An-Najah National University

Faculty of Engineering

Building Engineering Department

4-star hotel design

Graduation Project

By:Hiba Salameh

Ghadeer amoudi

muna ahmad

tamara aker

Supervisor: Dr. Monther Dweikat

Acknowledgment:

We have made a great effort to bring this project into light. However, it would not have been possible without the real support and help of many individuals. We would like to send our sincere thanks to all of them.

Thanks to all members committee and special thanks for our supervisor Dr. Monther Dwaikat For his guidance and support by providing us with important references and spend many hours in reading, editing, and giving us the freedom to investigate things to help us in accomplishing this project

Thanks are extended to the head of building engineering department Dr. Moutasim Baba’ and to the examination committee.

last but not least we would to thank all persons who provided us with the necessary information to complete the project and singled out Dr.Ali Abed elhameed , Eng Jehad Gazal and Khaled Salem from Ministry Of Tourism.

Finally, we would like to thank our parents, brothers for encouraging us to pursue our dreams, and for raising us in a stable and nurturing home also thanks for our friends for their endless love, trust, encouragement, and support throughout our life.

Table of content:

Table of figure:

Table of table:

Abstract:

The basic idea of the project is to design a 4-star hotel in Sabastiya. It is well known that many Arab and foreign tourists travel to Sabastiya many reason including recreational, therapeutic and religious reasons. Therefore, we selected the design of a hotel in this region to be our project.

The project will include an integrated design of all aspects that we have learned over 5 years in the Faculty of Engineering. This means that the project will involve a study of the nature of the site, architectural, structural, electrical, environmental and mechanical design, and safety aspects. Architectural and environmental design will takes into consideration the orientation, form, spaces; fenestration will be designed based on environmental requirements. The structure will be designed using computer software where the analysis will include a 3-D model, soil structure interaction and dynamic analysis for seismic design. In addition, the project will be designed for fire safety using fire alarms, elevators, exits and other systems that may be important to provide public safety. The electrical design involves lighting systems, electrical wiring, and sockets, especially for high-power devices. The design will comprise mechanical and HVAC installations and plumbing.

At the end of the project, a report which includes all design and analysis details will be submitted. The report contains table of quantities, cost estimate and shop drawings that can be implemented in practice.

Chapter one
Introduction

1. Introduction.

1.1 General:

The tourism industry is one of the most important aspects of the economy. Through tourism, hotels are built; roads are repaired in order to attract visitors. This has created positive effects to any country. Tourism is an excellent way to develop a country.

Palestine is one of the important tourist areas in the east due to the large number of tourist attractions and diversity of ancient monuments and shrines also Palestine geographical location is featured as a point of contact between the continents of Africa and Asia.

One of the fastest growing sectors of the economy of our time is hotel industry. Thus, creation of hotels is one of the most important factors that will help the development of internal and foreign tourism; hence the basic idea of the project is to design a 4-star hotel which offers for tourists the best services. After many studies the location was selected for the project in Sabastiya, in Nablus city. **[1]**

Therefore, many considerations are integrated when choosing a site for hotels because it affects the whole design process. These considerations are related to the nature of the region and its natural and historical features which are attractive factors for tourists. In addition; we will highlight the important considerations and recommendations related to the design of such spaces, main entrances, corridors, and vertical transportation. Also some special structural design like Hall wedding because of long span, business center and conference facility must be isolated against the hassle and safety design such as exits and fire.

The proposed project will illustrate and discuss in details how to provide an integrative design of 4- star hotel, The hotel will be designed in an integrated manner which includes, architectural, structural, environmental, mechanical and, electrical aspects and the overlap of these design elements together in order to achieve human comfort commensurate with the specifications and requirements.

1.2 Significance of the Work:

The number of hotels in Nablus as 6 hotels in 2010, a rate of 6.9% of the total hotels in the West Bank, and the average number of rooms 108 rooms, as the number of guests spent the 9656 guest 17540 overnight stays in city hotels [2]

Hence the idea of the project came, and hotel will revive the tourism in the region based on the ministry of tourism sabstiya is the best selection on Nablus city this is because of the unique location of the area and the presence of relics and historical monuments which have become a tourist attraction point.

Finally, It worth mentioning that the number of tourists suitable for the establishment of such a project and currently similar idea is implementing in the region, which means that project executable.

1.3 Objectives:

The main objective of this project is to provide an integrative design of a 4-star hotel in Sabastiya. The specific objectives are:

- Architectural design: in the architectural design the structure will be design based on functionality and the environmental requirements.
- Structural design: In the structural design, the structures in the project will be analyzed and designed using computer software. The analysis will include dynamic analysis, 3-D model of the structure, and soil structure interaction.
- Mechanical and environmental design, HVAC, water, and sanitary systems in the project will be analyzed and designed.
- Electrical design will include designing power and lightening systems in the project.
- Public safety design includes designing the emergency exits, alarm system and fire protection system.

1.4 Scope:

This report is divided into five chapters. Chapter One introduces the idea of the project and main objectives. In Chapter Two, we present the development in tourism and hotel, in addition to the requirements of hotel design and hotel classification also principles of hospital design will be clarified In Chapter Three two case studies related to the project are discussed. In Chapter Four,

the site of the project is selected and analyzed. Finally, in Chapter Five future work for the second semester is discussed.

Chapter two

Hotels review

2 Hotel review

2.1 General:

Tourism defined as an activity of traveling to place for pleasure, recreation and it's the business of providing restaurant and hotels for the people who are traveling, to activate the movement of tourists must take care to achieve the highest level of service in hotels. [3]

A hotel is a type of commercial establishment that accommodates visitors for a short stay at a stated fee. Services offered while at the hotel include meal, bathroom, restaurants, conference rooms, stores, facilities and other sporting or leisure activities. A hotel can also be defined as the place where it provides lodging to the travelers and offers food to the guests and making revenue on the owner's point of view.[4] [5]

In this Chapter, tourism type and accommodation and hotel classification and all hotel design requirement such as architectural, structural, environmental, electrical, mechanical and finally public safety are discussed in this chapter.

2.2 Tourism and accommodation:

Tourism: is travel for one purpose or more. The world tourism organization defines tourists as people traveling to and staying in places outside their usual environment for not more than one year for any of the following purpose:

a. Religious tourism.
b. Medical tourism
c. Social tourism
d. Eco-tourism
e. Scientific Tourism
f. Sports tourism.
g. Leisure tourism
h. Cultural tourism (tourism, archaeological and historical)
i. Beach tourism. [6]

But in sabastyia mostly there are two types of tourism which is: religious tourism and cultural tourism (tourism, archaeological and historical) ,Due to the presence Many of the Roman Theater effects and the Temple of August and the Church of head and Albzeljka and pitch and the tower and street pole . And other historical and religious monuments.

In our project the most common patterns of Tourism is religious and cultural tourism due to the presence of many historical and cultural monuments such as roman theater, church of head, street pole. And other historical and religious monuments

The hotel, which will be designed to meet the many services for tourists, in addition to the fantastic characteristic of the site.

2.3 Hotel Classification Systems:

In the past, hotels were just a place to sleep and food only the emergence of tourism in the latter half of the 19th century brought with it an improvement of the standards of the early hotels. Some pressure was placed on these facilities to offer some minimum standards where the consumer was able to identify a property with specific amenities.

After World War II National Tourist Boards began to consider some form of hotel registration/classification system. There was some difficulty in doing so. By 1970 only five European countries had national classification systems, by 1980 this number increased to 22 European countries and 60 countries worldwide.

Hotels are classified depending on different criteria and therefore its difficult to make a precise classification for hotel.

The criteria applied by the classification systems were, and still are not uniformed. There were various meanings attached to registration, classification and grading.

Registration: Form of licensing which may or may not demand a minimum standard. Signifies some conformation with health fire safety. That means minimum criteria.

Classification: separation of different types and ranges of accommodation into several categories based on a range of criteria. Hotel accommodations can allow for five to seven categories to be applied. – Other forms of accommodation e.g. motels, guest-houses and self catering apartments seldom justify more than two or three classes.

Grading: Often combine with classification; this is a quality assessment awarding a symbol to denote an above average service to an accommodation facility. E.g. Green globe classification systems for environment.

❖ Minimum Requirements for hotels:

One Star Hotels:

Hotels in this classification are likely to be small and independently owned, with a family atmosphere. Services may be provided by the owner and family on an informal basis. There may be a limited range of facilities and meals may be fairly simple. Lunch, for example, may not be served. Some bedrooms may not have en suite bath/shower rooms. Maintenance, cleanliness and comfort should, however, always be of an acceptable standard.

Two Star Hotels:

In this classification hotels will typically be small to medium sized and offer more extensive facilities than at the one star level. Some business hotels come into the two star classification and guests can expect comfortable, well equipped, overnight accommodation, usually with an en-suite bath/shower room. Reception and other staff will aim for a more professional presentation than at the one star level, and offer a wider range of straightforward services, including food and drink.

Three Star Hotels:

At this level, hotels are usually of a size to support higher staffing levels, and a significantly greater quality and range of facilities than at the lower star classifications. Reception and the other public rooms will be more spacious and the restaurant will normally also cater for non-residents. All bedrooms will have fully en suite bath and shower rooms and offer a good standard of comfort and equipment, such as a hair dryer, direct dial telephone, toiletries in the bathroom. Some room service can be expected, and some provision for business travelers.

Four Star Hotels:

Expectations at this level include a degree of luxury as well as quality in the furnishings, decor and equipment, in every area of the hotel. Bedrooms will also usually offer more space than at the lower star levels, and well designed, coordinated furnishings and decor. The en-suite bathrooms will have both bath and fixed shower. There will be a high enough ratio of staff to guests to provide services like porter age, 24-hour room service, laundry and dry-cleaning. The restaurant will demonstrate a serious approach to its cuisine.

Five Star Hotels:

Here you should find spacious and luxurious accommodation throughout the hotel, matching the best international standards. Interior design should impress with its quality and attention to detail, comfort and elegance. Furnishings should be immaculate. Services should be formal, well supervised and flawless in attention to guests' needs, without being intrusive. The restaurant will demonstrate a high level of technical skill, producing dishes to the highest international standards. Staff will be knowledgeable, helpful, well versed in all aspects of customer care, combining efficiency with courtesy. **[7]**

2.4 Architectural design

Architecture is defined as the art and science of designing buildings and structures. The following subjects talk about the most important elements in architectural design.

2.4.1 Premises:

The Premises shall include one building or buildings which are on one site and which are physically linked by well-lit, covered or insulated corridors which mean buildings shall share common access and exit and the premises shall contain such amounts as determined of main and secondary entrances, exits, reception ,areas, dining areas, kitchen and service areas, lounge areas, cloakroom facilities, bathrooms and toilets, guest bedrooms, staff accommodation, storage areas, together with sufficient corridors and stairways to ensure proper circulation of air, proper movement of people and proper access to the various units. The premises shall be of substantial and durable construction, structurally safe and in good repair throughout.

Floors, walls and ceilings throughout the premises shall be of suitable type and design to maintain the highest standards of hygiene. The premises shall contain effective means of natural lighting and ventilation. The premises shall have in the public rooms and bedrooms means of space heating capable of maintaining at all times a minimum room temperature of 20º.

The following picture shows an example of a 4-stars hotel in Angkor Cambodia (Tara Angkor) :

Figure 2.1: premises in a 4-stars hotel in Angkor Cambodia

1. The premises, including the exterior and interior, outdoor areas, grounds and car parking areas shall be kept clean and well maintained throughout. Car parks, where provided, should be well lighted and have proper directional signage.

2. The premises shall be used primarily for the lodging or sleeping of travelers and shall provide a service to such travelers, of meals and refreshments which shall include breakfast and dinner. The provision of dinner shall, at minimum, mean the availability of a choice of hot cooked 8meals together with desserts.

3. Sufficient general internal and external lighting shall be provided in all areas and in addition a suitable intensity of local lighting for eating, reading, writing and toilet purposes.

4. The premises shall have a telephone installation connected with an external telephone system in bedrooms and public areas for use by guests.

5. Facilities shall be provided for the storage of cleaning materials for each of the various units of the premises and for the storage and airing of necessary stocks including bed linen and blankets.

Where a banqueting area is constructed on the premises after the commencement date, the dining area in the said banqueting facility shall have:

a. A floor to ceiling height of not less than 2.5 meters .
b. At least one window to provide natural light and ventilation.
c. Furniture, fittings and equipment of good quality .
d. Adequate toilet facilities for the patron capacity of the banqueting area which shall be well ventilated by natural or mechanical means be properly supervised and kept in a clean and hygienic condition.

6. Where a wedding hall is constructed in the premises, it shall have:

a. Its own entrance and exits.
b. Adequate insulation to ensure that the noise transmitted there does not interfere with the comfort of other guests within the hotel.
c. Furniture, fittings and equipment of good quality and condition.
d. Adequate toilet facilities for the patron capacity of the hall wedding which shall be well ventilated by natural or mechanical means be properly supervised and kept in a clean and hygienic condition.

The following picture shows an example of premises in a 4-stars hotel:

Figure 2.2: premises in a 4-stars hotel:

2.4.2 Entrances and exits:

The main requirements that should be available in the entrances are as the following:

1. Entrances and exits shall be of sufficient size to cater adequately for the overall guest capacity of the premises. The main entrance should consist of a double door 2.5 meters height and pivotal conventional doors with a minimum width of 90 cm.
2. The premises shall contain a service entrance, separate from the guest entrance, and suitably located for the reception of goods necessary for the operation of the premises.
3. The entrance hall shall be:

a. Sufficient size to cater adequately for the volume of traffic normally using the premises.

b. Suitably located, laid out and contain furnishings, fittings and equipment of good quality and in good condition.

4. In the case of premises which apply for initial registration the following must be provided:
5. Access for persons with mobility difficulties, including wheelchair users, to the entrance hall, reception, bedrooms and public areas, including bathroom and toilet.

The following picture shows an example of an entrances and exits in a 4- stars hotel :

Figure 2.3: an entrances and exits in a 4- stars hotel

2.4.3 Dining area:

The main requirements that should be available in the dining area are as the following:

1. The dining area shall have:

a. A floor to ceiling height of not less than 2.4 meters.
b. At least one window to provide natural light and ventilation.

2. The dining area shall contain seating, furniture, fittings and equipment of good quality and condition. High chairs (or suitably adapted chairs) shall be available for children.
3. Tables and seating shall be of adequate size to enable the diners to dine in comfort and be capable of easy and flexible arrangement and permit diners and staff to circulate easily in the dining area.
4. Crockery shall be adequate to serve the maximum number of diners capable of being seated in the dining area, be in good conditions, of good quality and of uniform design.

The following picture shows an example of a dining area in a 4-stars hotel:

Figure 2.4: dining area

2.4.4 Kitchens and service areas:

The main requirements that should be available in the kitchens are as the following:

1. The kitchen shall have direct access to the dining area, with double service doors between the dining room and kitchen. Service access to the dining area shall not be through a public area that is normally used by guests as a lounge area and/or a passageway or corridor.

2. There shall be easy access by means of internal or enclosed corridors and stairways from the kitchen and service areas of the hotel to the public rooms and the bedroom units.

3. for kitchens:

   a. Doors should be 1.2 m. wide, opened by pushing and closed automatically.
   b. Walls tiled from floor to roof.
   c. Water-proof, non-slip floor. Slopes down to drainage outlets.
   d. White ceiling.
   e. Rounded off corners.

The following picture shows an example of a kitchens in a 4-stars hotel :

Figure 2.5: kitchens in 4-stars

2.4.5 Lobby/lounges:

The main requirements that should be available in the lobby are as the following:

1. Lobby and lounge space shall be provided in common areas.
2. Lounge space of not less than 20 square meters in a communal area shall be provided.
3. Each lobby/lounge shall have:

   a. a floor to ceiling height of not less than 2.4 metres .

b. at least one window to provide natural light and ventilation. Alternatively, climatic controlled air circulation or mechanical system of ventilation. The following picture shows an example of a lobby in a 4-stars hotel:

Figure 2.6: a lobby in a 4-stars hotel

2.4.6 Toilets:

The main requirements that should be available in the toilets are as the following:

1. Toilets for residents and casual patrons shall be provided separately for men and women and shall be located adjacent to or easily accessible from both the entrance hall and the public rooms.
2. Toilets shall contain WC units (in separate compartments) and fixed wash-hand basins equipped with plumbing for the continuous supply of hot and cold water and the disposal of waste.
3. The number and type of sanitary fittings installed shall be calculated in relation to the resident guest capacity of the premises as follows:

MEN			
20 persons	1 WC	1 Urinal	1 WHB
21-50 persons	1 WC	2 Urinal	1 WHB
51-100 persons	2 WC	2 Urinal	2 WHB
101-200 persons	3 WC	3 Urinal	2 WHB
201-300 persons	4 WC	4 Urinal	4 WHB
WOMEN			
20 persons	2 WC		1 WHB
21-50 persons	3 WC		2 WHB
51-100 persons	5 WC		3 WHB
101-200 persons	7 WC		4 WHB
201-300 persons	8 WC		6 WHB

Figure 2.7: guest capacity of the premises

4. The toilets shall be well ventilated (by natural or mechanical means).

The following picture shows an example of toilets in a 4-stars hotel:

Figure 2.8: toilets in a 4-stars hotel

2.4.7 Guest bedrooms:

The main requirements that should be available in the guest bedrooms are as the following:

1. All guest bedrooms for this category of accommodation must have private bathroom. There shall be a minimum of ten guest bedrooms with private bathrooms ensuite, all of which shall have separate access from the bedroom corridor.
2. Bedrooms, the toilets and bathrooms servicing them and the corridors off which they shall open shall be “out of view” from the public areas and separated from each other by properly constructed and suitably sound resistant walls or partitions, floors and ceilings and having an acoustic attenuation of 50dB.
3. Each bedroom shall have:
    a. A floor area for single bedrooms of not less than 9 square meters exclusive of private bathroom and lobby area.
    b. A floor area for double/twin bedrooms of not less than 15.00 square meters exclusive of private bathroom and lobby area.
    c. A floor area for triple bedrooms of not less than 20 square meters exclusive of private bathroom and lobby area.
    d. a floor to ceiling height of not less than 2.4 meters.
    e. at least one external window with clear glass to provide natural light and ventilation. The position of the window should be such that at least one third of the glass area is below a level of 1.6m from the floor.

f. Terrace has a surface area of 8 m² and the surface area of the bathroom is usually 6 m².
g. at least two electrical outlets suitable for the attachment of electrical equipment including heaters and cleaning equipment to be provided.

4. Access to bedrooms is not acceptable through public sitting rooms, dining rooms or kitchen save where any of the latter forms part of the same individual let table suite in which the bedroom(s) is/are located.
5. Each private bathroom attached to a bedroom shall have a minimum floor area of 3.8 sq. meters, and 3.5 sq. meters where the facility includes a shower unit only rather than a bath.

The following picture shows an example of a bedroom in a 4-stars hotel:

Figure 2.9: a bedroom in a 4-stars hotel

6. For Beds the minimum size should be:
   a. Standard Double room (KS): 2.00 x 2.00
   b. Standard Single room (SGL): 1.20 x 2.00
   c. Standard Twin room (DD): 2 beds 1.00 x 2.00
   d. Junior Suite with double bed (KS): 2.00 x 2.00
   e. Junior Suite with Twin beds (DD): 2 beds 1.20 x 2.00
   f. Suite with double bed (KS) : 2.00 x 2.00
   g. Suite with Twin beds (DD): 2 beds 1.20 x 2.00.

- ***Required dimensions and specifications for doors and windows in interior rooms:***

1. Doors:

a. 85 cm wide (minimum). Except in rooms for the handicapped, this will be 90 cm and height of 2.15 m.
b. Door knob with a handle (mandatory in rooms for the handicapped) with safety lock.
c. Must have door stop to prevent door banging against the wall.
d. Made of wood and Fire resistant, RF=32.
e. Should be appropriately soundproofed and give a sensation of security.

2. Glass windows:

a. A minimum glass surface of 1,5 m^2 is recommended.
b. Windows will have a blocking mechanism at 1.5 m., out of the reach of children (except handicapped rooms).
c. The frame will be made of aluminum or wood, reinforced with double glazing 10/6/8 mm.
d. Inflammable curtain materials are required for all sliding windows in rooms.

2.4.8 Bathrooms and toilets:

The main requirements that should be available in the bathrooms are as the following:

1. To serve bedrooms which do not have private bathrooms attached, each premises shall contain in separate compartments:
   a. one bathroom for the first fifteen persons or portion thereof .
   b. two toilets for the first 20 persons or portion thereof .
   c. thereafter one bathroom for every additional fifteen persons or portion there of and one toilet for every additional ten persons or portion there of .
   d. up to 50% of the additional toilets may be provided in the bathroom compartments .
   e. each floor of bedrooms shall have on, or adjacent to it without access through the public areas .
2. Bathroom/toilets shall have a vanity light, and an electrical shaving point. [8]

The following picture shows an example of private bathrooms in a 4-stars hotel:

Figure 2.10: private bathrooms

2.4.9 Main restaurant:

The main requirements that should be available in the restaurant are as the following:

1. Approximately. Room capacity 0.75 m^2 x seat available plus 100 m^2 for buffet and scullery.
2. The main restaurant should have the largest capacity, as it is where the main meals will be served with a buffet.
3. Furniture should be positioned depending on the layout of the premises.
4. The restaurant should provide air-conditioning. If it is an open restaurant it should have fans.

The following picture shows an example of a restaurant in a 4-stars hotel:

Figure 2.11: a restaurant in a 4-stars hotel

2.4.10 Meeting rooms/halls:

The main requirements that should be available in the meeting rooms are as the following:

1. A main meeting room that can be divided into smaller ones is recommended.
2. The hotel will provide breakout rooms. The total capacity of all these rooms must be equal to that of the large
3. Room Ideally, these rooms should have a capacity for 20 to 50 guests.

The following picture shows an example of a meeting room in a 4-stars hotel:

Figure 2.12: meeting room in a 4-stars hotel

2.4.11 Health club:

The hotel will provide a Spa-Health Club with the following facilities:

a. Gymnasium
b. Aerobic room
c. Squash
d. Sauna
e. Turkish bath
f. Massage parlour
g. Swimming pool, Jacuzzi
h. Men's & Ladies baths and showers
i. Beauty parlour.

2.4.12 Other services and personal areas:

- ***Business centre:***

Depending on the hotel's needs and possibilities, the business centre will be a department with its own equipment and facilities or will share resources and functions with other departments.

The following picture shows an example of a business centre in a 4-stars hotel:

Figure 2.13: business centre in a 4-stars hotel

- ***Laundry:***

The main requirements that should be available in the laundry are as the following:

a. Laundry staff should move around guest areas using service corridors.
b. The building should be designed to allow an efficient circulation of laundry items, both internally and externally, the storage of linen and cleaning materials.
c. When the laundry service is not contracted through an external company, the hotel will have machinery to provide the following services:

- Washing, drying and ironing of bed linen and bathroom towels of the guests
- Washing, drying and ironing of hotel's drapery (table cloths, napkins, etc.)
- Washing, drying and ironing of guest's personal clothing
- Washing, drying and ironing of uniforms
- Dry cleaning
- Sewing material for guest & staff clothing and hotel drapery and linen.

The following picture shows an example of a laundry in a 4-stars hotel:

Figure 2.14: a laundry in a 4-stars hotel

- ***Medical centre:***

Hotels located far away from towns/cities will provide a room for a doctor for receiving guests and members of staff.

The following picture shows an example of a medical centre in a 4-stars hotel:

Figure 2.15: a medical centre in a 4-stars hotel

- ***Shops:***

Depending on guests' needs, the hotel can provide the following shops:

1. Newsstand
2. Crafts shop

3. Perfumery
4. Boutique
5. Jewelers
6. Small supermarket.

The following picture shows an example of shops in a 4-stars hotel:

Figure 2.16: shops in a 4-stars hotel

- ***Offices:***

Depending on capacity and architecture the hotel will have offices for:

1. General Manager
2. Assistant or Resident Manager
3. Administration Director
4. Rooms Division Manager
5. Front Desk Manager
6. Revenue Manager
7. Human Resources Manager
8. Banquets Director
9. Maintenance Manager
10. Security Manager.

The following picture shows an example of an office in a 4-stars hotel:

Figure 2.17: office in a 4-stars hotel

- ***Swimming pools:***

The main requirements that should be available in swimming pools are as the following:

a. The design and maintenance of the swimming pool comply with existing local regulations.
b. They comprise of a bathing basin and encircling path can be surrounded by gardens .
c. Must have a width of 2 m around the bathing area with a minimum slope of 2% towards the basin.
d. Decorative or other types of elements can be installed, although they should never exceed 20% of the perimeter of the swimming pool.
e. Each element should not measure more than 8 m.
f. Swimming pools in hotels should have toilets less than 60 metres away from the swimming pool basin.
g. Depths under 160 cm will have a minimum slope of 2% and maximum of 10%.
h. Greater depths will have a maximum slope of 35%.
i. Swimming pools with a depth over 7 m will provide a ladder/ stairs every 20 m. **[9]**

The following picture shows an example of a swimming pool in a 4-stars hotel.

Figure 2.18: swimming pool in a 4-stars hotel.

In the end, there are several requirements on the tourist buildings in Palestine as the following table

Ground area	**30%**
Floor area	180%
Number of floor	6 floors
Building height	22m
Front rebound	10m
Side rebound	5m

Table 2.1: standard for tourists building in Palestine

2.5 Environmental design:

- ***Introduction:***

Environmental design principle recognizes the existence of the interaction between nature and people, therefore achieving comfort is an important factor in all buildings, especially in hotels where it is designated areas for rest and relaxation must be designed to protect human from the surrounding environment like heat ,noise, moisture, light and other.

Environmental design is process of addressing surrounding environmental parameters such as adjacent buildings and nature of the site.

- ***Solar design***

- Orientation:

Orientation of the building is generally used to refer to solar orientation which is the orientation of building with respect to solar access, the building orientation can have an impact on heating, lighting and cooling costs

With rising energy costs, it is becoming increasingly important to orient buildings to capitalize the Sun's free energy.

Figure 19 shows the Sun movements in Summer and Winter. This movement strongly affects the orientation of the building.

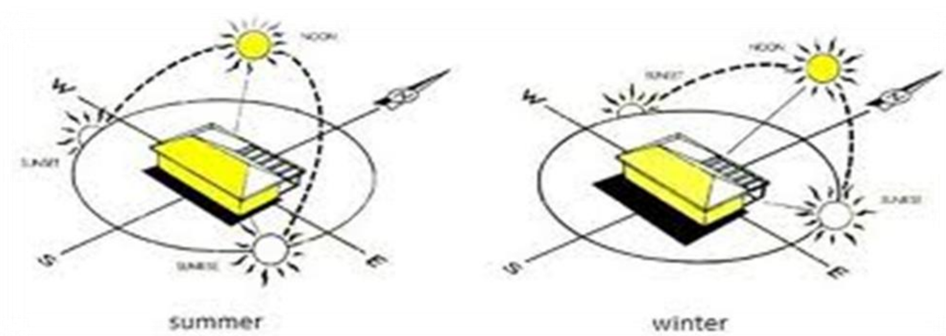


Figure 2.19: Sun movement in Summer and Winter.

- ***The main technical aspects for success of solar design are:***

1. Maximizing south façade exposure for daylight harvesting to reduce lighting electrical loads.
2. Using southern exposure for solar heat gain to reduce heating loads in the heating season.
3. Using shading strategies to reduce cooling loads caused by solar gain on south façades.
4. Turning long façades in the direction parallel to slopes to take advantage of cool updrafts to enhance natural ventilation.
5. For most regions, optimum façade orientation is typically south. South-facing glass is relatively easy to shade with an overhang during the summer to minimize solar heat gain.
6. North-facing glass receives good daylight but relatively little direct isolation, so heat gain is less of a concern.
7. Another environmental factor that should be considered in the equation of building orientation and positioning is prevailing winds, which are the winds that blow predominantly from a single, general direction over a particular point. **[10]**

- ***A-Passive solar Design:***

Solar passive design is a very important design factor. Passive solar design include features in your design and its natural surroundings that takes optimal exploitation of the Sun's low rays in Winter and deflect the Sun's high rays in summer to naturally warm and cool the spaces.

The orientation, elevation, room layout, materials, and surrounding outdoor landscaping all contribute to it passive solar design

Unlike active solar heating systems; passive solar design does not involve the use of mechanical and electrical devices, such as pumps, fans, or electrical controls, **[11]**

The following figure shows the elements of passive solar design:

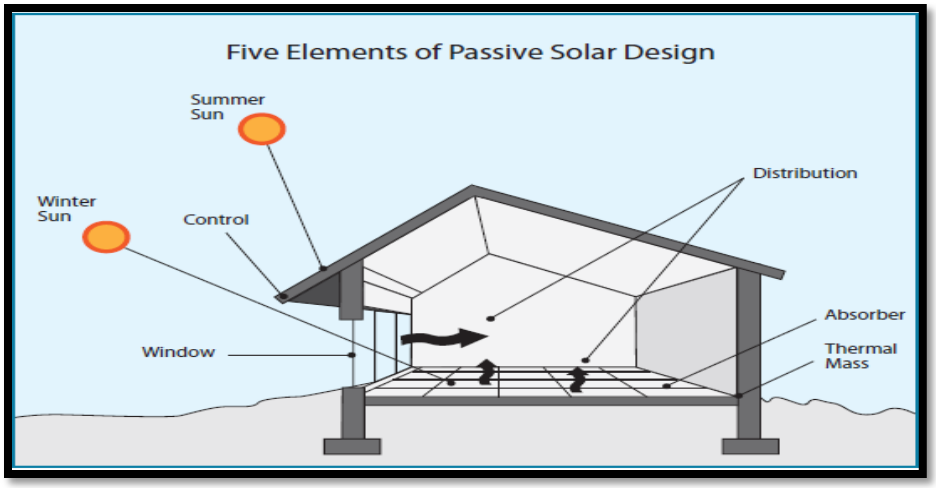


Figure 2.20: elements of passive solar design

- ***Passive solar design concept:***

Solar concepts described into two categories first those that use the energy from the Sun to directly or indirectly impact the thermal needs (heating and cooling, energy use) of the building, and the second those that use the energy from the sun to directly impact the lighting needs of the building.

Solar systems that heat or cool the building will be called solar thermal systems; ones that light the building will be called day lighting systems.

It is not expected that a passive solar designed properly in commercial-type building leads to eliminate the need for the auxiliary energy systems used to heat, cool, or light the building. Because of the size of the buildings, large internal loads, and their diverse use patterns, it is anticipated that passive solar systems will supplement the energy systems of the building. **[12]**

- ***Passive solar design strategy*:**

  A. *Solar window*:

a sealed large double-glazed window oriented to the south and characterized by simplicity ,low cost and high gain (transparency 85%) however it has many disadvantages such as extra lighting and glare also huge losses mainly at night Figure 3 illustrates a passive solar strategy used by the solar window

Figure 2.21: Solar window

B. Solar wall (Trombe wall):

Using a Trombe wall is the most common indirect-gain approach. The wall consists of an 8 to 16 inch-thick masonry wall on the south side of a house a single or double layer of glass is mounted about 1 inch or less in front of the wall's surface. Solar heat is absorbed by the walls dark-colored outside surface and stored in the wall's mass The Trombe wall distributes or releases heat into the home over a period of several hours with efficiency less than 65% the following figure shows. **[13]**

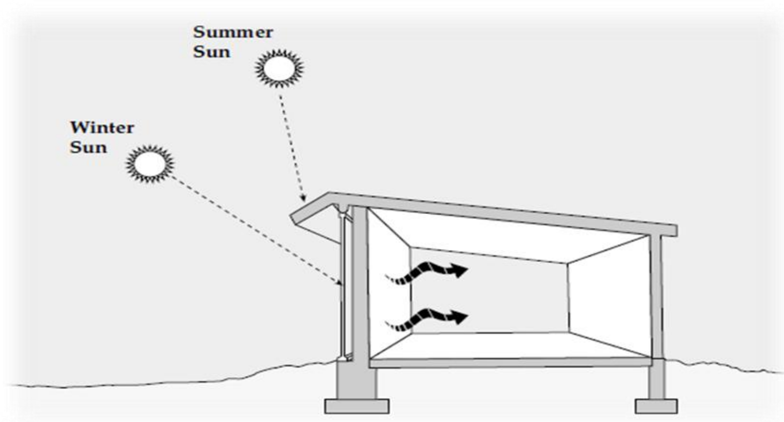


Figure 2.22 : Solar wall

C. Solar room:

Solar room known as a sunspace is a room built largely of glass to afford exposure to the Sun. Solariums has glass roofs (and often curved glass corners)A sun space or solarium is the combination of direct and indirect gain systems.

The solar radiation heats up the Sun space directly, which in turn heats up the living space by convection and conduction through the mass wall also solarium may experience high heat gain, high heat loss and extra glare The temperature variations caused by the heat losses and gains can be moderated

by thermal mass and low-emissivity windows. Figure (23_a)shows an attached Sunspace passive solar heating system Sunspaces In hotel solar room maybe used as winter gardens or restaurant the figure   (23_b)illustrate solar room and solar room design . **[14] [15]**

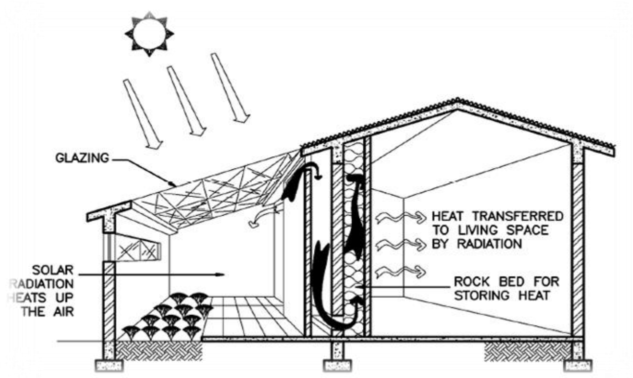


Figure 2.23_a: Solar room

Figure 23_b: Solar room design

D. Solar chimney:

Solar chimney is a very simple way to avoid many of the problems arising from the direct gains systems, such as glare and heat loss. Also, they are easy to attach to provide home, suitable for Summer and Winter, and all elevations East, West, South and North and does not need to shade but the heat loss are very high which lead to fluctuation this problem of fluctuation in temperature can be solved by a thermal mass and the following figure represent solar chimney strategy

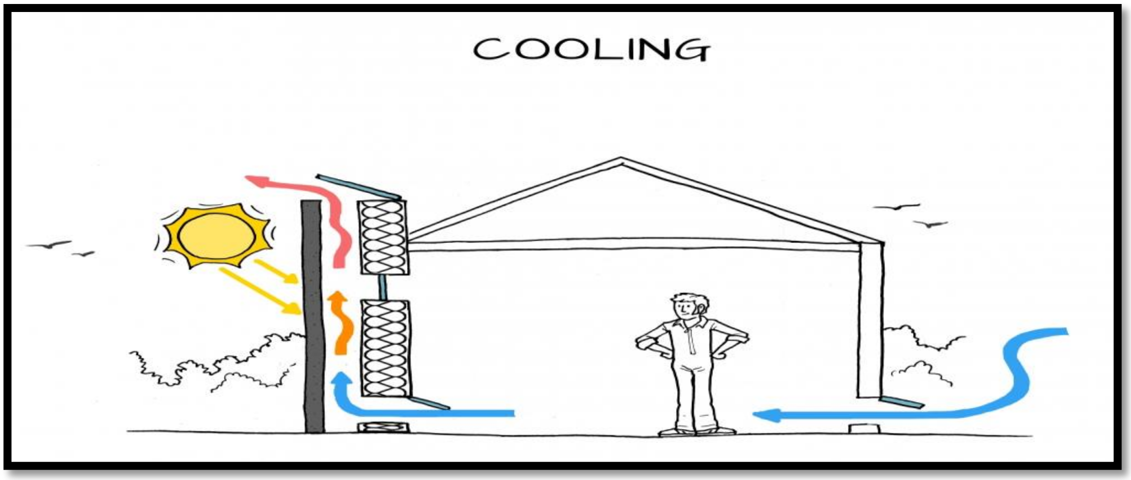


Figure 2.24: solar chimney strategy

E. Solar roof :

Solar roofs are similar to solar walls, they are often called "thermal storage roofs." Most solar roofs use water in large black plastic bags to absorb heat during the day, the water ponds store the heat and Insulating panels cover the ponds at night it will reduce heat loss also solar roofs can, in certain climates used to cool your house during the summer.

This system can be effective in some climates, it is provides all heating and cooling needs but solar ponds require careful design because their efficiency and cost effectiveness are not nearly as good in cold climates as they are in dry, sunny, Southern ones. Figure 25 shows the solar roof in the building. **[16]**

Figure 2.25: solar roof

- ***Shading strategies:***

All elements in the building envelope, windows and other glazed areas are most vulnerable to heat gain or losses. Proper location, sizing, and detailing of windows anshading form an important part of solar design as they help to keep the Sun and wind out of a building or allow them when needed. **[17]**

To control the heat gain and losses some shading strategies will be used, shading may be exterior, interior, fixed motorized Figure 26 shows some examples of shading systems. A good shading system permits lower levels of artificial illumination.

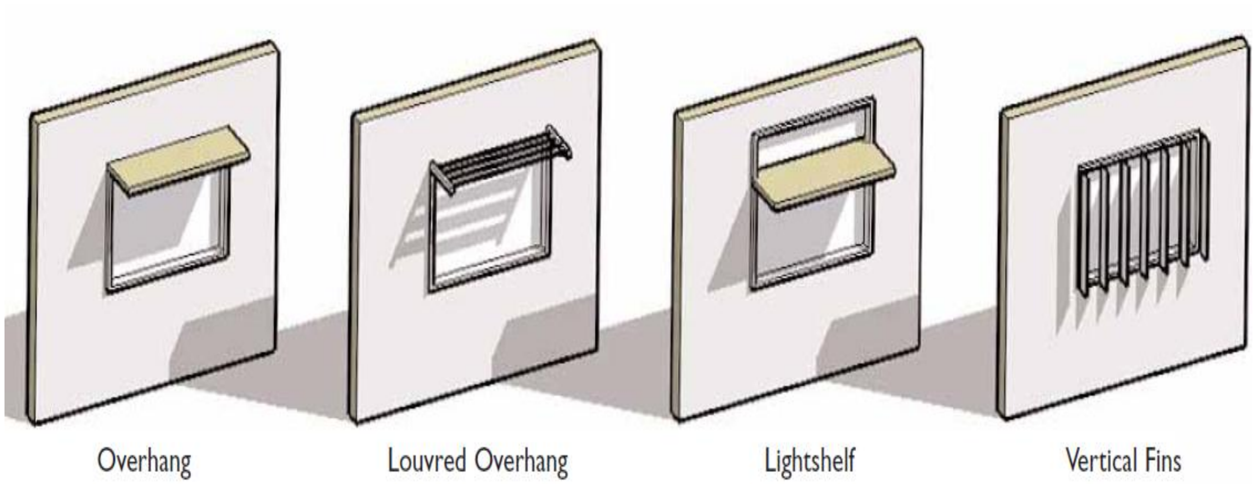


Figure 2.26: example of shading

Shading devices are of various types:

1. Moveable opaque (roller blind, curtains, etc): These can be highly effective in reducing solar gains but eliminate view and impede air movement.
2. Louvers: can be adjustable or fixed. These affect view and air movement to some degree.
3. Fixed overhangs: its efficient for low Sun angle.
4. Light shelf: it allows daylight to penetrate deep into a building and this surface is then used to reflect daylight onto the ceiling and deeper into space. **[2]**

- ***Active solar design***

Active solar design system converts solar energy into another more useful form of energy; this would normally be a conversion to heat or electrical energy. Inside a building this energy would be used for heating, cooling, unlike passive solar technologies active solar uses electrical or mechanical equipment for this conversion. **[18]**

- ***Active solar design strategies:***

Solar Water Collectors are located outside the house and have to be designed to last for many years, it is important that the materials used in their construction are durable and The following types of collectors are most common:

a. Flat plate collector: (as shown in the figure 27)they are inexpensive, simple systems that can provide all the heating needs for residential outdoor swimming pools, also they are simple to install land their use is limited to non-heating seasons and if damaged the entire flat plate must be replaced.

Figure 2.27: flat plate collector

b. Evacuated tube collector: this type more expensive than the previous type generally, evacuated tubes perform better in colder and cloudier conditions also it is sealed with a vacuum without this vacuum an evacuated tube collector performs very poorly. If a tube were to lose it is vacuum, it is generally very easy to correct, and can be done easily by simply replacing the tube, it is typically less sensitive to sun angle and orientation because of their circular design which allows sunlight to pass at an optimal angle throughout the day from morning to night figure 28 illustrate the design of evacuated tub collector. **[19]**

Figure 2.28: evacuated tube collector

- ***Thermal mass:***

Thermal mass offers the architect the opportunity to manage thermal energy flows of a building to the advantage of its occupants without the use of large amounts of high-grade fuels. The following picture represents thermal mass

Figure 2.29: thermal mass

In order to be effective as a thermal mass, a material must have a high heat capacity, a moderate conductance, a moderate density, and a high emissivity. It is also important that the material serve a functional (structural or decorative) purpose in the building.

The distribution of the thermal mass inside the building is also important. The mass must be proximate to the primary thermal stimulation in the space and unhindered by thermal obstructions such as Carpeting, wall coverings, and suspended ceilings. When solar gain is being exploited, the mass should be exposed to the sun for extended Periods for maximum effectiveness.

Night insulation enhances the efficacy of thermal mass during the heating season. This improvement comes not from added effectiveness of the mass, but from reduction of the thermal liability of the glazing—its low R-value in comparison to other building components. Switchable insulation may also be used effectively as day insulation to improve mass cooling strategies, such as roof ponds. [20]

The following table shows different thermal storage in some materials

Material	C_p (Btu/lb-°F)	ρ (lb/ft³)	Q (Btu/ft³-°F)
Wood	0.57	27	15.4
Steel	0.12	489	58.7
Glass	0.18	154	27.7
Concrete	0.156	144	22.4
Water	1.0	62.3	62.3

Table 2.2: thermal storage in some materials

2.6 Lighting design:

- ***Introduction:***

lighting is an very important element in architectural and environmental design, from an architectural point of view, lighting can be used externally to display the character and features of the building and internal design may also serve to emphasis feature of the decor moreover illumination is used to draw attention to sign, direction and hazards, another positive factor in the realization of lighting design it is the work on illumination systems and levels which affect on the human comfort and performance. [21]

- ***Natural lighting:***

Day lighting is the practice of placing windows or other openings and reflective surfaces so that during the day natural light provides effective internal lighting. Particular attention is given to day lighting while designing a building when the aim is to maximize visual comfort and to reduce energy use. Energy savings can be achieved either from the reduced use of artificial lighting or from passive solar heating or cooling. Artificial lighting energy use can be reduced by simply installing fewer electric lights because daylight is present, or by dimming electric lights automatically in response to the presence of daylight. The following figure shows an example of natural day lighting. [22]

Figure 2.30: natural lighting

- ***Lighting system:***

General lighting provides a uniform level of illumination over a large area. In some rooms, for example closets, storage rooms, utility rooms and garages.

Architectural lighting aims to highlight on features and specific elements of the space itself, like walls, ceilings, floors, etc, instead of the objects present. [23]

- ***Artificial lighting:***

Artificial light is a more specific light source, meaning that different types of lighting fixtures and methods can be used for the specific function of the space. For example restaurant lighting needs to set a comfortable mood the function of the space also plays an important role in the selection of the lighting fixtures for restaurants; the light level does not need to be to excessive, due to the reasons that the customers are there to relax and dine. As for an office space, the level of light needs to be more illuminating, due to the fact that the tasks preformed in an office needs more concentration and clarity of light. [24]

Artificial lighting is more accurately examined in conjunction to the function it performs. The typical explanations of these functions are: ambient lighting, accent lighting, focal lighting, and task lighting.

- Ambient lighting is generally used as an all propose light within a space, the light source for ambient lighting comes from different light fixtures within a space can be individually controlled to set the light level in the space. The following figure shows example of ambient lighting

Figure 2.31: ambient lighting

- Accent light is best described as spotlights, spotlights are used to illuminate significant pieces within a space such as artwork, design details, furniture etc. Accent lights are a low-voltage fixture and the figure below illustrates the accent lighting.

Figure 2.32: accent lighting

Focal lighting takes forms of certain lighting fixtures such as chandeliers. Wall scones and lamps. These are stationary expressive light sources unlike ambient lighting and accent lighting; focal lighting is glowing objects that initially serve as a focal point in the space. **[24]**the following figure represent focal lighting

Figure 2.33: focal lighting

Task lighting is a light source used to light up a certain activity. for example office spaces generally use ambient light in the form of fluorescent grids, although every desktop is provided with a task light. The level of light used with task lighting can differ from each activity that is performed in the space. Task can require different light levels, therefore allowing it to be executed with ease. Light levels are examined and measured in foot candela as shown in the table below **[25] [21]**

Area	**Lux**	**Lumens/ft²**
Entrance lobby	200	20
Reception area	400	40
Public room	100	100
Lounges	200	20
Guest room	100	10
Bed head	200	20
Bath room	100	10
Kitchen		
General	200	20
Food preparation	400	40
Stores	200	20
Laundry	200	20
Offices	400	40
Accounting machines	600	60
Swimming pool		
Top pool	500	50
Spectator areas	150	15
Club recreational	300	30
Gymnasium	500	50
Circulation area		
Corridors	100	10
Lift	150	15
Stair	150	15

Table 2.3 : standard illumination level

- ***Lighting Design in Hotels and creation of Spatial Character:***

Lighting is very important element in the creation of the environment therefore it should be studied with care.

The quantity of light should be sufficient but the quality is overriding important so it is desirable to provide the designed hotel with natural light needed in bedrooms, circulation spaces, and lavatories, because of that in this part the main usage areas of a four star hotel will be investigated, the main types of lighting that is needed for these spaces will be explained. **[24]**

Lobby

The lobby is by far one of the most important spaces within a hotel environment there the lighting needs to be considered and designed as carefully as possible to create the desired first impressions of guests that arrive at the hotel.

Conference rooms

A modern lighting control system gives enormous flexibility in professional conference rooms so the lighting can be adjusted for specific tasks. Various light colors, different types of luminaries and direct and indirect light in different combinations mean the lighting system can cover a wide range of situations, and basic lighting in conference rooms is complemented by indirect wall luminaries.

Restaurant

The most important aspects within a restaurant of a four star hotel is that it must have a distinctive concept and design, for dining and entertainment areas, it must be fresh and emphasized through lighting within the dining area, accordingly with the catering traditional concepts, These concepts could only be achieved through the right type of lighting fixtures and effects.

The two essential ingredients for perfect restaurant lighting are atmosphere and zoning. The overall lighting should be subtle but walkways, service zones and such areas should be more brightly lit. Tables and other seating areas call for a relaxing atmosphere. The light should be bright enough for food and drink to be seen in their best light.

Figure 2.34: natural lighting in restaurant

Bar

Within modern hotels bars can include different array of activities depending on the hotel, these activities can range from, band, concerts, or nightclub style entertainment, or otherwise contain all within the same area.

Lighting obviously plays an important role within bars creating the necessary mood/scene to cater to its audience; entertainment venues most commonly use lighting controls such as time clock based scene changes, LED lights, RGB color.

Guest room

The guestrooms should radiate atmosphere and comfort. Good hotel room lighting should be glare-free and cast little shadow. Ideally, guests should be able to adjust the lighting to suit their needs. **[24] [26]**

Guests expect at least as many features as they have in their home by providing control of lighting, integrated with shades, audio visual components, and temperature also Each guest desires different lighting levels for reading, writing, and watching TV . **[23]**
Lighting in lavatories or bathrooms not associated with bedrooms, can be combined with police lighting for the circulation areas leading to them, for instance by providing double-sided fittings to illuminate both lavatory and corridor outside.

Figure 2.35: natural lighting in guest room

- ***The following general points should be considered with regard to lighting;***
  1. Sudden changes in luminance should be avoided to prevent adaptation difficulties.
  2. Ensure that stairs, ramps and slopes are lit so that they can easily be identified when approaching in either direction.
  3. Localized lighting for specific tasks may normally be better than increasing the overall luminance necessary for all tasks in a multi-use area.
  4. Minimum requisite luminance should be provided and it should be uniform. Care should be taken to minimize glare.
  5. Just as important as the lighting itself, is the choice of décor and ensuring that there is color and luminance
  6. Contrast between different areas, To assist color discrimination, the color rendering index of the light source should be at least Ra80, the recommendation for most interiors, and where feasible, lamps of Ra90 should be used.
  7. Most users, including those with visual impairments, prefer natural lighting providing it does not create problems of glare. **[27]**

- ***Color temperature:***

  Lighting can affect an interiors color in many different ways. The actual color temperature of a lamp(as shown in figure) creates physical and psychological effects within interior environments; it adds the essence a Lighting overall is mostly used to enhance a designed interior space It could be used to enhance the colors. **[21]**

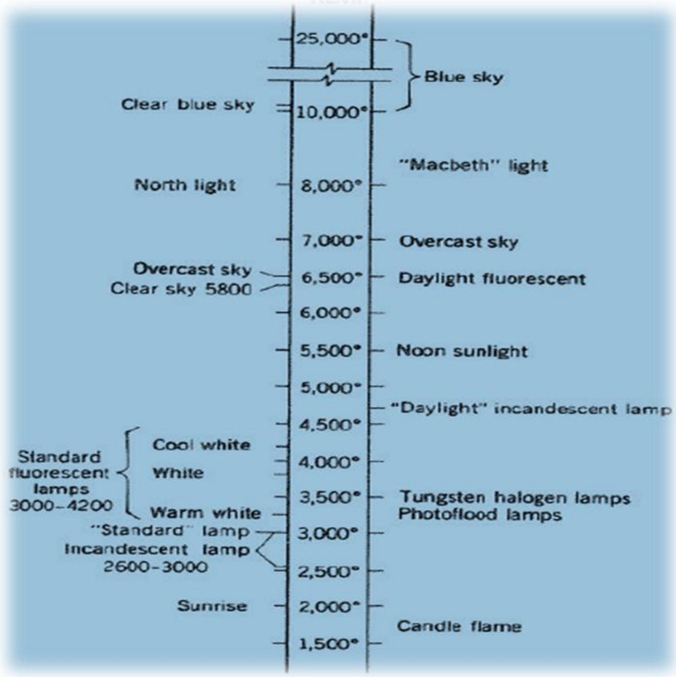


Figure 2.36: Approximate color temperature of common illuminants

- ***Glare:***

Glare is a visual sensation caused by excessive and uncontrolled brightness and there are many factors produces discomfort such as the luminance size and position of each light source in the space so reducing glare is an effective way to improve the lighting and we can get rid of glare by controlling the light source or by filtering it before it reaches your eyes. **[28]**

Figure 2.37: example of glare

2.6.1 Acoustics design:

- ***Introduction***

The acoustical behavior of spaces is an important aspect of comfort analysis. There are several different considerations in acoustic isolation normally, this is the amount of interface within the space and the transmission of noise from area to another within a hotel and the high levels of noise which can be generated and reverberated within large lobbies and public rooms and in work areas such as kitchens are acoustical problems should be solved in an efficient way. also external noise is a potential source of annoyance, not only in hotel and motel rooms facing the high speed or concentrated traffic noises of high ways and streets, but also from adjacent car parking areas. **[21]**

Sound control is an important aspect of hotel design which include two aim

1. In general noise attenuation within a room for clarity of speech and reduction of noise level ,specific attenuation must be paid to some areas in hotel such as
   a. Kitchens and restaurant (irritation).
   b. Services area and banquet room (speeches).
   c. Work area, public toilets, and corridors. (transmission).
   d. Public room and guest room(music, crowds)
   e. Noise disturbance can come from neighboring rooms (adjacent, above or below) in the form of airborne sound from TV and voices, impacts from footsteps along corridors and stairs, or services like showers and toilets
   f. Noise from impacts travels horizontally along floors as well as up and down; impact through walls can be a concern where there are no buffers from wardrobes or bathrooms
   g. Noise from lobbies, entertainment and conference rooms can require special attention
   h. Protection from external noise is important near main road and parking
2. Noise insulation will reduce the noise transmission through the building; the maximum acceptable level of noise for any room will depend in the use of the room the following table represent background noise level in hotel space. **[21] [30]**

Space	Ambient noise (db)
Guest room	25
Concert hall	20
Convention room (over50 seats)	25
Meeting room(20 seats)	30
Management offices	40
Restaurant	45
Gymnasium	50
General offices(typewriter and machine)	55
Workshop	65

Table 2.4: common background noise in hotel spaces

- ***Noise criteria in hotel spaces:***

1. Corridor To prevent noise from traveling throughout the corridors and/or hallways If surfaces are left untreated, a corridor can act as a megaphone, transmitting conversations into nearby spaces be cautious with curved surfaces, as they can compound this megaphone effect the noise criteria for background noise should not exceed NC 35-40.
2. Conference Room and offices: the recommended reverberation time is between 0.6 and 1 second, absorptive materials will most likely be necessary for the ceiling also potential noise will impact the space from exterior sources and excessive HVAC noise; the NC level should not exceed 25 to 35. If an electronic masking system is being used throughout the facility, it is best to avoid installing speakers in the conference room. If this cannot be avoided, consider at least turning down the speakers in this space.

Figure 2.38: noise criteria in conference room

3. Cafeteria and restaurant : because of the size and the materials typically used in this type of space, a cafeteria and restaurant can become very reverberant, causing a tremendous build up of noise, absorptive materials are needed to help control this reverberation. Although acoustical wall treatments can help, or might be necessary for some restaurants, the majority of the noise is often controlled through the ceiling treatment.

Figure 2.39: noise criteria in cafeteria

4. Lobby: due to their high ceilings and reflective surfaces, lobbies can become reverberant, causing a buildup of noise and it is often not considered acoustically critical spaces, however, if there will be people within the space (receptionist, security guard, waiting room, etc…), this build up of noise can become problematic. The installation of acoustically absorptive materials can mitigate this concern.

Figure 2.40: noise criteria in lobby

- ***Acoustical insulation:***

There are several issues that must be addressed concerning acoustics in a hotel project, these issues stem from the two types of sound that must be controlled: airborne sound and impact sound such as sound of music or talking. A typical impact sound is the footfall sound of an upstairs guest **[31]**.

There are two types of sound insulation in buildings

a. Airborne sound insulation method:

a. In case of lightweight structures consisting of multiple layers, such as a gypsum wall, the spring-mass law is applicable. If highly absorbent material such as stone wool is used as the spring in a double wall, the sound insulation improves. The wider the cavity, the greater the benefit from stone wool will be achieved. **[32]**

Figure 2.41: stone wall

Another method for air borne insulation is cavity wall, cavity wall Installed from outside or inside no blockages during installation process not abrasive for the blowing wool machine, meaning longer life time reduced environmental impact and improves overall sustainability of buildings in which they are incorporated also it is has excellent thermal, acoustic and fire performance

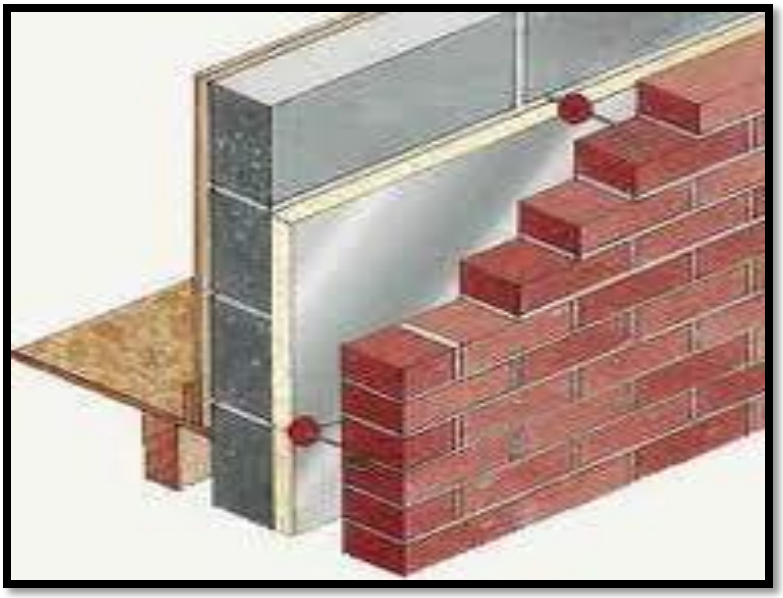


Figure 2.42: cavity wall construction

b. Structure airborne insulation method:

Impact sound insulation relates to the reduction of footstep sound from people walking on a floor structure. It is determined by the impact sound level in the room below. A floating floor system can be used to improve the impact sound insulation and therefore reduce the impact sound level. **[32]**

- ***Noise from engineering services:***

Reduction of noise disturbance in hotels is a achieved by:

a. Location of plant rooms and roof mounted equipment away from noise sensitive area
b. Isolation of noise generated by machinery and confinement ,separation and insulation
c. Correct size analysis, design, support, and positioning of pipe work, ducting outlet.
d. Sealing of voids and silencing of air passages
e. Reduction of impact from vibration or movement.

The level of noise generated is often closely related to speed of movement of flow. As rule fans, motors or diffusers should be below their maximum rating transfer of vibration and noise may be reduced by the use of the resilient mountings and connections, and by the absorption of noise within the ducts also it is important to reduce sound travelling from one room to another through air ducting .**[21]**

2.6.2 Thermal design:

The thermal design of the building envelope, which includes all the structural elements is the most important ways to save energy the ideal thermal design reduce heating and cooling loads also the thermal insulation material and site selection and space exterior windows is an important factor to achieve thermal comfort in economical and effective way

In addition, there are other methods of design as a means of passive design should not be neglected to raise the level of satisfaction in the building thermal.

- ***Introduction***

One of the earliest reasons for building was to create shelter from the climate and to enhance thermal comfort in this section all the factors that affect on the human comfort will be discussed such as the climate, relative humidity and the thermal insulation material and method of ventilation. **[33]**

- ***Thermal comfort***

Thermal comfort is the condition of mind which expresses satisfaction with thermal environment and the thermal comfort zone is a combination of air temperature and relative humidity as shown in the figure 43 the comfort zone ranges from 22 ^{o}C to 24 ^{o}C and the relative humidity shouldn't exceed 50% when air temperature is higher than 22 ^{o}C

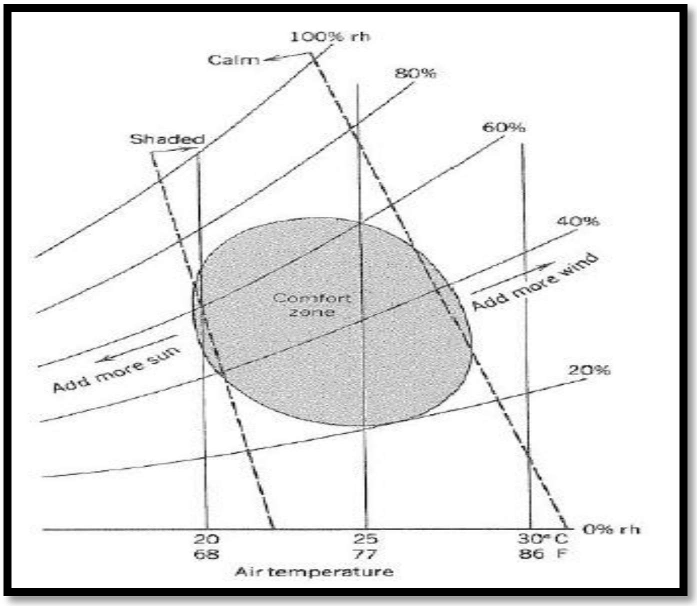


Figure 2.43: thermal comfort zone

- ***Heating strategies:***

It is needed to minimize the heat gain in the Winter and maximize it in Summer and also to minimize heat loss in Winter and maximize heat loss in Summer order to achieve the thermal comfort and there are many heating sources which affect comfort in building

Heating systems based on energy source

a. Oil firing
b. Gas firing
c. Solids fuel
d. Electrical heating
e. Night storage heating
f. Convectors

Source of heating gain in the building:

a. Solar gain
b. Human bodies
c. Lighting system
d. Appliances and equipments

e. ` Source of heating gain in the building:
f. Envelope
g. Infiltration.

- ***Ventilation:***

Air quality is an important part of a guest's stay in any type of hotel. Guests can immediately recognize a poor ventilation system by the stagnant, polluted smell of the air in their rooms and common hotel areas. Because of that a hotel's ventilation system should maximizes air flow and circulates oxygen.

In order to achieve the required air quality, two methods of ventilation are used in different spaces of hotels.

a. Natural ventilation is the ventilation of a building with outside air without the use of a fan or other mechanical system. It can be achieved with windows or vents and it is has many advantages

- No noise is produced in the operation of the
- System is completely passive so no energy is required
- Minimal maintenance required
- Decreased capital costs

b. "Mechanical" or "forced" ventilation is used to control indoor air quality. Excess humidity, odors, and contaminants can often be controlled via dilution or replacement with outside air. However, in humid climates much energy is required to remove excess moisture from ventilation air. The advantages of this system are :

- Fresh air can be supplied with ease deeper within the building.
- Not dependant on outdoor weather conditions
- Air flow rate is easily controllable
- Air can be directed to allow the output to be passed through a passive heat exchanger.

- ***Spaces need special attention for ventilation***

   a. Hotel Kitchen Ventilation

Kitchen Ventilation is important to remove heat, smoke, grease, steam, and combustion products.

It helps to keep fresh air in the kitchen.

   b. Hotel bathrooms

Hotel bathrooms are one of the important rooms in hotel that need proper ventilation to ensure that the bathroom ventilation system is operational while the bathroom is in use and that it remains on only for a few minutes after the light has been switched off

   c. Hotel indoor pool ventilation

Water evaporates no matter what temperature or what condition it is in, the amount of evaporation can be reduced by covering the pool If the pool is left exposed the evaporation would produce high humidity in the pool hall and promote mould and corrosion of the hotel building structure.**[34]**

In general, it may be said that a mechanical ventilation rate of 1 ACH (one air change per hour) of the pool enclosure will be sufficient to maintain reasonable relative humidity levels when a pool cover is used regularly. However, the ventilation system should be capable of supplying 2 (two) ACH for maintenance of good air quality in all operating conditions.

Figure 2.44: swimming pool ventilation

- ***Material used for insulation:***

For every hotel, a well design and efficient hotel will incorporate a many thermal insulation features .Thus the selection of insulation material is very important and we can use different insulation material such as:

• Fibrous Insulation

Composed of air finely divided into interstices by small diameter fibers usually chemically or mechanically bonded and formed into boards, blankets, and hollow cylinders.

a. Fiber glass or mineral fiber
b. Mineral wool or mineral fiber.
c. Refractory ceramic fiber

• Cellular Insulation

Composed of air or some other gas contained within foam of stable small bubbles and formed into boards, blankets, or hollow cylinders.

a. Cellular glass
b. Elastomeric foam
c. Phenol foam
d. Polystyrene
e. Polyurethanes.**[35]**

The fowling picture shows different insulation material:

Figure 2.45: Polyurethanes Figure 2.46: foam

- ***Method of insulation:***

There are three methods of wall insulating:

1. Outside insulating:
   In this system the insulation materials are installed between the stone layer and concrete layer.
2. Insulation in the middle
   In this system the insulation materials are installed between the concrete layers and block layer.
3. Inside insulation:
   In this system the insulation materials are installed between the block layers and plaster layer.

2.7 Structural design:

2.6.1 Introduction

Structural design also known as structural engineering is a field of engineering with the analysis and design of structures that support or resist loads. Its theory is based upon physical laws and empirical knowledge of the structural performance of different landscapes and materials. The structural design of a building must ensure that it satisfies the given criteria, predicted based on safety (e.g. structures must not collapse without due warning). The objectives of structural design are to design the structure for stability, strength and serviceability. It must also be economical and aesthetic. **[36]**

Figure 2.47: The Borgata Hotel and Casino in Atlantic City

2.6.2 Objectives and Basic Requirements of Structural Design:

1. Stability to prevent overturning, sliding or buckling of the structure, or parts of it, under the action of loads,
2. Strength to resist safely the stresses induced by the loads in the various structural members.
3. Serviceability to ensure satisfactory performance under service load conditions – which implies providing adequate stiffness and reinforcements to contain deflections, crack-widths and vibrations within acceptable limits, and also providing impermeability and durability (including corrosion-resistance), etc.

There are two other considerations that a sensible designer ought to bear in mind, via **economy and aesthetics**. One can always design a massive structure, which has more-than-adequate stability, strength and serviceability, but the ensuing cost of the structure may be exorbitant, and the end product, far from aesthetic.

In the words of Felix Candela "the designer of a remarkably wide range of reinforced concrete shell structures, It is indeed a challenge, and a responsibility, for the structural designer to design a structure that is not only appropriate for the architecture, but also strikes the right balance between safety and economy". **[37]**

2.6.2 Main Structural materials

- ***Concrete***

Concrete is a composite building material made from the combination of aggregate and a binder such as cement. The most common form of concrete is Portland cement concrete, which consists of mineral aggregate (generally gravel and sand), Portland cement and water.

The concrete structure has a high fire resistance than other types of structures such as steel and timber structures.

Concrete cannot be set on fire like some other materials in a building. It is resistant to smoldering materials, which can reach very high temperatures, igniting or even re-igniting a fire, and flames from burning contents cannot ignite concrete. In addition to that, concrete does not emit any smoke, gases or toxic fumes when affected by fire. **[38]**

- ***Compressive strength of concrete:***

The compressive strength of concrete is the most common performance measure used by the engineer in designing buildings and other structures. The quality of building material used in construction of hospital should be improved. A minimum compressive strength of 21MPa should be used when designing reinforced concrete structures.

- ***Steel***

Steel is an iron alloy with between 0.2 and 1.7% carbon; it's used extremely widely in all types of structures, due to its relatively low cost, high strength to weight ratio and speed of construction.

Steel is a ductile material, which will behave elastically until it reaches yield when it becomes plastic and will fail in a ductile manner. Steel is equally strong in tension and compression.

Steel is weak in fires, and must be protected in most buildings. The elastic modulus of steel is approximately 205 GPA. **[38]**

2.7.1 Structural Elements:

The structural elements include: Columns, beams, slabs, walls and foundations.

- ***Footings***

Footing is a concrete support under a foundation that rests in solid ground and is wider than the structure supported. Footings distribute the weight of the structure over the ground.

The main two types of foundation are:

a. Shallow foundation systems.

   1. Spread foundation.
   2. Mat/Raft foundation.

b. Deep foundation systems.

   1. Pile
   2. Pile walls

- ***Shallow foundations are including:***

- Spread foundation

1. Isolated footing which is used when the spacing between columns are long.

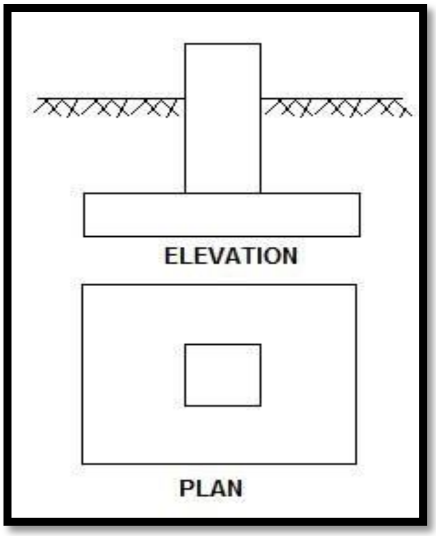


Figure 2.48: Isolated footing

2. Combined footing that is used when two columns are so close in the away that single footing cannot be used.

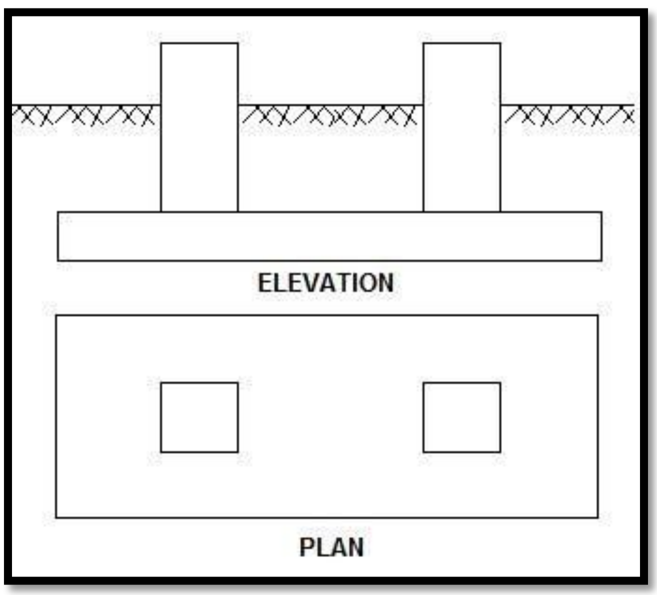


Figure 2.49: Combined footing

3. Strap footing

It consists of two single footing connected with strap beam. This type replaces a combined footing.

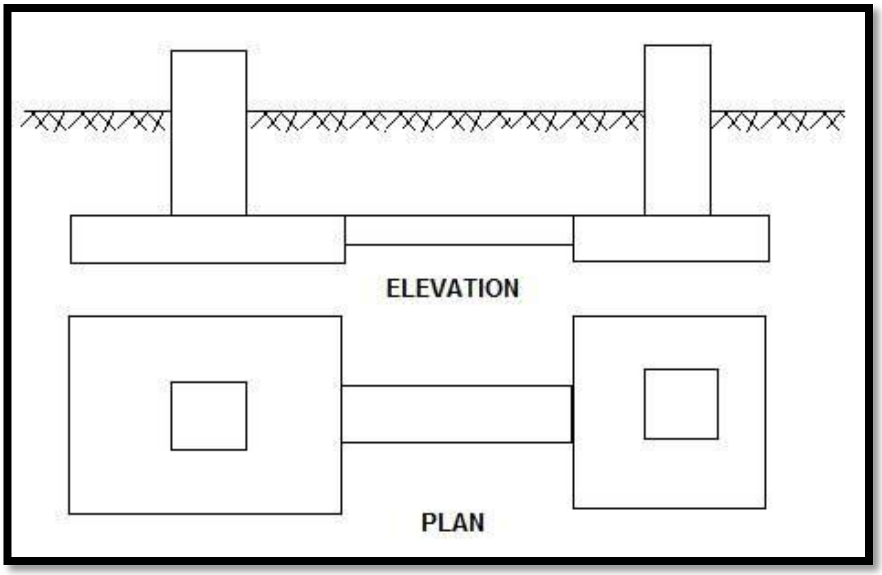


Figure 2.50: Strap footing

4. Continues footing that can be used if there is a row of three or more columns have limited width.

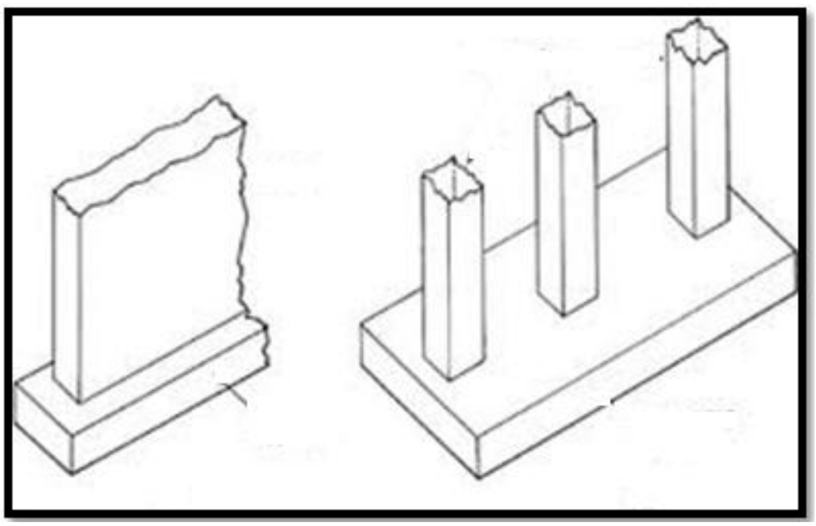


Figure 2.51: Continues footing

5. Wall footing that is used to support structural and non structural walls.

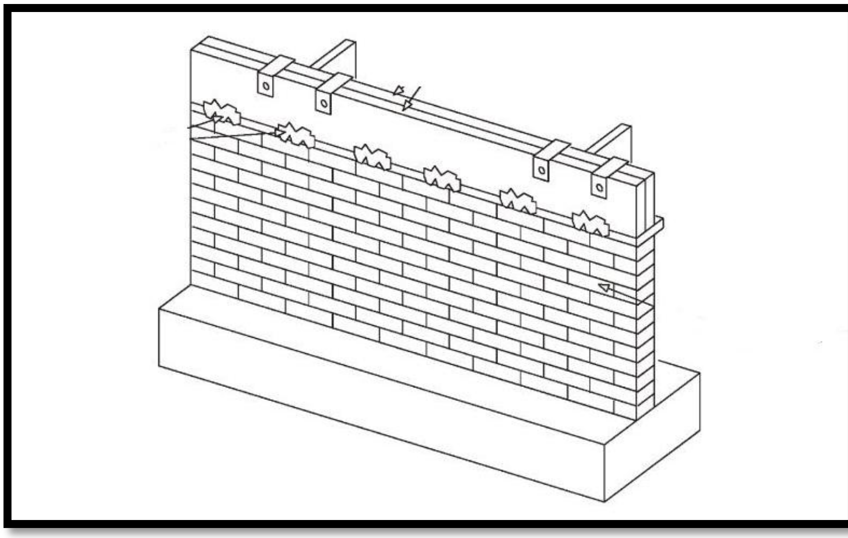


Figure 2.52: wall footing

6. Mat/Raft foundation

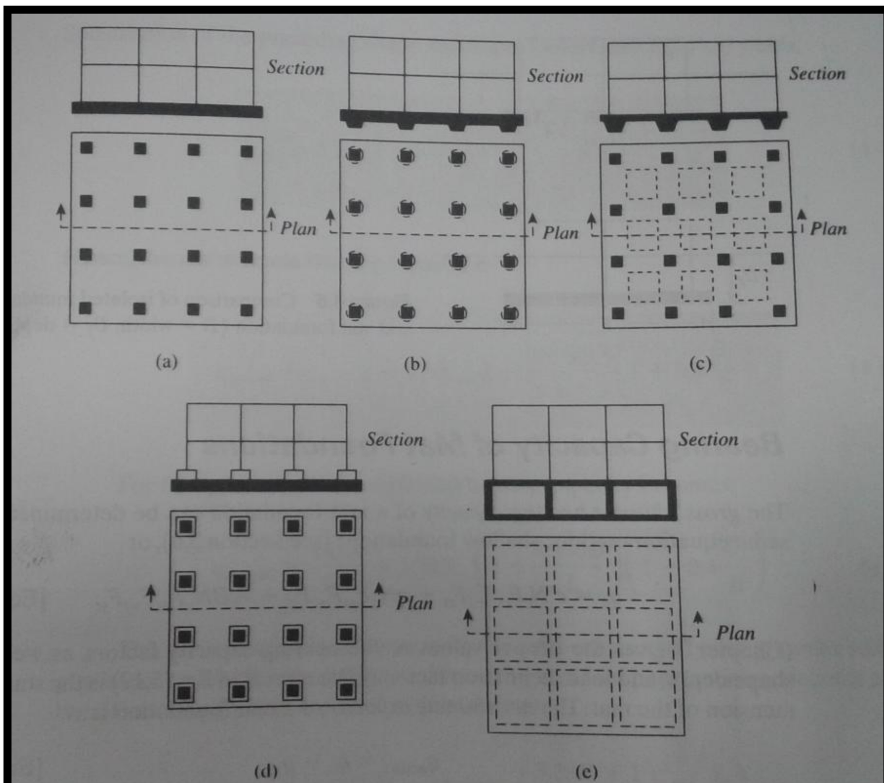


Figure 2.53: common types of mat foundation

This type of foundation is usually used when the bearing capacity of the soil is low. It consists of one footing spread under the area of the building.

- ***Deep foundation***

Deep foundations are used when there are weak soil near the surface, or when loads are very high. Deep foundation include

1. Piles foundation

It is type of foundation distinguished from shallow foundations by the depth they are embedded in to the ground.

There are many reasons an engineer would recommend a deep foundation over a shallow foundation, but some of the common reasons are very large design loads, a poor soil at shallow depth, or site construction.

Piles are generally driven in to the ground in suit, other deep foundations are typically put in place using excavation and drilling.

Deep foundations can be made out of timber, steel, reinforced concrete and pre-stressed concrete.

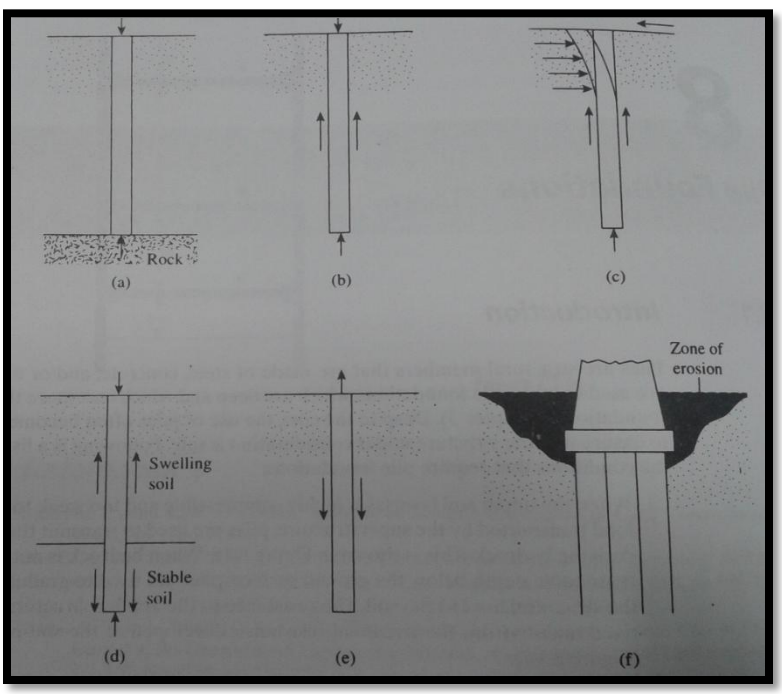


Figure 2.54: Pile

2. Pile walls [39]

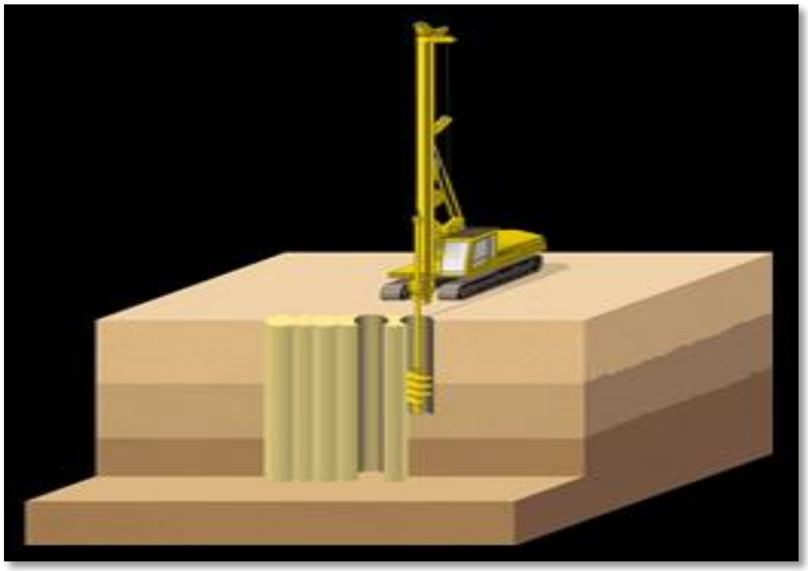


Figure 2.55: Pile wall

- ***Slab***

A concrete slab is a common structural element of modern buildings. Horizontal slabs of steel reinforced concrete, typically between 100 and 500 millimeters thick, are most often used to construct floors and ceilings, while thinner slabs are also used for exterior paving.

And it is classified according to the way that the loads transferred to supporting beams and columns into two types; one-way and two-way.

Structural systems for reinforced concrete slab include

1. One way reinforced solid slab

Which used when the ratio of the long span to short span is greater than 2; the thickness for slab is usually 10-12 cm. The main reinforcement steel bars are put on the short span.

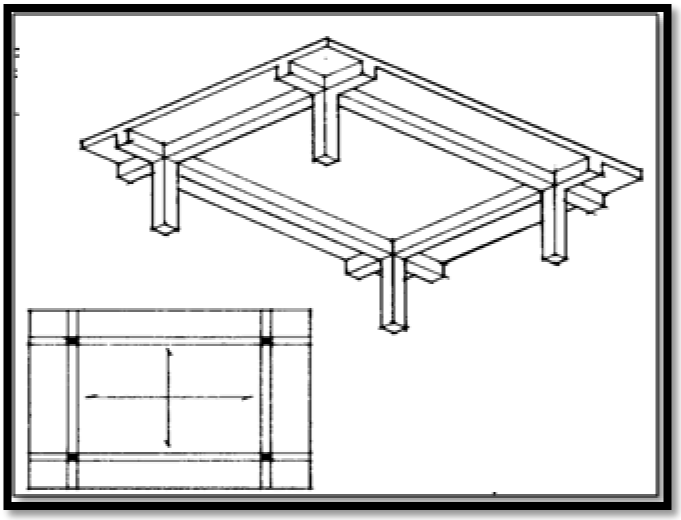


Figure 2.56: One way solid slab

2. Two way reinforced solid slab

Which used when the ratio of the long span to short span is smaller than 2, the main reinforcement steel bars are put on both direction.

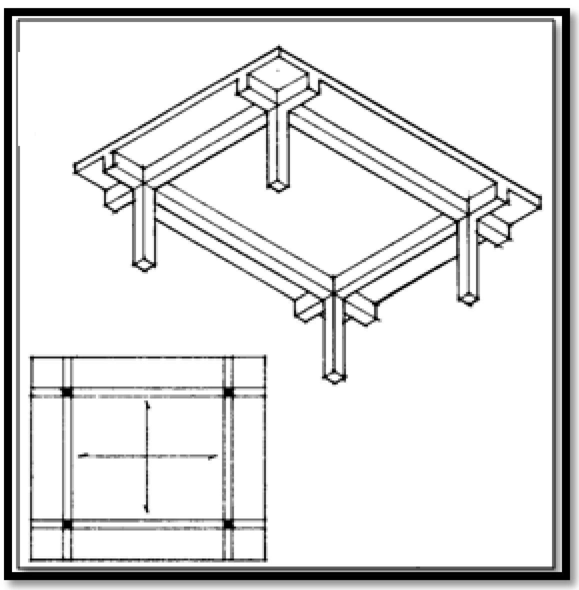


Figure 2.57: Tow way solid slab

3. One way ribbed slab

Ribbed slabs are used to minimize the dead load of the slab by using special hollow blocks. It is used when the ratio of the long span to short span is greater than 2.

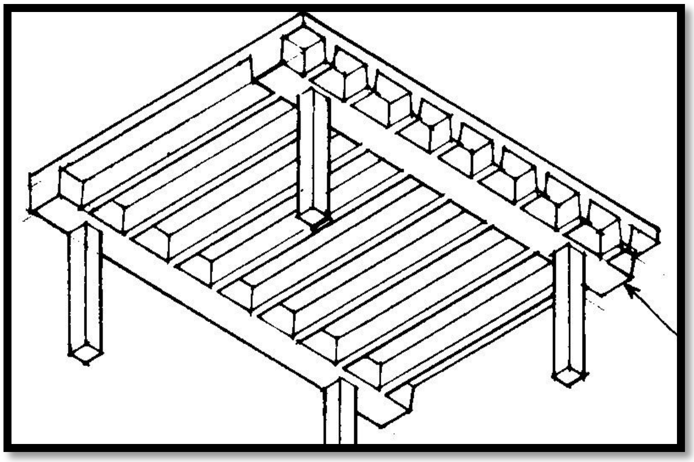


Figure 2.58: one way ribbed slab

4. Tow way ribbed slab

Which used when the ratio of the long span to short span is smaller than 2.

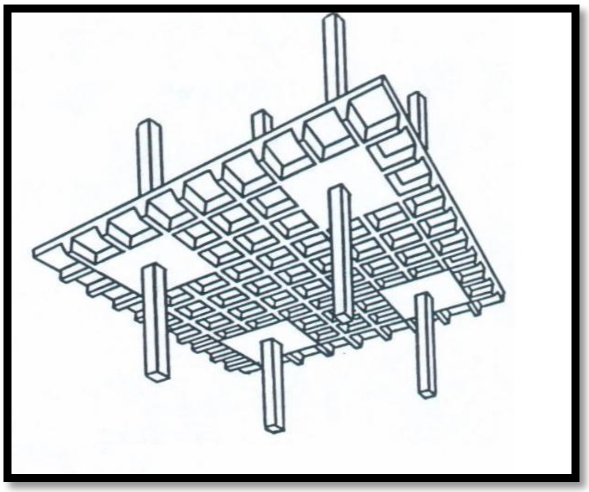


Figure 2.59: Tow way ribbed slab

5. Waffle slabs

Waffle slabs are used similar to the two way ribbed slabs except that special removable scaffolding units are used instead of hollow block. Because the units are removed after structure is finished then there is zero load of blocks, which means minimizing the dead load of the concrete.

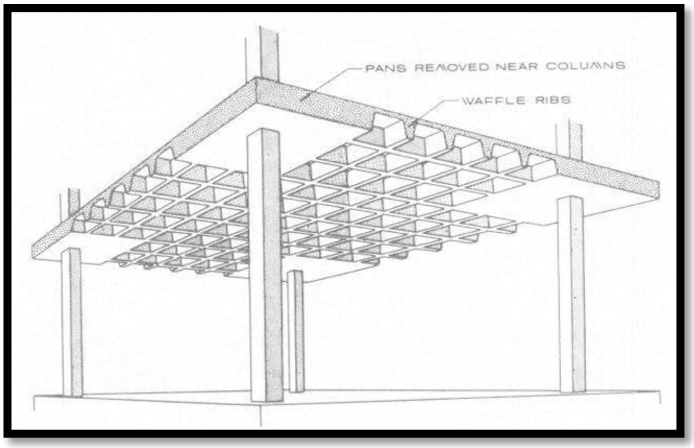


Figure 2.60: Waffle slab

- ***Columns***

Column or pillar in architecture and structural engineering is a structural element that transmits, through compression, the weight of the structure above to other structural elements below. In other words, a column is a compression member which may be designed to resist lateral forces. Columns are frequently used to support beams or arches on which the upper parts of walls or ceilings rest. For design purposes, the columns are separated into two categories: short columns and slender columns.

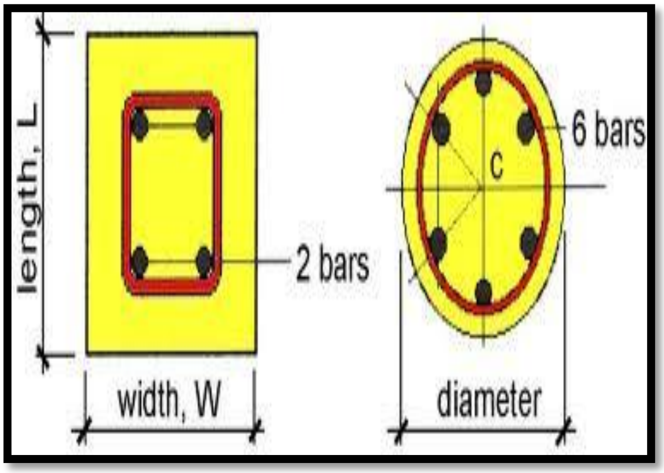


Figure 2.61: Sections in columns

a. Short columns

A column is said to be short when its length is such that lateral buckling need not to be considered. Most of concrete columns fall into this category.

b. Slender columns

When the length of the column is such that buckling need to be considered, the column is referred to as slender column, it's length could exceed 10m. It is recognized that as length increases, the usable strength of a given cross section is decreased because of buckling problem.

Types of reinforced concrete columns are:

1- Tied columns: columns reinforced with longitudinal bars and lateral ties.

2- Spiral columns: columns reinforced with longitudinal bars and continuous spirals. **[40]**

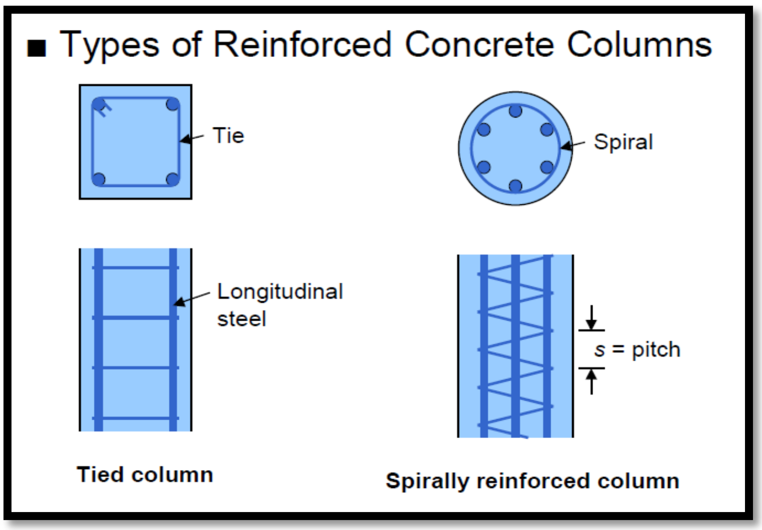


Figure 2.62: Type of reinforced concrete columns

- ***Beams***

Beam is a structural element that is capable of withstanding load primarily by resisting bending. The bending force induced into the material of the beam as a result of the external loads, own weight, span and external reactions to these loads is called a bending moment.

Beams generally carry vertical gravitational forces but can also be used to carry horizontal loads (i.e., loads due to an earthquake or wind). The loads carried by a beam are transferred to columns, walls, or girders, which then transfer the force to adjacent structural compression members. In light frame construction the joists rest on the beam.

Beams are classified on the basis of:

1. Beams profile: the shape of their cross section, most of reinforced concrete beams has rectangular cross section.
2. Beams length.
3. Beams materials.[41]

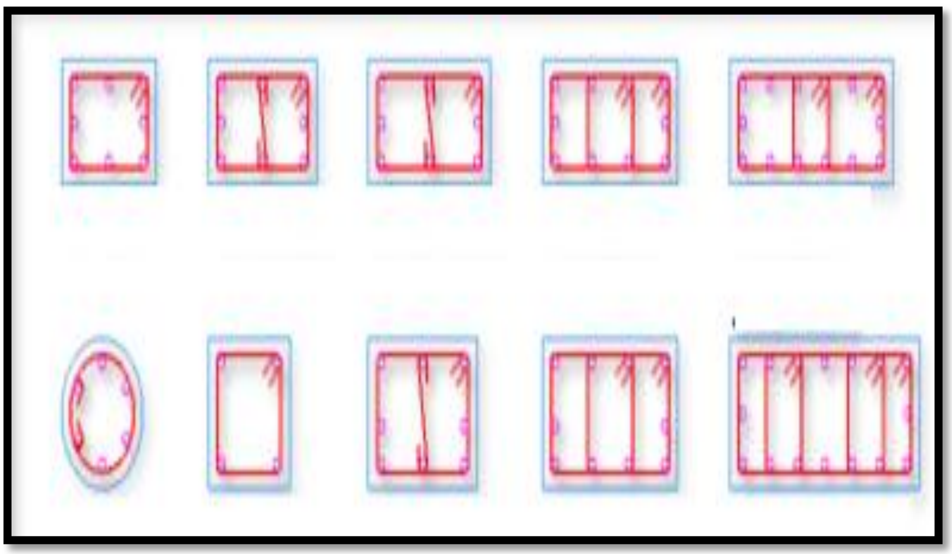


Figure 2.63: Sections in beams

- ***Walls***

Wall are vertical members, usually solid, that defines and sometimes protects an area. Most commonly, a wall sets a building and supports its superstructure, separates space in buildings into sections, or protects or delineates a space in the open air. There are three principal types of structural walls: building walls, exterior boundary walls, and retaining walls.

- ***Swimming pools***

A swimming pool, swimming bath, wading pool, paddling pool, or simply a pool, (water element) is a container filled with water intended for swimming or water-based recreation. A pool can be built either above or in the ground, and from materials such as concrete, metal, plastic or fiberglass.

Pools that may be used by many people or by the general public are called public, while pools used exclusively by a few people or in a home are called private.

Many health clubs, fitness centers and private clubs have public pools used mostly for exercise. Many hotels have pools available for their guests. Swimming pools are also used for diving and other water sports, as well as for the training of lifeguards and astronauts.

We define swimming pool as structural, basin, or tank that contains water more than 610 mm deep at any point, and we design it as an underground water tank.

Figure 2.64: Water tank

2.7.2 Loads:

Structural loads or actions are forces, deformations, or accelerations applied to a structure or its components.

Loads cause stresses, deformations, and displacements in structures. Assessment of their effects is carried out by the methods of structural analysis. Excess load or overloading may cause structural failure, and hence such possibility should be either considered in the design or strictly controlled.

The acting loads on a structure are classified into three main categories according to their types:

1. Dead load:

   Dead loads are static forces that are relatively constant for an extended time. They can be in tension or compression.

   Usually the major part of the dead load is the self weight of the structure. The dead load can be calculated from the design configuration, dimension of the structure and density of the material.

2. Live load:

   Live loads are usually unstable or moving loads. These dynamic loads may involve considerations such as impact, momentum, vibration, slosh dynamics of fluids, etc.

   Live loads may change its present location as they are not lifetime part of a structure. Therefore in structural design live load provided a large safety factor than the others.

3. Earthquake load:

   Seismic load is a lateral external force applied to the building as a result of earthquake generated agitation, and it happens at a contact surface of a structure either with ground, or with adjacent structures.

   Seismic load depends, primarily, on:

1. Anticipated earthquakes parameters at the site.
2. Geotechnical parameters of the site.
3. Structure’s parameters.

2.7.3 Load combination:

A load combination results when more than one load type acts on the structure. Design codes usually specify a variety of load combinations together with Load factors (weightings) for each load type in order to ensure the safety of the structure under different maximum expected loading scenarios.

Load combinations specified by ASCE07 (2010) are listed below:

- 1.4 D
- 1.2 D + 1.6 L
- 1.2 D + L
- 1.2 D + 0.8 W
- 1.2 D + 1.6 W + 1.0 L
- 1.2 D + 1.0 E + 1.0 L
- 0.9 D + 1.6 W
- 0.9 D + 1.0 E

In above mentioned load combinations:

D is the dead load.

L is the live load.

E is the earthquake load and

W is the wind load. [42]

2.6.6 Structural analysis:

Structural analysis is the determination of the effects of loads on physical structures and their components. Structural analysis incorporates the fields of applied mechanics, materials science and applied mathematics to compute a structure's deformations, internal forces, stresses, support reactions, accelerations, and stability. Computer software is also being used for the analysis and the calculation of forces, bending moment, stresses, strain, and deformation. The results of the analysis are used to verify a structure's fitness for use, often saving physical tests.

Figure 2.65: Terminal building, Dulles airport, Washington, D.C

- ***Seismic Analysis:***

Seismic analysis is a subset of structural analysis and it is to calculate the response of a structure to earthquakes. In the seismic design of reinforced concrete structures, some level of damage would be expected and permitted against a moderate earthquake that can be prevented over the life of structure, whereas structural collapse should be prevented under a server earthquake defined by relatively long recurrence period. **[37]**

Earthquake forces are lateral forces and the inertia of the building tries to keep it from moving. The resulting force on the building can be simplified to be a lateral force- a shearing force on the base of the structure, and this force depends on **[37]**

- Earthquake intensity.
- Soil conditions.
- Stiffness of building.

2.6.7 Structural design:

There are two acceptable methods to design concrete [29]:

1. Working stress design model assumes that as the concrete beam bends due to induced moments the strain relationship between the rebar in tension and the concrete in compression remain constant.
2. The ultimate strength design method is mostly common used, and its places the rebar in fully yield so the strain relationship between reinforcement and concrete is ignored and a rectangular concrete compression block stressed at design strength formed. **[43]**

2.6.8 Common Recommendation for the Structural Design of Hotels:

1. Bearing walls should be reinforced with steel bars instead of being constructed without any reinforcement (in the case of masonry structure).
2. Cement mortar should be improved in quality (ratio 1:3 cement: sand).
3. Drop beam system will be used in rooms with large spans.
4. The thickness of the walls surrounding the stairs should not be less than 15 cm from the. **[44]**

2.8 Mechanical design:

- ***Introduction:***

The mechanical services installation shall comprise heating, ventilation, water, soils and wastes, and fire protection services. The design of the mechanical services must take into account the site climate, the building form and orientation of spaces, the thermal performance characteristics of the building ,the occupancy trends and restrictions on pollutant emissions. The criteria for the design and selection of the various mechanical systems shall be examined on an individual basis to provide as accurate result as possible.

The HVAC systems maintain a comfortable and healthy indoor environment by responding to the loads imposed by the building envelope design, lighting system design, and occupant activities. Proper design of the control schedule for the systems that heat and cool the interior spaces, provide fresh air for the occupants, and remove contaminants from the building. The

HVAC system operation complements the architectural and lighting designs and minimizes building energy consumption. [45]

In HVAC system there are four components must be taken into consideration:

1. Temperature: which have an allowable range *(20°C) and (25°C)).*
2. Humidity: which have an allowable range(*30% relative humidity (RH) and 60% RH)*
3. Pressure: *a slightly positive pressure to reduce outside air infiltration.*
4. Ventilation: *rooms typically have several complete air changes per hour*.**[46]**

HVAC system components may be grouped into three functional categories:

a. Source components.
b. Distribution components.
c. Delivery components.

Source components provide or remove heat or moisture. Distribution components convey a heating or cooling medium from a source location to portions of a building that require conditioning. Delivery components serve as an interface between the distribution system and occupied spaces. Compact systems that serve only one space or zone of a building (local systems) often incorporate all three functions in a single piece of equipment. Systems that are intended to condition multiple spaces in a building (central systems) usually have distinctly different equipment elements for each function.

2.8.1 Heating systems:

Heating can be accomplished by heating the air within a space using radiators, or by heating the occupants directly by using radiant panels .therefore the methods of heat transfer are as the following:

a. Conduction: Conductive heat flow involves the transfer of heat from one location to another in the absence of any material flow. There is nothing physical or material moving from the hot water to the cold water. Only energy is transferred from the hot water to the cold water**.**
b. Convection**:** is the process of heat transfer from one location to the next by the movement of fluids. The moving fluid carries energy with it. The fluid flows from a high temperature

location to a low temperature location. It involves fluid being forced from one location to another by fans, pumps and other devices.

c. Radiation: involves the carrying of energy from an origin to the space surrounding it. The energy is carried by electromagnetic waves and does not involve the movement or the interaction of matter. [47]

- ***Heating methods:***

There are more than one method for heating but the following method are the famous:

a. Electric Heat Pump: heat pumps work by shuffling heat from one place to another. They also serve as air conditioners during warm weather. Heat pumps extract warmth from outdoor air, ground or surface water, or from the earth.

The following picture shows basic heat pump configuration:

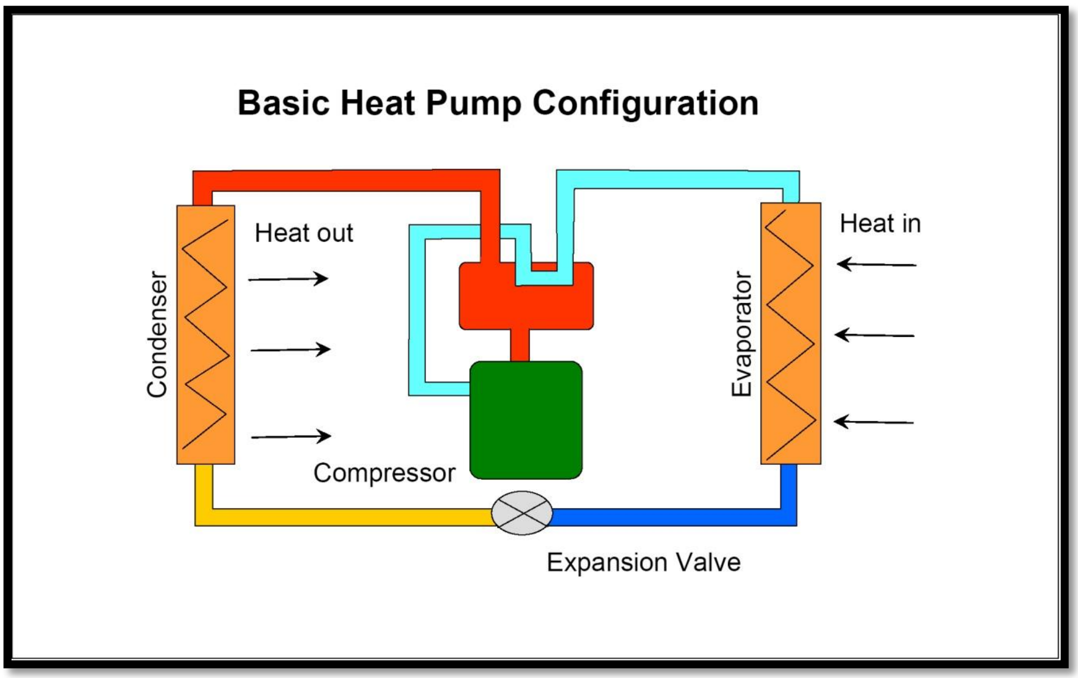


Figure 2.66: heat pump configuration

b. Radiant Baseboard Heat: baseboard heaters are often visible as long, metal units with electrical elements inside. Each unit has its own control, which may be marked in increments from low-to-high, but will not show the room's current temperature.

The following picture shows radiant baseboard heat and how it is fixed to walls:

Figure 2.67: Radiant Baseboard Heat

c. Radiant Ceiling or Floor Heat: Radiant systems warm objects in much the same way as the sun does. No blowers are used. Electric radiant elements are installed in floors or ceilings, heating elements can also be installed in walls, but that location is less common.

The following picture shows how to worm up a cold room by using radiant floor heat:

Figure 2.68: radiant floor heating

The following picture shows radiant floor heating laminated, tile over, sleeper and floating applications: **[48]**

2.8.2 Cooling systems:

There are many alternatives that provide cooling with less energy use. A combination of proper insulation, energy-efficient windows and doors, day lighting, shading, and ventilation will usually keep homes cool with a low amount of energy use in all but the hottest climates.

a. Evaporative Coolers: In this example of an evaporative cooler, a small motor (top) drives a large fan (center) which blows air out the bottom and into the building. The fan sucks air in through the louvers around the box, which are covered with water-saturated absorbent material. In low-humidity areas, evaporating water into the air provides a natural and energy-efficient means of cooling. Evaporative coolers, also called swamp coolers, rely on this principle, cooling outdoor air by passing it over water-saturated pads, causing the water to evaporate into it. The -9°C- 4°C cooler air is then directed into the home, and pushes warmer air out through windows. When operating an evaporative cooler, windows are opened partially to allow warm indoor air to escape as it is replaced by cooled air. Unlike central air conditioning systems that recalculate the same air, evaporative coolers provide a steady stream of fresh air into the house

The following picture shows the components of evaporative coolers:

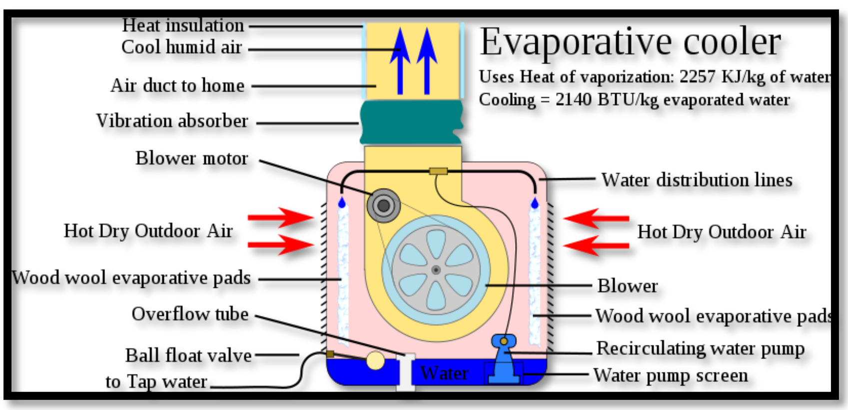


Figure 2.69: components of evaporative coolers

b. Air Conditioning: an air conditioner uses energy to transfer heat from the interior of home to the relatively warm outside environment. Air conditioners employ the same operating principles and basic components as a refrigerator. Refrigerators use energy to transfer heat from the cool interior of the refrigerator to the relatively warm surroundings.

The two most common types of air conditioners are room air conditioners which provide cooling only where they're needed and central air conditioners which circulate cool air through a system of supply and return ducts.

The following picture shows air conditioning system and it is components:

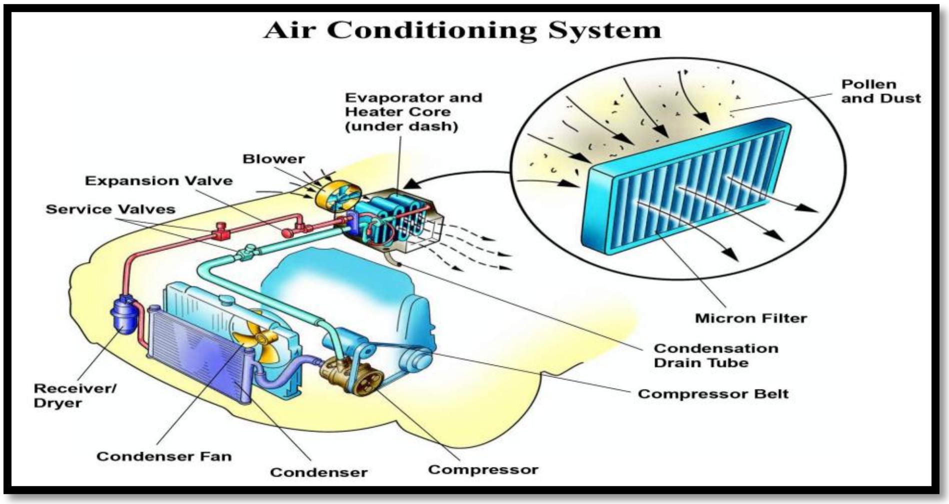
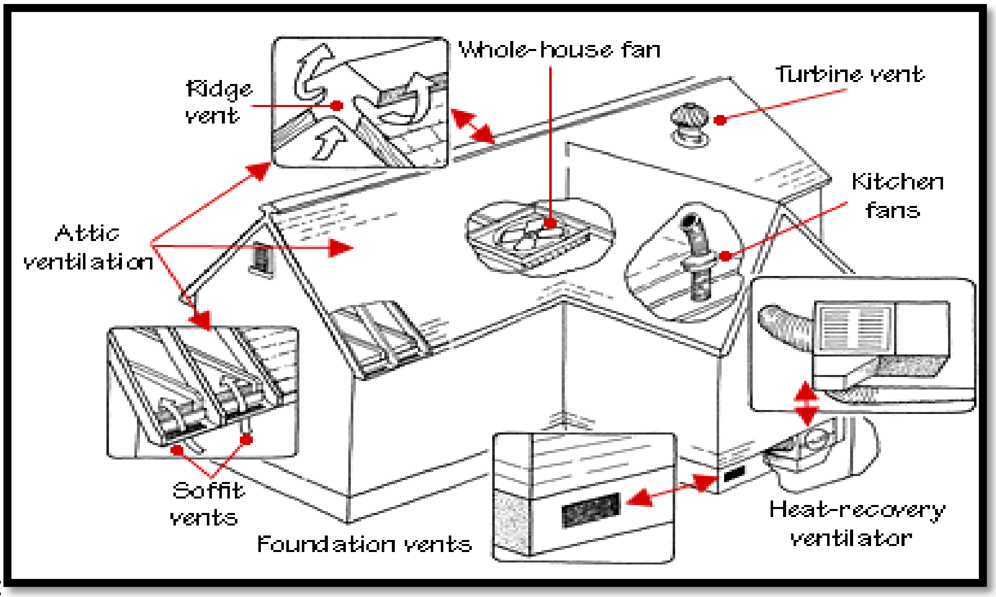


Figure 2.70: air conditioning system and it is components

2.8.3 Ventilation Systems

Ventilation is the least expensive and most energy efficient way to cool buildings. It works best when combined with methods to avoid heat buildup in the building. In some cases, natural ventilation will suffice for cooling, although it usually needs to be supplemented with spot ventilation, ceiling fans and window fans, for large areas whole house fans should be considered. Ventilation is ineffective in hot, humid climates where temperature swings between day and night are small. In these climates, attic ventilation can help to reduce your use of air conditioning. Ventilating attics greatly reduces the amount of accumulated heat; ventilated attics are about 30°F (16°C) cooler than unventilated attics. Properly sized and placed louvers and roof vents help prevent moisture buildup and overheating in attics. Ventilation should be from 15 to 20 cubic feet per minute per person.

The following picture shows how ventilation system is work:



:

Figure 2.71: ventilation system

1. Absorption Cooling: absorption cooling is essentially an air conditioner driven not by electricity, but by a heat source such as natural gas, propane, solar-heated water, or geothermal-heated water. Because natural gas is the most common heat source for absorption cooling, it is also referred to as gas-fired cooling. Although mainly used in industrial or commercial settings, absorption coolers are now commercially available for large residential homes.

The following picture shows the components of absorption cooling:

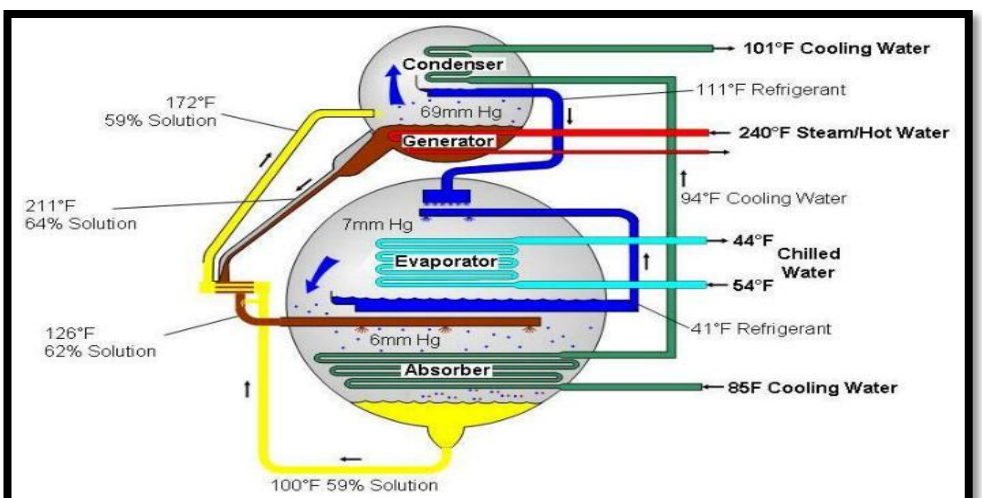


Figure 2.72: components of absorption cooling

2. Radiant Cooling**:** radiant cooling cools a floor or ceiling to provide a cooling effect by absorbing the heat radiated from the rest of the room. Although potentially suitable for homes in arid climates, radiant cooling is problematic for homes in more humid climates.

The following picture shows radiant cooling system under ground :

Figure 2.73 under ground: radiant cooling system

3. Earth Cooling Tubes: earth cooling tubes involve routing air through underground tubes or chambers to achieve a cooling effect. **[49]**

The following picture shows earth cold and hot tubes:

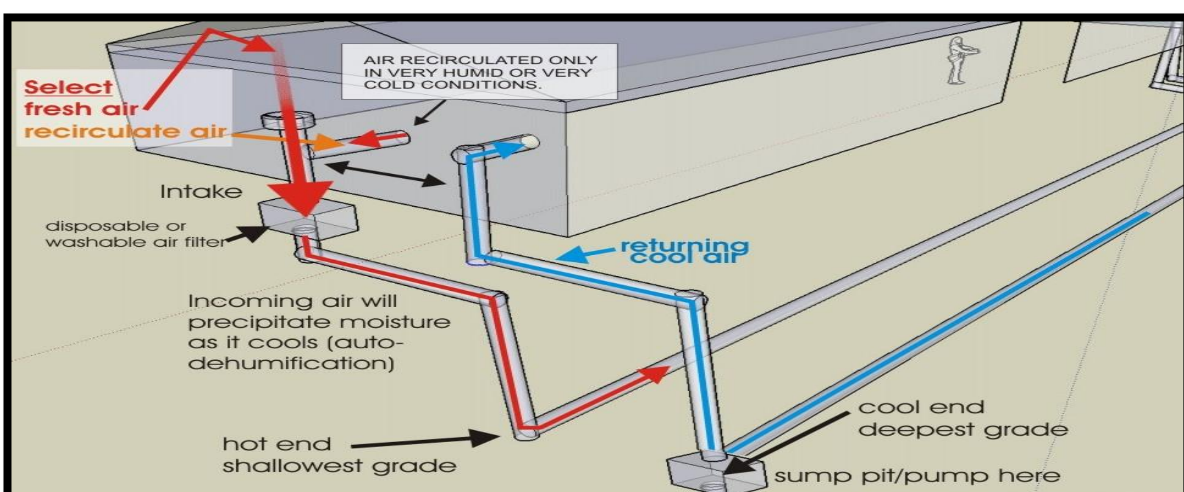


Figure 2.74: earth cold and hot tubes

The most commonly encountered heating and cooling source components for active systems:

- Fireplace**:** a fireplace is, as its name suggests, a location where on-site combustion is used as a means of producing heat. A descendent of the campfire, the typical fireplace consists of a niche or well constructed of non-combustible materials that will withstand the temperatures generated during the combustion process. Although freestanding fireplaces are sometimes used, most fireplaces are installed in exterior walls.

The following picture shows an example of fireplace:

Figure 2.75: example of fireplace

- Furnace: it is a heating system component designed to heat air for distribution to various building spaces. Small-capacity furnaces that rely on natural convection for heat distribution would be classified as local systems and usually effectively condition only one space. Furnaces equipped with fans to circulate air over greater distances or to several rooms would be found in central systems.

The following picture shows the components of a furnace:

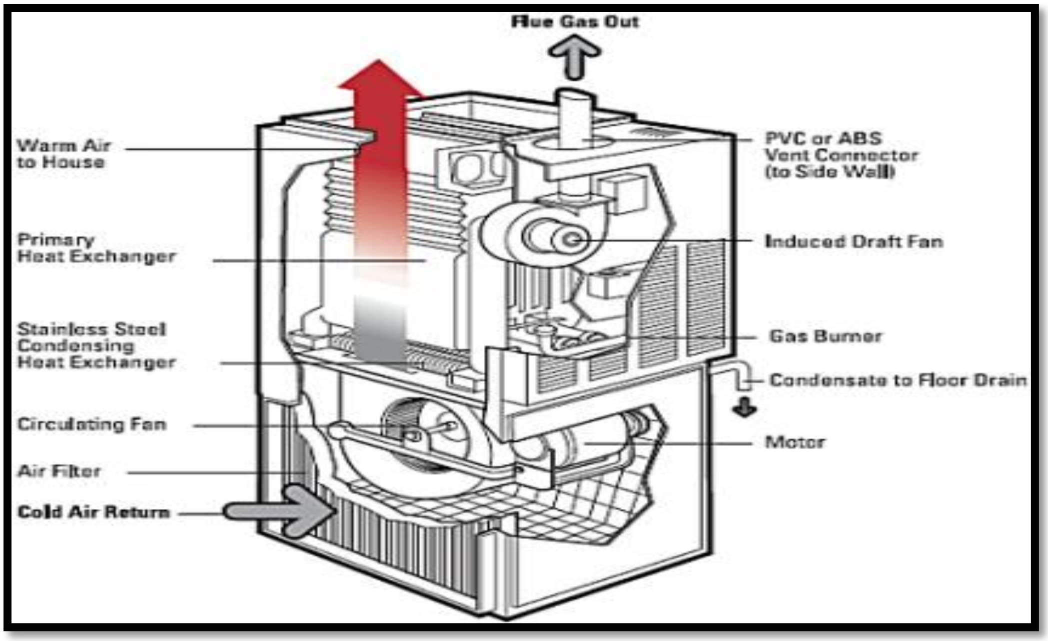


Figure 2.76: components of furnace

- Boiler**:** it is a heating system component designed to heat water for distribution to various building spaces. As water cannot be used to directly heat a space, boilers are only used in central systems where hot water is circulated to delivery devices (such as base board radiators, unit heaters, convectors, or air-handling units.

The following picture shows a boiler:

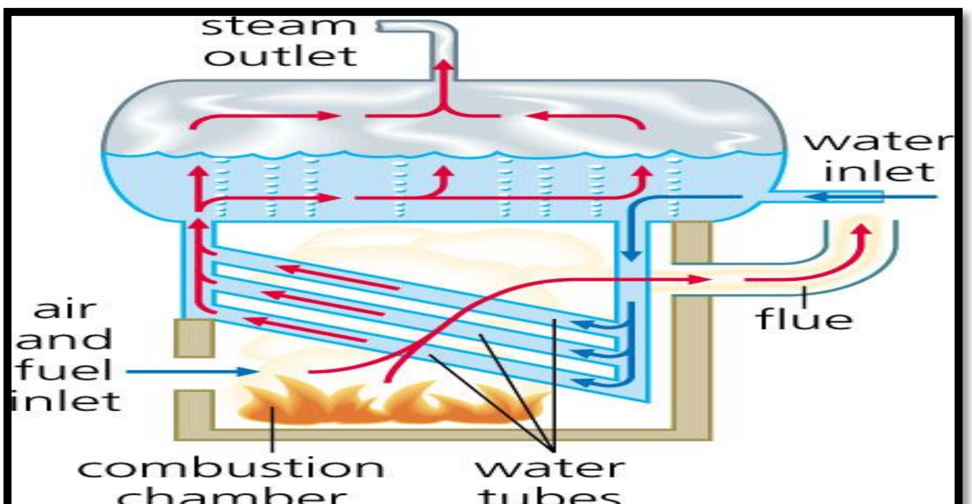


Figure 2.77: component of boiler

- Portable Heaters: many consumer appliances are available to provide spot heat wherever needed. Portable heaters are normally occupant selected and “installed”, often to supplement conditions provided by another heating system. Such portable devices, however, might collectively constitute a complete building heating system. Portable electric resistance heaters are more common than portable combustion heaters as they involve fewer air quality and safety concerns.

The following picture shows a portable heater:

Figure 2.78: a portable heater

- Solar Thermal Collector: solar collectors may be used to heat air or water for building heating purposes. Water-heating collectors may replace or supplement a boiler in a water-based heating system. Air-heating collectors may replace or supplement a furnace. As solar energy in an active solar system is typically collected at a location remote from the spaces requiring heat, solar collectors are normally associated with central systems. Solar water-heating collectors may also provide heated water that can be used for space cooling in conjunction with an absorption refrigeration system.

  The following picture shows a solar thermal collector :

Figure 2.79: thermal collector

- Heat Pump: a heat pump is a reversible cycle vapor compression refrigeration unit. Through the addition of a special control valve, heat flow in a mechanical refrigeration loop can be reversed so that heat is extracted from the outside air (or ground water or soil) and rejected into a building.

  The following picture shows a heat pump:

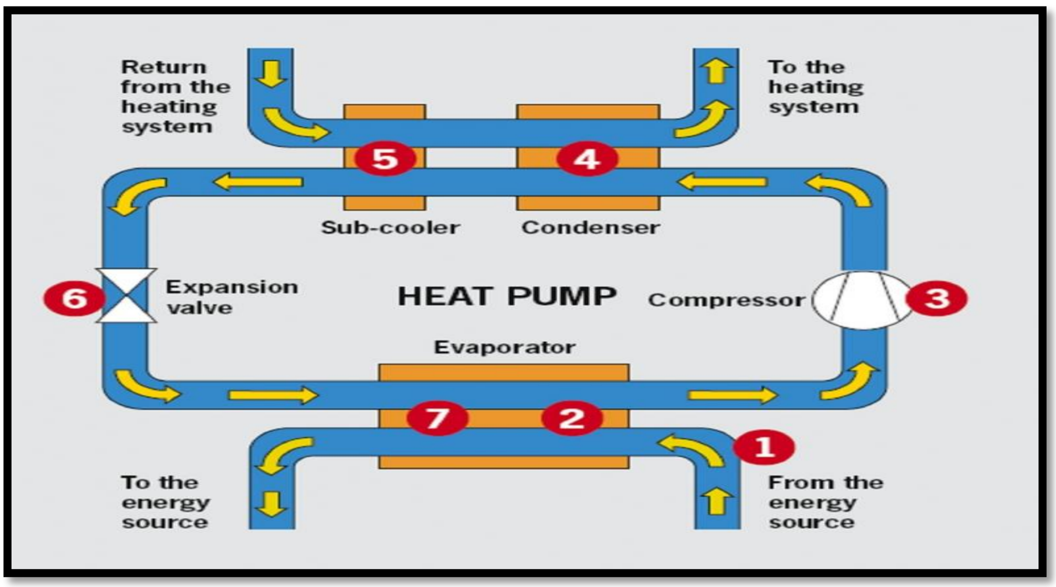


Figure 2.80: heat pump

- Chiller: a chiller is a refrigeration unit designed to produce cool (chilled) water for space cooling purposes. The chilled water is then circulated to one or more cooling coils located in air handling units, fan-coils, or induction units. Chilled water based cooling systems are typically used in larger buildings. Capacity control in a chilled water system is usually achieved through modulation of water flow through the coils.

The following picture shows chillers and boilers and how they work together:

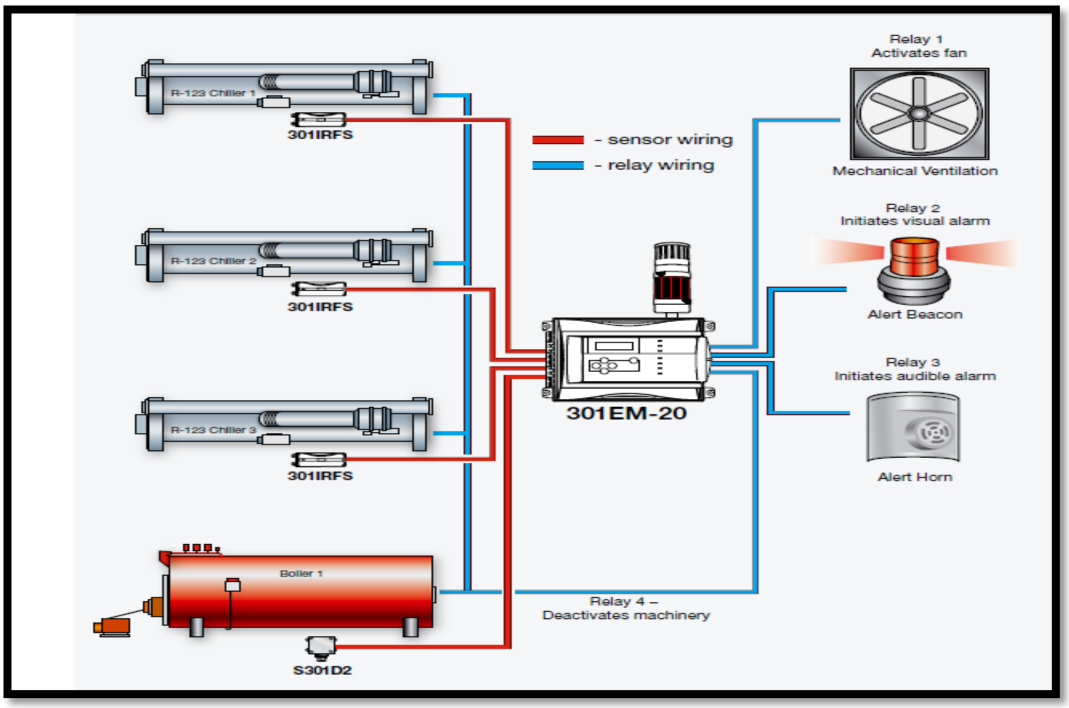


Figure 2.81: chiseler and boiler system

- Cooling Tower: it is a heat rejection device, installed outside of the building envelope, through which condenser water is circulated. Refrigerant in the refrigeration cycle is condensed in a refrigerant-to-water heat exchanger. Heat rejected from the refrigerant increases the temperature of the condenser water, which must be cooled to permit the cycle to continue. The condenser water is circulated to the cooling tower where evaporative cooling causes heat to be removed from the water and added to the outside air. The cooled condenser water is then piped back to the condenser of the chiller.

There are some devices designed to provide the interface between occupied building spaces and distribution components these devices are named delivery devices . Some of these devices are :

- Diffuser: a diffuser is a device designed specifically to introduce supply air into a space, to provide good mixing of the supply air with the room air, to minimize drafts that would discomfort occupants, and to integrate with the ceiling system being used in the space in question.The following picture shows the shape of diffusers:

Figure 2.82: shape of diffuser

- Register: is similar to diffusers except that they are designed and used for floor or sidewall air supply applications or as return air inlets.

The following picture shows a combined shape from diffusers in the left side and registers in the right side:

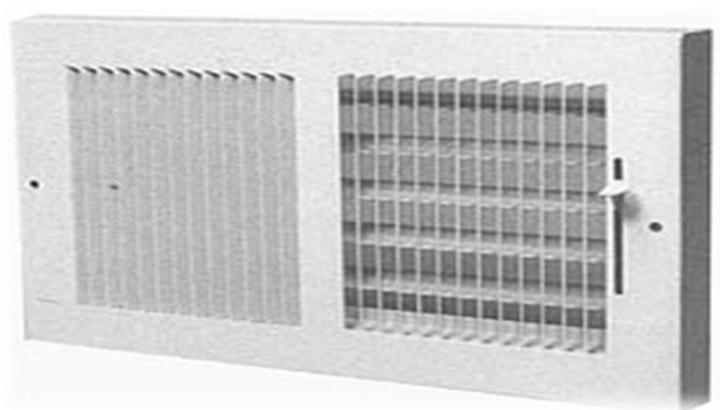


Figure 2.83: diffuser and register

- Grille: is simply decorative covers for return air inlets; they are used to block sightlines so that occupants cannot see directly into return air openings.

The following picture shows the form of grille :

Figure 2.84: example of grill

- Convector: basically a high capacity heat exchange element consisting of one or more finned-tube heat exchange elements, housing, and possibly a fan. Convectors are used in steam or water (hedonic) central heating systems to provide high capacity heat delivery.

The following picture shows the shape of convectors:

Figure 2.85: the shape of convectors

- Unit Heater: is an industrial style heat delivery device, consisting of a fan and coil packaged in a housing, used in water or steam central heating systems.

The following picture shows an example of heaters:

Figure 2.86: example of heaters

2.8.4 Water Services:

The water services shall comprise mains water supplies, cold and hot water installations. The mains, cold and hot water distribution services shall be gravity systems. The cold and hot water piping shall be appropriate for use and where exposed must be of rigid construction. The water systems shall be designed to ensure water hammer and air locking does not occur and shall be provided with an adequate number of isolating valves for the purpose of isolation and maintenance.

1. Cold Water Services:

Cold-water outlets shall be as indicated on the room layout drawings. For cold-water storage an insulated sectional tank suitable for the provision of potable water shall be used. For ease of maintenance, the provision of cold water storage shall be centrally located with easy all round access. It shall not be located in the boiler room. The tank and tank sections shall be located so that it is possible without any structural changes to repair or replace any sections of the tank. All tanks must be supplied with lightweight covers and fitted. Overflow and warning pipes to the tank shall be incorporated discharging at a point of nuisance.

2. Hot Water Services:

The hot water system may comprise of either an indirect hot water cylinder with an integral high recovery multi coil heat exchanger, a gas fired instantaneous hot water generator with minimum storage/ buffer tank, electric water heaters or a hybrid of all three solutions.

A suitable hot water supply strategy shall be established, this will take into account available fuel sources, hot water demand and energy efficiency.

All hot water heaters shall be complete with all necessary controls, safety devices and instruments. A suitable single hot water recirculation pump shall be provided on any central storage distribution hot water systems, the pump shall be located adjacent to the hot water heating unit.

All hot water outlets (excluding the cleaners sinks) shall be provided with hot water outlets with fail safe lockable local thermostatic blending valves limiting maximum temperature to 43°C to prevent scalding. **[50]**

2.8.5 Water Sources:

There are many sources of water, also we have many ways to collect them, including:

a. Wells: wells are preferable water from these sources usually has at least the advantages of purity, coolness and freedom from turbidity, odor, and unpleasant taste any of which may be encountered in addition to either acidity or hardness his section focuses on the equipment used to capture and store groundwater from wells.

The following picture shows a well water sources:

Figure 2.87: a well Water Sources

b. Pumps: usually in this system the water come from municipal water supplies and be extended to the building by using bump system. The tank maybe located above the building method or underground behind building.

c. Pressure Tanks: serving also for water storage, these tanks are frequently used both to maintain a constant pressure on a pump-supplied water system and to allow for temporary peaks in water supply rates that exceed the capacity of the pump.

d. Gravity Tank: which water is stored at atmospheric pressure and distributed by gravity flow in a down feed system; the tank is usually elevated above the roof of a building and is filled by a house pump. They are usually used for two purposes, pressurizing the domestic water system and providing a separate source of water for fire protection.**[51]**

2.8.6 Wastewater Sanitation:

The standard sanitation technology in urban areas is the collection of waste water in sewers, its treatment in wastewater treatment plants for reuse or disposal in rivers, lakes or the sea.

- ***Reuse of Wastewater:***

The reuse of treated wastewater in landscaping irrigated agriculture and for industrial use is becoming increasingly widespread. In many suburban and rural areas households are not connected to sewers. They discharge their wastewater into septic tanks or other types of on-site sanitation.

- ***Solid Waste Disposal:***

Disposal of solid waste is most commonly conducted in landfills, but burning, recycling, composting and conversion to bio fuels are also avenues. In the case of landfills, daily cover with topsoil may be done. The importance of daily cover lies in the reduction of vector contact and spreading of pathogens. Daily cover also minimizes odor emissions and reduces windblown litter.

For burning options, the release of air pollutants, including certain toxic components is an attendant adverse outcome. Recycling and bio fuels conversion are the sustainable options that generally have superior life cycle costs, particularly when total ecological consequences are considered. **[1]**

2.9 Electrical design:

2.9.1 Introduction:

Electrical design for hotel design include design of lighting and power.

There should be at least one socket outlet for each bed, possibly incorporated with the lighting control panel, so that guests may use any portable appliances they may bring.

One socket outlet is also desirable in each room for cleaning, in small rooms one socket beside the bed may also serve for cleaning.

Probably 13 amp ring sockets are the most generally useful, but in hotels frequented by foreign visitors a two pin 5amp socket may be better beside the bed as most appliances of foreign origin have plugs of this type. In corridors a reasonable number of socket outlets for cleaning is essential.

Provision should be made for using electric razors in all bedrooms and bathrooms .In bathrooms a shaver unit to BS 3052 is essential and must be out of reach from the bath.

The outlet is fed from an isolating transformer which eliminates the risk of shock. The transformer is the most expensive item and it is often possible to provide one to serve several socket outlets.

Where bathrooms are not grouped together the increase in wiring costs may reduce the saving on transformers.

In bedrooms it is desirable, though not essential, to provide an isolating transformer. It is important that razor outlet accept standard foreign razor plugs and run at 200/250 and 100/120 volts.

- ***Technical specifications of the rooms***

Some technical specification should be taken in consideration in electrical controls headboard:

a. Auxiliary socket base h=30 cm.
b. Telephone socket base h=30 cm.
c. 4-position A/C switch with clear and distinctive labeling; h=70 cm.
d. Switch for table lamp h=70 cm.
e. General light switch h=70 cm.
f. Switch for lift-hand headboard light h=70 cm.
g. Switch for right-hand headboard light h=70 cm.
h. Electrical control unit on bedside table optional (mandatory for royal service and garden villas).

Electrical controls on dressing table:

a. Auxiliary socket base h=30 cm.
b. Refrigerator socket base h=30 cm.
c. TV socket base h=30 cm.
d. TV aerial socket base h=30 cm. (interactive connection).
e. Pc socket base h=1 m.
f. Telephone/modem socket base h=1 m.
g. Socket base for guest use h=1 m.

- ***Electrical controls in the entrance:***

a. General room controls h=1.6 m.
b. Card base h=1 m.
c. Bathroom light switch h=1 m.

d. General light switch h=1 m.

2.9.2 Electrical sockets:

sockets should be located so as to allow the most appropriate positioning of equipment and lighting using the shortest possible cable length. Wiring cables of connected devices will be discretely and neatly arranged.

Some easily accessible sockets should be available permanently for use by guests.

The corresponding voltage should be indicated next to each plug and the protection in all rooms against direct and indirect contact in the mains will be in phases, so that a failure in one phase won't affect more than one third of the mains.

2.9.3 Lighting:

Sufficient light should be available in working, reading and personal preparation areas with 300 lux minimum in each area.

There will be a light source at each side of the bed, with sufficient lighting. h =1.3 m. P. 15 W (low consumption).

There will be two ceiling lights 60 cm away from the bed headboard (halogen lights are recommended). The following figure shows a bedroom lighting (one bed):

Figure 2.88: bedroom- lighting (one bed)

If the rooms have two beds, each light will be located right above the centre of each bed, 60 cm away from the ceiling)

A halogen light will be fitted in the ceiling above free standing lamp. P. 15 W (low consumption). Figure below show bedroom lighting (two bed)

Figure 2.89: bedroom- lighting (two bed)

The picture below show the lighting if there is more than two beds:

Figure 2.90: lighting (more than two bed)

Table lamp (articulated is recommended) on the dressing table or writing desk P. 15 W (low consumption).

2 ceiling lights in the entrance hallway P. 9 W (low consumption)

Wall lamp or halogen light P. 15 W (low consumption).

Footlight h=50 cm (low consumption)

The cupboards will have an interior light that will activate automatically when the door is opened. In its absence there will be a light in the cupboards area which will allow guests to see the interior without any shadows, The light intensity will be controlled with a dimmer in suites. The switches must be accessible from the bed, simple to use and easily identifiable. Energy saver card-switch should have luminous indicator that can be visible at night, There will be sufficient lighting in the bathroom. The lights by the washbasin should be lateral throwing no shadows. Figure below show bathroom lighting **[52]**:

Figure 2.91: bathroom lighting

This figure shows the lighting in corridor:

Figure 2.92: corridor lighting

Lighting in restaurant should be distributed, the figure below show the lighting in restaurant.

Figure 2.93: Restaurant lighting

2.9.4 Requirement of Lighting Provision for Swimming Pool License:

The pool shall be provided with a lighting system which shall

(a) maintain a standard of illumination of an average intensity of not less than 200 lux at all sidewalks and standing space immediately adjoining the rim. of the pool and the water surface of the pool; the illumination shall be of acceptable uniformity and such that the underwater areas of the pool and other appurtenances are clearly visible; and

(b) have emergency luminaries supported by emergency power supply for lighting all sidewalks and open spaces surrounding the pool, all dressing, shower, bathing, washing and toilet accommodation and exit passageways. They shall be capable of automatically operating continuously for not less than 1 hour. The following figure shows lighting of swimming pool: **[53]**

Figure2.94: swimming pool lighting

- ***Type of lamps:***
  1. Incandescent Lamp:

Incandescent lamps in general are mostly used in home settings; they are mostly referred to as the general service lamp that we use today. The bulb of the lamp is composed of soda- lime silicate glass. The bulbs size is determined by the lamp cap temperature. early lamps of this type usually had a larger bulb to avoid the blackening that was caused by the evaporating tungsten from the filament. Through development a new type of inert gas filling was introduced to maintain the pressure upon the filament, therefore reducing the evaporation caused by the tungsten filament. Safety of these types of lamps were thought of, and the installation of a fuse in one of the supply leads, breaking the circuit if there was a power overload (Natural resources Candela). The following figure shows this type of lamps:

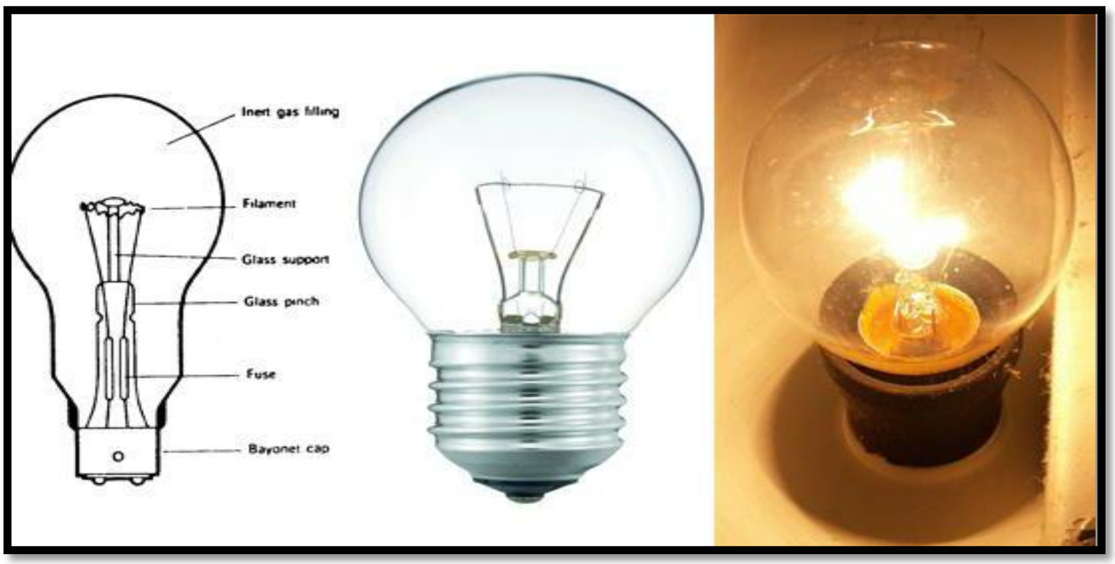


Figure 2.95: incandescent lamp

2. Tungsten Halogen:

The technology behind the tungsten halogen cycle eliminated the blackening caused by the lamp wall by the evaporation of the tungsten filament. Furthermore through the use of this technology the bulb sizes were reduced for this effect to take place. The use of quartz in its composition brought closer the lamp wall and the filament therefore allowing for a higher gas pressure and increased mechanical strength. The improvement gave lamp designers the flexibility to increase the lamp life and the output of light while sustaining the temperature. The following figure shows this type of lamps:

Figure 2.96: -tungsten halogen

3. Fluorescent:

The fluorescent lamp is the most extensively used lamp within commercial buildings, educational building and industrial buildings. They are believed to have a variety of advantages compared to other light sources. One of the advantages that they have comparing is the low operating temperature; additionally they have a wide array of different color spectrums and high efficiency. The operation of a fluorescent lamp is relies on the usage of mercury discharge that induces UV radiation from an efficient first energy level excitation. The following figure shows this type of lamps:

Figure 2.97: Fluorescent lamp

4. compact fluorescent:

Through the development of the fluorescent lamp; compact fluorescent lamps where processed. The introduction and composition of the compact fluorescent lamp, involves the tube diameter to be smaller in scale and high efficiency triphosphors allow for the tube to be folded producing a more single ended lamp that is compact. Furthermore the inclusion of electronic control gear that is built into the lamps cap, allowed this product to gain more popularity in almost all situations thus being a replacement of the incandescent lamp. The following figure shows this type of lamps:

Figure 2.98: Compact fluorescent

5. Low and High Pressure Sodium Lamps:

The low pressure sodium lamp is seen to be the most ideal lamp, due to it being highest efficacy of all the lamps available. The reason for this is that the output is near the peak of the human eye response curve. On the other hand the high efficacy is also the drawback, high efficacy means that its color rendering index is effectively zero. Therefore the low pressure sodium lamps are mostly used as road lighting where the yellow light is tolerable, although they are mostly replaced by high pressure sodium lamps.

6. High pressure sodium lamps had many difficulties in its development the arc tube was the sole reason in its delay of advancements for decades. The eminent solution to these difficulties where resolved by the finding of an arc tube that can withstand the high pressure sodium vapour that consists within. The following figure shows this type of lamps:

Figure 2.99: Low and High Pressure Sodium Lamps

7. Metal Halide Lamps:

The high pressure mercury vapor are rarely used today, this due to the developments with the metal halide lamp the advancements came from the ordinary mercury vapour lamp. Mercury vapor lamps where dominantly used for street lighting , further more it found its place in factories when the color corrected versions were made , this light source was later on not so popular when the metal halide was introduced. There are a wide range of metal halide lamps that is now available; this is including reflector versions which have gain popularity due to the very good color rendering achieved. The following figure shows this type of lamps:

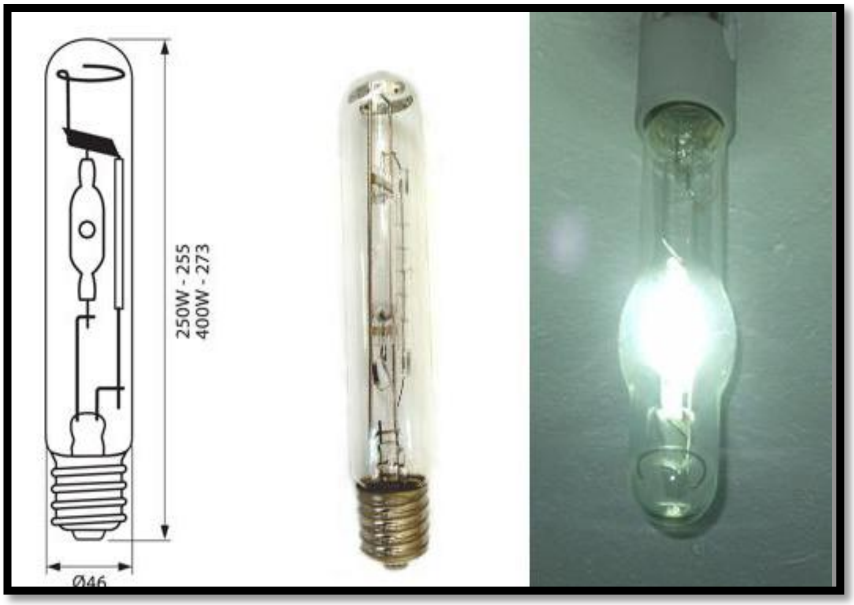


Figure 2.100: Metal Halide Lamps

8. LED lamp

LED lighting otherwise known as light emitting diodes are known for their low consumption of electricity and last longer than normal fluorescent lamps. However LED costs are much higher when considering general lighting. LED lights come in a variety of colors red, green, blue and the combination of all their colors creates white, for this reason a full spectrum of colors is available with LED lighting.

Another advantage that LED lighting provides is that they produce no heat. LED is most dominantly used in interior designs due to the fact that designers can create desired effects with the light color rendering of LED lights. With ongoing technological. developments in LED lighting, suggests that over time it will replace other conventional lighting and be used as general lighting. **[54]**

The following figure shows this type of lamps:

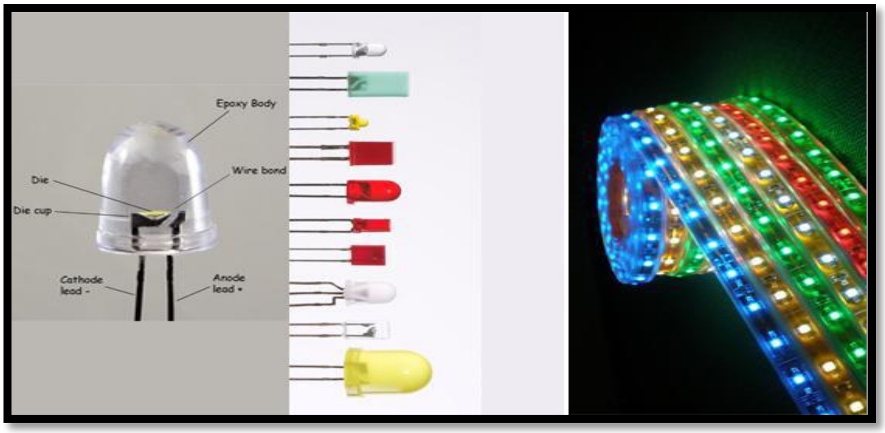


Figure 2.101: led lamp

2.10 Public Safety.

2.10.1 Introduction

The primary goal of safety engineering is to manage risk, eliminating or reducing it to acceptable levels. Risk is the combination of the probability of a failure event, and the severity resulting from the failure. For instance, the severity of a particular failure may result in fatalities, injuries, property damage, or nothing more than annoyance. It may be a frequent, occasional, or rare occurrence. The acceptability of the failure depends on the combination of the two. Probability is often more difficult to predict than severity due to the many factors that could lead to a failure, such as mechanical failure, environmental effects, and operator error.

The best architectural design that satisfy the client's needs and requirements and at the same time does not conflict of the environmental, structural and seismic design without taken in consideration the safety design is still not the best design for the buildings.

Therefore the best design is the one which cares about all issues especially safety design.

Fire safety of each place in a hotel must be planned individually and carefully. At the end , all fire safety systems must be combined as a whole fire detection & suppression system of Hotel.

2.10.2 Safety systems:

1. Smoke detectors: smoke detectors in every room save occupant's lives. If a fire starts in a guest room, the occupant has, on average, two minutes to get out alive. A smoke detector will give the necessary warning to facilitate escape. The following figure shows a smoke detector:

Figure 2.102: smoke detector:

1. Self-closing doors: (fire doors, stairwell doors) save lives by confining the smoke, flames and heat and leaving evacuation routes clear. It is imperative that these doors are not blocked or propped open. The following figure shows self-closing door:

Figure 2.103: self-closing door

2. Fire Proof Door: These doors must be protected from fires, and it is used for stairs and for restaurants kitchens to prevent fire from spreading and expansion. The following figure shows a fire proof door:

Figure 2.104: fire proof door

*3. F*ire alarm*:*

An automatic fire alarm system is designed to detect the unwanted presence of fire by monitoring environmental changes associated with combustion. In general, a fire alarm system is classified as either automatically actuated, manually actuated, or both. Automatic fire alarm systems are intended to notify the building occupants to evacuate in the event of a fire or other emergency, report the event to an off-premises location in order to summon emergency services, and to prepare the structure and associated systems to control the spread of fire and smoke. The following figure shows a fire alarm: [1]

Figure 2.105: fire alarm

4. Sprinklers:

Fire sprinklers are fundamental to hotel fire safety, there is a basic criterion for hotel fire safety, a fire sprinkler system with sprinklers in every room, installed in compliance with nationally recognized standards and then maintained by qualified technicians.

If a fire can be stopped before it grows, it cannot develop a lot of smoke, which is the biggest killer in fires. Smoke alarms are great and we look for them as well as sprinklers. But smoke alarms can only alert people to a fire, and fires can grow so quickly that they can kill before people can escape. A sprinkler will not only alert people to the fire (when a sprinkler opens, the water flowing through the system triggers an alarm), but it also opens very quickly and stops the fire. A fire that is quickly stopped cannot produce smoke and the carbon monoxide it carries.

Fire sprinklers are designed to operate when a fire is small and stop it before it grows to a stage known as flashover. At the flashover stage, the fire travels from the room of origin with a large burst of energy, pushing great amounts of heat and smoke to the rest of the building. Sprinklers are spaced so that they can stop a fire with a relatively small amount of water. If a hotel does not have sprinklers in every room then it does not meet criteria for hotel fire safety.

A sprinkler located outside a burning room cannot stop the smoke that is being produced in the room, and this is a bigger threat to people than the flames. The following figure shows a Sprinkler system:

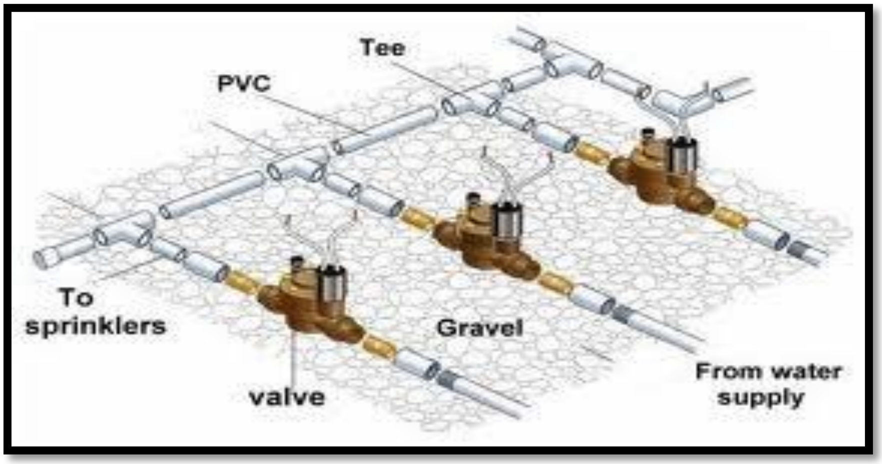


Figure 2.106: Sprinkler system

5. Extinguishers: Portable extinguishers are designed to control or extinguish small fires. They are placed throughout a hotel to be readily available when someone finds a fire. Installers follow a nationally recognized standard that dictates what type (based on the type of fire expected at that location), their location, and size. Different locations will require different types, depending upon the type of fire expected. For example, the corridors will have units for extinguishing paper and other similar combustibles. A kitchen area will have units designed to put out grease fires.

Notice that the extinguishers are placed in wall cabinets at a height that makes it easy for an average-sized person to remove. If they are found on the floor, then they are not in the proper location. The following figure shows an extinguisher:

Figure 2.107: fire extinguisher

Emergency lights: It indicates for the location of the emergency lights in hotels. The following figure shows an emergency light:

Figure 2.108: emergency light

2.10.3 Emergency egress system:

Because stairways are such a critical part of the egress path, they have requirements that do not allow any combustible material at all - thus the lack of carpeting or storage of anything is forbidden in stairways. In addition to doors, the walls and ceilings of the egress paths are part of the added protection. These items combine to be the passive system of barriers that slows down the progress of a fire and smoke. That is why all doors should have self-closers, even the guest room doors. Any coverings on walls and ceilings should be limited to materials that will not contribute to the rapid spread of flames or development of a lot of smoke. The following figure shows an emergency egress:

Figure 2.109: fire escape located external to a building

1. Safe area in case of earthquake: It is an indication of safe areas or zones in the building in case of earthquakes as shown in the following figure:

Figure 2.110: safe area

2. First aid: It indicates the location of the first aid in the hotel as shown in the following figure:

Figure 2.111: first aid

3. Assembly Points: It indicates the locations of areas around the building are safe in case of earthquakes or fires **[55]**. As shown in the following figure:

Figure 2.112: Assembly Points

Chapter three

Case study

3 Case Studies

3.1 Introduction:

In this chapter, some case studies for existing hotels will be displayed and studied in several ways.

3.2 Description and Location:

The project is located in a central point in the developing districts of Amman the capital of Jordan. It is located almost 7 km from central Amman and 24 km from Queen Alia airport. The project is constructed over 15000 m^2 on a land of approximately 32000 m^2.

3.3 Analysis:

Figure 3.1 explain the details of the functional and space analysis of this project

Ground floor plan

Total floor area = 1340 m^2

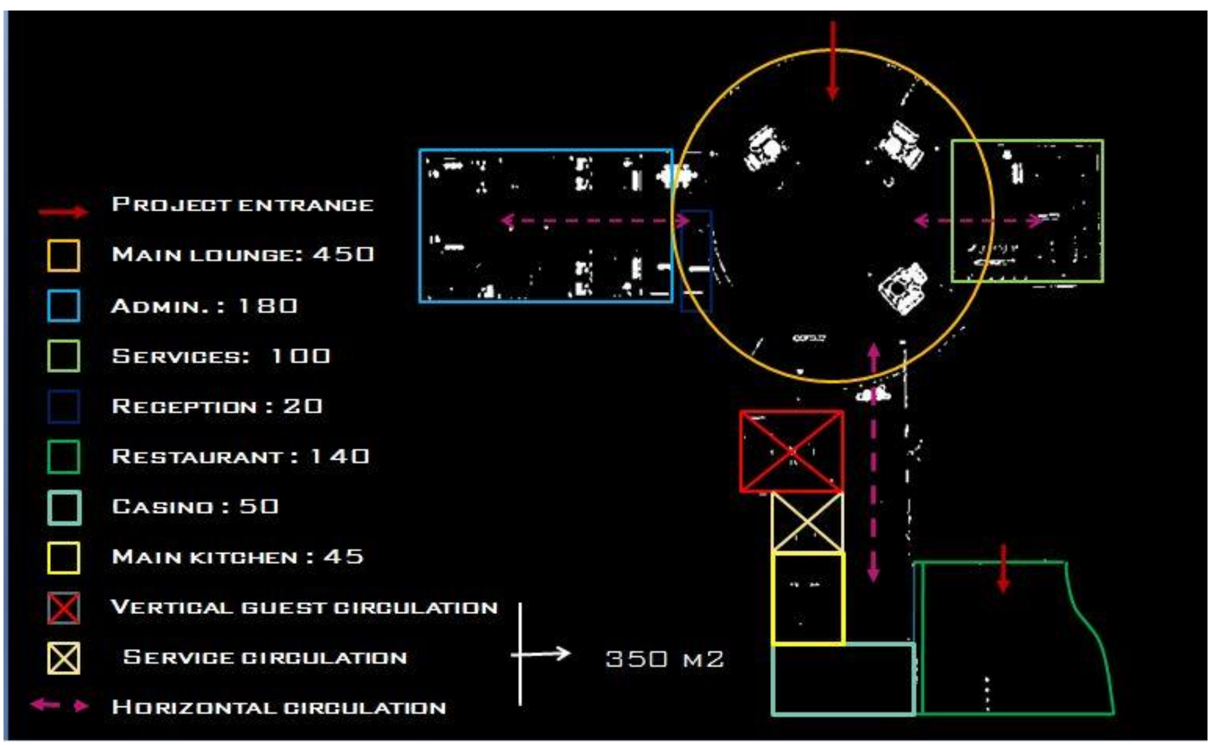
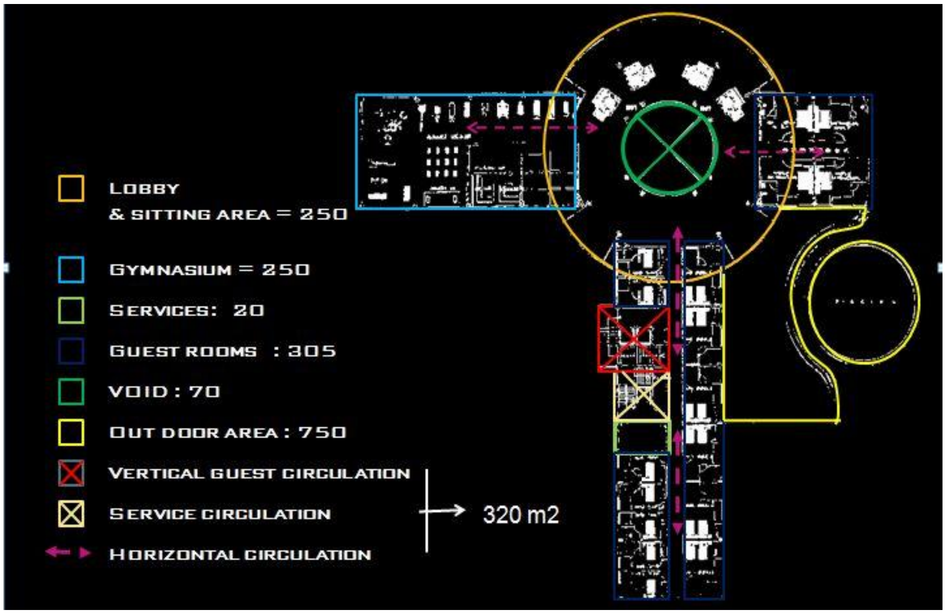


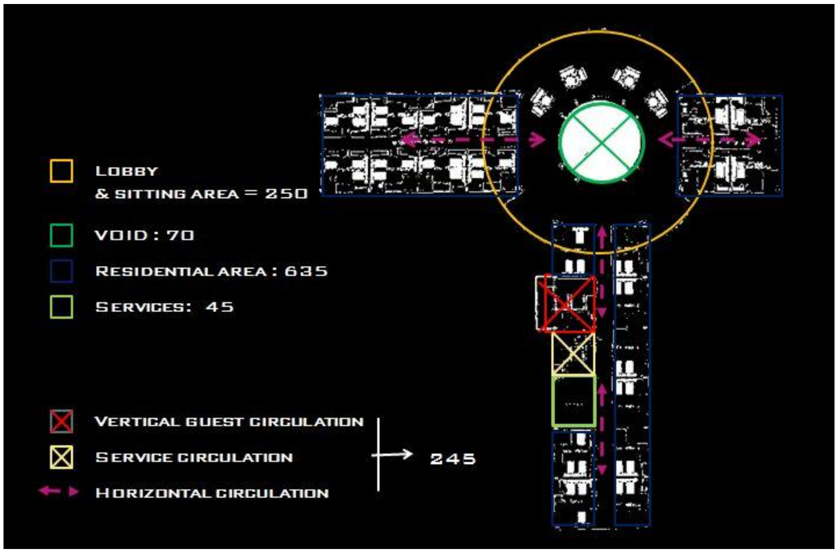
Figure 3.1: ground floor plan

First floor plan the total floor area = 1125 m^2



3.2: first floor plan

Second, Third, Fourth floor plan the total area for each floor = 1125m^2



3.3:2th ,3thand 4thplan

Function of areas and areas percentage

1. Total project area = 5600 m^2
2. Build up area= 4850 m^2 (86.6%)
3. Outdoor area =750 m^2 (13.4%)

FUNCTION	AREA (m^2)	Percentage (%)
Residential area	2210	45
Main lounge	500	10
Administration	180	4
Services	120	2.5
Entertainment	300	6
Restaurant	140	3
Circulation	1400	28

Table 3.1: function area and its percentages

Function percentage

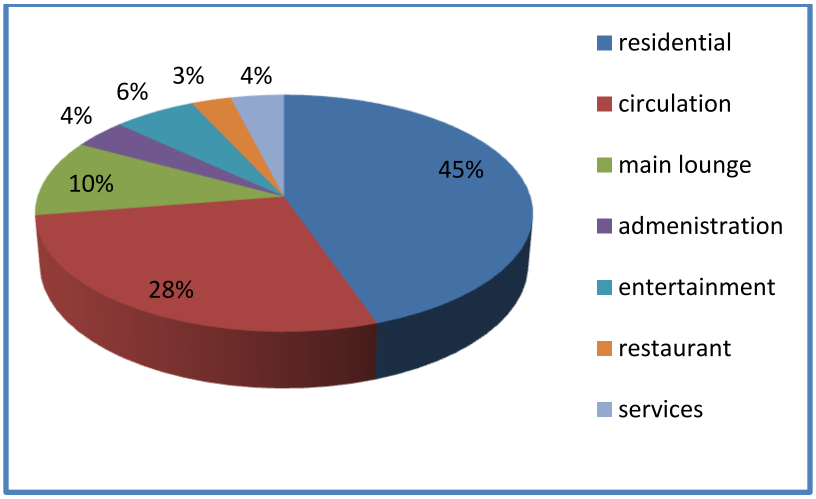


Figure 3.4: the function of the area and its percentage

According to New Fort Standards, an area of 60 m^2 is required for every 20 person.

Thuse, the distribution of areas according to its functional target matches the New Fort standards as we can see in the table below

MEETING ROOM	OCCUPANCY / room (PERSON)	Area/person (m^2/person)	Area/room m^2/room
SMALL	6	3	18
MIDIUM	20	3	60
LARGE	40	3	120

Table 3.2: New fort standard for the percentages between the needed areas for each person

1. On the other hand the hotel design did not consider the handicapped requirements and did not create any helping facility to give them free movement.
2. The design did not consider units that cover the need of handicapped.
3. The hotel does not have enough emergency exits, and does not have emergency stairs.
4. The hotel does not have enough windows openings in the south side, on the other hand it has extra windows in west

3.4 Armani hotel in Jakarta:

3.5 Description and Location:

The project is briefed as a boutique – business hotel located in a main busy road in central of Jakarta, which called Wahid Hasyim Street.

The hotel is a nine floor building**:**

1. Basement one (B1) and ground floor (GF) parking.
2. First floor main entrance and main lounge and main hotel services.
3. Mezzanine floor: business centre administration.
4. Podium roof: entertainment section.

5. Second to eighth floor are residential section.
6. Roof: VIP suite floor.

3.6 Analysis:

The following figure explains the details of the functional and spaces analysis of this project.

Basement and Ground floor plan

Total floor area = 930 m^2

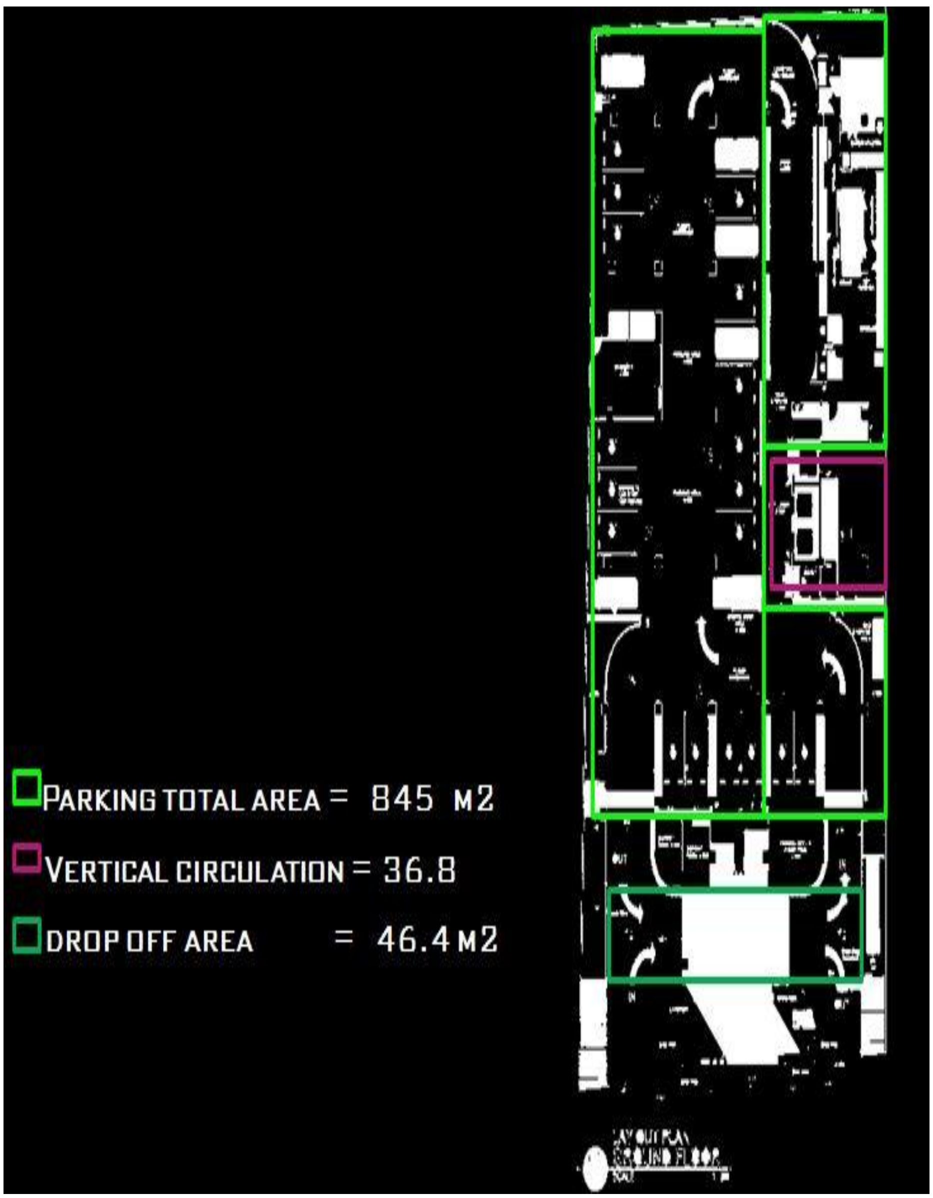
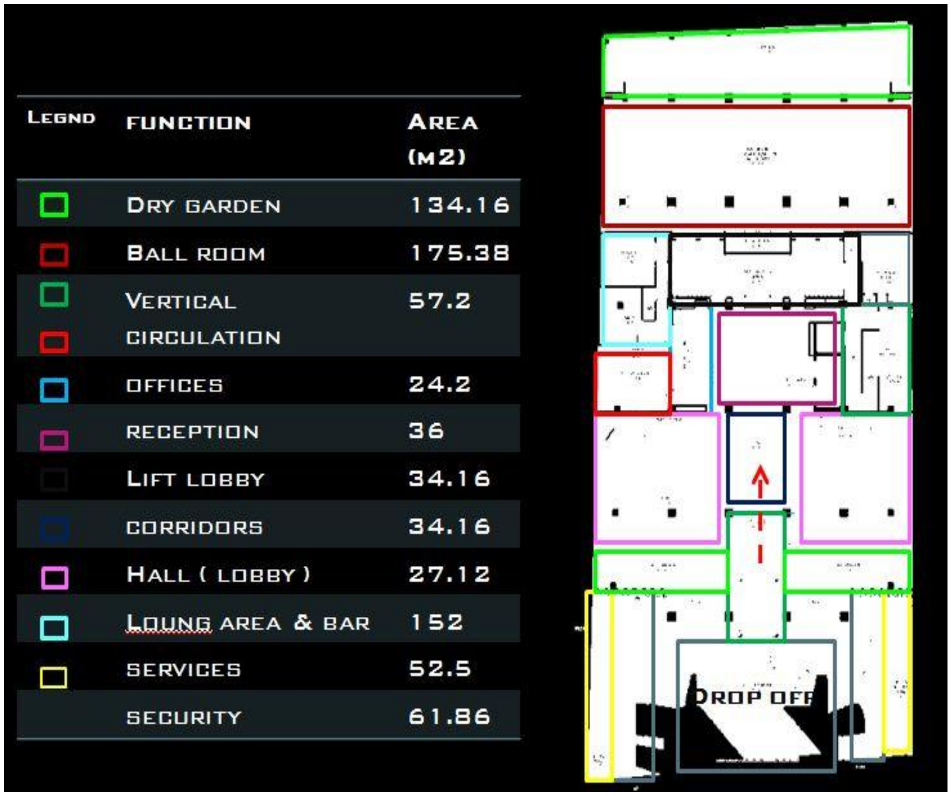


Table 3.3: basement and ground floor plan

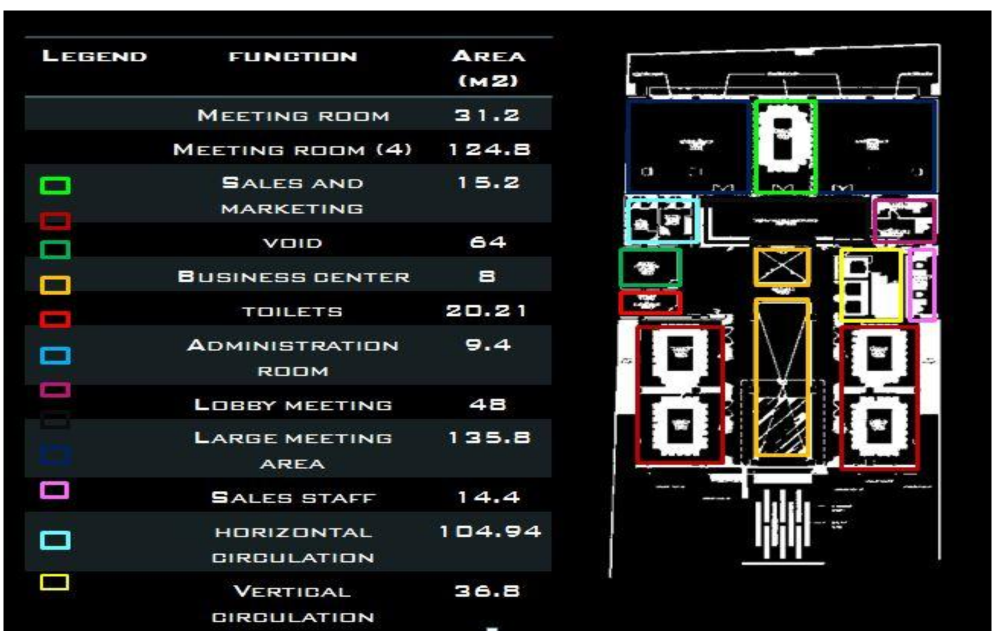
First floor plan the total floor area = 770 m^2



LEGND	FUNCTION	AREA (M2)
	DRY GARDEN	134.16
	BALL ROOM	175.38
	VERTICAL CIRCULATION	57.2
	OFFICES	24.2
	RECEPTION	36
	LIFT LOBBY	34.16
	CORRIDORS	34.16
	HALL (LOBBY)	27.12
	LOUNG AREA & BAR	152
	SERVICES	52.5
	SECURITY	61.86

Figure 3.5: first floor plan

Mezzanine floor plan Total floor area = 544 m^2



LEGEND	FUNCTION	AREA (M2)
	MEETING ROOM	31.2
	MEETING ROOM (4)	124.8
	SALES AND MARKETING	15.2
	VOID	64
	BUSINESS CENTER	8
	TOILETS	20.21
	ADMINISTRATION ROOM	9.4
	LOBBY MEETING	48
	LARGE MEETING AREA	135.8
	SALES STAFF	14.4
	HORIZONTAL CIRCULATION	104.94
	VERTICAL CIRCULATION	36.8

Figure 3.6: mezzanine floor plan

Podium floor plan

Total floor area = 510 m^2

Leg-nd	Function	Area (m2)
	Dining lounge	240
	Lobby	63
	Buffet	36
	Swimming pool	27.72
	Pool area	70.18
	Fitness area	15.21
	Services	34
	Vertical circulation	36.8

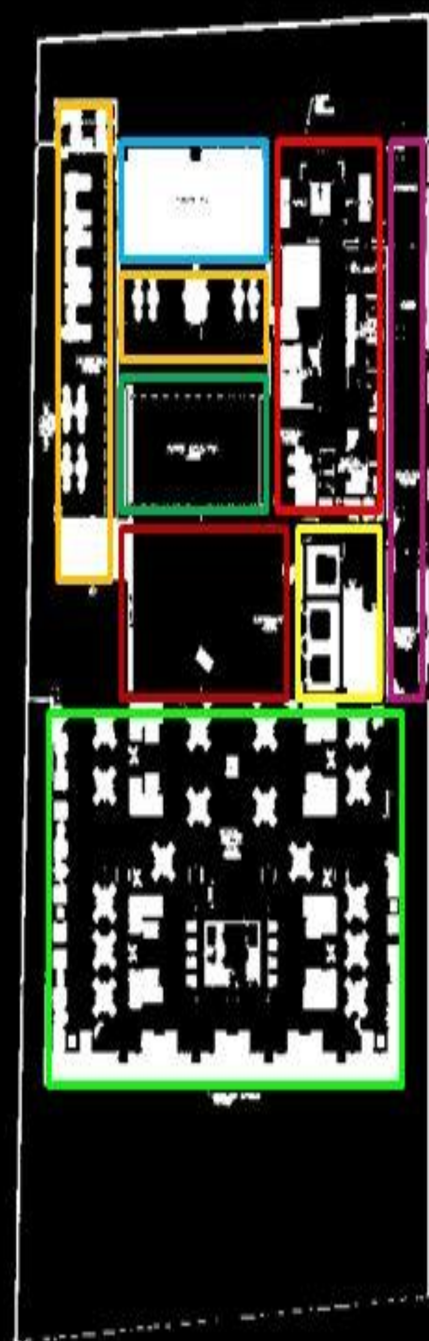


Figure 3.7: podium floor plan

2^{ed} -8th floor plan

Ttotal floor area = 3010 m^2

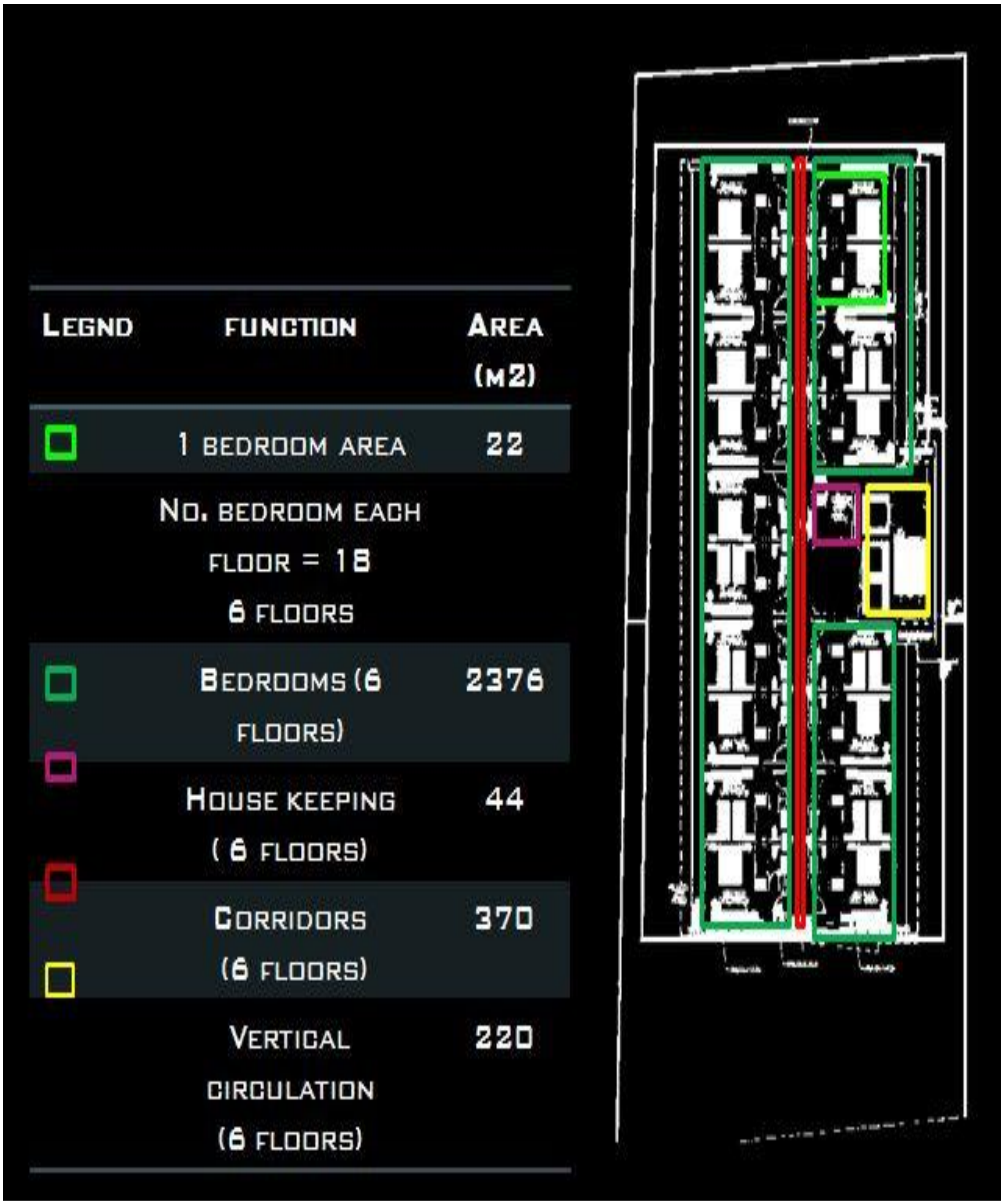


Figure 3.8: 2th-8th floor plan

VIP suite floor plan

Total floor area = 186.2 m^2

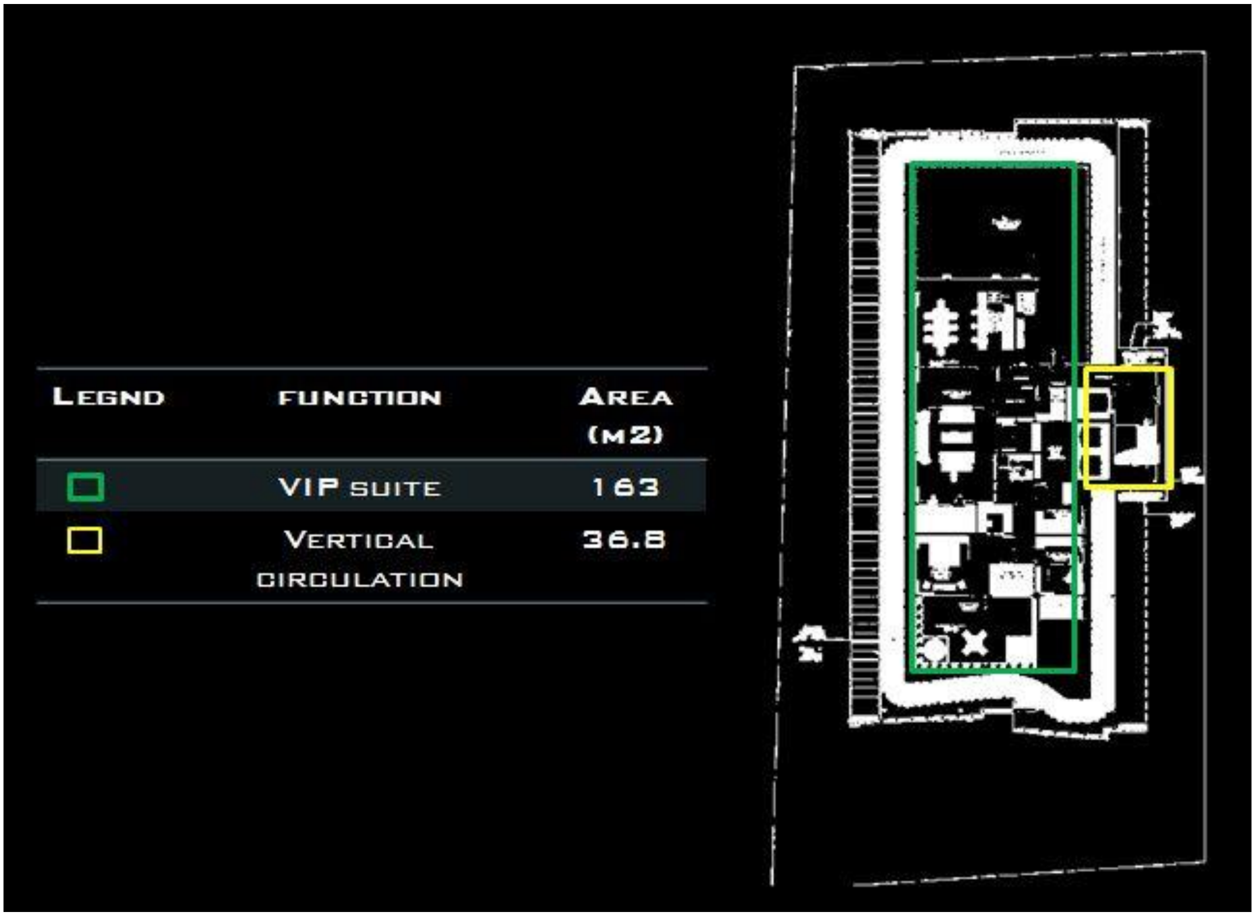


Figure 3.9: vip suit floor plan

Function of areas and areas percentage

4. Total project area = 5920 m^2
5. Build up area= 5920 m^2 (100%)
6. Outdoor area =0 m^2 (0%) which does not satisfy hotel design requirements

FUNCTION	AREA (m2)	Percentage (%)
Parking space	890	14
circulation	989.4	16
Main lounge	250	5
administration	133	3
Communication ,conference center	550	10
Entertainment	250	4
Restaurant	276	4
Services	200	3
Residential	2540	41

Table 3.4: the function area and its percentage

Function percentage

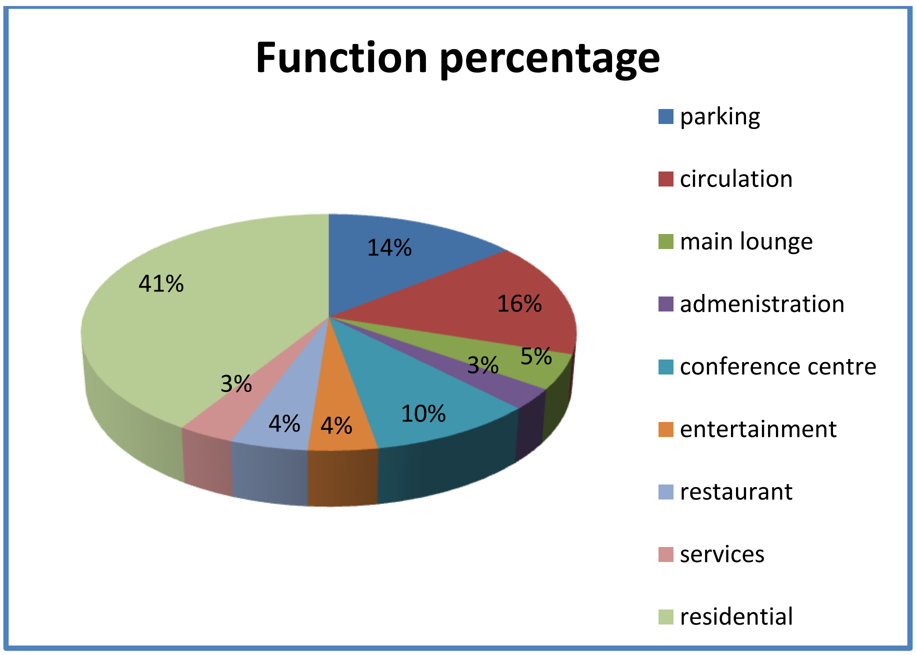


Figure 3.10: the function of the area and its percentages

1. The disruption of areas in the hotel matches the New Fort requirements for hotel.
2. The design did not consider outdoor green areas.
3. The hotel does not enough emergency exits, and emergency stairs.
4. The hotel has unneeded openings in all sides.[56]

Chapter Four

Site analysis

4 Site analysis.

Site analysis is the process of studying how to situate a building or object, layout and orient its spaces, shape and articulate its enclosure, and establish its relationship to the landscape.**[57]**

In our project, site survey will begin with the site description and gathering of physical site data, and all the different aspects of the selected site for this project, location, climate, geographical condition, and the reasons of choosing this site will be illustrated in this chapter

4.1 Location advantages

1. Easily access since it is on a main street.
2. Quit region and far from the noise of the city.
3. The slope of the land is moderate.
4. No surroundings of high building that prevent Sun and wind.

4.2 Site description:

The selected site is in Sabastyia which located in Nablus, It is to the north-west and ten kilometers from the city of Nablus, about 463 m above sea level .Land topography is flat with very small slope and the area is about 25000m^2.the fowling figures shows site plan .**[58]**

Figure 4.1: proposed site plan (Google earth,2013)

Figure 4.2: proposed site plan (Google earth,2013)

It is worth mentioning that the site away from the archaeological area and the figure below wil illustrate that.

Figure 4.3: site and archaeological area

The following figure shows the proposed site plan

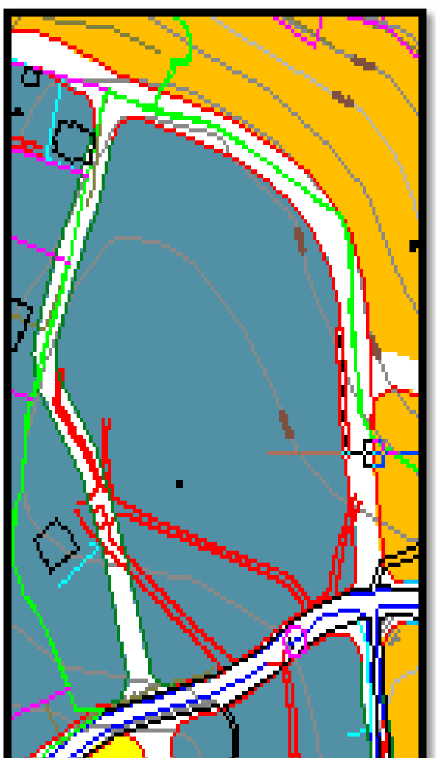


Figure 4.4: proposed site plan

The site is located in overlooking area and in addition it is overlooks to the monuments which attract the tourism, the fowling figures show the view of the site

Figure 4.5: general view for the site

All the following figures show the view for the site from different elevation

Figure 4.6: view from east elevation

Figure 4.7: view from south elevation

Figure 4.8: view from the south elevation

Figure 4.9: view from the north elevation

4.3 Climate:

Climate of Sabastiya follows the climate for the Mediterranean Sea, which is characterized as a hot, dry Summers and cool rainy Winters with an average amount of rain that falls annually on Sabastiya of 650 mm, temperature ranging between 8-12 degrees Celsius in Winter and 22-30 degrees Celsius in Summer, and humidity ranging between 50% -70%

The local prevailing wind direction in Sebastiya is north, south and south-eastern and western winds associated in lowlands on the town in the winter, while the northern and north-western wind blows in summer weather from highlands

Weather condition of Sabastiya is wet dry in summer and cold rainy in winter, and the following tables and figures will show that: **[59]**

Month	Air Tem(C^o)	Rainfall quantity(mm)	Mean relative humidity (%)	Mean wind speed(Km/hour)
January	12.7	89.6	69	5.8
February	17.3	249.7	65	6.1
March	21	12.8	63	6.6
April	23.5	.1	60	6.0
May	27.1	0.0	53	6.7
Jun	29.9	0.0	55	7.1
July	30.8	0.0	70	8.0
August	33.5	0.0	68	6.2
September	30.6	0.0	70	6.2
October	29.2	5.3	55	5.4
November	26.7	0.0	46	3.8
December	14.1	151.1	55	6.8
Annual mean	24.7	508.6	61	6.2

Table 4.1: climate characteristic of Nablus city (Palestinian Statistics, 2010)

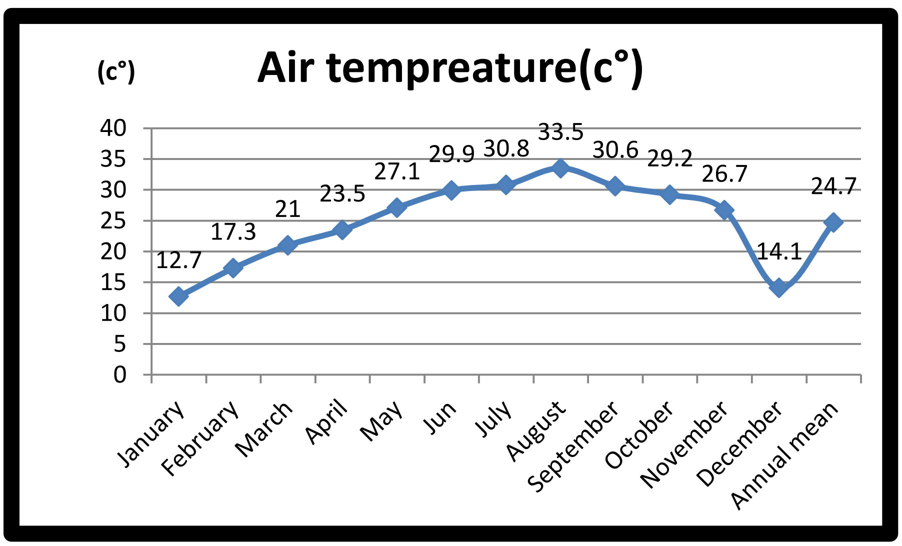


Figure 4.10: air temperature for each month

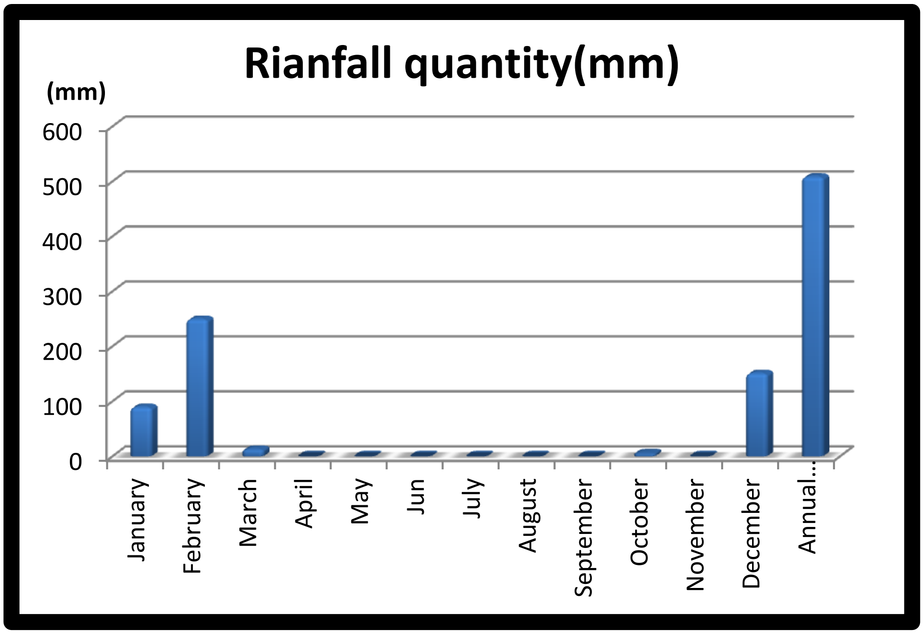


Figure 4.11: rainfall quantity for each month

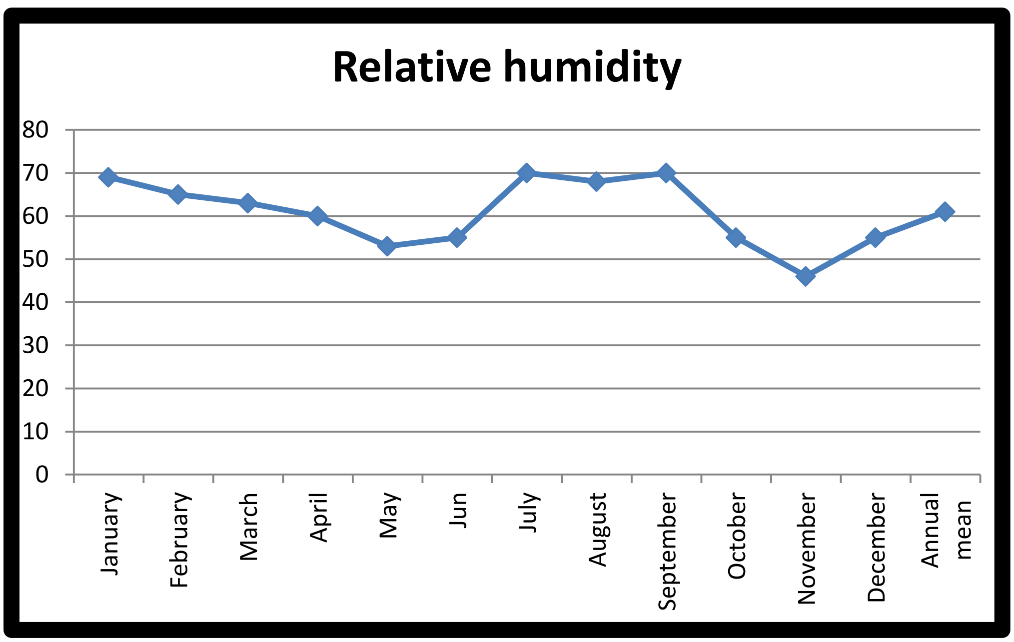


Figure 4.12: relative humidity for each month

As for the direction of the prevailing winds in Sebastia, it north, south, south-eastern and western winds associated with in the winter, while the wind blows the northern and north-western in the summer air of the highlands and the anuual mean speed is 6.2 Km/hours

The following figure will shows the wind speed at different month on year

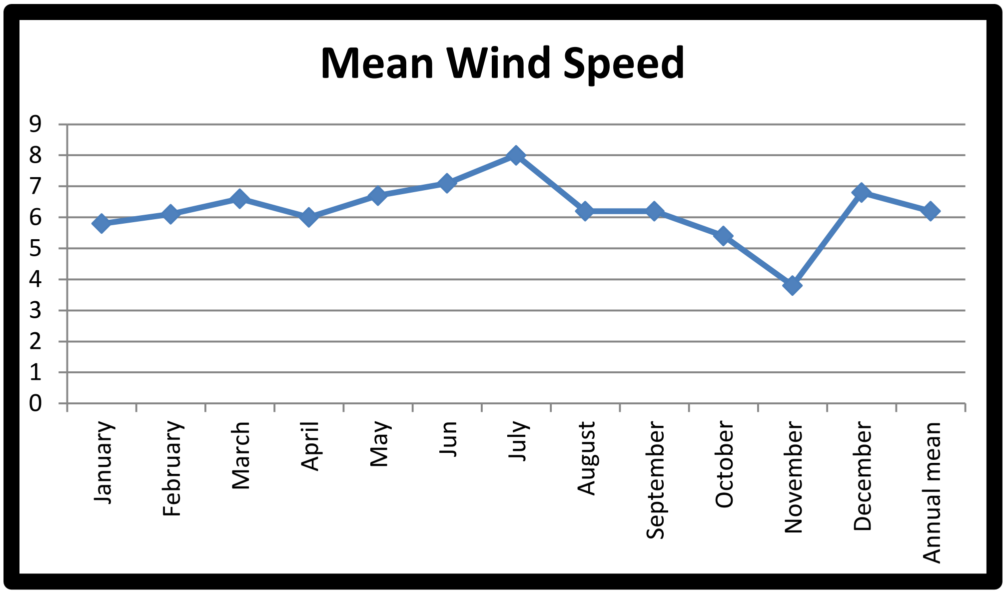


Figure 4.13: main wind speed for each month

4.4 Environmental analysis:

The solar study, prevailing wind, noise level, site circulation, parking demand all of this item will be illustrated in this section

4.4.1 Analysis of the Sun movement

The orientation of the site plays a very important role in sitting of the building. This, when combined with the wind direction and Sun path, would give a good idea as to how the building should be oriented.

To make best use of the Sun and the wind site were analyzed via revit for summer and winter solstice at three times different.

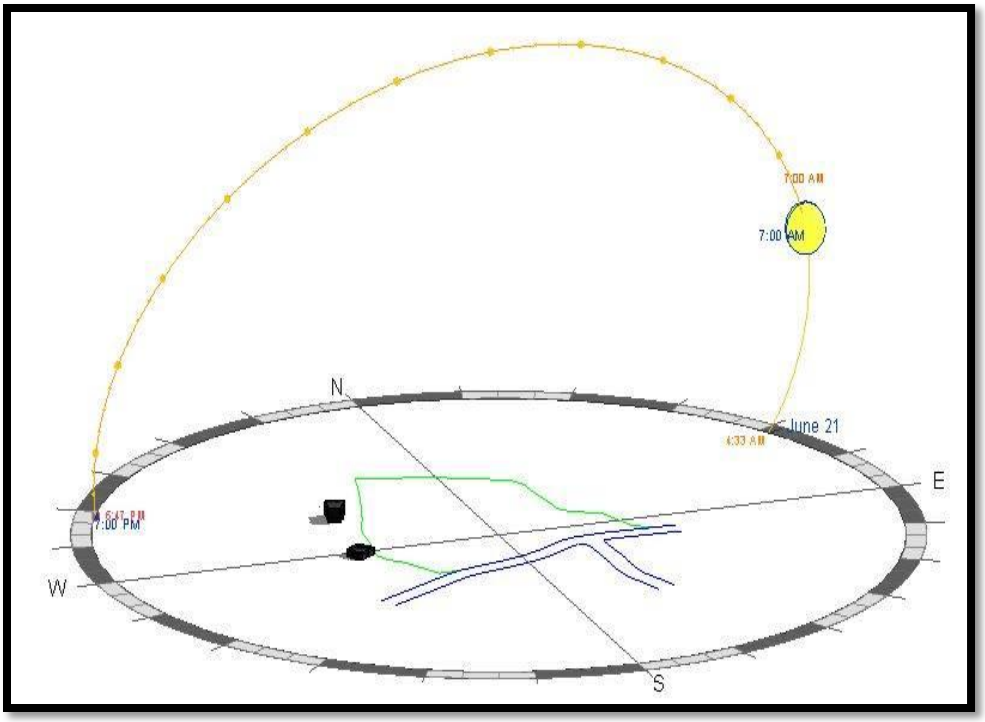


Figure 4.14: Shadow due to the surrounding at 7:00am- June

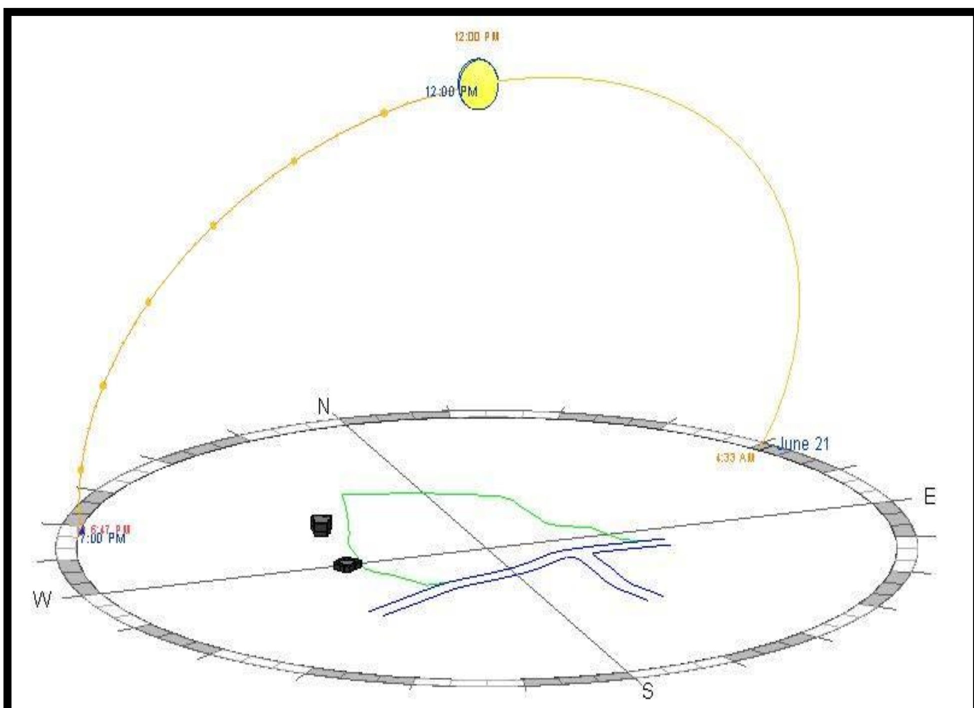


Figure 4.15: Shadow due to the surrounding at 12:00pm- June

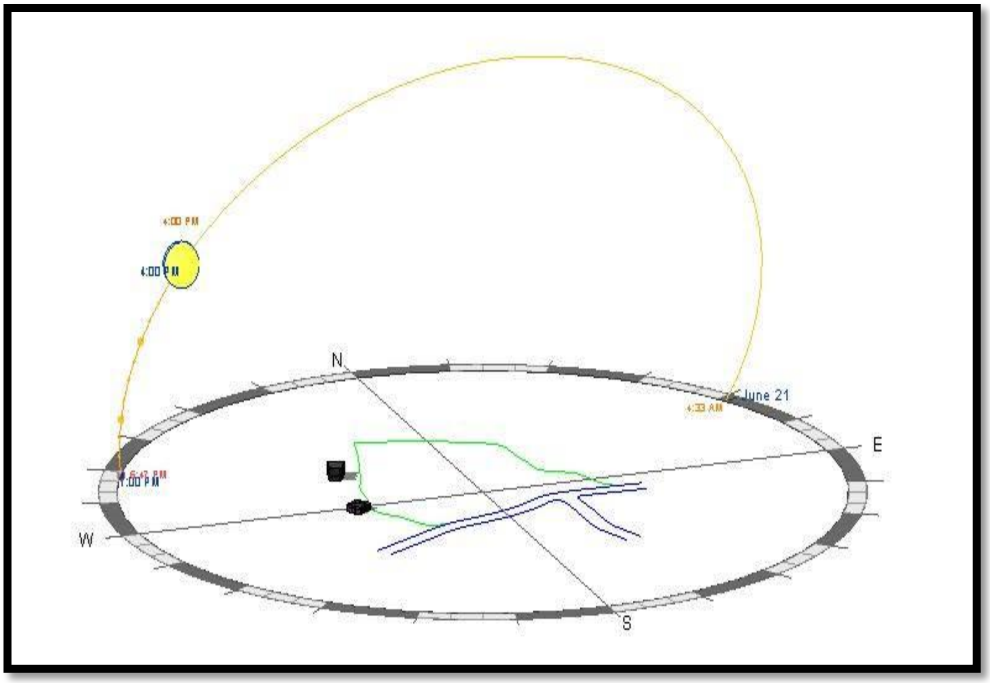


Figure 4.16: Shadow due to the surrounding at 4:00pm- June

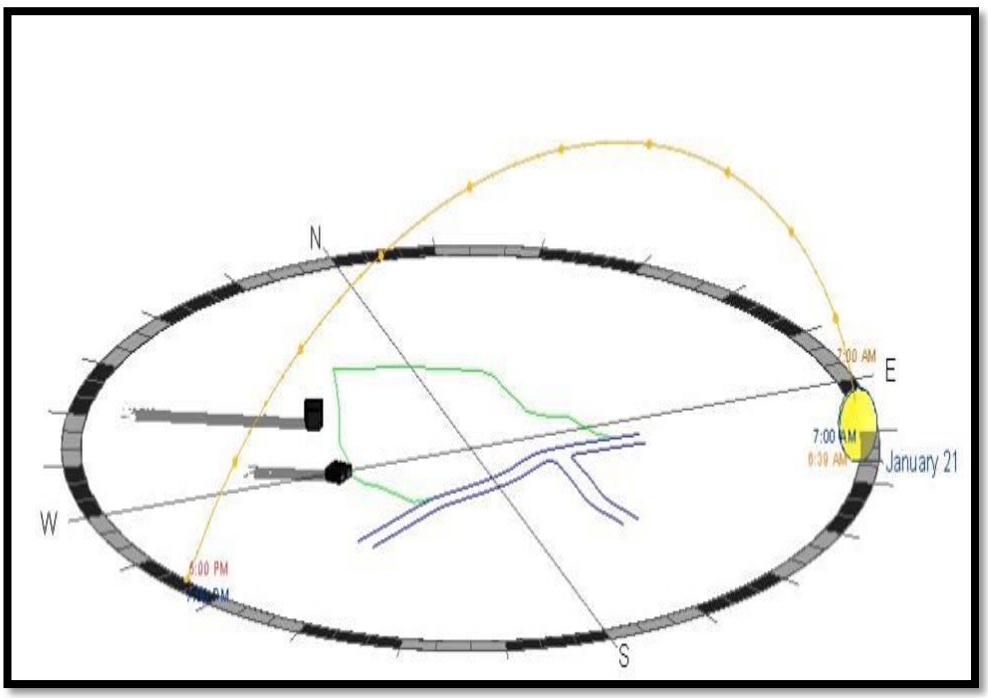


Figure 4.17: Shadow due to the surrounding at 7:00am- January

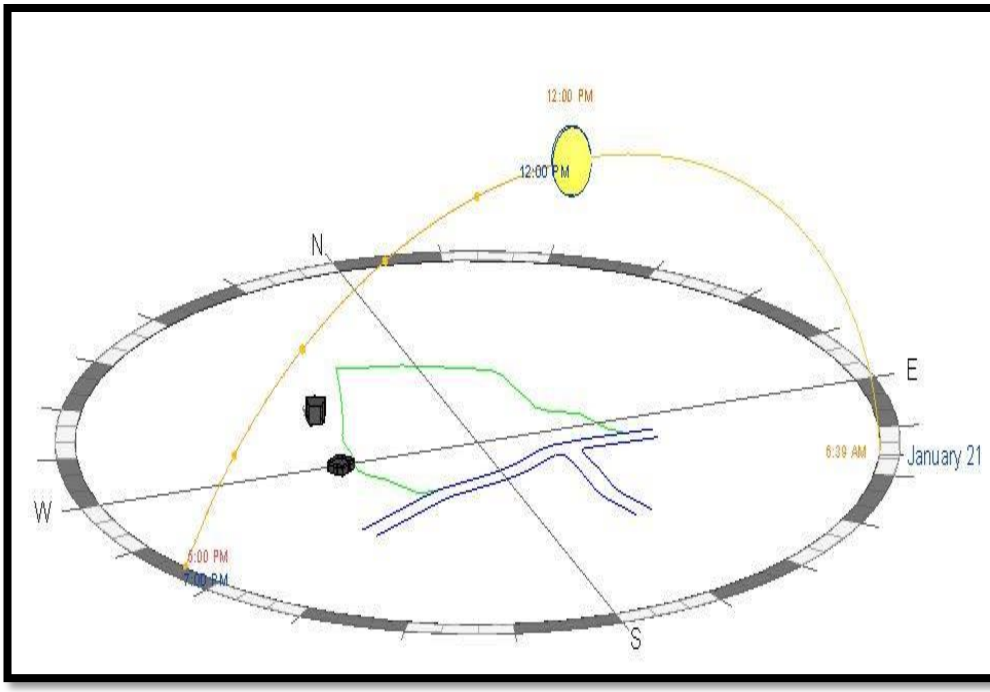


Figure 4.18: Shadow due to the surrounding at 12:00pm- January

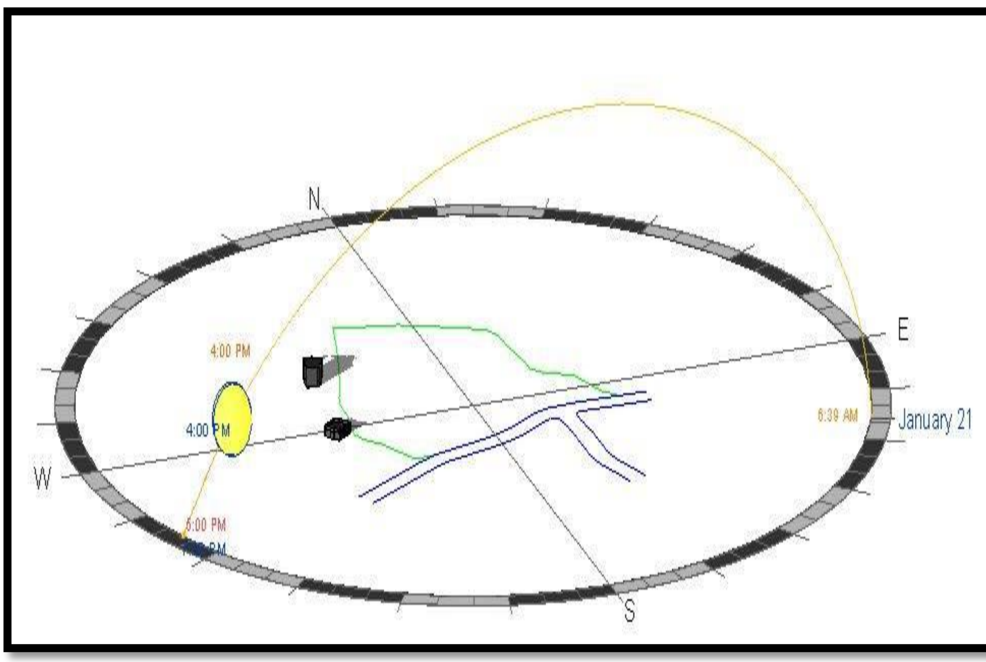


Figure 4.19: Shadow due to the surrounding at 4.00pm- January

4.4.2 Analysis of the noise level

A field campaign was carried out at three different times of the day to evaluate the noise level at the site due to surrounding streets and built environment. Figure illustrate the measured values.

In addition, the average noise was calculated and finally we find the site is very quiet and if we orient the hotel to any direction it will be good

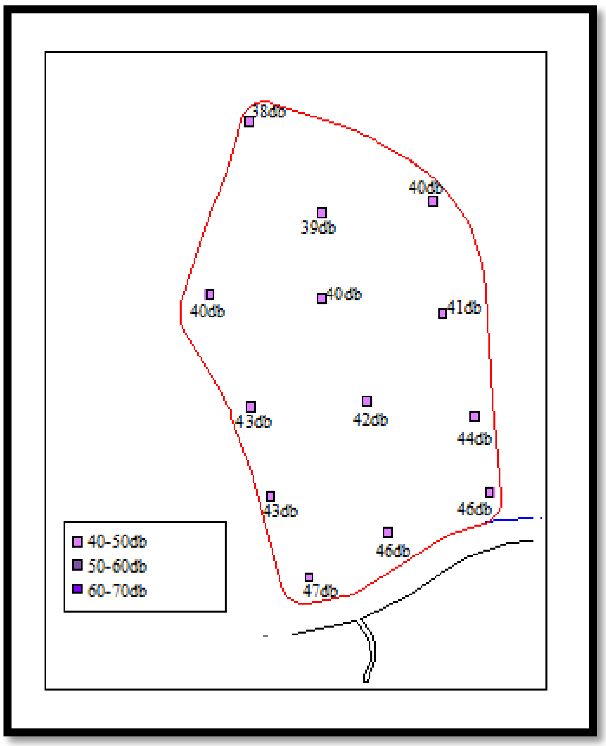


Figure 4.20: Noise level at 8.00am.

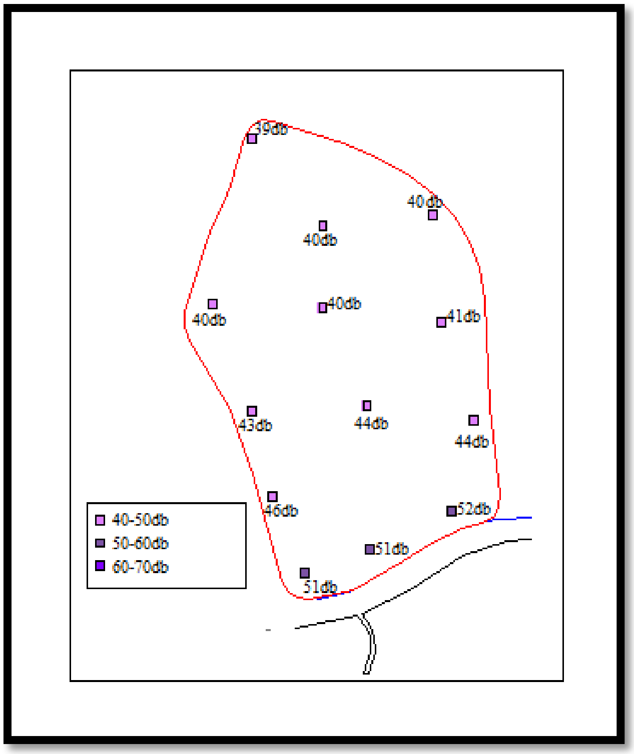


Figure 4.21: Noise level at 12.00pm.

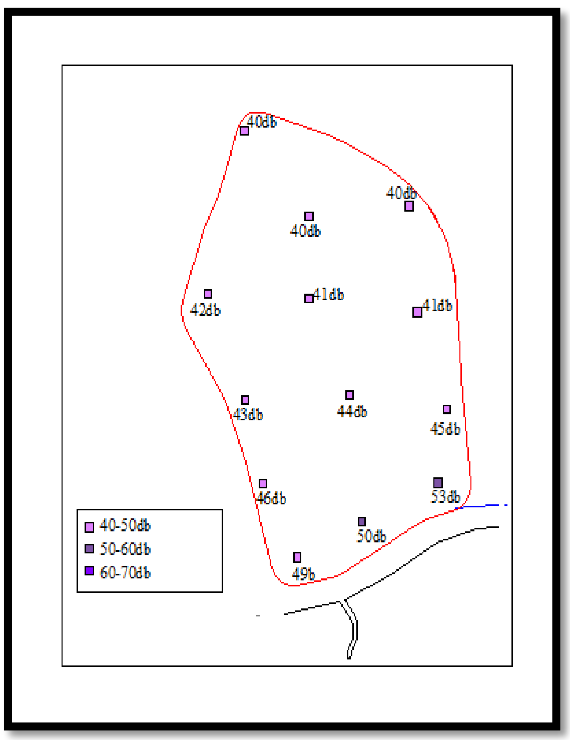


Figure 4.22: Noise level at 4.00pm.

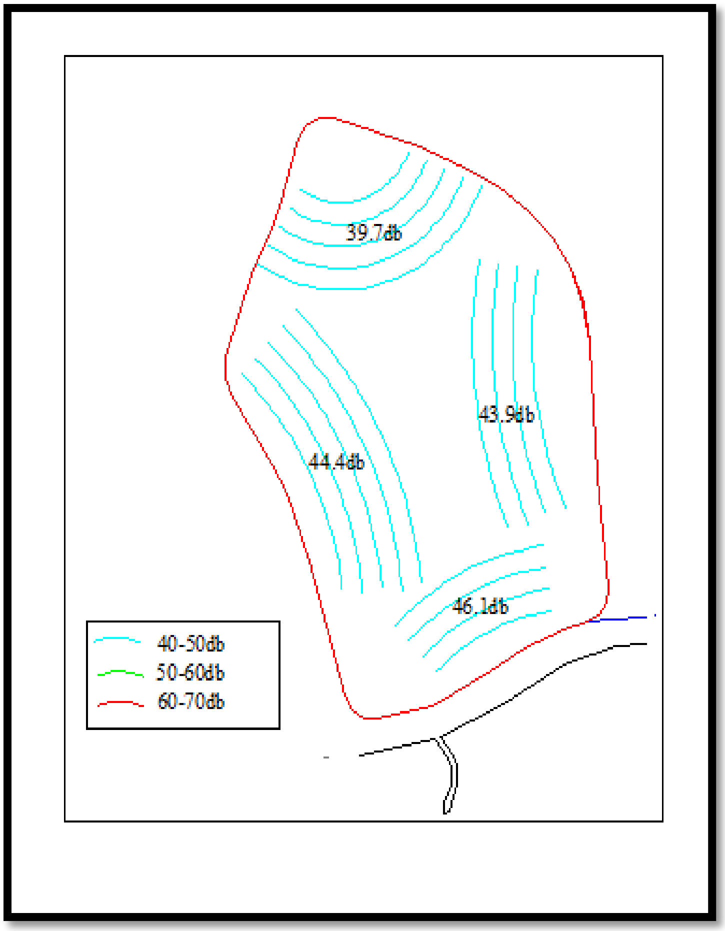


Figure 4.23: Average value of noise level.

In conclusion, the area is very quite thus noise ranges between (39-46)db which is perfect

4.4.3 Analysis of parking :

Most hotels combine at least three separate uses that require on-site parking:

1. guest room parking,
2. restaurant and lounge parking,
3. Meeting/conference and banquet facility.

Because the demand for each of these uses peaks at different times of the day, total parking space demand should not be calculated by simply summing up the three peak parking demands. Also, multiple sources indicate that demand for hotel guest room parking peaks between 10 p.m. and 6 a.m. In contrast, restaurant and lounge parking demand peaks between 7 p.m. and 10 p.m.

and . Finally, meeting rooms typically bring about peak parking demand between 9 a.m. and 9 p.m.

Based on American architect institute parking ratio in the range of 1.0 to 1.2 is typically adequate for a good-quality, full-service luxury hotel. However, appraisers should be aware of the variables that influence parking demand and how it is estimated. A hotel is a complex mixed-use facility, with multiple parking demands peaking at different times during the day. In some cases, it is possible to examine occupancy and various categories of revenues for additional indicators of parking inadequacies. [60]

4.5 Structural analysis:

Often, the color of the soil is the first property distinctive and that can be observed. Especially distinctive colors and contrasting shapes of fractions. For example, the white soil called lime soil and the allowable bearing capacity for this type of soil ranges between (250-300) KN/m^2

Chapter Five

Future work

5 Future work:

Achieving the research objectives set forth as part of this project requires the completion of six tasks include:

- Architectural redesign.
- Structural design for all facilities in the project.
- Environmental design.
- Mechanical design.
- Electrical design.
- Safety design.
- Cost estimation.

5.1 Architectural design:

The architectural drawing of the hotel will be redesign to satisfy environmental, safety, and functionality requirements. Based on the advisory committee suggestions, the architectural drawing will be made for the hotel in the second semester.

5.2 Structural:

Several steps will be carried out in the structural design, namely:

- Making a 3D Sap model for the hotel.
- make dynamic seismic analysis for the hotel.
- Producing AutoCAD drawings for structural detailing.

5.3 Environmental:

- In environmental design will be taken into account ventilation including the fenestration and its location, lighting and obtaining the largest amount of natural light.
- Dialux & Ecotect programs will be used to give a clarification about the environmental design.

5.4 Mechanical:

The mechanical will be design for the hotel including the HVAC (heating and ventilation air conditioning) system design.

5.5 Electrical:

Electrical design will be applied for the whole hotel.

5.6 Safety design:

safety design will be applied for the whole hotel including: sprinkler system, emergency exit system, Emergency lights, Extinguishers, Smoke detectors, and Fire alarm.

5.7 Cost estimation:

Quantity surveying will be estimated for every all elements in the building and cost of the building will be estimated.

The whole work will be divided in the Second Semester as given in the Bar chart shown below:

Task	**2**	**4**	**6**	**8**	**10**	**12**	**14**	**16**
Architectural								
Structural								
Mechanical								
Electrical								
Public safety								
Cost estimate								
Writing								

Table 5.1: future work schedule

References:

1. *scholar.najah.eduOctober,2,2013*
2. *www.usingenglish.com October.2,2013*
3. *www.merriam-webster.comOctober,5,2013*
4. *www.ask.comoctober,7,2013*
5. *wiki.answers.comoctober,7,2013*
6. *www.sef.ps October, 9,2013*
7. *Research Department of the Caribbean Tourism Organization,2002, Summary of articles and Information on Hotel Classification System*
8. *www.failteireland.ie October.9,2013*
9. *www.Mai-bs.com October,10,2013*
10. *www.sustainable-buildings.org October,9,2013*
11. *www.energysavers.gov October,10,2013*
12. *Joseph A. Ahearn, Major General, passive solar design hand book*
13. *www.nrel.gov October,17,2013*
14. *www.mnre.govOctober,20,2013*
15. *www.pdhsite.com October,22,2013*
16. *www.builditsolar.com October,28,2013*
17. *http://bookstore.teriin.orgOctober,30,2013*
18. *www.esru.strath.com October,15,2013*
19. *www.solarpanelsplus.comOctober,29,2013*
20. *www.arch.ced.berkeley.eduOctober,28,2013*
21. *LawsonFred,1980,Hotels,Motelsand Condominiums:Design,Planning and Maintenance,*
    1st ed. USA.
22. *www.wikipedia.org November,1,2013*
23. *www.seekingalpha.com November,3,2013*
24. *ArikanMustfa,2012,interior archtiture,msc,eastern Mediterranean university*
25. *www.pioneerlighting.comNovember,5,2013*
26. *www.osram.com October,28,2013*

27. *www.itechconference.comNovember,4,2013*
28. *Groundzik, W, B Stein, J Reyenolds, and G Kwork. Mechanical and electrical equipment for building. 2008.*
29. *www.lrc.rpi.edu November,7,2013*
30. *www.gib.com November,10,2013*
31. *www.acoustics.com November,17,2013*
32. *www.paroc.comNovember,9,2013*
33. *Groundzik, W, B Stein, J Reyenolds, and G Kwork. Mechanical and electrical equipment for building. 2010.*
34. *www.hotelenrgysolutions.net November,8,2014*
35. *Kalinina Anna ,2011, Mechanical ventilation systems in swimming pools ,Bsc*
36. *encyclopedia2.thefreedictionary.comNovember,10,2014*
37. *www.scienceray.comNovember,12,2013*
38. *Jean-Pierre Jacobs, 2007*
39. *DAS, 1983,Principles of Foundation Engineering,7th ed*
40. *U.S. Department of the Army (1999). Concrete, Masonry and Brickwork. General Publishing Company.*
41. *(Nilson, Darwin,dalon,2004, Design of Concrete Structures*
42. *Vishal Saxena,2003)*
43. *www.pdhonline.orgOctobar,25,2013*
44. *www.gyprock.comOctober,27,2013*
45. *Los Alamos National Laboratory Sustainable Design Guide*
46. *Invensys Building Systems 1354 Clifford Avenue (61111) P.O. box 2940 Loves Park, Illinois 61132, U.S.A.*
47. *Carl Ian Grahm, High Performance HVAC, June 2009, WBDG" a program of the National Institute of Building Science*
48. *www.Physicsclassroom.com November,21,2013*
49. *Cooling Systems, September 2011, US Department of Energy "Energy Efficient Renewable Energy and*
50. *V I T A L S I G N S C U R R I C U L U M M A T E R I A L S P R O J E C T . HVAC COMPONENTS AND SYSTEMS*

51. R. Wulfinghoff, Service Water System, Energy Efficiency Manual

52. www.ebookbrowsee.net October,28,2013

53. www.fehd.gov November,1,2013

54. www.emu.eduNovember,5,2013

55. www.iklimnet.comNovember,12,2013

56. Neufert E. Bauentwurfsleher. Germany: Lockwood, 1970.

57. Architectural Design and Theory 1 May 2010 By: Eng Rinbo

58. www. travelpalestine.ps,November,26,2013

59. www.pcbs.gov.ps November,20,2013

60. www.aia.orgNovember,28,2013