T.C.
ISTANBUL GEDİK UNIVERSITY
INSTITUTE OF GRADUATE STUDIES

STUDY ON THE SUSTAINABLE PROJECT MANAGEMENT REQUIREMENTS: A CASE STUDY OF A BUILDING IN THE IRAQI MEDIA NETWORK IN BAGHDAD

MASTER'S THESIS

Basheer Majeed AL ZUBAIDI

Engineering Management Department

Engineering Management Master in English Program

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Thesis Advisor: Assist. Prof. Dr. Redvan GHASEMLOUNIA

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İSTANBUL GEDİK ÜNİVERSİTESİ
LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ MÜDÜRLÜĞÜ

Yüksek Lisans Tez Onay Belgesi

Enstitümüz, Engineering Management Department İngilizce Tezli Yüksek Lisans Programı (201281018) numaralı öğrencisi Basheer Majeed AL ZUBAIDI'nin "Study on the Sustainable Project Management Requirements: A Case Study of a Building in the Iraqi Media Network in Baghdad" adlı tez çalışması Enstitümüz Yönetim Kurulunun 09/01/2023 tarihinde oluşturulan jüri tarafından *Oy Birliği* ile Yüksek Lisans tezi olarak *Kabul* edilmiştir.

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DECLARATION

I, Basheer Majeed AL ZUBAIDI, hereby certify that this thesis entitled " Study on the Sustainable Project Management Requirements: A Case Study of a Building in the Iraqi Media Network in Baghdad" is my original thesis for the award of Master's Degree in Engineering Management at the Faculty of Engineering Management. I further certify that this thesis or any part thereof has not been submitted and presented for any other degree or research thesis at any other university or institution.

Basheer Majeed AL ZUBAIDI

DEDICATION

This Thesis Is Dedicated To The Istanbul Gedik University; My Second Magnificent Home , My Great Parents, Who Never Stop Giving Of Themselves In Countless Ways, My Dearest Wife (HUDA), Who Leads Me Through The Valley Of Darkness With Light Of Hope And Support, My Beloved Brother And Sister, My Beloved Kid (FAHAD), Whom I Can't Force Myself To Stop Loving. To All My Family, The Symbol Of Love And Giving, My Friends Who Encourage And Support Me, and All The People In My Life Who Touch My Heart.

PREFACE

In the Name of Allah, the Most Merciful, all praise be to Allah, First and foremost, I must acknowledge my limitless thanks to Allah, the Ever-Magnificent; the Ever-Thankful, for His help and blessing. I am sure that this work would have never become truth, without His guidance. I owe a deep debt of gratitude to our university for allowing us to complete this work. I am grateful to some people, who worked hard with me from the beginning till the completion of the present research, particularly my supervisor Dr. Redvan Ghasemlounia, who has been always generous during all phases of the research, and I highly appreciate the efforts expended by. I would like to take this opportunity to say warm thanks to all my beloved friends, who have been so supportive along the way of doing my thesis, especially Dr. Ameer Salam Al Shibany.

I also would like to express my wholehearted thanks to my family for the generous support they provided me throughout my entire life and particularly through the process of pursuing the master's degree. Because of their unconditional love and prayers, I have the chance to complete this thesis.

I owe profound gratitude to my wife, Huda, whose constant encouragement, limitless giving, and great sacrifice, helped me accomplish my degree.

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January 2023 Basheer Majeed AL ZUBIDI

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ABBREVIATIONS

ABL	: Atmospheric Boundary Layer
ASHRAE	: American Society of Heating, Refrigerating and Air Conditioning Engineers
BWh	: Hot-Arid Climate Region
CAD	: Computer-Aided Design
ICUC	: International Conference on Urban Climate
IEA	: International Energy Agency
ISO	: International Organization for Standardization
IPCC	: Inter-Governmental Panel on Climate Change
LST	: Land Surface Temperature (From Satellite Images)
TMRT	: Total mean Radiant Temperature
SVF	: Sky View Factor
LCA	: Life Cycle Assist
LCC	: Life Cycle Costing
S-LCA	: Social Life Cycle Assist
HVAC	: Heating, Ventilation, and Climate Control
UHI	: Urban Heat Island

STUDY ON THE SUSTAINABLE MANAGEMENT REQUIREMENTS: A CASE STUDY OF A BUILDING IN THE IRAQI MEDIA NETWORK

ABSTRACT

Sustainability consists of three components: economical, socially, and ecological. The goal of sustainable progress is to decrease the negative effects of all three aspects. There is presently a variety of technologies available for measuring goods' long-term effects and enhancing their efficiency. Among the most often utilized methods for this aim is life cycle assessment (LCA). LCA is used to examine the natural implications of an item's life cycle from beginning to end. (raw material extraction, manufacturing, distribution, use, and end-of-life). Relates Life cycle costing (LCC) and Social-LCA are two methodologies that have been created to examine economical and socially implications (S-LCA).

The origins and evolution of both the integrative framework to thermal comfort are discussed. A variety of advancements inside the economic theories implementation are studied, as well as the basis of the disparities among adaptable thermal comfort as well as the 'logical' criteria is investigated. The emergence of thermal comfort requirements is reviewed, and suggestions for the optimal comfort temperature, variety of relative comfort, and the limit rate at which ambient temperature are established. The use of sustainability factors to improve thermal standards is being investigated.

Thermal comfort is a mental condition that symbolizes satisfaction with one's surroundings. Thermal comfort differs from individual to individual. To sustain thermal equilibrium, the warmth created by human activities must be dissipated at a pace sufficient to keep balance inside the organism. Whenever the heat increase or temperature exceeds this level, irritation develops. Considering thermal comfort is critical in construction since it not only serves as a basis for designing buildings but also has an impact on the field of sustainability.

Modern thermal comfort theories recommend that a restricted temperature difference be evenly maintained throughout all architectural styles, regions, and people. This strategy treats structure inhabitants for heating purposes, resulting in thermal comfort criteria that necessitate power climate management measures. This frequently results in a high need for air conditioning. Initial investigation and new Technology, HVAC (Heating, Ventilation, and Climate Control) advanced facilities are contesting conventional assumptions of thermal comfort criteria on the basis that they ignore main social and environmental comfort elements. In this thesis the researcher took the effect of the modification in the design on the thermal comfort by several engineering solutions for reducing the total meain radiant temperature (TMRT), Potentil air temperature (PAT), and the developing of the relative humidity (RH) with the wind speed (WS) Which are playing a significant rool on improving the urban heat island (UHI) The research mainly aims to analyze the effect of urban green spaces on the urban heat island as a common strategy for improving the thermal comfort.

Ultimately, the researcher wishes to explain that the structure was improved during the thesis, resulting in a clear difference in potential air temperature, humidity, and total mean radiant temperature

Keywords: *Urban Heat Island (UHI), Thermal Comfort, Total Mean Radiant Temperature (TMRT), PPTENTAIL Air Temperature (PAT), Relative Humidity (RH).*

SÜRDÜRÜLEBİLİR YÖNETİM GEREKSİNİMLERİ ÜZERİNE BİR ÇALIŞMA: IRAK MEDYA AĞINDAKİ BİR BİNA ÖRNEĞİ

ÖZET

Sürdürülebilirlik üç bileşenden oluşur: ekonomik, sosyal ve ekolojik. Sürdürülebilir ilerlemenin amacı, her üç yönün de olumsuz etkilerini azaltmaktır. Halihazırda, malların uzun vadeli etkilerini ölçmek ve verimliliklerini artırmak için çeşitli teknolojiler mevcuttur. Bu amaçla en sık kullanılan yöntemlerden biri de yaşam döngüsü değerlendirmesidir. bir öğenin yaşam döngüsünün başından sonuna kadar doğal etkilerini incelemek için kullanılır. (hammadde çıkarma, üretim, dağıtım, kullanım ve kullanım ömrü sonu). İlişkili Yaşam döngüsü maliyeti ve Social-LCA, ekonomik ve sosyal etkileri incelemek için oluşturulmuş iki metodolojidir.

Termal konforun bütünleştirici çerçevesinin kökenleri ve gelişimi tartışılmaktadır. Ekonomik teorilerin uygulanmasındaki çeşitli gelişmeler incelenir ve uyarlanabilir termal konfor ile 'mantıksal' kriterler arasındaki farklılıkların temeli araştırılır. Termal konfor gereksinimlerinin ortaya çıkışı gözden geçirilir ve optimum konfor sıcaklığı, bağıl konfor çeşitliliği ve ortam sıcaklığının belirlendiği sınır oranı için öneriler belirlenir. Termal standartları iyileştirmek için sürdürülebilirlik faktörlerinin kullanımı araştırılmaktadır.

Termal konfor, kişinin çevresinden duyduğu memnuniyeti simgeleyen zihinsel bir durumdur. Termal konfor kişiden kişiye değişir. Termal dengeyi sürdürmek için, insan faaliyetleri tarafından yaratılan ısı, organizmanın içindeki dengeyi korumaya yetecek bir hızda dağıtılmalıdır. Isı artışı veya sıcaklık bu seviyeyi aştığında, tahriş gelişir. Termal konforun göz önünde bulundurulması, yalnızca binaların tasarımına temel teşkil etmekle kalmayıp aynı zamanda sürdürülebilirlik alanında da etkisi olduğu için inşaatta kritik öneme sahiptir.

Modern termal konfor teorileri, tüm mimari stiller, bölgeler ve insanlar boyunca sınırlı bir sıcaklık farkının eşit olarak korunmasını önerir. Bu strateji, yapı sakinlerini ısıtma amaçlı olarak ele alır ve bu da güç iklim yönetimi önlemlerini gerektiren termal konfor kriterleri ile sonuçlanır. Bu genellikle klima için yüksek bir ihtiyaç ile sonuçlanır.

İlk araştırma ve yeni Teknoloji, HVAC (Isıtma, Havalandırma ve İklim Kontrolü) gelişmiş tesisleri, ana sosyal ve çevresel konfor unsurlarını göz ardı ettikleri temelinde termal konfor kriterlerinin geleneksel varsayımlarına karşı çıkıyor. Bu tezde araştırmacı, toplam ortalama radyant sıcaklığın (TMRT), Potentil hava sıcaklığı (PAT) azaltılması ve bağıl nemin (RH) geliştirilmesi için çeşitli mühendislik çözümleri ile tasarımdaki değişikliğin ısıl konfor üzerindeki etkisini ele almıştır. Kentsel ısı adasının (KIA) iyileştirilmesinde önemli bir rol oynayan rüzgar hızı (RH) ile Araştırma, temel olarak termal konforun iyileştirilmesi için ortak bir strateji olarak kentsel yeşil alanların kentsel ısı adası üzerindeki etkisini analiz etmeyi amaçlamaktadır.

Son olarak, araştırmacı yapının tez sırasında iyileştirildiğini ve potansiyel hava sıcaklığı, nem ve toplam ortalama radyan sıcaklıkta net bir farkla sonuçlandığını açıklamak ister.

Anahtar Kelimeler : *Kentsel Isı Adası (KIA), Termal Konfor, Toplam Ortalama Radyant Sıcaklık (TORS), PPTENTAIL Hava Sıcaklığı (PHS), Bağıl Nem (BN).*

1. GENERAL OVERVIEW

The latest spate of rapid urbanization and its effects, along with the rise in human activity, have posed substantial difficulties to urban management and development. Urban problems are extremely difficult, if not impossible, to control due to the various factors that affect urban development. Globalization makes it even more difficult for urban planners and designers to include all the many variables in managing urban environments. Cities are not wholly problematic because they are the engines of the economy and the centers of innovation. Urban issues arise from ineffective government and management, not from the inherent characteristics of cities. It is widely acknowledged that planning for land use and urban design plays a significant part in managing urban development. Planning and urban design have an impact on the form and structure of the city, which in turn influences the land use activities that take place there. All pertinent aspects of urban growth (social, economic, and environmental) must be taken into account at the planning and design level to conduct good city administration. Traditionally, all of these factors are taken into account while designing a development. The advent of the idea of sustainable development has accelerated the planning process's consideration of all three elements (social, economic, and environmental). To follow the principles of sustainable development, development efforts must take into account all of their social, economic, and environmental effects. The frameworks for incorporating sustainability principles into urban design have been extensively discussed by several writers, although the frameworks have mostly focused on fundamental and operational components of urban design. It is necessary to go into more detail regarding the other aspects of urban design.

1.1 The Importance of the Study

Urban planning and design may be immensely significant in achieving environmental sustainability. This is due to the fact that the design and layout of the town get influence its productivity and excellence. For coordinated urban growth, the

processes of the urban design phase must be linked with sustainability ideas. By implementing sustainable design ideas, urban areas can be protected against the negative consequences of business organization of space. Because no civilizations are alike, the environment in which implementing sustainable concepts are used will differ from place to place. The problems of sustainable urban design in dry climatic zones are addressed in this viewpoint, as is a plan for incorporating sustainability into urban design supervision. There ought to be more research into the various facets of sustainable urban development. For example, in terms of substance, the amount of closeness that a city must retain is still contested. The use of these concepts in practical examples will help throw additional insight into how we can apply things to achieve sustainable urban development. Furthermore, architects and urban management engineers must better understand the tensions that arise from the application of sustainably.

1.2 The objective of the Study

First, this thesis aims to highlight the significance of managing sustainable city design, particularly in hot and dry environments. Finding the most crucial design criteria for the implementation and management of sustainable construction in hot, dry regions is the second and most crucial goal of this study. Baghdad has selected a city as having one of the longest summers, lasting for more than seven months out of the year and being distinguished by hot temperatures in comparison to nearby cities. The most crucial and fundamental goal is to suggest a set of design changes to a significant structure in Baghdad and to manage all the aspects and advancements required to accomplish thermal comfort and achieve sustainable construction for this building.

1.3 Methodology

Urban microclimate models have quite different physical bases, temporal and spatial resolutions, and input-output values, to name just a few. Major atmospheric phenomena incorporating wind speed, solar exchanges, heat, and moisture can all be represented using ENVI-met. All microclimate elements that affect thermal comfort, such as Ambient temperature, moisture content, wind velocity, solar output, and mean radiant temperature are all factors to consider. This software was chosen

although it can model three-dimensional structures and determine how vegetation affects outdoor thermal comfort. In order to determine the thermal comfort of the outdoors and the mean radiant temperature at the pedestrian level, we adopted Tmrt (mean radiant temperature) indices. Calculations of potential air temperature, relative humidity, and wind speed are also made, as well as examinations of the selected building's responses to the researcher's suggested modifications, the construction of hot-climate buildings sustainably, and the management of future sustainable construction.

1.4 Organization of the Study

There are five chapters in the thesis. A brief review of sustainability terminology and concepts, sustainability principles, the idea of sustainable management, and the impact of climate change are given in Chapter two. The context for the numerical modeling of the urban microclimate is provided in the third chapter. It also emphasizes ENVI- met importance and characteristics. In chapter four, the outcomes of the numerical simulation for the Baghdad study case are provided, examined, and thoroughly explored. Chapter 5 discusses the insightful results gleaned from the simulation models. It also offers suggestions and viewpoints for additional study.

2. INTRODUCTION

One of the most important concepts generated recently in the 20th century is Sustainability which played a significant role in the engineering fields, This concept of sustainable practices seeks to preserve economic growth while preserving the long-term worth of the environment; it presents a structure for combining regulations with future development. (Maysoon.M.et al., 2014), explained that The construction sectors in this century are no longer in isolation from the environmental cases which threaten the world and the community began alerted in the past few years ago these sectors consumed the most important dangerous environmental resources users like the soil, resources, and waters, energy and contrary to popular belief the process of the construction industry of the many and complex produce large amounts of noise population and construction solid's waste Recently, researchers have shown an increased interest in the great problems of the energy and water waste in construction due to its continued uses of it during the structure life. From the above different reasons a new idea has been generated in the mind of the advanced industrial countries in the world which are not familiar with before throughout the design and implementation stages ؛ sustainability, green buildings, and sustainable engineering are the same concepts, these whole concepts reflected the growing interest in those aspects of urban economic development that are concerned with environmental protection, reduce the energy consumption, optimal use of natural resources and a greater reliance on renewable energy sources. Previous studies have reported sustainability in construction generally but there is no specialist study on the significant role of sustainability in the sector of construction to reduce the negative effect on the environment. One major issue in early Sustainable Development research concerned is the balancing of economic, social, and environmental objectives in the present and future, and it is becoming increasingly relevant for a variety of organizational and spatial needs. As a result, in recent years, sustainable development has become a major topic on worldwide, regional, and national education policy agendas, (Ali-Toudert F, 2005).

2.1 Sustainability Definition and Concept

(Enno Koehan et al., 2009), defined sustainability as the administration of resources to fulfill present demands without risking future needs. which takes into account social, economic, and environmental development in a management structure. The major objective of sustainability was to achieve the balance of environmental social and economically durable as shown in Figure (2.1).

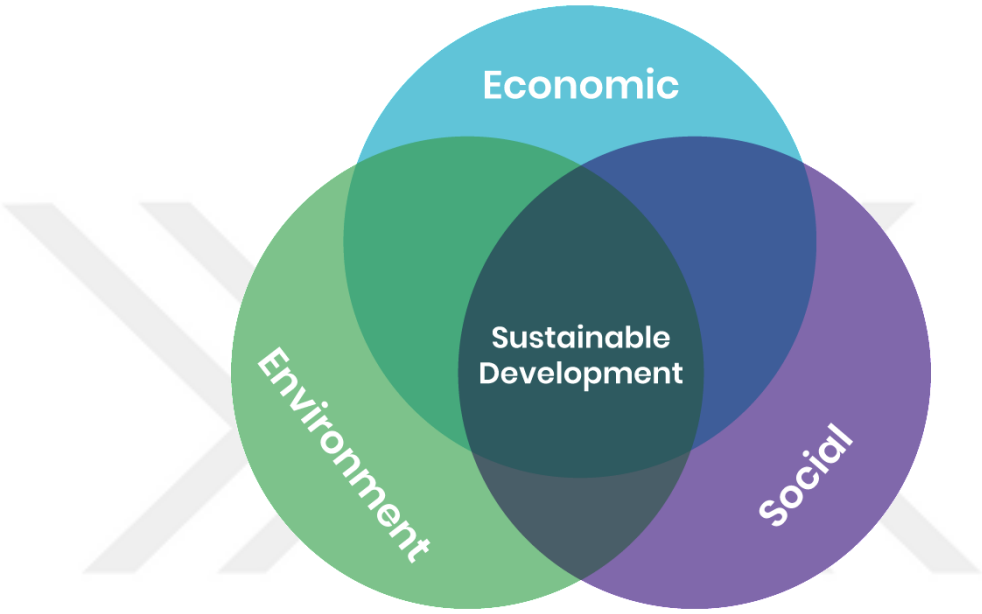


Figure 2.1: Sustainability Objectives

Source: (Jean-Charles Thiry,2020)

(Lindberg et al., 2011) confirmed A primary concept of sustainability assumes that nature and the atmosphere are not in infinite supply Second, sustainability seeks to encourage social development by bringing communities and cultures together. It aims to achieve sufficient levels of quality of life, health, and education through this. resources and that their conservation and reasonable usage are required.

(Akbari, et al., 2010). highlighted A secondary concept of sustainability seeks to encourage social development by bringing communities and cultures together. It aims to achieve sufficient levels of quality of life, health, and education through this .finally, sustainability stimulates economic development that provides equal prosperity for all while minimizing environmental impact. The notion of sustainability is fulfilling present demands without jeopardizing future generations' capacity to meet their own, providing a balance between growth progress,

environmental stewardship, and social protection. As a result, sustainable development is the style of advancement that maintains this delicate balance today without risking tomorrow's resources. To accomplish this, the rule of threes, the rule of fives, and the elimination of waste and rubbish must all be followed. We can battle climate change and global warming with initiatives like these (Brown.H. et al., 2013). The modern idea of sustainability first occurs in the Brundtland Report, commonly known as "Our Common Future," released in 1987. As a result, for the first time, this statement issued by the United Nations cautioned about the environmental repercussions of economic progress and globalization. As a result, the UN attempts to provide answers to the issues caused by urbanization and rapid urbanization. Sustainability is represented by various linked ideas, including environmental, social, and economic sustainability. As a result, many of the problems that humans confront, like climate change or a lack of water, can only be remedied on a global scale and by fostering sustainable growth, (Medany M. 2012).

(Ambinakudige, S. 2011) evaluated that sustainability offers the opportunity to sustain biological factors in their efficiency and variety over time and, as a result, take very good care of the protection of natural resources by helping to promote an aware duty regarding the ecological and, at the same time, develop in human development by caring for the environment in which they live. Currently, numerous businesses and organizations are promoting these reforms.

(Amirtham, L. R. 2016) showed that sustainability offers the opportunity to develop resources in acceptable quantities that are fair in various social lands, as well as an able and stable population of its economic issues, as well as boosting demand and supply in areas of production. It offers the opportunity to develop resources in acceptable quantities that are fair in various social lands, as well as an able and stable population for its economic issues, as well as boosting demand and supply in monetary areas of production. In a nutshell, it is an equilibrium between humanity and wildlife that satisfies demands while not sacrificing the new generation.

2.2 principles of Sustainability

(Mohammad Taleghani, 2011) evaluated that there are three main principles for architectural sustainability represented resources economics, structure life cycle, and human design these principles can be represented as :

- Energy and water-saving: this principle includes energy saving by planning the Climate conditions according to the building direction, wall thickness, suitable planning for the work site, and uses of natural energy throughout the usage of the shape and it is resources.
- Building life cycle: the building passes over three stages during it is life as shown the phase before construction which includes the planning and offering of the resources and materials, the construction phase which is associated with the first phase includes the non-usage of organic materials during the implementation, phase after finishing the building which includes reuse of the building and the infrastructure.
- Human Design: this includes saving all the natural resources through topographic placement, urban design, and site planning by utilizing the drawings of the neighbor building to reduce energy and water demands and achieve human comfort by sustaining health.

2.3 The Concept of Sustainable Development

Despite the multiple interpretations of environmental sustainability, (Rachel Emas, 2015) noted that the recommendation of the National Land Committee is the most commonly used. This wide notion, which will be used in this research, does not restrict the extent of sustainable. The answer, however, emphasizes the significance of multigenerational justice. The notion of conserving for upcoming populations is one of the major factors that distinguish sustainable development policy from conventional climate issues, which also try to absorb the costs of environmental contamination. Long-term financial and ecological sustainability is the overarching aim of sustainable development (SD); nevertheless, this must be accomplished by taking and recognizing financial, ecological, and social factors all across the judgment processes. When using this concept of sustainable development, one factor to examine is asset complementarity. (Nichol.J, 1996) agreed that the three types of capital are societal, environmental, and man-made. In accordance with the notion of poor sustainable development, only the total level of capital things matters: man-made, or produced, capital is a suitable alternative to natural capital. The idea of sustainability, on the other hand, acknowledges the distinct qualities of environmental assets that cannot be replaced by created capital. Norton, B.

(Ambinakudige et al., 2015) found that a majority of ecologists and activists endorse the consistent operating notion. In additional to complementarity, this idea of sustainability is based on numerous other important qualities. The notion of equality is incorporated into the conventional understanding of sustainable development. It acknowledges the long-term magnitude of durability to satisfy the needs of future generations. As a consequence, government action must try to absorb ecological costs as much as possible, hence lowering inefficiencies. (Panariti.A, 2014). shown that According to the doctrine, if there is a large or permanent danger of harm, a lack of total certainty must not be used as a justification to postpone adopting cost-effective actions to prevent ecological damage. As a consequence, the action's promoter is accountable for establishing it will not cause significant damage. As made clear in the Rio Declaration, the notion of equal but varied commitments highlights that each country has a responsibility to play in the problem of sustainable development. This concept also acknowledges the varied responsibilities of established and emerging nations to biodiversity loss, while also addressing the future development requirements of less rich societies. As a result, industrialized countries face an unfair share of the burden. the energy they require and the demands they put on the ecosystem The primary concept of sustainable development that supports all others is the incorporation of ecological, cultural, and policy factors into all areas of decision-making. The SD framework's other principles are similarly built on effective decisions. The deeply rooted idea of inclusion distinguishes durability from other forms of policy, (Fukuda. H et a., 2014).

2.4 Advanced Sustainable Building Methods and Elements

The Lack of natural resources has existed as a health problem for many years. Over the last several years heavy consumption of natural resources has created alarm about the usage of these resources in building implementation that wastage of land, pure water, wood, iron, and other non-renewable resources like petrol, gas, …etc which may lead to a shortage in these resources in the future. Sustainability is the suitable use of resources such as land, sunshine, and ventilation to reduce the unnecessary usage of non-renewable energy (Prutha Platelet al., 2009).

2.5 Sustainable Architectural Design

The subject of sustainable architecture has become one of the most critical concerns that are being addressed in many nations throughout the world. The uses of this design help to improve the interior and Structure exterior designs and urban gatherings up to the city level. What precisely is sustainable architecture? And what is its function? What are its constituents and the circumstances for its formation and accomplishment? Describe the methods and methods of implementing them at various levels. Our geographic and municipal architecture, in specific, is plagued by troubles of decline and rotting of its successful learners and useful outlooks, as well as its cultural and moral features, which are exposed to varied kinds of progressive harm, beginning with its outer shell and structural structures and ending with the low level of performance that is an unavoidable result of the foregoing. Recently investigators like Omar H. Kharofa (2018), have examined the effects of Sustainable design response to the environmental challenges of fast economic activity and population increase, Sustainable design is an integrated design process within civil/construction and architectural engineering, not an add-on or addition to architectural design. The deliberate blending of architecture with electrical, mechanical, and structural engineering is what defines sustainable design. Aside from the classic aesthetics of massing, proportion, size, texture, shadow, and light, the facility design team must consider long-term costs: environmental, economic, and human. The idea of [Manage projects using sustainable engineering methods] will be explained in this study by (Baetz, B.W. et al ., 2008) who try to adopt a newfound notion, aside from across all constraints of consumption understandings that fail to confront restricted facets in dealing with this idea, as advanced technical requirements have supplied broad prospects for the use of the idea of sustainable engineering. Although its thoroughness and numerous characteristics go under the heading of sustainability, modernism is focused on one goal: to enhance the degree of constructions, making them constant and continuing throughout time, and then preventing their harmful impact on both people and the ecosystem.

2.6 The Effect of Green Building Material

Green buildings are those structures that create a balance between the biosphere and the structure's residents. The structure is built to fit into the local climate in which it is situated. This building consumes far fewer resources, particularly electricity and water, than standard structures. These structures are distinguished by their capacity to preserve energy. Using renewable power, such as solar energy, and relying on natural ventilation and lighting to minimize energy use and the pollution it causes. Recent developments in the field of green buildings have led to a renewed interest in Green construction materials made from renewable resources instead of nonrenewable resources. (Shahriar Shams et al ., 2018) defined the concept of Green buildings as those structures which are planned, built, managed, and kept utilizing methods and practices that conserve the environment, decrease pollution, and minimize the use of various resources, while also improving the integration between the building and its surroundings. Green materials are environmentally acceptable since their effects are examined throughout the product's life cycle. Green building elements also give the homeowner and inhabitants the following benefits. Green buildings comprise sustainable and high-performance structures that seek balance and integration between humans and their surroundings as explained by (David V. J. Bell , 2016).

- fewer repairs expenses incurred during the structure's existence.
- Saving power.
- The efficiency and wellness of residents have developed.
- Reducing the costs of changing room configurations
- expanded creative options

Green building standards may be applied to the majority of structures that are built, taking into consideration the distinctions for each form of construction based on the intentions, as follows:

1. Public Structures Such As :

- Schools And Colleges

- Departments Of The Government (This Will Be Addressed In Our Research Chapter Four, As a Building Was Taken In The Iraqi Media Network For The Printing House Of Al Sabah Newspaper)
- Shopping Center
- Hospitals

2. Private Structures Such As:
- Residential Structures Such As Homes And Villas
- Meeting Rooms

2.7 Changes in the climate

Because of its impacts on ecological, precipitation, heat, and air currents, climate change is going to have a significant impact on all economies. No one will be avoided the consequences. Nevertheless, certain individuals and nations are more susceptible than elsewhere. Long-term hazards affect all of mankind, but the most urgent concerns disproportionately affect the world's poorest in society individuals. Scientists believe that the temperature is rising, so the rate of warming has risen by around 0.7 degrees Celsius since the beginning of the industrial era. We also know that this tendency is accelerating: the world average mean temperature goes up by 0.2 degrees Celsius per year. Local changes in precipitation are altering, biological zones are moving, oceans are warming, and ice caps are melting as the global temperature rises which have been shown by (Federico M. Butera, 2014).

According to the Fourth (IPCC) Report Panel on Climate Change (IPCC), the biggest environmental impacts on ecologies and water supplies are likely at worldwide temperature goes up by 1 to 2 °C and net adverse effects on agriculture worldwide are likely at temperature increases of 2-2.5 °C or higher, ranging from pre levels Figure (2.2)

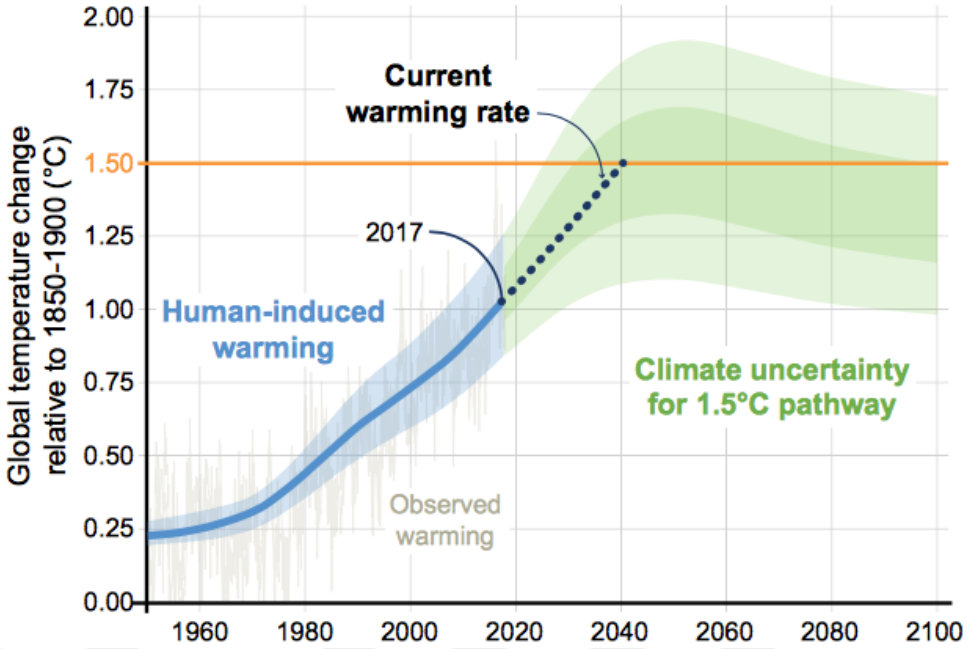


Figure 2.2: Temperature Increase Level

Source: (Alan Buis, 2019)

According to the IPCC assessment, significant worldwide reduction emissions of at minimum 50% under 1990 levels are required up to 2050, with further global emission reductions after 2050 to achieve a zero-carbon economy by the end of the 21st century. It's the only option to limit the temperature rise to 2 degrees Celsius, which is thought to be the maximum mankind can tolerate without devastating effects.

The current scenario is concerning. In 2010, global greenhouse gas (GHG) emissions surpassed 7 tons of CO2 equivalent per capita2, with a significant disparity between industrialized and poor nations Figure (2.3) To meet the 2°C goals, global GHG emissions need to be cut to 2 tons CO2eq per capita. The EAC countries are now around this level; the difficulty is to maintain that level of emissions without stifling economic progress.

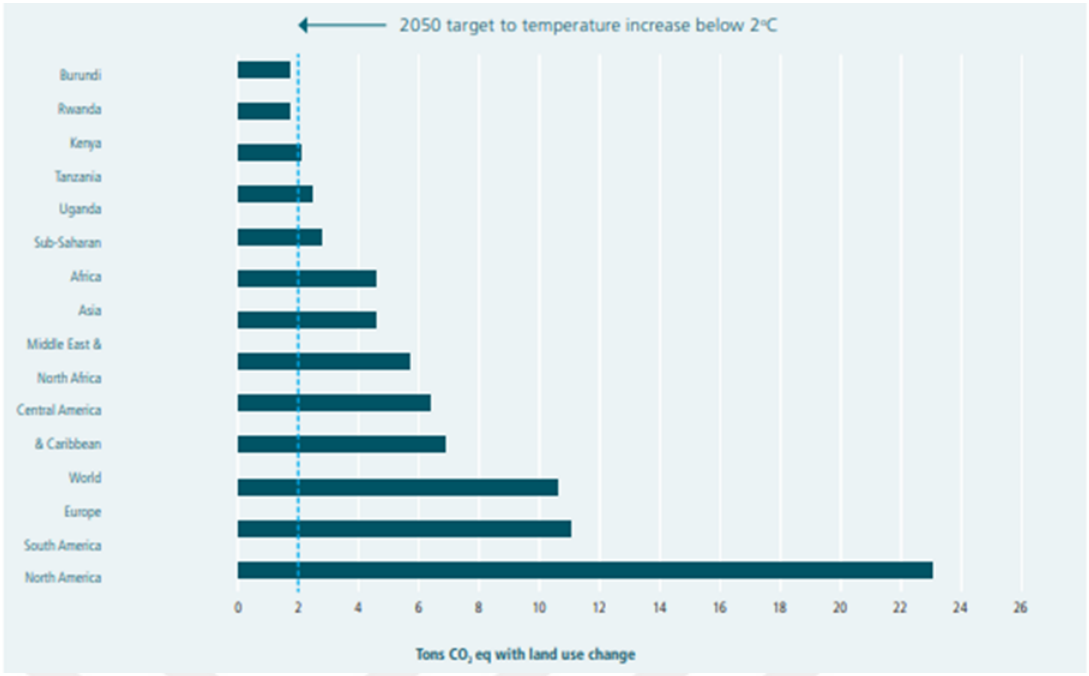


Figure 2.3: Global Greenhouse Gas Emissions

Source: (Federico M. Butera, 2014)

Another significant concern is resource depletion. Mineral and biological supplies have been exhausted, and very little will be available for future generations. Because of the increasing drop in ore grades, most essential minerals will last fewer than 40 years Figure (2.4)

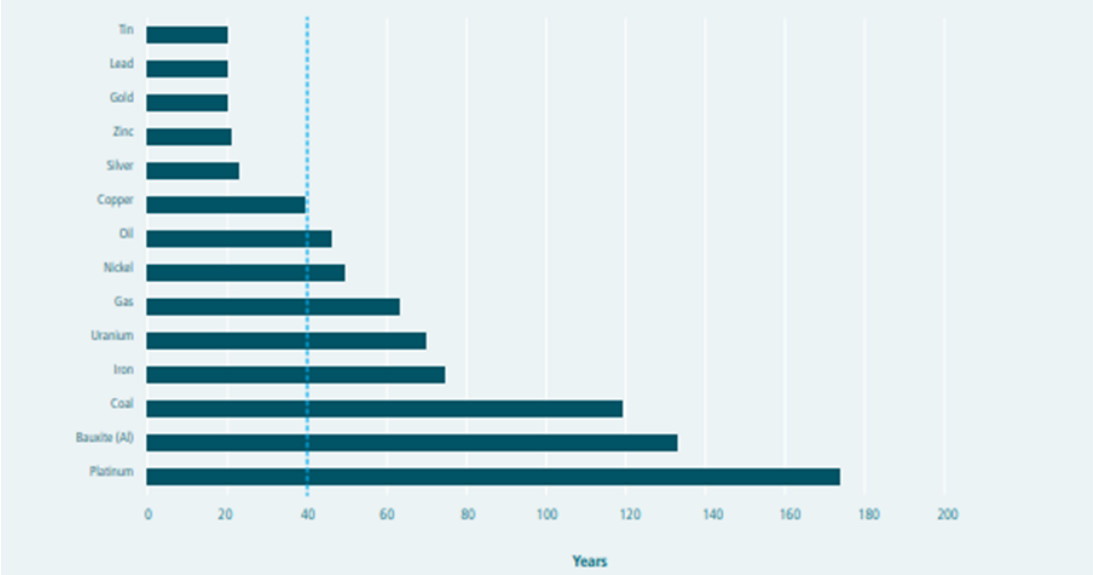


Figure 2.4: Mineral and biological supplies exhausted

Source: (Federico M. Butera, 2014)

2.8 Climatological effect

(Ratti. C et al., 2003), clarified that the Climate refers to the accumulation of meteorological conditions throughout time, Depending on the magnitude of the geographical region under consideration, several terminologies are employed. We use the terms macroclimate for a big area, meso climate for a medium-sized region, local climate, and microenvironment for a limited region at the individual or confined space level.

Regional weather is often associated with a surface area varying from a few square meters to a few miles. It can apply to the hillside, a valley, or a part of the building space, for example, and is described by just about notable temperature changes, humidity levels, wind, sunlight due to the specific nature of the terrain, urban morphology, alignment, resource nature, located close to water, appearance or lack of vegetative cover, and so on (Setaih. K et al ., 2013).

Solar Radiation is the element that affects temperature and causes local winds The temperature at a provided latitudinal is affected by the attitude of inclination of sunrays on the surface, which is best at the earth's floor and smallest at the axes. The extra electricity that reaches the earth and the larger the air temperature, the increased the tilted perspective (therefore the smaller the latitude).

The Ambient Temperature is strongly affected by a specific situation, which includes geological elements (longitudes and hydrogeology), terrain (altitude and landscape), features (soil structure and appearance), position (urban or rural), and also radiation from the sun and air, that can occur more or less important difference, that can be partial or total.

Humidity The percentage of the volume of water evaporation possibly carries in the air to the highest variety which can be stored earlier than precipitation falls is expressed as relative humidity. Usually, it is cited as a percent. Relative humidity fluctuates cyclically; it norms at night and at some point in the colder months when the ambient temperature is at its smallest and falls as temperature increases.

The Wind is a form of a jet stream resulting from differences in earth's atmosphere pressures generated by earth, water, and air heat transfer, which can happen on a fundamentals level (between global locations) or even on a small level (seafront, the lake area, hillsides, etc).

The Impact of Climate Change on Infrastructure: Traditionally, it has been argued that Climatic change refers to any major change in climate measurements over a certain period (Mirosław, 1982). Today, the terms climate change and global warming are sometimes used interchangeably. Natural events like volcanic eruptions, energy releases from the sun, and fluctuations in the earth's orbit have produced changes in the earth's temperature, ranging from ice ages to warm times. Human actions such as the use of fossil fuels and deforestation may have produced an increase in heat-trapping 'greenhouse gases' in the atmosphere. According to current assessments, the global average temperature has risen by 1.2 to 1.4°F during the last century.

2.9 Using Green Buildings To Improve Thermal Comfort In Hot And Dry Climates

Architect selection is critical to The possible profitability of the structure. As a result, it is critical to understand the specific attributes Across the concept stage and consider the seasons and climates outside the structure to determine the best option. The thermal environment in outdoor areas in warm climatic zones requires the use of passively design concepts and architecture features that encourage building users' adjustment to regional climate changes. contribution to city vitality and the best of living (Bansal N.et al., 1994) Trying to motivate citizens to use outdoor areas would benefit communities from all walks of life, which include physiological, social, financial, and social factors of thermal comfort. As the worldwide trend shifts from volume to excellence, new aims for construction projects have emerged, and with rising market expectations and the rise of a global awakening to the notion of sustainability, the major goals of sustainable buildings have been crystallized via five factors: [resource efficiency - energy efficiency - pollution avoidance - environmental compatibility - integration of activities and systems] Since these five components constitute the primary axis for attaining successful design thru the combination of designing and management so that the architecture is identity as compared to typical trends, and early design decisions have a significant influence on energy efficiency. The user-friendly environment in terms of thermal comfort and humidity level, as well as the usage of various types of heat-reflecting glass, And depending on natural ventilation - restoring the notion of interacting with

architectural theory while creating rather than just turning to recognized forms - One of the key aspects in the design is achieving an integrated design to rationalize energy usage and promote user health, which is followed by other elements, with the requirement to include technologies that are friendly with the environment and with people.

Ventilation systems are among the most important passive systems for hot and humid climates where airflow is difficult to access. Ventilation is required for humidification and consumer life quality when pressure or temperature changes. The design of the site, its geometrical, airflow region, speed and altitude, the location of the window panes, and the angle of wind occurrence (in which the high-pressure occurrence on the construction face is regarded (productive years of life), and the low-pressure is on the leeward face) are the major factors that affect the airflow strategy performance (Gaetani Dell'Acqua D'aragona I. I., 2003).

2.10 Shape, Design, And Orientation Of Buildings For Climate Responsibility

The initial decisions made by the designer include the building shape and orientation. Those are often the most important since they have the largest effect on visual and thermal comfort, and another energy usage. The third biggest choice concerns the envelope's heat resistance and insulating and the measurements of holes. This is truly the case for designing buildings anywhere in the world. Furthermore, when dealing with small housing, the architect of a housing complex in the EAC, and in all emerging nations with comparable conditions environments, faces a unique challenge: the layout of the kitchen. This is due to the kitchen innovations used or the effect they have on health and comfort (M. Hamdani, 2014).

2.10.1 Shape of the Building

(Alfredo Esteves, et al., 2014), defined The capacity of a structure to switch or radiate warmness is proportional to its extent (including its volume and shape), due to the fact losses and positive aspects show up all through its roofs. Therefore, the surface-to-volume ratio determines the warmness input at some point of the day and the cooling time at night. Thermal reduction and increases boost as we step away from a more concentrated way, the box, at a fixed mass and therefore workable floor surface Figure (2.5)

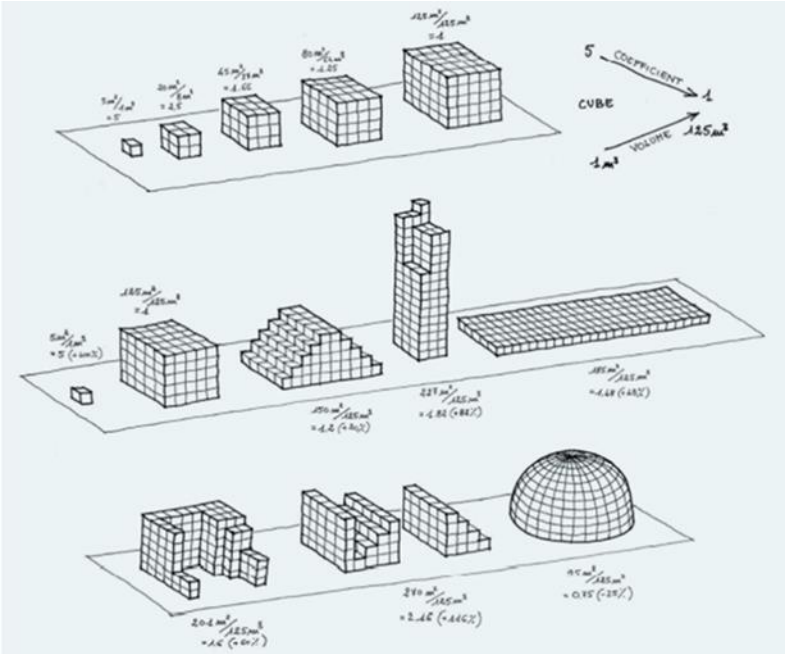


Figure 2.5: Surface To Volume Ratio (Shape Coefficient) Variation For Rising Cube Volume

Source: (Federico M. Butera, 2014)

Moreover, lowering the exterior-to volume (S/V) ratio decreases the quantity of material needed to construct the package, due to lower building costs and less amount of energy. On the other hand, for the functions of natural lighting and natural ventilation, a long, slim structure is higher than a square one Figure (2.6) The best possible shape depends on what type of tropical climate: in contested areas with high hourly thermal stress (warm times and cool temperatures), a compressed shape (reduced roof to volume) is best to minimize the area of the box exposed to sunlight. In contested areas, when the monthly air temperature is modest and the percent moisture is considerable, the design should be as wide as practical to allow ventilation systems to function. Simultaneously, sunscreen is vital, and every attempt would be taken to supply nothing is necessary (M.T Araji, 2019).

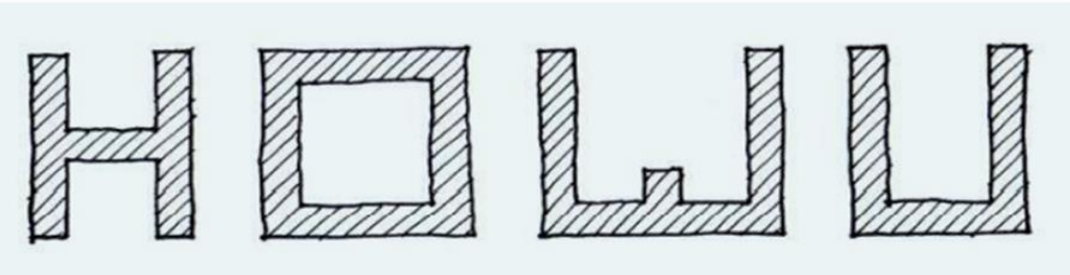


Figure 2.6: Cases of Construction Drawings With Great Natural Light Entry and Natural Air Circulation Possibilities

Source: (Federico M. Butera, 2014)

2.10.2 Courtyard

Usually in hot countries, the majority of everyday activities are outside. In tropical regions, the optimum design of relaxed outdoor areas is thus essential. The courtyard is the clearest illustration of a very well outdoor area Figure (2.7), and it is particularly fitting in warm environments where this is conventional and popular. A portfolio of cool night air could be maintained in a courtyard because it is thicker than the nearby hot air. If the courtyard is narrow (width below height), cool air will not interrupt such pools of colder air. The small courtyard appears to work well as a high-temperature controller. Except for around noon time, high fences block out the sun, and large areas of the internal surface and roof are shaded during the day, trying to prevent increasing temperatures; additionally, the ground beneath the courtyard tries to draw heat. The heat collected during the day is drained away by re-radiation during the night. Thermal resistance through the interior surfaces should be aided by proper ventilation at night. Therefore, the layout of holes should be directed by two things: during the day, small openings are favored in the evening, and the holes should be big are capable of providing proper ventilation to drain away from the heat emission by the courtyard's walls, and floor. An option that meets both these conflicting necessities is to use holes with large heat resistance shutters, such as massive, wood-framed shutters that are partially coated to allow light in. They would've been shut tight during the day and allowed access at night (Rahman M., 2003).

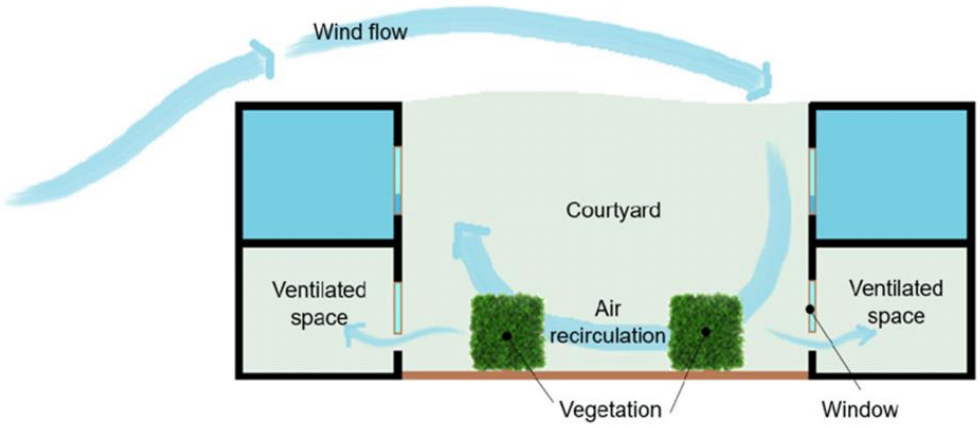


Figure 2.7: Courtyard

Source: (Hao Sun, et al ., 2021)

2.10.3 Building Direction

Building orientation is critical in tropical climates, and the basic rule is to reduce the exterior facing east and west Figure (2.8) and to consider local wind directions, which are linked to natural air circulation. The first-class orientation of construction with admiration for Because they spread across a closer distance of degrees near the equatorial (from around + 5° N to - 10° S), the sun is similar to all climates in EAC nations. The sun route would be such in this variation that a large quantity of renewable radiation can drop on the east and west-facing building facades., the place solar safety difficult. As a result, the most appropriate building direction and shape are lengthened along the east-west axial direction, maximizing the north and south-facing exterior (that are easy to defend with narrow trusses) and minimizing the east and west-facing exterior (that are hard to protect), thereby reduce thermal progress to a minimal level.

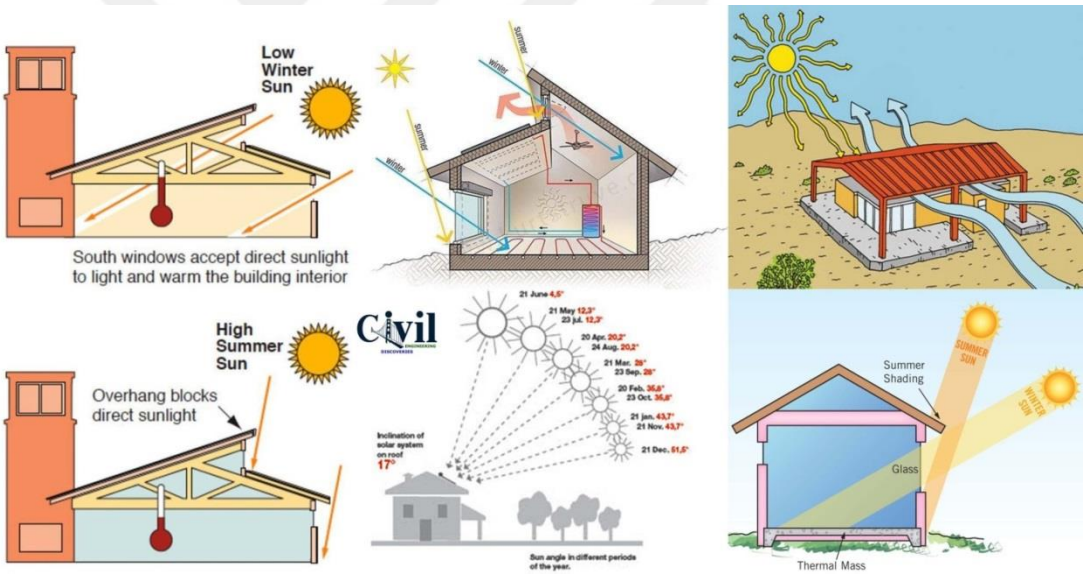


Figure 2.8: Building Orientation

Source: (Aiman M Albatayneh ,2018)

2.11 Building Roofs And Walls Design For Climate Responsibility

Roof style, color, and structure, as well as wall color and composition, are critical even though they evaluate a structure's actual quality. Roof design choices in single-story building structures are extremely important, whilst also wall design choices both in high- and low buildings are vital.

2.11.1 Building Roof

The roof of a construction site is the member that obtains the most solar irradiance. The external surface helps to absorb radiation and overheats, The roof of a construction site is the member that obtains the most solar irradiance. The outer surface helps to absorb radiation and overheats; the roof after which communicates this warm air to its inner side, which heats and radiates inward, starting to heat the indoor environment and ultimately being absorbed by the people living in the area and objects inside. The building's thermal performance is very important for the thermal environment. The roof's shape must be designed with rainfall, solar effect, and usage habits (thrown, lat, vaulted, etc.) Figure (2.9) , (Fernando Barriuso et al., 2021) .

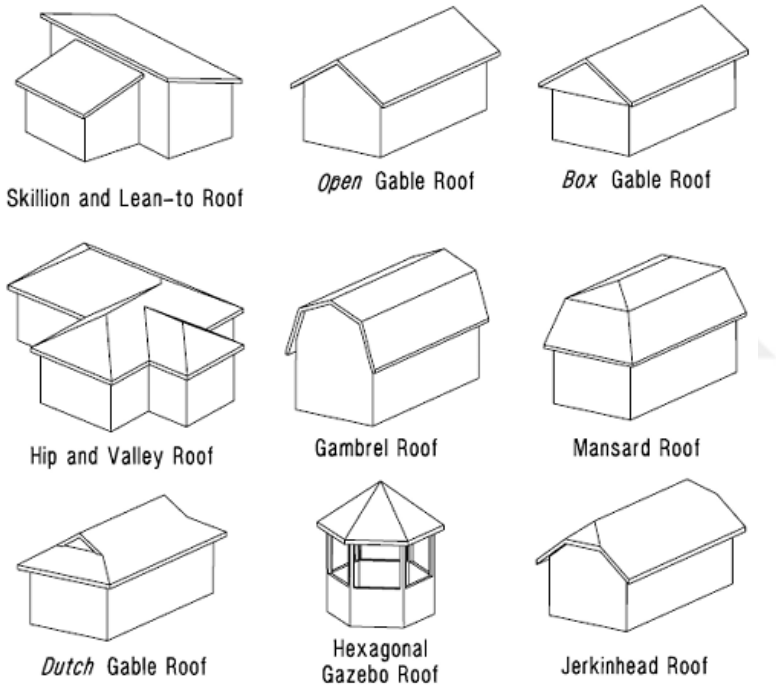


Figure 2.9: Roofs Design For Tropical Climate.

Source: (Ethan et al., 2011)

even many insolating materials can use on the roof can reduce the sun's heat and give sufficient thermal comfort to Whom occupies the building Roofs must be sloped towards the dominant cold wind to keep them cool, and any impediments that prevent airflow all along roof surfaces should be prevented.

2.11.1.1 Domed and curved roofs

For centuries, warm areas have been using domed roofs. These roofs have small holes above that have been made of local materials like rock or bricks and are finished with plaster. The upper holes offer airflow and a means of escape route for warm air collected at the top. These have many advantages :

- When The Sun Is Shining, Vaulted Roofs In The Form Of A Half-Cylinder And Those Domed In The Shape Of A Hemisphere Have Always Had At Least Part Of The Ceiling Shaded.
- Because of temperature changes, all the warm air inside building structures with curved roofs congregates in the space beneath the roof, producing a more pleasant experience at floor level.
- Because of the Bernoulli effect, domed and vaulted roofs increase the rate of the air flowing placed above their domed surfaces, trying to make cooling wind speeds more efficient at lowering the temperature of such roofs.

Curved roofs absorb pretty much the same amount of solar irradiation as flat roofs, but they absorb more irradiance. The enhanced solar radiation input is offset by the larger convective heat transfer with outside air as a result of the greater surface area and higher convection losses; additionally, the bigger surface tends to favor thermal losses during the night to irradiation in the far-infrared, with probably resulting from the cooling effect, which is incredibly useful in the moonless days of warm environments Figure (2.10). As a result, curved roofs are suitable for areas of high total irradiance and limited sky-dispersed radiation, such as hot areas. However, to be truly efficient, they must be done correctly with a top opening for air circulation at night, (Krystyna Strumio, 2021).

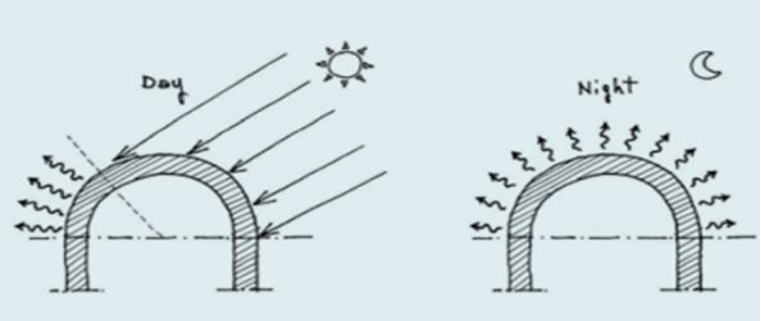


Figure 2.10: Rounded Roofs.

Source: (Federico M. Butera, 2014)

2.11.1.2 Roof with a single leaf

The single-leaf roof, which is most popular in hot, humid areas, must be made of thin materials with low-temperature volume and high reflectivity. The best reflectivity is discovered on metallic and light-colored surfaces. Going to paint the exterior in light colors, including a cover of white implemented yearly, is an inexpensive way to increase reflectivity. This should not be neglected because soiling and growing older degrade reflective properties. Regardless of the material was using, whether aluminum, concrete, or galvanized steel sheet metal, the difference in temperature here between the bottom of the layer and the interior air is around 35 °C19 during the hot hours of a clear day. the Aluminum layer is an excellent product for the top roof layer. This material, even so, has some disadvantages, like a bright light from sparkling sunshine and loud sounds from rain, wind, or even other equipment trying to strike it (twigs, fruit, etc.). Even the sound of living creatures (birds, small animals) trying to walk across the top roof surface can be audible.

2.11.1.3 Roof with two leaves

A ventilated dual-leaf roof is the most efficient roof type for all EAC climatic regions. The exterior layer helps to protect the interior by shading it and absorbing the sun's rays based on its reflectivity, which also should be just as large as possible. Air circulation and ventilation of the interior space between both the roof and the ceiling are vital for comfort.

2.11.2 Walls

The majority of the external walls are made up of panels. A wall that is not shaded from the sun warms heat and radiates heat to the interior. Excess heat can be controlled by varying the thickness and materials of a wall. Thermal resistance across exposed walls can be enhanced in the following manner Figure (2.11) :

- Increasing its thickness
- Using hollow wall construction
- Using walls composed of heat-insulating materials
- Install heat-insulating material on the exposed wall's interior or exterior
- Using radiation barriers.
- Whitewash the exposed side of the wall with a light color.

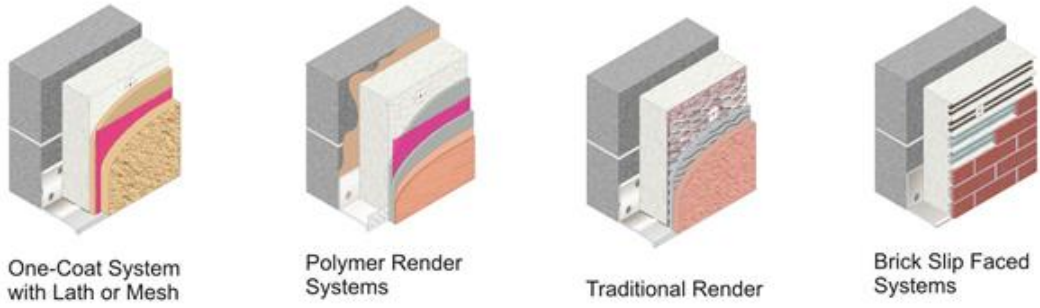


Figure 2.11: Wall Insolation

Source: (Hao Wang et al ., 2018)

2.11.2.1 Wall thermal insulator

Insulators in tropical climates should be regarded as well as in the mountains, in which temperature changes could be significant that some temperature is needed, and in hot-arid plains, in which the concentration of irradiance on walls must be reduced. The coating would reduce heat loss caused by the solar excessive heat on the outer surface. Roofs obtain much more solar radiation than wall surfaces and, with exception of walls, could not be shaded; therefore, a wall insulator is critical. Ground exposure to the outside local weather experiences each advantageous in absorbing (both short and long waves) and convection and radiation transfers. If the flooring is dull and exposed to sunlight, this can reach a maximum that some distance enlarges those of the air, impacting the heat air quantity of light at some stage in the wall, which can be very high.

The better insulation of a wall is determined by several elements, including the external ambient temperature the object's resistance and high-temperature inertia, the airspeed, the severity of incoming radiation, the performance relates to the absorption of sunlight, and the emission spectra in the far-infrared.

2.11.2.2 Heat mass

Thermal mass is essential in warm tropical climates in which the daily thermal swing is significant, absorbing heat throughout the day and bringing it back to it at night to keep climatic conditions comfortable. Thermal mass, on the other hand, is of very little when used in a wet valley's tropical climate with a small daily thermal swing, so because warm air kept throughout the day with incident solar energy would've been published at night, trying to make the comfort circumstances even worst.

2.12 Effected Ventilation

effected ventilation can be extremely successful in both hot and tropical climates and hot and dry climates. Ventilation can be generated in three different ways. One method involves warming air in a confined region using sun radiation, resulting in a heat differential and air movement, as in solar chimneys. The airflow forces heated air to ascend and exit outside, bringing in colder air and therefore cool Figure (2.12).

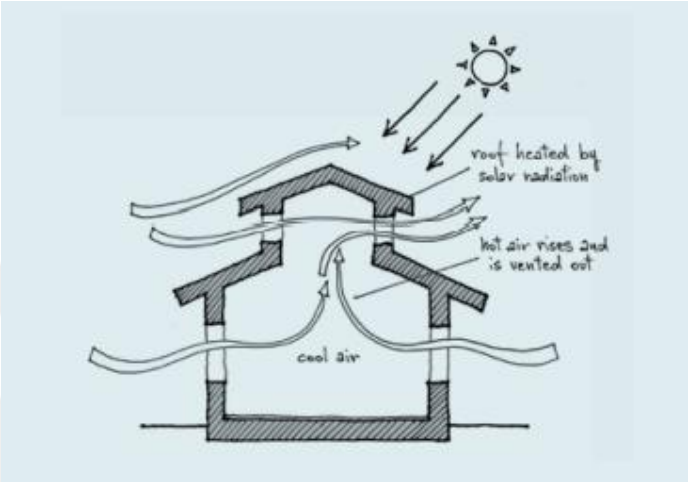


Figure 2.12: Effect Of Stacking On Affected Ventilation

Source: (Federico M. Butera, 2014)

The second method uses wind speeds to withdraw air from a structure, either channeling the airflow within or producing a depression using a spinning device pushed by the wind, Figure (2.13).

Figure 2.13: Air Ventilator On The Rooftop

Source: (Federico M. Butera , 2014)

The third method takes advantage of the Ventures effect, in which air is evacuated from the structure due to the low pressure caused by wind on top of a tunnel. It could be an excellent option to wind catchers in windy places, Figure (2.14).

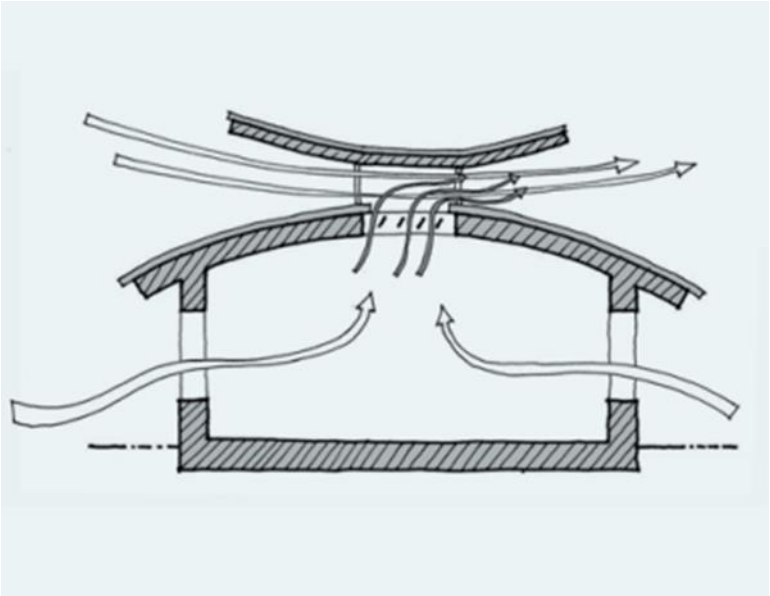


Figure 2.14: Venturi passive ventilator with louvers that may be adjusted

Source: (Federico M. Butera, 2014)

2.13 Day lighting

(Barbara Gherri, 2013) clarified that Taking advantage of daylight is critical for sustainable building in every climate since it provides aesthetic comfort, reduces the amount of conventional energy consumed, and reduces Heating increases caused by ambient light inside Sky illumination and thus passively designed solutions are important in warmer and hot-arid environments varies. The luminance of clear sky in hot-arid regions is not equal, decreasing from the level to the summit with a significant rise at the sun's location. Sky brightness is more uniform in cloudy skies typical of hot-humid climes, but rises from the horizon to the zenith. Daylight needs are often divided into theoretical and practical categories. The lighting intensity inside is referred to as quantitative needs, while the distribution of brightness in the visual field is referred to as qualitative requirements.

2.14 Shading

Whether a facility is air-conditioned or not, the purpose is to manage direct sun radiation to provide thermal comfort, light, and energy usage. The perfect sun-shading mechanism will block radiation from the sun while allowing sunshine, breeze, and an exterior view to penetrate the window. Shading is mostly connected to the direct component of radiation, whereas the diffuse and reelected elements

(unless mirrored), which travel in an essentially isotropic manner, have a considerably less role. Shading can be inadvertent or independent of architectural choices, or it can be specifically engineered to regulate the amount of solar energy in a structure. In the first scenario, the fundamental source of shade is the atmospheric circulation environment and the existence of shading features such as trees, buildings, and so on. In the second example, certain factors and features, such as overhangs and shading, are employed, Figure (2.15).

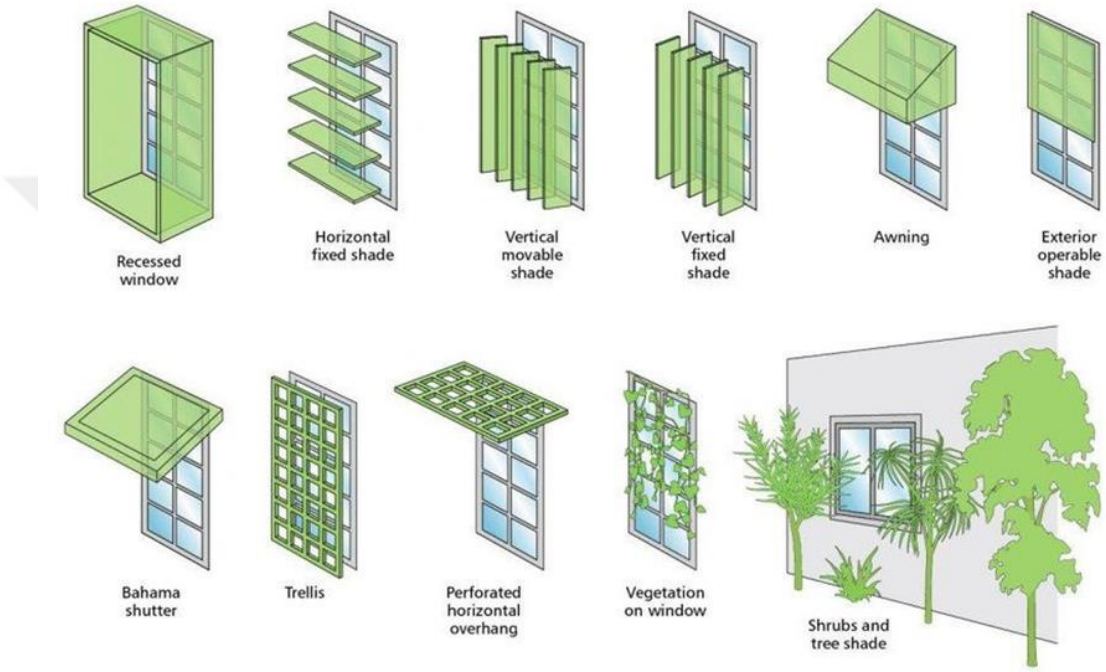


Figure 2.15: Shading By The Building's Context And Elements.

Source: (Qudama Al-Yasiri,2021)

3. INTRODUCTION

The urban environment is a result of a permanent reaction between the physical elements which constituent of urban space and the climate conditions, the relationship between them is like a chemical reaction, hence it comes with the difficulty of anticipating and dealing with these relationships complex; that is the reason which led the designers to use simulation programs. Designers in this field of urban design should have the creativity and the awareness by using this program and to use the optimum use and verify the extent of the impact of using the green element within the urban space in advance during the design process before implementation in practice. The aims of this chapter appear to merge both the urban design of the urban spaces and the climate simulation programs; by using one of the climate simulation programs (ENVI-met software), and determine the influence of optimum usage of the green element in the urban spaces under study and it is the effect on the heat comfort of the living people.

Millions of people live in cities and are subject to the different climatic circumstances of their surroundings daily. Minimization of extreme heat, resources pollution, and wind danger ought to be a priority for lawmakers, designers, and planners in need to provide healthy living circumstances for individuals, specifically when climatic factors harm life. Our objective is in human and plant regions.

Sustainability is frequently viewed as a balance between everyone's wants and environmental concerns. Nevertheless, we demonstrate statistically that the opposite is correct. Knowing the complexities of the surrounding ecology is all that is required to create green buildings. Using our ENVI-met modeling program, we investigate and evaluate the impacts of architectural and urban design on the microenvironment of outdoor places.

This method is built on an elevated simulation analysis of the urban environment that employs the most recent advances in science in thermodynamics, fluid modeling, and plant biology. Climate conditions, plants, pavements, and constructions all react continually in the complicated realm of outdoor habitats. Because of the ensuing

interdependence, these aspects cannot be examined or analyzed separately from the others. It is critical to combine all of the complex interaction data into a single system for appropriate modeling of a similar ecosystem and its feedback mechanisms, even if only a single climatological feature such as ambient temperature is needed. To resolve these concerns, ENVI-met employs an unrivaled and distinctive comprehensive method that involves all characteristics of an environment being integrated and reproduced in one single complicated model, ensuring some all study, (Michael Bruse, 1994).

3.1 Urban Heat Island

The green element if it is well chosen and designed, will have an important role to generate a nice climate throughout it is role as an essential element in designing an urban environment, the visualization of plants and real trees by using simulation software interests a large groups of designers and researchers. Each plant affects the climate elements in the urban environment that depends on it is volume, density and it is elasticity.

Plants are the most climate elements affected which affect the wind motion, air temperature, humidity, and radiation ratio in addition to the significant role of the plants in reducing the heat urban island throughout the processes of evaporation, shading, and transpiration which led to lower temperatures, (Helge et al .,2018) .

A modeling program, ENVI-met Version 5.0.3, was utilized to anticipate climatological variations within the metropolitan environment. It was deemed the best tool for estimating the microenvironment characteristics of planned urban settings because of its customer design, low given input requirements, and a huge quantity of comprehensive microclimatic results (Alznafer etal ., 2014).

This microenvironment framework has already been frequently utilized to calculate the climatological variations indicated by urban geometry (e.g. Johansson, 2006) ; (Ali-Toudert and Mayer, 2007); (Fahmy and Sharples, 2009).

The adoption of environment modeling was motivated by two primary benefits: First, field investigations might be time-consuming and necessitate the use of several instruments dispersed throughout the research locations. A number of the research characteristics, including such Radiant Temperature, were also challenging to

quantify. Furthermore, modeling systems like Envi-met may anticipate the impact of urban modifications on microenvironment circumstances with reasonable accuracy. This conclusion has been proved in several earlier research, including (Alznafer, 2014) ; (I. Ozkeresteci, K. Crewe, A.J. Brazel, 2003) ; (Bruse, M., Fleer, 1998); (Perini & Magliocco, 2014).

Figure (3.1) showed the Envi-Met version 5.0.3 The required information is divided into two files: the Region Information Data, which defines the physiological and special attributes of the urban region being studied in addition to effectors, and indeed the primary Programming Environment, which includes the beginning weather information, the dating site and length of time of the modeling, the location of the urban studied area, and even some heat capacity of the concrete structures utilized in the prototype, such as U-value, in addition to the interior building. Aside from the two fundamental files required for every microenvironment simulation (Region Entry Information and Settings Data), the system requires extra information on the surroundings, vegetation, or emission.

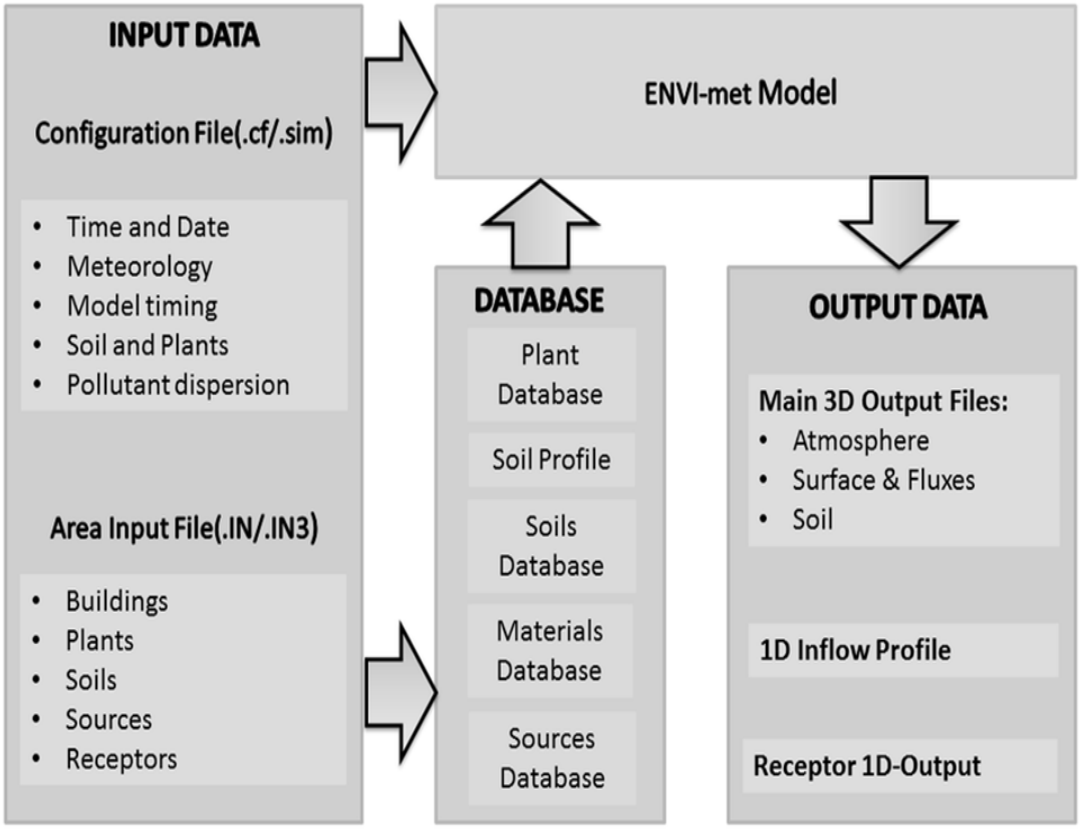


Figure 3.1: General data flow in Envi-Met,

Source: (Bruse, 2014)

Envi-met version 5.0.3 software includes calculations of the local climate model below :

1. The Flow Of The Long And Short Waves Radiation Considering Shading And Multiple Reflection Of Surfaces And Buildings.

2. Determine The Evaporation And Heat Flow From And To The Plants In Addition To The Whole Simulation of All Physical Information Of The Vegetation

3. Dynamic Calculations Of The Surfaces And Temperatures Of The Walls Of The Building Facades The Building Ceiling And All The Building Members.

4. Reconsidering The Building Facades And Roof Vegetation Which is Related To Collect The Heat Flow.

5. Heat rises induced by artificial light within Sky lighting are essential in hotter and hot-arid settings, hence passively constructed solutions are crucial.

6. Three Dimensional Representation For The plants By Using Specific Models To Simulate Biomechanics Loading And Deformations Due To Wind Forces

7. Spreading Of Gases And Particles; The Model Considers The Particles (Including The Saturation And Saturation On Leaves) And The Idle Gases Reactivity Of The Ozone Reaction Cycle NO-NO2

8. Determination Of The Various Biometrics Like The Mean Radiation Temperature (MRT) The Physiological Equivalent Temperature (PET) And The Global Thermal Climate Index (GTCI).

9. Comprehensive Software For Managing And Processing Digital Data For Creating (Digital Twins) And For Evaluating Graphs.

10. Use Python Power For Analyzing And Displaying Data or For Programming Your Application Directly From The Envi-Met Interface

3.2 Background for Urban Micro - Climate Numerical Modeling

Identifying and resolving difficulties in multiple environmental designs depend primarily on modeling techniques. The dynamical variety of weather conditions, complicated geometry of urban architecture, and various city layouts throughout the globe limit the empirical studies of urban microclimate. As a result, numerical

calculations are increasingly being used to simulate the shifting of urban climate zones. The size of urban climate change models has been categorized, which may vary from miles to a few millimeters. Features produced for the urban climate are often intended to mimic the impacts of surroundings such as the Urban Heat Island. Techniques for connecting small-scale and mesoscale urban climate designs are needed. Masson (2000) detailed the principles of valley geometries used to compute urban interfacial budgets in mesoscale modeling. He noted that the true city geometric needed to be simplified, and the valley layout is used to portray a town as a location on the surface of a meteorological model. An extra isotropy assumption for the road orientations has been introduced to describe a city district, allowing the system to be used at longitudinal levels bigger than that of the road width for local-to-region effect assessments. The fundamental underpinnings of urban climate models, as well as their temporal and geographical accuracy, vary greatly. Three-dimensional winds flow variations are among the most well-established at the micro-scale, (Johnsson & Hunter, 1995) investigated the three-dimensional properties of the concentration field created for the stream transverse to the valleys with pollution emitted towards the valley bottom by motorized vehicles using a simulation. This study focused on the dispersal of passive contaminants. They concluded that the system might be employed successfully with current laboratory and field methodologies. Thus according to (Herbert et al., 1998), a mathematical model of airflow and thermal climatic radiation was modeled, and the model evaluated the feature of urban valleys in Columbus, Ohio, and Los Angeles. The study determined that the simulation was used to study lowering temps in constructed regions where Urban Heat Islands can be a concern during the summertime. According to (Bouyer et al., 2009), they presented strategies to minimize building power usage by altering the local climate. They employed a CFD tool (Fluent) and a thermal properties model They determined that the characteristics connected in urban design that play a major part in the microenvironment and power usage are various: urban forms, surface materials, vegetation, and water present, as well as the influence of geometrical, is taken into consideration by the sky view factor, Figure (3.1) depicts the 3D simulation and surface geometry.

3.3 Reasons for Chossing Envi-met Version 5.0.3

It is a three-dimensional simulation program used to simulate the climate in which ENVI-met dynamic software may objectively examine the consequences of alternative planning scenarios generated by designers or urban planners, allowing them to establish sustainable living circumstances in a changing world. The ENVI-met modules cover a wide range of scientific discipline-from fluid dynamics and thermodynamics to plant physiology and soil science, which made the ENVI-met software different from the other environmental simulation modules programs. many factors calculate the airflow between buildings and solar radiation from the building facades but few consider the complex urban environment as a single system and consider the many processes that occur between elements. By using The ENVI - met we will be able to model an open environment and analyze this environment in terms of solar radiation, wind conditions, and other urban environments. In this chapter, we will briefly explain what ENVI- met. What kind of tools it is?

This program depends on a multi-model that can simulate radiation, wind conditions, and other conditions like soil response to humidity and solar radiation. In our thesis our interest is the build environment building systems however we will not go into detail about building physics inside the building but only see and watch what happened outside we will find there are methods in these tools couple indoor environments and like building energy modules and the urban environment and can calculate different types of materials and buildings and can see the heat running through the building and out to be part of the facades, figure (3.2).

Through The ENVI-met spaces, we can model a site for simulation of environmental simulation. Space is a tool we can create a three-dimensional object representing buildings, trees, and other environments. First of all, we need to assign the site location to our software from the basic settings while the program will directly take the altitude and the longitude of the actual site and bring it to the simulation model. y taking the map of the site for the framework which needs to be simulated and applying the real map in the program also we can put the actual sizes of the building by the scale we want from the work platform through the grid points. Each point is a pixel or a grid, (Michael Bruse, 1994).

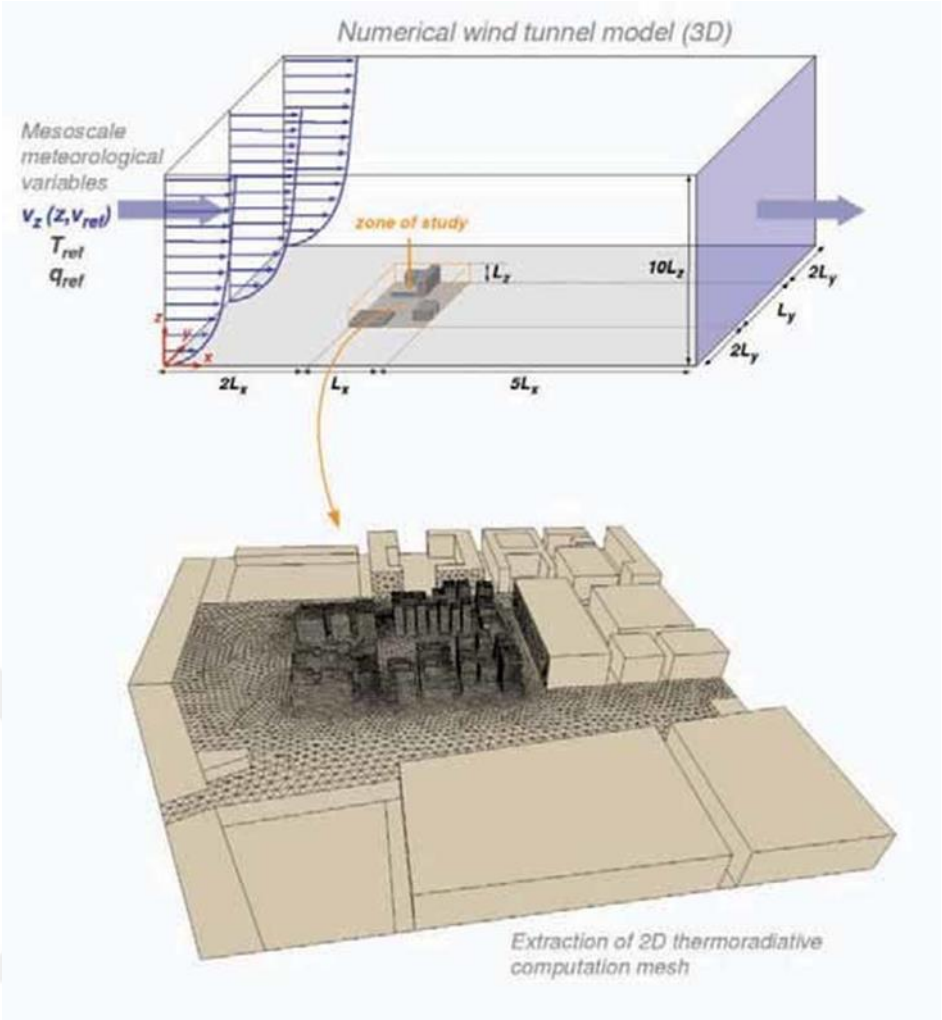


Figure 3.2: Surface Meshing and Simulation 3D Model

Source: (Bouyer et al., 2009)

(Allegrini et al., 2013) undertook a study to evaluate the urban microenvironment and its potential impact on the energy usage of structures in metropolitan areas CFD (partial differential equation) and BES were used to evaluate the design (building energy simulations). It was determined what factors influence the surrounding ecology, culminating in localized microclimate and intricate wind fluid flow. (Dorer et al., 2013) evaluated the influence of the UMC (urban microclimate) on the interior heating energy consumption for fairly ordinary commercial properties in road valley designs, Figure (3.3) demonstrates the multi-scale method for simulating urban microclimates. BES was employed by the researchers for their simulation study. The simulation findings demonstrated that determined by the shape and design of the structures, the urban microclimate can have a substantial impact on thermal exchange and energy consumption.

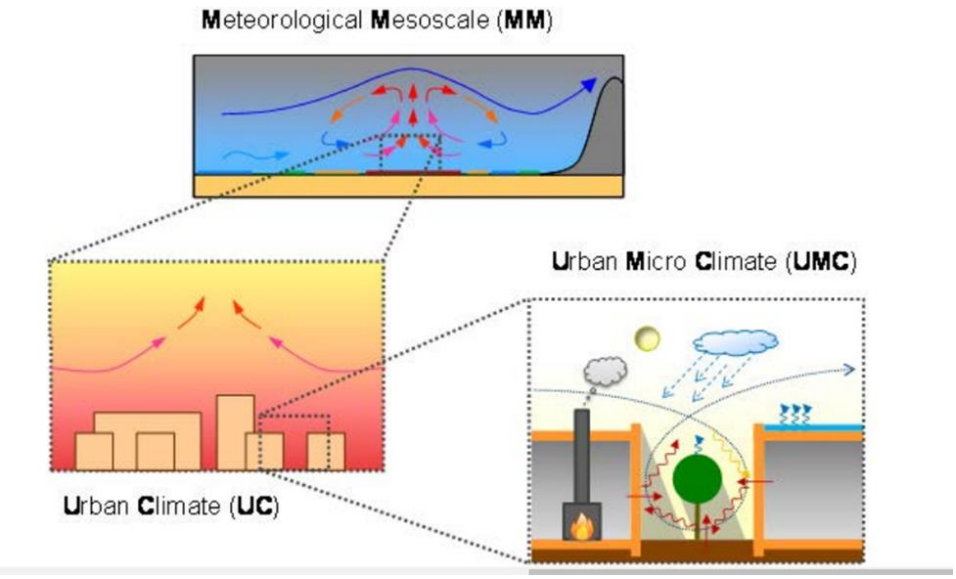


Figure 3.3: A multi-scale method for simulating urban microclimates

Source: (Dorer et al., 2013)

Itzhak et al. performed inquiry research to validate the thermal properties model (SOLENE) and its use for studying the street valley energy budget. The results demonstrated that hot air was transported mostly from valley surfaces to the surrounding atmosphere, as well as from air to land during the day. The canyon's effective albedo had a daily amount of 0.20-0.25 but plummeted to 0.10 in the evening when the surface significantly converted incoming and reflected solar energy into sensible heat. The data were chosen to confirm the capacity of the thermal properties model (SOLENE) to simulate the thermal properties activity of a roadway. The information was chosen to validate the temperature model's (SOLE) capacity to simulate the temperature-dependent behavior of a roadway. According to (Lemonsu and Masson, 2002), the influence of Urban Heat Island in Paris was investigated using a simulation method TEB (Town Energy Balance) urban scheme and the computational weather model Meso-NH. Meso-NH is used in conjunction with a basic simulation to measure the meteorological impacts of Paris on flow separation. The results indicated that the UHI over Paris reaches 8 degrees Celsius at night, while the UBL exhibits severe stability and volatility during the day. (Johnson et al., 1991) constructed a computer model to explore the cooling of rural and urban valley surfaces during calm, clear nights. A system of ordinary differential equations must be solved for the model to work. This model's simplified method is known as SHIM, which stands for Surface Heat Island Model. It employs the conduction of heat.

3.4 Measurements and Standard Decisions of ENVI-met Software

Envi-met is a local climate simulation program that simulates a specific metrological condition (for example hot days in summer) horizontal accuracy usually ranges from 1 to 10 meters with simulation periods of 1 to 5 days.

The city model volume usually ranges between 50x50 and 500x500 cells horizontally and 20-50 cells vertically, this program can do a comparison between two cases one for a structure built in normal conditions and the other for the same structure built with sustainable requirements with analysis the two cases.

3.5 Simulate an Entire City or a Medium-Sized area by Using Envi -met

By using Envi-met software this program can give you simple environmental calculations with different sizes which started from single buildings to whole urban cities, however, the basic physics of the model should also work in much larger areas and more stringent accuracy of the network, so, therefore, can also use ENVI-met to module the normal range the prerequisite for this is that the characteristics of the area can be represented by the used numerical model.

3.6 General Features of the Program

The ENVI-met framework is made up of two parts: a one-dimensional border design with lateral profiles of various meteorological conditions average height of 2500 meters (approximately the height of the atmospheric boundary layer) and a three-dimensional central model with all ambiance, ground, construction, and forest cover workflows.

The one-dimensional model was used to estimate from the top of the three-dimensional model, which is generally around 50 and 200 m based on the model architecture, with the entire elevation of the model at 2500 m. The vertical profiles of all model variables are provided by the one-dimensional model.

3.7 ENVI-Met is a Micro-Environment Simulator

ENVI-met is a three-dimensional, elevated microenvironment model with predictive capabilities. With its basic underpinnings related to fluid mechanical systems,

thermodynamics, and meteorological physics rules, it can compute three-dimensional wind domains, turbulent, ambient temperature, radiation fluxes, and pollutant distribution (Bruse, 1999).

The thorough simulation of plants is one of ENVI-distinguishing met's qualities. ENVI-high met's sensitivity and specificity enable the modeling of single photosynthetic rates while accounting for local solar irradiance, ambient temperature, air velocity, Carbon dioxide concentration, and a variety of other characteristics (Bruse, 2004).

The ENVI-met model has become a widely accepted standard tool for measuring urban microclimate. The model's quality is regularly assessed by completely separate papers and studies, (Nikolova et al., 2011) ; (Yang et al., 2012).

3.8 The Boundary Conditions and the Nesting Area

As shown in Fig. 1, the nesting region is a ring of grid points that surrounds the center of the 3D model (3.4). ENVI-met constructs a nested grid region around the core model to relocate the model's border away from the interesting area, minimizing unwanted boundary impacts (Michael Bruse, 1994).

A new article by (Tomy Jensen,1998), includes testing multiple boundary conditions for several co prototypes and discovers, along with many other items, that the three-dimensional layer model reacts sufficiently under comparatively dangerous circumstances comforting to the almost appropriate boundary conditions.

The finer grids may have accessibility to the 'nearly' accurate values. The coarser grid provides these data. Under these conditions, when one is near the border, the boundary values can be roughly estimated in the fine grid. The pushing can be achieved, say, inside a band having a width of roughly half the coarser grid's length

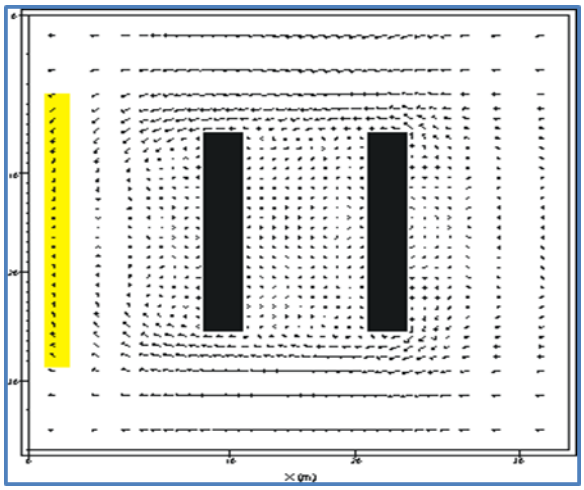


Figure 3.4: Flow three nested grids over two structures.

Source: (Michael Bruse, 1994)

The ENVI-met model has three types of laterally initial conditions (Bruse, 2015):

- Open oblique following assumptions are made: Each time step, the values with the next grid point near the boundary are transferred to the border.
- Extended transverse initial conditions: The one-dimensional model's values are replicated to a border.
- Cyclic loading border conditions: The values of the downstream model border are transferred to the upstream model border.

The unrestricted and cyclical lateral boundary condition types enable models to begin with only just a few initial values. However, because these lateral circumstances make it impossible to duplicate precise scenarios, comparing the simulation result to a real-world situation is extremely challenging. The forcing approach, on the other hand, provides for the reconstruction of actual or fictitious situations by setting a daily cycle of boundary conditions for the different meteorological parameters derived from observed data or data from other simulations, such as sunlight, ambient temperature, or moisture (Simon, 2016).

The formulas for the initial conditions are depicted in Figures (3.5). Depending on the input values of the lateral airflow (u,v) at 10 m above ground and the roughness length z 0, the 1 D model calculates the vertical axis wind inflow pattern average height of 2500 m using an exponential law.

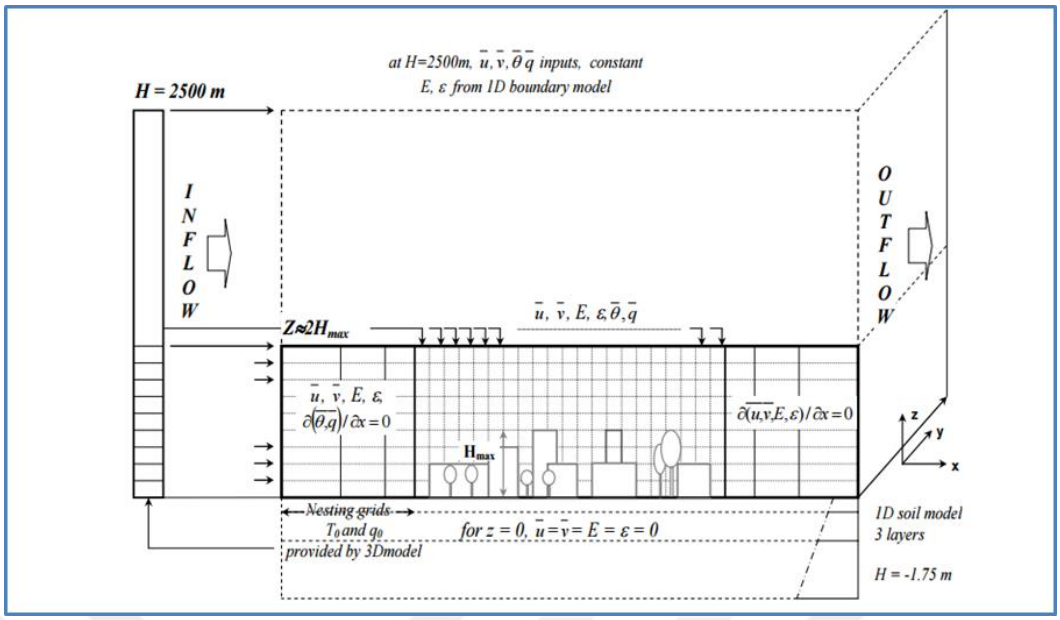


Figure 3.5: General scheme of the ENVI-met model including the boundaries

Source: (Ali-Toudert, 2005)

The surrounding conditions at z=0 and on the walls K are derived as a function of the local frictional velocity u* obtained from the flow elements perpendicular to the ground. The one-dimensional model yields the inflow pattern and top boundary, and at outflow limits, a zero-gradient condition is utilized (Bruse & Fleer 1998).

3.9 Basic Design Characteristics

The ENVI-met model has comprised a one-dimensional border simulation with vertical patterns of various meteorological variables reaching a height of 2500 m over floor level and a three-dimensional core simulation with all atmospheric, soil, construction, and plant activities (Simon, 2016). The ENVI-met model is made up of various sub-models that communicate with one another (Huttner, 2012), as shown in figure (3.6).

- One-dimensional border model
- Three-dimensional atmospheric model
- Soil model in 3D/1D.
- Physical model

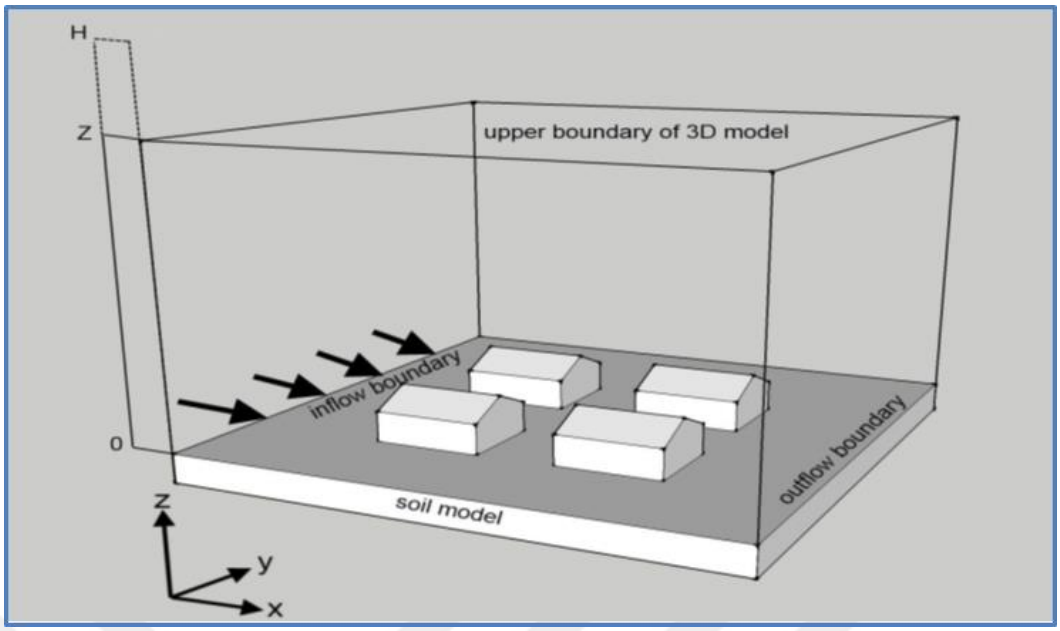


Figure 3.6: Basic Model Design Diagram

Source: (Huttner, 2012)

3.9.1 One-dimensional border model

One-dimensional profiles for climatic data such as air temperature, air humidity, wind vectors (horizontal), kinetic energy, and turbulence interchange are generated using the One-dimensional boundary model. The boundary model includes an elevation of 2500 meters (the typical height of the atmospheric boundary layer) to provide stable turbulent circumstances (Simon, 2016).

3.9.2 Three-dimensional atmospheric model

The three-dimensional positioning strategy is made up of three orthogonally oriented dimensions that produce a three-dimensional cube. The modeling region is made up of cells that depict various items such as residences, plants, and the environment. The number of cells is determined by the modeling area's size and spatial resolution. The physical qualities of a cell characterize it. Component types constitute a building cell, and component kinds are determined by particular heat capacity and other factors. This framework, when combined with databases of all the different items, allows for a thorough restoration of an urban area (Simon, 2016).

3.9.3 Soil model in 3D/1D

According to (Huttner, 2012), the soil model estimates the temperature and relative humidity of the soil down to a depth of 1.75 m. Each diagonal row of the matrix has

a soil profile with 14 depth-varying layers. The depth of single layers grows from top to bottom, with the top layers being 1 cm thick and the bottom layer being 50 cm deep. Without considering horizontal transmission, the soil is modeled as a vertical column, with temperature T and volumetric moisture content provided by (Bruse & Fleer, 1998):

The vegetative model offers the moisture absorbed by the plant roots and treats it as an internal moisture sink (Bruse & Fleer, 1998). The higher boundary value will be provided by the boundary layer for the surface temperature, according to (Bruse & Fleer, 1998). Model of vegetation: According to (Huttner, 2012), the plants in ENVI-met combine with the climatic and soil models.

3.9.4 Physical model

Wind velocity and orientation. The atmosphere and ground heat. The atmosphere and moisture levels. These are the key prognostic factors derived by ENVI-met (Bruse & Fleer, 1998).Fluxes of radiation Diffusion of gases and particles. These parameters must be computed using various sub-models that interact with one another. The ENVI-met sub-models are depicted in Figure (3.7).

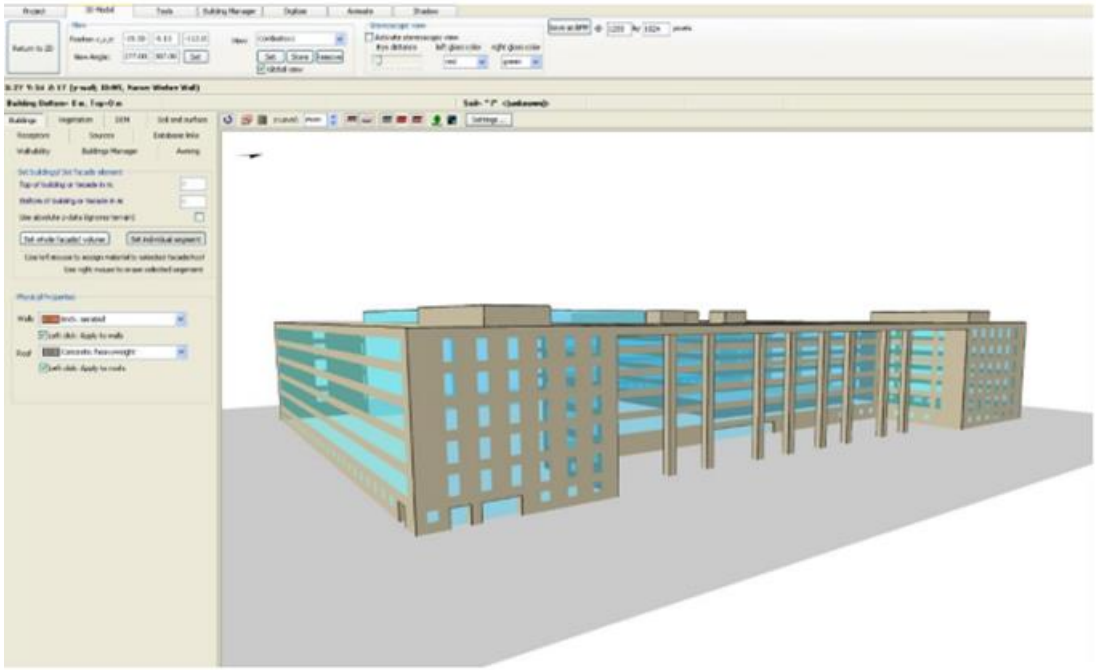


Figure 3.7: Graph of ENVI-met sub-models

Source: (Huttner, 2012)

Structures compose the priority of the urban environment and serve as the contact in both the interior and exterior worlds. An intelligent structure modeling is required to comprehend the characteristics of the urban environment and analyze its effects on the power conditions and usage of structures. At the intersection between the open area and the inside world, physics is critical. The urbanization trends have become more necessary to examine the effects of urban environmental factors affecting thermal islands and climate change, in addition to the influence on building power use. Furthermore, urban friendliness, healthcare, and structure lifespan as they relate to walking breezes, thermal environment, and pollution distribution are becoming increasingly important to engineers and consultants. Structures may be viewed as the astronomical units of urban metabolism: the power exchange activities that occur at their outside perimeter influence the regional microenvironment circumstances, forming the model known as the urban climate. In turn, the resultant microenvironment model establishes the border requirements for the interior climate circumstances of the structures. The more accessible the architecture of a structure, the greater it relies on local factors to ensure adequate living requirements for its residents. Sustainable urban design entails not only comprehending the influence of building layout just on weather patterns but also investigating the complex interactions at the single structural level. Sustainable urban design entails not just comprehending the influence of structure layout just on weather patterns, but also investigating the complex interactions at the individual structural levels.

ENVI-met was used to investigate the aspect ratio for two distinct street alignments in Fortaleza. Due to higher shade from buildings, the ideal aspect ratio was found to be greater than 1.5 (Dardel, 2015) ; (Maleki & Mahdavi, 2016) employed ENVI-met to simulate microclimate conditions in a section of Vienna in recent research.

The purpose of this study was to look into the impact of changing the physical and geometrical qualities of an urban environment (cooling rooftops, green areas, and perviousness of road pavements) on the urban micro-climate and outdoor heat gain. The findings indicated that changes to the urban canopy were more effective than changes to the roof levels in changing microenvironment circumstances. The addition of plants and permeable pavements can reduce the atmospheric temperature by up to 3 degrees Celsius.

3.10 Investigational Methodology

Computational modeling will be employed in this study to examine the three research items (patterns). The micro-climatic parameters of the three chosen designs will be studied and assessed for their impact on thermal comfort and quality of open environment among both vegetative and non-existent scenarios during the summertime.

The influence of microenvironment enhancement measures on the 3 areas is going to be explored, which is the key concern in this research. Three enhancement tactics will be used: urban geometry, greenery, and cooling products.

This investigation will look at five microenvironment variables and their impact on environmental sustainability and personal thermal comfort in outdoor places. The ambient air temperatures (Ta), roadway surface temp (Ts) within the urban canyon, average temperature (Tmrt), moisture content (RH), and wind speed are the circumstances (V). The impact of these variables on thermal comfort will then be evaluated using the Certain That Vote, or PMV (UNI EN ISO 7730 2006).

3.11 ENVI-met Version 5.0.3 Connecting Building Inside/Outside

Structures are not self-contained ecosystems therefore internal atmosphere and mechanics of the structure communicate with the outside microenvironment on a regular base. Furthermore, especially in metropolitan settings, structures communicate with one another by modifying wind flows, sun accessibility, and thermal impacts.

Each site's microenvironment is formed by the structure of structures, their position, and management. A group of structures, when combined with urban surroundings including such green spaces or transportation infrastructure, forms a much more complex and dynamic creature. This encompasses construction materials, sun-exposed characteristic properties, and colors, as well as the architecture of open areas such as squares, retail roads, parks, and roadways. New generations of structures have been produced in past years that are impacted by adaptable materials and structures that can react to changes in their immediate or indirect surroundings. All aspects should be modeled in an interconnected modeling tool to evaluate the impact

of individual buildings on the urban microenvironment complex and to analyze the power exchange between the inside of the building and the outside environment. ENVI MET's comprehensive and elevated methodology enables the modeling of microscale urban metabolism as a complicated system, as well as energy, flows at single façade elements of a separate layer.

3.12 Providing Connection Between Interior and Exterior by using ENVI-met Version 5.0.3

Many structures aren't any more massive entities that find employment in their surroundings and need to keep their metabolic running. Structures are now planned with an understanding of climate patterns in mind, and areas of layer demonstration of both the inside and exterior are common. To comprehend the meteorological circumstances at such an increasing distance, the hydrological models must account for both the inside and outside systems' behaviors. Furthermore, because both networks are always engaging with and impacting each other, the parts cannot be examined separately.

ENVI MET provides a comprehensive collection of mathematical methods for estimating power and interchange circumstances at the border of the outdoor and interior environments.

3.13 ENVI-met Tree Passage

Finding the best vegetative growth for certain vegetation or assisting environmental engineers in determining the best-planted system: The ENVI-met Tree Pass provides a detailed breakdown of all important microenvironment growth circumstances. Vegetation or trees are extremely important in the context of the ENV-met Tree Passing function. Wind loads, water usage, and growth conditions, for example, may be researched and evaluated to the demands of vegetation at various locations. The study of (possible) tree locations in connection to wind flow circumstances regarding tree size and geometry is an essential tool for adaptable nature conservation as well as catastrophe prevention. The high-resolution microenvironment simulation, in principle, portrays the plant summit as a three-dimensional input image of varying total leaf density coupled to a root structure. This method enables a preliminary

comparative measurement of the danger potential generated by wind loads based on the tree shape, position, and climatic conditions. In addition to the strictly mechanical elements that influence the tree's durability throughout heavy wind occurrences, the site's long-term characteristics are critical. Trees that are generally wind-shielded and hence conditioned might be more vulnerable to harm if heavy wind occurrences are complemented by atypical wind patterns. The model could also be employed to broaden the risk management plan for plants to include pest infestations, excessive heat, and waterlogging. This last feature has been employed in environmental adaptation models nowadays, figure (3.8).

Figure 3.8: ENVI_MET GmbH

Source: (Zhixin Liu et al ., 2018)

Finally The procedure used in producing the physical and geographic characteristics of the theoretical urban settings, in addition to the temperature and humidity designs being used their significance to the characteristics of the subject under inquiry, such as exterior thermal comfort at the pedestrian level, were shown in this chapter. The findings of the microenvironment modeling and external thermal comfort assessment for the suggested urban settings will be reported in the next chapter.

4. INTRODUCTION

This chapter provides an overview of particular research fields and their features. In addition to the research parameters, measuring and assessment procedures were used. first of this chapter, a broad overview of Baghdad City's geographical position, environmental characteristics, and climate conditions, in addition to urban characteristics and the size of the population, is offered as a basis for comprehending the necessity of this thesis. a research study that includes a Ground Surface Temperature (GST) study to investigate the heat transfer layout of urban surfaces in Baghdad's conurbation, as well as their relationship to current urban shape and density. which will be obtained through the GST study, intends to address one of the survey Wonders about the effect of the current urban form on the climatic condition in Baghdad City, as indicated before in the survey Wonders. includes the methodology, along with a summary of study variates, as well as the procedures, measurement, and assessment instruments utilized to fulfill the data analysis aims and address its wonders.

The last episode of agricultural land in Iraq specially the orchards , and the lands which owned by civilian divided and changed to Residential lands and industrial projects like a factories and oil and petrol projects , it is noteworthy that nature residential of Iraq is horizontal housing complexes these horizontally complexes could not absorb the future extension of population moreover lack of water which is used for hydrating of Agricultural crops and Reducing agricultural plans by targeting agricultural areas surrounding cities and transforming them into random housing complexes that began to threaten the ecosystem these reasons led the farmers to sell their agricultural lands or change the nature of these lands to housing complexes which is more advantage to them if it is compared with the production of agricultural crops and started the immigration from the countryside to the city , another important reason when the USA had occupied Iraq they cut more than million tree like palm and Perennial trees even the USA army followed a policy of demolishing orchards and agricultural lands were turned into investment projects

and military camps, all of That led to A dangerous phenomenon on the natural ecosystem in Iraq , figure (4.1). Agriculture reduction and agriculture lands changing to random housing complexes constitutes an existential threat to the country , climate change must become a national priority for Iraq. Strategic projects are needed for reforestation and the modern management of water resources and clean energy.

Figure 4.1: Orchards Demolish and Lack Water

Source: (Ali Al Mamry, 2014)

4.1. Summry

This chapter analyzed and explained the outcomes of the Thermal Comfort determination's microenvironment modeling simulations. Exterior microenvironment characteristics were evaluated depending on their influence on environmental sustainability and individual thermal comfort in outdoor places at the pedestrian size as shown in figures (4.2) Next chapter will discuss the conclusions and recommendations (Chapter Five).

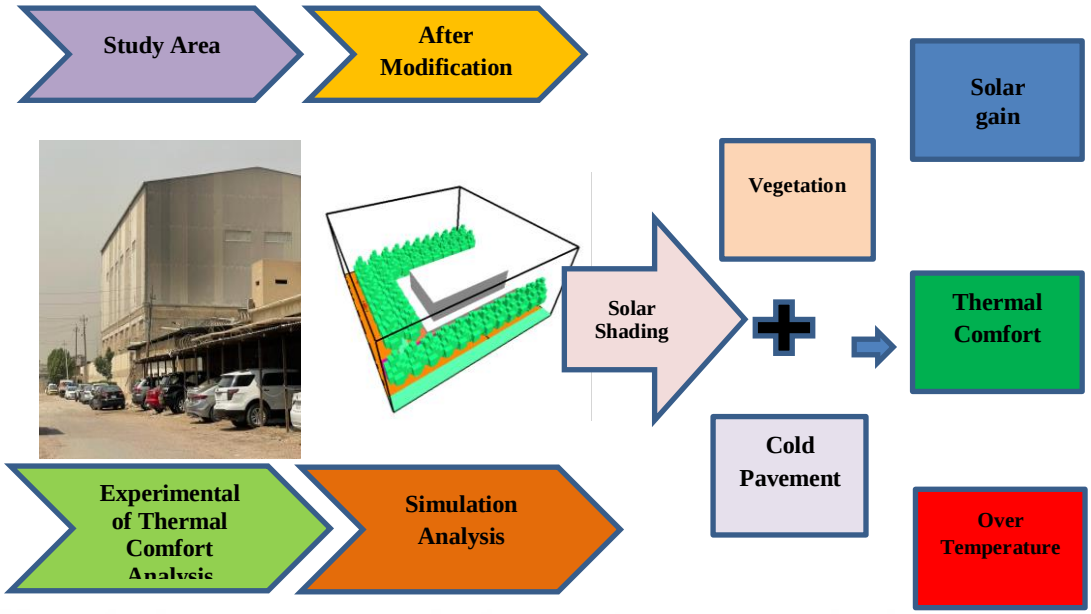


Figure 4.2: Summary Flow Chart

4.2 Baghdad City

Baghdad Governorate the capital of Iraq Is The Smallest Iraq Governorates Bay Area and the second largest Arabic capital in the Arab homeland which came in sequence after Cairo and the second city in population size in western Asia which came after Tehran. Baghdad Is Ranked First Among Iraq Governorates By Population Density With A Population Size Of 8.1 Million In 2018, as announced by the Ministry Of Planning \ Central Statistical Organization (CSO) that size of the population represents nearly a quarter of the whole Iraqi population. There Is A River Pass Through Baghdad City And Divides It Into Two Halves the east side is called (Karkh) And the west side is called (Risafah) it is built 1299 years ago and was known as Mesopotamia.

4.3 Baghdad Location

Baghdad governorate is located in the middle of Iraq, Baghdad is located at latitude 33 and longitude 44 on the Tigris River with an area of (5,169) square kilometers significance of Baghdad's place exists in the accessibility of water and the reduction in the danger of flood events, that also led to the city's growth and growing strength, as well as the easiness of its linkage from across Tigris River further through bridges

that communicate it across the sides of the river, which permeates its middle. Baghdad city has a benchmark level of 41 meters above sea level, figure (4.3).

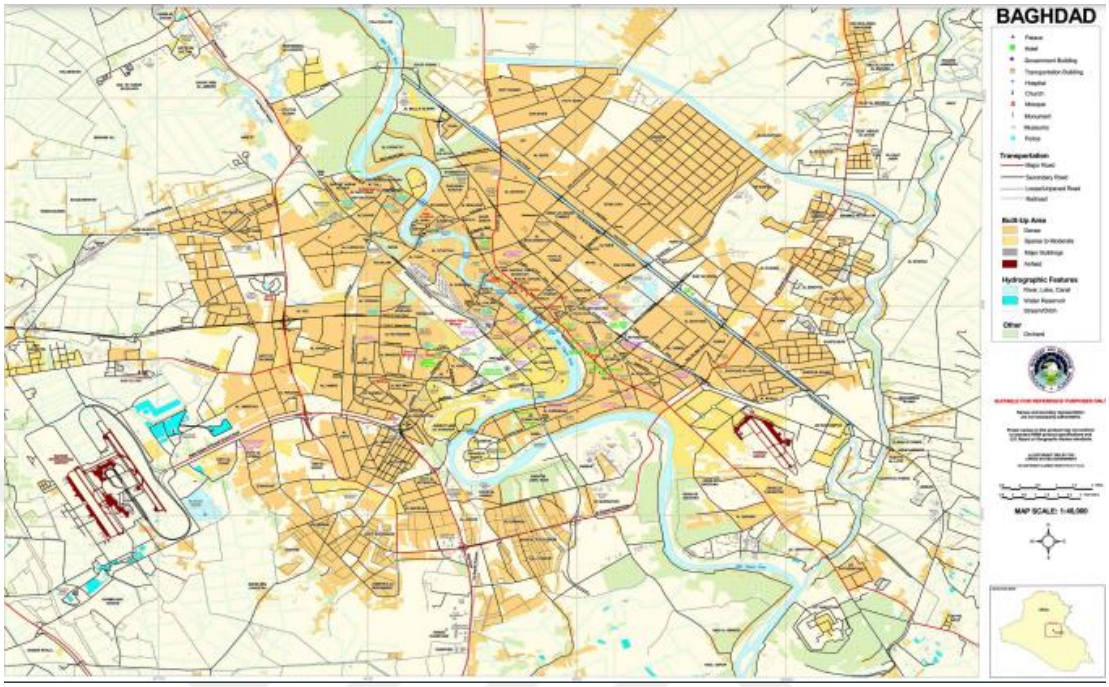
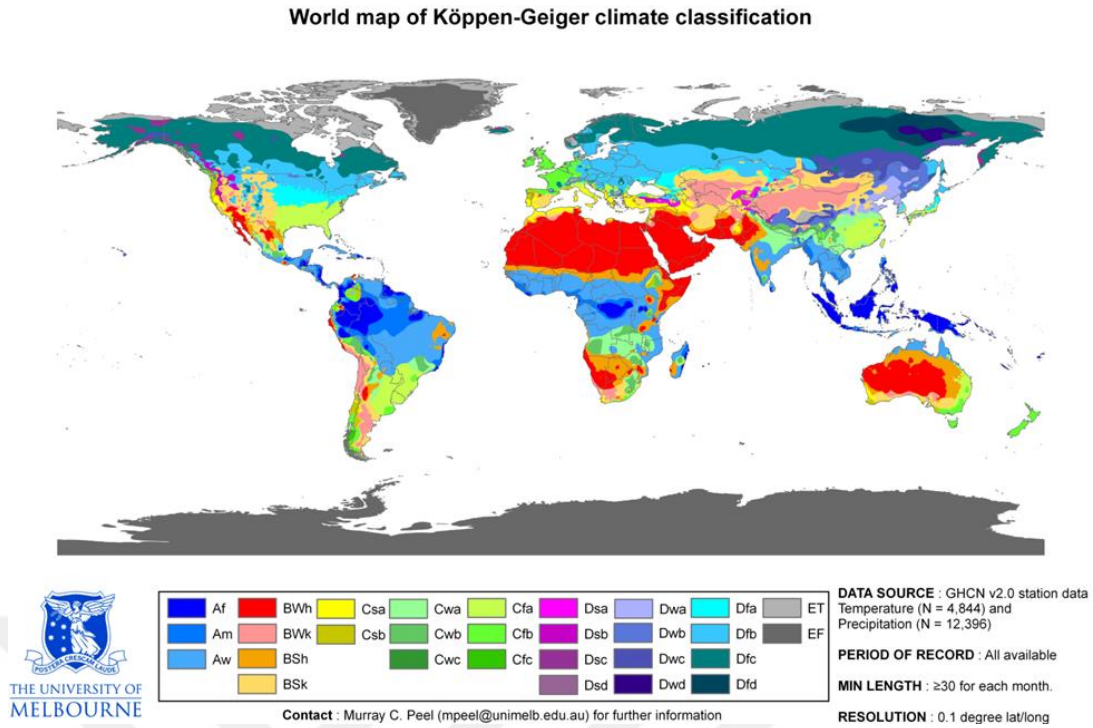


Figure 4.3: Baghdad Map

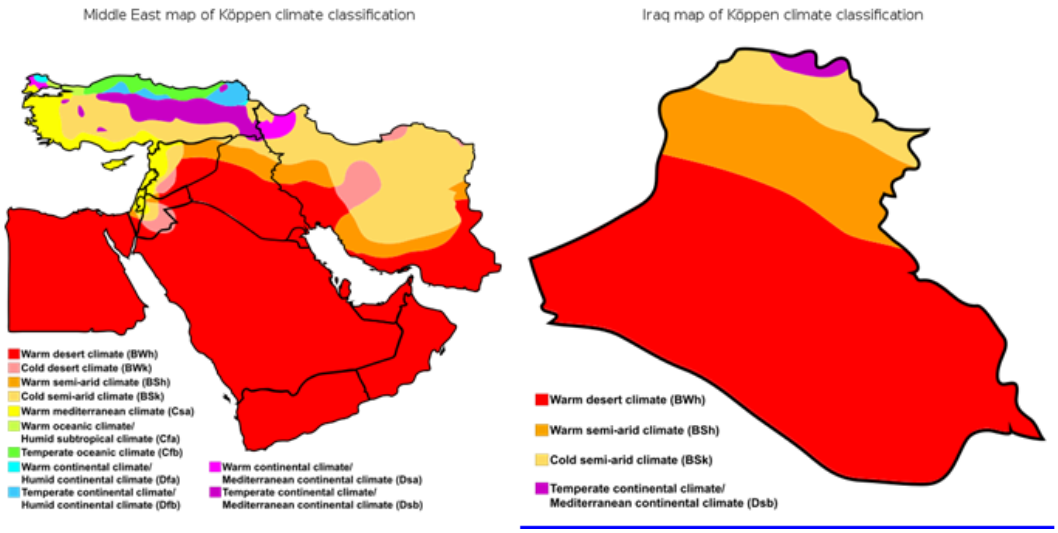
Source: (Inter-Agency Standing Committee)

4.4 Baghdad Climate

Baghdad city is one of the world's hottest cities, with a sub-tropical desert environment. Baghdad has a desert climate, during summer the thermal intensity increases which means the temperature increases and may exceed 50 degrees centigrade while the weather prevails in a state of drought, and the city is exposed to severe dust storms, especially in April, May and June's scientists think that is due to the global warming, Iraq desert climate in addition to the increase in the carbon proportions in the atmosphere and the spread of desertification and other environmental factors Because of Baghdad's distance from the Arab Gulf, the moisture content is very low (usually less than 10%). yearly amounts of rain average about 150 mm, nearly completely limited to November to March. Figure (4.4) go to show the world's climatic change categorizations and the location of Baghdad It is clear that it is characterized as Warm in the [BWh] climatic zone. Nations in the climatic region [BWh] have a desert climate, with extremely hot temperatures, severe circadian rhythms air temperature, low moisture content, high evaporation, and scarcity of precipitation (Peel et al., 2007).



a) World climate map of the Koppen-Geigerclimate classification,



b) Middle-East climate map of the Koppen-Geiger climate classification,

c) Baghdad location.

Figure 4.4: Climate Categorizations

Source: (Peel et al., 2007).

Figure (4.5) showed Baghdad city climate which is a range between 4 degrees centigrade the lowest temperature in winter exactly on 29 January to 50 degrees centigrade in summer the highest temperature in summer the period between 16-30 July

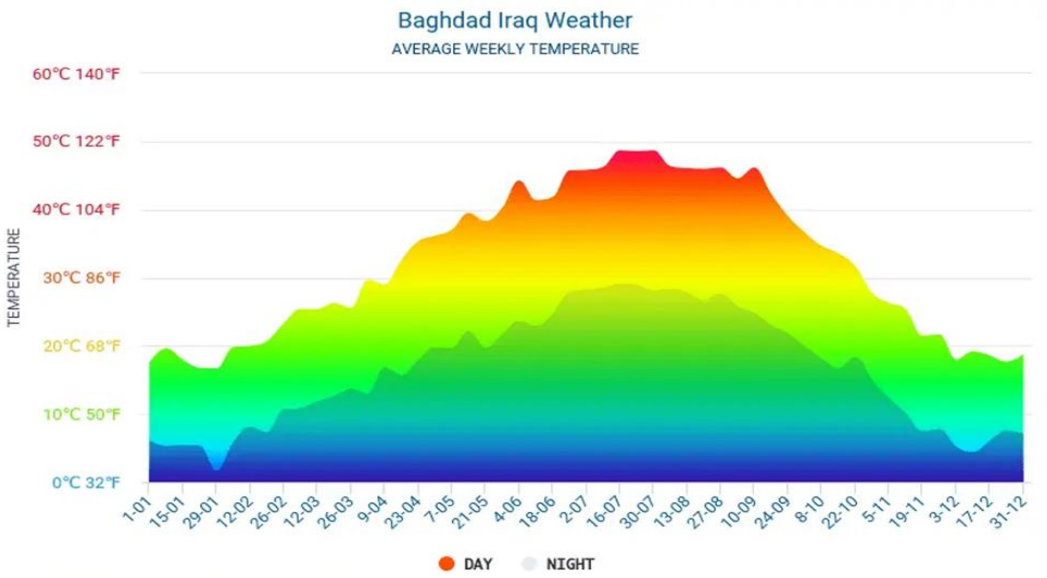


Figure 4.5: Baghdad city climate

Source: (Hoda A. et al., 2021)

4.5 Baghdad Housing Type

Housing usage accounts for approximately 62.6% of overall utilization (Mayoralty of Baghdad 2000). The city comprises both transverse and longitudinal dwellings. There are three main types of lateral housing. such as small, linked, and detachable The long urbanized conventional area, which was established mostly in the seventeenth century, is one of the types. places that have predominantly grown in the contemporary suburbs in the center of the twentieth century; and the areas developed predominantly during the last fifty percent of the twentieth century and are found in the outskirts (Alobaydi et al., 2016) Firstly, there are urban clusters featuring natural transport systems and small urban blocks, and low-rise structures in the typical instance. All structures take up entire properties including open areas known as courts that are utilized for ambient heating and cooling. Secondly, the smart household case consists of square large urban blocks, polygonal roadway networks, and connected structures on side walls, all of which are put out diagonally on the roads. Lastly, although being developed from either the preceding design, the contemporary detachable example has broader roads associated with detachable houses that have modest layouts but are also positioned in the center of fields.

4.6 Study Area

One of the Iraqi Media Networks / Building Of the Directorate of Printing of al Sabah Newspaper Which is Located In Al Waziryah City North Of Baghdad As Shown In Figure (4.6). A Multi Store Building Which Includes Huge Printing Modern Machine 30 Meters in Width & 50 Meters In Length 18 Meters In Height, The Ground Flour Built By Brick Wall With Concrete Slab (0.6) Meters Thickness, And The First Floor is Built With Brick Wall With Concrete Slab, The Final Slab & Wall Were Made Of Sandwich Panel As Shown In Figure (4.7). It Is Noteworthy That In The Selected Building Contains Huge Printing Machines When It Is Running In It Is Total Capacity It Radiate High Heat Specially It Have A Roof And Wall Built With Sandwich Panel Which Need Continuous Air-Conditioning To Maintain The Temperature Recommended By The Manufacturer Of These Machines, Which Is 20 Degrees Centigrade.

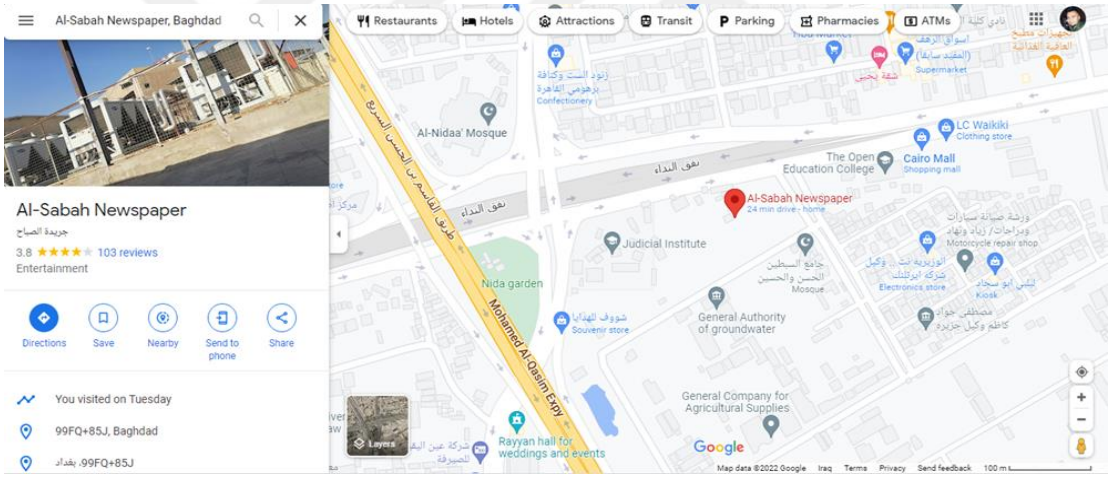


Figure 4.6: Iraqi Media Network / Printing house of Al Sabah Newspaper

Source: Google maps

The selected area building (printing house of al Sabah newspaper) was chosen because it is a very important place that contains huge modern printing machines for producing different printing productions newspapers, magazines, and booklet in different cutoff sizes especially since it is a governmental organization that gave it a special priority to print the private Publications like colleges and schools exams copybooks and exams questions also the governmental secret documents due to its privacy even so many commercial products are being printed in this work over the year, the location in which this building was established surrounding by many buildings the main road, interior concert roads which radiate the heat of the sun and

generators which gave extra heat and exhaust more energy for air conditioning. that The selected area contains many land surface temperatures (LST)values which affect the thermal comfort of the buildings and the pedestrians around the building also there is no green cover like trees or plants which helps to improve the thermal comfort or gives a little shading in summer conditions.

Figure 4.7: Selected Building (Printing House Al Sabah Newspaper)

4.7 Thermal Comfort

Thermal comfort (the focus of the study) is an essential part of human happiness. It is up to the designers to make it happen.

Which of the following sustainable building aims was to provide the highest degree of thermal comfort for the occupants within the institution while also consuming the minimum amount of energy for trying to cool in the summertime and heating in the cold season? And, while establishing the right heat medium for any A building or any interior space, knowing the sort of things inside the structure and the nature of its users from the ground up is essential. Gender, as well as the sort of activity carried out within the building spaces The atmosphere has a variety of effects on humans. Thermal comfort is regarded as one of the physiological variables influencing a person's overall well-being and the sensation of restoration without alleviation.

Thermal temperature arises when a combination of surrounding environmental effects and sloughing occurs, as the surrounding environment can stay heat-free. And received. 37 degree centigrade Feeling and no excess moisture at the same rate of productivity while maintaining the air temp continuity at 35, The verbal definitions differed in the present time while containing the same substance, and they were in another view It is the mental state in which an individual feels at ease and content with his or her existing surroundings. Any typical individual living in it does not

experience thermally relaxation if the heat rises or falls above specific limitations, that is, it

He is not at ease in hot temperatures, and he is also not at ease in excessively low temperatures.

The body's capacity to keep an equilibrium between its heat and the temperature of the environment, (Fanger, P. ,1988) .

4.7.1 Factors influencing thermal comfort within the building

The rate of heat loss and uptake from and to the human body is affected by several variables, including the present environment, environment, and what is due to the human being's palpation as explained in figure (4.8) All these things balance each other out to finally lead to the thermal comfort.

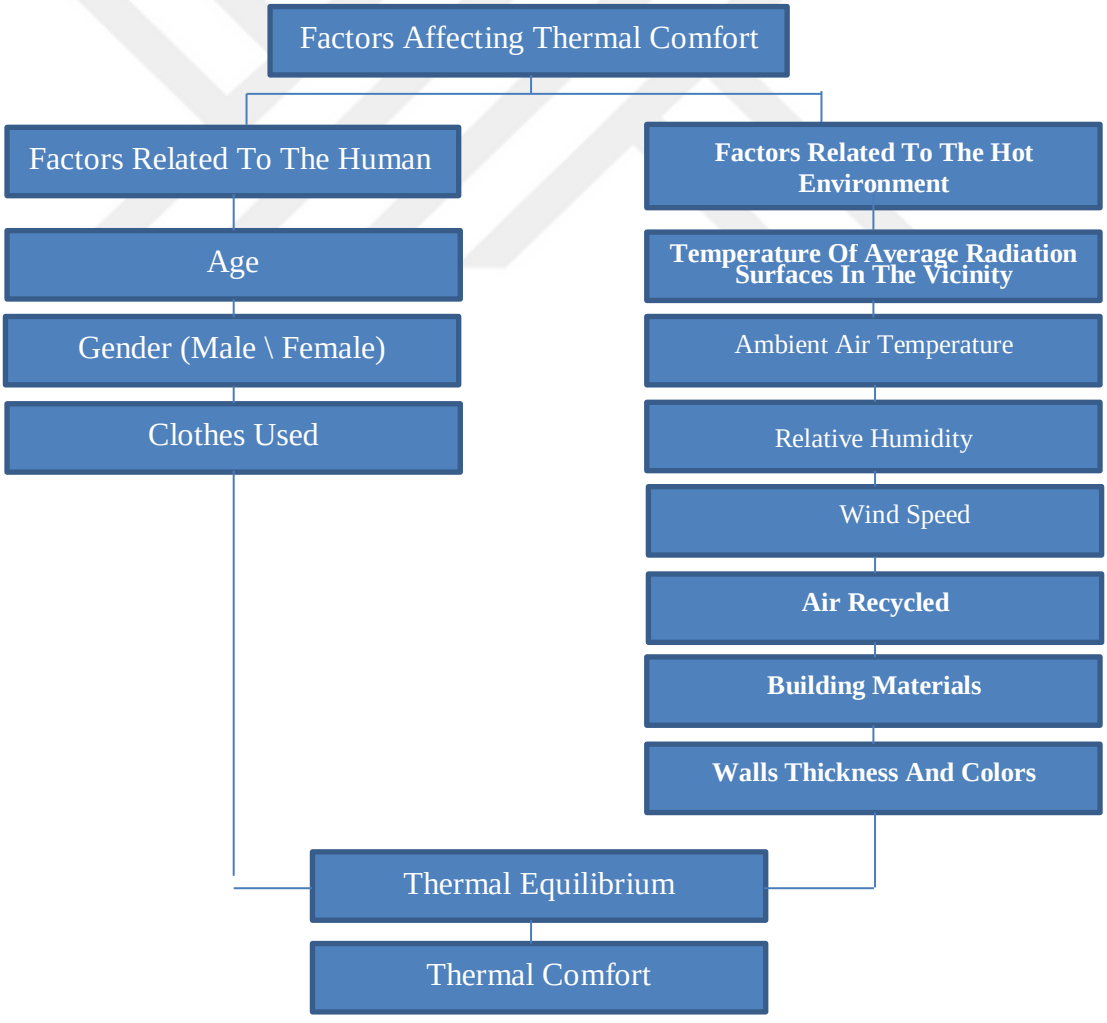


Figure 4.8: Factors Affecting Thermal Comfort

Source: (Fanger, P. ,1988)

4.7.2 Changes in the feeling of thermal comfort

The occurrence of the explosion is determined by the moment at which the environmental damage is attained. The surroundings include a variety of elements, some of which are caused by the climatic environment. (Temperature of the air - relative humidity - radiation - air movement Others Activity - health state - body metabolic rate) assuming Individual component inconsistencies that span the gap between a good and hence difficult to measure precisely (Fanger, P. O., 1988).

The impact of climatic environmental elements may be measured. The sensation of serenity in the freedom of the time in which the present exchange takes place The human situation and the surrounding environment are conveyed via four physical methods to move (Heat, Cold, Wind, and Water) (conduction - convection - radiation - vapor) six variables were discovered to determine the thermal comfort as explained in figure (4.9) :

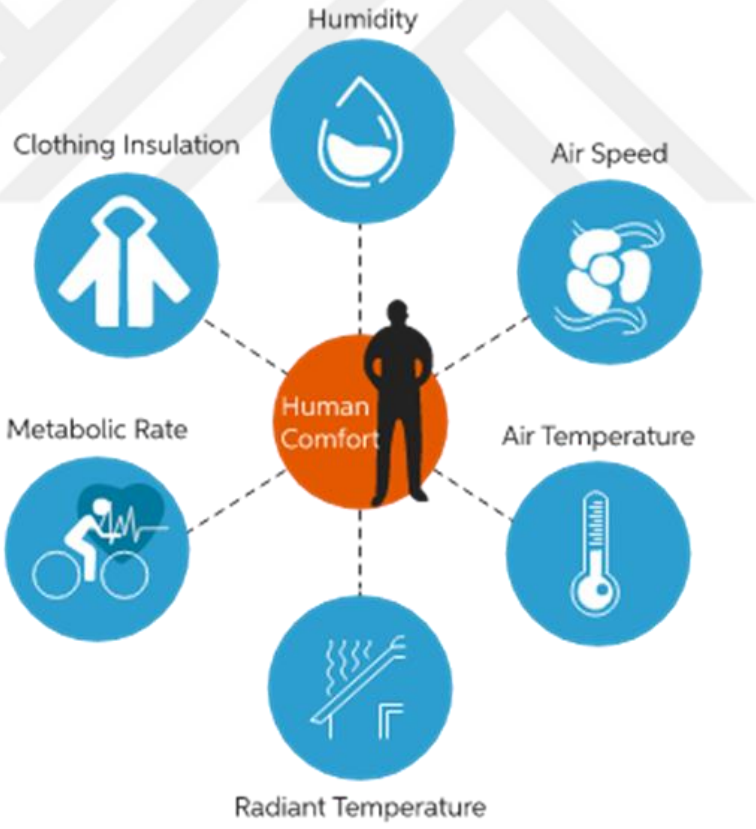


Figure 4.9: Thermal comfort perception changes

Source: (Fanger, P. O. , 1988)

4.7.3 Thermal comfort determinants inside the buildings

The areas of the feeling of thermal rest can be divided according to the degree of effective temperature into 7 determinants which are shown as follows :

A - very hot, greater than 37.5 °C

B - hot 34.5

C - tends to heat 25.6 ° C

D - comfortable 22.6

H - tends to be cold at 17.5 ° C

F- Cold 14.5

Z - very cold less than 14.5 °C

4.8 Factors Influencing Thermal Comfort

Thermal comfort depends mainly on variables affected by the climate or the environment:

4.8.1 Total Mean radiant temperature (TMRT)

is the total of all irradiation exposures that a living organism is subjected - regulates individual thermal comfort, The radiative heat on average Because the combination of radiating and turbulent thermal gains/losses strongly affects the human equilibrium state in outdoor locations, Tmrt represents the most essential climatic essential contribution for the human energy expenditure during bright weather in summer. Another method for determining Tmrt is to use Rayman output. "Trying to model of the total Mean Radiant Temperature in Urban Structures - Estimation of Heating Index", The mean radiant temperature (Tmrt) represents one of the most significant elements influencing human thermal comfort in an urban surrounding area, (Lindberg et.al ., 2014).

TMRT is the regular heating of a fictitious boundary for which radiative heat flow from most of the body system equals that of the real non-uniform boundary. International Organization for Standardization (ISO).

It is the mean temperature of the body's radiative surroundings as a whole. In comparison to circulation or evaporation, radiant energy flow is responsible for a significant portion of body thermal transfer (Folk G.et al., 1974). because it is directly connected to both the temperature outside and walker activity (Whyte.W, 1980).

As a result, modeling radiative heat exchange in both living organisms and the surrounding structures is a matter of practicality. Once Tmrt is determined in a real-world urban environment, we would be capable of anticipating and managing heat damage in the context of the growing urban heat island effect (UHI) and more frequent extreme weather events. .

In cities, Tmrt fluctuates both temporally and geographically as urban structures react with sunlight, collecting, reflecting, or producing radiative energy at different waves, (Jianxiang, 2014).

External shade influences the temperature of nature and human indoor thermal, impacting area use, (Tzu, 2012) It was discovered that if a region is more covered somewhat during springtime, summertime, and fall, human thermal comfort improves. Because the scarcely shaded state may contribute to more sun's rays in the wintertime, the individual thermal environment is higher when the place is less covered, (Hwang et al., 2011).

It was also shown that when the weather is warm or hot, individuals tend to relocate from sunlight to shady regions, [Kántor & Unger, 2011).

One of the significant atmospheric characteristics affecting the human equilibrium state is the mean radiant temperature (TMRT), (Sofia, 2007). Among the most significant environmental factors affecting human energy balance and comfort conditions is the mean radiant temperature (TMRT), which summarizes all short-term and long-wave energy flows (including straight and reflective) that the individual is subjected to, (Sofia, 2007).

TMRT is described as such "consistent temperature of an imagined boundary wherein radiative thermal expansion from the human body matches radiative thermal performance in the real non-uniform confinement" (George Reeves et al ., 2001).

Ta influences the energy taken by interior heaters. MRT is the total of all initial and long radiant flows received by the human body, which impacts its equilibrium state

and outdoor thermal. SVF in metropolitan locations has an impact on both Ta and TMRT. In this study, we will examine the influence of the SVF on the urban microenvironment in Montreal by measuring heat transfer (Ta), human-scaled mean radiant heat [MRThuman weighted], and wind velocity (WS) (Akbari, 2014).

A total of any short- and long-wave radiated emissions received by the human body that impact his energy equation is represented by the MRT human weighting factor. TMRT human-scaled measure is much more reliable than Ta in evaluating comfort conditions (Peng et al., 2011). Past studies have verified MRThuman weighted ENVI-met calculation (Bruse, 1999) ; (Ali-Coudert & Mayer, 2006).

TMRT human reflectance is affected by the external area, which involved creating materials, the earth surface, as well as the atmosphere. At road level, 50% of the long-wave radiative emissions are considered to come from the upper globe, with the other half coming from either the earth or structure sides (Appendix). We concentrated on the influence of SVF on air temperatures, MRT, and WS for 24 hours in both summer and winter. The link between SVF and UHI is substantial in suitably advanced metropolitan settings; the connection between SVF and outside thermal comfort (MRT human weighted) is especially strong. Nevertheless, the link is weak in densely vegetated regions .

Eventually, the mean radiant temperature is described as the consistent temperature of an imagined container within which the transmission of thermal radiation from the body equals the transmission of thermal radiation in the real anomalous envelope, and it is a principle derived from the fact that net interaction of radiant power generation among two bodies is roughly commensurate to the thermal distinction magnified by their capacity to emit and contribute to global warming (emissivity). It is essentially the normalized average temperature of all the things around the body. This is true as long as the relative heats of the items in issue are considerable in comparison to the heat transfer, providing for uniformity in the ambient temperature from Stefan Boltzmann's law.

4.8.2 land surface temperature LST

Once delving into indoor environmental circumstances and the impact of micro-climate development initiatives, an analysis based on Land Surface Temperature (LST) is presented to determine the heat transfer of personal urban places and to

demonstrate the existing map of heat variations over Baghdad's conurbation. The temperature model would be compared to Baghdad's urban geometry, the density of population, and land uses. Based on this, a research region will be determined based on the thermal characteristics of the thermal map, which varies and contain diverse urban trends.

The total energy of urban infrastructure is critical in influencing the climatic and atmospheric features of cities. The elements of the urban infrastructure collect radiation energy from various heaters, including the sun, the environment, or other adjacent land objects, and return the accumulated warmth to its near area in the form of a radiative heat load. This continuous thermal and mass exchange between urban elements, either roads, structures, or plants, and the adjacent outside world is dependent on the thermal equilibrium of the exterior surfaces, which governs their heat (Santamouris, 2014,). Ground thermal load impact the urban microenvironment and is strongly related to heat wave intensity typically found in the lower urban environment. (Weng, 2006). A variety of tools and approaches have been developed to assess the influence of urban infrastructure on the microenvironment. Variables differ in a particular topic of study and spatial and cultural sensitivities. In particular computational and physiological simulations designed to analyze urban surface temperature (Saitoh et al., 1996) ; (Oke et al., 1999); (Cenedese & Monti, 2003); (Tong et al., 2005).

4.8.3 Potential air temperature (PAT)

Warming is measured by the temperatures of the environment. The majority of temperature measurements measure the warmth of the surrounding air. Thermal radiation waste or increase, on the other hand, is significant. Warm ambient is the influence of chilly or warm items in the region which is not taken into account inside the atmospheric warmth. Surface thermometers, which will be explored individually, can be used to detect warmth. The warmth within a structure is determined by the external solar irradiation exposure, as well as any warm air or coolant provided by the HVAC system or even other warmth and conditioning suppliers. Because the usual air average temp is substantially greater than the ambient heat, space residents do provide warmth to the room. Air heat is largely influenced by the specific situation, something that includes regional variables (longitudes and bathymetry), terrain (angle and terrain), features (potting medium and color), but also placement

(urban or remote areas), in addition to infrared photons from the sun and waves, that could induce a lot of wide differences, that may be reversible or irreversible (George Reeves et al ., 2001).

4.8.4 Relative humidity (RH)

Thermal comfort is governed either by temperature, moisture, and wind velocity of the space. Several other variables, like level and lifestyle, attire, age, gender, and general health, influence your comfort. Heat transfer is also affected by thermal radiation (hot surfaces) or thermal radiation loss (cold surfaces). The water content (RH) of the environment is a measurement of the water content in comparison to the possible saturation level. More humidity may be held in warmer air. The dew point is the temperature at which air water condenses when saturation approaches 100%. Because relative humidity varies with temperature. As cooler air coming from the outdoors warms up, its humidity levels fall. As it cools, refrigeration air conditioners frequently eliminate the air's humidity. Water is added to the air through evaporation conditioners. The percentage of the amounts of moisture molecules supposed to involve within the atmosphere to the highest number that may be retained until precipitation falls is expressed as moisture levels. Usually, it is stated as a proportion. Moisture levels fluctuate cyclically; it typically peaks at nighttime and over the winter-summer window, while ambient temperature reaches its minimum, and falls as temperatures increase (George Reeves et al ., 2001).

4.8.5 Wind velocity

Wind is the motion of air currents induced by variations in atmosphere pressures generated by terrain, and sea, including air thermal variations, that can happen on fundamentals (among different areas) or small dimensions (riverfront, lakefront zone, lowlands, etc.). In the first scenario, we're talking about global winds, whereas in the latter, we're talking about localized winds. Air is defined by three variables: speed, the location where it blows, and regularity. The influence of terrain on local storms is significant and quantifiable. Air configuration changes as a consequence of two characteristics on the land with obstacles: layer thickness of the terrain and altitude. Meteorological sensors located in a specific geographical setting detect wind. Adjusting this environment also alters the velocity, particularly affects in proportion to the altitude within the given location, (Federico M. Butera, 2014).

4.9 Model Preparation

By using Auto CAD software to draw the model area for the elected location which is mentioned before in the true scale as Shawn in figure (4.10) To create a technical representation of the chosen location and what it includes in terms of industrial and engineering models, as well as to create an engineering drawing of engineering tools and structures to help the visualization of their ultimate form through creative designs. even so, to create a model by the ENVI-met software as well as their qualities Given the research parameters, monitoring and assessment procedures were used.

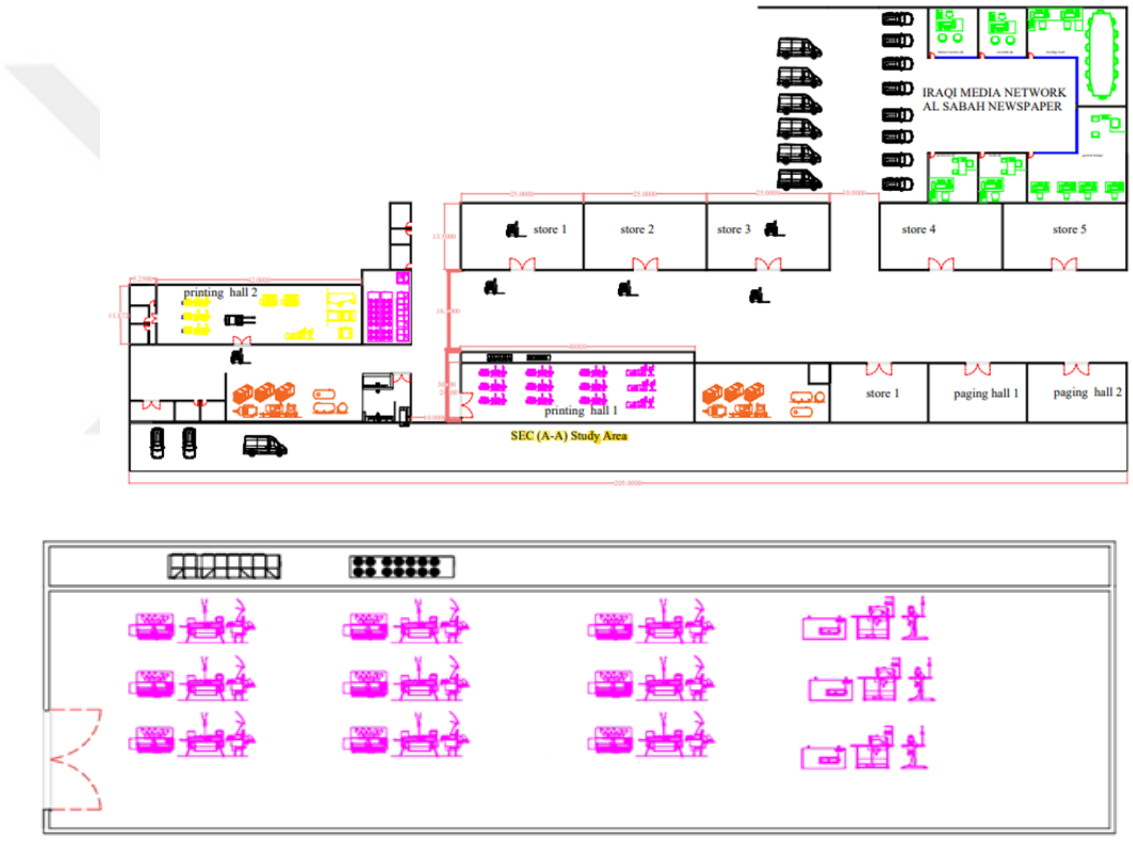


Figure 4.10: Study Area By Auto CAD

According to the genuine dimensions specified in the Auto CAD developed model shown in figure (4.10) that is utilized in the development of the model by ENVI-met 5.0.3 software to give actual imagination for the simulation process to offer excellent results after the modification by the ENVI-met program, One of the ENVI-met program's features is the ability to find the location of the selected area and automatically provide the latitude and longitude of this area, which provided accurate

results for air temperature, wind speed, relative humidity, and total mean radiant temperature, as shown in figure (4.11)

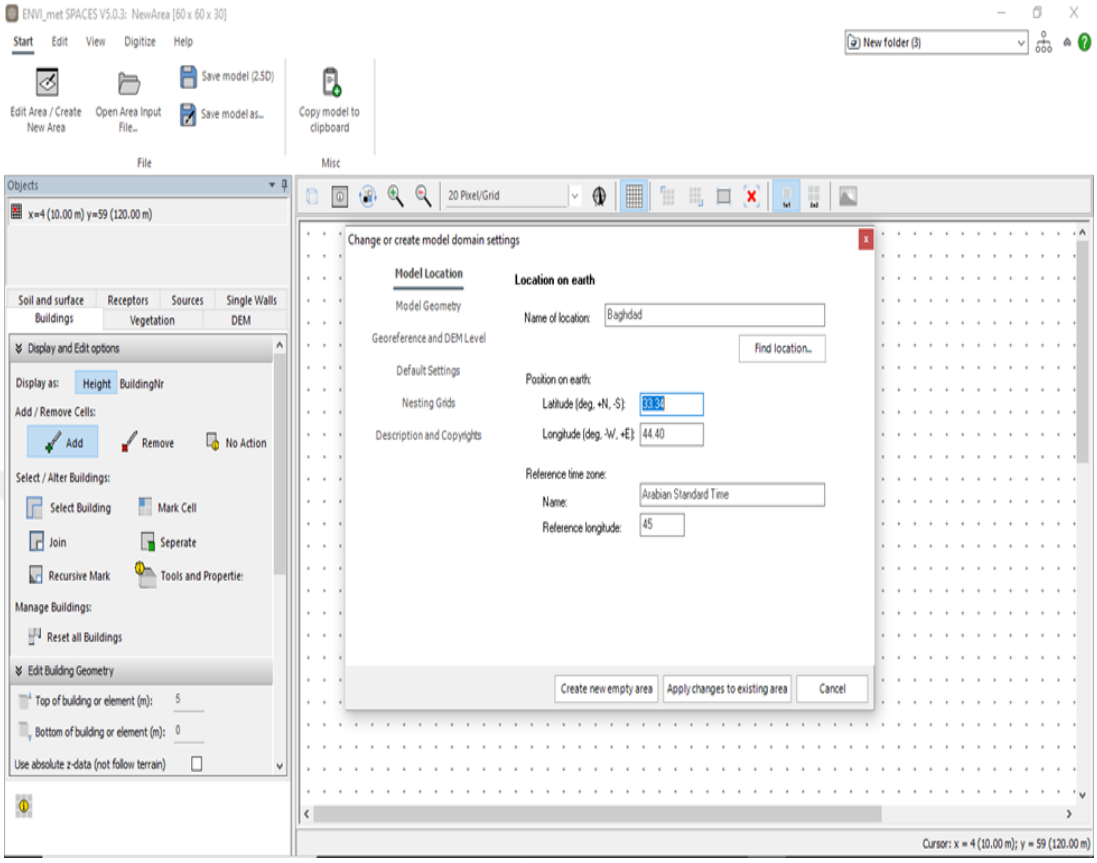


Figure 4.11: Location Determination by ENVI -met 5.0.3

Model geometry used to create the model was x-grids, dx 2.0, y-grids, dy 2.0, z-grids, dz 2.0 where the dx,dy, dz are the size of grid cell in the meter after inputting these data location reality information should be entered like the nature of the main road which is paved by asphalt and the interior road's materials which is paved by concrete, the nature of the building walls and roofing materials in addition to determine the true north for the building which is important to give the actual building orientation to the sunlight or thermal radiation, these functions must enter accurately before designing the model carefully to give accurate and satisfying results to improve the thermal comfort for the environment and the human using this building or walk around it as shown In figure (4.12).

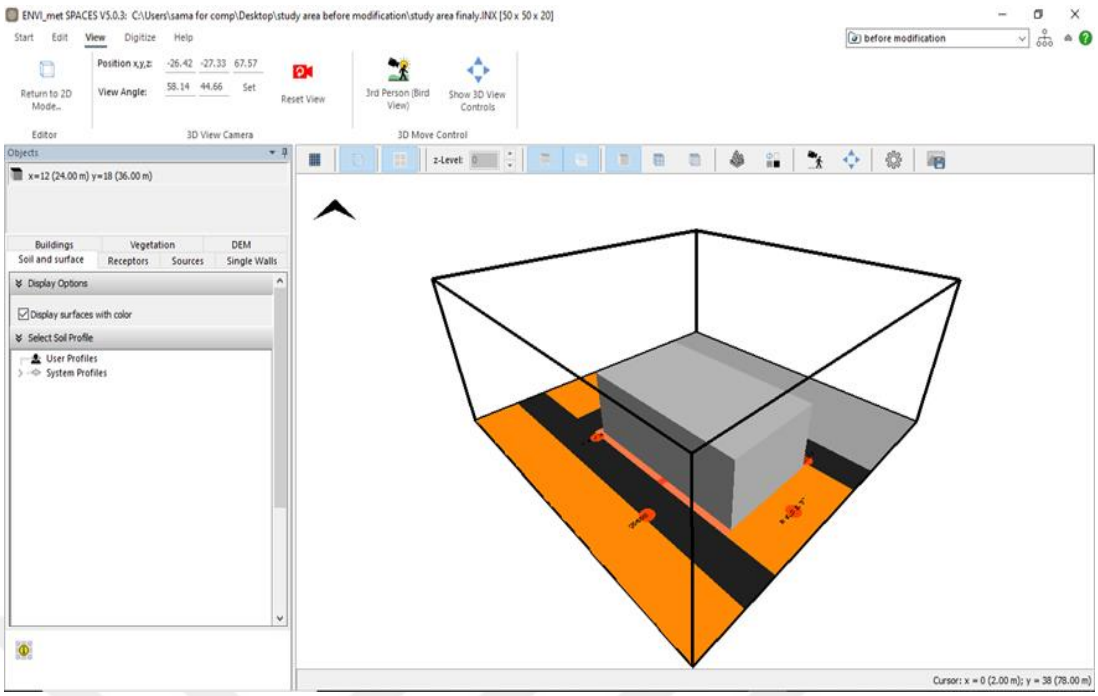


Figure 4.12: Designing Model by ENVI -met 5.0.3

The date of the hottest day in Iraq, which is July 30th, 2015 in which Baghdad experienced the warmest weather ever and recorded 123.8 degrees Fahrenheit equal to 50 degrees centigrade at 03:00 pm, should be determined to produce correct results in the simulation as shown in figure (4.13),[Washington post journal]

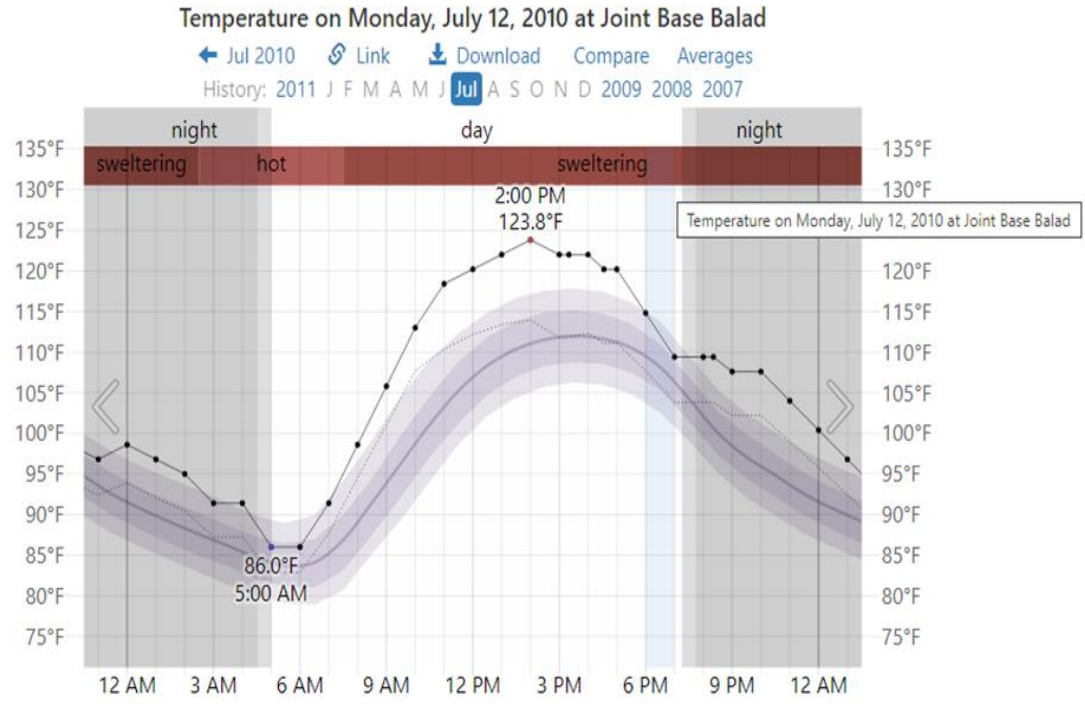


Figure 4.13: Warmest Day In Baghdad

Source: Washington post journal

Receptors Distribution around the building to detect and record the temperature around the study area as shown in figure (4.14)

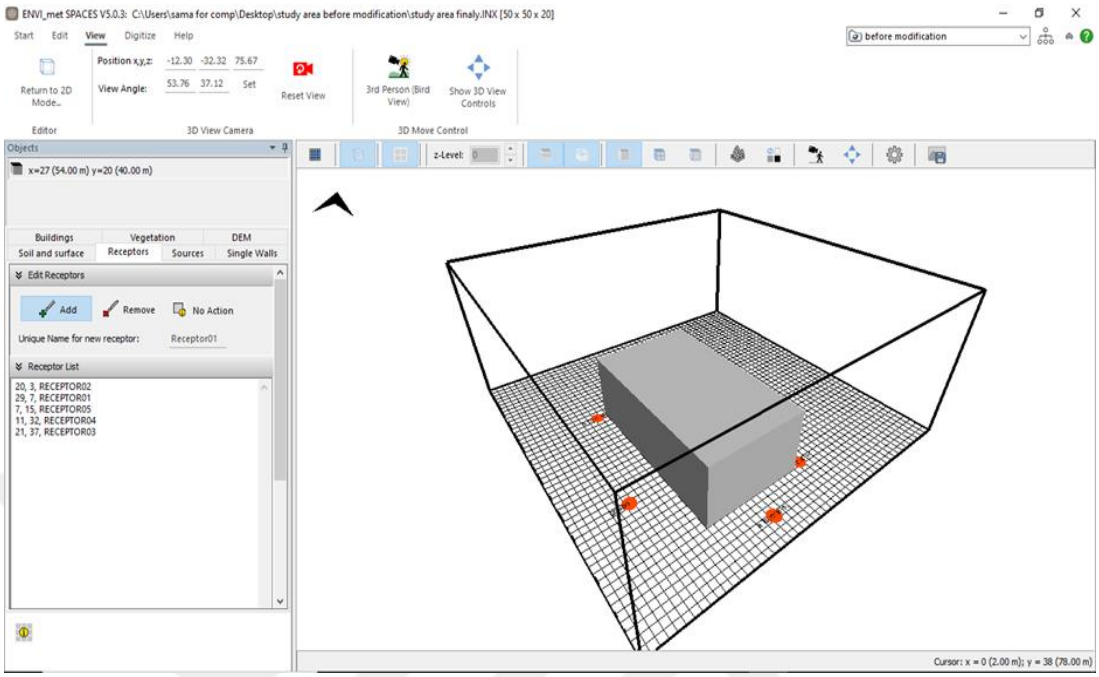


Figure 4.14: Receptors Distribution by ENVI- met 3.0.5

Entering this information Even the startup time to end of simulation for 24 hours in ENVI-met 5.0.3 as shown in figure (4.15) to prepare the model for simulation.

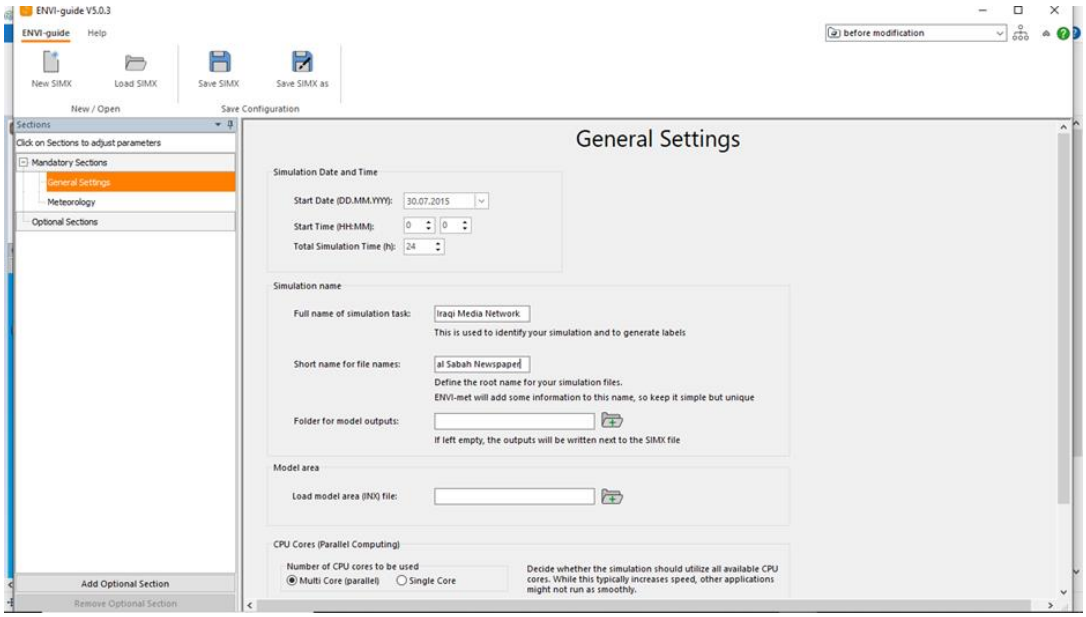


Figure 4.15: Preparing a Model for Simulation by ENVI-met 3.0.5

Setting the maximum and minimum temperature that day and relative humidity as shown in figure (4.16)

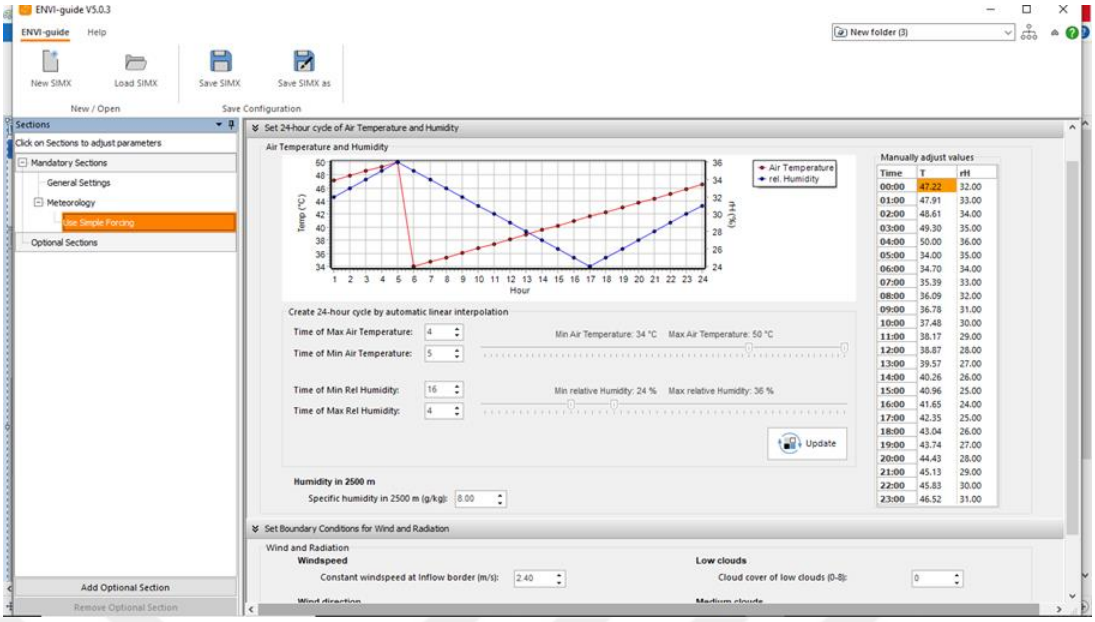


Figure 4.16: Setting The Temperature And Humidity For The Model by ENVI-met 5.0.3

Simulating the model mentioned in figure (4-11) for 24 hours continuously to gain results as shown in figure (4.17).

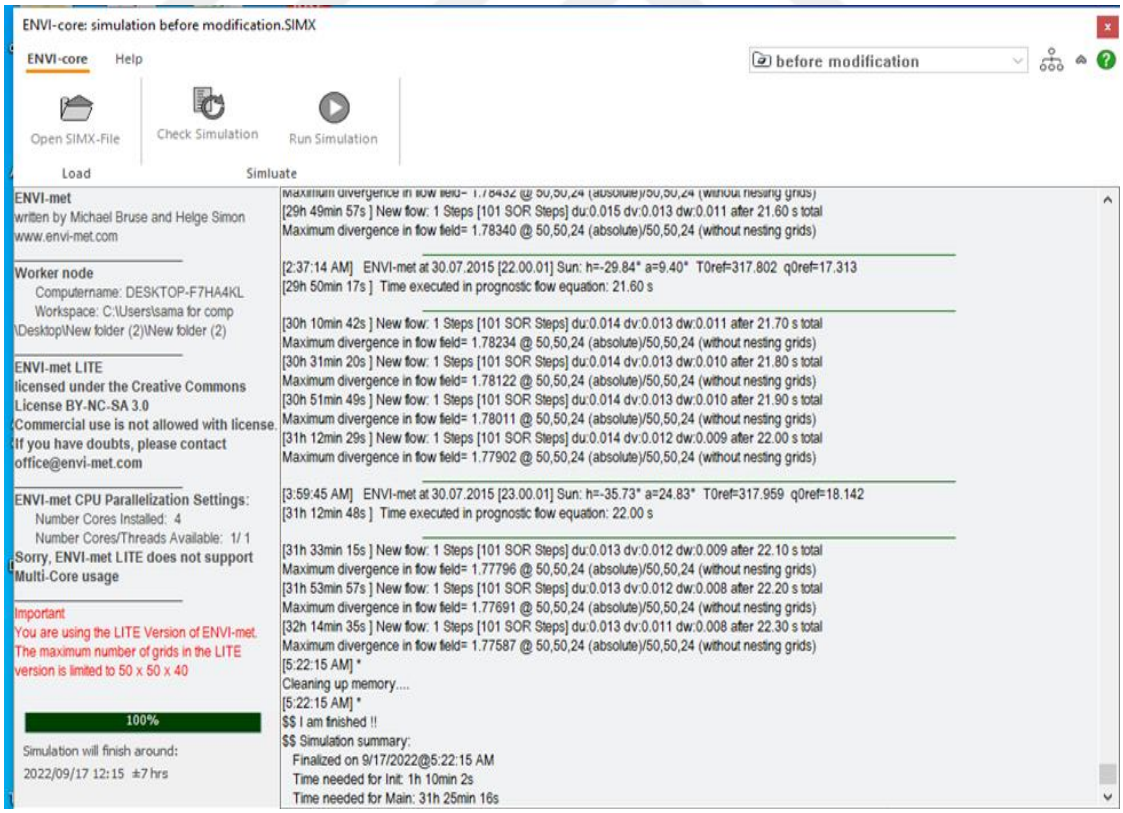


Figure 4.17: Running Simulation for 24 Hours by ENVI-met 3.0.5

4.10 Results before modifying the model

4.10.1 Potential air temperature (PAT)

According to the Washington Post, the results were chosen around 3 p.m. on the hottest day in Baghdad, July 30, 2015. Temperature indications around the facility have significantly increased. Because the region is constrained and bordered by multiple concrete structures, as well as the lack of greenery and the asphalt pavement utilized on roadways. Noticed That The maximum (PAT) on that day was 47.43 ºC where as the minimum (PAT) recorded that day was 43.89 ºC as shown in figures (4.18).

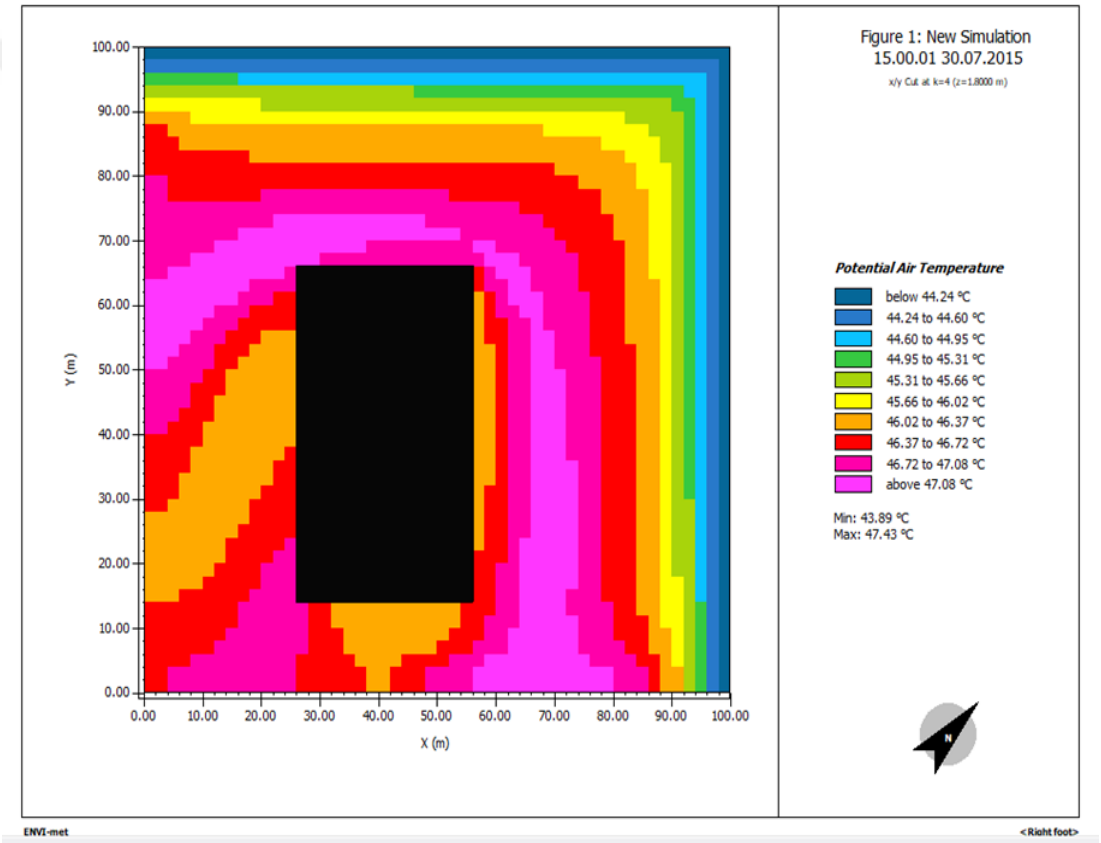


Figure 4.18: Potential Air Temperature Map (PAT)

According to the potential air temperature histogram,shawn in table (4.1) noticted that the proportion of the highest temperatures (higher than 47 degrees Celsius) was 40% of the total percentage of temperatures recorded on that day.

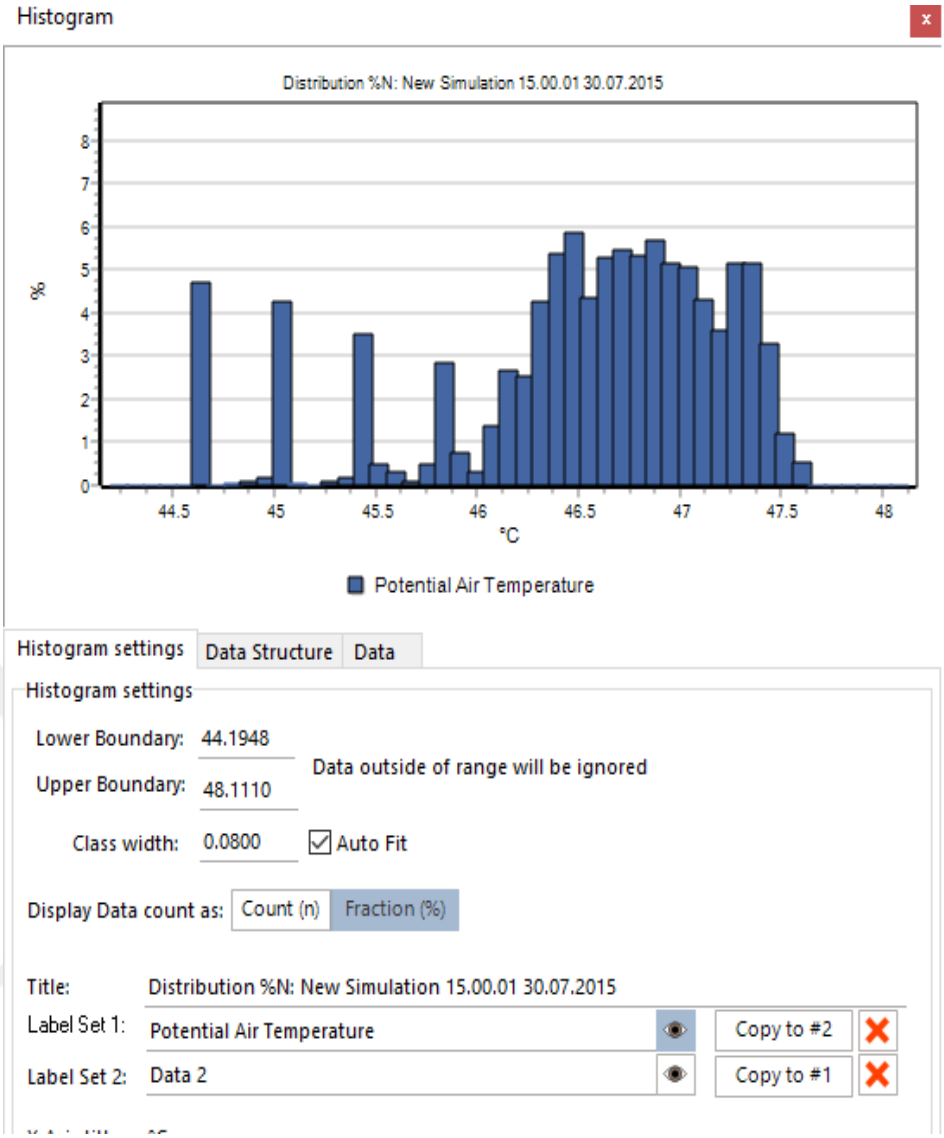


Figure 4.19: Potential Air Temperature Histogram

4.10.2 Mean Radiant Temperature (TMRT)

After finishing the weather simulations on the model for the research region on the warmest day in Baghdad's climate, July 30, 2015, as indicated in the Washington Post magazine, and after analyzing the results in the total mean radiant temperature map of the study area (building in the IMN) results gain as shown in figure (4.19) where the maximum (TMRT) on that day was 77.04 ºC whereas the minimum (TMRT) recorded that day was 58.74 ºC .

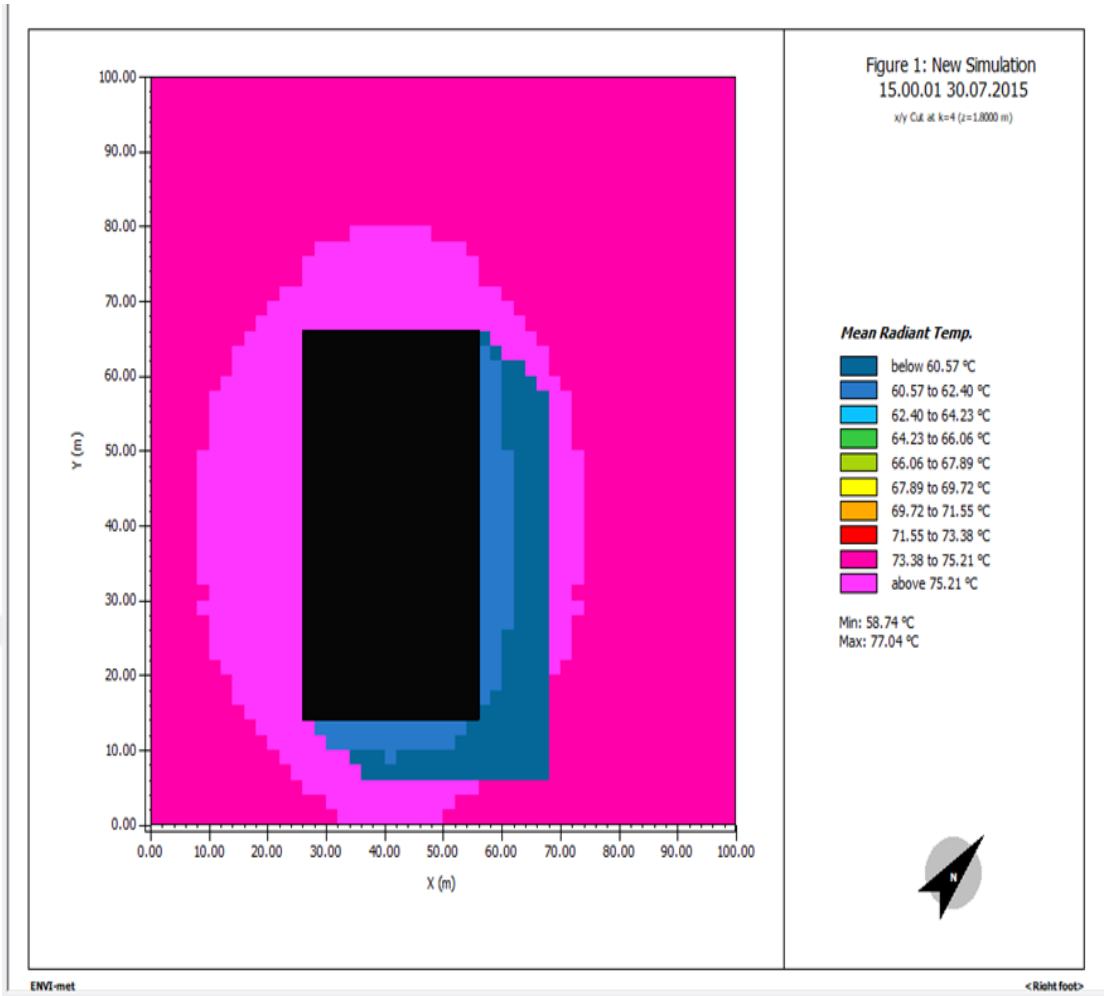


Figure 4.20: Mean Radiant Temperature Map (TMRT)

The researcher can see from the total mean radiant temperature histogram of the model that the proportion of the highest temperature on that day was 35% of the total mean radiant temperaturesrecorded that day , which is a high rate that negatively impacts thermal comfort. The region glow is visible in the weather map depicted in the purple color in table (4.2).

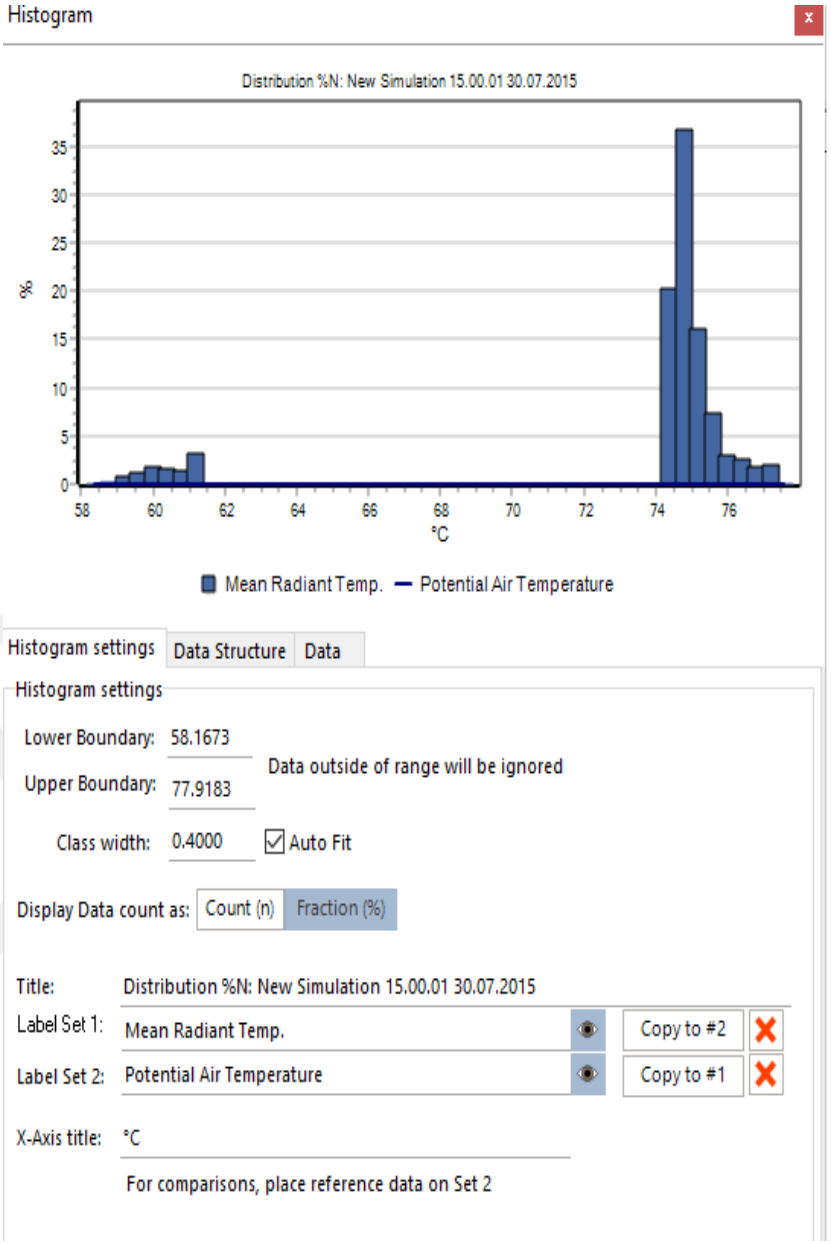


Figure 4.21: Mean Radiant Temperature Histogram

4.10.3 Wind velocity

After finishing the simulation on the model used for the study region and examining the findings of wind speed, which has a significant impact on the climate, the researcher concludes that The Maximum speed of wind recorded that day was 3.13 m\s whereas the minimum wind speed recorded was 0.03 m\s as shown in figure (4.20), It's worth mentioning that the building is surrounded by other concrete structures and is devoid of greenery, thus wind movement is severely limited This, in turn, has a detrimental impact on the thermal comfort .

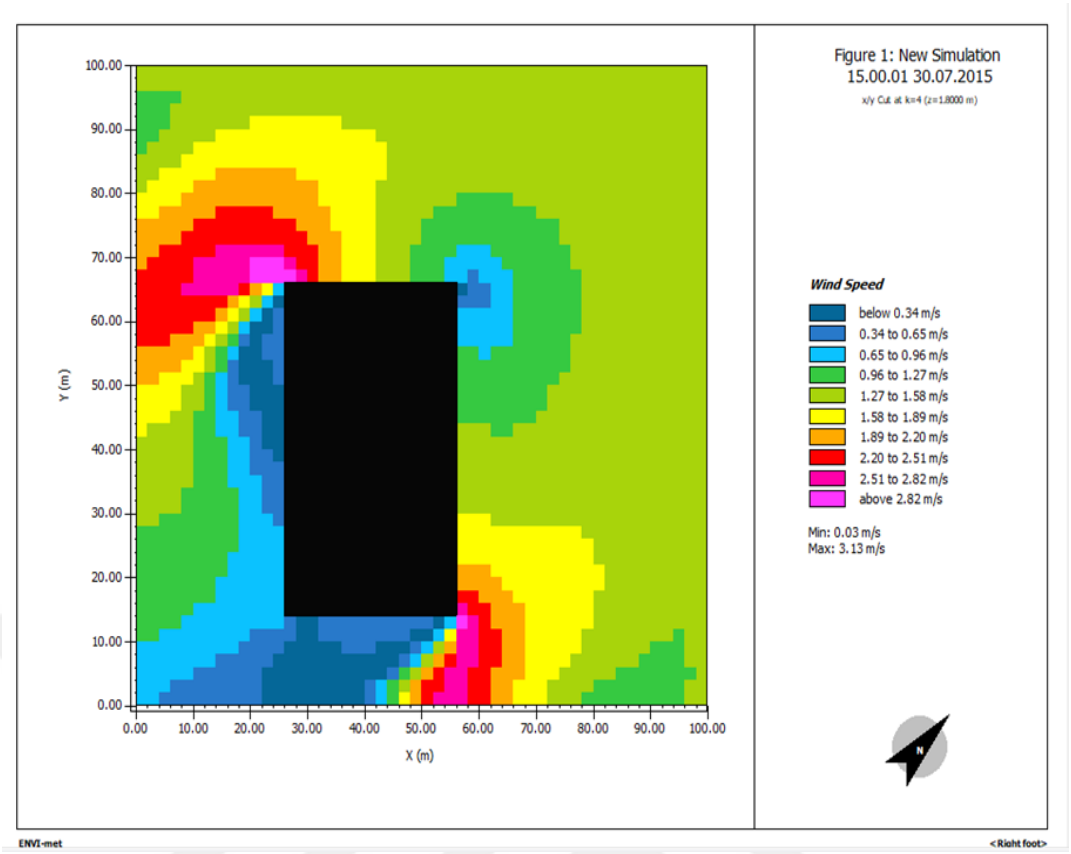


Figure 4.22: Wind Velocity

For the purpose of analyzing the data obtained after completing the simulation of the model used in the ENVI- met program and regarding wind speed, it is clear to the researcher that the highest rate of wind blowing at a speed of 3.13 meters per second is almost non-existent and accounts for approximately 0.05% of the rate of wind speed on that day, as shown in table (4.3).

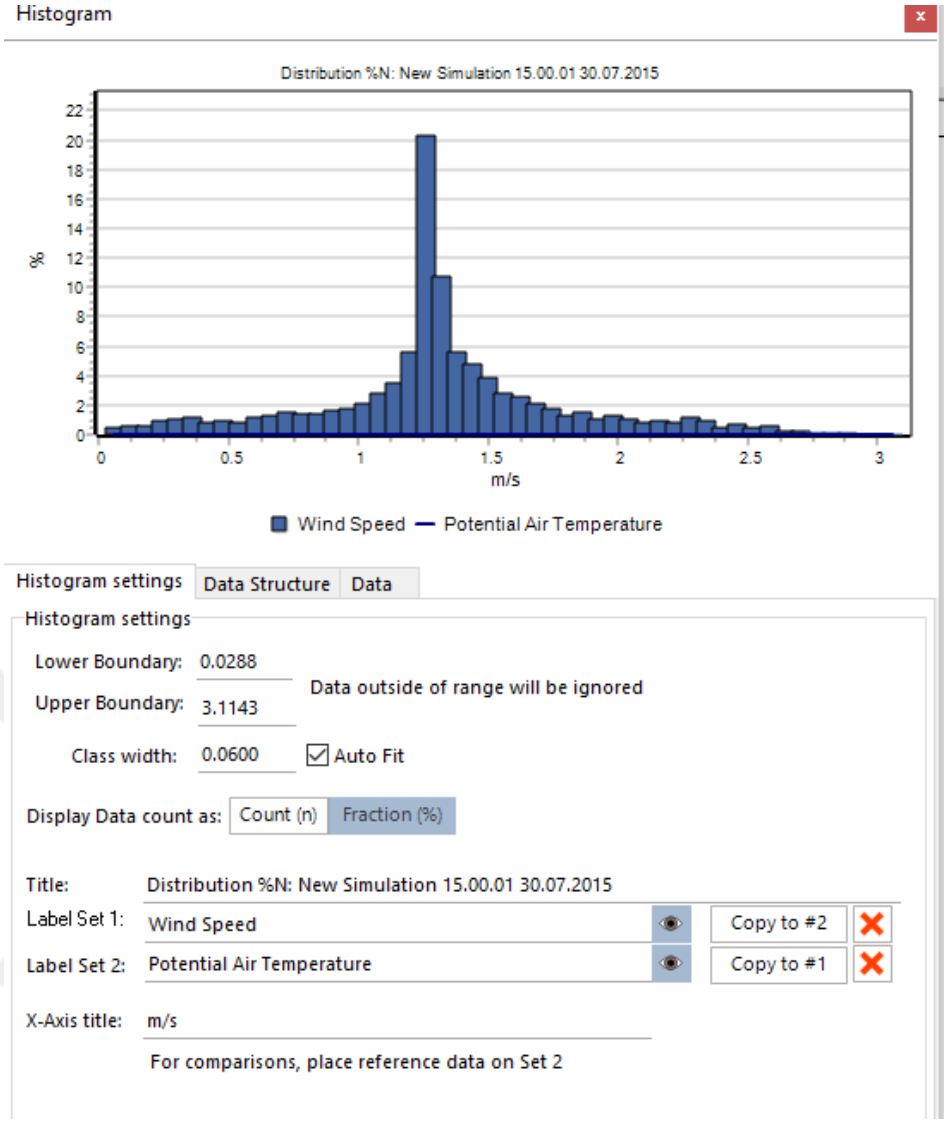


Figure 4.23: Wind Speed Histogram

4.10.4 Relative humidity (RH)

Many meteorological factors, such as the creation of thunderstorms and storms, are determined by the proportion of humidity. When the humidity hits 100%, the air becomes saturated with water vapor, causing dew or precipitation to occur. Examining the relative humidity map of the model in use that day reveals to us that The maximum level of the relative humidity recorded that day was 24.89 % whereas the minimum level of the relative humidity was 20.31% as shown in figures (4.21).

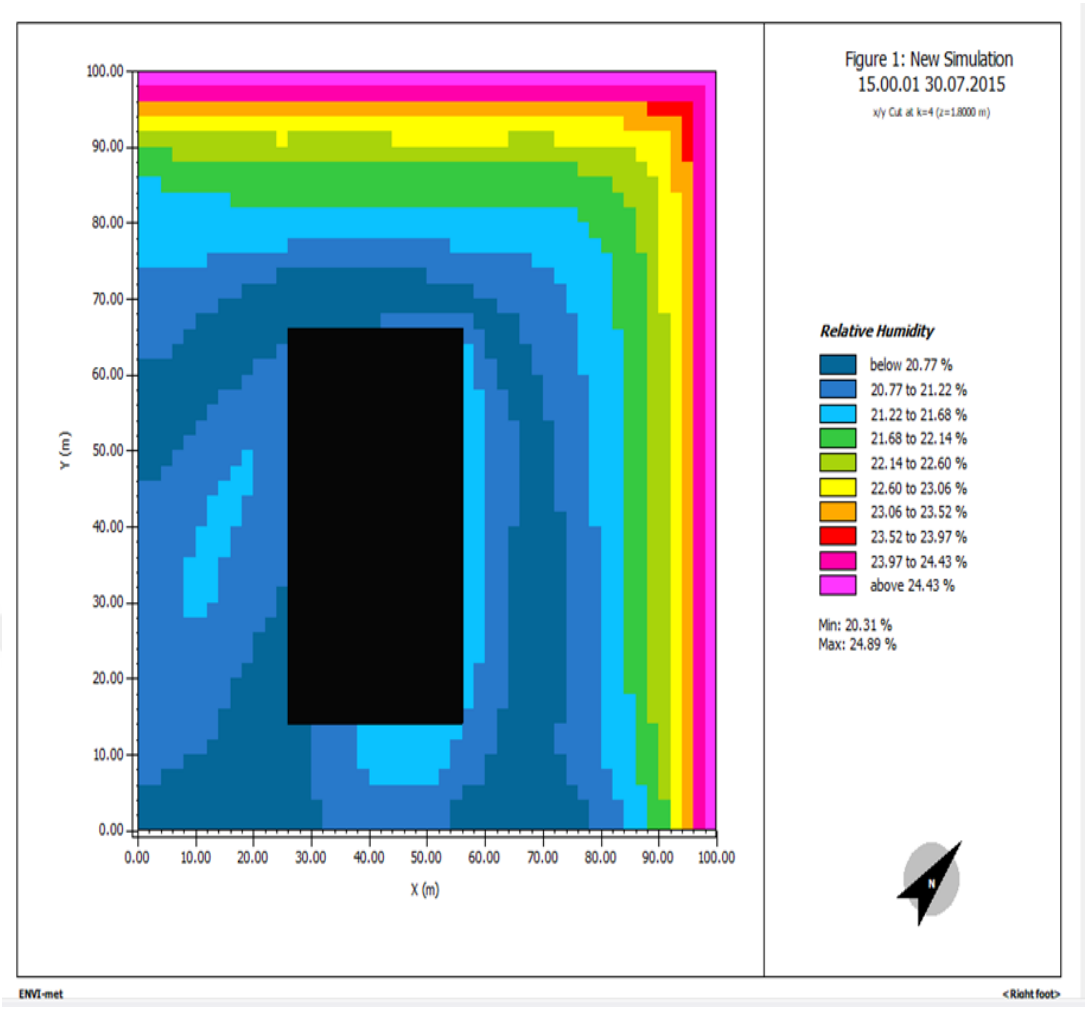


Figure 4.24: Relative Humidity

To check the data generated from the simulation of the applicable model and related to the relative humidity rates of the study area, the researcher determines that the percentage of obtaining the highest relative humidity rate is approximately 5%, which has a negative impact on the duration of thermal comfort as shown in Table (4.4) .

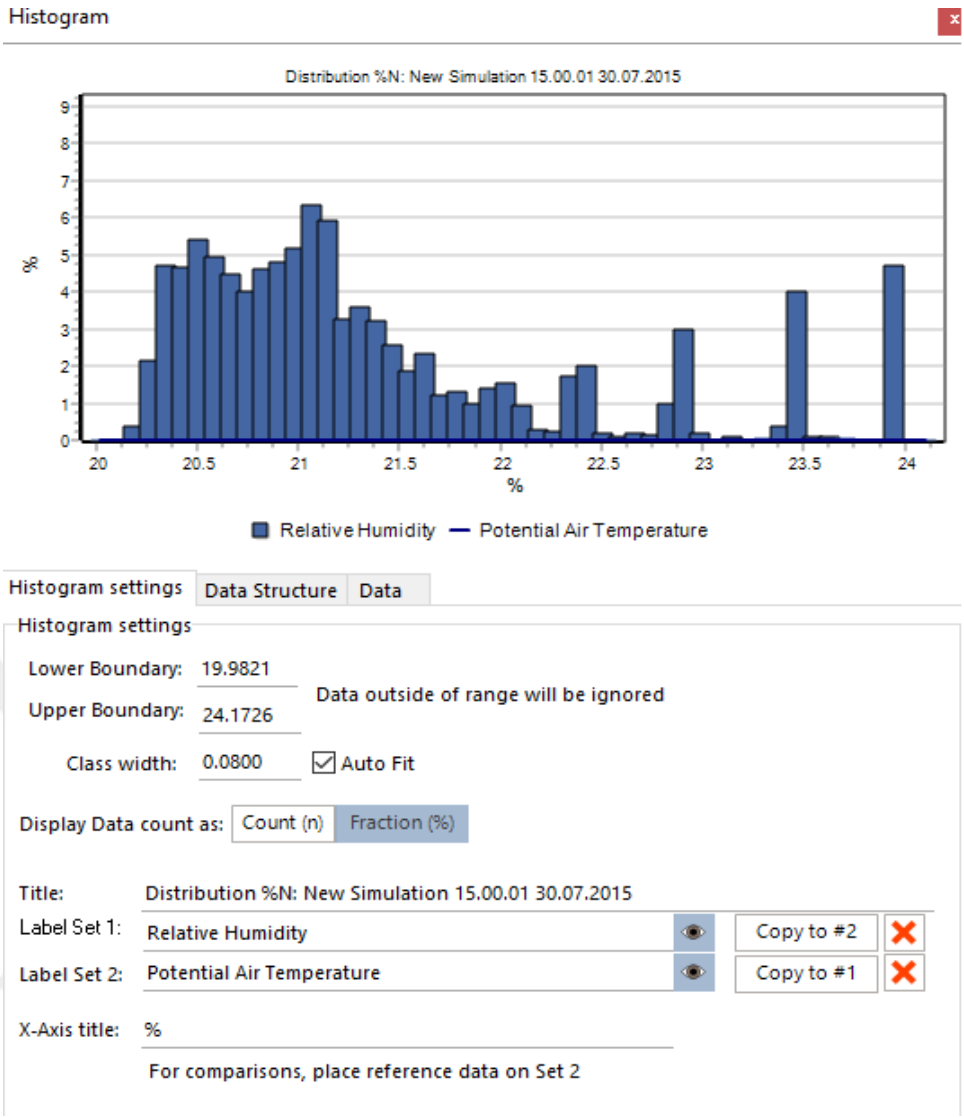


Figure 4.25: Relative Humidity Histogram

4.11 Modification

Achieving the thermal comfort for the structure by reducing the mean radiant temperature (TMRT), reducing the potential air temperature, and reducing the relative humidity levels that will happen in several ways :

1. The much more important topics influencing the lowering of the (PAT) values when results were documented around (47.43 – 43.89) °C, and the (TMRT) values (77.04 -58.74) °C whilst non-vegetated surfaces were reported the highest Land Surface Temperature (LST) values. the reduction of the (LST) needs Shading the area by Planting densely trees that offer plenty of shade, one of the most significant of these trees that have lately expanded in Iraq is (Melia Azedarach) tree, The price of this tree in Iraq ranges between (5 to 6) dollars, depending on its size. Since it

accepts dryness and is perennial, thick in shadow, and attractive, it is grown for ornament and shade. It is an appropriate tree for wayside decoration. Its leaves are not seasonal, it grows quickly, and its leaves are elegantly feathery in form and vivid in colors, and reproduction is simple (by seeds). This tree is a plant of the Azoderacht family that belongs to the genus Azodrachtian. It is a deciduous tree with huge, rapidly developing leaves. It is used to offer shade in gardens and fields, and it tolerates dryness but not fumes or dust. It is a plant that has been known in the ancient world's tropical, temperate, and warm climates. It thrives in a variety of soil types and does not grow very tall, reaching just 10-15 meters in height. It can withstand drought and cold and thrives in subtropical, temperate, and warm climates. It has already been planted in many tropics and semi-tropics nations expanding in Southeast Asia, Central Asia, the Caucasus, and Crimea, and has been brought as a fast-growing ornamental tree to Syria and Iraq. It is employed in wood industries and alternative industries, but it was first used for medicinal characteristics and as an exterminator. Its leaves grow up to 50 cm (20 inches) wide, alternating, lengthy, twice or triple times compounded (occasional), and have toothed edges. Delicate and aromatic, the blooms have 5 light violet or violet flowers that grow in bunches. The fruit is a drupe, marble-sized, pale yellow when mature, and hangs on the branch throughout wintertime until turning twisted and virtually white. Modifications happen in the root as it matures and expands, transforming its covering into wood, (Orwa et al., 2009) figure (4.22).

Figure 4.26: Melia Azedarach

Source: (Orwa et al.2009)

2. Using roofing Thermal insulators in a building which are materials that limit heat transfer through and through walls, ceilings, and floors. Insulators are made from several different materials and in different shapes and are most often assembled into rolls. The thermal insulating performance of a material is measured by its ability to resist heat flow Thermal insulating panels are manufactured from fibrous materials or plastic foams. It can be used with other combinations of insulators, for example, to be installed on the outer surfaces of walls that have been filled with cellulosic materials or fiberglass insulators. Thermal insulation panels are usually installed on the outer surfaces of structural structures when they are made of steel. Thermal insulating panels prevent the formation of thermal bridges across the structure. The best choice is to use (Isogam) which is made in the form of rolls (aluminum rolls with bituminous felt inside) with a width of 1 m * 10 m in length and 4 mm thick, consisting of aluminum and tar as shown in the figure (4.23). It is characterized by a low price of approximately 10 dollars for one roll in addition to it being lightweight, Aluminum is a very reactive metal. It transmits warmth rather than isolating the mechanism. Inter Insulated serves as a heat insulator to shield spacecraft from excessive heat. (William C. Turner, 2011).

Figure 4.27: Isogam with a single aluminum layer

Source: (William C. Turner, 2011)

3. Pavements made of asphalt collect and hold greater warmth than rough surfaces. As a result, traditional asphalt pavements release extreme temps, producing heat into

the sky and contributing to the urban heat island (UHI) phenomena. To mitigate the impact of UHI, various cool asphalt solutions have been implemented, such as the supply of chemicals and substances, protective coatings, and multilayer design. This paper examines the thermal characteristics of various mitigating strategies in the context of cool asphalt pavement depth. The literature is organized into three sections. The first section examines the effect of pavements on UHI as well as heat transport processes in pavements.

Using asphalt roads with red coating instead of a traditional layer of asphalt to modify the model. It is an iron oxide pigment, which is the same pigment used in the red pavement stone, and it is not expensive. One of its benefits is to provide lighting, as the distance between the lighting poles and the lifespan is longer than black and aesthetic asphalt, and the heat is less in the summer, which helps to preserve tires and roads, (Phelan et al., 2015); (P.E. Phelan, et al.2017) as shown in figure (4.24).

Figure 4.28: Red Coated Asphalt

Source: (P.E. Phelan et al., 2017)

4. Use the decorative brick road (red stones) in the interior roads of the building instead of the concrete roads which absorb the sunlight less than the concrete as shown in figure (4.25)

Figure 4.29: Red stone (brick road)

Source: (Wienerberger, 2009)

4.12 Model After Modification

Apply The Modification Which Is Listed In Paragraphs 4.10 As Shown In figure (4.26), (4.27) by planting trees around the building , isolate the walls and roofs by isolating material (isogam) , using asphalt (red coated) which reflect heat and using aluminium shades around the building to develop the thermal comfort.

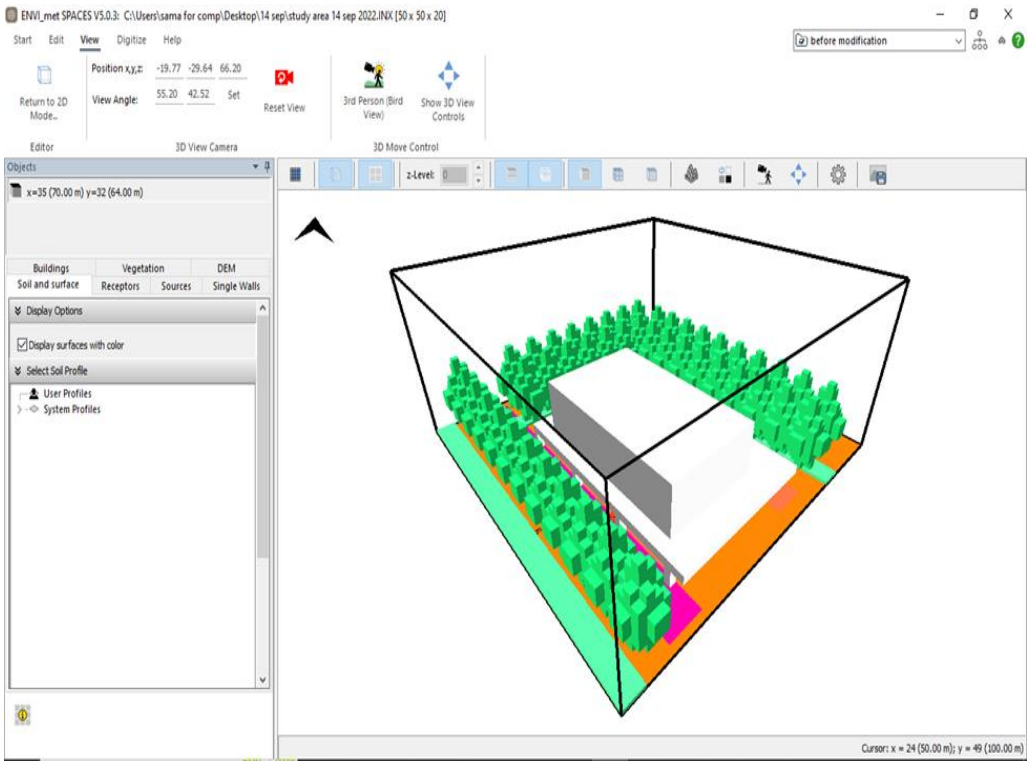


Figure 4.30: Model After Modification (3D)

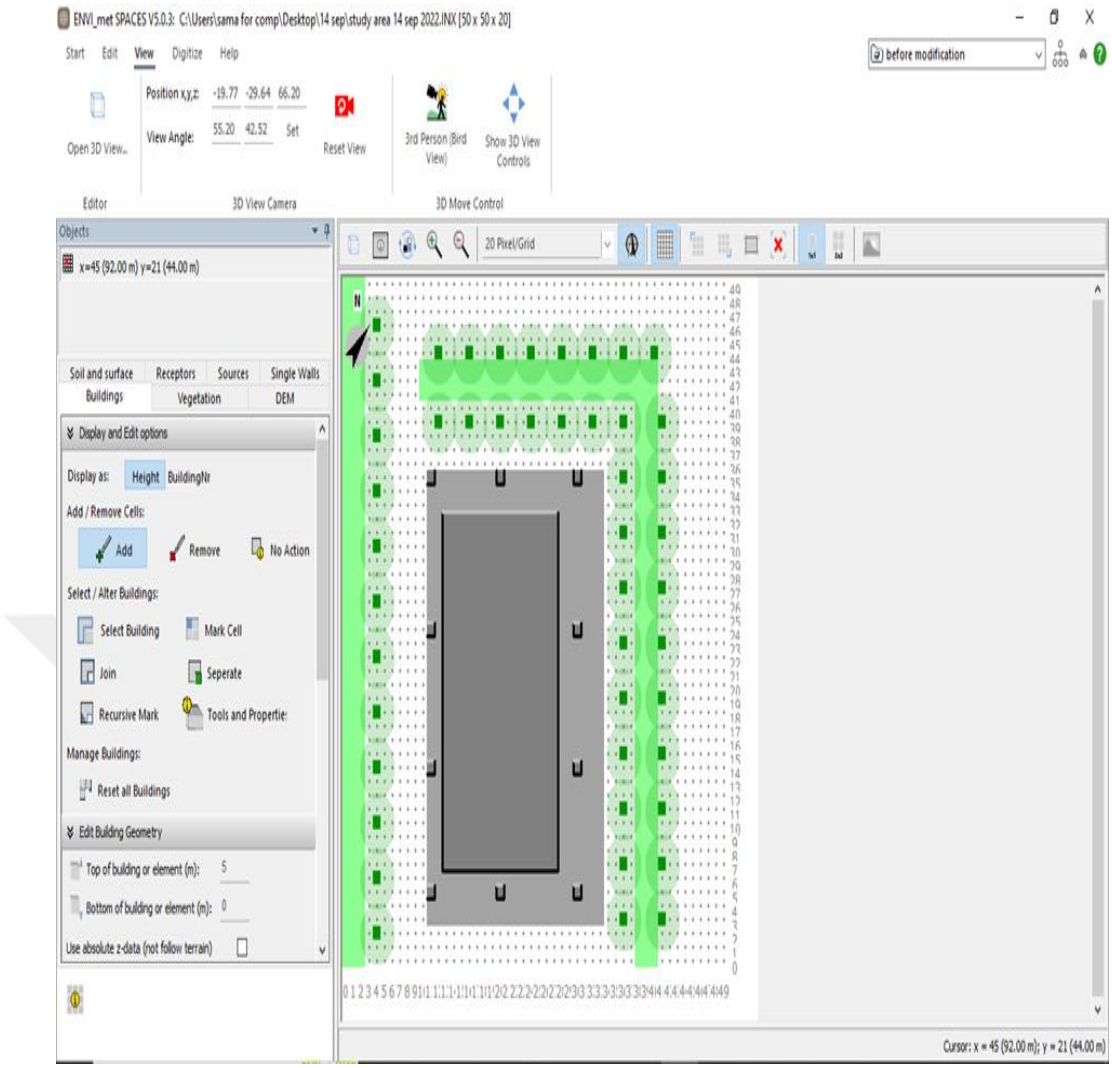


Figure 4.31: Model After Modification (Top View)

4.13 Results after Modification

4.13.1 Potential air temperature (PAT)

As reported by the Washington Post, the outcomes are picked at 3 p.m. on July 30, 2015, Baghdad's warmest day, A relative decrease in temperature is observed after applying the modifications on the model and the maximum (PAT) on that day was 45.20 ºC whereas the minimum (PAT) recorded that day was 40.90 ºC as shown in figures (4.28) .

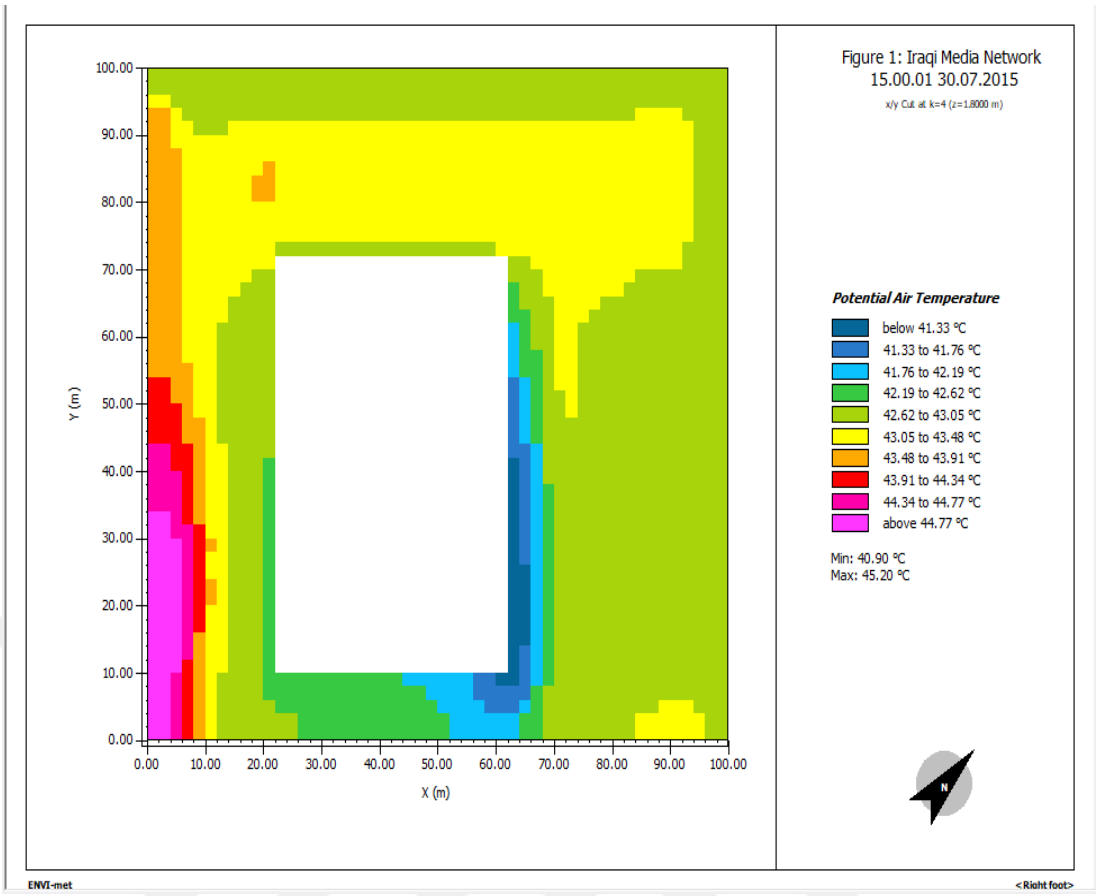


Figure 4.32: Potential Air Temperature Map (PAT)

Results observed in table (4.5), including the potential air temperature histogram, that the percent of the highest temperatures (more than 45.2 degrees Celsius) was 0.03 % of the overall percentage of temperatures recorded on that day. Which notes a significant drop in temperatures for that day after the improvements

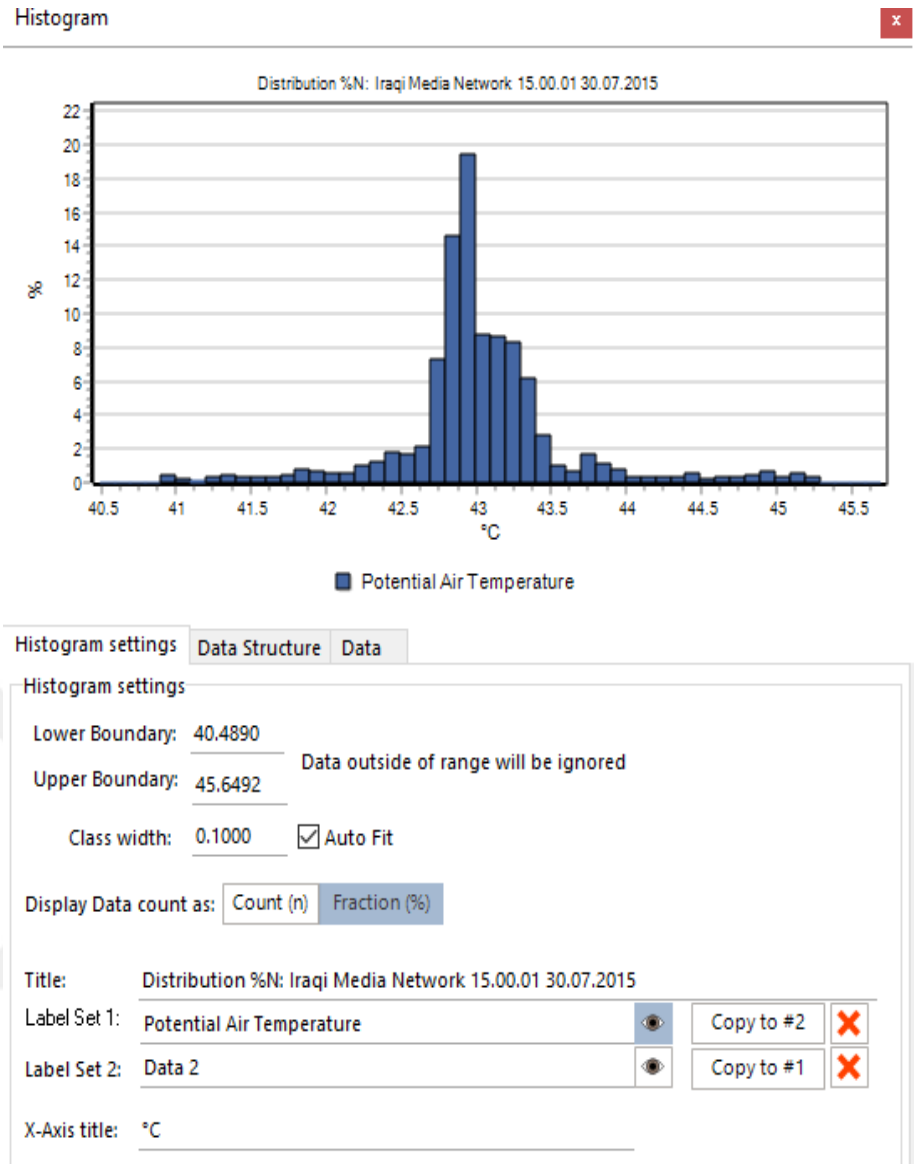


Figure 4.33: Potential Air Temperature Histogram

4.13.2 Mean radiant temperature (TMRT)

When the researcher applied the modifications on the model and after finished the simulation results on the total mean radiant temperature showed that the maximum (TMRT) on that day was 66.83 ºC whereas the minimum (TMRT) recorded that day was 20.18 ºC as shown in figure (4.29), it is note worthy the development in the thermal comfort on the (TMRT) map if compared with the results gained before modifications .

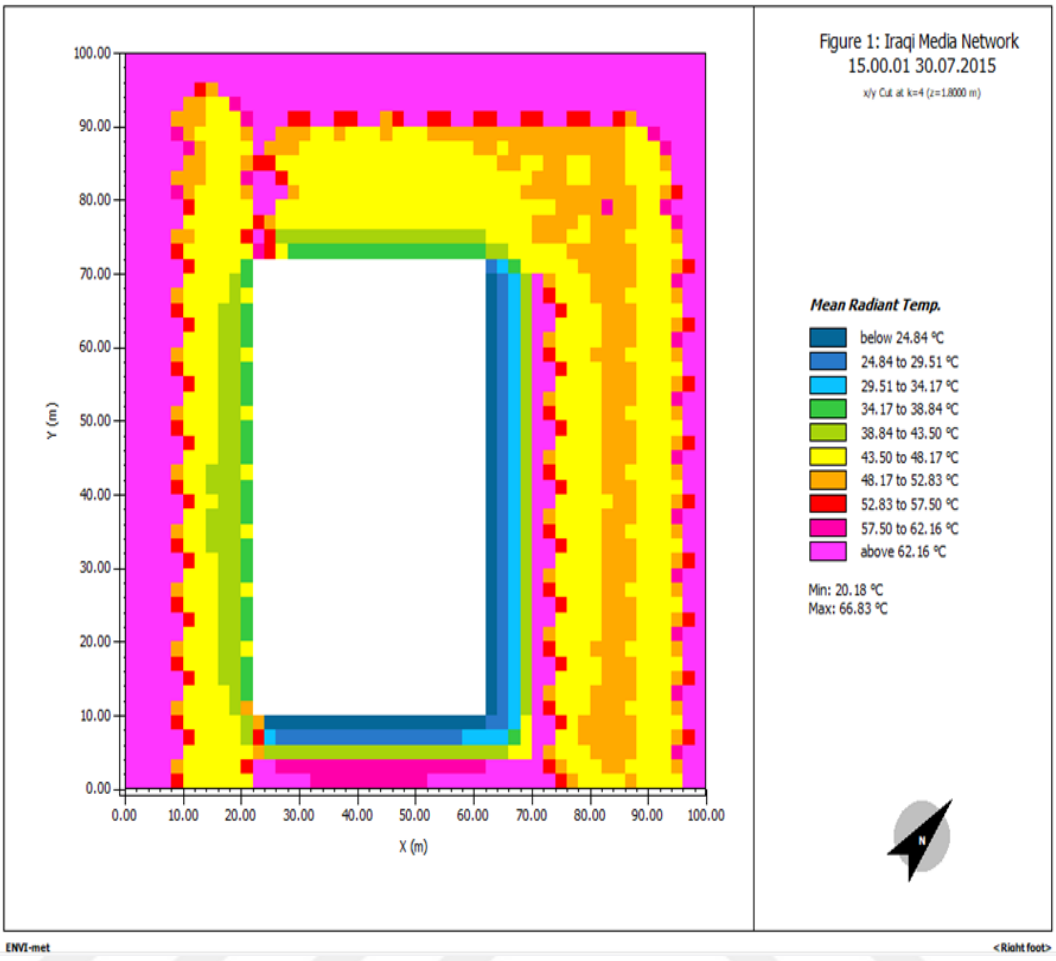


Figure 4.34: Mean Radiant Temperature Map (TMRT)

Analysing results gained in the (TMRT) histogram shown in table (4.6) noticed that the percentage of gaining maximum (TMRT) is 17.5% in that day it is a good percentage if compared with the results before modify the model which leeds to development in the thermal comfort.

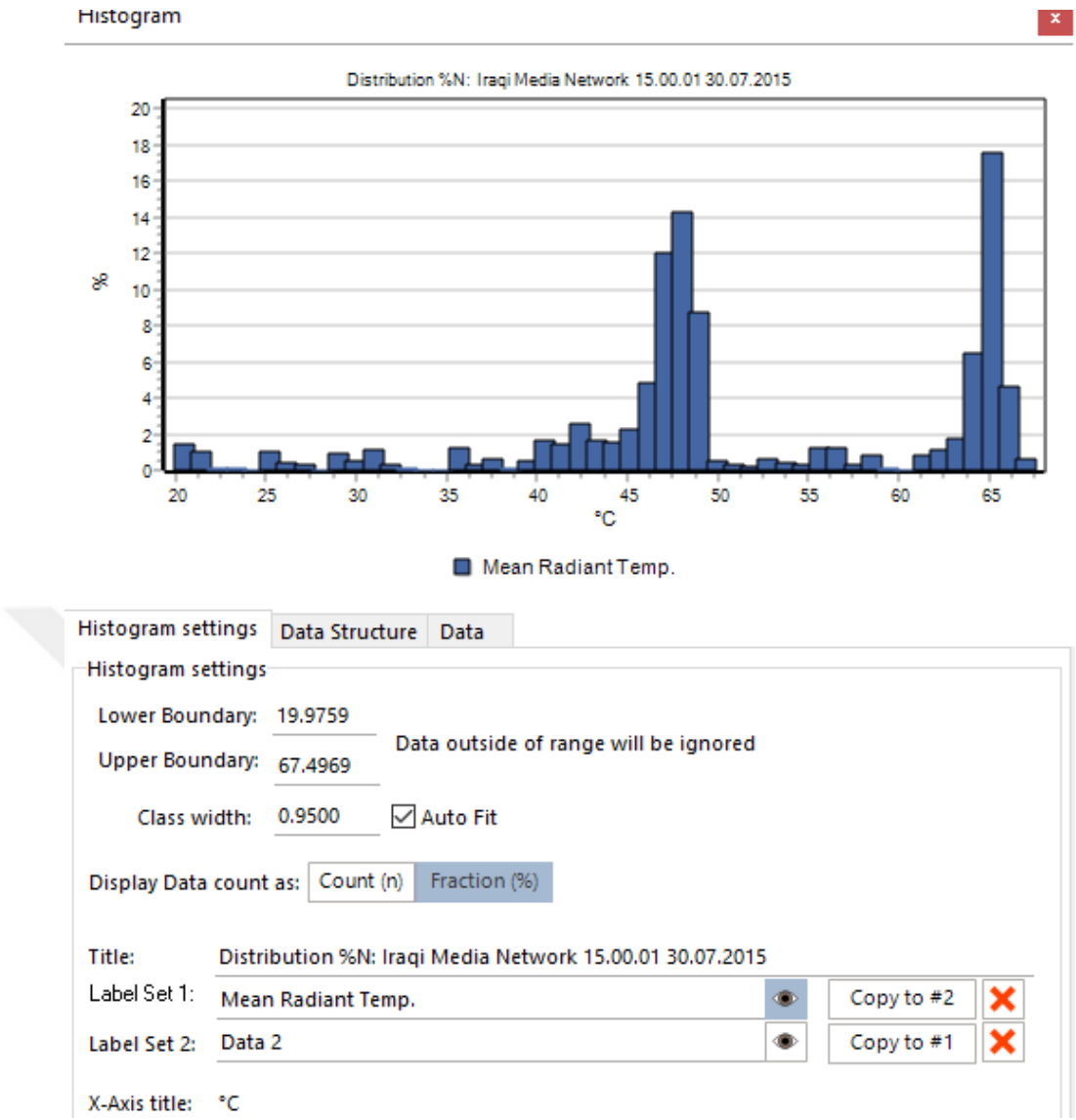


Figure 4.35: Mean Radiant Temperature Histogram

4.13.3 Wind velocity

After modifying the modeland simulated it via ENVI- met software reslts in figure (4.30) showed that there is an improvement in the thermal comfort while The Maximum speed of wind recorded that day was 2.98 m\s whereas the minimum wind speed recorded was 0.06 m\s

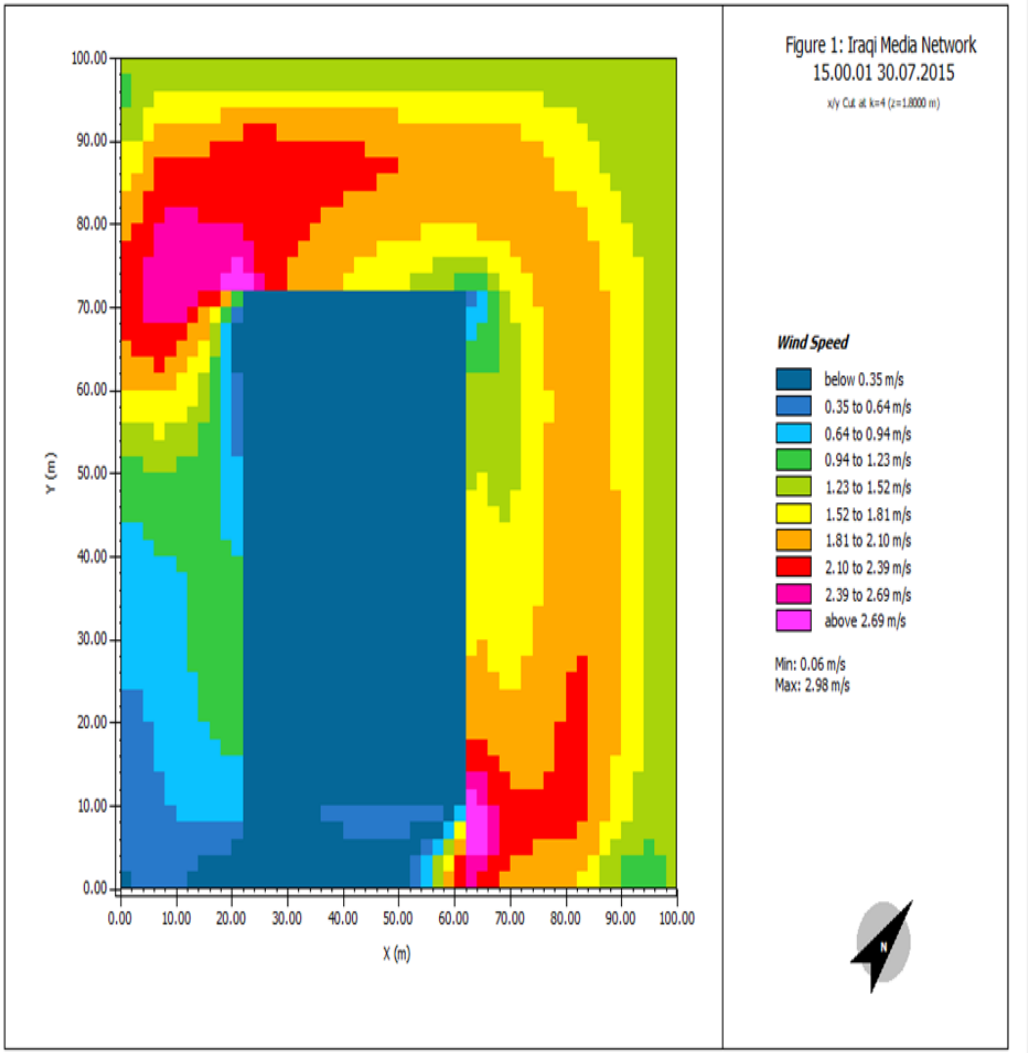


Figure 4.36: Wind Velocity

After looking at the histogram of the wind speed map, it becomes clear that the percentage of winds blowing at a speed 2.98 m\s almost non-existent on that day as explained in table (4.7)

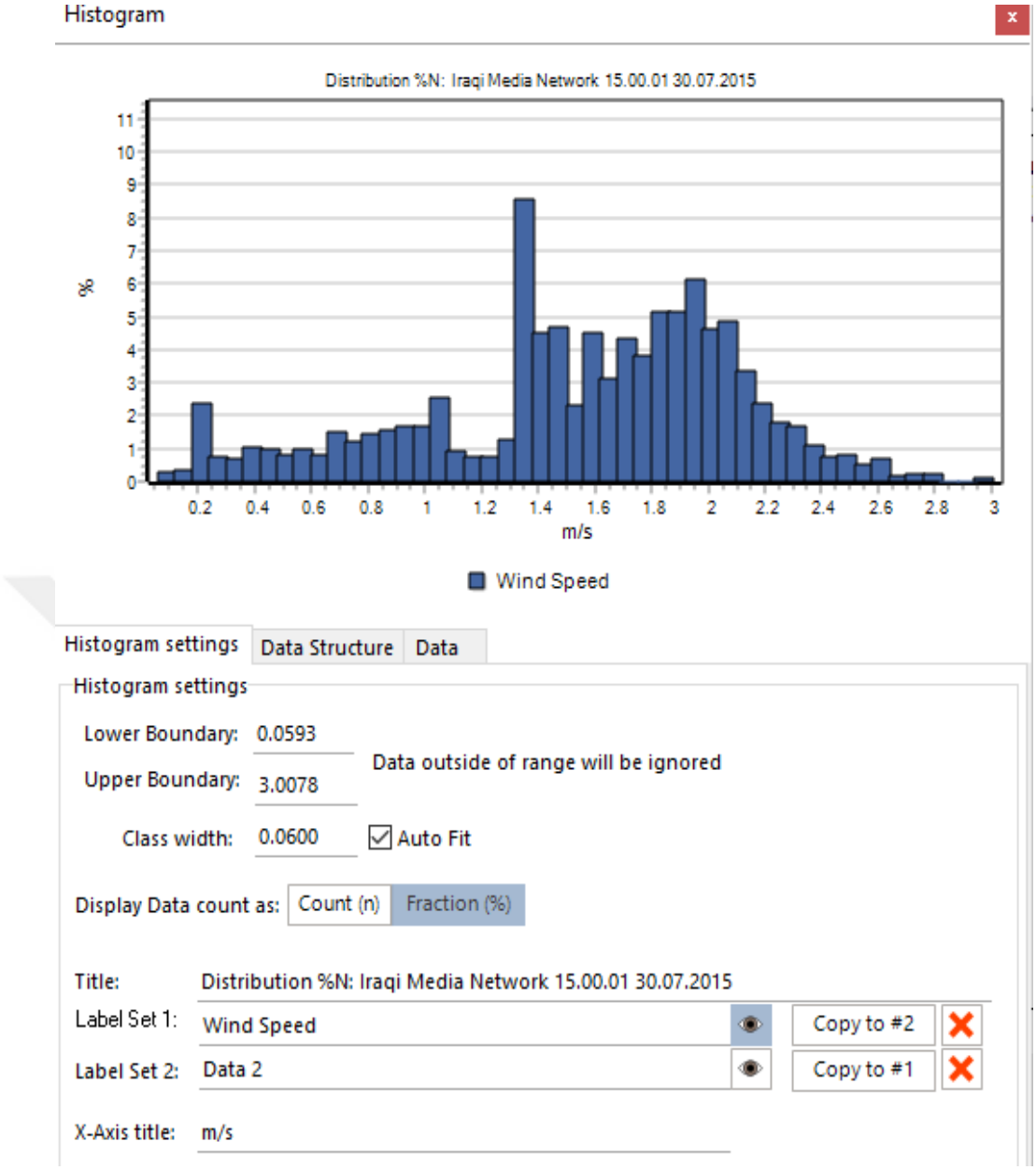


Figure 4.37: Wind Speed Histogram

4.13.4 Relative humidity (RH)

The results obtained by the researcher after modifying the model indicated that the relative humidity map shown in Figure (4.31) showed the following, The maximum level of the relative humidity recorded that day was 22.03% whereas the minimum level of the relative humidity was 27.53 %

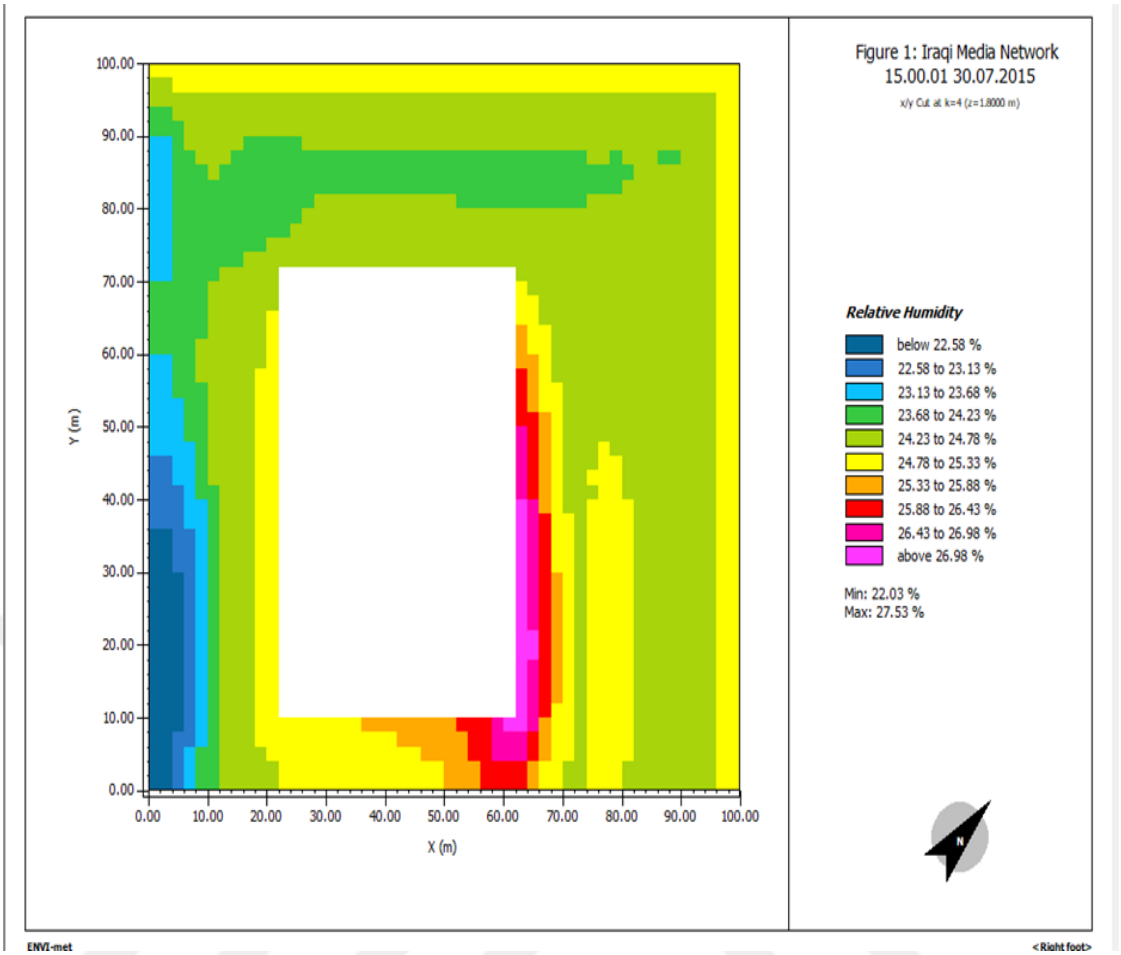


Figure 4.38: Relative Humidity

After checking the relative humidity histogram It can be seen that percentage of gaining relative humidity between 24.5 to 25 has a 14.5 % in that day which leeds to develop the thermal comfort in the study area as showed in table (4.8).

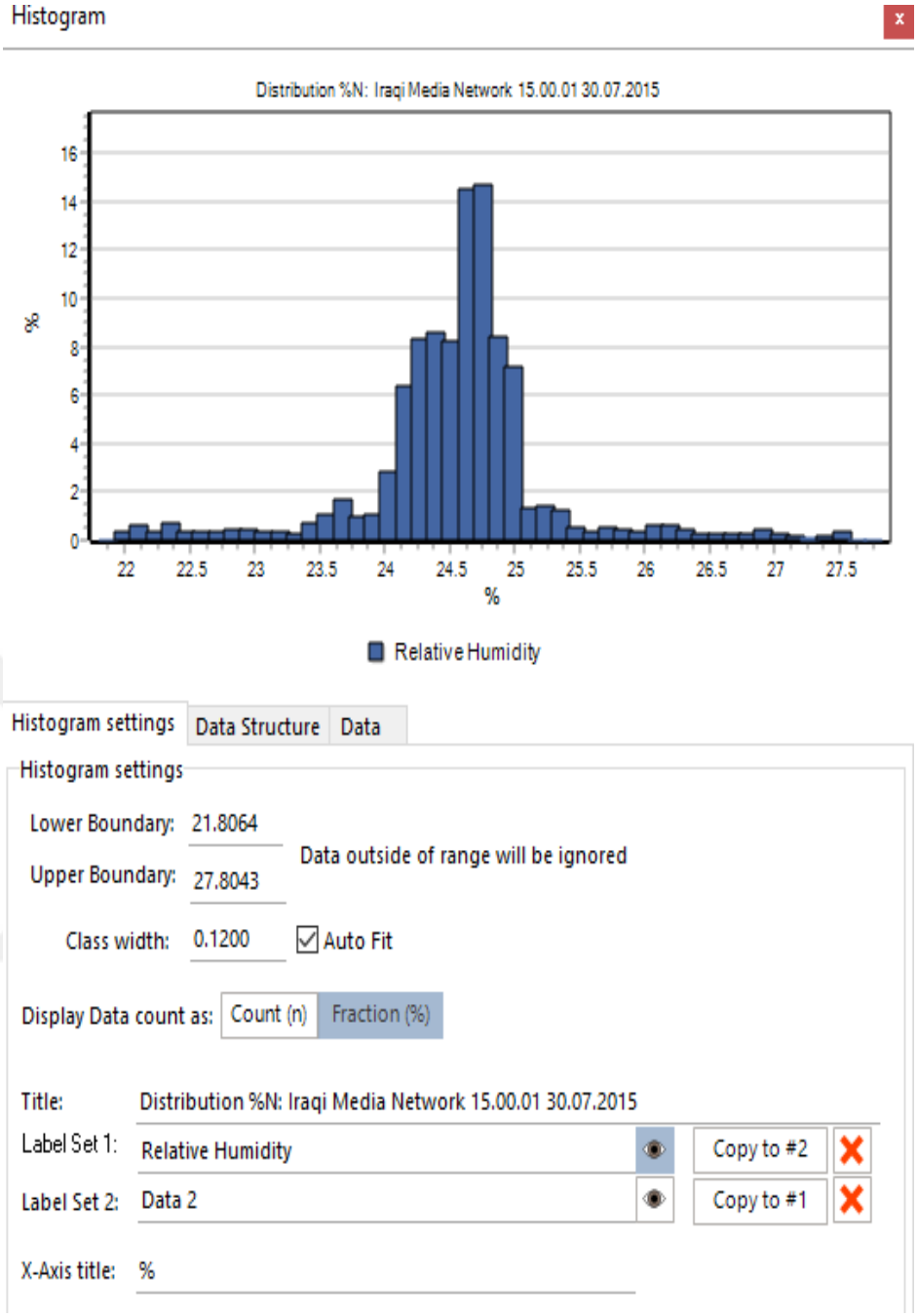


Figure 4.39: Relative Humidity Histogram

4.14 Comparing Results Gained Before and After Modification

Table 4.1: Results Comparing

NO.	Before modification	After modification
1	Maximum potential air temperature = 47.43 °C Minimum potential air temperature = 43.89 °C	Maximum potential air temperature = 45.20 °C Minimum potential air temperature = 40.90°C
2	Maximum total mean radiant temperature = 77.04°C Minimum total mean radiant temperature = 58.74°C	Maximum total mean radiant temperature = 66.83°C Minimum total mean radiant temperature = 20.18°C
3	Maximum wind velocity = 3.13 m\s Minimum wind velocity = 0.03 m\s	Maximum wind velocity = 2.98 m\s Minimum wind velocity = 0.06 m\s
4	Maximum relative humidity = 24.89 % Minimum relative humidity = 20.31%	Maximum relative humidity = 27.53 % Minimum relative humidity = 22.03 %

5. CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Comparing the outcomes of the previous chapter (Methodology) The results of this study indicate that:

1. The analysis indicated the educational program's failure to address many of the ideas of And the principles of sustainability, as well as its failure to investigate technologies connected to sustainability, such as simulation techniques and Software that assists the sustainable design process.
2. The results showed that the majority of clients are uninterested in incorporating sustainability concepts and principles into the design of their architectural projects. It is obvious that environmental consciousness is lacking in our culture, and we confront several factors and hurdles, some of which are material in nature.
3. When seeking a design, there is a social obstacle to prioritizing the environmental component.
4. The lack of vegetation cover in the study area led to a hot and dry climate with an also low rate of relative humidity that affect the thermal comfort of the human occupants of the building.
5. The absence of shades in the study area led to an increase in the ground surface area which reflects the solar radiation of the sun affecting the pedestrians walking through the building.
6. The study area was surrounded by many buildings which restrict the wind flow subsequently the air circulation become nonexistent and affected thermal comfort, The greatest level of the mean radiant temperature was measured due to the high amount of both short and long waves radiated by the nearby structures.

7. Construction materials used for roofs, walls, and facades of the study area which are traditional materials absorbed a huge amount of heat in the daytime and are stored until night.
8. Asphalt used in the main road of the study area (black asphalt) absorbed the heat and reflect solar radiation that give huge amounts of (tmrt) and (PAT) affecting the thermal comfort.
9. interior roads of the study area are paved with Concrete which absorbs the sun's heat giving huge amounts of (tmrt) and (PAT) and thus affecting thermal comfort.
10. In a hot, dry environment, like the study area, the mean radiant temperature seems to be affected mostly by the urban configuration, shade distributions, and the breadth of internal corridors among structures. Those variables are important in determining microclimate circumstances and outdoor thermal.
11. Poor thermal insulation of the building has a detrimental impact on the thermal comfort of the personnel within.
12. Because of the great activity levels in a printing hall, and the heat radiation from the printing machine inside the building, outdoor thermally requirements need high power for the conditioning system which in turn results in a large decrease in the power demand required to adjust the structure. It is probably worth mentioning that structure congestion and an absence of adequate circulation spaces, as well as direct sun exposure.

5.2 Recommendation

1. The significance of modeling thermal performance in the early stages of design utilizing simulation programs and footpaths, permits evaluation of the environmental design criteria employed in the project.
2. From the point of view of thermal performance, it is better to extend residential and small structures in the direction of the east-west axis, as this condition increases the proportion of the facades viewing the north and south directions, allowing sunshine to enter when heating is required. It is worth noting that the sun is high in the south during the warmer months and low in

the south during the winter months. And, if the windows face south, the balconies of the higher roofs of the homes, as well as the methods of shade, will be among the simplest ways of shading that block the sun's rays during the hot months while enabling it to penetrate the architectural spaces during the cool months. will be one of the simplest forms of shade that blocks the sun's rays during the hot months while enabling it to penetrate architectural areas during the cold months.

3. Creating dense green areas around the building to give shade and thermal comfort to the building's inhabitants. Planting thick, permanent trees with huge leaves is desirable.
4. Sun shades should be constructed from materials that do not collect or hold heat, such as hardwood, and should be constructed in such a manner that they do not obstruct the sun. The fundamental role of air circulation is in lowering atmospheric temperature.
5. Avoid using high-density concrete in the design of sun shades or the interior roads surrounding the building Where this type of concrete is considered a heat reservoir because of the concrete's ability to retain heat during the day and radiate it at night when the air temperature is lower than the surface temperature, which affects the thermal comfort of the building's occupants.
6. Avoid using asphalt in the interior roads surrounding the building also in And pedestrian walkways where they have the capacity in Absorbing and reflecting heat Which adversely affects thermal comfort.

5.3 Recomandation Future Work

Although, as previously said, Resercher believe that the thesis's purpose has been met, other changes might be made to attain greater outcomes. In the following sections, we provide some of the outstanding questions that need future investigation (some of which we are currently working on) for each of the components of the research conducted in this thesis. It should be noted that it is essentially a collection of the Future Work portions of the preceding chapters.

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RESUME

Eng. Basheer Majeed Ali AL ZUBAIDI

RELEVANT EXPERIENCE

- Fluent in auto cad program .
- Fluent in Microsoft office (Word , Excel , Powerpoint).
- Fluent in ENV- met .
- I have very good experience in primavera program with certification that recommend that .
- Very Good expert in survey works regarding Level ,
- Simple Expert in theodolite & Total station device

EDUCATION

- Bachelor's degree in civil engineer from al mustansiryah university (2011-2012)

OTHER SKILLS

- Write and read in English easily
- Good dealing with deference computing program

SUMMARY OF QUALIFICATIONS

- Working from the beginning in Badrah Oil Filed project (CPF Phase 1) as a site engineer with ALMCO Company in many items like{ pipe racks , tanks , piles ,different types of foundations , pipe sleepers} under supervising of petrofac and gazprom companies .
- Working in designing works by using Auto cad program With Middle East Company (MEC) .
- Working in sanitary works in { surveying , pipe lining and quantity surveyor} in al Kut Governorate Sanitary Project .
- Finally a still working as an governmental employ as an engineer in the Iraqi media net work