Sustainable Tourism Heritage Village – Al-Ula, Saudi Arabia

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Sustainable Tourism Heritage Village – Al-Ula, Saudi Arabia

By

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Thesis Submitted in Partial Fulfillment of The Requirements for The Degree of

Master of Architecture

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COMMITTEE APPROVAL

“Sustainable Tourism Heritage Village – Al-Ula, Saudi Arabia”

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ABSTRACT:

The city of Al-Ula in the Kingdom of Saudi Arabia is a historic city that considered as a supplier of natural and cultural heritage that allows the city to be a unique tourist destination that distinguished with a specific type of nature that attracts tourists to enjoy the natural desert mountainous landscape. However, Al-Ula city lacks accommodation and entertainment to encourage tourists to come according to MAS (Tourism Information and Research Center for the tourist investment in al-Ula city).

This design thesis will support the development of tourism by designing a sustainable tourism heritage village that matches the existing environment since the proposed design accommodate the 2030 vision of Saudi Arabia which is the plan to reduce Saudi Arabia's dependence on oil, diversify its economy, and develop public service sectors such as health, education, infrastructure, entertainment and tourism that includes the promotion of economic and investment activities. The importance of the project lies in the link between the urban heritage of the city culturally, economically, and emotionally with citizens and linking generations with their history to draw inspiration from the values represented by this heritage and share with tourists and interested in heritage.

The proposed sustainable tourism heritage village enhances sustainability within several aspects for major environmental benefits; also, it breaks down the climate barrier that prevents tourists to come. The first sustainable aspect is passive ventilation which is activated by cooling towers as the main source for cooling. In addition, the Vernacular Architecture with the use of adobe clay material will help to handle the hot weather. Vernacular Architecture includes also Mashrabiya that will be another factor that aids with passive ventilation. These aspects help to make the heat tolerable to visitors. Another function of Mashrabiya is allowing the daylighting to enter during the day which adds more sustainable benefits. Furthermore, water management systems are added to the project which rely on both ground and gray water.

Keywords: kingdom of Saudi Arabia, Heritage Tourist village, Passive Ventilation, Cooling Towers.

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1 Mashrabiya is a spiritual, decorative, and functional architectural element that merges the form and function of the Islamic window screen.
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1. INTRODUCTION:

Kingdom of Saudi Arabia is located at the crossroads connecting the continents of Asia, Africa, and Europe. Its area is expanding around 2.24 million km², which is approximately four-fifths of the Arabian Peninsula’s area\(^2\). Saudi Arabia is known for the subtropical climate. Temperatures are subject to considerable diurnal and seasonal fluctuations. In winter, the weather is usually considered cool to warm with uncommon frost at night. It is rarely snowing in the northern areas and at high altitudes. Summers tend to be very hot with temperatures above 40\(^\circ\)C and sometimes exceeding 50\(^\circ\)C. Humidity is generally low during summers, ranging between 15% and 65% with almost dry air in the interior; and exceeding 70% along the coasts during winter nights\(^2\). It is important to identify the climate since it is helpful for the architect in the pre-design phase. Saudi Arabia’s climate could be a constraint especially in designing a touristic project.

![Vision 2030 graph](Image By Ikrami Abdullah-Edited By Author)

**Figure 1.** Vision 2030 of Saudi Arabia (Image By Ikrami Abdullah-Edited By Author)

This thesis aims to support the development of tourism by designing a sustainable tourism heritage village that accommodates the 2030 vision of Saudi Arabia. The 2030 vision's purpose is

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\(^2\) Child, Graham, and Grainger. “A system plan for protected areas for wildlife.”
to diversify Saudi Arabia's economy and declines the relying on oil by improving public service sectors such as health, education, infrastructure, entertainment and tourism that includes the promotion of economic and investment activities.3

There is a need for increasing the tourism sector as it has been indicated that tourism accounts for about 9% of Saudi Arabia's GDP.4 According to the paper “Tourism in Saudi Arabia”, Saudi Arabia is a land that has many historical, cultural, and amusing sites to offer, enhancing its tourism industry and taking full advantage of the lands spectacular sites would be a great opportunity to increase the number of tourists. Based on that, one of Saudi Arabia’s 2030 Vision Goals Is to Increase the number of the Non-Religious Tourism projects as Saudi Arabia aims to compete with other Gulf Cooperation Council (GCC) countries that have much more established tourism sectors such as Bahrain, Oman and the UAE.5 Increasing touristic projects in Saudi Arabia will have many benefits for the country and its citizens. “The Saudi tourism sector also stands to be a major contributor to job creation, given the government’s aim of increasing the number of jobs in the tourism sector by almost 50 percent to 1.2 million by 2020”.

However, the current situation in Saudi Arabia toward sustainability confirms that the Saudi Arabian government has given significant consideration to sustainability, thus new projects in Saudi Arabia need to be sustainable. There are several reasons why constructions need to be sustainable. One major reason is energy consumption, especially, in cooling systems because most of Saudi Arabia’s electricity is consumed on air conditioning.6 Air Conditioning is threatening our ability to tackle climate change which is a serious problem that impacts our planet negatively, but likely we can help on decreasing the consumption of Air Conditioning (AC); hence, help to

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3 Ikrami Abdullah, “Saudi Arabia aims to reduce dependence on oil”.
5 N.D, “Arabian business”.
7 Nanavatty and Rushad,” World Economic Forum.”
maintain the planet from CO2 emission's damages. To help to decrease AC consumption, there are many architectural methods. Firstly, in the earlier stages of the design, including the evaluation of the building's energy consumption is important in order to avoid any major flaws in the design. Higher operating costs will accrue over the life of the building if energy efficiency is not adequately considered. Secondly, designing an innovative building such as designing a building with passive cooling techniques also helps. The passive ventilation systems are requiring no energy for operation. One form of passive ventilation is cooling towers. What cooling towers can do is that it can save the electrical energy used to provide thermal comfort during the warm months of the year, especially during the peak hours; also, cooling towers are very efficient since it is passive systems requiring no energy for operation. Moreover, cooling towers reduce electrical energy consumption and environmental pollution.

Another way of reducing the cooling systems consumption is the careful choice of construction materials. “Impacts from materials are less understood and reflected in building legislation than impacts related to energy consumption, but responsible material use can yield great benefits” The touristic desert village project addressed in this paper is designed accurately when it comes to construction materials. The project appears as the Vernacular Architecture. This building style is known to have superior qualities compared to the modern ones, and what characterizes it is that the energy could be minimized in buildings. The specific material in this project is Adobe Clay Brick as it exists plenty in Saudi Arabia's lands. The Adobe Clay Brick is the best for this type of projects according to its local availability and its ability to protect from the outside weather. On the other hand, the vernacular architecture in Saudi Arabia known for the

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8 Kharchi and Imessad, “Passive Cooling of Housing by Natural Ventilation.”
9 Sanij, Soltani and Raahemifar, “A new design of wind tower for passive ventilation,” P.183
10 Nordby, Sigrid and Shea, “Building materials in the operational phase,”
11 Mohammadzadeh, Farshchi and Ford, “Vernacular architecture and Energy Use,”
12 Alrashed, Farajallah, Asif and Burek, "The role of vernacular construction techniques and materials,” P.3
use of Mashrabiya\textsuperscript{12}. The Mashrabiya is also called Rowshan which is a screened bay window that allows for natural ventilation and daylighting without affecting the resident’s privacy\textsuperscript{13}. The existence of the Mashrabiya in the project allows the cool air from the street to flow through. The designs of the latticework in the wooden screen have smaller openings at the bottom part and larger openings in the higher parts, thus, it causes the draft to be fast above the head and slow in lower parts. This provides a significant amount of air moving in the room without causing it to be uncomfortable \textsuperscript{13}. Therefore, Mashrabiya is a major part of lowering the AC usage. The other function of Mashrabiya is preventing direct sun radiation while allowing the daylighting to enter\textsuperscript{12}. By this, the complete depended on artificial lighting will be declined at least in the day hours; thus, electric bills can be reduced. Besides that, the occupants can get the full benefits of the indirect sunlight.

In the same line of sustainability, the project includes a grey water system. "greywater is defined as light grey water from lavatory sinks, showers, bathtubs, laundry and other process-related water that does not come into contact with human waste. Water from toilets and urinals is excluded. Greywater systems involve on-site capture and reuse of water that would otherwise be comingled with wastewater and conveyed offsite for treatment"\textsuperscript{14}. At the same time, the project takes the advantage of the availability of the abundant of the groundwater in Al-Ula city \textsuperscript{15}. The use of the ground water will be mainly for the swimming pools located in the hotel at the village. The usage of the groundwater helps enormously in reducing the number of gallons needed to fill the pools.

\textsuperscript{13} Almusaed and Amjad, “Biophilic and bioclimatic architecture: analytical therapy,” P.241-242
\textsuperscript{14} Council, Cascadia Green Building. "Toward net zero water: best management practices.".
\textsuperscript{15} Alzahrani, Qasemah,” Tourism Investment in Al Ula”.
2. LITERATURE REVIEW:

The research titled "Eco-Efficient Resort Planning and Design" is useful for this thesis as, in their paper, El-Barmelgy and Abdelkhalek provoked the importance of adopting an eco-efficient design for applying a sustainable design in resorts. In their paper, the authors addressed Egypt as a case study where they tested a resort building called Marina-Alamein. In their beginning, researchers provided the audience with some background information that explained why they chose Egypt exactly. The main reason was that the country's resources have been inefficiently consumed to a degree that the country has lost a number of its sensitive sites and resources. The dimensions of an ecosystem design that aimed to be designed on Egypt's resort were listed on the paper. The main dimensions are land, water, energy, and materials. Each one is described with the details so that a reader will fully understand what the paper delivers. To test the building, the paper suggested a broad-scale to test the environmental sustainability of existing resorts by using eco-efficiency indicators. The authors stated the results after analyzing the case study with the tool they create 16.

The paper provided valuable information that can be applied in this study since it addresses a case in Saudi Arabia which is similar to Egypt in the use of the resources in buildings. Although El-Barmelgy and Abdelkhalek included a resort existing next to a beach while the current project will be located in the desert, they have explained a tool that can examine the sustainability level of a resort that can be used to test the building in this thesis.

Another study conducted by Ryan, Chris, and Morag Stewart called "Eco-tourism and luxury—the case of Al Maha, Dubai" is greatly helpful as the writers Chris and Stewart presented a case study of a desert resort located in Dubai. The paper claimed eco-tourism status through its

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16 El-Barmelgy, Ibrahim and M, “Eco-Efficient Resort Planning and Design.”
desert regeneration program. The author considered questions like does ecologically motivated reclamation based on revenue from luxury-based tourism condone ecologically unaware tourist behavior? The paper argued that eco-tourism is not inconsistent with luxury. By including Al Maha resort, the authors are proving that luxury designs can be embedded into deserts. By applying the Ecosystems on the design, the yellow warm deserts will be turned into a wide green land. The paper explained how greening the deserts will help the global problem of encroaching desertification. Based on the Islamic culture, the Qur’an conceives of Paradise as a green garden with running waters and fountains. This is the vision of designing this project was about, proving that turning the warm deserts into green land is not contradicting the Islamic culture.17

This document included beneficial information that; especially that the location of the proposed project and their case study location are sitting in Islamic countries that have the same culture. However, the authors seemed very knowledgeable about what they argue. What distinguishes this paper is how both writers have the power of the authority. Basically, authority signifies believability which going to make the writing valuable.

Similarly, a study published by Al-Sulbi is more related to the scope of the current thesis as it addressed qualitative information related to my country. This study named "Potentialities Planning of sustainable ecotourism in the Kingdom of Saudi Arabia". Throughout his paper, Mr. Alsulbi’s identified the purpose of his paper which enriches the sustainable ecotourism in Saudi Arabia by exploring some natural potentialities and their opportunities for different types of ecotourism. The author organized the order of the paper very well. Before addressing the details, he provided the audience (which seems that they are not only Saudis) with great material introducing Saudi Arabia with its geography. He also started his point by mentioning when and

17 Ryan, Chris, and Stewart, “Eco-tourism and luxury–the case of Al Maha, Dubai.”
how tourism started in Saudi Arabia. Alsulbi concluded his research by asserting that planning for sustainable ecotourism in Saudi Arabia must appreciate the natural and socio-cultural heritage and that all regions are treated according to their potentialities for ecotourism 18.

Since the current project is about designing a sustainable tourism heritage village in Saudi Arabia, the project gained valuable information about the history of tourism and the division of Saudi Arabia's geographically from the previous paper. The researcher drew several planning and management guidelines in order to ensure acceptable environmental qualities and the sustainable use of the resources within their natural ecosystems which going to benefit my steps of designing the project. After analyzing the information from this study, it was important to see the Saudi Arabian position toward sustainability so that the full image of the proposed design can be completed.

Regarding sustainability, Al-Yami, Ali MH, and Andrew DF Price published an article titled "An overview of sustainability in Saudi Arabia" that investigates sustainability in Saudi Arabia in terms of strategies, policies, barriers, and enablers associated with its implementation and as perceived by key decision-makers. The writers asserted the need to maximize the efficient use of Saudi Arabian natural resources and that the Saudi entity is paying attention to this. The paper revealed the current situation in Saudi Arabia toward sustainability where it confirms that the Saudi Arabian government has given significant consideration to sustainability 6.

It is very significant for the touristic heritage village project to know what the Saudi Arabian government's situation toward sustainability is. The information provided in the previous paper helped to recognize the government's attention to the environment.

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18 Al-Sulbi, "Potentialities Planning of sustainable ecotourism in the Kingdom,"
3. BACKGROUND | AL-ULA:

A. Geographical Location

The city of Al-Ula and its surrounding cultural and natural heritage sites is located in the northwestern part of Saudi Arabia in the region of Medina. The city is surrounded by mountains from the east and west. The erosion factors have affected these mountains until they have taken stunning natural forms, which are suitable to be among the natural tourism resources in Saudi Arabia.
B. Geology of Al-Ula

The geological construction unit of Al-Ula city consists of three main different geological formations which are origins, rock characteristics, and age. The western part of the land belongs to the Arabian Shield (an ancient crystalline mass consisting mainly of igneous and metamorphic rocks). It covers large parts of the volcanic spills, while the eastern section is within the scope of the Arabian shelf region made up of modern porous sand rocks.

The general geological features in Al-Ula Governorate are as follows:

- A wide variety of igneous rocks, sedimentary rocks, and metamorphic rocks which are multiple sources of wealth of minerals and building materials.
- The presence of highly fertile volcanic soil is supported by a large reservoir of groundwater.
- The diverse mountain ranges of natural scenery are magnificent and attractive.

Figure 4. A Picture Representing The nature of Al-Ula City (Image By Mohmmed Alateeq)

Figure 5. A Picture Representing the Terrain of Al-Ula City (Image from Google Maps)
C. Climate

The Summers in Al-Ula are long, dried, sweltering, and clear. In Contrast, Winters are short, cool, and mostly clear. Generally, over the course of the year, the temperature typically varies from 38°F to 101°F and is rarely below 31°F or above 105°F.

i. Temperature

The Hot Season:

It lasts for 4.1 months, from May 24 to September 27, with an average daily high temperature above 94°F. The hottest day of the year is August 9, with an average high of 101°F and low of 72°F.

The Cool Season:

It lasts for 2.9 months, from December 2 to February 27, with an average daily high temperature below 75°F. The coldest day of the year is January 21, with an average low of 38°F and a high of 69°F.

![Figure 6. The Daily Average High (Red Line) And Low (Blue Line) Temperature, With 25th To 75th And 10th To 90th Percentile Bands. The Thin Dotted Lines Are the Corresponding Average Perceived Temperatures (Image By Weather Spark)](image)

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ii. Clouds

In Al-Ula, the average percentage of the sky covered by clouds experiences significant seasonal variation over the course of the year.

The clearer part of the year in Al-\textsuperscript{`}Ula begins around May 23 and lasts for 4.9 months, ending around October 19. On June 18, the clearest day of the year, the sky is clear, mostly clear, or partly cloudy 97\% of the time, and overcast or mostly cloudy 3\% of the time.

The cloudier part of the year begins around October 19 and lasts for 7.1 months, ending around May 23. On December 12, the cloudiest day of the year, the sky is overcast or mostly cloudy 28\% of the time, and clear, mostly clear, or partly cloudy 72\% of the time.

\textbf{Figure 7.} The percentage of time spent in each cloud cover band, categorized by the percentage of the sky covered by clouds (Image By Weather Spark)
iii. Rainfall

The sliding 31-day quantity of rainfall in Al-`Ula does not vary significantly over the course of the year, staying within 0.1 inches of 0.1 inches throughout.

![Figure 8. The average rainfall (solid line) accumulated over the course of a sliding 31-day period centered on the day in question, with 25th to 75th and 10th to 90th percentile bands. The thin dotted line is the corresponding average liquid-equivalent snowfall. (Image by Weather Spark)]](image)

iv. Sun

The length of the day in Al-`Ula varies over the course of the year. In 2019, the shortest day is December 22, with 10 hours, 28 minutes of daylight; the longest day is June 21, with 13 hours, 49 minutes of daylight.

![Figure 9. The number of hours during which the Sun is visible (black line). From bottom (most yellow) to top (most gray), the color bands indicate: full daylight, twilight (civil, nautical, and astronomical), and full night. (Image By Weather Spark)]](image)
v. **Humidity**

The perceived humidity level in Al-Ula, as measured by the percentage of time in which the humidity comfort level is muggy, oppressive, or miserable, does not vary significantly over the course of the year, remaining a virtually constant 0% throughout.

![Figure 10. The percentage of time spent at various humidity comfort levels, categorized by dew point. (Image By Weather Spark)](image)

vi. **Wind**

The average hourly wind speed in Al-Ula experiences mild seasonal variation over the course of the year. The windier part of the year lasts for 5.6 months, from January 20 to July 9, with average wind speeds of more than 9.0 miles per hour. The windiest day of the year is June 9, with an average hourly wind speed of 9.8 miles per hour. The calmer time of year lasts for 6.4 months, from July 9 to January 20. The calmest day of the year is October 23, with an average hourly wind speed of 8.2 miles per hour.
Figure 11. The average of mean hourly wind speeds (dark gray line), with 25th to 75th and 10th to 90th percentile bands. (Image By Weather Spark)

Figure 12. The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.0 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions. (Image By Weather Spark)
D.  Transportation

Transportation in the various means of road transport, air transport, and maritime transport is one of the most important services related to the tourism industry, with regard to travel and the movement of people from and to tourist attractions. Al-Ula city has two transport factors which are road and air transport.

- **Land Transportation:**

  In Al Ula has recently enjoyed wide development, especially in the field of internal paved roads, and the paved roads linking some Saudi regions, especially neighboring areas such as the city of Khyber, Jahra, Al Wajah, Medina and Tabuk. At the city level, buses are available to travel from Al Ula to neighboring cities. As for cars, many citizens in Saudi Arabia prefer to travel by car. The advantage of this type of transport is the non-observance of flight schedules such as airplanes and trains. It has become an important pillar of the tourism industry, and there are transportation services from the residence to visit the tourist landmarks.

- **Air Transport:**

  Is a means used by a large segment of tourists, to be characterized by speed and convenience. To reach the city of Al Ula by air transport there is more than one option. There is an airport about 20 miles from Al Ula, which receives aircraft coming from Jeddah and Riyadh only. The indirect flight is located in the city of Al-Wajah, which is 160 miles from Al Ula and then go to Al Ula by car. There is another indirect flight. It is located in Medina, which is about 260 miles and then goes to Al-Ola by car.
E.  Accommodation Services

Housing services are the most important factor in the tourism industry and represent the main part of the tourism sector. Accommodation services are divided into several sections including hotels, furnished apartments, and resorts. In addition, desert camps are a new addition to short-term housing services.

- **Hotels:**

  The hotels are the most important accommodation services, especially for foreign tourists. It is the most popular and widespread form of residence. Across the city, there are only two hotels serving guests. One of these hotels is the Mada'in Saleh Hotel. Mada'in Saleh Hotel is a 4-star hotel. It has 50 rooms with 132 beds and 16 separate tents on site. There are also swimming pools and gardens as a recreational factor for guests. The second hotel is ARAC. ARAC Hotel is a 4-star hotel with 42 rooms, 4 suites with a capacity of 92 beds and a camping center. There are also swimming pools and amusement parks for guests.

- **Furnished Apartments:**

  Furnished apartments are apartments equipped for longer stays. This category is the preferred category for family citizens. There are 12 furnished apartments spread throughout the city.

- **Desert Camps:**

  Desert camps are a new addition to short-term housing services and are tents placed between the mountains to give a sense of reflection and integration with nature. The desert camps are a new addition to short-term housing services. Four investment sites totaling 900,000 square meters have been awarded by Al-Ula Municipality to establish desert camps, three of which have been implemented and operated from the private sector and the other under construction.
“Al Ula is a city that lacks tourist villages, which are major tourist gatherings. Provide all required tourist services from shopping centers, restaurants, exhibitions, and daycare. These tourist villages in the region represent the long-term tourism development plan” 14.

F.  Catering Services 14

Catering services in the city are an essential part of tourists coming to Al Ula, which is a key factor to support tourism. The first section is the hotel restaurants which are included in ARAC Hotel and Madain Saleh Hotel. The second section is a variety of fast-food restaurants which are seventeen restaurants in Al Ula. The third section, which is a restaurant that offers popular cuisine that has seven restaurants in Al Ula, areas commonly frequented by tourists to learn the prevailing food culture in the region.

G.  Commercial Markets 14

Commercial markets are a major factor to support tourism, which meets the requirements of tourists, and through the inventory of commercial markets, there are many shops centered in the center of the city, estimated at about three thousand shops, which sells different types of goods, food, and various luxuries.

“Al-Ula lacks antique shops and traditional crafts in the tourism industry, although the area is rich in folklore, cultural and natural heritage” 14.
4. **PRECEDENT STUDIES:**

Precedent studies can aid the design process in terms of functionality and area that are not copied but used as an inspiration to the design. These Studies are a guide or idea to the method that employs in scheme design. Precedent studies may help to solve problems in the design process that have previously been solved in other designs whether it is a material choice, a construction method, or a design concept which are vital in the design process.

**A. Graduation Project (Heritage Tourist Village Interested in Traditional Crafts)**

The project is a heritage village concerned with traditional crafts. The site is located southwest of the city of Assiut in Egypt (the western mountain) and north of the village of Darnah. The goal of the project is to revive the heritage and keep it from extinction. Also, to build a cultural and artistic nucleus leading to the development of the region. Finally, to link past and present to heritage and contemporary life through an old show with an attempt to develop it.

**Components of The Project:**

- Administrative part (administrative building and reception halls).
- Service part (cultural services represented in the information center, library, and folklore theater) - (entertainment services represented in an Arabic cafe, restaurant and motel - Khan -) - (public services are a mosque, green spaces, and parking spaces).

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20 Abdulbaset, “Heritage tourist village interested in heritage crafts.”
- Heritage part (Exhibitions consisting of handicraft exhibitions, exposed and covered exhibitions, audiovisual exhibitions, and the Bazart Group) - (Group Workshops School of Crafts Education).

![Figure 13. Drawing Showing the Components Of The Precedent (Image By Author Of The Thesis, Abdulbaset Saleem)](image1)

![Figure 14. Drawing Showing the Elements Of The Precedent (Image By Author Of The Thesis, Abdulbaset Saleem)](image2)
Site Analysis:

The site is located southwest of the city of Assiut in Egypt (the western mountain) and north of the village of Darnah. The graphs illustrate the surroundings area that shows vehicle movement and the public transportation near to the site.

![Site Analysis](image1.png)

*Figure 15. Site Analysis of Heritage Tourist Village Concerned With Traditional Crafts In Egypt (Image by Author Of The Thesis, Abdulbaset Saleem)*

Pedestrian Movement:

Site traffic is of two types: main and Secondary paths that led to components of the project. Starting from the main entrance by using main path led to secondary path to destinations.

![Pedestrian Movement](image2.png)

*Figure 16. Drawing Showing the Paths and Entrances (Image By Author Of The Thesis, Abdulbaset Saleem)*
B. **Heritage Culture Urban Village**

The project targets groups (individual groups of children, youth and elders). The site is located in an island in the southeastern part of Assiut, Egypt.

**The Project Has the Following Objectives:**

- Objectives of the organization: the objectives of the owner, which is the preservation of heritage and interest in cultures.

- Aesthetic and cosmetic objectives: This center is a distinctive sign for the region in which there is a leading that this center is distinctly formally.

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21 Wazery, “Heritage Culture Urban Village.”
▪ Functional Objectives: Dissemination of general culture, dissemination, and development of artistic culture, development of crafts and preservation of antiquities.

▪ Economic objectives: employment of workers and secure a material return to add to the national income and the revitalization of domestic and foreign tourism.

**Project Elements Related to The Goals:**

▪ Dissemination of Public Culture led to Public Library and Science Club.

▪ Dissemination and development of artistic culture led to a studio for the dissemination and development of artistic culture.

▪ Handicraft Development led to A part of the handicrafts industries.

▪ Employment of workers led to workshops and housing for workers.

▪ Financial return insurance led to Showrooms for rent.

▪ Revitalizing domestic and foreign tourism led to a museum and exhibition to display heritage.

**Site Analysis:**

The site is located in island in the southeastern part of Assiut, Egypt. Ease of regional and local access through the Nile River and a marina to reach the city of Assiut

**Features of The Site:**

▪ Reduce congestion in Assiut city and their party on the other side

▪ Wonderful view of the Nile from all sides.

▪ Most elements of the project enjoyed the magnificent view.

▪ Ease of awareness beneficiaries of the project site as the site is easily seen from the city of Assiut.
There was a flaw in the way of access, but it could be remedied by a marina.

**Figure 19. Site analysis of Heritage Cultural Urban Village in Egypt**  
*(Image by Author Of The Thesis, Ahmed Wazery)*

**Components of The Project:**

The project consists of several sections starting from Handicraft, Marina, Museum, Mosque, Restaurant, Café’, Stage, Library, Day car, and Sports that It is the result of the functional elements of the project.

**Figure 20. Drawing Showing the Components Of The Project**  
*(Image By Author Of The Thesis, Ahmed Wazery)*
Criteria for Choosing The Optimal Alternative:

▪ Economically, there are no wasted spaces.
▪ Appropriate planning with the nature of the project.
▪ Easy access to any building.
▪ Put the educational kit in a quiet area to prevent noise.
▪ Prevent cars entering the site to avoid accidents

C. Caesarea Market

A heritage landmark and a popular market in the region follow this market to the Tourism and Antiquities Authority. It has been famous since ancient times. It is one of the most important landmarks in Al-Ahsa where visitors come from all Gulf countries. The site is located in the center of the city of Al-Ahsa in the old area of Hofuf, Saudi Arabia. The idea of this project is to rebuild this market in the same way it was in the past than add some changes and improvements to the main facades in order to be an attractive market for visitors.

The Project Is Divided into Three Main Sections:

▪ The Druze are the gateway to the market and the main entrance.
▪ Popular shops consist of 422 shops.
▪ Mosque.
▪ Covered corridors account for 24.4% of the total project area.

Site Analysis:

The site is located in the center of the city of Al-Ahsa in the old area of Hofuf, Saudi Arabia. Ease local access through the king Abdul-Aziz Rd cross Alfath Street.

---

22 AlSubehy, “Caesarea Market.”
Adjacent Sites:

- From North: Old Kut District. - From South: Northern Rifaa District.
- From East: Northern Rifaa District. – From West: Northern Rifaa District.

Components of The Project:

The project consists of several sections starting from Spices shops, Clothes shop, Leather Footwear shops, Mosque, Furniture, sewing shops, and Bashout shops that It is the result of the functional elements of the project.
**Pedestrian Movement:**

On-site traffic is of two types:

- Motor traffic (main and secondary).
- Pedestrian movement (main and secondary).

As in the figure (21), the movement within the project is a maze to visitors for the first time because there are many sub entrances in it.

The movement is divided into three types:

- The main path axis for Pedestrian.
- The secondary axis of pedestrian traffic that is in the middle of the market.
- Pedestrian pathway.

*Figure 23. Pedestrian Movement on The Site (Image by Author of The Thesis, Turky, AlSubehy)*
Figure 24. Vehicles Movement on The Site (Image by Author of The Thesis, Turky, AlSubehy)

Figure 25. Project Perspective (Image by Author of The Thesis, Turky, AlSubehy)
5. **SAUDI BUILDING CODE**\(^{23}\)

The Saudi Building Code is a group of terms and requirements as of laws, regulations, and annexes related to buildings and constructions to ensure safety and public health since all facilities, in general, require availability of building code that determines safety and security terms as well as comfort in all building stages and the issue increases in its significance in the Kingdom of Saudi Arabia due to its geographical nature and difference in climates of its regions. The Saudi Building Code contributes to putting an end to differences resulting from numerous opinions of entities working in the building and construction sector through use and application to rules of code as a system recognized on a national level and resorting to it to decide on differences (if any) among all activities of its users.

**Hotels:**

- **Orientation:**
  
  Guest rooms go east, west or south. Kitchen, servicing rooms, and user rooms head north.

- **Car Entry:**
  
  It is preferable to secure the entry of cars to the main entrance covered and give this road sufficient width of the movement of entry and exit.

- **Entrance Hall:**
  
  The entrance foyer forms the heart of the hotel and must have access to all elements of the hotel. The counter is 2.3 meters long per bed and the lobby often forms a covered garden around which various guest lounges are gathered, such as a breakfast lounge that can accommodate 25% of guests and a dining hall that can accommodate 50% of guests. The café and restaurant must have a private entrance.

---

\(^{23}\)Saudi Building Code, (SBC201).
o **Public Lounges:**

Public lounges are often grouped in one floor and separated by light cutouts that allow these lounges to open to form a large hall for celebrations when necessary. In this case, it is necessary to provide a private entrance with dressing areas and toilets.

o **Cafeteria Lounge:**

They often reside on the ground floor. In some large cities, hotels have only a few simple lounges for breakfast and rest. As for other lounges such as restaurants, these hotels deal with restaurants to work for, in which case the ground floor is invested as stores and showrooms.

Often, hotels include a breakfast lounge and a dining hall (food or dinner), and sometimes contain other lounges. Up to 3 times depending on the type of hotel.

o **Bedroom:**

The bedroom starts from the first floor and the large rooms overlook the courtyards or gardens and head east or south.

The height of the rooms is not less than 2.8 meters in the common lounges. 20 square meters.

The total area required for the bed ranges from 35 to 40 square meters.

o **Kitchen:**

It is preferable to have a kitchen on the ground floor next to the restaurant, breakfast lounge and foyer. Accordingly, basic areas for the kitchen in general are taken for each guest as follows:

- Public kitchen area of about 0.6 square meters per guest.
- The hotel's kitchen and breakfast lounge are 0.4 square meters per guest.
- Total 1 square meter’s kitchens per guest.
- There is one office per floor or per 25 to 30 rooms and an elevator dedicated to transport meals to the rooms with full equipment.
o Ventilation:
Renewal of air in hotel rooms should be calculated from 1 to 5 times per hour. In crowded lounges, the volume of renewed air should be from 20 to 30 square meters per person. Taking into account the presence of suction fans over the stoves to drain the resulting heat.

o Building Materials:
Hotels are built of non-combustible materials and equipped with fire extinguishers.

o Stairs and Doors:
Stairs shall be broad enough to be equipped with a handrail and shall be placed on the outside to be larger or equal to the width of the stairs. Doors should be at least 1 meter wide and open outside.

o Bathrooms:
Two urinals and one toilet for 80 to 100 men, 3 toilets for every 100 women, and in the rooms one toilet for every 10 beds.

o Elevators:
One elevator is allocated for every 150 beds.

o Refrigerators:
Prepared for meat, fish and poultry must be close to kitchens.

o Other Services:
  ▪ Service rooms and cleanliness: placed a clean room in each role and a cupboard to save cleaning tools.
  ▪ Linens Rooms: They are usually on the last floor below the roof next to the moxibustion room and must open directly on the corridor.
o **Restaurants and Cafes:**

The general area of the restaurant is from 290 to 440 square meters including roads, seating, cashier, kitchen, children's playroom, laundries, toilets, food services and second floor.

o **General Division:**

- The entrance should not contain tables and the cashier should be facing the door, but with enough dimension to allow the passage of the individual on the tables and then access to the cashier.

- There is a distribution method of about 10 meters followed by the cashier and behind the cashier there is a kitchen and in the right and left corner seating areas can be allocated 1.25 square meters for each chair lounge dining.

- Toilet is required for every 1 to 10 people, as well as a laundry for every 1 to 10 people. The minimum bathroom area is not less than 1.20 square meters. To provide toilets for women in the case of families going to these restaurants the same proportion as before.

o **Types of Tables:**

There are three types of tables:

- First: Installed in the ground: It is usually installed with 4 chairs and between each chair and the other a distance of not less than 30 cm and a distance between the chair and table not less than 50 cm. The distance between each table and the other about 1.20 meters.

- Second: Moving Tables: There are movable tables with a height of about 1.20 and chairs with a height of 60 cm.

- Third: dining table installed in the wall and wheelchairs: Rise from the ground about 1.5 meters and the chair with a height of 1.10 cm.
- **Warehouse:**
  Area not less than 20 square meters.

- **Kitchens:**
  The kitchen area is about 50 square meters and contains cooking utensils and refrigerators.

- **Kitchen Site Requirements:**
  The kitchen should not be located on a commercial street. At least one car park should be provided in silent-built areas. The kitchen area should not be less than 80 square meters. The site should be at least 30 meters away from gas stations measured from the outer borders of the land. The site should be at least 25 meters away from the gas shops measured from the outer borders of the land.

- **Kitchen Sections:**
  The kitchen is divided into three sections: The first area includes warehouses, the second area includes food processing and cooking area, and the third area includes fuel depot and cleaning supplies.

- **The Stage:**
  The design of theaters depends on the capacity required for the audience, the quality of the performances, and therefore the size of the stage, and the relationship required between the actor and the spectator.

- **Theater Chairs:**
  The distance between the back of the chair and the back of the chair should be from 86 cm to 144 cm, where the last distance is suitable for the spectator so that he does not stand to pass another spectator in the same row of theater seats.
- **Theater Hall Corridors:**
  The maximum number of chairs in a row is 14, for the purpose of seeing the stage in a way that puts radio corridors where this method is preferred. The vision of the spectator sitting on his seat in the theater hall. The width of the corridors must be at the level of the theater less than 2 m and in other levels the width is 1.5 m, but if the area of the theater more than 350 square meters, the width of the corridors must be increased by 15 cm per 50 square meters.

- **Vision Lines:**
  The largest horizontal angle in the lines of view is 60 °, otherwise the image will be distorted, and the 33 ° angle is the largest vertical angle helping to distinguish the actor on stage.

- **Theatrical Service Behind the Stage:**
  - Less space for theater service behind the theater:
  - Distribution hall: 4.5 square meters
  - Sentinel booth: 2.7 square meters
  - Fashion theater room: 1.5 square meters per person
  - Makeup compartment: 9 square meters
  - Bathrooms: One toilet for every 6 persons and one shower for each actor with a private room.
  - Corridor: minimum width of 1.5 m as a ramp is used instead of stairs in case of level difference,
  - Waiting place on stage: 4.5 square meters,
  - Changing room: 9 square meters,
  - Variety shop: 13.5 square meters,
  - Management: 9 square meters.
Spaces to Enter the Theater:

Theater entrance hall requires an area of 0.929 square meters per seat, as well as one exit to have the minimum allowed.

6. MUNICIPAL REGULATIONS

Similar to Zoning Codes, the municipality's regulations are set by the government. It applies to engineering design and construction works in the neighborhoods of Medinah Region. Also, it applies to all works related to engineering design and construction, such as changes, replacements, repairs, works, equipment, housing, maintenance, partial or total demolition, removal of demolition disputes, and any rights and privileges related to the constructed buildings. Saudi code building is part of these regulations.

Heritage Villages:

Location:

- The project should be located on at least two streets, one of which is a commercial main.
- The site should be intended for recreational use according to approved plans. The approval of the municipality on the site in organizational terms.
- The area of the site is not less than 2000 square meters.
- Provide privacy to neighbors and do not influence them.
- Fencing and lighting the site and afforestation.
- Providing car parking for every 100 square meters of land area.
- Provision of at least nine fully equipped toilets and seven handwashers (calculated on the basis of 2.78 square meters, 400 persons, and an additional cycle for each 150 persons).
- Provide a first aid room placed in a clear place.
- Providing management rooms and a chapel.
- Providing kiosks for services (selling tickets and drinks).
- Provide at least an ambulance.

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o **Technical Requirements:**

- At least 25% of the land area has been left to walk or sit, and no facilities are set up.
- Entrance from the main street provided that an exit is provided on each side of the fence so that the number of exits is not less than 2 and the width of the exit is not less than 4 meters open to the outside.
- All buildings and constructions shall be made of fire-resistant materials and comply with the Saudi standard specifications.
- Rolling doors shall not be installed as entrances or exits.
- Coverage for the whole area is about 60% of the land area.
- Provide sign boards inside the site according to the technical requirements of the advertisement boards.
- Disability Requirements: The requirements for municipal services relating to persons with disabilities must be complied with in terms of pathways.

o **Four Star Hotels:**

- Location: Very good location in an upscale and quiet area.
- The building - a very good building inside and out, excellent decorations and superb views.
- Entrance - a grand main entrance for guests and another sub-luggage working.
- Front Offices - independent offices for reception, information, guest accounts and treasury
- Salons - reception lobby, sitting salons and reading room
- Banquet and Meeting Hall - one or more banquet hall and meeting room
- Elevators - sufficient elevators for guests if the building more than two floors and another bags
- Suites - provide standard suites.
- Water - cold and hot running water for bathrooms and healthy water to drink sweet in the rooms.
- Air conditioning - central in all rooms with personal control or units and in public areas all year round or by atmosphere in seasonal areas.
- Floor coverings - carpets in rooms, halls and corridors.
- Telephone - Telephone booths on the ground floor and a telephone in each room.
- Restaurants - an excellent restaurant to provide cuisine and menu.
- Room meals - the possibility of serving meals in rooms.
- Café (cafeteria) Very good cafe to provide light food and drinks.
- Fittings - Excellent installations and equipment, refrigerators and food cooling rooms.
- Number of employees - a number and level commensurate with the size of the hotel and performs excellent service with the provision of special uniforms and proficiency of workers in foreign languages besides Arabic.
- Laundry and ironing - Provide laundry and ironing service for guests quickly enough.
- Barber shops provide a salon for men and another for women.
- Postal and Telegraph Services Telephone and Telex - Providing boxes for mail and telegraph service and telephone and telex
- Gift shop, essential goods, newspapers and magazines: a place to sell gifts and necessary tools newspapers and magazines and some tickets.
- Flowers - flower shop.
- Innocent entertainment - swimming pool - gardens - sports courts - barbecue garden - showroom and music.
- Parking place - parking space for each room.
- Rooms - Private bathroom
- Area: not less than 28 square meters including the bathroom and entrance - 10% of the rooms for individual works area of 24 square meters including the bathroom width of corridors not less than 1.80 square meters.

- **Hotel Spaces:**
  - Hotels within the City:
  - The area allocated for the hotel must not be less than 750 square meters for investment residential areas and 500 square meters for commercial areas.
  - Hotels in the Coastal Strip:
  - The space allocated for the hotel must not be less than 2500 square meters.
  - The design of hotel units may be as follows:
    i. Separate or connected rooms with a minimum of 60% of the space allocated for rooms and health facilities.
ii. Distinct suites or units of large sizes or chalets of one or two floors (ground + first) at a rate not exceeding 40% of the space allocated to rooms and health facilities.

iii. Complying with the requirements of the disabled.

○ **Height Building:**

The maximum allowed height of the building (20 m) with 4 floors including the ground floor.

7. **PROGRAMMING**

The programming phase is an essential step that leads to the final Architectural Design. In this phase, establishing the functions of the spaces and their relationships, developing the shape of the building, and identifying the room sizes are done. For the current study, the schematic was mainly based on two factors.

The first one is the precedent studies. The precedent studies aid in choosing the functions since these selected studies are similar to the current one. Analyzing those studies gives a general idea about what does a heritage village can include for attracting tourists, so it becomes easier to choose what to provide in the new project based on that analysis, and also based on the site surrounded functions. The precedent studies are helpful too in designing the sizes of the spaces.

The second main factor for programming is both Building Codes and Municipal Regulations. Similar to how does the precedent studies help to establish the sizes, the Municipal Regulation, and Building Codes provides a guide that assists in creating the accurate areas needed for each function.
A. Selecting Project Elements Processes

<table>
<thead>
<tr>
<th>Components</th>
<th>Pr. Study 1</th>
<th>Pr. Study 2</th>
<th>Pr. Study 3</th>
<th>Functional Program for Sustainable Tourism Heritage Village</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Heritage Cultural Urban Village</td>
<td>Caesarea Market</td>
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Table 1. The Table Illustrates the Elements (Functions) Of Each Precedent Studies, And What Functions Are Applied in the Current Project (By Author)
<table>
<thead>
<tr>
<th>Components</th>
<th>pr. study 1</th>
<th>pr. study 2</th>
<th>pr. study 3</th>
<th>functional program for Sustainable Tourism Heritage Village (m²)</th>
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Table 2. The Table Illustrates the Areas in (m²) For Each Elements (Functions) Of Each Precedent Studies, And What Sized Are Applied in the Current Project (By Author)
<table>
<thead>
<tr>
<th>Project Elements</th>
<th>Number</th>
<th>Total Area First Floor (Square Meters)</th>
<th>Number of Floors</th>
<th>Total Area (Square Meters)</th>
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31000 square meters = Total built up area

*Table 3. The Table Illustrates the Selected Functions Applied in The Current Project with The Number of Each Function, The Area In (M²), Number of Floors, and the Total Area in Square Meter (By Author)*
B. Final Survey and Functional Schedule

This is the final result for establishing the project schematic design after referring to precedent studies, Saudi Building Code, and Municipal Regulations.

<table>
<thead>
<tr>
<th>Project Elements</th>
<th>Precedent Studies</th>
<th>Saudi Building Code</th>
<th>Municipal Regulations</th>
<th>Proposed Project (1st Floor Area)</th>
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Table 4. The Table Illustrates the Average Numbers of Areas According to The Precedent Studies, The Minimum Required Areas Based on the Saudi Building Code and The Municipal Regulations, and the Proposed Total Area. (By Author)
8. PROPOSED PROJECT

A. Location

The site is located in 2294 Hail Road, Al Ula 43534, KSA. What distinguishes the site is that it is located in the middle of the historical monuments and heritage, where the farthest distance to the historical sites is approximately 18 minutes by car.

Figure 26. A Picture Showing the Site and The Geographical Surrounding (Image from Google Maps)

Figure 27. A Picture Showing the Site Boundary from a Closer View and The Geographical Surrounding (Image from Google Maps)
B. Site Analysis

i. Sun Path and Wind Direction

![Image showing sun path and wind direction](image)

*Figure 28. A Picture Showing the Sun Path in Winter and Summer, And Shows the Wind Direction (Image from Google Maps Modified by The Author)*

ii. Accessibility to Site

![Image showing accessibility to site](image)

*Figure 29. A Picture Showing Main roads lead to the site (Image from Google Maps Modified by The Author)*
iii. The Features of the Region (Surroundings)

The heritage features of the region are divided into two parts:

1- Cultural Heritage Landmarks.

2- Natural Heritage Landmarks.

1- Cultural Heritage Landmarks:

   o Historical Sites:

      ▪ Funerary architecture (tombs carved on rock), inscriptions and rock inscriptions.
      ▪ Human and animal drawings.
      ▪ Wells and water canals.
      ▪ Civil Architecture (Housing).
      ▪ Museums.
- **Historic Buildings:**
  - Islamic castles.
  - Buildings of railway stations.

- **Traditional Architectural Heritage:**
  - Heritage village.

- **Folklore:**
  - Physical Heritage (Crafts and Handicrafts).
  - Folklore (Folk Dance).

2- **Natural heritage landmarks:**

- **Topographic Sites:**
  - Mountains and rock masses (Elephant Mountain).
  - Volcanic plateaus (Hurat Alewayrd).
  - Canyons (Canyon Sharaan).
  - Desert, sand dunes and sand hills.
  - Wildlife (deer, eagles, birds).

- **Human Environment Sites:**
  - Palm plantations.
  - Gardens
Figure 31. A Picture Showing Cultural and Natural heritage landmarks. (Image from Google Maps Modified by The Author)
The site is a link between cultural heritage and natural heritage landmarks adjacent and close. The most important factor is the proximity of the distance between the regions and tourist sites plays an effective role in increasing tourist flows.
C. Architectural Drawings

i. Sketches for Design Process

![Bubble Diagram Sketch](image)

*Figure 33. Bubble Diagram Sketch for Distributing Functions of the Project (By Author)*

![Site Development Sketch](image)

*Figure 34. Site Development Sketch (By Author)*
Figure 35. Site Development Sketch (By Author)

Figure 36. Sketch of The Final Layout of The Design and how to orientate the buildings to take advantage of the wind (By Author)
ii. Master Plan:

Figure 37. A Picture Showing the Master Plan Design of the Proposed Project (By Author)
o **Hotel:**

The hotel is a residential place; hence, the better placement for it is to be located nearby the main road for allowing smooth transitioning. It is close to the parking lot, so the occupants can easily carry their luggage without walking for long distances. Besides that, the ground floor of the hotel includes a spacious public space which is an area for welcoming visitors in the village. For these reasons the hotel is place in the front of the heritage village.

o **Heritage Market:**

The Heritage Market is divided into two buildings, and each building is facing a specific direction. The first one is placed in the south front where it will attract people passing from the main road while the other building is placed on the north side to grab people’s attention from the other direction. The placement of the two buildings encourages people to come and explore the new project.

o **Cafes and Restaurants:**

The attractive path created between the two buildings of the market will lead to a new space that has the Cafes and Restaurants building. The building is designed as a U-shaped so it creates an area in the middle for outdoor seating space, and also for directing the people not to go beyond the Cafes and Restaurants building but to go to the other side where the tents and the empty theater existed.

o **Empty Theater:**

The empty theater is placed in an open space where it can benefit from the wind blowing from both the northeast and southeast to regulate the warm temperatures. It is also including a steel frame structure that has water sprays to help reduce the warm breeze. The capacity for the empty theater is 1500 seats.
o **Tents:**

The traditional fabric tents are located on both sides of the empty theater for allowing a better view of what is performing in the theater. These tents can be rented by hours. It is a main part of the project as it delivers a good sense of Saudi traditions.

o **Services:**

This small building is for visitors coming for attending a show in the empty theater or people who rent the tents. It has the place for the reservations and tent rentals. It is also including bathrooms for visitors.
iii. Site Plan

Figure 38. A Picture Showing the Site Design of the Proposed Project (By Author)
iv. **Floor Plans**

- **First floor plan:** The hotel in the Sustainable Tourism Heritage Village contain three buildings. All the three buildings include a public space in the first floor. These public spaces are open to all the visitors not only the hotel residents. Each building has an outdoor swimming pool and outdoor seating’s. The buildings in the sides are 602 M$^2$ while the one in the center is 1100 M$^2$. The first floor of each building includes: lobby with reception desks, café, internal courtyard, and different seating spaces.

- **Second floor plan:** The three hotel buildings are connected in this floor by a bridge. The second floor for each building is for hotel residents only. The floor contains 12 suite rooms overlooking the heritage market. On the other side, it contains 18 rooms overlooking the main street. The hallways of this floor are let by the skylight during the day hours.

- **Third and Fourth floor plans:** Both third and fourth floors contains suites, rooms, and services rooms. These floors contain 24 suite rooms total overlooking the heritage market. The third and fourth floors are also including 36 rooms total overlooking the main street. The hallways of this floor are let by the skylight during the day hours.
Hotel’s First Floor Plan:

Figure 39. First Floor Plans for the Proposed Hotel (By Author)
Hotel’s Second Floor Plan:

Figure 40. Second Floor Plans for the Proposed Hotel (By Author)
Hotel’s Third and Fourth Floor Plan:

*Figure 41. Third and Fourth Floor Plans for the Proposed Hotel (By Author)*
The Heritage Market contains 29 stores in each building, so 58 stores total. The areas vary between 81 M2 minimum – 150 M2 maximum. The proposed market stores are series of handicraft products stores, antique stores, and traditional industries stores. The market design provides shaded areas in both ends surrounded by Mashrabiya to allow daylighting and blowing air to sparkle in which create comfortable seating spaces. The building of the market has a skylight in the roof to lit the area naturally. This natural lighting enables some plants in the internal courtyard to grow.

Figure 42. Floor Plans for the Proposed Heritage Market (By Author)
v. Sections:

Figure 43. A-A Section (By Author)

Figure 44. B-B Section (By Author)
vi. Elevation:

Figure 45. Main Street Elevation (By Author)

vii. Rendered Perspectives

Figure 46. Perspective of The Main Entrance of the Hotel. (By Author)

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**Figure 56.** Bird Eye Perspective Showing The Whole Sustainable Tourism Heritage Village from Main Street (By Author)

**Figure 57.** Perspective Showing the Sustainable Tourism Heritage Village from Main Street (By Author)
9. SUSTAINABLE FACTORS:

The Three Sustainable Focus Areas Will Be Shown as Graphics Only in the Hotel of the Sustainable Tourism Heritage Village.

A. First Sustainable Factor:

i. Passive ventilation (Cooling Towers)

The cooling towers systems account for a substantial amount of energy use in buildings and represent a significant opportunity for energy savings, thus, sustainable ventilation technologies have been proposed to the Sustainable Tourism Heritage Village to reduce the building's energy consumption and carbon footprint. To approach energy-efficient and environmental-friendly ventilation, the Sustainable Tourism Heritage Village includes cooling towers for providing passive ventilation. The cooling towers are not only reducing energy consumption and cost but also it is essential for providing a good indoor air environment while enhancing a healthy, comfortable, and productive internal climate. The main role of natural ventilation is that providing optimum indoor air quality and maintaining acceptable thermal comfort without the aid of mechanical systems, thus enables fresh air delivery to occupants using sustainable and energy-efficient methods.²⁵

²⁵ Hughes, Richard, Calautit and Abdul Ghani. "The development of commercial wind towers for,” P.607
The Design of the Cooling Towers and How it Works:

The cooling tower is considered a multi-directional tower meaning air is captured from all sides. The air is captured from the top part of the towers where all the four openings are located. The interior structure of the cooling towers includes clay channels divided into small sections. These clay channels aid in reducing the temperature as they got wet from water sprays. Water sprays are also located inside the towers right above the clay channels. At the bottom of the clay part, there is a water tank and pumper that pumps the water to reach the clay channels, so they increase the hydration process as well. The integrated cooling towers with wet interior surfaces can reduce the internal air temperature up to 20°C. Cooling towers can provide a new source of air and improve thermal comfort for residents regardless of extreme outdoor conditions.

Figure 58. How the Cooling Tower works (By Author)
Figure 59. Hotel’s Second Floor Plan Illustrating the Cooling Towers and Wind Flow in the Interior of the Building (By Author)
Figure 60. Section C-C Illustrates the Design of the Cooling Tower and How It Work (By Author)

Figure 61. Section D-D Illustrates the Design of the Cooling Tower and How Wind Flow works (By Author)
The cooling towers placed carefully in spots where it can cover as much area as possible. The one tower allows the air to blow in two suit rooms or three to four rooms per floor. The rooms located far away from the cooling tower are able to be featured by the passive cooling because the cooling towers are provided with a fan inside the ducts as shown in the section above to pump the air for longer distance. This way, the hallways also can be benefited with the passive cooling systems. On the other hand, the warm air by its nature always goes up. The hotel is provided with fans above each skylight so it can suck it to the outside.

In Saudi Arabia, most of the energy is consumed in the air consisting by 72%. The hotel of the proposed project contains 14 Cooling Towers. These cooling towers work mainly as a passive cooling system requiring 0.2% energy for the fans. In this specific hotel, the AC consumes 2297.07 megawatts/year. This amount of energy causes 1233.96 tonnes of Co2 emissions yearly which is a serious damage to the environment. This amount of consumption costs $158,497.88 per year. In comparison, the cooling tower’s 36 fans consume 5050.8 kWh/year assuming that these fans work 10 hours per day for 305 days per year because they will not need to work during the two cold months of winter. The amount of the Co2 levels caused by these fans is 2246.5 Kg/year. The cost of utilizing those fans in the hotel building is $348.5 per year. That’s means the Co2 levels are reduced by 99.8%, and that $158,149.37 is saved, considering that the price of kWh= 0.069 cents (based on the Saudi Electric price for commercial buildings transformed to USD).

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27 N.D, “GlobalPetrpPrices”
*The calculation of the Co2 emissions from electricity generation with the EPA’s eGRID emission factors based on 2016 data published in 2018, using the US average electricity source emissions of 0.9884 lbs CO2 per kWh (0.4483 kgs CO2 per kWh)  

Table 5. Comparison Between Air conditioner and Cooling Towers (By Author)

<table>
<thead>
<tr>
<th></th>
<th>Air Conditioner</th>
<th>14 Cooling Towers in Hotel</th>
</tr>
</thead>
<tbody>
<tr>
<td>kWatt/Year to cool Building</td>
<td>2297.07 megawatts/year</td>
<td>36 fans</td>
</tr>
<tr>
<td>Tonnes of Co2 emissions yearly</td>
<td>1233.96 Tonnes</td>
<td>2.24 Tonnes</td>
</tr>
<tr>
<td>This amount of consumption costs</td>
<td>$158,497.88 per year</td>
<td>$348.5 per year</td>
</tr>
</tbody>
</table>

Chiara,” Ecobnb”

28 Chiara,” Ecobnb”
B. Second Sustainable Factor:

i. Vernacular Architecture:

Architecture has the ability to reflect social values and the natural environment of its people. Vernacular Architecture in specific can be the mirror of the societies. "Elements of sustainable design are integral to vernacular architecture that has evolved over time using local materials and technology emerging from ambient natural and cultural environments creating optimum relationships between people and their place, sustainability has often been a fundamental part of the composition of both tangible and intangible cultural resources; sustainability and preservation of cultural identity are complementary” 29.

1) Mashrabiya 30

Mashrabiya is a common Arabian architectural element. It is a form of a window covered by a wooden latticework made as a screen distinguished by unique geometrical patterns, plant ornaments, and Arabic writings inspired by Islamic art. Mashrabiya has many benefits besides the impact on the aesthetics of building facades.

The need for the Mashrabiya started as a social and cultural function according to the Middle East people where privacy is an important need in their culture. To illustrate, in the middle eastern cities, the urban patterns were planned with narrow roads to provide a balance with the human scale. This means that the buildings had a short distance between each other which allowed to penetrate people's privacy. The Mashrabiya was the perfect solution that can preserve privacy as it does not isolate the occupants from the outer world, but it enabled them to observe the outside

---

29 Salman, “Sustainability and Vernacular Architecture: Rethinking What Identity Is,”
30 Abdelkader, Reem And Park, “Sustainable Building Façades: Modern,”
without being seen from the outer side. The wooden patterns prevented passersby to observe who is behind the Mashrabiya, but it allows the occupants to see outside.

The Mashrabiya does not only have social and cultural features besides the aesthetics features, but it also is known for its significant sustainable benefits. The primary sustainable function of Mashrabiya is that it serves as an important device for efficient heating, cooling, and ventilation as it supports passive cooling systems. Basically, it controls airflow and filters the light through different sizes of openings in its lower and upper parts. The various openings in the Mashrabiya provide shade from the summer sun while permitting the flow of cool air from the road. This allows for greater air circulation within the room without causing discomfort. The wood itself removes moisture from the air. The other sustainable function is breaking down the direct sunlight while allowing natural light to enter the interior. This allows adjustments to the access of sunlight and protection from glare. In general, Mashrabiya shields the occupants from the hard-surrounding environment and provide them filtered daylighting and airflow.

- **Functions of Mashrabiya:**

  - **Controlling the Passage of Light:**

    Figure 62 illustrates how Mashrabiya able to control light ratio since it is structured as a group of small openings that allows the building to get the full advantage of indirect sunlight.

---

31 Ashour, "Islamic Architectural Heritage: Mashrabiya."
Figure 63. First Floor Plan Illustrating daylighting analysis as result of Mashrabiya. (By Author)
Figure 64. Second Floor Plan Illustrating daylighting analysis as result of Mashrabiya. (By Author)
Figure 65. Third and Fourth Floor Plan Illustrating daylighting analysis as result of Mashrabiya.
(By Author)
- **Controlling the Air Flow and Humidity:**

The Mashrabiya is an architectural element that contributed to solving many concerns in architecture; mainly, it deals with three main aspects which are: ventilation, lighting, and humidity. The Mashrabiya works to soften the light intensity and the air sliding on its surface at the same time which makes it give wonderful ventilation to the place it contains. The Mashrabiya works to reduces the light passage and regulates the air flow due to the different sizes of voids of the Mashrabiya in the lower and upper parts. The voids are narrowed in the lower parts and widening in the upper parts. To ensure air circulation inside the building, the air is pulled into the room through the small interstices of the Mashrabiya in the lower part and hot air is ejected out through the large interstices of the upper part. "This technique not only enhances the air circulation but also speeds it into other indoor rooms. When the temperature of the air diminishes, its size decreases, per contra the weight and density of it increase. The output rise in the air pressure drives the air to blow into the internal spaces through the small interstices. As the air temperature increases, the size of air increases also, while its weight and a density decrease, therefore low pressure makes the air move upwards and out of through the large interstices in the upper part of the Mashrabiya. It is worth mentioning that the rounded surfaces of the latticework of Mashrabiya provide smooth airflow". In addition, the emergence of the mashrabiya from the wall level allows it to be exposed to the air currents Parallel to the façade of the building. Also, the degree of humidity entering the house has also been controlled by the Mashrabiya since it made out of wood. The nature of the wood material known for its natural porous material which made of organic fibers that absorb and retain water. This operation is efficient as it make the dry air more moist in the heat of the day.

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31 Hiba Alothman, "The cooling effect of Mashrabiya through the evapo-transpiration process"
Adobe Clay Brick

The primer building material utilized in the project is the Adobe Clay Brick. Adobe Clay Brick is the most prevalent material in the Saudi Vernacular Architecture. Its main advantages are fireproof, durable yet biodegradable, non-toxic building material which provides sufficient thermal mass to buildings to ensure excellent thermal performance. Other benefits include low sound transmission levels through walls and a general feeling of solidity and security. One of the biggest advantages of the Adobe system is that the risk of extensive shrinkage and cracking, which would otherwise occur in soils of high clay content in a large monolithic wall, is prevented.

33 N.D., “Solid Earth Adobe Buildings”
An adobe wall is characterized by its sustainable advantages. It is self-sustaining, and naturally energy efficient. Adobe walls are often thick, forming natural insulation from the environmental heat that creates and sustains the material 34. Adobe brick absorbs and releases heat slowly and thus keeps the house cool during daytime and warm during night-time 35. These features ensure regulating the warm temperatures in the interior of the proposed project aligned with the use of the cooling towers and the Mashrabiya.

- **Maintenance Guide for Adobe Clay Brick:**

  Cyclical maintenance is the key to a successful adobe building survival. This means that once the building is constructed, some program of continuing maintenance should be initiated. For instance, all the changes in the building or any editions should particularly be noted. In addition, all water damage should be noted and remedied at its earliest possible stages. Also, the early stages of cracking, sagging, or bulging in adobe walls should be monitored regularly. Another major point is that cyclical maintenance help halting the plant, animal, and insect damage before it becomes substantial. Moreover, surface coatings must be inspected frequently and repaired or replaced as the need indicates. The roof is also a big part of cyclical maintenance where it should be inspected periodically. Lastly, the mechanical systems should be monitored for a breakdown. To illustrate that, problems like leaking water pipes and condensation are more potentially occurs to the adobe building than to a brick, stone, or frame structure. Hence, observing adobe buildings for performing maintenance and making the appropriate changes on a regular basis is a major important policy. It is essential to know that adobe construction's nature is more willing to

---

34 Jackie, “Thought Co”
35 N.D, “Clay Brick”
deteriorate, but this issue can be solved by cyclical maintenance. The cyclical maintenance can substantially deter this process, thus producing a relatively stable adobe structure\textsuperscript{36}.

C. Third Sustainable Factor:

i. Water Management

1) Gray Water Systems

One of the ways that can achieve sustainability is reducing water consumption. Water usage reduction can be beneficial to the environment as it reduces the energy demand required to pump the water into the building. This way, the load that the water treatment centers have to handle in ensuring that water is purified is reduced from the total energy required by water distribution and water purifying companies. Reducing energy usage means less electricity and in turn, fossil fuel use is also cut down eventually helping to reduce Co2 emissions \textsuperscript{37}. This massive positive reduction could be accomplished by the use of Gray Water Systems. This system is defined as “gently used” water that comes from restroom sinks, kitchen sinks, showers, etc\textsuperscript{38}. Although

\textsuperscript{35} N.D, “Preservation Brief 5: Preservation of Historic Adobe Buildings”
\textsuperscript{37} Rinkesh,” Conserve Energy Future”.
\textsuperscript{38} Lodging Staff, “Lodging”
greywater may seem discolored or even “dirty,” they are usually beneficial and safe for some practices like, irrigation or toilet flushing, but not safe for human consumption.

The proposed sustainable tourism heritage village contains spacious spaces of landscaping that requires big amounts of water; hence, the reuse of water can prove to be significant water and cost savings. In the regions that lack plants, like Saudi Arabia, the use of the gray water provides an alternative source for irrigation. However, for this specific project, the hotel contains 90 bathrooms in total, and the average water consumption is between 382 to 787 liters per room per day according to the American Water Works Association \(^3^9\), assuming that Saudi hotels consume the same amount because of the lack of data. This means that the 90 bathrooms consume 34380 liters daily in case of using the average water consumption which is 585 liters. Hence, the 90 bathrooms’ water consumption is raised to be 19,788,078 liters/year.

\(^3^9\) N.D, “Green Hotelier”

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Figure 67. A Chart Illustrating the Total Amount of Gray Water from The Hotel, and How Much of that Water is Utilized in Toilet flushing and Irrigation (By Author)
On the other hand, the green spaces in the proposed project are approximately 12,230 square meters which means that it requires 205,590 liters every time the sprinklers are turned on. If watering the vegetation happened 3 times a week, it will need 616,770 liters per week, 29,604,960 liters per year.

Besides the Graywater provided by the hotel's bathrooms, other bathrooms in the project, such as the ones in the market, services building, and cafe and restaurant will also be used for irrigation.

As the Graywater provided from the gray water systems is 12,548,700 liters/year, 83% will be used for irrigation and the other 17% will be consumed in toilet flushing.

Now, the rest of Graywater provided from the gray water systems in hotel bathrooms are going to be used for the hotel's toilet flushing too. The average person flushes the toilet 5 times a day, 1825 flush/year. The one toilet flush requires 4.22 liters. Assuming that the 54 rooms are rent for 2 to 4 guests maximum this means that these bathrooms are flushed 394,200 times a year, consuming 1,663,524 liters per year.

On the other side, the hotel includes 36 suite rooms that can be rent for 4 to 6 guests maximum. The number of flushing the toilet is 30 times a day for the one suite room which is 10,950 flush a year; hence, all the 36 suite rooms require 394,200 flushes a year, 1,663,524 liters/year.

So, 1,663,524 liters per year from the 54 rooms + 1,663,524 liters/year from the 36 suite rooms = 3,327,048 liters/year.

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40 Lipford, "Today's Homeowner with Danny Lipfords"
41 Sprague, "Home Guides | SF Gate"
Figure 68. Section Illustrates the Design Gray Water System in the Hotel and How It Work (By Author)
2) **Ground Water**

Al-Ula is rich of ground water\(^\text{15}\). The existence of the ground water is a good opportunity that aids on achieving sustainability. In this specific project, the ground water is provided with a system that enable pumping the water to use it in both water sprays existed in the cooling towers and in draining the swimming pools located in the hotels.

To fill a Pool with 12meter Length x 5meter Width x 2meter Deep, it needs 78,408 liters. So, the three swimming pools requires 235,224 liters for each drain. By utilizing the ground water, we are eliminating most of the energy consumed in case of filling the pools with fresh water.

*Figure 69. Section Illustrates the Design Ground Water in the Hotel and How It Work (By Author)*
This Thesis addressed a design of a sustainable tourism heritage village in Al-Ula city in Saudi Arabia. The sustainability is achieved in the project through:

1) The passive ventilation that was activated by the cooling towers.

2) Vernacular Architecture; more specifically, utilizing the local material adobe clay that deals well with extreme weather as well as the existence of Mashrabiya which allow both airflow and sunlight to enter.


Assuming that if this project is constructed, the percentage for the non-oil revenues will increase by 2%. Hence, to reach the 2030 vision goal the Saudi Arabia, it will require at least 8 projects of this scope and scale to get 70% of non-oil revenues.
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