
Bait-Mofeed Amin	Mamluk period by King Ahmad Shahabedin	 Ground floor	This house is located in "Bab Palmira" neighborhood near "Siraj Mosque" (source: syria.sy). The house has a beautiful entrance which is located in the east on Al-Siraj Street. In the middle of this house is a courtyard that consists of several rooms. These spaces have plaster and gilded decorations. (Source: View Author) This house is m2 and made of stone (Source: esyria.sy).	 Exterior  Interior	Prior to 2011, music evenings were held at the house (Department of Antiquities) with the aim of reviving local heritage and introducing people to the city's monuments.
Bait-Al-Mahish	Ottoman period, Area: 826 m2.	 Ground floor	It is located in the eastern region called the Crusades. It has seven rooms, this house is located in Hay (Al-Warsha). The first yard is in the middle of this house and this yard is related to the second yard. There are stone steps in this yard that lead to the porch. This house was made of black stone.	 House central section	Before the war: a historical monument. In the 2011 war: the terrorists' hospital was used.
Bait-Al Droubi	Ottoman era Architect: Mohammad Anis Owner: Abdul Hamid Pasha Al-Droubi	 Ground floor	This house is located in the middle of nature and is surrounded by water. It has a square yard. It has two porches (south + east) and three large rooms. Its windows are covered with colored crystals. This house is made of stone and has an area of 967 m2.	 House central section  House picture	This historic house was demolished in the 1980s by Drubi grandchildren, and a modern complex (plaza) replaced it
Bait-Dawamah	Ottoman period	 Ground floor	It has three places to stay and two steps. In a period this house went to school then became home again. This house is made of stone with an area of 405 m2.	 House section	So far, it has been used as a house.
Bait-Nakror	Ottoman period	 Ground floor	It is located near the old bazaar of Homs. It is one of the first small houses in the city. It consists of two floors with a large yard and several rooms. It is made of black and white stones.	 Outer façade	Unknown

T3. Case Study houses registered in Homs

According to the studies presented on the traditional architecture of Homs, it can be said that in order to create favorable conditions for human comfort, passive methods have been used to maximize the use of natural energy and then, if necessary, active methods are used.

Characteristics of Modern Houses in Homs

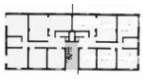
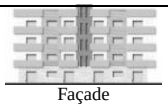
In some parts of the city, attention to modern European architecture, particularly to the French architecture, is mainly seen due to the colonization and the imposition of its culture in all its forms throughout Syria (Ali, 2016: 49). It can be said that during the French colonization, the construction of the country, especially residential buildings, suddenly became numb. This westernization has had a direct effect on the construction of buildings, especially in residential houses. These effects were too severe that made the principle of extrovert and introvert

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architecture forgotten. In today's architecture, constructed around the courtyard anymore. These elements are replaced with Western ones regardless of the needs and opinions of the local residents leaving the housing of this area without identity. The selected examples in the table below are from the most there are no Turkish halls and no rooms are important and largest residential complexes in the new part of Homs. In addition, these houses have features that can be generalized to other houses in the city.

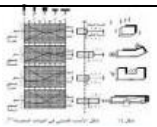
The buildings of contemporary residential architecture in the city of Homs are as follows:

Name	Period	Plan	Materials	Picture/Façade	Today
Ajam Oghli	French colonization	 Building plan	This house is constructed in Almohateh with three floors and two gates.	 Facade	Operating
No. 275	French colonization	 Building plan	This house is constructed in the center of Homs with one southern entrance and three floors each having four units.	 Picture	Ground floor: Commercial units, Upper floors: Residential units
No. 111	After colonization, contemporary period	 Building plan	This building is constructed in Alwar in an area known as the fourth island. It has one entrance and four floors.	 Façade	Most of the buildings of this area have been affected by war. It is not possible to distinguish demolished houses from others.
No. 325	Contemporary	 Building plan	This building is constructed in Alwar in an area known as the fourth island. It has one entrance and four floors.	 Farecade	

T4. Contemporary residential houses in Homs

Data Analysis

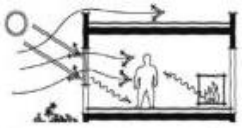
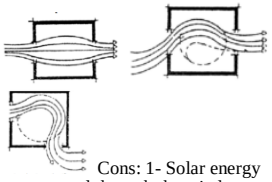
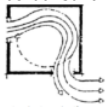
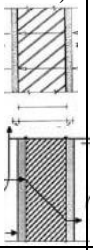
The following table contains the positive and negative aspects of different houses according to the previous research to be accepted by the scientific community. This study, which was conducted on two groups of residential buildings in the city of Homs, shows that the historical texture was completely better in terms of compatibility with climate. This superiority is evident in the housing dimensions, the color, the number of floors and the location of the openings. However, new residential buildings were in a better condition regarding the method of construction and materials. The condition of roofs is almost the same in all the old and new buildings, and it is poor.

	Homs traditional houses		Homs residential buildings		Climatic superiority	Solution
	Info	Pros/Cons	Info	Pros/Cons		
Location of the house on the site	High density of residential architecture in the urban texture	Pros: 1- Heat Insulation Most walls are protected from the sun. Cons: 1- Transmission of sound through the retaining walls. Need for large area for small number of houses.	Large buildings - single buildings	Pros: 1- Formal beauty of the building, 2- At present, the construction of the building is difficult in the form of residential proximity. Cons: 1- Increased level of contact with your surroundings; 2. Planning regardless of the environment.	Location: Traditional houses are in better condition.	Habitat residential units are proposed that have a combination of compactness (traditional housing) and the ability to build in contemporary architecture.
Housing direction	Stretching in the east-west direction	Pros: 1- With the establishment in this way, the lowest level is placed against undesirable winds, most of which blow from the west.	Without a specific direction.	Positive: 1- Freedom in design Negative: 1- Increase energy consumption	Dominant wind: Traditional houses are in better condition.	 Best examples
Number of floors	Low (two to three floors)	Pros: 1- The low height of the building helps the movement of air throughout the building.	More than three floors	Pros: 1- In order to prevent the penetration of moisture and rain water, the ground floor is located above the natural level of the ground by creating a suitable foundation. Cons: 1- The high height of the building does not help the movement of air throughout the building; 2- Cold wind blowing on the exterior walls of the building increases the speed of heat transfer to the outside or heat loss	Minimum heat exchange with the outside: Traditional buildings were superior due to their low height.	Habitat residential units with a height of 3-4 floors.

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Street design	Narrow alleys and roads	Positive: 1- Causes shade and natural air flow inside the area Negative: 2- The difficulty of moving and moving the car in the present age	Large and vast	Pros: 1- Ability to use the car (mobility and movement) Cons: 2- It is not comfortable.	For low temperatures, traditional residential areas prevailed.	Large streets for cars in the residential area - inside the area of children's parks and toys
Physical aspects	Central courtyard at home With a square yard 	Pros: 1- A manifestation of creativity in combining architecture with nature, 2- Natural air flow due to the temperature difference between the alley and the yard, 3- Using the evaporative cold of water, comfort conditions are provided. Cons: 1- It is difficult to move inside the house, especially in very cold and dry conditions.	Use of balconies	Pros: 1- Due to the protrusion of the balcony and creating shadow on the walls of the house, the amount of radiation will be low; 2. Where the balcony (opposite the yard) is not the center of the house and therefore not the center of family life that preserves the privacy of the interior. Cons: 1- Heat loss in winter	Temperature and humidity of traditional houses was in a better condition.	Use large balconies facing the parks to create shade for optimal comfort.
Level and number of windows	The surface of the house is sloping	Cons: 1- It is difficult to build a roof in old materials and it always needs to be repaired.	The surface is sloping	Pros: 1- This way it is easy to use contemporary materials. 	Temperature and humidity: It is better to have a sloping roof.	The dome roof is the best, but because the people of the area know that the dome roof is for religious buildings or places of worship. Residential buildings are constructed with sloping or sloping roofs.
	Windbreaker	Positive: 1- It is located in the comfort zone using natural ventilation; 2- It is designed with a suitable slope and direction according to the prevailing wind. Because air routes are used. Cons: 1- It is difficult to employ this device in multi-storey residential buildings.	There are many windows.	Pros: 1- If they are in a good position, they may create comfort in the building.  Cons: 1- Solar energy penetrated through the windows	Large windows should be on the south front to get the most out of the light.	This is the best way to place windows in residential buildings. 
Materials	The use of local materials	Positive: 1- It exists in the surrounding nature and with the least need for expertise in its implementation; 2. Some materials with low heat capacity such as wood. Negative: 1- The use of heavy materials such as stone that have high heat capacity increases the thermal stability of the house; 2- There is always a need for repairs; 3- Wall thickness to achieve proper application.	New materials (concrete and iron ...) 	Pros: 1- Available - There is little confusion in the use of new materials; 2- The low thickness of the walls makes it easier to design. Cons: 1- By using concrete materials, a large part of the energy produced for heating and cooling is wasted; 2. The heat transfer property of bricks is not logical.	Temperature and humidity: Materials with high resistance and heat capacity should be used	Using new materials by employing disposal materials to achieve the comfort that old materials created.
Color	dark color 	Positive: 1- The reflection coefficient of dark colors is less than light colors; 2 - All areas of common color cause justice for the inhabitants of the area, 3 - Its color is inspired by its location (color of soil and rocks).	without a specific color.	Pros: 1- Using new materials, the possibility of using different colors based on the taste of the designer of residential buildings. Cons: 1- It may destroy the overall view of the site (each person chose a color based on his taste for the facade of the house).	Receiving solar energy: Traditional houses were in better condition.	Employing construction materials (brick-stone--) dark colors

T5. General specifications of indigenous contemporary architecture in Homs

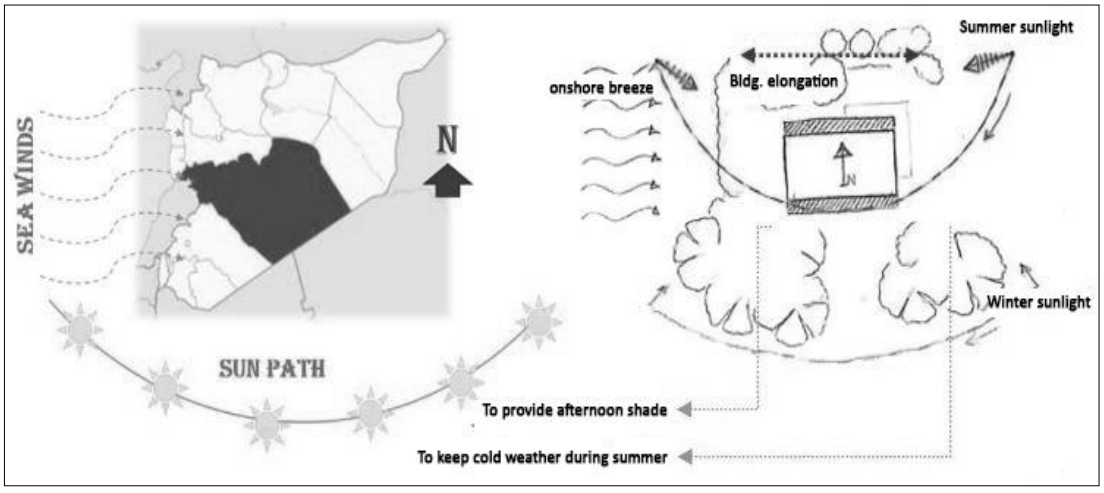
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Criteria for Designing Climate-Responsive Buildings based on the positive aspects of traditional and contemporary residential buildings in Homs, Syria

As mentioned, climate is the main factor influencing the formation of housing in the city of Homs. Designing a new housing model requires the development of criteria commensurate with the changes made in the pattern of people's housing over time and the changes made with the characteristics of housing. Therefore, the proposed criteria for climate-responsive housing design are presented below using the results of comparing the architecture of traditional and contemporary buildings. These criteria are based on the prevailing wind flow, solar energy, temperature and humidity.

- Based on the prevailing wind flow ((west direction)): the orientation of the building elongation or residential blocks stretch east-west, or northeast-southwest ("the lowest level is against adverse winds, most of which blow from the Mediterranean Sea").
- The most suitable direction for receiving solar energy is from the north and south, and the best choice for material is dark stone since the color of the building darkens over time.
- Optimal light utilization: rectangular plan design, building orientation to the south and southeast; There are large windows on the south front.
- Based on temperature and humidity: use the formation of building spaces so as to create shadows through balconies similar to old residential porches. Because the establishment of shade and the use of wind flow can provide comfort conditions, the surface and facade of the building is usually dark and the surface of the building is uneven to absorb heat from the sun in winter. It has up to four floors. For the least heat exchange with the outside, semi-dense texture is recommended. In terms of controlling the temperature of the indoor air, the best type of building is a cube with a square or rectangular plan. Closed forms or back-to-back structures are preferred on the north-south axis. Roofing in this climate is mostly flat, but it is better to be in the form of a whole.



F3. Sketch of the climatic residential architecture of Homs based on the advantages and positive features of traditional and contemporary residential buildings

Conclusion

The design pattern of residential buildings compatible with the hot and humid climate of Homs province in the central part of Syria was investigated in the present study. The results of the study showed that it is better to reduce energy consumption by using climate design indicators in the construction of residential buildings in order to obviate the environmental problems of the city of Homs.

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Based on the climatic conditions of the city and due to the high heat and humidity in the region and its critical conditions in the summer, the design is based on reducing humidity through ventilation and air flow and controlling energy intake. In short, it can be said that in order to achieve a desired design, depending on the type of climate in the area, a few factors must be considered: the direction of the dominant wind flow has a great effect on the location and comfort of the building, the sun and its position, the location of the building and the dimensions of the windows, canopies, etc. are also effective. In addition, temperature and humidity play a great role in choosing the best materials, the shape and the color of the building. Comfort should be considered in new buildings, so the idea presented in this study is to create an urban fabric that is inspired by Habitat residential units, able to grow and expand naturally and reflectively from traditional houses. Moreover, with regard to the benefits and positive features of existing houses, new climate-responsive houses can be built.

Endnotes

1. Homs, known as Emisa/Emesa, is a city in western Syria

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