

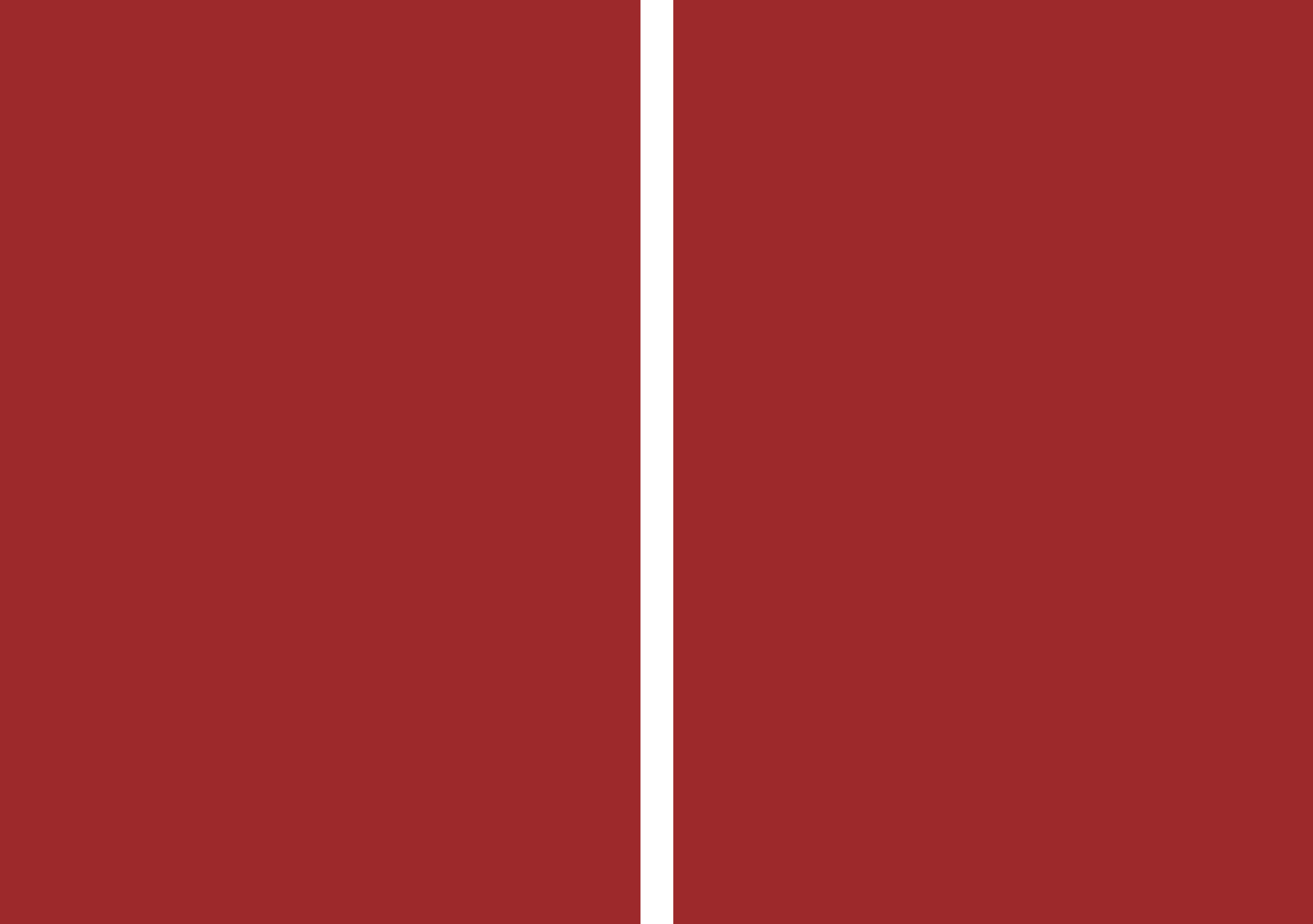


Fajer Ali Al Tawayha

The influence of the Palestinian sociocultural values in shaping the vernacular sustainable architecture in the old cities of Palestine

Universidade do Minho  
Escola de Engenharia







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values in shaping the vernacular sustainable  
architecture in the old cities of Palestine

Tese de Doutoramento  
Programa Doutoral em Sustentabilidade do Ambiente Construído

Trabalho efetuado sob a orientação de  
Professor Doutor Luis Braganca  
Professor Doutor Ricardo Mateus

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## **Dedication and Acknowledgements**

First and foremost, I must thank my parents, my wife, and my daughters for their love and support throughout my life, without their support the completion of this thesis would never have taken place.

With great pleasure, I would like to acknowledge the support, assistance and contribution made by my supervisor Prof. Luís Bragança and my Co-supervisor Prof. Ricardo Mateus, from the beginning of the fieldwork, providing me access, data and information, to the writing process until the completion of this thesis.

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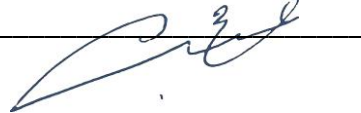
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## **A influência dos valores socioculturais palestinos na formação da arquitetura vernacular sustentável nas antigas cidades da Palestina**

### **Resumo**

A harmonia entre o ambiente e os edifícios é a característica mais relevante da arquitetura vernácula. Neste contexto, a Arquitetura vernácula mediterrânica encontra-se harmonizada com o seu contexto local, incluindo cultura e tradições. A Palestina, como país Mediterrânico, apresenta também, neste contexto, um legado bastante rico, apesar da pobre situação socioeconómica. A atual condição arquitetónica é muito pobre no que respeita à adoção de conceitos de sustentabilidade, especialmente os socioculturais. Este tipo de preocupações é praticamente ignorado nos processos atuais de projeto – por todos os intervenientes, começando pelos utilizadores, equipas de projeto, promotores, municípios e governos locais.

Neste contexto, o principal objetivo deste trabalho passa por clarificar a importância dos valores socioculturais como uma das três dimensões do desenho sustentável, analisando as estratégias vernáculas aplicadas na cidade antiga de Nablus, que é o caso de estudo deste trabalho. No final, será apresentada uma lista de orientações que poderão ser adotadas pelos projetistas e outros decisores para aumentar o nível de sustentabilidade dos edifícios na Palestina.

A metodologia de investigação adotou uma análise qualitativa explicativa e métodos comparativos de síntese para a comparação entre a antiga e a nova área da cidade de Nablus. Nesta análise consideraram-se muitos parâmetros que afetam as características socioculturais da cidade. Após analisar o efeito desses valores socioculturais sobre as componentes da cidade, explorou-se como esses valores socioculturais potencializam, a sustentabilidade da cidade. O trabalho de campo e as observações no local foram as principais ferramentas deste trabalho. Adicionalmente, foi desenvolvido um modelo 3D de modo a explorar e compreender as estratégias utilizadas na parte antiga da cidade e a suprir a falta de informação.

Os resultados deste trabalho permitiram compreender quão afastada dos princípios de sustentabilidade se encontra a parte nova da cidade e quão próxima está a parte antiga, e como as equipas de projeto e outros decisores poderão aprender com as estratégias adotadas na arquitetura vernácula. A investigação permitiu o desenvolvimento de um conjunto de recomendações para arquitetos, municípios e outros decisores. Estas recomendações foram testadas através de um modelo experimental que contou com a participação de uma amostra de famílias de diferentes classes sociais, modos de vida e níveis de educação.

**Palavras-chave:** arquitetura vernacular; prédios residenciais; valores socioculturais; sustentabilidade

# **The influence of the Palestinian sociocultural values in shaping the vernacular sustainable architecture in the old cities of Palestine**

## **Abstract**

The harmony between the environment and buildings is the strongest point of vernacular architecture. In this context, the Mediterranean vernacular architecture is harmonised with its local context, including culture and traditions.

Palestine, as a country in the Mediterranean, also has a very rich background, but with a very poor reality. The current architectural condition is very poor regarding sustainable concepts, especially sociocultural aspects. This type of concerns is almost ignored during the design process nowadays by all the parts of the design process, beginning with users, design teams, developers, municipalities, and local governments.

The main objects of this research in this context, is to clarify the importance of sociocultural values as one of the three dimensions of sustainable design, investigating the vernacular strategies applied in the old city of Nablus, which is the case study of this research. As result, list of guidelines is developed as a reference for designers and stakeholders to enhance the sustainability of buildings in Palestine.

The research methodology adopted an explanatory qualitative analysis and comparative synthesis methods for both the old and the new area of the city of Nablus. It considered many parameters of the city features affected by sociocultural values. After analysing the effect of these sociocultural values on the city components, it was explored how do these sociocultural values enhanced, directly and indirectly, the city's sustainability. Fieldwork and site observations were the main tools of this research. Also, a 3D model was established to explore and understand the strategies used in the old city and to cover the lack of information.

The outcomes of this research allowed understanding how the new city is far away from the sustainability principles and how the old city is close to it, and how the architects and stakeholders could learn from the strategies of vernacular architecture. The research enabled drawing a set of guidelines and recommendations for architects, municipalities, and stakeholders. These guidelines were tested by an experimental model with the participation of a sample of families from different social classes, standards living, and levels of education.

**Keywords:** residential buildings; sociocultural values; sustainability; vernacular architecture



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# Chapter 1. Introduction

In the past, people in Palestine built their houses depending on their possibilities, needs, available materials, topography, and culture. Without any control from the government or any legal limitations or architects, it was people architecture, simple architecture.

Seeing that modern buildings have started to take place in some of the Third World's cities, including Palestinian ones, it has become difficult for these cities to maintain their own cultural identities and to achieve sustainable buildings. Stakeholders and designers in Palestine, which is considered as a multi-climatic region, need to consider the variety of climatic and geographic behaviours that should govern the architectural aspects and sustainable themes within the design process. Unfortunately, design processes in Palestine have become typical and identical despite the different climate zones within the country.

Architects and designers do not consider sustainable aspects, such as special construction materials and techniques that help to reach sustainable buildings and cities. It was not the case when it comes to mentioning the traditional architecture of the Palestinian cities before the energy concept rises in the market. Traditional architecture was more environmentally friendly in the way it utilised vernacular materials and renewable energy to environmentally protect the building from climatic changes and to reduce its reliance on other energy resources.

Moreover, traditional buildings met the social, environmental and functional needs of their residents. In addition, they allowed employing architectural elements like the traditional courtyard and "*Almalga*" (a chimney for air circulation) to create a comprehensive and sustainable balance in and out of the building.

The German orientalist Otto Spies says that the neighbour rights between people are strongly affecting the Islamic cities, and these rights or constraints come from the religious laws (Abu-Lughod, 1987). The Palestinian society is a society of people who believe themselves bound together by strong links such as family ties, ethnic or sectarian religious identity, and many other cultural relations, as most of the Arab countries, which are strongly affected by such links.

The strongest and the most effective bounds in the Palestinian society are cultural ones, which come from the religious believes; religion is very dominant and touches every side of the daily life and affects it, such as

the habits of clothing, food, the way of thinking and learning, and many other sides which architecture and building are one part of them (Stevenson & Ball, 1998).

If such constraints are not taken into consideration, it will cause negative side-effects on any product of construction, and the current samples of contemporary building omitted this side and failed in achieving sustainable concepts.

To avoid such failed samples, this research is focusing on the importance of sociocultural values in improving the sustainable features of the city. A Palestinian vernacular city, which is an example of a sustainable one, was chosen as a case study.

The effect of sociocultural aspects on the city features was analysed in both urban and building levels, comparing them with the new urban areas from a sustainable point of view. It aimed at basing the development of guidelines which could help architects and municipalities to improve the current architectural and built environment situation.

## 1.1. State of art

Many definitions of sustainable design have emerged in the past twenty years, most of which focused on the sustainable part of the design process and its three elements (Figure 1). In recent years, especially with the emergence of sustainable design as an international trend, more attention has been directed towards the social and economic part of the sustainable design for a building to be truly sustainable and able to fit in any context, for the long run. This thesis explores the social and cultural dimensions of sustainable design, studying the sustainable effect of such dimensions, using a case-study as a base to explore sustainable design in the region of Palestine, a small country in the northern part of the Middle East and east of Mediterranean. The main aim of the work was to define a framework of sustainable design.

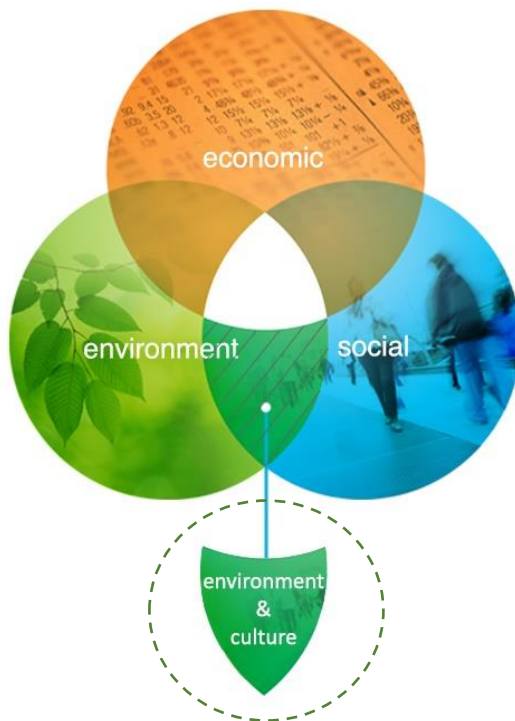


Figure 1. The three pillars of sustainable design and the relation between environment and culture(Renewable energy newsletter -October 2012, n.d.)

### 1.1.1. Vernacular architecture and sustainable design

In general, most of the current studies in the Middle East about vernacular architecture focus on thermal and climatic aspects of sustainable design, with emphasis on Pros and Cons. These say that architects and

stakeholders must reuse the traditional architectural elements and solutions in future sustainable designs to ensure the identity and to benefit from the historical passive design solutions (Haddad, 2010).

An important study about the Middle East vernacular architecture 'The Vernacular and the Environment towards a Comprehensive Research Methodology' states that considering vernacular housing prototypes as a context which is adapted to the constraints of the natural environment will not definitely lead to the right conclusions regarding appropriate technologies and solutions in general, it should be analysed and understood in its content (Meier et al., 2004). This study analysed several generic types of housing common around the Middle East and the Mediterranean – where Nablus city locates – and assessed their performance vis-à-vis different low-tech upgrade and retrofit strategies. The investigations included different building technologies and materials, morphologies and details, under different arid conditions typical of the Middle Eastern climatic regions (Meier et al., 2004).

Another recent study (Haddad, 2010), focused on sustainable design in Palestine, trying to connect sustainable design and social or cultural aspects, using the courtyards house which is a result of cultural constraints in the old city of Nablus. Choosing a case study in Nablus, the study began to define a framework. Nablus was identified as a city in the core of the West Bank (Palestine) and the building selected was an already built case study which was already examined for its energy use, social qualities, and later transformed because of cultural aspects into a courtyard structure, with the same occupancy and spatial praxis. Later in the study, a proposed design was compared with the existing one, to examine the ability of the courtyard structure to serve as a sustainable architectural element.

Haddad thesis tried to adopt or to find a broader socio-economic definition of sustainable design, using it to find a module of regional sustainable design with contextual adaptation.

The study explored the region of Palestine. It explored the integration of passive design systems that existed in vernacular buildings, together with the currently used techniques. It was expected that this integration with the added sociocultural and economic aspects, could provide a basis for a framework of sustainable design in Palestine (Haddad, 2010).

Another study, published in the Iraq Academic Scientific Journal presented sustainability principals of traditional architecture in the Islamic perception (Iraq Academic Scientific Journals, n.d.). This work studied the sustainability potential in traditional residential architecture in the Arab world. The study highlights that

the built environment in the Islamic World reflects the Muslims view to the environment as a living entity. This view was achieved and translated in both urban and design levels.

### **1.1.2. Cultural aspects and sustainability**

Sustainability and culture are generic concepts. Studies deal with culture as an element to be considered while designing, instead of analysing the exact effect – "technical effect" – of culture on the buildings or whole cities. A few number of studies in the Arab area dealt with culture from a technical point view such as Hussein, Barlet, and Semidor (2010) and J. Akbar (2008).

UNESCO (United Nations Educational Scientific and Cultural Organisation) coined the term "whole life sustainability" in order to expand the general meaning of sustainable architecture from designing sustainable friendly buildings to architecture incorporating local identity into design process (Tocher, 2011).

A paper on the role of culture in sustainable architecture by (Kultur, n.d.), discusses the cultural dimensions of sustainable architecture, and it is divided into three parts. Part 1 introduces eco-cultural architecture from among different kinds of sustainable architecture. Part 2 analyses the architectural practices with their cultural components worldwide as practices adopting eco-cultural logic and part 3 interprets the sustainable architectural approaches in Turkey as a largely linked country to cultural and religious legislation. In his essay, Kultur underlines the importance of engaging sustainable architecture in the design process, not only as a technique or an approach but as a cultural paradigm. Frampton's addresses the notion of "critical regionalism" seeking to address both local conditions and contemporary global culture of architecture as a part of the solution (Kultur, n.d.).

### **1.1.3. The cultural effect on architecture**

A more detailed study focused on cultural and place identity in the house's environment in a traditional Turkish house, discussed the effect of the cultural identity on the indoor environment of the house. It mentioned the importance of cultural aspects on architecture, and said that culture is not as simple as it looks, it is a concept that carries many meanings, something that is transformed from one generation to another, a concept that people could fight to defend, it contains a system of rules, attitudes, values and believes, and this concept also has the ability to change ("Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors," n.d.). Part of this paper explores certain concepts which

will help to explain the interaction that exists between these internal spaces and their users. There is a complex interaction between a person and a space. The person defines the space, and the space defines the person; the person gives meaning to space, and space gives meaning to the person. In other words, there is a complex and bilateral interaction between the person and space in its cultural, psychological, economical, and physical dimensions. One house, where cultural influences may be intensely observed, is a space where this bilateral interaction can be easily perceived. Rapaport, 1969 defines the cultural elements that affect the house formation as:

- Religion;
- Language and these kinds of peculiarities;
- The structure of family and relatives;
- Child raising methods;
- Settlement patterns;
- Land division and land-owning systems;
- Nutrition habits;
- Symbolic and traditional systems;
- Status defining methods and social identity;
- Cognitive maps; privacy, intensity, territoriality;
- Behavioural organization in a house;
- Working, business with others and trades.

It is not only a physical building carrying all these cultural, social and psychological aspects, it becomes a home with high symbolic and emotional meaning also ("Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors," n.d.).

A place's formation can be defined as the individual forms towards a certain environment. The concept of place involves not just a physical element but also emotional factors ("Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors," n.d.). With such a huge influence and effect of such impacts, the home becomes a concept of place rather than space. Therefore, while designing a place,

architects should design every single detail related to this place; it is more than a place, it is a place filled with motion, meanings, and stories. This is vernacular architecture, which is a space that becomes a place by the effect of time and culture.

#### **1.1.4. Mediterranean vernacular architecture**

There is no doubt that Mediterranean countries, in general, have some common sides regarding vernacular architecture aspects, such as climate, materials, and building strategies. Such common aspects will be presented in more details in chapter 2 of this study, showing the common materials, building structures and building strategies. Thus, it is necessary to highlight and mention this region in this study because Palestine is one of the Mediterranean countries.

One of the most recent studies in this field (Fernandes, Dabaieh, Mateus, & Bragança, 2014a) is based on a comparative analysis between the vernacular responsive architecture of southern Portugal and north of Egypt – both Mediterranean countries. It considered that Mediterranean vernacular architecture have been developed in many sites and have been affected by many factors, such as climatic, environmental and cultural aspects. It was possible to find similar vernacular strategies through this study under the influence of the Mediterranean climate even if the culture between Roman and Arab are different. An important approach is raised in this paper, which is covering the topic from many sides and dividing the analysis through:

- Analysing and comparing site planning and urban layout;
- Building design and architectural elements such as courtyard house, (*Mashrabiya*), fountains, colours, and openings;
- Building materials use and relation with local topography and natural resources;
- Historic and cultural aspects.

The paper concludes that climate is an important issue to consider in building design. However, in fact, and in practice, the current designs are depending majorly on fossil energy for running the building, because of the great role of mechanical equipment's to control the indoor climate. Moreover, to avoid such problems, this study recommends that architects and planners should learn from the past, from the vernacular architecture solutions and techniques. So, in the future, one can use the potential of existing technology to

improve vernacular architecture solutions and techniques to change the current energy paradigm. The study does not talk about using or copying the vernacular dwelling as it was in the past, because it may not be suitable to the current standards of comfort, instead it tries to give some clues about strategies to mitigate the use of non-renewable energy. Also, applying these strategies should improve and satisfy the desired standards of nowadays' comfort and, at the same time, reduce fossil energy consumption (Fernandes et al., 2014a).

An important study recalls what happened with Iranian vernacular architecture, stating that it should be noticed that vernacular methods are used for creating principles trying to preserve energy in buildings, providing a compatible climate indoors, and meet the people's needs. Additionally, for achieving these outcomes, the study concluded that general architecture, where all the green architecture principles are concentrated should be followed. This is what has happened in Iranian vernacular architecture (Mohammadabadi & Ghoreishi, 2011).

Mohammadabadi and Ghoreishi (2011) presented the Iranian architecture as a good example for architects to follow, depending on the way it was formed because it is considering the different sites and climates and cultural and social elements. Using clean and renewable energy and organic growth, and all of this finally is respecting the environment.

Another relevant study discusses the vernacular and contemporary buildings in Qatar. It discusses different passive techniques used in the traditional old buildings, and their role in providing comfortable indoor climate, especially in Qatar that has a desert climate which is very hot during the day (Sayigh & Marafia, 1998). This paper clarified such techniques by analysing and explaining how these were employed, such as (Sayigh & Marafia, 1998):

- Town layout;
- Massive walls;
- Courtyards;
- Wall air vents;
- Wind tower (Badjir).



After that, the authors discussed contemporary buildings in Qatar and analysed some contemporary buildings influenced and affected by the layout and techniques of the traditional building. The study recommended as a result of this discussion to reuse vernacular strategies in contemporary buildings design.

#### **1.1.5. Fundamental regional research**

There are some main fundamental studies which provide the basics of cultural effect on the design process in the Middle East area in general, and specifically in the Arab region. One of the main books in this field is "The construction of Earth in Islam" by Akbar (1992). This study analyses the traditional environment in the old Islamic cities, trying to explore some architectural and urban approaches and concepts to apply in the current context. The book also demonstrates the current environmental conditions in the Islamic world, which is simulating or copying solutions and approaches from other cultures, trying to adopt them in a very sensitive community like the Arab's one. Moreover, it shows the problems caused by this type of copied solutions and suggests effective solutions concluded from religion and culture (Akbar, 1992). The book also highlights some main questions related to the concept of environmental sustainability such as:

- What do we know as urban designers and architects about our environment?
- What are the skills that we should have to develop and to raise the value of our environment in the framework of the Islamic concept?

That means that the architect and the urban planner should deal with their environment and its constraints, whether cultural, resources or economic aspects (Akbar, 1992).

The book also addressed the concept of "dynamic environment", how it could grow and be vital in the city, giving some examples from the old Islamic cities which were established and developed depending on the Islamic laws and showing how it differs from the current examples of Muslim cities (Akbar, 1992). Finally, the book addressed that people are the main contributor to framing the environment, after dividing the environmental researchers into two types. The first says that the environment is a purpose, while the second says that the environment is a mean, and between these two opinions the author concluded that:

- Cultural and functional legislation have a great effect on the traditional Islamic cities;
- The difference between the old and the new context is caused by ignoring religious constraints by urban planners and architects;

- The responsibility of people is very limited in the new rules.

A more detailed study from Akbar (2008) is "Urbanisation institutions and sustainability", which addresses the concept of property at different levels, starting from the individual, to the family, and community levels. The author discusses and gives examples about the property at the streets, neighbourhoods, and the hall infrastructure of the city, and how that should be organised in the Islamic constraints framework, and comparing that with capitalism and socialism and how every system deals with the property (Figure 2).

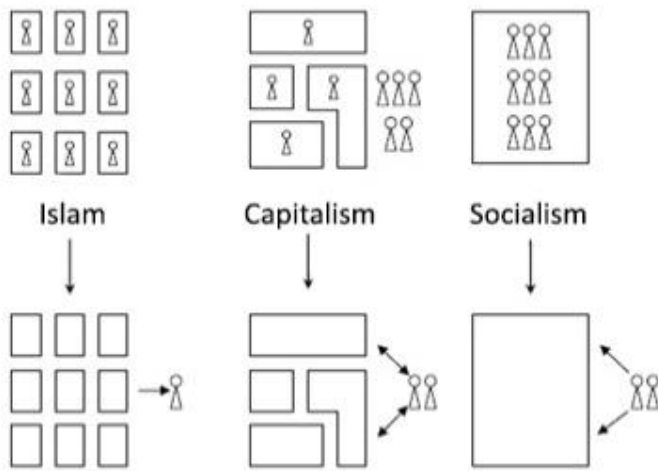


Figure 2. Property and different views between Islam, capitalism, and socialism(Akbar, 2008)

Mustapha Ben Hamouche (2007) also studied the sustainability and urban management in old Muslim cities, deeply focusing on specific aspects of sustainable design. The author states that urban management in traditional Islamic cities largely relied on endowment foundations voluntarily financed by the people, known as "Habūs" in North Africa and "Waqf" in the Middle East.

The "*Habūs*" covered most municipal services and public utilities through a sustainable and autonomous financial system that depended on incomes from the assets of these foundations. Also, it performed a significant socioeconomic role with poor people (Hamouche, 2007). Analysing the concept of *Habūs* in traditional Islamic cities, this study offers a historical analysis of the impact of these foundations on the quality of the traditional built environment in Algiers during the Ottoman period (Hamouche, 2007). Moreover, it shows how effective such an Islamic concept could be in the design process.

As noticed from the reviewed fundamental studies, sustainability, as a general concept, is discussed with examples explaining the importance of the Islamic laws in the design and urban planning process. Furthermore, some detailed environmental aspects should be discussed to show the effect of cultural and religious constraints of a place, analysing the Pros and Cons from ignoring and adopting such constraints.

### **1.1.6. Practical regional efforts**

Some practical efforts that should be reviewed are the sustainable efforts from a cultural view. These are a translation of the studies mentioning the importance of culture and religion in the urban and design process. One of the main and almost only practices are Gournia village in Egypt by Hassan Fathy, as seen in Figures 3 and 4. It is considered as architectural Practices adopting Eco-Cultural Logic.

The concern for the cultural sustainability, continuity of space characteristics, use of local materials and proper responses to nature can be seen in such a city (Kultur, n.d.).



Figure 3. Gournia Village in Egypt by Hassan Fathy(UNESCO, n.d.)



Figure 4. Gournia Village in Egypt by Hassan Fathy(UNESCO, n.d.)

Hasan Fathy is one of the earlier visionaries of sustainable architecture in the Arab area, and his design of new Gurna Village is a translation and an example of his vision about the traditional urban and architectural setting. It is an outstanding example of the integration of vernacular technology with modern architectural principles (Kultur, n.d.). Fathy also tried to reuse mud brick (adobe) with some techniques that helped the building to be cool during the hot summer days and warmer during the cold nights. Fathy believed that the harmony between new and old architectural techniques will bridge the gap. He also believed that older techniques are sustainable and could save energy, and would help people to depend more on their local environment, which is not expensive for them, and would help them to avoid negative effects on their culture and environment (Kultur, n.d.).

### **1.1.7. Sustainable Design in Palestine**

An important comparative study in Palestine area (Hussein et al., 2010), highlighted the socio-environmental characteristics or dimensions of private outdoor spaces in contemporary Palestinian housing, compared with the traditional outdoor spaces, and tried to improve the living quality of future housing design in Palestine. The comparative analysis was carried out considering two different cities in two different climatic zones of Palestine – Jericho and Nablus. The study focused on the courtyard concept and the importance of reintroducing this concept consciously into the design of future housing. This paper evaluated the contemporary housing by applying a survey over 300 dwellings from different housing typologies such as detached houses and apartment flats, which is the most common typologies of contemporary housing in Palestine. The characteristics of traditional design were analysed from the old historical part of these two cities (Hussein et al., 2010). Finally, the study concluded that the private outdoor spaces are an important and main element for improving and achieving housing sustainability, showing the positives coming from involving the courtyard concept in the design processes.

Another comparative study regarded the high-density housing in Palestine and the lack of land. The study tries to learn from traditional typologies, comparing contemporary and traditional typologies, seeking to find the values of traditional housing examples to improve contemporary housing in Palestine (Itma, 2014). It introduces housing typologies in general, such as courtyard houses, single houses, and attached houses. This introduction leads the study to address the contemporary housing in Palestine and to try to classify them into three main typologies: (i) low-rise-low-density housing; (ii) high-rise-high-density housing and; (iii)

courtyard housing. It highlights the advantages and disadvantages of such typologies, depending on limitations of land in Palestine and on sociocultural, environmental, and healthy aspects.

The study then introduced traditional housing in Palestine, trying to take advantages from typologies used in the old city of Nablus as a case study especially the courtyard concept, concluding that traditional typologies gathered the advantages of both low-rise and high-rise typologies providing a low-rise and a high-density building, achieving sociocultural aspects.

Moreover, to avoid such problems, this study recommends that architects and planners should learn from the past. From the vernacular architecture solutions and techniques, the future can use the potential of existing technology and improve it to change the current energy paradigm.

A few studies in the field of sustainable design in Palestine were done despite the dire necessity for it. One study by the Ministry of Housing in Palestine by Architect Mohammed Abaid, reached a new architectural design made with a climate design tool, increasing the housing comfort in Palestine. This study provided data about the history, architecture, and climate of Palestine without analysing these elements deeply. The study introduced a building model case study with the aim to find optimal principles for passive heating and cooling for multi-stories building in Gaza City – Palestine. This model could not be generalised as a good case study in Palestine because of the special circumstances and conditions of the Gaza strip (Haddad, 2010). In this study, a computer simulation examined the influence of various parameters on the indoor temperature, the case study analyses different aspects: insulation, ventilation, shading, orientation, and colour. It was concluded that once the architect or the designer has a comprehensive and scientific understanding of climate design, he can begin a serious and effective process of integrating such principles into a contemporary or modern architecture (Haddad, 2010). The author states that in order to draw a good and clear path of development, there is a crucial need to study the results of both traditional and modern tools. This latter can give some rough specifications for building design in a specific region and climate (Abaid, 1998).

One last survey reported by Haddad (2010) studied the different contemporary building styles in Palestine and its adaptation to the Palestinian climate. The author verified no special contemporary architectural elements were used in West Bank and Gaze Strip for energy saving or reducing thermal loss.

Building technology in Palestine pays little attention to climate and most people build their houses without referring to any engineering consultancy, in addition to that most designers do not consider climate as one of the main design criteria in their buildings. On the other hand, the traditional architecture provides the architect with the experience of climate-adapted building learned through generations of trial and error.

Although traditional buildings and traditional building methods have always paid some respect to the climate and its ingenious solutions, it is strongly believed that these buildings and solutions should be studied, evaluated and developed and not copied (Haddad, 2010).

Another practical effort has been held in Jericho – Palestine. Those works are considered as some good environmental design efforts in Palestine, and one of these main efforts is the desert house in Jericho as seen in Figure 5, which depends completely on studying and analysing climatic aspects and building materials in the area.

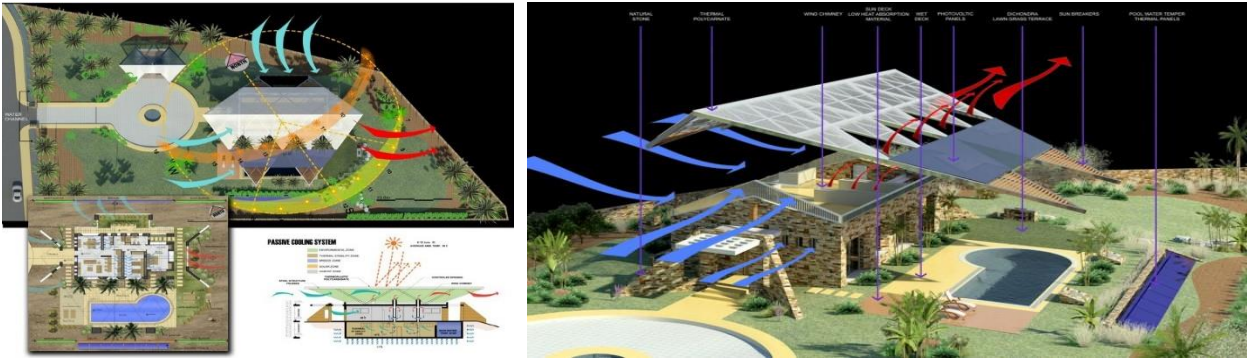


Figure 5. Desert house in Jericho by Hani Hasan (*Hani Hassan Architects / Desert House, n.d.*)

This example as said is depending on studying and analysing building materials and climatic aspects and conditions without mentioning if cultural legislations are taking a role in such design.

Some forward efforts have also been made in Jericho-Palestine, these efforts are depending on mud architecture or "earthbag house" (Figure 6).



Figure 6. Earthen buildings in Jericho by ShamsArd group (ShamsArd, n.d.)

Most of these efforts were made by "ShamsArd studios" who states that "As architects and designers we recognise that we have an important role and responsibility in the decisions we make and the consequences of these decisions in shaping our future, preserving our natural resources and empowering our community". Most conventional building materials used locally are neither locally produced nor sustainable. ShamsArd studio's objective is to find, experiment, play with, test, and use building materials and techniques that have a minimal impact on the environment, creating a healthy, comfortable, and modern space for the client (ShamsArd, n.d.).

As seen, not enough literature or studies were carried out to experiment the effect of cultural and religious laws on environmental modules in Palestine or its surrounding regions, and all the existing ones are considered as individual efforts. The available literature is focusing on either sustainable aspect in general terms, or environmental design depending on climatic and building material calculations, and for Palestinian society, it is a crucial need to understand and study such constraints. Moreover, trying to copy some prototypes from developed countries seems to be effective, but such efforts show that these prototypes do not work in different cultural and social environments like the Middle East and especially Palestine.

The analysis of Nablus city, presented in this thesis, focused on both, urban and design scale. An urban scale such as public, semi-public, and private spaces. It also considered the roads connecting such spaces and the general context of the city, and the relationship between all urban components regarding the cultural constraints. The design scale analysis encompassed architectural elements like dooms, oriels, courtyard house, and yards.

The first step was to analyse these sides and components, by understanding the general content of the old city of Nablus. That was achieved through a 3-dimension (3D) model giving most of the information needed about the components.

As seen in the state-of-art review, until now there is not an approach that allows identifying the different vernacular approaches used in the development of the Palestinian cities, respecting the local traditions, besides the complicated political conditions in Palestine and the difficulties facing the field work. All the research work leads suggesting a new tool which provides deep understanding – a physical and practical way to analyse and to check out the strategies of the vernacular architecture in every part of the old cities of Palestine the old city of Nablus and parts of the old cities of Hebron were used as case study.

The developed methodology, based on the development of a 3D model, (that can also be applied in other cities) has the advantage of:

- Developing a document that can preserve the memory of the city as it is built today.
- Allowing to identify and highlight the different vernacular approaches identified in the city, both at city and building levels and, as mentioned before, because the site visits are very difficult as a result of the actual political conditions.
- The developed model can, in the future, be very beneficial for city municipality/planners as a basis for developing urban policies.

These 3D models for the old city of Nablus and parts of the old city of Hebron rely on data collected from many resources like municipalities, universities, and fieldwork. The models focused on some strategies from a sustainable point of view, depending on sociocultural effects, from both urban and building scale.



## 1.2. Nablus city 3D modelling

The 3D modelling was used as an approach to make vernacular strategies analysis in an easier and feasible way of clarifying and manifesting both urban and design elements of urban context as in Figure 7 and 8, for a clear approach and to have an orderliness result. The analysis was divided into two scale axes, urban scale and building scale.



Figure 7. 3D modelling of the old city of Nablus showing buildings and public areas

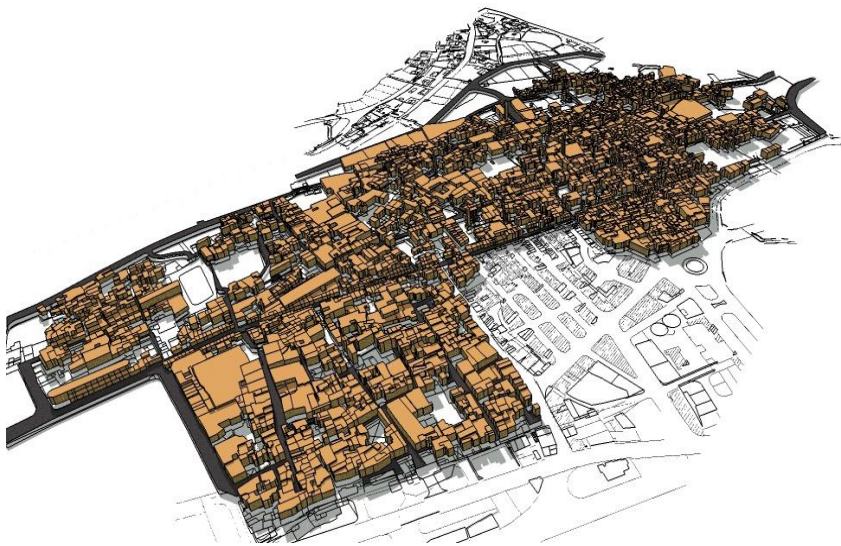


Figure 8. 3D modelling of the old city of Nablus showing the city layout

Fieldwork and data collection from visiting the old city of Nablus represented the main source of information. Nevertheless, the 3D modelling supports this data, as it is a tool which helps to make analysis more efficient

and to clearly reach the expected results and to explore different strategies used in both urban and building levels as presented in Figures 9 and 10. Next, the relevant elements for carrying out a 3D model and the analysis levels are presented.



Figure 9. 3D model showing different strategies in both building and urban scales all around the old city of Nablus

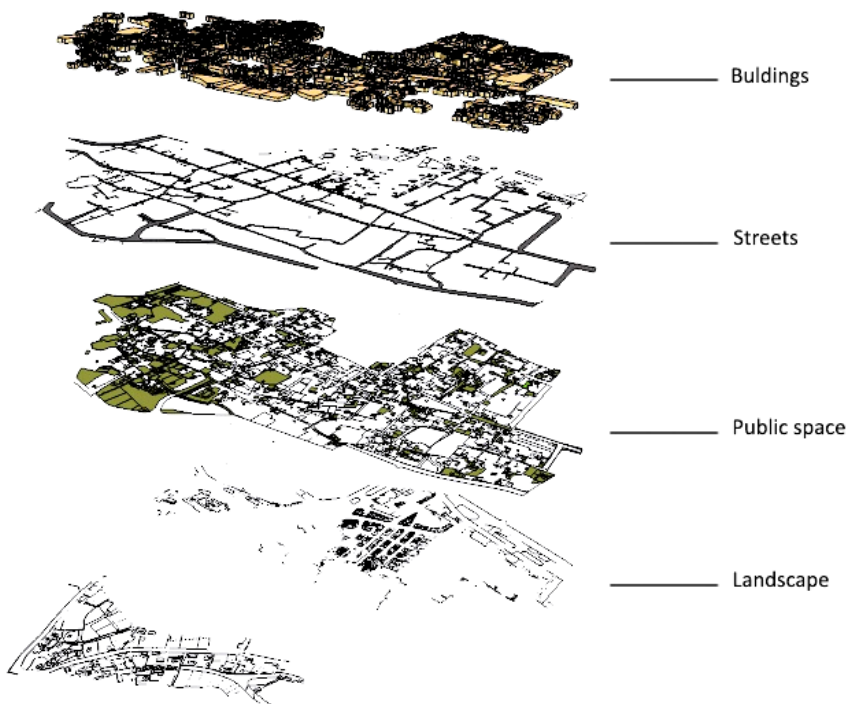


Figure 10. 3D modelling analysis for the old city of Nablus

### **1.2.1. Urban level analysis**

Urban design can significantly influence the economic, environmental, social and cultural outcomes of a place. Also, it is affected by those, as there is an Integrative relationship between each other. To understand urban design as a general concept, the elements of urban design should be clarified as (*URBAN DESIGN*, n.d.):

- i. Buildings: are the most pronounced elements of urban design – they shape and articulate space by forming the cities' street walls. Well-designed buildings and groups of buildings work together to create a sense of place.
- ii. Public Space: are the living room of the city – the place where people come together to enjoy the city and each other. Public spaces enable high life quality in the city. Public spaces range from grand central plazas and squares to small local neighbourhood parks.
- iii. Streets: are the connections between spaces and places, while being spaces themselves. They are defined by their physical dimension and character as well as the size, scale, and character of the buildings that line them.
- iv. Transport: transport systems connect different parts of cities, help shape these, and enable movement throughout the city. They include road, rail, bicycle, and pedestrian networks, and together form the total mobility system of a city.
- v. Landscape: is the green part of the city that weaves throughout – in the form of urban parks, street trees, plants, flowers, and water in many forms. The landscape helps to define the character and beauty of a city and creates soft, contrasting spaces and elements.

### **1.2.2. Semi-public gardens**

Semi-public gardens were created for family relatives in each neighbourhood as an alternative solution for public parks, where free contact between people – women and men – is not widely allowed by sociocultural and religious constraints.

The cultural and social activities were not ignored, but such solutions were created (Figure 11). Strangers or foreigners are not allowed to use these gardens. These can only be used by the people allowed to communicate in this community.



Figure 11. Courtyard house in Nablus old city (Horn, 2012)

In this sense, a new concept was created, which is sharing the city responsibilities between authorities and people. This could be considered as a sustainable concept, so that people would feel their responsibilities towards their city and these parks, by knowing they were also responsible for taking care of and keep these in a good condition. These green areas still vital and exist all around the city. Such concept would be very useful for poor countries and governments — in developing countries such as Palestine. It is clearly observed in the old city of Nablus that was an early application of people participation. These semi-private parks and gardens give the city vitality, healthy environment, and reduce pollution (Akbar, 1994).

Ignoring this concept and the lack of governmental possibilities, led to a great scarcity in public parks in Nablus city and Palestine, even the existing ones are ignored and disabled, and people do not care nor feel any responsibility towards these. This causes many semi-desert lands and unhealthy environments, besides some significant social problems resulting from ignoring the city and society culture. As seen in Figure 12, the main parks in Nablus city are losing the green and water elements and they are also losing the interaction with society.



Figure 12. Public Park in Nablus neglected because of cultural aspects. ("DOOZ," n.d.)

### 1.2.3. Semi-private spaces

Semi-private spaces were created for very close relative's meetings, such as "extended family" which includes the parents and their married sons and their families, these spaces are called "Al Hosh" or the "Yard" as in Figure 13.

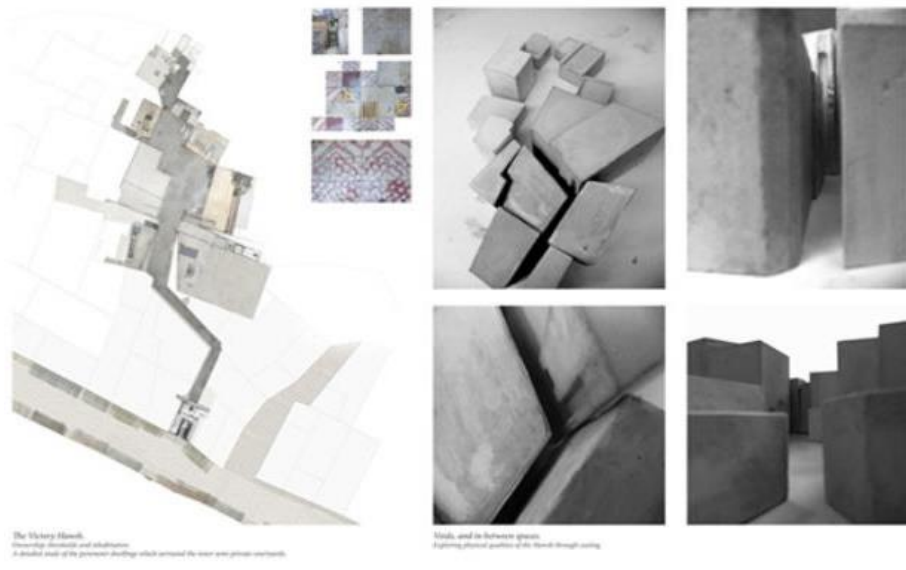


Figure 13. "Yard" space in Nablus old city (Horn, 2012)

The gradual transition from public space, to semi-public and semi-private spaces, as seen in Figure 14, gives people and their families a high sense of safety, or which is called Urban Security. This could also be considered as a sustainable concept, people are very attached with such spaces, because of the high sense of property.

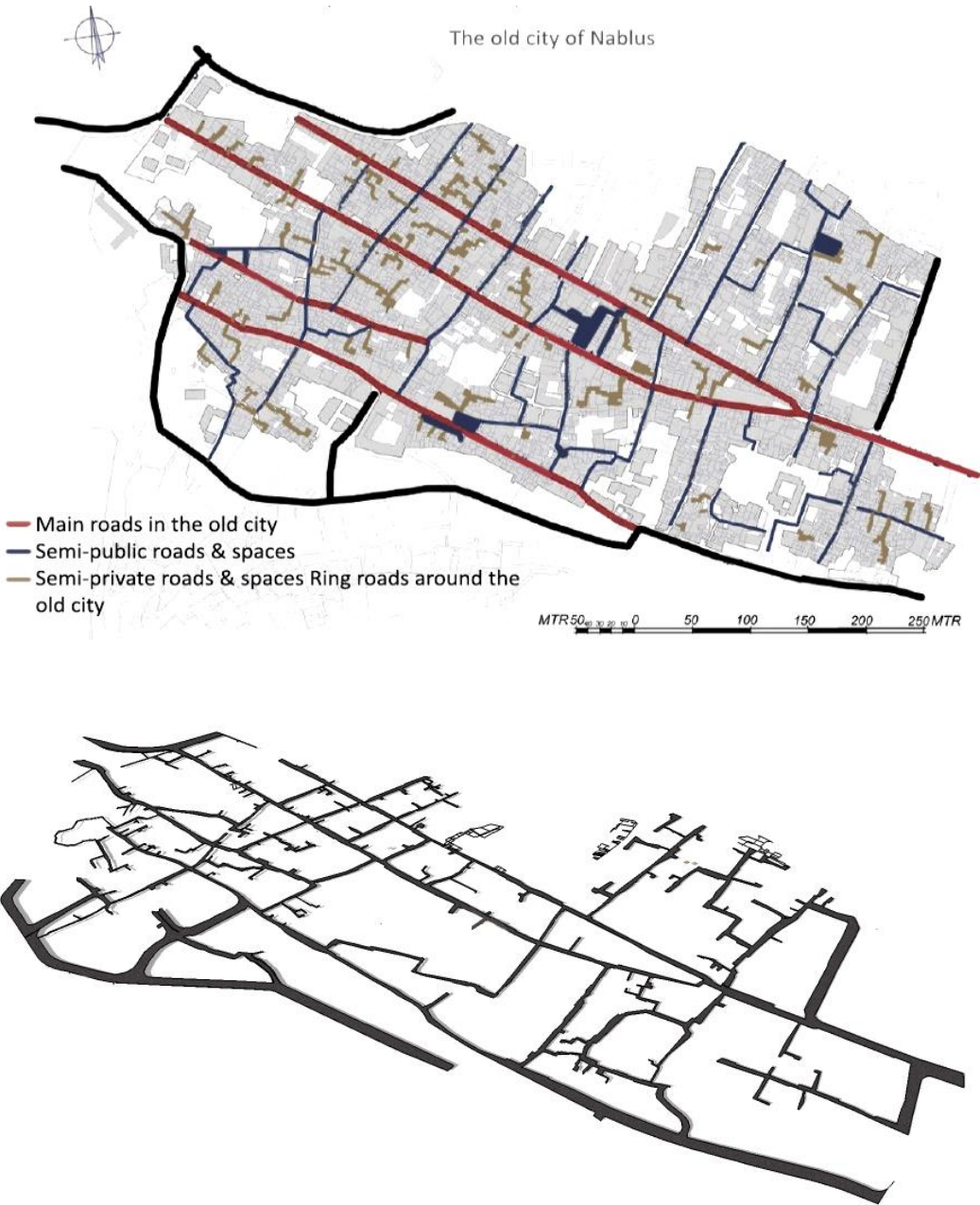


Figure 14. The gradient in public, semi-public, and private roads in Nablus old city (adapted from: Engineering department 2002)

#### 1.2.4. Design level analysis

The design level scale analyses the architectural elements on a small scale, such as a specific building, design approaches, architectural elements, and building elements used to achieve sustainable aspects affected by cultural rules.

As in the urban scale, the design scale is easier to be understood when divided and explained into components such as (Faimon & Weigand, 2004):

- i. **Materials:** in early times, simple materials such as rocks, hides and minor wood elements were used in buildings. By the time the use of these materials has developed along with the technology of producing them. This eventually led to the evolution of new architectural forms. Early materials are still used in design to suit the nomadic lifestyle. Architects used these rocks, hides, and minor wood elements to create new methods (arches and vaults), expanding the design opportunities.
- ii. **Texture:** is how the surface of something feels. It is recognised by touching however, one can sometimes interpret a texture with the eyes. In architecture, a texture can either be hard or soft, depending on the material used. For instance, if an architect uses hard stones and rocks, the texture will be rough and hard. On the other side, the texture will look soft if an architect uses carved woods. Moreover, decorative building materials add visual interest to the buildings.
- iii. **Colour:** is related to the visual perception of lights after the brain interprets them. It has a great effect in building construction. When talking about colour as an element of building construction, it should be taken into consideration the colour of primary materials used by an architect such as woods, stones, and bricks.
- iv. **Space:** when considering building construction, there are two kinds of space; inner and outer ones. Inner space relates to the sizes of rooms and hallways, the height of ceilings and the ease of entering and exiting each living area. This depends on the number of people who will occupy the space and the amount of activity that will occur in it. When considering outer space, architects speak of the amount of land that will be occupied by a building and the open space that is remained. Space is a vital element of building construction because it should match the function of the building.

### 1.2.5. The courtyard houses

The courtyard house gives privacy, preventing family entertainment and special activities from happening in urban areas and public squares, so they find private spaces inside their houses which clog their needs for external spaces (Figure 15).



Figure 15. Court yard house in Nablus old city(Horn, 2012)

As mentioned before, this simple concept indirectly led to the development of a green environment inside the house, with watery elements, which help to keep the climate suitable and comfortable especially in summer days. Also, privacy prevents the neighbours from rising their buildings in order not to reveal other houses in the neighbourhood as presented in Figures 16 and 17.

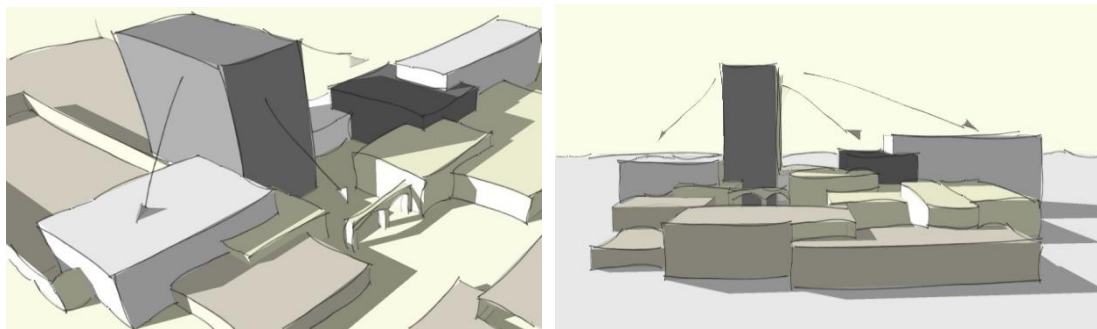


Figure 16. 3D model showing the negative effect of high-rise buildings



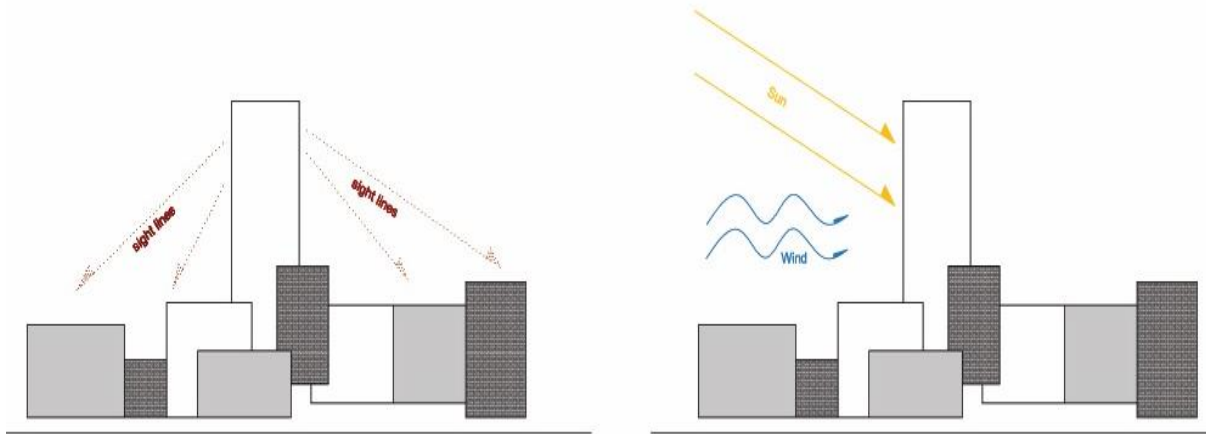


Figure 17. 3D model showing the negative effect of high-rise buildings

This rule has other indirect advantages as seen in Figure 18, it does not block the sun and the wind from reaching the house, aiding to preserve a healthy climate and good ventilation in all the dwellings in the city.

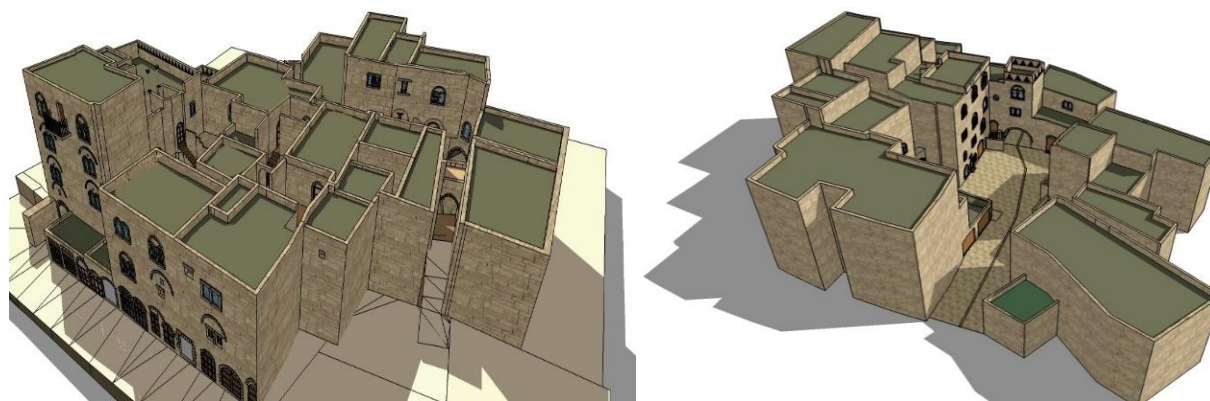


Figure 18. 3D model showing the sun effect on buildings

### 1.3. Hypothesis and questions

The review of the theoretical and practical designs showed that people's culture is ignored and not included in the design process. Thus, the old city of Nablus is much different and far from the new urban areas, being different in many ways of sustainable aspects.

Also, a gap was found in identifying the different vernacular approaches used in the old cities of Palestine, comparing them with the new approaches. This fact lead this research to identify the importance of the

sociocultural aspects through: (i) presenting the effect of such aspects of the city context, and (ii) comparing the old and the new urban areas depending on the result of the sociocultural effect.

From the reviewed data, important questions were raised, some as general questions about the whole topic and general meanings, others wondering about detailed aspects and issues as follows:

- i. Is it possible to reach sustainability by applying cultural constraints in the design process?

This general question can be divided into a group of sub-questions, as follows:

- i. To reach a sustainable city, is it necessary for the government to set rules and limitations for building construction?
- ii. Leaving people to act as their nature, can culture and beliefs lead to high environmental performance?
- iii. Is it possible to take advantages from the old Palestinian cities to reach or explore and achieve sustainable concepts and strategies in the future Palestinian architecture?

#### **1.4. Research objectives**

To reach a sustainable environment context, cultural aspects or awareness should be taken into account, and without cultural awareness, any attempt to achieve sustainability mostly would fail (Ujam & El-Fiki, 2006).

For a developing and growing country, such as Palestine, it is necessary to begin and to grow in a right way; to build in accordance with strong and clear foundations to reach suitable and sustainable buildings for the people, especially when there is a very rich background which still exists and is vivid. A huge experience could be utilised through analysing and understanding these cities and how they work.

Surely, the old cities in Palestine were strongly affected by cultural constraints, as presented in this work plan. These aspects help vernacular architecture techniques to improve sustainability in a direct or indirect way and provide many solutions and elements that help these buildings or cities to be sustainable.

The cultural constraints presented in this research show the big advantages that could be achieved by taking culture into consideration while designing buildings. This field of research is very poor in Palestine and thus,

it should be discussed and explored, especially in a society linked to culture such as Palestinian society. Because of this lack of information regarding Palestinian context on this subject, more studies are needed to interpret and understand this deep and effective concept, so that it could be applied and transposed to contemporary buildings and cities. This could be achieved by exploring the importance of these constraints and how it could be effective and included in the design process. It is up to the community to employ and apply their culture and give the building the identity and sustainability which is lost now.

The strong effect of the cultural constraints on the design process is demonstrated here, both on urban and building scale, and ignoring such laws causes huge cultural, environmental, and economic problems.

On the other hand, contemporary buildings in Palestine are far away from being sustainable buildings. Architects and stakeholders concentrate their modern "sustainable designs" on climate aspects and materials, ignoring people, culture, and needs. Such designs will eventually fail.

Traditional cities in Palestine such as the old city of Nablus take these constraints into account, so the result was sustainable cities and buildings, while the current designers and stakeholders should take all the advantages of these models which are working from more than 1000 years ago and are still used.

This proposed research was conducted to satisfy several objectives that may be taken into consideration in analysing the research results and in data collection. These objectives can be listed as follows:

- i. Clarifying and revealing the importance of the cultural constraints and limitations as a main element in the sustainable design process;
- ii. Setting general and special rules for constructing sustainable buildings in Palestine to be a reference to the ministry of planning and municipalities;
- iii. Investigating the traditional buildings through a case study to develop and simulate sustainable design approaches that could be used in the present and future and which could be changed to reach sustainable buildings.

## 1.5. Research methodology

This research addressed a way of how to create a link between traditional and future architecture regarding the importance of the cultural effect on the sustainable design, to reuse this important element in environmental design, and it also tries to highlight such effect on the design process. Therefore, the methodology of the research was based on research approaches aiming at analysing the old architectural form and context to come up with new reasonable outcomes. This qualitative research depended completely on analysing a case study – the old city of Nablus in Palestine.

The research can be subdivided into the following six main phases/tasks:

**Phase 1:** State of art review and case study selection, qualitative analysis and data collection regarding the case studies, trying to understand such cities from a sustainable point of view. Data collection depended on fieldwork, municipalities, universities, and publications in the topic.

**Phase 2:** Identification of most common vernacular strategies affected by sociocultural values in the old city of Nablus, in both urban and building scales, such as city layout, urban and green spaces, infrastructure, cooling, openings, etc.

**Phase 3:** Establishing a 3D model of the old city of Nablus and some parts of the old city of Hebron, as this 3D model does not exist until now. With the identification of the strategies used, this 3d model is foreseen to provide and check out certain expected strategies and it's a new approach.

**Phase 4:** Comparative study of the old cities with the new extension or the contemporary cities, trying to explore the pros and cons of the different urban areas to highlight suitable strategies that could help in achieving sustainable residential buildings in Palestine.

**Phase 5:** Setting guidelines and strategies for sustainable residential buildings in both urban and building design scales for architects, urban designers, municipalities, and stakeholders.

**Phase 6:** A prototype design for the most common building typology especially depending on sociocultural aspects which have been ignored, and not ignoring the new and contemporary needs in a modern community.

During the definition of these tasks, many aspects have been raised. Therefore, to make it easier to improve the methodology and to keep it updated during the work, the aspects to be undertaken in the work are presented in Table 1.

Table 1. Questions to be addressed during the research.

<b>Historical overview</b>	<b>Current context</b>	<b>Proposed solutions</b>
<b>Literature research</b> <b>- Environmental architecture (Regional, local)</b> <b>- Old cities in Palestine (environmental view)</b> <b>Analysis</b> <b>- Case study selection</b> <b>- Classify and analyse environmental Concepts &amp; choose interesting concepts to be analysed and utilised. (Using Amos Rapoport`s model of learning from vernacular residential buildings)</b>	Literature research - Previous research results - causes and circumstances (old city of Nablus) Analysis - Case studies selection depending on data collection from sustainable view analysing strategies used to achieve sustainability depending on the sociocultural effect. - Finding disadvantages based on analysis, depending on the environmental view, using cultural constraints to examine.	A set of <b>design principles</b> and recommendations were suggested that may improve the environmental quality in future Palestinian residences. Analysis Compare the results founded from analysing current context with old one`s results using theoretical models Design A prototype design for the most common building typology considering both new and old needs.

It is to be mentioned that the research is based on qualitative data collection that starts from old maps and writings, literature review, and observation within open spaces in the field. Obstacles and challenges might appear in gaining data and visiting spaces in Nablus city which is under Israeli occupation.

Moreover, depending on Amos Rapoport`s model of "learning from vernacular" through analysing and through copying without understanding the way it works, as shown in Figure 19, the research depended on analysing a case study in Nablus city of Palestine. Nablus is in a mountainous topography that has cold

winter and warm to hot summer. The region also includes a wide range of traditional patterns of architecture within the old city of Nablus that require a deep study analysis to utilise their sustainable approaches in modern architecture. To do so, there was a need for a comprehensive analytical study, which implied investigating architecture approaches of the city besides holding interviews with specialists and stakeholders.

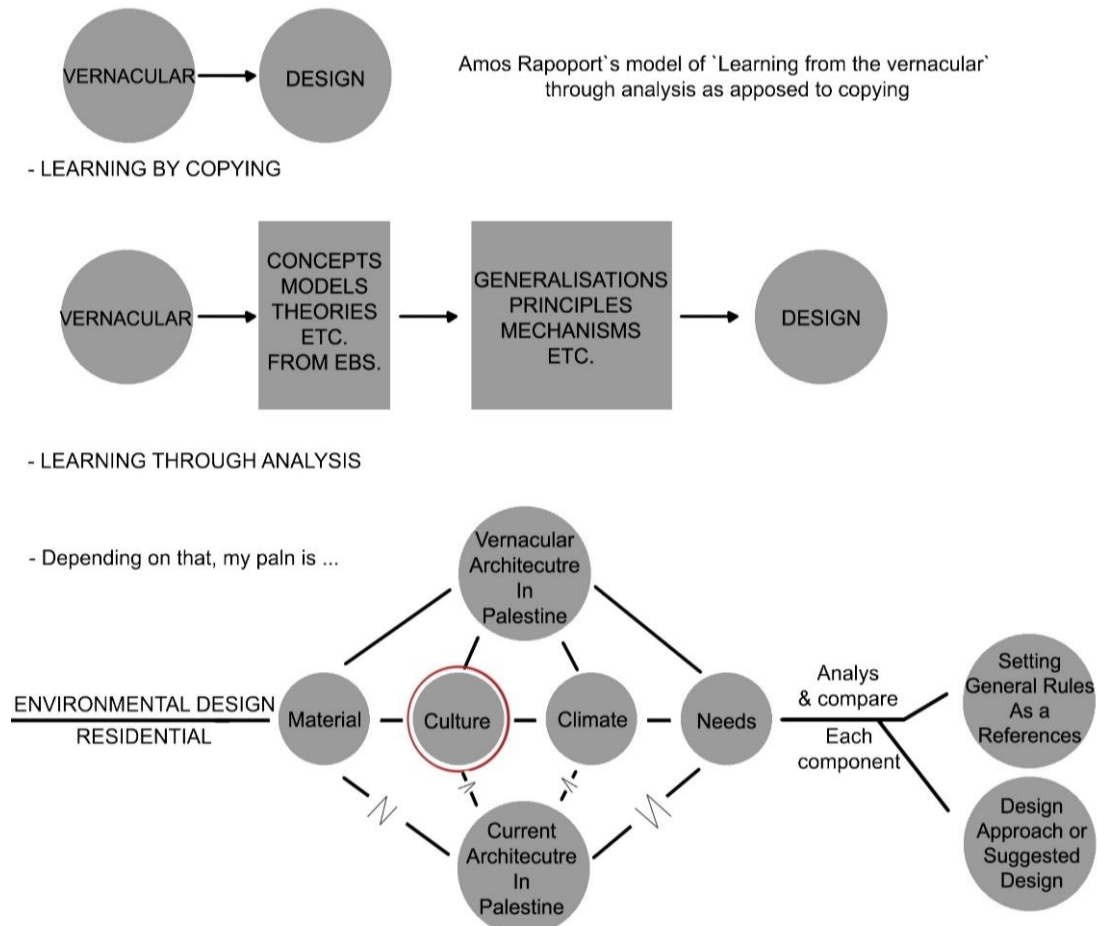


Figure 19. Amos Rapoport's model of learning from vernacular

## 1.6. Research limitations

In every research, there are some unavoidable limitations, even if the research achieved its aims. The main effective limitation was the missing of literature review in the case study area, it is a kind of scattered information's and data, not documented or gathered except some papers and one or two theses. Also, Palestinian cities live under Israeli occupation, and this make it too hard to gather data from the field

regarding safety privacy aspects. All these limitations obliged the author to create the 3D model to cover this gap. Eventually, the limitation of time of the scholarship was also one of the research limitations.

## **Chapter 2. Residential vernacular architecture in the Mediterranean region**

### **2.1. Characteristics of vernacular architecture in the Mediterranean basin**

The Mediterranean basin is considered as the cradle of the oldest urban civilizations, and to have a deep insight of this civilization, vernacular architecture is the wider artistic expression. It is based on the value of the freedom of style, saving natural resources, intelligent exploitation of the territory and indoor comfort in living spaces (Cardinale, Rospi, & Stefanizzi, 2013).

There is no doubt that Mediterranean countries, in general, have a lot of common aspects regarding vernacular architecture like climate, materials, and building technologies (Al Tawayha, Bragança, & Mateus, n.d.).

Nowadays, vernacular architecture is considered as a model for sustainable architecture and the strategies that are now the basis of sustainable construction were derived from aspects and characteristics of this type of architecture (Fernandes, Dabaieh, Mateus, & Bragança, 2014b).

The Mediterranean residential architecture is mainly affected by people culture which is conservative, especially in the Arab Mediterranean countries. It is also affected by the climate of the basin, and natural resources such as local materials.

These three main elements give the Mediterranean its special character. The people's culture is shaping buildings in a powerful way. Buildings should achieve many levels of privacy, such as visual and acoustical privacy. Also, neighbours should respect each other by not preventing sunlight or the wind to reach their houses. All these cultural constraints and other – which will be presented in more detail – are leading to special building strategies and approaches such as the courtyard, the openings screen “Mashrabiya”, broken entrances, the layout of the city, etc.

The climate of the Mediterranean basin is characterised by hot and dry summers, and mild and moist winters, under prevailing westerly winds. This climate conditions lead to thermal passive solutions for cooling houses in hot summer days and preventing in wet winter days, that was achieved by design strategies and available



materials such as, for instance, the compact city layout, wooden screens, courtyard concept as seen sequentially in Figures 20, 21, 22.

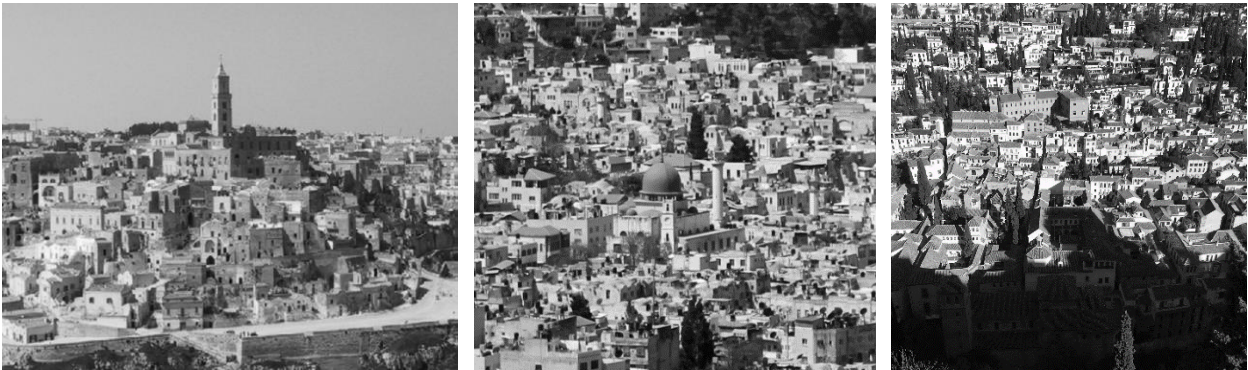


Figure 20. Sequentially; South Italy, Palestine, South Spain, the compact city layout (Cardinale et al., 2013)



Figure 21. Sequentially; South Portugal, Palestine, South Italy, screens for privacy (Fist picture; Fernandes et al. 2014a)



Figure 22. Sequentially; South Portugal, South Spain, Palestine, courtyard house concept (First picture; Fernandes et al. 2014a)

The buildings are also characterised by the presence of constant seasonal temperatures and have natural ventilation that guarantees comfort, especially during the summer season. There are numerous bioclimatic strategies such as the courtyard concept, vegetation, and openings orientation.

The construction of such houses was based on the available materials in the area. In that time, it was stone and mud mixed with some straw. In this way, the result was a great thickness of the perimeter load-bearing walls, often higher than 1.00 m (Figure 23). These were formed by a dry double-wall, with a cavity filled with loose material from the working of the stones. The roof based on short spans with 3 m maximum and a room area not greater than 9-12m<sup>2</sup>. Most of the buildings depended on each other, resulting in a series of hypogean rooms, meaning that houses and rooms overlap each other, forming an urban terraced area, where the roof of the lower houses is the access road to the superior houses (Cardinale et al., 2013).

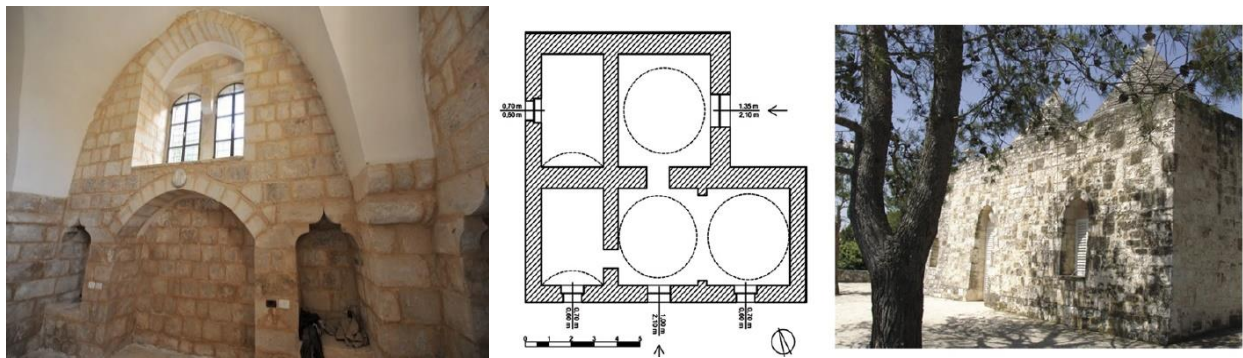


Figure 23. Sequentially; The structure of houses in Palestine, South Italy (Cardinale et al., 2013).

## 2.2. Mediterranean vernacular architecture and culture aspects

Nations are strongly affected by their own culture and believes, culture affects the production of every civilization, and it should be found in their legacy. One of the most important ways to express a nation's culture is art, it carries and expresses all these believes, traditions, culture, and religion (Figure 24). This effect of culture is different from one nation to another, some nations and communities are highly affected by culture, it's even controlling relations and behaviours, affecting every single detail in their life, every decision, and giving the community its special identity (Al-Tawayha, 2011). These aspects can be clearly found in the Mediterranean basin area, especially the Arab and Islamic countries.

On the other hand, other communities get rid of traditions and culture, and people were seeking freedom in their understanding, even this way of thinking was expressed by arts, through an unlimited and undefined way, like the deconstruction school in architecture as an example (Al-Tawayha, 2011).



Figure 24. Architecture as a way to express different community cultures (Fontana-Giusti & Schumacher, 2004)

UNESCO (United Nations Educational Scientific and Cultural Organization) has coined the term “whole life sustainability” in order to expand the general meaning of sustainable architecture from designing environmentally friendly buildings to architecture incorporating local identity into design process (Tocher 2011 cited by Kultur, n.d.).

"The word culture is a determining a very complicated concept which expresses all the intellectual activities of a civilization. The culture is: dynamic, expressed through the community as well as the individual, interpreted with each member of the community, shared with groups and transformed into a new generation. It involves a system of rules, and also attitudes, values, believes and norms. It conveys the sustainability of vitality of the community and has the potential to change” (“Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors,” n.d.).

To clarify, an example of this effect on a small scale (design scale) is useful. According to Rapaport (1969), the cultural elements that affect the house design in the Middle East are:

- Religion;
- Architectural language and other heritage peculiarities;
- The structure of family and relatives;
- Child raising methods;
- Settlement patterns;
- Land division and land-owning systems;
- Food habits;

- Symbolic and traditional systems;
- Status defining methods and social identity;
- Cognitive maps; privacy, intensity, territoriality;
- Behavioural organization in a house;
- Working, business with others and trades.

With all these cultural, social, and psychological impacts, a house is more than a design, drawings, walls, and materials. It became a home that gains high symbolic and emotional meaning (Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors, n.d.).

A place formation can be defined as “the individual forms towards a certain environment. The concept of place involves not just a physical element but also emotional factors” (Cultural Identity and Place Identity in House Environment: Traditional Turkish House Interiors, n.d.). With such a huge influence and effect from such impacts, the home becomes a concept of place rather than space.

So, while designing a place, the architect should design every single detail related to this place. A home is more than a place to live in, it is a place filled with emotion, meanings and stories. This is the feeling while looking and feeling vernacular architecture, it is a space at the beginning, and by time and culture it witnesses a lot of stories and experience and becomes a place.

Perhaps a simple and quick look at the old town of Nablus gives a sense of a big difference between it and the modern part of the city regarding the general image, context, design approaches and methods of construction.

Moreover, with deeper insight, the difference grows and expands concerning achieving environmental concepts and observing the needs of the people, culture and place, unlike the modern part. Perhaps, the most prominent solution is taking the cultural aspect into account within the design process, and the sustainable building process will come as a result.

Some of these cultural concepts will be discussed in the further section regarding how these affect the city and the buildings, from the performance point of view. These effects can be either direct (Intentional) or indirect (Unwitting).

### 2.3. Palestine as an example in the Mediterranean basin

Palestine is a small country, in space, but it is rich in heritage. It is in the Mediterranean basin which was the core of the great old empires like Roman, Greek, and Islamic' "Ottoman, Umayyad, The Mamelukes, etc. Also, for its geographical position, it is a bridge between Asia and Africa. Therefore, Palestine has the chance to be an example of a cradle of civilization, and architectural heritage, for sure, is one of the most important examples of this civilization. Palestine reflects different layers of history because of the different cultures which have passed through it.

The architectural heritage in Palestine was firmly affected by the different cultures that passed through it, and most of these were based on very strong constraints and believes. So, the role of culture in Palestine is critical in the formulation of architecture.

The climate and the environment in Palestine are also relevant in forming the character of architecture in this area. The climate of Palestine is influenced by the Mediterranean climate where long as presented in Figure 25, hot and dry summer, short, cool, and rainy winter climate conditions prevail.

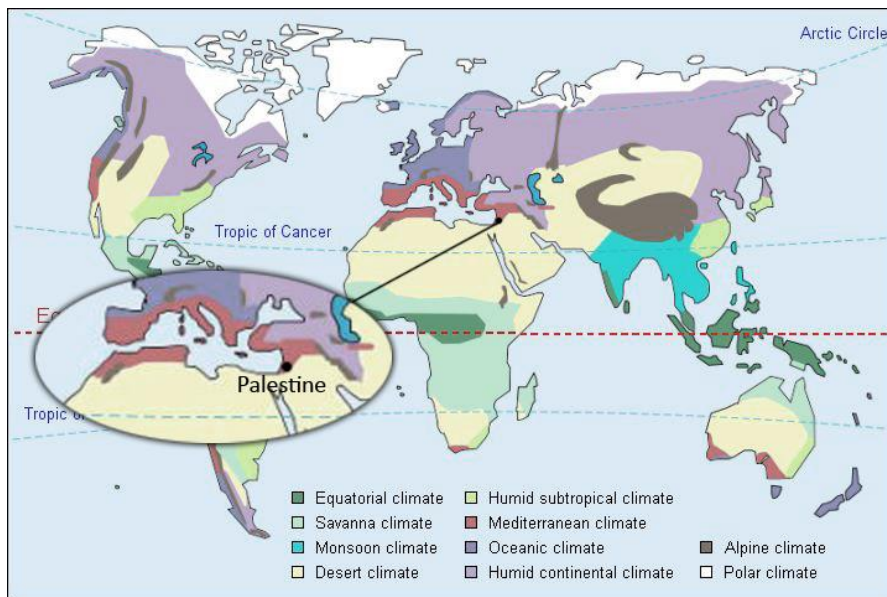


Figure 25. World climates map (Kottek, Grieser, Beck, Rudolf, Rubel, et al., 2006)

Climatic variations occur in the different topographical regions. Figure 26 shows that the case study area – Nablus – is moderately arid, with about 50% of the land having a rainfall less than 500 mm/year, including a hyper-arid area with rainfall less than 100 mm/year.

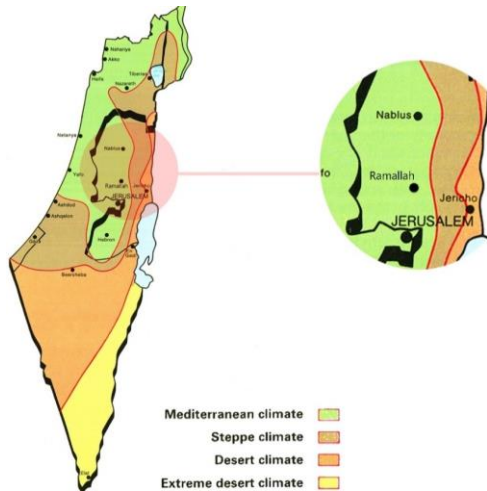


Figure 26. Palestine climatic zones (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

Palestine contains several zones regarding its topography as seen in Figure 27. The heights start from -415 m below sea level – which is the lowest land in the world – passing by the coast and ending with 1208 m above sea level. This variation gave Palestine the advantage to be attractive for several empires and cultures to occupy it. The elevation map of Palestine (Figure 27), which displays a range of elevation with different colours was generated using elevation data from NASA's 90m resolution SRTM data. The maps also provide an idea of topography and contour of Palestine; Figure 27 presents the elevation Map at different zoom levels.

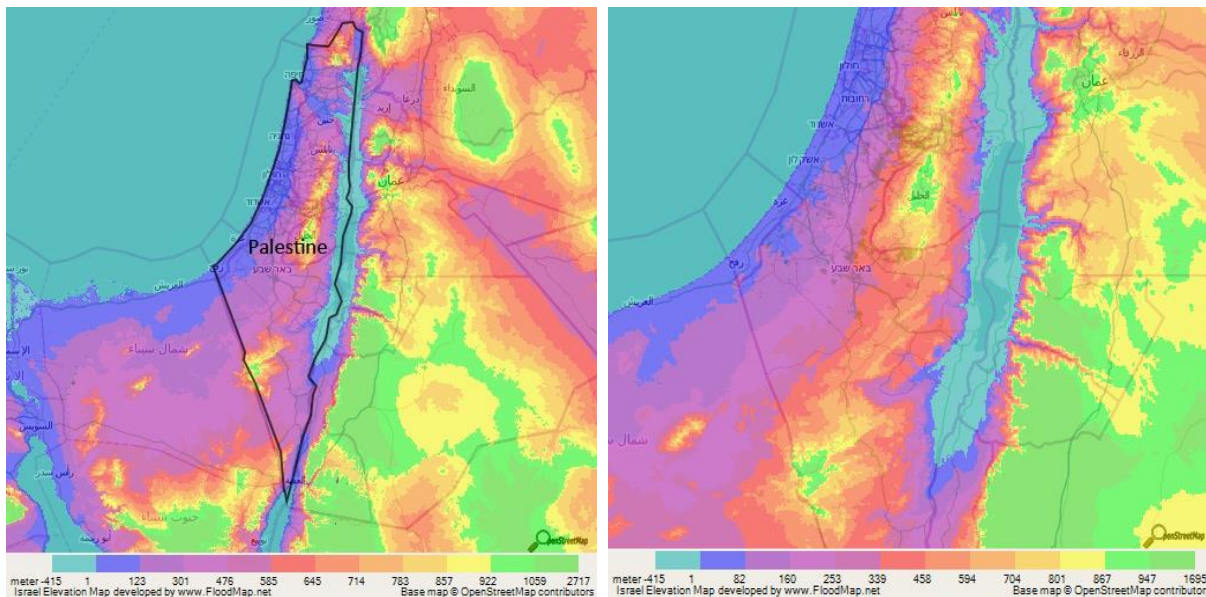


Figure 27. Palestine elevation map ("Israel Elevation and Elevation Maps of Cities, Topographic Map Contour," n.d.)

Most Palestinians live near the wetter, i.e. more moderate western slopes in major cities. The climate of Palestine is common in the Mediterranean basin. In summer, the mean maximum air temperature varies between 25 C – 32°C. Occasionally reaching maximum temperatures of 38°C, being July and August the hottest months. The annual average rainfall is below 500 mm, being July the driest month which means below than 5 mm (Haddad, 2010).

Palestinian residential traditional architecture is mainly affected, as a Mediterranean country, by people culture, climate, resources and local materials. Thus, the elements and components are like the components noticed in the rest areas of the Mediterranean basin (Figure 28).



Figure 28. Palestinian old cities architectural elements and urban components (left: privacy screens, middle: courtyard house, right: vegetation)(by Raghad | We Heart It, n.d.)

“A very rich background, and a very poor reality”, this is the description of the current residential architectural situation in Palestine. The most important and vital old cities in Palestine are Jerusalem, Nablus and Hebron which could give a great example of the traditional or vernacular Levantine cities. Subsequently, the urban fabric in Palestine follows the main module of a traditional Islamic city; a centralised organic grid overlaid the main axis to emphasise the main circulation paths of the market leading to the city centre (Al Tawayha et al., n.d.).

Figure 29 shows that the construction strategies of the Palestinian residential vernacular architecture are similar to the Mediterranean strategies. These are based on load-bearing- Walls “1 - 1.5m” with a dome or a barrel vault ceiling, houses were based on the available materials in the area, stone, mud mixed with some straw, and wood.

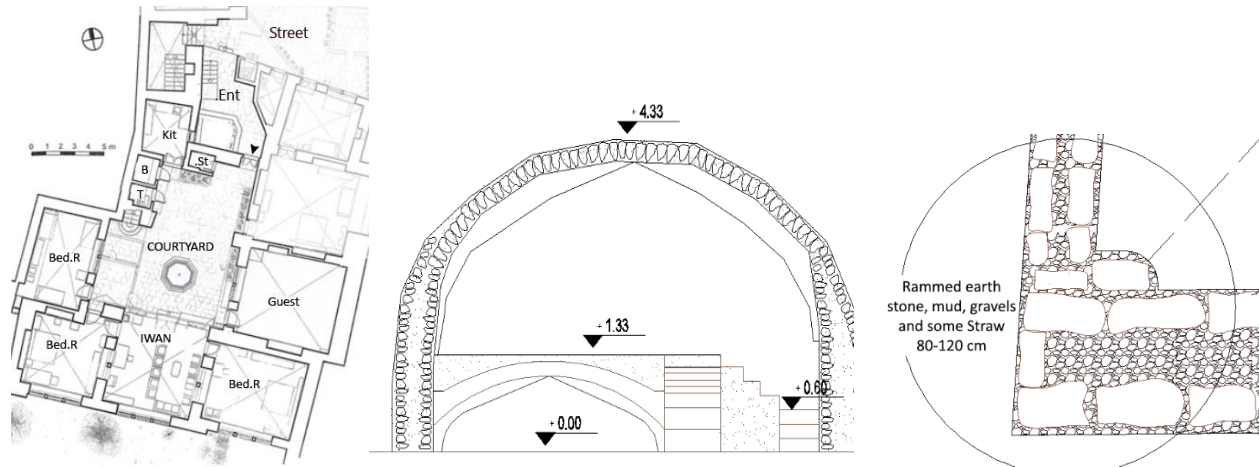


Figure 29. Construction strategies depending on load-bearing walls and ceilings

These strategies could be figured clearly at the basin countries, with some little differences depending on the local material and people needs.

It is important to notice that construction strategies were also used for other aspects, not only as a construction solution but for thermal aspects. For instance, the thick dimension of the bearing walls was useful for reducing solar gain in winter and cooling the building in summer, and the dome was also useful for air circulation inside the building.

## **2.4. Palestinian vernacular architecture: sociocultural values, economic and environmental considerations**

The German orientalist Otto Spies says that "The Islamic city is affected by the neighbour rights between inhabitants which come from the religious legislation" (Abu-Lughod, 1987).

The Palestinian society believed to relate together by the fundamental ties such as family links, common village origin, and ethnic or sectarian Religious identity, as most Arab countries. The strongest and the most effective bounds in the Palestinian society are cultural, which come from the Islamic religious believes. Religion believes affect every aspect of daily life, such as clothing habits, food or the way of thinking and learning, and of course, architecture (Stevenson & Ball, 1998).



Therefore, if these specific principles are not taken into consideration, it will cause negative effects on any product, including those from the construction industry. However, the current samples of contemporary building omitted this side and thus, failed in achieving a sustainable built environment.

Privacy is one of the concepts mainly affecting Palestinian society. It comes from strict cultural believes, meaning that nobody can reveal their home, cultural activities, or family life. It also means preventing gathering together women and men in social or cultural activities and daily life (Al-Tawayha, 2011).

This aspect led people to find and create many different architectural solutions such as the courtyard house, semi-public gardens, semi-private spaces, as previously discussed.

Palestine is considered as a developing country with a local authority under Israeli occupation. This reality directly affects people, the financial condition of the majority of Palestinian people is below the poverty line, with an unemployment rate around 27.2% (Palestinian Central Bureau of Statistics - State of Palestine 2017).

Such economic condition has greatly affected the construction activities in Palestine. During the design process, the most important element for people to think about and to deal with is the cost. Therefore, it could be noticed that all the attempts of finding sustainable construction in Palestine were limited to a certain class of people with a good financial condition.

On the other hand, vernacular cities in Palestine were for all people, and the whole city achieved a great level of sustainability. The financial condition of people was considered during the building process, and local and low-cost materials were used recurring to low-cost strategies so that all people could benefit from these building strategies.

Also, the local environmental conditions were considered in building at vernacular cities in Palestine. Considering the local climatic aspects, land topography, materials, etc., enhanced and lead to high environmental performance.

## **2.5. Nablus city as a case study**

The old city of Nablus is an old town in Palestine founded by the Roman Emperor Vespasian in 72 CE. Nablus has been ruled by many empires over the course of its almost 5000 yearlong history years, ending with the Islamic civilization which stills until now from more than 1000 years ago. The old city of Nablus still exists

and is vital, filled with culture and traditions. Its old buildings give a good example of the effect of culture on architecture. The extinction of Nablus which is the new city or contemporary city is leading it to become much different. A general look on these two contexts illustrates the big difference between them as seen in Figures 30 and 31, regarding the general image, context, design approaches and methods of construction.



Figure 30. A top view map for the old city of Nablus and the extension urban area (*Nablus / Food Tales from Nablus*, n.d.)

Furthermore, with deeper insight, the difference grows and expands considering the achievement of sustainable concepts and observing the needs of people, culture, and place, unlike the modern part. Perhaps, the most prominent driver or factor causing this difference and differentiation is considering the cultural aspect into account within the design process, and thus an important part of the sustainable building concept in the Palestinian context can be archived.



Figure 31. The general image of the new and the old city (*The Context*, n.d.)

According to Rapaport (1969), for a conservative middle east community, the main and most effective cultural concepts are religion, the structure of family and relatives, and behavioural organization in a house. These were discussed in this study regarding the way they affect the city and the buildings from a sustainable point of view, either directly "Intentional" or indirectly "Unwitting". It has become an urgent need to study the new and old urban contexts of Palestine and their relevance to sustainable design, regarding the use of local and vernacular building materials and techniques. To do so, the link between these different forms of architecture was explored to come up with the concept of sustainable and friendly buildings (through construction materials and techniques) since a house is a place that forms the third skin of people and in a way or another, it is meant to meet their basic needs.

It is also important to stress that the current political and security conditions of Nablus are very critical. It is a city under the Israeli occupation, under the siege most of the time, with many financial problems. Many parts of the old city were destroyed by the Israeli army, as residential buildings, traditional soap factories, and parks. This situation is affecting many parts of the city, for instance preserving and restoring the old buildings is very difficult. Additionally, data collection and contact with people is also difficult.

Nablus is in the warm Mediterranean climate area (Csa), per the Köppen-Geiger climate classification. It has long, hot and dry summer, and short, cool and rainy winter days. Therefore, some passive solutions were developed to avoid the heat gain and to achieve suitable interior temperatures, as it will be clearly presented in figure 32.

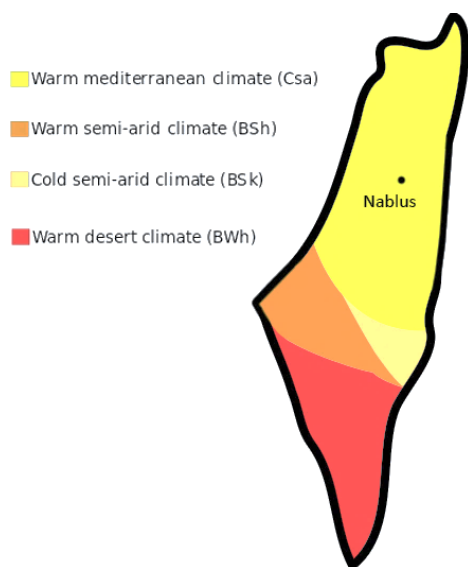


Figure 32. Palestine map of Köppen-Geiger climate classification (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006)

As mentioned before, Nablus is relatively arid, with about 50% of the land having a rainfall less than 500 mm/year, including a hyper-arid area with rainfall less than 100 mm/year (Figures 33, 34).

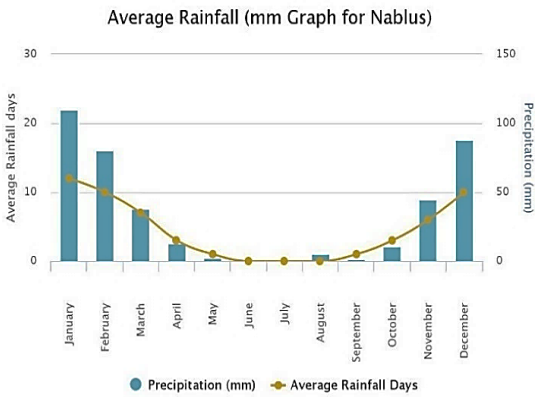


Figure 33. Average rainfall graph of Nablus (World Weather Online | World Weather | Weather Forecast, n.d.)

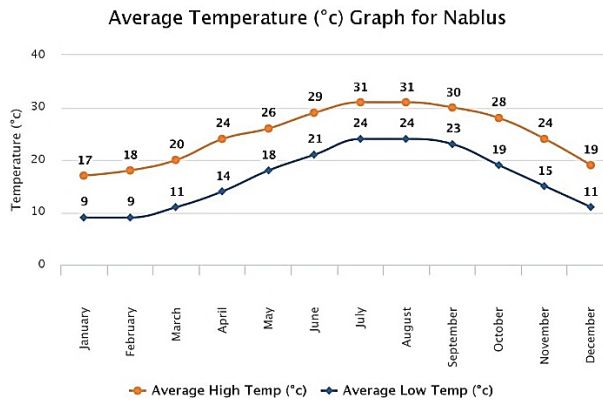
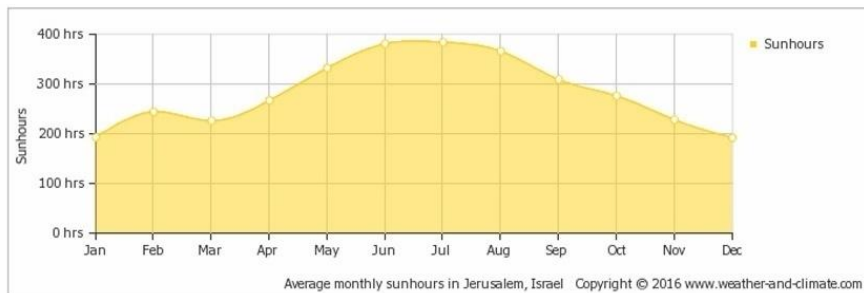


Figure 34. Average temperature graph of Nablus (World Weather Online | World Weather | Weather Forecast, n.d.)

The sunshine period is about 12 h/day in July and 5 h/day in January, corresponding to approximately 250 h/month average sun hours as seen in Figure 35, and 45% relative humidity as seen in Figure 36. This hot dry zone has a violent and short duration of rainfall showers to have an annual mean rainfall about 136 mm. This zone has the climatic characteristics of the Jordan Valley and Eastern Slopes regions (Hadid, 2002).



Data from nearest weather station: Jerusalem, Israel (0.0 KM).

Figure 35. Average sun hours graph of Nablus ("World Weather Online | World Weather | Weather Forecast," n.d.)

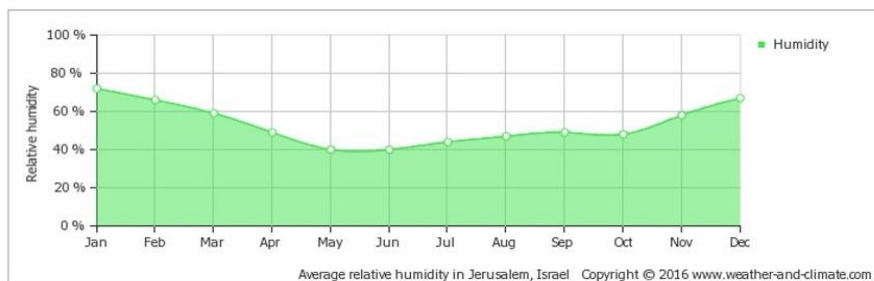


Figure 36. Average Humidity graph of Nablus ("World Weather Online | World Weather | Weather Forecast," n.d.)

This zone has a wind speed of about 3.4 km/h around the year where the maximum wind speed is measured during spring to reach approximately 4.3 km/h on average. The general wind direction is north-west wind, the wind in winter is WNW wind as presented in Figure 37, cold and dry, causing great loss of interior heat in buildings, in summer it is a WNW wind also with some humidity coming from the coast.

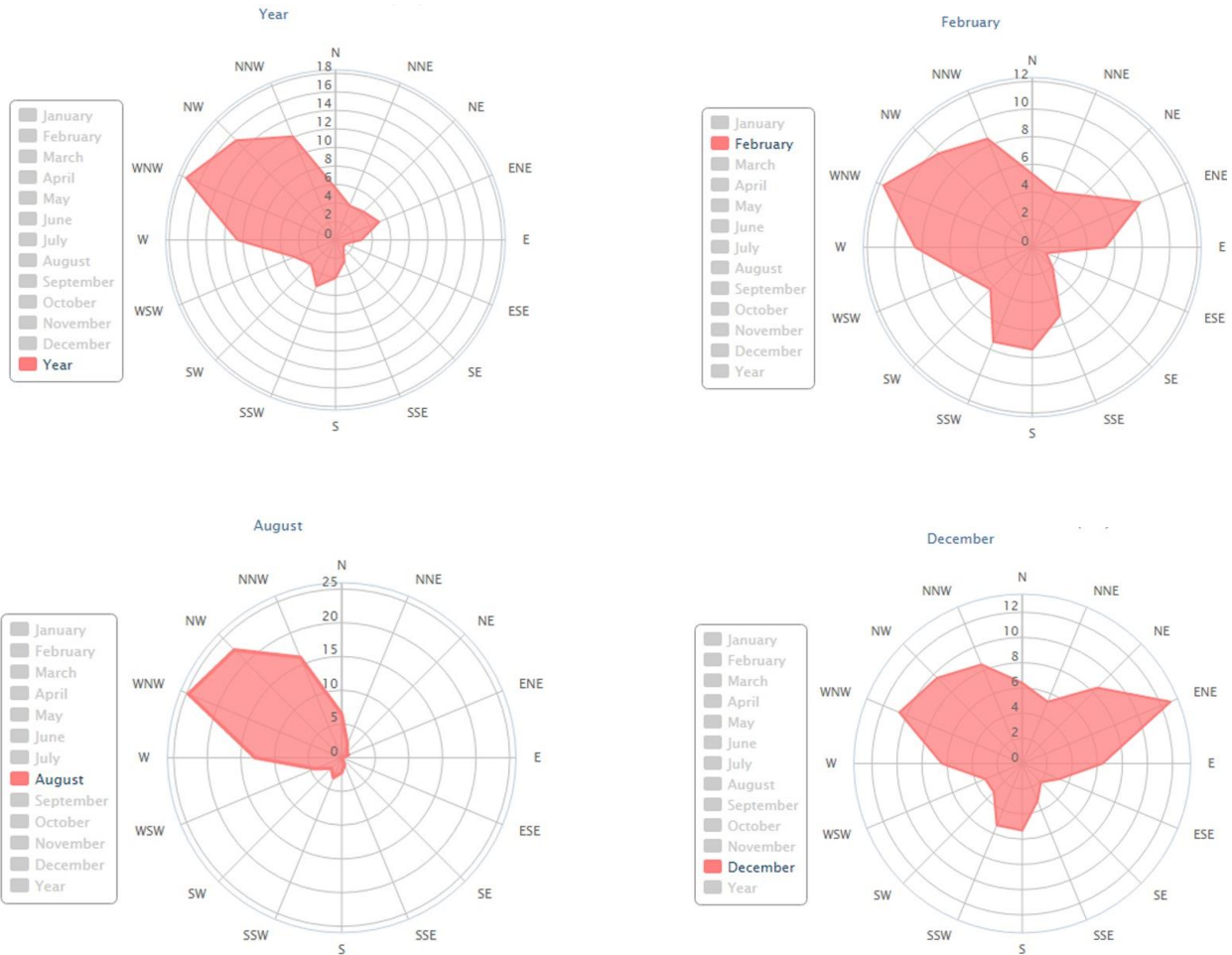


Figure 37. Nabulus wind map in different seasons ("Wind & weather statistics Shomron Ariel - Windfinder," n.d.)

Regarding its topography, the old city of Nabulus is located between two mountains and the new urban areas are extending between the mountains and the mountainsides. As seen in the elevation map below (Figure 38), the mountains are 951 m and 881 m above sea level and the old city is in the 550 m. The elevation map of Nabulus provides an idea of topography and contour of the city (Figure 38). It displays a range of elevation with different colours, at different zoom levels, and was generated using elevation data from NASA's 90m resolution SRTM data.

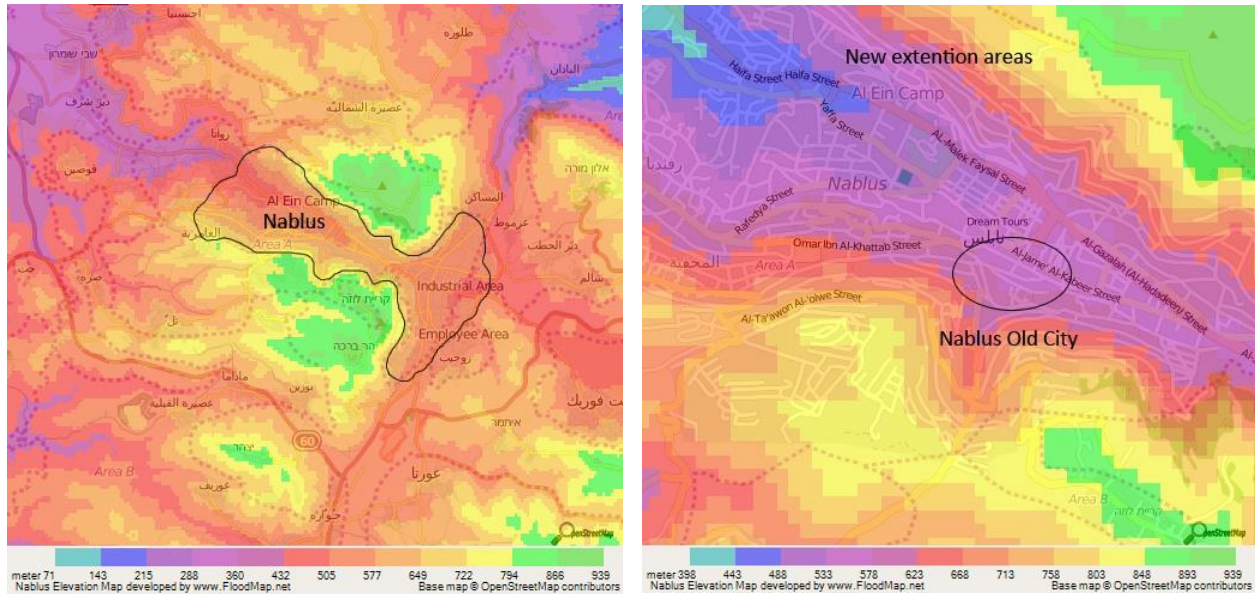


Figure 38. Nablus elevation map (“Israel Elevation and Elevation Maps of Cities, Topographic Map Contour,” n.d.)

The buildings in the old city of Nablus are oriented towards northwest and southeast, closed to south-west and northeast in order to collect the wind in hot summer days and sun in cold winter ones (Figure 39, 40).

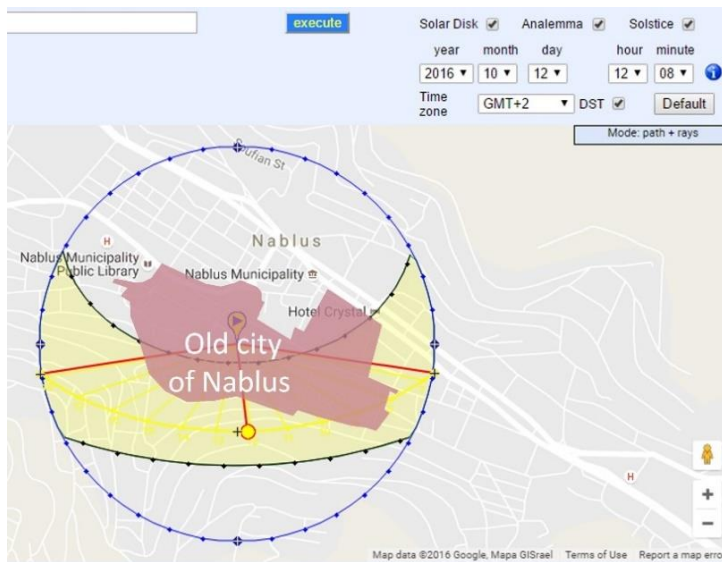


Figure 39. Nablus old city orientation regarding sun movement model (<http://www.sunearthtools.com/>, n.d.)

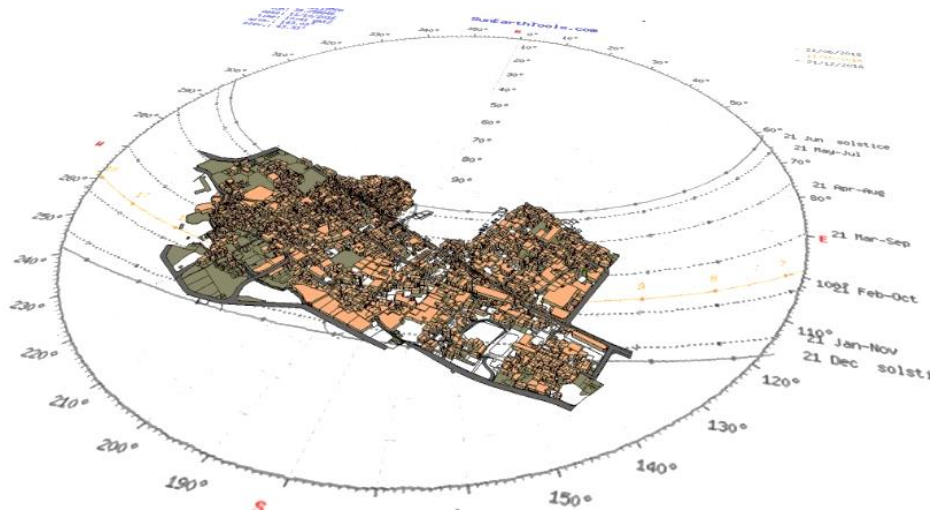


Figure 40. Sun position map with the 3d model of Nablus old city

These characteristics and features of the old city of Nablus were analysed and are presented in detail in the comparison part. These features affect the strategies and solutions created by people, some of these solutions were created to take advantage of these characteristics, and others were created to avoid disadvantages.

## **Chapter 3. Culture and traditional spatial context in Nablus**

### **3.1. Sociocultural values: a sustainable element**

The Palestinian current architectural approaches and designs are distant from sustainable concepts, copying and simulating abroad approaches, without considering the culture, climate, and inhabitants' needs. In contrast, vernacular architecture coped with environmental concepts and gave suitable approaches and samples – without any need to simulate or copy – which come from people and land.

Cultural constraints which affect architectural approaches are also improving the city and giving the city the sustainable character, in both urban and building levels. The design of traditional Arab and Muslim cities either in urban or building scale is subjected to the following principles outlined in the Islamic religion, which are derived from the Quran (the holy book of Islam), as well as some utterances and actions of Prophet Muhammad. These constraints and principles gave the city its special context and character. Those were very strict principles coming from religious believes of people and, therefore, nobody could avoid them.

Some of the main and the most effective principles regarding the city and homes, which have emerged from these guidelines, are (Othman, Aird, and Buys 2015 and Al-Tawayha 2011):

- i. Privacy, safe and private place for personal and family daily life;
- ii. There should be neither harming nor reciprocating harm;
- iii. Modesty, a house with spaces for people's daily life activities and needs, further defined by humility in design through economic and sustainable approaches;
- iv. Hospitality, a dwelling with opportunities to extend hospitality to neighbours and enhance relationships with the society;
- v. Responsibility, sharing responsibility with people.



## 3.2. The effect of sociocultural values on the old city features

The community's traditions and beliefs contain guidelines that should be directly applied and followed in the local area. As presented before, concepts of privacy, harm, modesty, hospitality, and responsibility are the base or the core of these guidelines. Each concept has its great effect on the traditional city components, starting from the city layout and urban fabric, until the organization of space and local behaviours within each home. The domestic effect is next presented in two levels, urban and building level, showing the effect of each one of these main principles or concepts on the city levels (Othman et al., 2015).

### 3.2.1. Privacy

A safe and private place for personal and family daily life is one of the most influential rules in the process of building cities in the Mediterranean basin. In the Arab and Islamic world, and even in other cultures especially on the Mediterranean basin, privacy should be achieved in any residential building whatever are the surrounded conditions and the applied strategies (Al-Tawayha, 2011).

Perhaps, privacy is the first thing the owner should think about when building a house. Privacy should be achieved for the inhabitants and for the neighbours, with many types of privacy in public and private spaces and buildings as seen in Figure 41, such as visual, acoustical or olfactory, and many layers of privacy such as public, self-privacy, family, women and men privacy (Bahammam, 1987).

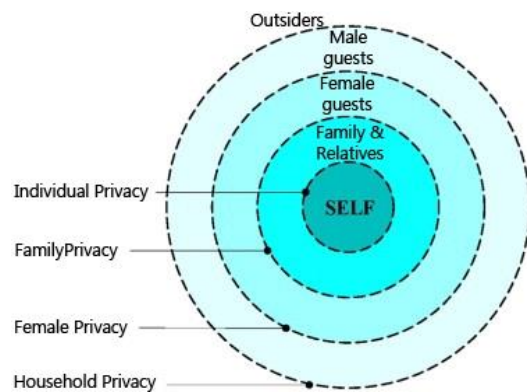


Figure 41. Privacy layers in traditional Muslim home (Bahammam, 1987)

This concept affects the city in both urban and building levels. The effect of privacy on these two levels are presented in detail in the next sections.

## Urban level

The city in its urban scale should also achieve privacy for its people. For instance, the demand for privacy prevents family entertainment and special activities in urban public areas and open squares, especially when women and men were included in such activities. Contact between women and men were not allowed. This led people to create private spaces inside their backyards to overcome their needs for external spaces. These private spaces were not all the same; some spaces were for extended families like siblings, cousins, their families and children.

Other private spaces were only for nuclear family, only to the couple and their children as presented in Figures 42 and 43. Some other spaces were depending on the gender of users, being women or men only.



Figure 42. 3D model of the old city of Nablus presenting the Semi-public and private spaces



Figure 43. Semi-public and private spaces in the old city of Nablus

Additionally, paths inside the city should guarantee levels of privacy. Public paths are different from semi-public or private ones. Public paths should be reduced to the minimum to achieve both visual and acoustical privacy. This led people to create a kind of city street network, which depends on three types of streets (Hakim, 1986). The first type of streets is the basis of the network (Figure 44). The main purpose of these

roads is to connect all main parts of the city, its neighbourhoods, and to guarantee access to the city centre. Usually, this kind of roads carries most of the commercial activities in the city, it is the most public road, with the larger width between all types of streets, and with the lowest level of privacy in the city.



Figure 44. Public streets in the old city of Nablus

The second type of streets is the neighbourhood's street. These streets are branches from the main public one, being the connection between the city neighbourhoods. These are the main access routes within, and between neighbourhoods' quarters. Some commercial activities could be found on these streets, such as retail stores, and the necessary needs for the dwellers of the neighbourhood, these streets have an advanced level of privacy, which makes them semi-public streets. The width of these streets is smaller than public ones (Figure 45).



Figure 45. Semi-public streets, the old city of Nablus

The third type of streets is the semi-private street, those of the minor neighbourhood. These streets provide access to the areas within the neighbourhood that were not serviced by semi-public ones. These are only used by the dwellers of the neighbourhood, or by people who require frequent contacts there. Usually, no commercial or public activities can be done here (Figure 46). The width and lightening of these streets are lower than public and semi-public ones, which means more privacy and less welcoming.



Figure 46. Semi-private streets, the old city of Nablus

The fourth type is the yard path, which is accessible for dwellers and their guests only. The dark and narrowness give these paths the level of privacy needed, where no public activities can be found, and strangers are not welcome (Figure 47).

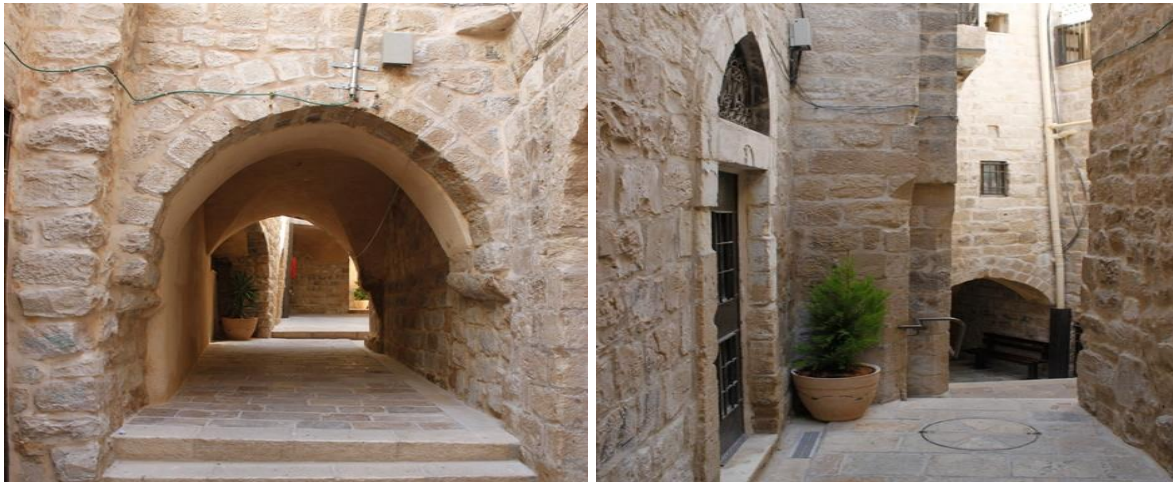


Figure 47. Examples of private paths in the old city of Nablus

The old city depends more on narrow pedestrian paths, where people need to walk, meaning fewer people and cars using the road. This solution reduces the noise caused by cars, wheelbarrows, animals, and the possibility for strangers to reach private areas. Due to that, the city network seen in Figures 48 and 49 was created and streets were classified. On the other hand, public and wide roads mean more noise caused by more people and equipment using the road and more foreigners for work or trade activities.

To separate the paths, their function, and users, two strategies were applied. The first was controlling the width of the street so that it would give the sense of public use, while narrow streets give a sense of privacy or not welcoming street. Between public and private streets there were many levels, each with a suited and needed width.

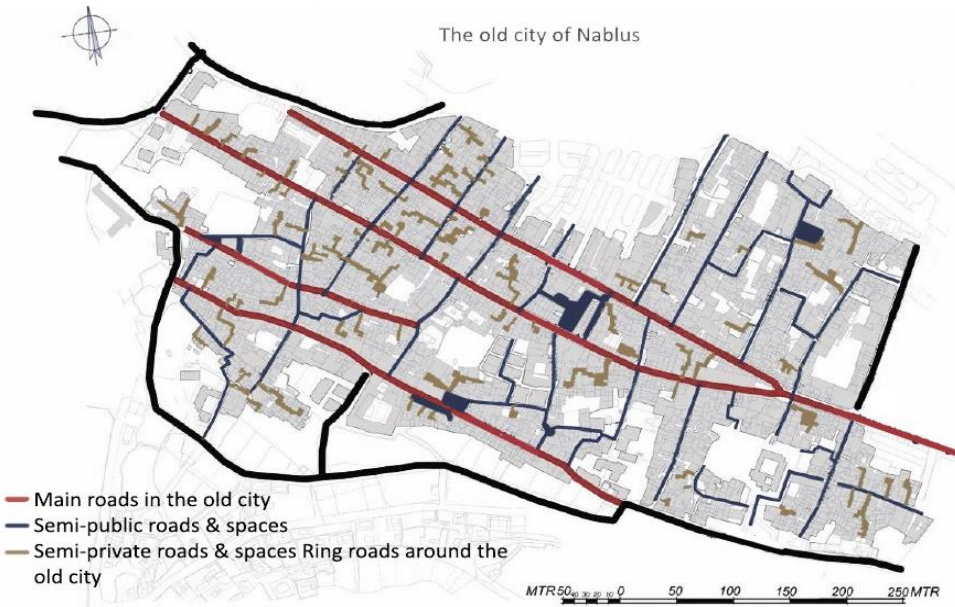


Figure 48. Public, semi-public and private paths at the old city of Nablus

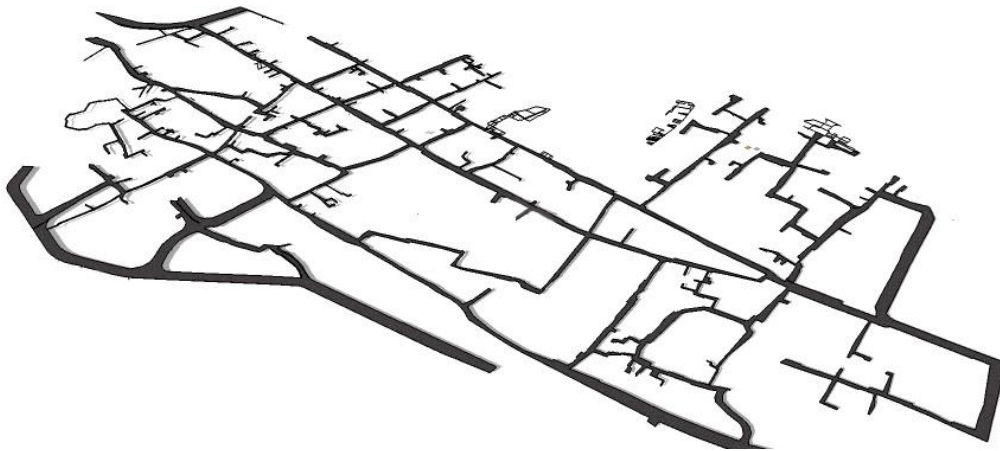


Figure 49. 2D model showing the network of roads and paths with different dimensions, directions and orientation

The second strategy used was broken paths that are not straight and have an unclear end with some darkness caused by the little width (Figure 50). This gives strangers a non-welcoming sense, thus these paths were used for private areas, since public paths are almost straight and linear (Figure 51).



Figure 50. 3d model showing wide public paths leading to narrow and broken semi-public and private streets and areas



Figure 51. Straight and clear paths for public users

While people are walking through these public paths, there are no dark or unclear areas, but suddenly if someone wants to turn to any of the private areas, it is clear that if not a dweller, one would feel unwelcomed (Figure 52). This strategy was used in many Arab and Islamic cities, using light for privacy aspects.



Figure 52. Dark and narrow paths in private areas and yards (Khalil Kawa Photograph, 2017)

The effects of privacy on the urban layout do not stop here. Also, the height of buildings should not exceed the neighbour buildings' height so that visual privacy is achieved. In this way, the skyline of the city is like a horizontal line (Figures 53, 54 and 55).



Figure 53. 3D model showing equal height for buildings in the old city of Nablus



Figure 54. Converged buildings heights in the old city of Nablus (Presidentsmedals, 2016)



Figure 55. 2D model presenting the skyline of the old city of Nablus

More components are affected by privacy, like commercial areas and workshop areas. These city components should also respect acoustic privacy because of the loud sound and vibrations coming from

such buildings. These facilities are normally located away from residential buildings and worship places (Figure 56, 57).

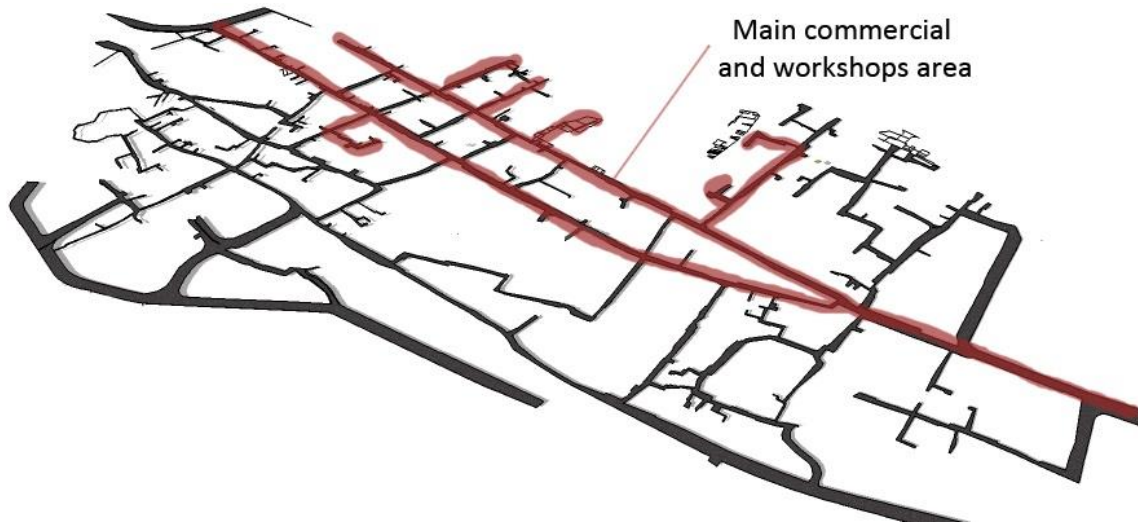


Figure 56. 2D model showing separated commercial and workshops areas in Nablus old city



Figure 57. Commercial and workshops areas are separated from residential areas in Nablus old city (Alwatanvoice, 2017)

Even if some workshops or stores were built beside or close to some residential buildings, some sound transmission mitigation solutions were applied to promote acoustic privacy, such as covering the commercial areas with a vault ceiling or by any kind of ceiling to reduce the sound coming from such place (Figure 58). Another solution to achieve acoustic privacy and to reduce the noise coming from commercial or workshops areas was separating these places and areas with public spaces or wide roads to get a kind of a buffer zone around the area reducing the noise transmission to the minimum (Figure 59).



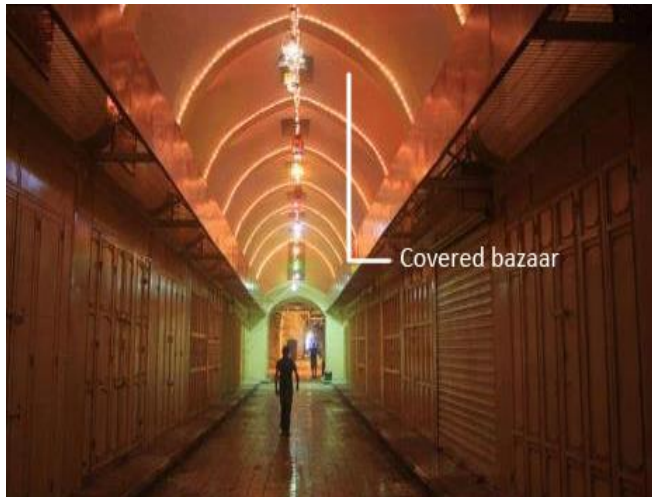


Figure 58. Applied solutions at the old city of Nablus to achieve acoustical privacy through covered bazaars (Ahmad Khalaf Photography 2017)



Figure 59. Applied solutions at the old city of Nablus to achieve acoustical privacy through buffer zones (Ahmad Khalaf Photography 2017)

So, the general concept depended on the urban organisation, by separating commercial and workshop buildings or areas from residential neighbourhoods, if not, some specific solutions were applied. For instance, if any side of a workshop was in touch with any of the neighbours' building, an impressive solution was applied. This solution depended on finding a cavity space between the two buildings, double walls or two walls separated by an empty space. This space was not more than 15 cm on each side (Figure 60).

The main purpose of this space or cavity was to prevent vibration in the structure of the building and acoustic vibrations from reaching the building bedside. This solution was not used in a wide way, it was applied for specific and extreme cases.

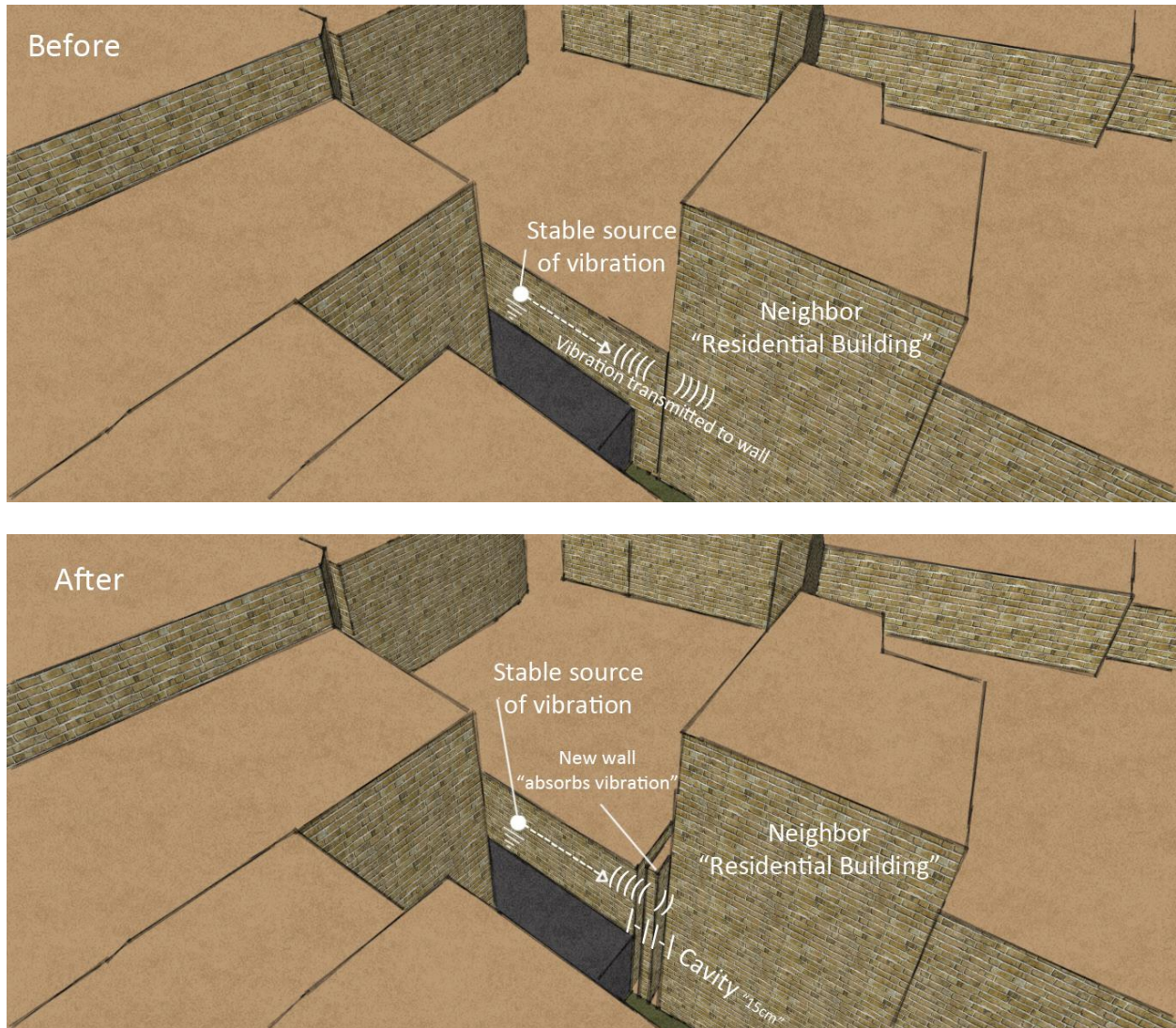


Figure 60. Solution applied by people in Arab cities to avoid noise caused by vibration and airborne sounds

### **|Building level**

Also, the city in its building level should achieve privacy for people, and building level could not be separated from the urban level since these complement each other. One of the main results of implementing the concept of privacy at the building level is the courtyard house (Figures 61, 62). This solution gives families the special space they need to do their private activities without being seen by strangers. This solution was widely applied in the Mediterranean basin countries also because of its environmental and thermal advantages.

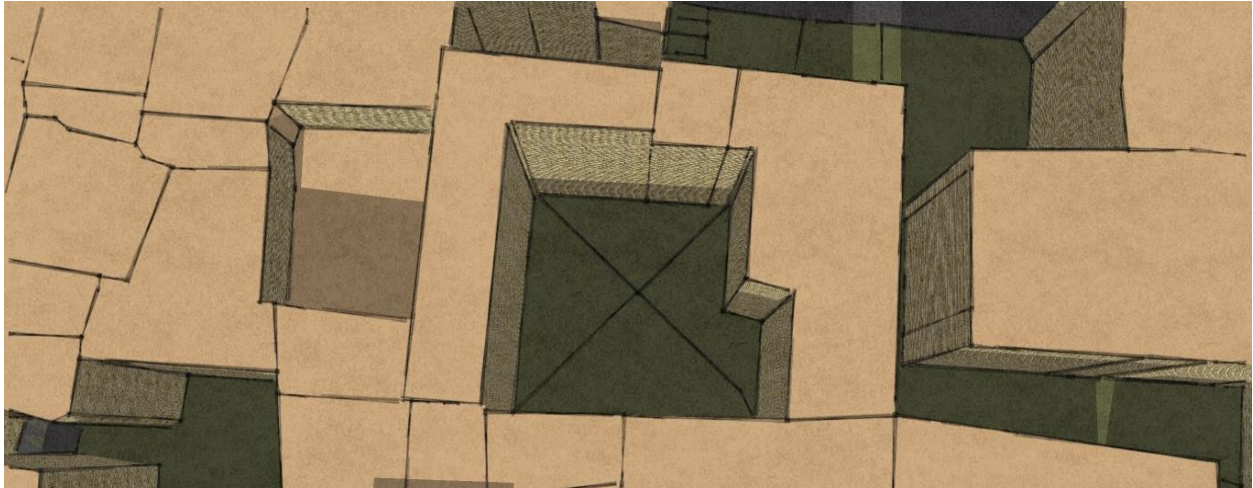


Figure 61. The courtyard house in Nablus as a privacy solution and concept



Figure 62. Courtyards houses at the old city of Nablus

The concept of the court achieved many types and levels of privacy, such as visual, acoustic, and olfactory privacies as presented in Figure 63, through separating, blocking, or orienting certain parts and rooms of the house, like bedrooms, living area, and kitchen, to avoid privacy breaches.

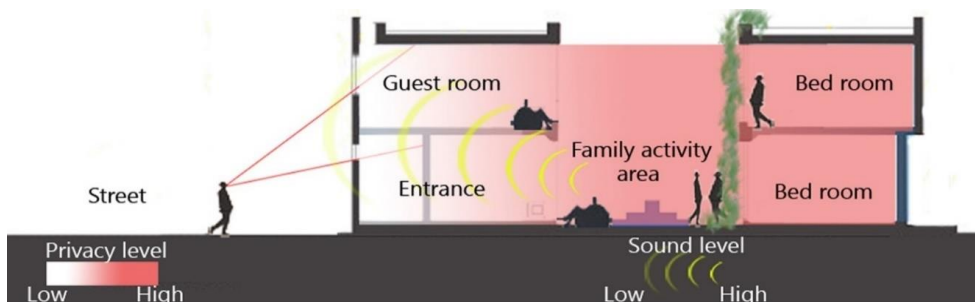


Figure 63. The role of the court in improving privacy

Privacy is not a general approach. It has many rules, limitations, and levels to be achieved according to people's needs. For instance, the guest room has a low level of privacy, so there is no problem if it has openings to the street. However, at the same time, the guest should not see any part of the house, especially bedrooms and women living areas (Figure 64). Additionally, no voice from inside the house should be audible by the guest.



Figure 64. Privacy levels at Arab and Islamic homes

These limitations could be achieved by the position of the guest room mainly, or, if not possible, by a kind of barrier, like a natural barrier of plants and trees as seen in Figure 65, or by wooden screens used on openings and called "*Mashrabiya*". Both barriers could prevent a visual and acoustical breakthrough. These elements were invented and applied to improve privacy at houses but are not the only way to achieve it since priority should be given to building design strategies. Moreover, these were widely used in the Mediterranean basin, for both privacy and thermal advantages, especially in the warm Mediterranean climate Csa and the warm desert climate BWh in the Arabian Peninsula.



Figure 65. Vegetation used at the old city houses of Nablus to improve privacy

The advantages of these solutions do not stop improving privacy.; these also help to cool the courtyard house. Plants could help to shade in the court, thus reducing the area exposed to solar radiation, and could work as an evaporative cooler through the evaporation coming from the leaves and the soil of the plant. “*Kizar*”, which is the Arabic name of the pottery screens presented in Figure 65, was built and organised to create a screen or a wall. These screens were a good approach for improving privacy, and an innovative evaporative cooler when watering this screen during hot summer days (Figures 66, 67).

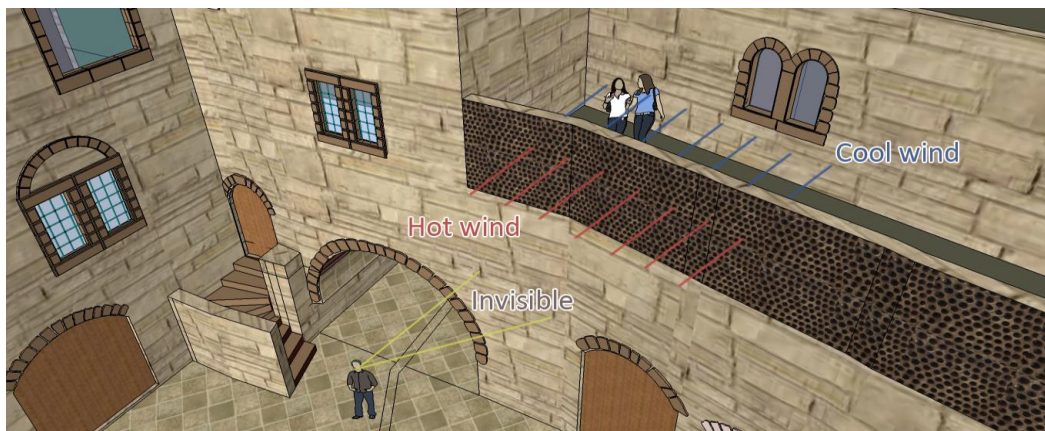


Figure 66. 3D figure presenting the rule of “*Kizar*” in improving privacy and cooling the houses

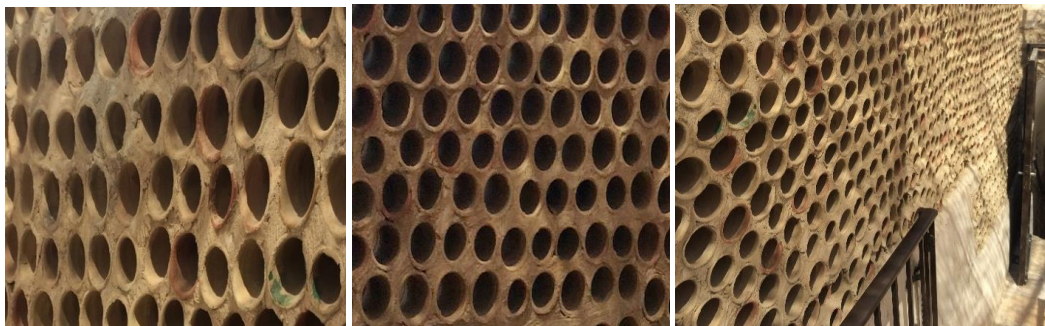


Figure 67. “*Kizar*”, privacy and cooling element in traditional Arab cities

This element helped people to cool their houses by adding some water to the pottery cylinders during the dry, hot summer days. The pottery absorbs and distributes the water around the cylinders, while hot air moves inside each one. It becomes cooler than before, through water evaporation as seen in Figure 68, which is one of the simple aspects of the evaporative cooling system applications.

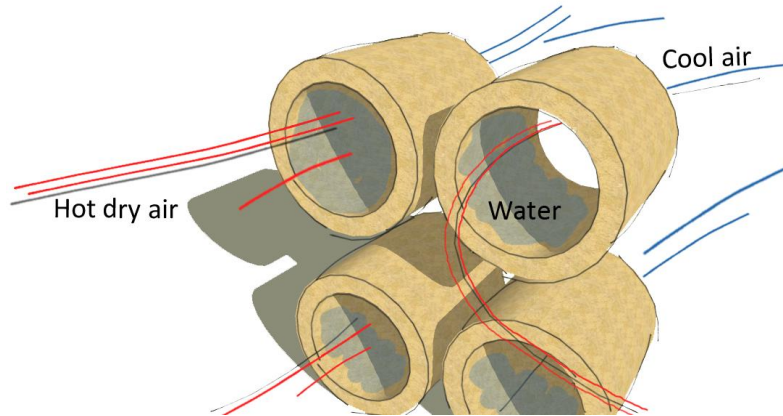


Figure 68. The evaporative cooler concept of the "Kizari"

The openings of the houses at Nablus old city also played a major role in achieving privacy, through reducing these opening at the elevations exposed to the public to the minimum, or by making them higher than the average human height.

Reducing the number of openings was useful in achieving visual privacy, and also for reducing the voice coming from inside the house to the road or the public area as seen in Figure 69, therefore achieving acoustic privacy.

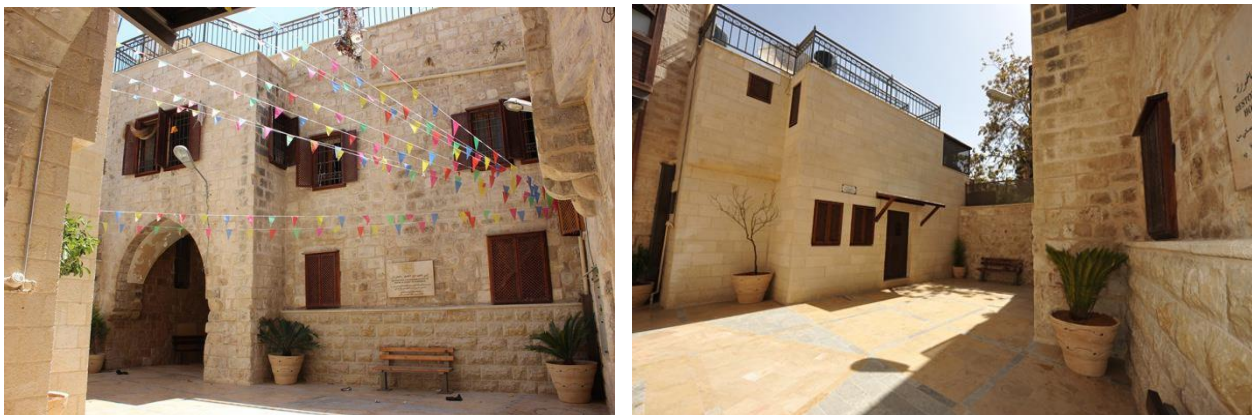


Figure 69. Few openings exposed to the public at the old city of Nablus

The altitude of the openings was also an aspect to achieve both visual and acoustic privacy. No one walking outside the house was able to see the inside because the windows were located in a position higher than the human high and it also prevented hearing clear voices and conversations from inside (Figure 70).



Figure 70. The high height of the openings in public areas in the old city of Nablus

If more privacy was needed for the openings, “*Mashrabiya*” was the element normally used (Figure 71). It was built using intersecting wooden segments, producing a wooden screen, giving the house, the privacy needed so that the family inside the room could see people outside, but the inverse was not possible. The visual privacy aspects are the main advantage of this element, but it was also useful for reducing the voices arising from inside through the dispersive sound surface caused by the intersecting woods (Figure 72). At the same time, it does not prevent the air or sunlight to reach the inside of the house, because of the space between the intersecting segments.

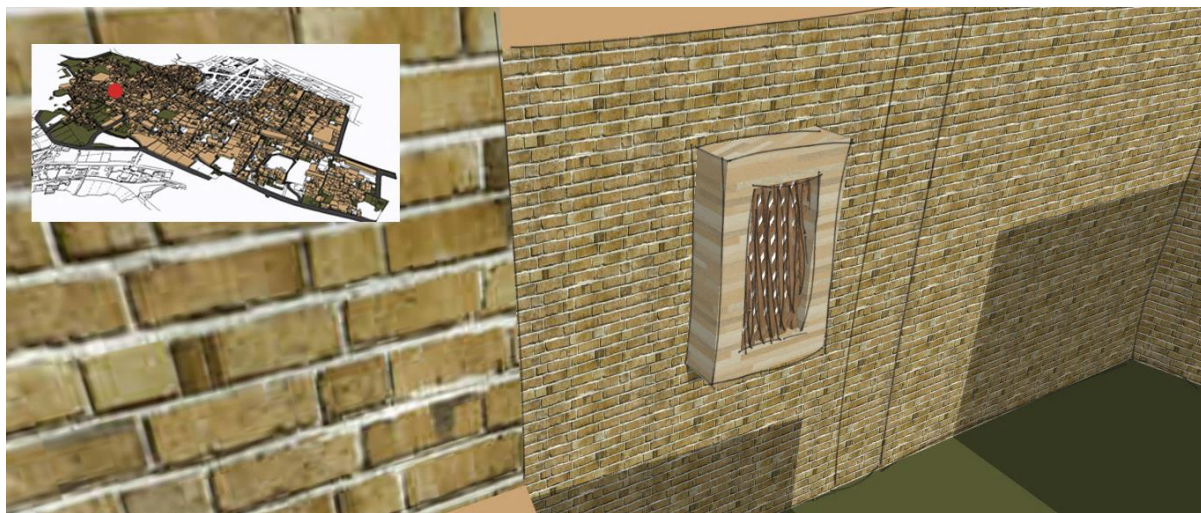


Figure 71. 3D model of the “*Mashrabiya*” privacy element in the old city of Nablus



Figure 72. “*Mashrabiya*” element for improving privacy in the old city of Nablus

This element was used for shading the rooms, giving rooms the air circulation needed with indirect sunlight, which means less heating caused by direct sunlight.

As seen before, these were the main effects of privacy on the city in both its urban and building levels. More examples could present the effect of privacy on other types of buildings, such as public or governmental buildings. Additionally, more detailed effects could be studied and presented in this context, such as the effects on the street’s furniture, on public spaces facilities, worships functional design, and many other facilities in the city, but this study is concerned with the residential buildings only.

### **3.2.2. No harm caused by building process**

There should be neither harming nor reciprocating harm; which is an important and so effective utterance of Prophet Muhammed.

This huge concept or constraint perhaps was covering many sides, which were not covered by privacy. It even intersects in many sides and actions with the concept of privacy. People during their life should not harm or be harmed in any single and small detail or act, and building their houses and facilities is one of the life actions.

The concept of no harm could be divided into several actions, before, during, and after the construction process. First, harm should be avoided before happening, people should predict the harm before starting the building process, decide and diagnose the potential harm before occurring and avoid it. The second action was, if two harms occurred, the lower harm should be chosen. The third act consists in accepting private harm to avoid public harm. The fourth action was to solve problems, which happened after, for instance,



adding a new road. The final action was to assimilate the problems or to circumscribe problems between the neighbours by themselves without resorting to the authorities. Figure 73 summarises these actions.

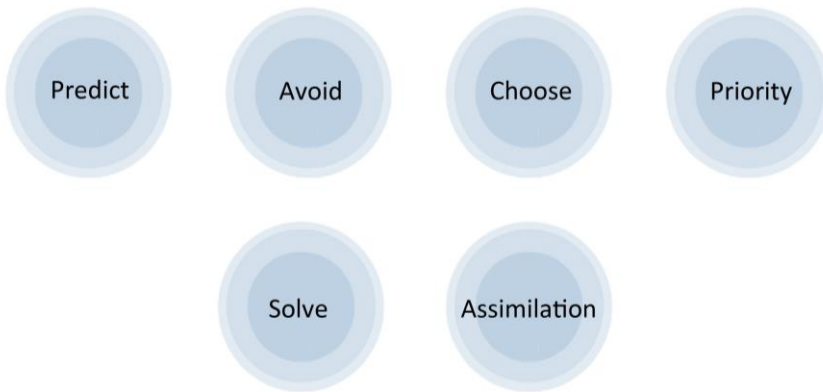


Figure 73. Dealing with harm actions before, during, and after construction

Before building homes or any other facility, people should think about this constraint and should ask for neighbour's acceptance or approval before building a house, opening a window or a door, or raising a room above the roof of the house. They should not harm other people, and they should not be harmed by anybody. Harm will affect, in general, one of the people senses, which was divided in the Islamic cities into three types of harm (Figure 74).



Figure 74. Types of harm in the city content

It was found, in the traditional Arab-Islamic cities, that visual harm could occur by revealing the neighbours' house and rooms, like seeing the court, or the active area of the house. Acoustic harm could happen when neighbour changes the function of the building from residential to carpentry, for instance, this would harm neighbours. Finally, olfactory harm can occur when changing a residential building to a tannery with a very nasty smell (Akbar, 1992).

These three types of harm were more effective on the building level of the city, because these were more related to human senses, while the urban level was affected more by the harm caused to the city facilities and infrastructure, such as roads, parks, etc.

## Urban level

The no-harm concept affected the city in its urban level in many ways. People while using the city facilities should not harm each other. For instance, people should not harm others by road infringements. Thus, the road should keep a minimum width and height as seen in Figure 75 and should be streamlined, depending on the road's typology – private or public – and on its users.



Figure 75. 3D model showing the buildings respecting the minimum width of the paths

In the early time of traditional cities, camels and horses were used to carry goods. So, public and commercial roads should be able to accommodate at least two camels in two directions, both at full load (Figures 76, 77). On the other hand, private paths and roads should be able to deal with one loaded camel, because most of the users are the dwellers and therefore the path is not for commercial use.

After that, carts dragged by horses or camels were used, so, more width was needed. Thus, the priority was to avoid the general harm caused by not expanding the road; private harm was chosen, and the width needed was taken from the houses on the edge of the road.

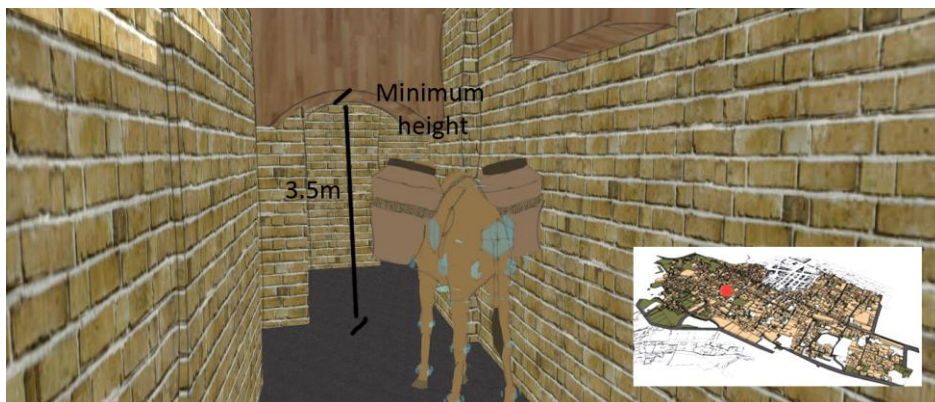


Figure 76. 3D model showing the minimum height of the road regarding the old means of transportation

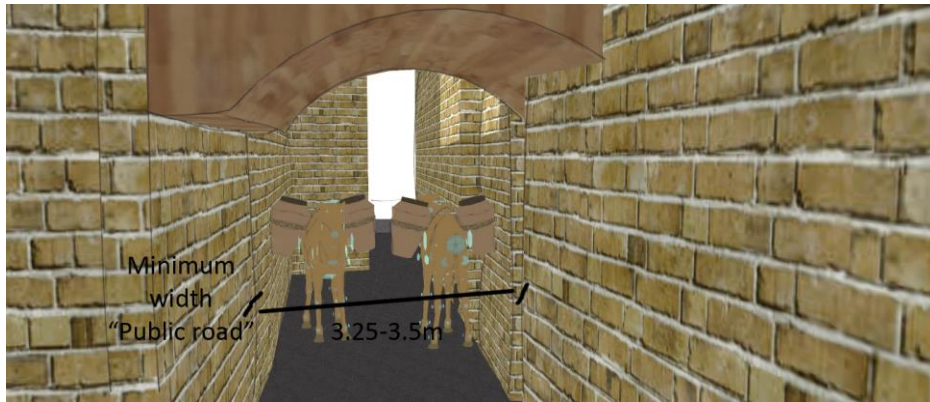


Figure 77. 3D model showing the minimum width of the road regarding the old means of transportation

More limitations on the city level were caused by the concept of no harm, such as the sewage system in the city. This system should not affect clean water sources, such as springs, water tunnels, and wells. If someone's sewer was closed or leaking inside a spring or a well, one should fix it. Otherwise, it should be closed or removed, so that the private property ends when causing harm. Also, workshops should not affect these resources, either by the output materials or by vibration which could make cracks in these resources. Therefore, workshops should be away from water resources, as this action keeps the clean water resources safe from being polluted (Figure 78).



Figure 78. Clean water tunnels and wells in the old city of Nablus (Nablus Springs, n.d.)

As mentioned before, this concept was intersecting and complementing privacy in many ways. For instance, as seen in Figure 79, the height of buildings; even if a wall did not have any openings to the neighbour's side, not breaching the neighbour's privacy, the harm caused by preventing the neighbour from sunlight and wind should be avoided.

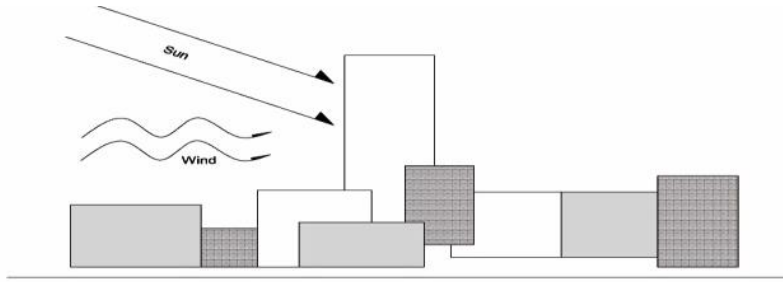


Figure 79. Preventing sunlight and the wind, an example of the possible harm that should be avoided

This affects the skyline of the city in general, and keeps it within the height of two to three floors, meaning natural heating efficiency and healthier houses.

The rule of “no harm” also affected the environment. People should not harm it in accordance with the basic and simple concepts of environment they knew at that time. For instance, during the building process, trees should not be destroyed, agricultural lands should not be widely used, and materials and local resources consumption should be limited. The local government and people controlled and guaranteed this process and any occurring harm should be justified for necessary reasons only (Akbar, 2008).

Also, public and residential buildings should not harm the environment as mentioned before in the example of protecting natural springs and keeping them clean, many rules were created for workshops such as tanneries to prevent them from polluting springs with their wasted water.

### **Building level**

It is a vice versa concept, affecting the decision of both the local authority and the people as individuals, as this concept affects the whole city. In building level, it is clear that no harm between neighbours is accepted, including visual, acoustic and olfactory harms. Also, the function of the residential building should not be changed without the neighbour’s acceptance, as already stated. Any changes at the building is not accepted, like opening a new window or rising a new floor or room, since this should be approved before by the neighbour.

Periodic maintenance of buildings is mandatory and therefore people should keep their buildings in a good condition to keep public safety (Figure 80). This leads people to create sustainable solutions and to use sustainable materials, which keeps the whole city in a good condition, and closer to sustainability premises.



Figure 80. Restoration and preservation of the old city of Nablus

Regarding workshops, if a workshop was nearby a residential building and both visual and acoustic privacy were achieved, but some toxic industrial materials resulted, the concept of harm prevents this workshop to be beside residential buildings, forcing them to create solutions to avoid such harms. However, if the workshop was established before the residential buildings, the workshop has the right to stay, having the priority because of seniority. Due to that, some interventions between residential buildings, commercial, and workshops could be found in the old city of Nablus (Figure 81).

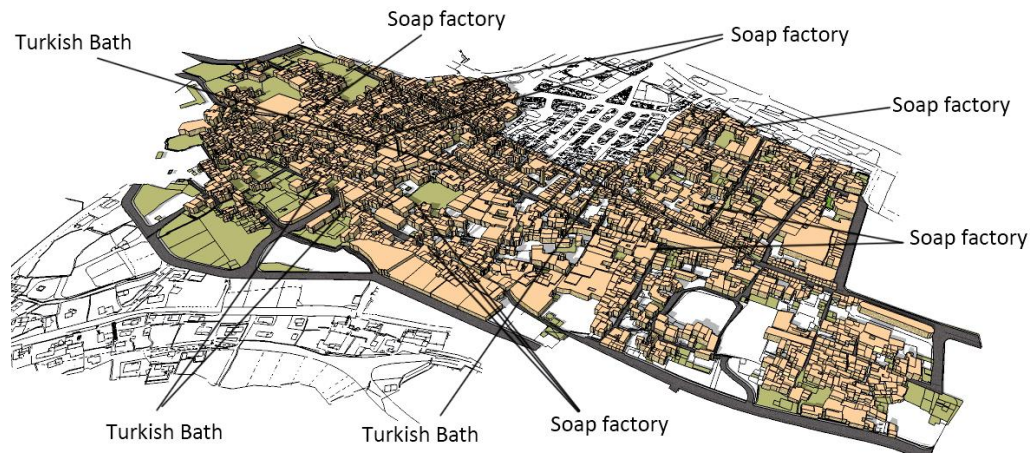


Figure 81. Interventions between factories, public Turkish baths in the old city of Nablus

### 3.2.3. Modesty

A house with spaces for people's daily life activities and needs must be defined by humility in design through economic and sustainable approaches (Othman, Buys, & Aird, 2014). Culturally, modesty was an obligation in people's lifestyle, arrogance was rejected, no one is better than another except by righteousness, and all people are equal; this concept has made people simpler and less arrogant (Al-Tawayha, 2011).

In the built environment aspects, economic and simple approaches are one of the clearer characters of the Mediterranean cities in general, and the traditional Islamic cities specifically. Only people's important needs are taken into consideration while building, raw materials from the environment are used, as stones, mud, and some green and sustainable elements, without exaggeration. People should show modesty in every single detail of their life and in what it contains (Figure 82).



Figure 82. Modesty, as a cultural constrain affecting people

### **|Urban level**

This cultural and religious constraints were certainly reflected in the city components. The feeling of equality and simplicity was reflected on the general image of the city, as for instance, the equal height of buildings – almost a straight skyline (Figure 83) – or the simple furniture of the streets with no imported elements or materials (Susilo, 2011).



Figure 83. The equal height of buildings, reflecting equality as a cultural constraint

The city layout was simply and naturally growing depending on people's needs, with no natural resource's consumption. The city components such as buildings, infrastructures, and spaces, were all built from local and sustainable materials.

Modesty also led to minimising the number and width of roads. The city depended on the minimum number and wide of roads as presented in Figure 84, saving land and natural sources such as materials for covering these roads, and reducing the natural sources needed for their illumination (Figure 85). All of these are aspects that improve the sustainability of the old city of Nablus.

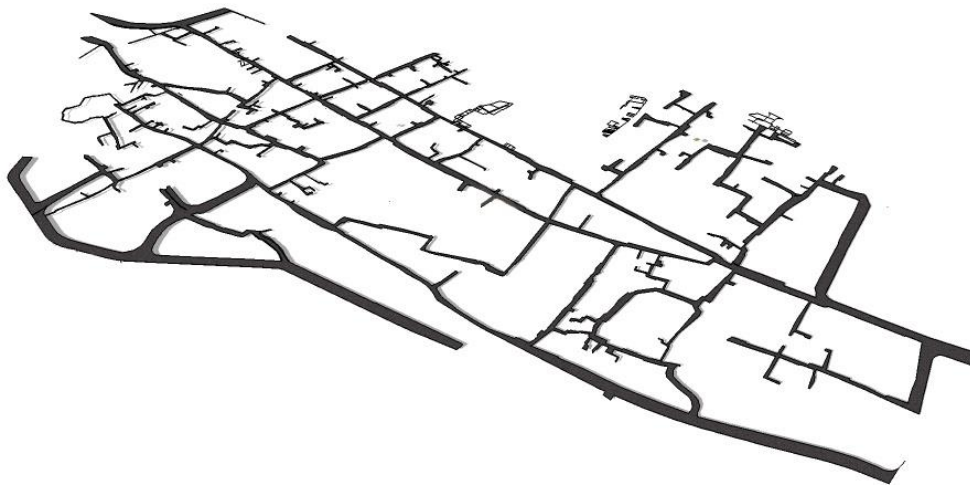


Figure 84. Simple city network of Nablus old city



Figure 85. Street and sewers using local building materials (Palestine Remembered, n.d.)

Even the important areas in Nablus were simple and local. The main commercial street in Nablus “An Nasir Street” was simple, just functionally solved (Figure 86). Stores were simply arranged on the street sides

without any need to import new materials or elements. A linear and a clear path which was easier to use by people, this was saving natural sources and saving the land from being consumed or exhausted by buildings.



Figure 86. Simple compound and forming of An Nasir Street, the old city of Nablus (Horn, 2012)

### **|Building level**

The city building level was also affected by this constraint, the outside image of buildings was similar, the use of same local materials and architectural elements on the elevations, no special elements or imported elements or shaping and even the same doors and windows (Akbar, 1992).

For a foreigner, it is not easy to distinguish a house of a rich merchant from a poor worker house, while walking inside the old city of Nablus. The feeling of equality and simplicity is dominating since buildings have the same aspect from outside. The financial condition of the dwellers could only be noticed when entering the house, (Figure 87).

Inside the house, people were free to do and to live in the way they want. There were no crucial limitations on the way people live inside their home, but of course, the feeling of modesty had an indirect effect on people personalities, so that, even inside the home there was no exaggeration regarding the architectural elements or the interior environment (Akbar, 1992).





Figure 87. The difference between outside and inside homes, Nablus old city

The spaces inside the house were created depending on the basic needed spaces, such as bedrooms, where men's bedrooms should be separated from the women ones, kitchen, guest room, bathroom, and living private area (Figure 88).

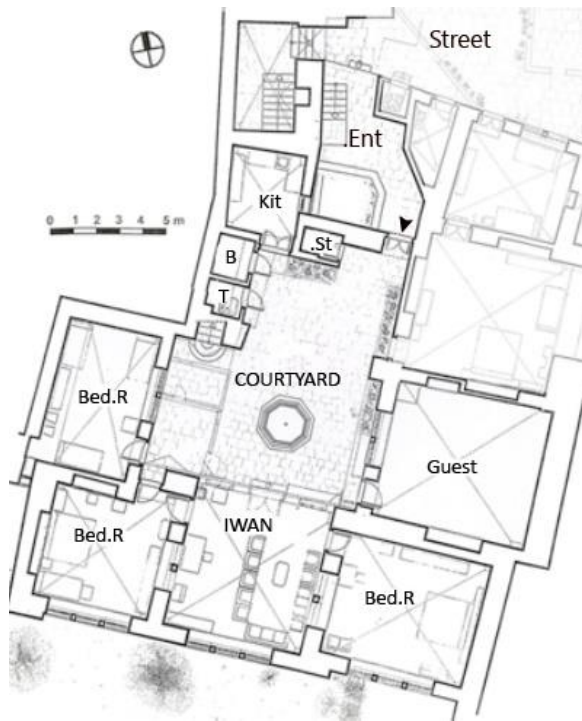


Figure 88. Modesty in a courtyard house in Nablus city

There was no material imported from outside the local environment, no manufactured or synthetic materials, only raw materials with humility (Figure 88). The components of the buildings are history, terrain and sand,

which are all considered as the site features. People try to sow the seeds and build, to compose with the existing topography.



Figure 89. Examples of the simple use of local material in the old city of Nablus

### 3.2.4. Hospitality

Mediterranean people, in general, are considered as a social and friendly society (Othman et al., 2014). Relationships between people are very important, and this phenomenon could be seen entrenched in the Arab and Muslim community as a result of some religious principles, encouraging people to be generous with guests, relatives, and neighbours.

#### **|Urban level**

Hospitality has been reflected in the city in general. Some hospitality aspects could be noticed such as the “*Sabil*” element. *Sabil* is a water element that supplies people with free water in the streets all around the city, the main concept of this element was the people commitment to the value of generosity (Al-Tawayha, 2011).

This element served foreigners in the first-place. It was important for people from outside the city, coming for trade, work, or visit, and by default, it was useful for the people of the city. Providing them with water have a great value in the Islamic religion, so people created this architectural element. Usually, this element could be found beside the mosques, public streets and beside public spaces and areas (Figure 90).

At the old city of Nablus, twenty-four “*Sabil*” have been recorded around the city, nearly half of them still serve until now (Figure 91).



Figure 90. location of "Sabil" in the old city of Nablus (Nablus Springs, n.d.)



Figure 91. The concept of "Sabil", as a result of hospitality, the old city of Nablus

Public baths, also known as "Turkish baths", also became a social place for people to meet and talk and spend some time at night (Figure 92). Although at the beginning it was a need, it later evolved to create a social effect in the city.



Figure 92. Public baths (Turkish baths) as a social activity place at the old city of Nablus (Khalil kawa photograph, n.d.)

Because of hospitality, it is noticed that hotels were very scarce in Islamic cities. People who came to the city could be invited to stay with many people, even visitors who were not a previous friend or a relative could be invited.

This is the general behaviour with foreigners, but for some people who were coming or visiting frequently the city, or in groups of pilgrims, it was not possible to stay in someone's house especially when having goods and animals. Therefore, people established a place for these people called "*Khan*", which is a motel for traders and their goods and animals. For groups of visitors such as pilgrims, animals were kept on the court and the ground floor, traders were on the first floor, and of course, there was a kitchen, bathrooms, and all necessary facilities to stay for several days. *Khan* was the only place like a hotel in the old city of Nablus as seen in Figure 93 (Pagliarini, n.d.).

The animals' place was located on the backside of the first floor. The first floor of the "*Khan*" also contained some stores on the front side, for traders to sell their goods at the wholesale price, the city residents knew that there was this kind of stores inside the "*khan*", which makes the "*khan*" one of the most active commercial areas in the city.

This "*khan*" has been almost separated from the main residential area of the city, and it was also oriented to the yard, inside the building, which allows enhancing the privacy of the neighbours.



Figure 93. "*Khan*" of traders, past and present at the old city Nablus (Pagliarini, n.d.)

## Building level

Hospitality effect was clear on people personalities. This fact had a direct effect on their buildings and an indirect effect on the city in general. It had been noticed that especially residential buildings were designed in the past, and are still used nowadays to serve guests, neighbours, and relatives.

People in Arab-Islamic cities still allocate a special room or suite in their houses to serve guests. In some cities, two guest rooms were allocated to separate women and men, with all needed facilities like a kitchen, a bathroom, and sometimes a bedroom (Al-Tawayha, 2011). The spaces to host guests had taken many forms, starting from the guest room inside the house, to the separated guest suite, to the yard where daily guests were hosted, such as neighbours and friends (Figure 94). This gives the suitable space needed for people to stay in contact and to keep the society healthy regarding social aspects, it enhanced social activity and strengthened relationships between the community.

Definitely, finding a healthy and a social community is an important element of sustainability, in all social aspects, and that will lead to a sustainable and healthy city, free from any social problems.



a

b

Figure 94. Dwellings that enhance social activities and relationships (Sources – figure a (The Presidents Medals Student Awards, n.d.); figure b (Nablus 24, n.d.)

As mentioned before, even in contemporary buildings and apartments, people are taking into consideration during the design process this important constraint, depending of course on their financial condition. Some of them allocate a small guest room in their houses, and others allocate a suite containing a kitchen, a bathroom, and a bedroom as seen in Figure 95, but all people take into consideration that guests should have a special space inside the house, and social relationships are very important. This could be noticed in all the Mediterranean basin countries but in varying degrees.



Figure 95. Contemporary apartments, guest rooms as a room and a suite, Nablus new urban areas

### 3.2.5. Responsibility

In according to the fact that the city is owned by the whole community, people of this community are responsible for protecting their own city with all its components, facilities, infrastructure and spaces to keep them vital and still serving.

Even if the responsibility of creating legislation and finding solutions for construction issues was of the people, it could be seen in the traditional Islamic cities that many parts and neighbourhoods have created their own laws, which were different from other neighbourhoods. It depended on all on the agreement between dwellers, and the common norms in that neighbourhood (Akbar, 1984).

Streets, rebounds, open-spaces, and paths in neighbourhoods have their own dimensions and are approved by the dwellers of those neighbourhoods. The local authority does not interfere if people agree between each other, so, all these components are owned by the people who take the decision. Therefore, these components are still vital and working as long as people are occupying the city.

The scale more affected by this constraint is urban level because this concept is concerned with the relation between people regarding their public components and facilities, and how to arrange and to organise these issues. Therefore, parks, streets, and green elements were the most affected components (Akbar, 2008).

Sharing responsibility enhanced the concept of vernacular architecture, the architecture of people and the architecture people create, without any engineering or governmental participation, as mentioned before. Vernacular architecture is one of the greatest examples of sustainable architecture (Foruzanmehr & Vellinga, 2011). This constraint also enhances people participation in the design process, this is one of the latest concepts in the design process. There is consensus between architects and stakeholders that urban planning and building design without people participation are very poor and many examples could be presented about the stunning results of designing without people participation and decisions, such as Carrières Centrales Housing project, Morocco where major changes occurred and conducted by dwellers because of sociocultural aspects, see Figure 96 (Carrières Centrales Housing Project, n.d.).

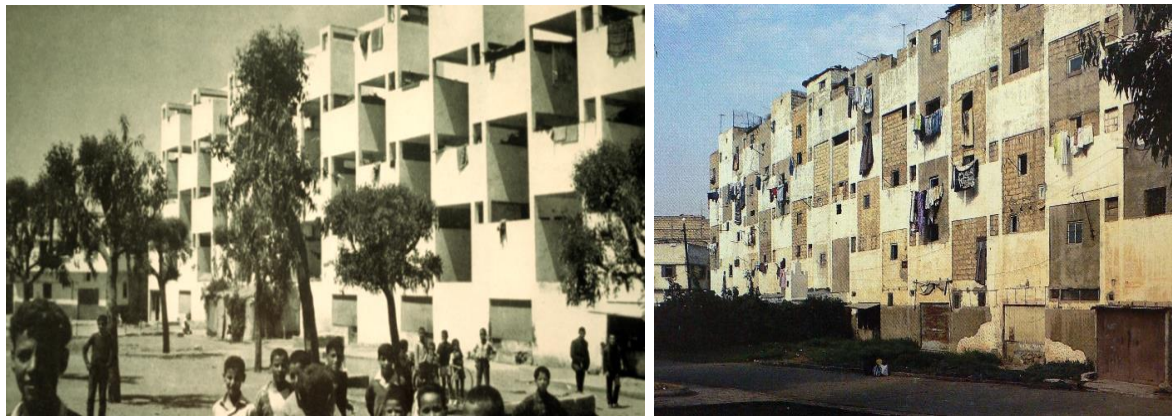


Figure 96. Changes in the right picture conducted by the local citizens on buildings because of the ignorance of people participation (Tawayha, Bragança, & Mateus, 2015)

### **|Urban level**

As mentioned before, the city on its urban level was affected by this constraint more than building level, because it is more concerned with issues between people and the city components and facilities. For instance, people while adding and constructing their houses create the green spaces they needed, depending on their needs and with consultations between them. Most of these green areas were inside private property, such as extended family yards, courtyards, and some public activity areas. They were all owned by local people and therefore, people carried the responsibility to take care of them.

The land, trees, and fruits of those trees were owned by the people living in the area. Anyone could benefit from these trees. In some cases, it was noticed that the crop of some planted areas was given to the poor people of that neighbourhood, and sometimes they sold the crop and restore some old or destroyed buildings for poor people who do not have enough money to do that.

Here two examples are presented to explain the effect of this constraint on city green elements. These examples could be generated to all urban sides affected by this constraint. One is the current system in planting trees in the Nablus city, which depends on planting fruitless trees by the municipality in public streets (Figure 97).

This system failed in keeping these trees healthy and vital since people did not care about them because they were not inside their property and not within their responsibility.



Figure 97. Planting trees on streets sides as a governmental responsibility, new urban areas of Nablus

The second example is the system of planting trees in the old city of Nablus. Fruit trees were planted inside private properties such as yards, courtyard houses, and some lands, which have a joint property. These trees are still vital, providing the city with the needed green areas to keep a healthy environment.

People were responsible for looking after the trees because they were inside their property and because their fruits were useful and important for them and their community and city.



This sharing of responsibility with people was fundamental to keep the city green areas (Figure 98) while providing the city with an important and innovative restoration and reservation system; an independent system financially covered by people and the city trees production, without any governmental intervention. This system was serving many facilities in the city, streets, private and public buildings, parks, etc.



Figure 98. Planting trees in the old city of Nablus as a people responsibility (Presidentsmedals, n.d.)

This example shows how involving people in making decisions and sharing the city responsibilities helped to keep the city healthy and vital, being one of the main aspects that support sustainability in the city.

**|Building level**

In building level, this constraint works as if two parties had a problem or dispute. The first responsibility to solve this problem was theirs. They should try to solve it depending on their religious constraints and legislation presented before, such as no harm, or privacy limitations, etc. (Akbar, 1992). If these two parties failed to solve the problem, the responsibility was transferred to the neighbours to solve it, depending on the

norms in that neighbourhood or quarter. Finally, if neighbours failed in solving the problem, the two parties went to a judge to solve the problem. Nevertheless, most of the cases were solved internally without going to a judge, and the government did not interfere if people do not recourse to it (Al-Tawayha, 2011). This constraint guaranteed and insured that the previous constraints, such as privacy or no harm would still work and stay as a reference for any problem that people would face.

Also, this concept was useful for buildings, as mentioned before, as their maintenance was the responsibility of the community, so that poor people could rebuild and restore their buildings without any problem.

### **3.3. Summary**

Based on the previous analysis, the effect of cultural and religious constraints on the built environment of Nablus, as a city of the Mediterranean basin, was clear. These constraints give the city its special and own features, and without them, the city may not be as it is today.

These effects on the city features led the city to achieve a good level of sustainability. Not only for considering sociocultural aspects – as a sustainable element – during the building process, but also, it led to innovative sociocultural solutions, strategies, and architectural elements which improved the environmental performance of the city in all its components.

These features, strategies, and elements – as a result, and a product of sociocultural and religious constraints implementation – were acting, working, and improving the built environment in many other sides beside its cultural benefits.

In some cases, it helped to improve the building thermal performance, either cooling or heating it. In other cases, it worked as an organiser and controller of the city layout, while sometimes working as a governmental alternative in resolving conflicts between people.

Table 2 summarises these sociocultural effects on the old city of Nablus and shows the result of these effects on the city features.

Table 2. Summary of the effects of sociocultural values on the old city of Nablus and the results of each effect

<b>Constrain</b>	<b>Effect on old city features</b>	<b>Result</b>
<b>Privacy</b>	City layout, city skyline, streets classification, openings, city ordering, separated commercial and workshops, vegetation, and noise reduction.	Courtyard house, low-rise buildings, <i>Mashrabiya</i> , yards, <i>Kizan</i> , cavity walls, perforated facades, noise transmission solutions, city streets and paths classifications.
<b>No harm</b>	Land use, building use, streets dimensions, building restoration, city skyline, preventing city infrastructure and noise reduction.	Functional areas, equal buildings height, buffer zones and sewer system.
<b>Modesty</b>	Equal height of buildings influencing the “city skyline”, simple city network, local building materials in urban and building levels, simple compound and forming, simple dwellings needs.	Reasonable use of the land, sustainable materials, effective city network, uniform building image, and reducing resource consumption.
<b>Hospitality</b>	Interior spaces, city layout, public facilities, new architectural elements and infrastructure	<i>Sabil</i> , Public baths “Turkish baths”, <i>Khan</i> , public green spaces, activity areas.
<b>Responsibility</b>	Interior spaces, infrastructure, vegetation, streets, rebounds, open-spaces, paths, Noise reduction.	Vital green areas, planting trees system, people participation in decision-making regarding city components, self-restoration system, noise transmission solutions.



## **Chapter 4. Comparison of design strategies: past and present**

### **4.1. Nablus, past and present**

To develop something and to improve it, it is necessary to learn from previous experiences, to learn from the past for the future, especially when dealing with a very rich background and a very poor reality.

Vernacular architecture is considered as sustainable architecture, and cultural constraints are one of the main cornerstones of sustainable buildings and structures. The effect of the sociocultural context of vernacular architecture in Nablus old city was presented before, and to learn from the past, contemporary architecture – which ignored these constraints – should also be discussed through a comparative approach.

So, the positive sides of vernacular architecture could be considered in the design process of modern buildings, especially, the strong and major effect of the Palestinian sociocultural context, particularly, and the Middle Eastern society in general, as already presented.

Nowadays, the architectural approaches used in Palestine completely forget the learnings from the traditional architecture and are mainly based on design approaches from abroad. The new urban areas are completely different from the old city of Nablus, regarding building strategies in urban and building scales.

The new urban areas design approaches do not consider Palestinian's specific climate conditions, the internal organization of spaces or the sociocultural constraints (including specific demands for privacy), among other aspects. These models are inadequate in maintaining the indoor environment within comfort boundaries, they ignore the inhabitants' needs, and do not reflect the cultural and religious identity of the Palestinian society (Asquith & Vellinga, 2006).

As mentioned before, this chapter presents the comparison of some of the main strategies in the old and the new urban areas of Nablus, in both urban and building level. These strategies led the old city of Nablus to achieve a great level of sustainability, depending on people believes and culture, without any previous knowledge regarding sustainable elements or demands.

## 4.2. Comparison approach

The comparison depended mainly on the fieldwork and the site observations because of the lack of available data from the municipality, governmental sources, and the sensitive political situation. Collecting data directly from people was a limitation during the work. Visits and observations showed, as in Figure 100, a similarity in the old city building strategies, materials, openings, approaches, etc. This similarity referred to the people's religion and culture, the similar financial conditions, and the same building strategies and approaches. Therefore, the sample of buildings, streets, materials, and all city components represented the whole city.



Figure 100. The old city of Nablus, similar building strategies, materials, and components

Also, the similarity was clear in the new urban areas of Nablus, during site visits and observations, like the style, the construction technologies, the approaches, the architectural elements, and the city components.

The bad financial condition of the government and people is very effective in shaping the new urban areas. Besides the lack of land, these are the main factors controlling almost everything in this process. These factors, besides neglecting cultural aspects, led to the current state of the new urban areas in Nablus. Due to this common background, similarity could also be noticed in the new urban areas, the same design approaches, building strategies, limitations, materials, and components.

It can be said that the city in its building level is a copy of the same buildings, with all its details such as elevations, plans, etc. Additionally, and of course, the urban level is the same, infrastructure, spaces, city components, etc., have the same features (Figure 101). Therefore, any sample of the new urban areas of Nablus city components could represent the whole city.

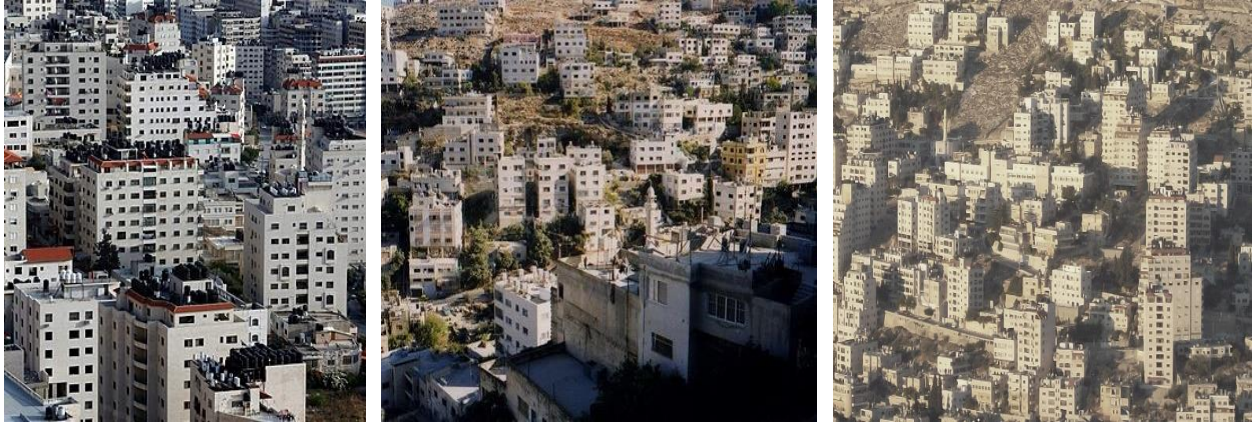


Figure 101. The new urban areas of Nablus city, similar building strategies, materials, and components

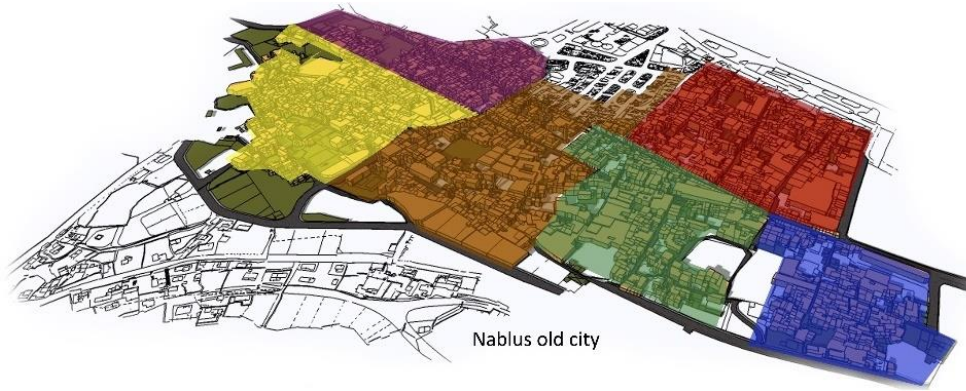
In order to build a comprehensive documented knowledge for conducting this comparison, the following methods and criteria should be considered:

- Comparable components of the urban fabric of the old city and the contemporary urban expansion areas – these components were chosen by site observation.
- Comparable architectural components, including the building elements with similar functions (residential buildings) in both, the old and the contemporary architecture
- Present the urban and building components affected by sociocultural values.

These comparable components were all affected by sociocultural values in the old city of Nablus and were missed or ignored in the new urban areas of Nablus.

To cover most of both urban areas, these were divided into smaller urban ones. The old city was divided into five quarters, based on neighbourhoods or quarters names. These were named originally by local people (Figure 102). The names were obtained directly from people and municipality resources.

The quarters in the old city are mostly residential ones, with the necessary commercial and workshop areas and stores, which means no special industrial strips, or special agricultural areas. All quarters connect at least to one main street, the public street named and classified previously. The quarters were not separated by any boundaries or breaks, only by names, a kind of moral separation by family.



- Al Qaysaria Quarter
- Al Habaleh Quarter
- Al Qarayoun Quarter
- Al Aqaba Quarter
- Al Yasmenah Quarter
- Al Qarb Quarter

Figure 102. The five quarters of the old city of Nablus

The observations and fieldwork were distributed in the five quarters. Pictures and data were collected from each quarter, houses, streets, and all city components were observed equally from these quarters (Figure 103).



Figure 103. Fieldwork and observations, equally distributed in the city five quarters



On the other hand, the new urban areas were divided during the fieldwork and site observations into two dominant zones in accordance with the structural master plan from Nablus municipality – residential zone A and B. Residential zone A sets some rules regarding the number of floors, rebounds and materials. There, the limitations led to separated villas and isolated buildings. This zone occupies less than 25% of the city.

The residential zone B covers around 75% of the city, and it has fewer limitations regarding the floors number, rebounds, and materials. Most people in the city live in this zone. Therefore, to the dominant type of buildings in the city is high-rise residential buildings, from 7-16 floors, with about 2-5 apartments on each floor (Figure 104).

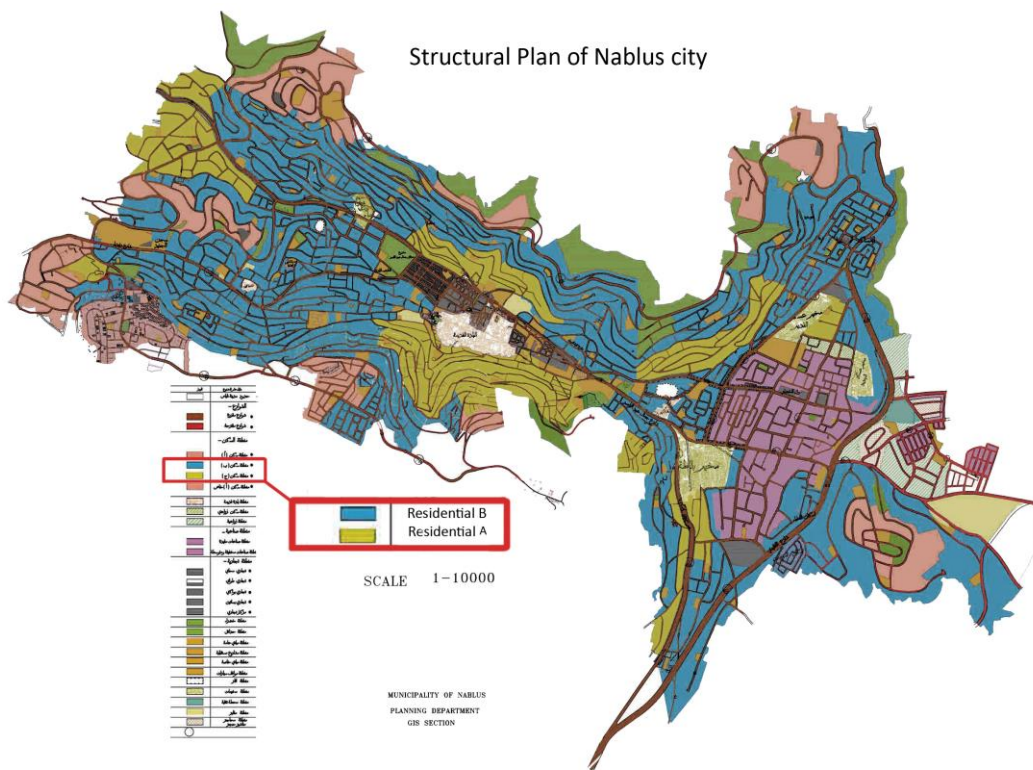


Figure 104. Two residential zones of Nablus new urban areas, zone A and B

As presented in Figure 105, the fieldwork and site observations were distributed on the two residential dominant zones of the city, zone A and B. These two residential zones contain the most common building patterns in the new urban areas of Nablus. Additionally, they contain most of the city urban components, such as public areas, parks, main squares, and network. So, the city in its two levels could be represented in these two areas.







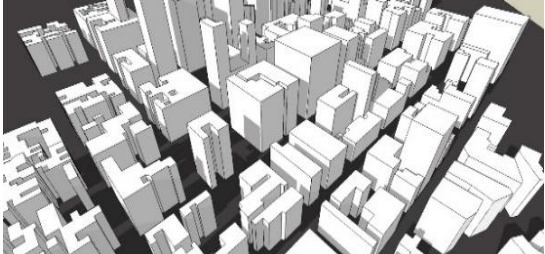
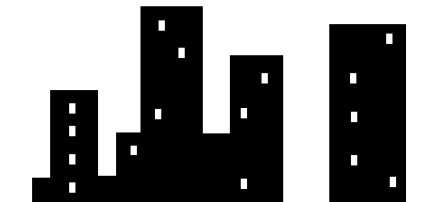
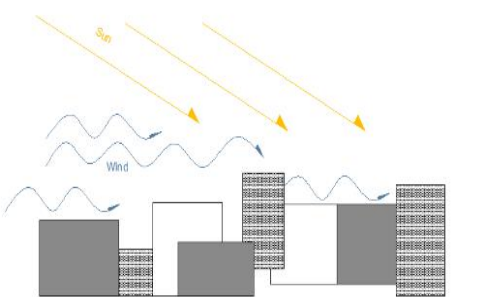
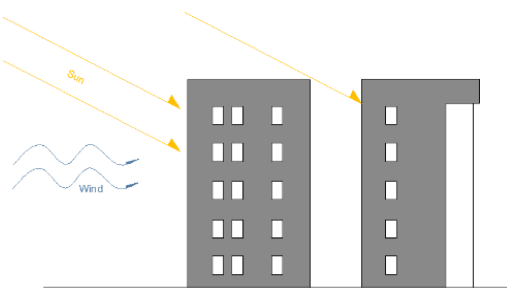
TABLE 3. CITY LAYOUT COMPARISON BETWEEN THE OLD CITY AND NEW URBAN AREAS OF NABLUS (SOURCES – FIGURES A AND E: “HTTP://WWW.NABLUS.ORG/” 2011; D, C AND F: “DOOZ” 2016)

OLD CITY (NABLUS)	NEW CITY
<p>A</p>  <p>NABLUS OLD CITY MAP SHOWING THE COMPACT LAYOUT</p>	<p>D</p>  <p>SEPARATED BUILDING IN THE NEW URBAN AREAS</p>
<p>B</p>  <p>3D MODEL OF NABLUS SHOWING THE COMPACT LAYOUT</p>	<p>E</p>  <p>2D MAP OF THE NEW URBAN AREAS SHOWING THE DISPERSE LAYOUT</p>
<p>C</p>  <p>SHADED STREETS AND WALKWAYS AS A RESULT OF COMPACT LAYOUT</p>	<p>F</p>  <p>STREETS AND WALKWAYS EXPOSED TO DIRECT SOLAR RADIATION DUE TO WRONG CITY LAYOUT</p>

### 4.3.2. City skyline

The difference of the skyline (Table 4) between the heights of buildings in both contexts is clear. Buildings in the old city are not very high, 2-3 floors maximum (Figures A, B, C), and are of equal height, unlike buildings in the new city area, with 6-12 floors and not with the same height (Figures D, E and F).

Table 4. Skyline comparison between the old city and new urban areas of Nablus (Sources – figure A: “Http://www.nablus.org/” 2011; B: “Presidentsmedals” 2016; D and H: “Tawayha, Bragança, and Mateus 2015”)

OLD CITY (NABLUS)	NEW CITY
<p data-bbox="256 310 272 331">A</p>  <p data-bbox="256 695 586 716">BUILDINGS HEIGHT AT THE OLD CITY OF NABLUS</p>	<p data-bbox="824 310 841 331">D</p>  <p data-bbox="824 695 1138 716">BUILDINGS HEIGHT AT THE NEW URBAN AREAS</p>
<p data-bbox="256 772 272 793">B</p>   <p data-bbox="316 1312 630 1333">SECTION SHOWING COMPOSITION AND HEIGHT</p>	<p data-bbox="824 772 841 793">E</p>   <p data-bbox="878 1312 1198 1333">3D AND 2D VIEW FOR THE NEW URBAN AREAS</p>
<p data-bbox="256 1360 272 1381">C</p>  <p data-bbox="316 1722 760 1774">THE EFFECT OF THE HEIGHT OF THE BUILDING ON THE WIND AND SUNLIGHT ACCESS</p>	<p data-bbox="824 1360 841 1381">F</p>  <p data-bbox="824 1701 1356 1753">THE EFFECT OF THE HEIGHT OF THE BUILDING ON PREVENTING THE WIND AND SUNLIGHT ACCESS</p>

### 4.3.3. Urban public and green spaces

As seen in Table 5, there are a meaningful number of green and public spaces in the old city of Nablus (Figures A, B and C), which are still in use as public spaces and are suitable for cultural activities. On the other hand, in the new city, these spaces are fragmented into small spaces, depending on the legal rebound ruled by the municipality (Figures E and F). In the new urban areas, these spaces are not considered as a public space, neither as green spaces, and the inhabitants do not generally use them, and therefore such spaces are completely neglected (Figure D).

### 4.3.4. Infrastructure

As presented in Table 6, the new technology gives some positive inputs to the new urban areas. For instance, an improved sewerage network (Figures D and E), in contrast with the old sewerage network created by the Romans that is still in use in the old urban areas until now (Figures I and J). Regarding the water distribution system, in the new urban areas, both the higher population density and higher buildings drove the use of solutions with greater potential environmental impact and not always so well integrated into the urban layout as the traditional water distribution systems (figure B and C compared with G and H).

Table 5. Urban public and green spaces comparison between the old city and new urban areas of Nablus (Sources – figure A: “Presidentsmedals” 2016; figure D “DOOZ” 2016; figure E “Google Maps” 2016)

OLD CITY (NABLUS AND HEBRON)	NEW CITY
<p data-bbox="245 1199 272 1226">A</p>  <p data-bbox="256 1703 786 1770">PUBLIC SPACES AND GARDENS DISTRIBUTED ALL AROUND THE OLD CITY OF NABLUS</p>	<p data-bbox="786 1199 813 1226">D</p>  <p data-bbox="824 1703 1321 1770">NEGLECTED GARDENS AT THE NEW URBAN AREAS</p>

Table 5. Urban public and green spaces comparison between the old city and new urban areas of Nablus (Sources – figure A: “Presidentsmedals” 2016; figure D “DOOZ” 2016; figure E “Google Maps” 2016) (continuation)

B



SEMI-PUBLIC SPACES BETWEEN BUILDINGS

E



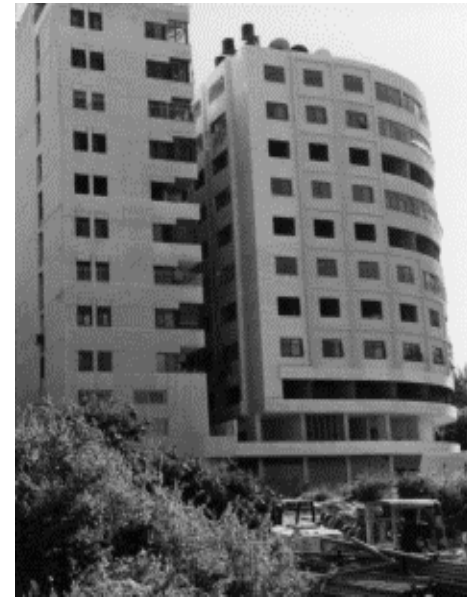
URBAN SPACES CAUSED BY REBOUNDS

C



SEMI-PRIVATE SPACES FOR EXTENDED FAMILIES

F



SPACES BETWEEN BUILDINGS CAUSED BY REBOUNDS

Table 6. Infrastructure networks comparison between the old city and new urban areas of Nablus (Sources – figure F:“Google Maps” 2016; figure A: Tawayha, Bragança, and Mateus 2015; Figures D, E, I, J: “The Applied Research Institute Jerusalem - Home” 2016)



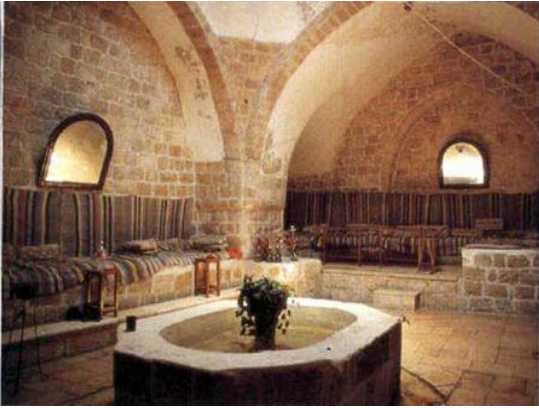






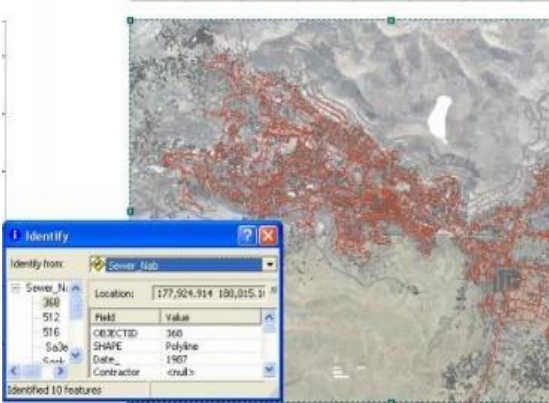
OLD CITY (NABLUS)	NEW CITY
1) ROADS AND TRANSPORTATION	
<p>A</p>  <p>TOP VIEW PICTURE FOR THE TRANSPORTATION NETWORK THE OLD CITY OF NABLUS</p>	<p>F</p>  <p>TOP VIEW PICTURE FOR THE TRANSPORTATION NETWORK THE NEW URBAN AREAS OF NABLUS</p>
2) WATER DISTRIBUTION	
<p>B</p>  <p>WATER ELEMENTS IN THE PUBLIC BUILDINGS OF NABLUS</p>	<p>G</p>  <p>WATER TANKS ABOVE BUILDINGS, NEW URBAN AREAS</p>
<p>C</p>  <p>“SABIL” PUBLIC FREE WATER ELEMENT</p>	<p>H</p>  <p>ELECTRIC PUMPS FOR WATER DISTRIBUTION</p>

Table 6. Infrastructure networks comparison between the old city and new urban areas of Nablus (Sources – figure F:“Google Maps” 2016; figure A: Tawayha, Bragança, and Mateus 2015; Figures D, E, I, J: “The Applied Research Institute Jerusalem - Home” 2016) (continuation)

OLD CITY (NABLUS)	NEW CITY														
3) SEWER NETWORK															
D	I														
															
OLD ROMAN CANAL FOR WATER DISTRIBUTION	NEW WATER NETWORK AT THE NEW URBAN AREAS														
E	J														
	 <table border="1" data-bbox="824 1150 1101 1331"> <thead> <tr> <th>Field</th> <th>Value</th> </tr> </thead> <tbody> <tr> <td>Sever_Nr</td> <td>360</td> </tr> <tr> <td>Location</td> <td>[177,924,914 190,915, 5]</td> </tr> <tr> <td>OBJECTID</td> <td>360</td> </tr> <tr> <td>SHAPE</td> <td>Polyline</td> </tr> <tr> <td>Date_</td> <td>1/6/07</td> </tr> <tr> <td>Contractor</td> <td>&lt;null&gt;</td> </tr> </tbody> </table>	Field	Value	Sever_Nr	360	Location	[177,924,914 190,915, 5]	OBJECTID	360	SHAPE	Polyline	Date_	1/6/07	Contractor	<null>
Field	Value														
Sever_Nr	360														
Location	[177,924,914 190,915, 5]														
OBJECTID	360														
SHAPE	Polyline														
Date_	1/6/07														
Contractor	<null>														
NATURAL SPRINGS USED FOR WATER SUPPLY	NEW WATER NETWORK PLAN OF NABLUS														

### 4.3.5. Discussion

For a developing and growing country, such as Palestine, it is necessary to begin and to grow in a right way and to build on strong and clear foundations to reach suitable and sustainable buildings for the people, especially when there is a very rich and vivid background that still exists. The empirical experience that was applied by our ancestral in the design of vernacular cities has potential to be applied in the design of new building areas. Nevertheless, it is necessary to prior analyse and scientifically validate the performance of these vernacular design principles.



Contemporary buildings in Palestine are far from being sustainable. Architects and other stakeholders are too much concentrated in the financial characteristics of their projects, forgetting other important principles that should root the building design, such as local climate, local materials, and populations' culture and needs. Therefore, such "modern" designs are doomed to failure. As presented before, there are many strategies, used in urban design scale of the old cities of Palestine that can be used in contemporary design. Those strategies are summarised and discussed below at the following levels: i) city layout; ii) city skyline; iii) urban public and green spaces and; iv) infrastructures.

#### **i.** City layout

The comparison between the old and the new city revealed vast differences in the city layout. In the old city, it is clear the compact urban layout. This design strategy decreases the number of surfaces exposed to the sun, reducing the solar gains in summer and preventing the building from losing heat in winter. At the same time, it provides shaded pedestrian streets in summer and protects people from the hard wind and rain at the roads in winter. On the other hand, the layout of the new city is wide, streets are opened, the buildings are separated, and all are exposed to sunlight in the hot days of summer, and the cold wind and bad weather in winter.

#### **ii.** City skyline

The height of buildings controls and affects both wind movement and sunlight access. At the old city, it is clear that no building is higher than 2-3 floors. This standard allows the sun and the wind to reach all buildings and all their private spaces, making a good circulation and ventilation, providing a healthy environment all around the city. On the other hand, in the modern city areas, there are higher buildings with 7-16 floors that prevent the wind and the sun from reaching a huge part of the neighbour buildings. Therefore, in this case, buildings are worst regarding healthy aspects.

#### **iii.** Urban public and green spaces

The old cities in Palestine depend more on semi-public, semi-private and private spaces, which puts the responsibility of these spaces on people that use them. In this case, the users are responsible for taking care of these spaces and even for trying to develop them. In contrast, the new areas of the city depend mainly on public spaces. In this case, the poor local government is responsible for maintaining these spaces, which means poor care and abandonment of these areas.

#### **iv. Infrastructure**

The city infrastructure is divided into hard and soft elements. In this case, hard elements are discussed, which are roads, water distribution and supply and sewerage networks.

##### **- Roads and transportation**

As seen before, the old city of Nablus depends mainly on pedestrian paths that are shaded, thus protecting people from rainy and sunny days. Only two main roads exist, passing along the old city, allowing people to reach their neighbourhoods. This allows protecting the city from pollution caused by vehicles. The design of the new city areas ignores completely the pedestrian paths and assumes that people depend on vehicles to reach every side of the city.

##### **- Water distribution**

The old city has a good water supply network, depending on the natural springs which are all over the city. This network is based on a unique concept that is called "Sabil", providing people with free drinking water. On the other hand, although the new city areas also have a good water network, which is providing water to almost all the parts of the city, the image of the tanks in the top of the buildings has a very bad aesthetic impact on the city.

##### **- Sewer networks**

Without any doubts, the sewerage network in the new city areas is much better than the old one. Nevertheless, the old network has no problems, and it is still working well.

### **4.4. Building level comparison**

As seen in the comparison between the old and the new city from the urban scale, this section presents the comparison between both parts of the city but at the building scale. All the differences are clarified. The comparison highlights the differences between the building scale strategies used in the old city and the new city, showing advantages and disadvantages caused by using such strategies.

#### **4.4.1. Building material**

Materials in the old city buildings of Nablus mostly depend on natural elements, such as stone, mud, and earth. Buildings have thick envelopes as seen in pictures A, B and C of Table 7. This technology improves the thermal performance and the sound insulation of the buildings, unlike modern or contemporary buildings of the city which are depending on synthetic elements like concrete and steel as in D, E, and F, without any concern for thermal or sound aspects.

Many studies in this field could be presented to show the differences between the thermal and acoustic performance between the old and the contemporary city buildings in Palestine, such as Abdel hadi, Majd (2013). This study compares old and contemporary buildings in Palestine, concluding that old buildings have a much better thermal performance and cost than contemporary buildings.

These results were summarized in the study through two charts, the result of these two charts was based on tests and simulations on computer programs. The first chart compares the total cost “the running cost and constructing cost” of two residential buildings in Palestine, an old and a new building (Figure 106).

Table 7. Building materials comparison between old and new urban areas of Nablus.

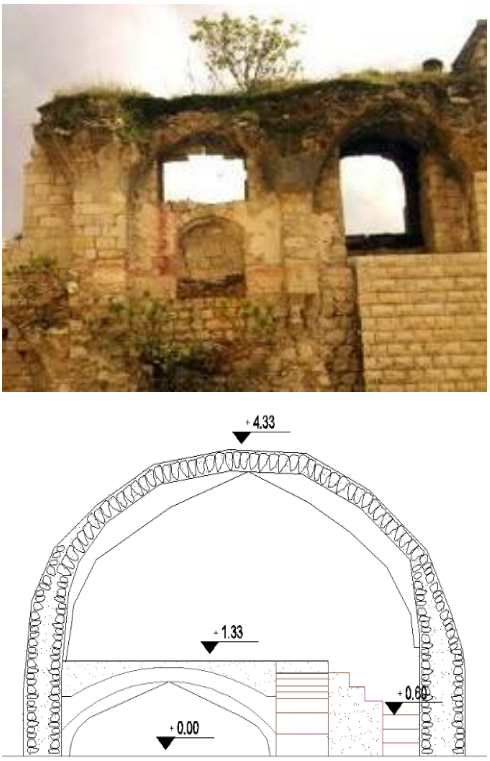
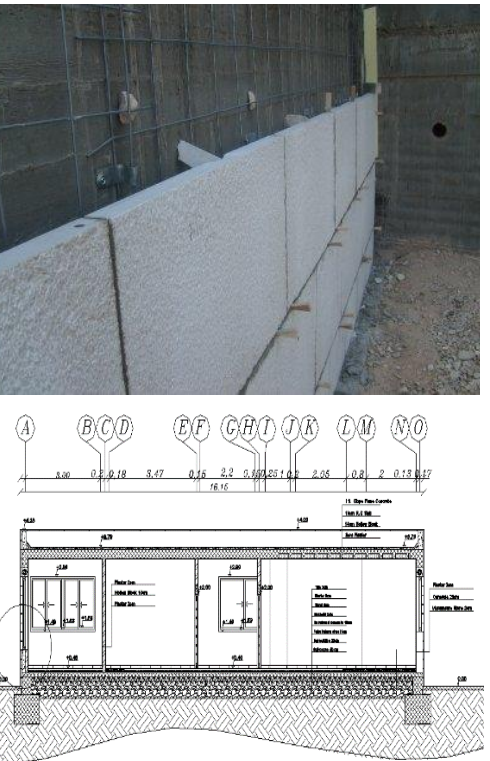
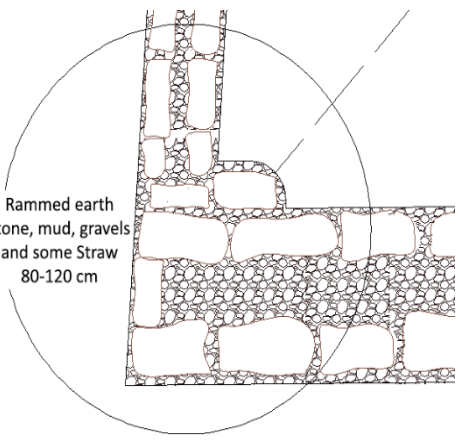
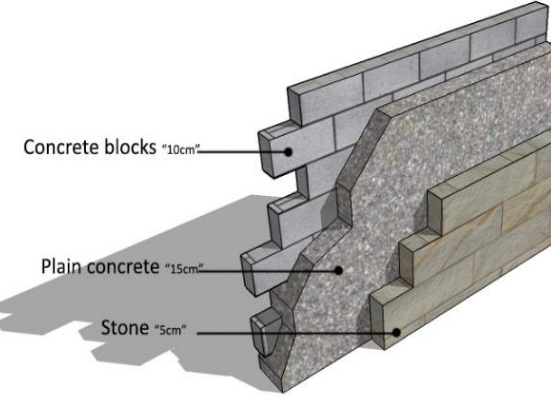
OLD CITY (NABLUS)	NEW CITY
<p>A</p>  <p>SECTIONAL ELEVATIONS SHOWING THE COMPONENTS OF THE OLD CITY BUILDINGS (STONE, MUD)</p>	<p>C</p>  <p>DETAILS SHOWING THE COMPONENTS OF THE CONTEMPORARY BUILDINGS (CEMENT, STEEL, STONE)</p>
<p>B</p>  <p>Rammed earth stone, mud, gravels and some Straw 80-120 cm</p> <p>HORIZONTAL SECTION SHOWING THE THICKNESS AND THE COMPONENTS OF THE EXTERNAL WALLS OF THE OLD CITY BUILDINGS</p>	<p>D</p>  <p>Concrete blocks "10cm"</p> <p>Plain concrete "15cm"</p> <p>Stone "5cm"</p> <p>HORIZONTAL SECTION SHOWING THE THICKNESS AND THE COMPONENTS OF THE EXTERNAL WALLS OF THE CONTEMPORARY BUILDINGS</p>



Figure 106. Total cost comparison, an old and a new building in Palestine (Abdel Hadi, 2013)

The second chart compares the design building capacity of both buildings (Figure 107). The result of the two charts proved that natural and local materials used in vernacular buildings could play a good rule in improving contemporary buildings and could save a lot of natural resources and energy.

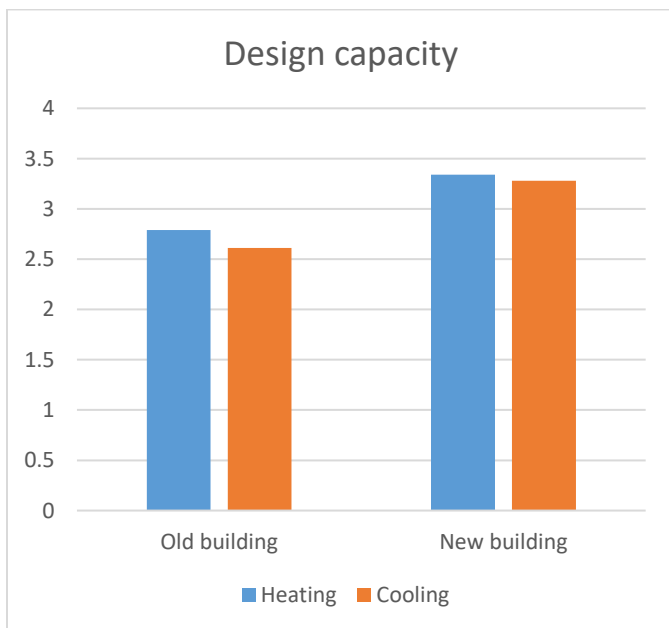


Figure 107. Design capacity comparison, an old and a new building in Palestine (Abdel Hadi, 2013)

Materials used in old and contemporary buildings are different in many properties, such as density, thermal conductivity, and heat transfer, etc. These differences affect the thermal performance of the buildings. In this context, Table 8 presents the properties of some vernacular and conventional building materials used in the Mediterranean basin. Some of these materials were used for insulation to enhance the building thermal performance, for structural aspects, or for both.

Table 8. Properties of some vernacular and conventional building materials (Source- Fernandes et al. 2014b)

Material	Density Kg/m <sup>3</sup>	Thermal conductivity $\lambda$ - value (W/m.°C)	Thermal storage capacity (Wh/kg°C)	Heat transfer time lag (250mm thickness(hr.))	Embodied Energy (MJ eq./m <sup>3</sup> )	Global Warming Potential (kg CO <sub>2</sub> eq./m <sup>3</sup> )
Rammed earth/adobe	1770-2000	1.00-1.20	0.23-0.30	10/9	943	38
stone	2600-2800	2.3-3.5	0.22-0.24	5.5	1300	26
Concrete	2400	1.8	1.10	7	1450	264
Hollow bricks	1200	0.39-0.45	0.26	6	4245	357

Also, the thickness is much different. Therefore, the thermal performance of the old building is different from the contemporary ones, as seen in the last part of this study.

#### **4.4.2. Interior spaces**

One of the most important characteristics of the traditional residential buildings in Islamic countries is the courtyard, which is an open sky space created and caused by both environmental and privacy aspects.

Privacy was one of the main motivations behind creating and using courtyard (Azab, 2008). The courtyard is the most active space in the house; it is vital as the heart of the house. This open sky space occupied around 20% of the total area of the house as seen in Figure A of Table 9 (Hussein et al., 2010).

Environmental aspects were also important regarding the climatic conditions in such area. Hot and dry summer days should be faced with a “radical” and lasting solution. This solution should depend on the design and building integration of passive cooling strategies.

Table 9. Interior space comparison between old and contemporary houses (Sources – figure A: Hussein, Barlet, and Semidor 2010).

OLD CITY (NABLUS)	NEW CITY
COURTYARD CONCEPT	
A	B
COURTYARD SPACE SURROUNDED BY ROOMS AND SPACES	CONTEMPORARY APARTMENTS, NON-ORGANIZES SPACES
B	D
COURTYARD SPACE INCLUDING GREEN AND WATERY ELEMENTS, NATURALLY LIGHTED AND VENTILATED	INTERIOR SPACE, CONTEMPORARY APARTMENT DEPENDING ON ELECTRIC LIGHTING AND MECHANICAL VENTILATION

### 4.4.3. Openings

The old strategies used in such climatic area, characterised by hot summer and cold winter days, depend on reducing heat gains, both in summer and winter.

Many studies based on computer measurements were done to show the importance and the effect of openings on building thermal performance, such as Meier et al. (2004) and Fernandes et al. (2015). Fernandes studied a building situated in Évora, a city located in southern interior Portugal. The climate there is Mediterranean temperate (Csa – according to the Köppen climate classification) which is the same climate zone of Palestinian areas. The study highlights that most vernacular buildings in the region of Évora used small exterior doors/windows as a strategy to mitigate the influence of the climate on the conditions of indoor thermal comfort of buildings.

The findings showed a difference of 7°C and 16°C between indoor temperatures and the peak outdoor temperatures, which means that the number, size and the building openings' orientation has great potential on the building thermal performance (Fernandes et al., 2015).

Controlling buildings thermal performance could be achieved and improved through the building openings design, dealing with the size, number, shading, and orientation. The suitable design for this element affects the building thermal performance directly, as it reduces heat gains efficiently, benefits the wind breeze in summer days to cool the building, and the intake of sunlight in winter days.

Old buildings have less and smaller openings than the contemporary ones (Figures A, B and C compared with Figures G, H and I of Table 10). In contemporary buildings, the number and the size of the openings are higher, without any concern of the climate conditions or any consideration of privacy aspects.

When talking about privacy, which is an important aspect, the number, size, and orientation of windows is very important. Ignoring this will expose the community to some serious social problems.

Some solutions were implemented for some necessary “Windcatcher” openings to avoid the direct sunlight while maintaining privacy. These solutions are represented with the concept of “*Mashrabiya*”, which is an architectural element acting as a screen (Figure C of Table 10). This screen allows wind movement to enter or exit the building during summer days, at the same time preventing sunlight from entering the building, and also giving visual privacy for the room behind.



Orientation is also an important used strategy. In general, buildings in the old city are compact and side-by-side and most of the openings are oriented into the courtyard as presented in Figure B of Table 10. Most of the outside openings are oriented to the north and the west because of the old city's layout, while the new urban areas are not oriented systematically, it is irregular and not pre-planned. Privacy could not be ignored here, the main reason behind the inside oriented openings at the old city of Nablus is minimising the possibility to be seen or heard by the people outside.

Also, some small openings in the external wall were enough for visual contact and to promote natural ventilation, which was the approach used in the vernacular buildings. At the old city, a kind of perforated facades was also used in the name of "*Kizar*" for both privacy and cooling purposes.

It was generally used on building roofs or terraces, as seen in Figure F in Table 10. These pottery facades were used to prevent the users of the space from both hot winds in summer and visual contact with the public. The main used material was pottery, as it was cheap, easy to use, and available in the environment. However, in a few cases, it could be found in wood, but pottery is more effective in the cooling process.

Table 10. Openings comparison depending on number and size, shading, orientation, facades (Sources – figures A and E: "Nablus" 2011"; D, C and F: "DOOZ" 2016).



OLD CITY (NABLUS)	NEW CITY
1) NUMBER AND SIZE	
A	G
	
A LIMITED NUMBER OF BUILDING OPENINGS	A LARGE NUMBER OF BUILDINGS OPENINGS

Table 10. Openings comparison depending on number and size, shading, orientation, facades (Sources – figures A and E: “Nablus” 2011“; D, C and F: “DOOZ” 2016) (continuation)

OLD CITY (NABLUS)	NEW CITY
B	H
	
PROPORTION OF THE OPENINGS (10-15%)	PROPORTION OF THE OPENINGS (30-35%)
2) SHADING	
C	I
	
	
SHADING AND PRIVACY ELEMENT “MASHRABIYA” WOODEN SCREEN, PRIVACY AND SHADING ASPECTS	NON-SHADED OPENINGS, CONTEMPORARY BUILDING THE LOSS OF PRIVACY CONCEPT

Table 10. Openings comparison depending on number and size, shading, orientation, facades (Sources – figures A and E: “Nablus” 2011“; D, C and F: “DOOZ” 2016) (continuation)

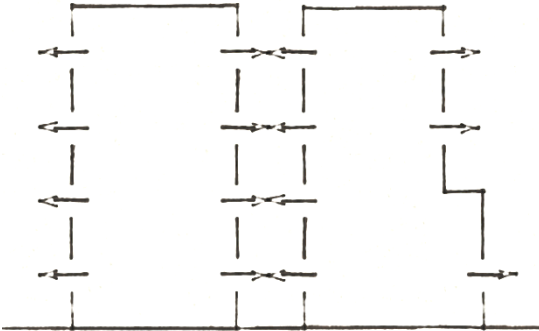
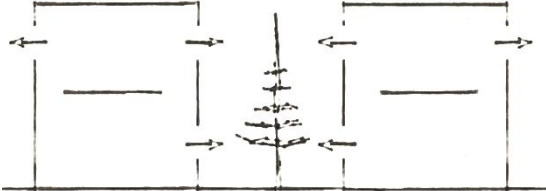
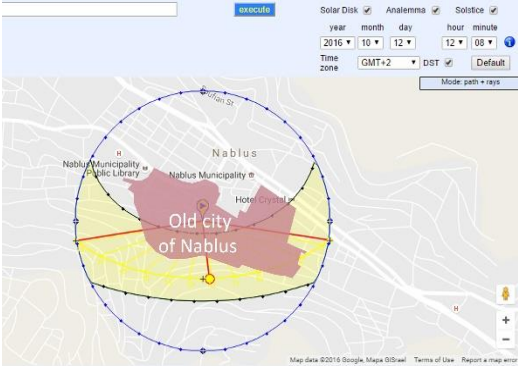
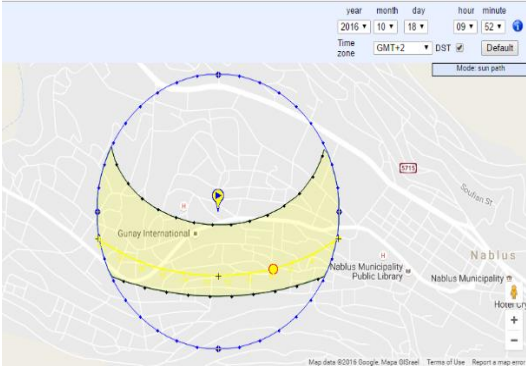
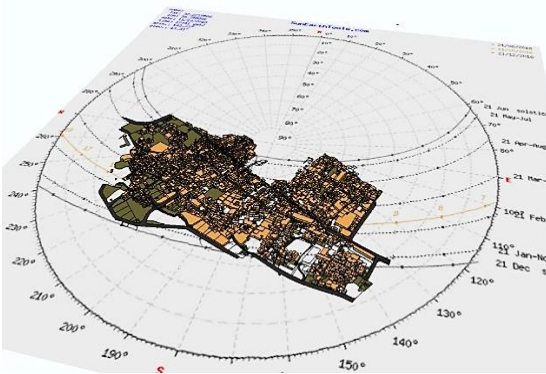

OLD CITY (NABLUS)	NEW CITY
3) ORIENTATION	J
D	
	OPENINGS ORIENTED TO ALL DIRECTIONS
OPENINGS ORIENTED INSIDE THE COURTYARD	
E	K
	
ORIENTATION DEPENDING ON SUN POSITION, AIR MOVEMENT, AND TOPOGRAPHY	ORIENTATION DEPENDING ON STREETS AND TOPOGRAPHY ONLY
F	L
	
OLD CITY BUILDINGS, NORTH-SOUTH ORIENTED OPENINGS	REGULAR OPENINGS AT CONTEMPORARY BUILDINGS

Table 10. Openings comparison depending on number and size, shading, orientation, facades (Sources – figures A and E: “Nablus” 2011”; D, C and F: “DOOZ” 2016) (continuation)

OLD CITY (NABLUS)	NEW CITY
3) BUILDING PERFORATED FACADES/FACES	
F	L
	
THE USE OF “ KIZAN ” FOR PRIVACY AND COOLING ASPECTS	THE SOLID HUGE ELEVATIONS IN THE NEW URBAN AREAS

#### 4.4.4. Vegetation

Vegetation is useful to provide shade and to increase air moisture via evapotranspiration process, helping to cool the airflow before reaching the building. This strategy was used in the old city of Nablus in residential and public buildings such as mosques and the “*khan*”. Trees were planted beside windows and doors, inside and outside houses, as seen in Figures A and B from Table 11, providing the building with shadow in hot summer days. In the new urban areas, buildings do not have green elements, being directly exposed to sunlight in hot summer days as seen in Figures D and E from Table 11.

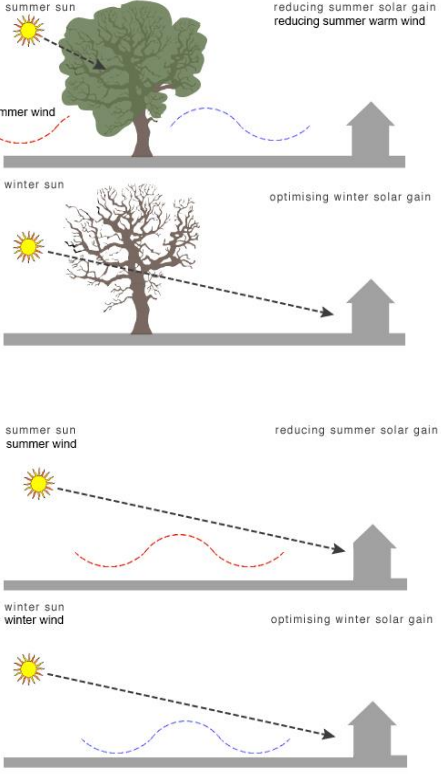

Also, green elements are effective during different seasons. In summer, trees are filled with leaves, which provide the shadows needed to reduce sun exposure. In winter, the leaves fall, and more sunlight reaches the building heating it on cold winter days. This process has no cost, using only a natural element, unlike the

process in the new urban areas were buildings are exposed to sunlight in summer, causing a high rate of solar gain, without any attempt to ventilate buildings naturally through trees (Figures C and F from Table 11).

Table 11. Vegetation outside and inside buildings, comparison (Sources – figure A:("Nablus," 2011); B, D:" ("House of Water and Environment," n.d.)

OLD CITY (NABLUS)	NEW CITY
<p data-bbox="256 405 272 426">A</p>  <p data-bbox="256 1178 708 1199">THE USE OF GREEN ELEMENTS ON ELEVATION AND INSIDE COURTS</p>	<p data-bbox="824 405 841 426">D</p>  <p data-bbox="824 1178 1222 1199">MISSED GREEN ELEMENTS ON ANY PART OF THE BUILDING.</p>
<p data-bbox="256 1220 272 1241">B</p>  <p data-bbox="256 1682 678 1703">SHADOWS BECAUSE OF USING PLANTS AND GREEN ELEMENTS.</p>	<p data-bbox="824 1220 841 1241">E</p>  <p data-bbox="824 1682 1317 1745">BUILDINGS EXPOSED TO DIRECT SUNLIGHT WITHOUT PLANTS AND GREEN ELEMENTS.</p>

Table 11. Vegetation outside and inside buildings, comparison (Sources – figure A:("Nablus," 2011); B, D:" ("House of Water and Environment," n.d.) (continuation)

OLD CITY (NABLUS)	NEW CITY
<p data-bbox="256 310 272 331">C</p>  <p data-bbox="256 1150 743 1213">SHADING BY SUSTAINABLE MATERIALS COMPATIBLE WITH THE SEASONS, WITHOUT ANY OPERATING COST.</p>	<p data-bbox="824 310 841 331">F</p>  <p data-bbox="824 1161 1369 1182">MANUFACTURED, AN UNSUSTAINABLE MATERIAL WITH AN OPERATING COST.</p>





#### 4.4.5. Building image

The sense of equality among people living in the old cities of Palestine is achieved through the outside image of the buildings. Depending on the modesty constraint, all the buildings seem to be equal. No one is rich or poor from the outside, and they all have the same building characteristics from outside. As seen in Figure B of Table 12, and as mentioned before, inside the building people are free to live however they want within the Islamic constraints.

This equality principle is missing in the new urban areas. Rich people had their special deluxe houses, that could be noticed from both, outside and inside, through building material, shape, area, and number of floors (Figure C of Table 12). At the same time, poor people had their simple and modest houses which could also be noticed through the building material, shape, building areas, and floors number. This image is clear from

outside the house as seen in Figure D of Table 12. This feeling of equality in the old city was supporting the national and local security between people, unlike the modern buildings where very wild differences could be noticed between buildings, poor and rich people are extremely perceived.

Table 12. Building image comparison, outside and inside view (Sources – figure B:("Nablus," 2011)

OLD CITY (NABLUS)	NEW CITY
<p data-bbox="250 464 266 485">A</p>  <p data-bbox="250 1003 634 1024">THE SIMILAR AND SIMPLE OUTSIDE IMAGE OF BUILDINGS.</p>	<p data-bbox="821 464 837 485">C</p>  <p data-bbox="821 1003 1357 1066">THE FINANCIAL SITUATION OF DWELLERS REFLECTED ON BUILDING ELEVATIONS AND IMAGE.</p>
<p data-bbox="250 1083 266 1104">B</p>  <p data-bbox="250 1539 776 1602">DWELLERS ECONOMIC CONDITION WAS REFLECTED IN THE INTERIOR SPACE OF HOUSES.</p>	<p data-bbox="821 1083 837 1104">D</p>  <p data-bbox="821 1539 1227 1560">POOR AND RICH AREAS ARE CLEAR ON THE BUILDING IMAGE.</p>

#### 4.4.6. Noise transmission (controlling the exposure to noise)

Noise transmission almost did not exist in the old city of Nablus because of many reasons. The urban design strategy depended on low-rise separated cluster houses (Figure A of Table 13), and on the courtyard house.

These strategies reduced the level of noise transmission between neighbours to the minimum due to non-continuous mass, as seen in Figure B of Table 13, and, to the different scale and use of streets and paths.

Many studies focused on the relationship that can exist between urban fabric and noise distribution, proving that the distribution of road noise depends on the urban form and that there is a strong relationship between urban fabric and road noisescape (Bouzir & Zemmouri, 2017). The spacing between buildings, cavities, and streets dimensions could play a good rule in distributing noise, areas between buildings and semi-courts have the lowest noise levels (Figure 108).

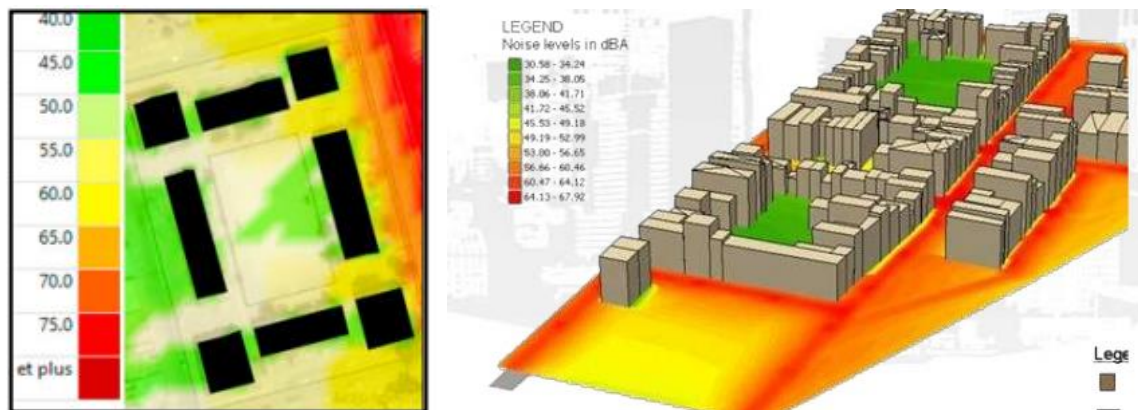


Figure 108. Noise map showing the rule of city urban fabric in distributing noise (Bouzir & Zemmouri, 2017)

These strategies reduced noise transmission between buildings to the lowest or minimum levels as seen in Figures C and D of Table 13. On the other hand, noise transmission in the new urban areas was clear and effective in a very strong way.

The designs strategy used here depends on high rise overlaid apartments (Figure E from Table 13), leading to a continuous vertical mass, which transmits noise and sounds between the floors and apartments (Physical Techniques to Reduce Noise Impacts - FHWA, n.d.). Also, airborne sound transmission between apartments is high, since there is no insulation between those; there is like a continuous space on the horizontal level, as seen in Figure F from Table 13.

Streets and city network in the new urban areas enhanced noise transmission. More parts of the buildings were exposed to outside or street noise because of the semi-grid system since the public streets were used by many types of cars and vehicles, as seen in Figures G and H from Table 13.



Table 13. Noise transmission comparison depending on vertical and horizontal, outside and inside transmission (Sources – figures A and D: (“presidentsmedals,” n.d.); E, F and H: (“Acoustic insulation | Ursa,” n.d.)


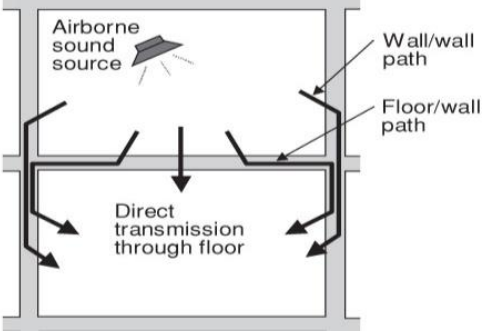
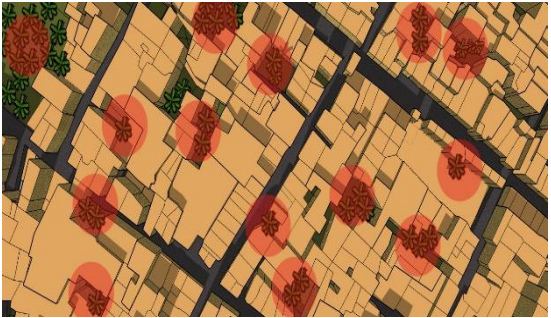
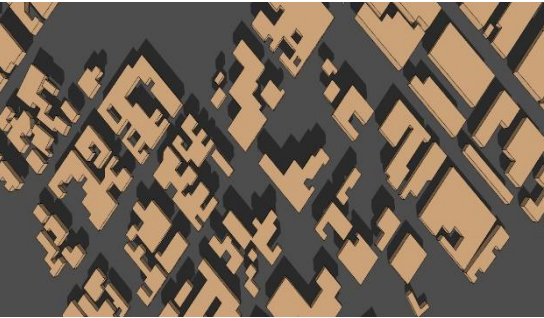

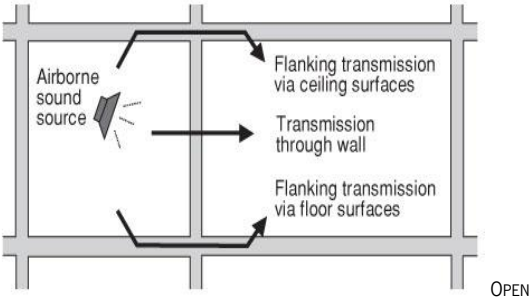
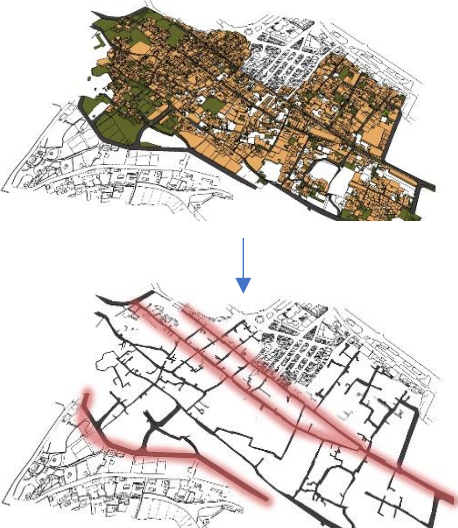

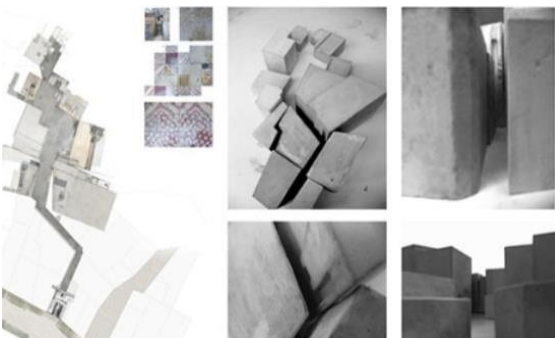
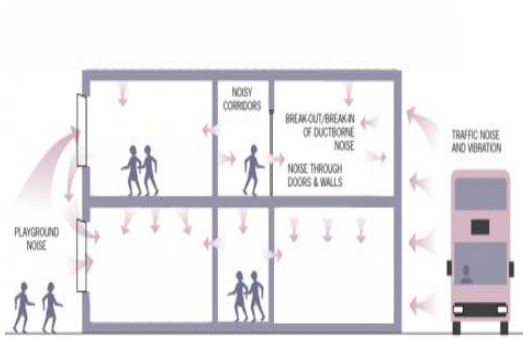
OLD CITY (NABLUS)	NEW CITY
1) VERTICAL NOISE TRANSMISSION	
A	E
	
LOW NOISE TRANSMISSION THROUGH LOW RISE BUILDINGS.	HIGH LEVEL OF VERTICAL NOISE TRANSMISSION.
2) HORIZONTAL NOISE TRANSMISSION	
B	F
	
	
COURTYARDS WORKING AS A “CAVITY”, A PREVENTIVE TOOL OF NOISE HORIZONTAL TRANSMISSION	STREETS AND SEPARATED BUILDINGS INCREASE NOISE FROM OUTSIDE BUILDINGS.

Table 13. Noise transmission comparison depending on vertical and horizontal, outside and inside transmission (Sources – figures A and D: (“presidentsmedals,” n.d.); E, F and H: (“Acoustic insulation | Ursa,” n.d.) (continuation)

OLD CITY (NABLUS)	NEW CITY
2) OUTSIDE NOISE TRANSMISSION	
<p>C</p> 	<p>G</p> 
THE DIFFERENT STREETS TYPES ALLOWED TO DECREASE NOISE TRANSMISSION.	PUBLIC AND NOT CLASSIFIED STREETS HELPED TO INCREASE NOISE TRANSMISSION.
<p>D</p> 	<p>H</p> 
PEDESTRIAN PATHS WITHOUT VEHICLES ALSO HELPED TO DECREASE OUTSIDE NOISE.	Allowing vehicles to use all streets helped to increase outside noise.

#### **4.4.7. Discussion**

As presented, there were many strategies used in the old city during the building process, in both building and urban level, and most of these were based on sociocultural and religious constraints such as privacy, no harm, etc.

These building level strategies were missed in contemporary building design and construction and city planning. Those strategies are summarised and discussed below at the following levels: i) building material; ii) interior spaces; iii) openings; and iv) vegetation; v) building image and; iv) noise transmission and exposure.

##### **i. Building material**

Materials used in buildings in the old city depended on natural, local, and sustainable materials. No materials were imported from outside the area, and no materials were processed or manufactured, the elements used were mud and earth with thick dimensions. It allowed improving the buildings' thermal and acoustic performances and enhancing sustainable aspects in the city.

The new urban areas and modern or contemporary buildings are very different. They depend more on synthetic materials such as concrete and steel, which are not sustainable materials, not local, and hard to reuse in Palestine. These construction elements are also poor regarding thermal or noise insulation if used alone without adding insulation materials.

##### **ii. Interior spaces**

The great difference between interior spaces of both the old city houses and new city apartments was clear. Privacy in the old city was very important and the house design was depending mainly on this constraint.

More constraints affected interior spaces at the old city of Nablus, such as modesty and hospitality; the courtyard house was one of the many solutions responding to these values. Also, the temperature of these interior spaces was important, hot and dry summer days were faced with suitable and environmental solutions, such as evaporative cooling tools.

The contemporary houses depend more on financial aspects, ignoring the other important aspects. People want to build a cheap house, or a cheap place to stay, whatever the result was, or if this house fits their culture or believes. As a result, the houses were designed without any care about sociocultural values, interior environment, and without any care about the environmental aspects.

### **iii.** Openings

Openings are very important in the design process, namely their area, location, and orientation.

In the old city houses, it was clear that people considered that either for privacy aspects or passive cooling strategies. The number of openings was limited to control heat gains and losses, and oriented to collect the needed cool wind in hot summer days, and sunlight in cold winter days, besides achieving the suitable level of acoustical and visual privacy.

On the other hand, in the contemporary buildings, this strategy is missing, as openings were located without any concern regarding the sunlight or wind direction in summer and winter, and privacy was not achieved at any level.

### **iv.** Vegetation

Green elements, in general, are very important in both city and building levels, and even if trees were planted to achieve a building level goal, it was useful for the city in its urban level.

In the building level in the old city, trees and plants were used to achieve many aspects and constraints, such as privacy, but it was also useful in cooling building during hot summer days, and making the city healthy.

This is missing in the new urban areas and buildings. It is difficult to plant trees in the new apartments because there is no suitable place, and the local governments are poor and cannot allocate a place for a green area for the neighbourhoods. Thus, shading and cool wind were missed in the new urban areas, and the city tends to become unhealthy.

### **v.** Building image

The commitment with modesty, the most effective constraint here, led to the image of the old city buildings, where the feeling of equality is dominant. From the outside, the buildings are similar and almost the same and rich and poor people have buildings with a similar outside aspect. That would reduce the manifestations of envy and antagonism among people in society. Inside the house, people could live free and give the interior space the image they want, but without luxury. This is missing in the new urban areas and buildings. The outside image of the building depends on the financial condition of the owner, and that could be easily noticed in the new urban areas.

## **vi.** Noise transmission

As seen, the strategies of the old city and the contemporary city strongly affects the noise exposure. The old city strategies helped to reduce noise to minimum levels. This was achieved by reducing main roads passing through the residential areas, depending more and more on minor and pedestrian roads. With such formation, noise becomes imperceptible because of the reduced number of users and their tools or carts.

Moreover, the concept of "*Housh*" or yard which is a private area with the refracted entrance also reduces the noise arising from the different activities to the neighbours. Also, the courtyard is separated from the neighbours, preventing noise transmission between buildings.

At the contemporary buildings, the activity area and the living room are not separated, thus the noise is simply transmitted through walls, doors, and floors. The contemporary city is also designed and based on a grid system, depending on separated buildings surrounded from, at least one side by a street with a 6-meter width in tow way path. Thus, buildings are surrounded by roads, generally main roads, and the outside noise reaches directly every side of the building.

The comparison presented strategies in the old city of Nablus, which were stimulated by sociocultural values, affecting the city sustainability, and one of the main goals of this research was to learn from such an old and sustainable city to improve the contemporary buildings and new urban areas regarding sustainable aspects. Table 14 summarises and clarifies the differences between old and new urban areas, and how the strategies used in each part of the city enhanced sustainability or how sustainability is affected negatively.

Table 14. Comparison between the old city of Nablus and the new urban areas, at the level of each city component and features

City components and features	Old city		New urban areas	
	EFFECTIVE CONSTRAIN	EFFECT ON THE CITY SUSTAINABILITY	EFFECTIVE CONSTRAIN	EFFECT ON THE CITY SUSTAINABILITY
<b>CITY LAYOUT</b>	PRIVACY, NO HARM	LIGHTING AND SHADES, LIMITED LAND AND RESOURCES USE	IMPORTED LAWS AND LEGISLATION, STAKEHOLDERS	NON-SHADED AREAS, HIGH CONSUMPTION OF RESOURCES
<b>CITY SKYLINE</b>	NO HARM, PRIVACY	LIGHTING, WIND, SUNLIGHT EXPOSURE AND VENTILATION	FINANCIAL ASPECTS, LACK OF LAND	SOCIAL PROBLEMS AND DIFFICULT ACCESS TO DIRECT SUN AND THE WIND
<b>URBAN PUBLIC AND GREEN SPACES</b>	RESPONSIBILITY	PEOPLE CONCERN AND PARTICIPATION, GREEN VITAL AREAS, SOCIAL ACTIVITY AREAS AND HEALTHY ENVIRONMENT	POOR LOCAL GOVERNMENTS, LACK OF LAND AND LACK OF CONCERN FROM PEOPLE	LACK OF PARKS AND GREEN AREAS, CREATING AN UNHEALTHY ENVIRONMENT
<b>INFRASTRUCTURE</b>	RESPONSIBILITY, MODESTY, HOSPITALITY, NO HARM	CITY NETWORK, PUBLIC WATER FOUNTAINS AND OTHER PUBLIC ELEMENTS,	NEW TECHNOLOGIES AND CONTEMPORARY SEWER SYSTEM	POOR STREETS NETWORK CLASSIFICATION, EFFECTIVE SEWER NETWORK
<b>BUILDING MATERIAL</b>	MODESTY, NO HARM	LOCAL SUSTAINABLE MATERIALS AND THERMAL EFFICIENCY	FINANCIAL ASPECTS	LOCAL AND IMPORTED SYNTHETIC MATERIALS AND LOW THERMAL EFFICIENCY
<b>INTERIOR SPACES</b>	PRIVACY AND HOSPITALITY	THERMAL EFFICIENCY, PASSIVE COOLING, HEAT GAIN AND PROMOTION OF NATURAL LIGHT	FINANCIAL ASPECTS, LOW LEVEL OF PRIVACY	RANDOM INTERIOR SPACES AND THE USE OF ARTIFICIAL LIGHT
<b>OPENINGS</b>	PRIVACY, NO HARM AND MODESTY	ORIENTED OPENINGS, AND PASSIVE COOLING AND VENTILATION	NO RULES OR LIMITATIONS	RANDOM OPENINGS AND BAD ORIENTED
<b>VEGETATION</b>	PRIVACY, RESPONSIBILITY AND NO HARM	PASSIVE COOLING AND HEALTHY ENVIRONMENT	NO RULES OR LIMITATIONS	UNHEALTHY ENVIRONMENT AND ARTIFICIAL COOLING
<b>BUILDING IMAGE</b>	MODESTY	SOCIETY SECURITY	IMPORTED LAWS AND LEGISLATION	SOCIAL CLASS
<b>NOISE TRANSMISSION</b>	PRIVACY, NO HARM AND RESPONSIBILITY	LOW LEVELS OF NOISE	NO RULES OR LIMITATIONS	HIGH LEVELS OF NOISE

## **Chapter 5. Guidelines, future work and improving reality**

### **5.1. Guidelines extraction and development**

Through the previous comparative approach, the differences between the old and the new urban areas strategies were discussed. In both urban and building levels, the old city strategies – coming from sociocultural aspects – led the city to achieve a great level of sustainability. On the contrary, the new urban areas strategies ignored the sociocultural aspects, leading the city to a lower level of sustainability.

At the new urban areas of Nablus, urban designers in municipalities, architects in consultant offices, and stakeholders are responsible for the current architectural situation in both urban and building levels, as they followed the rules and legislation in municipalities, and the result of such an approach could be noticed in the comparison chapter (Chapter 4) between the old and new urban areas before.

Based on the conclusions of the previous chapters, some guidelines were developed. These guidelines aim to support decision-making in the designing stage of residential areas and dwellings in Palestine, in order to restore the spirit of vernacular architecture. This would aid achieving and reaching sustainable architecture as in the past, the architecture of people. These guidelines are also suitable to be used in the design of residential buildings in the Arabic and Islamic cities in the Mediterranean basin, regarding a lot of common aspects, such as the similar climatic conditions, the similar culture and religion.

These guidelines extract the advantages from both the old and the new urban areas and summarise the strategies, which can support the development of more sustainable cities.

The guidelines were suggested and developed as a result from the analysis of Nablus old and new city areas. The positive and negative aspects of both urban areas were noticed and reformulated in the next suggested guidelines.

## 5.2. Urban level guidelines

The urban level suggested guidelines are addressed for inhabitants, architects and urban designers. As mentioned, urban designers at municipalities and local governments are responsible for the contemporary architectural situation more than its inhabitants. Of course, people are concerned with these guidelines. Therefore, they should be aware of these guidelines and should also participate in the urban level design process. Nevertheless, architects and urban designers are the ones that must follow the rules and laws, which led the contemporary city to the image seen nowadays.

The guidelines concluded from the previous parts could be summarised and classified within sustainable categories: innovation and design; awareness and education; indoor environmental quality; materials and resources; energy and atmosphere; water efficiency; sustainable sites and location and linkages (Figure 109).

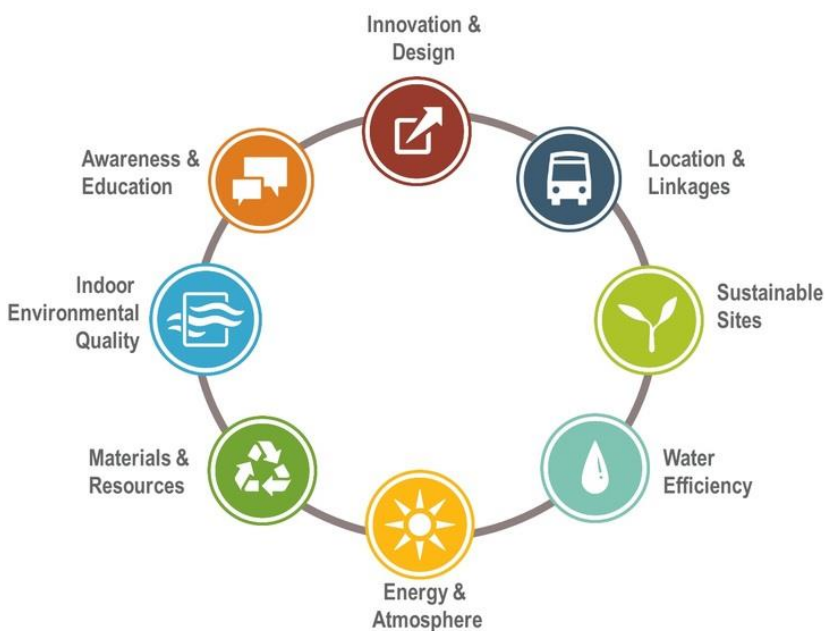


Figure 109. Sustainable categories for certifying sustainable buildings. Adapted from (Council, 2010)

These categories could make it easier for designers to reach the gap during the design process and could help designers to understand these guidelines, these guidelines could be summarised at the urban level in table 15:



Table 15. Suggested urban level guidelines within each sustainable category



Sustainable category	Suggested guideline
<p>Awareness and education</p> 	<ol style="list-style-type: none"> <li>1. People should be involved and participate in the urban design process, supporting decision-making. Municipalities and local governments should invite people to participate in any design related to their city.</li> <li>2. Sociocultural constraints are crucial during the urban design process. The city in its components and design should respect people's culture.</li> <li>3. The city layout should enhance privacy in all levels, acoustic, visual and olfactory privacy. The compact layout is a good example of city design, preventing sounds from being transmitted or private spaces from being exposed or seen by others.</li> </ol>
<p>Energy &amp; atmosphere</p> 	<ol style="list-style-type: none"> <li>4. The city layout should consider the climatic aspects; hot summer days should have less effect on buildings by the compact buildings shading the streets and paths, especially pedestrian paths.</li> <li>5. The climatic aspects should be taken into consideration during the urban design process. For instance, a hot city area design is different from a cold city area design; the city components and layout are quite different.</li> <li>6. Sun movement and wind directions should be included in urban design considerations. Designers should be aware of sun movement calculations and find solutions such as sun breakers.</li> <li>7. The city should be oriented to benefit from sunlight and wind circulation. Sunlight in winter is essential, thus it should be collected through openings, and the effect of the sunlight in summer should be reduced by orientation.</li> </ol>

Table 15. Suggested urban level guidelines within each sustainable category (continuation)







Sustainable category	Suggested guideline
 <p data-bbox="337 405 581 436">Energy &amp; atmosphere</p>	<p data-bbox="654 310 1281 443">8. City skyline line should guarantee that neighbour buildings would not prevent sunlight and wind from reaching other buildings, through a limited height for instance.</p>
<p data-bbox="199 478 440 510">Innovation &amp; Design</p> 	<p data-bbox="654 478 1281 653">9. City layout should reduce and avoid noise transmission between buildings. Through cavities in the city layout such as courts and public, semi-public areas, these cavities reduce noise transmission.</p> <p data-bbox="654 688 1281 863">10. City skyline should respect privacy in all its levels, through a limited height of buildings, for instance. Other solutions could be created to avoid breaking privacy such as building orientation, size and number of openings facing neighbours.</p> <p data-bbox="654 898 1281 1073">11. Workshops, commercial areas, and residential quarters are different functional areas and should be separated in the city structural plan regarding privacy, and no-harm constraints.</p>
<p data-bbox="199 1119 402 1150">Sustainable sites</p> 	<p data-bbox="654 1119 1281 1199">12. The city should benefit from the topography of the place, in sewer and water networks, for instance.</p> <p data-bbox="654 1234 1281 1451">13. Green areas should be included in the structural plan designs by urban planners at municipalities and local governments; these green areas should also respect sociocultural constraints and should occupy at least 40% of the urban areas.</p> <p data-bbox="654 1486 1281 1619">14. Green and public areas should be distributed throughout the city in the urban design process, where every quarter or neighbourhood should have a green and a public space.</p> <p data-bbox="654 1654 1281 1829">15. The city should contain public spaces for different social activities; these should respect sociocultural and religious constraints such as social interaction between women and men.</p>

Table 15. Suggested urban level guidelines within each sustainable category (continuation)

Sustainable category	Suggested guideline
Material & resources 	16. Sustainable materials should be used in streets, paths and other city components. Local materials which are available and could be reused and recycled  17. Light coloured materials should be used to reduce solar gains.  18. The city network should use local and recycled natural materials such as local stone or building stone remains, rather than imported synthetic materials.
location and linkages 	19. The city network system -“streets”- should adopt streets types and classifications depending on privacy levels, like public, semi-public, and private streets.  20. Streets used by pedestrians, private and public cars should be identified; the mix between street users causes more pollution and non-organised cities.  21. The city network should depend more on pedestrian streets to reduce noise and pollution and to encourage people to walk, which is healthy for them.
Water efficiency 	22. Water network and people should benefit from natural springs at the city. Many springs in the new urban areas are not used because they are allocated in state-owned land.  23. Public water resources should be distributed all around the city to enhance social interaction between people. Water is very important in Palestine, and public water through the history was a place for people to meet and to talk.  24. Water elements should be used to cool temperature in public areas and to keep the city healthy.  25. Water distribution to the city should benefit from the city topography to reduce dependence on mechanic tools, to reach the buildings all around the city.

### 5.3. Building level guidelines

The guidelines suggested at the building level are more directed to the dwellers in the first place than to architects because owners and building promoters are the ones responsible for the budget decisions, which play an important in the design decision process.

Generally, in Palestine and the Arab Islamic area, architects follow the wishes of the owner while designing a house, but of course, people are not aware of all the details during the design process. Therefore, these guidelines are important for both architects and dwellers.

Although, the building level guidelines concluded from the previous parts could be summarised and classified within sustainable categories mentioned before, and the guidelines could be summarised in table 16 as:

Table 16. Suggested building level guidelines within each sustainable category



Sustainable category	Suggested guideline
Awareness and education 	<ol style="list-style-type: none"> <li>1. People should be involved in the dwelling's design and participate in the decision-making process.</li> <li>2. Differences between people should be hidden by designing and approximate external building image, people must feel a sense of equality in the society or state in which they live.</li> <li>3. Building design should respect and enhance people sociocultural aspects, such as privacy, modesty, etc., especially while designing a building for conservative people such as Arab and Muslim people.</li> </ol>
Energy & atmosphere 	<ol style="list-style-type: none"> <li>4. Buildings in the Mediterranean basin countries should benefit from the sunlight in the long sunny days for energy production, through providing the energy needed for cooling and heating. Many technologies could be used here such as solar thermal collectors and PVs.</li> </ol>

Table 16. Suggested building level guidelines within each sustainable category (continuation)




Sustainable category	Suggested guideline
Energy & atmosphere 	<ol style="list-style-type: none"> <li>5. Heat gain could be enhanced by studying and analysing the orientation and the height of the openings, courtyards, roof gardens, dynamic and perforated envelopes; these strategies to capture the solar radiation during winter must be a priority.</li> <li>6. To improve passive cooling and to reduce the use of air conditioning systems, it is possible to consider some principles already used in the vernacular construction, such strategies such as “Kizan” or “Malqaf”.</li> <li>7. Screens such as “Mashrabiya” or “Kizan” improve building thermal performance either in cooling or heating the building, for instance, wet “Kizan” work as an evaporative cooling system is hot summer days.</li> </ol>
Innovation & Design 	<ol style="list-style-type: none"> <li>8. Building screens are important in achieving the requested level of privacy if not achieved by the building itself, either visual or acoustical privacy, building screens act as auxiliary elements.</li> <li>9. The exterior building image should keep a level of equality and modesty in the city; Many social problems occurred because of the high financial differences between people.</li> </ol>
Material & resources 	<ol style="list-style-type: none"> <li>10. The building materials should depend more on the local environment, selecting sustainable and local materials instead of imported synthetic materials. Preference should also be given to materials that can be recycled and reused such as building stone.</li> <li>11. New insulation materials and technologies should be developed and used to improve indoor environmental quality (IEQ), instead of depending on mechanical and electrical tools to improve indoor environmental quality.</li> </ol>

Table 16. Suggested building level guidelines within each sustainable category (continuation)




Sustainable category	Suggested guideline
<p>Material &amp; resources</p> 	<p>12. Light colours should be used especially on building roofs and facades to decrease heat gain in hot summer days and to reduce the heat island effect.</p> <p>13. Give preference to local, available, and cheap materials such as stones and mud, as these promote sustainability by reducing the potential environmental impacts and costs. Nevertheless, such materials should be used parsimoniously when needed.</p>
 <p>Sustainable sites</p>	<p>14. Plants and trees should be used for shading buildings and streets around the city.</p>
<p>Indoor env. quality</p> 	<p>15. Interior spaces should fit the user's needs and size; space should be compatible with the number of family members; to achieve that, analysis followed by bubble zoning should be done. Imported and non-compatible plans or interior spaces with the people's needs and culture would drive social problems.</p> <p>16. Interior spaces should respect sociocultural aspects such as privacy and modesty. Interior spaces are the place where people live most of their time, and it should fit their believes and culture.</p> <p>17. It is recommended to use green elements in the house indoor spaces such as balconies and living areas, and on building facades for healthy and cooling aspects.</p> <p>18. Building openings should be oriented to benefit from sunlight in cold winter days, and the wind in the summer hot days. Sun and the wind should be studied and analysed. South sunlight is important in Nablus winter, the north wind is important in Nablus summer days.</p>

Table 16. Suggested building level guidelines within each sustainable category (continuation)

Sustainable category			Suggested guideline
Indoor	env.	quality	<p>19. Building openings should respect privacy levels, the height and the number of openings should be analysed and studied to achieve different levels of privacy.</p> <p>20. In addition to buildings height, openings should not harm neighbours by not respecting their privacy in all its levels. For instance, people should not see their neighbours house or part of the house through an opening.</p> <p>21. Buildings openings are very important in enhancing building thermal performance; by studying the position of the opening, the height and the sun or the wind it could collect during summer or winter.</p> <p>22. Green elements are important in improving the dweller's health. Regarding psychological aspects, people feel relax and close to nature when green elements are available in the house, if possible, green elements could be placed in courtyards, balconies, and outside surfaces.</p> <p>23. Plants and trees used in houses aid achieving interior thermal comfort, because of the leaves of the plants and trees work as an evaporative cooling tool.</p> <p>24. Buildings should be designed to avoid noise transmission through the interior spaces and cavities; cavities help to reduce noise transmission between buildings, courtyards are a good example of such cavities.</p>



As mentioned before, these guidelines would help designers during the design process to be a sustainable one. Designers pass through many stages to produce the final product, starting from the designer himself, passing through establishing the program of the project, and ending with producing the design solution. Designers study this process during their education and it represents their language, therefore, these

guidelines should address designers (architects, interior designers, urban designers, and landscape architects) in their own language to be more effective (Figure 110).

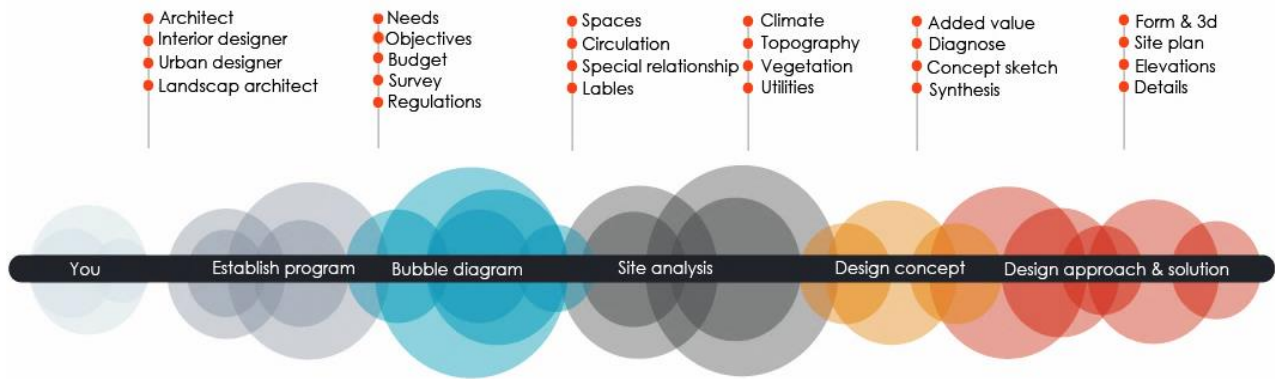


Figure 110. A diagram representing the overall relationship of the design process (Lin, 1993)

The next diagram presents the design process stages including effective sustainable categories on each phase, this could save time and effort during the design process, designers could use this diagram as a manual for the guidelines (Figure 111).

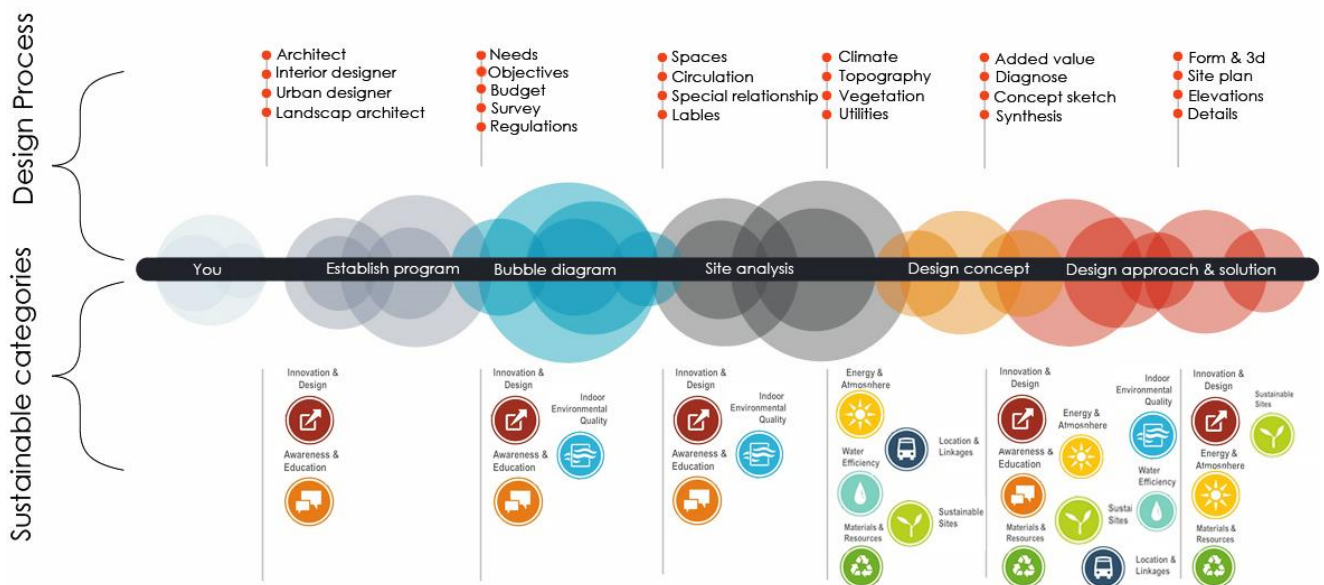


Figure 111. Guidelines categories manual for designers (Lin, 1993)



## **Chapter 6. Application of the developed guidelines to a case study**

The guidelines suggested in the previous chapter should be tested, to check if these would be able to change some of the building design processes followed nowadays.

The two main parts of the contemporary design process in Palestine are the owners of the house and the architect of the consultant office. So, the test should be applied to these main parts, a consultant office designing a residential project for a group of dwellers.

To achieve that, the test should be applied in cooperation with an engineering office or a consultant office designing a house or a part of one for a nongovernmental or a public sector, to be able to communicate with dwellers. The target group should belong to the average Palestinian citizen, considering the jobs, educational levels, and backgrounds. Special social classes such as doctors or engineers are excluded from the study since they can have different opinions and demands, and not to be a representative group for the community.

### **6.1. Case study selection**

A housing project for the employees of a local communication company was chosen on the outskirts of Nablus city. The workers' association of the company, as a representative of the employees, bought the land with the contribution of the employees. They planned to hire a contractor to build the houses and the employees would make monthly payments so that the site and the buildings could be theirs.

The housing project consists of dwellings for seventy-five families, divided into two phases (Figure 112). The first phase includes 35 dwellings on a site area of 4760 m<sup>2</sup>, while the second phase includes 40 dwellings on 9850 m<sup>2</sup>. The consultant office was assigned to design the first phase of the project. A good sample of the community was achieved in this project, as the considered employees of the company, have different jobs (managers, secretaries, maintenance workers...), different financial conditions, different education level, different number of family members, and different needs.

The responsible consultant of the office gave permission to the researcher to carry on with the test of the guidelines without mentioning the name of the communications company, the consultant office, the location of the project, or any of the families of this housing project, for privacy reasons.

The contact with the consultant office was at the final stages of the design process, which allowed a good and updated case for the contemporary design process without the researcher intervention or influence.

The thirty-five dwellings were distributed on four buildings, each building consists of six floors, each floor contains two apartments. And for future extinction of the project, there is a proposed fifth building. In addition, the project contains proposed streets, green area, commercial stores and cars parking.

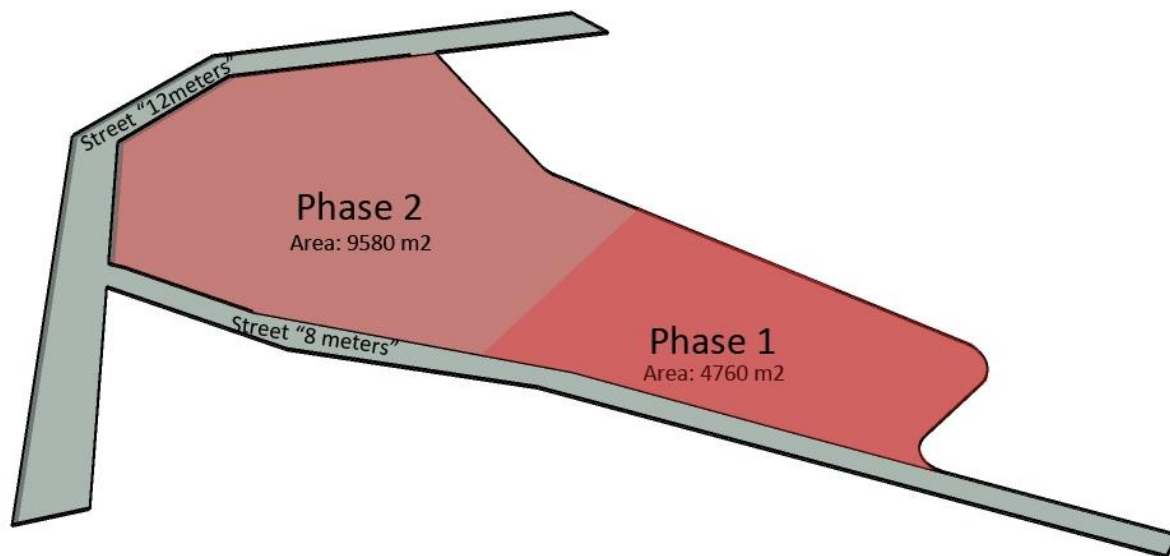


Figure 112. The land allocated for the proposed housing project with the 2 phases plan

Here, the plans of the consultant office will be presented without analysis, to give an idea about the way the design process was done and the result of this process. Inhabitants participated through meetings that were held at each stage of the design process, for instance, meetings were held ant site plan design stage, plans stage, elevations stage, etc.

The grid system planning is clear at the urban level as seen in the site plan (Figures 113 and 114), the main street or a public street is then distributed to bystreets or semi-public streets between the buildings. Both streets are not less than eight meters wide, mainly suitable for vehicles circulation. A pedestrian can use

sidewalks to move or walk from a place to another. People here can use only the sidewalks of the streets to walk and to move from a building to another since streets here are serving vehicles more than pedestrians.



113. perspective site plan of the first phase project

Figure



Figure 114. General view of "the first phase" of the proposed project

To be at the same distance from all buildings, green areas are in a specific spot, in the middle of the development, surrounded by the five buildings. The green areas contain trees and plants, a playground area, and a sitting area.

To reach this public garden, children should pass the streets from their buildings to reach it. Additionally, parents could not see their children while playing there, since the garden is not seen from a lot of the

apartments, and they should be with their parents or one of them. Parents should keep children under their supervision while playing and staying in this area.

Trees were also distributed on the streets sides and around the buildings (Figure 115). This type of parks and trees are usually under the responsibility of the municipality or the local government.



Figure 115. The compound park showing the trees and the playground

Each building consists of six floors. The ground floor contains stores to supply the dwellers with the daily goods they need (Figures 116 and 117). The other five floors consist of two apartments in each floor, the roof and the rebounds “legal distance between the building and the land boundaries”, which are owned by all dwellers. Dwellers can use it for public purposes and not for private use.



Figure 116. A general view of one of the buildings, showing the number of floors and the stores on the ground floor



Figure 117. A general view of one of the buildings showing the number of floors and the stores on the ground floor

All the five buildings are surrounded by walls with a height of one and a half meters for privacy aspects as mentioned by the designer. At the top of the walls, there is a 70 cm fence for safety aspects. Each building has two gates in the wall, one of them is for vehicles to reach the parking under the building or around it and the other one is for pedestrians. From the main street, people could reach each building through bystreets with a suitable width for cars and vehicles (Figure 118).



Figure 118. A view of a bystreet inside the housing

Each apartment has three bedrooms, one of them being a master bedroom, two bathrooms, a living room, a kitchen, a guest room, and some balconies, with a separated entrance for the guest room (Figure 119). This design represents almost all contemporary residential apartments in Palestine.



Figure 119. The duplicated plan of the buildings with materials used in the exterior building walls

Regarding Inhabitants participation in the design, the process depended on an initial design sketch prepared by the architect. Then the design was discussed with the inhabitants and some small modifications could be done, such as: i) adding a bathroom for the guest room; ii) removing or adding a balcony or iii) changing the

kitchen interior design and its relation to the living room. Nevertheless, at the end, the architect provided the base of the design and people only proposed small modifications on it.

This kind of participation is a common practice in Palestine, inhabitants participated partially in the design process, such as the site plan design meeting, during which they asked for different commodities such as: a playing area for their children, a parking for their cars in each building and commercial store in each building to avoid going to the city centre to buy home supplies.

Higher participation was noticed in the design meeting of the interior spaces “plans” of the buildings and apartments, such as the number of staircases, where people asked for two staircases in each building, for more privacy while using them.

People also participated in determining the number of bedrooms, the location of some spaces, and adding some balconies, but, at the end, the design of the apartments in each floor was similar in all the buildings (Figure 120).

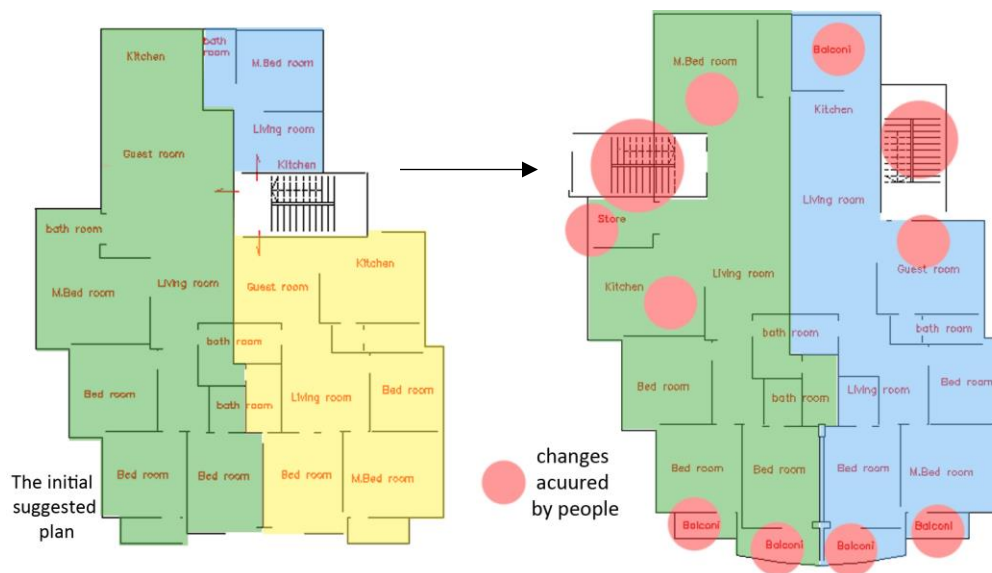


Figure 120. Changes occurred by people during the design of the plans

As noticed from the design process and from meetings with the architects involved in this project, people participation in the design of the dwelling was limited in certain actions. Additionally, urban level participation was almost completely ignored, and limited participation in building level was noticed.

The apartments openings, as seen in Figures 121 and 122, are distributed among all the building facades, and their size should match the standard opening size used nowadays in Palestine. Buildings are displayed in parallel, curtains or window shutters can solve the privacy issues.



Figure 121. The opposite openings in buildings

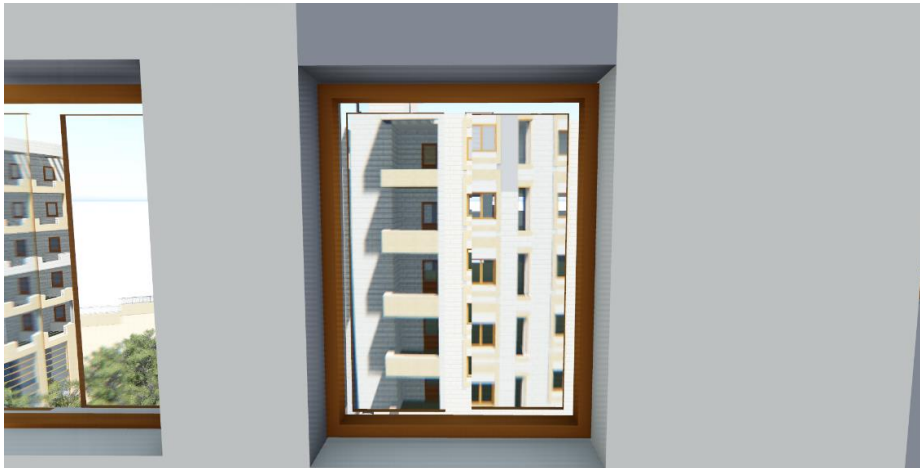


Figure 122. An interior view from inside an apartment

The building materials used in this project were the typical contemporary materials. The outside layer is the natural building stone, while the inside layer is cement plaster, and between these two layers, there is plain concrete (Figure 123).



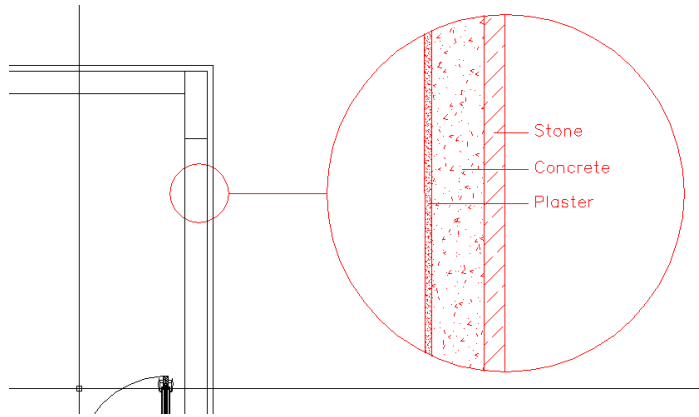


Figure 123. Materials used in exterior facades and building roof, first section from left is a roof section, second and third are wall sections

For more sustainable indicators, simulations on DesignBuilder software were carried out to assess the thermal performance proprieties (heat gain, interior and exterior temperature) of each design. Additionally, the program was used to check how the application of the suggested guidelines led to a good thermal performance inside the two proposed units.

A limited simulation of the housing units was carried out in each project (Figure 124). One building in the first design was chosen for the simulation; the building materials provided to the program were the ones used by the consultant, like stone, cast, reinforced concrete, and cement plaster (Figures 125 and 126).

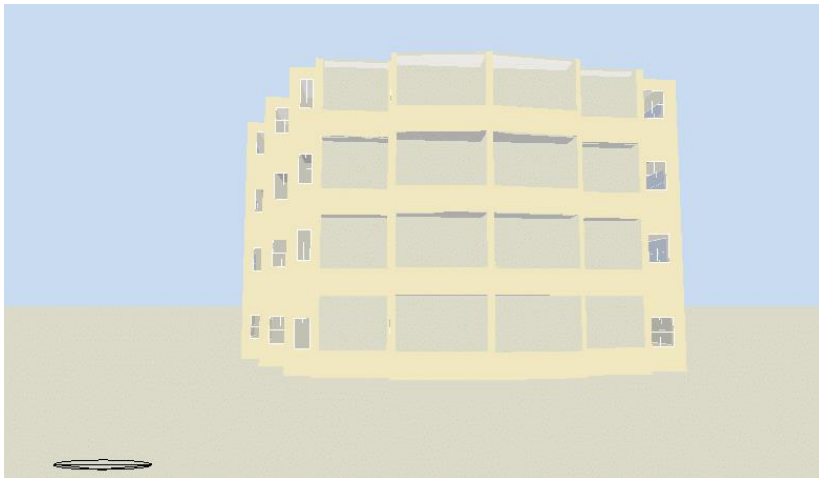


Figure 124. 3d building simulation model of the first proposed building



Figure 125. Materials used in the first design simulation, the roof of the building



Figure 126. Materials used in the first design simulation, the external walls

Figure 127 shows the results of this simple simulation; the first version of the proposed design has a bad and an unstable interior temperature – cooler in winter and warmer in summer.

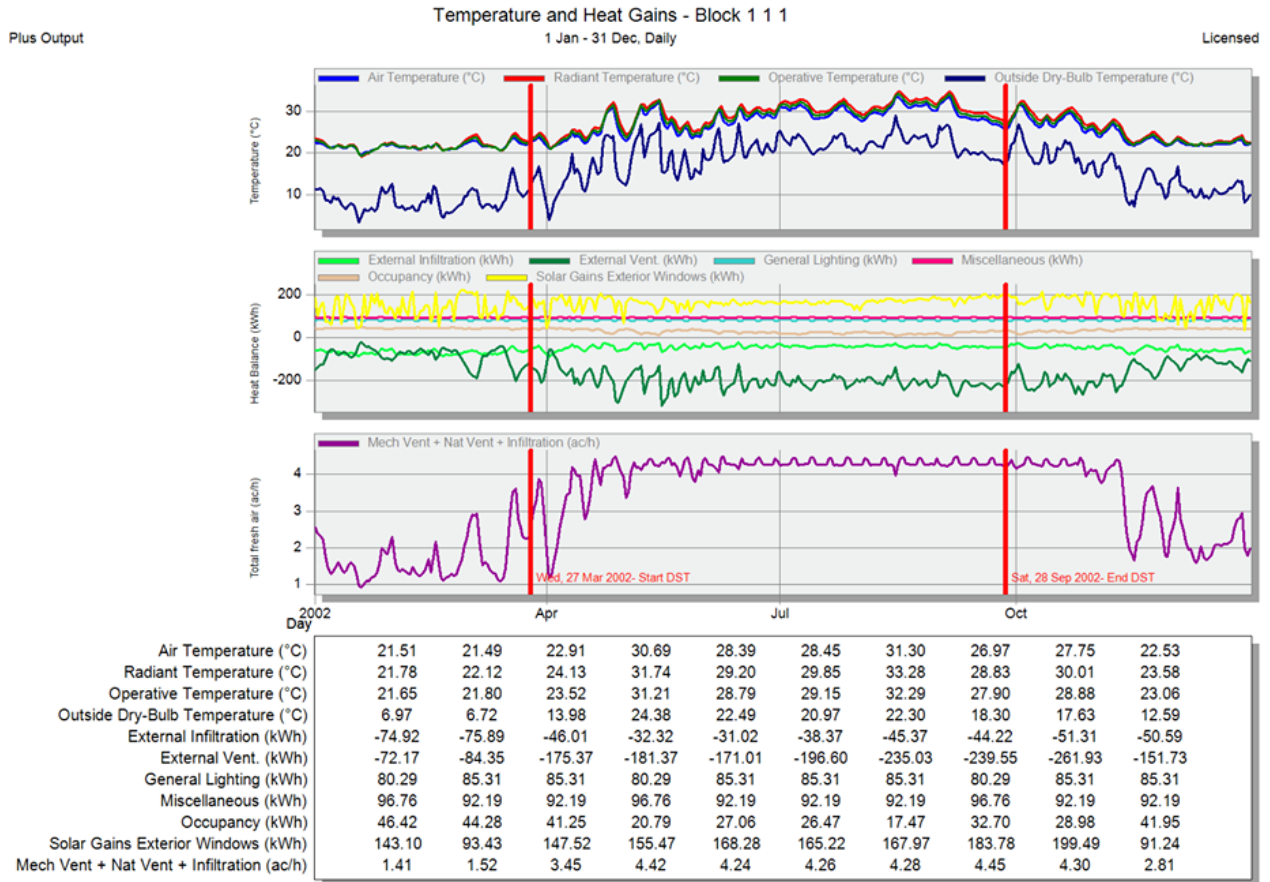


Figure 127. Indoor and outdoor temperatures during a year for the first design simulation

## 6.2. Guidelines application

The first step of this study was to introduce the proposed housing for the thirty-five families done by the consultant office. The consultant office was in the final stages of the design process, and they were preparing for the final drawings stage.

The second step of the test was to provide the consultant office with the guidelines of this research. For this purpose, a meeting was held with the architects of the consultant office to give them a general idea about the background of these guidelines, how these guidelines and their importance were reached.

The impression after the meeting was very remarkable, the three architects and the head of the office took all the notes of the presentation, and they were provided with the printed guidelines. The work started with a completely new proposed project, depending on the guidelines and with some consultations with the researcher.

The core of this new beginning was the respect for the sociocultural values of the Palestinian society and the participation of people in all the design stages, which relies on learning from the past using the guidelines developed within this research. To improve the design and to develop it, the team started to work on the site analysis, trying to benefit from natural and endogenous resources in the site, studying the orientation of the building, openings size and shading, etc.

Here, some of the tools used in climatic and site analysis were briefly presented (Figure 128). Some of these tools were used directly in the design process, while the others were used for the simulation at the end of this study.

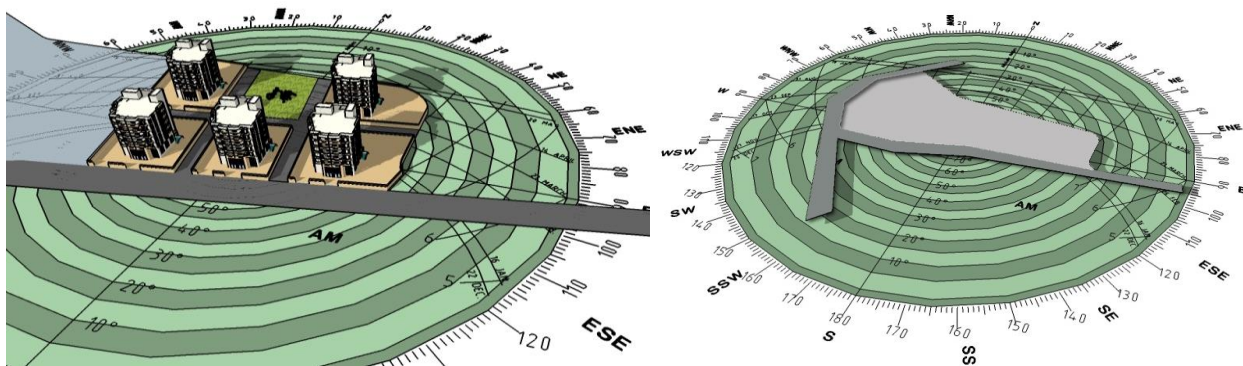


Figure 128. Building position "Left" and land position "right" related to sun path

More drawings were created to understand the sun movement and angles during the year related to the buildings. These drawings helped the team to improve the design to benefit from the sun as possible as they could (Figure 129).

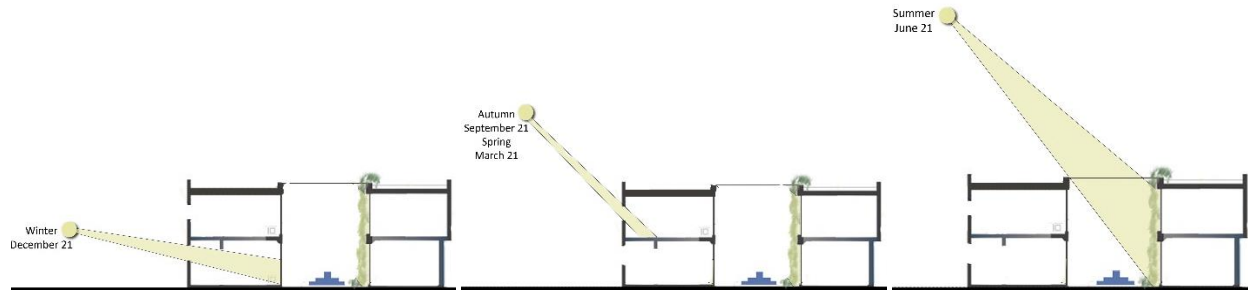


Figure 129. Sun angles during the year, building section

Also, the wind directions during the year in the area of the project should be taken into account during the design process. The wind movement during the coldest and the hottest months in the year have been taken into account – February as the coldest month, and August as the hottest (Figure 130).

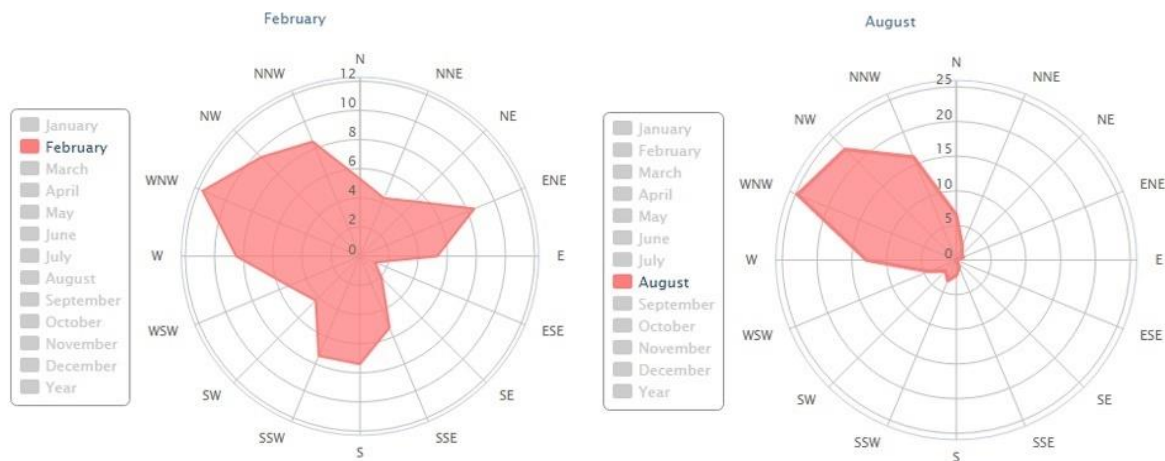


Figure 130. Wind direction during the year in the project land area

More statistics regarding the average monthly temperature, relative humidity, and sun hours in Nablus area were collected in Figures 131, 132, 133 to benefit from and to understand the climate in the area during the design process.

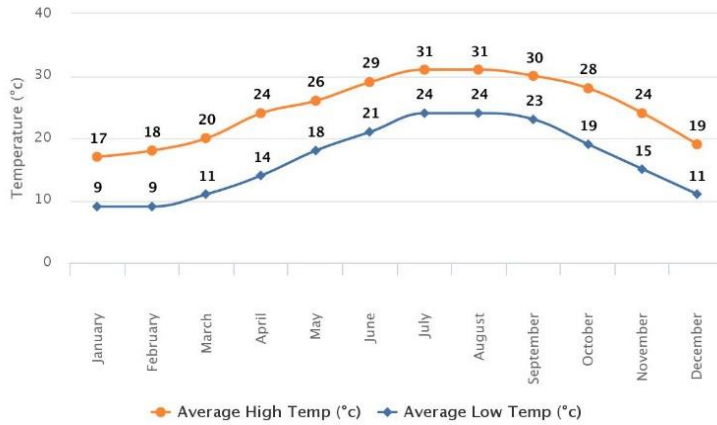


Figure 131. The average temperature during the year in the project land area.

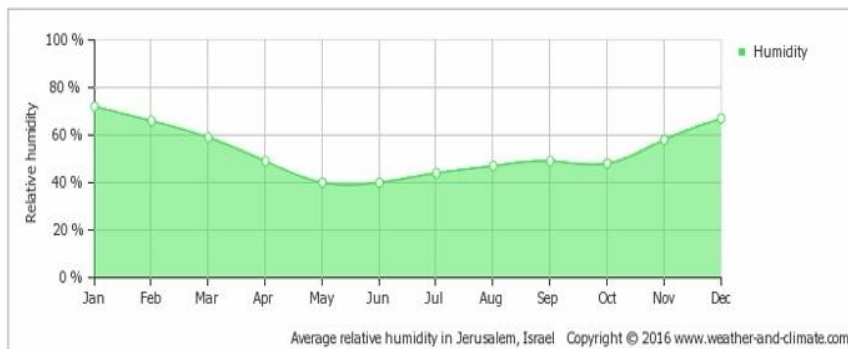


Figure 132. The mean monthly relative humidity in the location

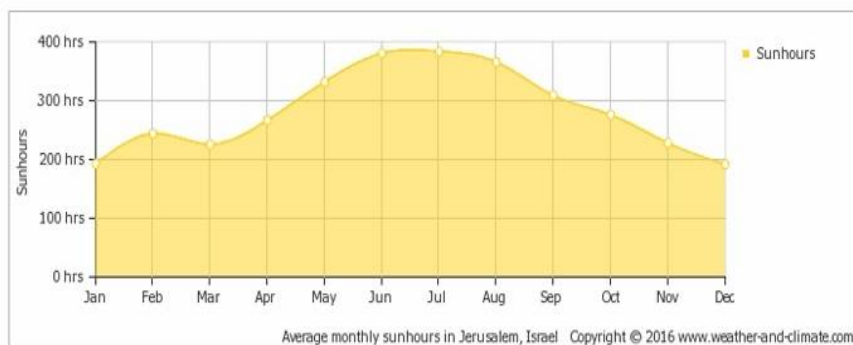


Figure 133. The monthly total of sun hours in the location

After studying the previous data and analysing it, the team and the researcher started with the initial sketches and conceptual drawings. The team decided to start from the base unit of the housing project, keeping sociocultural values in mind, and having the guidelines to support decision-making in this process.

To achieve that, a main Palestinian vernacular concept, the courtyard house, was used. The objective was to build the neighbourhood depending on single housing unit, and to be replicated all around the project, giving the family the privacy in all its levels, and achieving a big part of sociocultural values through this concept as seen in the suggested unit (Figure 134).

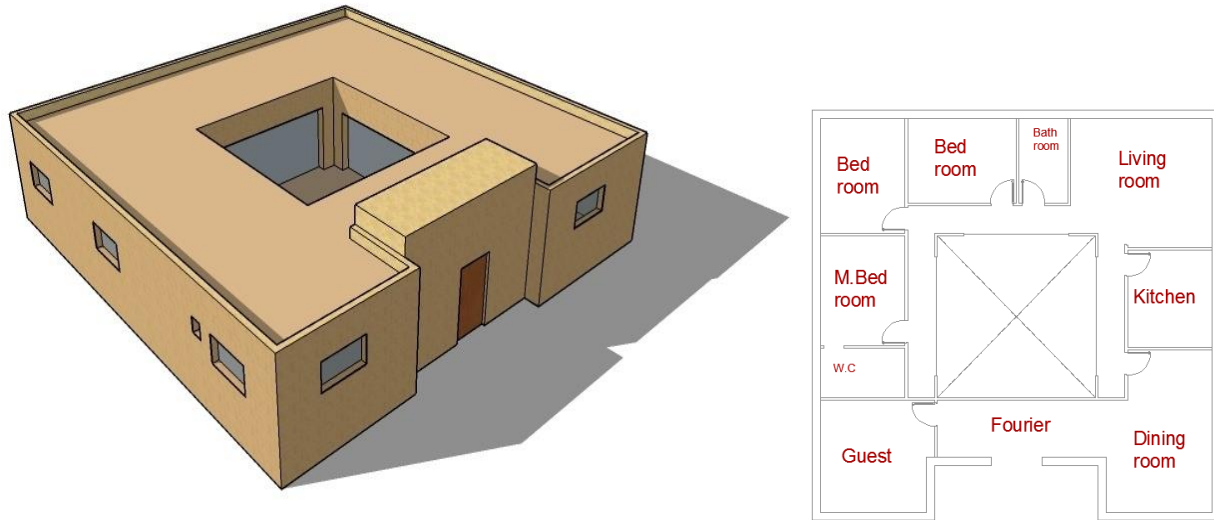


Figure 134. The suggested building unit in the new design, 3D picture on left, plan on the right

This suggested unit was presented and shared with the families after the first sketches. A good reaction was noticed, but people had some comments especially on spaces. The area of the unit was bigger than what the people needed, and therefore, the cost was higher than expected.

The team started to modify the proposed unit to account the contemporary needs and conditions. The area of the unit was reduced to the lowest needed areas and spaces, but without losing the advantages provided by the courtyard house, such as a private family area or green area.

The result of the people's comments and the teamwork was a semi courtyard house, (Figure 135). A house with a court with two being walls from the building and the other two sides with perforated facades, fabricated from reinforced pottery grids like the "*Kizan*" element (Figure 136).

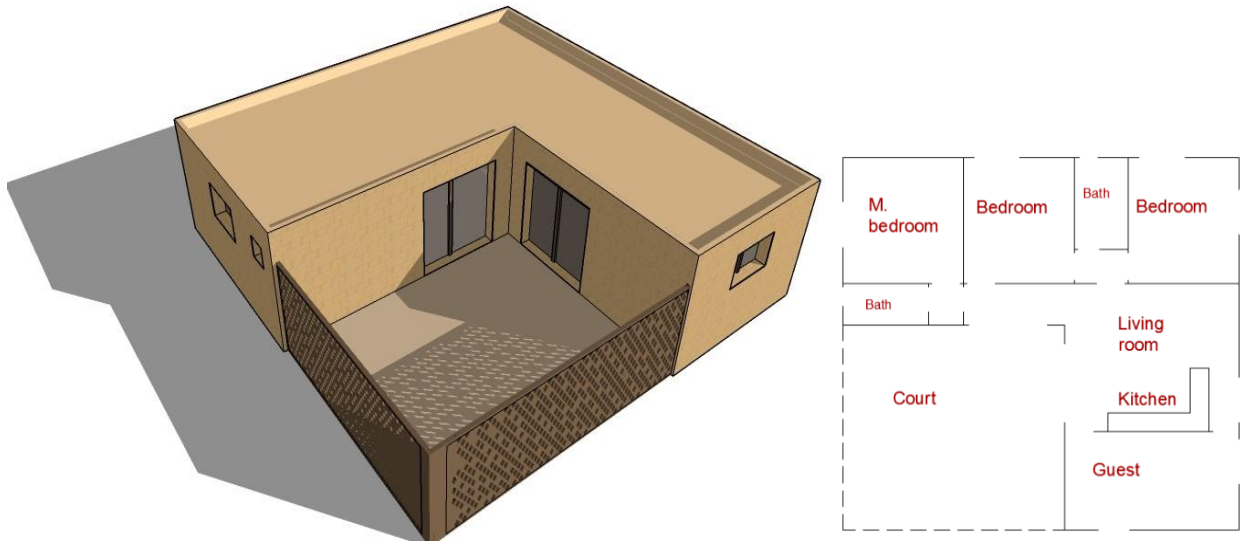


Figure 135. The new suggested residential unit, 3D picture on the left, a plan on the right

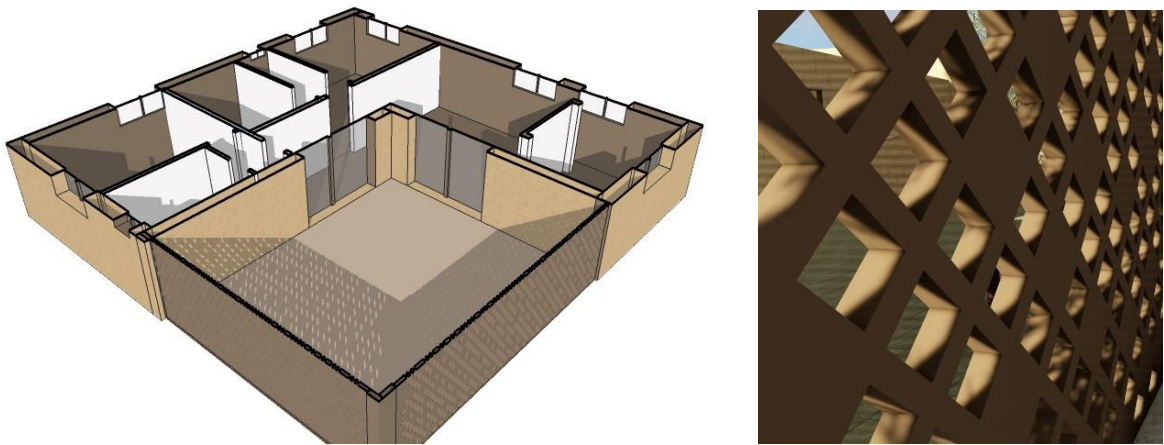


Figure 136. Perspective plan for the new proposed unit on the left with the suggested perforated fence on the right

The redesigned unit consisted of three bedrooms with two bathrooms, living room, guest room and a kitchen, with an area of 110 m<sup>2</sup>. In addition to the courtyard with 45 m<sup>2</sup>, these spaces were discussed with the dwellers.

More comments were discussed regarding the area and spaces, with new couples, and because of that, another unit was designed with only two bedrooms for new couples.

The courtyard contains green elements and a fountain, it represents the family special garden and the outside private area as presented below (Figure 137). The family is completely responsible for keeping this area vital,

which means they are also responsible for the sustainability of the city, as this green and watery areas help the city to be healthy and to be still vital, as it has been noticed in the old city of Nablus.



Figure 137. shots from the proposed courtyard with the fountain and green elements, showing family activities.

The outside openings of this unit were limited in both the number and the altitude. The altitude was higher than a standing man could reach (Figure 138).



Figure 138. Openings altitude is more than a man can reach.



Figure 139 shows that the number of openings was reduced to the minimum needed to provide the suitable light during the day, to reduce solar gain during the hot summer days, and to gain the needed sunlight during winter days.



Figure 139. A view showing the number of openings in a street view.

The materials used in this proposed housing depended on both natural and fabricated materials. To achieve a good thermal performance, some efficient insulation materials such as polystyrene and extruded polystyrene were used (Figure 140, 141), which are available and cheap in the Palestinian market. Natural local materials that could be reused, such as natural stone and pottery are also extensively used.



Figure 140. Building materials used in the new proposed units, roof materials

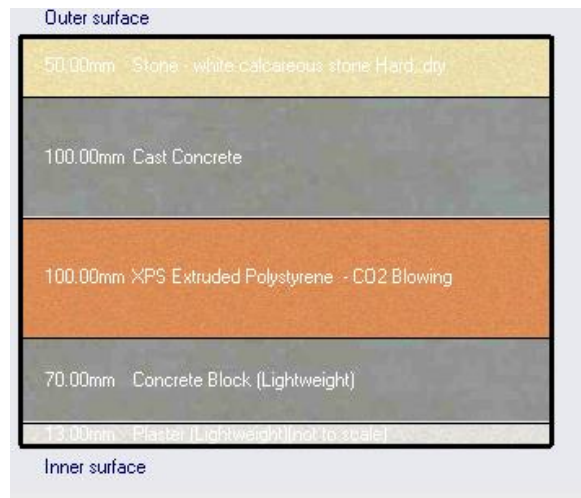


Figure 141. Building materials used in the new proposed units, wall materials

Also, the large horizontal spaces and areas above each unit could be used to benefit from the sunlight during the long sun hours in Palestine during the year (Figure 142). Therefore, solar panels were placed on the roof of each unit to reduce and to avoid heat gains through the roof due to direct sunlight, and to generate clean energy to supply each unit with a good amount of energy most days of the year.

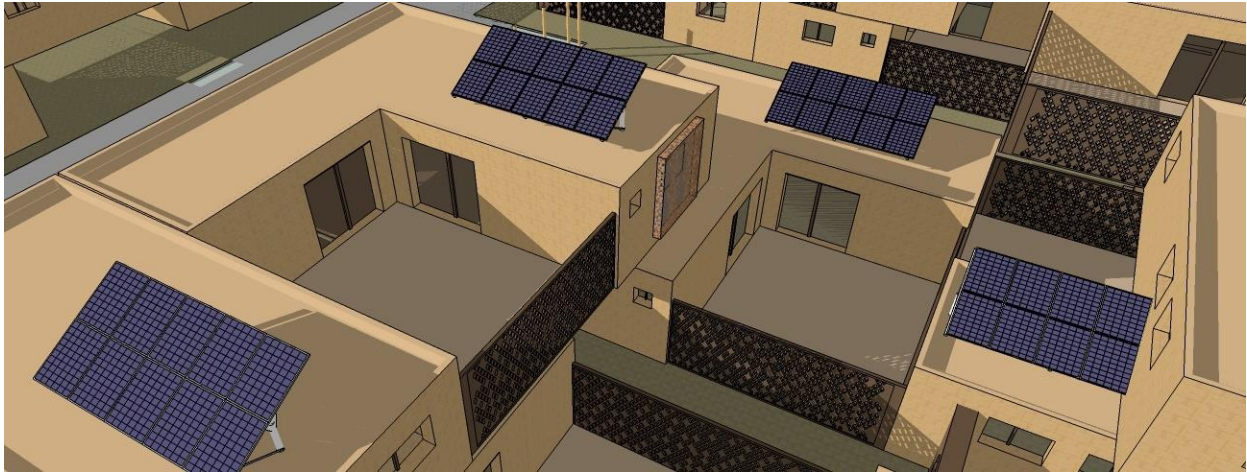


Figure 142. Solar panels located and distributed on the units

After this unit sample was approved, the design of the city began to grow gradually by repeating and duplicating the unit considering people's participation, and all the guidelines related to the urban and building levels, such as streets classifications, public areas, privacy in all its levels, etc. (Figure 143).

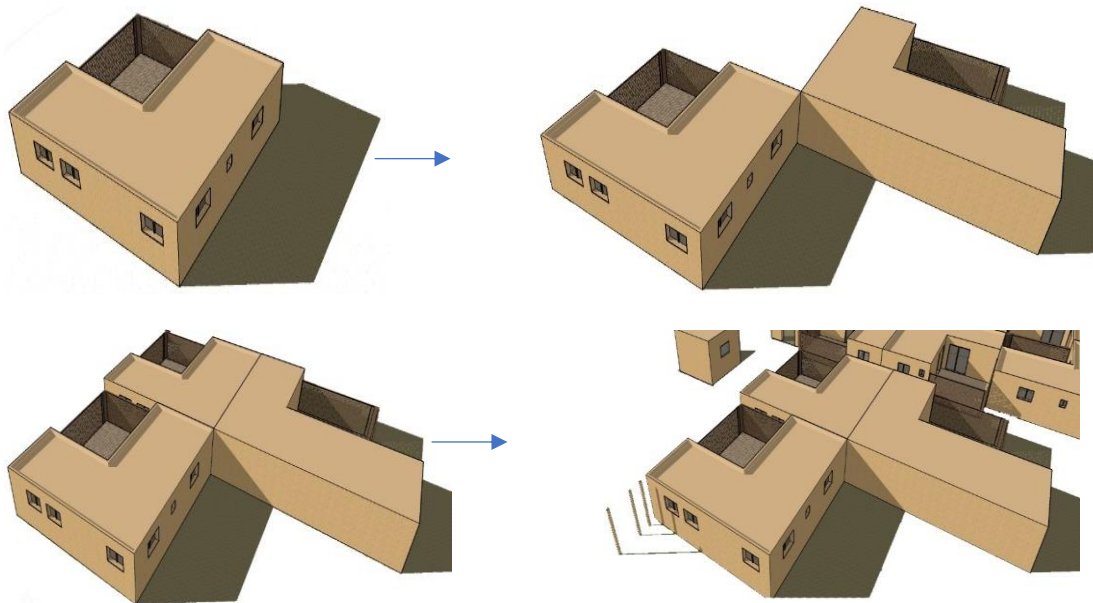


Figure 143. A picture showing the stages of the repetition of the housing unit

The urban level design process grew in parallel with the building level. The team considered public, semi-public, private yards and streets, privacy through the city skyline, layout and network, and all the guidelines.

The configuration of the units shaped the streets and the yards, giving the housing its shape and composition, step by step with cooperation between people and the design team. Through adding units, removing, and rotating others, the quarters were achieving its layout.

Some families enjoy having their relatives or close friends in the neighbourhood buildings, so they can make their common yards and private areas with some architectural elements to emphasise the privacy of the yard such as arc gates and small paths (Figure 144).

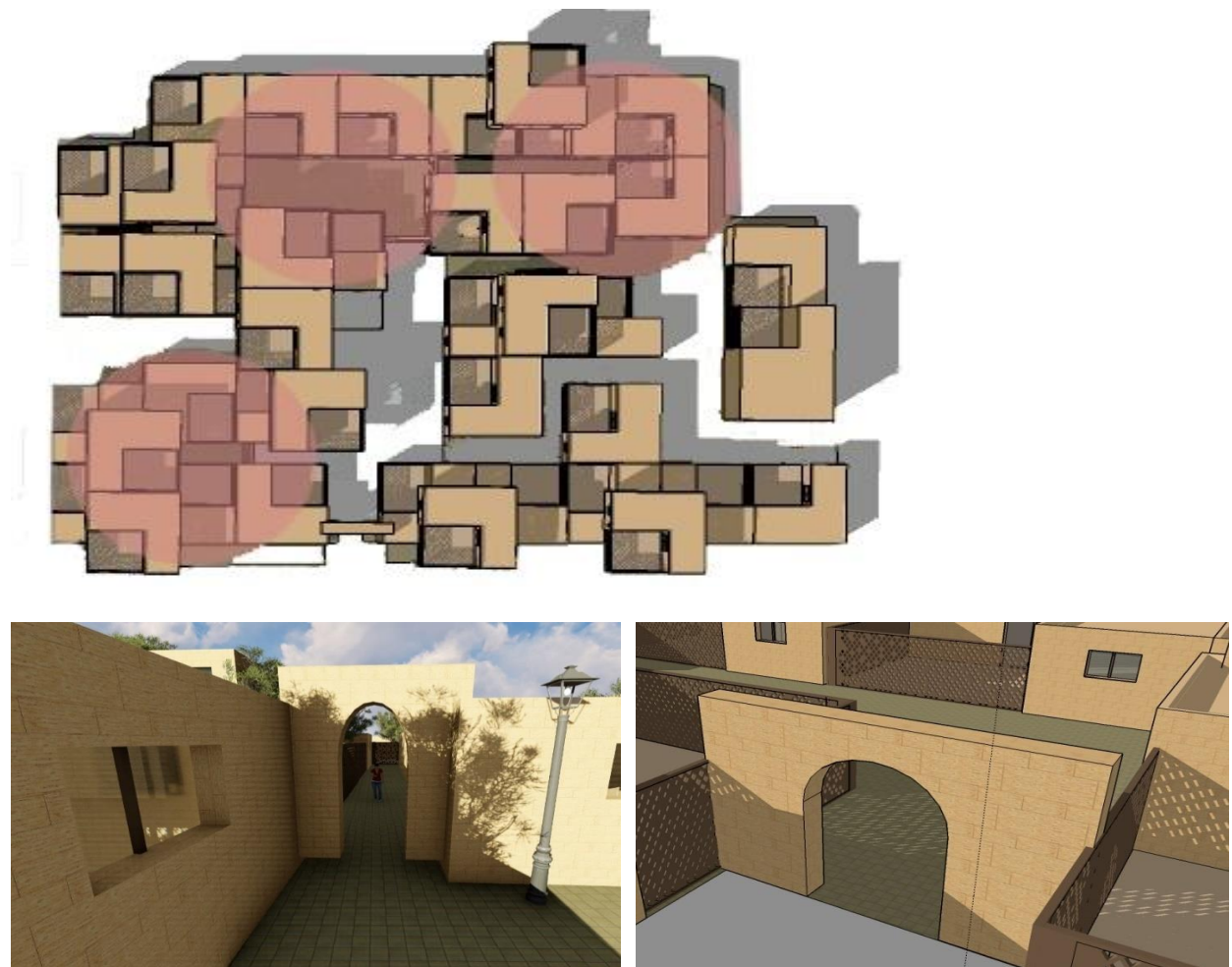


Figure 144. The yards caused from people's desire to gather with close relatives and friends

The streets were also reaching their own shape and, by default, the streets were classified depending on the area each street was serving (Figure 145).



Figure 145. Housing network and streets classifications

Vehicles could only reach specific areas such as the public squares, parking area and buildings. All the other paths were pedestrian, meaning that people were required to park the cars and reach their dwellings on foot, thus having the housing network depending more on pedestrian streets (Figure 146).



Figure 146. The housing network, depending on pedestrian streets and streets classifications

Vertical and horizontal extensions are very important in such a project, especially when designing low-rise buildings. The number of units after the design plays a major role and should meet the dwellers' needs.

Vertical extension is important for sharing the land cost. As the team expected, people started asking about the possibility to add a second level of units to share and reduce the cost of the land, (Figures 147 and 148).

Other people asked for a duplex unit with two floors for their big families, so that, the second level of the housing started to take place in the design of a smaller number of units regarding privacy and no harm aspects.

As mentioned before, some of these second level units were added to a ground unit to become one unit, like a duplex unit, and some of these second level units were added as separate units each with its special stair and entrance.

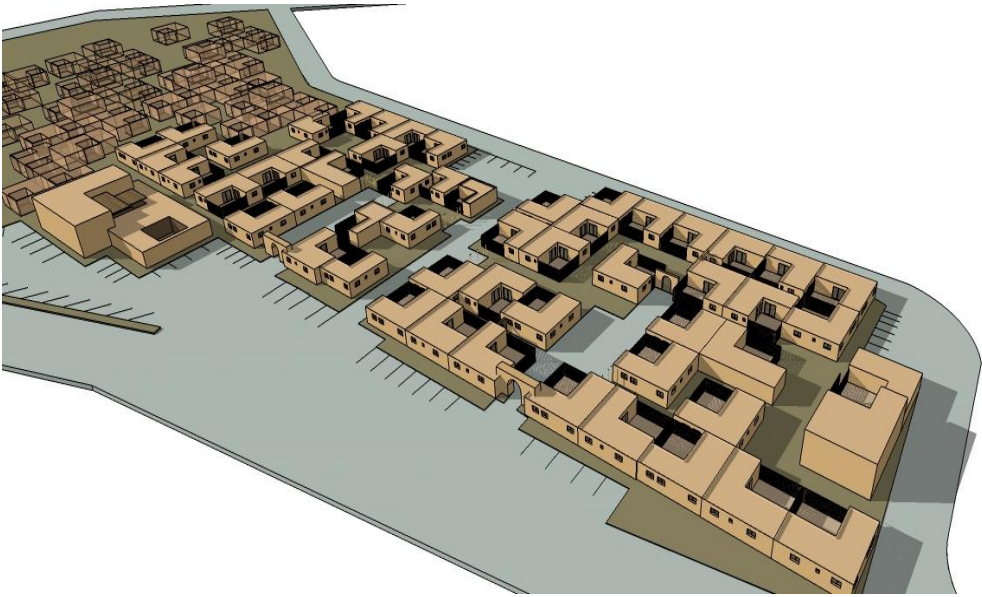


Figure 147. The first level of the proposed housing units

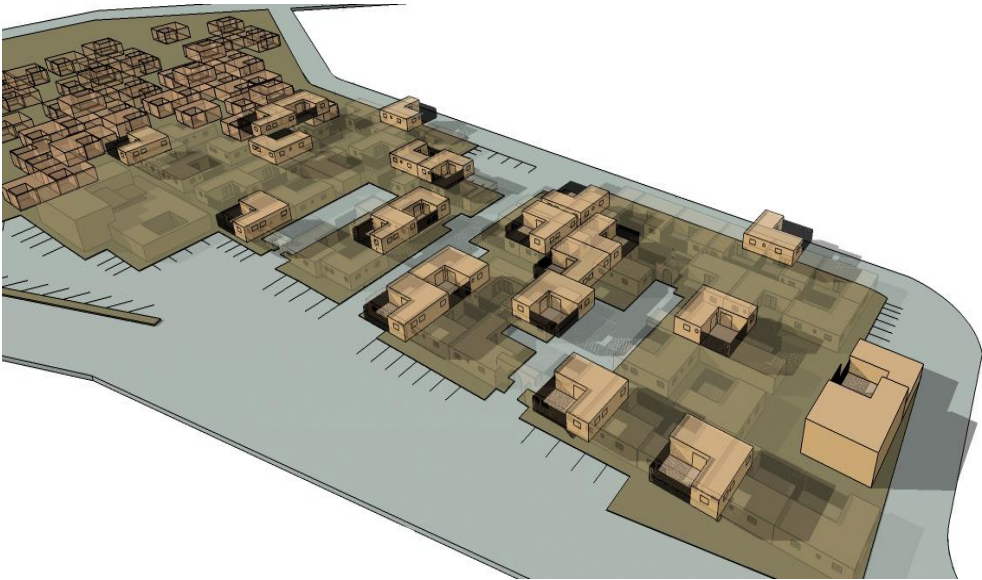


Figure 148. The second level of the proposed housing units, with a less number than the first level

The number of residential units at the first two levels seen below were thirty-six units, in addition to a public building with a total area of 1900 m<sup>2</sup> (Figure 149). These thirty-six units and the public building were located and designed in the area proposed for the first design. Therefore, low-rise buildings were not using more land than the high-rise buildings, on the contrary, land use was more efficient.

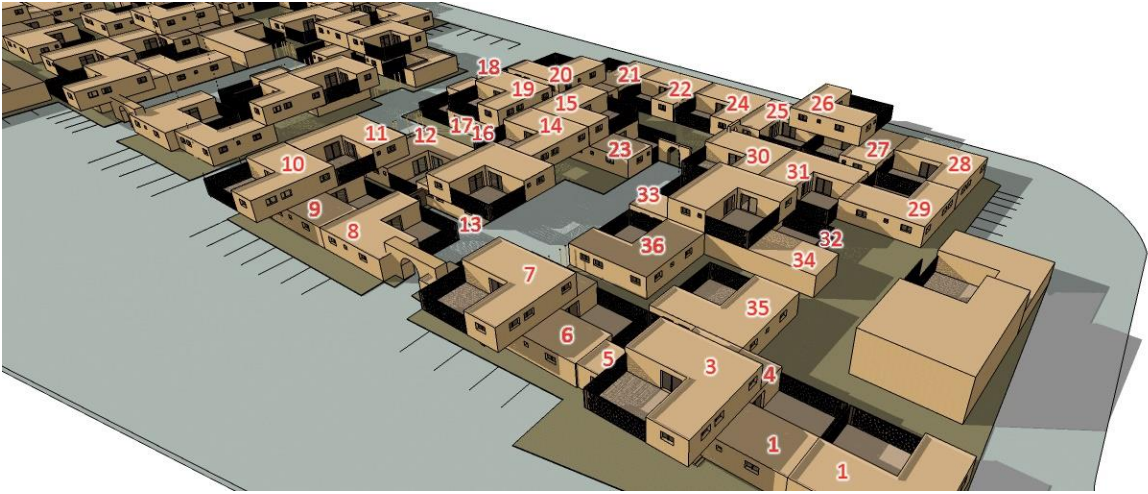


Figure 149. The number of residential buildings in the same area of land used for the first project.

The design team thought about a future vertical extension of this project and suggested a third level of units with a smaller number of residential ones regarding privacy and aesthetic aspects (Figure 150), this is the final level of units. However, it's not allowed to add any more levels, this decision was based on the guidelines of this research and people participation.

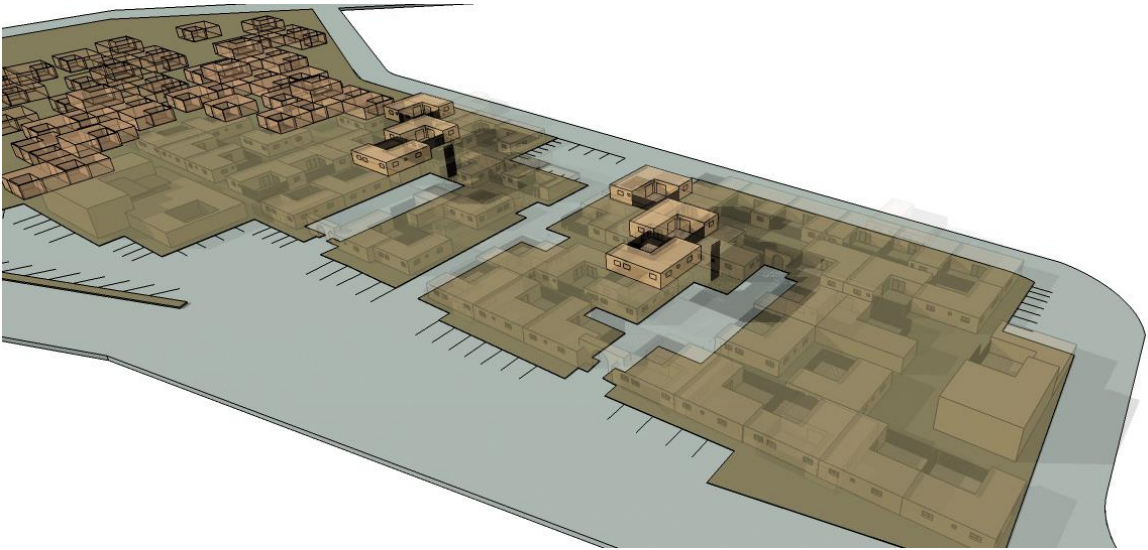


Figure 150. The third level of the proposed housing units with a smaller number of units.

Beside private green spaces in each unit, public and green areas and playgrounds were created depending on the subtractions in the city layout caused by the unit's positions and changes, (Figure 151). Other green areas were created by the design team in specific places where green areas were missed or needed (Figure 152).



Figure 151. Public green areas located throughout the housing.



Figure 152. Public playgrounds located throughout the housing.

In summary, the above is the way the housing was growing, people and guidelines were the most effective elements, besides the awareness of the design team, this is the keyword of the new design.

This design was completed within seven weeks, starting from the first presentation done by the researcher until the last meeting with the families in this project, more than 10 meetings were held with people.

Some families, of course, responded more actively and attended most of the meetings, and some relied on the design team's opinion with some comments and modifications. The result was something new in the opinion of both dwellers and the design team.

Regarding the cost differences between the two proposed designs, the cost comparison is divided into two main parts, the land cost and the construction cost. For the second proposed design, the land which is 4760 m<sup>2</sup> area, consists of 36 units with 110 meter square of area for each unit, two public buildings with a total area of 1900 m<sup>2</sup>, public green spaces and playgrounds with a total area of 1700 m<sup>2</sup>, for the first proposed housing with 35 housing units with 120 m<sup>2</sup> of area for each unit, a green area and playing ground with 500 m<sup>2</sup> of area, and without any public buildings.

The cost of land in the new proposed housing is less than the first one, more units, public buildings and areas were created in the same area of land.

Regarding the cost of the unit's construction, according to the Palestinian Central Bureau of Statistics, the cost of each meter square of high rise building in Palestine (4-6 floors) is around 140 USD/ m<sup>2</sup>, while the cost of separated buildings is around 170 USD/ m<sup>2</sup>, the new version of the design is between 2-3 floors and the estimated cost according to the consultant office could be around 155 USD/ m<sup>2</sup>, taking into account the flexibility of the design to be extended vertically to reach 4 floors which mean reducing the cost of construction.

Also, the area of the new units is less than the first version with 10 m<sup>2</sup> for each unit, besides the cost of the external walls of each building which is not existing in the new version of the design.

An important aspect which is the unit operating cost should be taken into account also. In the new version, it is possible to benefit from solar thermal collectors and PVs due to the presence of large horizontal areas on the unit's roofs, which is not available in the first version of the design. The thermal indoor performance of the new units is better in winter and summer because of the building strategies and elements and insulation materials used, which reduces the unit operating cost.

All these costs were discussed and presented for inhabitants and the general cost of the new version of the design is not much different from the old one, it's even better when taking the operating costs of the units into account, and because of that, inhabitants adopt the new version of design and approved the estimated costs.

The new design was also tested. A simulation was held to three units as seen in Figure 153. The building's materials were inserted as the team designed, depending on the guidelines and the recommendations of the research.



Some insulation materials were added to the cast and reinforced concrete, plaster, and natural stone as presented (Figures 154 and 155). It did not represent a higher or costly difference from the first design.

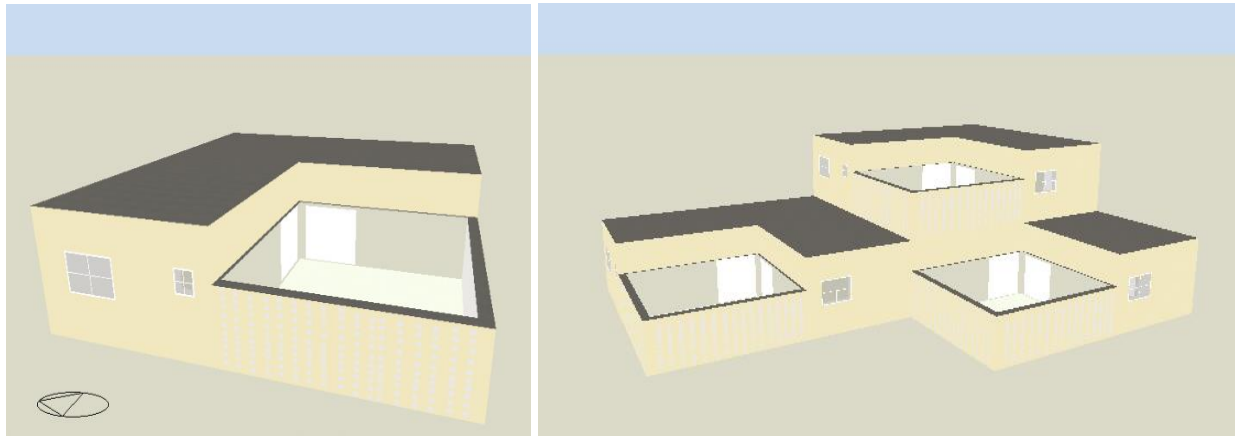


Figure 153. A shot during the simulation on the new proposed housing, component simulation

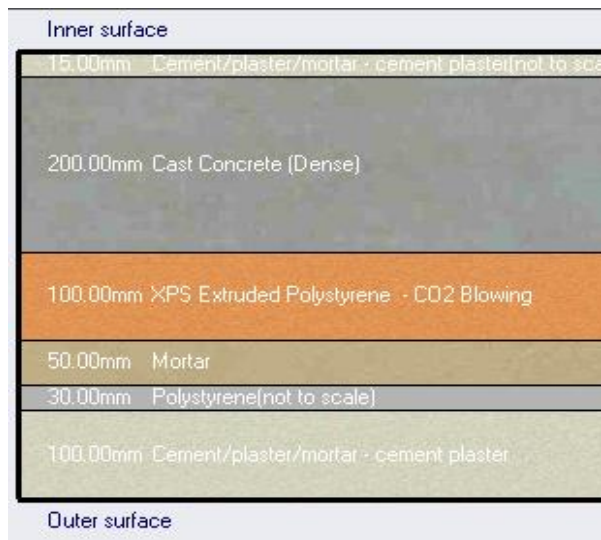


Figure 154. Materials used in the new design simulation, the roof of the building

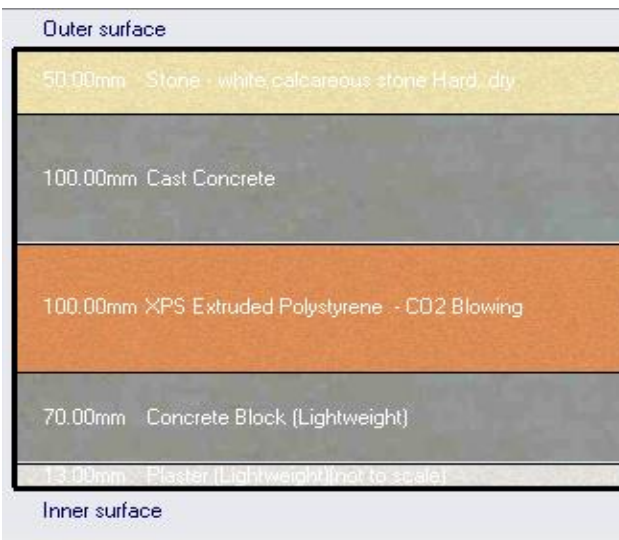


Figure 155. Materials used in the new design simulation, the external walls

The results of these simple simulations showed that the new proposed design has a better and more stable indoor air temperature; warmer in winter and cooler in summer as depicted in Figure 156. These results open the door for more in-depth studies, based on a quantitative survey with energy efficiency measurements in the Mediterranean climate.

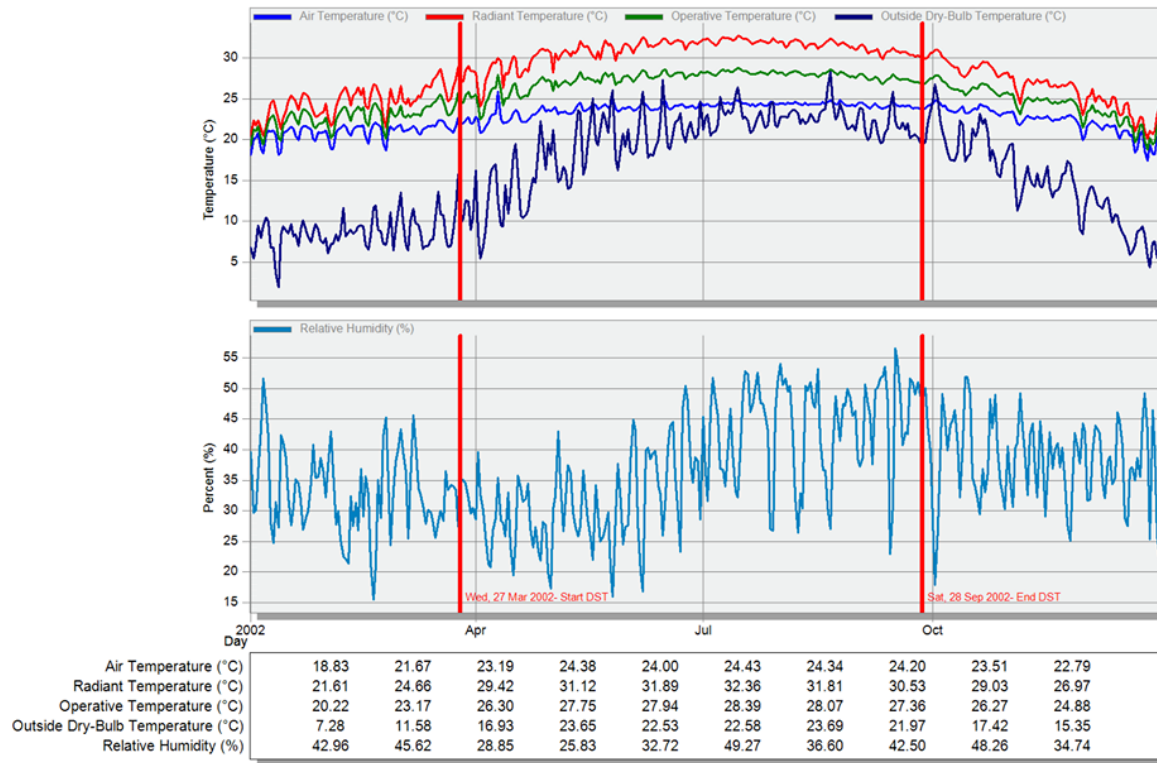


Figure 156. Interior and exterior temperatures during the year, new design simulation.

Figures 157 to 159 present the project in general, several shots in different views, giving an insight into how different the new version of the project is from the first one.

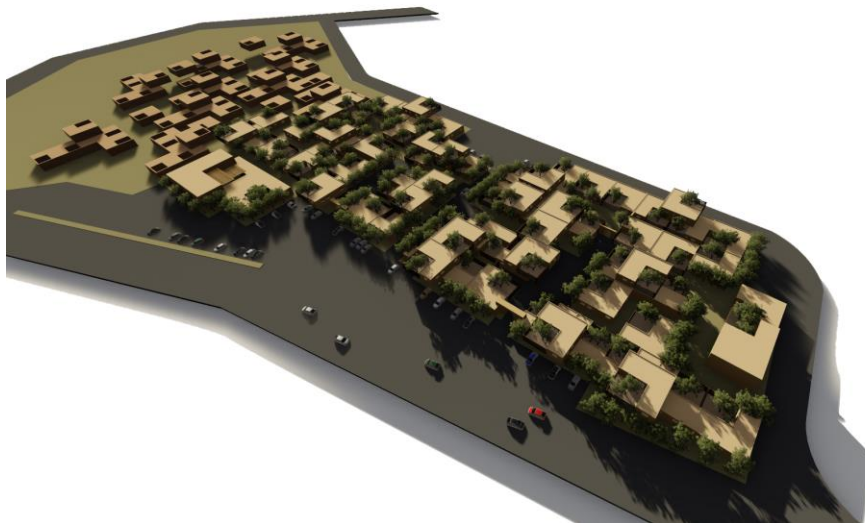


Figure 157. 3D picture of the new version of the proposed housing project



Figure 158. 3D picture of the housing layout in the new version of the proposed housing project



Figure 159. 3D picture for one of the public buildings "cultural centre" in the new version of the proposed housing project

From the previous chapter presenting the two proposed housing projects and their design process, the big change occurred after applying the suggested guidelines in the design process is clear. The new design contains a lot of vernacular architecture elements and features. Besides that, people have adopted this design and participated in every stage of the process and therefore this design considers sociocultural aspects, along with new construction techniques and materials, which was something inexistent in the first version of the housing project.

It is now clear that the test also shows that it is possible to make a qualitative leap in the architectural reality in Palestine without much effort, cost, or resource consumption. Some awareness about the importance of sociocultural values is needed from the two sides of the design process, with some support from the local governments and municipalities.

## **Chapter 7. Conclusions and recommendations**

The architectural reality in Palestine as mentioned before is very poor, missing an important element of sustainability: sociocultural values are very effective elements especially in a Mediterranean Arab country such as Palestine. This study led – through analysing the great effect of sociocultural values on the old city of Nablus and comparing it with the contemporary buildings – to a set of guidelines which could help to improve the architectural designs at engineering and consulting offices, municipalities, and other engineering work institutions.

The suggested guidelines and their application to the presented case study together with sociocultural values consideration show that adding a little effort, cost, and resources could enhance the current residential construction in Palestine.

Following people's needs and culture is missing in the design process. More efforts are needed to aware both architects and dwellers about the importance of such main element in sustainable architecture. Thus, this study can contribute to enhancing the global quality of the design and therefore the sustainability of the built environment in Palestine.

Furthermore, the analysis presented in this thesis emphasised that the current residential construction in Palestine is not leading to a sustainable community. Palestinian society nowadays suffers from many economic and political problems, thus turning cultural and social values as secondary aspects in the building design. This is reflected directly on the products of this society, such as architecture, and on the way people think of the sustainability goals. The society is focusing more on economic aspects, trying to produce buildings with economic solutions only which lead to an unsustainable community.

The framework presented in this thesis is raising and exploring some strategies in urban and building design scale, comparing the old and the contemporary city areas of Nablus. These strategies were summarised as a guideline at the end of the study, combining technologies that best fit for a specific community like Palestine from a vast amount of passive and active sustainable design strategies available. However, the proposed mix of technologies draws the features of a sustainable building within a Palestinian social and economic background.

During the work, many limitations were found, especially in data collection. Collecting data related to the old city of Nablus was divided into two parts. The first consisted of collecting data from official bodies such as municipality or reconstruction committees. This part was difficult because such bodies would not share the data they collected in the old city of Nablus. The second part of data collection limitations was collecting data from people. The inhabitants of the old city of Nablus are living daily political and security problems, which makes them very sensitive towards giving detailed information about their private life. Maybe only general answers could be collected.

The future work based on what has been discussed in this study should focus more on the comparison part related to indoor environmental quality. More studies should be done on measuring the indoor environment of buildings in the new and the old urban areas and making computer simulations for any suggested designs. This study regarded sociocultural values and their effect on sustainable buildings in Palestine, raising many questions about topics related to the reality of Palestinian sustainable buildings.

This study is the basis for further research since it discusses in details the missing link in achieving sustainable reality in Palestine. Sociocultural values and their importance must be observed in any future work or research.

Also, the implications of this study could aid to improve sustainable reality in Palestine, as its buildings and cities are concentrating on economic aspects only. Construction solutions depend on economic and land savings only, so the lack of land led to high-rise buildings as a solution to overcome this reality. Additionally, high-rise buildings were a solution to minimize the construction cost, due to the low income of most families. In this context, passive design strategies became a luxury, because of its cost.

So, the motivation behind the building process was to have a shelter at the lowest possible cost, and this has become a vicious cycle with no end. The only beneficiary in this process are the contractors and some architectural offices, who copy some designs without the effort of thinking and designing. This low-cost engineering product is behind this bad reality.

This bad reality of the Palestinian residential buildings led and justified this study to be developed in order to find solutions to improve this reality. The first step was to understand the background and analysing the rich heritage of residential architecture in Palestine. After that, the strategies which led to such sustainable cities were presented. That paved the way to find the missing link in contemporary buildings and cities – the

sociocultural values –. Finally comparing and then suggesting guidelines which can be adopted by municipalities and architectural offices.

When taking the guidelines of this study into account, the whole design process could change, as presented in the case study chapter. Not only aspects related to social issues were improved, but many of the applied issues such as the buildings thermal performance, city network, and public and green spaces have also changed and improved.

The effect of the guidelines in improving the buildings design process in Palestine could be of significant extent, as concluded from their application in the case study. It is useful to summarize the effect of the guidelines on the design stages in architects' language, and how these could improve the following stages of the design:

- Site analysis

Sun, wind, orientation, and all site components analysis can improve dealing with the site of the project. Architects should understand the site before starting any step of the design, and they should try to benefit from the site in every single detail.

- Units design

Through encouraging architectural offices to benefit from the local heritage while designing the residential units, some residential concepts such as courtyards should be reused in a new version serving peoples new needs, and old strategies should be improved.

Regarding the unit's plan, the guidelines emphasised that people needs should be the basis of the design. Beside enhancing people participation during the design process, people have the right to add, remove, and change some spaces in the plan, and determine the area of the unit depending on their needs and the estimated cost.

- Openings and elevations

The unit's facades were simple, the openings were distributed around the unit depending on the need of these openings - allow the sun and air to enter - the height of the openings was more than people could see through, and some elements such as "*Mashrabiya*" were used to reduce solar radiation in southern windows.

- Materials

By encouraging the use of local materials for buildings, streets, and other urban components, in addition to using insulation materials, materials should play a greater role in enhancing and improving the building thermal performance.

- City network

The guidelines enhanced the concept of streets classifications, public, semi-public, private streets, providing the city with a good network, which reduces pollution and increases the city healthy level.

- Public spaces

The guidelines promote the designers to create semi-public, semi-private and green spaces all around the city or the neighbourhood, with playing areas and other public facilities.

- City layout

The guidelines seem to encourage low-rise building solution, the reason behind that is privacy as seen in the test model, but in fact, any solution that respects privacy is acceptable. The guidelines did not oblige designers to design buildings with a certain height, and the result of the test is non-binding as a standard design model, it is only the way the design team thinks and how the process developed.

In addition, municipalities and official bodies can adopt these guidelines as a reference to assess the work of the engineering offices. Every office should submit a report in addition to the plan of any project. This report shows the design process and its stages, such as people participation during the design and the changes occurring etc.

As the main conclusions, this study highlights that:

- I. The current residential construction in Palestine is far away from sustainable construction, even with some attempts, they remain superficial.
- II. Sociocultural values are the main element in sustainable design. Architects need to work within the umbrella of sociocultural aspects which is missed during their study and after graduation nowadays, and ignoring such an important element has an impact in the architectural, social, cultural and environmental reality.



- III. The sustainable reality is easy to reach with some efforts, awareness, and a little additional financial cost, in terms of initial cost.
- IV. New building technologies do not conflict with sociocultural values.
- V. Architects and engineers should learn from vernacular strategies and to develop them, such as developing passive strategies to reach the best possible low energy and natural climatic control for their buildings, such strategies should be reused and developed to serve people life.
- VI. Designs imported from abroad without considering the local environmental, sociocultural and economic aspects could lead to major problems at the building, city and country level.

The study results proved that vernacular strategies in urban and building levels set an approach for improving contemporary residential buildings and draws recommendation for further research, such as:

- I. More intensive quantitative studies and surveys are needed to adapt vernacular strategies to modern applications;
- II. Vernacular architecture strategies should be studied at the universities and architects should be aware of such a rich heritage;
- III. During any design process in the urban or building levels, people should participate and take their responsibilities toward their city;
- IV. Sustainability is based on a multidisciplinary approach and therefore during the design process architects should follow some guidelines to stay on the right track;
- V. Passive strategies should be applied in contemporary designs and applications especially after the current climate change symptoms;
- VI. Vernacular strategies should be used as guidelines for contemporary urban planning and building design regulations;
- VII. More studies should take place in testing materials efficiency and develop sustainable materials;
- VIII. Currently, there are no national reference documents for vernacular passive construction performance in Palestine and therefore the guidelines in this research could be a good start for the effective contemporary application.

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