O.M. Beketov National University of Urban Economy
in Kharkiv
(full name of university)

School of Architecture, Urban Planning and Design

(full name of institure or faculty)
department of Architecture of buildings and constructions
(full name of the department)

Explanatory note

for the diploma project (work)

Bachelor
(educational scientific level)

on the topic of:
«OFFICE CENTER IN MOROCCO (MARRAKESH)»

Completed by: student of the 4th year,
group **A 2021-5a**
branch of knowledge (specialty)
19 Architecture and construction
(code and name of branch of knowledge, specialty)
191 Architecture and Town Planning
(code and name of branch of knowledge, specialty)
EP Architecture
(code and name of branch of knowledge, specialty
Daanouni Bilal
(last name and initials)
Supervisor PhD, assist. prof. Kononenko H.Y.
(last name and initials)
Reviewer PhD, senior lecturer Borysenko A.S.
(last name and initials)

Kharkiv – O.M. Beketov NUUE in Kharkiv – 2026

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

Educational and scientific institute School of Architecture, Urban Planning and Design

Department Architecture of buildings and constructions

Educational and scientific level **Bachelor**
Educational program **Architecture**
(code and name)
Specialty **191 Architecture and town planning**
(code and name)

APPROVED
Head of ABaS department
Smirnova O.V.

December 2, 2025

T A S K

FOR THE STUDENT'S DIPLOMA PROJECT (WORK)

Daanouni Bilal
(full name of the student)

1. Topic of the project (work) «Office Center in Morocco (Marrakesh)»
supervisor(s) of the project (work): Kononenko H.Y., Associate Professor, PhD

approved by order of higher educational institution № 165-03, issued on **December 2, 2025**

2. The deadline for student submission of the project (work) **February 25, 2026**

3. Initial data for the project (work): diploma design task, results of the computer pre-diploma practice, topographic maps of territory, analytical studies (analysis of analogues of the design object), grapho-analytical materials

4. Contents of the explanatory note (list of questions to be developed): CHAPTER 1. «ANALYSIS OF ANALOGUES OF THE OFFICE CENTER», CHAPTER 2. «ARCHITECTURAL PLANNING AND SPATIAL SOLUTION OF THE OFFICE CENTER», CHAPTER 3.«TECHNICAL AND ECONOMIC INDICATORS OF THE OFFICE CENTER», CHAPTER 4. «LABOR SAFETY»

5. A list of graphic materials (with exact indications of mandatory drawings): Schemes of urban planning analysis of the site for design, reference plan (S 1:500), master plan (S 1:500), floor plans of the architectural object (S 1:200), elevations S (1:200), section (S 1:200), 3D spatial model of the architectural model, perspective projections of the building.

6. Consultants of chapters of the project (work)

Chapte r	Прізвище, ініціали та посада консультанта	Підпис, дата	
		завдання видав	завдання прийняв
1-2	Kononenko H.Y.., PhD, Assoc.Prof. of ABaS department		
3	Kononenko H.Y.., PhD, Assoc.Prof. of ABaS department. Constructions section		
4	Seryogina D.O., lecturer of the department of EaM		
5	Viktoriia Malysheva. PhD, Occupational and Life Safety Department		

7. Date of issuance of the task **December 2, 2025**

CALENDAR PLAN

№	Name of stages of the diploma project (work)	Term of completion of stages of the project (work)	**Note**
1	Determining the topic of the diploma project, justifyingthe choice of the chosen object. Introduction	December 2025	Done
2	Analysis of analogues of the selected design object. Information collection and analysis	December 2025	Done
3	Urban planning analysis of the project area (analytical schemes, reference plan, master plan)	December 2025	Done
4	Architectural and planning solution of the selected design object (graphic design of plans, facades, section)	January 2026	Done
5	Volume-spatial solution of the selected design object (graphic design of perspective projections, 3-D models, perspective angles)	January 2026	Done Done
6	Development of an explanatory note (chapter 1)	January 2026	Done
7	Development of an explanatory note (chapter 2)	January 2026	Done
8	Completing the tasks of adjacent chapters of diploma projects (chapters 3-4)	January 2026	Done Done
9	Completion of the explanatory note (all chapters of the work) - check for plagiarism	February 2026	Done
9	General exposition of graphic material	February 2026	Done
10	Defense of the qualification work	February 2026	Done

Student ____________ Daanouni Bilal
(sign) (last name and initials)

Supervisor of the project (work) ____________ Kononenko H.Y.
(sign) (last name and initials)

CONTENT

INTRODUCTION

The architecture of modern cities is shaped by rapid socio-economic changes, the development of global communications, and increasing population mobility. In this context, particular attention is given to creating environments that ensure the efficient functioning of business activities while meeting the requirements of sustainable urban development. One of the key elements of such infrastructure is office centers, which not only serve utilitarian functions but also significantly influence the spatial organization of the city, its architectural appearance, and the level of social activity.

Contemporary office buildings are increasingly designed as complex, multifunctional facilities that combine workspaces, communication areas, public zones, and recreational elements. This approach aims to create a comfortable and flexible environment capable of adapting to the changing needs of users and new formats of work organization. Consequently, architectural design of office centers requires a comprehensive analysis of functional, urban, climatic, and cultural factors.

Designing office buildings in regions with a strong historical and cultural identity, as well as unique natural conditions, presents both challenges and professional interest. One such example is the city of Marrakech – a major administrative, tourist, and economic center of the Kingdom of Morocco. Over the past decades, the city has experienced active development, accompanied by growing business activity, expanding services, and attracting international investments. As a result, there is an increasing demand for modern office spaces that meet the requirements of a global business environment.

At the same time, Marrakech is a city with a rich architectural heritage shaped over centuries. Traditional Moroccan architecture is characterized by climate adaptability, the use of local materials, the presence of inner courtyards, shaded passages, and decorative elements. All of these features must be considered when designing new buildings to ensure harmonious coexistence between modern developments and the historic urban fabric.

Another critical factor is the city’s natural and climatic context. Marrakech experiences high temperatures during summer, intense solar radiation, and limited water resources. This necessitates architectural solutions aimed at reducing heat loads, optimizing the indoor microclimate, and minimizing the building's energy consumption. Therefore, an office center must be not only functionally efficient but also environmentally sustainable.

The relevance of this bachelor's thesis is determined by current trends in the development of Marrakech as a regional and international business hub. Increasing economic activity and the city's integration into global business processes drive a growing demand for high-quality office spaces that meet modern standards of comfort, safety, and technological equipment.

At the same time, designing office buildings in Marrakech involves several challenges, including the need to address complex climatic conditions and preserve the cultural identity of the urban environment. In this context, implementing sustainable development principles – such as rational use of energy resources, passive cooling strategies, and environmentally safe materials – becomes especially important.

Moreover, the study is relevant due to the necessity of developing a contemporary architectural language that integrates traditional Moroccan architectural motifs with innovative design approaches. This synthesis allows the creation of a facility that not only meets functional requirements but also contributes to preserving the city's unique architectural character.

The aim of this bachelor's thesis is to develop a concept and architectural-planning as well as volumetric-spatial solution for an office center in Marrakech, taking into account climatic conditions, urban environment features, functional user needs, and principles of environmentally oriented design.

To achieve this aim, the following main tasks are proposed within the scope of the bachelor's work:

– nalyze the climatic characteristics of the region and determine their influence on the architectural solutions of the office building;

– examine the urban context of the project site, including the nature of existing development and spatial connections;

– study domestic and international experience in designing office centers under similar climatic conditions;

– develop the functional structure of the office center according to modern requirements for workplace organization;

– design the volumetric-spatial and artistic-architectural solution of the building while respecting local traditions;

– justify the choice of structural, engineering, and material solutions from the perspective of energy efficiency and sustainable development;

– propose principles for landscaping the adjacent territory and integrating the facility into the urban environment.

1. GLOBAL EXPERIENCE IN DESIGNING BUILDINGS OF THE SELECTED TYPOLOGY: PROTOTYPE ANALYSIS

Buildings, regardless of their functional purpose, can acquire the status of architecturally significant landmarks and become visually dominant elements within the urban fabric. Being present in such spaces and carrying out daily professional activities fosters a positive emotional perception of the work process. By combining original architectural solutions with contemporary design approaches, a comfortable environment is created that not only provides convenient working conditions but also stimulates employee efficiency and creative potential.

1.1. Spiral Tower in Panama – F&F Tower / Revolution Tower (El Tornillo)

The F&F Spiral Tower, unofficially known as El Tornillo («The Screw»), occupies a distinctive place among the modern high-rise developments of Panama City. The building is situated in one of the city's key business districts – Calle 50 – and functions primarily as an office complex. Its unique appearance is defined by an unconventional spatial composition, which distinguishes the tower from the surrounding buildings and establishes it as a prominent feature in the city skyline [1].

The architectural concept is based on the principle of sequential rotation of floors around a central vertical axis. Each level of the building is shifted relative to the previous one by a specific angle, forming a helical volumetric configuration. This approach imparts a sense of dynamism and spatial fluidity to the structure, creating a striking contrast with traditional rectilinear skyscrapers.

The twisted geometry serves not only an aesthetic purpose but also directly influences the organization of the interior spaces, providing a variety of visual connections and panoramic views from office areas. As a result, the façades avoid monotony, and the building acquires a distinct individual character. The architectural style of the tower leans toward modern expressive forms, where volume and plasticity become the primary means of artistic expression (pic. 1.1).

Picture 1.1. Spiral Tower in Panama

The exterior enclosing structures are composed of glass and metal, which visually lightens the mass of the building while emphasizing its verticality. Extensive glazing allows natural light to penetrate deep into the interiors, while the reflective properties of the façades create a changing perception of the building depending on weather conditions and time of day.

The floor plans are based on a centralized layout scheme. The plan geometry approaches a circular or sectoral configuration, with all levels organized around a central core. Within this core are concentrated elevator shafts, stairwells, engineering systems, and auxiliary spaces.

Around the perimeter of the core is an open office area, which does not have rigidly fixed internal partitions. This organization allows the layout to be easily reconfigured according to user needs and aligns with modern standards for premium office buildings.

The tower’s structural system is based on a monolithic reinforced concrete core, which provides overall spatial rigidity. This element carries the primary vertical loads and resists horizontal forces, including wind and seismic impacts, which is critically important for high-rise structures in tropical climates.

The interfloor slabs are made of monolithic reinforced concrete and operate in a cantilevered manner, supported by the central core. This structural scheme allows each floor to rotate without compromising the overall stability of the building. As a result, the complex spatial form is achieved without employing overly complicated structural solutions.

The foundations of the building are designed considering the significant height of the tower and the geotechnical conditions of the site. A deep foundation or pile system is likely used to ensure reliable transfer of loads to the soil base.

The twisted volumetric configuration positively affects the aerodynamic performance of the structure, reducing wind pressure intensity on the façade surfaces. Glass enclosures are combined with sun-shading elements and modern engineering systems aimed at optimizing the interior microclimate and reducing thermal loads in the hot climate conditions of Panama.

1.2. AEME Office Building with Underground Parking, Guatemala

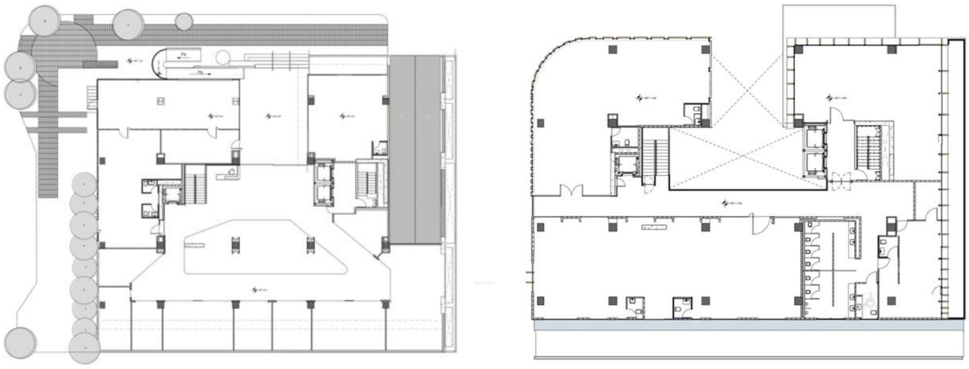
The AEME office building, located within the urban fabric of Guatemala City, exemplifies a modern approach to designing multifunctional commercial architecture. The building integrates office spaces, public areas, and an underground infrastructure for vehicle storage into a cohesive spatial system, meeting the requirements of dense urban development [2].

The design is based on the concept of vertical zoning, where each level performs a clearly defined function. The lower floors are oriented toward active interaction with the urban environment and include commercial and service spaces. Above these, office floors are designed with flexible layouts, allowing interior spaces to be adapted according to tenant needs.

A key element of the internal organization is the multi-story atrium, which forms the compositional axis of the building. It provides visual connectivity between levels and facilitates natural light penetration deep into the structure, enhancing user comfort and reducing reliance on artificial lighting.

The interior space is characterized by openness and clear circulation logic. Vertical transportation, including elevators and staircases, is integrated into the atrium, becoming part of the interior architectural composition. This approach combines functionality with a striking spatial experience.

Office floors feature predominantly open-plan layouts, allowing the space to be adapted for various work formats – from open offices to private offices. This makes the building highly versatile in terms of usage (pic. 1.2).



Picture 1.2. Plans

The exterior appearance of the AEME building is based on a combination of restrained geometry and a rhythmic composition of façade elements. The architectural language of the structure is built on the alternation of transparent and solid planes, creating a dynamic visual effect that changes the perception of the building depending on the viewing angle and lighting conditions.

The glass surfaces provide ample natural light for the office interiors, while the opaque façade elements serve as visual accents and sun-shading devices. This balance between openness and enclosure contributes to the building’s energy efficiency and emphasizes its contemporary character (pic. 1.3).

Picture 1.3. Exterior Appearance of AEME – Section View

An important component of the project is the underground parking, located across multiple levels below ground. It offers convenient access for office and commercial users while reducing the load on adjacent streets. The traffic flow logistics are organized so that vehicle movement does not intersect with the main pedestrian pathways.

The AEME building demonstrates a balanced approach to creating a modern office environment within a densely built urban context. Its combination of multifunctionality, thoughtful spatial organization, and expressive architectural language makes it a notable example of contemporary commercial architecture in Central America.

1.3. Regus Zenith Office Building, Casablanca

The Regus Zenith office building represents a modern business center designed for flexible workspace use in the densely built urban environment of Casablanca. The architectural design is characterized by restrained forms and functional efficiency, meeting the standards of international commercial real estate [3].

The building has a clear geometric form, close to a rectangular volume, with a rational width-to-height ratio. This configuration allows for efficient use of the plot area and facilitates optimal organization of interior spaces. The volume is perceived as a cohesive architectural element that integrates harmoniously into the business context of the Zenith district.

The façade composition emphasizes the horizontal division of floors, visually balancing the building's mass and making its scale legible within the urban environment. The architectural expression is not overloaded with decorative details; instead, emphasis is placed on proportions and the rhythm of window openings.

The Regus Zenith façades are composed using modern glazing systems alternating with solid panels. The extensive use of glass ensures ample natural lighting for office spaces, which is a key factor in creating a comfortable working environment (pic. 1.4).

The glass surfaces simultaneously serve as a visual link between the interior and the surrounding environment, reflecting nearby buildings and altering the perception of the structure depending on lighting conditions. The probable use of sun-protective or tinted glass helps reduce thermal loads in the hot climate of Morocco.

Picture 1.4. Exterior Appearance of Regus Zenith

The internal organization of the building is based on flexible office floor layouts. The planning scheme revolves around a central vertical circulation core, which houses elevators, staircases, and service shafts. Surrounding this core are workspaces of varying scales, from private offices to open co-working areas.

This approach allows the interior to be easily reconfigured without significant intervention in the building’s structural system, which is a key advantage for serviced office environments.

The building’s structural system is likely composed of a monolithic or monolithic-frame reinforced concrete frame, a typical solution for office buildings of this class. Load-bearing elements include columns and floor slabs, which enable flexible floor layouts. Vertical loads are transmitted through the frame to the foundations, while the building’s spatial rigidity is ensured by core structures and shear walls. This scheme efficiently resists both permanent and temporary loads, including wind forces.

The Regus Zenith office center in Casablanca exemplifies modern commercial architecture focused on functionality and spatial flexibility. The building features a restrained geometric form and a rational volumetric-spatial composition, compatible with the character of the surrounding commercial area. The façade design combines transparent and opaque elements, providing adequate daylighting and comfortable working conditions. The framed structural system allows for open-plan office floors and easy adaptation of spaces to different functional scenarios.

1.4. Galilée Office Center, Toulouse

The Galilée complex is a modern business center designed by the French architectural studio Studio Bellecour. The building is located in the Andromède district of Blagnac, near Toulouse, an area with high business and industrial activity. The location is closely linked to the aerospace sector, as it hosts several industry enterprises, including the main Airbus office, as well as key transport hubs, including the international airport.

The architectural composition consists of two separate blocks connected by a sculptural structure in the form of a curved white concrete wall. This element has a dynamic form combining horizontal and vertical directions and symbolically references an aircraft propeller, emphasizing the identity of the site and its industrial context. This structure defines the building's distinctive silhouette and gives it a unique architectural character (pic. 1.5).

Picture 1.5. Exterior Appearance of the Galilée Office Center in Toulouse

The total office space of the Galilée complex amounts to approximately 10,500 m², providing accommodation for around 700 employees. The interior layout is organized to ensure flexibility in planning and the ability to adapt to different work formats. The façade design incorporates sun-shading elements, which help reduce thermal load and improve the internal microclimate of the building.

The Galilée project was developed in accordance with sustainable development principles. The building integrates systems for the efficient use of energy and water, as well as solutions for effective waste management. This aligns with the environmental regulations of the Andromède district and minimizes the complex's ecological impact throughout its operational life.

A key engineering feature of the project is the curved concrete wall, constructed using prestressing technology with CCL systems. The wall, measuring 56 m in length and 12.1 m in height, contains approximately 530 m^3 of concrete. This technology allowed the overall wall thickness to be reduced by nearly half a meter while maintaining the required strength and stability. CCL XM20 anchoring systems were used during construction, and the prestressing process was completed within a short timeframe.

Construction works were carried out by CARI Sud-Ouest under the direction of the client, SCCV Les Alexandrins, while PCB was responsible for the technical execution of the prestressed reinforcement.

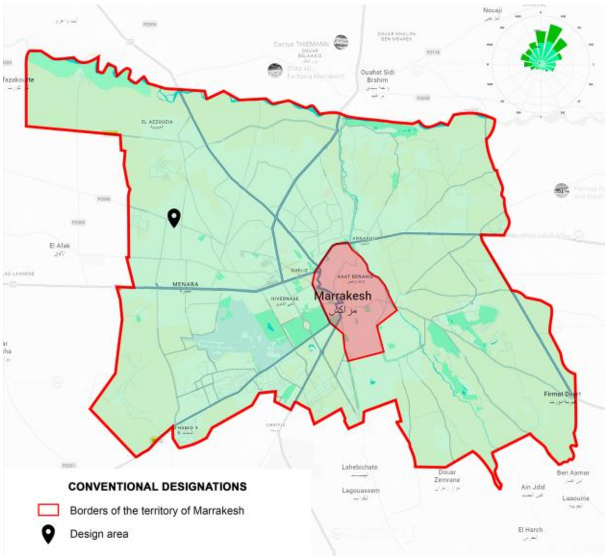
As a result, the Galilée office center stands as a successful example of integrating innovative structural solutions, contemporary architectural expression, and an environmentally conscious approach, making it a competitive and attractive workspace for companies in the Toulouse region.

2. ARCHITECTURAL AND SPATIAL DESIGN SOLUTION

2.1. Urban Analysis of the Project Site

The diploma project for an office building is being developed for the city of Marrakech, located within the Kingdom of Morocco and counted among the country's four imperial cities. Marrakech plays a significant role in shaping the historical, cultural, and economic development of the nation.

Geographically, the city is situated in the western part of Morocco, at the foothills of the High Atlas Mountains, at an elevation of approximately 450 meters above sea level. The distance from the capital, Rabat, is about 330 km, while the distance to the largest economic center, Casablanca, is roughly 240 km (pic. 2.1).



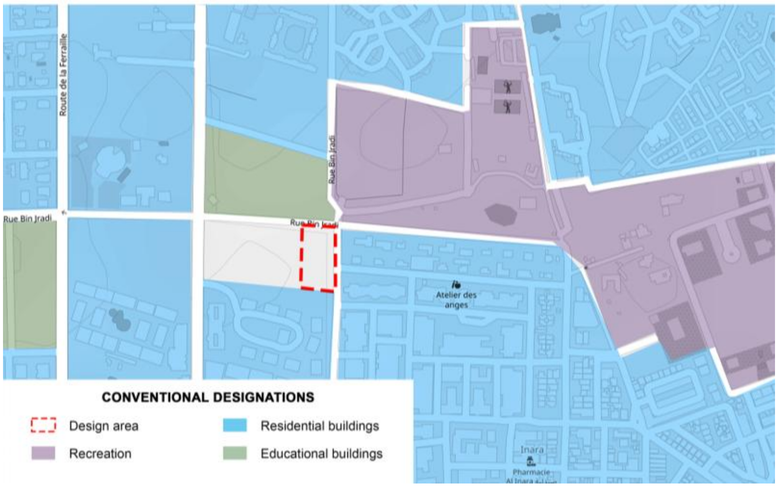
Picture 2.1. Scheme of the placement of the selected site for dessgn in the structure of the city of Marrakesh

The spatial image of Marrakech has been shaped by a combination of traditional urban planning approaches and contemporary processes of urban development. The city is distinguished by a rich architectural heritage, represented by religious buildings, palace complexes, historic gardens, and culturally significant sites. The planning core of the city is the medina – a historic district that emerged during the rule of the Berber dynasties and still retains its dense development, enclosed block structure, and system of defensive walls.

One of the main compositional landmarks of the urban space is the minaret of the Koutoubia Mosque, built in the 12th century in the Moorish style. Due to its dominant height and distinctive silhouette, it shapes the panorama of the historic center and serves as a spatial accent both within the medina and in the surrounding districts.

The natural and landscape environment of the city plays an important role in shaping architectural and planning solutions. To the southeast of Marrakech lies Jebel Toubkal, with an absolute elevation of about 3,240 meters, whose snow-capped peak creates a striking contrast with the city’s dry and hot climate. The combination of climatic, geographical, and cultural factors determines specific requirements for designing contemporary buildings within the urban environment.

The site chosen for the office building is located within an established urban area of Marrakech and has clearly defined boundaries determined by the existing street and road network. The plot is situated along Bin Jradi Street (Rue Bin Jradi), which is classified as a local urban street and provides direct pedestrian and vehicular access to the project site. The northern part of the site faces a recreational area with publicly accessible green spaces. The green zone positively influences the microclimate of the site and creates favorable conditions for the formation of open public spaces. Access to the recreational area is provided through a system of pedestrian connections integrated into the structure of adjacent streets and driveways branching off Rue Bin Jradi (pic. 2.2).



Picture 2.2. Scheme of the placement of the selected site for dessgn in the structure of the micpodistrict

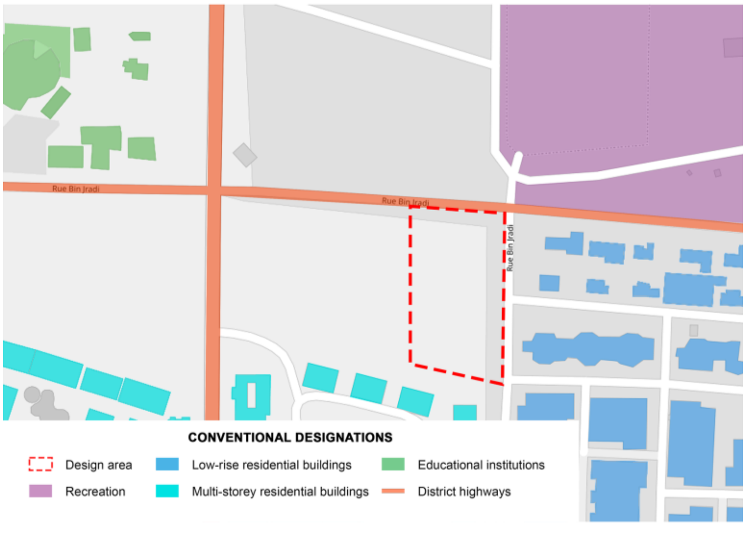
On the eastern side, the site borders blocks of multi-story residential development organized according to a regular planning scheme. The presence of residential buildings creates an active pedestrian environment and a stable flow of people throughout the day, which is an important factor for the functioning of the office facility.

The southern boundary of the site adjoins areas designated for public use, where educational and social institutions serving the adjacent residential neighborhoods are located. This functional environment reinforces the civic and business character of the area and promotes the formation of a multifunctional urban environment.

The western part of the surroundings is predominantly composed of low-rise residential buildings connected by local streets and internal driveways. This zone has a lower building density and provides a gradual transition from intensive traffic corridors to a more intimate residential environment.

The site's transport accessibility is determined by its proximity to major roads located a short distance from Rue Bin Jradi, which carry the main traffic flows of the district. These roads ensure efficient connections between the site and the business, residential, and public areas of Marrakech.

Pedestrian routes are organized along Rue Bin Jradi and adjacent local streets, providing convenient access to the office building from residential neighborhoods and public transport stops located within standard walking distance. The planning organization of movement supports the separation of pedestrian and vehicular flows, enhancing safety and comfort for users (pic. 2.3).



Picture 2.3. Scheme of functional organization and transport-pedestrian conntctions

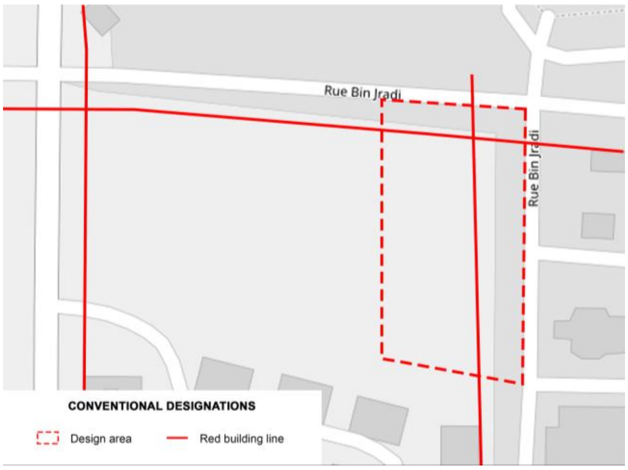
In summary, the project site along Rue Bin Jradi is characterized by a favorable urban location, a combination of residential, public, and recreational functions, as well as a well-developed system of transport and pedestrian connections. The combination of these factors creates favorable conditions for the placement of a modern office building, integrated into the existing urban fabric and oriented toward the needs of the district and the city as a whole.

2.2. Master Plan Solutions and Site Improvement

The site designated for development is situated within a flat landscape with minimal topographical variations, providing favorable conditions for the preparation of design documentation and construction work without the need for complex preparatory measures. The absence of significant elevation changes allows for convenient organization of transport and pedestrian connections and simplifies the engineering development of the site.

No objects of historical or cultural heritage or architectural monuments have been identified within the site or on the adjacent territory, eliminating the need for additional approvals or restrictions associated with preservation regulations. This allows the implementation of design solutions without complications arising from historical environment requirements.

The land plot has no existing permanent structures or engineering facilities, is free for development, and is predominantly covered with natural or partially landscaped surfaces. This condition allows for rational spatial organization and maximizes the effective use of the site's potential for the implementation of a new architectural concept (pic. 2.4).

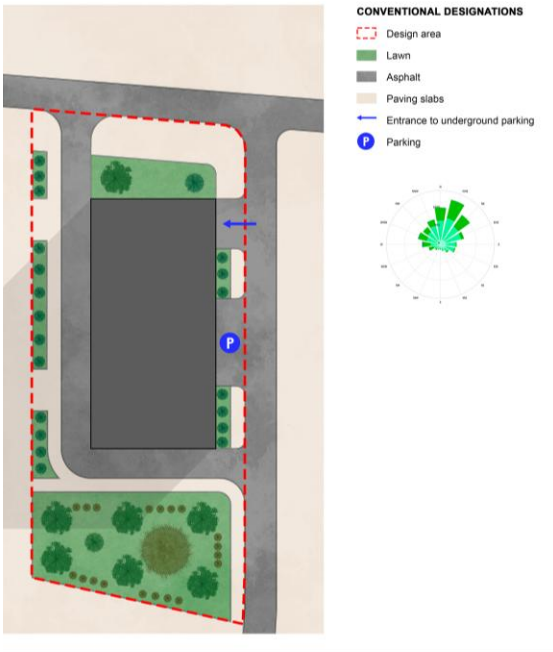


Picture 2.4. Basic plan

The project envisions the placement of an office complex on a site that is currently undeveloped and characterized by a flat terrain, suitable for construction and installation works without significant preparatory measures. The geomorphological conditions of the site facilitate rational planning of the buildings and the organization of the facility's transport services.

The master plan includes an open parking area for vehicles with convenient access from Rue Bin Jradi. Separate access routes are provided for fire-fighting equipment and service vehicles, ensuring the proper functioning of the complex. In particular, zones are organized for the loading and unloading of goods for cafés, as well as areas for the collection and subsequent removal of solid household waste. This planning solution allows for a clear separation of traffic flows and enhances safety within the site.

An important component of the project is the comprehensive improvement of the adjacent public space. The design envisages the maximum preservation of existing greenery, complemented by new elements of landscape design, including decorative shrubs, lawns, and small architectural features. Comfortable recreational areas are planned for employees and visitors, along with spaces for short-term rest and open areas for informal social interaction (pic. 2.5).



Picture 2.5 Master plan

Existing pedestrian connections will be modernized in accordance with the principles of universal design and accessibility: this includes lowered curbs, tactile paving elements, and convenient routes for people with reduced mobility. The site will also be equipped with a modern outdoor lighting system featuring energy-efficient fixtures, which will enhance safety during evening and nighttime hours.

The site’s engineering infrastructure includes a comprehensive set of measures aimed at the stable and safe operation of the facility. The territory is connected to the city's water supply and wastewater networks, with wastewater directed to local treatment facilities. The project also provides for a stormwater drainage system to ensure organized collection and removal of precipitation from roofs and hard surfaces, preventing flooding and maintaining proper sanitary conditions.

2.3. Architectural and Spatial Solution

The architectural and spatial concept of the office center is developed in accordance with current requirements for public and administrative buildings. The design takes into account existing building regulations regarding the rational functional division of spaces, the creation of an accessible environment for people with reduced mobility, fire safety, and the implementation of energy-efficient solutions.

In plan, the building has a clear rectangular configuration, which facilitates logical organization of the interior space, optimization of the structural scheme, and uniform natural lighting of work areas. The dimensions of the building along the outer coordination axes are 30.2 × 60.0 m, allowing for flexible office modules of varying sizes depending on tenant requirements.

The building consists of nine above-ground levels and two underground floors. The basement, with a floor-to-ceiling height of 3,2 m, is designed to accommodate car parking, engineering equipment, technical units, and auxiliary service rooms. This solution allows for efficient use of the site area and reduces the load of parking on the adjacent territory.

The typical floor height is 4,25 m, which meets regulatory requirements for administrative buildings with significant human traffic. These parameters provide adequate daylighting, ventilation, and acoustic comfort, while also allowing adaptation of spaces for different functional scenarios – from traditional office layouts to commercial or exhibition areas.

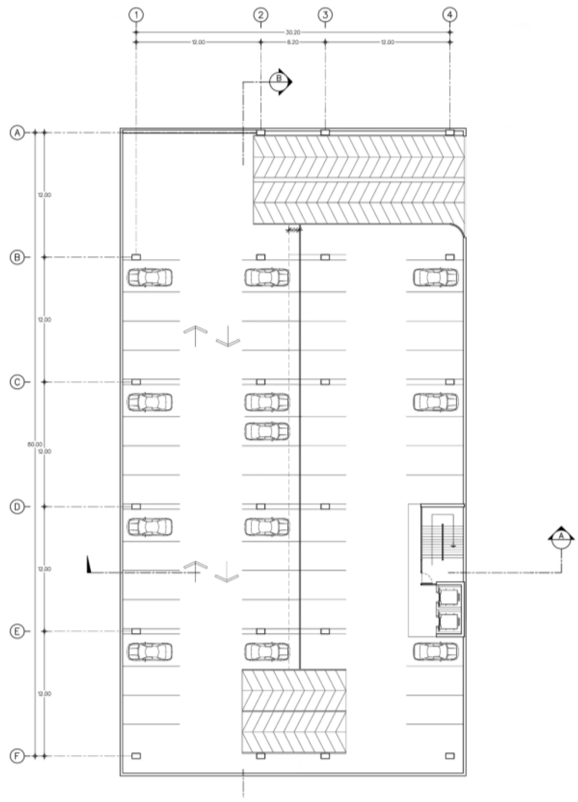
The building's maximum structural height reaches 44.0 m, creating a prominent silhouette in the urban environment and emphasizing its role as a dominant element of the development (pic. 2.6).

Picture 2.6. Overall View of the Hotel Complex

The volumetric-spatial concept of the building provides for a flexible organization of the interior environment, with the possibility of further transformation of spaces depending on changes in operational needs or functional purpose. The planning structure allows for the reconfiguration of office blocks without affecting the main load-bearing system, ensuring the long-term relevance of the facility and its adaptability to modern real estate market requirements.

An important element of the architectural solution is the rationally designed system of vertical connections. It includes passenger and service elevators, emergency stairwells, as well as engineering shafts for utility lines. This arrangement ensures convenient navigation between floors, efficient evacuation in case of emergencies, and uninterrupted operation of engineering networks.

The underground part of the complex is used to maximum functional effect. At the basement level, there is a parking area for employees and visitors, technical rooms for housing engineering equipment, ventilation chambers, and electrical switchboards. In addition, a separate room is provided for the security service, enabling access control, video surveillance, and monitoring of engineering systems, thereby enhancing the overall safety level of the facility (pic. 2.7).



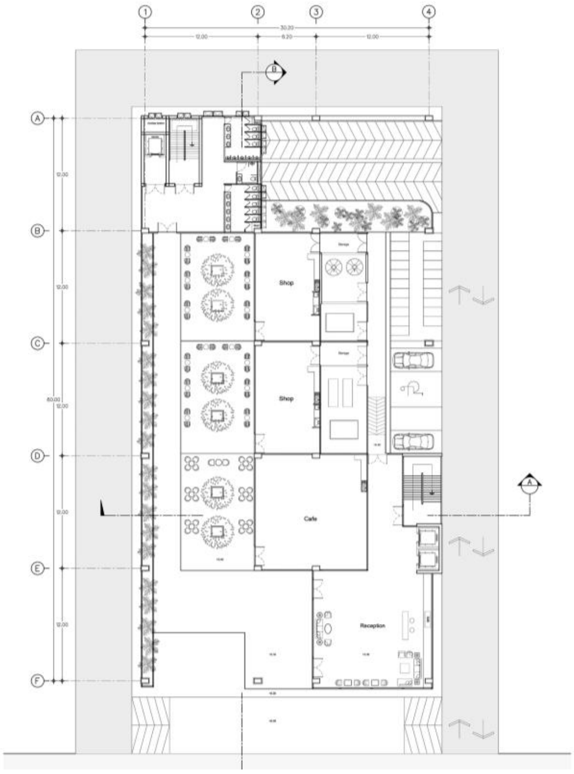
Picture 2.7. Plan at -3,400

The first level of the building serves a representative and public function. It features the main entrance node with a spacious lobby, forming a convenient waiting and visitor circulation area. Adjacent to it is the security service room, which provides visual control of the central entrance and the surrounding space.

The floor includes commercial spaces with independent entrances, allowing them to operate separately from the main office center. A cafeteria is also designed here, with a guest hall and an open summer terrace. The food service area comprises production rooms, including a cooking zone, a dishwashing section, and storage rooms for food products and auxiliary materials. The layout of these spaces ensures a logical sequence of technological processes and compliance with sanitary requirements.

In addition to public areas, the floor houses staff rooms, utility spaces, and other auxiliary zones. Restrooms for men and women are located for convenient access from the main functional areas.

The spatial organization provides clear separation of visitor, employee, and supplier flows, minimizing route intersections and increasing comfort and safety. This zoning complies with current requirements for ergonomics, fire safety, and sanitary-hygienic standards (pic. 2.8).

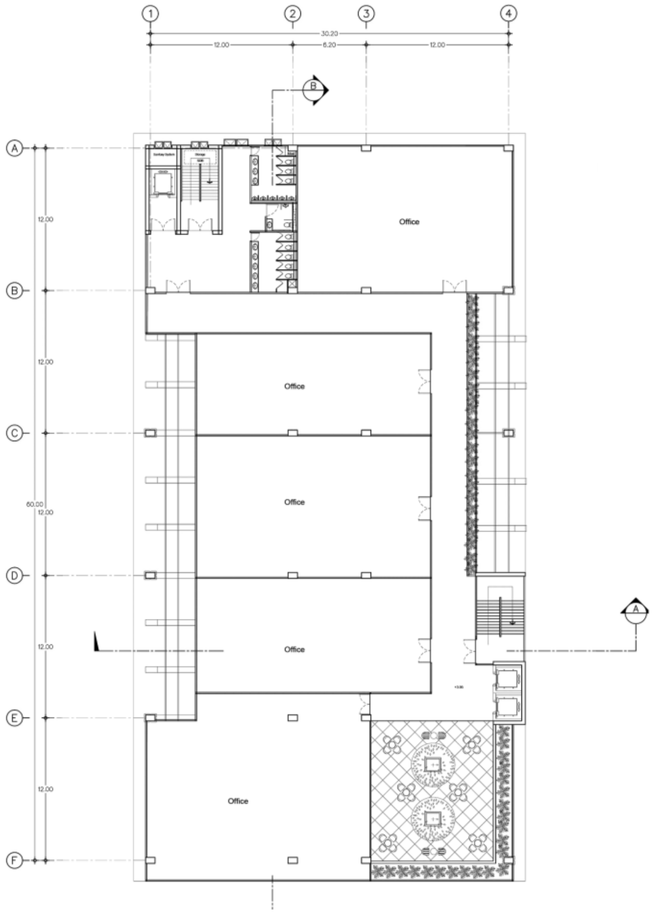


Picture 2.8. Plan at 0,000

The typical floors are designed to accommodate workspaces of various formats, allowing the environment to be adapted to the needs of tenants. The planning structure combines open-plan office zones for team collaboration with individual offices for managers and meeting rooms. This approach supports efficient work organization, providing opportunities for both collective interaction and confidential work.

For user comfort, each typical level includes restrooms for men and women, located near vertical circulation elements. Auxiliary and service spaces are also provided, including storage rooms for cleaning equipment, utility closets, and technical niches for engineering equipment and networks. Their placement minimizes intersections between the main flows of employees and service personnel.

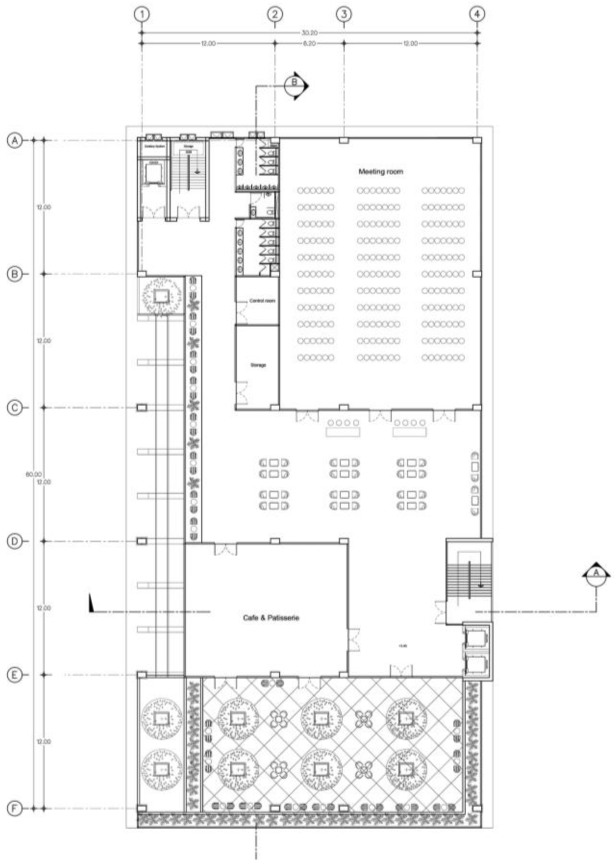
The planning solutions ensure logical navigation and convenient movement between functional zones. Workspaces are oriented to maximize the use of natural daylight, positively impacting working conditions and the building’s energy efficiency. In addition, requirements for evacuation routes, fire safety separations, and regulatory clearances are observed, ensuring an appropriate level of operational safety for the facility (pic. 2.9).



Picture 2.9. Plan at +21,250

The organization of a typical floor space includes the arrangement of sanitary facilities, wide communication corridors, and a central elevator hub, ensuring quick and convenient access to all functional zones. The corridors receive natural light through window openings, contributing to a comfortable interior environment and reducing the need for artificial lighting during daytime hours. A specially designated smoking room has been designed separately, isolated from the main work areas, and constructed in accordance with current sanitary, hygienic, and fire safety regulations. This solution allows for maintaining an appropriate level of safety and comfort for all building users.

Thanks to a well-thought-out planning structure, the implementation of modern engineering systems, and the favorable location of the facility, the prerequisites for creating a high-class office center are established. The complex is aimed at accommodating large companies, international organization representatives, the IT sector, and other business structures that have elevated requirements for the quality of the working environment, technical equipment, and infrastructure support. The top floor provides a space for relaxation and informal interaction, a café with access to an open terrace, as well as a multifunctional conference hall for business events, presentations, and meetings (pic. 2.10).

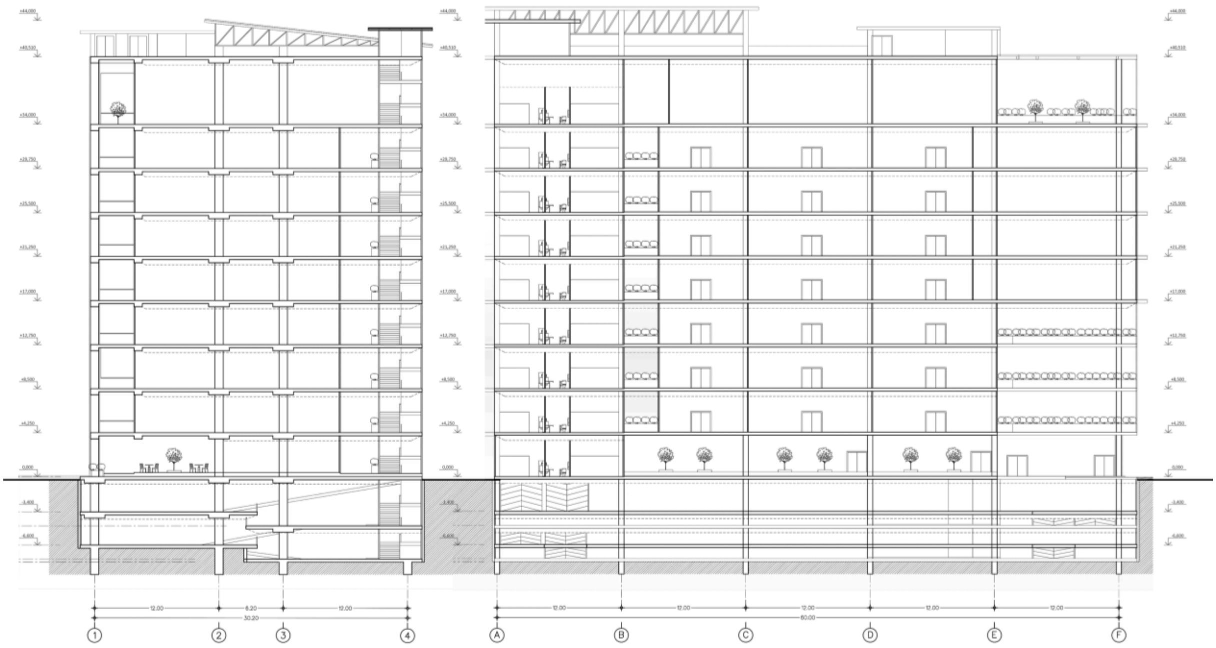


Picture 2.10. Plan at +38,250

Vertical circulation within the building is organized through two emergency stairwells and three passenger elevators, each with a load capacity of up to 400 kg. The stairs are designed as two-flight with intermediate landings, ensuring safe and convenient movement for users. Elevator equipment operates in autonomous control mode – calls and operation can be made both from the cabin and from the floor lobbies. Access to the roof and the elevator machine room is provided directly from the stairwell, in compliance with operational safety requirements. To improve vertical connectivity between the first and second floors, two escalators have been installed, facilitating the movement of visitors in areas of high traffic.

In the event of a fire, evacuation is carried out via isolated stairwells, separated from corridors and elevator lobbies by fire-resistant partitions with a standard fire-resistance rating. The smoke protection system provides for the removal of combustion products through ventilation ducts in the roof, as well as the use of electric fans that automatically activate in response to fire alarm signals.

The stairwells feature combined lighting: natural light through window openings in the exterior walls and artificial light from the emergency and operational lighting networks. All doors along evacuation routes, including exits from stairwells and vestibules, open in the direction of movement toward the building exit, fully complying with current fire safety regulations (pic. 2.11).



Picture 2.11. Sections

To create a barrier-free environment for people with limited mobility, the project includes a number of special measures. Specifically, ramps with a standard slope are planned, as well as the installation of automatic and semi-automatic lifting platforms to overcome changes in elevation.

The entrance nodes are arranged to provide convenient and safe access without barriers or complicated movement areas. The dimensions of passages, corridors, and main functional zones are designed with the needs of visitors with limited mobility in mind, allowing comfortable movement in wheelchairs and the use of assistive devices.

Additionally, specialized equipment and navigation elements are provided: tactile strips, information signs with Braille, visual indicators, and other orientation aids, which facilitate accessibility for all categories of users.

The building roof is designed as a flat roof with a minimal slope of i = 0.03 to ensure proper drainage of precipitation. The drainage system is internal, organized through roof drains and downspouts. The reference zero mark (0.000) corresponds to the finished floor level of the first floor.

3. ARCHITECTURAL AND STRUCTURAL SOLUTION

The building is designed with a combined structural system using monolithic reinforced concrete and local building materials. The main load-bearing system consists of columns and slabs made of locally produced concrete, as well as vertical shear walls. The walls are made of clay bricks and locally produced blocks. The frame structure, without beams and with flat slabs without capitals, ensures optimal load distribution and allows flexible organization of interior spaces.

Spatial stability of the structure is achieved through the interaction of vertical and horizontal load-bearing elements and shear walls. Foundations under the columns are made of monolithic concrete of local production; walls rest on basement concrete structures. The use of reinforced concrete ensures the required fire resistance of the building in accordance with regulations.

External walls are designed as self-supporting multilayer structures made of clay bricks and local aerated concrete, with additional insulation using natural materials such as cork or mineral wool. Horizontal fire-resistant belts are integrated into the structure. This solution provides high thermal insulation and energy efficiency of the building.

Stairwells are constructed of brick and concrete elements, with a wall thickness of 380 mm, meeting fire resistance standards. Internal partitions between rooms are made of 120 mm thick clay bricks on a mix of local cement and sand, with subsequent plastering using a traditional Moroccan mixture. This provides strength and good sound insulation. Precast concrete lintels are used above door and window openings.

Facades are finished using natural stone, terracotta tiles, and double-glazed windows in metal frames. Both "warm" and "cold" facade sections are used to improve energy efficiency. The facade color scheme consists of natural shades of sand, beige, and gray stone.

Stairs are two-flight, made of local reinforced concrete and terracotta tiles. Stair landings rest on concrete slabs and are tiled. Steps are equipped with metal railings and wooden handrails. Elevator shafts are constructed from monolithic reinforced concrete.

The roof is flat, roll-type, with localized gravel protection and bitumen-based waterproofing; polyethylene film is used for vapor insulation. Drainage is organized through an internal system with roof drains and downspouts connected to the storm sewer.

Exterior doors are aluminum with glazing; interior doors are wooden, made from local wood species, either solid or partially glazed, custom-made.

Floor finishes:

– in lobbies and corridors – ceramic zellige tiles;

– in office spaces – wooden parquet or laminate on a thermal insulation base;

– in restrooms – high-quality ceramic tiles.

Restroom walls are finished with glazed tiles featuring traditional Moroccan motifs. Wooden and metal surfaces are painted with two layers of oil paint. Ceilings are suspended.

Around the building perimeter, asphalt or stone pavement 1 m wide with a slope of $i = 0.03$ is arranged to direct water away from the foundations.

4. ECONOMIC SECTION OF THE BUSINESS CENTER

4.1. Analysis of the Existing Situation

4.1.1. Functional Zoning of the Territory

№	Name of the elements of the territory*	Area, m²	Per cent of total, %	Specific indicators, m²/person

1	Office and business area, totally	9,000	36	15
1.1	Built-up area	5,500	22	9
1.2	Roads, driveways and other asphalt surfaces	1,500	6	2.5
1.3	Area of open car parking	1,000	4	1,7
1.4	Sports / fitness area	300	1,2	0,5
1.5	Landscaping	700	2,8	1,2
2	Public and service area, totally	16,000	64	27
2.1	Cafes and restaurants	800	3.2	1,4
2.2	Conference halls / meeting rooms	3,500	14	5,9
2.3	Public services / reception	1,200	4.8	2
2.4	Shops and stores	1,500	6	2,5
2.5	Parking garages	7,000	28	11,8
2.6	Miscellaneous / auxiliary	1,000	4	1,7
Total amount	25,000	100	42	

*The name of the elements of the territory may vary depending on the project.

4.1.2. Technical and Economic Indicators (Project Proposal)

№	The name of indicators	Units	Amount
1	Project area	hectares	2,5
2	Population (employees and visitors)	persons	550
3	Territory load	persons/hectare	220
4	Built-up area	m²	6,500
5	Building density	%	26
6	Landscaping	%	12
7	Landscaping density	m²/person	12,7
8	Road surfaces	%	6
9	Road surfaces density	m²/person	2,7
10	Area of open car parking	m²	1,000
11	Parking capacity	places	60

4.2. Technical and Economic Indicators of the Business Center

4.2.2. Planning Indicators for a Public (Business) Building

№	The name of indicators	Units	Amount
1	Number of floors	unit	9
2	Capacity of building (population)	persons	550
3	Building volume:	m^3	33,500
	- above-ground part	m^3	30,000
	- underground part (parking, technical)	m^3	3,500
4	Built-up area	m^2	6,500
5	Total area	m^2	14,000
6	Effective office area	m^2	11,000
7	Total area per person	m^2/person	25,5
8	Effective area per person	m^2/person	20
9	Building volume per person	m^3/person	60,9
10	К1 = effective area / total area	–	0,79
11	К2 = building volume / total area	–	2,39
12	К3 = outer wall perimeter / total area		

5. OCCUPATIONAL HEALTH AND SAFETY

5.1. Legislative and Regulatory Framework

During the construction of the proposed business center in Casablanca, Morocco, all works are carried out in strict compliance with Moroccan occupational safety and health legislation, as well as international construction safety norms. The main regulatory documents include:

Moroccan Labour Code (Code du Travail, Law No. 65-99), which establishes general obligations of employers to provide safe working conditions.

Law No. 19-12 on Occupational Safety and Health, regulating workplace risk management, mandatory employee training, and preventive safety measures.

Moroccan Building Regulations (Réglementation de la Construction au Maroc), including national standards for industrial and construction safety (e.g., NS 03.203 for building site organization).

These regulations define the minimum requirements for workplace safety, hygiene, and health protection, ensuring both workers and visitors are safe during the construction and operational phases of the business center.

Article 84 of the Labour Code requires the employer to guarantee healthy and safe working conditions, including structural safety, proper use of machinery, and prevention of occupational hazards. Law 19-12 sets out the principles of systematic safety management, defining responsibilities for:

– regular inspections of construction sites;

– training and safety briefings for all employees;

– provision of personal protective equipment (PPE);

– implementation of emergency procedures and fire safety plans.

To ensure safety on the construction site, the following measures will be applied, in accordance with Moroccan standards:

Construction Site Organization:

– all temporary structures, scaffolds, and ladders will meet NS 03.203 standards;

– clear pedestrian routes of at least 1,2 m width will be provided for workers;

– emergency exits and assembly points will be marked and illuminated.

Personal Protective Equipment (PPE):

– all personnel must wear hard hats, safety shoes, reflective vests, and gloves;

– specialized staff (electricians, crane operators) will use additional protective equipment such as insulated gloves and harnesses.

Machinery and Equipment Safety:

Cranes, lifts, and hoists must comply with Moroccan industrial safety standards, inspected weekly;

Heavy machinery operating zones are clearly separated from pedestrian areas.

Fire Safety and Emergency Procedures:

– fire extinguishers, hoses, and alarms are installed at intervals of 50 m across the site;

– staff training and drills will be conducted monthly.

Sanitary and Hygienic Conditions:

– construction site will include temporary toilets (1 per 20 workers), washing facilities, and potable water supply;

– waste disposal follows municipal regulations to prevent contamination or accidents.

Monitoring and enforcement of occupational health and safety will be carried out at multiple levels:

– Moroccan Labour Inspectorate conducts scheduled and unscheduled inspections to ensure compliance;

– Local Municipal Authorities issue permits for construction and monitor adherence to safety standards;

– Internal Safety Officers within the construction company are responsible for daily checks, maintaining records of safety briefings, PPE issuance, and accident reports.

Regular documentation and reporting will be maintained, including:

– daily site safety log;

– records of employee training and briefings;

– equipment maintenance and inspection reports.

These measures ensure a high level of occupational safety for all construction personnel, as well as for future occupants of the business center, aligning with Moroccan legislative requirements and international best practices.

5.2. Analysis of Working Conditions and Identification of Potential Hazards at

the Project Site (Business Center in Marrakech, Morocco)

A detailed assessment of working conditions and identification of potential hazards are critical steps to ensure occupational safety and reduce the likelihood of accidents during the construction of the business center in Marrakech.

The evaluation focuses on recognizing mechanical, physical, technological, biological, and ergonomic hazards that may occur on the construction site, affecting workers, equipment, and the overall project.

Mechanical hazards include risks such as falls from heights, falling objects from scaffolding or storage areas, and accidents involving construction vehicles or machinery. Implementation of secure scaffolding, guardrails, and clearly marked pathways for vehicles is required to minimize these risks.

Physical hazards involve exposure to electrical currents from faulty wiring or malfunctioning equipment, harmful chemicals (paints, solvents, adhesives), as well as dust and aerosols generated during construction processes. Appropriate personal protective equipment (PPE), such as gloves, safety goggles, and respirators, is mandatory for workers.

Technological hazards cover potential emergencies, including fires, explosions, flooding of work zones, and other accidents related to equipment failure or hazardous materials. Fire safety systems, emergency exits, and regular equipment inspections are in place to mitigate these risks.

Biological hazards may occur due to contact with harmful microorganisms, bacteria, or pests in construction debris or contaminated areas. Proper sanitation of work zones, hygienic practices, and pest control measures are essential to protect workers.

Ergonomic hazards include excessive physical strain, awkward postures, and incorrect lifting techniques during manual tasks. To address these risks, work organization is optimized to distribute loads, and workers receive training on proper lifting, posture, and movement practices.

Through systematic analysis and implementation of preventive measures, the construction site of the Marrakech business center will ensure high standards of occupational health and safety, safeguarding employees and complying with Moroccan labor laws as well as international construction safety best practices.

5.3. Assessment of Risks from Potential Hazards at the Project Site (Business Center in Marrakech, Morocco)

Identifying and evaluating potential hazards in high-risk zones of the construction site is essential for ensuring occupational safety. This process involves hazard recognition, assessing the likelihood of their occurrence, and estimating potential consequences.

Table 5.1 – Identification of High-Risk Zones and Potential Hazards

Zone	Hazards	Likelihood of Occurrence	Possible Consequences	Risk Mitigation Measures
High-elevation work areas	Falls of workers, falling tools and materials	High, if proper fall protection is not used	Serious injury or fatality	Use of fall arrest systems, guardrails, and safety harnesses
High-elevation work areas	Falling tools and materials	Medium, depends on site organization and use of protective equipment	Minor to moderate injuries	Regular inspection and secure storage of tools and materials
Areas with moving construction machinery	Collisions with vehicles, equipment tipping	Medium, depends on traffic management and operator experience	Injuries or property damage	Clear vehicle routes, operator training, and warning signage
Zones with high risk of falling objects	Falling construction materials or tools	Medium, depends on quality of material fastening	Varying degrees of injury	Use of safety nets, barriers, and controlled storage
Electrical	Electric	Medium,	Severe injury	Routine

equipment zones	shock, equipment malfunction	depends on equipment condition	or death	inspection, preventive maintenance, and PPE
High-noise and vibration areas	Noise exposure, vibration-related disorders	High without proper protection	Hearing loss, fatigue, stress	Hearing protection, limited exposure time, rotation of workers

Creating a safe construction site protects not only workers but also nearby pedestrians and the general public. One of the most effective measures is systematic control of equipment condition, which is critical for accident prevention.

Stages of Equipment Safety Control Include:

– Initial Inspection and Testing – all new and existing equipment is checked before use;

– Verification of Compliance – ensuring equipment has certificates and technical documentation;

Scheduled Inspections and Maintenance – setting up regular inspection schedules according to manufacturer guidelines;

– daily visual checks of machinery and tools before starting work;

– performing preventive maintenance at manufacturer-recommended intervals;

– documentation – maintaining equipment logs with inspection results, maintenance, and repairs;

– recording all identified issues and corrective actions taken.

Repairs and replacements are carried out immediately when defects are detected, and equipment beyond repair is replaced. All workers using machinery receive training on safe operation, detection of malfunctions, and reporting procedures.

Specific Measures Include:

– Construction Machinery: Check brakes, steering, hydraulic systems, lighting, and tires;

– Power Tools (drills, grinders, perforators): Inspect cables, plugs, fuses; clean from dust;

– Lifting Equipment (hoists, winches): Inspect ropes, chains, hooks; test lifting mechanisms and emergency stops;

– Stationary Equipment (mixers, welding machines): Check stability, fixings, and potential leaks; test for proper functioning.

Specialized technical control teams are responsible for inspection, maintenance, and coordination. Internal regulations and procedures for reporting defects and performing repairs are established. Modern tools, including automated monitoring systems, are used to track equipment condition and document maintenance activities.

Systematic equipment monitoring is a cornerstone of site safety, reducing accidents, ensuring worker productivity, and maintaining uninterrupted construction progress.

5.4. Organizational, Technical, and Architectural Measures to Improve Working Conditions

Developing organizational, technical, and architectural measures for the Marrakech business center requires an integrated approach. Key measures include:

1. Organizational Measures:

– worker training and safety briefings;

– safety planning and worksite organization;

– provision of personal protective equipment (PPE), including helmets, gloves, protective footwear, and safety clothing;

– establishing a safety management team to monitor compliance;.

– specialized training for working at heights, handling electrical tools, and chemicals;

– scheduling work to avoid overloading personnel and ensuring adequate rest;

Providing safe dining and break areas.

2. Technical Measures:

– regular equipment inspection and maintenance;

– use of automated systems for monitoring safety (CCTV, motion sensors, alarm systems);

– controlled access to high-risk zones;

– implementation of energy-efficient materials and technologies to improve worker safety and comfort.

Architectural and Planning Measures:

– designing work zones with proper ventilation and lighting;

– separating high-noise and vibration areas from main workspaces;

– organizing safe movement routes for personnel and machinery;

– ensuring ergonomic workstation design to reduce physical strain;

– installing adequate staircases, handrails, and protective barriers;

– providing sanitary facilities, showers, rest areas, and designated eating zones.

5.5. Conclusions

Implementing these occupational safety measures for the Marrakech business center ensures a safe and comfortable working environment throughout all stages of construction:

Initial Stage:

– conducting risk assessments and developing a safety plan;

– preparing the construction site according to safety standards;

– procuring necessary PPE.

Ongoing Stage:

– continuous training and safety briefings;

– monitoring PPE use and compliance with safety rules;

–regular maintenance and inspection of equipment.

Final Stage:

– preparing the building for commissioning with all safety requirements met;

– performing a final occupational safety audit;

– ensuring safe project completion and handover.

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