O. M. Beketov National University of Urban Economics
in Kharkiv

School of Architecture, Urban Planning and Design

Department of Architecture of Buildings and Constructions

ABSTRACT

for the master's degree

on the topic: **"Regional features of the architectural formation of modern office centers in Morocco"**

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O. M. BEKETOV NATIONAL UNIVERSITY OF URBAN ECONOMICS IN KHARKIV

Institute **School of Architecture, Urban Planning and Design**
Department **Architecture of Buildings and Constructions**
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APPROVE
Head of ABaC department
Olga V. Smirnova
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T A S K

FOR THE STUDENT'S QUALIFICATION WORK
Laabidi_Hassan

Topic of the project (work): "Regional features of the architectural formation of modern office centers in Morocco"

1. Supervisor of project (work): Borysenko A.S, PhD, Associate Professor approved by order of the higher educational institution from 26 November 2025 № 1116-03
2. The deadline for student submission of the project (work): May 23, 2026.
3. Initial data for the project (work): diploma design tasks, results of pre-diploma practice, theoretical studies, graphic-analytical materials.
4. The content of abstract (list of issues that need to be developed):
   Section 1. "Theoretical and practical experience of forming modern office centers", Section 2. "Principles and methods of forming the architecture of modern office centers in the structure of the city", Section 3. "Experimental Design. Project of a modern office center", Section 4. "Calculation and Constructions", Section 5. "Occupational Health and Safety".
5. A list of graphic material (with a precise indication of mandatory drawings): scheme of the location of the territory in the structure of the city; scheme of the location of the territory in the structure of the district; scheme of the existing functional and transport organization; scheme of the project functional and transport organization; reference plan, general plan; photo fixation; plans, facades, section, perspective projections of the main angles of the building.

6. Consultants of project sections (works)

Section	Surname, initials and position consultant	Signature, date	
		Task issued	Task accepted
1	Borysenko A.S, PhD, senior lecturer	01.12.2025	14. 02.2026
2	Borysenko A.S, PhD, senior lecturer	16.02.2026	14.03.2026
3	Borysenko A.S, PhD, senior lecturer	16.03.2026	18.04.2026
4	A.V. Naboka, Ph.D., Senior Lecturer	20.04.2026	30.04.2026
5	V.V. Malysheva, Ph.D., Assoc. prof.	20.04.2026	30.04.2026

7. The date of issue of the task is December 1, 2025.

CALENDAR PLAN

№ s/p	Name of diploma project stages (work)	Term of project stages execution	Note
1	Clarification of the design task	December 2025	Done
2	Development of the staging part (relevance, problems, tasks, object, subject, research methods)	December 2025	Done
3	Approval of the plan for conducting scientific research (content of the qualification work)	February 2026	Done
4	Analysis of scientific literary sources on the topic of the master's qualification work (writing "Introduction", "Section 1" subsections 1.1, 1.2)	February 2026	Done
5	Analysis of prototypes (writing "Section 1" subsection 1.3, "Conclusions to Section 1"). Hypothetical model of an architectural project	February 2026	Done
6	Methodology and techniques of scientific research of an architectural object (writing "Section 2" subsections 2.1, 2.2)	February-March 2026	Done
7	Development and graphic design of analytical schemes (models) based on scientific research (writing "Section 2", subsection 2.3 and "Conclusions to Section 2")	March 2026	Done
8	Generalization of the conclusions of the conducted scientific research work and design of a graphic model of the design object (writing "Section 3" subsections 3.1, 3.2, 3.3, "Conclusions to Section 3")	March, April 2026	Done
9	Writing related sections ("Section 4" and "Section 5")	April 2026	Done
10	Preparation of the master's thesis	April 2026	Done
11	Defense of the master's thesis before the examination commission	May 2026	Done

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CONTENT

INTRODUCTION

The current stage of development of global architecture is characterized by active processes of transformation of the urban environment, associated with the globalization of the economy, the development of information technologies, changes in the structure of employment, and the growing role of business infrastructure in urban development. Under these conditions, the formation of modern office architecture becomes particularly important, as it ensures the creation of an efficient and comfortable environment for professional activities, business communication, and the development of entrepreneurship.

Office buildings and business centers today function not only as spaces for accommodating workplaces, but also as important elements of the architectural and spatial structure of the city. They shape new business districts, influence the development of transport and social infrastructure, and define the architectural image of modern megacities. In global practice, there is a tendency toward the creation of multifunctional office complexes that combine work, public, and recreational spaces, providing a high level of comfort for users.

At the same time, an important trend in contemporary architecture is the consideration of regional characteristics in building design. Despite global architectural processes, each region has its own natural and climatic conditions, cultural traditions, and urban planning features that influence the formation of the architectural environment. In this regard, the study of the interaction between modern architectural trends and traditional principles of architectural formation is highly relevant.

Of particular interest in this context is the experience of the countries of North Africa, especially Morocco. This country has a rich historical and cultural heritage shaped by the influence of various civilizations and cultures. At the same time, Morocco demonstrates high rates of economic development and urbanization, which contributes to the active formation of modern business infrastructure and the construction of new office centers.

These processes are most intensive in the country's large cities, such as Casablanca, Rabat, Tangier, and Marrakesh. It is in these cities that new business districts are being formed, and modern business centers and office complexes are being constructed in accordance with international architectural and urban planning standards. At the same time, architects strive to preserve national identity and integrate elements of traditional Moroccan architecture into modern architectural solutions.

The architectural tradition of Morocco has been formed over many centuries under the influence of Berber, Arab, Andalusian, and European cultures. As a result, a unique architectural system has emerged, characterized by the use of internal courtyards, arcaded galleries, geometric ornaments, decorative ceramics, and carved wood. These elements create a distinctive architectural aesthetic while also performing important functional tasks related to the adaptation of buildings to climatic conditions.

Traditional Moroccan buildings are distinguished by the efficient use of natural resources to create a comfortable microclimate. The use of internal courtyards, shaded galleries, thick walls, and natural ventilation systems makes it possible to reduce overheating and ensure optimal indoor conditions. Today, these principles of bioclimatic architecture are once again gaining relevance due to the need to improve energy efficiency and reduce the environmental impact of buildings.

In the modern architecture of office centers in Morocco, there is a reinterpretation of traditional architectural principles. Architects use modern structural technologies, advanced materials, and engineering systems, while integrating traditional architectural elements into facade solutions, planning structures, and spatial organization of buildings. This approach makes it possible to create architectural objects that meet modern functional requirements while preserving cultural identity.

Natural and climatic conditions have a significant influence on the formation of office architecture in Morocco. The country is characterized by a warm climate, high levels of solar radiation, and significant temperature fluctuations. In this regard, architectural solutions must ensure effective protection against overheating, rational use of natural lighting, and the organization of natural ventilation. In modern office

buildings, sun-shading screens, double facades, green terraces, atriums, and other elements of bioclimatic design are used.

The relevance of the research topic is determined by the need for a comprehensive analysis of regional features in the formation of modern office architecture. In the context of globalization, architectural solutions often acquire a universal character, which can lead to the loss of local identity. Therefore, it is important to study architectural approaches that combine modern technological capabilities with traditional principles of architectural formation.

The aim of the **master's thesis** is to identify and analyze the regional features of the architectural formation of modern office centers in Morocco, as well as to determine the principles of their design, taking into account natural and climatic, cultural, and urban planning factors.

To achieve this aim, the following **research tasks** must be addressed:

– to analyze current trends in the development of office architecture in global practice;

– to study the historical and cultural features of the formation of Moroccan architecture;

– to determine the natural and climatic and urban planning factors influencing the architectural formation of office centers;

– to analyze modern office complexes in the cities of Morocco and around the world;

– to identify characteristic architectural, planning, and compositional solutions of office buildings;

– to formulate principles for the design of modern office centers taking into account regional specificity.

The **object of the research** is a modern office center in the city of Marrakesh, Morocco.

The **subject of the research** is the regional features of the architectural and spatial formation of modern office centers.

The **theoretical basis** of the research consists of scientific works on architectural theory, urban planning, and the design of public buildings, as well as studies devoted to the architecture of North African countries. The methodological basis of the work includes the analysis of scientific sources, the historical and architectural method, comparative analysis of architectural objects, graphical and analytical methods for studying planning and compositional solutions, as well as a systemic approach to the analysis of the architectural environment.

The **scientific novelty** of the research lies in the comprehensive analysis of regional features of the architectural formation of modern office centers in Morocco, taking into account natural and climatic, cultural, and urban planning factors. The work systematizes the factors influencing the architectural formation of office buildings, identifies characteristic architectural, planning, and compositional features of modern office complexes, and analyzes the possibilities of integrating traditional architectural elements into contemporary office architecture.

The **practical significance** of the research lies in the possibility of using the obtained results in the practice of architectural design of modern office buildings and business centers. The principles of office complex formation generalized in the work can be used by architects and urban planners in the development of new projects, the formation of business districts, and the creation of energy-efficient public buildings. The results obtained can also be applied in the educational process of architectural specialties, as well as in further scientific research in the field of modern architecture.

Thus, the study of regional features of the architectural formation of modern office centers in Morocco contributes to a deeper understanding of the interaction between traditional architectural principles and contemporary trends in architectural development.

SECTION 1. THEORETICAL AND PRACTICAL EXPERIENCE OF FORMING MODERN OFFICE CENTERS

1.1. Clarification of Terms and Concepts of the Design Object

In the process of studying the architectural formation of modern office centers, a clear definition of the main terms and concepts used in scientific and design practice is of great importance. Clarification of the conceptual framework makes it possible to more fully reveal the specifics of the research topic and ensure the correct interpretation of key aspects of architectural design. This is especially relevant for a topic related to the regional features of the formation of modern office architecture in Morocco.

One of the main concepts of the study is the **office center**. An office center is understood as a multifunctional public building or a complex of buildings intended for the placement of administrative, managerial, business, and commercial organizations. Such facilities may include office workspaces, conference halls, areas for business meetings, service and public spaces, as well as auxiliary infrastructure necessary for the effective functioning of enterprises and institutions. Modern office centers often combine various functions – business, commercial, public, and recreational – which makes them important elements of urban infrastructure.

In modern architectural practice, the concept of a **business center** is also widely used. This term is mainly applied to denote large office complexes that concentrate offices of various companies, banking institutions, consulting firms, and other organizations. Business centers are usually characterized by a high level of engineering equipment, modern planning solutions, developed service infrastructure, and convenient transport connections.

An important concept in the context of this study is the **architectural formation of a building**. This term refers to the process of creating the architectural image of a building or a complex of buildings, which includes defining the volumetric-spatial composition, functional planning structure, structural solutions, materials, and artistic means of expression. The architectural formation of buildings depends on many

factors, among which natural and climatic conditions, socio-economic needs, cultural traditions, and urban planning context play an important role.

One of the key concepts of the research topic is the **regional features of architecture**. This term refers to specific characteristics of the architectural environment that are formed under the influence of natural, cultural, historical, and socio-economic conditions of a particular region. Regional features may be manifested in the use of characteristic building materials, types of structures, planning solutions, decorative elements, and principles of spatial organization.

In the case of Morocco, regional architectural features are largely associated with the combination of traditional architectural principles and modern design technologies. The architectural heritage of the country has been shaped under the influence of Berber, Arab, and Andalusian cultures, which is reflected in characteristic architectural forms, decorative ornaments, and principles of organizing the internal space of buildings.

An important element of traditional Moroccan architecture is the internal **courtyard** (riad) – a space around which the planning structure of residential and public buildings is organized. Internal courtyards provide natural ventilation, create a favorable microclimate, and at the same time perform compositional and aesthetic functions. In modern architectural projects of office buildings, this principle is often transformed into the form of internal atriums or open recreational spaces.

Another important concept is **bioclimatic architecture**. This term refers to an approach to building design that takes into account natural climatic conditions in order to create a comfortable indoor microclimate and reduce energy consumption. Bioclimatic architecture involves the use of natural ventilation, rational orientation of buildings relative to the sun, the application of sun-shading elements, landscaping, and other means of adapting buildings to the environment.

Modern office centers are also characterized by the concept of the **functional planning structure of a building**. It defines the organization of the internal space of the building, the mutual arrangement of various functional zones and premises. In

modern office buildings, flexible planning solutions are widely used, allowing easy transformation of internal space depending on user needs.

Another important concept is the **volumetric-spatial composition of a building**. It characterizes the interaction of the main volumes of the building, their proportions, scale, rhythm, and relationship with the surrounding urban environment. The volumetric-spatial composition of modern office centers is often formed taking into account the urban planning situation, building height, and panoramic views.

The concept of **urban planning context** is also important, as it refers to the set of factors that determine the interaction of a building with the surrounding urban environment. These factors include the structure of development, transport infrastructure, natural landscape, historical heritage, and functional purpose of the territory. For office centers, their location within business districts of the city is particularly important, as it ensures convenient access to transport and public communications.

In the process of forming modern office centers, the concept of **sustainable development in architecture** also plays an important role. It involves the creation of buildings that ensure rational use of natural resources, minimize negative environmental impact, and provide comfortable conditions for users. In modern office buildings, the principles of sustainable development are implemented through the use of energy-efficient technologies, environmentally friendly materials, and engineering system management.

Thus, the clarification of the main terms and concepts related to the architectural formation of modern office centers allows for a deeper understanding of the specifics of the research object and creates a theoretical basis for further analysis of regional features of office architecture. Understanding these concepts is essential for a comprehensive study of the architectural environment and for developing effective approaches to the design of modern office buildings.

1.2. Theoretical Experience in the Formation of Modern Office Centers

The problem of the humanization of urban space has a long-standing theoretical foundation in architectural and urban studies. Scholars from different countries interpret a humanized environment as one that is oriented toward people, creates conditions of comfort and safety, and promotes social interaction and aesthetic harmony. Special attention in this context is given to the study of the organization of business centers, where administrative, financial, and commercial functions are concentrated, since the quality of space here directly affects the efficiency of a large number of people.

The book "Tower and Office: From Modernist Theory to Contemporary Practice" by Iñaki Ábalos and Juan Herreros is devoted to the study of the evolution of office buildings and high-rise towers in the context of architectural theory and practice of the 20th – 21st centuries. The focus is not simply on the form of the skyscraper, but on its role as a reflection of the cultural, economic, and technological processes of its time [1].

The authors begin with an analysis of the modernist tradition, drawing on the ideas of architects such as Le Corbusier and Ludwig Mies van der Rohe. In this context, the office building appears as a rationally organized "machine for work," where the principles of standardization, functionalism, and technical efficiency dominate. Considerable attention is given to office typology: planning solutions (from cellular offices to open spaces), façade technologies (in particular glass curtain walls), and engineering systems that determine the functioning of the building. Thus, the office is viewed as a complex system that combines architecture, technology, and the organization of labor.

At the same time, the authors emphasize the crisis of the modernist paradigm at the end of the 20th century. Unified glass towers lose their individuality, become energy-intensive, and are increasingly criticized for their anonymity and detachment from the urban context. In response, new approaches to office building design emerge, oriented toward spatial flexibility, environmental sustainability, and active interaction with the environment and users.

Methodologically, the book combines theoretical analysis with the examination of specific architectural examples, which allows the authors not only to trace the historical development of office building typology but also to formulate broader conclusions. In particular, they show that office architecture is a mirror of economic and social changes, and that contemporary trends indicate the need for more adaptive, diverse, and context-sensitive solutions.

In conclusion, the work of Ábalos and Herreros is an important contribution to understanding the evolution of skyscrapers and office buildings, as well as the transition from modernist ideals to more complex and multidimensional approaches in contemporary architecture.

The article “Office Buildings Throughout Centuries vs now, in the 21st Century – Developing Innovative Space Concepts” by P. Milošević, V. Milošević, and G. Milošević is devoted to the theoretical interpretation of the evolution of office buildings from early historical forms to modern office centers of the 21st century. The work traces the gradual transformation of the functional, spatial, and social significance of the office under the influence of economic, technological, and cultural changes [2].

The authors emphasize that early office spaces were formed as administrative premises with a clear hierarchy and a strictly regulated organization of work. During the period of industrialization, office buildings gained greater scale, standardization, and functional rationality, reflecting the principles of modernism: open plans, repetitive structures, and an orientation toward efficiency. In the 20th century, the office tower emerged as a symbol of corporate power and urban development, where architecture functioned not only as a functional but also as a representative tool.

In the 21st century, according to the authors, a qualitative shift occurs in the understanding of the office environment. The office ceases to be merely a place of work and transforms into a multifunctional space that combines communication, creativity, and social interaction. Digitalization plays a significant role in this process, changing the nature of work and reducing dependence on a physical workplace. As a

result, new types of offices emerge: flexible offices, open space layouts, coworking environments, as well as hybrid models that combine physical and virtual space.

Special attention is paid to environmental and energy-efficiency aspects. Modern office centers are designed in accordance with the principles of sustainable development: the use of natural lighting, energy-saving technologies, environmentally friendly materials, and the creation of a healthy microclimate for users. Thus, office architecture becomes a tool not only of economic efficiency but also of improving the quality of life of employees.

From a theoretical perspective, the authors emphasize the interdisciplinary nature of the formation of modern office spaces, where architecture, urban studies, sociology, and management intersect. The office is viewed as a dynamic system that responds to changes in society, technology, and forms of labor organization. The conclusion of the work is that the future of office buildings is associated with increasing flexibility, technological integration, and a human-centered approach, defining a new paradigm for the design of office centers in the 21st century.

The scientific article “Office concepts: A scoping review” by A. Gjerland, E. Søiland, and F. Thuen summarizes contemporary approaches to the organization of office spaces, considering them as dynamic environments that reflect changes in work practices, technologies, and organizational culture. The focus of the study is the analysis of various office concepts that have emerged in response to the need to increase productivity, comfort, and employee well-being [3].

The article describes the evolution from traditional cellular offices to more open and flexible models. One of the key concepts is the open-plan office, which minimizes physical barriers and stimulates communication between employees, but at the same time may create problems with noise and concentration. In response to these shortcomings, combined models have emerged, such as activity-based working (ABW), where space is divided into different zones depending on the type of activity – individual work, teamwork, or informal communication.

Particular attention is given to flexible offices, which allow the configuration of the working environment to be changed according to organizational needs, as well as

to the concept of hot-desking, where employees do not have fixed workplaces. These approaches are closely related to the development of digital technologies and mobile work, which reduce dependence on a fixed workplace.

An important aspect of modern office concepts is the human-centered approach: the impact of space on physical and psychological health, stress levels, job satisfaction, and performance is studied. In this context, the importance of acoustic comfort, air quality, lighting, and ergonomics is emphasized. The role of biophilic design – the integration of natural elements into the working environment – is also increasing.

Overall, the article shows that the modern office is no longer just a place for performing tasks but is transformed into a multifunctional space that supports different work styles, promotes interaction, and takes into account user well-being.

Modern scientific approaches, formed within the framework of the concept of sustainable development, consider business and office centers as complex, multi-level urban systems that combine environmental, social, and economic components. In particular, in the studies of Peter Calthorpe presented in “Urbanism in the Age of Climate Change”, the need for an integrated approach to the formation of the urban environment is emphasized [4]. In this context, office centers are considered not only as places of concentration of business activity but also as important elements of the urban fabric that affect environmental balance, population mobility, and quality of life.

Special attention is paid to the consideration of natural and climatic conditions in the design and placement of business centers. This includes building orientation, the use of natural lighting and ventilation, reduction of thermal loads, and adaptation to local climatic challenges. At the same time, transport accessibility is an important aspect: modern office centers must be integrated into a multifunctional transport network that includes public transport, pedestrian, and cycling infrastructure. Such an approach helps reduce dependence on automobiles and, consequently, greenhouse gas emissions.

Energy efficiency of buildings is also of great importance and is achieved through the implementation of innovative technologies, the use of renewable energy sources, and environmentally friendly materials. In this context, green infrastructure – including landscaping, green roofs and façades, and recreational spaces – performs not only an aesthetic function but also contributes to improving the microclimate, reducing the urban heat island effect, and increasing the overall environmental sustainability of the city.

Thus, modern approaches to the formation of office centers are based on the idea of harmoniously combining humanistic principles with environmental requirements. Business spaces are transforming into open, flexible, and integrated environments that meet human needs while ensuring the sustainable development of urban areas in the long term.

The scientific article “Comparative study of factors affecting the generativity of office spaces”, prepared by Kerstin Sailer and co-authors, examines the problem of the influence of the spatial organization of the office environment on social processes within organizations [5]. The central concept of the study is “generativity” – the ability of office space to stimulate the emergence of new forms of interaction, knowledge exchange, and collaborative creative activity among employees.

The authors approach the analysis of office spaces from an interdisciplinary perspective, combining methods of architectural analysis, spatial syntax, and organizational sociology. The study emphasizes that office efficiency is not limited to functionality or aesthetics but is largely determined by how its spatial configuration promotes informal contacts, spontaneous meetings, and collective discussion of ideas.

The research shows that spatial configuration – particularly the level of openness, interconnection between zones, accessibility of shared spaces, and location of communication nodes – directly affects the intensity of social interaction. For example, open or semi-open layouts, as well as the presence of central spaces (atriums, lounges, kitchens), increase the likelihood of spontaneous interactions, which in turn stimulates information exchange and innovation. At the same time, excessive

openness may reduce concentration, making it important to maintain a balance between collective and individual spaces.

Special attention is given to organizational factors, emphasizing that space alone does not guarantee generativity. Its effectiveness depends on company culture, employee behavior patterns, and management practices. Thus, generativity is formed at the intersection of the physical environment and the social processes occurring within the organization.

In conclusion, the study demonstrates that modern office design should focus not only on ergonomics and economic efficiency but also on creating conditions for communication, collaboration, and innovation. The office is viewed as an active tool for shaping organizational dynamics, capable of supporting the development of knowledge and the creative potential of a team.

The book “A Handbook of Management Theories and Models for Office Environments and Services”, edited by Vitalija Danivska and Rianne Appel-Meulenbroek, is a comprehensive theoretical study devoted to the management of office environments as a complex interdisciplinary phenomenon. The work emphasizes that modern office spaces can no longer be considered solely from the perspective of architecture or functional planning, since their effectiveness is determined by the interaction of spatial, organizational, social, and economic factors [6].

The authors note that research on the work environment has historically developed fragmentarily across different disciplines – such as facility management, corporate real estate management, and organizational theory – which has led to a gap between scientific knowledge and office management practice. In this regard, the book aims to integrate key theoretical approaches into a unified system that allows for a more holistic understanding of the processes of formation and management of office spaces.

The publication presents a wide range of management theories and models applied to office environments. These include systems thinking theory, which considers the office as a dynamic system requiring comprehensive decision-making;

strategic management theories that emphasize the need to align office space with organizational goals; and concepts of socio-technical transformation that take into account the influence of technology and changes in work forms on the organization of the work environment. Considerable attention is also paid to user-centered approaches, which orient the design and management of offices toward user needs, comfort, productivity, and experience of interaction with space.

A special emphasis is placed on the strategic role of the office environment as an organizational resource. The book highlights that office real estate and workspace can serve as tools for improving operational efficiency, supporting corporate culture, and stimulating innovation. Accordingly, office management is viewed not merely as an operational function but as an important element of overall business strategy that should create added value for various stakeholder groups.

From a theoretical perspective, the authors interpret the management of office environments as a "wicked problem," characterized by multiple stakeholders, diverse approaches, and the absence of universal solutions. This necessitates interdisciplinary integration of knowledge and the development of a generalized theoretical model that takes into account both physical spatial parameters and social processes, organizational culture, and technological changes.

Thus, the book forms a new paradigm for understanding the office environment as an integrated system in which management decisions, spatial planning, and behavioral aspects interact. It lays the foundation for the further development of a unified interdisciplinary theory of workplace management, which is especially relevant in the context of transformations in labor, digitalization, and the spread of hybrid work formats.

The biophilic approach to the formation of the architectural environment, which involves the inclusion of natural components in spatial organization, has received extensive theoretical justification in the works of Edward O. Wilson "Biophilia" [7] and Stephen R. Kellert "The Practice of Biophilic Design" [8]. Although these studies are not limited exclusively to business or office centers, the principles they establish are активно applied in modern business space design. In particular, this includes the

use of natural lighting, the introduction of greenery in interiors and surrounding areas, and the integration of water and other natural elements into the environmental structure.

In the context of business zones, biophilic design is considered an effective tool for improving spatial quality and creating a comfortable environment for users. Its application contributes not only to the aesthetic enrichment of architecture but also to the formation of more favorable conditions for work and rest. Numerous studies show that the presence of natural components in the work environment positively affects psychological well-being, reduces stress levels, increases concentration, and improves overall productivity.

Moreover, the biophilic approach is increasingly considered within the broader context of sustainable development, as it promotes a more harmonious relationship between the built and natural environment. In modern office centers, this is manifested in the creation of "green" spaces, internal courtyards, open terraces, and recreational zones that not only improve the microclimate but also support the physical and emotional well-being of users. Thus, the integration of biophilic principles becomes an important direction in the design of business centers oriented toward people and their interaction with the environment.

Modern studies focused on Morocco make it possible to better understand the regional features of the architectural formation of office centers, which develop under the influence of specific climatic, cultural, and socio-economic conditions. In particular, in the work of D. E. E. Alaoui "Urban Landscape Design in Morocco: Climate, Culture, and Policy Impacts", it is emphasized that architectural and planning solutions in Moroccan cities largely depend on the need to adapt to a hot and arid climate [9]. In the context of modern office centers, this is manifested in the use of passive cooling strategies, including the creation of shaded spaces, internal courtyards, galleries, and passages that provide comfortable conditions even during periods of high temperatures.

An important role is also played by the integration of natural elements into the structure of business complexes. The use of water features, landscaping, and

traditional landscape techniques contributes to the formation of a favorable microclimate and improves the quality of the working environment. At the same time, the architecture of office centers in Morocco often combines modern technologies with local traditions, which is reflected in the use of regional materials, ornamental motifs, and typological solutions characteristic of historical development.

An additional aspect of the formation of modern office spaces is related to the consideration of user social behavior. The article “Integrating Behavioral Science into Urban Planning” emphasizes the importance of integrating behavioral sciences into the planning process [10]. This means that office centers should be designed not only based on functional requirements but also with a focus on social interaction, mobility, and user needs. In particular, the development of pedestrian infrastructure, the creation of open public spaces, and the involvement of local communities in the planning process contribute to the formation of a more comfortable and efficient business environment.

Thus, the regional features of the architectural formation of modern office centers in Morocco are determined by a combination of climatic adaptation, the use of natural elements, preservation of cultural identity, and the implementation of human-centered approaches. This ensures the creation of office spaces that correspond both to global development trends and to local conditions, forming a sustainable and comfortable urban environment.

1.3. Practical Experience in the Formation of a Humanized Environment of Modern Office Centers

After generalizing theoretical approaches to the formation of a human-centered urban environment, it is appropriate to turn to the practical experience of implementing these principles in modern office centers in different countries of the world. In international architectural and urban planning practice, business districts are increasingly considered not only as centers of economic activity, but as полноценные urban environments oriented toward comfort, safety, and social interaction of users. Thus, the effectiveness of modern office centers is determined not only by their

functional organization or technical characteristics, but also by their ability to form a humanized space that meets human needs.

In many cities around the world, new business districts are being implemented as multifunctional complexes, where office buildings are integrated with public spaces, cultural institutions, service facilities, and recreational areas. Such an approach contributes to the formation of an active urban environment throughout the day, reducing the monofunctionality of business areas. An important component is the organization of open and semi-open spaces – squares, boulevards, and internal courtyards—which stimulate social contacts and create conditions for informal communication.

A significant role in the formation of a humanized environment is played by the integration of natural elements into the structure of office centers. Landscaped areas, pedestrian alleys, green roofs, and terraces not only improve environmental indicators but also have a positive effect on the psycho-emotional state of users. In modern projects, these elements are considered an integral part of the architectural solution, contributing to the improvement of the quality of urban space and the creation of a favorable microclimate.

In addition, considerable attention is paid to the implementation of climate-adaptive and energy-efficient technologies. The use of sun-shading systems, natural ventilation, innovative façades, and renewable energy sources makes it possible to reduce the environmental impact of buildings and ensure comfortable conditions for occupancy. At the same time, the development of pedestrian infrastructure, the creation of a barrier-free environment, and accessible public spaces strengthen the social component of office centers.

Thus, the practical experience of forming modern office centers around the world demonstrates a transition from narrowly functional business zones to comprehensive, humanized environments. In such spaces, architectural, environmental, and social principles are combined, ensuring not only functional efficiency but also a high level of comfort, promoting communication, and improving the overall quality of urban life.

1.3.1. Office Complex The Edge (Amsterdam, Netherlands)

The office complex The Edge is located in the business district of Amsterdam, in the southwestern part of the city, near key transport nodes that provide easy access by public and private transport. The building was designed for Deloitte Netherlands and has become a landmark example of high-tech and environmentally oriented architecture. The authors of the project are the architectural firm PLP Architecture in close cooperation with the engineering company Arup, which was responsible for engineering systems and energy-efficient solutions [11].

The office complex The Edge is an outstanding example of contemporary ecological architecture, where architectural form, structural solutions, and engineering systems work in close interaction to create a human-centered environment. The building is designed as a spatially open complex with a central multi-storey atrium that functions as a "social core." The atrium provides visual and physical connections between floors, allows natural daylight to penetrate deep into the building, and creates a comfortable atmosphere for collaborative work and informal interaction among employees (Fig. 1.1.).

Figure 1.1. General view of the The Edge

The volumetric form of the building resembles a wedge, which allows for maximum use of natural lighting and the reduction of excessive solar heat gain. The southern façade is open and fully glazed along the entire height of the floors, while the northern façade is more solid and functions as a thermal insulating buffer. The use of high-performance glass in combination with automatic sun-shading elements

ensures an optimal level of daylight and protection from overheating throughout the day.

Structurally, the building is based on a monolithic reinforced concrete frame with a column grid, which provides flexibility in interior planning. This makes it possible to organize open-plan office spaces while minimizing the number of load-bearing partitions. The floor slabs are made of flat reinforced concrete slabs, and the roof of the atrium is designed as a transparent lightweight structure that facilitates the uniform penetration of natural light into the central part of the building (Fig. 1.2).

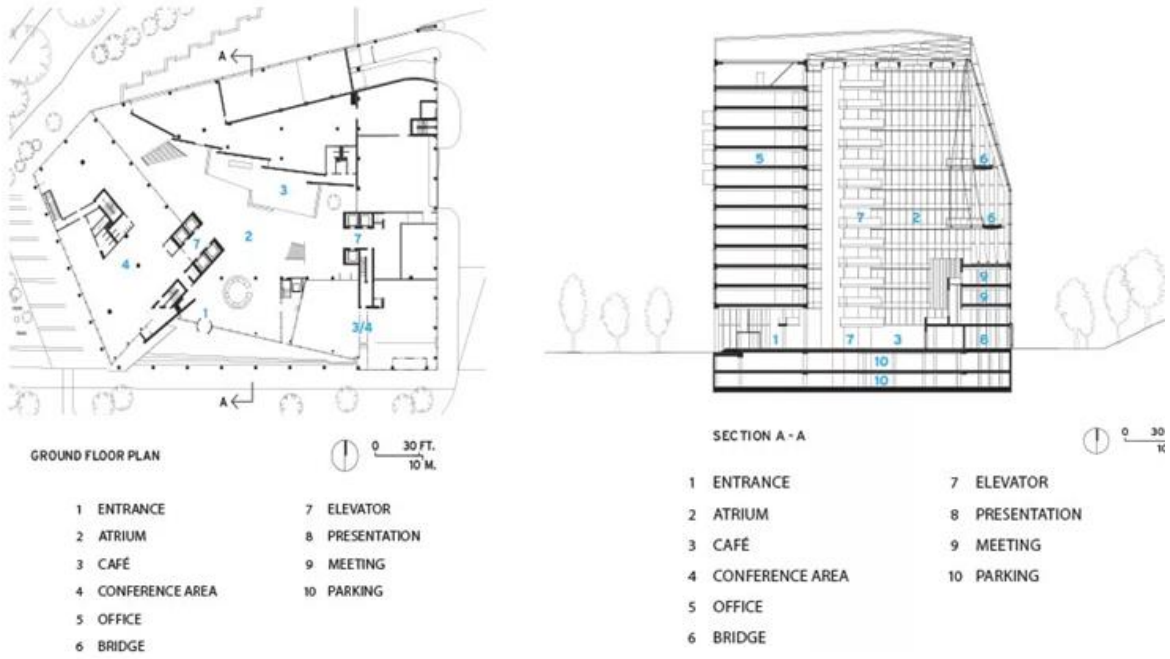

Figure 1.2. Plan and section of the The Edge

Special attention is given to the integration of energy-efficient and climate-adaptive solutions. Geothermal heat pumps are used, natural ventilation is provided through the atrium and façades, and solar panels are installed on the roof for electricity generation. As a result, the building consumes a minimal amount of external energy and reduces its carbon footprint.

A key element is also the application of “smart” technologies: a sensor system monitors temperature, lighting, workstation occupancy, and activity within the premises. This allows automatic regulation of the microclimate and lighting to ensure employee comfort, as well as optimization of resource use.

In the The Edge complex, architecture, structural systems, and engineering technologies are integrated to create a flexible, ecological, and comfortable environment. The building not only meets modern energy-efficiency standards but also creates conditions for increased productivity and social interaction among employees, demonstrating how contemporary architecture can combine technological innovation, sustainability, and the humanization of the working space.

1.3.2. Apple Park in Cupertino (California, USA)

The Apple Park office complex is located in the city of Cupertino, California, in the heart of the Silicon Valley technology region. The complex was designed by the architectural firm Foster + Partners in close collaboration with Apple's design and engineering teams, who actively participated in the development of the concept, planning, and spatial organization [12]. The aim of the project was to create not just an office campus, but a human-centered, ecological, and high-tech environment that combines work, recreation, and interaction with nature (Fig. 1.3).

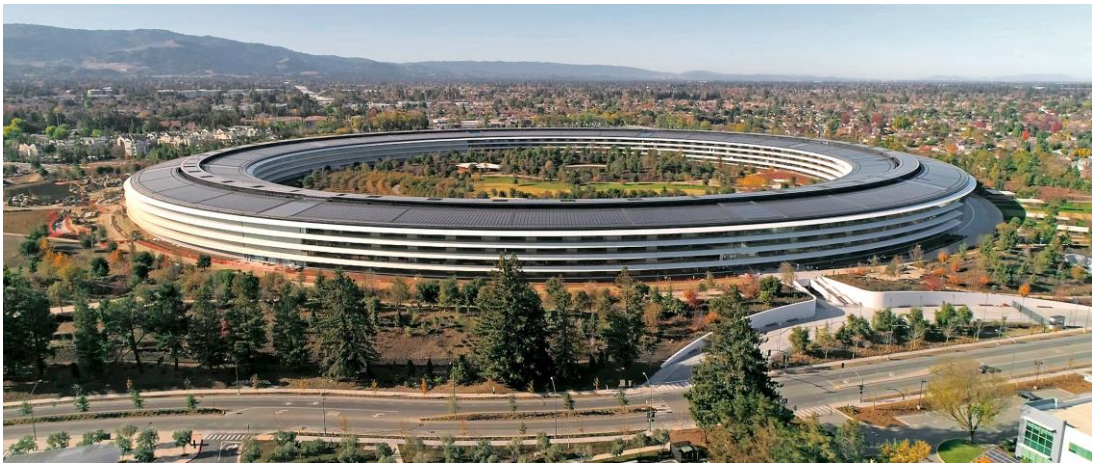

Figure 1.3. General view of the Apple Park

The architectural composition of the campus forms one of the largest enclosed office rings in the world, with a diameter of over 500 meters, symbolizing openness, integrity, and the interconnection of all functions. The central core of the building consists of an open atrium and internal courtyards that allow natural light to penetrate deep into the office spaces and ensure effective air circulation. Along the perimeter of the ring are flexible workspaces, meeting areas, laboratories, and coworking zones, which makes it possible to organize work according to the principle of "activity-based

working” with the ability to change the layout without major structural interventions (Fig. 1.4).

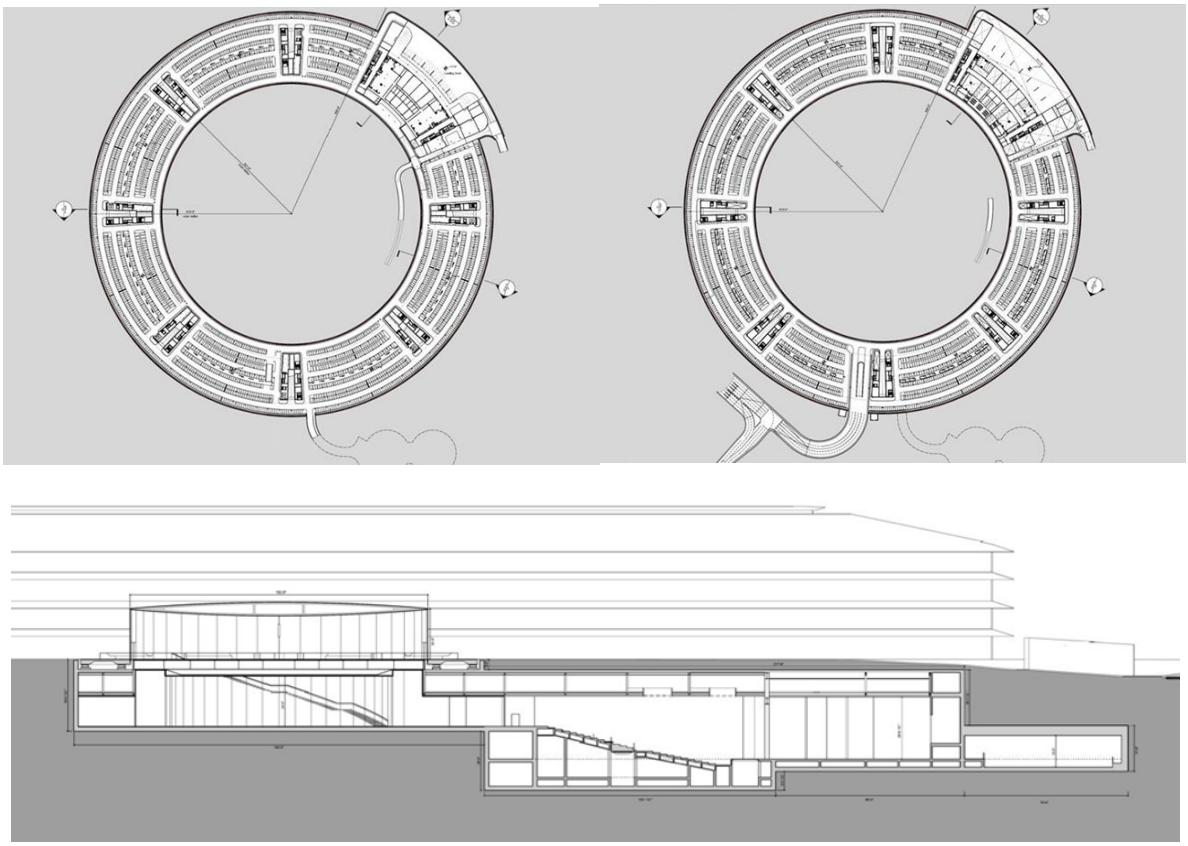

Figure 1.4. Plans 1 and 2 levels, section of the Apple Park

The structural system of Apple Park is based on a reinforced concrete frame with a regular grid of columns that support flat floor slabs and allow the creation of open office spaces without unnecessary load-bearing walls. To increase the flexibility of interior zones, lightweight partitions made of environmentally friendly materials are used. The façades are made of large-format, high-performance energy-efficient glass, which optimizes natural lighting and reduces thermal load. The southern façade is characterized by a highly transparent structure that allows maximum penetration of sunlight, while the northern façade is more solid and performs a thermal insulation function (Fig. 1.5).

The roof of the office ring is equipped with one of the largest solar panel systems in the world, generating approximately 17 megawatts of electricity, covering most of the campus’s energy needs. The natural ventilation system is organized through the central atrium and façade elements and is complemented by highly efficient heating and cooling systems. Geothermal heat pumps are used to regulate the temperature of

interior spaces, while an intelligent climate and lighting control system allows automatic maintenance of comfortable conditions depending on the time of day, the level of occupancy of spaces, and weather conditions.

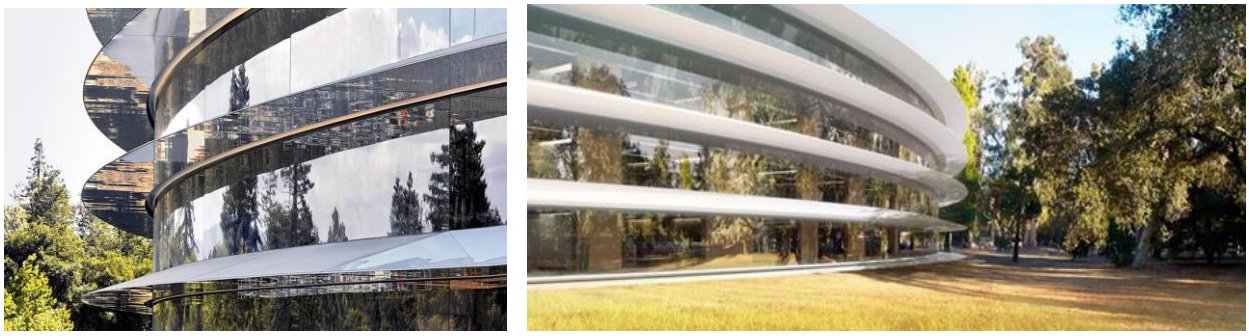

Figure 1.5. Facades of the Apple Park

Particular attention is given to landscape design: the campus territory covers more than 70 hectares and includes over 9,000 trees, open lawns, internal gardens, and recreation areas for employees. Pedestrian routes and bicycle paths ensure active mobility connections between different parts of the complex, while numerous internal and external public spaces stimulate social interaction and outdoor recreation.

Thus, Apple Park combines innovative architecture, well-considered structural solutions, and high-tech engineering systems. The complex is designed as an ecologically sustainable, flexible, and human-oriented environment that ensures comfort, productivity, and social interaction among employees, demonstrating how modern architecture can combine technological innovation with the humanization of the working environment.

1.3.3. Bloomberg European Headquarters Office Complex (London, England)

The Bloomberg European Headquarters office complex is located in the business heart of London, in the Bloomsbury district, in close proximity to transport hubs that provide convenient access by public and private transport. The project client was the international media company Bloomberg, while the architectural and engineering design was carried out by the Foster + Partners studio and the engineering company Arup. The project was aimed at creating an office environment that combines high standards of energy efficiency, environmental sustainability, and employee comfort, while also fitting harmoniously into the dense urban fabric of London [13].

The architectural concept of the building is based on an open-plan layout and the integration of natural lighting. The central element is a multi-storey atrium almost 60 meters high, which connects all levels of the building. The atrium provides visual connections between floors, allows daylight to penetrate into the interior spaces, and functions as a natural ventilation channel. The internal spaces are organized as open-plan office areas, meeting rooms, relaxation zones, and internal courtyards, creating a favorable atmosphere for social interaction and a flexible organization of the working process (Fig. 1.6).

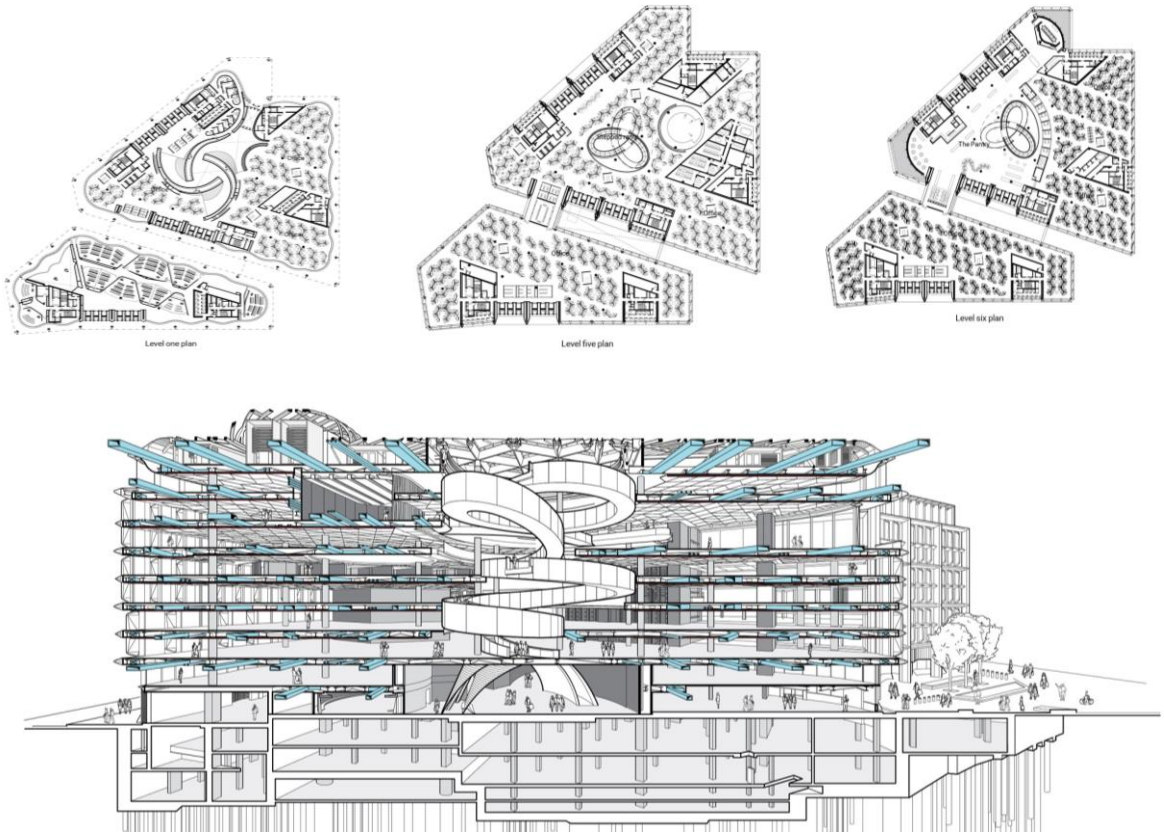

Figure 1.6. Plans 1 and 2 levels, section of the Bloomberg European Headquarters

The structural scheme of the building is based on a combined reinforced concrete and steel frame. The columns are arranged in a regular grid, which allows for large open spaces without load-bearing partitions. The floor slabs are made of monolithic reinforced concrete with a thickness of 30 – 35 cm, ensuring the necessary strength and enabling the organization of zones with different functional loads. The roof of the central atrium is designed as a lightweight transparent structure made of multi-layer

glass panels, which allows daylight to penetrate deep into the building and minimizes the need for artificial lighting.

The façade system consists of energy-efficient high-transparency glass with a low heat transfer coefficient, combined with automated external blinds and sun-shading elements that regulate lighting conditions and thermal insulation depending on the season and solar exposure. The southern façade has a large proportion of transparent surfaces to maximize the use of daylight, while the northern façade is more solid, ensuring thermal stability and reducing heat losses (Fig. 1.7).

Figure 1.7. General view of the Bloomberg European Headquarters

The building's engineering systems are integrated with the architecture: ventilation is hybrid, combining natural air circulation through the atrium with mechanical air conditioning. Heating and cooling systems operate on heat pumps and energy recovery. Solar panels are installed on the roof, covering part of the building's electricity demand, while the use of energy-efficient equipment reduces overall energy consumption by 30 to 40 percent compared to standard office buildings.

The internal layout provides flexible zoning of floors: open workspaces for team collaboration, enclosed meeting rooms, laboratories, and creative thinking areas. The spaces are organized in accordance with the principles of biophilic design: green internal courtyards, vertical green panels, and open terraces create a favorable microclimate and enhance the emotional comfort of employees. Pedestrian routes and open public squares encourage social interaction and facilitate movement throughout the campus.

Thus, Bloomberg European Headquarters is an example of the combination of modern architecture, well-considered structural solutions, and highly efficient engineering systems. The building demonstrates how dense urban development can be harmoniously integrated with energy-efficient technologies and create a human-oriented environment that combines comfort, productivity, and environmental sustainability.

1.3.4. Torre Reforma Office Skyscraper (Mexico City, Mexico)

The Torre Reforma office skyscraper is located in the central part of Mexico City, on Paseo de la Reforma Avenue –m one of the city's main transport and business arteries. The building is integrated into a dense urban fabric while also taking into account the region's complex seismic conditions. The author of the project is Mexican architect Benjamin Romano and the architectural studio LBR&A Arquitectos, who aimed to create not only a modern office center but also a structurally reliable building adapted to local natural challenges [14].

The architectural solution of the building is based on a pronounced triangular geometry that forms a dynamic silhouette in the urban space. The volume consists of two massive inclined walls and a transparent façade opening toward the city. This composition not only creates a recognizable image but also serves a functional purpose: the solid concrete surfaces act as a protective screen against solar radiation and simultaneously function as key load-bearing structural elements. At the same time, the glazed façade provides natural lighting of the interior spaces and establishes a visual connection with the external environment (Fig. 1.8).

The structural scheme of Torre Reforma is one of its main distinctive features. The building is constructed using massive monolithic reinforced concrete walls that form a spatial system capable of effectively resisting seismic loads. The central part includes a stiffness core, which together with the external walls ensures the stability of the structure during earthquakes. Thanks to this approach, it was possible to minimize the use of internal columns, which allowed the organization of open and

flexible office spaces. The floor slabs are made of monolithic reinforced concrete, and their design ensures sufficient rigidity and an even distribution of loads (Fig. 1.9).

Figure 1.8. General view of the Torre Reforma

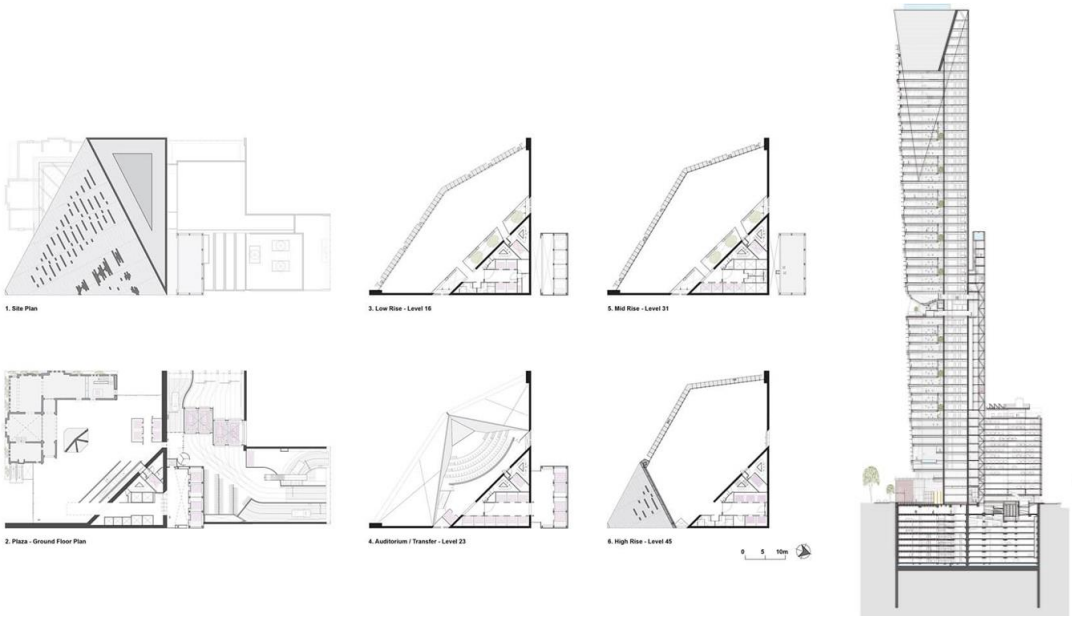

Figure 1.9. Plans 1 and 2 levels, section of the Torre Reforma

An important element is the adaptation of the building to the historical context of the site: at the lower levels, a restored historic mansion has been integrated, preserved as part of the cultural heritage. This combination of old and new emphasizes the connection between contemporary architecture and the historical environment of the city.

Engineering and environmental solutions also play a significant role in the project. The building uses natural ventilation systems, efficient solar shading, and

rainwater collection systems, which reduce resource consumption. The rational orientation of the façades and the use of massive structural elements contribute to the stabilization of the internal temperature regime within the premises.

Thus, Torre Reforma is an example of the combination of expressive architectural form, innovative structural solutions, and adaptation to complex natural conditions. The building demonstrates how a modern office center can meet the requirements of safety, energy efficiency, and flexibility, while simultaneously forming a recognizable image within the urban environment.

1.3.5. BCP Tower Office Skyscraper (Casablanca, Morocco)

The BCP Tower office skyscraper is located in the city of Casablanca, one of the main economic and financial centers of Morocco, within the modern business district Casablanca Finance City. The building is part of a large-scale urban development aimed at forming an international business hub that meets contemporary requirements for office architecture. The client is the banking group Banque Centrale Populaire, and the architectural concept was developed by the international architectural firm Morphosis under the leadership of Thom Mayne [15].

The architectural solution of the building is based on the creation of a dynamic vertical volume distinguished by plastic expressiveness and a complex geometry of façades. The tower's form was shaped taking into account the climatic characteristics of the region, in particular intense solar radiation and high temperatures. The façade has a multilayer structure with the use of sun-shading elements that reduce overheating while ensuring an adequate level of natural lighting. In this way, a balance is achieved between the transparency of the building and its energy efficiency (Fig. 1.10).

The structural system of the building is represented by a monolithic reinforced concrete frame with a stiffness core, which ensures the spatial stability of the high-rise structure. Vertical loads are transferred through a system of columns and core walls, while horizontal forces (in particular wind loads) are resisted by the rigid central core and the optimized geometry of the volume. The floor slabs are made in the form

of flat reinforced concrete plates, which allows the formation of open office spaces with the possibility of flexible planning.

Figure 1.10. General view of the BCP Tower

Special attention is paid to the integration of engineering systems into the structure of the building. Modern ventilation and air-conditioning systems are used, as well as energy-efficient technologies aimed at reducing resource consumption. The façade system acts as a climatic filter, regulating thermal and light flows, which is especially important in the conditions of the Moroccan climate.

The internal spatial organization is focused on creating a comfortable working environment. The layout provides open office areas, communication spaces, conference rooms, and recreational zones. Significant attention is given to visual connections with the external environment, achieved through panoramic glazing and the rational orientation of the building (Fig. 1.11).

Thus, BCP Tower is an example of modern high-rise office architecture in which innovative structural solutions are combined with adaptation to climatic conditions and an orientation toward creating a comfortable and efficient working environment. The building reflects the trend of integrating global architectural approaches with local characteristics, forming a new image of business centers in Morocco.

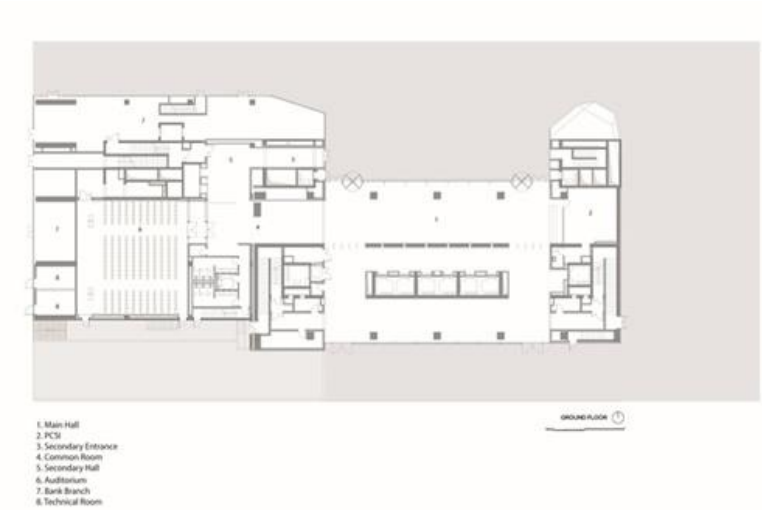

Figure 1.11. Plan of the BCP Tower

1.3.6. Casablanca Finance City Tower Office Skyscraper (Casablanca, Morocco)

The Casablanca Finance City Tower office skyscraper is located in the city of Casablanca, the main financial and economic center of Morocco, within the modern business district Casablanca Finance City [16]. The building is a key element in the formation of a new international business cluster that integrates global standards of office architecture with local climatic and cultural conditions. The project was developed by the architectural firm Morphosis under the leadership of Thom Mayne, known for his experimental approaches to form-making and the use of innovative structural solutions.

The architectural composition of the tower is characterized by a dynamic, asymmetrical form that changes along its height and creates a distinctive silhouette in the urban space. The building volume was designed taking into account intense solar radiation and the climatic conditions of the region: the façades feature a complex geometry with variable depth, which allows control of solar penetration and reduces overheating of interior spaces. A significant part of the façade envelope is made of glass with high energy-efficient properties in combination with sun-shading elements that act as a climatic screen (Fig. 1.12).

The structural system of the building is based on a monolithic reinforced concrete frame with a central stiffness core, which ensures the stability of the high-rise structure against wind loads. The vertical load-bearing elements are combined with a system of

columns and rigid floor slabs, which allows the creation of open office spaces without a significant number of internal load-bearing partitions. The floor slabs are made in the form of flat reinforced concrete plates that evenly distribute loads and provide flexibility in planning. This approach makes it possible to adapt the interior space according to the changing needs of users.

Figure 1.12. General view of the Casablanca Finance City Tower

Engineering solutions are integrated into the architectural structure of the building and are aimed at improving energy efficiency. Modern air-conditioning and ventilation systems are used, as well as technologies that optimize energy consumption and maintain a comfortable microclimate. The façade system plays an important role in regulating heat flows, reducing the load on engineering systems in hot climate conditions.

The interior space is organized according to an open-plan principle, including office zones, communication spaces, conference rooms, and recreational areas. Thanks to panoramic glazing, visual connections with the city are provided, which enhances the quality of the working environment (Fig. 1.13).

Thus, Casablanca Finance City Tower is an example of modern high-rise office architecture in which expressive form, innovative structural solutions, and adaptation to climatic conditions are combined. The building demonstrates a synthesis of global architectural trends and regional characteristics, forming a new image of business centers in Morocco.

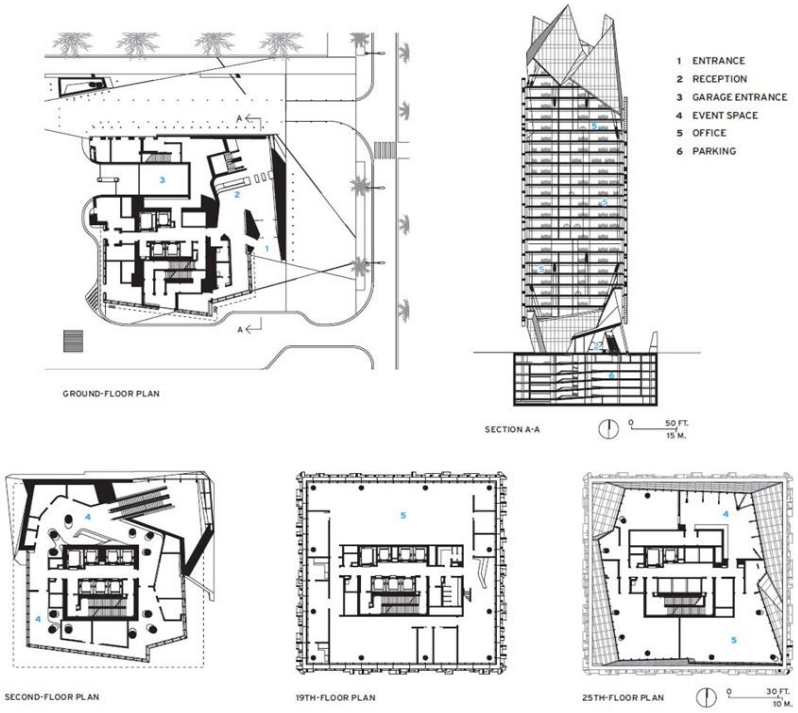

Figure 1.13. Plan, section of the Casablanca Finance City Tower

1.3.7. Maroc Telecom HQ Administrative Building (Rabat, Morocco)

The Maroc Telecom HQ administrative building is located in the capital of Morocco, the city of Rabat, in the modern business district Hay Ryad, which is actively developing as a center for governmental institutions and corporate offices. The complex serves as the headquarters of the national telecommunications operator Maroc Telecom and represents an important element in the formation of a modern administrative and business environment in the city [17]. The architectural solution of the building was developed taking into account a combination of contemporary international approaches with local climatic and cultural characteristics of the region; the project was implemented with the participation of Moroccan and international architects focused on creating a functional and representative corporate space.

The volumetric-spatial composition of the complex is based on a combination of several interconnected mid-rise blocks that form internal courtyard spaces. This structure ensures sufficient insolation, natural ventilation, and creates semi-enclosed green areas for employee recreation. The façades of the building are designed with consideration of climatic conditions: a combination of transparent elements and more solid surfaces is used, incorporating sun-shading solutions such as horizontal louvers,

canopies, and recessed window openings, which reduce overheating while ensuring an adequate level of natural lighting (Fig. 1.14).

Figure 1.14. General view of the Maroc Telecom HQ

The structural system of the building is represented by a reinforced concrete frame with a regular grid of columns and a rigid core, which ensures spatial stability and resistance to both vertical and horizontal loads. The floor slabs are designed as monolithic or precast-monolithic systems, which allows the organization of open office spaces with the possibility of further transformation. This approach contributes to the flexibility of planning solutions and the adaptability of the building to changing functional requirements.

The internal layout provides a combination of open office areas, private offices, conference rooms, and spaces for informal communication. The organization of space is oriented toward effective interaction among employees and the creation of comfortable working conditions (Fig. 1.15).

Engineering systems are integrated into the overall architectural concept and are aimed at ensuring energy efficiency and a comfortable microclimate. Modern air-conditioning and ventilation systems are used, as well as solutions that take into account natural climatic resources – particularly the possibility of natural ventilation through internal courtyards. The greening of the territory and interior spaces additionally contributes to the improvement of the microclimate and creates a favorable working environment.

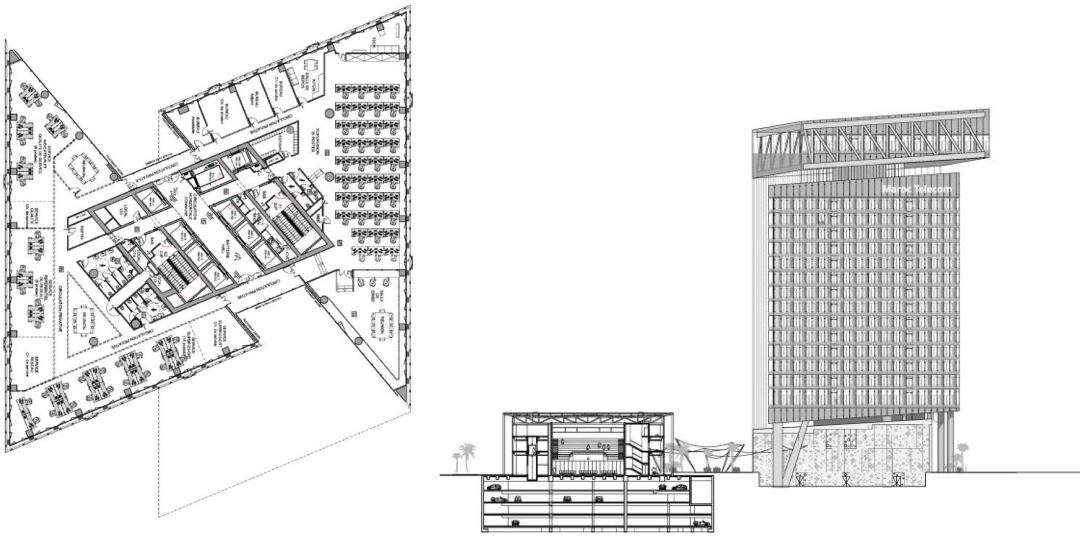

Figure 1.15. Plan, section of the Maroc Telecom HQ

Thus, Maroc Telecom HQ demonstrates an example of modern office architecture in Morocco, where structural rationality is combined with climate-adapted solutions and a human-oriented approach, forming a balanced and functional working environment.

1.4. Contemporary Trends and Principles of Architectural Design of Modern Office Centers Considering the Latest Safety Standards

At the current stage, the development of office center architecture is undergoing significant changes under the influence of technological progress, globalization processes, and the transformation of work organization forms. Office buildings are no longer limited to the function of a workspace – they act as multi-component environments that combine social, engineering, and ecological aspects.

1) Flexibility and Transformability of Space

One of the leading characteristics of contemporary office design is ensuring the ability to quickly adapt the internal environment to the changing needs of users. Spatial solutions are oriented toward universality and variability of use.

The application of modular structures, movable partitions, and transformable furniture makes it possible to create spaces that can be easily reconfigured for different work formats – from individual activity to collective interaction. For Morocco, such an approach is particularly relevant given the diversity of functional scenarios and the cultural characteristics of users.

2) Multifunctionality and Interaction with the Urban Environment

Modern office complexes are increasingly formed as multifunctional structures that include public, commercial, and recreational zones alongside main working spaces.

The integration of such objects into the urban environment contributes to:

– activation of public life;

– improvement of the economic efficiency of territories;

– formation of a comfortable urban space.

A characteristic feature of Moroccan architecture is the tradition of internal courtyards and semi-open spaces, which can be adapted in modern office centers as elements of public interaction and climatic adaptation.

3) Energy Efficiency and Environmental Orientation

In contemporary design, significant attention is paid to the principles of sustainable development. Architectural solutions are aimed at reducing energy consumption and minimizing negative environmental impact.

Key directions include:

– implementation of alternative energy sources;

– use of resource-efficient materials;

– optimization of natural lighting;

– application of ventilation systems with heat recovery.

Considering the climatic conditions of Morocco, passive methods of microclimate regulation are of particular importance, including sun-shading elements, use of shaded zones, and materials with high thermal mass.

4) User Orientation and Biophilic Solutions

Modern office spaces are designed with consideration of human needs, physical and psychological comfort. One of the important directions is the integration of natural components into the interior environment.

The use of green plantings, natural materials, water elements, and sufficient natural lighting has a positive impact on work productivity and the overall well-being of users.

In the Moroccan context, this may be expressed through the adaptation of traditional gardens, internal courtyards, and water compositions that have historically established cultural value.

5) Technological Integration and “Smart” Systems

An important aspect of modern office construction is the implementation of intelligent building management systems. Such technologies make it possible to optimize building operation and improve user comfort.

These include:

– automated climate and lighting control systems;

– digital space management platforms;

– access control systems;

– energy consumption monitoring tools.

Digitalization of office centers contributes to increasing their efficiency and competitiveness.

6) Modern Safety Requirements

Safety is one of the key aspects in the design of modern office buildings. It covers a wide range of measures aimed at protecting users and ensuring stable operation of the facility.

Main directions include:

– ensuring structural reliability of the building;

– implementation of effective fire safety systems;

– organization of safe evacuation;

– use of video surveillance and access control systems;

– creation of backup life-support systems.

In modern conditions, the design of autonomous operational systems and shelters is also of particular relevance.

For Morocco, an important aspect is the consideration of seismic risks, which necessitates the use of appropriate structural solutions.

7) Inclusivity and Universal Design

Modern office centers must comply with accessibility principles for all population groups. This involves creating a barrier-free environment suitable for people with different physical abilities.

In addition, significant attention is paid to the quality of the internal environment: acoustics, lighting, ergonomics, and microclimate, all of which directly affect work efficiency.

8) Consideration of Regional Characteristics of Morocco

The architectural formation of office centers in Morocco should be based on a combination of modern approaches and local traditions. Important factors include:

– climatic conditions;

– historically developed architectural techniques;

– cultural features of spatial organization;

– use of local construction materials.

The combination of innovative technologies with traditional architectural heritage makes it possible to create unique buildings that meet modern requirements while preserving regional identity.

Thus, modern office centers are formed on the basis of principles of flexibility, functional diversity, environmental efficiency, technological integration, and a high level of safety. In the context of Morocco, it is important to take into account local natural-climatic and cultural characteristics, which ensures the creation of a harmonious and efficient architectural environment.

Conclusions to section 1

1. In the course of the research, the main terms and concepts forming the theoretical basis of architectural design of modern office centers were clarified and systematized. The essence of key categories such as office and business center, architectural formation, functional-planning structure, volumetric-spatial composition, and urban context was defined.

Special attention was paid to the concept of regional architectural features, which is decisive for this study, particularly in the context of Morocco, where traditional

architectural principles are combined with contemporary design approaches. The role of bioclimatic architecture and sustainable development principles was also considered as important factors in shaping a comfortable and energy-efficient environment.

Thus, the established conceptual framework ensures a comprehensive understanding of the research object and creates a basis for further analysis of architectural solutions for office centers, taking into account the regional specificity of Morocco.

2. The analysis of theoretical research has shown that the formation of modern office centers is the result of the evolution of architectural, social, and technological approaches – from strictly functional modernist models to flexible, human-oriented, and multifunctional spaces. Contemporary concepts are based on the principles of humanization of the environment, integration with the urban context, environmental sustainability, and the implementation of innovative technologies.

It has been established that the effectiveness of office space is determined not only by its functional organization, but also by its ability to stimulate social interaction, creativity, and user comfort. Interdisciplinary approaches that combine architecture, urban planning, sociology, and management are of particular importance.

In the context of Morocco, theoretical provisions are complemented by the necessity to consider climatic conditions, cultural heritage, and local traditions, which forms unique approaches to the design of office centers. Thus, contemporary theory provides a foundation for the formation of adaptive, sustainable, and socially oriented office spaces.

3. Practical experience in the formation of modern office centers shows that the effectiveness of business districts is determined not only by the technical characteristics of buildings, but also by their ability to create a humanized, people-oriented environment. The most common trends include the integration of open and public spaces, the combination of work, recreation, and social interaction, the use of natural elements and biophilic design, as well as the implementation of energy-efficient and climate-adaptive technologies.

Examples of such projects worldwide – The Edge (Amsterdam), Apple Park (Silicon Valley), Bloomberg European Headquarters (London), Torre Reforma (Mexico City), BCP Tower and Casablanca Finance City Tower (Casablanca), Maroc Telecom HQ (Rabat) – demonstrate a comprehensive approach: flexible internal layouts, open atriums, green areas, modern façade systems, and "smart" engineering solutions. These objects combine architectural expressiveness, environmental sustainability, and user comfort, forming urban spaces that promote productivity, social interaction, and an improved quality of urban life.

4. Contemporary architectural design of office centers is based on the principles of flexibility, multifunctionality, environmental friendliness, and technological integration. Special attention is given to user comfort and safety, biophilic solutions, "smart" management systems, and universal design. In the Moroccan context, this involves combining the latest standards with local climatic, cultural, and historical characteristics, ensuring an efficient, safe, and harmonious environment for work and social interaction.

SECTION 2. PRINCIPLES AND METHODS OF FORMING THE ARCHITECTURE OF MODERN OFFICE CENTERS IN THE STRUCTURE OF THE CITY

2.1. Factors Influencing the Design of Modern Office Centers in the Urban Environment

The design of modern office complexes in cities is a complex and multidimensional process that takes into account the interaction of technological, social, economic, and natural factors. This is especially relevant for countries with specific climatic and cultural conditions, such as Morocco, where contemporary architecture must combine innovative approaches with traditional elements. Modern office buildings are no longer perceived solely as workplaces – they form

multifunctional environments that integrate social, engineering, ecological, and cultural aspects.

1) Natural and climatic conditions

Morocco is characterized by diverse climatic zones: a Mediterranean climate in the northern regions, and semi-arid and desert climates in the central and southern areas. This requires adaptation of architectural solutions to specific conditions:

– control of solar insolation: office building façades are designed using sun-shading screens, canopies, louvers, and shading structures, which provide protection from overheating during summer months;

– optimization of natural lighting: the use of large windows with light regulation systems and light wells reduces the need for artificial lighting and creates a comfortable working environment;

– passive cooling methods: internal courtyards, green roofs, vegetated terraces, and water features help reduce air temperature and increase humidity, which is especially important in semi-arid regions.

Taking these aspects into account allows the creation of energy-efficient buildings that comply with sustainable development principles and ensure user comfort.

2) Urban and social aspects

The urban environment defines specific requirements for office centers. The complex must be harmoniously integrated into the urban context and interact with surrounding buildings:

– building density and transport accessibility: the location of offices must consider proximity to public transport, main roads, and pedestrian routes in order to ensure convenience for employees and visitors;

– urban integration and multifunctionality: modern office centers often include public spaces, retail areas, cafés, and recreation zones, which activate social life and contribute to the economic efficiency of the territory;

– interaction and socialization zones: internal courtyards, terraces, and coworking spaces create conditions for informal meetings, knowledge exchange, and cultural events, supporting the social dynamics of the city.

Traditional Moroccan courtyards and garden compositions can be adapted as modern public spaces that combine work and recreation while preserving the historical value of space.

3) Technological and engineering factors

Innovative technologies define modern standards of comfort and energy efficiency:

– energy-saving systems: the use of heat recovery, natural ventilation, solar collectors, and geothermal installations reduces energy consumption;

– intelligent management systems: automation of lighting, climate, security control, and resource consumption monitoring increases building operational efficiency;

– flexibility of interior spaces: modular structures, mobile partitions, and transformable furniture allow adaptation of offices to different work formats – from individual activity to collaborative projects.

In Morocco, technological solutions are often combined with passive cooling methods, such as internal patios and water elements, which simultaneously ensure energy efficiency and comfort.

4) Cultural and architectural features

To preserve national identity, architectural design takes into account historical and cultural traditions:

– traditional façade and planning elements: arches, decorative ornaments, internal courtyards, and fountains are organically combined with modern technologies;

– use of local materials: stone, tiles, wood, and other resources allow integration of the building into the surrounding environment and ensure ecological sustainability;

– adaptation of cultural scenarios: spaces are designed to correspond to local social and working habits, ensuring comfort and productivity.

This makes it possible to create office centers that not only function as workplaces but also support the cultural identity of the region.

5) Safety and resilience

User safety and building operational stability are key factors:

– structural reliability: buildings are designed considering seismic loads and climatic risks;

– fire safety and evacuation: automated alert systems, access control, and evacuation route planning are developed;

– backup life-support systems: autonomous energy and water supply sources ensure uninterrupted operation in emergency situations.

A comprehensive approach to safety contributes to the creation of reliable and long-lasting buildings.

The design of modern office centers in the urban environment of Morocco requires a systematic consideration of climatic, urban, technological, cultural, and safety factors. The combination of innovative solutions with traditional architectural elements makes it possible to create comfortable, efficient, and sustainable buildings that are harmoniously integrated into the urban environment and emphasize regional identity. Such an approach ensures high productivity of office spaces, employee comfort, and socio-cultural value for the city.

2.2. Main Requirements for the Design of Modern Office Centers

The design of modern office centers involves a comprehensive approach that combines international standards with consideration of local climatic, cultural, and urban characteristics. It is important to take into account functional, spatial, environmental, technological, safety, and social aspects that ensure the efficiency, comfort, and sustainability of these facilities.

1) Functional structure and spatial adaptability

Modern office buildings must include spaces that can be easily adapted to different work scenarios. It is important that premises can be transformed for individual activities or team collaboration.

In Moroccan conditions, a multifunctional approach is particularly relevant, taking into account the cultural and business traditions of the country. The use of modular structures, mobile partitions, and transformable furniture allows rapid reconfiguration of working areas. At the same time, spaces for relaxation, meeting rooms, and coworking areas are provided, which stimulate social interaction and increase labor productivity.

2) Interaction with the urban environment

Modern office complexes are designed as part of the urban structure and integrated into the surrounding environment. They include open squares, public areas, pedestrian routes, and green spaces.

In Moroccan architectural tradition, it is important to consider internal courtyards that provide natural lighting and ventilation. Such spaces not only improve user comfort but also create conditions for social interaction and harmonious integration of the office building into the urban environment.

3) Energy efficiency and sustainable resource use

One of the main requirements is the optimization of energy consumption and minimization of environmental impact. In the hot Moroccan climate, passive temperature regulation methods are applied: shading screens, high thermal mass façades, green roofs, and internal gardens.

It is also important to use renewable energy sources, such as solar panels, as well as energy recovery systems and natural lighting. Local materials and modern construction technologies contribute to reducing operational costs and support the principles of sustainable development, which is important for international investors and local companies.

4) User comfort and biophilic design

Office center spaces must create a comfortable environment that meets the physical and psychological needs of people. The biophilic approach involves integrating natural elements into the indoor environment, which positively affects employee productivity and well-being.

In the Moroccan context, this may include internal gardens, water elements, and green plantings that not only enhance aesthetics but also regulate the building's microclimate. The space should be ergonomic, flexible, and convenient for all categories of users.

5) Implementation of modern technologies

Modern office centers actively use "smart" building management systems. These include automated lighting and climate control systems, energy consumption monitoring, digital space management platforms, security systems, and access control systems.

In Morocco, the use of such technologies allows optimization of building operation, improves user comfort, and ensures energy savings. These solutions contribute to efficient spatial zoning and control of human flows.

6) Safety and structural reliability

The design of office centers involves a high level of safety: structural stability, fire protection systems, evacuation routes, video surveillance, and backup life-support systems.

In Morocco, special attention is paid to seismic safety. Building structures must withstand earthquakes, and internal spaces must be organized to ensure safety while maintaining usability.

7) Inclusivity and universal design

Modern office buildings must be accessible to all population groups. This includes barrier-free space, convenient circulation routes, ergonomic furniture, and adequate lighting. Ensuring inclusivity increases the social responsibility of buildings and comfort for all users.

8) Regional and cultural characteristics

The design of office centers in Morocco must take into account the local climate, traditional architectural techniques, and cultural characteristics. The use of local materials, internal courtyards, gardens, and water elements makes it possible to create unique buildings that combine modern technologies with national identity.

Thus, the design of modern office centers in Morocco is based on a combination of flexibility, sustainability, technological integration, safety, and cultural-regional adaptation. Compliance with these requirements allows the creation of comfortable, efficient, and sustainable working environments that are harmoniously integrated into the urban context.

2.3. Analysis of the Functional and Spatial Planning Structure of Contemporary Office Center Architecture

Modern office complexes represent complex architectural systems that combine practicality, aesthetics, and adaptation to regional climatic and sociocultural conditions. The planning organization of such centers is formed taking into account various factors: the structure of tenant companies, the need for internal communications and natural lighting, as well as the specifics of the local urban environment.

1) Main functional segments

The planning of modern office buildings in Morocco involves the allocation of several key zones:

– office zone – the central part of the building, which includes management offices, staff workstations, and conference rooms. Many modern centers apply open-space office layouts, which allow more efficient use of floor area and improve interaction between employees;

– service and technical zone – technical rooms, server rooms, maintenance spaces, kitchens, restrooms, and storage areas. In the conditions of Morocco’s hot climate, it is important to integrate efficient ventilation and air conditioning systems that maintain comfortable conditions throughout the year;

– public spaces – lobby, reception area, cafés, relaxation zones, and meeting rooms. These areas are designed with a focus on high accessibility and aesthetic attractiveness for visitors;

– transport and technical nodes – staircases, elevators, parking areas, underground garages, and delivery zones. Significant attention is paid to organizing human flows and ensuring safe movement inside the building.

2) Planning structure and modularity

Modularity of planning is a characteristic feature of modern office centers. It allows the space to be easily adapted to the different needs of tenants. The use of standard office blocks, open-plan work areas, and transformable meeting rooms increases the flexibility of the building.

Special attention is given to the rational use of natural light. Due to intense sunlight, large windows, light wells, and sun-shading systems are used, which reduce energy consumption for lighting and air conditioning.

In addition, the planning takes into account local cultural characteristics: in many buildings, separate rooms for private meetings and prayer spaces are provided in accordance with Islamic traditions.

3) Vertical and horizontal organization

The vertical structure of modern office centers often involves the distribution of floors according to functional purpose: lower levels are allocated to public and commercial spaces, middle levels to office workspaces, and upper levels to executive offices and conference rooms. Such organization promotes efficient movement of visitors and employees while ensuring access to natural lighting and panoramic views.

Horizontal organization is oriented toward rational movement routes, where corridors, open spaces, and lobby atriums ensure the integration of different zones. Atriums and internal courtyards also contribute to creating a comfortable microclimate and visual transparency of the building.

4) Technological solutions

Modern office centers integrate advanced building management technologies. Automated systems for controlling lighting, climate, and security are organically incorporated into the planning structure. The use of energy-saving solutions, such as solar panels and heat recovery systems, is considered already at the design stage without disrupting the functional integrity of the building.

Thus, the functional and planning organization of modern office centers combines global architectural trends with local climatic and sociocultural features. Planning flexibility, the use of natural lighting, energy-saving technologies, and clear floor zoning ensure efficient building operation and comfort for its users.

2.4. Contemporary Trends and Principles of Spatial-Volume Organization of Modern Office Centers

The spatial-volume organization of office centers is one of the key factors determining not only the external appearance of buildings, but also the efficiency of their functioning, user comfort, and integration into the urban environment. In Morocco, modern office architecture is developing under the influence of global trends while simultaneously being adapted to the specific climatic, social, and cultural conditions of the country. This creates a unique architectural image of office centers that combines modern technologies with traditional elements.

1) Contemporary trends in spatial-volume organization

In recent years, several key trends have emerged in global office building architecture, which are also actively implemented in Moroccan projects:

Modularity and scalability

Modern office centers are designed so that individual blocks and floors can change their functional purpose without major reconstruction. Modular structures allow the space to be quickly adapted to different tenant companies, to increase or decrease the area of work zones and partitions. This is especially relevant for the dynamic labor market and high demand for rented office space in Moroccan urban centers such as Casablanca or Rabat.

Open and transparent spaces

The “open space” principle is increasingly used in modern offices, and internal courtyards, atriums, and glass façades promote the penetration of natural light and create a sense of spaciousness. Such organization improves user comfort and promotes effective communication between employees.

Energy efficiency and environmental sustainability

Given Morocco’s hot climate, special attention is paid to the use of sun-shading systems, light wells, green roofs, and materials with high thermal insulation properties. This reduces energy consumption for lighting and air conditioning, creating more environmentally balanced buildings.

Integration of modern technologies

Automated systems for controlling lighting, ventilation, climate regulation, and security are integrated already at the design stage. This determines both the external form of the building and its internal planning structure, since technical nodes and communications must be logically integrated into volumetric solutions.

2) Main principles of spatial-volume organization

The spatial-volume structure of modern office centers defines the relationship between the external volume of the building and its internal functional zones. In the Moroccan context, several main principles can be identified:

Vertical and horizontal zoning

A typical organization includes lower floors for public and commercial functions (lobbies, shops, cafés), middle floors for working offices, and upper floors for conference halls and executive offices. Such a structure ensures logical movement of visitors and staff, optimizes access to natural light, and creates convenient navigation within the building.

Functional zoning of volumes

Office, public, technical, and service spaces are distinguished, which allows for efficient organization of communications and ensures user comfort and safety. An important aspect is the integration of technical rooms into the overall volume so that they do not disrupt the aesthetic integrity of the building.

Use of atriums and internal courtyards

Internal courtyards and atriums provide natural lighting, ventilation, and a comfortable atmosphere for employees. In addition, they form architectural accents and create visually attractive spaces that combine working and public functions.

Flexibility and adaptability

Modern projects provide for the possibility of changing workplace layouts, partition configurations, and relaxation zones without significant structural interventions. This allows for rapid response to business needs and changes in staff numbers.

3) Moroccan context of spatial-volume organization

Climatic and sociocultural features of Morocco influence the spatial-volume structure of buildings:

Sun-shading façades and terraces reduce indoor overheating and improve employee comfort during hot seasons.

Internal courtyards and atriums create natural air circulation, improve lighting, and reduce electricity demand.

The presence of prayer rooms and separate meeting spaces corresponds to sociocultural traditions and religious practices of local users.
The combination of traditional materials and modern technologies—Moroccan architecture actively integrates local decorative motifs, ornaments, and tiles, combining them with modern façade systems and glass.

In addition, large urban office projects in Morocco often include integration with the surrounding urban fabric, green areas, and transport infrastructure, which increases usability and makes buildings more functionally coherent.

4) Implementation examples and future trends

Modern office centers in Casablanca and Rabat demonstrate the application of flexible planning principles, integration of green zones, and energy efficiency technologies. In the future, more intensive use of smart building management systems, integration of renewable energy sources, and a stronger combination of traditional architectural elements with modern trends are expected.

The spatial-volume organization of modern office centers in Morocco reflects a combination of global architectural trends and local climatic and cultural conditions. Flexible modular solutions, open spaces, atriums, optimization of natural lighting, and integration of energy-efficient technologies ensure comfort, functionality, and a modern appearance of buildings. These principles form a unique image of Moroccan

office centers and contribute to their effective use in a rapidly changing urban environment.

Conclusions to section 2

1. The modern design of office centers in the urban environment is determined by the comprehensive consideration of natural-climatic, urban, technological, cultural, and safety factors. The combination of flexible spatial solutions, energy-efficient technologies, integration into the urban environment, and consideration of national architectural traditions makes it possible to create comfortable, functional, and sustainable facilities that harmoniously meet user needs and reflect regional identity.

2. In contemporary office center design, a comprehensive approach plays a key role, combining international standards with consideration of regional climatic, cultural, and urban characteristics. The main requirements include ensuring functional flexibility and transformability of space, integration of the facility into the urban environment, energy efficiency and sustainable development, user comfort and safety, application of modern technologies, and inclusive design. Taking into account local traditions, climate, and materials makes it possible to create unique office centers that combine efficiency, ergonomics, and cultural identity, forming a harmonious and sustainable architectural environment.

3. The functional and planning structure of modern office centers combines efficient spatial organization, planning flexibility, and adaptation to regional climatic and cultural conditions. The main zones – office, public, technical, and transport – are clearly integrated into the vertical and horizontal structure of the building. The use of modular solutions, natural lighting, and energy-saving technologies ensures comfort, efficiency, and a modern architectural appearance that meets the needs of local users and global trends in office architecture development.

4. The spatial-volume organization of modern office centers combines global architectural trends with local climatic and cultural characteristics. The use of modular solutions, open spaces, atriums, and internal courtyards ensures efficient circulation of people, optimal natural lighting, and comfortable working conditions. The

integration of energy-efficient technologies and adaptation to sociocultural needs make buildings functional, flexible, and contemporary, forming a unique architectural image of Moroccan office centers.

SECTION 3. EXPERIMENTAL DESIGN. PROJECT OF A MODERN OFFICE CENTER

3.1. Pre-design analysis of the project site

The office building project is being developed for the city of Marrakech, which is located within the Kingdom of Morocco and is included among the four historic imperial cities of the country. This city holds significant importance in shaping the cultural heritage, historical development, and modern economy of the state, serving as one of the key urban centers of the region.

3.1.1. Urban planning analysis of the location of the modern office center

From a geographical point of view, Marrakech is located in the western part of the country, near the foothills of the High Atlas Mountains, at an altitude of approximately 450 meters above sea level. The distance to the capital of the state – the city of Rabat – is about 330 km, while the distance to the country's largest economic center, Casablanca, is about 240 km. Such a location provides the city with advantageous transport and economic connections (Fig. 3.1).

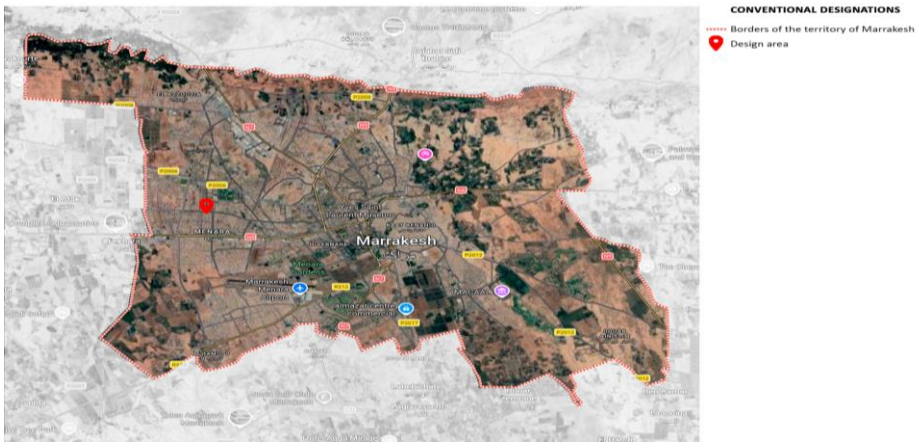

Figure 3.1. Scheme of the placement of the selected site for design in the structure of Marrakesh

The formation of the spatial structure of Marrakech took place under the influence of a combination of traditional urban planning principles and modern urban transformations. The architectural environment of the city is characterized by significant diversity and includes religious buildings, palace ensembles, historic gardens, as well as objects of high cultural value. The central planning element is the medina – a historically formed district with dense development, a closed квартальна (block-based) structure, and a preserved system of defensive walls, reflecting the features of the city's development during the period of Berber dynasties.

An important architectural and spatial landmark is the minaret of the Koutoubia Mosque, built in the 12th century. This structure, executed in Moorish style, due to its height and expressive silhouette, serves as a dominant feature in the panorama of the historic center and shapes the visual identity of the city.

The natural environment also has a significant influence on architectural and planning solutions. In particular, to the southeast of the city lies the highest peak in North Africa – Mount Jebel Toubkal (approximately 3240 m), which contrasts with the arid and hot climate of Marrakech. This combination of natural conditions necessitates consideration of climatic factors in the design of modern buildings, including building orientation, protection from solar overheating, and the organization of natural ventilation.

3.1.2. Natural-climatic and artistic-architectural features of the city of Marrakech

The natural conditions and architectural appearance of Marrakech have been formed under the strong influence of climate, geographical location, and cultural traditions, which together create a unique urban environment.

The climate of Marrakech belongs to the semi-arid type and is characterized by significant air dryness and sharp seasonal contrasts. Summers are long and very hot: temperatures often rise above +30…+35 °C, and rainfall is almost absent. Winters, on the contrary, are mild, with average temperatures around +12…+15 °C, although noticeable cooling can occur at night. Most precipitation falls during the winter months, while in summer it is almost nonexistent. In general, the annual amount of

precipitation is low, which leads to limited water resources and the need for their rational use (Fig. 3.2).

The Atlas Mountains play an important role in shaping the climate. They create a kind of barrier for moist air masses coming from the Atlantic Ocean, which results in drier conditions prevailing in the lowland areas where Marrakesh is located. At the same time, the proximity of desert regions contributes to the inflow of hot and dry air currents. These natural features lead to the formation of a semi-desert landscape with sparse vegetation, dominated by shrubs, palm trees, and olive trees. To sustain life under such conditions, complex irrigation systems have historically been used.

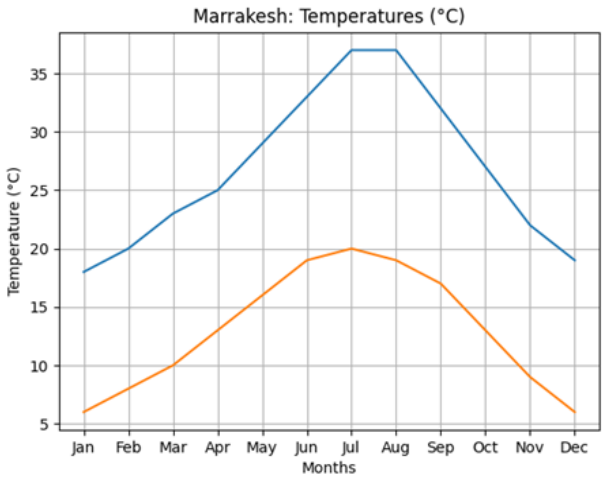

Figure 3.2. Average monthly values of minimum and maximum daytime temperatures

Climatic conditions have directly influenced the appearance of the city and the principles of its development. The architecture of Marrakesh was formed with consideration for the need to protect against heat, dust, and a lack of moisture. One of the most characteristic features is the dense development of the old city – the medina. Narrow, winding streets create shade and reduce surface heating, helping to maintain coolness even on the hottest days. Traditional residential houses, known as riads, have inner courtyards, often with fountains or small gardens. This structure promotes natural ventilation and creates a comfortable microclimate inside the buildings. The walls of the houses are usually thick, made of clay or stone, which allows them to retain coolness during the day and warmth at night.

Building materials also play a distinct role in shaping the image of the city. Local reddish sandstone was widely used in construction, which is why Marrakesh is often called the “Red City.” This material not only determines the color of the urban landscape but is also well adapted to climatic conditions, as it has the ability to regulate heat exchange.

The architecture of public and religious buildings is distinguished by the richness of decorative elements. Mosques, palaces, and other historical structures are adorned with carvings, ornaments, mosaics, and calligraphy. At the same time, decoration is combined with functionality: interior spaces are often organized in a way that ensures coolness and comfort in a hot climate.

Gardens and water features are an essential element of the urban environment. In an arid climate, water has not only practical significance but also performs aesthetic and climate-regulating functions. Fountains, pools, and greenery help reduce air temperature and create a favorable atmosphere for relaxation.

Thus, Marrakesh is an example of a close relationship between natural conditions and human activity. Its climate, characterized by heat and aridity, has determined both the way of life of its inhabitants and the features of its architecture. The city demonstrates how traditional construction solutions can effectively adapt to complex natural conditions, creating a comfortable and at the same time aesthetically expressive environment.

3.1.3. Analysis of the existing functional organization and transport-pedestrian connections of the project site territory

The territory is located within the urbanized part of the city and is shaped by various functional zones with different purposes. Spatial analysis makes it possible to determine the nature of interaction between residential, public, and recreational elements, as well as to assess the level of transport and pedestrian accessibility of the site.

The eastern direction from the site is represented by compact residential development with a regular planning structure. The street network has a clear

geometry, which ensures convenient orientation in space and contributes to the formation of intensive pedestrian flows. Such an organization of the residential environment creates a stable level of daily activity, which is an important prerequisite for the placement of business facilities.

In the southern sector, there is a combination of residential functions with service facilities and public infrastructure. The presence of educational institutions and service establishments generates additional user flows and increases the overall functional intensity of the area. This, in turn, contributes to the activation of the urban environment and strengthens its multifunctional character.

The western part of the surroundings is characterized by lower building density and the presence of vacant or partially developed plots. Such a territorial morphology provides spatial “relief” and creates a reserve for further urban development.

An important element of the structure is the green areas located near the site. They perform not only a recreational but also an ecological function, improving the microclimate and increasing the comfort of staying in the urban space. The presence of green zones also opens up opportunities for integrating open public spaces into the future project.

The territory selected for the design of the office building is located within an established urban fabric and has clearly defined boundaries formed by the existing transport network. The site adjoins Rue Bin Jradi, which belongs to the category of local streets and provides direct access for both pedestrians and vehicles. This contributes to the convenience of using the facility in the future (Fig. 3.3).

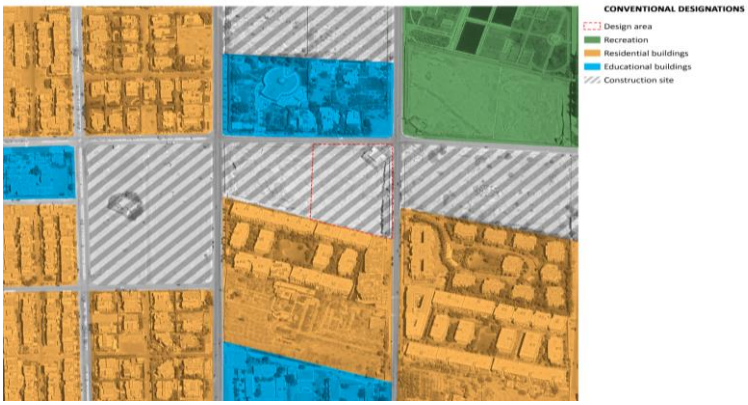

Figure 3.3. Scheme of the placement of the selected site for design in the structure of the microdistrict

The transport accessibility of the site is բավական high due to its proximity to major highways that provide connections with various functional zones of the city. At the same time, the local street network ensures convenient access directly to the design area.

The pedestrian infrastructure is represented by sidewalks along Rue Bin Jradi and adjacent streets, providing safe and comfortable access to the site from residential neighborhoods and public transport stops located within standard walking distance. An important feature is the separation of transport and pedestrian flows, which increases the level of safety and the overall quality of the urban environment (Fig. 3.4).

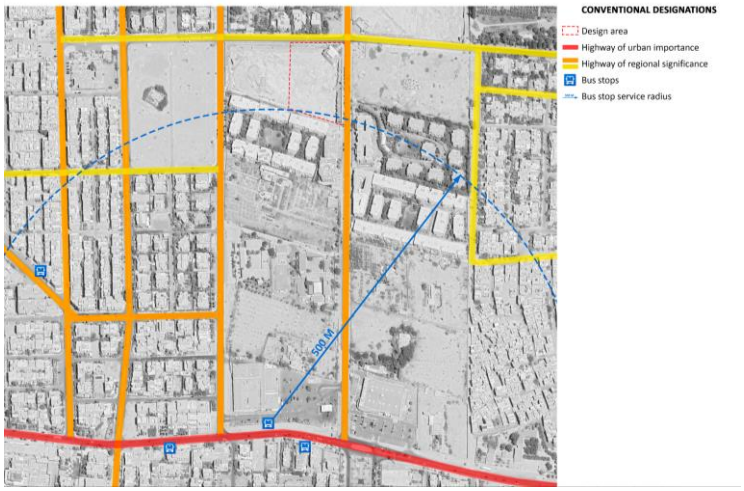

Figure 3.4. Transport and pedestrian accessibility scheme

Thus, the selected design area is characterized by a favorable location within the city structure, a harmonious combination of residential, public, and recreational functions, as well as a well-developed transport and pedestrian infrastructure. The combination of these factors creates favorable conditions for the implementation of a modern office facility that will be organically integrated into the existing urban environment and meet the needs of both the local district and the city as a whole.

3.2. Main Idea of the Modern Office Center and the General Plan Solution

Modern office complexes in the city of Marrakesh should be considered not as isolated business units, but as integral components of the urban space, oriented toward comfort and the everyday needs of people. Their formation is based on the integration

of the working environment with public functions, recreation areas, and spaces for cultural interaction, which contributes to the creation of an active and attractive urban environment.

A key principle is the combination of modern architectural solutions with local traditions. In this context, forms, materials, and spatial techniques characteristic of Morocco are taken into account, making it possible to achieve a harmonious coexistence of new development with the historically established environment.

The organization of space is based on a human-centered approach, which provides convenient pedestrian routes, openness of the territory, and the correspondence of building scale to human perception. Particular attention is paid to climatic adaptation: the use of shaded galleries, inner courtyards, landscaped areas, and water elements, which positively affect the microclimate and increase the level of comfort.

The designed territory has a conventionally rectangular configuration and is located within an already established urban fabric, with direct access to existing transport infrastructure. On the western side, the site borders a main street that functions as the primary transport axis. This is where the main entrances and transport approaches are planned. Along this side, a heterogeneous development has formed, defining the character of the surrounding environment.

The red lines outline clear building boundaries and establish the logic for the placement of objects in relation to the street network, ensuring an orderly integration of the new complex into the existing urban structure.

The inner part of the site is mostly free from dense development, which opens up opportunities for a comprehensive planning solution. The terrain of the area is flat, without significant elevation differences, which simplifies the design process.

From the north and east, the territory borders open spaces, creating preconditions for further development and the formation of new functional and spatial connections (Fig. 3.5).

The master plan of the territory reflects a comprehensive approach to the formation of a modern office center in the conditions of the city of Marrakesh, taking

into account regional architectural traditions, functional zoning, and the characteristics of the urban environment. The planning structure is based on a clear compositional organization of space and a logical distribution of flows, which ensures efficient use of the site and increases its functional intensity.

Figure 3.5. Basic plan

The architectural and spatial solution provides the formation of semi-enclosed internal spaces characteristic of Moroccan architecture. Inner courtyards, patios, and small squares serve as buffer zones between public and work functions, creating comfortable conditions for recreation, informal communication, and short-term stays. Such spatial techniques contribute to the formation of a favorable microclimate and support the traditions of local development.

The organization of the pedestrian network is of significant importance, as it connects all functional elements of the complex into a unified system. Priority is given to pedestrian movement, which corresponds to modern principles of sustainable urban development. Along the main routes, landscaping is provided, along with the use of small architectural forms and the arrangement of recreation areas, which improves the quality of space and ensures comfortable use for visitors.

The transport scheme is organized in such a way as to minimize the impact of vehicular traffic on the internal space of the complex. The main entrances are located along the perimeter of the site, where parking areas are also provided. The central part of the territory remains predominantly pedestrian, which contributes to increased safety and the formation of a favorable public environment.

Special attention is paid to the landscaping of the territory, taking into account the climatic conditions of Marrakesh. Greenery is arranged both along the main pedestrian axes and within the inner courtyards. The use of shading elements, water features, pergolas, and vegetation makes it possible to reduce thermal loads and create a comfortable microclimate. When selecting plant species, local varieties adapted to an arid climate are taken into account.

Improvement elements include the installation of urban furniture – benches, lighting fixtures, decorative structures, and recreation areas. The space is adapted for various user groups, including people with limited mobility, through barrier-free solutions such as ramps, gentle changes in elevation, and convenient access to buildings. In the evening, the territory is provided with energy-efficient lighting that emphasizes the architectural expressiveness of the space (Fig. 3.6).

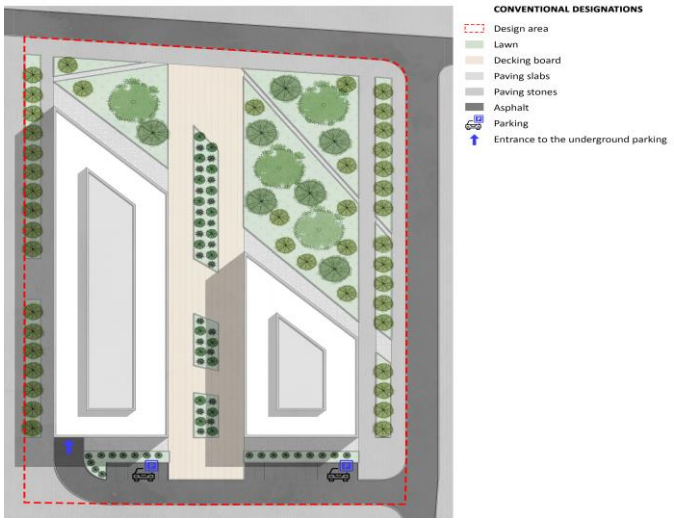

Figure 3.6. Master plan

The engineering provision of the complex is oriented toward the implementation of modern ecological and energy-efficient technologies. The use of alternative energy sources is provided, in particular solar panels, which are highly relevant for the climatic conditions of the region, as well as backup power supply systems to ensure the uninterrupted operation of the facility.

An important component is the organization of drainage systems and the rational use of water resources, which makes it possible to prevent the accumulation of precipitation and ensures the efficient functioning of the territory. Lighting is implemented using modern LED technologies and automated control systems. A

комплекс of safety measures is also provided, including video surveillance, access control, and fire protection systems.

All engineering and planning solutions are developed with consideration for long-term operation, adaptability to change, and the possibility of further development of the territory, which meets modern requirements for the formation of office centers in the context of the city of Marrakesh.

3.3. Concept of Forming the Volumetric-Spatial Solution of a Modern Office Center

The conceptual foundations for shaping the volumetric-spatial solution of a modern office center in Marrakesh reflect a comprehensive approach to organizing the architectural environment, taking into account regional specifics. In this context, an important aspect is the synthesis of current architectural trends with traditional Moroccan principles of spatial formation, which are based on climatic expediency, cultural heritage, and social characteristics of the region.

The volumetric-spatial structure of the business center is oriented toward creating a cohesive, functionally flexible environment that combines the efficiency of organizing work processes with the comfort of users. A significant role is played by the interaction of the development with open spaces, pedestrian connections, and transport infrastructure, which forms a выразительный architectural image and ensures the organic integration of the object into the existing urban fabric.

The architectural solution of the building provides a four-story structure with a complex plan configuration, close to a rectangular shape but with certain plastic deviations that give the object dynamism. The elongated composition of the building is determined by the urban planning conditions of the site and contributes to the rational use of the territory. The building dimensions in axes are 66,0 × 18,0 m.

The building includes two underground floors with a height of 4,15 m, while the height of the above-ground floors is approximately 4,0 m, ensuring an adequate level of insolation, ventilation, and spatial comfort.

The total height of the structure corresponds to the parameters of mid-rise development characteristic of modern districts of Marrakesh, which makes it possible to avoid dissonance with the surrounding environment, and amounts to 18,5 m. The volumetric-planning characteristics contribute to a clear functional distribution of spaces and the formation of a cohesive architectural image (Fig. 3.7).

Figure 3.7. *General view of the building*

The underground part of the building exceeds the above-ground part in area and has dimensions of 66,0 × 54,0 m. These levels accommodate engineering and auxiliary rooms, including a heating substation. Service zones are designated for the installation and maintenance of water supply, sewage, and heating systems; control units are located at the points of cold and hot water supply entry, as well as at the connection to the heat network. All engineering communications are interconnected through technical passages, which ensures convenient operation and maintenance.

The underground level also includes a parking area for vehicles, which increases the functionality of the building and makes rational use of the available space. The parking facility is organized in accordance with safety requirements, ease of maneuvering, and access to engineering systems.

Two separate direct exits to the outside are provided from the basement premises, functioning as evacuation routes. In order to increase the level of safety, a shelter is designed in the underground part. It is equipped with reinforced protective elements, including strong walls, a ceiling structure, hermetically sealed doors, and anti-blast

devices. Such constructions provide protection not only from shock waves and debris in the event of destruction, but also from the effects of penetrating radiation, light radiation, and high temperatures (Fig. 3.8).

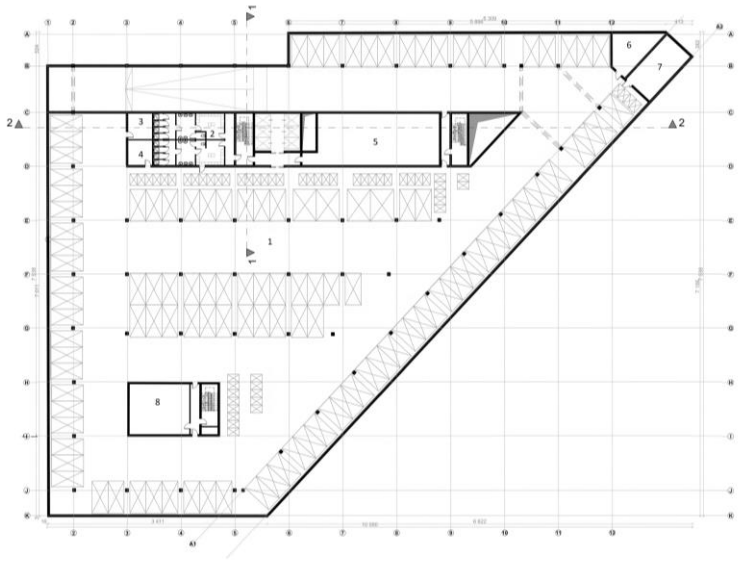

Figure 3.8. Plan at level -4,150

The first floor of the building is designed as a multifunctional space with a clear division into public, administrative, and service-technical zones.

The entrance group includes a reception area that provides visitor orientation and access control. Adjacent to it are auxiliary rooms: a utility room, a mother and child room, a service room, as well as a fire safety control room and an archive.

The public part is represented by retail and service spaces that can be used for servicing visitors. A significant role is played by the dining area, which is functionally connected to the kitchen, serving area, and dishwashing zone. To ensure the operation of the food service unit, storage rooms and a refrigeration chamber are provided.

The administrative zone includes office spaces, a conference hall, as well as technical rooms such as a server room and a BMS room, which ensure monitoring and management of the building's engineering systems.

For staff, rest rooms, changing rooms (male and female), and additional service rooms are provided.

The sports and wellness function is implemented through a gym, which is located in a separate part of the building and has convenient access to the changing rooms.

A separate area is allocated for the collection and temporary storage of waste, in accordance with sanitary and hygienic requirements. The overall planning solution ensures efficient spatial organization and convenient operation of the building (Fig. 3.9).

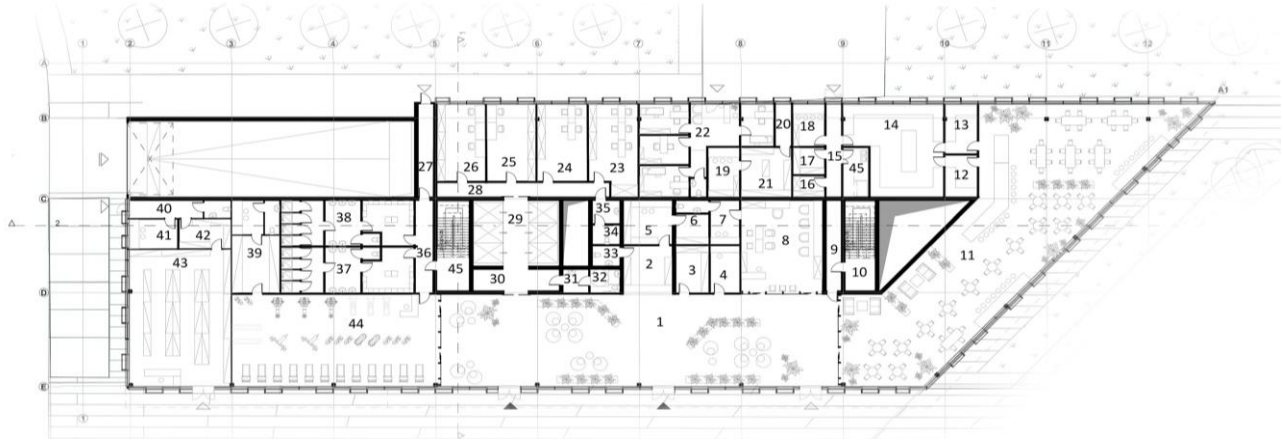

Figure 3.9. Plan at level 0,000

On the upper floors of the building, office spaces are planned, including an administrative office, as well as modern open-plan work areas in an open space format. This approach to planning allows for the rational organization of workplaces within a unified environment, improves interaction between employees, promotes the rapid exchange of information, and ensures flexibility in the use of space.

Additionally, the office area includes isolated rooms for meetings and individual work, which increases the comfort and functionality of the space.

To ensure proper sanitary and hygienic conditions, separate sanitary facilities for men and women are arranged on each level (Fig. 3.10).

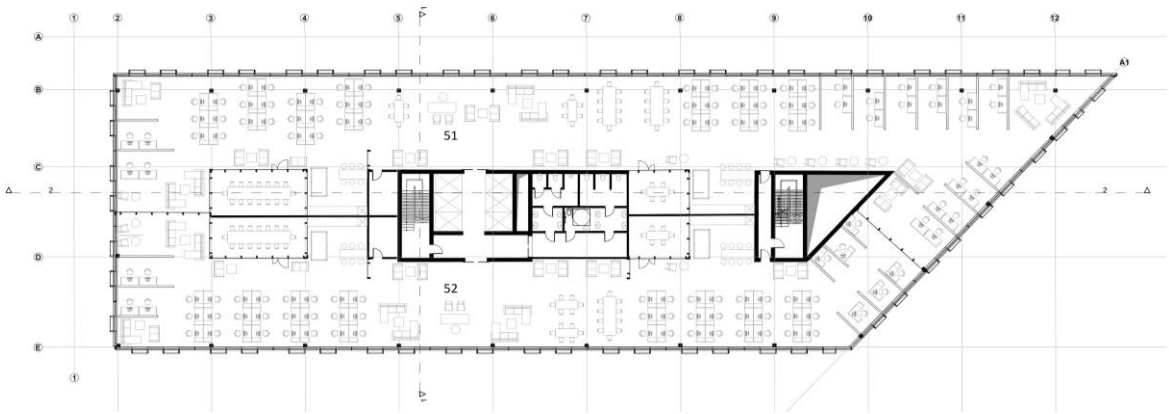

Figure 3.10. Plan at level +8,000

Vertical circulation between floors is organized by means of two staircases and six passenger elevators with a load capacity of 400 kg. The elevators are equipped with a control system both from inside the cabin and from each floor, which ensures convenient operation.

For smoke removal in the event of a fire, both natural and mechanical smoke extraction systems are provided: through ventilation openings in the roof, as well as by means of special electric fans integrated into the elevator shaft system, which are automatically activated in case of fire.

The staircases are equipped with artificial lighting. Doors leading to staircases and vestibules open in the direction of evacuation, which complies with fire safety requirements.

The width of the corridors on all floors is not less than 1.5 m, which ensures comfortable and safe movement.

Access to the roof is organized via a staircase and external stairs with further access via a ladder from elevation +30.900. The operational part of the roof is equipped with a metal safety railing and a lightning protection system (Fig. 3.11).

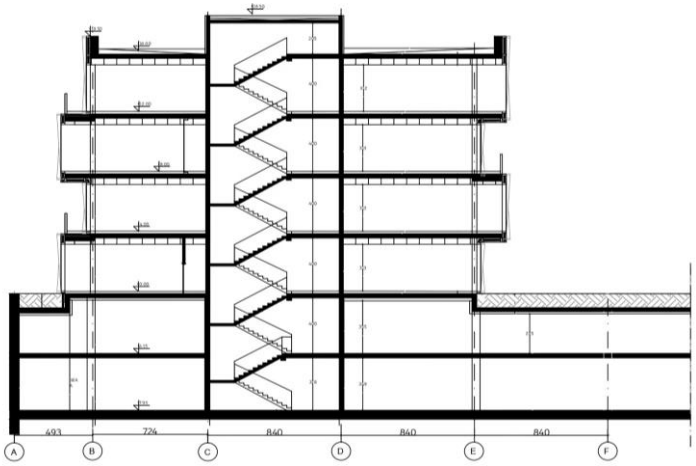

Figure 3.11. Section

The project has been developed taking into account the requirements for accessibility of buildings for people with limited mobility. For this purpose, a set of measures is provided: the installation of ramps and lifting platforms, convenient placement of entrances without obstacles to movement, sufficient width of passages

and corridors, as well as the installation of navigation elements and auxiliary equipment.

The roof of the building is flat, with a slope of 0.03, and features an internal organized drainage system. Access to the roof is provided via the staircase.

The conventional zero level (0.000) is taken as the level of the finished floor of the first floor.

Conclusions to section 3

1. The geographical and natural environment of the site was considered. It is located in the southwestern part of Marrakesh, in the Menara district, characterized by predominantly flat terrain, a dry subtropical climate, olive and palm plantations, as well as important recreational areas (Menara Gardens).

The architectural features of the city were also examined, in particular the adaptation of traditional architecture to the local climate (massive walls, inner courtyards, narrow shaded streets), the preservation of the historical heritage of the Medina, characteristic riads, and the modern combination of traditional motifs with new construction technologies in the Menara district.

In addition, the transport and pedestrian accessibility of the territory was analyzed, including main roads and pedestrian routes, which ensure convenient access to the central parts of the city, commercial, and recreational facilities.

2. Thus, the formation of a modern office center in Marrakesh is based on a comprehensive combination of functional expediency, human-oriented principles, and consideration of regional architectural features. The proposed master plan ensures efficient spatial organization, clear zoning, and a balanced interaction between pedestrian and transport flows. At the same time, the use of traditional spatial techniques, climate-adapted solutions, and modern engineering technologies contributes to the creation of a comfortable, environmentally sustainable architectural complex integrated into the urban environment.

3. The volumetric-spatial solution of the modern office center in Marrakesh is formed as a coherent, functionally and compositionally balanced structure that takes

into account the urban planning conditions of the site, the climatic characteristics of the region, and the requirements of modern business infrastructure. The proposed architectural model combines rational organization of internal spaces with expressive volumetric form and harmonious integration into the urban environment. Clear functional zoning, a developed system of underground and above-ground levels, as well as well-planned vertical and horizontal circulation ensure efficient use of space and convenient building operation. Special attention is paid to safety, inclusivity, and engineering infrastructure, which enhances the overall quality of the architectural solution.

Thus, the adopted concept of volumetric-spatial organization makes it possible to create a modern office center that meets functional, aesthetic, and operational requirements and is harmoniously integrated into the context of the city of Marrakesh.

SECTION 4. CALCULATION AND CONSTRUCTIONS

4.1. Architectural Structures of the Above-Ground Part of the Building

The structural scheme of the office center building is based on a spatial reinforced concrete frame of the moment-resisting type, complemented by monolithic wall elements. Considering the seismic activity of certain regions of Morocco, the frame is divided by expansion (seismic) joints, which helps reduce the impact of dynamic loads (Fig. 4.1).

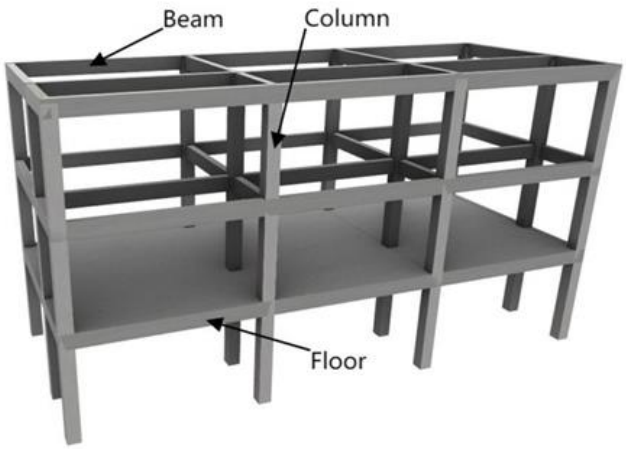

Figure 4.1. Spatial reinforced concrete frame of frame type building model

The load-bearing capacity and spatial stiffness are ensured by the interaction of vertical and horizontal elements – columns, beams, shear walls, as well as floor slabs acting as diaphragms. The design provides a frame system of monolithic reinforced concrete columns with a cross-section of 400 × 400 mm, shear walls 250 mm thick, and a core formed by the walls of stairwells and elevator shafts of similar thickness. The floor system consists of a monolithic slab 160 mm thick, supported by beams with a cross-section of 400 × 460 mm.

The foundations for the columns are designed as individual reinforced concrete pad footings, while the walls transfer loads through foundation beams. The basement walls are designed as self-supporting monolithic structures 400 mm thick, supported on grillages and not rigidly connected to the frame (Fig. 4.2).

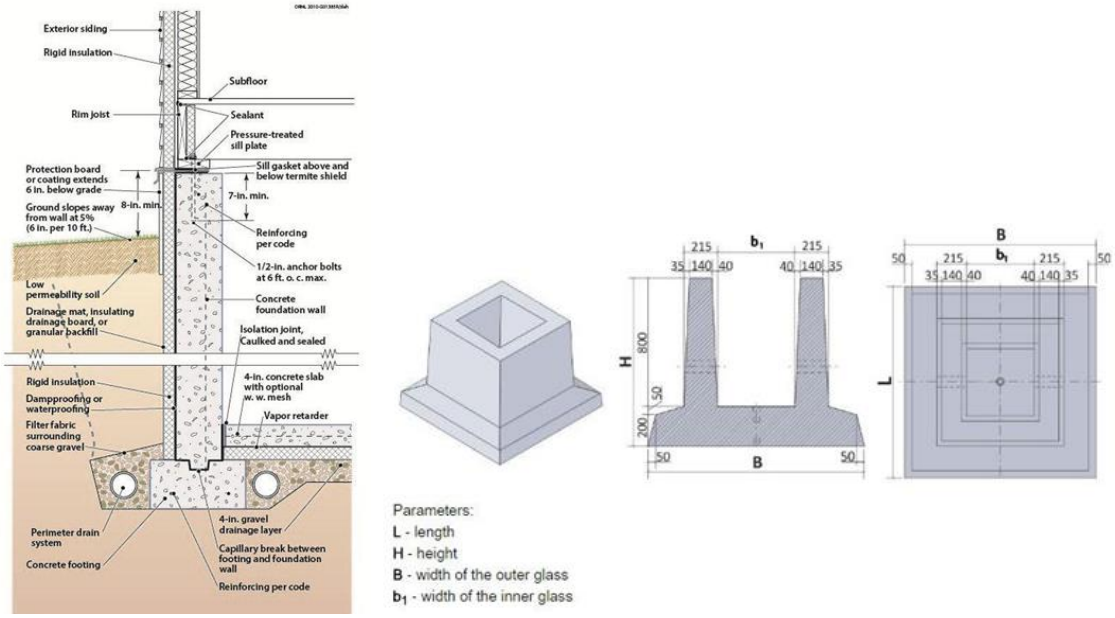

Figure 4.2. Basement walls and the column foundation

Taking into account the climatic conditions of Morocco (high temperatures and intense solar radiation), traditional local building resources are used alongside modern materials in the external envelope structures. In particular, adobe blocks, rammed earth (pisé), natural stone, as well as Moroccan brick and decorative tadelakt plaster are applied, the latter providing additional protection against moisture and overheating.

The external walls are designed as self-supporting with floor-by-floor support and hinged connections to the frame, ensuring their independent behavior under

seismic effects. The wall structure is multilayered: an inner layer of monolithic reinforced concrete, thermal insulation (cork panels), and an outer layer finished with tadelakt or decorative plaster applied over reinforcing mesh. The total thickness of the envelope structure is approximately 250 – 300 mm.

Internal partitions are made of brick or local materials (adobe blocks) with a thickness of about 120 mm, which contributes to improving the indoor microclimate.

Floor systems consist of monolithic reinforced concrete slabs 160 mm thick. In specialized areas (in particular, shelters), enhanced monolithic structures are used.

Stair flights and landings are constructed as monolithic reinforced concrete elements with a slope of 1:2. Railings are made of metal with vertical elements and horizontal rails, complemented by comfortable handrails. In modern office centers in Morocco, decorative metal grilles with ornamental motifs characteristic of Islamic architecture are also often used (Fig. 4.3).

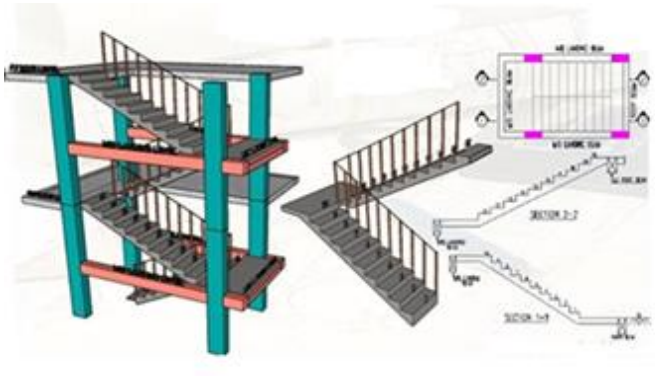

Figure 4.3. Reinforced concrete staircase

The roof is flat, in accordance with local construction traditions. It is made of multi-layer rolled waterproofing materials with a protective covering (gravel or tiles). Vapor insulation is provided by polymer membranes. In some cases, the roofs are used as terraces or recreational areas with canopies made of lightweight materials (Fig. 4.4).

The internal drainage system includes roof drains, risers, and pipelines that carry rainwater to the stormwater sewer network. Window and door infill elements are designed with consideration of the climate: energy-efficient double-glazed units in aluminum profiles are used, often supplemented with sun-shading elements such as blinds, mashrabiya screens, or deep reveals. This helps reduce overheating of interior spaces. Floors in lobbies and corridors are made of mosaic tiles, ensuring high wear

resistance and durability under heavy foot traffic. In office spaces, laminate and linoleum on a thermal insulation base are used, creating comfortable operating conditions, improving acoustic properties, and helping retain heat.

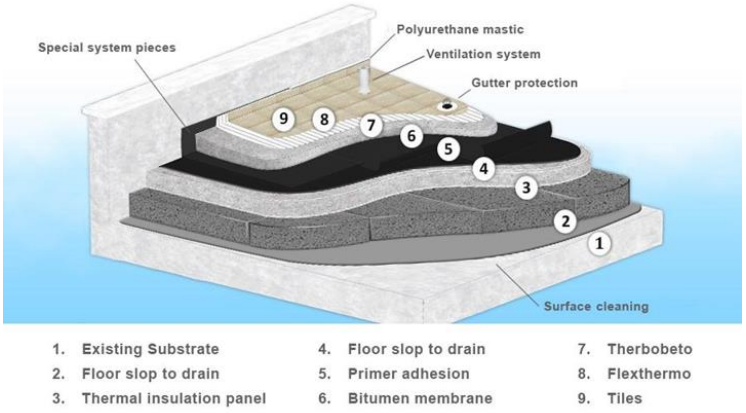

Figure 4.4. Roof diagram

The load collection for the intermediate floor slab is determined based on the adopted structural layers and normative values of permanent and variable loads.

Notes:

Load values are determined in accordance with standard material densities and typical structural solutions.

Partial safety factors γfm are adopted according to design standards.

1 kN/m² ≈ 100 kg/m².

The main contribution to the total load is provided by the reinforced concrete slab and cement screed.

Sanitary facilities and buffet areas are equipped with floors made of high-quality ceramic tiles, which are moisture-resistant, hygienic, and easy to maintain. To enhance safety in these areas, it is advisable to use tiles with a non-slip surface.

The interior finishes depend on the functional purpose of the spaces. Walls are finished with paints and decorative plaster.

The building façade is designed as a continuous glass envelope with panoramic glazing, in which individual glass panels are set at different angles relative to the main wall plane. This structural solution creates a distinctive plastic effect – the surface is perceived as multifaceted, as if composed of separate “faces” resembling a crystalline structure or a cut gemstone.

Table 4.1. Load Collection per 1 m² of Intermediate Floor Slab

Description	**Thickness, mm**	**Density, kg/m³**	**Gn, kN/m²**	**γfm**	**G, kN/m²**
Permanent loads					
Laminate flooring	8	900	0.07	1,2	0,084
Protective film	1	950	0,01	1,2	0,012
Film underfloor heating	1	1200	0,012	1,2	0,014
Reflective layer (underlay)	3	50	0,002	1,2	0,002
Cement screed	50	2000	1,00	1,3	1,30
Reinforced concrete slab	220	2500	5,50	1,1	6,05
Total permanent loads			**6,59**		**7,46**
Variable load					
Live load (public areas, halls, corridors)	–	–	1,50	1,2	1,80
Total design load			**8,09**		**9,26**

The façade composition follows a clear modular organization: horizontal bands correspond to the building's floor levels, emphasizing its functional structure. Within each level, vertical profiles create an ordered yet non-monotonous rhythm, giving the façade dynamism and visual diversity.

Thanks to the inclined glazing planes, the façade actively interacts with the surrounding environment. Glass surfaces reflect the sky, light, and adjacent buildings in different ways, changing their appearance depending on the viewing angle and time of day. This ensures a constantly shifting visual perception of the building and enhances its modern architectural image.

To protect the underground parts of the building from moisture, a комплекс of waterproofing measures is provided, as well as the installation of a perimeter apron (blind area) around the building with a slope away from the walls, made of layers of dense materials (stone, sand, asphalt, or clay), preventing the penetration of surface water.

4.2. Fire Protection of the Building

Ensuring fire safety in a modern office center in the city of Marrakesh is based on a comprehensive approach that includes architectural, planning, structural, and engineering solutions. All measures are developed in accordance with current Moroccan regulations (in particular the requirements of the Règlement de Sécurité Incendie, provisions of the Maroc Building Code, and Eurocode recommendations) [34; 35], taking into account climatic factors, dense urban development, and principles of sustainable development. Such an approach makes it possible not only to guarantee safety but also to ensure the durability and adaptability of the building to local operating conditions.

The structural scheme of the building is oriented toward the maximum fire resistance of its main elements. Load-bearing structures are made of monolithic reinforced concrete capable of maintaining its properties under fire conditions for a long period of time (fire resistance level not lower than REI 120). Floor slabs are designed as monolithic structures with increased fire resistance (REI 90 – 120). Internal walls and partitions are made of non-combustible materials such as brick or concrete blocks, and their connection joints are sealed with special fire-resistant compounds that prevent the penetration of smoke and flame. Vertical communications – staircases and elevator shafts – are isolated by structures with an increased fire resistance rating and form a safe core of the building.

Considering the climatic specifics of Morocco, the behavior of materials under high temperatures is also taken into account when selecting them. In addition to modern non-combustible insulation materials, traditional local materials may be used – stone, adobe blocks, and mineral plasters such as tadelakt – which have natural fire

resistance and contribute to increasing the thermal inertia of the building envelope. Decorative wooden elements characteristic of Moroccan architecture (in particular mashrabiya screens) are treated with fire-retardant compounds.

The planning organization of the building provides clear spatial zoning with division into fire compartments that limit the spread of fire. Special attention is paid to evacuation routes: they are designed to be short, logically understandable, and sufficiently wide (not less than 1.2 m), with direct access to smoke-free staircases. To increase safety, such staircases are equipped with air pressurization systems that prevent smoke penetration. Emergency exits are fitted with doors with panic hardware, as well as emergency lighting and visual navigation systems.

Engineering fire protection includes modern early fire detection systems – automatic fire alarm systems with smoke and heat sensors. The notification system ensures timely communication of danger to occupants and coordinates the evacuation process. In public and office areas, the installation of automatic fire suppression systems (in particular sprinkler systems) is provided, as well as an internal fire water supply system with hydrants.

To limit the spread of combustion products, integrated smoke control solutions are applied. Ventilation systems are equipped with fire dampers that automatically close in the event of a fire, and doors between functional zones are designed with appropriate fire resistance ratings. All engineering networks are installed using fire-resistant materials, and their penetration points through structures are carefully sealed.

Modern office centers in Marrakesh also integrate intelligent building management systems that combine fire alarm systems, ventilation, and smoke extraction into a single automated network. In addition, site landscaping is taken into account: open spaces with non-combustible surfaces are arranged around the building, access for fire-fighting vehicles is ensured, and a reliable external water supply for fire suppression is organized.

Thus, the combination of well-considered planning solutions, reliable structural systems, effective engineering systems, and the use of both modern and traditional Moroccan materials allows achieving a high level of fire safety. This complies with

current requirements for office architecture and ensures the safe operation of buildings in the specific conditions of the city of Marrakesh.

Conclusions to section 4

1. Thus, the adopted architectural and structural solutions for the above-ground part of the building combine modern engineering technologies with consideration of the natural-climatic and regional characteristics of Morocco. The use of a monolithic reinforced concrete frame ensures the reliability, spatial rigidity, and seismic resistance of the structure, while the application of traditional local materials contributes to improved thermal performance and the formation of a comfortable microclimate.

The design of the enclosing structures, façade solutions, and engineering systems is oriented toward increasing the building's energy efficiency, protection against overheating, and long-term durability in operation. At the same time, the architectural image, formed through a dynamic glass façade and the use of local decorative motifs, corresponds to modern trends in office center design and reflects regional identity.

2. Thus, the proposed solutions ensure the functionality, safety, and architectural expressiveness of the building, which is essential for the formation of a modern office environment in the context of Morocco.

The proposed fire protection system of the office center is comprehensive and complies with modern safety requirements, taking into account the specifics of the city of Marrakesh. The combination of effective planning solutions, fire-resistant structures, and modern engineering systems provides reliable protection of the building against fire risks and creates safe conditions for occupants.

The use of both innovative technologies and traditional Moroccan materials with appropriate properties makes it possible to increase the overall level of safety and adaptability of the building to local climatic conditions. As a result, a resilient, functionally well-considered, and safe architectural structure is formed, meeting modern standards for the design of office centers.

SECTION 5. OCCUPATIONAL HEALTH AND SAFETY

5.1. Regulation of occupational health and safety issues at the legislative level

Occupational safety issues are regulated at both the international and national levels. At the international level, the approaches of the International Labour Organization form the basis. These documents enshrine the idea that occupational safety should be ensured systemically: risks are first identified, then eliminated or minimized, and only then are additional protective measures applied. At the same time, much attention is paid to prevention – hazards must be considered even before the building is occupied. Modern regulations also emphasize that working conditions include not only physical safety but also environmental parameters such as air, lighting, temperature, and noise levels.

Similar principles are enshrined in international standards such as ISO 45001. Here, occupational safety is viewed as a continuous management process that requires constant analysis and improvement of conditions. For office buildings, this means the need for regular monitoring of the microclimate, ventilation, and other factors affecting employee comfort.

Moroccan occupational safety legislation is largely based on these same basic principles, but implements them through national regulations, primarily labor law and building codes. Unlike international documents, which set a general approach, national legislation more specifically regulates working conditions, including requirements for premises, ventilation, lighting, and the safe operation of buildings.

The difference lies in the level of detail and the consideration of local conditions. In Morocco, particular attention is paid to climatic factors. High temperatures make ventilation, cooling, and sun protection not simply a matter of comfort, but an element of occupational safety. This means that architectural solutions – such as shading, the use of patios, or limiting overheating – become part of ensuring safe working conditions, even if not directly specified in international documents.

In Morocco, the fundamental document is the Moroccan Labor Code. It enshrines the employer's obligation to provide safe and healthy working conditions. The code specifies requirements for workspaces, including ventilation, lighting, sanitary conditions, and worker protection from harmful factors. Unlike international documents, the standards here are more specific and mandatory, making them directly applicable to the design and operation of office buildings. Building and sanitary regulations, such as the Moroccan General Building Regulation, also play an important role. These documents establish requirements for building parameters, such as lighting, air exchange, structural safety, and evacuation. For office buildings, this means that many occupational safety aspects are effectively implemented through architecture – room dimensions, window placement, and utility system organization.

Also noteworthy are regulations governing energy efficiency and thermal comfort, such as the Moroccan Thermal Regulations for Buildings. Although these documents are aimed at reducing energy consumption, they are directly related to occupational safety, as they regulate indoor temperature conditions. In Morocco's hot climate, this is critical: overheating can negatively impact employee health and performance.

Comparing these documents with international approaches, it can be noted that international standards focus more on management systems and risk assessment, while Moroccan legislation emphasizes compliance with specific requirements. This means that in Morocco, safety is often ensured through compliance with established regulations, whereas international standards require a more flexible and analytical approach.

At the same time, there is no contradiction between these systems. National standards establish a basic level of safety, while international approaches allow for its development and adaptation to modern requirements, particularly in complex and technologically advanced office buildings.

However, a convergence of approaches is observed. Modern office buildings in Morocco are increasingly being designed with international requirements in mind,

especially when they cater to international companies. This leads to the implementation of a more systematic approach to occupational safety, including risk assessment and monitoring of indoor environmental parameters.

Thus, a comparative analysis shows that international legislation sets general principles and direction for development, while Moroccan legislation adapts these principles to local conditions. This is important for the thesis topic, as it demonstrates that the architecture of office buildings in Morocco is shaped not only by climate and traditions, but also by occupational safety requirements, which combine global and regional approaches.

5.2. Identification of potential hazards in relation to the thesis object

An analysis of hazards for office workers in Morocco should be considered taking into account two groups of factors: those common to all modern offices and those specific to the climate, urban environment, and building operation in the country. In such buildings, the risks are often cumulative rather than acute, but their impact on health and productivity can be significant.

One key issue is air quality. In hot climates, office buildings in Morocco are often heavily sealed and rely heavily on air conditioning. If ventilation is ineffective or improperly maintained, carbon dioxide, dust, and outdoor pollutants can accumulate indoors. In large cities such as Casablanca, these factors are compounded by the effects of urban traffic and dust. The result is a feeling of stuffiness, headaches, and decreased concentration. Long-term exposure can worsen overall health.

Temperature also plays a significant role. Outdoor temperatures can be very high, so cooling is often used indoors. However, sudden temperature changes between outside and indoors create additional stress on the body. In some cases, rooms can become overcooled, especially when air conditioning systems operate unevenly. This leads to discomfort, colds, and decreased productivity.

Lighting is also an important factor. Morocco has high solar radiation, so buildings are often protected from direct sunlight by façade elements and shading. If these solutions are implemented incorrectly, spaces may lack natural light. Combined

with artificial lighting, this strains eyesight and causes fatigue. This is especially noticeable in deep office spaces.

Noise. Modern offices often feature open floor plans. Conversations, technology, and phone calls create a constant background noise. In densely populated areas and busy urban environments, external noise from the street can add to this. Constant sound exposure impairs concentration and increases stress levels.

Physical risks in offices are less pronounced, but they are present. Slippery surfaces, especially when exposed to sand or moisture from the street, can lead to falls. Uncomfortable staircases, overcrowded elevators, or poorly organized circulation within the building also pose a risk of injury. In high-traffic environments, such situations can be more frequent.

Prolonged sitting and computer work pose a separate risk. Poorly designed workstations, lack of movement, and repetitive postures lead to spinal, muscular, and vision problems. These problems develop gradually but affect a significant number of workers.

Psychological factors also play a significant role. High workspace density, limited personal space, and constant noise create a stressful environment. In hot climates and with insufficient natural light, this can increase fatigue and irritability. As a result, work efficiency decreases and the risk of burnout increases.

Risks associated with utility systems should also be considered. In Moroccan office centers, air conditioning and power supply systems are crucial. Their failure can quickly lead to deterioration of conditions within the building, especially during hot periods. Power outages are also possible, affecting lighting, elevators, and security systems.

Emergencies, such as fires, should not be ruled out. In densely populated areas with large numbers of people, it is important that evacuation routes are clear and accessible. Poorly organized spaces can make even a routine situation dangerous.

Overall, hazards in Moroccan office buildings are influenced by climate, the urban environment, and the building's operational characteristics. These hazards are

rarely acute, but prolonged exposure can significantly impact the health and well-being of workers.

5.3. Study of the risk of realization of potential dangers at the thesis object and development of measures for their prevention

Risk assessment plays a central role in ensuring workplace safety because it enables early identification of where problems arise and how they can be prevented. Without this step, occupational safety becomes a formality: measures are taken after the fact, not before. In today's environment, especially in office buildings, where many hazards are not immediately obvious, risk assessment is becoming a key safety management tool.

The essence of risk assessment is to translate a general understanding of hazards into concrete solutions. For example, it's not enough to know that a room may have poor air quality or high noise levels. It's necessary to determine where exactly these hazards occur, how severe they are, and how they affect workers. Only then can the necessary measures be determined.

The first stage is hazard identification. This involves analyzing all possible factors: from air quality and lighting to workplace organization and the movement of people within the building. It's important to consider both obvious and less obvious risks that develop over time.

Next, a risk assessment is performed. This determines the likelihood of a given situation occurring and the severity of its consequences. For example, short-term discomfort and long-term health impacts have different levels of significance. This allows for prioritization.

The next step is selecting risk mitigation measures. Preference is given to solutions that address the problem at the environmental level, rather than simply protecting the individual. In the context of office buildings, this could involve changing the layout, improving ventilation, or reducing noise through architectural design.

After this, it's important to implement the selected measures and ensure their effectiveness. It's not enough to simply envisage solutions; their effectiveness must be monitored during the building's operation.

The final step is regular risk assessment. Working conditions change, buildings are modernized, and the number of people and the nature of their activities change. Therefore, risk assessments should not be conducted once but continually updated.

Risk assessments link hazard analysis and practical safety measures. They not only identify problems but also substantiate solutions that improve occupational safety. In modern office buildings, where environmental conditions are of great importance, this process becomes especially important, as it ensures the transition from formal compliance with regulations to the creation of a truly safe and comfortable workspace.

In the process of risk analysis, an expert point scale will be used. The risk R is determined by the formula:

$$R = P_a \cdot Q$$

where P_a – is the probability of hazard realization;

Q – is the severity of the consequences.

Recommendations for Moroccan office buildings should consider not only general office risks but also the hot climate, dusty urban environment, and the high load on utility systems. The primary goal is to create conditions that allow people to work for long periods without overexertion or harm to their health.

It's essential to ensure stable air quality. In buildings with air conditioning, it's important not only to cool the air but also to ensure a full supply of fresh air. Ventilation systems should be regularly maintained, and filters should be cleaned or replaced, especially in cities with high dust levels. It's advisable to provide ventilation or localized adjustments to avoid feeling stuffy.

Temperature control should be carefully adjusted. In hot climates, it's tempting to over-cool rooms, but sudden changes between the outdoors and the office put stress on the body. Maintaining a moderate temperature and uniform cooling without drafts

is more appropriate. It's also important to avoid situations where temperatures vary greatly in different areas of the building.

Table 5.1 – The results of risk assessment

Hazard	P_a	Q	R
Air quality	7	6	42
Temperature	7	7	49
Lighting	6	7	42
Noise	5	6	30
Physical risks	6	5	30
Prolonged sitting and computer work pose	8	6	48
Psychological factors	7	6	42
Risks associated with utility systems	5	5	25
Fires	4	8	32

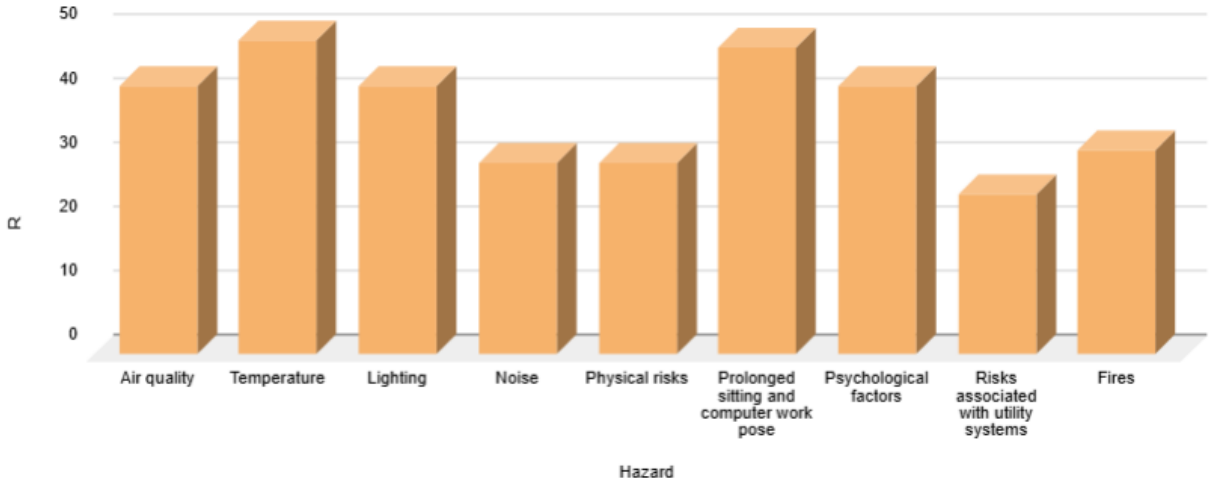

Figure 5.1. *The graphics of risk assessment*

Lighting should be designed to accommodate strong solar radiation. It's important to protect spaces from direct sunlight using façade elements, while still maintaining sufficient natural light. Workstations should be positioned so that the

light is diffused and glare-free. Artificial lighting should complement natural light, not completely replace it.

To reduce noise, it's important to carefully zone the space. Open offices should ideally be divided into areas with different levels of activity. Sound-absorbing materials, partitions, and ceiling solutions should be used. It's also helpful to provide quiet zones where people can concentrate without distractions.

Workstations should be comfortable and adjustable. Desks, chairs, and equipment should allow for flexible postures to avoid constant strain. It's important to encourage breaks and movement, especially when working for long periods at a computer.

Navigation within the building should be safe and intuitive. Floors should not be slippery, especially if sand or moisture gets in from outside. Stairs and corridors should be convenient and free of unnecessary obstacles. Elevators should be able to handle the load to avoid crowding. Special attention should be paid to psychological comfort. Areas for rest, informal communication, and short-term recovery should be provided. This reduces stress levels and improves the overall well-being of employees. It is also important to avoid excessively dense workstations.

Engineering systems require constant monitoring. Air conditioning, power supply, and other systems must operate reliably, especially during hot periods. It is advisable to provide backup solutions in case of failures to prevent a sudden deterioration in conditions inside the building.

5.4. Safety in Emergency Situations

In Moroccan office buildings, the high density of people and the hot climate make emergency situations potentially serious.

Fires and smoke. Fires are most often caused by electrical overloads, faulty equipment, or improper operation of equipment. In hot climates, equipment operates under increased load, increasing the risk of overheating. The danger is further exacerbated by the rapid spread of smoke throughout enclosed office spaces.

To reduce the risk, it is important to use properly functioning equipment, avoid overloading outlets, and regularly check electrical systems. The building must be equipped with a fire alarm and automatic extinguishing system. Evacuation routes must be clearly visible and always clear. Employees must know what to do in the event of a fire and the location of exits.

Power outages. Power outages can cause elevators to stop, and lighting and ventilation to fail. In hot climates, this is especially critical, as spaces heat up quickly, affecting occupants' well-being. To prevent potential consequences, it is necessary to provide backup power for key systems: lighting, elevators, ventilation, and security systems. Emergency lighting and clear instructions for workers are essential. Personnel must know what to do in the event of a power outage, especially if they are in an elevator or confined space.

Failure of Air Conditioning and Ventilation Systems. In Morocco, cooling systems are critical. Their failure can quickly lead to overheating of premises, deterioration of air quality, and decreased functionality.

To reduce the risk, it is necessary to regularly maintain equipment, clean filters, and monitor system operation. It is advisable to provide backup solutions or partial ventilation options. It is also important to have a plan for system failure, including temporarily restricting the use of premises.

Intense Heat and Heat Stress. Even with air conditioning, high outdoor temperatures affect indoor conditions. Overheating can lead to poor health, dehydration, and decreased concentration.

It is important to use architectural measures such as shading facades, reducing overheating, and oriented buildings appropriately. Maintain a comfortable temperature inside, provide access to water, and avoid sudden temperature changes. Crowds and evacuation problems. Business centers accommodate large numbers of people at any one time. In the event of an accident, this can lead to congestion, panic, and injuries.

To prevent this, it's important to properly calculate the width of passageways and the number of exits. Evacuation routes must be clear and well-marked. Regular training and drills are essential to ensure people know how to act safely.

Falls and injuries inside the building. In Moroccan conditions, sand and dust can fall onto floors, increasing the risk of slipping. Spilled water, cables, and awkward staircases are also dangerous.

To reduce this risk, it's necessary to use non-slip surfaces, regularly clean the premises, and properly manage cable systems. Stairs should have handrails and adequate lighting.

Failures in utility and smart systems. Modern office centers rely on automated systems. Their failures can disrupt ventilation, lighting, or security systems.

It's important to provide backup control modes and regular maintenance. Staff must be able to quickly switch to manual control if necessary.

Conclusions to section 5

Occupational safety and health plays a fundamental role in creating a safe and sustainable work environment. It determines not only protection from direct threats but also the conditions in which people spend a significant portion of their time. In modern office buildings, its importance extends beyond injury prevention to include maintaining health, productivity, and overall comfort.

It is particularly important that many safety factors are considered at the design stage. Layout, access to light, ventilation, and microclimate directly impact occupants' well-being. If these aspects are not considered upfront, they are difficult to address later. Therefore, occupational safety and health effectively sets benchmarks for architectural solutions and becomes one of the criteria for evaluating their effectiveness.

In the Moroccan context, its role is enhanced by the climate. High temperatures, solar activity, and a dusty urban environment make microclimate, ventilation, and heat protection particularly significant. Here, occupational safety and health are directly linked to the architectural adaptation of buildings to the climate. Solutions

aimed at reducing heat loads and improving air quality become not only elements of comfort but also essential safety conditions.

It's also important to consider the specific operating conditions of buildings. In Morocco, the high load on air conditioning and power supply systems makes their reliability critical. Any failures can quickly lead to a deterioration in indoor conditions, so occupational safety and health includes not only design measures but also organizational ones, such as system maintenance, operational monitoring, and emergency preparedness.

Thus, occupational safety and health generally acts as a systemic tool for ensuring safety and environmental quality, and in Morocco, it takes on additional significance due to the impact of climate and the urban environment.

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