Salahaddin University
College of Engineering
Architecture Department

GREEN BUILDING RESEARCH

Hawler Typical Secondary School

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Introduction:

In the Modern World of nowadays, Architecture is moving forward towards more Sustainability in Design to fulfill Human Needs and to provide Aesthetics , Human Comfort and Eco Friendly Building as well.

In order to understand the Principles of Green Building and Sustainability of an Architectural Piece, we made a Research on a School in Erbil (Hawler Typical Secondary School).
Data has been collected in detail, then they are analyzed based on Energy, Water and Material Conservation as well as the Site, Natural Preservation and the design for human comfort.

After all that, results are achieved and rating for Building is done based on Sustainability Design Factors.

CHAPTER ONE

DATA COLLECTION

1.1 Introduction:

Hawler Typical Secondary School is a 18 Class Secondary School Building that has two Times of Study (Mornings which is Governmental and for Free) and (Afternoon) which is Private Study (Parallel System) and students have to pay for their Study.

Main Entrance

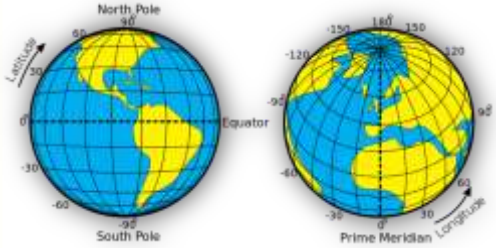
Front View

Entrance

Panoramic View (Front)

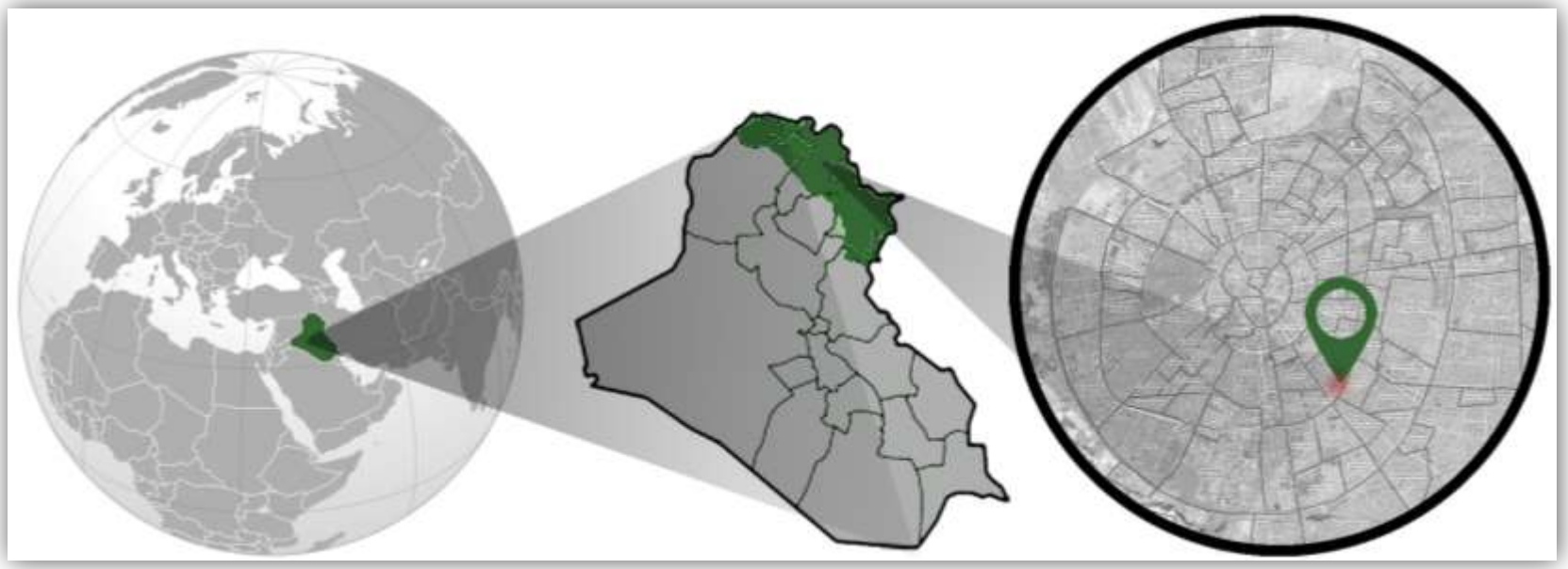
1.2 Location:

Hawler Typical Secondary School is located in Erbil City , on 40m Road, near to Fulka Zra3a and in front of (Mufti) Quarter.



Latitude: 36° 10.121’ North
Longitude: 044° 02.031’ East

Location on Map:



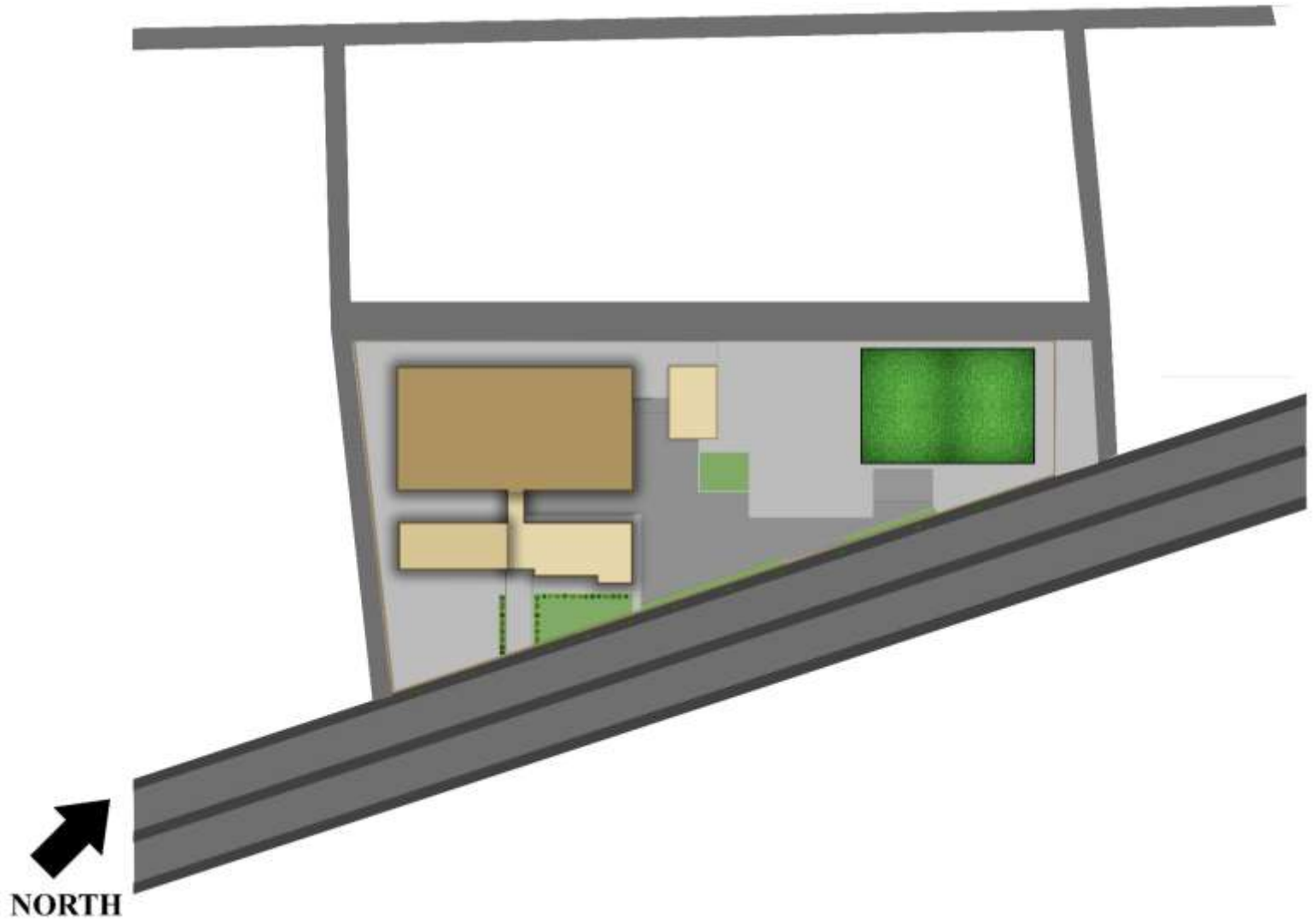
Iraq Kurdistan Erbil (HTSS)

1.2 Site Location:

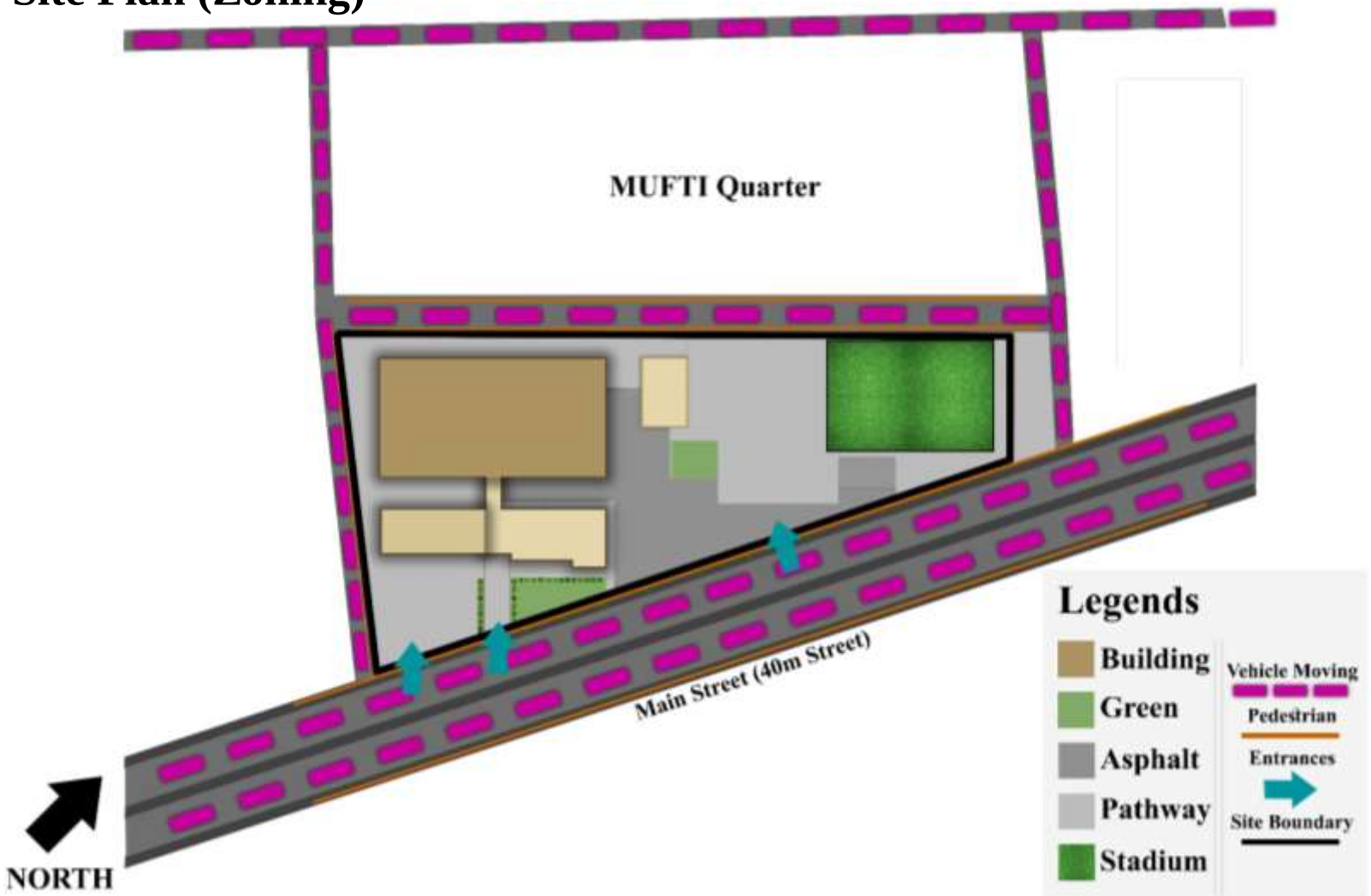
- Satellite Map
- Taken on: 24.Dec.2018
- Time:9:36 am

Site

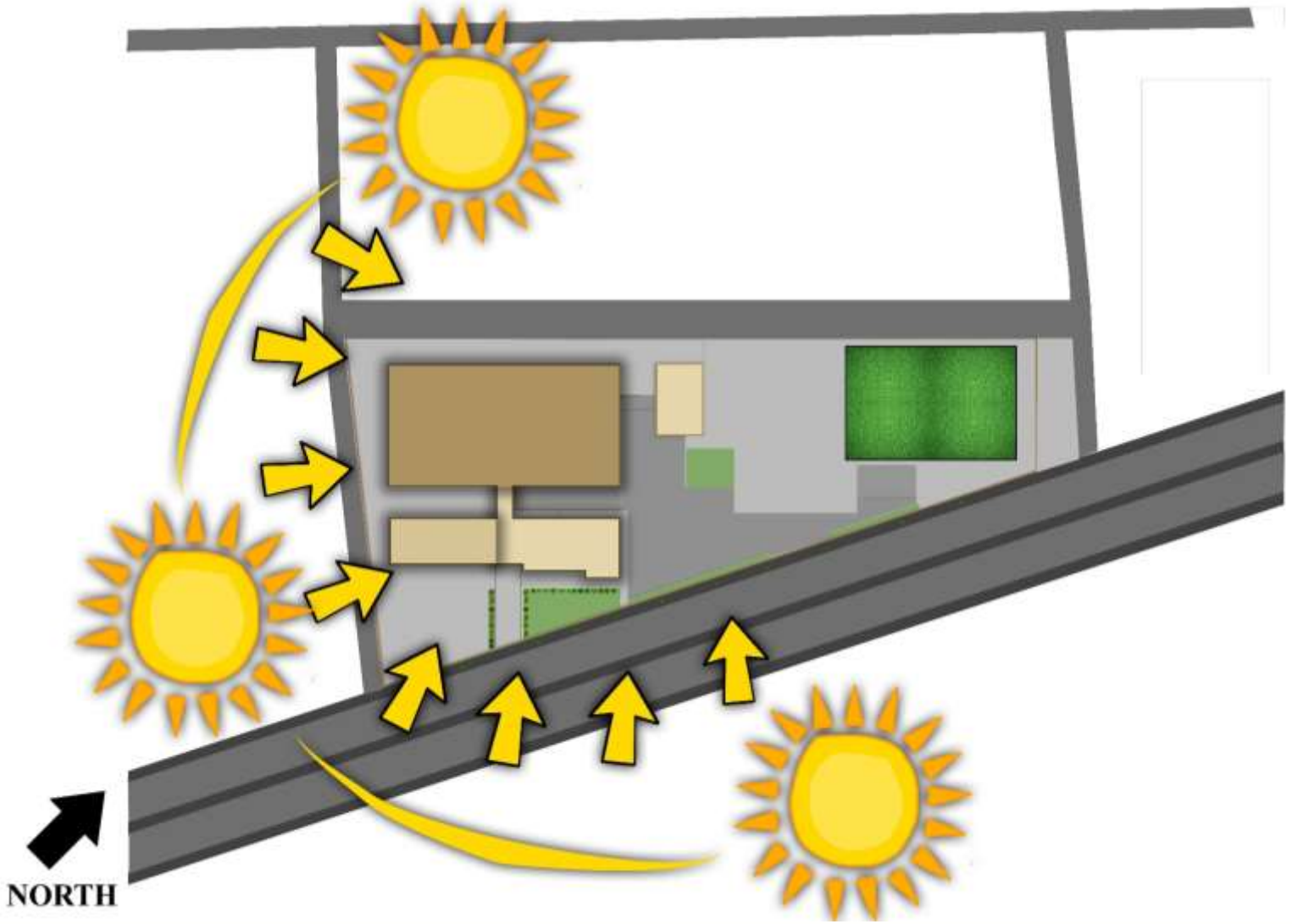
1.3 Site Plan (General)



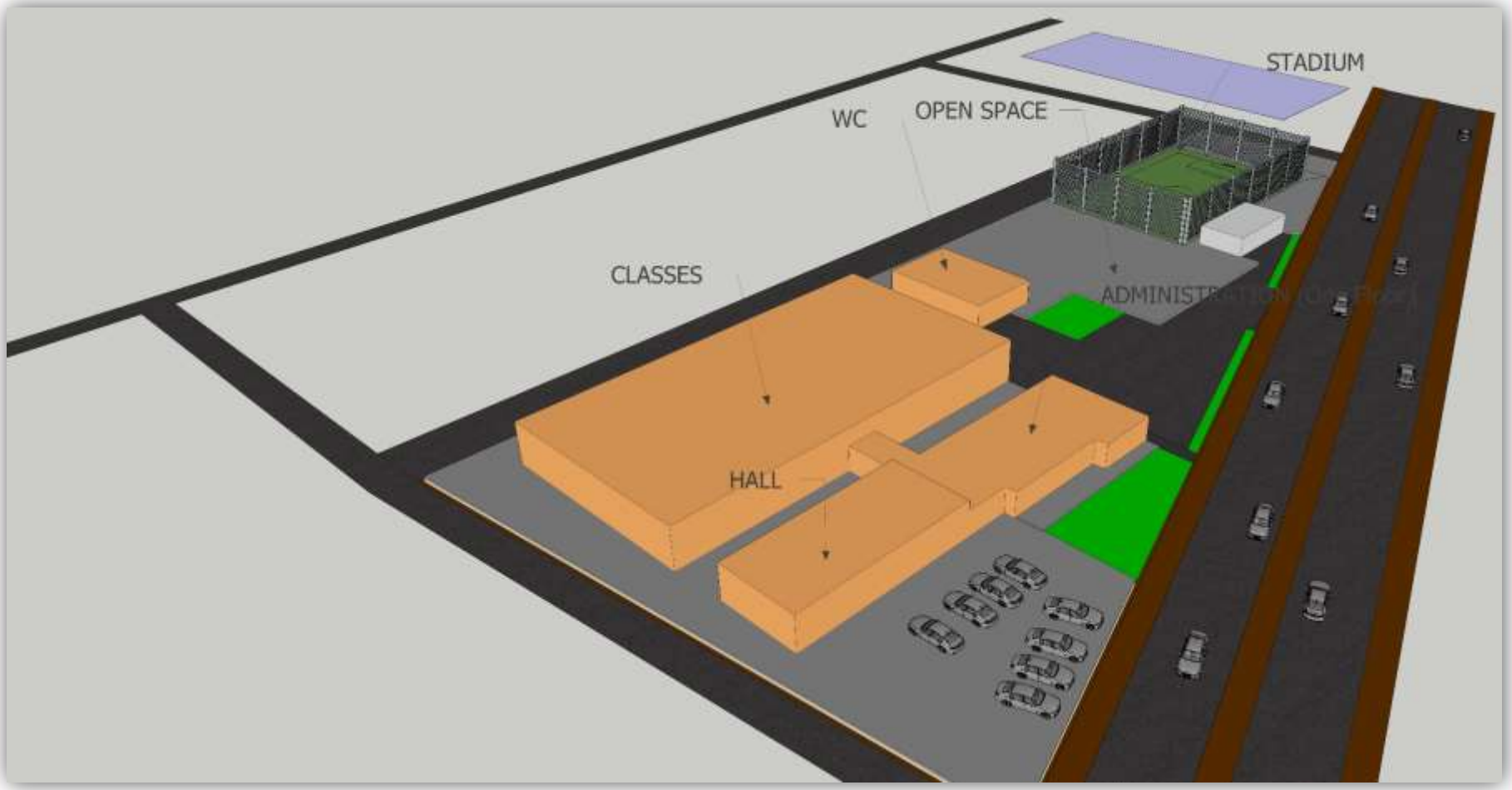
1.4 Site Plan (Zoning)



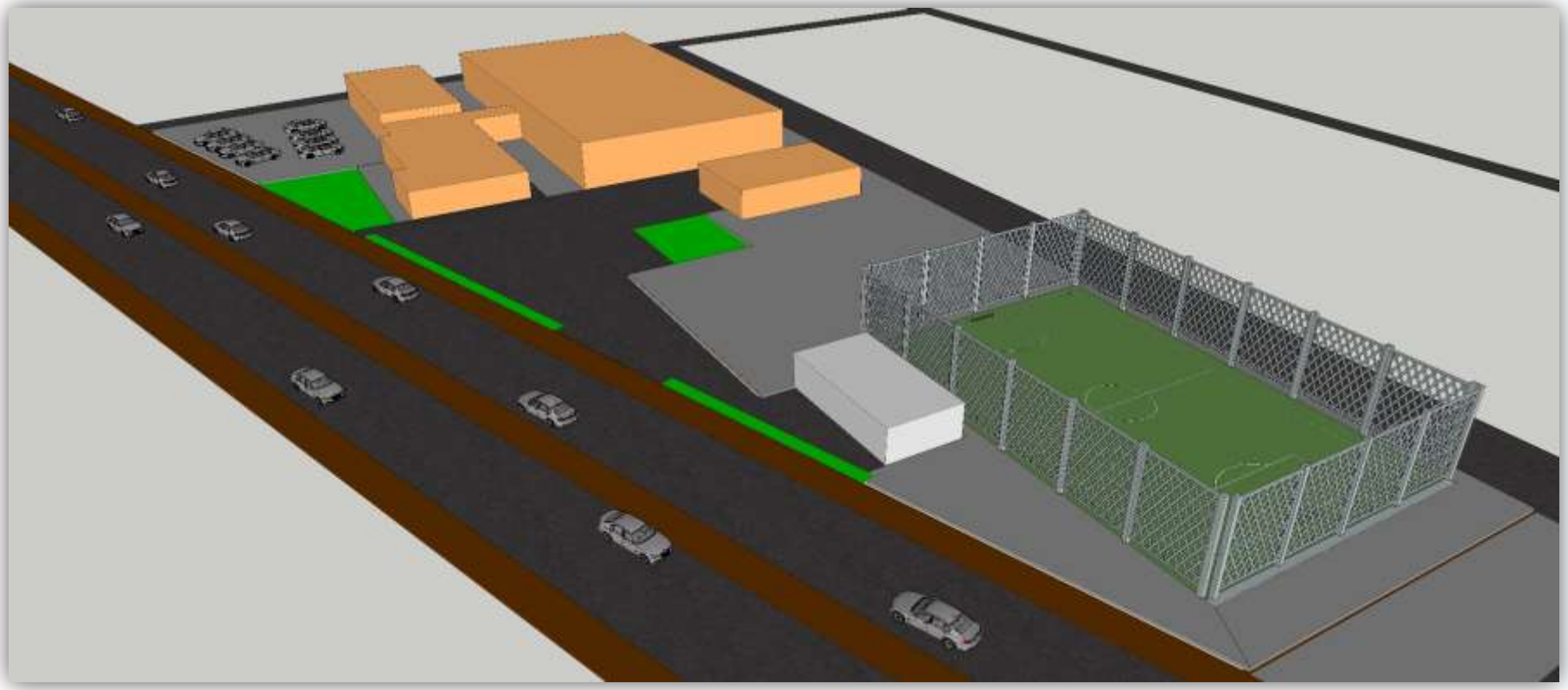
1.4 Site Plan (Sun Direction)



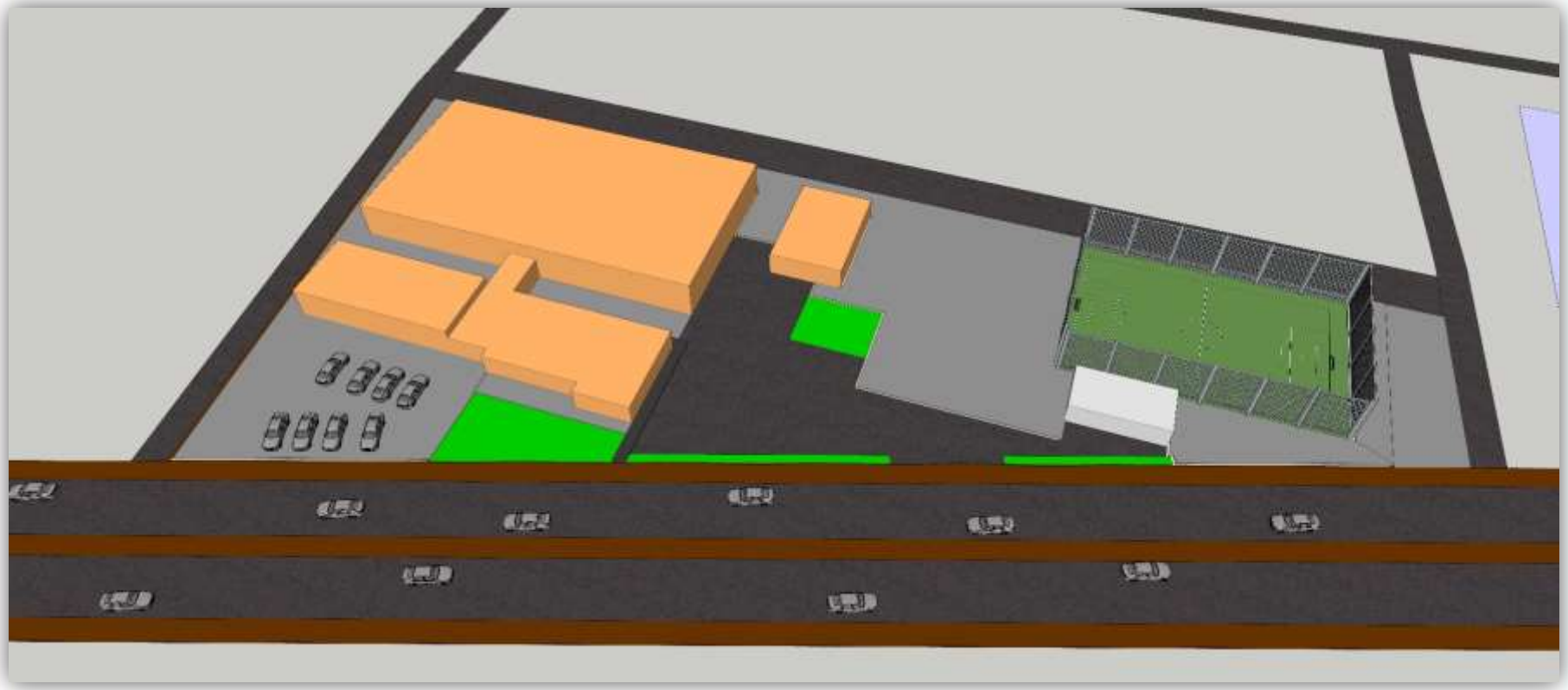
1.4 3D (Site Components)



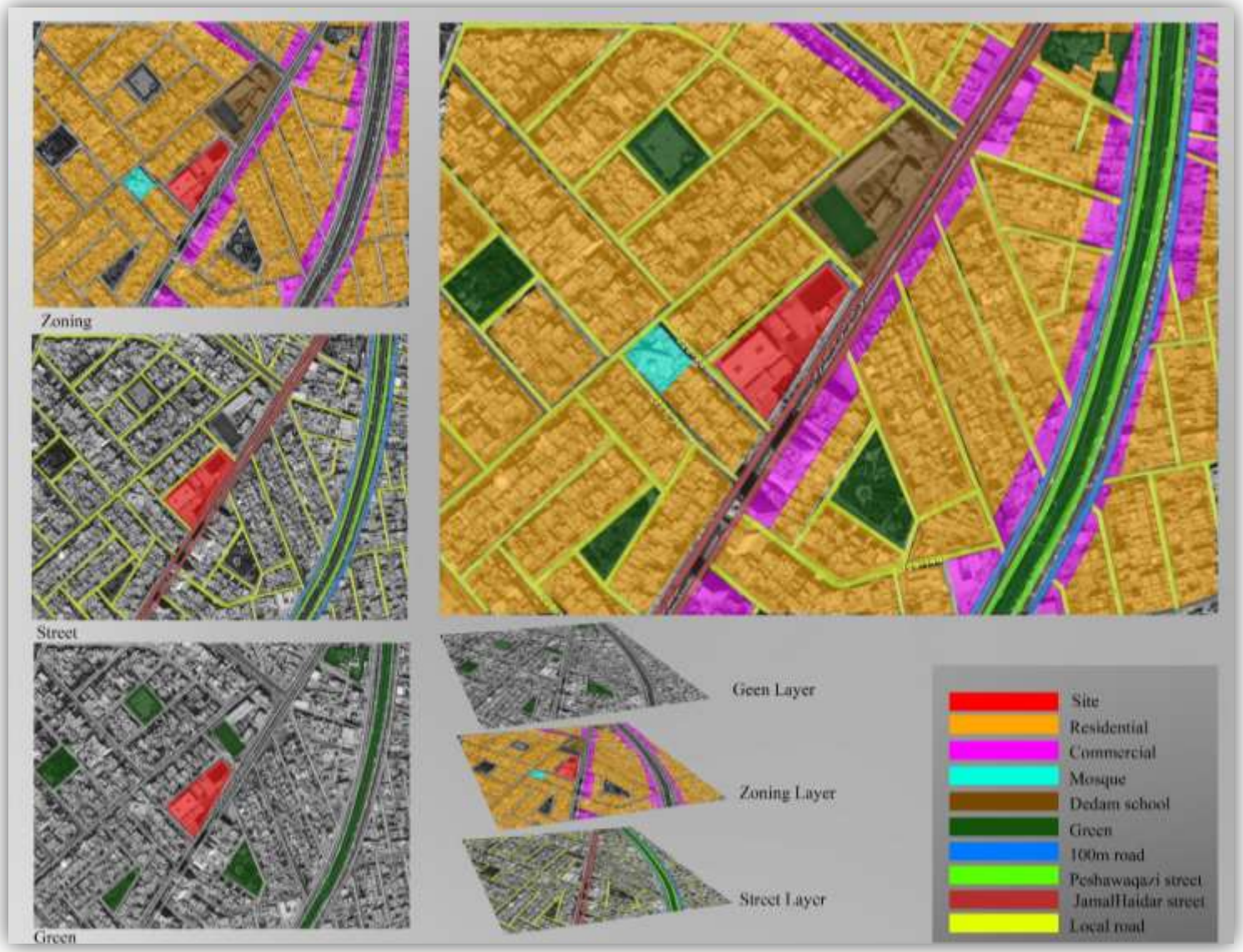
1.4 3D



1.4 3D

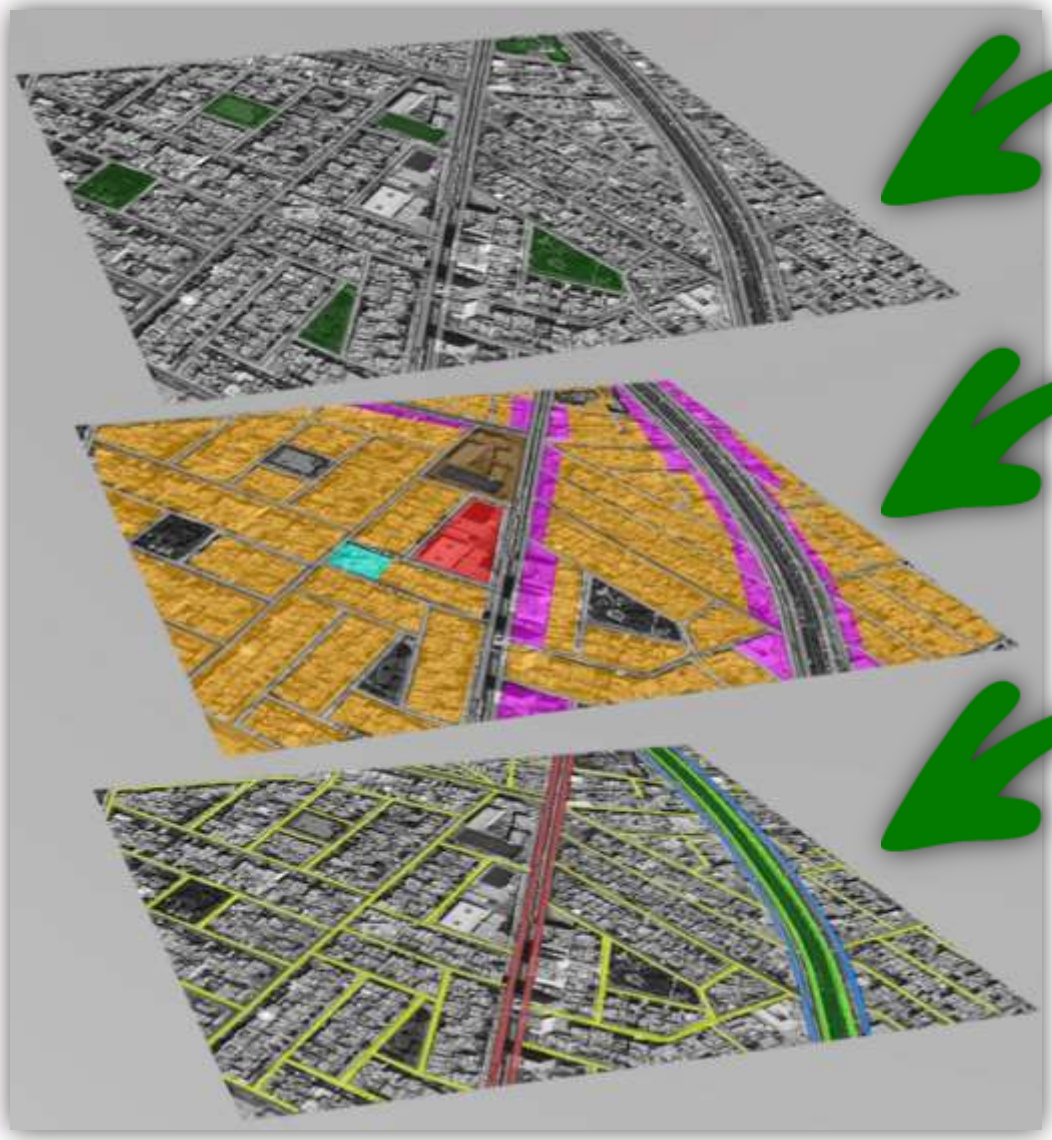


1.5 Site Urban Context



1.5 Site Urban Context

1.6 Layers of Site Surrounding Context



Green Layer

Zoning Layer

Street Layer

1.6 Site Surroundings - Photos

1.7 Site - Areas

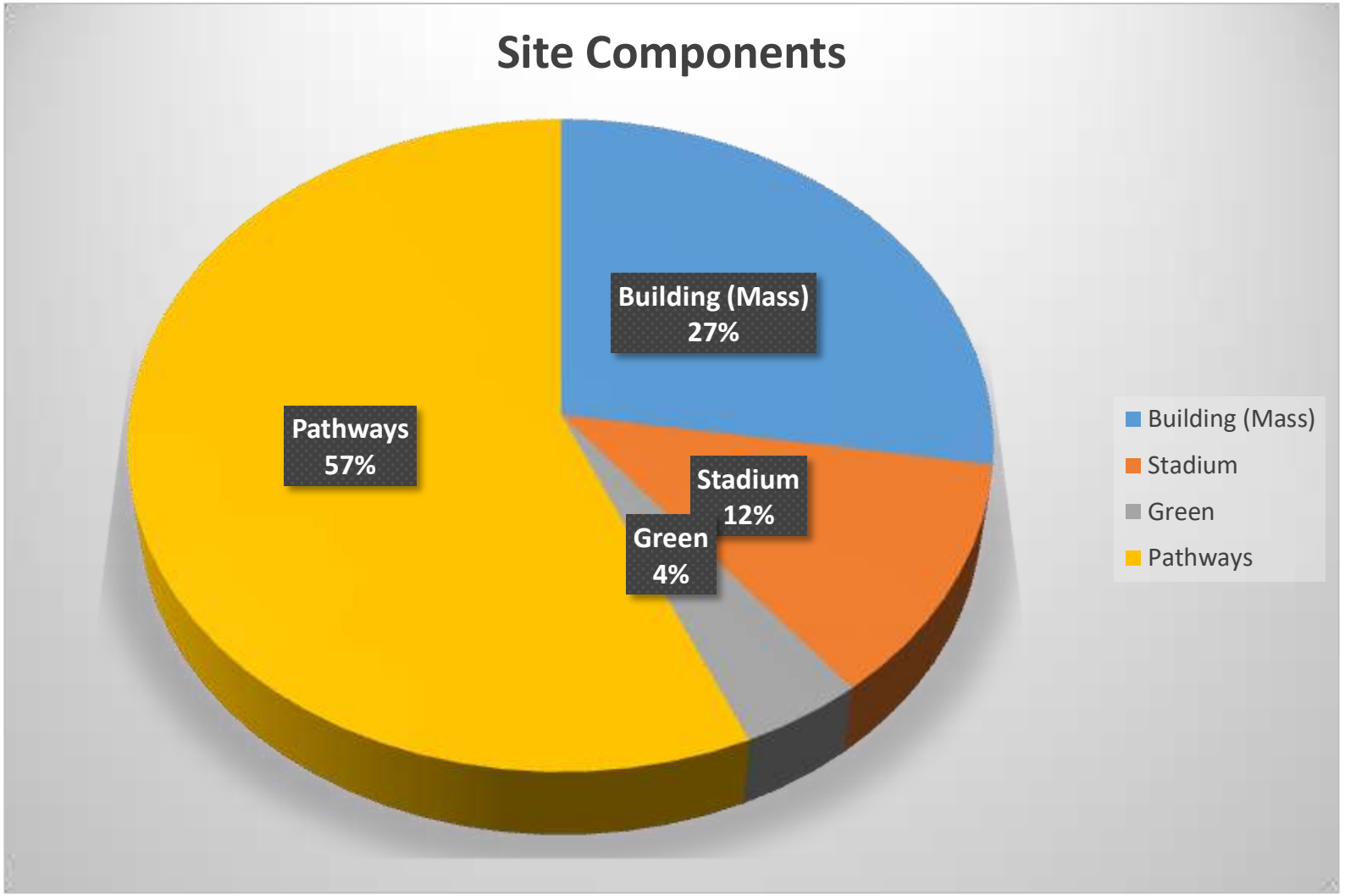
Total Site Area = **6879.58 sqm**

Site Component	Area (sqm)
Building (Mass)	1887.54
Stadium	815.29
Open Space (Green & Pathways) Green Pathways	 290.37 3886.38

Parking

Note: Part of the Pathway became Parking for the School, which is **355.72** sqm (Not Enough)

1.7 Site – Areas (Chart with Percentage)



School - Photos

Building

Green

Green

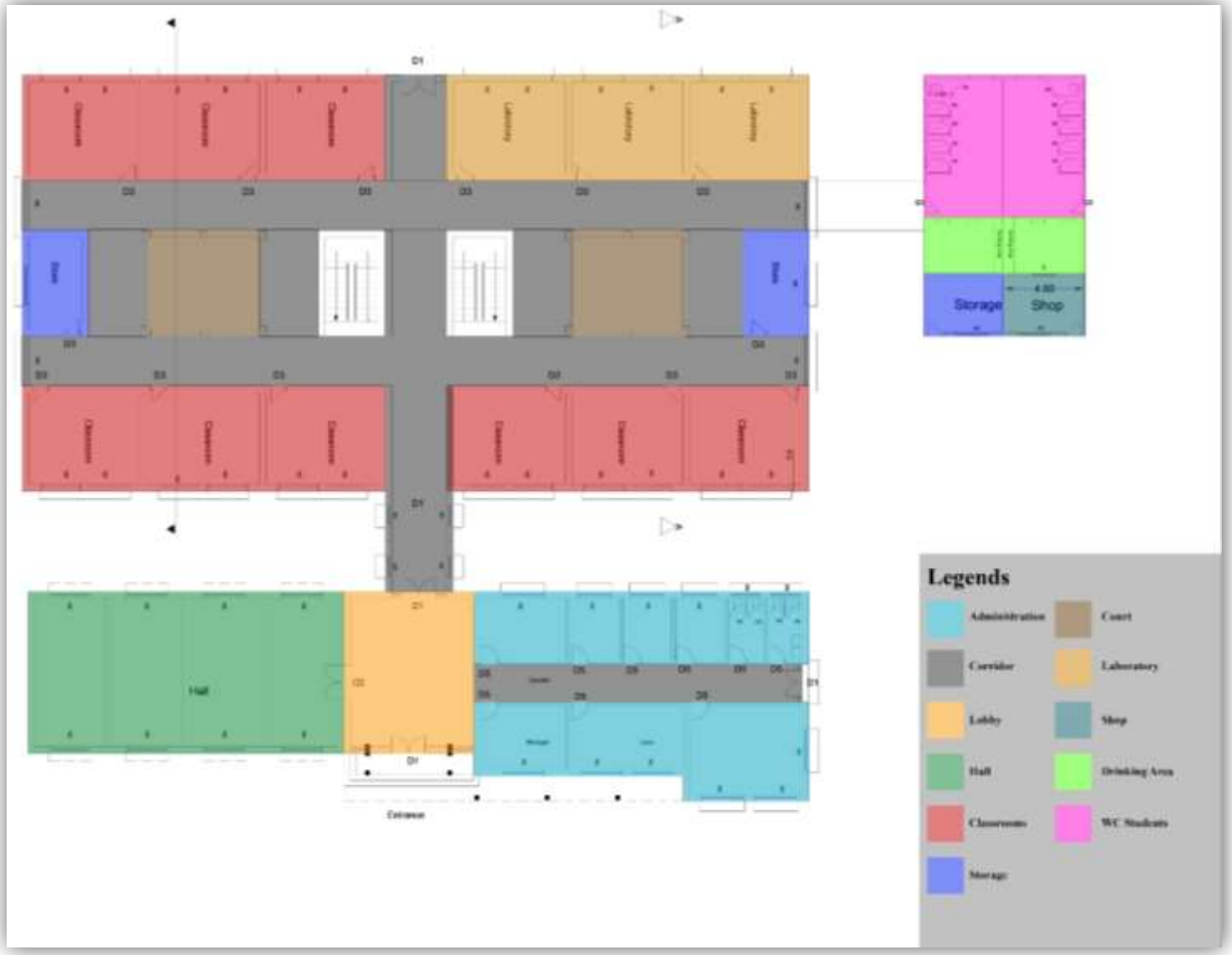
School - Photos

Stadium

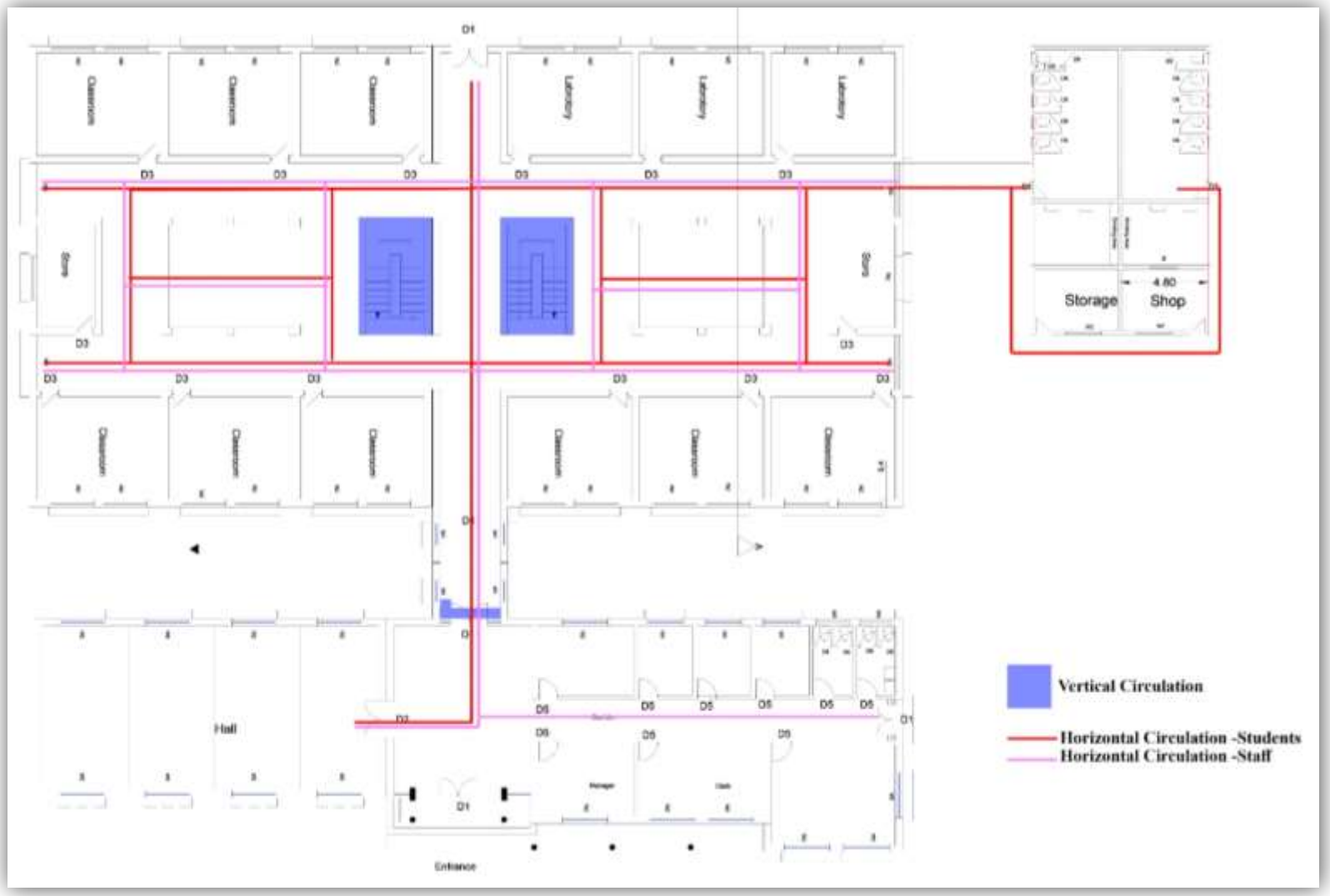
Parking

Parking

1.8 Ground Floor – Zoning Plan



1.8 Ground Floor – Circulation Plan



1.9 Ground Floor – Components and Areas

Component	Area (sqm)
Lobby	67.21
Hall	165.22
Teachers (Women)	20.51
Teachers (Men)	27.30
Headmaster	36.70
WC (Administration) WC (Administration)	8.36 7.98
Service	11.40
Archive	11.40
Headmaster Assistant	11.40
Headmaster Assistant	19.98
Classroom	38.08 * 9 = 342.72

1.9 Ground Floor – Components and Areas (Continued)

Component	Area (sqm)
Store	17.92 * 2 = 35.84
Laboratory	38.08 * 3 = 114.24
WC Students (Male)	37.72
WC Students (Female)	37.72
Drinking Area	15.64 * 2 = 31.28
Storage (Outside)	15.64
Shop (Outside)	15.64

Total Area of Components = **1018.26** sqm

1.9 Ground Floor – Circulation Area

Circulation Type	Area (sqm)
Horizontal Circulation	536.99
Vertical Circulation	38.40

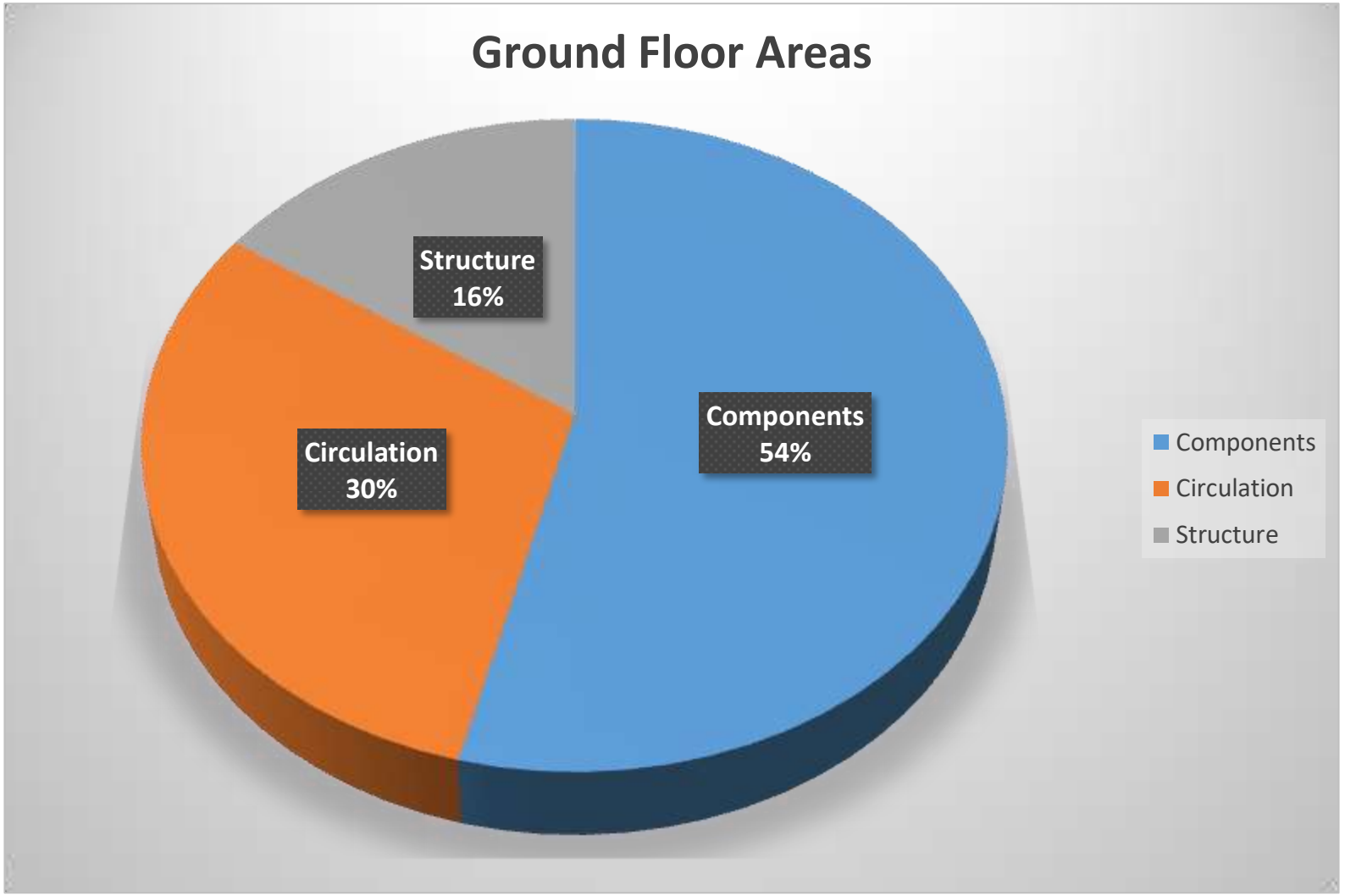
Total Area of Circulation = **575.39** sqm

Ground Floor – Structure Area

Structure	Area (sqm)
Overall Structure	293.89

Total Area of Ground Floor = (Component Area + Circulation Area + Structure Area)
Total Area of Ground Floor = (1018.26 + 575.39 + 293.89) = **1887.54** sqm

Ground Floor – Areas (Chart with Percentage)



1.10 First Floor – Zoning Plan

1.10 First Floor – Circulation Plan

First Floor – Components and Areas

Component	Area (sqm)
Classroom	38.08 * 9 = 342.72
Store	17.92 * 2 = 35.84
Art Room	38.08
Library	38.08
Computer Room	38.08

Total Area of Components = **492.80** sqm

First Floor – Circulation Area

Circulation Type	Area (sqm)
Horizontal Circulation	421.46
Vertical Circulation	38.40

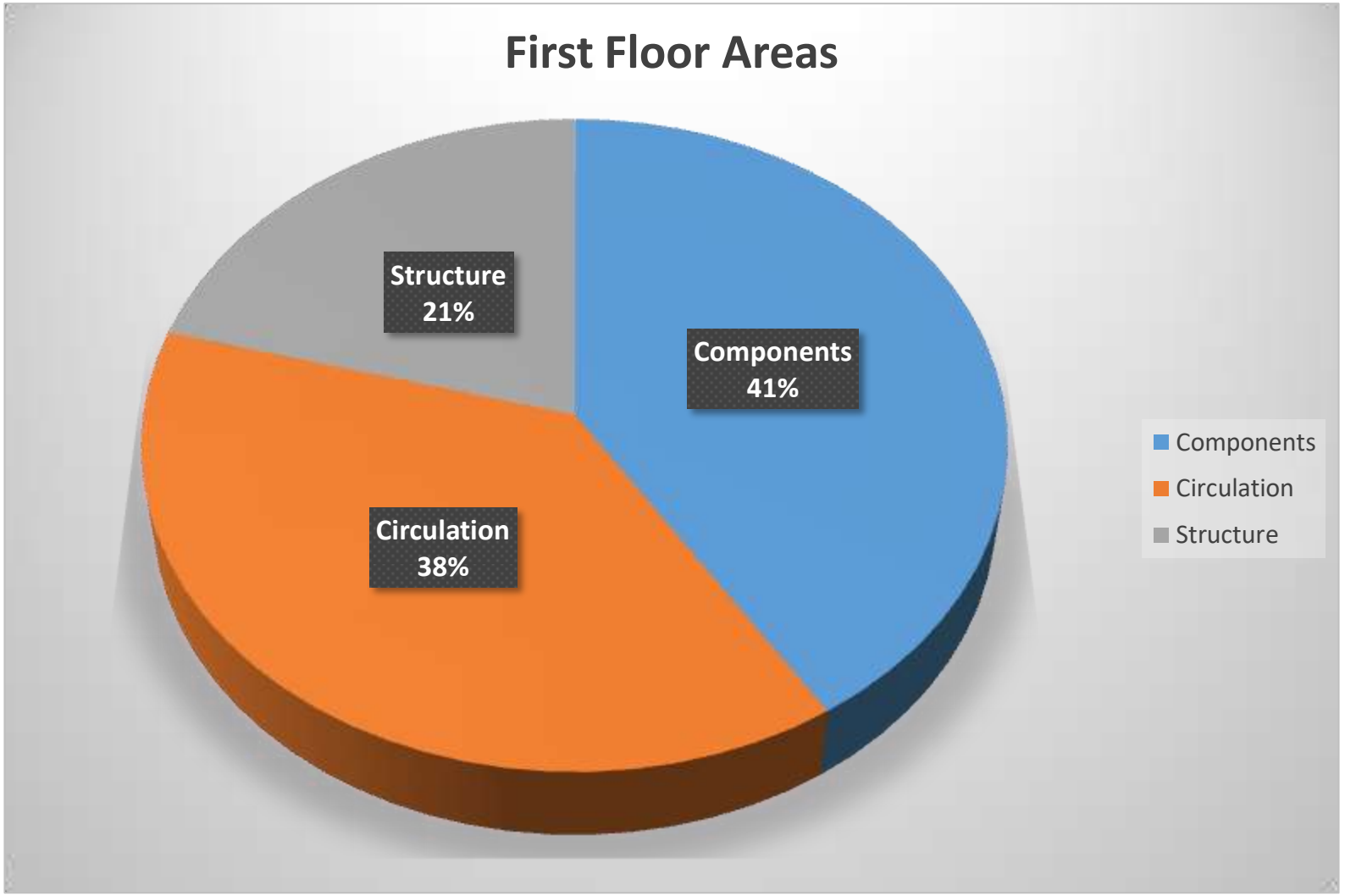
Total Area of Circulation = **459.86** sqm

First Floor – Structure Area

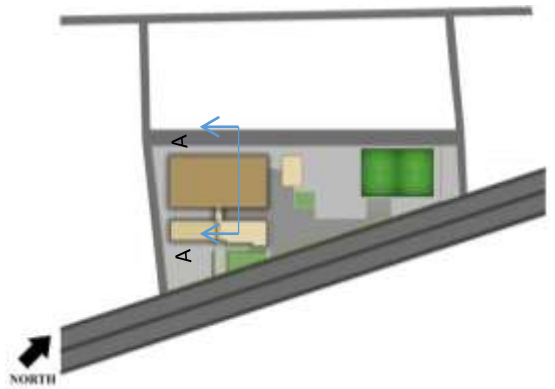
Structure	Area (sqm)
Overall Structure	250.64

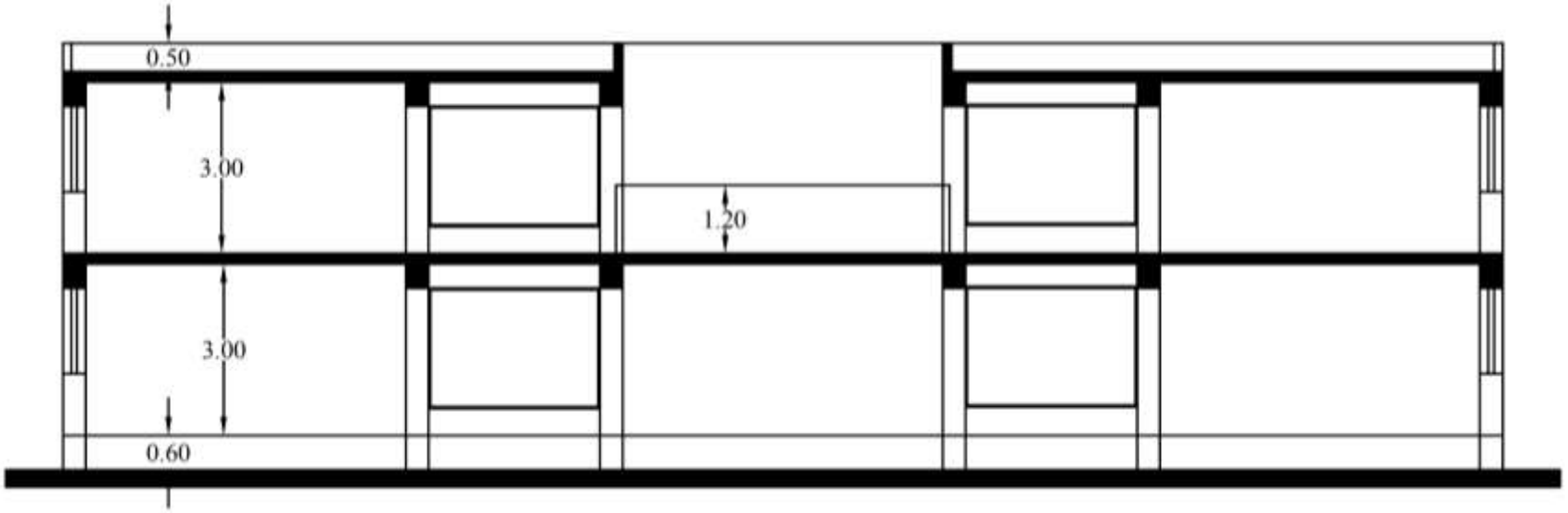
Total Area of First Floor = (Component Area + Circulation Area + Structure Area)
Total Area of First Floor = (492.80 + 459.86 + 250.64) = **1203.30** sqm

First Floor – Areas (Chart with Percentage)



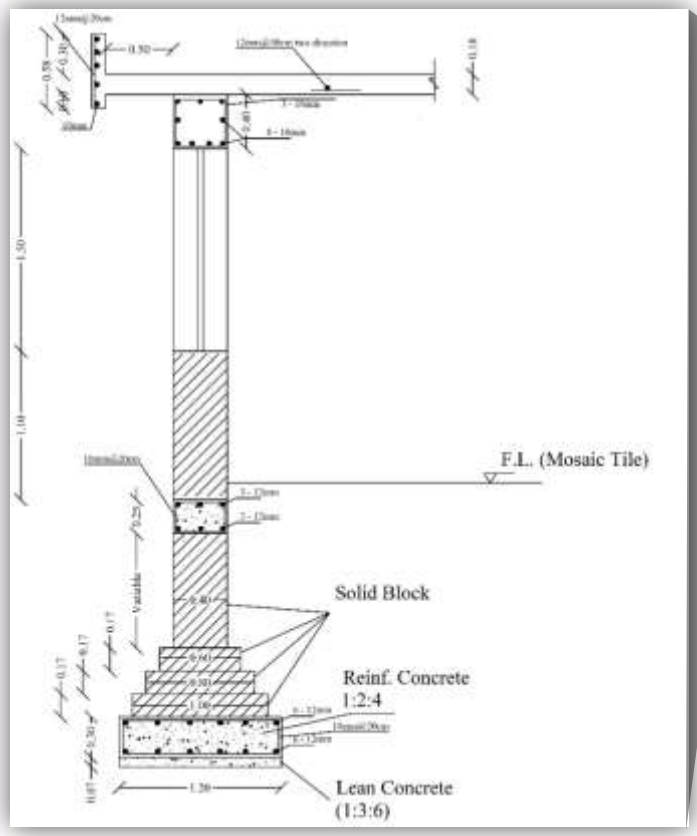
1.11 Sections

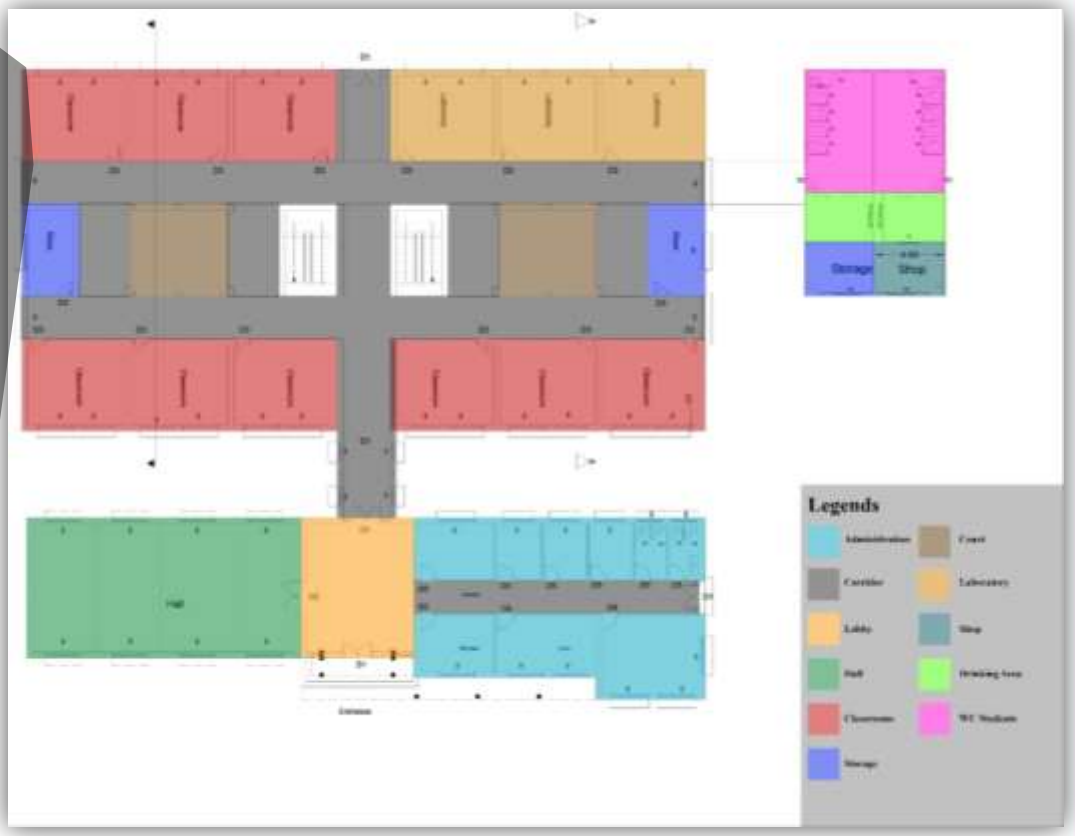




Section A-A

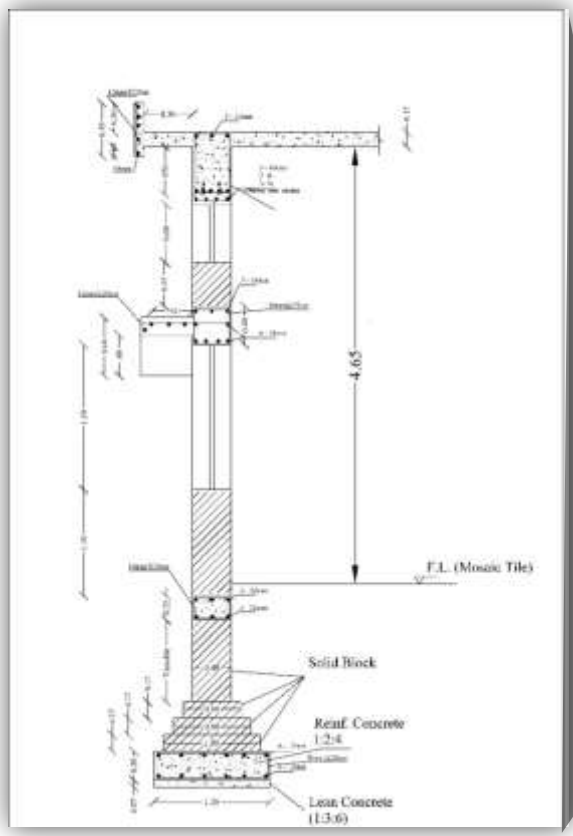
1.11 Sections

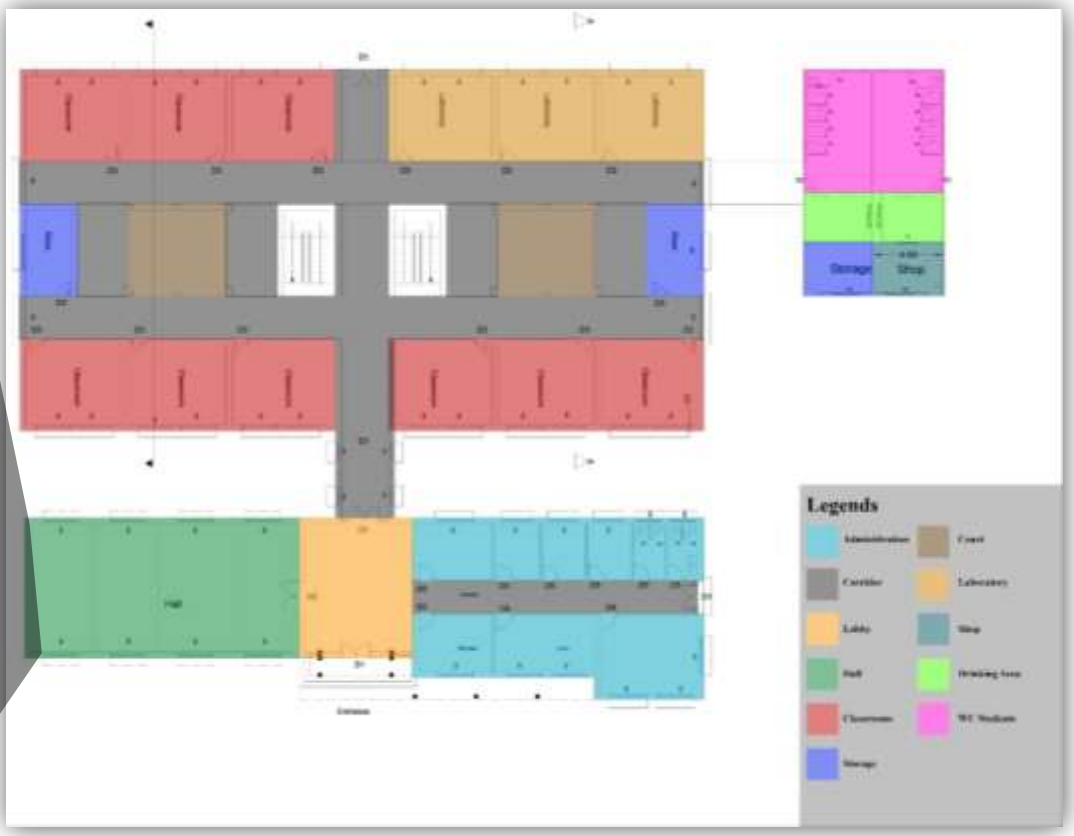




Wall Section

1.11 Sections





Section of Wall - Hall

1.12 Elevations

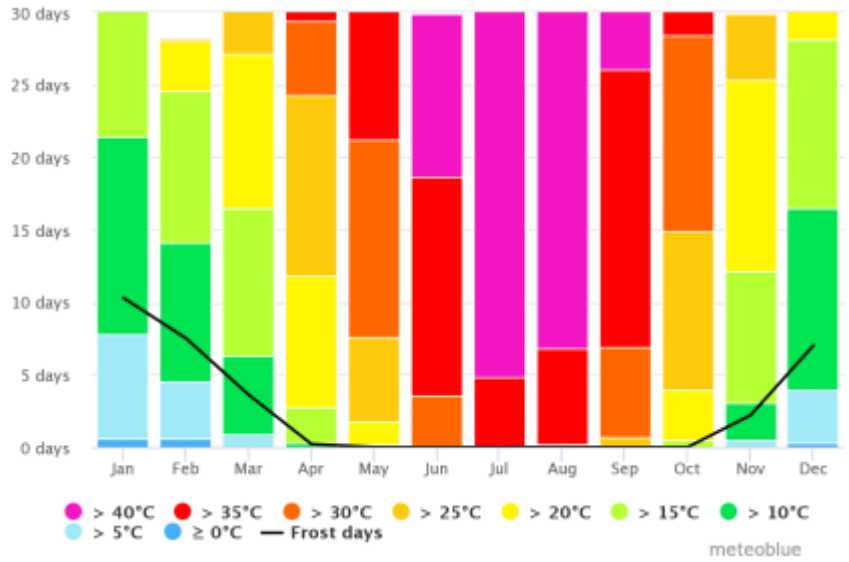
Front elevation

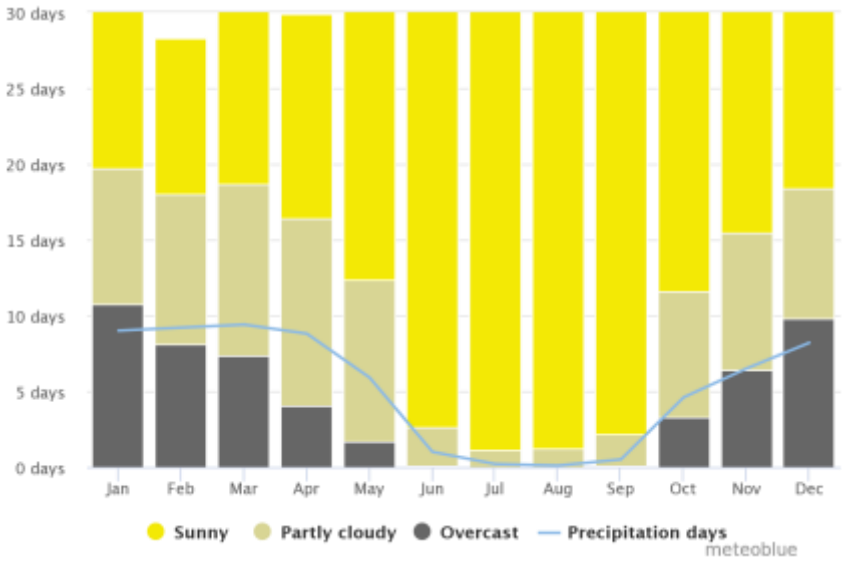
Side elevation

CHAPTER TWO

DATA COLLECTION ANALYSIS

2.1 Environmental Analysis

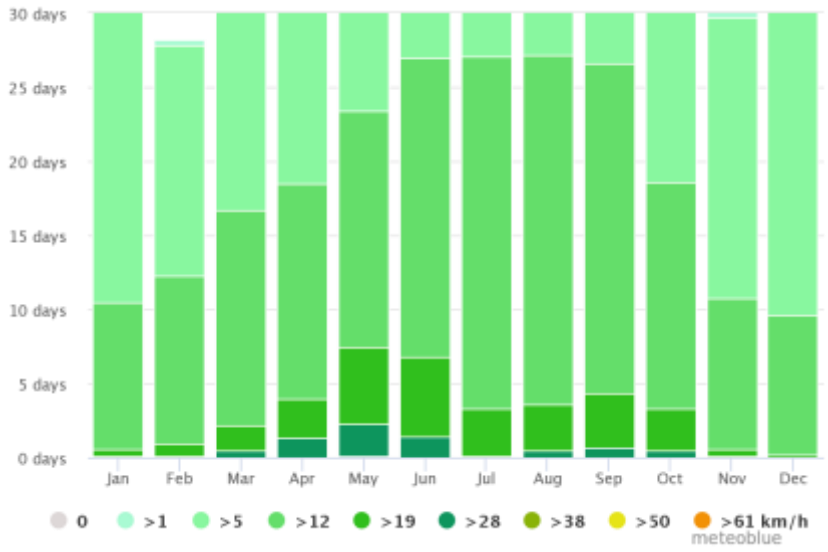




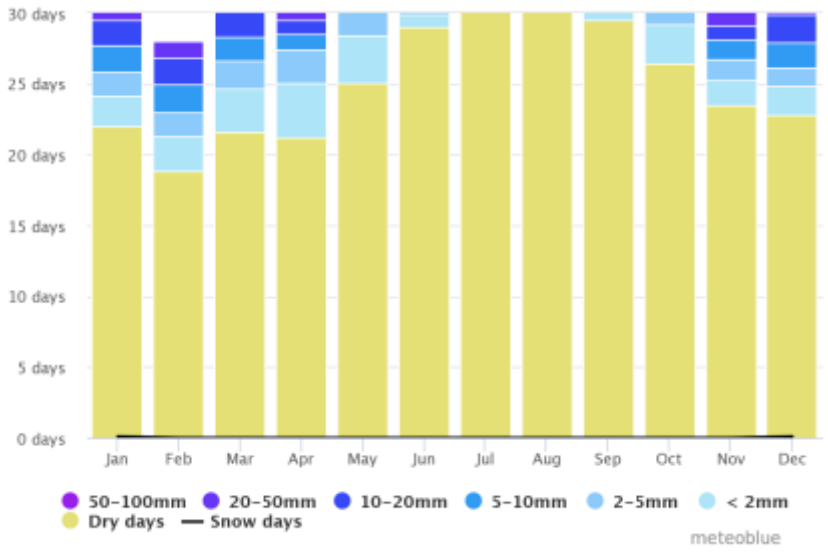
The maximum temperature for Erbil displays how many days per month each certain temperature .In July most of the days the temperature is greater than 40 c.
School times starts at September to June ,during this month's June is the hottest which most days the temperature is between 35 -45 .

The graph shows the monthly number of sunny ,partly cloudy ,overcast and perception days days with less than %20 cloud cover are considered as sunny , with 20-80% cloud cover as partly cloudy and with more than %80 as overcast .
In June 17 days are sunny , 2 days overcast ,and 11 days are partly cloudy .

2.1 Environmental Analysis



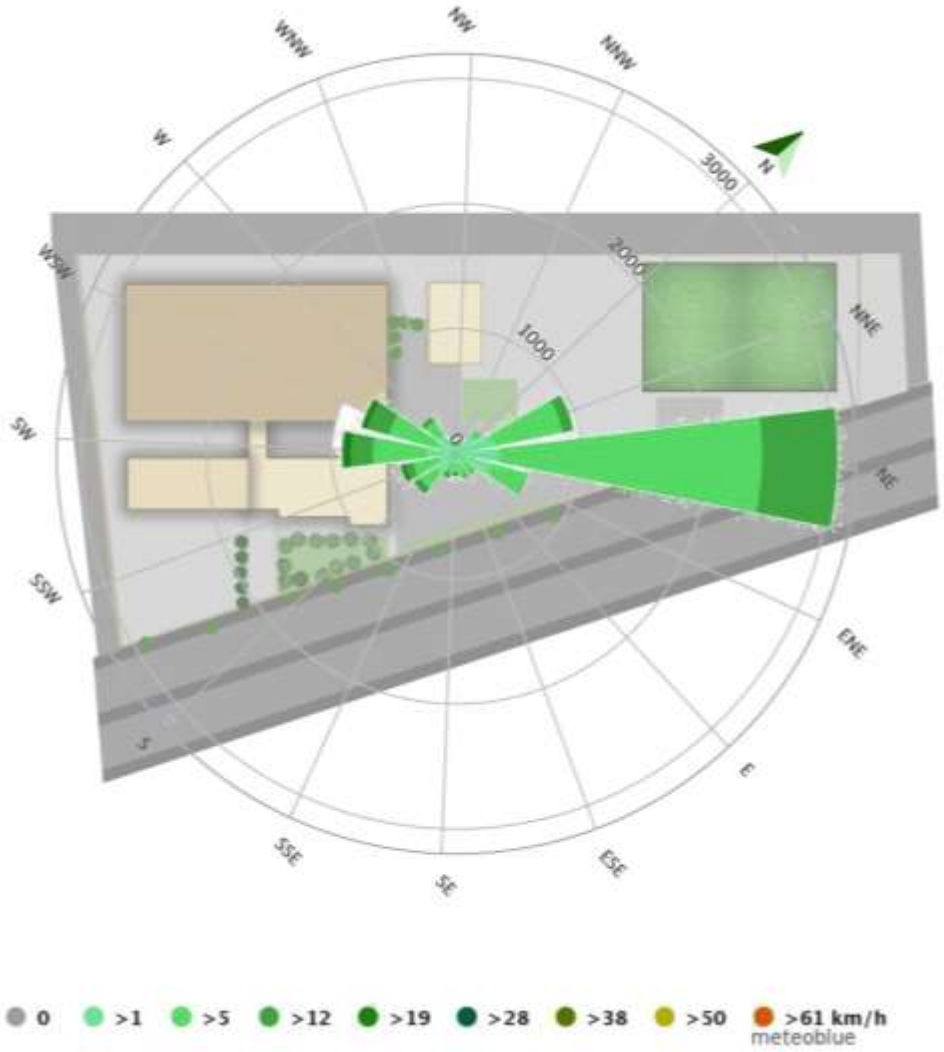
The diagram shows the days per month, during which the wind reaches a certain speed .
At May 3 days the wind speed is greater than 28 km/h.
At December 20 days the wind speed is greater than 5 km /h



The perception diagram for Erbil shows on how many days per month , certain perception amounts are reached .

2.2 Energy Conservation

2.2.1 Natural ventilation



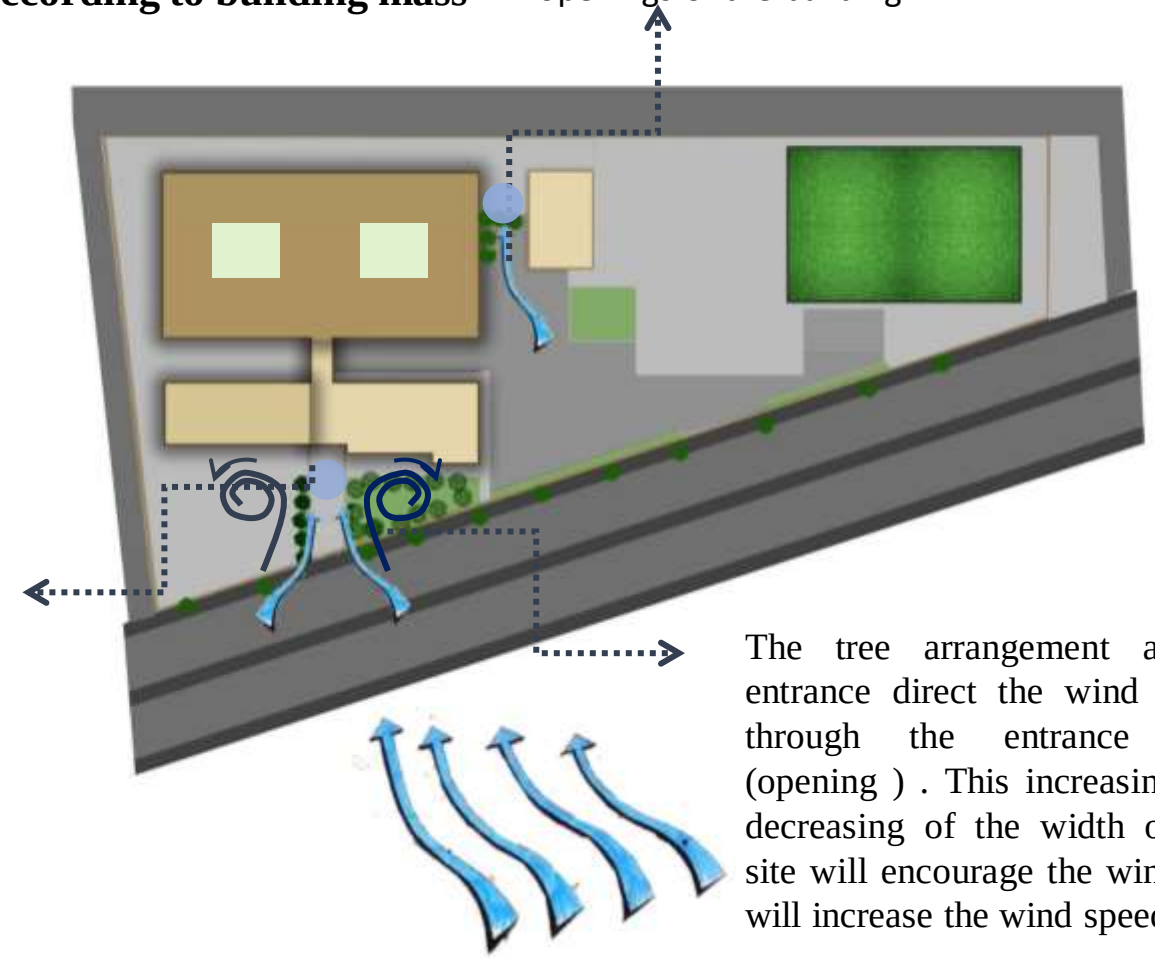
Erbil wind rose analysis

2.2 Energy Conservation

2.2.1 Natural ventilation

- **Ventilation according to building mass**

The shape of the school direct the wind through the shafts and openings of the building.



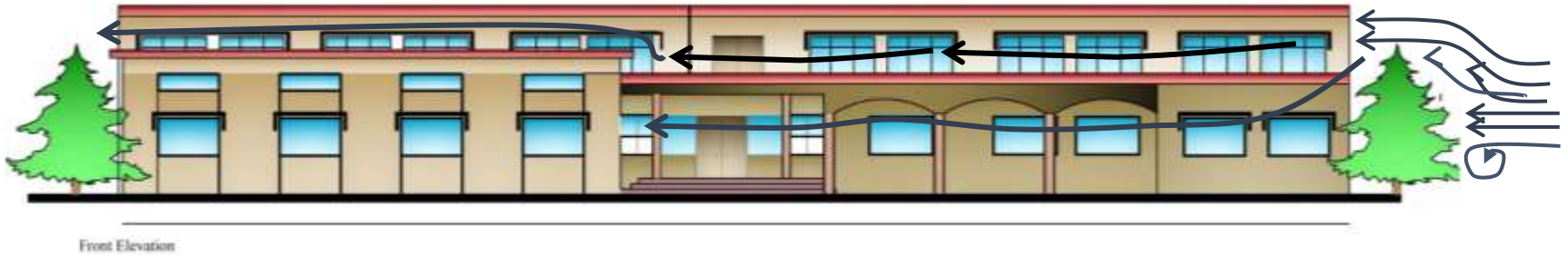
Wind speed

The tree arrangement at the entrance direct the wind to go through the entrance door (opening) . This increasing and decreasing of the width on the site will encourage the wind and will increase the wind speed .

2.2 Energy Conservation

2.2.1 Natural ventilation

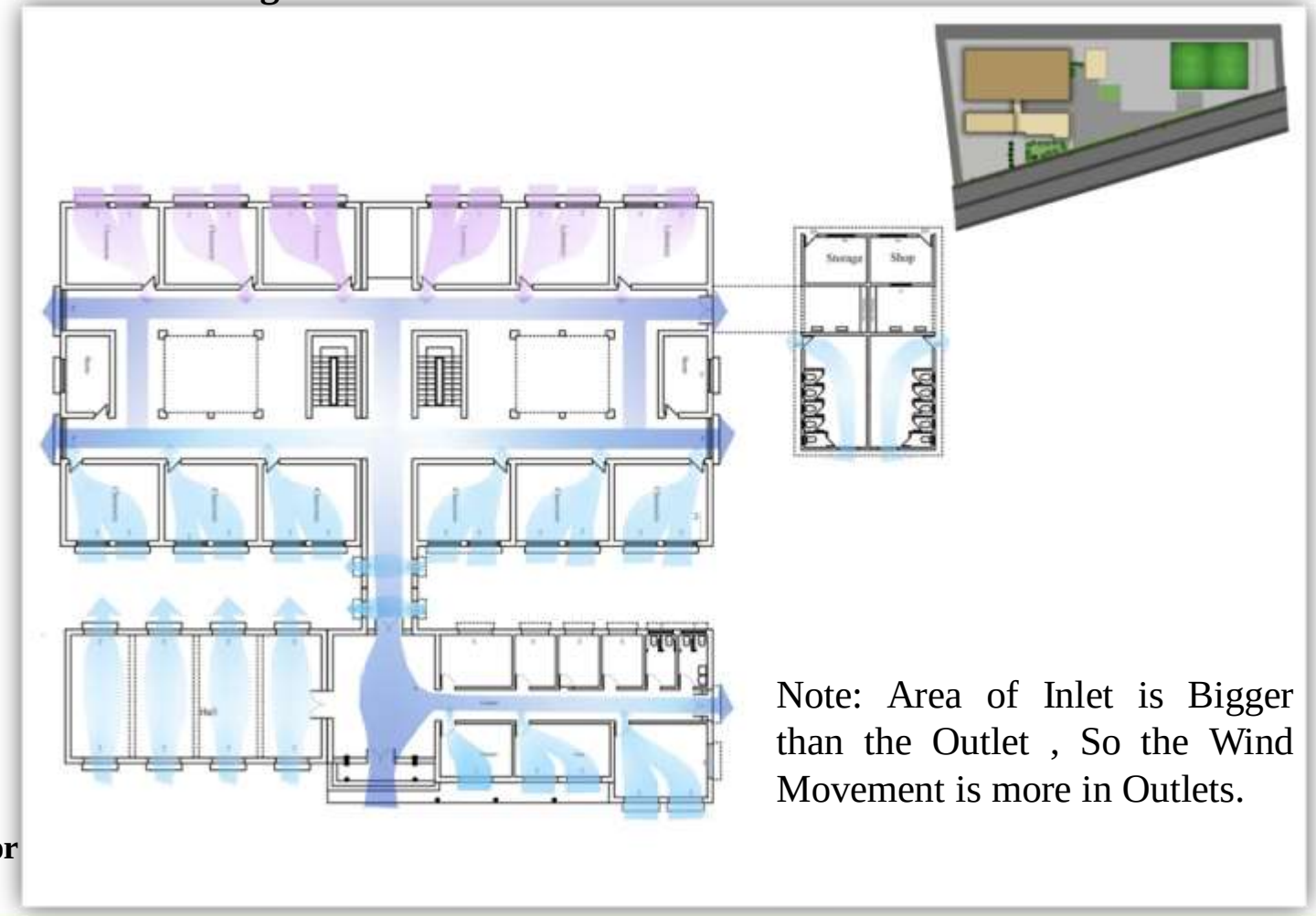
- **Ventilation according to building mass**



2.2 Energy Conservation

2.2.1 Natural ventilation

- **Ventilation according to size of inlet and outlet**



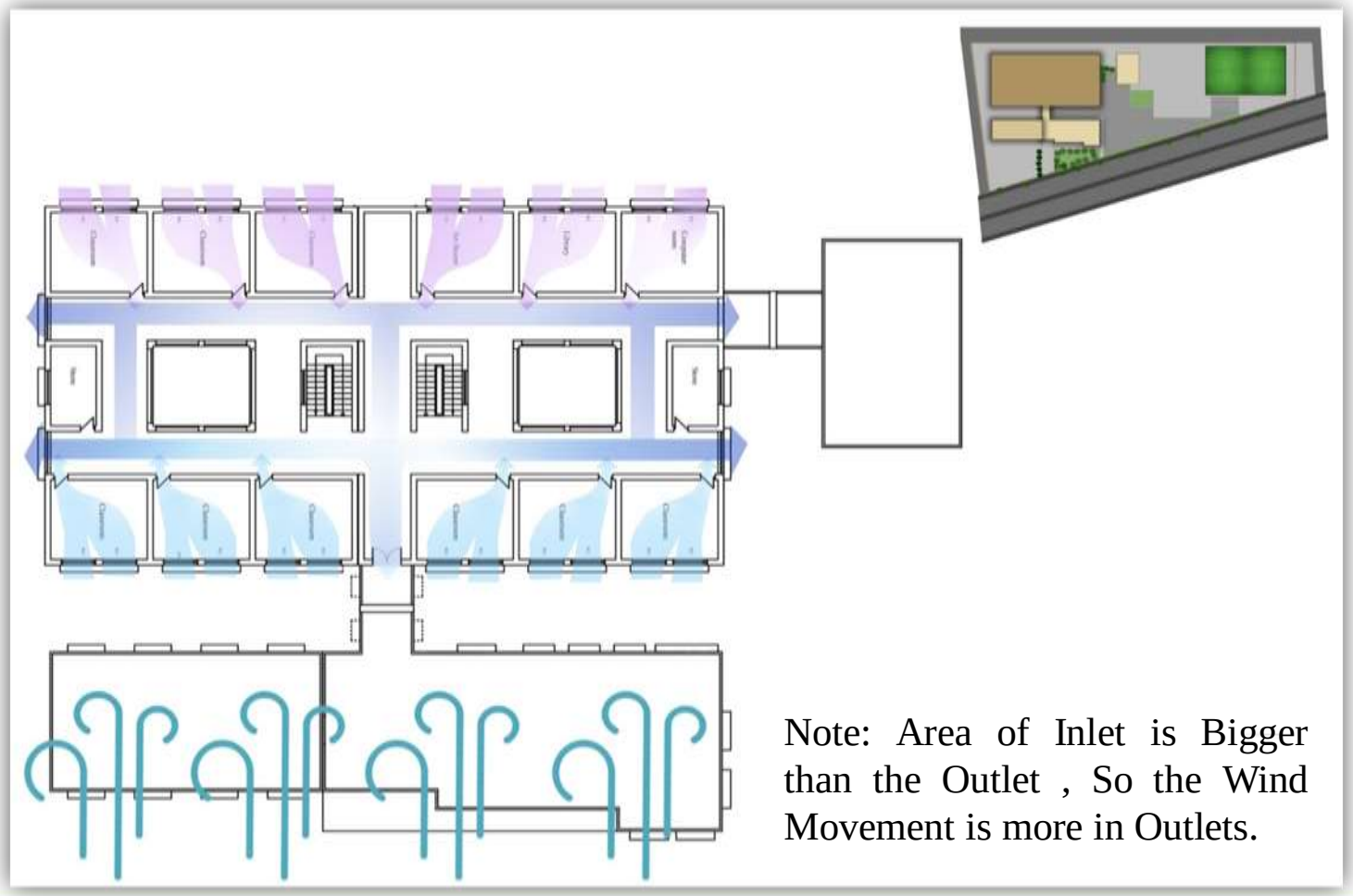
Note: Area of Inlet is Bigger than the Outlet , So the Wind Movement is more in Outlets.

Ground floor

2.2 Energy Conservation

2.2.1 Natural ventilation

- **Ventilation according to size of inlet and outlet**



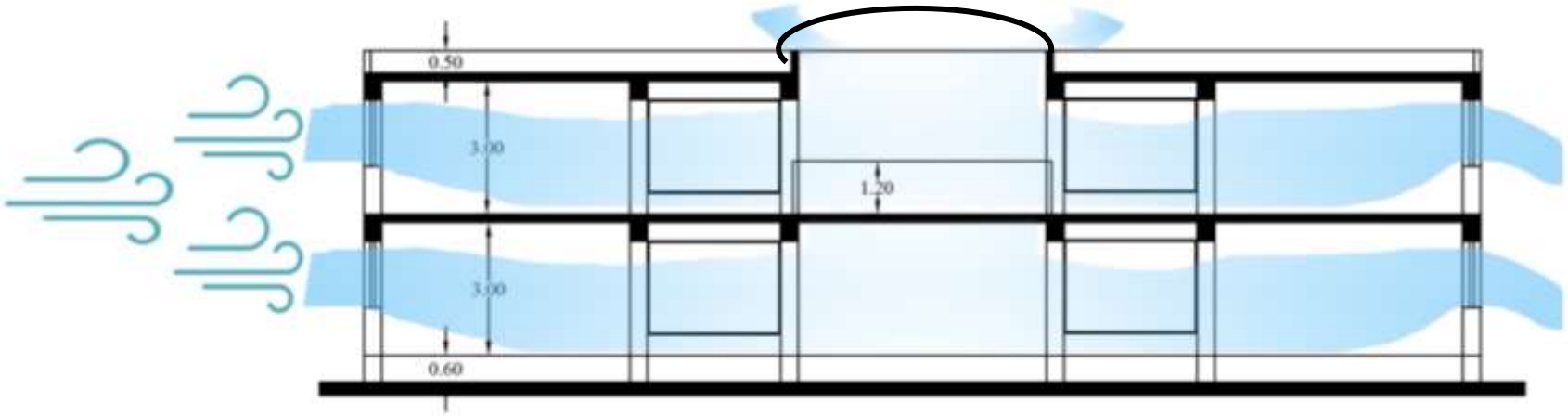
First floor

Note: Area of Inlet is Bigger than the Outlet , So the Wind Movement is more in Outlets.

2.2 Energy Conservation

2.2.1 Natural ventilation

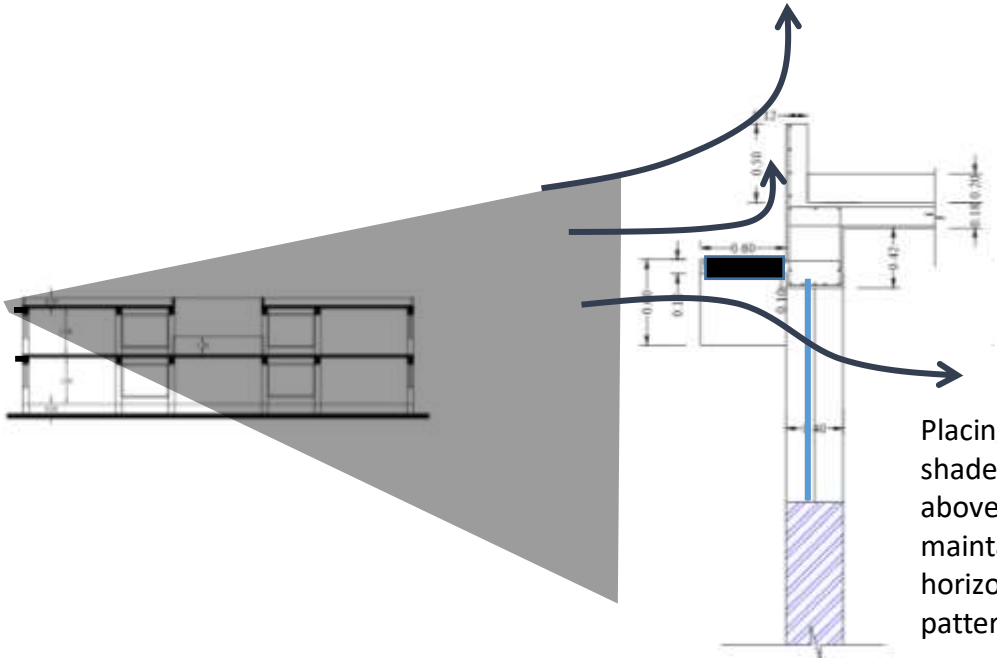
- **Ventilation according to size of inlet and outlet**



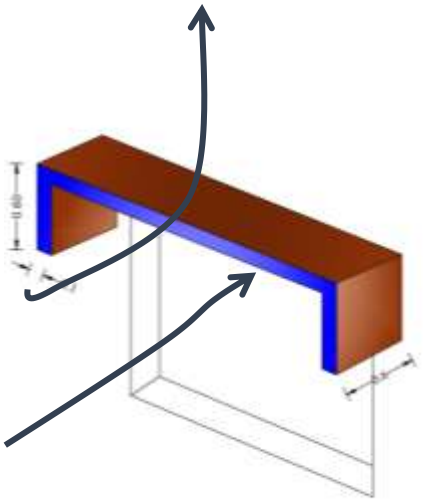
2.2 Energy Conservation

2.2.1 Natural ventilation

- **Ventilation according to sun shade**



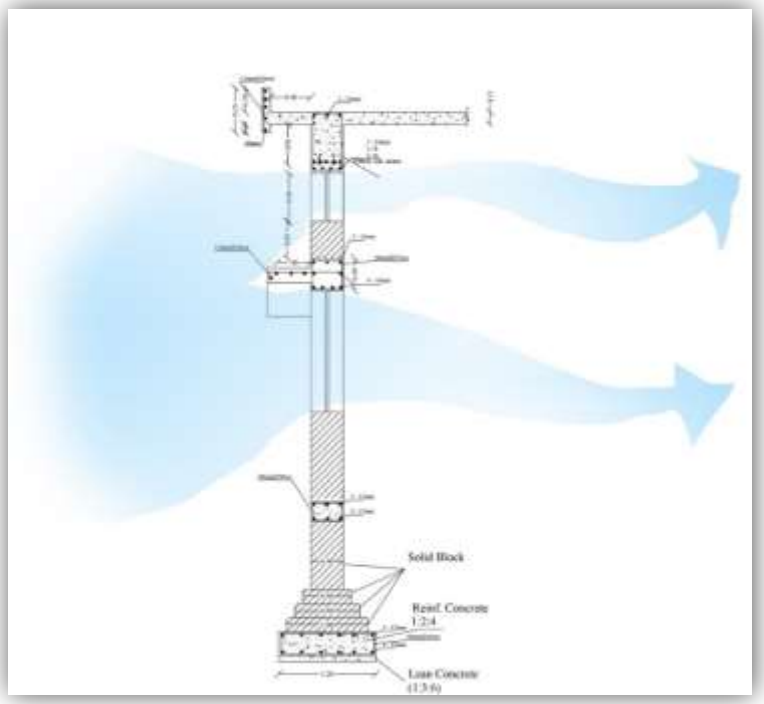
Placing the sun shade slightly above the window maintains a horizontal airflow pattern.

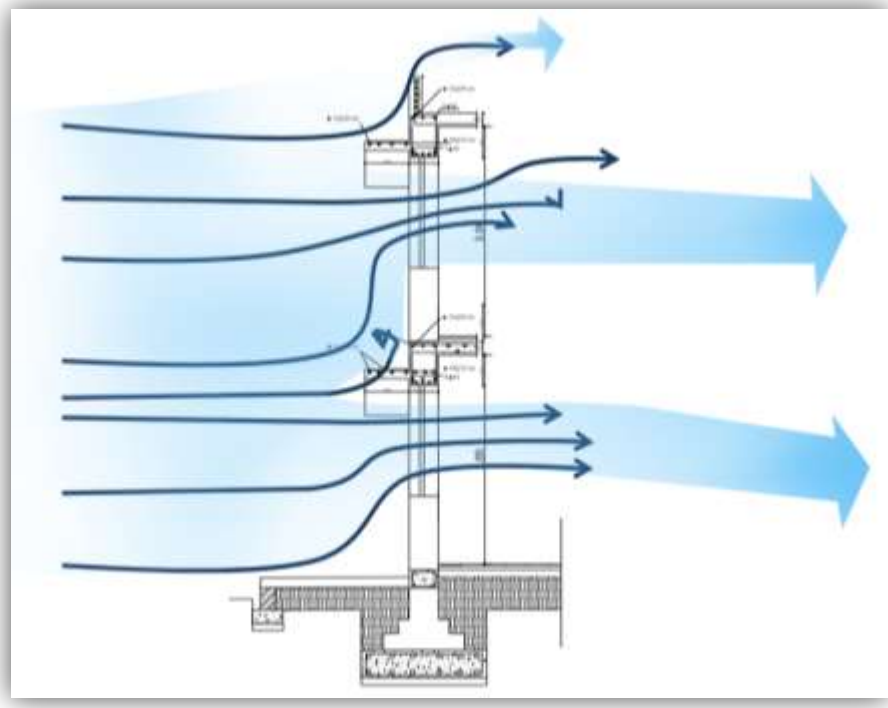


2.2 Energy Conservation

2.2.1 Natural ventilation

- **Ventilation according to sun shade**



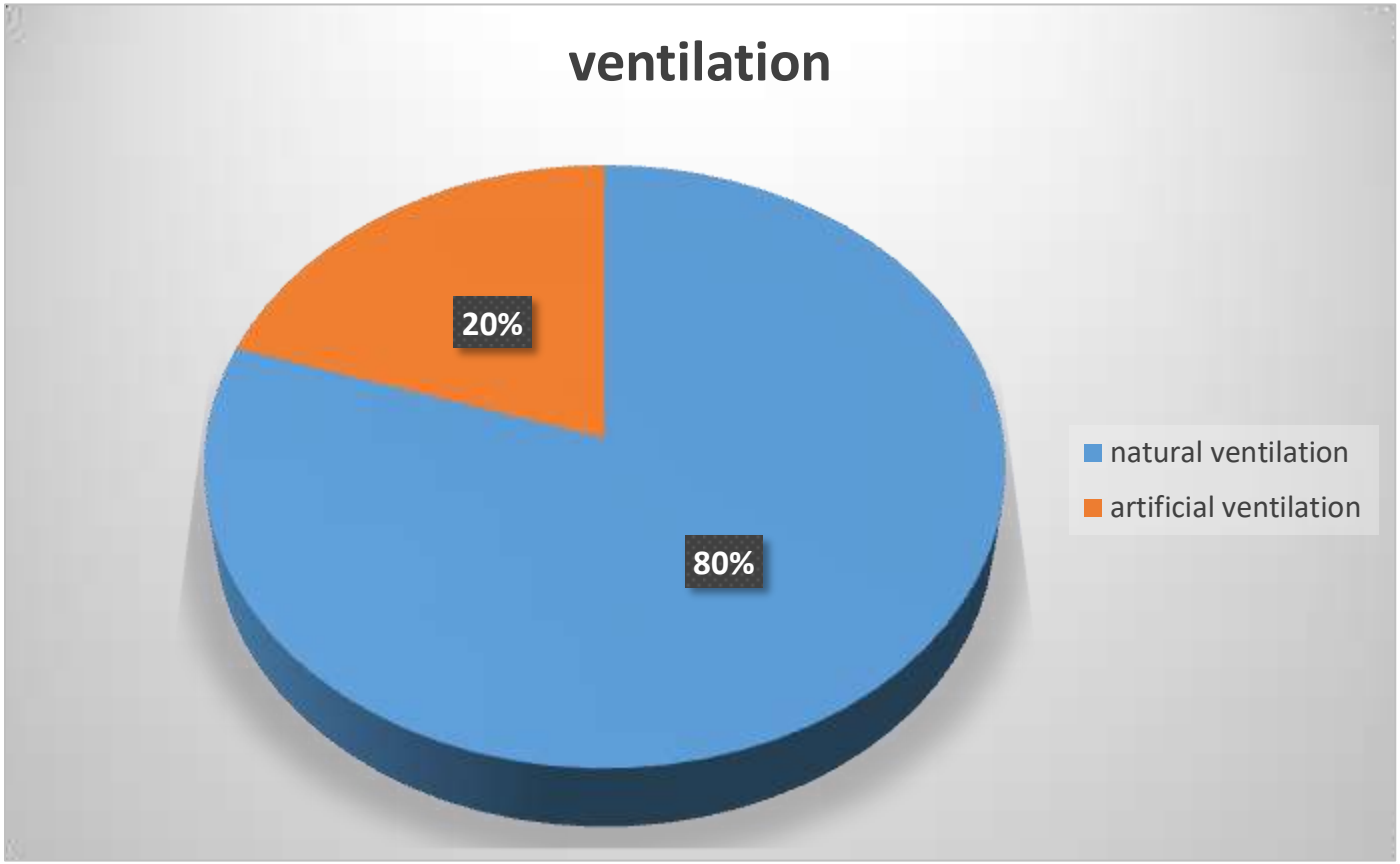


Sun shade is attached to wall surface will create horizontal air movement to inner space.

2.2 Energy Conservation

2.2.1 Natural ventilation

Ventilation – Chart with Percentage



2.2 Energy Conservation

2.2.1 Natural ventilation

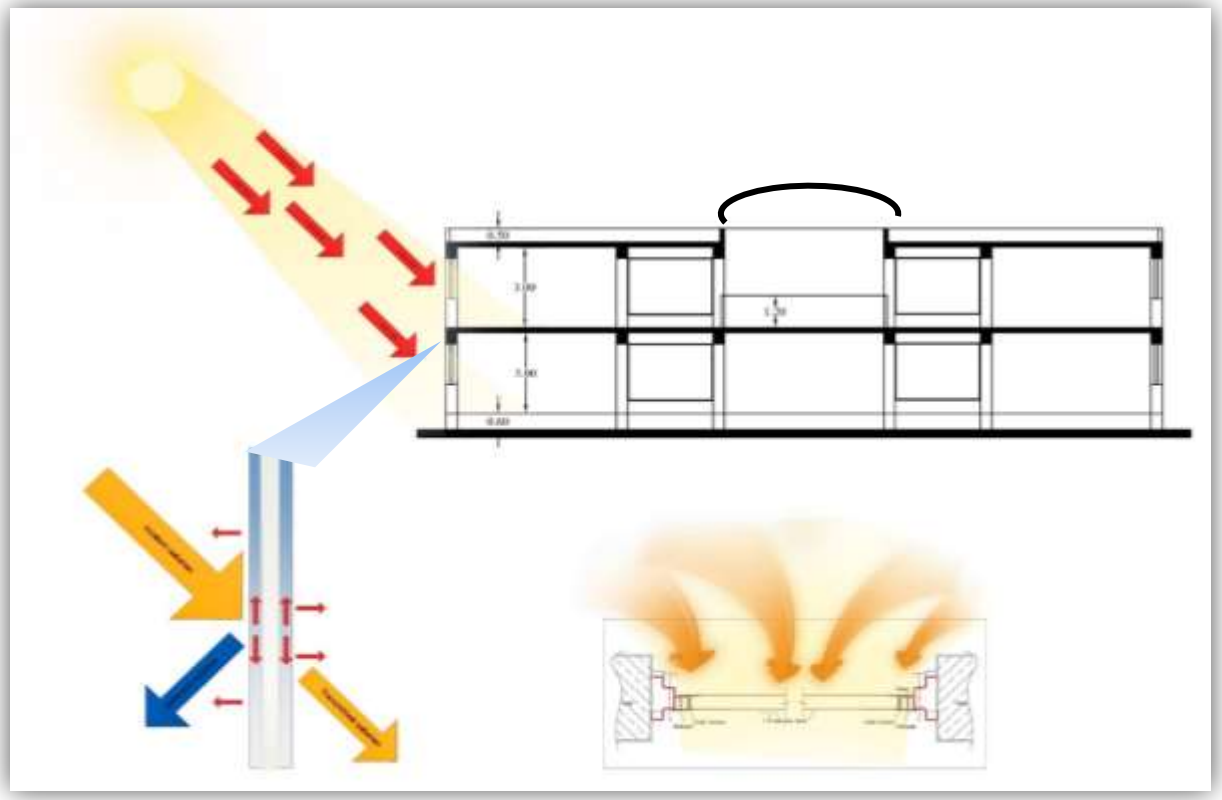
Court Working as Skylight

Court Working as Skylight

2.3 Passive Solar Heating

2.3.1.Natural heating

1. Direct gain

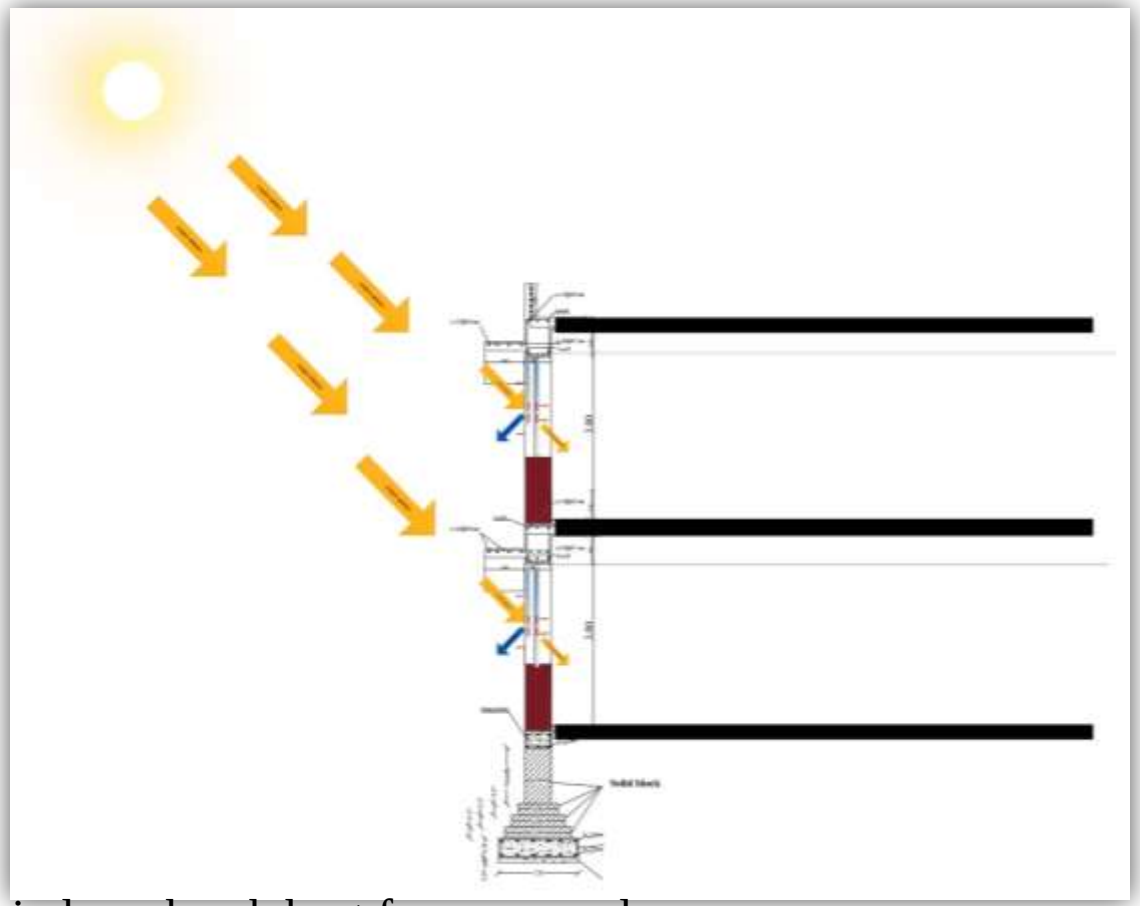


Double glass window absorb heat from sun and reradiate at night ,
works as heat storage.

2.3 Passive Solar Heating

2.3.1.Natural heating

1. Direct gain



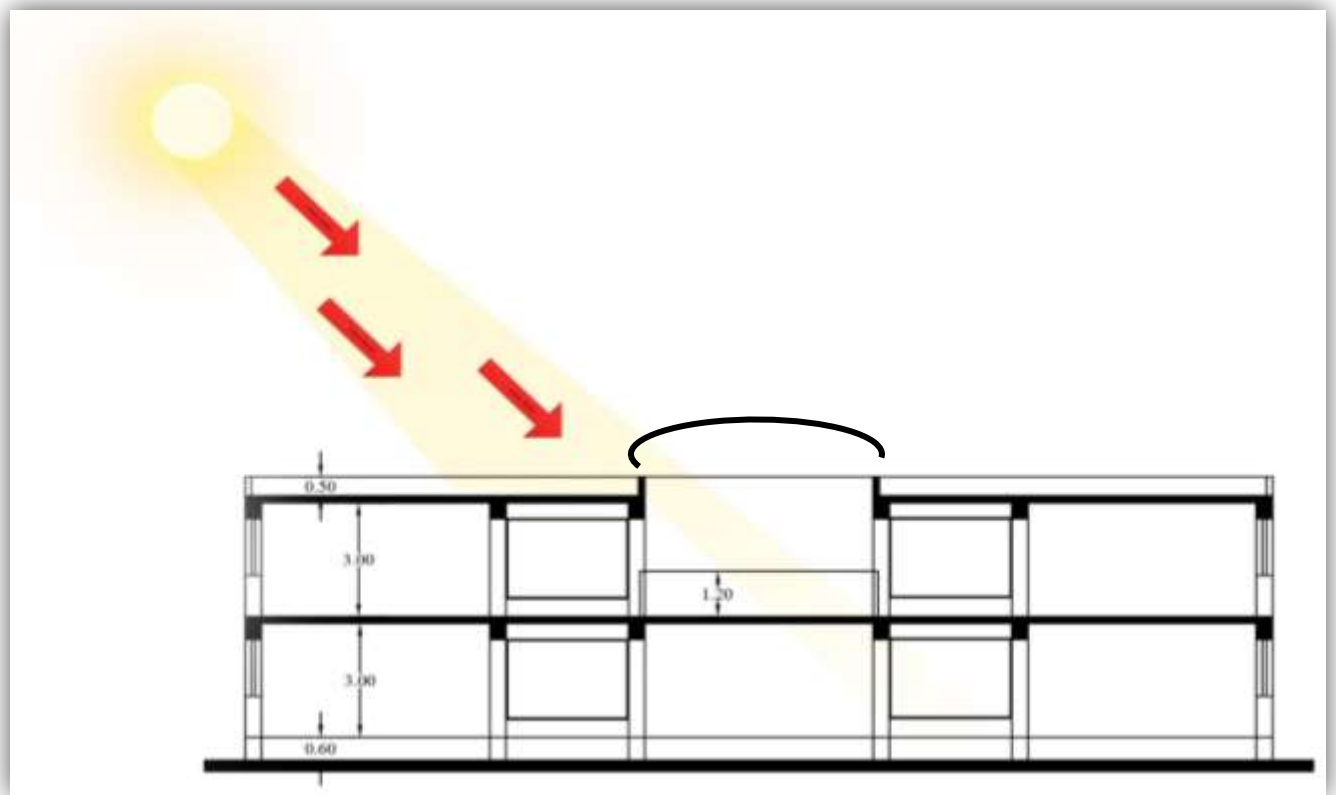
Double glass window absorb heat from sun and reradiate at night , works as heat storage.

2.3 Passive Solar Heating

2.3.1.Natural heating

1. Direct gain

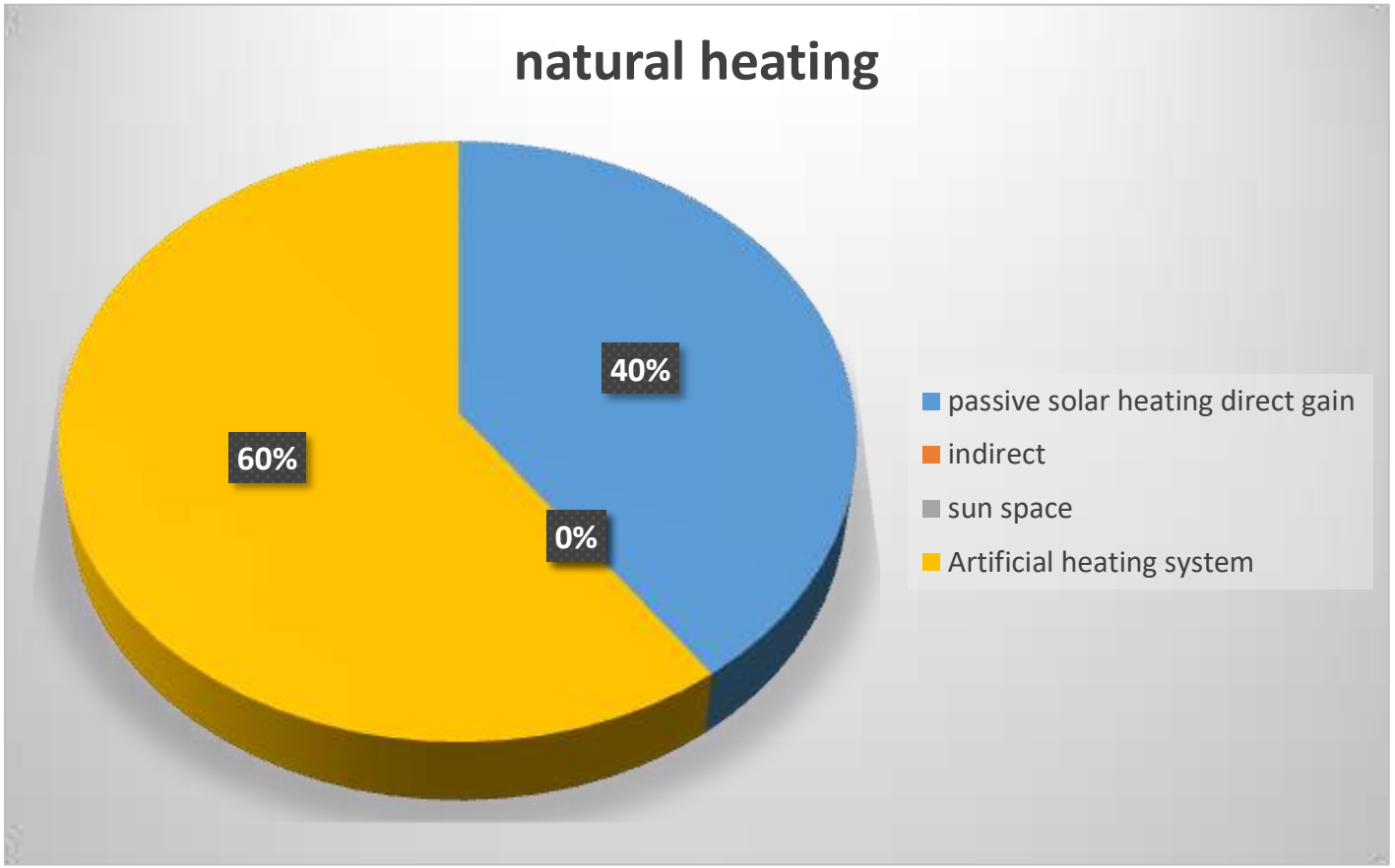
Clear story help lighting inner spaces which has a deep distance .



2.3 Passive Solar Heating

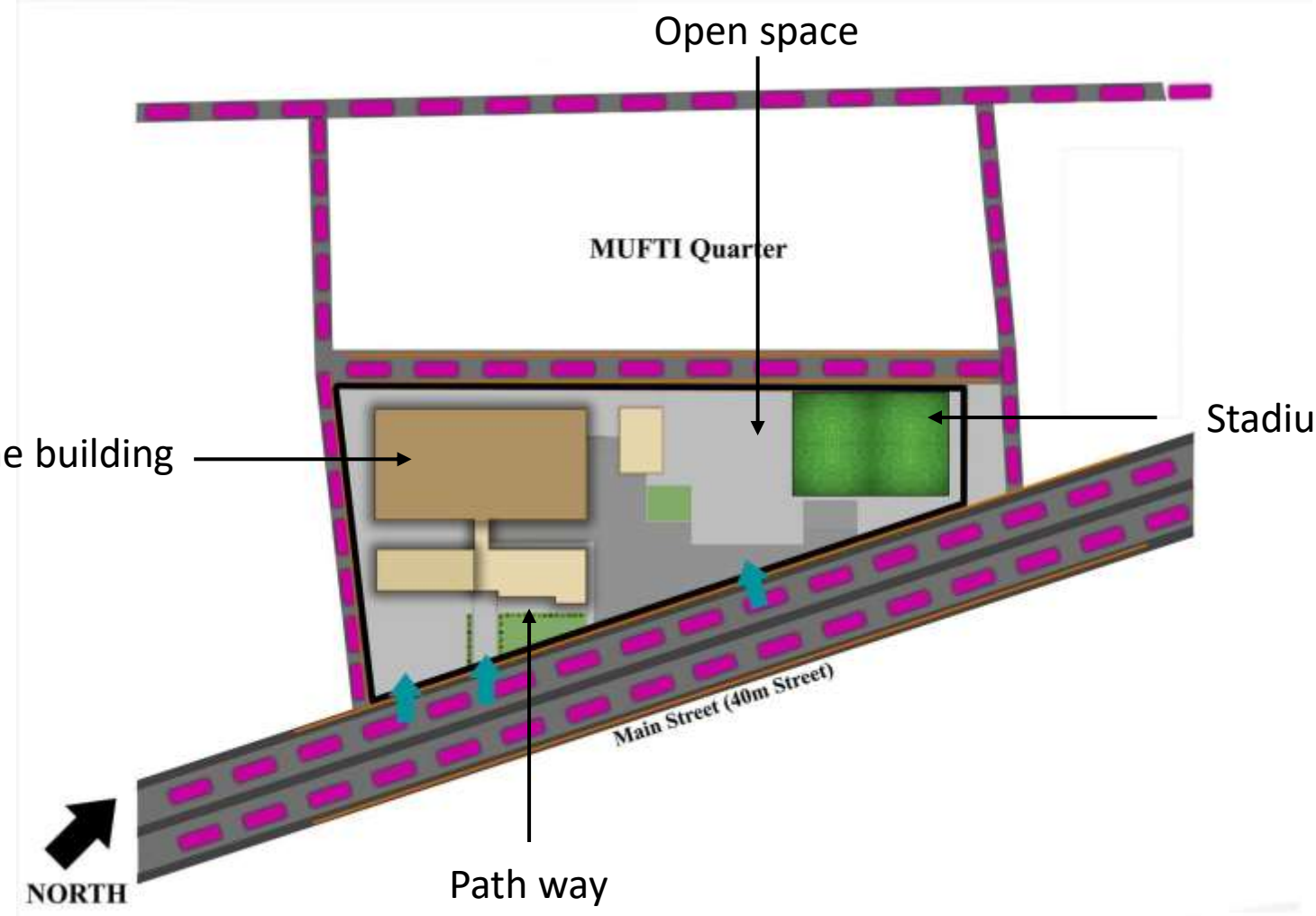
2.3.1.Natural heating

1. Direct gain



Natural Heating – Chart with Percentage

2.4 Material Conservation and Efficiency



2.4 Material Conservation and Efficiency

Elements	Used Material	Image
Building Elevation	(plaster , stone)	 
Building Wall and Finishing	(double layer block , plaster)	
Building window (frame+ glass)	(pvc , double transparent glass)	
Building slab and finishing	(reinforcement concrete , plaster and false ceiling)	 
Building doors	(wood , aluminum)	 

2.4 Material Conservation and Efficiency

Materials – Building (Continued)

Elements	Used Material	Image
Inside building floor	(Tile)	

Materials – Stadium

Elements	Used Material	Image
Stadium	plastic grass	
Stadium fence	Metal	

2.4 Material Conservation and Efficiency

Materials – Open Space

Elements	Used Material	Image
Open space	Concrete , Asphalt	
Pathway	Concrete	

Three Life Cycle Phases related to the Flow of Materials throughout Building Life

Materials	Material definition	Pre-building phase	building phase	Post building phase	
				Reusability of material	Recyclability of material
Block 	a large solid piece of hard material, especially rock, stone, or wood, typically with flat surfaces on each side.	Generally, concrete blocks are fabricated using products such as Portland cement, different aggregates such as stone or quartz, and water			
concrete 	a construction material made of a mixture of cement, sand, stone, and water that hardens to a stone like mass.	installation team must work quickly and efficiently to create a strong, durable, and aesthetically pleasing structure. Any deviations from the required steps can impede the shaping and curing process, resulting in a weakened structure.		cannot be re-formed once set, but it can be ground up and used as aggregate in new concrete or as road bedding.	very little concrete from site demolition is recycled because of the difficulty in separating these materials from construction debris
plaster 	Plaster is a building material used for the protective or decorative coating of walls and ceilings and for molding and casting decorative elements	a soft mixture of lime with sand or cement and water for spreading on walls, ceilings, or other structures to form a smooth hard surface when dried. On site prepared.		Not really safe to reuse it	Cant be recycle
Stone 	hard solid nonmetallic mineral matter of which rock is made, especially as a building material	It is comes direct from mountain and reshaped in factory .		It can be reused .	It can be recycle.
pvc	Polyvinyl chloride is the world's third-most widely produced synthetic plastic polymer, after polyethylene and polypropylene.	PVC production usually refers to the manufacture of PVC resin, which is the basis for the plethora of PVC products around us. Three types of PVC manufacture exist, it is installed in site .		It can be reused .	PVC waste is ground into small pieces that can be easily processed into new PVC compounds ready to be melted and formed into new products.

Materials	Material definition	Pre-building phase	building phase	Post building phase	
				Reusability of material	Recyclability of material
wood 	Wood is the harvested material most commonly used in buildings and building products.	Wood products such as plywood, particleboard, and paper are used extensively throughout the construction industry. Until recent years, the most common method of harvesting wood was clear-cutting, a process wherein all vegetation within a given area is removed for processing.		Once wood can no longer be reused or its material recovered, for use in fiberboard and other sheet materials for example, it can still generate energy through incineration.	Slightly more than a decade ago, most of the recycled wood was channeled to panel board mills for the manufacture of chipboard, middle-density fiberboard (MDF) and higher value fiberboard
glass 	Glass is a non-crystalline amorphous solid that is often transparent and has widespread practical, technological, and decorative usage.	Glass installers, also known as glaziers, often work within the construction field As a glazier, Glass installers usually determine the specifications of the project and cut the glass using cutting wheels or automatic cutting tables before putting it into place.		cannot be re-formed once set, but it can be ground up and used as aggregate in new concrete or as road bedding.	. Once separated, glass is very easy to recycle
Aluminum 	Aluminum is a silvery-white metal, the 13 element in the periodic table. One surprising fact about aluminum is that it's the most widespread metal on Earth, making up more than 8% of the Earth's core mass.	Aluminum is found naturally on Earth, Aluminum, derived from bauxite ore, requires a large amount of raw material to produce a small amount of final produce. Approximately 0.02 pounds of pot liner are produced for every pound of aluminum	it is best applied where its light weight, corrosion resistance, and low maintenance can be used an advantage. for installation also need high electricity and welding .	It can be reused always .	Recycling aluminum requires only about 20% of the energy of refining bauxite into usable metal, only about 15% of the aluminum used in construction is ever recovered.
tile 	A tile is a thin object usually square or rectangular in shape. Tile is a manufactured piece of hard-wearing material such as ceramic, stone, metal, baked clay, or even glass, generally used for covering roofs, floors, walls, or other objects such as tabletops , minimum of 15 years with most lasting up to 30.	They are usually found in shallow surface deposits, and manufacturing is often done nearby, reducing extraction and transportation costs. With the exception of tiles must be fired to be useful building materials.		reusing ceramic tile is almost fruitless. The reason is because tile is usually adhered either with thinnest mortar or some type of epoxy (most likely the former). The mortar almost becomes part of the tile. Even if you can remove the tile, the bottom is highly uneven and unsuitable for reuse.	It can be recycle.

Density, Thermal conductivity, Specific heat capacity and Water vapor diffusion resistance of important building materials

Building materials	Density ρ Kg/ m	Thermal conductivity λ W/ m . K	Specific heat storage capacity J/ kg . K	W. v. diffusion resistance co.
Hole block	1800	1.15	1000	5/10
Vole block	2400	2.10	1000	
Aluminum	2100	160	160	∞
Asphalt	2800	0.70	1000	50000
wood	300	0.09	1600	50
Internal gypsum plaster	1300	0.57	1000	6
Limestone (Hard)	2200	1.7	1000	150
glass	2500	1	750	∞
(PVC)	1390	0.17	900	50000

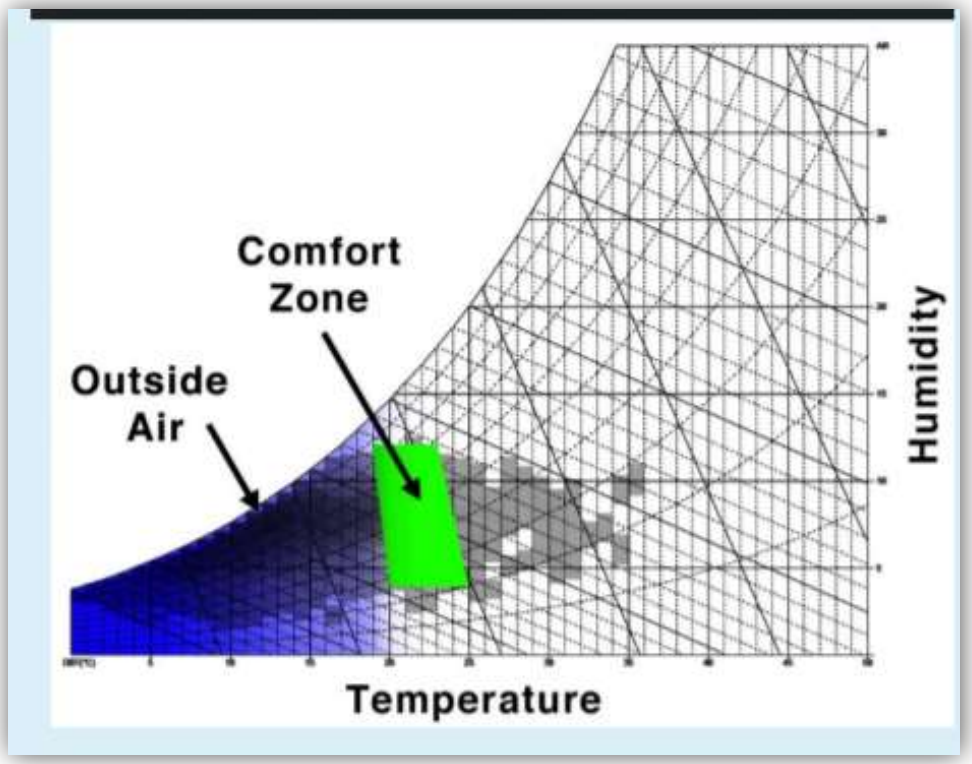
2.5 Human comfort

Buildings are designed for people, and those people are trying to accomplish a task – whether it's raising a family, running an office, or manufacturing a product. The building needs to keep people comfortable, efficient, healthy, and safe as they set about their task. Our interface to the world is through our senses: touch, sight, hearing, smell, and taste. Each one of these senses can lead to a greater or lesser degree of comfort Building better is not only about avoiding problems, it should also be about creating positively pleasurable and healthy living places.

2.5 Human comfort

Comfort is about the physical environment in its totality. The issues which are most obviously associated with comfort are:

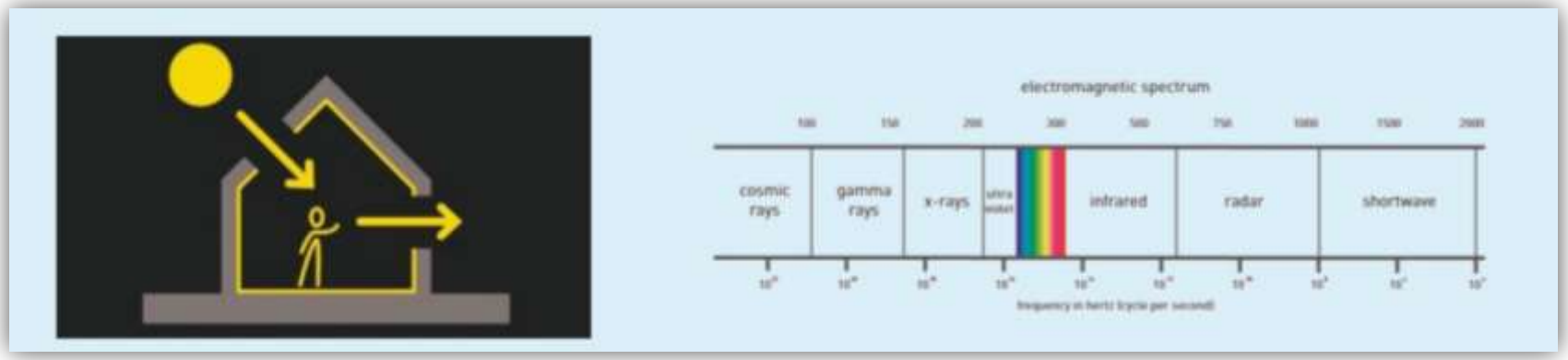
- Temperature
- Humidity
- Noise
- Light
- Smell
- Temperature and Humidity



2.5 Human comfort

Visual Comfort

Maintaining visual comfort means ensuring that people have enough light for their activities, the light has the right quality and balance, and people have good views.



When light strikes a surface, its energy is either transmitted, absorbed, or reflected. The color of a surface represents the frequency of the spectrum reflected back to the observer. A surface that is white has most of the spectrum reflected back equally, whereas one that is black has had most of the energy absorbed.

2.6 Day Lighting

Good lighting is well-distributed, is not too dim or too strong, and uses minimal energy. Day lighting is a significant factor for pleasant interior conditions. Without sufficient day lighting, people cannot perform well and healthy. Daylighting, or using sunlight to illuminate your building, is an effective way to both decrease your building's energy use and make the interior environment more comfortable for people. Day lighting Integration Practice of using windows, skylights and other forms of fenestration to bring light into the interiors of buildings using various means. Incorporating day lighting in the lighting design can be done by: •Proper control of the fenestration luminance •Daylight sensing and compensation control systems which allow adjustments to electric electrical lighting system •Glare controls should also be incorporated in the design •New techniques for "piping" light into interior spaces can allow sunlight and daylight to furnish a higher percentage of illumination requirements and more uniform distribution

Daylighting design strategies like high or clerestory windows, light shelves, and well-placed skylights can help distribute sunlight inside a space

Day Lighting from Sky Light - Photos

Sky Light

Sky Light

Window

Appearance and Space of Luminaires

Luminaire efficiency and the ability to use efficacious sources have become increasingly important criteria for selecting luminaires. Designer should find lighting systems that embody the project's style or aesthetic but to do so using high-efficacy sources and efficient principles. For instance, choose luminaire that "hide" light source but avoid such as crystal chandeliers that require lamps with bare incandescent filaments.

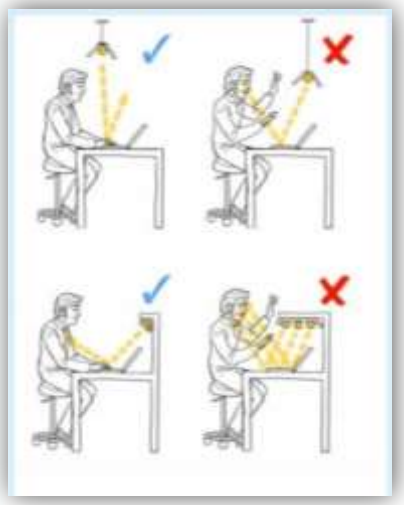
Artificial Lighting

Artificial Lighting

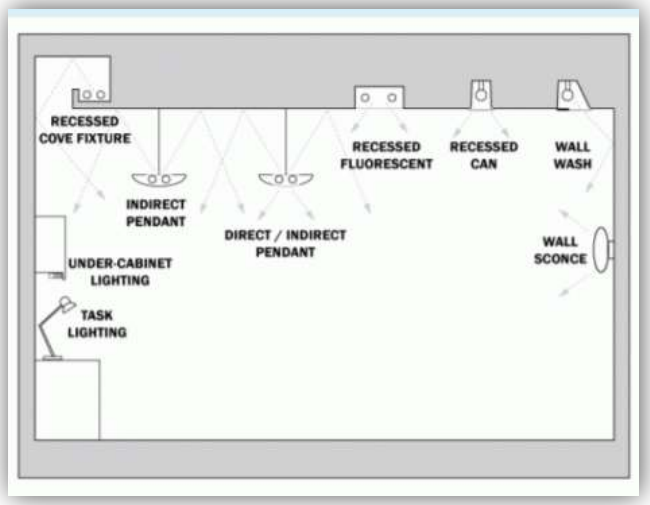
Space and Workplace Considerations, including:

- Flexibility
- Appearance of the space and luminaires
- Color appearance
- Luminance of room surfaces
- Direct glare
- Reflective glare

Even when you can't use daylighting, good lighting design can reduce energy use significantly. Both are important in Net Zero Energy Buildings.



The primary concern in lighting layout is to avoid glare on activity surfaces. Such glare is a result of light bouncing directly into user's eyes, rather than diffusely



Light fixtures ("Luminaires") are the hardware required to hold and operate artificial light sources

Color

Color is one of the most powerful tools used in interior design/ decorating. Color shoul d be studied both psychologically and emotionally to be understood and used correctly . The amount of light also affects color Dim lighting reduces a color's value and diminishes its hue.

High lighting levels can either intensify the hue or make the color appear washed out Color swatches should be tested in their actual location under the expected lighting conditions before final decisions are made The amount of area covered affects color . Color intensifies as the area of color increases It is also important to remember that interior colors should be chosen inside and exterior colors outside

Visual Comfort

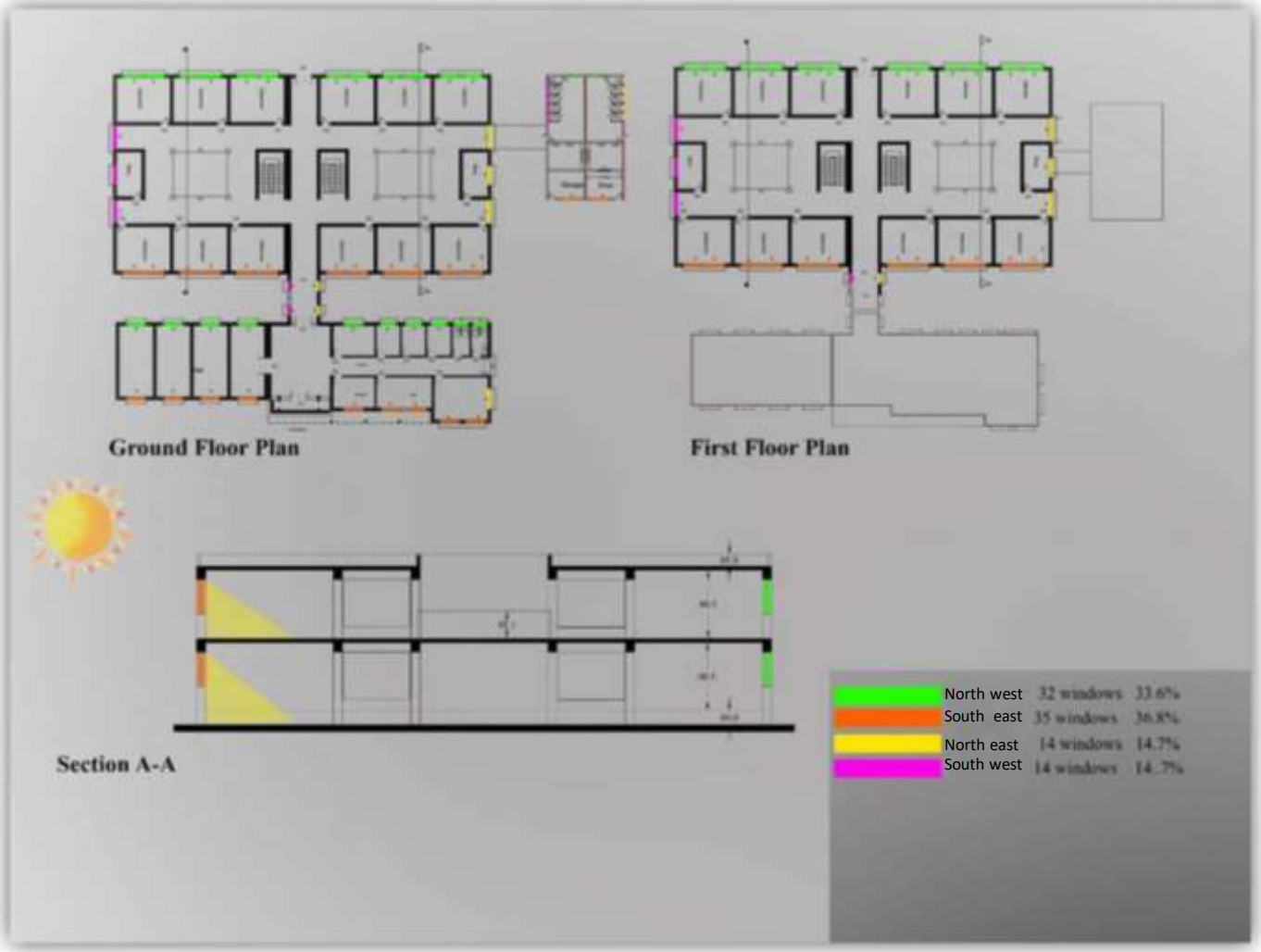
In order to develop a better understanding about the influence of color on visual comfort, we need to first understand the meaning of this term and the variables that interact with it. Visual comfort exists when the perceptual faculties in the human brain can operate without interference.2 When there is no inhibition of perception, the basic functions of the eyes, such as vision, speed, and contrast sensitivity, are optimized. This optimization of the basic perceptual functions is very important while perusing optimal working conditions. Some factors that can inhibit perception in an interior setting include incorrect distribution of light density, glare, poor color selection, and inappropriate interior design. While this paper focuses on color selection, other aspects of an interior should also be taken into consideration when designing for visual comfort.

Interior Design Views

Energy Efficiency

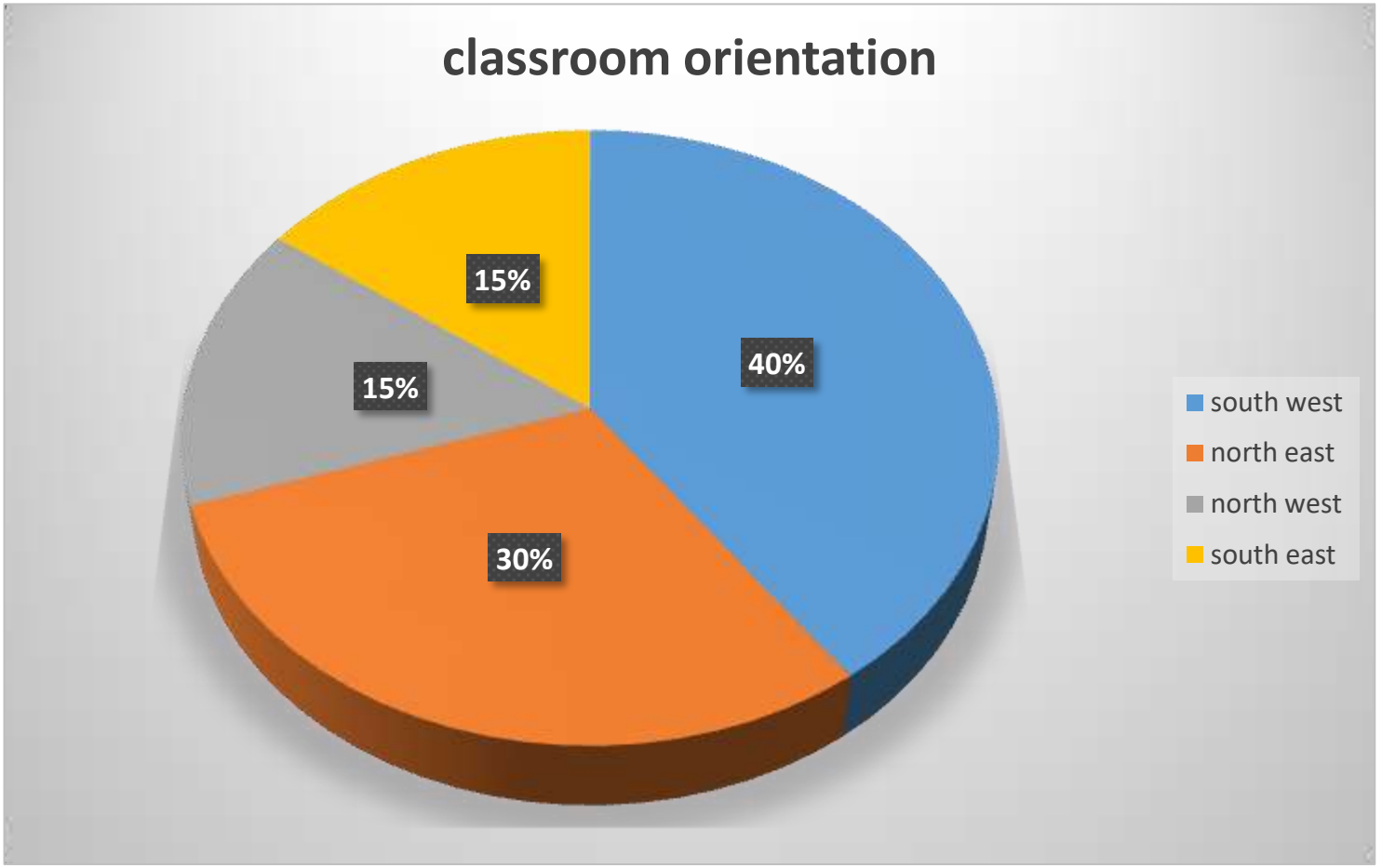
Energy Efficiency Use of Daylight …Replacement with energy efficient lamps CFLs and LEDs Energy-efficient lighting design focuses on ways to improve both the quality and efficiency of lighting. •Match the amount and quality of light to the performed function. •Install task lights where needed and reduce ambient light elsewhere. •Use only energy-efficient lighting components, controls and systems. These include Fluorescent and LED lighting options. •Maximize the use of daylighting. Daylighting is the use of windows and skylights to bring natural light into your home.

2.6 Day Lighting– Orientation Percentages



2.6 Day Lighting

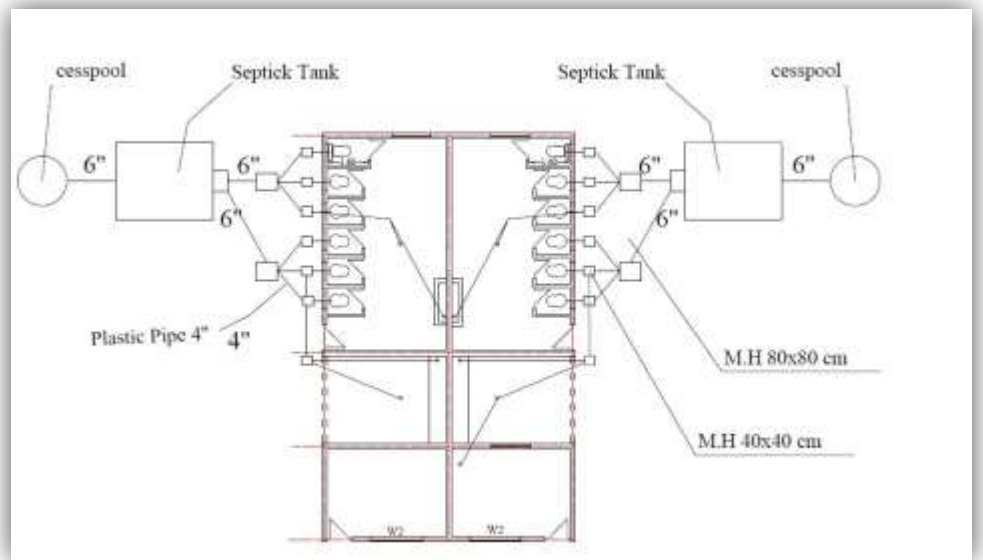
Classroom Orientations – Chart with Percentage



Human Comfort – School Wall Paintings Photos

2.7 Water Conservation

Water used for Drinking, Cleaning and Vegetation is Clean water, there is no reusing of Water. The Building has not the means of Water Conservation.



2.7 Energy Conservation

The Building did not get benefit from any Natural Resources to Produce Energy , So it is Considered as (Non Renewable Energy) Building.

Artificial Heating and Energy Generating System

Generator – Artificial Electricity Producer

Water Tank and Water Pump

2.8 Preservation of Nature

Preservation of Nature for any Building includes the Presence of enough Green Area, Availability of Natural Resources Systems that can recycle water to be used again for vegetation and storing of heat energy from the sun to be used again for heating a Space.

The school does not have enough Green for its users , although it has good layers of glasses (Double Glass) that perform good insulation and heat not passes through windows easily , however the building walls are made of Blocks and has a Good thickness to protect to store heat.

Water that is used in the building will not be reused again for vegetation and cleaning purposes that not preserving water resources.

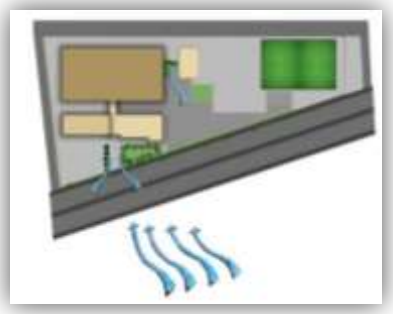
2.9 Green building factors

Factors	Sub factors	Good satisfaction design	neutral	Not Good satisfaction design	Detail photo
Water conservation	Rain water collection and reuse	-	-	*	Rain water spread direct on the ground 
	Gray water collection and reuse them	-	-	*	Gray water flow direct to but not reused 
	Reduce toilet water	-	-	*	---
	Others	-	-	*	There is no system for reusing any type of water

2.9 Green building factors

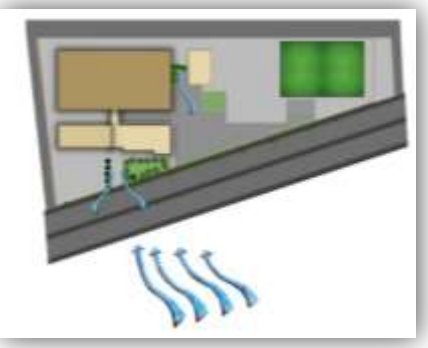
Factors	Sub factors	Good satisfaction design	neutral	Not Good satisfaction design	Detail, photo
Material conservation	Use of recycled material	*	-	-	Use of concrete , glass , pvc , aluminum , and wood
	Use of non conventional materials	-	*	-	
	Type of glass used in opening	-	*	-	
	Others	-	-	-	

2.9 Green building factors

factors	Sub-Factors	Good Satisfaction Design	Neutral	Not Good Satisfaction Design	Detail, photo , Description, Schematic Drawings
1- Site	1-1- Layout and form			*	• lay out of the site cannot support increasing natural ventilation . • Layout is not suitable to the site layout . • Connection between masses are weak . 
	1-2 -Open Spaces			*	• Open spaces are not designed and cannot approve human comfort .  

Types of Vegetation in Green Types

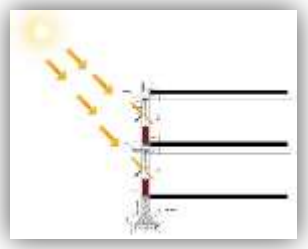
2.9 Green building factors

factors	Sub-Factors	Good Satisfaction Design	Neutral	Not Good Satisfaction Design	Detail, photo , Description, Schematic Drawings
1- Site	1-3 -Green Spaces			*	• ratio between open space ,green and building is bad . • Green of school must not by less than (30-40)% Of gross 
	1-4-School Building orientation			*	• Best orientation is south-east, the school is oriented to north east and most of classes are oriented to north east .

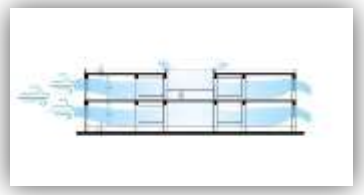
2.9 Green building factors

factors	Sub-Factors	Good Satisfaction Design	Neutral	Not Good Satisfaction Design	Detail, photo , Description, Schematic Drawings
1- Site	1-5- using any natural resources as active energy			*	no use of natural resources to produce energy ,to approve a sustainable quality . 
	1-6- Location and transportation method		*		• the location of the site according to urban is suitable because it is on residential zone ,but the bad habit is ,it's on the main street ,with no green isolation between building and road. • the neighborhood has public transportation .

2.9 Green building factors

factors	Sub-Factors	Good Satisfaction Design	Neutral	Not Good Satisfaction Design	Detail, photo , Description ,Schematic drawings
2- School building Conservation	2-1- Passive heating		*		• use solar radiation to heat the building by double glaze window which help saving heat . • The 40 cm width wall works as a heat storage . 
	2-2 –Passive cooling			*	• Use of wind turbine as a cooling source. 

2.9 Green building factors

factors	Sub-Factors	Good Satisfaction Design	Neutral	Not Good Satisfaction Design	Detail, photo , Description ,Schematic drawings
2- School building Conservation	2-3 –Natural ventilation	*			• 80 % depends on natural ventilation ,because the location and area of openings support helps increasing wind movement through the building. • Use clearstory at the central of the building to create an air outlet at the hall . 
	2-4-Horizental and vertical gardening			*	• small range of horizontal gardening with no vertical gardening.

CHAPTER THREE

RESEARCH RESULTS

3.1 (LEED) Definition

LEED (Leadership In Energy And Environmental Design) is an ecology oriented building certification program run under the auspices of the U.S. green building council (USGBC).LEED concentrates its efforts on improving performance across five key areas of environmental and human health, energy efficiency , indoor environment quality , materials selection , sustainable site development and water saving .

3.2 (LEED) Green Building Standards

Green Building Design and Construction LEED v4	New Construction and Major Renovation (NC)	Schools (SCHOOLS)	Core and Shell (CS)	
Location and Transportation (LT)	16	15	20	100 Base Points
Sustainable Sites (SS)	10	12	11	
Water Efficiency (WE)	11	12	11	
Energy & Atmosphere (EA)	33	31	33	
Materials & Resources (MR)	13	13	14	
Indoor Environmental Quality (EQ)	16	16	10	
Innovation (IN)	6	6	6	10 Bonus Points
Regional Priority (RP)	4	4	4	

3.3 Evaluation according to (LEED)

Green building design and construction LEED v4		LEED standard weight for school	Value	
Location and Transportation (LT)	Location	8	1	8
	Transportation	8	2	16
Sustainable site(SS)	-	12	1	12
Water efficiency (WE)	-	12	1	12
Energy and atmosphere(EA)	Energy conservation	31	1	31
Material and Resources (MR)	Material efficiency	7	3	21
	Resource efficiency	6	1	6
Indoor Environment Quality (EQ)	Human design	8	1	8
	Environment quality	8	1	8
		100%	Total	**40%**

3.4 Conclusion:

- According to (LEED) , Hawler Typical Secondary School is 40% Sustainable
- it has a good Material Conservation
- Good Transportation
- Low Energy conservation

3.5 References:

- Municipality of Erbil
- Our Visit to Hawler Typical Secondary School
- www.centerforgreenschools.org
- www.LeadershipInEnergyAndEnvironmentalDesign.com