ANALYTIC APPROACH TO MARDIN VERNUCALAR ARCHITECTURE
IN THE CONTEXT OF SUSTAINABLE DESIGN

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF NATURAL AND APPLIED SCIENCE
OF
ÇANKAYA UNIVERSITY

BY

SABA ESİN AYDIN

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
INTERIOR ARCHITECTURE

DECEMBER, 2009

Title of the Thesis : **Analytic Approach to Mardın Vernacular Architecture in Context of Sustainable Design**

Submitted by **Saba Esin AYDIN**

Approval of the Graduate School of Social Sciences, Cankaya University.

Prof. Dr. Taner ALTUNOK
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Science/Arts / Doctor of Philosophy.

Prof. Dr. Cüneyt ELKER
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Science/Arts/Doctor of Philosophy.

Prof. Dr. Faruk Y. UĞURLU
Supervisor

Examination Date: 03.12.2009

Examining Committee Members

Prof. Dr. Faruk Y. UĞURLU (Çankaya Uni.)

Asst.Prof.Dr. Çiğdem B. GÖKHAN (Çankaya Uni.)

Asst.Prof. Dr. Tayfun YILDIRIM (Gazi Uni.)

STATEMENT OF NON PLAGIARISM

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name : SABA ESIN AYDIN

Signature :

Date : 03.12.2009.

ABSTRACT

ANALYTIC APPROACH TO MARDIN

VERNUCALAR ARCHITECTURE

IN THE CONTEXT OF SUSTAINABLE DESIGN

Aydın, Saba Esin

M.S. c. Department of Interior Architecture

Supervisor: Prof. Dr. Faruk Yalcın Ugurlu

December 2009, 119 pages

In order to achieve sustainable architecture, cultural and sustainable design principles should be considered in a complementary relationship. Cultural context implies a sound respect to the traditional knowledge of place, technology and local materials. Sustainable design implies the recycling of energy, either by the use of passive energy or renewable energy. It also requires harmony with local economies and data supporting biological diversity.

In this thesis it is aimed for energy passive strategies in urban design and building design to be analyzed for hot dry zone in Mardin, Turkey. Moreover, it is also an inspiration for sustainable urbanized living pattern. From such a point of view, certain themes such as harmony with topography, collaboration which climate and passive energy use will be discussed in addition to the sustainability of cultural values. Throughout this study traditional and some modern samples were analyzed. All of the traditional samples within the zone, which was built before today's construction and energy supply technology, are well responsive to the local environmental conditions and therefore they are energy efficient.

It should be remembered that sustainable architecture should start with understanding of energy design. Therefore the aim of this study is to remind the traditional samples through implementation of their strategies with new materials and technologies in traditional houses in Mardin

Keywords: Energy Design, Energy Efficiency, Sustainable Design.

ÖZET

MARDİN GELENEKSEL MİMARİSİNİN SÜRDÜRÜLEBİLİR TASARIM YAKLAŞIMLARI BAĞLAMINDA ANALİZİ

Aydın, Saba Esin

Yükseklisans, İç Mimarlık Bölümü
Tez Yöneticisi: Prof. Dr. Faruk Yalçın Uğurlu

Aralık 2009, 119 sayfa

Sürdürülebilir bir mimari elde etmek için kültürel ve süründürülebilir tasarım ilkeleri birbirlerini tamamlayıcı bir ilişki dâhilinde değerlendirilmelidir. Kültürel bağlam yeri teknoloji ve yerel malzemelere dair geleneksel bilgi birikimine sağlam bir şekilde yanıt vermektedir. Sürdürülebilir tasarım, pasif enerji veya yenilenebilir enerjinin kullanımı ile enerjinin geri dönüşümünü içermektedir. Aynı zamanda yerel ekonomilerle bir uyumu ve verileri destekleyici nitelikte biyolojik çeşitliliği de gerektirmektedir.

Bu araştırma Türkiye'nin Mardin bölgesindeki bir kuru ve sıcak alanda kentsel tasarım ve yapı tasarımındaki pasif enerji stratejilerinin analiz edilmesini amaçlamaktadır. Bununla birlikte sürdürülebilir kentsel yaşama modeli için de bir ilham kaynağı olmuştur. Böyle bir bakış açısından, topografı ile uyumluluk, iklim ve pasif enerji kullanımı ile birlikte çalışma gibi belirli temalar kültürel değerlerin sürdürülebilirliğine ek olarak tartışılacaktır. Geleneksel ve bazı model örnekler bu araştırmada analiz edilmiştir. Bölgede bugünlerin inşası ve enerji tedariki teknolojisinden önce inşa edilmiş tüm geleneksel örnekler yerel çevresel koşullara iyi bir şekilde yanıt vermişlerdir ve bu sebeple enerji yönünden tasarrufludurlar.

Sürdürülebilir mimarinin enerji tasarımının anlaşılması ile başlaması gerektiği hatırlanmalıdır.Bu sebeple bu araştırmanın amacı stratejilerinin yeni malzemeler ve teknolojiler ile Mardin'deki evlerde uygulanarak hatırlatılmasıdır.

Anahtar Kelimeler: Enerji Tasarımı, Enerji Tasarruflu, Sürdürülebilir Tasarım.

ACKNOWLEDGMENTS

The author wishes to express his deepest gratitude to his supervisor Prof. Dr. Faruk Yalçın Uğurlu and co-supervisor Asst.Prof.Dr. Tayfun Yıldırım for their guidance, advice, criticism, encouragements and insight throughout the research. And also I have to pass my special thanks to the technical assistance of Ms.Nilüfer Vural for her suggestions and comments.

To my mother Seher and father Yusuf, I offer truthful thanks for their unshakable faith in me.

TABLE OF CONTENTS

3. GENERAL CHARACTERISTICS OF MARDIN CITY

LIST OF TABLES

TABLES **PAGES**

LIST OF FIGURES

FIGURES **PAGES**

LIST OF PICTURES

PICTURES **PAGES**

CHAPTER 1

INTRODUCTION

Among today's society, the common procedures of modern building practice has separated people from the natural world, in turn cutting of access to the positive benefits contact which can be provided. Need of humans for nature is not a new idea, but one that has been ignored and pushed aside in modern times. Causes of this separation from nature are a result of modern day industry and growth. Until recently most of the research on the urban design has concentrated on the negative aspects of urban design such as pedestrian way, traffic road and landscape design etc…

Moreover, humans live and depend on the environment that is being built. An essential role in interior design and urban design is to provide environments that sustain occupants' safety, health, physiological comfort, physiological well- being and productivity. Fortunately, in the last fifteen years the design community has slowly begun to address these issues by designing their environments with human health and well- being moved to the forefront of their design process. It is now the responsibility of designers, architects and urban planners to start fostering a relationship between people and nature by harmonizing the built environment with ecological design. Humanity's connection with nature can be traced back to the beginning of our species and how our intimates survived and deeply depended on the natural environment for survival.

Sustainability is that humans have an innate or evolution-based affinity for nature. According to this, a framework has been developed that will reconnect humans and nature within the built and urban environment. This framework is the sustainability, which incorporates energy consumption and energy efficiency, namely the principles of interior and exterior architecture.

The role of energy is becoming more and more important because of a possible energy shortage and also global warming in the future. Efficient use of energy has become a key topic for the most energy policies and buildings are one of the most essential energy consumers. Sustainable design and construction strategies are of great importance nowadays. From Vitruvius till today, problems regarding to protection in design and construction has not changed significantly although a lot of progress has been made in terms of materials and technology.

According to Meyson (2004), ecology provides the new great narrative of modernity. He underlines Lyotard's contrasting point of view that 'the great narrative' became unsuccessful in terms of presenting and justifying a modern world in a holistic way; yet there is a new uniting force, regarding to a great progress of science, which undoubtedly is dominating everyday life. This new critical position conveys itself in a different way; it is scattered, has no center, immanent to the general going, possessing the potential to shape the future developments.

One important source of energy consumption is definitely the built environment, and architecture is one of the most questioned disciplined that might provide a vast contribution to this struggle of the world. 'Sustainability' as a well known concept is yet an undeniable component of any built environment. Cultural and ecological contexts should be considered in a complementary relationship in order to achieve sustainable architecture.

Cultural context implies a sound respect to the traditional knowledge of place, technology and local materials. Ecological issue implies the recycling of energy either by the use of passive energy or renewable energy. It also requires harmony with local economies and data supporting biological diversity (Çalgüner, T.2003)

Construction heritage of Mardin city can be seen as the essence of sustainability with its inherent characteristics addressing both cultural and ecological contexts. Moreover, climatic nature of place and culture are the basic elements of architectural style especially in desert region, these factors are important factor and effected to the composition of architectural style. In desert region, traditional buildings have been built by the available local resources and design strategies include solar control and natural illumination, ventilation and insulation.

Other important factor is heat transfer and perception of the space in desert region buildings. Moreover, traditional architecture style which presents ideal thoughts for receiving improvements for the desert by improving it's efficiency using the modern technology. And also these traditionally designed buildings play a big role in obtaining the thermal comfort for the residents according to modern buildings in Mardin city. Generally in desert region, building pattern depends on creating functional spaces rather than aesthetical, but in Mardin both functional and aesthetical traditional building pattern has also developed the design style and using the potential of the local materials to the best results in comfort conditions and wind catchers, the interaction of building to obtain the required shading, and widening walls to guarantee insulation and time lag. Apart from that, providing perfect comfort of the inner spaces, interior elements and furniture combines keeping the temperature conditions and social privacy. An important fact is that there are both aesthetical and functional elements controlling solar radiation, ventilation, lightening or thermal insulation.

So, research is an attempt to conduce the design pattern for as much as necessary models in desert region and related method for applying all or most of the design or modern technical ideas supporting the natural conditioning concept which adds an ecological and sustainable point while searching for the identity of the place.

1.1 Objectives

Considering the explanation of ecological design principles combines the building methods and conducts certain architectural characteristics, the most significant objective of defining the ecological design principles, by studying its traditional buildings. And also these design advantages for obtaining comfortable interior and exterior spaces and then, to develop they while saving the cultural effects on the desert residents. These advantages include the suitable temperature control, depending on the thermal treatment design elements of ventilation, insulation, shading, rather than the complete dependence on privacy characteristics to be included in the traditional dwelling in addition to seeing same advantages between buildings.

1.2. Objective of the Study

The scientific hypothesis of this research depends on the sustainability and ecological design principles for the possibility of making use of both traditional and modern materials technology in designing and redesigning dwelling in traditional pattern. That is to say, assumption should be in terms of improving the traditional architectural pattern and increasing its efficiency more than modern building pattern. Besides, old characteristics of its architectural elements' materials to support its structural, constructional and also both interior and exterior finishing factors, would not handicap its improvement in terms of obtaining the modern dwelling conditions for the same area.

1.3. Method of the Study

This research to expose architectural pattern of the desert region has required a wide assessment of relevant architecture and other effective fields. At the same time as an attempt to obtain the demanded analysis and study, the literature review has included the following subjects:

- Ecological design
- Sustainability
- Built environment
- Living among buildings
- Architecture
- Interior architecture
- Design pattern
- Desert circumstance

The literature survey has also included many libraries and related internet sites. The interest of the desert region architecture topic has contained almost all related sides of building, space of between buildings, as in traditional and modern buildings, climatic, social and economical circumstances and other direct and indirect effects of building in hot regions in the southeastern part of Turkey and Mesopotamia plain in Mardin.

The most significant libraries were as it follows:

- Library of Çankaya University- Ankara
- Library of Bilkent University- Ankara
- YOK Library- Ankara

1.4. Methodology

The study is based on the detailed analysis of traditional housing in Mardin City according to ecological design principles as a case study.

Using the urban pattern language as a tool, all elements or architectural pattern will be pointed out and evaluated. The elements which require improvement within the frame of solar radiation, passive heating and cooling, thermal and also cultural pattern and technological conditions will be developed. The new pattern cannot harmonize with the traditional ones which is a great distinction between old and new ones.

CHAPTER 2

THE CONTEMPORARY PARADIGM IN DESIGN SUSTAINABILITY

> Ecology is a form of nature which is a direct response to capturing the flow of energies and materials that reside within that bioregion. The huge diversity in natural forms teaches us that are many ways, many forms, to capture and use available energy. The form itself, made up of biological processes, maximizes the use and storage of energy and materials for its needs and functions within the use and storage of energy and materials for its needs and functions within its ecological and energy location. (Williams, D, E, FAIA, 2007.1)

It is the study of that spatial connectivity between organism and environment which makes ecology an estimable model for sustainable design. Moreover, the physical environment includes the sun, water, wind, oxygen, carbon dioxide, soil, atmosphere and many other elements and processes. The variety and complexity of all the components in an ecological study require studying organisms within their environments. Ecological study connects many fields and areas of knowledge and doing so illustrates aspects of components and their relationships to one another within their spatial community.

Additionally, planning and architecture must work together to be sustainable. Sustainable design challenges the designer to design relations to the site and to the site's resident energy for designing holistically and connectedly and address the needs of the building, relevant environment and community of which it is a part. Also, sustainable design and planning make use of the regional climate and local resources.

To design sustainably is to put together the design into the ecology of the place, the flow of materials and energy residing in the community. "Sustainability is in urban form, transport, landscape, buildings, energy supply, and all of the other aspects of vibrant city living.'' (Thomas, R, 2003. 3) Sustainable development is a key aspect of creating environments with pedestrian, cyclist and public transport in mind. Three interdependent aspects of sustainability: social, economic and environmental are shown in (Figure 1).

Besides, design is a powerful process, and as such, when it is informed by the knowledge gleaned from truly sustainable systems, design has the potential of changing how buildings, communities, and societies function. Moreover, the unsustainable approaches to designing and building energy- consumptive structures must develop to location-based energy and self-sufficient designs and they need to develop rapidly.

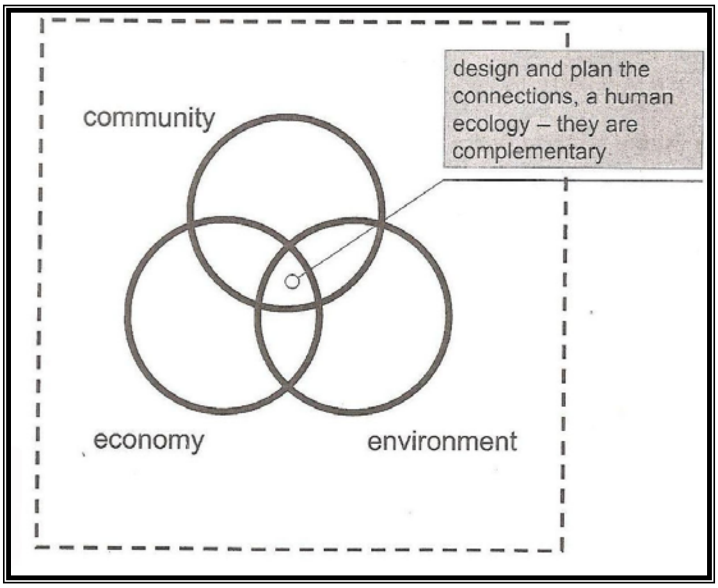


Figure 2.1.The Three Rings of Sustainability Illustrate The Interdependence of The Elements. (Williams, D, E, 2007. 14)

Built environment can exist independent of the natural environment. The result of this is the design of buildings and developments that 'mistreatment and shame, people's experience of nature, fostering separation and caustic environmental practices'.

As a result of this practice, there has been common land dreadful conditions soil, water, air pollution and fatigue of natural resources. The answer for this problem has been the achievement of ‘sustainable design’ practice or ‘green design’.

Besides, sustainable design is the one that has a low contact on the environment by ‘pursuing energy efficiency, using renewable energy, reducing resource spending, reusing and recycling products and materials, lessening waste pollution, employing non toxic substances and materials, protecting indoor environmental air distinction, and avoiding habitat destruction and loss of biodiversity. This practice is also known as low environmental impact design, which has lessened the impact on the natural environment but has failed to foster a connection between people and nature in the built environment. Today’s technology and knowledge regarding to the settlement of association with nature can minimize harm to the environment as well the built environment. Moreover, built environment consists of history and culture of the relevant place.

Users directly, indirectly or symbolically through a building’s exterior facial appearance, interior space, decoration and exterior landscapes. The built environment is to discharge into the evolutionary empathy that people have with nature to encourage physical and psychological well-being.

> Environmental psychologist Judith Heerwagen argued that the human brain is constantly reverting to its survival instincts of seeking out and things and places that help survival such as food (plants, flowers and animals) shelter, light, water and fire. It is important to understand what attracts people to these types of features so that they can be introducing into the built environment. (Taylor, K, L.2007.20)

Additionally, in short, natural design can be achieved from beginning to end the use of natural lightning, natural materials, natural ventilation; forms that take off nature and views of nature.

It is suggested for that buildings to be designed based on survival needs and well being. Design should be built around our ‘primitive preferences’ and our connection to nature.

In architecture and interior space, refuge can be achieved by creating spaces that cover up and protect but provide views to neighboring spaces. Protection can be created all the way through, lowered ceilings, canopies as well as partial enclosures. Lacking protection one can feel ‘on display’ which can cause discomfort or disorder. Prospect can also be achieved by brightly colored walls, art or varied lighting.

Moreover, nature is full of mysteries and complexities that are discovered all the way through understanding of the senses. Attraction is the wish to know more or to explore and expand knowledge, a critical part of human development. In the built environment one can be enticed to explore by complex details or spatial variety. The built environment can also entice the user with danger, the want for mystery, excitement and danger. Threat can be achieved by features such as cantilevered balconies, catwalk, hidden or curved pathways as well as variations in altitude.

Water that is integrated into the built environment can be successful in fostering a correlation between people and nature as well as having positive psychological special effects. Some of the most successful designs that incorporate the use of water are those that copy water in its natural state such as waterfalls which follow the laws of significance as opposed to up shooting fountains which seem to disagree with it. Furthermore, water reacts to all of senses: sight, sound, touch, and even smell. The suitable use of sounds of water can produce agreeable results. So that designers can use sound to attach people to the natural flow of water, which can be consoling or block out unwanted noises by creating ‘white noise’. The thoughtful properties of water can be used to reduce feelings of claustrophobia and can even develop spaces to make them feel larger.

Sensory variability involves elements which activate the human common sense of sight, sound, smell and touch. All the things which have evolved from our survival instincts, life sustaining elements such as water, fire and sun are also experienced this way. The natural environment is full of sensory experiences that can be incorporated into the built environment. In design, the senses can be enticed with heating and cooling with solar energy, temperature, natural ventilation and water.

2.1 Sustainable Design Principles

> Building design consideration in cities show how closely the buildings are linked to their surroundings. The temperatures, wind speeds, humidity levels, air quality and noise levels are related to, and will depend on density of development, energy sources, landscape, choice of transport systems and similar factors. Urban design and building design are inextricable. (Tomas R.2003. 46)

Need good quality buildings and better spaces between buildings and good sustainable design seeing Figure 2.1.1

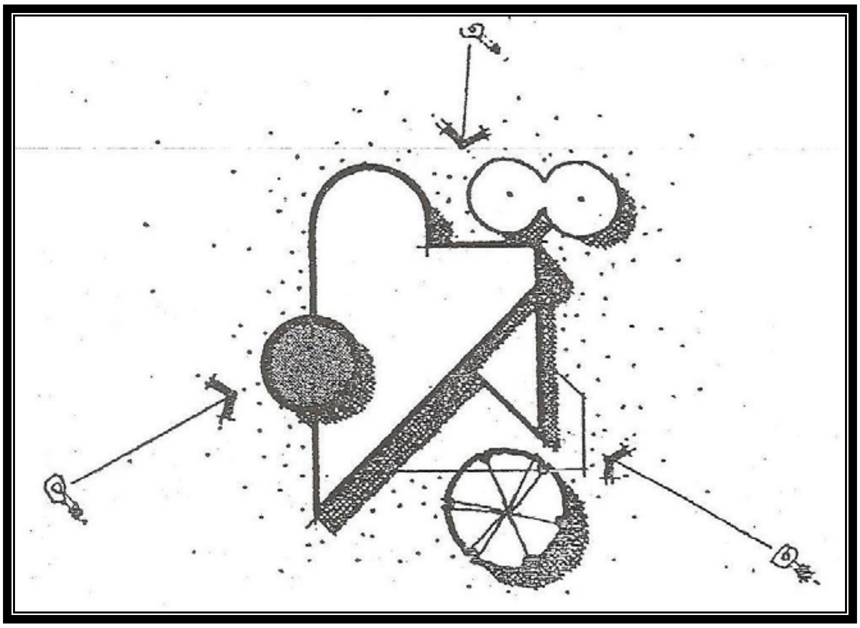


Figure 2.1.1 Sustainable Design
(Robinette, G. 1993. 2)

When a group of buildings are clustered together positively defined outdoor spaces recognized in the voids between the building masses. Looking at the Figure 2.1.2 is seeing different kinds of spaces defined between buildings.

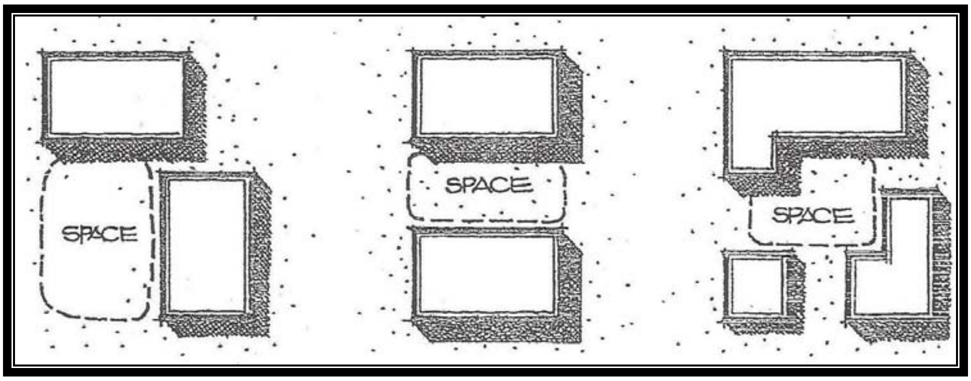


Figure 2.1.2 Showing the Space Between Buildings Masses
(Robinette, G.1993. 2)

Distance to building height ratio: The quantity of enclosure and the resulting degree of spatial observation depends on the distance to height ratio between a person standing in an outdoor space and the height of surrounding building walls. According to the standards stated by Gary Robinette in 'Plants, People and Environmental Quality' full enclosure occurs when the surrounding building walls create 1:1 distance to height ratio or fill a 45 degree cone of vision. A hold of enclosure occurs with a distance to height ratio of 2:1, minimum enclosure with a ratio 3:1 and loss of enclosure with ratio of 4:1. (See Figure 2.1.3)

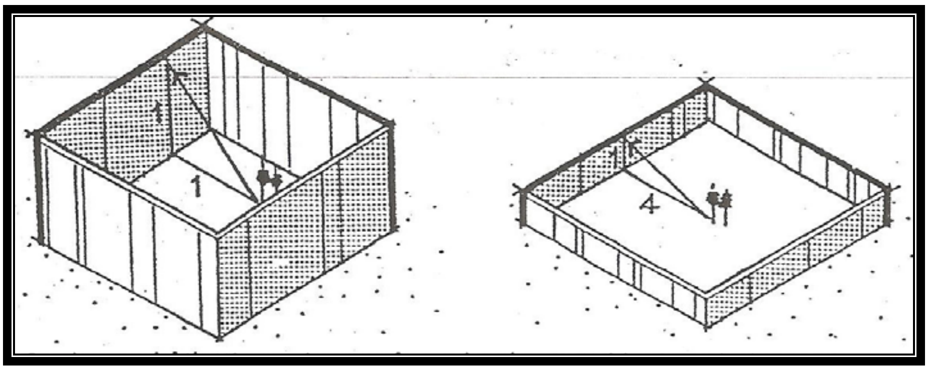


Figure2.1.3 Building Height Ratio
(Robinette, G. 1993. 3)

Moreover, 'the stronger sense of spatial enclosure is felt when a building wall fills and extends beyond the cone of visualization. The distance to building height ratio also affects the feeling and use of an outdoor space in addition to influencing spatial enclosure. In Exterior Design in Architecture, Yoshinobu Ashihara analyzes the effect of the distance to building height ratio on the hierarchy of exterior to interior spaces.

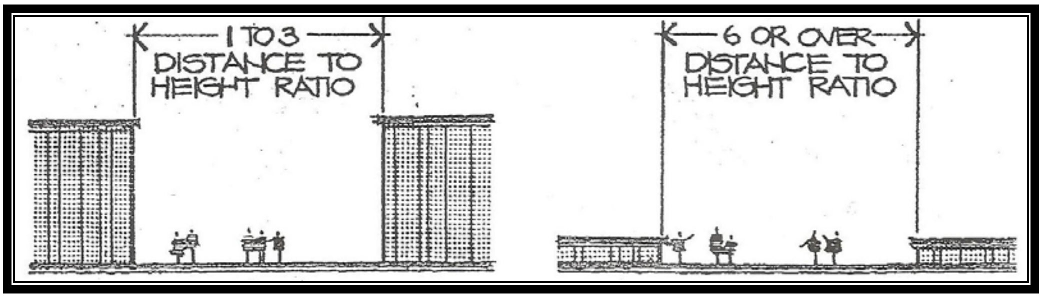


Figure2.1.4 Height Ratio Examples
(Robinette, G.1993. 3)

The nearest and interior-like space has a distance to building height ratio of between 1 and 3, while the most public and exterior like space has a distance to building height ratio of 6 or over (See Figure 2.1.4). Although a strong sense of spatial enclosure is often a design objective in arranging a cluster of buildings, care must also be taken not to create outdoor spaces where the building height and mass overpowers that scale of adjacent exterior areas. This occurs when the distance to building height ratio becomes much less than 1.

The more spatial leaks there are, the weaker the perception of spatial enclosure is. One method for eliminating spatial leaks when working with a multiple building layout around an outdoor space is to overlap the building facades as much as possible to prevent views into or out of the space (see Figure 2.1.5).

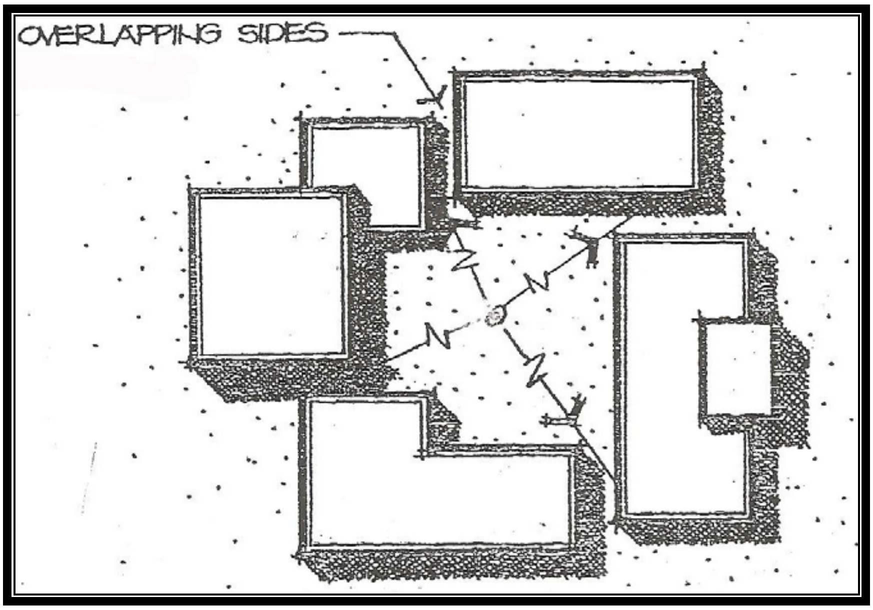


Figure 2.1.5 Outdoor Space around the Overlap Building Facades
(Robinette, G.1993. 5)

Spatial leaks can also be eliminated or concentrated through the use of other design elements such as landform, plant material or freestanding walls that block views considering Figure 2.1.6 as a more sustainable design than overlap building facades.

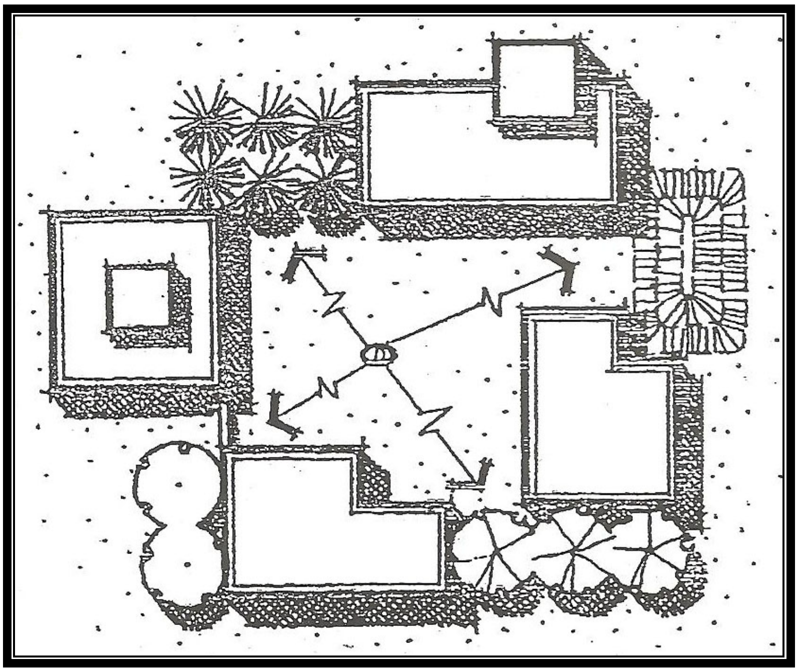


Figure 2.1.6 Creating Outdoor Space with Landscape Elements
(Robinette, G. 1993. 5)

However, the weakest definition of exterior space by buildings in plan occurs when they are organized in a long row or are scattered so indiscriminately on a site that no logical perceptional relationship among them can be realized as seen in Figure 2.1.7.

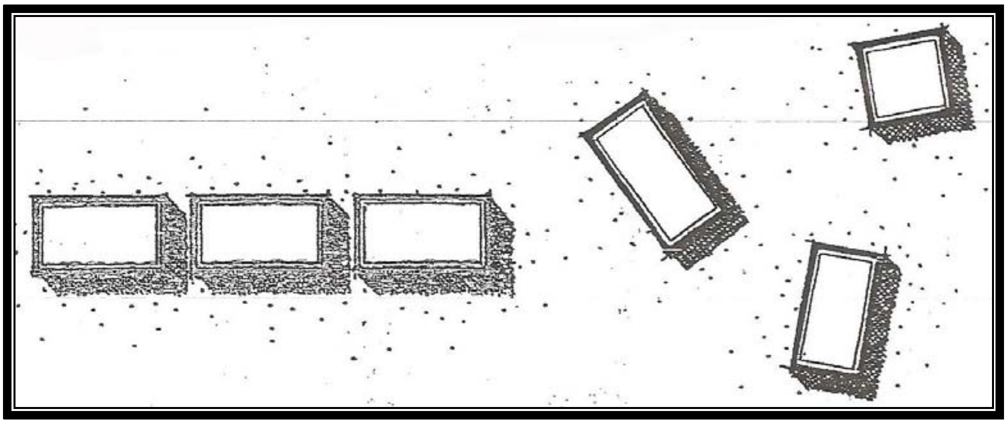


Figure2.1.7 Weakest Building Plan
(Robinette, G. 1993. 6)

When spatial organization is attractive design purpose as seen in Figure 2.1.8, which is the sketch view, a situation occurs in which it is best to allow and even give confidence views to the outside of an outdoor space defined fundamentally by buildings. Moreover, GHIRARDELLI Square in San Francisco designed by LAWRENCE HALPRIN is an example of an urban space both as a sense of enclosed space and outward views seen in Picture 2.1.1

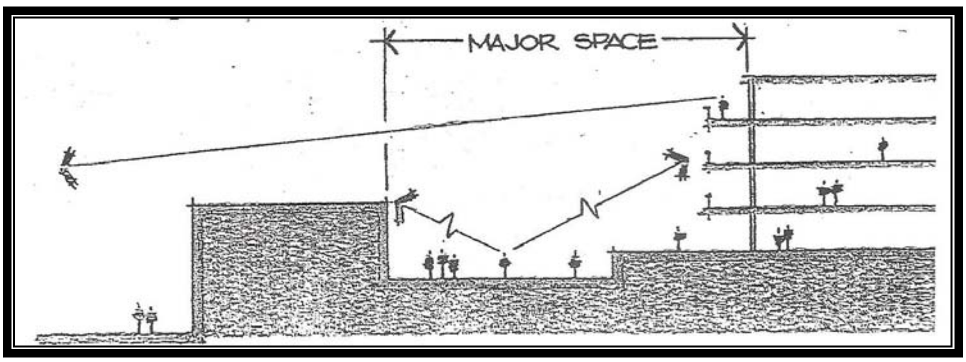


Figure 2.1.8 Varied Spaces
(Robinette, G.1993. 6)

Picture 2.1.1 GHIRARDELLI Square in San Francisco

The easiest method for creating outdoor space with buildings is by a simple continuous surrounding wall of the facades. Considering Figure 2.1.9 a central space can be seen as surrounding building facades.

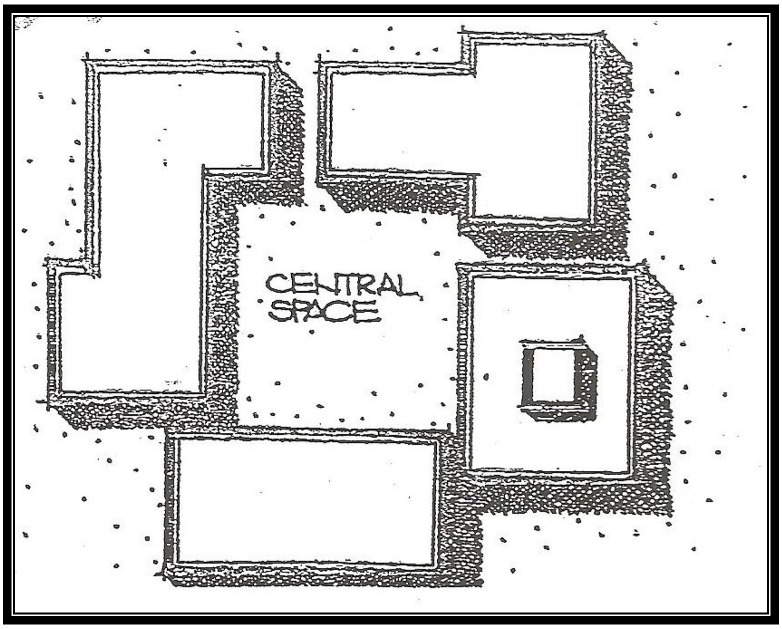


Figure 2.1.9 Building Surrounding Central Space
(Robinette, G. 1993. 6)

This is attractive when one clearly defined space is required. Nevertheless this may also be least exciting because the entire space is at once easily observed. Such space is static; it lacks subspaces and indirect movement. When the plan's outline of surrounding building walls becomes more varied and complex, the resulting outdoor space takes on a richer quality with a number of implied subspaces contributing to the overall spatial fabric (see Figure 2.1.10).

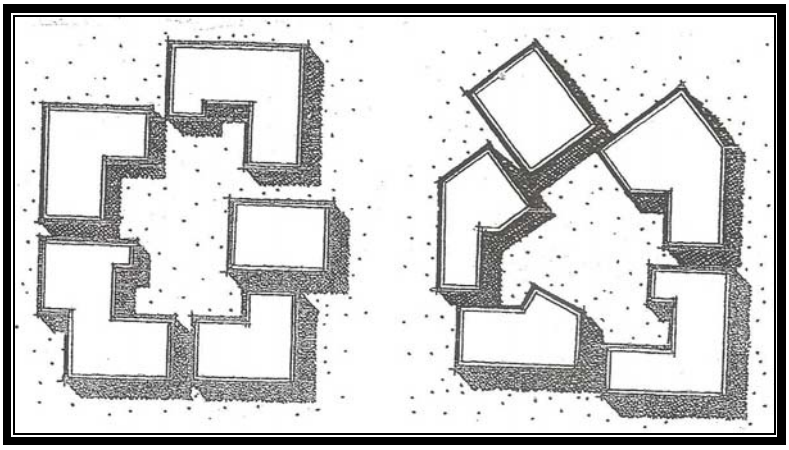


Figure 2.1.10 Varied and Complex Outdoor Spaces
(Robinette, G.1993. 7)

A simple outdoor space defined by buildings becomes more complex if it is varied so much. It perceptually breaks apart, having sense of separate spaces (see Figure 2.1.11).

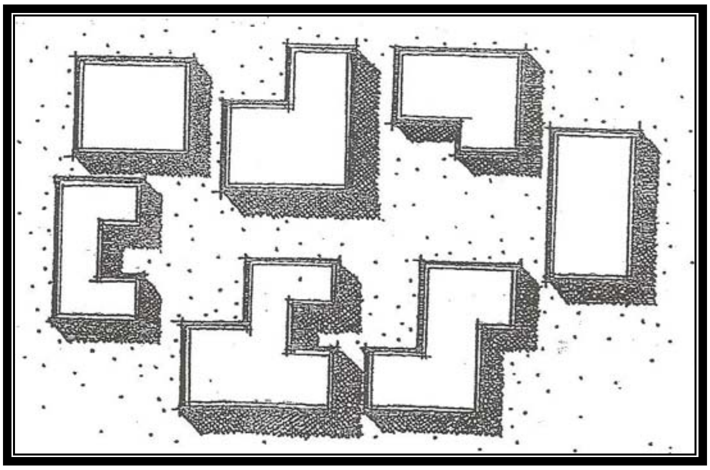


Figure 2.1.11 Separate Spaces
(Robinette, G. 1993. 7)

The identity of one more than enough space is lost to a feeling of a number of smaller spaces. The design objective is to preserve the feeling and identity of one large space with relevant subspaces. Attention should be paid to avoid the subspaces from becoming too enclosed or separated from each other. It is a helpful design assisting a spatial volume to order in size for organizing a focus for the composition.

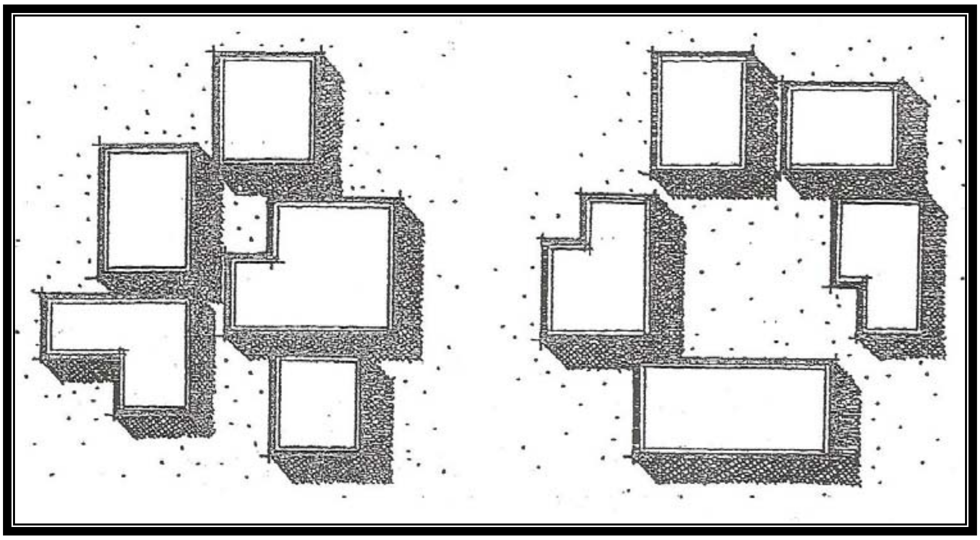


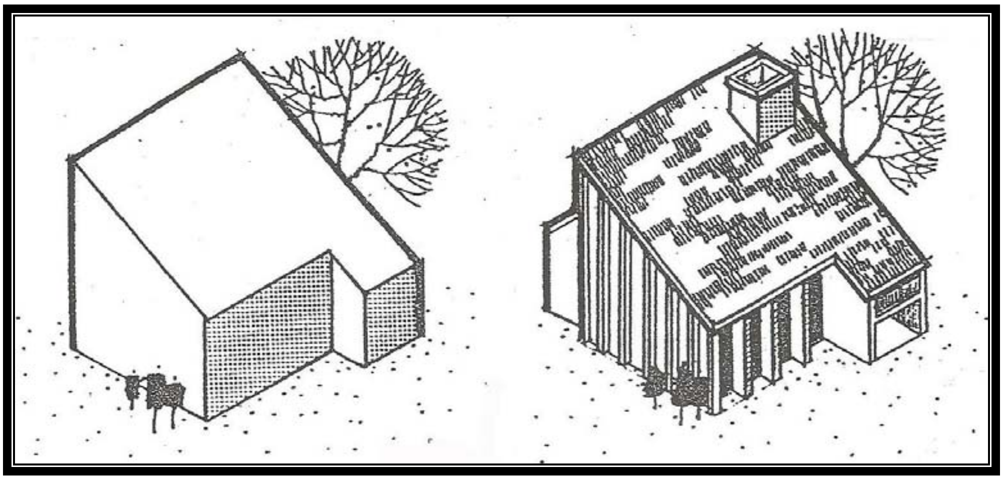
Figure 2.1.12 Smaller Subspaces and Larger Spaces.
(Robinette, G.1993. 8)

Here the smaller subspaces are unable to complete with or detract from the major space (See Figure 2.1.12). Another factor, which is affecting spatial perception of central open spaces defined by buildings, and is relevant to the distance to height ratio, is the plan horizontal dimension of a space. References book such a 'PAUL D. SPREIREGEN in Urban Design: *The Architecture of Towns and Cities'* which has outlined the effect of distance on the feeling of outdoor space. Moreover, spaces defined primarily by buildings that are 24m or fewer in horizontal distance may be described as intimate.

It is also suggested that 'grand urban space' to be between 24m and 137m. The maximum distance for being able to see body action and movement is 137.

Character of Building:

The character of the building facades also affects the quality of space (see Figure 2.1.13).The color, texture, detailing, and proportion of a building façade influence the personality of an outdoor space adjoining it. The space can be made to feel cold, harsh and in human if the building walls surrounding the exterior space are massive, gray, and lack fine detail.

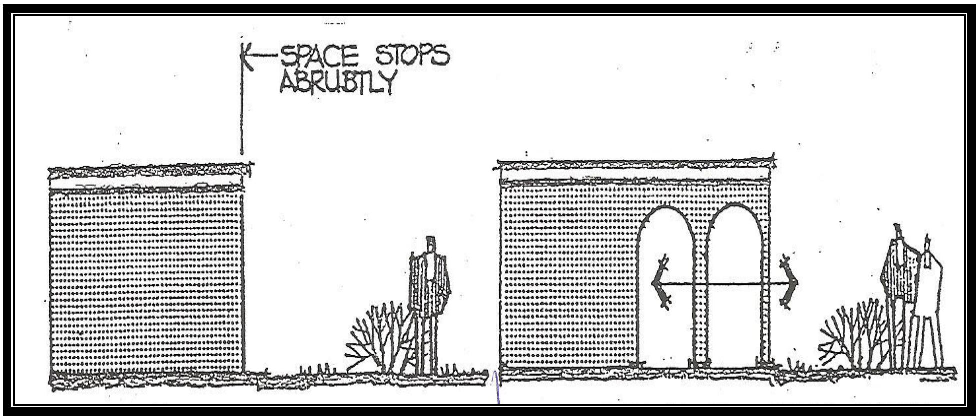


*A building block plan lacking detail spaces seems harsh

* Buildings that are finely detailed adjoining exteriors spaces more human and pleasant

Figure 2.1.13 Building Facades (Robinette, G. 1993. 9)

Or on the other hand, the same dimensions of space can be made to feel delicate, light, and airy also inviting if the spaces defining building walls are warm in color finely detailed and proportioned for the human. A colonnade can also produce a less character than a wall that is a solid mass (see Figure 2.1.14).



* Flat wall creates a definite spatial edge no interpenetration of space.

*Colonnade provides inter-penetration of of indoor/outdoor

Figure 2.1.14 Differences Between Spatial Edge Buildings and Colonnade Space Building. (Robinette, G.1993. 9)

Besides, building walls are subdivided and proportioned for the size of a person, particularly at ground level as seen in Figure 2.1.15.

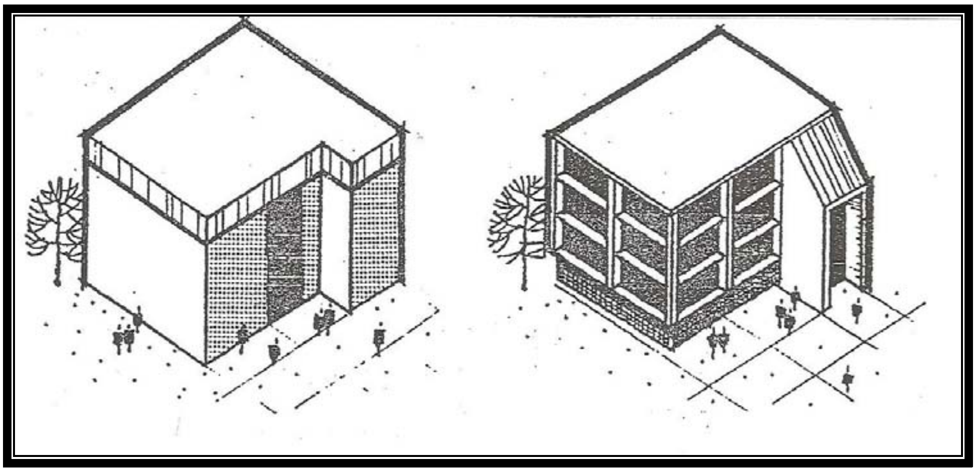


Figure 2.1.15 Building Walls are Divided
(Robinette, G.1993. 10)

The use of reflective glass walls on a number of contemporary buildings is another treatment of building facades. This wall material acts as a mirror reflecting the surrounding environment in the building façade. With this effect the building is not just an object in the landscape. The physical edges of the space are perceptually lost.

2.1.1 Passive Heating

Temperature can be controlled in indoor environments. However, only very limited control is possible in outdoor areas, (Figure 2.1.16) shows the main factors determining our perception of the temperature.

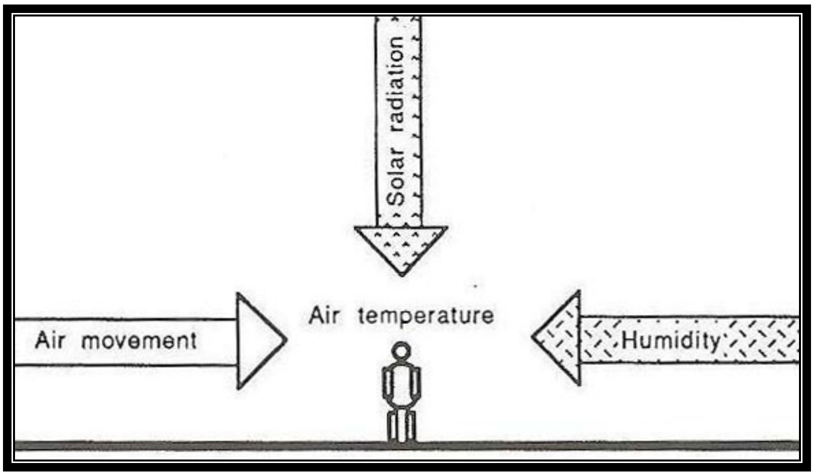


Figure 2.1.16 Climatic Factors Influencing Human Comfort
(Beer, R, A. 1990. 69)

''The deep body temperature has to be maintained at a temperature between 35ºC and 40ºC (normally about 37 ºC for survival).''(Beer Anne R, 1990. 69) Heat from the skin has to dissolve, although it is possible for humans to survive much higher temperatures for a period of time, given the right environmental conditions. The actual air temperature is not the only faction of our perception regarding to the human comfort. The relationship between the humidity of the air and the actual temperature is of particular importance (see Figure 2.1.17).

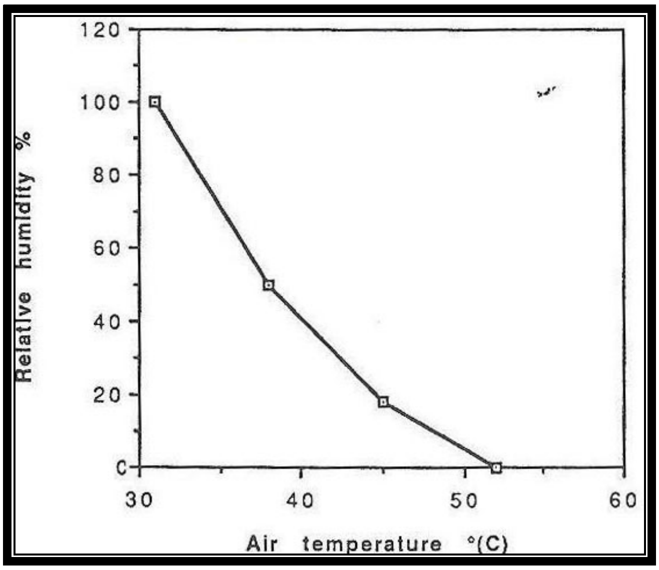


Figure: 2.1.17 Proportion of Air Temperature and Humidity

(Beer, R, A.1990. 70)

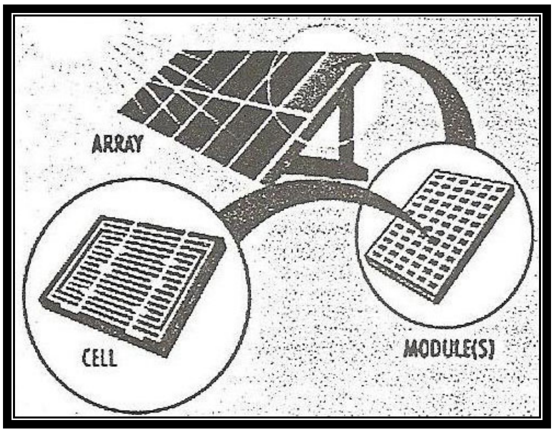
What is about the wind still situation at high temperatures' evaporation is the main way that the body controls human temperature. For instance at 100% relative humidity no evaporation can take place and therefore, conditions are extremely uncomfortable and people cannot survive high temperatures for long.

In cold conditions, very dry air increases the fall of colds as perspiration is evaporated quickly from the skin and this adds to sensation of cold. That makes conditions feel more comfortable at the temperature levels, but less comfortable in cold air. Therefore, the site planner needs to create special micro- climates outside the buildings.

In addition, using solar collectors the sunlight is directly transformed into heat. Usage of solar heat has many advantages. Power from the sun comes to the Earth as heat. Processes of fusion produces large amount of energy. The average amount of energy that contacts the Earth's surface in a day is $200W/m^2$. This means that the average building has more than enough roof space to produce enough electricity to supply all of its power needs.

A variety of types of technologies connected to solar power can be divided into two groups. First group are those that use the sun to generate heat, called solar thermal technologies, which take in solar concentrator power systems, solar collectors and passive solar heating. The other group is about the solar radiation into electricity through the photoelectric effect by using photovoltaic.

1. Photovoltaic cells and modules: these cells in many sizes are in many sizes, including 10 cm to 10cm sizes and generate about half a volt of electricity. According to the report by Ben Said, PV cells are bundled jointly in modules or panels to produce higher voltages and increased power as seen in (Figure 2.1.18). For example, a 12 volt module, depending on its power output, could have 30 to 40 PV cells. A module producing 50 watts of power measures approximately 40 cm by 100cm.



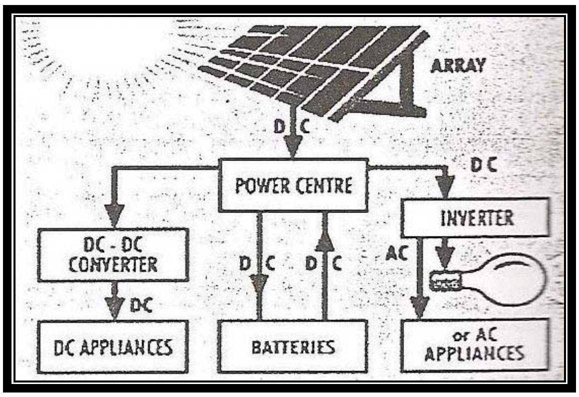


Figure: 2.1.18 Photovoltaic Cells and Modules

(Said, S, N, B. 2004. 3)

2. Solar thermal technologies:

- Solar collectors combining the use mirrors and lenses to concentrate and focus sunlight into a receiver mounted at the system's focal point. The receiver absorbs and converts the sunlight into heat which is transported by means of heat fluid through pipes to a condensation generator or engine, where it is converted into electricity.
- Solar collectors are large boxes with one or more glass covers. Also inside the boxes are dark colored metal plates that absorb heat. Air or liquid such as water, flows through the tubes and is warmed by heat stored in the plates.
- Passive solar heating design methods are features such as large south-facing windows and building materials that absorb the sun's thermal energy. The simplest common of the passive solar technology is referred to as direct solar gain. The result is that cold weather; the large thermal mass in the room absorbs solar energy and radiates heat.

2.1.1.1 Day Light

Day light refers to spread natural light coming from the surrounding sky dome or reflected off nearby surface. Direct sunlight is very much brighter than ambient daylight. So that the benefits of daylight have traditionally included better health which sense of well-being, as well as architectural character of spaces. Presently, providing more natural light in many spaces can reduce the CO2 emissions associated with artificial lighting from conservative power sources. Improvement of glazing has also meant that it has been possible to provide more natural light with lower heat losses in winter. Successful spaces are those with good day lighting from two sides, a wall and roof. We can give the eighteenth century Georgian home in London with elegant proportions and tall windows facilitated spaces as an example. London homes built in the 1840s had windows which normally had wooden internal shutters and were used at night to provide insulation to maintain comfort and provide privacy as seen in (Picture: 2.1.2).

Picture: 2.1.2 A London Terrace had Wooden Shutters

Design that utilizes daylight as an important part must be integrated with other environmental concerns: view, natural air movement, acoustics, heat gain and loss and electric lightning. For example, an operable window will permit daylight and natural air flow, but it will also allow noise to enter the space.

2.1.1.2 Solar Radiation

People feel warm in the sun because of direct radiation which is registered like heat, but also because of the reflected radiation which bounces back from vertical and horizontal surfaces. Illustrates very simply the complicated process by which the sun warms the surface of the earth. A few limited controls over direct and reflected radiation (see Figure 2.1.19) for instance, can decrease the direct heat by creating canopies of plant material or some form of roofed structure, otherwise shade can fall on a particular spot by planting vegetation, building walls or changing the landform.

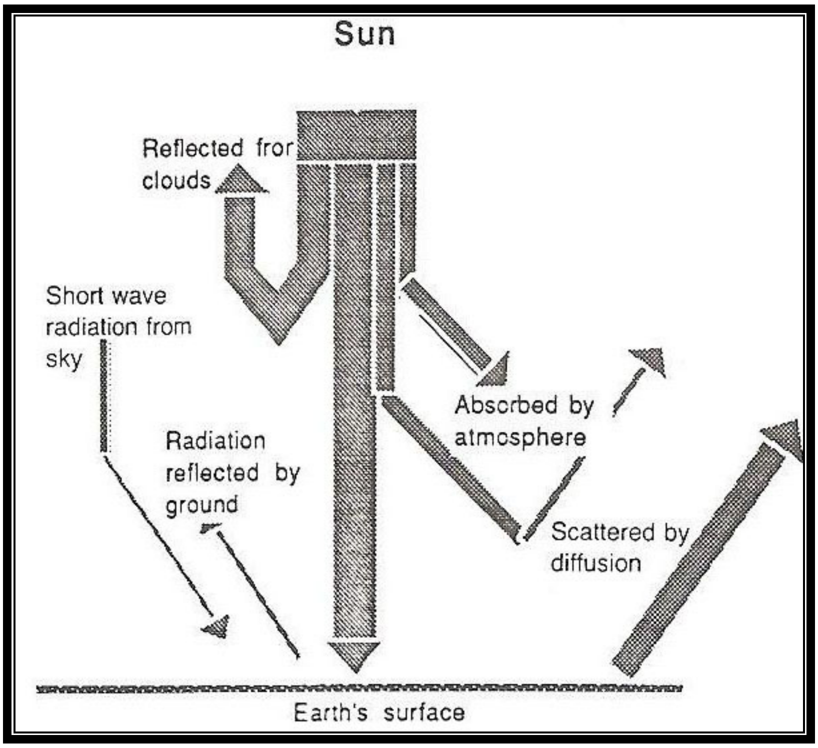


Figure 2.1.19 Solar Radiation and it's Reflection on The Earth's Surface
(Beer, R, A.1990. 72)

2.1.1.3 Passive Solar Gain

Passives solar gain takes advantage of the solar radiation falling on roofs, walls and windows. There are three approaches to passive systems; direct gain, indirect gain and isolated gain. At the same time the building' elements (or material) is absorbing heat for later use; solar heat is available for keeping the space comfortable. As in the example seen in (Figure 2.1.20), in summer time the potential solar gain which could lead to overheating needs to be controlled at facade like it is done in the BRE Environmental Building.

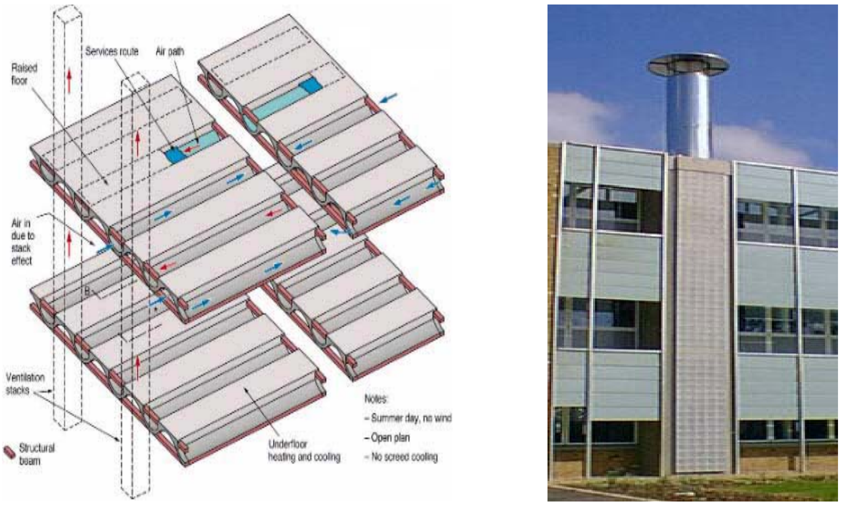


Figure 2.1.20 Movable Louvers at The BRE Environmental Building

2.1.1.3.1. Direct Gain

In this type of system sunlight passes through the windows and its heat is trapped by the thermal mass in the room. The mass absorbs solar heat in winter throughout its exposure to direct sunlight and radiates that heat back into the space during the cooler night. Nevertheless, during the summer, the reserve occurs and the thermal mass is prevented from receiving direct sunlight and absorbs the heat in the room shown (Figure 2.1.21).

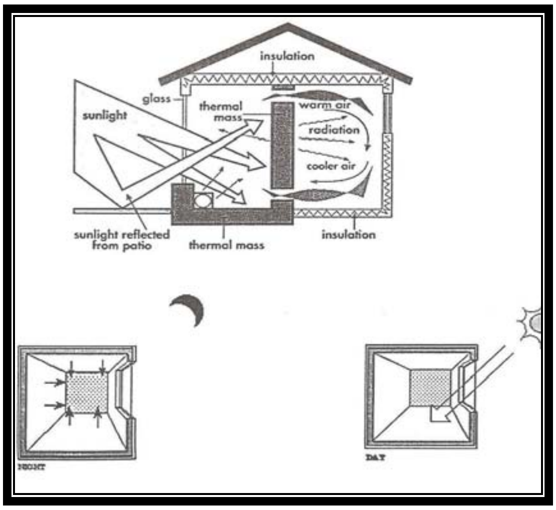


Figure 2.1.21 Thermal Mass in The Interior Absorbs The Sunlight and Radiates The Heat at Night (Said, S, N, B.2004. 11)

2.1.1.3.2. Indirect Gain

Having same materials and design principles as a direct gain system, an indirect gain system positions the thermal mass which contained liquid between the sun and the space to be heated.

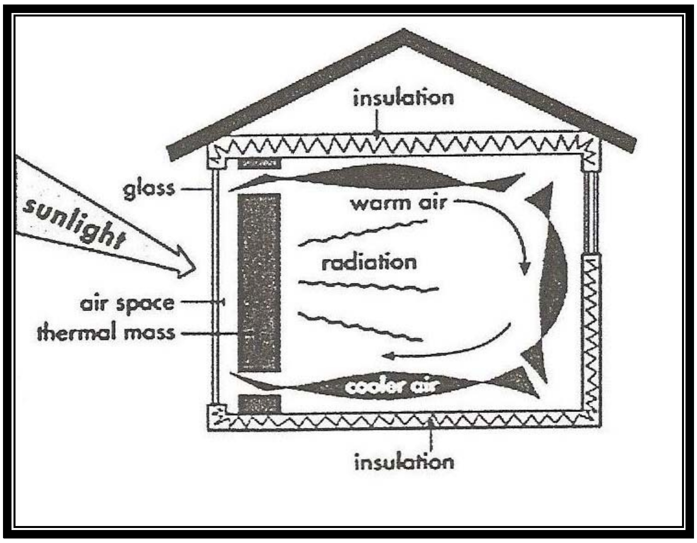


Figure 2.1.22.a. Solar Heat (Said, S, N, B.2004. 13)

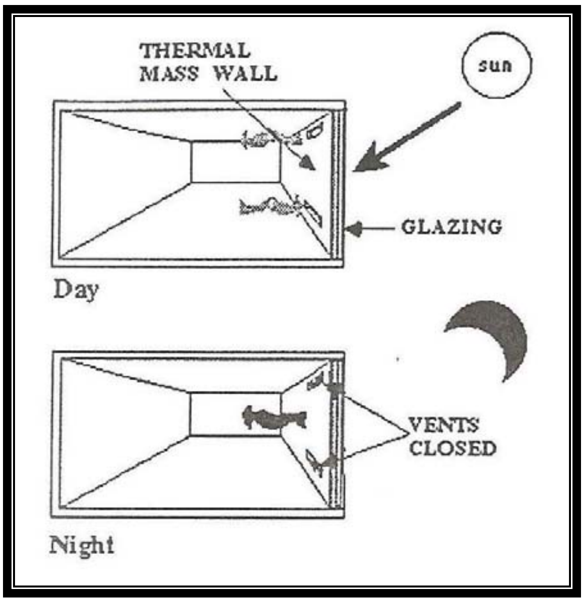


Figure 2.1.22.b. Thermal Mass Wall
(Said, S, N, B. 2004. 14)

As it is seen in Figure 2.1.22a and 2.1.22b, the sun’s heat is collected and trapped in a narrow space between the window and wall (thermal mass), after it passes through the window. Heats air, rises and spills into the room through vents at the top of the wall and cooled air and store moves to take from vents at bottom of the wall. The heated air circulates throughout the room by convection. Moreover, the thermal mass continues to absorb and store heat to radiate back into the room after the sun has gone. The process is reversed during summer time.

2.1.1.3.3. Isolated Gain

An isolated gain system has its integral parts separate from the main living area of a house which provides a convective loop through an air collector to a storage system such as sunroom. The isolated gain system will utilize 15-30% of the sunlight striking the glazing toward heating the adjoining this areas. And also well designed sunspace can provide up to 60% of a home’s winter heating requirements.

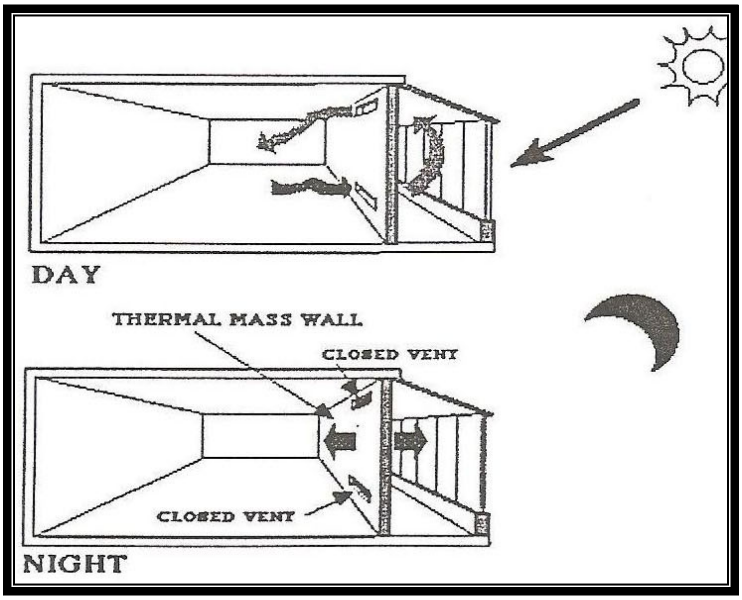


Figure 2.1.23 Sunroom and Thermal Mass Wall an Air Collector of a Storage System in The House. (Said, S, N, B. 2004. 16)

Solar rooms are spaces with large areas of windows facing south. Examples include, sun rooms, solariums, sun porches and green houses without ventilation or thermal mass also provide growing plantation (see Figure 2.1.23). Solar rooms that face east or west do not work as well for heating as those that face south. They supply less heat during the winter and may provide too much in summer. A solar room results when the space between the glazing and the wall is greatly enlarged. This space, in a sense, absorbs the shock of outdoor weather extremes, tempering their effect on the building while also providing solar heat (see Figure 2.1.24 and Figure 2.1.25).

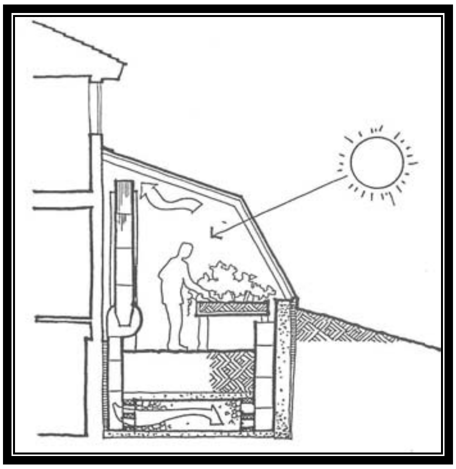


Figure 2.1.24 Solar Room Providing The Growth of Plants
(Why Passive, 1997. 38)

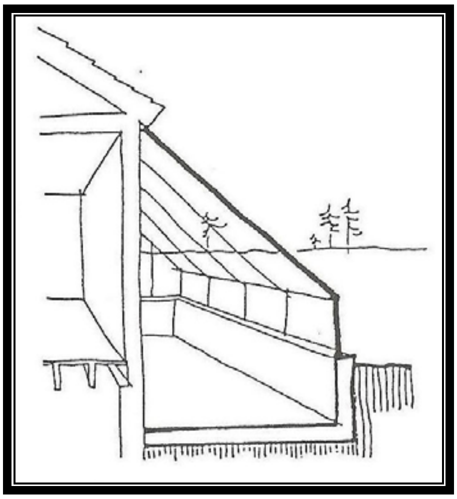


Figure 2.1.25 A Solar Room Results when The Space Between The Glazing and The Wall is Greatly Enlarged. (Why Passive, 1997.36)

Solar rooms have a number of advantages;

- Both the solar rooms and building/house will lose less heat
- Natural light can be made to penetrate deep into your house
- Heat will move easily from the solar room
- The solar room can be easily heated by the house if necessary and so is unlikely to freeze
- The solar room can be readily used as an expanded living space
- Solar room will provide a feeling of large exterior wall and window area
- The excess humidity of the solar room can be somewhat reduced by and profitably used by the excessively dry winter house.

2.1.2 Passive Cooling

2.1.2.1 Cross- Ventilation

The most common way to cool a building with moving air, without using mechanical power, is to open windows and doors. This is a natural ventilation and do not underestimate its cooling effect. Simply, open windows let air flow through the lower part of the room which are narrow and facing the wind, or which are T or H shaped, trap breezes and enhance cross ventilation through the building shown (Figure 2.1.26).

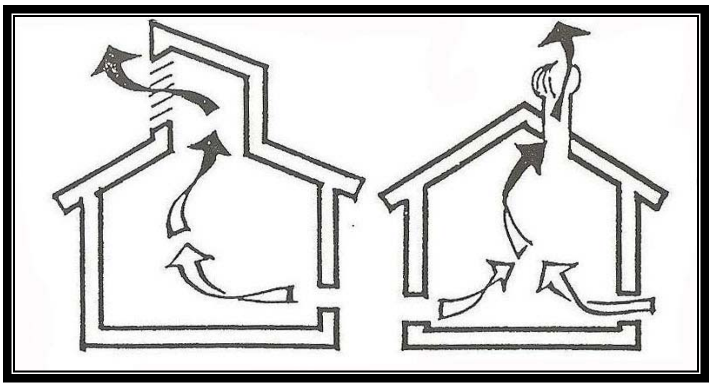


Figure 2.1.26

Natural Ventilation in T or H Shape

(Why Passive, 1997. 87)

Warm air rises to the top of a high space, where openings naturally exhaust the warm air. As well, summer nights are a lot cooler than days in houses built by using heavy materials. Cool the house at night by natural ventilation and the thermal mass will keep it cool during the day. Furthermore, natural ventilation can be effected by land planning. Natural breezes should not be blocked by trees, brushes or other buildings. The shape of buildings, proper clustering of buildings and other landscaping features, such as bushes and fences, can funnel and multiply natural breezes such as shown Figure 2.1.27.

> Natural ventilation system has the advantage of requiring very little energy but may need more space for a low-resistance air path. A rough guideline is that ventilation from one side is enough for 6 to 8m and cross-ventilation is suitable for spaces across 15-20 m. (Thomas, 2003. 54)

In most of the housings natural ventilation is the rule and dual aspect flats provide an opportunity cross ventilation and more access to the sun. However, in office and other buildings, though, the problems are often more complex. A range of solution is being developed, running from assisted natural ventilation with the assistance of wind.

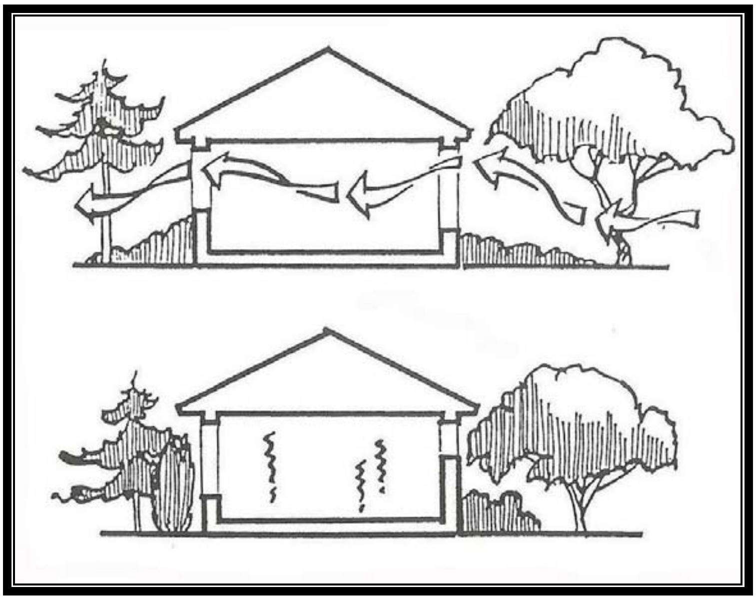
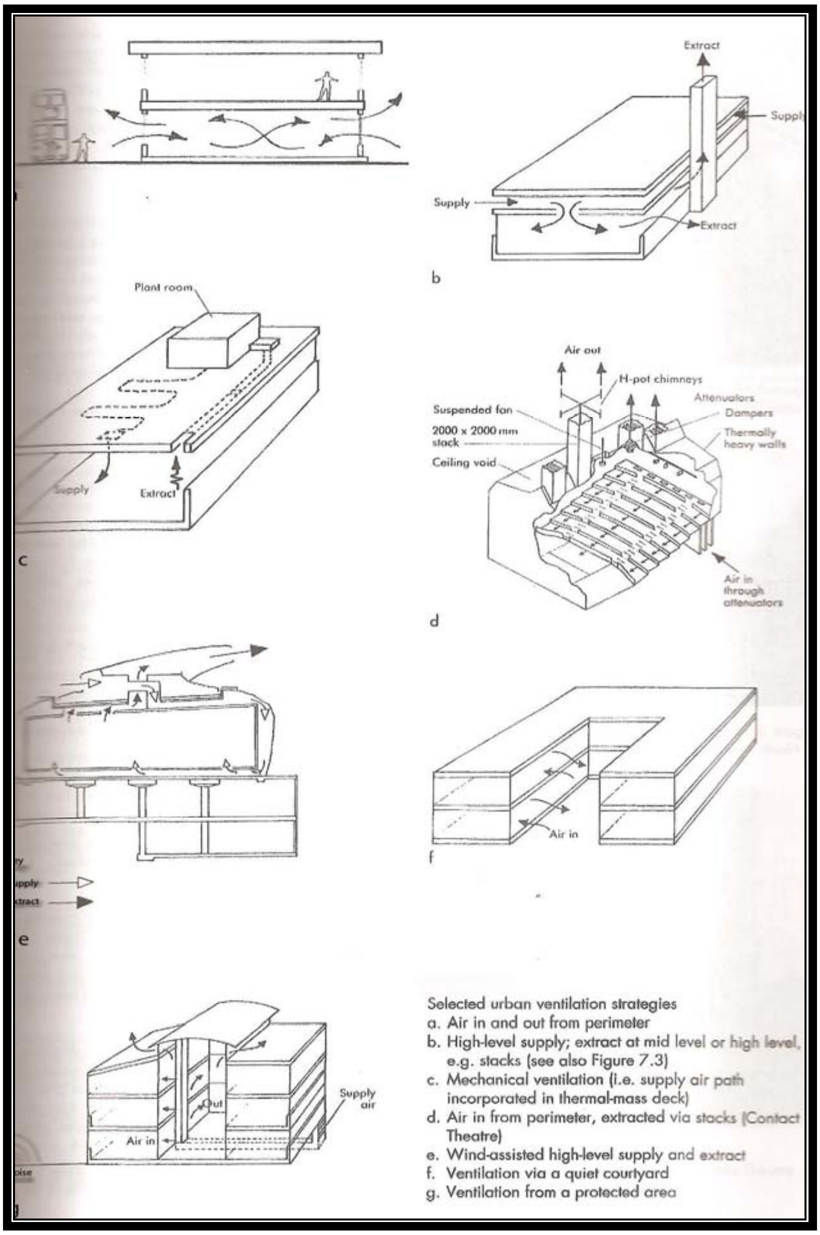


Figure 2.1.27 Multiple Natural Breezes

(Why Passive, 1997.88)

Ventilation Strategies:

Many of the methods that have been shown are 'suitable' and hybrid solutions combining natural and mechanical ventilation might be a way of dealing with variable urban pollution rates. Mechanical ventilation might be provided when pollution is high and filtration is needed (see Figure 2.1.28).



Selected urban ventilation strategies
a. Air in and out from perimeter
b. High-level supply; extract at mid level or high level, e.g. stacks (see also Figure 7.3)
c. Mechanical ventilation (i.e. supply air path incorporated in thermal-mass deck)
d. Air in from perimeter, extracted via stacks (Contact Theatre)
e. Wind-assisted high-level supply and extract
f. Ventilation via a quiet courtyard
g. Ventilation from a protected area

Figure 2.1.28 Urban Ventilation (Thomas, R. 2003. 55)

In a similar way, the ventilation mode is suitable for noise level if required. These approaches could function on plan, reacting to local roads or vertically in tall buildings. It is the best example of Jean Nouvel's brilliant gambit at the Cartier Foundation Paris (see Picture 2.1.3)

Picture 2.1.3 Cartier Foundation, Paris

There, a glass building will be set behind a glass screen and also the building will thus be protected by its distance from much of the noise pollution of the busy Boulevard Raspail.

Moreover, facade will need to have a way of controlling solar gain which controls measures to not to interfere with the air path. Example of Granta Park is shown schematically in Figure 2.1.29.

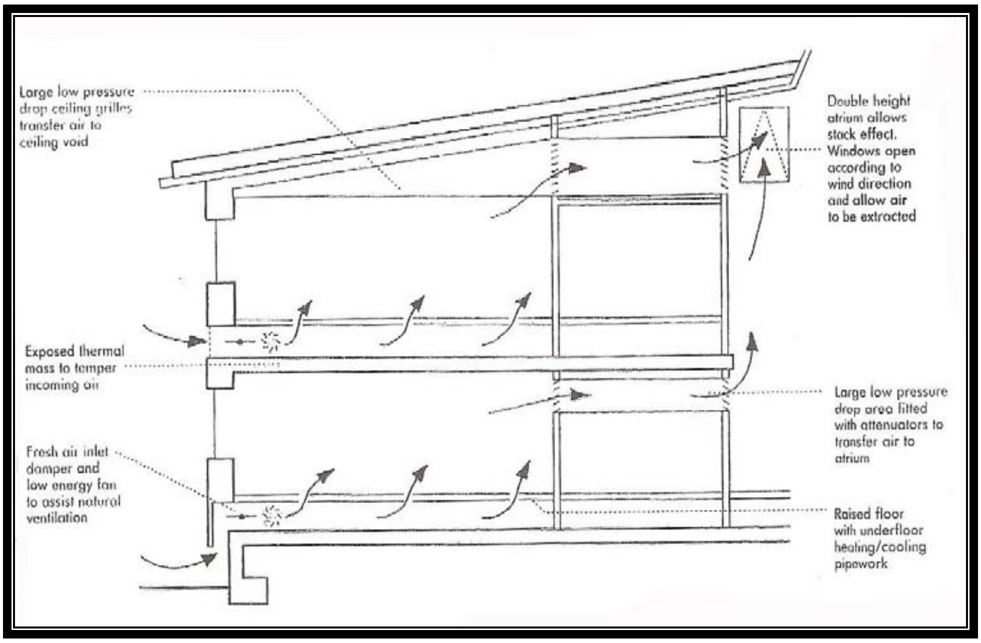


Figure 2.1.29 Schematic Section Showing The Ventilation Path and Thermal Mass at The McClinctock Building, Granta Park (Thomas, R. 2003. 57)

The air enters via floor grilles. After passing through the space, the air rises into the ceiling and then out into an atrium, which is at a 2.8 m distance from the ceiling. Higher ceilings will allow greater penetration of daylight. The thermal mass in this design is in the floor void and to a lesser extent the walls; on the ground floor there is also thermal mass, at the ceiling.

2.1.2.2 Shade

In hot climates, even tropical ones, an area is more pleasant to walk through if it is well forested. The reason for this effect to occur is partly because of the plants shading the ground from direct solar radiation and partly because of the fact that plants absorb and do not reflect heat as it is seen in Figure 2.1.30. Shade is a common tool used by site planners to control microclimate. The amount of the sunlight in winter, spring and autumn in such latitudes can be limited and people want as much in their homes as possible.

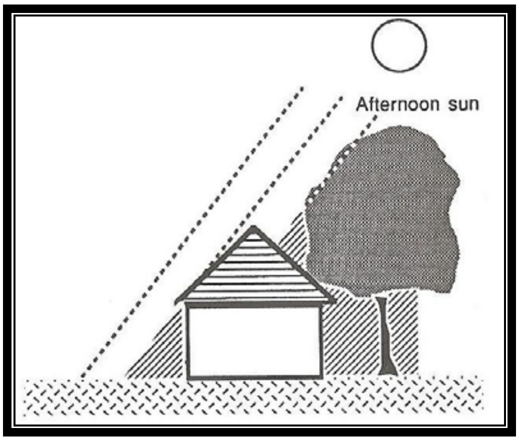


Figure: 2.1.30 Trees Can be Used a Shade a House in Summer.

(Beer, R, A. 1990. 73)

The site planner must be able to calculate the position of the shady areas n the project site. In the higher latitudes there can be significant differences in shadow area between winter and summer and autumn/spring. The higher the sun is in the sky, the more radiation is available to hit the ground. In the summer at higher latitudes the sun is visible for a longer period of time and this also increases the opportunities for warming the surface and air (see Figure2.1.31).

These considerations, together with local information on average cloud cover, allow the site planner to estimate the amount of sunshine and to spread it through the year for an individual site.

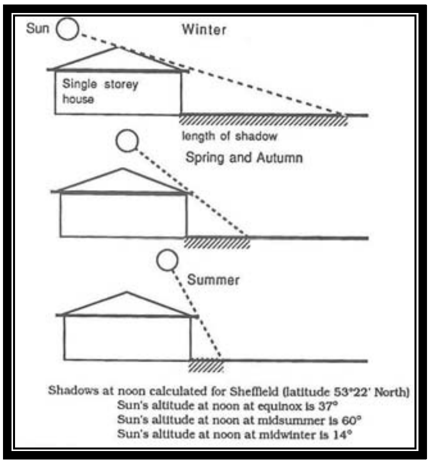


Figure 2.1.31 Shadows as Factor in Site Planning

(Beer, R, A.1990. 75)

> Air conditioning and cooling is not only expensive in terms of the capital required to build the cooling systems and power needed to run them, but also in terms of the air pollution created by the system. Before modern times other systems of cooling were developed throughout the world, which worked without great use of energy. (Beer, Anne, R. pg: 77)

So that site planners working in environments where extremes of temperature are experienced can learn much by studying how life was made bearable in the past. Some examples of adapting a local climate are different forms of housing developed, for example:

- To give minimum surface for largest volume and with few opening to the wind as in igloo design;
- The houses with openings only on the side facing the sun;
- In hot and dry climates courtyards of the houses are designed in a way to have a cooler shade open area at its core with a pool or fountain to humidity the air;
- Constructed houses in wet tropical climates are designed to give the cross-ventilation as it is necessary to make such climates bearable;

Therefore, the shading of buildings and open spaces bye deliberately positioning trees or other buildings to cast shadows is an important tool for designers attempting to manipulate the local climate in hot countries, in cool countries the fact that is of importance is the trapping of the sun's warmth (see Figure 2.1.32).

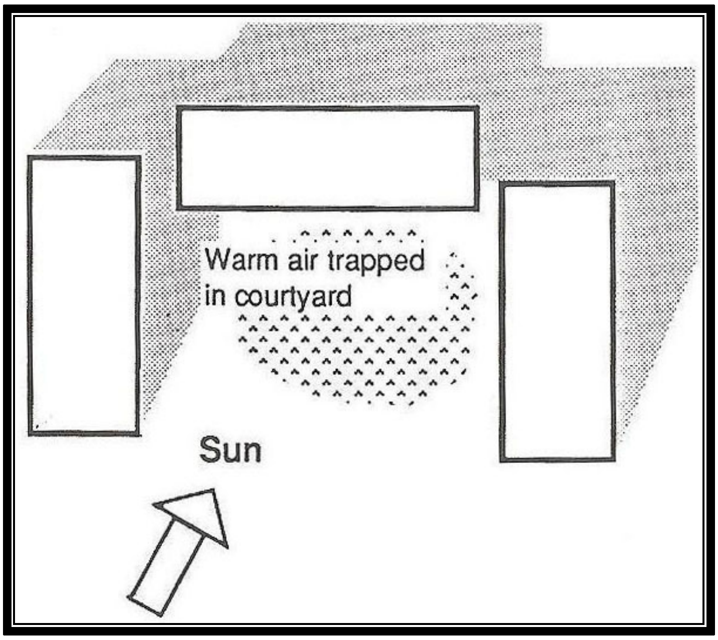


Figure: 2.1.32 Buildings can be Arranged to Trap Warm Air in Courtyard in Cool Climates. (Beer, R, A. 1990. 78)

As seen in (Figure 2.1.33) warm air can also be trapped by walls and buildings, just as temperatures can be reduced by creating shady areas

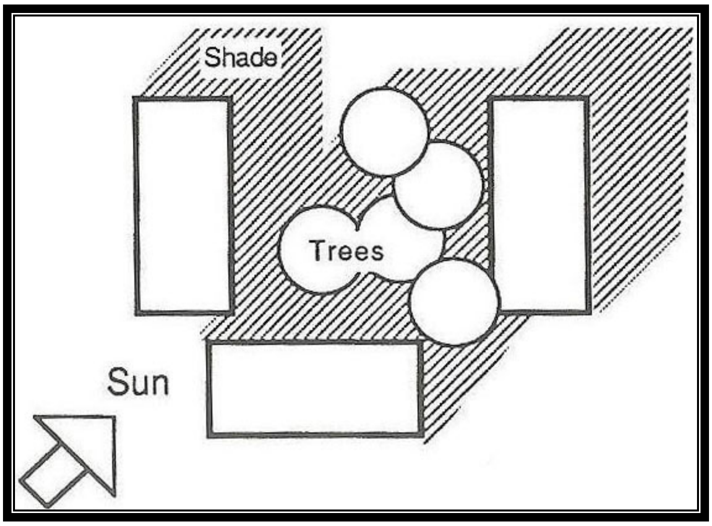


Figure: 2.1.33 Buildings and Trees Can be Arranged to Cast Shadows on Outdoor Spaces in Warm Climates (Beer, R, A. 1990. 79)

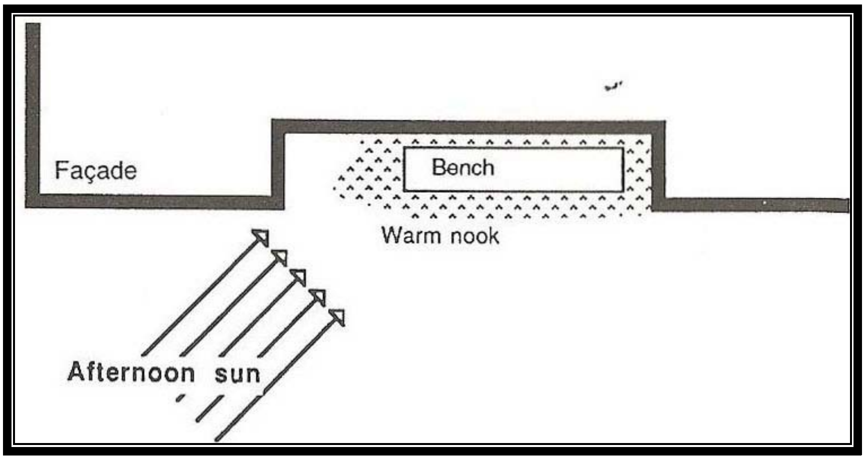


Figure: 2.1.34 The Air is Relatively Warm which May Even Cause Small Recesses in The Facade to Form Pockets (Beer, R, A. 1990. 80)

Moreover, a detailed design of the facade of a building which can be used to create local effects of cooling or warming can be seen in (Figure 2.1.34).

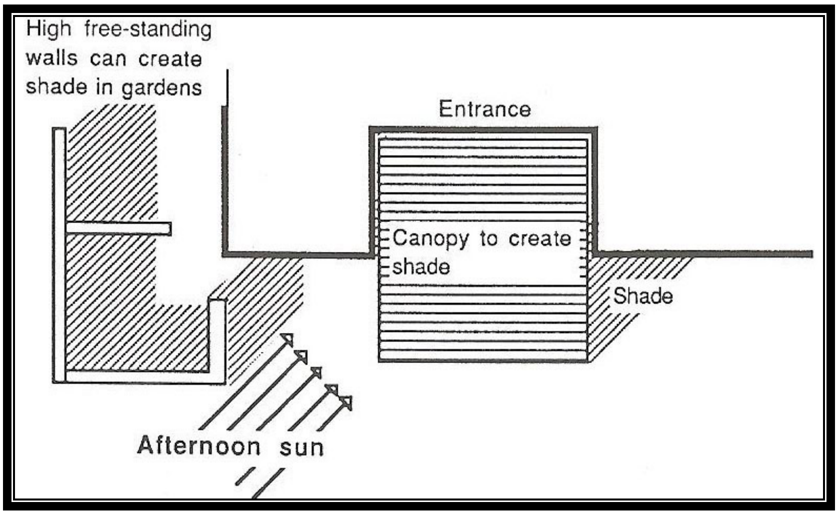


Figure: 2.1.35 The Positioning of Walls and Buildings Can Create Cooler Areas by Casting Shade. (Beer, R, A. 1990. 80)

In cool climates, this type of space can increase the likelihood of people sitting outside or lingering there, even in the colorful seasons. However, in hot climates shade around entrances cast by canopies or walls is welcome (see Figure 2.1.35).

2.1.3. Energy Gain Systems

2.1.3.1. Solar Panels (Photovoltaic Cells)

Solar panels, the sun' energy is actively collected by either water or air and the heat is then used inside the building. Moreover, photovoltaic (PVs) are environmental systems that produce electricity directly from solar radiation. In buildings, PVs are in use on roofs, walls and also be parts of sunspaces and sunshades. Besides it is flexibility and orientation within 30degrees east and west. The most promising PVs systems are what are known as- grid-connected ones. These are currently more cost-effective because they supply excess energy to grid rather than store it in batteries.

2.1.3.2 Wind

The wind crossing a site is potentially beneficial. It can assist in the natural ventilation of buildings to remove pollutants and heat, and be a potential source of energy. Moreover, tall buildings may experience high wind speeds at both the top and the bottom. At the top this is a potential source of energy. However, may be compensated for by an increased wind turbulence in some parts of cities (such as urban courtyards, will be sheltered) and deliberately so. Buildings also may serve as masts for wind turbines where height and turbulence may be advantages. (Figure 2.1.36) shows a simplified diagram of wind speeds.

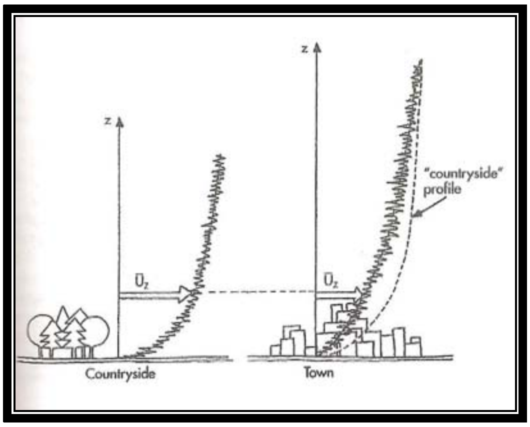


Figure 2.1.36 Wind Seeds Over Varying Terrains (Thomas, R. 2003. 69)

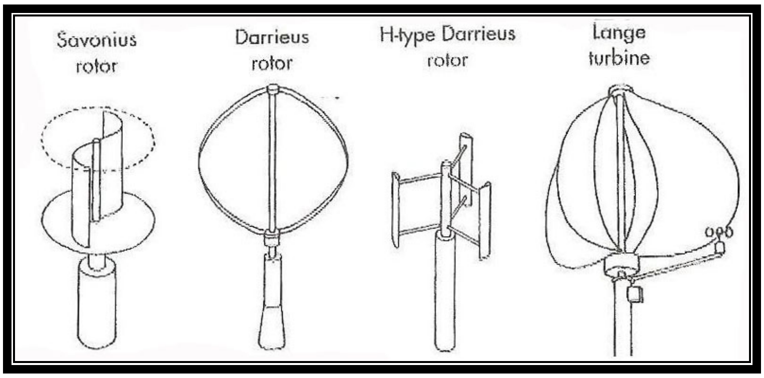


Figure 2.1.37 Vertical Axis Devices (Thomas, R. 2003. 70)

(Figure 2.1.37) shows some less common vertical axis turbines. Urban building types and characterized three as suitable for small- scale wind power; these are

a) the 'wind- catcher'- good height plus relatively free flow
b) the 'wind- collector'- a somewhat lower building in a area with more surface roughness and more turbulence
c) the 'wind- sharer' experiences high wind speeds and high turbulence.

(Figure 2.1.38) compares the characteristics of these types. Obviously, this research work is a valuable step in assessing the resources available at a site. Each urban situation will be different and so its specific potential needs to be analyzed.

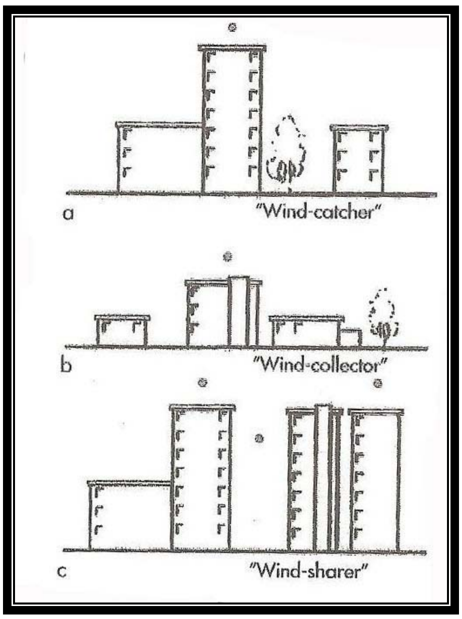


Figure 2.1.38 Small Scale Wind Power (Thomas, R.2003. 70)

To see combined systems of wind turbines and PV modules fully in the future neither integrated with the roof design wind turbines, with nor without PVs may also be located in open spaces such as car parks.

2.1.3.3 Water

The energy available in groundwater, whether from aquifers or, say, tidal mudflats or from the ground itself, can also be upgraded using heat pumps to provide a source of heat. However, most of the heat which is currently available use refrigerants which deplete the ozone layer to a greater or lesser extent and or contribute to CO2 emissions, and so a brighter, long-term future awaits new materials. In some cities, water in aquifers is, curiously, a growing problem because, extracting less water from the aquifers for manufacturing and processing industries then in the past and so the water level is rising in London at a rate of 2m a year for example. (Figure 2.1.39) is a sketch showing water levels at Trafalgar Square.

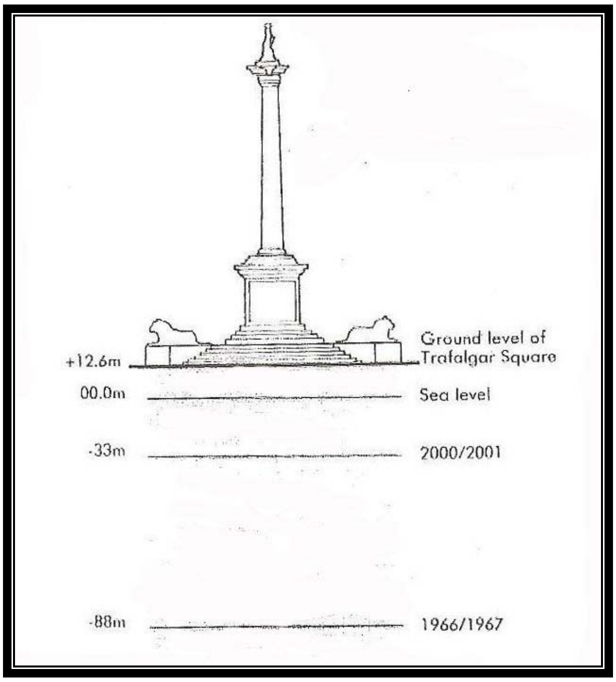


Figure 2.1.39 Water Levels at Trafalgar Square (Thomas, R. 2003. 72)

Geothermal energy is also available. For example, in a number of areas in the Paris region, geothermal energy is exploited by extracting water at 73ºC from an aquifer at a depth of 1500-2000m and using it for the hot water service. In the spa city of Bath the water is at a temperature of 47 ºC

2.1.4. Water System

Urban water systems are closely related to their surrounding regions. Another important point is the relationship of the quality of the product to its intended use, for example, drinking water, is subject to strict quality controls. Groundwater is normally abstracted from boreholes into aquifers. Treatment of both groundwater and surface water is important for sustainable cities. Groundwater, for example, can be contaminated by many processes, varying from deicing chemicals used on roads, to acid rain resulting from combustion processes, to chloride and ammonia resulting from landfill. In many urban areas there is also a history of land contamination leaching into the groundwater, so this needs consideration.

The tendency of urbanization has been to seal more and more of the surface of the earth, usually with an unattractive material known as Tarmac. One result of this has been the need to deal with the run off large volume of solar radiation absorbed, thus contributing to the urban heat island.

2.1.4.1 Rainwater

A well-thought out natural drainage strategy takes the points just raised further and has a profound effect on a strategic as well as a local level. Tarmac, paving and parking seal vast areas of cities. Instead, water is channeled into gullies and fed into the municipal sewer or straight out into rivers, lakes and oceans. Reducing the amount of rainwater entering municipal sewer is positive as it means less was water needing treatment in sewage plants and hence less wasted energy.

Natural drainage systems can help improve water quality and also reduce the risk of flooding shows in Table 2.1.1

Table 2.1.1 Drainage Systems

Inner Urban Areas	0.97
Dense Residential Areas	0.75-0.80
Mixed- use Areas	0.80
Terraced Housing	0.52
Semi -detached with small gardens	0.50
Semi- detached with medium gardens	0.42
Detached houses with large garden	0.20

Degree of Impermeability of Different Uses (Thomas, R. 2003. 38)

Implement a natural drainage system that can absorb all rainwater falling on all sealed and unsealed ground on the site. Interconnected water system can provide an important amenity function as well.

The possible retentions systems are;

- low area drain;
- ditches and swales;
- permanent retention ponds and;
- underground collection cisterns;

These are illustrated in (Figure 2.1.40) depending on the specific aims to be achieved in the development, systems offer different advantages. The land take necessary depends on the depth of the drain which in turn depends on the local soil.

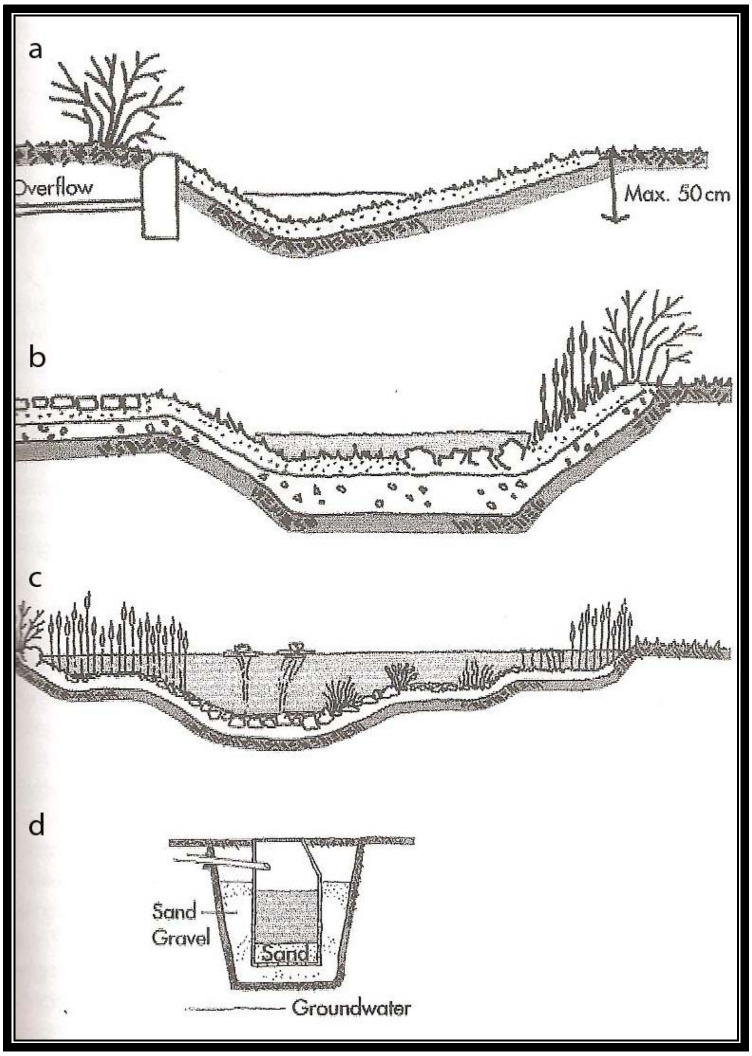


Figure 2.1.40 Different Retention System (Thomas, R.2003. 39)

The mains water supply is of course used in thousand of ways. However, the choices are in fact up to us. For example in Tokyo, for a building with a floor area of over 30.000m² to get planning permission it must recycle rainwater. And also in building grey water treatment system (Thomas, R.2003. 96)

Definitions vary somewhat but often rainwater is considered as one category, grey water as another and black water as a third. Grey water is considered to be all the waste water from domestic appliances with the exception of toilets. Thus it includes discharges from kitchen sinks, washroom basins, baths, showers, washing machines and dishwashers. Black water is all water that combines into the foul drain and then into the sewer system. It thus includes all grey water and the waste water from toilets. (Figure 2.1.41) shows some typical present day.

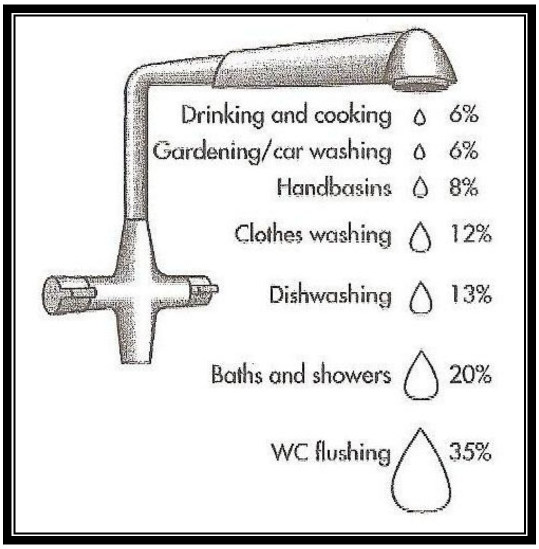


Figure 2.1.41.Typical Domestic Water Use (Thomas, R. 2003. 96)

Rainwater is generally considered to be cleaner than grey water and to entail less risk of infection in the event of systems not operating properly. Traditionally, rainwater has been stored in a butt and used for watering the garden, next step is to collect the rainwater, filter it and store it in underground storage tank of concrete or plastic. (Figure 2.1.42) shows one that has been widely installed in German homes where the filtered rainwater is used for WC flushing, the washing machine and for the garden.

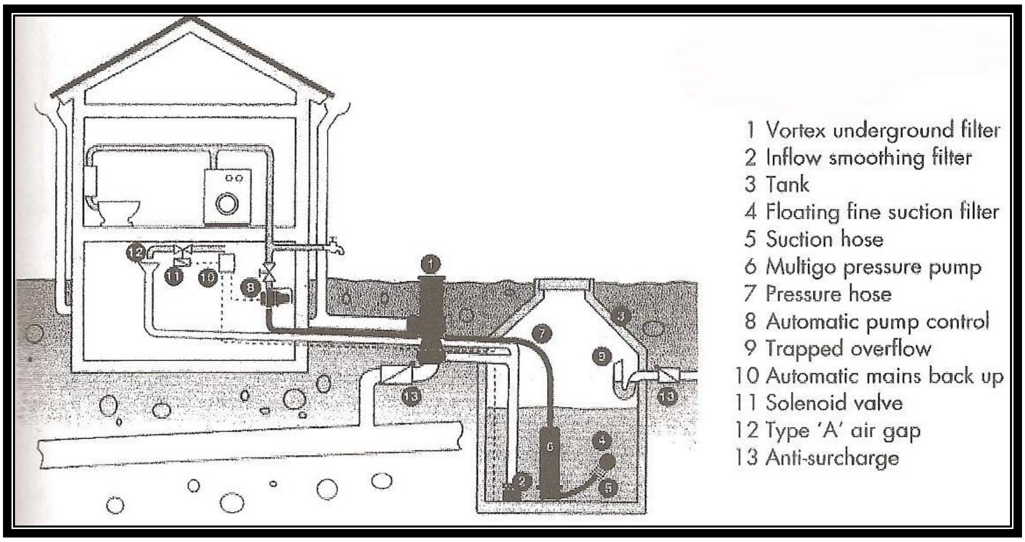


Figure 2.1.42 Rain Water Collection and Recycling System.
(Thomas, R. 2003. 97)

Larger projects often provide scope for significant saving in water use.(Figure 2.1.43) shows the schematic of recycled water used for WC and urinal flushing at Millennium Dome in Greenwich, London.

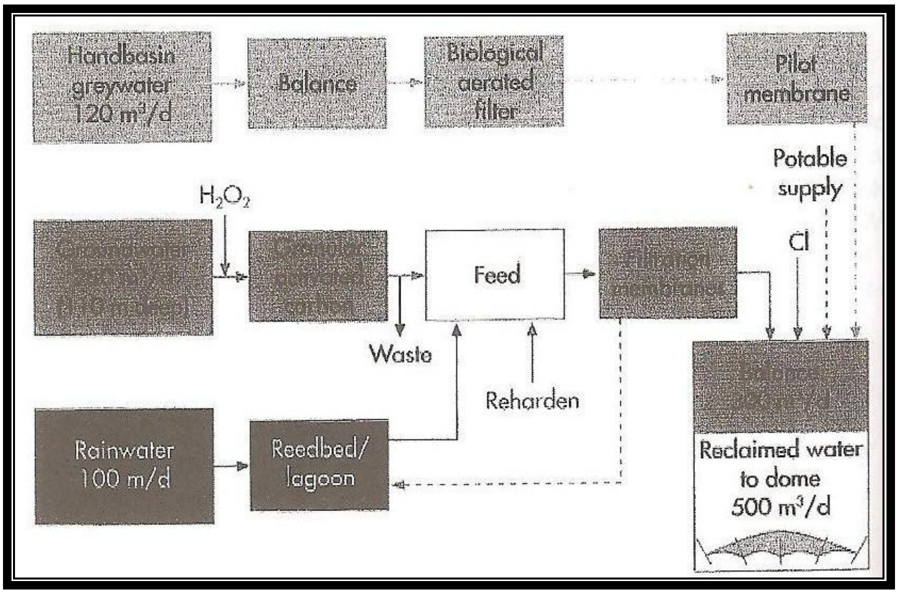


Figure 2.1.43 Water Recycling at The Millennium Dome
(Thomas, R. 2003.98)

The analysis involves minimizing water use and maximizing the ability of the site to provide the predicted water requirements of the building and the landscape. For example, the average annual rainfall over the past 30 years was 557mm, or about 1.5mm per day. (Figure 2.1.44) illustrates the proposed water and waste schematic.

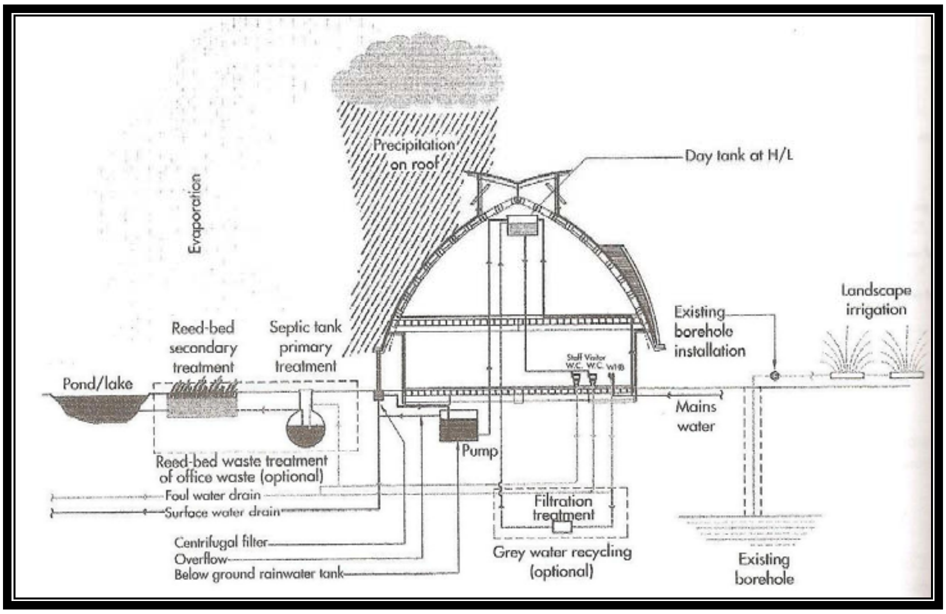


Figure 2.1.44 University of Cambridge Botanic Garden Water and Waste Schematic (Thomas, R. 2003. 106)

Rainwater incident on the roof will be collected and stored in a below-ground tank in darkness and at 10-20ºC during most external conditions to minimize bacteria multiplication. As a result of these a chlorinated day-storage tank will be provided for flushing WCs and will also be water back up for mains if necessary.

CHAPTER 3

GENERAL CHARACTERISTICS OF MARDIN CITY

3.1 General Information

The study area is located on the slope of a hill looking down south to the Mesopotamian plains. Mardin is on the rail and highway routes connecting Turkey to Syria and Iraq. The main objective for the design will be harmonizing the capability with natural environment by sustainable design principles. The project redesigns will include environmental space, both formal and informal as well as squares, building's open space, agricultural areas, commercial areas and social areas. The design will also initiate regenerate suggestion project.

3.1.1 General Location of Mardin

Mardin is in Southeast Anatolia 39 56 ° - 42 ° 54 east longitude and located between 36 55° - 38 51. Mardin is surrounded by Sirnak and Siirt to the east, Sanliurfa to the west, Diyarbakir and Batman (see Figure 3.1.1) to the north, Syria to the south and Mardin's altitude is 1082 m. The area has an acreage of is 8891 km^2.

Figure 3.1.1 Map of Turkey

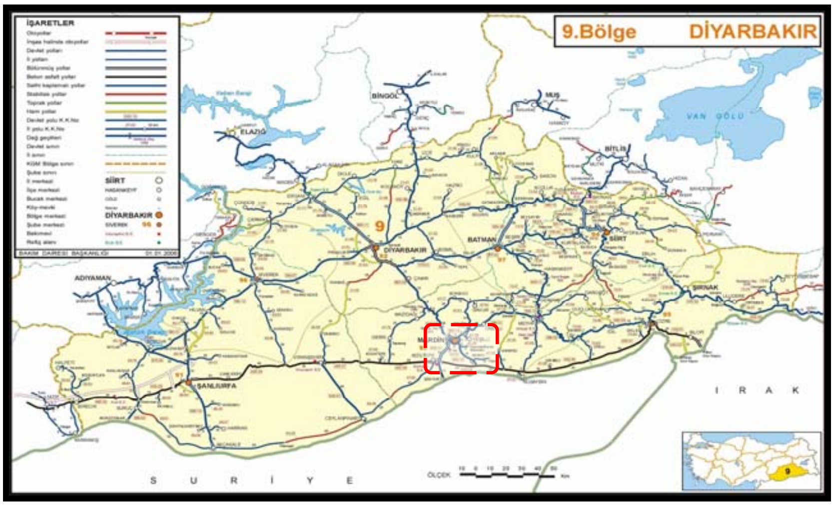


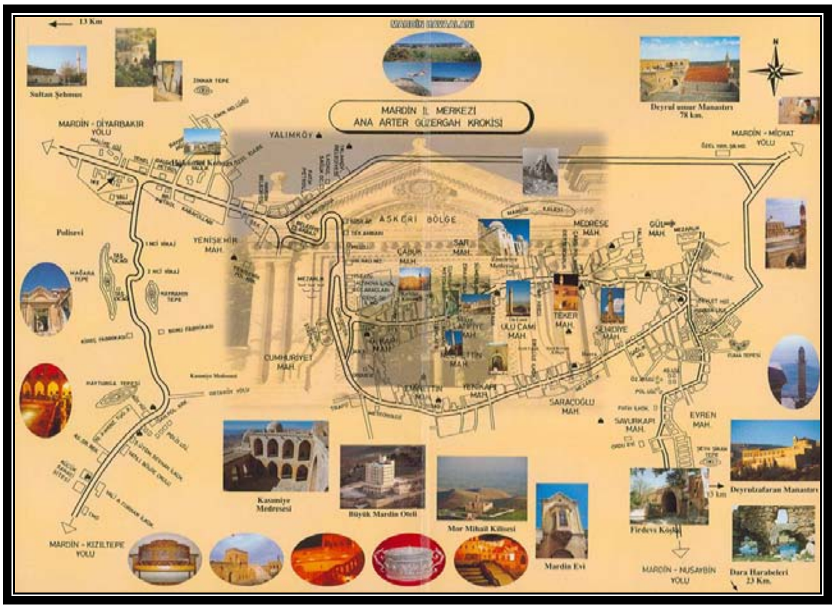
Figure 3.1.2 Map of Southeast Anatolia Regarding to Mardin

According to a hearsay, the history of the city dates as far back as the flood. The city lived under the rule of the Hurri-Mitani, Hittites, Surs, Babylonians, Persians, Romans, Arabs and the Seljuk Turks. Later, the Mardin branch of the Artuklu Kingdom called "Tabaka Ilgaziyye" was established and the city flourished during this time.The city used to be known as "Marde" by the Persians, "Mardia" by the Byzantine, "Maridin" by the Arabs and "Merde-Merdo-Merdi" by the Syriac. These were transformed into "Mardin" after the area was occupied by the Turks.

Southeastern Anatolia Region of the Tigris and Euphrates basin in the various land forms found in Mardin that who represent all geologic time and sedimentary mass crystal types and their crops from the inside püskürük to change to occur there until the field has been represented by various formations.

The foundation has been formed by soil and rocks. The accumulation of old volcanoes and lava Turabdin, Karacadağ formed as sets. It divides the territory by the middle of the territory and Diyarbakir which is a threshold between the Syrian Desert (see Figure 3.1.2). A dominant position in the Syrian Desert and Mesopotamia Plains as Mardin Mountains, plains and shades at night in a vast sea approximately 600-1000 m, height is a very large mass.

The Kasimiye Medresse, Zinciriye Medresse and Grand Mosque are important historical sites around the city. Other historical assets in the area worth seeing include Dayrul-Zeferan Monastery and Harizm Medresse (see Picture 3.1.1).



Picture 3.1.1 Historical Areas in Mardin City

http://www.mardin.gov.tr

The best examples of Artutid architecture can be seen at Kiziltepe, 21 kilometers south of Mardin, with the 13th century Ulu Mosque with its fine niche of a mosque indicating the direction of Mecca (Mihrap) relief and beautifully decorated entrance. Syrian Orthodox gold and silver smiths whose work is famous throughout the country still practice their craft here, their workshops side by side with those of Muslim copper smiths. Along with the buildings themselves, it is to be hoped that this living culture can also be preserved. Having a provincial territory of 12,760 square kilometers, Mardin is located in the area where the Southeastern Taurus Range meets the Arabian platform to the south. The area called "Mardin-Midyat Passage" constitutes a large part of the territory of the province.

The population is 646,826 (1997 Census). Mardin's administrative districts are Dargecit, Derik, Kiziltepe, Mazidagi, Midyat, Nusaybin, Omerli, Savur and Yesilli. Unfortunately, migration from Mardin to other big cities of Turkey such an Istanbul, Ankara, Izmir etc... The popularity cannot be attributed to its diverse types of industry and work force. Upon the completion of GAP Project 100,000 hectares of land will be brought under irrigation in Mardin. Newly irrigated areas will mainly grow cotton that is to be processed by enterprises in the Organized Industrial Zone. Besides flour products, fruit processing and seed production, Mardin will also process its local grapes. A part of the phosphorus fertilizers which crop farming needs will be provided by the fertilizer industries existing in the province.

Besides an organized Industrial Zone, Mardin also has a site for small enterprises which provide employment to 1,140 people with an approximate number of 190 work places. Finally, Mardin also has its Free Trade Zone.

3.1.2 Climate

It has some qualities similar to the climate of Mediterranean region. Summer times are quite hot and arid whereas winters are quiet rainy and mild. The high pressure area in winter time causes winter months to be cold in Mardin because it is both affected by desert climate from south (low pressure of Basra) and the high mountains preventing the cold air masses to arrive in to the region. The plain of the city has a quite hot summer time. It is possible to feel some qualities similar to arid climate in somewhere. It is possible to appraise the climate of Mardin which has two forms; part of plain and part of mountain. The difference between two parts can be determined as values of precipitation temperature and breeze. While the summers are quiet hot in the part of the plain, winters are mild and rainy. It is possible to impose a little and temporary snow. And summers are colder in mountain areas than the plain areas and also the winters are quiet windy, rainy and snowy. Mardin, its provinces and neighbour cities show an interesting difference in terms of the rate of wind and rain; and moisture, and the decrease of their values of temperatures.

Climate of high mountains to the north of Mardin is effective. During winter time, cold winter months are dominant in an area of high pressure. On the other hand, desert climate is seen to the south under the influence of this fact. Unması, the highest mountain in the north of the mass of cool air in the region due to the entry barriers in the province of very hot summers when the typical features of continental climate is seen.

3.1.3. The Temperature

According to the meteorological data regarding to Mardin province maximum amount of rainfall Mardin had was in March when it fell as 115.8 m and also the highest temperature as seen as 42.5°C in July whereas the lowest temperature is seen as -2.6 °C in February.

The high humidity in January and 76.1% were measured. It is highly difficult, if not impossible, to forecast what the weather will be like at a certain time in a very precise place. The temperatures mentioned hereafter are expressed in degrees Celsius and represent the monthly averages observed over a great number of years and according to Meteorological data, temperature table showing the average temperature of Mardin also show the highest and the lowest temperatures (see Table 3.1.1).

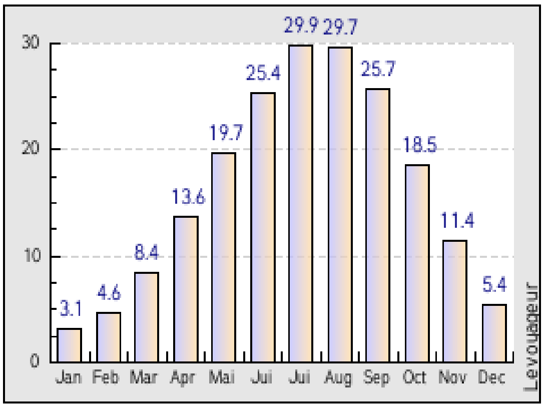
Table 3.1.1 Mardin' Temperature

Month	The Highest	The Lowest	Average
January	5.6	0.4	2.9
February	6.9	1.0	3.9
March	11.1	4.2	7.6
April	17.0	9.4	13.2
May	23.6	14.8	19.4
June	30.3	19.9	25.5
July	34.8	24.3	29.8
August	34.4	24.3	29.4
September	29.9	20.5	25.1
October	22.6	14.3	18.2
November	14.4	7.9	10.9
December	7.8	2.6	5.1
Average	**19.9**	**12.0**	**15.9**

(http://www.mardin.gov.tr/english/cografya/cografya.asp)

In addition, Table 3.1.2, Table 3.1.3 and Table 3.1.4 shows more details of average temperatures, minimum and maximum temperatures and also rainfall in Mardin.

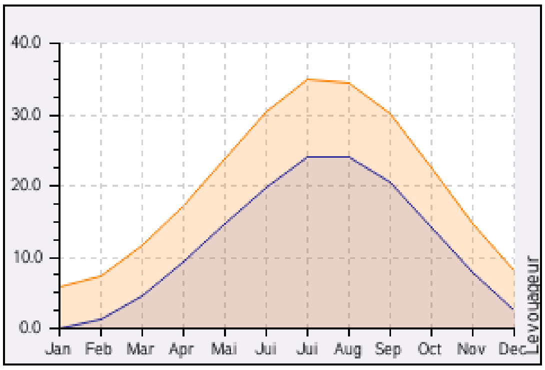
Table 3.1.2- Average Temperatures



(http://www.mardin.gov.tr)

Looking at Table 3.1.1 we can see the highest temperatures are observed in July and August.Besides, Januarary and February has had the lowest temperatures in Mardin city where we can see the average of all months.

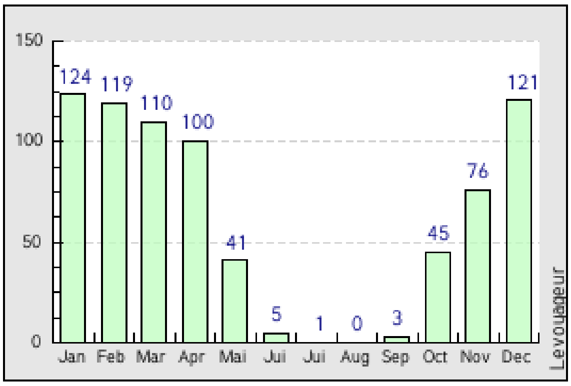
Table 3.1.3- Minimum and Maximum Temperatures



(http://www.mardin.gov.tr)

Moreover, Table 3.1.2 which shows are minimum temperatures as blue line and maximum temperatures as red lines of Mardin city. Table 3.1.3 showing the rainfall in Mardin city as mm illustrates that the lowest rainfall has occurred in July and August whereas the highest rainfall has occurred in January and December.

Table 3.1.4- Rainfall in mm



(http://www.mardin.gov.tr)

3.1.4 Economy

The construction of Mardin Organized Industrial District was given start in 1976 to boost the development of industrial activities in the province and the District became active in 1972. Small economic enterprises in Mardin, which now amounts to more than 1,000 units, will grow by time in parallel with industrial developments to take place in the province. In Mardin there are potentially competitive sectors such as foodstuffs, construction, agricultural machinery, chemical products, textile-garment, etc… Further development of economic activities and the growth of industry will eliminate such important problems as unemployment. These are the leading manufacturing branches in Mardin. There are eleven large-scale enterprises in this sector and seven of them are presently active. Products include cement, clinker, concrete, concrete pipe, plaster, lime, brick, tile, etc. Many of these products are exported. Starting in 1985, there was intensive migration from rural to urban areas, a process that gave momentum to construction sector. The growth of construction sector further supported these industries.

Cement, concrete tile and brick, Marble and Tile, Lime and Plaster, Food and Flour, Metal Products, Machinery and Equipment, Iron-Steel Basic Industries, Textiles, Chemical Products and Plastic Industry, Forest Products and Furniture, Small industries and agricultural products in Mardin.

3.1.5 The Population

The Administrational division of Mardin was altered in 1990. After Cizre, İdil and Silopi provinces had been separated from Mardin on 16.05.1990 within accordance to the law numbered 3647 they were received by Şırnak and Gercus province was also transferred according to the same law. In 1927, when the population of Turkey was 13.648.270 Mardin had a population of 183.317 and it was the 35^{th} city among 63 cities in terms of population.

Mardin stands in Turkey southeast Anatolian Region. The area of the city is 8806 square kilometers which is about %1.14 of Turkey's area. In 1927 the number of people per square km was about 14 and now it has risen to 80 people per square km. The annual population rising rate of Mardin is 23.4% between 1990-2000 years. In 1927 the population living in town was 22.8 % whereas it has risen to 55.5% now (see Table 3.1.5).

Table 3.1.5- Annual Population

				Growth	**Annually Population**	
Province	**Total**	**City**	**Village**	**Total**	**City**	**Village**
00 City Centre	108 340	65 072	43 268	17.24	20.51	12.52
01 Dargeçit	27 611	16 541	11 070	-4.02	49.53	-52.23
02 Derik	55 278	19 806	35 472	18.67	40.56	8.26
03 Kızıltepe	183 475	113 143	70 332	33.86	63.19	-0.42
04 Mazıdağı	27 434	11 194	16 240	-9.85	16.13	-24.50
05 Midyat	128 085	56 669	71 416	50.25	65.03	39.90
06 Nusaybin	103 863	74 110	29 753	21.06	40.00	-14.69
07 Ömerli	14 584	7 197	7 387	-39.92	0.63	-68.04
08 Savur	34 402	7 817	26 585	2.56	22.46	-2.61
09 Yeşilli	22 026	19 700	2 326	41.38	63.37	-56.91
General Total	705 098	391 249	313 849	23.34	45.16	1.48

(http://www.mardin.gov.tr/english/tarihi/nufus.asp)

The population structure of Mardin according to the results of the 14th general census done on October 22nd 2002 can be seen in terms of population growth in Table 3.1.5. Also (Figure 3.1.3) shows the neighborhoods of Mardin.

Figure 3.1.3 Neighborhoods of Mardin.

www.mardin.gov.tr

3.2 Mardin Urban Texture

Mardin city's simple geometry expresses purposeful aspects of the regeneration project and free line expresses the particular, the unusual, and the affecting aspects of the design. Works with orthogonality and linearity and allows for the interaction of polygonality. The interface of fraught with geographic irregularities geometry with the freeform always gives the project its expression.

Topography and natural setting, including castle and its interrelated views, terrace houses, Mesopotamia plain and vine yards. Gateway and arterial routes provide strong visual messages about the character of the city; image and identity (see Picture 3.2.1) Google Map of Old Mardin city (scale 1:5000). Moreover, structures, building patterns and building form including skylines, terrace houses and landmarks. Although the existing typology of the buildings regenerate urban spaces of Mardin on the highest level, original solutions have gathered the information and have had some response, waiting for the creativity to begin.

Picture 3.2.1Google Map of Old Mardin City (scale 1:5000)

Map of Mardin (see Figure 3.2.1 Site Plan) scale 1/5000 shows a bubble diagram displaying commercial areas, surrounding settlements around the city of Mardin, education area, main roads, land, green networks and vineyards and finally graveyard. However, the whole city texture also showed the castle in addition to these cultural buildings which are affected dominantly for recognition showing the numbers.

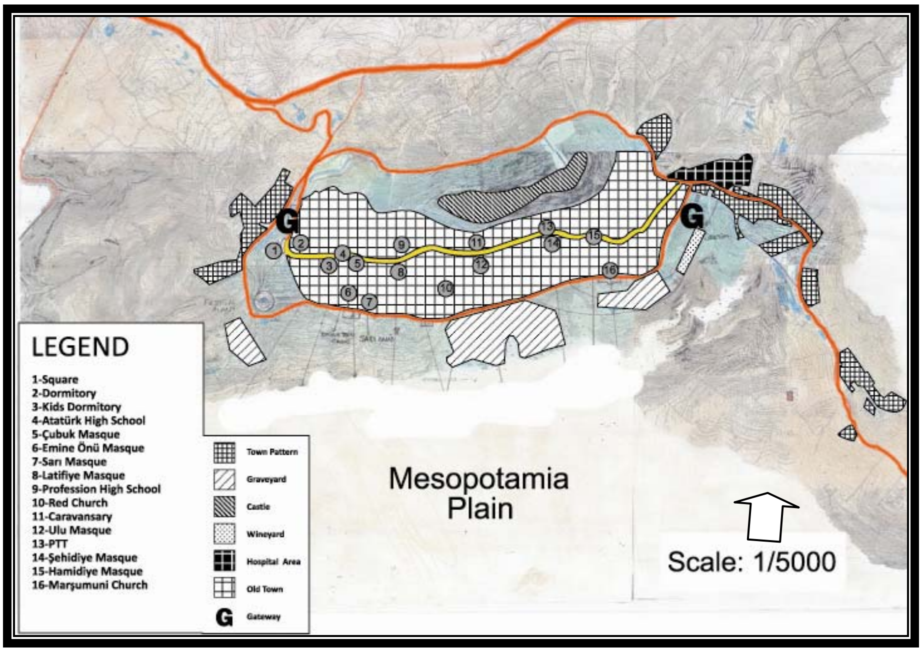


Figure 3.2.1 Site Plan,

Drawing: Esin Saba Aydın

Clearly defined and varied urban edges and urban/rural areas are divided by the attractive Mesopotamia plain that wraps and interlocks with the urban form. Historic buildings and its courtyards, some public bazaars and puzzle reminiscent in city texture significant points are in the sites.

In addition, there are several urban expressions areas and these with the large-scale regeneration of a number of inner and outer city sites help defining the modern Mardin.

Wide visual appreciation of much of the city' core and surrounding is made possible by Mardin's spectacular topography revealing both the urban grain and often-dramatic townscape. A complex interplay of elements has shaped the character of Mardin. It is a city in which urban design, history and building forms are combined in harmony (see Picture 3.2.2 View of Mardin City texture).

Picture 3.2.2 View of Mardin City Texture

http://www.mardin.gov.tr

Mardin is located on the western slope of an isolated mountain (see Picture 3.2.3 Mardin castle from the city' southwest) reaching an altitude of 1,300 meters/ 4,300 ft. The town has a great view over the Mesopotamian plains even beyond the border between Turkey and Syria.

Picture 3.2.3 Mardin Castle From The City’ Southwest.

The side of Mardin towards the plain was protected by modest walls (see Picture 3.2.4 city walls of Mungan House from city’ southeast) which had the main purpose of defining the boundaries of the town for the collection of duties. Short stretches of these walls have been incorporated into houses.

Picture 3.2.4 City Walls of Mungan House From City’ Southeast.

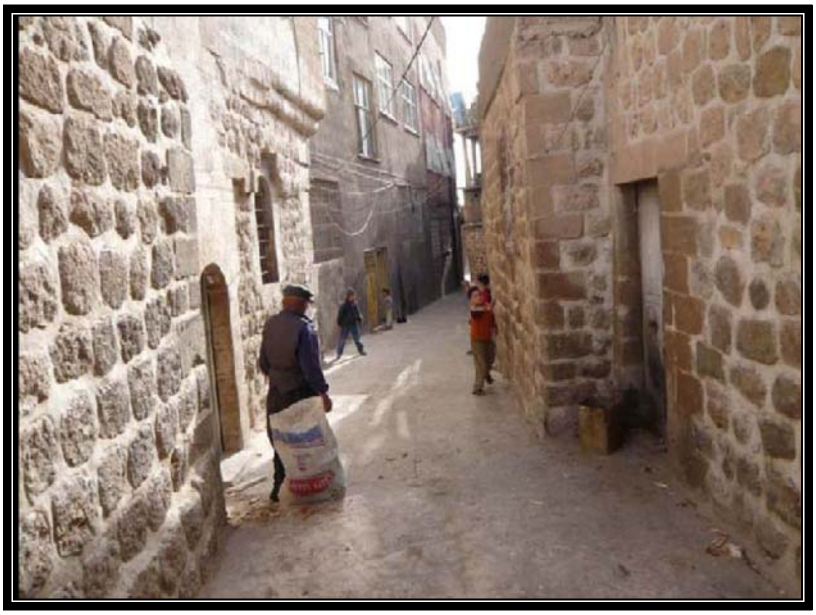
The houses of Mardin are carefully arranged in tiers on the mountain slope so that the roof of each house serves as the terrace of the one above.

The streets are connected via a network of passages known as '*abbara'* that sometimes pass directly under the houses. The abbara provides shelter from the hot sun in summer and from cold weather and rain in winter.

Kabaltı / Abbara: The room with the top of the street is a hot climate solution in dense dwelling fabric of the cities which developed on the flat grounds in hot climate regions. These rooms cross the narrow streets by creating shade (see Picture 3.2.5), which allows an effect of cooling in outside space in summer. This shaded space becomes a playing space for the children and resting space for the old people.

Picture 3.2.5 Creating Shade Space in Hot Summers
Photo: Nilay Ünsal Gülmez from Bazaar in city center.

Mardin's narrow streets are becoming houses high stone walls and these ones looking at the plan are viewed as a labyrinth (see Picture 3.2.6).



Picture 3.2.6 Narrow Streets of Mardin

Moreover, these labyrinth streets generally junction with abbara which are provides a pass under the houses usually (see Picture 3.2.7). Besides, many streets are away from the sun directions and many times tourists lose their directions under the narrow abbara.

Picture 3.2.7 Abbara – A Pass Under The House.

Types of developments needing a particularly careful design approach at the strategic level are those which are: located at or below the castle, at a gateway, along an arterial route or other linear features. Besides, near or within a major area of transition between one kind of edge and another, development close to open space a residential area and local centre, around villages. Moreover, in areas of strategic change for example, regeneration areas, concentrations of old city’s commercial areas and transport interchanges etc (see Picture 3.2.8). Capable of contributing significantly to the city’s public realm, particularly new it has civic urban environment.

Picture 3.2.8 Castle and Residential Areas
Photo: Esin Saba Aydın

Protect and enhance views from established landmarks, square, castle, vineyards, Mesopotamia plain, skylines and recognize characteristic of urban zones, layers of built form and courtyards. Maintain strategic views from major entrance routes and public vantage points.

Development can affect views of building environment, skylines and traditional urban patterns in parallel.

These are integral parts of the city's structure and identity, history, urban and architectural character. In the city, large footprints, bland forms, poorly articulated massing and insensitively formed terrace structure can have a harmful effect on these important amenities (see Picture 3.2.9).

Picture 3.2.9 Recreational Areas in Old City
Photo: Esin Saba Aydın, from second road trough the castle

CHAPTER 4

ANALYTIC APPROACH TO MARDIN VERNECULAR ARCHITECTURE WITHIN THE CONTEXT OF SUSTAINABLE DESIGN

> Sustainability means protecting and continuing the genius loci and working within the limitations and possibilities required in these terms. Sustainability of the building is sublimated to sustainability of the place. The image embraces a concern for the way local people live and interact with their buildings, and an expectation that this will be different from other places' (Williams, R. & Bennets, 2003.29-30)

4.1 Sustainable Characteristics of Urban Texture

Considering the climatic characteristics, the climate of the south-eastern Anatolian plateau is relatively similar to desert climate. This region represents the hot-dry climatic zones with a great temperature difference between day and night. Therefore, the most important energy efficient design strategy in traditional buildings is providing to big thermal mass on building envelope. All of the traditional buildings' envelopes are constructed with local stones with about 1.00m thickness. This big thermal mass will slow down the heat transfer through the envelope and thus higher day- time temperatures will be reached indoors when outdoor air temperature is much lower and consequently more stable indoor thermal conditions will be provided.

On the other hand, this thermal mass, which has higher surface temperature on outer side, will rapidly lose heating energy to the atmosphere via thermal radiation at night to start the next day from a cooler level. The high heat capacity of the opaque component provides a high time lag for the transmission of the outside temperature to the internal area. While the low transparency ratio minimizes the direct solar radiation gained through the windows.

In the micro-climate of Mardin region, with hot and dry summers and big temperature changes between day and night, thick walls act as a heat reservoir in addition to their insulting capacities. During the hot day, the heat flow from the exterior due to solar radiation to the inside is retarded and stored part of the heat is released during the cooler hours especially at night. Consequently temperature change inside the building is minimized. On the other hand, the heating requirements are reduced in winter time, because the heat stored in the walls is radiated during the night.

Solar radiation and ventilation: Solar radiation and ventilation are two important aspects that Mardin house form takes into account. Mardin town layout provides a short of thermal comfort since the streets are very narrow and thermal comfort since the streets are very narrow and the ascending walls of houses on both sides create shady space against sun. Meanwhile those walls also provide partial shadows for the courtyards and terraces. In urban scale 'abbara' which means covered streets provide extra cooling and protection from the sun during the day time which can also be seen in the house scale as well.

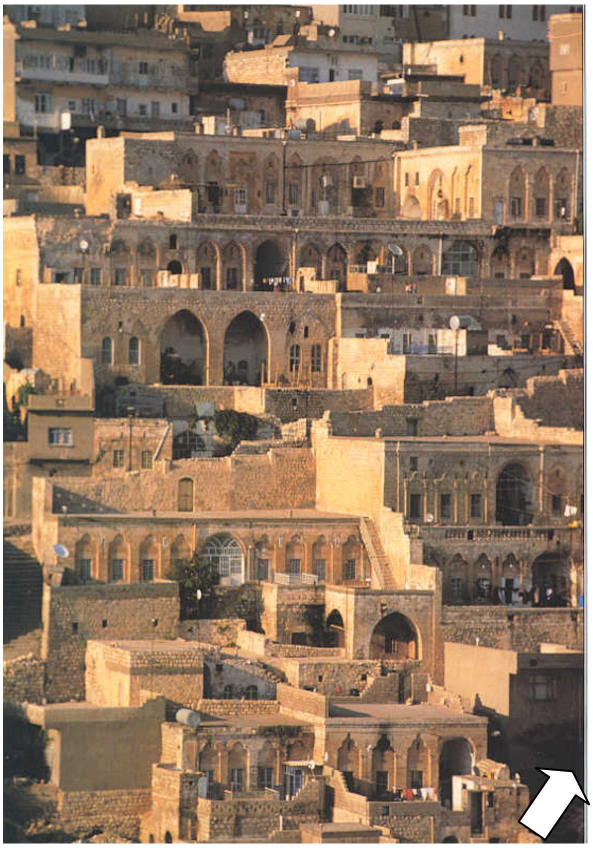
Limestone (kalker taşı) is the main construction material of Mardin houses. The exterior openings are mostly facing south where it is easier to control the undesired summer sun and let the desired winter sun it. For example Mungan house in Mardin, that the small openings located at the top of larger windows, act as natural ventilators helping the atmosphere retain its coolness. (Balmair & Uraz, 2004)

4.1.1 Settlement Concept Depending on Topography

The old town of Mardin is located on the southern slopes of a hill, which overlooks the Mesopotamian plain, crowned by a historical castle, looks like an edifice carved from stone. The general form of the city looks like slightly touching the earth echoing nature. In other words, buildings do not dominate the natural setting. On the inclined land, adjoining plots are naturally organized along. East-west direction facing south that provides every house the view of Mesopotamia plain and also day light refers to spread natural light from the terrace throughout the interior for every Mardin houses.

In current houses, Sürücüler Sitesi-Ankara is best example of day lightning because this architectural approach base on sun direction (see Picture 4.1.1)

Picture 4.1.1 Contemporary Architectural Sample of Daylight Gain (Sürücüler sitesi Ankara –Melih Karaaslan)



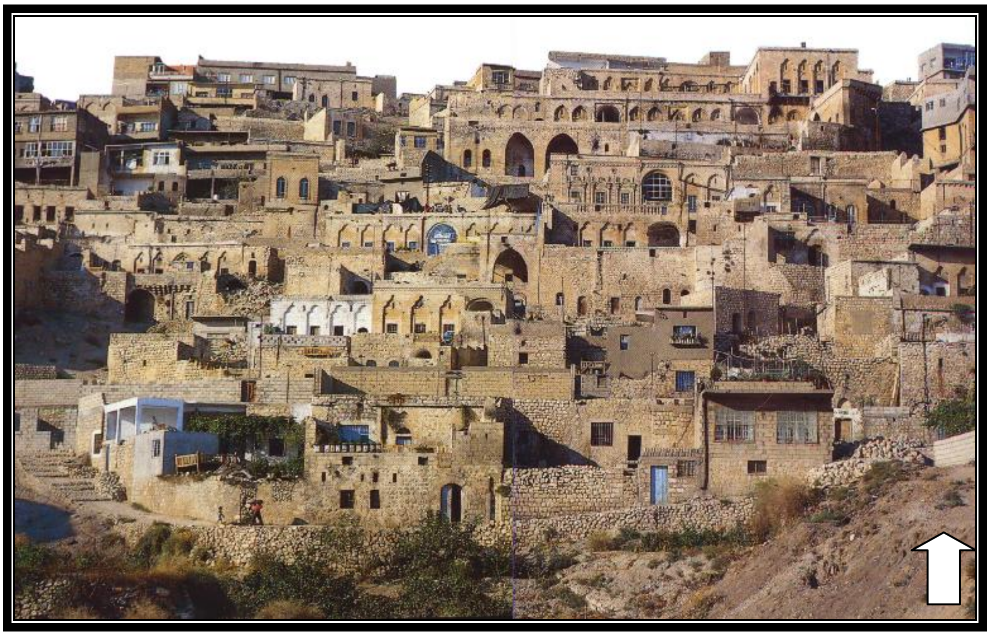
Picture 4.1.2 Day Light

http://www.mardin.gov.tr

These kinds of sustainable design strategies are being used in current architectural design but it has been started to be used several years ago. As seen in Picture 4.1.2 every house in Mardin is affected by day light.

Streets as fundamental elements of the urban pattern have two kinds of relationship with the topography .The ones parallel to slope in east-west direction give the sense of continuity. On the other hand, the streets traversing the city in north-south direction perpendicular to the slope are organically formed generally with stairs. Certain breaks and directional changes moderate the slope.

Every single building in old Mardin gives a certain sense of place since each share the typical sectional pattern with the urban silhouette at micro level. (Alioğlu 2003) indicates three important spatial characteristics of the sectional pattern identifiable in the urban silhouette which constructs a strong relationship between the building and its site. These are open spaces (courtyards and terrace), semi-open spaces (courtyards, eyvan) and enclosed space (living units and service areas.)

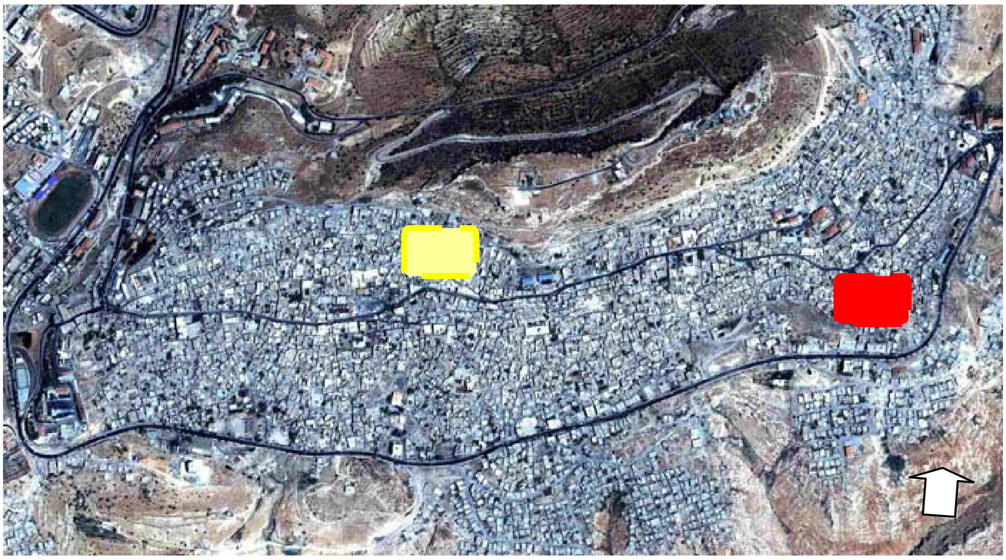


Picture 4.1.3 City Texture

Photo: Volkan Sağlar from the second road to the southern direction.

This sectional pattern is not only applied to houses but also to all types of buildings in the city. According to Balamir and Uraz (2004) the topography and scenery also caused a radical change in the archetypical introverted courtyard house and 'the town has grown into a cascading macro form composed of individual stepped prismatic forms with front terraces see Picture 4.1.3. Contrary to the typical courtyard house, this is presenting a fusion of introvert and extrovert plan schemes (Balamir and Uraz, 2004.1).

Therefore, it is possible to say that genius loci of Mardin, along with the prolonged experiments of the local community created a unique urban house typology. Moreover, in order to differentiate between the simplicity and the complexity of the spatial structure of this main typology, (Uraz 2005) groups all the spatial elements under two main headings: Main spaces (courtyards, terraces, front rooms, back rooms) and intermediary spaces (doorways /entrance passages, eyvan, courtyards, intermediary rooms on the mezzanine floors). She claims that '*the main spaces and the main spatial order they generate are found in almost every Mardin House. However, with the addition of intermediary space in time the simple orders turn into complex ones with increased thresholds of privacy*.'



Picture 4.1.4 Google Mardin Map s: 1/5000

Erdoba mansion; 1st street no: 135

Mungan House;gülderen 17.street

This more sophisticated organization, formed the basis of intricate space structure of urban mansions, emerging later from the 19th century on wards. The Mungan house, and also Erdoba Mansion along with many others, is one of the most renowned examples of this type. (Uraz, 2005.94) (see Picture 4.1.4).

In Mardin, section of various types and sizes of courtyard buildings; either small houses from early periods or the huge mansions of later period altogether have been contained and formed the urban morphology at macro level
(see Figure 4.1.1).

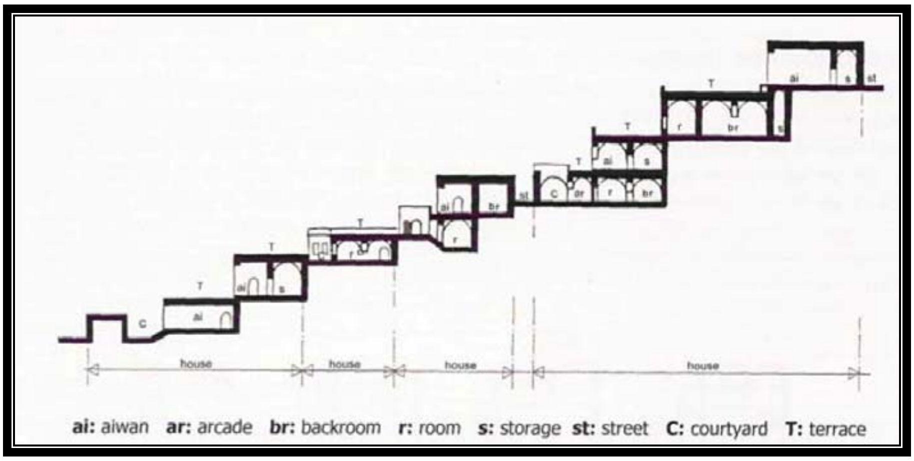


Figure 4.1.1 Section of Types and Sizes Building (Alioglu, E, F. 2000. 55)

Therefore, it is worth focusing on a single house instead of the urban morphology. Mungan house see Picture 4.1.5 which will be examined for the embodiment of certain concepts of sustainability harmony with topography and climate, use of local materials and passive energy sources, cultural values) is an old mansion in Mardin for an extended family. Although it is larger in size than typical Mardin houses, it definitely conveys typical features of old town.

Picture 4.1.5 Mungan House

Photo: Türkan Ulusu Uraz from southeast direction.

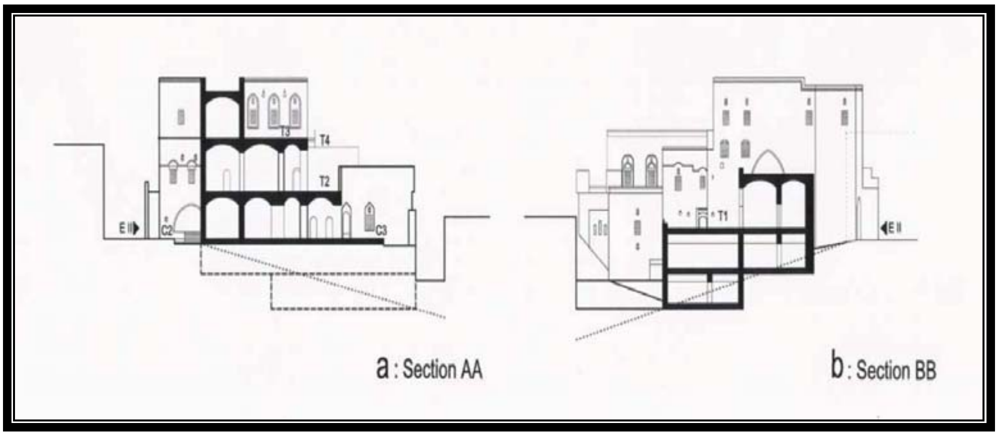


Figure 4.1.2 Mungan House of Sections (Gülmez, Ü, N., Uraz, U, T, 2004.8)

C: courtyard E: entrance T: terrace
ai: aiwan ar: arcade p: passage r: room s: store ss: service space st: stable
t: toilet

Mungan House rest on an urban block but it is not possible to become aware of it within the very intensive unity and integrity of the urban pattern.Although the inclination does not allow very stepped level sit on the ground, the house itself is specially set back at level (see Figure 4.1.2).It grows around three courtyards and connects to the streets that surround the building with four entrance at different levels.

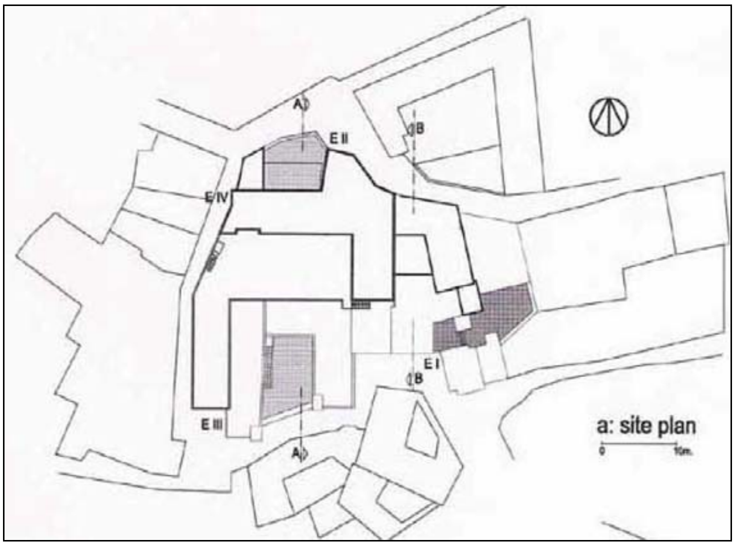


Figure 4.1.3 a: Site Plan (Alioğlu (2003.132-133)

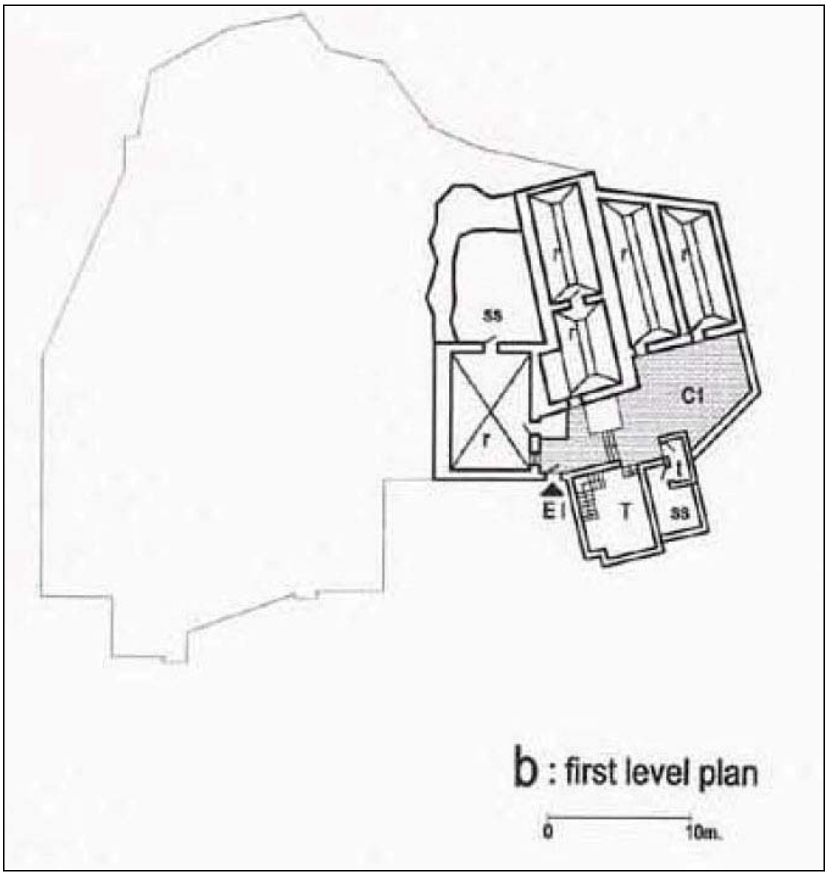


Figure 4.1.3 b: First Level Plan (Alioğlu (2003.132-133)

C: courtyard E: entrance T: terrace
ai: aiwan ar: arcade p: passage r: room s: store ss: service space st: stable
t: toilet

Courtyards have a double function within the spatial organization of the house. It both protects privacy and enables gathering. It establishes a relationship between the public street and private areas within the house. In Mungan House, as in other houses of old Mardin, there are intermediary transition spaces between the entrances E (I-II) and the courtyards, preventing direct contact with the public to protect the privacy of life taking place in the courtyards (see Figure 4.1.3 c).

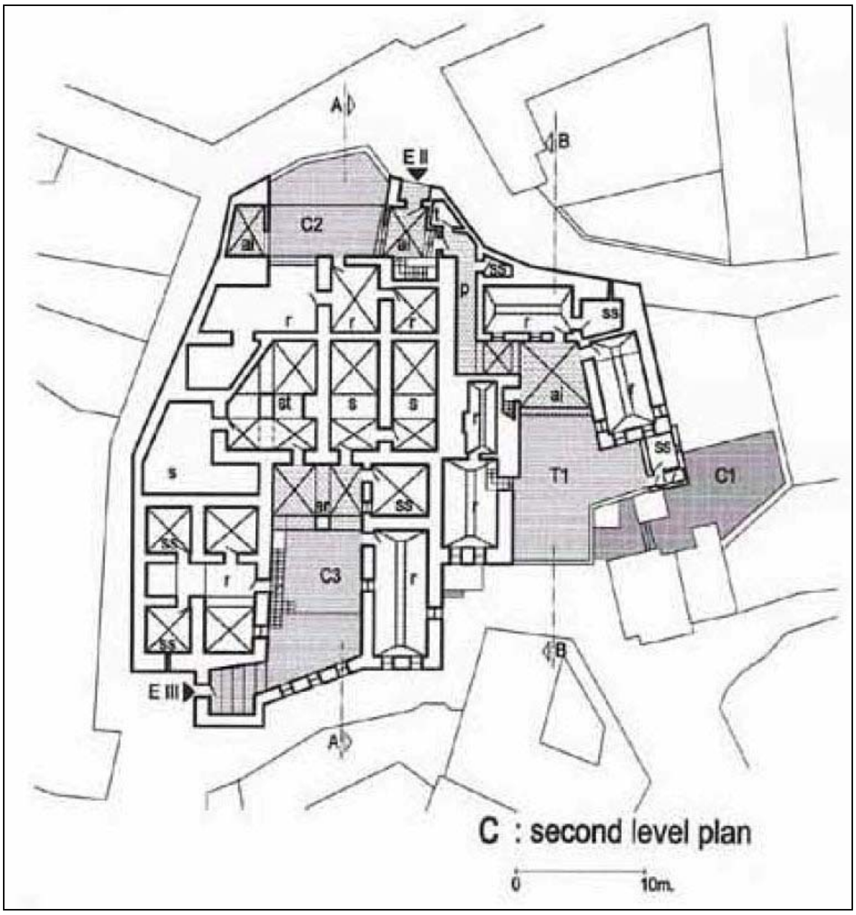


Figure 4.1.3 c: Second Level Plan (Alioğlu (2003.132-133)

C: courtyard   E: entrance   T: terrace
ai: aiwan ar: arcade p: passage r: room s: store ss: service space st: stable
t: toilet

There are two epigraphs on the building, the first one at EII (see Figure 4.1.3 c) and the second one on the aiwan facade of the fourth floor (see Figure 4.1.3 f) which proves that both the vertical and horizontal formation of the house is not planned in a totalitarian way. After the completion of the layout to define the boundaries of the building plot, construction of the ground floor is completed in time by adding spaces; when needed, construction of the upper floor would start. Due to this almost immediate reflection of the act of inhabitation, sequentially and spontaneity occurred during the building construction have been observed both in floor plans and the space relations (Alioğlu, 2003).

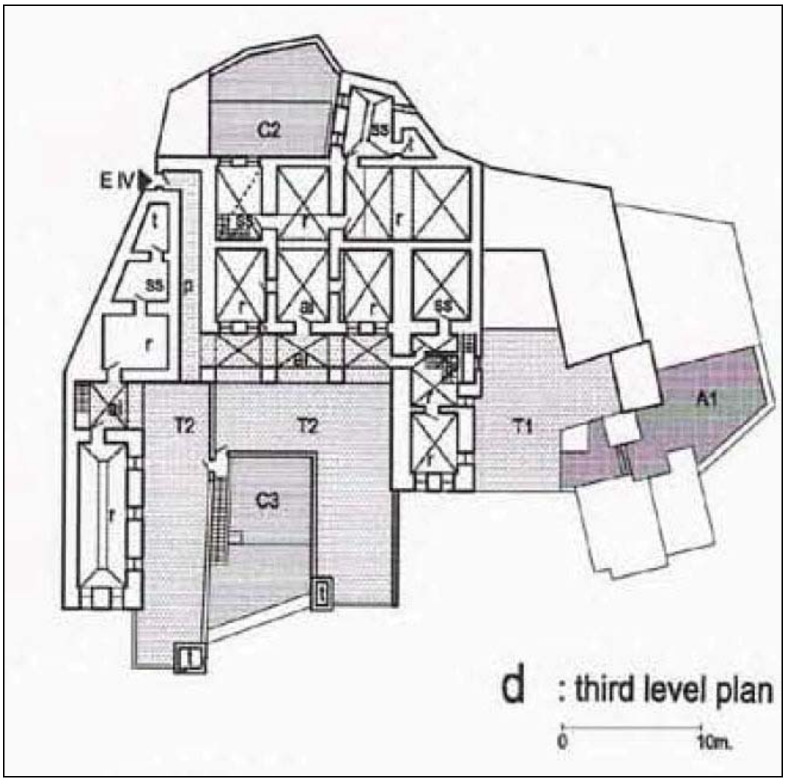


Figure 4.1.3 d: Third Level Plan (Alioğlu (2003.132-133)

C: courtyard E: entrance T: terrace
ai: aiwan ar: arcade p: passage r: room s: store ss: service space st: stable
t: toilet

Entrance I is opened to a two leveled courtyard (CI), where one employees used to reside. All rooms opening into CI (courtyard I) flow backwards into the hill and become cave like (see Figure 4.1.3 b).

Those caves like parts of the rooms, which are warm in winter, and cool in summer are used as storage spaces and are sometimes separated from the front part by curtains. At this point, house blends with the topography and the hill becomes a part of the house.

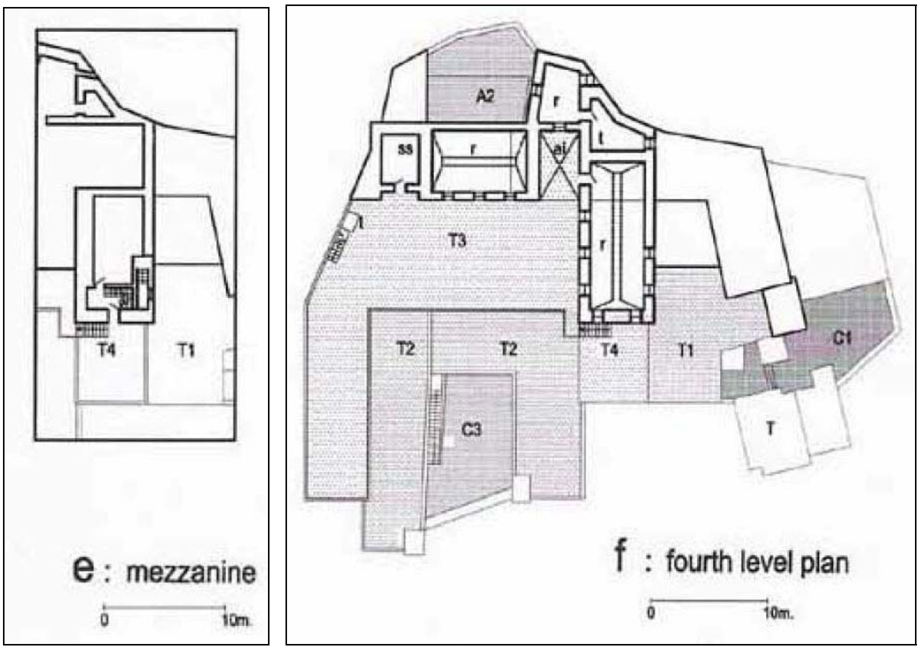


Figure 4.1.3 e: Mezzanine and f: Fourth Level Plan (Alioğlu (2003.132-133)

C: courtyard E: entrance T: terrace
ai: aiwan ar: arcade p: passage r: room s: store ss: service space
st: stable t: toilet

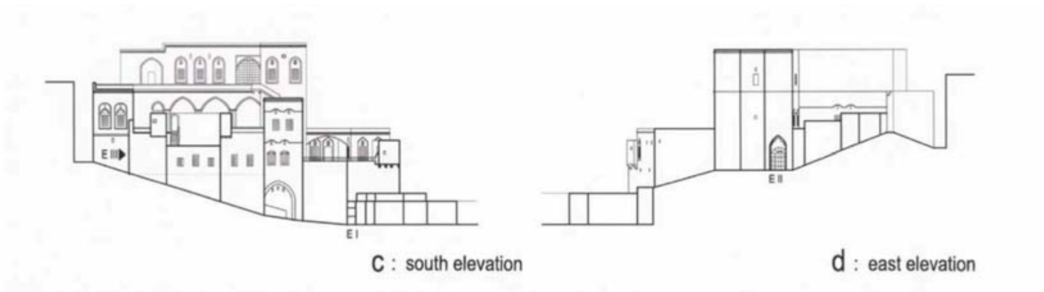


Figure 4.1.4 Mungan House Elevations
Elevations of Mungan House drawn by Nilay Ünsal Gülmez ,under the supervision of Aydan Balamir and Türkan Ulusu Uraz.

Moreover, the life on terraces is more public and open to communicate with the neighborhood. However, the house itself introduces extra opportunities for the users to communicate more privately.

For instance original inhabitants of the house, talks about the holes in the thick load bearing stone walls, which sometimes hide the stairs or manually working elevators, provided a kind of communication channel in the huge mansion, as household members used to communicate by calling out each other. In this regard, house is a reflection of family structure and a part of an organic unity. It has storage floors and secret spaces that are mostly used by women. A dialectical relationship between inside and outside, private and public, simplicity and splendour prevails in Mungan House. The striking ornamentation of the upper floors can not be perceived from the narrow streets surrounding the high walls of the mansion (see Figure 4.1.4 and Picture 4.1.6).

Picture 4.1.6 Narrow Streets Surrounding Mungan House
Photo: Nilay Ünsal Gülmez.

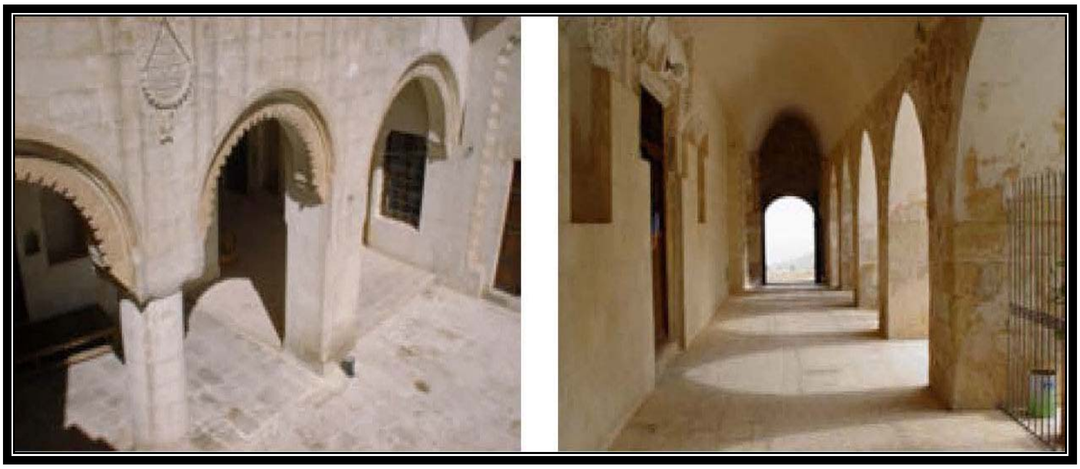
4.2 Characteristics of Mardin Houses

This city about which the earliest information is to be found in Roman sources contains remains from various civilizations, ranging from the Persian and Byzantine to the Syrian and Arabian. These traditional stone houses in Mardin which are hundreds of years old are built from yellow limestone and cut stone. Courtyard walls resembling castle defenses, monument vaults, decorated arches and moldings are the most striking features of the Mardin houses see Picture 4.2.1.

Pre-planned straight and stepped streets as well as little squares are formed according to a human scale. Every house faces the plain without obstructing the view of its neighbors.

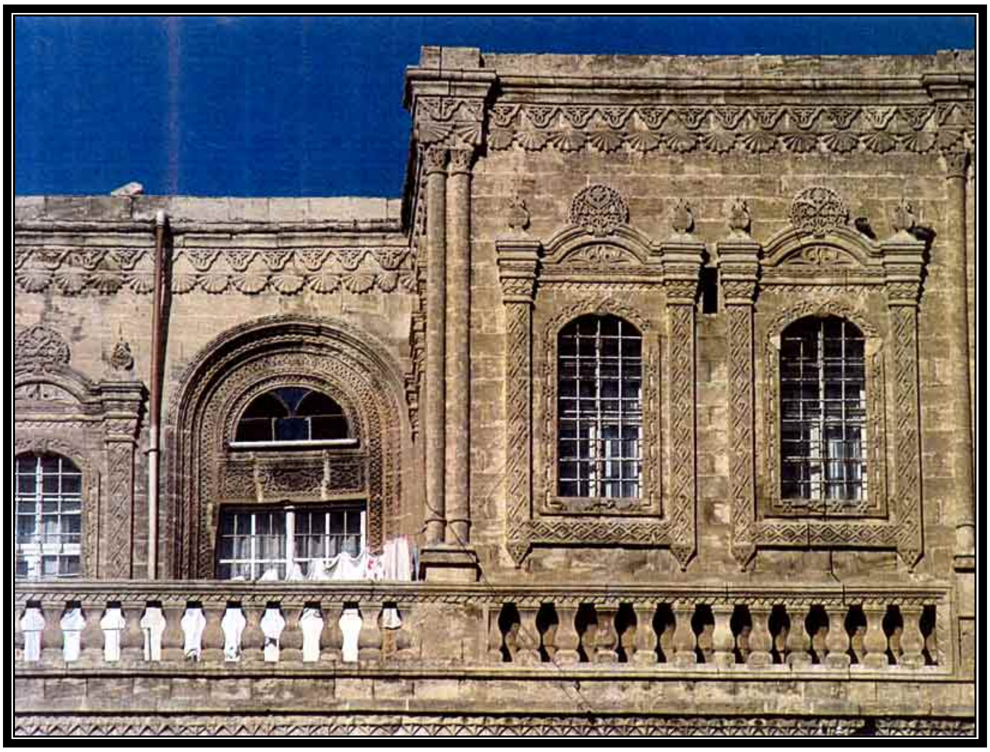
Picture 4.2.1 Mardin houses' Terrace and Courtyard (Erdoba konakları)

Mardin has conserved the old-style monument in its houses see Picture 4.2.2. Since located in a volcanic area, the basic input used in local architecture is easily effective calcareous rock. Houses in Mardin, reflecting all features of a closed-in life style are surrounded by 4 meters high walls and isolated from the street.



Picture 4.2.2 Old Style Monuments (Zinciriye monastery)

These walls also provide protection from ruthless climatic conditions. Houses have their separate sections for males and females and mostly have no kitchen. The most important feature of these houses is the stone craftsmanship called "*Midyat Work*" see Picture 4.2.3.

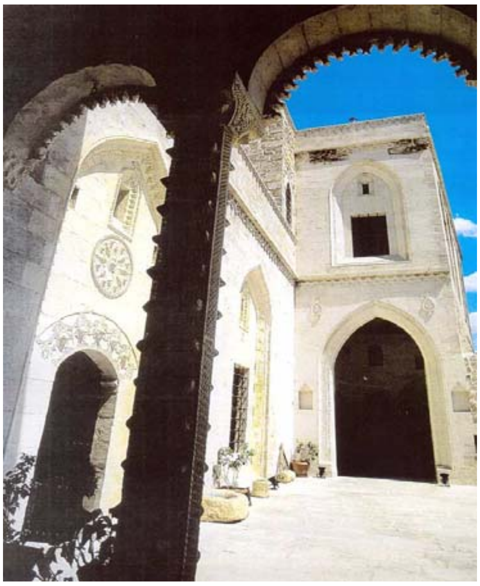


Picture 4.2.3 Midyat Work (Post Office building on the main road)

Doors, windows and small columns are dressed with arches and various motifs see Picture 4.2.4. The central settlement was given the status of urban site area in 1979. Above the house, doors see Picture 4.2.5 are carved pictures of the 'Kaaba' if the owner has made the pilgrimage to Mecca, and the doorknockers have a distinctive form similar to the beaks of birds. Often the lanes run through arched tunnels beneath the upper floors of houses. Relief carvings of animals and fruit lend the city a dream-like character, and the modern world seems to fade away.

Picture 4.2.4 Windows Motives (Erdoba Mansion)

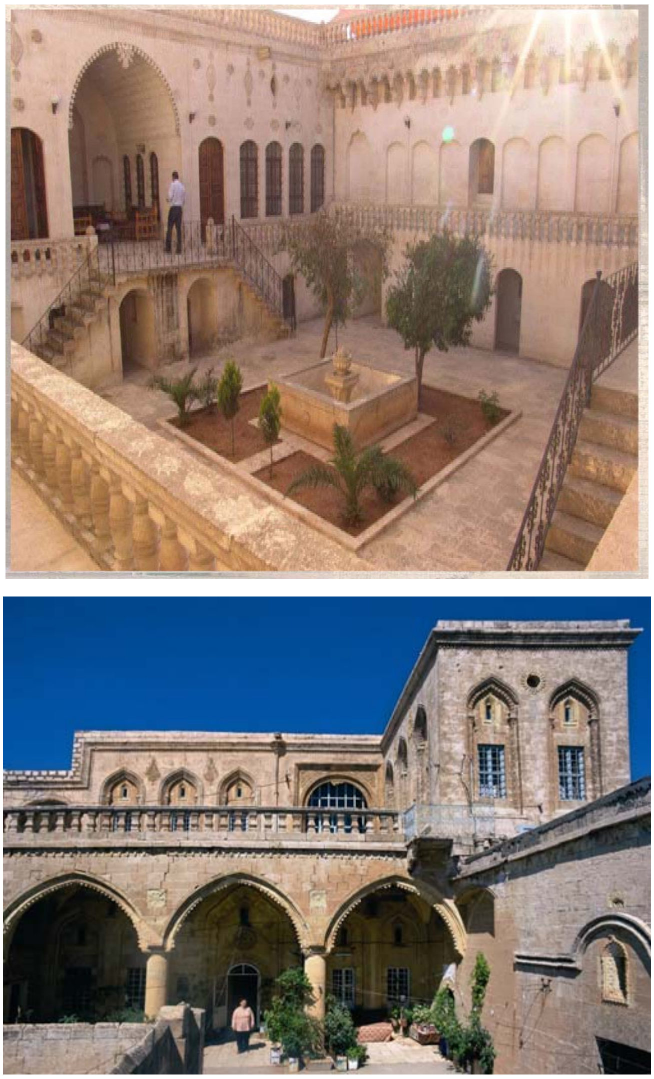


Picture 4.2.5 Doors and Columns Motifs (Erdoba Mansion)

4.2.1 Sustainable Interiors of Mardin Houses

Courtyard: The most significant unit in designing and its form is courtyard in this region. The courtyard is open spaces located among group of functions and surrounded with walls see Picture 4.2.6.

The courtyard taking place at the entrances of many houses has been designed at different size depending on the parcel where the house located on. The usage of each courtyard varies according the life styles, habits, customs, social and economic values of inhabitant people.



Picture 4.2.6 Mungan House' Courtyards

The main character of Mardin houses is that the courtyards are transformed into vast terrace opening towards the valley.
Cool air descends into the courtyard and into surrounding rooms during the night.

The structure even the furniture is cooled and remains so until late afternoon. At midday, the sun strokes the courtyards floor directly.

Some of the cool air begins to rise and also leaks out of the surrounding rooms providing extra comfort in terms of convective currents. Afternoon, the courtyard floor and interior rooms become warmer. Most of the trapped cool air spills out by sunset. However, after sunset the air temperature falls rapidly and cool air begins to descend into the courtyard completing the cycle.

Courtyards moderate the climatic extremes in many ways;

- The cool air of the summer night is kept undisturbed for many hours
- The room draw daylight and cool air from the courtyard
- It enhance ventilation and filter dust
- It provides a comfortable outdoor space to enjoy with its gentle microclimate.

Terrace: In Mardin terraces also help to moderate the climate extremes. Although they receive solar radiation throughout the day they provide the maximum comfort after hot summer sunset since they are open to the evening breeze coming from Mesopotamia see Picture 4.2.7. In the evenings, the custom of watering the terrace floor also helps to facilitate heat loss from the terrace floor by evaporation, and increases the relative humidity for a short time. Therefore wooden platforms called ‘thrones’ placed on terrace have been the most appreciated sleeping spot. (Uraz, 2005)

Picture 4.2.7 Mungan House Terrace2 (T2) and Tearrace 3(T3)
(Mardin City Guide, p.45)

Eyvan: The eyvan is a semi-open transition space between the courtyard and interior spaces. They have important role in the formation of a building according to land. There sides of it and top of it are closed and top of it is generally covered with a dome and one side of it is open. The eyvan is the passageway in front of the rooms (see Figure 4.2.1 Eyvan plan), which permits a common life inside.

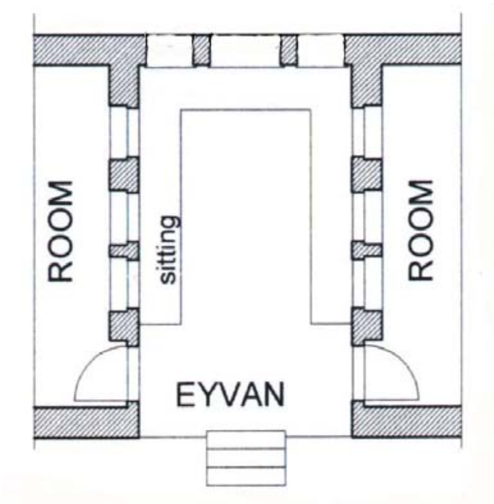


Figure 4.2.1. Mungan House, Eyvan Plan
(Gülec,S, A., Canan ,F., Korumaz, M. 2006.7)

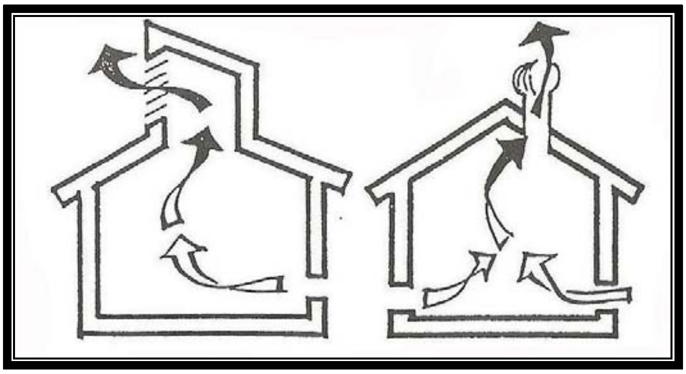
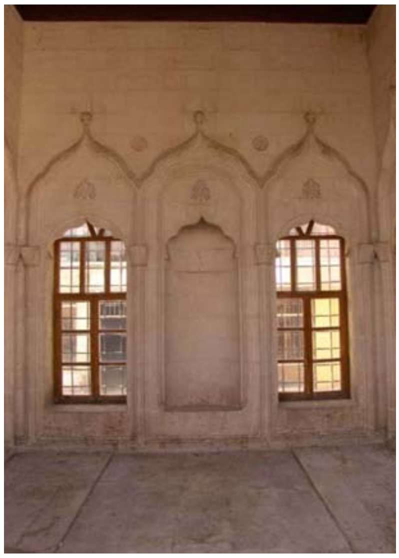


Figure 4.2.2 Natural Breezes

Ref: Chapter II

According to the mentioned part of two, natural cross ventilation has seen eyvan as a part of the Mardin House (see Figure 4.2.2).



Picture 4.2.8 Mungan House, Eyvan of Semi Open Space

In historical Mardin houses and monumental buildings the 'eyvan' developed like the extension of the courtyard to provide a horizontal widening. It is organized according to direction of the hot summer day's sun in order to provide shadow spaces see Picture 4.2.8.

There are eyvan' directed towards the south against the morning sun and there are the others which are directed towards the east against the mid afternoon sun. Besides, in this semi open space natural ventilation is the important role in Mardin city (see Figure 4.2.3).

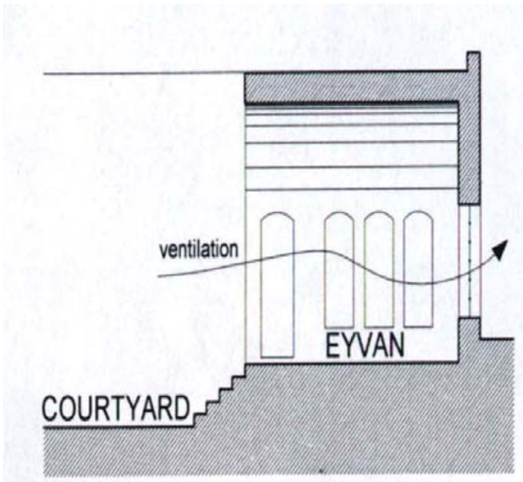


Figure 4.2.3 Mungan House, Eyvan Ventilation
(Gülec,S, A., Canan ,F., Korumaz, M.2006.7)

As mentioned in study about the part of two shading is an important role for both site planners and also architecture and they must be able to calculate the position of the shady areas in the project site like as (Figure 4.2.4)

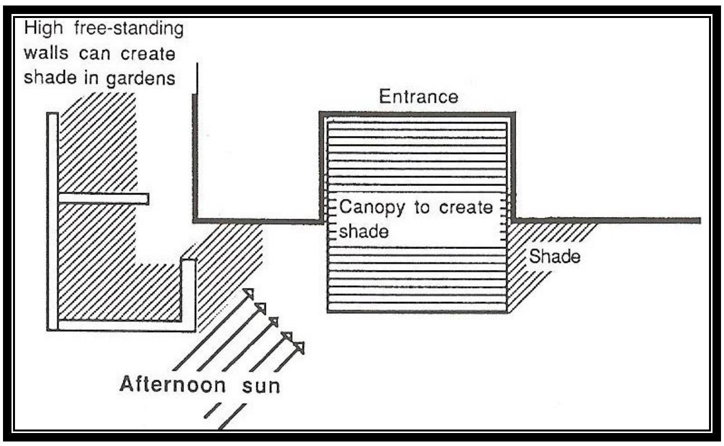


Figure 4.2.4 Shady Space

In Mardin houses, there is low-mark furniture for sitting called ‘seki’ in the middle of this space, sometimes the pool is placed at weather which reinforces the cooling of space see Picture 4.2.9

Picture 4.2.9 Cooling Space (Mungan House)

Revak: The revak which has common peculiarities in the city is located throughout the courtyard on the ground floor. It is a semi open space of life, sitting and resting see Picture 4.2.1.5. If there is sufficient surface for the courtyards and other spaces, the revak is built for making shady space as same as eyvan, on the remainder of the surface of the land.

Picture 4.2.10 Revak (Post Office Building)

Water Channels:

Picture 4.2.11 Water Channels on The Ground (Mungan House)

Picture 4.2.12 Water Channels on The Ground (Darülzaferan Monastery)

Water channels have been used in ground floor for several years both at interior materials and also at courtyards providing thermal mass cooling as seen in Picture 4.2.11 and Picture 4.2.12.

Picture 4.2.13 Water Channels in Interiors (Kasimiye Medresseh)

Water channels in the middle of the eyvan become narrow while passing here and then reach out to the pool in the middle of the courtyard see Picture 4.2.13.

Water units see Picture 4.2.14 and Picture 4.2.1.15 small pools in front of eyvan decrease the temperature by evaporating and storing the heat in hot summer months. And they also provide needed comfort conditions by increasing the ratio of relevant humidity in the weather.

Picture 4.2.14 Water Units (Kasimiye Medresseh)

Picture 4.2.1.15 Water Pool in Courtyard (Kasimiye Medresseh)

Moreover, water channels have been being used not only in courtyards and interior house parts but also in city's water channels drainage and cisterns for reusable rainwater as seen in Picture 4.2.1.16 and Picture 4.2.1.17.

Picture 4.2.1.16 Water Channels for Rainwater (Mesepotamia Plain)

Picture 4.2.1.17 Water Cisterns (Mesepotamia Plain)

CHAPTER 5

CONCLUSION

Throughout the history of architecture various stylistic, philosophical, artistic movement and also design movements were observed to influence the architecture and interior architecture design. For instance; gothic and baroque concept of formatting, more diversification is observed in the modern area.

Moreover, brutalism, functionalism, postmodernism, such as deconstructive artistic insight as examples can be given but such as environmental pollution, depletion of natural resource today, with reasons in all areas of life is compatible with the concept of sustainability and eco-environment is the most important paradigm. Obligations' arising from this basic understanding of all production is the main philosophy. Besides, urban design architecture, interior architecture and physical environment affect human lives directly, such us forming the sustainability and eco-system compatibility situation today was very important.

In this thesis, firstly, the researches have been investigated how the current approaches is being carried on in designing. Moreover, Sustainable Design Principles are investigated in four main aspects. First of all, passive heating which included day lightning, solar radiation, passive solar gain, direct gain, indirect gain, isolated gain. At the second part, passive cooling methods, including cross-ventilation and shade, were studied. Energy gain systems including solar panel (photovoltaic cells), wind and water were mentioned as a third part.

As a final part water systems containing rainwater were examined. The aim of this thesis, the current approaches there was for centuries in traditional architecture as in the process of design criteria have been observed. UNESCO has entered the cultural heritage of the traditional architecture of the century, the city containing Mardin. For this reason, Mardin city was chosen as the area for the study. Among the sustainable design principles of today the traditional architecture of Mardin samples were analyzed with acceptance. We mentioned in this research paper that part of the contemporary paradigm in design sustainability has been tried to confirm such samples in the part of analytic approach to vernacular architecture of Mardin within the context of sustainable design and also sustainable design data in Mardin city are such as;

- **Abbara/kabaltı:** The room at the top of the street is a hot climate solution in dense dwelling fabric of the cities which developed on the flat grounds in hot climate regions. These rooms cross the narrow streets by creating shade which allows an effect of cooling in outside space in summer. This shaded space becomes a playing space for the children and resting space for the old people.

- Mesopotamia plain and also day light refers to spread natural light from the terrace throughout the interior for every house in Mardin and concepts of sustainability, harmony with topography and climate for using local materials is an important role for the houses in Mardin to provide a passive energy source.

- Houses in Mardin, reflecting all features of a closed-in life style are surrounded by four meters high walls and are isolated from the street. These walls also provide protection from ruthless climatic conditions.

- The main character of Mardin houses is that the courtyards are transformed into vast terrace opening towards the valley.

And also cool air descends into the courtyard and into surrounding rooms during the night.

- The arrangement, even the furniture is cooled and left over so until late afternoon. At noon, the sun strokes the courtyards floor directly. Moreover, some of the cool air begins to rise and also leaks out of the surrounding rooms providing extra comfort in terms of convective currents. In the afternoon, the courtyard floor and interior rooms become warmer. Most of the trapped cool air spills out by sunset. However, after sunset the air temperature falls rapidly and cool air begins to descend into the courtyard completing the cycle.
- In Mardin, terraces also help to moderate the climate extremes. Even though they receive solar radiation throughout the day, since they are open to the evening breeze coming from Mesopotamia, they provide the maximum comfort after a hot summer sundown. In the evenings, the custom of watering the terrace floor also helps to facilitate heat loss from the terrace floor by evaporation, and increases the relative humidity for a short time.

- The eyvan is a semi-open transition space between the courtyard and interior spaces. According to the second part mentioned, natural cross ventilation has considered eyvan as a part of the Mardin House. It is organized according to direction of a hot summer day's sun in order to provide shadow spaces. There are eyvans directed towards the south against the morning sun and there are the others which are directed towards the east against the mid afternoon sun. Besides, natural ventilation plays an important role in Mardin city in this semi open space.

- The revak which has common peculiarities in city is located throughout the courtyard on the ground floor. It is semi open space of life, sitting and resting. The revak is built for making shady space.

- Water channels have been used in ground floor for several years both at interior materials and at courtyards providing to thermal mass cooling as it is seen in the pictures .Water units and small pools in front of eyvan decrease the temperature by evaporating and storing the heat in hot summer months. And they also provide required comfort conditions by increasing the ratio of relevant humidity in the weather. Moreover, water channels have been used not only in courtyards and interior parts of houses but also in city's water channels drainage and cisterns for reusable rainwater.

Consequently, taking all the opinions into consideration, a conclusion regarding to the current approach for sustainable design principles in architecture was drawn here.

REFERENCES

1. **ALİOGLU, E, F.** (2000), *Mardin Şehir Dokusu ve Evler,*Türkiye Ekonomik ve Toplumsal Tarih Vakfı, Istanbul.

2. **BEER, R., A.** (1990), *Environmental Planning for Site Development*, E&FN Spon, London.

3. **BEDİR, B.** (2005), *Sürdürülebilir Bina Üretiminde Alternatif Bir Yaklaşım: Sıfır Enerjili Binalar* (2004-2005 Bahar Dönemi) Mimarlık Fakültesi, Gazi Üniveristesi, Ankara.

4. **ÇALGÜNER, T.** (2003), *Çevre mi Ekoloji mi, Empatinin Uyanışı ve Süreklilik*, Nobel Yayınları, Ankara.

5. **FABOS, G, J.** (1985), *Land- Use Planning: Fro Global To Local Challenge*, Chapman and Hall Ltd., Great Britain.

6. **GEHL, J.** (1980), *Life Between Buildings Using Public Space*,Van Nostrand Reinhold Company, New York.

7. **GIBBERD, F.** (1953), *Town Design*, The Architectural Press, London.

8. **LYLE, T, J.** (1985), *Design For Human Ecosystems,* Van Nostrand Reinhold Company, New York.

9. **MARSH, M, W.** (1991), *Landscape Planning Environmental Applications,* John Wiley& Sons Inc, New York, Chic esters, Brisbane, Toronto, Singapore.

10. **MICHAEL, B, D.** (2005), *Sustainable Land-Use Planning: The Integration of Process and Technology, UMI* Dissertation Services, London.

11. **NEILL, J. V. W.** (2004), *Urban Planning and Cultural Identity,* Rout ledge Taylor & Francis Group, London.

12. **TURNER, T.** (1996), *City as Landscape-A Post Postmodern View of Design and Planning,* E&FN Spon, London.

13. **THOMAS, R.** (2003), *Sustainable Urban Design an Environmental Approach*, Spon Press, USA, Canada.

14. **WIILIAMS, E, Daniel.** (2007), *Sustainable Design*, John Wiley & Sons.Inc., Hoboken, New Jersey.

15. **SILBERSTEIN, J., MASER, C.** (2000), *Land-Use Planning for Sustainable Development*, CRC Press LLC, Florida.

16. **GEDIK, Z., UNVER, R., OZCAN, K.**, *Turkish Regulations on Energy Conservation, German-Turkish Workshop on Sustainable Energy*, TUBITAK MRC, Gebze, Kocaeli, Turkey.

17. **MYERSON, G.** (2004), *Ekoloji ve Postmodernliğin Sonu,* Translation: E.Kılınç,Everest Yayınları, Istanbul.

18. **BALAMIR, A., URAZ, T.** Eds. (2003), ISUF International Conference: *The Planned City, Old New Fabrics of Mardin: Loss of Transitions in Spatial and Constructional Form* (3-6 July), Trani (Bari), Italy.

19. **GULEC, A, S., CANAN, F., KORUMAZ, M.** Eds. (2006), 23rd International Conference on Passive and Low Energy Architecture, Geneva, *Analysis of the Units Contributing Climate Comfort Conditions in Outdoor Space in Turkish Traditional Architecture* (6-8 September), Selcuk University, Konya, Turkey.

20.**GULMEZ, Ü, N., URAZ,U,T.** Eds.(2007), International Conference on Sustainable Urban Areas, *Vernacular Urban Fabric as a Source of Inspiration for Contemporary Sustainable Urban Environments: Mardin and The Case of 'Mungan House'*(25-28 June)Department of Architecture, Bahcesehir University, Istanbul, Eastern Mediterranean University, Cyprus.

21. **YILMAZ, A, Z.** Eds. (2008), 25th Conference on Passive and Low Energy Architecture, Dublin, *Low Energy Strategies for Different Climates of Turkey: Comparison of Traditional and Modern Samples* (22nd-24th October) Faculty of Architecture, Istanbul Technical University, Istanbul.

22. **AKSIT, Ş, F.** Eds. (2006), *Türkiye'nin Farklı İklim Bölgelerinde Enerji Etkin Bina ve Yerleşme Birimi*, *Tasarım* 157, Istanbul.

23. **AYAZ, E.** Eds. (2002), *Yapılarda Sürdürülebilirlik Kriterlerinin Uygulanabilirliği,* Mimar, Istanbul.

24. **HALIFEOGLU, M, F.** Eds. (2006), Elektronik Sosyal Bilimler Dergisi, *Savur Geleneksel Kent Dokusu ile Sosyal Yapı İlişkisi Üzerine bir İnceleme,* ISSN: 1304-0278 C.5 S.17 (76-84).

25. **SAID, S, N, B.** (2006), *Multi-Cultural on Tripoli Architecture Between 16th-19th Century,* Unpublished, Department of Interior Architecture, Cankaya, Ankara.

26. **SHATEH, S, H.** (2002), *Development and Use of Traditional Patterns for Design in Hot Arid Zones*, Unpublished, Department of Interior Architecture, Cankaya, Ankara.

27. **SAID, S, N, B.** (2004), *Heating and Cooling with Solar Energy*, Unpublished, Department of Interior Architecture, Cankaya, Ankara.

28. http://www.mardin.gov.tr/english/cografya/cografya.asp

29. http://www.mardin.gov.tr

30.http://www.mardin.gov.tr/english/tarihi/nufus

APPENDIX

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Aydın, Saba Esin
Nationality: Turkish (TC)
Date and Place of Birth: 3 May 1980, Ankara
Marital Status: Single
Phone: +90 312 225 30 69
email: esinaydn7@gmail.com/ sabaesinaydin@hotmail.com

EDUCATION

Degree	**Institution**	**Year of Graduation**
MS	Cankaya University Interior Architecture	2009
BS	Bilkent Univesrity Landscape Architecture and Urban Design	2004
High School	Arı Science High School	1997

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2008-2009	Bostan's Furniture	Model Design and Control Chief
2007-2008	Selvira Kitchen and Bath Firm	Model Design and Control Chief
2006-2007	Maybak Construction	Control Chief
2005-2006	Oguz Aldan Urban Design Office	Landscape Architect
2004-2005	Yeşil Ilgaz	Landscape Architect

FOREIGN LANGUAGES

Advanced English, Medium French

COURSES

2003- AutoCAD, Photoshop, 3DMax
2002- French

MEMBERSHIP

Landscape Architecture Association

HOBBIES

Furniture Design, cinema, take a photograph.